

Quel équilibre futur pour l'offre et la demande d'énergie ?

By Dr Fatih BIROL

Executive Director, International Energy Agency

The world has undergone numerous energy transitions since the *Annales des Mines* was first published in 1794: from steam locomotives to electric rail; from the internal combustion engine to the widespread revival of electric cars; from coal-fueled power to nuclear, natural gas and, more recently, renewables. Through the years, these transitions have been driven by innovation.

The last few decades have focused on a new energy challenge – how to ensure secure and affordable supplies while addressing fundamental concerns over environmental sustainability and energy access. In the 21st century, we are no longer only asking how we can produce enough oil to meet demand but also how we can grow our economies while reducing carbon emissions; how to avoid the air pollution that threatens the health of people living in our largest cities; and how to ensure that everyone around the world enjoys the same access to modern energy services that is taken for granted in countries like France?

There is no single answer to these complex issues. Energy transitions underway around the world require the full range of policies, fuels, technologies and innovations – a long list that includes carbon capture, utilisation and storage (CCUS), hydrogen, efficiency standards and, for some countries, nuclear energy.

The challenge we all face cannot be understated. Last year, global energy consumption increased at nearly twice the average rate of growth since 2010. And while renewables saw impressive growth, demand for all fuels increased – notably natural gas, but also oil, nuclear power and coal. As a result, CO₂ emissions rose 1.7% last year and hit a new record. The increase in emissions was equivalent to the total annual emissions of international aviation today.

Energy production and use is the largest source of global emissions, which means that the energy sector is crucial for achieving the objectives of the Paris Agreement on climate change. The Paris Agreement requires energy-related CO₂ emissions to peak around 2020 and then decline rapidly. The IEA outlines that path in our Sustainable Development Scenario (SDS), which also results in universal electricity access and reduces deadly air pollution. By 2040, emissions would need to be at around half of today's level and on course towards zero by 2070, in line with the Paris climate goals.

How can this scenario be turned into reality?

The good news is that our analysis shows there is no need for trade-offs between the different goals that underpin the SDS. In fact, achieving universal access to modern energy only leads to a 0.1% increase in CO₂ emissions. But again, this will depend on using the full range of fuels and energy technologies, including nuclear, renewables and emerging technologies like CCUS and hydrogen.

All of these efforts to find new ways to produce energy in a sustainable manner must rest on a solid foundation of energy efficiency – the best source of energy is the one we never have to produce. But here, the news is not encouraging: energy intensity improved by just 1.3% last year. The disappointing pace is the third year of slowing improvement and results from weaker energy efficiency policy implementation and strong demand growth in more energy intensive economies. We cannot underestimate the long-term implications of this trend, nor the potential benefits of taking quick action.

If the world had adopted the best passenger fuel standards, we could have saved 2.2 million barrels of oil per day last year. Over USD \$20 billion could have been saved if everyone had switched to an energy efficient refrigerator. Almost 20% of industrial electricity use could have been saved if countries had adopted the strongest electric motor standards. These are all massive opportunities, and the benefits go far beyond the energy sector. Energy efficiency can support economic growth, enhance social development, advance environmental sustainability and ensure energy security.

With this range of different technologies, fuels and approaches, each country will find its own path towards a common goal. France is an example of how to decouple energy consumption and CO₂ emissions from economic and population growth. The carbon intensity of the French economy is about half the IEA average.

Much of this can be attributed to nuclear power as a source of emissions-free electricity. France is one of the world's largest economies yet has remarkably low emissions from its power sector. The French nuclear fleet is also flexible enough to match peak demand periods, both in France and across Europe.

But the energy transition requires new approaches. Europe's nuclear fleet is ageing, building new nuclear plants has become difficult in the current market environment and coal is being phased out. The French government is discussing its energy plan for the next decade, and one of the questions is to what extent renewables can be integrated into the country's power sector.

Today, the share of wind and solar in France is below 8%, similar to other nuclear leaders like Canada and Japan. Global experience shows that power systems can easily accommodate shares below 10% through the ability to ramp power generation up or down to meet demand. But as renewables' share of the power mix grows – in countries like Germany or Denmark, for example – additional flexibility is needed. These include regional power trade, smart grids, energy storage or demand-side response in buildings.

Hydrogen is also a promising technology that is of particular interest to France. It provides flexible means of linking different energy sectors and energy transmission and distribution networks. The opportunities for using hydrogen across the economy and its benefits for system integration should be clearly highlighted.

Given the complex, interlinked challenges facing today's energy sector, it is imperative that policymakers, industry, researchers and academics work together to share best practices on policy and keep up to date on emerging market trends and innovative technologies. These are global challenges that require global thinking. At the IEA, we are committed to working with not only our 30 Member countries, but also our 8 Association countries, including Thailand on electricity security, China on emissions trading and India on energy efficiency. We are also expanding our work beyond the IEA family of countries, including projects to increase the quality of energy statistics in Africa.

Within this edition of the *Annales des Mines*, you will find articles showcasing the full range of challenges facing the energy sector, from technological barriers to geopolitical concerns, and an equally impressive range of possible solutions. I am pleased to see that a number of my current and former colleagues have contributed to this issue, along with a very impressive list of energy experts.

Despite our challenges, with our best minds working together, we can all move towards a more secure and sustainable energy future for all.