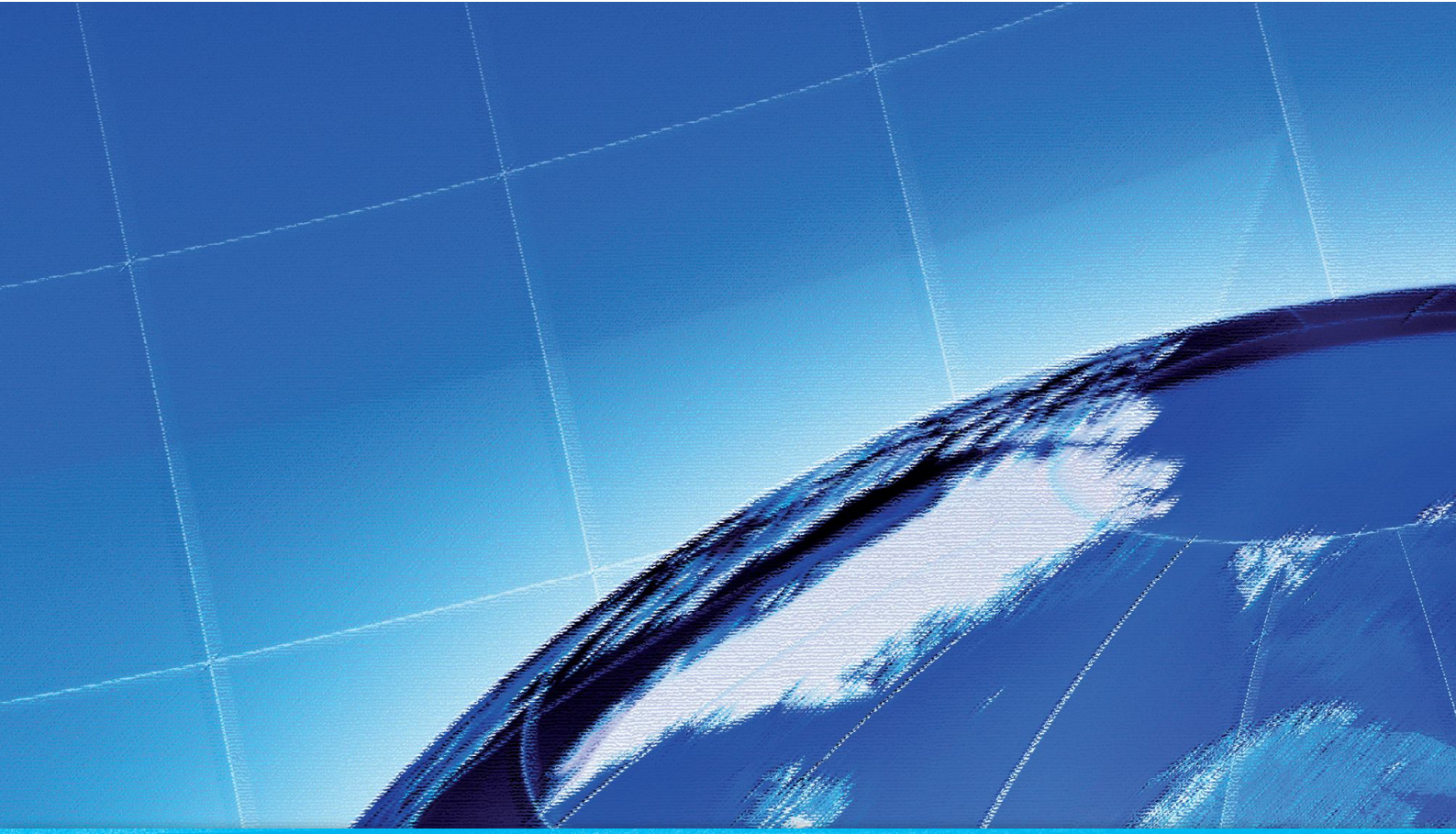

Energy and Geostrategy 2015

Spanish Institute for Strategic Studies

Spanish Committee of the World Energy Council
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PREFACE

Miguel Ángel Ballesteros Martín

Arturo Gonzalo Aizpiri

Collaboration began between the *Instituto Español de Estudios Estratégicos* (IEEE) and the *Comité Español del Consejo Mundial de la Energía* (CECME) in 2014, with the publication of the book "Energy and Geostrategy 2014". The excellent reception received by this first volume encouraged us to continue with this fruitful cooperation in the future, turning our "Energy and Geostrategy" into an annual publication that will periodically analyse the complex geopolitical reality of the global energy context.

The events that society has witnessed over the last year have confirmed the idea underlying this collaboration from its inception. Energy and Geostrategy are two concepts that will invariably be interlinked. This connection is one of the basic vectors for understanding and interpreting the world today. Many of the ideas that the authors put forward in the previous edition are not only still valid, but have also been further confirmed in the international relation scenario.

As of this date, many of the conflicts that began in 2014 are still unresolved. The Ukraine crisis has revealed the weaknesses affecting the European Union energy supply security. The new Commission, under the leadership of Jean Claude Juncker, is immersed in a process of reformulating the European energy policy, something that will eventually give rise to the so-called *Energy Union*, whose purpose is to rectify this fragility, while at the same time tackling such important questions as achieving the domestic energy market or the objective of reaching an agreement concerning climate change at the COP in Paris in 2015. Russia, as a result of the international sanctions and the oil prices, is currently going

through a delicate period in which the country will no doubt consider the potential advantages of reorienting its energy policy towards Asia. In an environment of low oil prices and with the relative passiveness of Saudi Arabia, many of the oil-producing countries are finding themselves in a difficult situation, and even the so-called "energy revolution" in the USA, based on unconventional resources, is being affected.

This complex reality has been analysed by the authors in this volume, excellently coordinated by Claudio Aranzadi, whom we have once again recommended for the task, in view of his experience and farsightedness in this field as a former Minister of Industry & Energy, and to whom we would like to give special thanks for his commitment. We would also like to thank the authors for participating in this second book. They have used their insight and experience to enlighten us about such interesting subjects as the aforementioned Ukraine conflict, the effects of the Middle East conflicts, the prospects for nuclear energy in the aftermath of Fukushima, the challenge of electricity supply universalisation and the Arctic region's complex geopolitical problems.

In view of the rapidly-moving geopolitical scenario and much to our regret, it is impossible to deal with all the topics that have been emerging. However, you can rest assured that these will be taken into account in subsequent editions.

Last but not least, we would like to thank the sponsors, CEPSA, Enagas, Iberdrola and Repsol, for their support for and commitment to the project, which have been essential to guaranteeing its success and continuity.

INTRODUCTION

Claudio Aranzadi

The new publication "Energy and Geostrategy 2015"

The publication "Energy and Geostrategy 2015" has been prepared along the lines of last year's edition. Questions dealt with in the publication "Energy and Geostrategy 2014", such as energy security, unconventional hydrocarbons or China's role on the global energy scenario still have a major bearing on the geopolitical context in which the topics analysed in this publication are to be found. With this in mind, three works have been selected for the current publication, with a territorial approach, namely the Middle East (**F. J. Berenguer**), Russia (**F. J. Ruiz**) and the Arctic (**V. López-Ibor**), and two more, related with cross-cutting themes such as Nuclear Energy (**A. Colino**) and the *Universalisation* of Electricity Supply (**C. Sallé**).

The issues reviewed in the current publication reveal that over the past year we have witnessed a variety of events that have had a major effect on the layout of the geostrategic global energy map, meaning that it is undoubtedly necessary to broaden the perspective from which to approach the significant changes observed.

Complexity and uncertainty in the global energy environment

On the preceding year, the introductory framework revolved around analysing the global strategies aimed to approach the traditional *trilemma* of energy poli-

cy objectives (competitiveness, security and sustainability). Although reference was made to the complex nature of the way the stakeholders (basically States) behave in the geopolitical energy scenario on considering competitiveness and cooperation strategies, the analysis took place within the limits imposed by the chosen framework. Energy policy management aimed at achieving the goals of competitiveness, security and sustainability (among which there are obvious trade-offs) can be formulated in a similar way to an optimisation programme: the energy policy would seek to minimise the cost of the energy supply (competitiveness), subject to the restrictions imposed by the security and sustainability requirements (the more constrictive the restrictions are, the higher the supply cost will be).

Drawing up an energy policy along the lines of an optimisation programme is consistent with the logic behind mechanism design theory.[1] Eric Maskin points out that this theory "can be regarded as representative of the "engineering" aspect of economic theory" and defines it as: "Beginning by identifying a desired goal or "social objective, it then turns to investigate whether a suitable institution (mechanism) can be devised to achieve this goal". The existence of a centralised decision-making body that would act in accordance with the "rationality" pattern prevalent in the "main trend" of economic theory, and in harmony with what V. Smith calls "constructivist rationality", is also implicit to the energy policy concept explained. Vernon Smith,[2] following Hayek, makes a distinction between two types of rationality: "constructivist rationality" and "ecological rationality". "Constructivist rationality", applied to individuals or organisations, means the deliberate use of reason to analyse and prescribe actions that are considered to be better than other alternative and feasible actions that could be selected. When applied to institutions, constructivism involves the deliberate designing of systems based on rules for obtaining the desired results. This includes the "optimum design" of institutions, where the intention is to provide incentives to enable the stakeholders to choose better courses of action than those that would be yielded by alternative designs". "Ecological rationality" refers to an emerging order in the form of institutional rules, practices and standards in processes of evolution that constitute part of our cultural and biological legacy and are created by human interactions, but not by a conscious human design".

Maskin's mechanism design model or the "constructivist rationality" model described by Smith, provides a suitable analysis framework for the energy policy as it has been defined, as long as the scope of this policy is the State or a regional union (such as the European Union) with common policies. However, this framework of analysis is clearly insufficient for examining the behavioural patterns of the agents involved in the geostrategic global energy map. There is no centralised subject of the energy policy on a global level; the way

1 E. Maskin (2008). "Mechanism Design: How to implement Social Goals". American Economic Review (June).

2 V. Smith (2008). "Rationality in Economics". Cambridge University Press.

the global geostrategic scenario evolves is the result of interaction between a host of decision-making centres that, in the case of States, enjoy full (or almost full) sovereignty. It could be argued that the game theory offers analytical instruments suitable for modelling the global scenario; this would probably be the orientation that economists would prefer. Nevertheless, the limits to these types of approach have been indicated from perspectives closer to the domain of historians. The case in point is illustrated by L. Freedman[3] in his historical analysis of strategic thought and conduct. To a great extent, Freedman bases his reservations on the developments of "behavioural economics" and, above all, on the criticisms levelled at the descriptive value of the conventional concept of "rationality" in economic theory, which A. Dixit[4] defines as "the calculation of conscious optimisation of a target function featuring a complete and consistent specification". Freedman stresses the importance of "stories", "narratives" and "scripts" (the latter being defined as "a coherent sequence of events that an individual can reasonably anticipate") when preparing and implementing strategies. A. Dixit, who, in the article mentioned in which he performs an extensive synopsis of Freedman's work from an economist's perspective, positively rates the incorporation of "narrative" into strategic thinking (although he considers that the concept of "script" has a notable familiarity with the concept of "common knowledge" in game theory) and considers the complementariness of theory and history to be fruitful in this sphere of knowledge.

However, the analytical framework offered by the breakthroughs made in the theories of "complexity" or "networks" might be more enlightening when it comes to tackling the geostrategic scenario of energy. As H.L. Root[5] points out, there is no "captain at the helm" in a global environment, and the "complexity" of its structure is something qualitatively different from its mere complicated nature. Root uses the concept of "complexity" as "a quality inherent to systems that contain many interdependent parts that manifests itself when the behaviour of the whole emerges from the interactions between the components"; he states that in "a complex system, the removal of one individual part will induce changes in the behaviour of the rest of the components". This emphasis on interdependence also characterises the analytical developments in "networks" theories as an explanatory framework for the behavioural patterns of economic and social stakeholders affected by a "complete network of relations (their density, the way in which some groups are separated, who occupy the central positions)".[6] These perspectives for analysing a global scenario are somewhat similar to Vernon Smith's aforementioned "ecological rationality" concept; yet in Root's conceptualisation of international relations as a complex network in

[3] L. Freedman (2013). "Strategy: A History". Oxford University Press.

[4] A. Dixit (2014). "Strategy in History and (versus?) in Economics: A Review of Lawrence Freedman´s "Strategy: A History". Journal Economic Literature (December).

[5] H. L. Root (2013) "Dynamics among Nations". The M.I.T., Press.

[6] M. O. Jackson (2014). "Networks in the Understanding of Economic Behaviours". The Journal of Economic Perspectives (Fall).

which "the stakeholders adapt but are not optimisers" and co-evolve in an environment of complex feed-backs and changing rules, it would seem to be difficult for any notion of rationality to fit in. Being true that the current state of development of these theories does not permit the construction of models with the ability to forecast the way the global energy environment will evolve that are notably better than the forecasting ability of other analysis frameworks, their ability to provide a relevant description is however greater. To a certain extent, and following L. Freedman, these approaches could be used to make up a "narrative" that eclectically combines the formal thoroughness of programming techniques or game theory, with more qualitative viewpoints coming from other disciplines, along the lines of what A. Dixit suggests.

The use of a perspective that incorporates the notion of "complexity" as an essential component in the analysis will favour the understanding of the way that the global energy environment has recently evolved. The behaviour of the decision centres (companies, States, or groups of States such as the OPEC) in the global energy geostrategy has not followed a pattern of strict continuity while the interrelation between economic, political, technological and merely energy factors has served to create a network of complex feed-backs where the causality relations were difficult to anticipate. Although new explanations have been provided in hind sight, the recent triggering of the fall in oil prices was not expected by the experts, and neither was the subsequent reaction of Saudi Arabia and the OPEC, which have helped to consolidate that oil-price lowering process. Furthermore, the new geopolitical positioning of Russia in the aftermath of the Ukraine Crisis has led to significant changes in the global geostrategic energy scenario that had not been fully anticipated a few years ago: energy insecurity in Europe has increased, the redirecting of Russian gas supply to Asia has predictably speeded up, economic sanctions (with the added effect of the drop in oil prices) will tend to destabilise Russia from an economic and political perspective, bringing about geopolitical consequences that are difficult to forecast and, in the longer term, the geopolitical tensions associated with an eventual exploitation of the Arctic energy resources could considerably increase. This complex combination of geopolitical and energy factors is extensively described in the works of **F. J. Berenguer, F. J. Ruiz**, and **V. López-Ibor**, included in this publication.

Therefore, preparing strategies at the individual decision centres (whether companies or States) cannot merely be a task that involves calculating optimisation in an uncertain -yet "probabilisable"- environment. As Root indicates in the aforementioned book, rather than "optimising", these decision centres would follow a strategy of "adaptation" to a global energy environment in which, although certain rules (e.g. market functioning and reliability of contracts) remain reasonably stable, the system as a whole co-evolves in a highly complex way, with the "emergence" of new and important geostrategic factors, which makes it very difficult to incorporate into the analysis such concepts as balance or rational design. Along similar lines, it is extremely difficult to model the uncertainty that is inherent to the current complex evolution of the global geostrategic ener-

gy environment, which means greater risk premiums (and greater capital cost) for energy projects and thus a deterrent effect on the high value medium- and long-term investment in the energy programme that is required to achieve the efficiency, security and sustainability goals.

Although the "first best" (an example of a global centralised decision-making body responsible for optimising worldwide management of energy resources) is obviously a utopia, a "second best" approach (achieving a balance between competition and cooperation in the relations between companies and States that might make it possible to minimise the distance from the optimum situation) was examined in the 2014 publication. It was pointed out there in that international cooperation is absolutely essential for achieving the targets, necessarily global, of the decarbonisation policy (axis of the sustainability requirement in the energy area); convenient, but difficult to attain, in the pursuit of an all-encompassing energy security goal; and with few prospectives in the quest for competitiveness, which is essentially based upon competition and rivalry between companies and States. B. Jones and D. Steven[7]conducted an extensive analysis of the lines that define an international energy governance able to contribute to institutionalising efficient forms of international cooperation, especially where climate policy is concerned. These authors reserve the leadership role in this global governance for the USA, all the more so when they consider that the USA is "the country which, in strategic terms, receives the greatest benefit from the energy revolution" that is taking place both on the demand side (growing energy dependence of China, India and in general, Asia), and on the supply side (essentially, the major development made in the use of unconventional hydrocarbons in the USA). However, one might well question the USA's capacity for leadership of the global decarbonisation policy (this being the area where international cooperation is most clearly defined and most necessary), in view of its track record and the deep division existing between legislative and executive bodies where this matter is concerned. Be that as it may, the global geostrategic environment will continue to be characterised by its intrinsic "complexity" and, after the changes that typify what B. Jones and D. Steven call energy revolution, we will witness the "emergence" of substantial new changes that, just like the previous ones, will not have been fully anticipated. In that context, any attempts at the global governance of energy (hopefully with the exception of the decarbonisation policy) will foreseeably be a result of "trial & error" and, in many cases, will lead to coalitions with conflicting interests.

Oil supply as a central geostrategic factor

Ever since the first drillings in Titusville (Pennsylvania) in 1859 and, particularly, throughout the 20th Century (and its two World Wars),[8] oil has been the most

[7] B. Jones and D. Steven (2015). "The risk pivot". Brookings Institution Press.

[8] S. Furfari (2007). "Le Monde et l´Énergie. Enjeux géopoliques". Editions Technip.

important energy resource from a geostrategic viewpoint, not only because vital sectors of the economy, such as transport, depend on that fuel and find it difficult to replace, but also in view of the fact that the global exportable supplies of the resources are concentrated in a limited number of countries that do not belong to the most highly industrialised group. Global dependence on oil will still be very heavy in the first half of the 21st Century. As the International Energy Agency (WEO 2014)[9] states, in 2040, the percentage occupied by oil in the world energy demand (in the Agency's central scenario) will still be 26% (compared to 31% in 2012), and the demand in absolute terms would show an increase amounting to 104 million barrels/day, basically as a result of transport requirements (85% of transport depending on oil in 2040) and petrochemical needs. But even in the Agency's most demanding scenario (compatible with the limitation of the long-term global temperature increase to 2ºC), which would require new global measures for greater energy efficiency and intensive electrification of the transport sector, in 2040 this sector would still be dependent on oil for 63% of its necessities and the global demand for oil would reach 72 million barrels/day. Most of the demand falls ever-increasingly on non-OECD countries, particularly those in Asia (especially China and India). Meanwhile, under IEA's central scenario, the oil demand in OECD countries will fall until 2040 at an annual rate of 1%, the demand in China and India will grow at an annual rate of 1.8% and 3.5%, respectively.

In this global oil demand context, the supply of this fuel will carry on being a key geostrategic variable throughout the first half of this century. Two works were included in last year's publication (by Mariano Marzo and Ignacio García Sánchez) that provided a detailed analysis of the development of unconventional hydrocarbons and the supply of energy in China (with the effects of the strong demand expected in this country), something that B. Jones and D. Steven (in their aforementioned book) consider to be key elements in what they call global energy revolution. The evolution of oil markets since June 2014 confirms just how right this assertion was and also reflects the growing complexity of the global geostrategic energy environment, where considerable changes have taken place in the traditional two-directional causality patterns between strictly energy related factors and geopolitical factors.

The sudden change in the oil markets, with free-falling prices throughout the second half of 2014, has been explained away by the combination of a sharp increase in the offer of oil by the USA (associated with a rapid increase in the production of "tight-oil" since 2010), and a moderation in the global demand (linked to a sluggish growth in the world economy, caused by the quasi-stagnation in Europe and the slowing down of the growth rate in China and other emerging countries); the depressing effect on the prices would have been accentuated by Saudi Arabia's behaviour, because that country did not play its expected price-stabilising role by lowering (or, at least, announcing its intention

[9] I.E.A (2014). "World Energy Outlook 2.014".

to lower) its production rate. However, this explanation was construed in hind sight. The factors that triggered off an oil supply surplus were heralded several months before, the experts being unable to anticipate a collapse in prices like the one that occurred. It could be argued that the growth in the production of "tight-oil" in 2013 and 2014 in the USA has been particularly intense, yet unscheduled stoppages in world oil production were also extremely frequent during that period.[10]

The controversies surrounding the diagnosis of the causes of current drop in oil prices and the caution with which the experts approach any forecast concerning the future development of the oil market, are an indicator of the uncertainty that is hovering over the global geostrategic oil scenario, probably caused by the emergence of new determining factors on that scenario. Explaining the fall in prices by claiming that it is simply due to an offer surplus is conventional and almost undisputable (yet neither the schedule nor the severity of the process were properly anticipated). There is less consensus however when one tries to look for other explanatory factors, specifically the role of Saudi Arabia, the country that stands accused of trying to bring about a low-price scenario that would help to force the new high-cost producers off the market (supposedly affecting the "tight-oil" offer by the USA) and would economically damage Russia, Iran and Venezuela, whose geopolitical positions are hostile to the USA. B. Fattouh[11] plays down these explanations, indicating that Saudi Arabia has not used oil as a political weapon since 1973 and has always adapted to the arrival of market newcomers. Furthermore, it would not seem to be very consistent the alleged alignment of Saudi Arabia with the USA, for damaging its rivals by means of a low oil price policy while at the same time attempting to cause, through a strategy of "predatory prices", high-cost producers (supposedly producers of tight-oil) to disappear from the market, whose expansion helps to enable that same country to achieve energy self-sufficiency. Moreover, as Fattouh demonstrates, the cost (breakeven prices) of tight-oil production in the USA presents a wide variety so the effect on the oil offer coming from these facilities would be far from even. The interpretation of the Saudi position is even more problematic if the country's declarations are analysed. Fattouh (2015) quotes previous Saudi statements (MEES, Dec 6, 2013), i.e., just as the prices started to drop, when it was announced that Saudi Arabia was hardly prepared to modify its production and to continue playing a "cushioning" role in the oil market; Fattouh himself (2014) quotes statements made by the Saudi Oil Minister (Reuter, May 12,2014) where the latter states that "one hundred dollars per barrel is a fair price for all –consumers, producers, oil companies, ...".

Whatever the case may be, the geopolitical effects of a prolonged period of low oil prices, examined by **F. J. Berenguer** and **F. J. Ruiz** in this publication are,

[10] "U.S. Energy Information Administration". Short-Term Energy Outlook. January 2015.

[11] B. Fattouh 2014 "Saudi Arabia´s Oil Policy in Uncertain Times: A shift in Paradigm? Oxford Institute of Energy Studies. B. Fattouh. 2.015. "Current Oil Market Dynamics and the Role of OPEC: Reflections on Robert Mabro´s Work". Oxford Institute of Energy Studies.

to say the least, uncertain. The impact on the consuming countries economy, to which there is a transfer of profit from the producing countries, is clearly positive. However, the profit adjustment in the exporting countries may lead - depending on the particular economic characteristics of each one of them - to economic difficulties and political consequence with unwanted effects on global geopolitical stability. Firstly, not all oil-exporting countries are hostile to the USA, and some are even allies, e.g. Saudi Arabia, and prices of around 50$/barrel (where some predictions[12] situate them during the first half of 2015) would impose considerable budget imbalances on such countries , although it is true to say that some such States (Saudi Arabia in particular) have a comfortable cushion of net financial assets in their sovereign wealth funds[13] that afford sufficient cover to cope with budgetary contingencies that do not last too long.

Secondly, the economic destabilisation of countries whose geopolitical position is hostile to the USA, such as Russia or Iran, through a policy of low oil prices (whose impact would be added to the economic sanctions imposed for good reasons on these countries), could have undesired effects. In the case of Russia, if the result were to give rise to the country drifting towards a long-lasting and more aggressive and authoritarian nationalism, this would be detrimental to the European energy security strategy, a solution to many of the Middle East conflicts would be made more complicated (given that Russian collaboration is essential) and even initiatives of major geostrategic importance, such as the multilateral approach to exploiting Arctic resources (a question tackled by **V. López-Ibor** in this publication) would be fraught with serious difficulties. Along the same lines, it is debatable that a "shock" to the Iranian economy brought about by low oil prices, would help to achieve a final nuclear agreement that would, should it be attained, have a decisive geostrategic impact in the region; although, in this case, the geostrategic interests of Saudi Arabia are not necessarily the same as those of the USA. Imposing economic sanctions on countries that violate international law or breach international treaties is, of course, justified, but its modulation is necessary to limit unwanted effects; this seems to be clearer still if the intention is to use energy supply conditions as a political instrument.

Some of the geostrategic ingredients in the current episode of the drop in oil prices are likely going to determine the future global scenario of oil geopolitics too. In the short term, it is difficult to know how far prices will drop and for how long prices will remain low in the market. The rock bottom price will initially be determined by the operating cost of marginal exploitations, which would leave a reduction margin even above the minimum price envisaged by the U.S. Energy Information Administration (around 45$/barrel) in its January forecast..[14] The

12 "U.S. Energy Information Administration". Short-Term Energy Outlook. January 2015.

13 B. Fattouh 2014 "Saudi Arabia´s Oil Policy in Uncertain Times: A shift in Paradigm? Oxford Institute of Energy Studies. B. Fattouh. 2.015. "Current Oil Market Dynamics and the Role of OPEC: Reflections on Robert Mabro´s Work". Oxford Institute of Energy Studies.

14 "U.S. Energy Information Administration". Short-Term Energy Outlook. January 2015.

price recovery schedule is more uncertain. It depends on the rate at which the surplus offer of oil is corrected and the degree of firmness shown by Saudi Arabia (and the OPEC) in retaining their position. Notwithstanding, the International Energy Agency seems to regard the current low-price episode as a transitory loop that will not affect the long-term oil price trend. Before the current fall in oil prices, the IEA (WEO 2013) predicted for its central scenario, a trend (as from the current values of around 100$/barrel) that would lead to prices (in 2012´s dollars) of 113$/barrel in 2020 and 128$/barrel in 2035. This long-term price profile has not been modified in the WEO's (2014) predictions, made public after the beginning of the drop in oil prices; the new WEO predictions (2014), in the central scenario, amount to a price (in real terms) of 118$/barrel in 2025 and 132$/barrel in 2040.

IEA's long-term price forecasts are consistent with their long-term marginal cost estimates for production in countries that are not OPEC members (normally higher costs than the OPEC costs)[15] and are consistent also with their predictions for a major part of the global oil demand being still covered from countries that are not members of the Organisation. The relative weight of these countries in the global production would continue to show a slight increase until the early 2020s and would then decrease considerably, although it would remain high in the long term (51% in 2040, as per IEA's central scenario (WEO 2014)). However, the production profile for countries that do not belong to the OPEC depends, to a large extent, on the way unconventional oil production evolves in the world and especially in the USA. Both the IEA and the U.S. Energy Information Administration (the latter in its own scenario) predict a peak in the production of US tight-oil in the early 2020s, which would prevent the USA from achieving its goal of being fully self-sufficient in oil; nevertheless, the U.S. Energy Information Administration[16] predicts, under its most optimistic scenario, an ongoing increase in the production of tight-oil that would make the USA a net exporter of oil by 2040, modifying the geographical production distribution profile envisaged by the IEA.

The eventual exploitation of the Arctic's oil resources (not taken into account in IEA´s predictions) adds a further element of uncertainty to the long-term geographical distribution of oil production. This subject is dealt with extensively in the work by **V. López-Ibor** included in this publication and in a recently-published book co-authored by him.[17] The economic viability of exploiting the Arctic's hydrocarbon resources would be greatly enhanced, as is pointed out in these publications, if the thawing process continues and new extraction technologies are developed that make it possible to alleviate the difficulties inherent to this geographical location (climate, transport infrastructures and distance from the markets); although the basic restriction affecting the exploitation of Arctic energy resources would be imposed by the need to protect

[15] I.E.A. 2.013. "World Energy Outlook 2013".

[16] U.S. Energy Information Administration 2014. Anual Energy Outlook.

[17] V. López-Ibor, L. F. Martínez, E. Sánchez de Rojas (2014). "Apuntes sobre el Ártico". Opera Prima.

the environment, which is the absolute priority. Of course, should the Arctic, in the long term, prove to yield significant hydrocarbons to offer, their production would fall into the highest-cost segment. Whatever the case may be, it is clear that the eventual exploitation of Arctic resources could become a long-term geostrategic factor (not only in the energy domain) that would require a complete multilateral agreement (not only involving the countries with an Arctic coastline) for which purpose a cooperative attitude from Russia is an essential prerequisite.

Evolution of technology will be a decisive factor in determining the availability of oil production in countries that do not belong to the OPEC, not only where non-conventional oil or oil extracted from deep waters is concerned, but also regarding Arctic resources. Although, given that most of the operations involved in extracting these resources will be of a high-cost nature, the geographical distribution of the global oil offer in the long term will also depend on the decisions of the low-cost countries (mainly the Middle East) regarding the extent to which they will exploit their resources (and, thus, the larger or smaller extent to which the high-cost production is priced out of the market). Excessive high-cost oil extraction over a long period of time, would affect the way prices evolve in the long term (it ought to make them go down, since the long-term marginal production cost would be very low), which hardly seems compatible with the long-term interests of the low-cost producing countries (at least, under the hypothesis of low discount rates). Even when these uncertainty factors are taken into account, the most likely scenario with the information currently available is undoubtedly the data furnished by IEA (WEO 2013, WEO 2014), which forecasts that as from the 2020s, the Middle East will play a central role in the supply of extra oil, with Iran and, especially Iraq, (whose production, in IEA's central scenario would rise from 3.2 million barrels/day in 2013 to 8.2 million barrels/day in 2040) being the key producers. However, this profile of the Middle East offer in the long term would be hardly compatible with the continuity or worsening of tension in the area. A return to greater stability, for which an agreement with Iran and the cooperation of Russia seem to be decisive factors, is therefore of paramount importance, so the strategic involvement of the USA in the Middle East will still have to be intense, even under the hypothesis of the former's high level of oil self-sufficiency, as was pointed out in last year's publication.

Europe and the global geostrategic energy framework

Major changes have taken place in the European energy geostrategy scenario throughout 2014, not only within the European Union (Agreement by the European Council regarding the action frame on climate and energy matters for 2030, coupling of electricity markets, numerous communications issued by the Commission providing guidance on energy policy, etc.) but also beyond the EU (Ukraine crisis, tensions in the Middle East and North Africa, drop in oil

prices, joint cooperation commitments between China and North America regarding climate change and clean energy, etc.). Given that the jurisdictions of the EU Member States in defining and implementing the energy policy are still very important, achieving a suitable balance between the goals of competitiveness, security and sustainability for the European energy policy requires management be exercised on two levels. Firstly, the Member States and the Community institutions must cooperate closely both in order to develop communal policies and to liaise the policies implemented by each country, should they be different, in order to ensure that they are consistent with the common objectives. Secondly, in the international context, where in contrast to what happens internally within the EU, competition takes precedence over cooperation, and not only the Member States but also the Community institutions must make the most of the scale economies from a joint European action.

The EU objectives for 2030 on matters concerning climate and energy, as approved by the European Council on 24th October 2014, amount in that sense to holding a balance between the political will to carry on with Europe's exemplary leadership in the global policy for climate change, preserving a decarbonisation path consistent with European long-term targets, and the sensitivity versus the positions of States and companies that are more concerned about the effects on the European economy's competitiveness, of the undertakings to which they have committed themselves. The approved emission reduction target (40%) seems consistent with the global reduction of greenhouse-gas emissions (between 40% and 70% for 2050) that the Intergovernmental Panel on Climate Change (fifth working group report issued November 2014) considers necessary to achieve (with a probability of between 60 and 70%) the target of limiting temperature growth in the 21st Century to 2ºC, when compared to the preindustrial period. It can also be considered consistent with the ambitious decarbonisation policy established by the EU for 2050 (reduction of greenhouse-gas effect emissions by between 80% and 95% below the 1990 levels). At the same time, the European Commission in its 22nd January 2014 communication, provided some figures regarding how the 20/20/20 objectives for 2020 are being fulfilled, as well as the forecasts for what can be achieved by 2030 on the basis of current policies, which would indicate that the targets set in the November Agreement (40% emission reduction from 1990 levels, up to 27% renewable energy penetration and an objective of improving efficiency by 27%) do not appear to require any further special effort. In addition, the approval given to the EU objectives for 2030, needs intense diplomatic activity not only from the Community institutions but also from the Member Countries, in order to fairly share out the global effort necessary to attain the emission reduction commitment established at the 2015 Paris Conference consistent with the aim of limiting the temperature growth to 2ºC. It is unlikely that the commitments made by the USA and China (jointly accounting for over 40% of the emissions) in their November 2014 agreement to collaborate in matters concerning climate change and clean energy, will be sufficient. Furthermore, in view of the political divorce between the President of the USA (Democrats)

and the two legislative chambers (both controlled by the Republicans), there is a risk of a repetition of what happened with the Kyoto Protocol, signed in 1998 by President Clinton but never ratified.[18]

The internal management of the EU's energy policy, in its task of integrating national energy policies with a view to achieving common objectives, is fraught with major institutional deficiencies and has governance mechanisms showing considerable room for improvement. As far as the electrical sector is concerned, for example, the aim of reaching an almost complete decarbonisation by mid-21st century will require qualitative changes to what has been the standard regulatory framework of liberalised models, in a direction where the weight of the regulation will be on the increase.[19] These changes will make it necessary to approach the process of regulatory design in a unified way. However, in the EU, where there is a common competition policy there is considerable regulatory fragmentation in energy matters (especially in the electrical sector). The absence of a standardised regulation and of one single European regulatory body is a factor of inefficiency for the electricity market operation and a cause of uncertainty (and, thus, regulatory risk) for the sector operators. One clear example of dysfunction is the existing difference between the common competition policy and the approaches of national regulatory authorities when assessing corporate control operations.

Nevertheless, one thing that is a lot more important (especially for Spain) is the insufficient use of the efficiency potential offered by coupling the electricity markets owing to a limited interconnection capacity. Coupling the daily electricity markets makes it possible to attain efficient zonal prices determined by the existing connection capacity (extremely low in the case of the Iberian Peninsula). This type of efficiency is compatible with the experience of a high number of hours when the grids are saturated; under these conditions the optimisation of the Spanish intermittent renewable generation capacity and making the best use of our excess generating capacity with combined cycles using gas are considerably limited, but it also makes optimum operation of the European system as a whole more remote. In this case, the fragmentation of the regulatory powers in matters concerning the authorisation of transport grids investments has also been a hindrance to developing a more rational policy for investing in connection infrastructures between the Iberian Peninsula and the European grids. An efficient integration of the electricity systems does not only need an agreement between countries with respect to the interconnection grids, but also the unilateral consent of each country to perform a grid mesh not necessarily optimum for its domestic interests (as has happened with the need to mesh the grid in the south of France). The interconnection commitments taken on in the

[18] C. Aranzadi (2015). "EU 2030: Objetivo clima y Energía". Política Exterior (Enero-Febrero). IPCC (2014)."Fifth Assessment Synthesis Report. Approved Summary for Policymakers". European Commission (2014)."A Strategic Climate & Energy Policy Framework from 2020 to 2030. (Communication). European Commission (2011). "Energy Road Map for 2050" (Communication).

[19] C. Aranzadi (2015). "La política energética en el sector eléctrico". Economía Industrial.

November 2014 Agreements and the priority given to investment in this type of infrastructure are steps in the right direction. Nevertheless, the best solution would be to progress towards establishing one single European regulatory body responsible for authorising investments in transport grids, since grid development makes a positive contribution to operating the European electricity system in an optimum way.

The proposal for "national plans", in the communication issued by the European Commission in January 2014, constitutes a major step forward in the governance of the EU energy policy. The role allocated to these "national plans" consists firstly in that they should serve as instruments to enable the Commission to assess the extent to which domestic energy policies adapt to the common goals. However, as these plans should also include (in accordance with the Commission's approach) the initiatives of each country's energy policy regarding such aspects as promoting renewable energies, energy saving, energy security and research, as well as the extent to which nuclear energy, shale gas, carbon capture and storage, etc. should be developed, these plans could become highly-useful tools for the comprehensive management of the European energy policy, although their efficiency will depend on the degree of authority that the Community institutions have (specifically the Commission) to enforce modifications to the initial proposals put forward by the Member States, if it is assumed that these proposals are not in keeping with the common goals set by the European Council for 2030, or when they are not in harmony with the Directives for internal market and public assistance. An obligation to draw up "national plans" would also enable the citizens of the Member Countries not only to become familiar with the contents of the domestic energy policy explained systematically, but also to understand the logic behind its regulatory policy, which would help to reduce the regulatory risk run by the operators in the sector.

Special attention will presumably be paid in these plans to the electricity sector technology mix. First of all, within the framework of complying with the established decarbonisation targets, the Member Countries would benefit from greater freedom to manage the decarbonised generation technology mix given that, in contrast to what took place with the goals for 2020, in the goals for 2030 set by the European Council Agreements, the use of renewable energies is not a strictly binding requirement for each Member Country. Secondly, the new generation capacity (which except for backup capacity, must basically use decarbonised technologies) is going to be set, both in volume and in technology mix, by a centralised administrative body, which means that it will be required for the national energy plans to specify not only the selection criteria considered, but also the incentive mechanisms used. One of the questions that these national plans will have to prompt is the one that affects the future role of nuclear energy in decarbonised generation technologies, a question that is extensively dealt with by **A. Colino** in his work for this publication. As he points out, estimates of the average cost of nuclear generation (measured by their levelised costs) offered by prestigious institutions (M.I.T., OCDE, etc.) indicate that this technology would be

competitive with the rest of the generation technologies in terms of cost. However, after the Fukushima accident questions must be asked about the degree of competitiveness vs cost of nuclear technology, at least for the new investments being made in the near future. It is true that recent estimations (after the Fukushima accident),[20] still yield estimations about the cost of nuclear generation (levelised cost) that would enable this technology to carry on being competitive under a hypothesis of sufficiently high CO_2 prices. However, it must not be forgotten that the Fukushima accident not only brought about the requirement of new specifications pursuant to nuclear security (which would mean greater investment and operating costs), but also increased the likelihood of eventual modifications to these requirements in the future and, so, the regulatory risk inherent to investing in this technology has also risen significantly. This higher regulatory risk is coupled with the greater risk of failing to fulfil construction deadlines and the anticipated investment costs for the first-of-a-kind reactors of the nuclear technology's third generation. All these factors affect the "capital cost" (discount rate) considered for new investments in this technology, thus having a decisive effect on the total cost, given that the capital intensity of nuclear technology is considerably higher than it is for the alternative conventional generation technologies. The fact that nuclear energy (with new first-of-a-kind reactors) is unable to compete under market conditions, has been brought to light as a result of the conditions required by those who are investing in new nuclear projects in the United Kingdom (very long-term contracts for difference, with a strike price much higher than the average prices, both current and expected, in the electricity wholesale market). Nevertheless, it is possible that nuclear generation technologies that have progressed sufficiently on their learning curve (because they are repeating similar reactors in countries with investment criteria not dictated strictly by the market, such as Russia, the Middle East and especially China) might, in the more distant future, be able to provide a competitive decarbonised generation capacity that is acceptable to those European countries that accept nuclear technology in their new generation capacity mix.

The EU energy security policy, dealt with in detail by G. Escribano in last year's publication, is another example of the twofold dimension "strategic internal coordination – unified external action" that characterises the Community energy policy. In its communication dated May 2014 on energy security,[21] the European Commission stressed the need to coordinate the national energy policies in this area and to act beyond the EU with one single voice. In this sense, the Ukraine crisis has served to remind us about Europe's strategic fragility where the supply of an essential fuel like gas is concerned, while at the same time providing the occasion to make progress in drawing up a joint strategy to successfully overcome the problems involved in achieving European energy supply security

[20] D.E.C.C. (2.013). "Electricity Generation Costs". Department of Energy and Climate Change U.K.

[21] European Commission (2.014). Communication (28-8-2014), "European Energy Security Strategy".

(especially natural gas security) in the long term. This long-term vision is necessary, given that the IEA (WEO 2014) predicts (in its central scenario) that by 2040, the European Union will have to import 81% to cover its gas demand (the figure for 2012 was 64%) and that Europe, whose gas demand will also increase by 2040, will still be the world region that imports most natural gas. Not only the IEA but also the European Commission are considering many courses of action to cover the natural gas supply security requirement in its twofold dimension of "physically" guaranteeing the supply and obtaining it at "reasonable" prices. This mix of measures includes, amongst others, deepening the domestic market (for which it is necessary to have the cooperation of the Member Countries, in order to construct transport infrastructures, developing organised markets (hubs) that make it possible to continue with the growing trend towards a decoupling of gas prices with respect to oil prices, an increasing coverage of the demand via LNG imports , and the greater geographical diversification of both supply sources and supply routes associated to the fixed transport infrastructures (gas pipelines) when these are used.

The geographical diversification of supplies is favoured by a sparser geographical concentration of natural gas production (when compared to oil), which in addition is less dependent on geopolitically unstable areas. However, as the IEA (WEO 2014) points out, gas has a low energy density, which limits the use of its theoretical potential for geographical diversification at reasonable cost. For example, although the supply of natural gas (LNG) by the USA would, in the medium and long term allow for a significant geographical diversification of the supplies (nowadays excessively concentrated in Russia), the cost of transporting and liquefying-gasification this resource would significantly reduce the competitiveness vs price of gas coming from the USA (with the price forecasts from WEO 2013 and IEA for this country) when compared to the prices that would be permitted for Russian gas, taking into account the cost of extracting it and transporting it through pipelines to Central and Eastern Europe. To a certain extent, this geographical conditioning also occurs in the opposite sense, given that the natural destination (in terms of cost) of the gas from Russia's western gas fields seems to be the European market too. This might well explain the apparently greater shielding of the EU-Russia gas relations despite the tense geopolitical scenario caused by the Ukraine crisis.

Planning of the infrastructures for transport, gasification and storage of natural gas under a European perspective is a major challenge in the EU's energy security policy. As is the case with electricity, the limited capacity of the gas connection infrastructures between the Iberian Peninsula and the rest of Europe is not only having an adverse effect on the efficiency of the European gas system, but also amounting to a serious obstruction to optimising this system from an energy security perspective. The limited interconnection capacity is rendering it impossible to make the most of Spain's gasification and storage infrastructure potential, as well as the potential of the gas-pipeline connections with North Africa. Once again in this case, the commitments of the Council Agreement 2014

and the Commission's recommendations seem to indicate a greater Community awareness about problems such as gas and electricity interconnections that have not only affected Spain negatively, but also the EU as a whole. The external aspect of transport infrastructure planning is also fraught with problems. Apart from the failed projects, there are also uncertainties affecting the southern corridor that the Commission is in favour of speeding up. It seems clear that a southern connection, to channel Russian gas through alternative routes and, above all, to channel gas from the Caspian Sea and the Middle East, would help to improve Europe's supply security. However, Turkey's political drift is causing further uncertainty regarding the optimum layouts for these connections.

Energy Equality and Geostrategy

This publication, "Energy and Geostrategy 2015", features a work by **C. Sallé** concerning the role of universal access to electricity in the fight against poverty, which highlights the importance of a factor like equality in an area where it does not appear to belong, such is energy geostrategy. The fight against poverty is a priority goal in the fight for equality and, undoubtedly, a more urgent task; this assertion could be regarded as an application of the Rawlsian principles[22] of justice, but it is also a response to the greater awareness of citizens in developed countries towards the phenomenon of poverty, which the current economic crisis has turned into an experience that is much "closer to home" for a considerable proportion of them. In fact, concern over "energy poverty" that is beginning to feature increasingly on the agendas of think tanks and multilateral organisations is not limited to developing countries but also includes social groups in the industrialised countries. However, as **C. Sallé** states, a distinction must be made between the concept of "energy poverty" and the one that describes the existence of technical and institutional barriers preventing access to energy (specifically to electricity,) regardless of the income level. "Energy poverty" is a manifestation of general poverty (an income level that is insufficient to guarantee basic needs) and this can occur in economies where there are no technical and institutional barriers preventing access to energy, which is generally the case in industrialised countries.

Deciding what the best instruments are for combating "energy poverty" is surrounded with controversy. It could be thought that the mechanisms for fighting it are included within the tools used for combating poverty in general: social allowances, minimum salary, unemployment subsidies, negative taxation, etc. Specific protection through the energy supply could also be considered however. This is the case, for example, in the requirement to protect "vulnerable consumers" contained in the European Directives for the domestic gas and electricity markets, and in the implementation of "social tariffs" or other ways of subsidising the fuel bills for the households with the lowest incomes. In this latter

[22] J. Rawls (1971). "A Theory of Justice (Rev. 1999). Harvard University Press.

case, it would be considered that there are minimum energy requirements (e.g. light, heating in extreme circumstances, etc.) that the public authorities must guarantee - as they do with food, health, basic education, or a decent home -, through the least distorting specific protection mechanism of efficient resource allocation.

The *universalisation* of access to electricity is considered mainly in countries with little economic development and a scattered rural population. What makes universal access difficult are the institutional, technological and demographical barriers rather than the low income level. Technological breakthroughs such as those associated with generation and distributed storage make it possible to deal with technical problems, but institutional barriers are more difficult to overcome. Private initiative might take on projects associated with the *universalisation* of access to electricity if they can be justified by being profitable to the companies concerned; such projects would probably be the most sustainable ones. However, it would appear to be difficult to make significant progress without resorting to initiatives receiving support beyond the market. In this sense, energy companies, bearing an important know-how when it comes to developing new technologies that are better adapted to the needs of groups who have no access to electricity, have a wide range of activity as part of their corporate responsibility policies. Furthermore, there are groups of professionals in the industrialised countries (e.g. retired technical experts) who can play a major role in performing these tasks and guaranteeing that the facilities are efficiently maintained, thereby overcoming one of the main problems affecting the long-term sustainability of this type of projects. Universal access to electricity also has the ability to magnify the beneficial effects on the welfare of scattered communities in developing countries (e.g. improving their access to water). Policies that support the *universalisation* of access to electricity are just one component of development aid policy, their contribution to any of this policy's strategic lines of action being undoubtedly positive, , however the numerous controversies that the different alternatives give rise to. Nevertheless, just as an efficient development aid policy is not only essential for attaining equality, but also a geopolitical stability factor, it is also true to say that a successful *universalisation* of energy (particularly electricity) supply policy in developing countries is more far-reaching than the scope linked to the need for a distributive law and must occupy a place in the reflection on energy Geostrategy.

Chapter I

Review and international prospects of nuclear power in 2014

Antonio Colino Martínez

Introduction

Every system for the supply of goods or services must be secure, economical and sustainable. This applies to the energy supply in general and to the electricity supply in particular.

The electricity supply system must consider all the primary energy options in the proportions that are most suitable for every country or geographical area.

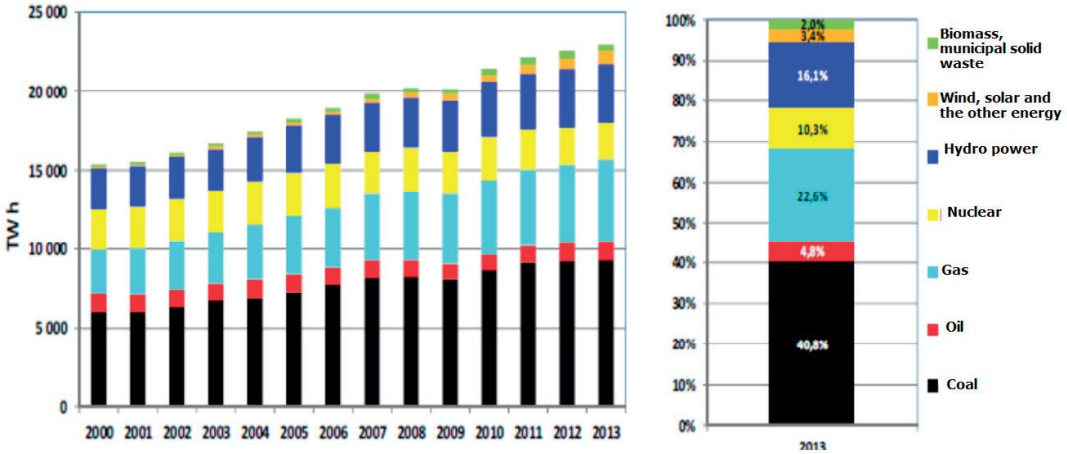


Figure 1. World electricity production.

The energy from the core is applied in a variety of areas of human activity, health, agriculture, livestock, water, food, industry and energy.

One of the main applications of nuclear energy is to generate electricity in nuclear plants, more than 10% of the world's total electricity being produced in those plants.

In recent years, the percentage of electricity produced in the developing countries has increased at a greater rate than the percentage produced in developed OECD countries. As a result, in 2014, the amount of electricity produced in the developing countries was the same as the amount generated in all OECD countries.

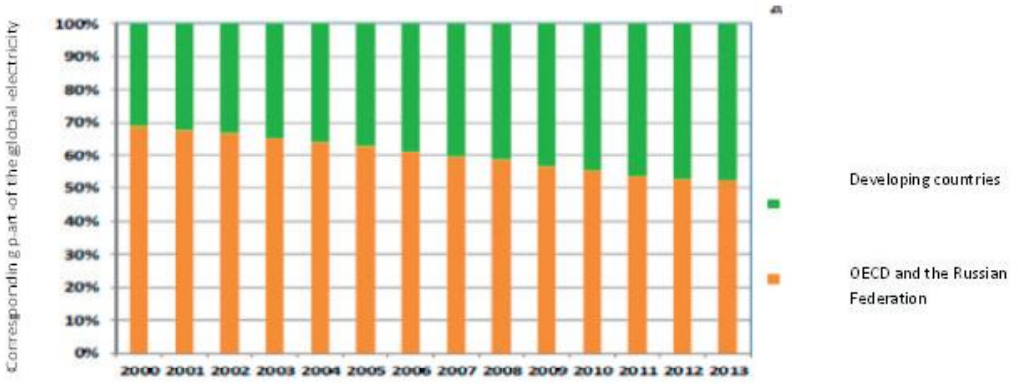


Figure 2. Electricity production by regions.

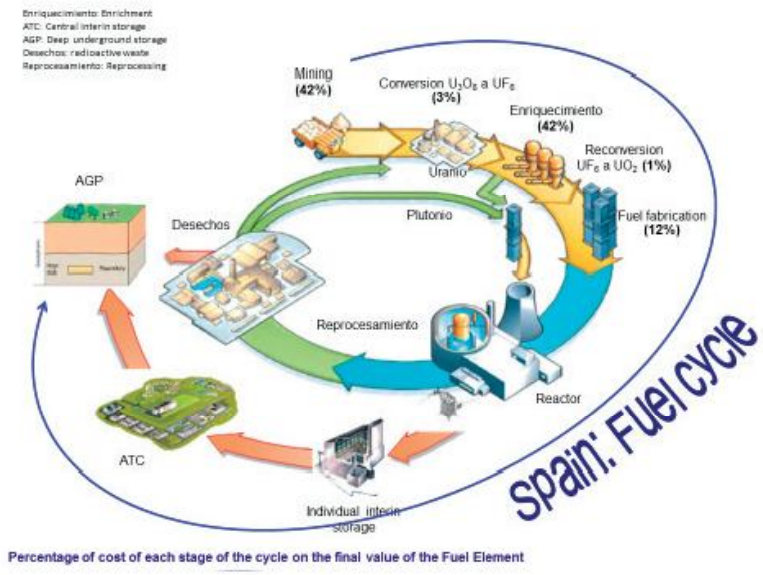


Figure 3. The nuclear fuel cycle. The cost % of each stage of the initial part of the cycle, out of the cost of the fuel element, is indicated.

Electricity generation by means of nuclear fuel takes place in three main stages:

- The initial part of the nuclear fuel cycle, i.e.: the uranium, from the mine until it enters the nuclear plant.
- Burning of the nuclear fuel in the plant reactor.
- Final part of the nuclear fuel cycle, from its departure from the plant until its final disposal.

Nuclear power plants

Electricity production in nuclear plants

The 435 nuclear plants in the world at the end of 2013 produced 2,363.9 Terawatts-hour (TWh), equivalent to more than 10% of the total electricity.

CAPACITY, NUCLEAR PRODUCTION, YIELD AND CONTRIBUTION TO THE TOTAL AMOUNT OF ELECTRICITY, BY WORLD COUNTRIES

	Num. of reactors	Net capacity (MW)	2013, Gross production (TWh)	D%	2013Load factor (*) (%)	Electricity from nuclear sources in 2013 (%)
Germany	9	12,068	92,1	-2,1	83,0	15,5
Argentina	2	935	5,7	-2,9	66,6	4,4
Armenia	1	375	2,2	1,9	62,6	29,2
Belgium	7	5,927	40,6	5,6	74,5	52,1
Brazil	2	1,884	14,6	-8,9	84,5	2,8
Bulgaria	2	1,906	13,3	-10,4	75,9	30,7
Canada	19	13,500	97,0	6,6	78,1	16,0
South Korea	23	20,710	132,5	-7,7	69,5	27,6
China	21	16,890	110,7	12,7	71,3	2,1
Slovakia	4	1,815	14,0	-3,2	83,6	51,7
Slovenia	1	688	5,0	-4,0	79,5	33,6
Spain	**7**	**7,121**	**56,7**	**-7,3**	**86,6**	**19,8**
United States	100	98,560	789,0	2,6	87,0	19,4
Finland	4	2,752	22,7	2,8	89,6	33,3
France	58	63,130	403,7	-0,3	69,5	73,3
Hungary	4	1,889	14,5	-2,7	83,6	50,7
India	21	5,308	30,3	2,1	62,0	3,5
Iran	1	915	1,3	0,0	15,7	0,5
Japan	48	42,388	13,9	-18,3	3,6	1,7
Mexico	2	1,330	11,4	35,2	92,9	4,6
Netherlands	1	482	2,7	-27,0	61,6	2,8
Pakistan	3	690	4,4	-16,7	69,2	4,4

CAPACITY, NUCLEAR PRODUCTION, YIELD AND CONTRIBUTION TO THE TOTAL AMOUNT OF ELECTRICITY, BY WORLD COUNTRIES

	Num. of reactors	Net capacity (MW)	2013, Gross production (TWh)	D%	2013Load factor (*) (%)	Electricity from nuclear sources in 2013 (%)
United Kingdom	16	9,231	64,1	0,3	75,5	18,3
Czech Republic	6	3,804	29,0	1,4	82,9	35,9
Rumania	2	1,300	10,7	-6,7	89,4	19,8
Russia	33	23,643	161,4	-2,5	74,2	17,6
South Africa	2	1,860	13,6	10,0	79,6	5,7
Sweden	10	9,474	63,7	3,7	73,1	39,1
Switzerland	5	3,308	24,9	1,7	81,7	36,4
Taiwan	6	5,032	40,1	3,1	86,6	19,1
Ukraine (*)	15	13,107	78,0	-8,0	64,7	43,6
TOTAL	**435**	**372,022**	**2,363.9**	**0,4**	**69,1**	**10,5**

Data on 31.12.2013.
(*) Compiled by the author, considering a Gross Capacity = 1,05 x Net Capacity
D % = Percentage change rate in production between the latter with respect to the former
Source: PRIS-IAEA, Nucleonics Week and compilation by the author

Figure 4. Capacity, nuclear production, yield and contribution to the total amount of electricity, by world countries.

Installed capacity at nuclear plants

There are 435 nuclear power reactors operating in 30 countries throughout the world, and 69 reactors under construction in 15 countries.

REACTORS IN OPERATION, UNDER CONSTRUCTION AND ANNOUNCED IN THE WORLD, BY COUNTRIES. (Data on 1st February 2014)

	In operation		Under construction		Planned(*)		Proposed(**)	
	No.	MWe(***)	No.	MWe	No.	MWe	No.	MWe
Germany	9	12,068	0	0	0	0	0	0
Saudi Arabia	0	0	0	0	0	0	16	17,000
Argentina	2	935	1	745	1	33	2	1,400
Armenia	1	375	0	0	1	1,060		
Bangladesh	0	0	0	0	2	2,000	0	0
Belgium	7	5,927	0	0	0	0	0	0
Belarus	0	0	1	1,200	1	1,200	2	2,400
Brazil	2	1,884	1	1,405	0	0	4	4,000
Bulgaria	2	1,906	0	0	1	950	0	0
Canada	19	13,500	0	0	2	1,500	3	3,800
North Korea	0	0	0	0	0	0	1	950
South Korea	23	20,710	5	6,870	6	8,730	0	0
Chile	0	0	0	0	0	0	4	4,400

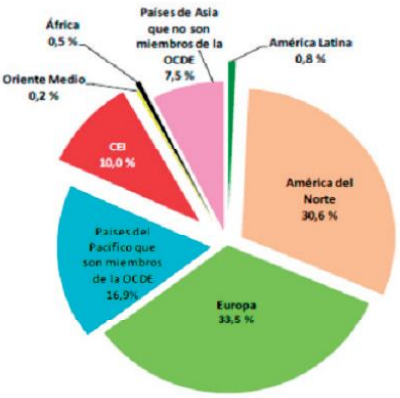
REACTORS IN OPERATION, UNDER CONSTRUCTION AND ANNOUNCED IN THE WORLD, BY COUNTRIES. (Data on 1st February 2014)

	In operation		Under construction		Planned(*)		Proposed(**)	
	No.	MWe(***)	No.	MWe	No.	MWe	No.	MWe
China	21	16,890	27	31,635	58	62,635	118	122,000
Egypt	0	0	0	0	1	1,000	1	1,000
U.A. Emirates	0	0	2	2,800	2	2,800	10	14,400
Slovakia	4	1,815	2	942	0	0	1	1,200
Slovenia	1	688	0	0	0	0	1	1,000
Spain	**7**	**7,121**	**0**	**0**	**0**	**0**	**0**	**0**
United States	100	98,560	5	6,018	7	8,463	15	24,000
Finland	4	2,752	1	1,700	0	0	2	2,700
France	58	63,130	1	1,720	1	1,720	1	1,100
Hungary	4	1,889	0	0	2	2,400	0	0
India	21	5,308	6	4,300	18	15,100	39	45,000
Indonesia	0	0	0	0	1	30	4	4,000
Iran	1	915	0	0	1	1,000	1	300
Israel	0	0	0	0	0	0	1	1,200
Italy	0	0	0	0	0	0	10	17,000
Japan	48	42,388	3	3,036	9	12,947	3	4,145
Jordan	0	0	0	0	1	1,000		
Kazakhstan	0	0	0	0	2	600	2	600
Lithuania	0	0	0	0	1	1,350	0	0
Malaysia	0	0	0	0	0	0	2	2,000
Mexico	2	1,330	0	0	0	0	2	2,000
Netherlands	1	482	0	0	0	0	1	1,000
Pakistan	3	690	2	680	0	0	2	2,000
Poland	0	0	0	0	6	6,000	0	0
United Kingdom	16	9,231	0	0	4	6,680	7	8,920
Czech Republic	6	3,804	0	0	2	2,400	1	1,200
Rumania	2	1,300	0	0	2	1,310	1	655
Russia	33	23,643	10	9,160	31	32,780	18	16,000
South Africa	2	1,860	0	0	0	0	6	9,600
Sweden	10	9,474	0	0	0	0	0	0
Switzerland	5	3,308	0	0	0	0	3	4,000
Thailand	0	0	0	0	0	0	5	5,000
Turkey	0	0	0	0	4	4,800	4	4,500
Ukraine	15	13,107	0	0	2	1,900	11	12,000
Vietnam	0	0	0	0	4	4,000	6	6,700
World	**435**	**372,022**	**69**	**74,911**	**173**	**186,388**	**310**	**349,170**

(*) Approved, firm commitments and financing (most would be operating in 8 to 10 years).
(**) There are specific programmes or proposals for sites (most would be operating in 15 years).
(***) Net capacity for plants "in operation" and Gross capacity for the rest
(****)The total includes 6 reactors in operation in Taiwan with a capacity of 4,927 MWe, and 2 under construction with 2,700MWe

Figure 5. Reactors in operation, under construction and announced in the world, by countries. (Data on 1st February 2014).

Units operating: 435 (372 GWe)



Units under construction: 69 (74.9 GWe)

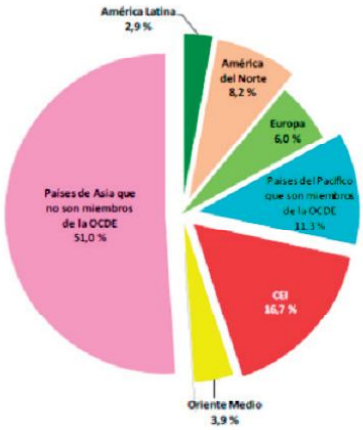


Figure 6. Nuclear power plants by regions.

Age of the world's nuclear plants

Many of the world's nuclear plants being more than 30 years old, authorisation and licensing are being applied for in many countries to enable them to operate for up to 60 years.

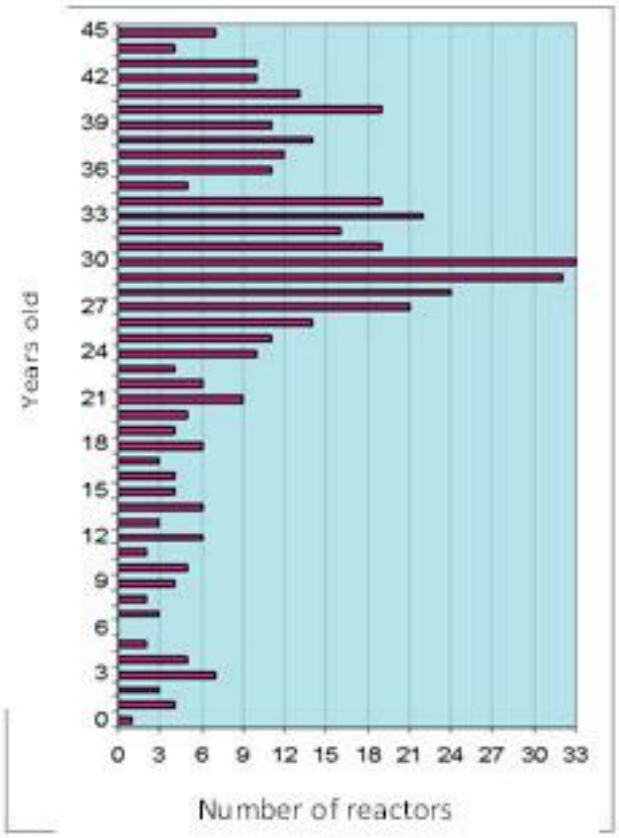


Figure 7. Nuclear reactors in the world grouped according to their age.

Types of reactors in nuclear plants

There are a variety of reactors types depending on their coolant, the moderator and the fuel.

TYPES OF REACTORS IN THE WORLD

REACTORS IN OPERATION AND UNDER CONSTRUCTION IN THE WORLD, ACCORDING TO TYPES

	Units	Total MWe
In operation		
BWR	81	75.773
FBR	2	580
GCR	15	8.040
LWGR	15	10.219
PHWR	48	23.900
PWR	274	253.510
Total	**435**	**372.022**
Under construction		
BWR	4	3.925
FBR	2	1.259
HTGR	1	200
PHWR	5	3.212
PWR	57	66.315
Total	**69**	**74.911**

BWR: Boiling Water Reactor
FBR: Fast Breeder Reactor
GCR: Gas-Cooled Reactor
LWGR (RBMK): Light-Water Graphite Reactor
PHWR: Pressurised Heavy-Water Reactor
PWR: Pressurised Water Reactor
Source: IAEA (PRIS Database, 14th March 2014)

Figure 8. Types of reactors in the world.

MAIN CHARACTERISTICS OF NUCLEAR REACTORS

REACTOR GROUPS	TYPE	COOLANT		MODERA-TOR	FUEL
Graphite-Gas	AGR MGUNGG HTR (GT-MHR, PBMR)	CO2 CO2 He	Advanced Gas Cooled Magnox Gas Cooled High tempe-rature	Graphite	Enriched UO2 Natural U. UO2, UC2, ThO2
				Graphite	
				Graphite	
Heavy water	PHWR	Heavy water	Pressurised	Heavy water	Natural or enriched UO2
Ordinary water	BWR (ABWR) PWR (APWR, WWER)	Ordinary water	Boiling	Ordinary water	Enriched UO2, or enriched UO2 and MOX
		Ordinary water	Pressurised	Ordinary water	
Rapid Neutrons	SUPERGENERA-TOR	Sodium			Enriched UO2 - PuO2
Water-Graphite	RBMK (LWGR)	Ordinary water	Boiling	Graphite	Enriched UO2
Ordinary Water - Heavy Water	HWLWR (ATR)	Ordinary water	Boiling	Heavy water	Enriched UO2 - PuO2

ABWR, APWR, GT-MHR, PBMR: these are the advanced models for the reactor type concerned
Source: ELECNUC ed. 2013 (CEA)

Figure 9. Main characteristics of nuclear reactors.

Security in the electricity supply

The electricity supply must be secure at all three stages of the nuclear fuel cycle, i.e. burning of the fuel, initial part of the cycle and final part of the cycle.

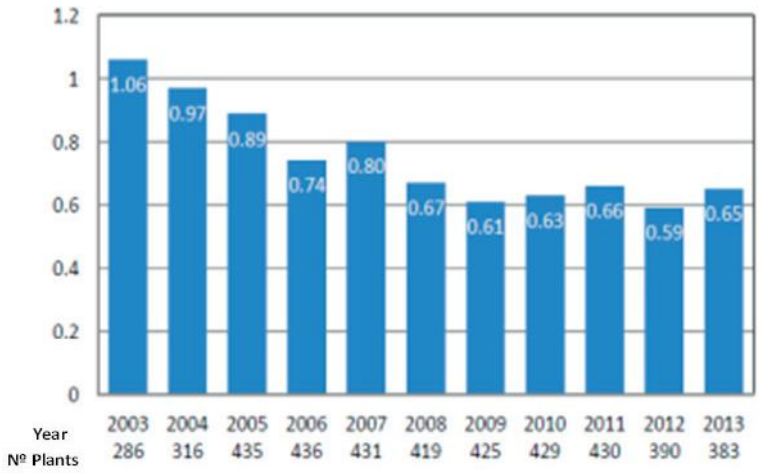


Figure 10. Number of shutdowns per 7,000 hours of operation.

Nuclear plant operational safety

The way nuclear plants operate has been improved and the number of unscheduled shutdowns has decreased throughout the years, which has led to an increase in electricity production, the load factor and their general efficiency.

The nuclear fuel cycle

Initial part of the nuclear fuel cycle

There are several stages in the initial part of the nuclear fuel cycle that are carried out by multinationals in different parts of the world; the mining, the uranium concentrate, the uranium hexafluoride conversion, the enrichment, reconversion to uranium oxide and manufacturing before inserting it into the reactors at the nuclear plants.

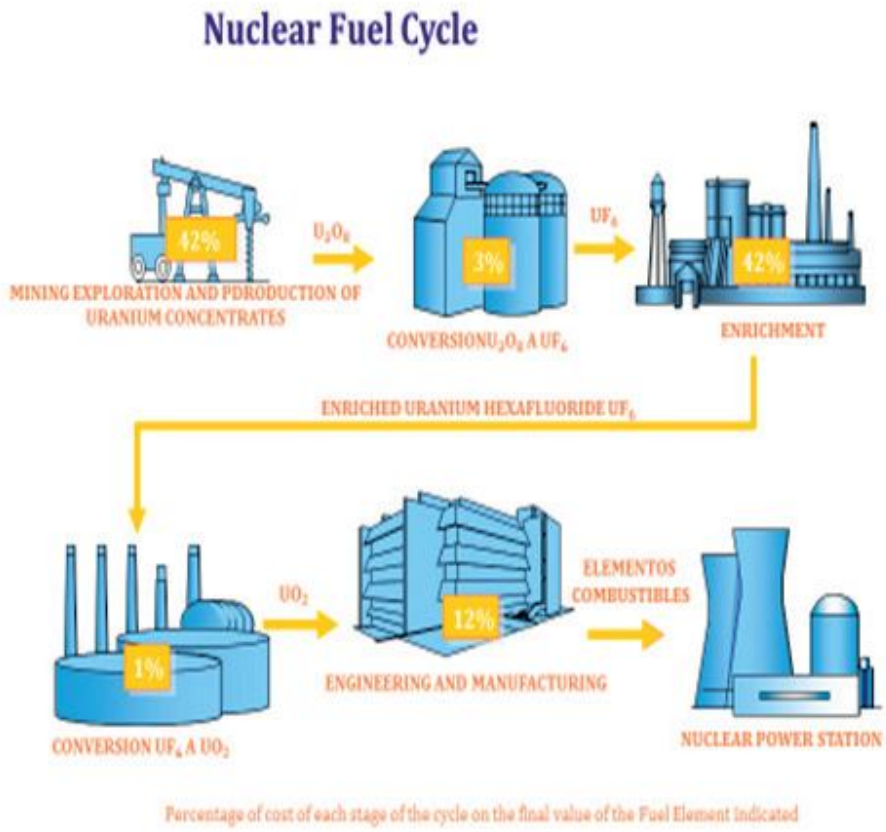


Figure 11. Initial part of the nuclear fuel cycle.

WORLD URANIUM PRODUCTION

U tonnes	Until 2008	2008	2009	2010	Until 2010	Predictions 2011
Germany(b)	219,517	0(c)	0(c)	8(c)	219,525	80(c)
Argentina	2,582	0	0	0	2,582	0
Australia	147,996	8,433	7,934	5,918	170,281	7,300
Belgium	686	0	0	0	686	0
Brazil	2,509	330	347	148	3,334	360
Bulgaria	16,361	1(c)	1(c)	1(c)	16,364	1(c)
Canada	417,670	9,000	10,174	9,775	446,619	8,600
Rep. Congo	25,600*	0	0	0	25,600	0
China	30,629*	770*	1,200	1,350	33,949	1,500
Slovakia	211	0	0	0	211	0
Slovenia	382	0	0	0	382	0
Spain	**5,028**	**0**	**0**	**0**	**5,028**	**0**
United States	362,148	1,492	1,594	1,630	366,864	1,555*
Finland	30	0	0	0	30	0
France	75,980	5(c)	8(c)	9(c)	76,002	5*(c)
Gabon	25,403	0	0	0	25,403	
Hungary	21,051	1(c)	1(c)	6(c)	21,059	2(c)
India(*)	8,903	250*	290*	400*	9,843	400*
Iran	11	6	8	7	32	9
Japan	84	0	0	0	84	0
Kazakhstan	118,388	8,512	14,020	17,803	158,723	19,968
Madagascar	785	0	0	0	785	0
Malawi	0	0	90	681	771	850
Mexico	49	0	0	0	49	0
Mongolia	535	0	0	0	535	0
Namibia	91,098	4,365*	4,626*	4,503*	104,592*	3,781*
Niger	103,911	2,993	3,245	4,197	114,346	4,264
Pakistan(*)	1,119	45	50	45	1,259	45
Poland	650	0	0	0	650	0
Portugal	3,720	0	0	0	3,720	0
Czech Rep.(a)	110,152	275	258	254	110,939	226
Rumania	18,339	80*	80*	80*	18,579*	80*
Russia	136,214	3,521	3,565	3,562	146,862	3,364
South Africa	155,679	566	563	582	157,390	615*
Sweden	200	0	0	0	200	0
Ukraine	123,557	830	815	837	126,039*	875
USSR(d)	102,886	0	0	0	102,886	0
Uzbekistan	110,077	2,283	2,657	2,874	117,891	3,350
Zambia(e)	86	0	0	0	86	0
Total	**2,440,226**	**43,758**	**51,526**	**54,670**	**2,590,180**	**57,230**

(*) Secretariat's estimate.
(a) Including 102,241 Ut coming from the former Czechoslovakia and CSFR from 1946 until the end of 1992.
(b) Including 213,380 Ut from GDR until the end of 1989.
(c) Coming exclusively from mine reconditioning.
(d) Including the production from the former S.S. Republics of Estonia, Kirghizstan, Tajikistan and Uzbekistan.
(e) Correction based on a recalculation of 102 tons of U_3O_8 as Uranium.
Source: Uranium «Red Book» 2011, Resources, Production and Demand (N.E.A.).

Figure 12. World uranium production.

URANIUM RESERVES, BROKEN DOWN INTO COUNTRIES AND COST RANGE

U tonnes	<US$ 40/Kg U	<US$ 80/Kg U	<US$ 130/Kg U	<US$ 260/Kg U
Germany (b, c)	0	0	0	3,000
Algeria (b,c)	0	0		19,500
Argentina	0	5,000	8,600	8,600
Australia	0	961,500	1,158,000	1,180,100
Botswana*	0	0	0	23,100
Brazil	137,900	155,700	155,700	155,700
Canada	237,900	292,500	319,700	421,900
Congo Rep.(a, b, c)	0*	0*	0*	1,400*
Czechoslovakia	0	0	300	300
Chile(d)	0	0	0	700
China(c)	45,800	88,500	109,500	109,500
Slovakia (c)	0	0	0	0
Slovenia (a, b, c)	0	1,700	1,700	1,700
Spain	**0**	**0**	**0**	**14,000**
United States	0	39,100	207,400	472,100
Finland(b, c)	0	0	1,100	1,100
France	0	0	0	11,500
Gabon (a, b)	0	0	4,800	4,800
Greece (a, b)	0*	0*	0*	1,000
India (c,d)	0	0	0	77,000
Indonesia (c)	0	2,000	8,400	8,400
Iran	0	0	700	700
Italy (a, b)	0	0	4,800	4,800
Japan (b)	0	0	6,600	6,600
Jordan (c)	0	0	0	0
Kazakhstan (c)	17,400	244,900	319,900	402,400
Malawi*	0	0	10,000	11,300
Mexico (c)	0	0	2,800	2,800
Mongolia (c)	0	0	30,600	30,600
Namibia*	0*	5,900*	234,900*	362,600*
Niger*	5,500*	5,500*	339,000*	340,600*
Peru (c)	0	1,300	1,300	1,300
Portugal (a, b)	0	4,500	6,000	6,000
Central African Rep. (a,b,c)	0	0	12,000	12,000
Rumania (a, b)	0	0	3,100	3,100
Russia	0	11,800	172,900	218,300
Somalia (a, b, c)	0*	0*	0*	5,000*
South Africa *	0	96,400	144,600	192,900
Sweden*	0	0	4,000	5,000
Tanzania*	0	0	28,700	30,100*
Turkey (b, c)	0	7,300	7,300	7,300
Ukraine	2,800	44,600	86,800	143,300
Uzbekistan	46,600	46,600	64,300	64,300
Vietnam (a, b, c)	0	0	0	1,000
Zambia*				9,900
Zimbabwe (a, b, c)	0	0	0*	1,400
TOTAL	**493,900**	**2,014,800**	**3,455,500**	**4,378,700**

(1) Reserves «fairly well guaranteed» in tonnes of uranium on 1st January 2011, rounded off into hundreds.

* Secretariat's estimate.

(a) Data were not published in 2011. The data shown are based on the previous «Red Book».

(b) No assessment made in the last 5 years.

(c) Data adjusted and corrected by the Secretariat.

(d) For the lack of data, the resources are allocated to the section "less than $260".

(e) The totals that appear up to $ 40 and up to $ 80 are actually higher, because there are countries that do not give resources data at low prices, mainly as a matter of confidentiality

Source: Uranium «Red Book» 2011, Resources, Production and Demand (NEA).

Figure 13. Uranium reserves, broken down into countries and cost range.

ESTIMATE OF WORLD URANIUM DEMAND UNTIL 2035

Utonnes (**)	2011	2015	<US$ 130/Kg U	<US$ 260/Kg U
		Low	0	3,000
Germany	2,110*	1,890*		19,500
Saudi Arabia	0	0	8,600	8,600
Algeria*	0	0	1,158,000	1,180,100
Argentina	120	265	0	23,100
Armenia	65	65	155,700	155,700
Bangladesh*	0	0	319,700	421,900
Belgium	1,080	730	0*	1,400*
Belarus*	0	0	300	300
Brazil	450	450	0	700
Bulgaria*	270	335	109,500	109,500
Canada	1,600	1,750	0	0
Rep. South Korea+	4,400	5,100	1,700	1,700
China(a)	4,150	4,600	**0**	**14,000**
Egypt*	0	0	207,400	472,100
United Arab Emirates*	0	0	1,100	1,100
Slovakia	390	505	0	11,500
Slovenia+	170*	0	4,800	4,800
Spain	**1,320**	**1,350**	0*	1,000
United States	19,995	20,930	0	77,000
Finland	510*	700	8,400	8,400
France	8,000	7,500	700	700
Hungary	435	435	4,800	4,800
India	925*	1,600	6,600	6,600
Indonesia*	0	0	0	0
Iran	160*	160	319,900	402,400
Italy	0	0	10,000	11,300
Japan	6,400*	7,040*	2,800	2,800
Jordan*	0	0	30,600	30,600
Kazakhstan	0	0	234,900*	362,600*
Lithuania*	0	0	339,000*	340,600*
Malaysia*	0	0	1,300	1,300
Morocco*	0	0	6,000	6,000
Mexico+	410*	420	12,000	12,000
Netherlands+	60	60	3,100	3,100
Pakistan*	80	105	172,900	218,300
Poland*	0	0	0*	5,000*
United Kingdom	1,000	1,040	144,600	192,900
Czech Rep.	840	650	4,000	5,000
Rumania*	190	190	28,700	30,100*
Russia	4,500	5,800	7,300	7,300
South Africa	290	290	86,800	143,300
Sweden+	1,645	1,900*	64,300	64,300

ESTIMATE OF WORLD URANIUM DEMAND UNTIL 2035

Utonnes (**)	2011	2015	<US$ 130/Kg U	<US$ 260/Kg U
Switzerland	235	225	0	1,000
Thailand	0	0		9,900
Turkey*	0	0	0*	1,400
Ukraine	2,480	2,480	**3,455,500**	**4,378,700**
Vietnam*				
TOTAL WORLD		**65,180**		

*Secretariat's estimate until 2030, based on data from the IAEA (Vienna) in August 2011. From 2030 to 2035, based on trends and Government plans and intentions, when they have been available.

When they have not specified the U demand in the questionnaire, the figure is assumed to be 175 Ut/GWe per year.

(**) Ut rounded off into multiples of 5.

(+) Data obtained from "Nuclear Energy Data" (NEA, Paris 2009).

(a) The following data for Taiwan are included in the World total, but not in the totals for China: 900 Ut/Year in 2011, 1325 in high and low in 2015; 1115 and 1325 in low and high respectively for 2020; 615 and 1325 in low and high respectively for 2025; and 455 and 775 in low and high respectively for 2035.

Figure 14. Estimate of world uranium demand until 2035.

THEORETICAL WORLD URANIUM PRODUCTION CAPACITY UNTIL 2035

U tonnes/ Year (1)	2011		2015		2020		2025		2035	
	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II
Argentina	120	120*	150	150*	150	250	500*	500*	500*	500*
Australia	9.700	9.700	10.100	16.600	10.100	24.200	10.100	27.900	9.800	27.600
Brazil	340	340	1.600	1.600	2.000	2.000	2.000	2.000	2.000*	2.000*
Canada	16.430	16.430	17.730	17.730	17.730	19.000	17.730	19.000	17.730	19.000
China*	1.500	1.600	1.800	2.000	1.800	2.000	1.800	2.000	1.800	2.000*
United States(b)	2.040*	2.040*	3.400	6.100	3.800	6.600	3.700	6.500	3.100*	5.600*
Finland(**)	0	0	0	350	0	350	0	350	0	350
India*	295	980	980	980	980	1.200	1.000	1.600	1.000	2.000
Iran	70	70	90	90	100*	100*	100*	100*	100*	100*
Jordan*	0	0	0	0	2.000	2.000	2.000	2.000	2.000	2.000
Kazakhstan	22.000	22.000	24.000	25.000	24.000	25.000	14.000	15.000	5.000	6.000
Malawi*	0	1.000	1.270	1.270	1.425	2.525	0	0	0	0
Mongolia*	0	0	0	500	150	1.000	150	1.000	150	1.000
Namibia*	5.350	5.350	7.600	13.400	9.450	19.250	5.450	15.250	1.600	10.050
Niger*	5.400	5.400	5.500	10.500	5.500	10.500	5.500	10.500	2.500	7.500
Pakistan(a)	70	70	70	110	140	150	140	140	140	650
Czech Rep.	500	500	50	50	50	50	50	50	30	30
Rumania(a)	230	230	230	230	350	475	350	475	350	630
Russia	3.360	3.360	4.480	4.790	5.840	6.610	6.410	7.270	5.450	10.450

THEORETICAL WORLD URANIUM PRODUCTION CAPACITY UNTIL 2035

U tonnes/ Year (1)	2011		2015		2020		2025		2035	
	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II
South Africa*	1.050	1.050	1.588	2.360	2.686	3.460	2.795	3.565	1.381	2.150
Ukraine*	1.500	1.500	2.700	2.700	2.700	2.700	5.200	5.200	5.200	5.200
Uzbekistan	3.350	3.350	4.150	4.150	4.500	4.500	5.000	5.000	5.000*	5.000*
Total	**73.305**	**75.090**	**87.488**	**110.310**	**95.451**	**133.570**	**83.975**	**125.050**	**64.831**	**109.460**

(1) Taken from "RAR" and "estimates" recoverable resources at a cost lower than 130$/kgU with the exceptions quoted .
"RAR": Reasonable assured reserves. "estimates": translation of "inferred"
A-II: Production capacity at existing centres committed to go into operation, based on "RAR" and "estimated" type recoverable resources at < $130/kgU
B-II: Production capacity at existing centres, committed centres, planned centres and probable centres, based on "RAR" and "estimated" type recoverable resources at < $130/kgU
* Secretariat's estimate
(**) A by-product of nickel production
(a) Projections based on the plans submitted to supply their internal needs, which will require the identification of further resources.
(b) Data from the previous Red Book.
Source: Uranium "Red Book" 2011, Resources, Production and Demand (NEA).

Figure 15. Theoretical world uranium production capacity until 2035.

URANIUM ENRICHMENT NOMINALCAPACITY

kTSU / Year (**)	COMPANIES	2010	2015	2020
France	Areva, Georges Besse I&II	2.500	7.000	8.200
Germany+Netherlands+United Kingdom	Urenco: Gronau, Almelo			
	Capenhurst	12.800	14	16
Japan	JNFL, Rokkaasho	150	150	1.500
USA	USEC, Paducah & Piketon	5.000(*)	3.800	3.800
USA	Urenco, New Mexico	2.000	5.700	5.700
USA	Areva, IdahoFalls	0	1.500	3.300(*)
USA	Global Laser Enrichment	0	1.000(*)	3.000(*)
Russia	Tenex: Angarsk, Novouralsk, Zelenogorsk, Seversk	25	30	37
China	CNNC, Hanzhun & Lanzhou	1.500	3.000	8.000
Pakistan, Brazil, Iran		100	500	1.000(*)
Total		**49.000**	**65.000**	**87.200**

(*) Estimate value
(**) TSU: Technical Separation Units. Measurement of the energy consumed in splitting the uranium into two parts, one enriched and the other impoverished in the fissile isotope uranium-235. The number of TSUs is proportional to the degree of enrichment required
Source: WNA 2013 (cited by CEA. Mémento sur l'énergie 2013)

Figure: 16. Uranium enrichment nominal capacity.

Uranium reserves are distributed throughout the world in countries on different continents and belonging to different political blocks. These reserves, under present conditions can supply the nuclear power plants for about one hundred and twenty years, so uranium supply is more secure than the supply of other energy resources and the cost of this uranium mineral is only a small fraction of the total cost of nuclear fuel.

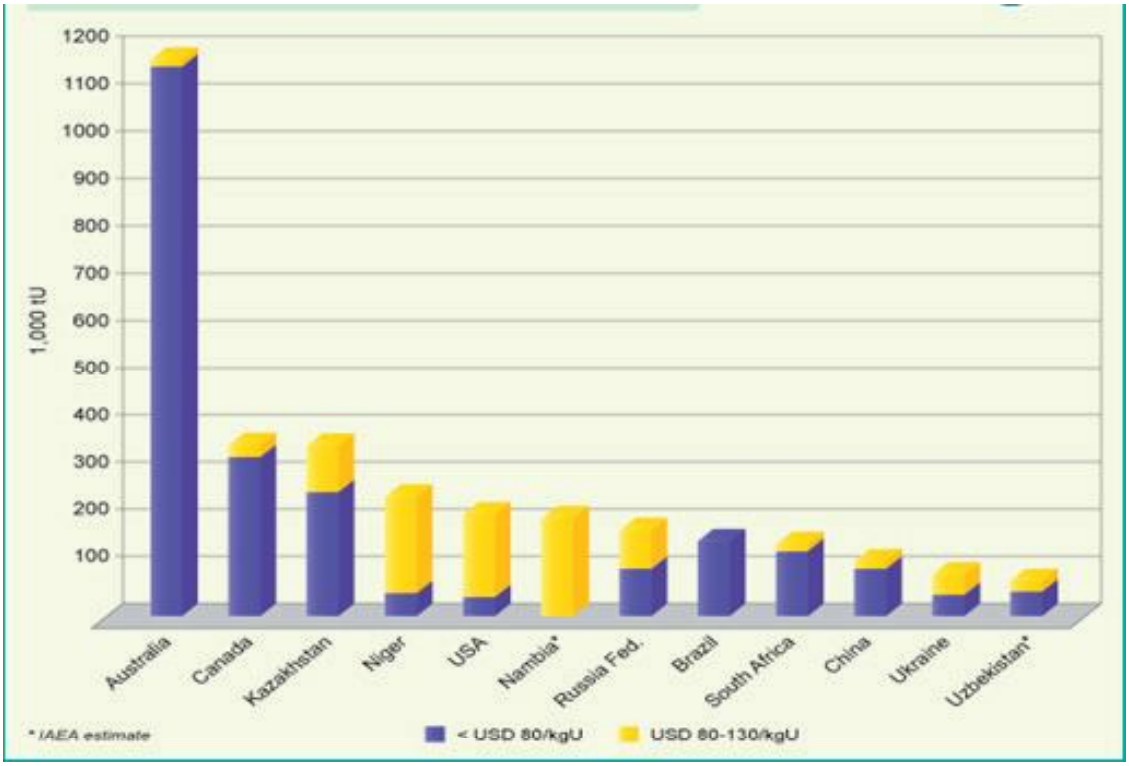


Figure 17. Uranium reserves by country.

Security at the final part of the nuclear fuel cycle

The use of nuclear energy in its many applications, health, agriculture, livestock, water, food, industry and energy, generates radioactive waste whose activity level is classified as very low, low, average and high.

The high activity waste is produced inside the nuclear reactor, when burning the uranium fuel to generate electricity.

The amounts of radioactive waste that will be generated in Spain with the current facilities, in the different nuclear energy applications, vary greatly in volume, thus the high activity waste will be 12,000 m^3, the average and low activity waste would be 200,000 m^3, about sixteen times higher. Furthermore, Spain produces approximately 580,000,000 m^3 of industrial waste, about 6,400 times higher.

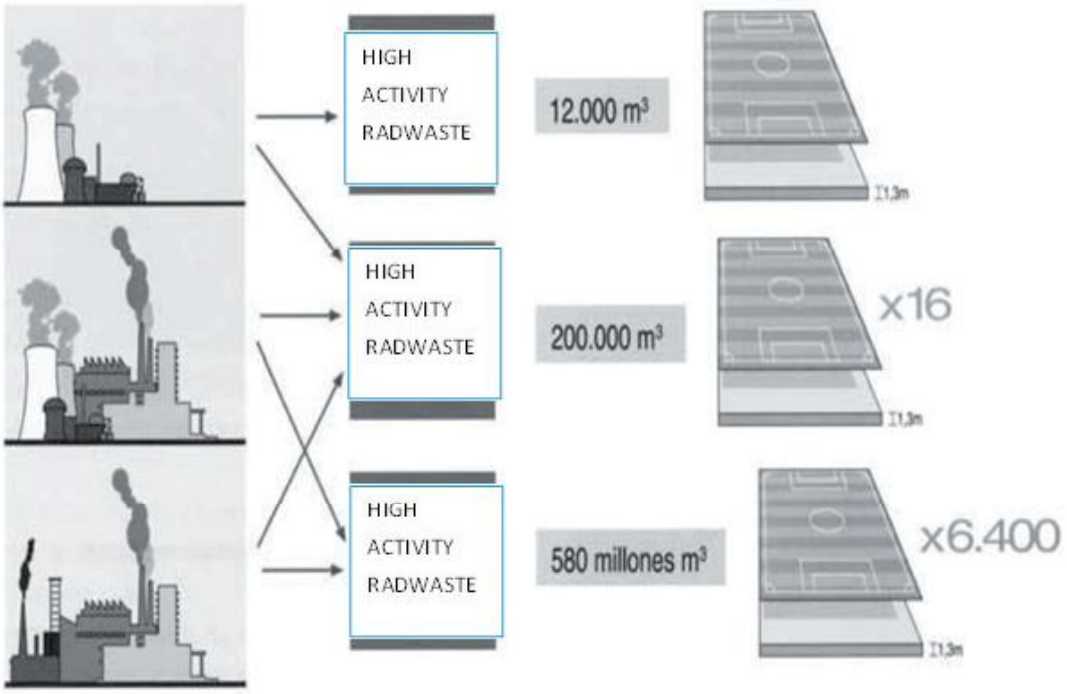


Figure 18. Comparison between amounts of radioactive and industrial waste in Spain.

Figure 19. The final part of the nuclear fuel cycle.

WORLD INVENTORY OF RADIOACTIVE WASTE FOR 2013

Waste Type	Storage, Processing and Treatment (cubic metres)	Finally Disposed off (cubic metres)
Waste with very low activity	163.000	193.000
Waste with low activity	56.663.000	64.992.000
Waste with average activity	8.734.000	10.588.000
Waste with high activity	2.744.000	72.000

Figure 20. World inventory of radioactive waste for 2013.

FACILITIES FOR VERY LOW, LOW AND MEDIUM ACTIVITY WASTE

COUNTRY	*FACILITY*	*TYPE*	*STATUS*
Germany	*Morsleben*	*Deep*	*Closed down*
	Konrad	*Deep*	*Under licencing*
Slovakia	*Mochovce*	*Surface*	*Operating*
Spain	***El Cabril***	***Surface***	***Operating***
United States	*Clive/Richland/ Barnwell/Andrews*	*Surface*	*Operating*
	Hanford/Fernald/Idaho Nat. Lab/Los Alamos Nat. Lab		
	Nevada Test Site/Oak Ridge/Savannah River	*Surface*	*DOE Operation*
	Beatty/Maxey flats/Sheffield/ West Valley	*Surface*	*Closed down*
Finland	*Olkiluoto*	*Cavern*	*Operating*
	Loviisa	*Cavern*	*Operating*
France	*La Manche*	*Surface*	*Closed down*
	L'Aube	*Surface*	*Operating*
Hungary	*Puspokszilagy*	*Surface*	*Operating*
	Bataapati	*Cavern*	*Operating*
Japan	*Rokkasho Mura*	*Surface*	*Operating*
United Kingdom	*Dounreay*	*Surface*	*Operating*
	Drigg	*Surface*	*Operating*
Czech Republic	*Dukovany*	*Surface*	*Operating*
	Richard	*Cavern*	*Operating*
	Bratrstvi	*Cavern*	*Operating*
Sweden	*Forsmark (SFR)*	*Cavern*	*Operating*

Figure 21. Facilities for very low, low and medium activity waste.

CENTRALISED TEMPORARY STORAGE FACILITIES WORLDWIDE FOR HIGH ACTIVITY WASTE AND SPENT FUEL

Country	Facility	Technology	Material stored
Germany	Ahaus Gorleben	Metal containers Metal containers	Spent Fuel Spent Fuel and glass
Belgium	Dessel	Vault	Glass
Spain	ATC (**)	Vault	Spent Fuel and glass
Russian Federation	Mayak (*) Krasnoyarsk (*)	Pond Pond	Spent Fuel Spent Fuel
France	The Hague (*) The Hague (*) CASCAD	Pond Vault Vault	Spent Fuel Glass Glass
Netherlands	Habog	Vault	Spent Fuel and glass
Japan	Rokkasho Rokkasho	Pond Pond	Spent Fuel Glass
United Kingdom	Sellafield (*) Sellafield (*)	Pond Vault	Spent Fuel Glass
Sweden	CLAB	Pond	Spent Fuel
Switzerland	Zwilag	Metal containers	Spent Fuel and glass

Figure 22. Centralised temporary storage facilities worldwide for high activity waste and spent fuel.

Economics of nuclear energy

In 2010, the Organisation for Economic Cooperation and Development (OECD), published a survey concerning the cost of generating electricity, the results of which are summarised in the following table. The table shows the average costs of generation throughout the working life of the power plant, including capital costs, operating costs and fuel costs.

Technology	region or country	At 10% discount rate	At 5% discount rate
Nuclear	OECD Europe	8,3-13,7	5,0-8,2
	China	4,4-5,5	3,0-3,6
Black coal with CCS	OECD Europe	11,0	8,5
Brown coal with CCS	OECD Europe	9,5-14,3	6,8-9,3
CCGT with CCS	OECD Europe	11,8	9,8
Large hydro-electric	OECD Europe	14,0-45,9	7,4-23,1
	China: 3 Gorges	5,2	2,9
	China: other	2,3-3,3	1,2-1,7
Onshore wind	OECD Europe	12,2-23,0	9,0-14,6
	China	7,2-12,6	5,1-8,9
Offshore wind	OECD Europe	18,7-26,1	13,8-18,8
Solar photovoltaic	OECD Europe	38,8-61,6	28,7-41,0
	China	18,7-28,3	12,3-18,6

Figure 23. Costs of generating electricity (US cents/kWh).

The cost of nuclear energy is competitive with other ways of generating electricity, except in cases where there is access to fossil fuels at a very low cost.

In a survey conducted by OECD in June 2013, based on the following parameters, the cost came to 0.66 cents of a dollar per KWh.

Uranium:	8.9 kg U_3O_8 x $130	US$ 1160
Conversion:	7.5 kg U x $11	US$ 83
Enrichment:	7.3 SWU x $120	US$ 880
Fuel fabrication:	per kg	US$ 240
Total, approx:		US$ 2360

Figure 24. Costs of the various stages at the initial part of the nuclear fuel cycle.

The cost of nuclear fuel accounts for a relatively low percentage of the total cost of the KWh.

Furthermore, the survey published in 2013 by the Nuclear Energy Institute, analysed the operating, maintenance and fuel costs for different primary energy sources, finding nuclear energy to be highly competitive.

Another survey published in Finland in 2003 shows the comparative costs of the various primary energy sources, and the breakdown in terms of capital cost, O&M cost, fuel cost and the cost of CO_2 emission.

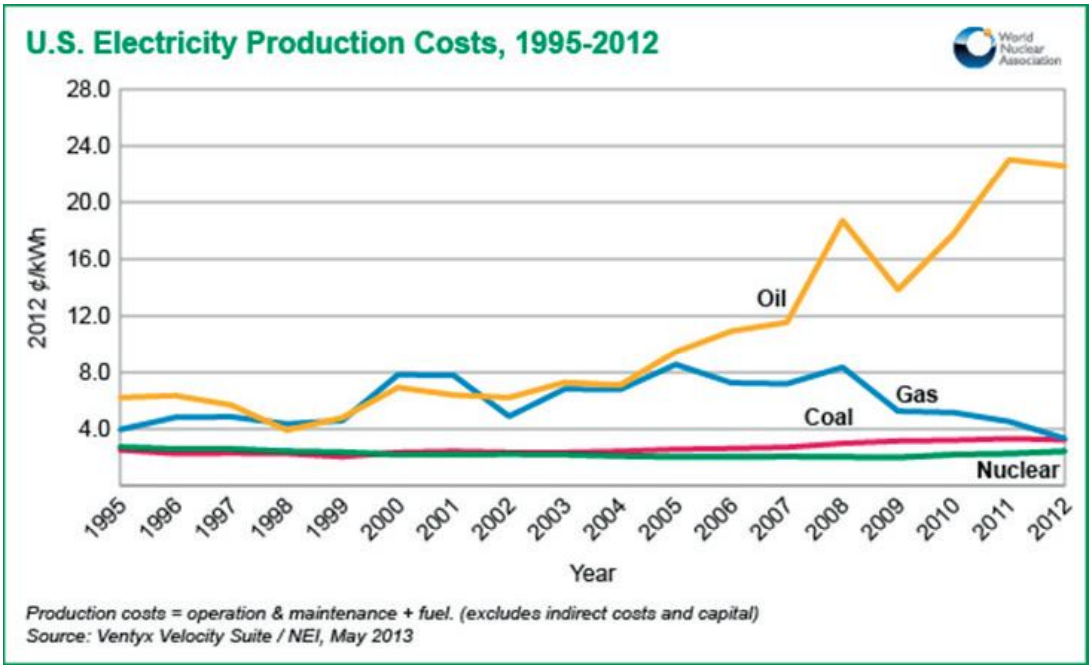


Figure 25. Cost of Generating Electricity with different primary energy sources.

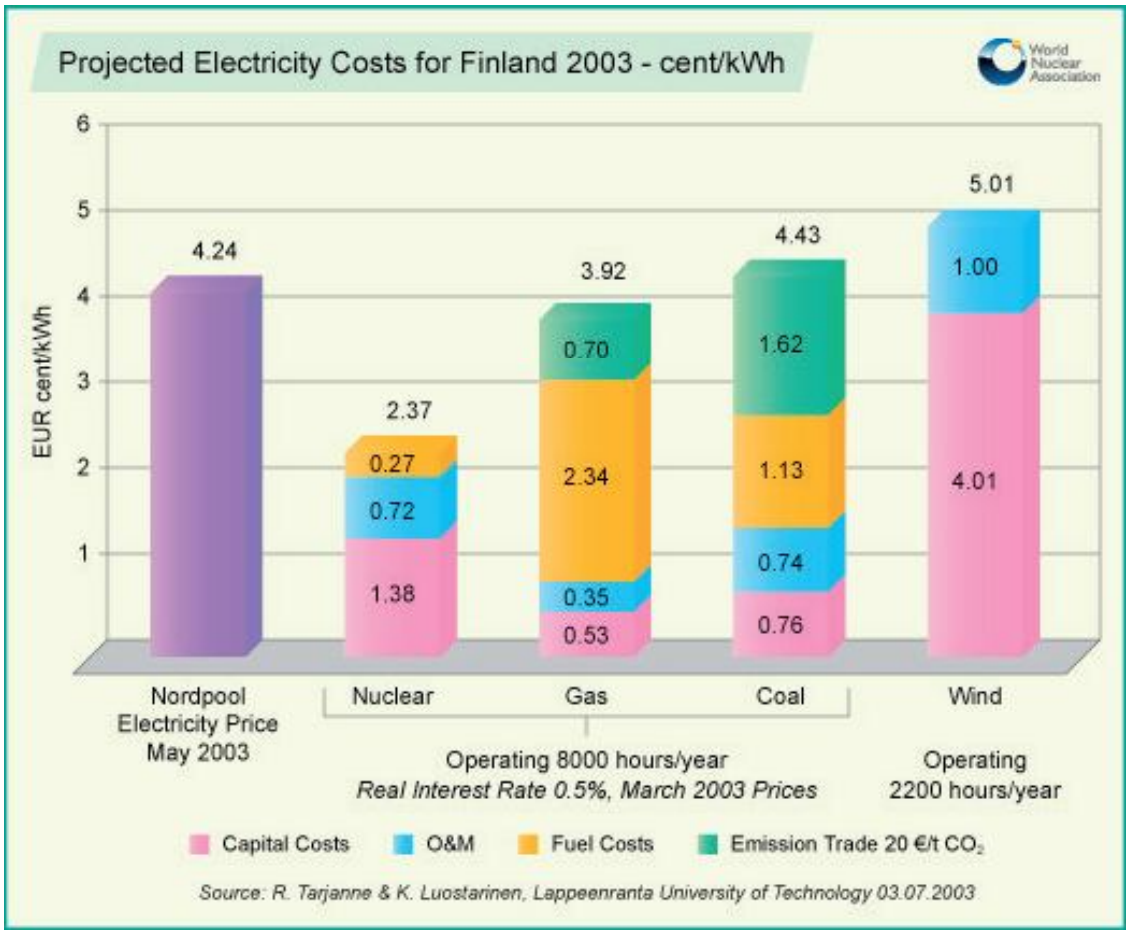


Figure 26. Projected electricity costs for Finland 2003 – cent/kWh.

Nuclear energy sustainability

Nuclear energy features a very low level of greenhouse gas emission per kWh generated, the average values emitted by light water nuclear reactors being estimated to be 14.9 gr of CO_2, including the emissions throughout the working life of the plant, as well as during the uranium mining and the management of radioactive waste. The equivalent emission for coal-fired power stations is set around 1,200 gr of CO_2, while the emission from gas-fired power plants is 650 gr of CO_2 per kWh.

In view of the greater efficiency of the uranium enrichment process, the new fuel types and the longer working life of reactors, it will be possible to reduce the emissions of greenhouse gases still further in the nuclear plants of the future.

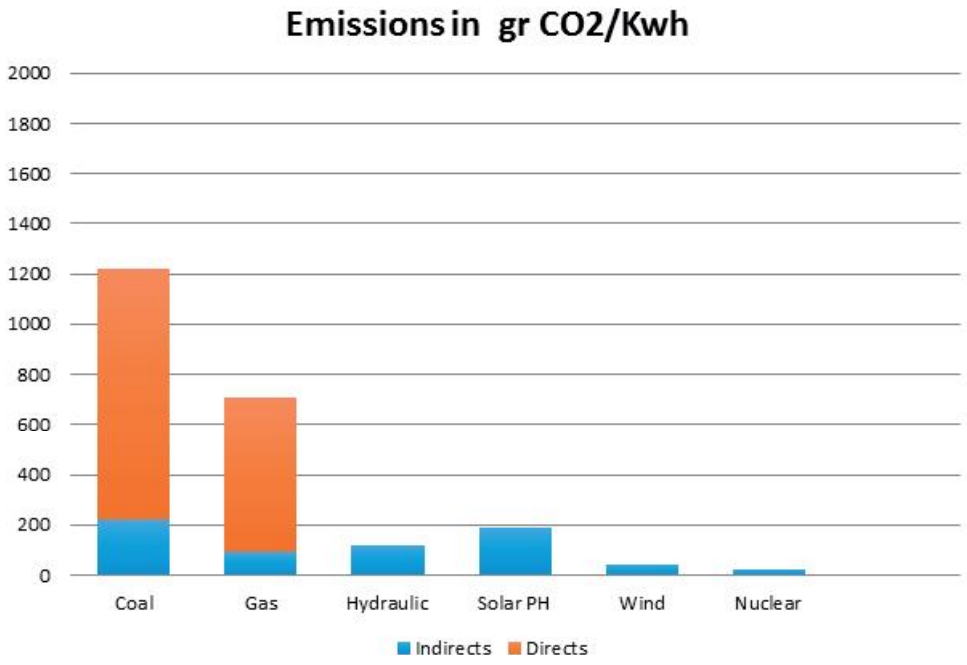
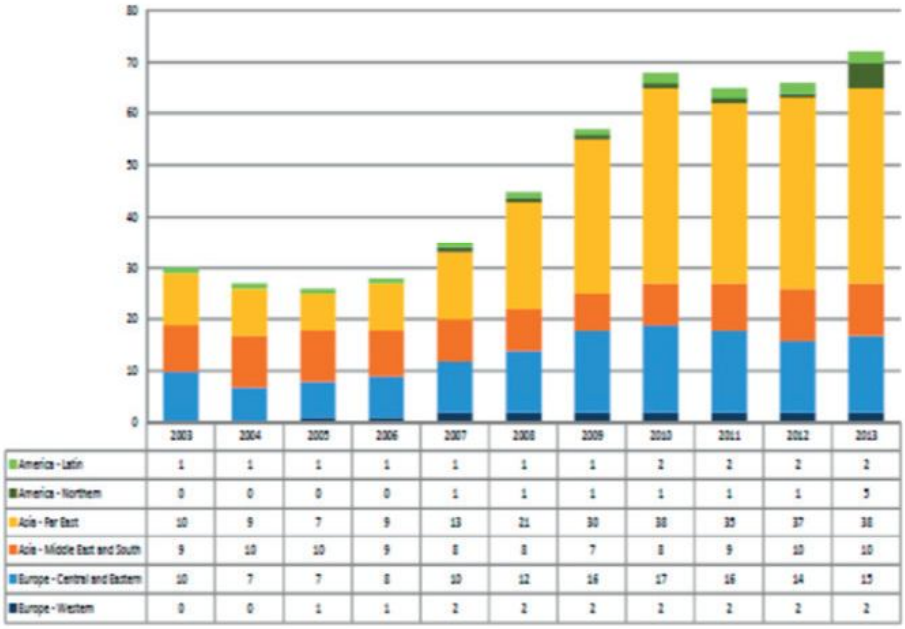


Figure 27. Emissions in gr CO2/Kwh, by energy source.

Construction of new nuclear power plants

Nuclear plants under construction

The number of nuclear plants under construction shows a slight increase, mainly concentrated however in Asia and Eastern Europe.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
America - Latin	1	1	1	1	1	1	1	2	2	2	2
America - Northern	0	0	0	0	1	1	1	1	1	1	5
Asia - Far East	10	9	7	9	13	21	30	38	35	37	38
Asia - Middle East and South	9	10	10	9	8	8	7	8	9	10	10
Europe - Central and Eastern	10	7	7	8	10	12	16	17	16	14	15
Europe - Western	0	0	1	1	2	2	2	2	2	2	2

Figure 28. Nuclear plants under construction, by world regions.

Starting of new nuclear plants

Until 2011, the year of the Fukushima accident, the rate for starting the construction of new nuclear plants was increasing all over the world, but after the accident every country in the world reconsidered its energy policy, resulting in a reduction of the number of plants that started to be constructed, although lately the rate is back on the increase.

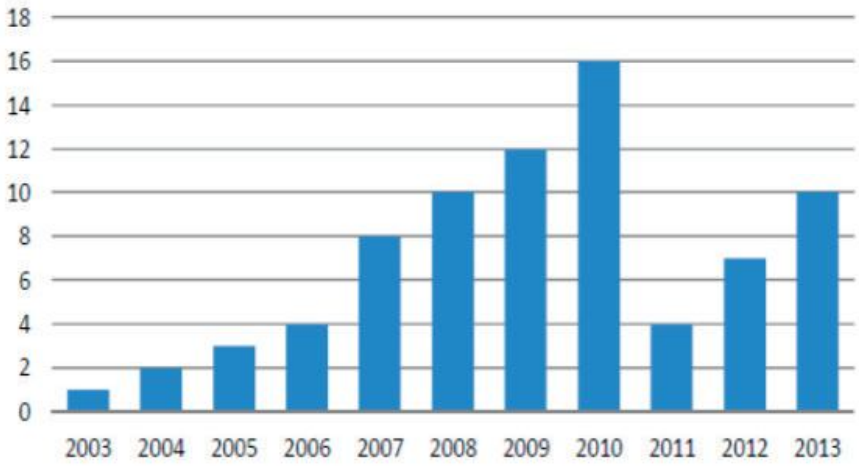


Figure 29. Construction start of new nuclear plants.

Reactors used to produce electricity and for other purposes

There are nuclear plants that apart from producing electricity are used for other purposes, such as supplying heat to the industry or to communal central heating systems.

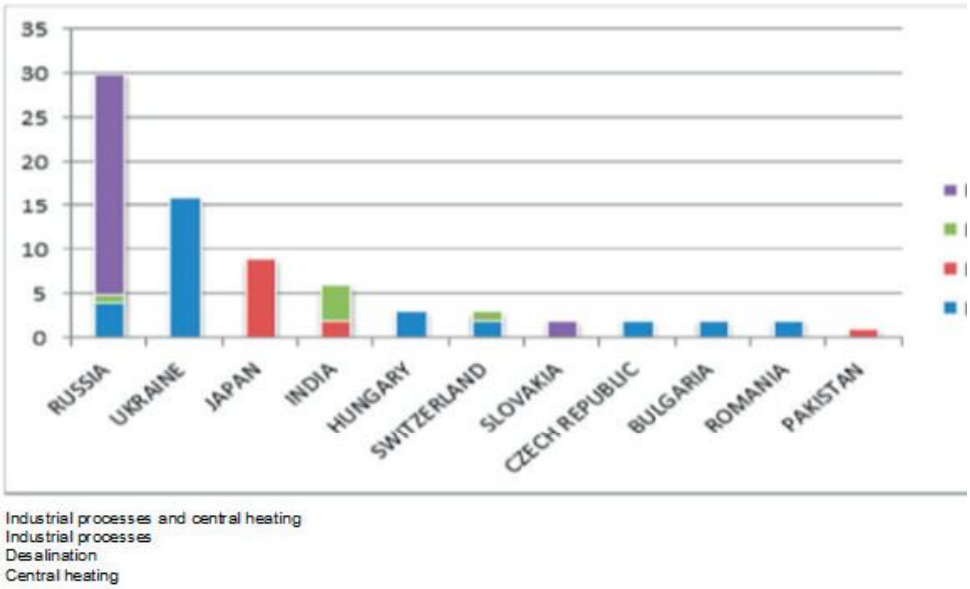


Figure 30.

Prospects of nuclear electric power

Predictions from International Bodies

Several international bodies have carried out analyses and surveys about the future of nuclear energy, considering all the variables that could affect the world's economy in general and the energy sector in particular.

The consequences in the world of the 2008 financial crisis, and the different pace at which the affected countries are recovering, are still the most important short-term factors that affect the energy markets. The main consequence of the crisis being a reduction in the growth of world´s energy demand.

Another major factor is that nearly all nuclear reactors in Japan are still shut down, when they used to supply before the Fukushima Daiichi accident approximately 30% of the country's electricity.

Since 2012, the technological breakthroughs having the greatest effect on the future of nuclear power are those associated with hydraulic fracturing for shale gas and with renewable energies.

Surveys conducted on different premises with respect to the future of nuclear energy, can be grouped on those with low nuclear energy development perspectives and those with high nuclear energy development perspectives.

In the survey conducted by the UN International Atomic Energy Agency, headquartered in Vienna, two projections are considered, one low and the other high.

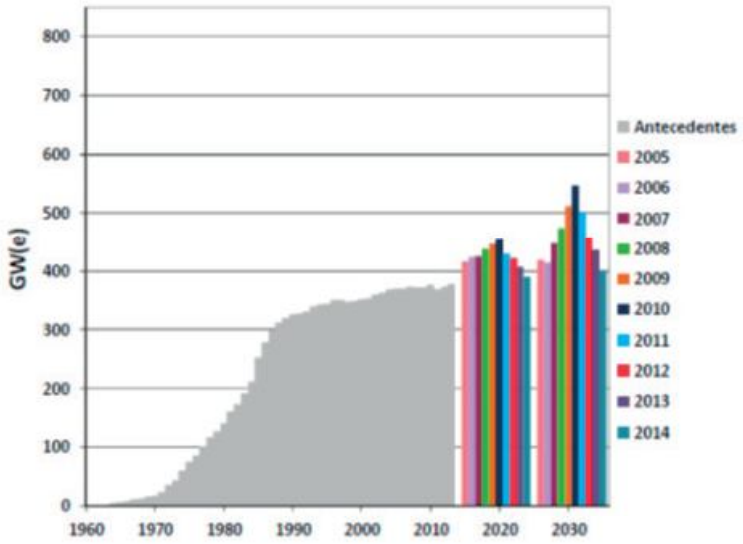


Figure 31. World nuclear electric power projections low projections.

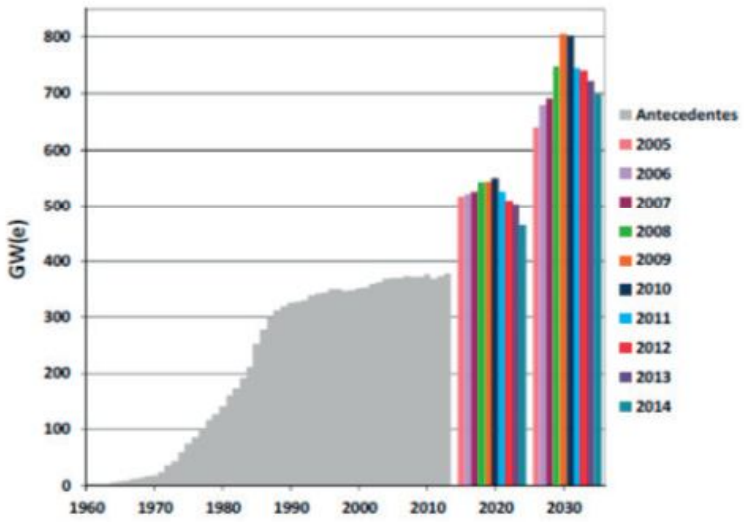


Figure 32. World nuclear electric power projectionsHigh Projection.

Comparison of high and low projections

Year	Projection	North America	Latin America	Europe	CEI	Africa	Middle East	Pacific countries members of the OECD	ASEAN	Asian countries not OECD members	The whole world
2013	Low	112.6	4.1	125.0	37.1	1.9	0.9	63.1	0.0	27.0	371.7
	High	112.6	4.1	125.0	37.1	1.9	0.9	63.1	0.0	27.0	371.7
2020	Low	111.9	4.5	112.9	47.1	1.9	3.6	51.9	0.0	56.4	390.1
	High	118.7	5.8	124.8	55.2	1.9	6.6	71.7	0.0	78.8	463.5
2025	Low	98.4	5.9	82.7	48.1	1.9	6.6	51.6	0.0	83.7	378.9
	High	124.2	7.9	130.0	63.6	1.9	11.4	81.2	2.0	135.6	557.7
2030	Low	92.4	6.9	81.5	50.7	1.9	8.6	52.5	2.0	104.1	400.6
	High	138.9	14.5	144.3	78.2	9.9	13.4	93.7	9.0	197.3	699.2

Figure 33. Comparison between the high and low projections.

Figure 33 compares the high and low projections elaborated by UN´s IAEA, emphasizing on the considerable uncertainty regarding any projection about the future of nuclear power.

In the low projection, according to estimates, the percentage of electricity produced in the world based on nuclear power decreases to 9% in 2030, which still represents an overall growth, albeit moderate, in world production. The situation is different in regions of Asia, where electricity generation based on nuclear power is still on the increase at a rate similar to the global growth of electricity.

In the high projection, the percentage of electricity produced in the world based on nuclear power is estimated at 13% in 2030, a percentage slightly above the current figure. It can be deduced from the above that nuclear power is growing more rapidly than electricity as a whole, and this is more marked in developing countries rather than in OECD countries.

On a world scale, the high projection assumes that, as from approximately 2025, between 33 and 36 new reactors per year will be connected to the grid. The highest number of new connections to the grid happened to be 33, in 1984. It is estimated that the current world manufacturing capacity, especially of heavy forging plates, match the amount needed for 30 to 34 reactors per year, this item will not serve therefore to limit the number predicted in the high projection.

The challenges will rather tend to require achieving sound political support and fair rules of the game affecting all the electricity production options, making the comparative advantages of nuclear power and the risks involved more visible and comprehensible to investors and the general public. In summary, if 33 connections to the grid are to be made between the present time and 2025, immediate measures will have to be taken now.

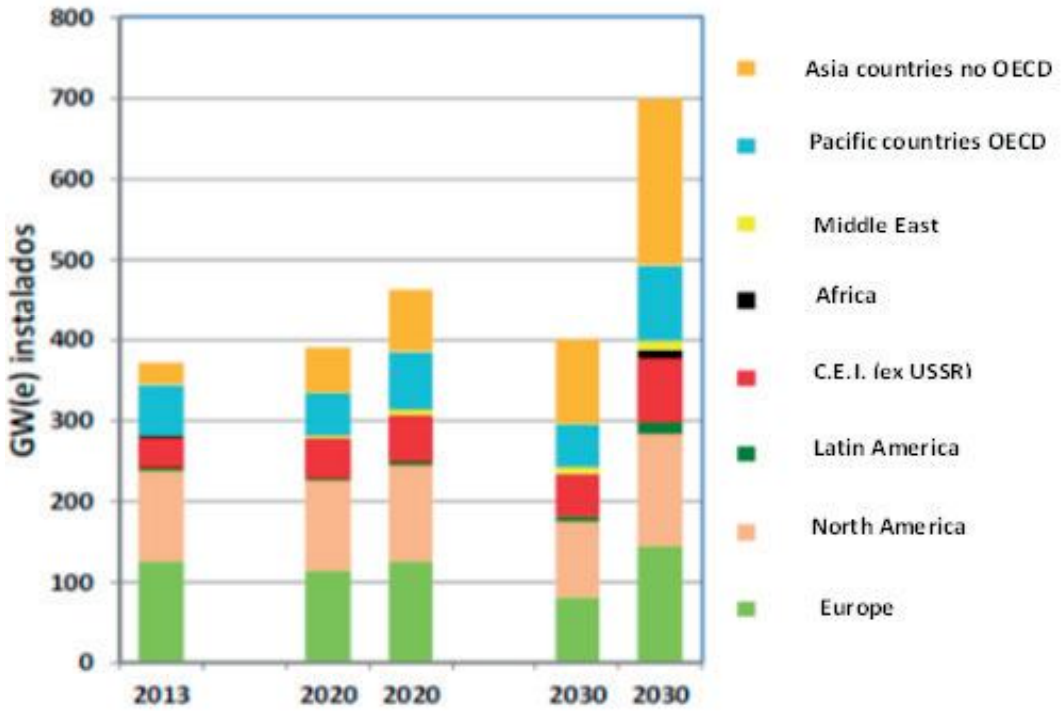


Figure 34. Evolution of regional capacity for the low and high projections.

Extending the low and high projections beyond 2030 involves much greater uncertainties regarding the technical, economic and political events that may affect energy decision-making. However, should the main hypotheses adopted for both projections remain the same, it is estimated that in 2050 the world nuclear power capacity will reach 413 GW(e) for the low projection and 1,092 GW(e) for the high projection.

Nevertheless, even under the high projection, in spite of the considerable increase expected between 2030 and 2050, 393 GW(e), nuclear power in 2050 would only account for 5% of the world production capacity. The percentage would be much higher in terms of actual production (12%) since nuclear power is to a large extent used for base load generation.

Factors affecting the projections

The following considerations are made in the survey conducted by the UN´s IAEA concerning nuclear energy projections.

The real situation in the future will probably be somewhere between the high and low projections. There is no reason why the intensive use of one energy type should exclude the use of other alternative energies.

Furthermore, it is essential to have a present and future security record if nuclear power is to be accepted by the general public.

It is also important that nuclear power receives firm and non-party political backing, in those countries that are operating with or introducing nuclear energy. The reopening of the nuclear debate in public grounds is frequently off-putting to investors, the general public and nuclear workers. Any delay in making political decisions to implement nuclear power reduces the incentives to construct new plants.

Extending the operating licences to sixty years and increasing the capacity of the existing nuclear plants, have proved to be more interesting from an economic perspective and less controversial than constructing new nuclear facilities.

The progress made in creating and using repositories for high-level waste (HLW) could have a major impact on political and public acceptance of nuclear power. The countries that have clear policies on waste management and that are making visible progress towards operational HLW repositories are also the countries where acceptance of nuclear power by the general public is at its highest.

The availability of small and medium capacity reactors (RPMP, Reactor Plant Master Processors) could greatly increase the potential of the nuclear power market, not only on islands or in countries with small electricity grids, but also in countries with established nuclear power programmes and a stagnant electricity demand. RPMPs could reduce marketing time and the financial risk to which investors are exposed, making it easier for the latter to obtain financing. Modular RPMPs can serve to respond flexibly to demand´s insecurity and are also more suitable for applications other than generating electricity.

The future of policies that encourage renewable and nuclear energies will also be a major factor. Regulated tariffs and guarantees for purchasing electricity produced from renewable and nuclear sources (regardless of whether the electricity is needed or not) also contribute to altering the electricity markets and increasing the cost of the system. The subsidies and regulated tariffs for wind and solar energy in Germany have led to a paradoxical situation in which the country has some of the lowest wholesale prices and at the same time some of the highest retail prices in the EU.

Furthermore, the intermittence and unpredictability that affects the production of renewable resources require rapid responses from the system (for example, mobile reserves, linear increase and reduction, and emptying or replacing the hydroelectric energy stored) in order to guarantee their integrity and stability. The ability to increase and decrease in larger energy forks is not a quality that is inherent to nuclear power, unless, as in France, there are numerous nuclear plants on the grid, in which case many plants can adapt the energy level to a small margin.

The many environmental advantages of nuclear power could tip the balance in its favour, if the advantages can be quantified in monetary terms and this can be clearly shown to the Authorities, investors and the general public. As has already been pointed out, strict policies for reducing climate change would improve nuclear power economics when compared to fossil fuel production, in the

sense that technology is judged by the advantages it has for the climate, which are similar to those of other technologies with low greenhouse gas emissions.

Other advantages of nuclear power that might tip the balance in many countries consist of improving the poor air quality, increasing energy security and permitting a basic load production that can be distributed at stable and predictable prices. The policies for combating atmospheric pollution such as those recently announced in China, make fossil fuel production more expensive than nuclear power and renewable energy. The policies for monetising contributions to energy security could also make nuclear power more appealing. Finally, the mechanisms for remunerating capacity or compensation for distributable production would provide the owners of nuclear plants with a further source of income.

All nuclear designs are undergoing innovatory changes to cut costs and improve safety. The commercialisation of RPMPs, of which there are 45 models currently being subject to research and development, could also be a crucial factor when it comes to realizing the aforementioned high projections.

Other designs, such as fast reactors and high temperature reactors, will not play a decisive role before 2030, but they could become important later, especially when sustainability considerations require waste to be reduced to a minimum, not only regarding volume, but also longevity and the conservation of resources.

One essential characteristic for the satisfactory and safe use of nuclear power is to enable those parties with direct interest in drawing up nuclear policies and making decisions in investment matters - especially regarding security and safety matters -, to take part in those processes. Such participation is vital not only when it comes to adopting a national position in the countries that are going to use nuclear power in the future, but also when it comes to selecting the sites for new nuclear construction projects and HLW repositories. This could also include examining competence and efficiency in matters concerning regulations.

Public acceptance is of paramount importance for the future of nuclear power. The differences in the degree of acceptance in different countries and locations show the way the general public weighs up and perceives the advantages and risks involved in nuclear power (generally regardless of the risks and advantages of non-nuclear alternatives). Exhaustive and transparent energy planning, with the participation of those directly involved, and the evaluation of all the technological and fuel options available in a particular country, help to ensure that feasible energy options are adopted. The general public usually gives greater credibility to the interested parties that do not form part of the nuclear community than those that do form part of the nuclear community and, so, they are in a better position to explain and put across not only the risks and effects of radiation, but also the matters concerning operational safety.

Nuclear power is nowadays at a paradoxical phase. On the one hand, it appears to have entered a period of diminished expectations. The projections that the Agency has been making every year since 2010 about nuclear power in the

world in 2030 have been diminishing every year with respect to the previous year. However, the number of countries that are prepared to introduce nuclear electric power, and the long-term potential, are still high. In 2012 the United Arab Emirates, was the first country in 27 years to start constructing its first nuclear plant, with connection to the grid planned for 2017.

Some of the economic, technological and political factors that could affect the events either way are not under the control of the nuclear industry or even the governments. On other factors, the nuclear industry, governments and even the International Atomic Energy Agency could have a greater influence however.

Conclusions

Electricity production in nuclear power plants meets all the conditions required to a system that supplies goods or services, that is: security, economy and sustainability.

In 2013 nuclear plants provided 10.5% of the world's electricity supply, and the predictions made by a variety of international bodies for 2030 indicate that this percentage could fall to 9%, according to the low perspective, or rise to 13%, according to the high perspective.

Half of the 435 nuclear plants currently in operation will complete their operating life cycle before 2040, so it will be necessary to dismantle them and construct new nuclear plants to replace them.

The cost of nuclear fuel amounts to only a small percentage of the total cost of the KWh and is not exposed to supply interruptions on the international market, constituting therefore the basis for a secure energy supply.

In the current conditions, uranium reserves can supply nuclear plants with the fuel they need for approximately one hundred and twenty years.

Nuclear energy is one of the few options for generating electricity reducing CO_2 emissions into the atmosphere.

Documentation used in preparing this report

This Report has been prepared using texts, tables, figures, graphs and general information issued by a variety of Organisations, Bodies and Companies, including the following:

- International Atomic Energy Agency of the United Nations Organisation (IAEA-UN).
- Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA-OECD).
- *Consejo de Seguridad Nuclear* (CSN, Spain).

- Atomic Energy Commission (AEC, France).
- *Centro de Estudios Superiores de la Defensa Nacional* (CESEDEN, Spain).
- *Centro de Investigaciones Energéticas Medioambientales y Tecnológicas* (CIEMAT, Spain).
- Nuclear Energy Institute (NEI, United States).
- World Association of Nuclear Operators (WANO).
- *Empresa Nacional de Residuos Radiactivos* (ENRESA, Spain).
- *ENUSA Industrias Avanzadas (*ENUSA, Spain).
- *Equipos Nucleares* (ENSA, Spain).
- *Asociación Española de la Industria Eléctrica* (UNESA, Spain).
- *Foro de la Industria Nuclear Española,* Spain.
- *Real Academia de Ingeniería*, Spain.

Chapter II

Energy and the Arctic

Vicente López-Ibor Mayor

Abstract

The object of this work is to analyse the characteristics that could define the energy geopolitics or geopolinergy in the Arctic Region. This objective is carried out firstly by examining the concept of energy geopolitics in the Arctic in connection with other similar concepts, not only in the conceptual frame of the Arctic Region, but also in its relationship with and interdependence from other regions in the world, especially the European Union and the Atlantic Basin.

The work also pinpoints the potential of energy resources and reserves of each one of the countries that constitute what is known as the Arctic Council, and the aggregate potential that would result if the region is considered as a whole.

The geopolitical expression of energy in the Arctic also emphasises another aspect of great importance, which is the opening up of transport routes and the development of the equipment and infrastructures needed to allow for the transit of energy resources in the future.

This work draws attention to what is referred to as "the Arctic energy paradox", which synthesises the possibility of having available huge volumes of energy resources, amounting to almost one third of the world's existing hydrocarbon reserves, while at the same time pointing out that their use would basically be the cause of serious and widespread environmental degradation in the zone.

The work likewise deals with certain aspects of energy governance in the Arctic, the underlying conflicts where public international law is concerned and the possible courses of action to be taken to improve both aspects.

Keywords

Arctic and Energy; The Arctic Energy Paradox; Arctic and Geopolinergy; Arctic and Energy Resources; Alternative Transport Routes and the Arctic; Energy Governance and the Arctic.

The arctic and geopolinergy

A review of the overall energy situation in a world region such as the Arctic, requires a rather unusual approach, since it is not only a question of making an inventory of reserves, resources, types of sources, energy capacities or of the extent to which infrastructures are integrated to make it possible to prepare an indispensable part of these systems, essential, and sometimes critical, for the functioning of our economies and, thus, for society in its current state of evolution or development. It is a question of something else. Neither would it be enough to explain the general layout of the energy sector in the Arctic in relation to other regions or areas in the world, because the measurement parameters are not sufficient, in our view, to make a comparison or correspondence. The initial approach requires us to geopolitically contextualise this vital, while at the same time sensitive and in many senses remote, area of the planet.

Remote, as a result of its singular geographical position, as the Earth's axis at its northernmost point, and for the living and inhabitability conditions in that space.[1] The Arctic is an essentially maritime territory. Unlike the Antarctic, which is a continent surrounded by oceans, the Arctic is an ocean surrounded by continents. Defining the region with precision from a geographical perspective is a challenge in itself, yet there are three ways of defining the region.[2] The first one would be on the basis of its astronomical limits, which define the region as being the area north of the Arctic Circle (66° 33´ N), which is approximately the limit of the midnight sun and the polar night.[3] The second way of definition would have to do with the limits created from the geographic climate conditions, so: "the area north of the three lines, lying 10°C to the north of July´s isothermal, which runs south reaching Greenland and the Bering Strait region".[4] Another way of defining it would be as "the region to the north of the Arctic Circle adding territories belonging to five coastal States –Russia, United States, Canada, Norway and Denmark with its territory of Greenland– in which parts of Sweden and Finland, as well as parts of Iceland's continental shelf,[5] lie to the north of the Arctic Circle". We also said that from a geographical perspective, the Arctic

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1 The ice floe in the Arctic Region plays a major role in global climate maintenance because of its reflectivity, or *albedo* effect, and its loss could constitute a turning point in global warming. Reliable measurements of the ice floe edges were first taken at the end of the 1970s. The ice floe extension in September is at its lowest, and decreases have been recorded since 2002. The North-West Passage was completely open for the first time ever in 2007 (NASA Report, which for this type of measurements uses "The Advance Microwave Scanning Radiometer" (AMSR-E) in "The Aqua Satellite". See NASA´s Website.

2 RINCÓN SÁNCHEZ, Mauricio. "Analisis de las ventajas de las características geopolíticas de la región del Ártico". Universidad del Rosario, Bogotá, 2012.

3 See Harvard Model United Nations, "Disarmament and International Security Committee: Militarization of the Arctic". 2010.

4 DIETHARD, Mager, "Climate Change, Conflicts and Cooperation in the Arctic: Easier Access to Hydrocarbons and Mineral Resources". International Journal of Marine and Coastal Law, Vol. 24, 2009.

5 BYERS, Michael, "Arctic Region". Max Planck Encyclopaedia of Public International Law, 2010.

was also characterised by its extreme singularity. This is a fact because it is our smallest ocean,[6] but not the least important for the balance of the currents, the global temperature[7] and the multiple ecosystems.[8] If there is anywhere a place that serves to establish to what extent preservation of our natural heritage cannot be separated from the future model of welfare or malaise, we must look to the Far North and thoroughly assess, with good arguments, the risks, demanded actions, seriousness of the events, depth and extension of data and scientific consensus, forecasts and meteorological and climate models.[9] Furthermore, it must be emphatically stated that the "Arctic space" is a region with a very long history, inhabited for thousands of years and with a wealth of settlements and indigenous communities.[10] The Arctic is to a significant extent the epicentre, the natural space where the greatest environmental challenge of our times is faced and, so, its own evolution, impacts or treatment will be regarded as benchmarks when considering the conditions and effects of the climate maintenance or general change, even in some cases changes at local or regional levels, and many other factors that are crucial in natural impact assessment. Yet at the same time, it must be pointed out that the solutions to some of the problems in the Arctic, especially environmental ones, cannot be implemented by actions on the Arctic itself, or exclusively by such actions.

In view of the above and as a consequence thereof, it could be stated that, from an environmental or natural heritage viewpoint, the Arctic brings together two characteristics that would be extremely difficult to find coexisting together anywhere else in the world. On the one hand, its radical singularity, fruit of its location, its extreme environmental conditions and climates, its remoteness from the planet's other inhabited zones and the sparseness of its population density.[11] And on the other hand, the internal reality of the Arctic offers *ad extra* to the

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6 It covers a surface area of roughly 14 million km2 or 1.5 times the size of the United States, with a maximum depth of 5,500 metres (18,040 feet).

7 See WMO (World Meteorological Organization) statement on the status of the global climate in 2013: "Globally, sea level has risen by 19 cm since the start of the twentieth century, mostly because of the thermal expansion of the oceans and the melting of glaciers and ice caps. Since measurements began in 1993, sea level has been rising at about 2.9-3.2 mm/yr (based on two separate estimates, each with an uncertainty of ± 0.4 mm/yr), with some year-to-year variability. This range encompasses the observed rate of about 3 mm/yr for the 2001-2010 decade and is around double the observed twentieth century trend of 1.6 mm/yr".

8 KELLY, Eamon. "Powerful Times". Pearson Education, 2006.

9 BAUTIER, Catherine and FELLONS, Jean-Louis, "Eau, pétrole, climat: Un monde en panne sèche", Pages 21 and 22. Odile Jacob. Sciences, 2008.

10 In the 2004 Arctic Human Development Report, Page 27, and ECONOR 2006, Page 17, the "circumpolar area" is defined as comprising 29 regions: Alaska, Northern Canada (Yukon, North-West Territories of Nunavut and Nunavik), Greenland, Iceland, Faroe Isles, parts of Northern Norway (Finnmark, Nordland, Troms, Svalbard), Sweden (Norrbotten, Västerbotten), Finland (Capland, Oulu), and the northern part of Russia (Karelia, Komi, Murmansk, Khanty-Mansi, Yamalo-Nenets, Taymir, Sakha, Chukotka, Magadan and Koryakia).

11 The Arctic is estimated to have a population ranging from 4 to 10 million, depending on the area that is defined. If we take 4 million, this amounts to 0.07% of the world population, and

rest of the world - on the basis of the conditions for its evolution and development – an insight into finding out to what extent climate, or to put it another way, the challenges posed by the inevitable fight against climate change, could vary or shape for better or for worse, our ecological system, our economic model and our contemporary political stand. Therefore, the Arctic is not the rhetoric script of some future era, but a geopolitical factor of paramount importance in this first half of the 21st Century.[12]

Geography and geopolitics, two sides of the same coin, in time and in physical and historical space, that makes it possible today to include other essential elements in the analysis, given that "political matters" also accept, in the geopolitical sense, some of the basic variables that condition its action, whether in the form of attributes of its own conceptual perimeter– the economy, energy, environment, migratory movements, etc.- or because of its relationship and interpenetration with that term, e.g., the strategic aspects.

As has rightly been included in another text in this same collection,[13] J. Black[14] defines geopolitical content as "the relationships between political, mainly the composition and use of power, and the geographical factors, especially space, location and distance". He adds that "geopolitics concerns itself with the context in which the decisions that affect national security are taken and the questions revolving around peace and war are decided and, more specifically, the relationship between strategy and geography". However, L. Freedman[15] defines the concept of strategy as referring to "maintaining a balance between end targets, courses of action and means; pinpointing objectives and resources and the methods available for reaching those objectives". Freedman also points out that "strategy plays its role where there is an actual or potential conflict, when

0,8% of the total population of the eight Arctic States.

12 As Richard Labévière and François Thual point out, «Au début du XIXe siècle, le Bassin arctique –avec ses 14 millions de km2 constitués par l'océan Arctique qui n'est lui-même que le nord de l'océan Atlantique, le Groenland (2.175.600 km2), la plus grande île du monde après l'Australie, et les littoraux des continents eurasiatiques et nord-américains- était demeuré, sur le plan géopolitique et politique, inexistant. Quasiment inhabité, inaccessible, peu exploré, le monde arctique constituait une tache blanche dans l'histoire humaine. Deux cents années après, l'Arctique est en passe de devenir l'un des centres du monde et, sans jeu de mots, l'un des lieux les plus chauds de la planète politique, qu'il s'agit de comprendre». «Un géographe a d'abord la passion des cartes et il les lit comme nous regardons nos potos familières. Mais elles on l'inconvénient d'être plates, alors que la Terre est ronde. À petite échelle, cela n'a pas d'importance, mais à grande échelle cela déforme la réalité, surtout au voisinage des pôles. Il est facile de comprendre que, les dits pôles étant des points, les planisphères agrandissent les régions polaires démesurément, comme les miroirs déformants de notre enfance. C'est pourquoi les globes sont irremplaçables. En les regardant, on 's'aperçoit immédiatement que la Terre, que nous imaginons continentale, est en fait maritime». BARREAU, Jean-Claude and BIGOT, Guillaume, "Tout la géographie du Monde". Librairie Fayard, 2007.

13 See ARANZADI, Claudio, "Cuadernos de Estrategia 166. Energía y Geoestrategia 2014", Page 19.

14 BLACK, J. (2009). Geopolitics. The Social Affairs Unit.

15 FREEDMAN, L. (2013). Strategy: A history. Oxford University Press.

interests are on a crash course and some kind of solution is required, which is what makes a strategy much more than a plan". All that is needed is to add the geographical factor to this definition in order to obtain a characterisation of the geostrategy concept. Freedman also states that his definition of the term strategy can be applied not only to military world, but also to the worlds of politics or business.[16]

Therefore "energy geostrategy" requires an interdisciplinary approach and a balance between the use of quantitative techniques and knowledge that is difficult to quantify.

The concept of "energy geostrategy" also reflects a bidirectional causal relationship between the two terms in its definition. Factors specifically associated with energy have a bearing on the global geopolitical and geostrategic scenario, just like the general geopolitical framework conditions the parameters that define the energy environment. Furthermore, the geoenergy context, of resources, access, capacities, infrastructure, engineering, legal arrangements, regulation, etc., must necessarily be interpreted in the light of the undeniable multipolarity of the political power in the region. Moreover, it must not be forgotten that multipolarity is defined as a circumstance in which three or four major powers possess very similar material capacities from a defensive or security viewpoint. At the same time, polarity is not a consequence of the number of major powers, but rather a measurement that takes into account how capacities are distributed between major powers.[17] In the case we are analysing, and with specific reference to the energy sector or system, it can be said that at least four major global energy powers directly coexist in the Arctic: United States, Russia, Canada and Norway.

Therefore, of all the different concepts mentioned, it is basically the geoenergy concept to which we must limit ourselves, approaching it from a twofold perspective: firstly, from the perceptible energy reality, now in the context of the Arctic countries, with regard to the existing resources and reserves; and, secondly, from the potential of the Arctic energy system as a whole, as a regional zone, and with regard to its connection with the geopolitical grounds. However,

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[16] "Energy geostrategy", as is generally the case with all strategic studies, can efficiently use the conceptual framework that it is offered by techniques basically developed in economic theory, such as the theory of cooperative and non-cooperative games or the theory of real options. However, there is a trade-off between the analytical rigour of these disciplines in the modelling of decision making and the realism and practical relevance of the conclusions in very complex environments. States, coalitions of States or companies that interact on the global energy resource map must take into account not only the sophisticated formal decision-making models and geographical factors (space, location and distance), but also other factors that are extremely important, such as technology, geology, institutions, history and ethnic peculiarities. SMITH, H.T.J. and TRIGEORGIS, L. (2004). Strategic investment. Real options and games. Princeton University Press.

[17] See KEGLEY, Charles W., Jr. and RAYMOND, Gregory A., "The Multipolar Challenge", Page 82. Editorial Almuzara, 2008.

even with this latter point, which can theoretically be tackled, certain clarifications have to be made, because although from a strictly geographical perspective the Arctic is defined as being the parallel to the north of latitude 66º 33´ N, in energy and climate terms this limit is enlarged to take in other areas, characterised by extreme temperatures and, for the most part, bordering on the Arctic zone but not forming part of it, which likewise generally contain considerable wealth where energy is concerned.[18]

We can thus state that as a result of a combination of the analysed factors: geopolitical space, associated political fact and energy dimension, there would be a "Geopolinergetic" reality, which is to be understood as meaning one that is able to weigh up the energy aspect of the geopolitical – and strategic – circumstance or of the energy bases of actions by the political power, on a specific or specifiable geographical area.

Environmental degradation and the arctic paradox

In the aforementioned context, it would also be necessary to establish what kind of impacts this modern energy geopolitics, or "geopolinergy" have on globalisation, or, to put it another way .... Will political and energy development in the Arctic Region increase globalisation? How will it do so, to what extent and how far-reaching will the effects be?

The Arctic contains new resources and opens up new routes, as well as being an area where the major powers will project their power, a conflict-of-interest zone, and, probably, a space where geostrategies will collide.

With major economic opportunities and serious environmental problems, the Arctic is emerging as a region that is, geopolitically speaking, of the first order, to which global stakeholders from inside and outside are paying special attention. While Russia is a traditionally Arctic state with economic and security interests in the region, China, United States and the EU have likewise explicitly expressed their interest in the Arctic.

Moreover, in spite of an increase in the geopolitical importance of the region where global balance is concerned, the Arctic Council has not yet formulated a coherent plan for incorporating the emerging interests of the Non-Arctic States and organisations, encompassing their geographical differences and plurality (for example China, Japan or Singapore, on the one hand; and the EU on the other).

[18] Including among them, from a conceptual viewpoint, even some intellectual or experimental exercises, like the one devised by John Dykeman (Harvard University) about controlled atmospheric disturbance (Scopex Project), intended to recover or "reconstruct" the ozone layer.

Furthermore, in the current global community, one State cannot base its security exclusively on the basis of the areas that immediately surround it. The security of each one is closely linked to the security of all.[19]

Along the same lines of argument, Cohen formulated the theory of "geostrategic domains", which are to be understood as being zones that are large enough for processing characteristics and functions that are "globally influential, serving the strategic needs of the major powers, States and regions that they include. Their frameworks are composed of circulation patterns that unite people, goods and ideas, and these are joint by the strategic control of localised landscapes and territories". Cohen groups the world into three major "geostrategic domains", combining large maritime and continental zones.[20] The Arctic is obviously a maritime domain, in view of the fact that its extent, location, sea passages and available routes are fundamental, not only for the strategic aspirations of the Arctic States, but also as a geostrategic territory for States for which it is out of reach. In this sense, the geostrategy would serve as a power structure that would emerge as a result of the interactions between geography, economy – mainly energy in this case, and transport – and the political forces, and all of this would reveal that the geopolitical structures are, in fact, power structures.

One of the aspects that we believe would enable the Arctic to be defined as a geostrategic domain in the Cohen sense of the term, is the fact that it is rich in energy and mineral resources, in the latter case concentrated in Alaska, Labrador, the eastern part of Greenland, the northern part of Scandinavia and the northern part of the Urals. The quantity and quality of these resources in its territories, at the service, at least potentially, of the States in the zone and certain other external States able to take part in it within the framework of "geostrategic relations" based on economic and political power, would be extraordinary. From estimations of the energy resources in the gas and oil basins, they lie in zones classified as Exclusive Economic Zones of the States, i.e., within the 200 nautical mile limit, in that struggle between the States to conquer, in this case using Law, the underlying sea or land areas. The largest energy and mineral reserves in the world would be found however in unexplored and currently inaccessible resources.

The Arctic thus appears, regardless of how world events evolve over the next few decades, as a region of major geopolitical importance in terms of security and, within that, in terms of energy security, that is: a "geostrategic domain" for the interactions within economic power, underlying with the political structures in the zone in a legally undefined status, where the capacity of energy resources is once again a basic asset. Moreover, the geopolitical consideration of the Arctic

[19] LÓPEZ-IBOR MAYOR, Vicente, MARTÍNEZ MONTES, Luis Francisco, and SÁNCHEZ DE ROJAS DÍAZ, Emilio, "Apuntes sobre el Ártico".Editorial Opera Prima. 2014.

[20] COHEN, Paul,"Geopolitics of the World System", 2003.

Basin as an Atlantic Basin[21] or as a Eurasian Basin[22] takes on special prominence from the foregoing perspective, in view of the fact that this appreciation is not irrelevant in the context of the aforementioned interactions and, in the form of political and legal cooperation of the Arctic States or their governance mechanisms with other organisations or regions in the world.

Therefore, it could well be stated that although from an environmental viewpoint the thawing of the Arctic is an occurrence with serious negative consequences in the fight against climate change, requiring special attention from the international community in order to increase the efforts needed to reduce those negative consequences of this phenomenon, by correcting it or, at least, mitigating it,[23] from an economic perspective though the possibility of obtaining resources and the opening up of transport routes in the Arctic Region can be regarded as potentially positive and will serve to enhance commercial exchanges and international legal security. Regarding the latter point, this will be the case as long as the access, operating and production conditions of the energy resources adhere to rational procedures and guidelines that are compatible with internationally accepted environmental standards and requirements.

On alluding to the existence of a possible "energy paradox" in the Arctic, we are referring to the fact that although huge deposits of raw energy materials and mineral resources lie in the sedimentary basins of the Arctic, which in themselves could contribute decisively, if used, to a significant increase in the life-expectancy for the use of hydrocarbons – conventional or unconventional – , by making more reserves available and applying them to industrial, transport or energy production models, constituting an "aside" energy reserve of great value to Humanity, their exploitation would lead however to an environmental deterioration of the Arctic Region with an increase in the thawing of large tracts of its territory, mainly caused by anthropogenic factors associated with the intensive use of our global industrial equipment, supported as essential production input on solid fuels and, thus, on the energy factor.[24]

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21 ISBELL, Paul, "The future of the Energy in the Atlantic Basin.The dynamics and paradoxes of the Atlantic energy Renaissance".Johns Hopkins University, 2014.

22 According to the USGS, it is estimated that Eurasia is the area where 63% of all the Arctic resources lie, while the remaining 36% would be found in North America. In terms of resources, the Eurasian zone would basically contain natural gas, which would account for 88% of its resources. The North American resources would mainly be oil. However, I would like to add that, although this data and these estimations are very salient, the main point in this case would be exactly defining the areas from a geopolitical perspective: Atlantic Basin –and its possible perimeter-; Eurasian Zone.

23 ALLEY, Richard B. "El cambio climático", Pages 148, 150 and 187.Siglo XXI Editores, 2007.

24 See "Advance Science.Serving Society.Climate Science". Panel, 2014: "Based on well-established evidence, about 97% of climate scientists have concluded that human-caused climate change is happening. This agreement is documented not just by a single study, but by a converging stream of evidence over the past two decades from surveys of scientists, content analyses of peer-reviewed studies, and public statements issued by virtually every membership organization of experts in this field. Average global temperature has increased by about

Therefore, the energy that, on the one hand generates destabilising conditions where climate is concerned, jeopardising global targets in the fight against the negative effects of climate change, on the other hand opens up a horizon of future promise by making it possible, at least partially, to consider the best identification and a gradual access to and use of its energy resources, which would be required by a sustained demand or at least a remarkable demand, for global energy resources, especially during the next fifty years, coming from the so-called emerging countries.

It is well worth analysing how this paradox would develop, given that its manifestation in the medium term appears inevitable. However, for the purpose of this study we will limit such an analysis to the most direct and positive aspects, i.e. the real possibility, albeit not immediate, of access to a relevant percentage of energy sources, an access that must in any case pay serious attention to prevent further environmental deterioration, not only regarding the deployment of infrastructures needed to carry out the exploration activities, but also with respect to the subsequent transporting, exploitation or production operations.

In terms of resources and reserves, although final or conclusive data are not yet available, the sole information of an indicative nature available brings to light their importance to the energy system as a whole, and all the more so for the neighbouring countries and the European Union, or for China due to the geo-economic implications that they will have for the Asian giant.

Whatever the case may be, the concurrence of the exhaustion of resources and reserves, the material difficulties involved in exploiting new fields under economically profitable conditions, and the impact that the use of fossil fuels has on the environment especially where global warming is concerned, are aggregate variables when it comes to evaluating the problem, and the potential "energy emergency", in the medium term, of the Arctic.

The oil offer will probably decrease over the next few decades, specifically around 2030, and we will find ourselves having to make it up with what can be obtained from oil fields yet to be discovered or from hydrocarbons in a liquid state in the subsoil. There is thus a broad consensus among the scientific energy community that the priority should be to improve efficiency conditions and gradually but constantly replace petroleum with other energy sources in the medium and long term. And it is at that transitional phase where the Arctic resource could play a very important role.[25]

1.4oF over the past 100 years. Sea level is rising, and some types of extreme events –such as heat waves and heavy precipitation events- are happening more frequently. Recent scientific findings indicate that climate change is likely responsible for the increase in the intensity of many of these events in recent years".

[25] See, amongst others, the World Meteorological Organization statement on the status of the global climate 2013, or in the opposite sense, the Calderón-Stern Report, "Better Growth, Better Climate" (2014).

Image 1.

The arctic states and their energy resources

Before tackling the Arctic energy question we must set certain limits, because we are not intending to study in detail the internal functioning of the Arctic energy systems, merely to provide a general description, i.e., a reference to the systems that serve to supply the inhabitants of the Arctic with light, water, gas or electricity. However, it should be pointed out that, in certain areas of Arctic society, in spite of the huge energy resources that the territories contain, the inhabitants suffer from major supply interruptions – caused by the deficient infrastructures in some regions, the great distances that have to be covered to develop them, the high cost involved – energy poverty is suffered in urban and rural zones – particularly in the rural areas, where the prices per kW-hour range from three to five times higher than in the cities – the fluctuation in the prices of the oil that is imported, in large quantities, in the region, obviously causing an effect on the domestic and industrial consumers.

Arctic residents generally demand a high level of energy consumption per capita to maintain their economic systems and living conditions. The cost of transport and the taxes paid on energy fuels make a major contribution to the high cost

of living in the zone. With regard to the energy sources, apart from generating with diesel, renewable sources such as wind energy, mini-hydro or biomass are used.

Anyway, the fact that the Arctic is presently considered to be an "emerging energy region" refers to its hydrocarbon, oil & gas and mineral resources potential.

As Mariano Marzo[26] reminds us, and contrary to what is generally believed, exploration and exploitation of hydrocarbons in the Arctic have been going on for more than a century. The Inuit in Alaska were aware since immemorial time of the presence of surface emanations of oil on the Arctic's coastal plain. Furthermore, when Alaska was under Russian control, which lasted until 1867, the settlers in this region also observed the presence of oil.

More than 400 oilfields and gas fields have been discovered in the Arctic so far, containing approximately 40,000 million barrels of oil, 30.8 thousand million cubic metres of gas and 8,500 million barrels of natural gas liquids.[27]

Most of the fields have been located on dry land, whereas hardly any research has been undertaken into the sedimentary basins detected under Arctic waters, in spite of their great potential. That is why the United States Geological Service (USGS) has been able to state that the Arctic continental shelves are one of the most extensive unexplored zones in the world for hydrocarbon exploration and production. This is due to their remoteness, the environmental and technological challenges involved in the quest for and exploitation of oil and gas in these zones, and also the availability of abundant resources at a much lower cost in other parts of the world.

According to the 2009 US Geological Survey, the Arctic could contain around 90 thousand million barrels of oil and 1.6 trillion cubic feet of natural gas, respectively 13% and 30% of the undiscovered reserves of the two hydrocarbons. Approximately 84% of these reserves would be offshore. Other sources estimate that 6.7% of the potential oil reserves and 26% of the natural gas reserves in the area could be extracted with current technological means.

The largest energy resources currently known in the Arctic Region lie in Arctic Alaska, in the Amerasia Basin, the Greenland Fault Basin, the Pechora Sea (Russia), Bassi Bay (Canada) and the North Islet, in Alaska. Around 84% of these resources are close to the coast. Huge gas fields have been found on the Yamal Peninsula and in the Kara Sea (Russia), and also in the Barents Sea. However, more than one third of the Arctic surface still lies beyond technical verification regarding its potential for containing oil and gas resources. In spite of this, it is estimated that there is no other zone on the planet that matches the Arctic Circle for exploration and exploitation of energy resources.

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[26] La promesa del Ártico. Vanguardia/Dossier, 2014.

[27] More detailed information about this subject, in both data and context, can be found in "The role of Arctic Hydrocarbons for Future Energy Security". KEIL, Katherine, 2014.

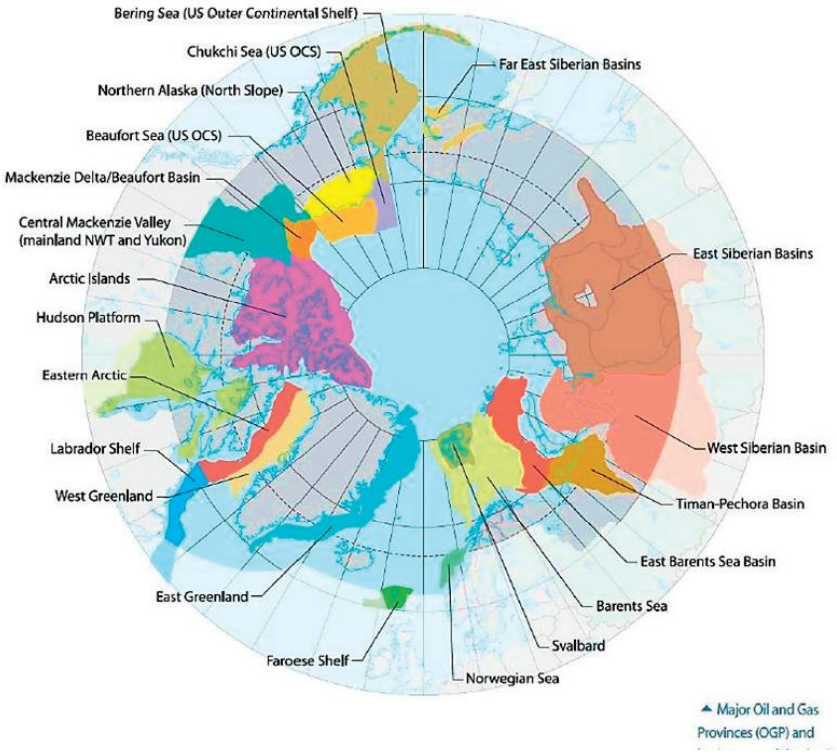

Image 2. Source: Major Oil and Gas Provinces and Basins around the Arctic (OGA Overview, 2007).

It should not be forgotten that marine oil production increased from 16% of the world production in 1977 to more than 30% as from the end of the 1990s. Furthermore, offshore gas has shown a constant growth since the 1980s, mainly owing to technological breakthroughs, which have played a basic role where seabed extraction capacity is concerned.

According to a variety of sources, and as we have already pointed out over 20% of the world's hydrocarbon deposits could lie in the Arctic, as yet undiscovered (about 20.5% of oil and around 27.6% of gas), as well as 25% of the total proven gas reserves. Approximately 10% of the global oil production currently takes place in the Arctic Region. Furthermore, huge mineral reserves, such as tin, manganese, silver, diamonds, nickel and others would be found. The potential for accessing and exploiting them could radically change the geostrategic dynamics of the region in the future, and even international energy relations, and this would clearly have consequences for the economy and global security.

The basic energy structure of the countries in the Arctic Region is as follows: Canada is an important nation where energy is concerned. It comes third in the oil reserve ranking, after Saudi Arabia and Venezuela, with reserves of 180.000 million barrels, and is fifth where oil production is concerned (3.948 Mbd), as well as in gas production. Apart from its great potential in the conventional area of oil and gas reserves and production, which makes Canada a major energy power, it also plays a considerable role in the "American Revolution" with re-

spect to non-conventional hydrocarbons, especially regarding the tar sands of Alberta. Furthermore, Canada has the third largest uranium reserves in the world.

The main resources in the Canadian Arctic are in the River Mackenzie´s Delta and on Baffin Island, where one of the world's largest iron ore deposits is located.

The Canadian Mackenzie Valley gas pipeline project located in the Northern Territories is a major initiative in this context, and many energy majors such as Shell, Exxon Mobil, and Conoco-Phillips are involved. The project is being supervised by the Aboriginal Pipeline Group (APG), and its ultimate aim is to convey natural gas 1,196 kilometres from the Beaufort Sea and the River Mackenzie´s Delta, to the Province of Alberta, in the south of Canada. The project crosses four regions and takes supplies from three fields: Taglu, Parsons Lake and Niglintgak.

Furthermore, there are two Provinces in Canada (Alberta and Saskatchewan, on the West Coast) which have the largest oil reserves. The East Coast has 273 million cubic metres of oil. The biggest natural gas reserves lie in Alberta.

Denmark has the fourth largest recoverable oil, natural gas and tar sand (oil sand) reserves in Europe, excluding the Russian Federation. At present, three quarters of Danish oil production (concentrated in the North Sea) are exported, mainly to Eastern European countries. The importance of oil and gas resources for Greenland lies in the potential for development and future profits from the concessions and the extraction. The official Arctic strategy estimates that 31 thousand million barrels of oil and gas could be found off the north-east shores of Greenland, and 17 thousand million barrels in the western part of the country, although the likelihood of further discoveries is greater in the north-eastern zone.[28]

Since 2002, The Mineral & Oil Agency has been issuing rounds of licensing every two years, approximately. More than 200,000 km^2 are currently covered by concessions belonging to Cairn, EnCana, Exxon Mobil, Chevron, DONG, Husky Energy, Shell, Statoil, GDF, Conoco-Phillips and Maersk. The next round of licensing 2012/13 will be concentrated on the marine region in the north-east of Greenland, and on the Greenland Sea. The tendered area has a surface of around 50,000 km^2, and is split into 19 blocks (Mineral & Oil Agency 2012a, 2012b; HammekenHolm 2012). The British company Cairn Energy has shown its greatest interest in Greenland, where it currently has 11 lease holdings that cover an offshore[29] area of over 100,000 km^2. In 2010, Cairn completed the drilling of three marine wells to the west of Greenland, hydrocarbons being found in two of these, albeit in hardly marketable amounts. In the summer of 2011, Cairn drilled a further five wells, but failed to find any marketable hydrocarbons, so

[28] For an accurate description of this subject, see Katherine Keil, "The Role of Arctic Hydrocarbons for Public Energy Security".Napsnat.Special Reports, 2013.

[29] Cairn Energy 2011.

they were sealed and abandoned.[30] In view of the considerable expense, about 965 million Euros, invested in the eight wells, and without any credible results to date, Cairn's present plans are to share the financial risks with other companies. The licence for the Baffin Bay area, together with Statoil, will be withdrawn, but not before 2014. Cairn also plans to participate in a deep-drilling programme in Baffin Bay alongside Shell, Conoco-Phillips, Statoil, GDF and Maersk (Cairn Energy 2012b; Sharp 2012; Zander and Flynn 2012).

To a large extent, Greenland's continental shelf has remained unexplored to date. The marine surface off the west of Greenland is similar in size to the North Sea, where 15,000 wells have been drilled. The concession areas for the north-west and north-east of Greenland lie in extremely hostile waters in winter and summer, ice-reinforced equipment being required. Should hydrocarbons be found, the deficiencies of Greenland´s infrastructure for exporting oil and gas, coupled with the harsh marine operating conditions, make the challenges even greater.[31]

The United States has one of the world's top oil exploiting industries. It is the third producer after Saudi Arabia and the Russian Federation, but it is expected that in 2015 it will once again regain the leadership it lost four decades ago. The country consumes 18,887 Mbd of oil, second only to China. The USA is also the biggest consumer of gas and also the leading producer of this energy resource. It is ranked fifth in world's gas reserves, has the largest coal reserves and is second in coal production.

The truth of the matter is that the position of the United States with regard to the Arctic is ambivalent and, on occasions, low profile or "reactive", when it comes to formulating a clearly defined position pursuant to the international agreement on the Arctic, in spite of undeniably being one of the region's leaders – part of the State of Alaska lies within the Arctic Circle – and keeping a military presence dating back to the Cold War. It was not until 2013, under Obama´s presidency, that the United States adopted its Security Strategy regarding the Arctic Region, followed a year later by a plan to implement it. The document in question sets as a priority the defence of territorial integrity and the sovereignty of the North American Arctic territories, within a framework of regional cooperation through the Arctic Council.

Much of the USA's interest lies in the potential for extracting energy resources in Alaska[32] and, eventually in other zones. However, the "revolution" brought about

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30 Cairn Energy 2012a.

31 National Petroleum Council 2011, 63.

32 CORDESMAN, Anthony H. y AL-RODHAN, Khalid R., "The Global Oil Market: Risks and Uncertainties". Centre for Strategic and International Studies. Washington D.C. 2006: *"There has been much debate about the size of reserves in Alaska, and their expected production. Current technology and simulation models cannot predict exact reserves, cost of production, or the grade of oil in the Arctic National Wildlife Refuge (ANWR). At this point, all that is certain is that production in the ANWR also depends on the price of crude oil. The EIA has summarized its views on oil in the ANWR*

by fracking to extract gas and oil in several States in the country, has temporarily detracted from the urgency of this subject.[33]

As from 1960, the former USSR began to exploit the oil and gas in the zones close to Tyumen, in Western Siberia (a field that covers almost one million km^2) and similar activities were also carried out in Urengoy, at the mouth of the Obi River.

The Russian Federation has considerable recoverable reserves of oil, natural gas and oil sand. Siberia contains 59% of the world's coal reserves, nearly 40% of the planet's natural gas and 14% of its oil, as well as guaranteeing more than half of Russia's hydro resources. A special reference must be made to the Shtokman field, the largest marine gas deposits in the world, covering a surface area of 1,400 km^2 and a volume of reserves estimated at 3,200 million m^3. However, it must be mentioned that production is in decline in the three very extensive fields (Yamburg, Urengoy and Medrezne) that generate a substantial percentage of Russian gas at present.

Russia's annexation of Crimea caused the suspension of several joint military exercises between Russia, Canada and the United States, complicating, or at least changing, the planned search and rescue operations that are so necessary in a region that is destined to considerably increase its transit options. Furthermore, not long after the bringing down of Malaysia Airlines Flight 17 over Ukraine, tension began to escalate, in the framework of the economic sanctions that the western countries imposed on the Russian Federation. The European Energy Commissioner at the time, the German Günther Oettinger, stated that *"if the Russians do not try to do anything to prevent this escalation, we will have no reason to help to promote the growth of their industry and develop new gas and oil resources"*.

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as follows: Alaskan crude oil production originates mainly from the North Slope, which includes the National Petroleum Reserve-Alaska (NPR-A) and the State lands surrounding Prudhoe Bay. Because oil and gas producers are prohibited from building permanent roads in NPR-A, exploration and production are expected to be about 30 percent more expensive than is typical for the North Slope of Alaska. Because drilling is currently prohibited in the Arctic National Wildlife Refuge (ANWR), AE02005 does not project any production from ANWR; however, an EIA analysis [of 142] projects [states] that if drilling were allowed, production would start 10 years later and reach 900,000 barrels per day in 2025 if the area contains the mean level of resources (10.4 thousand million barrels) estimated by the U.S. Geological Survey. In the reference case, crude oil production from Alaska is expected to decline to about 810,000 barrels per day in 2010.After 2010, increased production from NPR-A raises Alaska's total production to about 890,000 barrels per day in 2014. Depletion of the oil resource base in the North Slope, NPR-A, and southern Alaska oil fields is expected to lead to a decline in the State's total production to about 610,000 barrels per day in 2025. As in the lower 48 States, oil production in Alaska is marginally sensitive to projected changes in oil prices. Higher prices make more of the reservoir oil-in-place profitable. In 2025, Alaska's production is projected to be about 100,000 barrels per day".

[33] LÓPEZ-IBOR MAYOR, Vicente, MARTÍNEZ MONTES, Luis Francisco, and SÁNCHEZ DE ROJAS DÍAZ, Emilio, "Apuntes sobre el Ártico".Editorial Opera Prima, 2014.

The effects of the sanctions imposed on the Russian Federation by the West also have a bearing on the development of Arctic projects.[34]

For Alexander Skaridov, a Russian strategy for the Arctic Region clearly stresses a direct economic interest in new forms of performance, especially owing to energy production and the opening up of new maritime transport trade routes. Therefore, the first objective is to consider the Arctic as a main strategic point for the nation, as a base for its natural resources with 2020 in mind, and to conserve its leadership position as an Arctic power.[35]

In the Kara Sea, in the Russian Arctic, the US oil company Exxon Mobil and the Russian State-owned oil company Rosneft signed a multimillion dollar deal in April 2012 to explore and exploit hydrocarbons on the continental shelf. The agreement envisaged the setting up of an Arctic Research Centre for Maritime Projects, with headquarters in St. Petersburg. These activities came on top of the Yamal liquid natural gas megaproject, developed by Gazprom on the peninsula of the same name, which is expected to come into operation towards the end of 2016, after nearly nine years of hard work.

By the end of 2005, the total oil reserves in Norway amounted to 1,230 million cubic metres (approximately 1,034 million tonnes), the natural gas reserves came to 138 million tonnes plus 30 million tonnes of condensate. Norway, a country with a high profile in terms of hydrocarbons and a net oil exporter, has some of the main world giants in the sector, namely Statoil and Aker Kvaerner. In global terms, the resources exploited in the Arctic account for around 15% of Russia's GDP and 25% of Russia's exports. As far as Norway is concerned, production activities in the Arctic amount to 7% of its GDP, and to smaller figures, at present, for Canada, Norway or Denmark.

Moreover, in Norway's case, 55 of the hydrocarbon fields being operated at the end of 2010 lie within the Arctic Region, 13 in the Norwegian Sea and 1 in the Barents Sea. Most of Norway's current offshore oil production still lies outside the Arctic waters however, although the potential within those confines is considerable.

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[34] MIKKOLA, Harri and KÄPYLÄ, Juha, "Russian Arctic sanctioned". Fia Comment 16/2004: "The crisis in Ukraine has spilled over to the Arctic. The gradually tightened sanctions imposed on Russian Arctic off-shore oil projects have been one of the primary Western tools to counter Russia's actions in Ukraine.The cooperation between Exxon Mobil and Rosneft is a case in point. According to the 2011 Strategic Cooperation Agreement between the two companies, they will work jointly on several projects, including Arctic off-shore energy, shale oil and LNG development. The agreement also includes technology-sharing between the two. The Arctic off-shore joint venture in the Kara Sea includes 14 exploration wells scheduled to be drilled over the next 10 years".

[35] SKARIDOV, Alexander, "Russian Policy on the Arctic Continental Shelf", in the joint work "Changes in the Arctic Environment and the Law of the Sea".Leiden, 2010.

The Norwegian Government's Oil General Directorate estimates that most of the undiscovered gas resources lie in the Barents Sea, amounting to almost 40% of the total.[36]

Goliat, Skrugard and Haris are among the fields that could be exploited in the near future, plus the second stage of Snøhvit.[37]

However, there is no doubt that the future exploitation of Norway's Arctic reserves will be concentrated on the coastline around the Barents Sea and its proximity. The USGS estimates that 85% of the above-mentioned resources lie beneath the sea, most of them not very far from the coast, and that the Arctic oil and natural gas resources respectively account for 13% and 30% of the total volume yet to be discovered in the world.

Although this is, along general lines, the general situation concerning the energy resources in the zone and the most important elements country by country, the legal position of the Arctic countries regarding their maritime-coastal territorial rights is far from peaceful.

The different marine zones regulated by International Law include inland waters, territorial waters, the economic exclusion zone, the continental shelf, the high seas and the International Seabed Zone, including the ocean floor, each one of which has its own legal status.

Strictly speaking, the continental shelf concept refers to the continent submerged under seawater. In a broader sense, i.e., in the legal sense, the continental shelf is the natural extension of the continental territory or 200 nautical miles, as from the baselines of the territorial sea.[38]

Several States bordering on the Arctic have begun the complex research required to back up their claims to extend the continental shelf in the Arctic. Perhaps the case that best illustrates concerns the claims laid on the Lomonosov Ridge, a huge underwater cordillera that runs through the Arctic from Russia to Canada.[39]

Two thirds of the natural gas resources yet to be discovered lie in just four areas: north of the Kara Sea, north of the Barents Sea, south of the Barents Sea and the Alaska Platform. The first of these areas, which is the underwater extension of the Western Siberia basin, contains approximately 39% of the total, so Russia, with 60% of the Arctic Coast, would take most of the potential natural gas

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36 See Ministry of Petroleum and Energy 2011.Table 30, 32.

37 YERGIN, Daniel, "The guest". Penguin Books (2012), points out that "The Arctic projects are classic long-term development. How much would be oil and how would be gas is not known. Production would start around 2020 at the earliest".

38 CONDE PÉREZ, Elena, "El Derecho internacional ante el proceso de cambio climático en el Ártico. Especial referencia al derecho del Mar". Documentos de Seguridad y Defensa 58. Escuela de Altos Estudios de la Defensa.

39 LÓPEZ-IBOR MAYOR, Vicente, MARTÍNEZ MONTES, Luis Francisco, y SÁNCHEZ DE ROJAS DÍAZ, Emilio, "Apuntes sobre el Ártico".Editorial Opera Prima, 2014.

resources. As far as oil is concerned, most of the resources lie in the aforementioned sedimentary basins, the maximum potential being in the Alaska Platform and in Greenland, as well as in the south of the Barents Sea and adjoining regions, as we mentioned earlier.

Therefore, the USGS studies indicate that the Arctic subsoil is richer in natural gas than in oil and that most of the hydrocarbons are to be found in geological basins under seawater.

Once again it must be emphasised that, in industrial terms, it is extremely difficult to exploit energy reserves in the polar zones, since exploring resources is very problematic not only due to the climate, but also owing to the lack of sufficient energy infrastructures to transport these resources and to their distance from the markets concerned. Therefore, it is unlikely that they will be exploited before 2020. Nevertheless, in spite of the hostile conditions, the melting of the ice coupled with new technologies will make it easier to access the energy resources and open up the possibility of using new navigation routes.

It is thus estimated that there are reserves in the Arctic zone ranging from 20,000 to 46,000 mbp of barrels of oil and 36 to 83 thousand million Mg of gas, 50% of the potential oil reserves and 90% of the Russian reserves[40] lying in that region.

The European Union and the Arctic: the energy question

The EU is inextricably joined to the Arctic Region for a series of historical, geographical, and economic reasons, and as a result of scientific achievements. Three member states, Denmark (Greenland), Finland and Sweden possess territories in the Arctic. Another two Arctic States, Iceland and Norway, are also members of the European Economic Area by virtue of the International Treaty signed in 1992 between the European Union and several countries in the north of

[40] BOWER,Tom, "Oil". Hachette Group. 2009: "Just as North Sea oil undermined OPEC in the 1980s, oil from the Arctic could trigger an era of surplus oil and animate cooperation. At least 100 billion tons of hydrocarbons can be extracted from the Arctic, although the technological obstacles are considerable and the starting cost will be at least $20 billion. Only four Western companies possess the skills –Exxon Mobil is not among them-. So far, two suitable drill ships have been built, both under contract to Shell. Alaska took three years to master. The Gulf of Mexico has so far taken 40 years, and its exploration is still handicapped by a myriad of obstacles. But extracting oil off Brazil's coast has confirmed that no technical obstacle is insuperable, if the finance is available. Drawing on that new technology, the Arctic riches will eventually be released, despite Russia's attempts to establish territorial ambitions. In that unusual battleground, Russia has neither the financial nor the technical ability to execute the task. The fate of Arctic oil will depend on the oil majors repudiating their former cowardice. As the pressure of the price has eased during 2009, the chairmen have had time to conduct an autopsy on the past hectic months and consider the shrinkage of their corporations. Their salvation could be brought about by renegotiating their relationship with the governments of the oil-producing countries".

the European continent,[41] which gives these signatory countries a special statute with the Union, enabling them to form part of its internal market, i.e., part of its single economic space, albeit without being able to access the Economic and Monetary Union. Thus, the main conclusion is that the signatory countries begin to form part of the EU's internal market, through the automatic insertion of standards.

Canada, Russia and the United States are strategic members of the EU, although the degree of closeness and convergence in the relationship is obviously not the same in all cases. The European Arctic zones are a strategic priority for the Union and its Northern Dimension (joint policy between the EU, Iceland, Norway and Russia, which promotes stability, prosperity and sustainable development as its main courses of action).

Moreover, beyond the national jurisdiction zones, there are Arctic Ocean zones that belong to the high seas and the seabed, managed by the International Seabed Authority, in compliance with the Law of the Sea, the Convention signed by all the Arctic States, except the United States.

In principle, the Arctic has large hydrocarbon reserves to be exploited. The known resources in the high seas lie within the Arctic States' exclusive economic zones and could contribute to increasing the energy supply and raw materials supply security in general of the EU, as we have been reiterating in our analysis.

The positions adopted by the two main European institutions about the "Arctic question" have not always been consistent however, especially where Governance is concerned. Nevertheless, the Community Authorities are showing a growing interest in associating the EU with the process of Arctic strategic and political observation, as well as with continuing to provide increased support for certain programmes of mutual interest and specific neighbourhood policies, in the north of Europe, with regard to fishing, maritime, trading and energy matters.

The European Commission, on behalf of the EU, has given priority to the environmental aspect of the European institutions' Arctic policy, not forgetting though the other questions involved. As a result, it has stressed that support will be granted to exploiting the Arctic's hydrocarbon resources providing strict compliance however with environmental standards and bearing in mind the area's extreme vulnerability. The European Commission has also recognised the EU's technological expertise when it comes to exploiting resources in polar conditions, by supporting the long-term cooperation, especially with Norway and Russia, facilitating sustainable and environmentally-friendly ways of exploring,

[41] See 94/1/CE, CECA. Decision of the Council and the Commission, dated 13th December 1993 concerning the signing of the Agreement about the European Economic Area between the European Communities and their Member States, on the one hand, and the Republic of Austria, the Republic of Finland, the Republic of Eire, the Principality of Liechtenstein, the Kingdom of Norway, the Kingdom of Sweden and the Swiss Confederation, on the other hand. "European Economic Area Agreement.Final Act.Joint Declarations".

extracting and transporting the Arctic's hydrocarbon resources, by applying internationally binding standards based on the guidelines laid down by the Arctic Council and the applicable international conventions, and based as well on the performance of research and development regarding high-sea technology and infrastructures.[42]

The EU has likewise seen fit to recall that its Member States have the largest merchant shipping fleet in the world and many of these vessels use transoceanic routes. The thawing of the marine ice is gradually opening up opportunities for shipping to follow routes through the Arctic waters, and the EU is all too aware of this fact. The first immediate consequence is of particular interest in terms of competitiveness and freight transport costs: considerably shortening the distance of journeys between Europe and the Pacific enables those concerned to save energy, reduce emissions, encourage trade and ease the pressure on the main transcontinental navigation channels. However, there are serious problems, including the drifting blocks of ice, the lack of infrastructure, the risks to the environment, recalled so often, and the uncertainty with respect to future trading guidelines. Therefore, developing commercial navigation in the Arctic requires time and effort.

The EU is interested in exploring and improving conditions so that it can gradually introduce commercial navigation into the Arctic, while at the same time encouraging stricter standards –it must not be forgotten that the EU is the world´s main regulatory power in environmental policy and climate change – concerning the environment and security. The Union has asked to play an active role as a stakeholder with its own legal personality in defining the new governance of the Arctic and has expressed a wish to be given the status of observer on the Arctic Council, so far without success. Policies and instruments for community action converge in these matters, from specifically environmental questions to foreign policy and common security or energy policy, above all in matters concerning the security of supplies from beyond its boundaries and their environmental aspect and, perhaps, the possibility of activating in the future, mechanisms for enhanced cooperation, i.e., opening up the possibility for a group of countries to go further than others in *Community integration* scenarios like, for example, with respect for the Arctic policies considered.[43]

A Communication from the Commission is a *soft-law* instrument that makes it possible to position the opinions of European institutions with regard to subjects of a specific or a strategic nature and that, quite often serves as a guideline for subsequent binding regulatory acts. In this case, the Communication is signed by

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[42] See, amongst others, Commission Communication "An Integrated Maritime Policy for the European Union". 10th October 2009. COM (2007) 575 final.

[43] In June 2012, the European Commission approved a joint communication to the European Parliament and to the Cabinet Council about developing a policy for the Arctic, examining what the Commission believed to be progress in its policy in the area since 2008 and the next steps to be taken.

the European Commission and the European Union High Commissioner for Foreign Affairs and Security.[44] The document is important, in its timely appearance and much of its content, using specific data and transparency to put forward a forceful argument in favour of the EU's status as an observer on the Arctic Council. One of the sections in the Community reflection is entitled «Components of the EU's contribution to the Arctic Region»; it contains certain data concerning research & development, investments and maritime security. Data, in some cases, that are reliable and measureable, and in others, expressions of goodwill more along the lines of *wishful thinking* than anything else. It stresses that the EU has supplied more than 1,140 million Euros to develop the economic, social and environmental potential in the EU Arctic regions and the «neighbouring regions» in the last five years, although when redirected to the EU's seventh R&D Framework Programme – in which the Faroe Isles, Norway and Iceland participate with the same rights as the EU countries–, the figure shrinks to 200 million euro. Even so, the Community Authorities state that the Union has carried out a «pioneer assessment» of the EU's current and future ecological footprint in the Arctic. It also emphasizes the importance of the satellites orbiting the Earth as essential instruments for communication, navigation and observation in this region. In this sense, the intention is to broaden the scope of the Galileo Programme, deploying it in the zone and using the new Sentinel satellites, within the framework of the Global Monitoring for Environment and Security (GMES) Programme. Sentinel satellites will enable their users to control the way the thickness and extension of the ice flow evolves.

The European Union also economically supports a series of financial assistance programmes for specific lines of social action, development cooperation, health and culture for the indigenous and local inhabitants, programmes which a large number of ethnic groups and inhabitants in the region have been beneficiaries of.

In any event, the Community commitment revolves around guaranteeing both bilateral and multilateral cooperation mechanisms in the zone, taking into consideration the influence that the EU countries exert upon the group of circumpolar States and the ability of European external action to affect them directly or indirectly. The EU does its utmost to express in its official texts that it will do «whatever it possibly can» to increase its cooperation in Arctic matters in the bilateral dialogues that it takes part in with its "Arctic partners". One singular case is Greenland,[45] because of its special political and legal status within a European context, it is a territory that has had experiences both with and with-

[44] See Report "Climate Change and International Security" from the High Commissioner and the Commission for the European Council, published on 14th March 2008.

[45] Greenland came to form part of the Kingdom of Denmark in 1953 and in 1979 it was granted Home Rule within the Kingdom, with extensive powers. In 1985 it withdrew from the EEC, although certain important provisions still apply to it, such as those concerning the "Association of the Overseas Countries and Territories", Articles 198 to 204 of the TFEU, and Protocol Num. 34 of the Treaty "Specific Provisions for Greenland", concerning fishing rights. It must be remembered that the questions dealing with energy and security policies fall within the juris-

out Denmark, and the aim is for the existing agreement to be renewed for a further period, 2014-2018. Regarding environmental matters, there is a reiteration of the commitment to the defence of environmental protection and the fight against climate change in the now classic areas of biodiversity, ecosystem-based management, persistent organic pollutants, protected marine zones, direct discharge of wastewater or the ways of materially accessing energy and mining resources, where it must be remembered that 88% of the EU's total iron ore production comes from the Barents region.

For obvious reasons, the European Union holds an active interest in the Arctic energy question. The Union's great dependence on the exterior for its energy needs, measured as 46%, its external vulnerability where hydrocarbons are concerned and its still inefficient and incomplete domestic market, make it essential to pay particular attention to the foreign aspect of the Community energy policy, especially where its neighbours are concerned, in dialogue with the major suppliers, and in the strategic regions or spaces, such as the Arctic area for its economic or geopolitical resources. The EU is highly dependent on two Arctic nations for hydrocarbons, Norway and Russia. One third of our natural gas imports come from Russia, whereas Russia obtains 60% of its foreign currency income from gas and oil exports.

It must be borne in mind that the EU is still considering a formal combination of energy policy and domestic market that is still far from complete, causing serious damage to the competitiveness of the European economy and its manufacturing network. It is true to say that considerable progress has been made in the policy of encouraging renewable energies, or for using them to a greater extent in industry applications, such as wind energy and in recent years solar photovoltaic energy, but the convergence of a deficient and asymmetrical regulatory policy and the emergence of a very serious economic and financial crisis weighs heavily on the structure and development of a sector that urgently requires changes and certain moves for transition towards new forms of production, use and consumption. In recent years, albeit with major difficulties, the EU has implemented a public policy of encouraging energy efficiency measures and displaying new commercial energy services to optimise consumption, all the more so in the public sector. However, although such measures are of undoubted interest, they still lack not only the implementation required but also, in many cases, sufficient technical and economic culture from the operators and suppliers of these new energy services or products. Furthermore, a sharp drop in energy demand prompted by the economic crisis has also made it more difficult for these techniques to make inroads at the desired rate.

We cannot therefore ignore the impact of the new energy reality in the transition towards less pollutant forms of energy, involving not only the use of the various renewable technologies, but also the recent use of non-conventional gases.

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diction of the Danish Government and that Greenland currently receives half of its budget from the Danish Central Authority.

The term «energy transition» is consistent with the political aim of achieving a low-carbon economy within a clearly-defined timescale.

The Arctic as an alternative energy transport route

The geopolitical emergence of the Arctic is due, amongst other things, to the conceivable possibility that the region will become a new scenario for opening up maritime and air transport routes. A new and central enclave through which continents, oceans, seas and maritime and air routes can communicate and, with this, send huge amounts of products, goods and services, in yet another qualitative leap in this period of inter-exchanging flows and economic, financial and commercial globalisation, in which the energy question is going to have a particularly high profile.

If we focus on the term "maritimization", it could be understood as meaning the act of putting into practice and creating commercial routes and strategies inside and around the Arctic Basin. It must not be forgotten that this "commercial opening up" or Arctic *maritimization* is not new. Russia tried unsuccessfully to activate it after the defeat inflicted by Japan in 1905, and on fearing that the Suez Canal would be blocked in the event of a war between Germany and Turkey.

The first journey between Murmansk and Vladivostok, 11,000 kilometres, took place in 1932, representing half the distance covered by the traditional routes through the Suez Canal or around the coast of South Africa. The construction of an icebreaker was crucial to this journey and to the original opening of this strategic route that crosses the basin from the Pacific across the Bering Strait to the Island of Sakhalin, and finally to Vladivostok. Alejandro MacKinley reminded us to what extent the prosperity of East Asia relies on trade exchange connecting China,[46] Japan, Korea and other nations by sea with the rest of the world. Fourteen of the twenty container ports with the highest world turnover are found in East and South-East Asia and, of those, eight are in China.[47]

One of the main and necessary effects to enable the energy resources to be accessed and transported is for the Arctic routes to open up.[48]

Apart from making hitherto inaccessible fields and deposits available for exploration and eventual exploitation, within the context of the energy transition in course, the gradual thawing of the Arctic also makes it feasible to use new maritime routes that bring distant points on the globe closer together. As a result, it will be possible to transport and delocalize energy resources and minerals from

[46] It is estimated that 5.15% of China's trade value, around 500 thousand million dollars will be transported via the Arctic. "US State Department Office of Ocean and Polar Affairs".

[47] MACKINLEY, Alejandro, "La geopolítica y el retorno de lo marítimo". Diario El Mundo, 14th August 2014.

[48] See for general purposes, LÓPEZ-IBOR MAYOR, Vicente, MARTÍNEZ MONTES, Luis Francisco, y SÁNCHEZ DE ROJAS DÍAZ, Emilio, "Apuntes sobre el Ártico".Editorial Opera Prima, 2014.

remote Arctic areas to the main international economic nodes. If the past aim of looking for the elusive North-West Passage was intended to alter the global balance of power in the era of colonial competition, the increasingly close perspective of not only one but several Arctic routes being feasible for navigation and communication offers hitherto unprecedented potential for modifying the current global geopolitical and geo-economic balances.

If the thawing phenomenon carries on at its current rate, the most conservative estimates consider that the Arctic would be suitable for trans-oceanic navigation between the Atlantic and the Pacific in the summer by around 2030, and for at least six months of the year in about 2050. This process could have extraordinary consequences for the international economy. A taste of what could be to come took place in August 2011, when the Russian tanker Vladimir Tikhonov, with a displacement of 160,000 tonnes and a load of 120,000 tonnes of condensed gas, crossed the Arctic between the Port of Murmansk and the Bering Strait - the so-called North Route - in seven and a half days, reaching its destination in Thailand one week earlier than it would have done had it used the Suez Canal.[49]

All that is needed to give an idea of the importance that opening up the Arctic would have, is to bear in mind that maritime transport accounts for 90% of world trade.[50] The source and destination points of most of this trade are Asia and Europe and, in view of the growing economic weight of Asia, the volume is destined to carry on growing. At present, maritime traffic between the two continents mainly takes place via the Panama Canal and the Suez Canal, following routes that are well known but very long, with the consequent increase in cost. Therefore, control over both routes has always been, and still is, one of the basic principles of global geopolitics. It is likely to carry on that way in the near future, but the centrality of both canals to economic and political balances could diminish as the Arctic routes become more practicable.

Another energy giant, in this case with regard to consumption requirements and infrastructure creation, is China, a nation facing increasing vulnerability where its hydrocarbon transit routes are concerned. The country imports mainly from the Middle East and most of the hydrocarbons pass through the Hormuz Strait between the Persian Gulf, the Indian Ocean and the Strait of Malacca, which guarantees passage between the Indian Ocean and the South China Sea; this is the route followed by 80% of China's oil imports.

According to Humpert and Raspotnik[51] there are three trans-oceanic maritime routes in the Arctic Region, navigable to different extents, that could potentially be exploited for trading purposes, : the Northern Sea Route, which runs along

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[49] The Economist, «Short and Sharp», 16th July 2012.

[50] The main data showing how maritime transport evolves can be seen at www.shipping-facts.com

[51] HUMPERT,Malte, and RASPOTNIK, Andreas, «The Future of Arctic Shipping along the Transpolar Sea Route», accessible in www.thearcticinstitute.org/2012/10/the-future-of-arctic-

the Russian Coast and has been open to international navigation since 1991; the North-West Passage, which runs around the north of Canada, between Alaska and Greenland, and the so-called Transpolar Sea Route, which is the only one that does not cross waters claimed by any national jurisdiction. Apart from the above-mentioned routes, the Arctic Bridge is usually added, this being a maritime route that links the ports of Murmansk, in Russia, and Churchill, in Canada. All that is needed to obtain further insight into the potential importance of these routes to world trade is to mention the fact that the distance between the ports of Rotterdam and Shanghai through the Suez Canal could be cut by 22% if the Northern Sea Route is used, and by 15% if the North-West Passage is followed.

Even shorter than the two routes mentioned – with a total length of 2,100 nautical miles – and more direct for navigating between the Atlantic and the Pacific, is the Transpolar Route. It also has the advantage of being governed by the 1982 Law of the Sea Convention, its traffic only being subject to the conventional maritime security and environmental protection laws. However, it is the route that is fraught with the most practical difficulties, even with the current climate change trend that is conducive to the ice floe melting. In spite of the expected drastic reduction in the amount of perennial sea ice and even though seasonal ice disappeared for long periods, the presence of icebergs and other floating ice formations, coupled with the variable hidden currents would continue to pose considerable risks to shipping. A similar yet less dramatic phenomenon occurs with the North-West Passage, whose different optional routes are obstructed by the presence of ice-generating islands, hindered by the non-existence of coastal support points and by the absence of an agreement between Canada and the rest of the international community, starting with its neighbour the United States, about its legal status.

In view of the aforementioned, it is the Northern Sea Route the one that is currently the most likely to open, especially if one takes into account the interesting options that it offers for transporting Russia's huge energy resources to the Asian markets. It is thus hardly surprising that Moscow, which is equipped with ten polar icebreakers (compared to the United States, which only has two), is preparing extensive infrastructure projects aimed at turning the port of Murmansk into a terminal that can store huge amounts of hydrocarbons and coal prior to being shipped to the Far East.

Apart from reducing the distances between many areas, seas and continents, the opening of the Northern Sea Route would cut the cost of transporting hydrocarbons obtained in northern Russia (Timano-Pechora Region) and currently channelled through the Baltic oil pipeline system.

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shipping.html. It must be remembered that, in addition to the trans-oceanic routes, the Arctic can also be used as a means for inter-regional transport.

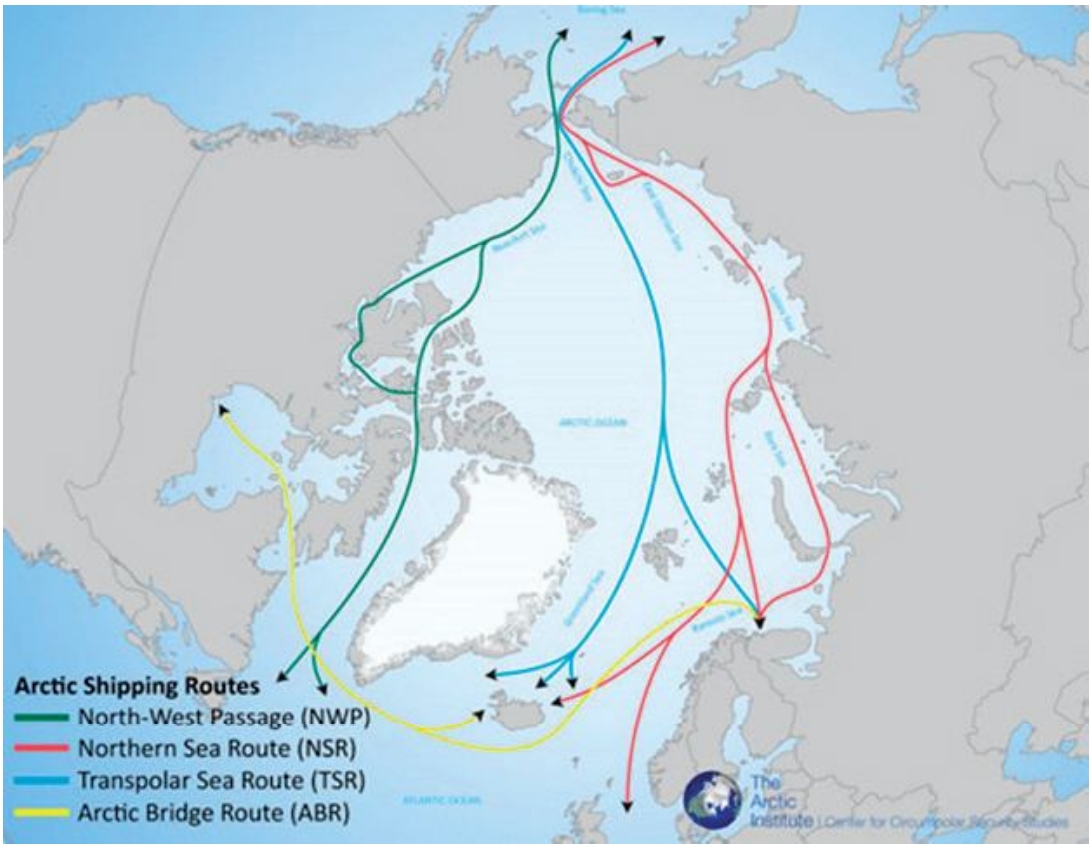

Image 3.

Icebreakers would be needed to cross the Northern Sea Route. Its feasibility was verified in August 2010 when the Russian tanker Baltika used this route to transport 72,000 tonnes of liquefied gas to China. Almost a year later, the tanker Vladimir Tikhonov followed the same route, assisted in its crossing by two nuclear icebreakers. Nevertheless, the difficulties posed to shipping are still extraordinary. In this sense, some of the risk factors identified by London Market's Joint Hull Committee (2012) are the following: damage to the vessels' propellers, rudders and machinery, caused by contact with ice formations and uncharted rocks (from November to March); fog (worse in June and July), and collisions and delays in rescue operations complicated by remoteness and a lack of information about safe ports. These risks are further complicated by a series of secondary factors including: poor mapping, insufficient hydrographical and meteorological data, little information for satellite navigation and general or momentary communication problems between operators.

Nevertheless, it must be remembered that nearly all the current maritime transport activity on the Arctic routes presently open to traffic, involves the regional, and not transarctic transit of natural resources, from the ports located in the Arctic Ocean, or to deliver goods and supplies to the ports and facilities that provide support for the extraction of those resources, plus the economic activity generated by Arctic tourism, whose efficient development is also asso-

ciated with improving vessel safety protocols, rescue devices, and regional and international powers to regulate and inspect, etc.

In any event, enhancing Arctic *maritimization*, whether in the field of new types of construction or building vessels adapted to the characteristics of the zone, icebreakers or similar, and a boom in operations involving research, assistance, rescue and environmental conservation, will increasingly become realities in the area, in the form of a technical budget leading to greater development – perhaps huge – in trade exchange, in the medium and long term, depending on the extent to which potential navigation routes are effectively developed in the future, where the transport of energy resources (oil and gas), as well as fish, extracted from the region and available for international exchange, will play a major role.

Image 4.

However, it is not just a question of opening up maritime routes, of greater *maritimization* of international relations, in a world that is becoming increasingly intercommunicated and interdependent. The Arctic, if the trend towards global warming or ice melting continues in the terms expressed, will give a new meaning to commercial power and, with it, maritime energy power.

Not only this, the warming of the Arctic would naturally open up other transport routes by air,[52] in the near future. As R.D. Kaplan stated, *"Supersonic transport could cut by two thirds, the distance between the west coast of the United States and cities in Asia. Globalisation, in the sense of overcoming barriers, would bring about an increase in the number of contacts and their intensity, which would also involve the likelihood of an even greater number of political and cooperation conflicts".*[53]

Drilling oil and gas wells in the Arctic is not only a very complex and risky technical task, but also an experience that can prove to be very costly (one single productive well can cost up to 900 million dollars). The development in the Barents Sea of the Snøhvit gas field, a project led by Statoil in order to supply the liquefied natural gas plant in Hammerfest, the only one to the north of the Arctic Polar Circle, is a perfect example of the time and cost involved in production projects in the region. The field was discovered in 1984, but the first commercial flow of gas was not obtained until 2007, after an investment of 8,000 million dollars (even though Snøhvit is located in the south of the Barents Sea, in a zone relatively free of ice).

Shell's recent decision to give up its Arctic exploration campaign gives a clear indication of the difficulties of all kinds experienced by that oil company in the region. We now know that the great plans for the Arctic do not always turn into great realities and the industry considers that the intensive development of the region is a project that is still far away, and one which will take decades to be fully realised, as we have analysed in the preceding pages, using specific examples.

Notwithstanding the above, it should once again be borne in mind that a lot of exploration work is being carried out in this region by major energy and engineering companies.

Obviously most of this drilling and exploration work takes place in coastal zones or nearby, in locations such as Slope North (Alaska), Baffin Bay (Canada), the Pechora Sea (Russia) or the coastline of the Norwegian Sea, in Barents.

The Prirazlomnoye oil rig (in the Pechora Sea), or the one in Prudhoe Bay (in Alaska) are good examples of such notable energy infrastructures. It must also be taken into account that at depths greater than 100 metres in coastal zones, semi-submersible rigs have to be used that are able to reach depths of over 2,000 metres.

As we have endeavoured to point out, from an energy perspective, the Arctic cannot be regarded as a remote, isolated and future phenomenon, but as part of

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[52] As Gonzalo SIRVENT ZARAGOZA points out, until very recently the frozen waters of the Arctic could only be flown over or crossed underwater by nuclear submarines, apart from powerful icebreakers, which were the only vessels that could cut through them. "Nuevas rutas de navegación a través del Ártico", Page 198. Documentos de Seguridad y Defensa 58.Escuela de Altos Estudios de la Defensa.

[53] KAPLAN, Robert D., "La venganza de la geografía". RBA Libreros, S.A. Barcelona, 2013.

an interdependent, complex and current global reality, with major implications from the energy side of geopolitical events.

If anything were to define our global energy situation and its expression in international relations and exchanges, apart from its growing technological sophistication and regulatory complexity, it would be its evolutionary hallmark and its interdependence equation. It would thus be difficult, or unwise, to evaluate the consequences of an energy occurrence in a particular zone on the planet, without considering its effects not only on the political and economic systems closest to it, but also on others, given the intercommunication of the effects that the key economic events have on today's world. Or to put it another way, the rise or fall in the price of oil in one region, brings about an increase or a decrease in others. The construction of strong infrastructures that cover several countries can modify the transaction or demands in other parts of the world or the mandatory nature of certain procedures or formalities.

One of the most outstanding aspects in the geopolitical energy equation in recent years is the production of shale gas in the United States, increased by one thousand per cent in the last decade, whereas the production of shale oil has meant that, for the first time in the history of the USA, the country has begun to reduce its oil imports. This is a matter of great strategic importance.[54] The exploitation of gas or oil contained in shale formations opens up a new chapter in the energy world and invites to one reflect on three basic challenges: geological-environmental, geopolitical and economic.

From a technical perspective, progress is achieved through the development of a new geology. More specifically, based on so-called «unconventional technologies» for drilling, extraction, transporting and exploitation of gas and oil. Some of the gas fields cover extremely large areas and horizontal drilling technology interconnects reserves by through the use of what are known as hydraulic fractures. The technique involves controlled explosions of water, accompanied by sand and chemical products, on the rock that contains these energy resources. Bituminous sands, extra-heavy oil, and gas and oil produced in lutite and shale i.e., shale gas and shale oil,[55] are amongst the most remarkable unconventional hydrocarbons.

From an economic viewpoint, shale has changed many things in the US energy economy in recent years and, indirectly, in the world energy economy: derailment of gas and oil prices; fast reduction in the import demand; cheapening of the energy and industry sector; increase in the hydrocarbon recovery factor; raise in the investment and expansion of the infrastructures, plus the creation of employment.

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[54] See the excellent work by BLACKWILL, Robert D. and O'SULLIVAN, Meghan L., "America's Energy Edge.The Geopolitical Consequences of the Shale Revolution". Foreign Affairs, April 2014.

[55] A well-documented synthesis can be found in "Recherche et production du pétrole et du gaz, réserves, coûts, contrats", pages 99-104. Coordination, Centre Économie et Gestion de l'École du pétrole et des moteurs.Edition Technip, 2002.

However, it is true to say that criticism has also been levelled at the shale gas challenge. The main argument against it concerns environmental care, basically the unknown factors regarding how the water used is dealt with - as it is contaminated in the fracking process -, including the risk assessment in the injection systems and treatment of polluted water and the fear of possible contamination of aquifer mantles intended for consumption. The US Environmental Protection Agency (EPA) has already made statements about these matters on more than a dozen occasions. In fact, the most significant benefit brought by shale gas, is its ability to help the electricity and transport sectors to reduce their emissions of greenhouse gases – because this gas emits 50% less than coal (which is still the predominant generation energy) and 33% less than oil (the main energy form used for transport). Some argue that the methane leaks that can escape during the production of the shale gas could make it even worse than coal in terms of emissions.

The EU has drawn attention to the fact that, on an international level, the International Energy Agency (IEA) has prepared a series of recommendations about the secure development of unconventional gases. These "good codes of practice" require sound and suitable regulatory regimes to be established, a careful selection of sites, suitable planning for the projects, a description of the underground risks, strict standards for correct design, complete operational transparency and close monitoring of the impacts caused, as well as careful water and waste management and a reduction in the emission levels of atmospheric pollutants and greenhouse effect gases.

Therefore, prior to starting high-volume fracking operations, the Member States shall ensure that the operator establishes the environmental course (the reference situation) of the facility site, the surrounding surface area and the subsoil potentially affected by the activities, and that a suitable description of the reference situation is submitted to the relevant Authorities before operations begin.

The reference situation must likewise be defined with respect to the quality and characteristics of the surface water and underground water flows; the water quality at the drinking water extraction points; the air quality; the ground conditions; the presence of methane and other volatile organic compounds in water; the seismicity; the land use; the biodiversity; the state of infrastructures and buildings, as well as the state of existing wells and abandoned structures.

From a geopolitical analysis viewpoint, the fact that the United States has once again re-joined the group of major energy-producing powers and perhaps potential energy exporters in the medium term, with self-sufficiency levels of more than 75% at the end of this decade, creates a new and optimistic situation in the international relations that will have to be suitably interpreted. It would seem to be the case that shale - both gas and oil – has begun to displace the centre of gravity in terms of energy influence, from the Middle East and Central Asia to the Atlantic.[56]

[56] LÓPEZ-IBOR MAYOR, Vicente, ISBELL, Paul. "Shale" o no "shale"? Diario ABC, 7 April 2013.

In institutional or political terms, the Arctic Region does not offer similar elements compared to other parts or regions of the world, which once again, as we stressed in the first few pages of this work, emphasizes the need to approach the way it is studied with knowledge and respect – at least at the outset – for its specificity. It is a region composed of sovereign States or parts of these, institutionally united by certain cooperative governance instruments based on exchanging experiences and positions, formulating approaches that are not optional nor compulsory for the parties that take them on or jointly formulate them, as well as mechanisms for internal organisation and external representation, of an intergovernmental nature, albeit open to other organisations, bodies, stakeholders or lobbies, whose most advanced governability structure is represented by the Arctic Council, which brings together the representatives of the Arctic States so they can examine plans of action, topics or strategies of mutual interest to its members.

The difficult arctic governance and energy

In 1952, the five European Arctic States, Norway, Iceland, Finland, Sweden and Denmark –with Greenland-, established the first Subpolar Council, the Nordic Council, and in 1971 the Nordic Council of Ministers was set up. Furthermore, at the beginning of the 1990s, the European Union decided to join the Council of the Baltic Sea States and the Barents Euro-Atlantic Council, respectively. The Arctic Council was formally established in 1996, by the Ottawa Declaration, although the first steps had been taken in 1991, when eight Arctic countries (those that currently make up the Council) signed the Strategy to protect the Arctic environment. The Council meets about once every six months in the country that happens to be occupying the rotating presidency of the Organisation at the time.

From a formal viewpoint in terms of governance, it is now the countries with an Arctic coastline - more precisely those with land and territory beyond the Arctic Circle -, that form the Arctic Council. These States are Canada, Denmark (because of its sovereignty over Greenland and the Faroe Isles), Finland, Iceland, Norway, Russia, Sweden and United States.

Those countries currently *govern* the Arctic in a broad sense, rotating the presidency every two years, although they do not constitute an international legal entity but rather an intergovernmental exchange forum[57] and, so, they fall within a frame of international cooperation relations -not integration- between the members. The forum is also open to other countries that are granted the status of observers, including most of the countries in the European Union, such as

[57] See the European Parliament Resolution on Arctic Governance dated 9th October 2008, as the most advance step in this area, from a Community institutional perspective.

France, Germany, Poland, Netherlands, Spain or the United Kingdom, and certain bodies that have been granted the status of "Permanent Participants".[58]

Other countries have applied to be observers for that purpose, such as China, Singapore, South Korea or Italy, and even the EU hopes to be given the status of permanent observer. The legal-political scope of the Arctic Council must be borne in mind, its objectives being limited to something as important and specific as guaranteeing environmental protection and sustainable development in the broadest sense since it would include economic and social matters, as well as health protection and the defence of cultural values, its functions not including though security or military questions. Along the same lines, the Arctic Council lacks a specific institutional structure, although it does have a permanent Secretary who is responsible for overseeing the fulfilment of the aforementioned missions, looking after and implementing the communal projects, and trying to find, through intergovernmental dialogue, the balances that are needed to ensure that the Council's decisions are adopted by consensus.

Another figure of special importance has to be added to the above-mentioned list of countries that constitute the permanent or constituent members that alternate in holding the presidency of this organisation and the observers who also participate. These are the groups of indigenous peoples who attend the Council in the capacity of «Permanent Participants».

Access to energy is a prerequisite to the existence and development of the Arctic peoples and their societies. Energy resources are essential for energy, heat, lighting and transport.

Since 1996, the Council as a "high-level forum for the Arctic" has promoted the cooperation and interaction within the Arctic States, together with the participation of the indigenous peoples, "particularly on matters concerning environmental protection and sustainable development".

The term "Arctic Energy resources", is often considered to be synonymous with "Arctic Oil and Gas", *"A broader spectrum of Energy issues requires examination in the context of the Arctic".*[59]

In its first year of functioning, the Arctic Council already set a Working Group devoted to study the Arctic energy question and, in particular, the gas and oil activities. It presented its first general document in 1997, as "Guidelines" in response to the Report of the 3rd Ministerial Conference on the Protection of the Arctic Environment, held in Inuvik, Canada, in March 1996. These Guidelines have been

[58] Such as the Arctic Athabaskan Council (AAC); the International Energy Agency (AIE); the Inuit Circumpolar Council (ICC), the Saami Council; the Russian Association of Indigenous Peoples (RAIPON).

[59] AMAP Report on the Arctic Oil and Gas Assessment 2007.Economy Report 2006.

further elaborated in successive years, until being completely updated in a new version issued in 2009.[60]

We stated that the Arctic is not – and it is highly unlikely that it will become – one single regulatory space. However, this should be an objective for the countries that have direct or indirect interests in the zone.

Arctic governance gets even more complex and complicated when new economic or political interests come into play, by the emergence of new world stakeholders in the region: it is probable that there will be an adverse effect on sustainable development in Arctic governance, that the indigenous peoples lose influence, that the Arctic States will be affected by the new stakeholders, interests and dynamics, and that the appearance of emerging stakeholders reduces the influence of the small Arctic States.

It is necessary to assess the advisability of developing a package of measures for enhancing trust and security specifically for political-military questions in the Arctic, in the image and likeness of the CSBM developed by the OSCE for Europe, but including all the interested parties. The role of the EU as the main regulatory power in the world would be fundamental for Arctic governance.

The increasing importance that energy issues have in the Council's scope or sphere of activity and that of its constituent members must be stressed, and the same applies to the Working Groups established within its institutional development or "implementation" framework. All of these express a special concern about the problems arising from the fight against climate change and the search for sustainable development.[61]

Some of the documents prepared and approved to date, although most are not mandatory in nature, contain many principles (especially where the environment is concerned) and regulatory techniques, borrowed from public International Law and even from the EU legal corpus in the matters concerned, although we must insist that they generally appear in the form of *soft law* or *soft regulation* in an enlarged cooperative context, affecting not only the Governments of the Arctic States, but also other States with Observer Status, NGOs and indigenous peoples, for whom special significance and protection is required.

[60] Different permanent or semi-permanent working groups have been established to prepare and support these activities, such as "Protection of the Arctic Marine Environment" (PAME); or the "Arctic Monitoring and Assessment Programme" (AMAP); the "Emergency Prevention Programme", etc.

[61] Sometimes with a high level of detail in their regulation. One such example is the 2009 Final Draft Arctic Offshore. Oil and Gas Guidelines.

Chapter III

Universal access to electricity and its role in the fight against poverty

Carlos Sallé Alonso[1]

Abstract

Providing energy to the more than 1,300 million people who lack modern forms of it is a key factor in the fight against poverty, as it makes it possible to tackle various problems that affect this group (health, education, economic development, development of women, etc.) and puts an end to one of the negative factors on the security of nations (leaving rural areas, large-scale migration, epidemics, etc.).

Although social action and philanthropy must continue to play a major role in taking electricity to those who do not have it, the aim of Universalising the Access to Electricity Supply requires solutions to be scalable. With a view to this, multi-stakeholder solutions must be considered, with specific governance systems that allow projects to be profitable and attract companies (already well established or recently set up) to the Bottom of the Pyramid. Furthermore, it is essential that the beneficiary communities are involved at all phases of the project and, above all, at the sustainability phase subsequent to the investment. Numerous successful initiatives already exist, which will be further boosted by the major programmes under way (SE4ALL, Light for All, etc.), and by the introduction of a specific goal of Universal Access in the future Sustainable Development Goals that will replace the Millenni-

[1] Miguel Ángel Muñoz Rodríguez, Lucía Arraiza Bermúdez, Rodrigo Sousa, Antonio Erias Rodríguez, María Jesús Mattern, Mónica Oviedo, Agustín Delgado, Julio Lumbreras, Ana Moreno, Claudio Aranzadi and Ignacio Pérez-Arriaga have collaborated in the preparation of this article.

um Goals and that will be able to establish the synergies and scalability required to successfully face up such a challenge.

Keywords

Universal Access to Electricity Supply; energy poverty; Business at the Bottom of the Pyramid; Public-Private Partnerships for Development; Light for All; Millennium Goals; Sustainable Development Goals; Payment Capacity; Reverse Innovation; Sustainable Energy for All; Electricity for All; Energía sin Fronteras; Security; Microgrid; Grid Extension.

Introduction

Access to energy is vital to enable humans to attain a decent development level. However, the right to have energy was not specifically included in the Human Rights, and neither was it included among the 8 Millennium Goals, even though it was subsequently accepted that such access is essential if those Goals are to be achieved. The Project *Sustainability Energy for All* (SE4All) launched by the United Nations does recognise this role for the access to energy, supporting a series of objectives to enable this universal service to be available to all by 2030. The work currently being done to establish the Sustainable Development Goals that will take over the baton from the Millennium Goals in 2015, now include universal access to modern, reliable, affordable and sustainable energy for 2030.

It is a major challenge however: approximately 20% of the world's population, which amounts to around 1,300 million people, 95% of whom live in Sub-Saharan Africa and Asian developing countries, do not have electricity, and 2,600 million use traditional biomass for cooking and heating[2] without having cooking facilities that comply with minimum health and safety standards.

The lack access to modern forms of energy is not only preventing many people who coexist with us on Earth from enjoying decent and fair human development, but it also hinders them in their attempts to overcome all the problems caused by poverty: hunger, health problems, lack of education, perpetuation of gender-based discrimination against women, environmental problems, migration, etc.

A few months ago, at a conference[3] attended by Julio Lumbreras, a Professor at the *Universidad Politécnica de Madrid* and one of the experts in Spain on the fight against energy poverty, staggered those present with the millions of deaths that could be prevented in the developing countries just by installing improved stoves that do not cause the "bad smoke" that is emitted by traditional wood-burning stoves, and how little it would cost to install an improved version of one of these stoves. At the same conference, Eduardo Sánchez Jacob of the NGO ONGAWA stressed the paradoxical situation whereby something as vital as access to water or energy was not originally included as one of the Human Rights.[4]

Something else that left a profound impression on me regarding this problem was when I read the justification for a collaboration project led by UNHCR in which my company is participating, seeking to standardise electrification in refugee camps (in this case in Ethiopia). In that justification, apart from the typical reasons given for needing to have electricity to cater for the basic requirements of the thousands of refugees, there were others, less obvious at a first glance, such as decreasing the degree of deforestation around those camps or reducing

[2] International Energy Agency, 2012.

[3] Escuela Técnica Superior de Ingenieros Industriales de la UPM, 2013.

[4] In the case of water, on 28th July 2010, as a result of Resolution 64/292, the United Nations General Assembly explicitly recognised the right to water and sanitation.

the number of rapes committed against the women who, in most cases, are responsible for finding wood – having to go increasingly far away from the camps due to the deforestation being caused – to provide for the minimum cooking and heating needs of their respective families.

Unfortunately, these are just a few of the many examples...

Poverty and lack of energy are thus closely linked. That is why all types of initiatives are on the increase: public and private initiatives, and those from Multilateral Intitutions and from Non-Governmental Organisations, tending to help in solving poverty problems through Universal Access to Energy Supply.

Solving the problem is by no means easy. There are many questions that we shall see throughout this article that stand in its way. The most basic one is a lack of financing for the programmes, philanthropic contributions not being enough, because the problem is so big that it requires solutions scalable to millions of people; or the administrative complexity, having to determine the rights and obligations of the many parties involved in these programmes, providing with adequate legal security the large Universal Access programmes that are established; the ethical dilemma arising from having to choose one of the potential Universal Access projects in order to maximise the results of applying the few economic resources available, which will generate the problem of having to choose helping some group while leaving others out, which often means not solving cases that affect people's lives, etc. We don't have to forget also the importance of choosing solutions that ensure that the energy demand generated by those groups does not cause the planet further environmental stress, especially where climate change is concerned.

By way of a disclaimer, it must be pointed out that this article is approached from the viewpoint of one who sees the problem from the business world. Access to Electricity is just one among the means for fighting poverty that are used by the real experts in this field (NGOs, Multilateral Institutions, Administrations, Development Aid Agencies, etc.). The article aims to present the complexities involved in successfully dealing with the lack of electricity, creating awareness about the problem and, why not, channelling such awareness towards contributions that each individual can make to solve the problem within their own fields and using their own capacities.

Apologies are asked for in advance, because it has been necessary to limit the scope of the subjects dealt with, this article being focused on Universal Access to the Electricity Service. Universal Access to Energy Supply has many sides to it, some of them being critical and effective in their investment/negative effect prevented ratio, such as the aforementioned one of replacing traditional stoves with improved ones that, with only limited investment, can directly and considerably reduce the mortality rate; or the use of programmes in some countries that tend to improve access to other types of energies, gas for example, that improve the energy poverty level of the beneficiaries.

It must also be pointed out that, by way of simplification, this article tackles the concept of Universal Access to Electricity from a pragmatic-educational perspective, endeavouring not to enter into the legal and social connotations of the so-called "Universal Service", which is a broader concept. When mention is made of "Universal Access to Electricity" (or for simplicity "Universalisation") reference is being made to how to take electrification to the places where it is lacking. The Universal Service goes beyond the scope of this article, because it deals not only with the need for electrical installations to be available, but also the availability of the economic means to pay for it, and this applies not only to developing countries.[5]

This article has been structured as follows: a first general chapter that tries to establish the link between the security of the nations and their level of poverty. It explains how the presence of global problems – such as mass migration, climate change, epidemics, etc. – affects all countries, meaning that no particular country can guarantee that it will be free from such problems. It can be deduced from this that all countries should be committed to solve the problems that involve poverty, and not just the ones that suffer directly from it. Unfortunately, at the time of writing this article, Ebola has appeared as a good example of what is meant: it is better for the countries in the developed world to help to solve the problems of poverty in the countries of origin, even though they are supposedly far away from them, because globalisation has also globalised the problems. As Federico Mayor Zaragoza[6] said at a talk a few years ago, the lack of solidarity shown by the first world countries to poverty problems in the developing countries is like a boomerang, that always comes back….

Next, it has been thought interesting to feature a chapter – the second one– on certain concepts, in order that when these concepts are referred to in the main chapter – the third one –the plot thread will not be lost. By way of example, that second chapter presents such concepts as poverty data; electrification in the world; the concept of electrification; a definition for the so called Bottom of the Pyramid, payment capacity, reverse innovation, etc.

The main chapter of the article – the third one – tries to deal with the models, challenges and opportunities involved in the Universal Access to Electricity, also providing some examples of programmes and initiatives, presenting in greater detail one of the most successful *Universalisation* programmes that there have

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[5] For example, in Europe, the third Electricity Directive (European Union, 2009) considers in Article 3, not only the physical aspect of access but also the economic aspect: "The Member States shall guarantee that all their domestic clients and, when the Member States consider it advisable, the small companies, …, enjoy the right to a Universal Service on their territory, i.e. the right to an electricity supply of a particular quality, and at reasonable prices easily and clearly comparable, transparent and non discriminatory. … The Member States must require the distribution companies to connect the clients to the grid in accordance with the established conditions and tariffs…."

[6] Mayor Zaragoza, 2001. To consult the presentation please refer to this link: http://www.aulasolidaridad.org/documents/conferencias/ConferenciaMayorZaragoza_presentacion.pdf

ever been (because of the number of people it has catered for and the positive effects it has achieved), namely the Light for All Programme carried out in Brazil in recent years.

The connection between security, poverty, resource management and sustainable development

This chapter will outline – going into greater depths would merely make this article too long and lose its focus, which is the Universal Access to Electricity Supply – the security of nations in the new global context, the scale of the poverty problem, and how the fight to eradicate poverty and improve the security of nations, must manage the available resources in order to achieve a sustainable development.

The new Security approach

The inclusion of the present article in a document issued by the *Centro Superior de Estudios de la Defensa Nacional* (CESEDEN) meant that it had to be framed within the context of "security". The "security model" has been gradually changing since the end of the Cold War. What was originally associated mainly with the conflicts between blocks and decidedly ideological in nature, has been moving towards a broader and ambiguous framework of various factors. The new model contains a wide range of threats of different origin, sometimes located in particular nations, addressing many other questions too such as access to specific resources, international terrorism, the collapse of States, piracy, systematic financial instability, organised crime, environmental degradation and as part of the latter, climate change.

It has been established by general consensus that economic stability and sustainable exploitation of natural resources are inherent to the prosperity and security of any country. Thus, E. Sánchez de Rojas[7] points out that "a shortage of electricity, water and food, essentially associated with the emerging countries' ability to access the markets, has restructured the global architecture and given rise to new geopolitical priorities". All of this confirms that since the end of the old conflict between the two blocks and with the consolidation of globalisation, the concept of security has become a multi-faceted one that goes beyond military threat, and has complex origins of a political, economic, sociocultural and also ecological nature".[8] The way the concept has evolved, has led to a reformulation of "human security, by questioning the classic concept on different levels".[9] Along the same lines,

[7] Sánchez de Rojas, 2014.
[8] Conde, 2011.
[9] Pérez de Armiño, 2007.

L.B. Olivares (2014)[10] remembers the transcendental nature of the environmental aspects in the area of natural security and states "if society, military advisors and the strategic studies centres had fully understood the effects of climate change [...] measures could have been taken to minimise it, neutralise it and prevent its future projection".

In fact, the latest report issued by the National Intelligence Council[11] indicates that its exercise, that involves simulating long term scenarios, is a result of extrapolating four "mega trends": a) the progress or individual empowerment of persons as a result of the general improvement in living conditions, b) the proliferation of centres of influence, c) the demographic evolution profile and d) the growing link between electricity, water and food. Nevertheless, it is difficult to make a distinction between improving the living conditions of the inhabitants, on the one hand, which in many parts of the world simply means no longer living in extreme poverty and, on the other hand, exerting pressure on the natural resources and the environment, all within the context of an ongoing population growth. Therefore, it is likewise impossible to exclude an analysis of the actions involved in the fight against poverty from being a part of a global security strategy.

Population and Poverty in the World

The estimated population of 7,200 million in 2012 could increase by 1,000 million in the next 12 years and reach 9,600 million in 2050. This growth is accounted for by the developing countries, and more than half in Africa. The population of the world currently composed of the developed nations will remain constant at 1,300 million until 2050 (the population of Europe could even fall by 14%), whereas the number of inhabitants in the 49 poorest countries will double from 900 to 1,800 million.

The way the population is going to evolve, requiring a food production increase of 60% until 2050, from the 2005-07 level (Food and Agriculture Organization (UN), 2014), is going to exert increasing pressure on the availability of resources, with potential complications caused by armed conflicts, financial instability, natural-meteorological catastrophes, etc., and with a potential worsening of the serious situation affecting the approximately 3,000 million people with an income below 2.5 $/day, a very large group who not only have a scarce diet but also sanitation deficiencies, no access to tab water and electricity, depending almost exclusively on fossil fuels for cooking and heating (UNESCO, 2014).

[10] Olivares, 2014.

[11] National Intelligence Council, 2012.

Region	Population without electricity millions	Electrification rate %	Urban electrification rate %	Rural electrification rate %
Developing countries	**1.257**	**76,5**	**90,6**	**65,1**
Africa	600	43	65	28
North Africa	*1*	*99*	*100*	*99*
Sub-Saharan Africa	*599*	*32*	*55*	*18*
Developing Asia	615	83	95	75
India	*306*	*75*	*94*	*67*
Rest of developing Asia	*309*	*87*	*95*	*80*
Latin America	24	95	99	81
Middle East	19	91	99	76
Transition economies & OECD	**1**	**99,9**	**100,0**	**99,7**
World	**1.258**	**81,9**	**93,7**	**69,0**

Figure 1. Access to electricity in 2011.The regional aggregates. Source: International Energy Agency, 2013.

In the Millennium Declaration proclaimed by the world leaders in 2000, specific goals were adopted in the fight against extreme poverty,[12] the first of these being to reduce by half, in 2015, the percentage of people that in 1990 had incomes of less than 1.25 $/day. In 2010 that rate had been reduced to 22%, meaning that five years before the deadline the proposed goal had been achieved. This reduction has also been verified in absolute terms, falling from 1,900 million in 1990 to 1,200 million in 2010. "In spite of this, progress in reducing poverty has not been even. Eastern Asia, South-East Asia, Latin America, the Caribbean, the Caucasus and Central Asia all achieved the target of reducing by half the extreme poverty rate, but Sub-Saharan Africa and Southern Asia have yet to achieve this goal. According to the World Bank projections, Sub-Saharan Africa will possible not reach that goal by 2015" Naciones Unidas, 2014.

Although progress has been made in recent years, a considerable percentage of the world's population lacks access to the basic services. Although it is true to say that according to the reports issued by the World Health Organization, UNICEF[13] and the United Nations[14] progress has also been verified in this area, it would appear that the Millennium Goals are not being achieved regarding access to drinking water and sanitation facilities where the poorest sectors of the population are concerned. It is estimated that, in 2012, 748 million people did not have access to an *improved* drinking-water source and approximately 2,500 million did not have access to *improved* sanitation facilities.

12 See chapter 2. Basic concepts.
13 Organización Mundial para la Salud y UNICEF, 2014.
14 Naciones Unidas, 2014.

Approximately 20% of the world's population, which amounts to around 1,300 million people, 95% of whom live in Sub-Saharan Africa and Asian developing countries, do not have electricity, and 2,600 million use traditional biomass for cooking and heating.[15] A further 400 million would be using coal for those purposes. The use of these traditional fuels is associated with serious negative environmental impact (emissions, deforestation, etc.) and harmful effects on health (respiratory diseases, digestive diseases, etc.).

The report on world hunger issued by the FAO[16] estimated that 805 million people would have been chronically undernourished between 2012 and 2014. That report is optimistic about achieving the Millennium Goals in the area (reducing by half the malnutrition levels in the developing countries) and indicates general courses of action to achieve this, which apart from specific programmes, opt basically for a comprehensive approach, combining private and public investment, improving access to resources, land and technology, preventing conflicts and natural disasters and mitigating environmental degradation.

Resource Management and Development perspectives

Proceeding with the fight against poverty and especially against its most dramatic consequence, chronic malnutrition, in the coming years is going to mean successfully achieving major challenges with regard to managing very limited resources, such as arable land (which currently covers 11% of the world surface) and water, 70% of which is given over to farming (up to 90% in developing areas). According to UNESCO,[17] 2012 unless substantial improvements take place, the world demand for water for agricultural purposes could grow by 20% until 2050, which would subject rivers and groundwater to pressures difficult to withstand, since as UNESCO, 2014 points out, 20% of the aquifers are already overexploited. Taking into account that a large number of river basins are shared by two or more countries, this could be a specific cause of international tension, while also giving rise to problematic cases of mass migration.

The decisions that are made about the use of water resources and the production of energy have a major impact on a wide range of variables, in both ways positive and negative. They may generate greater welfare in all areas, which will lead to employment and growth, but they could also contribute to climate change, seriously interfere with the water cycles[18] and be conducive to causing extreme climatologic phenomena.[19] All these negative aspects could bring about a vicious cycle of bad harvests, food price volatility, food crises, mass

15 International Energy Agency, 2013.
16 FAO, IFAD and WFP, 2014.
17 UNESCO, 2014.
18 Bates, Kundzewicz, Wu, & Palutikof, 2008.
19 IPCC, 2012.

migration and, in short, setbacks in the fight against poverty. The United Nations has warned of the following:

«Human vulnerability is not new, but it is increasing due to financial instability and mounting environmental pressures such as climate change, which have a growing potential to undermine progress in human development. Indeed, since 2008 there has been a deceleration of growth in all three components of the Human Development Index in most regions of the world [...]. It is essential to deal with vulnerability in order to safeguard what has been achieved and prevent interruptions to development continuity» (United Nations Development Program, 2014).

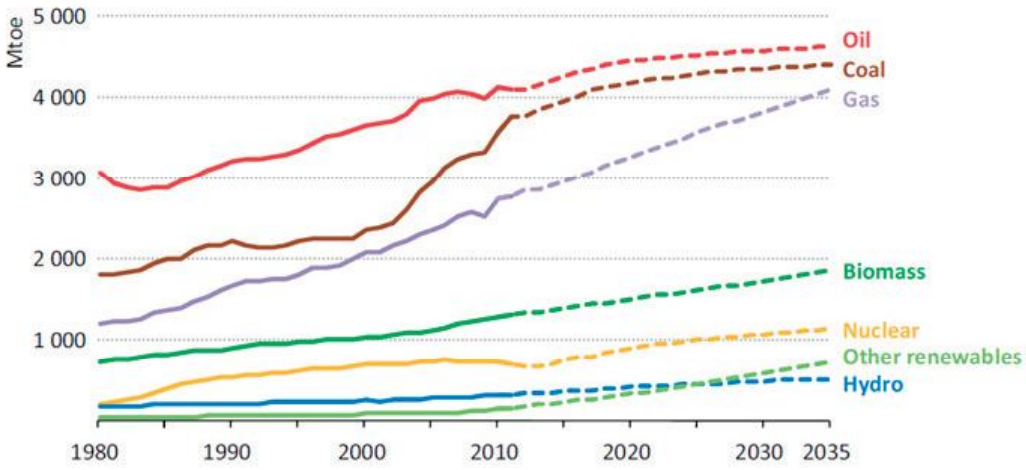

Figure 2. World demand for primary energy by fuels in the New Policies Scenario (Mtoe). Source: International Energy Agency, 2013.

According to the International Energy Agency,[20] the energy demand could increase by about 33% between 2011 and 2035.[21] This growth will be concentrated in the emerging economies, reaching more than 90% of the net growth in demand by 2035. Furthermore, the demand for electricity will grow in above two thirds over the same period, accounting for half the primary energy consumption increase. The non-OECD countries will mainly be responsible for the growth in electricity demand, led by China (36%), India (13%), South-East Asia (8%) and the Middle East (6%). These figures indicate a more rapid growth rate for electricity than for energies as a whole, which has led us to profile a variety of trends, to some extent overlapping: the Universal Access to Electricity Supply, the ev-

[20] International Energy Agency, 2013.

[21] This data is consistent with the central scenario of the International Energy Agency (IEA), *New Policies Scenario*, which proposes fulfilment of the energy and environmental policy goals set up to this date, in order to progress towards decarbonising the energy sector. This scenario attaches great importance to the implementation of renewable energies and improving energy efficiency. According to the IEA, this scenario is consistent with a global temperature increase of 4ºC in the long term.

er-increasing use of electricity in domestic appliances as a sign of an increase in living standards, and the replacement of other fuels by electricity, not only for commercial purposes but also for industrial or domestic use.

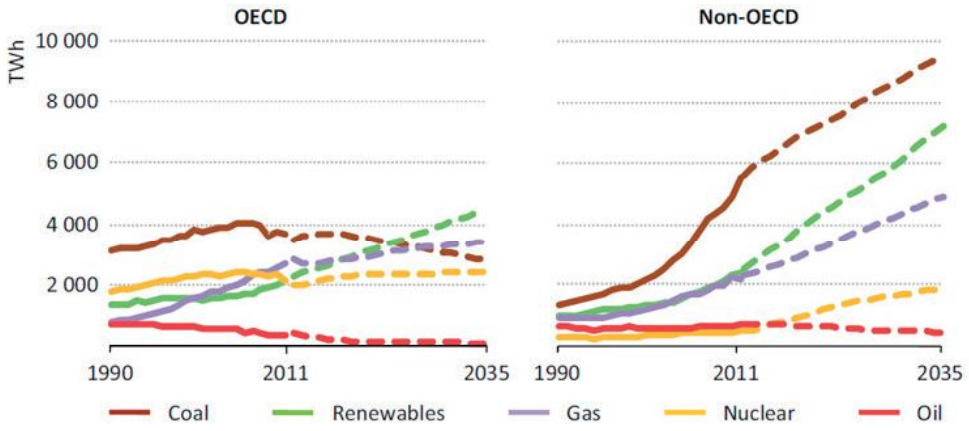

Figure 3. Electricity generation percentages by sources and regions in the New Policies Scenario. Source: International Energy Agency, 2013.

It also means a change in the electricity generation mix with a much higher percentage of renewable energies (31% in the *New Policies Scenario,* 48% in the *450 Scenario*[22]). These phenomena are crucial, not just because of the very different carbon footprint left by the different generation technologies[23] but also because this alleviates pressure on water resources, taking into account that 90% of electricity production is intensive in water use UNESCO, 2014, although there are great differences between the different technologies. In this sense, wind and solar photovoltaic energy, now easy and efficient to display in remote areas, require only very limited amounts of water. Hydro power production, which involves non-consumptive use of water, is considered to be the renewable source that will grow most rapidly in the coming years outside the OECD,[24] thanks mainly to the major hydraulic potential of the river basins in Africa, Asia and Latin America.

[22] The *450 Scenario* is the most ambitious scenario of the International Energy Agency (IEA) in environmental matters. It anticipates that a sustainable energy system will be achieved through the implementation of major structural and technological changes, as well as by modifying the behaviour of energy consumers. An important reduction in energy intensity is considered necessary. According to the IEA, this scenario is consistent with a global temperature increase of 2OC in the long term, which in turn is consistent with the aim of limiting the concentration of greenhouse gases in the atmosphere to 450 parts per million (ppm) of CO_2.

[23] International Energy Agency, 2013.

[24] International Energy Agency, 2013.

The United Nations remind us that in spite of the progress made in achieving the goals set in the Millennium Declaration,[25] in particular reducing extreme poverty, the differences that exist in conditions where access to basic services is concerned have become even greater in recent years. That is why it considers that "guaranteeing public financing for the universalised supply of public services – access to housing, water, sanitation facilities and electricity, as well as essential social services such as nutrition, health and education – is vital when it comes to reducing poverty and promoting equality of opportunities".[26]

Breaking the vicious circle of poverty

A great deal was written in the 20th Century analysing the vicious circle of poverty and underdevelopment. The works of R. Nurkse and the 1974 Nobel Prize Winner for Economics, G. Myrdalhave, have been particularly enlightening in explaining the circular relations that are preeminent when it comes to poverty or, alternatively, to economic development. It was Nurkse who defined underdevelopment as "a circular constellation of forces tending to interact upon one another in such a way as to keep a poor country in a state of poverty",[27] which determines that poverty tends to perpetuate itself because it generates, in the absence of external forces, the elements that prevent it from overcoming the situation. However, the vicious circle can be broken through the use of suitable levers. This is what Myrdal meant when he pointed out: "it is obvious that a circular relation consisting of less poverty, more food, better health and a greater ability to work would support a positive cumulative process instead of a negative one".[28]

Universalisation of access to electricity supply is not expressly mentioned among the Millennium Development Goal indicators,[29] which as a whole constitute an unprecedented international commitment, a fight against poverty, with perfectly quantifiable targets that can be achieved in the medium term. Nevertheless, universal access to supply is a key element for providing exponential improvements in the welfare of societies, a factor that enhances their economic development and makes it easier to attain most of the aforementioned Millennium Goals. Making access to supply universal paves the way for improving health conditions and comfort in homes, for increasing agricultural productivity, for alleviating the conditions that women and children have to tolerate in many areas and for making it possible to create new business or craftwork activities. Finally, the technological progress is enabling this process take place in sustainable conditions and with a minimal negative environmental impact.

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25 See chapter 2. Basic concepts.
26 United Nations Development Program, 2014.
27 Nurske, 1953.
28 Myrdal, 1957, pág. 23.
29 See chapter 2. Basic concepts.

In view of all this, the Advisory Council to the Secretary General of the United Nations asked the United Nations to become more involved in achieving universal access to modern energy services in 2030.[30] In this sense, Ban Ki-Moon himself made widespread sustainable energy one of his five priorities in his second mandate as Secretary General of the United Nations,[31] leading to the creation of the initiative "Sustainable Energy for All" and he endorsed it in his report made with a view to revise the Millennium Agenda after 2015.[32] Indeed, and although they are not formally adopted, the seventh Sustainable Development goal does already proclaim that by 2030 access is guaranteed to modern, affordable, reliable and sustainable energy.

Basic concepts

This chapter presents a series of concepts that are useful in the framework of the Universal Access to Electricity Supply. They will also make the main chapter[33] of this article easier to read and understand.

Universal Access, Millennium Goals and Sustainable Development Goals

The Millennium Goals were established at the Millennium Summit, in September 2000, by the United Nations, with a view to achieving them before 2015.[34]

These goals are as follows:

1. Eradicate extreme poverty and hunger.
2. Achieve universal primary education.
3. Promote gender equality and empower women.
4. Reduce mortality among children under 5.
5. Improve maternal health.
6. Combat HIV / AIDS, malaria and other diseases.
7. Ensure environmental sustainability.
8. Encourage a global partnership for development.

Although Universal Access to energy is not included as one of the Millennium Goals, it has been adopted as one of the three goals in the subsequent initiative

30 The Secretary-General's advisory group on energy and climate change (AGECC), 2010.
31 Ki-Moon, Sustainable Energy for All, 2014.
32 United Nations.
33 See chapter 0 Key Elements in Universal Access to Electricity Projects.
34 See http://www.un.org/es/millenniumgoals/.

"Sustainable Energy for All" (SE4All)[35] by the United Nations,[36] because access to electricity has been recognized as an essential element for achieving the aforementioned goals.

In September 2011, UN Secretary General, Ban Ki-Moon, shared his vision of making sustainable energy for all a reality by 2030. With a view to this, he launched the initiative SE4All as a global initiative that would mobilise all sectors of society to give their support to three interrelated objectives:

1. Providing universal access to modern energy services.
2. Doubling the global rate of improvement in energy efficiency.
3. Doubling the share of renewable energy in the global energy mix.

To quote Ban Ki Moon "Access to clean and affordable energy is critical to achieving the Millennium Goals and will enable sustainable development all over the world".

The initiative has an Advisory Body, co-chaired by the UN Secretary General and the President of the World Bank, which includes well-known world leaders from governments, companies and civil society. They offer strategic guidance to the initiative and serve as its global ambassadors.

SE4All also has an Executive Committee that provides operational supervision and is directed by Chad Holliday, Chairman of the Board of Directors of Bank of America.

Kandeh Yumkella, Special Representative of the Secretary General for Sustainable Energy for All, is the executive director of the initiative and is supported by a Global Facilitation Team. Equally interesting is the SE4All Forum, set up as a meeting point for all those involved or interested in the initiative.[37]

With respect to how Universal Access helps to achieve the Millennium Development Goals (MDGs), the United Nations itself[38] lists in the following way the benefits that Universal Access provides to each one of those MDGs:

- Reducing poverty and creating employment, making it possible to generate income and business opportunities, reducing famine and increasing farming and business productivity (MDG 1).
- Empowering women by freeing them and their daughters from time-consuming tasks, such as collecting firewood, grinding cereals, fetching water, so that they can spend their spare time on education or economic activities (MDG 2 and 3).

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35 Sustainable Energy for All, 2010 and Sustainable Energy for All, 2014.

36 See http://www.se4all.org/.

37 Sustainable Energy for All, 2014.

38 *UNDP and Energy Access for the Poor, Energizing the Millennium Development Goals*, United Nations, 2010.

- Improving health conditions by reducing the most arduous routine tasks for women and children, and removing the 'stove smoke' that kills almost two million[39] people (mostly women and children) every year (MDG 4 and 5).
- Promoting clean forms of energy to help development with low carbon emissions (MDG 7).
- Encouraging global alliances to promote Universal Access to modern forms of energy as a means for achieving the Millennium Goals.

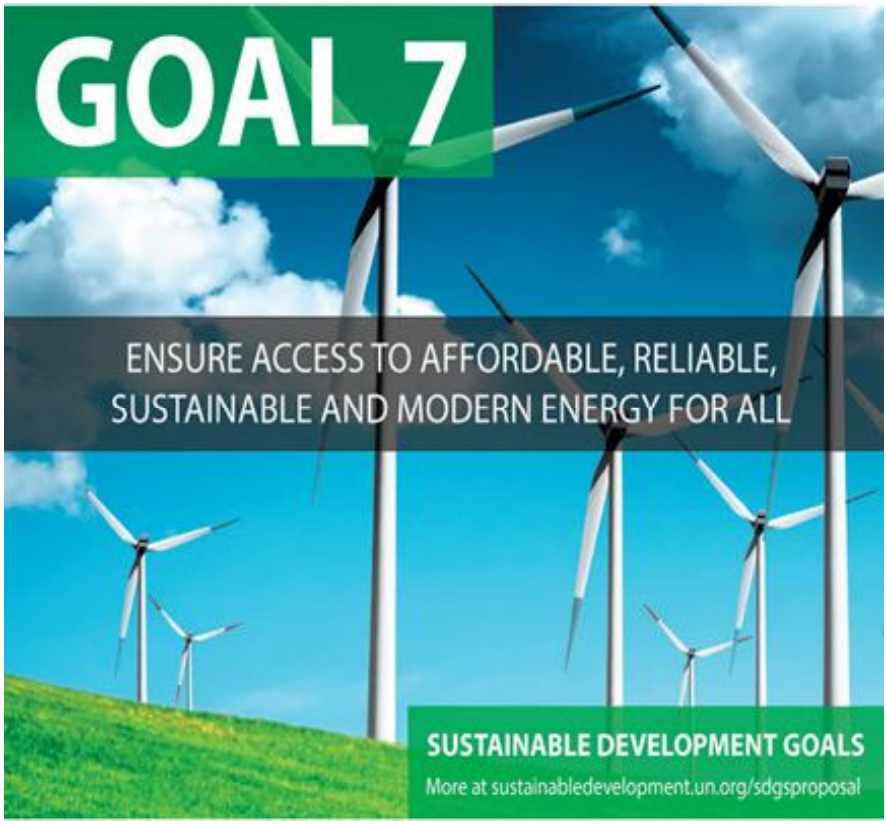

Figure 4.

As the deadline for achieving the Goals is about to be reached, the United Nations[40] is now collaborating closely with different interested parties on an international level to guarantee a sustainable development path after 2015. The United Nations has recommended that Universal Access be included in the Post-2015 Development Agenda. Indeed, in the preparatory work done for that Agenda,[41] the seventh goal is that access to modern, affordable, reliable and sustainable energy is guaranteed by 2030.

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[39] New references when it comes to closing this article put these figures at 4.3 million people. According to the Global Health Observatory, in 2012, air pollution in homes was responsible for 4.3 million deaths, i.e., 7.7% of the total mortality rate. This reference can be seen at http://www.who.int/gho/phe/indoor_air_pollution/en/.

[40] For further information see http://sustainabledevelopment.un.org/sdgsproposal.

[41] United Nations.

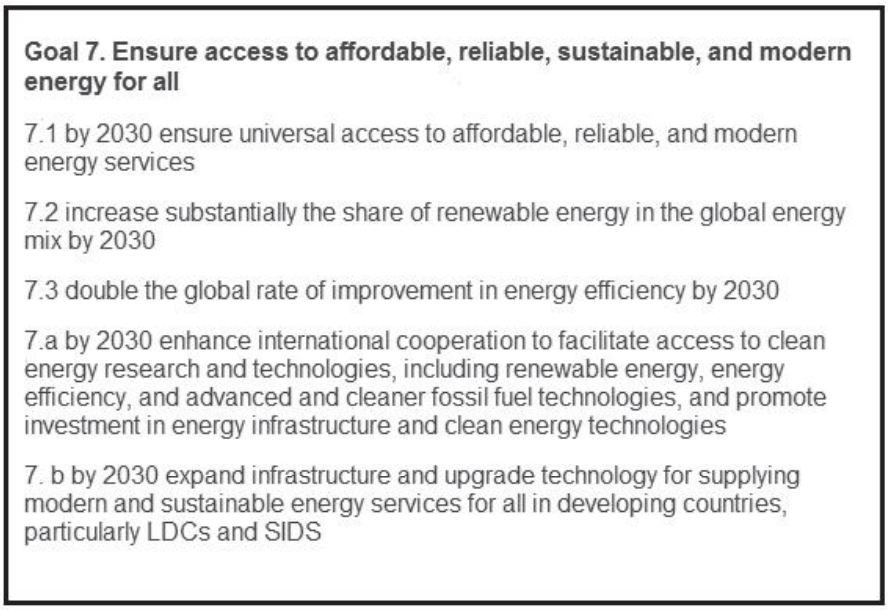


Chart 1.

Universal access to energy: extent of the challenge. The three gaps: equity, ambition and opportunity

The challenge of providing universal access to advanced energy services is enormous. According to the International Energy Agency (IEA),[42] it is estimated that around 1,300 million people, which amounts to approximately 18% of the world's population do not have access to electricity[43] and at least 2,600 million people (38% of the world's population), do not have cooking facilities that comply with the minimum health and safety standards and that do not cause pollution[44]. More than 95% of these people live in Sub-Saharan Africa[45] or in Asia.

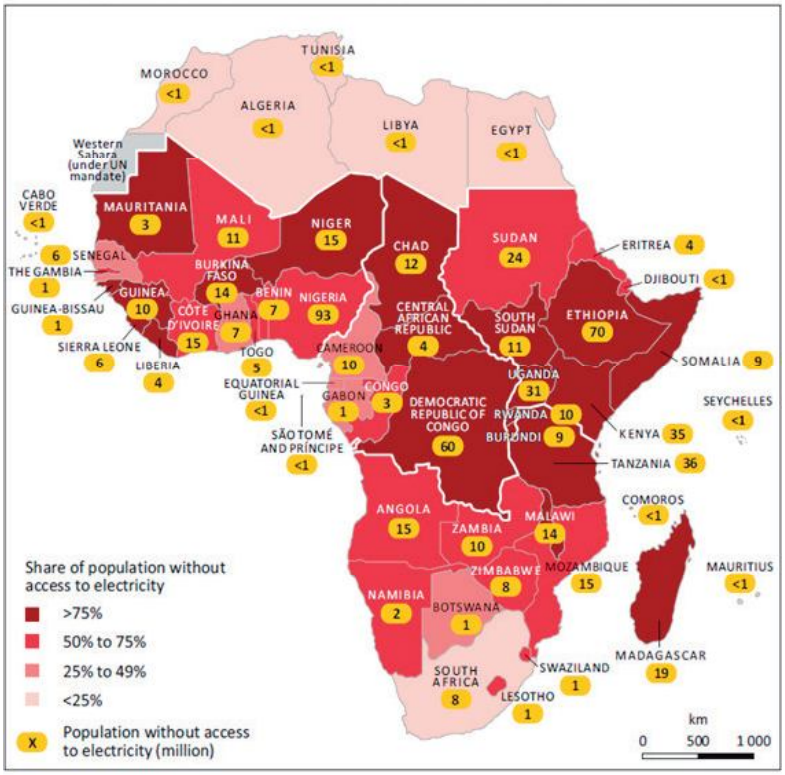
Africa, especially the Sub-Saharan zone, is the region with the highest number of people without access to electricity, with over 645 million people (620 million people in Sub-Saharan Africa)[46] who do not have this service, amounting to roughly 50% of the people without such service in the world. This problem is far from being solved, given that it is the only region in the world where the number of people who do not have access to electricity is on the increase number and percentage of people w/o access to electricity by country, 2012.

In spite of the efforts made by Governments (since 2000, access has been given to 145 million people), the rapid growth in the population rate largely overshad-

42 International Energy Agency, 2013.
43 Data from 2011.
44 International Energy Agency, 2011.
45 See Box 1.- Scale of the Access to Electricity problem in Africa.
46 Data for 2012, taken from (International Energy Agency, 2014).

owed the progress made. As a result, on average for the period 2000-2012, the percentage with access to electricity rose from 23% to 32%. Around 80% of these people without electricity are concentrated in rural zones, making it more difficult to develop policies to reverse this situation.

Box 1.- Scale of the Access to Electricity problem in Africa



Box 1.

Furthermore, over one billion people are in an infra-electrification situation owing to the poor quality of the supply available and the problems affecting continuity of supply.

Moreover, according to the IEA, since the year 2000 approximately two-thirds of the people that have had access to electricity, correspond to urban areas; the population without access to electricity are concentrated in rural areas.

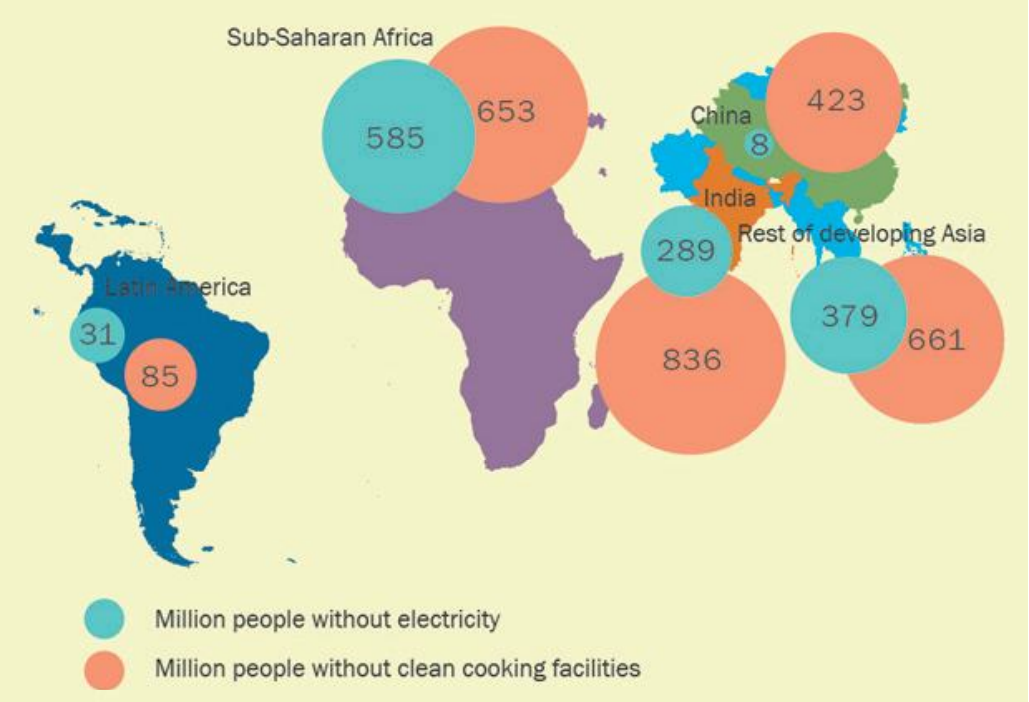


Figure 5. World population w/o access to electricity and without clean-cooking facilities. Source: SE4ALL, the United Nations.[47]

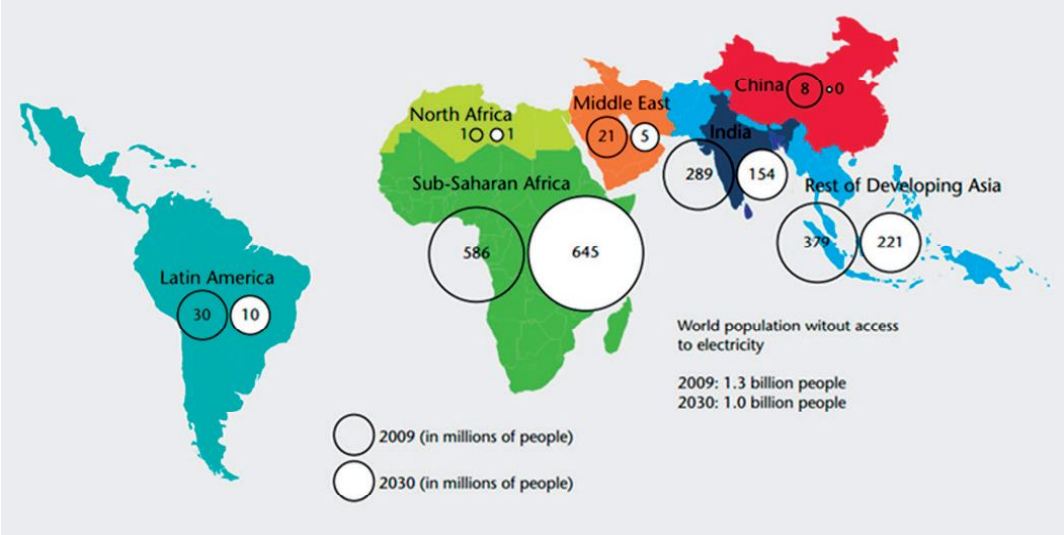


Figure 6. World population w/o access to electricity and prospects for evolution between 2009 and 2030. Source: WBCSD Access to Energy Initiative, 2012.[48]

[47] Originally in the International Energy Agency, "Energy for All: financing access to the poor", October 2011. International Energy Agency, 2011.

[48] Data and initial graph from the International Energy Agency International Energy Agency, 2010.

With regard to the forecasts made, using the scenarios contemplated by the IEA, at one of them, the central one called *New Policies Scenario,*[49] it was expected that the number of people without access to electricity would decrease by more than one fifth by 2030 (about 970 million, or 12% of the world population). That figure has been calculated on the assumption that around 1,700 million people will gain access to electricity, while expecting at the same time the population to grow by 1,400 million.

	Without access to electricity		Without access to clean cooking facilities	
	2011	2030	2011	2030
Developing countries	**1 257**	**969**	**2 642**	**2 524**
Africa	600	645	696	881
Sub-Saharan Africa	599	645	695	879
Developing Asia	615	324	1 869	1 582
China	3	0	446	241
India	306	147	818	730
Latin America	24	0	68	53
Middle East	19	0	9	8
World	**1 258**	**969**	**2 642**	**2 524**

Figure 7. People w/o access to modern energy services by regions, from the New Policies Scenario, 2011-2030. (Million people). Source: International Energy Agency, 2014.

The above table shows how the number of people without access to electricity in Asia will decrease by 290 million between 2011 and 2030,[50] it being also expected that universal access will be achieved by China in the next few years; improvements are likewise expected in India, where it is hoped that the current electrification level of 75% will reach 90% by 2030, although it will still be the country with the greatest number of people without access to electricity.

In Sub-Saharan Africa, the number of people without access to electricity in 2030 will be 645 million, which amounts to an increase of 8% since 2011. It is the only region where the number of people without access to electricity will rise.

Brazil is expected to reach Universal Access in the next few years (thanks to the "Light for All" Project)[51] whereas in the rest of Latin America it is expected that Universal Access will be achieved by 2020. As can be seen in the tables, the use of traditional stoves and the serious problems involved will still be huge in 2030.

[49] See Footnote 17
[50] International Energy Agency, 2013.
[51] See Point 2.14 Some examples of Universal Access to Electricity Supply Programmes.

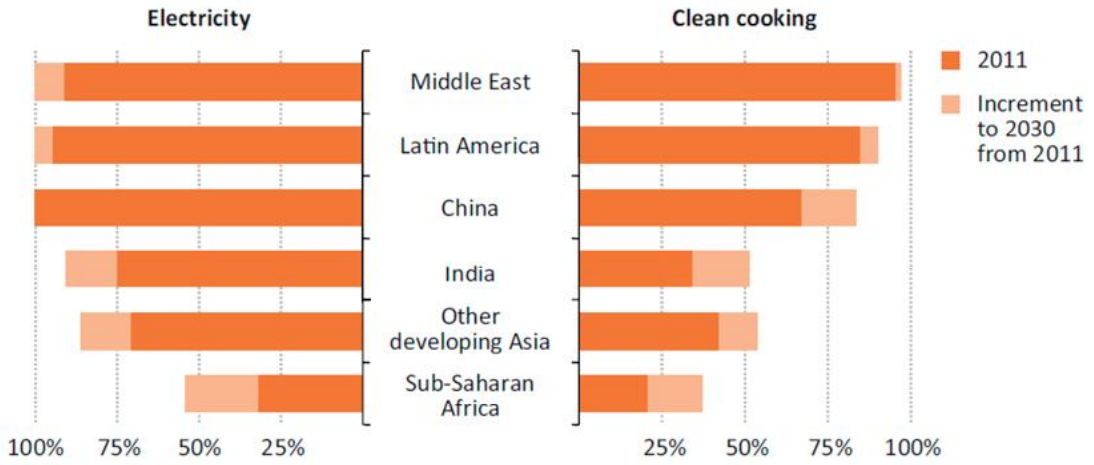


Figure 8. Percentage of the population with access to electricity and to clean-cooking facilities by regions in the New Policies Scenario. Source: International Energy Agency, 2014.

An interesting way of analysing the challenge of firmly establishing universal access to energy is to consider the problem as a question of covering three gaps, a concept that I first heard from my friend Ignacio Pérez-Arriaga at a lecture in the *Escuela Técnica Superior de Ingenieros Industriales de Madrid* about universal access, which appeared in a presentation he used at the Escuela Técnica Superior de Ingenieros Industriales de la UPM, 2013 and in Pérez-Arriaga J. I., 2014:

- The Equity Gap. This gap is strictly limited to ethics, it being considered totally unacceptable that millions of people do not have access to the most elementary electricity services. This is the approach that is generally followed in the reports issued by the International Energy Agency International Energy Agency, 2013.
- The Ambition Gap. This gap is approached from a technical perspective that considers offering certain levels of electricity supply that are required to enhance the productivity of the economy and increase welfare standards in the society concerned Bazilian & Pielke, 2013.
- The Opportunity Gap. From a business perspective, offering new supplies amounts to an opportunity to increase the market and generate new business areas International Finance Corporation (World Bank Group), 2012 scaling the solutions.

It should be pointed out that, when it comes to filling in these three gaps, it must not be forgotten that this challenge has to be faced within the framework of environmental and economic sustainability, particular consideration being given to the pressure that the various potential solutions will have on climate change.

Energy Poverty and instruments for overcoming it

Definition of Energy Poverty

The concept of "energy poverty" has emerged in some countries, but finding an objective definition of the term has been sought in only a few such countries, and establishing a legal framework to regulate the concept has been attempted by even fewer.

It must be borne in mind that "energy poverty" forms part of a much broader social, economic and environmental problem, and we cannot escape from the fact that this is, basically, a problem of income, i.e., of only being able to count on a limited ability to cope with expenses associate with such basic products and services as food, clothing, health or energy, in any of its forms. A certain degree of vulnerability and social exclusion has existed in all societies and the implementation of public policies has been used in an attempt to mitigate the problem. However, the economic crisis has considerably reduced the economic resources available in most households, which has caused an increase in the degree of exposure and vulnerability when it comes to paying for basic requirements such as those mentioned above.

This state of affairs is shown in the data published by Eurostat[52] or the OECD.[53] Spain is one of the EU Member States where a rise has been recorded in the percentage of people at risk of poverty and social exclusion between 2007 and 2012, increasing from 23.3% to 28.2%. At the same time, inequality in Spain, in terms of income distribution, likewise increased between 2007 and 2010 more than in any other OECD country.

In the places where the "energy poverty" concept has emerged, the debate has revolved around deciding who is responsible for financing the solution, rather than on merely acknowledging the existence of the concept and the problem itself, which is a fact that nobody questions. In some countries an attempt has been made to solve the energy poverty problem by establishing burdensome obligations directly on the energy sector operators themselves. This has given rise to debates about whether one type of poverty should be financed, in this case energy poverty, when other equally important types of poverty (lack of food, clothing, housing, education, health, etc.) are not financed, because they rely on support from public mechanisms/institutions created specifically for the purpose (free social security, compulsory schooling, monetary subsidies for underprivileged groups, etc.). In a similar way as it makes no sense for the State to delegate its responsibilities of providing the most disadvantaged members of society with food, clothing, housing, education or health, obliging supermarkets, clothing stores, estate agents, schools or private clinics, respectively, to pay for these, it would not make sense either to oblige private entities to pay for the

52 Eurostat, 2014.
53 OCDE, 2014.

energy requirements of those vulnerable communities suffering from energy poverty.

Therefore, defining energy poverty as a question of income will bring us closer to finding efficient solutions similar to others that are also generated by the aforementioned lack of income.

It is important not to confuse the concept of Universal Access to Energy that is being used in the article, with the concept of Energy Poverty, in view of the fact that, as has been pointed out in the Introduction, the use made of the former is basically "physical" (taking energy to those who do not have it) whereas the latter is essentially an "economic" concept. People may find themselves in a situation of "energy poverty" even when their homes are connected to the grid or when they have a gas connection, or if they have a stove that uses butane gas, or when they own a car, but they have not sufficient income to buy the electricity, the gas, the butane cylinder or to pay for the fuel to use their car. The concept of Universal Access to Electricity would be more closely associated with developing countries, where energy poverty means not even having access to the minimum consumption that a poor person could pay for, simply because there is no grid; the concept of "energy poverty" could affect even those countries where all the inhabitants have got the universal service, but they do not have sufficient income to pay for the purchase of energy.

Therefore, the concept of "energy poverty" would focus on defining the difficulty that many homes have in order to meet their energy requirements. The United Kingdom is one of the countries that have researched most deeply into this area. Until 2012, an approach based upon energy expenditure and household income was used. A household was thus officially defined as suffering from energy/fuel poverty if more than 10% of its net income was spent to obtain an acceptable level of heating comfort. This criterion was subsequently reviewed by the Hills Report[54], after receiving a great deal of criticism. As a result, a household is currently considered to be suffering from energy/fuel poverty when:

- The costs of domestic energy that would have to be paid to obtain an acceptable level of heat comfort is above the average, and,
- Should the household have to spend that amount, its income would fall below the official poverty line (60% of the average income after deducting the expenses associated with the household,[55] other than the energy expenses).

There are very few references in Spain, where there is no official definition of the term. The following is stated in the document *Energy Poverty in Spain. Potential for creating direct employment by rehabilitation of energy in homes*: "A household can be considered to be in an energy poverty situation when it is unable to pay for a sufficient amount of energy to meet its domestic needs and/or when it is

[54] Hills, 2012.

[55] These would theoretically include paying the mortgage and rent, and also water consumption, community fees, household expenses, etc.

required to allocate an excessive proportion of its income to pay the household energy bills" Tirado Herrero, López Fernández, & Martín García, 2012, pág. 21.

Instruments for reducing Energy Poverty

There are many ways of tackling the problem of energy poverty in the world, but they are basically divided into two:

a. Providing energyaccess to those that don't have it.

b. Seeking economic means for increasing the income available (subsidies) or reducing the energy expenses of vulnerable families (improving energy efficiency in their homes).

This article focuses on the first of these mechanisms, but in this section dealing with concepts, a brief reference will be made to the mechanisms in the second group.

Different initiatives have been taken internationally as means for providing economic support (subsidies) to vulnerable groups in this sense, ranging from general subsidies that leave the onus on each consumer to use these to pay for the energy/fuel, to subsidies that are directly associated with the electricity tariff (discounts or vouchers, like the ones established in Spain, Italy, some of the States in the USA, Brazil, etc.). The amounts that are used to provide these subsidies are raised in different ways: in Brazil they are raised from the Public Budgets, making it possible to establish the so-called "Social Tariff", subsidised for low-income clients; in Italy and France[56] they come from contributions made by the rest of the consumers with no income problems, through cross subsidies affecting the general tariffs, and in Spain it takes the form of a sort of tax on private operators through what is known as the "social bonus".

In the United States, there is no legislation at a federal level[57] but some States and municipalities have implemented policies for protecting vulnerable clients. Some States have dealt with the problem by introducing special terms for the payment of energy consumption as well as advantageous agreements in the event of delayed payment, allowing payments to be deferred and limiting supply cut-offs for non-payment during the winter months. These initiatives are normally paid for by the municipalities themselves.

It is clear that it helps to solve the problem too if the electricity tariffs (without subsidies) that clients have to pay are as cheap as possible, so any expenses

[56] Even though the debate about energy poverty in France is relatively modern, measures have been implemented since 1982 for people in poverty and deprivation situations, for example, social funds allocated for energy payments.

[57] «The United States Government has not considered poverty to be a phenomenon distinct from general poverty, and so, it has approached the problem through State programmes aimed at low-income households, which include measures for controlling it » (SIIS - Centro de documentación y estudios, 2013.

that are not strictly related to the electricity supply should be removed from these general tariffs. The more external cost issues are included in the tariffs, the greater income is required for the vulnerable consumers, so a higher subsidy will be necessary. The same applies to the mechanisms that include cross subsidies from the rest of the consumers, because such subsidies increase the efficient cost of electricity. In fact, in the report prepared for the CDC Climat Recherche,[58] it is stressed that many of these social tariffs are financed jointly by the energy consumers, generating price increases that merely serve to worsen the situation. In view of the foregoing and given that energy poverty is a social problem, it would be desirable if these policies were funded by public budgets, collecting the required resources from taxes, because then it is possible to phase in the payment of these aids and avoid price increases that would otherwise have an even more negative effect on vulnerable clients' payment capacity.

Pursuant to the mechanisms that tend to reduce the energy expenditure of vulnerable families, they mainly revolve around taking actions aimed at implementing energy efficiency measures in homes, so that it will be possible to reduce the energy requirements needed to make households reasonably inhabitable.

A package of measures has been implemented in the United Kingdom that, amongst other things, include defining situations where protection is necessary, establishing a registry of vulnerable clients, applying discounts to the tariffs, a series of obligations upon the suppliers aimed at making them carry out different activities to insulate homes in order to reduce the energy requirements of families who are particularly economically and socially vulnerable. Along with these measures, restrictions have been imposed on cutting off clients' supplies and credit facilities have been established. Once again, the debate does not discuss whether these underprivileged people ought to be covered, that is taken for granted, but rather if the public sector should delegate its financial responsibility by making certain private entities responsible for financing the cost of the measures.

In this article, what is meant by "making access to electricity supply universal"? What is meant by "rural electrification"?

As explained in the section describing the concept of "Energy Poverty", ensuring that energy infrastructure is deployed throughout all a country's inhabitants is not sufficient to eradicate such poverty, because it could be the case that the users do not have the income capacity to consume a decent amount of energy.

The aim of this article is to focus on Universal Access to Electricity Supply, i.e., on the "physical" aspect of the broader concept of Universal Service: that electricity reaches the customer's household. In this context, mitigating energy poverty consists of offering an energy supply to citizens in developing countries who still do

[58] Tyszler, Bordier, & Leseur, 2013.

not have this possibility. Therefore, the initiatives that are considered are mainly aimed at developing countries, given that the developed countries are generally 100% electrified and all that has to be done in these countries is to implement the mechanisms that make it possible to eradicate energy poverty.

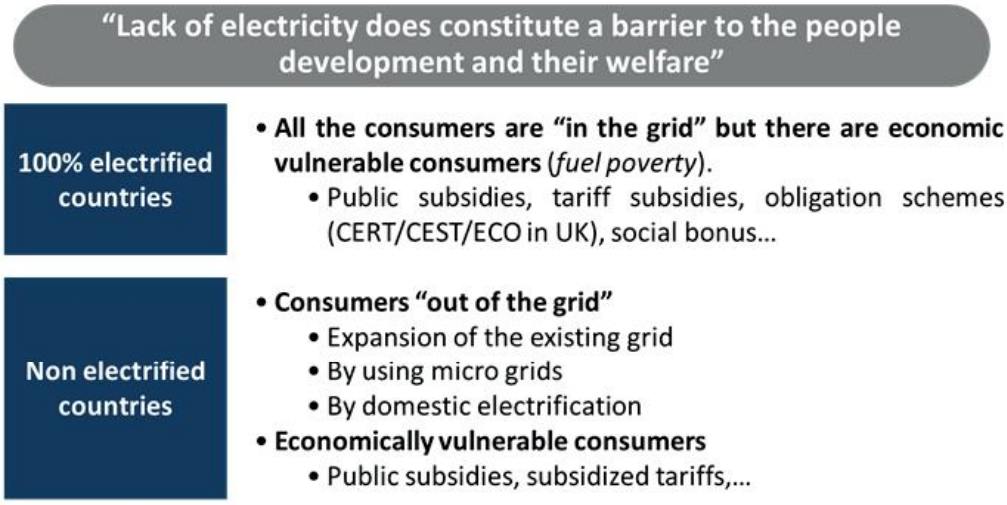


Figure 9. What does "universal access to electricity supply" mean?. Source: Own source.

Furthermore, when talking about Universal Access to Supply, people is generally refer to giving access to electrification in isolated rural areas, since there is a direct link between the poverty levels in those zones and the lack of electrification. Therefore, the electrification programmes focus on those zones. This does not mean that in those developing countries not completely electrified there should not be subsidy mechanisms for clients who are located in electrified zones. Energy poverty treatment for such groups is similar to the treatment that first world give to their vulnerable groups. Neither must it be forgotten that there are many outskirts of urban areas that, while not falling into the category of isolated rural areas, do not have physical access to electricity either, and these should also be included in specific plans for access.

Most usual mechanisms for electrifying supply in isolated rural zones: grid extensions, mini- and micro-grids and individual household electrification

Because of their greater economic efficiency in view of the technological state of the art, most of the rural electrification processes that have been implemented to date, have followed the grid-extension model, which involves enlarging the licensed companies' general electricity distribution or transport networks, in such a way that they gradually occupy a greater amount of land, and thus a larger number of clients who can potentially access supply.

However, this solution is not economically feasible in zones that are really located a long way from the current distribution grids, so it is necessary to find and use new models that make electrification feasible in all zones without grid extension requirements. The following would be such off-grid solutions:

- Isolated micro-grids. The idea would be to establish small and isolated grids to supply energy to isolated communities with few inhabitants, supplied from small generators using renewable energy and/or diesel units. This could even be the solution for certain zones in some countries where the supply quality provided by the main grid is so unstable and inefficient, that establishing a micro-grid would be more beneficial than relying on the main grid.[59]
- Individual off-grid supplies. The idea would be to establish individual supplies to homes or community facilities, normally by means of solar photovoltaic panels (Solar Home Systems, SHS).[60] This is suitable when the community to be electrified is so sparse and scattered that setting up a micro-grid does not make economic sense.
- Solar lantern delivery programmes. This is the cheapest and most feasible option when the others are not economically viable. As it is the simplest, it is probably the one that best shows the added value that electricity gives to the groups that access solar lanterns, in terms of enabling them to receive education at night, while at the same time reducing crime levels when the devices are located in key zones of the villages.[61]

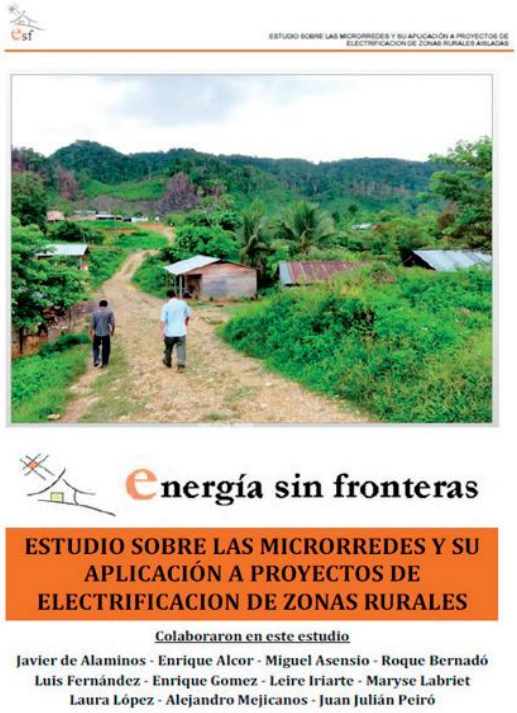


Image 1.

[59] The following documents are recommended: "*e(R) cluster" for a smart energy access.The role of micro-grids in promoting the integration of renewable energy in India* by Greenpeace. Greenpeace, 2012 and *Hybrid Mini-grids for rural electrification: lessons learned*, by Alliance for Rural Electrification and USAID Alliance for Rural Electrification & USAID, 2011 and the recent study published by Energía sin Fronteras "*Estudio sobre las microredes y su aplicación a proyectos de electrificación en zonas rurales aisladas*" Energía sin Fronteras, 2014.

[60] For further information please refer to Bhattacharryya, 2013.

[61] See Point 3.3.2 Global Sustainable Electricity Partnership, and for further information on the project please refer to http://www.globalelectricity.org/en/.

The above description is very general. However, an increasing number of new business models are being implemented internationally.

Among others, the reasons leading to the appearance of all these models include the following:

- The need to find solutions that are less expensive than grid extension, once the need to universalise the supply has been accepted.
- The emergence of cheaper and more suitable technologies, for providing isolated households with a service.

As the document "Africa Energy Outlook"[62] explains, the type of access to electricity that is provided may depend to a large extent on specific factors inherent to each individual country, such as the nature of the energy or financing policies that are developed in each one, the extent to which the distribution grids are developed, the state of the grid extension plans or the financial capacity to implement such plans.

Other factors that affect the optimum mix between grid connection, mini-grids or off-grid generation are, amongst others, the population density, the tariffs for solutions based on the grid, the technological cost of the mini-grids or the off-grid systems, the ultimate cost of diesel at the consumption point, the logistics of transporting materials to remote sites, etc.

The population density on the area that has not access to electricity has a great effect because, for example, in densely populated zones, on-grid solutions (grid extensions) are economically more effective in view of the low relative cost of an additional connection.

On-grid type solutions may also be efficient (the economically optimum option) for more sparsely populated areas that live at a reasonable distance from a transport and distribution grid. The maximum economically viable distance for a grid extension tends to become shorter in time due to the decrease in the generation costs with mini-grids or with off-grid solutions, the average cost of supplying with grids currently staying still lower than the cost of other options.

As from a particular distance, the cost of grid extension becomes prohibitive, and that is when off-grid solutions prove to be useful alternatives.

The following figures, extracted from the document "Africa Energy Outlook", show the result of making supply universal using a combination of solutions, based on optimising the resources available to maximise the value of *Universalisation*. Different electrification levels are normally established to achieve this, each with a different implementation cost; these generate different welfare levels but, at the same time, they also affect different groups of people (i.e., limited resources can be used to provide a fairly large group of people with minimum electrification, or in providing a smaller group with better electrification, making

[62] International Energy Agency, 2014.

it possible to provide better benefits and additional economic developments). The optimisation models used to generate the solution to be implemented, take into account not only the different costs involved in each solution, but also the degree of welfare that the groups benefit from and the extent to which the groups that do not receive the electricity supply lose out on.[63]

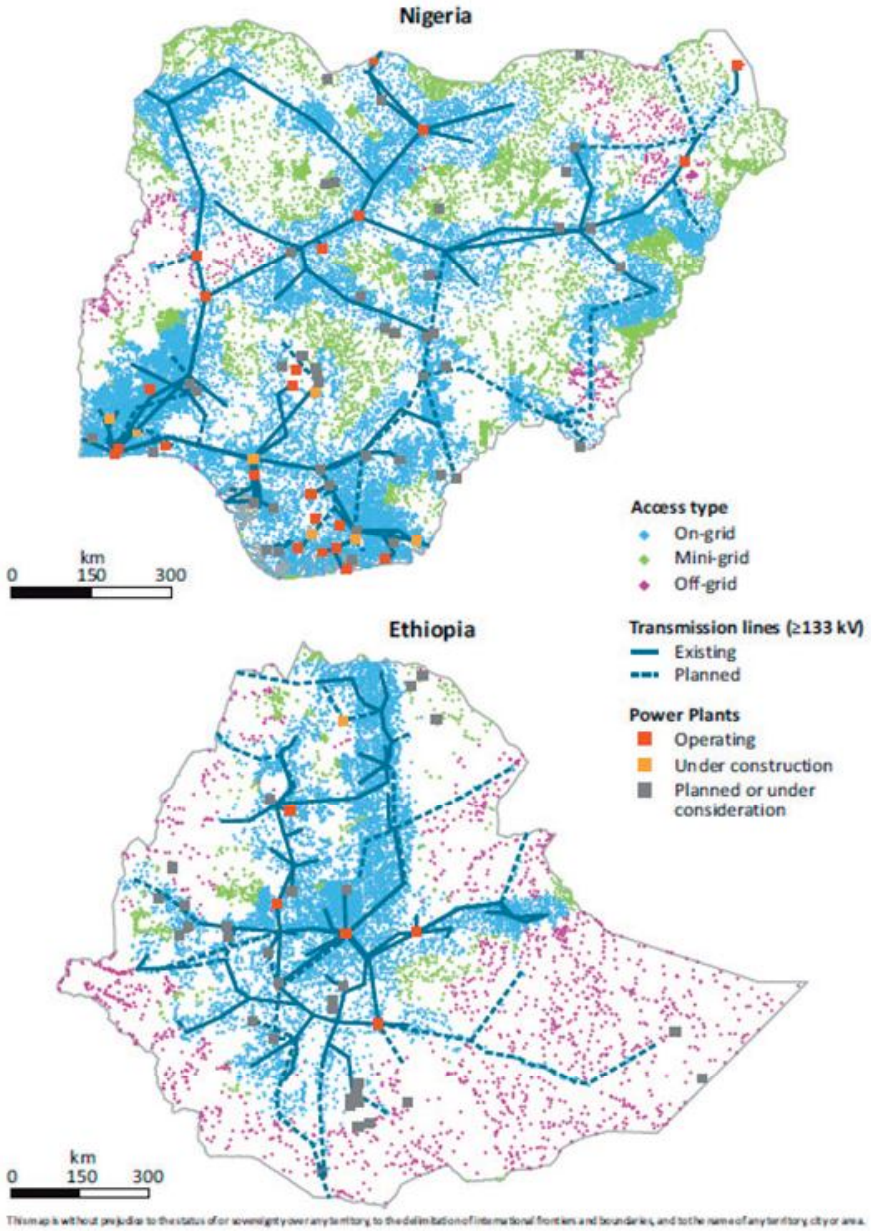


Figure10. Optimum division according to the grid type in Nigeria and Ethiopia based on the planned expansion for the main transport lines. Source: International Energy Agency, 2014.

[63] To know how similar projects work, refer to Pérez-Arriaga J. I., 2014, in which a case study is analysed for a region in India.

Many factors have to be taken into account when selecting the type of generation technology to be used for off-grid solutions. Renewable energies are a very appealing solution when it comes to considering the cost throughout the working life if the facilities and in terms of self-sufficiency, but it is necessary to find financing to pay for the relatively high initial cost that, at present, is still higher than the cost of a diesel generator. Moreover, the firmness offered by solutions based on solar, water and wind power is lower tha that provided by solutions using diesel units, because the renewable generation depends on variable natural resources. Diesel generators have the advantage of availability but they offer also several disadvantages, for example, fuel prices may fluctuate greatly, although in many countries such fuel is subsidised, or the need to have a supply logistics network available, or the negative impact on the local environment.

There are also combinations of technologies, for example diesel and solar photovoltaic, or solutions supplemented with batteries, which can provide the required flexibility. The poorest and most far-flung communities, which are invariably left out by the optimisation processes that allocate limited resources, may find that solar lanterns are a solution. In the optimisation process, the benefits of the first energy contributions to an isolated community are very high and, if they are provided with low-cost solutions such as the aforementioned solar lanterns, they would be given a great deal of consideration in the processes of allocating limited resources and, while waiting for better times to come, they would "sneak in" versus the more sophisticated electrification options in other zones.

What does "double discrimination" mean with reference to clients who do not have grid access?

The main problem in developing countries without 100% electrification usually revolves around the presence of major sectors of the population that do not have access to an electricity supply ("off-grid" consumers).

The people in this situation are subject to a double discrimination when compared to the population that lives in electrified zones ("on-grid" consumers) because not only are they not able to enjoy lighting, sanitation improvements from filtering the water, electrical cookers and appliances, modernised health centres, etc. (first discrimination), but neither are they able to access subsidies to enable them to pay for the energy that is received by vulnerable clients who do live in electrified zones (second discrimination).

Scalability as a comprehensive solution beyond philanthropy. The role of the private company

Providing 1,300 million people with access to electricity is a problem that cannot be solved through social action or philanthropy. Without wishing to underrate

these, their contribution to solving the general problem is severely limited and incidental to small projects only.

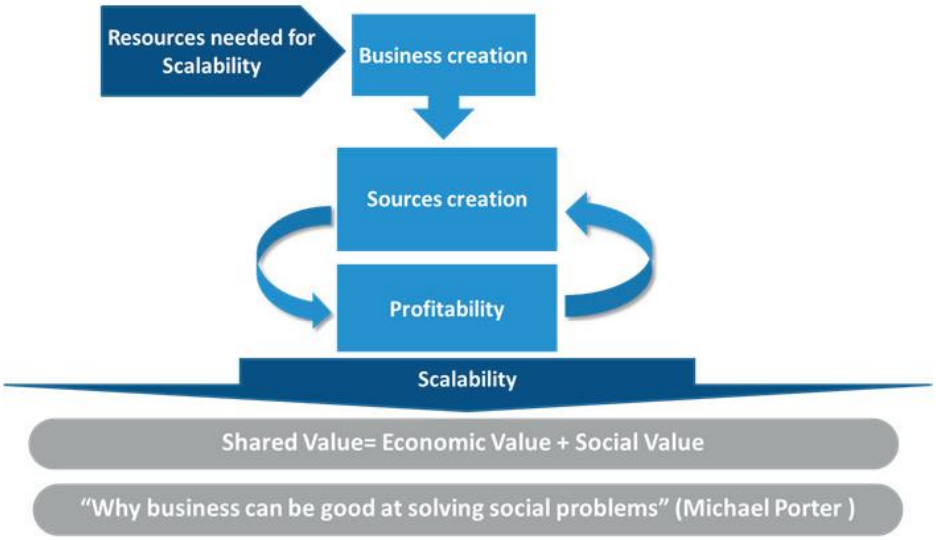


Figure 11. The role of the private company in scalability. Source: Own source.

Michael Porter[64] states that huge economic resources are required to progress in scalability, and that these can only be generated by creating specific businesses at the Bottom of the Pyramid that are founded on profitability and not on social action or philanthropy. Bottom of the Pyramid businesses, protected by sustainable frameworks defined by the public sector, will encourage private companies to contribute, maximising what is known as "Shared Value", the sum of the economic value provided by the Bottom of the Pyramid projects and the social value that is given to society.

The contribution made by private companies, whether already established or new, is crucial to the success of solutions that allow the solutions to be scaled. Private companies have the technical expertise to implement projects (human resources, technical equipment, etc.); they usually have a corporate culture based on efficient resource management; their financial weight enables them to obtain considerable resources for investment purposes; they have incentives that enhance innovation in the technical and business areas; they are capable of creating added value by generating products and services and by minimising costs, while at the same time their experience gives them clear advantage where risk management is concerned, which is vital in the process of obtaining capital on the financial markets to make the investments that major electrification projects require. Even where internal social action is concerned, they are able to mobilise groups of volunteers (working and retired people alike) who can put the value of their corporate expertise at the service of electrification projects in a supportive capacity.

64 Porter, 2013.

The importance of Public-Private Partnerships (PPPs)

As has already been pointed out, private sector participation is an essential factor in achieving universal access to energy.

Normally, and excepting philanthropic activity, private participation is attracted by the economic feasibility of the projects and by the financial returns they offer. Therefore, it is necessary to encourage private participation in this other type of projects.

The European Commission[65] states that a favourable environment must be created for business development with the participation of private initiative and the development of local companies in a position to create both decent employment and public income, as well as strengthening and making the most of the opportunities offered by the globally integrated markets. This approach is considered in numerous documents, including Greenpeace document on micro-grids[66]: «*sustainable technologies and innovative business models have to be implemented with governments, business, investors and civil society coming together to solve public problems…It can create millions of new jobs and increase productivity in rural areas, thus bringing about sustainable prosperity*».

That is why it is necessary to include activities and tools for helping the private sector to achieve favourable results as part of its "core-business".

Without public collaboration, it is likely either that companies will not make the required investments, or that they will not make the investment in the right place or at the right time.

In addition, achieving Universal Access to Electricity must focus on creating employment and on reducing poverty. The private sector must be given a different approach on this. It can act at local, regional, national or international level, in rural or urban areas, and in the context of countries that are very different; this requires a special treatment adapted to each particular case.

Public Private Partnerships (PPP) have emerged as the most suitable way of making major *Universalisation* projects feasible.

The idea is that governments, or other public institutions, associate with the stakeholders that do not belong to the public sector with a view to implementing projects together.[67]

Normally, the public institution defines the service standards (including deciding who receives the service, and what level and at what price) and monitors the supply, whereas the private institution makes the investment and takes on the responsibility for constructing and operating the project. The risks taken in this type of alliance are shared between the public and the private sector, bearing

65 European Commission, 2014.
66 Greenpeace, 2012.
67 Sovacool, 2013.

in mind that the risk taken on by the private sector must be limited to its own decisions and its management of the facilities.

New PPP models known as "5P" have emerged in recent years. These are "Pro-Poor" Public Private Partnerships, and governments, private companies, international development banks, NGOs, micro-finance institutions, etc. all participate in them, with a view to providing services to poor communities, which are normally left aside by the traditional PPPs owing to the business risks involved in projects providing universal access.

This type of alliance considers the people who receive the supply not merely as consumers who receive the benefit, but as stakeholders in the business. Equipment manufacturers, rural electrification companies, cooperatives and the users themselves are included as participants, along with the private sector, each one playing a role in the development of the project.[68]

Universal access to energy and businesses at the bottom of the pyramid. Payment capacity and sustainable solutions

The groups that are the target for Universal Access to Supply are normally identified as the most economically disadvantaged and are known as "the Bottom of the Pyramid".

The term Bottom of the Pyramid,[69] as defined in the document "The Next Four Billion",[70] refers to the four thousand million people who live with an annual income per capita below 3,000$ (equivalent to around 8$/day).

The aforementioned base itself is split into six levels of annual income, the lowest of these being an income of less than 500$ (equivalent to 1.4$/day) and the highest being 3,000$.

From an energy use perspective, access to energy for most people who belong to the Bottom of the Pyramid means using fuels such as kerosene, candles and wood, which are neither clean nor economical, and at the most, the use of batteries in the best of cases.

In spite of their very limited incomes, these people spend a lot to provide themselves with the kerosene, candles, wood, etc., and in most cases they spend more than they would if they had access to clean and modern forms of energy. In fact, they pay several times more for the same unit of energy than other groups with other income levels, given that for these groups with few resources, the small amount of energy they consume is all at the beginning of the utility curve, because it is used for basic human needs.

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68 United Nations Regional Comisssions, 2013.

69 Wilson, Rai , & Best, 2014.

70 Hammond, Kramen, Tran, Katz, & Walker, 2007.

Expenditure on energy in this segment on those inefficient energy uses, as indicated in "The Next Four Billion" is approximately 7% of their total expenditure, although this figure may vary from one country to another. Thus in countries like Ethiopia, India, South Africa or Uganda, the poorest spend between 7 and 15% of their income on energy.[71]

Approximately 75% of that expenditure covers domestic requirements, of which 80% is given over to cooking and 20% on lighting and communications.

If we calculate these values on a world scale, every year the people with very limited resources spend approximately 37,000[72] million dollars on poor quality energy (candles, wood, and kerosene) to meet their energy requirements.

This willingness to pay for such basic supplies defines what is known as the **"payment capacity"** of the clients at the Bottom of the Pyramid, and is a major factor to be taken into consideration when it comes to tackling scalable Universal Access to supply projects, since the existence of a certain payment capacity reduces the need for subsidies that make up the required profitability, as is explained in the document "Access to Energy for the Bottom of the Pyramid".[73]

Apart from the payment capacity, it is also important to take into account the concept of "Willingness to Pay", which means, what the consumer is prepared to pay for the service or product.

As is expressed in the document "From Gap to Opportunity",[74] some of the factors that have a bearing on the "Willingness to Pay" are difficult to predict. One example is the growth of mobile phone sales in underdeveloped countries, which shows that people with severely limited resources sometimes allocate a substantial part of their income to something they wish or that they think is valuable.

As has already been pointed out, it is generally considered that consumers are prepared to pay for access to modern forms of energy what they would be ceasing to pay for the traditional forms.

The next section shows how, when it comes to establishing cost-recovery systems sustainable in time that are capable of attracting investments, and, simultaneously, implementing affordable tariffs for the consumers in the new zones established, it is important to relate the payment capacity and the Willingness to Pay to the cost of the different options available (see the following figure) and with the subsidy mechanisms that might be established.

71 United Nations Regional Comisssions, 2013.
72 International Finance Corporation (World Bank Group), 2012.
73 Hystra, 2009.
74 International Finance Corporation (World Bank Group), 2012.

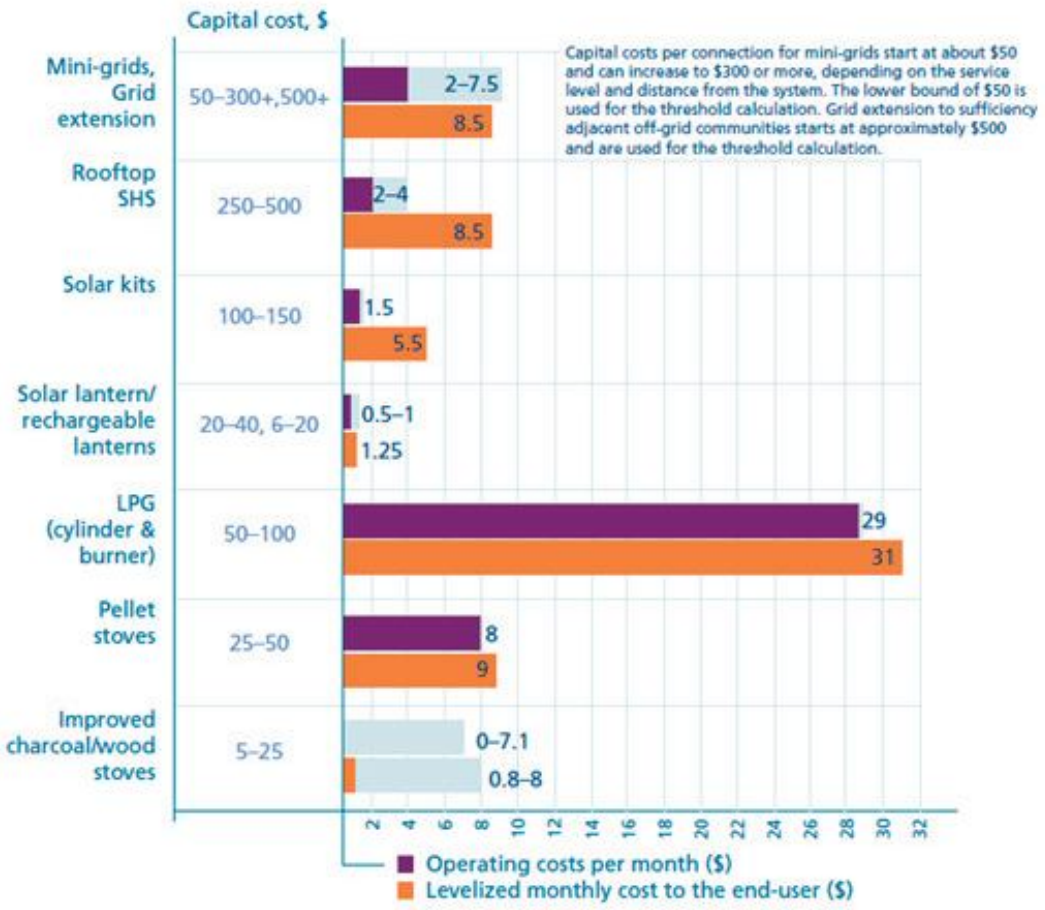

Figure 12. Market price for modern energy options. Source: From Gap to Opportunity, International Finance Corporation (World Bank Group), 2012.

The energy market at the Bottom of the Pyramid is immature and almost non-existent.

The concepts of payment capacity and willingness to pay must be taken into account when it comes to calculating the tariffs that the consumer must pay sustainably.

The document "The Fortune at the Bottom of the Pyramid"[75] points out that companies could obtain profit from their investments if they supply the people at the Bottom of the Pyramid, with services and products that they can afford, adapted to their payment capacity and to their willingness to pay, supplemented by the initial aids to investment and the subsidies that the Public Administrations might decide are necessary. The small profit margins would be compensated for by the large number of people in that market.

[75] Prahalad & Hart, 2002.

The final electricity tariffs must cover the cost of supply (to attract investments at the initial stages and to make it possible to operate, maintain and replace equipment at the operating stage) while at the same time keeping the prices at a level that consumers can afford. These goals are often difficult to achieve, but interesting experiences have already been gained. Many electrification projects that are successful at the investment stage (capital is obtained for the project often with official development aid or donated by philanthropists), fail after a few years because they lack a good business model for the operating stage.

That is why it is essential to carefully consider not only the project implementation stage but also to take great care over the sustainability of the project in time. One must leave the "work done" stage behind when the facilities are commissioned and suitably design the sustainability mechanisms (how the facilities are going to be maintained and by whom, how they will be replaced, and how their operation & maintenance will be financed and the equipment will be subsequently replaced). Experience has shown that this is a complex and complicated task.

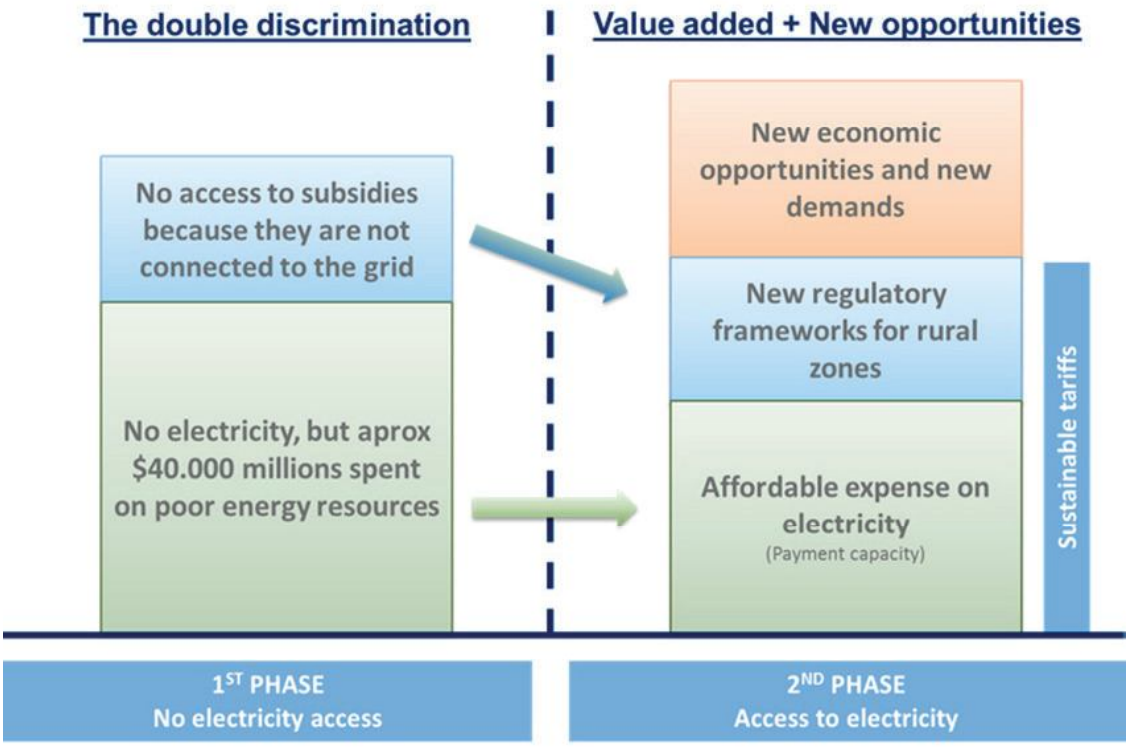

Figure 13. Breaking double discrimination and creating sustainable tariffs. Source: Own source.

The next figure shows how devising tariffs that are sustainable in time, can break the double discrimination model that is suffered by those who neither have a supply nor receive the subsidy that clients who are connected to the

grid do receive. The payment capacity that the rural consumers have already implicitly stated they have for their purchases of wood, candles, kerosene, etc., will then be used to set tariffs for them that are "a little bit" below that payment capacity, in such a way that opting for electrification appeals to them. The total operating cost (O&M and replacement) that guarantees sustainability, would be recouped by supplementing consumers' payments with subsidies similar to the ones received by the consumers who are already electrified. Furthermore, electrification will start to create business opportunities within the community, which will create new electrification necessities that will be covered at lower unit costs, not only improving the consumers' welfare, but also reducing the need for subsidies and increasing the profit margins in the electrification businesses that will gradually be created at the Bottom of the Pyramid.

Concerning the aforementioned new business models is of particular interest the work carried out by the SE4ALL Energy Access Committee, especially the document "Decentralized Energy Products and Services Off-Grid Enterprises".[76] The document describes for three potential performance models increasing in welfare level (Replacing Traditional Stoves; Basic Access to Electricity and Advanced Access) which public intervention policies, business models and financing systems are the most suitable for each one of the three performance models.

Reverse innovation and utility of the future: other benefits provided by universal access to electricity supply

Innovation is one of the key factors that account for the competitiveness and success of companies and nations. According to Porter,[77] a nation's competitiveness depends on its industry's capacity to innovate and improve. Companies have a competitive edge by innovating.

In the words of Schumpeter,[78] innovation can be defined as the development or adoption of new products and services, new processes, new sources of supply and changes in industrial organisation, in an ongoing way, and aimed at the client, consumer or user. It has traditionally been the industrialised countries that have been responsible for undertaking, financing and carrying out these kinds of activities so they can subsequently be applied in all world markets.

In the framework of the fight against poverty, the knowledge flow can change, the knowledge flow acquired when managing businesses at the Bottom of the Pyramid being possibly reversed, performing innovations in those businesses to optimise the limited resources available and the low payment capacity, and thereafter using the acquisition of such business awareness in the first world

[76] SE4ALL Energy Access Committee, 2014. For further information please refer to http://www.se4all.org/wp-content/uploads/2014/03/Background-Paper_-Enterprises-Energy-Services.pdf

[77] Porter, 2013.

[78] Schumpeter, 1934.

countries. Reverse innovation can thus be defined as the process of seeking, not only slight improvements but also disruptive solutions, implemented in developing countries that can subsequently be applied and marketed for products and services intended for the markets in the most developed countries. A greater degree of optimisation is thus achieved in the production processes, because starting from an initial idea developed and profiled in developed countries, and after the experience and development gained from its application in several projects in emerging countries, the idea goes back to the developed countries in a redefined form, thereby permitting a qualitative leap where quality, process and cost are concerned.

These type of innovations can bring about competitive changes, reaching new clients, affecting existing companies or contributing to open up new markets. As C.C Hang and E.W. Garnsey[79] point out, entrepreneurial companies are finding the opportunity to apply simple and accessible technologies in the emerging markets given that this creates opportunities for reverse innovation.

Reverse innovation can come from unexpected sources. A clear example of this is the Negroponte Project. In 2000, Professor Negroponte, Director of MIT´s Media Lab, devised and put into practice the OLPC (One Laptop per Child) initiative to develop a laptop that was both good enough and affordable enough for children from third world countries. Many hardware and software breakthroughs were made, but the target price of 100 $ was too difficult to reach and the purpose of the mission was not achieved. ASUS, one of the manufacturing contractors, from Taiwan, familiar with the laboratory where the initiative was launched, decided to take a different path by offering a new product to the developed market: a mini-notebook laptop, which was surprisingly well received by the new consumers.

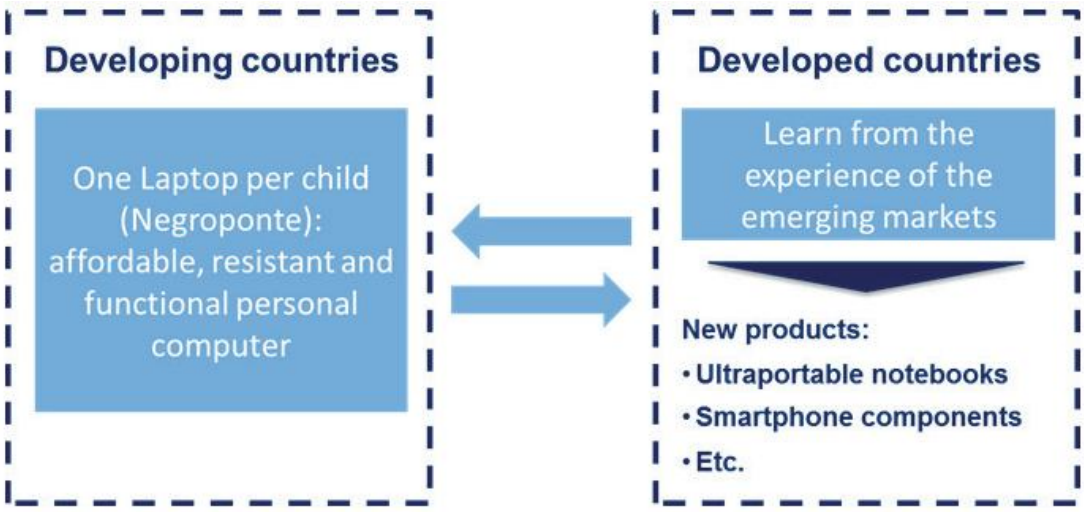

Figure 14. Reverse innovation, the Negroponte Experience. Source: Own source

[79] Hang & Garnsey, 2011.

The energy sector must not remain on the side-lines where the potential offered by these developments is concerned, and, so, it must try to capture all the experience gained from the development of programmes and projects for Universal Energy Access. It will make these projects twice as interesting, allowing them to have more resources available and enabling the benefits of the projects to affect all the players involved.

Furthermore, in connection with the reverse innovation generated in projects for Universal Access to Electricity Supply, an interesting link is beginning to emerge between this reverse innovation and the debate that has commenced concerning the "Utility of the Future", which is the term used to refer to the new business models that could appear and might transform the traditional models owing to such major challenges as: the fight against climate change; the new requirements that have to be implemented in electrical installations to withstand the effects of climate change (the so-called "resilience" to withstand the greater severity and frequency of natural phenomena); the more demanding quality requirements in a society that is becoming increasingly electrified; the "Big Data" phenomenon and all the business models that go with it; the implementation of Smart grids; cyber-security, etc. The Utility of the Future[80] will thus have to cope with these changes and make the most of all possibilities for potential improvement, including those that reverse innovation offer in the area of Universal Access to Electricity Supply.

In fact, the technological, economic and regulatory changes have positioned electricity (and the electrical sector) as one of the central axes in the transition towards an economy low in carbon. Some of the essential dynamic forces lying behind the change in model are as follows.[81]

- The trend towards decarbonising the electrical sector, with a major role for renewable energies and energy efficiency.
- Geographical Integration of the different electrical systems, with an effect on the way market and interconnection rules are designed.
- An increasing interrelation between the electrical sector and other sectors (for example, transport or building construction). This will pave the way for new business opportunities.
- A more active role played by the consumer in the electrical system (in some cases the consumer will also be the producer).
- A potential "revolution" in electrical distribution thanks to the breakthroughs in information and communication technologies.
- Governments' and regulators' growing concern over the robustness of the electrical infrastructures.

[80] Pérez-Arriaga J. , 2014.
[81] Pérez-Arriaga J. , 2014.

Universal Service projects had many of the aforementioned dynamic forces in their DNA long before they appeared in the first world. In particular, such concepts as:

- Use of renewable energies (not directly associated with the fight against climate change as it happens in the first world, but because they are often the only sources available);
- Energy efficiency (mandatory in the third world because energy availability is very limited and it feeds the basic supplies in the first part of the utility curve);
- Use of demand management applications (not in the same way as in the first world to economically manage invoices, but to make viable the operating stability of unstable grids);
- Use of isolated microgrids (not to guarantee maximum reliability, which is what some consumers require in the event of a general service blackout as occurs in the first world, but simply because there is no possibility of connecting to the general grid given that it is so far away);
- Use of high-charge lightweight batteries (not to optimise space or to provide back up when there are long-lasting blackouts, as is what happens in the first world, but to make the normal basic supply feasible in remote areas where communication is not possible and batteries are carried on foot or on horseback).

Electrification projects are pilot experiences, in a framework with less regulatory restrictions and a considerable scarcity of resources, which makes it possible to analyse on the basis of actual experiences, such questions as: grid restrictions, the value of unsupplied energy, how resistant the system is when faced with an intermittent growth of renewable energies, the impact of climate contingencies, etc.

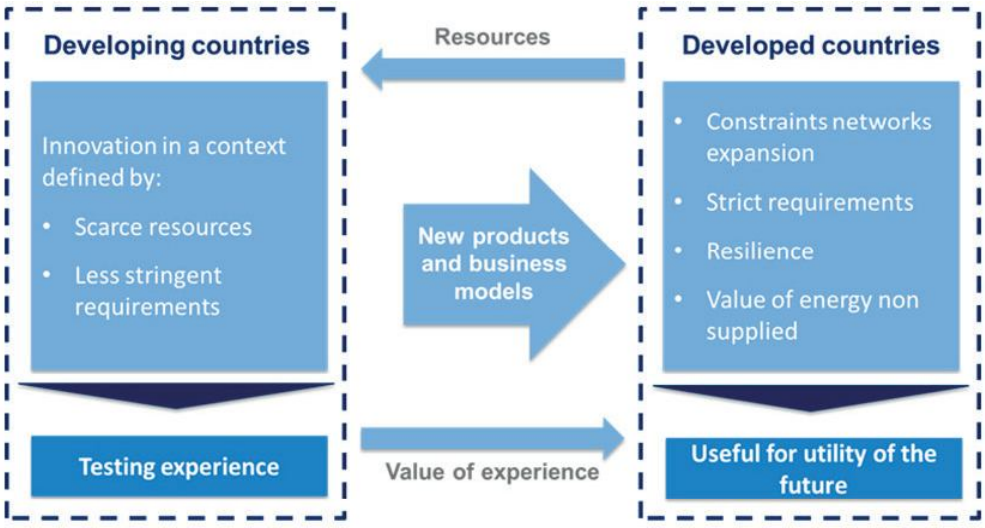

Figure 15. Reverse innovation and generation of added value for the utility of the future. Source: Own source.

Universal Access to Supply and Climate Change

When one talks of providing 1,300 million people with access to advanced (or modern) energy services, especially electricity, one of the most important aspects that has to be considered is the impact of this additional energy consumption on the energy prospect and greenhouse gas emission scenarios, and, ultimately, the impact on climate change.

Although this question has been to a certain extent the subject of debate, there is a broad consensus that universal access will have a limited effect on climate change, as it has been so stated by the International Energy Agency itself in its successive publications. In this sense, one of the most interesting analyses was made in the WEO 2013[82] in the scenario called "Energy for All",[83] in which it is explicitly stated that providing universal access to advanced energy services has a limited impact on global energy demand and CO_2 emissions. The demand increase would be around 120 Mtep, hardly 1% greater than in the base scenario called *New Policies* in 2030. According to this scenario, this demand increase would be covered 35% by fossil resources and the rest by renewable energies. The increase in CO_2 emissions with respect to the scenario called *New Policies* is only slight, hardly 0.7% in 2030 (260 Mton CO_2).

It is worth pointing out that the limited increase in emissions in the *Energy for All* scenario when compared to the reference scenario is due mainly to two factors; on the one hand, the limited amount per capita that would be consumed in the new households that access modern energy services and, on the other hand, the high percentage of renewable energies in the new solutions offered to the clients. Furthermore, it should be taken into account that the new solutions offered are generally more energy efficient than the ones that have been used before (this is particularly interesting in the case of traditional stoves with biomass that are replaced by electrical appliances).

The work by Chakravaty and Tobari[84] is along the same lines as that of the International Energy Agency where analysis is concerned, but starting from an analysis of their own base case. The work begins by classifying the degree of access to energy to find out the extent to which the environment is affected. The authors thus make a distinction between four ever-increasing levels of electrification in the Universal Access to Electricity Supply projects:

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82 International Energy Agency, 2013.

83 *Energy for All* is a scenario consistent with achieving universal access to electricity and to clean energy sources for cooking by 2030. If this deadline is to be met, the grid extension requirements are calculated (whether these are on-grid, micro-grid or off-grid solutions) for each region, taking into account the cost for each region and the consumer density, in order to establish the cost in MWh.

84 Chakravaty & Tavoni, 2013.

1. *Basic needs* (those associated with lighting, health, education, etc., special mention being made to the introduction of modern energy forms for cooking and heating);
2. *Productive uses* (access necessary to increase the productivity of agriculture, trade and transport);
3. *Modern society* (access necessary to cater for greater domestic demand for private transport); and
4. *High consumption level* (equivalent to the consumption *per capita* in the EU).

It is clear that each advance in electrification levels (ambition gap) provides the groups who receive the supply with greater welfare and development ability, but at a higher cost and with greater emissions. Thus, and on the basis of the calculations made taking their base case as the reference, if universal access to energy up to the productive uses stage were a reality by the 2030 deadline, this would mean a final energy consumption increase of 7% (20 EJ).

These energy consumption increases will mainly be concentrated in Africa,[85] although many of them will cater for the growing number of inhabitants on that continent.

The authors conclude that the impact on climate change would only be slight, the temperature increase being probably under 0.1ºC in most of the scenarios envisaged.

Key Elements in Universal Access to Electricity Projects

The preceding sections have presented some of the basic concepts and references that are usually found in the world that deals with universal access to electricity, making the plot thread easier to be followed in this chapter. An attempt is made in this chapter to go more deeply into the specific elements that constitute a Universal Access to Supply project: on the one hand, the involvement of many stakeholders (a multi-stakeholder solution), establishing their rights and obligations to guarantee the success of the governance, and on the other hand, an exhaustive solution that requires many stages and aspects to be envisaged in order to prevent that the absence of just one of these may lead to the failure of the project.

Governance Models and Stakeholders Involved. A Multi-stakeholder Solution

The empirical evidence, compiled and classified in publications such as "From Gap to Opportunity"[86] has revealed that the traditional models based on the public service theory (with a two-way relationship between the Licensee Company

[85] See Box 1.- Scale of the Access to Electricity problem in Africa.
[86] International Finance Corporation (World Bank Group), 2012.

and the Administration) have not succeeded in providing a satisfactory solution to a major problem that is highly complex from a technical, economic and social perspective. In order to guarantee the success of these projects, collaborative solutions (multi-stakeholder solution) must be proposed, supported by a credible legal and institutional framework, a suitable technical approach and a viable business model.

The governance model for this type of project, usually/must involve many stakeholders, giving them rights and powers on the one hand, and obligations and responsibilities on the other hand, in such a way that, although the framework that regulates those relationships may become complicated at the outset, once it is established it enables the actions that bring the project to fruition at all its stages (before, during and after the construction of the facilities that make universal access physically viable) to be carried out more smoothly and with greater guarantees.

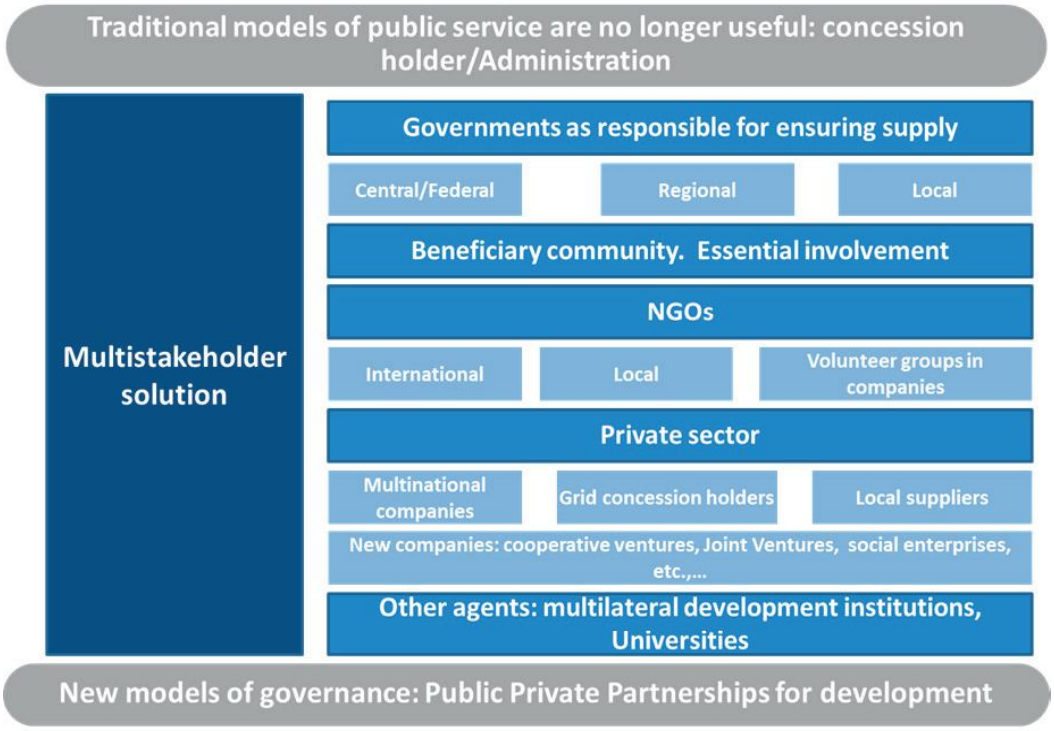

Figure 16. Multi-stakeholder Solution. Source: Own source.

The main stakeholders involved include:

Governments

The Administration is involved at all its levels: federal/national, regional/State, municipalities, etc. They have to include in their Agendas the way in which Universal Access to Electricity is used in the fight against poverty and they must be

the main driving force behind establishing a suitable Governance framework that encourages the other parties to successfully complete the Universalising Projects, given that it is they who are responsible for guaranteeing the supply of the goods that are essential to society. They have to show themselves to be strongly committed politically and must develop a rigorous and stable legal framework and be responsible – directly or by delegation - for supervising that all the stakeholders comply with their obligations at the different project stages. They must also be flexible when it comes to dealing with all the aspects that will undoubtedly crop up unexpectedly.

The beneficiary communities

Experience has shown that it is essential to the success and sustainability of the projects that the communities who are going to receive the benefit from *Universalisation* projects – in many cases Indigenous Communities –are actively involved from the early stages and that they participate at all the phases, mainly at the operating stage. They have to be made aware of the advantages and also some of the drawbacks involved in accessing the electricity supply, and they must take part in the decision-making process to the extent that their abilities permit. Furthermore, the model implemented must not be the classic "awarded" model where they receive a "gift" that has not been solicited and which they do not feel responsible for looking after. Success, especially at the operating stage, lies in the beneficiaries feeling that the project is their own, and they take on the responsibility for its sustainability.

Non-Governmental Organisations (NGOs)

Whether on a local, national or regional level, NGOs have been vital at the initial stages of *Universalisation*, especially when the projects were mobilised by philanthropy or social action, they being responsible, amongst other aspects, for making society aware, for helping to set up Agendas in the fight against poverty and for obtaining financial resources. Once the solutions escalate and go beyond philanthropic motivators, NGOs continue to be major stakeholders for many causes: for they carry on exerting pressure on the Cooperation Agendas, for their familiarity with the situation when they are locally rooted, for they are better at liaising with the beneficiar-

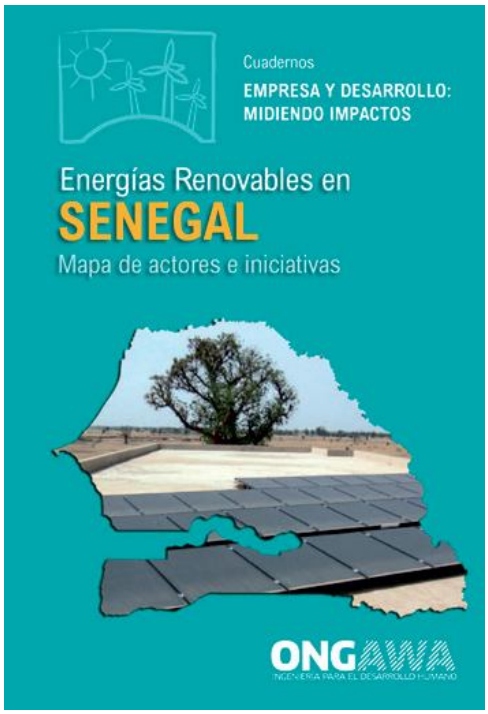

Image 2.

ies; for they also provide a more social attitude to be taken into account in the projects; and because they stay in the area after the investment phase of the project which, in many cases, due to their presence in distant lands, enables them to take over some of the supervisory functions or to inform about the need to carry out maintenance work on the facilities or to replace them before they deteriorate and cease to operate. International NGOs have a greater ability to obtain funds from Multilateral Institutions and a greater capacity to liaise with the different Administrations.

One of the NGOs' most valuable resources is their technical personnel, who often have extensive experience in developing and implementing projects. Their contribution is also particularly valuable when *Universalisation* is considered for situations that require special humanitarian skills, such as supplying large refugee camps with electricity; these camps are increasingly becoming zones with permanent inhabitants, even though they were originally thought of as temporary refuge sites.

Volunteers, specialist volunteers and retired specialist volunteers

The role played by volunteers in Universal Access to Electricity Supply projects, as is the case with all those associated with the fight against poverty in their different dimensions, is vital and this article is not going to go deeply into praising their social work. However, reference must be made to specialist volunteers, such as those who put their professional expertise into practice in their humanitarian activities, in the different fields where their knowledge is required in large (and also small) Universal Service projects. The idea is that, if what they contribute to projects is highly specialised expertise (of a technical nature, in purchase management, regarding regulatory, legal and economic proposals, etc.), which is necessary and would otherwise have to be acquired at market prices, the contribution made to society by these volunteers is maximised if they are focused on the areas where they can actually contribute with their know-how rather than in fields where they are not specialists. Therefore, it is particularly positive for the volunteers from companies linked to the electricity sector that the companies channel the awareness of their internal personnel towards social action projects associated with Universal Access to Electricity Supply.

Within this group of specialist volunteers, the contributions made by those who have retired from energy companies, manufacturers of goods and equipment and from the Administration are particularly interesting and important, because their awareness regarding the social action channelled into Universal Access to Supply projects enables them to make the very best use of the experience they acquired throughout their careers coupled with the fact that they have more time to devote to these activities. In this sense, the experience of *Energía sin Fronteras* (EsF), a Spanish NGO formed 10 years ago and given over to electricity and water projects in underprivileged areas, is a successful example not only in view of the numerous projects in which it has participated, but also because

it has established an NGO model based almost entirely on volunteers (very few contracted personnel), with numerous specialists from the electricity and water sectors, and a very high percentage of retired people who formerly worked in companies and institutions in the energy sector.

The private sector

Apart from the obvious value of the private sector´s contribution through social action or philanthropy, it is a sector that plays a major role in developing and implementing Universal Access to Supply projects where scalability of solutions is required. Major groups of actors can be pin pointed within this sector: multinational multinational electricity companies associated with energy and its equipment, grid operators, local suppliers of goods and services, new types of stakeholders ("cooperative ventures", "joint ventures", "social enterprises", etc.). Each one of these makes a positive contribution to the projects; for example:

- Multinational electricity companies: regardless of whether or not these multinational electricity companies are established in the region, they contribute with the technical experience of their departments and personnel, their capacity to access the capital markets, making large amounts of capital available for major projects; their help with risk management; their ability to liaise with Administrations and Multilateral Financial Institutions to obtain dedicated funds; their capacity for innovation with technical solutions adapted to the areas to be electrified; their ability to propose to the Administrations, potential economic, regulatory or pricing solutions adapted to the situations of the groups and the conditions in the zones to be electrified, etc.
- Licensed network companies (distribution companies): many of the Universal Access to Supply projects are based on implementing plans that have been accorded by the Administrations and the grid operators closest to the areas that are to be supplied. Even if those areas are a long way from the licence areas, the economies of scale or scope make it more appropriate for a major role to be given to the distributors nearest to those areas (with new rights and obligations, even if they are different from those applied to the supplies under the licence itself).
- Local suppliers: where Universal Access to Electricity Supply projects are concerned, local suppliers are vital, because they make it easier to adapt the solutions to the characteristics of the region, especially in matters concerning the diverse logistics that are required in remote zones. In many cases, these suppliers form part of the of the new business models that are created at the Bottom of the Pyramid.
- New stakeholders, fruit of the new businesses at the Bottom of the Pyramid: As has already been pointed out in preceding sections, the scalability of the solutions generates numerous business opportunities revolving around Universal Access to Supply projects. These businesses bring about innovations

from the traditional ways of operating to enable them to adapt to the specific characteristics of the projects in aspects such as:

- Creating new companies, either as private initiatives, cooperatives, subsidiaries of licensed companies, social companies, etc. so that, amongst other things, they can become the nominees or managers of the new facilities and responsible for their maintenance, for the commercial systems that will regulate their relationship with the users, and also responsible for the negotiations with the Administrations concerning the regulatory and pricing frameworks for the new consumers;
- Local contractors for the new technologies that are implemented in the zones and that have to be installed and subsequently maintained;
- Logistics companies to deal with the problem of transporting materials in remote zones where access is difficult (at the initial investment phase or for maintenance and replacement), such as for example, transporting batteries, panels, etc.;
- Companies that train specialists for the new facilities (at both the investment and maintenance stages);
- Micro-financing companies;
- companies/cooperatives of different types to make the most of the arrival of electrification and to create new economic structures in the community (for example, to use the refrigerating capacity for processing and preserving perishable foodstuffs that can be marketed outside the community);
- etc.

It must be pointed out that under this multi-stakeholder model the Public Private Partnerships, PPP[87] will play a basic role by making it possible to combine the financial and managerial capacity of the private sector with the regulatory and supervisory capacity of the public Administration to draw up general and contractual frameworks for the projects (rights and obligations, subsidy structures, specific quality standards for the electricity supply in isolated zones, etc.). One example of the success of this approach can be seen in the study conducted by Gassner, Popov, and Pushakin 2009,[88] based on data from 250 electricity companies from 50 countries. The study revealed that the utilities that had been privatised, or those that operated under a public-private partnership, provided access to electricity more quickly than those that remained public. The highest rate of access took place in the areas where private companies operated under concession contracts. These companies increased the connections to house

[87] «*Apart from tendering, contracting, providing specific services or providing the private management of public resources, Public Private Partnerships (PPPs) are strategic agreements between government institutions and companies made with a view to - depending on the promoters - achieving common goals.*» http://omal.info/spip.php?article4810.

[88] Gassner, Popov, & Pushak, 2009.

holds at a rate about 21% faster than the public companies.

The survey conducted by GSEP "Strengthening Public-Private Partnerships to Accelerate Global Electricity Technology Deployment"[89] is also very interesting for giving insight into which elements are provided by each part of a PPP.

And as experience in managing problems at the Bottom of the Pyramid is a degree, it is also interesting how those who are used to managing problems and have the processes relatively standardised approach them, as is the case of Protocols established by Development Aid Agencies, for example the one set up by the AECID to manage Public-Private Partnerships for Development.[90]

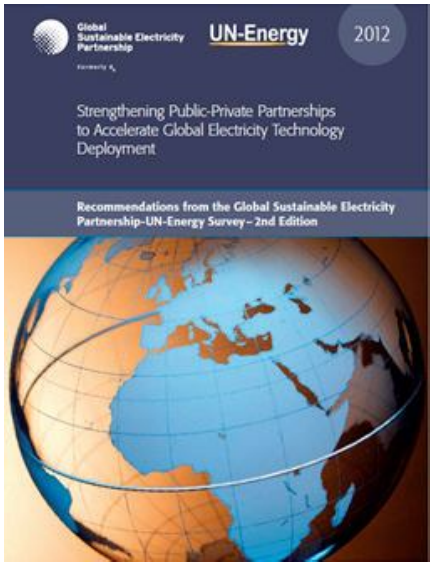

Image 3.

Universities and Academies

Universities and the different types of Colleges should play a basic role in the fight against poverty, as they do in other areas, especially with respect to the numerous aspects that are considered in Universal Electricity Service projects. Some of the contributions they can make are:

a. Serving as a neutral and independent meeting point between all the stakeholders involved, generating public debates that publicise the problem of the 1,300 million people without access to electricity;

b. Setting up training modules, providing specialised material (the report "Human Development Technologies for Isolated Rural Communities"

Image 4.

89 Global Sustainable Energy Partnership, 2012.
90 Cooperación española, 2013.

issued by the *Real Academia de la Ingeniería*[91] is particularly interesting), specialised itineraries, specific professorships, masters, etc., oriented towards the problem of energy poverty and that may help to train experts and increase the awareness of future professionals, while at the same time researching into and inventing technical solutions and new business models to apply in Universal Access to Supply projects.

Multilateral Institutions

In the context of Universal Access to Electricity supply, Multilateral Institutions have many and important tasks, including the following:

a. To identify the aim of attaining Universal Access to Electricity Supply as a vector in the fight against poverty (even as part of Human Rights), and as a contributory factor in achieving the Millennium Goals.[92]

b. To include on their Agendas and on Government Agendas, objectives in the fight against energy poverty, amongst others fighting against the lack of modern forms of energy, launching specific global programmes (example: Millennium Goals; Sustainability Energy For all; etc.).

c. Setting up aid funds and specific financing mechanisms aimed at eradicating energy poverty.

d. Preparing guidelines that help stakeholders to pinpoint the best practices in fighting poverty projects[93].

Some of the many stages for guaranteeing the success of a Universal Access to Electricity Supply project

The steps to be taken when carrying out a *Universalisation* project are numerous and complex. There is no standard procedure for establishing them, because the singular nature of the projects, the territories, the stakeholders involved, the economic situation, the technology, etc. make such standardisation impossible. Very good and comprehensive references and guidelines have been prepared by Institutions, NGOs, etc. that might prove to be very interesting to those who wish to examine them in detail. For example, the project.[94] "Public Private Partnership for electrification in Isolated Rural Zones in Latin America" carried out by the Sustainable Organisations Research Group at *Universidad Politécnica de Madrid*, jointly with the NGO *Energía sin Fronteras (EsF)* and the NGO *Aula de Solidaridad* – intended to systematise the experiences resulting from one of the first EsF

91 Real Academia de Ingeniería, 2011.
92 See 2.1. Universal Access, Millennium Goals.
93 For further information, See United Nations Economic Commission for Europe, 2008.
94 Proyecto APEL (EsF, GIOS/UPM, Aula solidaridad).

projects in this field (called Regulation for the Electrification of Isolated Rural Zones (REGEZRA)[95] in Guatemala).

A non-exhaustive list of the major phases/elements to be taken into account in a Universal Access to Electricity Supply project are presented below. Many of them are carried out simultaneously and others are necessarily sequential in nature.

Pinpointing the need

The first issue to be analysed when a project initiative crops up is whether it is necessary, and this cannot be done unilaterally, however commendable the initiative is. The needs may have been put forward by Multilateral Institutions, Cooperation Development Agencies, or the Governments of the countries concerned, causing the investment initiatives to attend the call. However, it could have been the other way around: somebody who wishes to extend the supply to isolated regions providing spontaneous initiatives (either altruistic or because of business appeal). Whichever way it is, the role of the stakeholders mentioned in Section 3.1 must not be forgotten, especially the role of:

- The Administration, as being ultimately responsible for supplying all citizens (which means that it is not recommendable to set unilateral initiatives without taking into account the Administration);
- The Beneficiary Community, given that its interests or its cultural position or its involvement may clash with the good intentions of those who are considering the project and cause the project to fail, either through opposition to it or because they do not get involved in it at the mature stages for making it sustainable in time;
- The companies responsible for making the investments or operating it (whether they are existing licensees or new ones), which must have a regulatory framework with sufficient legal guarantees when they propose a project or when one is imposed upon them because a new supply need has been considered.

Process of allocating very scarce resources. Welfare optimisation models

Once a need has been considered in a Community/Region/Country, work begins on collecting all kinds of information with a view to establishing whether the project is feasible and, should it be, to select the most suitable technical options. Before starting to analyse what information is required, it is essential to know what it is needed for, making it necessary to find out beforehand the Project eligibility process.

[95] See www.energiasinfronteras.org/.

In the case of a supply project for an isolated Community in the framework of an individual initiative, the eligibility problem is intrinsically complex. However, when the project forms part of a General Universal Access to Supply Programme in a country or a region, the case requires the support of optimisation systems that help with decision making for a multi-variable problem.

In fact, to greatly simplify matters, a good Programme requires to apply limited resources to improve the welfare of the society. Yet the decision-making tree for allocating such limited resources has many ramifications with questions like the following:

a. Is it preferable to devote the limited resources to solve other poverty problems, such as replacing traditional stoves with improved ones or drilling wells with water treatment to obtain drinking water in locations close to the villages?.

b. Of the resources finally given over to electrification.... Is it preferable to opt for giving a survival electricity supply (giving tens of thousands of people low-cost solar lanterns or, in an individualised Solar Home System, provide a small solar panel suitable for a couple of low-consumption lanterns and a plug) or to choose a more expensive solution, applicable to some hundreds of citizens only, creating a micro grid that can supply a settlement and some communal services (school, small health centre, a water pump, etc.)? Or is it preferable to rule out the two previous options and opt for a grid extension?.

c. etc.

When choosing between multiple alternatives, one enters the complex world of rating them, for the purpose of which it is necessary to give an economic value to the available technological and management options, choosing the one that maximises, not the number of consumers to be supplied with the finite resources available, but the overall welfare that the solution provides for the society. Optimisation models must be used to do this, in which not only the usual variables, like the investment, operating and maintenance costs of the various options, have to be assessed, but also something much more complex, such as:

a. What economic value does human health (even life) have?.

b. What economic value do the impact of the different options have on the environment?.

c. What future economic value can be placed on the education that will be permitted with the arrival of electrification?.

d. What economic value can be placed on the potential future development of economic sectors that grow thanks to electrification?.

e. What effect does a particular option have, in terms of probabilities, on health improvement, reduction in the death rate, on the environment,

etc.?, and on the contrary. How not including an option affects in terms of worsening of health, increase in the death rate, deterioration of the environment, for those groups whose electrification is ruled out?

All of the above – however cold it might seem – cannot be taken into account with subjective perceptions. Some kind of tool has to be used to weigh up the following:

a. An improved stove directly prevents deaths and has a major positive impact on health. It can even prevent rape, in the sense that the distance that women have to walk to find biomass is not as far thanks to the greater efficiency of the improved stove, which does not require as much biomass.

b. One well and a treatment plant in a community prevent many harmful effects on health.

c. Lighting, even in limited amount, can improve safety in a village.

d. A fridge in a distant health centre, allows drugs and vaccines to be preserved for much longer than if there is no fridge.

e. etc.

As has already been stated, optimisation becomes much more complicated when potential levels of electrification are introduced (very high, high, average, low) that can greatly improve the comfort of the fortunate groups, but at the expense of other groups, larger numbers of which are left out of the solution.

The problem also becomes more complicated when the deadline for optimization of the allocation of resources is extended, because elements that in the short term do not bring benefits or cause harm, begin to do so in the course of time (cumulative effects (positive or negative) on health, environment, education, economic improvement, etc.).

And what about the added complexity that taking into account the value of the synergies that a comprehensive solution to all the problems could provide (see the next section)? This is the complex situation that Governments, Multilateral Institutions and Development Cooperation Agencies have to face when establishing their agendas. Hence the great respect that those institutions deserve when they manage to set in motion a mechanism for fighting poverty.

Clearly, not all electrification projects have to go through this complex process, at least not explicitly. For example, an electrification initiative in a small village in any given country, could have been set in motion after a visit by volunteers, leading to contacts with potential financiers and with the Administrations, joining forces, and then carried out without forming part of a Global Programme. However, and without detracting from the importance of these initiatives and the great social benefits that the community concerned receives, the allocation of those resources will almost certainly not be optimised, whereas they would be optimised if they formed part of a Comprehensive Programme.

Synergies

Reference was made in the previous section to one element that gives greater value to Universal Service projects, but which also makes the analysis of the options more complex, this being the search for synergies. When it comes to rating the project, all the synergies involved in having electricity available (for example, improving sanitation conditions, accessing to water, having more spare time because it will no longer be necessary to cover long distances looking for water or firewood so that time can be spent on useful tasks or education, or setting up new businesses, etc.) must be incorporated into the analysis, in case it is advisable to undertake mixed projects instead of ones that are going to solve the different requirements on an individual basis. For example, it has been demonstrated that in isolated zones, electrification projects that also have associated projects that include raising water from wells and treatment plants, yield much more positive results where social welfare is concerned. Therefore, for example, the NGO *Energía sin Fronteras*, originally specialising exclusively in electrification projects, has changed its approach to mixed projects.

Technical solutions

The aforementioned optimisation models feature modules that allow the design of potential technical solutions (grid extensions, microgrids, household systems (Solar Home Systems), types of generation to be used, etc.) to which the optimisation process will be applied.

A better in-depth understanding of the aforementioned complexity of the whole optimisation process can be obtained by referring to the presentation used by Ignacio Pérez-Arriaga at the EPRG&CEEPR Conference held in Madrid in July 2014[96] in which he presents, amongst other interesting matters, the work that MIT is carrying out concerning Universal Service and, in particular, the optimisation models mentioned above.

Collecting information

The models in question require a huge amount of information to function. Some examples of the type of information required are:

- Resources available in the zones (background history of rainfall, river flow-rates, solar radiation levels, wind level, etc.).
- Socio-cultural surveys, to find out how the electrification projects might affect the groups.
- Cost (of investment and Operation & Maintenance) of the elements used to expand the grids, in the microgrids, in the household systems (SHS), etc.

[96] http://www.eprg.group.cam.ac.uk/wp-content/uploads/2014/07/2014_Madrid_5A_Arriaga.pdf.

- Cost (of investment and maintenance) of the generation and storage technologies.
- Position of the existing grids and location of the groups to be electrified, in order to "interweave" the various possible solutions (grid extensions, micro-grids, or SHSs) for the future electricity demand. GPS georeferencing systems are starting to be used to collect this information.
- Economic value assigned to health, environmental impacts, education, etc.
- Potential for economic development based on the electrification.
- Water problems.
- Sanitation situation.
- Regulatory and pricing frameworks, especially those that apply to underprivileged clients.
- Distance and access problems to the Communities, in order to assess logistics and stockpiling problems at the investment and operation stages.
- Payment capacity surveys and analyses, with a view to analysing potential approaches to pricing,
- etc.

This information is collected in different phases, as required. Some of it is available at official institutions; other data have to be collected *in situ* by persons/agents involved in the projects, and the rest simply has to be "invented" because it is unavailable, for example, historical records for radiation, water flow, etc.

Environment

As has been pointed out in preceding sections, respect for the environment has to form an essential part of Universal Service projects throughout. Not only must the most environmentally-friendly technologies be used, but care must be taken to prevent impact (at both the investment and operating stages) on the rural areas where they are applied, because the subsistence of the people depends on that environment.

Consequently, environmental impact studies are required beforehand. They must not only assess the negative effects of the projects, but also the positive ones, such as slowing down the deforestation that is caused, for example, by improving the traditional stoves, or replacing the use of biomass for cooking with the efficient use of electricity.

Analysis of Potential Collateral Effects

Notwithstanding the positive effects that the arrival of electricity has on rural environments, the derived social and cultural effects must also be taken into ac-

count. For example, night-time often takes on a new dimension once electricity arrives, causing changes in traditional habits and customs; spare time is more available when electricity arrives, for the release of the locals from the need to look for firewood and water, so the people (mainly women) can spend now their time on other activities; the arrival of fridges or televisions not only brings about changes of habit, but also leads to an opening up towards the behavioural models of other societies that is not always well assimilated or accepted by the traditional cultures in newly electrified communities, etc.

The same happens with possible inequalities between the people in the Community who have received the benefit from having access to electricity, and possible conflicts with other neighbouring groups where electricity has not yet arrived.

From the outset, education is vital in preparing people for the arrival of electricity and its uses, and it is also important to conduct surveys afterwards in order to assess the impact that it is having on the communities. Therefore, it is also important to try and determine *in situ* beforehand, the sociological and cultural profiles that might be affected by the arrival of electricity, so suitable training programmes can be prepared for the various groups.

Regulatory and pricing framework

The regulatory framework of an electrification projects is one of the first aspects that has to be analysed. A stable and rigorous regulatory framework is always essential for developing any type of project. However, when one is dealing with projects at the Bottom of the Pyramid, for which there are almost certainly no regulations, or those that do exist are of a general nature applied to electricity on the mains network only, the different stakeholders (Administration and remaining agents) must analyse the restrictions created by the regulations currently in force when it comes to developing Universal Service Projects, seeking solutions that will often be "*ad-hoc*" for this type of project. For example:

a. Making modifications to the quality criteria required for the systems included in such projects. In many cases it is impossible to apply the same criteria for wave quality, number of service cuts, response time to failures, etc. That is normally established for on-grid clients. As the projects are performed in remote zones and, at least at the outset, with precarious supplies, should the quality standards be rigorously applied (including penalties for non-compliance) investors would refuse to take on projects because of their un-sustainability. The most sensible idea is to establish specific quality criteria for those systems (it must not be forgotten that their initial quality was zero since there was no supply at all) until the grid extension arrives, after which the quality criteria can be brought into line with the rest of the country.

b. Establishing specific pricing systems. Pricing systems normally applied to grid clients cannot be applied to the new clients who appear in elec-

trification projects. Not only are there great differences between the cost (of investment and operation) that the tariffs have to cover in areas on the grid and those off-grid, but also there are great differences between the payment capacities of these two types of client. It should also be possible to conduct an *ad hoc* analysis of the way the Universal Access to Supply projects use the subsidies that are provided by the Administration or the Multilateral Institutions, and these subsidies should be different from the ones allocated to the clients who are "on the grid".

c. Major adaptations may have to be done on many aspects of the regulatory framework that sets out in general the rights and obligations of all the stakeholders (from investors to consumers). The approval of an adapted framework will improve the conditions and the legal guarantees that mobilise the investments, and the entire chain of added value that is created with the different businesses at the Bottom of the Pyramid, which will increase the likelihood of the project success and the scalability of the solutions.

Sustainability of the projects in time

Although the greatest administrative, logistical and investment effort is made until the moment when the investment work ends, most Projects fail, not at that stage when most of the capital is provided and most of the work is done, but at the operating stage, and this happens in the first two or three years of its life. Therefore, one of the most important aspects is correctly planning the sustainability phase, with respect to:

a. Involving the Community. It is vital that the beneficiaries see the Project as their own project and help to implement sustainability measures. Unfortunately, the value that is placed on what is "given" is not the same as the value that is placed on what is "purchased". Therefore, via social companies, cooperatives, etc., the Community must become involved in matters such as maintaining the facilities, training, payment systems, fight against fraud and misuse of the facilities etc.

b. Training specialist personnel. The best way to ensure that the Project remains in operation for many years, is to hire local specialists who take on the responsibility for maintenance. There are many ways of doing this, ranging from the Project Managers training personnel from the Community itself (personnel that are trained for basic supervision and maintenance of the equipment), until companies (already existing or newly established) taking over this function and periodically visiting remote areas. One factor to be considered is the possible loss of trained staff, because in these environments the skills that they have could lead to them being appreciated in the zone and "head-hunted" by other initiatives, giving up their Project responsibilities. That is why mechanisms must be established for the swift transfer of knowledge to potential replacements.

c. Fraud or misuse. Limited resources generate projects where the generation is very efficiently designed for the pre-established loads. If the facilities are affected by misuse or fraud (more equipment being connected than there should be) this can greatly destabilise the system, so both supervision systems and cut-off mechanisms should be implemented. Moreover, a system for penalising malpractices must be devised, which could even be used to prohibit from access to consumption those people who have repeatedly failed to fulfil the established electricity sharing and coexistence standards.

d. Tariffs for use. Imposing tariffs for use is vital to sustainability. Unfortunately, those who do not pay for a service (on the basis of their capacities) do not usually appreciate it as much as if they knew how much it cost and paid for at least part of it. Where the sustainability of solutions is concerned, it is paramount to be able to rely on financial resources, being as well necessary to optimise the combination of private and public subsidies, and to implement a pricing system that seeks a balance between affordability and profitability of the investments. The key lies in imposing the tariffs in a way that they are appropriate to the new clients' payment capacity. It has already been explained in previous chapters that the people in those environments pay for firewood, candles, kerosene, etc., which they will no longer be paying for when electricity arrives. The tariffs ought thus to appeal to the new clients (paying less than they used to). And, assuming that the initial investment costs came from different financing and will not be recovered by the usage tariffs, the latter will have to recoup all costs required for operation and replacement (i.e., for them to be sustainable in time). To fill in the gap between, on the one hand, the running and replacements costs and, on the other hand, the payment capacity, and make the projects appeal to private initiative, the Administration must establish a subsidy system (similar to the one already received by the disadvantaged clients who are "on the grid") that enables all costs to be recovered.

   All of this without prejudice to any subsequent adaptations that may be made from time to time when the surrounding economies develop and the clients' payment capacities improve.

   One interesting experience in this area was carried out in Peru by Acciona Microenergía, in the household electrification (SHS) project for isolated rural areas in the Cajamarca area, in which the Government established a specific tariff based on payment capacity supplemented with subsidies.

Some examples of Universal Access to Electricity Supply programmes

A great deal of experience has been gathered in the field of Universal Access to Electricity Supply, some cases being shown below by way of example. The

aim has been to include also examples of Spanish initiatives, sole purpose is to select some references. The exclusion of other interesting projects from this selection merely means either that I was unaware of them, or that their inclusion would have made the article too long.

«Light for All»

Surely the largest and most successful Universal Access to Electricity Supply Programme in recent years has been the «Light for All» Programme, in Brazil, that we will explain it in a little more detail. The interesting thing about this Programme is that it contains much of what has been mentioned in this article: a multi-stakeholder solution, with a complex governance that involves Federal, Regional and Municipal Administrations; publics and private companies; specific pricing frameworks; innovation at the Bottom of the Pyramid; with stakeholders that have generated new business models; with surveys that reveal the economic, cultural, social and health impact caused by the Programme, etc.[97]

The «Light for All» initiative arose as a response from the Brazilian Government to the serious social exclusion caused by a lack of electricity supply in many zones in the country. As we can see in the next figure, in 2000, the families without access to electricity were mainly concentrated in the areas that combined a lower level on the Human Development Index (HDI)[98] and a lower family income. Approximately 90% of the families in this social exclusion situation had an income lower than twice the minimum salary, and 80% of them were living in rural zones.

At the start of the project, approximately 2 million households did not have access to electricity, which was equivalent to over 12 million people suffering from electricity exclusion.

In this context, «Light for All» emerged as a rural electrification programme whose objective was (and still is) to bring an end to electricity exclusion, i.e., to supply electricity, free of charge, to more than 10 million[99] potential clients living in rural zones. This objective, set from the very beginning, consisted of guaran-

[97] There is a lot of easy-to-access material at their website https://www.mme.gov.br/luzparatodos/asp./

[98] The Human Development Index (HDI) is the indicator proposed by the United Nations Development Programme (UNDP) to measure the human development level in a territory. It measures the progress made by a country on the basis of three basic aspects of human development: having a longer and healthier life, access to education and decent standard of living. It is calculated as a simple average of the life expectancy rate, the education level and the real GDP per capita (PPA in dollars) adjusted or, what amounts to the same, dividing by three, the sum of the partial rates.

[99] It must be pointed out that as a result of demographic growth, the number of clients has generally been growing and so has the number of clients in the framework of the Universal Service. Therefore, at the date on which this article was written, access had been given to 15 million people, and there are still some groups without light, so the Light for All Programme is still operating.

teeing access to electricity in all the rural zones in the country by 2008, with the intermediate target of a 90% implementation by 2006. The objective had to be achieved by giving priority to the communities with the lowest rate of human development and the families with the lowest income. In view of the complexity of the challenge, in 2011, the period for achieving this target was extended to the year 2014.

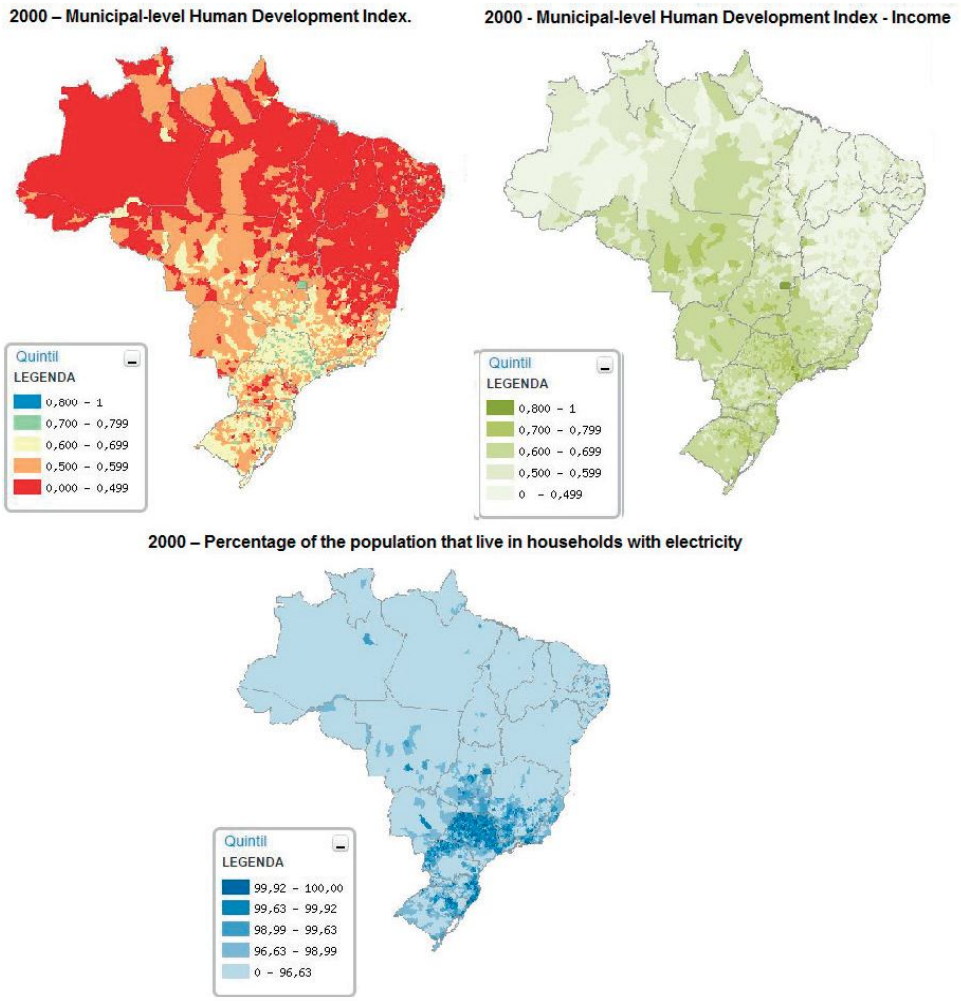

Figure 17. National Electricity Exclusion Map, Brazil 2000, (three maps). Source: Human Development Maps by Municipalities.[100]

The intent of this initiative was to contribute to a reduction in poverty and to increase family income through the removal of this clear barrier to social and economic development in rural communities. The arrival of electricity has thus made it easier to integrating the Federal Government's social programmes, as

[100] See Atlas do Desenvolvimento Humano dos Municipios, available at http://www.atlasBrazil.org.br/2013/pt/consulta.

well as enabling communities to access to health, education, water supply and sanitation services.

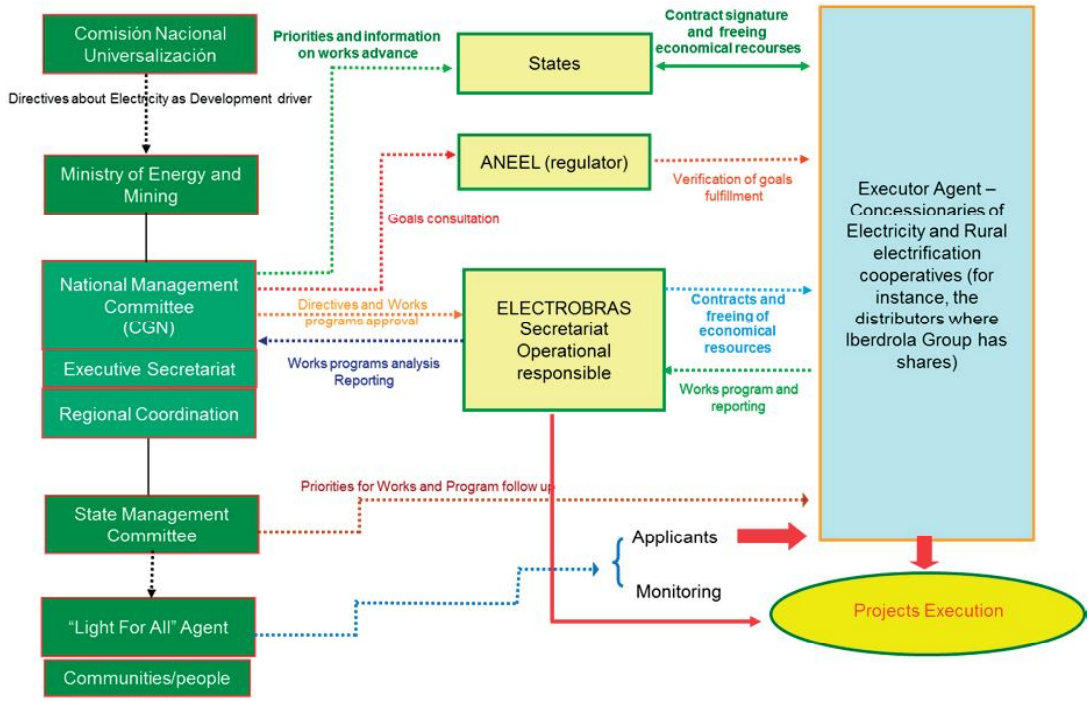

Figure 18. «Light for All» Governance Structure. Source: Own source, based on Light for All.

The programme was launched in 2003 by virtue of Decree 4873, dated 11th November, under the coordination of the Ministry of Mines and Energy in association with the governments of the various states. Local governments coordinate the operation with Electrobras[101] although the distribution companies are the ones responsible for implementing the different projects (including, for example, the distributor for the State of Bahia (Coelba[102]), belonging to the Neoenergia group, in which Iberdrola has a 39% share; this is one of the distributors that has made more new connections throughout the years in which the Plan has been applied). These companies are trying to cope with the needs detected by the representatives elected in the numerous communities where the electrification plans are going to be developed. The representatives (a new stakeholder that has appeared at the Bottom of the Pyramid, called "Light for All Agent") will also be in charge of carrying out the major task of providing information and education about the project by making the whole community aware of the progress involved in an initiative of this nature. This is how it has been possible to support and coordinate an initiative in which all the stakeholders involved know exactly what their tasks should be at every stage of the programme, both on a specific

101 http://www.eletrobras.com/elb/data/Pages/LUMIS293E16C4PTBRIE.htm.
102 http://www.coelba.com.br/Pages/Default.aspx.

project level and at a general level, invariably bearing in mind the need to reach the established goals.

With regard to financing, public funds from the Energy Development Account (CDE) and the Global Reversion Reserve (RGR) were originally allocated to develop this initiative, the rest of the investment being split between the state governments and the electrical power public services. It was later decided that the financing should only come from the Energy Development Account, bearing 75% of the cost, with the Global Reversion Reserve bearing the remaining 25%. States and municipalities were thus exempt from the requirement to participate in the financing. The distributors, apart from helping to select the projects and optimising the allocation of the limited resources, provide financing, as they defer the recovery of the costs incurred by including these costs in their asset base to be recouped in subsequent years, making it possible to mitigate the short-term cost to the State and to the consumer. The subsidies given by public funds enable the distributors to recoup the total cost of the projects, and adapt to the payment capacity of the clients in rural zones.

Some results of the programme: new opportunities at all levels

The Programme results have brought about a major change in the opportunities open to the people living in the communities catered for. The Programme has made an investment of over 20,000 million dollars, directly or indirectly creating approximately 460,000 new jobs. An attempt has been made to maximise the impact on Brazilian society by giving priority to the contracting of local labour and the purchasing of materials and equipment in the country.

According to the latest data published,[103] the programme has catered for the needs of over 3 million families in rural Brazil, thereby enabling more than 15 million people to feel the benefits of having electricity in their households. The results of the major effort made through this Programme - especially in the north of the country, where more than two thirds of the beneficiaries live -, can be seen by comparing the next figure with the previous one (comparison between the access to electricity data for 2000 and 2010).[104]

It is very complicated to calculate the actual extension of the Programme, in terms of improvement in the families' average income and improvement in the Human Development Index, but «Light for All» has undoubtedly had a very positive effect on these variables, clearly improving the welfare of the rural communities in Brazil. All of this is borne out by the great progress shown by both indicators in 2010, when compared to the indicators obtained in 2000 (Figure 17), as can be seen in figure 19. Studies and surveys have been conducted in this

[103] Ministério de Minas e Energia (Governo do Brasil), 2014.

[104] According to Light for All, Nº42, March 2014, over 10.5 million people benefited in the north of the country.

regard in an attempt to quantify the achievements obtained by the Programme.[105] According to the studies, 92.9% of those who have received the benefit from the Programme have experienced an improvement in their standards of living, while 81.8% of those people plan to invest in improving their homes as a result of the implementation of the Programme. Regarding employment opportunities, the studies have established that 40.5% of the beneficiaries now have a better prospect of finding a job.

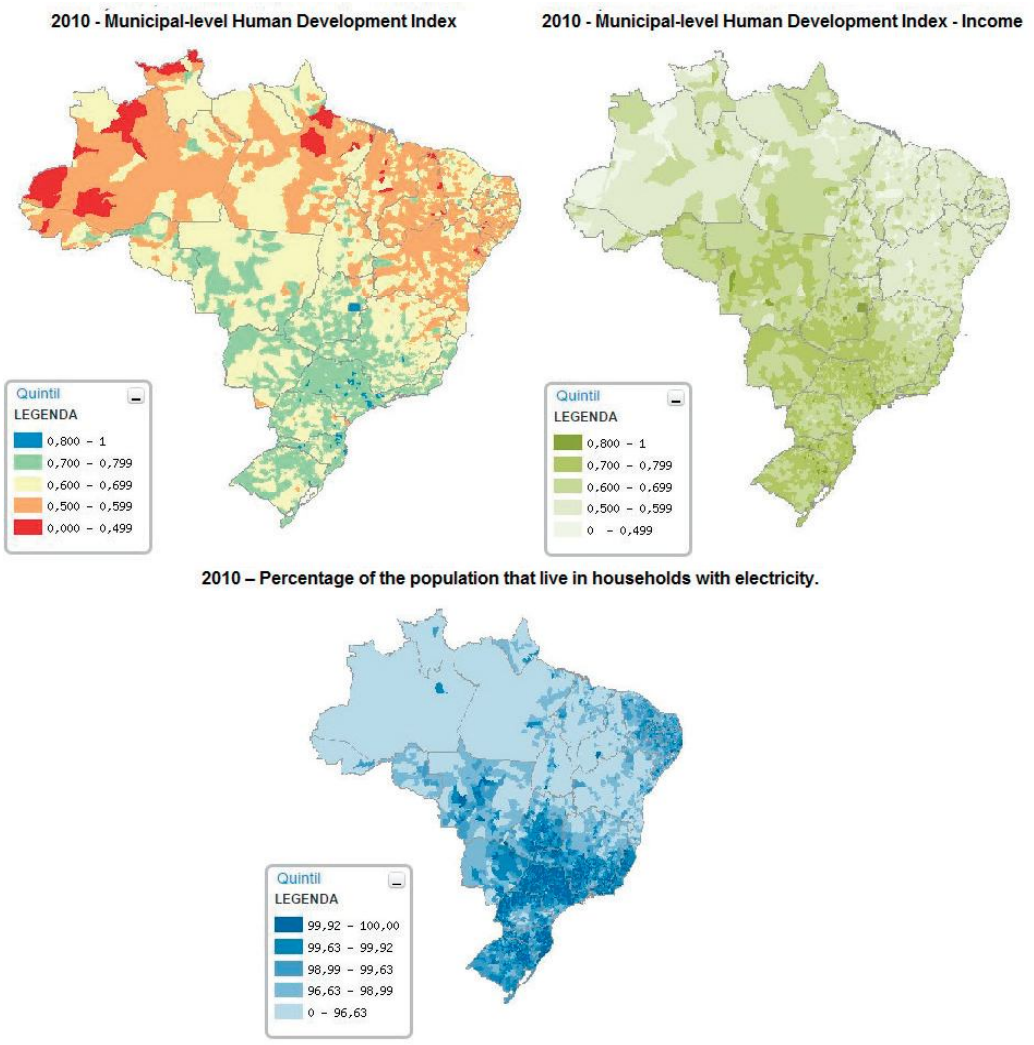

Figure 19. National Electricity Exclusion Map, Brazil 2010. (Three maps). Source: Human Development Maps by Municipalities.

These types of measures have enabled the population to purchase electrical appliances, not only for their own domestic convenience, but also to develop new businesses. The sale of such appliances has also made it possible to devel-

105 Ministério de Minas e Energia (Governo do Brasil), 2013.

op an industry to cater for the growing demand, which has, in turn, created employment and wealth in the zone.

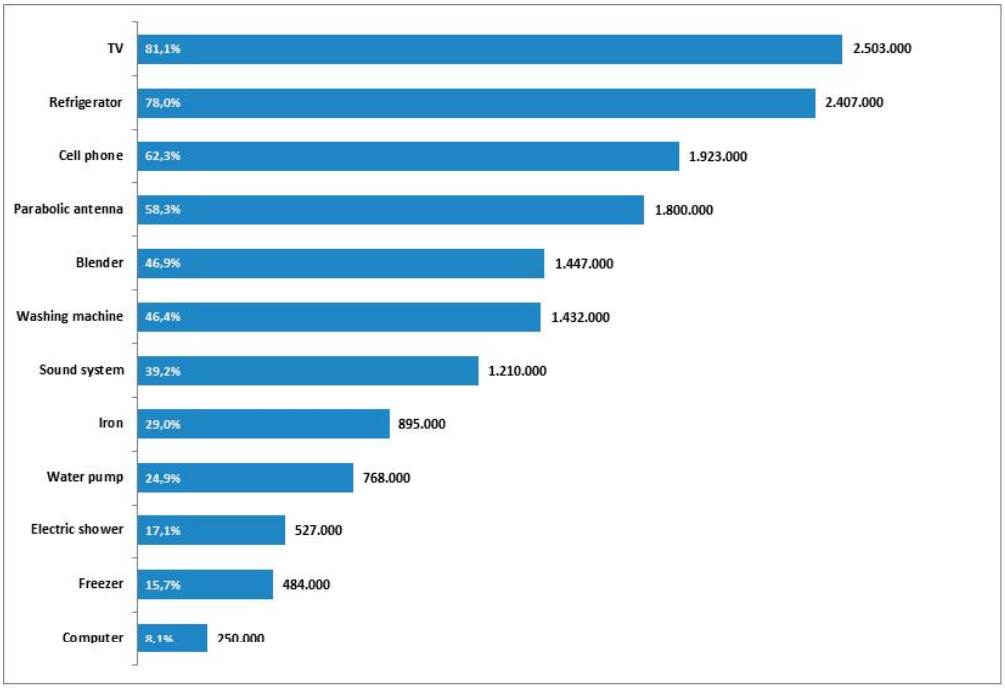

Figure 20. Volume and percentage of households benefited by the «Light for All» Programme that have purchased electrical appliances. Source: Own source, based on Ministério de Minas e Energia (Governo do Brasil), 2013.

The Programme has meant, in general terms, a greater access to electricity for the "Bottom of the Pyramid", permitting many potential clients who previously had no access, not only to have electricity, but also to benefit from the public aid granted to make the cost of their electricity bill cheaper. As a result, they no longer suffer from the double discrimination of not having access to electricity and not having access to subsidies.

Furthermore, these actions generate benefits for the collaborating companies. The following are some of the most outstanding potential benefits:

- They make it possible to increase the client base by exploring the potential for performing businesses at the Bottom of the Pyramid.
- They help to improve public-private collaboration with local and regional governments and to improve the perception that civil society has of the actions and, by extension, the perception of the collaborating companies.
- They make it possible to incubate technological innovation projects, some of which are of the reverse innovation kind[106], in the development of renewable

[106] See Point 2.10. Reverse innovation and utility of the future: other benefits provided by universal access to electricity supply.

energies and smart grids or the implementation of energy efficiency measures. These developments will make it possible not only to improve the way projects can adapt their technology to the specific conditions in each one of the zones where they are implemented, but also to enable progress to be made in the developed countries.

- In the field of human resources, they make it possible to strengthen the commitment of employees not only to the companies that participate in the Programme, but also to the projects that the latter develops, thanks to internal communication and to corporate volunteering programmes.

Global Sustainable Electricity Partnership (GSEP)

GSEP[107] is a non-profit- organisation, formed by some of the main electrical companies in the world, whose main aim is to promote a sustainable development in the energy field.

GSEP's goals include developing common policies, carrying out both domestic and international initiatives, participating in world debates on matters concerning electricity in order to make decisions, by previous consensus, and provide information and experience in the generation and efficient use of electricity, helping developing countries to strengthen their capacities.

So far, the Global Sustainable Electricity Partnership has put initiatives into operation in such countries as Nicaragua, Ecuador, Uruguay, Argentina, Jordan, Benin, Burkina Faso, Nigeria, Maldives, Bhutan, Nepal and the Philippines.

Image 5.

[107] http://www.globalelectricity.org/en/index.jsp?p=121.

Some of the projects promoted by GSEP are summarized below:

- A biogas micro-generation system in San Jose, Uruguay.
- A hybrid wind-diesel plant in Patagonia, Argentina.
- Distributing 50,000 solar lanterns in several Latin America countries as part of the SE4ALL Project.
- A project using wind energy to desalinate water in Tunisia.
- A programme with GESCO (Jordan's Central Electricity Generating Company) to increase efficiency at their thermal electrical generation power plants.
- Developing three isolated electrical systems in rural areas of Indonesia (one solar photovoltaic system, another one with diesel-solar hybrid plants and the third one based on a mini-hydraulic system).
- One project of particular interest is the one carried out in West Nepal,[108] to supply two schools with electrification by means of solar photovoltaic solutions, facilitating schooling to a large group of students, including adults. We recommend watching the video. The project also involves installing small household supply systems (SHS) as well as giving solar lanterns to the students so they can do their homework at night without having to resort to kerosene lanterns. A local NGO is involved in the project and an Operating Committee has been set up to run the solar system. A pricing system has also been implemented to make the project sustainable in time. The small tariff that the students pay is based on the students' families' payment capacity, assessed on the basis of how much they paid before when using kerosene lanterns.

Energía sin Fronteras Projects (EsF)

Energía sin Fronteras[109] is an NGO established in 2003 with the specific goal of enabling isolated rural zones in developing countries to access electricity and water. It is formed by a Board of Trustees comprising 17 Spanish energy companies. It enlists approximately 200 volunteers and two contracted employees.

Energía sin Fronteras develops, in collaboration with local counterparts, electrification facility projects, and drinking water supply and treatment projects, including training in both areas. It works mainly with community centres (health, training, communication and production) in isolated rural areas where there are no plans to install grids.

Their geographical spheres of activity are mainly Sub-Saharan Africa, Central America and the Andes Region.

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108 See http://www.globalelectricity.org/en/index.jsp?p=121&f=37.

109 See http://energiasinfronteras.org/es/quienes-somos.

Some examples are referred to hereunder of the numerous projects carried out by *Energía sin Fronteras*. The projects have been especially selected to illustrate the different approaches for projects at the Bottom of the Pyramid.

Regulation of Electrification in Isolated Rural Zones Project (REGEZRA)

The REGEZRA Project[110] was launched in 2008 with a view to analysing and making proposals to provide electricity to isolated rural zones (ZRA) in Guatemala.

Several Spanish and Guatemalan institutions participated in the project.

During the first stage, the basic principles of the project were defined, and they were discussed and accepted by the Guatemalan Administration. A "Basic Regulation Proposal" was then prepared containing all aspects of electrification in isolated rural zones. The deficiencies that had hitherto prevented electrification in those isolated rural zones were pinpointed and the regulatory actions required to overcome these were suggested, leaving it to the Guatemalan Administration to incorporate them into the national legislation. Furthermore, the persons responsible for the various activities were appointed, in order to enable them to put the whole process into practice, guidelines being proposed so that the process could be carried out smoothly.

The final proposal was submitted to the Guatemalan Administration in September 2009.

Isolated Communities Electrification Model Project (MECA)

The MECA Project consists of providing households with electricity in isolated rural communities in the Municipality of Coban (Region V, Alta Verapaz) in Guatemala.

The long-term objective of the project is to electrify the 42 communities in the aforementioned Region V.

The aim of this project is to help to improve the standard of living by supplying electricity in a sustainable way to the households in the communities in the Municipality of Coban, using solar photovoltaic panels (SHS), and to set up a cooperative to manage the scheme, which will be the owner of the facilities and responsible for providing the service, guaranteeing its sustainability.

The cooperative is composed of the beneficiaries or users themselves, and receives the backing of the local authorities in those communities, so the inhabitants are encouraged to play an active role through learning about energy matters and becoming skilled in this field.

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[110] See http://energiasinfronteras.org/es/estudios/nuestros-estudios/164-proyecto-regezra-modelo-de-regulacion-para-la-electrificacion-de-las-zonas-rurales-aisladas-de-guatemala-informe-final2009.

The project is being undertaken with the collaboration of a local partner.

- The project will be carried out in several phases. At the first phase, 380 solar photovoltaic household facilities were installed in isolated rural zones in 11 communities in the Municipality of Coban (Alta Verapaz).
- The cooperative that is going to run the service has been formally constituted, and is the first of its kind in Guatemala. A technical management model has been optimised, training local technicians and using companies in the zone to carry out maintenance work on the facilities.
- The weakest point where the long-term sustainability aspect is concerned is the major differences in the payment capacities of the Community members. Not all of them can make payments of 10 $/month.
- EsF will continue to give its support to the cooperative for the first few years, until it is firmly established, but if long-term sustainability is to be guaranteed, it will be necessary the social tariff to be applied to this type of facilities.

Street Lighting in Benin

This project involved erecting 120 autonomous solar photovoltaic street lanterns for public lighting in 15 communities in the Districts of Fö-Boure and Sikki (Benin) with a capacity to operate self-sufficiently for 6 hours as from nightfall.

The project was carried out between April 2009 and April 2010.

The street lanterns were purchased in Spain because there were no suppliers in Benin. The communities laid the foundations to enable the street lanterns to be erected. There is a local representative in every community who appoints a person responsible for each location, who receives the training needed to operate and maintain the lighting.

Energía sin Fronteras trained two local Benin´s technicians in solar photovoltaic energy, in order to guarantee the long-term sustainability if the facilities. They took part in the installing process and will supervise the maintenance work on the street lanterns throughout their working life.

As in most cases, the project was carried out jointly with a local counterpart, in this case the *Asociación Mensajeros de la Paz*.

Not less than 21,222 people are direct beneficiaries.

Electricity supply and communication by radio for 44 medical outposts in the Upper Amazon Basin (Peru)

The project involves electrifying and inter-communicating the health assistance outposts in 44 communities in a territory comprising several rivers close to the City of Yurimaguas, in the Province of Alto Amazonas in Peru.

Forty-four solar panel facilities with batteries were installed to guarantee the electrical supply to the medical outposts and to enable the radiotelephone systems between centres to operate. Long-term supply of spare parts and technical assistance were ensured, as was the disposal of waste and batteries.

An instruction programme was carried out involving 91 inhabitants, of whom one third were women, so that the operating and basic maintenance tasks could be carried out by local personnel.

The project beneficiaries are 44 communities with 8,200 people, 50% of whom are women.

As in most cases, the project is being undertaken with the collaboration of a local partner, which in this case is the *Asociación Seglar Misioneros de Jesús* (ASMJ).

Taba Project: water supply to communities in the Taba Region (Senegal)

The aim of this project is to provide a plentiful supply of good quality water to the inhabitants and livestock in the proximity of 18 urban settlements in the Taba Region of the Senegalese savannah.

- It is a major project that was split into three phases:
- The first phase consisted of drilling and lining the boreholes, and conducting the pumping tests, for which the NGO *Geólogos del Mundo* was responsible.
- The second phase involved equipping the facilities with a submersible vertical pump, a power unit, constructing a hut for the electrical and hydraulic connections, erecting the water storage system, installing two multi-tap drinking facilities for the people and a drinking trough pond for the livestock.
- The third phase of the project will involve laying the 16 km-long water distribution network, including construction of 18 drinking fountains, 2 drinking troughs and 60 latrines in 18 towns/villages.

Electricity for All Programme

Iberdrola launched the "Electricity for All" Programme in January 2014, intended to bring together all the scattered initiatives to which the company was already committed in the field of Universal Service, enhancing them and broadening the company's range of activities to promote access to electricity in emerging and developing countries, thereby uniting all these activities under one umbrella. The Programme has different lines of action including:

- Going ahead with and improving the collaboration activities with the Governments that are already being carried out in the countries where the company operates (for example, "Light for All" in Brazil);
- Financing projects by investing in capital, trying to ascertain the feasibility of the businesses at the Bottom of the Pyramid, to make them sustainable

in time. This is done by investing directly in projects, endeavouring to include them in the United Nations initiative SE4ALL, or in projects with other utilities;

- Continuing to develop projects of an essentially social nature, with support from NGOs and company´s volunteers. The following projects are examples of this course of action:

  1. Collaborating with the NGO *Energía sin Fronteras* (EsF) to install a solar field in an eco-village in Nyumbani, Kenya[111] inhabited by over 4,000 orphans, whose parents died due to HIV, and several hundred grandparents who look after the children. The project is a settlement in which every house has a small kitchen garden and a mini-farm with domestic animals.
  2. Collaborating with EsF for studying a model for rural electrification in remote zones using microgrids, in Brazil.
  3. A multi-stakeholder partnership has been set up under the auspices of the Spanish Agency for International Development & Cooperation (AECID) and the UNHCR to improve the situation in the refugee camps in Ethiopia. Iberdrola's participation is focused on energy auditing to solve the problem of electrification, based on the support of company´s volunteers and providing the *in situ* personnel with the required training.
  4. One pilot project (carried out jointly with the MIT, *Energía sin Fronteras* and the Technological Research Institute (IIT) of *Universidad de Comillas* in Madrid) to electrify a small village in Rwanda via the school as reference centre.
  5. A training plan project for young people at risk of social exclusion in Madrid, organised by company´s volunteers in collaboration with the *Fundación Tomillo*, with a view to creating new employment markets associated with energy efficiency, mainly aimed at homes in districts where underprivileged families live.

By way of a cross-cutting activity, the *Professorship* for the *Universalisation* of Basic Energy Services has been created with the Technology Innovation Centre for Human Development at *Universidad Politécnica de Madrid* (ITD-UPM). It is mainly devoted to training activities, pinpointing and giving publicity to potential R&D&I actions leading to innovative projects in the field of universal energy services.

[111] See http://energiasinfronteras.org/es/proyectos/nuestros-proyectos/en-ejecucion/413-kenia-electrificacion-integral-de-cinco-centros-comunitarios-en-la-ecoaldea-de-nyumbani-village.

Light at Home (Peru)

Acciona Microenergía, Peru[112] is a non-profit organisation set up in January 2009, whose purpose is to promote social development in rural areas by providing them with access to basic services.

Its business model is the same as a social enterprise's. Consumers benefit from a basic electrical service and pay an affordable periodical fee for it based on their economic situation. The company uses the fees to cover its operating, maintenance and equipment replacement expenses, thereby guaranteeing the project sustainability.

In August 2009, the Light at Home initiative was launched in order to demonstrate the feasibility of isolated rural electrification with renewable energies, as a proposition that was both economically sustainable for the service provider and affordable for the users in poverty. To prove this, it was decided to provide with an electricity supply 3,500[113] families scattered in rural areas in the Cajamarca Region, 3,000 metres above sea level. Two outstanding aspects of the initiative are as follows:

The example is an interesting experience in liaising with the Public Administration, using local organisations to liaise and to involve the entire community concerned by setting up Solar Photovoltaic Electrification Committees (which prepare a work plan jointly with the users, provide consumers directly with technical assistance and financial advice and offer any interested consumers with certified training on the system operation).

The pricing system is just as original, as it combines payment capacity with subsidy use. By 2013, the initiative had established itself as economically sustainable in the time.

Power Africa

This initiative,[114] launched in 2013 by President Obama, seeks to double access to electricity in Sub-Saharan Africa, to the benefit of countries like Ethiopia, Ghana; Kenya, Liberia, Nigeria or Tanzania. These countries have embarked on ambitious electricity generation projects at the same time as they have implemented electricity sector reforms, all conducive to investment and growth.

Power Africa offers a wide range of tools for supporting the energy sector in Africa:

- Encouraging the best policies and practices;
- Supporting feasibility and encouraging the creation of capacity;

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112 See http://www.acciona.es/sostenibilidad/sociedad/fundacion-acciona-microenergia/.

113 At present, 4,000 families are being supplied (about 16.000 people).

114 For further information see http://www.usaid.gov/powerafrica.

- Long-term financing, insurance, guarantees, improvements in credit terms;
- Technical assistance,

The USA has promised more than 7,000 million Euros in financial aid over the next 5 years. This programme also encourages private initiative to participate in the investment. At present, private investment commitments amounting to 9,000 million Euros have been made to develop 8,000 MW of new electricity generation in Sub-Saharan Africa.

This initiative is being developed with an approach that focuses on achieving an energy transition that generates incentives for Governments that accept these projects, the private sector and donators, all of which encourages a systematic reform of the energy sector for those countries with results that can be perceived in the short term.

Lights for Learning

«Luces para Aprender»[115] is an interesting Universal Access to Electricity project oriented to *education.*

> *"Lights for Learning arose within the framework of Education Goals 2021 and aims to tackle challenges still unsolved in Latin America, such as access to quality public education that offers better opportunities to children and enables them to overcome poverty and inequality. The Organisation of Ibero-American States (OEI), aware of this situation and taking into account the fact that education quality is one of the most important factors in achieving a social balance for citizens, proposed a project that will improve education for all children that have no access to a decent education for lack of resources. «Lights for Learning» aims to reduce the digital gap and put an end to the isolation of rural communities, which historically have lagged behind where technological breakthroughs are concerned, in order to help with their educational, economic, social and cultural development. It also opens up to the possibility of community participation, by making schools a meeting point and a leisure centre for the community"[116].*

Conclusions

1. In a globalised world, the problems caused by poverty go beyond the nations and groups that suffer from it.
2. Enabling the millions of people who lack electricity to access it is a vital tool in the fight against poverty, because it makes it possible to simultaneously tackle several problems that affect this group (health, education, economic development, development of women, etc.) and

[115] See http://lucesparaaprender.org/web/.
[116] Information from «Luces para Aprender».

stem the tide with respect to certain negative effects where the security of nations is concerned (leaving rural zones, mass migration, epidemics, etc.).

3. Although social action and philanthropy ought to carry on playing a major role in providing electricity to those who do not have it, the goal of Universal Access to Electricity Supply requires a scalability of solutions to be able to reach more than 1,300 million people. Therefore, profitable projects must be planned that attract companies (already existing or newly formed) at the Bottom of the Pyramid.

4. The profitability of the Bottom of the Pyramid projects must take into account the payment capacity of the citizens who are to receive the electricity, the potential subsidies established by Governments for underprivileged people in already electrified zones, improvements to economic activity brought about by the arrival of electricity and the advantages brought by the innovations achieved in these type of projects, so that they can be applied to other areas or regions.

5. Positive elements are inherent to the technical solutions included in the Universal Access to Electricity projects, including: energy efficiency, demand management, the use of renewable energies, etc.

6. Successful solutions are based on the collaboration of multi-stakeholders (Multilateral Institutions, NGOs, Governments, Development Agencies, State-owned and private companies, social enterprises, Universities, etc.). It is of paramount importance that the beneficiary communities are involved at all the stages of the *Universalisation* project that affect them.

7. Governance in such a multi-stakeholder solution must clearly define every party's rights and obligations, establishing a legal and economic framework that provides legal guarantees to all involved. Such frameworks have to adapt to the specific characteristics of the zones subject to *Universalisation*, making a legal distinction, where necessary, between those clients and the clients in the zones that are already electrified (for example, with respect to pricing systems, quality regulations, rights and obligations, use of subsidies, etc.). It is of upmost interest to include these Projects within the framework of so called Private Public Partnerships for Development.

8. Special attention should be paid to ensuring that the projects are sustainable at the operating stage. Therefore, it is important to involve the beneficiary communities at this stage in order to ensure that the projects do not fail a few years after the investments have been made.

9. There have already been many successful initiatives, and these will be given a considerable boost by major programmes such as SE4ALL, Light for All, etc. which will be all the greater by the inclusion of a

specific *Universalisation* objective in the future Sustainable Development Goals that will replace the Millennium Goals, and that will make it possible to bring to fruition the synergies and scalability required to successfully confront such a challenge.

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Chapter IV

Russia and the european energy security

Francisco José Ruiz González

Abstract

The Russian Federation is an energy superpower, and the export of its hydrocarbon reserves and other raw materials constitutes the backbone of its economy. Moreover, due to its geographical proximity and political stability, Russia is a key oil and gas supplier to the European Union, which depends to a large extent on resources from beyond its boundaries. This situation should normally foster a mutually beneficial strategic partnership; however the bilateral relation has never been free of tensions and the approval by Brussels of several legislative packages against Moscow's interests made the cooperation more difficult, which is something that the current Ukrainian crisis has only aggravated.

Keywords

Russia, gas, oil, Gazprom, European Union, Ukraine, China.

Introduction

The Russian Federation is a nuclear power in an exceptional geostrategic position with outstanding human and intellectual resources, plus vast reserves of hydrocarbons and all types of raw materials, the exploitation of which constitutes the backbone of the country's economy.

Furthermore, its geographical proximity and political stability make Russia a key supplier of oil and gas to the European Union (EU), which depends to a large extent on resources coming from beyond its boundaries, a situation that should normally serve to bring about a strategic and mutually beneficial relationship.

In spite of this, the bilateral relationship has never been tension free, especially since the EU enlargement in 2004. The fact that Brussels adopted successive legislative packages that went against Moscow's interests complicated the cooperation, something that the current Ukrainian crisis has merely served to accentuate.

This Chapter is organized in three parts: it first studies the energy sector in Russia, together with its geopolitical value to the Kremlin; the way its relations with the EU have evolved in this area are then discussed; and finally, an account is given of Russia's reorientation towards the Asian market, as an alternative to the European market.

The russian energy sector and its strategic importance

According to the figures presented by BP in its latest "Statistical Review of World Energy",[1] the Federation of Russia's proven oil reserves amounted to 93,000 million barrels,[2] which is equivalent to 5.5% of the world's total reserves. In 2013, the country produced 10,788 million barrels per day,[3] equivalent to 12.9% of the world total, a rate at which the aforementioned reserves will run out in 23.6 years.

In 2013, domestic consumption reached 3.313 million barrels per day (which thus meant a production surplus of 7.465 million barrels), and its oil refining capacity came to 6.027 million barrels per day. A total of 9.048 million barrels per day are exported from the post-Soviet space (66% of those to Europe), of which 6.027 million are exported as crude oil and the rest 3.021 million in refined form.

As far as natural gas is concerned, Russia has a much more predominant position, because it has proven reserves of 31.300 bcm,[4] equivalent to 16.8% of the

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1 *BP Statistical Review of World Energy*, June 2014, available at http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html. [Query: 17th November 2014].

2 Eighth in the world, after Venezuela, Saudi Arabia, Canada, Iran, Iraq, Kuwait and the UAE.

3 Second producer in the world, behind Saudi Arabia and just above the United States.

4 *Billion cubic meters*, thousands of millions of m3, the standard measurement for natural gas.

world total[5]. In 2013, Russia produced 604.8 bcm, which amounts to 17.9% of the world total,[6] so if production continues at the same rate, the aforementioned reserves would run out in 51.7 years.

In 2013, domestic consumption of natural gas reached 413.5 bcm (which thus meant a production surplus of 191.3 bcm). Russia piped 211.3 bcm abroad (136.2 of which went to Europe) and imported 27.8 bcm from other ex-Soviet Republics[7] (mostly with a view to mixing it and reselling it at a higher price). The country exported 14.2 bcm to the Asian market[8] in the form of Liquid Natural Gas (LNG).

As a whole, primary energy consumption in Russia reached 699 Mtoe,[9] broken down into the following by sources:

Source	*Mtoe*	*Percentage*
1. Natural gas	372.1	53.3%
2. Oil	153.1	21.9%
3. Coal	93.5	13.4%
4. Hydroelectric	41	5.8%
5. Nuclear	39.1	5.6%
6. Renewable	0.1	0.01%

Table 1: Primary energy consumption in Russia. Own Sources, elaborated with data from BP.

This energy wealth is of great strategic value for Russia, but on the negative side, the country's economy is far too dependent on those resources. In 2012, the exploitation of oil, gas and minerals made a 16.2% contribution to the Gross Domestic Product (GDP); in 2013, hydrocarbon exports amounted to 67% of the total exports (54% oil and 13% gas),[10] and the profit from that trade accounted

5 Second highest gas reserves in the world, after Iran.

6 Second highest world producer of gas, after the United States.

7 Of which 11.5 bcm are from Kazakhstan, 9.9 from Turkmenistan, and the rest from other countries.

8 To be specific, 11.6 bcm to Japan, 2.5 to South Korea and 0.1 to Taiwan.

9 Million Tonnes of Oil Equivalent.

10 These exports are subject to duties, what provides the State with further profit. In the case of oil, the duty in 2012 was approximately 420 dollars per tonne. *The Russian Federation Energy Sector*, Economic and Trade Office of the Spanish Embassy in Moscow, November 2012, Page 38, available at http://directorio.mcmi.com.es/adjuntos/20131161740210_sectorenergetico.pdf [Query: 3rd December 2014].

for 30% of the country's tax revenue, without which the official budget deficit of 0.5% would reach no less than 10%.[11]

To a certain extent, the Federation can be considered a victim of the so-called *resource curse,*[12] which is verified when an economy receives large profits from abroad (for example, for the sale of oil), without needing to make major capital investments (because during periods when the price of oil is high on a world-wide scale, these by far exceed the production costs).

The negative macroeconomic impact starts to be felt when the exports lead to a flow of petrodollars, which brings about an increase in the exchange rate that, in turn, causes a reduction in the competitiveness of the country's economic sectors that are not associated with energy. Furthermore, the energy industry can only provide employment for a limited number of people, and does not enhance modernisation or innovation where the national economy is concerned.

By way of a summary, an abundance of natural resources increases the likelihood of economic inefficiency, income inequality, an increase in poverty, low levels of democracy and high levels of corruption. However, everything would appear to indicate that these negative effects require a prior institutional weakness, as confirmed by the good way that Norway for example has managed its resources.

In the Russian Federation's case, after the unexpected and rapid collapse of the Soviet Union, and the humiliation experienced during the presidency of Boris Yeltsin in the so-called *Russian chaos* of the 90s, President Vladimir Putin came to power with the declared intention of restoring Russia to its lost status as a major power, and pinpointed the country's energy resources as a key tool for achieving this.

According to the World Bank's Report mentioned below,[13] after hitting rock bottom in 1998 the Russian Federation's economy grew during the decade thanks to the increase in the price of natural resources: the GDP rose by 95%, the *per capita* income doubled in real terms and the percentage of the population living on 5 dollars or less per day fell from 35% in 2001 to 10% in 2010.

With a view to introducing new standards for the energy sector that would contribute to the socioeconomic development of the country, in 2010 the Kremlin

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11 *Russia Economic Report nº 32*, The World Bank in The Russian Federation, September 2014, Page 38, available at http://www.worldbank.org/en/country/russia/publication/russian-economic-report-32. [Query: 9th November 2014].

12 Concept formulated by AUTY, Richard M., "Industrial policy reform in six newly industrializing countries: the resource curse Thesis", *World Development*, Vol. 22, nº 1, January 1994, pp. 11-26.

13 *Russia Economic Report*..., op. cit., p. 38.

gave its approval to the "Energy Strategy of Russia for the period up to 2030", where the following objectives[14] are listed:

- Modernising and establishing new infrastructures, especially in the regions of Siberia and the Far East of the Federation;
- Improving production efficiency and the way energy resources are processed in order to suitably cater for both domestic and foreign demand;
- Geographical diversification for both the product and exports. Less dependence on the European market in favour of Asian-Pacific countries;
- Reducing the role that the oil and gas industry plays in exports and its contribution to the GDP, from 30% to 18% before 2030;
- Reducing the country's energy intensity to the same level as countries with similar climates, such as Canada or the Scandinavian countries;
- Improving energy efficiency, encouraging renewable energies;
- Greater support for the small and medium-sized companies in the sector, reducing the monopoly by the major companies.
- Establishing an institutional environment suitable for the correct development of the energy sector.

These are clear objectives, established on the basis of a realistic diagnosis of the energy sector in Russia, but perhaps targets that are too ambitious to be fully achieved, as will be seen below for oil and gas.

The Russian oil sector

Russia is not a member of the Organization of the Petroleum Exporting Countries (OPEC), so it has no responsibilities in setting the prices of oil, but it does benefit from the Group's decisions when the prices are kept artificially high, enabling the country to exploit its resources in a more profitable way.

After the Soviet Union ceased to exist, the former horizontal organisation structure, in which the various Ministries were responsible for prospection, production, transporting, refining and distribution of oil, became a conglomerate of companies organised vertically, falling into the hands of a few oligarchies at a bargain price. At first, President Putin did not question those privatizations, but he required the oligarchies to do two things: stay out of politics and invest more in the country's development.[15]

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[14] *Energy Strategy of Russia for the period up to 2030*, Ministry of Energy of the Russian Federation, Moscow, 2010, available at http://www.energystrategy.ru/projects/docs/ES-2030_(Eng).pdf. [Query: 3 December 2014].

[15] These ideas are brought together in two reports issued in 2003 by the "National Strategy Council" entitled "State and Oligarchy" and "New Power Vertical", in which an account is given of the oligarchies' intention to instigate a coup d'etat to recover the power lost since Putin arrived

The most emblematic case was Yukos,[16] a company that in 2003 was the leading Russian oil company with 14,700 million barrels in reserves, a production of 1.6 million barrels per day, and an annual profit of 4,400 million dollars. 44.5% of Yukos belonged to MENATERP, owned by Mijail Jodorkovski. The aforementioned oligarch had purchased Yukos at a bargain price (350 million dollars), in exchange for his support to Yeltsin in the 1996 Presidential Elections, defrauding the minority shareholders, because in 2003 the company's value was 25,000 million dollars.

On 22nd April 2003 Yukos and Sibneft (which produced 700,000 barrels per day) announced their merger, and the giant company that emerged awoke investment interest among the US *majors*, such as Exxon-Mobil and Chevron, which endeavoured to offer up to 11,000 million dollars for a shareholding participation of 25%. This would have enabled Jodorkovski to finance his political ambitions, challenging Putin as a candidate in the 2004 Presidential Elections.

To prevent this from happening, the Russian public prosecutor decided to investigate Yukos' activities, and even ordered Jodorkovski to be held in preventive detention on 25th October 2003 under the accusation of tax evasion. After the elections held in December that same year, which were won by "United Russia" (President Putin's party), Sibneft stopped the merger, which caused the value of shares in Yukos to fall, coupled with the pressure exerted by the Ministry of Justice to rectify the company's financial statements.

To regularise the tax situation, in July 2004 the Kremlin suggested to Yukos that it sold its most profitable subsidiary, Yuganskneftegas, for 10,400 million dollars (when independent auditors estimated that it was worth between 15,000 and 18,000 million), which amounted to a covert nationalisation and caused a chain reaction among Western investors, such as Société Générale, which demanded that Yukos returned 1,000 million dollars' worth of credit.[17]

Yuganskneftegas was eventually purchased through auction in December 2004 by an unknown group, Baikal Finance, which resold it to the state-owned Rosneft at the very low price of 3,950 million dollars. The entire operation not only showed the Kremlin's intention to regain control over the strategic energy sector and reverse the gangster-like privatisations of the Yeltsin era, but also that

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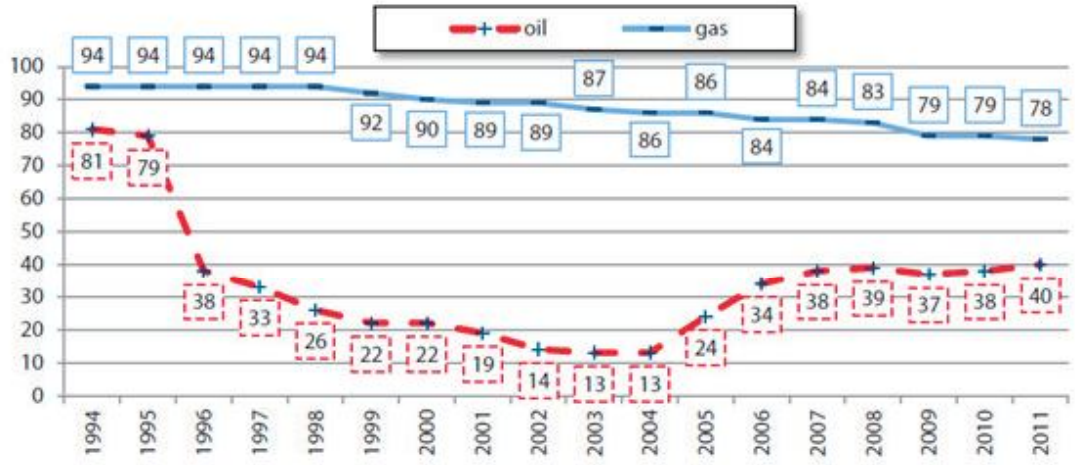
at the Kremlin. The Russian President gave his backing to the content of the reports, stating that "*Russia must not allow the businessmen to have individual influence on the country's political life in their own personal interest ... those who are not prepared to accept this standard must remember what happened to those who went down that path in the past*". SIXSMITH, Martin, *Putin's Oil: the Yukos Affair and the Struggle for Russia*, New York: The Continuum International Publishing Group, 2010, pp. 66-67.

16 For more on the Yukos saga, see FURFARI, Samuele, *The World and Energy: Geopolitical Challenges*, Vol. II, Vigo: Eixo Atlantico do Noroeste Peninsular, 2010, pp. 85-89.

17 See "Russia forces sale of top Yukos asset to cover tax bill", *The Telegraph*, (13/10/2004), available at http://www.telegraph.co.uk/finance/2897073/Russia-forces-sale-of-top-Yukos-asset-to-cover-tax-bill.html. [Query: 23rd November 2014].

it was prepared to do so without fully abiding by the methods inherent to a state under the Rule of Law.

Graph 1 shows how the participation of Russian oil and gas production companies with a public share majority has evolved.[18] It can be observed how the major privatisation of oil production took place after the Presidential Elections in 1996, when Yeltsin practically gave away the shares to the oligarches in exchange for supporting and financing his campaign. During Putin's first term of office the minimum percentage of State participation was reached (13%), but by 2008, at the end of the second term of office, the percentage had reached 39%.



Graph 1: Percentage of state participation in the production of oil and gas.

The major Western companies were very careful when it came to investing in the Russian Federation, not only because of the political uncertainties but, above all, because the climate for investment was still considered to be unfavourable.[19] One of the most ambitious projects was when BP purchased a 50% share in the Russian company TNK, a 6,000 million dollar investment that received the blessing of both the Governments of Russia and the United Kingdom.[20]

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[18] Source: HEINRICH, Andreas & PLEINES, Heiko, "The political challenges of an oil boom: the resource curse and political stability in Russia", *Russian Analytical Digest*, nº 113, 15th May 2012, p. 7, available at http://www.css.ethz.ch/publications/DetailansichtPubDB_EN?rec_id=2083. [Query: 23rd November 2014].

[19] *"The Russian authorities aimed to increase the profits from oil and gas by undermining the rights of foreign companies, normally by accusing them of violating environmental standards, the terms of the contracts or taxation standards. However, once the contracts were modified in their favour, the charges were systematically dropped"*. Idem, p. 4.

[20] The growth of TNK in Russia and the initial vicissitudes of its *joint venture* with BP are studied in detail in DIXON, Sara, *Organisational transformation in the Russian oil industry*, Cheltenham: Edward Elgar Publishing, 2008, pp. 86-124.

By the end of 2009, TNK-BP was producing 1.69 million barrels per day, had a refining capacity of 675,000 barrels, was the owner of 1,400 service stations and generated an annual profit of 5,000 million dollars. In spite of this positive data, there were ongoing disputes about its corporate governance and strategy for the future, with the British accusing their Russian partners of orchestrating a relentless campaign to persuade the Government to let them have control over the company.

In January 2011, a new problem arose when BP signed a strategic agreement with the State-owned company Rosneft to exploit resources in the Arctic. The agreement was denounced before the International Court of Arbitration in Stockholm, which blocked it in March of the same year, because BP was required by contract to channel all its operations in Russia via TNK-BP. That ruling brought an end to the agreement with Rosneft, which replaced BP with the U.S. company Exxon-Mobil.[21]

Finally, in March 2013 Rosneft purchased the entire company TNK-BP for 55,000 million dollars. With this operation, BP obtained 16,650 million in cash and became the second largest shareholder in Rosneft after the Russian State, with a shareholding of 19.75%. TNK-BP's Russian partners, four multimillionaire owners of the group AAR, obtained no less than 27,700 million dollars as a result of the operation.[22] Although BP's business deal turned out to be excellent, the perception is that its investments in Russia have been exposed to political decisions conditioned by the interests of the local magnates, instead of free market rules.

As far as the export routes are concerned, the oil-pipeline network belongs to the State-owned company Transneft, with three main infrastructures conveying oil to the West: one pipeline to the Russian terminals in the Baltic Sea, another to the Black Sea terminals and the Oil-pipeline "Friendship", which runs from the Volga Region as far as to Belarus, where it splits into the Northern Branch, to Latvia, Poland and Germany, and the Southern Branch, via Ukraine, Slovakia and the Czech Republic, with 8,900 Km of piping and a transport capacity of 1.4 million barrels per day.

One of Transneft's main projects in the zone is BPS-2, which came to prominence when in January 2007 Belarus began to demand compensation for the transit of Russian oil through its territory. The aim was to divert the oil from the Northern Branch of "Friendship", sending it directly to the Ust-Luga Terminal near St. Petersburg for export by sea. The BPS-2 Project came into service in 2012, at a total cost of 3,300 million dollars.

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[21] See "Exxon Reaches Arctic Oil Deal with Russians", *The New York Times*, (30.8.2011), available at http://www.nytimes.com/2011/08/31/business/global/exxon-and-rosneft-partner-in-russian-oil-deal.html?pagewanted=all&_r=0. [Query: 23rd November 2014].

[22] See "Rosneft takes over TNK-BP in $55bn deal", *The Guardian*, (21.3.2013), available at http://www.theguardian.com/business/2013/mar/21/rosneft-takes-over-tnk-bp. [Query: 9th November 2014].

The infrastructures to Asia are not as well developed, but they will be vital for Russian exports in the future. On 31st December 2004, the Kremlin gave its approval to the construction of the ESPO oil-pipeline (*East Siberia-Pacific Ocean*), 4,800 Km long. Until 2012, the ESPO transferred around 600,000 barrels per day along its first section, which links Taishet with Skovorodino, from where some of the oil is sent by pipeline to the Chinese city of Daqing (Manchuria),[23] and the rest goes by rail to the terminal in Kozmino, for export to Japan and South Korea by sea.

The Skovorodino-Kozmino section, 2,046 Km long, came into service in December 2012.[24] Upon completion of the ESPO (at a cost of 23,000 million dollars), it is planned to increase its capacity up to one million barrels per day, to give an outlet to Asia and the Pacific for the production in the new fields in Eastern Siberia.

The Russian Gas Sector

Russia is the world leader where gas is concerned. In contrast to what is occurring in the oil sector, the company Gazprom has virtually monopolised this market, from production to transport and distribution, so any company that wishes to develop its gas deposits on the Russian market knows that it has to negotiate with that company.

Gazprom was established in 1993, transforming the services of the Russian Ministry of Gas. It currently possesses 18% of the world's gas reserves and 72% of the Russian reserves, and it produces 14% of the world's gas and 74% of Russian gas.[25] It is the owner of the 168,000 Km of the high-pressure oil-pipelines and the State has a 50.1% share in the company, but it has had major foreign investors, such as the German E.ON, which had a shareholding of 6.4%.[26]

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[23] China wanted there to be only this branch for exporting Russian oil to Asia, but Russia preferred to construct another branch as far as Vladivostok to diversify its clients. Putin have the go ahead for the Skovorodino-Daqing branch during a visit to Beijing in March 2006, but construction did not get under way until February 2009, when China granted Rosneft credit under favourable terms in exchange for guaranteeing the supply of 15 million tonnes of oil per year from 2011-2031. VV.AA, "China's energy and security relations with Russia", *SIPRI Policy Paper*, nº 29, October 2011, Page 29, available at http://books.sipri.org/files/PP/SIPRIPP29.pdf. [Query: 4th December 2014].

[24] See FISHER, Eva, "Completion of the ESPO oil pipeline connects Siberia to the Pacific Ocean", *Analyses*, Centre for Eastern Studies, 9th January 2013, available at http://www.osw.waw.pl/en/publikacje/analyses/2013-01-09/completion-espo-oil-pipeline-connects-siberia-to-pacific-ocean. [Query: 2nd December 2014].

[25] Data from the company website, See http://www.gazprom.com/about/. [Query: 2nd December 2014].

[26] This maximum was reached in 2003. Subsequently, 2.9% was given to Gazprom by E.ON, in return for part of the Yuzhno Russkoye gas field. The remaining 3.5% was sold in 2010: 2.7% to Vnesheconombank, a state bank with Russian investment, and 0.8% on the stock market. See "E.ON sells its shares in Gazprom", the company website, (2.12.2010), available at http://

In 2013, the company produced 483.39 bcm (less than the maximum of 513.17 bcm in 2011), which is a rate that it can carry on producing for 73 years, until its reserves run out. One important fact is that Gazprom has a different price structure for each region, the data for 2013 being:

- On the Russian market, 106.7 dollars for every 1,000 m^3.
- In the post-Soviet space, 224.2 dollars for every 1,000 m^3.
- For the rest of the world, 304.2 dollars for every 1,000 m^3.

Along general lines, the sale of gas within the Russian Federation itself (228 bcm in 2013) takes place at a subsidised price fixed by the State, which does not cover the cost of exploitation, and the sale price to the ex-Soviet Republics (59.4 bcm in 2013) depends on the extent to which they cooperate politically with Russia, in such a way that Gazprom makes up for this loss and obtains its profit from sale to other regions, especially the EU. Gazprom's main clients, in absolute amounts, are:

Country	*Russian gas imported in 2013*
1. Germany	41 bcm
2. Turkey	26,9 bcm
3. Ukraine	25,8 bcm
4. Italy	25.3 bcm
5. Belarus	19.8 bcm
6. United Kingdom	16.6 bcm

Table 2: Gazprom's main clients in 2013. Source: Company website.

The export of Russian gas is the subject of long-term contracts ranging from 25 to 30 years, to guarantee client supply security and a suitable income for the producer-exporter. Some European companies, especially those coming from former State monopolies, such as ENI in Italy[27] or E.ON. Ruhrgas in Germany, are not against this predominant situation, rather coinciding with the Russian

www.eonespana.com/es/sala-de-prensa/notas-de-prensa/2010/12/2/eon-vende-su-participacion-en-gazprom.html. [Query: 23rd November 2014].

[27] In November 2006, ENI and Gazprom signed an agreement to supply 26 bcm per year from Russia to Italy, at a market price indexed to the international energy basket, with a clause that allows the Russian company to sell up to 3 bcm per year directly to the Italian consumers, in the period 2010-2035. FURFARI, Samuele, op. cit., p. 107.

giant in their reluctance to admit competition and to open the European energy markets.

The Western Siberia zone is the greatest gas producer, with the vast gas fields of Urengoi (with reserves of approximately 7,000 bcm) and Yamburg (with about 4,500 bcm). Other production zones are Orenburg (close to Kazakhstan), the Barents Sea and the Yamal Peninsula with its adjacent Kara Sea.

The Shtokman field lies in the Barents Sea, about 650 Km to the north of Murmansk. It has an estimated capacity of 3,900 bcm, which would enable it to produce between 60 and 90 bcm per year for half a century. In October 2006, Gazprom decided to exploit the field alone, but eventually kept 51% of the project, opening up the shareholding to the French company Total (25%) and the Norwegian company Statoil (24%), the latter being the one that was to provide the state-of-the-art technology needed to operate in the harsh Arctic conditions.[28]

The plan was to send 50% of Shtokman production (24 bcm for 25 years at Phase I) by gas-pipeline from Murmansk to the EU, using the extension of the Nord Stream gas-pipeline in the Baltic, and the other 50% in the form of LNG by ship to the USA. However, the high cost (30,000 million dollars per Phase I), the boom in shale gas (which made it impossible to export to the USA), and the draconian contractual terms and conditions that Gazprom imposed on its partners, caused Statoil to leave in August 2012, owing to a lack of economic feasibility.

While Shtokman was waiting for better times, interest turned to the Yamal Peninsula, where the consortium Yamal LNG (60% belonging to the Russian company Novatek, 20% to Total and 20% to the Chinese company CNPC) will exploit the Tambey Field.[29] Meanwhile, in January 2013 an agreement was signed between Gazprom and Novatek to produce LNG with the Gydan Field (28 bcm per year).

The important thing is that in contrast to the Shtokman Project, the future production of LNG from the Arctic is primarily aimed at the Asian market, which in 2025 will need between 600 and 800 bcm per year (50% in the form of LNG). And this will be possible because of global warming and the gradual thawing of the so-called northern route along the Siberian Coast, which will provide a perfect

[28] Information about Shtokman is available at the Gazprom Webiste, http://www.gazprom.com/about/production/projects/deposits/shp/. [Query: 6th December 2014].

[29] The proven reserves for this field are 480 bcm, which will be extracted at a rate of 27 bcm per year. CNPC purchased 20% of the project from Novatek in September 2013, and signed the LNG supply contract with the consortium in May 2014. See "CNPC buys a stake in Novatek's Yamal LNG project in Russian Arctic", *Bloomberg*, (5.9.2013), available at http://www.bloomberg.com/news/2013-09-05/cnpc-buys-stake-in-novatek-s-yamal-lng-project-in-russian-arctic.html. [Query: 2nd December 2014]. Natural Gas-Fenosa also signed a contract in September 2013 for the supply of 3.2 bcm per year from Yamal LNG, equivalent to 10% of Spanish consumption. See the company website, http://www.novatek.ru/en/business/yamal/southtambey/.

route from a maritime-safety perspective, because it avoids the *chokepoints*[30] that exist in other regions.

In the Pacific, the Sakhalin II Field specialises in the production of natural gas, its liquefaction and, as has already been pointed out, sending it to Japan, South Korea and Taiwan in the form of LNG. The Dutch company Shell was the owner of 55% of this project, but the pressures exerted by the Russian Government led to Gazprom entering, and in 2006 the latter company had obtained half the shares plus one.

The biggest problem faced by the Russian energy sector is the lack of investments. Most of Gazprom's expenses are aimed at activities that have nothing to do with the gas business, such as the construction industry, the mass media or even financing the 2014 Winter Olympics in Sochi. Furthermore, the Russian giant is much more interested in constructing new (and megalomaniac) gas-pipelines than in increasing the yield from the fields, improving efficiency or locating and developing new reserves.[31]

Furthermore, and in view of the aforementioned need for Gazprom to increase its profit with exports, its strategy has invariably been aimed at keeping prices high, even if this has meant losing its market shares on occasions. That is why it is vital for the company to keep its *take-or-pay* clauses, which require clients to import a minimum amount even if this exceeds its requirements, as well as indexing gas prices to oil prices, instead of to spot market prices associated with the LNG market that is traded by sea.[32]

Russian Energy Policy in the post-Soviet space

The original Russian position in the post-Soviet space for the production, marketing and transit of energy resources was monopolistic, due to the centralised layout of the Soviet duct networks. Thus for example, until 2004 Ukraine maintained a fictitious direct trading tie with Turkmenistan, its main gas consumer, since in practice and given that the gas had to be conveyed through Russia, that trade depended to a large extent on Gazprom's good will.[33]

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30 A *chokepoint* is a maritime strait that can be cut off to navigation, such as Ormuz in the Persian Gulf Bab-el-Mandeb in the Red Sea, or the Straits of Gibraltar. BALLOUT, Dana, *Choke Points: Our energy access points*, Oil Change, available at http://oilchangeproject.nationalsecurityzone.org/choke-points/. [Query: 29th November 2014].

31 INOZEMTSEV, Vladislav, "The resource curse and Russia's economic crisis", *Roundtable Summary*, The Chatham House, March 2010, available at https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Russia%20and%20Eurasia/100309inozemtsev.pdf. [Query: 24th November 2014].

32 GRÄTZ, Jonas, "Russia's pipeline overstretch: market monopolisation at the expense of reliability", *Russian Analytical Digest*, nº 113, op. cit., pp. 9-10.

33 ROBERTS John, "Russia and the CIS: Energy relations in the wake of the Russia-Ukraine gas crisis", *ISS opinion*, London, February 2009, p. 1.

The 2006 and 2009 "Gas Wars" with Ukraine

Moscow's interference in Ukraine's internal politics, by supporting the political successor to President Kuchma, Viktor Yanukovych, who beat Viktor Yuschenko in 2004 in elections tainted by fraud, left the Kremlin in a difficult situation when the popular pressure of the so-called Orange Revolution forced the elections to be repeated in 2005 giving the final triumph to reformists.[34]

Until that time, Russia provided Ukraine with gas at subsidised rates, similar to those applied to its own internal market. However, towards the end of 2005 Moscow adopted a much harsher position, making it clear that not only would prices have to go up, but also that Ukraine and Turkmenistan would not be able to establish supply agreements without approval from the transit country.[35] As Kiev refused to pay the price proposed, Russia cut off the gas supply to Ukraine on 1st January 2006.

The problem was that the Ukrainian gas-pipelines not only transported the gas consumed in that country, but also 80% of all the gas that Russia exported to the EU. The Ukrainian consortium Naftogaz decided to *appropriate* the gas in transit to Europe, turning a bilateral conflict into a confrontation with the rest of Gazprom's clients. The crisis ended on 4th January, with an agreement whereby the price to pay would by 95 dollars per 1,000 m^3, a combination of the more expensive price of Russian gas and the more economic price of the gas purchased from Turkmenistan.

Until that point, Gazprom had projected an impeccable image as a gas supplier to Europe. The temporary cutting off of the supply in the first few days of 2006 caused considerable damage to this image of reliability, but although the EU renewed the debate about the need to diversify its sources of supply, the construction of the Nord Stream gas-pipeline between Russia and Germany was immediately speeded up, with the result that on its completion gas would no longer have to be transported through Ukraine, the Baltic Republics or Poland.

The prices of gas paid by Ukraine and those paid by the EU gradually converged until 2008. On that year, undoubtedly under the influence of the support provided by Yuschenko's Government to Georgia in its war with Russia, in August, and as a result of the major increase in the price of gas paid by the EU (that reached

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[34] LAZAREVIC Dusica, "NATO Enlargement to Ukraine and Georgia: old wine in new bottles?" *Connections: the quarterly journal*, Partnership for Peace Consortium of Defence Academies and Security Studies Institute, 2009, Page 50, available at https://pfpconsortium.org/journal-article/nato-enlargement-ukraine-and-georgia-old-wine-new-bottles. [Query: 26th November 2014].

[35] "*Vladimir Putin informed Kiev on 8th December 2005 that in January, Gazprom would put up the price from 80 to 180 dollars for every 1.000 m3. In spite of the fact that Russia claimed that its actions were based exclusively on market criteria, the fact that it did not put up its prices to Belarus or to Transdniester revealed the political motives underlying the decision*". DONALDSON, Robert H. & NOGEE, Joseph L., *Russia: changing systems, enduring interests*, Armonk: Sharpe, 2009, Page 175.

418.9 dollars), Russia started to pay higher prices to the Central Asians,[36] which according to Moscow justified a price rise for the Turkmenistan´s gas supplied to Kiev.

On 31st December, Naftogaz rejected Gazprom's proposal to raise the price from 179.5 to 250 dollars for every 1.000 m^3, and Gazprom ended up threatening Naftogaz with a rise of up to the 418.9 dollars that the EU was paying, if all the Ukrainian debts were not paid and a long-term contract was signed. As an agreement was not reached, on 5th January President Putin ordered the gas supply to Ukraine to be completely cut off while maintaining the supplies to the EU through this territory.[37]

As was the case in 2006, Naftogaz began to retain the shipments to the UE, and on the 6th of January the supply was eventually cut off completely. Negotiations were not resumed until the 8th of the month, while the whole of Eastern Europe literally froze without a gas supply under extremely low temperatures, until an agreement between the three groups to resume supplies was signed on the 10th January. However, as a result of discrepancies about certain further clauses that Ukraine wished to include, the situation did not return to normal until 20th January, after 13 days of total interruption.[38]

It is not possible to go into all the details of the agreement, for which Lady Timoshenko, the Ukrainian Prime Minister, was given a 7-year prison sentence in 2011, but it must be pointed out that it was a long-term contract (10 years) intended to prevent annual disputes, a price of 450 dollars per 1,000 m^3 being taken as the basis for calculation, together with a transit charge of 2.04 dollars (per 1,000 m^3 every 100 Km). The internal struggle for power in Ukraine also had an effect, because Timoshenko gave priority to dispensing ŧ the company RosUkrEnergo from the role of intermediary.[39]

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[36] On 29th December 2008 Prime Minister Putin informed President Medvedev that Russia was paying 340 dollars for every 1,000 m3 to the Central Asians, whereas in September of the same year Turkmenistan had announced that the plan was that in 2009 Russia would pay Turkmenistan 300-305 dollars, an amount that as everything appears to indicate was finally less. ROBERTS John, op. cit., p. 2.

[37] For a complete study of this crisis, See VV.AA., "2009 gas conflict and its consequences for European energy security", *The EU-Russia Centre Review,* nº 9, June 2009, pp. 30-47, available at http://www.isn.ethz.ch/Digital-Library/Articles/Detail/?ots591=0c54e3b3-1e9c-be1e-2c24-a6a8c7060233&lng=en&v33=110607&id=105727. [Query: 3rd December 2014].

[38] Both Gazprom and the intermediary RosUkrEnergo reported Ukraine and Naftogaz, respectively to the Stockholm Court of Arbitration, and Ukraine also reported RosUkrEnergo, claiming that it was owed 40 million dollars for different services. Finally, on 30th March 2010, the Court ruled that Naftogaz had to pay 200 million for breach of contract, and on 8th June 2010, it ordered Naftogaz to return 11 bcm of gas to RosUkrEnergo.

[39] RosUkrEnergo owned exactly the same shareholding as Gazprom and the Ukrainian magnate Dimitri Firtash, linked to President Yushenko. After the crisis of 2006 sit became the sole intermediary for gas between Ukraine and Russia. LOSKOT-STRACHOTA, Ágata, "The complexity of the Russian-Ukrainian energy relations", *ISS Opinion*, 23rd February 2009, Page 2, avail-

Another basic question was the structure of the gas market in Ukraine, divided into three blocks of clients: industry, electricity generation and domestic consumers. Industry accounted for 40% of the total consumption, and was the only supply profitable for the marketers (because it paid market prices), being covered 15% directly by GazpromSbyt Ukraine; a percentage that rose to 50% after the 2009 agreement. By contrast, the other two blocks of clients are not deemed profitable (due to the subsidies) Naftogaz being required to cover them.[40]

By coincidence, the signing took place when the price that the EU was paying for Russian gas was at its maximum. From that time on, and owing to the economic crisis, the Union reduced its gas demand (a result of a decrease in domestic and industrial consumption), and the prices went down. The consequence of this was that Russia almost completely stopped importing gas from Turkmenistan and Ukraine began to pay higher prices than the EU, and had to do so with the contractual obligation of importing at least 42 bcm per year.

When Yanukovich came to power after the 2010 Presidential Elections the relations between Ukraine and Russia improved. To begin with, on 21st April 2010 the "Agreement between Ukraine and the Russian Federation concerning the stationing of the Black Sea´s Russian Fleet in Ukrainian Territory" was signed, whereby the renting of the base in Sebastopol was extended until 2042, in exchange for a 30% discount in the price of gas.

After this Agreement was signed, Russia insisted on a merger between Gazprom and Naftogaz (which in reality would be a take-over, because the turnover of the Ukrainian company came to less than 7% of the Russian giant), and an offer was made to invest in the essential modernisation of the Ukrainian gas transport system, in exchange for taking over control. Moscow negotiated from a position of strength, because it had diversified its gas export routes to the EU, once the Nord Stream gas-pipeline had come into service.

However, Yanukovich was opposed to these plans, as he defended the interests of the industrial elite in the Lower Don. In fact, the imprisonment of Timoshenko, criticised not only by the West but also by Russia, was presented as proof that the 2009 Agreements were unacceptable to Ukraine and should be revised. Meanwhile, the imports were gradually reduced to below the 42 bcm established in the contract: 40 in 2011, 27 in 2012 and 24.5 in 2013.

Furthermore, Kiev wanted Gazprom to pay for keeping its gas deposits in Ukraine, which guarantee the service to the EU during peak consumption times in winter. On its part Russia insisted that all the terms and conditions of the contract had to be fulfilled, and that if Ukraine wished to benefit from a substantial price reduction it should join the Customs Union of Russia, Belarus and

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able at http://www.iss.europe.eu/fr/publications/detail-page/article/the-complexity-of-russian-ukrainian-energy-relations/. [Query: 28th November 2014].

[40] Ibídem, Page 4.

Kazakhstan, something that Yanukovich refused for he feared that this would be tantamount to a definitive renounce of the rapprochement with the EU.

In order to improve its position in the negotiation, Ukraine tried to import LNG from Qatar and reverse the flow from the EU, to the extent that the imports would be reduced to a mere 5 bcm in 2030[41]. This was the situation when the Ukraine Crisis broke out in November 2013.

Russia and the energy resources of Central Asia

As far as Central Asia is concerned, the main players in this area are Kazakhstan for oil and the aforementioned Turkmenistan for gas.[42] In 2013, Kazakhstan produced around 1.64 million barrels per day (with a consumption of just over 200,000, since 64% of its primary energy consumption is covered by coal), its proven reserves being approximately 30,000 million barrels.[43]

After independence in 1991, the only way to send Kazakh oil abroad was via the Soviet oil-pipeline running from Atyrau (Kazakhstan) to Samara (Russia). President Nazarbayev, while keeping up excellent relations with Moscow, opted for a multi-faceted foreign policy, seen for example in the varied composition of the consortiums that exploit the main oil fields, i.e. the on-shore fields (albeit close to the Caspian Sea) in Tengiz and Karachaganak.[44]

To increase its export capacity, Kazakhstan negotiated with Russia the construction of the Atyrau-Novorossiysk oil-pipeline (on the Black Sea coast), as an outlet to Europe for its Tengiz oil. In 1996 the Caspian Pipeline Consortium (CPC) was established, in which the Russian company Transneft had a 24% share and the State-owned company Kazmunaigas (KMG) held a further 21.5%.[45] In October 2001, the first shipment of crude oil was sent from Tengiz, followed in 2003 by the oil flow coming from Karachaganak.

By means of the CPC, Russia still held the key to oil exports from Kazakhstan, including the future export of the off-shore Kashagan deposits (with around 9,000

[41] The problem is that Ukraine began to use local coal as a replacement for Russian gas, reconverting the electricity power plants (thanks to Chinese credit amounting to 3,700 million dollars), with the consequent pollution problems. "Ukraine to Keep Cutting Russian Gas Import in 2013", *Eurasia Daily Monitor*, Vol. 9, nº 169, the Jamestown Foundation, 18th September 2012.

[42] See FERNÁNDEZ, Rafael, "Control over the oil and gas export routes from Kazakhstan and Turkmenistan", *Analysis by the Real Instituto Elcano*, nº 80/2010, 3rd May 2003, available at http://www.realinstitutoelcano.org/wps/portal/web/rielcano_es/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/especiales/especial+cambio+climatico/publicaciones+rie/ari+y+dt/ari80-2010. [Query: 28th November 2014].

[43] Data from the 2013 Report on Kazakhstan issued by the *US Energy Information Administration*, available at http://www.eia.gov/countries/country-data.cfm?fips=KZ&trk=m. [Query: 28th November 2014].

[44] Tengiz is a joint venture composed of the US companies Chevron (50%), Exxon (25%), Kazakh KMG (20%) and the Russian company Lukoil (5%), whereas Karachaganak is composed of the Italian Eni (32.5%), British Gas (32.5%), Chevron (20%) and Lukoil (15%), Ibídem.

[45] The rest of the shareholders are Chevron (15%), Lukarco (12.5%), Exxon (7,5%), Rosneft-Shell (7.5%), Agip (2%), BG (2%) and Oryx (1.75%), Idem.

million barrels), whose exploitation rights are in the hands of an international consortium[46]. The alternative would be to construct a submarine oil-pipeline under the Caspian Sea going as far as Baku and by-passing Russia, the option preferred by the United States, as it would link up with the oil-pipeline Baku-Tiflis-Ceyhan (on the Mediterranean Coast of Turkey) which exports one million barrels of oil per day by sea.

The fact is that Russia has done its utmost to prevent that infrastructure: on the one hand it has the capacity to decide what new companies can operate with the CPC, enabling it to apply pressure; on the other hand it has joined Iran in objecting to the environmental impact that the project would have on the Caspian Sea, a problem that is complicated by the latter's legal status (i.e. whether it is a lake or an inland sea). As a result, Kazakhstan´s oil can only reach Azerbaijan by oil tankers.

By way of summary, in 2013 the total export capacity of oil from Kazakhstan was around 600,000 barrels through the CPC (which will be increased to 1.35 million), and 600,000 barrels via the traditional route to Samara (after the improvement works of 2009), plus, a reserve of capacity of up to 500,000 barrels per day through the BTC (to be carried to Azerbaijan by ship), and the country can export up to 340,000 barrels per day by rail (although this is the most expensive option).

Map 1: Oil-pipelines in Central Asia. Source: US EIA, http://www.eia.gov/countries/cab.cfm?fips=TX

[46] Formed by KMG, Eni, ExxonMobil, Shell and Total (each one with a 16.8% shareholding), Inpex (7.56%) and the Chinese company CNPC (8,4%). Production commenced in 2013, after an 8-year delay, due to the technical complexity of the project, Ibídem.

Moreover, and this is the most important matter pursuant to diversification, the oil-pipeline Atasu (Kazakhstan)-Alashankou (Chinese Region of Xinjiang) came into service in 2007, with a capacity of 400.000 barrels per day, It is owned by KMG and the State-owned Chinese company CNPC that, as has already been pointed out, purchased 8.4% of the Kashagan field and has exploitation rights for 25% of the Kazakhs fields.

Regarding Turkmenistan's gas, its proven reserves at the end of 2013 were 17,500 bcm (9.4% of the world total), its annual production was 62.3 bcm (only 1.8% of the world total), and its domestic consumption was 22.3 bcm,[47] which leaves a considerable surplus for export, not only to Russia (9.9 bcm in 2013) and Iran (4.7 bcm), but also to its main client, which is no other than China (24.4 bcm).

The only export route for Turkmenistan gas after the disappearance of the Soviet Union was to the Russian Federation, which enabled Moscow to manage these resources almost as if they were of its own and pay Ashgabat for them a price far below the market price. In view of this monopolistic situation, Turkmenistan has always sought to open up new transport routes in order to gain access to other clients.

The option that seemed most feasible was the one promoted by the West: constructing an underwater gas-pipeline (the Trans-Caspian), which leading off from Turkmenbashi would reach Baku, where it would connect up with the BTE gas-pipeline Baku-Tiflis-Erzurum (Turkey). However, that project came up against the same drawbacks mentioned for the Kazakhstan oil-pipeline in the Caspian, so it has not been able to materialise.

West failure in the Caspian contrasts with the relative ease for China to establish a connection via Uzbekistan and Kazakhstan, approved in April 2006 and operational as early as in January 2010. Moreover, the Chinese initiative was accompanied by CNPC's entry in the exploitation of the new fields in South Yolotan (also known as Galkynysh), whose proven reserves amount to 14,000 bcm, which came into production in September 2013.

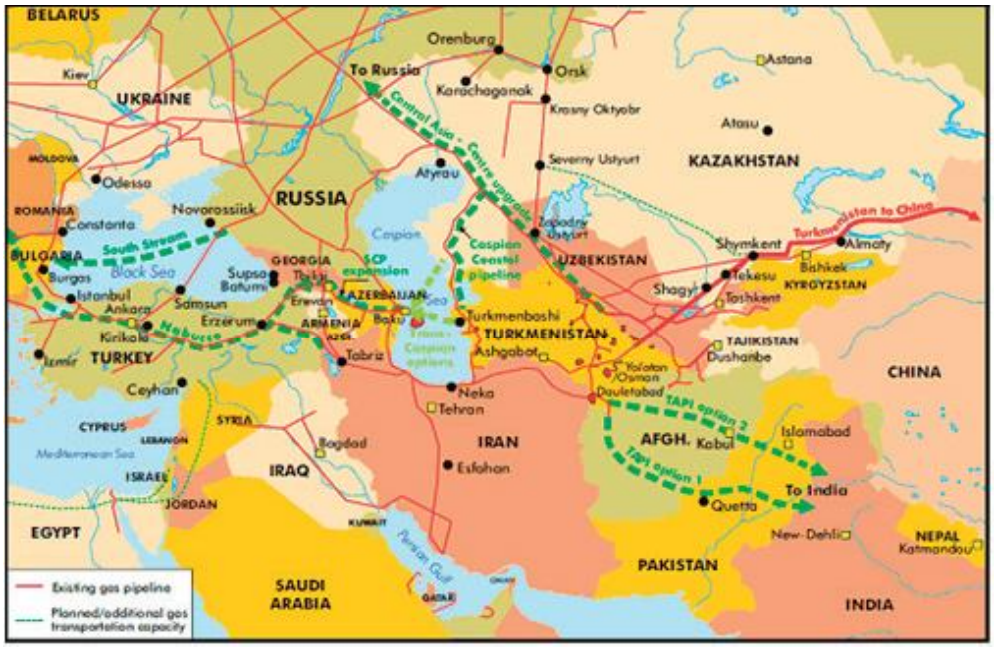
As was the case with Kazakhstan, the Turkmenistan Government has allowed certain foreign companies into its energy sector, such as Dragon Oil, ENI or Petronas, but on two conditions: that they form joint ventures with the State-owned companies Turkmengaz and Turkmenneft, and that they do not participate in the exploitation of any on-shore deposits, the only exception to this regulation being, as mentioned above, the investments made by the Chinese CNPC in the south-east of the country.

[47] Such relatively high domestic consumption, in a country with just over five million inhabitants, takes place because gas provides 76% of the total primary energy consumed by the country. Data from the *US Energy Information Administration*, available at http://www.eia.gov/countries/country-data.cfm?fips=TX&trk=m. [Query: 28th November 2014].

Apart from all the aforementioned infrastructures, there are further projects for exporting Turkmenistan gas to new markets, mainly the TAPI (Turkmenistan, Afghanistan, Pakistan, India) and a gas-pipeline that runs along the north of Afghanistan and Tajikistan up to the Chinese Region of Xinjiang.

The TAPI is being backed by the United States, but financing of this pipeline will not be easy because it passes through the most conflictive zones, under Pashtun dominance, such as Helmand or Kandahar.

By contrast, the second project would run along the north of Afghanistan, mainly controlled by Tajikas and much safer, and would be financed by China. At the Shanghai´s Cooperation Organisation (OCS) Summit in June 2012, CNPC signed a framework agreement with Turkmengaz to increase the supply to 65 bcm per year.



Map 2: Gas-pipelines in Central Asia. Source: US EIA, http://www.eia.gov/countries/cab.cfm?fips=TX.

Russia-EU relations in the field of energy

In the European Security Strategy of 2003, it was stated that "*Energy dependence is a cause for particular concern in Europe, which is the greatest importer of oil and gas in the world. The imports supply about 50% of the energy currently consumed. In 2030 this percentage will rise to 70%*".[48]

[48] *A Secure Europe in a Better World: European Security Strategy*, Brussels, 12th December 2003, Page 3, available at http://www.consilium.europe.eu/uedocs/cmsUpload/031208ESSIIES.pdf. [Query: 4th December 2014].

In the 2008 Monitoring Report, after the first Russia-Ukraine Gas War, it was reaffirmed that "*Concerns over energy dependence have grown over the last 5 years. Europe's decreasing production means that in 2030 up to 75% of our oil and gas will have to be imported*".[49]

In October 2014 a study[50] was made public of future scenarios concerning the supply of gas to Europe up to 2040, on the basis of the following assumptions:

- From 2015 to 2040 world gas consumption will increase by 48% to 5,300 bcm per year (an average increase of 1.6% per year).
- In the same period, European demand will grow by 20% (an average increase of 0.6% per year, thus below the global increase).
- Europe's own production will decrease to 208 bcm in 2020, and to 199 bcm in 2040 (including a production of 20 bcm of shale gas).
- In view of the political instability in Iran and Iraq, the "South Corridor" for energy supply to the EU will not be fully developed until 2030.

The basic scenario envisages a Brent barrel price of 100 dollars; that all the Russian supply contracts are extended for 10 years, with 65% of the supplies indexed to the price of oil and the remaining 35% to spot market prices; that the Ukrainian gas transit system will carry on being accessible; and that the South Stream gas-pipeline is constructed. All of the aforementioned questions are dealt with in the following sections. The main forecasts of the study for that basic scenario are as follows:

- LNG imports will rise from 66 in 2015 to 146 bcm in 2040, making up for a fall in internal production, whereas imports via gas-pipeline will only increase from 219 to 238 bcm.
- The EU consumption covered by gas-pipeline from Russia will fall from 31% in 2015 to 23% in 2040 (year in which 32 bcm of Russian LNG will be imported), whereas the consumption covered with gas from the Caspian Sea and the Near East will rise from 3 to 10%.
- Prices will go down between 2015 and 2020 because larger amounts of LNG will arrive, but they will go up again until 2040 due to the demand from Asia.

To summarise all that has been explained above, the EU is still going to require external supply sources and Russia is still going to play a basic role in providing

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[49] *Report on the application of the European Security Strategy: security in an evolving world*, Brussels, 11th December 2008, Page 5, available at http://www.consilium.europe.eu/ueDocs/cms_Data/docs/pressdata/ES/reports/104637.pdf. [Query: 4 December 2014].

[50] VV.AA, "Business as usual: European gas market functioning in times of turmoil and increasing import dependence", *Brookings Policy Brief*, nº 14-05, October 2014, pp. 11-20, available at http://www.brookings.edu/~/media/Research/Files/Papers/2014/10/european%20gas%20market%20import%20dependence/business_as_usual_final_2.pdf. [Query: 4th December 2014].

that need. However, the initiatives in this area have once again brought to light two important aspects of Russian foreign policy: the way the energy resources are regarded as a basic instrument for national power,[51] and its challenging attitude versus the *status quo* during the 90s, when commitments were made that went against Russia's own national interests.

The energy dialogue between the EU and Russia[52] takes place within the framework of the negotiations to renew the "Cooperation and Association Agreement" (signed in 1994, in force as from 1997 and expired since 2007), and revolves around four thematic groups: energy strategies, predictions and scenarios, market development and energy efficiency. Some of the conclusions affecting Russia are as follows.[53]

- Russia needs investments in its energy sector, which should make the Kremlin lower the barriers to foreign capital.
- The use of already existing infrastructures, such as the Baltic Sea and Black Sea oil terminals has to be optimised.
- Russia's energy efficiency needs to be improved, especially by reducing the amount of gas burnt in the oil fields.

However, in spite of the mutual interest, the relations were still marked by tension between 2009 to 2013, as explained below.

Disagreements over the Energy Charter Treaty

In view of its importance, reference must be made to the discrepancies between Moscow and Brussels with regard to the Energy Charter. The origins of this document date back to the end of the Cold War, since it was signed in December 1991, at the same time as the USSR ceased to exist and the Community of Independent States (CIS) was established.[54]

The aim was to formulate a multilateral regime on matters concerning energy investment, trade and transit, and gave rise to a first round of negotiations that lasted for three years, until a Treaty was signed (the Energy Charter Treaty, ECT)

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51 See COHEN, Ariel, "Europe's strategic dependence of Russian energy", *Backgrounder*, The Heritage Foundation, nº 2083, 5 de November 2007, available at http://www.policyarchive.org/handle/10207/bitstreams/13043.pdf. [Query: 26 November 2014]; y GOLDTHAU Andreas, "Rhetoric versus reality: Russian threats to European energy supply", *Energy Policy*, Vo. 36, nº 2, February 2008, pp. 686-692.

52 See in this regard FURFARI, Samuele, op. cit., pp. 131-141.

53 PREBALGS, Andris, "EU-Russia energy dialogue al the origins of the European Foreign Energy Policy", *The EU-Russia Centre...*, nº 9, op. cit., pp. 8-19.

54 On the ECT negotiation process, See WÄLDE, Thomas W. (ed.), *The Energy Charter Treaty: an East-West gateway for investment & trade*, London: Kluwer Law International, 1996. Concerning Russia's position during the negotiations, See KONOPLYANIK, Andrey, "The Energy Charter Treaty: a Russian perspective", Idem, pp. 156-178.

that was legally binding and contained a set of provisions on trade, transit and investments in the energy sector.[55]

These provisions were basically the ones proposed by the EU, for the lack of experience on the Soviet side in negotiating trade and investment agreements.[56] From a geographical perspective, as the USA abandoned the negotiations in 1993 and other oil-producing States such as Saudi Arabia, Venezuela and Iran had only observer status, the Treaty became a bilateral agreement between the EU and Russia.

The most complicated aspect of the Treaty was the freedom of transit for the resources, since the obligation contained in Article 7.1. that the signatories made no distinction between and did not discriminate for source, destination or ownership of the materials, was not sufficiently well defined and made it necessary to adopt a "Protocol on Transit" in 2000.[57]

When negotiating this Protocol, Russia defended its right to rescind long-term supply contracts (on grounds that were merely commercial in terms of quantity of resources and prices) when they were not consistent with the transit contracts (referring to access to the pipelines, transit charges and even the frequent cases of theft while in transit), a right that the EU found unacceptable. Furthermore, the Union wished to reduce the duration of both types of contract to encourage competition.[58]

As an agreement was not reached, Russia decided to condition the ratification of the ECT to the modification of the Protocol on Transit. The influence of Gazprom in the process was unquestionable, because the opening of a direct corridor between Central Asia and Europe would mean that it would lose its monopoly position.[59] Another source of conflict was the role of the conciliator, empowered

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55 "Energy Charter Treaty", *Diario Oficial No. L 380,* 31 dated December 1994, available at http://eur-lex.europe.eu/LexUriServ/LexUriServ.do?uri=CELEX:21994A1231(52):ES:HTML. [Query: 26th November 2014].

56 BELYI, Andrey, *The Russian position with respect to the Energy Charter Treaty*, Analysis by the Real Instituto Elcano, nº 98, 25th September 2009, Page. 2, available at http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/geoestrategia+de+la+energ_a/publicaciones/escenario+global/ari98-2009. [Query: 26th November 2014].

57 *Final Act of the Energy Charter Conference with respect to the Energy Charter Protocol on Transit*, Brussels, 31st October 2003, available at http://www.encharter.org/fileadmin/user_upload/document/CC251.pdf. [Query: 26th November 2014].

58 BELYI Andrei, op. cit., p. 3.

59 "*On analysing the way the ECT has evolved, not ratified either by the USA or Russia, in the case of the latter the bone of contention lies in the Protocol concerning transit that would require the country to lose its monopoly over the gas-pipelines and oil-pipelines*". MAS, Sergio, "Minsk, between Brussels and Moscow", various authors, *Spain and Eastern Europe: so far yet so near*, Valencia: Universidad de Valencia Publications, 2009, p. 299.

to make decisions about charges and supplies in the event of discrepancies between the signatory parties.[60]

After the gas crisis in January 2009, the Russian President Medvedev put forward a proposal for a new Energy Charter to replace the 1991 Charter, which should focus not only on the consumer countries but also on the producing and transit countries. Russia was in favour of including the United States and other oil-producing countries beyond the Euro-Atlantic zone in the Treaty, as well as other energy forms such as nuclear energy.

Acceptance of the Russian proposal was difficult, not only if it is regarded as a bilateral agreement with the EU which would require ratification by the 28 Member States (including those systematically opposing any agreement with the Federation), but also if it were regarded as a replacement for the ECT. However, it was a necessary initiative, since in practice the Treaty obligations only affect the former Soviet Republics, whereas the EU can use the Community legislation as an excuse for not complying with them.

In the framework of the current crisis in relations it does not seem possible to make any progress in this area. However, it would be in the EU's interests if its strategic association with Russia were to include an "Energy Charter Treaty +", which contained the entire process from production to consumption, including transit, with mediation mechanisms that were satisfactory to all parties, and the necessary legal guarantees that would make the contracts endurable and reliable, regardless their period of validity.

The infrastructures for supplying Russian gas to the EU

Gas infrastructures generally require huge investments, with returns that cannot be achieved unless the financing companies hold a monopoly on access. Nonetheless, the European legislation contained in the "Third Energy Package"[61] goes in the opposite direction, by endeavouring to apply the principle of separat-

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[60] "*The Russian Federation has also come to the conclusion that Article 7.3 (concerning transit charges) and Article 7.7 (concerning the conciliation procedure) of the ECT are extremely problematic. Russia is concerned* [...] *that Article 7.7 could be interpreted in such a way that the provisional charges established by the conciliator would not be recalculated in accordance with the charges eventually agreed upon*". KONOPLYANIK, Andrei, "Gas transit in Eurasia: Transit issues between Russia and the European Union and the role of the Energy Charter", *Journal of Energy & Natural Resources Law*, Vol. 27, nº 3, 2009, p. 475, available at http://www.konoplyanik.ru/ru/publications/articles.html. [Query: 26th November 2014].

[61] Composed of two Directives and three Regulations, the most important of which for the purpose of this document being the one concerning the domestic gas market, "Directive 2009/73/EC of the European Parliament and of the Council dated 13th July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC", *Official Journal of the EU*, 9th August 2009, available at http://eur-lex.europe.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0094:0136:en:PDF. [Query: 3 December 2014].

ing activities, requiring the major producing companies to dispense with their transmission assets.

Map 3: Main Russian gas-pipelines supplying the EU and Turkey.[62]

However, the European Commission plans were modified by Germany and France, not prepared to let their State monopolies lose ownership over their gas and electricity networks. As a result, companies such as EDF or RWE only transferred their network operations to companies that were independent of the system, being theoretically subject to an external audit.

The Community regulations do not allow a company from a third-party country from purchasing a European company in the energy sector unless it complies with the requirements of separation between generation and transmission, which has very eloquently been referred to as the *Gazprom Clause*. Nevertheless, in spite of this obsession by Brussels, Germany once again managed to qualify this by including the possibility of authorising the purchase of assets through a bilateral agreement, without having to comply with the clause.

62 Source: *Russian Analytical Digest*..., op. cit., p. 13.

In short, the main members of the EU, especially Germany,[63] were not prepared to let the Commission ruin their privileged relationship with Russia, which enabled it to announce the future closure of all the nuclear power plants after the Fukushima catastrophe, and they put their national interests first, instead of backing up the measures, openly anti-Russian, adopted in Brussels.

On 8th November 2011 a key event took place, the aforementioned Nord Stream[64] came into service. On that day the Russian President Medvedev and the German Chancellor Merkel symbolically opened the gas valve for the first stage, accompanied by French Prime Minister Fillon and Dutch Prime Minister Rutte, and in the presence of the European Energy Commissioner, Oettinger and Merkel's predecessor in her post, Gerhard Schroeder, Director of the "Nord Stream AG" Shareholders' Committee.[65]

Image 1: Opening the Nord Stream. Source: http://www.gazprom.com/press/gallery/.

63 For German energy policy, See SOLERA Miriam, "German Foreign Policy of Energy Diversification: Principles and Courses of Action (1998-2012)", *Working Draft*, Num. 11/2012, Real Instituto Elcano, September 2012, available at http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/dt11-2012_solera_Germany_energia_politica_exterior. [Query: 2 December 2014].

64 See RUIZ GONZÁLEZ, Francisco, "Novelties and trends in the Geopolitics of European Gas", IEEE Analysis Document, nº 31/2011, November 2011, available at http://www.ieee.es/Galerias/fichero/docs_analisis/2011/DIEEEA31_2011GasRuiz.pdf. [Query: 2 December 2014].

65 The Russian company Gazprom, the German companies Wintershall AG and E.ON. Ruhrgas, the Dutch company Nederlandse Gasunie and the French company GDF all have a shareholding, which explains the aforementioned institutional representation at the ceremony. Further information about Nord Stream AG at http://www.nord-stream.com/.

The gas-pipeline, which runs 1,224 Km below the Baltic Sea, consists of two lines running parallel with a capacity of 55 bcm per year. The underwater section is completed with two land connections, 917 Km long on the Russian mainland and 850 Km long in Germany, the total investment amounting to 7,400 million Euros.[66] Pursuant to the source for supplying gas to this pipeline, 25 bcm would be guaranteed from the exploitation of the Yuzhno-Russkoye gas fields, on the Siberian Peninsula of Yamal, whose proven reserves are 1,000 bcm, operated by the Severneftegazprom consortium.[67]

Apart from Nord Stream, reference must also be made to its equivalent in the Black Sea, the South Stream (which will be analysed later), reaching Austria via Bulgaria, Serbia and Hungary, and the EU's alternative for the so-called "South Corridor", the Nabucco,[68] whose purpose is to connect Azerbaijan wells with Central Europe, a 3,900 Km route running through Georgia, Turkey and the Balkans.

In any case, these projects were not the only ones in the zone: on 26th June 2012, the President of Azerbaijan, Aliyev, and the Prime Minister of Turkey, Erdogan, gave their approval to the construction of the TANAP (Trans-Anatolian Pipeline), which is scheduled to come into operation in 2017, with a capacity of 30 bcm in 2026 and up to 60 bcm in 2026. It is estimated that the TANAP will cost between 5,000 and 6,000 million Euros, to be paid for by Azerbaijan (80% via the State-owned company SOCAR) and Turkey.[69]

The consortium of producers[70] in the Azeri gas field Shah Deniz 2 selected the TANAP as the way to export to Europe the first 10 bcm of gas available as from 2017, which meant d*e facto* the cancellation of the Asian section of the Nabucco

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66 For details concerning the figures for the project, See *Nord Stream by numbers*, available at http://www.nord-stream.com/pipeline/. [Query: 30th November 2014].

67 A joint venture consisting of Gazprom (40% shareholding, 50.02% votes), Wintershall AG (35% shareholding, 24.99% votes) and E.ON Ruhrgas (25% shareholding, 24.99% votes). For further information about Severneftegazprom en http://www.sngp.org/en/about/index.php. [Query: 30th November 2014].

68 See BLANC ARTEMIR, Antonio, "La seguridad en el suministro energético, en particular de gas, como prioridad estratégica de la UE: ¿existen alternativas viables que reduzcan la dependencia de Russia?", en VV.AA., *Panorama Estratégico 2010/2011*, Madrid: Ministerio de Defensa, 2011, pp. 195-233.

69 See RUIZ GONZÁLEZ, Francisco, "Gas Geopolitics: the latest news concerning the South Corridor for supplying gas to the EU", IEEE Analysis Document, nº 10/2012, February 2012, available at http://www.ieee.es/Galerias/fichero/docs_analisis/2012/DIEEEA10-2012_FJRG_Geopolitica_del_gas_las_novedades_en_el_corredor_sur_de_suministro_a_la_UE.pdf; and "The gas labyrinth Eurasia: projects, realities and geopolitical consequences", IEEE Analysis Document, nº 30/2012, dated July 2012, available at http://www.ieee.es/Galerias/fichero/docs_analisis/2012/DIEEEA30-2012_LaberintoGasEurasia_ProjectsRealidadesConsecuenciasGeopoliticas_FJRG.pdf. [Queries: 2nd December 2014].

70 Comprising BP, which has a shareholding of 28.8%,Statoil (Norway, 15.5%), SOCAR (Azerbaijan, 16.7%), Lukoil (Russia, 10%), NICO (Iran, 10%), and TPAO (Turkey, 19%). Data from the BP website, http://www.bp.com/en_az/caspian/operationsprojects/Shahdeniz.html. [Query: 1st December 2014].

pipeline. Nevertheless, the project for the European part, a 1,300 long section, was kept, with the intention to transport those first 10 bcm from Shah Deniz 2, and it would have a maximum capacity of 16 bcm instead of the 32 bcm that was originally planned.

Map 4: Gas-pipelines in the South Corridor supplying the EU.

However, another European project was competing for this supply: the *Trans-Adriatic Pipeline* (TAP), 520 Km long , running through Greece, Albania and Italy. The TAP was to cost around 2,000 million Dollars, as opposed to the original 10,000 to 14,000 million Dollars for the original Nabucco, so returns can be achieved after only the first 10 bcm from Shah Deniz 2.

Another major difference was that although the shareholders in Nabucco did not have their own sources of supply, in the case of TAP the Norwegian company Statoil, with 42.5% of the shares, was also the owner of a 15% shareholding in the consortium that exploited Shah Deniz 2.[71] In view of all this, and in spite of the intense political pressure exerted by the USA and the European Commission, it was finally announced that the Azeri gas would reach the European market via the TAP, a decision meaning the complete abandonment of Nabucco.[72]

[71] Apart from Statoil, the Swiss company EGL (42.5%) and the German company E.ON Ruhrgas (15%) also had shareholdings in the TAP. On 22nd January 2013 an agreement was signed whereby three of the shareholders in Shah Deniz 2 (BP, Total and SOCAR) received stock option to purchase up to 50% of the shares.

[72] See "Shah Deniz's pipeline of Choice is TAP", *New Europe*, (28.6.2013), available at http://www.neurope.eu/article/shah-deniz%E2%80%99s-pipeline-choice-tap. [Query: 2nd December 2014].

A future vision for energy relations in Europe

As has already been pointed out, the European energy policy (*ergo* the Commission's) necessarily has to seek to diversify the supplies, so as to avoid being excessively dependent on Russia, and to prevent the purchase of company assets in the sector from companies like Gazprom.[73] These objectives seem to justify any means, even getting as far as the paroxysm as described in the South Corridor.

Nevertheless, as has already been stated, some of the main Member States were not prepared to follow Brussels' instructions in this area. Thus for example, in March 2012 the Chief Executive Officer (CEO) of the French company Total, Christophe de Margerie, stated during a visit to Moscow that "*the uprisings that are taking place in the oil-producing Arab countries have sent a signal to the investors to resort to Russia, since it is a country that offers a much more secure and stable environment*".

Perhaps that is why a change in trend would appear to have been detected in the energy relations between the EU and Russia, well apparent in the "Roadmap for EU-Russia Energy Cooperation until 2050",[74] a document that covers not only the electricity, gas, oil and renewable energy markets, but also any cross-cutting issues and the basic question of energy efficiency.

It begins by recognising something basic; such is the symbiotic relationship between the two interested parties in this area, because being true that Russia is a key energy supplier to the EU, Russia's proximity to an advanced market of 500 million consumers is of similar importance to Russia. This one-to-one relationship should enable them to strengthen the synergies and forge a long-term strategic collaboration.

Mention is made of forecasts from institutions like the International Energy Agency, which in its 2011 report predicted a 40% increase in energy demand between 2009 and 2035, 90% of this rise coming from States that are not OECD members, the natural gas trade increasing twofold.

In this changing environment, the aim ought to be to create a *Pan-European Energy Space*, with a network of integrated and functional infrastructures, transparent, efficient and competitive markets, which would contribute to guaranteeing energy security and to achieving the sustainable development objectives of the EU and Russia.

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[73] See ESCRIBANO, Gonzalo, "Europe's Hour, also in Foreign Energy Policy", *Working Draft*, Num. 2/2012, Real Instituto Elcano, January 2012, available at http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/dt2-2012. [Query: 2nd December 2014].

[74] *Roadmap for EU-Russia Energy Cooperation until 2050*, March 2013, available at: [Query: 1st December 2014].

Where natural gas is concerned, the goals of the Russian industry take account of a production increase that includes commissioning of new deposits to make up for the exhaustion of the current ones, renewal of the current conveyance networks and developing new ones, developing the production and export of LNG; and liberalising the gas market, enabling a variety of companies to gain non-discriminatory access to the infrastructures.

The aim of the EU is to guarantee secure sustainable energy at an affordable price to contribute to its competitiveness, and although the EU has decided that its economy must cease to rely on coal, of all the fossil fuels, natural gas is the favourite one, for it is the most economical, less pollutant and because it provides a suitable back-up to the intermittence in the supply from renewable sources.

With respect to prospective studies into the way the consumption of natural gas will evolve in the EU, the conclusions are not conclusive because they vary greatly from one study to another, mainly due to the fact that natural gas consumption will depend on factors affected by a degree of uncertainty, such as the price of gas compared with the price of other sources, the policies of promoting other sources that do not contaminate as much, the way the economy evolves, the progress made in developing pollutant gas capture and storage technologies, etc.

However, and in spite of those uncertainties and the growth of the Asian market, it is predicted that in 2035 Russia will be the greatest world producer of gas and EU its main client. That is why the shadow of doubt that has hung over relations between the two in recent years must be dispelled:

- On the EU's side, reference is made for the need to keep Russia regularly informed about long-term prospects for gas demand, so that the latter can plan ahead where investing in new infrastructures is concerned.[75]
- On the Russian side, the EU must be informed about the long-term capacity to provide Europe with gas, making it easier for the Union to invest in the Russian energy market.

Finally, a series of recommendations, actions and milestones to be achieved in 2020, 2030 and 2050 are established, most of which contribute to the aforementioned objective of improving mutual trust and, as a result, the strategic relationship in this area.

[75] That is to say, the opposite of what is promoted in the Third Energy Package. Let's take the case of the gas-pipelines that transport, once inside Germany, gas belonging to Nord Stream, OPAL and NEL. They cost 1,300 million dollars, financed by W&G (the German company Wintershall, with 51% of the shares, and Gazprom with 49%). W&G has 80% of the shares in OPAL (E.ON Ruhrgas owns the remaining 20%), and 51% in NEL (the Dutch company Gasunie holds 25% and the Belgian company Fluxys, 24%). Therefore, they are Pan-European projects, which have applied to be exempt from the obligation to enable other companies to access, but the mere presence of Gazprom probably conditions a decision to the contrary, which in practice is equivalent to the enforced expropriation of resources.

The new projects for supplying Russian gas to the EU

Before the Ukraine crisis, Russia was still promoting new projects to diversify its routes for supplying gas to the EU. Thus for example, on 3rd April 2013 President Putin and Gazprom CEO Mr. Miller announced an agreement to construct a new gas-pipeline, Yamal-2, which leading off from Belarus was to cross Poland to go as far as Slovakia. Russia's intention is to divert via this new route up to 15 bcm of the gas that is currently conveyed to Europe via the Ukrainian gas-pipelines.

The consortium that would construct the new gas-pipeline is the one that controls Yamal-1 (Belarus-Poland-Germany, with a capacity of 33 bcm), EuroPol-Gaz, in which Gazprom has a 48% shareholding, the same as the Polish state-owned company PGNiG. However, the Polish Prime Minister Tusk hastened to say that, in spite of the profit that the transit of that gas could bring, his country would not participate in any initiative to by-pass Ukraine.

Unlike the megalomaniac South Stream project, Yamal-II would be a practicable option that would have a major impact on Ukraine. If all the export capacities by gas-pipeline from Russia to Europe, including both those in service and planned, are brought together in one single table, the result would be as follows:

Gas-pipelines in service	*Capacity*
Ukrainian transit pipeline system	140 bcm
Nord Stream 1 & 2	55 bcm
Yamal-Europe 1	30 bcm
Baltic pipelines	12-15 bcm
Gas-pipelines being planned	*Capacity*
South Stream	63 bcm
Nord Stream 3 & 4	55 bcm
Yamal-2	15 bcm

Table 3: Russia-EU gas-pipelines in service or under planning. Source: compiled by the author.

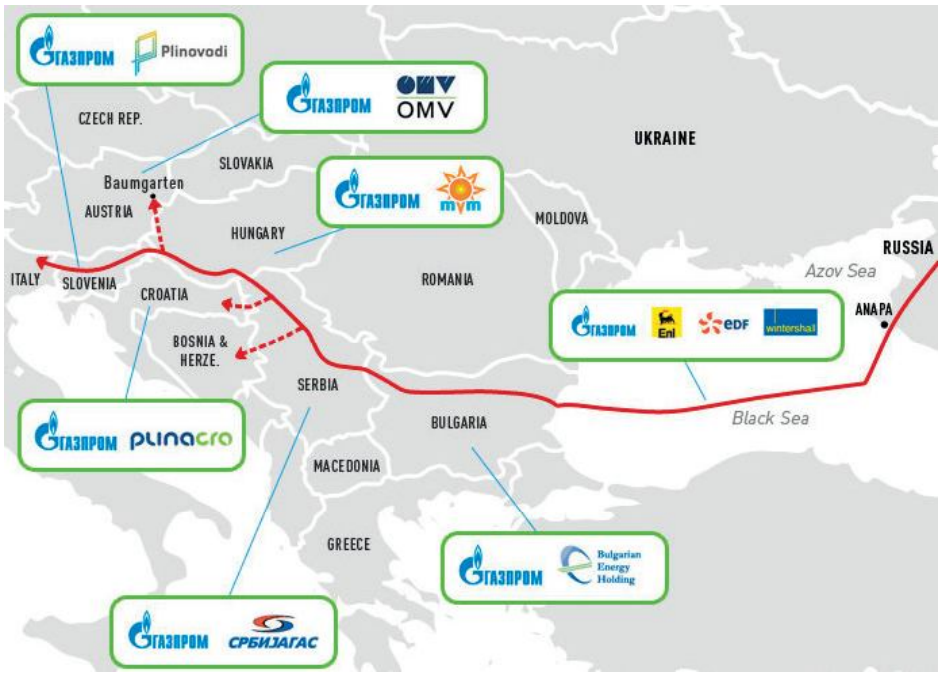
Some experts think that this transport capacity exceeds by far, not only Russia's supply capacity but also Europe's demand, referring to them as "*high-cost redundancies*".[76] In fact, if all these figures are added up, they reach a total capacity of 369 bcm, undoubtedly excessive; that analysis is based on false premises though because the Nord Stream, South Stream and Yamal-2 gas-pipelines (to-

[76] SOCOR Vladimir, "High-Cost Redundancies: Gazprom's Pipeline Projects in Europe", *Eurasia Daily Monitor*, Vol. 10, num. 74, April 2013.

talling 188 bcm) were not conceived as an addition to the traditional export route through Ukraine (140 bcm), but to replace that route.

In the case of the South Stream, one of the main stumbling blocks for its construction was obtaining permission from Turkey to lay the pipeline in the part of the Black Sea under its sovereignty, but this was overcome on 28th December 2011 with the lowering of the price that Ankara would have to pay for Russian gas, provided through the Blue Stream gas-pipeline, and by the agreement to extend this pipeline up to southern Turkey, from where it would be possible to distribute gas to Lebanon, Syria or even the Turkish Republic of Northern Cyprus.

Once the sea route had been guaranteed,[77] for which construction began in December 2012, Russia sought direct bilateral negotiations with the Balkan transit countries, signing between 2008 and 2011 government to government agreements for implementing the project, with Austria, Bulgaria, Croatia, Greece, Hungary, Serbia and Slovenia, and establishing joint ventures with local companies, as can be seen in Map 5 below, in which Gazprom has a minimum shareholding of 50%.



Map 5: South Stream and the companies participating. Source: www.south-stream.info.

[77] Gazprom had a 50% shareholding in the off-shore section of the gas-pipeline, ENI had 20%, Wintershall 15% and EDF 15%, according to information from Gazprom's website, available at http://www.gazprom.com/about/production/projects/pipelines/south-stream/. [Query: 3rd December 2014].

Nevertheless, at the same time as sanctions were imposed on Russia in association with the Ukraine crisis, both the Eurasian Economic Union (EEU) and the European Commission increased their pressure on the Member-States through which the South Stream[78] had to pass, especially Bulgaria that ended up stopping the project until it was certain that it fully complied with EU legislation.[79]

Theoretically, this decision amounted to a serious setback for the Russian projects to diversify the export routes avoiding transit via Ukraine. However, on 1st December, on the President Putin's official visit to Turkey, events took an unexpected turn when he announced the permanent suspension of the South Stream on the following grounds.[80]

> "The European Commission has not only not helped to realise the project, but has also created obstructions [...] So, if Europe doesn't want it to be done, it won't be done [...] Russian gas will be resent to other regions in the world, which will be done by speeding up the LNG projects [...] We don't believe that this is in Europe's economic interest and it damages to our cooperation. But that is what our European friends have chosen to do".

The Russian President added that Bulgaria had not acted as an independent State when it obstructed the project, and stated that Sofia would lose 400 million dollars per year by not being a transit country for Russian gas on its way to the EU, suggesting that the Bulgarian leaders asked Brussels for that amount.

Furthermore, Gazprom signed an agreement to construct a new Russia-Turkey gas-pipeline in the Black Sea, with a similar capacity to the cancelled one, 63 bcm, of which 14 bcm would be in the form of an extra supply to Turkey, and the rest would be transported to the latter's frontier with Greece and made available for consumption in South-East Europe. Turkey would benefit from the transit charges, receive a 6% discount on the gas that it was already purchasing from Russia, and would become vital for supplying gas to the EU.

The Ukraine crisis: a Russian turn towards Asia-Pacific?

As it has been demonstrated in previous sections, the symbiosis formed by Russia as a provider of energy resources and the EU as a client, was not fully consolidated, and the difficulties and disputes affecting relations have been constant over the last decade. Ultimately, the serious crisis affecting Ukraine,

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78 See "EU tells Bulgaria to stop work on Gazprom's South Stream Project", *The Wall Street Journal*, (3.6.2014), available at http://online.wsj.com/articles/eu-tells-bulgaria-to-stop-work-on-gazproms-south-stream-project-1401811829. [Query: 4th December 2014].

79 See "Bulgaria suspends gas pipeline project", *BBC*, (19.8.2014), available at http://www.bbc.com/news/business-28854089. [Query: 4th December 2014].

80 See "Putin: Russia forced to withdraw from South Stream project due to EU stance", *Russia Today*, (1.12.2014), available at http://rt.com/business/210483-putin-russia-gas-turkey/. [Query: 5th December 2014].

whose study does not fall within the scope of this work, [81] has complicated the panorama even more.

The energy dimension of the Ukraine crisis

After the coup d'état on 22nd February 2014 in Kiev,[82] which brought to an end Yanukovych's Presidency, the Kremlin ordered Gazprom to cancel the reduced price of 268 dollars for every 1.000 m^3 agreed to on 17th December 2013. When Russia annexed the Crimea Peninsula on 18th March, the aforementioned discount established in 2010, when the lease of Sebastopol Naval Base until 2042 was extended, was also cancelled

As Ukraine was teetering on the verge of bankruptcy, Naftogaz began to delay the payments. As a result, Gazprom decided on 16th June to cut off the gas flow, as the debt had built up to 5,200 million dollars. On the edge of this new dispute, without sufficient gas reserves and without being able to import them from Central Europe as an alternative, Ukraine would have to face severe restrictions, or would even have to once again interrupt the gas flow that crossed the country from Russia to Europe.

To prevent this, an initial agreement was reached on 26th September for the winter supply, under the auspices of the EU, whereby Gazprom would send 5 bcm from October to March, to cover the supply deficit to Ukraine, at a price of 385 dollars for every 1,000 m^3. The truth is that Kiev still considered this price to be abusive, in spite of the fact that it had been the EU who had established it as a reference for the negotiations.

As far as the outstanding debt is concerned, Gazprom asked to be paid 3,100 million dollars, deferring the remaining 2,100 million demanded until ruling was given by the Stockholm Court of Arbitration. The basis for calculation of this debt was a price of 485 dollars for every 1.000 m^3, whereas Naftogaz only accepted the debt calculated on the basis of the price agreed to between Russia and Yanukovych in November 2013, also refusing to pay in advance for the winter supply of 5 bcm.

On 31st October a new agreement was signed, the price being set at 378 dollars for every 1,000 m^3 in the last quarter of 2014, and 365 dollars in the first quarter

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81 See RUIZ GONZÁLEZ, Francisco, "Ukraine: Revolution and Civil War: an Alternative View of the Crisis", *IEEE* Framework *Document,* nº 19/2014, 13th November 2014, available at http://www.ieee.es/Galerias/fichero/docs_marco/2014/DIEEEM19-2014_Ukraine-Revolucion-GuerraCivil_FJRG.pdf. [Query: 3rd December 2014].

82 For a study of the energy dimension in this crisis, See PARDO, Eric, "25 years after the Fall of the Berlin Wall: a New Energy Wall?", *Eurasianet.es*, (17.11.2014), available at http://eurasianet.es/2014/11/25-anos-despues-de-la-caida-del-muro-de-berlin-un-nuevo-muro-energetico/; and "The Gas Games between Russia and Ukraine: Winter Truce?", *Eurasianet.es*, (1.12.2014), available at http://eurasianet.es/2014/12/los-juegos-del-gas-Russia-Ukraine-tregua-de-invierno/. [Queries: 3rd December 2014].

of 2015, taking into account that this amount is calculated indexed to an oil price that is freefalling. Furthermore, the supply was reduced to 4 bcm until March 2015, and financial assistance of the EU for the Ukrainian payments to Gazprom was confirmed.

Nevertheless, a new crisis cannot be ruled out, since Ukraine currently states that it will not need more than half the 5 bcm agreed to for the winter supply, as a result of saving measures and the greater amount of gas received from the West. However, this could be nothing more than a negotiating bluff, because Ukraine has lost its Lower Don coal production, and according to Gazprom the Ukrainians would have admitted in private that they require a minimum of 7 bcm.

At this point, now focusing on domestic matters, it is important to stress a collateral benefit for Spain in this crisis, particularly the demonstration that the gas connections between the Iberian Peninsula and the rest of the EU are deficient, due to France's traditional reluctance to establish new infrastructures in the Pyrenees.

Spain would be in a position to provide a new supply route, which would help to reduce the impact of a crisis with Russia, using its major regasification capacity (60 bcm per year, at six plants already in operation, and a further 7 bcm from the Gijon Plant, currently in state of hibernation), and the two gas-pipelines that connect the country with North Africa: the Magreb-Europe gas-pipeline, reaching Spain from Algeria via Morocco, with a capacity of 13.6 bcm; and MEDGAZ, that directly links Oran (Algeria) with Almeria, with a capacity of 8.36 bcm.

Should all these capacities be added up, and a domestic consumption of approximately 30 bcm is deducted, we can see that Spain could be a country for the transit of 50 bcm, However, the capacity of the current interconnections with France at Irun and Larrau do not permit more than 5.3 bcm per year in the south to north direction, a figure that will increase to 7.2 bcm in 2015, clearly insufficient to be considered as an alternative gas inflow point to be taken into account by the EU.

For this situation to be reversed, it would be essential to put into service the MIDCAT gas-pipeline between Catalonia and the south of France, totalizing a maximum capacity from south to north of 14.3 bcm. Yet, once again, that figure would only account for 10.5% of the European gas imported by gas-pipeline from Russia in 2013.[83] However the above, Spain has managed to capitalise on Brussels' uneasiness over the Ukraine crisis to give a boost to that infrastructure.

Thus, MIDCAT features since 2013 on the list of the Commission's 248 Projects of Common Interest (PCI) in the area of energy infrastructures,[84] as part of the Connecting Europe Facility (CEF) which is assigned 5,850 million Euros for fi-

[83] Which was 136.2 bcm, according to the *BP Statistical Review*, op. cit.

[84] Available at http://ec.europe.eu/energy/infrastructure/pci/pci_en.htm. [Query: 16th December 2014].

nancing until 2020. The advantages for States of being included in the EU's PCI Projects are that they contribute to market integration, improving supply security and reducing CO_2 emissions.

Furthermore, the European Commission, in its Communication on "European Energy Security Strategy[85] dated May 2014, proposed that the MIDCAT came into service in the medium term (2017-2020) to enable gas to flow north from Spain. This gas-pipeline however is not among the 34 projects for which the Commission allocated 647 million Euros on 21st November 2014, and if it is to be definitively included in a new PCI list, it will have to pass a cost-benefit analysis.

China as an alternative to the EU for Russian exports

Facing the unprecedented pressure that is arriving from the West, Russian interest has turned to Asia. There is no doubt about the fact that relations between Russia and China are good, proof of which is their prearranged voting in the UN Security Council, their collaboration in the Shanghai Cooperation Organisation, or the support that they both give to the BRICS (Brazil, Russia, India, China and South Africa) in their efforts to establish themselves as much as possible as a counterweight to West domination.[86]

In 2010, China overtook Japan as the second world economy in terms of GDP, and has become one of the major consumers of raw materials, a trend that will continue in the coming years.[87] If we also bear in mind the fact that Russia and China share 4,300 Km of frontier, it is only to be expected that energy would be one of their main common interests. Moreover, strengthening commercial ties helps to overcome tensions in the Far East Federal District of Russia, nowadays subjected to increasing migratory pressure from Manchuria.[88] Energy therefore is not only an economic factor, but also one of the essential components of the bilateral security relationship.

Diversifying its foreign clients became a top priority for Gazprom as from 2009, when the European Commission gave priority to diversifying the energy supply

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85 *Communication from the Commission to the European Parliament and to the Council. European Energy Security Strategy*, 28th May 2014, available at http://eur-lex.europe.eu/legal-content/ES/TXT/HTML/?uri=CELEX:52014DC0330&from=EN. [Query: 16th December 2014].

86 See FERDINAND, Peter, "Sino-Russian relations: strategic association . and beyond?", in Various Authors, *Russia in International Society*, Madrid: Universidad Complutense, 2012, pp. 269-296.

87 See GARCÍA SÁNCHEZ, Ignacio, "The growth of China and its energy supply", in Various Authors, *Energy and Geostrategy 2014*, Madrid: Ministry of Defence, 2014, pp. 229-297.

88 See RUIZ GONZÁLEZ, Francisco, "The Russian Far East: the Federation's Strength or Weakness?", *IEEE Analysis Document*, nº 7/2011, March 2011, available at http://www.ieee.es/Galerias/fichero/docs_analisis/2011/DIEEEA07_2011LejanoOrienteRuso.pdf; and "China: Opportunity or Threat for Russia?", *Russia Beyond the Headlines*, (29.4.2013), available at http://es.rbth.com/blogs/2013/04/29/china_oportunidad_o_amenaza_para_Russia_27383.html. [Queries: 6th December 2014].

routes to the EU and passed legislation against Russian interests, events occurring at the same time as the great economic-financial crisis that caused a reduction in the gas demand. China's gas consumption tripled between 2006 and 2013 (going from 56 to 169 bcm), quantities that cannot be covered by its own production, Russia being a realistic alternative for that extra supply.[89]

In spite of all the aforementioned, until 2014 it has not been possible to organise a strategic association in this area.[90] Back in October 2009 a basic agreement was signed for the annual supply of 68 bcm of Russian gas to China, 38 via the east route, from Eastern Siberia and Sakhalin Island, and 30 via the west route, from Western Siberia. However, the negotiations concerning the price of the supplies broke down, because the Chinese rejected the charging system that Gazprom applied to the EU, as in this case there are no expenses involving charges for transit through third countries.

The main reason for a lack of agreement was that the Russian investments in the Far East were more oriented towards the socio-economic development of the region (refineries, petrochemical plants and gas processing plants and storage of reserves) than exporting to the Chinese market, which made Beijing less interested in their financing.

Furthermore, in the same way that Russia was seeking to diversify its clients and obtain alternatives to Europe for exporting its resources, the Chinese objective was to diversify its supply sources,[91] so it did not want to encourage an excessive dependence on Russia. In the interim of negotiations, China made it clear that it would rather receive Russian gas in the form of LNG from Vladivostok or the Arctic, ruling out the west route, because the consumption in Xinjiang did not justify it.[92]

All of this has changed as a result of the Ukraine crisis. In May 2014, on a moment of maximum tension with the West, President Putin paid an official visit

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89 See DOWNS, Erika, "A grand bargain", *Ideas*, Gavekal Dragonomics, 22nd May 2014, p. 1, available at http://www.brookings.edu/research/articles/2014/05/28-russia-china-gas-grand-bargain-downs. [Query: 4th December 2014].

90 See RUIZ GONZÁLEZ, Francisco, "The role of energy resources in Sino-Russian relations", *IEEE Analysis Document*, nº 27/2011, October 2011, available at http://www.ieee.es/contenido/noticias/2011/10/DIEEEA27-2011.html. [Query: 29 November 2014].

91 Some examples of diversification are the construction of an oil-pipeline and a gas-pipeline from the Burmese port of Kyaukpyu, through which China could receive around 13 bcm per year, or the contracts for receiving LNG by sea from Qatar, Australia, Malaysia or Indonesia. Various Authors, *China's Energy and Security*..., op. cit., p. 35. in 2013, China imported 24.5 bcm in the form of LNG, as opposed to 27.4 by pipeline.

92 See HOLTZINGER, Jean-Marie, "The Russo-Chinese strategic partnership: oil and gas dimensions", *Connections: the Quarterly Journal*, Autumn 2010, pp. 69-82, available at http://www.baltdefcol.com/files/files/QJ_v94_China_Strategic_Growth%20Sliwa.pdf. [Query: 29 November 2014].

to China.[93] On 20th May, 43 trade agreements were signed together with a "Joint declaration on the new period of relations concerning global action and strategic cooperation", with a view to achieving in 2020 trade exchanges amounting to 200,000 million dollars per year. On 21st, in an atmosphere of certain suspense for not being signed with the rest of the trading agreements, the CEOs from Gazprom and CNPC eventually signed the contract whereby Russian gas would be sold to China.

Russia will be supplying 38 bcm per year to China for 30 years (2018-2048), from the Far East to Manchuria. Although the price has not been released,[94] the total amount involved in the operation is estimated at 400,000 million dollars, which means 350 dollars for every 1.000 m^3, more than satisfactory for Moscow since it is close to what the EU pays. The cost of the new infrastructures needed is around 70,000 million dollars, of which China will provide a minimum of 20,000.

The most important of these is the new "Force of Siberia" pipeline, which will connect the gas-producing zones of Eastern Siberia with the cities of Khabarovsk and Vladivostok. At the first stage, the Chayandinskoye field in Yakutia, with reserves of around 1,200 bcm, will be put into service, to be followed, at a second stage of production, by the Kovyktinskoye field, with reserves of 1,500 bcm. The pipeline will run parallel to the ESPO oil-pipeline, and the total length will be 4.800 Km.

The signing of the May agreements was very important to Russia, because it demonstrated that Russia was not internationally isolated, but it did not amount to a change for Europe's energy security, in view of the fact that the 38 bcm that will be sent to China via "Force of Siberia" will come from new fields in Eastern Siberia that do not serve the EU. What would be really important to Russia would be to have the possibility of diverting from Europe to China the production from the gas fields in Western Siberia, for which purpose it would need to recover west route from the Russian Region of Altai to the Chinese Region of Xinjiang.

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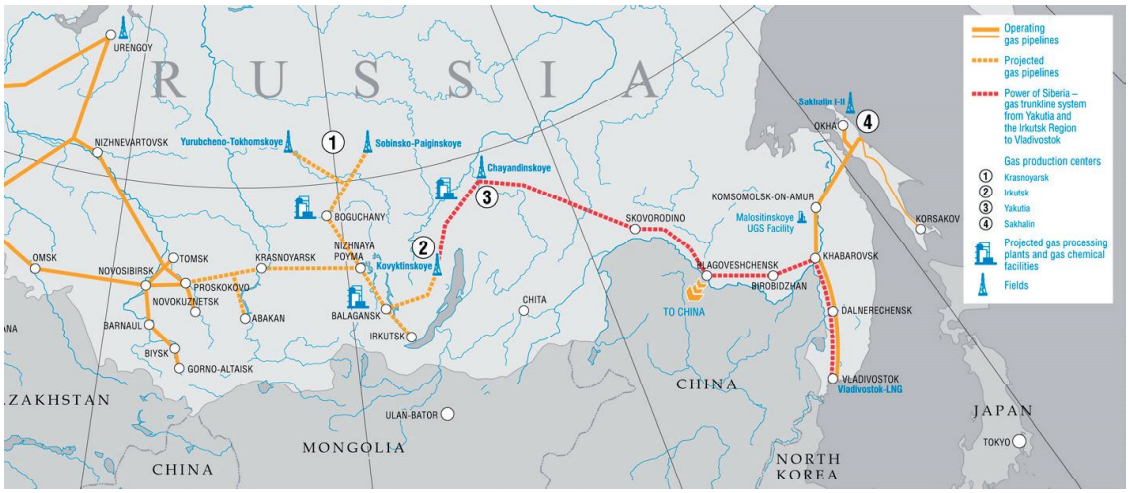
93 Concerning this visit, See LUKIANOV, Feodor, "China and Russia: a logical collaboration", *Russia Beyond the Headlines*, (22.5.2014), available at http://es.rbth.com/opinion/2014/05/22/china_y_Russia_una_colaboracion_logica_40237.html; TRENIN, Dmitri, "Russia and China: the Russian Liberal's revenge", *Eurasia Outlook*, 19 May 2014, available at http://carnegie.ru/eurasiaoutlook/?fa=55631; "Ukraine crisis pushing Putin toward China", *The New York Times* (19.5.2014), available at http://www.nytimes.com/2014/05/20/world/europe/ukraine-crisis-pushing-putin-toward-china.html?_r=0; y KAWATO, Akio, "Ukraine may facilitate a Eurasian Union-under the auspices of China", *Eurasia Outlook*, 28th April 2014, available at http://carnegie.ru/2014/04/28/ukraine-may-facilitate-eurasian-union-under-auspices-of-china/h9e6. [Query: 29th November 2014].

94 There could be two reasons for this secrecy: to present it as a *win-win* situation for the two parties, without announcing who has backed down most from the original positions, and to not encourage other clients of Russia (such as the EU) or other suppliers to China (such as Turkmenistan) to request price reviews to adapt them to those of this Agreement. DOWNS, Erika, op. cit., p. 2.

Although that option was ruled out in May, in spite of Moscow's insistence, at the Asia-Pacific Economic Cooperation Summit Forum (APEC) in November, Presidents Putin and Jinping signed a pre-agreement for the supply of 30 bcm per year via that west route, but now Gazprom will have to negotiate the conditions. With the two agreements, at the end of this decade Russia will supply China with almost 20% of its gas consumption, and China will have overtaken Germany as the main client for Russian gas.[95]



Map 6: Gas infrastructures in Far East Federal District of Russia. In red, "The Force of Siberia". Source: http://www.gazprom.com/about/production/projects/east-program/.

Conclusions and prospects

As it has been demonstrated, energy resources constitute one of the main strengths of the Russian Federation, and the profits obtained by exporting them have been one of the decisive factors in its resurgence as a major world power, after having hit rock bottom in the chaotic 1990s. However, Putin's Russia has had to maintain a complex balance:

- Insofar as oil is concerned, recovering the strategic assets that the privatisations of Yeltsin had placed in the hands of a few oligarchies, without discouraging investments from western companies.
- Insofar as gas is concerned, enabling Gazprom to obtain from abroad, the profits that would make up for the low domestic prices, but without abusing

[95] See "Russia, China add to $400 billion gas deal with accord", *Bloomberg*, (10.11.2014), available at http://www.bloomberg.com/news/2014-11-10/russia-china-add-to-400-billion-gas-deal-with-accord.html. [Query: 5th December 2014].

its predominant position to the extent that its clients are forced to seek alternative suppliers.

The energy supply for the EU is a question of security, in view of its dependence on external sources, hence it must be reduced as much as possible. Energy efficiency initiatives contribute to this target where consumption is concerned, as nuclear or renewable energy sources do contribute where supply is concerned, both of these being conducive to complying with the objectives of reducing greenhouse gas emissions.

However, the process of decarbonisation has limits, so much so that keep using fossil fuels in the future will be inevitable. Some European countries use large quantities of coal to generate electricity, but this does not seem to be an acceptable solution from an environmental perspective. Therefore, natural gas will continue to play a major role in the European energy mix for the coming decades.

Nevertheless, when it came to determining the geographical origins of the supplies, the European Commission adopted the diversification model, debatable if it is adopted on the basis that Russia is a threat, not taking into account the geopolitical risks from producing regions that are much more unstable, or ignoring the problems associated with the transit of LNG by sea through conflict zones.

In fact, until the current Ukraine crisis, establishing a common position in the EU was unfeasible, because Germany for example opted unilaterally to strengthen its ties with Russia. One might ask what is more reasonable from a geopolitical perspective; the decision made by Berlin or Brussels' decision to adopt "energy packages" based on the visceral resentment of the eastern members of the Union.

In answer to this question, we can go back to the conclusions drawn in a previous work,[96] in which we stated that gas supplies to the EU had to be guaranteed through suitable internal connections, a triple pipeline supply from Russia, Norway and Algeria, LNG supplies via safe seaways (from the Caribbean and in the future from the Russian Arctic), and regasification plants distributed along the shoreline.

To achieve this scenario, it would be necessary to form the Pan-European Energy Space envisaged in the "Roadmap for EU-Russia Energy Cooperation until 2050". Should this had been done, the now abandoned Nabucco and South Stream Projects would have never been considered, the geopolitical problems caused by making Turkey a transit country and making Azerbaijan a supplier would have never arised, and the gas from Turkmenistan would be sent to China, Pakistan or India. As far as the LNG from the Persian Gulf being concerned, it

[96] See RUIZ GONZÁLEZ, Francisco, "Reflections on European Energy Security", *IEEE Framework Document*, nº 12/2013, July 2013, available at www.ieee.es. [Query: 6th December 2014].

would be the Asia-Pacific countries that would have to worry about the maritime security on the supply routes.

The simplest option could have been that all the gas from Russia to the EU had been transported via Ukraine, using already-existing infrastructures, that the Ukrainian gas-pipeline network had been modernised and jointly operated by a Kiev-Moscow-Brussels joint venture, and that Ukraine could have used Russian gas for its domestic consumption at a lower price, as well as benefitting from the transit charges.

However, as a result of the confrontations between the two countries since the 2004 *Orange Revolution*, Russia and its closest associates in the EU had to embark on mammoth projects such as the Nord Stream to avoid transit through Ukraine, while Kiev considered measures such as replacing gas with coal, constructing regasification infrastructures, or even reversing the gas flow to receive supplies from the EU.

If after the gas wars of 2006 and 2009 it was not possible to find a definitive solution, the confrontation is now even greater with the current Ukraine crisis, and the aim of creating a common energy space has become a fantasy. Therefore, it is to be hoped that Gazprom prioritises the investments in Eastern Siberia and the Far East to comply with the agreements with China concerning gas supply, which have altered the geopolitical energy balance on a global level.

At the same time, the production from the new gas fields coming into operation in Russia, especially on the Yamal Peninsula, will go to the Asian market, either in the form of LNG supplies through the northern route via the Arctic, which is becoming increasingly navigable for more months of the year, or through the new gas-pipeline linking Western Siberia with Xinjiang. The Sakhalin production will still be exported to Japan and South Korea in the form of LNG and, in the future, through a gas-pipeline crossing the two Koreas from Vladivostok.

Therefore, and although it is impossible to break the energy ties between Russia and the EU in the short term, the most likely outcome is that the two parties seek medium-term alternatives in view of the mutual mistrust. The problem is that Moscow seems to be one step ahead, in view of the recently-announced mega-pipeline to Turkey and the new LNG projects together with the aforementioned contracts with China, whereas the EU does not appear to have any options other than increasing its dependence on unstable geopolitical regions, or fall into the arms of the USA to receive the latter's surplus production of shale gas in the form of LNG, a solution that would make the Union's energy bill considerably more expensive in a time of very weak economic growth.

In conclusion, it is well worth remembering that in June 2008, the then President Medvedev stated in Berlin that the EU, North America and Russia constituted the

three branches of common European civilisation.[97] That Russian perception of belonging to a *Great Europe* caused for example, Peter the Great's decision to move the capital from Moscow to St Petersburg in the 18th Century, to be seen as a window open to Europe, and explain Russians' constant attempts to consolidate the strategic association with the EU, an objective impossible to achieve after the Union's expansion to the east in 2004.

For those who share this view, it is sad to see how the reality of the situation is leading Russia to pivot to Asia and deliver itself into the arms of China, in the face of the evidence that creating a single economic, human and secure space from the Atlantic to Vladivostok is unfeasible. In 2012, the Director of the Moscow Centre of the Carnegie Endowment for International Peace stated that "*if Peter the Great were alive today, he would move the capital not to St. Petersburg, but to Vladivostok*",[98] words that then seemed to be a vision, but which time is turning into a prophecy, at least where energy is concerned.

[97] MEDVEDEV, Dmitri. *Speech at Meeting with German Political, Parliamentary and Civic Leaders*, 5th June 2008, available at http://archive.kremlin.ru/eng/speeches/2008/06/05/2203_type82912type82914type84779_202153.shtml. [Query: 6th December 2014].

[98] TRENIN, Dmitri, "Russia can pivot to the Pacific, too", *Eurasia Outlook*, 7th September 2012, available at http://carnegieendowment.org/2012/09/07/russia-can-pivot-to-pacific-too/ds58?reloadFlag=1. [Query: 6th December 2014].

Chapter V

The impact of Middle East conflicts on the energy sector

Francisco José Berenguer Hernández

Abstract

The direct or indirect relationship between energy, especially hydrocarbons, and conflicts, is all too clear these days. As a result, the instability and conflict situation in the Middle East, as the main production area for those hydrocarbons, is a source of concern for the international community and is also one of the predominant factors for present time geostrategy.

Keywords

Energy, Oil, Natural Gas, Conflict, War, Middle East.

Introduction

The relationship between oil and conflicts has been very marked ever since the start of the massive consumption of this natural resource. The use of fuels derived from crude by armies and navies in the years before the 1st World War.[1] the decisions adopted by the OKH[2] for planning and leading German military operations in the Soviet Union during the 2nd World War.[3] [4] or the North American oil embargo against Japan, which to a large extent brought about the attack on Pearl Harbour in 1941,[5] [6] are all classic and very enlightening examples of that relationship.

At a stage we could now describe as contemporary, after an initial period where there was a lack of political awareness in the countries that possessed most of the oil reserves, and subsequently in those that had the gas reserves, largely concurrent with the continued presence of colonialism in those territories, as well as during the first years of their full sovereignty after independence from the European powers, the potential geopolitical impact of the relations between major oil exporters and major oil consumers soon became apparent.

In more colloquial terms, the power of oil as a weapon, in a process that has kept growing ever since, was made evident in the all-too-frequently-dealt-with oil crisis of 1973, on consideration of the different international supports given to the sides involved in the Yom Kippur War.[7]

All in all, it seems clear that for decades hydrocarbons have established a two-way bridge with situations of instability, crisis and war. Hydrocarbons have been a concurrent cause, and sometimes even the main cause[8] of numerous conflicts and, in the opposite sense, have been victims of conflicts that, although for a different cause, as the conflicts affected gas or oil production zones they have either prompted production crises and considerably increased the hydrocarbon

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1 Federico Aznar Fernández-Montesinos, *Validez del modelo polemológico para el análisis de conflictos*, Doctoral Thesis, p. 136.

2 Oberkommando des Heeres, Supreme High Command of the German Army in 2nd World War.

3 Manuel Fuentes Irurozqui, *Historia económica de la Guerra Mundial 1939 – 1945*, Editorial Verdad, Madrid, 1945.

4 Bernhard von Lossberg, *En el Estado Mayor General de las Fuerzas Armadas alemanas: informe de un Oficial de Estado Mayor*, Círculo Militar, Buenos Aires, 1951.

5 A. J.Barker, *Pearl Harbour*, San Martín, Madrid, 1975.

6 Robert Goralski, Russel W.Freeburg, *El petróleo y la guerra*, Ed. Ejército, Madrid, 1989.

7 Ana Valle Padilla, *La función estratégica de los recursos energéticos*, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_opinion/2014/DIEEEO51-2014_FuncionEstrategica_AnaValle-Padilla.pdf.

8 Eduardo Giordano, *Las guerras del petróleo : geopolítica, economía y conflicto*, Icaria, Barcelona, 2003.

price on the international markets, or selective supply cuts, real or in capacity, which have been factors taken well into account, not only during the conflicts themselves but also in the international community's perceptions of and reactions to such conflicts. There is no better example than the current Ukraine crisis to illustrate this phenomenon.

It could even be stated that a certain degree of psychosis has taken hold, whereby crises or conflicts whose actual impact on the energy marked is limited, clearly coupled with the circumstances inherent to the market itself, have given rise to disproportionate price rises, such as the aforementioned ones of 1973-1974, where the price of crude oil rose suddenly from 12.38 to 39.27$,[9] or the continuous increase that took place between 2000 and 2008, during which the price went up from 20 dollars to over 100 dollars[10]. These are all chapters that have often harmed domestic economies, especially those of major importers, such as Spain.

However, the price of oil as a weapon can have another side to it. The drop in the price of oil from around 105 $/barrel at the end of June 2014 to 81.78 $/barrel by 15th October in the same year,[11] is generally explained by the joint effect of two undoubtedly influential circumstances. These are related to the gradual increase of United States production thanks to the new extraction techniques, and the production surplus in the OPEC countries, led by Saudi Arabia, which itself is a consequence of the economic slowdown affecting major importers, mainly China and the European Union.

The impact of the price lowering, apart from being an opportune lifesaver for many world economies, revolves mainly around the sudden reduction in income obtained by the exporters. As a result, economies that are highly dependent on this income are so badly affected that the situation could have a negative impact on their political stability or even the survival of the system. Saudi Arabia itself has to balance up its fiscal accounts with a price of around 90 $/barrel,[12] so the fact that it is currently disposed to overproduce cannot be attributed exclusively to economic factors, the main reasons being geostrategic.

And the fact of the matter is that, at present, the big losers calling the greatest attention in the international strategic panorama are the Governments of Iran, the great regional adversary of the Saudis, Venezuela –so much close to Iran –

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9 Price in 1999 constant dollars, Energy Information Administration.

10 Martín Ortega Carcelén, *Geoestrategia del petróleo: un factor de riesgo*, RIE, 2013, http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/dt15-2013-ortega-geoestrategia-petroleo-factor-riesgo.

11 Energy Information Administration, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RCLC1&f=D, queried on 20 October 2014.

12 Gal Luft, *W ¿Qué significa el auge de la energía estadounidense para oriente Medio?*, The Geopolitics of Energy, Vanguardia Dossier nº 53, October-December 2014.

and the Russian Federation. Notwithstanding that lower prices could also have a discouraging effect on North American extractions by fracking, as they require a relatively high price to make them profitable, plus of course could have a negative effect on the domestic economies of all the oil exporters, it would appear that at this stage considerations of a geostrategic nature could be prevailing on the market.

To be specific, according to experts like Faraco,[13] The Venezuelan Government is unable to sustain its policy of subsidies with prices lower than 120 $/barrel. That is why it tried, unsuccessfully, at an ordinary OPEC meeting on 27th November 2014, to convince the other members to cut back production and put oil prices up again, in much the same way that similar demands from Caracas to hold an earlier extraordinary and urgent meeting had failed.

However, it must be pointed out that should this situation continue and the low oil price cycle last for a considerable time, Iran and Russia might be the countries that find their interests damaged in the long term, in the latter case because Russia's relative recovery on the international scene has been based almost exclusively on the high price of the oil it exported in the previous decade.

One may well ask if, beyond the more or less effective coercive actions of an economic nature taken mainly by the United States and the EU against Russia, as a consequence of the latter's intervention in Crimea and Ukraine, might this sharp drop in prices, with Saudi Arabia and its strategic alliance with the United States – in spite of temporary disagreements – as the axis around which the system revolves, not be the genuine and really damaging sanction against Russia, whose return as a major global force seriously worries the Western block and constitutes a major challenge, in the words of the new Secretary General of NATO, Jens Stoltenberg.[14]

This attack on the Russian economy's real centre of gravity is amplified with different consequences, such as the 29.5% fall at the Stock Exchange between January and November 2014[15] and the fall of the ruble against the dollar and the euro. Therefore, the arms that to a large extent would appear to be used to combat those numerous Russian mechanised battalions concentrated on the frontier with Ukraine, seem to be mainly the economic sanctions and the somehow agreed changes in the price of oil.

However, these arms, just like any others, have to be used carefully and with common sense, avoiding to go so far that they become counterproductive causing Russia to take actions that involve high risks to all concerned. A long-term,

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13 Alfredo Meza, *La caída del precio del petróleo agrava la crisis económica de Venezuela,* El País, 17th October 2014.

14 Brooks Tigner, *Islamic State, Russia form NATO's greatest challenges, says new Secretary General*, Jane's Defence Weekly, 6th October 2014.

15 Pedro Calvo, *El hundimiento del rublo y del petróleo amenaza la estabilidad financiera de Rusia,* El Confidencial, 7th November 2014.

consolidated strategic and military alliance between Russia and China could go well against Western interests. This is more especially so for Europe, because it is much weaker than the United States from a political and military viewpoint, not only at present but also in the foreseeable future, with a Common Security & Defence Policy that for several decades has not been advancing at the rate that would be necessary.

Whatever the case may be, what seems to be clear is that the aforementioned two-way bridge connecting cause, effect and concurrence between energy in general, especially hydrocarbons, and situations of instability, crisis and war, does not appear to leave scope for too many doubts.

Under this background, it is hardly surprising that the situation in the Middle East, where the state of conflict both current and potential is very high, is a cause of great concern to the international community, which would find itself greatly damaged if the situation were to get any further out of control and the vital production of hydrocarbons by the countries in that region were to be altered significantly and for a prolonged period, truncating numerous nations' slight prospects of economic recovery and, all in all, global economic recovery.

As a result, it would seem logical, in the second volume of this collection, to pay attention to how the Middle East conflict might develop and its potential impact on the international energy scenario.Whether we like it or not, the region in the Middle East has become the world's strategic pivot.

A zone rich in hydrocarbons encrusted in a region in turmoil

The huge importance of the region that we generally refer to as the Middle East can be seen by just looking at the list of the world's main hydrocarbon producers. So, from the following table showing the major oil producing countries at present,[16]

it can be deduced that 6 of the top 15 producers belong to the region understudy, specifically, and in this order, Saudi Arabia, Iran, United Arab Emirates, Iraq, Kuwait and Qatar. They account for 38.34% of the oil produced by the top 15 producers.

However, in view of the high domestic consumption of some of the main producers in the above table, for the purpose of this chapter it is more useful to consider the main exporters of crude oil. Following this criterion, the classification varies considerably,[17] to the extent that, on this occasion, out of the 15 top oil exporters, the same 6 countries belonging to the Middle East remain from

[16] Energy Information Administration, http://www.eia.gov/countries/, queried 1st October 2014.

[17] Energy Information Administration, http://www.eia.gov/countries/index.cfm?topL=exp, queried 1st October 2014.

COUNTRY	MILLIONS OF BARRELS/DAY
SAUDI ARABIA	11.726
UNITED STATES	11.119
RUSSIA	10.397
CHINA	4.372
CANADA	3.856
IRAN	3.518
UNITED ARAB EMIRATES	3.213
IRAQ	2.987
MEXICO	2.936
KUWAIT	2.797
BRAZIL	2.652
NIGERIA	2.524
VENEZUELA	2.489
QATAR	2.033
NORWAY	1.902

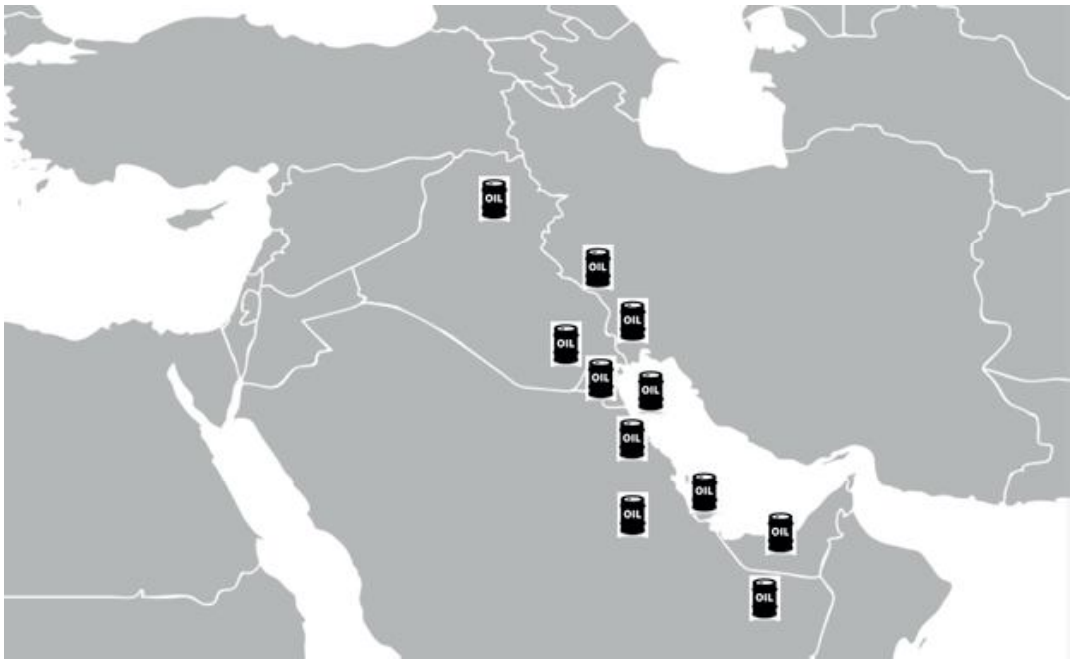
Chart 1.

COUNTRY	MILLION BARRELS/DAY
SAUDI ARABIA	8.865
RUSSIA	7.201
UNITED ARAB EMIRATES	2.544
KUWAIT	2.347
IRAQ	2.247
NIGERIA	2.224
QATAR	1.829
IRAN	1.728
ANGOLA	1.713
VENEZUELA	1.712
NORWAY	1.685
ALGERIA	1.507
CANADA	1.506
KAZAKHSTAN	1.355
LIBYA	1.244

Chart 2.

the previous classification, but their percentage share within the group rises to 49.26%.

Furthermore, if we look at a map of the region showing the zones where the oil extraction wells are concentrated,[18]



Map 1.

it can be seen that, in spite of the presence in the zone of countries of considerable size, not only the oil deposits but also the gas deposits, which are normally close to each other or associated, lie in a much narrower strip, centred on the Persian Gulf waters close to the Shatt al-Arab Estuary, not by chance the scene of the worst confrontations during the Iran-Iraq War[19] between 1980 and 1988.

This seemingly insignificant circumstance, is in fact one of the most important characteristics of the region where energy is concerned. It manifests itself in a clear dichotomy revolving around regional security. On the one hand, the high risk that is invariably involved when there is a concentration of infrastructures and resources to protect, because whenever a destabilising element emerges on the scene, this automatically makes the concentration in question the focal point of the region. To put it another way, any conflict in the zone shown on the map, immediately threatens many other production zones, even if it only occurs locally, so the possibility of it having a negative impact on the global energy market is high.

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18 Map prepared by the author.

19 Ralph King, Efraim Karsh, *La Guerra Irán – Irak*, Ministry of Defence, Madrid, 1989.

It was the invasion of Kuwait in August 1990 that, although initially limited to this small State, seriously threatened the Saudi wells literally located within reach of Sadam Hussein's army.[20] And the same applies now in the case of the recent appearance of the Islamic State (ISIS) in North and Central Iraq where, should they manage to control the south of the country as well, would directly threaten the Saudi and Kuwaiti wells.[21]

On the other hand, though, it is just as true to say that the same characteristic described in the preceding paragraphs, which we could refer to as high energy density in the Persian Gulf, facilitates the tasks of surveillance, protection and, if necessary, defence. This is the only reason for the display of different military bases, not only from the countries in the zone, which is natural, but also by international powers with global interests.

Furthermore, and despite the concept not being very well accepted these days, at least in the Western World, perhaps more as a result of a dialectic focused on dialogue and an image distorted by an unjustified optimism where international relations are concerned, it is a fact that the region as a whole, especially the zone rich in hydrocarbons, is fractured by a line of historical tension.

This geopolitical fault line revolves around the struggles for power and regional leadership, on the basis of the ancient rivalries and mutual confrontations between the Moslem Sunni and Shia communities. It is a sectarian aspect of the regional instability that should neither be magnified nor underestimated, as recent events in the Syrian Civil War or the emergence of the ISIS in Iraq should bear witness.[22]

The Iranian nuclear programme and the inevitable dominoes effect that is to be found at the end of this path form part of this struggle, which if it were to take place would have a greater impact on regional and global security than Teheran actually possessing nuclear weapons. This subject will be dealt with later in greater detail.

Neither does the domestic situation in the countries under study give cause for too much optimism. Most of them either have revolutionary governments, with a certain amount of radicalism in their approaches, both internal and external, or monarchies with varying degrees of politically and social archaism in their domestic dynamics, to a greater or lesser extent at the beck and call of progres-

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20 Antoni Segura, ***Irak en la encrucijada***, RBA Libros, Barcelona, 2003.

21 Francisco J. Berenguer Hernández, ***El Estado Islámico como oportunidad***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA47-2014_EstadoIslamico__como_oportunidad_FJBH.pdf.

22 Several Authors, ***Evolución del mundo árabe: tendencias***, Cuaderno de Estrategia 168, IEEE, Madrid, 2014.

sive political movements that could, when the time comes, constitute a second wave of the so-called Arab Springs.[23]

Furthermore, although these monarchies are largely similar, this does not stop them from being open rivals on occasions, like in the case of the now prolonged political and diplomatic confrontation between Saudi Arabia and Qatar,[24] undecided about whether to support or reject what the Muslim Brotherhood stands for, as the most outstanding conflict.

In conclusion, it is a zone that is extremely sensitive for the global economy, under severe risk of nuclear proliferation, where there is a dangerous concentration of resources, a high presence of military forces, that could potentially have a very profound impact on the global economy, a geopolitical fault line that far from being durmant is on the boil and, finally, with a series of political and social developments – not to call them revolutions – to come and one way or another overdue. Now is the time to deal with these questions in detail.

Regional conflicts

The Libyan case

Although the limits established for the different geopolitical regions are always debatable and subjective, it does not seem logical to include Libya as part of the Middle East, which is the scope and purpose of this chapter.

Nevertheless, the case of Libya does constitute a precedent that has many points in common with the region under study, mainly because it is a major exporter of hydrocarbons, coupled with the fact that it is an Arab country that developed one of the processes of political transition that, taking place or nominally, are fully present in Middle East. It is worth therefore conducting a brief analysis of what has been happening in this Maghreb country, mainly from an energy perspective.

When the civil war broke out in this country its daily production stood at about 1.8 million barrels.[25] A production level that was higher than the average for the previous decades, established at 1.36 million barrels,[26] which meant that it had recently risen from 19th to 17th position[27] in the world classification of oil pro-

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[23] Francisco José Berenguer Hernández, ***Hacia el nuevo paradigma árabe***, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_analisis/2012/DIEEEA03-2012HaciaNuevoParadignaArabe_FJBH.pdf.

[24] Francisco José Berenguer Hernández, ***Qatar en horas bajas***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA16-2014_Qatar_HorasBajas_FJBH.pdf.

[25] Energy Information Administration, http://www.eia.gov/countries/country-data.cfm?fips=LY&trk=m, queried on 14th October 2014.

[26] Ibídem.

[27] Ibídem.

ducers. All of this meant that Libya was an important player on the international market, of particular interest to certain specific countries, including Spain.

Production logically decreased as a result of the civil war. Proof of this lies in the fact that in 2011, Spanish imports of Libyan oil fell to one fifth of their 2010 level[28]. However, never ceasing completely, Libyan production went back to an average of 1.36 million barrels per day already in 2012.[29]

Paradoxically, it was considerably longer after the end of the war when production started to fall sharply and, at the time of writing this chapter, it remains below its capacity. The cause is clear. The administrative and institutional chaos that the country is experiencing is weakening its production capacity, at risk of if not already on the way towards a process of "Somalization". The recovery observed in the last few months of 2014 is fraught with uncertainty and the outcome is difficult to predict as far as figures to be achieved and validity time period are concerned.

As Fuente rightly points out, the country has entered a perverse downward spiral,[30] which would require a constructive spirit from the national factions that are in confrontation, and this is clearly lacking. In its absence, only a strong and determined intervention from the international community could help to stabilise Libya, but in the immediate future, the situation in areas of the Middle East where energy production is much greater are going to sap the energy and will of the international community, exhausted, impoverished and sated with interminable conflicts.

In fact, the armed conflict, mainly between the two strongest militias that emerged from the war against Gaddafi's regime, the Misrata and Zintan, and their different and circumstantial allies, clearly with opposing interests, threatens to lead to a new generalised civil war.This is at least what the majority of Libyans think and fear when asked if the country is heading for such a war, 64.9% of those interviewed showing great concern over this possibility.[31]

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[28] Martín Ortega Carcelén, ***Geoestrategia del petróleo: un factor de riesgo***, RIE, 2013, http://www.realinstitutoelcano.org/wps/portal/rielcano/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_es/programas/energiacambioclimatico/publicaciones/dt15-2013-ortega-geoestrategia-petroleo-factor-riesgo.

[29] Energy Information Administration, http://www.eia.gov/countries/country-data.cfm?fips=LY&trk=m#pet, queried on 14th October 2014.

[30] Ignacio Fuente Cobo, ***Libia, la guerra de todos contra todos***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA46-2014_Libia_Wartodos_Contratodos_IFC._doc_final.pdf.

[31] Munquith M. Dagher, Main Researcher for Iraq and Libya in the European Commission´s Project "Political and Social Transformation in the Arab World", in a lecture given at CESEDEN, 15th October 2014. Graph provided by Dr. Dagher.

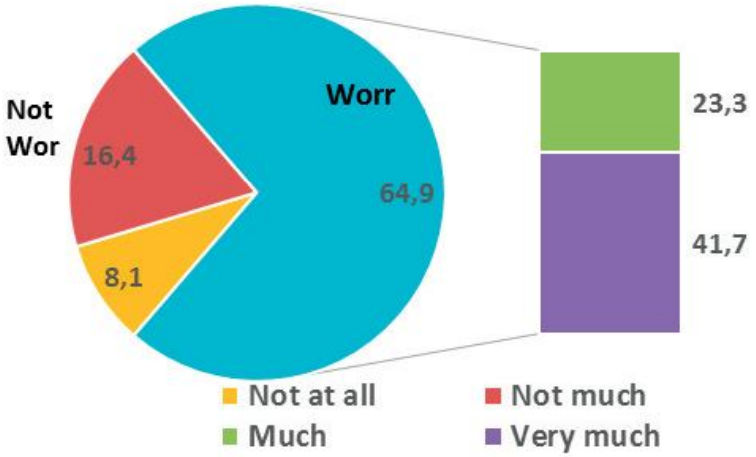

Figure 1.

All in all, figures that generated by those who best know the real situation, the Libyans themselves, witness fickleness and uncertainties of a geopolitical nature that do not bode well with the need for stability and predictability that are required by the markets, companies and governments of the nations that are major importers of hydrocarbons.

The passing of time in the new Libyan crisis merely serves to confirm the above data. A Government that is internationally recognised, yet taking refuge in what is presumably an unconstitutional way in Tobruk, far from the capital, which is largely controlled by Islamic militias. A Government resulting from a Parliament elected on 25th June 2014 and subsequently invalidated by the Supreme Court,[32] that does not only face illegality but is also in conflict with the previous Government, before those elections, setting the stage for a situation close to civil war, further stirred up by the activities of Ansar al Sharia in the east of the country, supported in the form of pro-jihadists abroad, mainly from Sudan, or from detractors contrary to the radical Islamists, Egypt being the main protagonist in this case.

It would come as a surprise to nobody that, as is the case with Syria, the special UN envoy to Libya, the Spaniard Bernardino Leon, target for all kinds of accusations in his role as a mediator and, fortunately, safe and sound after a serious terrorist attack[33] presumably aimed against him or his interlocutor Abdula Tini, may end up throwing in the towel. It goes without saying that he does not have an enviable task, but what is worse, he is also performing a high risk role.

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[32] Javier Casqueiro, *El Supremo libio anula las elecciones que avalaron al último gobierno,* El País, 6th November 2014.

[33] Laura J. Varo, *Un doble atentado obliga a cancelar las conversaciones entre Bernardino León y el primer ministro libio*, El Mundo, 9th November 2014.

Perhaps the only light, from the viewpoint of our interests, that could make the situation brighter, is the fact that the ground forces, albeit involved in a complex "everybody against everybody else" spiral, share a maximum interest in controlling the production and export of the country's hydrocarbons. As a consequence, the benefit, which would lead to obtaining political control over the entire country, lies in conserving the human and material resources that make exploitation of the oil and gas possible, hence a policy of systematically refusing to produce and export hydrocarrbons by either of the sides in conflict would appear to be unlikely.

Only increased control over production by the most radical Islamic factions – the third major force in conflict – could put it at risk, but the recent limited intervention from some regional powers, such as Egypt, Qatar or Arab Emirates,[34] seems to have limited this possibility, while at the same time increased the options of the aforementioned militias, whose interests are basically economic: to make a profit by selling the hydrocarbons from the oil-producing zones under their control.

Whatever happens, the Libyan example shows how the social turmoil in the region under study can lead to a prolonged chaos that has a negative effect on hydrocarbon production and export. It is a lesson that is to be learnt from the one-time enthusiastic western participation in the downfall of Gaddafi, and it has to be well learnt and remembered in the subsequent regional crises yet to come.

The Israel Palestine conflict

Although geographically located in the Near East, the long conflict between Israelis and Palestinians, with its recurrent and periodical confrontations with different degrees of intensity, to a certain extent affects and contaminates Middle East geopolitics. However, its influence on the regional energy sphere is not as great, at least from a direct viewpoint.

From this perspective, Israel appears, since recent times, to be a country with certain exportable energy resources, basically natural gas. Many of the deposits that have been discovered in the Eastern Mediterranean, practically all since the beginning of the century, lie in Israeli territorial waters, such as the Noa, Dalia, Leviatan, Dolphin and Tanin fields, as well as others that might be found in the near future. The off-shore situation regarding the Israeli deposits is that the latter's Navy has sufficient resources to protect the zones where the wells lie, and that the Palestinian factions that are most violently opposed to Israel have little or no naval resources capable of damaging the extraction infrastructure at sea.

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[34] Ignacio Fuente Cobo, *Libia, la guerra de todos contra todos*, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA46-2014_Libia_Wartodos_Contratodos_IFC._doc_final.pdf.

However, it must not be forgotten that as these facilities are fixed and rather large, this makes them exposed to rocket or missile attacks launched from the mainland. The increasing sophistication of the devices available to such groups as Hamas or the Palestine Islamic Jihad, coming from the arsenals captured from Gaddafi's forces in Libya and Asad's forces in Syria, or received directly from Iran, lead one to believe that they could constitute in the future a certain threat to Israeli gas extraction rigs. All the more so if one remembers that these facilities will soon have a major strategic dimension for Israel, which would make them highly profitable targets for that country's enemies.

Within this context, not only Israel's usual information and intelligence tasks but also the role to be played by its *Iron Dome* anti-missile system, with its ability to bring down missiles or rockets even at their launching or initial acceleration phase,[35] will be very important.[36]

Another aspect to be taken into account is the recent and by no means coincidental jihadist maritime "offensive", explained in other paragraphs in this chapter, which brings to light the upsurge in the threat to the energy lifeline that in this case is maritime transport.

Furthermore, the very recent reconciliation between Al Fatah and Hamas[37] opens up a new, and hopefully better, chapter to this conflict. Hope for local distension between the different Palestinian factions, plus the forthcoming elections, should also lead to a period of less tension with Israel, which would mean the path of dialogue and negotiation could have a new opportunity. Within this context, even the exploitation of the deposits found in waters that theoretically belong to the Palestine national entity would be possible, and progress could also be made to construct the complicated regional network of overland piping used to transport hydrocarbons that, in the medium and long term, would help to reduce dependence on transporting energy by sea through the Strait of Hormuz.

However, this would only be possible if the Palestinian reconciliation caused Hamas to make a greater move towards moderation and to abandon its most warlike theses. Otherwise, if this is not the case and the opposite occurs, i.e. the new situation causes Al Fatah to become more radical, new periods of armed conflict will inevitably cloud the Israel-Palestine scenario. In such a context, the above-mentioned attacks on Israeli energy facilities and the pipelines supplying the country's strong demand are more than likely.

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35 Francisco José Berenguer Hernández, *La dimensión estratégica de Iron Dome*, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_analisis/2012/DIEEEA54-2012_DimensionEstrategica_IronDome_FJBH.pdf.

36 Ignacio Fuente Cobo, *La operación "Margen Protector" y la defensa antimisil de Israel*, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA40-2014_Operacion-MargenProtector_DefensaAntimisil_Israel_IFC.pdf.

37 Juan Gómez, *Los partidos palestinos Al Fatah y Hamás anuncian la reconciliación*, El País, 23rd April 2014.

Hazarding a guess as to which side of the scales the mutual influence between Al Fatah and Hamas will be tipped is very difficult, there are two factors however that do not give cause for optimism. The first of these is the undeniable influence of Hamas, in its role as armed opponent of Israel, and its role as the only effective provider of social services[38] among the young citizens of Palestine, large numbers of whom are incessantly reaching the legal age and voting rights.

The second factor is that the fall of the Muslim Brotherhood, with whom Hamas had ostensibly come to terms after the victory of Mursi in Egypt, has reactivated the cooperation of this group with its traditional Iranian mentor, which considerably reduces its ability to manoeuvre towards a moderation that leads it to an improvement in its confrontation with Israel, to the extent that it is making repeated calls for a third *intifada,*[39] although this could be more a means for applying pressure and propaganda for domestic consumption in order to obtain electoral advantages against Fatah, rather than being a real intention.

Nevertheless, even though this apparently never-ending conflict has an effect on regional instability that can either be pacifying or stir up unrest, depending on the degree of activity that is taking place, it is a conflict that is no longer the protagonist that it was in the past. Its importance mainly lies in its ability to mobilise the rest of the Arab Governments in the region, when the Palestinian cause currently seems to be more of an excuse, or even a nuisance, unable to bring about actions or reprisals of note against other nations or governments, as it did in 1973.

The events in Syria and in Iraq, the effects of the Iranian nuclear programme and, last and perhaps more important, every nation's domestic political and social demands and unrest, are all aspects to be taken much more into account that a conflict that, although it is deeply entrenched in the collective Arab mind, seems to attract increasingly less interest where the governments of the region are concerned.

The Civil War in Syria

Although the conflict has a major impact on the country's economy, in contrast to other nations in the region, Syria is not a country that is particularly important as a producer of hydrocarbons. It is far from being a major producer and exporter unlike its neighbour Iraq, currently involved in and heavily affected by the Syrian war from its extension through the activities of the IS.

As is only to be expected, the prolonged civil war has brought about a drastic reduction in Syrian production, which was around 0.4 million barrels/day until

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38 IHS, *Hamas assent to Fatah governing Gaza reflects group's return to resistance, not reduced war risks*, Jane's Intelligence Weekly, 26th September 2014.

39 IHS, *Palestinian Authority opposes Hamas's call for intifada but potential triggers include collapse of security forces*, Jane's Intelligence Weekly, 2nd September 2014.

2010, whereas now the level barely reaches 25,000 barrels/day,[40] which would justify illegally "importing" across the frontier, even of the crude oil sold in this way by the IS from Iraq. So far, gas production has suffered less than oil production, with a reduction of around 50% only.

However, this state of affairs does not mean to say that Syria does not have a role to play in the regional energy scenario. By way of an analogy, the country could be compared to Tunisia as a transit country to Europe from the Maghreb, in the sense that the geographical position of Syria makes it a natural land bridge through which hydrocarbons can be sent to Mediterranean ports, mainly from Iraq and Iran, but also from at least the northern zone of the Persian Gulf monarchies.

The map below serves to illustrate this point. It shows the Arab Gas Pipeline (AGP)[41] that should permanently link Egyptian production with Jordan, Lebanon and Syria itself, plus a subsequent extension to Turkey, but it is subjected to the vicissitudes arising not only from the Syrian war but also the jihadist activity on the Sinai Peninsula and its hinterland.

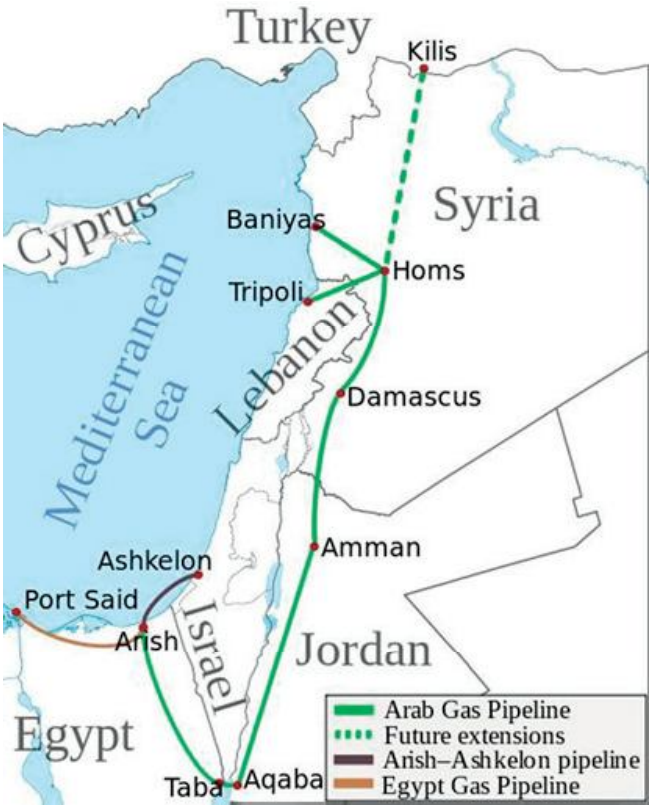

Figure 2.

[40] Energy Information Administration, http://www.eia.gov/countries/country-data.cfm?fips=SY, queried on 25th November 2014.

[41] hydrocarbons-technology.com, http://www.hydrocarbons-technology.com/projects/arab-gas-pipeline-agp/, queried on 25th November 2014.

In the event of a greater regional stability and the pacification of Syria making it possible to eventually establish a closely-woven interconnected network of gas- and oil-pipelines overland, thereby enabling the interested parties to isolate and bypass zones or nations in the region that are in conflict, or, simply to avoid zones where the threat of illegal interference to the transit of products exceeds acceptable limits, great progress would be made in the quest for regional and global energy security.

This possibility, in the light of past, present and probably future events, would become increasingly important in a region where instability is endemic and conflict, far from being likely to decrease or come to an end, merely changes its location from time to time. The situation in Syria before the social and political protests broke out, shortly turning into civil war, was suitable for the country to become the aforementioned land bridge, with sufficient security guarantees.

Establishing of this network, together with similar projects already constructed or to be constructed through Turkish territory, would have made it possible to gradually reduce the amount of risk caused by the Strait of Hormuz bottleneck, this being a subject that will be dealt with in greater depth throughout this chapter.

However, in much the same way as in Libya, the civil war in Syria has caused plans and prospects to be put on hold. This is so because in spite of the years that have passed since the war broke out, the eventual outcome is uncertain, and yet what is even more uncertain is what kind of state the country will be in when hostilities come to an end, at least from their current, highly virulent stage.

The consequences of a military victory for the regime, at present much more likely than unlikely, would strengthen Al Assad's position, establish a Kurdish region with a high degree of self-government, as well as reducing the relative regional dominance of Turkey and Saudi Arabia, to the benefit of Iran and its Lebanese associate Hezbollah, and also the Iraqi Government.[42]

To begin with, such conditions should not be negative for the continuity of the regional networking plans through Syria, amongst other territories. Moreover, the transit charge to be paid to the future Syrian government for allowing energy resources to be transported through the country could be of great help in the long and costly task of national reconstruction, in a country already severely damaged by a war that has lasted several years.

Nevertheless, it must be pointed out that a victory for Damascus would also be a victory for Moscow, because Russia would attempt to capitalise on the fact that it played a major role in supporting the Syrian regime during the war. It is possible that in that hypothetical post-war situation, the Russian Government would try to oppose the regional network running through Syria, because its

[42] Various authors, *Evolución del mundo árabe: tendencias*, Cuaderno de Estrategia 168, IEEE, Madrid, 2014.

presence there could, to a large extent, damage Russian interests by constituting an alternative to the strategically important hydrocarbon pipelines crossing Russian territory.

It is difficult to imagine, however, even in the case described in the preceding paragraphs, that - given the traditional characteristics, as well as the usual courses of action taken by Assad's main adversaries[43] currently composed of the myriad of jihadist groups, differing in size and numbers, that are leading the armed opposition -, the regime will be able to prevent military or terrorist actions that, in the framework of a residual insurgence, could prolong the instability and insecurity in Syria for several more years after the aforementioned hypothetical military victory of the regime. Furthermore, if the worst comes to the worst, the situation could become endemic as it has occurred in neighbouring Iraq and probably spread over the border to Lebanon, where the Syrian civil conflict has already manifested itself,[44] albeit to a relatively limited extent.

This possibility would make it difficult for the pipelines in the aforementioned regional network through Syria to be laid and to operate normally. It is to be noted that, as international companies in the energy sector know only too well through frequent experience, overland oil- and gas-pipelines are highly exposed to the threat of actions from any group determined to reduce or stop their functioning, even in the case of non-violent groups that are just seeking to attract attention to their demands. The threat is obviously much greater from heavily-armed terrorist groups operating within an insurgency framework that could gain access to any point on the pipeline layout. It must not be forgotten that Syria's population live mainly in certain towns and crossing areas, leaving large tracts of sparsely populated land that, as is the case in Mauritania[45] for example, eases uncontrolled armed groups to move freely.

However, as things stand, unfortunately there is no opposition as such in Syria. The confrontation has become extremely complex and quite often turns into situations where everybody is fighting against everybody else, depending on the day. On the other hand, the currently improbable victory of the various groups opposing the Damascus regime does not offer any complete guarantees to the geo-energy interests described. In fact, those interests would be exposed to even greater risks than in the event of a victory for the regime.

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[43] Guillem Colom Piella, ¿El auge de los conflictos híbridos?, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_opinion/2014/DIEEEO120-2014_WarsHibridas_Guillem_Colom.pdf.

[44] Francisco S. Barroso Cortés, , *El Líbano ante el reto de la gestión de una insurgencia crónica*, IEEE, 2013, http://www.ieee.es/Galerias/fichero/docs_opinion/2013/DIEEEO58-2013_Libano_GestionInsurgenciaCronica_Fco_Barroso.pdf.

[45] Pablo Mazarrasa Rodríguez, *Mauritania: ¿otro estado frágil en el Sáhara?* IEEE, http://www.ieee.es/Galerias/fichero/docs_opinion/2013/DIEEEO15-2013_Mauritania_EstadoFallido_PMazarrasa.pdf.

The fact that the opposition is extremely divided and, above all, the undeniably predominant role played by the most radical jihadism in its ranks, leads us to believe that a sudden collapse of the regime, which appeared to be as imminent and likely during the early stages of the civil war as it now seems unlikely, would bring the country close to a scenario very similar to the one in Libya at the moment, in serious risk of Somalization,[46] rather than a return to the country that pre-war Syria was. And it would be even more complex since in the Maghreb country the jihadist militias are just another one of the players, whereas in Syria they are the protagonists in the fight against Al Assad's government. In summary, it is a scenario that is even less advisable than the previous one, as far as international community's energy interests are concerned.

Only a negotiated end to the war, along with an inclusive process of political transition, leaving out only those Jihadist groups that renounce their conversion to a political scenario, and involving as we just said a speeded up process of political transition and national reconciliation – which at this stage of the conflict does not seem easy – could serve to stabilise the country enough to enable it to resume the energy-related projects that are currently suspended.

In spite of the illusory "do-gooding" that might be deduced from the previous paragraph, the prospects of an agreement are probably the only possible option, and this will come sooner or later. The reason, deep down, is very simple.

The geopolitical interests present in the Syrian war, plus their geostrategic management, are so complex and involve regional and global powers that are so important, that none of them can allow the adversary to prevail and their own side to be defeated. In the same way that Russia and Iran are prepared to go to great lengths, which is what they have been doing since the outbreak of the war, to keep the Damascus regime in power, for similar yet contrary reasons, the Gulf monarchies and the United States, once again fully involved after the death of several US journalists at the hands of the IS, cannot afford to let Al Assad's military victory be a resounding defeat for his adversaries, i.e. for themselves and for the side that they supported from the outset, that diffuse hotchpotch known as the Syrian Opposition.

In fact, rekindling support for the virtually disappeared moderate opposition, as a result of the broad international coalition plans to against the IS,[47] is going to mean, or at least should mean, a resuscitation of that moderate opposition and, all in all, a return to a situation of apparent stalemate on the war front. If that were not the outcome, the failure of the Coalition would be clear.

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[46] Ignacio Fuente Cobo, *Libia, la guerra de todos contra todos*, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA46-2014_Libia_Wartodos_Contratodos_IFC._doc_final.pdf.

[47] Burak Ege Bekdil, *Turkey, US Agree to Train and Arm Syrian Opposition*, Defense News, 24 November 2014.

If the balance was redressed in this desirable way, conviction of the impossibility of an outright military victory ought to lead, in the same way that chess players agree to a stalemate after a long game, to the negotiating table. This time though with the will and positive prospects for success, not like in the rounds of contacts already held in Geneva before,[48] to reach a negotiated end to the war.

This is probably the only short-term option that could favour international geo-energy interests and security interests at a time, although one might well ask if the separation between these two concepts is still valid today.

It seems that the situation in Syria could slowly head in that direction, which will only be possible after the work begun in September 2014, when the "acceptable" participants in the war, i.e., the Damascus Regime, the Moderate Opposition and the International Coalition, collaborate in some way, actively or by omission, in the degradation and destruction of the "unacceptable" participants, which are none other han the most extreme Jihadist groups, especially identified in the heart of the Islamic Front, as well as Al Nusra and, of course, the IS.

Peace, and the necessary yet painful agreements between the parties, will only be possible without their presence, while putting those agreements into practice among the population and applying them to the infrastructures in Syria will only be possible within the framework of a peaceful process of political transition.

The war in Iraq and its regional impact

Iraq is quite a different case, because unlike Syria it is indeed a major player in the international energy scenario, being the eighth largest oil producer and the world's fifth largest exporter.[49] Unfortunately, the now endemic instability and periodical conflicts in the country, which has so often slipped into and out of a low-intensity civil war, have finally ended up in an open conflict between the Iraqi State and the IS, allied in a certain way and to a certain extent with the opposition to the Baghdad regime as a whole, mainly composed of Sunni elements and remnants of the Ba'ath Party, once led by Sadam Hussein.

This instability acted in the years before as a deterrent to any foreign investment capable of developing and modernising the national infrastructures so that they could fully exploit Iraq's great energy potential, the country being the fifth proven possessor of oil reserves.[50] As a result, this is one of the clearest examples of the two-way bridge between geopolitics and hydrocarbons to which reference was made at the beginning of the chapter.

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[48] Francisco José Berenguer Hernández, ***Ginebra II***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA10-2014_Ginebra_II_FJBH.pdf.

[49] Energy Information Administration, http://www.eia.gov/countries/index.cfm?topL=exp, queried 1st October 2014.

[50] Energy Information Administration, http://www.eia.gov/countries/country-data.cfm?fips=IZ&trk=m, queried 25th November 2014.

It is difficult to talk about Iraq as one single entity. Although it did manage to acquire a degree of national consciousness and identity, to a large extent it is broken into three political identities, a legacy from the Ottoman Empire, on the basis of which it was originally constituted in the period 1919-1932, the latter date being the official year of independence. In fact, it is the best example of the existence of the geopolitical fault line mentioned earlier. Iraq thus has considerable influence in the Arab world with a Sunni majority, but, at the same time, the country has a Shia majority, where some of the most sacred Shia shrines are to be found, such as the Nayab and Kerbala Sanctuaries. Therefore, the links between Persian Iran and the majority Shia community are close, although this did not prevent the long and lethal war from breaking out between the two nations in the 1980s.

In this confusing environment, the aforementioned sanctuaries are important not only from a religious viewpoint, they are enclaves of a major geostrategic dimension. In fact, the very credible threat issued by the Iranian Government concerning the unimpeded intervention of its army in Iraq, should the advance of the IS enable its forces to amount to a risk to these sanctuaries,[51] is by no means disassociated with the United States' sudden decision to start air attacks in Iraq to contain the IS's advance, at that time still acting solo and in response to the request for military aid from the then Prime Minister Al Maliki, eventually filed months after the political-military situation in the country had made this option one worth considering.[52]

The trilogy that consists of belonging to the Arab geopolitical zone, reflected in the political predominance for several decades of a Sunni minority that was essentially Pan-Arabist, the majority of the population being Shia with links and interests much closer to Persia to the east than the Arab world to the west and, finally, the Kurdish community to the north with the secular project of constructing a Kurdish State together with its own ethnic communities from Turkey, Syria and Iran, all serve to make this country mainly a complex and unstable geo-energy player. As a consequence, it is still far from realising its potential as a necessary and convenient accessory to Saudi Arabia: the axis around which the stability of the oil market rotates.

Iraq ought to become an exporter with considerable spare capacity, so necessary to counteract the oscillations caused by exporting or transit countries when immersed in present or future instability situations. This should be one of the aims of the international energy sector, and more especially the aim of the major oil importers, insofar as the future of Iraq, although the actual situation makes this objective one that might only be obtained in the dim and distant future.

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[51] Amir Abdallah, *Iran deploys military to fight Sunni ISIL insurgents in Iraq*, Iraqi News, 13th June 2014.

[52] Spencer Ackerman, *Obama administration open to Iraq PM Maliki's request for surveillance help*, The Guardian, 1st November 2013.

The Kurdish community's relative *de facto* independence in the northern third of the country, enabling it in recent times to manage on its own the energy resources in the zone, has been replaced throughout 2014 by an all-out war, in view of its parameters and scale, not only in the regional sense but also, and mainly, because of the entity and capacity of the Kurdish people. By stating that they would only carry out armed actions against the IS and its allies,[53] the Kurdish gained credibility from the international community that one way or another is recognising its personality and authority by delivering arms and supplies directly to the Kurdish authorities[54] and not, as might appear logical, to the Baghdad Government.

However, what amounts to a qualitative leap forward in Kurdish self-management, by signing hydrocarbon supply contracts with different international companies,[55] has also proved to be a relatively weakening factor, because it has given the IS a motive for including the Kurdish region and community as one of its targets, and as the latter does not see eye-to-eye with the Baghdad Government, it is becoming the first and easiest target to obtain to achieve the desired economic stability that any state, which is what the IE is attempting to establish and maintain, requires.[56]

It can be stated, albeit on a much lower scale of operations, that in the same way that the oil in the Soviet Caucasus region caused the German OKH to prioritise Stalingrad and Baku rather than Moscow as the main targets in the Summer of 1942,[57] at the beginning of 2014, the IS leaders established their targets as Mosul and Erbil, instead of setting their eyes on Baghdad, which would have apparently been much more consistent from a political perspective. It is only to be hoped that, as was the case with Germany then, this error that involves putting economic objectives before political ones, when the war is in essence a political act, extremely complex yet political, will sow the seeds of the eventual defeat of what the IS stands for right now.

When the war ends, or at least when the threat that the IS is posing onto the Kurdish territory in Iraq subsides, it will be difficult to reverse the situation, because this, together with the role played by the Syrian kurds in that war and the

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53 Jackson Diehl, ***The Kurds' lonely fight against the Islamic State***, The Washington Post, 23rd November 2014.

54 Sabine Siebold, ***Germany to send Iraqi Kurds enough weapons for 4,000 fighters***, Reuters, 31st August 2014.

55 Walid Khoudouri, ***Kurdistan Region challenges Baghdad with oil exports,*** Al Monitor, 20th July 2014.

56 Francisco J. Berenguer Hernández, ***El Estado Islámico como oportunidad***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA47-2014_EstadoIslamico__como_oportunidad_FJBH.pdf.

57 War memoires from numerous 2nd World War German High Command Chiefs, especially ***Panzer Leader*** by Heinz Guderian and ***Lost Victories*** by Erich von Manstein.

increase in the tensions between the Kurdish community in Turkey and Ankara Government, will leave the Kurdish question as one of the major regional issues remaining from the current wars in Syria and Iraq. It must be noted that although the war in the north of Iraq is going to weaken the Kurdish Community's military capacity and badly damage its infrastructures, its nationalistic aspirations will be greatly enhanced and reaffirmed in the face of the evident weakness of Iraq to show itself to be one single and indivisible State.

Along the same lines, in spite of the excellent relations between this Community and the Turkish Government in recent years, in an apparently contradictory Turkish stance, aimed in reality at undermining the relative influence within the Kurdish National Movement of the members of this ethnic group living in Turkey, Ankara's attitude in the trans-frontier war conflict midway between Syria and Iraq, and especially Ankara's attitude versus the IS's siege of Kobane,[58] is going to make it more difficult to reconstruct those relations in the short term. The Turkish blockade of Kurdish reinforcements heading for that badly punished city has reopened and deepened the historic wounds that confront Turkey with the stateless Kurdish Nation. Turkey's modification of its stance, after strong pressures,[59] enabling Kurdish reinforcements to reach Kobane over Turkish territory, has probably come too late.

At present, when the Coalition's airborne bombardments seem to be beginning to weaken IS's military capacity, thus enabling the Kurds, the Shia militias and the Iraqi Army to gradually regain territory, the Kurdish cause appears to be the one that has triumphed in the conflict in this region, to the detriment of both the future role of the Iraqi Government and the role played by Turkey, whose attitude throughout the crisis has somehow caused a deterioration in its relations with its European and United States allies.[60]

In any case, if peace, albeit only relative peace, were to reach the north of Iraq, this would undoubtedly be beneficial to the energy sector, but a restructuring or readjustment of the main local players could all too easily occur, so the international companies in the sector should remain on their guard.

The other hydrocarbon-producing zone in Iraq is very different. Mainly inhabited by Shia Arabs and with its capital in Basra, IS's advance towards it was, for two basic reasons, the red line that prompted the international community to mobilise against the jihadist army. The first reason is perhaps the most interesting from the viewpoint of this book, because should IS have managed to simultaneously control hydrocarbon production in both the south of the country

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58 M*eysa Abdo, A Town Shouldn't Fight the Islamic State Alone, Turkey's Obstruction of Kobani's Battle Against ISIS*, The New York Times, 28 October 2014.

59 Associated Press, *Syrian rebels enter Kobani from Turkey border crossing*, Fox News, 29 October 2014.

60 Yaroslav Trofimov, *Turkey's Influence in Middle East Ebbs*, The Wall Street Journal, 31st October 2014.

and the north, it would have become a player, unwanted yet a protagonist, on the international energy stage. Moreover, this would also have put within its reach the Kuwaiti and Saudi oil wells, even if only to carry out specific destructive actions that would help to increase the relative percentage of production under its control.

The second reason is that, very clearly in this case, the IS would have been able to rely on a very secure base on which to settle economically, thus making its project potentially sustainable.

These two factors would jointly have made the IS a major international energy player, not only as a necessary supplier, but also as an entity capable of considerably damaging the international market, causing or threatening to cause significant damage to the world economy. This could have to a certain extent implied tolerating its existence, so that many governments might have turned a blind eye to the way IS governed, accepting a situation similar to the one in Afghanistan when it was controlled by the Taliban from 1996 to 2001.

Such hypothetical acceptance would have been a major error, because accepting the presence of such a group in the so often cited centre of gravity of the Shatt al-Arab Estuary, would have amounted to consolidating the instability and the permanent threat of international terrorism, on a much larger scale than at present, affecting a large percentage of the world's oil and gas.

Fortunately, the combination of Iranian and Western interests, together with those of other major energy importers such as China and India, and of numerous nations affected by the jihadist boom in recent decades, like Russia or China itself, plus the worst affected countries in the region, such as the Gulf monarchies or the countries in direct conflict, Syria and Iraq, made it possible to reach a practically unanimous international decision, aimed at turning the IS into a short-term jihadist revolutionary attempt, at least at its current feature of territorial control, as it will probably occur in the near future. However, its existence may linger on for much longer as a more "traditional" terrorist group.

The threat to the energy infrastructures posed by surviving members of the defeated Islamic State as a pseudo-state and jihadist army must be stressed at this point. In this sense, actions aimed at destroying those facilities on a regional level, i.e. at the heart of the conflict, cannot be ruled out. However, locations far away from the conflict or even in our country might be targeted too, either by local terrorist cells or by veteran jihadists returning from the Syria-Iraq front, and these would probably be even more dangerous that the former.

These survivors from the up to 4,000 Europeans who enlisted at the current phase of the IS spearheaded jihad,[61] could play the same role as the one played once by the anti-soviet non-afghan Mujahedeens, who were the real driving

[61] IHS, *Nearly 4,000 European fighters swell Islamic State´s ranks spurring concerns about terrorism in Westerns countries*, Jane´s Terrorism and Insurgency Monitor, 19th December 2014.

force behind the wave of terrorism in the first decade of the 21st Century, the period with the highest number of terrorist attacks in Muslim and Western countries, including Spain.

Ultimately, save for that reservation, what the international community is doing right now, not alone yet playing the main role, is to guarantee, throguh action from some of its members and by consent from others, the production of Middle East hydrocarbons, ensuring they are available on the market. Only rarely has it ever been possible on an international level to obtain a common position, qualified by many but essentially a general consensus, about any other subject, which merely serves once again to reaffirm the original theory that is postulated by the collection of which this publication forms part, that it is none other than energy and geopolitics are indissolubly linked.[62]

Relative stability in the region, with a reasonable end to the wars in Syria and Iraq, should be achieved as a continuation of this current initiative against international jihadism, which has become the main protagonist in both conflicts. Only then will it be possible to go ahead with the regional network of pipelines, essential for everybody's energy security.

Iran and its peculiarities

Iran's importance on the international energy scene hardly needs to be mentioned in a publication of this nature. All that has to be remembered is that the country occupies fourth place in the world where proven oil reserves are concerned, and is second in the case of natural gas reserves. However, this does not mean that Iran's energy sector is going through its best moments, because the economic sanctions applied as a result of its military nuclear programme have caused sufficient damage not only to its production capacity but also, and mainly, to its ability to develop projects aimed at enlarging, improving and interconnecting its energy infrastructures.

A drop in foreign investment for the above-mentioned reason, already complex due to the national legislation in this field, is causing, perhaps as the most outstanding example, the hydrocarbon prospecting and production in the Persian portion of the Caspian Sea to come to a virtual standstill, an activity supposed to be supplementary to the traditional activities of this nature in the waters of the Persian Gulf and its vicinity.

The reason for all this damage, not only to Iran as a producer but also to the international energy market – it must be remembered that Spain was one of the countries most affected by the implementation of the Iranian products embargo

[62] Francisco José Berenguer Hernández, *Consideraciones geoestratégicas y geopolíticas en torno a la energía*, en Energía y Geoestrategia 2014, IEEE, Cuaderno de Estrategia 166, Ministerio de Defensa, Madrid, 2014.

–, is none other than the prolonged controversy and crisis brought about by the aforementioned Iranian nuclear programme.

After countless rounds of conversations and more or less warlike statements made by both sides, the final episode is highly significant. Towards the end of November 2014 the representatives of the P5+1 Group (United States, United Kingdom, France, Germany, China and Russia) failed once again in the trite nuclear negotiations with Iran. The official announcement set the date for a new meeting on 30th June 2015.

Although it is true to say that President Rohani also failed in his bid to get the sanctions lifted or at least softened immediately, he claimed to be satisfied because he had noticed that his adversaries were convinced of the need to lift those sanctions in the near future.[63] However, this message, to a large extent aimed at the Iranian people, who are increasingly suffering from the effects of the sanctions in their own domestic economy, does not show the main trump card obtained by Iran in this failed round of negotiations, which is buying time.

It must not be forgotten that, although the Iranian regime is markedly conservative in many questions, it is also revolutionary, its policies being imbued with a degree of determination that is absent in many of the most active nations among the international community, mainly in Europe, and that, regardless of cosmetic changes such as replacing the previous leaders that were decidedly defiant with others who are more refined, the national objective to protect the revolution – including its potential expansion, i.e: equipping itself with nuclear arms or, at least, the possibility of constructing them in a short period of time, has not wavered at all.

The time to oppose this reality would appear to have already passed. Although the military option was considered at the time,[64] mainly by the United States and obviously Israel, they either refused to use it or were unable to use it, relying exclusively on negotiations and sanctions intended to prevent Iran from becoming a nuclear power. The Iranians' great diplomatic skill coupled with the determination driving the country's authorities meant that this decision was tantamount to accepting the fact that Iran would soon be joining the limited number of powers actually or potentially in possession of the atomic bomb.

In this sense, given the regional conditions, there is no reason why such acceptance should necessarily be branded as negative as is often considered. Faced with the regional presence of Israel, which is not formally recognised as a nuclear power either, brings about a situation of mutual deterrence, in the classic sense of the term, in an approximately similar way to what happened earlier

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63 Ángeles Espinosa, *La negociación nuclear con Irán se prorroga hasta el 30 de junio de 2015*, El País, 24th November 2014.

64 Mario Laborie Iglesias, *Beneficios y costes de un ataque militar contra Iran*, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_informativos/2012/DIEEEI61-2012_Beneficios_Costes_AtaqueMilitar_Iran_MLI.pdf.

with Pakistan and India. In this latter case it must be remembered that, although it did not lead to the normalisation of relations, it is equally true to say that a series of conventional wars were prevented that have threatened to engulf the two countries every few years.

The main problem over the next few years could come from the reactions of other regional powers, the famous "dominoes effect".[65] Indeed, the potential benefits of a mutual deterrent between two nations or blocks could be reduced by a similar situation if it affects several sides, since in that case it would be more difficult to maintain a security balance between the various nuclearized players.

Therefore, although it might appear paradoxical at present, maybe the greatest regional challenge in the future, where the military nuclear dimension is concerned, lies in making the greatest efforts to prevent other nations in the area from feeling the pressing need to act as a counterweight to Iran with their own military nuclear programmes. The country that could be the greatest cause for concern is Saudi Arabia, confronted with Iraq in a long regional struggle, not only in the classic fight for power but also for ideological, religious and ethical reasons, not to mention its excellent position on the world energy scene.

Perhaps only by providing an unequivocal security umbrella to protect the regional powers that could find themselves affected by Iran's nuclear status, mainly Saudi Arabia, but also Turkey and Egypt, and maybe others, will it be possible to deter them from setting off down the nuclear path. Unfortunately, it should not be forgotten that neither the West as a whole, nor its absolute leader, the United States, have been sending unequivocal signals in any particular direction for a long time.

The half-heartedness with which the International Coalition is reacting to the threat posed by the Islamic State, in spite of the virtually unanimous international reaction concerning the need to put an end to its atrocities, is not a good signal to the elites in the aforementioned nations, because it could serve instead to further convince them of the need to take control of their own security, even by means of nuclear deterrents.

In conclusion, and now with specific reference to the energy sector, the time seems to have come to start planning and programming how to go back to square one with Iran, adopting a realistic and pragmatic position, and allowing that country to resume normal diplomatic and commercial relations with the international market. That is to say, why not embark on a new phase in our relations with Iran, different and less conflicting? We must not forget that, just like the choice for the transit of hydrocarbon pipelines between Russia and Turkey is a zero-sum game, renouncing to a supply from Iran to a great extent amounts to the same zero-sum game with respect to the Gulf monarchies that, geopolitically overpowered by this circumstance present disadvantages of a different and opposite kind when compared to Iran, but disadvantages nonetheless.

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[65] Several authors, *Panorama Geopolítico de los Conflictos 2012*, IEEE, Madrid, 2014.

The Hormuz Question

Iran's position overlooking the Strait of Hormuz is by no means the least important of the country's peculiarities, this being worth a separate chapter. The regional importance and, hence, the global importance of the maritime transit of a large percentage of the hydrocarbons produced and exported to third countries through the Strait of Hormuz can be deduced by merely glancing at the region´s map at the beginning of the chapter. As much as 35% of the oil transported by sea necessarily has to pass through this maritime bottleneck, a figure that amounts to 20% of the world's daily trade of oil,[66] plus the ever more important gas carriers, becoming increasingly used and even more vulnerable than oil carriers, the Straitconcentrates in a very limited space a merchant traffic flow that is essential for the world economy.

As this question has been dealt with so often, instead of discussing the importance of its closure to the merchant traffic here, even in a partial mode, the likelihood of this actually happening will be reviewed.

A series of geographical, political and historical factors have combined to ensure that the waters in the Strait belong to two countries, not one. In fact, after territorial waters were generally extended to 12 nautical miles, the Strait, which is 20 miles wide at its narrowest point, became part of either Iranian or Omani territorial waters. Furthermore, as Carballo[67] advises clearly, this circumstance does not mean that third parties' right of passage is subject to the political will and in the exclusive hands of the two States, in view of the existence of the internationally recognised "innocent passage" and "transit passage" concepts.

Consequently, closing the Strait, as Iran has threatened to do so often, could only be carried out by this power in flagrant breach of international standards and customs, or at least that is how it would be perceived by the nations most affected, and of course by Oman's sovereignty. In practice, apart from an exhaustive exercising of its Navy's right of boarding, which although only affecting a part of the traffic would undoubtedly obstruct and slow up navigation, triggering international disapproval and potential sanctions, only a determined Iranian military intervention would manage to cause the blocking of the Strait.

Such a situation came as close as it has done to date in 2012, when, coinciding with rumours of a potential Israeli preventive attack and perhaps a US attack on Iranian nuclear facilities,[68] the Iranian army carried out the Velayat 90 mili-

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66 Energy Information Administration, http://www.eia.gov/todayinenergy/detail.cfm?id=4430, queried 21st October 2014.

67 Alejandro Carballo Leyda, ¿Puede Irán cerrar el Estrecho de Ormuz? algunas cuestiones jurídicas, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_opinion/2012/DIEEEO14-2012_CerrarEstrechoOrmuz-CuestionesJuridicas_Carballo.pdf.

68 Michael Eisenstadt, Michael Knights, *Iran's Likely Responses to an Israeli Preventive Strike*, The Washington Institute for Near East Policy, Policy Notes, nº 11, june 2012.

tary exercises, aimed specifically at finding out what military actions would be necessary to block the Strait of Hormuz,[69] backed up by fiery statements from Iranian members of parliament predicting the immediate and actual implementation of such measures.

Yet if the Iranian threats at that time of maximum tension were, as was to be demonstrated in the following weeks, more for the benefit of domestic consumption than anything else, the current threat of a blockade is even lesser. There are several reasons for this, all being relevant.

First and foremost, fortunately the architecture of the regional energy infrastructures is such that exports by sea via Hormuz are at least as important to Iran itself as they are for the rest of the region's exporters. In fact, Iran's oil wells lie close to the bottom of the large sack that constitutes the Gulf, to the west of the country, the oil- and gas-pipelines on Persian territory not being in any way sufficient to position the loading points on Iran's east coast, i.e., beyond the Strait of Hormuz and in a more open zone of the Arabian Sea. Thus many of Iran's own vital hydrocarbon exports, which bolster its ailing economy,[70] also have to pass through Hormuz.

Secondly, and this is directly related to the first factor, one could think how wrong the first argument might be, because the Iranian military resources would be perfectly capable of allowing safe passage to the maritime traffic of interest to its own country and not permit any other traffic. However, such an attitude, which would be what could be termed a "conventional" blockade, would be brief. Leaks, possibly biased, to the New York Times revealed on 13th January 2012[71] how President Obama, who was concentrating at the time on a process of terminating the conflicts in which the United States was involved, had unofficially warned the Iranian Authorities that the much –heralded blockade of Hormuz was unacceptable and would have given rise to an automatic military response from North America to re-establish unimpeded transit passage through the Strait.

It is not difficult to predict that such an attack would be able to count on the support and immediate participation of the Gulf countries whose exports were affected, European powers that import large amounts of energy and the at least tacit acceptance of the establishment of an International Anti-Iranian Coalition, if not direct participation, of Far East nations that, whether or not in collusion with the North American international initiatives, would also find themselves affected by such Iranian action, given that they would be deprived of their essen-

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[69] Francisco José Berenguer Hernández, ***Fintas y amenazas en Ormuz***, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_analisis/2012/DIEEEA08-2012_FintasyamenazasenOrmuz_FJBH.pdf.

[70] Erica S. Moret, ***Humanitarian impacts of economic sanctions on Iran and Syria***, European Security, 2014.

[71] Antonio Caño, ***Obama da un ultimátum a los ayatolás***, El País, 13th January 2012.

tial energy imports. In fact, most of the oil tankers that leave the Gulf via Hormuz nowadays head for China, as well as India, Japan and South Korea.[72]

As a consequence, it is highly likely that Iranian naval aviation resources and artillery ranges or anti-ship ballistic missile ranges would soon be either severely damaged or totally destroyed. Iran would then only have alternative means for continuing a hypothetical blockade of Hormuz, such as placing shipwrecks to make navigation difficult and, above all, the indiscriminate use of marine mines, which would affect its own ships as well as enemy vessels. Even attacks at the narrowest points using sophisticated naval devices equipped with explosives would potentially damage Iran's own navigation, as well as heavily polluting its own coastline.

Thirdly, apart from the self-inflicted economic damage and the probable loss of most of its air and naval power, the Iranian regime would also have to accept the internal political consequences not only of a radical worsening of its international relations but also of its domestic economy, as well as a likely military defeat on a grand scale. Such occurrences, happening all at the same time and in the same place, could be enough to make the regime teeter, perhaps to the extent that its survival as the political system governing Iran could be toppled.[73]

These reflections, made about two years ago by the author are still totally valid. The same applies to the evident conclusion concerning the more than improbable Iranian action of closing the Strait of Hormuz on its own initiative, which is now backed up for other additional reasons. One of these is the way the crisis triggered by the Iranian nuclear program – potentially with military purposes - has developed; it is currently at a point of relative *détente* when compared to the situation a couple of years ago, as has already been stated.

In fact, the aforementioned conversations between the Iranian authorities and the P5+1 Group, together with partial cessions by both parties, have lessened the tension at present, making radical actions by either party much less likely. The problem has not been solved, but at least time has been gained and the warmongering pressure has decreased.

Furthermore, the sudden and strong appearance of the IS on the regional scene does, to a certain extent, place Iran, at least momentarily, on the side of the interests shared by the United States, the Sunni monarchies in the Gulf and the European powers. The greater of two evils that the jihadist caliphate appears to represent, has undoubtedly contributed to virtually ruling out the possibility of Iran taking unilateral actions against maritime traffic, if ever it was a real threat.

The most likely conclusion is that Iran would only attempt the blockade on Hormuz in response to an external preventive aggression against the great national

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[72] Up to 85%, Gal Luft, *What does the United States Energy Boom Mean to the Middle East?*, The Geopolitics of Energy, Vanguardia Dossier no 53, October-December 2014.

[73] Ibídem.

nuclear project, taking a desperate course of action aimed at saving the regime, in an attempt to appeal to internal ultranationalism and to turn the international community against the hypothetical aggressor.

Nevertheless, facing this possibility, as well as Iranian interest in displaying its ability to damage world economies, in itself a trump card that Teheran has up its sleeve, Iran keeps equipping itself with high-performance equipment, as is demonstrated by the recent coming into service of the Khalij Fars anti-ship missiles[74], which amount to a qualitative leap forward in the military capacity of its army pursuant to carrying out naval attacks with a likelihood of success.

Fortunately such a possibility of a preventive attack against Iran, which was probably discussed by the maximum Israeli and North American authorities in the recent past, as has already been mentioned, seems increasingly unlikely, so any future attempt to blockade Hormuz must currently be regarded as improbable or highly improbable.

Egypt, the Suez Canal and the Gulf of Aden

Apart from the above-mentioned main regional maritime bottleneck, it is also advisable to briefly refer to the destination of this traffic that after passing through Hormuz branches off into two main routes. The main route leads to Eastern Asia, and roughly triples the amount of traffic heading for the Mediterranean,[75] via Suez, which is the second route. However, although it is the second one from a quantitative perspective, it is for Europe and specifically for Spainof considerable importance.

A cause for deep concern for many years has been the reappearance of the piracy phenomenon in the Western Basin of the Indian Ocean, especially in the geographical funnel that leads to the Strait of Bab-el-Mandeb and the entrance to the Red Sea; however the incidents where the pirates have managed to carry out their activities successfully have greatly decreased.[76]

The suitable measures taken, basically a naval aviation display with numerous resources and troops, both at sea and on land bases close to the pirate attack scenarios, aimed to guaranteeing unimpeded maritime transit, but also a very appreciated legal reaction after the initial stupor caused by the unexpected revival of an illegal activity that had disappeared from many national penal

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[74] Jeremy Binnie, Daniel Wasserbly, ***Pentagon report says Iran is fielding anti-ship ballistic missiles***, Jane's Navy International, 9th September 2014.

[75] Energy Information Administration, http://www.eia.gov/todayinenergy/detail.cfm?id=330, queried 3rd November 2014.

[76] International Maritime Organization (IMO), ***Piracy & armed robbery against ships in Asia***, 4-monthly reports available for consultation at http://www.imo.org/MediaCentre/HotTopics/piracy/Pages/default.aspx.

codes,[77] have jointly managed to reduce the threat to acceptable limits, although it has not disappeared completely.

The same could also be said about the other major compulsory passing point for vessels coming from the Arabian Gulf, which is the Strait of Malacca. For reasons at times somewhat different from those announced in Aden, regional initiatives such as the *Regional Maritime Security Initiative*, the *Cargo Security Initiative* and the *Proliferation Security Initiative,*[78] have likewise served to ease the piracy pressure in the zone, largely normalising the traffic of hydrocarbons to the Far East.

However, it must be remembered that the chance of a terrorist attack anywhere on the possible routes, especially from the southern shores of the Gulf of Aden and from Yemen itself, is still a possibility to be taken into account. The Somali jihadist groups, with Al-Shabab at the head, and the Yemenis with the prominence of Al Qaeda on the Arabian Peninsula, also known as Ansar al-Sharia,[79] may have the ability to plan and carry out actions that, disguised as just other attempts of piracy, are in fact lethal attacks of a jihadist nature.

These narrow stretches of water, surrounded either by fragile States or ones that have virtually disintegrated, are more likely to be the locations for housing attempts of this nature than the waters of Hormuz, whose shores belong to stronger States much more capable of preventing this type of attacks from being organised and performed. The joint force of the remaining pirates - liable to resurge should the successful naval aviation protection of the merchant ships be reduced or relaxed -, coupled with potential terrorist attacks from the very unstable Somalia or the only slightly more stable Yemen,[80] at serious risk of an open civil war, makes it advisable to retain the effective albeit costly efforts that the international community still procure in the zone. It is difficult to know how long it will be necessary to carry on displaying the forces of protection and escort in the zone, but the period concerned ought to be linked only to a substantial improvement in the political conditions and the fight against terrorism on both shores of the Gulf of Aden.

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77 Manuel Marraco, *Condenados a entre ocho y 12 años los seis piratas somalíes que intentaron asaltar el buque 'Patiño'*, El Mundo, 30th October 2013.

78 Natividad Carpintero Santamaría, *Seguridad energética en el suministro de petróleo y gas natural: factores de vulnerabilidad y nuevas rutas de abastecimiento*, IEEE, 2013, http://www.ieee.es/Galerias/fichero/docs_trabajo/2013/DIEEET05-2013_Seguridad_Energetica_N.Carpintero.pdf.

79 Jesús Alonso Blanco, *Al Qaeda en la Península Arábiga*, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_investig/2014/DIEEEINV01-2014_Al_Qaeda_PeninsulaArabica_JesusAlonsoBlanco.pdf.

80 Frank Gardner, *Yemen at risk of civil war, says ambassador*, BBC News World, 24th October 2014

Let us not forget that, in the struggle currently taking place between the IS and Al Qaeda for the world supremacy of jihadism,[81] an action of this nature, undoubtedly having a great media impact, carried out by a group participating under Al Qaeda´s flag, currently at a disadvantage to the IS, would help the organisation run by Al Zawahiri to regain the prominence it used to have. This aspect of international jihadism's internal dialectic must not be underestimated or forgotten, because it could be a source of motivation, perhaps temporary, yet lethal in each case.

A communication pointing in this direction was issued by Al Qaeda in November 2014, appearing in its digital journal in English "Resurgence". It called on its followers to increase their efforts to attack oil and gas tankers, marking to the local jihadist groups Suez and the Gulf of Aden[82] as the best places to carry out these attacks, although the Strait of Gibraltar was also indicated as a priority target this being of special interest to Spain.

In fact, at the 4th Conference on Piracy held in October 2014 in Dubai, the Arab Emirates Foreign Secretary stressed the importance of keeping all the current surveillance, because there were signs that the aforementioned jihadist rivalry, plus reasons of an economic nature, were driving the IS to get involved in the piracy business, possibly via agreements with Al-Shabab.[83]

As has already been pointed out, the next landmark for hydrocarbons on their way to the Mediterranean is the Suez Canal, also a very sensitive zone and one which is geographically favourable to illicit interventions affecting the traffic of oil and gas tankers. However, unlike the case of Aden, and given the characteristics of the Egyptian State that controls both banks of the Canal, the chances of terrorist attacks are much greater than the possibility of acts of piracy, which are negligible.

In contrast to what has been said in the preceding paragraphs about Aden, the risk situation for ships at this transit point seems to be evolving negatively, as can be seen from the frequent and serious attacks suffered by the Egyptian army on the Sinai Peninsula,[84] to the extent that the banks that form the Canal, especially the eastern bank, could be the starting point for attacks aimed at slowing down or temporarily blocking the Suez Canal, even its accesses to the north, in the Mediterranean, or to the south, in the Red Sea could be blocked. Such actions

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81 Francisco J. Berenguer Hernández, ***El Estado Islámico como oportunidad***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA47-2014_EstadoIslamico__como_oportunidad_FJBH.pdf.

82 IHS, ***Al Qaeda indicates increased intent to target shipping transiting chokepoints, but sustained attack are unlikely,*** Jane´s Intelligence Weekly, 11 November 20104.

83 Awad Mustafa, ***Is Islamic State Group Getting Into the Piracy Business?***, Defense News, 2 November 2014.

84 Francisco Carrión, ***Al menos 31 soldados muertos en ataques en la Península del Sinaí***, El Mundo, 24 October 2014.

are feasible, as was demonstrated during the extremely worrying attack carried out on 12th November 2014, 40 nautical miles to the north of Damietta. During this attack, several local fishing boats, whose skippers are clearly very sensitive to threat or extortion from the jihadists, ambushed a patrol boat belonging to the Egyptian army, causing 13 casualties among its crew. The vessel burst into flames, causing the sinking of four of the fishing boats involved[85] in the attack.

This type of attack, relatively new in a jihadist context, together with another type that has been used on several occasions involving a vessel loaded with explosives, in the form of a fireboat, merely serves to increase the threat level and indicates the need to tighten surveillance and self-protection measures, especially at the points and in the zones that lend themselves to this type of attack.

Although it would probably have been done with the local political aim of seriously damaging Marshal Al-Sisi's Government interests on one of the essential pillars of the troubled Egyptian economy, in his underground struggle with the most radical elements of the resistance headed by the remaining members of the Muslim Brotherhood still in the country, if such attacks were to happen and be successful, the impact on the international market would be considerable.

And the impact would be dual fold:in the first place from the crucial perspective of the supply and from the viewpoint of the potential hydrocarbon prices, but also as a geopolitical factor derivative that goes even deeper. Indeed, the current Egyptian Government, fruit of a complex political process – a round trip – triggered off in the country since 2011,[86] is one of the soundest anti-terrorist bastions in the region and a necessary ally for the West in the zone, a fact that cannot be stressed too strongly.

Egypt's influence is traditionally felt not only over the whole of the Middle East, but also west to its unstable neighbour Libya and, even south towards the Sudans. Furthermore, and in spite of the criticisms received because of its *modus operandi*,[87] the Egyptian regime is an international benchmark regarding the consequences of where erroneous political transition processes in the Arab world can lead to. Therefore, a successful terrorist attack in Suez would undoubtedly undermine the credibility of the relatively new Government, both domestically and abroad, raising doubts about the capacity of the Authorities, who emerged from the counterrevolution that took place against the sectarian and incompe-

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85 Francisco Carrión, ***desaparecen ocho soldados egipcios tras un ataque contra un barco patrulla en el Mediterráneo***, El Mundo, 13th November 2014.

86 Mayte Carrasco, ***La delicada transición democrática en el Egipto post revolucionario***, IEEE, 2011, http://www.ieee.es/Galerias/fichero/docs_opinion/2011/DIEEEO18_2011TransicionDemocraticaEgypt.pdf

87 Francisco José Berenguer Hernández, ***La Caída de Mursi en Egipto***, IEEE, 2013, http://www.ieee.es/Galerias/fichero/docs_analisis/2013/DIEEEA41-2013_La_caida_de_Mursi_en_Egypt.pdf.

tent regime established by the Muslim Brotherhood under the Presidency of Mursi, to take on the regional leadership inherent to the largest Arab nation.

Global awareness about the paramount importance of Egyptian stability ensures that the efforts of its Authorities to guarantee unimpeded transit through Suez will receive not only economic support but also intelligence and security support from most of the international community. However, at the same time yet in the opposite sense, this means that the Suez Canal is and will continue to be a highly profitable terrorist target that the opponents of the Cairo regime, and in certain circumstances also international jihadism or a combination of both players, could constantly have included on their respective lists of priority targets.

The Turkish Transit

In recent years, the role played by Turkey in global energy security, and basically in the European energy security, has undergone vicissitudes of different and often contradictory kinds.

The various projects, at different stages of completion or fully operational, that use Turkish territory or waters to send hydrocarbons to Europe from the Caspian Sea, Central Asia or the Middle East are well known. However, the contradictory aspects that appear in these projects from the optics of their regional geostrategic and geopolitical impact cannot be stressed too strongly.

On the one hand, it is undoubtedly the case that Turkey's status has been greatly enhanced by the transit of these products through the country, and thus the image of the Turkish State has improved in the eyes of the international community, all the more so as a result of the serious crisis in Crimea and Ukraine that, in the year that has passed since the previous volume of this collection, has not only failed to improve, but has threatened to become a long-term confrontation between Russia and the United States plus the EU.

From that perspective, the ever-increasing possibility of energy products heading for Europe overland by-passing Russian territory is very positive. Reducing Russia's ability to coerce not only its direct clients but also the clients of foreign products that pass through Russia is an extremely valuable geostrategic advantage in the long term, which must be regarded as convenient and even necessary.

Yet this approach also has its negative side, because the pivot around which this whole strategy revolves, none other than Turkey, happens to be an extremely complex country with increasing difficulties, coming not only from the great instability of its immediate neighbours, but also from the process of internal transformation that the country is undergoing, with clear influences from both endogenous and exogenous factors.

Turkey has been involved in a process of national reassertion and reorientation for many years, under the auspices of the Justice & Development Party led by the current President Erdogan. Under the conviction that Europe has finally turned its back on Turkey, it has announced an ambitious strategic plan aimed at turning the country into the principal regional power. This plan includes major expenditure on infrastructure and defence projects, with a view to making Turkey an essential regional hub for land, sea and air communications,[88] in addition to reasserting its already considerable military potential.

Moreover, in the context of the Arab world's political transition processes, the Turkish Authorities are trying to export Turkey´s political system as a model, known for reconciling a democratic regime with the respect for Muslim traditions, showing the new Arab Authorities the "right" path to follow when modernising their respective countries[89]. The combination of these factors has caused some authors to coin the term Neo-Ottomanism to describe Turkey's present expansionist policy over territories formerly dependent of the *Sublime Porte*.[90]

However, it must be borne in mind that these projects and initiatives coincide with Turkey's continued political turn, to a large extent centrifugal regarding its interests and Western modes, especially the European ones. Reference is often made to the progressive islamisation of Turkish politics and society, gradually taking place since the Justice & Development Party's first election victory, and that as a result, and in harmony with the predominant tendency in the regional vicinity, this process has been speeding up in recent times.

News like the ones that appeared on the same day of November 2014, in which Turkey's Directorate of Religious Affairs, an official State institution, gave its official position opposed to the use of the social networks,[91] or another one in which an unusually horrifying "honour crime" was reported,[92] in a country where hundreds are denounced every year, may seem incidental, but they are a symptom of the progressive and unstoppable *reorientalisation* of Turkey, which while in itself is not a cause for criticism, is nevertheless a symptom of an inevitable and growing distance between Turkish and European interests.

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88 Fernando Ruiz Domínguez, ***Turquía 2023: su plan B geoestratégico***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_opinion/2014/DIEEEO71-2014_Turquia_2013_PlanB_Geoestrategico_RuizDominguez.pdf.

89 Francisco José Berenguer Hernández, ***Oportunidades y temores en Libia***, IEEE, 2011, http://www.ieee.es/Galerias/fichero/docs_analisis/2011/DIEEEA24-2011OportunidadesLibia.pdf.

90 Elena María Labrado Calera, ***El papel de Turquía en la crisis siria: el nuevo "gran juego" con Irán***, IEEE, 2012, http://www.ieee.es/Galerias/fichero/docs_opinion/2012/DIEEEO66-2012_TurquiaenCrisisSyria_NvoGranuegoIran_ElenaLabrado.pdf.

91 Daniel Iriarte, ***Los imanes turcos se oponen a Facebook y los "selfies"***, ABC, 20th November 2014.

92 Daniel Iriarte, ***Un adolescente turco, enterrado vivo "por honor" por los parientes de su novia,*** ABC, 20th November 2014.

More worrying still is the clear orientation towards greater authoritarianism from the Turkish authorities, which have brought about repeated public protests, brutally supressed. These are the same authorities that, in relation to the above-mentioned exogenous factors, have managed the crises and open wars in neighbouring Syria and Iraq with at least doubtful results. Such situations have rekindled the instability elements pre-existing in Turkey, such as the smuggling networks working over the borders and, of course, the invariably sensitive Kurdish question, to which can now be added the strength of jihadism in its most extreme form on those frontiers, bringing with it the serious threat of contaminating Turkey itself.

In conclusion, an emerging Turkey with potential for regional leadership, but a country that is at serious risk of far-reaching social upheavals, that is gradually moving away from its US and EU allies, and that could become a new scenario for insurgency, be it linked to the Kurdish independence protests or associated with international Jihadism or, in the worst of cases, a combination of the two.

In view of the above, it must be remembered that the capacity to use the energy produced by third parties coercively when it has to cross or might have to cross parts of Russia and Turkey, is a zero-sum game, with a clear coercion transfer capacity in the face of third parties from one to another.

Therefore, regardless of circumstantial commercial questions, and from a geopolitical viewpoint, it is essential to achieve a balance between the two main players, without granting Turkey a monopoly over the energy by-pass of Russian territory Because it has been demonstrated time and time again, that "putting all one´s eggs in the same basket" is a strategic error. And that is true and applies whether the basket is Russian or Turkish.

Monarchies and Revolution

In spite of the fact that the Persian Gulf Arab monarchies as a whole are more heterogeneous than is generally considered, they undoubtedly have many characteristics in common. The most outstanding shared characteristic is their non-exclusive yet essential pivotal role on the international energy scene. Therefore, the succession of recent events of a geopolitical nature and, above all, those yet to come, are of paramount importance for global energy security.

As has already been pointed out in the previous volume of this collection, this privileged position and the huge economic returns obtained by these countries have served to inflate their geopolitical impact. However, the fact that these countries have often financed Islamic groups with varying degrees of radicalism, some of which eventually ended up forming part of militant jihadism, shows that these monarchies have not always used their capacities in a desirable way. Better control and greater determination from the authorities have been lacking when it came to cutting off or limiting the major flows of donations from their countries, via different channels, all these donations becoming one of the main financial strengths of international jihadism.

Fortunately, and despite the major interregional discrepancies, with the long-standing disagreement between Qatar and Saudi Arabia about the importance of the Muslim Brotherhood as the most significant affair,[93] one of the few positive consequences of the Islamic State bursting onto the regional geopolitical scene is what we hope will be the final and definitive awareness of the Gulf Governments about the need to combat these types of groups more steadfastly and effectively. IS's announcement that it intends to hoist its flag in Mecca,[94] with all its emotional overtones and symbolism for the Islamic world, is tantamount to declaring war on the Saud secular dynasty, who will certainly have understood what a revolutionary Islamist movement like the IS could mean not only to its own interests, but also to those of the country's neighbours around the western coast of the Persian Gulf.

However, it is not the IS threat, on the present circumstances and with very limited prospects of success, the greatest cause for concern where the stability of the Gulf monarchies is concerned. On the contrary, it is the overdue social and political transformation in these regimes, with all their nuances and differences, within political contexts of absolutism and authoritarianism, antiquated not merely by the standards of our societies but, much more importantly, becoming increasingly out of step with the demands of the new generations of Arabs.

The political and social changes that have constituted the political transition processes in the Arab world since 2011, have been possibly held back artificially in this geographical environment, basically thanks to the income their respective regimes receive from hydrocarbons. The evolution and modernization of their political systems is thus being delayed, which does not mean that such changes are not essential, even though some sectors of their society would disagree. Furthermore, the very high consumption per capita in the region, once again with Saudi Arabia at the head, makes it increasingly difficult to obtain sufficient income from abroad by selling the surplus. A sustained drop in this income could lead to growing instability.[95]

Therefore, it would appear to be advisable to help these countries, as much as possible, to undergo an orderly transition, providing these nations with systems that are more open and participatory. Otherwise, the traditional intransigence could lead the current Islamic elites in some of these monarchies to be replaced by social Islamism or even revolutionary Islamism through an outbreak of social unrest, which would radically alter the very precarious regional balance.

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93 Francisco José Berenguer Hernández, ***Qatar en horas bajas***, IEEE, 2014, http://www.ieee.es/Galerias/fichero/docs_analisis/2014/DIEEEA16-2014_Qatar_HorasBajas_FJBH.pdf.

94 Francisco Carrión, ***"La bandera del califato del IS se alzará sobre La Meca, Jerusalén y Roma"***, El Mundo, 27th November 2014.

95 Gal Luft, ¿Qué significa el auge de la energía estadounidense para oriente Medio?, The Geopolitics of Energy, Vanguardia Dossier nº 53, October-December 2014.

Evidently, the consequences of such hypothetical social and political outbreaks are not predictable, but quite unhappy in general, as the cases of Libya, Egypt or Syria bear witness. Apart from creating a situation of crisis or even conflict, they could spawn regimes that alter the strategic alliances in the zone, and such alliances, however precarious they might be, are the only guarantee of certain stability at present.

It would undoubtedly be extremely worrying if a situation similar to the one in Syria were to affect any of these major contributors to the international energy market, and if this were to happen to Saudi Arabia this would be a cause for widespread panic.

Fortunately, although the objective social conditions seem to exist, the risk of a social uprising in the region does not currently appear to be imminent, so it can be hoped for the good of all, that the different regimes are capable of achieving similar results and embark on processes of political transition, not necessarily along exactly the same lines as western political systems, but at least processes that are sufficient to reach an internal consensus. Perhaps a good example of what is possible and even desirable, bearing in mind all the aspects described, would be the Moroccan monarchy that, without being comparable with western systems, has been able to follow a path of rapprochement and modernisation widely supported by our neighbouring country's inhabitants.

All that has been described above makes it necessary to stress the advisability of reaching a reasonable balance regarding our energy dependence on the Gulf countries in comparison with other suppliers located in different corners of the planet. The risk of not doing so is difficult to quantify, and perhaps not very high in the near future, but the effect of not finding this balance, should the situation arise, would be extremely severe. Furthermore, it must not be forgotten that the social and political uprisings in Tunisia or Egypt, to name the first ones, came as a surprise that we could not foresee far enough in advance.

All this must be done without going to the other extreme, i.e. an artificially high assessment of the geopolitical risks faced by the major producing countries in the Gulf, would lead to an excessive drop in the imports from those countries, to the benefit of third-party producers. Such an attitude could have the effect of a fulfilled self-prophecy, speeding up the process of deterioration affecting the Gulf regimes and involuntarily encouraging the feared social and political upheavals in some of them.

Moderation, mutual understanding, orderly transitions, etc., are all concepts that it is easy to write about but much more difficult to put into practice, especially in extremely complex geopolitical environments, such as the Middle East, in general, and the Persian Gulf in particular. But failing to achieve them will not only jeopardise the stability of that region but also our own stability in the coming decades, in view of the huge effect that the zone has on the global economy.

Composition of the working group

Coordinator:	**Mr. CLAUDIO ARANZADI**
	Industrial Engineer and Economist. Ex Minister of Industry and Energy.
Member and Secretary:	**Mr. FRANCISCO JOSÉ BERENGUER HERNÁNDEZ**
	Lieutenant Colonel in the Air Force. Chief Analyst of the SISS.
Members:	**Mr. ANTONIO COLINO MARTÍNEZ**
	Academician of the Royal Academy of Engineering.
	Mr. VICENTE LÓPEZ-IBOR MAYOR
	Chairman of Estudio Jurídico Internacional. Commissioner to Comisión Nacional de la Energía.
	Mr. CARLOS SALLÉ ALONSO
	Director of Energy Policies, Grupo Iberdrola.
	Mr. FRANCISCO J. RUIZ GONZÁLEZ
	Frigate captain, Spanish Navy. Doctor in International Security by UNED. Escuela Superior de las Fuerzas Armadas.

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