Leveraging Industrial Decarbonisation Options in Indonesia by Anticipating International Carbon Tariff

Deliverable 2: GEM-E3 Model-based Impact Assessment on EU CBAM and Other Potential International Carbon Tariffs

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1 EXECUTIVE SUMMARY

This study assesses the impacts of possible international carbon tariffs, such as carbon border adjustment (CBA) measures, on Indonesian exports and the country's overall macroeconomic performance. To quantify these impacts, we have applied a large-scale computable general equilibrium model, GEM-E3-FIT. The model includes 47 sectors of production and 5 types of occupations, and it has global coverage. The model's starting point is the Input-Output tables which depict in detail economic transactions between agents in the economy. Computable general equilibrium models calculate a vector of prices that ensures that all markets (capital market, labour market, goods and services market) are in equilibrium at each point in time. Countries are linked through bilateral trade flows, which are influenced by production costs and consumers' preferences. The model features make it a unique and strong tool in assessing the impacts of alternative policies on the economy.

Carbon border adjustment mechanisms (CBAMs) are policy tools designed to protect domestic production in energy-intensive sectors and to mitigate carbon leakage. They impose a cost on exporters to the implementing country, proportional to the carbon emissions associated with their products. In this way, CBAMs incentivise producers abroad to invest in more energy-efficient and low-emission processes, thereby encouraging a shift away from fossil fuels.

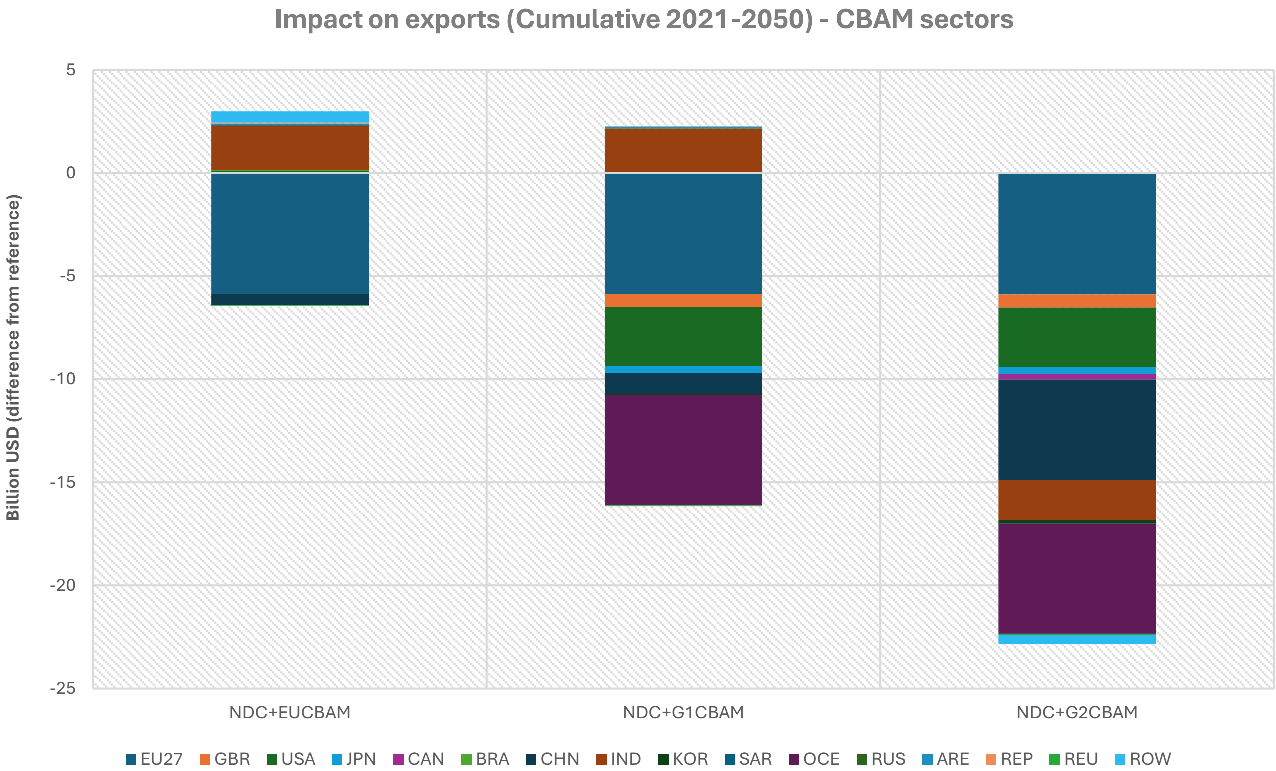
The European Commission has formally adopted the CBAM through Regulation (EU) 2023/956. The mechanism will become fully operational in 2026, with its effective carbon price progressively increasing in line with the phase-out of free allowances under the EU Emissions Trading System (ETS). Full implementation, marked by the complete elimination of free allowances, is expected by 2035. During the initial phase, CBAM covers imports of iron and steel, aluminium, fertilisers, cement, electricity, and hydrogen, although an expansion of its scope to include additional products remains under consideration.

It is anticipated that this type of measure will most likely be adopted in the future by other countries as well. For this reason, the impact assessment includes three scenarios: i) a scenario where only the EU adopts CBAM (NDC+EUCBAM), ii) a scenario where the UK, the USA, Japan and Australia also adopt CBA measures with the same scope and price (NDC+G1CBAM), and iii) a scenario where China, India and Canada also impose similar carbon tariffs on their imports (NDC +G2CBAM). These scenarios allow to identify the sensitivity of Indonesian products by exporting partner.

In principle, the implementation of CBAM by a partner country will directly affect demand for Indonesian goods and services in two key ways: i) it will create a level playing field for carbon pricing which will disadvantage those imported goods that have a higher carbon intensity than domestic ones, as the former become more expensive due to the added carbon cost and ii) it will influence the mix of importer sources: for example, Indian products are expected to face higher carbon tariffs than Indonesian products, given India has a more carbon intensive energy mix and less efficient production processes. This could translate into competitiveness gains for Indonesian producers.

The analysis shows minimal impacts on Indonesian GDP in all three scenarios examined. Cumulative GDP losses by 2050 range from USD 3 to 6 billion compared to a reference scenario where CBAM is not implemented, corresponding to a relative decline by just -0.004% to -0.01%. Impacts are higher in the NDC+G2CBAM and lower in the NDC+G1CBAM.

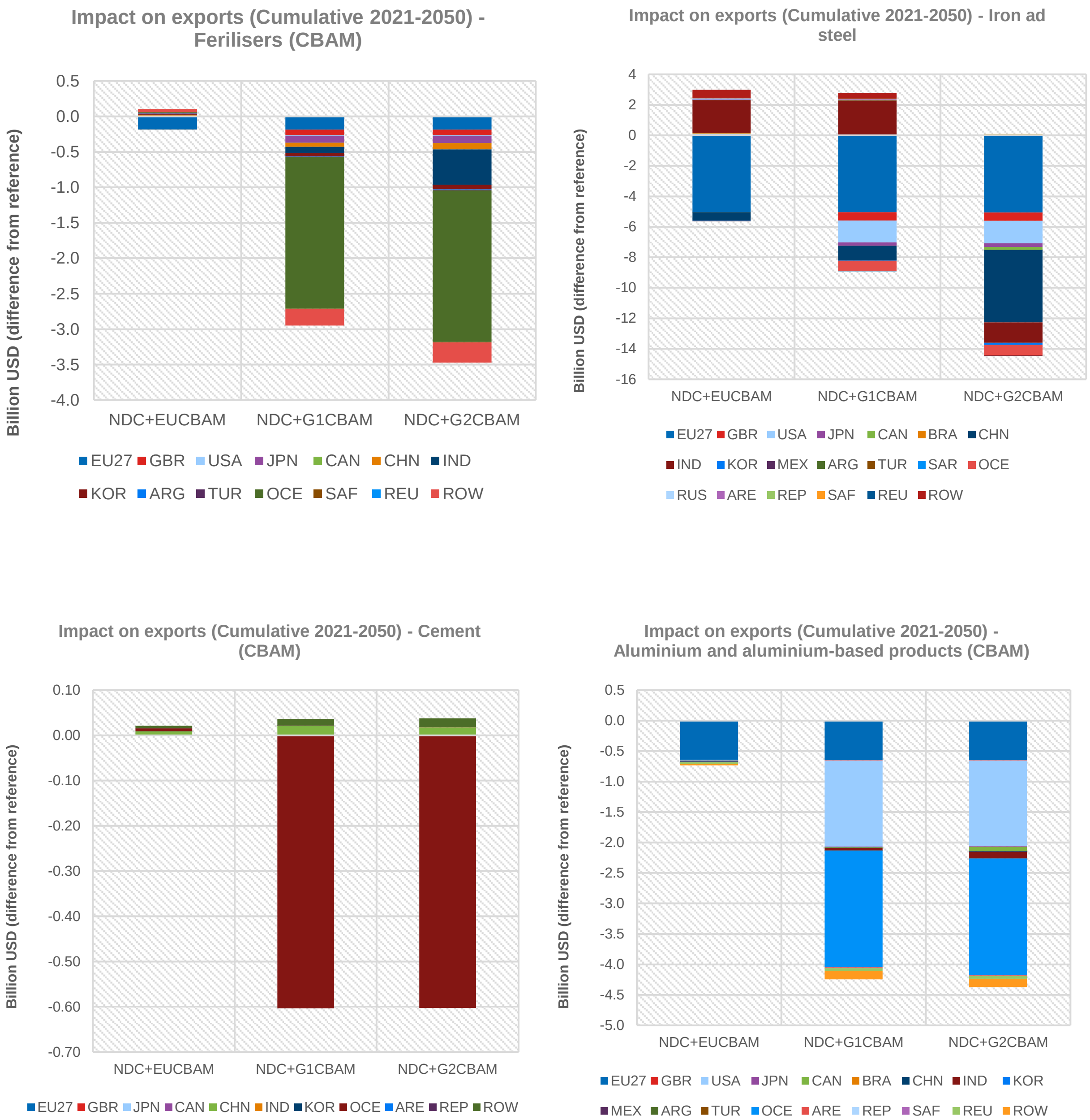
Figure 1. Indonesia's exports to main trading partner in CBAM-related industrial products



Similarly, total cumulative exports from Indonesia show only moderate changes across the scenario analysed. Under the NDC+EUCBAM scenario, exports decline by USD 0.4 billion (-0.04%), while in the NDC+G1CBAM scenario and the NDC+G2CBAM scenario the observed reduction is USD 5.2 billion (-0.052%) and USD 7.5 billion (-0.075%) respectively. The effects are lower in the period up to 2030 and escalate from 2035 onwards when the CBAM is fully implemented. The cumulative impacts of CBAM-related exports range between USD 4 billion and USD 23 billion. The largest reductions are observed in exports to the EU27, which decline by approximately USD 6 billion. Exports to Australia decline by USD 5.3 billion (NDC+G1CBAM and NDC+G2CBAM) and those to China by approximately USD 5 billion (NDC+G2CBAM). Changes in bilateral exports vary according to the specific characteristics of each scenario.

The response of exports of CBAM products by partner countries depends on the global policy context. For example, in NDC+EUCBAM and in NDC+G1CBAM, we find that iron and steel exports to India increase while they decline in the NDC+G2CBAM, where India also implements CBAM. Overall, exports of fertilisers and cement are primarily affected by development in the Australian market, while iron and steel exports are more responsive to changes in China and the EU27. Aluminium exports show greater sensitivity to shifts in demand from the United States and Australia.

Figure 2. Impact on exports (Cumulative 2021-2050) by CBAM sector



The impact assessment also reveals other important aspects of the CBAM implementation. The first one refers to the importance of indirect impacts for the Indonesian coal industry, which records export losses of approximately USD 5 billion in all scenarios examined, driven by the lower demand from India. Indian industries are particularly sensitive to the implementation of CBAM in EU27 and use coal as their main energy input. The second finding worth highlighting is the increase in the exports of other goods produced in Indonesia. The released productive capacities, either capital and/or labour force, lead to an increase in the exports of consumer goods industries, transport equipment and electronics.

2 INTRODUCTION

This report presents the findings of the macroeconomic analysis regarding the impacts of the adoption of CBA measures by major Indonesian trading partners. CBAs are policy instruments designed to reduce carbon leakage rates, and their effectiveness in protecting local industries has been at the centre of scientific research for decades. In principle, CBAs refer to the taxation of imports based on their emission content. In this way, exporters face the cost of their climate impacts. Typically, this type of measures includes energy/emission-intensive products, but they can be extended to any type of goods.

The economic analysis compares the performance of three alternative scenarios against a Reference scenario. The reference is a constructed scenario, i.e. it is calibrated to the most recent economic and demographic projections for Indonesia. Three scenarios were quantified and their effects on the economy of Indonesia were assessed: a scenario where CBAM is adopted only by EU27 Member States; a scenario where the USA, Australia, Japan and the United Kingdom also implement similar measures; and a scenario where Canada, China and India also adopt CBAM. These countries have officially expressed interest in adopting CBAM policies as a tool for alleviating the impacts of more stringent national climate policies on domestic industries. The list of goods covered by the CBA in our analysis includes iron and steel, aluminium, fertilisers, hydrogen and electricity.

Indonesia is a major exporter of energy-intensive goods (ferrous and non-ferrous metals, chemicals, paper and pulp, non-metallic mineral goods), which accounted for approximately 20% of total national exports[1] in 2023. This study allows for the quantification of the channels and the extent to which the Indonesian economy will be affected by the adoption of CBAM by its main exporting partners, to identify potential indirect impacts and opportunities. The report is constructed as follows: Section 3 presents the GEM-E3-FIT model, Section 4, Section 5 and Section 6 present the main assumptions of the reference scenario and alternative scenarios examined, Section 7 presents the main findings of the study and Section 8 concludes.

3 THE GEM-E3 MODEL

GEM-E3 is a large-scale, multi-sectoral hybrid computable general equilibrium (CGE) model designed to evaluate the effects of external shocks on the economy[2]. The model provides a robust framework to capture the complex energy-economy-climate interactions and simulate the impact of climate and energy policies on the performance of sectors, sectoral output, prices and bilateral trade, the competitiveness of regions and the welfare of communities. Results have a yearly frequency up to 2030 and 5-year time steps until 2050/2100. The model has a global coverage, with 47 regions (see Table 1), where Indonesia, the G-20 countries, EU27 Member States, and major equipment manufacturing or energy exporting countries are represented individually and are also linked through bilateral trade. All countries are linked through endogenous bilateral trade transactions. The model explicitly represents 50 distinct economic activities (see Table 1. Regional resolution of the GEM-E3 model), which are interlinked across the production and consumption value chain.

The focus is placed on the representation of the energy system, where specialised bottom-up modules of the power generation, buildings, and transport sectors are considered. To this end, the model includes a detailed representation of the power generation system (12 power technologies) and a detailed transport module (private and public transport modes), while different technological options for energy

[1] COMTRADE: https://comtradeplus.un.org/TradeFlow

[2] For a detailed presentation of the model please read https://e3modelling.com/modelling-tools/gem-e3/ - model manual.

use in buildings and industry are provided. The energy system representation includes an explicit representation of new technologies such as hydrogen, clean fuels, and bioenergy options.

The GEM-E3 environmental module covers all GHG emissions and a wide range of abatement options, as well as a thoroughly designed carbon market structure (e.g., grandfathering, auctioning, alternative recycling mechanisms). The model has been used extensively by the European Commission, the World Bank, governments, and public institutions to assess the macroeconomic, distributional and employment implications of the transition to climate neutrality.

The model is based on advanced applied modelling techniques and has been further extended to allow the representation of semi-endogenous technical progress, endogenous formation of labour skills and human capital and a detailed bottom-up representation of the energy system (in particular transport and power generation), along with non-CO_2 emission abatement options and negative emissions technologies. It moves beyond the standard CGE framework as it features involuntary unemployment in the labour market and alternative macroeconomic closures supported by a detailed representation of the financial sector. The model is established on rigorous microeconomic theory, it is empirically estimated (substitution and trade elasticities) and can undertake long-term analysis as opposed to econometric models that suffer from the Lucas critique[3]. The model can be used both in a comparative and what-if analysis framework, as it represents a closed and consistent accounting of resources.

The model is calibrated to a wide range of datasets comprising Input-Output (IO) tables, energy balances, GHG inventories, bilateral trade matrices, investment matrices and household budget surveys. All countries in the model are linked through endogenous bilateral trade transactions, identifying the origin and destination. The substitution elasticities of the model are not derived from the general literature but are estimated according to its dimensions and functional forms using the latest available datasets. The model is recursive and dynamic through the accumulation of capital via the decision for investments and through the accumulation of knowledge stocks via R&D. Model regions are linked through endogenous bilateral trade following the Armington assumption[4] of imperfect substitution across domestic and imported goods. The nested production functions are differentiated by sector and follow a CES structure. For the demand side, the model simulates consumer behaviour and maximises a Klein-Rubin utility function[5] that results in a Linear Expenditure demand system subject to its disposable income not used for obligatory consumption (subsistence minimum consumption), and after allowing for the decision on savings. The representative household decides on the allocation of its available income for consumption over different consumption categories (COICOP), distinguishing between durable and non-durable goods. The model has been calibrated to the latest statistics (GTAP 11, IEA, UN, ILO) while Eurostat statistics have been used for the EU.

The model is written in a structural form and can be used for the comparative analysis of alternative policy scenarios and the provision of insights on the distributional effects of long-term structural adjustments. In all simulation alternatives, the model ensures that the economic system is always in general equilibrium. The GEM-E3 model is written entirely in GAMS. The implementation of the model is split into two stages:

[3] The Lucas critique is a question of the ability of econometrically estimated models to assess the impacts of policy changes as the optimising behaviour of agents vary depending on the policy context.

[4] The Armington assumption implies that (specific) commodities produced in different countries are considered as imperfect substitutes. This means that a good cannot be completely substituted by the same good produced in a different country, as it embodies unique characteristics that distinguish it from other similar goods.

[5] It is assumed that consumers derive utility from superficial consumption. The Klein-Rubin utility function incorporates a subsistence minimum, representing the minimum level of consumption required to meet household's basic needs.

I. Calibration: At this stage the calculation of the model parameters is carried out so that the model replicates a single year (base year) data.
II. Scenario quantification: This stage entails model implementation that quantifies a reference and/or a counterfactual scenario.

The most important results, provided by GEM-E3 are: Full IO tables for each country/region identified in the model, GDP and GDP components, employment by economic activity and by skill and unemployment rates, capital, interest rates and investment by country and sector, private and public consumption, bilateral trade flows, consumption matrices by product and investment matrix by ownership branch, GHG emissions by country, sector and fuel and detailed energy system projections (energy demand by sector and fuel, power generation mix, deployment of transport technologies, energy efficiency improvements).

GEM-E3 enables a thorough understanding and detailed identification of risks and opportunities of the low-carbon transition and of the implementation of specific climate and energy policies by capturing:

- Direct impacts on each sector, e.g., how carbon prices and carbon border taxes will affect a sector's costs of production (considering carbon intensity) and thus its production levels (via domestic and international demand)
- Indirect impacts via value chain effects (e.g. changes in prices of intermediate products, of labour and capital inputs), technology costs, consumer preferences, material availability and costs
- Induced effects via economic feedback, prices, and income implications (e.g. overall drop in demand even for products not directly affected by carbon prices, etc.)
- The impacts of financing requirements (capital-intensive process of mitigation) and different financing
- Impacts on competitiveness by location site
- Impacts on sectoral productivity, household incomes and prices due to climate damages

Table 1. Regional resolution of the GEM-E3 model

Country Code:	Description:		Country Code:	Description:
AUT	Austria		**USA**	USA
BEL	Belgium		**JPN**	Japan
BGR	Bulgaria		**CAN**	Canada
CYP	Cyprus		**BRA**	Brazil
CRO	Croatia		**CHN**	China
CZE	Czech Republic		**IND**	India
DEU	Germany		**KOR**	South Korea
DNK	Denmark		**IDN**	**Indonesia**
ESP	Spain		**MEX**	Mexico
EST	Estonia		**ARG**	Argentina
FIN	Finland		**TUR**	Turkey
FRA	France		**SAR**	Saudi Arabia
GBR	United Kingdom		**OCE**	Oceania
GRC	Greece		**RUS**	Russian Federation
HUN	Hungary		**ARE**	United Arab Emirates
IRL	Ireland		**REP**	Rest of energy-producing countries
ITA	Italy		**SAF**	South Africa
LTU	Lithuania		**SVN**	Slovenia
LUX	Luxembourg		**SVK**	Slovakia
LVA	Latvia		**SWE**	Sweden

Country Code:	Description:		Country Code:	Description:
MLT	Malta		**ROU**	Romania
NLD	Netherlands		**REU**	Rest of Europe
POL	Poland		**ROW**	Rest of the World
PRT	Portugal			

Table 2. Sectoral resolution of the GEM-E3 model

Code	Description	Code	Description	Code	Description
Industry		**Industry (continued)**		**Agriculture**	
IND01	Ferrous metals	**IND19**	Equipment for PV panels	**AGR01**	Agriculture
IND02	Non-ferrous metals	**IND20**	Equipment for CCS power technology	**Services**	
IND03	Fabricated Metal products	**IND21**	CO_2 Capture	**SRV01**	Market Services
IND04	Chemical Products	**Energy**		**SRV02**	Non-Market Services
IND05	Basic pharmaceutical products	**ENE01**	Coal	**SRV03**	R&D
IND06	Rubber and plastic products	**ENE02**	Crude Oil	**Power Generation**	
IND07	Paper products, publishing	**ENE03**	Oil	**PGT01**	Coal fired
IND08	Non-metallic minerals	**ENE04**	Gas	**PGT02**	Oil fired
IND09	Computer, electronic and optical products	**ENE05**	Power Supply	**PGT03**	Gas fired
IND10	Other Equipment Goods	**ENE06**	Biomass Solid	**PGT04**	Nuclear
IND11	Transport equipment (excluding EV)	**ENE07**	Biofuels	**PGT05**	Biomass
IND12	Consumer Goods Industries	**ENE08**	Hydrogen	**PGT06**	Hydroelectric
IND13	Construction	**ENE09**	Clean Gas	**PGT07**	Wind
IND14	Batteries	**Transport**		**PGT08**	PV
IND15	EV Transport Equipment	**TRA01**	Warehousing and support activities	**PGT09**	Geothermal
IND16	Advanced Electric Appliances	**TRA02**	Air transport	**PGT10**	CCS coal
IND17	Advanced Heating and Cooking Appliances	**TRA03**	Land transport	**PGT11**	CCS Gas
IND18	Equipment for wind power technology	**TRA04**	Water transport	**PGT12**	CCS Bio

4 THE REFERENCE SCENARIO

The reference scenario serves as a point of comparison for the analysis of the policy scenarios. It provides a detailed outlook of GDP by component, employment and unemployment levels, sectoral production, bilateral trade, emissions, energy use and other indicators[6] for the long-term period. The baseline scenario reflects the most recent economic projections at the global and country level, as it builds on exogenous assumptions for key macroeconomic and socioeconomic indicators. The main exogenous assumptions include i) GDP and ii) Population, while further assumptions regarding the evolution of key socioeconomic variables include households' consumption, government expenditure, investment and

[6] Including disaggregates total domestic demand by sector, household consumption by consumption and by purpose categories, employment by sector and by skill type, labour force by skill type, population, GHG emissions.

trade, working-age population, labour force and unemployment rate. It further includes a predefined set of currently legislated energy and climate policies.

5 MACROECONOMIC ASSUMPTIONS

Regarding GDP and its components, Table 3 shows the sources used for the base year calibration of the model and the Reference scenario projections for Indonesia.

Table 3. Sources related to GDP and Components for Indonesia

	2017	2021-2023	2024-2028	2028-2029	2030-2100
GDP	GTAP_v11	Growth rate from IMF	Growth rate from IMF	Same growth rate 2028-2027	Growth rates from SSP2- OECD ENV-Growth 2023
Household Consumption	GTAP_v11	Growth rate from IMF	Growth rate from IMF	Gradual convergence to 61% (ratio to GDP) in 2200	Gradual convergence to 61% (ratio to GDP) in 2200
Government Consumption	GTAP_v11	Growth rate from IMF	Growth rate from IMF	Gradual convergence to 15% (ratio to GDP) in 2200	Gradual convergence to 15% (ratio to GDP) in 2200
Investments	GTAP_v11	Growth rate from IMF	Growth rate from IMF	Gradual convergence to 23% (ratio to GDP) in 2200	Gradual convergence to 23% (ratio to GDP) in 2200
Net exports	GTAP_v11	Growth rate from IMF	Growth rate from IMF	Gradual convergence to 1% (ratio to GDP) in 2200	Gradual convergence to 1% (ratio to GDP) in 2200

In the base year, the GTAP_v11[7] database is used, and projections up to 2100 are made using data on growth rates from the IMF, and the OECD ENV-Growth 2023 – SSP2[8].[9] With respect to macroeconomic components, for which the modelling period overshoots the projection period of the available published reports, we assume a gradual convergence to the observed global ratios (as % of GDP) for the remaining future years.

Figure 2 shows the projection of GDP and its components in Indonesia up to 2050. The average annual growth rate between 2021 and 2050 is 3.6%. GDP growth is driven by increase in export surplus and

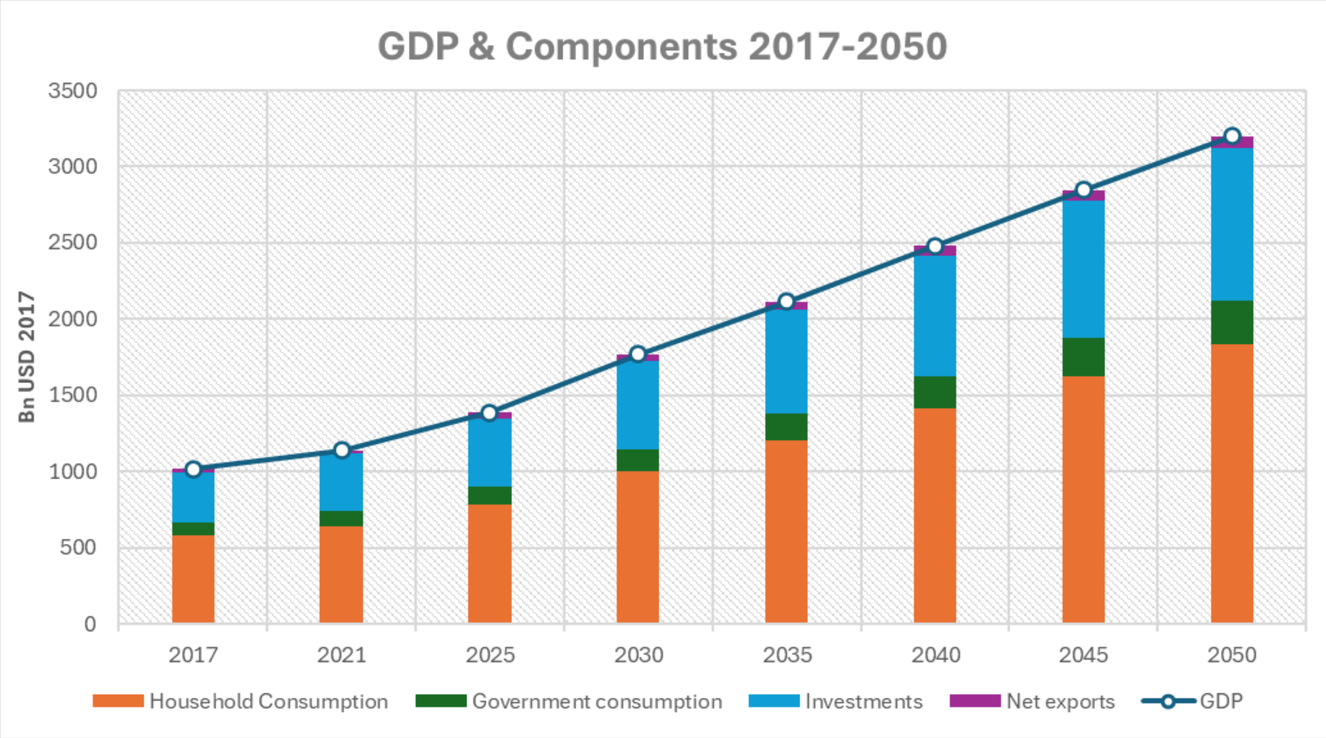
[7] See: https://www.gtap.agecon.purdue.edu/databases/v11/

[8] See: https://data.ece.iiasa.ac.at/ssp

[9] For projections related to GDP and its components for Indonesia, IMF and OECD data were preferred to the Government's own projections (e.g., Ministry of National Development Plan – BAPPENAS). The rationale for this choice is: (1) the national projections use highly context-specific variables and scenarios that are difficult to reconcile with other countries' datasets, and (2) adopting IMF/OECD data allows for greater consistency across all country projections. In particular, adopting IMF/OECD data allows for consistent calibration of GDP macro-components, especially trade and bilateral trade flows, while adopting national projections can lead to inconsistencies due to different methodological approaches.

investments, but its main component is private consumption. During the projection period, investments increase by an annual rate of 3.5% and with respect to trade Indonesia is projected to record small surpluses.

Figure 2. Projection of GDP and Components – Indonesia



Source: GEM-E3

5.1 Socioeconomic assumptions

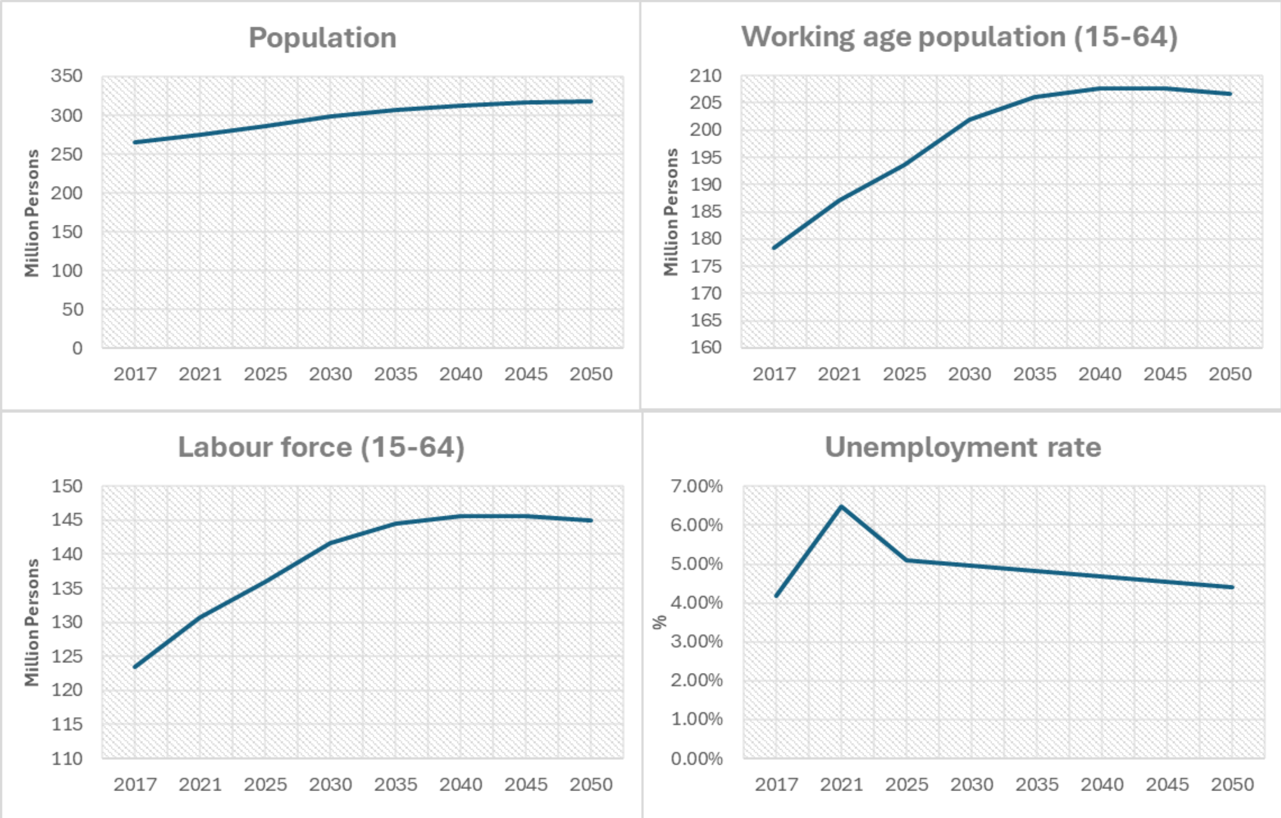
With respect to demographics and unemployment, the Eurostat database is used for the European countries and the ILO database for the non-EU countries, and projections up to 2100 are made using growth rates from the IMF, UN, ILO databases and the OECD ENV-Growth 2023 (Table 4). For the period 2028-2100 and for the years without available data, we assumed that the labour force has the same growth rate, while working age and unemployment rate gradually converge to the natural unemployment rate (3%) until 2100. Table 4 shows the sources used in the calibration and projection of the socioeconomic indicators.

Table 4. Sources related to Population and labour market data for Indonesia

	2017	2021-2023	2024-2028	2028-2029	2030-2100
Population	ILO	IMF		Same growth rate 2028-2027	Growth rates from SSP2-OECD ENV-Growth 2023
Working age population (15-64)	ILO	IMF		Same growth rate 2028-2027	UN growth rates adjusted to population
Labour force (15-64)	ILO	IMF		Same growth with working age population	
Unemployment rate	ILO	ILO	Gradual convergence to the natural unemployment rate (3%) until 2100		

Figure 3 shows the projected population, working-age population, labour force, and unemployment rate as assumed in the baseline projections. Population is expected to grow until 2055, followed by a downward trend. The working-age population and labour force shows a similar trend. In the projections, a decline trend of unemployment rate is assumed starting from 2021.

Figure 3. Projection of population, working age, labour force and unemployment rate



5.2 Sectoral production

Sectoral output is endogenous to the model, unless there is an exogenous assumption to consider explicitly in the modelling framework. Table 5 shows the average annual growth rate of sectoral production until 2050 and shows the share of the sector in the total economy production. These projections are based on i) historical trends, ii) the assumed growth pattern of the economy, iii) production factor productivity assumptions, iv) emerging cost and competitiveness dynamics. Between 2017 and 2050, the largest contributions to total domestic production come from the services sector (~35%, base year), manufacturing n.e.c[10] (~20%, base year) and construction (17%, base year).

Table 5. Sectoral production average annual growth rates

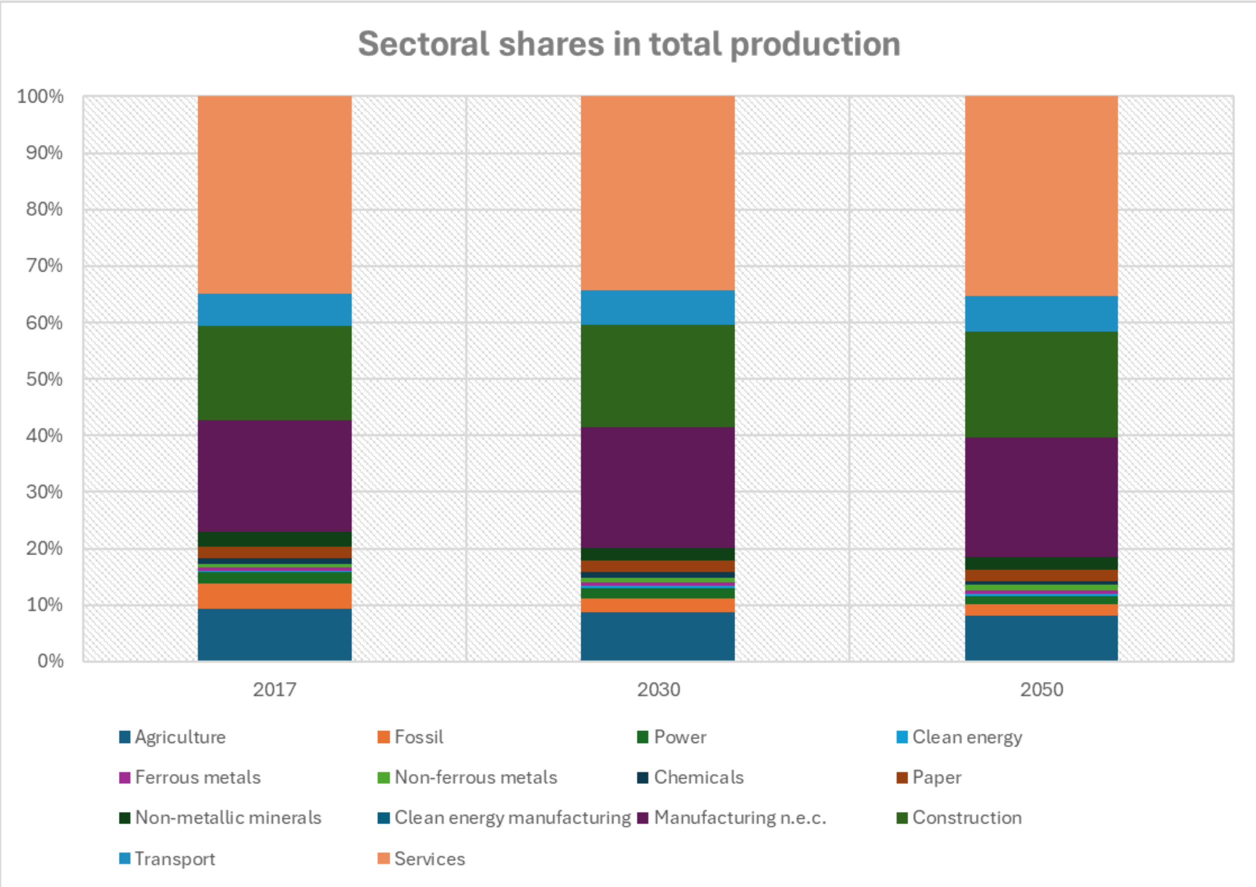
	2017-2023	2024-2030	2030-2050
Agriculture	2.6%	3.3%	2.4%
Fossil	-3.0%	0.8%	1.8%
Power	1.9%	2.5%	1.5%
Clean energy	19.0%	1.4%	0.8%
Ferrous metals	4.7%	5.3%	2.5%
Non-ferrous metals	6.4%	6.5%	3.4%

[10] n.e.c = not elsewhere specified (e.g., Computer, electronic and optical products, transport equipment goods, consumer goods etc.).

	2017-2023	2024-2030	2030-2050
Chemicals	0.4%	4.6%	1.6%
Paper	2.6%	3.6%	2.6%
Non-metallic minerals	2.3%	3.1%	2.3%
Manufacturing n.e.c.	3.8%	4.5%	2.7%
Construction	3.7%	4.8%	2.8%
Transport	3.2%	4.6%	3.0%
Services	2.5%	4.3%	2.9%

Source: GEM-E3

Figure 4. Sectoral shares in total production



Source: GEM-E3

Table 6. Sectoral production in Bn USD 2017

	2017	2021	2025	2030	2035	2040	2045	2050
Agriculture	173.3	185.6	214.9	252.6	289.9	329.2	368.5	406.7
Fossil	79.4	66.6	65.8	69.1	74.8	81.7	89.9	98.7
Power	39.7	42.0	46.5	53.0	57.8	62.7	67.2	71.4
Clean energy	4.5	12.2	12.5	14.3	14.9	15.5	16.1	16.7
Ferrous metals	9.4	10.7	13.7	17.9	21.0	24.0	27.0	29.6
Non-ferrous metals	11.4	14.0	18.8	26.0	31.8	38.0	44.4	50.8
Chemicals	19.7	19.3	22.1	27.9	30.7	33.4	35.8	38.1
Paper	37.1	40.6	46.6	55.9	64.7	74.0	83.7	93.6

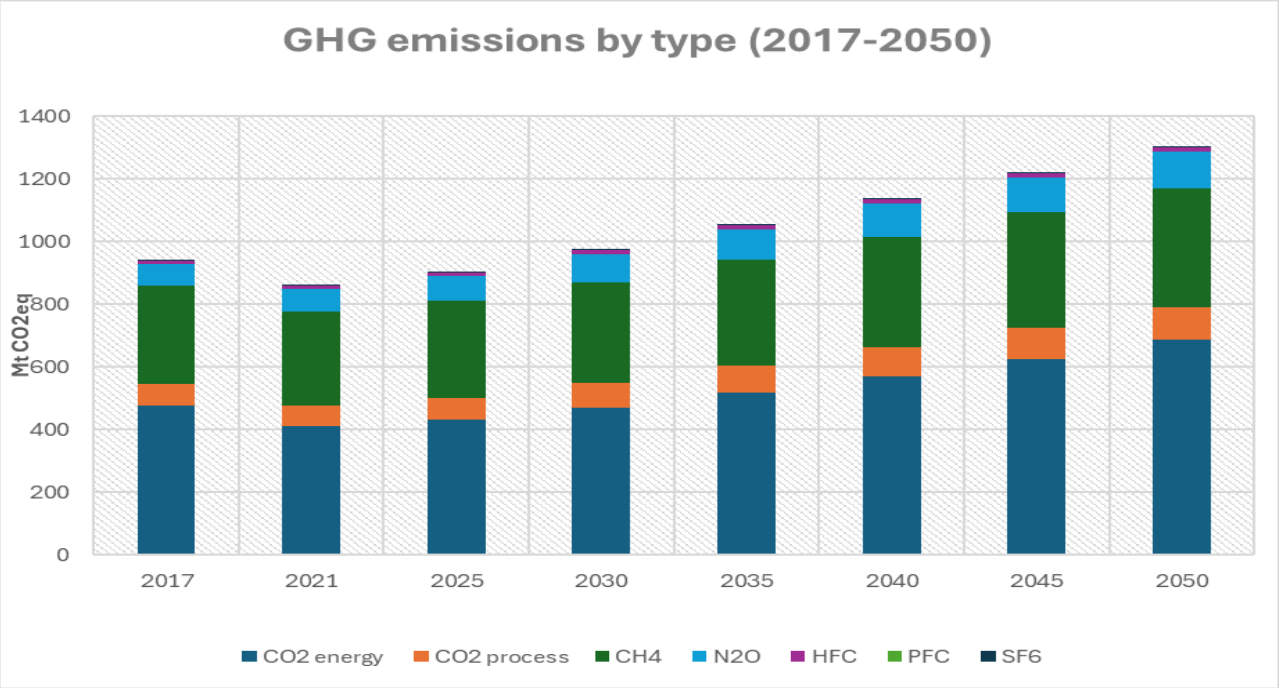
	2017	2021	2025	2030	2035	2040	2045	2050
Non-metallic minerals	49.7	53.4	60.0	70.7	80.3	90.4	101.1	111.9
Manufacturing n.e.c.	360.1	404.5	493.1	617.2	722.0	834.6	948.3	1060.3
Construction	307.1	351.6	416.5	529.0	629.6	730.5	830.2	925.9
Transport	105.3	116.0	139.5	174.1	207.5	242.8	278.9	314.9
Services	644.0	694.8	810.5	998.2	1177.3	1369.2	1566.3	1763.9

Source: GEM-E3

5.3 GHG emissions

Figure 5 shows the projection of GHG emissions. CO_2 emissions from energy account for approximately 50% of total GHG emissions, with a continuous increase over the years driven by the assumed GDP growth.

Figure 5. GHG emissions by type



5.4 Climate and Energy policies

Table 7 shows currently legislated policies that have been incorporated in the GEM-E3 Reference scenario. More details can be found in the Climate Policy Database[11] by Newclimate.

Table 7. Current policies that have been added to the baseline for Indonesia

Sector	Target description	Target year	Base year	Target
Electricity and heat	Primary energy renewables share	2025	-	23%
	Primary energy renewables share	2050	-	31%
	Capacity addition Hydro compared to BAU	2030	2021	10.5 GW
	Capacity addition Geothermal compared to BAU	2030	2021	3.2 GW

[11] https://climatepolicydatabase.org/

Sector	Target description	Target year	Base year	Target
	Capacity addition wind compared to BAU	2030	2021	0.4 GW
	Capacity addition solar compared to BAU	2030	2021	4.9 GW
Transport	EV share (NEW CARS)	2050	2020	100%
Economy-wide	Carbon tax	2060	2021	2 \$/t CO_2
	HFC emission	2045	2021	-80%

6 SCENARIO DESIGN

To examine the potential impact of more intense global climate action on Indonesia's economy, we formulate three alternative scenarios. It is assumed that the world achieves its NDC plans, and further, we examine the adoption of CBAM by major economies. The scenario specification aims to shed light on the extent of the country's export vulnerability, especially in the CBAM-affected industrial sectors. We assume a gradual adoption of CBAM by the world's greatest economies to identify the impacts by country groups. In the first scenario, namely NDC+EUCBAM, it is assumed that the CBAM is adopted only by the EU27, while in the NDC+G1CBAM scenario, it is also adopted by the USA[12], the UK, Australia, and Japan, and finally in the NDC+G2CBAM scenario, also China, India and Canada introduce this mechanism. To ensure consistency across the three main scenarios there is no differentiation in terms of climate policy. The grouping of the countries resulted from an early-stage discussion, considering the relevance of CBAM policies in the policy dialogue of each selected country. The functioning of CBAM was assumed to be the same as that of the EU CBAM. Hence, a carbon pricing instrument was assumed for each country, where the carbon price depended on the NDC targets of the respective country.

Table 8. Scenario specification

	Reference	NEUNDC (Intermediate reference)	NDC+EU CBAM	NDC+G1CBAM	NDC+G2CBAM
Indonesia climate policy	Current policies	NDC	NDC	NDC	NDC
EU climate policy	Fit-for-55 extended to net zero GHG by 2050				
Global climate policy	Current policies	NDC	NDC	NDC	NDC
EU CBAM	No	No	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956	EU CBAM Regulation (EU) 2023/956
Other CBAM	No	No	No	Carbon Border Adjustment schemes in **Group 1 (G1)** countries: Australia, USA, UK and Japan, considering domestic carbon pricing	Carbon Border Adjustment schemes in **Group 1 plus Group 2 (G2)** countries: Canada, China and India considering domestic

[12] The calculation was carried out before US announcement of trade tariffs on 2nd April. Even though the report authors acknowledge these new tariffs could affect trade flows, they underline that an updated impact assessment could be premature because the context seems to be unstable (e.g. US tariffs pause announced on 9th April) and tariffs implementation would require time to be fully effective.

	Reference	NEUNDC (Intermediate reference)	NDC+EU CBAM	NDC+G1CBAM	NDC+G2CBAM
				schemes or implicit carbon values from emission targets	carbon pricing schemes or implicit carbon values from emission targets
Sectors under CBAM	No	No	Cement, iron and steel, aluminium, fertilisers, hydrogen, and electricity		

7 MACROECONOMIC IMPACTS

7.1 Overview

The increasing rate at which countries adopt more ambitious climate targets is projected to reduce demand for fossil fuels and increase production costs of energy-intensive goods worldwide. The implications at the macro level can be significant for economies that are not diversified and rely heavily on the production of these goods. The key transmission channel is trade, which positively affects countries that are net exporters of goods and services necessary for decarbonisation and negatively affects net importers of clean energy technologies and net exporters of fossils. Economies with high trade openness, significant carbon content, and limited capacity for technical substitutions may experience reduced demand for their products in international markets. However, decarbonisation also presents new opportunities for structural transformation in the economy. This includes the development of productive capacities for clean energy carriers and the manufacturing of equipment essential for the transition.

The CBAM is a crucial measure established by the European Union[13] (EU) aimed to fight the pressing issue of climate change and prevent a phenomenon known as '*carbon leakage*'.[14] The CBAM forms an integral part of the EU's broader climate strategy, which has set a highly ambitious goal of achieving a 55% net reduction in greenhouse gas emissions compared to 1990 levels by 2030, with the ultimate objective of achieving climate neutrality by 2050.

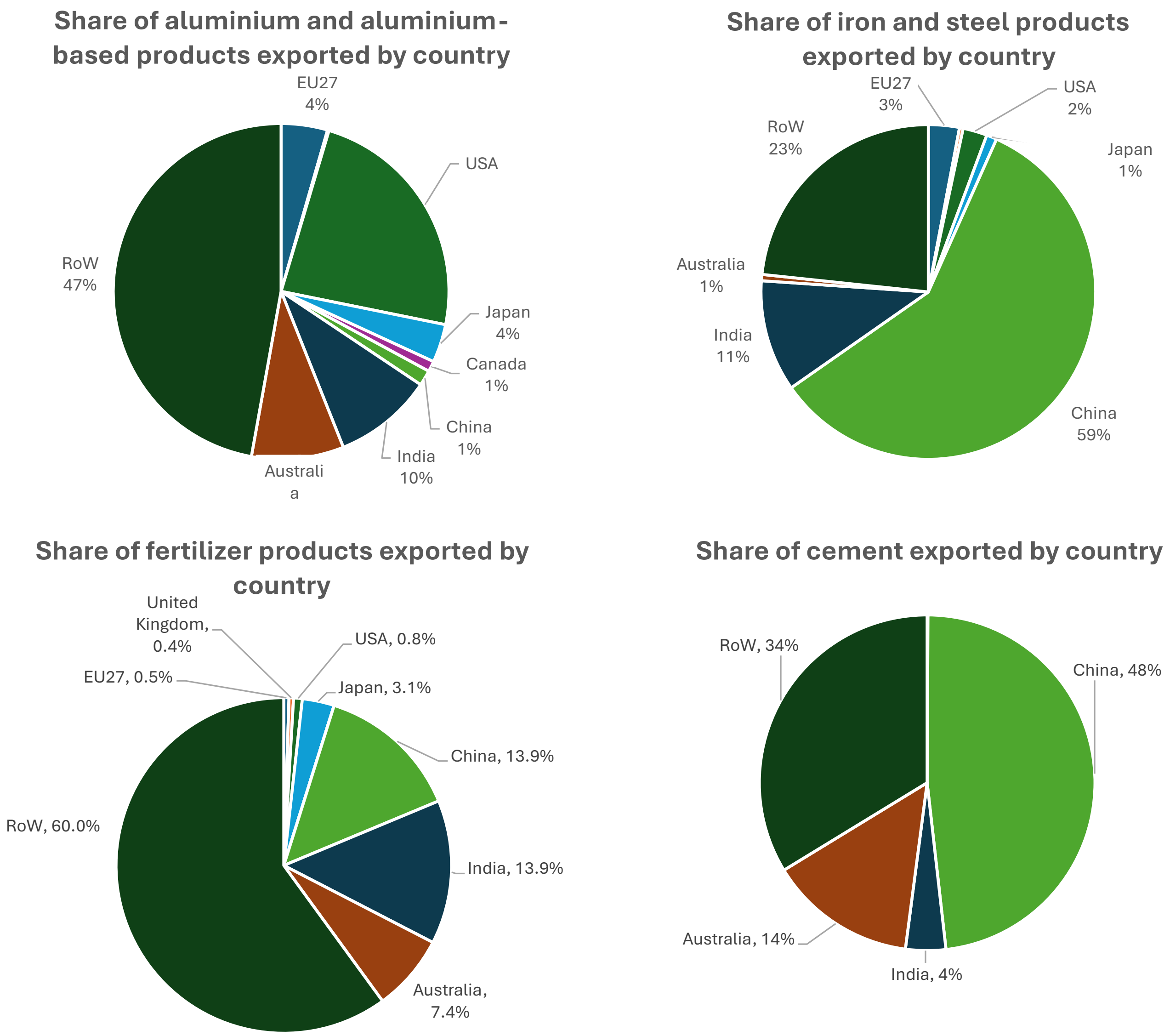
A key feature of the CBAM is that it actively encourages the adoption of the best available technology for production processes internationally. The emissions under CBAM are determined according to a methodology that aligns with the reporting of emissions under the EU ETS. Consequently, producers who invest in and adopt greener, more sustainable production methods will benefit from avoiding or reducing CBAM payments. This feature of CBAM provides a clear economic incentive for companies to invest in cleaner technologies and adopt more sustainable practices.

It is highly likely that other countries may follow the EU and adopt such a mechanism to avoid the competitiveness losses of domestic industries stemming from higher energy prices and capital costs. For Indonesia, the adoption of CBAM by other major economies could have implications for its industries. While the EU27 is not a major exporting destination for Indonesian products, other trading partners, such as China, India, the USA and Australia, are significant export destinations. Therefore, the implementation of a CBAM in these regions is likely to impact the demand for Indonesian products.

[13] https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

[14] This term refers to the relocation of carbon-intensive production to countries with less stringent environmental regulations.

Figure 6. Indonesia’s exports to main trading partner in CBAM-related industrial products

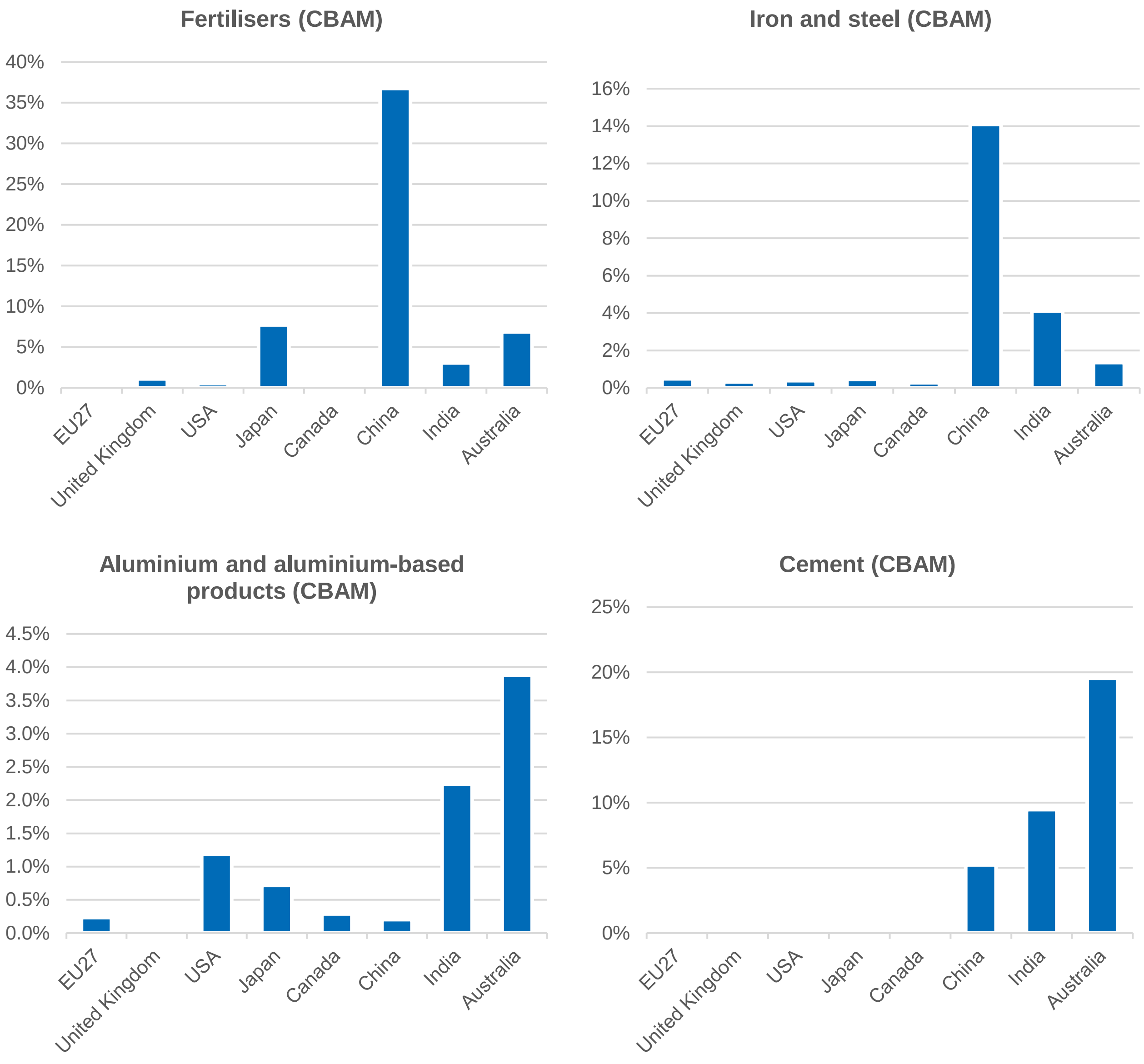


Source: GEM-E3

Three main factors will determine the response of Indonesian exports to the adoption of CBAM from main trading partners: i) the productive capacities and potential of trading partners in the specific sectors, ii) the carbon content of Indonesian products compared to other competitors (exporters), iii) the impacts from feedback loops (indirect impacts).

The adoption of CBAM will increase the average price of imports in the country adopting the relevant legislation. This will trigger substitution effects between domestically produced and imported products. The extent of this effect will be determined by the magnitude of relative price changes and technical constraints (first-level impacts). Therefore, the first driver refers to the extent to which Indonesian products can be substituted with products produced in the country of destination. For example, the direct impact of the CBAM on the overall volume of Indonesian exports will be relatively low if the destination country has limited domestic productive capacity and potential. The second driver refers to the importer’s composition in the countries adopting the CBAM (EU, G1 and G2). EU countries may switch importers depending on their carbon content. Hence, a low carbon content implies competitiveness gains over other exporters of the same products.

Figure 7. Share of Indonesian origin products to total sectoral imports of EU, G1 and G2 countries

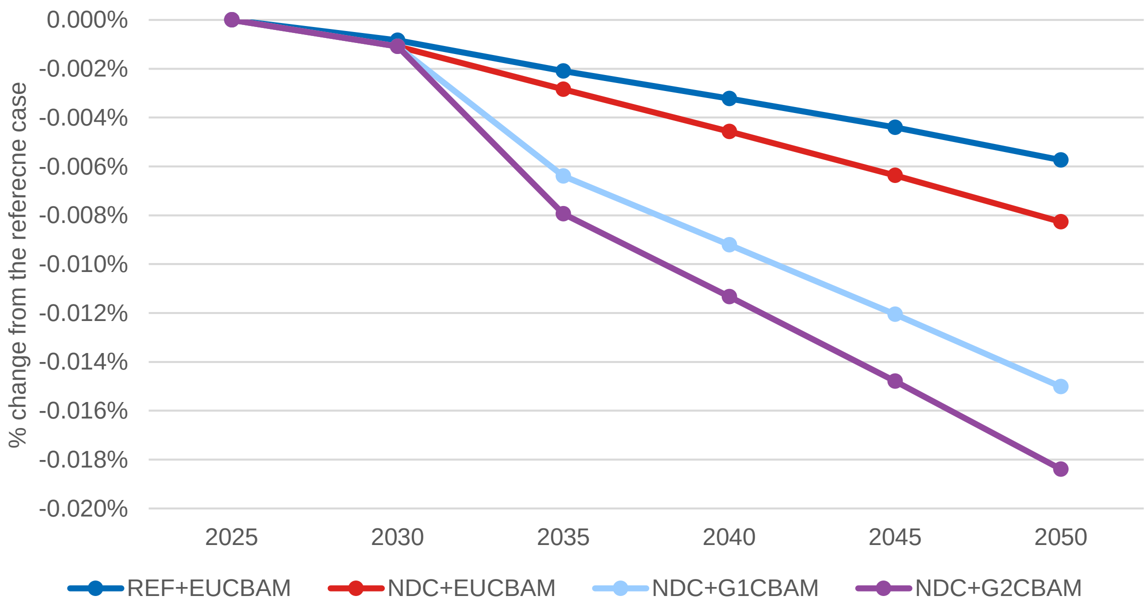


Source: GEM-E3

7.2 Macroeconomic Aggregates

Overall, the cumulative impacts on GDP from 2025 to 2050 are found to be minimal, ranging from -0.003% in the NDC+EUCBAM scenario to -0.04% in the NDC+CBAMG2 scenario, relative to the reference scenario. Impacts are higher in 2050 compared to 2030. The implementation of CBAM provides incentives for emission reductions by encouraging countries outside the CBAM zone to adopt more efficient production processes. In this way, Indonesia and other exporters can alleviate the impact on their exports. However, higher carbon prices in the EU, G1, and G2 countries in 2050 result in increased additional costs for exports, reducing the competitiveness of Indonesian products. In terms of growth, no significant implications were found in any of the assessed scenarios and the Indonesian economy is expected to maintain its high growth prospects.

Figure 8. Indonesia GDP under selected scenarios



Source: GEM-E3

For the remaining of the analysis, and to isolate the effect of the CBAM from other energy policies, we compared the NDC+EUCBAM, NDC+G1CBAM, and NDC+G2CBAM scenarios with the intermediate reference scenario (NEUNDC see Table 8). The adoption of CBAM from G1 countries almost doubles the GDP impacts, while its introduction to the G2 countries implies additional losses compared to the other two scenarios.

GDP changes are mostly driven by lower private consumption, which is induced by lower income due to the decrease in wages and in capital rents. In NDC+G1CBAM and NDC+G2CBAM scenarios, where extra-EU countries also adopt the CBAM, the impact on exports also plays an important role in explaining the overall economic impacts.

Lower imports in all scenarios are the product of (i) lower domestic consumption (due to lower income), (ii) lower intermediate demand (as activity falls in certain sectors) and, in certain cases, (iii) of the increase in the relative cost of imports. For example, and with respect to (iii), the introduction of CBAM in EU27 will also lead to an increase in the average prices of CBAM products, although it is projected to benefit industries under the CBAM umbrella. Hence, the cost of inputs (for other sectors) will increase, and this will ultimately lead to higher production costs and selling prices. In Indonesia, consumers (firms and households) will decrease the consumption of goods of European origin (imports) and substitute them with domestically produced ones or goods from other origins. The net effect on the current account balance is a (small) net increase in the projected surpluses.

Figure 9. Decomposition of GDP change per demand component under selected scenarios

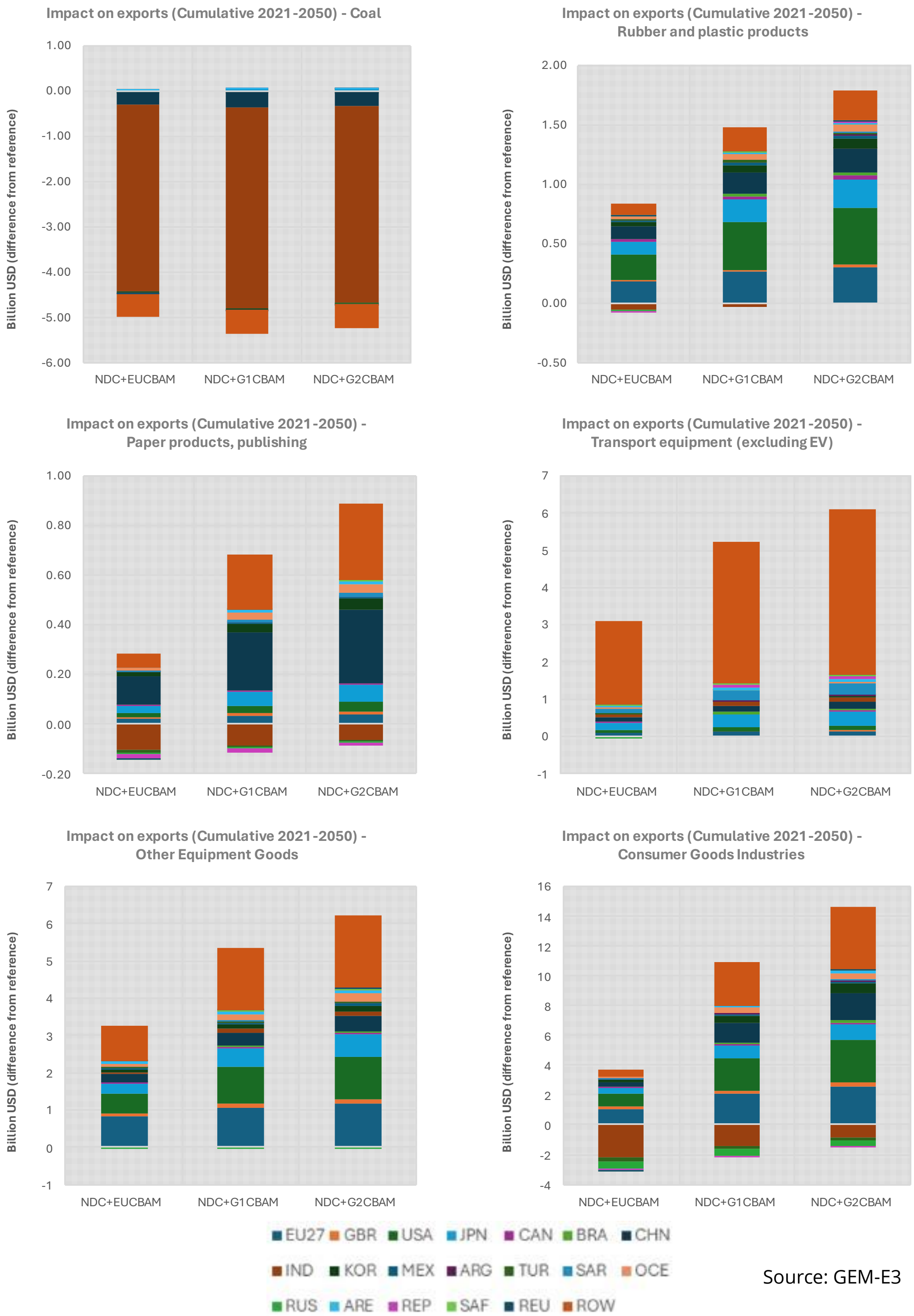
Source: GEM-E3

7.3 Sectoral exports

The impact on exports is found to be minimal throughout the projection period. The impacts are found to be lower in 2030 and higher in the long term (post 2030), reaching -0.1% in 2040 in the NDC+G2CBAM scenario. In the NDC+EUCBAM scenario, changes in total exports are trivial, implying a lower dependence of Indonesians' trade performance on the EU27 countries. Lower total exports are driven by lower demand for coal and energy-intensive goods. The reduction in coal exports (on average by 3% in all three scenarios) is not directly related to the CBAM adoption but is driven mainly by second-order (spillover) effects and, more specifically, by macro changes in India. India's export potential is constrained by the implementation of CBAM, particularly in Europe. This leads to reduced activity in energy-intensive sectors, which, in turn, reduces demand for fossil energy.

A shift in the sectoral composition of exports is observed in all scenarios, with industries producing consumer goods, transport equipment, and electronics recording higher export levels throughout the projection period. This indicates spillover effects on the competitiveness of non-energy-intensive, non-CBAM sectors, driven by changes in the markets of primary production factors (i.e., capital and labour). Additional productive potential is generated as industries most affected by the intensification of global action transition to activities with low energy and carbon intensity, achieved at a lower cost compared to the reference scenario.

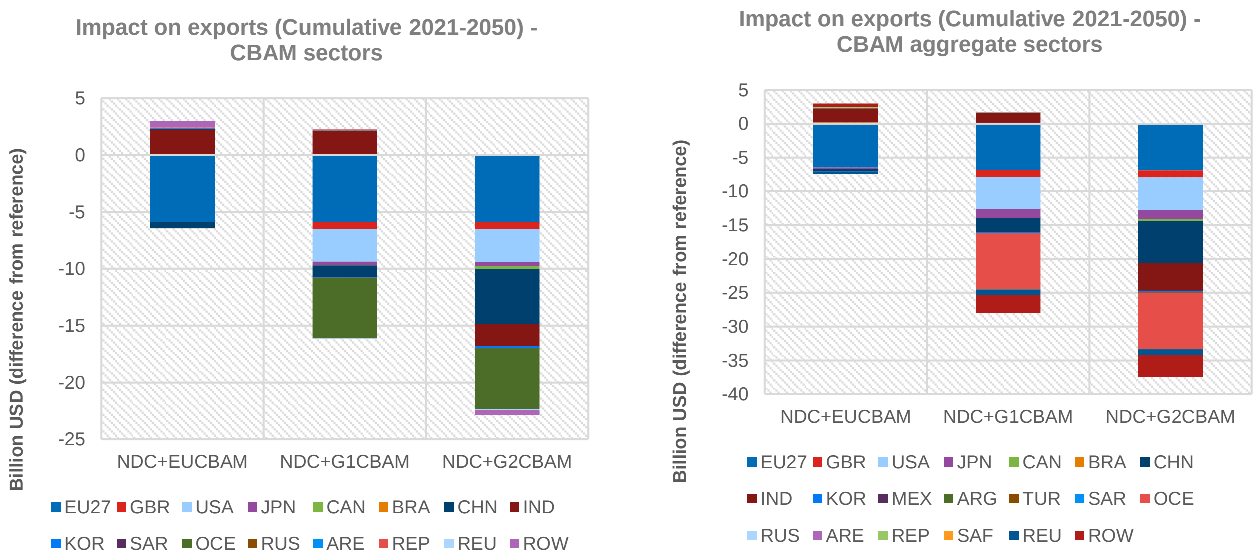
Figure 10. Impact on exports for selected goods (in USD billion from Reference)



Source: GEM-E3

Finally, and focusing on the impact on Indonesia's CBAM-related exports, we find that in the case where CBAM is adopted only by the EU27 member states, total cumulative (2024-2050) exports of CBAM products fall by USD 3.4 billion. Changes are mainly driven by lower exports of iron and steel products to the EU, while there is an increase in exports to India. The extension of its scope to G1 countries also leads to losses of approximately USD 13.9 billion (driven mainly by lower exports in EU27, Australia and USA), and when we also include G2 countries, the cumulative losses reach up to USD 22.8 billion. Hence, incremental losses are higher in the NDC+G1CBAM scenario compared to NDC+G2CBAM, and this effect is linked to the lower demand from Australia and the USA for Indonesian products assumed to be covered by CBAM. Overall, it is found that Indonesian exports of CBAM products fall annually (on average) by USD 0.1 billion to USD 0.7 billion.

Figure 11. Impact on exports in CBAM sectors and in the aggregate sector (in USD billion from Reference)



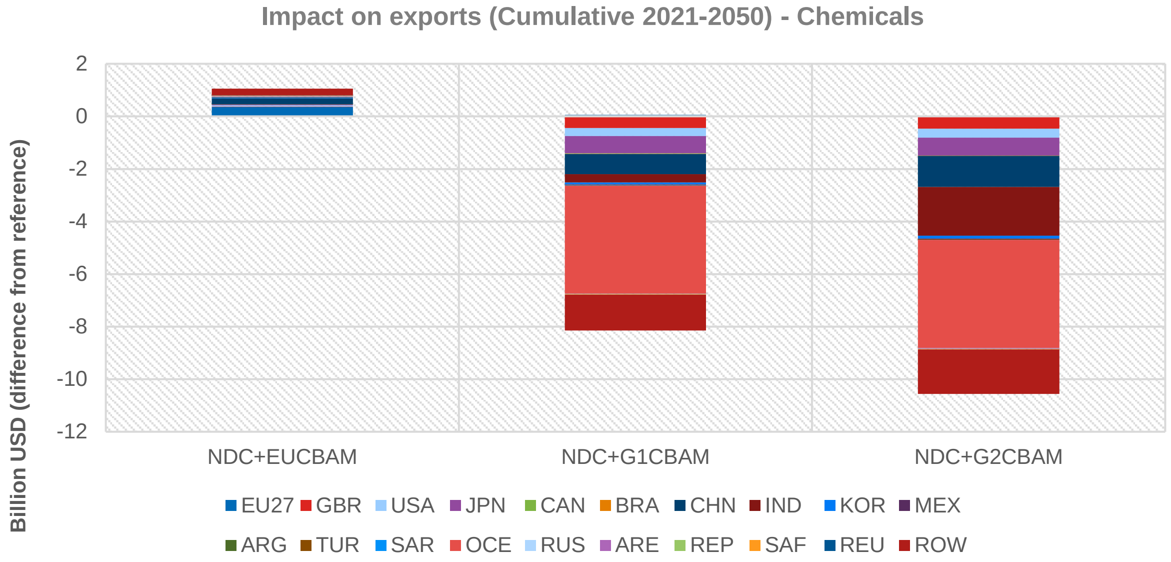
Source: GEM-E3

Chemicals

When considering the aggregated sector (i.e. fertilisers, manufacture of pesticides, and other agrochemicals products, manufacture of paints, dyes etc.[15]), we find small increases in exports in the NDC+EUCBAM scenario and small losses in the NDC+G1CBAM and NDC+G2CBAM scenarios. In the NDC+EUCBAM, intermediate demand for chemical products increases in the EU27 countries and in China as a result of sectoral developments (in EU27 due to higher production of iron and steel, non-ferrous metals and non-metallic minerals, in China due to higher industrial production in non-energy intensive industries).

[15] A detailed list of all the sub-sectors can be found in https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/ks-ra-07-015

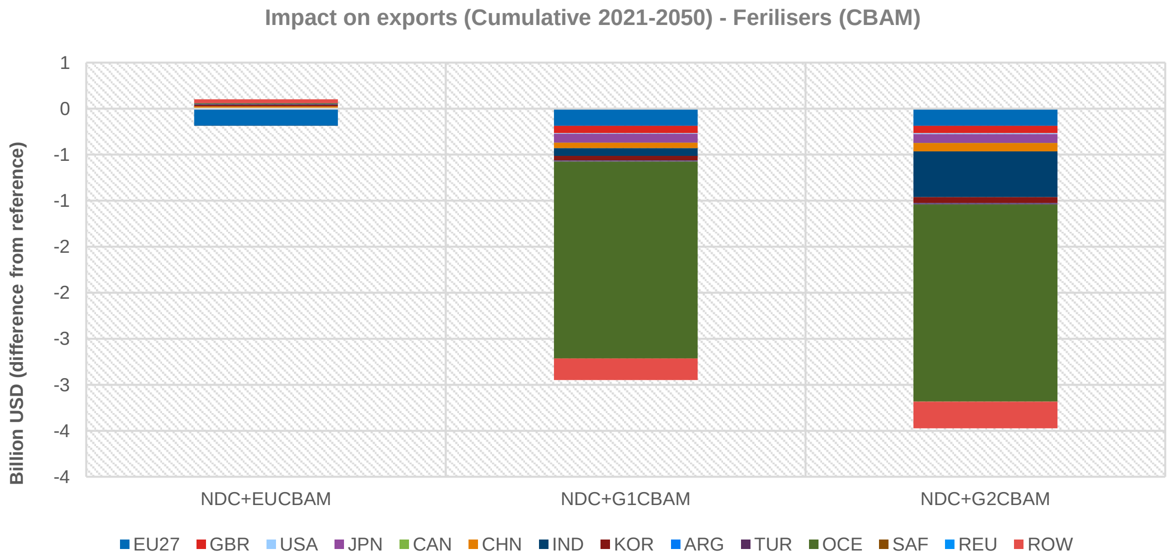
Figure 12. Impact on chemical exports



Source: GEM-E3

If the focus is shifted to fertilisers only, a minimal loss is observed from the adoption of CBAM from EU27, while small losses are observed in the NDC+G1CBAM (-3.7%) and NDC+G2CBAM (-4.4%) scenarios. The effect is mainly driven by lower demand for Indonesia-based products from Australia and, to a lesser extent, from Europe (G1), China and India (G2). In Australia, the adoption of CBAM leads to a shift in demand from imported products to domestically produced ones. The adoption of CBAM by G2 countries further adds to lower imports, but at a lower rate.

Figure 13. Impact on fertiliser exports

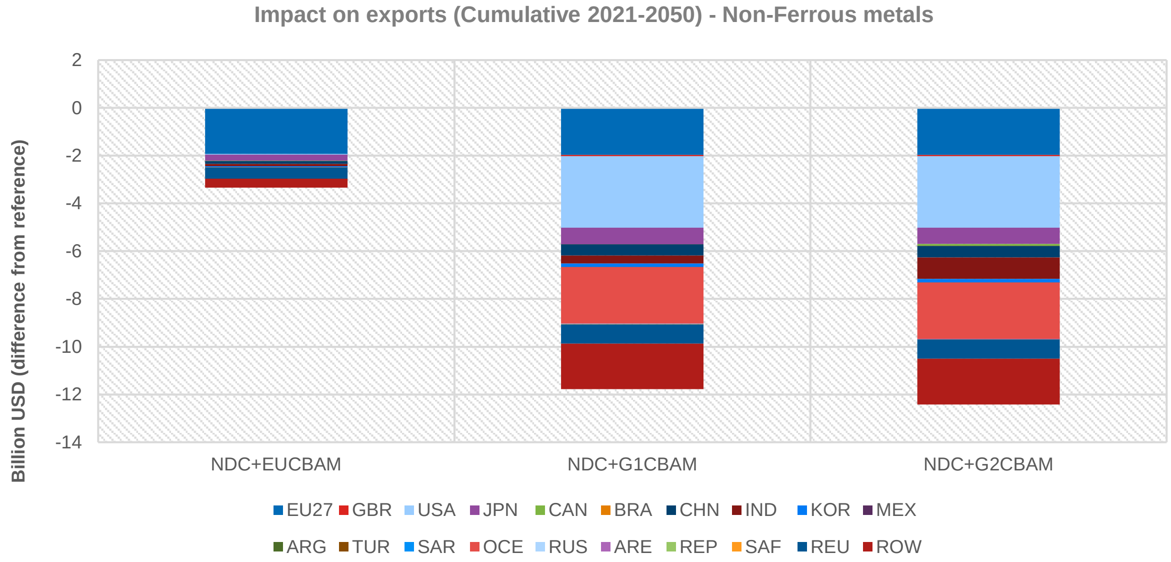


Source: GEM-E3

Non-ferrous Metals

With respect to manufacturing of non-ferrous metal, there are minimal differences in the response of sectoral exports. Changes range from -0.5% in the NDC+EUCBAM scenario to -1.8% (NDC+G1CBAM) and -1.9% (NDC+G2CBAM) scenarios. Exports fall is driven by the decreased demand in EU27, Australia and the USA and related mainly to changes in intermediate demand.

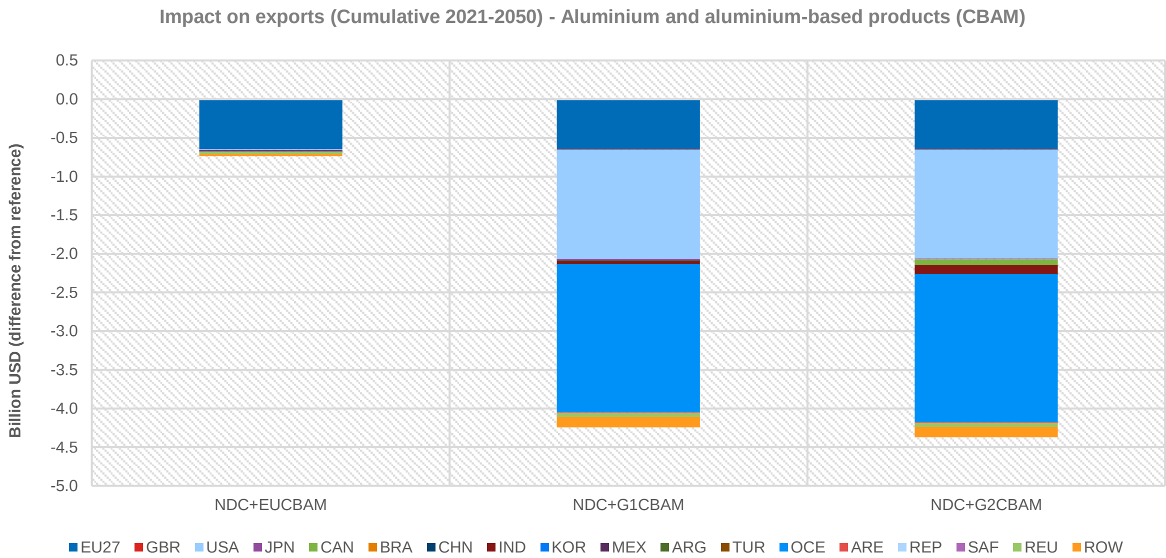
Figure 14. Impact on exports of non-ferrous metals



Source: GEM-E3

With respect to the non-ferrous metal CBAM-related sectors' exports (aluminium and aluminium-related products), there are minimal differences in the response of sectoral exports. Changes range from -1.3% in the NDC+EUCBAM scenario to -7.5% in the NDC+G1CBAM scenario and -7.7% in the NDC+G2CBAM scenario. The changes are mainly driven by the reduced demand from Australia and the USA, which together account for more than 20% of Indonesia's exports of aluminium products. As a result, the implementation of CBAM imposes an additional cost burden, leading to a loss of competitiveness for aluminium products produced outside these countries. Overall, aluminium exports decrease by 7% under both NDC+G1CBAM and NDC+G2CBAM scenarios.

Figure 15. Impact on exports of aluminium and aluminium-based products

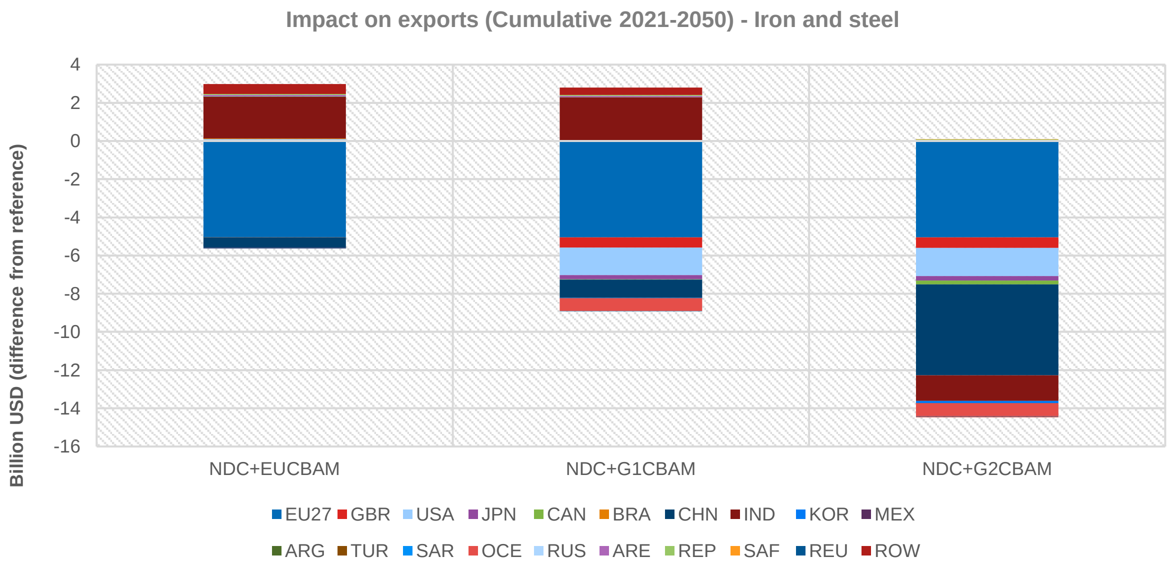


Source: GEM-E3

Ferrous Metals

Exports of iron and steel are found to be mostly affected by the introduction of CBAM in China and India in the NDC+G2CBAM scenario, recording a decrease of approximately 5% compared to their reference levels. Smaller reductions are projected in the NDC+G1CBAM and in the NDC+EUCBAM scenarios (of 2% and 1% respectively). In the NDC+EUCBAM and NDC+G1CBAM, the decrease in exports in EU27 and G1 countries, respectively, is partly counterbalanced by an increase in exports in India and the rest of the world countries, alleviating the negative influence of CBAM on overall sectoral exports.

Figure 16. Impact on exports of iron and steel

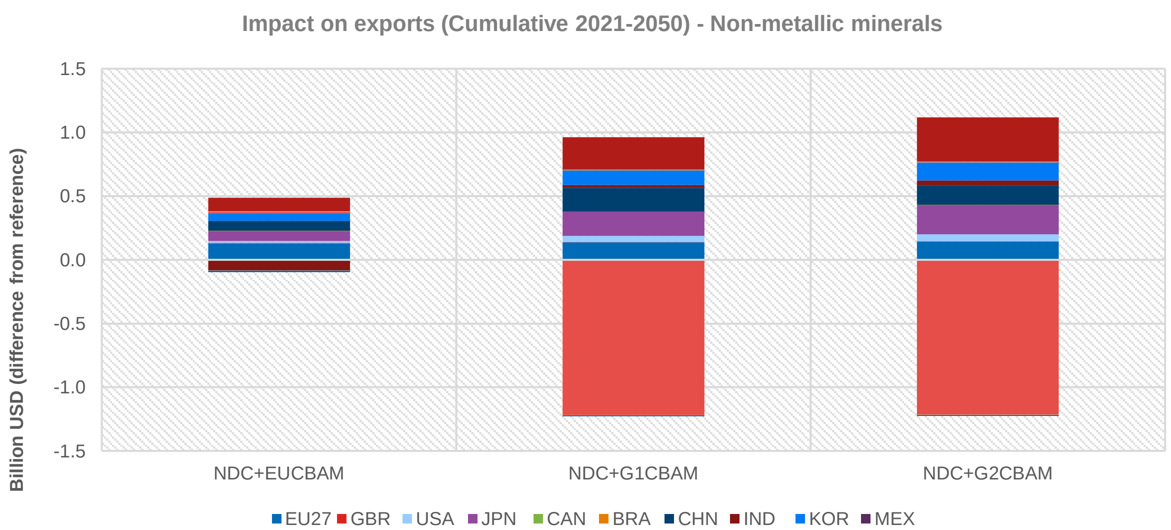


Source: GEM-E3

Non-metallic Minerals

With respect to the exports of non-metallic minerals, small changes are recorded in the scenarios assessed. Changes vary from +0.2% in the NDC+EUCBAM scenario to -0.11% (NDC+G1CBAM) and -0.05% (NDC+G2CBAM) scenarios. Exports to the EU27 member states, Japan, South Korea, and India increase, while a strong decrease is recorded to exports in Australia. The developments are mainly associated with changes in intermediate demand.

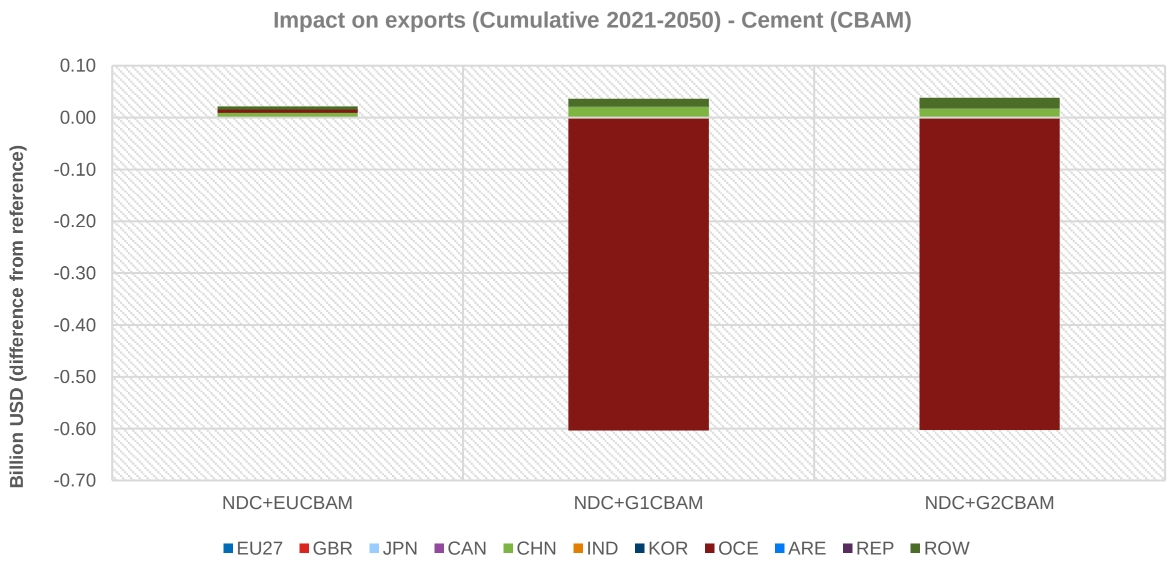
Figure 17. Impact on exports of non-metallic minerals



Source: GEM-E3

Cement exports show modest gains under the NDC+EUCBAM scenario (0.2%), as the implementation of CBAM from EU27 countries drives increased demand from China and Australia. However, under the NDC+G1CBAM and NDC+G2CBAM scenarios, cumulative exports fall by 5%. This decrease is primarily driven by lower exports to Australia, while exports to China continue to record small gains, implying that a relatively lower carbon content of Indonesian products compared to other export competitors. A similar pattern of export changes is observed in the aggregate sector producing non-metallic mineral goods. Exports to Australia experience a significant decline, partially offset by increased demand from EU27 countries, China, Japan, and Korea. The total net impact is negative for two out of three scenarios, with exports slightly decreasing by USD 0.2 billion in NDC+G1CBAM and by USD 0.1 billion in NDC+G2CBAM. Conversely, the NDC+EUCBAM scenario records a USD 0.4 billion increase in exports.

Figure 18. Impact on exports of cement and non-metallic minerals



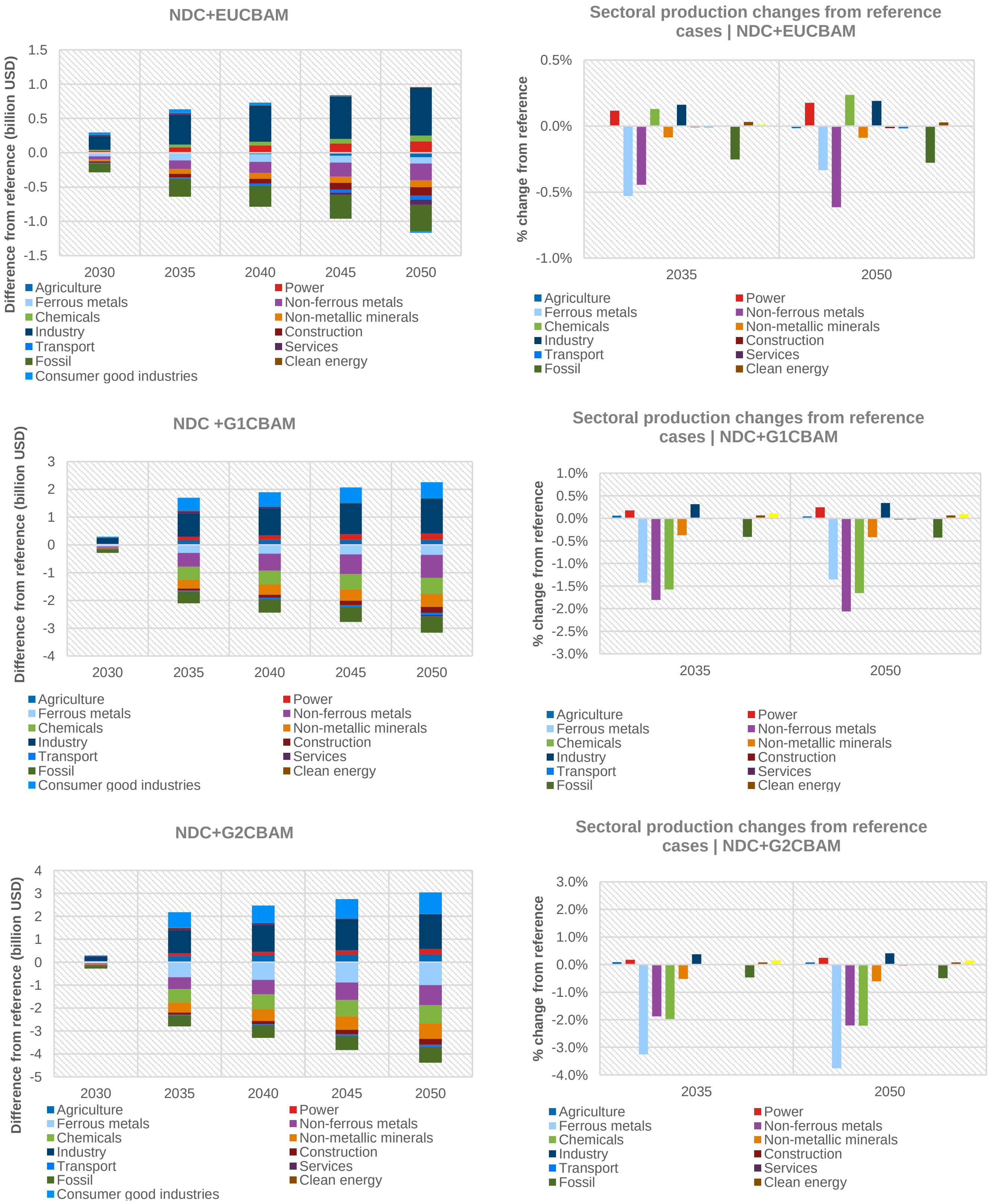
Source: GEM-E3

7.4 Production

Total economic output records marginal cumulative (2023-2050) decreases ranging from USD 1.4 billion (-0.001%) in the NDC+EUCBAM scenario to USD 17 billion (-0.02%) in the NDC+G2CBAM scenario. While the negative impacts are associated to lower overall output in energy intensive sectors and fossil fuel (due to exports and lower demand from energy industries), there is an increase in the production of consumer goods industries and other industrial goods (e.g., transport equipment, electronics and electrical equipment, rubber and plastic products etc.) and in agriculture. The effect is driven by wage and capital rents differentials induced by the reduction in activity of CBAM and energy-intensive sectors and competitiveness gains associated with higher production costs in these sectors in countries adopting the CBAM. Increases in agricultural output are primarily driven by the increased activity of consumer goods industries and other sectoral interlinkages. In fact, this sector includes both the production of agricultural and animal products, which are essential inputs for processed foods, textiles, clothes, footwear, and other industries.

The released factors of production move to other industries at a lower cost, which lead to competitiveness gains and higher production levels. Overall, under the NDC+EUCBAM scenario, it is estimated that for every dollar lost from fossil and energy-intensive industries, approximately USD 0.97 is offset by the increased activity of other sectors, leading to net losses of USD 0.03. In comparison, the net production losses are calculated to USD 0.27 and USD 0.24 under the NDC+G1CBAM scenario and NDC+G2CBAM, respectively.

Figure 19. Impact on sectoral production

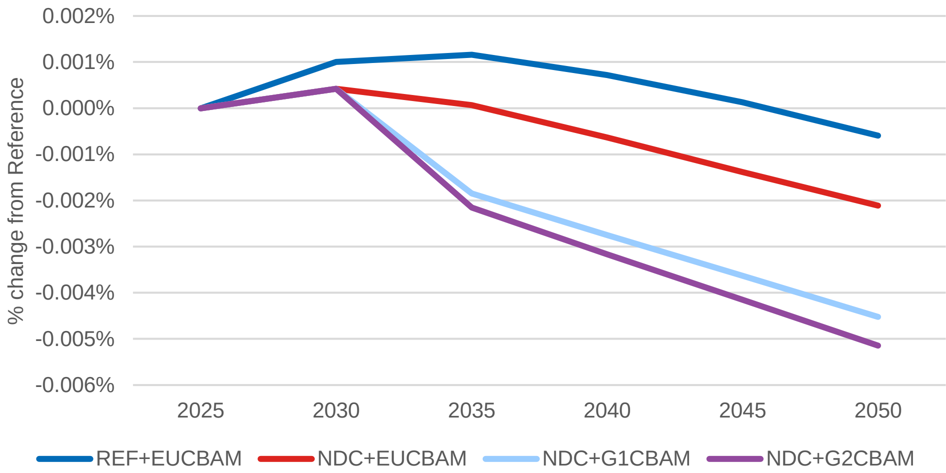


Source: GEM-E3

7.5 Employment

The assessment of alternative scenarios reveals marginal labour market implications. Similar to the GDP response, employment changes are minimal, ranging from -0.001% in the NDC+EUCBAM scenario in 2040 to -0.005% in the NDC+G2CBAM scenario in 2050. In terms of absolute numbers, job losses vary between 3,300 and 25,000. At the sectoral level, relatively higher losses are recorded in the chemicals sector and non-metallic minerals, averaging 16,000 jobs lost in the NDC+G2CBAM scenario. Employment losses in the coal industry in 2050 range between 4,600 (NDC+EUCBAM) and 6000 (NDC+G2CBAM), and in iron and steel between 300 (NDC+EUCBAM) and 6,500 (NDC+G2CBAM). However, these losses are nearly offset by increased employment in industries producing consumer goods, equipment goods, and agriculture. The net employment impacts are therefore influenced by the relative labour intensities of sectors experiencing losses or gains, with no significant overall change identified in any of the scenarios.

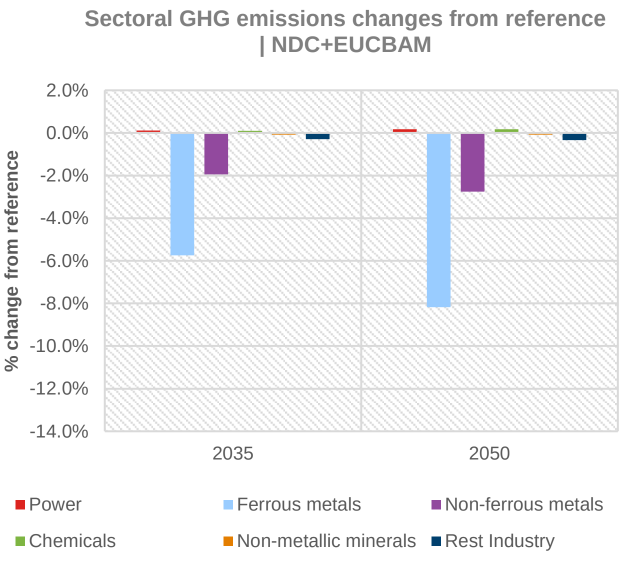
Figure 20. Impact on employment

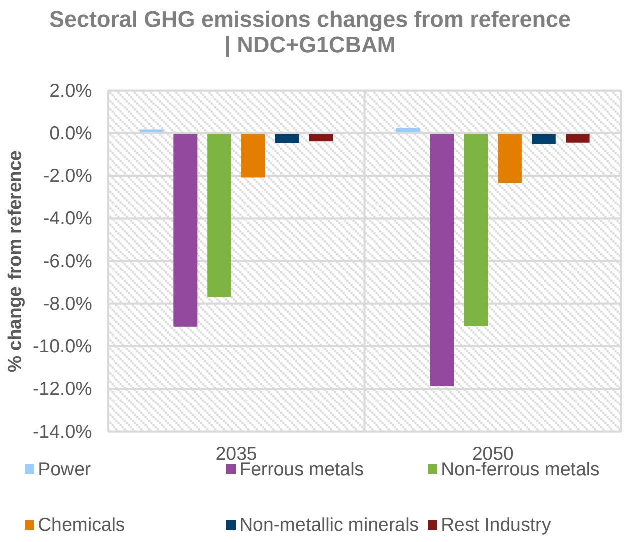


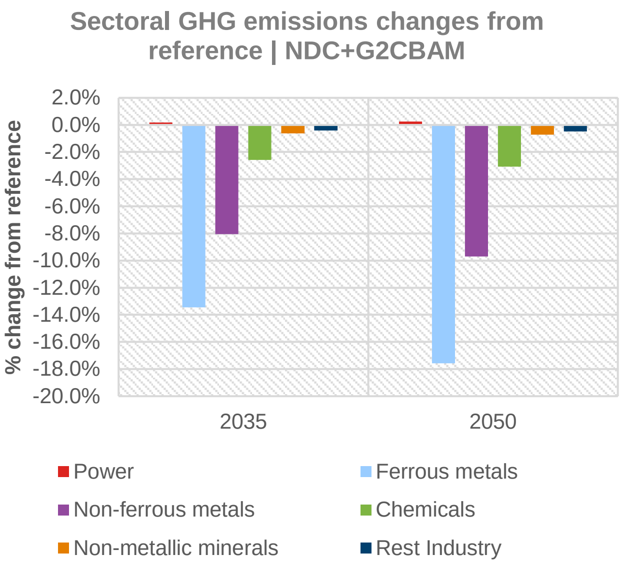
7.6 Greenhouse gas emissions

The adoption of CBAM by major global economies enhances the decarbonisation of the sectors included in the scheme. In Indonesia, the effect is stronger in the sector of ferrous metals (iron and steel), where emissions fall by 8% in the NDC+EUCBAM to almost 18% in the NDC+G2CBAM compared to the reference. However, power generation emissions increase slightly in all scenarios examined. This is mainly driven by higher electrification rates, especially in energy-intensive industries, as part of the response to the introduction of CBAM (i.e., CBAM incentives). The model assumes no change in the power generation mix between scenarios. This, therefore, leads to higher emissions from the power supply sector.

Figure 21. GHG emission changes (% change from Reference)



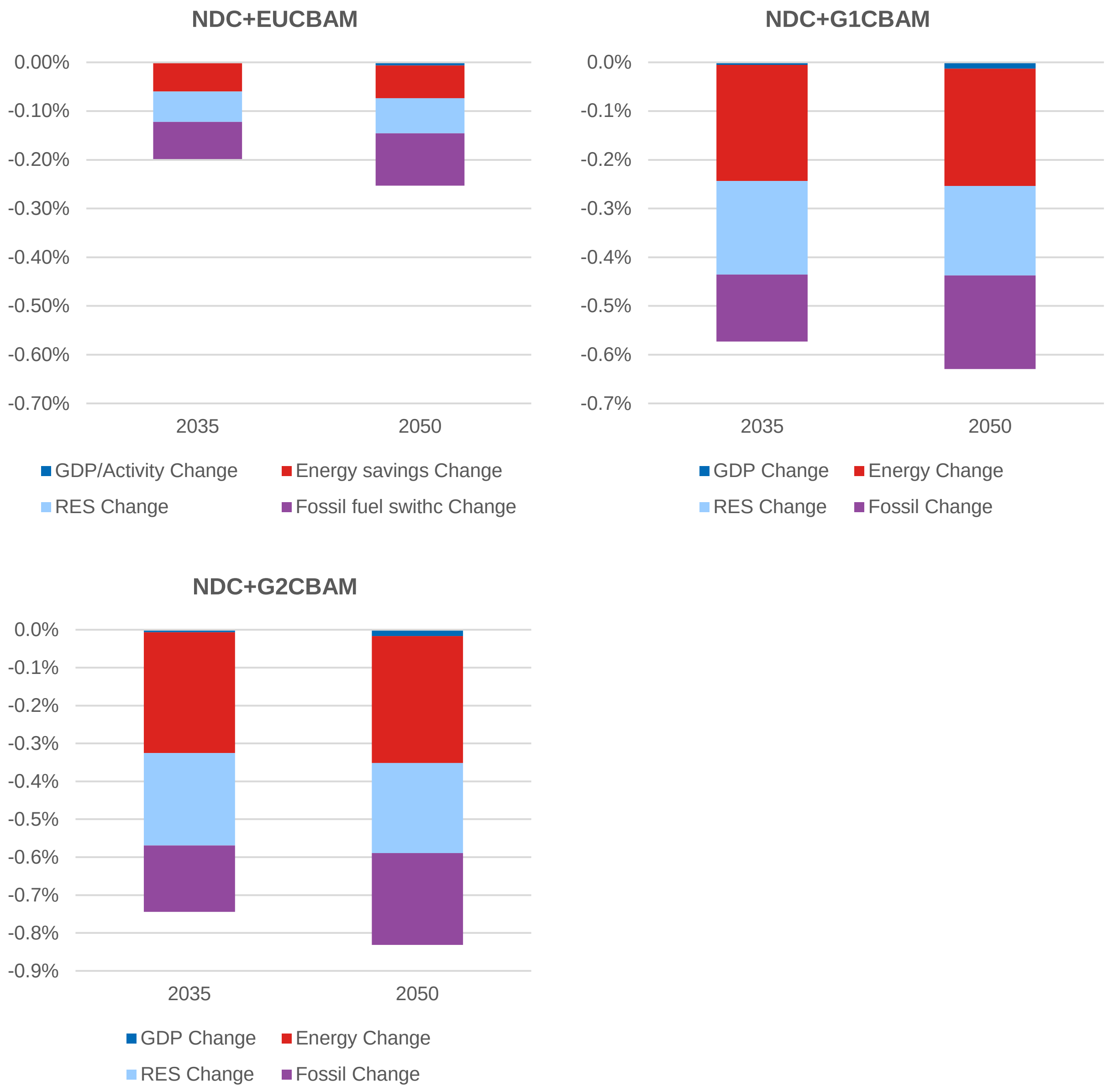




Source: GEM-E3

To identify the sources of emission reduction, we perform a decomposition technique known as the Kaya identity of CO_2 energy emission. The analysis reveals that activity changes have a marginal impact on emission reduction, with the greatest part of emission cuts being driven by system transformations, particularly fuel switching and the adoption of more efficient processes (energy savings). In the NDC+EUCBAM scenario, the adoption of less emission-intensive processes contributes most to the emissions reduction. Conversely, in the NDC+G1CBAM and NDC+G2CBAM scenarios, energy savings account for the largest share of emission cuts, at 38% and 40% respectively, compared to 29% in the NDC+EUCBAM scenario.

Figure 22. Decomposition of emission reductions



Source: GEM-E3

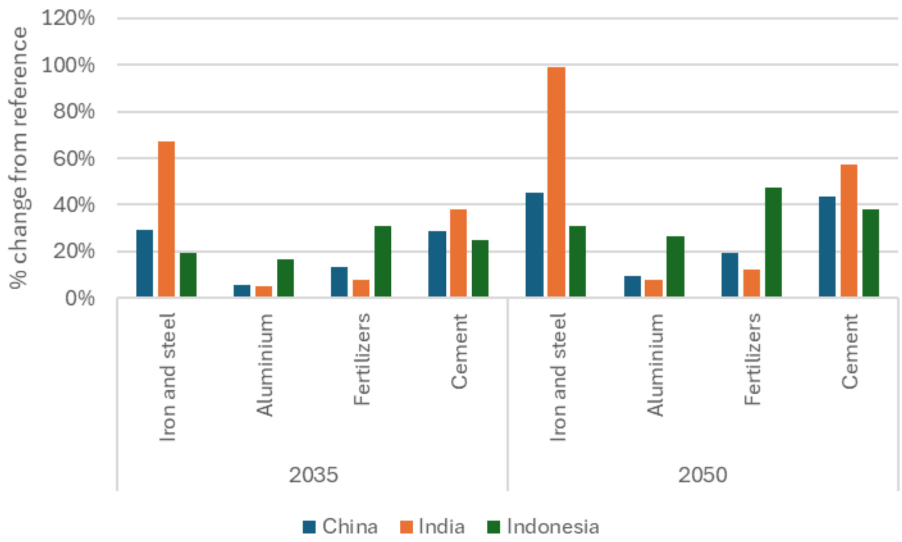
7.7 Impacts of CBAM implementation on other countries

With respect to other Asian countries, we find that the impacts of CBAM are, in principle, higher in India than in the rest of the major economies. The Chinese economy and its exports experience marginal changes, while Japan and the Republic of Korea record gains. With respect to India, EU27 countries are the destination of approximately 30% of its iron and steel and almost 14% of its aluminium exports.[16] The particularly high exposure of iron and steel exports, coupled with the relatively high emission intensity processes, leads to a higher CBAM burden compared to the rest of the countries. As products of Indian origin become more expensive, consumers turn to the consumption of relevant goods from other countries; hence, the demand for goods produced in India falls. For example, Figure 23 presents the additional cost imposed on the unit cost of imports by the introduction of CBAM in the NDC+EUCBAM scenario for China, India and Indonesia. The additional cost of iron and steel is significantly higher for

[16] Data refer to 2023 and are drawn from COMTRADE.

Chinese and Indian products than for Indonesian products. This implies that the impact on exports of China and India to the EU27 will be larger than that of Indonesia.

Figure 23. Price increase due to EU CBAM on export goods from China, India and Indonesia



On the other hand, the impact on China is lower, as the decrease in the exports of CBAM products is counterbalanced by higher exports in other manufacturing sectors. The dynamics of this shift are similar to the ones presented previously for Indonesia: i) capital and labour cost differentials due to the lower production of CBAM-related goods, and ii) higher production costs due to higher input costs[17], provide competitiveness advantages in other (non-CBAM) industries.

Table 9. Cumulative (2025-2050) export changes with respect to the reference (%)

	NDC+EUCBAM	NDC+G1CBAM	NDC+G2CBAM
China	0.01%	0.01%	-0.02%
India	-0.31%	-0.31%	-0.42%
Japan	0.05%	0.05%	0.01%
Korea, Rep.	0.02%	0.02%	0.04%

[17] For example, when the EU27 adopts CBAM, the price of iron and steel, aluminium and fertilisers increase on average compared to the refence. This increase is translated into higher production cost for other sectors that use these inputs in the production of their products leading to competitiveness losses.

8 CONCLUSIONS

The key findings and messages for policy makers of this study suggest that while the **macroeconomic impacts of CBAM on Indonesia are limited in scale**, the introduction of these mechanisms carries important strategic implications that require attention and development of tailored strategies from policy makers.

International carbon tariffs like CBAM act as a global market signal: even though direct GDP and employment effects are small, the mechanism exposes key sectors, such as fossil-fuel-based and energy-intensive industries, to competitiveness risks in major export markets. At the same time, Indonesia holds a relative advantage over more carbon-intensive producers, such as India, and this positioning could be strengthened through proactive decarbonisation policies.

Importantly, CBAM creates both pressures and incentives to accelerate industrial transformation. A clear policy response can help ensure that Indonesia captures the long-term benefits of this global shift by supporting vulnerable sectors in the transition, encouraging investment in cleaner technologies, and facilitating access to emerging low-carbon markets.

In particular, the analysis conducted using the GEM-E3-FIT model indicates that the adoption of CBAM by major global economies is unlikely to result in significant macroeconomic impacts for Indonesia. The model results show a projected GDP loss by 2050 ranging between USD 3 and 6 billion, equivalent to a relative decline of -0.004% to -0.01%. Employment impacts are also marginal, with estimated job losses between 3,300 and 25,000 across the scenarios, largely offset by gains in other sectors.

While these aggregate figures suggest a resilient macroeconomic position, the sectoral and structural effects are more pronounced, particularly in scenarios where CBAM is adopted not only by the EU but also by other key trading partners (USA, Australia, China, India).

Key findings include:

- CBAM-related exports fall by USD 4 to 23 billion cumulatively, depending on the scenario. Losses are largest in the NDC+G2CBAM scenario, where China and India also adopt CBAM-like policies.
- Exports to the EU27 fall by approximately USD 6 billion, regardless of the scenario. Exports to Australia and China decrease by USD 5.3 billion and USD 5 billion, respectively, under the more expansive CBAM adoption cases.
- Coal exports experience consistent declines of around USD 5 billion across all scenarios, driven not directly by CBAM but by indirect effects, especially reduced industrial activity in India.
- Fertilisers and cement exports are especially sensitive to demand changes in Australia, while aluminium exports are more vulnerable to shifts in the USA and Australia. Iron and steel exports are most affected by developments in China and the EU27.
- Importantly, not all effects are negative. The modelling reveals a reallocation of resources (labour and capital) towards non-CBAM and low-carbon sectors, particularly consumer goods, electronics, agriculture, and transport equipment. This results in modest increases in exports from these sectors, highlighting a potential structural shift in Indonesia’s industrial base.
- On the environmental side, CBAM supports a reduction in GHG emissions, especially in iron and steel production, where emissions decline by up to 18% under the most ambitious scenario. These reductions are primarily driven by efficiency improvements and fuel switching, rather than output reductions.

In summary, while CBAM does not pose a major threat to Indonesia's economic stability, **it acts as a catalyst for structural transformation**. The policy sends a clear market signal favouring cleaner production and diversified export portfolios. This presents both challenges for fossil-based industries and opportunities for forward-looking sectors and policies.

8.1 Policy implications

As mentioned above, although the direct economic impact of CBAM is limited, the strategic and structural implications warrant a proactive policy response. Policy makers shall focus on the identified findings, namely, leveraging the clear market signal to support the decarbonisation of energy-intensive and carbon-intensive industries, and planning a coal phase-out while providing the necessary policy mechanism to alleviate the impacts on this sector.

Regarding energy-intensive industries, the EU CBAM can be framed as a call to action for the Indonesian government and businesses to accelerate decarbonisation. The government can play a crucial role in strengthening industrial decarbonisation, particularly in CBAM-exposed sectors, by adopting targeted policies to mitigate the negative effects identified in the analysis.

While a full policy assessment with detailed identification and recommendations for incentives and disincentives for industrial decarbonisation will be delivered separately as part of this project, high-level policy implications and recommendations based on this analysis can be outlined below.

Develop industrial decarbonisation plans supported by policy intervention

The government should focus public support and incentives on measures like energy and resource efficiency, as well as fuel switching in CBAM-exposed sectors. Technological support, including the deployment of clean technologies and carbon capture and storage/usage (CCS/CCU), could also be considered. Carbon pricing instruments could strengthen the signal for decarbonisation, while providing revenues that could be recycled to finance decarbonisation projects. In addition, their presence would decrease the CBAM liability importers have to pay, preserving the competitiveness of Indonesian products in countries implementing CBAM.[18]

Policy interventions that facilitate access to climate finance, especially for SMEs in energy-intensive industries, or that attract foreign investment to boost domestic deployment and production of clean energy, would also limit the negative impact of CBAM, while potentially giving Indonesia a competitive advantage over other countries.

Awareness-raising campaigns and targeted technical assistance programmes to close knowledge and capability gaps in cleaner technologies are necessary to ensure that businesses understand the needs for the energy transition.

Plan a decarbonisation strategy for the coal sector

Coal exports are expected to decline in each of the assessed scenarios, with a cumulative decrease of approximately USD 5 billion. The main driver will be the reduced demand for coal from India: Indian industries are particularly sensitive to the implementation of EU CBAM, and their activity with related demand for coal imported from Indonesia will decrease as a result of EU CBAM implementation. In light of this upcoming trend, a national decarbonisation strategy should be developed to address asset management, covering the phase-out timeline of coal-related activities and the needed investments to re-purpose or decommission the existing coal-related activities and infrastructure. In addition,

[18] Under EU CBAM, importers pay a liability equal to the carbon content of the imported good (e.g. from Indonesia) multiplied by the average EU ETS price of the previous week. The liability on the imported good can be reduced if a carbon pricing instrument is in place in the country of origin. In this case, the carbon content is multiplied by the difference between the average EU ETS price and the carbon price in the country of origin.

consideration and support should be given to labour reallocation through the development of reskilling and upskilling programmes and social protection mechanisms for displaced workers.

Accelerate clean energy deployment, energy efficiency, and low-carbon technology

Policy action should focus on the energy supply and the need to transition away from fossil fuels to renewable energy sources (RES): fostering RES power generation and electrification, for instance, thanks to installation incentives[19] and phasing down of fossil fuel subsidies[20]. Energy efficiency measures should also play a role. Energy efficiency reduces the carbon content related to the energy input, affecting the CBAM liability negatively. In addition, energy efficiency measures lead to decreased energy bills for businesses, improving their competitiveness.

Measures should cover both supply and demand. Decarbonisation process can be supported through carbon pricing instruments, knowledge sharing and economic incentives.

Boost demand for low-carbon products

Increasing the market uptake of low-carbon products is essential to drive industrial decarbonisation. In addition to supply-side incentives and procurement policies, demand-side measures such as consumer awareness campaigns and green public procurement play a key role. Another important solution is the communication of green consumption to end-users, for example through carbon labelling and energy labelling programmes. These tools help consumers identify and prefer low-carbon options, thereby reinforcing market signals and encouraging companies to invest in cleaner production methods.

Monitor and engage with global CBAM development

As other countries beyond the EU might introduce similar mechanisms, Indonesia should strengthen its MRV (monitoring, reporting, verification) systems for industrial emissions. The government can play a key role by developing the right platform and providing the needed support and training.

[19] Examples of regulations providing incentives for RES are Presidential Regulation No. 112/2022, MoF Regulation No. 218/PMK.04/2019 and MoF Regulation No. 66/PMK.010/2015.

[20] The pieces of legislation defining the regulatory framework are Law No. 30/2007 on Energy and Law No. 22/2001 on Oil and Gas. Examples of recent regulations covering fossil fuel subsidies are MEMR Decree No. 206.K/HK.02/MEM.B/2021 concerning the selling price of coal (valid until 2022) and MEMR Decree No. 76.K/MG.01/MEM.M/2025 on natural gas prices for industry.