INTRODUCTION

Global visions about the energy transition

This journal was born in 2016 with the objective of contributing, from independent scientific knowledge, to the necessary debate about the global, European, and Spanish energy transition. As I mentioned in the introduction to the first issue, global energy systems face several challenges and opportunities in their evolution towards more sustainable and robust systems, and it is essential to reach a political and social consensus that will facilitate the investments and actions required, with a long-term vision. And a fundamental element for this consensus is rigorous and independent analysis from different perspectives.

In the seven issues published along these four years, major international researchers have been covering both general issues about the transition and particular aspects, such as the role of demand or business models, competition or innovation policies, the design of electricity markets, or the aspects associated to a just transition.

In this issue we return to the first topic, presenting the vision of three of the most renowned international experts on global energy transitions. As may be easily seen, these experts do not necessarily share their views, something not really surprising given the difficulty in predicting the future… although it is possible to extract a common message from their analysis, a message that, in my opinion, allows us to move towards this sustainable future desired by all.

In the first paper, **Vaclav Smil**, Distinguished Professor Emeritus at the University of Manitoba, and probably the best known analyst of the evolution of the use of energy throughout history, as shown in his many books, makes use of his ever-present critical spirit and reminds us that the public discourse about energy transitions has focused too much on the electricity sector and on the electrification of transport, has forgotten about the industrial transition, has not accounted

enough for the history of past energy transitions, and is, in general, excessively optimistic. In his paper he focuses on what he calls six fundamental realities: there is nothing new about energy transitions, which have taken place since the beginning of civilization; the current transition is unprecedented in terms of the desired speed, of the scale required, and of the use of variable and low-density energy sources; the decarbonization of the global energy supply is not being driven by energy prices or fuel scarcity, or by security of supply; even modest reductions in emissions will be very difficult; global civilization will be dependent on fossil fuels for a long time, and therefore any statement that decarbonization may be achieved in two or three decades is unrealistic and irresponsible; and finally, decarbonization includes some relatively simple transitions, but also others for which we do not have answers currently.

His conclusion, initially negative, is that this transition will share attributes of past ones: it will be gradual, intergenerational, and with different progress rates by region. However, he also ends with a positive note: engaging more strongly in innovation and energy efficiency can speed up this transition.

In the following paper, **Jorge Blázquez** and **Spencer Dale**, lead and chief economists respectively at the BP group, present the main questions and uncertainties related to the energy transition. Blázquez and Dale have a clear view that the energy mix in 2040 will be very different to the current one; that energy demand will continue growing in developing countries; and that we must reduce greenhouse gas emissions as quickly as possible. But this is where certainty ends: neither the speed of this transformation, or the role of the different technologies, or its share among sectors, are clear. Their Evolving Transition scenario tries to identify the key issues affecting the energy transition, in particular how much energy will the world require, how important are plastics for oil demand, how fast can renewable energy grow, and what else do we need to ensure a quick transition toward a decarbonized system.

Their (summarized) answers are: energy demand will grow 30% by 2040, driven by the increased prosperity of developing countries, mostly in Asia, something that clearly makes it more difficult to achieved the required reduction in emissions; growing trade disputes may reduce global GDP growth, and with it energy demand,

and also promote the use of domestic energy sources (including coal); regulations about the use of plastics may affect significantly oil demand; renewables are growing much faster than other energy sources in the past, but may be slowed by the capital intensity required, and may not grow enough to reach climate targets. The consequence of all this is that this scenario is not consistent with the Paris Agreement. Achieving it would require a much more rapid transition, which in turn will require a wide set of measures, combining carbon prices with other more specific policies, including in particular an unprecedented deployment of renewable energy. However, renewables will continue representing only a third of global energy supply (in primary energy terms), so other technologies will be needed to decarbonize the rest of the energy system, in particular hydrogen and carbon capture.

In a clear contrast, **Seb Henbest**, chief economist at Bloomberg New Energy Finance, seems to have a much clearer view, at least in the medium term. Henbest relies on the spectacular advances in the cost of photovoltaic and wind energy and of batteries to preview a future in which, by 2050, renewable power (photovoltaics and wind) will produce 80% of the electricity at the global level, something he calls Phase I of the energy transition. In addition, Henbest remarks that these advances will be more important for the global energy matrix than what is generally shown by primary energy statistics, which don't actually represent the real use of energy (which must be done in terms of final energy). Europe will clearly lead this process, but other regions must speed up renewable energy deployment if they want to achieve this level of penetration before 2050. In the US natural gas is more competitive and hence renewables do not progress that much. In China, India and Southeast Asia cheap coal is the major obstacle. However, a very important point in Henbest's conclusion, shared by the three papers, is that reaching the climate target of 2º C, or even 1.5º C, is impossible if current trends are not changed radically.

Therefore, beyond the different views of the authors, there is a shared central message: achieving the targets included in the Paris Agreement will require additional, substantive measures to speed up the transition. To this extent, the different author's proposals are not opposed but complementary. We will require, as Smil proposes, to step up our efforts on innovation and energy efficiency; also,

as mentioned by Blázquez and Dale, to explore the options offered by hydrogen and carbon capture; and above all, as put forward by Henbest, to create a regulatory framework that may mobilize the large investments required to achieve the targets. As I said at the beginning, these complementary proposals should allow us to advance, from a shared position, towards a more sustainable energy model, from a good understanding of the current situation and the potential constraints, but also of the benefits of adopting ambitious but sensible policies.

As has been repeatedly expressed in the recent COP in Madrid, it is time to act, it is the time to move from target setting to political action. It is the moment in which governments and opposing parties must act responsibly and with a long-term vision, creating those efficient and fair regulatory frameworks that promote investments, and also innovation and energy efficiency. I hope that from *Papeles de Energía* we will continue offering independent and rigorous knowledge that informs these regulatory frameworks.