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IICEC Energy Market Newsletter January 28, 2021 No:18

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IEA to Produce World's First Comprehensive Roadmap to Net-Zero Emissions by 2050

A growing number of countries, including major economies, are setting ambitious targets to end their contribution to global warming. Progress towards a net-zero emission future certainly requires a mutually agreed road map that cordially brings together the governments, industry, companies, investors, and citizens as well.

International Energy Agency (IEA), the leading global authority in energy and climate, is now preparing the world's first comprehensive roadmap for the energy sector to reach net-zero emissions by 2050. The World's Roadmap to net-zero by 2050 report will set out in detail what is needed from all stakeholders to fully decarbonize the energy sector and put emissions on a pathway in line with limiting the temperature rise within 1.5 °C.

> *Our climate challenge is an energy challenge. To drive the shift from targets to action, the International Energy Agency will in May publish the first comprehensive road map for the entire global energy sector to reach net-zero by 2050. This will set out a detailed analysis of what needs to happen across the global economy to recover from the Covid-19 crisis and put emissions on a path in line with a rise of 1.5°C. The road map to net-zero is vital ahead of the COP26 climate change conference in November when countries will set out their latest plans for cutting emissions.*
>
> **Dr. Fatih Birol's op-ed in Financial Times on January 11, 2020.**

"I am delighted to share that we are going to launch this special report in May to the global energy sector to reach net-zero target at 2020," said Dr. Fatih Birol, IEA's Executive Director, in a press webinar held online on 11 January 2020. "Tremendous amount of work needs to be done to achieve this goal from industry to companies, and governments to citizens," Dr. Birol added. The report will become a part of a series of new IEA projects to support efforts to reach global energy and climate goals.

Dr. Birol underlined the crucial importance of global tracking and accountability required to address climate change in his op-ed, published in Financial Times on January 11, 2020.

Dr. Birol: "National approaches are not enough to achieve the change we need – we must think globally."

IEA's Executive Director stressed the importance of global action emphasizing that the national approaches would not be enough to achieve the global targets. "We must ensure our collective aspirations can be turned into hard reality, because promises, however well-intentioned, can be broken. The U.K. and the Netherlands have set up domestic legal structures to hold governments of today accountable for delivering on their promises for tomorrow. But national approaches are not enough to achieve the change we need — we must think globally. That means better mechanisms to co-ordinate support for emerging and developing economies, so they have rapid access to the know-how, financing and technologies to provide clean and reliable energy for all their citizens." Dr. Birol noted.


Dr. Fatih Birol

2020 is considered to be a milestone in setting climate goals as many of the largest economies and companies have announced that they aim to bring their emissions down to net-zero by the middle of this century or soon after. If the incoming U.S. president Joe Biden follows through on his pledges, countries now accounting for more than 60% of global energy-related carbon emissions will have stated net-zero ambitions, according to Dr. Birol.

Dr. Birol: To ensure IEA leads global clean energy transformation will be my utmost priority

Dr. Fatih Birol also provided an update on the IEA's assessment of global trends and outlined IEA's plans to support international efforts to reach energy and climate goals in the lead-up to COP26. This included new special projects and initiatives, which Dr. Birol announced during the press webinar.

"2021 will be a pivotal year for the world, and this year will mark the milestone for the IEA for a number of reasons. First of all, the main reason why I believe that 2021 will be important for us is that there are significant possibilities that are ahead of us in committing towards achieving net-zero emissions in 2050. Secondly, under the current recovery plans and stimulus packages, clean energy technologies will gain further strengths. Lastly, the COP26 Glasgow summit will bring parties in 2021 to accelerate action towards the goal of Paris Agreement, for which I am very much hopeful that many governments around the world would be willing to commit to work together in the frontline of climate change." remarked the IEA's Executive Director.

"2020 has been a huge shock to the energy market. Energy demand declined by 5%, which was almost seven times bigger than what we experienced back in the 2008-2009 global financial crises. The Covid-19 pandemic in 2020 will undoubtedly leave scars on the energy industry in years to come. For instance, the oil and gas sectors experienced their wildest year in 2020. In April 2020, which I chose to refer as 'Black April', saw a demand decline of 25% for oil. Coal demand declined by 5%, but IEA expects coal demand to bounce back in 2021 due to the increasing demand for power in various parts of the world. In sharp contrast to oil and gas, renewables defeated Covid-19, and they were the only source where we have experienced growth during the pandemic. Both wind and solar share have increased. That was the reason why I called solar as the 'New King'. In 2025, the coal domination in the last five decades will end. In 2020, the world saw a 7% decline in carbon emission, bringing it back to the levels of 10 years ago. But this decline is not a result of implemented concrete policies and advanced technologies. Emissions declined as a result of the economic downturn, pandemic, and some other factors. How to avoid a strong rebound in emissions will be the key priority for 2021." Dr. Birol assessed.

Dr. Fatih Birol also mentioned 2021 projects of the IEA saying that 2021 would be a milestone in IEA's history, and the agency will prioritize five special projects in this pivotal year:

Key priorities and special projects of the IEA for 2021

- Special Report: The World's Roadmap to Net Zero by 2050: To be launched on May 18, 2021
- 2nd IEA Clean Energy Transition Summit: To be organized on March 31, 2021.
- Global Commission: Our Inclusive Energy Future
- Special Report on Financing Clean Energy Transitions in Developing Economies
- Special Report on The Role of Critical Minerals in Clean Energy Transitions

The 2nd IEA Clean Energy Transition Summit is to be co-hosted with the U.K. Government on 31 March 2021 and the summit will focus on how governments can work together more effectively to ensure long-term net-zero targets. Another project is related to gathering a high-level commission, which will be headed by the Denmark Prime Minister, Ms. Mette Frederiksen. The IEA will convene the commission for examining the clean energy transition to make recommendations for governments worldwide. Another report by the IEA will be about how to finance clean energy transition in developing countries. IEA will collaborate with the World Bank and the Global Economic Forum for this special report that will be available in May 2021.

Lastly, IEA will produce a new special report on The Role of Critical Minerals in Clean Energy to ensure that countries and companies are well prepared to accelerate the deployment of new technologies. Dr. Birol emphasized that the clean energy supply relies on some critical minerals and their sufficient supply. In his closing remarks, Dr. Birol said that "Taken together, the projects we are announcing today reflect our commitment to lead the global clean energy transitions at a critical time, and make sure we can address the challenge of climate change with sustainable, resilient and secure energy systems."

Energy Storage Fundamentals are Strong to Support Transition Towards A More Electrified and Distributed Energy Economy

Energy storage represents one of the most critical technologies to enable a more secure and flexible power system while advancing towards decarbonization of the power sector with technology-driven solutions and business models. Currently, energy storage capacity is largely dominated by Pumped Storage Hydro (PSH) technology (Figure 1). However, with cost reductions and continuous performance improvements, battery storage is set to remain the fastest growing technology to support energy transition including electro-mobility pathways and more distributed energy systems accommodating larger volumes of variable supply (wind and solar PV) and demand (such as electric heating, cooling along with vehicle charging).

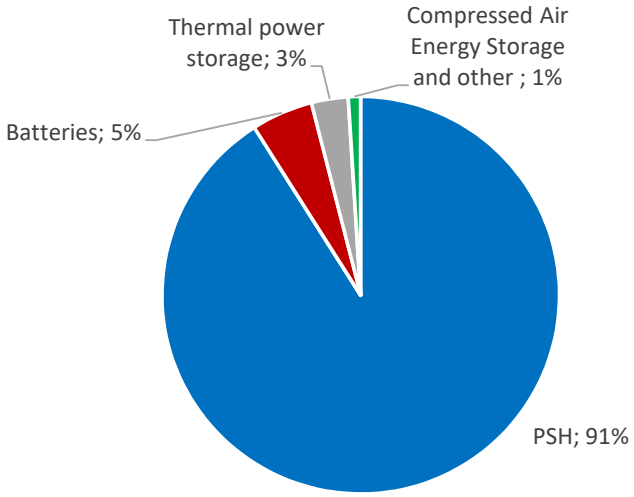


Figure 1: *Breakdown of Installed Energy Storage Capacity (2019, %)*
Source: *Innovation in Batteries and Electricity Storage, IEA, September 2020*

Battery technology is anticipated to become the leading energy storage option in the next two decades. Current annual demand for batteries is estimated at 200 GWh with three-quarters allocated for electrification of transport. The IEA projects under the WEO Sustainable Development Scenario that demand for batteries and other energy storage technologies will reach 10,000 GWh in 2040[1]. On the other hand, the recently launched "Energy Storage Grand Challenge Roadmap" of the US DOE estimates the global demand for energy storage solutions to reach over 2,500 GWh by 2030[2].

Yale Environment 360 informs on major deployment progress in the U.S., California in particular, and other regions including Australia and Europe[3]. U.S. Energy Storage Association reported that battery storage additions doubled in 2020 despite the Covid-19 pandemic. US Department of Energy recently released a storage roadmap[4] to enhance technology efforts and prioritize domestic industry development. Several other countries announced large-scale deployment plans for energy storage as part of wider net-zero emission plans. Canada aims to invest in a 250MW/1000 MWh battery facility within its "National Growth Plan"[5]. According to market data, Australia has developed a battery storage project pipeline of 7 GW[6]. Several battery storage projects are also ongoing in Europe. Spain's "Integrated National Energy and Climate Plan (PNIEC)" targets to deploy 2.5GW utility-scale battery systems[7]. University of Birmingham launched an energy storage roadmap focusing on research and innovation and including recommendations to support the UK Government's "Ten Point Plan for a Green Industrial Revolution" [8].

Li-ion benefits from spill over from auto industry and substantial innovation efforts

Currently, electric mobility applications dominate the battery ecosystem. The market for EV batteries is already ten times larger than for grid-scale batteries. Effects of innovation and cost reductions in e-mobility applications should support wider deployment of battery storage at power grids. At present, 60% of grid-scale batteries consist of Li-ion NMC chemistry which is the emerging technology choice for electric vehicles. The IEA expects that with supply chain and technology advancements towards other blends or chemistries, technologies that may

[1] https://www.iea.org/news/a-rapid-rise-in-battery-innovation-is-playing-a-key-role-in-clean-energy-transitions
[2] Energy Storage Grand Challenge Roadmap, US DOE, December 2020
[3] https://e360.yale.edu/features/in-boost-for-renewables-grid-scale-battery-storage-is-on-the-rise
[4] Energy Storage Grand Challenge Roadmap (ESGCR), US DOE, December 2020
[5] https://www.energy-storage.news/news/canadas-national-growth-plan-could-invest-in-250mw-1000mwh-ontario-battery
[6] https://www.energy-storage.news/news/australian-utility-agl-picks-global-leaders-fluence-waertsilae-for-up-to-1g
[7] https://www.energy-storage.news/news/energy-storage-potential-in-spains-upcoming-auction-as-country-targets-2.5g
[8] https://www.birmingham.ac.uk/news/latest/2020/12/energy-storage-experts-launch-research-and-innovation-roadmap.aspx

become less attractive for electric vehicles can be deployed at lower costs for stationary energy storage applications across the power grid.

Battery technology innovation has been among the most dynamic clean energy technology fields. The IEA reported that between 2005 and 2018, patenting activity in batteries and other electricity storage technologies increased at an average annual rate of 14%. This corresponds to four times faster rate than the average of all technology fields [9]. Li-ion technology dominate the innovation space, with five times as many patents than for all other chemistries combined in recent years [10]. Major innovation areas to improve technical and economic performance [11] include fast-charge capability, Si anodes, high-voltage cathodes and electrolytes, high-energy and low-cobalt cathodes, Lithium metal anodes and solid-state batteries given varying performance attributes along with different EV and energy storage applications (Table 1).

Li-ion cell manufacturing grows to address future demand

The global Li-ion cell manufacturing capacity is largely located in China, the U.S, and Europe. China hosts around 80% of the global manufacturing capacity (or about 500 GWh). The United States is the second-largest manufacturer of battery cells representing 8% of current global capacity (primarily at the Tesla-Panasonic plants in Nevada). Manufacturing in Europe is also expected to grow with clean energy aspirations, auto industry, power industry orientations, and government-back financing options.

Overview of lithium-ion electrode materials

Cathode materials	Main properties	Current main application areas
Lithium cobalt oxide (LCO)	– Excellent energy density and high cycling stability – High output voltage – High cost due to limited availability of cobalt	Portable electronics
Lithium nickel cobalt manganese oxide (NMC)	– High energy density and high capacity – High output voltage – Nickel improves capacity but is associated with low thermal and chemical stability – Cobalt improves charge/discharge kinetics but is expensive and in short supply – Manganese improves stability – Moving from NMC 811 to NMC 111, better thermal stability and capacity retention are achieved while discharge capacity decreases	Electric vehicles, portable electronics
Lithium nickel cobalt aluminium oxide (NCA)	– Highest energy density compared with NMC – Cathode materials with similar nickel content, high capacity – Lower safety than NMC	Electric vehicles, portable electronics
Lithium manganese oxide spinel (LMO)	– Moderate capacity and moderate energy density, good safety – Short lifetime	Power tools, medical devices
Lithium iron phosphate (LFP)	– Higher thermal and chemical stability than NMC, constant output voltage, longer cyclability, inexpensive and no toxic materials – Lower energy density and lower capacity than NMC	Stationary, electric vehicles, power tools

Anode materials	Main properties	Current main application areas
Lithium titanate oxide (LTO)	– High safety, long lifetime, high charging/discharging rate, longer cyclability, no toxic materials – Low energy density, lower capacity, lower output voltage	Stationary, small electric vehicles
Carbon/graphite/soft carbon/hard carbon	– High voltage output, high capacity, high energy density, good stability, low cost – Limited fast-charging performance at low temperatures	All high-energy Li-ion batteries
Lithium	– High energy density, high capacity, high output voltage – Safety issues due to thermal runaway and dendritic growth – Expensive to handle, need for inert atmosphere	No applications in secondary lithium batteries
Silicon	– High capacity – Poor cycling stability due to large volume expansion during cycling	Combined in small quantities with carbon-based anodes

Table 1: *Li-ion Electrode Material Properties and Application Areas*
Source: *Innovation in Batteries and Electricity Storage, IEA, September 2020*

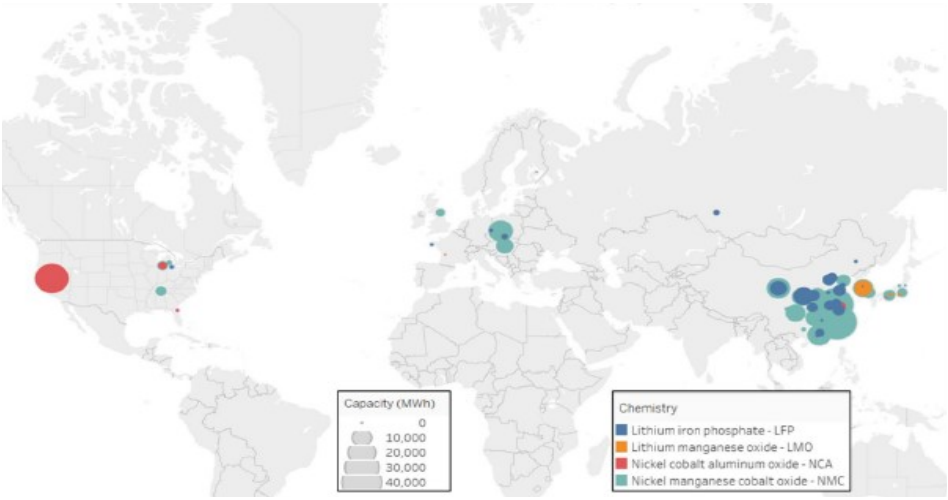


Figure 2: *Global Li-ion Manufacturing Status (Capacity and Chemistry, as of December 2020)*
Source: *US DoE* [12]

Turkey Energy Outlook presented key energy technology for Turkey to enable localization while advancing through energy transition

TEO also assesses that battery storage technology should be among clean energy localization options for Turkey towards a near-zero emissions pathway post-2040. According to TEO findings, Li-ion remains the leading technology of choice for many storage applications despite an extensive array of R&D activities in other chemistries to enable feasible deployment.

[9] Innovation in Batteries and Electricity Storage: A Global Analysis based on Patent Data, IEA, September 2020
[10] IICEC Energy Market Newsletter, Issue:16, November 2020
[11] Energy Storage Market Report, US DOE, December 2020
[12] Energy Storage Market Report, US DOE, December 20200

Energy storage is also one of the main technologies and investment themes for Turkey, as discussed in the IICEC Turkey Energy Outlook Supporting strong growth in intermittent renewables (wind and solar PV combined reaching 36% of total power generation in 2040 in the TEO Alternative Scenario up from 11% at present) and accommodating more variable demand features necessitate a growing role for energy storage technologies, batteries in particular, across the Turkish power system. According to the TEO Alternative Scenario investment estimates, energy storage and power grid investments combined represent 32% of the annual average power sector spending out to 2040.

Turkey is speeding up efforts in the battery ecosystem. In late December 2020, Turkey's ETİ-MADEN inaugurated the country's first lithium production facility. It will produce lithium from liquid wastes arising during the production process of boron. It is targeted that the plant, at full operation, will have a production capacity of around 600 tons/yr. "Today, Turkey has become a country that can produce lithium carbonate and boron products with its own technology and human capital through distilling boron and lithium in the waste in its own way," Energy and Natural Resources Minister Fatih Dönmez noted during the ceremony [13].

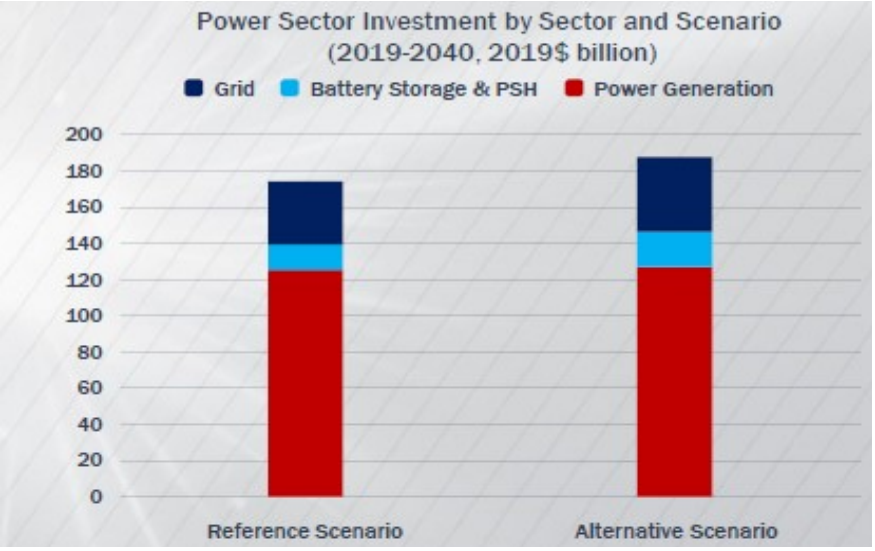


Figure 3: *Power Sector Investment by Sector and Scenario in the TEO (2019-2040, 2019$ billion)*
Source: *IICEC Turkey Energy Outlook, November 2020*

Source:: *https://iicec.sabanciuniv.edu/teo*
(Please click to access to TEO Book.)

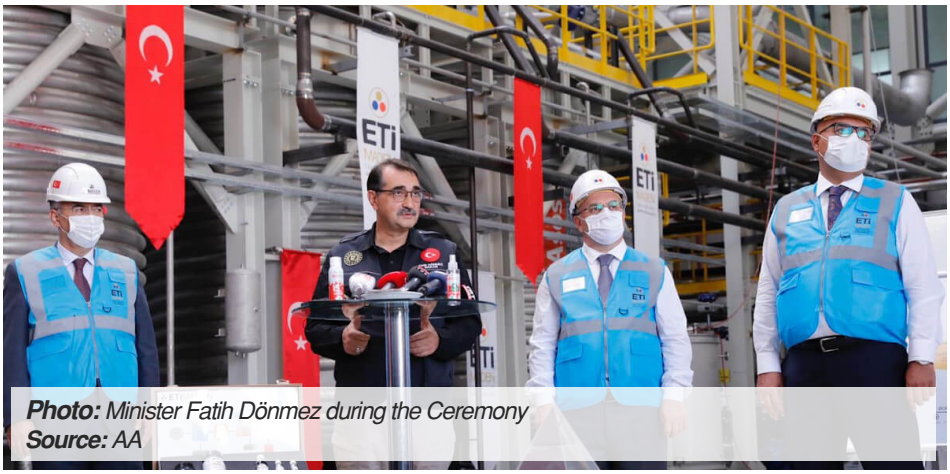


Photo: *Minister Fatih Dönmez during the Ceremony*
Source: *AA*

> *Today, Turkey has become a country that can produce lithium carbonate and boron products with its own technology and human capital through distilling boron and lithium in the waste in its own way.*
>
> **FATİH DÖNMEZ, Minister of Energy and Natural Resources**

[13] https://www.aa.com.tr/en/economy/turkeys-new-lithium-plant-to-save-20m-imports/2089658

Global Electricity Demand Shrink in 2020 but Renewables Based Supply Continued to Grow

Electricity Market Report [14] produced for the first time by the International Energy Agency (IEA) in December 2020 focuses on developments in electricity markets amid the Covid-19 pandemic. The report includes an assessment of 2020 trends together with 2021 forecasts for electricity demand, supply, and resulting emissions. The IEA announced that it will continue to publish electricity market reports on a regular basis providing the latest updates on key developments in global electricity markets.

The global electricity demand in 2020 is estimated to decline by 2%. This is the biggest annual drop since the mid-20th century and is far larger than what followed the global financial crisis (a decline in electricity demand of 0.6% in 2009). The contraction experienced in 2020 is a result of the Covid-19 pandemic's impact on economic activity and the measures taken to prevent the further spread of the virus.

Changes vary across the generation technologies. Coal-fired generation is estimated to decline by around 5% in 2020, the largest drop on record, bringing it back to levels last seen in 2012. Nuclear power generation is set to fall by around 4% in 2020, affected both by the pandemic itself and lower capacity availability, especially in the first half of the year. Gas-fired electricity generation is projected to shrink by 2% and its decline has been cushioned by lower natural gas prices enabling market share gains from coal, particularly in the United States and Europe. Renewable electricity generation is estimated to grow by almost 7% in 2020. Long-term contracts, priority access to the grid and sustained installation of new plants are all underpinning strong growth in renewable electricity production. The decline in electricity demand combined with solid growth in renewables has accelerated the reductions in coal, gas, and nuclear power output (Figure 4).

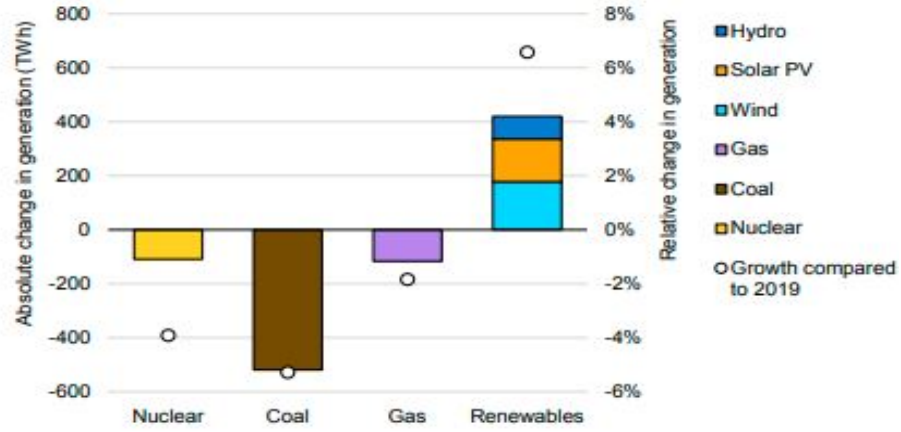


Figure 4: *Global Electricity Supply Change in 2020 Compared to 2019 (TWh)*
Source: *Electricity Market Report, IEA, December 2020*

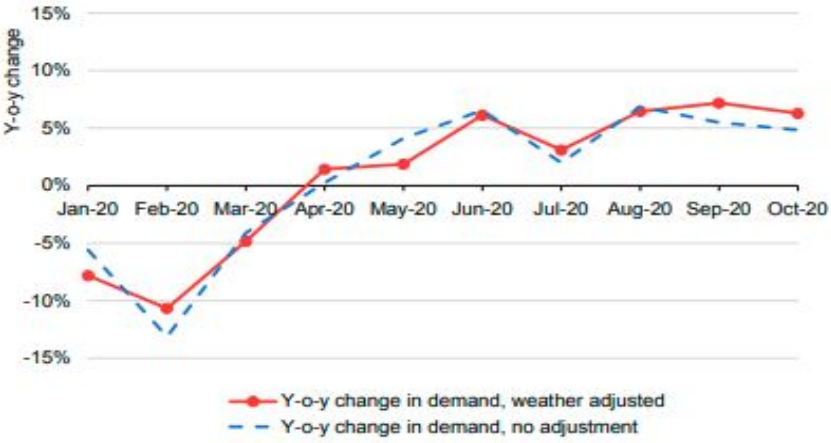


Figure 5: *Y-O-Y Change in Monthly Electricity Demand in China (2020, %)*
Source: *Electricity Market Report, IEA, December 2020*

The IEA's Global Energy Review 2020 report also shows that the extent of demand declines depends on the duration and stringency of lockdowns. Based on data collected for more than 30 countries (representing over one-third of global electricity demand, the IEA report highlighted that each month of full lockdown results in power demand decline of 20% on average (or over 1.5% on an annual basis).

Among major economies, China was the only large economy with higher electricity demand in 2020 compared to 2019. However, the projected demand growth of 2%, which represents about 28% of global electricity consumption, is still considerably below its average of 6.5%/yr since 2015. After implementing strict health measures early in the year and experiencing subsequent drops in electricity demand in the first quarter, China has experienced year-on-year demand growth every month since then (Figure 5).

[14] https://www.iea.org/reports/electricity-market-report-december-2020

A Modest Rebound in 2021

Following the shockwave of 2020, the IEA Electricity Market Report forecasts a modest rebound in 2021. With the recovery of the global economy expected in 2021, global electricity demand is estimated to grow by around 3%. However, this rebound is relatively low compared with 2010, when electricity demand increased by 7.2% after the global economic crisis in 2019.

Demand growth is expected to be mainly driven by emerging and developing economies. Two-thirds of the additional demand is expected in the Asia Pacific region. Most of the growth is concentrated in China and India (5.2% and 3.6%, respectively). Southeast Asia, one of the fastest-growing regions in electricity demand, is expected to realize 5.4% demand growth in 2021. In the United States only a slight recovery with 1.0% growth is anticipated, after 3.6% reduction in 2020. Demand in Europe is expected to grow by 2.3% (or 2% lower than in 2019) (Figure 6).

The growth of renewables will likely remain the lead power growth story in 2021. Electricity output from renewables, particularly wind and solar PV, is anticipated to continue to set new annual records in 2021, expanding their market share to 29% from 28% in 2020. In renewables, after net additions reached a new record of almost 200 GW in 2020, total capacity is expected to grow by around 218 GW in 2021 (9% more than 2020). The strong growth is driven by projects delayed in 2020 and newly financed capacity. Nuclear power would also experience growth with new capacity additions. Global natural gas fleet is expected to increase by over 30 GW throughout the year.

Turkish electricity demand also experienced a slowdown in growth due to the impacts of the Covid-19 in 2020. Power demand back in April 2020 and May 2020 experienced the largest declines with 14.6% and 16.5%, respectively, due to strict lockdown measures. Following the partial easing of restrictions, demand

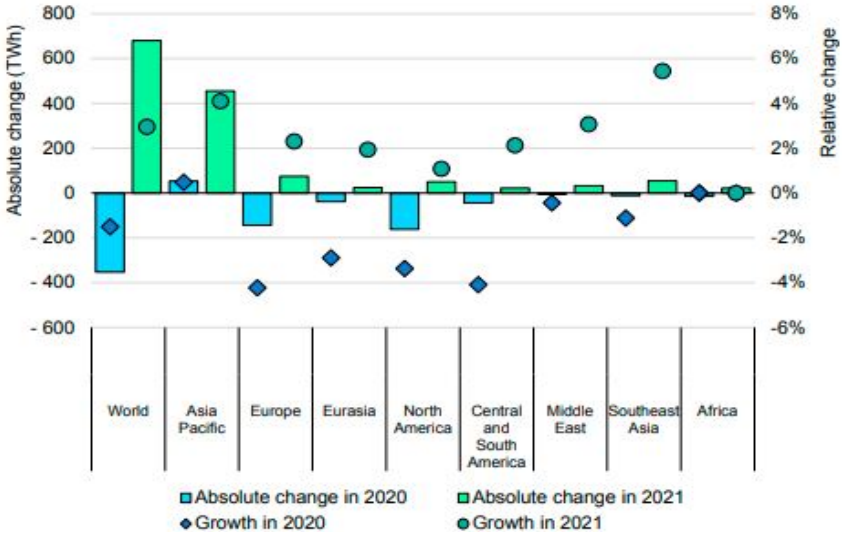


Figure 6: *Estimated Electricity Demand Growth by Region (TWh and %)*
Source: *Electricity Market Report, IEA, December 2020*

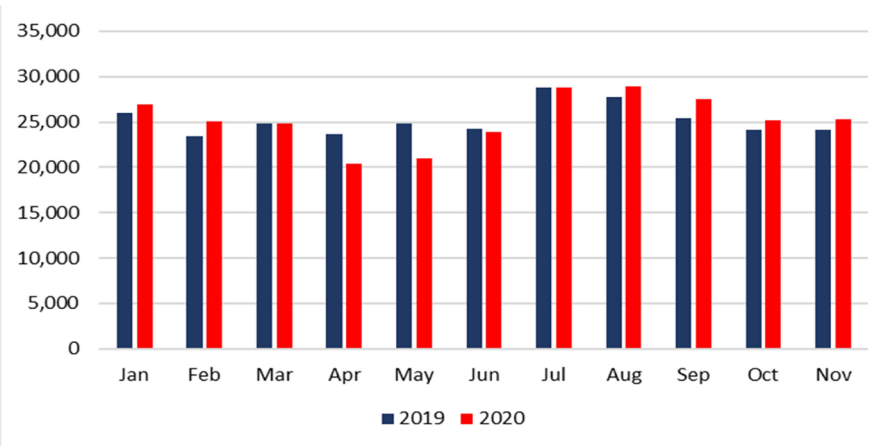


Figure 7: *Monthly Gross Electricity Demand (2019 and 2020, GWh)*
Source: *TEİAŞ*

started to recover including industrial and commercial segments. Despite the recovery in the second half of the year, the overall increase in demand still remained insignificant: 0.3% growth from January to the end of November 2020 compared to the same period of 2019 (Figure 7). However, the demand outlook is more robust for 2021 supported by ongoing vaccination efforts and expectations.

Turkey's installed capacity continued to expand in 2020 reaching 95.9 GW. According to TEİAŞ' monthly data of Turkey's gross electricity generation for the first 11 months, generation from lignite and hydro declined by 19% and 11%, respectively from 2019 to 2020, while wind, solar, and geothermal based power generation as well as natural gas fired production increased by 14% and 19%, respectively.

Globally, electrification is one of the major trends towards a more secure and sustainable energy future. Electrification is also one of the strongest trends in the Turkish energy economy as demonstrated in the Turkey Energy Outlook (TEO) of IICEC. TEO projects that electricity use will grow strongly but also that energy efficiency policies will limit the growth. The TEO Reference Scenario projects a 93% demand increase by 2040 while the more efficient TEO Alternative Scenario limits the growth to 64%. Electricity will also make up a larger share of Turkish total final energy demand: 28% in the Alternative Scenario in 2040, up from 22% now.

Turkish Energy Ministry to Receive 1 GW New Mini YEKA Solar Tender Applications in March


Fatih Dönmez

> *We consider the energy transition as a key part of Turkey's economic development strategy and a key element to mobilize the economy and revitalize the markets. At the basis of this transition, we ultimately aim to make energy more sustainable, eco-friendly, affordable, and accessible.*

The first Solar Summit of Turkey, organized by the Turkish Solar Energy Industry Association (GENSED), was held online 6 January 2020 with the participation of Fatih Dönmez, Minister of Energy and Natural Resources, Mustafa Yılmaz, President of the Energy Market Regulatory Authority (EMRA), and Mustafa Elitaş, Chairman of the Parliamentary Commission on Industry, Trade, Energy, Natural Resources, Information, and Technology.

Speaking during the opening session of the event, Minister Dönmez praised the exponential growth in solar power capacity both in Turkey and in the world despite a substantial decline in all other energy resource investments due to the Covid-19 pandemic. Referring to the latest report released by the International Energy Agency (IEA), where IEA Chief Dr. Fatih Birol named solar as the "new king of world energy markets", Minister Dönmez said that solar power would play a more substantial role in the future thanks to the ongoing decrease in installation costs. "Despite the global recession, renewable energy investments did not gear down. In the January-October period of 2020, 15% more renewable energy tenders were held globally compared to the same period in the previous year. On the other hand, the total market cap of publicly-traded solar energy companies in the world almost doubled by October 2020 compared to the same month of the previous year," he added.

Turkey ranks 13th in the world and 7th in Europe in terms of solar capacity

Highlighting rapid development in the Turkish solar industry despite its only one-decade long history, Minister Dönmez shared some key figures: "Turkey's solar installed power capacity had reached 6,630 MW today from only 40 MW in 2014. Turkey almost doubled its solar capacity within the last three years and now ranks 13th in the world and 7th in Europe in terms of solar installed capacity. Its share in our total installed capacity reached almost 7% and solar-based generation now represents 4% in power generation. Considering the 24-hour time frame, we meet an average of 0.7 hours of our daily consumption from solar energy."

The Ministry will hold new YEKA (Renewable Energy Resource Zones) tenders within the upcoming months in line with the government's ultimate target to triple solar energy share in total power generation by 2030. "We will receive applications for 74 tenders with a total of 1,000 MW in 36 provinces within two months. Our 'Mini YEKA-Solar' tenders are particularly important in terms of changing the investment culture and investor profile. Through these tenders, 'Energy SMEs' will emerge," Minister Dönmez noted.

Ministry of Energy will accept applications during 8-12 March 2020 and the auctions will take place after the evaluation of the applications. The starting ceiling price for each tender was determined as 0.35 TL/kWh and the guaranteed power purchase period is determined as 15 years from the date of signing a contract.

Highlighting that 98% of the 4,900 MW new capacity commissioned in 2020 consisted of renewable resources and total renewable installed power reached up to almost 50 GW (or over, half of Turkey's total installed capacity), Minister Dönmez said: "We consider the energy transition as a key part of Turkey's economic development strategy and a key element to mobilize the economy and revitalize the markets. At the basis of this transition, we ultimately aim to make energy more sustainable, eco-friendly, affordable, and accessible."

EPİAŞ Launched Virtual Tests for the Electricity Futures Market

Energy Exchange Istanbul (EXIST) announced launched virtual tests for the Electricity Futures Market (VEP) on 4 January 2021. EXIST earlier in November announced that, although the software and quality tests have been completed, the collateral, default, and settlement modules of the VEP need to be "carefully reviewed once again due to extraordinary conditions arising from the Covid-19 pandemic." Therefore, the launching date of the VEP was postponed to June 1, 2021, in accordance with the related resolution of the Energy Market Regulatory Board Market players will test the VEP via the virtual platform until it will resume live operation in June.

Through the VEP, market participants will have the opportunity to hedge price risks with predictable forward prices. The VEP will also offer power trading in different load types, including base and peak for future monthly, quarterly, annual, and remainder delivery periods. VEP contracts will impose 1 Lot (that is equivalent to 0.1 MWh) and its multiples of power supply or withdraw obligation for the parties of the contract during the relevant delivery period and on the days subject to delivery during the hours covered by the relevant load type.

Turkish electricity market took several steps towards a more competitive structure throughout Most recently, the eligibility threshold was lowered to 1.2 MWh/yr. for 2021. The cleared volume of the Day-Ahead Power Market reached 181.4 TWh, 19.2% up from 152.1 TWh in 2019.

Recently published Turkey Energy Outlook [15] (TEO) views electrification as one of the strongest trends in the Turkish energy economy. TEO assesses that a system-wide approach is required with long-term planning to balance power supply and demand, and to ensure a secure, reliable, and flexible Turkish electricity system.

Excerpts from IICEC Turkey Energy Outlook on developing Turkish power market:

Notable achievements in the short-term markets include the Balancing Power Market, Day-Ahead Market and Intra Day Market. These need to be complemented by advancing medium-term markets with more predictability, transparency, and enhanced risk management instruments, both for suppliers and consumers. These developments will enable price discovery over a longer time horizon and reflect supply and demand dynamics as well as a dynamic cost base that is linked to commodity and technology costs. The launch of futures market with physical deliveries will constitute an important step to achieve a more efficient, transparent, and competitive power market. Developments in the natural gas market will also be important for a better functioning power market since flexible natural gas fueled power plants are expected to continue their price setting role during peak demand periods."

"The Turkish electricity market should continue to evolve to a more competitive, more localized, and more diversified structure. While the market is currently oversupplied, with a projected demand increase, installed capacity needs to be almost doubled by 2040. TEO recommends continued sustainable power-sector investments aided by a stronger role for the private sector. This will also require continued reform of the Turkish power market toward cost-reflective pricing to motivate private sector engagement. The TEO indicates that the outcome of this marriage of private sector participation and government policy leadership will provide Turkey a 21st Century power sector that features clean and reliable power supplies, distributed generation, demand-side management, smart grids, battery storage, electric vehicles, and digitalization. It will also drive Turkish technological and industrial development resulting in broader economic advantages for Turkey. "

[15] https://iicec.sabanciuniv.edu/teo

IICEC was Among the Sponsors of the U.S. Clean Energy Education & Empowerment (C3E) Symposium Hosted by the MITei

The MIT Energy Initiative (MITEI) hosted the U.S. Clean Energy Education & Empowerment (C3E) Symposium and Awards virtual symposium on 8-9 December 2020, in collaboration with the U.S. Department of Energy (DOE), the Stanford Precourt Institute for Energy, and the Texas A&M Energy Institute.

The C3E Symposium is designed to inspire more women to enter leadership roles across the clean energy arena to address a diverse set of energy challenges. Since 2012, the C3E traditionally has been convening international women leaders on climate and energy. This was the 9th C3E event bringing together prominent women researchers, entrepreneurs, women energy professionals from students to mid-career and senior leaders to share their insights and perspectives towards an eventually carbon-free energy future.

C3E Symposium recognizes the exceptional achievements of mid-career women whose work in clean energy help address challenges and honors rising women working in a variety of fields (such as Business, Education & Advocacy, Entrepreneurship, Government, International, Law & Finance, Social, Economic & Policy Innovation, Technology and Research Innovation) to advance clean energy development. The 9th C3E Symposium honored nine women for their outstanding leadership and success in clean energy.

MITEI's Director, Robert C. Armstrong said "We need to keep breaking down systemic barriers to women's advancement in these sectors, and your [women], participation and leadership is absolutely critical for our shared success in this challenge."[17] MITEI Executive Director, Martha Broad stated that the world needs more women in decision-making to fundamentally change the way we produce and consume energy: "It's no longer about fairness and equality, but about increasing our chances of success in making strategic decisions around climate mitigation and adaptation. In order to meet a net-zero carbon emissions goal within the next few decades, it's obvious we need to have women at the table."

The First "C3E Symposium and Awards" took place in 2012 with the goal of advancing women in clean energy

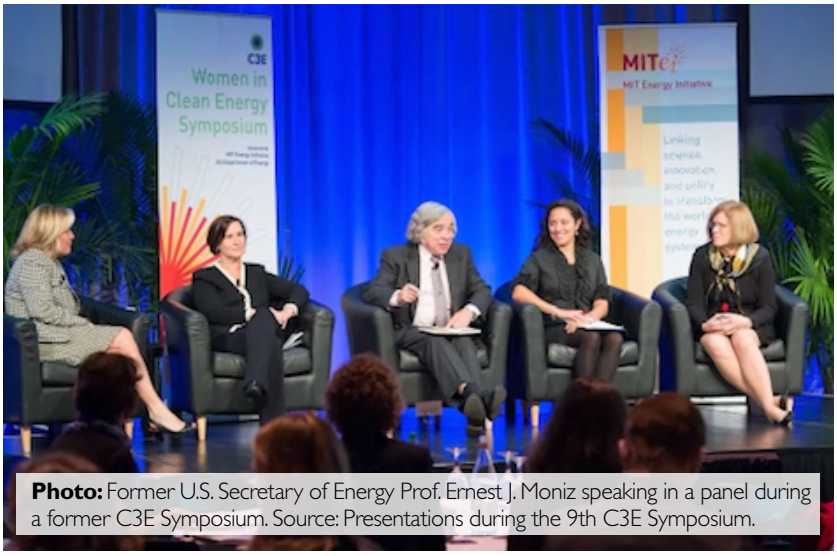


Photo: Former U.S. Secretary of Energy Prof. Ernest J. Moniz speaking in a panel during a former C3E Symposium. Source: Presentations during the 9th C3E Symposium.

Photo: Nine women received the 2020 U.S. C3E awards.
Source: MITei Website [16]

[16] http://energy.mit.edu/news-tag/c3e/
[17] http://energy.mit.edu/news/envisioning-an-equitable-inclusive-low-carbon-future/

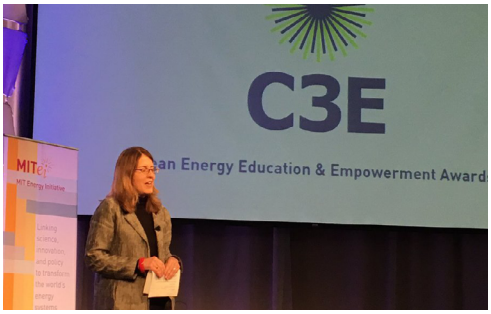


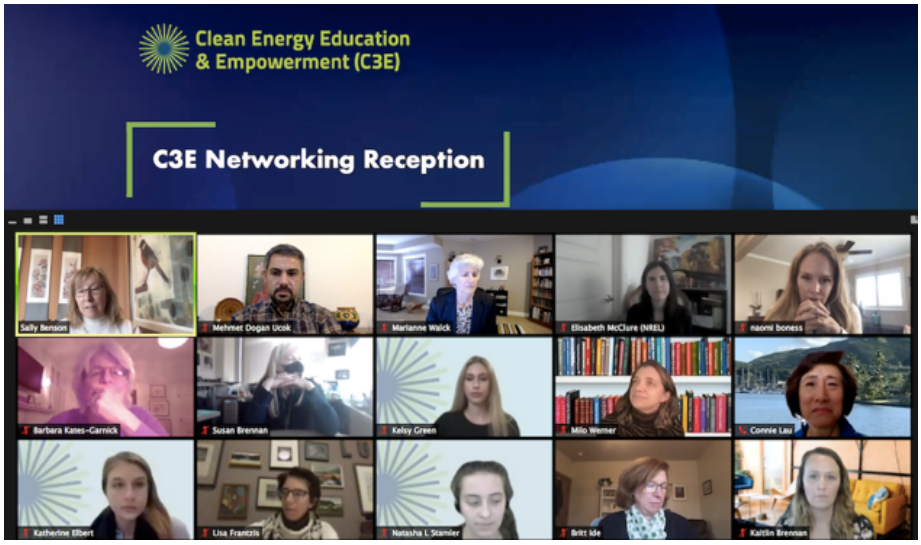
Photo: Martha Broad, MITei Executive Director
Source: MITei

It's no longer about fairness and equality, but about increasing our chances of success in making strategic decisions around climate mitigation and adaptation.

Dr. Fatih Birol addressed women's participation in the energy workforce

IEA Executive Director Dr. Fatih Birol had stated "Today when we look at the entire workforce we see that the share of women is close to 50% but in the traditional energy the share of female staff is only 25%. When you look at the renewable energies, which you may think would be much higher, it is only one-third."

MITei Director Robert Armstrong also suggested that "The virtual format [of the event], a necessity during the pandemic, may actually prove a productive, ongoing tool for catalyzing the connections and mentorship that flow from such gatherings." Power of online communications and high attendance to this virtual event has also been pointed out on the MITei website: "One sign of the power of online communications: More than 1,100 people attended each day of this virtual symposium, almost five times the number of people who normally attend in person." [18]



A Virtual Networking Reception was held after the C3E Symposium where the participants and sponsors of the Symposium attended. Dr. Mehmet Doğan Üçok represented Sabancı University IICEC at the reception.

Sabancı University IICEC has been a sponsor of the C3E event for the last 3 years, and IICEC also had "Women Leaders in Clean Energy, Science and Technology" Conference in December 2019 convening a diverse platform of women from the academia and business community. IEA Executive Director Dr. Fatih Birol had stated "Today when we look at the entire workforce we see that the share of women is close to 50% but in the traditional energy the share of female staff is only 25%. When you look at the renewable energies, which you may think would be much higher, it is only one-third. If you look at the management levels the numbers are even poorer." [19]

Touching on a similar topic, Maria T. Vargas, the senior program advisor for the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE) pointed out that while women make up about half of the total U.S. labor force, they comprise less than a third of those employed in the renewable energy sector."[20] The IRENA numbers also point to the same statistics. IRENA's Renewable Energy: A Gender Perspective report states that "Women's participation in the energy sector is below that of the broader economy and varies widely across energy sub-sectors. Despite making up 48% of the global labor force, women only account for 22% of the labor force in the oil and gas sector and 32% in renewables." [21]

[18] http://energy.mit.edu/news/envisioning-an-equitable-inclusive-low-carbon-future/
[19] https://iicec.sabanciuniv.edu/content/women-leaders-clean-energy-science-and-technology-conference
[20] http://energy.mit.edu/news/envisioning-an-equitable-inclusive-low-carbon-future/
[21] https://www.irena.org/newsroom/articles/2019/Jan/Gender-equality-for-an-inclusive-energy-transition

Natural Gas Demand is Expected to Recover After its Largest Demand Shock in 2020

In response to the exceptional circumstances originated from the coronavirus pandemic, the IEA published a market update on natural gas in June 2020, providing a detailed analysis of recent natural gas market developments. The Gas 2020[22] report assesses the main drivers and uncertainties awaiting the gas supply and demand to 2025.

The year 2020 experienced the largest recorded demand shockwave in the history of global natural gas markets. The Covid-19 pandemic hit an already declining gas demand. Faced with this unprecedented shock, natural gas markets went through a strong supply and trade adjustment, resulting in historically low spot prices and high volatility. As a result, overall gas consumption across the world is estimated to decline in almost all countries in 2020. Despite the lockdown measures are being progressively lifted, the Gas 2020 report predicts that economies would not recover promptly.

Consequently, global natural gas demand is predicted to fall by about 150 bcm/yr (or 4%) in 2020. This forecasted decline in demand was revised from the initial 5% estimation published in the Global Energy Review 2020[23] report, which was published two months prior to April 2020. As Figure 8 shows, all regions of the world are impacted, with mature markets across Europe, North America, Asia and Eurasia together accounting for about 75% of reduced gas consumption in 2020 compared to 2019.

Across different sectors, power generation is the hardest hit sector, making up half of the total demand drop. It was followed by the residential and commercial consumption and the industrial sector. Natural Gas use in the residential and commercial sector is estimated to decline by 4% representing 20% of total consumption decrease. The industrial sector also accounts for another 20% of the global decrease, again dropping by about 4% in 2020. The energy sector itself accounts for the remaining 10% of the fall in global gas demand (Figure 9).

Rebound in Natural Gas Demand and Beyond?

The IEA Gas 2020 report forecasts that natural gas demand is expected to recover only progressively in 2021; however, the Covid-19 crisis will have leave long-lasting scars on natural gas markets as the medium-term demand drivers are still subject to high uncertainty. Demand is expected to recover gradually in both mature and emerging markets as a result of low price expectations for 2021. But the repercussions of the 2020 crisis on growth are set to result in 75 bcm of lost annual demand by 2025, which is almost equal to the global annual demand increase realized in 2019.

Gas 2020 report adjusted its forecast with an average annual growth rate of 1.5% per year for the 2019-2025 period, compared to the initial forecast of an average growth rate of 1.8% per year over the same period. Natural gas demand is projected to reach 4,370 bcm/yr in 2025 from 3,929 bcm/yr in 2019 (Figure 10).

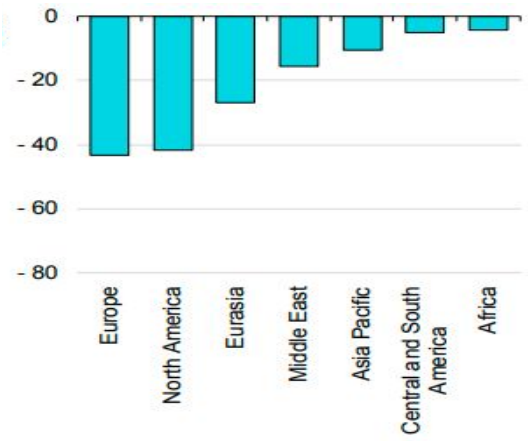


Figure 8: *Natural Gas Demand Decline per Region (2019-2020, bcm)*
Source: *Gas 2020, IEA, June 2020*

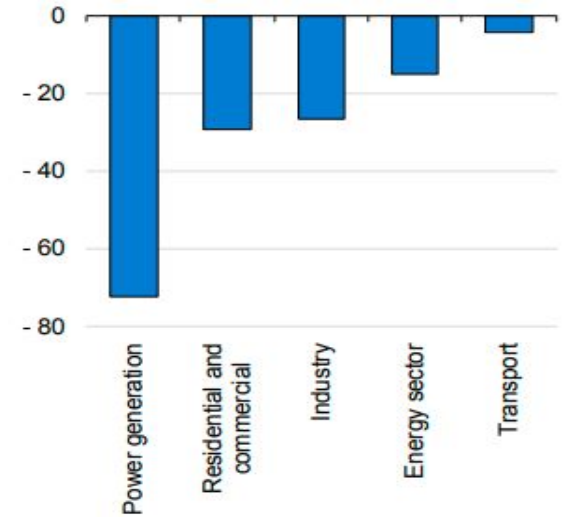


Figure 9: *Natural Gas Demand Decline per Sector, (2019-2020, bcm)*
Source: *Gas 2020, IEA, June 2020*

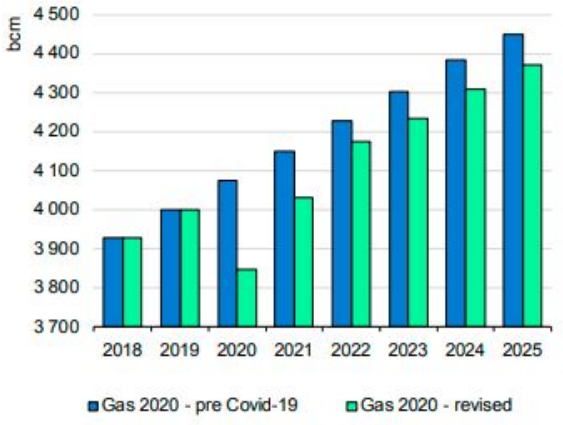


Figure 10: *Global Gas Demand Projections: Pre Covid-19 vs. Adjusted for Covid-19 (bcm/yr)*
Source: *Gas 2020, IEA, June 2020*

[22] https://www.iea.org/reports/gas-2020
[23] https://www.iea.org/reports/global-energy-review-2020

The report projects that Asia will remain the primary driver of global demand growth, with China, India and emerging Asia together accounting for over half of the net increase in 2019-25. In addition, mature markets in Europe, Eurasia and North America are also expected to recover most of their consumption losses in 2021 as demand drivers in the industrial and power generation sectors gradually get stronger. While European gas demand is expected to stay stable, gas consumption in North and South America grows at 0.4% and 0.6% annually until 2025, respectively. African natural gas consumption grows at an annual average of 3.3% year towards 2025.

Global LNG Scene

- Global LNG trade is expected to reach 585 bcm/yr by 2025, a 21% increase compared to 2019.
- LNG demand is anticipated to increase in China and India, but shrinks in Japan and South Korea.
- China is expected to become the largest LNG buyer in 2023.
- The United States is anticipated to become the largest LNG exporter in 2025.

As a leading fuel in residential, commercial and public buildings and in industry, natural gas provides multiple opportunities including energy security and environmental performance towards a more sustainable energy future for Turkey, the TEO reported.

Turkey has been one of the fastest-growing gas markets. For the past two decades, natural gas has been a dynamic fuel and playing a more significant role in Turkey, representing about 30% of Turkey's total primary energy supplies and 22% of final energy demand. Turkey's daily demand for natural gas reached a record level of 280 mcm/d on 19 January 2021. EMRA predicts 50.9 bcm/yr of gas consumption in Turkey in 2021. Low hydrology ramped up CCGT utilization in the power sector.

Under the TEO Reference Scenario, natural gas demand increases by 1.5%/yr, resulting in 16 bcm more demand in 2040 (35% cumulative growth) compared to 2019. The largest growth in absolute terms takes place in the industrial segment followed by the residential sector. In the Alternative Scenario, natural gas demand in 2040 is 11% lower than the Reference scenario as a result of better energy efficiency performance in buildings and industry and larger increases in renewables and nuclear output in the power sector. Natural gas demand is projected to reach 55.0 bcm/yr in 2040 (61.5 bcm/yr in the Reference Scenario). Largest growth is expected in the residential buildings with wider expansion of the distribution grid. (Figure 11). These growth pathways strengthen the role of gas in final energy consumption from 22% at present towards 30% until 2040.

TEO [24] assesses that Turkey has the potential to enter a new phase in the development of its natural gas market through optimizing natural gas supply and demand with enhanced flexibility, efficiency and technology-oriented business models. Global and regional developments together with Turkey's expanding infrastructure provide important opportunities for more flexible and competitive natural gas supplies. LNG supplies are anticipated to play a larger role in imports while the recent success in Black Sea discoveries is important to substantially lower the imports that currently represent 99% of total annual gas demand. Turkish Petroleum Corporation (TPAO) announced that they finalized drilling operations at the Türkali-1 well in the Sakarya gas field in the Black Sea after 77 days. Operations of Turkey's first drillship, Fatih, extended to depths over 3,920 meters in the Türkali-1 well. The drillship last year discovered 405 bcm of natural gas at the Tuna-1 location in the Sakarya gas field, located about 100 nautical miles north of Turkey's Black Sea coast. News regarding the Black Sea discovery has been comprehensively detailed in IICEC Newsletter Issue:15 [25]

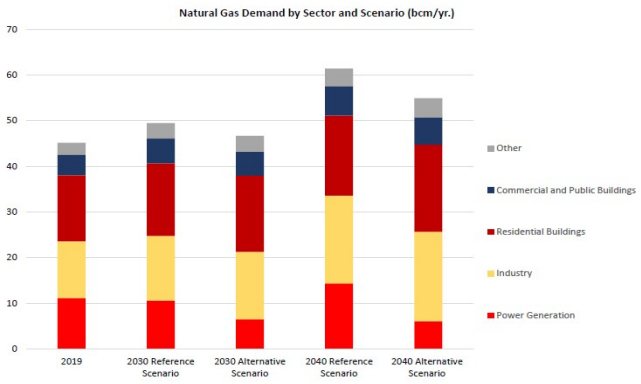
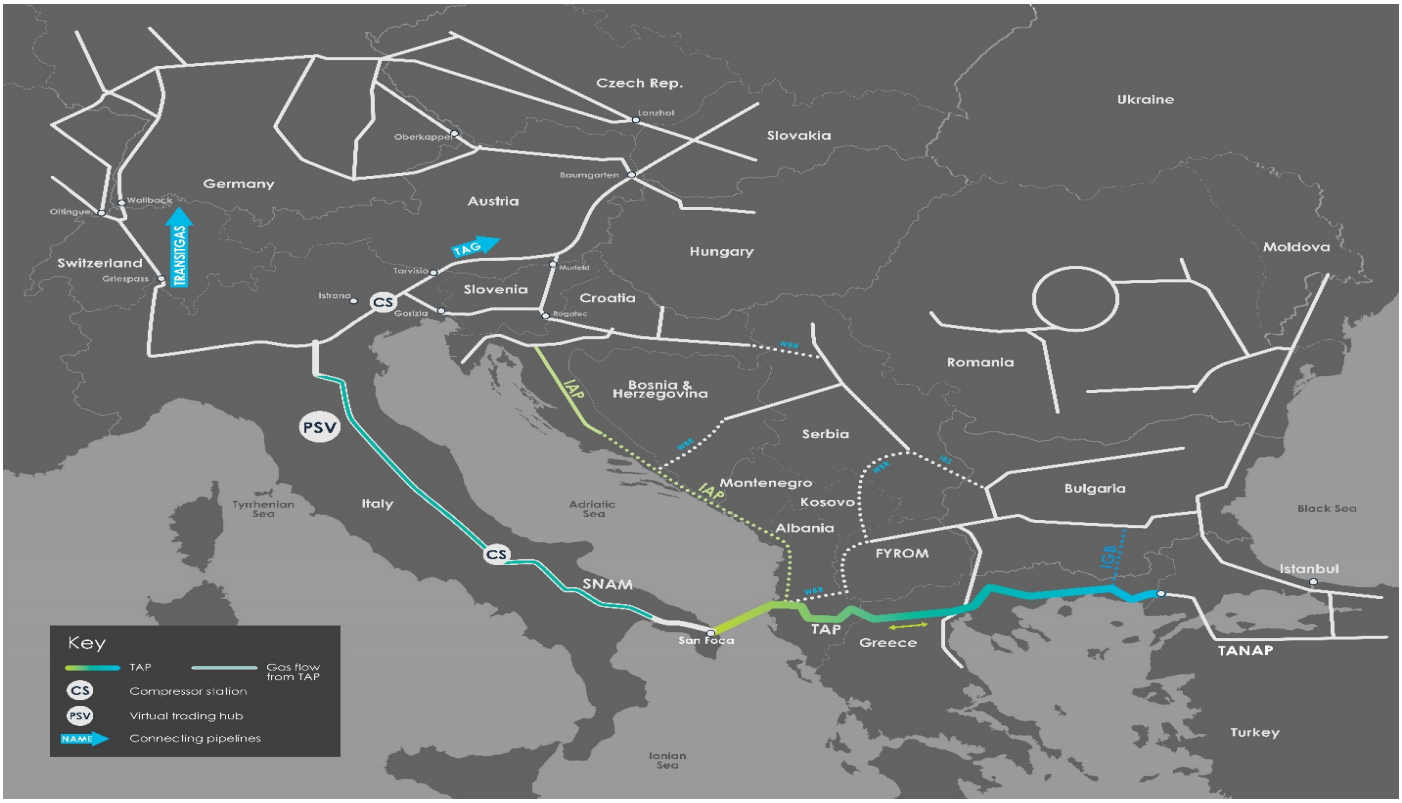


Figure 11: *Natural Gas Demand by Sector and Scenario (bcm/yr) in the TEO*
Source: *IICEC Turkey Energy Outlook, November 2020*

[24] https://iicec.sabanciuniv.edu/teo
[25] https://iicec.sabanciuniv.edu/sites/iicec.sabanciuniv.edu/files/iicec-energy-market-newsletter-issue-15.pdf

Azeri Gas Began to Flow to the European Market Through TAP



Source: *TAP-AG*

Azerbaijan has started commercial natural gas supply to Europe via the Trans Adriatic Pipeline (TAP) on 31 December 2020. As the second leg of the 3,500-km-long Southern Gas Corridor project, TAP ultimately seals the access of Azerbaijan's giant Shah Deniz II field in the Caspian Sea to the European gas market. The 878-km-long (773 km onshore and 105 km offshore) pipeline connects to the Trans Anatolian Pipeline (TANAP), which crosses 20 Turkish provinces from Ardahan to Edirne and delivers 6 billion cubic meters per annum (bcm/yr) to Turkish market of its 16 bcm/yr capacity. TAP is designed to supply 1 bcm/yr to Greece, 1 bcm/yr to Bulgaria, and 8 bcm/yr to Italy after a 15-month ramp-up period.

TAP earlier on 15 November 2020 announced that it started commercial operations and auctions for within-day, day-ahead, and monthly products for delivery in December 2020. On 31 December 2020, the first gas reached Greece via the Nea Mesimvria, the new interconnection point with DESFA, and Italy via the Melendugno, the interconnection point with SNAM Rete Gas. Azeri gas will flow to Bulgaria via the Kula-Sidirokastro pipeline and then via the Bulgaria-Greece Interconnector (IGB). After the completion of the IGB by July 2021, Bulgaria will be able to cover up to 33% of its total gas demand through TAP.

"Today is a historic day for our project, as well as for our host countries and Europe's energy landscape. TAP is an essential part of the continent's gas network, contributing to the energy transition roadmap. We offer a reliable, direct and cost-effective transportation route to southeast European countries and beyond" Luca Schieppati, TAP's Managing Director, said. The TAP stakeholders are BP (20%), SOCAR (20%), Snam (20%), Fluxys (19%), Enagas (16%) and Axpo (5%), while Shah Deniz Consortium consists of - BP (28.8%), TPAO (19%), SOCAR (16.7%), Petronas (15.5%), Lukoil (10%) and NIOC (10%).

The first phase of the Shah Deniz field began production in 2006, delivering more than 10 bcm/yr to Azerbaijan, Georgia, and Turkey. Beginning with a pre-feasibility study in 2003, the TAP project was selected by Shah Deniz Consortium in February 2012 as the priority route to Italy. Following the Intergovernmental Agreement among Albania, Greece, and Italy in February 2013, onshore construction works began in Greece in May 2016 and Albania in September 2016. After Shah Deniz Consortium delivered the first gas via TANAP to Turkey in July 2018, TAP and TANAP were physically connected in November 2018. In the following month, TAP completed its 3.9-billion project financing provided by a group of 17 commercial banks as well as the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB). The 105-km offshore section's construction across the Adriatic Sea was launched in March 2019 and completed in June 2020.

OPEC+ Agreed to Roll Over Production Cuts, Saudi Arabia Made a Move Cutting Oil Production Sharply

The year 2020 has seen historic turbulence in energy markets and has been an unprecedented year in energy history due to COVID-19 pandemic. Responses to the pandemic led to steep declines in petroleum demand and caused high volatility in crude oil markets. West Texas Intermediate (WTI) crude oil futures prices fell to less than zero on April 20 and 21, the first time the price for the WTI futures contract fell lower than zero since trading began in 1983[26].

April 2020 has been referred to as "Black April" by IEA Executive Director Dr. Fatih Birol with the demand decline of 25% for oil. The second half of 2020 was relatively more stable price-wise as demand began to recover and global production fell as OPEC+ cut back production. Following an unprecedented collapse of 8.8 mb/d estimated by the IEA for 2020, the IEA predicts that global oil demand is expected to recover by 5.5 mb/d to 96.6 mb/d in 2021[27]. Following 2020's unprecedented collapse, both supply and demand are shifting back into growth mode[28], according to IEA's January 2020 Oil Market Report, however, it is also emphasized that it would take more time for oil demand to recover fully as renewed lockdowns in a number of countries continue and affect fuel sales negatively.

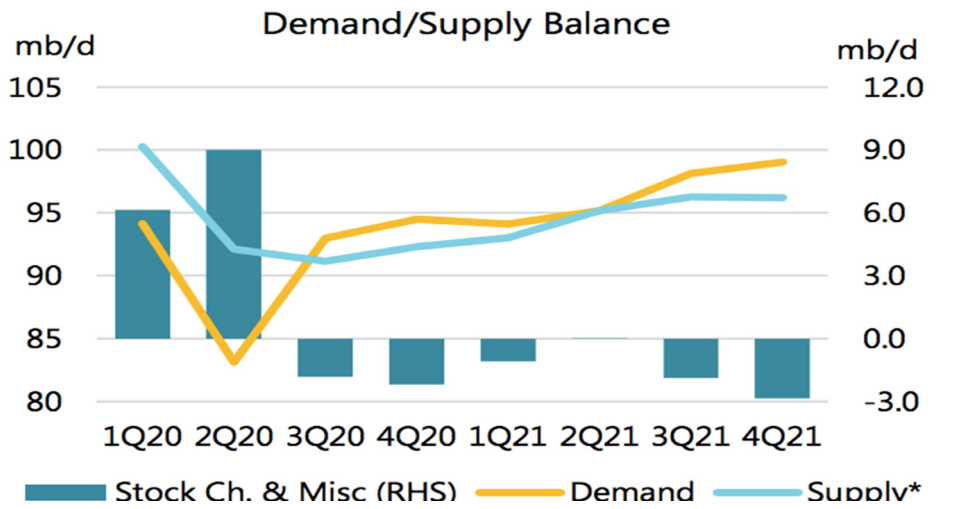


Figure 12: *Oil Demand-Supply Balance (Assuming 100% compliance with OPEC+ deal.)*
Source: *IEA, Oil Market Report, 19 January 2021*

Regarding the ongoing uncertainty in the oil market, IEA Executive Director Dr. Fatih Birol had pointed out in late 2020 that "Even if a viable vaccine becomes widely available, only a little recovery would be expected in oil markets. There is great uncertainty in the oil market and it may take a longer time for demand to recover." IEA's previous Oil Market report underlines that "It will be several months before we reach a critical mass of vaccinated, economically active people and thus see an impact on oil demand." [29]

Uncertainty has also been underlined at the last OPEC+ meeting. The world's major oil producers, the Organization of Petroleum Exporting Countries (OPEC) and its allies, known as OPEC+, met on January 4th


Dr. Fatih Birol

> *IEA's previous Oil Market report underlines that "It will be several months before we reach a critical mass of vaccinated, economically active people and thus see an impact on oil demand.*

[26] https://www.eia.gov/petroleum/weekly/
[27] IEA, Oil Market Report, 19 January 2021
[28] Ibid.
[29] https://www.iea.org/reports/oil-market-report-december-2020

and 5th amid weak oil demand from ongoing lockdowns. Meanwhile, OPEC+ switched to meeting every month, rather than just a few times a year, in order to fine-tune production levels, as renascent coronavirus is threatening global economic recovery with the ongoing lockdowns and struggles to distribute vaccines.

The OPEC+ meeting agenda (on Jan 4th and 5th) focused on the impact of the Covid-19 pandemic on the world economy and energy markets. OPEC+ countries committed to the largest and longest crude oil production adjustments in response to the unprecedented market conditions caused by the pandemic. The meeting underlined the need to closely monitor market fundamentals for global oil balance and overall market stability[31] - hence switched to above mentioned every month meeting schedule.

Russian Deputy Prime Minister Alexander Novak had told reporters last month that Russia favored another increase of 500,000 b/d in February, pinpointing that OPEC+ should proceed with its supply increase as prices are in an optimal range of $45/b to $55/b. In Novak's view; if OPEC+ refrained from increasing exports, its competitors would simply fill the gap[32]. However, Saudi Arabia and a majority of members were not on the same page with Russia during the OPEC+ meeting; opposing Russia's proposal for another supply hike. Saudi Energy Minister Abdul Aziz, in his opening remarks on Monday, Jan 4th, told the delegates that "The level of uncertainty in the world remains high," urging caution that a new wave of restrictions on activity could harm demand for transportation fuels: "I urge you today not to take for granted the progress we have made as a group over the past year. Do not put at risk all that we have achieved for the sake of an instant, but illusory, benefit."[33]

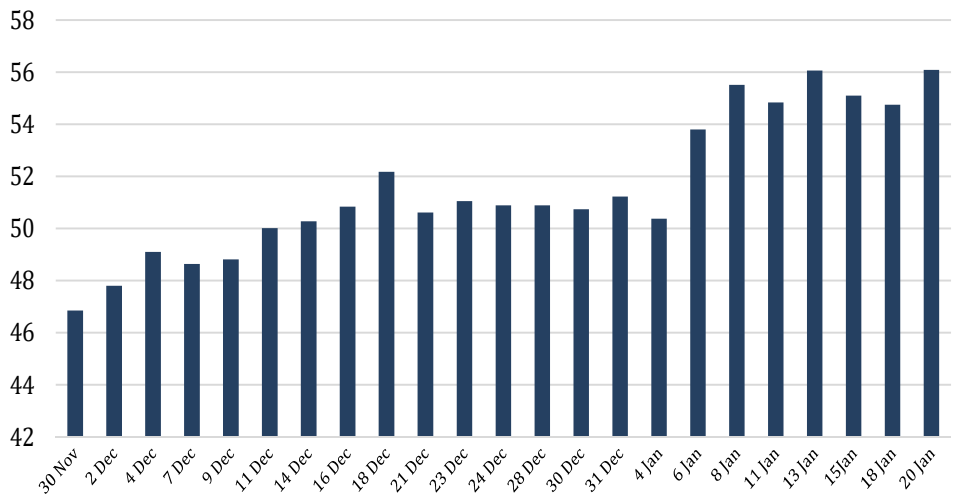


Figure 13: *Europe Brent Spot Price FOB (December 2020-January 2021, $/b)*
Source: *Energy Information Administration*[30]

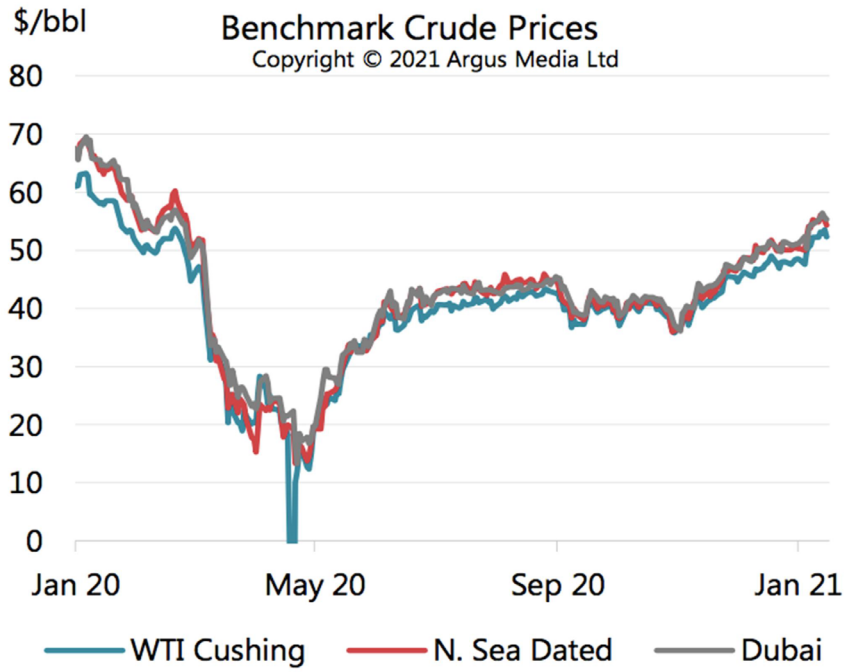


Figure 14: *WTI Cushing, N. Sea Dated, Dubai, Benchmark Crude Prices ($/b)*
Source: *IEA, Oil Market Report, 19 January 2021*

[30] https://www.eia.gov/dnav/pet/hist/rbrteD.htm
[31] https://mobile.opec.org/6310.html
[32] https://www.bloomberg.com/news/articles/2021-01-04/opec-wary-of-risks-to-oil-recovery-before-debate-on-output-hike?utm_source=google&utm_medium=bd&cmpId=google
[33] https://www.opec.org/opec_web/en/press_room/6305.htm

On the second day of the OPEC+ meeting (on Tuesday, Jan 5th), the outcome was in line with the decision taken at the December meeting: Anticipating weaker demand, keeping production steady in February and March (broadly unchanged from current levels). OPEC+ is currently cutting its output by 7.2 million b/d (about 7% of world supplies) in January. OPEC+ members agreed to roll over production cuts. Only Russia and Kazakhstan had a special grant to lift oil production by 75,000 b/d [34] over January levels [35] . Thus, the OPEC+ production cut that was 7.2 million b/d in January will be 7.125 million b/d in February and 7.05 million b/d in March. However, in a press conference after the meeting, a unilateral announcement came from Saudi Arabia, that the country would voluntarily cut an additional 1 million b/d both in February and March above its current quota. Hence, in total, OPEC+'s February total production cuts will be 8.125 million b/d, and March cuts will total 8.05 million b/d.

Upon Saudi Arabia's announcement, oil prices increased. The U.S. benchmark (West Texas Intermediate futures) passed through the $50/b mark for the first time since last February. Brent rose to $57/bbl and WTI to $53/bbl, affected by OPEC+ supply cuts (Figure 13,14). Hence, global oil markets are starting to gain ground and opened the New Year with a price rally gathering pace. With the effect of Covid-19 vaccine developments and commitments from OPEC+ to curb oil output, oil prices have increased more than 45% since the end of October [36] .

> *"The reason of the unilateral move from Saudi Arabia was explained by Saudi Energy Minister Abdulaziz bin Salman: "We do that willingly and we do that with the purpose of supporting our economy, the economies of our friends and colleagues, the OPEC-plus countries, for the betterment of the industry."*

The reason for the unilateral move from Saudi Arabia was explained by Saudi Energy Minister Abdulaziz bin Salman: "We do that willingly and we do that with the purpose of supporting our economy, the economies of our friends and colleagues, the OPEC-plus countries, for the betterment of the industry." [37]

From the perspective of the shale drillers, the additional 1 million b/d the cut back of Saudi Arabia was positive news as it caused price increases and hence could incentivize higher production. As mentioned in IEA's January Oil Market Report, "Higher crude prices could also provide an incentive to increase production by the US shale industry, which saw the biggest fall in output last year. For now though, companies seem committed to pledges made to keep production flat and instead use any price gain to pay down debt or to boost investor returns."[38]

Regarding the profitability of the shale, IEA Executive Director Dr. Fatih Birol in a Bloomberg television interview said that: "A 'big chunk' of U.S. shale is profitable at current oil prices" however also warned that "but drillers should be aware of crude's declining share in the future global energy mix." [39] As investors are expecting higher supply from North America, Birol said that "Many shale producers will be able to increase production in 2021 and 2022" and continued: "In the short term we will need shale oil from the United States to fill the gap in the supply-demand oil balance" adding also "However, shale companies 'shouldn't underestimate' the electrification of the transportation sector." [40]

[34] All the production increases will be realized by non-OPEC members. Russia and Kazakhstan will produce more oil over the coming months under the deal. There are no changes for February as to the quotas of Saudi Arabia, UAE or Iraq.

[35] Prince Abdulaziz said that the production increases granted to Russia and Kazakhstan were necessary for seasonal reasons. https://www.bloomberg.com/news/articles/2021-01-05/saudi-arabia-said-to-plan-voluntary-oil-output-cut-in-february

[36] https://www.worldoil.com/news/2021/1/12/iea-chief-says-us-shale-is-needed-for-now-as-oil-prices-climb

[37] https://www.wsj.com/articles/saudi-arabia-russia-reach-compromise-on-opec-plus-production-plan-11609857544

[38] IEA, Oil Market Report, 19 January 2021

[39] https://www.worldoil.com/news/2021/1/12/iea-chief-says-us-shale-is-needed-for-now-as-oil-prices-climb

[40] Ibid.

Global Nuclear Power Plant Fleet is Aging Despite New Additions

Nuclear power contributes to 10% of world electricity generation. It represents about 30% of global low carbon electricity generation technology after hydro. Currently, 443 nuclear reactor units are in operation with a total net installed capacity of 393.1 GW. Despite two major waves of growth since the first nuclear power reactor commissioning in mid-1950s, the number of operating units worldwide has remained largely unchanged for the past three decades. Since 2011, 56 units have been closed compared to the startup of 58 new units (Figure 15) according to the recently released World Nuclear Industry Report[41] that presents a detailed overview of nuclear industry trends on a global and regional basis.

The number of operational nuclear units remained almost constant in 2020 with five new connections (2 in China and 1 in Russia, Belarus and UAE) and six permanent shutdowns (2 in US and France, Russia and Sweden). Most recently, India commissioned its 23rd nuclear unit on 10 January 2021[42].

Global nuclear fleet at an average age of 31 years

Two-thirds of the global nuclear fleet is over 30 years old (Figure 16). The U.S and France, two leading countries in terms of the number of operating nuclear units, also represent an aging fleet profile with the U.S. exceeding the 40-year average age in 2020 while the fleet in France now, on average, is 35 years old. China, a relative newcomer, has one of the youngest fleets with an average age of fewer than 9 years.

Currently, 51 nuclear reactors are under construction with a total net installed capacity of 54.6 GW (or one-seventh of the current net installed capacity). New construction is largely concentrated in Asia: China leading with 11 units followed by India (6) and South Korea (4). 2 units are under construction at Akkuyu site in Turkey with a total installed capacity of 2.4 GW (Figure 17).

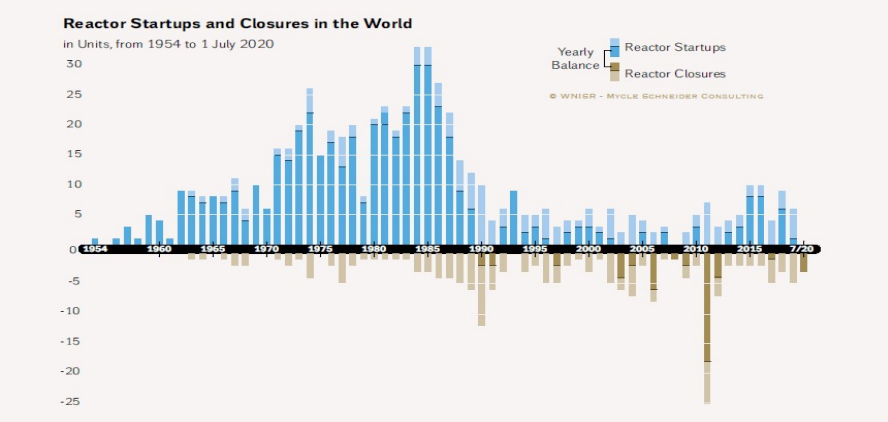


Figure 15: *Nuclear Reactor Start-ups and Closures since the First Nuclear Unit in Operation*
Source: *The World Nuclear Industry Report 2020*

The World Nuclear Industry 2020 report also provides future capacity estimates. Assuming that all existing reactors remained operational until the end of their licensed lifetime (and including those that already received lifetime extensions) and all units under construction to become operational, an additional 105 GW would have to be installed in order to maintain the total installed capacity base. This translates into more than doubling of the annual average rate of the past decade (from 6 to 14). The IEA projects that, assuming 60 years lifetime for all units and with current construction trends, nuclear capacity will reach 455 GW in 2040[43] .

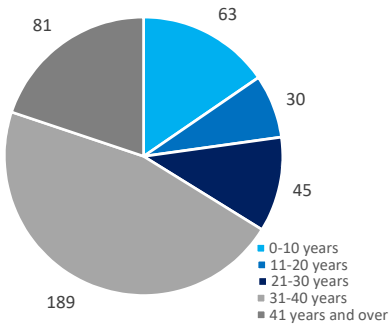


Figure 16: *Age Distribution of Global Nuclear Fleet (as of July 2020)*
Source: *The World Nuclear Industry Report 2020*

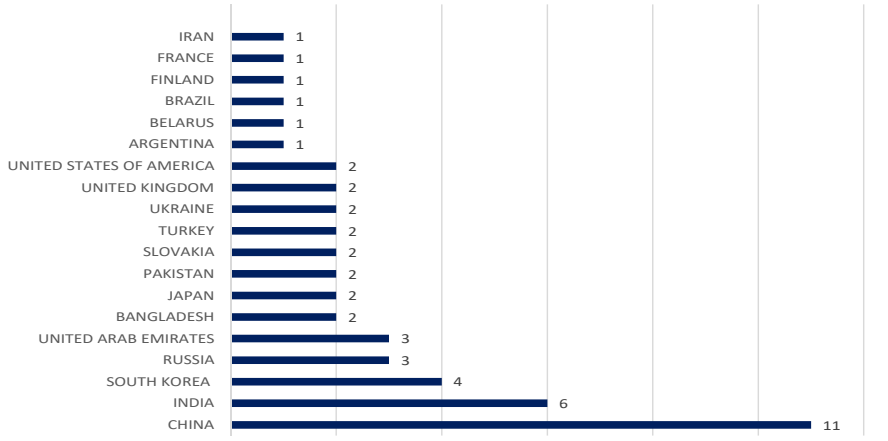


Figure 17: *Number of Nuclear Reactors under Construction (January 2021)*
Source: *IAEA PRIS database 2020*

[41] The World Nuclear Industry Status Report 2020, A Mycle Schneider Consulting Project, December 2020
[42] IAEA PRIS database
[43] https://www.iea.org/fuels-and-technologies/nuclear, August 2020

Highlights from Turkish Energy Industry

Seamless Integration Between STAR Refinery and Petkim Has Ensured Continued Operations During The Pandemic


Anar Mammadov

STAR Refinery is implemented by SOCAR Turkey, the largest direct foreign investor in Turkey, with US$6.3 billion investment. The Refinery continues production on an uninterrupted basis during the challenging course of the pandemic with its cutting-edge technology and integration with PETKİM. While the average capacity utilization rate of refineries in the Eastern Mediterranean was reportedly around 86% in the first three quarters of 2020, the STAR Refinery achieved an impressive average capacity utilization rate of 98% in the same period.

Cutting-Edge Technology Coupled With Resilience against Naphtha Stock and Price Fluctuations –

Anar Mammadov, the Head of the Refinery and Petrochemicals Business Unit at SOCAR Turkey remarked “The SOCAR Turkey Group has become increasingly influential both in terms of domestic and global markets with the STAR Refinery, which represents the largest real sector investment made in a single point in Turkey, as a result of customer satisfaction and continued confidence in the production and sustainability of this high-performing facility. As a reliable supplier, the STAR Refinery, which has been established in integration with Petkim, continues its production without interruption during the course of the pandemic. We see that the capacity utilization rate of most refineries in the Eastern Mediterranean (whose results are publicly available) has decreased significantly during the course of the pandemic. In comparison, our production continued at almost 100% capacity. We believe these impressive results were driven by the following: (i) upon the rapid decrease in jet fuel consumption in the early days of the pandemic, the STAR Refinery swiftly converted its jet fuel production into diesel by making use of its cutting-edge technology; and (ii) the structural integration with Petkim, which has meant the STAR Refinery has not been significantly affected by the global fluctuations in naphtha stocks and prices. The success of the STAR Refinery in managing operations and productivity during the pandemic over the first three quarters of the year demonstrates the value of the STAR Refinery for Turkey and also for our region."

Additional $45 Million Planned Investment in the Star Refinery

In recognition of the value of additional investments in advancing the operational flexibility of the STAR Refinery further, Mammadov stated that "The IFOP (Improvement of Flexibility, Operability and Profitability) Project represents an approximate US$45 million investment by SOCAR Turkey. It is currently in progress and commissioning is planned before the end of 2020. This project is intended to ramp up the operational flexibility, logistics capability and competitive power of the STAR Refinery by means of establishing additional sales and transmission systems."

Highlighting the STAR Refinery’s continued sustainability efforts, Mammadov noted that: "The high rates of conversion to white products (saleable refined oil products ‘diesel, jet fuel, LPG’ etc.) achieved by the STAR Refinery, which does not produce heavy black products such as fuel oil and asphalt during normal operations, are of great importance in terms of the overall environmental impact of the STAR Refinery's configuration. By doing so, STAR Refinery is contributing to the improvement of environmental sustainability. While doing this, based on crude oil throughput and refining capacity in excess of targets, I anticipate that refined products outputs at the STAR Refinery will exceed planned production targets for 2020. We are planning to increase our targets further in 2021.”

Stating that the SOCAR Turkey Group maintains production-level goals as well as achievements as to R&D and innovation, Mammadov ended his statements noting that: "Under the umbrella of SOCAR’s ambitious vision on sustainability and green chemistry, we continue our research and development investments and activities. I am proud to say that the SOCAR R&D and Innovation Company is partnering with expert researchers from Europe, the US and China on Project NEFERTITI (the acronym for 'Innovative photo catalysts integrated in flow photo reactor systems for direct CO2 and H2O conversion into fuels'). With Project NEFERTITI, the SOCAR Turkey Group aims to develop a commercial process for the photocatalytic conversion of carbon dioxide (one of the biggest contributors to global warming) into valuable chemicals such as ethanol and isopropanol for energy and transport, using solar energy."

Highlights from Turkish Energy Industry

SANKO Enerji's Salihli Geothermal Power Plant Became the First Geothermal Power Plant to Receive TSE Covid-19 Safe Production Certificate

SANKO ENERJİ

Sanko Energy's JES1, JES2, and JES3 geothermal power plants serving in the Salihli district of Manisa received the Covid-19 Safe Production Certificate issued by the Turkish Standards Institute (TSE) based on the measures taken against the epidemic. Salihli Geothermal Power Plant (GPP) became the first facility in the geothermal energy sector to receive this certificate.

Salihli GPP, whose application was accepted upon meeting the conditions in the Covid-19 Hygiene, Infection Prevention and Control Guide published by the Turkish Standards Institute (TSE), was thoroughly and meticulously examined by TSE officials. After the evaluations, it was determined that Salihli GPP was carrying out its business processes in accordance with the standards in the guide. Following this determination of TSE, Salihli GPP was entitled to receive the Covid-19 Safe Production Certificate, the international quality certificate of TSE in the geothermal energy sector.

Since the epidemic started, Sanko Enerji has been regularly disinfecting offices and businesses, distributing masks to employees, using disposable materials in cafeterias, hanging warning posters that keep hand washing and social distance rules in mind, alternating working hours, remote working, meeting, and visitors. The company followed the World Health Organization and the Ministry of Health publications and informed its employees regularly. In order to manage extraordinary conditions, Sanko Enerji ensured the correct and effective implementation of the measures taken through the board formed by the relevant department managers.

Sanko Enerji's Sanibey Hydroelectric Power Plant and Dam received the TSE Safe Production Certificate in June and became the first enterprise in the energy sector to receive this certificate.

Since its establishment, Sanko Energy has made significant contributions to meet Turkey's energy demand with investments in renewable energy sources. The company once again proved that it operates with an approach that prioritizes the environment and its employees' health with the certificate received by Salihli GPP. Serving in the Salihli district of Manisa, Salihli JES1, JES2, and JES3 power plants meet the electrical energy needs of approximately 200,000 thousand houses with a total capacity of 69.5 MW.

Sanko Enerji's Sanibey Hydroelectric Power Plant and Dam received the TSE Safe Production Certificate in June and became the first enterprise in the energy sector to receive this certificate. Following Sanibey, Sanko Energy's three hydroelectric power plants operating in Rize and Tepekışla Hydroelectric Power Plant were also entitled to receive this certificate.

With an investment of $1.5 billion in six hydro, two wind and three geothermal power plants, Sanko Energy generates 2.7 TWh electricity from renewable sources with a total installed capacity of 725 MW. The company aims to generate 3.4 TWh of electricity per year by increasing its capacity to 900 MW with an additional investment portfolio of $200 million currently in place.

Highlights from Turkish Energy Industry

Enis Amasyalı Appointed as General Manager of Borusan EnBW Enerji

Borusan EnBW Enerji, one of Turkey's leading renewable energy companies, appointed Enis Amasyalı as the General Manager of Borusan EnBW Enerji as of January 1, 2021. Enis Amasyalı managed the investment processes of 12 renewable energy power plants, which are among Turkey's most valuable assets, during his post as the Deputy General Manager of Borusan EnBW Enerji since 2011. He pioneered the commissioning of the project management system, project management and engineering expertise processes compatible with international practices, the transition to the matrix organization system, and the commissioning of the Information Management System, which constitutes the company's corporate memory.

Expressing his views on the appointment of Enis Amasyalı as the General Manager to Borusan EnBW Enerji following the successful projects carried out within the company so far, Erkan Kafadar, the CEO of Borusan Holding, said:

"We have been investing in our talented employees for many years and focusing on career development at Borusan Group. As Borusan, we first evaluate our internal candidates in appointments to all levels and use the company's promotion and rotation opportunities and among group companies at the highest level. I believe that every employee that we invest in career development today and in the future will make significant contributions to both their own life and the Borusan Group, and I wish Enis Amasyalı success in his new position."

After graduated from Çağaloğlu Anadolu High School, Enis Amasyalı had a B.Sc. degree from the Electrical Engineering Department of Istanbul Technical University and completed the Executive MBA program at Sabancı University. He worked as an electrical engineer and project manager at Baytur İnşaat and its subcontractors between 1996 and 2000. Amasyalı joined Siemens Turkey in 2000 and worked as a senior project manager in many projects of various industries. He then took over the management of the Project Management Office and the company's Industry Sales Group. Enis Amasyalı has been serving as Borusan EnBW Enerji Deputy General Manager responsible for investments since 2011.


Enis Amasyalı

Borusan EnBW Enerji is established in 2009 by Turkey's one of the leading conglomerates, Borusan Holding, and Germany's EnBW AG, one of the leading energy companies in Europe, to support the development of Turkey's renewable energy sources. The entire generation portfolio of Borusan EnBW Enerji consists of renewable energy power plants. The company puts efficiency and harmony with the natural and social environment at the forefront of its activities from investment to operation. Borusan EnBW Enerji also assumes a leading role in the Turkish power market by its electricity sales and trading. Borusan EnBW Enerji targets to evaluate Turkey's potential in renewable energy in the most effective way and will reach 725 MW total installed capacity at the beginning of 2021.

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