Mitigating the Impacts of the Energy Crisis and Achieving Net Zero

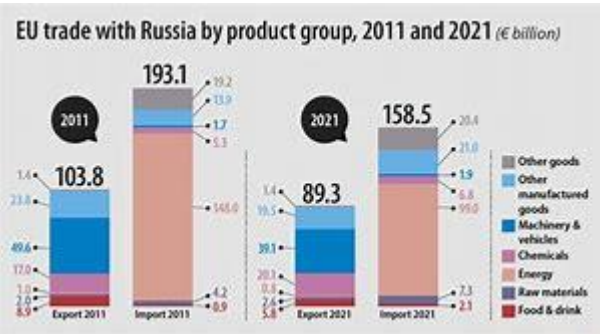
Beginnings of the Energy Crisis: 2021

The current global energy crisis began in the aftermath of the COVID-19 pandemic in 2020, with much of the globe facing shortages and increased prices in oil, gas, and electricity markets. The crisis was caused by many economic factors, including the rapid post-pandemic economic rebound that outpaced energy supply. Also, although recovery efforts to mitigate the economic damage of COVID-19 were expected to be a significant green energy catalyst, emissions in many countries rebounded to pre-pandemic levels relatively quickly.[1] Finally, the pandemic highlighted the devastating effects of income inequality around the world, both in terms of economic costs and the impact of energy transition. Addressing the distribution of energy is key to evaluating future energy policies, so developing countries are included in cleaner energy transitions.

Not only did the economic rebound after the COVID pandemic lead to an increased demand for energy, but during the pandemic itself, oil production was curtailed due to decreased demand.[2] The main consumers of oil around the world are the United States and China, which together use about one-third oil the world's supply.[3] The biggest growth in demand for oil will likely be seen in China as well as India.

Russia's Invasion on Ukraine

Russia's invasion of Ukraine in February 2022 has had a profound impact on global energy markets. Price volatility, supply shortages, security threats, and economic uncertainty have contributed to what the International Energy Agency is calling "the first truly global energy crisis, with impacts that will be felt for years to come".[4] Developing countries in particular, who are still recovering from the impacts of the global pandemic, are disproportionately impacted by the current energy crisis. Before the Russian invasion of Ukraine, Russia was one of the largest producers of oil in the world, with it producing 10-15% of global oil



[1] "5 key lessons for energy transition from COVID-19 recovery." *World Economic Forum.* https://www.weforum.org/agenda/2021/04/5-key-lessons-for-energy-transition-from-covid-19-recovery/.
[2] "Coronavirus pandemic curtails global oil production." *World Economic Forum.* https://www.weforum.org/agenda/2022/10/coronavirus-pandemic-curtails-global-oil-production/.
[3] "What countries are the top producers and consumers of oil?" *U.S. Energy Information Administration.* https://www.eia.gov/tools/faqs/faq.php?id=709&t=6.
[4] "6 ways Russia's invasion of Ukraine has reshaped the energy world." *World Economic Forum.* https://www.weforum.org/agenda/2022/11/russia-ukraine-invasion-global-energy-crisis/.

production.[5] After Russia's invasion of Ukraine, however, many countries, principally the United States, Europe, and its allies like Japan, Australia, and New Zealand, have placed sanctions on Russia and targeted its fossil fuel industries. In 2021, oil and natural gas contributed 45% of the Russian government's budget.[6] Sanctions targeted ships transporting Russian oil and natural gas by refusing to allow them to dock or preventing them from getting insured; sanctions sought to prevent new technologies from reaching the Russian energy sector; and sanctions sought to set a price cap on Russian fossil fuels—meaning that countries agreeing to the cap will not buy Russian fossil fuels priced above the cap, forcing Russia to sell energy at a financial loss.[7]

All of these impacts have reduced the supply of oil and natural gas on the global energy market and caused an increase in price. Higher energy cost directly raises the price of electricity in many countries—particularly those that are still dependent on oil and natural gas for electricity generation. A World Economic Forum study found that total energy costs to households increased by on average by at least 63% in 116 countries.[8] But higher energy prices also lead to all around rising prices of goods and services, having impacts in energy intensive industries and agriculture—which forces these industries to also raise their prices to compensate for higher energy prices. Currently, oil prices are the highest they have been since 2008.[9]

European Crisis

Sanctions from Europe and the United States as well as changes in trade flows have caused Russia to cut gas exports to the European Union by about 80% between May and October of 2022.[10] Although, Russia was withholding gas from Europe months before the Ukraine invasion. Russia is by far the world's largest exporter of fossil fuels, and their shut off of exports has greatly and negatively impacted European access to energy resources. Many countries of Europe, that have continuously relied on Russia for oil and natural gas imports, have had to ration their gas during the winter. The need has also caused some countries in Europe to revert back to coal-fired power plants—which generate more pollution and carbon emissions than electricity generated from natural gas or oil. This created a pressing need for the EU to find energy alternatives elsewhere. Also, while many nations have reduced or cut ties with Russia, the nation has still kept its oil production and exports at close to pre-invasion levels by increasing exports to China, India, and Turkey.[11] Coupled together, these factors are potentially leading the globe towards a major recession and forcing more people into poverty is rising. It is also important to note that comparatively, in 2022, the Northern Hemisphere experienced a very mild winter—so while prices stayed lower in Europe than expected, a harsh

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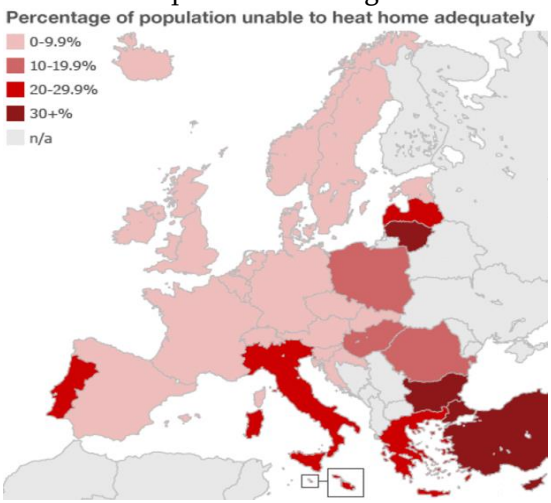
[5] "Energy Fact Sheet: Why does Russian oil and gas matter?" *International Energy Agency.* *https://www.iea.org/articles/energy-fact-sheet-why-does-russian-oil-and-gas-matter*.
[6] Ibid.
[7] "Russia Sanctions Year in Review: Impact on Energy Sector." *Global Trade and Sanctions Law.* https://www.globaltradeandsanctionslaw.com/russia-sanctions-year-in-review-impact-on-energy-sector/.
[8] "Russia-Ukraine war has nearly doubled household energy costs worldwide – new study." *World Economic Forum.* https://www.weforum.org/agenda/2023/02/russia-ukraine-war-energy-costs/.
[9] "Global Energy Crisis." *International Energy Agency.* https://www.iea.org/topics/global-energy-crisis.
[10] "US and European Energy Security amid Great-Power Competition." *Air University.* https://tinyurl.com/2zv2mhu3.
[11] "Asia crude imports hit high as China, India gorge on Russian oil." *Reuters.* https://www.reuters.com/markets/commodities/asia-crude-imports-hit-high-china-india-gorge-russian-oil-russell-2023-08-03/.

winter in the future could send prices exponentially higher. The consequences of failing to address the current energy crisis could potentially lead to disastrous effects if more severe winters are ahead.



Energy Poverty

Energy poverty is the dedication of more than 6% of one's household income to energy bills.[12] In the European Union, energy poverty is also when the extent to which someone must reduce their energy consumption negatively impacts their health and well-being.[13] Definitions of energy poverty sometimes include limited access to clean energy. The term also can refer to living without any access to electricity. People who cannot afford to live in buildings with efficient heating systems or adequate insulation rely on supplementary heating appliances, like space heaters, which require a lot of energy to run and can have negative health impacts. Older, more affordable buildings and homes often have less effective insulation and older, less efficient appliances, raising energy consumption.[14] Lower-income people—who are already more likely to live in energy poverty because of low wages and high prices—are also more likely to live in these older and less efficient buildings, exacerbating their poverty.

In the United States, 16% of the population lives in energy poverty, 5.2 million people of which live above the federal poverty line and communities of color are 60% more likely to live in energy poverty than white communities.[15] Globally, more than 750 million people lack access to electricity—a majority of which live in Africa—and 2.6 billion people cannot cook with clean energy.[16] Many of those without access to clean cooking energy rely on coal, charcoal, wood, or waste to heat their stoves or ovens in their homes. These sources not only produce high levels of greenhouse gas emissions but also fine particulate matter which can damage lungs, the heart, and brain. Excluding South Africa, Sub-Saharan Africa, which has a population of 1 billion people, has an energy production capacity equivalent to Germany—81 gigawatts—despite Germany having a population of only 83 million. Energy poverty most significantly affects the rural regions of developing countries.[17]

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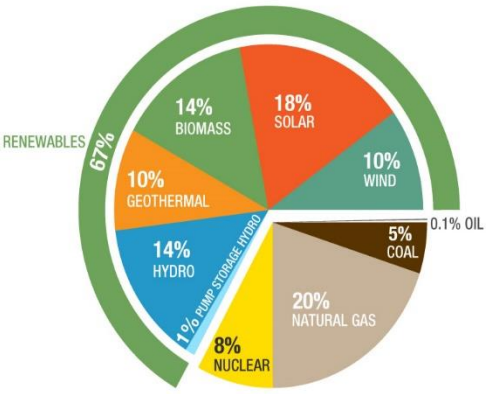
[12] "Energy inequity is an urgent public health issue, as Bronx fire illustrates." *University of North Carolina-Chapel Hill.* https://sph.unc.edu/sph-news/energy-inequity-is-an-urgent-public-health-issue-as-bronx-fire-illustrates/.
[13] "Energy Poverty in the EU." *The European Commission.* https://tinyurl.com/mvccx7tx.
[14] "Introduction to the Energy Poverty Advisory Hub (EPAH) Handbooks." *The European Commission.* https://energy-poverty.ec.europa.eu/system/files/2022-06/EPAH%20handbook_introduction.pdf.
[15] "Energy inequity is an urgent public health issue, as Bronx fire illustrates." *University of North Carolina-Chapel Hill.* https://sph.unc.edu/sph-news/energy-inequity-is-an-urgent-public-health-issue-as-bronx-fire-illustrates/.
[16] "Net Zero by 2050 A Roadmap for the Global Energy Sector." *International Energy Agency.* https://tinyurl.com/3yyerzjv; "How to end energy poverty and reach net-zero emissions." *World Economic Forum.* https://tinyurl.com/bdcs46tj.
[17] "Energy Poverty assessment in the Belt and Road Initiative Countries: based on entropy weight TOPSIS approach." *Energy Effic.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9393102/.

Achieving Net Zero: What does it mean?

Climate Neutrality is an effort to halt anthropogenic (human-caused) contributions to climate change. The IEA wants to stop global warming at 1.5˚C by reaching climate neutrality by 2050.[18] Net Zero refers to "et zero refers to the balance between the amount of greenhouse gas (GHG) that's produced and the amount that's removed from the atmosphere. It can be achieved through a combination of emission reduction and emission removal."[19] Though plans will vary from country to country, the goal requires a massive reduction of net greenhouse gas emissions and the storage of persistent pollution. Because the energy sector produces three-quarters of emissions, almost every plan will involve climate-neutral energy production. Further innovation in that area and energy storage is paramount. Favoring more efficient appliances, fuel-cell and electric vehicles, heat pumps, etc. and other behavioral changes—such as walking, cycling, or using public transportation rather than driving—should not be overlooked. The transition away from fossil fuels will result in job loss—in the IEA's plan, 5 million—but also result in the creation of new jobs—14 million in the IEA's plan.[20] Governments will need to create programs to retrain workers from the fossil fuel industries in other areas.

The energy transition might at first seem unliked from the energy crisis and energy poverty, yet the drive to Net Zero is more important than ever as it offers the ability for countries to reduce their reliance on oil and natural gas and reduce the impacts that price fluctuations in those two resources have on their economies. In essence, if oil is responsible for less of a country's electricity generation, a large increase in the price of oil will impact them less. By investing now, countries can help offer a less volatile energy market and help keep individuals out of energy poverty. Additionally, the drive of Net Zero is also reliant on energy sources that produce fewer pollutants, helping improve air quality and reducing particulate matter that is harmful to humans and animals.

Shift to renewable energy by 2050 as proposed by the Institute for Sustainable Energy Policies



Renewable Energy

The invasion of Ukraine and the subsequent reduction of Russian oil exports to the Western world has led to an increased focus on maintaining energy security. Having a diverse energy platform is key to avoiding a future energy crisis and the IEA claims that the current crisis could accelerate the move to more sustainable fuels. Below are overviews of many alternative and sustainable and some renewable energy sources that could be adopted by nations in the near future to decrease reliance on fossil fuels.

Nuclear Power

[18] "Net Zero by 2050 A Roadmap for the Global Energy Sector." *International Energy Agency.* https://tinyurl.com/3yyerzjv
[19] "What is net zero?" *National Grid. https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero.*
[20] "Net Zero by 2050 A Roadmap for the Global Energy Sector." *International Energy Agency.* https://tinyurl.com/3yyerzjv

Nuclear power involves the use of nuclear fission, the splitting of atoms, to produce heat and electricity. Nuclear Power Plants use fuel made from uranium or plutonium which are put into a reactor. The reactor heats water to make steam, generating electricity.[21] Nuclear power contributes to the security of an energy grid: and could provide a constant and predictable energy baseline, The use of nuclear power also averts the contribution of 1.5 gigatons of emissions every year.

However, nuclear power faces opposition in many countries. Memories of Fukushima and other meltdowns make the construction of nuclear powerplants unpopular. Construction is expensive (in part due to safety regulations) and is often delayed—making it even more expensive. Given these factors, governments favor natural gas and other renewable energy sources. Additionally, while nuclear power is nonrenewable, uranium is abundant.[22] Even if having enough fuel is not a problem, where nuclear fuel go after it is used, is a problem. Waste from reactors can sometimes remain radioactive for thousands of years. Its transportation and storage are difficult and expensive, and if done improperly, radioactive waste can damage the environment and harm human health.[23]

Solar Power

Solar power is the conversion of energy from sunlight into electricity and has been used by humans since ancient times. Solar energy does not produce carbon dioxide or other atmospheric pollutants. Also, solar arrays have minimal effects on the environment.[24] Agrivoltaics—agricultural activity done alongside solar panels—should be investigated as a means of reducing agricultural water use and increasing land productivity.[25] Solar power is also very flexible and its deployments range from utility-scale farms to roof-top installations.[26] It is also the cheapest option for new electricity generation in most countries. The per-square-foot production potential of solar power is notably low, so utility-scale production requires large installations. The time of day, location, season, and atmospheric conditions make solar at least less desirable than its competitors, if not untenable, and anywhere it is unproductive at night.

Wind Power

Wind power is a renewable energy source that uses wind turbines to convert the kinetic energy of wind into mechanical or electrical energy. The wind turbines have blades that rotate when the wind blows across them, creating an aerodynamic force that spins a generator. Wind power, like solar and geothermal, is inexhaustible.[27] Wind is also abundant, and it is not temporally restricted. Utility-scale wind farms are one of the most cost-effective energy sources—though this will vary depending on land availability and climate; in some locations, many factors can render wind power untenable.

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[21] "Nuclear explained." *U.S. Energy Information Administraiton.* https://www.eia.gov/energyexplained/nuclear/nuclear-power-plants.php.
[22] "Renewable Energy." *MIT.* https://climate.mit.edu/explainers/renewable-energy.
[23] "Nuclear explained." *U.S. Energy Information Administraiton.* https://www.eia.gov/energyexplained/nuclear/nuclear-power-plants.php.
[24] "Solar explained." *U.S. Energy Information Administraiton.* https://www.eia.gov/energyexplained/solar/.
[25] "Growing Plants, Power, and Partnerships through Agrivoltaics." *NREL.* https://www.nrel.gov/news/program/2022/growing-plants-power-and-partnerships.html.
[26] "Solar PV." *International Energy Agency.* https://www.iea.org/energy-system/renewables/solar-pv.
[27] "Advantages and Challenges of Wind Energy." *U.S. Department of Energy.* https://www.energy.gov/eere/wind/advantages-and-challenges-wind-energy.

Wind power requires large swaths of open land, and some places lack the infrastructure to transport electricity to urban areas. Wind turbines are considered visually obstructive and produce a lot of noise pollution. Like agrivoltaics, the viability of offshore wind should be investigated, given its potential.[28]

Geothermal Power

Geothermal energy is the heat from the Earth's core that can be used for power and heating. Geothermal power plants use steam to turn large turbines to generate electricity. Geothermal energy is continuous—it does not vary with time and changes in conditions—but it is geographically specific. The decay of radioactive elements inside the earth will continue for billions of years. And, a country does not need to import fuel for it. Geothermal energy is a clean and renewable source of energy that emits little to no greenhouse gases.[29] Both large- and small-scale installations can use geothermal energy.[30] However, geothermal is expensive to implement. It only accounts for about 0.3% of the world's electricity production.

Hydrogen Fuel

Hydrogen fuel is a clean fuel that produces only water when burned with oxygen. However, there are several means of producing hydrogen fuel. The thermal process—which produces 95% of hydrogen fuel—requires burning hydrocarbons in a reaction with steam.[31] To reach carbon neutrality, replacing it is necessary. However, the usefulness of hydrogen is not a given and will vary given the context. This is because Hydrogen fuel can be produced from various domestic resources, such as natural gas, nuclear power, biomass, and renewable power like solar and wind.

Hydrogen fuels are as carbon neutral as the means used to create them—outputting only electricity and water upon use. It is also abundant—the most common element in the universe.[32] Hydrogen is more energy dense than any of the hydrocarbons currently in use. It has high energy content by weight and can be used in fuel cells or internal combustion engines for transportation and electricity generation. Comparatively, fuel cells are more efficient than internal combustion engines. While battery-electric vehicles require long charge times (compared to ICE cars), fuel-cell vehicles don't. Fuel cell-powered vehicles are also as silent as battery-electric vehicles.

However, infrastructure for mass production and widespread use will be expensive and take time—having the political will to invest those resources will be difficult. The materials used to build fuel cells are hard to come by and expensive. Storing hydrogen is also complicated. Given its molecular weight, completely sealing pressure vessels is almost impossible. Also, there are safety concerns, given hydrogen's penchant for combustion (think Hindenburg).

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[28] "Wind." *International Energy Agency.* https://www.iea.org/energy-system/renewables/wind.
[29] "Geothermal Basics." *U.S. Department of Energy.* https://www.energy.gov/eere/geothermal/geothermal-basics.
[30] "Renewable Energy Essentials: Geothermal." *International Energy Agency.* https://tinyurl.com/4amshc5x.
[31] "Hydrogen Fuel Basics." *U.S. Department of Energy.* https://www.energy.gov/eere/fuelcells/hydrogen-fuel-basics.
[32] "What Are the Pros and Cons of Hydrogen Fuel Cells." *TWI.* https://tinyurl.com/mr4cc42k.

International Goals

Despite the many pledges, few countries have published plans to reach Net Zero by 2050. Even if carbon neutrality is reached by 2050, humanity will have increased Earth's average surface temperature by at least 1.5˚C. This unprecedented temperature rise will continue to endanger ecosystems globally and drive many species to a precarious existence or even extinction. The warmer climate has affected growing seasons and contributed to drought conditions and subsequent fires in Australia and the American West. The melting of surface ice has caused sea levels to rise, putting low-lying coastal regions at risk of flooding. Many countries are planning new or bolstering pre-existing flood-prevention infrastructure at great expense. The UN has taken on an advisory role for committed countries, researching and setting standards for carbon neutrality. The UN has also passed many treaties to combat climate change—such as the Paris Agreement and Kyoto Protocol.

This committee needs to address the short-term issues raised by the energy crisis and ensure that energy poverty is addressed at a global scale, not just in the areas in Europe impacted by their sanctions on Russian energy exports. Long-term, the committee must seek ways to encourage countries—all countries—to work towards Net Zero energy production in order to limit the amount of greenhouse gases in the atmosphere and slow climate change.

Questions to Ponder

- What role can renewable energy sources, such as solar, wind, and hydropower, play in achieving net-zero emissions? What are the consequences of shifting to these resources?
- How can we balance economic growth and energy conservation in our efforts to mitigate the energy crisis?
- How can governments and industries collaborate to accelerate the development and adoption of sustainable energy technologies?
- How do we address the challenges of energy storage?
- What strategy can be put in place to distribute energy efficiently to all those that need it?
- What are the potential risks of not taking substantial action to mitigate the energy crisis and transition to a net-zero carbon future?