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Germany's Energy Crisis: A Scramble for Sustainable Solutions

In February of 2022, after the Russian invasion of Ukraine, economic sanctions greatly restricted the amount of gas flowing from Russia to Germany through the Nord Stream 1 and 2 pipelines. At the beginning of the year, Russian gas made up 45% of Europe's gas imports. Now, it constitutes just 7.5% of it. Germany itself is astoundingly dependent on Russian energy: 55% of its natural gas, 52% of its coal, and 34% of its mineral oil is bought from Russia (The Guardian). Germany's heavy reliance on Russian gas, coal, and oil has long been criticized by policymakers as a geopolitical, economic, and environmental disaster. With the advent of Russian war in Ukraine, it is overwhelmingly evident that Germany can no longer support Russia's economy through energy purchases. Now, the country is left without its main source of energy and a national oil reserve compromised by Putin's intimidation tactics. Analysts speculate that Putin might shut down both pipelines' reserves permanently for political leverage; additionally, sporadic "maintenance" shutdowns initiated by the Kremlin have already caused unrest throughout the European continent. This winter is shaping up to be financially devastating for many: 40% of Germans expect to have difficulty paying their electricity bills this winter due to energy cutbacks and rising living costs (Deutsche Welle).

Located in Central Europe, Germany is about the size of Montana. With 84,316,622 residents in 2022, Germany is the second most populated country in Europe. The average household size in Germany is two people. 77.6% of the population lives in urban areas which are commonly plagued by air pollution generated by coal-burning plants. Despite its high urban population, 48% of Germany's land is used for agriculture. Farms across the country produce milk, sugar beet, wheat, barley, potatoes, pork, maize, rye, rapeseed, and triticale to be exported or used for domestic consumption (CIA World Factbook).

The average German resident is male, ethnically German, and 47 years old. Employed Germans, which make up 95% of the population, commonly work in the service, electronics, and automotive industries. These industries are among the most successful in the world; they make Germany the largest economy in Europe and the fifth-largest economy in the world by purchasing power parity. Despite this immense wealth, 14.8% of Germans live below the poverty line. Poor Germans are likely to come from minority ethnic and religious groups. Additionally, Germany has received 2,150,339 refugees from Europe, Africa, and Asia in the past decade. With limited resources from their home countries, this portion of the population is also likely to struggle with poverty (CIA World Factbook).

Culturally, Germans greatly value environmental protection. The country has enacted an energy transition plan that involves phasing out nuclear energy by the end of 2022, heavily taxing fossil fuel use, expanding public transportation, and a detailed recycling program. It was the first country in the world to enact a plan to phase out nuclear energy. Due to its involvement in numerous climate agreements, Germany is known as one of the most environmentally friendly and sustainable countries in the world (Deutschland.de).

Germany is also at the forefront of universal healthcare and education. In 1883, Germany created the first social health insurance system in the world. Now, approximately 86% percent of Germans participate in the national health insurance program. Germany's universal healthcare is considered to have the broadest coverage of any country in the EU. The remainder of Germans, who are likely to be of higher income, is enrolled in more expensive private health insurance programs. Every German resident is required to

participate in either public or private health insurance, which means 100% of Germans have access to healthcare.

Almost all Germans have access to clean water, toilets, and telephones. Marginalized Germans, such as refugees and the homeless, are the rare exception to this rule. This portion of the population may face structural barriers to accessing these resources, such as a lack of transportation and funds. Housing prices in Germany have skyrocketed due to the country's energy crisis and increased immigration. High rent prices have recently forced people to decide between paying their rent or paying for groceries. Despite the resources they lack, 100% of Germans still have access to electricity (CIA World Factbook).

Germany currently has a high cost of living because of rising inflation. In November, inflation was at 11.3%-- the highest it had been in 70 years. This is largely due to the removal of Russian gas from the German economy. Unfortunately, the issue of inflation is not expected to go away anytime soon. Ulrike Malmendier, an economics professor at the University of California, Berkeley, said, "We are dealing with the fact that we will have long-term, significantly higher energy prices." Rising costs do not only affect Germany's poor; in recent months, even Germans with high salaries have been limiting their spending out of fear of an economic recession (Reuters).

It is shocking to imagine the wealthiest country in Europe struggling to heat its homes. Yet across Germany, concerned citizens have begun stockpiling firewood, portable heaters, and electric heaters (Deutsche Welle). Trends are only worsening as Germany and the rest of Europe enter the winter season with less and less gas in storage. In February of 2023 storage tanks in Europe could be at 25-30% of their capacity. Currently, they are at around 90% of their capacity (Reuters).

Despite warnings from the EU about energy cutbacks, Germans are currently still using too much gas to have a sufficient supply for this winter. The head of Germany's network agency Klaus Mueller said that in the first week of October, Germans consumed too much gas to maintain a steady reserve for this winter. He also said that Germany will experience a gas emergency this winter if it does not achieve at least a 20% reduction in its natural gas use (AP News).

The chief contribution to the worsening gas crisis in Germany is a lack of official restrictions on gas consumption. While it is beneficial to know that a 20% reduction is necessary, the information is only useful if enforced. No laws have been passed limiting corporate or household energy use in Germany. Germany's federal government has been slow to respond to the gas crisis from the beginning, notably still allowing Russian oil to enter Germany. In October, Chancellor Olaf Scholz announced all oil imports from Russia would be banned by the end of 2022 (Geopolitical Intelligence Services).

Due to its low supply of gas, the cost of fuel is high in Germany. This has an impact on all areas of the supply chain, with a drastic effect on the cost of transporting produce and agricultural products such as fertilizers. Because of this inflation, farmers struggle to afford the materials necessary to yield large harvests and transport their produce to be sold (TopAgrar Online). In the future, Germany may experience a sharp decrease in food supply in addition to the expensive produce prices the country is experiencing due to the inflated cost of transporting goods.

Social circumstances also contribute to the financial struggles rising from Germany's energy crisis. There are more than 2.1 million single mothers in Germany raising children by themselves, often under a single income. Higher gas prices, along with the consequence of inflation in almost every economic sector, put great financial stress on single mothers. This exacerbates a significant problem that Germany experienced before its gas crisis: 3 million children live in poverty due to the country's high living costs (TRTWorld).

As Ukrainians flee the very war that triggered Europe's gas crisis, they feel its effects at refugee centers in Germany. Hannover, a city in northern Germany and a hub for refugees and immigrants, has stopped the flow of warm water in public facilities, including homeless and refugee shelters. At night, all public facilities in the city are dark. Ukrainian refugees, as well as other populations dependent upon government resources, experience a lower quality of life due to these poor living conditions (Deutsche Welle).

While Germany's reduction in its gas consumption would appear to benefit the environment, the country's current solutions to its gas crisis present greater threats to the environment than the previously higher CO₂ emissions caused by the combustion of natural gas. In August, Germany reopened a second coal-fired power plant to preserve its supply of natural gas, despite its goal to phase out coal-fired power by 2038 (Deutsche Welle). Germany mines its domestic coal reserves and also combusts it to create energy. The mining of coal releases methane, which harms the atmosphere more than the emission of carbon dioxide. The combustion of coal, like other fossil fuels, releases large amounts of carbon dioxide and contributes to global warming. Coal mines and power plants are also more likely to pollute waterways and cause illness in humans than the combustion of natural gas.

The German government has yet to enact a sustainable solution to its gas crisis. While politicians rush to create complex combinations of nuclear, coal, and gas to fuel the world's third-largest economy, a potentially life-saving solution is being overlooked: solar energy. Solar panels are quite literally right under the noses of Germans; the country has installed two million solar arrays since 1991. Solar energy constitutes a significant portion of all energy used in Germany, particularly in the summer months. Between March and August 2021, solar panels generated more power than all of the country's hard coal-fired plants combined. Just this past June, Germany's solar panels generated the most energy in the country's history. While certainly not a comprehensive replacement for the heavy burden carried by Russian gas-- currently, only 20.7% of all energy in Germany is solar generated-- with expansion, solar energy can enter a mosaic of environmentally sustainable power sources and solve Germany's gas crisis (Clean Energy Wire).

First, solar energy must become economically viable for it to expand. One way this can be achieved is through government subsidies. In September 2022, the German government passed a law ensuring that small-scale solar photovoltaic panels would be exempt from income taxes in 2023 (PV Magazine). While certainly a step in the right direction, this act does not incentivize consumers to buy solar panels; rather, it removes a consequence from their potential purchase. A more effective method for the expansion of household solar use can be seen in Australia. Government rebates can relieve citizens of as much as \$2,950 when they install solar panels in their homes. The offer even extends to wind turbines and hydro systems, though these are less common sources of household energy (Solar Quotes). Particularly during an economic downturn, a financial incentive may be what it takes for Germans to incorporate solar energy into their homes.

Germany needs to build large-scale solar farms to achieve the goal of replacing Russian gas. A variety of factors prevent solar panel installation, including supply chain issues affecting available materials and labor shortages. Supply chain issues are compounded due to Germany importing the vast majority of its solar panels from China. This can be partially solved, however, if Germany increased its domestic production of solar panels. It would still rely on China and other industrial nations for building parts, but by doing so, the country could reduce the cost of transporting solar panels and boost its own economy. Manufacturing solar panels would also be a seamless addition to the German economy, considering that Germany is the third largest economy in the world and is known for its manufacturing (Clean Energy Wire).

Despite its efficacy, it is unreasonable to expect solar power to generate the majority of Germany's power. Due to its location in northern Europe, the country has relatively few sun hours. In fact, Germany has

roughly the same solar potential as Alaska, at approximately 3 sun hours per day. (Washington Post). Even with financial benefits and domestic solar panel manufacturing, solar energy alone cannot solve Germany's energy crisis. In combination with wind energy, it can.

In a country that is 30% forest and 52% farmland, large-scale wind farms may seem unreasonable. However, according to a study conducted by the German Institute for Building, Urban Affairs, and Spatial Development, installing wind turbines on just 1.7% of the country's land could generate 125 gigawatts of electricity. Additionally, if solar panels are installed on 0.9% of the country's land, 143 gigawatts of electricity could be generated. Germany could meet 100% of its energy needs if this plan is put in place (Energy Transition). By harnessing available farmland while maintaining its original use, Germany can boost its agricultural sector, promote sustainable energy sources, and finally attain energy independence from Russia.

So how does Germany generate enough wind energy to achieve this audacious goal? The country is already off to a great start. In 2021, 28,320 onshore wind turbines and 1,501 offshore wind turbines produced 23% of Germany's energy, more than any other power source in the country. The prevalence of wind energy in Germany can be attributed to the Renewable Energy Sources Act of 2000, which set a goal of generating 35% of electricity nationwide from sustainable sources by 2020. Despite these steps in the right direction, Germany still lacks the wind turbines needed to replace the energy previously provided by 55 billion cubic meters of Russian gas (Federal Energy Organization).

The first step to bridging the gap between wind energy and Russian oil is an expansion of wind farms. Amazingly, wind turbines can be installed in agricultural fields with little disruption to crops. In fact, farmers can plant crops right up to the base of the turbines. The wind turbines produce energy that provides vital electricity to farms, with a notable increase in energy production during the winter months, when electricity is most needed in Germany (Wind Energy Solutions). Wind energy has already had a massive impact on agricultural communities around the world, particularly in the United States. In the US state of Iowa, 34% of all electricity is provided by wind farms. Additionally, approximately 85% of land in Iowa is farmed (American Farm Bureau Federation). This means that 52% of Germany-- its farmland-- is ample ground for installing wind turbines.

Similar to wind energy, solar energy also does not hinder agricultural production; in fact, it helps it. A study conducted by Fraunhofer ISE, a German environmental research organization, showed that the shade provided by solar panels protected crops from overexposure to sunlight and increased agricultural yields in southern Bavaria. Additionally, soil tests showed that solar panels prevented irrigated water from evaporating and helped soils retain more moisture. The result was a larger and healthier harvest for Bavarian farms. The country's "big three" crops, beets, barley, and wheat, all greatly benefit from the increased moisture and protection from sunlight. As European summers grow hotter and hotter due to climate change, such protections are increasingly vital for food security. Farmers must be aware of the immense impact wind turbines and solar panels can have on their agricultural yield, economic security, and gas bill. Unlocking dual use of farmland can increase Germany's food production while also sustainably replacing Russian gas (Wind Energy Solutions).

While the expansion of wind and solar energy is certainly possible, it remains to be seen if it will be economically viable for the average German farmer in the future. In 2021, capture prices for wind and solar energy in Germany hit record highs (S&P Global). However, it is important to acknowledge the value Germans place on environmental sustainability. Despite sky-high inflation, the advent of war in Europe, and a tense political atmosphere, 28% of Germans believe climate change is the single most serious problem facing the world right now (Clean Energy Wire). As inflation continues to rise, government intervention may be necessary to ensure that sustainable sources of energy are inexpensive for farmers. This may look like funding the electricity bills of farmers who generate energy on their

farms, waiving their taxes, or granting them subsidies. Subsidies for farms that install wind turbines and/or solar panels can be viewed as an investment in Germany; after all, increased agricultural production and energy independence promote national stability and economic growth.

Fueling 83 million Germans, the largest economy in Europe, and an important model for global sustainability is certainly a challenge. However, this challenge is by no means insurmountable. By utilizing two economically viable and environmentally sustainable techniques, solar energy and wind energy, Germany can overcome its current gas crisis and grow its economy as a result. While Europe's gas shortage is a pressing issue now, it will have great ripple effects in the years to come; by choosing to act proactively and sustainably, Germany will set an example for the world and instill hope that renewable energy sources are effective and powerful.

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Works Cited (MLA)

- “10 Things Germany Is Doing for the Environment.” *Deutschland.de*, 23 May 2018, <https://www.deutschland.de/en/topic/environment/10-things-germany-is-doing-for-the-environment>.
- 2021, 13 Jul, et al. “Solar Germany's Biggest Power Source in June as Price Reaches All-Time High.” *Clean Energy Wire*, 13 July 2021, <https://www.cleanenergywire.org/news/solar-germanys-biggest-power-source-june-price-reaches-all-time-high>.
- 2022, 13 Apr, et al. “Solar Power in Germany – Output, Business & Perspectives.” *Clean Energy Wire*, 13 Apr. 2022, <https://www.cleanenergywire.org/factsheets/solar-power-germany-output-business-perspectives>.
- “Boycott of Russian Gas and Oil 'Could Cause Mass Poverty in Germany'.” *The Guardian*, Guardian News and Media, 14 Mar. 2022, <https://www.theguardian.com/world/2022/mar/14/russian-gas-oil-boycott-mass-poverty-warns-germany>
- Connor, Richard. “Hanover Turns off Hot Water with Eye to Winter Gas Shortages – DW – 07/29/2022.” *Dw.com*, Deutsche Welle, 29 July 2022, <https://www.dw.com/en/hanover-turns-off-hot-water-with-eye-to-winter-gas-shortages/a-62638434>.
- Deutsche Welle. “Germany Reactivates Coal-Fired Power Plant to Save Gas – DW – 08/22/2022.” *Dw.com*, Deutsche Welle, 22 Aug. 2022, <https://www.dw.com/en/germany-reactivates-coal-fired-power-plant-to-save-gas/a-62893497>.
- Die Gaskrise Und Ihre Auswirkungen Auf Die Deutsche Landwirtschaft*. <https://www.topagrar.com/energie/news/die-gaskrise-und-ihre-folgen-fuer-die-landwirtschaft4-13138384.html>.
- Diermann, Ralph. “Germany Introduces Tax Breaks for Rooftop PV.” *Pv Magazine International*, 16 Sept. 2022, <https://www.pv-magazine.com/2022/09/16/germany-introduces-tax-breaks-for-rooftop-pv/>.

e.V., Bundesverband WindEnergie. "Statistics Germanybwe E.V." *BWE E.V.*,
<https://www.wind-energie.de/english/statistics/statistics-germany/>.

Franke, Andreas. "German Wind, Solar Capture Prices End 2021 at Record Highs." *S&P Global Commodity Insights*, S&P Global Commodity Insights, 11 Jan. 2022,
<https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/011122-german-wind-solar-capture-prices-end-2021-at-record-highs>.

"Germans Warned: Gas Use Is Too High to Avoid Energy Crisis." *AP NEWS*, Associated Press, 6 Oct. 2022,
<https://apnews.com/article/business-germany-government-and-politics-0e2a5f4bb528bd71128c0278650a410c>.

"Germany." *Central Intelligence Agency*, Central Intelligence Agency,
<https://www.cia.gov/the-world-factbook/countries/germany/>.

iStockPhoto, Credit: "Wind Generation Benefits Farmers, Rural Communities and the Environment." *American Farm Bureau Federation - The Voice of Agriculture*, 13 Sept. 2017,
<https://www.fb.org/viewpoints/wind-generation-benefits-farmers-rural-communities-and-the-environment>

Morris, Craig, et al. "Does Germany Even Have Enough Space for Renewables?" *Energy Transition*, 19 Jan. 2017, <https://energytransition.org/2015/10/does-germany-even-have-enough-space-for-renewables/>.

Person, and Kate Abnett Essi Lehto. "Gas Crisis Set to Worsen after Europe Burns through Winter Stocks." *Reuters*, Thomson Reuters, 5 Oct. 2022,
<https://www.reuters.com/markets/europe/europes-gas-crisis-set-deepen-after-winter-drains-reserves-2022-10-05/>.

Plumer, Brad. "Germany Has Five Times as Much Solar Power as the U.S. - despite Alaska Levels of Sun." *The Washington Post*, WP Company, 25 Nov. 2021,
<https://www.washingtonpost.com/news/wonk/wp/2013/02/08/germany-has-five-times-as-much-solar-power-as-the-u-s-despite-alaska-levels-of-sun/>.

Richtmann, Mathis. "Stockpiling Wood in Fear of Gas Shortage – DW – 07/26/2022." *Dw.com*, Deutsche Welle, 26 July 2022,
<https://www.dw.com/en/germany-stockpiling-wood-in-fear-of-gas-shortage/a-62601419>.

"Solar Panel Rebate: How It Works and How to Get It." *SolarQuotes*, 25 Feb. 2022,
<https://www.solarquotes.com.au/panels/rebate/>.

Solutions, WES - Wind Energy. "Land Use Efficiency Dramatically Increases through Dual Use." *WES, Wind Energy Solutions*, WES - Wind Energy Solutions
[Htts://Windenergysolutions.nl/Wp-Content/Uploads/2020/10/WES-Logo-RGB-Profile-180x180-2.Png](https://Windenergysolutions.nl/Wp-Content/Uploads/2020/10/WES-Logo-RGB-Profile-180x180-2.Png),
4 Sept. 2019, <https://windenergysolutions.nl/uncategorized/optimal-efficiency-agricultural-land/>.

Thurau, Jens. "Why Germans Fear a Cold Winter – DW – 09/24/2022." *Dw.com*, Deutsche Welle, 24 Sept. 2022, <https://www.dw.com/en/gas-crisis-why-germans-fear-a-cold-winter/a-63221531>.

TRTWorld. *Germany's Rising Cost of Living Puts More Children at Risk of Poverty*, TRT World, 30 Aug. 2022, <https://www.trtworld.com/europe/germany-s-rising-cost-of-living-puts-more-children-at-risk-of-poverty-60301>.

Ziomecki, Mariusz. "Germany's Scramble to Revamp Its Energy Policy." *GIS Reports*, 14 Oct. 2022, <https://www.gisreportsonline.com/r/germany-gas/>.