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CAN CANADA AVOID EUROPE'S ENERGY CRISIS?

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Executive Summary

Robust economic growth as the world emerged from the pandemic, coupled with the world's strong reliance on abundant and affordable energy from fossil fuels, has led to a significant post-COVID rebound in oil and gas consumption. According to most forecasters, oil and gas will continue to be a large component of the world's energy mix in the next decades even in the most conservative estimations. In fact, projections show that, at least in the medium term, demand for these conventional energy sources will increase and they will continue to fuel economic growth, particularly in developing countries.

However, a combination of market forces and government policies is threatening global energy security as demand for oil and gas is expected to increase in the coming years without a commensurate increase in supply. Declining investment as a result of volatile commodity prices and aggressive climate policies, in combination with the West's response to the war in Ukraine, risk limiting the world's ability to supply this growing demand. The inevitable consequence of this supply and demand mismatch is an energy shortage that will lead to higher energy prices for a sustained period of time, hampering economic growth and increasing the cost of living.

Nowhere is this truer than in Europe, which is experiencing its worst energy crisis in decades. For the last twenty years, governments across Europe have intervened in the region's energy markets by drastically altering the composition of its energy mix. In particular, European climate policies have strongly encouraged the proliferation of wind and solar power at the expense of coal and nuclear. Yet because renewables (wind and solar) cannot fully support European demand for electricity due to their intermittency, the market has become increasingly dependent on natural gas—a predictable and dispatchable energy source—as a marginal supplier in times of high electricity demand. But European climate policies have also resulted in significantly lower domestic natural gas production and storage capacity, making Europe reliant on Russian natural gas imports. Specifically, several EU countries, such as Ireland, Germany, and France, have banned fracking, which effectively impacted the region's ability to produce the reliable and affordable energy they need. Another example is the EU's soaring carbon prices, which are driven by the region's ambitious climate policies and targets. For most of its history, the European Union had modest carbon prices, typically under 15 euros per tonne. Yet recently the carbon price has risen very rapidly, going from 22 euros per tonne in early 2020 to more than 60 euros by the fall of 2021 and 90 euros by December 2021.

Lower production and storage, coupled with increased demand for natural gas as a result of greater reliance on intermittent wind and solar and of a strong economic recovery, eventually led to a significant spike in the price of natural gas in 2021. Because natural gas is such a crucial component in European electricity generation, the price of natural gas partially drives the price of electricity. As a result, electricity prices soared to record levels in 2021, rising more than 200 percent in Germany, the UK, Spain, and France. In the Nordic region, prices surged 470 percent compared to 2020. Overall, aggressive climate policies through soaring carbon prices and forced energy transitions to renewable energy sources have largely contributed to Europe's energy crisis.

Europe's experience can serve as a cautionary tale for the federal government in Canada, which is implementing the same set of policies that contributed to Europe's energy crisis. For example, Canada will have a carbon tax of $170/tonne of carbon dioxide by 2030 while the European Union Emission Trading System allowance price sits at around $110/tonne. Like many European countries, in particular Germany, Ottawa has mandated the phase-out of conventional coal-fired electricity generation and accelerated the deployment of renewable energy sources to support its target to achieve 90 percent of non-emitting electricity generation by 2030.

In addition, Europe's cap on greenhouse gas emissions is a feature of its regional carbon pricing system and some countries, like Germany and the UK, have added a carbon tax on top of this cap-and-trade system. Canada's federal government plans to cap the greenhouse gas emissions from the oil and gas industry—without creating a corresponding permit market—on top of its already poorly designed carbon tax.

Although global market forces are out of Ottawa's control, many of our policy decisions are self-inflicted wounds contributing to the problem. Given the current context of rising energy prices, Canadian policymakers should consider the policy implications of aggressive climate policies that considerably limit the production of reliable and affordable energy.

1 Introduction

Oil and gas are essential energy sources that fuel our current standard of living. In fact, almost 60 percent of global primary energy consumption comes from oil and natural gas (bp, 2021). As with all commodities, oil and gas prices are determined by the laws of supply and demand. If supply outpaces demand, there will be an abundance of oil and gas and prices will go down. The more there is of something the less the incentive there is to produce more. On the other hand, if demand outpaces supply, there will be a shortage of energy and prices will spike, which will harm consumers in the short term but will also incentivize more production.

In the aftermath of Russia's invasion of Ukraine, we have seen a sudden withdrawal of the supply of oil and gas from the market as countries have moved to exclude Russian exports from the world market. But the imbalance of supply and demand precedes this current crisis. Quite apart from the Ukraine-related situation, a combination of market forces and government policies is threatening global energy security as demand for oil and gas is expected to increase in the coming years without a commensurate increase of supply. Even in the most conservative estimations, oil and gas will continue to be a large component of the world's energy mix in the next decades, and consumption will continue to rise as developing countries transition from low- to middle-income countries. Nonetheless, structural underinvestment in the sector as a result of aggressive climate policies and volatile commodity prices risk limiting the world's ability to supply this growing demand. The inevitable consequence of this supply and demand mismatch is a long-term increase in energy prices.

Nowhere in the world has this risk materialized as much as in Europe. Europe's ongoing energy crisis is a result of forceful government intervention in energy markets through aggressive climate policies. European governments have drastically altered the region's energy mix in favour of renewable sources and have discouraged the production of fossil fuels and nuclear power. In addition, the European Union's Emission Trading System (EU ETS) allowance price—Europe's carbon price—has increased significantly due to the tightening of governmental climate policy targets, namely the EU's 2030 Climate Target Plan of reducing net greenhouse gas emissions by 55 percent.

As a result, electricity bills are soaring across the region, hurting the pockets of households and businesses given the importance of coal and natural gas in European electricity generation. A key problem is that European governments overestimated the ability of solar and wind to provide reliable power and underestimated the need for fossil fuels and nuclear to provide the reliable and affordable electricity the region needs. Aggressively intervening in the region's energy markets by picking winners and losers restricted the market's ability to supply hydrocarbons in a world of growing demand.

Europe's experience can serve as a cautionary tale for the federal government in Canada, which is implementing the same set of policies that led to Europe's energy crisis. For example, Canada will have a carbon tax of $170/tonne of carbon dioxide by 2030 while the EU ETS allowance price sits at around $110/tonne. Like many European countries, in particular Germany, Ottawa has mandated the phase-out of conventional coal-fired electricity generation and accelerated the deployment of renewable energy sources to support its target to achieve 90 percent of non-emitting electricity generation by 2030.

In addition, Europe's cap on greenhouse gas emissions is a feature of its regional carbon pricing system and some countries, like Germany and the UK, have added a carbon tax on top of this cap-and-trade system. Canada's federal government plans to cap the greenhouse gas emissions from the oil and gas industry—without creating a corresponding permit market—on top of its already poorly designed carbon tax.

Overall, aggressive climate polices through soaring carbon prices and forced energy transitions to renewable energy sources have contributed significantly to Europe's soaring gas and electricity prices. The purpose of this study is to make the case that Canadian policymakers should reverse course and avoid the mistakes that led to Europe's energy crisis.

The study proceeds as follows. It begins by analyzing the International Energy Agency's medium- and long-term oil and gas demand forecasts and by highlighting the structural underinvestment in the sector caused by low commodity prices and aggressive climate policies as main constraints affecting the supply of oil and gas. The next section discusses Europe's energy crisis and the underlying factors that caused it. The penultimate section warns about the negative implications of higher energy prices by drawing lessons from the literature and from the inflationary environment of 2021. Concluding comments are provided in the final section.

2 Oil and Gas Demand

2.1 Oil and gas demand in the medium term

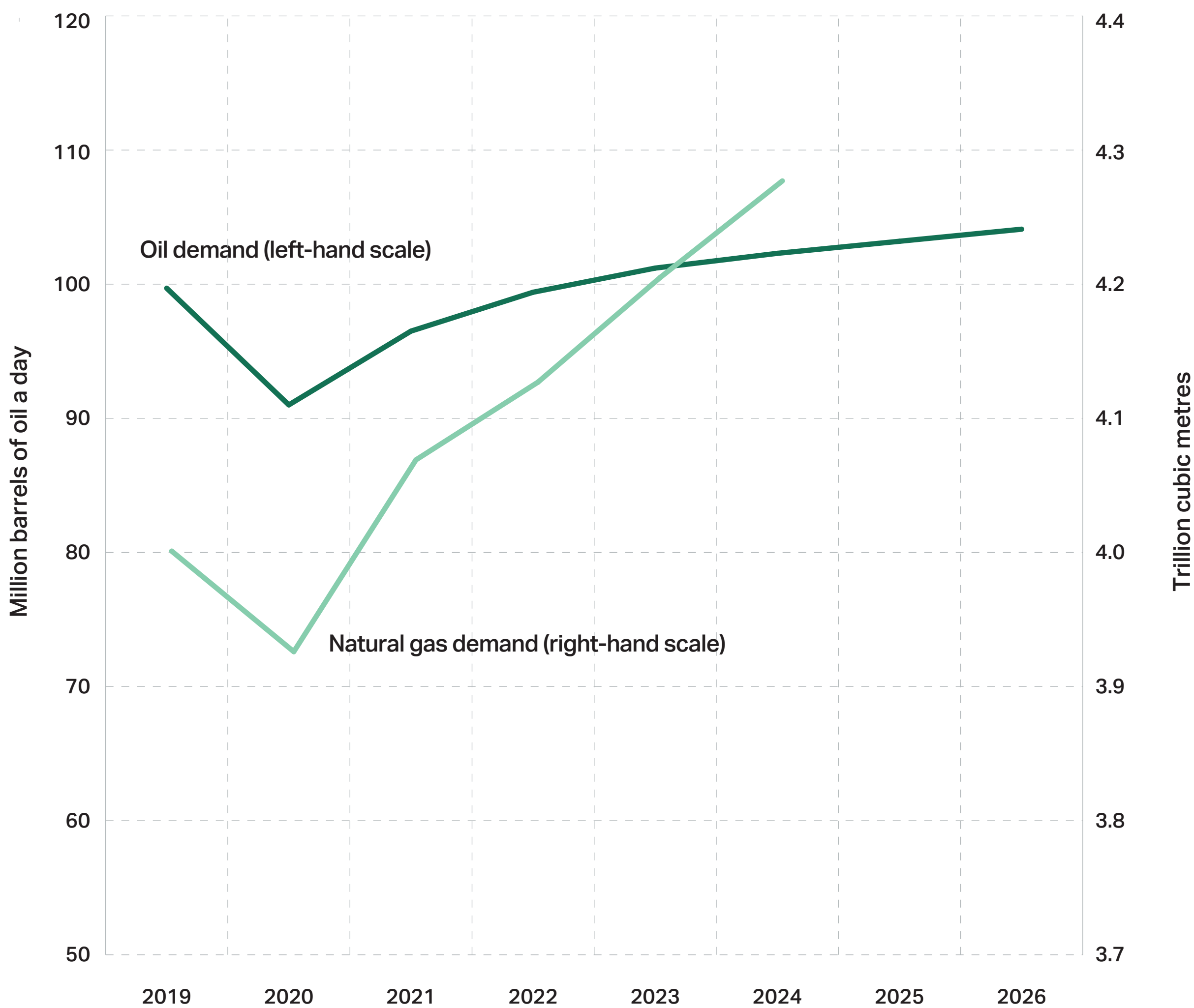
The IEA (2021a) estimated oil demand in 2020 was 91 million barrels of oil a day (mbd)—nearly 9 mbd less than in 2019. This historic year-on-year collapse in demand was a direct result of COVID-related restrictions on mobility—which accounts for almost two-thirds of global oil consumption (IEA, 2021a). In April 2020, arguably one of the most traumatic months of the pandemic, the daily average number of flights was 70,000—62 percent less than the daily average for the entire year in 2019 (FlightRadar 24, 2019). The impact on energy markets was significant. At one point, benchmark West Texas Intermediate (WTI) went into negative territory (BBC, 2020) as supply clearly outweighed consumption.

Many commentators claimed that oil consumption would never return to pre-pandemic levels and predicted that peak oil demand was already behind us (The Guardian, 2020). However, robust economic growth as the world emerged from the pandemic, coupled with the world's strong reliance on abundant and affordable energy from fossil fuels, proved these predictions wrong.

Figure 1 shows the International Energy Agency's (2021a) global oil demand projections until 2026 and natural gas projections until 2024. After the COVID-induced demand collapse in 2020, the IEA forecasted oil demand to strongly rebound by 5.5 mbd in 2021 and 2.9 mbd in 2022. By 2023, the world will consume 1.5 mbd more than it was consuming pre-COVID. Post-2023, the IEA forecasts oil demand to grow by an average of 1 mbd annually until 2026 when it reaches 104.1 mbd—4 percent more than in 2019 and 14 percent more than in 2020. These numbers show that, at least in the medium term, oil demand will continue to grow and will continue to be an important component of the world's energy mix.

A closer examination of these numbers reveals that developing countries are the main drivers of this medium-term oil demand growth. Emerging economies are able to grow and develop because they consume abundant, reliable, and affordable energy (in the form of fossil fuels) as a factor of production for many industries (Stevens, 2018). This means that efforts to reduce oil consumption in developed countries won't result in a collapse of global oil demand.

Figure 1: Oil and gas demand in the medium term



Source: International Energy Agency, 2021a, 2021d.

A big caveat is worth highlighting. These oil demand forecasts are conservative estimates of what oil demand might look like in the medium term. [1] Consider what happened in 2021, when a shortage of coal and natural gas led to an unexpected increase in oil demand of about 500,000 barrels a day as a result of fuel-switching (IEA, 2021b). Given the extraordinarily low levels of investment in coal and natural

[1] In its February 2022 Oil Market Report, the IEA (2022) made significant upward revisions to their oil demand baseline numbers for 2018, 2019, 2020, 2021, and 2022. The changes indicate that demand for oil just about recovered to a pre-pandemic high of 100.3 million mbd by the fourth quarter of 2021 and will exceed pre-COVID levels by 2022.

gas in recent years (IEA, 2021c), fuel-switching to oil might become a regular feature in global energy markets in the near-future.

Similarly, according to IEA (2021d), natural gas demand is set to increase in the medium term at an annual average growth rate of 1.7 percent per year for the 2021–2024 period. Projections estimate global natural gas consumption in 2024 at 4.3 trillion cubic metres—seven percent more than in 2019 and nine percent more than in 2020.

As with oil, emerging economies in Asia Pacific (56 percent) and the Middle East (25 percent) account for most of the incremental natural gas consumption from 2021 to 2024.

Overall, estimates of oil and gas consumption show that, at least in the medium term, demand for these conventional energy sources will increase and they will continue to fuel economic growth in developing countries, particularly in Asia, the Middle East, and Africa.

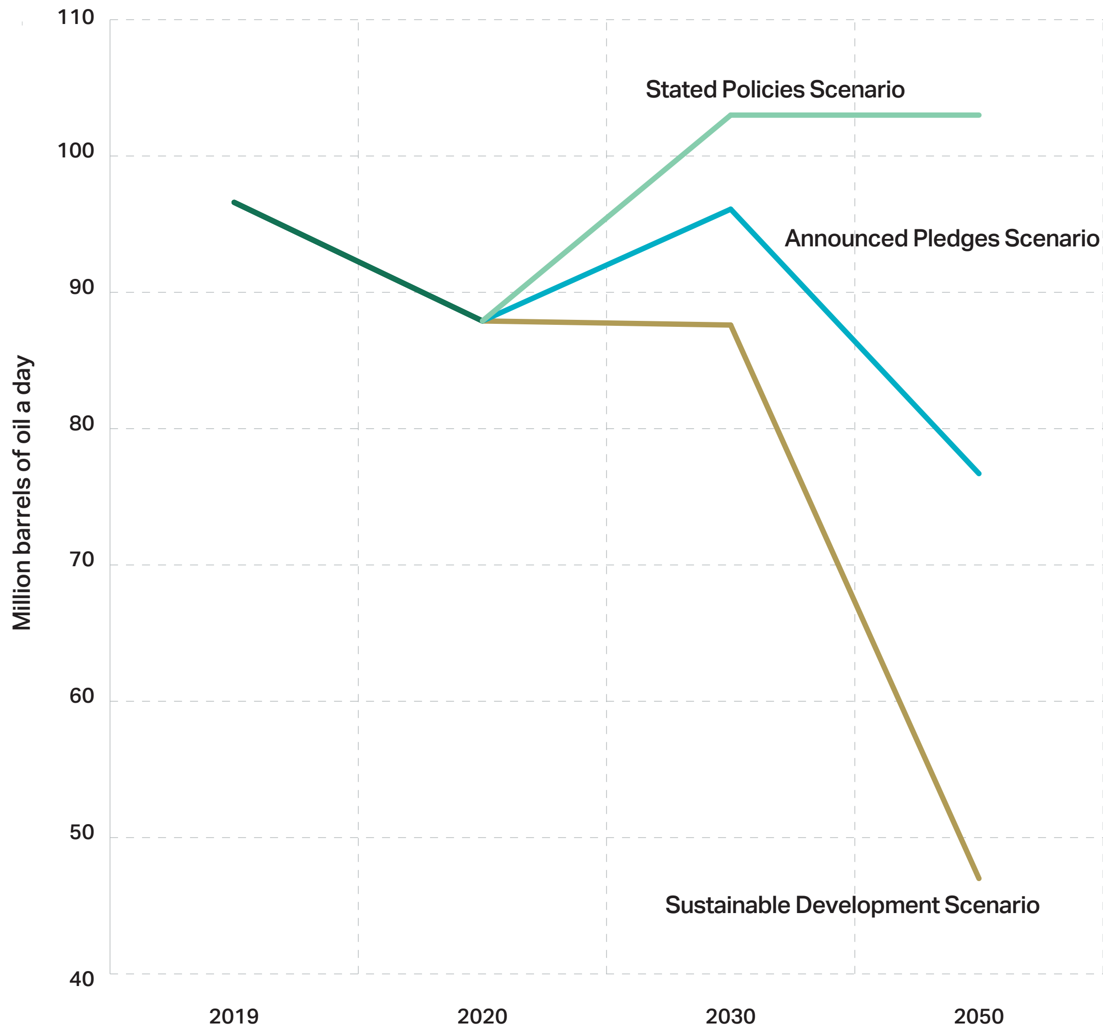
2.2 Oil and gas demand in the IEA's Long-Term Scenarios

The IEA (2021e) outlines several long term scenarios for global energy markets based on assumptions of population and economic growth, technological innovations, and government policies. These are not predictions but rather scenarios that "enable readers to compare different possible versions of the future and the levers and actions that produce them, with the aim of stimulating insights about the future of global energy" (IEA, 2021e). However, they do give a picture of what the global energy mix would look like based on a set of reasonable assumptions.

The first scenario, called the Stated Policies Scenario (STEPS), reflects current policies put in place by governments and can be characterized as the "status quo" scenario. Based on an assumed climate model, this scenario would yield a 2.4–2.8 degrees Celsius increase in temperature by 2100. The second scenario, called the Announced Pledges Scenario (APS), assumes all climate commitments made by governments around the world, in the context of the Paris Agreement and country-specific net zero targets, will be met in full and on time. This scenario would translate to a 1.9–2.3 degrees' Celsius increase in temperature by 2100. Finally, the IEA's Sustainable Development Scenario (SDS) sketches a pathway for the global energy sector to achieve net zero emissions by 2070 and would achieve the Paris Agreement goal of limiting global warming well below 2 degrees Celsius to 1.3–1.5 degrees Celsius.

As shown in **figure 2**, global oil demand continues to grow for the rest of this decade in two out of the three scenarios. In the STEPS, oil demand peaks in the mid-2030s, reaching between 103 and 104 mbd, and then plateaus at 103 mbd. In the APS, oil demand growth slows down soon after 2025 at around 96 mbd and then declines significantly due to country-specific emission targets reaching 76.7 mbd in 2050. Finally, the SDS assumes oil demand peaked already in 2019 at 96.6 mbd. However, as referenced before, oil demand in the fourth quarter of 2021 was already at 2019 levels.

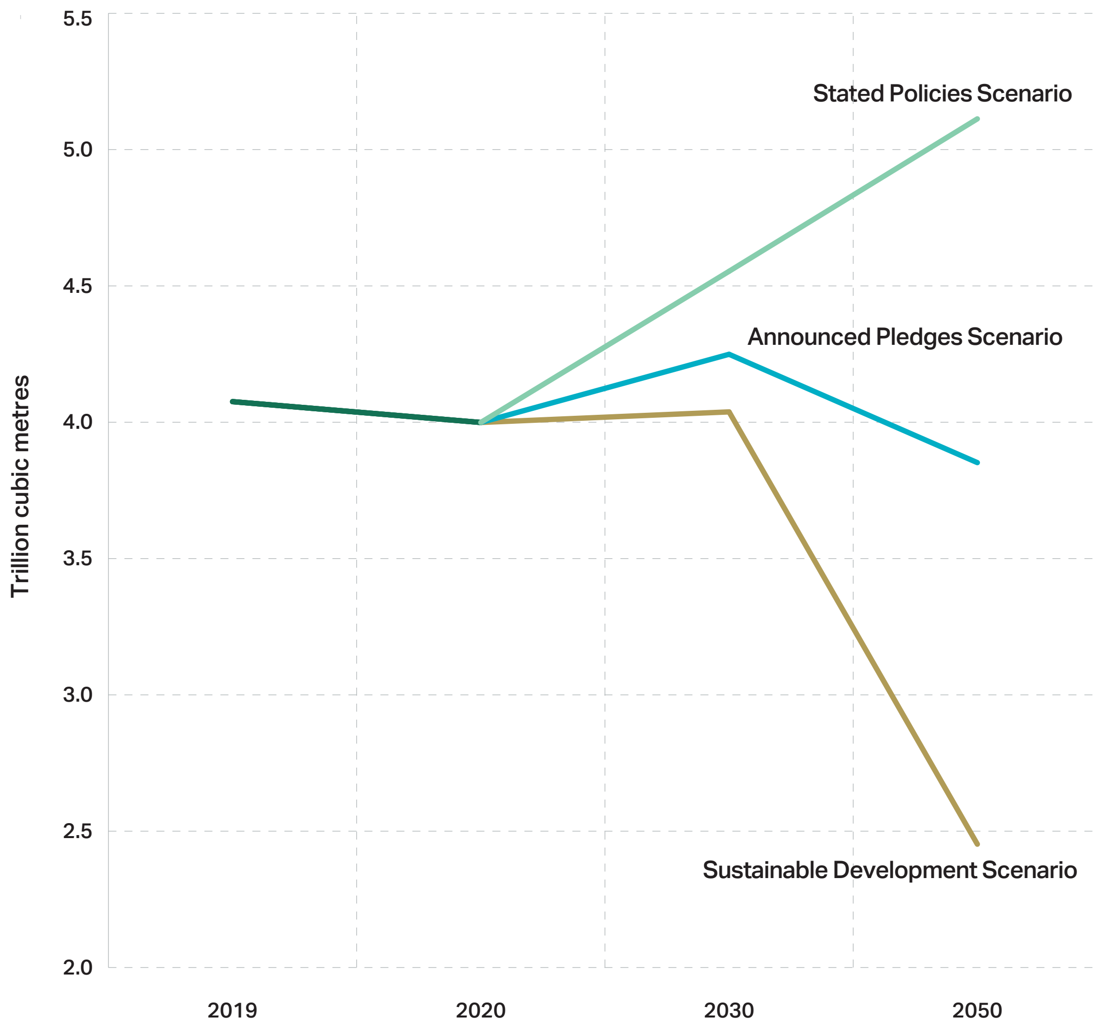
Figure 2: Global oil demand with IEA's scenarios for 2030 to 2050



Source: International Energy Agency, 2021e.

As with oil, IEA (2021e) sees natural gas demand increasing in two out of the three IEA's scenarios (**figure 3**). In the STEPS, natural gas demand rises steadily and reaches 4.5 trillion cubic metres (tcm) in 2030—around 12 percent higher than what it was in 2019 and 15 percent higher than in 2020. In the APS, natural gas demand peaks around 2030 at approximately 4.2 trillion cubic metres—still four percent higher than in 2019 and six percent higher than in 2020. So, in a scenario in which governments fulfill their climate promises and pledges, natural gas demand continues to rise until at least 2030.

Figure 3: Global natural gas demand with IEA's scenarios for 2030 to 2050



Source: International Energy Agency, 2021e.

3 Current Oil and Gas Supply Constraints

IEA demand projections show that oil and gas consumption will continue to increase in the medium term and even in the long term, depending on the underlying assumptions. However, declining investment as a result of an extended supply glut, in combination with aggressive climate policies and the western response to the war in the Ukraine, are all combining to create the opposite situation to the past decade, namely a shortage of oil and gas. These can be expected to lead to higher energy prices for a sustained period of time and threaten not only the post-pandemic recovery but also economic growth in developing countries.

3.1 Declining investment

The US shale revolution was a disruptive event for energy markets. The United States went from producing 5 mbd of oil in 2008 to a peak of 12.2 mbd in 2019 (EIA, 2021b). Similarly, the country went from producing 19.5 trillion cubic feet of natural gas in 2005 to 36.4 trillion cubic feet in 2019 (EIA, 2021b). Technological improvements in hydraulic fracturing and horizontal drilling, historically low interest rates, and sustained high oil prices were key enablers of the massive production growth in the US (Azar, 2017).

By the third quarter of 2014 global oil and gas was in a structural surplus. The same year production growth rose to an average of 2.7 percent while demand growth remained in line with its 2001–2013 average of 1.4 percent (Ellwanger, Sawatzky, and Zmitrowicz, 2017). In addition, OPEC refrained from cutting oil production, engaging in a volumetric war for market share against the US. In sum, US shale hypergrowth and OPEC's refusal to cut production led to a glut in oil markets that lasted for 12 consecutive quarters.

As a result, oil prices collapsed dramatically, going from a steady US$110 per barrel between January 2011 and June 2014 to a low of US$29 in January 2016 (Ellwanger, Sawatzky, and Zmitrowicz, 2017). Ellwanger, Sawatzky, and Zmitrowicz (2017) showed that "supply factors explain most of the decline in oil price since mid-2014".

Low oil prices imply lower revenues and a weakening incentive to plan new investments in production capacity. Overall investments in oil and gas yielded negative returns after 2014. The S&P 500 Energy, which comprises those companies included in the S&P 500 that are classified as members of the energy sector, fell by a cumulative 44 percent between June 2014 and February 2020 (S&P Global, 2021).

Simultaneously, the investment environment in the sector was becoming more hostile as demands for a rapid energy transition started to arise after the Paris Agreement was signed in 2015. Many countries in Europe and North America started to implement aggressive climate policies with the goal of discouraging the production of fossil fuels and thereby reducing GHG emissions. This was also accompanied by private sector initiatives like ESG reporting which discouraged large fund managers from investing in the hydrocarbon sector.

Reflecting all these influences, figure 4 shows annual average global upstream oil and gas investment fell steeply after 2014. Investment spending averaged US$661 billion annually between 2010 and 2014. Following the price collapse of 2014–2016, average annual investment spending dropped almost 30 percent to US$484 billion for the period 2015–2019. Spending in 2020 dropped further, to USD $330 billion, mainly due to COVID-19. While the IEA (2021c) estimates that investment recovered somewhat in 2021 to $362 billion, this is still only 55 percent—just over half—the annual level observed in 2010–2014.

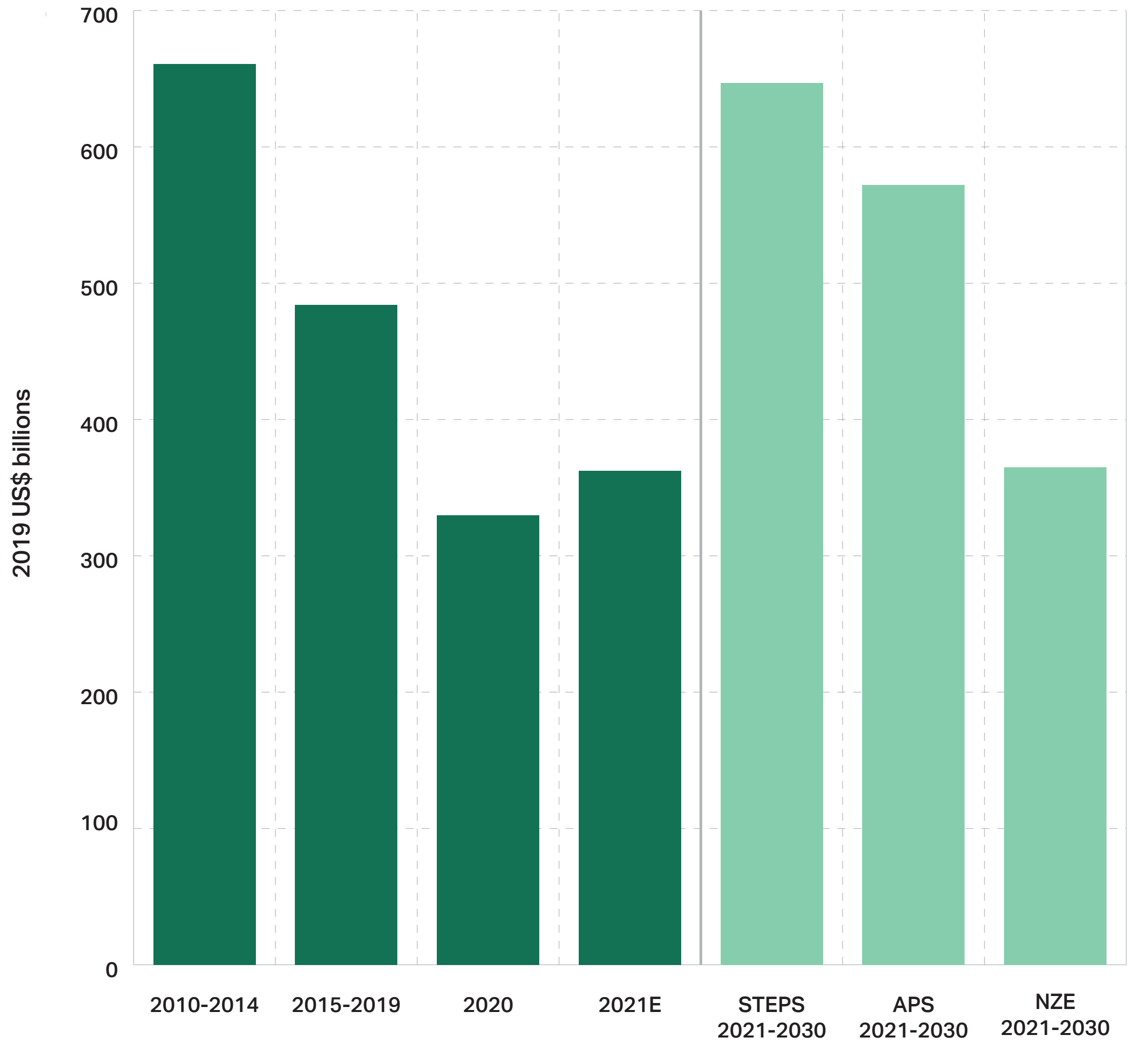
Figure 4 also shows estimates of the annual amount of upstream oil and gas investment spending required to ensure adequate supply per outlook scenario. Under STEPS, the stated policies scenario, investment spending needs to return to pre-2014 levels, which will require near doubling from current levels. Spending needs to rise by about 50 percent to match the Announced Pledges scenario and is even somewhat short of the Net Zero scenario.

Overall, investment data shows that oil and gas production investment is currently at net-zero type levels, but demand is not following the net-zero trajectory. This asymmetry creates a risk of starving the sector from the capital base it needs to grow supply, which in turn foreshadows substantial commodity price increases.

Another signal pointing to a changed stance on long term capacity development in the oil and gas sector is the newly found commitment to capital discipline in the US shale sector and in the oil Majors. [2] With higher oil and gas prices come higher revenues and the US shale sector is "using the influx of cash to pay down debt and return money to shareholders, rather than increase output" (IEA, 2021d). Following a similar path, oil Majors have also increased share-buybacks and dividends, while lowering both their debt levels and their capital expenditure budgets relative to pre-COVID levels (Chevron, 2021; Exxon Mobil, 2021). After the poor returns of the last five years and the uncertainty surrounding the aggressive climate policies of Western oil producing nations, oil Majors and US shale companies are hesitant to invest in meaningful supply growth.

[2] Oil Majors, or supermajors, are the seven largest publicly traded Western oil and gas companies: BP, Chevron, Eni, Exxon Mobil, Shell Plc, TotalEnergies, and ConocoPhillips.

Figure 4: Annual average global upstream oil and gas investment spending

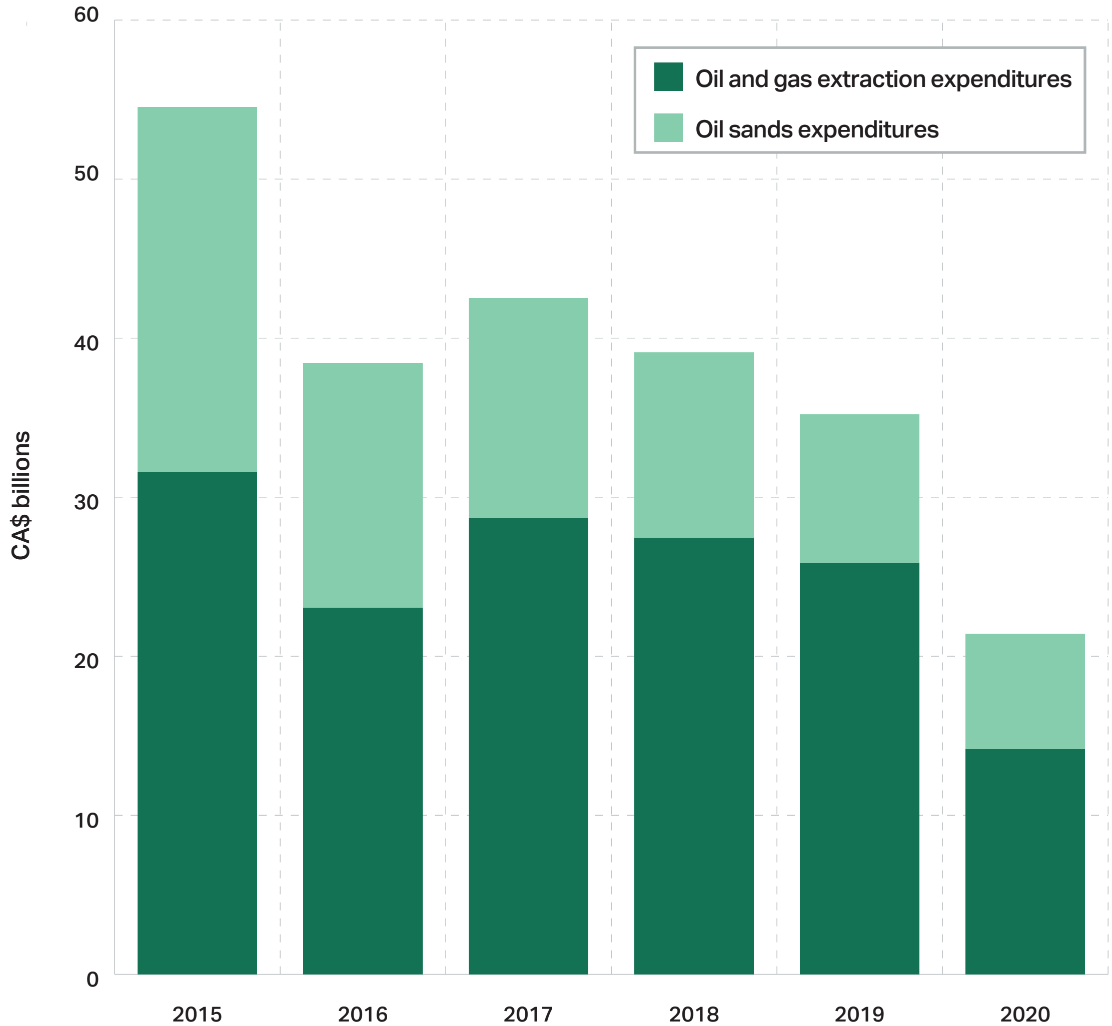


Source: IEA, 2021c, 2021e.

This capital discipline is the new normal in the US oil patch—where most production growth outside of OPEC+ came before COVID-19—and highlights the risks of underinvestment in the sector.

As shown in **figure 5**, Canada is no stranger to the story of deteriorating investment climate in the oil and gas sector. Oil and gas extraction capital expenditure has significantly collapsed due to a combination of market forces and a hostile policy environment. Indeed, before COVID-19, Canada's upstream capital expenditure was shrinking at an average annual rate of 9 percent for the period 2015–2019. In particular, oil sands expenditure rapidly declined from CAD $22.9 billion in 2015 to CAD $7.2 billion in 2020—a 68 percent decrease.

Figure 5: Total oil and gas extraction capital expenditure, Canada, 2015–2020



Source: Statistics Canada, 2021.

On the policy front, several reports have highlighted the deterioration of Canada’s oil and gas investment attractiveness due to regulatory barriers, including extensive reforms introduced by Bill C-69 and Bill C-48 (Yunis and Aliakbari, 2021a; Yunis and Aliakbari, 2021b). In addition, Canada’s ambitious carbon pricing plan, which intends to increase the rate of carbon tax from its current level to $170 per tonne by 2030 is another policy hurting the investment climate in the oil and gas sector. The federal government’s climate plan also contemplates a Clean Fuel Standard (CFS), a regulation that will require producers and importers of liquid fossil fuels to reduce the carbon intensity of their products. This regulation will be added on top of the carbon tax, further limiting supply growth of oil and gas in Canada.

In addition to this plethora of regulations, the federal government has also set national mandates and targets that will inevitably limit the supply of fossil fuels. For instance, Ottawa has set a mandatory target of 90 percent of zero-emitting electricity by 2030. It has also promised to phase out coal from Canada's electricity grid by 2030. Another massive risk for the Canadian oil patch comes from the recent announcement by Prime Minister Justin Trudeau that it will cap oil and gas emissions (Tasker, 2021), effectively curtailing the industry's output. This new announcement risks deterring flows of capital investment to an already diminished sector.

4 The Causes of the European Energy Crisis

As mentioned in the previous sections, if demand for oil and gas continues to grow and governments continue to artificially curtail the world's ability to supply it, we risk creating scarcity which will put an upward pressure on prices. Nowhere is this truer than in Europe, a textbook example of what happens when governments intervene in energy markets to drastically alter the composition of the energy mix.

4.1 Documenting Europe's energy crisis

In this section we provide several charts to document the recent price changes in Europe for several key energy items, namely crude oil, natural gas, and electricity. For each, we provide figures of both the level and 12-month growth rate so the reader can distinguish between a mere return to pre-pandemic levels versus a historically high price.

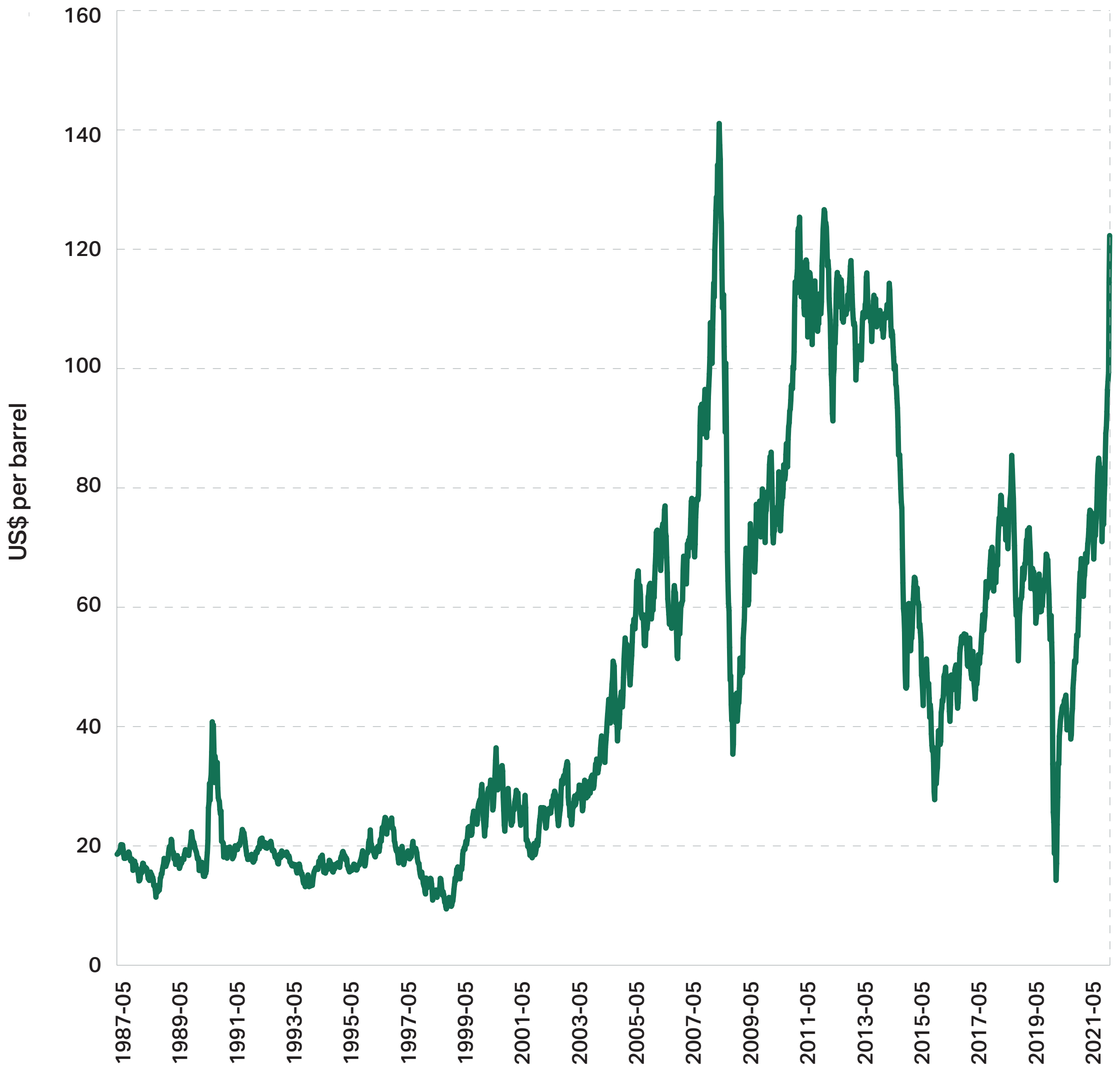
In figures 6 and 7, we show the level and growth rate in the price of crude oil. Figure 6 shows that, after the collapse following the 2008 financial crisis, oil prices have occupied two distinct bands, including a temporary high in 2010–2014 and a lower range since then, interrupted by the V-shaped 2019 Covid-related collapse. The December 2021 value of USD$71 per barrel is largely a return to the pre-pandemic range that was in operation since the mid-2000s.

As figure 7 indicates, the recent growth rate in crude oil prices in Europe has been remarkable; with the pre-Ukrainian invasion almost 360 percent increase (in April 2021) being by far the highest one-year jump in the three decades covered in the graph.

However, as figure 6 shows, in this case the tremendous growth rate is possibly misleading. When we consider the *level* of crude prices, the December 2021 value of USD$71 per barrel was largely a return to the pre-pandemic range that was in operation since the mid-2000s, while the price spike since then could plausibly be attributed to the Russia-Ukraine crisis, as opposed to government climate policies.

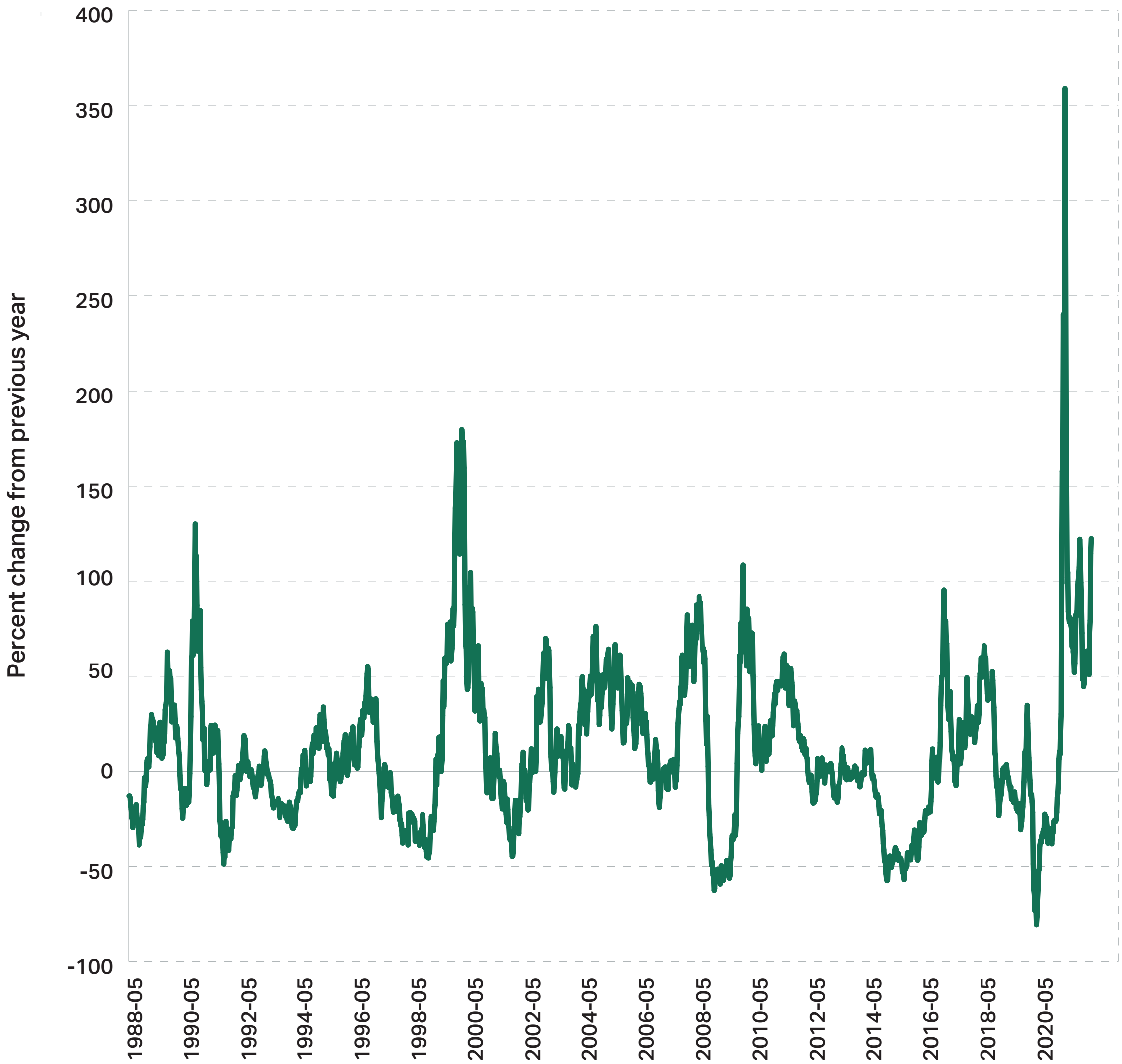
Although there is nothing historically unusual about the current level of European crude oil prices, the same cannot be said for electricity or natural gas. For these energy items, the recent percentage growth has been quite high, *and* the level of the prices have also reached unprecedented heights.

Figure 6: Brent crude oil price, 1987-2022



Source: Federal Reserve Economic Data, <https://fred.stlouisfed.org>.

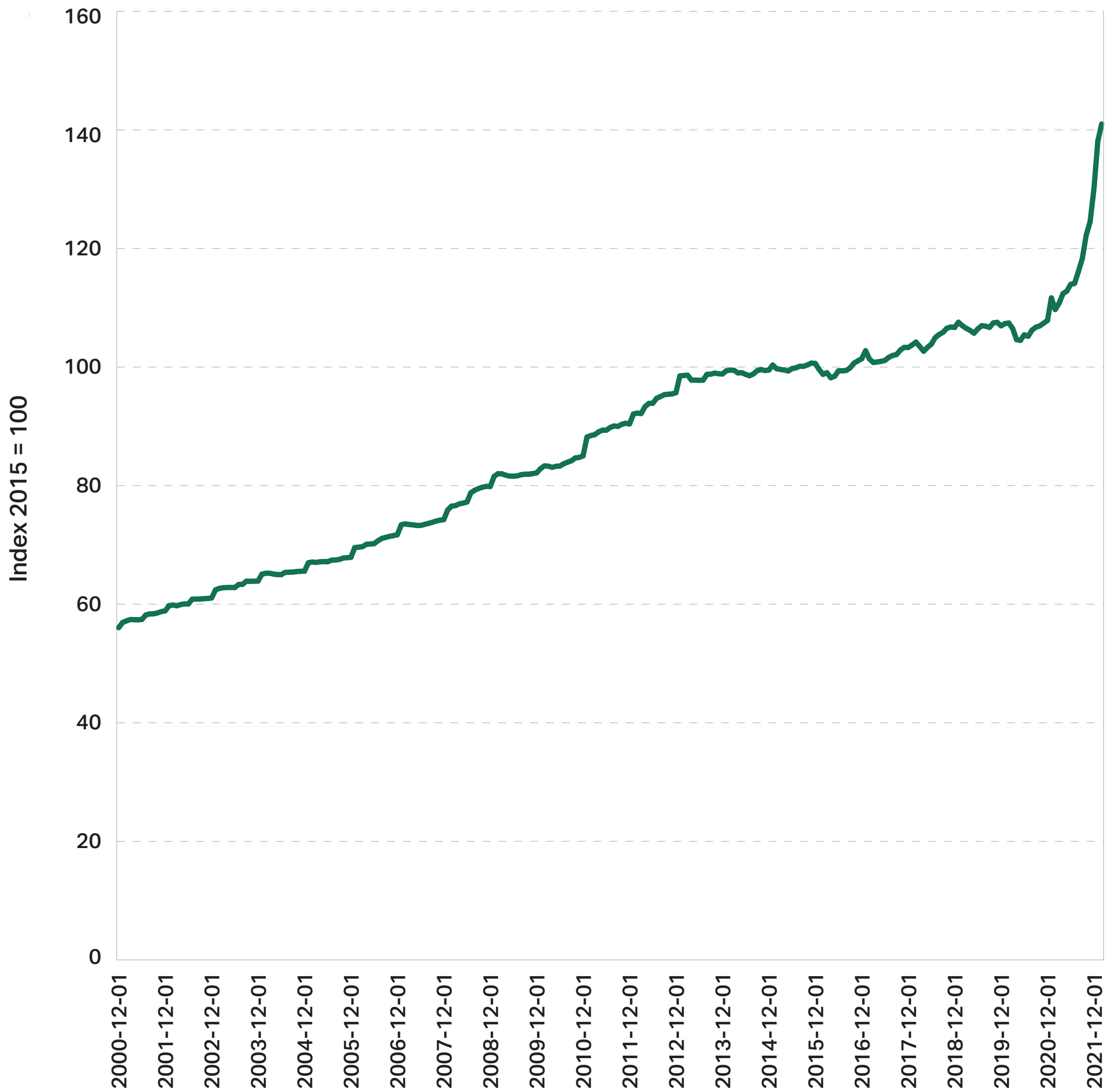
Figure 7: 12-month % change in Brent crude price, 1988-2022



Source: Federal Reserve Economic Data, <https://fred.stlouisfed.org>.

In figures 8 and 9, we chart the level and growth rate of a harmonized index of electricity prices across 27 EU members. **Figure 8** indicates that electricity prices have surged in the past year, which comes on top of a multi-year upward trend. They are not merely rebounding from a pandemic slump; they are much higher now than they ever were before.

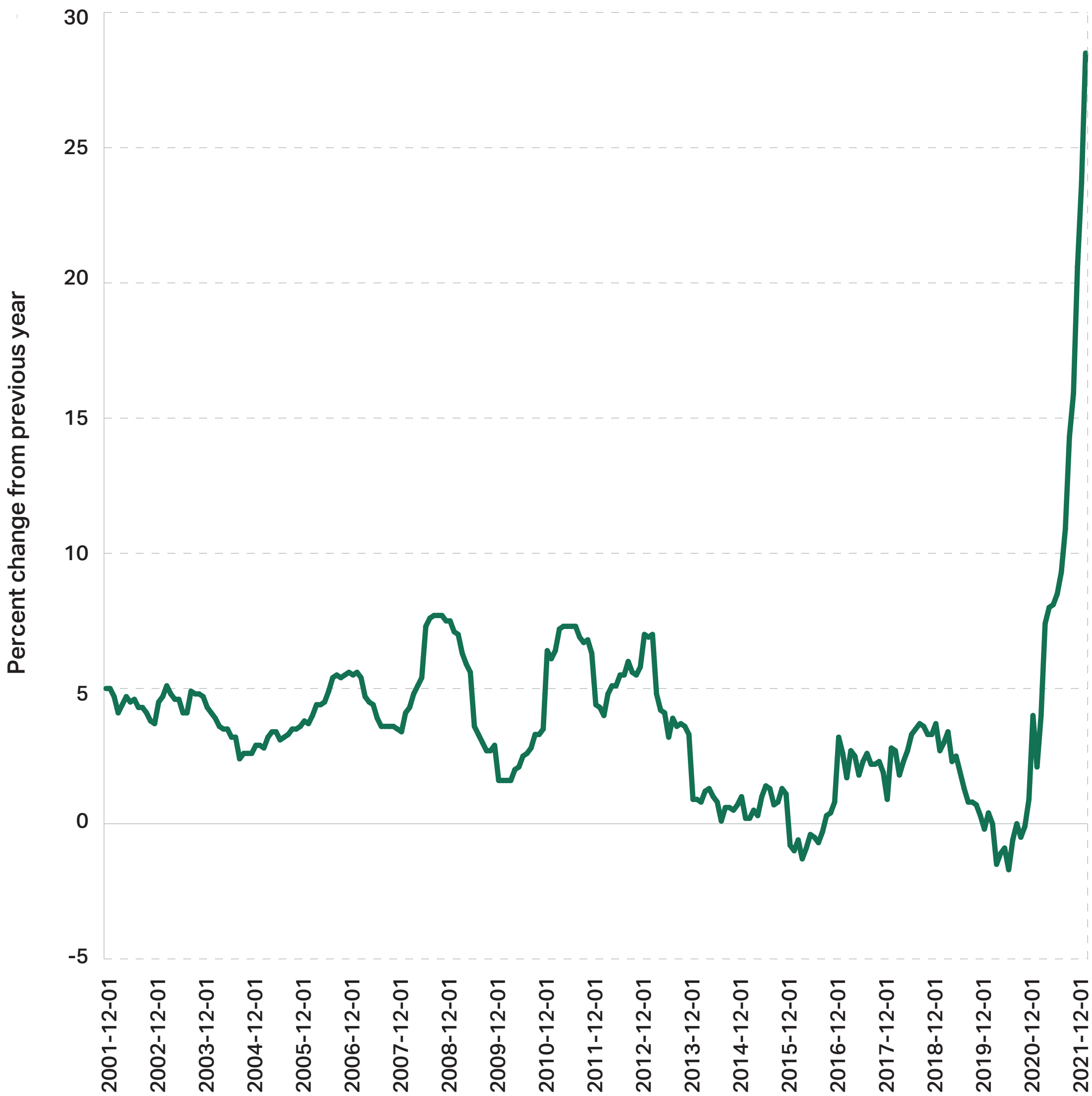
Figure 8: Harmonized index of electricity prices for EU



Source: Federal Reserve Economic Data, <https://fred.stlouisfed.org**>.**

To see more specifically what has happened with the *growth* in our harmonized index of EU electricity prices, we turn to figure 9. As it makes clear, the recent growth in European electricity prices has been quite significant. In December 2021 (before Russia's invasion), the electricity price index was more than 20 percent higher than it had been a year earlier, whereas in the prior two decades, the highest twelve-month growth rate was only 7.7 percent.

Figure 9: 12-month % change in EU electricity prices, 2001-2022

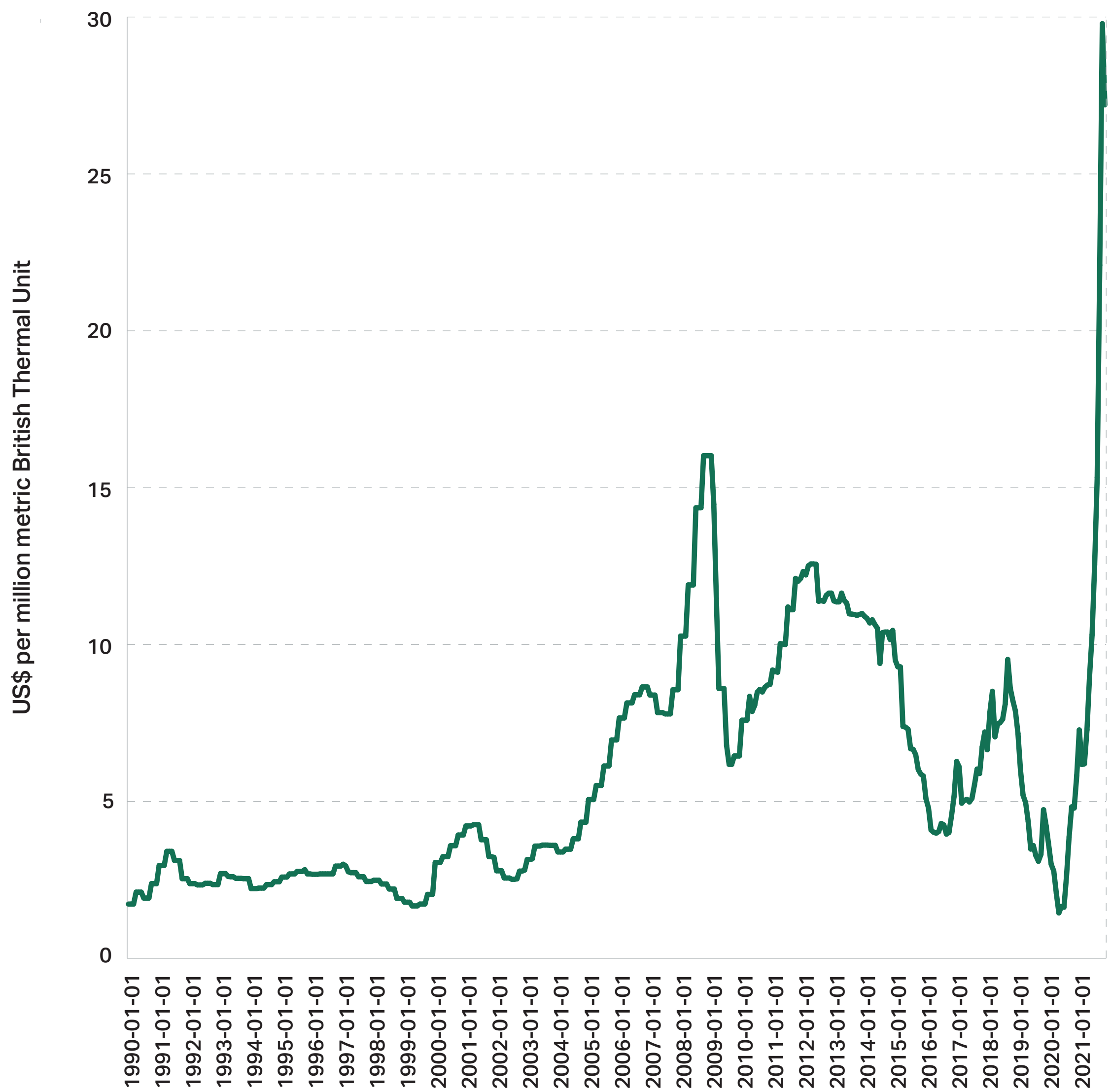


Source: Federal Reserve Economic Data, <https://fred.stlouisfed.org>.

In particular, some countries like Germany, the UK, Spain, and France experienced wholesale electricity price increases of over 200 per cent in 2021 while in the Nordic region power prices surged 470 per cent compared to 2020 (European Union Agency for the Cooperation of Energy Regulators, 2021; Mathis and Starn, 2021; Kern, 2022).

Last, we turn to natural gas. Natural gas prices in Europe trended down after 2008 but have recently skyrocketed, reaching levels well above the previous peak set in late 2008 (**figure 10**).

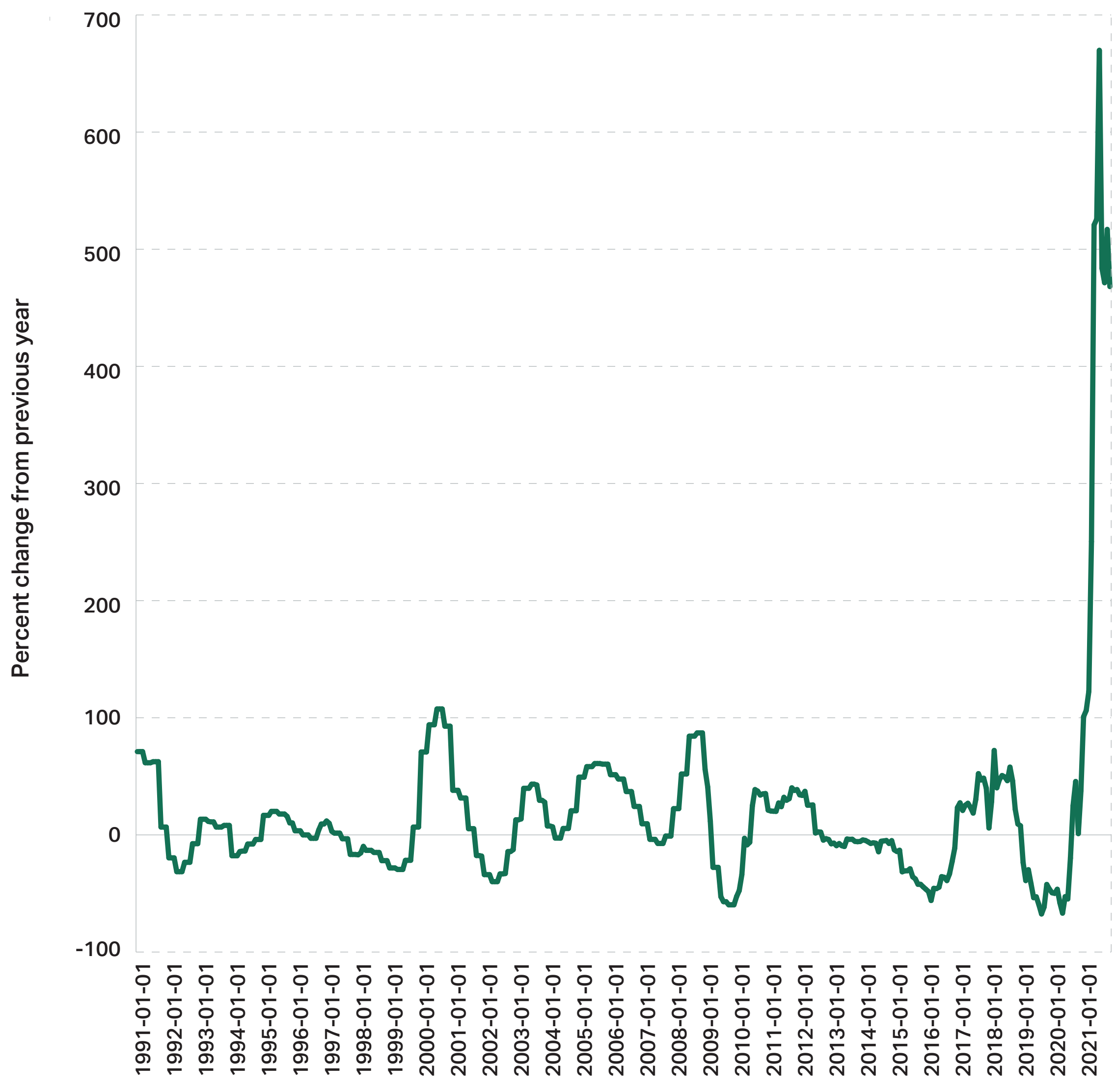
Figure 10: Global price of natural gas, EU, 1990-2021



Source: Federal Reserve Economic Data <https://fred.stlouisfed.org>**.**

Turning to **figure 11**, we can see that the recent growth rate in European natural gas prices dwarfs anything observed in the three decades reported in this data set. In July 2021, natural gas prices were nearly 670 percent higher than a year earlier. This contrasts with the earlier spike (in this data set) in the summer of 2000, when natural gas prices were "only" 108 percent higher than the previous year.

Figure 11: 12-month % change in EU natural gas price,1991-2021



Source: Federal Reserve Economic Data <https://fred.stlouisfed.org>.

In summary, the prices of key energy items—namely crude oil, electricity, and natural gas—have all risen very sharply in Europe in 2021. Of these, an argument can be made that the spike in oil prices mostly represents a return to pre-pandemic economic activity (and consequent higher demand for oil). Yet as the figures in this section have made clear, no such excuse can be given for the prices of electricity and natural gas. These really *have* been driven to heights far outside typical levels, going back at least 30 years.

Furthermore, as most commentators on the European energy crisis stress, these two items are related: Because natural gas is such a crucial component in electricity generation, the skyrocketing price of gas is driving the price of electricity. Consequently, to understand the European crisis, we must understand why natural gas prices have been driven so high, so rapidly.

4.2 The role of EU ETS carbon allowances

The Ukrainian war has had an obvious effect on European gas prices since Russia is such a key supplier to Europe. But gas prices had been trending upward sharply since early 2020. In this essay we seek to uncover *systemic* drivers of the surge, and in particular those factors that can be attributed to government policy. The benefit of this approach is that Canadian policymakers can, if desired, *avoid* the same mistakes in order to reduce Canadian exposure to the same crisis befalling Europe.

In this spirit, we examine the role of carbon allowances in the European Union Emissions Trading System (EU ETS). As the official website explains in a post from July 2021 (emphasis added):

> The EU Emissions Trading System (ETS) works on the principle of 'cap-and-trade'. It sets an absolute limit or 'cap' on the total amount of certain greenhouse gases that can be emitted each year by the entities covered by the system. This cap is reduced over time so that total emissions fall.
>
> Since the EU ETS was introduced in 2005, emissions have been cut by 42.8% [as of July 2021] in the main sectors covered: power and heat generation and energy-intensive industrial installations. As a market-based system, the ETS ensures that emission reductions take place where it is cheapest to do so. As a result, **most emission reductions until now have taken place in the power sector**.
>
> Under the EU ETS, regulated entities buy or receive emissions allowances, which they can trade with one another as needed. At the end of each year, regulated entities must surrender enough allowances to cover all of their emissions. If a

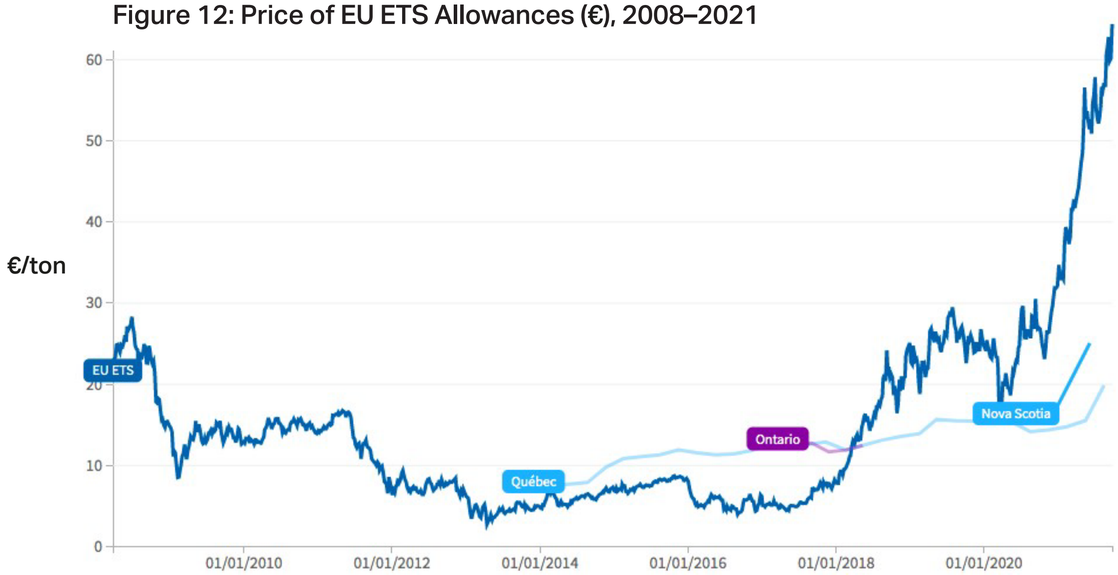
> regulated entity reduces its emissions, **it can keep the "saved" allowances to cover its future needs** or sell them to another installation that is short of allowances. A Market Stability Reserve, in place since 2019, stabilises the market by removing surplus allowances from it.
>
> The sectors covered by the existing EU ETS include power and heat generation, energy-intensive industrial sectors and aviation within Europe. **The Commission has today proposed to apply emissions trading in other sectors** through a separate new system, to build on the positive results of the current system, and to incentivise the transition to cleaner road transport and heating fuels through a carbon price.
> (European Commission, 2021.)

The initial allocation of allowances issued by the authorities in the EU ETS consists of both "free" and auctioned components, with the auctioned share of each year's total allowances increasing over time. However, whether a given power company has received allowances through a free issuance or whether they were purchased in an auction, either way the market price of the allowances represents an opportunity cost and gives an incentive to the power company to reduce emissions, because the allowances can be sold or carried to the future.

For example, if the market price of an EU allowance is 20 euros, then that provides a 20 euro incentive for a utility company to avoid a tonne of carbon dioxide emissions, on the margin. This is obvious if the company doesn't have any extra allowances and needs to go into the market to buy an additional one (in order to satisfy its regulatory obligation the following April, when it must present allowances covering its prior-year emissions). But even if the utility company had extra allowances that were allocated to it freely by the authorities, it *still* has a marginal incentive of $20/tonne to reduce its emissions. This is because, for every tonne that it reduces emissions, the company needs one fewer allowance to present the following April, and hence it can sell that allowance into the market (at a supposed price, in this example, of 20 euros). Thus, either way, a market price of 20 euros for EU ETS allowances acts as a penalty (whether explicit or implicit) on carbon dioxide emissions, and gives utilities an incentive to move away from carbon-intensive energy sources. This is the *whole point* of the EU ETS, after all.

In this light, we can examine the evolution of the market price of EU ETS allowances, as shown in figure 12.

Figure 12: Price of EU ETS Allowances (€), 2008–2021



Source: <https://icapcarbonaction.com/en/ets-prices>

As figure 12 indicates, for most of its history the EU ETS had modest carbon prices, typically under 15 euros per tonne. Yet recently the price has risen very rapidly, going from $25/tonne in early 2020 to more than 60 euros by the fall of 2021 and 90 euros by December 2021 (not shown on figure 12; see Twidale, 2021). (For the benefit of Canadian readers, in figure 12 we have also included the price histories of some provincial allowance systems for comparison.)

Both fans and critics of the EU ETS agree that the surge in EU ETS allowance prices is due to the tightening of governmental climate policy targets. For example, as energy analyst Mark Nicholls explained in June 2021:

> For those who believe in the "polluter pays" principle, the EU Emissions Trading System (ETS) is starting to deliver …
>
> [T]he market no longer takes its cue only from near-term factors, says Marcus Ferdinand, head of European power and carbon analytics at market intelligence firm ICIS. "Now, all of a sudden, there are players in the market who take the long-term view … These investors have priced in the [EU's] 2030 [climate] framework and see the market as a good buying opportunity."
>
> This switch in thinking dates back to the election last November of US President Joe Biden. That set the stage for more aggressive climate policy globally, including the EU's decision in December to increase its 2030 emissions reduction

target to 55% from 40% and, more recently, the G7's pledge to hold global warming to the more ambitious 1.5°C limit set out in the Paris Agreement.

Expectations that carbon prices will have to rise if Europe is to meet its climate objectives have piqued the interest of investors–hedge funds as well as more cautious institutional investors. While the former are trading carbon as they would any other commodity, some of the latter are equity investors buying EU carbon allowances as a hedge against climate risk. As climate policy becomes more stringent, the thinking goes, carbon prices are likely to rise, potentially offsetting declines in the value of carbon-intensive assets. "This makes carbon less of an energy commodity than a financial asset," says Ferdinand at ICIS. (Nicholls, 2021)

Nicholls' article goes on to present data showing that investment funds' net positions in EU ETS allowances increased roughly 75 percent from April 2020 through April 2021.

To appreciate the role of government climate policy on energy markets, we stress that *anticipated* tightening of emission caps can cause *current* allowance prices to rise. By design, current allowances can be carried forward or "banked" to satisfy regulatory obligations for future emissions. [3] Therefore, an allowance obtained (either through free allocation or auction) in 2021 can be carried forward to, say, 2023 and be interchangeable vis-a-vis regulatory requirements with newly-created allowances in 2023. Therefore, if investors anticipate that the total emission caps will be tightened over time (in order to meet increasingly stringent climate targets, for example), they will expect higher future prices for EU allowances, and hence it makes sense—purely as an investment—to begin buying allowances today, holding them off the market, and selling them in the future at a higher price.

To understand the *direct* impact of rising allowance prices on European natural gas prices, we can rely on simple chemistry. Per the US Energy Information Administration (EIA), there are 55.03 kg of carbon dioxide in 1,000 cubic feet of natural gas. [4] To convert units, this works out to about 1.94 metric tonnes of CO2 per 1,000 cubic meters. Thus, every 1 euro increase in the market price of ETS allowances corresponds to a *direct* increase in natural gas prices of (a little less than) 2 euros, when quoted in euros per 1,000 cubic meters.

[3] There are some subtleties in the validity of allowances issued in different periods of the EU ETS, but the statement in the text is still correct. For more details see <https://www.emissions-euets.com/euas-validity>.

[4] See <https://www.eia.gov/environment/emissions/co2_vol_mass.php>.

As we have explained in this section, EU ETS allowance prices have risen some 65 euros (per tonne of emissions) from early 2020 through the end of 2021. That means we can attribute about 130 euros of the jump in gas prices over this same period to this factor directly, or about 20 percent of the price spike. However, as we argue in the next sub-section, there is also reason to believe that aggressive government climate policy has had an *indirect* effect on energy prices, by drastically changing the composition of electricity fuel sources over time.

4.3 "Green" renewables displace coal and nuclear

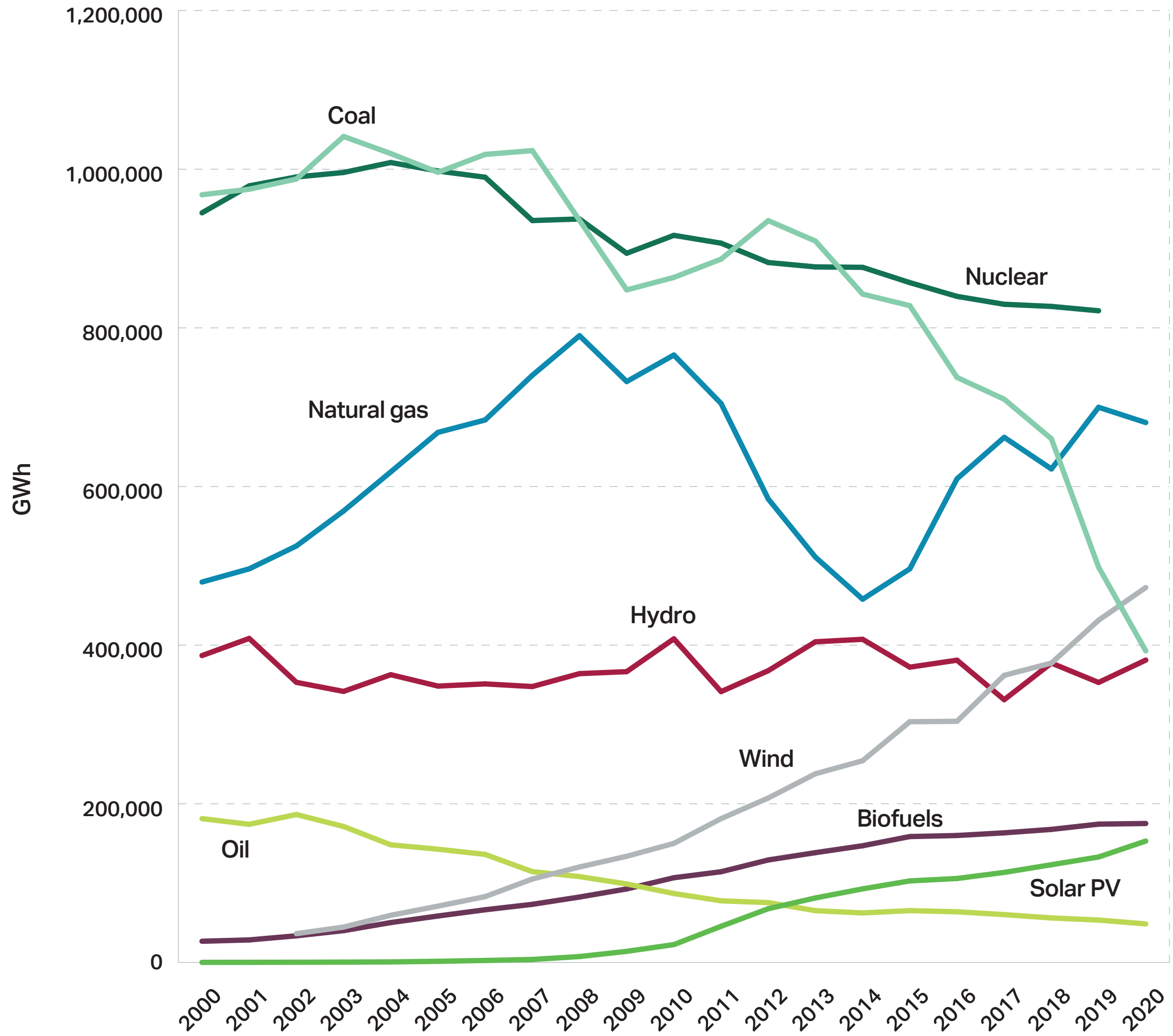
As explained in section 4.2, we can roughly estimate that 20 percent of the recent surge in European natural gas prices is directly attributable to the dramatic rise in prices for EU ETS allowances. However, the European climate policy framework may also have played an *indirect* role in sowing the seeds for the current energy crisis, through displacing the use of coal and nuclear in electricity production.

In figure 13 we show the major sources of electricity by fuel type in 28 EU countries over the period 1990–2020. As figure 13 indicates, from the mid-2000s through the present, the European electricity mix has seen a drastic drop in the contribution from coal, offset by an enormous increase in the use of renewables (particularly wind, biofuels, and solar PV). Specifically, generation from coal has dropped some 600,000 GWh (about 60 percent) from 2005 to 2020. Similarly, the annual contribution from nuclear power also fell about 170,000 GWh from 2005 to 2019 (the last year for which data is available in this source).

In absolute terms, the contributions from wind, biofuels, and solar PV increased to almost perfectly offset this drop-in coal and nuclear. In contrast, the contribution from natural gas, though it fell during the Great Recession, has returned to roughly the same level as in the mid-2000s, while hydro power has remained relatively steady throughout.

The sharp displacement of coal by renewables was the explicit goal of EU climate policy. The resilience of natural gas, even though it too is a fossil fuel (and is thus penalized by the EU ETS regime), is due to the fact that renewable electricity sources famously suffer from problems of dispatch and intermittency. Here too, both fans and critics of EU climate policy agree that natural gas must bear the lion's share of electricity production during a transition period, waiting on improvements in technologies for solar generation, battery storage, etc.

Figure 13: EU electricity generation by source, 2000-2020



Source: IEA, 2022.

For example, a McKinsey report from early 2018 explained:

> In November 2017—just in time for the UN climate meeting in Bonn—the EU reached an agreement to reform and further tighten its Emissions Trading Scheme (ETS). In September 2017, French President Emmanuel Macron argued for higher carbon prices of at least EUR25-30/t, while the Dutch government communicated a plan to impose a carbon price floor of EUR18/t starting in 2020. The oil and gas industry also seems to agree; **in 2016, the CEOs of some of the biggest oil and gas companies argued for the introduction of carbon prices to decarbonize the power sector by encouraging coal-to-gas switching**.

> However, the actual impact of carbon prices on gas consumption is not straightforward. Carbon prices favor gas versus coal and can make gas the fuel of choice for baseload power. At the same time, carbon prices penalize gas versus increasingly competitive renewables. (Leger et al., 2018, emphasis added)

Regarding the recent energy crisis, a Politico article from September 2021 explains:

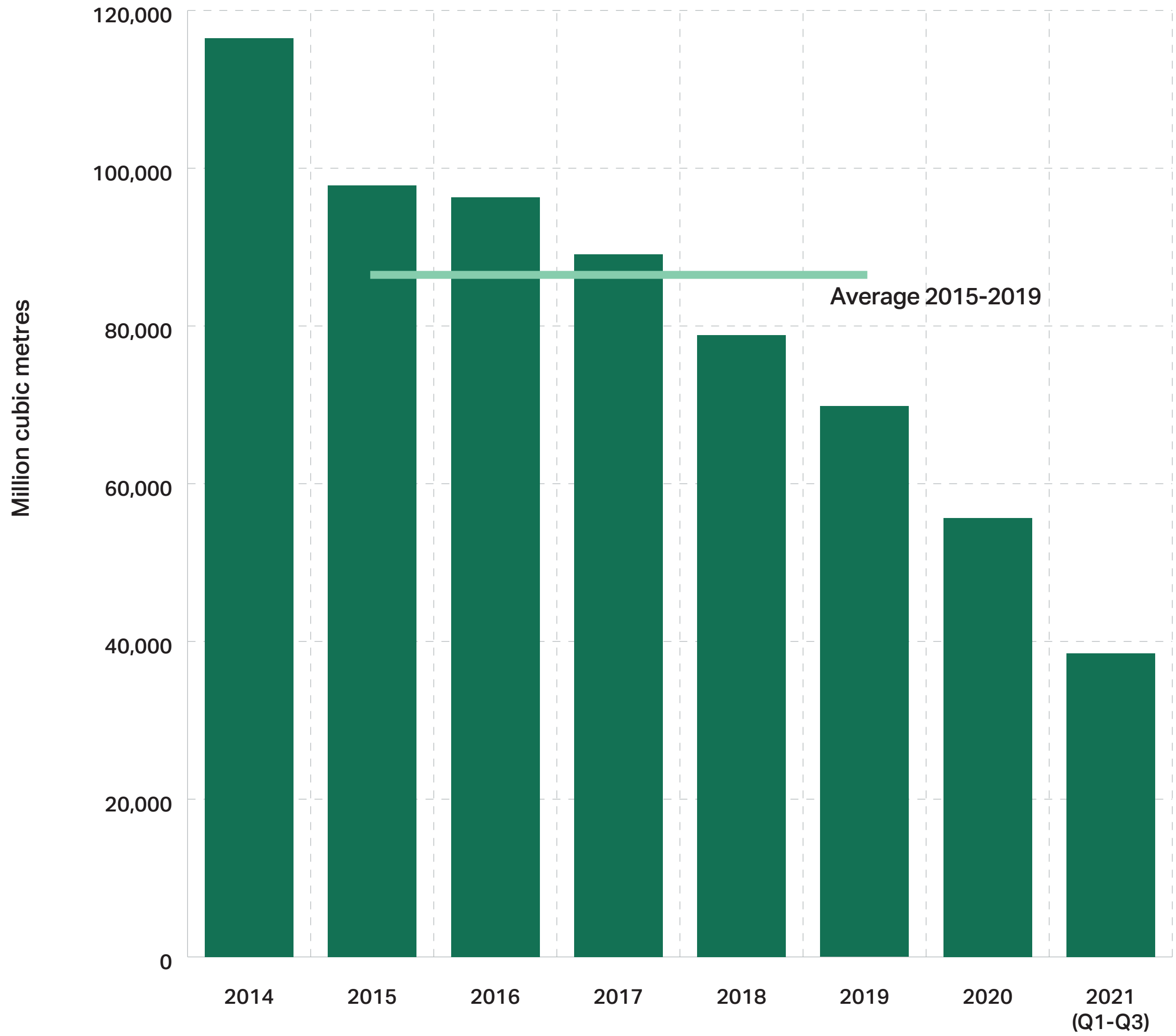
> In 2020, renewables generated 38 percent of the bloc's electricity, overtaking fossil fuels to become the leading source of power in Europe for the first time ever. But wind and solar power are incapable of generating enough power to account for 100 percent of demand year-round, even in the most favorable climate conditions.
>
> **The phaseout of nuclear in countries like Spain and Germany, which have set national targets for winding down their existing nuclear fleets, also increases the gap** between consumer demand and the electricity supply that can be generated by renewable sources. (Cienski and Hernàndez-Morales, 2021; emphasis added)

Given that Europe significantly reduced its reliance on nuclear and coal, the need for a predictable and dispatchable energy source—such as natural gas—in times of high demand became imperative. However, markets were faced with a shortage of natural gas in 2021 as a result of Europe's push towards decarbonizing its energy mix.

Take the Netherlands for example, the European Union's largest natural gas producer. The country went from producing 70.1 billion cubic metres of natural gas in 2014 to roughly 24 billion cubic metres in 2020—a 66 percent decline in just six years. The main reason for this reduction is the ongoing phasing out of the Groningen gas field—the largest natural gas field in Europe—due to environmental concerns. In addition, several EU countries, such as Ireland, Germany, and France, have banned hydraulic fracturing—a technique that allowed the United States to significantly double its natural gas production in just a few years.

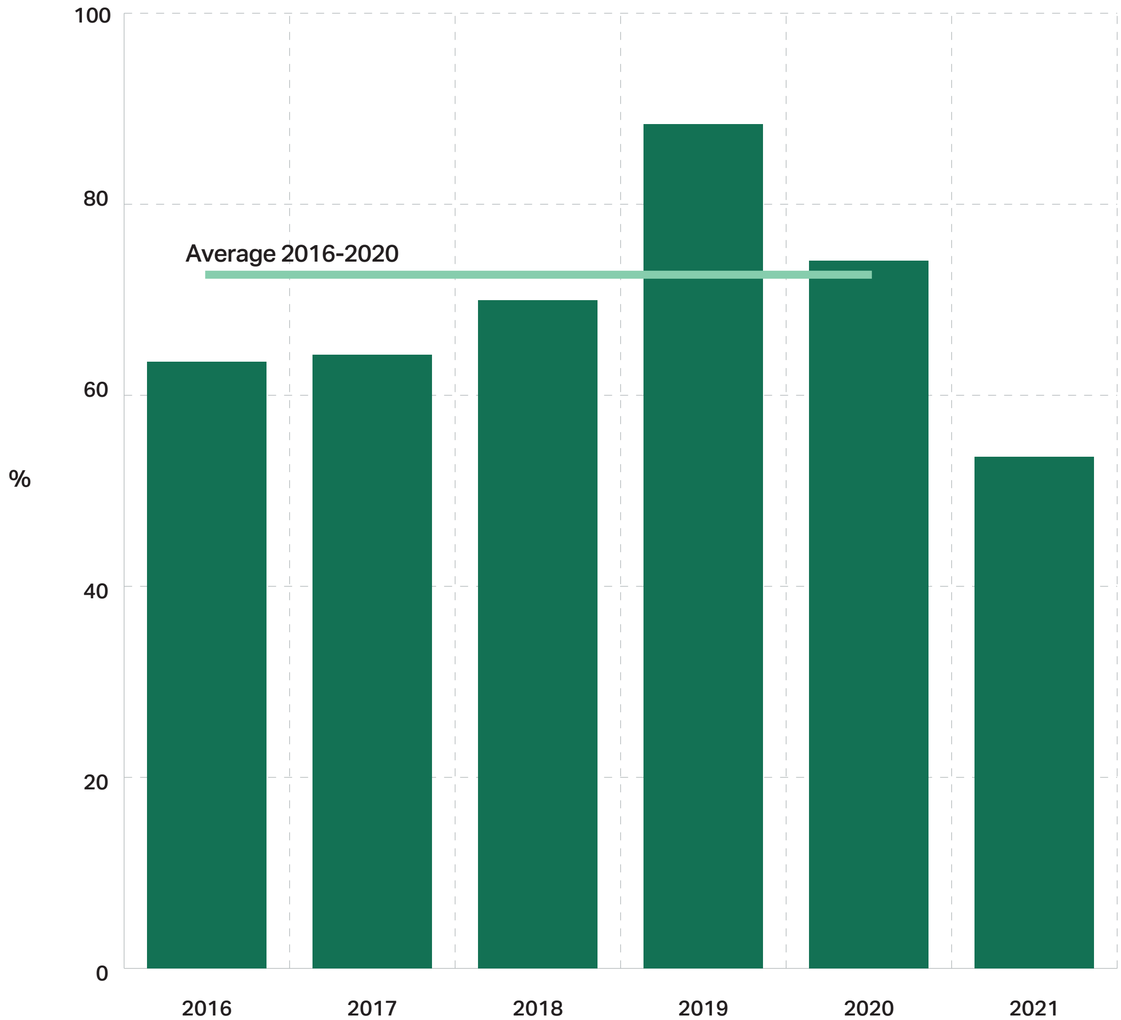
As a result, EU countries have dramatically reduced their natural gas output from 115 billion cubic metres in 2014 to 38.4 billion cubic metres in the first three quarters of 2021 (latest available data). As shown in figure 14, 2020 and 2021 levels of production were considerably lower than the 2015–2019 average. Inventory levels followed a similar pattern. On December 31st of 2021, European natural gas storage was roughly 54 percent full—25 percent lower than the previous 5-year average as shown by figure 15.

Figure 14: European natural gas production, 2014–2021



Source: Eurostat, 2021.

Figure 15: European natural gas storage, reported inventories as percentage of total capacity each year on December 31st

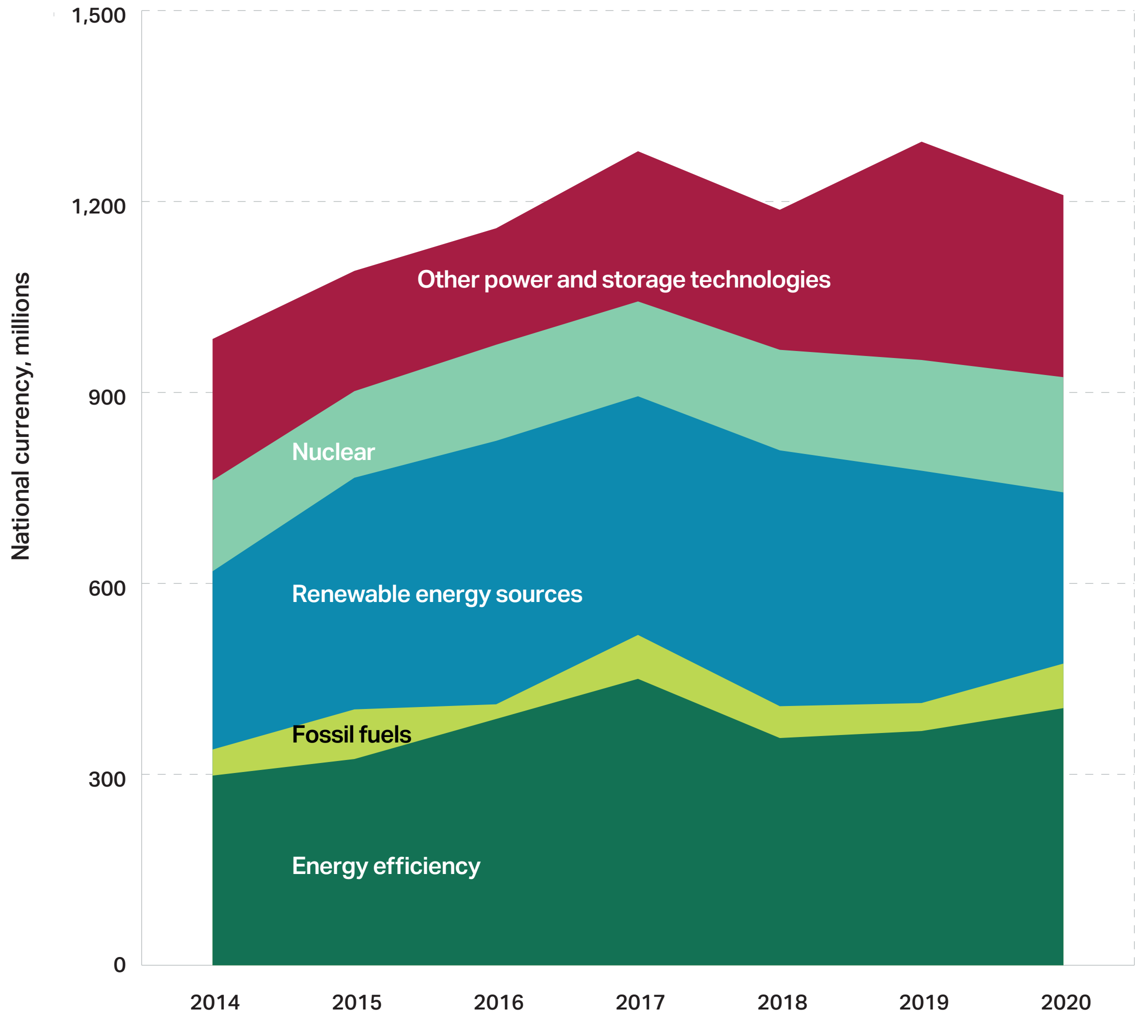


Source: Eurostat, 2021.

Lower production, low storage, and lower imports from Russia, coupled with increased demand for natural gas as a result of greater reliance on intermittent wind and solar and a strong economic recovery, are what eventually led to a significant spike in the price of natural gas in 2021. In sum, a supply and demand mismatch due to the EU's misguided climate policies.

Moreover, we can see further evidence that EU climate policy has encouraged electricity producers to focus their efforts on expanding renewables rather than fossil fuels. Specifically, figure 16 shows the RD&D budgets across 28 EU countries from 2014 through 2020.

Figure 16: RD&D budget by technology, EU28, 2014-2020



Source: <https://www.iea.org/data-and-statistics/data-browser?country=EU28&fuel=Energy%20technology%20RD%26D%20budgets&indicator=RDDTechSplitNC>

As figure 16 reveals, EU countries have been investing far more in renewable energy (and related items) than in conventional fossil fuels.

Stepping back, what has happened is this: The climate policies of European governments have strongly encouraged the proliferation of "green" renewables at the expense of coal and nuclear. Yet because the (non-nuclear) renewables cannot currently support European demand for electricity, the market has become increasingly dependent on natural gas, particularly in periods when the sun isn't shining and/or the wind isn't blowing as happened during the summer of 2021 (Buli and Jacobsen, 2021).

This evolution in European energy markets makes them far more vulnerable to shocks to the natural gas market. Consider: Had coal and nuclear retained the same share of generation capacity as they possessed in 2005, an interruption in Russian gas supplies would not be nearly as significant, because the nuclear plants would have been supplying some of the market in a predictable manner, while coal-fired plants are able to quickly ramp up generation when needed. Alternatively, if EU countries had not decided to move away from natural gas production there would've been sufficient storage to cover for the shortfall caused by wind power.

In these alternate scenarios (with less government intervention in energy markets), electricity prices wouldn't have been so responsive to natural gas prices, *and* natural gas prices themselves would not have been so sensitive to short-term supply disruptions (as they would not be as critical in supplying marginal supply in the electricity market).

5 Implications of Higher Energy Prices

Global demand for energy—from airlines, shipping lines, manufacturers, utilities, etc.—rebounded from the COVID recession much more quickly than supply has been able to catch up due to capital constraints. Consequently, the world experienced higher energy prices during 2021. Indeed, the International Monetary Fund's Energy Index, which tracks the global price of crude oil, natural gas, and coal, increased by 74 percent during 2021 (IMF, 2021).

The drastic increase in energy prices experienced in 2021 begs the question: What would be the implications of higher-for-longer energy prices, which are largely driven by aggressive climate policies? Put simply, climate-policy-induced higher energy prices will increase the price of most energy-intensive goods and services, which will hurt long-run economic growth.

5.1 Greenflation

Decarbonizing the world's energy mix will force up prices for primary energy and given that it is a key input cost for most businesses this will increase the cost of all goods and services—from flights and cars to electricity and heating. That is the primary objective of climate policies that aim to reduce emissions: making fossil fuel production and consumption of fossil-fueled products more expensive so we "transition" to less emissions-intensive energy sources.

This "green premium"—the difference in cost between a product that involves emitting carbon and an alternative that doesn't—will bring a period of higher energy costs. Isabel Schnabel, Member of the Executive Board of the European Central bank, recently stated that:

> The combination of insufficient production capacity of renewable energies in the short run, subdued investments in fossil fuels and rising carbon prices means that we risk facing a possibly protracted transition period during which the energy bill will be rising. (Schnabel, 2022)

The world already experienced the negative consequences of higher energy bills in 2021. In fact, energy accounted for most of the prices increases in most countries.

In Europe, for example, more than half of the recent rise in the Harmonized Index of Consumer Prices (HICP)—5 percent for 2021—reflected energy price inflation which reached a record high of almost 30 percent (Schnabel, 2022). In the United States, where the Biden administration has signalled its intention to curtail oil and gas production, energy costs were the main driver of inflation in 2021, rising 29 percent from 2020 (U.S Bureau of Labor Statistics, 2022). Gasoline costs surged 50 percent, fuel oil costs jumped 41 percent, and overall US inflation rose 7 percent in 2021 (US Bureau of Labor Statistics, 2022).

Canada's inflation rate for 2021 was 4.8 percent—the highest it's been since 1991 (Fan, 2022). If we exclude energy and food, Canada's inflation rate would have been 3.4 percent (Fan, 2022). Indeed, energy inflation was 21.2 percent while food inflation was 5.2 percent, meaning that higher energy prices were one of the major drivers for overall Canadian inflation (Fan, 2022). Higher energy prices increase the costs of producing most goods and services and "can impact all facets of the CPI basket, including food. Along the production chain, farmers, manufacturers, wholesalers, and distributors are all witnessing higher costs" (Abdelrahman, 2021).

One might argue that these price increases are temporary—a result of economies reopening after the COVID shock. Pent-up demand meets a supply-constrained world economy due to lockdowns and restrictions. But what if this significant increase in energy price is a new feature of the world's economy, and not merely a transitory phenomenon related to COVID-19? In fact, higher-for-longer energy prices are a feature of aggressive climate policies that are being implemented all over the world. It is the intended consequence of emissions-reduction policies. The structural "green premium" will increase the price of many goods and services and will prove to be a drag on economic growth.

5.2 Impact on growth

McKitrick and Aliakbari (2014) showed that increases in energy abundance, i.e., when prices are stable and low due to an abundant supply of energy, will cause an increase in GDP. Therefore, policies that encourage an abundant supply of energy are central for sustaining economic growth while policies that constrain the production of energy (and that therefore increase its price) will likely have negative macroeconomic consequences. In sum, "real per-capita income is constrained by policies that restrict energy availability and/or increase energy costs" (McKitrick and Aliakbari, 2014).

Other empirical studies have also shown that high energy prices harm economic growth. Asmin et al. (2020) examined the relationship between energy poverty and several macroeconomic variables in seven developing South Asian countries. The study found that "energy poverty negatively impacted economic development both in the long- and short-run in the seven selected South Asian countries" (Asmin et al., 2020) and that these results can be used as a reference for other developing countries. Limiting energy production—the intended consequence of aggressive climate policies—will exacerbate energy poverty around the world and will put the brakes on the economic expansion of developing countries.

Berk and Yetkiner (2014) also gathered data on real GDP per capita, energy consumption per capita, and composite energy prices for fifteen of the most advanced economies in the world covering the period from 1978 to 2011. After performing a series of econometric analyses, the authors showed that "energy price growth has a negative effect on the growth rates of GDP per capita and energy demand" (Berk and Yetkiner, 2014). In addition, van Zoon and Yetkiner (2003) showed that increases in real energy prices will increase the cost of producing intermediate goods, which will lower their profitability. Lower profit margins for intermediate goods will reduce the incentive for research and development, which in turn will have a negative effect on economic growth.

Likewise, Edelstein and Kilian (2009) showed that a 10 percent increase in energy prices in the US results in a 4.7 percent decline in the consumption of durable goods. In addition, Walker et al. (2021) showed that the increases in energy prices in 2021 reduced the growth rate of consumption in the US by 0.4 percentage points. It is worth noting that consumer spending accounts for roughly 70 percent of the US GDP (U.S. Bureau of Economic Analysis, 2022). As energy becomes more expensive, firms will pass through the increased cost of producing certain goods and services in the form of higher prices for consumers. This, as proved by the literature, will have a negative effect on consumption, which in turn will hinder economic growth.

Moreover, energy price volatility, as we are currently experiencing and expected to experience as governments continue to alter the world's energy mix, also has negative implications on economic growth. For example, van Eyden et al. (2019) proved that "real oil price volatility is negatively associated with aggregate economic activity and growth" by using data from 17 highly industrialized OECD countries over a period of more than 100 years. The authors place a significant emphasis on oil-exporting countries from the sample, namely Norway and Canada, arguing that oil price uncertainty disproportionately affects these countries as they rely heavily on oil revenues.

One might argue that high oil and gas prices benefit major oil exporting countries like Saudi Arabia and Canada but hurt major oil importing countries like India or China. If high oil prices cause an appreciation of the Canadian dollar this will reduce the costs of imports for Canadians but will also have a negative effect on growth in other export sectors. In general, since the higher energy prices discussed in this report are largely driven by supply-restricting government policies, the harm to energy consumers is not being offset by gains to energy producers or reductions in other aspects of the cost of living.

In sum, both theory and practice prove that higher energy prices hurt economic growth in both advanced economies and developing countries. While the events in the Ukraine are outside Canada's control, many of the harms arising from our anti-energy policy decisions, including the loss of investment in exploration and pipelines, and the associated increases in consumer prices, are self-inflicted. Even if Russia hadn't invaded Ukraine, we would be grappling with rising inflation propelled by energy price trends. Policymakers around the world, including in Canada, should consider the policy implications of aggressive climate policies that considerably limit the production of reliable and affordable energy.

6 Conclusion

Demand projections show that oil and gas consumption will continue to increase as economic growth takes hold of developing countries particularly in Asia. However, declining investment as a result of an extended supply glut, in combination with aggressive climate policies and the western response to the war in the Ukraine, are all combining to create an energy shortage. These can be expected to lead to higher energy prices for a sustained period of time and threaten not only the post-pandemic recovery but also global economic growth.

Europe is already experiencing its worst energy crisis in decades. In July 2021, natural gas prices were nearly 670 percent higher than a year earlier, reflecting a shortage. Given the importance of natural gas in European power generation, electricity prices soared to record levels in 2021, rising more than 200 per cent in Germany, the UK, Spain, and France. In the Nordic region, prices surged 470 per cent compared to 2020.

Europe's ongoing energy crisis is a result of forceful government intervention in energy markets through aggressive climate policies. Specifically, European climate policies have strongly encouraged the proliferation of intermittent wind and solar power at the expense of coal and nuclear, making the region's power market highly dependent on natural gas as a marginal supplier in times of high electricity demand. However, European governments have discouraged the production of natural gas through fracking bans and soaring carbon prices. In sum, Europe's increased reliance on natural gas for power generation due to wind and solar intermittency, and a strong economic recovery, coupled with lower production and inventories, ultimately led to a spike in natural gas prices in 2021, which in turned hiked electricity prices.

Canada's federal government should take note of Europe's experience as policymakers in Ottawa are implementing the same set of policies that led to Europe's energy crisis. For example, Canada will have a carbon tax of $170/tonne of carbon dioxide by 2030 while Europe's carbon price sits at around $110/tonne. Like many European countries, in particular Germany, Ottawa has mandated the phase-out of conventional coal-fired electricity generation and accelerated the deployment of renewable energy sources to support its target to achieve 90 percent of non-emitting electricity generation by 2030.

In addition, Europe's cap on greenhouse gas emissions is a feature of its regional carbon pricing system and some countries, like Germany and the UK, have added a carbon tax on top of this cap-and-trade system. Canada's federal government plans to cap the greenhouse gas emissions from the oil and gas industry—without creating a corresponding permit market—on top of its already poorly designed carbon tax.

Higher energy prices will increase the cost of living and hamper economic growth. Given the current context of rising energy prices, Canadian policymakers should consider the policy implications of aggressive climate policies that considerably limit the production of reliable and affordable energy.

References

Abdelrahman, Omar (2021). *Food Prices: A Growing Tailwind Behind Canadian Inflation*. TD Economics. <https://economics.td.com/domains/economics.td.com/documents/reports/oa/CA_Food_Inflation.pdf>

Aliakbari, Elmira, and Jairo Yunis (2021a). *Canada-US Energy Sector Competitiveness Survey 2020*. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/canada-us-energy-sector-competitiveness-survey-2020.pdf>

Aliakbari, Elmira, and Jairo Yunis (2021b). *Canada-US Energy Sector Competitiveness Survey 2021*. Fraser Institute. <https://www.fraserinstitute.org/studies/canada-us-energy-sector-competitiveness-survey-2021>

Amin, A., Y. Liu, J. Yu, A. A. Chandio, S. Faiz Rasool, J. Luo, and S. Zaman (2020). How Does Energy Poverty Affect Economic Development? A Panel Data Analysis of South Asian Countries. *Environmental Science and Pollution Research* 27, 25: 31623–35. <https://doi.org/10.1007/s11356-020-09173-6>

Azar, Amir (2017). *Reserve Base Lending and the Outlook Shale Oil and Gas Finance*. Columbia SIPA Center on Global Energy Policy. <https://energypolicy.columbia.edu/sites/default/files/Reserve_Base_Lending_Outlook_For_Shale_Oil_Gas_Finance_May2017.pdf>

BBC (2021). *US Oil Prices Turn Negative as Demand Dries Up*. BBC. <https://www.bbc.com/news/business-52350082>

Berk, Istemi, and Hakan Yetkiner (2014). Energy Prices and Economic Growth in the Long Run: Theory and Evidence. *Renewable and Sustainable Energy Reviews* 36: 228–35. <https://doi.org/10.1016/j.rser.2014.04.051>

Blas, Javier, and Laura Hurst (2021). *BP Says Oil Demand Is Back Above 100 Million Barrels a Day*. Bloomberg. <https://www.bnnbloomberg.ca/bp-says-oil-demand-is-back-above-100-million-barrels-a-day-1.1675602>

bp (2021). *Statistical Review of World Energy 2021*. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/xlsx/energy-economics/statistical-review/bp-stats-review-2021-all-data.xlsx>

Buli, Nora, and Stine Jacobsen (2021, December 21). *Weak Winds Worsened Europe's Power Crunch; Utilities Need Better Storage*. Reuters. <https://www.reuters.com/markets/commodities/weak-winds-worsened-europes-power-crunch-utilities-need-better-storage-2021-12-22/>

Chevron (2020). *2020 Supplement to the Annual Report*. <https://www.chevron.com/-/media/shared-media/documents/2020-chevron-annual-report-supplement.pdf>

Chevron (2021). *Third Quarter 2021 Earnings Call*. <https://chevroncorp.gcs-web.com/static-files/987719af-7c73-433d-b674-d1ce70acb884>

Cienski, Jan and Aitor Hernàndez-Morales (2021, September 21). *Why Europe's Electricity is so Expensive*. Politico. <https://www.politico.eu/article/why-europes-electricity-is-so-expensive/>

Edelstein, Paul, and Lutz Kilia (2009). How Sensitive are Consumer Expenditures to Retail Energy Prices? *Journal of Monetary Economics* 56, 6: 766–79. <https://doi.org/10.1016/j.jmoneco.2009.06.001>

Ellwanger, Reinhard, Benjamin Sawatzky, and Konrad Zmitrowicz (2017). *Factors Behind the 2014 Oil Price Decline*. Bank of Canada Review – Autumn 2017. <https://www.bankofcanada.ca/wp-content/uploads/2017/11/boc-review-autumn2017-ellwanger.pdf>

European Commission (2021). *Questions and Answers: Emissions Trading–Putting a Price on Carbon*. <https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3542>

European Union Agency for the Cooperation of Energy Regulators (2021). *High Energy Prices: October 2021*. <https://documents.acer.europa.eu/en/The_agency/Organisation/Documents/Energy%20Prices_Final.pdf>

Eurostat (2021). *Supply, Transformation and Consumption of Natural Gas*. <https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_cb_gas&lang=en>

Exxon Mobil (2020). *2019 Financial and Operating Data*. <https://corporate.exxonmobil.com/-/media/Global/Files/annual-report/2019-data-downloads/2019-Financial-and-Operating-Data_xls.xlsx>

Exxon Mobil (2021). *Third Quarter 2021 Earnings Supplement*. <https://corporate.exxonmobil.com/-/media/Global/Files/investor-relations/quarterly-earnings/earnings-supplements/2021-earnings-supplements/earnings-supplement-3q-1.xlsx>

Fan, Claire (2022). *Canada's Annual Inflation Rate Rises to 30-Year High in RBC Economics Daily Economic Update*. RBC. <http://www.rbc.com/economics/daily-economic-update/CA%20CPI_Jan2022.pdf>

FlightRadar 24 Live Air Traffic (2021). *Flight Tracking Statistics: Total Number of Flights Tracked by Flightradar24, per day (UTC time), 2019 vs 2020 vs 2021.* <https://www.flightradar24.com/data/statistics>

Hoffman, Andy (2021). *Oil Demand Is Back at 2019 Levels and Set to Rise, Vitol CEO Says in BNN Bloomberg*. Bloomberg. <https://www.bnnbloomberg.ca/oil-demand-is-back-at-2019-levels-and-set-to-rise-vitol-ceo-says-1.1679264>

International Energy Agency [IEA] (2022). *Energy Data by Category, Indicator, Country or Region*. IEA. <https://www.iea.org/data-and-statistics/data-browser?country=EU28&fuel=Electricity%20and%20heat&indicator=ElecGenByFuel>

International Energy Agency [IEA] (2021a). *Oil 2021: Analysis and Forecast to 2026*. IEA. <https://iea.blob.core.windows.net/assets/1fa45234-bac5-4d89-a532-768960f99d07/Oil_2021-PDF.pdf>

International Energy Agency [IEA] (2021b). *Oil Market Report – October 2021*. IEA. <https://www.iea.org/reports/oil-market-report-october-2021>

International Energy Agency [IEA] (2021c). *World Energy Investment 2021.* IEA. <https://iea.blob.core.windows.net/assets/5e6b3821-bb8f-4df4-a88b-e891cd8251e3/WorldEnergyInvestment2021.pdf>

International Energy Agency [IEA] (2021d). G*as Market Report Q4-2021 including Global Gas Security Review 2021*. IEA. <https://iea.blob.core.windows.net/assets/261043cc-0cb6-498b-98fa-a1f48715b91f/GasMarketReportQ42021.pdf>

International Energy Agency [IEA] (2021e). *World Energy Outlook 2021*. IEA. <https://iea.blob.core.windows.net/assets/888004cf-1a38-4716-9e0c-3b0e3fdbf609/WorldEnergyOutlook2021.pdf>

International Energy Agency [IEA] (2022). *Oil Market Report February 2022*. IEA. <https://www.iea.org/reports/oil-market-report-february-2022?mode=overview>

International Monetary Fund [IMF] (2021). *Primary Commodity Prices Database. Accessed in January 2022*. IMF. <https://www.imf.org/-/media/Files/Research/CommodityPrices/Monthly/external-datajanuary.ashx>

Kern, Timo (2022). *European Day-Ahead Electricity Prices in 2021*. Ffe. <https://www.ffe.de/veroeffentlichungen/european-day-ahead-electricity-prices-in-2021/>

Léger, Sébastien, Bram Smeets, Tristan Swysen, Jerry van Houten, and Frithjof Wodarg (2018). *Can Carbon Prices Fire Up Gas Demand in Electricity Generation?* McKinsey & Company. <https://www.mckinsey.com/industries/oil-and-gas/our-insights/can-carbon-prices-fire-up-gas-demand-in-electricity-generation>

Mathis, Will, and Jesper Starn (2021). E*urope's Never Paid So Much for Power as 2021 Breaks Record*. Bloomberg. <https://www.bloomberg.com/news/articles/2021-12-30/europe-has-never-paid-so-much-for-power-as-2021-costs-hit-record>

McKitrick, Ross, and Elmira Aliakbari (2014). *Energy Abundance and Economic Growth: International and Canadian Evidence*. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/stimulating-economic-growth-through-abundant-energy.pdf>

Nicholls, Mark (2021, June 3). *Why European Carbon Prices Could be Higher for Good*. Energy Monitor. <https://www.energymonitor.ai/policy/carbon-markets/why-european-carbon-prices-could-be-higher-for-good.

Restuccia, Andrew, and Siobhan Hughes (2021). Biden's Spending Bill Includes $555 Billion for Climate Measures. *Wall Street Journal*. <https://www.wsj.com/articles/bidens-spending-bill-includes-555-billion-for-climate-measures-11635441565>

Schnabel, Isabel (2022). *Looking Through Higher Energy Prices? Monetary Policy and the Green Transition*. Speech given in Frankfurt, Germany on January 8, 2022. <https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220108~0425a24eb7.en.html>

S&P Global (2021). *S&P 500 Energy*. <https://www.spglobal.com/spdji/en/indices/equity/sp-500-energy-sector/#overview>

Statistics Canada (2021). *Table 25-10-0064-01 Oil and Gas Extraction Capital Expenditures and Expenses (x 1,000,000)*. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510006401>

Susanna Twidale, Susanna (2021, December 8). *EU Carbon Price May Hit 100 Euros This Year, Buoyed by Gas Price Surge*. Reuters. <https://www.reuters.com/markets/commodities/eu-carbon-price-could-hit-100-euros-by-year-end-after-record-run-analysts-2021-12-08/>

US Bureau of Economic Analysis (2022). *Shares of gross domestic product: Personal consumption expenditures [DPCERE1Q156NBEA]*. Retrieved from FRED, Federal Reserve Bank of St. Louis. <https://fred.stlouisfed.org/series/DPCERE1Q156NBEA>

US Department of Labor, Bureau of Labor Statistics (2022). *The Economics Daily, Consumer Price Index: 2021 in Review*. Government of the United States. <https://www.bls.gov/opub/ted/2022/consumer-price-index-2021-in-review.htm>

US Department of the Interior (2021). *Report on the Federal Oil and Gas Leasing Program*. Government of the United States. <https://www.doi.gov/sites/doi.gov/files/report-on-the-federal-oil-and-gas-leasing-program-doi-eo-14008.pdf>

US Energy Information Administration (2021a). *Short-Term Energy Outlook*. Government of the United States. <https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf>

US Energy Information Administration (2021b). *Crude Oil Production*. Government of the United States. <https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbblpd_a.htm>

Van Eyden, R., M. Difeto, R. Gupta, and M. E. Wohar (2019). Oil Price Volatility and Economic Growth: Evidence from Advanced Economies Using More than a Century's Data. *Applied Energy* 233–234: 612–21. <https://doi.org/10.1016/j.apenergy.2018.10.049>

Van Zoon, Adriaan, and Hakan Yetniker (2003). An Endogenous Growth Model with Embodied Energy-Saving Technical Change. *Resource and Energy Economics* 25, 1: 81–103. <https://doi.org/10.1016/S0928-7655(02)00018-0>

Walker, R., J. Hatzius, A. Phillips, D. Mericle, S. Hill, and J. Briggs (2021). *The Growth and Inflation Consequences of Higher Energy Prices*. In US Daily, Goldman Sachs Research Economics. <https://www.gspublishing.com/content/research/en/reports/2021/10/19/20bbe862-ea2e-4925-9b88-b4a8061ffd76.html>

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