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Fiscal Policy Options to Accelerate Emissions Reductions in Belgium

Belgium

Nate Vernon

SIP/2023/017

***IMF Selected Issues Papers* are prepared by IMF staff as background documentation for periodic consultations with member countries.** It is based on the information available at the time it was completed on February 10, 2023. This paper is also published separately as IMF Country Report No 23/099.

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Prepared by Nate Vernon

Authorized for distribution by Mark Horton
March 2023

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ABSTRACT: *Belgium's current policies fall short of achieving its climate targets and promoting emissions reductions at limited economic costs. We recommend that domestic carbon pricing form the centerpiece of an emissions reduction package, as pricing promotes mitigation at the lowest economic cost, can be phased in as international energy prices fall, and generates revenue to compensate vulnerable households and reduce taxes on productive activities. Sectoral policies, such as subsidy-tax schemes to promote low emissions vehicles, should reinforce carbon pricing and regional efforts, while the social protection system can be made more efficient and environmentally friendly by switching from energy subsidies to income-based support. Belgium should also promote dialogue at the EU-level to harmonize ETS prices and include all sectors under a single trading scheme.*

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Belgium

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BELGIUM

SELECTED ISSUES

February 10, 2023

Approved By
European Department

Prepared By Andre Geis, Yu Ching Wong (both EUR) and Nate Vernon (FAD).

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FISCAL POLICY OPTIONS TO ACCELERATE EMISSIONS REDUCTIONS IN BELGIUM[1]

Belgium's current policies fall short of achieving its international climate targets and promoting emissions reductions at limited economic costs. Price-based federal reforms would help reduce greenhouse gas emissions and reinforce regional initiatives. These include economy-wide carbon pricing reinforced by sectoral policies:

- *A carbon tax that progressively increases to around €100 per tonne by 2030 for sectors not covered by the existing EU Emissions Trade Scheme (ETS)—namely, transportation, buildings, agriculture, and excluded industrial emissions. The tax should be phased in as international energy prices fall and ahead of the EU-wide ETS for buildings and transportation. Such a policy would promote cost-effective emissions reductions, bring Belgium closer to meeting mitigation commitments, reinforce regional policies, and act as a domestic price floor for the coming EU-wide ETS for buildings and transportation. Revenues should be used to compensate vulnerable households and trade-exposed firms and increase productivity, with direct support for firms phased out as the Carbon Border Adjustment Mechanism (CBAM) is phased-in. The tax should be extended to non-carbon greenhouse gases (e.g., methane) if administrative and political costs are manageable.*

- *A domestic price floor for sectors covered by the existing EU ETS—namely, industry and power—with the floor equal to the non-ETS sector carbon tax to increase investor certainty and equalize emissions prices across the economy.*

- *A feebate for the power and transportation sectors to promote decarbonization as nuclear power is planned to be phased out and to speed up electrification of the vehicle fleet. Transportation sector feebates should be coupled with the removal of the company car regime. Feebates for industry, building heating, and appliances could also be considered to promote cost-efficient, deeper decarbonization in these sectors and the needed renovation of the housing stock.*

- *Reduced fees and levies on electricity consumption for charges that are not directly related to delivering electricity to the end-user to allow for more cost-reflective pricing of electricity and promote switching from fossil fuel-based to electricity-powered activities.*

- *Transitioning from the current social tariff to a fiscally-sustainable, income-based social protection system with benefit levels that phase out as total income or wealth increases to improve employment incentives and decarbonization.*

- *Promoting dialogue at the EU-level to harmonize ETS prices and include all sectors under a single trading scheme.*

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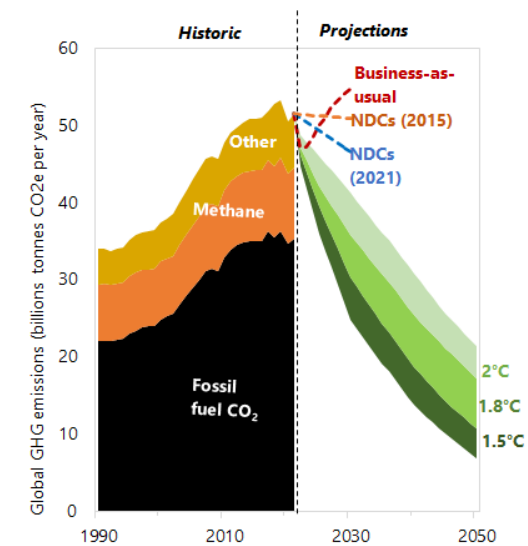
[1] Prepared by Nate Vernon (IMF Fiscal Affairs Department), with comments from Mark Horton, Ian Parry, the National Bank of Belgium, and Belgium's Federal Planning Bureau.

A. Background

1. The window of opportunity to achieve warming targets and limit climate damages is closing. Limiting global warming to 1.5 to 2°C, the central goal of the Paris Agreement, requires cutting emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) by 50 and 25 percent, respectively, by 2030 compared to 2019 levels, followed by a rapid decline to net zero emissions near the middle of the century (see Figure 1 and IPCC 2021). Over 85 countries, representing around 80 percent of current emissions, have communicated 'net-zero' targets by mid-century but intermediate mitigation targets and policies remain insufficient.[2] Under current policies, global emissions are expected to increase significantly to 2030, despite reductions caused by higher energy prices and the Covid-19-induced economic slowdown. Such an increase in emissions will contribute to more frequent and severe climate events and increase the risk of 'tipping points'.[3] Belgium's primary climate-related economic risks are heat-related productivity and health losses and flooding, with annual economic costs projected to be up to one percent of GDP by 2050 (see IMF 2021 for an overall review of climate-related costs).

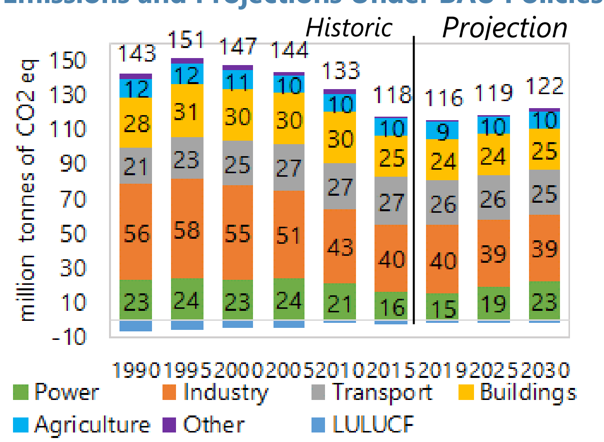
Figure 1. Belgium: Global GHG Emissions vs. Targets and Pledges



Source: IPCC (2021); and IMF staff using the IMF-WB Climate Policy Assessment Tool (CPAT).

2. Belgium's emissions in 2019 were 19 percent below 2005 levels (Figure 2). The industrial sector is the largest contributor to emissions (34 percent in 2019), followed by transportation (21 percent), buildings (20 percent), power generation (13 percent), and agriculture (8 percent). Emissions reductions have been realized in all major sectors except transportation and agriculture, with emissions in power generation, industry, and buildings falling by 38, 21, and 21 percent, respectively.

Figure 2. Belgium: Trends in Historical Emissions and Projections Under BAU Policies



Source: UNFCCC and IMF staff using CPAT.

[2] Intermediate targets are primarily specified in Nationally-Determined Contributions (NDCs), which contain country-level targets. Target years for net zero emissions range from 2035 (Finland) to 2070 (India) (ClimateWatch 2022). Net zero emissions allows for negative emissions in some sectors and activities (e.g., forestry, direct air capture) to offset positive emissions in others. Some targets refer to CO_2 while others cover all GHGs.

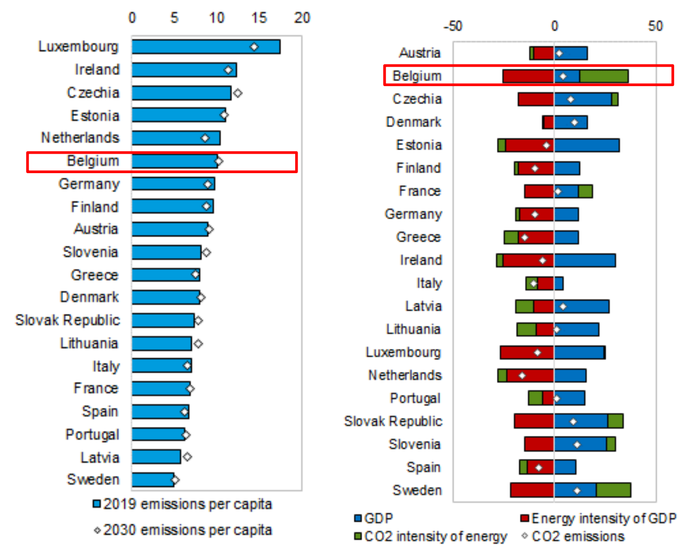
[3] A tipping point is a threshold that, once crossed, would lead to large and irreversible climate impacts, such as melting of Arctic ice sheets.

Emissions in transportation and agriculture have remained relatively constant. Economy-wide emissions reductions slightly lag those of other advanced EU economies (24 percent below 2005 levels) and the EU as a whole (22 percent). Belgium's emissions per capita are similar to those of the Netherlands and Germany but on the higher end of advanced EU economies (Figure 3). Overall emissions-intensity is slightly below the EU average, but relatively high in the agriculture, heating, and road transportation sectors.

3. Belgium's emissions are projected to grow under current policies (i.e., no tightening of existing policies or additional policies).[4] By 2030, total emissions are estimated to increase to four percent above 2019 levels, with the increase driven by a higher power sector emissions-intensity due to the phase out of much of Belgium's nuclear generation capacity—nuclear power generated 45 percent of electricity in 2019 (compared to 27 and 10 percent from natural gas and wind, respectively, with the remainder split among solar, bioenergy, and coal). Natural gas power generation will rise, although an increase in wind power generation partly offsets the switch from nuclear to natural gas.[5] Industrial, transportation, building, and agricultural emissions are projected to remain relatively stable. In line with other advanced EU economies, the energy-intensity of GDP should fall, partly due to increased energy efficiency improvements induced by higher natural gas and oil prices and the introduction of newer, more efficient technology.

Figure 3. Belgium: Emissions Trends across Europe

Current and Projected per Capita GHG Emissions, 2030 (Tonnes of CO2 eq) | **Changes in Projected Emissions by Economic Factor across Countries**



Source: UNFCCC, Eurostat, IMF Staff estimates using CPAT.
Note: international comparison reflects existing policies as of December 2022.

4. Without more ambitious policy actions, Belgium will fall short of its key, binding emissions-reduction target (Table 1). Under the EU Effort Sharing Regulation (ESR), Belgium is required to reduce emissions to 47 percent below 2005 levels by 2030 for activities not included in the existing EU Emissions Trading Scheme (ETS)—the EU ETS covers power and large industrial

[4] Analysis is done using the IMF's Carbon Pricing Assessment Tool (CPAT). CPAT has been developed jointly by IMF and World Bank staff and evolved from an earlier IMF tool used, for example, in IMF (2019a and b). For descriptions of the model and its parameterization, see IMF (2019b), Appendix III, and the Appendix of Black et al (2021). Results generally align with EEA (2022) and Leuven (2022). See Annex and Table 4 for more details.

[5] Belgium has committed to phase out nuclear power generation by 2035 (one reactor has already been decommissioned). Additional wind generation came online in 2020 and increased total offshore wind capacity by about 20 percent. A large, additional increase in wind power capacity is expected starting in 2025.

activities. The required 47 percent reduction compares to a projected decline of 11 percent by 2030 under current policies. The additional policies described in Belgium's National Energy and Climate Plan (NECP) do not close the gap, with overall emissions falling by 28 percent, split between a decline of 35 and 22 percent for non-ETS and ETS sectors, respectively (EEA 2022).[6] Failing to meet ESRs and other targets will result in financial costs, potentially through purchasing 'statistical transfers' from member states that overachieve on their targets or using additional flexibilities. Table 1 summarizes the Belgium's targets and projected emissions reductions.

Table 1. Belgium: Summary of Mitigation Targets

Scope	Target (relative to 2005 unless noted)	Assessment (relative to 2005) 3/	
		2019	2030
ETS sectors, emissions	No explicit targets	-27%	CPAT: -20% (WEM) EEA: -14% (WEM), -19% (WAM)
Power, emissions	NECP: -100% by 2050, no 2030 target	38%	CPAT: -10% (WEM) EEA: 4% (WEM), -4% (WAM) 1/
Industry, emissions	NECP: -33% in 2030, -79% in 2050 for non-ETS industry	-21%	CPAT: -24% (WEM) EEA: -25% (WEM), -29% (WAM) 1/
Non-ETS sectors, emissions	ESR: -47% in 2030 NECP: -35% in 2030, -85 to 87% in 2050; Flanders (-40% in 2030, -85% in 2050); Wallonia (-35% in 2030); Brussels (-40% in 2030)	11%	CPAT: -10% (WEM) EEA: -10% (WEM), -35% (WAM)
Transport, emissions	EU: -55% reduction by 2030 relative to 2021 2/ NECP: -27% in 2030, -100% in 2050; Wallonia (-24% by 2030);	3%	CPAT: -6% (WEM) EEA: 4% (WEM), -32% (WAM)
Buildings, emissions	NECP: no explicit federal target; Wallonia (-29% by 2030)	-21%	CPAT: -18% (WEM) EEA: -24% (WEM), -44% (WAM)
Agriculture, emissions	NECP: -23% in 2030, -47% in 2050	-4%	CPAT: 1% (WEM) EEA: -8% (WEM), -18% (WAM)
Economy-wide, emissions	NECP: no explicit federal target, Wallonia (-30% by 2020 and -95% by 2050, compared to 1990), Brussels (-40% in 2030, 'approach net zero' by 2050), Flanders (no explicit target)	-19%	CPAT: -16% (WEM) EEA: -13% (WEM), -28% (WAM)
Power, renewable share	EU: 25% of gross final energy consumption by 2030 NECP: 17.5% of energy consumption by 2030	9.9%	CPAT: 16.7% (WEM)

Source: National Energy and Climate Plan (2019), Flemish Energy and Climate Plan, IMF staff estimates using CPAT, EEA 2022.

1/ Power in the EEA analysis includes petroleum refining and manufacture of solid fuels, while these activities are included in industry for the IMF analysis.
2/ Reflects proposals in the Fit for 55 package.
3/ WAM refers to 'with additional measures' and accounts for policies that are in the planning stages but have not been implemented, while WEM refers to 'with existing measures' and only considers policies that are currently being implemented.

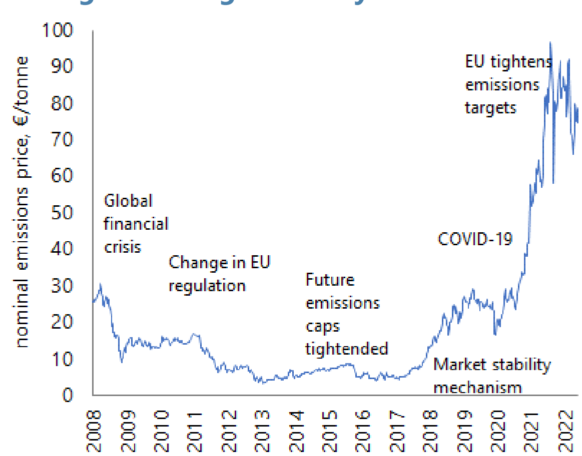
[6] Although the additional policies were designed to comply with the less stringent, pre-'Fit-for-55' ESR target and it is not yet clear whether revised a NECP, slated for 2024, will close the gap.

5. This paper evaluates fiscal policies to promote cost-effective emissions reductions in Belgium. Specifically, the analysis covers economy-wide carbon pricing; reinforcing sectoral policies, such as feebates; policies to reduce the relative price of electricity to support electrifying traditionally fossil-based activities, such as transportation; and the energy-related aspects of the social protection system, including the recent policy response to the current energy crisis. The analysis builds off previous work by the IMF, European Commission, OECD, IEA, Belgian institutions, and others.[7] The paper first provides an overview of Belgium's climate policies then assesses the reform options. The Belgian authorities—at the federal and regional levels—are closely engaged in a series of reforms related to energy and climate policies, including updating climate and energy plans and considering tax changes. A Tax Blueprint was presented by the federal financial minister in July 2022 and called for more extensive carbon pricing in non-ETS sector to support emission reductions efforts. This paper aims to contribute to the policy debate.

B. EU and Belgian Policies

6. The centerpiece of EU climate policy action is the ETS, which covers large emissions sources from energy, industry, and within-EU aviation. The ETS works on the 'cap and trade' principle, where a cap is set on the total amount of GHGs that can be emitted at the EU level, while companies buy or sell allowances, which establishes the emissions price. The EU scheme currently covers about 41 percent of total EU GHGs (WBG 2022). Presently the cap declines by 2.2 percent each year, but this rate is expected to increase to 4.3–4.4 percent annually to comply with the new 'Fit-for-55' target. EU allowance prices rose to around €80 per tonne in September 2021 and have since hovered around this level (Figure 4). Drawbacks of the ETS include volatile emissions prices, which creates uncertainty for investors, and also that with a fixed cap on emissions at the EU level, emissions reductions from overlapping policies for ETS sectors in Belgium are offset by extra emissions in other EU countries via a decline in the ETS allowance price (i.e., full leakage). This problem is, to some degree, mitigated by the Market Stability Reserve (MSR), which withdraws emissions allowances from the system (sometimes permanently) when the amount of banked allowances (i.e., that firms

Figure 4. Belgium: Daily EU ETS Price



Source: Ember (2022)

[7] For example, the European Commission (2020) found gaps in climate policy coordination and design; the OECD (2022) found low carbon prices in the buildings and industrial sectors; the IEA (2022) noted that taxation and social protection reform may promote price signals that drive least cost decarbonization; the National Carbon Pricing Debate (2018), the National Bank of Belgium (2021), and Transport and Mobility Leuven (2022) found that carbon pricing is generally low, and higher prices could cost-effectively reduce emissions; and the IMF (2021) found carbon pricing and subsidy removal, with policies to support vulnerable households, could form part of a mitigation package.

have purchased but not yet used) exceeds a threshold level. Energy intensive, trade exposed (EITE) industries (e.g., metals, chemicals) have historically been granted free allowance allocations to address competitiveness and leakage concerns, but these are expected to be phased out as the recently-agreed EU Carbon Border Adjustment Mechanism (CBAM) is introduced.

7. In December 2022, the European Commission and the European Parliament provisionally agreed to introduce a separate ETS for road transportation, buildings, and other sectors. The new ETS would be introduced in 2027 (or 2028 if energy prices are 'exceptionally high'), with the price of allowances not exceeding €45 per tonne and the allowance cap set to an annual, linear decline of 5 percent per year from 2024 emission levels. The agreement provides an exemption for member states in which there is a national-level carbon tax equal to or above the ETS allowance price. A portion of the revenues from the ETS will support vulnerable households and small businesses through the Social Climate Fund.

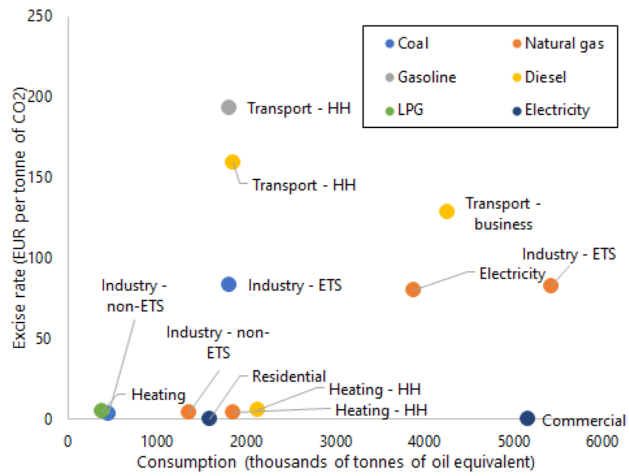
8. Additional EU-level policies are generally issued through directives and regulations and are, at times, binding. Key directives include: (i) the Energy Taxation Directive (ETD), which provides minimum excise duties on energy products and electricity; (ii) the Renewable Energy Directive, which sets renewable energy targets for electricity, heating, cooling and transportation and is legally binding as of 2021; (iii) the Energy Efficiency Directive, which provides binding energy consumption reductions relative to a baseline level; (iv) the Energy Performance of Buildings Directive, which requires each member to provide a long-term renovation strategy for buildings and phases in minimum energy performance standards for buildings; and (v) CO_2 emissions performance standards for road transportation, which become progressively more stringent and will require all new passenger vehicles and vans to be zero-carbon by 2035.

9. Belgium's regional and federal governments share competencies over domestic policies impacting emissions reductions. Specifically, regions control policies related to electricity and natural gas distribution (including tariffs), district heating networks, onshore renewable energy, waste management, public transportation, urban and rural planning, agriculture, building and vehicle efficiency requirements (except for federal buildings), and vehicle registration. The federal government is responsible for tax policy, offshore renewable energy, nuclear energy, energy R&D, energy pricing policy, and the national rail system. There are forums to support coordination between regions and the federal government (such as the National Climate Commission), but these do not ensure binding coordination.

10. Excises are Belgium's main instruments to (indirectly) price carbon emissions, but current rates result in substantially different carbon prices across fuels and activities (Figure 5). Excises on unleaded petrol and diesel are €193 and €160 per tonne of CO_2 (€0.45 per liter of fuel), respectively, when the fuels are used for transportation but are significantly reduced (to around €0.02 per liter) for other diesel uses, such as heating and non-transportation commercial activities. Moreover, a portion of the excise charged on transportation diesel for professional use is refunded (the refund was €0.08 per liter most recently). Other fuels are lightly taxed—notably the excises on natural gas and coal, with maximums of €0.31 and €0.37 per GJ (equivalent to around €4.3 per tonne of CO_2) and exempt in many cases. The electricity excise is €0.50 and €2.93 per MWh for commercial and residential use, and the biofuel content of blended fuels is taxed at the rate of the fossil fuel (e.g., diesel with biofuel is fully taxed at the diesel rate). The VAT is also applied to energy consumption and impacts prices paid by residential consumers—the standard VAT rate is 21 percent but has been reduced to 6 percent for natural gas, district heating, and electricity.[8]

11. Fossil fuel subsidies, such as reduced excise rates and social tariffs, result in a large fiscal cost and primarily support natural gas, heating oil, and company cars purchases. Reduced excise duties, especially those for natural gas and heating oil, made up the bulk of subsidies at €10.5 billion in 2019 (around 2.2 percent of GDP).[9] Preferential tax treatment for company cars and road fuel subsidies is also significant at around €2.5 billion and growing. The cost of the social tariff, which provides reduced natural gas, heating oil, and electricity prices to vulnerable households, has historically been relatively low but has increased with the expanded coverage introduced during the recent energy crisis (now around 20 percent of households) and higher per-unit level of natural gas subsidy.[10] Overall, around 40 percent of subsidies were provided for heating and electricity, 30 percent for transportation, and 25 percent for industry. Although total subsidies decreased from 2015 to 2019, recent policy decisions (i.e., expanded social tariff coverage and reduced VAT on natural gas, district heating, and electricity) and international price developments are likely to reverse the recent trend. Box 1 provides more detail on recent policy changes and support measures in response to the 2022 energy crisis, as well as impacts on purchasing power.

Figure 5. Belgium: Excise Rates and Consumption by Fuel and Use



Source: Eurostat.
Note: Electricity does not emit carbon when consumed but presented as a rate of zero.

12. The combined effect of the excise, VAT, and social protection systems results in effective carbon tax rates that are particularly low for buildings and agriculture (Figure 6). Road transportation and power sector carbon taxes are broadly in line with the EU average and slightly above the average among OECD countries, but still below that of neighboring countries and levels needed to meet emissions-reductions targets. The industrial, buildings, and agricultural, fish,

[8] The reduced VAT rates are currently temporary but may be made permanent and coupled with higher excise rates for residential energy use to result in an effective tax rate similar to that under 2021 natural gas and electricity prices.

[9] Excise duty subsidies are measured as the gap between various fuel excise rates and the excise rate on unleaded petrol (FPS 2021)

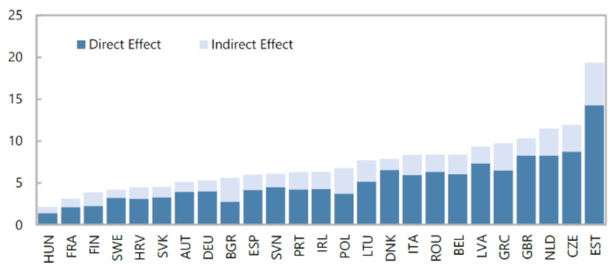
[10] Social tariff rates are set every 3 months at the lowest retail, distribution, transmission components of tariffs over previous periods with limits on how much they can increase each quarter (IEA 2022). The limited rise in quarterly rates means that the level of the subsidy increases when energy prices surge, such as 2022.

and forestry sectors lag levels elsewhere in the EU, OECD, and in neighboring countries. In the industrial sector, this is due to low natural gas and coal excise rates compared to other EU countries and a significant portion of emissions that are not covered by the ETS (around 20 percent of industrial sector emissions).[11] Low carbon price levels for buildings and agricultural, fish, and forestry are driven by reduced excise rates for diesel (when used for heating) and natural gas.

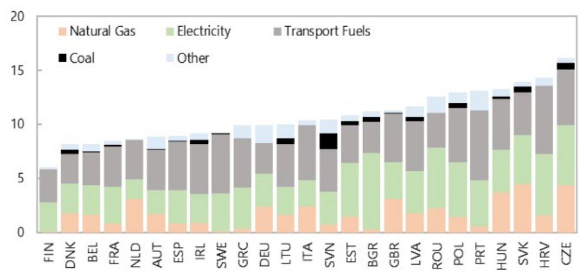
Box 1. Belgium: Response to the 2022 Energy Crisis

Surging energy prices in 2022 impacted a significant share of household consumption, with lower-income households particularly exposed. Electricity, natural gas, and oil products make up 3.9, 2.1, and 3.5 percent of total household consumption, respectively, for the lowest 20 percent of the income distribution.

Household Burdens



Budget Hares



The federal and regional governments introduced swift measures to assist households and firms. These cost about 1.7 percent of GDP and include reduced VAT for natural gas, electricity, and district heating; reduced excises on petrol and diesel; additional cash transfers; and expanded eligibility for the social tariff. Roughly 1/3 of measures are targeted and distort price signals, while 2/3 are untargeted and not price distortionary. Automatic wage and social benefit indexation, as well as limits to social tariff energy price increases, provided additional boosts to household purchasing power.

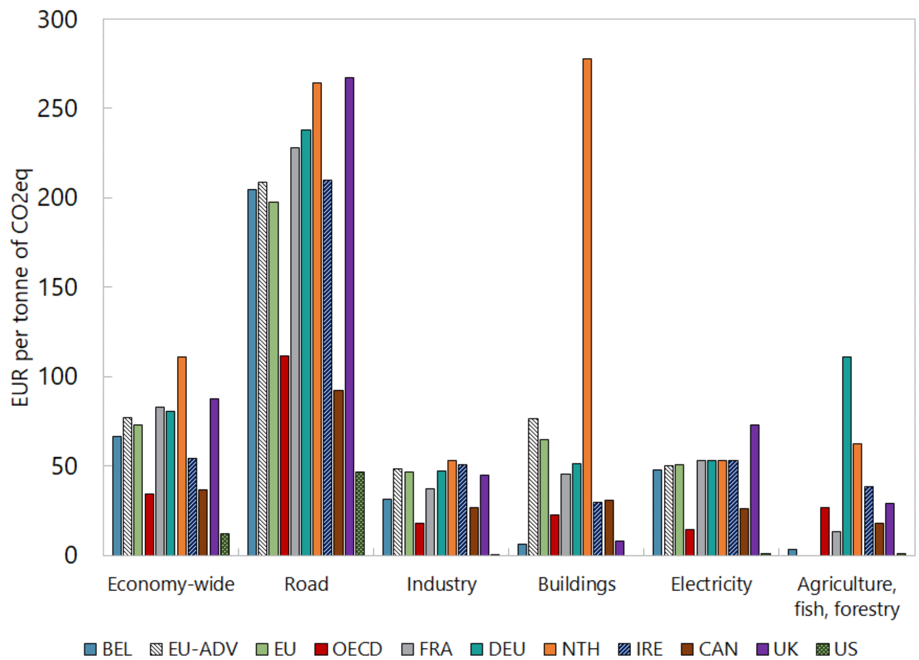
Ideally household assistance should be targeted (to limit fiscal costs) and unrelated to energy consumption (to preserve incentives for energy conservation). In this regard, the government plans to introduce a flexible excise rate that declines for base levels of consumption as natural gas and electricity prices rise. Improving targeting mechanisms through matching tax, household size, and third-party data (as legally possible) is a medium-term exercise that could improve social benefits during regular times and prepare for future energy shocks, which could become more frequent under a disorderly energy transition.

13. The authorities are considering reforms related to energy and climate policies, including possibly increasing carbon prices on non-ETS sectors. A Tax Reform Blueprint was presented by the federal finance minister in July 2022, containing measures to be introduced in subsequent budgets. The Blueprint notes the importance of more extensive carbon pricing in non-ETS sectors to support emission reductions efforts. While the recently-reduced VAT rates for natural gas and district heating are likely to be made permanent, the government plans to raise excises to levels that allow for 2021 post-tax prices to be reached and to make the portion of the excise applicable to base electricity and natural gas consumption vary with energy price spikes, as a way to

[11] Seventeen percent of industrial emissions were from non-ETS contributions as of 2015-16. Non-ETS industry emissions comprised 65 percent energy vs. 35 percent processes, and primarily came from the chemical (37 percent) and food, beverages, and tobacco (17 percent) sectors (Climact 2018). Also, emissions from biomass are not covered by the EU ETS and are estimated to make up around four and 10 percent of energy use for industrial and electricity generation, respectively (Eurostat 2022).

support base levels of energy consumption. There is an understanding that energy taxation needs to shift from electricity to fossil fuels. This could entail a progressively rising excise rate on natural gas (and other fossil fuels), potentially through carbon pricing.

Figure 6. Belgium: Effective Carbon Tax Rates by Sector in 2021



Source: OECD 2022

C. Reforming Existing Fuel Taxes and Introducing Economy-Wide Carbon Pricing

14. Carbon pricing for non-ETS sectors should be at the center of federal decarbonization reforms, as it has environmental, fiscal, economic, and administrative advantages over other mitigation instruments.[12] Carbon pricing provides across-the-board incentives for firms and households to reduce energy consumption and shift to cleaner fuels without favoring any specific energy matrix, other than discriminating by its carbon content (by reflecting the cost of carbon emissions in the prices of fuels, electricity, and other intermediate and final goods). It also automatically minimizes mitigation costs by equalizing the cost of the last tonne of emissions reduced across fuels and sectors ('marginal abatement cost'); it mobilizes valuable revenues; and it generates domestic environmental benefits (e.g., reductions in local air pollution mortality). Carbon pricing is administratively straightforward and can build on the existing excise tax system.

15. Good carbon pricing strategy covers emissions comprehensively, establishes predictable prices, aligns stringency with mitigation goals, and exploits fiscal opportunities. Introducing a carbon price for non-ETS sectors, combined with the EU ETS, would ensure that fossil

[12] See, for example, IMF (2019a and b) and Stern and Stiglitz (2017).

fuel emissions in Belgium are comprehensively covered by pricing schemes. Efficiency benefits are achieved through equalization of abatement costs across the economy, by coupling the non-ETS carbon price with a price floor for ETS sectors. Progressively increasing the policy's stringency with a price path announced well in advance allows households and firms to adjust input choices and spending decisions (making it more acceptable and efficient), helping promote investment in clean technologies with longer payback periods, such as electric vehicles and heat pumps. Carbon pricing should also raise revenue, which can be used for support of both vulnerable households and firms with the remainder used to improve productivity.

Box 2. Belgium: Carbon Taxes vs. Cap-and-Trade Systems

Certainty and investment. Carbon taxes may provide greater price certainty, which supports investment in energy efficiency and clean technology. This is especially important for investments with long payback periods, such as power generation, electric vehicles, and residential energy efficiency improvements. This benefit of the carbon tax is diminished if the price trajectory is not credible, or the tax is adjusted frequently (perhaps due to public resistance or a view that the tax will need to be increased in the future to meet legally required emissions targets). To date, ETS prices have been volatile (Figure 4), increasing risks and uncertainty and abatement costs (studies show 15 percent higher marginal abatement costs under an ETS due to the uncertainty in future prices (Fell, MacKenzie, and Pizer 2021))—this deters private innovation and adoption of clean technologies, especially in activities with long payback periods. This weakness can be alleviated by including a price floor, such as in the UK, Denmark, and in the Netherlands' power sector (see Flachsland and others (2018) for further discussion of price floor mechanisms). The market stability reserve (MSR) acts as a weak version of a price floor.

Administration. Carbon taxes are easier to administer as they typically build off the existing fuel tax regime and can be applied at the point of fuel refining/processing or importation (midstream), with rebates provided to downstream firms that capture emissions. This omits industrial process emissions, but these can be captured through actual measurement. ETS have been applied downstream at large stationary sources in power and industry, although the German, Californian, Austrian, and Korean ETS cover heating and transportation.

Revenues. The carbon tax generates government revenues, while the ETS only does so if allowances are auctioned. There has been a tendency to grant free ETS allowances to build political support and protect energy-intensive, trade-exposed firms (EITE). Generating revenue provides much greater flexibility since revenues can be used to promote social (e.g., income support to vulnerable households and firms) or economic objectives (e.g., reducing labor taxes), while free allowances can generate windfalls for low-emitting firms in the short-term depending on the distribution. For policies that generate revenues, competitiveness can be protected, and carbon leakage reduced by providing output-based rebates or imposing carbon border adjustments. However, international coordination for carbon pricing (or other mitigation policies) is the most efficient approach as it covers emissions much more comprehensively (see Parry et al. 2021a for more).

Overlapping policies. The carbon tax is more compatible with other policies (e.g., feebates, emission rate regulations, clean technology subsidies) since the other policies provide additional incentives, on top of the carbon tax. For an ETS without a price floor, the quantity emitted is fixed so other policies to promote clean energy or disincentive emitting energy will result in a lower ETS price and, therefore, do not reduce emissions—this effectively results in the subsidy having a fiscal cost without any benefit but can be alleviated through a price collar (a price floor on the ETS price).

16. Carbon pricing can take the form of either a carbon tax or cap-and-trade system (i.e., ETS). A carbon tax is simply a tax on the carbon content of fossil fuel supply, while a cap-and-trade scheme requires firms to have allowances to cover emissions, with the allowance cap set by the government and a market for trading of allowances across firms. The carbon tax provides certainty over the carbon price, while the ETS provides certainty over the emissions level. See Box 2 and Parry et al (2022a) for more.

17. Several other European countries have carbon pricing of non-ETS sectors, and some are introducing price floors to the ETS. Currently, prices for non-ETS sectors vary from €35 to €110 per tonne (Table 2) and all are effectively taxes (i.e., no ETSs) since Germany and Austria have fixed, progressively increasing levies until 2026, at which time they plan to transition to a price determined in ETS markets—Germany will have a price floor and ceiling. The policies only cover non-ETS sectors, except for Finland, Ireland, and Portugal where a portion of industrial emissions are taxed. Denmark, the Netherlands, and the UK have or are considering a price floor for power and/or industry—such a policy has the benefit of providing price predictability, which is important to incentivize investment with long payback periods (e.g., power generation and industry), and equalization abatement costs across the economy if the price floor is equal to the non-ETS carbon price.

Table 2. Belgium: Carbon Pricing in Non-ETS Sectors

Country	Year intro.	Type	Price € / tonne	Sectors
Austria 1/	2022	Tax to ETS	35 (2023) to 55 (2025)	Heat, Tran.
Denmark	1992	Tax	47 (2022) to 101(2030)	All 2/
Finland	1990	Tax	77 (2022, Tran.), 53 (2022, other)	Heat, Tran., Ind.
France	2014	Tax	45 (2022)	Heat, Tran., Ind. 3/
Germany 1/	2021	Tax to ETS	30 (2022) to 55 (2025)	Heat, Tran.
Ireland	2010	Tax	34-41 (2022) to 100 (2030)	Heat, Tran., Ind. 4/
Portugal	2015	Tax	Previous years' avg. ETS price	Heat, Tran., Ind.
Sweden	1991	Tax	110	Heat, Tran.

Source: WBG 2022.

1/ The price is fixed until 2026, at which point it will be subject to ETS market conditions.
2/ lower rate for ETS sectors.
3/ ETS sectors are exempt.
4/ Other sectors are covered but with several exemptions.

18. A carbon price could bring Belgium significantly closer to its mitigation targets with manageable costs.[13] Table 3 shows mitigation reductions and other outcomes under a carbon price

[13] These results are valid whether EU-wide or national carbon pricing is imposed on non-ETS sectors. Modelling assumes that the carbon price is applied to all greenhouse gas emissions (i.e., methane). Emissions reductions would be lower in the agricultural sector if the policy is only applied to carbon as the majority of agricultural emissions are from methane and nitrous oxide.

in Belgium for non-ETS sectors and a price floor for industry and power (i.e., the tax only applies if the price levels exceed the EU ETS price). Results show that, for example, a tax progressively reaching €75 per tonne reduces overall emissions to 25 percent below 2005 levels in 2030 (or 12 percent below a Business-as-Usual (BAU) scenario),[14] while raising revenue of 0.6 percent of GDP and not making people worse off (the economic efficiency costs of 0.2 percent of GDP are offset by improved health, reduced congestion, among others).[15] At the sectoral level, the response to additional carbon pricing depends on how the pricing affects future energy prices and assumptions about the price responsiveness of the use of fuel and electricity in each sector. Emissions decline by 1 percent (power), 19 percent (industry), 6 percent (transportation), and 13 percent (buildings) compared to BAU levels.[16] Agricultural emissions (primarily methane and nitrous oxide, rather than CO_2) have a modest price responsiveness at low carbon price levels, but are more costly to deeply abate (see Parry et al (2022b)). However, as carbon pricing even at relatively high levels (e.g., €125 per tonne) does not achieve mitigation targets, reinforcing sectoral policies are required. These are discussed in the subsequent section.

Table 3. Belgium: Sectoral Emissions Outcomes, 2030 Relative to 2005 Levels

			Carbon price (€ per tonne of CO_2eq)					
Scope	Target	2019	0	25	50	75	100	125
Non-ETS	-47	-11	-10	-14	-17	-19	-21	-23
Transport	-27	-3	-6	-8	-10	-12	-13	-15
Buildings		-21	-18	-21	-25	-28	-31	-34
Agriculture	-23	-4	1	-8	-9	-10	-12	-13
ETS		-21	-18	-23	-27	-30	-33	-38
Power		-39	-10	-11	-11	-11	-11	-17
Industry		-21	-24	-30	-34	-39	-44	-48
All		-19	-15	-20	-22	-25	-28	-32
Ren. share	17.5	9.6	17	18	18	19	19	20
Revenue raised (% GDP)				0.2	0.3	0.6	0.8	1.1
Efficiency costs (% of GDP)				-0.1	-0.2	-0.3	-0.4	-0.6
Welfare benefits (% GDP) 1/				0.0	0.0	0.0	-0.1	-0.2
Deaths averted 2/				50	72	93	114	132

Source: IMF Staff estimates using CPAT.

1/ welfare benefits refer to the benefits from reduced air pollution net of losses to consumer welfare caused by higher taxes.
2/ see Parry et al. 2021b for more on air pollution co-benefits.

19. A practical and effective reform for Belgium would be to phase in a carbon price on non-ETS activities and introduce a domestic carbon price floor for those covered by the EU ETS, as international energy prices fall. This would lead to lower post-tax prices, as compared to

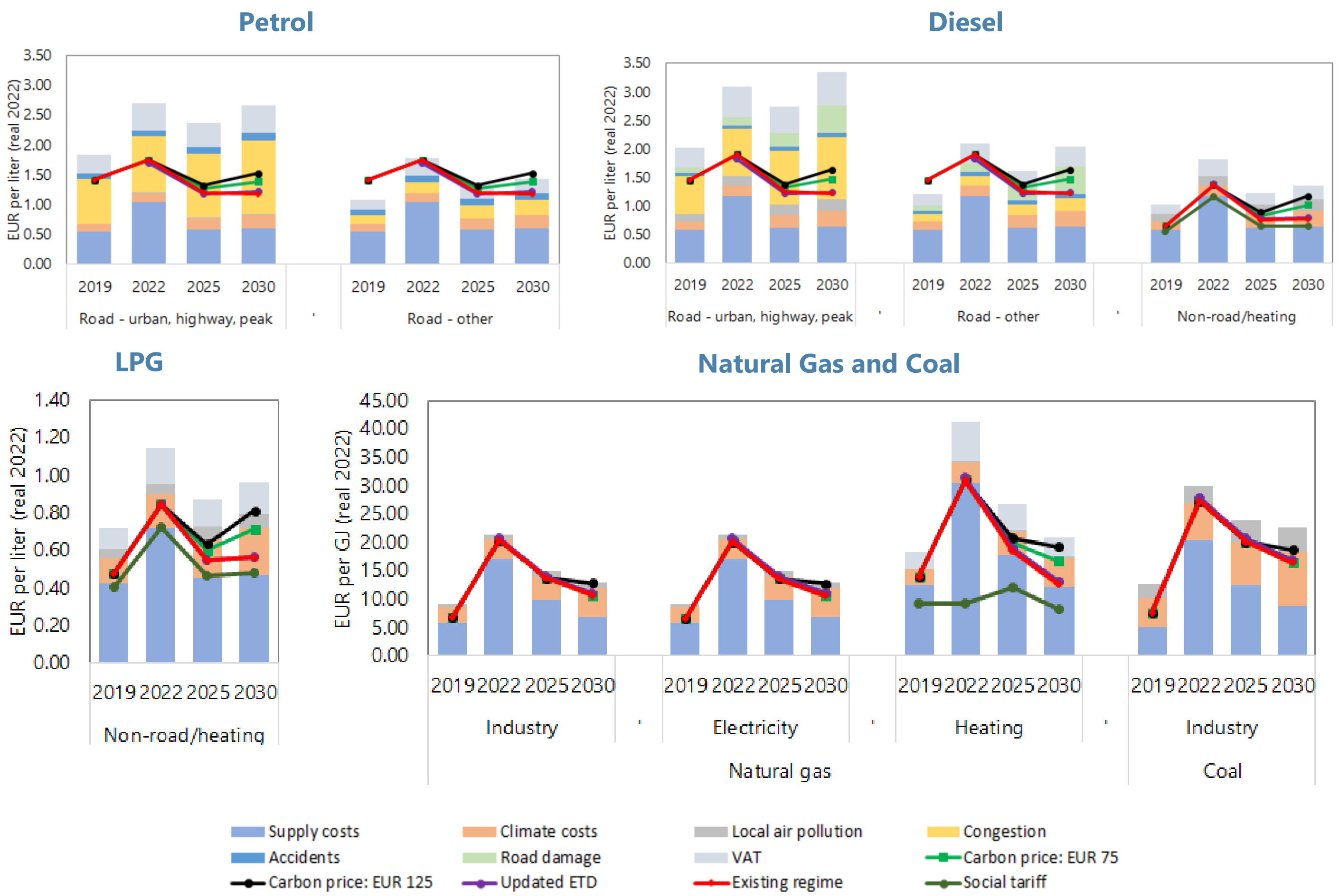
[14] The BAU scenario only considers existing fiscal policies and, thus, does not consider the planned EU ETS for transportation and buildings nor regional renovation obligations.

[15] The efficiency cost of non-pricing mitigation policies is larger but less visible to the consumer and more difficult to quantify. For example, a subsidy for clean technology must be funded through taxes or borrowing—taxes on activities that are beneficial to society (such as working or investment) reduce value-generating activities and, thus, impact GDP and consumption levels, which also lead to efficiency costs but are more difficult to quantify.

[16] Price responsiveness of the power sector, transportation, and buildings are relatively low—due to the slow turnover of the vehicle and building stock—but emissions cuts are still significant, except for power. In the power sector, capacity committed to natural gas through the Capacity Remuneration Mechanism and the fact that the tax only applies above the EU ETS prices limit reductions.

current levels, assuming that international energy prices fall in line with futures markets and would help return the relative price of natural gas to coal closer to pre-crisis levels (Figure 7). The overall tax system, with a carbon tax of €125 by 2030 would nearly result in fully efficient pricing of externalities.[17]

Figure 7. Belgium: Price Impacts of Carbon Pricing, Compared to Efficient Levels

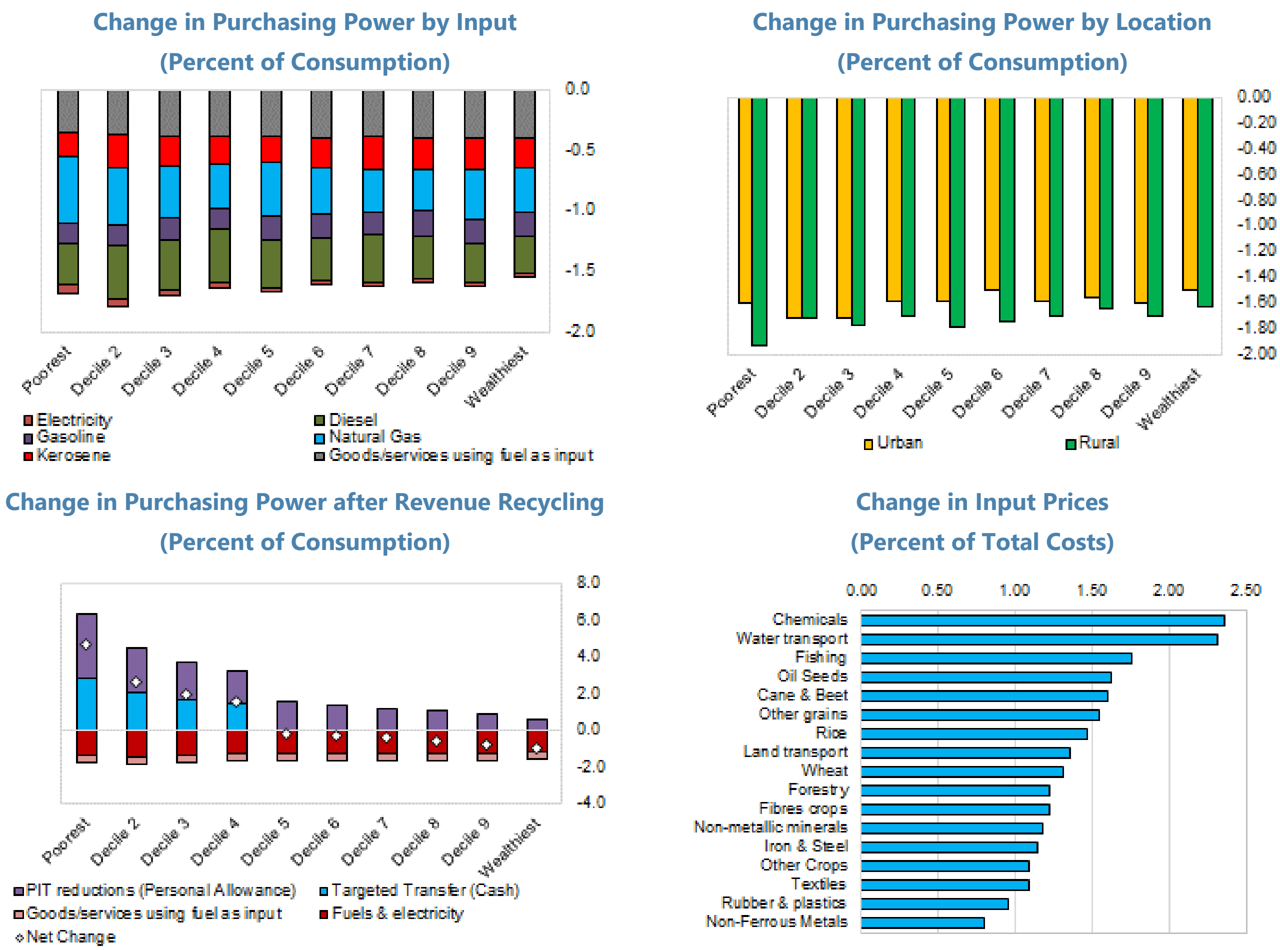


Source: IMF Fossil Fuel Subsidy Database (Parry and others, 2021) and IMF Staff estimates.
Note: This assumes a global warming cost consistent with a least-cost trajectory to meet global temperature stabilization goals (USD 40-60 per tonne in 2020, growing to 50-100 in 2030) Stern and Stiglitz (2017). The ratio of congestion costs between urban roads and highways during peak hours to other road transport roughly aligns with Hoornaert and Steenbergen 2019.

[17] The economically efficient (i.e., first-best) fuel pricing regime includes full passthrough of commodity supply costs (labor, capital, and raw materials), a carbon tax equal to the damage from CO2 emissions (or in line with meeting emissions reduction targets), an excise equal to the cost of local externalities caused by fossil fuel combustion, and the standard VAT rate. Such an economically optimal regime ensures that fossil fuel end-users consider the full, societal costs (supply costs plus externalities) when using fossil fuels, improving the allocation of the economy's scarce resources and in line with the 'polluter pays' principle. Driving related externalities (e.g., congestion) are best addressed through various distance-based charging systems; however, until such systems are comprehensively implemented, fuel taxes remain a valid (albeit blunt) second-best instrument (see the Transportation sector for more).

20. The distributional impacts of a €100 per tonne carbon price are small considering extensive indexation in Belgium (Figure 8). The current system for wage and social benefit indexation automatically protects the average household that uses electricity and/or natural gas for heating since higher energy taxes increase inflation.[18] Ignoring the impact of indexation, the loss in purchasing power of poorer households is slightly higher than that of wealthier households (1.8 percent of total consumption vs. 1.5 percent under a €100 per ton carbon tax) and higher for rural vs. urban households across all income deciles.

Figure 8. Belgium: Distributional Impacts of a €100 per Ton Carbon Tax



Source: IMF staff estimates.
Note: Firms would receive an income tax deduction for their increase in input costs, which would result in a 25 percent (i.e., the Belgium CIT rate) lower change in post-tax costs.

21. Revenue could be recycled through targeted cash transfers to vulnerable households to increase acceptability and reductions in labor and/or corporate income taxes to increase productivity. Setting aside the impact of indexation, around 25 percent of carbon pricing revenue is

[18] For example, indexation compensated for roughly half of the 2021-22 increase in energy prices for the lowest two income deciles and almost fully for those in the top half of the income distribution (Capeau et al 2022).

needed to fully compensate households in the lower four income deciles, leaving around 0.6 percent of GDP in revenue to allocate for other objectives, such as reducing income taxes (Figure 8). Energy intensive firms would see a 1–2 percent increase in input costs due to higher electricity prices and could be supported through reductions in the corporate income tax, investments in productive public infrastructure and R&D, and/or rebates based on output,[19] rather than energy inputs, to maintain incentives for emissions-intensity reductions. Support to vulnerable households should be provided through income-based measures (e.g., cash transfers) and phased out as total income (labor and capital income) or wealth increases. Providing income-based support preserves price signals and allows households to make optimal budget allocation decisions for energy versus other uses. Phasing out support avoids reinforcing the unemployment trap where households lose all social benefits once income crosses a specific threshold; instead, the support would be gradually reduced as income grows. Support should not be conditional on household or firm energy expenditure, as this effectively subsidizes energy inefficiency and increases the costs of investing in emissions (and energy) reductions since doing so would mean losing a portion of benefits. More detail on the design of social protection support is outside of the scope of this report, but could be assessed in subsequent Article IVs or capacity development.

22. It is recommended that a carbon tax for non-ETS sectors be phased in through the excise regime, prior to the planned EU-wide ETS for buildings and transportation, and reaching €100 per tonne by 2030. Also, a price floor for ETS sectors would provide greater certainty for investors and help minimize abatement costs across the economy.

- **There are several benefits to introducing domestic carbon pricing for non-ETS sectors prior to the planned EU-wide ETS (proposed to be introduced in 2027).** These include: (i) non-ETS emissions reductions are needed immediately to meet Belgium's ESR.[20] This would help avoid rapid and more costly decarbonization that may be needed if transportation and building emissions reductions are delayed, and support energy security through reducing fossil fuel use (as well as, avoid financial penalties associated with not meeting annual targets, which has previously created politically difficult arrangements among regional and federal governments); (ii) final design decisions for the EU-wide ETS for buildings and transport are pending, increasing the riskiness of investments in the needed clean technology, such as heat pumps and electric vehicles. Introducing a domestic carbon price alleviates uncertainty, especially if the carbon price path is announced in advance and will subsequently act as a price floor for the future EU-wide ETS (roughly following the approach taken by Germany); (iii) competitiveness and leakage concerns are less pronounced for transportation and buildings (since households and non-industrial firms are not likely to move homes and economic activity across borders due to the tax), meaning that pricing coordination across countries (which will be achieved through the future EU-wide ETS) is not needed; and (iv) the expected decline in

[19] Rebates based on output would need to be phased out as CBAM is phased in to ensure WTO compatibility.

[20] Medium-term emissions responses can be significantly greater than short-term responses for transportation and buildings because, for example, in the medium-term, households can purchase more energy-efficient homes and vehicles and closer to working locations, while short-term responses are more on the margin (i.e., driving less).

international energy prices provides an opportunity to phase-in carbon pricing without increasing post-tax prices.

- **The carbon price should progressively increase to around €100 per tonne by 2030**. This would mirror levels in other countries (Table 2), promote significant emissions reductions (Table 3), and align with the global price needed to achieve warming targets. The price path should be announced in advance, with small annual increases (e.g., €10 per tonne each year) and be adjusted for inflation to maintain its real value.
- **The price should be phased in through introducing a carbon tax element to the existing excise regime.** This approach, as compared to an ETS: (i) would avoid volatility in carbon price levels, in line with Belgian's intention to re-balance from the VAT to excise for natural gas and electricity; (ii) build off the existing excise duty regime and, therefore, could be introduced with a minimal administrative burden and within the federal government's competencies; (iii) be compatible with the EU ETS for buildings and transport once it is introduced and act as a domestic price floor; and (iv) avoids leakage that would be caused by regional mitigation policies and a national ETS (leakage would materialize through lower ETS prices), allowing the regions to effectively maintain their building- and transportation-related competencies and for regional policies to reinforce the cost-effective mitigation promoted by the carbon tax.
- **The tax could be extended to non-carbon GHG emissions (e.g., methane)** if administrative, compliance and political costs can be managed. This would allow abatement costs across GHGs to be equalized and promote cost-effective mitigation. The agricultural sector would see the largest impact (since it is the primary source of non-CO_2 GHGs) and competitiveness concerns would need to be addressed through revenue recycling. Proxy taxes could be used in the medium-term to address administrative and compliance barriers (see Parry et al. 2022b for design considerations).
- **The authorities could use a portion of carbon tax revenues to compensate vulnerable households** through income-based support that is phased out as total income or wealth increases.
- **The authorities should also consider a price floor for ETS sectors** (i.e., power and industry) with the level aligned with the carbon tax for non-ETS sectors. This would provide more abatement cost certainty, promoting investment and equalizing abatement costs across the economy (i.e., cost-efficient, economy-wide mitigation). Revenues generated from industry could be recycled to protect against competitiveness concerns. The price floor could be applied as a surcharge, resembling the U.K. Carbon Price Floor, which imposes a national level variable tax (set for three years in advance) on power sector emissions equal to the difference between an exogenous target price and the projected EU ETS price (Hirst and Keep 2018). The Netherlands is implementing a similar scheme for emissions from the power, but at price floor levels that are likely below the EU ETS level and, therefore, will not be binding.

23. Further, Belgium should promote dialogue at the EU level to strengthen the EU's decarbonization policy framework and promote synergies across countries. Ideally, the EU would have a single carbon price across all sectors as this would remove gaps in the marginal abatement costs among sectors and help cut aggregate emissions in an economically efficient way. Suggestions on ways to strengthen EU-wide policies are:

- **Extend the EU ETS so that aggregate emissions from power**, industry, transport, and buildings are subject to one aggregate cap with a common emissions price across all sectors. This would lead to a more cost-effective balance of emissions reductions across sectors, but would require compensation for lower-income member states with relatively less stringent targets under the current effort-sharing mechanism. Including agriculture emissions would increase economic efficiency but may be administratively infeasible in the near-term.
- **Extend the ability of member states to re-allocate a greater share of emissions reductions from the transport/buildings sectors to the power/industry sectors.** This would lower mitigation costs at the national level, given the much higher cost of incremental abatement in transport and buildings. Such a re-allocation is limited under EU burden sharing rules.
- **Extend the ability to trade ESR quotas between states**, allowing states with emissions reductions in excess of their quota to trade with states not meeting their quota. This would promote cost-efficiencies. A political agreement to do so was reached in late November but details are not yet clear.
- **Establish an exogenous and escalating price floor for both EU ETSs.**[21] Besides providing a critical signal for ensuring that new investment is efficiently allocated to clean technologies, this reform would also allow overlapping measures at the member state level to lower emissions at the EU level (under a pure EU cap these measures only lower allowance prices without affecting EU emissions).

D. Reinforcing Carbon Pricing with Feebates and Other Sectoral Policies

24. Achieving mitigation targets with carbon pricing is likely to require high prices, especially in the transportation and building sectors, which may be politically challenging. Therefore, there is a balance to be struck between economy-wide pricing measures and reinforcing instruments at the sectoral level, which are not as efficient but can have a key role in reducing emissions while avoiding a significant increase in energy prices. Sectoral instruments should be designed flexibly, allowing firms and households to choose responses that minimize costs for a given emissions reduction and (ideally) be technology neutral. Reinforcing instruments can imply differing implicit carbon prices across sectors but can be appropriate as countries move to decarbonize sectors like transport and buildings that are less responsive to carbon pricing and meet sectoral or technology-specific targets (like Belgium's renewable energy share commitment under the EU Renewable Energy Directive).

[21] There is some uncertainty over the legality of an EU level price floor if it is viewed as a fiscal (general revenue-raising) instrument rather than an instrument to support an environmental regulation. Use of allowance auction revenue to support the low carbon transition may help to address this issue (e.g., Cosbey et al 2019).

25. Feebates—revenue neutral tax-subsidy schemes—are a relatively efficient reinforcing policy. Feebates are the fiscal analogue of more traditional emissions-rate regulations and involve financing subsidies to relatively clean activities while taxing relatively dirty ones. They are novel instrument as they would be applied by finance ministries; reinforcing instruments have largely taken the form of regulations to date, which are the more natural instrument when climate policy is under the purview of environmental ministries. Feebates are potentially more flexible and cost effective than emissions-rate regulations given that the latter are only fully cost-effective with extensive credit trading provisions across firms and time. At the same time, feebates can naturally complement and reinforce (rather than substitute for) existing regulations, for example, by rewarding firms for going beyond standards. Also, feebates do not raise average prices for consumers or costs for firms, making them less politically challenging. The discussion below illustrates the use of feebates for transportation, power, buildings, industry, and agricultural sectors, as well as other sector level policies.

Power Generation

26. Decarbonizing electricity production is key to realizing decarbonization. Industry, transportation, and buildings need to electrify several activities, along with improving energy efficiency, in order to reduce fossil fuel use. This switch will significantly increase electricity demand, but will only result in the needed emissions reductions if the emissions-intensity of electricity is low. Analysis shows that there is significant renewable potential in Belgium—for example, there is enough potential onshore wind and rooftop solar capacity to more than double existing electricity demand (EnergyVille 2021)—but improvements to the fiscal and regulatory framework are needed to cost-effectively realize benefits.

27. Belgium currently has a relatively low-carbon electricity grid, but the emissions impact of Belgium's nuclear power phase out needs to be managed. Nuclear power currently makes up 45 percent of generation and provides the largest 'baseload' electricity source (i.e., sources that can reliably provide electricity at any point in time). The nuclear phase-out was legislated in 2003 and is expected to be complete by 2035.[22] Belgium's current policy to ensure enough adequate baseload capacity is the Capacity Remuneration Mechanism (CRM), which provides payments for future capacity guarantees through auctions. The first CRM auction (in 2021) awarded 4.4 GW for delivery in 2025, with 3.6 GW from natural gas and the rest primarily from co-generation and demand-side response. Annual CRM auctions are planned to ensure capacity one and four years ahead. There is a derating factor, which effectively requires lower auction prices for energy sources with less reliability (i.e., renewables). Also, the federal government is undertaking an auction to develop 3.15 to 3.5 GW in new offshore wind generation in Princess Elisabeth Island, and is increasing interconnections to import clean electricity from Norway and Denmark.

[22] The first reactor (17 percent of nuclear capacity) was decommissioned in 2022, and others are planned for 2023, 2025, and 2035.

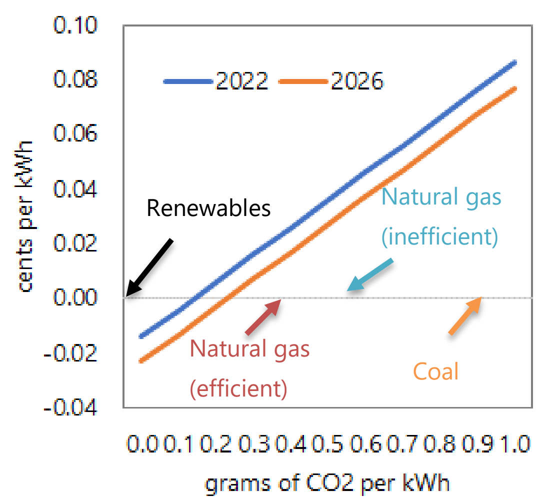
28. A feebate reinforces incentives for shifting to a cleaner power generation mix without a first-order tax burden—that is, a tax on remaining emissions—for the average electricity producer and consumer.[23] Under a feebate scheme, generators could be subject to a fee given by:

$$\{CO_2 \text{ price}\} \times \{CO_2/kWh - \text{industry-wide average } CO_2/kWh\} \times \{\text{electricity generation}\}$$

29. A feebate in the power sector could be practically implemented in Belgium, and could reinforce a price floor on the EU ETS. The scheme could build off existing procedures for monitoring power company emissions under the EU ETS. Nuclear would be exempt given the planned phase-out, and a smoothing mechanism used to determine the industry-wide average emissions-intensity (e.g., a five-year average) to help promote certainty and avoid jumps in subsidies for renewables as nuclear power is decommissioned. For the feebate to be within the federal government's competencies, it could be applied through refundable credits and taxes in the corporate or personal income (PIT) tax regime, which may require additional information sharing between the tax authority and electricity grid companies, or (ideally) as a direct excise/subsidy scheme.[24] A feebate interacts well with the CRM as incentives for capacity would be maintained through the CRM's auction mechanism and derating factors, while the feebate would allow a more market-based, efficient policy to promote low-carbon electricity within the CRM framework.

30. For illustration, a feebate with price €100 per tonne would have applied a fee equivalent to 3 cents/kWh for natural gas and a subsidy of 1.5 cents/kWh for renewables in 2022 (Figure 9). Fees on fossil fuel generation would decrease as nuclear is phased-out since the average emissions-intensity of electricity would increase. To avoid a declining fee on fossil-fuel based generation, the pivot point (i.e., the emissions-intensity that results in no subsidy or fee) could be set exogenously to decline at a rate that would allow Belgium to meet its renewable energy targets.[25] The feebate also promotes more energy efficient natural gas technologies, hydrogen blending with natural gas, and carbon capture, and provides a strong disincentive against coal power generation. It could be applied to

Figure 9. Belgium: Illustrative Feebate for Power Sector



Source: IMF staff estimates.

[23] The feebate would impact electricity prices at times when the marginal supply is powered by natural gas, but lower prices at times when renewables do so.

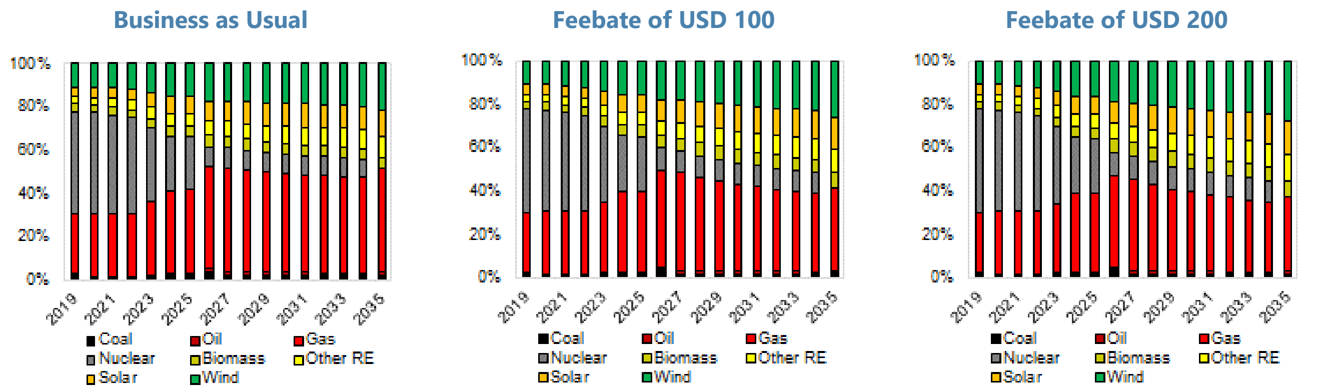
[24] The PIT-related feebate would apply to production and not purchases. For example, a household with a rooftop solar panel would receive X per kWh produced.

[25] Additional analysis is needed to calibrate the specific price level and decline rate.

residential renewable energy production that is connected to the grid; heating using renewables (for instance, rooftop solar PV to heat water) would require a separate policy.

31. Analysis shows that feebates can significantly reduce the emissions-intensity of electricity as compared to the business-as-usual scenario (Figure 10). Switching towards renewables needs to be combined with electricity grid management, demand-side response, and energy storage measures to reduce concerns around intermittency. Importantly, while a feebate would reduce national emissions, they will not (fully) reduce EU-wide emissions if the MSR is not operating since falling emissions in Belgium will reduce the ETS price and result in leakage to other countries and to Belgium's industrial sector.

Figure 10. Belgium: Electricity Mix under Various Scenarios



Source: IMF staff estimates using CPAT.

32. The primary existing clean energy promotion scheme ('Green Certificate Scheme') should be reconsidered.[26] The Green Certificate Scheme effectively results in electricity consumers paying green electricity producers for certificates, which had a cost of €2.4 billion in 2020, and has contributed to growing debt levels for Elia, Belgium's electricity transmission system operator (Cornille and others 2021). The scheme is regressive since wealthier households have a large share of rooftop solar and, thus, residential renewable electricity production; includes several arbitrary design parameters (such as the minimum level of support); and is partly financed through surcharges on electricity bills, which contributes to a higher price of electricity relative to fossil fuels. Feebates could replace the existing scheme to improve the efficiency of incentivizes, while not increasing prices. See Cornille and others 2021 for more analysis on the Green Certificate Scheme.

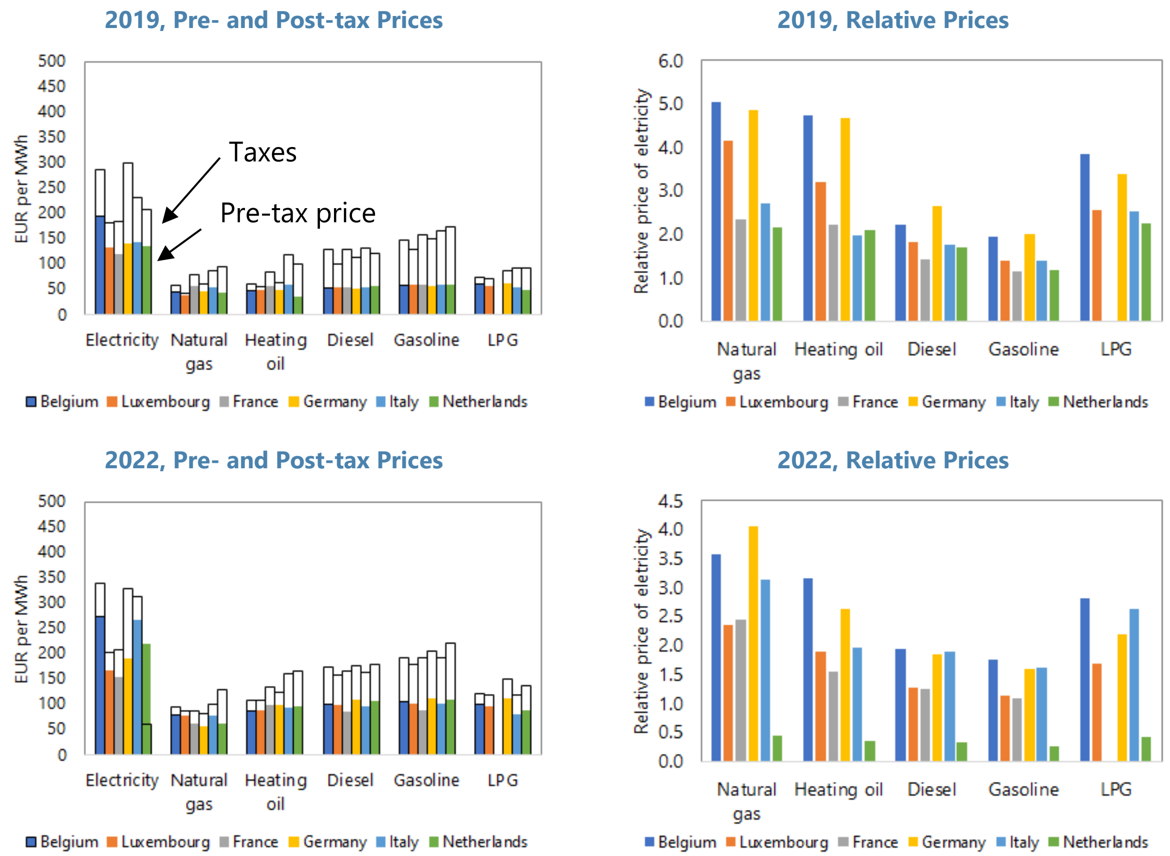
33. Reducing fees and levies on electricity would promote electrification by lowering the price of electricity relative to fossil fuels. The price of electricity relative to heating oil, natural gas,

[26] The current scheme works as follows: green power generators receive certificates as they produce power, energy suppliers purchase enough certificates from generators to meet a quota expressed as a percentage of total electricity supply (there is a minimum certificate price), and suppliers can pass on the cost of certificates to consumers.

The transmission system operator (Elia) is obliged to purchase any surplus certificates at the minimum price, which is reported to result in significant debt for Elia that will eventually be paid for by taxpayers and/or electricity consumers. Certificates are not tradable across regions and each region has its own policy design.

diesel and gasoline is generally higher in Belgium than it is in neighboring countries (Figure 11). The high electricity price reduces incentives to switch from polluting vehicles and heating systems (as well as industrial processes) to electricity.[27] The energy portion of electricity costs (i.e., the cost

Figure 11. Belgium: Relative Price of Electricity



Source: IMF Staff estimates.
Note: assumes natural gas and electricity prices for consumption of 20 to 200 GJ and 2.5 to 5 MWh, respectively. The relative price of electricity is calculated as electricity divided by the other commodity's price.

excluding all fees, levies, and taxes) is on par with that in France, Germany, and the Netherlands (CREG 2021, Deloitte 2022) and, therefore, differences come from charges to recover network costs (such as transmission and distribution), fees, levies, taxes, and (potentially) market power. The full set of electricity charges is not entirely clear, but they do include levies to pay for various programs that are not directly related to the delivery of electricity to end-consumers, such as charges to fund a heating premium, green certificates, and decommissioning of the Mol-Dessel nuclear site (Deloitte 2022). Belgium should gradually remove charges that do not directly relate to delivering electricity to end-users and, instead, finance those measures through the general budget as this will promote

[27] For example, the discounted purchase and electricity cost of a €30,000 electric vehicle would decline by 4.5 percent (9 percent for a €15,000 electric vehicle) if the electricity price declined from €0.29 to €0.19 per kWh.

climate objectives, as well as economic efficiency by better aligning electricity prices with their generation costs.[28]

Industry

34. Industrial emissions contribute 35 percent to Belgium's total emissions, and there are important exclusions from the ETS. The main emitting sub-sectors are chemicals, refining of oil and coke, and manufacture of non-metallic minerals and metals. Emissions are roughly split between direct fuel combustion and industrial processes.[29] About 20 percent of industrial emissions are outside of the ETS due to emissions from installations below the ETS threshold of 25,000 tonnes of CO_2 per year and emissions from biomass being excluded from the ETS. Most excluded emissions occur in the chemical and food sectors and are currently not covered by domestic mitigation policies, with the exemption of voluntary agreements at the regional level (Climact 2018).

35. Feebates could reinforce incentives for cleaner production processes in carbon-intensive industries. The scheme could be like a policy being introduced in the Netherlands and a tradable emissions rate standard in Canada. In this case, firms within an industry would be subject to a fee given by:

$$\{CO_2\ price\} \times \{CO_2/output - industry\text{-}wide\ average\ CO_2/output\} \times \{firm\ output\}$$

36. The feebate, which would be applied to emissions from fuel combustion and direct and process emissions, avoids a first-order burden on the average producer as they pay no charge on their remaining emissions. This helps to alleviate concerns about competitiveness and leakage compared with a pricing scheme that charges for remaining emissions, but is less efficient in reducing emissions because it does not result in a decrease in output. Again, the scheme could build off existing procedures for monitoring firms' direct emissions under the EU ETS, and operate in tandem with voluntary agreements, which are the primary existing domestic policy to promote emissions reduction in the industrial sector.[30] The pivot-point (i.e., industry-wide average emissions-intensity) could be set exogenously based on future projected emissions-intensity if there are concerns around market power, where a few firms have a significant influence on the industry-wide emissions-intensity. The pivot-point could be unique to each sub-sector within industry (i.e., steel) with permit trading across sub-sectors, as this would avoid promoting relatively clean industrial sub-sectors (which could lead to leakage of relatively dirty sectors abroad) while promoting cost-effectiveness.

[28] It is important that such measures are coupled with enhanced policies to promote renewable energy (discussed above) and energy efficiency (a subset of which are discussed in the subsequent section on buildings) to avoid promoting polluting electricity use.

[29] CO_2 is released as a by-product from chemical processes that produce various industrial outputs. For example, a key part of the ammonia (NH_3) production process is to decompose methane (CH_4) into carbon and hydrogen. The carbon then binds with oxygen and is released as CO_2.

[30] Agreements cover the bulk of sectoral emissions and require firms to take actions to reduce energy efficiency and/or emissions reduction, in exchange for tax reductions (IEA 2022). The details of these agreements are not available, but they are reported to have been effective.

Buildings

37. Buildings make up 21 percent of total emissions.[31] Residential buildings are the primary source of building emissions (75 percent), and largely use natural gas and oil for energy. The energy share from oil far exceeds the EU average (32 percent of total energy consumption in Belgium vs. 21 percent in the EU), while renewables (8 vs. 20 percent) and electricity (20 vs. 25 percent) lag. Most energy is used for space and water heating (83 percent), with the remainder for lighting and electrical appliances. Commercial buildings use natural gas for 70 percent of their energy (Climact 2018). Buildings also are the main source of pollutants with local health impacts, such as PM2.5, due to the large share of biomass burned for heating during winter months (7 percent of total household heating in 2020) (Climact 2018, FOD Economie 2022).

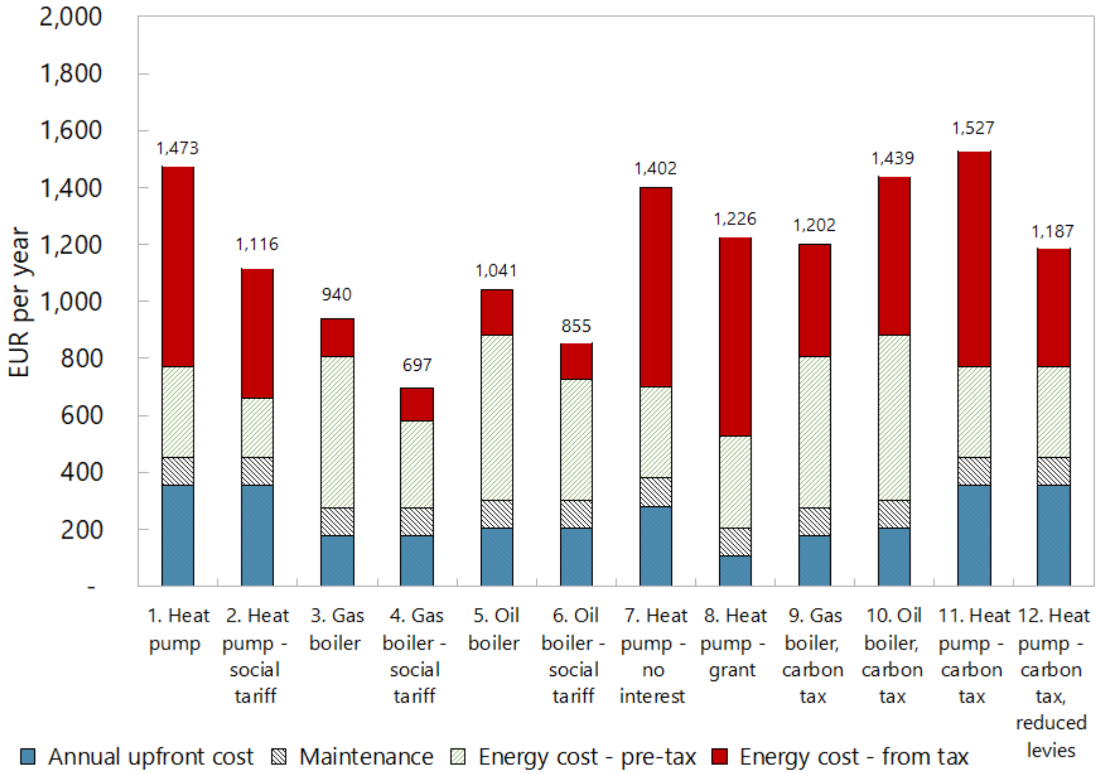
38. Building energy performance, age, and heating methods vary across regions and income levels, suggesting that mitigation policies could have quite heterogenous impacts. Belgium's building stock is relatively old with 80 percent of constructions occurring prior to energy standards across Belgium and 94 percent in Brussels (Climact 2018). Poorer households have worse insulation on all key dimensions, including windows, roofs, and walls, while apartments have much better energy performance, as measured in energy used per area, thanks to their more insulated structure. This results in Brussels having a relatively more energy efficient housing stock due to its large share of apartments, although recently purchased dwellings have similar energy efficiency scores across regions (Reusens et al 2022). The heating source varies significantly, with 16, 24, and 50 percent of houses heated using an oil boiler in Brussels, Flanders, and Wallonia, respectively, partly due to the low share of houses connected to the natural gas grid in Wallonia. Household consumption surveys support these results—for example, households in the lowest income quartile spent roughly eight percent of total consumption on natural gas, heating oil, and electricity, compared to 3.6 percent for the highest quartile in 2018. Heating oil spending is far higher in Wallonia than other regions for all income quartiles.

39. The current policy mix creates disincentives to invest in low-carbon heating; a carbon tax combined with reduced electricity fees and transitioning from a social tariff to income-based support would close the cost gap. Figure 12, which shows the annualized cost of heating across technologies over a 20 year period, illustrates that heat pumps are not cost competitive (column 1) compared to natural gas and oil boilers (columns 3 and 5), assuming pre-crisis price levels.[32] The social tariff significantly reduces costs for electricity, natural gas, and oil (columns 2, 4, 6), while a carbon tax raises all-in natural gas heating costs by about 28 percent (column 9), 38 percent for oil (column 10), and 4 percent for a heat pump (column 11). Removing fees and levies charged on electricity consumption (outside of those covering network costs) reduces heat pump

[31] Building emissions only capture fossil fuel used directly to heat and cool non-industrial buildings and for appliance uses. It does not include emissions from electricity generation (i.e., indirect) or the industrial sector.

[32] Households that are not connected to the natural gas grid (45 percent of households) generally choose between heat pumps and oil boilers, while others choose between heat pumps and natural gas boilers. All systems could be combined with a rooftop solar system to provide additional, low-carbon heating.

Figure 12. Belgium: Illustrative Average Annual Cost of Heating Options



Source: IMF Staff estimates.

Note: assumes air-source heat pumps (95 percent of existing heat pumps in Belgium are air-source), a discount rate of 7 percent, and interest rate of 4.5 percent. The grant is assumed to cover 70 percent of equipment and installation costs. The calculation ignores replacement costs for an existing boiler and assumes that all heating sources last for 20 years. A heat pump likely needs to be combined with another heating source (e.g., solar PV or a fossil fuel boiler) when temperatures drop, but this is not modelled as there are additional incentives provided for solar PV. Results are sensitive to fuel price assumptions—prices are assumed to be at pre-crisis levels and are EUR 0.054 and 0.034 per kWh (natural gas; without and with social tariff, respectively), EUR 0.060 and 0.045 per kWh (heating oil), and EUR 0.290 and 0.189 per kWh (electricity).

costs by 20 percent (column 12). An efficient pricing system of a carbon tax, no social tariff, and network fees and levies in line with neighboring countries would align costs of fossil fuel and electricity-based heating. Revenue gains could be recycled to support impacted households or subsidize low-carbon heating. This would be especially important to help households transition from heating oil to heat pumps due to the large cost increase for heating oil and the possibility that households would switch to biomass use, which has much worse local health impacts. Grants and no-interest loans could help reduce costs (columns 7 and 8). It should be noted that the social tariff makes natural gas heating significantly cheaper than heat pumps, even if the entire capital cost of a heat pump is paid for by government.

40. **The current renovation rate of 1 percent annually needs to increase 2.5 to 3 percent to meet emissions targets, and deep renovations are needed** (Climact 2021). Actions through existing buildings are needed given the very gradual turnover of the building stock and as

requirements for new builds are quite strict. Energy efficiency improvements have been found to significantly influence housing values, indicating that homeowners in general have an incentive to renovate existing or buy new energy efficient households (Reusens and others 2022). However, building refurbishment may still be held back by liquidity constraints (especially for lower income households), cost-benefit mismatches between owners and renters,[33] unawareness or uncertainty of potential energy savings from upgrades, lack of consistency in the criteria for energy performance certificates (EPCs) across regions, and lack of knowledge of long-term EPC requirements. It is unclear whether recently introduced regional policies, which appear to target liquidity and income constraints (through concessionary loans and grants), will promote the needed renovation; this needs to be monitored as well as supply constraints in the construction sector, including labor.

41. Feebates could be used to encourage the phase out of fossil fuel-based space heating, use of more energy-efficient appliances, and building renovations. For household heating, a feebate could take the form of a carbon tax on heating fuels and subsidies for electric or clean-fuel heating systems and energy-efficiency improving renovations. Sales of appliances, such as refrigerators, air conditioners, washing machines, could incur a fee equal to:

{CO_2 price} × {CO_2 per unit of energy} × {energy consumption per unit – industry-wide energy consumption per unit} × {number of units}

For refrigerators, for example, the energy consumption per unit would be kWh/cubic foot cooled (and the number of units would be cubic feet).

42. Property taxes could be linked to energy use per square meter of a building or EPC scores to mimic a feebate, but such a policy would need to be studied in detail to ensure its efficiency. The cost to administer the property tax would increase, as reported energy efficiency or EPCs would need to be audited, and the effectiveness of a tax based on the EPC score would depend on the correlation between EPC scores and CO_2 emissions.[34] It would also be a regressive policy, as poorer households generally live in dwellings with worse insulation (Cornille et al 2021). Federal policy options to implement feebates in this area are limited due to a lack of information and competency.

Transportation

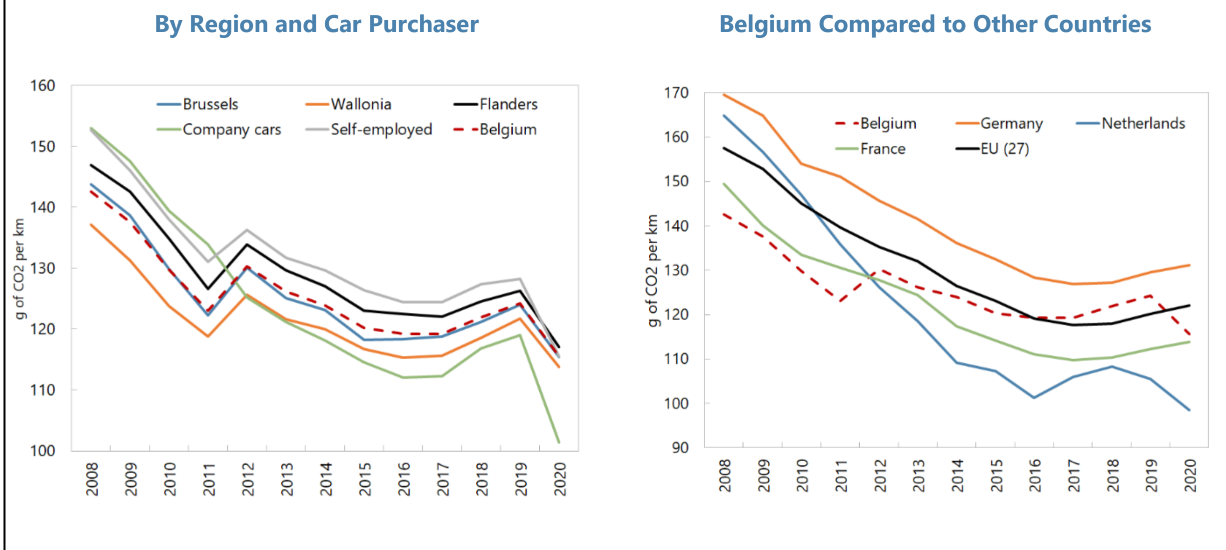
43. Road transportation emissions mainly come from passenger vehicles (75 percent), with road freight making up most of the remainder. Car ownership is similar to the EU average and neighboring countries at around one car for every two people. The share of EVs and plug-in hybrids in new car sales is relatively low (5 percent in 2021), and growth has not accelerated at the pace of neighboring countries. However, the fuel efficiency of new cars is below the EU average at the national and regional level (Figure 13), with company cars driving recent reductions. Statistics

[33] See for example Arregui et al (2020). One-third of residential builders are not owner-occupied, and owners cannot easily passthrough the financial benefits of green investments to renters due to rent indexation.

[34] For example, the energy conversion factor to determine the efficiency of heat pumps is expected to currently be too low, creating a bias against heat pumps when determining the EPC.

indicate modest availability of EV charging stations relative to other EU countries (8.8 charging points per 100 km of road, ACEA 2022b). Belgian lags countries with ambitious EV plans and higher EV uptake, such as Germany (26 per 100 km) and the Netherlands (64 per 100 km). Less than 10 percent of charging stations in Belgium are 'fast' compared to much higher rates in other countries (ACEA 2022b).

Figure 13. Belgium: CO_2 Emissions of New Cars



Source: Federation Belge et Luxembourgeoise de L'Automobile et du Cycle and Eurostat.

44. There are registration and annual circulation taxes applied at the regional level, as well as other policies to reduce transportation emissions. Such policies are especially important since decarbonizing road transportation through carbon pricing alone is difficult due to the political resistance to higher road fuel prices. The design of registration and annual circulation taxes differ by region, with the Flanders and Walloon registration taxes varying based on the vehicle's CO2 emissions-rate and Brussels considering such a policy (IEA 2022). There is also a federal income tax credit of 15 percent of the purchase price up to €5,150 for electric vehicles purchased by individuals available until 2024, and a nationwide scheme that charges heavy commercial vehicles per kilometer travelled. Each region has its own incentive regime for low-emitting vehicles (such as Low Emissions Zones, which prohibit high emitting vehicles from driving in specific areas), as well as requirements to green the public transport and government vehicles stock.

45. The existing tax system for transportation has limited effectiveness for two reasons. First, expressing the registration and annual circulation tax on a lifetime basis, Flanders, Brussels, and Wallonia apply only modest taxes on high emission vehicles, and the relative price of low-emitting, non-electric vehicles is not decreased relative to vehicles with average levels of emissions in Brussels or Wallonia (Figure 14). Second, as the EU emission rate standards are applied to fleetwide average emissions, any shift in demand to low-emission vehicles created by the tax system might be offset by less efforts in reducing emission rates of other vehicles in the fleet.

46. A feebate applied to vehicles, which are paid by consumers, would address both problems. A feebate provides a sliding scale of fees on vehicles with above average emission rates and a sliding scale of rebates for vehicles with below average emission rates. Specifically, vehicle sales would be subject to an annual fee given by:

{CO_2 price} × {the vehicle's CO_2/km – the industry average CO_2/km} × {the average lifetime km driven per vehicle}

47. For illustration, a feebate with price of €400 per tonne of CO_2 would provide the same EV subsidy as at present, but apply a tax of €3,000 to a vehicle with 200 g CO2/km (an increase of around €1,000 for Brussels and Wallonia). Importantly, it would incentivize purchase of low emissions vehicles that are not electric, which are currently not subsidized in Belgium, and could replace the company car regime—the federal government could introduce it unilaterally through personal income tax credits,[35] but ideally would work with regions to harmonize vehicle taxes/subsidy systems and provide any necessary financing. Subsidies for EVs would decline over time as the average fleet emission rate declines, which is appropriate as the cost differential between clean vehicles and their gasoline/diesel counterparts narrows over time (e.g., with improvements in EV battery technology). And manufacturers would be penalized for any increase in emissions for the rest of their fleet in response to higher sales shares for EVs.

Other attractions of feebates include as follows:

- Feebates automatically maintain revenue neutrality despite the progressive decarbonization of the vehicle fleet because the average fleet emission rate in the feebate formula updates; and
- Feebates do not require new data or administrative capacity relative to the existing emission rate program.

48. The generous incentivizes for company cars has been made more environmentally friendly, but further reform is needed, and ideally, the regime would be replaced with a feebate policy. The tax treatment of company cars (i.e., cars purchased by companies and available to employees for private use) creates a significant incentive for employees to be compensated with a car, rather than in cash.[36] Recent reforms include restricting company car eligibility to EVs by 2026 and the introduction of the mobility budget, but it is reported that the take-up rate of the mobility

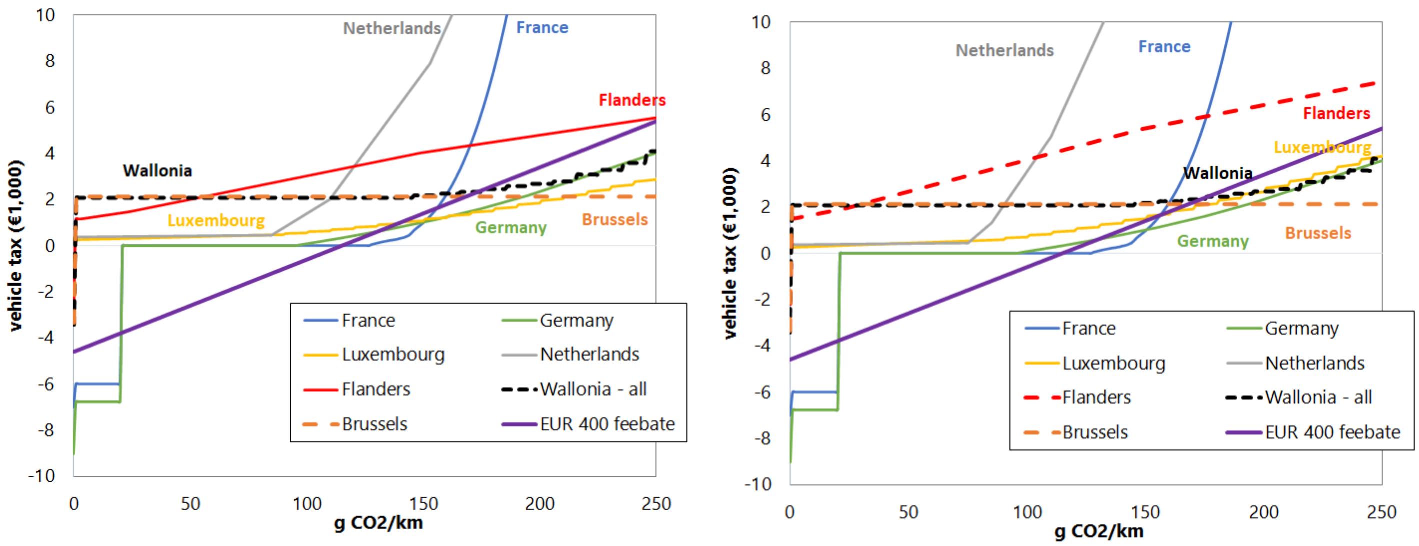
[35] Credits would be preferred to deductions since deductions disproportionately favor those with higher marginal tax rates (i.e., wealthier households, IMF 2021). Credits would need to be refundable to incentive households with low-income tax payable.

[36] The incentive materializes through company cars effectively not subject to VAT (since businesses can reclaim VAT on inputs), costs are tax deductible for the company, and provides an income tax advantage for the recipient since in-kind benefits are not subject to social security contributions. The portion of the company car value that is subject to personal income taxation as in-kind benefits depends on the vehicle's carbon-intensity and will progressively shift towards limiting tax deductibility to only electric vehicles.

budget is low.[37] Ideally, the company car regime would be eliminated as it is regressive (Traversa and Valenduc, 2020), contributes to congestion (around 12 percent of the total vehicle fleet), and is fiscally costly (estimated at around 1 percent of GDP).

Figure 14. Belgium: CO_2-Based Components of Vehicle Taxes

Petrol and Electric Vehicles | **Diesel**



Source: ACEA 2022a, IMF Staff estimates.
Notes: assumes an engine strength of 1,500 cc (average for new Belgian vehicles in 2018, ICCT 2019) and vehicles meet Euronorm 6 standards. Annual Circulation Fees are discounted at 7 percent over 13 years.

49. **Broader reforms using other fiscal instruments could address other transportation externalities in the future.** Transportation externalities, such as congestion, road damage, and accidents, are best addressed through distance-, location- and time-based (i.e., congestion) charges, rather than fuel taxes. The existing heavy duty truck distance-based charge is an example of pricing road damage through a distance-based mechanism. The importance of moving towards such a tax system for transportation grows with EV penetration as EVs contribute to external costs but driving is not discouraged through road fuel taxes (nor are fiscal revenues gained). Moreover, the administrative feasibility of such charges is increasing with technological improvements, such as improved and lower cost global positioning system (GPS) tools. Such policies, at least with respect to congestion,[38] would be within regional competencies but should be coupled with reductions in road fuel taxes (and potentially vehicle registration and annual circulation fees). Moving towards more efficient distance and time-based pricing would, therefore, result in a revenue shift from

[37] The mobility budget allows employers to provide workers with in-kind, tax preferred benefits for low-emissions company cars and other mobility options (e.g., bicycles) and cash for public transport and accommodation near the place of employment, The mobility budget is a minimum of € 3,000 per year and maximum of the lesser of one fifth of gross remuneration and €16,000 per year.

[38] See Hoornaert and Steenbergen 2019 for a quantification of distance and time-based charges in Belgium.

federal to regional governments but still provide the general government with a robust source of revenue from transportation as the base of traditional fuel tax systems is eroded.[39]

E. Conclusion and Summary of Policy Recommendations

50. Carbon pricing coupled with reinforcing sectoral policies would promote emissions reductions at limited economic and administrative costs. Carbon pricing should be the centerpiece of Belgium's the decarbonization policy as it is most efficient and can be easily implemented through the existing excise regime. Price-based, sectoral policies, such as feebates, provide a compliment when exceedingly high carbon prices are needed to meet emissions reduction targets (e.g., in the buildings and transportation sector) or significant non-climate considerations (e.g., nuclear phase-out and industrial competitiveness concerns).

51. Several policies are recommended, with carbon pricing in non-ETS sectors and a price floor for the existing EU ETS ideally prioritized. The full set of recommendations would reduce emissions to at least 20 percent below business-as-usual levels by 2030 (33 percent below 2005 levels) and raise substantial revenue (at least 0.6 percent of GDP) that could be used to support vulnerable households and firms and increase economic productivity.

[39] To more accurately price accident-related externalities, pay-as-you-drive (PAYD) vehicle insurance could be promoted through fiscal incentives at the household or insurance company level. PAYD insurance would work by charging a premium per kilometer travelled, rather than a lump-sum amount, and, therefore, incentivize reductions in driving levels.

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Appendix I. Recent Studies on Climate Mitigation Policies and Other Carbon Taxes in Belgium

Several studies have been published on mitigation policy in Belgium. This annex reviews those by Transport and Mobility Leuven and the National Bank of Belgium (NBB), as well as the National Carbon Pricing Debate of 2018. Additional studies include Climact 2021 and FPS 2019.

A. Transport and Mobility Leuven

1. A study by researchers at Leuven University (Leuven 2022) focuses on carbon pricing for two non-ETS sectors—transportation and buildings. It finds that revising energy taxation to be based on carbon content would reduce transportation and building emissions by 11.3 percent and 14.1 percent, respectively, by 2030 in the context of a reference scenario for a €100 per tonne carbon tax).[1] The tax would raise significant revenues (€2.7 billion by 2030), and revenue could be recycled to improve equity, maintain reduced VAT on electricity, and/or promote economic efficiency, for example, by reducing labor taxes.

2. The study recommends a policy package with a carbon price, revising aligning excise taxes on fuels with the soon-to-be-revised Energy Tax Directive,[2] and recycling revenues through direct income transfers to vulnerable households. Moreover, the study urges that reforms should be introduced as quickly as possible to achieve the necessary emissions reductions in non-ETS sectors, which require long-term investment in clean technologies. The study also suggests progressively introducing the reform as international energy prices fall, as well as ensuring complementarity with other EU, federal, and regional measures.

3. The Leuven study also recommends sectoral-level policies. These include: removing preferential VAT treatment for fertilizer, pesticides, meat, and aviation; a tax on pesticides and fertilizers;[3] phasing out or reduce the reimbursement for commercial diesel; phasing out the preferential tax treatment of company cars and fuel cards; increasing the aviation departure tax; and introducing excises on LPG, compressed natural gas (CNG), and kerosene. The study also states that further work is needed to assess the possibility of increasing the current tax on nuclear energy rents and potentially extending it to other energy sources with high upfront and low operating costs (e.g., renewables), as well as taxation of inland waterway transport.

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[1] The study uses the European Model for the Assessment of Income Distribution and Inequality Effects of Economic Policies (EDIP) to assess emissions reductions from carbon pricing and microsimulations based on the 2018 Household Budget Survey to assess distributional impacts.

[2] The ETD update will impact the level and base of tax rates. Tax rates will be tied to a fuel's energy content rather than volume, rates will be adjusted upward to reflect inflation occurring since the initial ETD in 2003, and subsequently be adjusted annually for inflation, and more fuels will be included (such as kerosene for aviation, heavy oil for maritime, and products used in mineralogical processes).

[3] Fertilizers have climate impacts through during production and directly in their use, as they are energy-intensive to produce and increase the release of nitrous oxide (N_20, which is an important greenhouse gas) from soil into the atmosphere when they are used.

B. National Bank of Belgium

4. The National Bank of Belgium (NBB) study (Cornille et al 2021) finds that effective carbon tax rates are currently relatively low for industry and buildings in Belgium, and that tax rates should be partly linked to the carbon content of fuel consumption. The study suggests that the Green Certificate Scheme, which is meant to promote investment in renewables, is likely not cost-effective, and promoting renewable energy should be done through carbon pricing and subsidies on the capital cost of low-carbon, residential technology. Reducing of the price of electricity relative to natural gas, which is partly high due to extensive surcharges for electricity consumers and low natural gas taxes, would support investment in heat pumps. Current support for heat pumps is relatively low, with subsidies for condensing boilers that use natural gas or oil.

5. Extensive incidence analysis is provided in the NBB study. The share of spending on transportation varies by region and income groups, with more spending on transportation in Flanders and Wallonia and by high-income households. Electricity spending is skewed towards low-income households, but there is significant heterogeneity withing income groups and across regions (lower consumption and similar shares across income groups in Brussels). Natural gas and heating oil spending is higher for low-income groups across all regions. High-income households have houses with better insulation, and one study found that this could be due to financial constraints for low-income households (Heylen and Vanderstaeten, 2019). The conclusion of the incidence analysis is that low-income households would benefit from general income support as carbon prices are introduced, as well as subsidies for clean technology, including concessionary access to financing. The study also notes that environmental tax revenues should not be earmarked but rather spent considering the full set of government objectives.

C. National Carbon Pricing Debate

The National Carbon Pricing Debate (Climact 2018) was launched by the federal government in 2017 and provided a comprehensive evaluation of potential carbon pricing options in Belgium.

6. The evaluation concluded that three principles should be followed when introducing carbon pricing: (i) carbon pricing should be revenue neutral, potentially through reducing labor taxes or electricity charges and levies, or with lump-sum transfers, (ii) the pricing policy should send a credible, long-term signal to direct investments and other input choices towards greener options, and (iii) complementary policies are needed to maximize the benefits of carbon pricing and promote further emissions reductions, as well as address barriers (such as information gaps and principle/agent problems).

- *Buildings:* the study noted that carbon pricing is an efficient way to green residential and commercial buildings, although there is a concern that raising taxes on buildings will disproportionately hurt the vulnerable. Taxes are regressive without compensating measures, and the study suggests either lump-sum transfers or energy vouchers to vulnerable citizens. A secondary option is renovation programs for households, support to SMEs, or lump-sum transfers to every citizen.

- *Transport:* the carbon price should cover all fossil fuels (with the biomass component of fuels subject to taxation using the emission factor equivalent to the associated fuel), with special care given to diesel used for commercial purposes since freight activity is mobile (i.e., subject to leakage and lost economic activity). The study provided two options: (i) including a carbon price on top of the existing excise and limiting the final price of diesel for commercial purposes to that of neighboring countries or (ii) introducing carbon pricing using a 'smart' road pricing system, although this would require time to implement. Other transportation policies (e.g., company cars) should be made consistent with emissions reduction goals.

- *Industry:* non-ETS emissions are 17 percent of total industrial sector emissions—35 and 65 percent are from processes and energy, respectively.[4] The report proposed two options: (i) price all fossil fuel emissions except for those at risk of carbon leakage, for which carbon prices would be limited to the current price difference with neighboring countries, and price process emissions conservatively due to leakage concerns and high abatement costs; and (ii) reform the voluntary agreements of the Walloon and Flemish region to incorporate an explicit carbon price and impose a carbon price on those that do not use the voluntary agreement.

- *Agriculture:* these are some Belgium-specific aspects to consider, including that a relatively large portion of products are trade exposed. Carbon pricing should cover energy-related emissions from non-stationary sources (offroad vehicles and machinery) and use a similar approach for stationary sources (mostly agricultural greenhouses) to that of the non-ETS industry (cap post-tax price levels or implement voluntary agreements). Pricing non-CO2 emissions would be complicated by the difficulty in measuring emissions.

D. Key Modelling Parameters

7. Modelling the emissions trajectory with and without fiscal policies requires several assumptions. The CPAT model is used for this paper and its results are primary dependent on energy price projections (and relative prices across different energy sources), which are driven by international prices and domestic policies; the responsiveness of energy use to prices and income (i.e., elasticities); and energy efficiency improvements from the autonomous technological change. A subset of key assumptions is provided in Table 4 and have been calibrated based on the existing literature and to align model results with that of more complex climate models. Forecasted international energy prices use the average of the IMF's World Economic Outlook and the International Energy Agency's World Energy Outlook (Stated Policies Scenario) and forecasted GDP is sourced from the IMF's WEO.

[4] Specifically, these emissions are from chemicals, food and drinks, textiles, off-road emissions from industry and construction, manufacture of wood products, glass, ceramics, cement, lime, and plaster.

Table 1. Belgium: Key Modelling Parameters						
Energy source	Elasticity with respect to income 1/			Elasticity with respect to price 1, 2/		
	Transport	Residential	Industry	Transport	Residential	Industry
Coal	NA	NA	0.5	NA	NA	-0.2
Natural gas	0.5	0.3	1.0	-0.4	-0.3	-0.4
Gasoline	0.7	NA	0.5	-0.3	-0.4	-0.3
Diesel	0.6	0.5	0.5	-0.2	-0.2	-0.6
Electricity	1.2	0.8	0.8	-0.1	-0.2	-0.2

1/ elasticities are interpreted as the percent change in fuel use that corresponds with a percent change in prices or income.
2/ there are separate cross-price elasticities.