world energy

we.

JULY 2018

DISRUPTION AND OPPORTUNITY

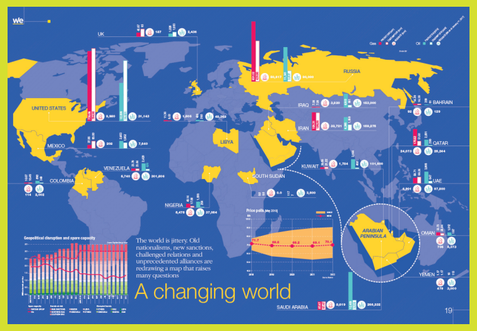
Number 39

World Energy no. 39/2018 - Targeted mailshot

C O N T E N T S



6
TECHNOLOGY AND MOTHER NATURE
by Moisés Naím



18
A CHANGING WORLD

3 *Editorial*
CHANGING COURSE
by Mario Sechi

6 *Taking stock*
TECHNOLOGY AND MOTHER NATURE
by Moisés Naím

9 *Scenario*
THE BLACK SWAN OF THE OIL AND GAS MARKET
by Francesco Gattei

12 *Analysis*
THE RETURN OF BOOM-BUST OIL PRICE CYCLES
by Robert McNally

DISRUPTION & OPPORTUNITY

18 **A CHANGING WORLD**

32 *Outlook*
THE OTHER SIDE OF U.S. ENERGY INDEPENDENCE
by Ian Bremmer

34 *OPEC+*
THE VIENNA COMPROMISE
by Marc-Antoine Eyl-Mazzega

38 *Latin America*
ALL THE FACES OF THE CONTINENT

VENEZUELA, A DIFFICULT COMEBACK
by Francisco Monaldi

WELCOME TO THE SOUTH
by Caio Pizzetta Torres

48 *U.S.*
THE POWER OF THE D FACTOR
by Fabio Squillante

52 *Brexit*
A DISRUPTIVE AND HARMFUL SEPARATION
by Paul Betts

DISRUPTION & OPPORTUNITY

58 *Innovation/Roberto Cingolani, Scientific Director, Italian Institute of Technology speaks*
TECHNOLOGY, DIVERSIFICATION AND EDUCATION
by Roberto Iadicicco

62 *Technology*
THE AMERICAN REVOLUTION
by Davide Tabarelli

66 *Climate change*
THE ENERGY TRANSITION: SUPERHIGHWAY OR DEAD END?
by Katherine Hamilton

71 *Digitalization/IEA Focus*
A NEW ERA FOR ENERGY
by Dave Turk, Laura Cozzi, Luis Munuera and George Kamiya

76 *Renewables*
THE UNKNOWNS OF THE TRANSITION
by Bassam Fattouh, Rahmatallah Poudineh and Rob West

80 *Research/MIT*
THE BIRTHPLACE OF THE FUTURE
by Giancarlo Strocchia

Dialogue with Francis O'Sullivan, research director at MIT
NO TURNING BACK

Interview with Bob Mumgaard, CEO of Commonwealth Fusion Systems
THE ENERGY OF THE UNIVERSE

85 *Storage*
THE MISSING PIECE
by Nicolò Sartori

88 *Big Data*
THE SOCIAL RUPTURE
by Roberto Di Giovan Paolo

90 *Data*
$70/B, A NEW COMFORT ZONE?
by Anna Capalbo, Simona Serafini and Francesca Vendrame - Eni



32
THE OTHER SIDE OF U.S. ENERGY INDEPENDENCE
by Ian Bremmer



39
VENEZUELA, A DIFFICULT COMEBACK
by Francisco Monaldi



80
THE BIRTHPLACE OF THE FUTURE
by Giancarlo Strocchia

This issue of WE World Energy is distributed jointly with Foreign Affairs (September/October 2018)

- All opinions expressed in *World Energy* represent only the personal viewpoints of individual authors.
- All the maps are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

world energy we

Quarterly
Year 10 - N. 39 July 2018
Authorization from the Court of Rome No. 19/2008 dated 01/21/2008

Publisher **eni spa**
Chairman: Emma Marcegaglia
Chief executive officer: Claudio Descalzi
Board of Directors: Andrea Gemma, Pietro Angelo Guindani, Karina Litvack, Alessandro Lorenzi, Diva Moriani, Fabrizio Pagani, Domenico Livio Trombone
Piazzale Enrico Mattei, 1 - 00144 Roma
www.eni.com

■ ***Editor in chief***
Mario Sechi

■ ***Editorial Director***
Marco Bardazzi

■ ***Editorial committee***
Geminello Alvi, Robert Armstrong, Paul Betts, Ian Bremmer, Roberto Di Giovan Paolo, Gianni Di Giovanni, Bassam Fattouh, Francesco Gattei, Roberto Iadicicco, Alessandro Lanza, Lifan Li, Molly Moore, Moisés Naím, Daniel Nocera, Lapo Pistelli, Carlo Rossella, Giulio Sapelli, Davide Tabarelli, Lazlo Varro, Enzo Viscusi

■ ***Editorial team***
Coordinator: Clara Sanna

Evita Comes, Simona Manna, Alessandra Mina, Serena Sabino, Giancarlo Strocchia, Manuela Iovacchini

■ ***Authors***
Laura Cozzi, Marc-Antoine Eyl-Mazzega, Katherine Hamilton, George Kamiya, Robert McNally, Francisco Monaldi, Luis Munuera, Caio Pizetta Torres, Rahmatallah Poudineh, Nicolò Sartori, Fabio Squillante, Dave Turk, Rob West

Thanks for collaborating in the creation of maps and charts: Elvira Di Sibio, Andrea Di Chiara, Riccardo Mercuri, Simona Serafini (Eni)

■ ***Editorial Staff***
Piazzale E. Mattei, 1
00144 Roma
tel. +39 06 51996385
+39 06 59822894
+39 06 59824702
e-mail: info@abo.net

Website:
www.aboutenergy.com

Social:
@AboutWEnergy
@AboutWEnergy
AboutWEnergy

■ ***Authors' portraits***
Stefano Frassetto

■ ***Photography***
Contrasto, Reuters, Luz, IPA Independent Photo Agency, Getty, Servizio Fotografico - Vatican Media, Sie Masterfile, Archivio Eni

■ ***Design***
Cynthia Sgarallino
■ ***Graphic consultant***
Sabrina Mossetto
■ ***Graphics and layout***
Imprinting www.imprintingweb.com
■ ***Printer***
Stab. Tipolit. Ugo Quintily S.p.A. viale Enrico Ortolani, 149/151, 00125 Roma

■ ***Translated by:***
LOGOS GROUP - www.logos.net

Sent to press on July 9, 2018

MIX Paper from responsible sources FSC® C100565

Paper: Magno Natural 100 grammi

Editorial/A new idea of global coexistence

Changing Course



No energy transition and technological advancement strategy can ignore the objective of reaffirming the primacy of the environment, allowing future generations to benefit from a "common home" that combines progress with responsible protection



have always viewed *WE* as a magazine that is not restricted to the industry but open to "visions" that are seemingly unconnected and far removed from our everyday work, in order to tell the whole story of energy. As I have written since the very first edition, this activity is synonymous with "life," with what happens in "Creation," a word that is filled with meaning, rooted as it is in the dawn of mankind and the search for an answer to its existence. In order to understand what Creation is today, we need to take a journey through the contemporary industrial revolution, technology, philosophy and theology. At the end of this journey, we shall return to what lies at the heart our work: energy. Two thousand years is an infinitesimal period in the titanic history of the universe, but this finite time in the history of the Church gives us an infinite capacity to "see" the future. It is a time populated by us, and the reason for our existence is one of the fundamental questions of philosophy and theology. In a booklet entitled *The Concept of Time* (Adelphi), Martin Heidegger writes: "The theologian is the competent and adequate knower of time (...) theology treats human existence as a being before God." This God presents himself as a primary power that creates the world. No text in the world is more charged with energy than Genesis: "In the beginning, God created the heavens and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the spirit of God moved upon the face of the waters. And God said: "Let there be light!" And there was light. And God saw the light, that it was good: and God divided the light from the darkness."

Creation, a heritage of mankind and source of life

Light. Energy. Creation. Our world, often hastily defined as "the environment," forgetting that it has a profound philosophical and theological meaning. Venerating Creation as the work of God and the heritage of mankind was the mission of Saint Francis of Assisi. The Canticle of the Creatures is a sublime work of verse, the oldest in Italian literature (circa 1226) to have a known author. If you have never read it, make up for lost time (there it is, time again). You will find a majestic piece of writing that irradiates love. And once again light, energy: "Praised be you, my Lord, with all your creatures, especially brother sun, who is the day and through whom you give us light. And he is beautiful and radiant with great splendor and bears a likeness of you, most high one." Saint Francis and the Creation. There is nothing stronger, more natural and crystal clear than this in the history of literature. Many poets have sung about nature and the life force, trying to celebrate it and give it order—think of Walt Whitman ("the darting swallow, the destroyer of insects, the fall traveler southward but returning northward early in the spring") or Ralph Waldo Emerson, who, in his search for a transcending philosophy, wrote an essay entitled "Nature"—but nothing comes close to the natural beauty of the composition by Saint Francis, illuminated by his closeness to God. The Creation sung by Saint Francis is our world, the one from which energy, the source of life, is drawn. In 2015, Pope Francis published the encyclical *Laudato si'* subtitled "On care for the common home": Creation. The Holy Father's letter begins with the verses of Saint Francis, goes on a journey through the complexity and problems of the ecosystem, presenting it as a set of relationships, urges us "to develop policies so that, in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced, for example, substituting fossil fuels and developing sources of renewable energy."

Care for the common home as a shared responsibility

Care for Creation. The responsibility for this care lies with all of us, with no exceptions. Starting from the small things, from the waste we produce in our daily life, from the consumption of energy. This is where we become responsible. Towards ourselves, our loved ones, and everyone else. The environment is suddenly no longer something "external," but internal, it becomes a philosophical subject, a question that needs a non-elusive answer. We live at a time of transition, shock and rapid change. In his encyclical, Saint Francis defines this time (there it is, time again): "The continued acceleration of changes affecting humanity and the planet is coupled today with a more intensified pace of life and work, which in Spanish some call "rapidación" (rapidification)." The curvature of our space—and time—today is the product of this mix of forces, thrusts and counter-thrusts, where technology plays a key role. In this edition of *WE*, we have tried to focus on this "rapidación," taking a snapshot of this scenario and giving it a name: "Disruption and Opportunity." Technological leaps, geopolitical shocks, climate change are a problem and an opportunity. At the center of our reflection is the environment, Creation.

While at *WE* we were going into the darkroom to develop this picture, on June 8 and 9, the Pontifical Academy of Sciences hosted a meeting in the Vatican promoted by the University of Notre Dame (U.S.) and the Department for the Promotion of Integral Human Development on the theme of the "energy transition" and "care of our common home." It was attended by the CEOs of some of the biggest energy companies, including Exxon, BP, Equinor and Eni. Once again, the Church is a precious forum for discussion and cooperation on these subjects. Pope Francis took this opportunity to ask all the participants to "identify a long-term global strategy, which offers energy security and thus fosters economic stability, protects health and the environment and promotes integral human development, establishing precise commitments to tackle the problem of climate change." This work for Creation, this focus on ensuring the well-being of us all, is not a mirage, not an abstract ideal, it is a possibility that can—and must—become concrete through technology. It is here that the men who do must combine pragmatism with the highest purpose. These are subjects I have often discussed with Claudio Descalzi. Looking at the problems of opulence and consumption in the West, the poverty, human and material wealth of Africa, the glittering development of Asia: the big game played in the geopolitics of energy (i.e., everything), human beings in search of life and space in a scenario of acceleration and compression. There is urgency, an inner impulse and a clear sense of time flying in this discussion between us, because in a world of "disruption and opportunity," in this cycle of ruptures and opportunities, the lesson of Saint Francis recalled by the Pope becomes a daily challenge.



The safeguard of the fate of the planet needs a changing course

Talking and doing. Talking to awaken often dormant consciences. Ensuring that words are never a dead letter. "We must promote a reduction in the carbon footprint of our business through the digitalization and development of new technologies, the widespread use of carbon capture, reuse and storage systems, the greater efficiency of energy transformation processes," said Descalzi commenting on the meeting in the Vatican. In this edition of *WE*, Moises Naim points out that "a powerful storm is looming on the horizon: Mother Nature. Climate change is bound to create constraints, incentives and requirements that will force governments, businesses and consumers to radically change their habits. The world will urgently need to change course in terms of policy, institutions, economics and energy technologies, and sooner than is normally thought.This is the storm for which we need to prepare." These words sound like a reminder to us all that technology is a factor of innovation but not always of advancement, and it can also hold us back. Naim reminds us of this in respect of the fracking revolution—beautifully described from its origins in an article in *WE* by Francesco Gattei—while Ian Bremmer draws the geopolitical conclusions: American disengagement from the Middle East. Technology. Rupture. Opportunity. Shock. This is all reflected in the price of energy, an (un)predictable series of highs and lows, where the winners and losers alternate, but only up to a certain height on the ladder, because at the top are the permanent players, the ones who open and close the faucet: the United States, Russia, Saudi Arabia. Big consumers without large resources, China and India, are burning oil, gas, and coal and using the lever of technology to move as quickly as possible to a system where the share of fossil fuels will decrease. They have the strength of demographics, but the weakness of a system of supply, production and consumption that remains to be built. In this context, new and challenging leaders (e.g., Donald Trump) are questioning seemingly established paradigms (the inexorable expansion of free trade pacts), political events that open cracks in global governance (the European Union and Brexit), pervasive computerization and digitalization that change the mode of production and—we return to mankind, to its essence—the feeling of privacy, reducing the individual to a dematerialized element: Big Data.

Restoring a constructive dialog between politics and economics

Technology. Rupture. Opportunity. Shock. At the end of the day, having sifted through the news, weighed up the facts, if we look up, let the dust settle on this battlefield, we can see that the biggest challenge is the one identified by the Pope in his *Laudato si'* encyclical: "Politics and the economy tend to blame each other when it comes to poverty and environmental degradation. It is to be hoped that they can acknowledge their own mistakes and find forms of interaction directed to the common good. While some are concerned only with financial gain, and others with holding on to or increasing their power, what we are left with are conflicts or spurious agreements where the last thing either party is concerned about is caring for the environment and protecting those who are most vulnerable. Here too, we see how true it is that "unity is greater than conflict." In a world of ruptures and opportunities, we need to turn our gaze and lend our ear to words and visions that come from afar. We have traveled together. And we have found them. There were born twenty centuries ago.

AN HISTORICAL MOMENT

On June 8th and 9th, 2018, the Pontifical Academy of the Science hosted, in the Vatican, a summit promoted by the University of Notre Dame (U.S.) and from Dicastery for the Promotion of Integral Human Development on the theme of "transition energy" and "care of our common home." The highest international exponents of the energy world were present. The photo shows Pope Francis with the participants.

Taking stock/The reasons behind the transformations in the world of energy

Technology and Mother Nature

Most of energy industry disruption has come from new technologies. This will continue. But a source of turmoil far more potent looms large



MOISÉS NAÍM

He is a Distinguished Fellow at the Carnegie Endowment in Washington, D.C. and the author most recently of *The End of Power*. He is a founding member of *WE* editorial board.

A study of 3600 major companies published this year by Accenture, a management consulting company, examined the exposure of major industrial sectors to disruption. It found that the energy sector is the most vulnerable, followed by banking and utilities. The report reiterates that disruption can take different forms and varies from industry to industry, and even among companies within the same industry. For some corporations, disruptive forces pose an existential threat, while, at the same time, they create attractive new possibilities for others. The main source of disruption in the energy industry are new technologies. This is unsurprising. What is, however, rather unexpected is that these new, disruptive technologies are also helping preserve, and in some cases even reinforce, traditional strategies and business models in the fossil fuel sector. These clashing forces of disruption and continuity are influencing the direction and speed of what, so far, has been an orderly, albeit slow-moving, global transition from a high carbon to a low carbon economy. If this transition is not speeded up Mother Nature will become the most important source of disruption in the energy industry and, arguably, in all industries.

It is tempting to evaluate disruption and continuity on the basis of their short to medium term economic or technological impact rather than in terms of the true end-game, which is their impact on the future of the industry and ultimately of our planet. From this perspective, innovations that disrupt the fossil-fuel industry and promote the use of new, cleaner sources of energy appear to be headed in the right direction. There is abundant proof that such a process has already been initiated and appears to be irreversible, but the central question remains: will this change take place in time to prevent a major global upheaval?

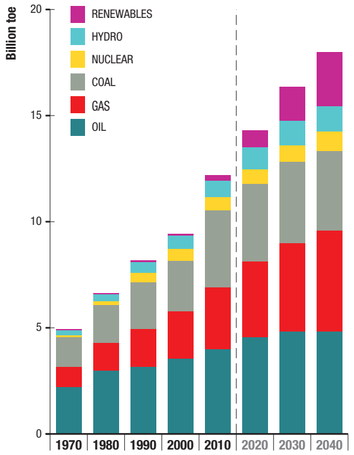
Change and continuity

The best-known and most dramatic example of a new technology that has upended the energy sector is hydrofracking. Paradoxically, this new way of producing energy from fossil fuels also contributes to slowing down the speed at which the industry moves towards a lower carbon business model. By making it possible for the United States, one of the world's top oil consumers, to also become one its leading producers, fracking has lowered the risks of drastic disruptions in the orderly supply of oil to the global market. The risks of supply disruptions caused by geopolitical accidents were higher when the swing producers were located in politically unstable areas like the Middle East and Latin America. By boosting the reliability of supply to the world's oil market, fracking helps to prolong the life of fossil fuels as a predominant source of energy. Significant new sources of supply of cheaper, less polluting, higher quality oil and cleaner natural gas are available thanks to fracking. This, in turn, facilitates a slower and perhaps a less disruptive transition towards a situation in which renewables substantially replace fossil fuels as sources of energy. The risk, of course, is that the transition is slower than desirable or necessary. Many experts believe that what the world needs is an acceleration of this transition, as its inevitable costs may end up being lower than those created by too slow a shift to a global economy that consumes drastically less fossil fuels.

New technologies can help in this transition. Although few technological innovations in the energy industry have been as impactful as fracking, there are many less spectacular innovations that are also transforming the ways in which we search, produce, transport and consume energy. The examples are too many to list, but to illustrate the range and potential impact of new technologies that are already changing the energy industry, suffice it to mention the simple solar charger that when placed in a sunny window can store up to 10 hours of electricity or the popularization of →

PRIMARY ENERGY CONSUMPTION

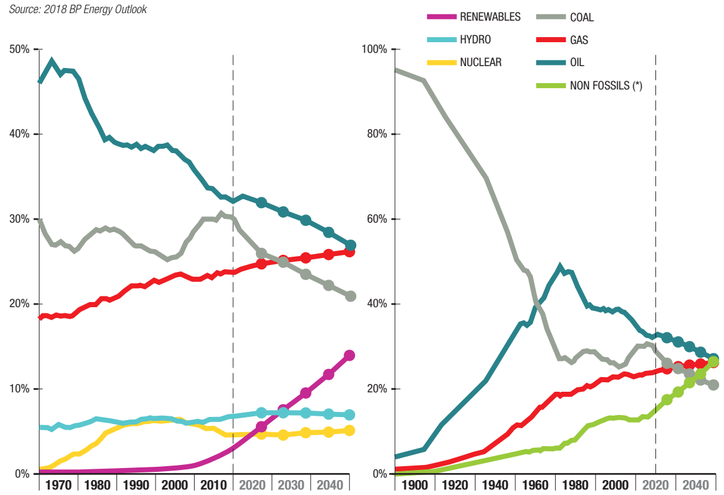
Source: 2018 BP Energy Outlook



SHARES OF PRIMARY ENERGY

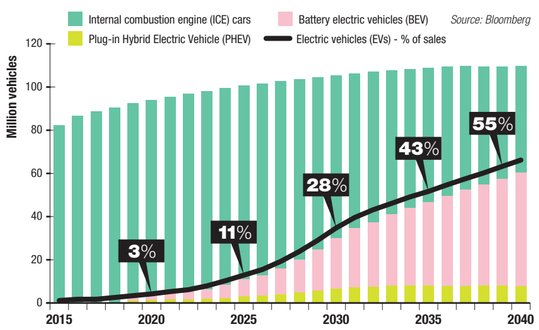
(*) Non fossils includes renewables, nuclear and hydro

Source: 2018 BP Energy Outlook



By 2040, oil, gas, coal, and non-fossil fuels are projected to each provide around a quarter of the world's energy. This would be the most diversified fuel mix ever seen.

ANNUAL GLOBAL LIGHT DUTY VEHICLE SALES



By 2040, around 55 percent of new car sales will be electric models, with a reduction in fossil fuel consumption of approximately 8 million barrels of oil per day.

batteries for electric cars or industrial-scale batteries that reduce the problem of intermittency in the solar and wind energy production.

The good news is that the "greenification" of the energy industry is now in full swing. According to the International Energy Agency, renewable energy will make up about 40 percent of global power generation by 2040. This is possible thanks to the advent of cheaper and more reliable technologies for the production of renewable energy.

Although the 2017 Thomson Reuters Index of the top 100 Global Energy Leaders is still dominated by oil and gas corporations and related utilities, close to 10 percent of the companies in this list belong to the renewable energy sector. In parallel to this intense effort by private corporations an impressive array of innovations for energy generation, conversion and storage are being developed in academic and governmental research centers.

Fast-growing disruptive renewables

In the 2017 Thomson Reuters Index of the top 25 companies engaged in renewable energy generation, twelve generate solar power, eight generate wind power and five are engaged in the production of biofuel. According to the projections of the U.S. Energy Information Administration, EIA, in 2040, wind and solar will become the predominant sources of electricity generation, significantly surpassing the growth of hydroelectricity. In particular, tangible cost reductions, tax credits and technological improvements are stimulating the rapid growth of the solar energy sector. British Petroleum projections indicate that by 2040 renewable sources of energy will make up to 26 percent of the world's energy supply, about the same percentage of natural gas and, clearly, will have overtaken coal as an energy source. According to Bloomberg, by 2040 about 54 percent of all new car sales will be for electric models, representing savings in fossil fuel consumption of some eight million barrels of oil per day.

Irreversible, slow transition

That renewable energy sources will increasingly replace fossil fuel is a clear trend. Less clear is the speed at which this replacement will take place. Many experts believe that the change will be too little, too late. James Temple, for example, reported in MIT's Technological Review that, despite the efforts to change the energy model, in 2017 the world still increased carbon emissions by about 2 percent. At this rate, he alerts, the desired transformation of the energy system would not take three decades, as now planned, but four centuries. The effort required to accelerate the rate of change by a factor of 20 is so enormous, the report notes, that it can be best imagined as the overhaul of the U.S, economy into a war economy *without being at war*.

The incentives to undertake this massive endeavor are largely absent due to lack of the public's awareness of—or indifference to—the looming threat. Moreover, as is well known, since the effects of carbon dioxide emissions are significantly delayed in time, they become fully apparent to the public only after they have become irreversible.

In conclusion: we need more, different disruption

The energy industry has been disrupted and has changed accordingly. Most of the disruption came from new technologies. This will continue. But a source of disruption far more potent is looming large: Mother Nature. Climate change is bound to create constraints, incentives and requirements that will force governments, corporations and consumers to drastically alter their ways. The world will urgently need disruptions in the politics, institutions, economics and technologies of energy. And will need them sooner than most people expect. That is the disruption for which we should be preparing.



THEORY

Formulated by the Lebanese philosopher, statistician and trader Nicholas Taleb, the black swan theory puts forward the importance of rare events and unlikely yet high-impact radical phenomena, and demonstrates the limits of our model of knowledge, based on deduction using historical data and empirical experience.

Photo: Melchisédech Thévenot (1620-1692): "Hollandia Nova detecta; Terre Australe découverte l'an 1644", Paris: De l'imprimerie de Jacques Langlois, 1663.

Scenario/The traditional rules have changed, and further changes are on the horizon

The Black Swan of the Oil and Gas Market

By combining horizontal drilling with hydraulic fracturing for shale gas extraction, the oilman George Mitchell revolutionized the world of hydrocarbons and more



FRANCESCO GATTEI

Executive Vice President, Scenarios, Strategic Options & Investor Relations of Eni, previously responsible for the E&P portfolio at Eni, where he also held numerous planning, negotiation and commercial roles in Italy and abroad.

The *Cygnus atratus* is a peaceful and relatively sociable bird, unknown to most people until the late 17th century, when Willem de Vlamingh, the captain of a Dutch ship, first set foot on the Australian continent near the city of Perth. The discovery of black swans did not change the course of history, nor did it result in any notable addition to the European diet, but it rapidly dispelled the notion, widely held since the time of Juvenal (rara avis in terris, nigroque simillima cygno), that black swans were rarer than the virtue of Roman matrons. Over three hundred years later, in 2007, before a song or a movie added new meanings to the peculiarity of black swans, the Lebanese philosopher, statistician and trader Nassim Nicholas Taleb published a book that went on to become one of the most frequently cited best sellers in recent years.

The Theory of the Black Swan, as presented in Nassim Nicholas Taleb's book, postulates the importance of rare events, of low-probability but high-impact radical phenomena, and highlights the limitations of our theory of knowledge based on deduction through historical data and empirical experience. Until a rare event occurs, political, economic and social systems move within areas of relative stability and certainty. Oscillations are reduced, whereas effects and iterations are more predictable. This is what Taleb calls 'Mediocristan,' the region of the world dominated by the central section of the Gaussian curve. But when history decides to make a leap forward and produce the extreme event, then everything changes and we enter the region of 'Extremistan' and we have to update our previously easy understandings. In the absence of previous data, our cognitive tools are fragile and the possibility of predicting the future becomes mere prophecy. While failing to predict the Black Swan of his own success, Taleb laid the philosophical foundations of many of the events that would subsequently occur, including the most serious global financial crisis since 1929, the traumatic and abrupt change of several apparently solid and long-established Arab regimes and Britain's exit from the European Union. But we will not dwell on the political world. The world of energy, too, is a land where unknown birds build their nests. The traditional rules of the oil and gas market have changed and even more radical changes could be around the corner.

An eighty-year-old man who changed the world

The Black Swan of the oil and gas market is called George Mitchell, one of the few businessmen to have changed the world, according to *The Economist*, and whose date of birth, May 21, could become a future national holiday in the Unites States. Mitchell didn't take his name from his father, Savvas Paraskevoupolos, but he did inherit his father's commitment and sacrifice and put it to good use in the land of opportunity where his parents had emigrated at the beginning of the century. Young George got rich and eventually became an oilman while also buying and selling his companies. But the roads to immortality are not all the same for everyone, including American oil tycoons. In his early eighties George's life was paved with two difficulties: he produced gas, which was a less valuable resource than its twin brother oil, and he produced it from shale rocks so hard that they had to be fractured with water injected at high pressure in order to unlock their precious content. While the financial value of these wells was fairly marginal, the mineral potential trapped inside them was almost incalculable. Mitchell had a brainwave. He hit on the idea of combining fracking, the hydraulic fracturing of rocks, with another well-established technique: horizontal drilling, to maximize contact with the rocks and thereby boost well production rates. By around 2004, the two weaknesses of the Mitchell model were suddenly reversed. Gas, which was increasingly scarce in the United States and was about to be imported via LPG, became more expensive, fetching almost the same price as crude, and the gas molecule, smaller and therefore more mobile than the crude molecule, proved to be highly suited to the application of the new technique. The dream of an eighty-year-old thus became the opportunity for an entire generation of oilmen. Mitchell's resounding success led to the discovery of six vast shale gas fields with estimated resources of 1,800 trillion cubic feet, equivalent to three times the volume of proven American gas reserves. As a result, twenty regasification plants still under construction and never actually commissioned immediately became obsolete, probably one of the greatest forecasting failures in American industrial history, and were gradually converted into export facilities. An important fact about the new technique is that the wells have a very short-lived output capacity, and after two years they only produce 25 percent of their (already low) initial production level. They are like gigantic match boxes that can be lit at different speeds or left to go out depending on market conditions. And they can be commissioned in less than two months. In other words, they have a just-in-time gas production cycle, the exact opposite of traditional upstream projects, which require a long exploration of 4-5 years, an investment phase of 4-5 years, and whose production lasts a few decades.

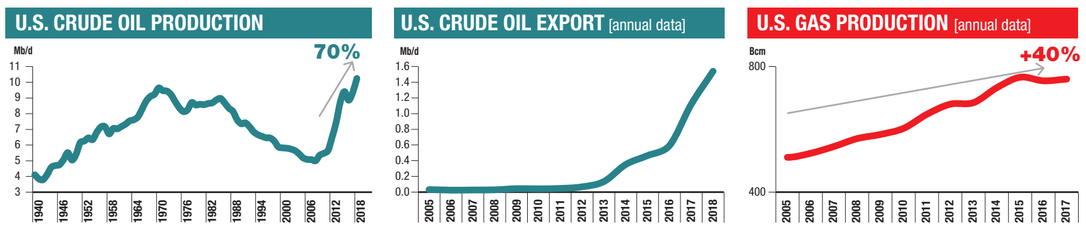
The new American miracle

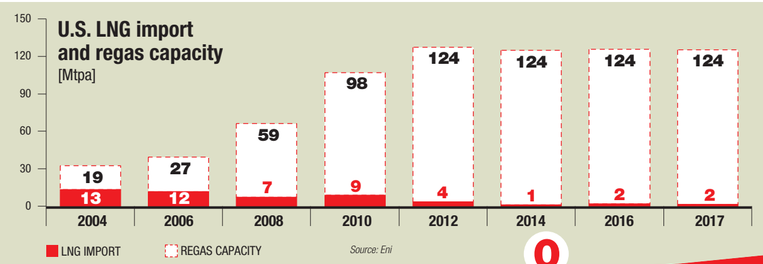
As the history of great pandemics shows, contagion is difficult to contain in the New World. Yet, the absence of solid trends and useful historical data makes forecasting impossible. Thus, while gas prices were already deflating due to a supply glut in 2010, fracking started to be applied to the oil fields in the Bakken formation, a region situated between North Dakota and Montana. and popularized by the film Fargo, though not as a holiday spot ("A lot can happen in the middle of nowhere"). In this case, the pioneer was the slightly younger, almost seventy-year-old Harold Hamm, who contributed to increasing output in the Bakken from next to nothing to over 1 million barrels per day. Hamm also broke a less enviable record with the world's biggest divorce settlement valued at USD 1 billion. The shale virus thus spread rapidly from North to South, from the Bakken oil fields to the Permian Basin, the most oil-rich region of Texas. And, today, it is not surprising that, after reaching its output peak in 1970 (the Club of Rome, Hubbert's peak and *Interceptor*—remember?), the United States is again at all-time high oil production levels and competing with Saudi Arabia and Russia in the race to become the global oil leader. Doubling U.S. output in less than six years is a worthy accomplishment, all the more so as it has taken place in the country with the most advanced mining industry.

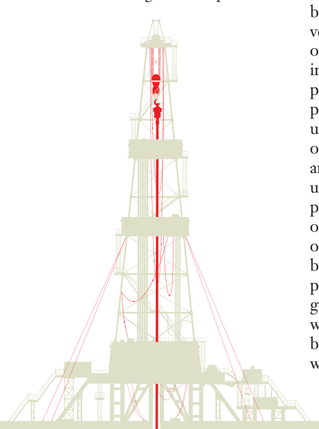
It was one surprise after the other and one map after the other. Today, the United States exports petroleum, gasoline and liquefied gas and re-imports heavy industry goods, driven by the largest availability of cheap energy in the West. It's the trend reversal of the last thirty years. Large-scale chemical and refinery projects and the replacement of coal with gas make the American recipe both expansive and low-carbon (13 percent reduction in CO_2 emissions since 2005). Thanks to the market's invisible hand, the new American miracle successfully combines Reagan with Al Gore. This kind of transformation would have been impossible to plan. The contagion then crossed the Atlantic by ship. American coal took the sea route with an unprecedented flow of exports. Likewise, imported gas, which never made it to the coast of the Gulf of Mexico, is now saturated due to America's new-found gas self-sufficiency and has been rerouted to Europe. And it claimed another victim: Europe's traditional gas exchange model. The wide availability of spot volumes of gas combined with weaker demand due to the economic crisis, the boom in renewables and American coal, boost the opportunities for European consumers to obtain their supplies directly from hubs close to major ports or gas networks. Thus, the traditional model on which the gas industry had been steadily and progressively developed in Europe during the previous fifty years was brought to an end in less than five years. Previously, the pricing structure meant that gas prices were oil linked, while gas volumes were delivered with collection obligations or payment of the amount due even in the event of failure to collect, the so-called take-or-pay contract. In the past, the duration of a contract covered the period of one or possibly two generations. But buying from a hub is cheaper. Why pay the premium on crude for the geopolitics of the Arab revolutions when we are living through a gas bubble? It's less risky because in a weak and evolving market take-or-pay conditions are negative to the consumer. New supply contracts became shorter-term and with more options for flexibility with multiple delivery points or reduced volumes leading the price of gas to finally reflect its fundamentals and not those of liquid fuel, which benefits from the monopoly in transport consumption. It is the birth of the equivalent of Tinder for methane trading. After European gas, the next to be hit was the global market for crude oil. And with crude, too, it was shipping that set off the domino effect on a global scale. Growing supplies of American oil caused the price to collapse in 2014 so that OPEC was faced with Hamlet's dilemma of whether to cut production and lose market share or accept head-on collision in order to curb the new oilmen's irrational exuberance by using moral suasion. OPEC didn't cut production and went to war, but after twenty years of blood and tears the gamble failed. Shale oil is like a subterranean river, always ready to resurface as soon as the price rebounds. As in the final scene of *Terminator*, the monster gets up again every time the game seems to be over. The change is more structural. Like the gas market, today's crude oil market has to coexist with a volatility caused by the reaction and contraction capacity of shale oil, which makes long-term investment very risky and prices extremely volatile. Any project that involves lengthy development time is to be avoided. Only a decade ago a ten year lag time between discovery and production was considered more than reasonable. Production that lies on the costliest part of the supply curve is also to be avoided. Ask the large corporations that bought oil-rich sands in western Canada. But what will future market conditions be like? Will the loss of sustained long-term production alongside burgeoning shale oil growth be able to create an orderly market and a suitable climate for stable investments? Or are we in danger of seeing ongoing cycles of raging storms and calm seas? It's hard to tell, although the risk of this happening seems high. As yet, we don't have enough case studies to be able to reach our deduction.

Winners and losers

In conclusion, we are in an unknown world and we are exploring it step by step. In less than ten years, Mitchell's revolution has claimed many victims, including American gas import terminals, American coal producers, traditional European contracts with oil-linked formulas, and costly and long-term oil projects like those involving bituminous sands. But there are also new winners, first and foremost the United States, which benefits from the lowest energy cost than any other OECD country and is rebuilding its domestic industry, and European hubs now dominating gas trading. Finally, there are the oil companies that avoided betting on price hikes and on the need to invest on more expensive crude like Canadian oil. These are the few companies that still know how to look for oil and gas that can be produced as soon as possible, in less than three or four years, in the best case scenario, between discovery and project commissioning). There are therefore many reasons for making May 21 a national holiday, and not just in the United States. But there are many other reasons for cursing that day.





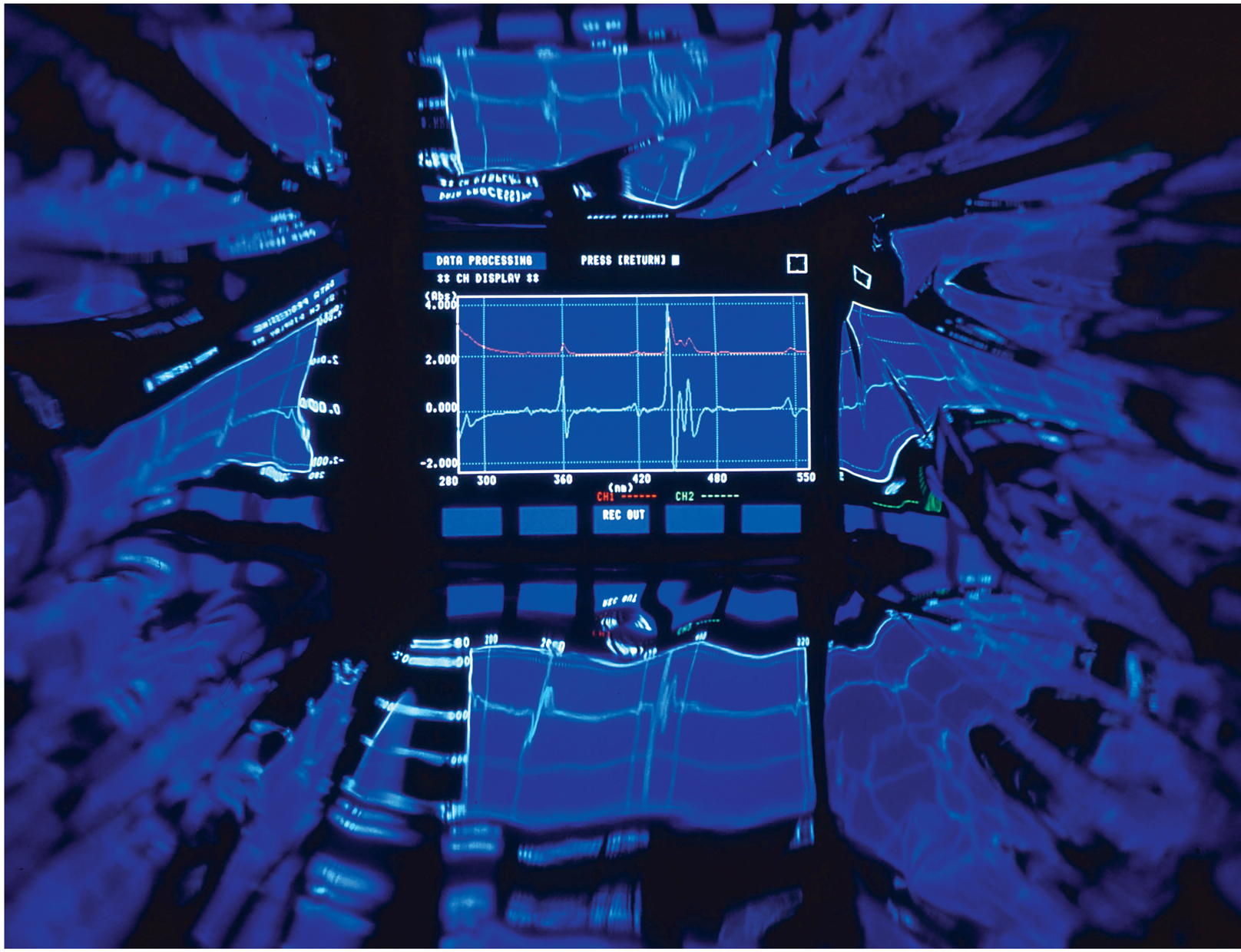


The Impact on the U.S. Market of the Shale Gas Revolution

Analysis/The chronic volatility of oil prices and attempts to contain it

The Return of Boom-Bust Oil Price Cycles

Analysts are divided about the trajectory of crude prices in the short term, but there is a risk of a price drop next year due to an unexpected plateau





ROBERT MCNALLY

He is a non-resident Fellow at Columbia University's Center on Global Energy. He is also the founder and President of The Rapidan Group, an independent energy consulting and market advisory firm. He is the author of *Crude Volatility: The History and the Future of Boom-Bust Oil Prices*, Columbia University Press, 2017.

il is, and for the foreseeable future will remain, the world's dominant transportation fuel, and as such is nothing less than the lifeblood of modernization. Beyond personal transportation, oil powers our trade, agriculture, and security. Patterns and disruptions in the global oil market anywhere are therefore of the utmost importance to broad swaths of every country's business, consumer and government sectors. While countries vary widely in their oil production, demand, and imports (as well as their taxation and regulation of oil and oil products), they all face a price for crude oil which derives from a single, global market.

The global oil market, this article shall contend, has undergone a seismic structural shift the likes of which have not been seen in at least 50 (and more appropriately 80) years. Today's market is structurally unbalanced and lacking a swing producer. Given oil supply and demand's extreme inelasticity (or unresponsiveness to price), this yields price swings of a magnitude best characterized as boom and bust. Multi-year episodes of relative calm, such as the last two years when prices ranged around $50, or between 2010 and 2013, when they hovered around $100, may spawn expectations of long-term price stability. But it is more likely that relatively calm periods will give way to new boom and bust phases as supply and demand imbalances persist, and are indeed intensified by prior booms and busts, while the absence of a capable, proactive supply manager or swing producer remains painfully evident.

The history and future of oil price volatility

Oil's chronic tendency toward wildly unstable prices has vexed the oil industry since its earliest days in 1859. After oil graduated from illumination to strategic transportation fuel over 100 years ago, governments began to care about and pursue oil price stability. Oil is naturally prone toward wild price swings because supply and demand are inelastic or unresponsive to price changes in the short run. Petroleum fuels are must-have commodities for which there are no short-term substitutes, while on the supply side, oil exploration, production, transportation, and refining have relatively low operating costs once sizeable up-front capital expenditures are made. Consequently, when the market is unbalanced, wide price swings are needed to incentivize changes in producer/consumer behavior. Storage can help smooth supply and demand imbalances, but storage capacity is costly and limited.

Oil's proneness to instability emerged in the earliest days after Edwin Drake's well ignited the modern oil era in August 1859. Producers drilled more oil than the market could handle, producing price busts, which in turn wiped out investment. With demand rising briskly, prices recovered from busts and soared, attracting more investment, overproduction, and another price bust. These price busts (the first occurring in November 1861) often triggered ad hoc attempts by producers to form cartels and collectively reduce production. While these efforts sometimes enjoyed temporary success, they invariably failed due to fast-rising production outside the cartel and cheating within. These early ad hoc cartels, as we shall see, bear more than passing similarity to today's efforts by some OPEC and non-OPEC countries to collectively restrain production.

History shows only a firm and dominant hand on the oil spigot was able to impose lasting oil price stability. The first successful supply manager was oil magnate John D. Rockefeller and his Standard Oil Trust. Rockefeller started as a grocer in Cleveland but moved into refining oil during the Pennsylvania oil boom. He was appalled by price instability due to uncontrolled drilling in western Pennsylvania, then the center of the global oil market. So, he devised and implemented a grand plan, first to monopolize refining, then integrate with key transportation sectors (railroads and later pipelines), and finally, dictate prices to an unruly host of drillers. Through his actions, Rockefeller brought relative stability to crude prices (see chart on pages 14-15) as well as the primary refined product at the time, kerosene. Even Rockefeller's detractors applauded the order and stability he brought to burgeoning oil markets. However, he and his corporate empire became deeply unpopular at the turn of the century, and Standard Oil was broken up by the U.S. Supreme Court in 1911. With the stabilizing hand gone, oil prices reverted to wild instability.

The fear of peak oil

The twenty years of boom-bust oil prices that followed Standard Oil's →

breakup disrupted not only the oil industry but the broader economic and public sectors, including governments. The reason: oil's primary use had shifted from a relatively unimportant illuminant to a strategic transportation fuel. The oil price boom after World War I enraged new motorists, spawned government investigations, and prompted widespread fears that we were running out of oil (this came to be known as "peak oil," a prediction that would continue to emerge periodically into the 21st century). But prices collapsed later in the decade that lasted through the early 1930s as new fields were discovered and came on stream, especially in Oklahoma and Texas. Low prices caused oil state officials to begin regulating supply. The Texas Railroad Commission (TRC) and the Oklahoma Corporation Commission (OCC) acted as the regulators of the oil industries in their states, which combined accounted for 55 percent of U.S. production in 1927. Starting in the 1930s, and for the next forty years, oil state regulators imposed strict quotas on drillers to keep oil prices high and stable. U.S. oil state regulators cooperated informally but tightly with the major international oil companies—the "Seven Sisters"—that collectively controlled the foreign assets through concessions with foreign governments and pricing power. U.S. oil state quotas effectively created a global benchmark price in the U.S. Gulf Coast which the Seven Sisters used to base prices in global markets.

A notable development during this forty year period of oil price stability—the "Texas Era" which lasted from 1932 to 1972—was the buildup of enormous spare production capacity in the 1950s. Spare capacity is wellhead production held off the market in periods of excess supply by a regulator or cartel members with the aim of stabilizing oil prices. In the mid-1950s, large new Middle Eastern fields began producing, but the big wave of transportation demand was still ten years in the future, in the 1960s. With massive new Middle East discoveries threatening to overwhelm supply and cause destructive price busts, oil state regulators and the Seven Sisters were obliged to order at times swinging cutbacks in their production. As shown in chart below on page 16, in the mid-1950s, some two-thirds of global oil production was held off the market by U.S. regulators and the Seven Sisters. Oil drillers forced to accept these mandatory production cutbacks were very displeased, but regulators and major oil companies saw little alternative to prevent destructive price busts.

One side benefit of having sizeable spare production capacity was a cushion when substantial geopolitical disruptions occurred. The 1956-1957 Suez Crisis and 1967 Arab-Israeli War disrupted large amounts of crude oil. In fact, the Suez Crisis saw the largest ever oil market disruption in percentage terms. However, U.S. oil states—primarily Texas—responded by increasing production from ample spare capacity, preventing a significant oil price spike. The Arab oil embargo in October 1973, by contrast, caused a major price spike because the year before, the U.S. had run out of spare production capacity and ceased playing the role of global oil price stabilizer.

Enter OPEC

OPEC was founded by Venezuelan and Middle East oil policy officials who admired and intended to emulate the Texas Railroad Commission's quota systems. However, OPEC producers have never been as unified as the U.S. oil states and the Seven Sisters. While OPEC countries wrested control of revenues, and then ownership of concessions, from major oil companies, in only one instance did they live up to the role of their predecessors in terms of stabilizing oil prices. High oil prices during most of the 1970s, due to firm supply and demand and geopolitical risk and disruptions, obviated any need for OPEC to coordinate output, much less agree how to share the burden of production cuts. But in the early 1980s, oil markets weakened sharply due to the start-up of major new fields, fuel switching and efficiency, and a deep economic recession. Saudi Arabia stepped up and played the "swing producer" role, cutting its production from 10 to below 3 million barrels per day between 1982 and 1985, while other OPEC producers implemented trivial cuts of little significance. Saudi Arabia's big supply cuts staved off an oil price collapse, but Riyadh alone suffered a huge loss of revenue and market share. When Saudi Arabia ramped up production in 1986 by adopting netback pricing, oil prices collapsed.

Since 1986, Saudi Arabia and OPEC have adjusted quotas based upon global events, such as an increase in production after the September 11th attacks or a production cut after the 2008 financial crisis, but these adjustments do not constitute a resumption of the swing producer role.

Some 14 years ago, oil prices began a historic boom, nearly quintupling between 2003 and 2008. In addition to the largest boom in modern times, it was the only one not caused by a war in the Middle East and supply disruption. This boom happened because demand, fueled by 6 percent global GDP growth and soaring Chinese demand, especially for distillate in electricity - outstripped supply (non-OPEC supply failed to rise appreciably). Saudi Arabia threw all its barrels into the market, and spare capacity vanished—precisely what happened in the 1960s and early 1970s when the U.S. ran out of spare capacity in peacetime amidst a demand boom and supply plateau.

Oil prices crashed as the Great Recession began in late 2008 but recovered quickly, stabilizing for a few years around $100. After 2008, prices recovered and stabilized around $80 and then, in 2011, another price shock pushed oil up as high as $110 largely on unplanned outages. Soaring U.S. shale oil production prevented oil prices from reaching recent highs. But by late 2014, surging shale oil production, along with new supplies from Brazil, Canada, and other producers, threatened to flood the market. This danger became apparent by the November 2014 OPEC meeting, and market participants expected OPEC would respond by "doing its job"—curtailing supply. But in practice, only Saudi Arabia has been willing to cut supply in the face of a surplus. Riyadh's refusal to cut alone in 2014 shocked the market and sent oil prices hurtling down to $45 by January 2015, 60 percent below their level just six months prior. Despite periodic oil price rallies since 2015, oil prices remained under downward pressure due to an inventory glut. After oil prices crashed to $26 in February 2016, producers took fright. Saudi Arabia and Russia, which had contributed to the excess by each ramping production to record levels by October 2016, spearheaded a new effort to organize collective cuts among leading oil producers.

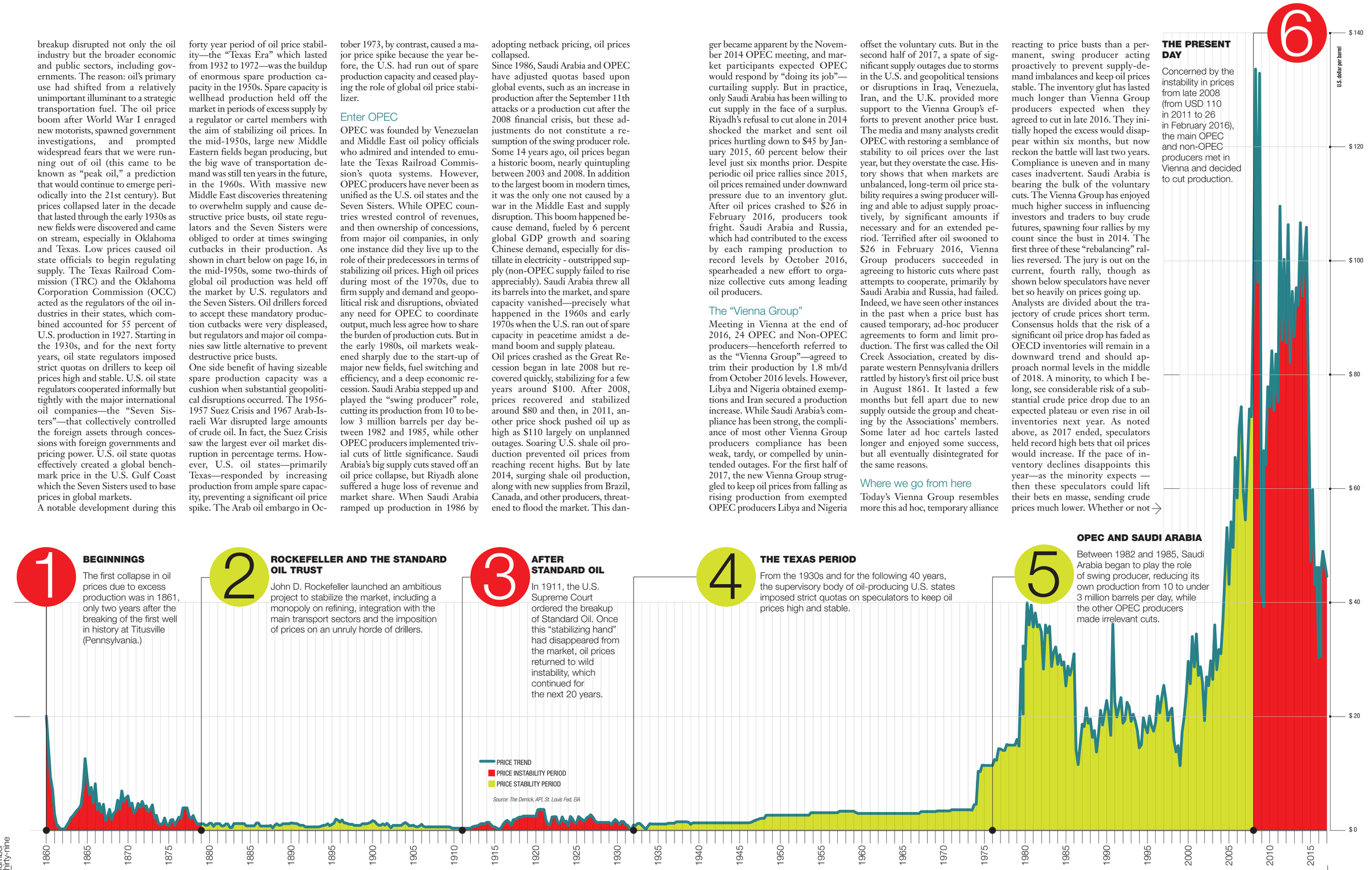
The "Vienna Group"

Meeting in Vienna at the end of 2016, 24 OPEC and Non-OPEC producers—henceforth referred to as the "Vienna Group"—agreed to trim their production by 1.8 mb/d from October 2016 levels. However, Libya and Nigeria obtained exemptions and Iran secured a production increase. While Saudi Arabia's compliance has been strong, the compliance of most other Vienna Group producers compliance has been weak, tardy, or compelled by unintended outages. For the first half of 2017, the new Vienna Group struggled to keep oil prices from falling as rising production from exempted OPEC producers Libya and Nigeria offset the voluntary cuts. But in the second half of 2017, a spate of significant supply outages due to storms in the U.S. and geopolitical tensions or disruptions in Iraq, Venezuela, Iran, and the U.K. provided more support to the Vienna Group's efforts to prevent another price bust. The media and many analysts credit OPEC with restoring a semblance of stability to oil prices over the last year, but they overstate the case. History shows that when markets are unbalanced, long-term oil price stability requires a swing producer willing and able to adjust supply proactively, by significant amounts if necessary and for an extended period. Terrified after oil swooned to $26 in February 2016, Vienna Group producers succeeded in agreeing to historic cuts where past attempts to cooperate, primarily by Saudi Arabia and Russia, had failed. Indeed, we have seen other instances in the past when a price bust has caused temporary, ad-hoc producer agreements to form and limit production. The first was called the Oil Creek Association, created by disparate western Pennsylvania drillers rattled by history's first oil price bust in August 1861. It lasted a few months but fell apart due to new supply outside the group and cheating by the Associations' members. Some later ad hoc cartels lasted longer and enjoyed some success, but all eventually disintegrated for the same reasons.

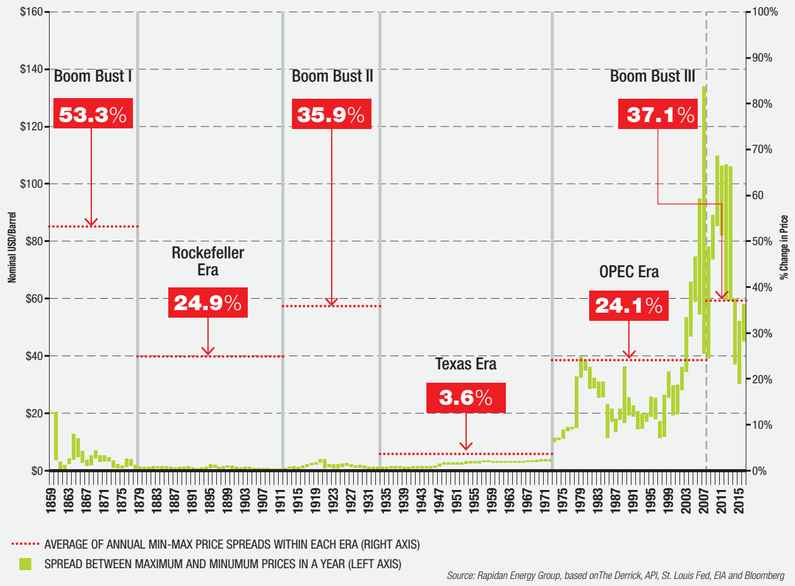
Where we go from here

Today's Vienna Group resembles more this ad hoc, temporary alliance reacting to price busts than a permanent, swing producer acting proactively to prevent supply-demand imbalances and keep oil prices stable. The inventory glut has lasted much longer than Vienna Group producers expected when they agreed to cut in late 2016. They initially hoped the excess would disappear within six months, but now reckon the battle will last two years. Compliance is uneven and in many cases inadvertent. Saudi Arabia is bearing the bulk of the voluntary cuts. The Vienna Group has enjoyed much higher success in influencing investors and traders to buy crude futures, spawning four rallies by my count since the bust in 2014. The first three of these "rebalancing" rallies reversed. The jury is out on the current, fourth rally, though as shown below speculators have never bet so heavily on prices going up.

Analysts are divided about the trajectory of crude prices short term. Consensus holds that the risk of a significant oil price drop has faded as OECD inventories will remain in a downward trend and should approach normal levels in the middle of 2018. A minority, to which I belong, see considerable risk of a substantial crude price drop due to an expected plateau or even rise in oil inventories next year. As noted above, as 2017 ended, speculators held record high bets that oil prices would increase. If the pace of inventory declines disappoints this year—as the minority expects — then these speculators could lift their bets en masse, sending crude prices much lower. Whether or not →



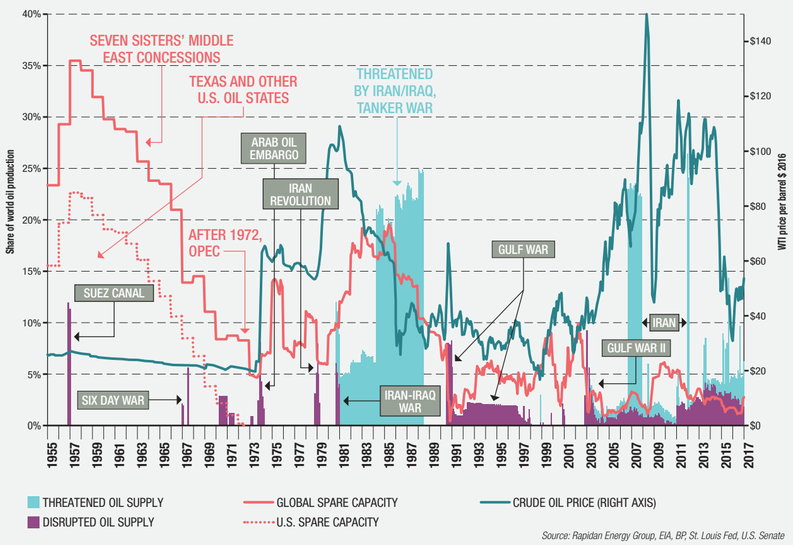
ANNUAL RANGES OF MONTHLY U.S. CRUDE OIL PRICES [1859-2017]



Source: Rapidan Energy Group, based on The Derrick, API, St. Louis Fed, EIA and Bloomberg

According to the chart, showing the differences between minimum and maximum crude oil prices by year, it seems clear that periods of sizeable changes in prices have alternated with less turbulent periods, due to the presence on the market of a "stabilizing hand."

OIL DISRUPTIONS, SPARE CAPACITY AND CRUDE PRICES



Source: Rapidan Energy Group, EIA, BP, St. Louis Fed, U.S. Senate

In the mid-1950s, the U.S. supervisory bodies and the Seven Sisters prevented the marketing of around two-thirds of total oil production, to avert a collapse in prices. The considerable unused capacity represented a "buffer stock," to be used in the event of significant geopolitical tensions.

oil prices have seen the last of the big swoons since 2014, the question for the medium to longer term is whether oil prices will remain stable or revert to the triple digits seen just ten years ago.

Medium term, the consensus appears to be that oil prices will remain in a $40 to $60 range. Even after inventories normalize, the risk of another price boom is deemed by the consensus to be low, partly due to shale oil's ability to ramp up quickly and partly due to widespread expectations that a large scale-up of electric vehicles and fuel efficiency policies will crimp future demand for oil in transportation. I disagree with the consensus view that shale oil and electric cars will prevent a return to triple-digit crude oil prices. More likely, an oil price boom will follow the bust. The main reason is consensus assumptions about policy-driven efficiency gains in transportation are optimistic.

These expectations that are nowhere more visible than in official forecasts for U.S. gasoline demand. The U.S. Energy Information Administration forecasts gasoline demand will shortly enter an abrupt and permanent decline, driven by tighter federal fuel efficiency standards and California's electric vehicle mandate. My colleagues and I at Rapidan Energy Group have thoroughly analyzed the history and outlook for these policy drivers and concluded they are too weak to cause demand to peak.

Whether or not U.S. gasoline demand peaks in the coming years will resonate globally. The U.S. gasoline demand market is massive—accounting for nearly one in ten barrels per day consumed on the planet—and enjoys symbolic importance among leading energy media, forecasters, and analysts.

The next boom phase in oil prices is likely to arise due to faster-than-expected demand, both because policies will turn out weaker than expected and because this period of low oil prices will have encouraged more consumption, requiring more oil than can be supplied given the bust phase's hit to investment in new oil fields and production facilities. Once inventories normalize, robust price increases will be required to enforce the iron law of economics that you cannot consume what you cannot produce.

Oil demand remains insensitive to price increases in the short run, so the price increases will be significant. And with spare production capacity wafer thin, geopolitical disruption risks will result in further oil price spikes.



Gas PRODUCTION [bcm] CONSUMPTION [bcm] RESERVES [bcm]

Oil PRODUCTION [kb/d] CONSUMPTION [kb/d] RESERVES [MD as at January 1st 2017]

Source: Eni

UK 42.67 83 187 1,028 1,593 2,436

UNITED STATES 735.06 764.90 8,980 12,539 19,901 31,143

MEXICO 37.55 80.00 208 2,463 1,952 7,640

COLOMBIA 10.07 10.49 114 890 349 2,002

VENEZUELA 23.79 23.64 5,740 2,429 629 301,806

NIGERIA 40.14 17.58 5,475 1,938 254 37,054

LIBYA 11.36 6.53 1,505 426 260 48,363

RUSSIA 631.12 429.96 50,617 11,341 3,637 80,000

IRAQ 7.04 7.04 3,820 4,503 851 153,000

IRAN 191.31 189.09 33,721 4,395 1,959 159,275

SOUTH SUDAN 0.0 0.0 0.0 117 7 3,500

KUWAIT 16.85 21.22 1,784 3,194 468 101,500

SAUDI ARABIA 87.47 87.47 8,619 12,408 3,220 266,332

BAHRAIN 14.39 14.39 92 209 61 129

QATAR 175.52 51.81 24,073 2,001 299 25,244

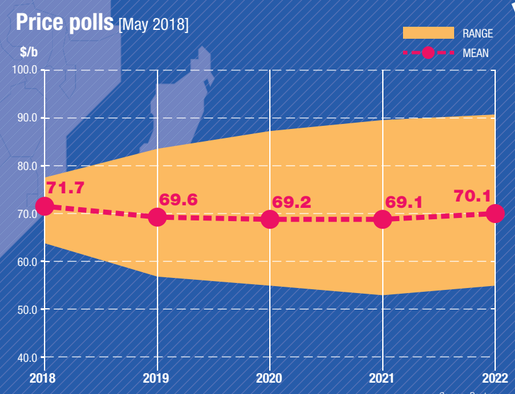
UAE 58.71 69.24 6,901 3,865 847 97,800

OMAN 33.73 25.04 705 1,012 197 5,373

YEMEN 1.17 1.17 479 16 113 3,000

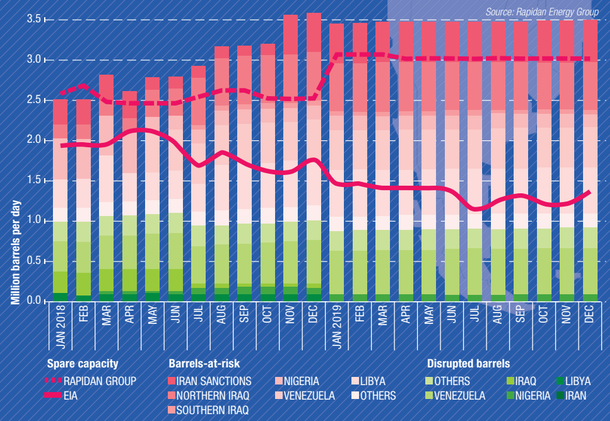
ARABIAN PENINSULA

Price polls [May 2018]



Source: Reuters

Geopolitical disruption and spare capacity



The world is jittery. Old nationalisms, new sanctions, challenged relations and unprecedented alliances are redrawing a map that raises many questions

A changing world



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+2.27

INFLATION [% change from previous year]
+2.14

COMMERCIAL SURPLUS
[as % of GDP]
-4.18

FRANCESCO MARINO

Donald Trump's administration is trying to exploit its advantage on the industrial and energy front to strengthen domestic economic growth and influence geopolitical relations externally. This dynamic is clearly demonstrated by Washington's opposition to the Nord Stream 2 gas pipeline project promoted by Russia with the support of Germany. The United States is suspicious of the gas pipeline, which is also opposed by the Baltic countries, Poland and the Ukraine, for geopolitical and economic reasons. The four E.U. countries are worried about increasing energy dependence on Moscow, while Kiev fears losing its status as a transit country for Russian gas.

The U.S. has long pursued an energy strategy aimed at increasing its integration with the European oil and gas market, stealing market share from Gazprom and Rosneft with the aim of replacing Russian gas with its own shale gas. In an even more direct way, Trump would like to penalize European companies involved in the Nord Stream 2 project, including the German ones. This suggestion has come from sources within the administration and would confirm the growing tensions between Washington and European governments, especially Berlin. Germany companies Wintershall and Uniper, Engie in France, Anglo-British company, Royal Dutch Shell and OMV in Austria, all involved in sponsoring the Nord Stream 2 gas pipeline, would be hit by the new U.S. sanctions.

Despite Washington's interest in promoting national interests on the European energy market, it would be difficult in any case for it to replace Russian gas supplies with U.S. shale gas, at least in the short term. In the event of sanctions, the French company Engie would suffer another blow after the U.S. withdrawal from the Iranian nuclear agreement. As for Germany, Trump has already complained about Berlin's intention to earmark billions of euros for the Nord Stream 2 project, refusing to instead increase defense funds as part of the joint commitment of NATO countries. While the U.S. president's accusations may seem irrelevant, given the private investment nature of the Nord Stream 2 pipeline, friction between Washington and Berlin is now significantly affecting economic dynamics between the two sides of the Atlantic, as clearly shown by the outcome of the G7 summit in Charlevoix, Canada.

The issue of duties imposed by the Trump administration on European aluminum and steel, starting on June 1, took up a great deal of the discussion. The U.S. decision affects Germany in particular and the impact of duties on commercial relations between the two countries had already been debated in the bilateral meeting between Trump and the German Chancellor Angela Merkel at the end of April in Washington, when there was no meeting of minds. Berlin's trade surplus has always been a cause for concern inside and outside the European Union, and Trump's threat to impose U.S. tariffs on the automotive sector scares German politicians and industrialists. Such a measure would in fact have a devastating effect on giants such as Volkswagen, Daimler and BMW, which export 1.5 million cars a year to the U.S., added to which are the 700,000 cars produced by their factories in the United States.

The U.S. Federal Reserve's attack on Deutsche Bank, Germany's biggest banking institution, should be seen in this context of growing tensions between Washington and Berlin. The accusation made by the Fed that the Frankfurt-based bank has too many risky assets in its portfolio comes at the same time as a downgrading of Deutsche Bank's rating by Standard & Poor's (from A- to BBB +), casting a shadow over the German banking system.

Trump's intention is for the protectionist measures in question to reduce the trade deficit, favor U.S. producers, in particular the steel industry, and create difficulties for China and the European Union, which are establishing closer and more substantial economic ties.

While the confrontation with the European Union on tariffs seems to be instrumental in loosening ties between Berlin and Beijing, the measures taken against China, the military pressure in the South China Sea and the attempt to diminish Beijing's influence on North Korea, are part of a precise strategy to reduce Chinese expansion, both geopolitically and globally, by attacking excess productivity that upsets the trade balance, counteracting the theft of intellectual property, and thus hitting the very engine of Chinese growth: industry.

To strengthen economic growth and influence geopolitical relations, the Trump administration is trying to exploit the U.S.'s advantage in the energy and industrial sectors.



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+2.32

INFLATION [% change from previous year]
+6.04

COMMERCIAL SURPLUS
[as % of GDP]
-0.95

RAFFAELE BERTINI

Mexico will be opening a new political chapter in December—one that promises big changes. The country has decided by a big majority to be led by Andres Manuel Lopez Obrador, the first president in over 70 years to come from outside the ranks of the centrist Institutional Revolutionary Party (PRI) or the conservative National Action Party (PAN). The leader of the young National Regeneration Movement (Morena) will take over from Enrique Peña Nieto, the president who in 2013 put his name to the historic reform of the national energy sector. The outgoing government's plan removed the state-owned company Pemex 's monopoly, one it had held for over ten years and, while maintaining ownership of the resources in state hands, allowed private and foreign capital into the sector. This was a wakeup call for the sector designed to make production more efficient, reduce fuel costs and, ultimately, increase the competitiveness of the entire country. According to government estimates, the move has so far ensured investments of about USD 200 billion, as a result of over one hundred contracts signed following auctions for onshore reserves or unexplored fields in deep and shallow waters in the Gulf. But also there have been tenders for an ambitious renewable energy development plan which aims to increase installed wind and solar power capacity by 2020 to four times its level in 2012 and to generate 49 percent of all energy from green sources by 2030. This is a reform that the newly elected president has never entirely supported. With his strong message about making public life more moral, Lopez Obrador will first want to check that the contracts signed do not hide sinecures. In the long term, he plans to relaunch the country's production of refined products to reduce dependence on foreign countries—primarily the U.S.—and cut internal costs. However, Mexico cannot afford to delay its search for energy sector investments too long, as there is competition for investment in the region—from the crowded auctions for pre-salt layer deposits in Brazil, to Chinese investments in the Argentinian renewable sector.

The hope of making the energy sector a driving force of Mexico's economy is also put in jeopardy by Donald Trump's hostility to renewal of the North American Free Trade Agreement (NAFTA). The White House does not seem willing to be helpful: in addition to its promises to stiffen migration policies, since June it has also triggered import duties on steel and aluminum from Mexico, as well as Canada and the E.U. Mexico City for its part must be careful, as more than 70 percent of the value of its national exports go to the United States and, more generally, the bulk of the country's production and infrastructure framework is designed for trade with its northern neighbor.

This scenario is encouraging Mexico to seek potential new outlets: the country ratified in record time the new Trans-Pacific Partnership Treaty, from which the U.S. has withdrawn; in April it also reached an agreement to update its free trade agreement with the European Union and, thanks to an existing convergence of political orientations, is pressing for synergy between the Pacific Alliance—to which it belongs together with Peru, Chile and Colombia—and Mercosur, the area that includes Brazil, Argentina, Uruguay and Paraguay.

On the domestic front, Lopez Obrador does not want to forget the promise of change that has given him a relative majority in both branches of parliament. The changes immediately introduced—a heavy hand against waste, ending privileges, international experts to control state contracts—can alter the habits of the political class, wealth redistribution policies and peace strategies that also include an amnesty and try to attack the disturbing cycle of violence at its root. In 2017, murders in the country exceeded the record figure of over 29,000 and projections for 2018 are even worse. The previous government had brought the army into the streets and introduced a reform intended to regulate its activities, which soon ended up at the center of numerous court appeals.

During the election campaign, the new president of Mexico, Andrés Manuel López Obrador, hinted that he would revoke the energy reform introduced by Peña Nieto.

The change may lead to less firmness in the country's position regarding the Venezuelan government of Nicolas Maduro. Mexico has thus far been a member of the 'Lima Group' of fourteen American countries which, in close cooperation with the U.S., are working to intensify international pressure on Caracas, even calling for its suspension from the Organization of American States (OAS). The new government preaches more respect for non-interference, but perhaps that is not enough to suggest that Mexico City could move autonomously from Washington at the regional level.



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
-9.11

INFLATION [% change from previous year]
+1,040.32

COMMERCIAL SURPLUS
[as % of GDP]
+10.77

RAFFAELE BERTINI

The oil price crisis could not have left Venezuela unscathed, a country with the largest crude oil resources in the world that entrusts the fate of its economy almost entirely to black gold. Caracas has been unwilling to pull back on the wide-ranging social plans put in place over the years by the "neo-socialist" governments of Hugo Chavez first and then Nicolas Maduro. But the sudden drop in revenues from the sale of oil and derivatives has exposed the country to increasingly complicated maneuvers to finance the debt, and it is also weighed down by inflation, which, according to the International Monetary Fund (IMF) currently stands at 13,000 percent, with a contraction in GDP estimated at around 15 percent.

Suffering from a lack of investment in infrastructure, oil production, which was once guaranteed by high prices, is experiencing increasing difficulties and—according to OPEC estimates based on secondary sources—by 2018 it has fallen to its lowest levels in thirty years. The resulting decline in exports is further aggravating the crisis. The government is making radical changes to the leadership of the state energy company—Petroleos de Venezuela (PDVSA)—denouncing serious corruption plots on which the judiciary are working. It is also attacking Washington, considered to be the "leader" of an international "economic siege" operation that has sparked the crisis.

In order to raise the resources needed to deal with the emergency, the Maduro government has launched the "petro," a cryptocurrency linked to oil reserves. The tool is designed to raise up to six billion dollars by evading the "economic stranglehold" imposed by neighboring countries. To ease the effects of inflation, a new currency will be launched in August that knocks three zeros off the end of the existing one.

Caracas is suffering the effects of increasingly severe international pressure. The 14 member countries of the so-called "Lima group"—including Argentina, Brazil, Mexico, Colombia, Chile, Peru and Canada—are intensifying their action and, in agreement with the United States, trying to force the exit of Venezuela from the Organization of American States (OSA). They approved a motion which refuses to recognize the presidential elections that reinstated Maduro as president of Venezuela and urges member countries to continue with sanctions, along with the U.S. and the European Union.

There is as yet insufficient support for the complete isolation of Venezuela, but intense pressure by the White House has begun to undermine some privileged connections that Caracas had with countries in the Caribbean area, starting with the Dominican Republic, which hosted the last unsuccessful talks between the government and the opposition. Venezuela continues to be supported by its traditional allies, including Cuba and Bolivia, while non-engagement by a country like Ecuador, which was a solid regional partner under the presidency of Rafael Correa, increases the isolation of Caracas.

The crisis in the country is causing emergency situations that cross national borders and allow international organizations and neighboring capitals to increase demands on Caracas. Examples of these are the many reports of human rights violations and the constant exodus of people fleeing economic hardship, which has pushed the governments of Colombia and Brazil to intensify border control measures. In addition the country is beset by an healthcare emergency, noteable in particular by the resurgence of measles: 84 percent of cases recorded in eleven countries since the middle of 2017 have been in Venezuela.

All of this is beginning to erode the relationship which the Venezuelan government has built with the population over many years of welfare interventions. Since the protests in the spring of 2017, the violence seems to have abated but, despite the presence of a very divided opposition, in the May elections over half the population failed to turn up at the polls to confirm Maduro as the country's leader.

Despite the economic crisis increasing discontent with the government among Venezuelans, the elections in May confirmed President Maduro at the helm of the country.

ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+1.79

INFLATION [% change from previous year]
+4.31

COMMERCIAL SURPLUS
[as % of GDP]
-1.50

RAFFAELE BERTINI

Despite delays in the fulfillment of commitments, the persistence of gray areas in the legislation, the wounds that remain to be healed and the promises of a review by the new president Ivan Duque, the peace agreements that the government of Juan Manuel Santos signed at the end of 2016 with the Revolutionary Armed Forces of Colombia (FARC) have pushed Columbia into a situation from which it is increasingly difficult to turn back. This scenario should allow the economy, which is strictly supervised in terms of fiscal consolidation, to benefit from the recovery in raw material prices. In May, Colombia became one of the top oil suppliers to the U.S., overtaking Venezuela for the first time in twenty years. The country's historic ties with Washington, Bogota being one of the strategic capitals in the region's economic and security arena, are a contributory factor.

On June 17, conservative candidate Duque won the presidency of the country for the next four years. The newly elected president has given guarantees that the peace agreements will not be "torn up," but will be interpreted "less generously" for the guerrillas. However, before he ended his mandate, president Santos scored two important victories: the country's admission to the Organization for Economic Cooperation and Development (OECD), after a process that began in 2013, and the formalization of its status as a global ally of NATO. Bogota is the first and to date the only Latin American capital to have entered into this collaboration with the Atlantic Pact, not an actual accession, but a useful step toward consolidating security strategies and putting the many decades of fighting internal and cross-border terrorism to good use. It also strengthens the strategic agreement with the U.S., a decision that raises the fears of neighboring Venezuela, as the two countries, whose governments have long been in open discord, share 2,200 kilometers of a border where relations are strained by migratory movements resulting from the economic and social crisis affecting Caracas and the criminal activities of Colombian armed groups.

Colombia is furthermore among the countries most seriously committed to putting international pressure on the government of Nicolas Maduro, both within the Organization of American States (OSA) and in the so-called "Lima group," the fourteen countries which, among other things, have promoted a campaign of determined delegitimization of the last Venezuelan presidential elections.

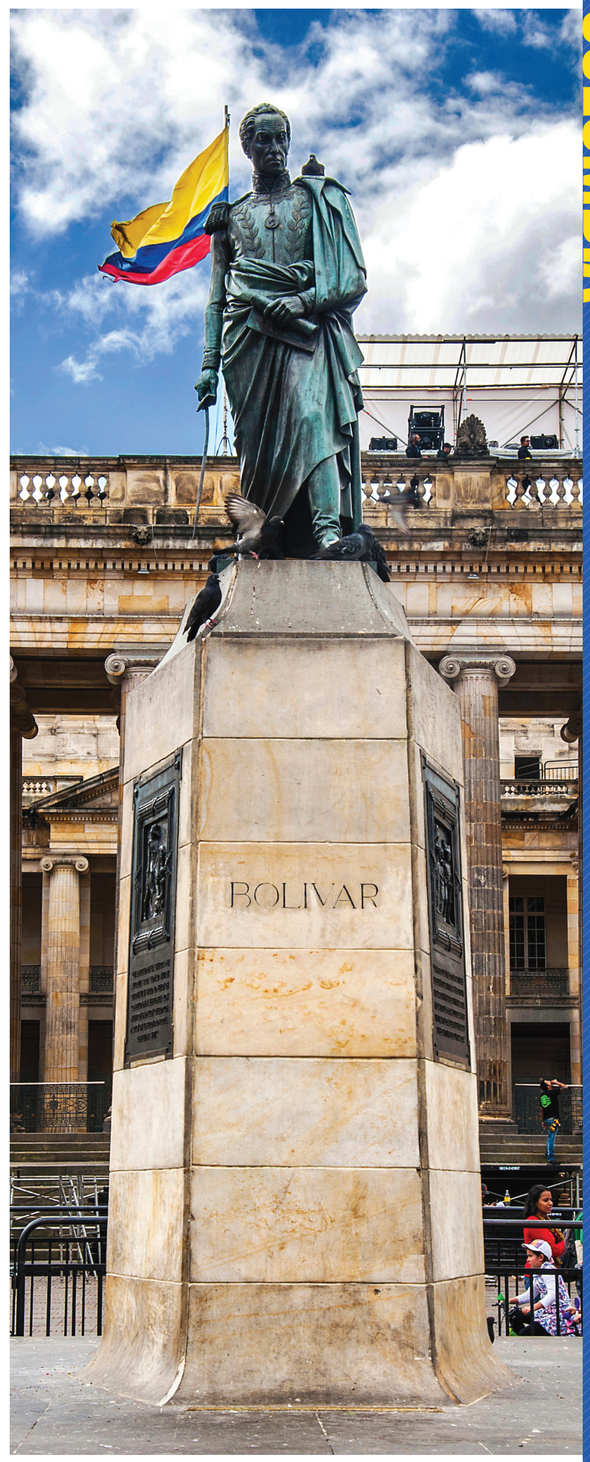
The country has a privileged regional position in the Pacific Alliance, the young regional body created with Mexico, Peru and Chile—40 percent of Latin American GDP—which intends to act as a national economy accelerator with a commercial strategy aimed primarily at markets in the Asia Pacific region. The block attracted 69 billion dollars of direct foreign investment in 2015, 44 percent of all the investment made in Latin America and the Caribbean.

Challenges remain in consolidating the peace achieved and in terms of translating the agreements reached into law and putting an end to the violence itself. The thorniest issue at the moment is the peace negotiations with the National Liberation Army (ELN), another powerful armed group still operating in the country. In this case, the reasons for a ceasefire include the need to secure oil pipelines and energy infrastructure, the traditional targets of guerrillas who, before they established dangerous links with the drug trade, were focused on countering the incursions of large companies into lands inhabited by rural people.

No less challenging is the struggle against FARC dissidents, who, engaged together with other illegal organizations, are seeking criminal control of the areas liberated by the peace agreements.

The goal of a true reconciliation in the country, which is also being tested by the entry of former guerrillas into national political life, can only be achieved over a period of years, but the abandonment of weapons by a formation that has held the country in ransom for decades has greatly diminished the incidence of violence in the country. Between 2012, the year when negotiations began, and 2017, the rate of homicides per hundred thousand inhabitants fell from 34 to 24; displaced people fell from 272,000 to 75,000; last year, 180 kidnappings were recorded, the lowest level in the last thirty years, and the number of Colombians hit by anti-personnel mines fell to 180 from the thirty thousand cases recorded in the 1990s.

Thanks to the country's historic ties with Washington, Bogota is one of the strategic capitals in the South American economic and security arena.





ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+1.79

INFLATION [% change from previous year]
+2.68

COMMERCIAL SURPLUS
[as % of GDP]
-6.65

GEORGIA GARRITANO

The U.K. energy industry contributes around £ 83 billion (over € 94 billion) to the country's GDP, employs more than 600 thousand workers and supplies 26 million households and businesses. As a member of the European Union, the United Kingdom has pursued its energy security objectives by collaborating with the E.U. and other Member States (energy policy is an area of shared responsibility) to simplify the cross-border energy trade and make it less expensive. The country's departure from the Union, or "Brexit", could therefore have a significant impact on the sector. The E.U. supplies Britain with around 12 percent of its gas and 5 percent of its electricity, both of which are estimated to grow based on official U.K. data for 2016. There is no doubt that the country is not meeting its needs through internal production but there is also no doubt that gas and electricity will continue to flow, under conditions that will depend on the agreements between the parties.

According to some research centers, including the Durham Energy Institute, it is however possible that the British market will become more peripheral, resulting in higher prices and less reliable supplies, especially in cases of adverse weather events or unplanned production interruptions. In particular, with the withdrawal from the European Atomic Energy Community (Euratom), which facilitates the trade in nuclear materials for civil use, the British nuclear industry may struggle to maintain current levels of electricity production. This segment, more than others in the energy sector, employs qualified non-British personnel, which is why the final agreements on the movement of workers will be decisive. The research and development agreements will also be decisive. While the current collaboration offers valuable opportunities for both parties, in nuclear research the departing country has benefited from European programs which have contributed substantially to its leadership.

The European Union is responsible for ensuring the efficient operation of the energy market, the security of supply, the promotion of energy efficiency and the interconnection of networks. States determine their energy mix and structure their offers. The United Kingdom has played a leading role in developing E.U. energy policy and its national policy is strongly aligned with the European one. As a result of its withdrawal, it could change its policies, establishing new rules and objectives of his own; support some technologies without restrictions on state aid; intervene on the tariffs for electricity exchanged through interconnectors or VAT. It is also highly likely that the influence exerted as a Member State will be reduced, even if the country remains in the European Network of Transmission System Operators for Electricity (ENTSOE), in the European Network of Transmission System Operators for Gas (ENTSOG) and in the Agency for the Cooperation of Energy Regulators (ACER), although the idea of remaining in these organizations is challenged by non-governmental organizations and business associations.

The current interconnection situation—which is made possible in particular by European Investment Bank (EIB) funds and by the Connecting Europe Facility (CEF) financing tool—sees the U.K. connected to Norway (which is not part of the E.U., but of EFTA, the European Free Trade Association), the Netherlands, Belgium and Ireland with gas interconnectors, and to the Netherlands, France and Ireland with electricity interconnectors. Further electricity interconnectors are planned with Norway, Denmark, Germany, Belgium, France and Ireland. It seems unlikely that tariffs will be applied on the gas and electricity trade, as the United Kingdom is a member of the World Trade Organization (WTO), although tariffs could be applied to products used for the construction and maintenance of energy systems, which remain to be regulated.

Among the Member States of the European Union, Ireland is dependent on a supply of gas and electricity through the British market for its energy security: its only physical connection with continental Europe in fact passes through the United Kingdom. Since 2007, the Republic of Ireland and Northern Ireland have been united by the Single Electricity Market (SEM), the continued existence of which could be complicated by London's withdrawal from the E.U.'s internal energy market. The "Impact of Brexit on the E.U. energy system" study published at the end of 2017 by the E.U.'s Directorate General for Internal Policies, believes that special attention should be paid to the impact on the Irish energy system, although overall it predicts "limited" consequences for European companies and citizens and for the achievement of energy security and climate change objectives.

The U.K. has pursued its energy security objectives by working with the E.U. and the other Member States. Brexit could therefore have a significant impact on the sector.

ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+1.54

INFLATION [% change from previous year]
+3.68

COMMERCIAL SURPLUS
[as % of GDP]
+7.29

LELLO STELLETTI

Russia has experienced a great recovery in recent years, both economically and above all in terms of geopolitical influence. Participation in the conflict in Syria has allowed President Vladimir Putin to return Moscow to a leading role in the Middle East, an arena both complex and crucial for the stability of the Caucasus and, therefore, southern Russia. Armed intervention, while costly, has favored arms exports and driven the new leadership of Saudi Arabia to seek a dialog with Moscow.

It is in this context that, at the end of 2016, an agreement was reached between the OPEC countries and 11 oil-producing countries that are not members of the organization. The agreement, which came into force on January 1, 2017 for six months and was then extended until the end of 2018, provides for a production cut of 1.8 million barrels per day (mbd). Russia is required to reduce its production by 300 thousand barrels a day (tbd), but the agreement is holding and the price of crude is rising, as a result of which USD 20 billion have flowed into the country's public coffers.

The Russian economy, which is heavily dependent on oil and gas exports, can breathe a sign of relief after the crisis which began in 2014 and led to a significant contraction in GDP, affecting the living standards of the population, perhaps even endangering approval ratings for Putin and his party. The military intervention in Syria has thus proven to be a tonic for the president, who achieved a landslide election victory on March 18 of this year, winning 76.69 percent of the votes. However, Russia remains largely dependent on imports, and the Western sanctions regime is a serious problem. The country has an unbalanced economy focused on raw materials and heavy industry and is unable to satisfy its population's desire for consumer products. With the "May Decree," Putin attempted a transformation, tasking the new government with improving the social and living conditions of the population by growing the economy, which he intends to transform into the fifth largest economy in the world by 2024.

Although the goal is to diversify the economy, much will depend on the fortunes of the five major oil companies: Rosneft, Lukoil, Gazprom Neft, Surgutneftegaz and Tatneft, which provide the state with an impressive cash flow. The government may soon decide to open up the Arctic fields, where currently only the state subsidiaries Rosneft and Gazprom Neft can operate.

In August, a summit of Caspian countries will be held in Astana, the capital of Kazakhstan, where a convention that establishes its legal status is expected to be signed. If the Caspian were to be recognized as a sea—and not as a lake as it is legally today—important prospects for energy cooperation would open up with the other coastal countries: Azerbaijan, Iran, Kazakhstan and Turkmenistan.

The Russian government has implemented a rationalization of investments in the less productive fields and, with the subsequent optimization of investments, can count on an unused capacity of about 500 tbd. U.S. sanctions against Iran and the collapse of oil production in Venezuela, which have increased oil prices, could therefore be a good opportunity for Russia to gradually relax the capacity reduction agreed with OPEC and non-OPEC countries. The issue is being discussed intensively with Saudi leaders but no decision has yet been taken.

The crucial game for Putin, however, lies in the country's relations with the United States. The hopes that the election of Donald Trump to the White House had raised in Moscow have been frustrated by investigations into members of Trump's family and staff, accused of inappropriate relations with emissaries of the Kremlin.

The U.S. president seems to want to re-establish dialog with Russia and, if successful, Putin will be able to look forward to his last presidential term with greater serenity.

The Russian economy, which is heavily dependent on oil exports, can breathe a sigh of relief after the crisis that began in 2014 and significantly contracted the country's GDP and the standard of living of its population.



Following Trump's decision to pull out of the historic nuclear agreement, Iran has seen its economic and energy agreements with many Western powers evaporate. Photo: president Hassan Rouhani.

ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+4.14

INFLATION [% change from previous year]
+9.99

COMMERCIAL SURPLUS
[as % of GDP]
+5.92

SIMONE CANTARINI

In the last few years, Iran experienced geopolitical change that fueled hopes of reaching an end to the tensions in the Middle East, first as President Hassan Rouhani came to power in 2013, and two years later with the signing of the historic agreement on nuclear armaments, which is considered the main legacy of U.S. President Barack Obama. As Donald Trump was elected president of the United States, and Israel and the Gulf countries became central to U.S. foreign policy again, Washington abandoned that agreement on May 8, 2018. The decision of the White House, which accuses Tehran of supporting terrorist groups, developing ballistic missiles that can transport atomic warheads and fomenting divisions in the region, has provoked a marked change in Iran's situation. In a short time, the country has shifted from being the center of interests for a key slice of the global economy, to witnessing the dissolution of a number of agreements with several western powers that followed the implementation of the Joint Comprehensive Plan of Action (JCPOA) in January 2016.

At the moment, the remaining five signatories of the agreement—China, Russia, France, the United Kingdom and Germany—are working to keep the cooperation they developed with Iran. However, many companies who signed historical agreements, like the French energy company Total, and Boeing and Airbus, already announced their withdrawal from the Iranian economy to avoid U.S. sanctions. In the first quarter of 2018, nearly USD 30 million in capital fled Iran, mainly in favor of near countries and the Caucasus.

Trump's move also had an impact on the FIFA World Cup that began in Russia on June 14th, as Nike terminated its contract to supply shoes to the Iranian football team for fear of sanctions. If we look at the benefits following the 2015 Vienna agreement, we see that the Iranian economy reached record macroeconomic results after the implementation of the agreement in January 2016. According to the International Monetary Fund, Iran's GDP grew by 12.5 percent in the year following the implementation of the agreement. The oil industry, which is the backbone of Iran's economy, especially benefited from the agreement. In May, Iranian oil exports reached a record level of 2.7 million barrels a day, while before the agreement, on average, they amounted to 1.1 million. Non-oil exports reached USD 47 billion, surpassing their 2014 level by nearly 5 billion. According to the Iranian ministry of Agriculture, exports of key products like pistachios amounted to 1.1 billion at the time.

Washington's decision to abandon the agreement has led to a downward revision of the 2018 growth estimates for Iran, now expected to be around 4 percent, well below the target set by Tehran after the historical agreement. The remaining five signatory countries and the international community fear a return of conservative rule in Iran, even more than the effect on the economy, as this would nullify the push towards reforms that began with Hassan Rouhani in 2013. The reformist push has already being put into question by the wave of demonstrations that took place in the country last December and January.

A first indication that the country may revert to conservative policies came directly from the Supreme Leader, Ayatollah Ali Khamenei, who, on June 4th, ordered the Atomic Energy Organization of Iran (Aeoi) to start preparing for uranium enrichment of up to 190'000 Separate Working Units (Swu). These units define the effort required in the uranium enrichment process, where uranium 235 and 238 are separated, but it needs to be said that this increase is still within the limits set in the agreement.

However, the renewed tensions with the U.S. have not halted the expansionary ambitions of Iran in the Middle East. The Guardians of the Revolution are still in Syria, despite Israel's attempt to push Moscow to pressure Bashar al Assad for their withdrawal. In Iraq, the party linked to the Shiite Popular Movement linked to Iran, Fatah (Conquest) came second in the Parliamentary elections on May 12th, behind the al Sairoon, coalition of Shiite religious leader Moqtada al Sadr. He is also linked to Iran.



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+1.78

INFLATION [% change from previous year]
+0.18

COMMERCIAL SURPLUS
[as % of GDP]
+8.72

FRANCESCO DE FELICE

Fifteen years after the fall of Saddam Hussein and just over six months since its victory over the Islamic State, Iraq is still in a state of chronic instability. The country is in the midst of a very serious political and institutional crisis following the annulment of the parliamentary elections held on May 12 due to electoral fraud. The poll ended without any coalition achieving the majority required to form a government, but the first in the running was the Sairoon ("On the Move") coalition, an anti-system group led by the Shia cleric Moqtada al-Sadr, who is close to Iran and hostile to the United States. Following in second and third position were two more Shia coalitions with conservative leanings: Fatah ("Conquest"), supported by Iran, and Nasr ("Victory"), led by Prime Minister Haider al-Abadi.

Abadi, in office since 2014, has pursued a skillful policy based on maintaining close ties with both the United States and Iran. This strategy is likely to be increasingly untenable in the future, due not only to Iraq's internal political crisis but especially in view of the growing confrontation between Washington and Tehran. With the ascension of Donald Trump to the U.S. presidency, tensions between the two countries have further exacerbated, and Iraq has become one of the natural battlegrounds for their competing interests.

Iraq is strongly influenced by Iran, which receives support from Russia and China in its conflict with Washington. Brought together by their hostility against the United States, Tehran, Moscow and Beijing are actively pursuing their interests in Iraq, particularly in the energy sector. The United States, however, has a strong strategic presence in Iraq, retaining key military bases. For Washington, the country plays a crucial role in containing Iran and its ambitions in the Middle East. The United States also has significant investments in Iraq's oil sector, particularly in the autonomous region of Kurdistan.

In recent years, Iran has become involved in the development of the energy sector, refining part of Iraq's crude oil, investing in oil and natural gas fields and supplying electricity to Iraq. By so doing, the Islamic Republic is helping to rebuild Iraq's infrastructure, which is in a state of near total collapse after almost forty years of conflict.

Iran supports Iraqi militias, which, with the backing of political parties and independent movements, played a crucial role in the defeat of the Islamic State and could become a decisive factor in the domestic political arena. Iraqi Paramilitary forces in Iraq are believed to number in the region of 152,000, and 122,000 of these are thought to belong to the Popular Mobilization Units (PMU), a mostly Iranian-backed coalition of Shiite militias operating side by side with the regular army and making up the main electoral base of Fatah. In the crisis following the May 12 elections, the militarization of politics appears to be one of the major threats to the country's stability and weak economy.

Iraq's domestic economy, which is heavily dependent on international aid and foreign direct investments, is based on crude oil exports. In 2017, Iraq's GDP fell by 0.4 percent, its trade deficit stood at 6.4 percent, and its government debt was equivalent to 63.8 percent of its GDP. The Iraqi government is very keen to maintain high oil prices, and is therefore striving to confirm the Vienna agreement to cut crude supply signed by OPEC and non-OPEC oil producing countries in 2016.

On 12 June, Iraqi Oil Minister Jabar al-Luaibi warned against accepting the proposals put forward by Saudi Arabia and Russia to review the agreement in order to increase crude supply, proposals which immediately led to falling oil prices. In May, Iraq, the second largest oil producer in the OPEC cartel, increased its crude exports, which stood at 108.1 million barrels, year-on-year, with revenues amounting to USD 7.5 billion. The figures, released by the state oil marketing firm (SOMO), do not include exports from the disputed oil fields in the northern Iraqi province of Kirkuk, claimed by both the central Iraqi government and the autonomous region of Kurdistan.

Heavily reliant on crude oil exports, Iraq is striving to ensure that the Vienna agreement on production cuts is confirmed and prices remain at sustained levels.



Libya is still beset by widespread political instability and is struggling to maintain production levels of around one million barrels a day.

ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+76.17

INFLATION [% change from previous year]
+24.51

COMMERCIAL SURPLUS
[as % of GDP]
+15.29

ALESSANDRO SCIPIONE

Libya is still beset by widespread instability, deep internal divisions, extreme fragmentation of power and divergent geopolitical interests. The country, which is a member of OPEC, is struggling to maintain production levels of around one million barrels a day (mbd), more than the 200,000 produced in April 2013, but still far fewer than the 1.6 mbd of the Gaddafi era. This decline results from both disputes between militias and the poor security of infrastructure. Most of the gas extracted from existing fields is used to fuel power stations but, despite being rich in oil and gas, the country is experiencing frequent blackouts especially in summer.

The large amount of weapons in circulation, despite the embargo imposed by the U.N., is fueling violence in almost all areas of the country, from the capital Tripoli to the eastern city of Derna and the southern town of Sebha. Of particular concern is the presence of Islamic State militants in the desert areas south of Sirte, This was Gaddafi's former stronghold occupied in 2016 by the self-styled "caliphate" and freed with U.S. help by the militias of Misrata, a city-state in the Tripoli region with close links to Turkey and Qatar. Human trafficking is a significant source of income for Libyan tribes and militias, and the conditions of migrants detained in Libya are deplorable, despite some improvement thanks to the presence of U.N. humanitarian workers and non-governmental organizations on the ground.

The 2015 U.N.-mediated political agreement led to the formation of the Presidency Council and the daring installation of an interim government in Tripoli. However the implementation of the agreement is being hindered by allegations of illegitimacy by rival political forces, fueled by regional powers. The U.N. launched a roadmap in November 2017 to overcome the deadlock and achieve parliamentary and presidential elections by the end of the year, but to date, Libya remains deeply divided. The failure to implement the U.N. plan could have a negative impact on regional security, perhaps even increasing migratory flows to the European Union.

President Emmanuel Macron's France tried to take the initiative, inviting the four main national players (the Presidential Council of Tripoli, controlled by the prime minister of the National Accord, Fayez al-Sarraj; the High Council of State, chaired by Khalid al-Mishri, a representative of the Muslim Brotherhood; the Tobruk Chamber of Representatives, led by Aguila Saleh; and the Libyan National Army of General Khalifa Haftar) to Paris in May 2018. The meeting ended with an agreement to hold elections by December 10, but the agreement was only verbal. Some of the players, particularly the High Council of State in Tripoli and the Libyan National Army in Benghazi, have diametrically opposing agendas and starkly contrasting geopolitical interests.

On the one hand, the High Council of State and the Presidential Council are linked to the Muslim Brotherhood block led by Turkey and Qatar. On the other, the Chamber of Representatives in Tobruk and the Libyan National Army have strong ties with Egypt and the United Arab Emirates. Evidence of Cairo's involvement in the region can be seen in the frequent trips made by Libyan leaders to Cairo, as well as in the direct military interventions, including air raids by the Egyptian airforce, on Derna. Relations between Tobruk and Egypt are also based on a shared political project: to eradicate the Muslim Brotherhood and strengthen the independence of eastern Libya.

The United Arab Emirates supported the United Nations negotiations and is currently less involved because of its expensive intervention in Yemen, but they have supplied arms to Haftar and the militia in the "City-State" of Zintan, where Saif al-Islam Gaddafi, the deceased colonel's second son, is believed to be hiding.

One of the biggest problems for Libya at the moment is the lack of any truly "national" players. The overwhelming majority are local actors, armed groups, "City-States" and tribes that hold huge sway on a national level while representing the interests of their region or, in most cases, their municipality.

ECONOMIC DATA 2017

SAUDI ARABIA

GROWTH RATE OF REAL GDP [% change from previous year]	-0.74
INFLATION [% change from previous year]	-0.84
COMMERCIAL SURPLUS [as % of GDP]	+14.36

BAHRAIN

GROWTH RATE OF REAL GDP [% change from previous year]	+3.88
INFLATION [% change from previous year]	+1.39
COMMERCIAL SURPLUS [as % of GDP]	-2.08

UAE

GROWTH RATE OF REAL GDP [% change from previous year]	+0.94
INFLATION [% change from previous year]	+1.97
COMMERCIAL SURPLUS [as % of GDP]	+20.42

KUWAIT

GROWTH RATE OF REAL GDP [% change from previous year]	-1.55
INFLATION [% change from previous year]	+1.95
COMMERCIAL SURPLUS [as % of GDP]	+21.33

OMAN

GROWTH RATE OF REAL GDP [% change from previous year]	+0.74
INFLATION [% change from previous year]	+1.67
COMMERCIAL SURPLUS [as % of GDP]	+13.67

QATAR

GROWTH RATE OF REAL GDP [% change from previous year]	+1.60
INFLATION [% change from previous year]	+0.39
COMMERCIAL SURPLUS [as % of GDP]	+21.92

YEMEN

GROWTH RATE OF REAL GDP [% change from previous year]	-8.65
INFLATION [% change from previous year]	+43.87
COMMERCIAL SURPLUS [as % of GDP]	-13.84



SIMONE CANTARINI

The oil price crisis that started in the second half of 2014, and the arrival of Donald Trump at the White House in 2016, radically changed the alliances within the Gulf Cooperation Council (GCC), which includes Saudi Arabia, the United Arab Emirates, Qatar, Kuwait, Oman and Bahrain. Soon after his appointment, Trump relaunched the historical relations with Riyadh, which had deteriorated under Barack Obama, because of the Iranian Nuclear Agreement signed in July 2015. This agreement was in fact denounced by Washington on May 8th.

The clash with Tehran, furthermore, caused Saudi Arabia and the U.A.E. to informally cooperate with Israel, isolating Qatar—accused of supporting terrorism and sharing intelligence with Iran, with a diplomatic and economic boycott that has been going on for over a year now. The embargo had two main effects: it strengthened the Doha-Ankara alliance, which already united in its support of the Muslim Brotherhood, and it pushed Qatar to reinforce its relations with Iran, against the Saudis. The change in traditional geo-political alliances, favored by the drop in petrol prices, finally created a new and unprecedented collaboration between Saudi Arabia and Russia, which climaxed with the agreement for a reduction in oil production signed in December 2016 in Vienna, among the Riyadh-led OPEC countries and ten producers outside the cartel, led by Moscow.

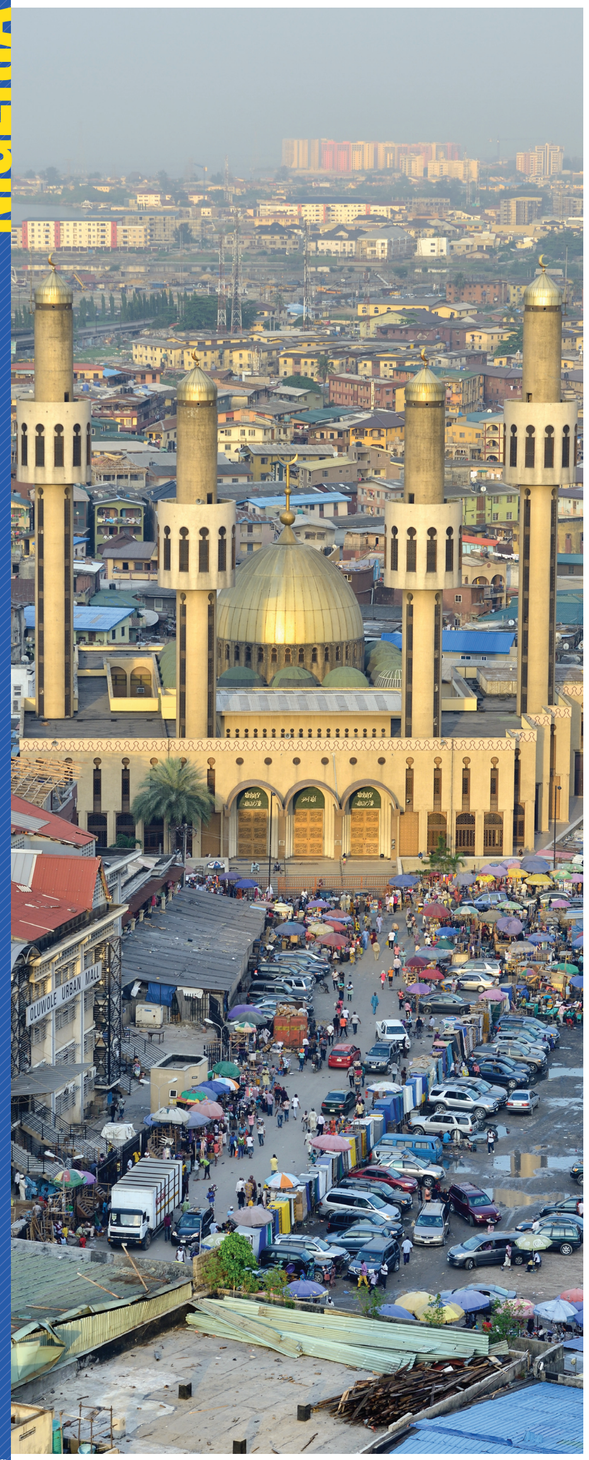
As for the domestic economies, the drop in crude prices has been the major driver of change for the Gulf economies. Riyadh, in particular, has moved from being the most conservative and backward country in the region, as far as economic diversification is concerned, to becoming a beacon for many Muslim developing countries. Risen to power in 2015, the leadership represented by King Salman and the heir to the throne Mohammad bin Salman, in 2016 launched the Vision 2030 program to reduce dependency from oil revenues, diversify the economy and develop public services like health, education, infrastructure, leisure and tourism.

Among the 80 grand projects linked to Vision 2030, the key one is the ambitions project to build Neom, the city of the future, which is going to be located in the north west of the country, near the border with Egypt. The plan is financed by the public sales of 5 percent equity in oil giant Aramco, with the Initial Public Offer scheduled for 2019. Together with the economic reforms, Riyadh propelled a wave of unprecedented social changes, such as abolishing the ban on women driving, opening cinema theaters, allowing women to watch men's football games.

Following Riyadh's example, neighboring Kuwait and Oman also launched their ambitious plans to relaunch their economies and reduce dependency on oil. The United Arab Emirates and Qatar are a different story: they can be considered the pioneers of the economic change in the region. The Emirates are soon to host the Universal Exhibition in Dubai, in 2020: the first to be held in a Middle Eastern country. This confirms the role of this country as a financial center and also a key hub for new technologies. The Emirate of Abu Dhabi, the political and oil center of the confederation, has launched a number of radical reforms, modernizing oil giant Adnoc with investments along the entire oil production chain (from exploration to chemical industry), also developing the renewable energy industry. The Emirates have also launched an ambitions energy renewal plan that aims to generate 50 percent of the energy needs from renewable sources, with expected investments amounting to USD 163 billion.

For many years, Qatar has been one of the most active players on the global financial scene, and is soon to become the first Arab and Muslim country to host the football World Cup in 2022. Past diversification policies are enabling Doha to survive the boycott, so much so that despite the embargo, its trade balance achieved a surplus of 14,7 billion riyal (USD 4 billion) in April. Bahrain has worked to come out of its crisis in recent years, but without much success, at least in the short term. The small kingdom is not a member of OPEC; it only produces 200 thousand oil barrels a day and depends on the economic support of its neighbors, particularly Saudi Arabia. The International Monetary fund has recently revised its 2018 GDP growth estimates to 1.6 percent. However, the discovery of a new non-conventional gas and oil field in the Khaleej basin, announced on April 4th, could change all that, as its reserves are estimated to be 80 billion oil barrels and 390 billion cubic meters of gas.

The fall in crude oil prices in the recent past has encouraged many Gulf countries to move towards economic diversification.



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+0.81

INFLATION [% change from previous year]
+16.52

COMMERCIAL SURPLUS
[as % of GDP]
+3.17

CATERINA SEMERARO

Nigeria lived the rise in crude oil prices on international market as a shot in the arm, as two third of its revenues depend on oil exports. The crisis in the sector, which began in the second half of 2014, seriously affected the country's coffers, in 2016 plunging the country into its first economic recession in about twenty years. The crisis was exacerbated by the increase in attacks on oil infrastructure in the Niger Delta, which nearly halved production and led OPEC to exempt the Abuja government from capacity cuts decided in December 2016.
The rise in crude oil prices and the ceasefire signed with the armed militias operating in the south of the country have allowed Africa's most populous country to overcome the recession, while it remains highly vulnerable to the volatility of oil prices. On May 16, the Nigerian parliament approved a budget increase for 2018 of around six percent, raising the funds available from the USD 23.8 billion dollars announced in November to USD 25.2 billion.

Despite the measures aimed at revitalizing the domestic market, the Nigerian economy remains dependent on oil profits, as demonstrated by the huge investments in the sector.

Despite policies introduced by the presidency of Muhammadu Buhari to diversify the economy, such as the executive order signed this year to increase domestic production and create jobs in the technological, scientific and engineering sectors, the country remains dependent on the oil and gas industry, as demonstrated by significant investments made in the sector. First of all, the project launched with the Moroccan government was designed to construct a gas pipeline in West Africa to provide Europe with an alternative source to Algerian gas. Launched in 2016, the project was at the center of the latest visit by the Nigerian head of state to the Kingdom of Morocco, during which the next steps in the construction of the infrastructure were agreed upon.
Restoring the economy to a pre-crisis growth rate will be the main challenge for Buhari ahead of his standing again in the presidential elections scheduled for February 2019.
Added to these problems are the numerous security threats in many parts of the country, which continue to represent an obstacle to investment in some areas of Nigeria. In the north-east, attacks by the Jihadist group Boko Haram continue, despite the counter-offensive launched by the Abuja government together with its partners in the Lake Chad basin.. According to government estimates, attacks by the terrorist group since 2009 have caused over 33,000 deaths and forced around 2.6 million people to abandon their homes. Clashes between the army and militia, as well as the growing drought in the Lake Chad area, have caused a massive migration from the north, which is prevalently Muslim, to the south, mostly Christian, aggravating the clashes over access to land and water resources which have been gripping the central part of Nigeria for some time.
According to data gathered by the U.S. project on the location of political violence in developing countries (ACLED), almost 400 people have been killed since January in the state of Benue in clashes between herders, mostly ethnic Fulani Muslims, and farmers, primarily ethnic Bachama Christians. Inter-ethnic violence in central and eastern Nigeria has been taking place for years, but its political significance has been growing in the light of next year's elections, with President Buhari accused by many parties of favoring Fulani herders, the ethnic group to which he belongs.
The security situation also remains unstable in the south, where there continues to be a threat from militias in the Niger Delta area, who regularly return to threaten the central government with new attacks against the large amount of oil infrastructure in the region.
For now, in the absence of any other prominent candidates, Buhari seems to be the only one who can gain the approval of the ruling party.



ECONOMIC DATA 2017

GROWTH RATE OF REAL GDP
[% change from previous year]
+2.00

INFLATION [% change from previous year]
+187.86

COMMERCIAL SURPLUS
[as % of GDP]
+0.00

MARCO MALVESTUTO

South Sudan has remained dependent on Sudan, particularly as regards energy policy, since its independence was declared on July 9, 2011. Worn down by a bloody conflict that has forced more than 1.8 million people to leave the country since December 2013, the "youngest country in the world" is landlocked, a factor that Khartoum exploits. In 2013, Sudan imposed a tax on the Republic of South Sudan for oil transported to Port Sudan on the Red Sea coast. Little has changed since then, although in 2016 a partial revision of the agreements between the two countries led to the introduction of a flexible tax that fluctuates according to global oil prices.
The substantial lack of adequate oil infrastructure is another factor of subordination for South Sudan, despite the country owning 75 percent of the former unitary state's oilfields. The only existing oil pipelines are in fact those that transport crude oil to the north, to Port Sudan, where oil tankers flying the South Sudanese flag are moored, but it is Khartoum's territory and under its administrative control.
The Juba government, which depends almost entirely on oil revenues, is trying to relaunch the country's production and develop refining capabilities, making the most of its position as the main production country in Eastern Africa. The government announced its aim to return to production levels that existed prior to the civil war of 2013 and to start selling refined products to neighboring countries.
The plan provides for an increase in oil production from the current 135 thousand barrels per day (tbd) to 350 (tbd) by the end of 2018. In order to implement the program, Juba aims to attract more foreign investments Among the companies involved at the moment are the French company Total and the British company Tullow Oil, and they intend to resume development of the B1 and B2 fields.
The ambitious LAPSSET (Lamu Port-Southern Sudan-Ethiopia Transport) project involves the construction of an infrastructure corridor to connect Kenya, Uganda, South Sudan and Ethiopia. Announced in 2009 but launched officially in March 2012, LAPSSET includes the construction of a 32-berth port in Lamu, Kenya; a series of oil pipelines; a six-lane highway and a railway that would cross the northern part of Kenya to reach Addis Ababa, in Ethiopia, Kampala in Uganda and Juba itself. The program also includes the construction of three international airports and three new cities.
Once completed, the LAPSSET project would allow South Sudan to "hook" onto the pipeline—currently under construction—that will link the city of Hoima, in western Uganda, to the port of Tanga, on the Tanzanian coast. The project would allow Juba to export its oil by circumventing Sudan and at the same time gaining an outlet to the sea and reducing its dependence on Khartoum.
Another project of strategic interest for South Sudan is the planned construction of a regional transport network for East Africa, which took an important step forward last year with the inauguration of the railway connecting the Kenyan capital Nairobi to the port city of Mombasa. This infrastructure is only the first part of a larger project, the second stage of which involves extending the line from the Kenyan capital Nairobi to the city of Malaba on the border with Uganda, to the Rwandan capital Kigali and subsequently to Juba. The work has been financed by the Chinese government, which has a strategic interest in developing infrastructure in East Africa. China is among the countries most involved in developing the oil industry in South Sudan and looks to the region as a natural outlet for the so-called Maritime Silk Road, an initiative launched by the Chinese government in 2013 that aims to increase inter-regional investments and trade along the historic trade route that extends between Asia, Europe and East Africa. Growing Chinese influence in the region may ultimately benefit South Sudan's attempt to divest itself of its cumbersome Sudanese neighbor while awaiting a solution to the civil conflict that continues to rage in the country.

South Sudanese President Salva Kiir Mayardit's efforts are aimed at reducing the constraints imposed by Khartoum on the exploitation and marketing of oil.

Outlook/New supply-side shocks can be expected in the short term

The other Side of U.S. Energy Independence

Soaring unconventional production has helped stabilize global supplies, but it has also led to progressive American disengagement from the Middle East, causing increased geopolitical risk



IAN BREMMER

He is the President of Eurasia Group and GZERO Media, and author of the *New York Times* bestselling book, *Us vs. Them: The Failure of Globalism.*

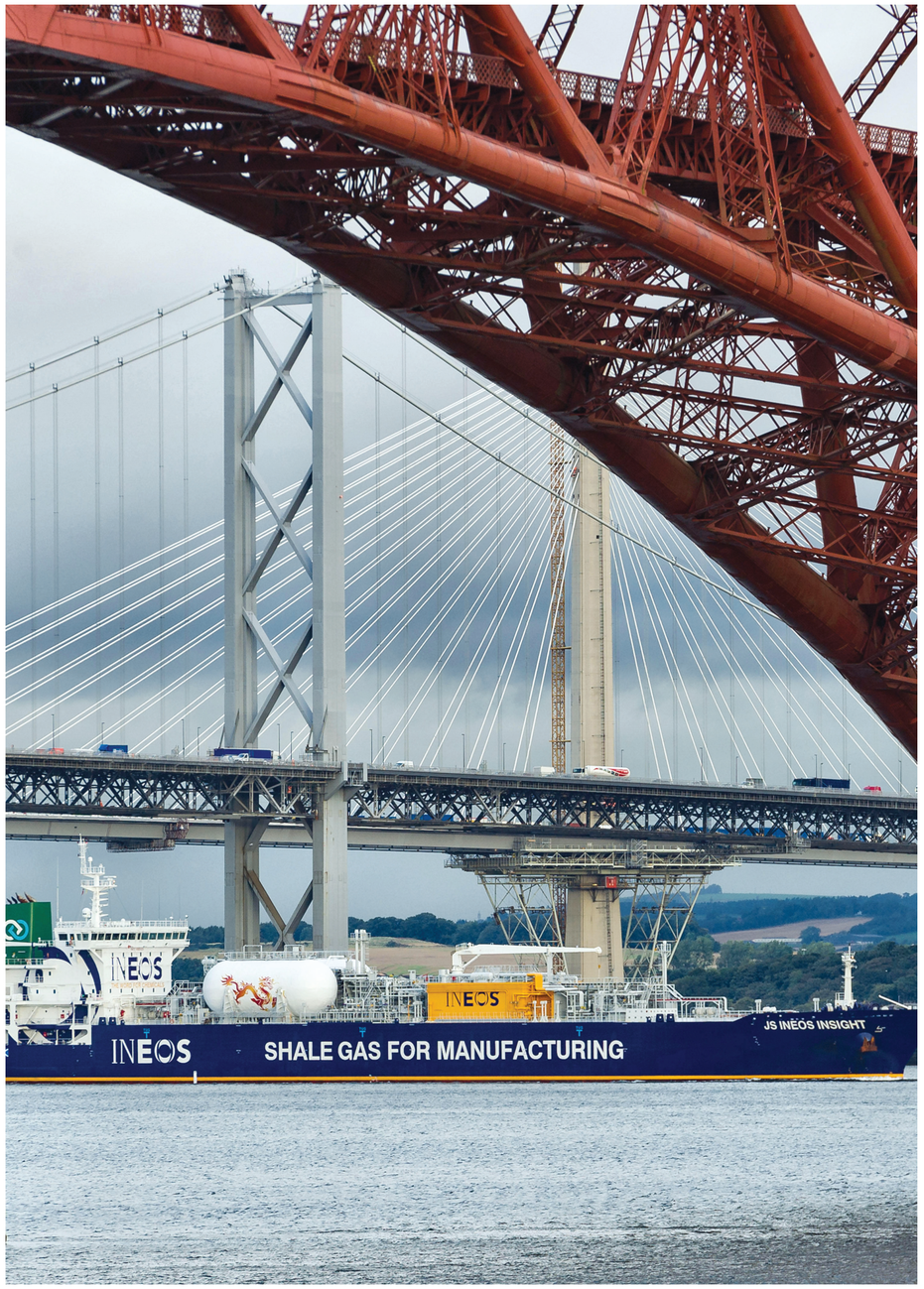
Technological advancements in unconventional drilling techniques, such as hydraulic fracturing and horizontal drilling, have enabled U.S. producers to stun global oil markets with their production output—today, U.S. energy producers account for 13 percent of global crude oil production, nearly double their worldwide market share a decade ago. True, U.S. President Donald Trump's trade agenda has darkened the outlook for U.S. energy producers somewhat, as China has threatened to limit oil imports from the U.S.in the next round of retaliatory tariffs. But even countries like China must prioritize their energy security in today's world, which necessarily means diversifying imports—thanks to technological advances, the U.S. is now an important component of that diversified mix. And at a time when China is on a trajectory to overtake the U.S. economy in coming years—increasing global political risk in new, and still unpredictable ways—the additional stability U.S. oil producers provide energy markets these days is very much welcome.

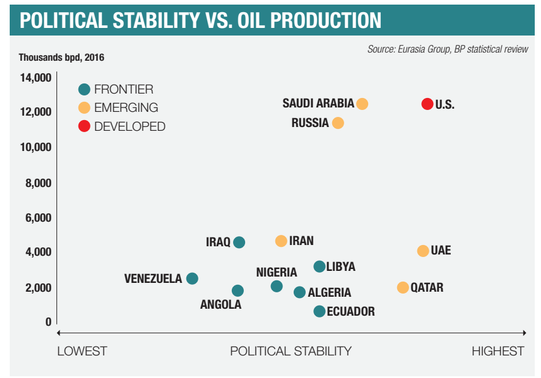
Yet those same technological shifts that have empowered U.S. oil producers have given rise to other geopolitical risks that cannot be ignored. With the U.S.'s relatively new-found "energy independence" has come a gradual detachment from the Middle East, opening the door for others, including a more assertive Russia (see: Syria, Iraq). China has signaled it is more than happy to step into the economic void left by the U.S. in the region, primarily through its ambitious One Belt One Road series of infrastructure projects. But China—the only country that can credibly claim any type of superpower status approaching that of the U.S.—is nowhere near as capable (not to mention interested) in upholding the region's complex and oftentimes contradictory security dynamics as the U.S. once was.

Uncertainty of demand and risks for producers

And then there's the looming question of "peak oil demand"—uncertainty about when and if demand for oil will crest (or at least grow slower) complicates the investment profiles of significant, long-term energy projects. Saudi Arabia, through its Vision 2030 program, is among the first countries to undertake comprehensive national reforms to reduce its oil dependency given such market uncertainties. But not all major oil-producing countries will be able to afford such Saudi-scale reforms, politically dangerous and socially destabilizing by their very nature.

A peak or even slowing in global oil demand will have massive geopolitical implications, with the initial losers being economies that are highly tied to oil revenues and political risk. In Libya, French President Emmanuel Macron's May visit ostensibly helped push the country closer to presidential and parliamentary elections, slated to take place by the end of the year. But on the ground the country's factions continue to fight fiercely, and oil facilities controlled by respective sides remain prime military targets for all involved. Libya's oil production and exports remain at significant risk of disruption and will be so for the foreseeable future; the country will struggle to churn out more than one million barrels per day (it was averaging 1.6 million bpd before the war).





The chart compares oil production to the political stability of some of the main producing countries. The United States has both high daily output and high stability.

In Nigeria, the recent announcement that President Muhammadu Buhari will again stand as a candidate for office is a positive sign for the country's ability to preserve the recent gains in its oil sector. But as always, concerns over Buhari's health remain paramount—especially given how successfully his administration has negotiated with the Niger Delta militants to avoid significant production disruptions. There are no guarantees others will be able to replicate that success.

In Iraq, recent elections and the surprise announcement of a broad coalition government headed by anti-American cleric Muqtada al Sadr is unlikely to change oil policy much, as Iraq looks set to continue cooperating with OPEC to raise the price of oil. But as always in Iraq, politicians and parties are fluid, making it particularly difficult to pinpoint when and how the next political crisis will erupt.

For the time being, it appears the U.S. and Saudi Arabia will have less influence over the country's domestic politics going forward—and at a precarious time for a country still struggling to catch its democratic footing.

Uncertainty over Venezuela and Iran

Venezuela, meanwhile, has caught a break, as the Trump administration remains concerned that imposing harsh sanctions against the South American country could drive up domestic gas prices ahead of summer driving season and November midterm elections. But Venezuela's oil production output has already taken a tumble as the country's aging refineries continue to be plagued by mismanagement and disrepairs. As the country's economy spirals further down and social dynamics worsen on the back of continued hyperinflation and food shortages, Venezuelan President Nicolas Maduro's hold on power will be severely tested over the coming year. That's potentially good news for Venezuela's long-term political fortunes, but bad news for its already-strained short-term oil production. And of course, Iran.

Trump's decision to withdraw the U.S. from the Joint Comprehensive Plan of Action not only directly impacts oil markets by knocking roughly 500,000 Iranian bpd offline, but makes it more likely that an aggrieved Iranian leadership increases the intensity of its proxy fights across the Middle East, imperiling oil production elsewhere in the region.

The U.S. has also made clear that any countries that continue to do business with Iran (as the Chinese, Russians and Europeans have all vowed to do) will face stiff U.S. penalties, potentially setting up trade showdowns with traditional friends and foes alike this fall, when the terms of the re-imposed sanctions fully go into effect.

As much as U.S. oil producers have helped stabilize global energy supplies with a surge in U.S. unconventional production, near-term supply-side shock risks loom overhead as challenging geopolitical and trade environments deteriorate further. While geopolitically-driven supply shocks have largely been priced into global oil prices at the moment, there is no guarantee they will continue to be going forward. If the politics of 2018 have taught us anything, it's that there are plenty of political twists and turns left ahead. The energy industry needs to be ready.

The Vienna Compromise



In June, the alliance of producing countries decided to increase the output of crude oil, against the backdrop of a surge in prices and severe restrictions on imports to Venezuela and Iran, shaken by sanctions and economic difficulties



MARC-ANTOINE EYL-MAZZEGA

He joined Ifri's Centre for Energy as a Director in September 2017. Prior to this, he spent six years at the International Energy Agency (IEA), notably as Russia & Sub-Saharan Africa Programme Manager where he conducted oil and gas market analyses and was responsible for institutional relations with these countries and regions.

During the last OPEC meeting, on June 23, 2018, that gathered members of the organization and their allies (the so-called OPEC+ alliance) notably including Russia, a number of interesting developments have been reached. Unexpected declines in production from Venezuela led to a very large overrun of the production reduction targets set in November 2016 and in a context of robust demand growth, markets got tighter with stock levels down. On the backdrop of a global economic growth projected at over 3.9 percent for 2018 by the International Monetary Fund, oil prices have risen by more than 50 percent in less than a year, reaching $77 per barrel in May 2018. That has the potential to boost U.S. production further and to slow down global oil demand growth. Producers without the ability to raise output and/or that were hit hard by the falling oil prices and had an interest in cashing in as much as possible, wanted to avoid a change in quotas to keep prices up. This included Venezuela, Algeria, Iran and Iraq.

On the other side, Russia and Saudi Arabia were pushing to increase output as both countries can produce more and were seeking to benefit from higher prices ahead of the summer demand increase and to avoid a further rise in prices. The latest OPEC+ agreement is a compromise that makes the U.S., Saudi Arabia and Russia the winners. The elephant in the room in the Vienna negotiations was Donald Trump, and his concerns about high oil prices going into the summer driving season and the November midterm elections, while U.S. liquids output is on a steady rise, fueling growing exports.

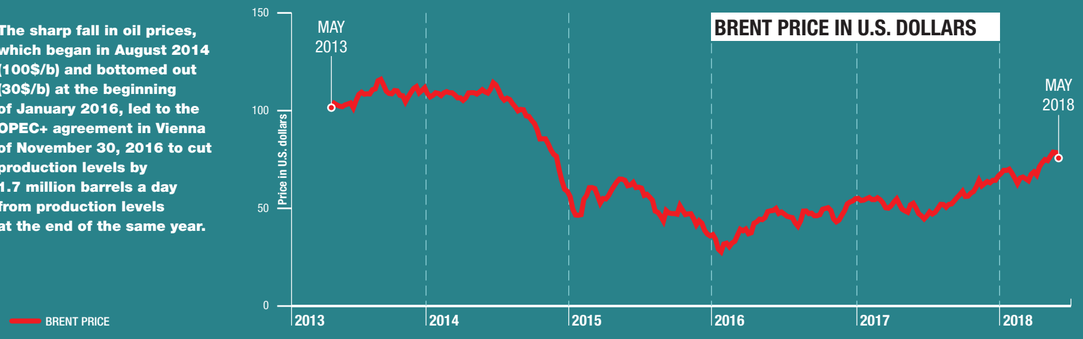
The latest agreement will see an increase in output by over 500 kb/d but it is still unclear how this will be done. Russia will be able to boost output by at least 200 kb/d as of this summer, and is on track to be able to raise budgetary spending with no deficit. And this comes just after the introduction in Russia of a major fiscal change that will make the Russian budget even less dependent on oil price fluctuations. De facto, Saudi Arabia, the U.S. and Russia are also winners because they will be able to progressively take market share away from Iran and Venezuela, who will respectively face sanctions coming into force in November and a continued chaotic situation. Iran granted its support to this latest agreement despite strong reluctance as the increase is within the boundaries of the 30 November 2016 agreement. The country's oil revenues are already starting to be hit by the new wave of American sanctions constraining its crude exports and will be further reduced with a lower oil price. Four questions remain: will China and India continue to buy Iranian oil and to what extent? What will Iran's geopolitical response be to export limitations? Will the price of oil stabilize or continue rising and put demand levels at risk? Lastly, will producers finally introduce serious economic reforms?

OPEC's total liquids output *de facto* only decreased by around 400 kb/d in 2017 versus 2016, due to the surge in output from Libya and Iraq. This also highlights the extent to which the production levels chosen as the baseline for the cut were high. With the return of U.S. sanctions, Iran's 2.5 million barrels per day (mb/d) liquids exports are expected to decline, but it is expected that China, India, possibly also Russia and others, can find ways to access most of this oil, possibly at some discount. Ensuring strong discipline to respect unilateral U.S. sanctions is not a given. In Venezuela, production has fallen by 700 kb/d to below 1.5 mb/d in the past 18 months and could fall by another 300 kb/d, given the magnitude of its economic and political crisis and the risk of more U.S. sanctions being introduced. Raising OPEC+ output in the second part of 2018 will help avoid accelerating the weakening of OPEC's market position, which is a serious issue for consideration.

Price growth to rescue the weakest economies

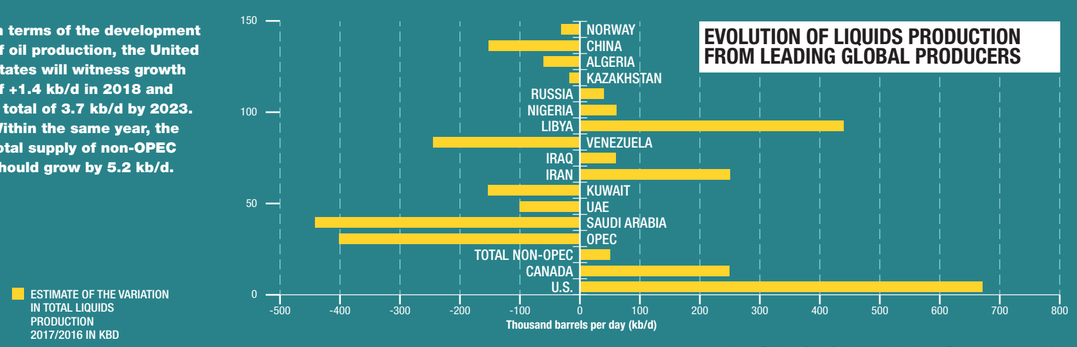
With the exception of the dramatic social and economic crises in Venezuela, leading OPEC+ oil producers have managed to navigate through the storm of lower oil prices. This is because the real stress and strain period only lasted around 16 months, from January 2015 until August 2016, when the price of oil started moving slowly upward. Kazakhstan and Algeria avoided sliding into economic recession but experienced sluggish growth rates. Beyond the chaotic situation in Venezuela, Russia faced the longest and sharpest recession, while Angola, Azerbaijan, Saudi Arabia, Iraq, Iran and Nigeria also went through a year of economic recession and stagnation. Angola's economic situation worsened →

The sharp fall in oil prices, which began in August 2014 (100$/b) and bottomed out (30$/b) at the beginning of January 2016, led to the OPEC+ agreement in Vienna of November 30, 2016 to cut production levels by 1.7 million barrels a day from production levels at the end of the same year.



Source: Thomson Reuters

In terms of the development of oil production, the United States will witness growth of +1.4 kb/d in 2018 and a total of 3.7 kb/d by 2023. Within the same year, the total supply of non-OPEC should grow by 5.2 kb/d.



Source: IEA, Market Report Series: 2018 Oil – Analysis and Forecasts to 2023, March 2018

dramatically, yet was stabilized by the government. However, no IMF country support program was put in place for any of these oil producers. Had Saudi Arabia pursued its high-output/low-price strategy during one additional year and had Venezuela's production not collapsed, several regimes would probably have been exposed to social tensions, falling production and unsustainable budget deficits, risking destabilization. A sustained period of $30/bbl oil would probably have created very serious macroeconomic, social and financial challenges for Algeria and possibly also, Russia, Nigeria, Angola, Azerbaijan and Kazakhstan. Saudi Arabia itself would have struggled to finance its social and military spending. The OPEC+ agreement and Venezuela's output collapse have certainly set a floor to oil prices, making producers cautiously optimistic that the worst is behind them. For most of these countries, the fall in oil prices and revenues led to currency depreciation or devaluation following costly attempts to defend the exchange rate (with the notable exception of Algeria), a move to floating currencies (Russia, Kazakhstan), rising inflation (due to imported inflation and monetary creation), spending cuts (primarily social or infrastructure spending, but also military outlays), growing state budget deficits, a fall in real incomes, a rise in poverty, lower upstream capital expenditures (with the exception of Russia), a weakened banking sector and weaker sovereign credit ratings. Ultimately, producers did not drastically cut their public spending to avoid economic and social issues, yet decided to run budget deficits, covered by fiscal reserves and recourse to domestic or international bond markets. They also benefited from the currency depreciation, which has softened the impact of falling oil prices, export values and tax revenues. Russia masterminded management of its budget deficit thanks to its Reserve Fund, from which it drew more than $50 billion, as did Algeria, Kazakhstan and Azerbaijan. Yet these countries also tapped into strategic welfare funds aimed at supporting infrastructure investments or pensions for example. Russia's Reserve Fund was emptied, as was Algeria's. Azerbaijan and Kazakhstan, by comparison, have managed to limit excessive withdrawals. Saudi Arabia managed to mobilize its large reserves, which are still far from depleted.

The stability of the political system put to the test

No producer has faced collapse, with the exception of Venezuela. It has been confronted with a perfect storm of falling investments, falling production, soaring inflation, insecurity, social uprising, institutional collapse and political turmoil. Despite strong backing from Russia, Cuba and China, the country could not contain the deepening crisis. In the ten countries examined here, only one electoral change occurred which can be related to the fall in oil prices: in Angola, the former President Dos Santos finally left office after 38 years in power and the recent elections brought new persons in charge and reduced the direct influence of the Dos Santos family. It is noteworthy that presidential elections took place in Kazakhstan in 2015 and then in Russia, Azerbaijan, Venezuela in 2018, without any serious challenge to the rulers seeking re-election, although none of these elections were free and fair. With the exception of Venezuela, the current turnaround has been strong. No policy shift has occurred in these countries. Social unrest has taken place here and there, locally in Russia, Kazakhstan, Nigeria, Algeria, and to a larger extent in Iran during the winter of 2017-2018, but under tight government control and with no political impact. Last but not least, in Saudi Arabia, a new leader has risen to power, Crown Prince Mohammed bin Salman. Legitimized by his father, he is young (born in 1985) in a country where 25 percent of the population is less than 15. He displays vision and ambition, but he has also been taking big risks, both internally and externally, with still-uncertain consequences. The resilience of regimes has many explanations. Yet, in Russia, Saudi Arabia, Iran and to some extent Azerbaijan, regimes have used their geopolitical conflicts to strengthen loyalty and their legitimacy. Russia is involved in wars in Ukraine and Syria, and has engaged in a confrontation with the E.U., NATO and the U.S. Saudi Arabia is involved in a war in Yemen and has been playing up two enemies, Iran and Qatar. Azerbaijan engaged militarily in the Karabach conflict in spring 2016. And Iran was involved in the fight against the ISIS terrorist group in Iraq and is actively engaged in Syria and Lebanon in order to "stabilize the region" and fight terrorism. Regimes have played the geopolitical card in order to underplay, sideline or silence, political or social demands, and have resorted to repressive policies. This may backfire as the middle class, and the poorest can opt for the "voice" option. Yet in many cases, these countries lack a political system, or opposition leaders, to channel political discontent, with opposition forces being marginalized or oppressed.

Iran, Iraq and China in focus

Iran is a special case because it was freed from sanctions when the storm of oil prices came, and benefited from a rapid increase of production and exports by 1 mb/d as of autumn 2015. A major political change had happened in 2013, when Iranians elected a reformer as President, Hassan Rouhani, after years of conservative ruling and economic degradation. After successfully reaching the nuclear deal in 2015, he was re-elected by a stronger majority in the May 2017 presidential elections, in a clear signal that Iranians supported his economic reforms and want change: internal liberalization and external normalization. Supreme leader and all-powerful cleric Ali Khamenei had given his blessing to these changes. Yet President Trump's repudiation of the 2015 nuclear deal and the re-imposition of sanctions—officially to negotiate a better nuclear deal that would go beyond 2025 and also address Iran's ballistic missile program as well as its expanding military activities in the region, possibly with the ultimate goal of fostering internal divisions and tensions and provoking a regime change—is hazardous and dangerous. The country is deeply marked by a sentiment of injustice following the hyper-violent Iran-Iraq war. It is a proud nation that can be expected to unite when facing other injustices. The economy is much less dependent on oil than usually assumed, whereas financial sanctions, trade restrictions and lack of investments are more problematic. The regime has proven remarkably resilient since 1979 and against this backdrop, the hardliners may well become more aggressive, whereas the reformers may be increasingly weakened and marginalized, with average Iranians left hostage, and helpless, in a wider geopolitical conflict and internal power struggles. Iran could well leave the nuclear agreement altogether, opening the way for further confrontations, if not wars, that will leave no winners.

Iraq has faced the triple storm of falling prices, the fight against ISIS and severe tensions with the Kurdish Regional Government (KRG), which culminated with the referendum for independence and the retaking of key oil fields controlled by the Kurds by the central government's army. The country is on the path to overcoming these challenges and its stabilization, reconstruction and pacification will be helped by higher oil prices and production. Nonetheless, the country will have to address urgently critical challenges: diversifying its economy, developing its agricultural sector, reforming its institutions, combating corruption, and attracting investment. These challenges will be very hard to address and it will take strong and credible leadership and responsible behavior by foreign powers to succeed. China in many aspects was a key backer of several weakened oil producers: it made inroads or provided investments or credit to Russia and Venezuela notably (to state or private stakeholders). Yet the crisis is expected to have a structural impact on China's overseas strategy: Angola and Venezuela turned into poisoned debtors so that China's generous credit lines in return for future oil supplies and infrastructural development may be reconsidered in future. However, China is expected to be the key winner from the new confrontation with Iran at the expense of Western interests and companies, leaving Iran no choice but to go East, towards India and China. The other unfolding geopolitical changes are Russia's engagement with Saudi Arabia, which is only an oil alliance so far but has the potential to widen, and a major question mark over China's role in the Middle East, given its significant imports of Saudi, Iraqi and Iranian oil.

Adaptive up & mid-stream strategies and corporate reconfigurations

National oil companies reduced their capital expenditures and drilling operations (with exceptions in Russia, due to the ruble's depreciation and flexible taxation), and moved to prepayments or managed to issue bonds. Traders such as Vitol, Trafigura and Glencore have certainly strengthened their positions in becoming creditors to several national oil companies. So did China and Russia, yet with unsatisfactory results. Nonetheless, major investments have been sanctioned, mainly in partnership with foreign companies: for example, in Azerbaijan (ACG-BP) or Kazakhstan (Tengiz-Chevron). Others were pushed back and oil exploration efforts delayed, as in Russia's Arctic, which is marked by high costs and technological constraints following sanctions. In Algeria, a February 2016 energy policy meeting laid out priorities for structural reforms, but was not implemented. Investment friendly amendments to the hydrocarbon law are being worked out, with no certainty over timing and content. Privatization and asset divestment have taken place or are being planned in several producer nations, directly in the oil sector or in the overall economy. In Russia (19.5 percent of Rosneft), in Saudi Arabia (5 percent of Aramco now pushed back to 2019), in Angola, in Kazakhstan (KazMunaiGas). Iraq is planning to establish a state-owned oil company. Algeria's upstream sector requires large foreign investment and technology, yet no change is expected until the 2019 presidential election.

A worrying alarm bell for a fall in prices

The storm of lower oil prices left these oil producers weakened and their ability to navigate another similar storm will be largely diminished. If prices fall again, they will have lost their fiscal reserves and buffers to resist. Their ability to develop sufficient financial reserves again is uncertain. Their longer term development is at risk: Russia, Azerbaijan, Kazakhstan face a weak banking sector and have tapped into their strategic pension and infrastructure funds. Budgets were curtailed everywhere. Poverty has increased in Russia, Venezuela and Kazakhstan. In Algeria and in Russia, the middle class has been hit. Combined with high unemployment, especially in rural areas, and a very young and growing population, this could lead to tensions in Algeria unless structural reforms address these issues. All these regimes have fossil fuel dominated energy and power generation mixes, which limit their oil and gas exports, represent a subsidy burden and hamper their economic diversification. The ability of these regimes to diversify their economies and energy mix and invest in alternative, low carbon electricity supplies appears weakened. On the one hand, they have a chance to benefit from the falling deployment costs of solar and wind power, and could reap the large benefits of energy efficiency investments. Energy subsidies have indeed been reduced in Iran and Saudi Arabia. Angola and Nigeria have introduced several important reforms, and Kazakhstan has been pursuing the attempt to increase the share of private investments in its economy. On the other hand, the oil rent system itself is unlikely to be changed because many of these countries are involved in wars and larger geopolitical tensions (Russia, Iran and Saudi Arabia), face sanctions or the threat of sanctions (Russia, Iran and Venezuela) and are exposed to social instability, institutional weaknesses and insecurity (Nigeria, Angola, Venezuela and Iraq). Their energy sectors are dominated by state-owned companies (with the exception of Iraq), which can deliver large projects if they have access to finance. But they cannot change a country's energy governance and system marked by inefficiencies and corporate governance challenges (Russia, Iran, Venezuela, Nigeria, Angola and Algeria). With renewed sanctions, Iran's economy of resistance may well be perpetrated further. Priorities may be elsewhere: Saudi Arabia has just raised its military spending by 10 percent. Yet among all these countries, Saudi Arabia's Vision 2030 plan unveiled in April 2016 clearly stands out as one of the boldest and most realistic programs to diversify an economy. But it can only succeed if the society becomes more inclusive and if the country reduces its geopolitical exposure. Algeria also has a large, untapped potential to diversify its energy and electricity mix and reform its economy, but this will depend on political will, a change in government and in the governance of state-owned enterprises, as well as the ability to attract more foreign and private investments.

Text extracted from the Report: Navigating the storm: "OPEC +" producers facing lower oil prices" (ifri Center for Energy, 2018)





Venezuela, a difficult Comeback

Falling oil production, billions claimed by creditor countries, weak infrastructure and the threat of U.S. sanctions make any attempt at a recovery unlikely to succeed

Latin America/A giant waiting to take off

All the Faces of the Continent



Split between development pressures and old weaknesses, the region offers a fragmented economic and social landscape. The worsening of the Venezuelan crisis, the consequences of which weigh on the entire world energy sector, contrasts with the attempt by a group of countries to modernize their governance systems, breaking up old monopolies and opening up to investors able to exploit their enormous untapped resources









FRANCISCO MONALDI

He is Fellow in Latin American Energy Policy at the Baker Institute for Public Policy at Rice University in Houston; Non-Resident Fellow at the Center on Global Energy Policy at Columbia University in New York City; and Founding Director and Professor of the Center on Energy and the Environment at ISEA in Caracas.

The Venezuelan oil sector is imploding. Production is falling so fast that it has become a major geopolitical risk for the oil market. Since the Venezuelan economy depends on oil exports for more than 90 percent of foreign exchange, the production collapse is worsening what already is the worst economic depression in Latin America's recorded history. The country is in hyperinflation, and the meltdown has produced a massive humanitarian and refugee crisis in the region. More than two million Venezuelans have emigrated in the last two years. Nicolas Maduro's "reelection" was considered illegitimate by most of the Western Hemisphere and Europe, and the U.S. and other Western countries are tightening sanctions against Venezuela. The implosion will likely continue unabated unless a political transition occurs.

The figures that point to a deep crisis

When Hugo Chavez came to power in 1998, oil production was close to 3.5 million barrels per day (mbd). When president Maduro was first elected in April 2013, oil production was close to 2.7 mbd; when he was "reelected" in May 2018, production was at half that level, about 1.36 mbd. The collapse has rapidly accelerated; in fact, most of the decline (about 1.25 mbd) has occurred in the last two years. Production operated solely by PDVSA, the national oil company, has been falling faster and it is currently estimated at 600 thousand barrels per day (tbd), whereas in 2016 it was around 1.5 →

mbd, and 3.1 mbd in 1998. Production operated by joint-ventures with foreign partners has also been falling recently, but less sharply, to about 750 tbd, from around 1.1 mbd in 2016. Even the production operated by the Russian and Chinese national oil companies has recently been falling, even though these companies have provided significant financing to PDVSA. The collapse in conventional production has been more significant, but recently extra-heavy production has also been falling. Close to 60 percent of total production, about 800 tbd, is of extra-heavy oil, and the country is importing close to 125 tbd of diluents to blend and re-export the diluted crude oil. The heavy oil is sold at a discount with respect to lighter oil and the profit margins it generates are generally smaller.

A spiral that could prove lethal

Less than half of PDVSA's total production, about 550 tbd, generates cash flow. More than 350 tbd are consumed in the subsidized domestic market at a massive loss; more than 400 tbd are committed to repay debts with Russia, China, and other creditors; and around 50 tbd are sold subsidized to Cuba. The cash flow collapse has resulted in an investment meltdown, generating a death spiral. Oil rigs in operation have fallen to 28 in May 2018, a level not seen since the massive oil strike of 2003, less than half the levels in 2014-2016, and less than a quarter the levels reached when production peaked in the 1990s. Moreover, rig productivity is about a third of what it was then. PDVSA is estimated to owe more than USD 15 billion to service companies and partners, on top of more than USD 40 billion in financial debt. Except for debt to Rosneft, the Russian national oil company, which appears to be current, PDVSA has defaulted on everyone else. Until recently with minor exceptions, creditors have been patient and have not sued to collect, but patience is starting to dwindle. Venezuela and PDVSA entered selective default on some bonds in late 2017, and full blown default is likely in 2018. Bond-holders are organizing to develop a legal strategy to collect, and some contractors and clients recently began to take legal actions for contract breach, and the bad news does not end there. Recently, ConocoPhillips was awarded USD 2.04 billion from PDVSA, by an arbitration tribunal of the International Chamber of Commerce, in compensation for the 2007 expropriation of their assets in Venezuela. They quickly moved to get injunctions to seize PDVSA's assets and cargoes in the Dutch Caribbean islands. As a result, more than 20 percent of Venezuelan exports have been hindered as PDVSA stopped sending tankers to those facilities and there were close to 80 tankers in Venezuelan waters in late May, a massive accumulated inventory backlog. By early June some production had to be shut-down when they ran out of storage. Reuters reported that Venezuelan exports declined to 765 tbd in the first half of June, versus 1.13 mbd in May. This type of legal trouble is likely to increase when defaulted creditors also attempt to seize assets, cargoes, and revenue streams. CITGO, PDVSA's refining subsidiary in the U.S. is a likely target of litigation.

The international weight of sanctions

The U.S. government imposed financial sanctions on Venezuela and PDVSA, limiting their capacity to issue, restructure or refinance debts, sell assets, including receivables, or obtain dividends from CITGO. Sanctions have made it harder for PDVSA to buy diluents in the U.S. without paying in cash, obtain letters of credit, or accumulate arrears with service companies. Sanctions also imply that any macroeconomic adjustment program with debt renegotiation would require U.S. support. The U.S. has refrained yet from imposing oil sanctions, neither limiting the export of diluents and refined products nor banning oil imports from Venezuela. Even though U.S. officials have announced that these sanctions are still on the table, it appears unlikely that they will be implemented, especially the import ban. The Venezuelan oil industry is imploding without these sanctions, so why would they accept the blame for collapse and further disturb the world oil markets, especially when there are other priorities like the Iranian sanctions?

The domestic market

Although the domestic market, currently below 400 tbd, has collapsed to less than half what it was at its peak, largely matching the collapse in GDP, it still represents a massive loss for PDVSA. Transport fuels and energy in general are provided for "free," not even covering distribution costs. Domestic refineries are operating at less than a third of their capacity, and Venezuela has been increasingly importing products for the domestic market. Domestic refinery output in early June was below 500 tbd, 144 tbd less than a year ago and smuggling to neighboring countries is widespread. Unless the country removes energy subsidies, at the pace that production is falling it might need to ration energy consumption to maintain a surplus for exports.

It's a fight for survival now

The catastrophic socioeconomic situation, the growth collapse, hyperinflation, rising poverty, rampant crime, and hunger, is also taking its toll on the oil industry. Real wages, including those for the "privileged" oil workers, have collapsed. Workers are not showing up to work, blaming lack of transportation and PDVSA's inability to provide them with food, uniforms, and safe working conditions. Those who can, including some of the best engineers, are leaving the country, and by union estimates more than 20 thousand employees have quit during the last year. The theft of equipment, which was already problematic, has become one of the major impediments for operations. From wires, to spare parts, to multimillion dollar equipment, everything seems to be up for grabs. Workers have even faced armed robberies inside industry facilities. Corruption is also widespread, not only inflating costs but delaying the execution of even the simplest tasks. In 2017, the Maduro administration launched an anti-corruption drive, which has been widely perceived as a politically-driven purge of rival political factions. As a result, the last three CEOs of PDVSA were indicted, as well as more than a hundred executives. The already thin bench of experienced professionals is now almost completely depleted. Maduro's "solution" was to militarize the oil industry. A National Guard Major General with no relevant experience was appointed Oil Minister and PDVSA CEO. The results have proved disastrous, with significant managerial and policy mistakes worsening an already calamitous situation.

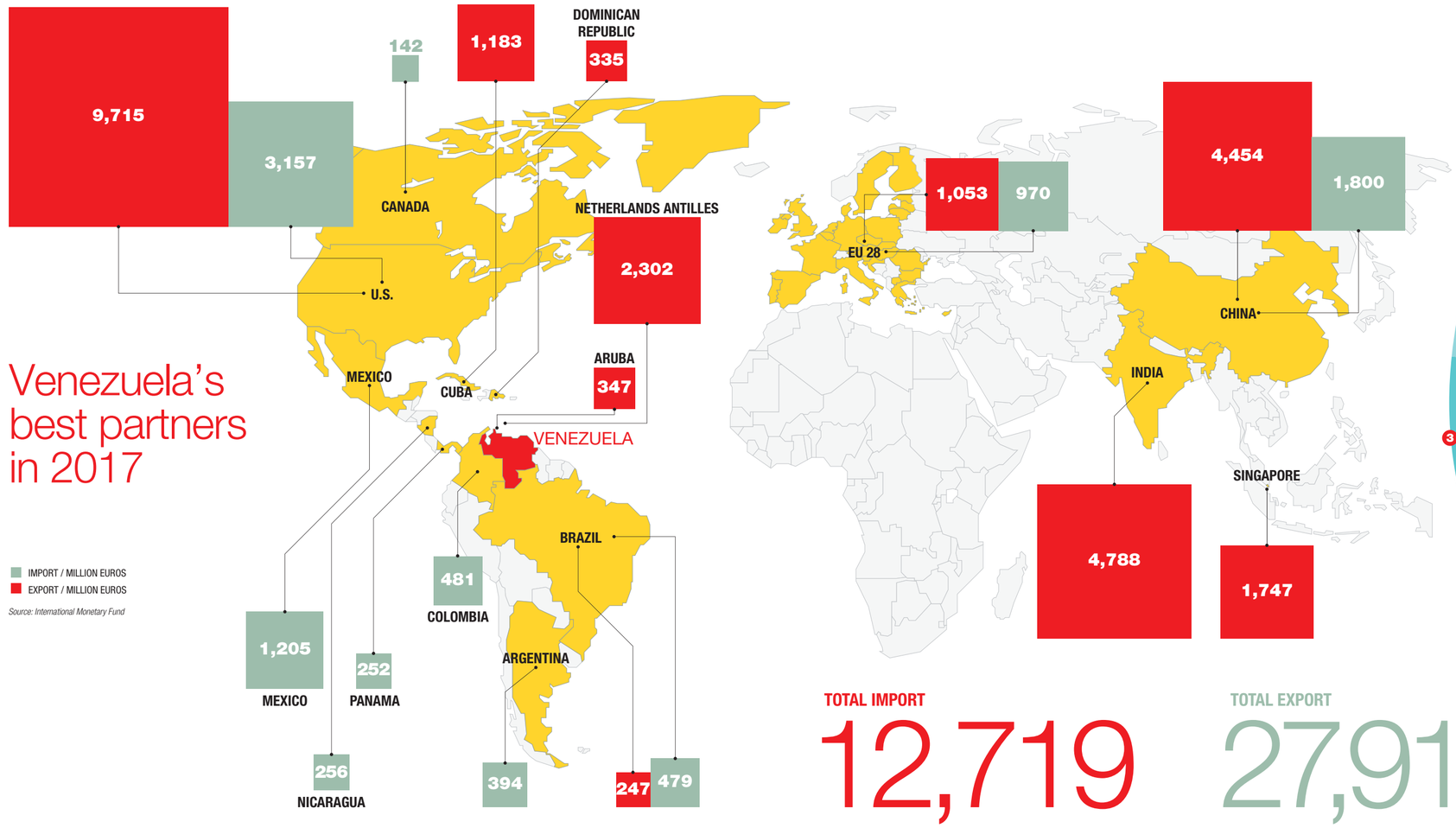
The remote possibility of a recovery plan

In June, the government announced a "plan" to increase production by one million barrels per day in one year. The stated goal is the reactivation of close to a thousand inactive wells using service contracts. Details are murky, but it appears that the contractors are supposed to recover costs with the new barrels of production and receive a premium for the additional barrels added over a baseline. Similar proposals have been announced in the past with no concrete achievements, and this time is unlikely to produce better results. The cash situation is worse, and the company lacks the human resources to properly supervise such a program. The government changed the law to give the oil minister full powers to sign and modify contracts without the current required approval by the opposition-controlled legislature. This might provide an opportunity for developing some "creative" structures to guarantee payments to contractors in ways not possible before. But as would be expected, given the disappointing historical record, there is skepticism about PDVSA's ability to implement the plan.

Venezuela's best partners in 2017

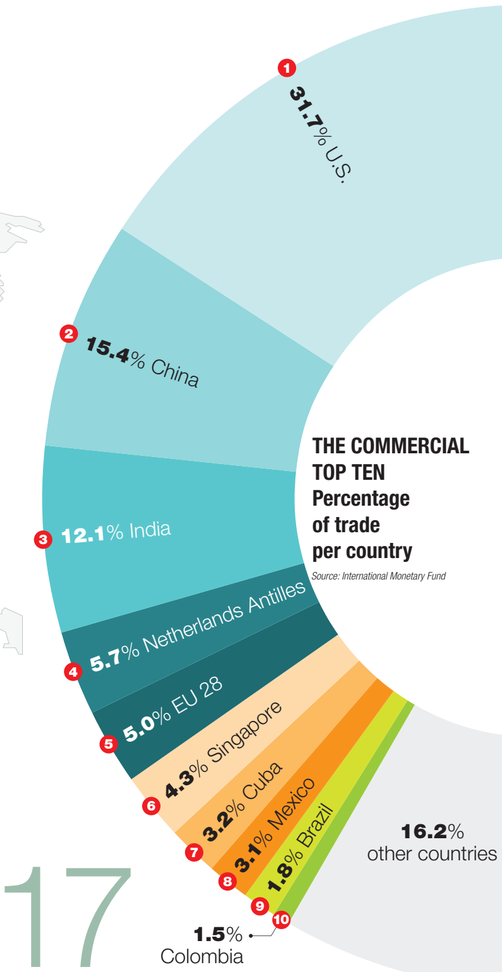
IMPORT / MILLION EUROS
EXPORT / MILLION EUROS

Source: International Monetary Fund



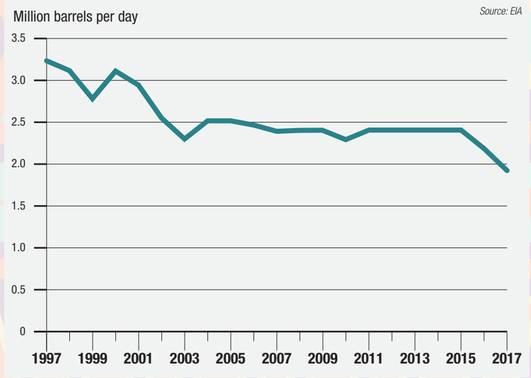
TOTAL IMPORT
12,719

TOTAL EXPORT
27,917

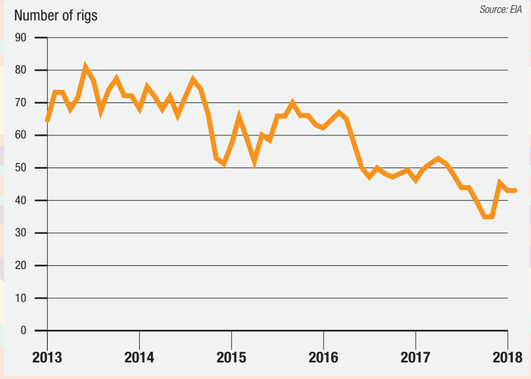


THE COMMERCIAL TOP TEN
Percentage of trade per country
Source: International Monetary Fund

VENEZUELA AVERAGE ANNUAL CRUDE OIL PRODUCTION



VENEZUELA MONTHLY RIG COUNT



The uncertainties of the global market

Because of the production collapse, Venezuela is over-complying with OPEC cuts by more than 700 percent. That has helped attain OPEC's goal of reducing surplus inventories, tightening world oil markets and putting upward pressure on the price of oil. Moreover, Venezuela is unlikely to reverse that decline any time soon. The Venezuela situation, combined with the U.S. announcement of renewed sanctions on Iran, forced OPEC to revise the production agreement with Russia and other non-OPEC countries. The Venezuelan heavy-oil production decline, combined with Mexico's, has been disruptive for the supply of heavy oil to U.S. Gulf Coast (USGC) refineries. These refineries were designed for a heavy oil diet, and they have been left searching for alternative supplies. According to Platts, USGC imports of Venezuelan heavy crude averaged 249 tbd in the first five months of 2018, down from 530 tbd in the same period of 2017 and 659 tbd in 2016. Canadian crude exports to the USGC area have increased from 336 tbd in January to 530 tbd in June, but the lack of sufficient transportation infrastructure limits Canada's capacity to cover the supply gap. Until the Keystone XL pipeline is built, bringing about 800 tbd of Canadian oil sands directly to the USGC, heavy oil imports from the Middle East, particularly Iraq, would have to increase. To be sure, Venezuela has incentives to export to the U.S. as much of its dwindling production as possible because it is its most profitable market and the only one that generates significant cash. In contrast, most exports to Asia and especially to China, are committed to repaying debts. In fact, CSIS reports that since March, exports to China have declined, while a larger share of exports was sent to USGC and India. However, the reality of Venezuela's production collapse, combined with the difficulties of obtaining diluents and the disruptive effect of financial sanctions, make it likely that there will be an increasing scarcity of heavy oil in the USGC. As a result, price spreads between light and heavy crudes would continue to decline, potentially reducing the profitability of U.S. refiners. Reuters recently reported that Venezuela was not fulfilling most of its contractual commitments with clients. In April, contractual supply commitments with U.S. clients were around 600 tbd and PDVSA did not even comply with half that amount. Contractual commitments with India and China were also partially unfulfilled, and only commitments with Russia were honored. Particularly surprising is the fact that Venezuela was reported to be buying oil from third parties to fulfill its subsidized oil commitments to Cuba, a very costly decision that can only be explained by political considerations.

Two widely divergent paths

Looking forward, the regime and the Venezuelan oil industry face two dramatically divergent paths. The first one requires a macroeconomic stabilization program with debt restructuring and the support of the IMF and the international community. It also requires massive foreign investment in the oil industry. To increase production by an average of about 200 tbd per year, Venezuela would need to invest an average of close to USD 20 billion per year for a decade, and the Venezuelan government will only be able to fund a small fraction of that amount. The opening to foreign investment would require an oil reform that provides institutional and contractual credibility. Such a path would be unthinkable without the cooperation of the U.S. and other Western countries, lifting sanctions in exchange for significant steps towards reestablishing constitutional democracy. Without such a plan, it appears close to impossible to stop hyperinflation, resume economic growth and recover oil production. Of course, there are no signs that the regime would be willing to negotiate such a deal, one which would weaken their grip on power.

The remaining path is one in which oil production continues to decline; Venezuelan creditors corner the country, seizing assets, cargoes and revenue flows; Western companies have a declining role in the oil sector; Russia and China increasingly manage Venezuela's oil exports and reluctantly become the largest operators in the declining oil industry; the country becomes highly politically isolated; and the massive exodus of emigrants from the region continues. There does not seem to be too much space for a middle ground. Perhaps a large increase in the price of oil could make the second scenario less dramatic. Even a transition within the regime, which could be seen favorably by some of its key allies, would require moving towards the first path if the second is to be avoided.

The question then is can the second path be politically sustainable? It seems implausible, but it cannot be discarded. The electoral route has been closed, military conspiracies against Maduro have been forcefully squashed in the last few months, and international pressures seem to have had limited effect on the regime. Thus, the future of Venezuela and its oil industry look grim.

Where is the bottom?

Until about a year ago the production of joint-ventures had proved more resilient than PDVSA's. Also, the extra-heavy oil production, with little geological risks, had partly compensated for the abrupt decline in conventional oil fields. As a result, the expectation was that the production decline will slowdown and automatically reach a certain level, e.g., 800-900 tbd, close to the joint ventures' and Orinoco Belt's "sustainable production" levels. However, the last year has put some of these assumptions to test. The joint ventures' output is declining fast and the infrastructure to increase the diluted extra-heavy has not been developed. All the problems described above, with human resources, theft, sanctions, injunctions and other issues do not seem to have an end in sight. Thus, some analysts have begun making apocalyptic predictions: that Venezuela would become a net importer of oil in 2019, that Venezuela's refineries would operate mostly with imported oil, that Venezuela would have to retire from OPEC. The problem with those projections is that if Venezuela does not export, it cannot import anything. So, the country simply cannot become a net importer of oil. Thus, we can expect that the government would have to do everything they can to maintain some exports and some cash flow. It is a matter of survival. It appears unlikely that they would be able to stabilize production, much less revert the decline, but they may be able to slow it down and reduce domestic consumption further to allow more exports. At the current pace of decline, production could reach the one million barrels per day threshold before the end of 2018. In fact, production in June is likely to fall significantly more than the average during the last year. It is less clear where the "bottom" production level is. Everything points south, but the government must react or else it will also implode.

Welcome to the South

Venezuela aside, the results of elections held across the region suggest that future governments will adopt a more welcoming approach to a foreign presence in the energy sector





CAIO PIZETTA TORRES

He is an political risk analyst for Brazil and the Southern Cone in Control Risks' Global Risks Analysis practice, based in São Paulo. He holds a BA in Law and a MSc in International Law from the Université Paris I Panthéon-Sorbonne.

Against the backdrop of extensive dissatisfaction with mainstream politics, wide-ranging corruption probes and an uptick in violence, Latin America is experiencing a wave of presidential elections which could lead to momentous political change. A recent reversal of the pink tide—as the surge in left-leaning administrations in the 2000s is commonly known—brought to power a series of business-friendly governments that courted international investors and introduced more flexible regulations for the oil and gas sector. Nevertheless, pressed by the end of the commodities boom and a deteriorating international environment, some of these governments failed to deliver on many promises—including renewed economic growth—and address some of the country's most pressing problems. As a result, Latin American voters today seem to be less driven by ideology or party affiliation and more by their frustration with particular issues such as corruption and violence, which helps explain the comeback of populist rhetoric and the rise of outsider candidates promising to clean up politics and stand up to organized crime. While this uncertain context increases the political risk for oil companies, several elements suggest that the region is not yet on the verge of dramatic changes to recent liberalizing energy reforms. Apart from Venezuela, most will see their elections play out under democratic institutions and an adverse economic environment that will compel candidates to maintain their countries attractiveness to international investors, even if they do not openly admit it on the campaign trail.

The risk of a new energy "nationalization" in Mexico

Nowhere in Latin America are election-related fears more strongly felt than in Mexico, which elected its first leftist president in decades in the July 1, 2018 elections. Andrés Manuel López Obrador (AMLO) is a polarizing figure in Mexican politics, and his victory comes on the back of widespread disillusionment with establishment political parties, which also resulted in AMLO's National Regeneration Movement (Morena) becoming the largest party in both houses of Congress. He ran on a strong anti-corruption platform, taking advantage of major bribery scandals affecting the current administration, President Enrique Peña Nieto and his Institutional Revolutionary Party (PRI), which has dominated Mexican politics for most of the past century. AMLO's upcoming presidency has raised many eyebrows in the business sector, as his rhetoric is often populist and rooted in resource nationalism. Energy remains a galvanizing →

Doors open to foreigners



Comision Nacional de Hidrocarburos (CNH)
- Burgos-Tampico-Misantla - **CNH-R03-L03/2018** - Deadline September 27, 2018
- **CNH-R03-L02/2018 – 37 blocks** - Deadline September 27, 2018
- Sureste and Veracruz basins - **CNH-A6-7 Asignaciones/2018 – bids** for seven contracts – Deadline September 27, 2018

- **Petroamazonas EP auction** - **bid for six fields**
- **Agencia Nacional de Hidrocarburos (ANH)**: bid deadline extended for **Sinu-San Jacinto 2017 blocks**

- **Ministry of Energy** has announced new bidding blocks for 2018

Agencia Nacional do Petroleo, Gas Nat e Bio (ANP)
- **1st Open Door Bid Round system** - 898 blocks
- **2nd Open Door Bid Round system**
- **5th PSC Pre-Salt Bid Round** - bid presentation September 28, 2018
- bids expected: **6th PSC Pre-Salt bid Rounds, ANP 16, 17, 18**

- **Uruguayan government** considering plans to auction 17 offshore blocks

- **Government of Argentina** has provided updates on **Offshore Round 1**

Source: IHS

The radical energy reforms that have affected many Latin American countries in recent years, which will have to be confirmed by the new executives, have led to many foreign companies entering these markets through the granting of concessions for the exploitation of the fields. The map shows which of these operations took place in 2018.

topic in Mexican politics and adopting a more nationalistic stance can be an effective strategy to garner votes. AMLO has implied in the past that he would roll back the successful energy reform enacted by Peña Nieto in 2013, which ended state-owned Petróleos Mexicanos (PEMEX)'s monopoly in the oil and gas sector and opened the industry to foreign investment. AMLO's probable pick for energy minister, Rocio Nahle, stated in February that the future administration would halt new auctions, and oil contracts would be put under scrutiny. Since then he has walked back this uncompromising stance, adopting a more conciliatory tone towards the business sector. On April 4, he issued an open letter to appease investors, stating that he will not confiscate assets or unduly reverse agreements.

AMLO has pledged to increase economic growth, which he concludes can only be achieved through an open market and pro-investment stance. AMLO's experience as mayor of Mexico City indicates that he values the private sector and international capital as important drivers for local development. Furthermore, Mexico has consolidated democratic institutions—if flawed ones—that guarantee checks and balances in the political sphere and ensure the stability of the current regulatory framework of the oil industry. Moreover, in the unlikely event of a radicalization of AMLO during his presidency, he would require a supermajority of two-thirds in Congress to scrap the energy reform, which is enshrined in the country's constitution, creating a major deterrent against its reversal. As a result, the main impact of an AMLO administration to energy policymaking is expected to be associated with his anticorruption agenda. His campaign platform indicates his administration will make efforts to increase the sector's transparency by providing more publicity to contracts and adjudication processes. This is likely to lead to an enhanced scrutiny over the links between the public and the private sector, ultimately reducing integrity risks for businesses. On the other hand, this revamping of regulatory processes might reduce the pace of auctions and oil exploration projects during his first year in office.

Venezuela: a strenuous path to recovery

With the largest confirmed oil reserves in the world, Venezuela's oil industry has been significantly impacted by the country's political and economic turmoil. Unlike its neighbors, there is little uncertainty regarding the government's stance towards the oil sector, which will continue to be marked by an explo- →



THE COLOMBIAN CHANGE
On June 17, 2018, Iván Duque, of the Democratic Center, was elected president of Colombia, beating the radical left candidate Gustavo Petro Urrego in the second round.

sive cocktail of nationalism, cronyism and a generally hostile attitude towards the private sector. Reelected last May for another six-year term after widely disputed elections, President Nicolás Maduro has expressed his intention to revive the country's economy, restore the operational capacity of state-owned Petróleos de Venezuela (PDVSA) and turn around the plummeting oil output, which has declined by 60 percent since June 2016. The ongoing economic crisis and the hurdles created by U.S.-imposed sanctions, however, will hinder the government's ability to finance infrastructure investments, suggesting that output figures will likely continue to decline this year. According to the U.S. Energy Information Administration (EIA), the number of active rigs in the country fell from 70 to 35 from the first quarter of 2016 to April 2018. Despite the president's rhetoric, on June 22 oil minister and PDVSA head Manuel Quevedo indicated that achieving Maduro's production-boosting goals would be "very challenging" for PDVSA. The company mirrors the vicious financial cycle currently affecting the country: to maintain its production pace, PDVSA deeply relies on international oil services companies which, due to systematical non-payment and Venezuela's overall risk outlook, are scaling back their operations. Without these foreign operators, PDVSA's production capabilities are further diminished, and the cycle continues unabated. Mismanagement and corruption within PDVSA and other governmental energy entities will contribute to further the deterioration of the local oil industry. Maduro reaffirmed that the military will continue to run the sector, a move meant to cement its loyalty—and which signals a radicalization of his leftist, anti-business regulatory policies to cling to power. It also indicates that turning around the oil decline is not a priority. Military rule will mean more graft within PDVSA, as well as a continued lack of knowhow and defective decision making for the foreseeable future. This will mean an increasingly inhospitable business climate, where companies will face a high risk of expropriation of assets and arrest of key staff members at a moment's notice.

Colombia: Duque's new openness

On June 17, right-wing Iván Duque of the Democratic Center (CD) won the second-round run-off by a comfortable margin and was elected to succeed current president Juan Manuel Santos. Unlike the ambiguous scenario in Mexico, Duque's policy towards the oil industry is unequivocally positive and supportive of foreign investment. He has promised a business-friendly agenda and economic reforms, such as the simplification of tax policy and a tightening of fiscal spending. He plans to promote infrastructure development through the existing investment framework and has said the country needs to take advantage of its extractive resources and attract foreign direct investment in oil, gas and mining.

With dwindling oil reserves (the Ministry of Mines and Energy estimates current reserves to last for 5.7 years), Duque hopes to increase the sector's efficiency by promoting the use of technology and has overtly supported fracking to increase Colombia's reserves, although this remains a controversial topic that could raise significant social resistance. Duque has also espoused some of the oil industry's claims to improve the sector's regulatory framework, particularly with regard to the current opaque environmental licensing process and the popular consultation mechanisms through which local communities can vote to approve extractive projects. These referenda have been one of the main obstacles holding back the development of the oil industry in the country; they also are a consistent source of conflict between local communities and businesses, as well as tension between the local and central governments. During his campaign, Duque repeatedly criticized the existing rules and expressed his intention to limit the binding force consultations enjoy to effectively block extractive projects. That said, the social component is expected to remain a pressing issue for businesses in Colombia—particularly for those operating in rural areas. Duque's aim to increase the number of oil projects, compounded by his controversial plan to curtail the power communities currently possess, is likely to generate further backlash from local populations. The security component is also likely to be affected by Duque's election as he vouched to implement controversial modifications to the historic peace agreement signed by Santos with the former Revolutionary Armed Forces of Colombia (FARC) in 2016. An immediate return to conflict is unlikely, but the security environment is likely to worsen in the medium term. Moreover, the ongoing peace process with the National Liberation Army (ELN) guerrilla group will depend on the group's willingness for a unilateral ceasefire, which is unlikely to take place. The ELN regularly perpetrates targeted attacks against oil and energy infrastructures, a strategy which is expected to continue as the Duque administration will adopt a more intransigent stance regarding ongoing negotiations.

Brazil: clearer rules for the oil industry

Few sectors have benefited more from the administration of President Michel Temer than the oil industry. After taking office in August 2016 following the impeachment of his predecessor, Dilma Rousseff, Temer quickly undertook a series of measures to roll back Rousseff's interventionist policies, addressing most demands raised by oil and gas companies. These have included the end of the mandatory stake in pre-salt fields assigned to national oil company Petrobras, reduced local content requirements, and a steady calendar of bidding rounds. Temer has also established clearer rules for unitization processes and extended the special customs regime for the sector (known as Repetro), which was set to expire in 2019. Decreased regulatory risks have substantially improved the outlook for the oil sector and companies responded accordingly. Over the last two years, the government conducted six bidding rounds which generated a total of BRL 21 billion (USD 5.4 billion) in signature bonuses. Another auction of pre-salt blocks, scheduled for September, is expected to raise a further BRL 6.8 billion (USD 1.7 billion). Brazil will experience a closely contested and highly fragmented presidential election in October, held against the backdrop of the imprisonment of former president Luiz Inácio Lula da Silva, who is all but certain to be barred from running, and widespread dissatisfaction with the political class as a result of the Car Wash corruption probe.

Despite sluggish growth, economic matters will not play a prominent role in the campaign, which will be dominated by topics such as corruption and growing insecurity. Therefore, current uncertainties about the fate of Temer's energy reforms will continue, as the campaign platforms of most candidates remain vague on the matter. The frontrunner, far-right lawmaker Jair Bolsonaro, has traditionally espoused a nationalistic economic model, but has recently adopted a pro-market rhetoric. His ambiguous positions, however, make it hard to decipher what the economic agenda of his administration would look like. He is followed by left-leaning Ciro Gomes, who is the candidate most overtly opposed to Temer's energy reforms. Gomes has repeatedly declared he would expropriate the oil blocks recently auctioned by the government and has defended the strategic role of Petrobras in controlling fuel prices. The debate about political interference in Petrobras regained momentum after the Temer administration decided to walk back its policy to not subsidize fuel prices, a key element of the company's successful restructuring plan. While the issue has little impact over upstream activities, it may indicate a candidate's predisposition to intervene in the energy sector. Despite these uncertainties, a U-turn in the country's policies towards the oil industry remains unlikely, regardless of who is elected. Given that no candidate will secure an absolute majority in the first round, the electoral race will be decided on a second-round run-off. Precedent from previous elections (as well as from other countries) strongly suggests that centrist politicians have an advantage in run-off votes, and that more extremist candidates, such as Bolsonaro and Gomes, will be forced to moderate their policy agendas to secure the support of undecided voters. Furthermore, no candidate is expected to retain a majority in congress, which will limit the next president's capability to undo the energy reform. Finally, the next administration will face the challenge to put the country's public accounts in order and drastically reduce its deficit, a task that could be alleviated by the revenues of new bidding rounds.



ADVANTAGEOUS AGREEMENTS
Since he was installed in 2015, Argentinian president Mauricio Macri has listed currency controls, has drastically reduced export taxes and signed agreements with oil sector stakeholders to reduce labor costs at the Vaca Muerta field.

Argentina: Macri's reforms and the potential of Vaca Muerta

In contrast to its neighbors, Argentina's electoral cycle appears distant, with presidential elections scheduled for October 2019. Nevertheless, recent economic and political turmoil generated by a currency crisis and the subsequent decision by the government to conclude a stand-by agreement with the International Monetary Fund (FMI) fueled premature election buzz. The reforms launched by President Mauricio Macri to improve the business environment in the oil sector and unlock the vast potential of the Vaca Muerta shale deposits have attracted major players to the country. Since taking office in 2015, Macri has lifted currency controls, slashed export taxes and wrapped up agreements with oil sector stakeholders to reduce labor costs for projects in Vaca Muerta. Furthermore, Macri has staunchly defended his policy to cut the energy subsidies created by the previous administration and correct the ensuing distortions in the sector. A potential reversal of these measures would have a negative impact for investors, who remain wary of Argentina's track-record of political instability. However, an electoral defeat of his coalition, Cambiemos, in 2019 would not necessarily mean a radical change in the policymaking for the oil industry. If Macri's approval ratings eventually suffer significant blows prior to the 2019 elections, Cambiemos has a strong alternative in the governor of Buenos Aires, Maria Eugenia Vidal, currently the most popular politician in the country. Moreover, the fragmentation in the oppositionist Peronist movement is likely to undermine its capability to present a strong alternative for 2019. Even under a scenario where the Peronists do present a greater threat to Macri, the trend is positive for foreign investors. The new emerging Peronist leadership, headed by governors like Salta's Juan Manuel Urtubey, have an ideological profile similar to Macri's, acknowledging the importance of fostering private investments to unlock Argentina's extractive potential and thus limiting the risk of a major policy U-turn in the energy sector.

A new regional trend toward opening up the markets

Despite local peculiarities, the ongoing electoral cycle in Latin America presents common trends suggesting governments will adopt a more pragmatic approach to foreign investment. With the clear exception of Venezuela, this electoral season will likely be marked by less radical changes on regulation of the oil sector. Political and operational risks traditionally associated with power shifts in Latin America—including expropriation, capital controls and sudden regulatory changes—are expected to diminish. This is largely due to the consolidation of democratic institutions, generating more effective checks and balances and ensuring the independent functioning of judicial and regulatory bodies, a key component of a stable and reliable business environment. Furthermore, with an adverse international economic environment and unstable commodity prices, populist governments will not be able to self-fund their initiatives and will be compelled to work alongside international capital.

U.S./Checking Chinese expansionism and rethinking its liaison with the E.U.

The Power of the Factor



Unpredictable and unconventional, during his first two years in office, U.S. President Donald Trump has been a game changer for global politics and economics



Editor-in-chief of *Agenzia Nova*, of which he was founder, was correspondent from Moscow for the Italian agency *Ansa* and for the newspaper *La Stampa*, headed for which he also followed the activities of the E.U. Institutions from Brussels and Strasbourg. He was responsible for the regional service of the *AdnKronos* agency.

The factor of change that has most influenced international politics and economics in the last two years has the face and the name of the President of the United States: Donald Trump. He is generally considered erratic, unpredictable and resistant to conventions and diplomacy. Politicians and observers throughout the worlds find it difficult to interpret and anticipate his actions. His rhetoric on TV shows and his casual use of tweets are as bewildering as his verbal violence, regular use of threats in negotiations and blatant muscle flexing.

One and a half years into his presidency, it is perhaps time to acknowledge that Donald Trump's choices stem from a clearly identifiable vision of the international stage and are consistent with a well-defined policy line.

Reaffirmation of American dominance

President Trump's main goals are to check Chinese expansionism in the world and reaffirm the dominance of the United States. His overtures towards Russia and his determination to stop the European Union from breaking free from Washington's influence and become a global actor should be interpreted in the light of these goals.

To achieve these ends he uses his country's economic power and trade leverage and relies less on traditional diplomacy, a tool which has proved fairly ineffective for relations with Beijing. During the presidency of George W. Bush, while the U.S. was engaged and preoccupied with wars in Afghanistan and Iraq, China concentrated its effort on establishing harmonious relations with countries throughout the world while avoiding any possible clash with Washington. This approach led to a huge expansion of China's influence in the world, thereby securing Beijing privileged access to Africa's energy resources while still buying oil from Iran. During the Obama presidency, China expanded its sphere of influence further still, undermining U.S. hegemony in Latin America and even establishing a strong industrial and trade presence in Western Europe, for example by buying some major strategic companies in Italy and the United Kingdom.

China is the world's largest manufacturing nation and therefore relies on access to maritime trade routes. Coal-rich but with poor oil and gas resources, China is constantly increasing its oil imports, particularly from the Middle East and Africa, and these resources reach China by sea. Likewise, Beijing relies on sea transport for its exports. Overland trade routes to Russia, India and →

Duties, blow by blow



“America First.” This is the slogan that marked Donald Trump’s electoral path to the White House. To make this happen, the candidate declared, existing trade agreements would have to be renegotiated to make them more favorable to American. The following is a timeline of the events, the duties applied and the reactions caused since the installation of the new U.S. President.

APRIL 20, 2017

The Trump administration revives a 1962 law (Section 232 of the Trade Expansion Act) allowing duties to be applied to steel imports for reasons of “national security”. The White House requests a study on the impact of the duties and on the commercial effects for the steel industry.

JANUARY 22, 2018

The White House introduces duties on imports of solar panels and washing machines, as promised during the election campaign. A 30 percent duty is applied to solar panels, which will fall to 15 percent in four years, while for washing machines the duty stars at 20 percent, falling to 16 percent within three years.

MARCH 8, 2018

Trump signs the order on steel and aluminum imports, excluding Canada, Mexico and, for the time being, the European Union. South Korea, Australia, Brazil and Argentina are permanently excluded from this order. Both China and the E.U. lodge an appeal with the WTO (World Trade Organization).

APRIL 4 AND 5, 2018

China announces the introduction of additional duties of 25 percent on 106 U.S. products, including cars, airplanes and soybeans. On the following day, Trump states his intention to apply new duties on Chinese products of 100 billion dollars.

JUNE 3, 2018

The G7 countries condemn U.S. duties and warn against a trade war.

JUNE 5, 2018

Mexico introduces retaliatory duties on various U.S. products, including steel, pork, cheese, whiskey and apples, worth approximately 3 billion dollars.

JUNE 15, 2018

China announces the application of tariffs on U.S. energy products, which would affect crude oil, LNG and coal, worth 50 billion dollars.

JUNE 22, 2018

The E.U. applies retaliatory duties on 180 types of U.S. products, including steel, aluminum, agricultural products, clothing and boats, worth 3 billion dollars.

JUNE 25, 2018

Harley-Davidson announces that, owing to the duties imposed by the E.U., it will transfer part of its production overseas.

JULY 1, 2018

Canada applies retaliatory duties on U.S. imports. The new tariffs relate to 299 products, including steel, aluminum and whiskey, and hit regions of the country that play a key role in the U.S. electoral system.

JULY 6, 2018

Duties on Chinese goods worth 34 billion dollars are introduced by the Trump administration. A further list of Chinese products is published, worth a total of 16 billion dollars, on which duties are due to be applied from July 20.

JULY 11, 2018

The Trump administration announces its intention to introduce a new round of duties on Chinese goods worth over 200 billion dollars.

Southeast Asia are still relatively undeveloped so China’s long-term strategy compels it to challenge the United States for control of the seas. This strategy is clearly illustrated by its efforts to build a powerful navy, not only by transforming small atolls in the South China Sea into air and naval bases, but also by buying ports and infrastructure networks abroad, from Asia right to the Mediterranean and Latin America, where for a time Beijing considered building a canal in Nicaragua for large ships as an alternative to the American controlled Panama canal.

The “New Silk Road” project, launched by President Xi Jinping in September 2013, is also consistent with this expansionist grand strategy. The project involves two routes: a maritime route around the coast of Southeast Asia, touching India and reaching East Africa, where China already has a strong economic, commercial and even military presence; and an overland route across the former Soviet republics of Central Asia, then through Iran and Turkey and finally reaching Europe. It is significant that the land route does not go through Siberia, which already has a rail link. The rationale for this is not related to transport issues but to geopolitics. Russia and China are divided by a centuries-old rivalry, and the current alliance is a result of isolation imposed on Vladimir Putin’s government by the West. But there is still a great deal of diffidence between Moscow and Beijing, a fact reflected by the route of the “New Silk Road,” whose only connection with Russia is via a South-North link from Iran to Turkey. By contrast, the fact that this large-scale infrastructural work cuts across the Central Asian republics is indicative of Beijing’s intent to establish hegemony over these territories, first and foremost oil and gas rich Kazakhstan and Turkmenistan.

A coherent strategy

Under Bill Clinton’s presidency, and again under Barack Obama’s, the United States gradually rolled back Russia’s sphere of influence, particularly in the Caucasus and Ukraine, but also in Central Asia. With a population of 145 million and a GDP one-fifth that of the United States, Russia faces huge infrastructural challenges due to its geography, and despite its president’s undoubted abilities, it poses no threat to U.S. global hegemony. However, this rivalry between Russia and the West benefits a China which aspires to establish its hegemony over the whole of Asia’s continental landmass. If successful, Beijing would be able to meet its rapidly growing energy requirements without having to rely on the world’s maritime trade routes, which are still controlled by the United States.

Tapping into the dissatisfaction of white middle and working class Americans, made poorer by globalization, Donald Trump used a simple political message to denounce both the progressive decline of U.S. influence throughout the world and Beijing’s growing ambitions. His policy actions, too easily viewed by many observers as incoherent and messy, are instead clearly aimed at challenging Chinese expansionism, at keeping Russia from forging too close a relationship with China that could potentially weaken Moscow, and at preventing the European Union and China from building ever stronger commercial and political ties, all of the above with a view to re-establishing America’s hegemonic role in the West.

Seen from this perspective, Trump’s strategy seems entirely coherent, and there is no denying that the U.S. president has scored several major successes in recent months.

The opening of direct negotiations with the North Korean despot Kim Jong-un seeks not merely to defuse one of the world’s most dangerous hotbeds of tension, but also to deprive China of a powerful weapon for wielding its influence. Those who talk about the growing rivalry between China and North Korea seem to forget that in 2016, 85.6 percent of Pyongyang’s exports went to Beijing, and, in turn, Beijing supplied 90.3 percent of North Korea’s imports (CIA, The World Factbook). In other words, Kim Jon-un’s regime is entirely dependent on Beijing, which for decades has used Pyongyang’s military capability as a tool to blackmail South Korea and Japan.

In May 2018, Trump’s threat to introduce tariffs on USD 50 billion worth of Chinese goods was enough to persuade Beijing to abolish foreign ownership restrictions on companies in the auto, aircraft, shipbuilding and financial sectors, to lower tariffs on imported cars from 25 to 12.5 percent, and to acknowledge the need to introduce copyright protection measures.

Around the same time Washington accused the Chinese giant telecommunications equipment manufacturer ZTE of violating sanctions against Iran and North Korea and denied it access to the U.S. market. To avoid bankruptcy, the company agreed to direct U.S. government oversight of its activities, thereby dispelling any possible suspicion that its equipment would be used for industrial and non industrial espionage purposes.

On June 15 Trump announced he would place a 25 percent tariff on over 1,100 Chinese goods, targeting specifically key aerospace, robotics, and auto and manufacturing sectors, sectors that form the core of the technological innovation strategy pursued by Beijing. China has harshly criticized the measures, valued at USD 50 billion, threatening to retaliate with duties of the same value, mainly targeting U.S. food and agricultural exports produced in the American states where Trump enjoys the strongest political support. The President has already warned, however, that should China retaliate, his Administration will introduce new measures worth USD 100 billion. As a matter of fact, China cannot afford to enter into a trade war and will have to back down for the simple reason that it currently enjoys a huge trade surplus with the United States, which totaled USD 375.57 billion in 2017.

Confrontation with the European Union

Similarly, the European Union would stand no chance of winning a trade war against the United States, its biggest export market, accounting for 20 percent of total E.U. exports. In 2017, the U.S. imported E.U. goods valued at USD 375 billion, almost twice as much as China, which is worth 198 billion to European companies (11 percent of total exports). Also in 2017, the European Union’s trade surplus with the United States amounted to EUR 120 billion, equal to almost USD 140 billion at the current exchange rate. Germany takes the lion’s share, with exports worth more than EUR 112 billion and a trade surplus of over EUR 64 billion. In other words, the industrial driver of Europe’s largest economy is dependent on the U.S. market.

Even based on these considerations alone, anyone can see that the E.U. would have everything to lose from a harsh trade confrontation with the United States. The German Chancellor Angela Merkel is prudent in this respect, while French President Emmanuel Macron is pushing for



approval of retaliatory measures against the tariffs imposed by Trump on European steel and aluminum, 25 and 10 percent respectively. But on this point, Europe is far from showing a united front.

During the G7 summit held on June 8-9 in La Malbaie, Canada, Italian Prime Minister Giuseppe Conte broke European unity by arguing for the need to consider and understand the reasons for the U.S. position and find a solution to prevent the situation from getting out of hand. But there is another issue that has led to the escalation of the contradictions between the various European countries and put a definitive end to the ambitions of turning the European Union into a global power: migratory pressure.

Germany has persuaded Europe to allocate EUR 6 billion to Turkey to close the so-called “Balkans immigration route.” The war in Libya ,waged by France and Britain and joined reluctantly by Italy , opened the central Mediterranean route to immigrants, leading to the arrival in Italy of over 180 thousand irregular migrants in 2016. Since August 2017, the Italian government has managed to considerably reduce immigrant flows, but in the two-year period 2016-2017 Italy received over 300,000 irregular migrants. The European Union has done very little to close this route, initially allocating just EUR 300 million, and in some cases even encouraging NGOs to help carry migrants to Sicily across the Mediterranean. The issue is a source of major concern to Italian public opinion and has helped the League and the Five Star movement – two parties that have more in common with Trump and Putin than with Macron and Merkel – to get into government. Upon taking office as Italian Interior Minister, Matteo Salvini immediately opened discussions with the Visehrad Group (Poland, the Czech Republic, Slovakia, and Hungary) as well as with his Austrian and German counterparts. Germany’s Interior Minister Horst Seehofer is also the leader of the Christian Social Union. The party has ruled Bavaria since the end of World War Two and has always had an alliance with Angela Merkel’s CDU party. But in September this year it faces difficult regional elections in which it is in danger of losing its majority due to the rise of the xenophobic Alternative for Germany party.

In mid-June, Seehofer put forward a plan to refuse entry to migrants, a proposal immediately rejected by Angela Merkel. With its unity seriously undermined by the dispute, the German government will be more concerned with fighting for its survival than with engaging in trade wars with Washington, or in pursuing the chimera of the European Union as a world power.

Brexit/The main challenges for the E.U.: from London's divorce to Trump's duties

A Disruptive and harmful Separation



Negative repercussions are already starting to be felt on both sides of the English Channel, and will be even worse if the United Kingdom does not manage to negotiate an acceptable exit deal with Europe

The U.K.'s exit from the E.U. will be a long process that is likely to take more than five years. The slowness of this process is likely to have devastating consequences. Photo: Parliament and Big Ben on the banks of the Thames (London).



PAUL BETTS

He has been with the *Financial Times* for 36 years, of which 28 were spent as the paper's foreign correspondent in Rome, Paris, New York and Milan. He currently works as an international economics columnist and lives in Monaco.

Divorce is never a pleasant business. It is divisive, distressing and disruptive for both parties involved. It is the source of multiple conflicts: emotional, financial, social, bureaucratic, legal and regulatory. Brexit—the United Kingdom's decision to leave the European Union in barely a year's time after the slim victory of the Leave vote in the 2016 referendum—is no exception.

In a recent paper on the threats facing Europe, the veteran Hungarian financier George Soros warns that Brexit is an immensely damaging process, harmful to both sides. But he also argues that "a lose-lose proposition could be converted into a win-win situation." That is if both sides finally come to their senses by giving some ground in their so far contentious negotiations. Mr. Soros, who has actively and financially supported an initiative called Best for Britain, designed to avoid a messy divorce and calling for a second referendum, says Britain would render Europe a great service by rescinding Brexit and not creating a hard-to-fill hole in the European budget. He adds that the economic case for the U.K. to remain an E.U. member is strong, but it has become clear only in the last few months and will take time to sink in. "During that time," he says, "the E.U. needs to transform itself into an organization that countries like Britain would want to join, in order to strengthen the political case." To achieve this Europe would have to revisit its outdated treaties and allow member states to reassert their sovereignty rather than surrender more of it. A multi-track Europe would allow member states a wider variety of choices that could at the same time reinforce cooperation between these states.

In the meantime, the pressure has become all the greater to find a solution to the Brexit problem.

For if Brexit is already proving highly disruptive both for the U.K. and for the E.U. to a lesser degree—for the time being at least—there are a number of other even bigger disruptive forces at work in the world these days.

Disruption from across the Pond

By far the largest source of disruption from both a global and European perspective over the past year has arguably come from the White House, where Donald Trump continues to amaze, enrage, and confound his allies and foes alike. His decision to impose tariffs on both his allies and his economic adversaries threatens to spark a major international trade war. This has profoundly upset his western allies at the same time as risking to under- →

The negative repercussions of the Leave

1 INVESTMENTS

In the first half of 2018, there was a downturn in investments by companies as a result of the uncertainty created by Brexit. Foreign investment, which in 2016 helped to create 1,600 jobs per week, also declined.

2 GDP

The Bank of England reduced its forecast for average annual growth in the U.K. by 1.4 percent compared to the previously estimated 1.8 percent. The governor, Mark Carney, has also warned that exceptional measures may be required.

3 FINANCIAL SERVICES

London will maintain its status as the main European financial hub even after Brexit. Given the considerable interdependence between the E.U. and the U.K. financial services sector, it is likely that an agreement will be reached that satisfies both parties.

4 AUTOMOTIVE SECTOR

Freedom of movement of goods guaranteed by the Customs Union is particularly important for the automotive industry. A "hard" Brexit would make large-scale car production in the U.K. more difficult and cause a significant drop in sales between now and 2022.

5 TELECOMMUNICATIONS

Leaving the digital single market will have serious consequences for the U.K. telecommunications industry, including on investments in innovation and roaming charges that British consumers will have to pay for the use of mobile phones.

6 CONSUMER GOODS

Consumer goods and food products will suffer the knockback caused by the loss of manpower from E.U. countries and regulatory disputes. A no deal outcome would risk a slump in exports and further increase the price of imports.

7 ENERGY SECTOR

It is unlikely that the oil and gas trade will be affected by Brexit. Electricity will be more of a problem as the U.K.'s dependence on electricity imported from Europe is increasing. The U.K. will exit the E.U., but its link with the European electricity market is bound to get closer.

8 CLIMATE

The U.K.'s exit is likely to hamper the achievement of Europe's climate and energy goals. The U.K. is expected to continue pursuing these objectives, but this task will become more difficult if it cannot remain in the European Emissions Trading System.

mine the U.S. economy itself. It has caused consternation in Europe which now fears the transatlantic alliance is being destroyed, especially following the U.S. decision to reinstate sanctions against Iran thus threatening the collapse of the Iran nuclear deal that took so long to negotiate. All this is already having a negative impact on European trade and business as European manufacturers and energy groups are reviewing their investments and projects in Iran while steel producers are bracing themselves for difficult times as a result of the Trump tariffs. This is also affecting the U.K. which has long boasted of a special relationship with the U.S. In the current circumstances it looks highly unlikely London will secure any new favorable trade terms from Washington as long as President Trump occupies the White House.
In the meantime it is the U.K. steel industry, which has been slowly recovering during the last few years, which is baring the brunt of the tariff war.
The other pressures that have been building up and are among the root causes of both Brexit and the subsequent election of Donald Trump are two-fold. The first is the refugee crisis that has swept Europe and has strained relations between E.U. member states as well as having significant repercussions on individual countries. The U.S. has faced similar if less acute problems from the flow of migrants from Mexico, the Caribbean and other central and south American countries. The second is the still ongoing impact of the 2008 financial crisis that has led to many countries—including the U.K. and other European countries—to adopt economic and fiscal austerity policies.
These coupled with the refugee and mass immigration problem have inevitably provoked a popular backlash which has led to a sharp rise in populism and its growing influence on European politics.

A long transition period

Although Britain is due to leave officially the E.U. at the end of March next year, all signs suggest that the divorce is going to be a long process that will probably take more than five years. Such a long drawn out process risks being disruptive, especially if the most ardent Brexiteers in the Conservative Party force a showdown that could in turn bring down the government of Theresa May. That could lead to early elections where the opposition Labour Party, which has so far maintained an ambivalent position on Brexit, sees its chance of returning to power. Yet this long transition period could also have a positive effect in allowing politicians and voters alike to weigh up the pros and cons of leaving the E.U. and its long term impact on the U.K.'s future prosperity as well as its national security. In short, the question is whether the U.K. would be better off in an arrangement that enables it to retain the benefits of the single market and the customs union but obliges it to abide by E.U. rules and the European Court of Justice, or whether it will ultimately benefit more by leaving the E.U. altogether and forging a series of new relationships and trade deals with other countries including with the E.U. as well. It is basically an argument between sovereignty, or as the Leave campaign put it "taking back control," and economic rationale and pragmatism.
Whatever the most virulent Brexiteers may claim, the economic argument for leaving the E.U. is already lost. A leaked assessment by the U.K. government suggests that full control of its trade risks cutting off 8 percent of Britain's economic growth over 15 years. In the first part of this year, falling investment, weak household spending and a general loss of economic activity have proved a drag on the U.K. economy, which has almost stagnated according to official figures. Separate figures from the banking industry showed slow growth in consumer lending and another recent survey showed a decline in household confidence ahead of Brexit. Mark Carney, the governor of the Bank of England, has said business investment would normally grow much more strongly as the world economy prospers but is being held back by uncertainty over Brexit. The Bank of England has now chopped its forecast for annual average growth in 2018 to 1.4 percent from 1.8 percent.
Mr. Carney also told economists in London that interest rate-setters would be forced back into some of the same exceptional measures they pursued in the aftermath of the E.U. referendum if the Brexit transition was disruptive.

Economically, a terrible idea

At the end of May, a delegation of top European businessmen grouped in the influential European Round Table of Industrialists warned the Prime Minister that they needed clarity over Brexit on a frictionless border and customs union for their investments. Without such clarity, investments would suffer, as companies would be reluctant to embark on heavy funding commitments. The single market and customs union have long secured frictionless trade with the E.U., by far Britain's largest export market, representing over 40 percent of total annual flows or around £240 billion a year. They have also attracted foreign direct investment into the U.K., creating, according to government figures, 1600 jobs a week in 2016. It was after all Margaret Thatcher, whose relationship with the E.U. was challenging to say the least, who led an inward investment thrust into the U.K. with the Japanese Nissan and other car companies in the 1980s. As David Warren, a former U.K. ambassador to Japan, points out in a recent article: "the crucial selling point was that these investors would become British companies selling into Europe through the customs union."
He argues that an ability to trade without friction is as important today as it was then. This is particularly the case in the car industry.
The litany of why Brexit is simply a bad idea from an economic standpoint keeps growing. The well respected Institute of Fiscal Studies reckons that both growth and public finance will suffer. There would be no chance of the much vaunted £350 million a week of extra funds for the U.K.'s financially strapped National Health Service – a dubious claim at the centre of the Leave referendum campaign. The Central Board of Industry and the Institute of Directors have also voiced their concerns on several occasions. The House of Lords E.U. environment committee has said it was "inconceivable" that there would be no impact on E.U. produce, which makes up 30 percent of the U.K.'s food imports. Ryanair has for its part warned of the risk of serious disruptions to U.K.-E.U. flights from April next year unless unless new arrangements are agreed in advance of September 2018. Even the U.K. tax authority has warned that in the absence of a customs union, the cost of implementing a new customs regime to companies trading with the E.U. could be as high as nearly £20billion a year. And this does not take into account the damaging political repercussions should any new customs arrangements lead to the reinstatement of a "hard" border between Northern Ireland and the Republic of Ireland. An Ernst & Young annual survey of 502 multinationals based in Europe has found that 33 percent of these companies believe Brexit will impact their current activities and indeed is already doing so.
Most active international investors are busy reviewing their supply chains, trade and customs, the costs of imports and other new costs that could imperil their business. In short, they are profoundly rethinking their long term European and global investment strategies concludes E&Y.
The Economist Intelligence Unit has also recently compiled a report on how a number of key sectors of the U.K. economy will be impacted by Brexit. The impact would be all the greater in the case the U.K. fails to secure an acceptable exit deal with the E.U. on the basis of a Canada-style trade agreement that includes some special terms that are important to the U.K. economy. The report suggests three sectors will face a direct impact as a result of Brexit. These include financial services, automotive and heath care and life sciences.
In the case of financial services, it expects London to retain its status as one of the world's leading financial centers and Europe's biggest financial hub even after Brexit. Given the significant interdependence between the E.U. and U.K. financial services sector, it is likely that there will be a mutual interest in achieving a deal that satisfies both parties. But the deal will inevitably be partial and some institutions will relocate some parts of their businesses elsewhere as is already happening.

Health care is expected to see its exports fall, while the automotive sector risks facing even bigger challenges if there is no trade agreement. This would make large scale car production in the U.K. difficult and the result would be a significant decline in vehicle sales by 2022 in the event of a "hard" Brexit.
The impact of Brexit on the consumer goods and retailing sectors, telecommunications and energy is likely to be more diffuse but still disruptive. Consumer goods and the food sector will be affected by the loss of E.U. workers and disputes over regulation. A no-deal outcome risks pushing down exports and pushing up prices of imports even further. Exit from the digital single market will have an impact on the U.K. telecommunications sector that risk undermining investment in innovation and the price U.K. consumers pay for mobile roaming.

Impact on the energy sector and the climate

As for the energy sector, the irony is that the U.K. has in the past been one of the strongest advocates for deeper integration of the European internal energy market designed to enhance energy security, reduce energy costs and promote the decarbonisation of supply. All these issues, as well as direct energy trade, are now subject to greater uncertainty. According to the Economist Intelligence Unit trade is perhaps the least of the issues but nonetheless important. The U.K. is a net importer of oil and gas, with Norway a key supplier. This oil and gas trade is unlikely to be affected by Brexit. But any disruption to supply chains could have an indirect impact on the natural gas sector in terms of operational and investment costs. A bigger issue will be trade in electricity at a time when the U.K.'s dependence on imported electricity from Europe is on the rise. The irony here is that the U.K. will be leaving the E.U. but its connectivity with the European electricity market is set to deepen.
Energy companies have practically all recommended that the U.K. maintain its full participation of the European internal energy market as well as of the integrated single energy market. But staying in these may no longer be possible if the U.K. pulls out of the single market and the jurisdiction of the European Court of Justice. The U.K.'s departure also risks undermining Europe's climate and energy targets, as the U.K. has played an active role in the setting of the E.U.-wide 2020 and 2030 climate targets, the establishment of Europe's emissions trading scheme and the development of other policies such as air quality directives. The U.K., which has also relied on its own climate policies, is expected to continue moving forward on climate goals. But doing this may become more difficult if the U.K. cannot stay in the European emissions trading scheme, which once again involves accepting European Court of Justice jurisdiction.
The U.K.'s departure from the E.U. will also impact the efforts of the remaining 27 member states on climate and energy targets. In the case of reducing emissions by 40 percent from 1990 levels, the U.K. has been a big contributor to the overall E.U. targets. If and when it leaves, Germany can probably take up some of the slack but the pressure on coal-dependent countries such as Poland to clean up their act will increase. France may also come under pressure not to retire its nuclear plants too quickly. Thus the E.U. may find it misses the U.K. as much as the other way round when it comes to the energy sector as indeed in multiple other industrial, financial, social, medical, security and diplomatic areas.
Public sentiment has certainly changed in the U.K. since the referendum two years ago. "Taking back control" is no longer considered by a majority of people in Britain as a route to new prosperity with the promise of "amazing trade deals" with the rest of the world. Recent public opinion polls have all shown that protecting the economy after Brexit has become more important for the majority of voters, especially the younger generation, than sovereignty.
Diehard Brexiteers, such as the Conservative Member of Parliament Jacob Rees-Mogg, are continuing to insist that the U.K. must regain its full sovereignty and leave the single market and customs union. Mr Rees-Mogg has warned that any compromise outcome in the current negotiations that involved the U.K. remaining in some way or other in a customs union with the E.U. would be tantamount of turning the country into a "vassal state." This argument has support from older voters, but for the great majority of younger ones it seems to be far better to remain a "vassal state" if this protects their future economic prosperity and that of their families. The next few months will be critical for the outcome of the Brexit negotiations and the future course of the U.K.'s relationship with the E.U. But with each passing day, it is becoming clear that the price of frictionless trade and avoiding undermining the U.K. economy at large will be a requirement for the country to apply the current customs union and single market rules, or at least something similar.
The question is whether the hard core Brexiteers on both the right and left sides of the political spectrum will finally accept the general mood change towards Brexit or will fight to the bitter end for what would risk becoming a particularly disruptive divorce.



THE IRREPRESSIBLE
The Conservative MP Jacob Rees-Mogg is one of the main proponents of a hard Brexit. According to Rees-Mogg, any compromise solution in the ongoing negotiations would reduce the United Kingdom to becoming a "vassal state" of the E.U.





Roberto Cingolani

An internationally-renowned physicist, Cingolani has been the Scientific Director at the Istituto italiano di Tecnologia (IIT) [Italian Institute of Technology], Genoa since December 2005. He has written several popular science books, including “Il mondo è piccolo come un’arancia. Una discussione semplice sulle nanotecnologie” [The World is the Size of an Orange. A Simple Discussion on Nanotechnology] (Il Saggiatore, 2014) and “Umani e umanoidi. Vivere con i robot” [Humans and Humanoids. Living with Robots], with Giorgio Metta (Il Mulino, 2015).



> We’re used to the wonders of the digital world, the Internet, e-mail, mobile phones. The mass of junk e-mail we send out consumes much more energy than a letter written on paper every 10 minutes. At some point, we will need to determine how many kilowatts per capita we want, and then admit that beyond this limit we have to accept another kind of compromise, by economizing technology

Interview/Roberto Cingolani, Scientific Director, Italian Institute of Technology

Technology, Diversification and Education

If sustainable growth is to continue, we’ll need to seek new forms of integrated energy. We must also learn how to reduce our wastefulness of natural resources



ROBERTO IADICICCO

He’s Vice President for Health communication of Eni and Media relationship of the Eni Foundation.

If we consider watts instead of euros or dollars, a very clear map of world wealth can be plotted. The countries with more energy have a higher GDP; those with higher power supply have industry, roads, power stations, infrastructure, welfare and very long life expectancy. However, to manage this huge demand, education in avoiding waste is necessary, as well as valid technology choices. This is the energy management model of the future according to Professor Roberto Cingolani, Scientific Director at the Italian Institute of Technology.

Education and technology for more energy?

The energy use model is related to the idea of energy having citizen users. It is focussed on an educational problem. There is also instrumental discourse on technology, how strategic are the decisions, and what is to be done in the future. First, even if there were plenty of energy (basically, we are an energy-intensive race), it would still not be enough. In the completely hypothetical and imagined idea of a world with no energy problems, users could still not consider energy to be “free.” We’re now indirectly coming to terms with this. We wanted air conditioning in our homes as they seemed a great benefit, but then we come to see that the gases cause the greenhouse effect. Cars represented the revolution in individual freedoms in the last century, yet now we realize that their emissions are harmful. Industrial processes are an important part of our growth model but they frequently limit future environmental sustainability.
Of course, this doesn’t only apply to energy but also to the use of water and resources in general. We tend to be a model for growth and development, a social model, with little attention to the crucial fact that every action has consequences.

What is the problem of energy education?

The first point is that, regardless of how much energy is available, we are used to wasting it. In general, we use things badly. Losses and the misuse of resources are worth more attention from an educational point of view. Even keeping office lights on during the day is wasteful. This is the beginning of the integrated energy use model: as long as we don’t think of saving energy, whatever effort we make, we need to remember there will always be very high overheads, meaning we won’t get the efficiency we want. Then there is technology and the integration of different sources. Undoubtedly, there is no single solution to the problem of needs. Uses and the types of needs are too varied, whether dealing with big →

industry, transportation or domestic use. Integration is very important to harmonize these sources. The simplest example is when we install solar cells at home. During the day, we are never there, so we do many things in the evening and night when there is no light. So we need to rely on storage, which is a problem.

Is there an innovative model for domestic energy?

About 20 percent of the electric power used in advanced economies is for domestic use. Machines like dishwashers work at an average power of 1000 W. It's a bit strange that this equipment affects global energy consumption so much when actually, for power of this type, alternative forms of energy supply other than electricity could be considered. An electrical appliance is a machine with power consumption not unlike that of a human being. Humans are sub-1000 W machines. We function by metabolizing sugar and fat and we have our own fuel cells, the liver, with biochemical mechanisms. Obviously, unlike people, electrical appliances have peaks, but there needs to be reflection on alternatives.

Can we learn from nature?

In nature, there are three basic forms of power: one for huge systems, such as the universe and the planets, with energy produced by nuclear fusion, where everything originates; the second, medium-power systems such as animals and humans, which use mainly biochemical energy at power of 1000 W; finally, we have very low-power systems, plants, which use photosynthesis, artificially producing the same power the entire human race produces, six times per day. It is a low-efficiency system, but as there are so many leaves... We have not copied this model from nature very much, maybe because it's complicated, but neither has there been much effort to try to do so.

For example, nuclear fusion was abandoned for several reasons, not least because fission, i.e., the intermediate step, evoked great fears. As "advanced" peoples, we can feel that we have not moved forward as we could have done. In fact, all the major systems work on energy produced by nuclear fusion. Another example is solar power. This often reminds me of photosynthesis. Despite the mechanism being totally different, if there were no government incentives, it would have limited success because the per watt cost is still too high. It's great, it's renewable, but it's still too expensive.

So does technology always overlap with social conscience?

The energy cost of everything we want to own is very high. On one hand, we rely very much on technology as if it were completely free; on the other, we don't want oil pipelines, gas pipelines, or nuclear power.

We're used to the wonders of the digital world, the Internet, e-mail, mobile phones. All this stuff costs money. The mass of junk e-mail we send out consumes much more energy than a letter written on paper every 10 minutes. At some point, we will need to determine how many kilowatts per capita we want, and then admit that beyond this limit we have to accept another kind of compromise, by economizing technology. U.S. citizens use 12,000 kWh of energy per capita, Europe and Japan about 7,000 kWh, China 4,000 kWh and India just 800 kWh. Global supply is 17 terawatts per day, but it is not uniform, with 20 percent of the world population consuming 70 percent of total electricity supply. Most energy is produced by about 20 countries, where availability is very high. It's reasonable to wonder whether this "energy divide" could at least be mitigated. We need more energy, but what we have today needs to be saved and must not be wasted.

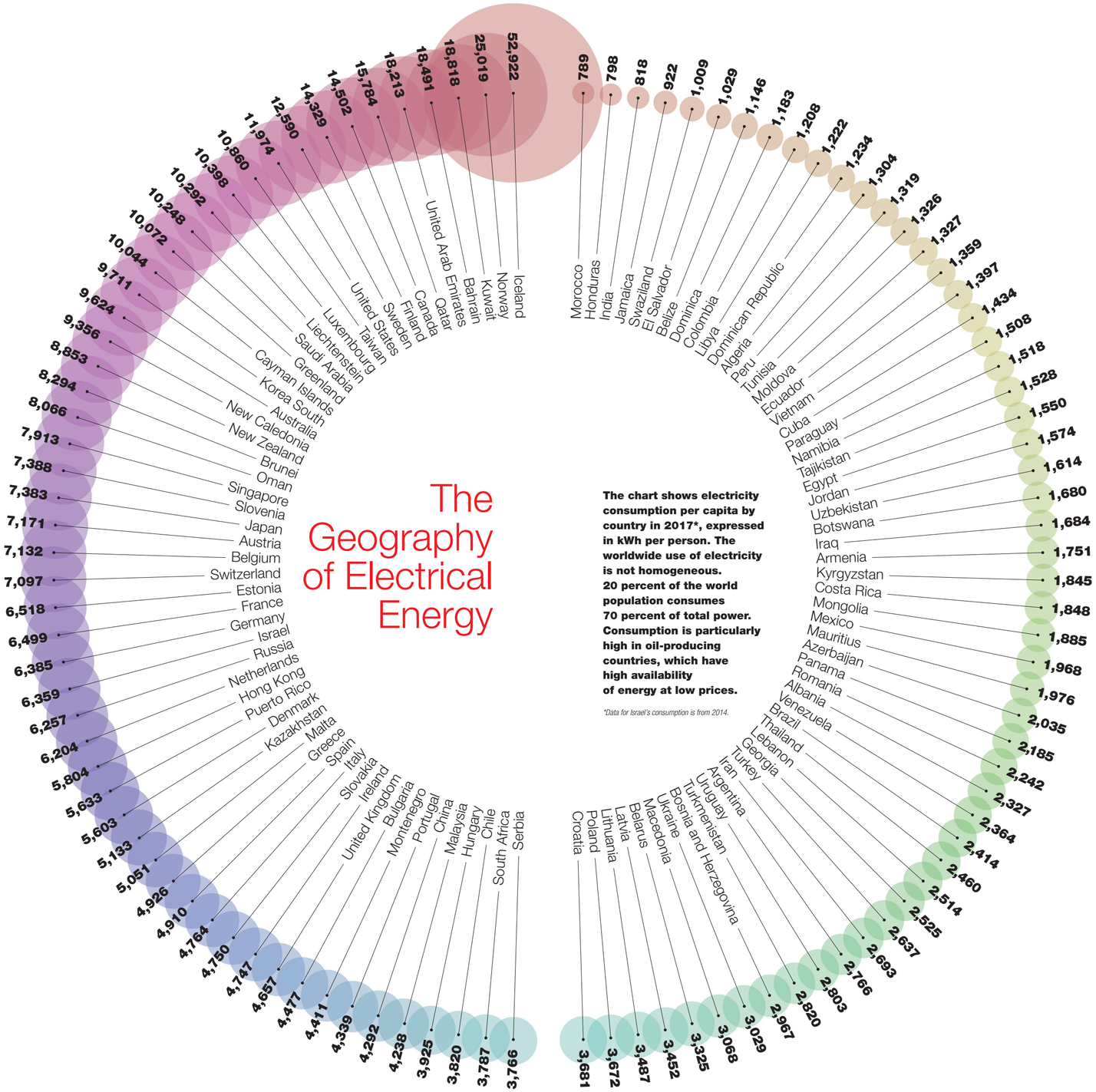
Which technological possibilities are innovative and sustainable?

There is hydroelectricity, which is great but does not provide enough power for everyone. Fossil fuels are very polluting. For nuclear power, we have seen various vetoes. Wind power has limits, including issues whether it is a windy day, that it can't be put everwhere and, like solar power, it has an environmental impact (in the long term, the world would end up filled with silicon and metals). At the moment, gas is one of the lesser evils. In the medium- and long-term, it is the most sustainable resource, but it creates infrastructure problems. Drilling technologies are also the subject of a lot of discussions. If growth is to continue, in some way we need to find technological solutions but also social solutions, to provide more forms of integrated energy. Renewables are the energy source with the least impact, but investment needs to be made and they do not solve all the problems, especially in that they cannot be used continuously as and when we want. An example here is the automotive industry. Our cars these days run on fossil fuels. Generally, one liter (or one kg) of gasoline produces around 2000 W/h. I know that if I put a certain number of liters in the car, I have a certain number of watts per unit of time guaranteed and therefore a certain quantity of energy to use as long as I drive efficiently.

Batteries these days produce about 150-200 W per kg/h, so a battery today stores up one-tenth of the energy produced by a liter of gasoline. Obviously, if I want similar performance, I need to charge many kilos of batteries in my car, making it extremely heavy. Therefore, efficiency is not very high. The dream would be to make batteries a much more efficient way to store power, not as much as gasoline, but at least 500-1000 W per kg/h. Technology is constantly improving batteries. We are witnessing a steady increase in storage capacity, while the autonomy of cars increases at the same time. But autonomy for gasoline vehicles is still far away. We also have another major limitation: a charging infrastructure is needed (like gas stations), every 30 km. But unlike gas stations where a car can be filled up in one minute, it takes 40 minutes to charge the batteries. Let's imagine rush hour one day. There might be 10 cars in front of me waiting to fill up with gas, taking 10 minutes. With recharging, I would have to wait 400 minutes. We therefore need to build batteries with very fast charging cycles. This is another technological challenge, a challenge within the challenge: batteries with higher capacity and being able to charge them very quickly. Lastly, we need batteries capable of supporting thousands of charge/discharge cycles without losing capacity. The giants of the industry are working on it, but it's still far off. In the meantime, a hybrid solution has been found, using batteries that provide a certain degree of autonomy, especially in cities (very important because the stop and go of the internal combustion engine produces a lot of pollution), together with an engine with the on-road performance and autonomy of fuel. This is the classic example of compromise until technology can solve the problem. The compromise needs to be able to handle multiple sources, electricity and thermal fuel, and must harmonize them. We seem to be going in that direction while we wait for batteries to be improved and the infrastructure to be built both outside and increasing the kW available to homes for charging at night.

So the future of cars lies in hybrids, toward totally electric?

I am not sure the only solution will be batteries. There is also hydrogen. In the meantime, some of the problems with the hydrogen cycle can be solved, such as storage, compression and the cost of materials. This way, it might be possible to discover how to use hydrogen instead of conventional batteries. Intense research is going on in this field. Of course, we're only talking about cars, with a power of hundreds of kW. When it comes to energy and megawatts, batteries are irrelevant. In this case, systems with large storage capacity are needed. Gas seems to be one of the technologies to look to, in combination with large solar and wind power stations. Unless there is a renaissance in nuclear energy, in fusion. To finish, the ideal solution is in the ability to differentiate. Focusing on so many parallel technologies means that one may be more suitable than another for given circumstances, locations or uses. Every form of energy can have its own application according to the field and the situation in which it is applied.

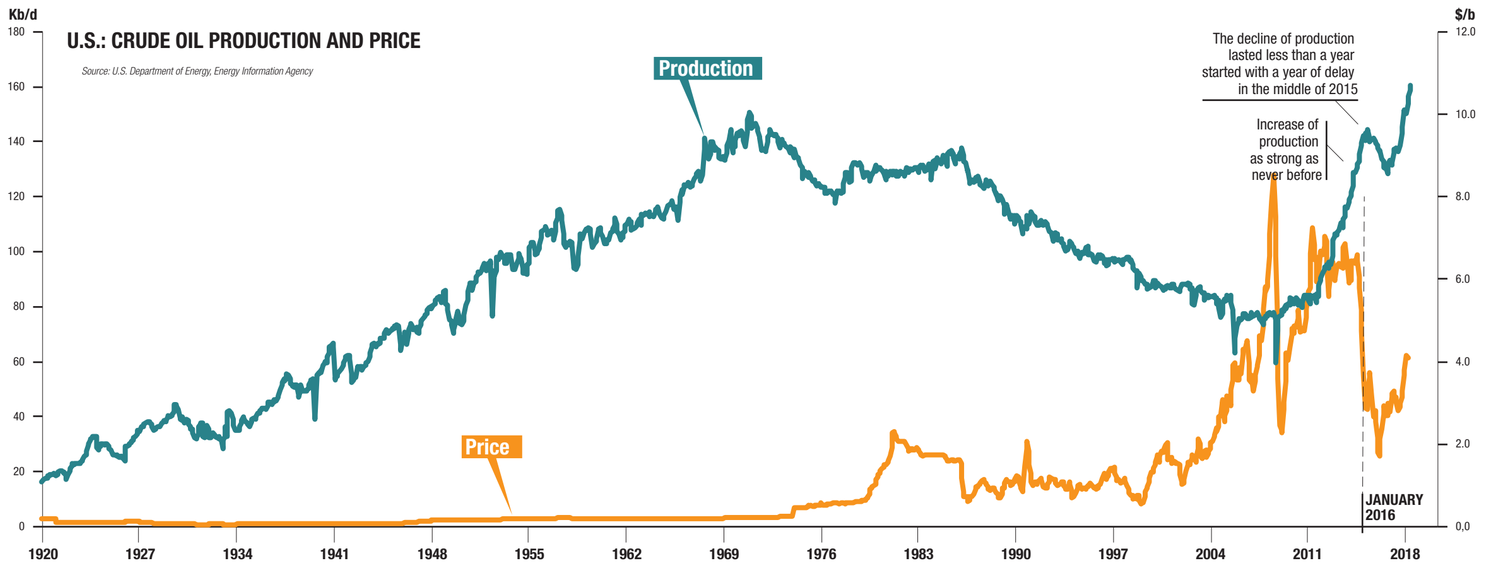


Technology/The consequences of fracking on the supply of oil and gas

The American Revolution

The exploitation of shale deposits is almost exclusively a U.S. phenomenon, but the benefits, in terms of falling fuel prices and reductions in carbon dioxide emissions, are widespread across the globe







DAVIDE TABARELLI

He is Chairman and co-founder of Nomisma Energia, an independent research company in Bologna that deals with energy and environmental issues. He has always worked as a consultant for the energy sector in Italy and abroad, dealing with all the major aspects of this market.

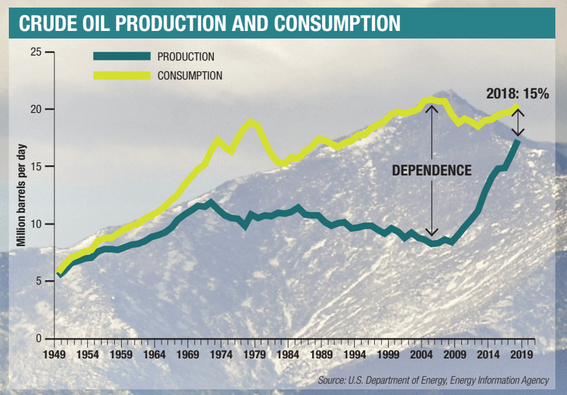
The mining of shale deposits is almost exclusively a U.S. phenomenon, but the benefits, in terms of falling fuel prices and reductions in carbon dioxide emissions, are widespread across the globe. Without it, oil prices would be USD 200 a barrel. The U.S. fracking revolution has released an additional volume of 5 million barrels a day (MMb/d) between 2010 and 2018, during which demand has risen by 11 million barrels a day, close to the new historical peak of 100 MMb/d. Texas, where the Permian geological basin is located, the most productive site of many in North America, is becoming an independent country in energy terms and is one of the main players in the international market, as it was in the early days of the modern oil industry in the 1920s. Thanks to fracking, the United States, the country that consumes more oil than any other, has reversed the decline in domestic production that lasted from 1985 to 2010, suddenly doubling its production to 11 MMb/d in mid-2018, with forecasts indicating this will reach 14 MMb/d by 2020.

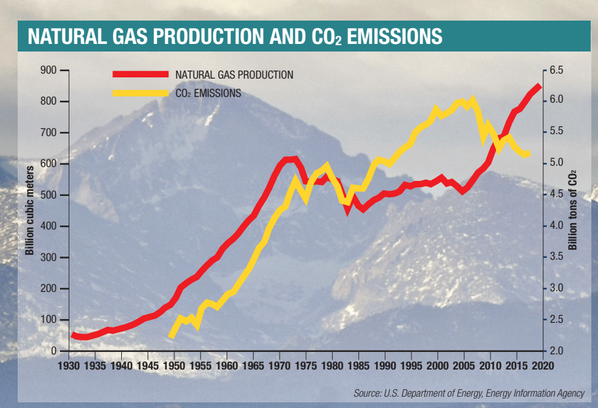
There are few comparisons in the past for such an increase in availability, both in the oil industry and, more generally, in the energy industry, so much so that it can be defined as a game changer at a global level. From a perceived lack of supply, with fears of exhaustion, certainty has emerged in recent years about the abundance of oil, with prices plunging from over USD 120 to lows in 2016 of under USD 30 a barrel. In mid-2018, they are hovering more cautiously above USD 70 a barrel.

For the United States, foreign oil imports have plummeted to historic lows not reached since the 1950s, which means that the long-awaited energy independence has been achieved. The issue has been of great political relevance since the Second World War, when it became →

Shale economy: the advantages of the fracking revolution

The dramatic increase in U.S. oil production, due to the exploitation of oil shale basins, has enabled the U.S. to independently meet its domestic needs, to the extent that it achieved self-sufficiency in energy in 2018. The abundance of gas on the U.S. market, due to the fracking revolution, has made it cheaper than polluting coal, with a net cut in CO_2 emissions.





clear that oil fuels were essential to drive the war machine. With the crises of the 1970s, the problem became more dramatic and since then all American presidents have placed energy independence among the main objectives of their policies. The first was Nixon, who, in a famous TV speech on November 7, 1973, announced drastic measures to achieve energy independence by 1980. His famous Independence Project failed, but its objectives continued to be pursued by successive presidents. Now, thanks to fracking, the target is closer and, unsurprisingly, U.S. policy in the Middle East, the main supply area, has changed dramatically in recent years.

Gas and the reduction in CO_2 emissions

The fracking revolution involved first the production of gas from the same geological formations, starting from the early 2000s. The abundance of gas on the U.S. market has brought down prices and made it more convenient for power plants to use it instead of dirtier coal, with a net cut in CO_2 emissions. From a peak of 6 billion tons of CO_2 in 2007, almost a fifth of the world total, U.S. emissions have fallen by 15 percent in 10 years, about 0.9 billion less, the bulk of it achieved by the replacement of coal in power plants. The penetration of gas in the U.S. electricity generation sector is the greatest single contributing factor to limiting the growth of CO_2 emissions from energy consumption. U.S. electricity production from gas more than doubled to 1,700 billion kilowatt-hours, leading to a reduction in CO_2 emissions, compared to coal-fired plant emissions, of 0.5 billion tons. The increase in renewable sources, in particular wind power, avoided emissions of 0.2 billion tons over the same period. In essence, fracking by oil companies, many of them Texan, has been better for the health of the planet than renewable sources.

Around 20 years since the systematic start of fracking activities, the issue of the environmental impact on the local area remains open, although it is less controversial than in the early years. The environment is one of the main reasons, though not the only one, why it is currently impossible to export this technology to the rest of the world. The United States has wide uninhabited expanses and less than strict environmental regulations, in several states at least, that favor fracking. The problem of contaminating groundwater has so far mainly been a concern in densely populated areas, such as in states like New York, New Jersey and Maryland. Here permits have been blocked, while in the rest of the country huge spaces mitigate the criticism, but water consumption is enormous. Abroad, as in China, where water is not abundant, little fracking has been possible, despite the presence of many potentially interesting reserves.

Extracting water from the most superficial layers, down to 200-300 meters, can cause subsidence or even micro-seismic phenomena, while actual fracking in rocks takes place so far from the surface, usually over 1000 meters down, that it is unlikely to cause similar effects. The greatest fear is the possibility that the numerous wells drilled far and wide across the formations will end up releasing chemicals into the surface water. In reality this is a remote possibility, given that deposits are located at greater depths than the aquifers from which drinking water is taken and these are separated by layers of hundreds and hundreds of meters of rocks that are impermeable and do not allow anything to pass through.

Environmental opposition has been attenuated over the years by the fact that the person owning the land, the one who is potentially most exposed to pollution damage, has a direct interest in the extraction. In fact, U.S. mining legislation uniquely establishes that the owner of the land also owns the resources in the subsoil and must be paid royalties, sometimes considerable, deriving from the extraction of gas or oil.

An almost exclusively American phenomenon

Large expanses of land and modest environmental opposition are two of the many reasons that explain why the industry has grown massively in the United States, despite the abundance of similar reserves throughout the world. Except for a few rare cases, such as in Argentina, fracking remains almost entirely an American phenomenon, which somewhat disappoints the optimistic expectations of 10 years ago when it seemed certain that similar kinds of production would take place in Europe, Africa and Asia.

An equally important factor, which is not found in other parts of the world, is the extensive geological knowledge that exists of the U.S. subsoil, a wealth of geological information accumulated thanks to the more than 3 million wells drilled over the last two centuries. The presence of gas and oil in clay rocks was known for decades, but, except for a few attempts that were made with poor results, little had ever been extracted. In Europe, many countries have similar knowledge of the subsoil, but strong local environmental opposition by people in densely populated areas actually makes existing reserves unrecoverable.

Equally important is the unique ability of the United States to innovate and disseminate this knowledge across the market. From North Dakota to Texas, there is a rich and dense fabric made up of hundreds of thousands of companies involved in every stage of the industry, from the collection and analysis of underground data, to the supply of equipment for recycling the water used, from drilling services and to legal advice for negotiating with the owner of the land. There are entrepreneurs who have come up with the idea of combining two techniques we have known about for some time, horizontal and fluid-assisted drilling. These companies have conducted experiments, initially considered bizarre by the major oil companies, for the mining of fields considered unproductive for decades. Linked to the previous aspect is the fact that in the U.S. there is a very widespread gas transport network. With relative ease, after constructing a few lines, even those producing gas in remote areas can access the main transport backbones leading to consumption centers where the prices are higher and more profitable. This was initially an element that favored gas, but which was then replicated for oil. However, precisely on this point, in mid-2018, some bottlenecks are developing in Texas due to the huge additional volume of crude oil being produced for which there are no adequate transport facilities to the coast from which to export it.

Another crucial element is the American financial system, characterized by a great propensity to grant easy financing to fracking companies, despite the fact that for many years they have operated at a loss, a less brilliant and somewhat forgotten aspect of this industry. On the one hand, the desire to make easy profits, such as those achieved in the Californian technology industry, has pushed financiers, who have plenty of liquidity available at low interest rates, to invest in this industry, one that is considered very technological and capable in the imagination of investors, and one that will make big profits in the future. Also, American legislation is particularly favorable to corporate bankruptcy, as it allows businesses, once they have declared themselves insolvent, to settle their debts to banks with risk capital and start again from scratch.

All of this explains how unconventional gas and crude oil production has so far mostly been a U.S. phenomenon, one difficult to replicate abroad. In the meantime, thanks to the abundance of gas, the environment has been able to benefit from lower CO_2 emissions, while the leap in American crude production has allowed consumers all over the world, including European environmentalists, to enjoy low fuel prices.

Climate change/Solutions and strategies to protect the environment

The Energy Transition: Superhighway or Dead End?

The path to cleaner and renewable sources is not a straight one, and there will undoubtedly be obstacles along the way, but turning back is neither possible nor financially viable





KATHERINE HAMILTON

She is Chair of 38 North Solutions, an American public policy consultancy specializing in clean energy and innovation. Katherine holds degrees from Cornell University and the Sorbonne and is Co-Chair of the World Economic Forum's Global Future Council on the Future of Energy.

As we confront the planetary crisis of climate change, global leaders have been actively instituting policies that can transition our systems away from greenhouse gas emitting resources to cleaner, renewable resources. The energy system—especially power generation—has been undergoing a rapid transformation. Fewer investments are being made in traditional generation, while solar and wind prices are plummeting and are increasingly able to compete with fossil resources. In addition, new technologies and applications, such as energy storage, demand response, and other distributed energy resources are enabling dynamic renewable energy resources to be managed more efficiently and effectively, causing electricity planning and business models to be rethought.

Whatever the main catalysts—public policy, government leadership, private investment, start-up innovation, or environmental stewardship—the transition is real and nonlinear. Governments and institutions appear committed to the trajectory. The E.U. recently committed to 32 percent renewable energy by 2030 with significant private sector participation. Even as the U.S. has backed out of the Paris Agreement, corporations have been stepping up efforts to purchase renewable energy and U.S. cities are serving as proxies for federal leadership toward a lower emission future. Clearly the linkage has been made between renewable energy and climate change mitigation, but how is this impacting economic development?

Economic indicators are favorable to green energy

Although I am not an economist, but a technologist turned public policy expert mid-career, even I can see that market indicators for clean energy are strong. The U.S.-based Advanced Energy Economy releases a market report every year; their Advanced Energy Now 2017 Market Report, which has tracked global and U.S. market revenue and trends over five years, found that the global advanced energy market surpassed USD 1.4 trillion in 2016, a 7 percent increase compared to an updated 2015 total of USD 1.3 trillion. Since the organization began tracking these trends in 2011, advanced energy has grown 24 percent, adding USD 257.7 billion in revenue during the ensuing six years. According to their findings, electricity generation remained the largest segment globally, with USD 455.6 billion in revenue, an increase of 5 percent from 2015. Transportation, coming in as the second largest global sector, saw 8 percent growth and reached USD 447 billion; building efficiency grew →

15 percent with USD 271.6 billion in revenue in 2016.

Individual states in the U.S. have identified renewable energy as an economic growth sector. One example is Michigan, which released a report citing that their 15 percent renewable portfolio standard (RPS) would yield by 2021 an economic impact of almost USD 6.3 billion, 32,500 job years and USD 2.2 billion in employee pay. If their RPS were to increase to 30 percent, those impacts would double by 2027. At least one major utility in the state, Consumers Energy, has committed to closing all coal plants and moving to 40 percent renewable energy by 2040. Michigan has also studied the use of demand response and other flexible resources and recommended that the state combine battery storage with consumer pricing incentives to maximize cost-effective demand response.

The progression of wind and solar by 2050

Globally, Bloomberg's New Energy Outlook 2018 asserts that, of the USD 11.5 trillion of expected investment in new power generation between 2018-2050, 73 percent, or USD 8.4 trillion, will go to wind and solar, while USD 1.5 trillion would be in other zero-carbon technologies. Their "50 by 50" contention is that wind and solar technology will supply almost 50 percent of global electricity by 2050, with only 29 percent of production from fossil fuels. Leaders would be Europe with 87 percent, India 75 percent, China 62 percent, and U.S. 55 percent.

The International Renewable Energy Association (IRENA) contended in their 2016 economic report that "doubling the share of renewables in the energy mix by 2030 would increase global GDP by up to 1.1 per cent, improve welfare by up to 3.7 per cent and support over 24 million jobs in the sector." Renewable energy costs have far outperformed expectations, in both price and timeline; battery storage has also beaten predictions. Prices of lithium ion batteries, scaled in electric vehicles, dropped 24 percent between 2016 and 2017 and are expected to fall even more in the coming decade. Pacific Gas and Electric, the largest utility in California, announced it would replace three gas-fired power plants with energy storage batteries to perform reliability services and relieve congestion on the grid. In another example, combining solar with storage brought in a record low bid in Nevada of 2.3 cents per kilowatt-hour.

Demand response, which pays consumers to reduce their peak demand, thus reducing stress on the grid and preventing dirty peaker power plants from running, has saved consumers in the U.S. billions of dollars per year and promises even more if fully deployed. One study found that in the Midwestern U.S., consumer savings from demand response participation could accrue between USD 1.5 million and USD 18.5 million annually. In fact, keeping down the cost of running peak generating resources keeps costs lower for all consumers, not just those directly benefiting from reducing their own demand.

Flexible resources like demand response and energy storage, with appropriate planning processes, allow higher penetration of dynamic renewable energy, increasing the value of those resources by maximizing their capacity factors and displacing more costly and carbon intensive fossil resources. In fact, these resources—often customer-sited—are not deployed solely for economic reasons but can also increase reliability or resilience, provide specific grid services or resolve issues like congestion, and lower carbon emissions from fossil fuel plants, including peaker units. Deploying more flexible resources will enable renewables to become even more economically advantageous and this trend will continue to grow.

The impact on employment

Given the commitment to invest in clean energy technologies, employment in those sectors has also increased. The U.S. Energy and Employment Report by Energy Futures Initiative (EFI) and the National Association of State Energy Officials (NASEO) found that within their low-emission category, natural gas, wind, and combined heat and power (CHP) employment increased in 2017. Wind energy grew a little less than 6 percent in 2017, adding 107,000 workers across the U.S. Coal-fired generation employment was stagnant, however, and fossil fuel extraction increased only slightly. Corn ethanol production grew over 20 percent, adding nearly 6,000 jobs; bioenergy and Combined Heat and Power were new growth entrants, with 55 percent and 51 percent respectively.

The Solar Foundation, a U.S.-based non-profit that tracks solar jobs in its annual Solar Jobs Census, found that while growth declined in 2017 by 3.8 percent, since 2010 employment in the U.S. solar sector has grown 168 percent—from 93,000 to over 250,00 jobs in all 50 states. Solar power represents less than 2 percent of the overall U.S. energy generation mix, but the sector employs as many as the natural gas sector, twice the number as coal, and five times that of nuclear power.

In 2013, the U.S. Bureau of Labor Statistics released a report that quantified the types and number of jobs in smart grid. The report identified over 350,000 jobs in the sector as of May 2012. While not all of these jobs directly contribute to the energy transition, smart grid certainly further enables the transition and requires similar skill sets.

While solar and other renewable jobs seem to be on a generally upward trajectory, jobs in the coal industry have been declining precipitously in the U.S. as coal fired power plants retire, both because they are non-compliant with environmental regulations and unable to operate economically. Even in states like Virginia, not traditionally progressive on renewable energy policy, solar jobs outnumbered coal jobs for the first time in 2016. It is not just Virginia losing coal jobs, but states throughout the U.S., as detailed in a Reuters article in 2018. To make up for coal industry job losses, organizations like Coalfield Development in West Virginia have stepped up to retrain workers in Appalachia and open up new industries in a part of the U.S. that for decades depended on the coal industry for economic growth. Of course, the U.K. saw this decline even earlier in the last century, with few jobs still existing in the sector. An article published by the World Economic Forum warns that attention must be paid to those who are left behind by the energy transition. We are already witnessing a backlash to that job loss in President Trump's pro-coal narrative.

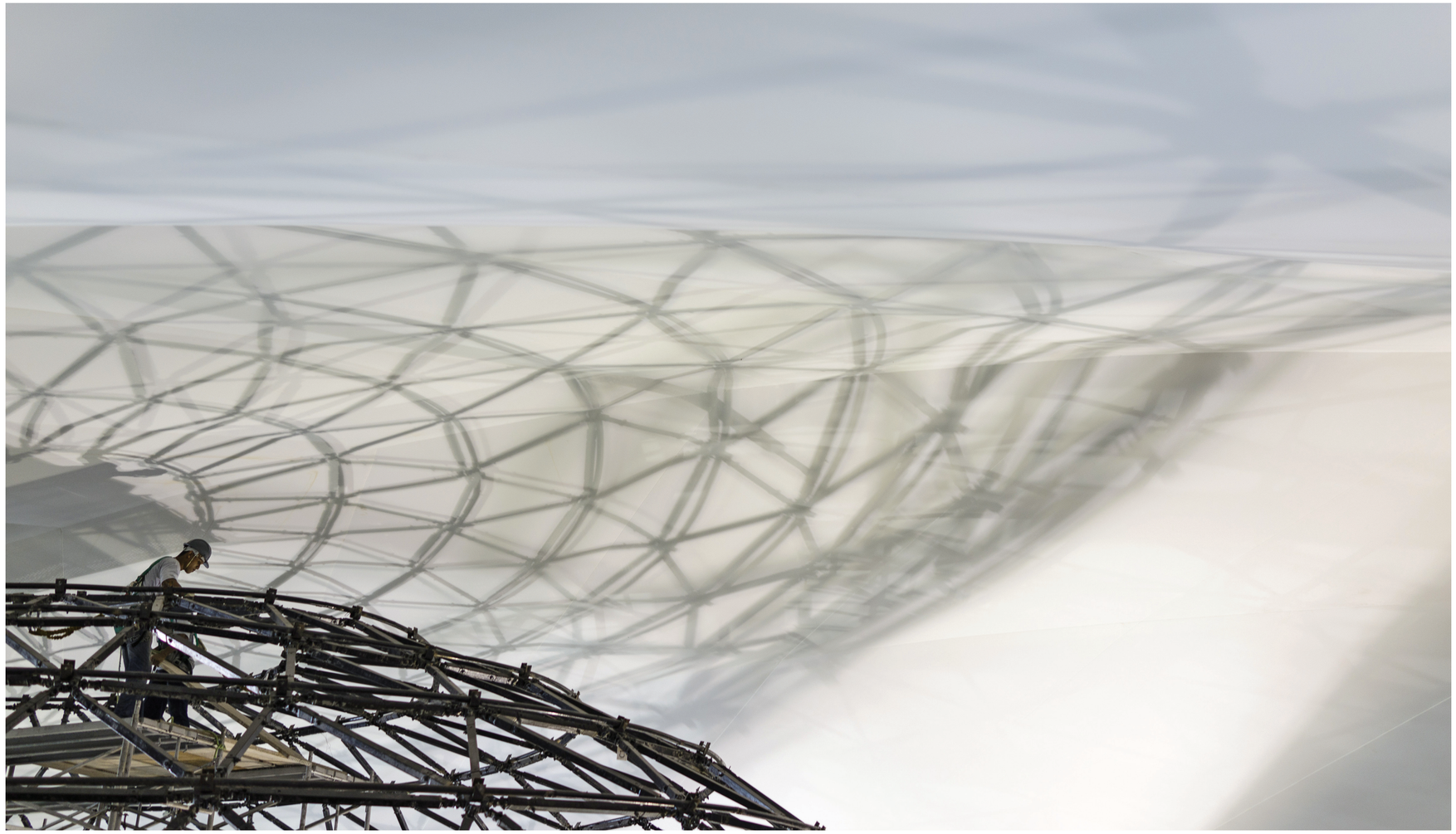
IRENA's 2018 jobs report found that the renewable energy industry created over 500,000 jobs in 2017, surpassing 10 million jobs globally. Of those jobs, 43 percent are in China alone. A key finding of the report was that countries with high renewable energy job growth experience significant economic benefits, although those are concentrated in a handful of countries and regions (China, E.U., U.S., Brazil, and India). Bloomberg Business reported that solar jobs employ more people than coal, nuclear, and wind energy combined.

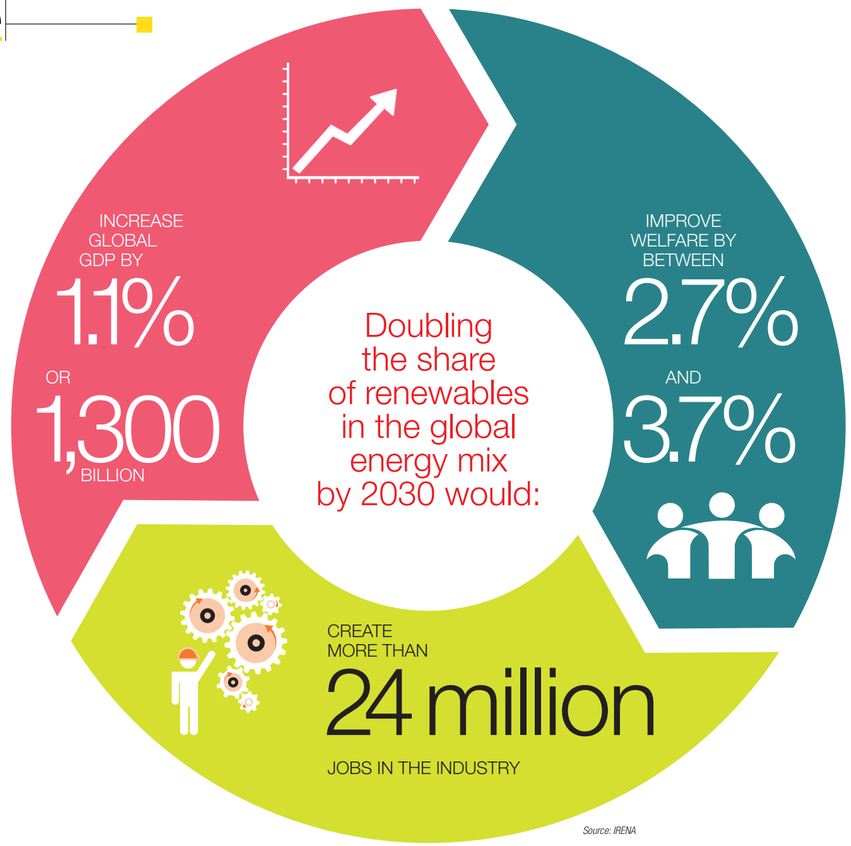
Access to energy in developing countries

Economic benefits of clean technologies have also accrued to developing countries as more people gain access to them. According to the World Bank in their 2018 Off-Grid Solar Market Trends Report, 130 million solar products have been sold in emerging markets, positively impacting 360 million people and generating USD 3.9 billion in cumulative revenue. Devices beyond PV lighting are being deployed, dozens of development institutions and governments are stepping up, new business financial and business models are being created, and more investors are coming to the table with both debt and equity. Benefits have included USD 5.2 billion in household economic savings (potentially double when taken system-wide) and the ability of 1.9 million people to support income-generating activities as a result of their electricity access. Even in more developed countries, economically disadvantaged residents are benefiting from clean energy solutions. Utilities and nonprofits such as the national and regional GRID Alternatives have →

WHAT WILL TOMORROW BE LIKE?

The Museu do Amanhã (Museum of Tomorrow) in Rio de Janeiro, the work of the Spanish architect Santiago Calatrava, is located inside the Porto Maravilha, a port area of the Brazilian metropolis that is the subject of a vast urban recovery and enhancement plan based on principles of sustainability. The Museum, opened in December 2015, presents an exploration path of the models of future development through an intertwining of art, technology and interactivity.





paired solar with energy efficiency to save low-income consumers in Colorado, lowering individual household electricity costs by as much as two-thirds. The GRID Alternatives model installs solar in neighborhoods of need, all the while training people from those communities to work in the solar sector.

While overarching trends are encouraging, the immediate news is not all positive. In a piece in Devex, Jonathan Phillips and Hannah Girardeau argue that recent tariffs on solar panels by the Trump Administration could have a chilling impact on the world's poorest consumers. It remains to be seen whether tariff policy in the U.S. will impact renewable energy jobs over the long run, but the U.S. solar industry stagnated in 2017 and was expected to lose approximately 23,000 jobs after the tariffs were announced. Nonetheless, the U.S. Bureau of Labor Statistics forecasts that solar will be the fastest-growing job sector in the U.S. economy—even outpacing healthcare and information technology—for the next decade.

The costs of climate change and a failed transition

Clean technology prices are not the only factors in the economics of climate change. The cost of not moving forward could be devastating and far higher than the investment needed to transition. Moody's Investor Services takes climate change seriously as it warns cities of their bond ratings decreasing should they choose not to act. Experts in Australia argue that billions of dollars in health-related costs as a result of climate change are being ignored in cost-benefits analyses.

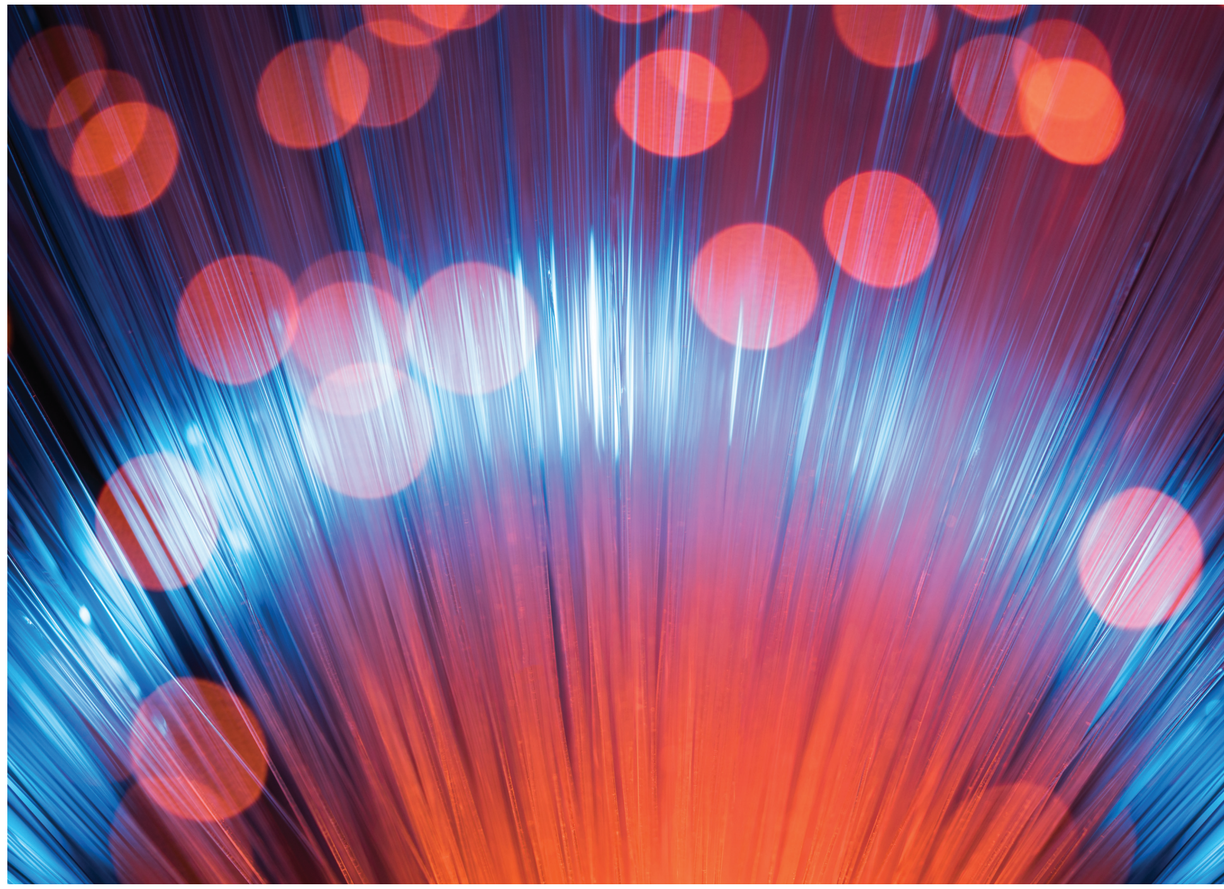
Dave Jones, California's Insurance Commissioner, undertook an initiative in 2016 to quantify the risk of climate change to insurers. Suisse Re recently announced that they would no longer provide insurance or reinsurance to companies that are exposed over 30 percent in coal—both in mining and power plants. The U.K. government's Department of Work and Pensions has given the approval and encouraged pension funds to divest from fossil assets that could be stranded in a move to a lower carbon future. Many religious institutions, private funds, and universities have already started divesting from fossil investments, although Cambridge University recently announced a controversial decision not to take that path.

While businesses and governments have seen economics as a key driver in the energy transition, on the grassroots level moral, health, and social justice issues have often motivated climate change mitigation. Environmental organizations, of course, have been working for decades to reduce pollution from carbon and other emitting resources. Based on public health issues Physicians for Social Responsibility has advocated for reduction in fossil fuels and increased renewables. Recently, grassroots groups like Moms Clean Air Force have started activating large segments of society focused on air pollution and children's health, holding peaceful protests and advocating at public venues across the U.S. Groups like the NAACP have shed light on the fact that climate change—both in location of fossil fuel resources as well as in the impact of severe weather events—disproportionately impacts communities of color and lower income. These groups of citizens can be important for keeping pressure on governments to continue the energy transition.

There are many unknowns along this road—totally new technologies in carbon capture, sequestration and usage and advanced nuclear, for example, as well as sectors that could grow exponentially such as electric vehicles and energy storage. There are also outstanding questions about the level of consumer participation in the transition and enabling applications like blockchain that may have a material impact on the speed and management of the transition. In addition, sectors like mobility, agriculture, and manufacturing all contribute substantially to climate change, but can also hold solutions for mitigation of greenhouse gases. For example, autonomous vehicles, indoor farming, water desalination, robotics, and bio-based chemicals could all increase sustainability. The jury is still out on whether all of these industries will create jobs and economic growth that replace the incumbent system. Many of these solutions will require sustained funding with patient investors and long-term commitment to change before their direct economic benefits will be realized.

As J. Adair Turner, Chairman of the Institute of Economic Thinking, argues in a recent article, policy will be critical to reducing climate change stating that, "If you are willing to pay $100 extra for your green car today, within a few decades the cost will probably be lower, but only if public policy forces the pace." The Paris Agreement was a start, but leaders, from local to national, understand we must go even farther with public policy and technology development to ensure that countries like China and India, whose demand and need for access continue to grow, have cost-effective alternatives to coal generation.

One thing is certain: we must continue the energy transition to save our planet from catastrophic demise. We are deploying renewable energy and energy management technologies that are cost-effective and that can benefit society as a whole. The road of the energy transition may have a few bumps and potholes, but we do not have the option of backing up—nor do we have to—given the economic return of consistent and aspirational public policy, institutional and private sector investment, leadership and peer pressure from all levels of government, and individually driven action and innovation. We already know that clean energy solutions are here today and are economically achievable; we also know that we can defy our own expectations with new technology innovation. Our destination should enable all to benefit and make us more secure, strong, and sustainable, such that we can collectively say, "you have arrived" at the energy transition.



Digitalization/Opportunities and challenges of the current revolution

A new Era for Energy

Digital technologies will have important repercussions on supply and demand, in terms of efficiency, reliability and sustainability, but they will also pose new risks to security and privacy. Governments will need to be prepared

DAVE TURK, LAURA COZZI, LUIS MUNUERA AND GEORGE KAMIYA
IEA, INTERNATIONAL ENERGY AGENCY

ver the coming decades, digital technologies are set to make energy systems around the world more connected, intelligent, efficient, reliable and sustainable. Stunning advances in data, analytics and connectivity are enabling a range of new digital applications such as smart appliances, shared mobility and 3D printing. Digitalized energy systems in the future may be able to identify who needs energy and deliver it at the right time, in the right place and at the lowest cost. But getting everything right will not be easy.

Digitalization is already improving the safety, productivity, accessibility →

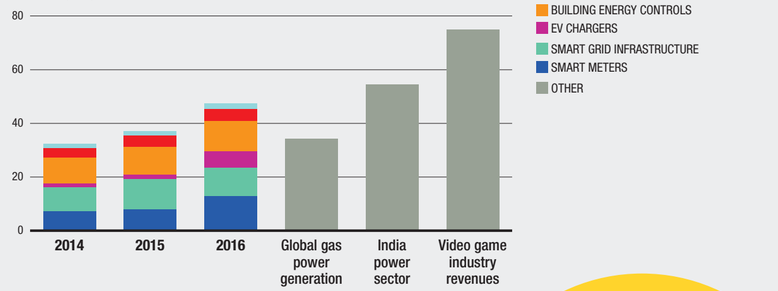
ALL THE ADVANTAGES OF DIGITAL TECHNOLOGY

The charts show the main trends within digitization: investment in infrastructure and software to digitize the electricity sector grew by over 20 percent per year between 2014 and 2016, exceeding global investments in production of electrical energy from gas. Connectivity is expanding rapidly, especially in developing countries. In construction, the spread of active control systems could help to save up to 65 PW/h by 2040, the equivalent of twice the electricity consumed by the entire construction industry in 2017. In the hydrocarbons industry, digitization could result in an increase of about 5 percent in technically-recoverable oil and gas resources worldwide.

Source: IEA

Investments in digital electricity infrastructure & software

USD billion (2016)



Global trends in connectivity

1987
2 terabyte
[10^{12} bytes]

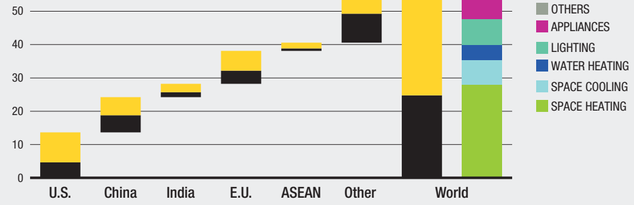
1997
60 petabyte
[10^{15} bytes]

2007
54 exabyte
[10^{18} bytes]

2017
1.1 zettabyte
[10^{21} bytes]

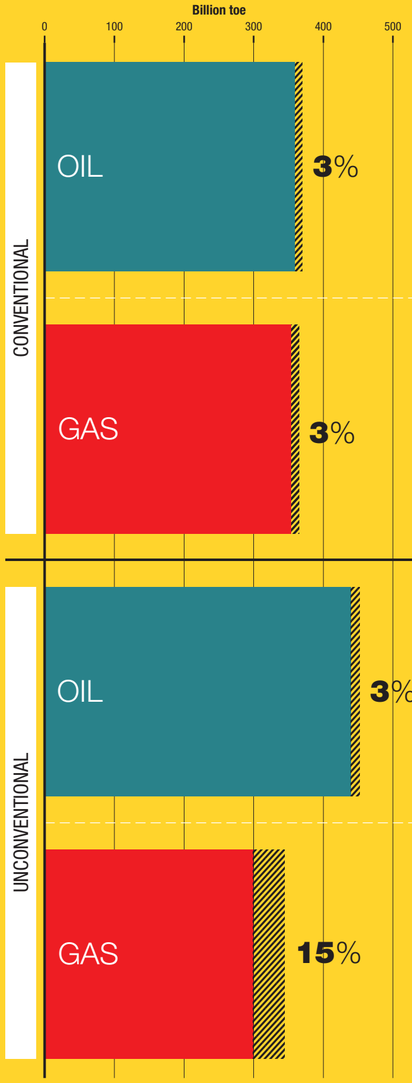
Cumulative energy savings in buildings from widespread digitalization

PWh

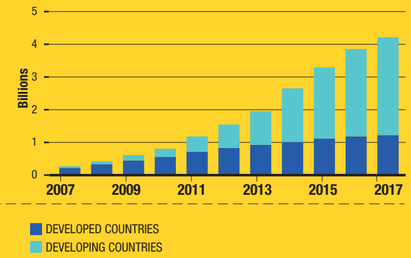


Impact of digitalization on global technically recoverable oil and gas resources

% INCREASE IN RESOURCES
ABSOLUTE INCREASE IN RESOURCES



MOBILE BROADBAND SUBSCRIPTIONS



and sustainability of energy systems. But digitalization is also raising new security and privacy risks. It is also changing markets, businesses and employment. New business models are emerging, while some century-old models may be on their way out. Policymakers, business executives and other stakeholders increasingly face new and complex decisions, often with incomplete or imperfect information. Adding to this challenge is the extremely dynamic nature of energy systems, which are often built on large, long-lived physical infrastructure and assets.

The International Energy Agency (IEA) has published a first-ever comprehensive report on digitalization and energy (iea.org/digital) to provide more clarity for decision makers on what digitalization means for energy—shining a light on both its enormous potential and most pressing challenges. It is also intended to serve as a springboard for future work, including deeper analysis in two key areas: digitalization of the electricity sector and automated and shared mobility.

Digital pioneers

The energy sector has been an early adopter of digital technologies. In the 1970s, power utilities were digital pioneers, using emerging technologies to facilitate grid management and operation. Oil and gas companies have long used digital technologies to model exploration and production assets.

Recent technological advances and trends are truly astounding. Data are growing at an exponential rate – internet traffic has tripled in only the past five years. There are now more mobile phone subscriptions than people in the world.

Advancing technology, falling costs, and ubiquitous connectivity are opening the door to new models of producing and consuming energy. Digitalization holds the potential to build new architectures of interconnected energy systems, including breaking down traditional boundaries between demand and supply. The impact of these tremendous digital advances and their rapid deployment across the energy landscape raises the fundamental question of whether we are on the cusp of a new digital era in energy and, if so, what are the emerging trends. This report attempts to answer these questions.

Digital technologies are already widely used in energy end-use sectors, with the widespread deployment of potentially transformative technologies on the horizon, such as autonomous cars, intelligent home systems and machine learning.

All energy demand sectors are feeling the effects

While these technologies could improve efficiency, some could also induce rebound effects that increase overall energy use.

In the transport sector, cars, trucks, planes, ships, trains and their supporting infrastructure are all becoming smarter and more connected, improving safety and efficiency. Digitalization could have its biggest impact on road transport, where connectivity and automation (alongside further electrification) could dramatically reshape mobility. Meanwhile, the overall net impacts on energy use are highly uncertain. Over the long term, under a best-case scenario of improved efficiency through automation and ride-sharing, energy use could halve compared with current levels. Conversely, if efficiency improvements do not materialize and rebound effects from automation result in substantially more travel, energy use could more than double.

In buildings, our analysis shows that digitalization could cut energy use by about 10 percent by using real-time data to improve operational efficiency. Smart thermostats can anticipate the behaviour of occupants (based on past experience) and use real-time weather forecasts to better predict heating and cooling needs. Smart lighting can provide more than just light when and where it is needed; LEDs can also include sensors linked to other systems, for example, helping to tailor heating and cooling services. In industry, many companies have a long history of using digital technologies to improve safety and increase production. Further cost-effective energy savings can be achieved through advanced process controls, and by coupling smart sensors and data analytics to predict equipment failure. 3D printing, machine learning and connectivity could have even greater impacts. For example, 3D printing can be used to make aircraft lighter, reducing both the materials to build the plane and the fuel to fly it.

Energy suppliers will reap greater productivity

The oil and gas industry has long used digital technologies, notably in →

upstream, and significant potential remains for digitalization to further enhance operations. Widespread use of digital technologies could decrease production costs between 10 and 20 percent, including through advanced processing of seismic data, the use of sensors, and enhanced reservoir modelling. Technically recoverable oil and gas resources could be boosted by around five percent globally, with the greatest gains expected in shale gas.

In the coal industry, digital technologies are increasingly being used in geological modelling, process optimisation, automation, predictive maintenance, and to improve worker health and safety. Specific examples include driverless trucks and tele-remote equipment operated from the control room. Digitalization's overall impact, however, may be more modest than in other sectors.

In the power sector, our analysis shows that digitalization has the potential to save around 80 billion USD per year, or about 5 percent of total annual power generation costs. This can be achieved by reducing operation and maintenance costs, improving power plant and network efficiency, reducing unplanned outages and downtime, and extending the operational lifetime of assets. One example of this is the use of drones to cheaply monitor thousands of kilometres of transmission lines over rough terrain.

A radical transformation of electricity markets

The greatest transformational potential for digitalization is its ability to break down boundaries between energy sectors, increasing flexibility and enabling integration across entire systems. The electricity sector is at the heart of this transformation, where digitalization is blurring the distinction between generation and consumption, and enabling four interrelated opportunities:

- "Smart demand response" could provide 185 GW of system flexibility, roughly equivalent to the currently installed electricity supply capacity of Australia and Italy combined. This could save USD 270 billion of investment in new electricity infrastructure that would have otherwise been needed. In the residential sector alone, 1 billion households and 11 billion smart appliances could actively participate in interconnected electricity systems, allowing these households and devices to alter when they draw electricity from the grid.
- Digitalization can help integrate variable renewables by enabling grids to better match energy demand to times when the sun is shining and the wind is blowing. In the European Union alone, increased storage and digitally-enabled demand response could reduce curtailment of solar PV and wind power from 7 percent to 1.6 percent in 2040, avoiding 30 million tons of carbon dioxide emissions in 2040.
- Rolling out smart charging technologies for electric vehicles could help shift charging to periods when electricity demand is low and supply is abundant. This would provide further flexibility to the grid while saving between USD 100 billion and USD 280 billion in avoided investment in new electricity infrastructure between 2016 and 2040.
- Digitalization can facilitate the development of distributed energy resources, such as household solar PV panels and storage, by creating better incentives and making it easier for producers to store and sell surplus electricity to the grid. New tools such as the blockchain could help to facilitate peer-to-peer electricity trade within local energy communities.

Direct energy consumption of digital technologies

Digital technologies that make all these potential benefits possible also use energy. As billions of new devices become connected over the coming years, they will draw electricity at the plug while driving growth in demand for—and energy use by—data centers and network services. However, sustained gains in energy efficiency could keep overall energy demand growth largely in check for data centers and networks over the next five years.

Data centers worldwide consumed around 194 TWh of electricity in 2014, or about 1 percent of total demand. Although data center workload is forecast to triple by 2020, related energy demand is expected to grow by only 3 percent thanks to continued efficiency gains.

Data networks, which form the backbone of the digital world, consumed around 185 TWh globally in 2015, or another 1 percent of total demand, with mobile networks accounting for around two-thirds of the total. Depending on future efficiency trends, by 2021 electricity consumption from data networks could increase by as much as 70 percent or fall by up to 15 percent. This large range highlights the critical role of policy in driving efficiency gains.

Beyond the next five years, providing credible assessments of energy use by digital technologies is extremely difficult. Direct energy use over the long run will continue to be a battle between data demand growth versus the continuation of efficiency improvements.

Building digital resilience to prepare for inevitable cyber-attacks

While digitalization can bring many positive benefits, it can also make energy systems more vulnerable to cyber-attacks. To date, the disruptions caused to energy systems by reported cyber-attacks have been relatively small. However, cyber-attacks are becoming easier and cheaper to organise. Moreover, the growth of the Internet of Things (IoT) is increasing the potential "cyber-attack surface" in energy systems. Full prevention of cyber-attacks is impossible, but their impact can be limited if countries and companies are well-prepared. Building system-wide resilience depends on all actors and stakeholders first being aware of the risks. Digital resilience also needs to be included in technology research and development efforts as well as built into policy and market frameworks. International efforts can also help governments, companies and others to build up digital resilience capabilities. A variety of organisations are involved, each contributing its comparative strengths, including to share best practices and policies as well as to help mainstream digital resilience in energy policy making.

Managing privacy concerns and impacts to jobs

Privacy and data ownership are also major concerns for consumers, especially as more detailed data are collected from a growing number of connected devices and appliances. For instance, data on energy use in households collected by smart meters can be used to tell when someone is home, using the shower, or making tea. At the same time, aggregated and anonymised individual energy use data can improve understanding of energy systems, such as load profiles, and help lower costs for individual consumers. Policy makers will need to balance privacy concerns with these other objectives, including promoting innovation and the operational needs of utilities.

Digitalization is also affecting jobs and skills in a variety of energy sectors, changing work patterns and tasks. This is creating new job opportunities in some areas while causing losses in others. Policy makers in the energy field should participate in broader government-wide deliberations about these effects and how to respond to them.

Government policy design is critical

Policy and market design are vital to steering digitally enhanced energy systems onto an efficient, secure, accessible and sustainable path. For example, digitalization can assist in providing electricity to the 1.1 billion people who still lack access to it. New digital tools can promote sustainability, including satellites to verify greenhouse gas emissions and technologies to track air pollution at the neighbourhood level.

Policy-making processes can also benefit from more timely and sophisticated collection and publication of energy data that greater access to digital data could facilitate. Emerging low-cost digital tools, such as online registries, web-crawled data and quick response codes, can lead to more targeted and responsive policy regimes.

While there is no simple roadmap to show how an increasingly digitalized energy world will look in the future, the report outlines ten no-regrets policy actions that governments can take to prepare:

- Build digital expertise within their staff.
- Ensure appropriate access to timely, robust, and verifiable data.
- Build flexibility into policies to accommodate new technologies and developments.
- Experiment, including through "learning by doing" pilot projects.
- Participate in broader inter-agency discussions on digitalization.
- Focus on the broader, overall system benefits.
- Monitor the energy impacts of digitalization on overall energy demand.
- Incorporate digital resilience by design into research, development and product manufacturing.
- Provide a level playing field to allow a variety of companies to compete and serve consumers better.
- Learn from others, including both positive case studies as well as more cautionary tales.

Reference: IEA 2017. Digitalization and Energy. International Energy Agency, OECD, Paris.

+5%

The widespread adoption of digital technology in the oil and gas industry could result in an increase in technically-recoverable oil and gas resources by about 5 percent worldwide, with the largest increases predicted in shale gas.

1 billion

In the residential sector alone, 1 billion homes and 11 billion smart appliances could make use of interconnected electricity systems, making it possible to vary their demand for electricity from the grid.

USD 80 billion

In the electricity sector, digitization could potentially achieve savings of USD 80 billion per year, reducing management and maintenance costs, improving the efficiency of electrical power stations and the grid, and reducing shutdowns.

USD 280 billion

The implementation of smart recharging technology for electric vehicles could result in savings, between 2016 and 2040, of between USD 100 and 280 billion in investments not made in new electricity infrastructure.

185 GW

"Smart demand response" could provide 185 GW of flexibility to the system, roughly equivalent to the electricity supply capacity currently installed in Australia and Italy combined.

185 TWh

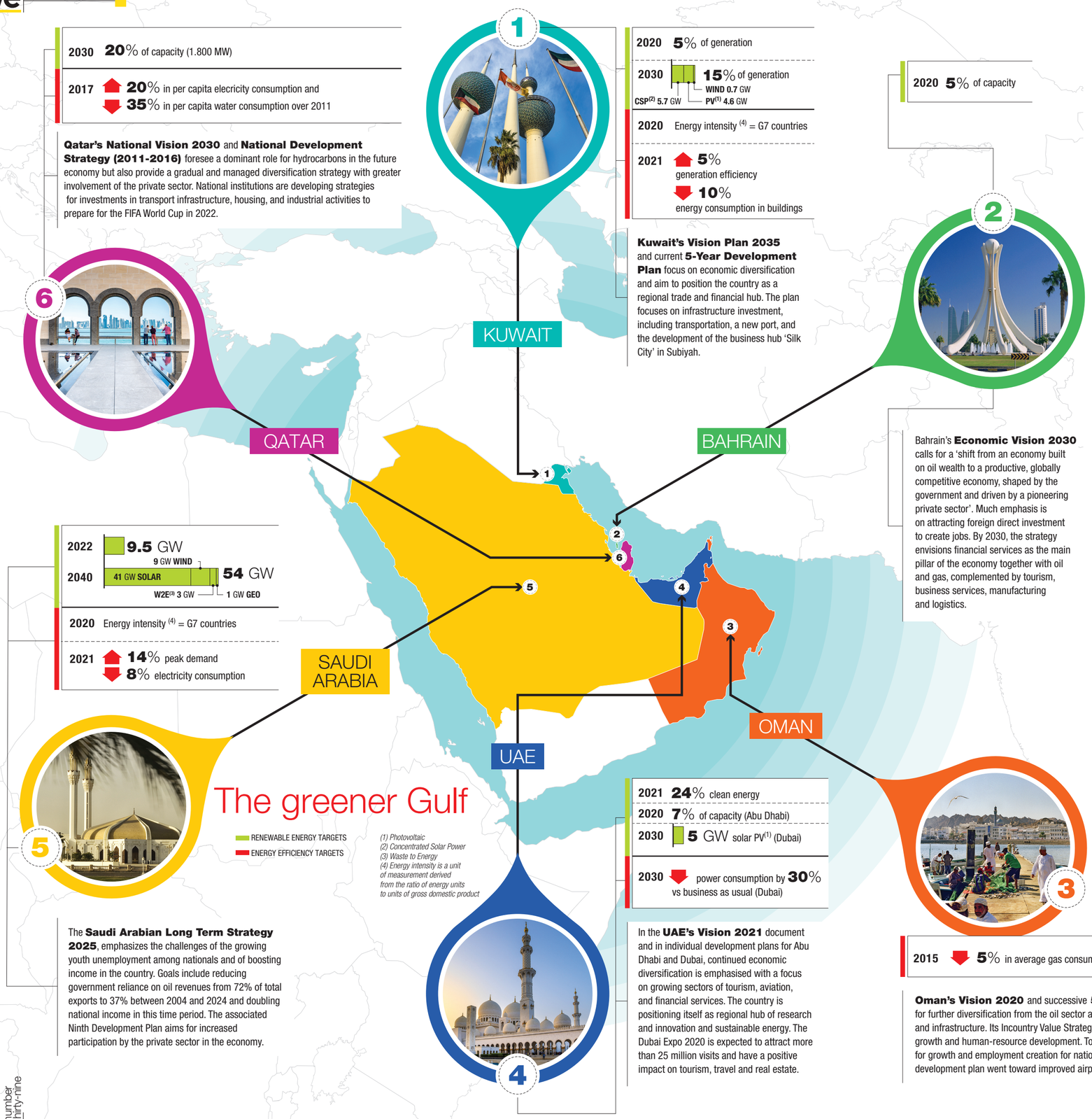
In 2015, data networks, the backbone of the digital world, consumed about 185 TWh of energy worldwide, equal to 1 percent of total demand, with mobile networks responsible for around two-thirds of the total.

30 million tons

In the European Union alone, improving digital demand accumulation and management, and the "curtailment" of solar and wind power could drop from 7 to 1.6 percent in 2040, preventing 30 million tons of CO_2 emissions.

1.1 billion

Digital technology could contribute to the supply of electricity to 1.1 billion people who currently have no access to it.



Renewables/The uncertain path of the Gulf countries

The Unknowns of the Transition

Caught between the need to free their economies from oil revenues and the duty to fulfil a now burdensome social pact, governments are looking at how and when to start a potentially painful transition



BASSAM FATTOUH*

He is the Director of the Oxford Institute for Energy Studies and Professor at SOAS (School of Oriental and African Studies), University of London.

The energy landscape is rapidly changing with wide-reaching implications for global energy industries and actors, including oil companies and oil-exporting countries. While there are many uncertainties induced by the energy transition, there is a near consensus in forecasts that renewables's share in the energy mix will rise. Renewable energy's recent cost deflation has been nothing short of revolutionary for the global energy industry. Five years ago U.S. wind costs were $11 c/kWh (U.S. cents per kilowatt hour) and solar costs were $17 c/kWh, on a fully loaded basis that includes the capital costs of construction, and neither was commercially feasible without subsidies. The International Renewable Energy Agency (IRENA) estimates that global average cost for onshore wind and solar has now declined to $5 c/kWh and $6 c/kWh respectively. A new record was set in 2016, with a $2.4 c/kWh bid in the United Arab Emirates. It was broken in October 2017 with a $1.8 c/kWh bid by the companies Masdar and Electricity of France for Saudi Arabia's 300 MW Sakaka plant. Wind power costs have also declined, and further deflation to $4 c/kWh by 2020 is within striking distance. As a result, on a plant-level basis and excluding the cost of dealing with intermittency, wind and solar have emerged as very competitive global sources of energy.

As the energy transition is expected to lead to structural changes in energy markets around the globe, oil companies and oil-exporting countries face serious challenges. The challenge for oil companies is the disruption of their business models and problems related to the integration of low-carbon assets into their portfolios. In contrast, oil-exporting countries with proved reserves-to-production ratios of multiple decades face the challenge of monetizing their large reserve base and the risk of reduced export revenues, which could disrupt their socio-economic wellbeing, given the high reliance of their budgets on oil revenues. The key question is: how should oil companies and oil-exporting countries position themselves in the transition era in order to be part of the renewables "revolution" and ensure long-term sustainability?

Uncertainty in the speed of the energy transition

Energy transition is a radical shift in the energy system from an existing model to a new paradigm. It is complex and goes beyond the replacement of one source of fuel with another. In essence, energy transition involves changes in three interrelated dimensions: 1) the tangible elements of the energy system, which include technology, infrastructure, market, production equipment, consumption patterns and distribution chains; 2) actors and their conduct, the development of new strategies and investment patterns, as well as changing coalitions and capabilities of actors; and 3) socio-technical regimes that contain formal regulations and policies, institutions as well as mindset and belief systems, discourse and views about normality and social practices. Therefore, transition is multidimensional, complex, non-linear, non-deterministic, and highly uncertain. Although energy transition is often assessed based on →



THE WIND OF EFFICIENCY
The sail shape of the two buildings that make up the BWTC, the World Trade Center in Manama, the capital of Bahrain, accelerates the speed of the winds blowing through them from the Persian Gulf, driving 3 wind turbines that can generate 225 kW each and supply 13 to 15 percent of all the energy required by the apartments.

the speed of changes in the tangible dimension, it is a multi-layered process with multiple actors.
As the transition outcome is the result of an interaction of technology, institutions, society and agents, in practice it is difficult to accurately predict the behavior of such a process. This is even more so the case when the speed of energy transition is taken into consideration, as it is the most critical parameter with serious implications for the business strategy of actors in the energy sector. Traditionally, relying on historical data has been one way to understand the future trajectory of a phenomenon. However, historical evidence regarding the speed of transition is inconclusive as cases of both slow and fast transitions populate history. Also the speed of transition differs across sectors and regions and has multiple layers that make it difficult to draw a concrete conclusion at the global scale. There is also another often-overlooked problem with extrapolating from the past. The drivers of the current transition are fundamentally different from past transitions. Past transformations of the energy sector were driven by innovation, technological advances and/or consumer preference, whereas policy plays a key role in the current transition, at least in the short to medium term before market forces fully take over. Thus, historical data about slow transition are instructive but not necessarily predictive about future transition. There is also some degree of subjectivity when we talk about the time dimension of transition because it is not clear what counts as fast and what counts as slow (for example, is 30 years fast or slow?). The speed of energy transition is also susceptible to governments' changes of priorities, election cycles, and political competitions.
Moreover, from an evolutionary perspective, historical transitions were more about developing new technologies in the age of scarcity, whereas low-carbon transitions are more about adjusting the selection of environments in the age of abundance (via policies, regulations, and incentives that shape markets) and this affects the balance of demand and supply.
Under energy scarcity in a world of increasing demand, it is possible to have a partial and slow substitution of traditional sources, where these sources even retain a pricing premium and satisfy the marginal demand in the presence of a new source of energy, which is cheaper and has more calorific content (the case of wood versus coal, for example). However, things can be completely different when there is supply abundance and demand is not growing. It is possible that a new source of energy completely displaces the incumbent. In such a world, the incumbents cannot retain a pricing premium if it is going to have a market share.

Integrating renewables into hydrocarbons projects

The countries that are dependent on oil and gas production for government revenue are highly vulnerable to changes in the energy landscape, and this also applies to oil companies to some extent. However, there are two important differences between major oil companies and oil-exporting countries in relation to energy transition. While the key issue for oil companies is the disruption of existing business models, the main challenge for oil-exporting countries, in addition to loss of revenues essential for the functioning of their economies, is the ability to monetize their large reserve base. This is mainly because the proved reserve to production ratio of international oil companies is typically around eight to ten years, whereas this number is several decades, beyond all peak oil demand forecasts, for some of the resource rich countries. For example it is more than 63 years for Saudi Arabia with around 90 percent dependence of government budget on oil revenues. This makes the inability to monetize the reserve base a risk for these countries.
The second important difference is that, unlike oil companies that may face risk by moving beyond their core business into renewables, for oil-exporting countries, there is no conflict between static and dynamic efficiency when it comes to positioning for the energy transition. Indeed, investment in renewables could help further boost the short-term revenues of oil-exporting countries by freeing up their hydrocarbon resources for export, as long as international prices are above the break-even price. Oil-exporting countries have unique characteristics that make the rationale of investment in renewables quite compelling. These countries have rising energy demand and are at a stage of development where economic growth is tied to energy consumption. The rise in energy demand is expected to strain the export capability of these countries. Indeed some of them, such as Kuwait and the UAE, are already net importers of natural gas.
The economics of renewables in exporting countries depends on the opportunity cost of domestic oil and gas consumption, which is reflected in the international price of hydrocarbon resources. According to the Energy Information Administration (2016), generating 1 MWh of electricity requires 1.73 barrels of oil or 10.11 thousand cubic feet (mcf)of natural gas. The record low auction prices for solar photovoltaics (PV) in Dubai, Mexico, Peru, Chile, Abu Dhabi, and Saudi Arabia have shown that, under the right circumstances, an LCOE (levelized cost of electricity) of $0.03/kWh for solar is achievable. IRENA also estimates the global average cost of solar PV to be around $0.06/kWh. If we consider the lower band, which is closer to costs of solar in the region, the break-even prices of oil and gas would be $17.34/bbl and $2.96/mcf respectively, which are well below international prices. If we consider the global average costs of solar, which is conservative for the region, the break-even prices will increase to $34.68/bbl and $5.93/mcf, which is still below the international price for oil but slightly higher than the average price for natural gas.
Even if we add the costs of dealing with solar intermittency at around $5/MWh to these numbers, the economics of renewables is still winning over traditional resources in these countries. The economics of renewables will be boosted if we account for the gain that these countries will make from liberated oil and gas for exports. This highlights the importance of integrating renewable into the existing fossil fuel based generation mix of oil exporting countries.

Diversification remains the key

For Middle East oil exporters, which are highly reliant on oil revenues, investment in renewables addresses, to some extent, the government's short-run revenue maximization objective by freeing exports of hydrocarbons, but does not guarantee their long-term sustainability. In the long run, diversification of their economies remains the main adaptation strategy that these countries need to pursue. Renewables may replace hydrocarbon resources in the domestic energy mix, but not in the government budget, because investment in renewables does not generate the high returns that the oil and gas industry does. Furthermore, while the renewable energy industry is part of the diversification strategy, it alone cannot deliver the real needs of these economies, such as job creation and welfare improvements. Thus, during the transition, the oil and gas sector will continue to play a key role in these economies, generating the rents needed to expand parts of the productive economy, including manufacturing industries, agriculture, and the service sector with a specific view to those sectors in which they have comparative advantage, in order to increase the non-oil portion of gross domestic product and consequently diversify the sources of governments' income. In fact the oil and gas sector may play its part in the diversification drive through building new industries and fostering backward and forward linkages. In an environment of heightened uncertainty about the speed of the transition, this represents a flexible strategy that maximizes the benefit from rent-generating capital, that is, oil and gas reserves and, at the same time, positions the country for an era that could see oil demand flatline or decline. During the transition period, export rents will initially constitute the bulk of the governments' revenues but will decline if diversification progresses as planned.
However, achieving economic diversification is easier said than done, because this entails extensive changes in the economy with implications for citizens' welfare and the distribution of national income. For example, oil-exporting countries need to carry out painful fiscal reforms that will lead to the reduction or removal of subsidies, including underpriced energy careers, and the introduction of taxes, such as income and value added tax. These issues are inherently complex given the rigidity of existing political structures, institutions, and the implicit social contract through which lack of political participation is compensated for by distribution of hydrocarbon rents. This is why gradual and small-scale reforms combined with mitigation measures can be implemented, but one should not expect speedy transformations of oil-exporting economies.
Also, there is a non-trivial probability that these countries could fail in their goal of achieving a diversified economy. This, in turn, will impact the speed of the global energy transition. In other words, the global energy transition will not only shape the political and economic outcomes in oil-exporting countries, but the transition in the major oil exporters will also shape the global energy transition. It is a two-way street. The feedback effect from exporting countries is relevant even if these countries succeed in expanding their productive economy, or the global oil market shifts from the current scarcity-oriented model to a marginal-cost-based market in which hydrocarbons cannot retain a premium pricing. For instance, if these countries succeed in their diversification objectives, they may engage in a more aggressive reserve monetization strategy, which will result in lower oil prices and large changes in the relative prices of fuels, affecting the speed of transition unless these changes in relative prices are adjusted through carbon taxes, which open new sets of issues related to international coordination and distribution. On the other hand, if the transition does not go smoothly and does result in many output disruptions and more volatile oil prices, this would in turn affect the energy transition process. Such feedbacks add other layers of uncertainty to the already complex issue of the current energy transition.

*With the collaboration of **RAHMATALLAH POUDINEH** and **ROB WEST**.

The Birthplace of the Future

The Massachusets Institute of Technology (MIT) in Boston is one of the world's hotbeds of innovation in science and technology. On June 12 and 13, 2018, the 2018 workshop, entitled "Research Progress towards Technology Deployment and Commercialization" took place at Eni headquarters in Bolgiano (Milan). The session illustrated the most important projects in energy production techniques in line with the requirements for a low-carbon societal model.



It was the perfect event to welcome two prominent figures from the prestigious U.S. research institute directly involved in developing new models of sustainable energy development: Francis O'Sullivan, Director of Research, Low Carbon Energy Centers, MIT Energy Initiative; and Bob Mumgaard, C.E.O., Commonwealth Fusion Systems.

BY GIANCARLO STROCCHIA





FRANCIS O'SULLIVAN
He is Director of Research for the MIT Energy Initiative, and a Senior lecturer at the MIT Sloan School of Management. He works on topics related to energy technologies, policy and economics. His current research is focused on unconventional oil and gas resources, particularly the productivity and economics of North America's shale resources.



BOB MUMGAARD
He is C.E.O. of the Commonwealth Fusion Systems. He study how entrepreneurship and innovative ecosystems can help bring large advances to hard-tech problems. Particularly he focus his engage on how fusion energy can be funded and advanced in the private market.

No Turning Back

The energy transition process is still moving too slowly. Despite progress in new technologies and cost reduction, commitments and projects are not wide-ranging enough. Francis O'Sullivan, research director at the MIT Energy Initiative in Boston (Low Carbon Energy Centers) explains

It seems that we have definitely embarked on the energy transition road. Never as in the aftermath of the COP21 in Paris has the world appeared more solidly united in supporting the objectives of a low greenhouse gas model of development, at the price of making categoric commitments, which were still particularly expensive at the time, to promote the spread of a cleaner form of energy. Since that day, costs have fallen significantly and production technologies have been further refined, yet the path taken still seems long and perhaps not so effective in the short term. But will it be the right one? We asked Francis O'Sullivan, research director at the MIT Low Carbon Energy Centers in Boston.

Professor O'Sullivan, how long will it be before the world can truly benefit from the consequences of the energy transition? Is the pace of development of renewable energies sufficient to guarantee an economically and environmentally sustainable future for the planet?

To be frank and direct I would say no. We are seeing an extraordinary movement in the right direction with regard to the adoption and use of new low carbon technologies, but this use will have to be significantly widened if we want to at least partially achieve the carbon emission reduction targets.

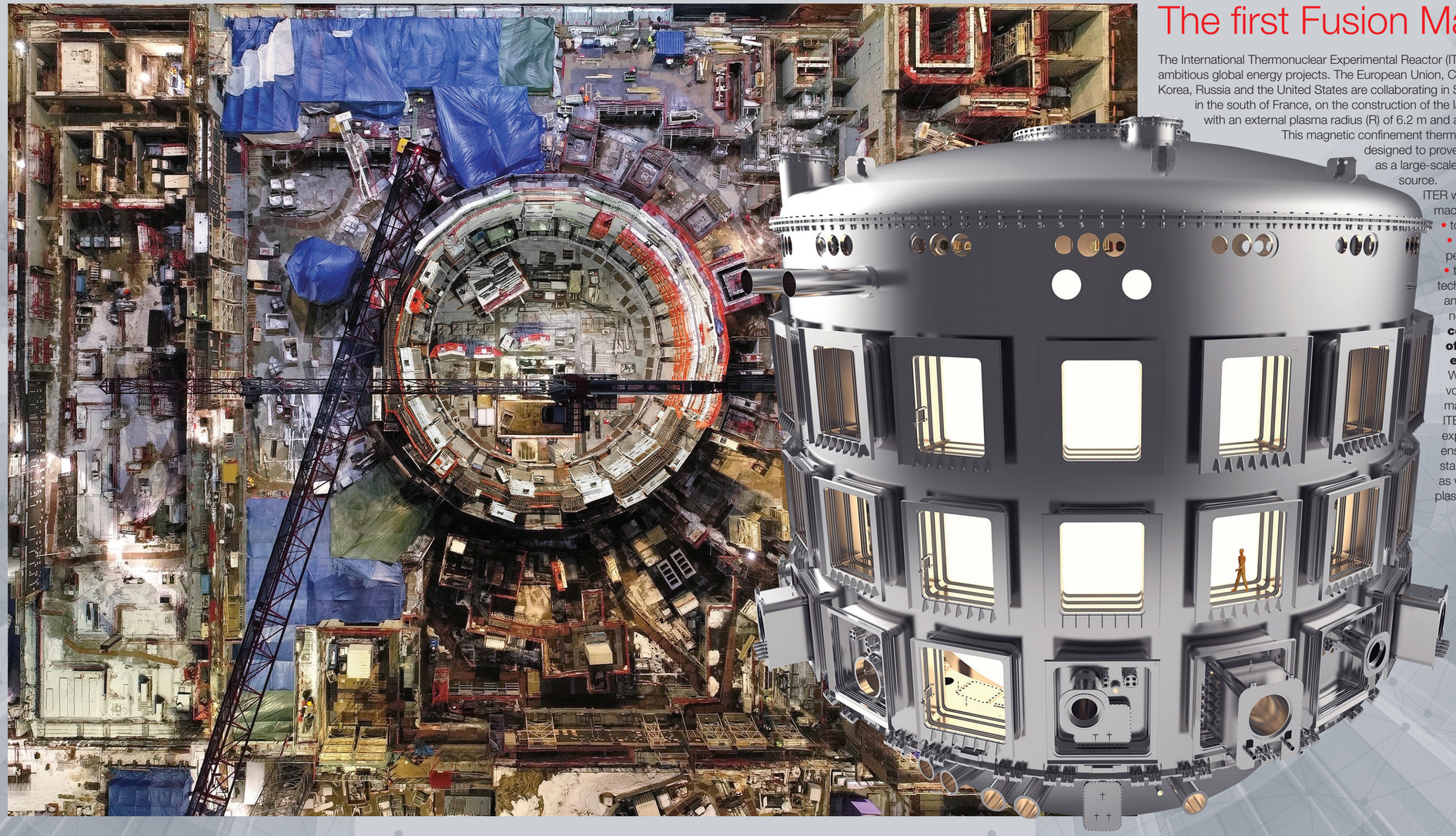
What aspect do you think will have the greatest impact on speeding up the spread of renewable energies: lower production costs, perfected technologies or political commitment by governments in terms of regulations and subsidies?

I don't think there is a single factor that can drive change on its own. In the future we will see exactly what has allowed us to get where we are today, which is a combination of reducing the cost of renewables, which favors their adoption, improving technologies, which allows further acceleration, and finally introducing specific market regulations. All these elements are needed to exploit the potential of these resources fully.

In your opinion, which areas of the planet or which countries can actually aspire to achieve significant targets in terms of creating low-carbon energy mixes in a relatively short period of time?

As far as geographical dissemination is concerned, I think we need to consider two existing scenarios. On the one hand there are developed countries—where the process is proceeding fast—which are reviewing their energy systems and gradually replacing their installed capacity. This is the case in Europe and North America. On the other are the emerging and growing markets—like India, China and Africa—where decisions are being made today about new additional capacity, which are perhaps more crucial. In my view, it is precisely here that the true potential lies, because if these countries decide to adopt low-carbon solutions, they will make a decisive contribution to the global transition. However, if they choose to rely on traditional technologies, we'll remain tied to large scale carbon emissions for another twenty, thirty or forty years. This is why I believe it is essential to focus on emerging markets and ensure that these new technologies are adopted and implemented in their respective regions. As for developed countries, change is already under way and investments in new capacity show that Europe and North America are adopting low-carbon technologies almost by default.

The spread of renewable energy is also hindered by inefficient storage systems. What measures have been taken in this respect?



A TRUE GIANT
An aerial shot of the ITER construction site in Saint-Paul-lex-Durance in the south of France. It is the largest tokamak ever made so far.

The first Fusion Machine

The International Thermonuclear Experimental Reactor (ITER) is one of today's most ambitious global energy projects. The European Union, China, India, Japan, South Korea, Russia and the United States are collaborating in Saint-Paul-lez-Durance, in the south of France, on the construction of the largest Tokamak ever built, with an external plasma radius (R) of 6.2 m and a plasma volume of 840 m^3. This magnetic confinement thermonuclear device has been designed to prove the feasibility of fusion as a large-scale and carbon-free energy source.

ITER will be the first fusion machine:

- to **produce net energy**.
- to maintain **fusion** for long periods of time.
- to test the integrated technologies, materials, and physics regimes necessary for the **commercial production of fusion-based electricity**.

With ten times the plasma volume of the largest fusion machine operating today, the ITER Tokamak will be a unique experimental tool, capable of ensuring that plasma remains stable for longer periods of time as well as guaranteeing better plasma confinement.

In a system that is strongly dependent on intermittent sources, storage is undoubtedly essential and the costs of such options represent a challenge. Significant progress has been made recently, for example, in improving the economic efficiency of lithium-ion batteries. These technologies are gaining more and more ground. However, it is clear that the range of storage needs is quite big and that lithium-ion technologies will not be able to satisfy all these needs. For this reason I believe it is important to continue to search for other technologies that may involve lower costs. This will ensure that when we need a very high storage capacity, we will have the technical options needed to allow a kind of efficient integration of renewable ones.

Many are beginning to realize the need to achieve this balance and to continue investing. However, given the expansion of the lithium-ion technology market, which attracts large investments, the difficulty lies precisely in not losing sight of the broader picture.

In your opinion, will the countries that signed the Paris climate accord be able to bear the costs of their commitments in future?

Many believe that the commitments made and efforts to achieve large-scale decarbonization will be burdensome and will result in additional costs for several countries. I don't see it this way. First of all, in many of these countries there is a strong growth in the demand for energy services, which will force them to invest in new capabilities and technologies. Furthermore, to date some of the low carbon and renewable technologies are, at least on the margin, competitive in terms of cost compared to traditional options. The difficulties lie in what I mentioned a bit earlier, namely in storage or, in a broad sense, in system integration. There remains a lot to do in this respect to ensure cost-effective integrable options. However, I am sure that if we manage to draw some momentum from the adoption of low carbon technologies, these options will become available and the nations that have taken on these commitments will be able to keep them. This is my hope and, despite the many challenges still to be overcome, I think we are on the right track.

The Energy of the Universe

Bob Mumgaard, C.E.O. of Commonwealth Fusion Systems, says we are "feet away" from large-scale implementation of the ultimate clean and renewable energy: nuclear magnetic fusion. He and his team have been working on this for some time, in close collaboration with MIT and Eni

Global energy developments are guided by a ceaseless ambition to realize the utopia of having a source of clean, safe, waste-free and unlimited energy. This ideal paradigm has always been identified with the model of nuclear fusion, and today, that desire is very close to being fulfilled. The team at Commonwealth Fusion Systems (CFS), a spin-out of the Massachusetts Institute of Technology (MIT), with whom Eni has a long-standing collaboration, has been working hard to achieve this goal. Bob Mumgaard, C.E.O. of the CFS project, explained when and how we will be ready to generate the first Kw of energy by magnetic fusion.

How was the magnetic fusion collaboration between Eni and MIT born?

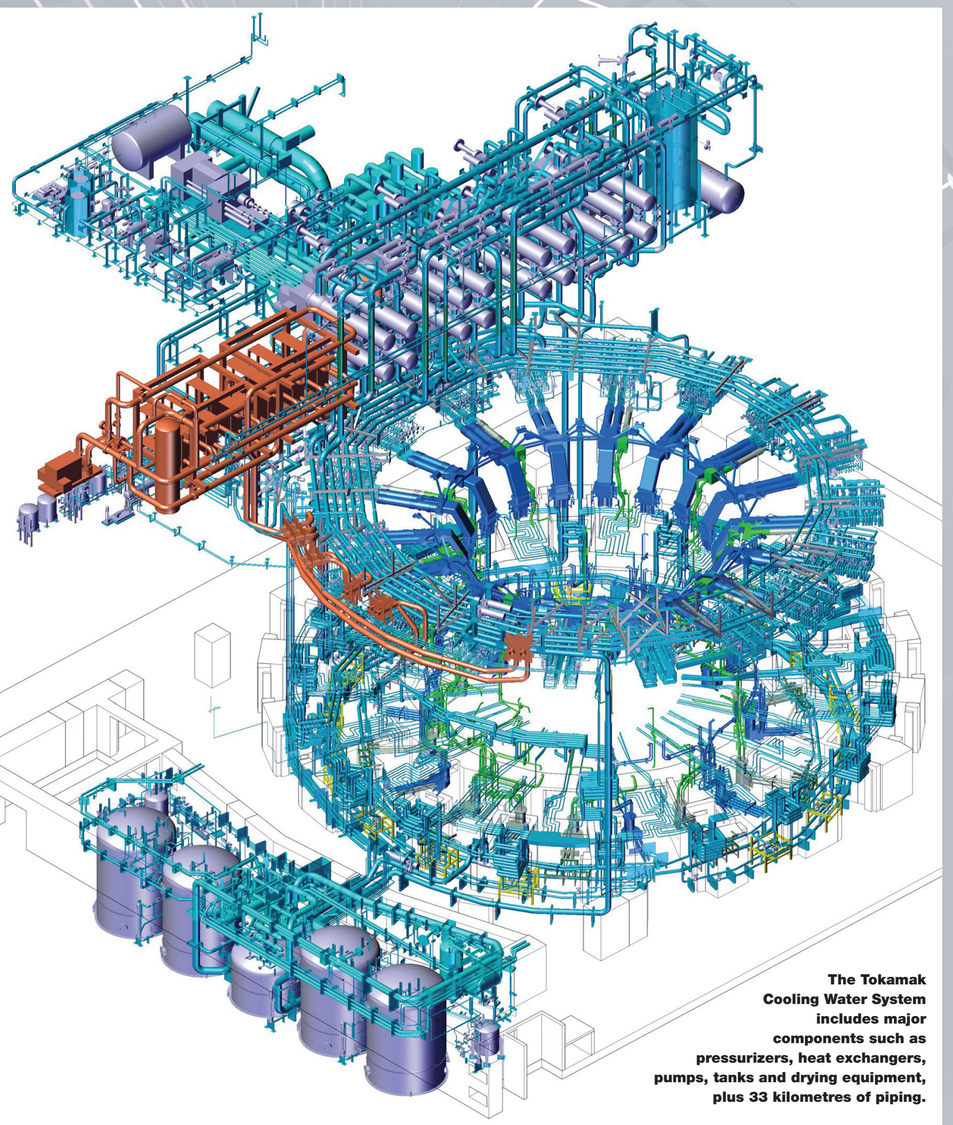
For many years at MIT we have conducted research into fusion and developed new projects to build smaller, faster, cheaper and smarter energy production systems. A few years ago, this led us to explore the possibility of creating a spin-out to market this technology, but we needed to find partners, stakeholders and investors who would support this design model. The profitable and long-standing collaboration between Eni and MIT allowed the company to take part in our project at an early stage, gradually following the developments and then, at the right moment, taking the next step by investing in Commonwealth Fusion Systems (CFS), created as a spin-out of MIT. Today, Eni and CFS form a kind of common front working with MIT for the technological development of magnetic fusion.

Fusion technology has been a real challenge for humanity. What makes you think the final goal will be reached this time?

Fusion is a goal we have been pursuing for a long time and huge progress has been made over the years. Scientific discoveries have been made and we have improved the technology and our skills. In the long term, these have contributed to producing positive results, although they are still insufficient to achieve standards that would allow us to derive a stable source of energy. Over the years, starting with basic science, we have developed a scientific understanding and the progress made so far means we can start thinking about efficient energy systems. Furthermore, we now have the magnet technology we need to take the final step towards creating a system capable of generating net energy on a large scale, and everyone agrees we are ready to definitively complete this historic transition. There is already a major ongoing project, "ITER," which proves the great scientific and technological development that has taken place over time, and the international interest in this system of energy production. In our specific case, new magnet technology will allow us to take that final step with relatively limited effort, human resources, technology and machinery, which are nonetheless sufficient to achieve our goal, thanks to the support of MIT and investors such as Eni.

What could the advantages of this new technology be for the energy sector and world as a whole?

Nuclear fusion is a goal pursued since time immemorial, as it uses resources that are available everywhere and are virtually inexhaustible. Furthermore, thanks to its high energy density, every time there is a fusion reaction, the amount of energy released is millions of times greater than that of a combustion or chemical reaction. Lithium and deuterium are the basis of nuclear fusion. These are abundant elements on land →



The Tokamak Cooling Water System includes major components such as pressurizers, heat exchangers, pumps, tanks and drying equipment, plus 33 kilometres of piping.

ITER Facts and Figures

Machine weight:
23,000 tons

Plasma temperature:
150 million °C
(10 times as hot as the core of the sun)

Fusion power:
500 MW
(energy produced)

Stored magnetic energy:
51 GJ

Magnet temperature:
4 K (-269 °C)
(the coldest object in the solar system)

and in sea water and can last for billions of years. The great energy density also allows systems to be created that are similar to those intended for fossil resources, on smaller sites and with small scale structures capable of generating large amounts of energy—a perfect solution for generating energy where necessary, for example near cities, particularly considering the increasing amount of urbanization affecting many regions of the world, including developing countries. It is also a very versatile system, which can either constitute the base load or supplement renewable resources and replace the fixed generation we depend on for the operation of our electricity networks. Another fundamental aspect, unlike traditional nuclear energy produced by fission, is that fusion does not involve any risk of accidents or proliferation of long-term radioactive waste, as these are completely opposite reactions. Fusion is much cleaner, more convenient and socially acceptable.

In your opinion, can magnetic fusion be considered a member of the clean energy family?

Definitely—it is the energy that created the universe, the ultimate renewable energy, the source of all energy, from solar to wind power: everything started with the fusion that occurred inside the stars. This makes nuclear fusion particularly attractive. Moreover, any system capable of generating energy without an initial input and with very few outputs, as in the case of fusion, is a system that is easier to manage. There is no need to research, extract and transform resources on a large scale because fusion is ultimately the universe's answer to energy problems.

Eni is, together with MIT, one of the main proponents of this project. Could you explain the dynamics of this relationship and the contribution that the company can make beyond financial support?

Eni has all the know-how and expertise on how to supply energy on a large scale, which is why we are very pleased that it is on our side, not only as an investor. A big company like Eni, with its history and its experience, knows how to manage and implement a project capable of providing access to energy to people who currently have no such access. Moreover, as an energy producer, Eni is well aware of the operation of these systems. Any system capable of supplying energy at a global level and therefore having an impact on the climate and on people's lives requires a structured team, and companies like Eni form the core of this, thanks to its long and distinguished history of engineering excellence. Furthermore, CFS continues to have deep-rooted and profitable relationships with MIT, of which it is a spin-out, and to collaborate in developing future and innovative technologies that will change the face of energy production in the future.



The island of Inkahuasa, in Bolivia, stands on the Salar de Uyuni salt flat. Under its crystalline crust is the world's biggest deposit of lithium, a primary element for the construction of energy storage systems.

Storage/International developments and challenges

The Missing Piece

Batteries and renewable energy storage systems–key elements for a successful transition process–are making technological headway, but it is difficult to source the raw materials required for their production



NICOLÒ SARTORI
He is Senior Fellow and Head of the Energy Program of the IAI (Institute for International Affairs), where he coordinates projects on the issues of energy security, with a focus on the external dimension of Italian and European energy policy.

ow much progress has been made in energy transition and in the change from a carbon intensive system to a largely carbon-free one? Despite the progress made thanks to the growing global market penetration of renewables and the significant targets set by the Paris accords, many questions remain over its future. Among the various factors that will lead to a complete and effective decarbonization process, batteries and electrochemical storage systems play a central role since they enable surplus electricity to be stored, thereby providing a solution to intermittent renewables such as solar and wind power. The power generation sector, just like the industrial, household and transport sectors, could gain significant benefits when storage technology is fully developed and economically competitive. Until that →

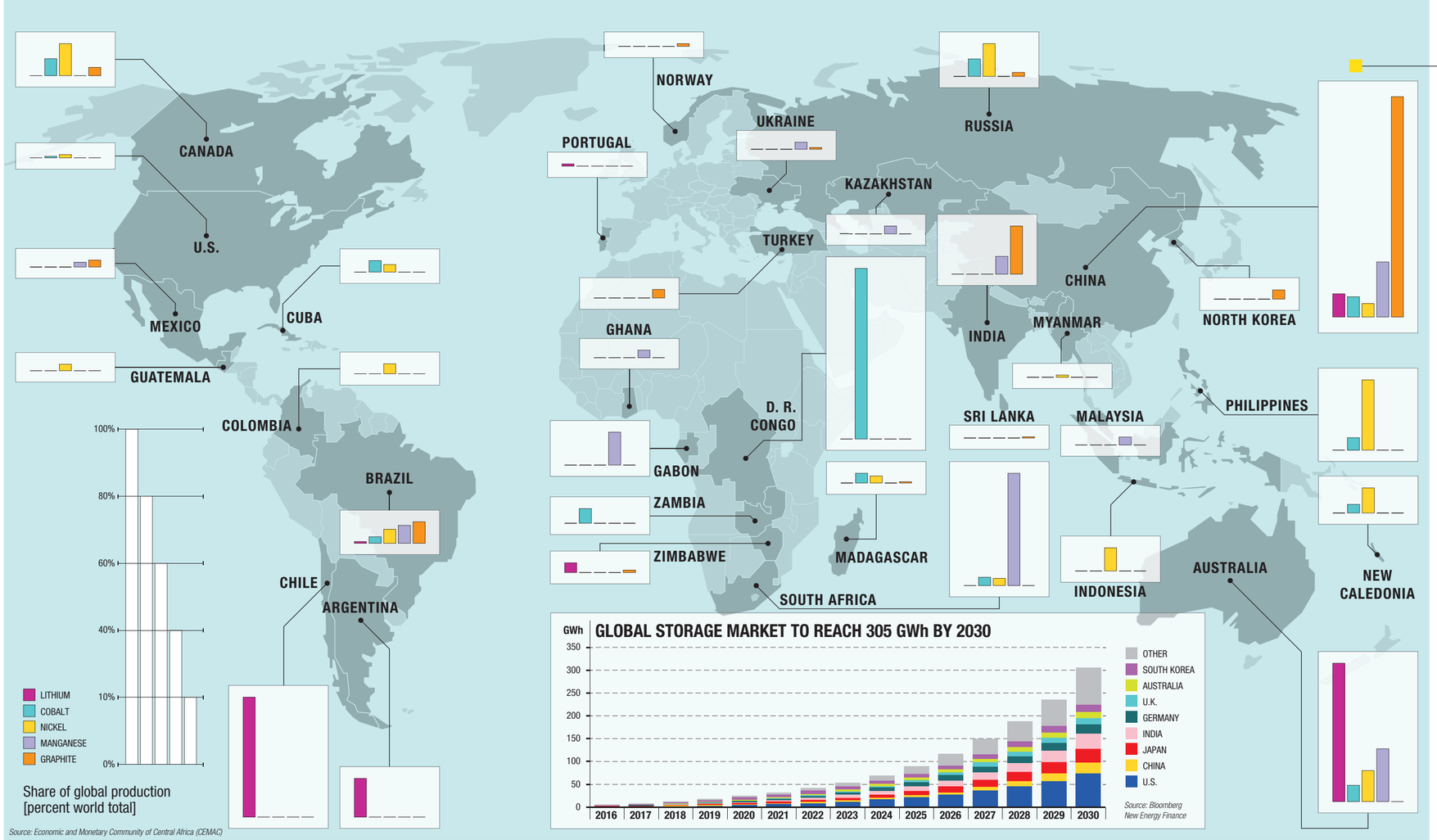
happens, low CO_2 emission fossil fuels, especially gas, will continue to be key for progress toward these important goals.

A technology with widespread applications

The future is storage if we intend to attain the targets set by the Paris accords to keep the increase in global temperature below two degrees Celsius, thereby limiting the devastating effects of climate change on human beings and nature. To achieve that end we must have a giant step forward in the technological development of batteries and storage systems. This is not the only technology required to achieve effective and sustainable global decarbonization. Digitalization and big data, carbon capture and storage, biofuels, and smart metering will all contribute to the successful transition of the energy system. But the use of electricity storage at different levels of the economy and in people's lives makes batteries a crucial factor. Batteries are poised to play a key role in integrating renewables into the power grid by helping overcome the intermittency of renewable energy, today's major limitation on their substantial use. The development of efficient, cheap and smart storage units will enable the excess electricity produced during the hours of maximum solar and wind output capacity as well as the electricity generated by thermoelectric power plants to be stored and fed into the grid during peak demand times, thereby balancing the electricity system. An example of this is Tesla's Powerpack storage system, the first of which was connected to a wind farm in southern Australia and has the capacity to store enough energy to power about 30,000 homes for an hour. Similar systems are also up and running in Puerto Rico, the United States and Belgium. Large-scale storage units can also be used by industrial complexes to store and use independently generated electricity–potentially from renewable sources–thereby optimizing load management. Mega batteries would thus make it possible to shift consumption from one time band to another in order to optimize energy costs and make industrial activity more efficient and sustainable. The spread of batteries and distributed energy storage systems on a large scale could also have a significant impact on the habits of families and individuals, opening the way to households making and consuming their self-generated power from renewables. Finally we need to consider the key role played by batteries in the mobility sector, where electric vehicles still constitute a niche market. By improving the performance of storage systems–considering that battery size, cost, recharging speed and range are currently still below optimal levels–the market share of electric cars will grow exponentially, particularly for urban and mid-range use. Also, looking ahead to ever smarter and more responsive electricity grids, it will be possible to use the batteries installed on electric vehicles during the charging phase to manage one-way and two-way electricity flows and thereby balance the grid more evenly (vehicle-to-grid, V2G).

MINING TREASURES

The development of the energy storage systems sector also depends on the possibility of finding the elements that contribute to their realization. In this map we see the worldwide distribution of reserves of the main minerals such as lithium and cobalt.



A strategic sector for accelerating the transition process

At the global level, the massive spread of batteries and electricity storage systems in conjunction with the growing reduction in the cost of wind and solar power will, along with other sectors, secure a rapid transition towards a strongly decarbonized energy sector. At the same time, it will help achieve one of the main goals of the United Nations 2030 Agenda, namely to provide access to energy to the one and a half billion people in the world, mainly in Africa, who are still not connected to a grid or lack any kind of electricity service. Given this vast market, possessing cutting-edge enabling technologies is a strategic factor from both an economic and a geopolitical perspective. According to International Renewable Energy Agency (IRENA) estimates, the installed capacity of storage systems for stationary applications is set to grow 17-fold by 2030, this to manage increased power generation capacity from renewable sources. Added to this is the demand for batteries for electric vehicles, a market expected to reach 700 GWh per year in 2030, with a total value of almost USD 250 billion. Today, this technological and industrial capacity is predominantly located in Asia. The current global leader, Japan's Panasonic, is in a race with Chinese giants BYD and CATL and South Korea's LG and Samsung, which together control almost 90 percent of the global market. Within a few years, partly driven by an unequaled domestic market for electric vehicles, Chinese production is expected to grow substantially and to account for as much as 70 percent of global production. In 2017 alone, a record year for global sales of electric vehicles with one million new registrations, the Chinese fleet grew by almost 600,000 vehicles, almost 100,000 more than in the previous year, This figure is all the more impressive when compared to the 200,000 vehicles sold in both the United States and Europe. It is on the trans Atlantic front that there is a danger of lagging permanently behind in this strategic sector. California-based Tesla is trying to close the technology and industrial gap with its Asian competitors through massive investments in both mega storage and lithium batteries for motor vehicles. In this respect, Elon Musk recently announced a partnership with Pacific Gas & Electric Company for the construction of a mega storage facility in California of over 1.1 GWh, almost ten times the current capacity of its Australian project. In the battery segment, Tesla is working to significantly reduce the use and related costs of cobalt, one of the costliest components of vehicle storage systems. For the new Tesla Model S cars, for example, the amount of cobalt used has been reduced from 11 to 5 kilos per car in a matter of a few months. Quality and innovation are the only solution for the Palo Alto based company–which has plans to build a Gigafactory in China and Europe–if it is to sustain its competitive advantage.

Batteries have still not taken off in Europe

In Europe there is a danger that Tesla, along with Asian giants like CATL and BYD, will continue to be the major industrial players in this sector. Despite the European Commission's initiative launched last year to create an "Airbus" for batteries and avoid missing engagement in a revolution with the potential to transform the electricity and transport sectors, the battery sector in Europe is struggling to get off the ground. While market forecasts are essentially rosy, with Europe expected to account for a third of global lithium batteries sales by 2025–with an energy storage capacity of approximately 200 GWh out of a total of 600–the European industrial sector's ability to grasp this major market opportunity seems highly doubtful. And Brussels' attempts to push innovation in this sector appear to be making little headway. For the two-year period 2018-19, the European Union will provide EUR 110 million worth of funding for research and development activities. This is far too little when compared to the EUR 3 billion investment planned by the Chinese company CATL to boost its battery-making capability almost fourfold by 2020. Despite the huge global market prospects for batteries and large-scale energy storage systems, there are several factors of uncertainty holding back the sector's full-scale expansion. The main factor has to do with the cost and performance of the available technologies. Although the price of lithium batteries has dropped dramatically from USD 1,000 to less than USD 300 per KWh in just a few years, there is still uncertainty as to the cost-effectiveness and hence the competitive edge of electric vehicles over cars powered by an internal combustion engine, net of government incentives and other subsidies. In addition to the cost of batteries, which would need to fall to USD 100 per KWh to make electric vehicles cost-competitive, a further highly significant cost factor is the new infrastructure required to provide charging points to a growing number of electric vehicles on the road. Other factors to be considered include the size of the batteries themselves, their range, efficiency and charging time, all of which currently limit the usability of electric vehicles, particularly for medium and long range trips. In this respect, however, technological progress will secure rapid growth in the market share of electric vehicles.

Lithium supply issues

Another factor that attracts less attention but certainly deserves to be taken into account is access to the natural resources required to develop and sustain the future market for batteries. Lithium reserves will play a key role in this rapid energy transition, and the focus in this respect has to be not only on the political implications of growing dependence for running the sector efficiently but also on the purely economic ones. Globally, lithium reserves are concentrated in a handful of countries, with Chile controlling almost 50 percent of the resources, followed by China, Australia and Argentina with 20, 17 and 12 percent respectively. This concentration causes considerable price volatility, as happened in 2017, when cuts in Australian production lifted prices in China by 300 percent. In general, the price of lithium has increased exponentially in the last fifteen years, rising from USD 1,500 per ton in 2002 to over USD 9,000 in 2017. This trend is set to continue in parallel with growing industrial production, and companies in the sector are responding to it by adopting raw material saving policies. These are the major challenges facing the electric battery sector, and they will determine the timeframes for the energy transition–a process as inevitable as it is still uncertain–to be finally completed.

Big Data/Risks and opaqueness of a world under observation

The Social Rupture

Profiled by sophisticated algorithms, conditioned by social media, still lacking an effective international legislative shield, we risk falling prey to the control of faceless powers





ROBERTO
DI GIOVAN PAOLO

A journalist, has written for, among others, ANSA, *Avvenire* and *Famiglia Cristiana*. He was Secretary General of the Italian Association for the Council of European Municipalities and Regions, and he is a lecturer at the University of International Studies of Rome.

Alan Turing could never have imagined that his mathematical work on algorithms to reveal the secrets of the powerful Nazi calculation and coding machine Enigma would have become as famous and widely-used as it has now. But in a world of communication and images, what is knowing how to do the math worth, albeit in such a sophisticated and ultimately hasty manner? Nothing, if you consider the computing skills of modern computers and smartphones, which contain, within a few centimeters, the thousands, sometimes millions of punched cards we saw in the science fiction films of the 1960s and 70s. Everything, if you apply this enormous computing capacity to the profiles of millions of people, to scientific research in oil or gas fields, to medical knowledge and treatments, for example, for Alzheimer's. Just consider its use in market research and politics, especially the latter if we consider its presence in individualized messages, devised and sent to specific people on the occasion of both the French and U.S. elections, let alone in the Brexit referendum and, some say, the recent Italian elections, messages that with sharp focus influenced the electoral market. Another issue that is resurfacing and could also be decisive for some momentous decisions is the impact of algorithms on which kinds of energy to use and how. However, if we go in search of what is internationally known as the "rupture" a turning point that many believe to be the key to understanding what is happening on a planetary scale in geopolitics and, therefore, in economics and finance. This "rupture" focuses the algorithm as the basis for capital investments, start-ups and the expansion of established companies at the expense of weakened nation states. The algorithm is a set of calculations that leads us, in successive steps, to a single solution to the request made. The more it is vertical and precise, the more our answer can be accurate and not only descriptive but also predictive because at each stage the data are transformed and refined. Mind you, even a computer is only a tool. It depends on what data is entered, and for what we are searching. Based on careful profiling, you can ask for the perfect jingle for a new car commercial, the survival rate of patients in a hospital, or even the mineral resources of a country with which you are in conflict and how long they will last. Just think of current conflicts in border areas with oil pipelines, or in far-off places in Africa unknown to the majority but still necessary because of their wealth of specific minerals.

A world of computing and power

To date *WE* has always dealt with the joys and sorrows of familiar geopolitics. What happens when private computer systems clearly overtake those of national governments? There will be a need for debate on rights to access the Internet or on open data if governments can no longer process that data. For many years, we warned each other, sometimes with partisanship, about "Big Brother." We then mocked and demystified him to make television programs, because the leviathan state was actually losing its teeth and its aggression. Calculation power, initially only that of humans then machines that filled room after room with tape and perforated card processors, and finally computers, strategy rooms, the cold war, all of which was government property. However, since the 1970s and the revolution in the garages of Cupertino and Silicon Valley, that power has gradually fallen into private hands. Few governments in the world now have the financial wherewithal and the intellectual and scientific strength to support the same "Big Data" processing capacity as companies like Google, Facebook, Amazon, Apple and even Alibaba. Of course, in their own way, they produce intangible assets, but they are competing in a market where until thirty years ago only nation states and, in some rare cases, large multinational companies which had—and still have—a highly strategic significance for the States that generated them, had the capacity to predict individual and collective behavior. Precisely because of the intangible nature of their consumer goods, they have at their service the citizens of every State and of every age and are the protagonists of an epochal battle in which they enjoy a privileged position, even in a philosophical sense: who can object to the use of Facebook or to allowing us to listen to the songs we love? Only a State that we would immediately define as culturally or practically dictatorial and immoral. In fact the controversy over these major 'Big Data' players is currently focused on whether they are paying their taxes, in Italy and in the E.U., and the people marching against cannot be said to be doing so in the name of fiscal virtue. There is no doubt that the offer of services in exchange for our tastes and preferences is tacit and understandable to most people. At most it causes a little annoyance when we browse the Internet and are bombarded with special offers for holidays or products that are very similar to the ones we often seek information about. We're not scared by this any more. But is that really all that's at stake? The mass communication theories of the 1970s taught us about the "hidden persuaders," so many became familiar with the meaning of product placement on the higher and lower shelves of supermarkets. Are we now fully convinced this is an objective analysis of the data, not always unwittingly instigated and not always malevolent, but nevertheless able to measure our resistance to buying? And beyond consumption, when we have to decide something that will have an important effect, like Brexit, are we certain that all the news fed us is democratically aimed at the entire populace. Or, instead, are we influenced by "bots" or robots that calculate and produce specific news addressed only to those who will take notice, using Twitter and Facebook to reach places where the vote is decisive, previously calculated and measured by that magical algorithm of which we know the function but about which neither we nor the national state knows anything else. How many people in Britain made up their minds about how to vote on Brexit on the basis of the news not about the potential negotiations or the economic loss resulting from the fact that, for example, in energy terms, the U.K. was one of the European Union's COP21 leaders compared to the other 27 countries, but rather on the barrage of news published at the time on the increase in immigration from the E.U., on the risk of a clash of civilizations in a Commonwealth that has been dealing with that for centuries, and on the widely-held notion of a glorious return to imperial isolationism?

A system of algorithm-based consensus

The new idea, a "rupture" from the past, is that these options, which may or may not be real, do not only depend on the policies of others that might have been advanced by rival countries through the customary battle between spies, albeit updated to modern times, but are the result of the "privatization" of Big Data. This may come in handy for Putin, as some have suggested, noting that, both for Brexit and the U.S. presidential elections, the investigations appear to lead to Russian hackers, but who in reality are also feared by an autocratic leader like "the redeemed Tsar" re-elected for a fourth term, so much so that control over the so-called OTT (Over The Top) players is very strict. And also by China, which has also been working to create its own connections, imitating Facebook and WhatsApp, no longer to guard against political dissent but in an attempt to control both dissent and uncontrolled (and uncontrollable) consensus, particularly around matters other than the usual "enemy," historically a foreign government with different interests. These days, Spotify's new and secret algorithm not only delights us with the music we love, offering us new tracks all the time and, based on our use and enjoyment, turning us into fans of a particular kind of music, predicting our tastes and ultimately producing the music it knows we will consume. The same algorithm process can be used to create consensus through news, music, ads or guided connections between people, or to pursue an energy source other than those chosen by the major countries and even the most cutting-edge companies? And why not? This is possible and no longer science fiction. We aren't yet the "Pre-cogs" that Philip Dick saw as superhuman and mutant figures, capable of predicting the crimes we did not plan to commit, but it's interesting to note that all the big Over The Top companies are investing in neuro-technological studies which, for a few years now, have been offered by faculties of Communication Sciences and Economics among the complementary studies for marketing courses. There's nothing to be scared of. We can't be millenarians. However, we must have an awareness and understanding of whether the State—understood as a collective mediator of collective freedoms, individual and market—still has a say or must resign itself to a decline in this field, which was once solidly its but is now seriously undermined. We cannot respond to the "rupture" of an exclusive domain with authoritarianism (they represent freedom, and free speech and it would be pointless) or antiquated rules, but by accepting the challenge and re-establishing a strategy that can reckon with it which is appropriate considering the "property" of algorithms. Just as has been done with this unique "immaterial geopolitics."

MARKET DEVELOPMENTS

Prepared by Anna Capalbo, Simona Serafini, and Francesca Vendrame - Eni

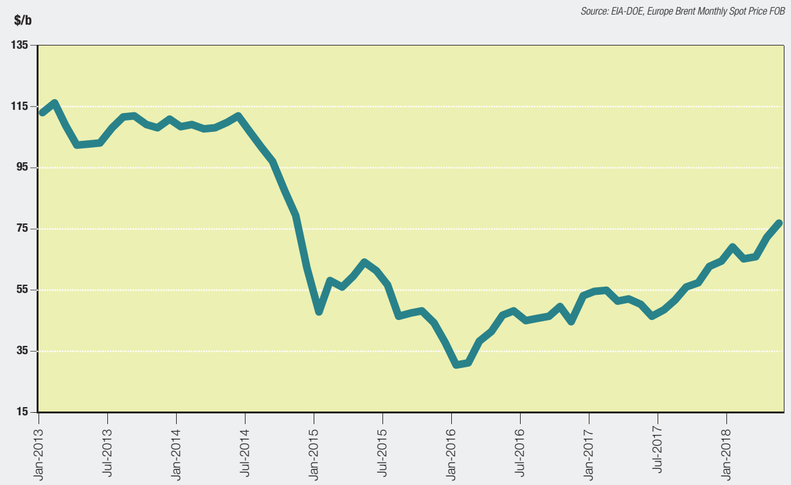
$70/b, a New Comfort Zone?

OIL PRICES

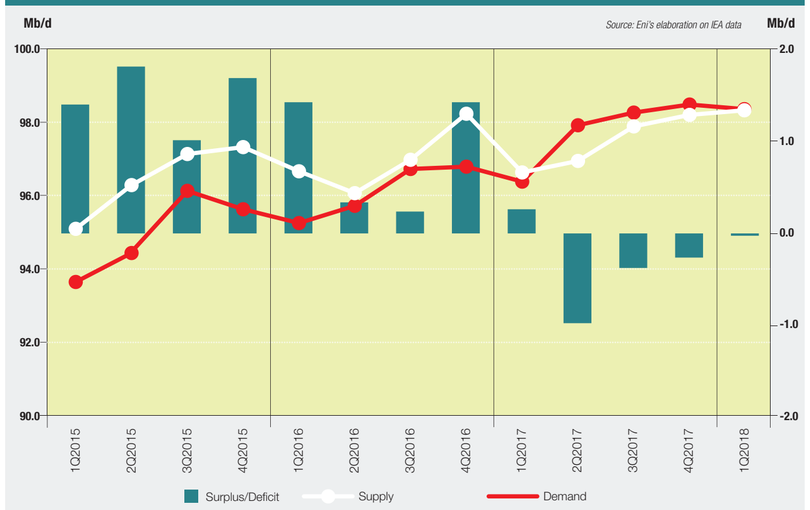
OPEC pragmatism still in support of the market

After reaching USD 70/b for the first time since 2014, oil prices, supported by strengthening fundamentals, were still rising at the start of 2018.
Positive economic indicators are supporting the demand. On the supply side, greater discipline from the major OPEC and non-OPEC producers has been confirmed in their compliance with the November 2016 agreement. The Saudi and Russian ministers have declared their intentions to maintain the cuts until the end of 2018 and may be considering a rolling in 2019 aimed at "permanent" cooperation between major producers. Conversely, the continued growth of U.S. crude production, currently above 10.5 Mb/d and estimated to exceed 11 Mb/d by the end of the year, has brought instability and uncertainty, correcting the upward trend in stages.
However, a perception of the gradual reabsorption of surplus stocks and the increased geopolitical risk prevails on the market. At the end of March, total OECD stocks fell below the average in the last five years, achieving the key OPEC target. On the geopolitical front, we are witnessing the collapse of production by Venezuela, which has suffered the expropriation of their assets in the Caribbean, compromising their storage and export capacity. There are new tensions, partly as a result of the plan to renew economic sanctions against Iran led by the U.S. President, over the major implications for crude imports to Europe and Asia and for upstream investors in Iran. In the context of balanced fundamentals, the loss of Iranian volumes is a further disruption both in terms of quantity and quality, to which the market reacted with prices up to USD 80/b. OPEC reacted immediately to guarantee the volumes at risk.
At the OPEC Meeting on June 22, an increase in production was agreed between 0.8 and 1.0 Mb/d, which was also supported by Russia. The additional production will not create a bearish trend on the price, given he geopolitical losses. Supply/demand balance, essentially flat in Q1 2018 after three quarters of deficit, could prospectively end the year flat or in slight deficit, depending largely on the trend of demand.

BRENT PRICE



SUPPLY/DEMAND BALANCE



OIL DEMAND

In Q1 2018, global oil demand rose by 2 Mb/d, with the increase equally divided between the OECD area (+1 Mb/d) and non-OECD countries (+1 Mb/d). Demand in early 2018 was supported by climactic factors in Europe and the U.S., and by the introduction of new petrochemical capacity in the U.S. The economic context remains solid, despite downside risks such as higher prices, a potential slowdown in international trade due to U.S. protectionist measures and a further strengthening of the U.S. dollar. In 2018, petrochemicals are a driver of growth not only in the U.S. but also in China. In the U.S., the low-cost availability of ethanol and other feedstock from the shale revolution represents a strong competitive advantage. Most of the ethanol plants will be on the Gulf Coast, near the non-conventional crude production basins of Permian and Eagle Ford. In China, some of the planned projects will be integrated with new or existing or new refineries. Unlike in the U.S., fuel oil and propane are the main feedstock. In the U.S., in addition to ethanol and LPG consumption, diesel consumption is also rising, due to the increase in trade and drilling activity in the upstream oil and gas sector. Based on the dynamics of ethanol, LPG and diesel consumption, demand in North America contributed 70 percent (+0.7 Mb/d) to the overall OECD rise in Q1 2018.

In non-OECD countries, more than 80 percent of the increase in demand came from China (+0.5 Mb/d in Q1 2018) and India (+0.4 Mb/d in Q1 2018). In India, government policy is supporting the use of LPG instead of kerosene for heating use in the civil sector, consumption of jet kerosene is continuing to increase sharply, supported by the boom in the airline industry, and benzene consumption is growing despite high end prices. The IMF forecast for the economic growth of India is robust due to the lessening of the factors behind the slowdown in demand in 2017, such as demonetization and the introduction of the "Goods and Services Tax," a kind of national VAT.

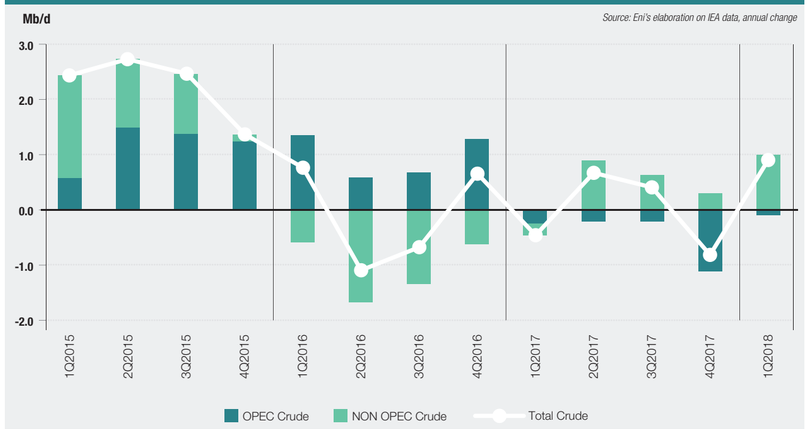
ANNUAL DEMAND CHANGE BY SELECTED AREAS



OIL SUPPLY

Global oil supply in Q1 2018 rose to 98.3 Mb/d, +1.5 Mb/d on Q1 2017. The only growth was still in non-OPEC countries, while OPEC continued to maintain production control to comply with the agreement on cuts, gradually falling to lows for the past three years. U.S. crude recorded one of the largest increases in recent years (+1.2 Mb/d). In particular, production increased in the Permian Basin (over 2 Mb/d vs. Q1 2017), so fast that it saturated the transportation capacity via pipeline to the USGC, where a large part of the domestic refining and export capacity is concentrated. There was a new production record for Canada, rising to 4.2 Mb/d (+0.2 Mb/d.) Increases in Kazakhstan and Congo offset the structural declines in Mexico and China. In line with the Vienna agreements, Russia stayed below 11 Mb/d, with a fall of 0.1 Mb/d vs. Q1 2017. OPEC, falling since the beginning of 2017, achieved very high compliance with cuts (over 150 percent in the quarter.) The deepening crisis in Venezuela, where production reached its lowest value in the last 30 years (1.5 Mb/d), resulted in a loss of over 0.5 Mb/d compared to one year ago. Venezuela's production capacity is expected to collapse under pressure from foreign debt and the tightening of U.S. sanctions. Saudi Arabia is largely stable below 10 Mb/d, while the recovery of Libya continued, returning to the limit of 1 Mb/d, despite the internal situation causes repeated production stoppages in some of the main oil fields. Nigeria grew (+0.3 Mb/d vs. Q1 2017), while the natural decline of Angola continued (-0.1 Mb/d.) Maintaining the OPEC-non-OPEC alliance remains a key factor in control of the market. In the June meeting, the countries agreed to restore compliance to 100%, with an increase in production of 0.8-1.0 Mb/d from July to December. As no individual targets have been set, the increase will come from countries with effective spare capacity: Saudi Arabia, UAE, Kuwait, Iraq and Russia. Saudi Arabia and Russia have already declared an increase of around 0.5 Mb/d from July.

ANNUAL CRUDE SUPPLY CHANGE





www.aboutenergy.com