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INTRODUCTION

As the world population continues to grow and the demand for energy increases, the dependency on energy sources is also expectedly to follow suit. It has become clear to scientists and countries around the world that our dependency and reliance on non-renewable energy sources such as fossil fuels are unsustainable in the long term and will have significant impacts for many generations to come. To be frank, even those previously opposed to the existence of climate change have seen the light. The burning of fossil fuels to produce energy releases harmful chemicals to the environment, such as carbon dioxide and other air pollutants that have been found to contribute to climate change and other negative impacts on both human and environmental health. In fact, it has been shown

that almost 80% of global Greenhouse gas (GHG) emissions come from burning fossil fuels and other energy-reliant activities, such as heating, electricity production, transportation, and manufacturing [1]. Studies have also shown that due to increasing quality of life globally, growing populations, and sophisticated technologies that rely on intense amounts of energy, global GHG emissions grew by 24% between 2005 to 2019, with the majority coming from developing countries [2]. Evidently, the continued excessive consumption of these resources has and will lead to numerous environmental and social consequences in the form of climate change, air pollution, and energy security around the world. To address these challenges and promote sustainable development, it is necessary to transition to cleaner and renewable energy sources. However, transitioning to renewable energy is a complex process that will require significant changes to our environment, ranging from infrastructure to behavior attitude towards the environment, and isn't a switch that can be turned on overnight. Obstacles such as grid interoperability and large capital investments will require both time and commitment from multiple companies and global organizations to overcome, and the cost and impact of these on mainstream are, as they should be, a factor in how fast it is implemented.

REASONS FOR THE TRANSITION

A. Environmental Concerns

Climate change and other environmental facts, such as air pollution, are perhaps one of the largest drivers for the transition to cleaner energy

sources and for creating a sustainable future. Burning fossil fuels such as oil, gas, and coal are the main contributors to rising levels of GHGs in the atmosphere which ensnare heat and therefore incite global temperatures to rise. The impacts of climate change are already being felt by millions of people, ranging from rising sea levels, droughts, storms, and heat waves. This demonstrates how our continued reliance on heavily polluting energy sources is contributing to increases in global temperatures. In fact, according to the United Nations (UN), global *“surface temperatures have increased faster since 1970 than in any other 50-year period over at least the last 2000 years”* [3]. This alarming statement raises much concern for our future; since technology and populations are only ever increasing, it can easily be inferred that our current temperature trajectory is unsustainable. The graph below gives a visual representation of the Earth’s rising temperature trend over the past 40 years.

GLOBAL AVERAGE SURFACE TEMPERATURE

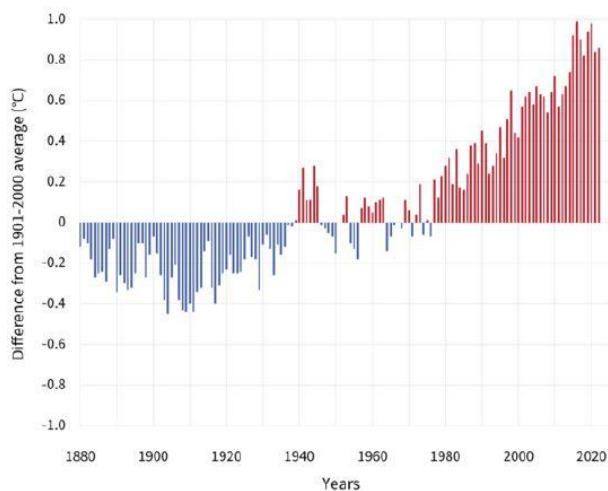
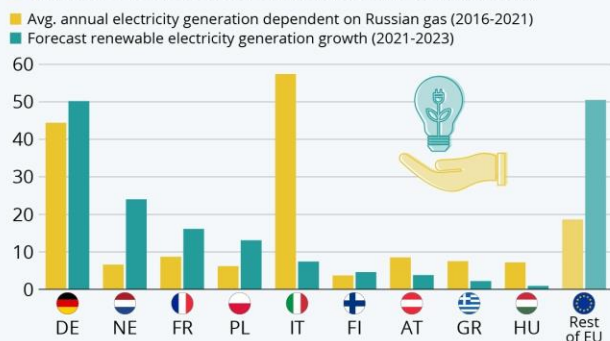


Exhibit 1. Global Surface Temperature Trend[4]

Thankfully the transition to renewable energy is already underway, with many initiatives, programs, and technologies making strides in efficiency and usability. However, despite our impressive technological leaps in sustainable energy sources, there is still a very long road ahead to achieving reliable, sustainable sources on a global scale. To make a transition properly and efficiently to renewable energy sources to lessen the impact on the environment, governments, businesses, and even individuals need to come together and play their part in hastening the transition. Governments can continue setting policies, carbon pricing, and tax incentives to support renewable energy development. Meanwhile, businesses need to invest in renewable sources as early as possible and adopt sustainable technologies. Individuals, on the other hand, also have a role to play. Installing solar panels and making sustainably conscience decisions can go a long way in improving the transition. Norway is a great example of a country that has been leading the world in renewable electricity generation. Almost 92% of Norway’s electricity comes from renewable sources thanks to its extensive hydropower resources [5]. Moreover, Norway was also successfully able to electrify most of its energy demand, posing it for an even better transition to renewables. In addition to reducing greenhouse gas emissions, transitioning to renewable sources brings many other benefits that countries can enjoy, such as energy security, technological innovation, and public health.

Where Renewables Are Poised to Reduce Russian Gas Dependency

Avg. annual electricity generation using Russian natural gas and forecast renewable generation growth (in TWh)



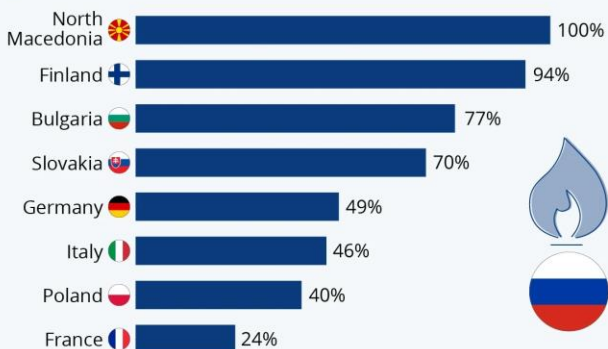
Source: International Energy Agency



statista

Which European Countries Depend on Russian Gas?

Share of gas supply from Russia in selected European countries (2020 or latest available)



Source: European Union Agency for the Cooperation of Energy Regulators



statista

Exhibit 2. Russian natural gas dependency [7].

B. Environmental Concerns

Energy security in a global scale has recently risen to the spotlight for many countries and communities and has been high on the global-

agenda due to the war in Ukraine. With oil prices at record highs, many countries experienced firsthand how energy reliance can severely impact national economics and pose a much larger threat to a country's stability [6]. Energy security is not only about ensuring uninterrupted access to energy, but also about securing said energy at a reasonable price. Fortunately, the transition to renewable energy sources can significantly aid in reducing a country's reliance on fossil fuel imports and thereby make it much more self-sufficient in terms of energy output. For instance, renewable sources such as wind and solar are much more abundant and widely distributed than fossil fuels. The increase in reliance on sustainable energy sources can reduce a country's exposure to price fluctuations and supply disruptions that are normally caused by political unrest and conflicts. This tremendously helps in establishing stability in the energy supply and allows countries to have more freedom regarding their energy usage. However, one major issue that stands against the transition is the fact that not every region can rely on renewable energy sources since geographic locations and electrical grid interoperability can pose challenges. This, however can come with a silver lining, as different regions will have to move away from an environment based on fossil fuel imports and exports to that of sharing resources depending on the current conditions. The graph below showcases how the energy security concerns sparked by the Russian conflict in Ukraine have fueled an increased growth towards renewable electricity generation [7]. This is a direct result of higher natural gas prices driving up the need for

greater energy security through the means of renewable energy sources, which are known to be much more stable in terms of economic and geopolitical conflicts.

C. Technological Innovations

Technological innovations have been one of the greatest drivers of modern renewable energy sources. As more and more advanced technologies emerge, efficiencies, costs, and storage of renewable energy make for a more competitive and lucrative industry. This goes a long way towards replacing fossil fuels, as companies and countries greatly value costs when it comes to replacing energy sources. In fact, the global cost of renewable energy produced from solar photovoltaic power has dropped by about 82% from 2010 to 2019, with wind power also dropping by about 29% in the same time period [8]. These reductions in cost can be directly attributed to the advancements in technologies being used when building these machines. Advancements toward the efficiency of these energy sources have also seen a massive leap in recent years. For instance, solar panels went from 6% efficiency rates back in 1954 to an average of about 20 to 22% in modern solar panels [9]. Scientists have also been able to achieve as much as 47.1% efficiency using advanced and expensive techniques [10]. These advancements, while may be currently expensive, can open thousands of opportunities for growth in the renewable industry in the near future. Grid integration is also a major challenge that poses a threat to the adoption of renewable energy sources. However, as emerging smart grid

technologies have been proven to significantly aid in the integration of renewable energy systems by managing and balancing the supply and demand of electricity in real time. Finally, there has been major advancements in the field of nuclear energy in recent times. For instance, scientists in California, US recently made a massive breakthrough in nuclear fusion technology [11]. For the first time, a reaction was created that produced more energy than it consumed. This seemingly unimpressive output is in fact, game-changing, the potential for limitless energy generation, while still perhaps decades away, for the first time is within reach. Such technological innovations help mankind continue improving and push the boundaries to what once was thought impossible.

The technological breakthroughs and work going towards the advancement of renewable energy has also given rise to millions of job opportunities. According to the International Renewable Energy Agency (IRENA) the renewable energy sector has brought about nearly 11 million job opportunities worldwide [12]. As more and more industries shift to the renewable energy sector, more jobs are expected to be created that focus on the maintenance, installation, and operation of these renewable systems. This massive growth in the renewable sector is helping stimulate the economy and create a more diverse system that is tailored for many different skills and positions.

D. Public Health

Finally public health. Very closely linked to climate change and perhaps just as important, public-

A Snapshot of Canadian Energy Use

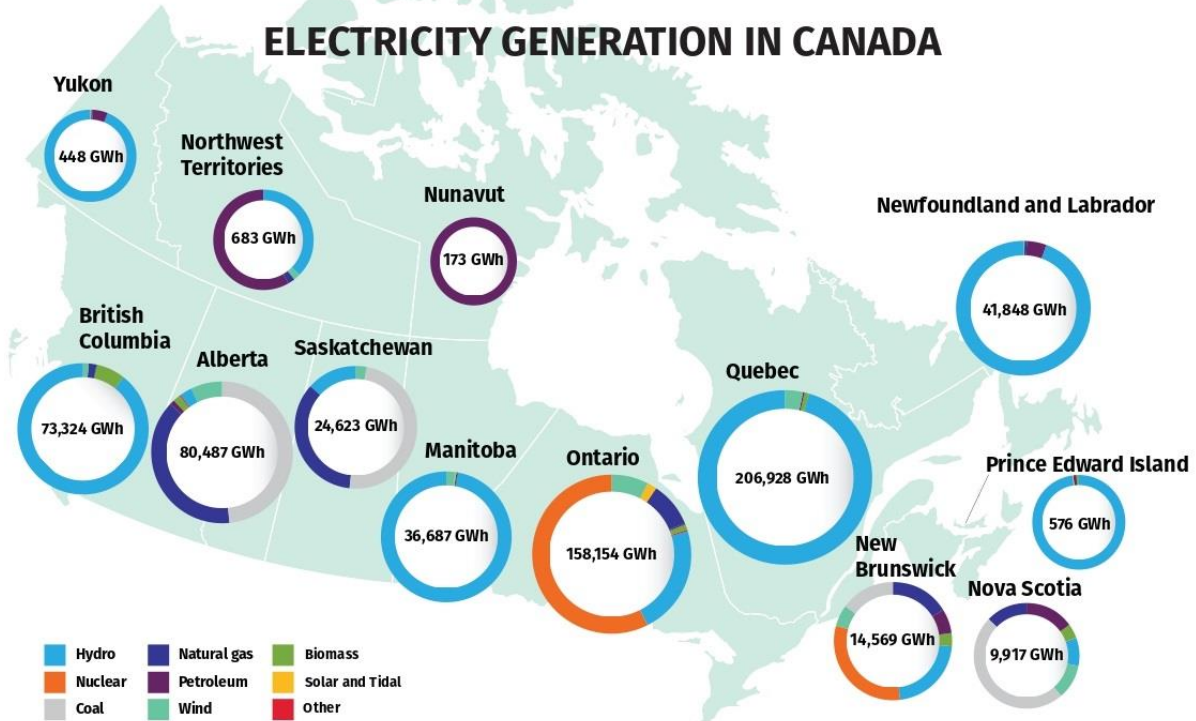
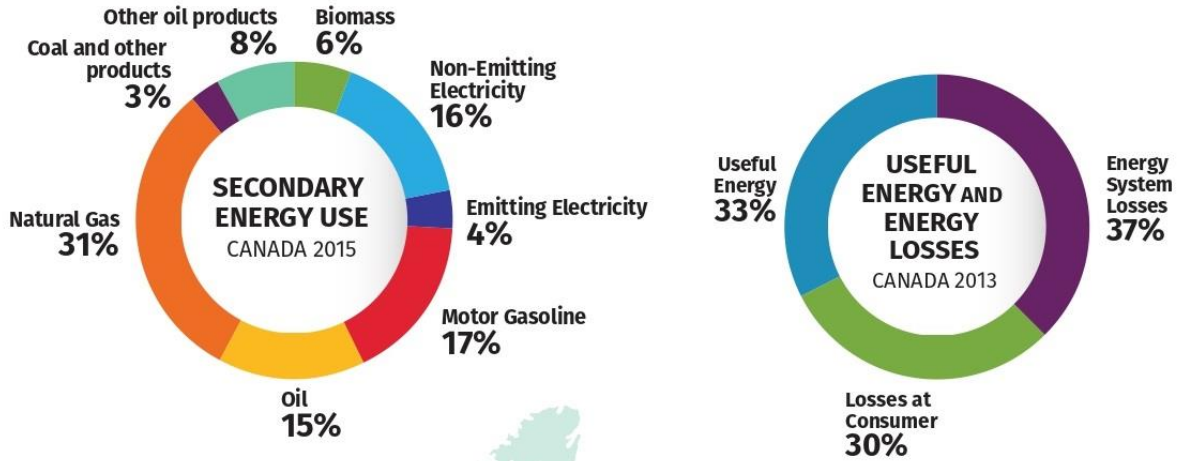


Exhibit 3. Energy Use in Canada

health in terms of air pollution is a very serious impact of burning fossil fuels and can be greatly mitigated with the adoption of renewable energy sources. Energy sources such as solar and wind power, for example, produce no on-site emissions and therefore create a much cleaner environment. These transitions, even on an individual scale, can go a very long way in helping clear the air and preventing respiratory and cardiovascular diseases that are linked to poor air quality. Another method that helps increase the quality of life of the community, is the greater transition to public transportation, cycling, and walking. All of these transportation methods reduce the reliance on personal vehicles and thereby further reducing the number of tailpipe emissions that lower air quality. The lower amount of vehicles also helps reduce congestion which lower the chances of accidents, again improving the overall quality of life. Transitioning to electric vehicles, which we are seeing much more of today, has also been linked to better air quality and improved public health. A study conducted in California found that for every 20 zero-emission vehicles per 1000 residents amounted to almost a 3% drop in emergency asthma-related visits [13].

China, for example, has been known to house one of the most polluted cities in the world, such as Beijing. In 2015 it was reported that sulfur dioxide (SO₂) levels exceeded the city's environmental absorption capacity by 50% [14]. Since then, China has made tackling air pollution one of its primary goals through greater adoption of renewable energy and by improving energy efficiency. Due

to these efforts, an estimated 2.5 million tons of CO₂ were reduced, and clear blue skies could be finally spotted.

Types of Renewable Energy Technologies and Their Cost

A. Photovoltaic Energy (PV Energy)

Photovoltaic devices utilize semiconductor materials like silicon to convert sunlight into electricity without any moving parts or emissions during operation. These devices are highly modular and can be used in small cells, panels, and arrays. These modules require minimal maintenance and typically have a lifespan of 30 years [15].

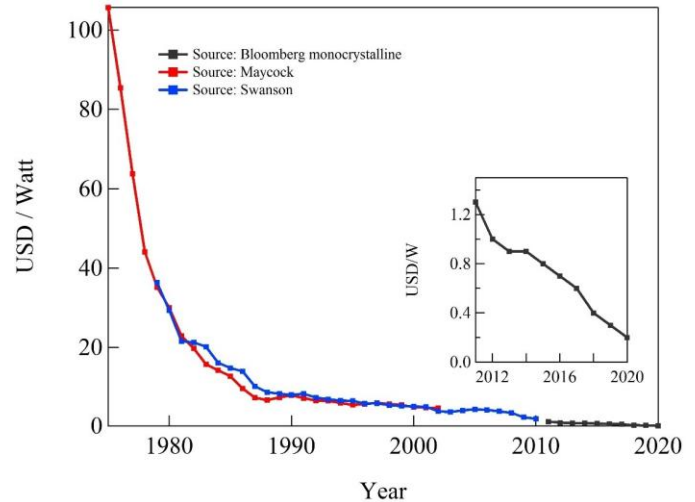


Exhibit 4. The cost of photovoltaic modules.

The cost of photovoltaic modules has significantly reduced over the years, from over \$30/W in the 1980s to about \$0.2/W today, and the levelized cost of electricity generation (LCOE) has also

decreased from \$0.42/KWh in 2010 to around \$0.05/KWh [16]. Provided the cost has become lower than conventional electricity generation (0.1/KWh for gas), photovoltaic panels have become increasingly popular, particularly in developed countries, for remote applications. The key driver for the reduction of installation cost can be attributed to the photovoltaic modules' conversion efficiency.

The photovoltaic industry has been experiencing steady growth over the years. In 1998, the photovoltaic market surpassed \$1 billion, sales rose by 30% in 1999 and 43% in 2000, and it has been flourishing ever since [17]. Solar PV capacity grew about 21-fold between 2010 and 2021, with over 843 GW installed by the end of 2021 [16].

Several factors have contributed to the improvement in the capacity, including the deployment of more solar panels in regions with greater irradiation, and increased usage of tracking devices in large-scale solar systems, and efforts to decrease system losses.

B. Wind Energy

Wind power systems convert the kinetic energy of the wind into other forms of energy such as electricity. Wind turbines come in different sizes, usually ranging from 200 to 750 KW.

The rapid advancement in wind power technology has made it cost-competitive with conventional power. The capital costs have

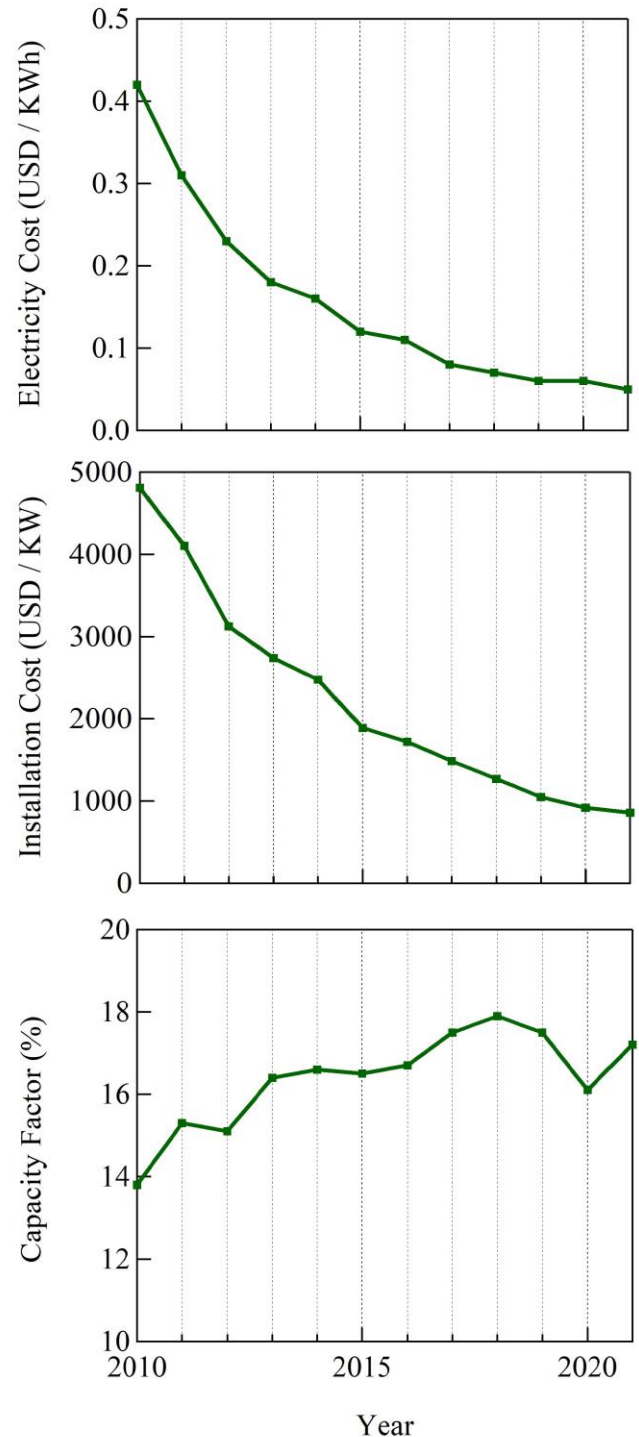


Exhibit 5. The cost and capacity of photovoltaic energy.

decreased from \$2042/KW in 2010 to \$1325/KW at present. Additionally, the LCOE has decreased from around \$0.10/KWh to as low as \$0.03/KWh in regions with favorable wind resources [16]. The estimated additional cost for advanced devices such as variable speed generators and better aerodynamic turbines are between \$0.02 to \$0.04 per kilowatt-hour. However, these advanced technologies often lead to increased capacity factor [18]. The capacity factor, which represents the annual output from a wind farm, is predominantly determined by location, hub height, and rotor diameter.

C. Biomass

Electricity is generated from biomass sources in biomass power plants. These sources include residues from agricultural and forest products, as well as crops that are grown solely for energy production. The economics of biomass power generation differ from those of wind and solar because biomass is dependent on the availability of a predictable, sustainably sourced, low-cost, and adequate long-term feedstock supply.

Globally, the biopower industry currently consists of approximately 4800 plants that generate electricity from biomass resources, including agricultural and forest product residues, and crops grown specifically for energy production [19]. These power plants use direct combustion, with some using co-firing. Their sizes range from 5 to 60 MW and operate at around 30% efficiency, producing electricity at a cost of \$0.06 to \$0.08 per kW h [16, 20]. Since 1978, grid-connected biopower capacity has increased from less than

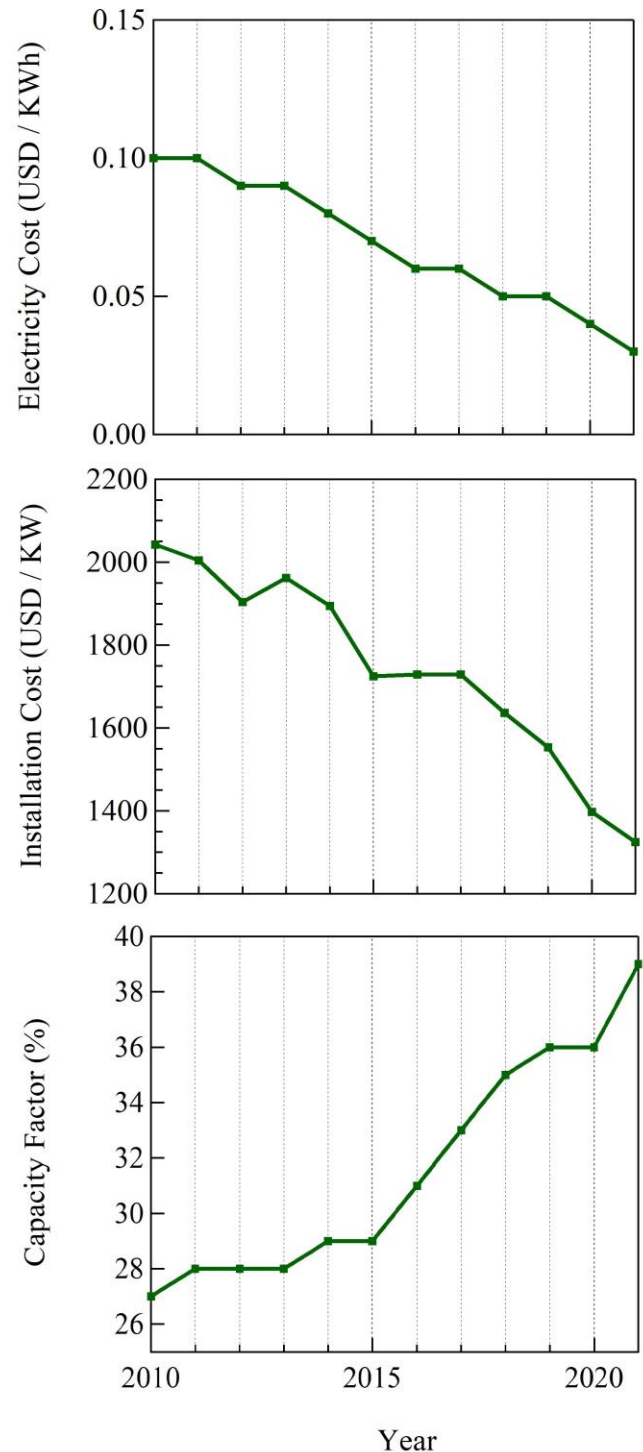


Exhibit 6. The cost and capacity of wind energy

200 MW to over 7500 MW, with around 56% of the capacity in the forest products and sugarcane industries, while municipal solid waste plants provide the remaining capacity of 3300 MW [21].

D. Biofuels

Ethanol is often utilized as a supplement to gasoline, or transformed into another additive known as ethyl tertiary-butyl ether, with the intention of increasing the gasoline's octane level and enhancing its cleanliness.

For many years, a fuel mix comprising 10% ethanol and 90% gasoline has been commonly used across the US. There are ongoing tests being conducted on government fleet vehicles, flexible-fuel passenger vehicles, and urban transit buses to determine the suitability of higher level blends of 85% and 95% ethanol.

The expense of producing bioethanol has gone down significantly over the years, from \$3.60 per gallon in 1980 to approximately \$0.90 presently, mainly because of technical advancements such as genetic engineering of specialized enzymes and microbes. The ultimate objective is for bioethanol to become as economical as gasoline [22].

E. Geothermal Energy

Geothermal resources are available in different forms such as dry steam, hot water, hot dry rock, magma, and ambient ground heat. Steam and water resources have been utilized to produce

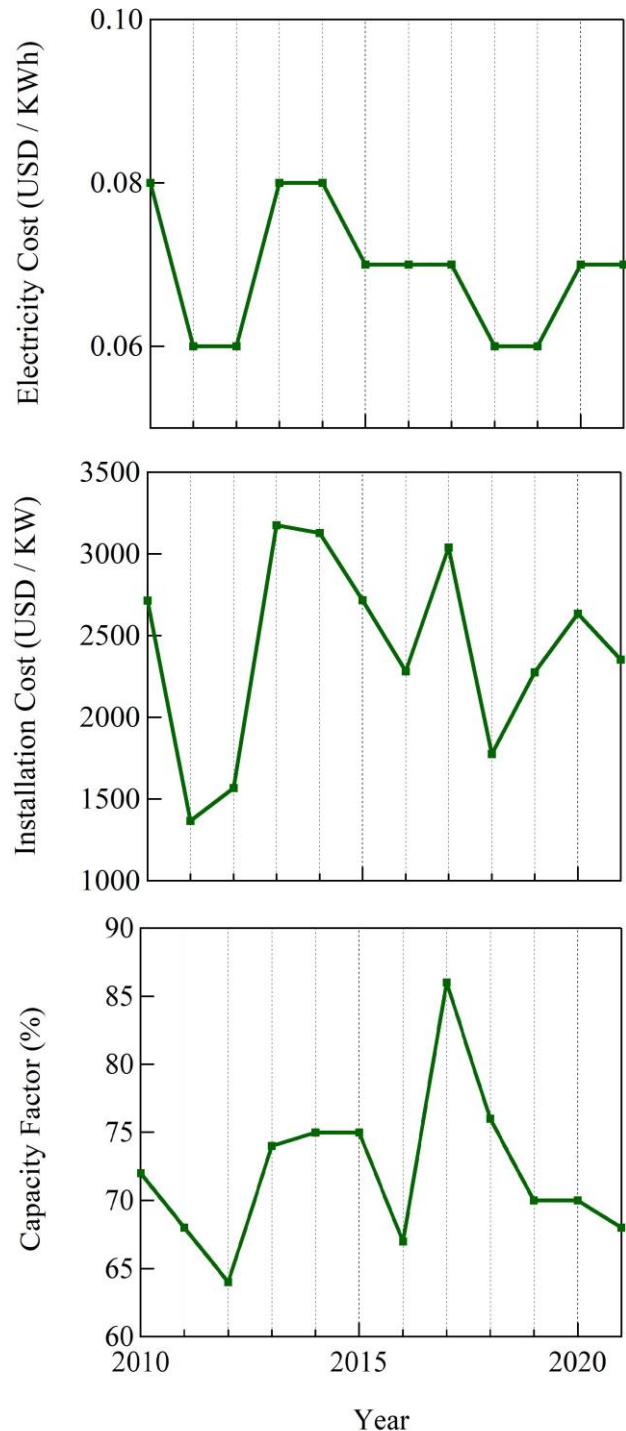


Exhibit 7. The cost and capacity of biomass energy

power, while ambient ground heat is used in geothermal heat pumps.

The Geysers steam power plant located in California, which has a capacity of 2000 MW, is the largest and oldest geothermal power plant in the world. Hot-water plants, which are a more recent development, have become the primary source of geothermal power globally. In the United States, the total capacity is around 3900 MW, which can supply electricity to three million people at a cost ranging from \$0.05 to \$0.08 per kilowatt-hour. In addition, hot water from geothermal sources is utilized directly to provide heat for industrial processes, crop drying, and building heating. The total U.S. thermal capacity for these purposes is about 500 MW. Many developing countries have geothermal resources and therefore represent a huge potential market [23].

One of the key advantages of geothermal plants is having continuous access to sources of energy, so that they can operate most of the hours of the year. However, there are notable differences among projects, and to a smaller degree among countries, which are influenced by various factors such as the quality of the resource, characteristics of the reservoir, and economic considerations. These are just a few of the primary factors that contribute to the variations in capacity.

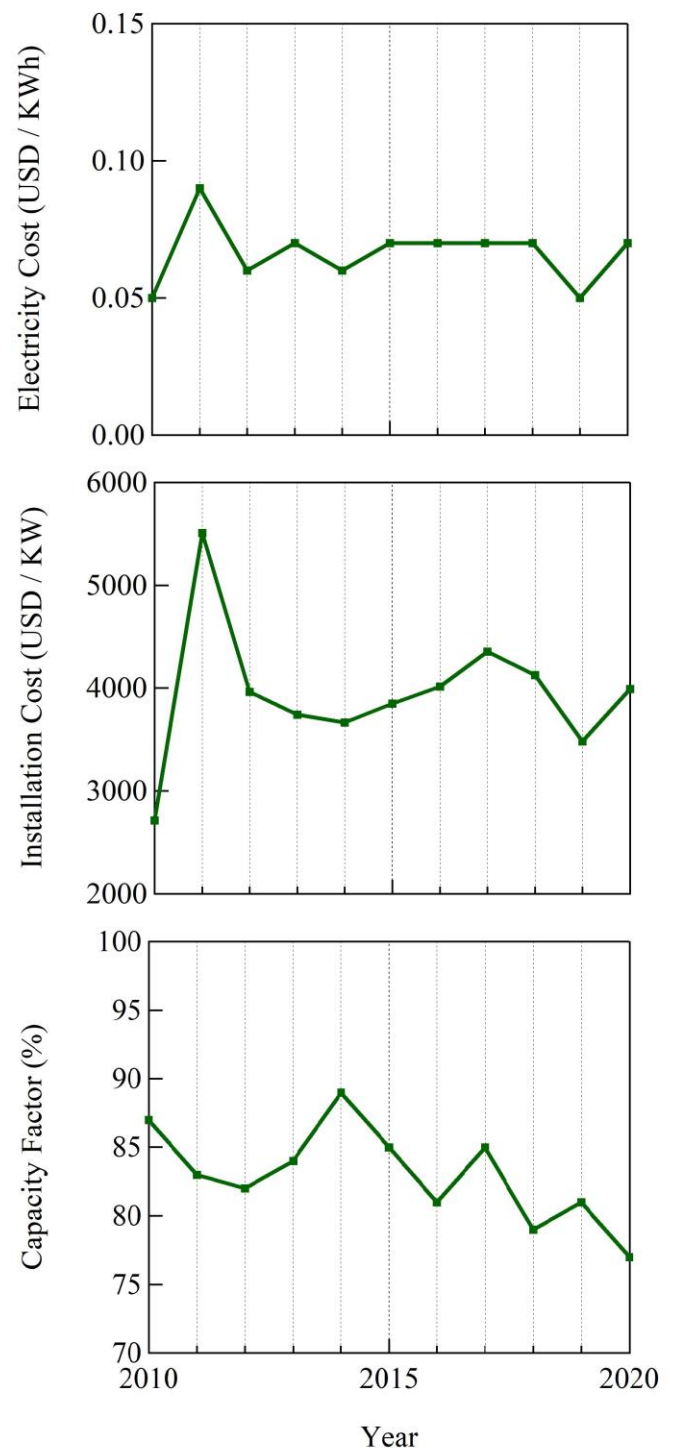


Exhibit 8. The cost and capacity of geothermal energy

F. Hydrogen and Fuel Cells

Currently, majority of the hydrogen is produced from natural gas, but this is only suitable for certain markets. Renewable sources can also be used to produce hydrogen, which has the potential to make significant contributions to global energy supplies in the future.

Fuel cells have the potential to be a secure and efficient method of utilizing hydrogen for power generation. They function by converting hydrogen, obtained either directly as gas or through reforming from sources such as natural gas or alcohol fuels, into electrical energy. Currently, phosphoric acid fuel cells are available for electricity generation, capable of producing 200 kW and running on natural gas as a hydrogen source. They are priced at \$3/W. Molten carbonate fuel cells have also been demonstrated at larger capacities of 2 MW [25]. The research obstacles involve finding affordable and energy-saving ways to produce hydrogen as well as secure and cost-effective techniques for storage and transportation.

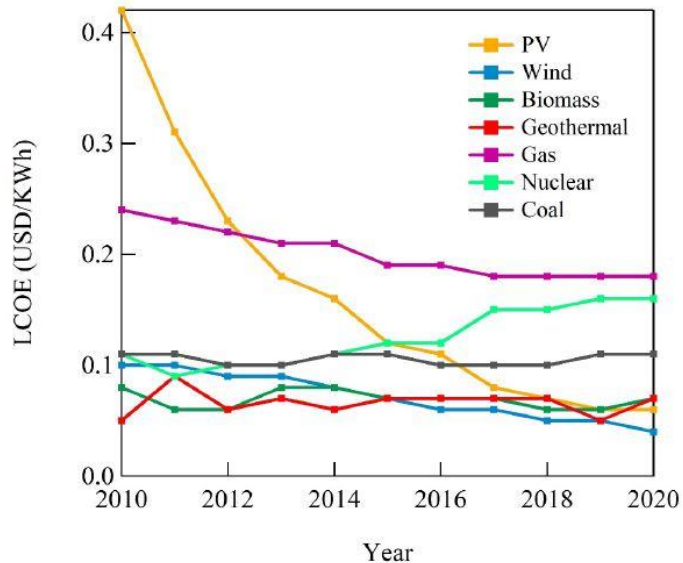


Exhibit 9. LCOE values of various energy

The figure above provides an overview of the economic potential of key renewable energy electric systems. While it is challenging to compare the costs of renewable energy electricity with those of traditional grid electricity, it is important to note that the average retail electricity price in the United States is \$0.12/kWh. However, if the true costs of energy sources, especially energy security costs, were re-considered, the cost of electricity from renewable energy would be more economical than fossil fuels. Nonetheless, our society has yet to determine acceptable methods for including these hidden costs in our energy prices.

TECHNICAL BARRIERS

Ensuring the energy grid is capable of managing the unpredictable output from renewable energy sources like wind and solar is one of the main technological hurdles in the transition to renewable energy. In contrast to fossil fuels, which provide a consistent and dependable output, renewable energy sources produce a variable output that is influenced by environmental factors such as weather. On the other hand, biomass, hydro, and geothermal energy sources are more predictable, and there hasn't been any significant problem with integration.

The effect on the power quality can be categorized into voltage fluctuation, power system transient and harmonics, reactive power, synchronization, storage/load management, and forecasting and scheduling.

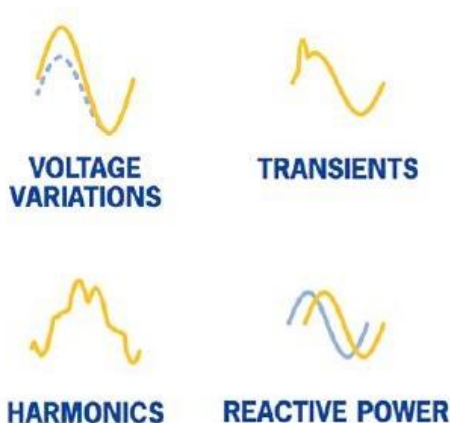


Exhibit 10. Examples of effect on power quality.

A. Voltage Fluctuation

The main cause of voltage fluctuations in the grid is the intermittent nature of renewable energy

sources. For instance, when the wind is strong, wind turbines generate more power output. Conversely, the output drops when the wind speed slows down. Similarly, solar panels produce more energy during peak sunlight hours than the sun sets or when clouds cover the panels. Voltage flicker is inversely proportional to the fault level at the grid connection point, and weak grids are especially vulnerable. Voltage fluctuations can harm sensitive electric and electronic equipment, shortening its lifespan [26, 27].

Grid operators employ a variety of techniques to manage these fluctuations. One popular method is to use voltage regulation equipment that can adjust voltage levels in real-time to keep them within safe limits. Voltage regulators and transformers that can step up or step down the voltage as needed are examples of such equipment.

B. Power System Transient and Harmonics

Transients are rapid fluctuations in voltage or current that can occur when the system undergoes a sudden change. Harmonics are high-frequency electrical signals that are superimposed on the power system's fundamental waveform. The most common cause of the problem is a sudden change in wind speed or power electronics in solar inverters [28].

To address these concerns, a sophisticated feedback control algorithm is required to manage the output. Another approach is to remove harmonics from the power system using filters. These filters can be tailored to specific frequencies and installed at various points

throughout the power grid to reduce the impact of harmonics on electrical devices and appliances [29].

C. Reactive Power

Reactive power is the portion of the power that is used to create and maintain the electromagnetic fields that are necessary for the operation of electrical components [30].

Induction generators are a common source of grid power quality issues because they consume reactive power. More reactive power is required as more power is generated. To maintain stability, it is critical to provide reactive power as close to demand as possible. Capacitors and reactors, for example, can be used to balance the reactive power requirements. These devices are intended to aid in voltage stabilization and power grid efficiency [31, 32].

D. Synchronization

There is a difficulty in synchronizing grid frequency, voltage, and phase in order to control power quality. The phase-locked loop (PLL) is the most commonly used method for grid synchronization, but other techniques, such as zero-crossing detection and filter combinations with nonlinear transformations also exist.

For wind power to be integrated into the grid, four conditions must be met: the wind power frequency must match the grid frequency as closely as possible, the terminal voltage magnitude must match the grid, the phase-sequence of the two voltages must be the same,

and the phase angle between the two voltages must be within 5% [33].

E. Storage and Load Management

Having a way to store excess energy is critical for ensuring dependable power delivery, especially for renewable energy sources that generate fluctuations and unpredictability. An energy storage system can help to store excess energy while also providing power when it is needed. Batteries, flywheels, supercapacitors, and superconducting magnetic energy storage are among the energy storage technologies available [28,30].

Long-term weather patterns must be known in order to develop better procedures and capabilities for integrating renewable energy sources into a smart national power grid. Renewable energy variations must be accurately predicted to reduce the impact of intermittent energy on network security. Accurate forecasting and scheduling systems are required for the appropriate and satisfactory use of renewable energy sources, as well as the establishment of long-term load management systems for the power grid. Solar irradiation, wind speed, and energy production from renewable energy sources should all be studied. Another objective of predicting renewable energy power is to optimize conventional unit output based on predicted output curves in order to reduce operating costs [34].

F. Integration with Existing Energy System

Integrating renewable energy into existing energy systems can pose technical challenges as well. Wind and solar energy are frequently located in remote areas, far from population centres and existing energy infrastructure. This can make transporting energy from the source to the end user difficult, as new transmission and distribution systems may need to be built.

To overcome these challenges, it is necessary to invest in new energy infrastructure that can support the integration of renewable energy into existing energy systems. This may include building new transmission and distribution networks, upgrading existing energy infrastructure, and developing energy storage systems to store excess energy when renewable energy output is high.

economic challenges. The transition could result in significant job losses and decreased economic activity in affected regions. This is especially concerning in countries like the United States, Russia, and Saudi Arabia, which rely heavily on fossil fuels for their energy and economic needs.

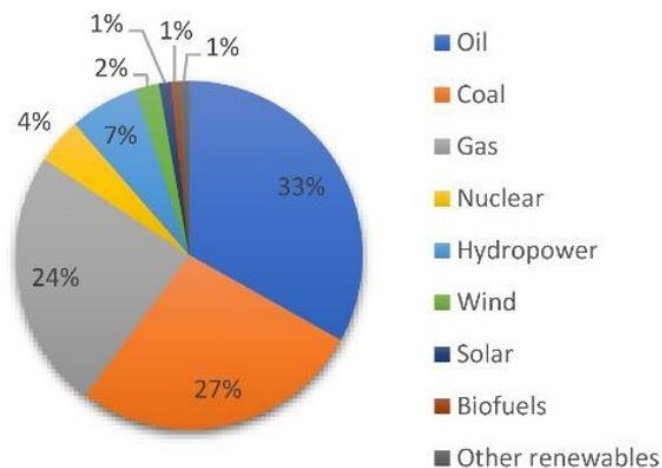
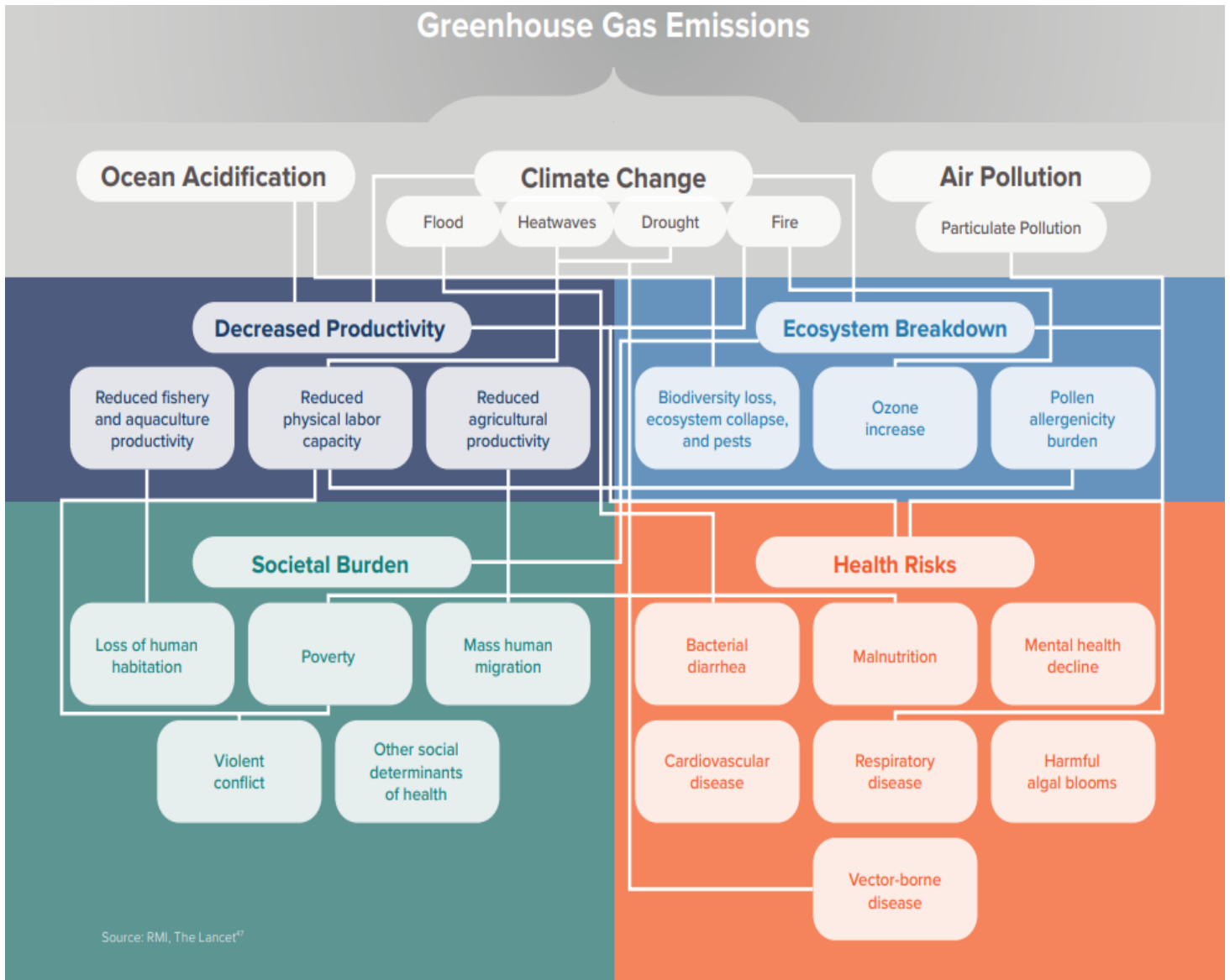


Exhibit 11. World's Energy.

ECONOMIC BARRIERS

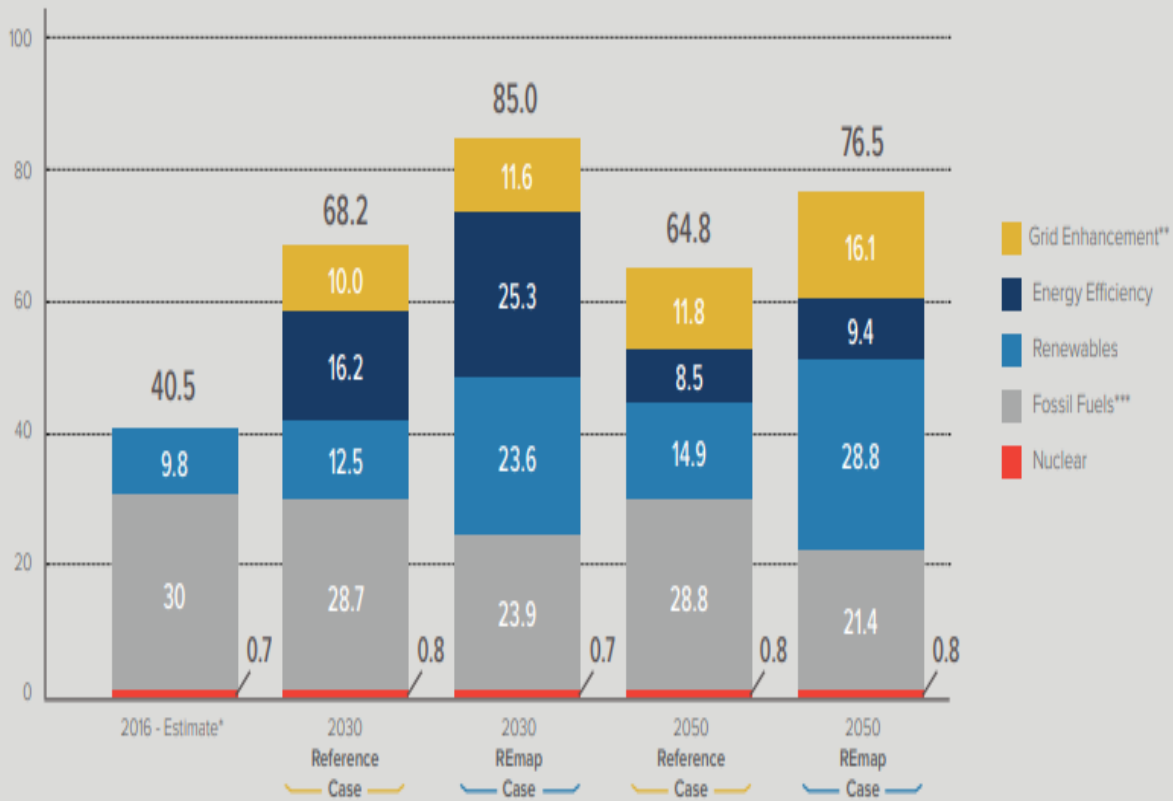
It is critical to recognize that the world's energy system is heavily reliant on fossil fuels. As a result, the transition to clean energy will necessitate substantial investments in new infrastructure, technologies, and industries. These investments can be substantial, especially in developing countries where financial resources are limited. Furthermore, the transition will necessitate changes in consumer behavior as well as government policies that promote the use of clean energy.

The loss of jobs and economic opportunities in the fossil fuel sector is one of the most significant.



Net Positive Employment Benefits of the Energy Transition

Million jobs



* Estimates for jobs in energy efficiency and grid enhancement are not available for 2016.

** The jobs in grid enhancement make reference to the jobs for T&D grids and energy flexibility, created in the development, operation, and maintenance of infrastructure to enable the integration of RES into the grid.

*** Includes all jobs in the fossil fuel industry, including in extraction, processing, and consumption

Source: IRENA⁰⁰



CLEAN CAPITAL FLOWS TO ENABLE CLEAN GROWTH IS NEEDED

Although developing economies often do not need to wrestle with a large stock of stranded fossil assets as we do in North America, they face the formidable challenge of driving significant new investment in clean energy.

Over the past decades, only 13% of clean energy investments have flowed to emerging markets, excluding China, with only 0.1% invested in the lowest-income countries.

Integrated resource planning without the latest demand- and supply-side technologies and market designs, electricity investments will be neither affordable nor accessible, and this needs to change.

EMISSION REDUCTION [35]

In 2022, the Government of Canada (the Federal Government) continued to push forward with new policies and regulatory measures to meet its greenhouse gas (GHG) reduction targets. In March, the Federal Government released its 2030 [Emissions Reduction Plan](#) (the Plan), which sets out the emissions reduction policies the Federal Government has in place and laid out new policies it is pursuing.

[A summary of the Plan can be read here.](#)

Two major components of the Plan which were implemented into law in 2022, the Federal GHG offset system and the Clean Fuels Regulations, are discussed in more detail below:

The Canadian Green House Offset System

In the wake of the Supreme Court of Canada's 2021 decision upholding the constitutionality of the Greenhouse Gas Pollution Pricing Act, S.C. 2018, c. 12 (GGPPA), the Federal Government set out to fortify the carbon pricing system in Canada and implemented the Canadian Greenhouse Gas Offset Credit System in June. This system, outlined in the Canadian Greenhouse Gas Offset Credit System Regulations, SOR/2022-111, consists of a credit and tracking system to register certified federal GHG offsets, and protocols to establish the activities which will be eligible to generate federal offsets and to quantify pollution reductions for those activities.

The Federal Government has published one protocol to date under the Federal Offsets system: the Landfill Methane Recovery and Destruction protocol. Five further offset protocols are currently in development, with the Direct Air Carbon Dioxide Capture and Sequestration protocol of particular interest to oil & gas corporations that are assessing the viability of carbon capture and storage projects.

Clean Fuels Regulations

The Clean Fuel Regulations, SOR/2022-140 came into effect on June 21, 2022, creating a requirement for liquid fossil fuel suppliers to reduce the carbon intensity of the fuels they supply in Canada. The Clean Fuel Regulations set 2016 as the baseline point for carbon intensity reduction and outlined July 1, 2023 as the first benchmark point by which suppliers must meet the carbon intensity reduction standards.

The Clean Fuel Regulations also implemented a credit trading system, giving suppliers the opportunity to meet their carbon intensity reduction requirements by generating compliance credits through three primary categories of activities:

- Compliance Category 1: GHG emission reduction projects which reduce the carbon intensity of a liquid fossil fuel over the course of its lifecycle;
- Compliance Category 2: supplying low carbon intensity fuels such as ethanol by producing or importing them into Canada; or
- Compliance Category 3: supplying fuel or energy to advanced vehicle technology projects aimed at changing or retrofitting fossil fuel combustion devices to be powered by alternate energy sources (e.g. electric vehicles).

LEGAL ISSUES [36]

One of the greatest challenges that businesses face as they try to pivot from traditional energy to renewable sources is managing the financial and legal risks that come with changing their investment and growth strategies. Even when the question is not whether a company should transition their business, but when and how, the decision is an extremely difficult one. Clients in this area who are seeking to be both proactive and risk-averse should begin seeking legal and financial advice early in the process, and do their due diligence to take advantage of the federal,

provincial, and municipal incentive and funding programs available to help minimize their risks.

The legal side of the energy transition in Canada has evolved in many ways in recent years. New statutes and regulations have been introduced and existing ones have been significantly amended. Courts have released several watershed decisions, including the Supreme Court of Canada's decision on the constitutionality of carbon pricing under the federal Greenhouse Gas Pollution Pricing Act. Furthermore, businesses have been advancing new and innovative projects ahead of the supporting regulatory frameworks being fully developed. These rapid changes make it challenging for lawyers to stay current, but for the lawyers who put in the time and effort to do so, the fresh landscape places all lawyers on an even playing field – from relatively junior lawyers to the most senior practitioners.

Another challenge specific to Canada's energy transition is the need for lawyers to gain understanding of the relevant emerging technologies and science. A lawyer who wants to assist clients interested in expanding into hydrogen or geothermal developments, for example, needs to have a basic understanding of the underlying technology and processes.

Finally, while energy law is a niche practice area, it is increasingly overlapping with areas like environmental, intellectual property, tax, and Indigenous law, requiring integrated legal teams with multi-disciplinary expertise.

Recent years have seen increased scrutiny and criticism of cross-border energy projects (Keystone XL, Line 5, Nordstream 2, etc.) with a risk of a shortfall as demand increases and capacity maxes out before replacement generation or transport infrastructure can be completed.

Canada's experience with cross-border energy projects in recent years has shown that different jurisdictions often have diverging priorities and interests in energy, and if the regulatory system allows any one jurisdiction to veto a project it is difficult to get anything done. Canada's constitution provides a model where the federal government can approve projects across multiple provinces even if certain provinces oppose the project, so long as the project is in the best interests of the country. If used strategically to advance our country's energy goals, this may provide Canada with competitive advantages over other jurisdictions.

As the energy transition picks up speed, Canadian law will have to evolve with it, and in many cases, it will have to evolve to allow for a smoother and more rapid energy transition to take place. Canadian energy, regulatory, climate change and emissions trading, and environmental laws are all legal spaces likely to see watershed changes over the coming years.

CONCLUSION AND RECOMMENDATIONS

Now is the time for action. Quite frankly, decades ago was the time to action but here we are. Bold and decisive actions by corporations, philanthropic institutions, national, international

and subnational leaders, regulators, and policymakers including by average citizens are needed. The will and the capacity to work together in new ways must be encouraged. As we have shown, the transition to clean energies is crucial and vital for ensuring a sustainable future. As populations continue to grow along with energy demand, it is imperative that we adopt sustainable energy sources as quickly as possible to maintain this increase in demand. From mitigating climate change to improving energy security, the benefits of transitioning to clean energy sources have been proven to outweigh the costs. While the transition is a complex and multifaceted process, it is an essential step to allow populations to continue to thrive and to prevent the quality of life of millions of people from deteriorating. Unfortunately, public health is often thought of as just a co-benefit from the transition to cleaner energy, when in fact it is a very serious problem that currently plagues many parts of the world.

Despite all the benefits that come with the transition to cleaner energy sources, there are many technological, economical and legal challenges that must be overcome before worldwide adoption becomes more prominent. Ranging from grid interoperability and power fluctuations to economic considerations, many of these issues can be resolved with increased research and funding towards renewable projects. The adoption of cleaner energy sources comes down to increased pressure from individuals as they become more aware of the immediate impacts of fossil fuels and the dangers that are



already here, companies and people alike will be more willing to step up and take action. Whether from making more eco friendly day-to-day decisions or supporting projects that help reduce impacts on the environment, all work towards a greener future will tremendously help with the stability of our world's future.

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