

03/2022

19/01/2022

José Pardo de Santayana

**Energy security during the energy transition**[Visit the](#)[Receive the E-NEWSLETTER](#)*Energy security during the energy transition**Abstract:*

*The energy transition, driven by climate emergency, is the biggest attempt in history to reshape the future. This coincides in time with an Heraclitian revolution that combines a deep socio-technological transformation with a tectonic process of power shift on a global scale. The resulting uncertainty and geopolitical tensions would require greater attention to energy security.*

*However, the dominant discourse has placed confidence that the shift towards cleaner energy will lead to safer energy markets and less dependent on geopolitical swings, overlooking that the road leading to this end is going to be characterized by the opposite. The deep crisis of the pandemic is but a warning of what the future may hold.*

*Keywords:*

*Energy, geopolitics, change, energy transition, energy security, major powers rivalry.*

**How to cite this document:**

PARDO DE SANTAYANA, José. *Energy security during the energy transition*. IEEE Analysis Paper 03/2022.

[https://www.ieee.es/Galerias/fichero/docs\\_analisis/2022/DIEEEA03\\_2022\\_JOSPAR\\_Seguridad\\_ENG.pdf](https://www.ieee.es/Galerias/fichero/docs_analisis/2022/DIEEEA03_2022_JOSPAR_Seguridad_ENG.pdf) and/or [bie<sup>3</sup> link](#) (consulted day/month/year)

**NOTE:** The ideas contained in the **Analysis Papers** are the responsibility of their authors. They do not necessarily reflect the thinking of the IEEE or the Ministry of Defence.

## Introduction

Before the start of the pandemic, Fatih Birol, executive secretary of the International Energy Agency (IEA), reminded us that the energy transition required an even greater effort in terms of energy security. While he may not have had in mind a crisis on the scale of the one we are currently experiencing, he wanted to highlight that the major transformation needed to meet climate goals—the largest attempt in history to reshape the future—is putting the global energy system under great stress. The number of as yet unknown variables magnifies uncertainty.

When energy security was addressed, the emphasis was that the transition to clean energy would lead to more secure energy markets. It was also claimed that nations would gain energy autonomy by reducing their dependence on fossil resource-producing countries. It stands to reason that this could be the case.

However, less attention was paid to energy security and the overall security challenges that would emerge during the period of the energy system transformation. The coronavirus shock has come as an eye-opener, as we are living through a very serious energy crisis which in 2020 reduced global energy demand by 4.5%<sup>1</sup> and which has been partly aggravated by the fact that it occurred in the middle of the energy transition, due to the negative pressure it has exerted on investments in hydrocarbon production.

The pandemic and the ensuing economic disruption, the most severe since World War II, led to unprecedented volatility and disruption in global energy markets, causing prices for natural gas—at 7 times the spot price of LNG—coal and, consequently, electricity to skyrocket. The resulting global outlook, aggravated by particularly extreme weather conditions, like a perfect storm, has led to geopolitical disputes in Eastern and Southwestern Europe that have put further pressure on gas and electricity prices and have put the Spanish economy on the ropes at a time of high indebtedness and uncertain scenarios for growth and economic recovery.

The overall outlook for the timely achievement of the energy transition objectives is not very promising. Firstly, the great powers—the US, China and Russia—which are also the energy superpowers, are reaching such a level of confrontation that collaboration

---

<sup>1</sup> BP Statistical Review of World Energy 2021. Available at: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf>.

between them, essential for the smooth running of the energy transformation process, now seems a chimera; on the other hand, as the Glasgow summit highlighted, the least developed countries, where the key to achieving the climate objectives lies, do not seem very willing to give up their development and economic growth projects to assume the cost of reducing accumulated emissions to which they themselves have barely contributed; finally, as the IEA acknowledges, the trends that would lead the energy sector towards zero net emissions (NZE) in 2050 are not yet emerging<sup>2</sup>.

Although there is a virtuous circle of policy action and technological innovation, underpinned by the lower costs of a new, more electrified, efficient, interconnected and cleaner energy economy, for every piece of evidence of rapid energy change, there is another that points to the persistence of the status quo<sup>3</sup>. Thus, despite all the progress being made by renewables and electric mobility, 2021 has seen a large spike in the use of coal (6%) and oil (5%) with the second largest annual increase in CO<sub>2</sub> emissions (5%) in history. The last word in the course of the energy transition will undoubtedly come from the technological advances, unknown today, that will make it possible.

This paper argues that, without questioning climate commitments, it is necessary to take into account the hypothesis that in the next three decades the process of transformation of the global energy sector may be punctuated by other high-impact crises, which calls for serious reflection on the importance of strengthening the energy security vector in energy transition policies.

### **The new challenges of energy security**

The IEA defines energy security as the uninterrupted availability of energy sources at an affordable price. At this point, the price aspect gains relevance towards the security of supply that previously dominated attention. Moreover, laws and regulation are increasingly the key to the equation.

Both disruptions to energy systems and their increasing cost have the potential to cause severe economic and social impacts. Modern energy systems must be able to withstand shocks from a wide range of sources, including natural disasters, geopolitical conflicts

---

<sup>2</sup> World Energy Outlook 2021. AIE, October 2021.

<sup>3</sup> *Ibidem*.

and new and emerging threats related to the ongoing digitisation of energy systems. States must therefore promote the resilience of their energy systems, while at the same time fostering their transformation. While short-term energy security focuses on the ability of the energy system to react quickly to sudden changes in the balance between supply and demand, long-term energy security is primarily concerned with timely investments to supply energy in line with economic developments and environmental needs.

The development of renewable energies entails important technological challenges still to be solved related to an electricity generation system based on variable energy sources, the development of new storage systems and intelligent infrastructures, as well as challenges related to the reduction of the impact on the natural and human environment.

Clean energy will transform geopolitics, though not necessarily in the idyllic way that its most ardent proponents proposed. In the very long term, when all the necessary technologies are in place and the energy systems have made the necessary adjustments, we can imagine a clear improvement in energy security with quite favourable prospects for Spain, which will have clean energies in better conditions than many of its partners and has made a major commitment to green hydrogen.

Meanwhile, talk of a smooth transition to clean energy is fanciful: there is no way that the world can avoid major upheavals as it remakes the entire energy system. The IEA recognises that the world is not investing enough to meet future energy needs. Policy uncertainty and demand trajectory are creating a serious risk of volatility in energy markets<sup>4</sup>. In addition, many elements of international politics that have shaped the global system since at least the Second World War will be reconfigured, significantly affecting the sources of national power, the process of globalisation, relations between great powers, and the ongoing economic convergence of developed and developing countries. The process will be complicated at best. Far from fostering cooperation, it is likely to produce new forms of competition and confrontation long before a new, more constructive geopolitics takes shape<sup>5</sup>.

Consensus about who will win and who will lose is often ill-founded. Petro-states, for example, could enjoy a favourable cycle before suffering shortages, because

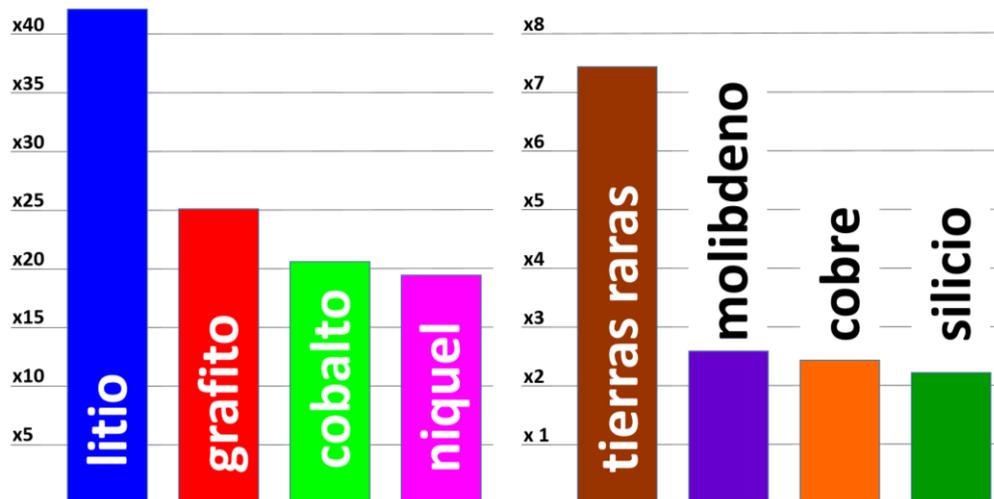
---

<sup>4</sup> *Ibidem*.

<sup>5</sup> BORDOFF, Jason, O'SULLIVAN, Megan L. 'Green Upheaval. The New Geopolitics of Energy', Foreign Affairs, January/February 2022.

dependence on dominant fossil fuel suppliers, such as Russia and Saudi Arabia, will most likely increase before it falls. On the other hand, according to the IEA, a world reaching the climate targets set for 2050 would still use half of the natural gas and a quarter of the oil it consumes today.

One source of power in the clean energy world is control of the supply chain of strategic minerals, which are critical to a variety of technologies, including wind turbines and electric vehicles. The small number of countries supplying the vast majority of critical minerals thus enjoy growing influence. Their growing demand to meet climate targets (Figure 1) is reaching dizzying proportions, which will also have a significant environmental impact.



**Figure 1: Growth in demand for selected minerals from 2020 to 2040 for the NZE target.** Source: Prepared internally based on AEI data.

In addition, higher and more volatile prices for key minerals such as lithium, cobalt, nickel, copper and rare earths could slow global progress towards a clean energy future or increase their cost. Price rises in essential minerals in 2021 could increase the costs of solar modules, wind turbines, batteries for electric vehicles and power lines by 5-15%. Critical minerals, along with hydrogen-rich fuels such as ammonia, also become important elements of international energy trade. Their total share rises from 13% today to more than 80% in the NZE scenario for 2050<sup>6</sup>.

<sup>6</sup> World Energy Outlook 2021.

All this has to take place in a world undergoing a Heraclitean process of transformation in which, as Emilio Lamo de Espinosa points out, we are experiencing the third great revolution in human history—after the Neolithic, the industrial and now the digital—which translates into a historical turning point. This makes any type of forecasting particularly difficult<sup>7</sup>.

In addition, in the three decades to achieve the climate goals, there will be two geopolitical revolutions—which feed into each other—as a result of China's likely rise to equal or even surpass the US as the world's leading power and the shift of the centre of gravity of human activity from the West to Asia. This has led to an increasingly ideological and intense confrontation between the major powers, which is already resulting in various obstacles to the proper functioning of energy mechanisms. The risk of a war directly affecting the major powers, particularly in Taiwan and Ukraine, is on the rise.

Thus, a serious contradiction is emerging between geopolitical dynamics and the need for effective multilateralism to address global crises and challenges<sup>8</sup>, particularly in the energy sector, with the global powers, in a tense dispute between Washington and the Sino-Russian strategic partnership, being the main players in the world energy market:

- The US, the largest producer of hydrocarbons—18.6 % oil, 23.7 % natural gas and 6.7 % coal (2020 figures)<sup>9</sup>—benefits from this in terms of prices and security of supply, which, unlike Europe, means that the great American power has maintained a very competitive economy and has not suffered an energy crisis.
- Russia, the world's largest hydrocarbon exporter, accounting for 16% of global energy trade<sup>10</sup>, and also the world's leading country with 50% of nuclear power plant construction outside its borders, still has a long way to go before its advantage as an energy superpower is amortised.
- China leads the clean energy sector. It produces two-thirds of the world's solar panels and has about half of the world's electric vehicles and installed solar and wind capacity. It has an even more dominant position in the processing

---

<sup>7</sup> LAMO DE ESPINOSA, Emilio. Speech at the roundtable 'Thinking the 21st century', 21 April 2021. Available at: <https://www.youtube.com/watch?v=3n-Ri0i5DEI>.

<sup>8</sup> 2021 National Security Strategy. Government of Spain.

<sup>9</sup> BP Statistical Review of World Energy 2021.

<sup>10</sup> BRICS Russia 2020 Energy Report. BRICS Energy Research Cooperation Platform.

and refining of critical minerals, accounting for 40% of copper, almost 60% of lithium, more than 60% of cobalt and close to 90% of rare earths<sup>11</sup>.

In the past, there have been other energy transitions that have been implemented progressively and unevenly as different societies have developed. The current one is characterised by urgency and the need to be carried out simultaneously on a global scale. Success thus depends on the weakest links, and we cannot wait to consolidate one intermediate goal before tackling the next, nor can technological neutrality be allowed to dictate the most appropriate solutions. Urgency and friction inevitably go hand in hand. As energy security, especially in the electricity sector, is also based on the experience acquired in resolving incidents of all kinds, time is a key factor in consolidating the mechanisms and protocols that make it possible.

An inescapable aspect of the energy transition is the coexistence of the two systems at the same time, each with its own vulnerabilities. Hydrocarbon-based energy still accounts for 80% of primary energy globally and 72% in Spain (2019 figure)<sup>12</sup>. While each system can complement the shortcomings of the other, the opposite effect can also occur, as is currently the case when the slow recovery of supply in the natural gas market is producing a spike in electricity prices.

Thus, the debate on nuclear energy has been reopened and, recently, the European Commissioner for the Internal Market, Thierry Breton, has defended the controversial proposal of the EU executive to include nuclear energy in its taxonomy of so-called 'green' energies and has stated that, in order to meet the objectives of the energy transition, the EU must include nuclear energy, which would imply an investment of half a trillion euros in new nuclear reactors between now and 2050<sup>13</sup>.

The rise of digital infrastructures and services, powered by disruptive and emerging technologies, implies an unstoppable digital transformation that offers countless opportunities, but also presents serious security challenges. At the same time, digitalisation and the green economy will have to move in tandem, in such a way that

---

<sup>11</sup> The Role of Critical Minerals in Clean Energy Transitions. IEA, May 2021.

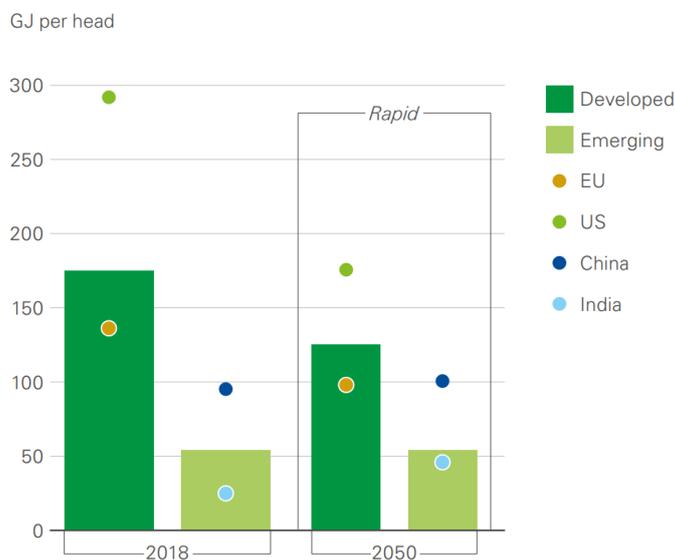
<sup>12</sup> Spain 2021, Energy Policy Review. IEA, p. 11.

<sup>13</sup> DE ARAGÓN, Esther. "La transición energética en la UE necesitará de la energía nuclear." Energy News, 10 January 2022. Available at: [La transición energética en la UE necesitará de la energía nuclear \(energynews.es\)](https://www.energynews.es).

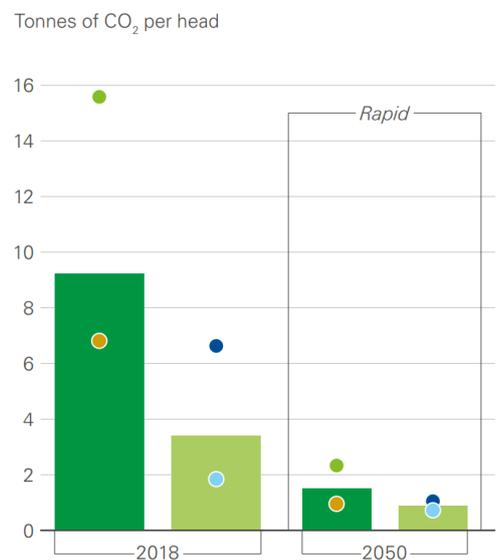
technology contributes to achieving green goals and digital technologies minimise their energy consumption and emissions<sup>14</sup>.

There are huge and diminishing development gaps in the world, and the least favoured countries will not give up on boosting their welfare levels. As climate change is the result of the accumulation of CO<sub>2</sub> emissions over time and half of the total emissions since the beginning of the industrial era have come from the United States and Europe—only 2% from the entire African continent—a just transition cannot fall equally on both<sup>15</sup>. While simultaneously facing the worst consequences of climate change, to reach half the standard of living of more developed nations, emerging countries would have to increase global energy consumption by 50%, which is in contradiction with the goals of the energy transition. However, as shown in Figure 2, in a scenario close to achieving the NZE in 2050 and where the growth in energy consumption and CO<sub>2</sub> emissions comes entirely from emerging countries, the more developed countries will continue to have higher per capita energy consumption and CO<sub>2</sub> emissions than emerging countries.

Energy consumption per head in *Rapid*



Carbon emissions per head in *Rapid*



**Graph 2: Evolution of the differences in energy consumption and CO<sub>2</sub> emissions between developed and emerging countries.** Source: BP Energy Outlook 2020.

<sup>14</sup> National Security Strategy 2021 (NSS 2021). Government of Spain. December 2021, pp. 31 and 32.

<sup>15</sup> BORDOFF, Jason, O'SULLIVAN, Megan L. Op. Cit.

As rich countries feel increasing urgency to reduce emissions and developing countries remain focused on the need to deliver growth for their citizens, tensions will inevitably arise between the two groups. Nor can it be overlooked that the pandemic has led to a 2% setback in universal access to electricity, reversing years of steady progress<sup>16</sup>.

Much international cooperation will be needed to replace the most polluting systems still in service in emerging countries—especially the coal-fired power plants that are still being built today and have a service life of about 40 years—as technology offers more cost-effective solutions but not enough to compensate for the decommissioning of power plants still in service life.

One consequence of the energy transition for global security is the destabilising impact it could have on countries that depend on hydrocarbons to sustain their economies. This is the case of Algeria—97% of whose exports are oil and gas and which, although it has an enormous solar resource, does not have a favourable institutional fabric<sup>17</sup>—, Libya or the producer countries of the Middle East, all of which are located in the Mediterranean arc of conflict that envelops the EU to the south and southeast.

### **The challenges for Spain**

Western societies—unlike the much more patient Asian ones—subject to the rapid cycles of democratic power renewal, tend to live with a short-term perspective and, while they recognise the challenges of the future in their analyses, they do not necessarily translate them into their strategic priorities. Thus, the 2019 Spanish National Security Report expressed the need to adopt health risk preparedness and response plans and stated:

“Global changes in recent decades, with the increase and ageing of the population; the growing volume of international travel and cross-border movement of goods; new production systems and forms of consumption; the waste generated and the associated climate change mark the increasing mobility of public health risks and,

---

<sup>16</sup> COZZI, Laura, TONOLO, Gianluca. “The pandemic continues to slow progress towards universal energy access.” AIE, 24 September 2021. Available at: <https://www.iea.org/commentaries/the-pandemic-continues-to-slow-progress-towards-universal-energy-access>.

<sup>17</sup> ESCRIBANO, Gonzalo. Available at: “Escribano (RIEicano): “En la transición energética habrá países vecinos perdedores””, El Español, 17 March 2021.

in particular, of pathogenic micro-organisms capable of generating epidemics and pandemics”<sup>18</sup>.

Similar wording appeared in the equivalent documents of the European partners, which did not prevent the coronavirus from catching them by surprise.

The current Spanish National Security Strategy 2021 (NSS 2021) therefore puts a strong emphasis on prevention and adaptation<sup>19</sup>. Thus, a primary objective of national energy policies should be to anticipate potential disruptive developments and incorporate an important energy security component into the very design of the energy transition. It must also be done with the confidence that Spain, as a member of the EU, has the will and the capacity to meet its climate commitments. The greatest danger lies precisely in the fact that excessive economic and social costs could generate great popular pressure against the process of transformation to clean energy or even social and political instability.

“Spain’s security of energy supply is guaranteed by 2022, although the same cannot be said for economic security. The consensus is that gas and oil will be available, but at high prices (...) which are already reflected in the sharp rise in inflation. Although central banks are cautious for the time being, the trend will reduce the competitiveness of many sectors and consumer incomes. These price increases constitute, together with the uncertainties arising from the pandemic and the collapse of value chains (which also affects renewable components), the greatest risk to global economic recovery and, of course, to that of Spain<sup>20</sup>.”

In the short term, the supply of natural gas at a proportionate price remains to be solved, although it seems to moderate after the winter. In the longer term and until a replacement is found, the evolution of its price will affect the development of the Spanish energy system as a whole. There is a broad consensus that there will be high volatility. High prices are once again reviving US fracking, although this time the sector no longer has the support of the US administration and, although it is expected to push prices down somewhat, it will not provide the stability of recent years.

---

<sup>18</sup> Annual National Security Report 2019. Government of Spain.

<sup>19</sup> NSS 2021, p. 20.

<sup>20</sup> ESCRIBANO, Gonzalo, LAZARO, Lara. España en el mundo 2022: Perspectivas y desafíos en clima y energía. RIE, 28 December 2021.

According to the IEA, while new policies and increased electrification will reduce Spain's import dependence, the rapid closure of coal and nuclear facilities over the next decade could increase demand for natural gas, especially if new renewable energy capacity cannot be built as fast as expected. At the moment, the current system is backed by huge quantities of oil and gas that can be flexibly shipped<sup>21</sup>.

However, the combination of conflicts and disputes to the east with Russia and to the south between Morocco and Algeria augurs an increasingly complex and dangerous scenario for the supply of gas to Spain at reasonable prices, making gas and electricity interconnectivity with other European countries increasingly important as a critical element for improving security of supply. However, while electricity interconnection projects with Portugal are progressing, the existing interconnection with France is often congested and new projects have been delayed, resulting in Spain falling short of its EU interconnectivity targets of 10% by 2020 and putting at risk its target of 15% by 2030<sup>22</sup>.

Russia, which currently accounts for 40% of the EU's gas imports, is its natural gas partner in addressing the energy transition. This would allow for long-term contracts that would ensure stable prices and a secure supply adapted to the timing of the substitution of one energy source for another. However, strategic considerations and the inability of Washington and Moscow to reach agreements to stabilise an increasingly tense and dangerous relationship prevent the most obvious solution. Ukraine is the bone of contention. Russia has drawn a red line at NATO membership, while the US is ready to impose its rules of the game on the Kremlin. The spiral of hostile reactions does not bode well. Delays in the certification of the Nord Stream II pipeline are causing great frustration in Moscow, which could lead to disputes over gas supplies to the EU this winter.

Moreover, the Algerian-Moroccan conflict is adding to the perfect storm. Both neighbours are engaged in an arms race and exhibit increasingly militant nationalism. The risk of escalation is real and a direct armed confrontation or one involving the Polisario Front should not be ruled out<sup>23</sup>.

Morocco, a country with means of pressure and territorial claims similar to those that the US reproaches other powers for, is currently backed by Washington and, incidentally,

---

<sup>21</sup> Spain 2021, Energy Policy Review. IEA. Pp. 11 and 15.

<sup>22</sup> *Ibidem*.

<sup>23</sup> FERNANDEZ, Haizam Amirah, MARÍN, Ainhoa. "España en el mundo 2022: perspectivas y desafíos en la vecindad." RIE, 23 December 2021.

London. In return, Rabat's rapprochement with Tel-Aviv commits it to facilitating US stabilisation policies in the Middle East. In parallel, the traditional link between Algiers and Moscow is being strengthened. Now that Russia is back in Africa, the rivalry between the White House and the Kremlin tends to find resonance in the Maghreb dispute.

Since Algeria's independence, Morocco has been engaged in an intense confrontation with its neighbour as a consequence of the Sand War in 1963 over the determination of the common border, inherited from French colonial rule. Subsequently, Algiers has continued to support the Polisario Front's aspirations. Since August 2021, the relationship has deteriorated significantly and, at the end of October, Algeria reacted by shutting off the flow of natural gas through the Maghreb Europe (GME) pipeline, which crosses Morocco before passing through the Strait of Gibraltar (Figure 3) and which has been supplying natural gas to Spain and Portugal for 25 years.

The Moroccan economy loses some \$200 million a year in rights of way and some of the gas from which it used to produce 12 percent of its electricity. Now all Algerian gas will reach the peninsula through Medgaz, the pipeline that links Algeria directly with Spain, but whose capacity (8 bcm) does not reach that of the other (over 10 bcm)<sup>24</sup>. The Iberian Peninsula, which had two pipelines and surplus capacity, now has only one pipeline and a more expensive and logistically complex LNG chain<sup>25</sup>. This translates into higher prices and lower resilience.

---

<sup>24</sup> BOUAZIZ, Fatima Zohra, OUABOU, Nacera. La incesante crisis Marruecos-Argelia acaba salpicando a España en 2021. Atalayar, 25 December 2021. [La incesante crisis Marruecos-Argelia acaba salpicando a España en 2021 \(atalayar.com\)](https://atalayar.com/la-incesante-crisis-marruecos-argelia-acaba-salpicando-a-espana-en-2021/).

<sup>25</sup> ESCRIBANO, Gonzalo, LAZARO, Lara. Op. cit.



**Graph 3: pipelines linking Algeria to the Iberian Peninsula.** Source: La Vanguardia.

In Spain, the regional administrations have considerable authority in the development and implementation of energy policy, which, according to the IEA, makes effective coordination between the central government and the regions even more decisive for the successful implementation of energy strategies<sup>26</sup>. Considering the disharmony that state administrations have demonstrated during the pandemic, a more constructive approach needs to be ensured in the energy field, and administrative procedures need to be streamlined. The new NSS 2021 emphasises that a comprehensive vision of National Security requires the necessary coordination of all public administrations and State resources<sup>27</sup>.

<sup>26</sup> Spain 2021, Energy Policy Review. IEA. Pp. 11.

<sup>27</sup> NSS 2021, p.

## Conclusion

The coronavirus pandemic has highlighted the need to pay greater attention to energy security as Spain moves towards a clean energy scenario. High electricity and natural gas prices are wreaking serious havoc on the economy, reminding us that the road to energy transition is paved with uncertainty and growing risks.

While energy transition is already an unprecedented effort to reshape the future, it will also coincide in time with the transformation of geopolitical relations towards an increasingly tense and dangerous world and an accelerated and profound socio-technological revolution.

The urgency that the major climate challenge imposes on the transformation of energy systems prevents this from being done in a more orderly and rational way.

Least developed countries seem unwilling to pay the cost of climate change that they did not cause and whose mitigation depends on them.

The success of the energy transition will depend on the development of disruptive technologies that make it possible at globally affordable prices.

The coexistence of the inherited and new energy systems means that two energy logics must be addressed that add up to vulnerabilities and where the volatility of hydrocarbon prices has repercussions on the rise in electricity prices.

The supply of hydrocarbons and strategic minerals will be the subject of global economic turmoil and geopolitical disputes between the major powers.

Both the NATO-Russia and the Algerian-Moroccan conflicts cast a shadow of serious concern over the supply of natural gas to the European Union.

Energy systems will be increasingly exposed to cyber-attacks.

In the future, regulatory developments will need to anticipate these eventualities and create agile mechanisms for both seizing opportunities and reacting to setbacks.

*José Pardo de Santayana\**  
DEM Artillery Colonel  
IEEE Research Coordinator