



INTERNATIONAL SUSTAINABLE  
FINANCE CENTRE

# CZECH HEAVY INDUSTRY DECARBONISATION

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## Policy and Financing Roadmap April 2023



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# List of abbreviations

3M	three months	GHD	Gas and Hydrogen Directive
BAU	business as usual	GHG	greenhouse gas
BECCS storage	bioenergy with carbon capture and storage	GVA	gross value added
bil.	billion	GW	gigawatt
BOF	basic oxygen furnace	H2	hydrogen
bps	basis points	HUF	Hungarian forint
capex	capital expenditures	IEA	International Energy Agency
CAGR	compound annual growth rate	IPCC	Intergovernmental Panel on Climate Change
CBAM	Carbon Border Adjustment Mechanism	ISFC	International Sustainable Finance Centre
CCS	carbon capture and storage	kt	kiloton
CCfD	carbon CfD	m(il.)	million
CfD	contract for difference	MF	Modernisation Fund
CCUS	carbon capture, utilization and storage	Mt	metric ton
CCU	carbon capture and utilization	MW	megawatt
CEE	Central and Eastern Europe	NACE	Statistical Classification of Economic Activities in the EC ( <i>from French</i> )
CNB	Czech National Bank	NECP	National Energy and Climate Plan
CO <sub>2</sub>	carbon dioxide	NFRD	Non-Financial Reporting Directive
CO <sub>2</sub> e(q)	CO <sub>2</sub> -equivalent	no.	number
Coll.	Collection of Laws	NRP	National Recovery Plan
CPI inflation	Consumer Price Index inflation	NZ	net zero
CSRD	Corporate Sustainability Reporting	OP TAC	Operational Program Technologies and Application for Competitiveness
Directive		PPI	Producer Price Index
CZ/CZE	Czechia	PRIBOR	Prague Inter-Bank Offered Rate
CZK	Czech koruna	PV	photovoltaic
ČR	Czech Republic	Q	quarter
DG CLIMA Action	The Directorate-General for Climate Action	R&D	research and development
DRI	direct reduction iron	R&I	research and innovation
EA	emission allowance	RED	Renewable Energy Directive
EAF	electric arc furnace	RES	renewable energy source
EBIT	earnings before interest and taxes	RRF	Recovery and Resilience Facility
EBITDA	earnings before interest, taxes, depreciation and amortisation	SEP	State Energy Policy (CZ)
EED	Energy Efficiency Directive	SFDR	Sustainable Finance Disclosure Regulation
EIB	European Investment Bank	SME	small and medium-sized enterprise
EIF	European Investment Fund	SPV	special purpose vehicle
ESG	environmental, social, and corporate governance	TRL	technology readiness level
ESIF	European Structural and Investment Funds	TWh	terawatt hour
ESR	Effort-Sharing Regulation	UK	United Kingdom
ETD	Energy Trading Directive	UN	United Nations
ETS	EU Emissions Trading System	UNFCCC	UN Framework Convention on Climate Change
EU	European Union (27 Member States)	US	United States of America
EUA	EU allowances	V4	Visegrad Group
EUR/€	euro	WAM	with additional measures
EV	electric vehicle	WEM	with existing measures
FCF	free cash flow	WEO	World Energy Outlook
GBER	General Block Exemption Regulation		
GDP	gross domestic product		

# Preface

# Preface

Heavy industries face several specific obstacles to reducing emissions to net zero: the high upfront costs of new low-carbon technologies, long-lived production facilities with often a single renewal window open until 2050, low readiness level of many technologies, and often internationally traded low-margin products – discouraging early adoption of new technologies and carrying the risks of carbon-intensive foreign competition.

This report outlines key aspects on the decarbonisation pathway for the Czech hard-to-abate industries – cement, steel and chemicals – primarily in the 2030 horizon, taking into account the ultimate 2050 net-zero target. The report has two central objectives: to link policy, investment and financing aspects relevant for the Czech heavy industry decarbonisation and to propose solutions to the obstacles that industrial stakeholders may face on the decarbonisation pathway. Investments and financing needs are clearly correlated, and policies, regulatory environment and government incentives and/or levies must also be aligned with decarbonisation targets to be mutually consistent.

The Czech context is specific in Europe: Czechia has the second most industrial economy in the EU. With increasing decarbonisation requirements, the country faces remarkable and politically sensitive challenges. Its landlocked location in Central Europe also limits the country's potential for (wind) renewable electricity generation or large-scale carbon storage compared to other European regions. Thus, Czechia needs to plan its transition to low-carbon growth wisely.

The economic, investment, and financing aspects of the Czech heavy industry decarbonisation have so far been addressed in a limited number of sources. The report aims to encourage policy, investment or financing actions by relevant stakeholders that will support and accelerate the decarbonisation of hard-to-abate industries. It is not intended to be exhaustive, but rather serve as a synopsis for possible considerations, steps, and actions.

It's worth stating that additional studies might be needed, e.g., to assess decarbonisation investments, estimate the financing capacities of hard-to-abate industries, understand the economic viability and competitiveness of new technologies and product opportunities, or outline policy scenarios addressing investment and financing risks.

One can view the decarbonisation of hard-to-abate industries through the lens of production and consumption. While the consumption side also has a sizeable decarbonisation potential through a reduced demand for emission-intensive products, it is addressed in the roadmap

only marginally, with respect to policy tools to stimulate demand for low-carbon product variants. Possible behavioural changes leading to an overall consumption reduction or estimates of changes in sectoral demand and related economic impacts are beyond the scope of this roadmap.

# Executive summary

# Executive summary

## Decarbonisation status

### Heavy industry's importance in the Czech economy

Having rich reserves of lignite and hard coal, Czechia has attracted energy-intensive industries for the past two centuries. With a third of its value added from industry, Czechia ranks second in the list of EU's most industry-dependent countries. The hard-to-abate industries – steel, cement and chemicals – are not major contributors to national added value, but provide necessary inputs for the country's most value adding sectors – automotive, construction or engineering. A failure to maintain industrial competitiveness in decarbonising European markets risks economic and social instability and will only grow resistance to decarbonisation or climate-friendly policies, while exacerbating regional disparities in the country.

### Decarbonisation pathway to date

Over the last two decades, emissions from hard-to-abate industries have decreased mostly due to declining production or decarbonisation of energy (heat) production, while emission intensity from product processing have not changed so much. In any case, major efforts will be necessary to reduce both energy- and processes-related emissions in these industries in the coming years and decades.

### Carbon investment timing conundrum

A vital aspect of decarbonising hard-to-abate industries is the assets' longevity and investment cycle. Often a single renewal window remains open until achieving the intended climate neutrality by 2050. While on the one hand, the timing of decarbonisation investments should maximally match their investment cycle, on the other hand, the gradual phase-out of emission allowances in 2026-34 may push them to realise major investments around this period to offset the negative impact on their profitability and keep up with the competition. Replacements thus need to be carefully considered and planned as capital-intensive renewals freeze emissions intensity for decades. While the cement and chemical sectors may have some time flexibility given their financial position, the steel sector faces a real investment conundrum.

### Desirable national sectoral pathways

Considering the above, sector-specific transition pathways for the Czech hard-to-abate industries are desirable, both in terms of their content and the process of their elaboration. They should address technological options and envisaged regulatory changes and set out the course of actions which will help to achieve a green

transition and improve the sectors' resilience, sustainability and circularity. Structured open consultation processes involving industries, public authorities, and possibly academia or financial industry representatives, whose outcomes could be regularly shared with an informed public, would bring the much-awaited alignment of all major stakeholders and minimise transition risks, inefficiencies or sunk costs.

### Limited information on the economic, investment, and financing aspects of decarbonisation

Sectoral pathways must stem from reliable information sources. While there are numerous sources available on the net-zero transition of the entire Czech economy and its energy sector, as well those focused on global or European industrial decarbonisation including its economic implications, there are a limited number of publicly available sources which address the economic, investment, and financing aspects of Czech heavy industry decarbonisation. Further feasibility studies might be needed, e.g., to understand the economic viability and (prospective) competitiveness of new technologies and product opportunities, or to outline policy scenarios addressing the investment risks and logistical challenges associated with heavy-industry decarbonisation.

### Decarbonisation investment to increase to 2030 and grow further in the 30s

Based on available public sources and ISFC calculations, decarbonisation is estimated to increase investments above business-as-usual levels by at least 10% in the period up to 2029 (i.e. until the last year before the roadmap's 2030 target year). A significantly higher increase is estimated in some cases in the years after 2030 when the decarbonisation investment cycle in hard-to-abate industries is expected to peak.

## Decarbonisation financing

### Sectoral financial situation co-determines decarbonisation capacity

With operating margins above 30%, the cement sector is well positioned to finance the transition investment. The relatively low share of carbon costs in total operating costs and sufficient, albeit volatile, operating profitability provide the chemical sector with some flexibility to adjust the pace of decarbonisation investments to a cyclical business environment. Both the cement and chemical sectors should be able to cover their increased investment needs due to decarbonisation, estimated at approximately EUR 0.3 bil. and EUR 2-4 bil. in 2023-9,



respectively, through a combination of private sources (free cash flow + additional debt capacity) and public sources (grants).

The low and volatile profitability of the steel sector may limit its financing capacity with respect to investments estimated in total at about EUR 1 bil. in 2023-9. The steel market is highly internationalised and manufacturers are exposed to competition also from non-European regions, which affects the sector's financial performance.

### **Low success rate in key grant calls, targeted technical assistance can help**

Most of the public funding available for heavy industry decarbonisation comes from the Modernisation and Innovation Fund. However, the volume of grants provided from the Modernisation Fund to Czech heavy industry has been limited so far. As regards the Innovation Fund, Czech (and CEE) companies have received less funding than would correspond to their share of total EU ETS emissions. It seems Czech companies are applying for less than desired and their success rate is also slightly lower compared to the average. Here, targeted efforts are necessary to mobilise local businesses and increase their success rate in grant calls. Intensive technical assistance could help to reduce the risks of a divergence in decarbonisation efforts between Western and Eastern EU countries, should this trend continue.

### **Industry decarbonisation among the targets for national revenues from EU ETS**

A large part of revenue from the auctioning of EU ETS allowances goes to national budgets, of which at least 50% (to be increased to 100% under the Fit for 55 package) must be used for climate and energy-related purposes. Czechia did not meet the threshold in 2020-21. So far, proceeds have not been used for industry decarbonisation at all. The above non-compliance is reportedly set to change and national proceeds from the auctioning of EU ETS allowances are proposed purely for decarbonisation purposes from 2024.

### **Large companies possibly back in the game for more grants and guarantees**

The limited applicability for hard-to-abate industries with respect to the National Recovery Plan and operational programmes financed by cohesion-policy funds stems from the fact that they predominately focus on other economic sectors or SMEs with low grant caps. In addition to direct financing, guarantees or risk coverage schemes and instruments, blended finance and other forms of

public-private cooperation can support enterprises implementing low-carbon investments, particularly for technologies at the critical stage between pilot projects and full operation. Here too, hard-to-abate industries appear to remain outside the mainstream at both the national and EU level. Most instruments target the SME sector, innovative start-ups or infrastructural projects. In the context of recent developments related to the Green Deal Industrial Plan and the US Inflation Reduction Act, reconsideration is on the table to broaden the target sectors.

## **Decarbonisation policy**

### **Higher EU climate ambitions and carbon prices shake up energy-intensive industries**

The EU's industrial strategies have received renewed interest following the publication of the European Green Deal. Czech companies operating in hard-to-abate industries are watching EU policy developments closer than a decade ago when the emission allowances price was negligible. Here, carbon pricing clearly represents the most significant transition tool influencing investments and financing in hard-to-abate industries. Since 2013, the carbon price has increased tenfold and the outlook to 2030 and beyond foresees further increases, exacerbating the expected financial impact of phasing out free emission allowances by 2034 (although in some sectors being possibly offset by the Carbon Border Adjustment Mechanism, still subject to its specific setting).

### **Role of country strategies within the EU regulatory environment**

More ambitious EU-level targets require closer cooperation between industry and EU and Czech leading policymakers to align climate ambitions, energy policy and technological scenarios within decarbonisation pathways, and to calibrate EU and national operational and funding programs. Thus far Czechia has not been a European frontrunner in climate or decarbonisation ambitions and the related agenda stems mostly from collectively agreed regulations at EU level, which significantly shape the external business environment of hard-to-abate industries.

Czech strategies and policies' implementation may, however, be locally specific and reflect the unique conditions of industry, energy, and environmental development in the country. Obviously, clear and consistent policies will help to reduce uncertainty for businesses on their decarbonisation pathway, such as the availability of renewable electricity, carbon storage regulatory framework or renewable hydrogen production and transport.

## **Highly industrial Czechia awaits a national industrial strategy**

Paradoxically, the highly industrial Czechia lacks a comprehensive national industrial strategy that would provide a transparent and predictable framework to support business planning in the context of the European Green Deal. The forthcoming strategy is required to clearly describe the vision of a resilient industry in a future decarbonising (decarbonised) and competitive environment, as well as the tools and measures that can be used alongside possible pathways, and the actions to support both the supply and demand side of decarbonising (decarbonised) heavy industry.

## **Energy and climate policies updates redefine the heavy industry framework environment**

The Climate Protection Policy, the State Energy Policy, and the National Energy and Climate Plan are currently under review, as they have been calibrated to the older national and EU ETS emission targets which have since been significantly revised. All these policies are crucial documents for hard-to-abate industries as they frame the overall business environment. Additional measures will clearly be needed to meet the new 2030 targets, including faster emission reductions (as almost 50% of free allowance will be phased out by 2030), earlier coal phase-out in the 30s, sufficient availability of renewable electricity, transmission grid modernisation due to increased share of renewables and (clean) electricity use by heavy industry, new energy import strategy, etc.

Also, the Czech hydrogen strategy update and more elaborated considerations on its deployment (capacity and timing scenarios) and hydrogen availability in the European context would give market participants more clarity and de-risk their deep decarbonisation strategic planning. Currently, the consumption assumptions in the strategy do not fully match those of hard-to-abate industries. And while bulk hydrogen imports will clearly be needed, hydrogen transport and storage infrastructure is only loosely addressed in the strategy.

## **Carbon capture use & storage strategies missing at both EU and country level**

Hard-to-abate industries also lack carbon capture use and storage strategies. At the EU level, the deployment of inter-regional transmission networks is expected to be outlined, while the lacking national strategy needs to address country-specific options, priorities, risks and opportunities (cross-sectoral cooperation, etc.). This is particularly true for Czechia as a landlocked country, with only a few obvious opportunities for clustering, as high transport costs may hinder technology deployment. Both

strategies will provide industrial stakeholders with a foothold on the long-term outlook and deployment strategy.

## **Demand side measures can get consumers to choose low carbon**

Public authorities are expected to leverage their tools to stimulate demand for low-carbon products that might initially be priced out by competing with less costly, simultaneously available carbon-intensive products. These include the systemic implementation of green public procurement rules in the buildings and construction sector, improving data transparency to accurately determine the product carbon content, or labelling schemes reflecting the environmental impact of intermediary industrial products.

Separately, given accelerated technical development, regulators are expected to flexibly and more frequently revisit and update existing standards and regulations, such as in the case of the clinker-to-cement ratio, construction materials standards, or applications of carbon capture and its geological storage. Horizontal collaboration across governmental agencies and with research and development institutions and companies will be important for timely standardisation and regulatory adoption.

# Current status

# Current status

Having abundant reserves of brown and black coal, Czechia has attracted energy intensive industries for two centuries. However, with increasing decarbonisation requirements, the country faces significant and politically sensitive challenges. With its landlocked location in central Europe, Czechia has less potential for (wind) renewable electricity generation than other European regions. It will need to plan its transition to low-carbon growth carefully.<sup>1</sup>

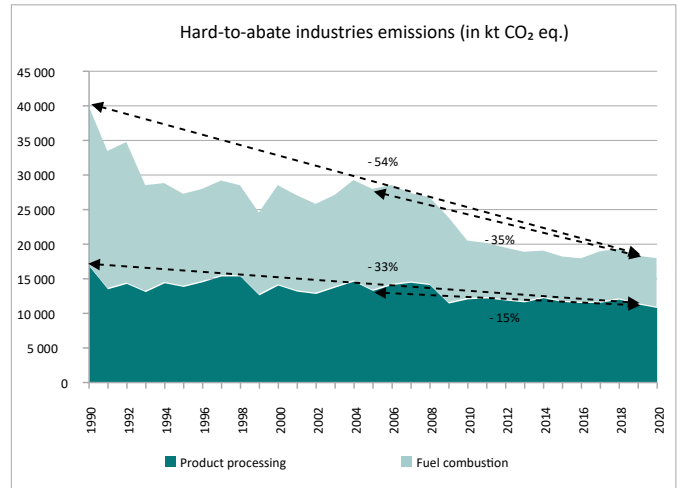
With one third of its value added from the industrial sectors in 2020, Czechia ranks second in the list of EU's most industry-dependent countries.<sup>2</sup> Hard-to-abate industries – steel, cement and chemicals – are not major contributors to the national added value, but provide necessary inputs to the country's most value adding sectors – automotive and construction. With 120,000 employees in supply chains, any failure to maintain industrial competitiveness in decarbonising European markets threatens to create major economic, social or political instability while fuelling a potential backlash to decarbonisation or climate-friendly policies, and deepening regional disparities in Czechia.

The course of industry decarbonisation in Czechia has had two distinctive features: (i) a reduction in emissions from energy (heat) production rather than from the product processing itself, and (ii) two significant drops in

emissions after economic shocks, driven largely by production declines, and a relatively steady development in between. Half of the decline occurred in the three years following the collapse of the country's central planning

system in 1989. Another major drop followed the financial crisis in 2008.

Chart 1: Industry emissions development in Czechia



Source: ISFC based on UNFCCC data

## Cement sector

<b>Emissions</b>	<b>5.9 Mt CO<sub>2</sub>e</b>
<b>GVA weight</b>	<b>1.1%</b>
<b>Employment</b>	<b>0.06m persons</b>

\* 2020, incl. other minerals (lime, ceramics, glass) and fuel-combustion emissions (Scope 1), GVA weight = share of the mineral segment in the total Gross Value Added.

Source: 2020, UNFCCC emissions data, Eurostat GVA and employment data (annual national accounts)

Table 1: Cement producers in Czechia

Company	Parent group	Cement plants	Emissions (CO <sub>2</sub> e k tons, 2021)	Sales (CZK billion, 2021)
Českomoravský cement	Heidelberg Materials	Mokrá, Radotín	1,232	4.2
Cement Hranice	Buzzi Unicem	Hranice	577	2.0
CEMEX Czech Republic	CEMEX	Prachovice	545	4.3*
Lafarge Cement	Holcim	Čížkovice	468	1.7

\* The cement and concrete businesses merged within CEMEX Czech Republic in 2018, separate data for the cement business is not available.

Source: EU ETS, company web pages, justice.cz

1 For further reflections on the obstacles to unlocking industry from fossil dependency, see for example: Unlocking the "Hard to Abate" Sectors, WRI, available at: <https://www.wri.org/climate/expert-perspective/unlocking-hard-abate-sectors>

2 Gross value added by economic activities, Eurostat, 2020: <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211021-1>

## Sector structure

Cement production sits in the high-emitting industry processes. The sector’s product is homogenous and often referred to as Portland-type cement. Companies convert calcium carbonate, typically limestone, into clinker, an intermediate product to cement. This process requires temperatures up to 1450°C and produces about half of cement-plant’s total GHG emissions depending on the feedstock used.

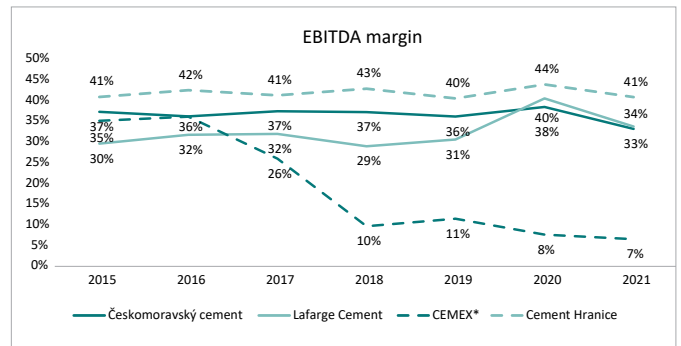
The sector contributes 5% to the country’s total GHG emissions, a touch lower than the global share of 7-8% according to market data provider Global Cement. Cement manufacturing has about a 1% share in national gross value added and employment. Four large European cement producers have their presence in Czechia – see Table 1.<sup>3</sup>

## Financial situation

Unlike other high-emitting industries, cement is not widely internationally traded and remains a local product due to transport limitations and weight-to-value considerations. European countries typically have production capacities matching their construction needs keeping the carbon leakage risks contained. Cement exports (as well as imports) represent approx. 13% of the country’s production.<sup>4</sup>

As Chart 2 shows, the above is reflected in high margins, profits and good financial health of the Czech cement operations, placing them in a good position to invest in decarbonisation. The sector-wise EBITDA margin ranged rather steadily between 35% and 40% in the last years. For further information see also the Private resources: Cement sector sub-chapter.

Chart 2: EBITDA margin of cement producers



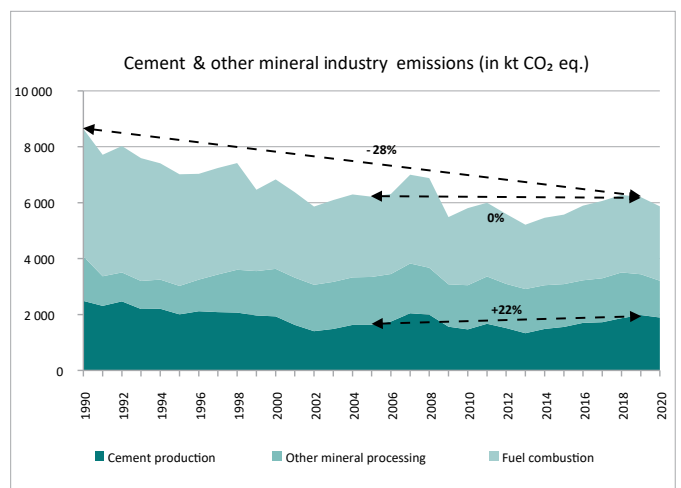
\* CEMEX’s financials have been influenced by intra-group mergers since 2017, the cement and concrete businesses merged within CEMEX CR in 2018; separate margin for the cement business is unavailable.

Source: ISFC based on company annual reports

## Emissions

Under the EU Emissions Trading System (ETS), the cement industry benefits from free allowances (and will continue to do so until their complete phase-out in 2034). Total emissions of the cement sector exceeded the level of free allocation granted under this scheme by 20-30% in recent years.<sup>5</sup> Since 2005, the total emissions in the mineral industry have remained unchanged, but emissions from cement production processes increased by 22% until the last pre-COVID 19 year in 2019.

Chart 3: Cement & other mineral industry emissions in Czechia



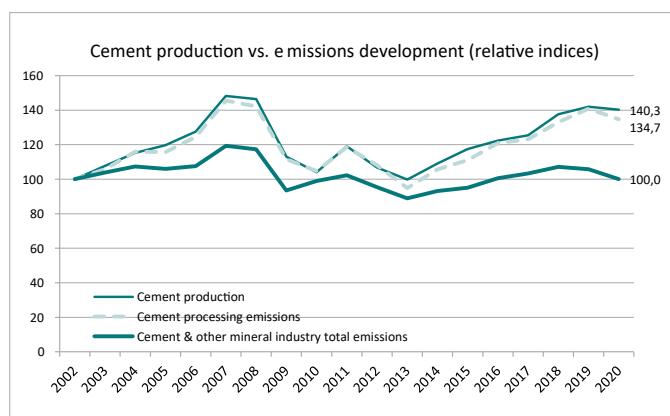
Source: ISFC based on UNFCCC data

<sup>3</sup> Country-level data on facilities is available from CEMNET: <https://www.cemnet.com/global-cement-report/country/czech-republic>  
<sup>4</sup> <https://www.svcement.cz/data/data-2022/>

<sup>5</sup> Total emissions are to be understood Scope 1 emissions in this Roadmap.

Decarbonisation gains stemming from the gradual reduction of the clinker-to-cement ratio were modest. Over the past almost 20 years, carbon abatement of the cement-production process in Czechia has been practically nil, as shown in Chart 4. The transition from coal to alternative feedstock is slowly gaining traction, but the impact on overall emissions is limited. The reduction in fuel-combustion emissions contributed a third of the difference of total mineral-industry emission's slope vis-a-vis cement production shown in Chart 4, while most of the reduction can be attributed to declines in emissions from the lime sector and other process uses of carbonates.

**Chart 4: Cement production vs. emissions development**



Source: ISFC based on Svaz výrobců cementu ČR and UNFCCC data

### Decarbonisation effort

International conglomerates have been able to market novel cement types and engage in projects to create demo plants for new technologies. All these top-tier parent companies have made decarbonisation commitments for 2030 and are aiming for net zero emissions by 2050. In doing so, they seem to have taken different paths, for example Heidelberg is currently focusing on CCUS technologies and circularity, Holcim also has CCUS projects but it leans more heavily into a business profile change by 2025.

Energy efficiency, fuel switching, and clinker reduction projects have demonstrated feasibility and cost benefits. However, chemical reaction-related emissions cannot be eliminated through fuel switching or electrification, as these two will only address the emissions that stem from heat generation. Bioenergy with carbon capture and storage (also dubbed as BECCS) and the introduction of new binders are emerging as strategies to achieve deep decarbonisation by 2050. Although top international companies, who own much of the global capacity, are pushing the envelope, scaling up breakthrough technologies remains a challenge for the sector.

More information about key investments areas can be found in the Investment needs chapter.

## Chemical industry

<b>Emissions</b>	<b>4.1 Mt CO<sub>2</sub>e</b>
<b>GVA weight</b>	<b>0.8%</b>
<b>Employment</b>	<b>0.03 persons</b>

\* GVA weight = segment share of total Gross Value Added; emissions incl. refining and fuel-combustion emissions, GVA and employment w/o refining as NACE data is provided only for refining together with coke production

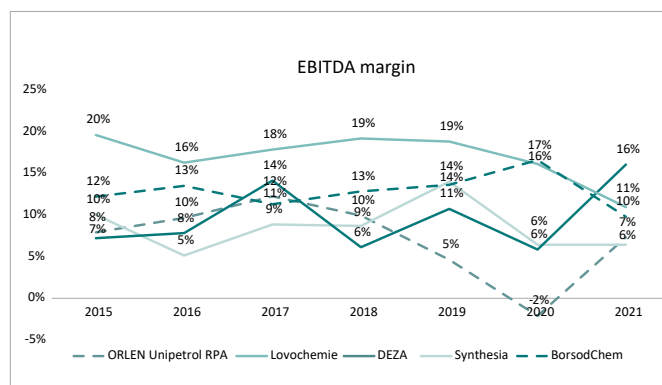
Source: 2020, UNFCCC emissions data, Eurostat GVA and employment data (annual national accounts, NACE-20)

### Sector structure

The Czech chemical sector, including petrochemicals, is represented by a single main producer, ORLEN Unipetrol RPA from the ORLEN Group, and numerous mid-to-small downstream producers. It is distributed rather unevenly across the country, mostly on the Elbe in Bohemia and on the Oder and Morava rivers in Moravia. The sector contributes less than 4% to overall GHG emission and less than 1% to GVA and employment in Czechia.

Besides oil refining, polymers like polypropylene and polyethylene account for the largest share of production – almost EUR 0.7 bil. in 2020, followed by synthetic rubber with production over EUR 0.25 bil. On the contrary, ammonia production is limited in Czechia. An overview of the major producers and their business focus is given in Chart 5: EBITDA margin of major chemical producers.

**Chart 5: EBITDA margin of major chemical producers**



Source: ISFC based on company annual reports

The sector is currently challenged by high energy and fuel prices while softer business demand may limit the pass-through of the higher costs to consumers. Over the longer term, the region's chemical industry would benefit from weaning itself off natural gas. Access to low-cost

gas in the region rendered petrochemicals and fertilisers as one of the fastest growing areas recently.

The looming fossil fuel supply shocks and physical climate risks (water levels, extreme weather, and heatwaves) may put a dent in the sector’s profitability and curtail production. If the prices stabilise at higher levels, compared to the pre-energy-crisis prices, local producers’ competitiveness will wane. To increase global competitiveness, not only do they need to diversify their operating footprint but also their product portfolio. Specialisation in low carbon technologies and biobased products offer a pathway to increase the value added while adding operational flexibility.

## Emissions

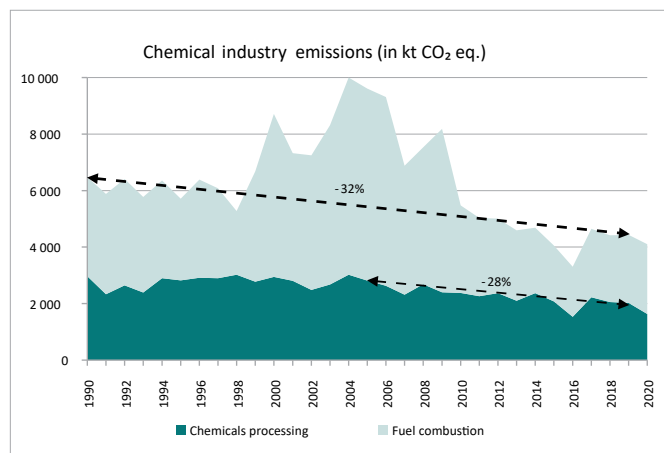
In the broader chemical sector (incl. petroleum refining), fuel consumption contributes about 60% of GHG emissions, as shown in Chart 6. The remaining emissions stem from fossil inputs used directly in chemical reactions during production. Production of high-value chemicals such as olefins (ethylene, propylene, butadiene), aromatics, as well as methanol or carbon black have the biggest emission footprint in the chemical downstream.

## Decarbonisation effort

Decarbonisation efforts have been moderate in the chemical industry in Czechia. Compared to 1990, emission of the chemical sector had decreased by 32% by 2019, or by more than 1% annually in average, as shown

in Chart 6.<sup>6</sup> At this decarbonisation pace, emissions would decrease by 41% until 2030, i.e. well behind the -55% EU-level overall target.

Chart 6: Chemical sector emissions in Czechia



Source: ISFC based on UNFCCC data

Chart 7 shows that emissions related to production processes have decreased more slowly than total emissions of the chemical industry (including from fuel combustion) over the past two decades. Thus, decarbonisation efforts appear to have focused on energy (heat) production.<sup>7</sup> Still, the process emissions decline could be due to slightly improving emissions intensity.

Table 2: Major chemical producers in Czechia

Company	Parent group	Key product categories	Emissions* (CO <sub>2</sub> e k tons, 2021)	Sales (CK bil., 2021)
ORLEN Unipetrol RPA	ORLEN, Poland	refinery, petrochemical and agrochemical products	4,244	124.5
Lovochemie	AGROFERT, Czechia	nitrogen-based fertilizers	330	6.2
DEZA	AGROFERT, Czechia	raw tar, benzole	288	9.3
Synthesia	AGROFERT, Czechia	nitrocellulose, pigments & dyes, organic chemistry	224	4.2
BorsodChem MCHZ	Wanhua Chemical, China	artificial sweeteners, water treatment chemicals, polyurethane	151	5.4
Synthomer	Synthomer, UK	acrylic acid, monomers	136	3.7
PRECHEZA	AGROFERT, Czechia	inorganic pigments	95	3.8
SPOLANA	ORLEN, Poland	caprolactam, PVC, sulphuric and hydrochloric acid	82	5.6

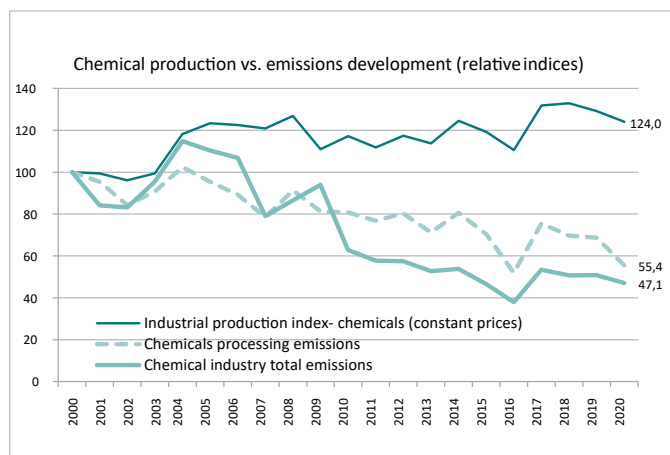
\* EU ETS Emissions including energy (heat) sources

Source: EU ETS, company web pages, justice.cz

<sup>6</sup> The latest available data for 2020 was affected (biased) by the COVID-19 outbreak, the 2019 data is therefore used instead.

<sup>7</sup> An example is the installation of a new heating plant fuelled by gas instead of coal in Spolana Neratovice in 2020; see <https://www.hybrid.cz/spolana-neratovice-ma-novou-teplarnu-vyrazne-snizi-emise/>

**Chart 7: Chemicals production vs. emissions development**



Source: ISFC based on Czech Statistical Office and UNFCCC data

While the cost of emission allowances has formed a small part of chemical companies' cost base, the increased price of carbon puts pressure on company profits going forward. Deep decarbonisation would require the deployment of multiple innovations. Fuel switching, electrification, adoption of circularity business concepts, green hydrogen, and carbon capture and utilisation (CCU) technologies should move in tandem to achieve the ambitious net zero pledges. However, looming uncertainty around scalability and operating costs of the best available technologies creates an investment conundrum.

## Iron & steel industry

<b>Emissions</b>	<b>7.8 Mt CO<sub>2</sub>e</b>
<b>GVA weight</b>	<b>0.9%</b>
<b>Employment</b>	<b>0.05m persons</b>

\* 2020 data incl. fuel-combustion emissions, GVA weight = share of the basic-metal segment in the total Gross Value Added  
Source: 2020, UNFCCC emissions data, Eurostat GVA and employment data (annual national accounts)

### Sector structure

The iron and steel sector is dominated by two large steel producers in the Silesian region – see Table 3 for details. The sector contributes 7% to overall GHG emission and less than 1% to GVA and employment in Czechia.

In 2022, annual production reached 4.2 mil. tonnes of crude steel in Czechia, down by 11% from 4.7 mil. tonnes in 2021. Exports and imports decreased by 18% and 20% to 4.0 and 6.6 mil. tonnes, respectively, the lowest

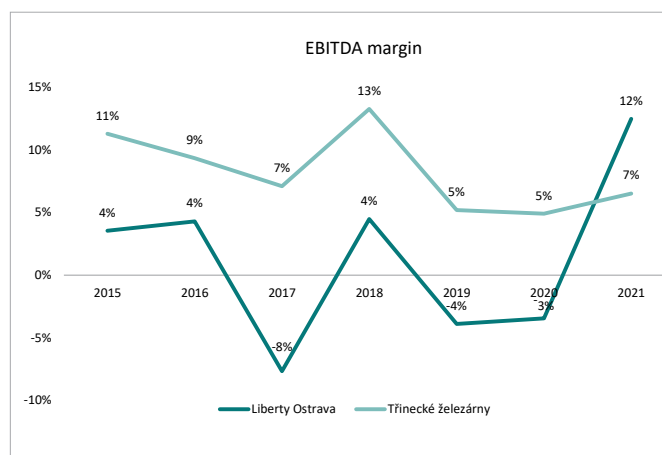
export volume from 2009.<sup>8</sup> While low-value-added steel products are imported, local manufacturers focus on and export higher-value-added goods: seamless tubes, long products, high-quality steel, etc.<sup>9</sup>

### Financial situation

Due to the lower proportion of transportation costs in the final price, it pays off to transport steel over longer distances. The global steel market is therefore highly integrated and manufacturers are exposed to competition from other regions. The ramping up of production capacity in China at the beginning of 2015 contributed in the following years to intense global price competition and a considerable increase in steel imports to Czechia at the expense of local production. Global steel facilities have been utilised at 70-80% of their capacities in recent years.<sup>10</sup>

The above affected the financial results of both Czech steel producers. Třinecké železářny's sales grew by an average of only 3% per annum in 2015-21, while Liberty Ostrava's sales even plummeted by -4% per annum over 2015-20. Profitability in the Czech steel sector has been mostly low, with EBITDA margins falling to about 5% at Třinecké železářny and turning mostly negative at Liberty Ostrava over 2017-20, only returning to positive territory in 2021 – see Chart 8 for details.<sup>11</sup>

**Chart 8: EBITDA margin of Czech steel producers**



Source: ISFC based on company annual reports and press releases

<sup>8</sup> Steel Union, 2023, see <https://www.ocelarskaunie.cz/spotreba-i-vyroba-oceli-v-cr-i-eu-loni-klesla-vyhled-je-nejisty/>

<sup>9</sup> Konkurenceschopnost českého ocelářského průmyslu, Svaz průmyslu a do pravy ČR, 2022, available at: [https://www.spcr.cz/images/mat\\_Konkurenceschopnost.pdf](https://www.spcr.cz/images/mat_Konkurenceschopnost.pdf)

<sup>10</sup> Capacity Utilization: Manufacturing: Durable Goods: Iron and Steel Products, FRED St. Louis FED, 2022, available at <https://fred.stlouisfed.org/series/CAPUTLG3311A2S>

<sup>11</sup> Liberty Ostrava prolonged its financial reporting period to 18 months in 2019, stretching from 1.1.2019 to 30.6.2020, and shortened it to 9 months in 2021, from 1.7.2020 to 31.3.2022. All the metrics were (linearly) recalculated to 12-month calendar-year periods to ensure their comparability with other analysed companies.



Table 3: Major players in the Czech steel industry

Company	Parent group	Key product categories	Production (m tons, 2020)	Emissions (CO <sub>2</sub> e k tons, 2021)	Sales (CZK billion, 2021)
TŘINECKÉ ŽELEZÁRNY	MORAVIA STEEL, Czechia	long rolled products: wire rod, steel bars, drawn steel, rails, seamless tubes	2.4	2,533	43.7
Liberty Ostrava	LIBERTY Steel Group, UK	hot rolled coils, sheets sand strips, road barriers, merchant bar & sections, wire rods	2.3	3,138	27.0

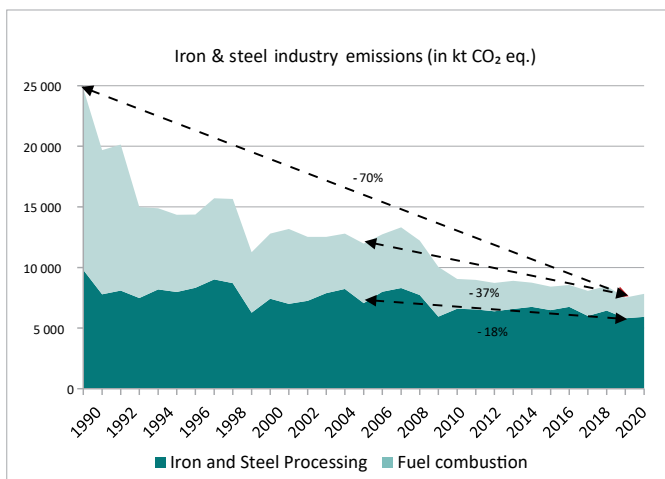
Source: EU ETS, company web pages, justice.cz

Note: Annualized sales of Liberty Ostrava extrapolated from 1/2019-6/2020 and 7/2020-3/2021 financial statements

### Emissions historical development

Between 1990 and 2019, the sector’s emissions fell by 70%. However, almost half of the decrease occurred in the three years following the country’s central planning system collapsed in 1989. Thereafter, emissions continued to decline by about 3% annually on average.

Chart 9: Steel sector emissions development in Czechia

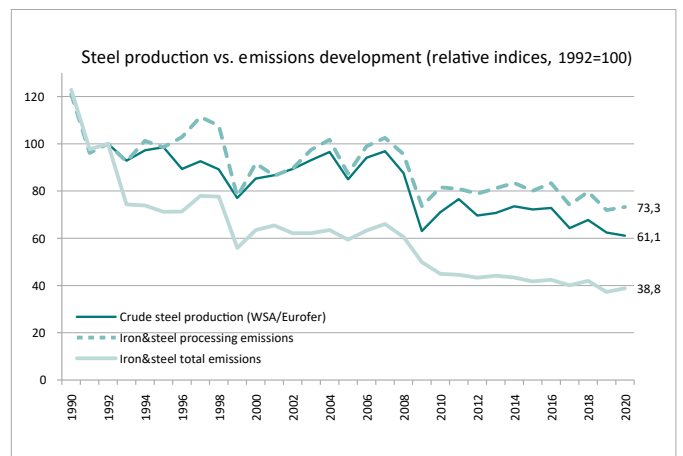


Source: ISFC based on UNFCCC data

As evident from Chart 9, the emissions decline has been mainly driven by the decarbonisation of energy (heat) sources rather than steel production processes.<sup>12</sup> While about 60% of GHG emissions were related to fuel consumption in 1990 (and the remainder to metal processing itself), today this stands at about 24%. With regards to process-related GHG emissions, Chart 10 shows that their decrease has been caused by declining production rather than decarbonisation measures.

<sup>12</sup> Fuel combustion CAGR -7.3% vs. production processes CAGR -1.4% in 1990-2019.

Chart 10: Steel production vs. emissions development



Source: ISFC based on World Steel Association, Eurofer and UNFCCC data

### Decarbonisation outlook

The sector participates in the EU ETS, with companies receiving free allowances (as they are exposed to competition from countries without carbon pricing) which provide them with an additional income source. With free allowances gradually phasing out over 2026-34, all steelworks are in imminent need of major climate-related capex to decrease their carbon intensity (any offsetting effects of the Carbon Border Adjustment Mechanism are still subject to the specific setting of its terms).<sup>13</sup>

Třinecké železářny plans to halve its CO<sub>2</sub> emissions to 2.4m tons by 2030; it has not disclosed a plan for full decarbonisation.<sup>14</sup> Liberty Ostrava plans to invest in hy-

<sup>13</sup> For more details on the sector’s decarbonisation ambitions at EU level refer to Low Carbon Roadmap: Pathways to a CO<sub>2</sub>-neutral European steel industry, 2019, the European Steel Association (EUROFER), available at: <https://www.eurofer.eu/assets/Uploads/EUROFER-Low-Carbon-Roadmap-Pathways-to-a-CO2-neutral-European-Steel-Industry.pdf>, and A Green Deal on Steel, 2020, Eurofer, available at: <https://www.eurofer.eu/publications/position-papers/a-green-deal-on-steel-update/>.

<sup>14</sup> Třinecké železářny, 2022, see <https://www.trz.cz/uhlikova-neutralita/155-uhlikova-neutralita>

brid electric arc furnaces and high voltage power lines by 2025 which should help cut CO2 emissions by 80% by 2027.<sup>15</sup> In line with the group strategy, it plans to achieve full decarbonisation by 2030.<sup>16</sup> To fund investments, Liberty Ostrava can use a significant amount of 'spare' free emission allowances accumulated in previous years.<sup>17</sup>

For more information on investments in the steel sector see the Investment needs chapter.

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15 Liberty Ostrava, 2022, see: <https://libertysteelgroup.com/cz/news/liberty-zahajuje-historickou-investici-do-transformace-ostravske-huti-ve-vyrobce-zelene-oceli/>

16 In Nov 2022, the parent LIBERTY Steel Group agreed with major creditors on its global debt restructuring which will allow it to continue implementing the green steel production strategy (GREENSTEEL) to achieve carbon neutrality by 2030; see <https://libertysteelgroup.com/cz/news/liberty-se-principielne-dohodla-s-veriteli-na-globalni-restrukturalizaci-dluhu/>

17 According to its annual report, Liberty Ostrava owned over 4 mil. of emission allowances at the end of May 2021. At an average price of EUR 80/allowance in 2022, the allowances' market value was about EUR 325 mil.

# Policy environment

# Policy environment

Czech companies operating in hard-to-abate industries are clearly watching EU policy developments much closer than they were ten years ago, when the price of emission allowances was negligible compared to that of today. More ambitious EU-level targets and their relatively rapid changes require closer cooperation between industry and EU and Czech leading policymakers, to align decarbonisation pathways and calibrate EU and national operational and funding programs. Three main areas shape the environment in which the hard-to-abate industries operate: climate ambitions, energy policy and industrial and technological pathways.

Czech industry and companies are influenced by policies and regulation adopted at EU level and later transposed into Czech legislation, as well as local strategies and policies that reflect the unique conditions for industrial, energy, and environmental development in Czechia. Here, the introduction of the missing comprehensive national industrial policy, sectoral transition pathways or CCUS strategy, updating the notoriously outdated State Energy Policy or Climate Protection Policy, or full legislative recognition of hydrogen, are among the most imminent steps to fill the gaps in the heavy-industry decarbonisation roadmap.

Given the above, the chapter is divided into two main subchapters: EU and Czech strategies, and policies & regulation, which are in turn divided to sections describing industrial policies and strategies, as well as the related environmental and energy policy framework.

## EU STRATEGIES, POLICIES & REGULATION

Czechia is not considered a frontrunner in climate or decarbonisation ambitions, or a country likely to set its own targets more ambitious than those proposed by EU legislators. The related agenda thus stems mostly from collectively agreed regulations of EU institutions. This sub-chapter explores the main strategies and policies that shape the external business environment of hard-to-abate industries operating in Czechia. It also recapitulates the main tools and measures that have the most influence on the financial perspective of hard-to-abate industries, including the EU emission trading system and the taxonomy of sustainable activities.

The subchapter is divided into three main parts. First, it introduces the climate and energy regulatory framework which has shifted heavily over the last five years to

become the most ambitious decarbonisation framework in place globally. Second, it looks at industrial policies that complement the decarbonisation framework and could enable hard-to-abate industries to succeed in the net-zero race. Finally, it summarises the key instruments and measures that focus, for example, on carbon pricing or sustainability of investments.

## Climate and energy policy framework

The climate agenda is one of the key pillars of the EU's overarching strategy and one of the Commission's six priorities for 2019-24. As such, it sets the industry on a path towards achieving very ambitious goals in the upcoming years.<sup>18</sup> Clearly, there would not be such a rush to deeply decarbonise hard-to-abate industries if there was not a consensual agreement on the need to build a strong and resilient climate and energy framework to combat climate change.

### Paris Agreement

In 2015, the EU and its Member states signed the Paris Agreement, an international climate treaty that aims to limit the global average temperature increase between 1.5°C and 2°C above pre-industrial levels.<sup>19</sup> The treaty develops and includes mitigation, adaptation and financial measures to achieve this goal. As a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the EU, Czechia follows the development in the climate and energy framework of both institutions.<sup>20</sup>

### European Green Deal

The European Commission set the course of the EU's climate and energy framework in the European Green Deal in 2019,<sup>21</sup> with three primary goals to achieve:

- climate neutrality by 2050,
- a growth decoupled from resources, and
- a just transition when no person or place is left behind.

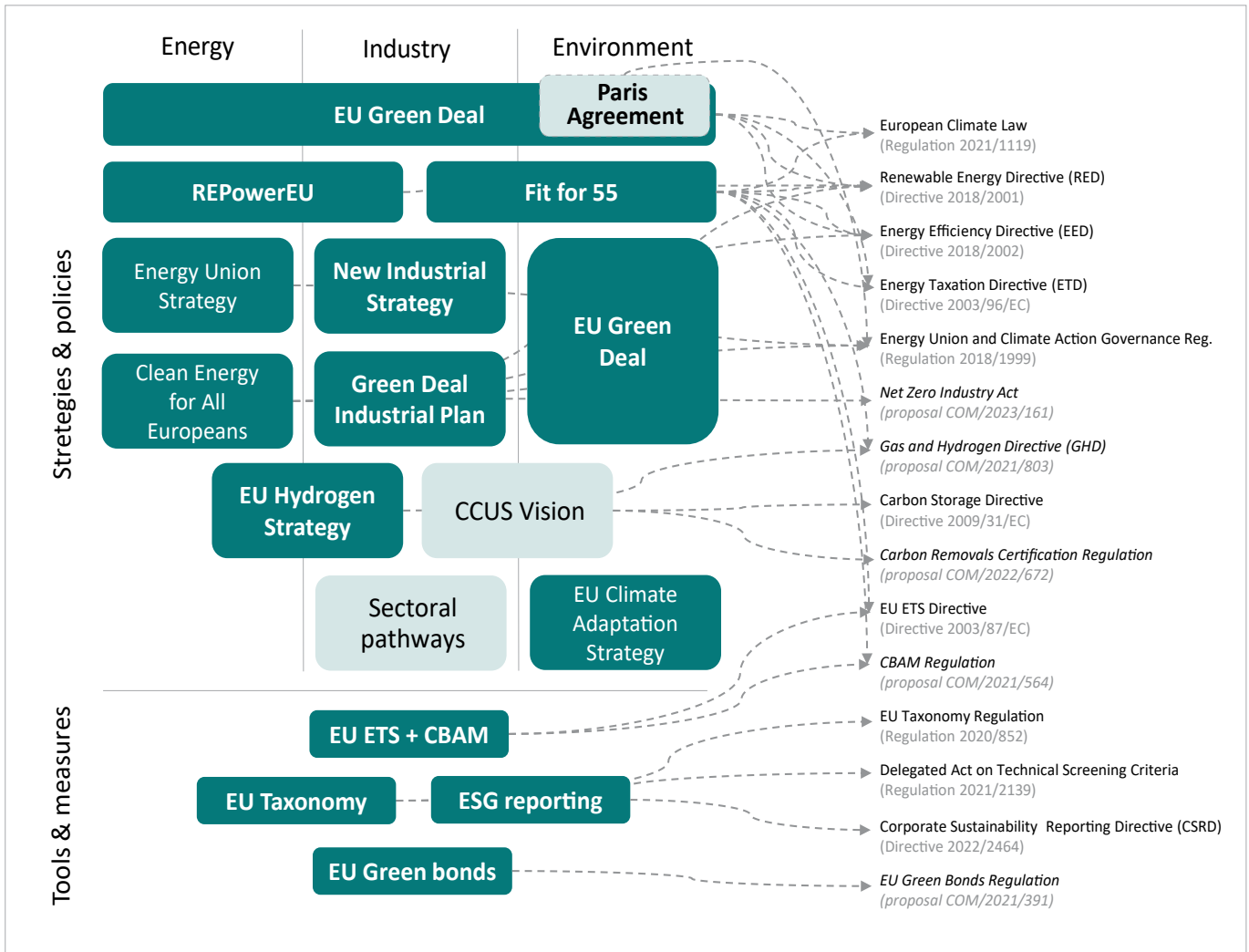
<sup>18</sup> The European Commission's 6 priorities for 2019-24, available at: [https://commission.europa.eu/strategy-and-policy/priorities-2019-2024\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024_en)

<sup>19</sup> United Nations, 2015, Paris Agreement, available at: <https://unfccc.int/process-and-meetings/the-paris-agreement>

<sup>20</sup> Czechia must prepare and regularly update national GHG inventories and report on its long-term climate strategy in the UNFCCC format. More details on the Czech long-term climate strategy are included in the sub-chapter: Czech strategies, policies & regulation.

<sup>21</sup> European Commission, 2019, Communication on The European Green Deal, available at: [https://commission.europa.eu/publications/communication-european-green-deal\\_en](https://commission.europa.eu/publications/communication-european-green-deal_en)

Chart 11: Simplified overview of the key relevant EU strategies, policies & tools



Source: ISFC

The European Green Deal also emphasised the need to increase the 2030 emission reduction target to 55% from 40% (from 1990 levels), previously set in the 2030 Climate and Energy Framework from 2014<sup>22</sup> and the Clean Energy for All Europeans package from 2019.<sup>23</sup> The Green Deal’s investment pillar, the European Green Deal Investment Plan, mobilises over EUR 1 trillion by 2030 and relies on the EU’s long-term budget (approx. half of the overall amount), the COVID-19 recovery fund, NextGenerationEU, private sourcing, bank loans and guarantees, also using revenues from the EU ETS.<sup>24</sup>

22 European Commission, 2014, 2030 Climate & Energy Framework. Available at: [https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2030-climate-energy-framework\\_en](https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2030-climate-energy-framework_en)

23 European Commission, 2019, Clean Energy for All Europeans package, available at: [https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package\\_en](https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en)

24 European Commission, 2020, The European Green Deal Investment Plan and Just Transition Mechanism explained, available at: [https://ec.europa.eu/commission/presscorner/detail/en/qanda\\_20\\_24](https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24)

### Fit for 55

To align with the Paris Agreement, achieve climate neutrality by 2050 and increase the 2030 emission reduction target to 55% (from 1990 levels), the European Commission proposed the 2030 Climate Target Plan, which turned into a set of legislative proposals of the Fit for 55 package in 2021.<sup>25</sup> It aims to ensure a just and socially fair transition, innovation and competitiveness of the EU industry, a level playing field vis-à-vis third countries, and EU leadership in fighting climate change. Key proposals include:<sup>26</sup>

25 The Council of the EU and the European Council, 2021, Fit for 55, available at: <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>

26 As of April 2023, EU ETS, CBAM, RED and EED are awaiting a final plenary vote before they are officially published. The Council adopted a general approach to GHD at the end of March 2023 and negotiations with the Parliament can begin. In the case of ETD, the Council is still discussing its official position on the proposed revision.

Strengthening the EU ETS and launching the Carbon Border Adjustment Mechanism (CBAM).

- Raising the 2030 EU-level target for the share of renewables in the energy mix from 32% to 42.5% through a revision the Renewable Energy Directive (RED).<sup>27</sup>
- Increasing the 2030 EU-level target for reducing final consumption from 32.5% to 36% (compared to 1990) through the revision of the Energy Efficiency Directive (EED).
- Aligning the taxation of energy products and electricity with EU climate and energy policies and maintain and improve the EU internal market by updating the scope of energy products through a revision of the Energy Taxation Directive (ETD).
- Deploying biomethane and hydrogen at scale to successfully switch fuels in selected sectors through a new Gas and Hydrogen Directive (GHD).

## REPowerEU

Published in May 2022, the REPowerEU initiative represented the EU's response to the Russian invasion of Ukraine.<sup>28</sup> The initiative presented a plan to end the EU's dependence on Russian fossil fuels and focuses on energy supplies diversification, energy savings and accelerated roll-out of renewables - the share of renewables in the EU's energy mix in 2030 should further increase to the envisaged 45% through an RED amendment.<sup>29</sup>

It stressed the need to scale up biomethane and hydrogen and focus on industrial electrification and smart investments through the yet-to-be-allocated money from the Recovery and Resilience Facility (RRF). Moreover, REPowerEU laid down a temporary framework for shortened and simplified renewables permitting processes, which was approved at the end of 2022.<sup>30</sup>

## European industrial policy

An ambitious approach to the climate and energy agenda means supporting industry not only through technology and investments, but also ensuring a just transition and maintaining global competitiveness. EU industrial strategies have received renewed interest following the

<sup>27</sup> The target has been increased to 42.5% from the original 40% during the negotiations.

<sup>28</sup> European Commission, 2022, REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition, available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_3131](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3131)

<sup>29</sup> The target has been finally set at 42.5% (up from the original 40%).

<sup>30</sup> See: <https://www.consilium.europa.eu/en/press/press-releases/2022/12/22/council-formally-adopts-regulation-to-speed-up-permits-for-renewable-energy-projects/>

publication of the EU Green Deal and specific sectoral transition pathways should be developed through an open consultation process. While selected hard-to-abate industries are still awaiting the EU sectoral strategy outlook, Czechia can inspire and start to prepare national transition pathways for hard-to-abate industries through a structured consultation process.

## New Industrial Strategy

The New Industrial Strategy outlined in the European Green Deal was published in 2020 and updated a year later in reaction to global economic and supply-chain conditions in the wake of the COVID-19 outbreak.<sup>31</sup> It aims to strengthen the EU Single Market's resilience and strategic autonomy and support a post-pandemic recovery. The future availability and affordability of large amounts of decarbonised energy are perceived as essential, as well as the de-risking of investments through carbon contracts for difference or pooling of resources and sharing risks.

The New Industrial Strategy highlights that cement, iron and steel, as well as chemicals supply chains are challenged by the downstream industries' decline (automotive, construction) and could face loss of competitiveness and carbon leakage. Although the strategy itself provides no clear outlook for hard-to-abate industries, it outlines the development of "transition pathway" analyses for fourteen selected industrial clusters (see below for details).

## Green Deal Industrial Plan

The European Commission complemented the New Industrial Strategy to reflect on the new economic environment (e.g. the US Inflation Reduction Act) and presented the EU Green Deal Industrial Plan in February 2023.<sup>32</sup> The plan does not elaborate on individual sectors, it is based on four general pillars to support EU industry and its competitiveness:

- a predictable and simplified regulatory environment,
- faster access to sufficient funding,
- skills for the green transition, and
- open trade for resilient supply chains.

<sup>31</sup> European Commission, 2020, European industrial strategy, available at: [https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en)

<sup>32</sup> European Commission, 2023, The Green Deal Industrial Plan: putting Europe's net-zero industry in the lead, available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_510](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510)

The outlined Net-Zero Industry Act aims to underpin the industrial manufacturing of critical technologies, create a simplified regulatory framework and set specific goals for industrial capacity by 2030. A one-stop shop for investors and industry stakeholders is planned to be launched, responsible for the entire administrative process of industrial projects. Moreover, the Commission intends to:

- simplify the process of placing green products in the market,
- support public procurement,
- incentivise the adoption of net-zero technologies, by requirements and new standards for net-zero products.

## Sectoral Pathways

The New Industrial Strategy foresees the development of sectoral transition pathways. Being prepared through open consultation processes with industry and stakeholders, these should set out the course of action to achieve the green and digital transition and improve sectors resilience, sustainability, and the circularity principle of the EU Green Deal.<sup>33</sup>

With respect to hard-to-abate industries, a transition pathway for the chemical industry was published in January 2023.<sup>34</sup> It consists of three major components:

- Actions - collaboration for innovation, clean energy supply, feedstock and its diversification
- Technology – electrification, hydrogen, biomass, waste, CCUS, process efficiency
- Regulation - existing legislation, research and innovation activities.

<sup>33</sup> See also [https://single-market-economy.ec.europa.eu/industry/transition-pathways\\_en](https://single-market-economy.ec.europa.eu/industry/transition-pathways_en)

<sup>34</sup> European Commission, 2023, Transition pathway for the chemical industry, available at: <https://ec.europa.eu/docsroom/documents/53078>. It extends the scope of the previous 2020 Chemicals Strategy for Sustainability: Towards a Toxic-free Environment, which focused on the safety and environmental impacts of the chemical industry, available at: [https://environment.ec.europa.eu/strategy/chemicals-strategy\\_en](https://environment.ec.europa.eu/strategy/chemicals-strategy_en)

### Box 1: Dutch case study – Stimulation of Sustainable Energy Production and Climate Transition (SDE++ 2022)

SDE++ is a large-scale policy scheme to promote low-carbon technologies and renewable energy production in the Netherlands, utilising an operating subsidy as the main incentive for the private sector.<sup>35</sup> Projects and their subsidy allocation can have a time horizon of up to 15 years. The scheme has the following elements:

Subsidies compensating for the difference between the cost of a reduction in CO<sub>2</sub> emissions or renewable energy and the revenue → a carbon contract for difference.

Support of low-carbon production, heat, renewable electricity, renewable heat and renewable gas.

For the hard-to-abate industries, low-carbon production categories include CO<sub>2</sub> capture and storage/use, electrolytic hydrogen production or advanced renewable fuels.

Subsidies aimed, inter alia, at promoting CO<sub>2</sub> storage in offshore fields in the Netherlands or the Dutch part of the continental shelf.

These components are divided into several specific roadmaps in short-, medium-, and long-term, including specific actions, actors to implement the actions and their expected timeframe. In total, it comprises more than 150 actions under 26 topics.

Although the iron and steel industry transition pathway has not been yet published, reference can be made to the Commission's working document from 2021.<sup>36</sup> The steel industry is foreseen to be one of the first hard-to-abate sectors to produce green products. However, it pinpoints that there is only one investment cycle left until 2050. It drafts several conditions to achieve climate neutrality, such as radical changes in steel production processes, ways to raise funding, support for research and innovation, circularity in production, and sector digitalisation.

<sup>35</sup> Netherlands Enterprise Agency (2022). Stimulation of sustainable energy production and climate transition (SDE++). Available at: <https://english.rvo.nl/subsidies-programmes/sde>

<sup>36</sup> Prepared as part of the updated New Industrial Strategy, see: Towards competitive and clean European steel, Publications Office of the European Union, 2021, available at: <https://op.europa.eu/en/publication-detail/-/publication/a9aeb01e-ae95-11eb-9767-01aa75ed71a1>.

The cement industry technical report also stresses that there is only one investment cycle until 2050.<sup>37</sup> It sum

### Box 2: Polish CCS-related projects

The Polish government is currently working on a national CCS strategy. With access to offshore storage and large-scale hard-to-abate operations across the country, CCS is an option for industrial decarbonisation. Currently, three key projects are developing the CCS business environment: the Polish EU CCS Interconnector, the Go4ECOPlanet of Holcim and the ACCSESS of Heidelberg Materials.<sup>38</sup>

The interconnector aims to create a CO<sub>2</sub>-export hub with interim storage for transported CO<sub>2</sub> from selected industrial facilities, while the other two projects aim to develop carbon capture in the cement industry. An exciting aspect of the ACCSESS project in the cement plant of Górażdże is its proximity to Czechia. The project aims to transport the CO<sub>2</sub> to the Gdansk interim storage of the EU CCS Interconnector for later storage in the North Sea.

marises that the industry's main focus is on CCUS technologies, but options exist also in process efficiency, kiln technologies and waste heat recovery. Moreover, efforts are aimed at cement content change to make the final product less emission-intensive.

In addition to the sectoral pathways, the Industrial Technology Roadmap for Low-Carbon Technologies in Energy-Intensive Industries published in 2022 states that:<sup>39</sup>

- the most significant investment gap exists in the implementation of first-of-a-kind installations and technologies due to the barriers and uncertainties associated with permitting these installations;
- several countries has developed strategies for energy-intensive industries (such as Finland, Germany, Slovenia and Sweden);

37 European Commission / Joint Research Centre, 2023, Decarbonisation options for the cement industry, available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC131246>

38 See: [https://ec.europa.eu/energy/maps/pci\\_fiches/PciFiche\\_12.9.pdf](https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_12.9.pdf), and <https://www.holcim.com/media/media-releases/eu-innovation-fund> and <https://www.heidelbergmaterials.com/en/pr-17-09-2021>.

39 European Commission, 2022, ERA industrial technology roadmap for low-carbon technologies in energy-intensive industries, available at: [https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/era-industrial-technology-roadmap-low-carbon-technologies-energy-intensive-industries\\_en](https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/era-industrial-technology-roadmap-low-carbon-technologies-energy-intensive-industries_en). For energy-intensive sectors, reference can also be made to the older 2019 Masterplan for a competitive transformation of EU energy-intensive industries enabling a climate-neutral, circular economy by 2050.

- EU green technology standards are underdeveloped, especially in the carbon capture and hydrogen storage areas.

Solutions are foreseen in establishing new industrial alliances or initiatives, facilitating specific national sectoral and cross-sectoral strategies, or launching communities of practice to support first-of-a-kind facilities. Moreover, the pathway stresses the need to improve knowledge, innovations, and cooperation.

### CCUS Strategy

Carbon capture and use or storage (CCUS) is a key technology expected to help decarbonise selected energy-intensive industries and energy production facilities, such as waste-to-energy and biomass-to-energy producers. Cement, chemicals, and iron and steel plants could benefit from the CCUS deployment as it allows them to deal with process emissions (unrelated to the fuel used). As a result, governments and industries in most countries in the region are thoroughly exploring options for the CCS technology - see Box 2 for a Polish example. Captured carbon can also be utilised (CCU) in industrial processes as a direct input to production, for example in the production of renewable fuels (RED) or as an input to the construction materials production. For more details see also the chapter: Key investment areas.

However, CCS still lacks an EU-wide strategy to give confidence to investors and industrial stakeholders on the long-term outlook and deployment strategy for CCS. For more information on the EU's CCUS visions see Box 3.

The only regulatory framework which has been adopted thus far was in 2009 through the Carbon Storage Directive, which sets out the rules and framework for the safe transport and storage of CO<sub>2</sub>.<sup>40</sup> In 2021, communication on Sustainable Carbon Cycles established a framework for carbon accounting and the promotion of industrial carbon capture, use and storage, including an assessment of infrastructure deployment and cross-border cooperation until 2030 and beyond.<sup>41</sup> In 2022, the Commission prepared a proposal for certifying carbon removals; bioenergy with CCS and direct air CCS are technologies that fall under the certification scheme.<sup>42</sup>

40 European Commission, 2009, A legal framework for the safe geological storage of carbon dioxide, available at: [https://climate.ec.europa.eu/eu-action/carbon-capture-use-and-storage/legal-framework-safe-geological-storage-carbon-dioxide\\_en](https://climate.ec.europa.eu/eu-action/carbon-capture-use-and-storage/legal-framework-safe-geological-storage-carbon-dioxide_en)

41 European Commission, 2021, Sustainable carbon cycles, available at: [https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles\\_en](https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles_en).

42 European Commission, 2022, Carbon removal certification, available at: [https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification\\_en#documentation](https://climate.ec.europa.eu/eu-action/sustainable-carbon-cycles/carbon-removal-certification_en#documentation)



## Hydrogen Strategy

Hydrogen as a carbonless fuel can replace carbon-based fuels in industry, energy or transport. Its primary industrial use is expected to be in the refinery and chemical sector. Hydrogen could also replace commonly used fossil fuels in steel production. The EU Hydrogen Strategy represents a key strategic document for the deployment of hydrogen in the EU, and states:<sup>43</sup>

- in the long term → the EU's priority is to develop and upscale renewable hydrogen production ("green" hydrogen);
- in the short and medium term → other forms of low-carbon hydrogen are needed, too, such as "blue" hydrogen using CCS in the hydrogen production process.<sup>44</sup>

The roadmap foresees three phases of hydrogen deployment:

- 2020 to 2024 → a key objective is to install the first renewable hydrogen electrolyzers that would be able to produce up to 1 mil. tonnes of renewable hydrogen.
- 2025 to 2030 → the installed capacity of electrolyzers is estimated to grow to enable the production of 10 mil. tonnes of renewable hydrogen by 2030 (while the EU would also need to import 10 mil. tonnes of hydrogen). This phase would nudge demand, especially in the industrial and transport sectors.
- 2030 to 2050 → hydrogen technologies become fully matured and deployed at scale, especially in hard-to-abate sectors where other decarbonisation technologies could be less scalable or less competitive than hydrogen.

## Key green transition tools & measures

Carbon pricing represents the most significant transition tool influencing investments and financing in hard-to-abate industries. Since 2013, the carbon price has increased tenfold and the outlook to 2030 and beyond sees further increases. Under current proposals, the carbon price is also expected to affect selected EU imports (i.e. CBAM). To align the climate agenda and technological pathways, the EU Taxonomy of sustainable activities offers a tool that clearly identifies activities that are considered aligned with the net-zero targets, and although voluntary,

43 European Commission, 2020, Hydrogen, available at: [https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen\\_en](https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en)

44 Under current EU gas market conditions, it seems likely that some Member States will not support hydrogen production from natural gas using CCS.

many EU directives and regulations will in future seek to support only taxonomy-aligned activities.

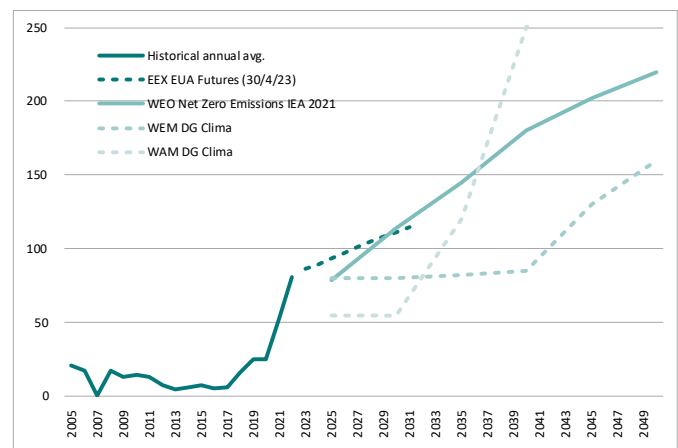
### Box 3: EU CCUS Vision

The forthcoming official EU communication on CCUS – also called EU CCUS Vision – is in draft and should be communicated at the end of 2023.<sup>45</sup> The communication draft stresses the importance of CCS in achieving the EU's climate targets. It outlines a long-term strategy and roadmap towards 2050 with proposed targets and policy initiatives for CCS deployment. The role, scope and requirements for CCS and CCU must be aligned with the EU's current and foreseen energy and industrial strategies.<sup>46</sup>

## EU Emissions Trading System

The EU ETS is a cap-and-trade mechanism that tags CO<sub>2</sub> emissions with a market price.<sup>47</sup> Carbon pricing is a technology-neutral tool designed to induce industry to take its emissions into account in its business decisions. The cap on the number of allowances, which represents the overall limit of emissions allowed in the scheme, is set to reflect climate policies and targets. Historical carbon market prices in 2005-22 and selected carbon price projections until 2050 are presented in Chart 12.

Chart 12: EU ETS carbon price (EUR)



Source: ICAP Allowance Price Explorer,<sup>48</sup> EEX Market Data, *Analýza Fit for 55 - hodnocení dopadů na ČR*<sup>49</sup>

45 See also [https://energy.ec.europa.eu/topics/oil-gas-and-coal/carbon-capture-storage-and-utilisation/ccus-forum\\_en](https://energy.ec.europa.eu/topics/oil-gas-and-coal/carbon-capture-storage-and-utilisation/ccus-forum_en)

46 Based on: CCS4CEE, 2022, Untapped potential: linking the CEE region to European CCS initiatives, available at: <https://ccs4cee.eu/an-overview-and-assessment-of-european-policy/>

47 EU Emissions Trading System (EU ETS), available at: [https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets\\_en](https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en)

48 International Carbon Action Partnership, 2023, ICAP Allowance Price Explorer, available at: <https://icapcarbonaction.com/en/ets-prices>

49 See "Analýza Fit for 55 - hodnocení dopadů na ČR", available at <https://seepia.cz/en/news/we-published-a-key-study-on-the-impact-of-fit-for-55-on-the-czech-republic/>.

Currently, in its fourth phase 2021-30, the scheme covers all large industrial facilities: energy, oil refining & coke, basic metals, mineral products, paper, chemicals, and aviation.<sup>50</sup> They account for around 40% of the EU’s overall GHG emissions. Allowances are auctioned (57%) or freely allocated (43%) within a capped volume of allowances issued with a linearly decreasing volume each year (see below).

Free allowances are allocated to industries at risk of carbon leakage, i.e. companies with a financial incentive to relocate and produce outside the EU, including steel, chemicals, or cement. All producers with potential carbon leakage receive a free allocation based on their production level and a benchmark of the 10% most effective producers in the benchmarked product or process categories.

At the end of 2022, a revision of the EU ETS and the CBAM was agreed with new ambitions for industrial decarbonisation towards 2030.<sup>51</sup> The EU ETS sectors must achieve a 62% reduction in emissions compared to 2005 levels (previously -43%). The European Commission proposed several steps to reduce overall emissions and to incentivise decarbonisation

The overall volume of tradable allowances will decrease by 4.3% and 4.4% annually in 2024-27 and 2028-30, respectively, and by a one-off reduction in 2024 and 2026 (-117 mil. allowances in total).

- The Market Stability Reserve will continue to withdraw allowances from the market each year (24%).
- Nevertheless, the free allocation to industries at risk of carbon leakage will be maintained up to 100% of the relevant benchmark until 2025.
- In 2026-34, the CBAM will gradually phase in and the free allocation will phase out at the same pace for all installations/sectors under CBAM, as shown in Table 4.

**Table 4: Phase out of free EAs allocation**

2026	2027	2028	2029	2030	2031	2032	2033	2034
2.5%	5%	10%	22.5%	48.5%	61%	73.5%	86%	100%

Source: EU ETS revision proposal<sup>52</sup>

50 The EU ETS II is proposed and approved by EU legislators. It will create a separate emission trading system for buildings and transport fuels, including fuels used in selected manufacturing industries outside the scope of the current EU ETS.

51 European Parliament, 2022, Climate change: Deal on a more ambitious Emissions Trading System (ETS), available at: <https://www.europarl.europa.eu/news/en/press-room/20221212IPR64527/climate-change-deal-on-a-more-ambitious-emissions-trading-system-ets>

52 See: <https://data.consilium.europa.eu/doc/document/ST-6210-2023-INIT/en/pdf>

## Carbon border adjustment mechanism

The CBAM introduces an obligation for importers to internalise the EU ETS CO2 price into the price of selected “carbon leakage” products, including cement, iron and steel, aluminium, fertilisers, electric energy production, hydrogen, some precursors and a limited number of downstream products.<sup>53</sup>

At the same time, financial mechanisms to support the decarbonisation of carbon leakage industries will be strengthened, including the EU ETS-based funds such as the Innovation Fund, Modernisation Fund, and other national funding programmes – for more details see the sub-chapter: Financing available / Public sources.

Local producers with higher costs (due to the EU ETS and its indirect costs, for example, through electricity prices) may struggle with exports to countries without any carbon pricing mechanism, therefore:

- export safeguard measures include a legal guarantee that phasing out free allocation is impossible without phasing in the CBAM;
- in 2025, the Commission should assess the risk of low competitiveness of EU exports on global markets;
- in 2021-30, Member States can support production at risk of carbon-leakage through indirect cost compensation schemes.

## EU Taxonomy

In 2020, the EU Taxonomy regulation launched an EU-wide classification system for sustainable activities to guide investments into sustainable projects and activities.<sup>54</sup> It identifies activities that are considered aligned with the net-zero targets, and although voluntary, many EU directives and regulations will in future seek to support only taxonomy-aligned activities. Activities are assessed with respect to six key environmental objectives:

53 All sectors at risk of carbon leakage will be incentivised to decarbonise through a bonus-malus mechanism:

- The top 10% of benchmark producers in each product/process category will be further supported through exclusion from the possible cross-sectoral reduction factor.

- Fully decarbonised installations will be able to stay longer in the EU ETS mechanism and thus benefit from the “extra” free allocation as a source of funding.

- Conversely, the bottom 20% of producers must undergo an energy audit. For some selected worst performers, a decarbonisation plan for climate-neutral operations must be created. If these conditions are not fulfilled, the free allocation to these producers will be reduced by 20%.

54 European Commission, 2020, EU taxonomy for sustainable activities, available at: [https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities\\_en](https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en)

- climate change mitigation,
- climate change adaptation,
- the sustainable use and protection of water and marine resources,
- the transition to a circular economy,
- pollution prevention and control, and
- the protection and restoration of biodiversity and ecosystems.

To be classified as sustainable, an activity must comply with four criteria: (i) substantially contribute to one of the six environmental objectives listed above, (ii) “do no significant harm” any of the six objectives, (iii) meet minimum social-impact safeguards, and (iv) comply with the technical screening criteria.<sup>55</sup>

The production of cement, iron and steel, and various types of chemical products are categorised as transitional activities, which must comply with several rules to be classified as sustainable. Specifically, they have to comply with the emission production limits associated with the Best Available Techniques emission range and the top 10% producers according to the EU ETS benchmarking.<sup>56</sup>

### Corporate sustainability reporting

Almost fifty thousand companies across the EU, including cement, iron and steel, and chemical companies, will be required to report on sustainability alongside their financial reporting, with some already for the fiscal year 2024, subject to the following criteria of the

- Corporate Sustainability Reporting Directive (CSRD):<sup>57</sup> companies listed on regulated EU markets, and all large companies meeting two of the three criteria (250+ employees, EUR 40+ mil. net turnover and EUR 20+ mil. assets);

<sup>55</sup> The technical screening criteria and methodologies for economic activities substantially contributing to the six environmental objectives are lively documents formally defined through delegated acts and amended according to technological developments. With respect to the first two objectives, the climate change mitigation and adaptation criteria were published as first in 2021 and have been applicable since January 2022. Further delegated acts focus on disclosing sustainability information by stakeholders or including gas and nuclear to the list of sustainable activities under strict conditions.”

<sup>56</sup> For more details see the EU Taxonomy Compass that provides a visual representation of the contents of the EU Taxonomy, i.e. delegated acts specifying technical screening criteria, available at: <https://ec.europa.eu/sustainable-finance-taxonomy/>.

<sup>57</sup> European Commission, 2022, Corporate sustainability reporting, available at: [https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting\\_en](https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en)

- listed SMEs with a longer transition period and the possibility to opt out;
- non-EU companies with a net turnover of EUR 150+ mil. in the EU and one subsidiary/branch in the EU.

These companies will have to report on environmental aspects, including the alignment to EU Taxonomy, social aspects, human rights, anti-corruption and bribery and diversity and inclusion on company boards. The directive builds on the previous Non-Financial Reporting Directive (NFRD), and companies classified under the previous directive will report for the fiscal year 2024 in 2025. All other large companies will have one extra year and report in 2026 for the fiscal year 2025.

### EU Green Bonds

Green bonds are playing an increasingly important role in financing the low-carbon transition. A European Green Bond Standard is being established to create an official voluntary standard for green bonds.<sup>58</sup>

This standard will be aligned with the EU Taxonomy, i.e. the financed activities/projects (assets, expenditures, bonds) must meet the EU Taxonomy requirements over a defined period according to alignment and action plans with a 5- or 10-year timeframe. If the technical screening criteria change (or minimum social safeguards, or do no significant harm rules), green bond issuers will be able to use the pre-existing criteria for the following five years.

<sup>58</sup> The political agreement on a European Green Bond Standard’s proposal was reached in March 2023, see: [https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard\\_en](https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard_en)

## CZECH STRATEGIES, POLICIES & REGULATION

This subchapter outlines Czech strategies and policies that must largely correspond to EU-level strategies on one hand, while their implementation may be locally specific and reflect the unique conditions for industry, energy, and environmental development in the country on the other hand. Given that Czechia has one of the highest shares of industry in the total national economy in the EU, the country should pay particular attention to supporting the industrial sector, especially in the area of decarbonisation of hard-to-abate industries. Obviously, clear and consistent policies help to reduce uncertainty for businesses on their decarbonisation pathway.

The subchapter is divided into three main parts. First, it introduces the high-level national economic strategies and their relevance for industry. Second, it looks at industrial policy that should address possible ways of industrial development and transformation. Finally, it inspects climate and energy strategies, such as the National Energy and Climate Plan, which influence the business environment for industry for the coming years until 2030, in

cluding the crucial and highly debated topics of ensuring sufficient supply of clean electricity and hydrogen.

### National strategies & policies

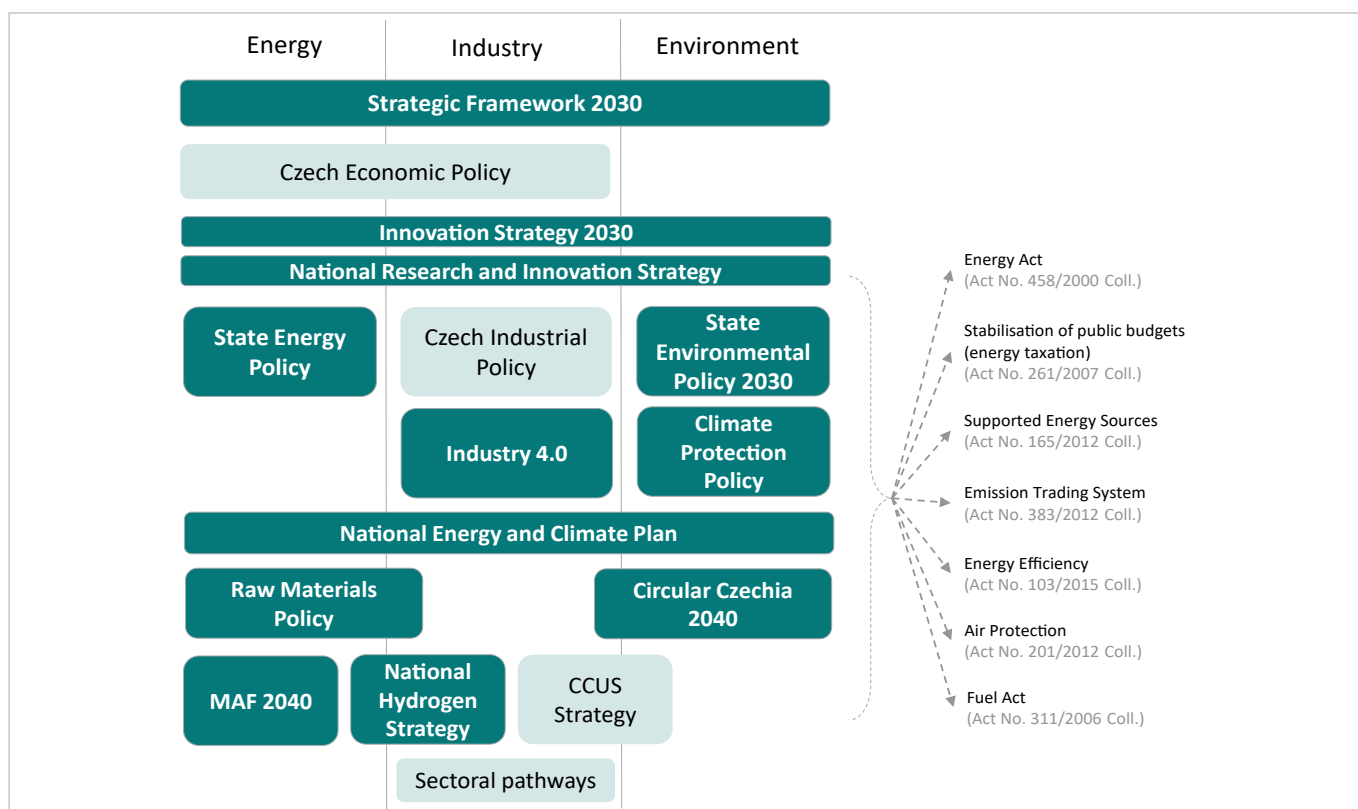
#### Strategic Framework 2030

The Strategic Framework Czechia 2030, from 2017, forms a basis for further strategies and policies with a vision of socially, economically, and environmentally sustainable development, which reflects the 2015 Paris Agreement.<sup>59</sup> It emphasises the need to transform the energy sector and revise pre-Paris ambitions for reducing GHG emissions. Without much detail, the framework briefly mentions industrial decarbonisation as an opportunity for technological growth and a contribution to global efforts to mitigate climate change.

#### National economic policies

Czechia has yet no comprehensive document summarising the country's economic policy. Its pillars - Theses of the Economic Strategy for 2020-30 - were prepared by the Ministry of Industry and Trade in 2020. However, with respect to the expected role of industry, it only stresses the goal of maintaining a strong industry sector in the

Chart 13: Simplified overview of the main Czech policies of interest



Source: ISFC

<sup>59</sup> Ministry of Environment, 2017, Strategický rámec Česká republika 2030, available at: <https://www.cr2030.cz/strategie/>

future.<sup>60</sup> Among other cross-sectoral policy documents relevant to industry, Innovation Strategy 2030<sup>61</sup> and The National Research and Innovation Strategy for Smart Specialisation of Czechia<sup>62</sup> represent research and innovation strategies with an outlook to 2030 and 2027, respectively. They address hard-to-abate industries indirectly. The production of modern technologies and machinery used in hard-to-abate industries are expected to contribute to local gross value added. The chemical sector and its technologies are perceived as strategically important given the export potential. However, the policies do not emphasise the later stages of technological development, necessary for the real decarbonisation of hard-to-abate industries. Unlike R&D, early pilots and demonstration projects, carrying high risks and not yet bankable, are not given much attention and funding.

## Industrial policies

Currently, industrial transformation is addressed in several national-level documents, but there is no comprehensive Czech industrial strategy. In its absence, businesses lack a transparent and predictable framework to support their planning activities. Furthermore, such a strategy would create the critical linkages of technology-related strategies, such as electricity resource adequacy, hydrogen strategy, and the still missing CCUS strategy.

The policy should clearly describe the current state of Czech industry, including its major strengths and weaknesses, the vision of a resilient industry in a future decarbonising (decarbonised) and competitive environment, and the tools and measures that can be used to achieve this. The detailed UK industrial strategy is presented in Box 4 as an interesting case study in this context.<sup>63</sup>

## Industry 4.0

Industry 4.0 from 2016 is an R&D strategy aimed at transitioning industry to the 4.0 model. It specifies the state of Czech industry and its possible future development, especially in the digitalisation agenda. The cement, iron

60 Ministry of Industry and Trade, 2020, Teze Hospodářské strategie České republiky 2020-2030, available at: [https://www.mmr.cz/getmedia/4703af96-bbb7-4fda-8c6d-c5cdfa446526/Teze\\_Hospodarske\\_strategie\\_2020\\_2030.pdf.aspx](https://www.mmr.cz/getmedia/4703af96-bbb7-4fda-8c6d-c5cdfa446526/Teze_Hospodarske_strategie_2020_2030.pdf.aspx)

61 The Research, Development and Innovation Council, 2019, Inovační strategie České republiky 2019-2030, available at: <https://www.vyzkum.cz/FrontClanek.aspx?idsekce=866015>

62 Ministry of Industry and Trade, 2021, RIS3 strategie, available at: <https://www.mpo.cz/cz/podnikani/ris3-strategie/>

63 Another good example of a comprehensive strategy is represented by the Industrial Decarbonisation Roadmap published by the U.S. Department of Energy in 2022, which provides key recommendations for reaching net zero emissions by 2050, and which also provides specific sectoral pathways for the iron and steel, chemical, food and beverage, petroleum refining and cement sectors; available at: <https://www.energy.gov/eere/doe-industrial-decarbonization-roadmap>.

and steel and chemical sectors are only briefly covered in terms of the high material intensity of Czechia, the basic circularity principles and the use of secondary raw materials, which are foreseen to play a significant role in the industry 4.0 model.

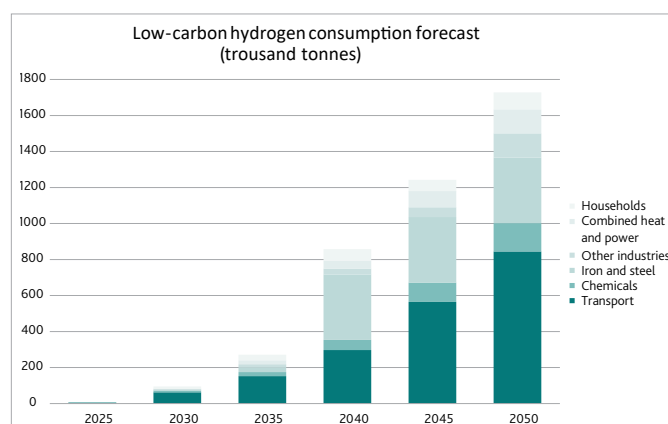
## Hydrogen Strategy

The Czech Hydrogen Strategy 2021 has two specific targets: reducing greenhouse gas emissions and promoting economic growth.<sup>64</sup> Its timeline is divided into three phases:

- 2021-25 → Phase 1 focuses on using low-carbon hydrogen in clean mobility and testing natural gas and hydrogen blends. Moreover, improving the efficiency of CCS technologies is mentioned as a precondition for using natural gas for hydrogen production.
- 2026-30 → Phase 2 can be characterised by operational validation in industry. Czechia could become a net importer of low-carbon hydrogen if local renewable electricity is not available at scale for hydrogen production (import via the pipeline system is unlikely before 2035, though).
- 2031-50 → In Phase 3, the pipeline transport routes are foreseeably available and low-carbon hydrogen is commercially deployed in industry.

The strategy prioritises four types of low-carbon hydrogen production: (1) green hydrogen – produced by water electrolysis using renewable electricity, (2) blue hydrogen - using CCS/CCU, (3) pink hydrogen - using nuclear energy, and (4) hydrogen produced by pyrolysis. Together, they would cover local consumption until 2035.

Chart 14: The Czech Hydrogen Strategy's consumption scenario



Source: ISFC based on the Czech Hydrogen Strategy

64 Ministry of Industry and Trade (2021). Vodíková strategie ČR schválena vládou. Available at: <https://www.mpo.cz/cz/prumysl/strategie-projekty/vodikova-strategie-cr-schvalena-vladou--262590/>

#### **Box 4: Case study – UK Industrial Decarbonisation Strategy**

In 2021, the UK government office published one of the first detailed national net-zero industrial strategies.<sup>65</sup> The strategy is divided into three main parts: (1) the foundations for achieving net zero for industry, (2) transforming industrial processes, and (3) maximising the UK's potential.

To make the decarbonisation roadmap and its targets attainable, it contains specific chapters covering the whole chain of events - from the support of engineering studies, call for evidence on low-carbon products, funding specific industrial energy-transformation projects, aligning the emission trading system with the 2050 net-zero target, to specific targets for low-carbon fuels, including hydrogen, and the CCUS technology deployment. The roadmap describes the current state, challenges, barriers and actions in each of the identified decarbonisation areas.

Additionally, it includes various considerations for small- and large-scale industrial transformation projects, including its supply side, such as infrastructure funding and building, support for both clustered and dispersed hard-to-abate facilities, development of new product standards, and demand side, such as support for low-carbon product marketing and procurement, product standards and new labelling tools.

The infrastructure for hydrogen transport and storage is not described in detail and large-scale infrastructure projects are not foreseen until 2030. Instead, more flexible and small-scale solutions are prioritised in this period, including rail and road transport and local storage tanks (storage in geological structures might be possible in the future).

Hydrogen is projected to play a key role in the transport, chemical and steel sectors:

- In 2030, two thirds of total hydrogen consumption will be used in transport, mostly in trucks and buses. The forecasted consumption is based on the evolution of the Czech fleet planned through the National Action Plan on Clean Mobility.<sup>66</sup>
- The chemical industry would consume 10 thousand tonnes of hydrogen by 2030, but also play a key role in hydrogen production.

<sup>65</sup> HM Government, 2021, Industrial Decarbonisation Strategy. Available at: <https://www.gov.uk/government/publications/industrial-decarbonisation-strategy>

<sup>66</sup> See: <https://www.mpo.cz/cz/prumysl/zpracovatelsky-prumysl/automobilovy-prumysl/aktualizace-narodniho-akcniho-planu-ciste-mobility--254445/>

- The steel industry is forecast to produce hydrogen direct reduced iron and consume around 4.5kt of hydrogen in 2030. After 2034, consumption in the steel industry would increase dramatically to more than 360kt/year, twice the level in the chemical industry.
- It is also planned to substitute hydrogen for natural gas (or coal) in combustion processes. In this case, however, the price of hydrogen is still perceived as an obstacle to the wider deployment of hydrogen as an alternative to other fuels. Combined heat and power production is therefore not explored closely in the strategy.

In the strategy, local hydrogen use is estimated to be covered by local production until 2035 (production not forecasted after 2035). However, if the Czech steel industry were to switch to low-carbon hydrogen before 2035, the hydrogen demand assumed in the strategy before 2035 would not match this.<sup>67</sup> Also, the green hydrogen needed by the heavy industry would require substantial additional clean electricity production. Hence, hydrogen imports appear to be the only remaining solution. Separately, hydrogen is not recognised in any binding legislation in Czechia, except as a fuel in the Fuel Act. Currently, the prepared amendment to the Energy Act may also newly recognise hydrogen as an energy medium.

In this context, Germany, the first EU country to publish its hydrogen strategy, is already drafting an updated version of the strategy, which now foresees increased consumption and imports of green hydrogen; imports increase in time to 70% of consumption - see Box 5 for more details.<sup>68</sup>

#### **CCUS Strategy**

Many of decarbonisation plans of Czech hard-to-abate industries include carbon capture, use and/or storage technologies (CCUS). The carbon capture potential in Czechia is estimated at 8-15 MtCO<sub>2</sub> per year in 2050, of which 3-4 MtCO<sub>2</sub> would come from industrial sectors.<sup>69</sup> At the same time, hard-to-abate facilities are relatively dispersed across the country and few obvious options exist for

<sup>67</sup> Consumption estimate by the Steel Union, Jak úspěšně dekarbonizovat ocelářství? [How to successfully decarbonise the steel sector?], 2022, see: <https://www.ocelarskaunie.cz/ak-uspesne-dekarbonizovat-ocelarstvi/>

<sup>68</sup> See: <https://www.hydrogeninsight.com/policy/leaked-document-germany-will-need-to-import-50-70-of-its-hydrogen-by-2030-and-that-share-will-only-grow/2-1-1416856>

<sup>69</sup> See "Analýza Fit for 55 - hodnocení dopadů na ČR". Available at <https://seepia.cz/en/news/we-published-a-key-study-on-the-impact-of-fit-for-55-on-the-czech-republic/>

Among other sources, a 2020 study by McKinsey & Company estimated the potential to capture 8 Mt of CO<sub>2</sub> per year in the refining, steel, and cement/lime industries in 2050; available at: <https://www.mckinsey.com/cz/our-work/pathways-to-decarbonize-the-czech-republic>

clustering different facilities for CCUS deployment, e.g. in Northern Moravia. Given the above, high transport costs (especially for building pipeline infrastructure) may prevent significant CCUS deployment. A clear national CCUS strategy is therefore needed for any reasonable planning in the industries concerned.

At present, no relevant national CCUS strategy has been published to set out the key country priorities for CCUS development and limit the associated risks in Czechia. Moreover, the critical climate and energy strategies are due to be updated in 2023/4 and to date they still include CCS in the energy sector scenarios (such as CCS applied to coal or gas-fired power plants). The national hydrogen strategy describes CCS as being not readily available and lacking a suitable option to store CO<sub>2</sub> near any facility of interest. Also, CCU needs to be addressed as an option for the chemical industry.

The EU CCS Directive has been transposed into Czech law. However, the act introduces a limit for commercial storage of no more than 1 MtCO<sub>2</sub> annually per site. Furthermore, to allow commercial CO<sub>2</sub> storage, the government will need to draft an implementing decree that would also lay down financial security rules for CO<sub>2</sub> storage. The decree currently needs to be prepared.

However, this obstacle does not prevent researchers from continuing research and development or piloting a first CCS project – see Box 6.

### **National sectoral pathways**

The elaboration of sectoral transition pathways for the Czech hard-to-abate industries is sorely lacking and desirable both in terms of their content and the process of their elaboration. Structured open consultation processes involving industries, public authorities, and possibly academia or financial industry representatives, whose outcomes could be regularly shared with an informed public, would bring the much awaited alignment of all major stakeholders.

In terms of content, the pathways should set out the course of actions which would help to achieve a green transition and improve the sectors' resilience, sustainability and circularity (e.g. a steel scrap reuse). Also, they would need to address technological options and regulation, whose possible adjustments can support the transition.

The pathways should reflect (or initiate, if not yet available) feasibility studies to understand the economic viability and (prospective) competitiveness of new technologies and product opportunities, or outline policy scenarios addressing investment risks and logistical challenges

### **Box 5: Germany's Hydrogen Strategy**

Germany has been a frontrunner in preparing a national hydrogen strategy, published in 2020. The document is one of the most detailed hydrogen strategies across the EU, attracting private investment in hydrogen generation, transport and use. Germany seeks to become a leader and exporter of green hydrogen technologies. Since its publication, Germany has also stepped up its goals from 5 to 10 GW of electrolyser capacity in 2030.

In the first stage, the strategy prioritises the chemical and refinery sectors, steel production or heavy-duty, to heating, passenger cars and cement. It focuses on producing hydrogen using renewable energy (green hydrogen). It previously saw a short- and mid-term use of hydrogen produced from natural gas using CCS (blue hydrogen), but the current gas market situation has forced Germany to rethink its plan and priorities. A budget of almost EUR 10 bil. will no longer support blue hydrogen.

associated with decarbonisation. What-if scenarios would help to clarify the best investment options and help avoid asset stranding - which remains one of the key financial risks.

While such studies are available on global or European industrial decarbonisation, or a net zero transition of the entire Czech economy and its energy sector, very limited publicly available sources have addressed the economic, investment, and financing aspects of the Czech heavy industry decarbonisation. Reliable and shared information would help de-risk the transition process, for example on the most significant investment gaps, the reasons for these gaps, the necessary volume of investment needed for a successful transition, etc.

## **Climate and energy policies**

Climate and energy sector policies have a significant impact on the industry decarbonisation process. Most notably, sufficient clean electricity volumes and capacity of electricity and other low-carbon energy product networks are key to the transition, and respective policies can reduce much of the associated uncertainty.

### **State Environment Policy 2030**

The State Environmental Policy 2030 with an outlook to 2050<sup>70</sup> is the overarching document of Czech

<sup>70</sup> Ministry of Environment, 2021, Státní politika životního prostředí ČR, available at: [https://www.mzp.cz/cz/statni\\_politika\\_zivotniho\\_prostredi](https://www.mzp.cz/cz/statni_politika_zivotniho_prostredi)

environment policy which should, inter alia, align domestic climate policy with the EU Green Deal and the Paris Agreement.<sup>71</sup>

It highlights the energy-intensive state of the Czech economy due to, among others, industrial sectors, with the overall target to reduce emissions, scale up renewable energy sources and increase the energy efficiency of the national economy. The policy identifies the EU ETS as a vital instrument for reducing industrial emissions. Chemicals and metals are deemed crucial for the transition to a circular economy focusing on a raw materials strategy.

### Climate Protection Policy

The 2017 Climate Protection Policy is Czechia's low-carbon development strategy required by the EU and UNFCCC (also known as the Long-Term strategy) as an overarching climate strategy, complemented by yearly GHG reporting.<sup>72</sup> It focuses on defining policies and measures from 2017 to 2030 with a view to 2050. It offers a selection of emission projections towards 2030 and beyond, and presents pathway scenarios with existing (WEM) and additional (WAM) measures to achieve the goals previously set in the EU's 2030 Climate and Energy Framework.

All these scenarios are calibrated to the targets that have since been revised.<sup>73</sup> For example, they do not reflect the fact that almost 50% of free allowance will be phased out by 2030. In the policy scenarios, however, industrial processes, including the production of iron and steel, chemicals and cement, are not significantly decarbonised between 2015 and 2030. Metals and cement are expected to remain the main emitters.

71 Czechia has not yet adopted its climate law. Although its adoption is not mandatory, Czechia is obliged to meet the climate targets of the Paris Agreement and the EU Climate Law. However, passing a local law would entail clear commitments and the government could directly enforce those commitments.

72 Ministry of Environment, 2017, Politika ochrany klimatu v České republice. available at: [https://www.mzp.cz/cz/politika\\_ochrany\\_klimatu\\_2017](https://www.mzp.cz/cz/politika_ochrany_klimatu_2017)

73 The main target of the policy was to decrease CO<sub>2</sub>eq emissions by at least 32 mil. tonnes in 2020 (which has been achieved) and by at least 44 mil. tonnes in 2030 compared to 2005 (146 mil. tonnes emitted in 2005). Moreover, an indicative target was set for 2050: emitting a maximum of 39 mil. tonnes of CO<sub>2</sub>eq. In the EU ETS sectors, the scenario with additional measures reached only a 38.5% emission reduction in 2030 compared to the 43% target set by the EU ETS.

### Box 6: CCUS potential and pilot projects in Czechia<sup>74</sup>

Landlocked Czechia has a conservative storage potential of around 850 MtCO<sub>2</sub>. For hard-to-abate industries, this would mean more than 50 years of continuous storage of all their current-level CO<sub>2</sub> emissions. However, little knowledge and technical details are available on most prospective storage reservoirs, and little information is available about the saline aquifer storage sites that offer the largest CO<sub>2</sub> storage potential (~90%). Another question remains whether the size of the potential locations within the borders of Czechia is/will be sufficient to make them economically viable.

Currently, the first pilot storage site is being prepared in the CO<sub>2</sub>-SPICER project coordinated by the Czech Geological Survey, which could be ready in 2024 in a depleted oil and gas field.

CCU is an attractive option especially for the chemical industry, which is currently exploring the possibilities of a first pilot project focusing on methanol production.

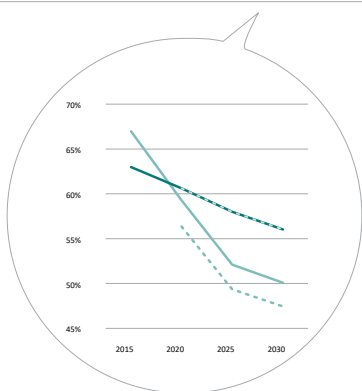
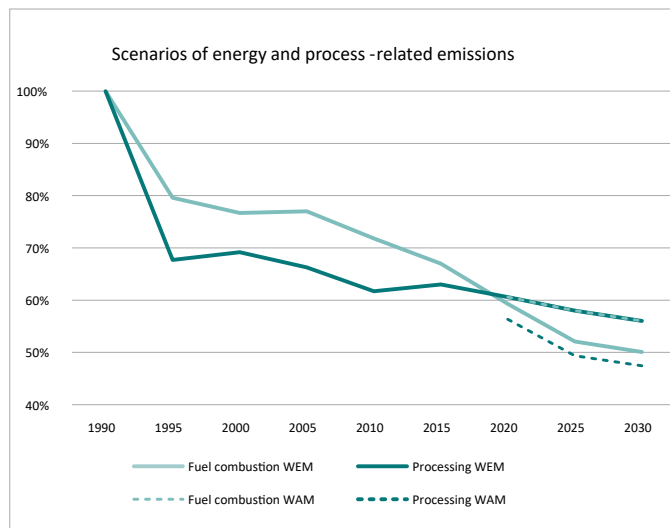
The recently published national CCS roadmap presents a blueprint and inspiration for the government to draft an official Czech CCUS roadmap.<sup>75</sup>

74 CCS4CEE (2021). Assessment of current state, past experiences and potential for CCS deployment in the CEE region: The Czech Republic. Available at: <https://ccs4cee.eu/assessment-of-current-state-ccs-4-cee/>

75 CCS4CEE (2022). CCS National Roadmap: Czechia. Available at: <https://ccs4cee.eu/building-momentum-for-the-long-term-ccs-deployment-in-the-cee-region-ccs-national-roadmaps/>



**Chart 15: CPP scenarios for energy and process-related emissions**



Source: ISFC, based on the Climate Protection Policy

The policy is currently under review and an updated version is due to be submitted to the Commission and the UNFCCC by the end of 2023. It will be adjusted towards revised emission reduction targets and will include new additional measures aligned with the higher ambitions. The 2021 policy evaluation pointed to the necessity to adopt additional measures, otherwise the new 2030 targets for national emissions and the EU ETS would not be met. The update is being drafted in parallel with the revision of the State Energy Policy and the National Energy and Climate Plan (see below).

### State Energy Policy

The State Energy Policy is a national strategic document from 2015 that expresses the objectives of national energy resources management and policies over a 25-year horizon.<sup>76</sup>

The policy is crucial for hard-to-abate industries as it frames the conditions under which companies can expect

<sup>76</sup> Ministry of Industry and Trade, 2015, Státní energetická koncepce, available at: <https://www.mpo.cz/dokument158059.html>

the availability and price of selected commodities such as local coal or electricity and its availability from renewable sources.

- The policy includes five major strategic priorities:
- a balanced mix of primary energy sources,
- efficient use of all available domestic energy resources,
- maintaining a surplus power balance with sufficient local energy reserves,<sup>77</sup>
- maintaining available strategic reserves of domestic forms of energy, and
- increasing the energy efficiency of the national economy.

Other targets of the policy include reducing the energy intensity of gross value added to the EU average and maintaining the import/export transmission capacity at 30% of the electricity load. The development of the Czech transmission network infrastructure in the context of Central Europe and the integration of electricity and gas markets in the region are mentioned as key areas.

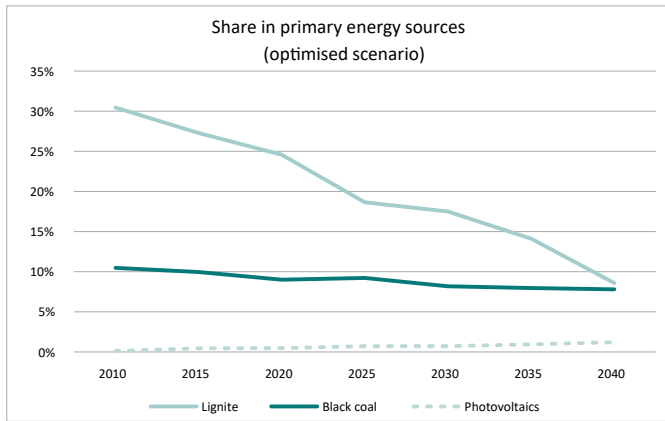
The policy has not been amended since its release and is therefore outdated, as it does not reflect many of the current EU climate and energy targets set in the years following its publication. For example, in the optimised scenario, which was selected as the key scenario of the policy, coal (lignite and hard) was kept as the primary energy source with a share of almost 20% in 2040, as shown in Chart 16.<sup>78</sup> The green scenario with limited energy self-sufficiency was classified as “not supported” in the policy annex.

The policy will be updated in 2023 and should consider the development of renewable energy sources and the planned coal phase-out (2033 proposed by the Czech government). It should also describe the forecasted availability of renewable electricity, highlight the need to upgrade the transmission network due to the increased share of renewables and plan a strategy for electricity imports. Changes in the policies and priorities of key neighbouring countries need to be reflected as well, to correctly assess hydrogen, renewable electricity, and captured carbon capacities and/or availability in the region.

<sup>77</sup> Surplus power balance means maintaining at least 90% self-sufficiency in electricity production even in periods of low local production.

<sup>78</sup> The policy also foresees the possibility of reconstruction, upgrading or building new coal-fired power plants with the best available techniques or at least a 60% efficiency rate, building two nuclear fission blocks with a total capacity of 2.5 GW by 2035, or maintaining net electricity exports towards 2040.

Chart 16: SEP's forecast of primary energy sources



Source: ISFC, based on the State Energy Policy

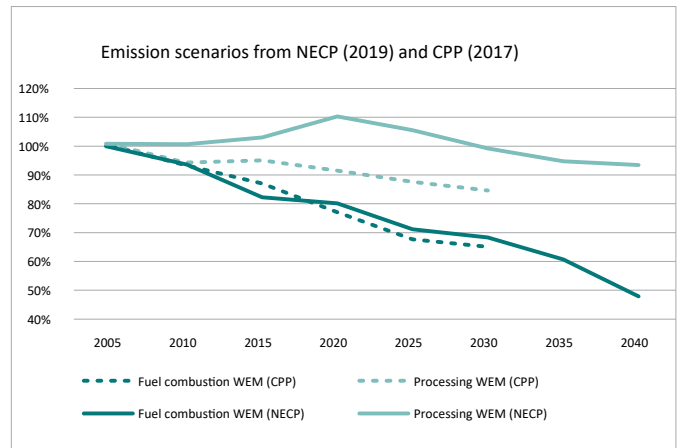
### National Energy and Climate Plan

The NECPs prepared for the period 2021-30 based on the Governance of the EU Energy Union and Climate Action regulation follow the EU's overarching energy and climate goals, but without binding rules for countries to achieve a specific energy mix.<sup>79</sup>

The Czech NECP foresees the country achieving a 22% share of renewables by 2030, an increase of 9 percentage points compared to the national 2020 target. It also limits the primary energy sources used and sets a target for the GVA energy intensity and cumulative energy savings.<sup>80</sup>

Decarbonisation targets are set through the Climate Protection Policy, while energy sources and their use are mostly set by the State Energy Policy. Chart 17 shows the decarbonisation scenarios with (WAM) and without (WEM) additional measures compared to the 2017 Climate Protection Policy scenarios.

Chart 17: Emission scenarios from NECP and Climate Protection Policy



Source: ISFC, based on the Czech NECP and Climate Protection Policy

As was already a concern of the Commission in its feedback to the national plan in 2019, Czechia does not utilise its full potential of renewable energy sources - such as solar or wind.<sup>81</sup> Moreover, the projected electrification of hard-to-abate industries will require large volumes of (clean) electricity, which needs to be properly addressed in the NECP. For example, producing low-carbon iron and steel at 2021 levels would require an additional 20-25% of the total electricity production in 2021, approximately.

As regards the manufacturing sector, a significant decrease in both fuel combustion and process emissions is not forecast in the coming years. The plan highlights the need to draft a national industrial strategy that would also focus on hard-to-abate sectors and their decarbonisation strategies. These sectors are not covered in detail in the NECP.

The NECP is due to be revised in June 2023, when a revision draft is due to be submitted to the Commission. As the NECP is closely linked to the Climate Protection Policy and the State Energy Policy (both due to be revised also in 2023), it is expected that all drafts will align and reflect the higher ambitions of the EU ETS, Effort-Sharing Regulation (ESR),<sup>82</sup> RED, EED and possibly even the subsequent amendment of RED through the REPowerEU initiative.

79 European Commission, 2018, Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, see: [https://energy.ec.europa.eu/topics/energy-strategy/energy-union\\_en](https://energy.ec.europa.eu/topics/energy-strategy/energy-union_en)

80 The targets are 1,735 PJ by 2030, 0.157 MJ/CZK, and 462 PJ, respectively.

81 European Commission, 2019, Commission analysis and recommendations on draft NECPs submitted, available at: [https://energy.ec.europa.eu/topics/energy-strategy/national-energy-and-climate-plans-necps\\_en](https://energy.ec.europa.eu/topics/energy-strategy/national-energy-and-climate-plans-necps_en)

82 European Parliament (2023). Revising the Effort-sharing Regulation for 2021-2030: 'Fit for 55' package. Available at: [https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2021\)698812](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)698812)

## Electricity grid development scenarios until 2040 (MAF 2040)

The latest version of the electricity grid development scenarios assessment (MAF 2040) was published by CEPS, the transmission system operator, in 2023.<sup>83</sup> It relies on national strategic documents such as the 2015 State Energy Policy, 2019 NECP and 2021 National Hydrogen Strategy, but is updated in many aspects, including the new EU climate and energy targets.

From the perspective of hard-to-abate industries, the document is important in how it approaches and can support sufficient volumes of (clean) electricity and hydrogen necessary to decarbonise industry:

- The forecast points out that a coal phase-out before 2038 requires high investment costs in additional new energy sources with a stable load. Czechia could become a net electricity importer as early as 2025. If the State Energy Policy target of a 90% self-sufficiency were adhered to, additional new sources would be required by 2030 in all scenarios (mostly new gas-fired power plants, possibly decentralised renewable sources).
- Hydrogen production and use are specified according to the National Hydrogen Strategy. All scenarios foresee less than 500 MW of installed capacity of electrolyzers by 2030. Several fuel cell units are expected to be operating by 2030 with capacity below 10 MW in 2030 in all scenarios.

The latest analysis confirms that even under the progressive scenario of the RES development, significant electricity imports would be needed and the decarbonisation trajectory would heavily rely on CCS technology. Another option would be to adapt the transmission and distribution systems to be able to absorb a significantly higher additional capacity of photovoltaics and wind power than assumed in the progressive and decarbonisation scenarios.<sup>84</sup>

However, such a scenario has not been developed and analysed in the CEPS document.

## Czech raw material and circular policies

The cross-sectoral raw material agenda in Czechia is shared by the Ministry of Industry and Trade, which

prepared two raw-material policies, and the Ministry of Environment, responsible for the national circular policy. The 2017 Raw Materials Policy sets strategic priorities; security of supplies and efficient and sustainable use of disposable resources are among these.<sup>85</sup>

With respect to hard-to-abate industries, the policy states that raw materials are available at scale with a view to 150 years of continuous production in the cement sector. In the chemical sector, Czechia only possesses limited amounts of raw materials, so it must rely on imports. The importance of steel scrap is emphasised - the EU is a net steel scrap importer and the national priority should be to reuse scrap locally rather than selling it internationally.

As the new EU circular-economy action plan became more ambitious, the Secondary Raw Materials Policy was published in 2018.<sup>86</sup>

Material flows for iron and steel, cement and chemicals are described in the context of the construction sector and plastics production, respectively. The policy aims to continue increasing the share of recycled raw materials in the total consumption of raw materials. Moreover, it specifies that the eco-design of products that will be key for the chemical or cement sector, including material and input substitution (such as the use of flying ash instead of cement clinker).<sup>87</sup>

The policy highlights the need for a steel scrap strategy, which is currently lacking. Although Czechia has a strong history of collecting steel scrap, the outlook for the upcoming years is problematic. The prolonged life cycle of steel and the drop in steel production and use since the 1990s mean that less steel is available for recycling. A clear plan for the increased use of steel scrap is therefore needed, among others, to enable saving of a significant share of process emissions and increase the raw materials' circularity and self-sufficiency.

83 ČEPS, 2023, Hodnocení zdrojové přiměřenosti ES ČR do roku 2040 [Resource Adequacy Assessment of the Czech Electricity Grid until 2040], available at: <https://www.ceps.cz/cs/zdrojova-primerenost>

84 SEEPIA (2022). "Analýza Fit for 55 - hodnocení dopadů na ČR". Available at <https://seepia.cz/en/news/we-published-a-key-study-on-the-impact-of-fit-for-55-on-the-czech-republic/>

85 Ministry of Industry and Trade, 2017, Nová surovinová politika v oblasti nerostných surovin a jejich zdrojů - MPO 2017, available at: <https://www.mpo.cz/cz/stavebnictvi-a-suroviny/surovinova-politika/statni-surovinova-politika-nerostne-suroviny-v-cr/nova-surovinova-politika-v-oblasti-nerostnych-surovin-a-jejich-zdroju---mpo-2017--229820/>

86 Ministry of Industry and Trade, 2018, Aktualizace Politiky druhotných surovin České republiky, available at: [https://www.mpo.cz/assets/cz/prumysl/politika-druhotnych-surovin-cr/2019/1/IV\\_Politika-druhotnych-surovin-CR.pdf](https://www.mpo.cz/assets/cz/prumysl/politika-druhotnych-surovin-cr/2019/1/IV_Politika-druhotnych-surovin-CR.pdf)

87 A new EU eco-design directive has been proposed by the European Commission in March 2022. See Proposal for Ecodesign for Sustainable Products Regulation available at: [https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation\\_en](https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation_en)

Circular Czechia 2040, published by the Ministry of Environment is a strategic framework that reflects on the necessity to implement the principles of circularity as required in the EU and outlined in the State Environment Policy.<sup>88</sup>

It also complements the Secondary Raw Materials Strategy, focused mostly on material availability and self-sufficiency. The document recognised the historically important role of heavy industry in the national economy, but highlights the necessity of decoupling the growth from material and energy resources and implementing eco-design of new products to increase their recyclability.

One of the circular strategy's targets is the implementation of green public procurement rules and criteria in buildings and construction, which are currently missing (e.g., requirements for transition plans or emission reduction targets, energy efficiency, carbon intensity monitoring and reporting). Almost half of all construction contracts are issued by public institutions. Such green public procurement would lead to an increase in demand for low-carbon products (steel, cement), which are not yet incentivised on the market.

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<sup>88</sup> Ministry of Environment, 2021, Cirkulární Česko, available at: [https://www.mzp.cz/cz/cirkularni\\_cesko](https://www.mzp.cz/cz/cirkularni_cesko)

# Roadmap's scenario description

# Roadmap's scenario description

Before moving to the next key chapters, which focus on investment needs and available financing, this chapter sets out the decarbonisation targets and scenarios used in the roadmap. The level of the targets' ambition and both capex and financing needs are clearly correlated. And the assessments of policies, the regulatory environment and government incentives and/or levies also need to match the target ambitiousness to be mutually consistent.

Building on the target definition, the chapter examines models and forecasting tools (and other resources) available for Czechia that provide comprehensive scenarios of decarbonisation pathways. Where multiple scenarios are available, those that most closely approach the targets are leveraged hereafter.

Individual scenarios are not discriminated in terms of technological pathways. Where possible and relevant, the role (in what proportion) of carbon capture and storage (CCS), renewables and hydrogen in achieving the targets is highlighted.

## ROADMAP'S SCENARIO TARGETS

In the Roadmap, the country targets are set to correspond to the EU's key emission targets for 2030 (while taking into account the 2050 net-zero target) under the European Green Deal including the Fit for 55 package reflecting the agreement between the Council of the EU and the European Parliament in December 2022.<sup>89</sup>

- a reduction in net GHG emissions by at least 55%
- by 2030, compared to 1990 levels,
- a reduction in overall emissions in EU ETS' sectors by 62% by 2030, compared to 2005 levels.

Targets for individual hard-to-abate industries are not set, emissions reductions may not be proportionate across sectors and within the EU ETS it may also partially offset the emissions trajectory in the electricity and heat generation sector. In its 2020 impact assessment, the European Commission projected that industrial emissions (excl. refineries) would decrease by 21-23% in 2015-30, while emissions from power generation would need to fall by 69-71% over the same period to achieve the

<sup>89</sup> See <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>

overall targets mentioned above.<sup>90</sup> The Roadmap primarily seeks such scenarios in which industrial emission reductions meet (possibly exceed), or at least get close to the Commission's projections.

## MODELS AND SCENARIOS

For Czech heavy industry, there are a few usable and publicly available sources with relevant scenarios simulating or modelling decarbonisation pathways. One is the 2050 Pathways Explorer, a simulation tool particularly suitable for impact analysis and for exploring assumption sensitivity, which helps to define relevant national decarbonisation scenarios. Another is the TIMES-CZ model, a comprehensive cost-optimisation model of the Czech energy system. A third is the dynamic modelling approach used by Material Economics specifically for hard-to-abate industries in Europe that first sets the baseline of material demand in 2050 in different sectors of the economy and then backcasts the pathways to meet the 2050 demand with net-zero emissions.<sup>91</sup>

### 2050 Pathways Explorer model and scenarios

The 2050 Pathways Explorer is an open source web-based planning tool to simulate key national energy transition scenarios.<sup>92</sup> The simulations are driven by people activities in a given context and reflect the impact of using technologies to carry out the activities on the energy system and its dynamics, GHG emissions, associated resources and socio-economic impacts. The user interface has been developed and is maintained by Climact.<sup>93</sup>

As a simulation tool, it is particularly suitable for assessing engineering policy questions such as the impact analysis of assumption changes. In several countries (e.g. Belgium), government administrations and agencies specify the input data and create their scenarios. In other cases, local research organisation, think tanks or other non-profit organisations perform quality assurance and/or create their scenarios. In Czechia, the Association for International Affairs reviewed the national assumptions and developed a national net-zero scenario in 2021.

<sup>90</sup> REG, MIX and CPRICE scenarios in Stepping up Europe's 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people: Impact assessment, European Commission, 2020, available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020SC0176>

<sup>91</sup> In addition to these models, McKinsey issued report in 2020: Pathways to decarbonize the Czech Republic, which however does not provide enough detailed information on the industry. Overall, it concludes that a 55% reduction in GHG emissions by 2030 and net zero by 2050 are achievable, and mentions selected key assumptions; available at: <https://www.mckinsey.com/cz/our-work/pathways-to-decarbonize-the-czech-republic>

<sup>92</sup> The model and its methodology are available at: <https://pathwaysexplorer.climact.com/>

<sup>93</sup> The platform technology, the underlying Python model, is based on the 2016-20 EU Calc project, in which Climact participated, see <https://cordis.europa.eu/project/id/730459>

Table 5: 2050 Pathways Explorer NZ-2050 scenario's emissions and energy consumption

	Total	EU ETS	Industry	Chemicals	Steel	Cement
Emissions 2005-2030	-67%*	-70%	-51%	-63%	-42%	-5%
Emissions 2015-2030	-48%	-64%	-27%	-24%	-17%	-3%
Energy demand final 2005-2030	-25%	-47%	-29%	-41%	-42%	12%
Energy demand final 2015-2030	-14%	-34%	-9%	-3%	-11%	-8%

\*Note: 1990-2030, Source: ISFC based on 2050 Pathways Explorer's scenario outputs

At the time of writing, this predefined scenario, of those available in the 2050 Pathways Explorer, best meets the above scenario targets, is regularly updated and leads to net zero in 2050.<sup>94</sup> It is therefore used herein among the relevant scenarios, despite being ambitious with respect to the major 2030 interim targets:

- the reduction of total Czech GHG emissions exceeds the -55% target (compared to 1990 levels) by 12 percentage points;
- the reduction of EU ETS GHG emission exceeds the -62% target (compared to 2005 levels) by 8 percentage points.

In addition to the above, the 2050 Pathways Explorer and the selected predefined net-zero scenario have the following limitations:

- no endogenous cost optimisation is performed in the model, costs are computed ex-post;
- the model does not include macroeconomic analysis and provides no impact assessment with respect to economic growth, employment, public finance, etc.;
- in the scenario, the EU ETS emissions decline is driven by the energy sector while the three hard-to-abate industries emissions fall short of the target and aggregate decline by 17% over the period 2015-30.

### TIMES-CZ model and scenarios

TIMES is an energy-system cost-optimisation model originally developed by the IEA.<sup>95</sup> It optimises the whole energy system to find the combination of technologies and fuels that meets the energy demand at the lowest total cost until

94 Referred to in the 2050 Pathways Explorer as "Czech Republic: AMO Net-Zero 2050" predefined pathway, release v28.1, 26/01/2023.

95 The Integrated MARKAL-EFOM System, see <https://iea-etsap.org/index.php/etsap-tools/model-generators/times>

2050. Its Czech derivation, TIMES-CZ, is managed by the Charles University Environment Centre.<sup>96</sup>

The Centre was engaged by the Czech government to assess the impacts of the EU's Fit for 55 package on the Czech Republic. First outcomes were published in September 2022<sup>97</sup> and already reflect the impacts of the Russian invasion of Ukraine, in particular the expected impacts on fossil fuel prices and limited availability of natural gas.<sup>98</sup>

The Centre's analysis works with several scenarios subject to key assumptions. Herein, such scenarios are considered that include the EU ETS revisions, the CBAM introduction, the ETS2 introduction (buildings and road transport), the limitation of registration of new passenger cars with combustion engines from 2035, and availability of natural gas at 100% of a reference consumption level.

The emissions trajectories are shown in Table 6. The selected scenarios differ in the assumed fossil-fuel and emission-allowance prices trajectories, the year of cessation of coal use in the power sector, and deployment of a new nuclear power plant. These assumptions have only a limited impact on the emission trajectory. Both major reduction targets, i.e. -55% in total GHG emissions by 2030 (compared to 1990) and -62% in EU ETS emissions in 2030 (compared to 2005), are significantly exceeded in all selected scenarios. Also, all scenarios result in only a slight decrease in final energy consumption but a substantial reduction in primary energy consumption by 2030. See Annex 1 for a detailed description of the selected scenarios.

96 For more information about the model and its methodology see <https://times.czp.cuni.cz/model/>

97 See "Analýza Fitfor 55 - hodnocení dopadů na ČR", available at <https://seepia.cz/en/news/we-published-a-key-study-on-the-impact-of-fit-for-55-on-the-czech-republic/>

98 Besides the TIMES-CZ model, the analysis works also with the macroeconomic model E3ME (managed by Cambridge Econometrics) and the computable general equilibrium model CGE-CZ. These, however, provide no details with respect to industry and are thus not referred to herein.

Table 6: TIMES-CZ scenarios' emissions and energy consumption

Scenario	Total emissions 1990-2030	EU ETS emissions 2005-2030	EU ETS emissions 2015-2030	Industry emissions 2015-2030	Primary energy consumption 2015-2030	Final energy consumption 2015-2030
ets2	-67%	-76%	-72%	-44%	-23%	-2%
n40	-67%	-76%	-72%	-45%	-23%	-2%
p50	-66%	-75%	-72%	-43%	-22%	-1%
wam	-66%	-75%	-71%	-41%	-22%	-1%
no_co	-67%	-76%	-72%	-45%	-23%	-2%

Source: ISFC based on TIMES-CZ scenarios' outputs

In all the above scenarios, CCS technology starts to pay off in terms of investment from the late 20s and early 30s. First in lime production, and later in cement and steel production or electricity generation from natural gas and biomass (the model does not consider current regulatory barriers to CCS technology). The emission trajectory is thus largely based on CCS technology rather than, for example, a greater renewables deployment.

The main features or limitations of the model and/or scenarios are as follows:

- none of the scenarios leads to climate neutrality by 2050 (not a model target);<sup>99</sup>
- REPowerEU measures from March/May 2022 are not reflected;
- renewables are assumed to develop within the limits of the Transmission System Operator's (CEPS') MAF 2021 Progressive Scenario,<sup>100</sup> leading to
  - a preference for CCS over a larger share of renewables, and
  - Czechia becoming a heavy net importer of electricity from 2025 onward (up to 15.5 TWh in the 40s, i.e. approximately 20% of total consumption), a politically difficult magnitude to pass;
  - conservative assumptions about the potential for importing renewable hydrogen severely limit the hydrogen-based energy transition channel.

The TIMES-CZ model scenarios also show that if CEPS' strategy allows for more ambitious scenarios of RES deployment and/or if sufficient imports of renewable hydrogen or electricity are secured, the pathway would

be opened to a higher decarbonisation of the metallurgical and chemical industries with less need for CO<sub>2</sub> capture and storage.

### Material Economics

The Material Economics study estimates the EU net-zero pathways specifically for hard-to-abate industries through a dynamic approach that first sets the baseline of material demand in 2050 and then backcasts the pathways to meet the 2050 demand with net-zero emissions.<sup>101</sup>

The study relies on various models applied to selected economic sectors across the EU. Backcasting is used to create pathways in five-yearly intervals, accounting for capital stock turnover, gradually improvement in technological maturity, lead times for construction, and other constraints.

Three final pathways are selected for each industry and described in detail: (1) new processes, (2) circular economy and (3) carbon capture. The pathways are not cost-optimising the decarbonisation process; they point to the technology combination options for achieving net-zero in 2050.

All three pathways combine the major decarbonisation technologies, including demand measures and circularity, yet each pathway has a standard technology that has a dominant role in the selected industry.

<sup>99</sup> Note however that the decarbonisation development in agriculture and waste management is not modelled in detail, and measures after 2030 (e.g. the new setting of EU ETS) are not anticipated.

<sup>100</sup> Hodnocení zdrojové přiměřenosti ES ČR do roku 2040 (MAF CZ) [Resource of the Adequacy Assessment Electrical Grid of the Czech Republic until 2040 (MAF CZ)], ČEPS, 2022, available at: <https://www.ceps.cz/en/ceps-publications>

<sup>101</sup> Material Economics, 2019, Industrial Transformation 2050 - Pathways to Net-Zero Emissions from EU Heavy Industry, available at: <https://materialeconomics.com/publications/industrial-transformation-2050>



# Investment needs

# Investment needs

A vital aspect of decarbonising hard-to-abate industries is the assets' longevity and investment cycle. These industries often face a single investment round before achieving envisaged climate neutrality by 2050.<sup>102</sup> Plants and equipment often undergo significant refurbishment after about 20-25 years of operation to extend their lifetimes, with associated investment costs of the same order of magnitude as those of new-build facilities.

The first subchapter below describes the technology perspectives for hard-to-abate industries, outlining the prospective technologies considered most feasible by the technology literature. The second subchapter presents investment scenarios of available models or studies with a focus on hard-to-abate industries. They are complemented by a business-as-usual forecast of total investments based on extrapolation of historical investments. The subchapter aims to roughly estimate the investment needs of hard-to-abate industries in the 2030 horizon.

In addition to technological factors, government policies play an essential role in shaping the investment environment towards 2030. The policy environment co-influence financial perspectives which determine the terms of investment in climate neutrality-aligned technologies and assets. Pressure from the phasing-out of free emission allocations, the rising price of carbon allowances, and the risk of future stranded assets potentially hindering bankability represent key transmission channels. These are addressed in the Policy environment chapter above. The proper targeting of public grants to support decarbonisation towards the ultimate net-zero target is addressed in the Financing available chapter below.

## KEY INVESTMENT AREAS

One can view the decarbonisation of hard-to-abate industries through the lens of production and consumption. Most investment areas described below relate to production.<sup>103</sup> A number of decarbonisation technologies are available or in the pipeline, though most of them are still burdened by uncertainty about their economical and technological feasibility.

Some of the technological options are common to all the three hard-to-abate industries: CCS, low-carbon hydrogen as a fuel and reducing agent, and electrification of heat processes. Here again, their current technology readiness level (TRL) still signals the need for further improvement and demonstration at scale. Bio-feedstocks, including biomass or biomethane, offer a way to decarbonise the high-temperature processes in existing hard-to-abate facilities where potential for fuel switching still exists. Increased energy efficiency, waste heat recovery and process optimisation through best available technologies are other common ways to improve decarbonisation efforts.

### Cement sector

Technology investments and decarbonisation efforts generally focus on two distinct carbon emission sources: fuel combustion and process emissions. In cement production, 60% of all emissions come from the process emissions of clinker production, where limestone calcination takes place.

In the area of heat production (fuel combustion emissions), fuel-switching, electrification, energy efficiency, and waste heat recovery can lead to significant emission cuts when combined. In chemical reaction-related processes (process emissions), CCS technologies appear to be the most advanced technological solution. Post-combustion carbon capture technology can be retrofitted to existing cement kilns, representing an "end-of-pipe" capture mechanism. In the case of CCU, captured CO<sub>2</sub> is regarded as a commodity (similar to waste heat from a kiln) and can be used to produce building materials. Besides technological advances, material efficiency, end-use recycling (e.g. reuse of concrete & demolition waste), and clinker-to-cement ratio reduction reduce emissions.

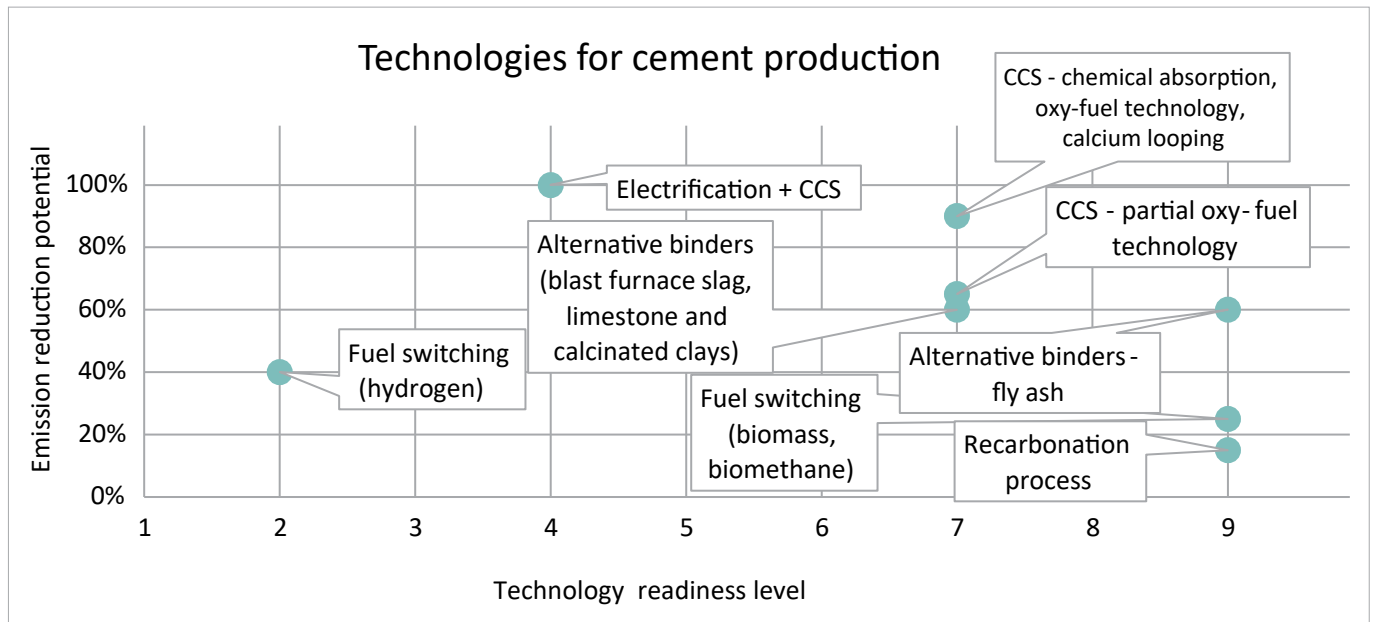
Chart 18 shows the essential decarbonisation technologies that are to some extent available to Czech cement producers. It highlights the cement industry's emission reduction potential and the technology readiness level (TRL).<sup>104</sup>

<sup>102</sup> For more information about investment cycles see: Achieving Net Zero Heavy Industry Sectors in G7 Members, IEA, 2022, available at: <https://www.iea.org/reports/achieving-net-zero-heavy-industry-sectors-in-g7-members>.

<sup>103</sup> The consumption side also has a sizeable decarbonisation potential through a potentially reduced demand for emission-intensive materials and products. Estimates of such changes in product demand and related economic impacts are beyond the scope of this chapter.

<sup>104</sup> The figure shows the higher emission reduction potential and TRL level values available in the study. Nurdiawati A. and F. Urban (2021). Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status, Technologies and Policies. *Energies*, available at: <https://www.mdpi.com/1996-1073/14/9/2408>

Chart 18: Technologies available for cement production decarbonisation



Source: *Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status*

- The combination of kilns electrification and CCS application could deliver almost a 100% decarbonisation effect, but still reach low TRL.<sup>105</sup> Electric rotary kilns meanwhile, can eliminate all fuel combustion emissions, and an example of such a technology research project can be found in Finland.<sup>106</sup>
- CCS application to heat production and chemical reaction-related processes can lead to 95% decarbonisation and is slightly more developed than the combination above. More time is still needed to demonstrate the technology in industrial operations.
- Alternative binders can reduce emissions by up to 60%. Several binders are commercially used as clinker substitutes,<sup>107</sup> such as fly ash, blast furnace slag or supplementary cementitious materials, including calcinated clays and limestone.<sup>108</sup> In many applications, the clinker-to-cement ratio needs to be at least 50%.<sup>109</sup>

Moreover, the cement-to-concrete ratio will decrease over time.<sup>110</sup>

- Increasing the use of fuels such as biomethane, biomass or waste, while commercially available, only yields about 25% emissions reduction. Using renewable hydrogen for heat production could reduce fuel combustion emissions to zero, i.e. a 40% total emission reduction, but it reaches a very low TRL.
- Energy efficiency through digitalisation, implementing state-of-the-art heat usage, and other process and logistics optimisation represents hidden pockets and delivers decent savings in real project applications, usually up to 10%.<sup>111</sup>
- Alternative chemistries exist (including calcium sulfone aluminate, geopolimer, and magnesium silicate), but their TRL is very low. Extensive piloting is a prerequisite for further estimation of their decarbonisation potential.

<sup>105</sup> IEA (2023). *Energy Technology Perspectives 2023*. Available at: <https://www.iea.org/reports/energy-technology-perspectives-2023>

<sup>106</sup> VTT Research (not dated). *Electric rotary kiln*. Available at: <https://www.vttresearch.com/en/ourservices/electric-rotary-kiln>

<sup>107</sup> The Portland type of cement usually contains around 90% of clinker.

<sup>108</sup> Some types of clays combined with ground limestone can potentially replace about half of the clinker used to produce cement without impairing quality. While this mixture is widely available cheaply, the substitution has yet to be commercialised in Europe. The International Energy Agency (IEA) reckons that calcined clay-based cement will have more than 25% global market cut by 2050; see IEA, 2018, *Cement Technology Roadmap*, available at: <https://www.iea.org/news/cement-technology-roadmap-plots-path-to-cutting-co2-emissions-24-by-2050>

<sup>109</sup> IEA (2023). *Energy Technology Perspectives 2023*. Available at: <https://www.iea.org/reports/energy-technology-perspectives-2023>

<sup>110</sup> Cembureau (2020). *Cementing the European Green Deal*. Available at: [https://cembureau.eu/media/kuxd32gi/cembureau-2050-roadmap\\_final-version\\_web.pdf](https://cembureau.eu/media/kuxd32gi/cembureau-2050-roadmap_final-version_web.pdf)

<sup>111</sup> For example, in the LEILAC2 project, production efficiency should increase by 14% by 2050 through process optimisation. See also Nurdiawati A. et al., 2021, *Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status, Technologies and Policies*

### Box 7: LEILAC carbon capture project

Some of the capture technologies have already reached the demonstration stage. The EU-sponsored LEILAC (Low Emissions Intensity Lime and Cement) project by Heidelberg Materials is a good case. Operational since 2019, the Belgian cement plant has demonstrated that CO<sub>2</sub> can be separated without compromising operations.<sup>112</sup>

Building on this pilot, the second project stage envisages a full-scale retrofit and scale-up of the existing capture technology. The LEILAC2 project in Germany is planned to apply carbon capture to its entire industrial operations from 2025.<sup>113</sup> CCU applications could achieve a 95% reduction in emissions if CO<sub>2</sub> is used in the production of materials that are not combusted or incinerated afterwards. Moreover, the project focuses on production efficiency and state-of-art optimisation processes that should increase total efficiency by 14% by 2050.<sup>114</sup>

International companies often pilot selected technologies in facilities abroad; see the example in Box 7. The local implementation of decarbonisation solutions will thus often depend on transferring know-how from abroad to Czechia. In the coming years, the Czech cement industry is expected to focus on increasing production efficiency,

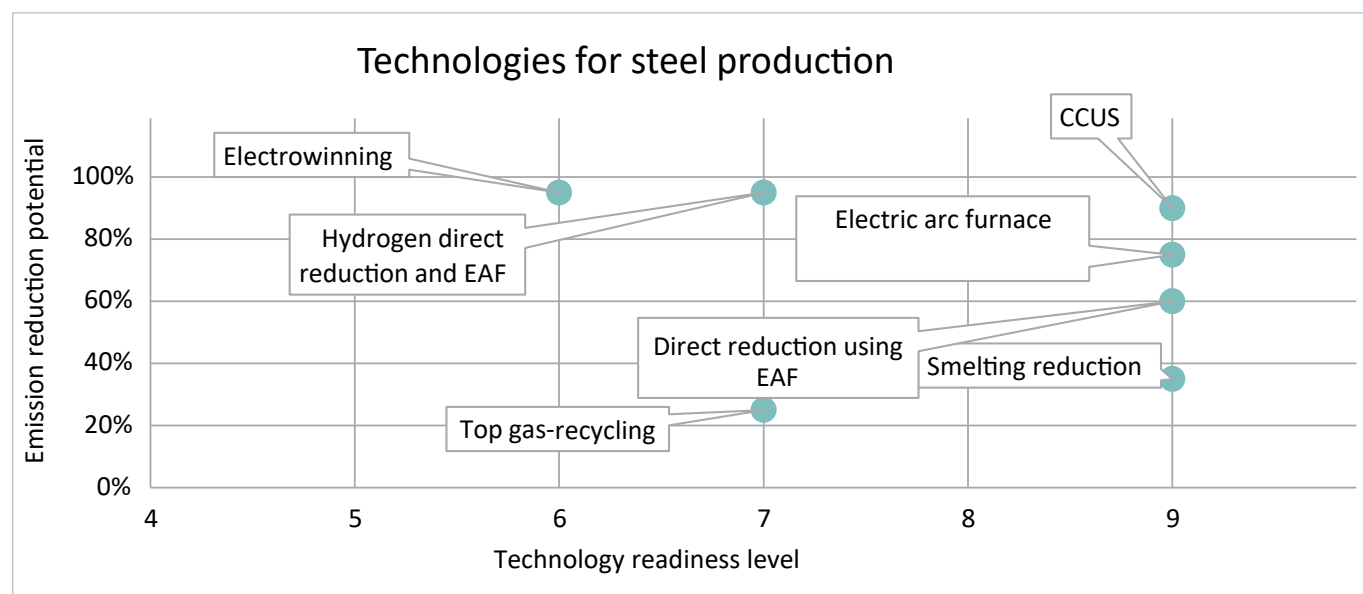
fuel-switching or waste heat recovery.<sup>115</sup> Although the share of biomass and waste for heat production has

increased in the sector in recent decades, there is still potential for tapping into using biomethane instead of natural gas. Ongoing efforts are aimed at reducing the clinker-to-cement ratio and increasing the content of other binders in the cement mix. An advantage of CCS application is the possibility to fully retrofit existing facilities with new technologies (or CCU applications), though major deployment is expected only after 2030.

### Iron & steel industry

A crucial part of iron and steel production is the iron ore reduction to iron. The Czech steel industry relies primarily on integrated blast furnaces using coking coal, and the related process emissions accounts for the majority of steel industry emissions. Nevertheless, other reducing agents can also be used in iron ore reduction processes. Direct hydrogen reduction is foreseen as a decisive technology of the future. As regards fuel combustion emissions, fuel switching, waste heat recovery, and optimisation processes can lead to reduction of emissions from heat production. In addition, steel scrap melting in electric arc processes can lead to reduction of emissions from heat production. In addition, steel scrap melting in electric arc furnaces represents another key and commercially used low-carbon technology. CCS

Chart 19: Technologies available for steel production decarbonisation



Source: *Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status*

112 LEILAC project, see <https://www.leilac.com/project-leilac-1/>

113 Heidelberg Materials (2022). Green light for LEILAC 2 carbon capture project at HeidelbergCement's plant in Hanover, Germany. Available at: <https://www.heidelbergmaterials.com/en/pi-23-03-2022>

114 LEILAC Roadmap 2050, 2021, see <https://www.leilac.com/wp-content/uploads/2022/09/LEILAC-Roadmap.pdf>

could also play a role in capturing both fuel combustion and process-related emissions. Complex pilot and demonstration

115 For example, Cement Hranice plans to use available waste heat for electricity production at the WHR power plant, see CO<sub>2</sub> Focus Roadshow, 2021, Buzzi Unicem, available at: <https://www.unicalcestruzzi.it/web/guest/presentations>

decarbonisation projects are starting to work in the EU. See Box 8 for two examples. Chart 19 shows the key decarbonisation technologies that are to some extent available to Czech steel producers. It highlights the steel industry's emission reduction potential and TRL.

### Box 8: EU pilot and demonstration projects

The HYBRIT project<sup>116</sup> aims to develop a demonstration hydrogen-based direct reduction steelmaking process and establish a fossil-free value chain from the mine to the final product. The first year of pilot-stage development confirmed the possibility of producing high-level steel with significant quality and improved properties. In the next phase, a demonstration facility in Gällivare, Sweden, is planned to start operating in 2026.

The 3D project<sup>117</sup> aims to develop a first-of-a-kind carbon capture unit operating in the steel industry. Using a novel DMX solvent to separate CO<sub>2</sub>-rich liquid from waste gases; using waste heat recovery for a less energy-intensive carbon capture process. ArcelorMittal foresees building a demonstration project in Dunkirk, France, to capture around 4,400 tonnes per year and prove the technology for full-scale industrial operation.

- Hydrogen direct reduction combined with EAF represents the most promising technology with a potential of up to 95% emission reduction. Although it reaches high TRLs, it is far from being cost-effective due to high investment costs, the massive increase in electricity demand, or the low availability/affordability of hydrogen.<sup>118</sup> Retrofitting some DRI plants from natural gas or coal to use hydrogen is possible.<sup>119</sup>
- Electrowinning, the electrolysis of iron ore into steel plate, could achieve a 95% emission reduction. Instead of a blast furnace, the plant would have to be electric, emitting only oxygen. Such a technology is still in an early stage of development and has a lower TRL than the hydrogen direct reduction process.
- CCS can reduce emissions by 90%. However, it is foreseen to be applied in the EU only in the 3D

116 HYBRIT. Fossil-free steel – a joint opportunity! Available at: <https://www.hybritdevelopment.se/en/>

117 European Commission (2022). DMX Demonstration in Dunkirk. Available at: <https://cordis.europa.eu/project/id/838031>

118 See <https://www.ocelarskaunie.cz/porucit-vetru-a-desti-uz-tu-jednou-chteli/>

119 IEA (2023). Energy Technology Perspectives 2023. Available at: <https://www.iea.org/reports/energy-technology-perspectives-2023>

project by 2030. High capex needed to build the CO<sub>2</sub> pipeline network (compared to the average size of steelworks) and early stages of development are currently delaying implementation in the region.<sup>120</sup>

### Box 9: Decarbonisation investments by Liberty Ostrava

Liberty Ostrava plans to modernise and build two new hybrid electric arc furnaces to decarbonise its operations, starting by the end of 2025. The company thus aims to reduce its carbon emissions by 80% by 2027. The total cost of the innovation is EUR 350 mil.<sup>121</sup> With this investment, the steel scrap use is planned to be ramped up. Yet the technology relies on a higher electricity demand for which a high voltage power line must be built by 2025.

The furnaces will reportedly be hybrid and allow using steel scrap and sponge iron from the direct reduction process. Questions remain about the availability of steel scrap and its future upscaling potential, especially if the other steelmaker, Třinecké Železárny, builds another electric arc furnace. Overall, Liberty Ostrava plans to invest a total of EUR 750 mil. (including EAF) to decarbonise its operations and achieve carbon neutrality by 2030.

- Electric arc furnaces may reduce emissions by 70% and the associated steel scrap use would save around 75% of energy needs.<sup>122</sup> Hybrid electric arc furnaces can use steel scrap and sponge iron from direct reduction. Although EAF technology significantly reduces total energy needs, it increases the demand for (renewable) electricity almost four-fold<sup>123</sup> and significantly also for steel scrap, which is not currently available in bulk.<sup>124</sup>
- Electric arc furnaces can also be used to reduce iron instead of any other natural agent directly.

120 For example, ArcelorMittal Poland 2021 Sustainability Report states that in Europe the group plans to implement CCUS combined with DRI-EAF (using natural gas in the first phase, eventually being replaced by hydrogen later) to replace coal and achieve the group's carbon neutrality by 2050.

121 See: <https://libertysteelgroup.com/cz/news/cez-esco-a-liberty-spolupracuji-na-dekarbonizaci-liberty-ostlava/> and <https://libertysteelgroup.com/cz/news/liberty-zahajuje-historickou-investici-do-transformace-ostlavské-huti-ve-vyrobce-zelene-oceli/>

122 See <https://www.ocelarskaunie.cz/recyklace-oceli-v-cesku-usetri-rozne-tolik-energie-kolik-se-ji-za-stejnou-dobu-vyrobi-z-obnovitelných-zdroju/>

123 European Commission, 2021, Towards competitive and clean European steel, [https://ec.europa.eu/info/sites/default/files/swd-competitive-clean-european-steel\\_en.pdf](https://ec.europa.eu/info/sites/default/files/swd-competitive-clean-european-steel_en.pdf)

124 In Czechia, steelworks currently use around 40-45% of scrap in steel production, and the share is expected to grow, based on Climate & Company, 6 Flagships to Accelerate Czechia's Green Transition – Accelerate Shift Towards Green Steel, available at: [https://issuu.com/climateandcompany/docs/industry\\_cz](https://issuu.com/climateandcompany/docs/industry_cz).

This process produces the sponge iron, which is melted afterwards.<sup>125</sup> Direct reduction using EAF may reduce carbon emissions by up to 60% and is commercially available.

- Smelting reduction enables using 100% of the biomass for heating and is a commercially available solution. Top-gas recycling blast furnaces use blast furnace gas and recycle it to reduce iron ore. However, the decarbonisation potential of these technologies without CCS is limited (30%).

Currently, Czech steelmakers are focusing on the deployment of EAFs and the associated use of steel scrap (see also Box 9), while CCS is receiving less attention and it seems more readily available to the cement or chemical industries. In this context, Czechia needs a clear strategy for steel scrap to become a local production input rather than an export commodity. Also, plans for electricity transmission and distribution need to be adjusted accordingly to prepare for higher electricity use by the sector. While the combination of EAF and steel scrap reuse has the potential to significantly reduce the country's steel emissions by 2030, iron sponge primary production through H<sub>2</sub>-DRI and EAF is likely to be crucial to achieving net zero thereafter.

## Chemical industry

- The chemical sector has benefited from access to low-cost natural gas in recent years, and many processes depend on this commodity as a critical input. Fuel combustion emissions are responsible for approx. 60% of emissions, hence fuel switching, waste heat recovery, electrification and, in general, energy efficiency represent an opportunity for significant decarbonisation. Chemical processes<sup>126</sup> are responsible for the remaining approx. 40% emissions. These can be captured and stored (CCS) or used (CCU), keeping CO<sub>2</sub> in the production loop as an input for producing methanol as a new base chemical, synthetic fuels, plastics, or other chemicals. Renewable inputs and bio-based production offer a way to shift towards new value-added products.<sup>127</sup>

125 Nurdiawati A. and F. Urban (2021). Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status, Technologies and Policies. *Energies*, available at: <https://www.mdpi.com/1996-1073/14/9/2408>

126 Including emissions from downstream operations such as the production of olefins, aromatics, ammonia, methanol, carbon black, or grey hydrogen, typically produced by steam-methane reforming (SMR) or partial oxidation (POX), using natural gas as the primary input.

127 Bio-based chemicals can be considered a low or no-carbon alternative to the usual petrochemicals (polymers, fossil-based ethylene). Bioplastics technologies still need to be deployed at scale, but early markets have been successful for bottle packaging and cosmetics. See: <https://drawdown.org/solutions/bioplastics>

- Chart 20 shows the essential decarbonisation technologies that are to some extent available to Czech chemical producers. It highlights the chemical industry's emission reduction potential and TRL.
- CCS technology offers a 90% emission reduction potential, supported by high CO<sub>2</sub> concentration in some chemical processes; its pilot and demonstration projects can be found across the EU.
- Renewable and low-carbon feedstocks, such as bio-based feedstock for steam cracking, ammonia, fertilisers or methanol production, can also significantly reduce emissions; however, there is still a way to commercialise these technologies. Energy carriers such as green ammonia are being piloted. Bio-based commercialise these technologies. Energy carriers such as green ammonia are being piloted. Bio-based feedstock combined with CCS could theoretically produce negative emissions in several applications. In plastics production, renewable methanol from green hydrogen and captured CO<sub>2</sub> can serve for processes including methanol-to-olefins or

### Box 10: Large-scale electrically heated steam cracker furnaces

BASF, together with its partners SABIC and Linde have started to build the first demonstration plant for large-scale electrically heated steam cracker furnaces.<sup>128</sup> The plant utilises electricity produced by renewable sources and should come online in 2023.

The German government contributed EUR 14.8 mil to the project. The “Decarbonisation in Industry” funding program earmarked a cumulative EUR 3 bil. to support energy-intensive industries' transition efforts in Germany until 2024.

BASF will have received an additional EUR 134 mil. in state funding to expand its green hydrogen production capacities.<sup>129</sup> The hydrogen electrolyser is envisaged to start operating in 2025.

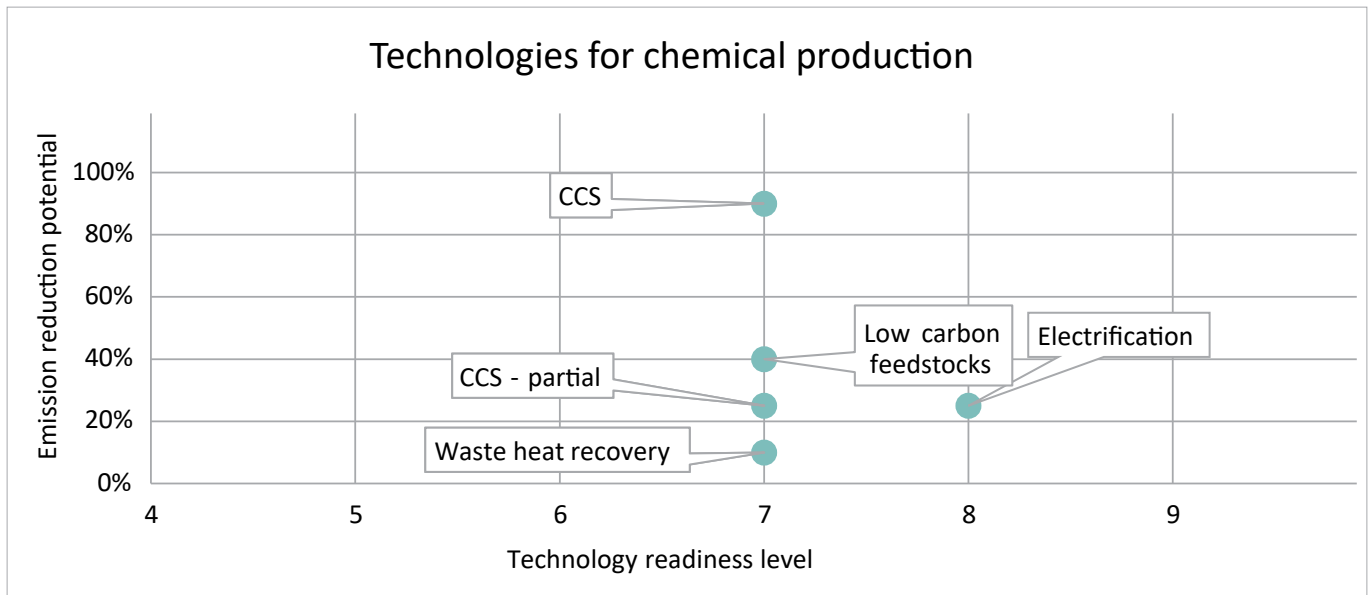
methanol-to-aromatics, with a current TRL of 8 and a potential for 100% emission reduction.

- Electrification of general operations and heating processes can deliver 25% emission reductions with a TRL of up to 8. As an example, the electrification

128 BASF, 2022, press release, see <https://www.basf.com/global/en/who-we-are/sustainability/whats-new/sustainability-news/2022/basf-sabic-and-linde-start-construction-of-the-worlds-first-demonstration-plant-for-large-scale-electrically-heated-steam-cracker-furnaces.html>

129 European Commission decision, Oct 2022, see [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_22\\_5943](https://ec.europa.eu/commission/presscorner/detail/en/IP_22_5943)

Chart 20: Technologies available for chemical production decarbonisation



Source: Towards Deep Decarbonisation of Energy-Intensive Industries: A Review of Current Status

of steam crackers can produce high-value chemicals with such decarbonisation potential. Demonstration projects are due to be commissioned by 2023/2024.<sup>130</sup> Box 10 gives an example of the renewable electricity use in the chemical industry.

- Waste heat recovery may reduce emissions by 10% across the sector, but still requires much attention for commercialising the most promising technical solutions (including optimisation and energy efficiency).
- The chemical industry is also a hydrogen producer. Such hydrogen can be an input to other chemical processes, such as the production of olefins or ammonia,<sup>131</sup> or represent a strategic power reserve for chemical industries to tap into. Unlike hydrogen produced via water electrolysis using renewable electricity, the “blue” hydrogen production (with CCS) is not supported based on the EU GBER decision.<sup>132</sup>

By 2030, the chemical industry is expected to focus primarily on energy efficiency and fuel-switching, including the electrification of low-heat processes. Currently, the natural gas market turmoil in 2022 is forcing consideration of bio-based feedstock and increased biomass and biomethane use, one of the areas increasing input

stability. Moreover, the Czech chemical industry is reportedly planning a pilot-scale CCU project. CCU could become the leading decarbonisation technology for the chemical industry after 2030. There, however, needs to be a clear EU regulatory framework for low-carbon products and their carbon accounting.

## INVESTMENT NEEDS ESTIMATE

To estimate investment needs of the hard-to-abate industries, three publicly available sources are discussed below to show the pathway towards achieving the emission target for 2030, as defined in the previous chapter.

The Material Economics study estimates the EU net-zero pathways in hard-to-abate industries through a dynamic model backcasting in three scenarios: new processes, circular economy and carbon capture. The 2050 Pathways Explorer with the AMO 2050 Net-Zero Scenario shows the estimates of annual capex for each of the hard-to-abate industries in Czechia. A study by the Charles University Environment Centre shows several scenarios using the TIMES-CZ model that estimate the impact of the Fit for 55 policies on the Czech energy system, where different assumptions shape how energy-system technologies are adopted.

Investment needs have been examined specifically for the period 2023-29, i.e. until the last year before the roadmap’s 2030 target year. Where appropriate, linear interpolation has been used to derive annual capex. For more information about the models, their assumptions and partial outcomes see Annex 2.

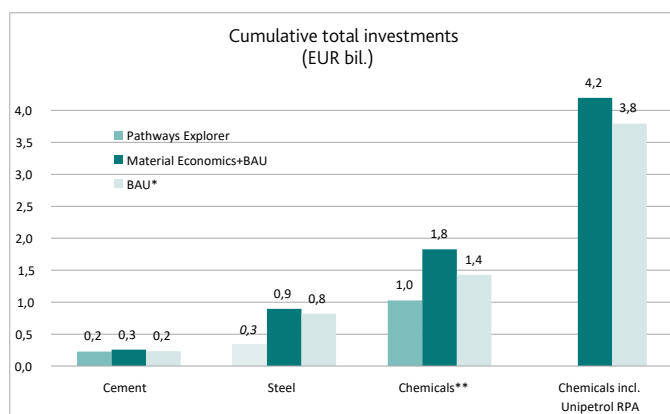
<sup>130</sup> IEA (2023). Energy Technology Perspectives 2023. Available at: <https://www.iea.org/reports/energy-technology-perspectives-2023>

<sup>131</sup> Ammonia can be considered a low-carbon seasonal energy storage and can facilitate electricity trading. Compared to hydrogen, it has the advantages of being more scalable and easier to store.

<sup>132</sup> European Commission, 2023. State aid: Commission amends General Block Exemption rules to facilitate further and speed up the green and digital transition. Available at: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_23\\_1523](https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1523)

An overview of the capex estimates resulting from the first two models above, supplemented by a business-as-usual forecast based on a historical capex extrapolation, is presented in Chart 21. Investment needs are estimated at approx. EUR 5.3 bil. in total in 2023-9, of which EUR 0.3 bil., EUR 1 bil. and EUR 2-4 bil. are in the cement, steel and chemicals sectors, respectively. As the TIMES-CZ model provides only partial capex estimates (energy-related industrial investments), its results are not compared in this chart. The business-as-usual forecast extrapolating the historical capital expenditures of the Czech hard-to-abate sectors is shown in Annex 3.

**Chart 21: Estimated investment needs in 2023-29**



Notes: \* Business-as-usual forecast based on historical capex extrapolation \*\* Chemical sector without refineries<sup>133</sup>

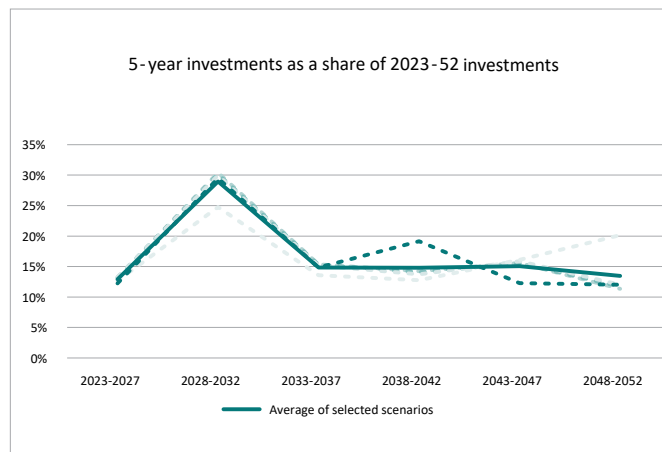
Source: ISFC calculations based on Material Economics and Pathways Explorer outputs

Chart 21 also indicates that additional decarbonisation-related investments can increase business-as-usual total capex by about 10% in the period up to 2029. During this period, additional investments increase gradually and reach 16%, 14% and 12% of business-as-usual capex in 2029 for the steel, chemical and cement sector, respectively. While TIMES-CZ indicates that energy-transformation decarbonisation investments should peak in the Czech industry around 2030, as shown in Chart 22,<sup>134</sup> Material Economics foresees farther growth in total additional capex of hard-to-abate industries after 2030, peaking around 2040, as shown in Chart 23 for the EU as a whole.

<sup>133</sup> The refinery business in Czechia is represented by ORLEN Unipetrol RPA, also the largest producer of petrochemicals and agrochemicals in Czechia. However, the company does not report financials by business streams. In the BAU estimate, the entire ORLEN Unipetrol RPA capex is excluded from the sector-wise figures to estimate capex of the chemical sector without refineries.

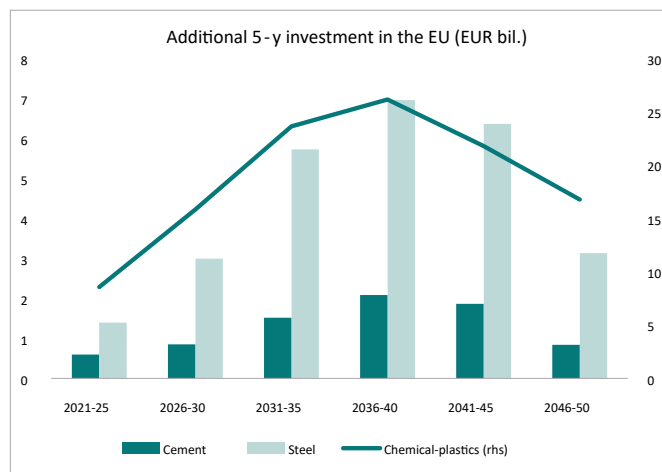
<sup>134</sup> On average, almost 42% of all one-off industry investments into energysystems in 2023-52 are projected before 2032. Compared to the reference scenario without the legislative package, the Fit for 55 measures shift the investment cycle peak, use much less carbon-intensive new technology and bring up to 13% more investments in industrial energy systems until 2052 (until 2032 the increase is double).

**Chart 22: Energy-related industrial capex in Czechia (5-year sums as a % of 2023-52 total)**



Source: ISFC calculations based on TIMES-CZ model results of the Charles University Environment Centre study

**Chart 23: Projected evolution of additional capex in the EU in 2020-50 by sector**



Source: ISFC calculations based on Material Economics<sup>135</sup>

There is limited publicly available information on the planned capex amounts from hard-to-abate companies to compare with model estimates. Libery Ostrava, one of the two Czech steel producers, has disclosed its plan to invest EUR 0.75 bil. in its local steelwork this decade (for more details see Box 9). The amount could indicate approx. 15-20% higher capex plans compared to the upper end of the model estimates above.

<sup>135</sup> A simple average of all three pathways (new processes, circular economy and carbon capture); see Annex 2 for details.



**Financing  
available**

# Financing available

This chapter discusses how and to what extent private resources, potential public support and other financial instruments such as guarantees or contracts for difference can contribute to the successful decarbonisation of the Czech hard-to-abate industries. The chapter also addresses the question of whether the industries will have available sufficient financing sources to cover the increased investment needs expected by the 2030 target year.

First, the ability of hard-to-abate industries to generate free cash flows for investment is examined. As discussed earlier, the profitability and financial situation of the three sectors concerned differ significantly; private resources are therefore assessed separately for each sector. Based on the operating profitability, the additional debt capacity of the sector is then estimated. Finally, their respective shares of available public funding (grants) applicable for financing decarbonisation investments are added.<sup>136</sup> Based on the grant conditions and the historical share of public vs. private funding achieved for the main EU funds, private sources are estimated to represent at least 55% of the total financing. The resulting total composite amounts of funding available are then compared to the investment needs of the sectors identified in the previous chapter.

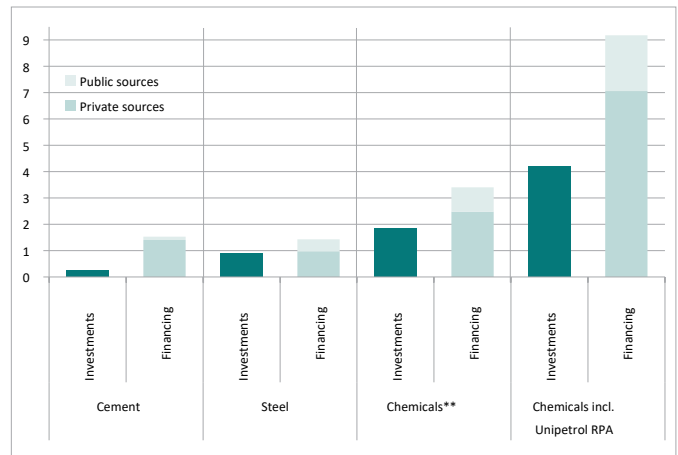
In summary, the cement and chemical sectors are well positioned to finance transitional investment needs in 2023-29, despite the relatively volatile operating profitability of the latter. The low and volatile profitability of the steel sector may limit its financing capacity for new investments, though in the period up to 2030, investment needs could be sufficiently covered by combination of private sources and public grants.

## PRIVATE RESOURCES

This sub-chapter addresses the investments financing capacity of hard-to-abate industries based on a combination of their estimated aggregated ability to generate free cash flow in 2023-9 (i.e. until the last year before the roadmap's 2030 target year) and their additional debt capacity. Financing capacity thus disregards any possible extra equity injections from their parent companies (or other related companies).<sup>137</sup>

The private financing potential of the three sectors considered – taking into account the safe debt level – is estimated at more than EUR 9 bil. over the period 2023-29, assuming zero dividend payments. Under a different actual dividend policy, the private financing potential would be significantly reduced. Of the above amount, 70% comes from free cash flow while the remainder from additional debt, as further described in the following subsections.

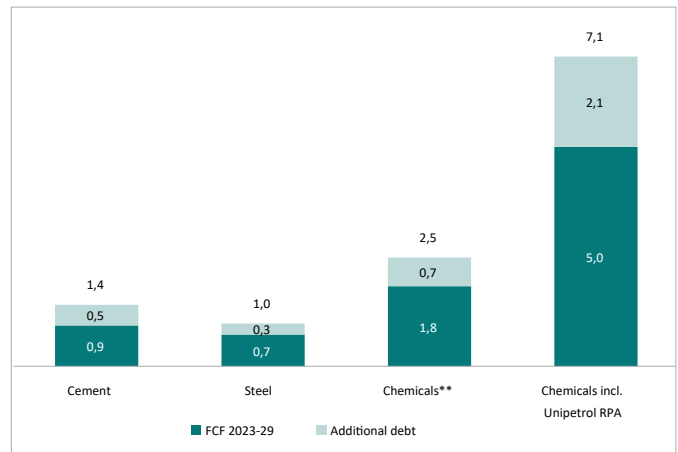
**Chart 24: Estimated coverage of investment needs by available funding in 2023-29 (EUR bil.)**



Notes: \*\* Chemical sector without refineries<sup>138</sup>

Source: ISFC

**Chart 25: Estimated private sources potentially available in 2023-29 (EUR bil.)**



Source: ISFC based on company and sector data

<sup>136</sup> In proportion of their respective investment needs identified in the previous chapter.

<sup>137</sup> This does not exclude situations where additional debt financing can be conveniently raised at the parent company level and provided to local companies through intra-group loans at the arm's length principle.

<sup>138</sup> The refinery business in Czechia is represented by ORLEN Unipetrol RPA, also the largest producer of petrochemicals and agrochemicals in Czechia. However, the company does not report financials by business streams. The entire ORLEN Unipetrol RPA's capex and financing potential is excluded from the sector-wise figures to estimate capex of the chemical sector without refineries.

The free cashflow estimates stem from the current economic position of the companies / sectors, their forecasted 2023-9 operating performance, usual investment policy and the related additional cash flows.<sup>139</sup> The forecasts consider, inter alia, the effects of recently increased energy and material input prices, decreasing volumes of free CO<sub>2</sub> emission allowances, expected CO<sub>2</sub> price growth, as well as current net debt levels. For the aggregate income statement and balance sheet forecasts of the three sectors until 2030 and selected key forecast assumptions, see Annex 3.

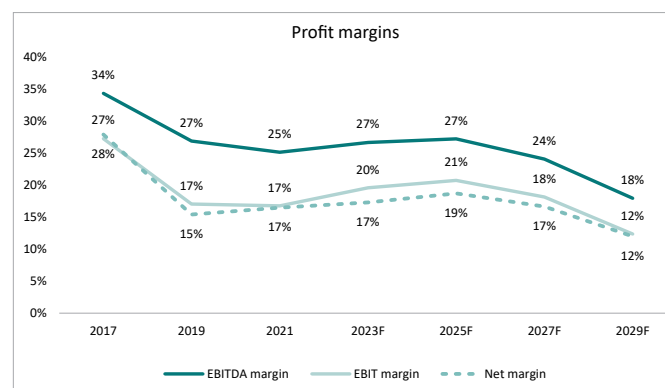
The additional debt capacity is equal to the difference between the level of debt considered safe for mature industries and the actual debt level. The maximum safe debt level is estimated using a 3x multiple of EBITDA and is checked also against its share of total capital, which should not exceed 50%, as should not the ratio of total liabilities to total assets.<sup>140</sup>

## Cement sector

The Cement sector financing capacity estimate combines financials forecast for four Czech cement producers: Českomoravský cement, Cement Hranice, Lafarge Cement and CEMEX Czech Republic.<sup>141</sup>

As already mentioned in the Current status: Cement sector chapter, the sector faces limited international competition as cement is not widely traded cross-border due to transport limitations and weight-to-value considerations. This should allow companies to maintain profitability in the coming years. Chart 26 also shows that the cement sector's profitability would be significantly affected by a gradually reduced free EAs allocation from 2026 (unless the EU market allows compensation through price increases).

Chart 26: Cement sector margins forecast - without major decarbonisation investments



Source: companies annual reports, ISFC calculations and forecast

The investment financing capacity in the sector in 2023-9 could reach EUR 1.4 bil. at current prices. However, the above assumes zero profit distribution in the period. All cement producers except CEMEX CR have applied a 100% pay-out ratio in recent years, though. Roughly half of this total amount is thus a function of the companies' dividend policy in the coming years,<sup>142</sup> assuming no public grants are used. For more information on possible grants, see the next sub-chapter Public sources.

## Chemical industry

Given the high number of market players in the segment, the Czech chemical sector's financing capacity has been estimated based on key sector-wise historical financials, as reported under the industry standard classification system code NACE-20: Manufacture of chemicals and chemical products.<sup>143</sup> At the same time, the aggregated financials of the main Czech chemical producers are modelled to fine-tune operating cost and key balance-sheet items forecasts.<sup>144</sup>

<sup>139</sup> Estimated business-as-usual investments are then added back and included in the industries' (pre-capex) free cash flow estimations and total investment financing capacity.

<sup>140</sup> A debt ratio about 50% is considered to be the maximum healthy debt ratio. Exceeding it leads, for example, to a credit rating downgrade below investment grade; see e.g. How much is too much? Debt capacity and financial flexibility, Hess, D. and Immenkötter, P., 2014, Centre for Financial Research Working Paper NO. 14-03, available at: <http://hdl.handle.net/10419/97174>

<sup>141</sup> Following several intra-group mergers in 2017-8, CEMEX Czech Republic's financials include cement, concrete and other business streams. As financial capacity is estimated per business entity, separate cement-specific results are not estimated, but the whole company's financials are included/modelled.

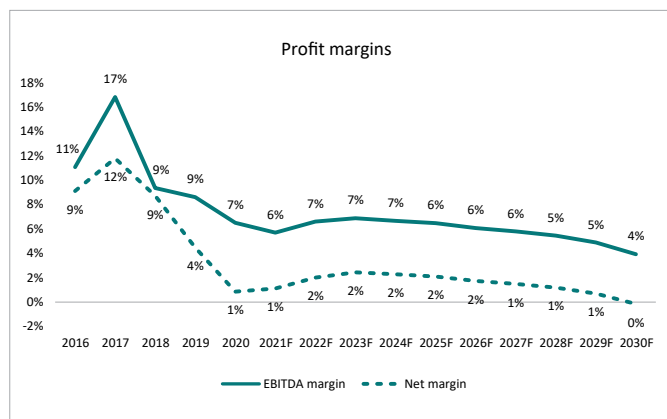
<sup>142</sup> This corresponds to the FCF part of the total amount less business-as-usual capex.

<sup>143</sup> Selected financials reported for NACE-20: Manufacture of chemicals and chemical products under the structural business statistics by Eurostat at: <https://ec.europa.eu/eurostat/data/database> and/or by the Czech Statistical Office at: <https://www.czso.cz/csu/czso/economic-results-of-the-industry-of-the-cr-2020>. For simplicity, gross operating surplus is approximated with EBITDA. ORLEN Unipetrol RPA's business is vertically integrated from oil refining (NACE-19) to manufacturing of petrochemicals and agrochemicals (NACE-20) and the company is also included in the chemical sector-wise financials; the company does not report financials by business stream.

<sup>144</sup> Mid-size chemical producers: BorsodChem MCHZ, DEZA, Lovochemie, Precheza, Spolana, Synthesia, SYNTHOS Kralupy, Synthomer.

The chemical industry profit is volatile as the sector's ability to pass on higher input costs (energy, materials) to consumers depends on the current market situation and demand. EBITDA margins of major chemical companies historically hovered in the range of 5-15%, but the deterioration of the operating environment in Europe (COVID-19, energy crisis, war in Ukraine) has put the sector under pressure recently. The sector will also be affected by increasing EAs prices and gradually reduced free EAs allocation from 2026 onward, though significantly less than the other two hard-to-abate industries given the smaller share of carbon costs in the sector's total operating costs.

**Chart 27: Chemical sector margins forecast - without major decarbonisation investments**



Source: ISFC based on Eurostat data

Investment financing capacity in the sectors in 2023-9 could reach EUR 7 bil. at current prices, assuming zero profit distribution in the period. The historical dividend policy of chemical producers has been cyclical, as has their profitability.

## Iron & steel industry

The steel sector financing capacity combines financial forecasts for two Czech major steel producers: Třinecké železářny and Liberty Ostrava.<sup>145</sup>

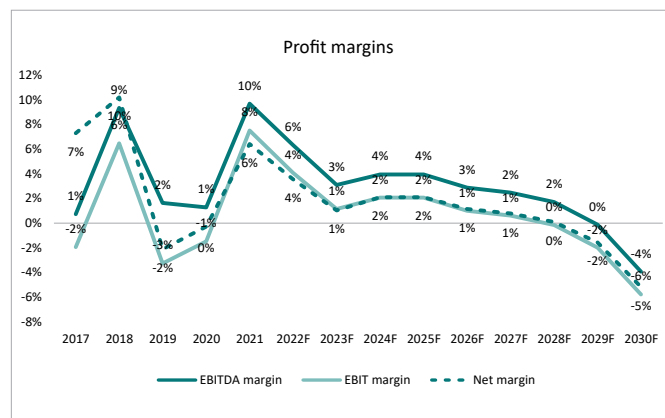
The steel market is highly internationalised and manufacturers are exposed to competition from other regions, inter alia due to the lower proportion of transportation costs in the final price. This and increased production capacity in China contributed to the weak financial results of both Czech steel producers. This market situation is expected to continue for at least the next few years. Chart 28 also shows that profitability is significantly affected by a gradually reduced free EAs allocation from 2026 onwards

<sup>145</sup> Liberty Ostrava prolonged its financial reporting period to 18 months in 2019, stretching from 1.1.2019 to 30.6.2020, and shortened it to 9 months in 2021, from 1.7.2020 to 31.3.2022. All the metrics were (linearly) recalculated to 12-month calendar-year periods to ensure their comparability with other analysed companies.

(unless the EU market allows compensation through increased prices after the CBAM gradual phase-in).

Given the unappealing and volatile financial results of the sector, its investment financing capacity is limited and could reach EUR 1 bil. in 2023-9 at current prices, assuming zero profit distribution in the period and no extra equity injections from parent companies (or other related companies).

**Chart 28: Steel sector margins forecast – without major decarbonisation investments**



Source: companies annual reports, ISFC calculations and forecast

## Additional debt

With respect to debt financing, Czech enterprises – not only in hard-to-abate sectors – traditionally rely on loans provided by banks at the local level or intra-group by parent companies. Nevertheless, several sizable green or sustainable-linked bond issues have been realised in recent years and the alternative of bond financing is also elaborated hereunder.

### Corporate loans

Current debt ratios are moderate in the three hard-to-abate sectors, with the debt-to-capital ratio ranging from 12% to 23%.<sup>146</sup> The combined additional debt capacity of the industries is estimated at EUR 2.8 bil. for the period 2023-29, most of which is in the chemicals industry.

An overview of the major banks and their activities and exposures with respect to sustainability transition financing is provided in Annex 4. Based on available reports, ESG-related lending (mostly supporting renewable energy sources and energy efficiency measures) can account for up to 20-40% of bank's corporate investment loan portfolio, although classification and/or reporting may not be fully comparable between banks. Most banks also provide discounted or partially guaranteed sustainable

<sup>146</sup> The ratio of total liabilities to total assets ranges from 37% to 45%.

financing in partnership with the European Investment bank or the European Investment Fund – see also Annex 5 for details.

The recently introduced EU taxonomy and mandatory reporting under the Sustainable Finance Disclosure Regulation (SFDR) puts additional pressure on financial institutions to expand their sustainability-aligned financing. This, and the increased level of non-financial corporate reporting standardisation introduced by the Corporate Sustainability Reporting Directive, is encouraging companies to embed sustainability into their business and investments.

## Green bonds

In addition to credit financing, companies can also issue green and/or sustainability-linked bonds to finance their

### Box 11: Environmental risk management and impacts on lending by Czech banks

Based on the Czech National Bank's 2022 survey,<sup>147</sup> almost all banks take into account the associated environmental risk when assessing client riskiness. Two-thirds of them incorporate environmental risks in their loan pricing and half of banks incorporate them into their internal credit risk analysis models, or will do so within two years.

Almost all the surveyed institutions use both qualitative and quantitative methods to analyse environmental risks or plan to do so within two years. The most widely used qualitative methods include consideration of external counterparty ESG rating and qualitative analysis of climate scenarios. In response to the results of climate scenarios, 50% of banks are implementing changes to their credit portfolio or plan to do so within two years.

No bank currently takes into account clients' voluntary carbon offsets when lending and only two banks are considering doing so by the end of 2023.

sustainability transition.<sup>148</sup> The EU Green Bond Standard allows bonds to be marketed as green if the proceeds will be used to fund an activity aligned with the EU taxonomy (as described in the sub-chapter: EU Strategies, policies & regulation – Key green transition tools & mea-

asures).<sup>149</sup> Green bonds attract high investor interest and, often, allow lenders to benefit from lower interest rates compared to standard bonds.<sup>150</sup>

There are several factors preventing hard-to-abate industries from issuing green or sustainability-linked bonds – including high administrative costs and minimum issue size:

- Any green bond issuance must be accompanied by the publication of a green bond framework detailing the company's sustainability goals and strategy to clarify the role of the bond issuance. The framework must be verified by a second party opinion to ensure its validity. Both steps impose additional costs on the issuer.
- Green bonds, like other bonds, must be issued in a certain minimum volume, usually estimated to be in the lower hundreds of million euros. This is to ensure the instrument will have a sufficient liquidity. Investors might perceive an issue of a smaller volume as less liquid and thus require compensation for the reduced liquidity through an increased interest rate.

These two limiting factors reserve bond financing for the largest decarbonisation projects. Only projects in steel production and possibly large investments in cement production would reach the ticket size justifying a green bond issuance. More likely, green bonds would be issued by the parent companies of Czech hard-to-abate industrial companies and by banks over their portfolio of eligible client loans.

The use of green and sustainability-linked bonds is increasing slowly and the volume of such bonds issued in Czechia currently lags behind Western Europe. No Czech company in hard-to-abate industries has yet issued a green or sustainability-linked bond. However, the EU Sustainable Finance agenda policies, together with investor pressure, are expected to lead to their wider use. An overview of recent sizable bond issues certified as green or sustainability-linked in other sectors is provided in Annex 6.

147 Financial Stability Report - Autumn 2022, Czech National Bank, December 2022, available at: [https://www.cnb.cz/export/sites/cnb/en/financial-stability/galleries/fs\\_reports/fsr\\_2022\\_autumn/fsr\\_2022\\_autumn.pdf](https://www.cnb.cz/export/sites/cnb/en/financial-stability/galleries/fs_reports/fsr_2022_autumn/fsr_2022_autumn.pdf)

148 A sustainability-linked bond is a bond whose financial and structural characteristics are based on whether the issuer achieves sustainability or ESG metrics within a given timeframe. If the company doesn't meet those goals, increased interest is usually paid to investors.

149 European Green Bond Standard, European Commission, 2022, available at [https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard\\_en](https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard_en)

150 Green Bonds offer pricing benefits both issuers and investors, Climate Bonds Initiative, 2022: <https://www.climatebonds.net/2022/03/green-bonds-offer-pricing-benefits-both-issuers-and-investors>

## PUBLIC SOURCES

Besides carbon pricing, public sources represent another major tool in public administration hands that, if applied properly, can significantly influence the decarbonisation pathway towards the ultimate net-zero target. As mentioned in the Investment need chapter, assets' longevity and investment cycle often limit hard-to-abate industries to a single investment round before achieving envisaged climate neutrality by 2050. Targeting public grants properly, so as not to under- or over-shoot the target, or miss the investment window, is therefore critical for a

Another portion of the EAs auctioning income flows directly to national budgets. In Czechia, however, these proceeds (over EUR 1 bil. per year - estimate for 2023) have not been used for industry decarbonisation and only part of them has been used for climate-related purposes. The Ministry of Environment plans to propose using all national proceeds from the EU ETS allowances auctioning for decarbonisation purposes from 2024

As elaborated further below, the vast majority of public funding available for the heavy industry decarbonisation comes from EU funds, mostly from the Modernisation and Innovation Fund, funded in turn by revenues from auctioning EU ETS allowances.

Another portion of the EAs auctioning income flows directly to national budgets. In Czechia, however, these proceeds (over EUR 1 bil. per year - estimate for 2023) have not been used for industry decarbonisation and only part of them has been used for climate-related purposes. The Ministry of Environment plans to propose using all national proceeds from the EU ETS allowances auctioning for decarbonisation purposes from 2024 onward as a result of the EU ETS revision,

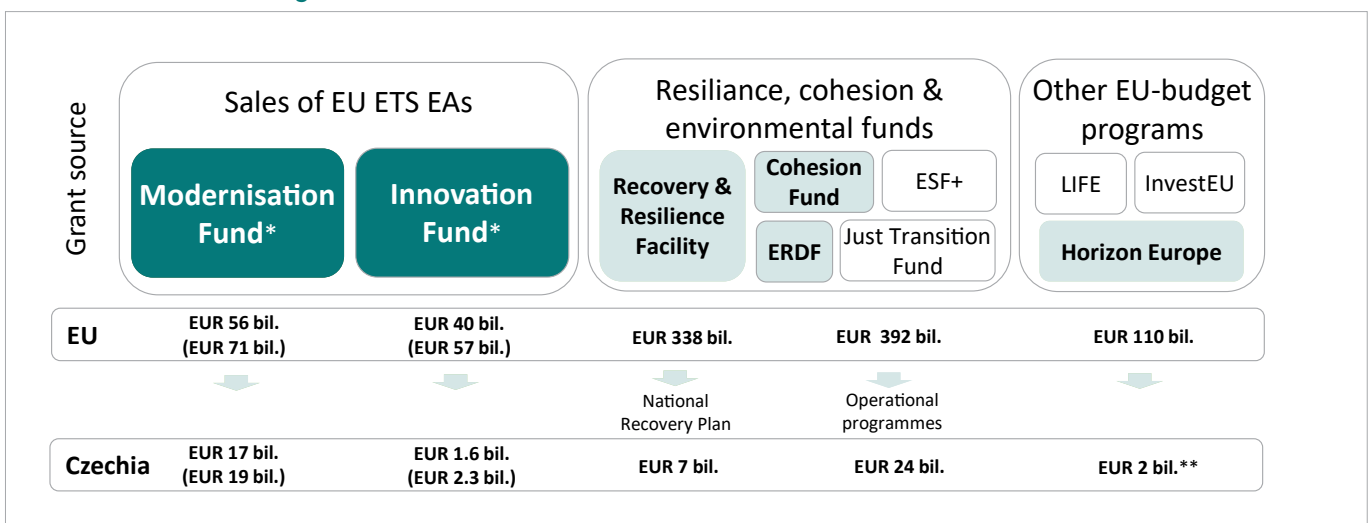
part of the Fit for 55 package (see the Policy environment chapter for more details). Nevertheless, no related possible funding is included in the amount hereunder as no details on the envisaged allocation between economic segments, let along individual sectors, are known to allow an accurate estimate.

Table 7 thus provides an overview of the grants available from EU-only sources until 2027 (2030 in the case of the Modernisation and Innovation Funds). The darker the colour, the more relevant the source is for hard-to-abate industries.

Table 8 below summarises the estimated portions of the major public sources effectively available for decarbonisation of hard-to-abate industries in Czechia in 2021-27/30. The total estimate amounts to EUR 2.3 bil. and EUR 2.7 bil. before and after taking into account the just-adopted EU ETS revision due to the Fit for 55 package, respectively. The above amounts correspond to approx. 44-50% of the total investments needs in 2023-29, as estimated in the previous chapter. The estimates are subject to simplifying assumptions on the EU ETS price, the Czech companies' success ratio in grant application processes, or the suitability of programmes/calls for hard-to-abate industries. More details on assumptions and further limitations are provided in the individual subsections below.

The table shows the maximum funding amount available, if fully applied for. The low values with respect to the National Recovery Plan and the operational programmes financed by cohesion-policy funds stem from the fact that they focus predominately on other economic sectors or SMEs with low grant caps, so their applicability to hard-to-abate industries is limited.

**Table 7: Overview of EU grants available for Czechia until 2027/30**



Note: \* Figures in brackets represent estimates reflecting the just-adopted EU ETS revision as part of the Fit for 55 package

\*\* ISFC estimate based on Czechia's share of EU GDP Source: EU Funding for climate action; EU's 2021-2027 long-term budget and NextGenerationEU

**Table 8: Estimate of public funds available for heavy-industry decarbonisation by 2027/30**

Funding source	Modernisation fund <sup>°*</sup>	Innovation Fund*	Cohesion Funds - OP TAC	RRF - National Recovery Plan	Horizon Europe	TOTAL*
EUR bil.	1.73 (1.92)	0.39 (0.56)	0.13	0.07	0.02	<b>2.3</b> <b>(2.7)</b>

Note: ° ENER G ETS programme only; other MF's programmes not included as they can only marginally contribute to the heavy industry deep decarbonisation.

\* Figures in brackets represent estimates reflecting the just-adopted EU ETS revision as part of the Fit for 55 package.

Source: ISFC's estimate based on data from/on Modernisation Fund, State Environmental Fund of the Czech Republic, Innovation Fund, EU ETS, National Recovery Plan, Ministry of Regional Development CZ (<https://dotaceeu.cz/>), Ministry of Industry and Trade and Eastern EU countries, should this trend continue.

The actual figures will also largely depend on companies' activity in grant calls and the quality of their funding applications. The low success rate of Czech/CEE companies in the first calls of the Innovation Fund and the limited amounts provided by the Modernisation Fund suggest that this may be a challenge. Intensive technical assistance seems thus desirable to reduce the risks of a divergence in decarbonisation efforts between Western and Eastern EU countries, should this trend continue.

### Modernisation Fund

The Modernisation Fund (MF) is designed to support lower-income EU Member States, including Czechia, in their transition to climate neutrality by helping to modernise their energy systems and improve energy efficiency.<sup>151</sup> Its funding pool is generated by the revenues from auctioning of 2% of EU ETS allowances in between 2021 and 2030 and additional allowances transferred to the MF by beneficiary countries. For Czechia, this means a total of 193 mil. allowances. As part of the Fit for 55 package, it was agreed to increase the fund's revenues by auctioning an additional 2.5 % of allowances in 2024-30

to support the energy transition of countries with GDP per capita below 75 % of the EU average in 2016-18.<sup>152</sup> Based on the above and other changes to the EU ETS, this could mean a total of 213 mil. allowances for Czechia (ISFC estimate).

The State Environmental Fund of Czechia, the fund administrator, has created a dedicated programme for industry decarbonisation called "ENERG ETS: Improving energy efficiency and reducing the emissions of GHG in industry in the EU ETS".<sup>153</sup> The programme focuses, inter alia, on the following areas relevant for industry decarbonisation:

- Reconstruction, replacement or reconfiguration of production or processing facilities reducing energy consumption or CO<sub>2</sub> emissions, incl. technologies for the use of hydrogen in industrial production or the implementation of energy management;
- Reconstruction or replacement of facilities for the generation and distribution of energy for own consumption increasing their efficiency and reducing energy consumption or CO<sub>2</sub> emissions, incl. the implementation of waste heat recovery systems.

The funding for this programme represents 13.3% of the total pool. Companies can also apply for subsidies from other MF's programmes, such as the "RES+: New Renewable Energy Sources" programme aimed at supporting

**Table 9: Modernisation Fund sources available for Czech heavy industry in 2021-30 (estimate)**

Total EAs per Czechia (mil.)	Value of EAs per Czechia (EUR bil.)	% of ENER G ETS programme	Funding per ENER G ETS (EUR bil.)	Estimated share of hard-to-abate sectors	Estimated funding per hard-to-abate sectors (EUR bil.)
193.15 (213.48)	16.87 (18.65)	13.3%	2.24 (2.48)	77.3%	1.73 (1.92)

Source: Modernisation Fund, State Environmental Fund of the Czech Republic, EU ETS, ISFC calculations

Note: Value of EAs per Czechia is based on the EU EAs spot price 87.34 EUR on April 30, 2023. The estimated share of hard-to-abate sectors is based on their share in total EU ETS emissions of all sectors except energy in Czechia in 2021.

<sup>151</sup> For more information see <https://modernisationfund.eu/> or [https://ec.europa.eu/clima/eu-action/funding-climate-action/modernisation-fund\\_en](https://ec.europa.eu/clima/eu-action/funding-climate-action/modernisation-fund_en)

<sup>152</sup> See the legislative proposal for the EU ETS Directive revision adopted by the Council on April 25, 2023, after the European Parliament's 1st (single) reading, available at: <https://data.consilium.europa.eu/doc/document/PE-9-2023-INIT/en/pdf>

<sup>153</sup> For ENER G ETS programme conditions see <https://www.sfzp.cz/dokumenty/detail/?id=2454>

### Box 12: Limited drawing of the Modernisation Fund by Czech heavy industry to date

Under the MF's ENER-ETS programme, three calls have been closed so far with a total available funding of approx. EUR 300 mil., targeting both large and small-to-medium projects.<sup>154</sup> As of 1Q 2023, eleven projects were approved, to be supported with a total amount of EUR 35 mil., of which a part goes to hard-to-abate industries.<sup>155</sup>

Two new calls are open until June 2023 with total available funding of approx. EUR 540 mil. for both large and small-to-medium projects.

new non-fuel renewable energy sources or "TRANSCOM: Modernisation of transport in the business sector" aimed at alternatively powered vehicle acquisitions. The fundings for the latter two programmes represent 38.7% and 3.5% of the total pool, respectively. As they can only marginally contribute to the heavy industry deep decarbonisation, they are not further included in the available funding estimate. Table 9 shows an estimate of funding possibly available for the Czech hard-to-abate industries in the period 2021-30, with the figures in brackets representing the ISFC's estimate that reflects the just-adopted EU ETS revision, part of the Fit for 55 package.

While the ENER ETS programme can cover up to 55% of projects' expenses, the real average coverage reaches slightly above 45%.<sup>156</sup>

### Innovation Fund

The Innovation Fund (IF) is tailored to the needs of decarbonising hard-to-abate industries. It targets highly

innovative technologies and big flagship projects within Europe, often the first-of-a-kind demonstration projects in-between pilot and ready-to-scale-up phases, which can bring on significant emission reductions:<sup>157</sup>

- innovative low-carbon technologies and processes in energy-intensive industries, including products substituting carbon-intensive ones,
- carbon capture and utilisation (CCU),
- construction and operation of carbon capture and storage (CCS),
- innovative renewable energy generation,
- energy storage.

The fund is managed centrally at the EU level and administered by the European Climate, Infrastructure and Environment Executive Agency (CINEA)<sup>158</sup> in cooperation with the European Investment Bank. Projects with capex of EUR 2.5 mil. or more are eligible.

The IF is funded by revenues from sales of 450 mil. of EU allowances and EUR 0.7 bil. remaining unused revenue from the NER300 programme between 2020 and 2030. As part of the Fit for 55 package, it was agreed to increase the fund's revenues by proceeds from auctioning of additional 25 mil. EAs, EAs that would otherwise be distributed for free to sectors covered by the CBAM in 2026-30, and EAs that could become available if aircraft operators cease operations in 2021-30.<sup>159</sup> Table 10 provides an estimate of the possible funding available for the Czech hard-to-abate industries in the period 2020-30, with the figures in brackets representing the ISFC's estimate that reflects the just-adopted EU ETS revision, part

Table 10: Innovation Fund sources available for Czech heavy industry in 2020-30 (estimate)

Total EAs (mil.)	Value of EAs + NER300 (EUR bil.)	% of Czechia in EU ETS emissions	Funding estimate per Czechia (EUR bil.)	Estimated share of hard-to-abate sectors	Estimated funding per hard-to-abate sectors (EUR bil.)
450 (645)	40.0 (57.1)	4.0%	1.60 (2.28)	24.6%	0.39 (0.56)

Source: Innovation Fund, EU ETS, ISFC calculations

Note: Value of EAs is based on the EU EAs spot price 87.34 EUR on April 30, 2023. The estimated share of hard-to-abate sectors is based on their share in total EU ETS emissions in Czechia in 2021.

<sup>154</sup> See also: <https://www.sfpz.cz/dotace-a-pujcky/modernizacni-fond/vyzvy/>.

<sup>155</sup> See also: <https://www.sfpz.cz/dotace-a-pujcky/modernizacni-fond/schvalene-projekty/>

<sup>156</sup> Czech Republic, 2021, Annual report to the European Commission on the implementation of the Modernisation Fund, available at <https://modernisationfund.eu/wp-content/uploads/2022/06/CZ-MF-AnnualReport-2021.pdf>

<sup>157</sup> Projects are evaluated based on the following criteria: GHG reduction effectiveness, degree of innovation, project maturity, scalability and cost efficiency; see also: [https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/what-innovation-fund\\_en](https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/what-innovation-fund_en)

<sup>158</sup> See [https://cinea.ec.europa.eu/index\\_en](https://cinea.ec.europa.eu/index_en)

<sup>159</sup> See the legislative proposal for the EU ETS Directive revision adopted by the Council on April 25, 2023, after the European Parliament's 1st (single) reading, available at: <https://data.consilium.europa.eu/doc/document/PE-9-2023-INIT/en/pdf>.

The number of EAs that would otherwise be distributed for free to sectors covered by the CBAM in 2026-30 is assumed at 165 mil., based on P.Liese, Background Note, Dec 2022, available at: [https://www.peter-liese.de/images/Briefing\\_Note2\\_-\\_EU\\_ETS\\_\\_SCF\\_-\\_provisional\\_agreement\\_20221218.pdf](https://www.peter-liese.de/images/Briefing_Note2_-_EU_ETS__SCF_-_provisional_agreement_20221218.pdf)



of the Fit for 55 package. For simplicity, it is based on the assumption of Czech companies' share being proportional to their share of EU ETS emissions in 2021 (i.e., an average success rate).

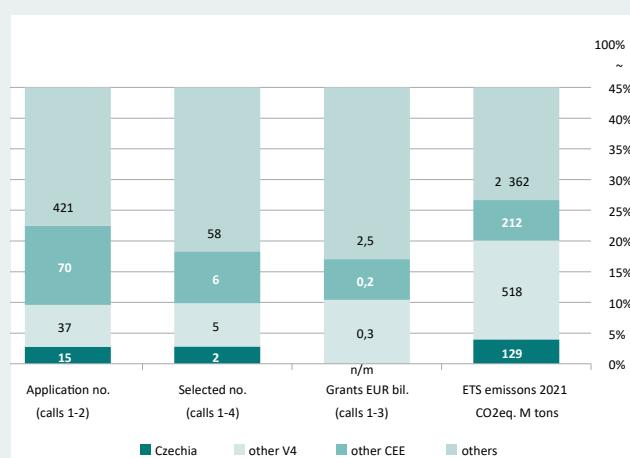
Up to 60% of projects' capital expenses can be reimbursed, of which up to 40% can be given in the pre-construction, project preparation phase. Unlike the remaining larger part, this part is not dependent on verified avoided emissions.

Based on the available data on the four closed calls, Czech and CEE companies have secured less funding from the IF than would correspond to their share of total EU ETS emissions. They appear to be applying for less than is desirable and with arguably less mature projects, resulting in a lower success rate compared to the average – see Box 13 for further call details. Here, targeted technical assistance provided to promising applicants, such as the Project Development Assistance by the EIB (for small to mid-size projects, lower-income countries),<sup>160</sup> may help to improve projects' maturity and increase the success ratio.

### Box 13: Czech / CEE companies participation in the Innovation Fund calls

The IF have opened six calls so far, with a total available funding of approx. EUR 6 bil., targeting both large and small projects.<sup>161</sup> Four calls have already been closed, 71 projects have been supported out of total 748 applications, giving an average success rate of 1:10. Thirteen CEE projects, including two small examples from Czechia focusing on green hydrogen production and EVs battery-related technology, are among the selected projects.

Key call statistics are presented in the chart below, supplemented with EU ETS emission data for comparison purposes.<sup>162</sup>



## Horizon Europe

Horizon Europe is the EU's key programme for funding research and innovation. It supports the creation and improved dispersal of cutting-edge knowledge and technologies in the areas of climate change, sustainable development and EU competitiveness and growth.<sup>163</sup> Although primarily aimed at research institutions, companies with strong R&D also actively participate in the funding programme.

Horizon Europe has a budget of EUR 95.5 bil. for 2021-7, divided into four pillars: excellent science, innovative Europe, widening participation and strengthening European research, and global challenges and European industrial competitiveness.

<sup>161</sup> The underlying data is available at: [https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/large-scale-calls\\_en](https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/large-scale-calls_en) and [https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/small-scale-calls\\_en](https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/small-scale-calls_en)

<sup>162</sup> Based on the data available, the application figures refer to the 1st two calls only, the selected project figures refer to the 1st four calls and the grant volumes refer to the 1st three calls.

<sup>163</sup> 35% of the budget should contribute to climate objectives; in the previous programming period 2014-20, 30% of investments addressed climate change and 80% sustainable development goals.

<sup>160</sup> See [https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/project-development-assistance\\_en](https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/project-development-assistance_en)

**Table 11: Horizon Europe sources available for Czech heavy industry in 2021-27 (estimate)**

HE: Digital, Industry and Space cluster (EUR bil.)	% for private companies	Digital, Industry and Space – private companies (EUR bil.)	Czech share in the Digital, Industry and Space cluster (EUR bil.)	Hard-to-abate industries funding estimate (EUR bil.)
15.3	44.5%	6.8	0.17	0.02

Source: Horizon dashboard, ISFC estimate

Note: The share of private companies in total grant volume provided under the Digital, Industry and Space cluster until April 1, 2023, is based on the Horizon dashboard R&I Projects data. The Czech share in the Digital, Industry and Space cluster is based on the Czechia 2.6% contribution to total EU industrial gross value added, based on the basic breakdowns of the main GDP aggregates reported by Eurostat for 2020 in the Annual National Accounts. The hard-to-abate industries funding estimate is based on the 9.3% hard-to-abate industries’ contribution to the total gross value added of Czech industry, based on the basic breakdowns of the main GDP aggregates reported by Eurostat for 2019 in the Annual National Accounts.

Of the last pillar, the Digital, Industry and Space cluster is the most relevant for (heavy) industrial R&D, with funding of EUR 15 bil. Its intervention areas include manufacturing technologies, emerging enabling technologies, advanced materials, circular industries, and low carbon and clean industries, which enable production and consumption respecting the planet boundaries.

Table 11 provides an estimate of the potential funding available for the Czech hard-to-abate industries in the period 2021-27, for simplicity based on their share of EU industrial gross value added.

On average, the EU’s contribution to the total project costs ranges between 80-85%. According to the data available as of April 2023, Czech applicants (unlike other V4/CEE applicants) have been successful in Horizon Europe calls in proportion to the country’s share of total EU GDP (2022), although they have secured proportionally less funding, as shown in Box 14.

### National Recovery Plan - Recovery and Resilience Facility

The Recovery and Resilience Facility is a temporary EU recovery instrument for the period 2020-26, originally created to mitigate the COVID-19 pandemic impact. It aims to help countries implement reforms and investments that make economies and societies more sustainable, resilient and better prepared for the green and digital transitions, including the implementation of the REPowerEU Plan.<sup>164</sup> The green transition represents one of the facility’s six pillars.

The facility provides funding to member states based on national recovery and resilience plans, called National Recovery Plan in Czechia.<sup>165</sup> Of the total EUR 7 bil. of

<sup>164</sup> A total of EUR 724 bil. is available to Member States under the Recovery and Resilience Facility, either in loans (EUR 386 bil.) or grants (EUR 338 bil.), see also [https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility\\_en](https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en)

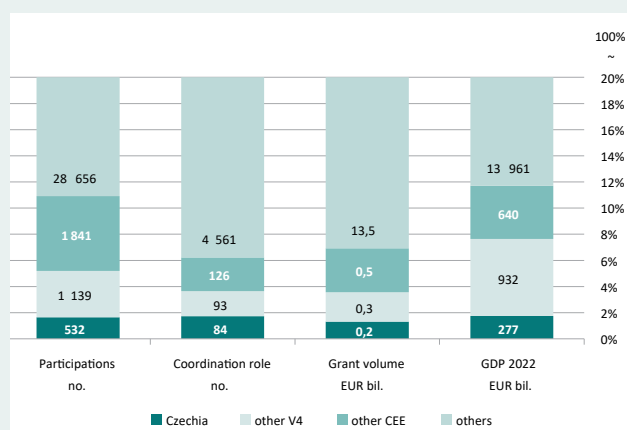
<sup>165</sup> Available at: <https://www.planobnovyrcr.cz/>

Czech funding, 42% support climate objectives. However, only a small part is earmarked for industry and even less (approx. 1%) can support heavy industry decarbonisation. R&D on environmental and business circular solutions is among potentially relevant intervention areas, e.g. with respect to secondary production of cement and steel.<sup>166</sup>

### Box 14: Czech / CEE participation in Horizon Europe

Czech applicants so far outperformed the average proposal success rate of 12% by more than 3 percentage points in the previous Horizon 2020 programme. In the current Horizon Europe programme, the success ratio has even increased to 21%, 4 percentage point above the average. However, the participation of Czech hard-to-abate industrial companies has been limited, with the only beneficiaries being ORLEN Unipetrol RPA and CEMEX Czech Republic.

Key statistics on the calls are provided in the chart below, supplemented by GDP data for comparison purposes. It shows the active participation of Czechia in calls, albeit with a slightly lower average amount of grant awarded.



<sup>166</sup> Heavy industry companies can also apply for subsidies within other (general) measures with climate tag such as the purchase of electric/H2 vehicles for private companies or the development of new PV sources.

**Table 12: National Recovery Plan sources available for Czech heavy industry in 2020-26**

NRP total (EUR bil.)	Industry relevant components / measures	Potential funding (EUR bil.)	Hard-to-abate industries estimate (EUR bil.)
7.0	Industry decarbonisation: <ul style="list-style-type: none"> <li>– Circular solutions in businesses</li> <li>– Aid for R&amp;D in companies in the environmental field</li> </ul>	0.05	0.00
	Others relevant for industrial companies: <ul style="list-style-type: none"> <li>– Digital transformation of manufacturing and non-production companies and increase of their resilience</li> <li>– Development of new photovoltaic energy sources</li> <li>– Aid for purchase of vehicles (electric, H2) for private companies</li> <li>– Water saving in industry</li> <li>– Aid for research and development in enterprises</li> <li>– Support for research and development cooperation</li> </ul>	0.74	0.07

Source: National Recovery Plan, ISFC estimate

Note: The hard-to-abate industries estimate is based on the 9.3% hard-to-abate industries' contribution to the total gross value added of Czech industry, based on the basic breakdowns of the main GDP aggregates reported by Eurostat for 2019 in the Annual National Accounts

**Operational programmes - EU cohesion & environmental funds**

The European Structural and Investment Funds (ESIF)<sup>167</sup> represent the major part of the EU sources managed by Czechia under the EU budget for the 2021-27 programming period. The funds focus on regional development & cohesion, social cohesion and support for rural areas. The Just Transition Fund supports the transition towards climate neutrality. At national level, EU financing is translated into operational programmes administrated by various ministries with individual calls for proposals.

Czechia is set to receive EUR 24 bil. from the ESIF and other EU funds in the period 2021-27, with the largest part, over EUR 10 bil., coming from the European Fund for Regional Development. EUR 6.3 bil. is earmarked for the policy objective of a greener, carbon-free Europe. However, of the twelve national operational programmes, only one appears to be relevant for industry decarbonisation. The Operational Programme for Technology and Competitiveness (OP TAC) aims, among others, to support research, development and energy efficiency measures in enterprises.

The OP TAC, like the other operational programmes, focuses predominately on SMEs and its applicability to hard-to-abate industries will be limited. For example, for grant calls to support energy savings (up to 35% of large company's expenditures) a cap of EUR 8 mil. per project is applied. Subsidies to support R&D activities are capped to EUR 4-5 mil. per project (up to 50-65% of large company's expenditures).

**Box 15: Operational programmes' grants to hard-to-abate industries over 2017-22**

During 2017-22, the largest Czech hard-to-abate industry companies received dozens of grants from national operational programmes, mostly the predecessor of OP TAC and from environmental programmes. Their total amount reached about EUR 50 mil., of which approx. 60% went to the steel sector, the average grant size remained below EUR 1 mil. and only 2 grants exceeded EUR 5 mil. The average grant coverage reached 45% of the total project cost.<sup>168</sup>

**Table 13: Operational programmes sources available for Czech heavy industry in 2021-27**

EU funds for Czechia total (EUR bil.)	Relevant operational programmes	Funds allocation per relevant OP (EUR bil.)	Relevant sub-programmes	Potentially available funding estimate (EUR bil.)	Hard-to-abate industries estimate (EUR bil.)
24.0	OP TAC	3.1	Energy savings, Application (applied R&D), Potential (R&D equipment)	1.44	0.13

Source: Ministry of Regional Development CZ (<https://dotaceeu.cz/>), Ministry of Industry and Trade, ISFC estimate

Note: The potentially available funding estimate is based the 47% share of calls under the relevant national sub-programmes (Energy savings, Application, Potential) in the total value of calls opened in 2022-23. The hard-to-abate industries estimate is based on the 9.3% hard-to-abate industries' contribution to the total gross value added of Czech industry, based on the basic breakdowns of the main GDP aggregates reported by Eurostat for 2019 in the Annual National Accounts

<sup>167</sup> European Regional Development Fund (ERDF), Cohesion Fund (CF), European Social Fund Plus (ESF+), European Agricultural Fund for Rural Development (EAFRD), European Maritime, Fisheries and Aquaculture Fund (EMFAF).

<sup>168</sup> Statistics based on the List of beneficiaries from all OPs in the 2014-2020 programming period, March 2023, available at: <https://www.dotaceeu.cz/en/evropske-fondy-v-cr/2014-2020/seznamy-prijemcu-1>

## LIFE Programme

The LIFE programme is the EU's instrument for funding environment and climate action, with sub-programmes focusing on, inter alia, climate change mitigation and adaptation, clean energy transition or circular economy.<sup>169</sup>

The programme is not further elaborated in the roadmap, being only marginally relevant for companies in hard-to-abate industries<sup>170</sup> and given limited funds available<sup>171</sup> - since 1992, EUR 69 mil. has been provided to 56 projects with Czech participation, mostly related to nature and biodiversity protection.<sup>172</sup>

## National sources – state budget

A large part of the revenue from auctioning EU ETS allowances represents income for the national budgets. In 2021, 80% of the EUR 31 bil. auctioned went directly to Member States.<sup>173</sup>

The states are obliged to use at least 50% of the auctioning revenues for climate- and energy-related purposes, such as GHG emission mitigation, climate change adaptation, R&D projects, renewable energy development, transitioning to a low-carbon economy, preventing deforestation and improving energy efficiency. In 2021, 76% were used for such purposes across the EU-27.

However, Czechia did not meet the 50% requirement in 2020 and 2021 (along with four other states) and most of the annual EUR 0.6 bil. revenue from auctioning EU ETS allowances went through the state budget for climate-unrelated public spending. A minority of the proceeds was used, inter alia, to cover feed-in-tariffs paid to historically connected renewable energy sources and micro-subsidies to households for environmental measures, or to compensate indirect costs to energy-intensive industries (see below for more details).

The above practice is about to change. The revision of EU ETS Directive mandates the Member States to use all

<sup>169</sup> See [https://cinea.ec.europa.eu/programmes/life\\_en](https://cinea.ec.europa.eu/programmes/life_en)

<sup>170</sup> The sub-programmes mostly provide action grants for projects implementing innovative and best practice solutions in their areas. They also cover the implementation, monitoring and evaluation of EU environmental policy, or provide operating grants to support the functioning of entities involved in the development, implementation and enforcement of EU environmental or climate legislation. Grants to private businesses may cover, for example, testing and validating eco-innovative methods, technologies, software or prototypes in real-life conditions in order to introduce them to the professional public and potential customers.

<sup>171</sup> With a budget of EUR 5.4 bil. in 2021-7, it usually covers 60-95% of project costs, with a typical range of EUR 2-10 mil.

<sup>172</sup> See [https://cinea.ec.europa.eu/system/files/2023-03/Czechia\\_Update\\_CZ\\_March23\\_Rev.pdf](https://cinea.ec.europa.eu/system/files/2023-03/Czechia_Update_CZ_March23_Rev.pdf)

<sup>173</sup> Use of auctioning revenues generated under the EU Emissions Trading System, EEA, 2023, available at: <https://www.eea.europa.eu/ims/use-of-auctioning-revenues-generated>

auction revenues for climate-related purposes. The Ministry of Environment plans to propose to the government using all national proceeds from the auctioning of EU ETS allowances, estimated at more than EUR 1 bil. in 2023 alone, for decarbonisation purposes from 2024. Industrial decarbonisation projects could also be supported, although the major hard-to-abate industries have not been explicitly mentioned by the ministry (unlike district heating or glassworks).<sup>174</sup>

## Indirect cost compensations

Industrial installations with a significant risk of carbon leakage may receive compensations for indirect emission costs to support their competitiveness. Their energy suppliers are subject to ETS trading and electricity prices (partly) absorb the cost associated with emission allowances. Ultimately, increased electricity prices could have a negative impact on the competitiveness of hard-to-abate industries, which could lead to carbon leakage.

To avoid such a development, Czechia started compensating energy-intensive companies for indirect emission costs in 2021 under the State Aid guidelines of the ETS.<sup>175</sup> The total budget was estimated at EUR 1.4 bil. for 2021–30.

An eligible enterprise must come from selected chemical, metal manufacturing or paper and pulp sectors, and the maximum aid amount equals to 75 % of the indirect emission costs incurred. Companies must also either implement certain energy audit recommendations or source 30% of their electricity consumption from carbon-free sources.<sup>176</sup>

As shown in Chart 29, the iron & steel sector received the largest part of compensations in 2021-2.

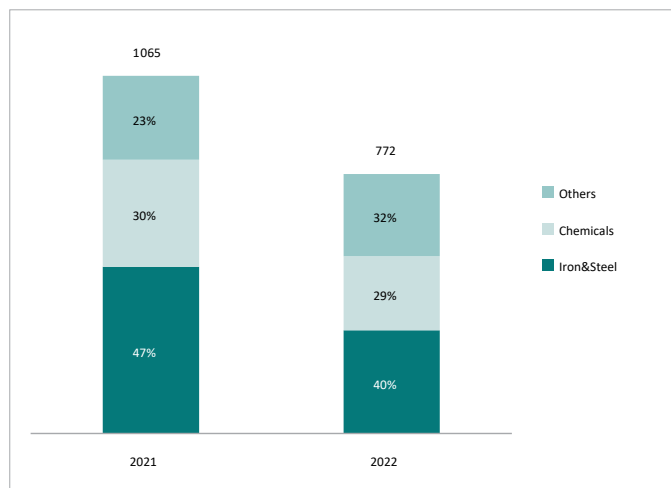
Indirect cost compensations represent an operating type of subsidy, they are therefore included in the free cash-flow forecasts of the three analysed hard-to-abate sectors and excluded from the public financing available to cover investment needs.

<sup>174</sup> Stát bude používat všechny příjmy z emisních povolenek na omezení emisí [The state will use all revenues from emission allowances to reduce emissions], CTK Ceske noviny, February 2023, <https://www.ceskenoviny.cz/zpravy/2328653>

<sup>175</sup> Commission approves EUR 1.4 bil. Czech scheme to compensate energy intensive companies for indirect emissions cost, European Commission, 2022, [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_22\\_1782](https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1782)

<sup>176</sup> Although the ratio of renewables in the Czech energy mix is well below 30%, the carbon-free limit should be met by Czech producers due to the 34% share of nuclear in the energy mix.

**Chart 29: Indirect cost compensation breakdown by sector (totals in CZK mil.)**



Source: ISFC based on OTE data<sup>177</sup>

## CREDIT ENHANCEMENT, BLENDED & OTHER FINANCING

In addition to direct financing from private or public sources, other financial tools can support companies implementing low-carbon investments. Guarantees or risk coverage schemes and instruments are considered particularly suitable for technologies in the critical stage between pilot projects and fully operational technologies.<sup>178</sup> Public-private cooperation through blended finance or other schemes incentivising private investments might be also implemented or expanded.

In this respect, hard-to-abate industries appear to remain outside the mainstream at both the national and EU level. Most of the instruments provided by the EIB, EIF or InvestEU target the SME sector, innovative start-ups or infrastructural projects. At the national level, the National Development Bank is also focusing on SMEs and their international expansion, providing discounted loans and other products capped mostly at approx. EUR 2.5 mil. Czechia has not participated in the European Guarantee Fund and therefore Czech businesses are not eligible to apply for this programme.

Carbon Contracts for Difference between public administration and a company enable carbon costs to be shared between the private and public sectors. They secure revenues from carbon savings, limit operating risks, improve bankability and lower carbon mitigation costs for low-carbon technology frontrunners. While their potential is

<sup>177</sup> See <https://www.ote-cr.cz/en/statistics/compensations-of-indirect-costs-co2/compensations-of-indirect-costs-co2>

<sup>178</sup> Council of Economic Policies, 2022, A Guaranteed Win for the Climate: Sustainable Loan Guarantees and Sustainable Loan Guarantee Facilities, <https://www.cepweb.org/a-guaranteed-win-for-the-climate-sustainable-loan-guarantees-and-sustainable-loan-guarantee-facilities/>

being thoroughly considered by selected EU institutions and countries, such as the Innovation Fund or Germany, no similarly serious initiative has been seen in Czechia.

### Contracts for difference

The pros and cons of using the principle of contracts for difference (CfDs) are often debated in the context of carbon, hydrogen and other climate-related assets to remove, share or otherwise manage high risks associated with investments in new technologies. CfDs are essentially contracts between a buyer and a seller that stipulate that the buyer must pay the seller the difference between the current value of an underlying asset and its value at contract time. As they are inherently derivative contracts, their possible secondary trading (amplified by leverage) is considered risky.<sup>179</sup>

Carbon Contracts for Difference (CCfDs) between a public administration and a company set a fixed carbon price over a given period, which reduces the investment risk for companies. Project-based CCfDs, as based on a case study in the steel sector, can reduce carbon mitigation costs for steel by up to 27% compared to no policy.<sup>180</sup> CCfDs would thus improve the medium to long-term competitiveness of low-carbon solutions and incentive related investments.

For example, the Hydrogen Strategy adopted by the German Federal Government in June 2020 envisages that CCfDs can be used by energy-intensive industrial companies in a pilot scheme.<sup>181</sup>

The legal and financial basis for CCfDs in Germany are being elaborated to support the industry transition, render climate-neutral manufacturing methods economically viable at an earlier point in time and to ensure that companies can better financially plan ahead.<sup>182</sup>

Another example is the Innovation Fund's consideration of auctioning CCfDs with respect to hydrogen projects in the EU – see Box 16 below. Similar serious considerations and discussions about leveraging CCfDs are missing in Czechia and need to be initiated to determine whether and how CCfDs can support the deployment of cutting-edge low-carbon solutions.

<sup>179</sup> See for example: Trading in contracts for difference (CFDs) remains restricted, CNB, 2018, available at: <https://www.cnb.cz/en/cnb-news/press-releases/Trading-in-contracts-for-difference-CFDs-remains-restricted/>

<sup>180</sup> Carbon contracts-for-difference: How to de-risk innovative investments for a low-carbon industry?, J.C.Richstein et al., iScience, 2022, available at: <https://doi.org/10.1016/j.isci.2022.104700>.

<sup>181</sup> See <https://www.bmwi-energiewende.de/EWD/Redaktion/EN/Newsletter/2020/11/Meldung/direkt-account.html>

<sup>182</sup> See <https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/20220111-habeck-presents-germanys-current-climate-action-status-need-to-triple-the-rate-of-emission-reductions.html>

### **Box 16: CCfD among the types of support considered by the Innovation Fund**

The Innovation Fund is considering the inclusion of CCfD in competitive biddings (auctions), currently being developed as a new way of supporting (hydrogen) projects at EU level alongside subsidies. It aims to support innovative low-carbon technologies whose market penetration is held back by the lower costs of incumbent fossil-based technologies and the high-risk perception by financial markets. Auctioning could then ensure that costs to the public are minimised. The following types of support are being considered to be awarded to hydrogen producers or purchasers:

- CfD: a contract covering the difference between the winning auction price (strike price) and the price of the low-carbon product, the market price of a close substitute or a combination of the two (reference price);
- CCfD: a contract covering the difference between the winning price (strike price) and the average
- EU ETS allowances price (reference price);
- Fixed Premium Contract: a contract that provides a producer with support in the form of a fixed amount per unit produced.

## **InvestEU**

Through the InvestEU Fund operational since 2022, the InvestEU programme provides guarantees that back implementing partners such as the EIB and the EIF in the direct and intermediated financing of private and public final recipients in targeted investment areas. A dedicated budget of EUR 10.5 bil. allows for providing guarantees of EUR 26.2 bil., which can be leveraged by financial partners to mobilise additional investments of at least EUR 372 bil., by attracting other private and public investors.

The InvestEU Fund targets economically viable projects in four investment areas where there are market failures or investment gaps, where financing could not be obtained at all or not at the required terms without InvestEU Fund support, and also in higher risk projects:

- Sustainable infrastructure - sustainable energy, digital connectivity, transport, the circular economy, water, waste, other environment infrastructure;
- Research, innovation and digitalisation - taking research results to the market, digitisation of

industry, scaling up larger innovative companies, artificial intelligence;

- SMEs - including innovative ones and those operating in the cultural and creative sectors;
- Social investment and skills - education, training, social housing, schools, universities, hospitals, social innovation, healthcare, long-term care and accessibility, microfinance, etc.

InvestEU also supports investments of strategic importance for the EU including Important Projects of Common European Interest, in particular with a view to green and digital transition, enhanced resilience and strengthening strategic value chains.

Of the 46 guarantees granted, to which detailed information has been provided, 20 involved Czechia and 24 the CEE region.<sup>183</sup> These include, for example, a fund investing in both established and emerging climate change mitigation technologies that have limited to no market adoption at this stage and whose regulatory frameworks are yet to take shape (including investments in low-carbon hydrogen, CCS, circular economy).

For more information about the major implementing partners, the EIB and the EIF, including their products and activities towards Czechia, see Annex 5.

## **European Guarantee Fund**

Set up by the European Investment Bank, the fund is aimed at EU businesses that are struggling as a result of the economic downturn but would have been strong enough to get a loan had the COVID-19 crisis not occurred. Member States participating in the fund provide guarantees to funded projects, with approx. EUR 200 bil. expected to be mobilised. However, Czechia has not participated in the guarantee programme and therefore Czech businesses cannot apply.

## **National Development Bank products**

The Czech National Development Bank offers a range of products from discounted loans to guarantees for banking products. However, the bank focuses on international expansion of SMEs and infrastructure projects, so its services for decarbonising hard-to-abate industries are limited. The most relevant product is a discounted loan for energy efficiency improvements, but its amount is capped at approx. EUR 2.5 mil.<sup>184</sup>

<sup>183</sup> InvestEU's operations database is available at: [https://investeu.europa.eu/investeu-operations\\_en](https://investeu.europa.eu/investeu-operations_en)

<sup>184</sup> National Development Bank, Product catalogue, 2023: <https://www.nrb.cz/podnikatele/>

# Conclusions – Policy and financing recommendations

# Conclusions – Policy and financing recommendations

## Highly industrial Czechia awaits a national industrial strategy...

Czechia lacks a comprehensive national industrial strategy that would provide a transparent and predictable framework to support business planning, also for hard-to-abate industries. Such a strategy would need to clearly describe the vision of a resilient industry in a future decarbonising (decarbonised) and competitive environment and the tools and measures that can be used to achieve this. It would also need to link technology-related strategies, such as the electricity resource adequacy, the hydrogen strategy, and the so far missing CCUS strategy.

The industry decarbonisation challenge must be clearly addressed in the strategy, also reflecting changes in the policies and priorities of key neighbouring countries to correctly assess, among others, hydrogen, renewable electricity, and captured carbon capacities and/or availability in the region. It should outline possible pathways for transforming industrial processes to achieve net zero for industry, focusing also on energy-intensive sectors. Summarising public actions to support both the supply and demand side would help industries to adjust their expectations. These include, inter alia, support for engineering studies, funding of industrial transformation projects, supporting low-carbon products (also through public procurement rules), addressing specific issues of medium-sized emission sources (clustered or dispersed), development of new product standards, labelling tools, etc.

## ... and missing follow-up sectoral transition pathways

The elaboration of sectoral transition pathways for the Czech hard-to-abate industries is sorely lacking and desirable both in terms of their content and the process of their elaboration. They should set out the course of actions helping to achieve a green transition and improve the sectors' resilience, sustainability and circularity. Also, they are expected to address technological options and regulation, whose possible adjustments can support the transition. Structured open consultation processes involving industries, public authorities, and possibly academia or financial industry representatives, whose outcomes could be regularly shared with an informed public, would help bring the much awaited alignment of all major stakeholders.

The pathways are expected to reflect (or initiate, if not yet available) feasibility studies to understand the economic viability and (prospective) competitiveness of new technologies and product opportunities, and outline policy scenarios addressing investment risks and logistical challenges associated with the heavy-industry decarbonisation. While such studies are available with regard to global or European industrial decarbonisation and the net zero transition of the entire Czech economy and its energy sector, very limited sources have addressed the economic, investment, and financing aspects of the Czech heavy industry decarbonisation.

## Updating energy and climate policies will redefine the heavy industry framework environment

The Climate Protection Policy, the State Energy Policy, and the National Energy and Climate Plan are crucial documents for hard-to-abate industries as they frame the conditions under which companies can expect to do business over the next decade, and even beyond. Currently, all these policies are under review as they have been calibrated to the older national and EU ETS emission targets, which have since been significantly revised. Additional measures will clearly be needed to meet the new 2030 targets:

- The Climate Protection Policy, for example, must include new additional measures to facilitate faster emission reductions to take account of the fact that almost 50% of free allowance will be phased out by 2030 (and all by 2034). Heavy industries, including the production of iron and steel, chemicals or cement, need to be already materially decarbonised by that date.
- The State Energy Policy must take into account the foreseen coal phase-out in 30s', as opposed to the currently expected 20% share of coal in primary energy sources in 2040. The policy is also expected to update forecasts on the availability of renewable electricity, emphasise the need to plan a strategy for electricity imports and to modernise the transmission grid due to the increased share of renewables and (clean) electricity required by hard-to-abate industries.
- The National Energy and Climate Plan, for example, needs to properly address the fact that the projected electrification of hard-to-abate industries will require large volumes of (clean) electricity and,



together with other decarbonisation measures, this will lead to a reduction in fuel-combustion and process emissions. It should also better reflect feedback on the current plan edition, according to which Czechia is not utilising the full potential of renewable energy sources.

### **The CCUS strategy at an EU level is expected to outline the deployment of inter-regional transmission networks...**

CCUS needs an EU-wide strategy to give investors and industrial stakeholders a sense of direction on the long-term outlook and deployment strategy for this technology. The above specifically relates to carbon storage and transmission networks that have significant cross-border elements. It is important that EU countries share their CO<sub>2</sub> storage resources and develop new European infrastructure, which is particularly true for landlocked countries such as Czechia. This requires, inter alia, sufficient alignment of regulatory approaches and technical standards. The EU-wide strategy is therefore expected to outline the overall ambition, but also to address the major challenges, outline funding options and provide a basis for cross-border infrastructure investments, storage deployment and the development of national CCUS strategies.

### **...while the missing national CCUS strategy needs to address the country's options, priorities and risks**

In addition to the missing EU CCUS strategy, the development of a national CCUS strategy is necessary to set out key national priorities for CCUS development and limit the associated risks in Czechia. Clearly, some of the decarbonisation plans of the Czech hard-to-abate industries include CCUS technologies, but at the same time their facilities are relatively dispersed across the country with only few obvious opportunities for their clustering. A clear national CCUS strategy is therefore a prerequisite for sensible planning in the industries concerned, as high transport costs may hinder significant CCUS deployment. Outlining the conditions for CCU technology is of greatest interest to the chemical industry in particular. The strategy should also provide inputs for updates to other climate and energy strategies, some of which are due as early as in 2023/4.

### **The Hydrogen Strategy could include more ambitious scenarios**

The Czech Hydrogen Strategy estimates local hydrogen use to remain rather low and be covered by local production until 2035. If the Czech hard-to-abate industries were to switch to low-carbon hydrogen before 2035, the

pre-2035 hydrogen demand assumed in the strategy does not meet this. This may discourage local companies from adopting more ambitious decarbonisation plans.

While hydrogen imports will be needed, hydrogen transport and storage infrastructure is loosely addressed in the strategy; more elaborated considerations on its deployment (capacity and timing scenarios) would be beneficial and give greater incentives to market participants to prepare deep decarbonisation plans without discriminating / disadvantaging hydrogen. Separately, hydrogen is also still awaiting its full recognition in Czech legislation, specifically as an energy medium.

### **Demand side measures can get consumers to choose low carbon**

Public authorities have many tools at their disposal to stimulate demand for low-carbon products that might initially be priced out by competing with less costly, carbon-intensive products available in parallel. These include improving data transparency to accurately determine the product carbon content or labelling schemes reflecting the environmental impact of intermediary industrial products.

Another instrument is the systemic implementation of green public procurement rules in the buildings and construction sector. As almost half of all construction contracts are awarded by public institutions, such green public procurement would increase demand for low-carbon products (steel and cement), which are not yet incentivised in the market. Such rules are currently lacking, despite being one of the objectives stated in the Circular Czechia 2040 strategy.

Separately, given accelerated technical development, regulators need to be prepared to flexibly and more frequently revisit and update existing standards and codes such as, inter alia, in the case of the clinker-to-cement ratio, construction materials standards (e.g. targeting the reuse of concrete & demolition waste), or applications of carbon capture and its geological storage. Horizontal collaboration across governmental agencies and with research and development institutions and companies is crucial for timely standardisation and regulatory adoption.

### **Targeted technical assistance can support the success of participants in key grant calls**

Most of the public funding available for the heavy industry decarbonisation comes from the Modernisation and Innovation Funds. However, the drawing of both funds by Czech heavy industry has been limited or under-proportionate. Here, targeted efforts are necessary to mobilise

local businesses and increase their success rate in grant calls. Technical assistance e.g. from a specialised agency would help to improve projects' maturity and increase the success ratio, similar to the Project Development Assistance provided by the EIB to promising applicants for Innovation Fund grants (small to mid-size projects, lower-income countries).

- The volume of grants provided from the Modernisation Fund to Czech heavy industry has been limited so far. Eleven projects were approved under the MF's ENER-ETS programme to be supported with a total amount of merely EUR 35 mil. as of 1Q 2023.
- As regards the Innovation Fund, Czech (and CEE) companies have received less funding than would correspond to their share of total EU ETS emissions. They seem to be applying for less than would be desirable and with arguably less mature projects, resulting in a lower success rate compared to the average.

### **National sources from auctioning EU ETS allowances must be dedicated to climate protection, including industry decarbonisation**

Revenue from auctioning EU ETS allowances not only provides income for the above-mentioned funds, but its larger part goes to national budgets, out of which at least 50% must be used for climate and energy-related purposes. While 76% was used for such purposes across the EU-27 in 2021, Czechia did not meet the threshold in 2020-21.

The above non-compliance is set to change as the revision of EU ETS Directive mandates the Member States to use all auction revenues for climate-related purposes, and the Ministry of Environment has announced its plan to propose to the government using all national proceeds for decarbonisation purposes from 2024. Industrial decarbonisation projects could also be supported. As not explicitly mentioned in the announcement, it is crucial to include the major hard-to-abate industries among the targeted sectors.

### **Make cutting-edge heavy industry investments more eligible for risk-coverage instruments**

In addition to direct financing, guarantees or risk coverage schemes and instruments, blended finance and other forms of public-private cooperation can support companies implementing low-carbon investments, particularly with respect to technologies at the critical stage between pilot projects and full operation. In this respect, large and/or mature companies in hard-to-abate industries currently appear to remain outside the mainstream at both national

and EU level. Most instruments target the SME sector, innovative start-ups or infrastructural projects. In the context of recent developments related to the Green Deal Industrial Plan and the US Inflation Reduction Act, reconsideration is on the table to broaden the target sectors towards hard-to-abate industries that would increase chances of their successful and timely decarbonisation.

Project-based carbon contracts for difference (CCfDs) secure revenues from carbon savings, limit operating risks, improve bankability and therefore reduce the overall carbon mitigation costs. CCfDs thus improve the medium to long-term competitiveness of low-carbon solutions and incentive-related investments. They are envisaged in several strategies and plans across the EU, for example as a pilot scheme for energy-intensive industrial companies in the German Hydrogen Strategy and in the Innovation Fund auctions as a new way to support (hydrogen) projects. Similar serious considerations and discussions about leveraging CCfDs are missing in Czechia and need to be initiated to determine whether and how CCfDs can support the deployment of cutting-edge low-carbon solutions.

# Annexes

## ANNEX 1: TIMES-CZ MODEL SCENARIOS

### Key assumptions of the TIMES-CZ model scenarios by the Charles University Environment Centre<sup>185</sup>

Scenario	Fossil fuel prices trajectory	EAs price trajectory	Coal phase-out	New nuclear unit (1.2 GW)
ets2	DG CLIMA recommendation	“Net Zero Emissions” in WEO by IEA	according to the territorial mining limits	2045
n40	DG CLIMA recommendation	“Net Zero Emissions” in WEO by IEA	according to the territorial mining limits	2040
p50	“Net Zero Emissions” in WEO by IEA	“Net Zero Emissions” in WEO by IEA	according to the territorial mining limits	2045
wam	DG CLIMA recommendation	WAM by DG CLIMA	according to the territorial mining limits	2045
no_co	DG CLIMA recommendation	“Net Zero Emissions” in WEO by IEA	2033	according to the model’s cost-optimization algorithm

Note: Fossil fuel and EAs price trajectories are based on DG Clima’s recommended parameters for reporting on GHG projections in 2023, DG CLIMA, 2022, and/or World Energy Outlook 2021, IEA, 2021.

<sup>185</sup> See “Analýza Fitfor 55 – hodnocení dopadů na ČR”, available at <https://seepia.cz/en/news/we-published-a-key-study-on-the-impact-of-fit-for-55-on-the-czech-republic/>

## ANNEX 2: INVESTMENT NEEDS ESTIMATES UNTIL 2030

### Material Economics: Industrial pathways

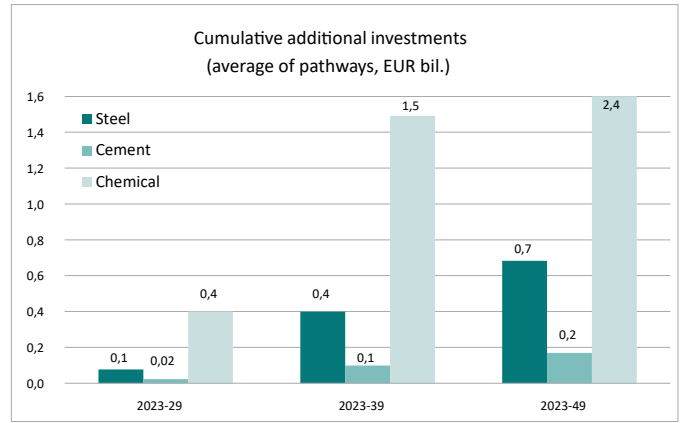
The Material Economics study shows dynamic pathways to achieve net-zero emissions by 2050 in the EU in selected industries: cement, steel and plastics.<sup>186</sup> The starting point of the EU pathways is the range of facilities and production levels before 2020. The EU baseline scenario then models the demand level of 2050 (and related capex) for each product of these industries without major shift in materials intensity or industry structure. Finally, the increased total capex is presented in three net-zero pathways: new processes, circular economy and carbon capture.

For the purpose of this roadmap, only the difference between investment needs in these net-zero pathways and the EU baseline scenario are used for each industry to obtain additional investments. As investments are presented as annual values in 5-year periods, they are interpolated to make a complete annual time series between now and 2050. Finally, additional investment needs in Czechia are estimated based on the Czech share of total EU production in each industry.<sup>187</sup>

Chart 30 shows the sectoral breakdown of cumulative additional investments (average of the three net-zero pathways) in the Czech hard-to-abate industries, estimated at EUR 0.5 bil. and EUR 3.3 bil. in the coming years 2023-29 and until 2050, respectively.

To estimate the total capex in the coming years 2023-9, increased by decarbonisation investments, the above additional investment estimate is combined with the ISFC's business-as-usual forecast extrapolating the historical capital expenditures of the Czech hard-to-abate sectors, as shown in Annex 3. Total capex is then estimated at EUR 4.2 bil., EUR 0.9 bil. and EUR 0.3 bil. in the chemicals, steel and cement sector, respectively.

Chart 30: Cumulative additional investments by industry



Source: ISFC calculations based on Material Economics

Chart 31 shows the estimated annual capex development for each industry towards 2030. The lower bound represents the business-as-usual capex forecast and the upper bound represents the total estimated capex, including additional investments estimated for Czechia in each industry. These additional investments increase the business-as-usual capex by 16%, 13% and 12% in the steel, chemical and cement sector in 2029, respectively.

Chart 31: Total estimated investment costs by industry 2023-29



Source: ISFC calculations based on Material Economics

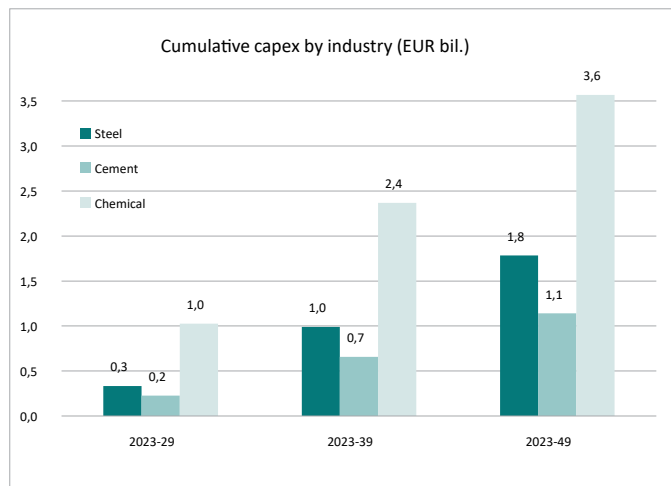
### Pathways Explorer

The AMO 2050 Net-Zero scenario in the Pathway Explorer provides capex estimates for selected sectors, including hard-to-abate industries. Investments are a function of the production volume and the technology used; the model does not show a dynamic picture of investment needs but rather an average development of costs over time based on expected production volumes and technology lifetime.

Chart 32 shows cumulative capex estimates of EUR 1.0 bil., EUR 0.33 bil. and EUR 0.23 bil. for the chemical, steel and cement industry in the 2023-9 focal period, respectively.

<sup>186</sup> In the Material Economics study, the plastics industry consists of the production of olefins and aromatics and polymerisation. It monitors the production process, including feedstock use, refining, cracking, polymerisation, and other processing, up to end use. The plastics segment is used to derive the (major part of) additional investment needs within the chemical industry.  
<sup>187</sup> Steel production share of 2.7% (2017), cement production share of 2.3% (2015) and chemicals production share of 2.3%, based on plastics converters' demand in the EU (for making primary plastics), Europe Plastics data (2016/7)

**Chart 32: Estimated cumulative investment costs by industry**



Source: ISFC calculations based on AMO 2050 Net-Zero scenario in Pathway Explorer

The scenario assumes a significant role for CCS in the steel and cement industry decarbonisation pathway. By 2030, 14% and 8% of cement and steel industry emissions will be captured, rising to 73% and 72% respectively by 2050.<sup>188</sup> Investment costs per tonne of captured CO<sub>2</sub> are included in the above capex estimates for each industry.

However, the historical capex in the steel industry in the model (the starting point of the trajectories) differs significantly from the historical gross investments provided by Eurostat for the steel sector or from capex aggregated from the annual reports of Czech steel producers. It is thus disregarded in the roadmap.<sup>189</sup>

### TIMES-CZ model

The model only deals with investments that relate to energy transformation or use.<sup>190</sup> Cumulative energy-related investments across the industrial sector are estimated to exceed EUR 24 bil. in 2023-52, of which almost EUR 6 bil. in 2023-9, as shown in Chart 33.

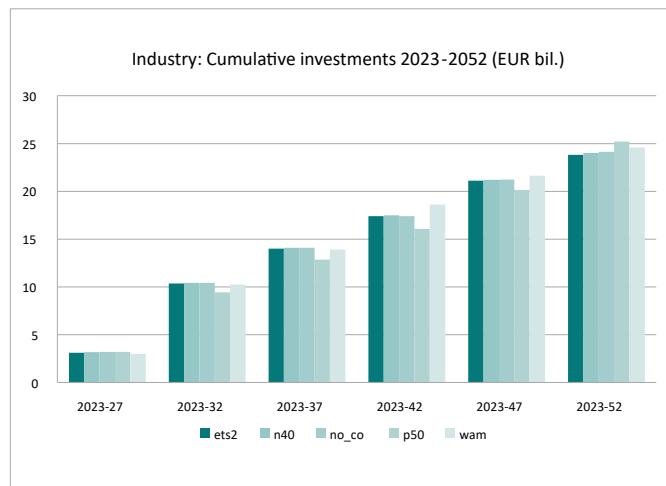
<sup>188</sup> There is also a limited role of CCU in the scenario, utilising 0.1 MtCO<sub>2</sub>eq by 2025 up to 0.8 MtCO<sub>2</sub>eq by 2050.

<sup>189</sup> With respect to the chemical sector, capex projections do not include refinery business, which is modelled separately.

<sup>190</sup> Investments in the TIMES-CZ model are roughly 4 times lower than total investments in the whole economy estimated by the E3ME model, another model referred to in the study by the Charles University Environment Centre, which however provides no breakdown to industry.

All amounts are in CZK fixed prices as of 2020; in the roadmap, they are recalculate to EUR using the CNB 2023 FX forecast of 24.5 CZK/EUR (as of 2 Feb 2023).

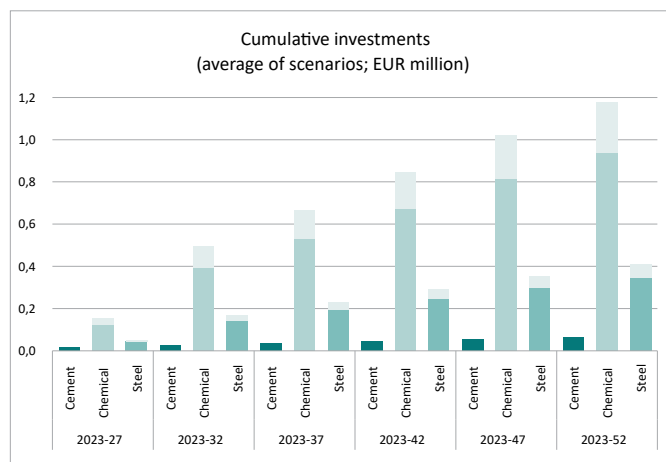
**Chart 33: Cumulative energy-related industrial capex by scenario**



Source: ISFC calculations based on TIMES-CZ model results of the Charles University Environment Centre study

The study does not offer details on hard-to-abate industries. Hence, for the purpose of this roadmap, two economic indicators are used to break down investments into the individual hard-to-abate industries: gross investments in tangible goods and gross value added.<sup>191</sup> Combining them produces an estimated range of energy system investments in the selected industries, with the lower bound given by the former and the upper by the latter, as shown in Chart 34.

**Chart 34: Cumulative energy-related capex in hard-to-abate industries**



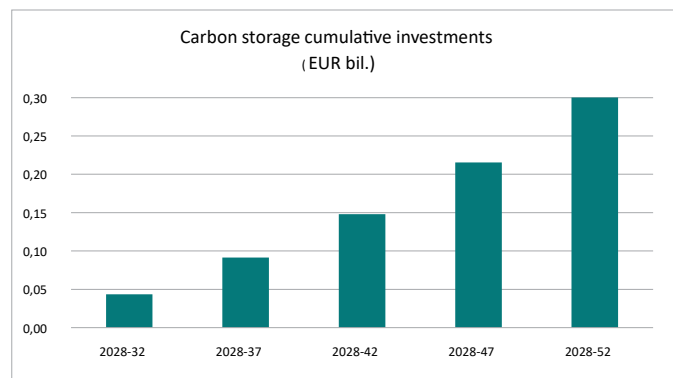
Source: ISFC calculations based on TIMES-CZ model results of the Charles University Environment Centre study

The TIMES-CZ model estimates a minor role for CCS compared to combined heat and power production. The first investments in carbon storage will occur in lime

<sup>191</sup> A share of the hard-to-abate industries in the entire manufacturing industry's gross investments in tangible goods / gross value added across the last ten years.

production around 2030, followed by the steel and cement industries only around 2035 and 2040, respectively. The model sees no CCS application in the chemical industry. The cumulative investments in building carbon storage infrastructure are presented in Chart 35.<sup>192</sup>

**Chart 35: Cumulative carbon storage investments (all sectors)**



Source: ISFC calculations based on TIMES-CZ model results of the Charles University Environment Centre study

The model scenarios expect first hydrogen production around 2030, but do not foresee hydrogen as a tool for industrial decarbonisation. Moreover, the model expects that grey hydrogen (fossil fuel-derived from natural gas) remains the dominant type of hydrogen used. The study also recommends focusing on predicting the neighbouring countries potential to export renewable electricity or hydrogen, which could help decarbonise the chemical and steel sectors and reduce the use of CCS. It also finds essential to upgrade the transmission grid to accommodate more renewable energy sources than previously predicted in MAF 2040 to decarbonise the Czech economy.

<sup>192</sup> The carbon storage investments are likely to be made outside the hard-to-abate industries and can be considered as extra investment to achieve full (industry) decarbonisation in Czechia.

## ANNEX 3: HARD-TO-ABATE INDUSTRIES SIMPLIFIED FINANCIAL STATEMENTS FORECAST UNTIL 2030

### Cement sector simplified financial statements – forecast without major decarbonisation investments and without profit distribution

(mil. CZK)	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Sales	10 983	11 254	12 194	13 974	14 724	15 019	15 319	15 626	15 938	16 257	16 582	16 914
EBITDA	2 956	3 180	3 071	3 899	3 930	4 049	4 175	3 867	3 840	3 655	2 978	1 365
Depreciation	1 083	1 799	1 023	1 033	1 043	1 019	994	968	942	934	925	917
EBIT	1 873	1 381	2 048	2 866	2 887	3 030	3 182	2 899	2 898	2 721	2 053	448
Net profit	1 693	1 632	2 013	2 533	2 552	2 739	2 870	2 649	2 657	2 522	1 990	650
Assets	17 932	16 962	18 810	18 571	21 519	24 352	27 318	30 066	32 823	35 449	37 544	38 302
Fixed assets	14 506	13 643	14 342	13 580	13 061	12 576	12 128	11 716	11 341	10 985	10 650	10 335
Current assets	3 425	3 319	4 467	4 991	8 458	11 776	15 190	18 350	21 483	24 463	26 894	27 966
Equity+liabilities	17 932	16 962	18 810	18 571	21 519	24 352	27 318	30 066	32 823	35 449	37 544	38 302
Equity	8 294	9 020	10 150	10 312	12 864	15 603	18 473	21 122	23 779	26 301	28 290	28 940
Debt	5 349	3 844	3 011	3 011	3 011	3 011	3 011	3 011	3 011	3 011	3 011	3 011
Other liabilities	4 289	4 098	5 649	5 248	5 644	5 738	5 834	5 933	6 034	6 137	6 242	6 350
FCF before capex				3 272	3 809	3 780	3 887	3 641	3 624	3 481	2 941	1 594
Capex (BAU)	564	592	668	763	773	789	804	821	837	854	871	888

### Chemical sector simplified financial statements – forecast without major decarbonisation investments and without profit distribution

(mil. CZK)	2019	2020	2021F	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Sales	292 192	217 056	273 575	313 517	339 539	346 329	353 256	360 321	367 527	374 878	382 376	390 023
EBITDA	25 202	14 132	15 606	20 726	23 373	23 137	22 906	21 900	21 343	20 480	18 738	15 352
Depreciation	10 168	11 224	11 907	12 338	12 774	13 047	13 314	13 574	13 827	14 074	14 313	14 545
EBIT	16 117	2 124	3 698	8 388	10 600	10 090	9 592	8 326	7 515	6 406	4 425	807
Net profit	13 108	1 853	3 067	6 320	8 317	7 915	7 434	6 269	5 504	4 469	2 658	-608
Assets	211 770	211 770	258 446	257 754	272 052	281 769	291 050	299 211	306 654	313 110	317 805	319 285
Fixed assets	127 233	142 695	155 336	152 084	151 523	150 924	150 295	149 646	148 986	148 324	147 671	147 038
Current assets	84 453	69 075	103 110	105 670	120 529	130 845	140 755	149 565	157 668	164 786	170 134	172 247
Equity+liabilities	211 770	211 770	258 446	257 754	272 052	281 769	291 050	299 211	306 654	313 110	317 805	319 285
Equity	137 502	129 959	143 105	142 767	151 084	158 999	166 433	172 702	178 206	182 675	185 334	184 726
Debt	12 633	18 578	19 428	19 428	19 428	19 428	19 428	19 428	19 428	19 428	19 428	19 428
Other liabilities	61 635	63 233	95 914	95 559	101 540	103 342	105 189	107 081	109 020	111 007	113 044	115 131
FCF before capex				21 678	19 583	20 810	20 601	19 702	19 196	18 415	16 851	13 824
Capex (BAU)	13 776	13 337	12 024	12 145	12 506	12 756	13 011	13 271	13 537	13 807	14 084	14 365



## Steel sector simplified financial statements – forecast without major decarbonisation investments and without profit distribution

(mil. CZK)	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Sales	63 084	62 135	93 431	92 009	107 043	112 772	115 027	117 328	119 674	122 068	124 509	126 999
EBITDA	1 040	797	9 059	5 821	3 317	4 458	4 543	3 383	2 967	2 093	-150	-4 981
Depreciation	3 093	1 710	2 032	2 058	2 089	2 123	2 158	2 194	2 230	2 267	2 304	2 343
EBIT	-2 052	-913	7 027	3 763	1 228	2 335	2 385	1 189	737	-174	-2 454	-7 324
Net profit	-1 327	-173	6 004	3 275	1 108	2 371	2 424	1 348	943	124	-1 936	-6 566
Assets	68 984	71 705	89 733	88 336	94 178	97 608	100 755	102 843	104 545	105 446	104 307	98 558
Fixed assets	41 786	38 536	35 527	34 791	34 290	33 883	33 476	33 067	32 659	30 913	30 503	30 093
Current assets	27 198	33 169	54 206	53 545	59 888	63 725	67 280	69 775	71 886	74 533	73 803	68 465
Equity+liabilities	68 986	71 704	89 733	88 336	94 178	97 608	100 755	102 843	104 545	105 446	104 307	98 558
Equity	40 890	41 805	47 810	51 085	52 193	54 565	56 989	58 337	59 280	59 403	57 467	50 902
Debt	8 761	8 658	9 269	9 269	9 269	9 269	9 269	9 269	9 269	9 269	9 269	9 269
Other liabilities	19 335	21 241	32 655	27 982	32 715	33 775	34 497	35 237	35 996	36 773	37 570	38 387
FCF before capex				3 416	667	3 211	4 141	3 094	2 720	1 932	-94	-4 691
Capex (BAU)	2 801	1 884	2 281	2 148	2 546	2 727	2 781	2 837	2 894	2 951	3 010	3 071

## Selected key forecast assumptions

CNB forecast (as of 2 February 2023)	2021	2022	2023F	2024F						
Headline inflation (%)	3,8%	15,1%	10,8%	2,1%						
Interest rates 3M PRIBOR (%)	1,1%	6,3%	7,0%	4,8%						
Exchange rate (CZK/EUR)		24,6	24,5	24,6						
	2021	2022	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
PPI - Intermediate goods	22,3%	14,6%	8,3%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
PPI - Energy	18,5%	40,4%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
PPI - Services for businesses	1,7%	7,3%	7,3%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Wages Q1-Q4 - Manufacturing	6,1%	8,0%	6,3%	4,7%	4,7%	4,7%	4,7%	4,7%	4,7%	4,7%
CPI Inflation		15,1%	10,8%	2,1%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
	2021	2022	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
EU ETS price (EUR) - 2030 according to WEO NZE (IEA 2021)		80,9	85,0	89,1	93,3	97,4	101,6	105,7	109,9	114,0
Exchange rate	25,6	24,6	24,5	24,6	24,6	24,6	24,6	24,6	24,6	24,6
EU ETS price (CZK)	1 356	1 986	2 082	2 193	2 295	2 397	2 499	2 601	2 702	2 804
Phase out of free allocation						2,5%	5,0%	10,0%	22,5%	48,5%
	2021F	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Product avg. price annual growth in cement sector		14,6%	8,3%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Product avg. price annual growth in steel sector	22,3%	14,6%	8,3%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Product avg. price annual growth in chemical sector		14,6%	8,3%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%	2,0%
Effective tax rate	19%									

## ANNEX 4: SUMMARY OF SUSTAINABLE LENDING BY SELECTED BANKS

- Československá obchodní banka (KBC group, market share 27%) reported CZK 13.5 bil. (EUR 0.6 bil.) of sustainable loans provided in 2022 (supporting PV and energy efficiency in buildings), of which CZK 1 bil. met the EU taxonomy criteria. In cooperation with EIB, it provides discounted financing for energy-saving projects. The bank stopped direct financing of coal-fired power plant expansion and construction projects and investments in existing coal-fired power plants.
- Česká spořitelna (member of Erste Group, market share 24%) mainly promotes sustainability products for retail investors – ethical investment funds<sup>193</sup> or mortgages for sustainable residential buildings are the main flagship offers for transition financing. For innovative projects, the bank provides loans partially guaranteed by the EIF, but with a capped size of EUR 7 mil. Discounted loans provided in cooperation with EIB are similarly capped at EUR 12 mil.
- Komerční banka (Société Générale, market share 18%) provided ESG-related loans of CZK 16 bil. (EUR 0.7 bil.) in 2022, of which 83% were environmentally beneficial, mostly to support PV and energy efficiency in buildings. The share of ESG-compliant corporate investment loans exceeded 38% in 2022, and the target for 2025 is 50%.<sup>194</sup> In 2022, the bank started to provide green (investment) loans and sustainability-linked (operating) loans linked to the achievement of sustainability objectives, in addition to acquisition loans for sustainable projects. The bank decides whether to support transactions at preferential interest rates based on sustainability criteria that follow the EU taxonomy and the SG group rules.
- UniCredit Bank CR and Slovakia (UniCredit Group, market share 11%) reported long-term corporate investment loans aligned with the ESG EU Taxonomy of CZK 33 bil. (EUR 1.4 bil.) at the end of 2021, representing almost 20% of the portfolio. In 2021, it provided CZK 23 bil. (EUR 1 bil.) of loans in environmentally beneficial finance, mainly in the

green energy sector.<sup>195</sup> Specifically for corporate clients in 22 industrial sectors, the bank developed the ESG Barometer, a simplified version of the ESG rating, for advisory purposes.<sup>196</sup>

- The European Investment Bank is a multilateral EU financial institution that provides loans also to the private sector (large firms, SMEs and SPVs), typically covering up to 50% of a project's total cost, starting at EUR 25 mil., with maturities up to 10 years for bullet loans and 30 years for project finance. The EIB signed EUR 65 bil. of financing in 2022 and it raises money by issuing bonds on the capital markets, including green bonds.<sup>197</sup> In recent years, majority of its lending has been for projects that support climate and environmental sustainability, one of its six objectives.<sup>198</sup>

This objective includes investments in energy, transport, industrial or agricultural projects that are aligned with the Paris Agreement objectives, the framework defined by the EU Taxonomy and the EU Green Bond Standard. The EIB supports climate mitigation projects that reduce or prevent the GHG emission by investing in:

- research and development of low-carbon technologies,
- renewable energy,
- low-carbon transport solutions,
- industrial de-carbonisation.

Chart 36 shows that Czech industrial companies engage with EIB under-proportionally (approx. one-fifth) then would correspond to the country's share of EU GDP, in contrast to the proportional engagement of other CEE countries.

<sup>193</sup> Sustainable investment solutions accounted for approx. 20% of CS's investment recommendations in 2021, based on: Zpráva o trvalé udržitelnosti 2021 [Sustainability Report 2021], 2022, <https://www.csas.cz/cs/o-nas/verime-dobrym-vecem>

<sup>194</sup> KB Group Sustainability Report 2022, <https://www.kb.cz/getmedia/c678c6c7-7dc8-4675-bde6-37ada3fbec65/Zprava-o-udrzitelnem-podnikani-KB-AJ-za-rok-22.aspx>

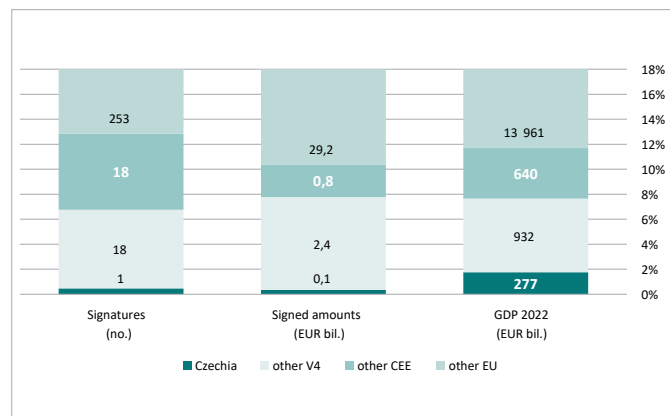
<sup>195</sup> UniCredit Bank CR and Slovakia Annual Report 2021, <https://www.unicreditbank.cz/en/o-bance/vysledky/vyrocní-zpravy.html>

<sup>196</sup> <https://www.unicreditbank.cz/en/velke-firmy/financovani/esg.html#esgbarometer>

<sup>197</sup> The total funding authorisation of EIB for 2023 reaches EUR 50 bil., see <https://www.eib.org/en/investor-relations/products/index.htm#sustainability>

<sup>198</sup> Other EIB objectives are: cohesion; innovation, digital and human capital; SMEs; sustainable cities and regions; and sustainable energy and natural resources.

**Chart 36: EIB loans to the industrial sector signed in 2018-22**



Note: Where multiple countries are involved in one project, only their respective share is included (i.e. while Czechia was involved in 6 multi-country projects in the period, its recalculated share corresponds to 1.3 projects)

Source: ISFC based on EIB project overview (<https://www.eib.org/en/projects/all>)

## ANNEX 5: EUROPEAN INVESTMENT BANK AND FUND

### European Investment Bank

In addition to loans described in Annex 4, the EIB also provides guarantees, equity investments, and their blending with other sources.

Designed for project financing of infrastructure projects, credit enhancement is provided to SPVs in the form of subordinated financing, funded or unfunded guarantees and contingent credit lines designed to enhance the credit quality/credit rating of senior debt. The EIB also provides guarantees for banks' SMEs loan portfolios.

Long-term venture debt is targeted at fast-growing innovative SMEs. The financing structure includes bullet repayment and remuneration linked to the equity risk of the investees and complements existing venture capital financing. Projects with a financing size between EUR 5-50 mil. should be in the commercial stage, although a pre-commercial stage may be acceptable for technologies in areas of strategic importance to the EU. They should fall in the innovative areas of health, future technologies (incl. industry 4.0, advanced materials, sustainable/advanced manufacturing) or sustainable infrastructure (incl. transition to clean energy, decarbonisation technologies, circular economy).

The EIB also engages in investments in debt and equity funds focused on private sector development or climate action and/or infrastructure projects, and in equity and hybrid debt co-investments with top-ranked funds and investment partners.

### European Investment Fund

The European Investment Fund (EIF), part of the EIB Group, specialises in providing indirect risk finance through portfolio guarantees and/or taking significant minority stakes and co-investment roles in:

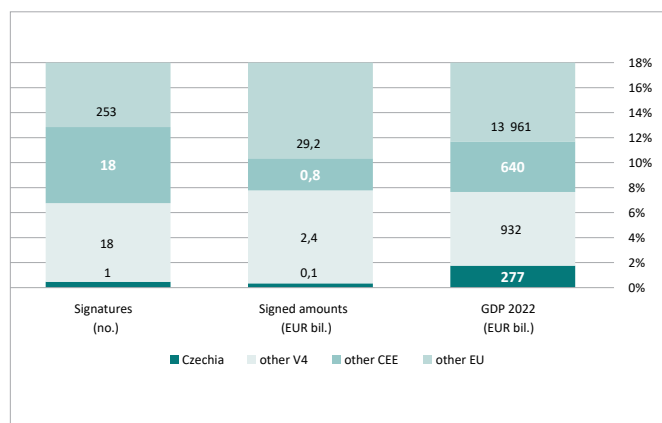
- financial intermediaries that offer financial products targeted at SMEs across their entire life cycle of corporate innovation
- venture capital and private equity funds that support high-growth and innovative small businesses in Europe in the very earliest stages of intellectual property development into technology transfer (from R&D into marketable products), to more advanced stages of development

- climate and infrastructure funds with a strong focus on environmental sustainability,
- hybrid debt/equity funds providing mezzanine financing.

It deploys more than EUR 30 bil. a year through financial intermediaries, of which three quarters are represented by guarantees, followed by equity investments, mobilising a total of more than EUR 100 bil. of funding a year.<sup>199</sup>

Hard-to-abate industries are not among the target groups. A basic overview of the funding distribution in 2021 by region/country is shown in Chart 37, supplemented with GDP data for comparison purposes.

**Chart 37: EIF guarantees and equity investments in 2021**



Source: ISFC based on EIF Annual Report 2021

<sup>199</sup> See EIF Annual Report, 2021, available at: <https://www.eif.org/attachments/publications/eif-annual-report-2021.pdf>

## ANNEX 6: RECENTLY ISSUED GREEN AND SUSTAINABILITY-LINKED BONDS

- Česká spořitelna issued EUR 500 mil. of green bonds in 2021 to finance energy efficiency improvements in commercial and retail buildings as well as renewable energy sources. Interest exceeded 2.6 times the issued volume.<sup>200</sup>
- Raiffeisenbank issued EUR 350 mil. of green bonds also in 2021 to finance energy efficiency projects, sustainable transportation, and land use. Interest exceeded 2.4 times the issued volume.<sup>201</sup>
- In April 2022, sustainability-linked bonds were issued by ČEZ, the largest Czech energy producer. The bonds worth EUR 600 mil. are linked to cutting emissions to 0.26 tCO<sub>2</sub>e/MWh of produced energy until end-2025. Should ČEZ fail in meeting this target, the coupon payment will increase by 75 bps from 2.375%.<sup>202</sup>
- Czech Gas Networks Investments, the parent company of the Czech operator of the largest fully regulated natural gas distribution network in the country, issued EUR 500 mil. in 8-year Green Bond in 2021, with a focus on the retrofit of the existing gas network to make it compatible for the distribution of hydrogen and other low-carbon gases.<sup>203</sup>
- Ceske drahy, the largest local railway operator, issued EUR 500 mil. worth of green bonds in 2022 to finance the purchase of new trains and other green projects.<sup>204</sup>
- CPI Property Group, the largest property owner in the CEE region, issued its first green bonds in Hungary in 2019, worth EUR 86 mil. (HUF 30 bil.).<sup>205</sup> This was the first green bonds issue in Hungary. Another pioneering event took place in early 2022, when CPI became the first real estate company to issue sustainability-linked bonds. The bonds were related to its goal of reducing emissions by 30% by 2030. If this target is not met, the interest rate on the last coupon payment will increase from 1.75 to 2%.
- February 2022, Czech-based logistics property developer CTP issued its third green bond with a nominal value of EUR 500 mil., following its debut issue (EUR 650 mil.) and second issue (EUR 400 mil.), both in 2020.
- Among smaller bond issues, Photon Energy issued EUR 80 mil. of green bonds in 2021/2 to finance its PV activities.

200 Česká spořitelna boosts green finances – it has issued the largest issue of green bonds in Czechia to date, Česká spořitelna, 2021, [https://www.csas.cz/content/dam/cz/csas/www\\_csas\\_cz/dokumenty/tiskove-zpravy/2020/pdf/Press\\_release\\_%C4%8CS\\_Green\\_bonds.pdf](https://www.csas.cz/content/dam/cz/csas/www_csas_cz/dokumenty/tiskove-zpravy/2020/pdf/Press_release_%C4%8CS_Green_bonds.pdf)

201 Emise zeleného dluhopisu, Raiffeisenbank, 2021, <https://www.rb.cz/informacni-servis/pro-media/tiskove-zpravy/tiskove-zpravy-2021/tiskove-zpravy-202106/0702021-emise-zeleneho-dluhopis>

202 ČEZ website: <https://www.cez.cz/cs/pro-investory/obligace/bonds-zpravy/emise-dluhopisu-v-ramci-emtn-programu-2022-157204>

203 CGNI website: <https://www.cgni.eu/-/media/Cgni/Files/Securities/CG-NI-EUR500m-0450-green-notes-due-2029-Listing-Particulars.pdf>

204 CD website: <https://www.ceskedrahy.cz/en/press-center/press-releases/ceske-drahy-has-issued-its-first-green-bonds>

205 Vítkova CPI prodala v Maďarsku dluhopisy za 2 miliardy, Dluhopisy.cz, 2020: <https://dluhopisy.cz/novinka-dluhopisy-2020-novinky-33-tydne>





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