FUTURE TRENDS

مؤسسة دبي للمستقبل
DUBAI FUTURE FOUNDATION

In collaboration with

مجالس دبي للمستقبل
DUBAI FUTURE COUNCILS
ENERGY
الطاقة

ENERGY

INSIGHTS IN BRIEF

2020 has seen the largest decline in global energy investment in history due to COVID-19, estimated at around $400 billion or 20 percent.

The decline in financing will not be equally distributed as more countries shift their investments into local production and renewable sources.

Further investment in supply-chain digitalisation and infrastructure security will help offset the total loss of investment in the industry.

CURRENT SITUATION

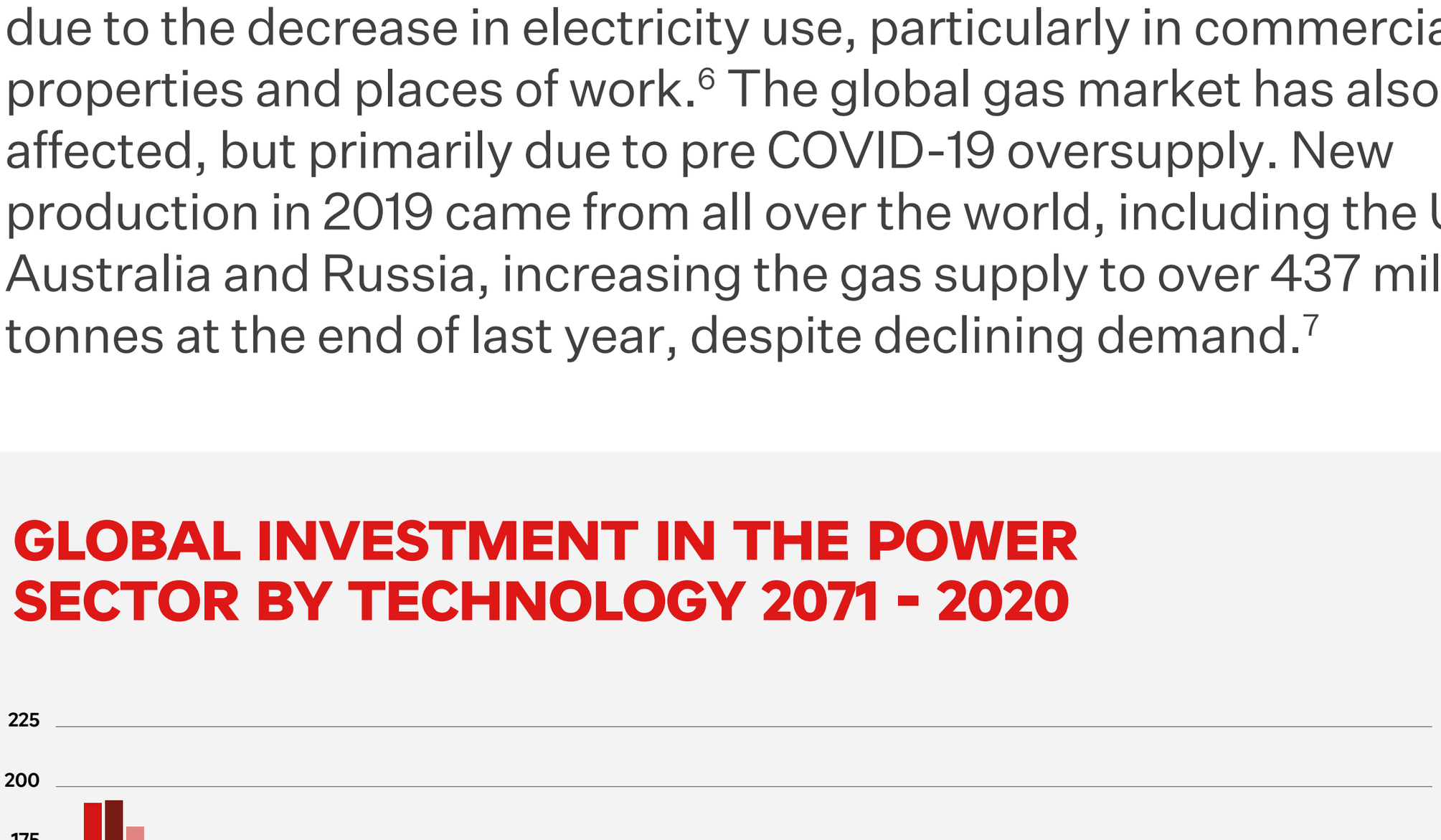
According to a recently launched report by the International Energy Agency (IEA), the COVID-19 pandemic will cause the largest decline in global energy investment in history, estimated at almost $400 billion or 20 percent, compared to 2019.[1] The most affected sector has been fuel supply, due to the decline in oil prices, whereas the power sector has been less affected with a 10 percent decrease in investment.[2] The decline in funding was unforeseen and has serious implications for the energy sector. At the start of 2020, global energy investment was on a rise and was expected to have risen by 2 percent year-on-year, the highest increase in spending in six years, in the absence of the COVID-19 pandemic.[3]

[1] "The Covid-19 crisis is causing the biggest fall in global energy investment in history", International Energy Agency, 2020.
[2] "World Energy Investment 2020", International Energy Agency, 2020.
[3] AlFaham, T., "COVID-19 crisis is causing the biggest fall in global energy investment in history: IEA", WAM, 2020.

On a human level, COVID-19 has also shed light on the number of people worldwide living without electricity, hindering access to reliable healthcare and services. While the number of people worldwide without access to electricity has declined from 1.2 billion to 789 million over the past 10 years, a joint report by the IEA, the International Renewable Energy Agency (IRENA), the UN Statistics Division (UNSD), World Bank, and World Health Organization (WHO) forecasts that nations, globally, will not be able to meet the 2030 deadline to provide universal access to affordable and reliable energy.[4] The report projects that 620 million people will still not have access to energy by 2030, a number that could increase if investment in energy production declines even further.

Oil prices have been volatile, with predictions that the level of supply in 2025 will be almost 9 million barrels a day lower than previously expected.[5] Coal, another fossil fuel, has also been hit substantially due to the decrease in electricity use, particularly in commercial properties and places of work.[6] The global gas market has also been affected, but primarily due to pre COVID-19 oversupply. New production in 2019 came from all over the world, including the US, Australia and Russia, increasing the gas supply to over 437 million tonnes at the end of last year, despite declining demand.[7]

GLOBAL INVESTMENT IN THE POWER SECTOR BY TECHNOLOGY 2071 - 2020



[4] "Tracking SDG 7: The Energy Progress Report (2020)", International Renewable Energy Agency, 2020.
[5] "Global oil and gas investment to fall by almost one-third in 2020, says IEA", Oil Review, 2020.
[6] Boom, D. "5 things to know about how coronavirus has hit global energy", World Economic Forum, 2020.
[7] Mills, R., "Why gas can emerge from negative pricing and the Covid-19 crisis as the major future hydrocarbon", The National, 2020.

Investment in power systems and electricity networks is expected to have declined by around 10 percent in 2020, including distribution, generation and all forms of generation. Renewables, although more still seeing more investment than fossil fuel energy, have seen a decline.[8] Energy efficiency is suffering too. Investment in efficiency and applications that utilise clean energy is estimated to have dropped by 10-15 percent in the year.[9] However, experts believe that investment in renewable energy will eventually increase, replacing other forms of energy production, post COVID-19.[10]

The nuclear energy market has also suffered slightly due to a decrease in demand worldwide. However, many experts predict that during the next decade or so China will surpass France as the world's second largest generator of nuclear power and then overtake the US, as the first, to become world's nuclear energy leader. This is due to the increase in reactors in China and the decrease in reactors in both France and the US, as they reach the end of their operating life.[11] Although renewables have overtaken nuclear, nuclear power still holds a large share in the energy market.[12] Construction of the UAE's Barakah nuclear plant has continued through COVID-19, and now the plant has begun generating nuclear power, providing the UAE with another form of energy beyond fossil fuels.[13] Barakah is one of the first nuclear plants in the MENA region, with Egypt's El Dabaa nuclear power plant also being developed.

Investment in efficiency and applications that utilise clean energy is estimated to drop by 10-15 percent this year.

However, experts believe that investment in renewable energy will actually increase post COVID-19.

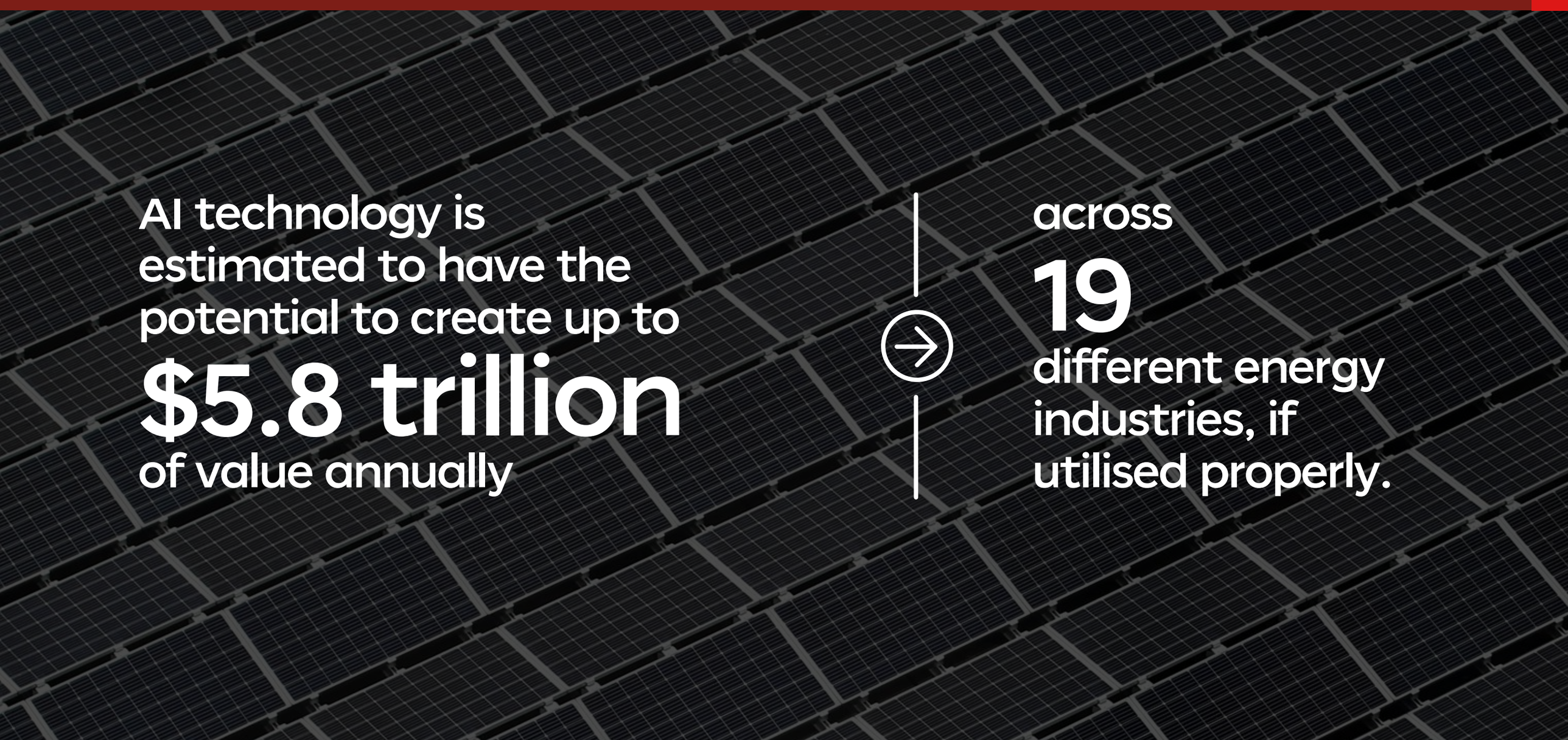
[8] IEA. World Energy Investment 2020. https://www.iea.org/reports/world-energy-investment-2020/power-sector
[9] AlFaham, T., "COVID-19 crisis is causing the biggest fall in global energy investment in history: IEA", WAM, 2020.
[10] Penn, I., "Oil Companies Are Collapsing, but Wind and Solar Energy Keep Growing", The New York Times, 2020.
[11] Pomper, M.A., "China Has Big Plans for Its Nuclear Energy Industry. But Will They Pan Out?", World Politics Review, 2020.
[12] Zaremba, H., "Can The Nuclear Industry Survive COVID-19?", OilPrice, 2020.
[13] Zaatari, S., "Construction of Abu Dhabi nuclear plant on track despite Coronavirus", Gulf News, 2020.

OPPORTUNITY

Digitalisation and emerging technology, such as AI, blockchain and IoT, are becoming key drivers in energy production and disruption. The increased focus on digitalisation during COVID-19 has both increased demand for energy in some sectors, for example through more electricity demand as people work remotely, and decreased the demand in other sectors. Experts predict that in the next five years, digitalisation could lead to more greenhouse gas emissions globally than road traffic does.[14] However, digitalisation has also provided greater efficiency and transparency in the energy sector, as well as more robust infrastructures.

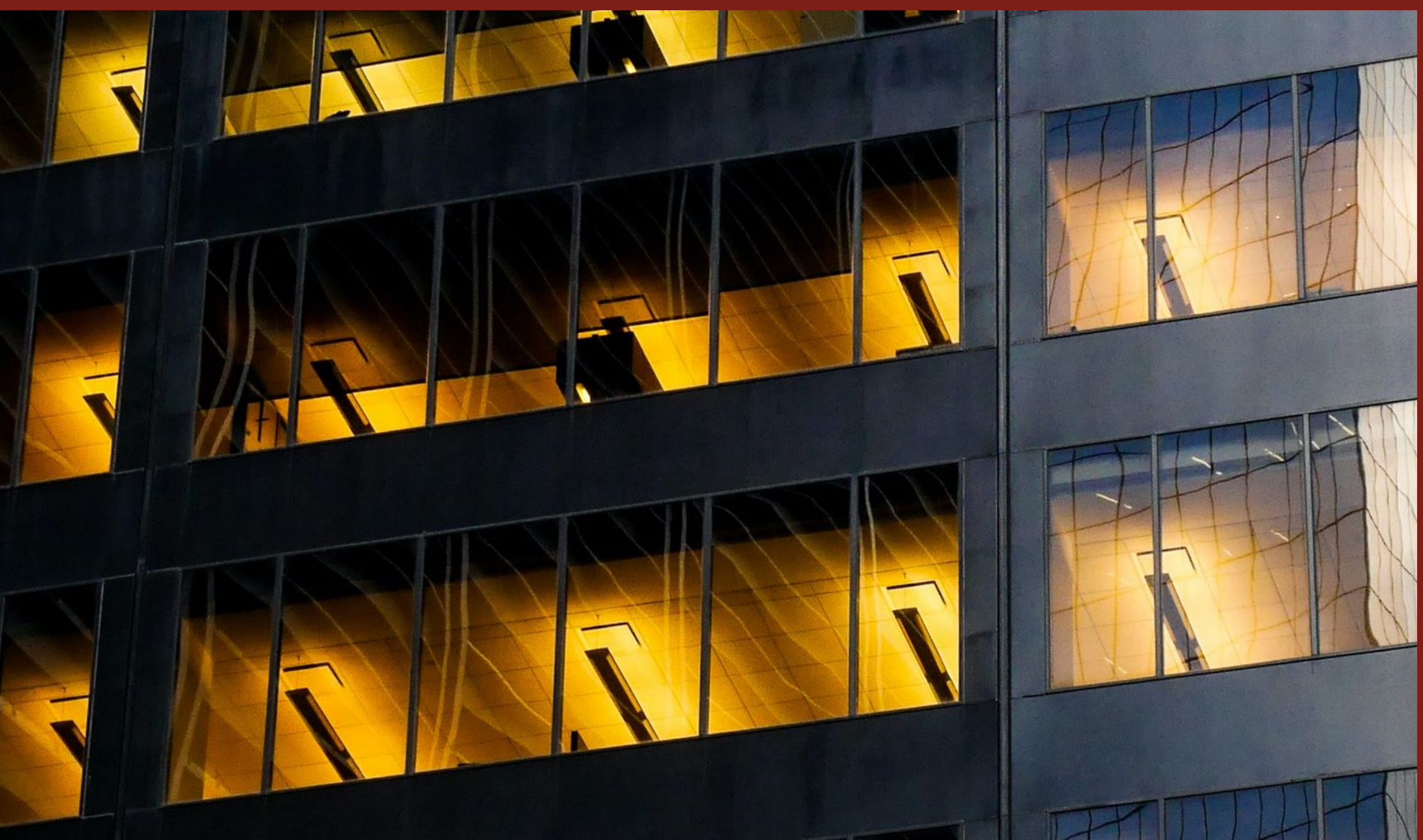
[14] Massei, C.V., “COVID19- will accelerate the revolution in energy systems”, World Economic Forum, 2020.

Artificial intelligence (AI) has been used to manage renewable energy generation, for example by supporting solar farm managers in monitoring and adjusting panels based on patterns in energy generation. The technology is estimated to have the potential to create up to $5.8 trillion of value annually across 19 different energy industries, if utilised properly.[15] Additionally, machine learning can be used to determine locations for new solar installations, also based on analysis of patterns to find the best generating space. The Internet of Things (IoT) and blockchain technology have also become more prevalent in the energy sector. IoT sensors have already been used across the world to monitor energy consumption in homes and offices. When paired with blockchain technology, they could provide access to a larger decentralised energy network as applicable in different countries and economies. Researchers have devised blockchain implementation pilots where blockchain and IoT would be used as the basis of an energy sharing platform, allowing more people to access and 'own' energy.[16] Other technologies, such as quantum computing and 5G, are also becoming more prominent, particularly in the management of smart energy grids.[17]



[15] Malek, C., "How artificial intelligence can revolutionize the Middle East energy sector", Arab News, 2020.
[16] Dogra, A. & Jain, R., "Solar Energy Distribution Using Blockchain and IOT Integration", Amity School of Engineering and Technology, 2020.
[17] Nerney, C., "Can quantum computing help power our energy grid?", Thrive, 2020.

Saudi Arabia has recently installed 120,000 smart meters in the north of the country to monitor consumption patterns. The output will provide the Kingdom with an effective strategy to further reduce operational costs and energy waste, as well as to develop better infrastructure for energy security and energy saving.[18] In the UAE, the Dubai Electricity and Water Authority (DEWA) has launched a smart meters initiative as part of its smart grid to support the aim of making Dubai the smartest and happiest city in the world. In addition, Digital DEWA has been established to provide support in increasing the use of solar power, energy storage, and Artificial Intelligence (AI) in the energy sector. It can also provide AI-based electricity and water services, expanded digital services and the management of cloud-based services.[19] Dubai has also installed more than 1.6 million smart meters for water and electricity, in addition to a number of full-fledged smart grid programs. The emirate is also building a hydroelectric power station, the first of its kind in the GCC region. The 250MW station will generate electricity by making use of the water stored in Hatta Dam. It will have a storage capacity of 1,500 MWh and a life span of 80 years.



[18] Malek, C., “How artificial intelligence can revolutionize the Middle East energy sector”, Arab News, 2020.
[19] DEWA, 2020.

In addition to the use of natural resources for electricity, nations have also been developing smart buildings. Digital connections between power grids and buildings can unlock huge potential. Currently, buildings account for approximately 40% of global energy consumption, but reportedly waste up to 50% of that energy. A digitised network that can monitor and manage building consumption could reduce energy waste by 80%. Companies such as Siemens, Honeywell, IBM and Cisco are already developing ways to support building manufacturers with such technology to boost smart building development.[20]

However, it is important to note that some researchers have advocated caution over the use of AI and blockchain in the energy sector, as both technologies require a lot of energy to operate, increasing demand on energy production. Many technologists are instead focused on improvements in the core technologies of low-carbon energy, such as advanced, high capacity, wind turbines, creating a cycle whereby each new generation of the technology is more efficient.[21]

As has been discussed in previous Dubai Future Research reports, COVID-19 has disrupted supply chains worldwide. This disruption has shed light on the different supply issues within the energy sector, including dependency on external sources, whether on particular companies or countries, for energy transmission. This has led to a focus on domestic energy security in countries around the world, with evaluations of risk and dependence on global energy markets. Internally, the Dubai Government uses long-term contracts with entities such as Dolphin gas and ADNOC, as well as Shell as an LNG supplier. This diverse approach to the gas supply chain provides alternatives if a global crash in the energy market takes place. ENOC also hosts stock in their refinery in case of necessity.

[20] Rohit, “Smart Buildings Market: Understand the Key Growth Drivers Developments and Innovations”, Cole of Duty, 2020.
[21] “The Developing Role of Blockchain”, World Energy Council, 2018.

FUTURE TRENDS: ENERGY

Energy security has also become key. In Dubai, energy security measures include reserve margins (power at 25% and water at 15%) that are available from production plants across the emirate. The reserves will ensure availability of supplies in Dubai for 2020 and beyond. From an emirate perspective, power transmission and distribution systems are highly reliable with strong fail-safe redundancy and plans for expansion and reinforcement. Dubai has already put in place contingency plan and risk mitigation measures to ensure reliability and accessibility of transmission and distribution networks for power and water. In MENA, as of 2019, Saudi Arabia and Egypt were leaders in electricity generation: Saudi Arabia due to the country's size and energy diversity projects; and Egypt due to the use of its rivers for hydroelectric power plants.[22] Energy security should be a priority for the MENA region as a whole, to ensure that nations that rely on major producers have the necessary reserves in place at times of shortage.

[22] Krylov, P.M., Ammar, J. & Troyanskaya. M. A., "Financial risk of the MENA's energy architecture", Espacios, 2020.

The MENA region has been dependent on oil and fossil fuel production as both a source of energy and income for a long time. A quarter of its power comes from oil, compared to 3% which currently comes from renewable energy.[23] Although oil prices have been on the rise, if the worst-case scenario remains, with oil priced at $20 a barrel for this year, PwC estimates that GCC governments could lose up to $500 million a day in state oil revenue.[24]

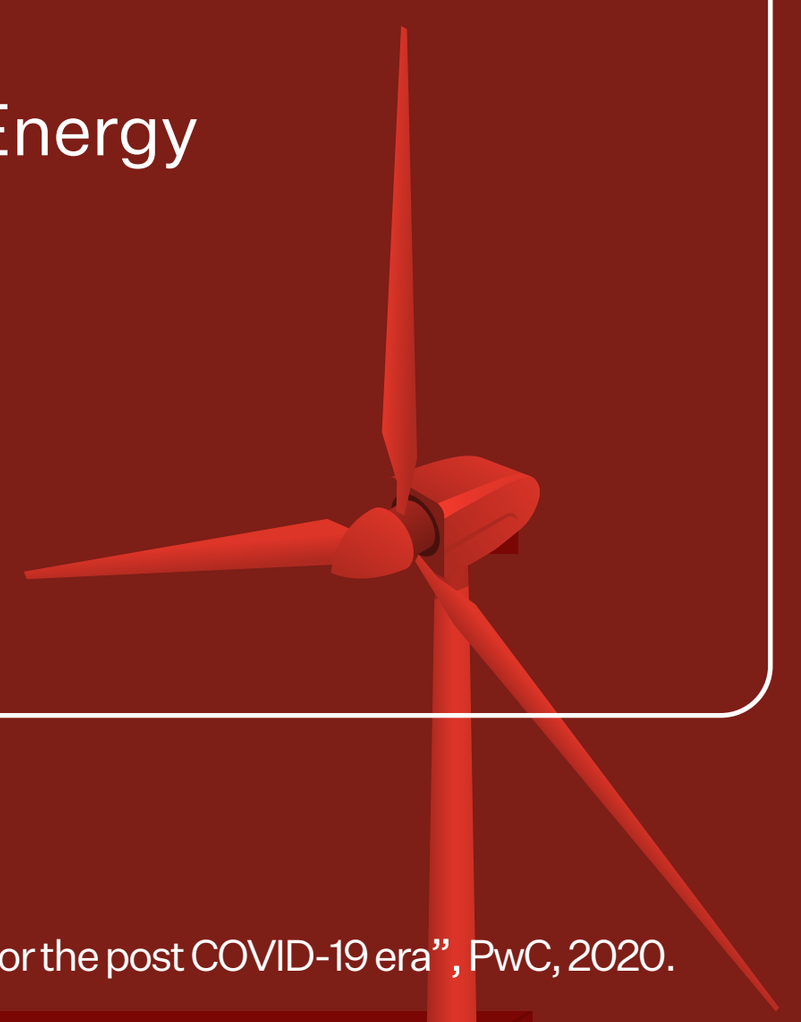
As a consequence, renewable energy is becoming more important in MENA, with infrastructure projects such as solar and wind farms underway in several countries. In the UAE, the Mohammed bin Rashid Al Maktoum Solar Park has been developed to achieve the target of 25% clean energy capacity in the emirate of Dubai by 2030, and 75% by 2050 in Dubai. DEWA is currently implementing a strategy for renewable expansion and diversification of fuel as most of its power currently comes from gas. Dubai's 2020 installed capacity from renewables was around 9% of its diversified energy mix.[25] All current and future water desalination expansions will rely on Reverse Osmosis technology and will utilise clean energy sources. Some fossil fuel plants will, however, continue to be needed as a backup source of energy for decades to come, providing system reliability and operational flexibility. Additionally, cogeneration combined cycle gas turbine (CCGT) plants that produce both power and steam are set to continue to operate due to their cost effectiveness in utilising waste heat for water desalination.[26]

The Mohammed bin Rashid Al Maktoum Solar Park has been developed to achieve the target **clean energy capacity** in the emirate of Dubai

25%
of Clean Energy
by 2030

↓

75%
by 2050



[23] Benban, "Arab states are embracing solar power", The Economist, 2020.
[24] Thomas, J., Pandey, A. & Ozeir, F., "Transforming the GCC's energy sector for the post COVID-19 era", PwC, 2020.
[25] DEWA, 2020.
[26] Interview, Dubai Electricity and Water Authority, 2020.

Renewable energy capacity in the region has doubled to 40 gigawatts (GW) over the past decade and is set to double again by 2024.[27] Solar power projects in Egypt, Jordan, Morocco, Oman and Saudi Arabia have all been on track in the MENA region and have a combined capacity of 4.22 GW, the equivalent of several massive power plants.[28] This drive towards renewables is also being seen in national policy targets. In the GCC, national strategies for renewable energy set targets for 15 percent in Kuwait, by 2020, 5 percent in Bahrain by 2020, and 24 percent in the UAE by 2021 – although these may change slightly due to COVID-19.[29] This has illustrated that energy policies should focus on investment of technology in supply chains and the diversification of energy production, moving towards renewables which are in turn more abundant and cheaper.

Country	Renewable Energy Generation 2019 (GwHr)
China	758,626
US	264,504
Brazil	141,933
India	128,233
Germany	125,386
Canada	100,997

Top Countries in Renewable Energy Generation from 2019 [30]

[27] "Saudi Arabia: Increase in VAT rate announced to assess the Kni gdom's medium and long-term fiscal position", PwC, 2020.
[28] Dimitrova, A., "MENA with 4.2 GW of solar under construction in 2019 – MESIA", Renewables Now, 2020.
[29] Al-Saidi, M. & Saliba, S., "Water, Energy and Food Supply Security in the Gulf Cooperation Council (GCC) Countries – A Risk Perspective", MDPI, 2020.
[30] "Will COVID-19 change the future of the electric grid?", ARC Advisory Group, 2020.

FUTURE TRENDS: ENERGY

Renewable technology also has other benefits. It provides employment opportunities, which will be even more necessary post COVID-19, as individuals are required to manage and monitor the systems. Due to the global decrease in production, and limited operations in the energy sector generally, job growth will be vital. 11 million people worldwide were employed in the renewables sector in 2018 and IRENA reports that this could rise to 42 million globally by 2050.[31] It also provides greater citizen involvement, with individuals being able to use solar panels in their own homes, or even to buy shares in energy companies so they can become part of a national clean energy program.[32]

COVID-19 has also highlighted how much of modern life is detrimental to our current ecosystem. As clean energy becomes a larger focus worldwide, COVID-19 has illustrated that decreasing daily commutes, limiting consumption and waste, restricting movement and limiting the number of people in offices has actually helped the environment. Although the economy cannot sustain a permanent lockdown, the impact of COVID-19 on the environment has raised questions around what countries need to do to sustain this positive growth, and to provide new sustainability policies for individuals' everyday lives. The Dubai Future Research team explored climate change and the environment in its "Tackling Climate Change" report.

[31] "More countries tapped into the socio-economic gains of the energy transition", IRENA, 2020.
[32] "Staying on Course: Renewable Energy in the Time of COVID-19", IRENA, 2020.

LOOKING AHEAD

Short term insight and recommendations
(during the COVID-19 outbreak)

- Digitalisation initiatives, if not already in place, will need to be developed further to allow for further interconnectivity within the local energy market. This will include incorporating technologies such as AI, IoT, and blockchain.

- Localisation of materials and supply chains will become even more necessary during and post COVID-19, given the volatility around production and investment in global markets. It is important to note however, that the energy sector has not been affected in all of its operations and strategic components due to the continuing availability of energy capacity and spare parts.

Short to long term insights and recommendations
(post COVID-19)

- There will need to be greater investment in renewable and alternative energy. There will also need to be a greater focus on the circular economy, to reap the largest benefit from clean energy.

THE LONG-TERM VIEW

Renewables are expected to surpass fossil fuels in time as the primary source of energy around the world as a result of efforts to tackle climate change, and as they continue to become an even cheaper source of energy. As the world transitions to renewable energy, energy firms will need to diversify from traditional fossil fuel infrastructure. The transition to renewable and clean energy within the energy sector will be positive. Existing fossil fuel infrastructure is expected to be repurposed for industries of the future, utilising technology and automation to monitor, manage, and plan energy production. ‘Green’ hydrogen produced from renewable sources, for example, could become a more prominent industry, with natural gas pipelines in some cases converted to be used for the distribution of this new form of energy.