Energy Journal

Issue 17 / September 2020

The Pandemic Crisis: Energetic Recovery

A magazine about energy and more by CESI

Energy Journal
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Editorial

The Pandemic: The Energy Sector Drives the Economy Forward

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The crisis that started in early 2020 and is unfortunately still spreading across the globe is tragic from a human, social and economic perspective. Some observers believe that the pandemic has had the effect of an asteroid colliding with our economy. All industries have been affected and, in many cases, entire industrial sectors have been severely impacted. The International Monetary Fund (IMF) forecasts the global GDP to fall by 4.9% in 2020, with enterprises hit harder than household consumptions.

Whilst it is plausible that COVID-19 has somehow altered forever certain lifestyles and consumption patterns, it is also true that this crisis represents an opportunity for change, from both an economic point of view and a technological development. In this regard, the energy sector can become a catalyst for resuming economic growth, as long as a series of urgent measures are enacted to make the system more flexible after the slump in the demand for electricity (looking just at Europe during the lockdown, -25% in Italy, while in Germany, France and Spain the decrease ranged from -7% to -17%).

The present issue of Energy Journal tries to investigate why COVID-19 has represented a stress test for the energy system and what this means for our energy future. Our analysis compares the effect of the pandemic on energy systems to a "sneak peek" into the future, a preview of what (prior to COVID-19) had been forecasted for 2026. The reader can delve into the indications that are emerging for the next decade in terms of both sector development and new measures to be implemented to increase flexibility, a key pillar for managing systems with high percentage of renewables. While the energy sector can bring together public and private investments to develop grid infrastructures and green power plants, it is now paramount to begin testing and fine-tuning technology for distributed generation, storage, energy efficiency, and electric mobility.

In general, the entire industry places great expectations in the further cost and performance improvement of key technologies. In the following pages, you will find an article (Future & Technologies Section) examining the impact of the COVID-19 crisis on technology for the energy transition. In this context, we also conducted interviews with Francesco Starace (CEO, Enel), Jean-Marie Dauger (President, World Energy Council) and Mark Jacobson (Professor of Civil and Environmental Engineering at Stanford University). According to Francesco Starace, "being sustainable, as demonstrated by the COVID-19 outbreak, is the best and only way for a company to create stable long-term shared value", whilst the WEC President added that "investments in renewables need to be boosted significantly, especially given the level stated in the last two years."

In the "Industries & Countries" section, we review the reactions and measures implemented by energy players across the world: from European projects for green technology to Indian investments in hybrid plants, from Japan quitting coal to China subsidizing electric vehicles.

Finally, let us conclude by mentioning the extraordinary effort that CESI has put since the end of February to implement a full set of measures to ensure the health and safety of all employees, clients, and partners in all our labs in Arnhem, Berlin, Chalfont, Mannheim, Milan and Prague. Thanks to those measures, all the clients at our sites have passed through the pandemic unscathed. We are aware the past few months and those that lie ahead have not and will not be simple. However, at CESI we are working hard not only to continue to uphold the strictest safety and security standards, but also to develop new and innovative ways to deliver our KEMA Labs services to clients. Stay tuned! Enjoy the reading.

Energy Journal can be browsed and downloaded at www.cesi.it

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"The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty and we must rise with the occasion. As our case is new, we must think anew and act anew."

Abraham Lincoln, 16th president of the United States








News

Latest from CESI

West Africa

Definition and Implementation of Regional Grid Code for WAPP Transmission Network

In the last few months, CESI Group has obtained a crucial project that revolves around the development of the regional Grid Code WAPP (West African Power Pool), which will open the doors to the implementation of the electric regional market ECOWAS (Economic Community of West African States), a regional political and economic union of fifteen countries located in West Africa. The project will carry on over the course of one year and, given its complexity and strategic relevance, will involve a 10-person Team. In order to establish the Grid Code, CESI will help creating rules and regulations for the management of the technical components of the electric regional market. These involve connection of generation, HVDC, and demand facilities; coordinated operation of each national power system; metering rules; cross-border electricity transfers and common market technical rules; trainings of operators. Furthermore, CESI will proceed with the drafting of the Code, which will later be submitted to the evaluation of all the interested stakeholders of the member States. The feedback gathered from this phase will help maximize the compliancy of the Grid Code with national rules and practices and will facilitate the harmonization on the national grid codes.

“CESI will help creating regulations for the management of the technical components.”

Digital excellence

CESI awarded the Digital Star 2020 for the Energy Sector

Thanks to our commitment to the energy sector, CESI has been awarded the Digital Star 2020 in the field of Raw Materials & Energy by the Deutsches Institut für Qualität und Finanzen and its Italian media partner Repubblica Affari & Finanza. With a staggering 65.7%, CESI obtained the fourth place amongst the so-called Digital Stars in the field of Raw Materials & Energy. The analysis carried out by the German Institute for Quality and Finance has produced a list of the 350 best companies in Italy with regard to their digital presence. The second edition of the study on digital excellence, which is based on the largest online analysis on the subject, has considered a longlist of 2.000 potentially relevant companies in Italy that employ at least 50 workers. In order to finalize the Digital Stars 2020 list, in the last 12 months all entries in the field of technology, digitization and innovation have been monitored on websites, social media, news portals and blogs in Italian. CESI Group has been awarded the Digital Star 2020 seal: a visible and official recognition of our innovative and entrepreneurial ability that represents an important opportunity for future developments, as well as testifying once again our role as world leader in Consulting, Testing, Certification & Inspection for the energy sector.

“A visible and official recognition of our innovative and entrepreneurial ability.”

KEMA Labs

KEMA Labs White Paper

Recently published, officialized and therefore now available for utilization, the IEC TS 63107 is a fundamental technical specification that assesses the necessary requirements for integration and testing of internal arc-fault mitigation systems in low-voltage switchgear and control gear assemblies – PSC-assemblies, according to IEC 61439-2, to demonstrate their correct operation. The scope and characteristics of IEC TS 63107 are explained, in detail, in the KEMA Labs Low-Voltage White Paper. Our KEMA Labs experts, as members of the IEC Project Team PT63107, have given a strong contribution, working closer with more than 30 worldwide experts to elaborate the new Technical standard, which brings some new safety concept on the LV Switchgear assembly market. Thanks to its long and recognized experience in testing of Low Voltage components and mainly switchgear assembly, KEMA Labs Low Voltage, located in Berlin, has recently performed several tests both for assembly and IAMS manufacturers to check the combination of these systems.

Smart Grid

EnerNex role in the SCE’s Grid Modernization Project

Over the last years, EnerNex, a CESI company, has been working with Southern California Edison (SCE) in the process of implementing Smart Grid applications as part of an ongoing grid modernization effort in the United States. The goal of the collaboration is to improve reliability and asset utilization, integrate Distributed Energy Resources, and timely demand response to market and other signals. In this respect, EnerNex and SCE have developed a methodology to support SCE’s deployment of Distribution System State Estimator (DSSE), using telemetry and operational forecasting to ensure optimal execution of applications such as Volt-Var Optimization (VVO) and Fault Location, Isolation, Restoration (FLISR), while avoiding voltage and capacity violations. Within this process, EnerNex and SCE made significant steps ahead in automating and refining the analysis so that it can be applied to different circuits. Currently, the project focuses on the development of a tool to guide the wide-scale deployment of sensors and operational forecasting on utility circuits.

Saudi Arabia

CESI | GEPL successfully completed the Type Test of Saudi Power Transformer 230 kV /13.8 kV

CESI GEPL, a joint venture between CESI and the GCC Electrical Testing Laboratory, is proud to announce that on March 18 the Type of Saudi Power Transformer (SPTC) 230 kV /13.8 kV has been successfully completed and accepted. CESI GEPL would like to thank SPTC for the full readiness to these critical tests at their facility and it is proud of this accomplishment from a local Saudi manufacture. CESI GEPL has been conceived as a call to stricter specifications of power components compliant to the highest international standards. The testing platform will provide engineering and consultancy services to the MENA region from its soon-to-be-built lab in Dammam, Saudi Arabia. Our vision is to enhance performance of the power systems already in place and sustain the electrical industry in the region through the first electromechanical testing platform in the region. CESI GEPL is one of the platforms of KEMA Labs, a CESI brand, the world leader in the independent testing for the electricity sector.

Scenario

The Impact of COVID-19 on the Global Economy

An extremely rapid, symmetrical and multidimensional crisis. In just a short period, the pandemic emergency has destabilized the global economy.
A series of analyses, studies and forecasts on what we may expect in the coming months.

An unprecedented economic shock, a violent financial collapse, a planetwide crisis… These are the terms employed by analysts, experts and economists to describe the global economic scenario caused by the COVID-19 pandemic. They all agree on the fact that there will be a serious global recession due to the measures enacted by governments to block contagion: the closing of borders in March, when all countries found themselves forced to reduce the mobility of people and goods; the suspension of activities in a wide range of economic and productive sectors that led to a collapse of aggregate demand and a reduction in employment. In conclusion, a situation of severe uncertainty led to a generalized collapse in the demand for non-essential goods.

The Figures of the Global Economic Recession

Recently, a wide range of analyses, forecasts and estimates have been presented on the global impact that COVID-19 will have on various economic sectors. These figures are continuously updated, with even lower estimates, as the pandemic evolves around the world. As this global overview may change extremely and rapidly, this article will analyze the data of greatest significance and interest published as of June 2020. The International Labor Organization (ILO) estimates that during the second trimester, 10.7% of working hours were lost due to the pandemic, as compared to 2019. This is the equivalent of ca. 135 million full-time positions. The study entitled "COVID-19 and the World of Work" identifies the geographical areas that have been most affected: the Americas, followed by Europe and Central Asia. Indeed, this phenomenon affected 94% of the workers in the countries that implemented restrictive measures to contain the spreading of the virus. According to ILO, the economic crisis set off by the pandemic will cause 25 million people to lose their jobs, globally.

The World Bank also highlighted the difficult situation in its Global Economic Prospects Report published in June. The document, which examines 183 countries, estimates that this is the most violent economic >

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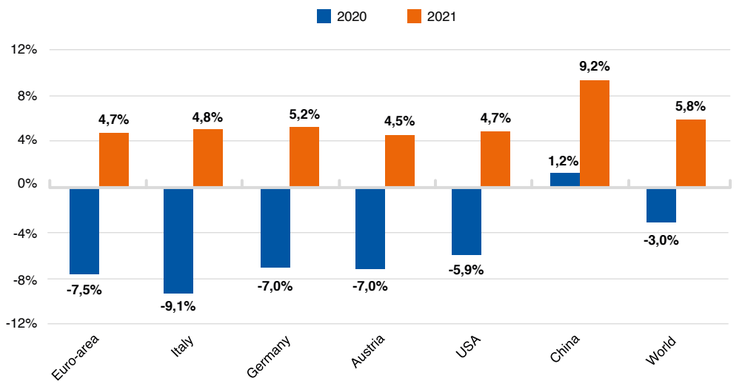
collapse since the Second World War. Data for 2020 indicates that the global GDP could decrease by 5.2%, more than twice the collapse of the 2008 financial crisis, with an average 3.6% decrease in pro capita GDP in over 90% of countries. This means that there could be 70-100 million people surviving with less than US $1.9 per day and living in conditions of extreme poverty. Trade could fall by 13% and emerging and developing economies will contract by 2.5%. However, advanced economies will suffer the most marked effects. The Director of the World Bank, Ayhan Kose has explained the gravity of the crisis: "The recession unleashed by the widening of COVID-19is singular from many points of view. Advanced economies will face a situation similar to that they experienced after the Second World War and, for the first time, developing countries will have to address the effects of economic contraction. However, estimates may even plummet further if the pandemic lasts longer than is expected. Taking into account the current easing in containment measures, global growth is forecast at 4.2% in 2021. However, if lockdowns were to be reintroduced, the GDP could fall by as much as 8% and any recovery in 2021 would barely exceed 1%."

The scenario described by the World Bank is even grimmer than the forecasts published in the World Economic Outlook by the International Monetary Fund (IMF) in April. "The Great Lockdown" Report estimates that the 2020 global recession will cause the global GDP to contract by 3%. Indeed, the report emphasizes that the crisis cannot be averted, not even with the significant fiscal and monetary measures implemented by governments and central banks to support enterprise assets and family income over the short-term. In greater detail, the IMF estimates that the Eurozone will suffer a 7.5% slump with a 7% recession for Germany and 9.1% for Italy. In the United Kingdom, there will be a 6.7% recession, but with the danger of the impending Brexit negotiations that may further damage the economy. The situation is extremely bleak in the United States, where the unemployment rate has increased by 1% in March, climbing to 4.4%. The forecast for the United States GDP indicates a 6% decrease. China, on the other hand, is forecasted to increase its GDP by 1.2% and avert the crisis. Estimates for Japan indicate a 5.5% fall, also caused by the delay of the 2020 Tokyo Olympics, which have been postponed to 2021, when the GDP should increase by 2.8%.

> **"In any given country, the possibility of an economic recovery in 2021 will depend on the state of the pandemic, the structure of its economy, and the ability to implement stabilization and growth policies."**

International Economy: Growth Rates (select countries)

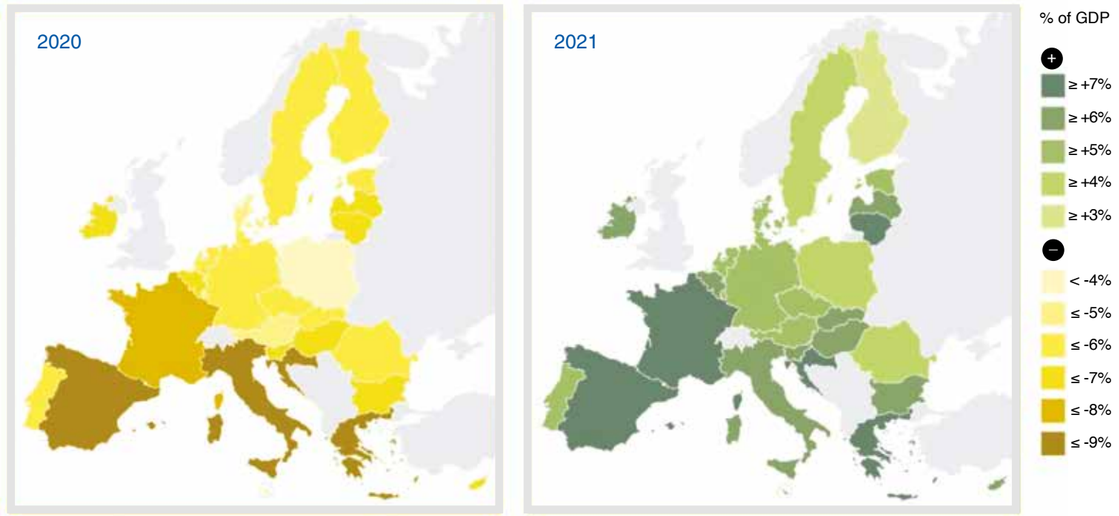
Variation of true GDP compared to previous year



Source: International Monetary Fund, World Economic Outlook (April 2020).

On May 6, 2020, the European Commission published its economic forecast for Spring 2020 with the expected results and projections for the first semester of the year. Interestingly, the document describes the shock to the EU economy as "symmetrical" as the pandemic affected every member state. This forecast contraction agrees with the estimates of the IMF study: 7.5% in 2020 and a growth of 6% in 2021, while the figures for 2020 production will vary in each member state (from -4.24% in Poland to -9.75% in Greece). The economic recovery of each country in 2021 will depend on the national state of the pandemic, on its economic structure and the ability of each individual state to implement stabilization policies.

Growth map



Source: European Economic Forecast, Spring 2020.

A Different Crisis, A Multidimensional Crisis

While the current crisis is surely not the first to have sent the global economy into disarray, it is certainly a peculiar one. In her analysis, Ouhab-Alathamneh Nassima, Professor of Economics at the University of Paris-Nanterre, explains that there are differences: "Previous financial crises were systemic and largely caused by the monetary system, starting with the 1929 crisis when thousands of stockholders lost their money due to a great economic depression, followed by a brutal deflation and a general collapse in production, while the 1987 stock exchange crisis and the 2008 subprime crisis had limited effects on the global economy. Previous crises were limited to the financial system, but the current health crisis is characterized by a vast array of dimensions that involves all sectors of the economy. The COVID-19 pandemic has crushed the world with a multi-dimensional crisis that is social, economic and geopolitical."

Therefore, this is a total crisis that has economically affected all sectors related to non-essential goods as described in the GlobalData Executive Briefing. While the automotive industry has registered a loss of over US $100 billion only in North America and Europe, forecasts for the construction sector indicate a global contraction of 1.4% in 2020 - a net change compared to the pre-COVID-19 forecast of +3,1%. The impact on retail sales is described as devastating with an increase in on-line purchases during the lockdown period. The crisis has also heavily affected the fashion industry with the cancellation of orders following the closing of shops.

The travel and tourism sector will fare even worse. During the period prior to the pandemic, it had reached a 10% share of global economic activity, totaling US $8.8 trillion. The collapse of the sector will impact many countries, especially the main international tourist destinations (including Italy where tourism accounts for 13% of the GDP). In 2018, the United Nations World Tourism Organization recorded a 6% increase in global vacationers, for a total of 1.4 billion travelers. This growth was generated especially by emerging markets – China and India – both in terms of outgoing and incoming tourism. The decrease in airplane travel has led to a loss of US $113 billion and, according to the World Travel & Tourism Council (WTTC), 50 million individuals employed in this sector are at risk of unemployment, including ca. 30 million people in Asia.

Thus, the decrease of the global GDP for 2020 could be further affected by the fall in commercial, productive, financial and investment activities amongst countries. Foreign trade, which currently registers -13%, has not only been damaged by the restriction in the mobility of people, goods and services, but also by the new economic tensions between the United States and China and the overall geo-economic uncertainty. The forecast for 2021 only points to a partial recovery that will be slowed down by a weak global demand and interruptions in the global chain of value.

This negative outlook, however, does not prevent optimism. Some of the lessons that we have learned from the Coronavirus experience address the management of human resources and, in particular, the massive implementation of agile work. "The changes that were forced upon us by this crisis," explains Francesco Starace, Enel CEO and General Manager, "may turn out to represent an opportunity. We currently have 37,000 workers - half of our employees - working from home, and the majority of them will continue to do so until the end of the year. We have identified many unnecessary processes that can be streamlined. And it's also an opportunity to change at the national level, to overcome bureaucracy in companies and administrative processes. The future must still be made, and this change can drive productivity, whilst improving our quality of life."

The Double Oil Emergency

One of the sectors hit hardest by the crisis has been the Oil & Gas Sector, which has suffered not only on account of the pandemic emergency, but also due to the new "oil war." On the one hand, the fall in the price of oil has been caused by a 30% contraction in global demand (especially from China that alone accounts for 10% of global oil imports). According to the International Energy Agency, global oil demand has fallen to 90,000 barrels per day since the beginning of the crisis. On the other hand, the excessive supply of oil on global markets is leading to a competition amongst the main oil exporters like Saudi Arabia and Russia. The problem arose at the OPEC Plus Meeting held on March 6, 2020, to decide on global production cuts for ca. 1.5 million barrels per day. The Russian refusal to accept the reduction in production quotas drove Saudi Arabia to acquire greater market quotas, increase production, and sell its oil at a significant discount. The dynamics arising from this competition led the price of the oil to fall to an average price of US $30 per barrel and discounts even lower than US $20.

In fact, the Saudi strategy was not only directed against Russia, but also against companies treating American shale, as the sale of this product (which started in 2014) revolutionized the hydrocarbon market and, in general, global geopolitical energy resources. Sales of shale stabilized the long-period price of oil to US $40-$60 per barrel (against the US $100 it cost in the previous period).

On April 12, at another OPEC Plus Meeting, producing countries agreed on a historical cut: 9.7 million barrels per day, ca. 10% of global production. These new production quotas will be valid for two years, starting on May 1, with decreasing reduction rates. During the first two months, cuts will total the announced 9.7 million barrels per day. Subsequently, the cuts will be reduced to 7.6 million barrels per day for the rest of 2020 and 5.6 million barrels until April 2022. Oil market estimates hypothesize a slow return to an average price of US $30 per barrel in 2020 and to US $45 in 2021.

Emissions Falling, Renewables on the Rise

The massive global reduction in the demand for energy during the health emergency has had an unprecedented impact on the entire sector. According to forecasts by the Global Energy Review in 2020, the global demand for energy will fall by 6%, seven times the reduction caused by the financial crisis of 2008. The most surprising data concerns global CO_2 emissions, which will decrease by nearly 8%, reaching their lowest level since 2010. This is the greatest reduction in emissions ever recorded, six times larger than the previous – 400 million tons in 2009 – also caused by a global financial crisis.

In terms of global electricity consumption, IEA estimates that 2020 will mark the greatest decrease since the Great Depression of 1929, with an average decrease of 5% and by as much as 10% in some countries. However, this will not affect the primacy of low CO_2-emission technology; as a matter of fact, it will further strengthen it. Since overtaking coal in 2019, this type of technology represents the main source of electric energy on the planet and will account for 40% of this year's global production, 6% more than coal.

The increase in electricity produced from renewable sources and the reduction in overall demand have negatively influenced the demand for electricity produced from coal and natural gasses. In fact, the combined gas and coal quota in the energy mix will decrease by 3 percentage points in 2020, returning to pre-2001 levels. The forecast is even more critical if coal and gas are analyzed separately. The global demand for coal should decrease by 8% to the historical minimum it recorded during the second world war; while the demand for gas, after 10 years of uninterrupted growth, will decrease by 5% in 2020.

Therefore, renewables will be the only source of energy to increase in 2020 with a quota of global production that is expected to rise thanks to their priority access to networks and low operative costs. Notwithstanding the interruptions experienced by the supply chain, the production of energy from renewables will increase by 5%. In other words, governments must now implement policies and investments that will address the global energy system towards a sustainable future. Indeed, as indicated by Fatih Birol, Executive Director of the International Energy Agency: "This crisis has revealed the profound dependence of modern society on reliable electricity sources to power health systems, enterprise and the basic infrastructure of daily life. However, no one should take all of this for granted. We require greater investments and intelligent policy to keep our supply of electricity safe."

In this context – and with the goal of carefully analyzing some of the critical issues generated by the economic and health emergency – CESI has developed a study that reveals how the effect of the pandemic on energy systems has provided us with a glimpse of the future. In the "Top Stories" (on Page 14), we will use the CESI analysis to discuss what – before the COVID-19 Pandemic – was considered the probable scenario for 2026. Indeed, together with other international studies, this research provides fundamental indications for the development of the sector over the coming decade.

Top Stories

Greater Stability Requires Greater Flexibility

In order to better understand the critical issues caused by the COVID-19 pandemic, CESI has developed a scenario analysis that reveals how the lockdown provided a vivid insight into the future of the power system, revealing fundamental indications on how to effectively develop the system in the coming decade.

"The COVID-19 lockdown and the current economic crisis are the greatest shock experienced by the global energy system in recent decades." The conclusions presented in the International Energy Agency's "Global Energy Review," which has analyzed data from the first 100 days of 2020, are very clear. "The sharp fall in the demand for all main fuels has been disconcerting," explains **Fatih Birol**, IEA Executive Director, "but especially so for coal, oil, and gas. Only renewables have held strong." In fact, during the first trimester of 2020, the global demand for energy decreased by 3.8% as compared to the same period of 2019. The most affected energy sources were fossil fuels: coal (-8%), oil (-5%), and gas (-2%), while the consumption of renewables increased globally (+1.5%). Exploiting its flexibility and increasing the quota of green energy, the system was able to contain the shock wave produced by a completely unexpected event. Now, however, experts continentwide look ahead and ponder the uncertain future. Given the instability of the current outlook, is it not time to cash in on the lessons learned from this experience and rely even more markedly on renewables? Is it not time to enact energy and (technological and infrastructural) investment policies that aim to achieve the objectives set for 2030 in terms of decarbonization, renewables and energetic efficiency? Indeed, the true question is: while this time the system resisted, how can we prepare for the future and ensure that everything is ready, rather than having to react to the consequences of future emergencies?

If we look at consumption levels during the lockdown months – when on any working day in March/April demand was similar to that of a pre-crisis Sunday – it is easy to grasp how this upheaval has noticeably changed our habits and the way in which we use electricity. The government-decreed lockdown – and Italy was the first to stop nearly all industrial and service activities – led to a sharp decrease in the demand for electricity. Compared to the same period in 2019, Germany, France and Spain registered a 7.17% reduction in the use of electricity. In Italy, demand fell by 25% over the previous year (or 23% if we compare it to the average of the past five years), a European record. "The global demand will decrease by 5% by the end of 2020," according to the IEA, a figure that correctly captures the greatest reduction since the Great Depression of the 1930s. Advanced economies will suffer the greatest decrease in demand: 9% in the United States

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and 11% in the European Union. Moreover, a further certainty is that every month of global inactivity (at the levels recorded at the beginning of April) will reduce the yearly energy demand by ca. 1.5%.

A Preview of the Consequences

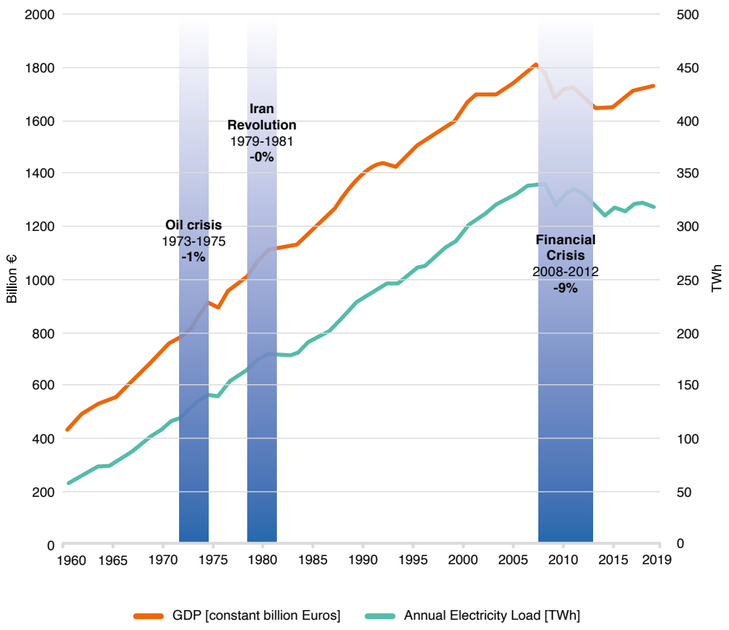
The 2020 crisis is unlike any other we have experienced. Together with the health emergency, the lockdown brought down entire industrial sectors. In Italy alone, the International Monetary Fund has forecasted a 9.1% reduction in the GDP, while the European Commission has estimated an even direr -11.2%. The price of electricity underwent marked reductions on the European energy market, as low demand, the high production of renewables and the fall in the price of fossil fuels dragged cost down significantly.

In order to better understand the critical issues caused by the COVID-19 emergency, CESI has prepared a complex analysis, a study that reveals how the pandemic lockdown actually opened up a new window onto the future. "What we have before us is a forecast of what, before COVID-19, had been proposed as a possible scenario for 2026," explains **Matteo Codazzi**, CEO CESI, commenting on the study.

If we are correctly following the roadmap for decarbonizing the production of electric energy, as indicated in the European agreement and the New Integrated National Plan for Energy and Climate (INPEC) published in January 2020 by the Ministry of Economic Development, "it's as if, in just a few weeks, someone had pushed the calendar forward and outlined a reference framework that would normally have required five years of policy, investments, and operative measures to enact," added Mr. Codazzi.

Examining the impact of the pandemic on the energy system, the CESI report highlights fundamental indications for the development of the sector over the coming decade. As the CEO points out: "focusing on Europe, and especially on Italy, our research reveals the unique nature of this crisis compared to the three previous post-war emergencies: the two oil crises (1973/1979) and the financial crisis of 2008. Although all of these crises have common features (fall in GDP, stagnation and collapse in demand for electricity),

Trend of Italian National Electricity Demand and GDP between 1946 and 2019



they were all the result of clear decisions and, therefore, potentially manageable by governments." Now, the picture is completely different. As we await the development of efficient therapies and vaccines, rather than "acting," politics has been forced to "react" by imposing restrictive measures, the ones that led to such significant consequences for many economies. Thus, the CESI analysis is significant in order to understand what could take place over the next five years in terms of the penetration rate of renewables: 44% in 2020 over 30% during the same period in 2019. Using the lockdown data to extrapolate what may

> **"Focusing on Europe, and especially on Italy, our research reveals the unique nature of this crisis compared to the three previous post-war emergencies."**

happen over the entire year, the study presents a forecast for 2026 and previews the consequences of the implementation of the flexibility measures necessary to manage a system heavily based on renewables for the Italian electric system.

Codazzi also points out that "over the past months, in order to balance the national energy system and guarantee its stability, there has been a drastic reduction in the capacity to import from abroad. This had led to a collapse of imports and market fragmentation. **Net Transfer Capacity** (NTC) has been reduced from 7-8 GW to less than 3 GW. Based on CESI simulations, a greater flexibility of the electricity system, which had already been hypothesized by the roadmap for 2030, would have avoided such a reduction in NTC.

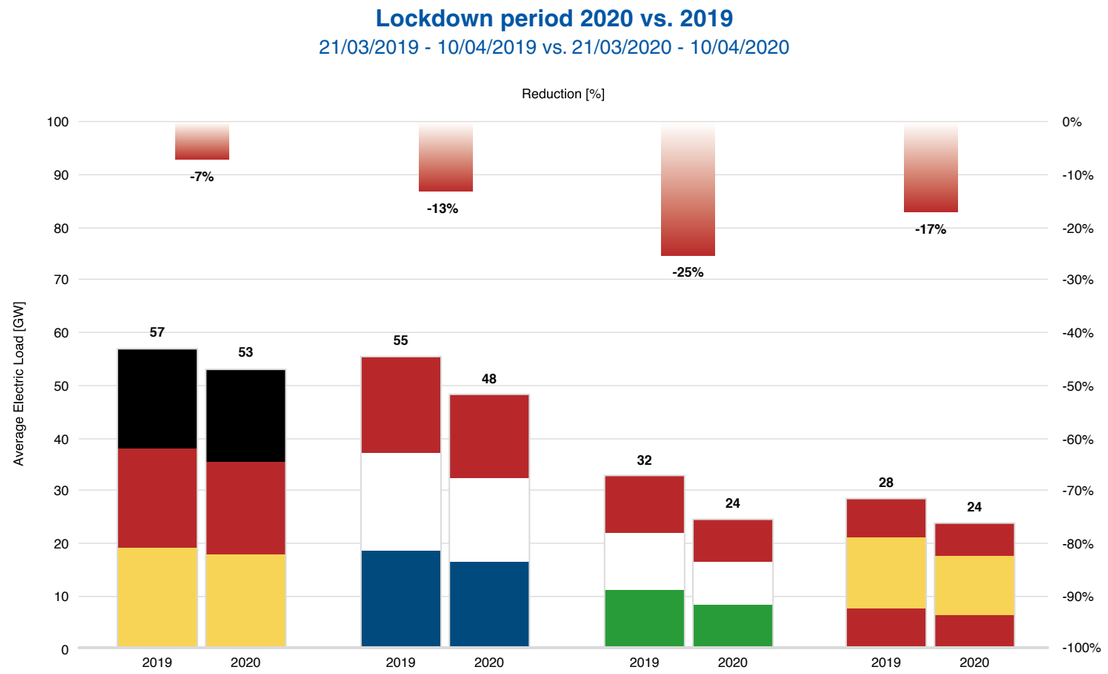
In greater detail, a series of investments to accelerate the use of batteries, hydroelectric pumping and turbogas – as well as to develop plants and interconnection infrastructure – would provide a significant boost to flexibility and system security. Moreover, it would also provide a great opportunity for economic recovery, both for the entire system and for employment levels."

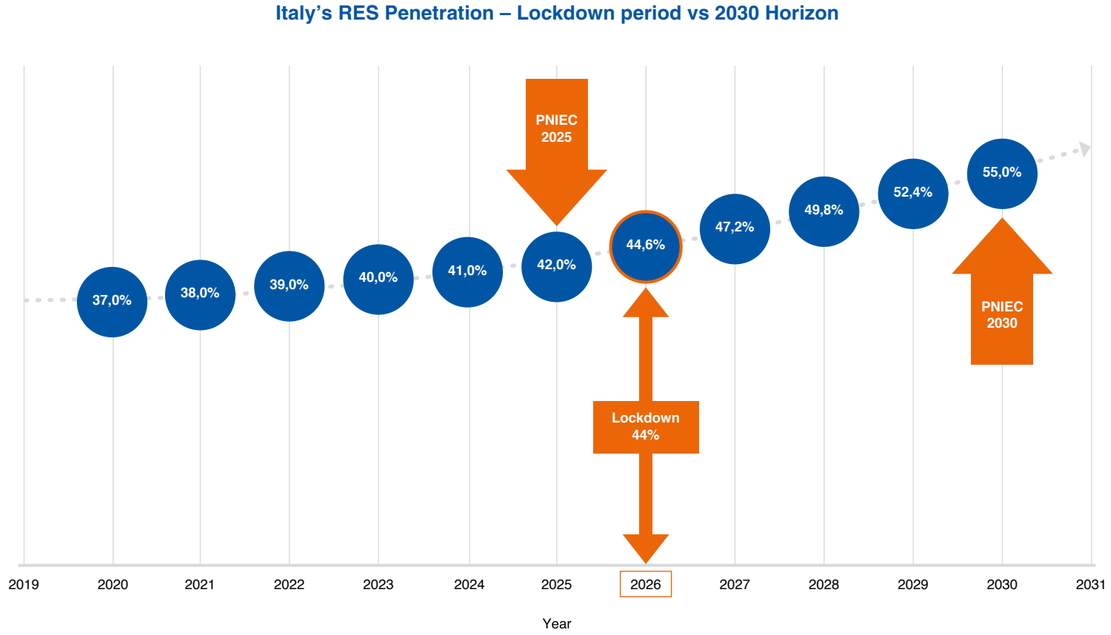
A Green New Deal

At the global level, the **International Energy Agency** has a similar vision of sustainable recovery. One of the possible scenarios forecast by the IEA is a "Planetary Green New Deal" to drive public and private investments in sustainability and buttress economic recovery. According to the IEA, the significant energetic transition towards new models – characterized by renewables, distributed generation and a reduction in energetic intensity – would not only provide certain returns on investment, but also allow a significant step forward in contrasting climate change and introducing a scenario of sustainable development for the new generations.

The "**Special Report on Sustainable Recovery**" presented by IEA in June (2020) is an analysis conducted in collaboration with the International Monetary Fund that contains a series of aimed investments and policy action to be implemented over 2021-23 in six key sectors: electricity, transport, industry, construction, fuel, and emerging low carbon-emission technology. These are measures that could stimulate global growth, on average, by as much as 1.1% a year, safeguard and create no less than nine million jobs annually and reduce the global emission of greenhouse gasses (related to energy) by ca. 4.5 billion tons by 2023. Analysts from the International Energy Agency recommend the following actions:

- Accelerate the development of low-carbon power generation sources, like wind and solar energy, together with the expansion and modernization of the electric grid;
- Improve the efficiency of equipment used in the manufacturing, food and textile industries;
- Promote innovation in key technological sectors (hydrogen, batteries, carbon capture, and storage).





Note: RES penetration is the ratio between yearly energy production from RES and yearly energy demand

A Starting Block for a Cleaner Future

The current crisis may be interpreted as a unique opportunity to make the energy sector more sustainable. Compared to the 2008-09 crisis, the cost of the technology necessary to exploit renewables – such as wind and photovoltaic energy – is much lower, while emerging technology – such as batteries and hydrogen – are ready to blossom. Moreover, global CO_2 emissions were stable in 2019, but they should fall sharply in 2020, as a result of the economic impact of the lockdown. In fact, IEA analysts believe that the reduction in CO_2 levels could represent a starting block for the structural reduction of emissions. "Our report," explains **Fatih Birol**, "shows that cleaner, fairer and safer energy can be achieved in the future. The sustainable recovery plan would make 2019 the peak year for global emissions and bring us closer to the achievement of long-term climate objectives."

Also, in June 2020, analysts at **Goldman Sachs** confirmed that investments in renewables will represent 25% of the total energy expenditure in 2021, and, for the first time ever, renewables will overtake the sales of traditional fossil fuels such as oil and gas. According to the study, green technology will play a prominent role in the future economic recovery with a potential attraction of US $1-2000 billion in green investments and the creation of 15-20 million new jobs, globally.

> "It is necessary to invest on the digitalization of energy, control tools and data monitoring."

Investment and Policies

What is the outlook in Italy? Should we review our national energy plan, or should we look at new ways of implementing it? Following the Coronavirus emergency, the **CESI analysis identifies a number of possibilities**: an accelerated roadmap to make the electric system more flexible and guarantee a greater integration amongst renewable sources. As the energy sector can merge public and private investments to develop new infrastructure and green electricity plants, it is now time to **activate testing and joint monitoring** on distributed generation, storage, energetic efficiency, and electric mobility. This would provide greater impetus to the development of so-called "energy communities," both for residential and industrial/commercial use.

In order to make demand generation and aggregation assets more efficient, it is necessary to invest on the **digitalization** of energy, control tools and data monitoring. Furthermore, it is necessary to modify **legislation** to provide the transition process with rapid and streamlined authorization procedures; uniform, simplified national regulations; and the adoption of simple and flexible support tools. The Italian Government has included a chapter on green actions (as part of the INPEC) in the so-called "Semplificazioni" Decree addressing fast-track action, simplified procedures and a special commission to evaluate environmental impact. In the coming months, we will understand how all of this will be transformed into an effective recovery for the energy system, which, as mentioned at the beginning, has suffered the greatest shock in decades.

Future & Technology

A Sustainable Tomorrow

What impact has the COVID-19 crisis had on technology for the energy transition? Forecasts by experts indicate that photovoltaic energy and electric cars are on track, but new strategies and investments are focusing on hydrogen and big data management.

The Italian energy system was not disrupted by the pandemic. It continued to ensure a steady supply of energy across all sectors (from gas to fossil fuels and electricity). Technology played a prominent role in this performance, thanks to previous investments and a vision of the future that continues to support the world of research, testing, and innovation in general.

In recent months, there has been a lot of talk about technology and the future worldwide in terms both of digitalization (how smart working has rapidly reorganized daily work in companies) and of the factors driving the energy transition and circular economy, which encourages the attention of companies that are increasingly focused on the United Nations' Sustainable Development Goals (SDGs).

Sustainable Technology

The energy system is keenly interested in the development and the cost of leading clean energy technology, even with respect to the 2008-2009 crisis. In terms of generation, greater competition and lower costs help **investments in wind and solar photovoltaic energy**, as well as in emerging technologies such as batteries and hydrogen. According to Enrico Giovannini, spokesperson of the Alliance for Sustainable Development and a member of the recovery taskforce, the role of Europe is fundamental: "The European Union is keeping attention high on the Green Deal and digitalization. If we look at expert analyses, the damage suffered by fossil fuels will have permanent consequences."

Nonetheless, as the COVID-19 crisis could slow down progress towards clean energy, **urgent and ambitious governmental action is necessary** to achieve the sustainability goals. Every year, the International Energy Agency (IEA) produces a study to investigate whether the global energy mix is compatible with the Sustainable Development Scenario and the climate objectives set in 2015 by the Paris Agreement. The objective is to reduce pollution and keep the average temperature increase under 2 degrees Celsius. In ***Tracking Clean Energy Progress***, published in June 2020, the IEA monitored 46 technologies in various sectors, ranging from the production of electricity to transport, as well as industry, construction, fuel supply and the energy integration of renewables.

Following the progress registered in 2019 and the recent impact of the lockdown, according to the IEA's "Tracking Clean Energy Progress," only six technologies are effectively on track for the energy transition: photovoltaic (which increased global electricity production by 22% in 2019 or +131 TWh) and bioenergy power generation, electric cars and trains, LED lighting, data centers, and data transmission networks. Nuclear energy, carbon capture, and use and storage (CCUS) from fossil fuel are not on track, together with "complex" renewables such as concentrating solar power and ocean power. Hydropower and wind power are partially on track but require greater investments to proceed towards decarbonization. "This is not the moment to take our foot off the accelerator," explains **IEA Executive Director Fatih Birol**. "Our recent discoveries reveal the urgency with which governments must promote the full development of these technologies that can create employment, stimulate economic growth and help us to accelerate the transition towards cleaner energy systems."

> **The European Union is keeping attention high on the Green Deal and digitalization.**

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Promoting Research

Global low-carbon-emission energy technology represents ca. 80% of total public expenditure in research and development in the energy sector, which increased by 3% in 2019 to US$30 billion. Given the shared advantages associated with the development of new technology for clean energy, research and development are often conducted at an international level. This has positive repercussions on the quality of innovation and the diffusion of knowledge, especially for emerging markets. However, the overall percentage of the GDP dedicated to R&D in the energy sector has remained constant over the past decade, whereas other public research sectors, such as health and defense, have received nearly five times more funding than the energy sector.

A survey conducted in mid- 2020 by the **Smith School of Enterprise and the Environment** at Oxford University (*"Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?"*) has certified the consensus on clean energy technology. Analyzing the various expense options, over 200 managers at the Ministry of Finance and the Central Bank, as well as economists from 53 other G20 countries, indicate that the priority is to invest in "**Clean Energy Research & Development**" and "**Clean Energy Infrastructure**," due to the positive impact provided by the shift to more sustainable energy systems and of long-term economic multipliers.

Big Data and Digitalization

In terms of digitalization and the Internet of Things, the energy industry clearly understands that "data" is the new oil. In the future – and more than ever after the COVID-19 crisis – **the competitive advantage of enterprises will depend on their ability to manage data and algorithms**, which will allow them to operate more efficiently in the global energy ecosystem. Alec Ross, technology expert, Professor at Columbia University and Former White House Senior Advisor on Innovation, believes that as machine automation and big data expands, the global economy will undergo a revolution driven by artificial intelligence. The enormous learning potential of these devices will have "effects on the work force as significant as the previous agricultural, industrial, and digital revolutions."

Analyzing the case of German utility E.ON, an INSEAD study describes the implications of artificial intelligence for a company in the energy sector in terms of value, outlook, barriers, and challenges; a key role will be played by **data evangelism** and educational events to promote digital culture in organizations.

EPCM contractors are especially interested in the energy sector as the digitalization of processes and the Internet of Things are key tools for production control, work safety, and the transportation of materials. Tracking and logistic monitoring, just like the development of new products, are fundamental activities to make the entire cycle of development and construction of a power station, refinery or power transmission plant more efficient and productive. A simple example is that of wireless digital systems that allow the elimination of kilometers of cables and wires both on construction sites and along networks (with a consequent enormous reduction in material costs and necessary time).

The development of big data, and real-time analyses that help to make the decisions necessary to run projects, **has transformed project management and consolidated new professional figures** such as that of the IT Scientist (who analyzes and reprocesses elements). Thanks to new custom-tailored apps and digital dashboards, process engineering now knows where (and when) specific items are located. Thus, a foundation project manager is able to consult a smartphone graphic interface and ascertain real-time information that, in the pre-digital era, often took two weeks to obtain.

> "A key role will be played by data evangelism and educational events to promote digital culture in organizations."

Smart Working and Safety

The enterprises that were already steadily promoting digital culture were the first to adopt and implement smart working - without affecting production processes - during the lockdown. Following the guidelines provided by the World Health Organization (WHO), from the end of February 2020, **CESI shared and implemented a series of measures** to promote the health and safety of all its clients and partners (smart working, personal protection devices for all lab personnel, social distancing, temperature readings) in Milan, as well as in our labs in Arnhem, Berlin, Mannheim, Chalfont, and Prague.

Multinational Enel has confirmed that it will continue to recommend that its personnel work from home at least until Christmas. Moreover, it will provide on-line courses and coaching to further stimulate digital literacy. "The two months of lockdown have driven us collectively into an extraordinary digital future," confirms Enel CEO Francesco Starace. The crisis has allowed many companies in the energy sector, In Italy and around the world, **to comprehend the value and potential of smart working**, which has often been viewed merely as a back-up solution. Those who had a solution in place before the problem arose have proven that resilience will make all the difference in our short-term and longer-term future.

The Potential of Hydrogen

In line with the Green Deal, at the beginning of July 2020, the **European Commission** unveiled its plans for launching the energy system of the future and for clean hydrogen. "The planned investments," the Commission explained in a note, "have the potential to stimulate post-Coronavirus economic recovery, create new employment and strengthen our leadership and competitiveness in strategic industries." The Commission also presented the **European Clean Hydrogen Alliance** with sector leaders, civil society, national and regional ministers, and the European Investment Bank. The alliance will represent "a tool to invest in large scale production and promote the demand for clean hydrogen in the EU, based on the principles of cooperation, inclusion and transparency."

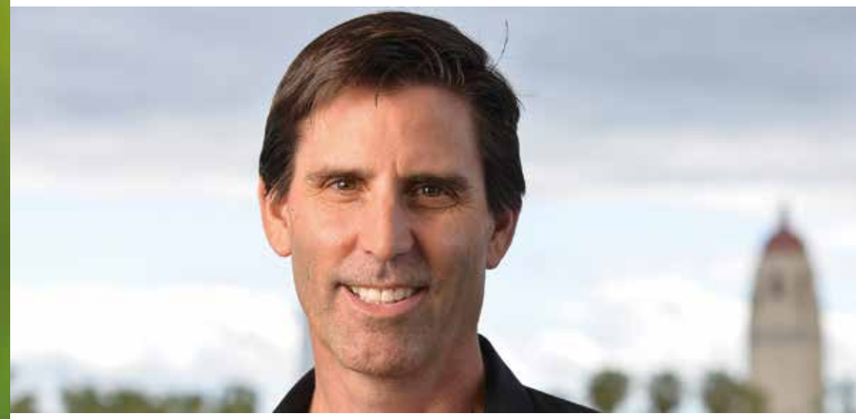
> **CESI shared and implemented a series of measures to promote the health and safety of all its clients and partners in Milan, as well as in our labs in Arnhem, Berlin, Mannheim, Chalfont, and Prague.**

According to the **Guidehouse** study prepared for the European **Gas for Climate** Consortium, if a 10% quota of renewable gasses (biomethane and hydrogen) is injected into European networks, along with the increase in electricity produced from renewables, the EU will be able to achieve climate neutrality by 2050, decreasing CO_2 emissions by 55% by 2030. Market forecasts confirm the vast potential of hydrogen for Italy too. A **McKinsey** study claims that hydrogen could satisfy nearly one-fourth of the Italian demand for energy by 2050 with marked demand segments in transport, heating, and industrial applications. With an eye to the markets in the United States, Chile, and Spain, **Enel is ready to launch a new green hydrogen business** in 2021 and become a zero-emission energy producer by 2050. The Group will install electrolyzers in its solar and wind farms to produce hydrogen for energy storage or for sale to industrial clients implementing decarbonization processes.

Opinions

How to React to the Pandemic Crisis?

In order to better understand the impact of COVID-19 on energy systems and to identify proposals and solutions for recovery, we have asked three representatives from different sectors for their opinions. Here are the interviews with Mark Jacobson (Professor of Civil and Environmental Engineering at Stanford University), Jean-Marie Dauger (Chairman of the World Energy Council) and Francesco Starace (CEO and General Manager of Enel).



Mark Jacobson

Director of the Atmosphere/Energy Program and Professor of Civil and Environmental Engineering at Stanford University. He is also a Senior Fellow of the Woods Institute for the Environment and Senior Fellow of the Precourt Institute for Energy.

1 ***The restriction imposed by COVID-19 has caused a decrease in energy demand. How do you think the market will react in the near future? In the post-emergency phase, what could the sector look like?***

The demand reduction has resulted in a greater decrease in fossil fuel use than renewable energy use. I think this will also translate into a greater increase in renewable energy use relative to fossil fuel use post-emergency.

2 ***The post lockdown debate concerns measures that can stimulate recovery and favor economic development. To exit the crisis, from many quarters comes the indication to focus and invest in renewables. What is your opinion on this?***

I think it is necessary to increase renewable spending to speed a transition away from fossil fuels. A recovery focused on spending on renewables will not only accomplish this goal but will also revitalize the economy.

3 ***A recent analysis by CESI shows the need to implement, even more quickly, the imperative flexibility measures in managing a system with high penetration of renewables, especially from a COVID and post COVID-19 perspective. In your opinion, what are the most urgent investment to be made in the electricity sectors?***

We should invest in batteries and other electricity storage option together with wind, water, and solar (WWS) generation technologies. In addition, by electrifying building water and air heating with heat pumps; by electrifying transportation; and by electrifying industrial heat, we can make it easier to match electricity demand with electricity supply due to the flexibility of heating and transportation, so we should invest in these transitions as well.

Jean-Marie Dauger

Chairman of the World Energy Council. Dauger has served several positions within Gaz de France, including Chief Operating Officer, and since the merger of Gaz de France and Suez, with GDF SUEZ, then ENGIE, as Former Senior Executive Vice President in charge of the Global Gas & LNG Business Line, one of the five business lines of the ENGIE Group.

1 *The restriction imposed by COVID-19 has caused a decrease in energy demand. How do you think the market will react in the near future? In the post-emergency phase, what could the sector look like?*

Incertitude is still high on the way to return to "normality" and even more so that it may differ substantially from one region to another. The WEC is presently exploring, with the community of its members, various possible scenarios that will be completed in the course of the next weeks to come. Of course, economic and the sanitary situations will be key. The drop of GDP, because of the COVID-19, has been second to none in the recent history (and thus its consequence on the level and the structure of the energy demand) and the virus is still active in some regions as second waves of the pandemic cannot be excluded. Public interventions will be crucial for economy (and social impact) and it may take a long time before a vaccine is made available (if ever) at a large scale. In this context a clear majority of our WEC members (more than 3000 members in 90 countries) share the opinion that recovery will take a long time, namely more than a year and possibly much more. On the short term, two items will focus attention: resilience and digitalization. 1) Resilience of the energy systems will be reassessed in respect both of the impact of large pandemic (in general major disruptions) and of the excessive dependence on some elements of supply chains. Responses will take time to be implemented but a reduction of the global interdependence by production relocation for some value chains will gradually be favored. 2) Most of the energy companies also indicate that acceleration of the digitalization of their systems will be one of their priorities in the next future.

But more fundamentally, the COVID-19 may reinforce trends that were already dictating evolutions referred to as the Energy Transition. Thus, the questions are a) will the COVID-19 accelerate the Energy Transition and b) what opportunities does it open for post-COVID energy policies? It is largely accepted that, post COVID, there will be no return to the former normality but to a "new normality". This new normality will be characterized by more focus to resilience, more digital and electrified energy systems, stronger push towards decarbonized society et energy usages, emergence of less centralized organization as well as consumer centric-systems, and even a noticeable change of consumption and life style. There are some good reasons to think that the COVID crisis may be an accelerator of the transition in particular because of public opinion inclination and because of growing intervention of governments (see the European Green Deal, indication by some governments that financial public support will prioritize project favoring emission neutrality, …).

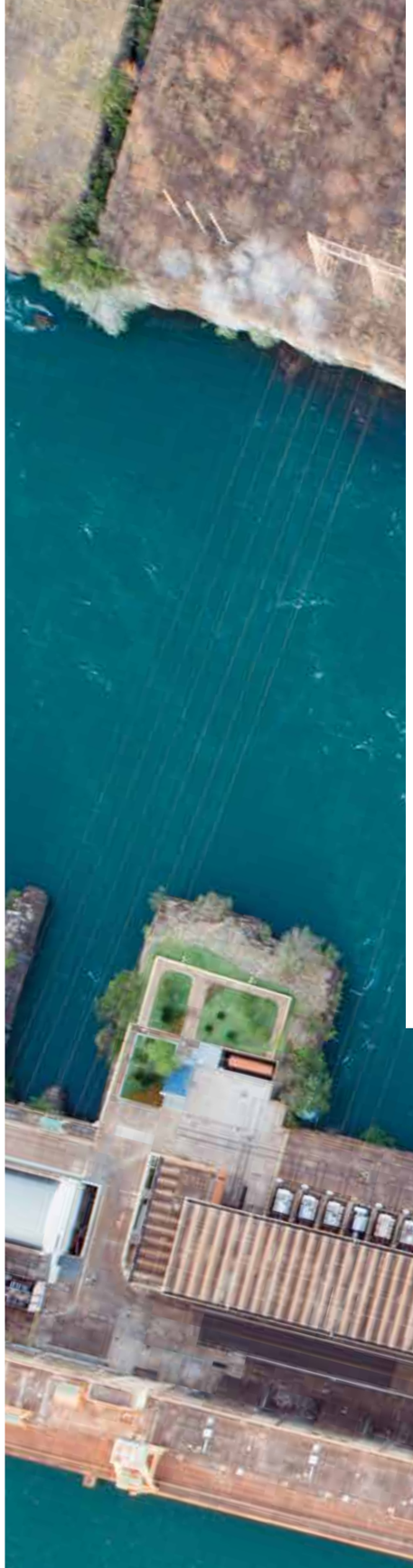
However, important conditions need to be met for this to happen, in particular:

a) Before the pandemic, volumes of estimated investments needed to meet the future energy demand were extremely high (in excess of 700 billion USD per year only for electricity generation). Acceleration of the energy transition will increase that number substantially. Will the energy companies (and the national budgets) be able to finance such efforts is far from being granted as many incumbents have been severely impacted by the pandemic episode? Incidentally, it could be anticipated that this situation results in several corporate restructuration and reorganization within the energy sector.

b) Given the level of uncertainty on many of the issues regarding the future energy picture (technology, pace of change, social acceptability, …) regional and global cooperation would be highly desirable to reduce the risks and share the financial burden of the transition. Whether conditions for such cooperation can be met in a period where fragmentation of the international relations and the level of conflictuality (trade war between China and US, political instability, emergence of new actors, dramatic impact of economic drop on the developing countries, immigration…) seem to increase.

c) And finally, as WEC COVID-19 last scenarios show, the human quality of the ambition and trust will be a determining factor for investor, governments, and increasingly other stakeholders to rethink resilience, enable sustained behavioral changes and move away from quick win agenda to a structural analysis and cooperation shaping the energy agenda for the future.

As a neutral and engaged platform, WEC is committed to bring its contribution to make this transition possible for the benefit of all.



2 *The post lockdown debate concerns measures that can stimulate recovery and favor economic development. To exit the crisis, from many quarters comes the indicaton to focus and invest in renewables. What is your opinion on this?*

COVID-19 or not, the world seems not to be on the trajectory set by the Paris agreement and in most of the reasonable scenarios the Paris objectives appeared difficult to reach at least in the expected timing. It was also clear that the substitution of coal and oil for power generation by renewable or nuclear sources would not even be sufficient in the long term and that, in any case there is limitation into the electrification of the global mix as well as to renewable as a single option. Investment in renewable therefore need to be boosted significantly especially given the level stated in the last two years. For that reason, support by public policies are largely welcome particularly to those of the non- fossil fuels which have reached or are close to reach economic competitivity. How to implement such support policies have to be decided on the basis of local contexts but social and societal dimension of one instrument or another must be carefully scrutinized to ensure social and local acceptability.

At the same time, it must be reminded that a one-sided solution is a risky one. It is why even if most of the power generation can be decarbonized, if the peak oil will probably be reached in the course of the next decade, it is also clear that the role of hydrocarbon (oil and natural gas) will be maintain at a very high level still for the many years to come.

As a consequence, it is also of the upmost importance that investment is maintained at the necessary level to produce such oil and gas as needed but even more to favor all the ways to "decarbonize" the oil and gas usages (carbon capture and storage, improve efficiency, net zero emission process, ….). In a word, there is not one given solution but a mix of solutions that needs to be put in place with a systemic and realistic vision.

3 *A recent analysis by CESI shows the need to implement, even more quickly, the imperative flexibility measures in managing a system with high penetration of renewables, especially from a COVID and post COVID-19 perspective. In your opinion, what are the most urgent investment to be made in the electricity sectors?*

More generally there are some important clarifications to be made to identify the future outlook of the energy picture. I mentioned earlier the necessity to further explore the ways to "decarbonize" the utilization of oil and gas. For the expansion of electrification as well as of the share of renewable into the power production the most critical bottleneck is the development of adequate technology for the storage of energy. In addition, as the share of renewable increases, as the emergence of decentralized power production grows and as the role of customers (or "prosumers") become a reality, there will be a need for an adaptation of networks regulations as well as adaptation of the networks (transmission as well as distribution) operation (further digitalization, new commercial instruments, …). The role of hydrogen should also be clarified for the future given its potential role in sector that are not easy to decarbonize including but not limited to the mobility one. In the above topics, there is room for public policies to favor R&D and support investments. I cannot but conclude by reminding that a very significant part of the world population (more than a billion) has not yet access to a modern source of energy. There are solutions and opportunity to bring to those populations solution adapted at their need under the form of clean and sustainable energy form. It should be also a priority for the investments to be directed towards them since it is not likely that an energy transition that would not moderate or remove the inequality it may create can be a successful one.

Francesco Starace

Francesco Starace CEO and General Manager of Enel since May 2014, has a degree in Nuclear Engineering from the Polytechnic University of Milan. Mr Starace joined the Enel Group in 2000, holding several top executive positions including Head of Business Power and Managing Director of the Market Division. From 2008 to 2014 he served as CEO and General Manager of Enel Green Power, the Group's renewable power generation subsidiary and a leading player in the global renewables industry.
Before working in Enel Mr. Starace began his career in construction management of power generation plants, first with the General Electric Group, then at ABB Group, and subsequently at Alstom Power Corporation where he was Head of Gas Turbine Sales Worldwide.

1 ***Pandemic-related restrictions imposed by many governments worldwide have determined a fall in the demand for energy. Once the economic recovery will kick in, do you believe energy demand will restore to pre-COVID levels? In other words, which permanent changes in the way we consume and generate energy will the pandemic leave to the world?***

The power sector was affected both in terms of overall demand and of consumption patterns, in particular in those countries where restrictive measures were implemented more decisively. According to the International Energy Agency (IEA), in Italy and Spain the reduction peaked at around -28% and -24% respectively. However, the reduction in electricity demand by the industrial, service and commercial sectors was partially offset by an increase in residential demand: people were forced to stay home, undertaking additional activities such as teleworking.

In the last week of March and first week of April, residential demand went up 40% across certain European economies compared to the same weeks in 2019. In late April, when confinement measures were eased in Italy and Germany, electricity demand showed the first signs of recovery. This trend was confirmed in May, as more countries, including Spain, softened lockdown measures. Nevertheless, in June electricity demand in most countries was still 10% below the pre-COVID period and, in Italy and Spain, the change was up to around -15%.

For 2020, the expected reduction of global energy demand stands at more than 5% compared to last year. In the European Union (EU), the estimated reduction is expected to be around 10%, almost double the decline seen during the 2008-09 financial crisis. However, not all energy sources are going to be affected in the same way: fossil fuels were more impacted than renewables. In Europe, coal-based production was 25% down during the first quarter of 2020, and renewables have taken the reins of power generation reaching a share of 43% throughout the period. Global CO_2 emissions are expected to decline by 8%, or almost 2.6 Gigatonnes (Gt), to levels last seen 10 years ago. Such a year-on-year reduction would be the largest ever, six times larger than the previous reduction record of 0.4 Gt in 2009 – caused by the global financial crisis – and twice as large as the combined total of all previous reductions since the end of World War II. To avoid past mistakes, in which the rebound in emissions was larger than the decline, investments to relaunch the economy must be directed to clean and more resilient energy infrastructure.

The impact of the pandemic is acting as an extraordinary accelerator of trends that we already knew were taking place, such as digitalization and the progressive replacement of fossil fuels with renewable sources in power generation. The energy system has once more proved to be fundamental for our economy and society, thus it is paramount to define and then implement a post-COVID recovery plan that ensures a sustainable and resilient electricity infrastructure, building upon the results already achieved so far by the energy transition.

2 ***Policy makers around the globe are debating how best to stimulate recovery and spur economic development again. Given Enel's global reach, what suggestions do you have for policy makers across the world?***

Looking at Europe, even before the COVID-19 health crisis – which is now increasingly an economic and social one - the European Commission identified the Green Deal (which also includes the Just Transition) and digitalization as the main levers for economic and industrial growth in Europe. As stated by the Executive Vice President of the European Commission, Frans Timmermans, we should not get out of this crisis by rebuilding the world we had before, as we did back in 2008, and then be concerned about how to change it, but rather get out of this crisis by using the opportunity that renewables and the green economy give us to restart the investment cycle on the right foot, with the right set of tools. Thus, the EU Green Deal, together with the recently agreed Next Generation EU, are key to rebooting our economies, fostering sustainability, circularity, competitiveness and social inclusion.

In this perspective, the Spanish Government, by Royal Decree Law 23/2020, has adopted regulatory measures to relaunch the economy by boosting the energy transition process. This framework is aimed at massively promoting and optimizing renewable energy deployment, increasing network investments, simplifying and accelerating the electrification of mobility as well as encouraging the installation of storage and the development of new technologies.

Looking at the other side of the Atlantic, for the first time in 134 years the United States consumed more renewables than coal and head to 50% share by 2030. According to the Energy Information Administration (EIA), 2019 marked the year when wind generation surpassed hydro for the first time, becoming the biggest source of renewable generation in the US. As solar output is accelerating, together with wind generation, they will soon exceed nuclear and eventually also natural gas. What is noteworthy is the speed of the transition over the past ten years and – even more important – the decade to come. Being sustainable, as demonstrated by the COVID-19 outbreak, is the best and only way for a company to create stable long-term shared value. Companies that adopt sustainable business models, such as Enel, are inherently more resilient to shocks and thus less risky. This is a key success factor that investors have long been aware of and which has finally been understood by many governments too.

Despite a clear growth trajectory, sustainable finance still does not direct the needed capital towards sustainable investments, which are required to achieve the United Nations Sustainable Development Goals by 2030. In order to encourage this, extra support is needed from Institutions. To avoid market failure, for example, the Next Generation EU should be deployed as a form of incentive (e.g. tax deductibility treatment of the financial expenses associated with the sustainable instruments, interest subsidies on the sustainable financial instruments…) to support corporates to raise capital that can be invested in sustainable assets. This can accelerate the deployment of corporate capital towards taxonomy-aligned investments, contributing to the EU sustainable objectives and generating enormous leverage on the deployed private capital.

3 ***A recent study by CESI, based on the analysis of power market reactions to the pandemic, shows how urgent it is to increase power system flexibility --if we want to ensure a sustainable energy future based on high penetration of renewables. In your opinion, what are the priorities in terms of investments and technologies in order to improve the system's flexibility?***

An increasing share of renewables in the energy mix is at the same time an inevitable and desirable consequence of the evolution of the energy sector.

In 2019 renewables accounted for 72% of all new capacity additions worldwide. Thanks to progress in materials science and digitalization, economies of scale, increasingly competitive supply chains as well as growing developer experience, renewables have become cost-competitive compared to fossil fuel technologies almost everywhere across the world.

Stimulus packages that are currently being debated and launched in various geographies around the world would give countries a unique opportunity to prepare the world's electricity infrastructure for a future that will require digital and resilient grids and greater sources of flexibility to accommodate an increasing share of renewables.

Batteries and Vehicle-to-Grid (V2G) represent technologies that simultaneously offer flexibility to the system and new opportunities for consumers (with V2G, consumers can monetize the energy storage capacity of their cars' batteries, storing energy from the system when in excess and injecting it back - or not consuming it - when the system needs).

When it comes to decarbonizing hard-to-abate sectors – such as heavy industries, long-haul road transport, aviation, and shipping – hydrogen produced via electrolyzers powered by 100% renewable electricity will play a key role as the most cost-effective and sustainable solution. The domestic production of green hydrogen has the potential to create a new value chain, bringing value and jobs in the coming years, and can effectively improve security of hydrogen supplies. Nevertheless, we must avoid building new dedicated pipelines to import hydrogen from abroad, minimizing the distance between the production areas and the consumption sites.

Industries & Countries

Reactions across the Five Continents

From European projects for green technology to Indian investments in hybrid plants, from Japan quitting coal to China subsidizing electric vehicles, here is a brief panorama of the countermeasures adopted by different countries for their energy systems. Italy is reaping the rewards of its investments in resilience, sustainability and efficiency.

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It is too early to foresee the long-term effects of this crisis on global energy systems. The low cost of oil has modified equilibria and rules, and not just for energy players and transition programs. Notwithstanding the unprecedented effect on international scenarios – and independently from possible economic recessions, banking crises or financial system alterations – the impact of the Coronavirus crisis has highlighted, more than ever before, the need for reliable energy and workers specialized in process digitalization.

Behind every health system, there is an energy system (and a team of system engineers and operators) that works incessantly to keep electricity flowing, homes at the right temperature and refrigerators working. "While courageous health workers and researchers worldwide work around the clock to cure the infected and develop a vaccine," explains Angela Wilkinson, Secretary General and CEO, World Energy Council, "we do not always remember those who work behind the scenes to provide electricity to millions of offices, workplaces, schools and households. And to guarantee clean, cheap and reliable energy, especially to millions of individuals who have difficulty accessing it."

According to many observers, this crisis represents a global stress test for the future of humanity. While many expect that the worst is yet to come, the energy sector has reacted by focusing on system balance and recovering from critical issues. Forecasts indicate that the pandemic will block the demand for oil and gas for a prolonged period and accelerate the global transition

towards green energy and fuels. In parallel, the electric sector will concentrate greater investments on digitalization with a special focus on resilience and cybersecurity.

United States

In March 2020, the American Wind Energy Association (AWEA) declared that interruptions and delays caused by the diffusion of COVID-19 could put ca. 35,000 jobs at risk, as well as investments for US$43 billion. In fact, wind and solar energy companies have asked the United States Congress to define a series of incentives to provide economic support to the sector and keep the financial flow open.

At the same time – as reported by the *Il Sole24Ore* Italian finance daily - Donald Trump dreamt of imposing American energetic dominance on the world. However, the shale gas industry is now in crisis and suffering just like the competition. The export of liquified natural gas has fallen by a third compared to before the COVID crisis. Oil supplies are decreasing, and imports have risen sharply to the levels of the mid-nineties. The Coronavirus has upset market equilibria and could force the United States to abandon its dream of world energetic dominance.

Moreover, in mid-June, renewables generated more energy than coal in the United States (a historical milestone: the consumption of coal has decreased by 15% and renewables have increased by 1%). According to forecasts by the US Energy Information Administration (EIA), renewables will soon lead to the demise of coal, notwithstanding the fact that this industry is still staunchly backed by President Trump.

In the meantime, presumptive Democratic presidential nominee Joe Biden has presented a green energy and climate plan that calls for US$2 trillion (US$2000 billion) in investments. In order to achieve a zero-emission electricity mix by 2035, a neutral standard will be defined in terms of utility and network operator technology. This will open up the playing field not only to renewables, but also to nuclear energy and – at least in theory – fossil fuels, such as gas and coal, as long plants are equipped with carbon capture systems. Biden has also announced measures for upgrading the energetic efficiency of over 4 million buildings (with a priority for schools, hospitals and other public real estate), the installation of at least 500,000 charging stations for electric vehicles, the renovation of public transport and rail services, and the creation of a million new jobs in the American automotive industry, with a particular focus on electric vehicles.

> **In July 2020, Enel Green Power began the construction of its first hybrid project (solar + storage) in North America.**

Last, but not least, in July 2020, **Enel Green Power** began the construction of its first hybrid project (solar + storage) in North America. Lily, as it's called, will integrate renewable energy plants with utility-scale battery storage. Over the next two years, Enel also plans to install a total of ca. 1 GW battery storage in existing and new wind and solar projects.

Australia

At the beginning of July, Sydney achieved a futuristic objective: the entire city is powered by 100% renewable energy generated by wind and solar farms. Every facility and activity that requires electricity in the metropolis – buildings, lighting, sports arenas, warehouses, pools and public buildings – will be powered by 100% locally-produced renewable energy. In greater detail, about 75% of this electricity is produced by exploiting wind energy, while the remaining 25% is produced from solar energy. Over the next ten years, Sydney will not only increase regional employment, but also save up to half a million dollars and reduce carbon emissions by 20,000 tons – the power normally consumed by 6000 average families.

Japan

Following the shutdown of most nuclear reactors (after the Fukushima disaster), the Japanese government has been heavily criticized by companies and NGOs for the country's continued dependence on fossil fuels. Indeed, Japan has been the only G7 member to launch plans for new carbon-powered electric plants, a technology that is responsible for the majority of greenhouse emissions causing global warming. Japanese banks are amongst the few major investors still driving this sector which represents 32% of the country's energetic mix. However, following the COVID-19 emergency, there are signals that the country is ready to stop this trend and promote new governmental and financial policies to limit the use of coal as a primary source

of energy. In April, acting upon investor insistence, a large global investment company headquartered in Ōtemachi (the Mizuho Financial Group) decided to pursue a more ambitious climate policy, interrupting financing and loans related to the development of new coal-powered electricity plants by 2050. Moreover, at the beginning of July 2020, the Japanese Ministry of Industry confirmed that the government has labelled 114 out of 140 coal-powered electricity plants – those built before the mid-nineties - as inefficient and that these plants will gradually be dismantled (along with other strict measures) in order to reduce emissions by 2030.

China

In China, the Coronavirus crisis has reduced the demand for NEVs (Neighborhood Electric Vehicles), decreasing their sales by 50% compared to the previous year. In April 2020, in order to reduce pollution and achieve a global leadership in the green automotive sector, the Chinese government had announced an extension to 2022 on subsidies for the purchase of non-polluting cars. NEVs, which include hybrid plug-ins and hydrogen fuel cell vehicles, were forecast to reach 20% of car sales by 2025 (from the current 5%).

However, due to the pandemic, by the end of June, the Chinese government was forced to review its green mobility objectives, reclassifying hybrid gas-electric vehicles and making it easier for automotive producers to satisfy environmental requirements. Based on the new regulations, hybrid gas-electric vehicles will now have preferential treatment over fully gas- or diesel-powered vehicles, but also over electric vehicles which are still more expensive.

In general, also due to the deterioration of relations with the United States, China is preoccupied about its energetic security and the reliability of its supplies. The COVID-19 crisis has further highlighted the bottlenecks in the national infrastructure affecting the transportation and storage of electric energy. Thus, at least in the short-term – without diluting its commitment to renewables (hydroelectric, nuclear, wind and solar energy) – the country will aim to electrify cities with investments in clean coal plants and network infrastructure. In this period of marked uncertainty, the objective is to guarantee system stability, avoiding the critical issues caused by China's dependence on gas and oil imports.

India

During the initial part of the lockdown (in March 2020), the Indian government authorized the renewable energy sector to remain operative, excluding it from the initial measures passed to block national activities. Fundamentally, clean energy plants were treated as an "essential service." The issue, however, is that, at the national level, India is still dependent on coal, notwithstanding the competitiveness achieved by photovoltaic energy. The Solar Energy Corporation of India (SECI), a company owned by the Ministry of New and Renewable Energy, announced a call for the development of hybrid plants capable of producing 5 GW of new energy capacity. While 51% of the energy will have to be produced from renewable sources, the remaining 49% will be produced by thermoelectric power plants. This decision to invest in the hybrid production of electricity is due to the insufficient flexibility of the Indian system. The objective of SECI is to reduce the issue of intermittency on the national electric infrastructure.

In June 2020, Prime Minister Narendra Modi confirmed his new pro-coal strategy by aiming – to ensure economic security, employment and energetic self-sufficiency – on this fossil fuel and opening up to private investors. A government call will assign

> **The Solar Energy Corporation of India announced a call for the development of hybrid plants capable of producing 5 GW of new energy capacity.**

extraction licenses to private companies for the development of 41 new coal mines that will have an estimated productive capacity of 225 million tons per year. Thus, after decades of stalemate, the Indian coal sector has been revived by the pandemic that is direly trying the country's economic resources. This strategy has been criticized not only on account of its social and environmental consequences, but also because of the gradual fall in the national coal demand due to the competitiveness of renewables.

Africa

The observers at the World Energy Council point out that "every vaccine needs a fridge and every fridge needs electricity." Today, over 600 million Africans do not even have the most basic access to electricity. And millions of others lack cooking

facilities or adequate bathrooms. In fact, this is the cause of the high death rate, especially amongst women and children. Over the next 30 years, another billion Africans will need clean, cheap and reliable energy in order to survive. The current crisis has shed light on this vast part of humanity that still does not have access to quality energy and faces a perilous journey to achieve the energy transition.

The impact of the pandemic on energy systems provides Africa with the opportunity to diversify its energy mix and separate economic growth from CO_2 emissions. It must accelerate the adoption of clean hybrid energy and green, as well as the development of devices for energy storage, in order to ensure greater flexibility with which to counter the fluctuations in the demand and supply of energy. The decreased cost of wind and solar energy provides an economic solution to energetic poverty, while off-grid systems can provide access to energy in areas that are not reached by national networks.

Naturally, renewables alone cannot be the solution to Africa's human development and energy access issues. The continent is blessed with abundant energy resources (oil and gas, uranium, biomasses and unexploited hydropower) and will have to responsibly develop its zero-emission energy services – including hydrogen – to achieve sustainable development, industrialization and prosperity.

The pandemic has shed light on the need to collaborate globally in order to manage the crisis. Indeed, this has been confirmed by the new directorship at the World Energy Council that is committed to "humanizing" the energy transition. United Nations Deputy Secretary General Amina J. Mohammed has launched a message of hope: "We must have faith that the pandemic is only a partial eclipse, and that Africa's sun will shine again—because of the continent's youth, innovation and genuine partnerships to recover better."

Europe

In July 2020, **Euroconsulting**, a consultancy specialized in monitoring EU regulations, described the current energy system as "still based on parallel and vertical energy value chains that rigidly interconnect specific energy sources to specific final use sectors. This compartmentalized model is not functional to the development of a neutral climate economy. It is technically and economically inefficient and provokes considerable loss through waste heat and low energetic efficiency."

Moreover, in July, the **European Commission** adopted a series of strategies for the integration of the energy system that will "pave the road to a more efficient and interconnected energy system, guided by the twofold objective of a cleaner planet and a stronger economy." The integration strategy, which leads to a decarbonization of the European economy in line with Next Generation EU and the **European Green Deal**, is based on a circular energy system, on an increase in renewables and electricity in sectors that have traditionally turned to fossil fuels (construction, industry and transport), and the promotion of renewable and low carbon emissions fuels (green hydrogen, biomasses, sustainable biofuels).

In general, according to a recent survey by the **World Energy Council**, the post-pandemic period will witness a reduction in productivity, demand, and cashflow with changes to electricity demand models (increase in residential use, decrease in industrial use, and lower daily peaks) and an acceleration towards digital solutions and system resilience (such as storage technology for electric systems).

In **Italy**, the energy system was able to benefit from the investments made over the past twenty years in resilience, sustainability, and efficiency, as well as investments in the development of new interconnections across the Alps and the Mediterranean basin. New renewable generation, efficient and flexible natural gas, digitalization of critical national infrastructure, and energy-related cybersecurity strategies have allowed Italy to face the COVID-19 crisis efficiently, providing a continuous supply of energy to both essential and non-essential infrastructure. And the same may be said about the sudden acceleration of digital services (from smart working to the remote management of systems and infrastructure). The shock wave was amply absorbed by support networks and did not stress the system. Governmental action is concentrating on the three deeply interconnected strategic axes: storage, demand response, and fair access to electricity markets. Storage remains the strategic asset to develop and to make the national energy system both safer and more sustainable. There are various types of technology that will compete in the short-term, including: hydroelectric pumping, electrochemical systems, including aggregates of electric vehicles, and hydrogen produced from renewable sources.

Germany is headed forward on a double track. On the one hand, it has planned the gradual termination of the era of fossil fuels (coal will be abandoned by 2038, nuclear by 2022). In July 2020, the Bundestag approved a bill to regulate the coal phase-out with a €50 billion fund to support mine and electric plant operators in the transition towards green energy sources. On the other hand, there is a consolidation of German investments in hydrogen as a carbon neutral strategy. By 2030, ca. 1100 kilometers of existing natural gas pipelines will be converted and adapted to use with hydrogen. Moreover, 100 kilometers of new pipelines will be installed for a total cost of €660 million. This network will interconnect 31 hydrogen production projects with consumers in the most populous German states: North Rhine-Westphalia and Lower Saxony.

A vision for the future is also provided by Ernst and Young, which at the beginning of September 2020 published a report entitled "**A Green COVID-19 Recovery and Resilience Plan for Europe**." The report identifies over 1000 green projects that could rapidly start in Europe thanks to the Recovery Fund for the Green Deal. Amongst the ca. 100 Italian projects, there is the **Enel Green Power** "3SUN Gigafactory: An Italian Sustainable Gigafactory for PV Modules" Project, which addresses an investment of €400 million for the development of a factory that should increase EGP 3SUN production to over 3 GW/year from the current 200 MW/year.

One on One

Formulas for Economic Recovery

Comparing estimates: economists and sector operators point to possible scenarios for economic recovery and the future of the energy system.

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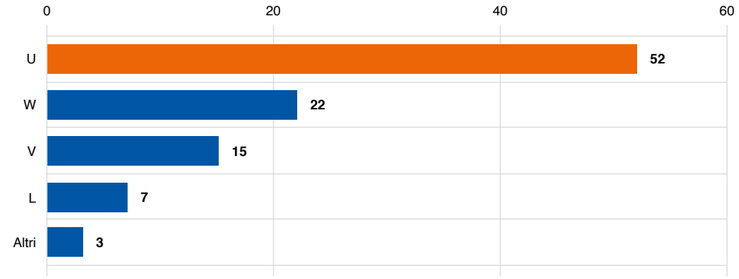
Forecasts for the post-COVID-19 economic recovery include a range of different scenarios. Some posit an optimistic V-curve, while more pessimistic forecasters suggest a U-curve as they do not believe that monetary policy is sufficient to stabilize the financial system. A V-curve would imply limited economic damage: temporary unemployment and an accumulation of savings that would allow for a swift recovery of consumption, while a longer crisis (U-curve) would have significant and long-lasting effects on employment.

According to the **Bank of America Corporation** (BofA), only 15% of global managers believes in an immediate V-curve recovery. In fact, 52% of market operators expects a longer and more complex U-curve, with an adjustment period, as part of a recession, before the economy returns to growth.

However, there actually are two further possible scenarios. There is a W-curve, championed by 22% of the experts who foresee two marked crises, each followed by a recovery (or in this case, a relapse), while the most pessimistic forecast – an L-curve – is only championed by 7% of the experts. In the latter case, a significant crisis would be followed by a long recession without any possibility of short-term recovery.

What Will the Recovery Look Like?

A U-curve Recovery is expected to follow the recession



Source: BofA Global Fund Manager Survey.

IEA: Economic Recovery Opportunities for the EU

Fatih Birol, Executive Director of the International Energy Agency, addressed the issue of recovery opportunities for the European energy sector at the presentation of the *European Union 2020 - Energy Policy Review*. According to the IEA, the European Union must grasp the opportunity to accelerate the energy transition during the post-pandemic recovery by making the most of the European Green Deal tool and, in particular, the economic recovery package and the additional €750 billion provided through the *Next Generation EU-Recovery Fund*, which were proposed at the end of May 2020 by the Commission in Brussels. This would allow the EU to implement the decarbonization planned for 2030 and 2050.

The IEA indicates six key points: renovating the sector by launching large-scale programs, streamlining bureaucratic barriers hindering the development of new projects and concentrating investments in technologically-advanced infrastructure and industry; reviewing energy policy and guaranteeing procurement, sustainability, competitivity and economic feasibility for the implementation of the model presented by PNIEC; promoting the integration of policy in all end user sectors (efficiency, FER, internal market, and CO_2 pricing), incentivizing digitalization and electrification processes; adjusting energy taxation to climactic and atmospheric pollution objectives. Moreover, the IEA underlines the fundamental need for new technology in order to implement climate neutrality by 2050, along with a constant monitoring of energetic security.

> **Renewables will clearly play a fundamental role in the energy markets of the future.**

IRENA Investments for Recovery

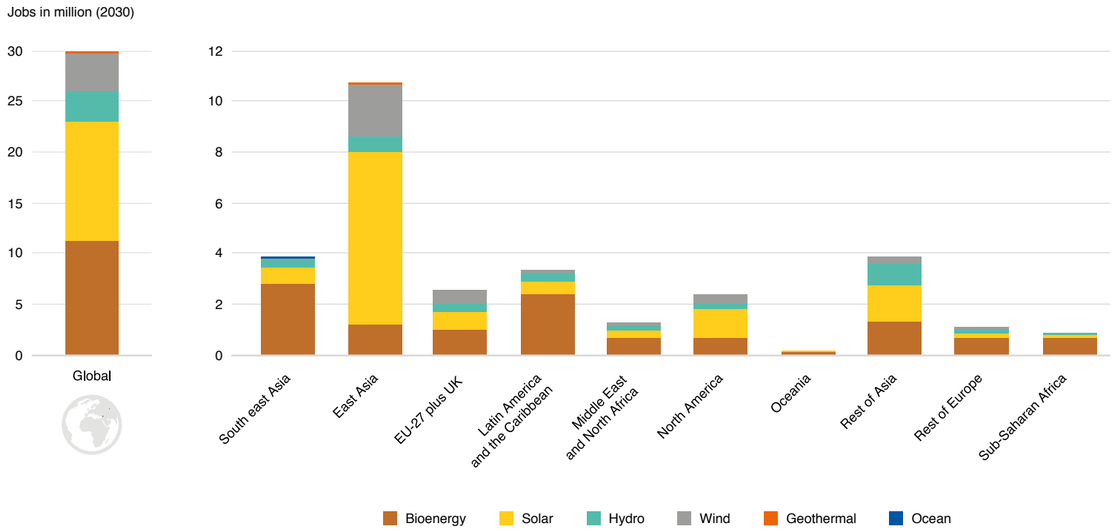
In order to find solutions to the crisis, on June 24, the **International Renewable Energy Agency** (IRENA) published the "Post-COVID Recovery: An Agenda for Resilience, Development and Equality" Report.

The plan outlined by IRENA includes the opportunity to address national economic stimuli, which every country is implementing to react to the Coronavirus crisis, towards decarbonization and energy transformation processes.

The study provides a detailed roadmap for 2021-23 with an outlook towards the end of the decade in 2030.

According to IRENA, increasing public and private spending in energy by as much as US $4.5 trillion per year could lead to a 1.3% global economic growth and create 19 million additional jobs related to the energy transition by 2030. Looking at renewables, jobs could triple, reaching 30 million by 2030. In fact, every million dollars invested in green resources generates three times more employment than investment in fossil fuels.

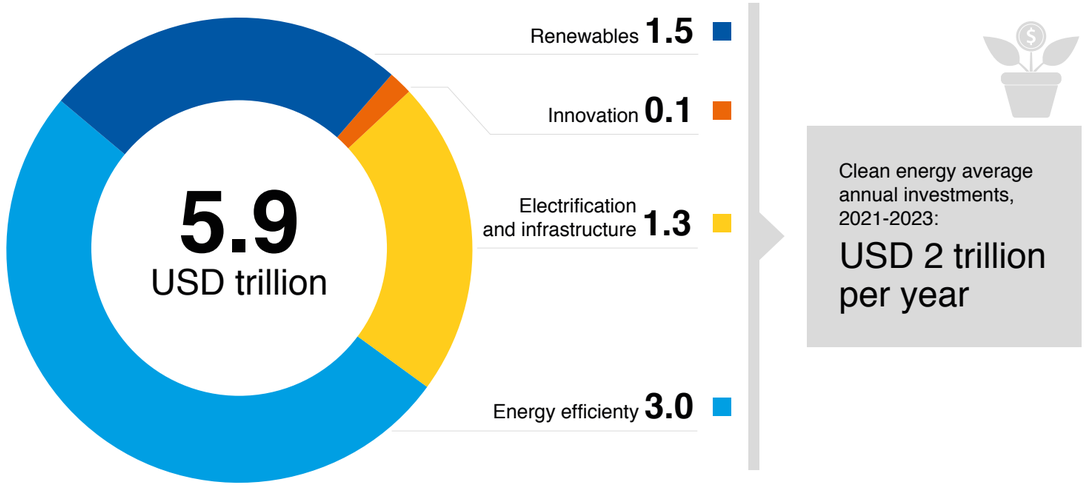
Renewable energy jobs in 2030 under the Transforming Energy Scenario, globally, by region, and by technology



Source: Irena (updated June 24).

Energy transition investment under IRENA Transforming Energy Scenario, 2021-2023

Cumulative clean energy investments between 2021 and 2023 in the Transforming Energy Scenario (USD2019 trillion)



Based in IRENA (2020), Global Renewables Outlook: Energy Transformation 2050.

According to IRENA forecasts, doubling annual investments in the energy transition – nearly US $2 trillion per year for the next three years – would provide a significant impetus to the recovery of the energy sector, accounting for 1% of the global GDP and 5.5 million new jobs (related to the transition) over three years.

This sum could include private sector investments (up to three quarters) and be raised for a series of priority measures to be implemented immediately: pricing review, fewer resources for the fossil fuels sector and development of new green funding to invest strategically in the energy transition.

As part of its long-term strategy, IRENA is looking at innovative solutions and emerging technology (including green hydrogen), which, according to IRENA, could guarantee a marked growth for governments and enterprise over the long-term. Renewables will clearly play a fundamental role in the energy markets of the future, along with support from transition-related sectors such as energy storage, batteries, green heating and cooling systems and energetic efficiency.

News & Events

Upcoming Energy Events

Power Week Africa

September 14-18, 2020

Johannesburg

https://www.power-week.com/africa/

The annual international summit, which is dedicated to the African electricity and energy industry, includes conferences, seminars and multiple case studies dedicated to market outlooks in the African continent. Participants include the major representatives of ministries and financial trusts, national electric companies, renewables companies and investors.

Solarpower Summit 2020

September 28 - October 2, 2020

On-line event

https://w.tame.events/e/147626163

At the first virtual edition of SolarPower Summit 2020, the main event organized by Solar Power Europa, interactive sessions will allow participants to join in conversations with experts, connect with other participants before and after events and conduct on-line networking. The summit will address the main developments related to strategy, policy and markets that model the future of solar power in Europe, concentrating on the contribution of solar power to a fully decarbonized economy on the continent.

Italian Energy Summit

September 29-30, 2020

On-line event

https://virtualevent.ilsole24ore.com/italian-energy-summit/

The twentieth edition of the Italian Energy Summit will focus on the impact of the recent pandemic on the energy sector. It will review trends, future outlooks and the evolution of the energy sector as a driver for economic recovery, whilst respecting all objectives and challenges in terms of environmental sustainability and green energy.

Energy Transition Virtual Forum

October 13, 2020

On-line event

https://informaconnect.com/energy-transition-world-forum/

As part of Flame, the main European conference on the global gas industry, the event aims to identify the technology and business models that are most economically sustainable to achieve the 2030 and 2050 climate objectives. The on-line forum will bring together the main parties interested in decarbonization of industry, transport and the related energy system.

AEE World 2020

November 30, 2020

On-line event

https://world.aeecenter.org/

The event organized by the Association of Energy Engineers (AEE), which brings together over 18,000 professionals from 105 countries, aims to promote actions for sustainable development related to energy engineering, energy management, renewables and alternative energy sources, energy production and energy services, including sustainability and all other related areas.

DistribuTECH 21

March 30 – April 1, 2020

Orlando, FL, USA

https://www.distributech.com/

DistribuTECH 21 is the leading annual T&D event that addresses technologies used to move electricity from the power plant through T&D systems to the meter and inside the home. The conference and exhibition, which EnerNex will take part in, offer information, products and services related to electricity delivery automation and control systems, energy efficiency, demand response, renewable energy integration, advanced metering, T&D system operation and reliability, communications technologies, cyber security, water utility technology and more.

Shaping a Better Energy Future

CESI is a world-leading technical consulting and engineering company in the field of technology and innovation for the electric power sector. In particular, through its Division KEMA Labs, CESI is the world leader for the independent Testing, Inspections and Certification activities in the electricity industry. With a legacy of more than 60 years of experience, CESI operates in 40 countries around the world and supports its global clients in meeting the energy transition challenges. CESI also provides civil and environmental engineering services.

The company's key global clients include major utilities, Transmission System Operators (TSOs), Distribution System Operators (DSOs), power generation companies (GenCos), system integrators, financial investors and global electromechanical and electronic manufacturers, as well as governments and regulatory authorities. In addition, CESI works in close cooperation with international financial institutions such as, among others, the World Bank Group, the European Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank, the Asian Development Bank.

CESI is a fully independent joint-stock company headquartered in Milan and with facilities in Arnhem, Berlin, Prague, Mannheim, Dubai, Rio de Janeiro, Santiago de Chile, Knoxville (USA) and Chalfont (USA).

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