Energy Poverty in

European Households:

An Advance Lesson

for Canadians

CEC Research Brief Eighteen

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NOVEMBER 2021

Canadian Energy Centre

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EXECUTIVE SUMMARY

Poverty and energy are not often studied as linked concepts, but economic growth in developed and developing countries is partly dependent on the availability of reliable and affordable forms of energy for households and industries. In this study, we focus on energy poverty.

Energy poverty is defined as the "inability to attain socially and materially necessitated levels of domestic energy services" (Kyprianou, et al., 2019). Energy poverty can occur due to high energy costs or low incomes, or both. A useful example is Spain, where the recent rise in electricity prices is due to a perfect storm of reduced energy production from renewables combined with increased demand. As noted by one Spanish newspaper:

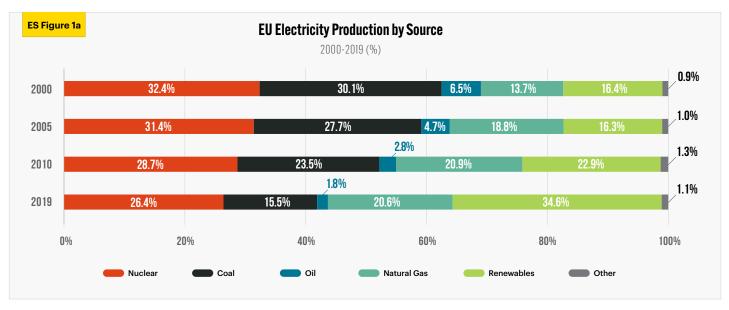
The price of energy has risen this month for all companies due to several factors. Because of the recent heavy storms and snowfall, there is less energy production from cheaper and renewable sources like wind and solar power. There is less supply. If you add that to the increased demand due to the colder temperatures, it causes the prices to increase. (*Barcelona-Metropolitan*, 2021.)

The problem of energy poverty affects tens of millions in Europe, with nearly 34 million Europeans unable to keep their homes adequately warm in 2018. Energy poverty is thus a significant challenge for the European Union (Bouzarovski and Thomson, 2020).

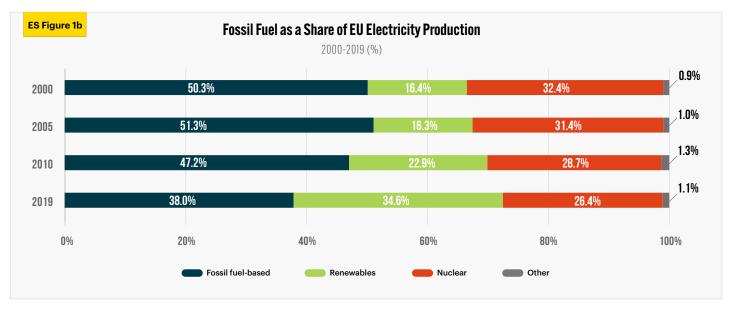
The change in European power generation: Renewables up and fossil fuels down

Between 2000 and 2019, renewable power generation in Europe has increased significantly with traditional coal-fired power declining, which in part explains higher power prices in recent years.

- In 2000, coal-fired electricity was responsible for 30.1 percent of EU electricity with natural gas at 13.7 percent, oil at 6.5 percent, nuclear at 32.4 percent, renewables at 16.4 percent and "other" at 0.9 percent.
- As of 2019, coal-fired electricity, was responsible for 15.5 percent of EU electricity or half what it was 19 years earlier. Natural gas was higher at 20.6 percent, oil was 1.8 percent, nuclear at 26.4 percent, and renewables more than doubled to 34.6 percent while other sources accounted for 1.1 percent of Europe's electrical power (see Executive Summary Figure 1a).
- Separated and totaled by fossil fuels, in 2000, 50.3 percent of electricity in the EU was generated by fossil fuels and that declined to 38 percent as of 2019. Renewables grew to 34.6 percent of EU electricity production over the same period (see Executive Summary Figure 1b).



Source: Author's calculation from Eurostat Database (2021).



Source: Author's calculation from Eurostat Database (2021).

The results on prices

Electricity end-user prices for households differ significantly in the EU member states. Multiple factors influence electricity prices including domestic regulations, taxes, and the energy source used in electricity generation. The most significant rise in household electricity prices between 2008 and 2020 occurred in France (61% higher), Spain (68% higher) and Latvia (70% higher) (see Executive Summary Table 1).

Energy poverty in Europe and the United Kingdom

The European Union measures energy poverty by using the indicator developed by EU Energy Poverty Observatory (EPOV). It provides four different primary indicators for energy poverty, of which two are based on self-reported experiences by household members. The other two are calculated using household income and/or energy expenditure data.

- Using household income and/or energy expenditure data,¹ European energy poverty indicators have not been updated since 2015, but in that year, the proportion of European Union households that faced energy poverty was 16 percent, with the United Kingdom at 19 percent.
- Using self-reporting data on utility bills and the ability to keep one's house warm as a stand-alone indicator,² as of 2018, 6.8 percent of people living in private households across the EU (30.3 million people) were unable to pay their utility bills, and 7.3 percent EU households were unable to keep their house warm; the figures for the United Kingdom were 5.4 percent for both indicators in 2018.

ES	Та	ble

European Household Electricity Prices

2008-2020

2008-2020					
	€/kilowa	att hour	Percentage change		
	2008	2020	2020 over 2008		
Latvia	0.0842	0.1432	70 %		
Spain	0.1366	0.2298	68 %		
France	0.1213	0.1958	61 %		
Estonia	0.0814	0.1291	59 %		
Greece	0.1047	0.1641	57 %		
Lithuania	0.0860	0.1321	54 %		
United Kingdom	0.1458	0.2203	51%		
Ireland	0.1769	0.2616	48 %		
Slovenia	0.1147	0.1694	48 %		
Finland	0.1223	0.1773	45 %		
Portugal	0.1482	0.2133	44 %		
Germany	0.2148	0.3006	40 %		
Bulgaria	0.0711	0.0982	38 %		
Belgium	0.1972	0.2702	37 %		
Romania	0.1061	0.1449	37%		
European Union*	0.1604	0.2134	33%		
Croatia	0.0990	0.1307	32 %		
Malta	0.0993	0.1298	31%		
Czech Republic	0.1401	0.1795	28 %		
Austria	0.1779	0.2167	22%		
Slovakia	0.1421	0.1724	21%		
Luxembourg	0.1645	0.1985	21%		
Poland	0.1259	0.1510	20 %		
lceland	0.1110	0.1248	12%		
Denmark	0.2635	0.2819	7%		
Italy	0.2031	0.2153	6%		
Sweden	0.1698	0.1718	1%		
Cyprus	0.1780	0.1698	-5%		
Norway	0.1639	0.1322	-19%		
Netherlands	0.1769	0.1361	-23%		
Hungary	0.1548	0.1009	-35%		
	_				

Source: Author's calculation from Eurostat Database (2021).

¹ Calculated using household income and/or energy expenditure data refers to expenditure-based indicators -M/2: Absolute (equivalised) energy expenditure below half the national median. 2M: Share of (equivalised) energy expenditure (compared to equivalised disposable income) above twice the national median.

² Self reported / consensual-based indicators: Ability to keep home adequately warm. This EU survey asked households if they could afford to keep their home adequately warm. The selfreporting on arrears concerned utility bills and if in the most recent twelve months, if the household habeen in arrears, i.e., had been unable to pay the utility bills (heating, electricity, gas, water, etc.) of the main dwelling on time due to financial difficulties.

Our estimates of Europe's high-cost electricity

Given the European Union's self-reporting of some energy poverty measurements, we have designed an alternate measurement. Our measurement tracks the increase in European electricity costs by country, compared with the increase in median household income. The measurement is for 2008 to 2020 for electricity costs and for 2008 to 2019 for household median income.

Given that European countries vary widely in median household income, in part because of communism in the 20th century, its collapse, and how many central and eastern European countries were in effect "starting over" in the 1990s, we have divided European countries into those with less than €15,000 in median household income in 2008, and those with more than €15,000 in median household income in 2008.

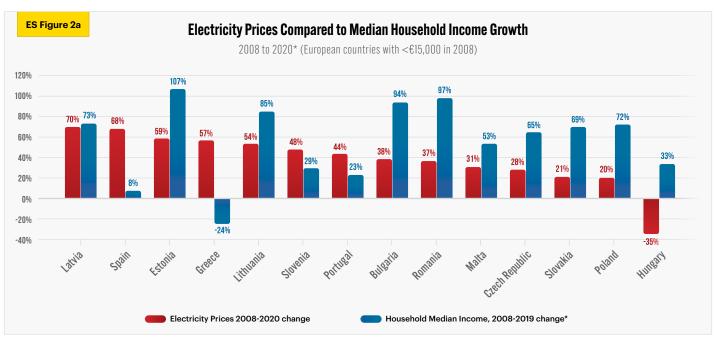
This is because we would expect, for example, median household income growth in Poland (€4,154 in 2008) and Romania (€1,954 in 2008) to easily outpace any growth in electricity prices in the years examined because those countries (and others) started with very low median household incomes.

Conversely, those with already high median household incomes in 2008 such as the United Kingdom (€18,766) and Ireland (€22,995) would be unlikely to see as dramatic a rise in incomes, given they were already developed economies. That means any rise in electricity prices beyond household median income growth could be more difficult for households to finance.

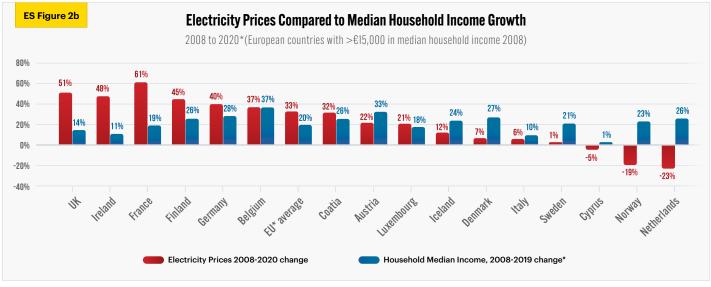
UK and Ireland see 51% and 48% rise in power bills with marginal increases in median income

The data in fact shows exactly that for many European countries for the 2008 to 2019/2020 period. For example:

- Electricity prices in Poland rose by 20 percent but household median income increased by 72 percent, thus making the rise in power prices manageable. The same was true of many other nations with low median household income in 2008: Bulgaria, Romania, the Czech Republic, and Slovakia (see Executive Summary Figure 2a).
- In contrast, in the United Kingdom and Ireland, electricity prices soared by 51 percent and 48 percent, respectively while household median income rose by just four percent and one percent, respectively (see Executive Summary Figure 2b). That split between significantly higher power bills and an almost status-quo reality on median household incomes helps explain why some European (or United Kingdom) households have found it increasingly difficult to pay their utility bills.
- The most challenging combination though is where a country already had low median household income in 2008 and saw little income growth over the next 11 years, but experienced a dramatic rise in the cost of power. This was the case for Spain, where electricity prices soared by 68 percent between 2008 and 2020 with median household income rising by just eight percent (by 2019) (see Executive Summary Figure 2a).



Source: Authors' calculation from Eurostat database.



Source: Authors' calculation from Eurostat database.

Energy transition issues

At the core of the European Union's high power prices is a swift energy transition framework that has not taken into account the reality that not all energy sources contain the same energy density, and nor are they as reliable.

To understand why, consider the insights from one of the world's leading experts on energy transitions, University of Manitoba professor of the environment (emeritus) Vaclav Smil, who has noted that "the reality of energy density (that is, how much energy can be extracted from a unit of raw material) in various forms of energy sources (be they oil, natural gas, coal, wind, solar and others) must be accounted for as part of any assumed transition" (Smil, 2017).

In 2018, Science magazine cited Smil's point that energy transitions are normally transitions away from "relatively weak, unwieldy energy sources for those that pack a more concentrated punch" (Voosen, 2018). Similarly, as Smil wrote in 2020, "Designing hypothetical roadmaps outlining complete elimination of fossil carbon from the global energy supply by 2050 is nothing but an exercise in wishful thinking that ignores fundamental physical realities." In other words, before abandoning something as a source of energy, we must consider how little (or much) of that source it takes to produce the outcomes we need (Smil, 2020).

Lessons from Europe for Canada

The core question is what lessons might be in store for Canada given that substantial changes are proposed on everything from how Canadians might heat their homes (more electrification) to higher carbon taxes and other policy, regulatory and legislative changes that discourage the consumption of hydrocarbons. There is much discussion about "transitions" to new energy sources, but few studies consider details on what consumers might be forced to spend in efforts to transition. This is best visible in Europe, where households increasingly face challenges in financing basic energy needs due to the increased cost of electricity and other forms of energy.

INTRODUCTION: ENERGY SCARCITY,

POVERTY, AND TRANSITIONS



Energy transitions

This paper explores the cost of attempts to order up energy transitions in Europe and the impact of the same on household energy costs, with the unintended consequence that is now evident: increasing energy poverty across many countries in Europe. This has obvious relevance to Canada where a transition not only from coal but also natural gas and oil and to electrification via renewables is assumed possible. As readers will note, the impact of the energy transition on retail prices of electricity is not uniform. It differs by country and is in part influenced by policy decisions and regulatory frameworks.

At the core of the European Union's high power prices is a rushed transition framework that has not taken into account the reality that not all energy sources contain the same density, and nor are they as reliable.

To understand why, consider the insights from one of the world's leading experts on energy transitions, University of Manitoba professor of the environment (emeritus) Vaclav Smil, who has noted that "the reality of energy density (that is, how much energy can be extracted from a unit of raw material) in various forms of energy sources (be they oil, natural gas, coal, wind, solar and others) must be accounted for as part of any assumed transition" (Smil, 2017).

In 2018, Science magazine <u>cited Smil's point</u> that energy transitions are normally transitions away from "relatively weak, unwieldy energy sources for those that pack a more concentrated punch." Instead, as Smil also remarked, trying to reverse that practical attention to energy density by moving to all-renewable sources of energy could require countries, to use his words from *Science*, to "devote 100 or even 1000 times more land area to energy production than today... [which] could have enormous negative impacts on agriculture, biodiversity, and environmental quality" (Voosen, 2018). Similarly, as Smil <u>wrote</u> in 2020, "Designing hypothetical roadmaps outlining complete elimination of fossil carbon from the global energy supply by 2050 is nothing but an exercise in wishful thinking that ignores fundamental physical realities." In other words, before abandoning something as a source of energy, we must consider how little (or much) of that source it takes to produce the outcomes we need (Smil, 2020).

Energy scarcity and poverty

Poverty and energy are not often studied as linked concepts, but economic growth in developed and developing countries is partly dependent on the availability of reliable and affordable forms of energy for households and industries. Thus, both energy scarcity and energy poverty matter, though in this study we will examine the latter problem.

Briefly, energy poverty is defined as the "inability to attain socially and materially necessitated levels of domestic energy services" (Kyprianou et al., 2019). This can occur due to high energy cost or low incomes, or both.

A variety of statistics exist to give some sense of the problem. The International Energy Agency (IEA) estimates that close to 770 million people worldwide lack access to electricity (IEA, 2020). That is a problem of energy scarcity. However, in developed countries, energy is normally widely available but becoming increasingly expensive. Thus, consumers in wealthier countries have access to electricity albeit not without interruptions due to brownouts and blackouts—but face higher electricity costs due the to transition away from affordable fossil fuels. As the European Union notes: [A]dequate warmth, cooling, lighting, and energy to power appliances are essential services that underpin a decent standard of living and health. Access to energy services is essential for social inclusion (European Union, 2020a).

This has consequences. Recent protests in Europe (BBC, 2021), where consumers and governments from Spain to the United Kingdom grapple with rising electricity costs, have placed the twin issues of reliable and affordable energy into focus. One example is the recent rise in electricity prices in Spain as noted by the Spanish newspaper, *Barcelona-Metropolitan* (2021):

The price of energy has risen this month for all companies due to several factors. Because of the recent heavy storms and snowfall, there is less energy production from cheaper and renewable sources like wind and solar power. There is less supply. If you add that to the increased demand due to the colder temperatures, it causes the prices to increase. The United Kingdom was the first country to identify and develop a policy to tackle energy poverty. (Thomson et.al.,2017). In North America, studies have found that as a percentage of incomes, poor households spend four times as much on utilities compared to higher-income cohorts. The low-income family spends 8.1 percent of their income on energy costs on average, compared to 2.3 percent for nonlow-income households (Drehobl, et al., 2020). In Europe, with nearly 34 million citizens unable to keep their homes adequately warm in 2018, energy poverty is a significant challenge (Bouzarovski and Thomson, 2020).

OVERVIEW OF THE EUROPEAN

UNION ELECTRICITY MARKET

The European Union (EU) is composed of 27 countries, with a population of approximately 450 million and a GDP of US\$15.6 trillion in 2019 (World Bank, undated).

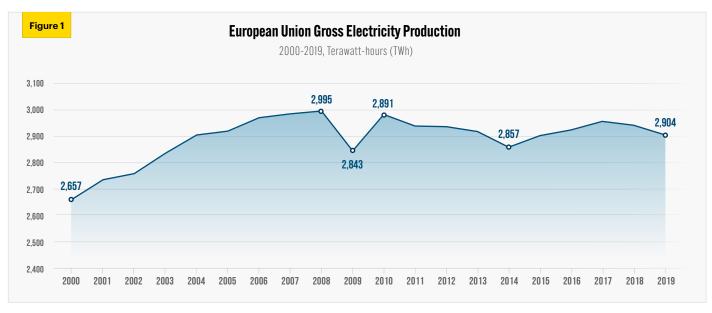
Gross electricity production³ in Europe increased from 2,657-terawatt hours (TWh) in 2000 to a high of 2,995 TWh in 2008, decreasing during the Great Recession but recovering thereafter to reach 2,904 TWh in 2019 (see Figure 1), the latest year for which data is available.

The change in European power generation: Renewables up and fossil fuels down

In 2000, coal-fired electricity was responsible for 30.1 percent of EU electricity, with natural gas at 13.7 percent, oil at 6.5 percent, nuclear at 32.4 percent, renewables at 16.4

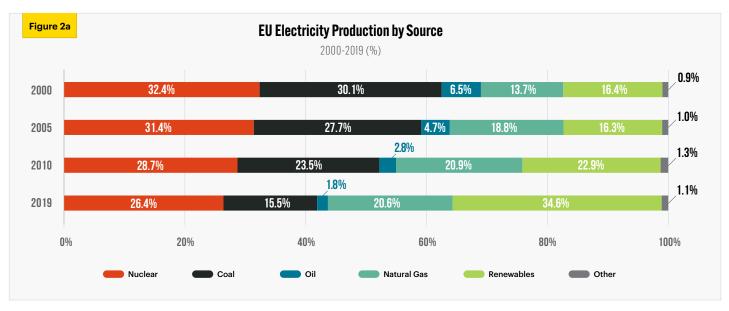
percent and "other" at 0.9 percent. As of 2019, coal-fired electricity was responsible for 15.5 percent of EU electricity, or half what it was 19 years earlier. Natural gas was higher at 20.6 percent, oil was 1.8 percent, nuclear at 26.4 percent, and renewables more than doubled to 34.6 percent while other sources accounted for 1.1 percent of Europe's electrical power (see Figure 2a).

Separated and totaled by fossil fuels, in 2000, 50.3 percent of the electricity in the EU was generated by fossil fuels, and that declined to 38 percent as of 2019. The share of renewables in EU electricity production more than doubled to 34.6 percent (see Figure 2b).

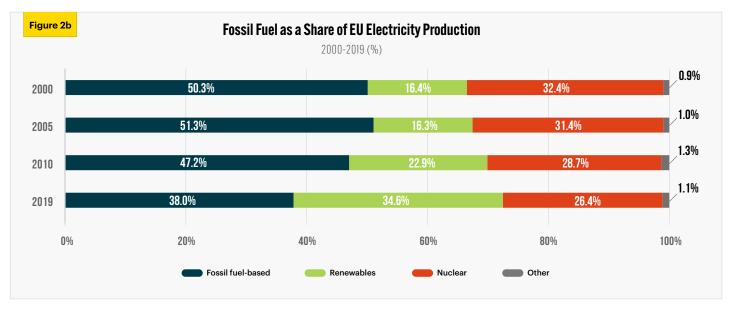


Source: Eurostat Database (2021).

^a. Electricity is produced as a primary or secondary product in power plants. The total amount of electricity produced is referred to as gross electricity production.



Source: Author's calculation from Eurostat Database (2021).



Source: Author's calculation from Eurostat Database (2021).

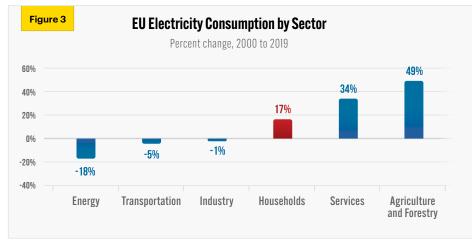
CONSUMPTION IN THE EU

Consumption in the EU electricity market by sector

Electricity consumption in the European Union between 2000 and 2019 decreased in the energy, transportation and industry sectors, while rising in households, services and in agriculture/forestry (see Figure 3).

Breaking down European household electricity consumption by country

The household sector's electricity consumption increased by 17 percent between 2000 and 2019 (see Figure 3). Household electricity consumption in absolute terms increased in many countries in the EU with most recording double-digit growth, except Germany (minus three percent), the United Kingdom (minus seven percent) and Belgium (minus 22 percent) (see Figure 4).



Source: Author's calculation from Eurostat Database (2021).

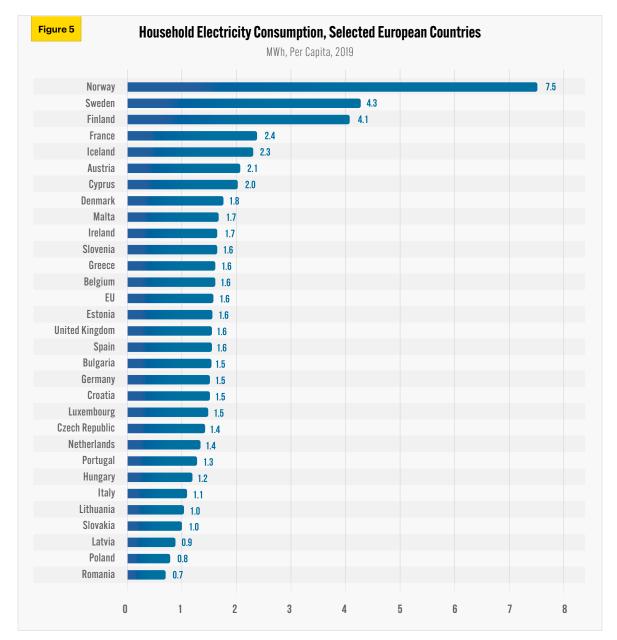
	E	Sy country, Per	cent change 200)0 to 2019			
Belgium	-22%						
United Kingdom	LL /0	-7%					
Germany		-3%					
Denmark		-0.2%					
Slovakia			1%				
Sweden			4%				
Italy			7%				
Croatia			8%				
Bulgaria			10%				
Czech Republic			10%				
Luxembourg			15	%			
Norway			16	1%			
EU 27 country average*			17	1%			
Netherlands			17	1%			
Hungary				19%			
Greece				22%			
Austria				23%			
France				24%			
Ireland				28%			
Finland				29%			
Slovenia				31%			
Portugal				31%			
Iceland					36%		
Latvia					39 %		
Poland					40%		
Estonia					41%		
Malta					49%		
Lithuania						65%	
Spain						67 %	
Cyprus						68%	
Romania						70%	

Source: Author's calculation from Eurostat Database (2021).

*EU 27-country average 2000 to 2020 calculated without United Kingdom

European household electricity consumption per capita

Electricity consumption per capita was highest in Norway, at 7.5 MWh per capita. The electricity consumption per capita in Europe has varied extensively among countries. It was 1.5 MWh per capita for Germany and for France it was 2.4 MWh per capita (see figure 5).



Source: Eurostat Database (2021).

HOUSEHOLD ELECTRICITY PRICES

Electricity end-user prices for households⁴ differ significantly in the EU member states. Multiple factors influence electricity prices including domestic regulations, taxes, and the energy source used in electricity generation.

Energy Poverty in Europe<mark>an H</mark>ouseholds: An Advance Lesson for Cana

- Environmental taxes and renewable levies on households matter to electricity prices in European countries. In 2019, environmental taxes paid by families ranged from €1/MWh in Luxembourg to €118/MWh in Denmark. Renewable levies range from €3/MWh in Sweden to €67/ MWh in Germany (European Commission, 2020b).
- Germany has the highest household prices due to its renewable surcharge (also called EEG surcharge), which consumers pay on their electricity bills to support renewable energy (Wettengel, 2019).
- In 2020⁵, a household user in Germany was paying the highest rate at €301 (which includes taxes levies), followed by Denmark €282 and Belgium €270. Household users in Hungary (€101) and Bulgaria (€98) were paying the least (see Appendix 3). Thus, prices in Germany are three times what they are in Bulgaria.

According to the European Commission (2020c): "An average household in the EU27 paid €25 /MWh in renewable taxes in 2019. This figure equals 29% of the taxes and levies component and 12% of the total average EU price. The average amount of renewable taxes paid by households in the EU27 rose by 153% since 2010."

Unsurprisingly, given the various levies and taxes as well as the change in the source for electricity (less fossil fuel-fired electricity and more renewables), prices have been steadily increasing in Europe over the 2008-2020 period (the earliest and latest years for which data is available). Since 2010, household electricity prices increased by 2.3 percent on average annually, while overall consumer prices increased by 1.4 percent per year in the EU 27 countries. In other words, electricity prices increased by a greater rate than the consumer price index (European Commission 2020c). Of note, the most significant jump in household electricity prices between 2008 and 2020 occurred in France (61 percent higher), Spain (68 percent higher) and Latvia (70 percent higher). The EU average increase was 33 percent (see Table 1).

⁴ The EU defines household consumers in the EU-27, as medium-sized consumers with an annual consumption between 2,500 kWh and 5,000 kWh.

^{5.} Annual prices calculated based on prices in the last six months of 2020.

Canada-Europe comparisons

European countries have significantly higher household electricity prices than other countries (and this is before the rise in the fall of 2021). For example, household electricity prices in Canada are one-third of what households pay in Germany (see Figure 6).

	ropean Ho lectricity 2008-20			Figure 6 Household End-User Electricity Prices (USD/MWh), 2020	
	0/1/1		Percentage	Germany	34
	€/kilow	att hour	change	Belgium 314 Denmark 307	
	2008	2020	2020 over	Italy 289	
			2008	Spain 275	
Latvia	0.0842	0.1432	70%	Ireland 261	
Spain	0.1366	0.2298	68%	Japan 1995 255	
France	0.1213	0.1958	61%	Portugal 242	
Estonia	0.0814	0.1291	59%	Austria 237	
Greece	0.1047	0.1641	57%	United Kingdom	
Lithuania	0.0860	0.1321	54%	OECD Europe 227	
		0.1321	51%	Switzerland 224 Luxembourg 218	
United Kingdom	0.1458			France 215	
reland	0.1769	0.2616	48%	Australia 210	
Slovenia	0.1147	0.1694	48%	Finland 207	
Finland	0.1223	0.1773	45%	Czech Republic 203	
Portugal	0.1482	0.2133	44 %	Slovak Republic 198	
Germany	0.2148	0.3006	40%	New Zealand	
Bulgaria	0.0711	0.0982	38%	Latvia 187	
Belgium	0.1972	0.2702	37%	Greece 185	
Romania	0.1061	0.1449	37%	Chile 180	
				Sweden 174	
European Union*	0.1604	0.2134	33%	Slovenia 173 OECD (all) 170	
Croatia	0.0990	0.1307	32%	Poland 169	
Malta	0.0993	0.1298	31%	Netherlands	
Czech Republic	0.1401	0.1795	28%	Lithuania	
Austria	0.1779	0.2167	22%	Colombia 148	
Slovakia	0.1421	0.1724	21%	Estonia 143	
Luxembourg	0.1645	0.1985	21%	United States 132	
Poland	0.1259	0.1510	20%	Hungary 115	
celand	0.1110	0.1248	12%	Canada 109	
Denmark	0.2635	0.2819	7%	Korea 104 Norway 83	
				Nulway 00	
taly Number	0.2031	0.2153	6%	0 50 100 150 200 250 300	350
Sweden	0.1698	0.1718	1%		
Cyprus	0.1780	0.1698 0.1322	-5%	Source: Eurostat Database (2021).	

Source: Author's calculation from Eurostat Database (2021).

0.1769

0.1548

0.1361

0.1009

-23%

-35%

Netherlands

Hungary

Energy Poverty in European Households: An Advance Lesson for Canadians

Canadian Energy Centre

ENERGY POVERTY

In recent years, energy poverty has become a challenge for European Union member countries, and each member country reports on energy poverty (Bouzarovski and Thomson, 2020).

Energy poverty can be measured by using various indicators.

- Expenditure based approach household energy costs measured against absolute or relative thresholds, i.e., incomes;
- Consensual approach self-reported assessments of indoor housing conditions, i.e., the ability to keep a home warm; and
- Direct measurement- where the level of energy services (heating) achieved in the home is compared with a set standard (Thomson et al., 2017).

The European Union measures energy poverty by using the indicator developed by EU Energy Poverty Observatory (EPOV). It provides four different primary indicators for energy poverty.

Two are based on self-reported experiences of limited access to energy services:

- The share of a country's population in arrears on their utility bills; and
- The proportion of a country's population unable to keep their homes adequately warm.

Two are calculated using household income and/or energy expenditure data:

- The proportion of households whose absolute energy expenditures are half the national median share of absolute energy expenditures, knows as the "M/2" indicator"; and
- The proportion of households whose absolute energy expenditures are twice the national median share of absolute energy expenditures, knows as the "2M indicator." We label this a "consumers facing a high share of energy costs."

Observing the "2M indicator" in 2015, the latest year for available data, the EU estimates that 16 percent of EU households face a high share of energy costs (see Table 2). In countries such as Germany and the United Kingdom, the proportion of households facing a high share of energy costs was 17 percent and 19 percent respectively in 2015, the most recent year for which this EU calculation was constructed.

EU Consumers Facing High Energy Costs						
Country	Consumers facing a high share of energy costs (2M) * (2010)	Consumers facing a high share of energy costs (2M) * (2015)				
Austria	12%	16%				
Belgium	14%	13%				
Bulgaria	14%	12%				
Cyprus	12%	12%				
Czech Republic	10%	11%				
Germany	17%	17%				
Denmark	18%	N/A				
Estonia	18%	19%				
Greece	13%	16%				
Spain	15%	14%				
Finland	18%	22%				
France	17%	15%				
Croatia	11%	12%				
Hungary	7%	9%				
Italy	N/A	N/A				
Ireland	19%	18%				
Lithuania	21%	14%				
Luxembourg	8%	11%				
Latvia	15%	13%				
Malta	18%	20%				
Netherlands	9%	11%				
Poland	18%	16%				
Portugal	18%	15%				
Romania	18%	17%				
Sweden	26%	29 %				
Slovenia	16%	14%				
Slovakia	10%	9%				
United Kingdom	19%	19%				
EU-28	17%	16%				

Source: EU Energy Poverty Observatory (undated).

*The 2M indicator presents the proportion of population whose share of energy expenditure in income is more than twice the national median share. This suggests the prioritization of energy costs over other household costs.

Another look at EU energy poverty: Behind on utilities/unable to keep the house warm

Using utility bills and the ability to keep one's house warm as a stand-alone indicator, as of 2018, 6.8 percent of people living in private households across the EU (30.3 million people) were unable to pay their utility bills, and 7.3 percent EU households were unable to keep their dwelling warm. The figures for the United Kingdom were 5.4 percent for both indicators in 2018 (EU Energy Poverty Observatory, undated). Readers should note that the EU estimates are not "watertight" as they are self-reported (see Table 3).

Our estimates of Europe's high-cost electricity

Given the European Union's self-reporting of energy poverty, we have designed an alternate measurement.

Our measurement tracks the increase in European electricity costs by country and compares it with the increase in median household income. The measurement is for 2008 to 2020 for electricity costs and for 2008 to 2019 for household median income (2019 is the most recent year for which a full set of median household income data is available).⁶

Given that European countries vary widely in median household income, in part because of communism in the 20th century, its collapse, and how many central and eastern European countries were in effect "starting over" in the 1990s, we have divided European countries into those with less than €15,000 in median household income in 2008, and those with more than €15,000 in median household income in 2008.

This is because we would expect, for example, median household income growth in Poland (€4,154 in 2008) and Romania (€1,954 in 2008) to easily outpace any growth in electricity prices in the years examined because those countries (and others) started with very low median household incomes.

^{6.} There is only a marginal difference between 2019 incomes and 2020 incomes, where available in the latter case. For example, Sweden's median het household income was €24,490 in 2019 and €24,710 in 2020.

Conversely, those with already high median household incomes in 2008 such as the United Kingdom (€18,766) and Ireland (€22,995) would be unlikely to see as dramatic rise in incomes, given they were already mature economies. That means any rise in electricity prices beyond household median income growth could be more difficult for households to finance.

The data in fact shows exactly that for many European countries for the 2008 to 2019/2020 period. For example:

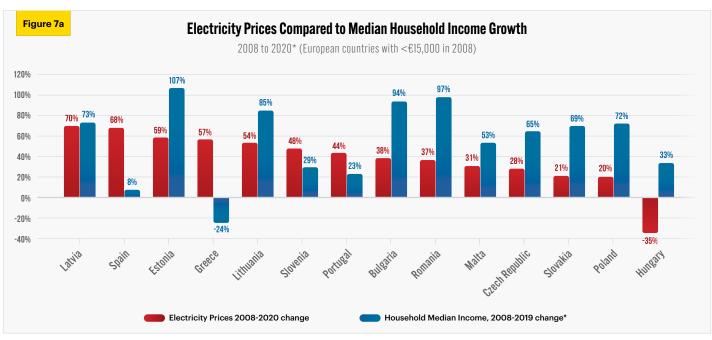
- Electricity prices in Poland rose by 20 percent but household median income increased by 72 percent, thus making the rise in power prices manageable. The same was true of many other nations with low median household income in 2008: Bulgaria, Romania, the Czech Republic, and Slovakia (see Figure 7a).
- In contrast, in the United Kingdom and Ireland (see Figure 7b), electricity prices soared by 51 percent and 48 percent, respectively while household median income rose by just four percent and one percent, respectively. That split between significantly higher power bills and an almost status-quo reality on median household incomes helps explain why some European (or United Kingdom) households have found it increasingly difficult to pay their utility bills.
- The most challenging combination though is where a country already had low median household income in 2008, and then saw little income growth over the next 11 years, but experienced a dramatic rise in the cost of power at the same time. This was the case for Spain, where electricity prices soared by 68 percent between 2008 and 2020 with median household income rising by just eight percent (by 2019) (see Figure 7a).

Table 3

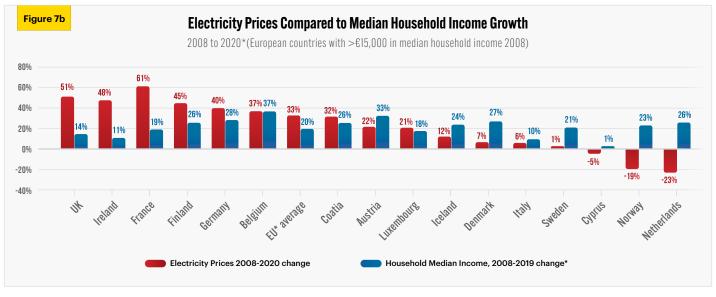
Europeans in Arrears / Unable to Keep Their Home Warm

Country	Arrears on utility bills (2008) %	Arrears on utility bills (2018) %	Unable to keep home warm (2008) %	Unable to keep home warm (2018) %
Austria	3.5	2.4	3.9	1.6
Belgium	5.1	4.5	6.4	5.2
Bulgaria	33.4	30.1	66.3	33.7
Croatia*	28.0	17.5	8.3	7.7
Cyprus	7.5	12.2	29.2	21.9
Czech Republic	2.6	2.1	6.0	2.7
Denmark	2.2	5.1	1.7	3.0
Estonia	7.4	6.5	1.1	2.3
Finland	6.6	7.7	1.9	1.7
France	6.1	6.4	5.3	5.0
Germany	3.9	3.0	5.9	2.7
Greece	15.9	35.6	15.4	22.7
Hungary	14.2	11.1	9.7	6.1
Ireland	8.3	8.6	3.7	4.4
Italy	13.9	4.5	11.4	14.1
Latvia	11.8	11.6	16.8	7.5
Lithuania	6.2	9.2	22.6	27.9
Luxembourg	1.1	3.6	0.9	2 .1
Malta	7.3	6.9	8.8	7.6
Netherlands	2.2	1.5	1.8	2.2
Poland	10.0	6.3	20.1	5.1
Portugal	3.7	4.5	34.9	19.4
Romania	23.5	14.4	24.4	9.6
Slovakia	3.8	7.9	6.0	4.8
Slovenia	14.2	12.5	5.6	3.3
Spain	4.6	7.2	5.9	9.1
Sweden	6.2	2.2	1.6	2.3
United Kingdom	4.7	5.4	6.0	5.4
EU Average	7.9	6.8	10.1	7.3

Source: Bouzarovski and Thomson (2020).



Source: Authors' calculation from Eurostat database.



Source: Authors' calculation from Eurostat database.

CONCLUSION: LESSONS FROM

EUROPE FOR CANADA

The core question is what lessons Canadian policymakers might glean from Europe, given that substantial changes are proposed in Canada on everything from how Canadians might heat their homes (more electrification) to higher carbon taxes and other policy, regulatory and legislative changes that discourage the consumption of hydrocarbons. This has obvious relevance to Canada, where a transition not only from coal and oil but also from natural gas is considered viable by some, with consequences for the electricity grid. The notion that all electrification in Canada via renewables is possible can have unintended consequences for Canadian households across provinces. As readers will note, the impact of the energy transition on retail prices of electricity in Europe is not uniform; it differs by country and can be influenced by policy decisions and regulatory frameworks. However, European and United Kingdom attempts to move away from affordable and reliable sources of electricity production and its subsequent impact on household electricity prices holds cautionary lessons for Canada.

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APPENDICES

Appendix 1		EU-27 countries production of electricity by source 2000-2019 (TWh)									
Year	Solid fossil fuels (Coal)	Peat & peat products	Oil shale & oil sands	Oil & petroleum products	Natural gas & manufactured gases	Nuclear	Renewables & biofuels	Waste (non-renewable)			
2000	800.34	5.90	7.66	172.85	362.72	859.93	435.91	11.61			
2001	792.91	8.56	7.63	168.92	386.55	888.89	464.91	14.30			
2002	814.35	8.83	7.65	181.70	403.48	902.35	423.07	13.85			
2003	849.14	9.58	9.29	166.82	453.37	907.17	428.54	9.48			
2004	835.57	8.74	9.50	143.65	493.98	928.44	472.24	10.53			
2005	808.88	7.49	9.29	137.43	549.67	916.08	476.99	11.83			
2006	816.50	9.27	8.77	130.04	576.65	914.43	499.87	13.14			
2007	828.81	9.97	11.40	109.43	610.15	872.25	527.25	14.25			
2008	757.05	8.60	9.63	101.54	648.26	884.73	569.82	14.97			
2009	703.57	7.80	7.63	92.94	590.18	824.91	599.54	15.97			
2010	701.23	9.33	11.05	82.09	623.37	854.47	682.00	17.44			
2011	724.83	8.26	10.90	74.59	591.39	837.77	670.93	18.39			
2012	742.71	6.61	9.70	72.57	516.16	811.96	756.37	18.28			
2013	728.93	5.85	11.41	63.21	446.60	806.22	835.83	18.31			
2014	692.77	6.17	10.30	60.52	388.69	812.55	866.24	19.37			
2015	705.03	5.84	7.89	63.30	428.59	786.68	883.82	19.48			
2016	659.06	5.49	9.62	61.99	498.24	767.96	899.00	20.81			
2017	638.84	5.24	9.91	58.68	557.98	759.38	903.64	20.92			
2018	595.50	5.92	9.38	54.54	522.38	761.94	968.91	21.70			
2019	450.93	5.16	4.32	51.95	599.54	765.34	1,005.27	21.49			

Source: Eurostat Database (2021).



Consumption of electricity by sector, EU- 27 countries

2000-2019 (TWh)

Year	Final energy consumption— The energy sector	Final energy consumption— Industry sector	Final energy consumption— The transport sector	Final energy consumption— Services	Final energy consumption— Households	Final energy consumption— Agriculture and forestry
2000	94	946	61	544	606	36
2001	95	962	62	565	627	36
2002	97	968	62	580	636	36
2003	102	979	60	610	661	33
2004	103	1,008	60	624	671	38
2005	106	1,015	60	641	676	39
2006	98	1,013	58	681	689	42
2007	100	1,026	57	692	683	42
2008	103	1,002	56	717	697	42
2009	104	862	55	725	700	42
2010	99	925	56	744	730	47
2011	88	936	58	724	704	47
2012	79	920	57	734	719	48
2013	77	906	57	729	716	48
2014	76	910	56	707	682	49
2015	77	914	56	733	692	51
2016	78	926	58	739	705	51
2017	78	943	58	744	707	52
2018	79	946	59	743	708	52
2019	78	934	59	729	706	53

Source: Eurostat Database (2021).

Appendix 3

Electricity Prices for household consumer, second half of 2020

Euro/MWh

Germany	300.6
Denmark	281.9
Belgium	270.2
Ireland	261.6
Spain	229.8
United Kingdom	220.3
Austria	216.7
Italy	215.3
European Union - 27 countries (from 2020)	213.4
Portugal	213.3
Luxembourg	198.5
France	195.8
Czech Republic	179.5
Finland	177.3
Slovakia	172.4
Sweden	171.8
Cyprus	169.8
Slovenia	169.4
Greece	164.1
Poland	151
Romania	144.9
Latvia	143.2
Netherlands	136.1
Norway	132.2
Lithuania	132.1
Croatia	130.7
Malta	129.8
Estonia	129.1
Hungary	100.9
Bulgaria	98.2

Source: Eurostat Database (2021).

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Acknowledgments and Notes

The authors and the Canadian Energy Centre would like to thank and acknowledge the assistance of two anonymous reviewers. Note that for Executive Summary Figure 2, Figure 7b and Appendix 3, EU 27-country averages between 2008 and 2020 were calculated without the United Kingdom.

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