UNIVERSITÄT HOHENHEIM

Application and further development of a tool kit to assess the impacts of implementation of response measures for Maldives

UNFCCC – Mitigation Programme

MIRO_UNFCCC v.2.1 USER GUIDE

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A. Overview

There is increasing demand to evaluate the impact of policy responses to the climate crisis. Impact assessments are regularly conducted by international organisations including IPCC, United Nations, World Bank, and European Commission, as well as by national governments. However, the models used to assess these impacts are often complex and using them requires substantial training. MIRO_UNFCCC is a user-friendly interface that enables users to run their own (simple) policy scenarios & visualise results using variants of the models used for in-depth impact assessment.

MIRO_UNFCCC is comprised of two interfaces: a global modelling interface and a national modelling interface. This user guide is for version 2.1 of both interfaces. The global modelling interface is tailored to a global Computable General Equilibrium (CGE) model (GLOBE, Thierfelder, 2024a) and a national CGE model for Maldives (GLOBE-SINGLE, Thierfelder, 2024b). Detailed information on the specification of the models, including model closure rules and elasticities, is available in UNFCCC *et al*., (2024).

MIRO_UNFCCC enables stakeholders to interact with the models to explore the impacts of the implementation of climate response measures in three ways:

- Evaluate the impact of global response measures using the global interface
- Evaluate the impact of national response measures (including policies aimed at achieving Nationally Determined Contributions (NDCs)) using the national interface
- Evaluate the impact of *global* response measures at the *national* level using the global interface linked to the national interface

Both models are run in comparative static mode via the interface, meaning that the impact of a change in a policy instrument is shown compared to the base situation. The comparative static mode is selected as the interface is a ‘sandbox’ environment in which users can quickly explore a wide range of scenarios. Running scenarios over many years, particularly in the global model, leads to long run times that are out of step with this purpose.

The MIRO_UNFCCC user interface offers several benefits. First, it allows stakeholders to interact with more complex models with a lower training requirement. This improves transparency and builds trust by demystifying the modelling ‘black box’. Second, the process of setting up, running and interpreting scenarios takes users through the process of considering likely impacts and promotes the consideration of unintended consequences from policies abroad and at home. Third, users can explore a wider range of scenarios beyond those that can be included in a written impact assessment report, thereby enriching the research offering. Fourth, it provides an accessible entry point to CGE simulations for stakeholders interested in investing in models for their own economies. Finally, the use of the same models by multiple stakeholders via the interface promotes discussion and collaboration by providing a common language for impact assessment.

Several assumptions underlie MIRO_UNFCCC. First, that the underlying data and model are of good quality. Second, that the behavioural relationships and parameter values that govern the responses in the model are suitable for the economy(-ies) in question. Third, that the policy instruments and results indicators in the interface cover relevant policies and outcomes. Furthermore, while the user interface provides an accessible entry-point for using complex models, a basic understanding of the underlying models is required to interpret the results and to construct logically consistent scenarios.

MIRO_UNFCCC is aimed at policy advisors and stakeholders who wish to interact with models to explore the possible impacts of response measures. It should be noted that, while MIRO_UNFCCC is based on complex impact assessment models, the use of the interface is not a substitute for in depth policy analysis by policy analysts using the core models. In depth analysis is needed ahead of any policy change being implemented. MIRO_UNFCCC offers a 'window' into an impact assessment toolbox rather than replacing the direct use of the toolbox for policy analysis. The toolbox offers wider range of options for policy analysis as well as the option to assess impacts over time using the models in recursive dynamic mode.

The MIRO_UNFCCC user interface is powered by GAMS MIRO (Model Interface with Rapid Orchestration) software (GAMS Software GmbH, 2023) using models populated with data from various sources; with each component operating under different licences. A summary of the required software, inputs and licences is provided in Annex 1. Users are responsible for ensuring that the licence terms are met before using the interfaces.

This user guide continues with a brief overview of the data and models used, followed by a detailed description of the global and national interfaces and a step-by-step guide to implementing scenarios in MIRO_UNFCCC.

Disclaimer: The material and information contained in the MIRO_UNFCCC user interfaces is for general information purposes only. The proprietors of the models, software and interfaces accept no liability for consequences arising from the use of the interface or data and models therein. Any reliance placed on such material is therefore strictly at the user's own risk.

B. Data and models

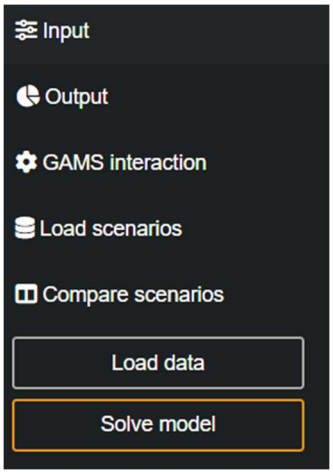
The global version of MIRO_UNFCCC allows for the assessment of global climate response measures. The global interface is tailored to a worldwide CGE model, GLOBE (Thierfelder, 2024a), based on 2014 data from the Global Trade Analysis Project (GTAP) (Chepeliev, 2020). The model includes 22 regions with 46 activities producing 40 commodities using 8 factors (land, 5 types of labour, capital and natural resources). A single representative household is included in the global model. Details of the global model aggregation are available in Annex 2.

The national version of MIRO_UNFCCC can be used to evaluate both the impact of global response measures and domestic climate policies aimed at meeting a country's Nationally Determined Contributions (NDCs). The national interface is tailored to an economy wide CGE model of the Maldives, GLOBE-SINGLE (Thierfelder, 2024b), based on 2019 data (Mainar Causapé *et al.*, 2023). The representation of the economy includes 48 commodities (of which 37 are produced within Maldives), 38 activities, 12 factors (labour and capital), and 10 household groups. Of the 12 factors included, there are 6 labour types grouped by location (Malé/Atoll) and skill level, and 6 capital types grouped by location (non-resort/resort) and type of capital (other/energy capital by fuel input). Households are disaggregated into 10 representative groups by location and income quintile. The remaining accounts consist of (incorporated business) enterprise accounts, a margin account, the government account and six tax accounts, the capital account (savings and investments) and the rest of the world (RoW) account. Details of the national model aggregation are available in Annex 3.

The global model has the advantage of global coverage while the national model allows for more detailed analysis through a wider representation of production activities, trade in commodities and household income and spending, as well as selected SDG indicators.

C. Global MIRO_UNFCCC interface

The structure of MIRO_UNFCCC follows *Input*, *GAMS interaction*, *Load scenarios*, and *Compare scenarios*. The MIRO_UNFCCC interface is navigated via the menu bar on the left-hand side of the screen.



Documentation of the GAMS MIRO software that complements this user guide is available at https://www.gams.com/miro/start.html.

C.1.1. Input

The *input* section is comprised of a welcome screen including the glossary of terms, scenario levers, and assumptions. A detailed description of the contents of the input tabs in the global interface is shown in Table C-1.

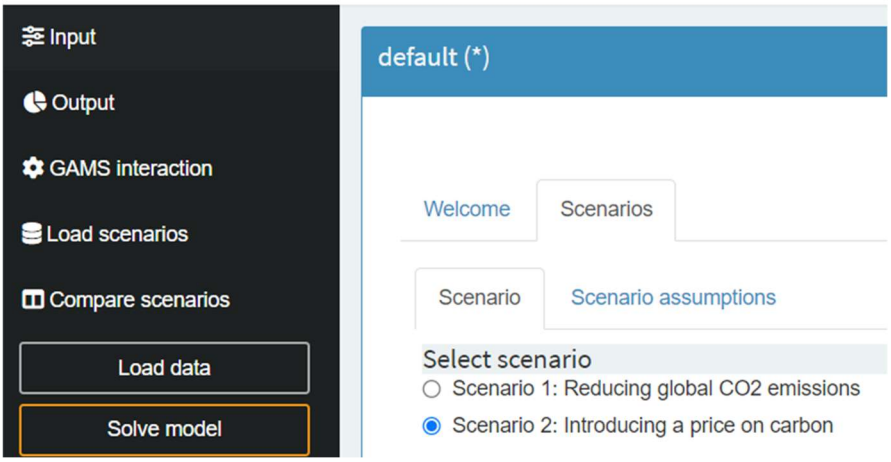


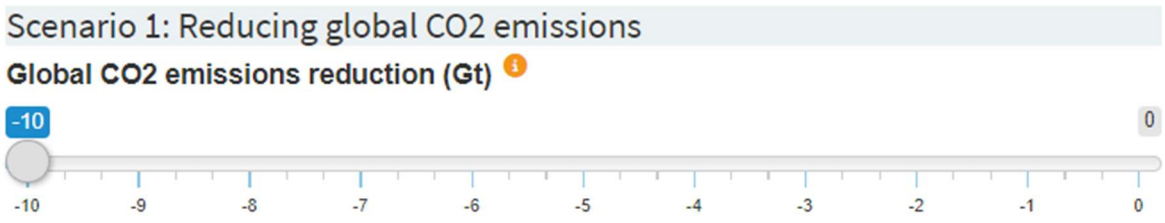
Table C-1 Inputs in the global modelling interface

Tab name	Description	Type
Welcome	Introduction to the global MIRO_UNFCCC interface and glossary of terms.	Information
Scenarios: scenario	Scenario 1: reducing global CO_2 emissions either in absolute or percentage terms. User specifies which regions participate in the emissions reduction. Scenario 2: Introducing a price on carbon. User specifies which regions participate in the emissions reduction and which products are included.	Scenario levers
Scenarios assumptions	Applies to whichever scenario is selected in the scenarios tab. User specifies the share of carbon revenue that is paid out in transfers. User specifies which regions pay and which receive the transfers.	Scenario assumptions

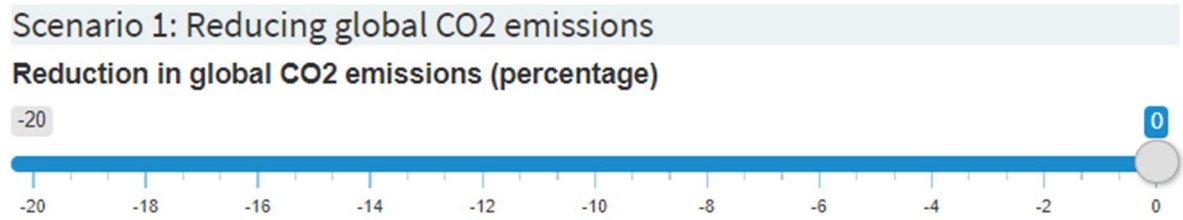
Scenario levers

Global response measures to reduce emissions are introduced via two scenarios: a reduction in global CO_2 emissions in either absolute or percentage terms, and the introduction of an international uniform carbon price. The type of approach to the response measure implemented is determined through the scenario selection:

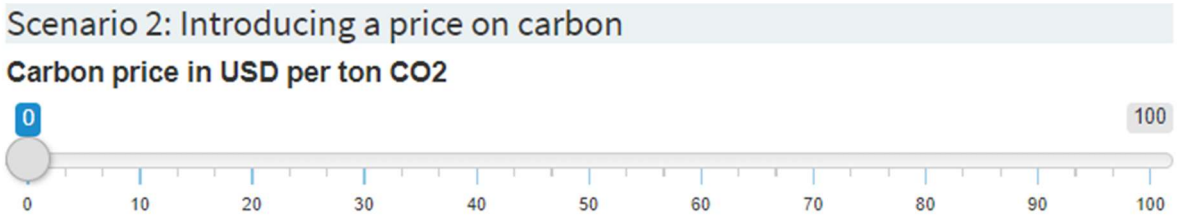
In scenario 1, the user chooses whether to implement a quantity reduction in gigatons of emissions:



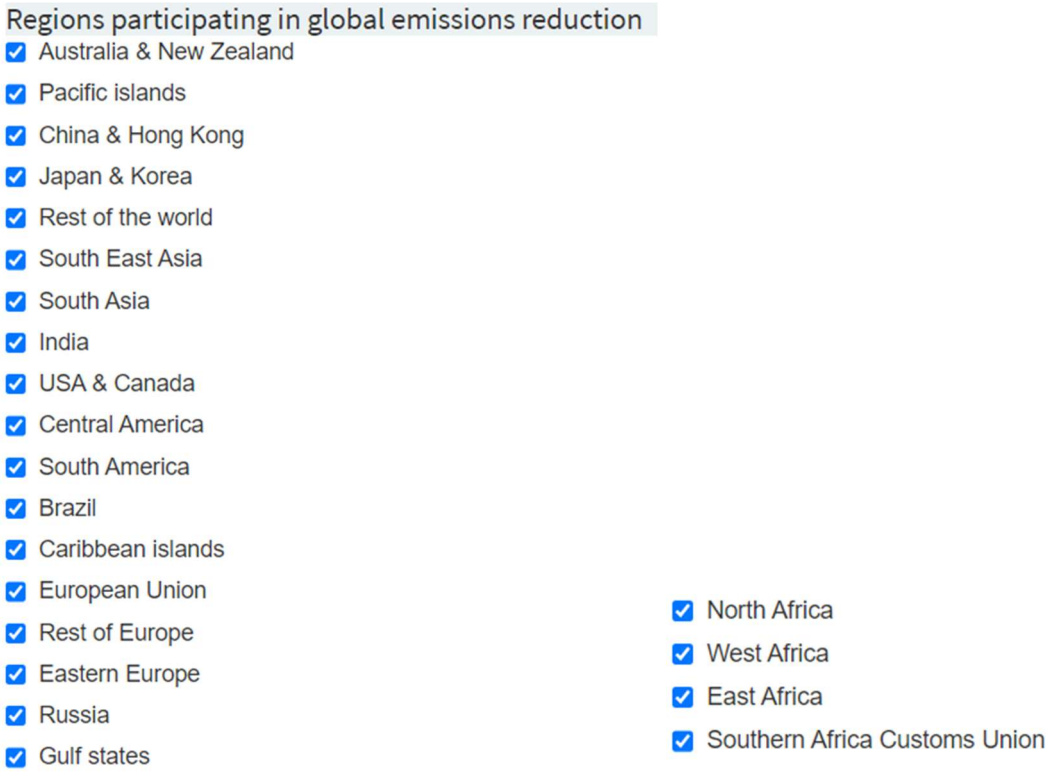
or a percentage reduction in emissions:



In scenario 2, the user specifics a carbon price in USD per ton of CO_2:



The user can choose which regions participate in the emissions reduction or carbon price introduction via the checkbox list of regions. The default is that all regions participate. This part of MIRO_UNFCCC can be used to explore the impact of response measures on participating regions when more – or fewer – regions are 'in the club' as well as the impacts for a particular region when they participate or do not participate.



Technical note: the global scenarios work by specifying a pair of exogenous and endogenous variables in the model: level of global CO_2 emissions and carbon price.

In scenario 1, the level of global emissions is exogenous (i.e., specified by the user) and the model solves for an endogenous uniform carbon price that brings about the reduction in emissions across all participating regions. Note that while the carbon price is uniform, the impact across regions will differ due to different emission intensities and patterns of production and consumption.

In scenario 2, the carbon price is exogenous and specified by the user. The model solves for the endogenous level of global emissions that results from the introduction of the carbon price across participating regions and industries.

In Scenario 2, the user can also specify the industries in which carbon pricing is applied to fuel combustion using the checkbox list:

Energy industries

- ☑ Petroleum & coal products
- ☑ Nuclear electricity
- ☑ Coal electricity
- ☑ Gas electricity
- ☑ Wind electricity
- ☑ Hydro electricity
- ☑ Oil electricity
- ☑ Other electricity
- ☑ Transmission & distribution
- ☑ Gas manufacture & distribution

Extraction industries

- ☑ Coal
- ☑ Oil
- ☑ Gas
- ☑ Other minerals

Agriculture & food industries

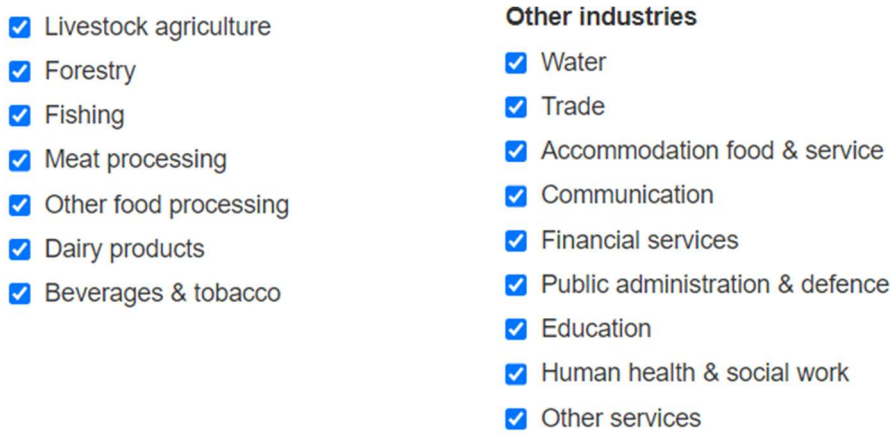
- ☑ Crop agriculture

Transport industries

- ☑ Air transport
- ☑ Water transport
- ☑ Other transport

Manufacturing industries and construction

- ☑ Paper products & publishing
- ☑ Chemicals & rubber
- ☑ Metals & metal products
- ☑ Textiles & apparel
- ☑ Leather products
- ☑ Wood products
- ☑ Electrical equipment
- ☑ Machinery & equipment
- ☑ Motor vehicles
- ☑ Transport equipment
- ☑ Other manufactures
- ☑ Construction



A *Reset scenario settings to default* button is available in both scenarios.

Scenario assumptions

The user may also specify whether a share of carbon revenues is distributed to recipient regions. The share of total carbon revenue is specified via the slider: the default is no transfers. The user may also select the basis upon which the transfer revenues are distributed as detailed in Table C-2.

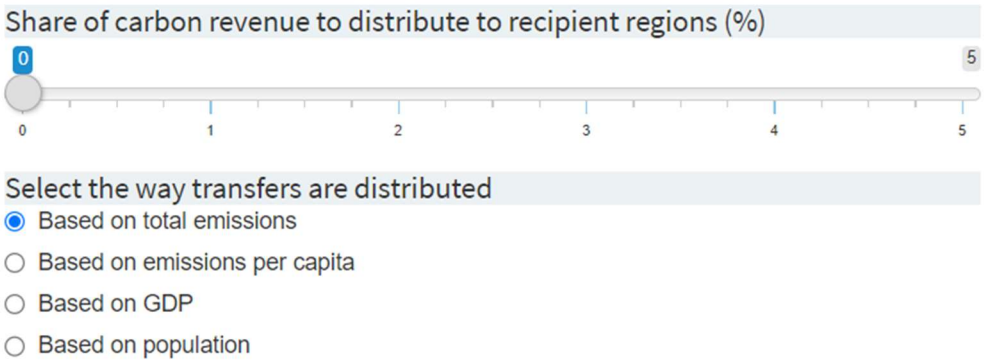
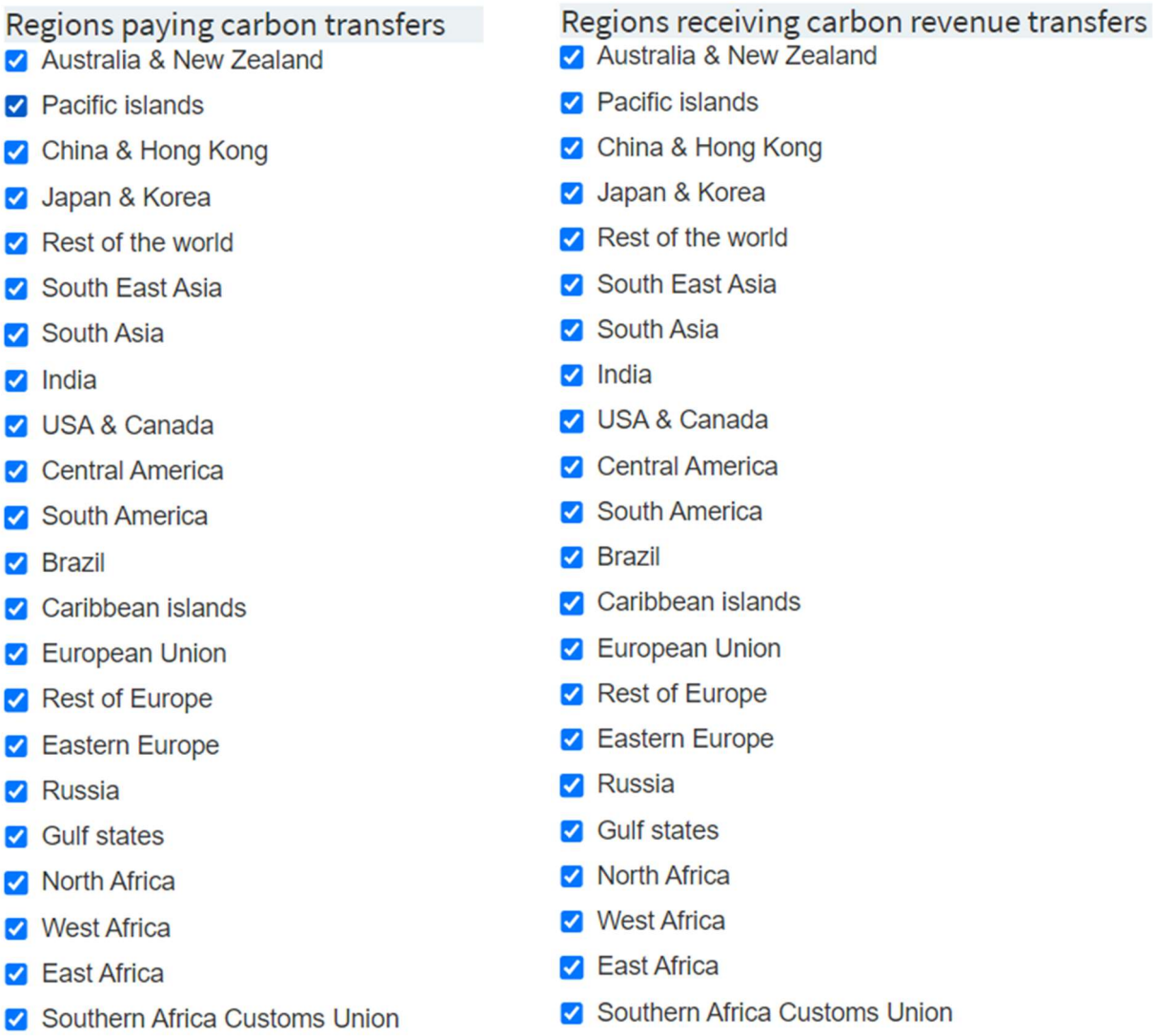


Table C-2 Transfer distribution options

Distribution method	Description
Total emissions	Regions with higher emissions in the base year receive a higher share of transfer revenues. The rationale is to help high emitting regions to bring down their emissions faster due to their larger contribution to global emissions.
Emissions per capita	Regions with higher emissions per capita receive a higher share of transfer revenues. The rationale is to help high emitting regions per capita to bring down their emissions faster due to their larger contribution to global emissions.
GDP	Regions with higher GDP receive a higher share of transfer revenues. The rationale is to help larger economies to bring down their emissions faster.
Population	Regions with higher populations receive a higher share of transfer revenues. The rationale is to help regions with larger populations to bring down their emissions faster.

The user can freely specify which regions pay carbon revenue transfers and which countries receive the transfers using the checkbox lists. Note that while only regions that participate in the climate response measure will have funds to contribute to the transfer fund, both participating and non-participating regions may receive transfers. The user does not need to deselect non-participating regions from the list of paying regions as their contribution will be calculated as zero by the model.



Save the scenario by selecting Scenario>Save as via the drop-down menu in the top right-hand side. Choose a name for the scenario and add tags if you would like, e.g., for a $25 carbon price, *25USD* and *carbonprice* are suitable tags.

C.1.2. Output

The Output section contains a dashboard of results from the last scenario run in, or loaded into, MIRO_UNFCCC.

Navigating the dashboard

The dashboard is navigated via the 'tiles' on the right-hand side of the screen. The tiles show headline results for the current scenario for results with a global average percentage change. Detailed graph and table results are accessed by clicking on the tiles.

Table C-3 Outputs in the global modelling interface

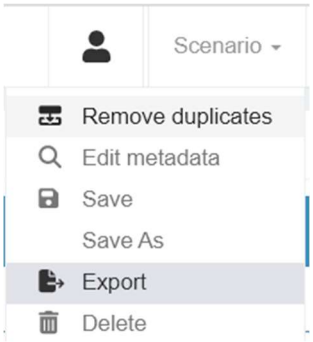
Indicator	Description	Type
Initial global CO_2 emissions	Starting level of global CO_2 emissions in gigatons (Gt).	Tile
Global CO_2 emissions (Gt)	Level of global CO_2 emissions in the scenario in gigatons (Gt).	Tile
Global CO_2 emissions (percentage change)	Percentage change in global CO_2 emissions in the scenario compared to base.	Tile

CO_2 emissions by region (percentage change)	Percentage change in regional CO_2 emissions by region in the scenario compared to base.	Graph, table
Carbon price ($/t)	Price of carbon in the scenario in USD per ton. In scenario 1, the carbon price is endogenously calculated to bring about the specified reduction in global emissions. In scenario 2, the carbon price equals the value set by the user.	Tile
Global GDP (percentage change)	Percentage change in real global Gross Domestic Product (GDP) in the scenario compared to the base.	Tile
GDP by region (percentage change)	Percentage change in real regional Gross Domestic Product (GDP) in the scenario compared to the base.	Graph, table
Global imports (percentage change)	Percentage change in real global imports in the scenario compared to the base.	Tile
Imports by region (percentage change)	Percentage change in real regional imports in the scenario compared to the base.	Graph, table
Global exports (percentage change)	Percentage change in real global exports in the scenario compared to the base.	Tile
Exports by region (percentage change)	Percentage change in real regional exports in the scenario compared to the base.	Graph, table
Exchange rates (percentage change)	Percentage change in the regional exchange rate in the scenario compared to the base. The exchange rate is defined as domestic currency per unit of world currency. An increase in the exchange rate is a depreciation and a decrease is an appreciation.	Graph, table
Rest of South Asia (Maldives)	Percentage change in the price of exports and imports in South Asia (region containing Maldives) in the scenario compared to the base. The price changes for South Asia are transferred to the national Maldives' model to examine the cross-border impacts of global response measures.	Graphs
Simulation shocks	Shows the shocks applied in the scenario in terms of emissions reduction or carbon prices, together with the assumptions on participating countries, products covered and the level and regional pattern of transfers.	Table

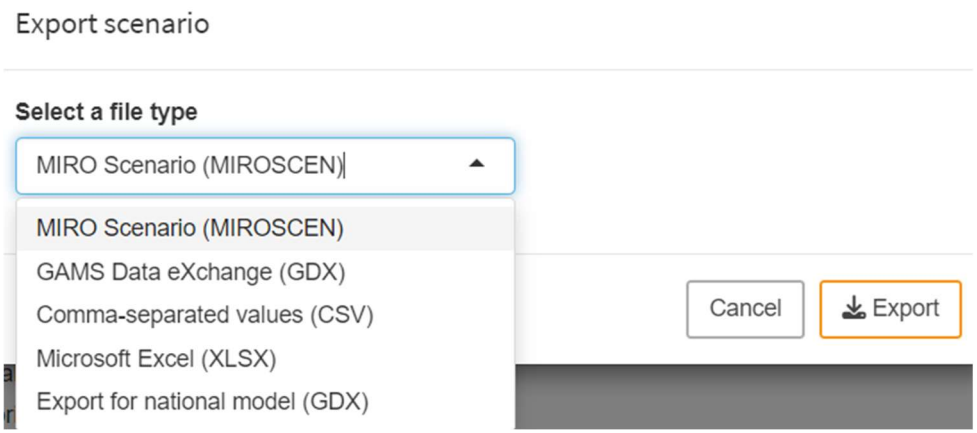
Exporting results for use in the national modelling interface

The MIRO_UNFCCC interface allows the global and national models to be 'soft-linked'[1] whereby price changes arising under the global scenarios are used as inputs to scenarios in the national model. This approach is used to evaluate cross-border impacts in which global response measures impact countries by changing global economic conditions i.e., world commodity prices.

To export the results of the global model, select *Export* from the Scenario drop down menu:



Then select *Export for national model (GDX)* and click *Export*



C.1.3. GAMS interaction

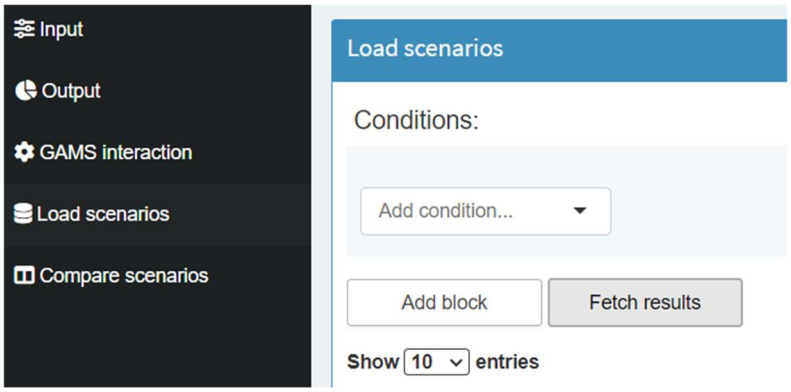
The GAMS interaction section of MIRO_UNFCCC provides information during and after the solving of the model. The Model Status bar shows the status of the model run while the GAMS output section provides information about the solution of the model.

The user can stop an active model run by pressing the *Stop* button. Further information on this section is available at https://www.gams.com/miro/start.html in the *Solve the model* section.

C.1.4. Load scenarios

The *Load scenarios* section allows the user to load scenarios from the MIRO_UNFCCC database of saved scenarios. Selecting *Fetch results* returns a list of all saved scenarios which can be ordered by time created, tags and all scenario settings.

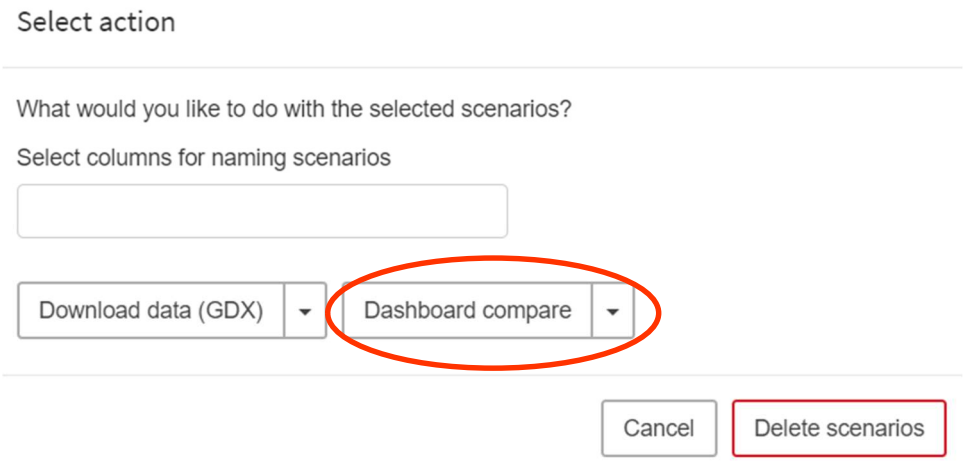
[1] A one-way link from the global model to the national model without feedback effects.



Alternatively, the user can restrict the scenarios fetched by using conditions to specify tags or lever values. Further information on this section is available at https://www.gams.com/miro/start.html in the *Finding and loading scenarios* section.

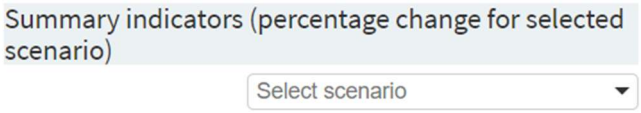
C.1.5. Compare scenarios

The *Compare scenarios* section is similar to the *Output* section but with comparisons across multiple scenarios. To load scenarios, select *Compare scenarios* and then *Load*. Choose the scenarios you want to include, click *Choose selected scenarios* and then *Dashboard compare*:



By default, the scenarios are named according to their saved name. The user can specify other fields to name the scenarios using the *Select columns for naming scenarios* option above.

The indicators in the *Compare scenarios* section follow those in the *Output* section. The user can populate the tiles on the right-hand side using the drop-down menu:



D. National MIRO_UNFCCC interface

The structure of the national MIRO_UNFCCC interface is the same as the global interface: *Input*, *GAMS interaction*, *Load scenarios*, and *Compare scenarios*. The MIRO_UNFCCC interface is navigated via the menu bar on the left-hand side of the screen.

D.1.1. Input

The input section is comprised of a welcome screen including the glossary of terms, scenario levers and data related tabs.

Table D-1 Inputs in the national modelling interface

Tab name	Description	Type
Welcome	Introduction to the national MIRO_UNFCCC interface and glossary of terms.	Information
World prices	Scenario: changes in world prices and exchange rate. Can be populated directly by the user or by importing results from the global interface. Note that higher world export prices reflect higher demand and incentivise production.	Scenario levers
Climate policies (NDCs)	Scenario: policy instruments to help an economy achieve its Nationally Determined Contributions (NDCs).	Scenario levers
Assumptions	Applies to whichever scenarios are specified. User selects how the government raises additional revenue to meet fixed spending commitments. Options are via increasing borrowing or raising income tax (levied only on enterprises in Maldives).	Scenario assumptions
Maldives SAM	Social Accounting Matrix for 2019.	Data
Maldives SAM expenditure shares	Expenditure shares of the SAM to show spending pattern in 2019 e.g., household consumption, export demand etc.	Data
Maldives SAM income shares	Income shares of the SAM to show income pattern in 2019 e.g., household income, government income etc.	Data

Navigating the data tabs

The national modelling interface input screen includes three data tabs which can be consulted for information about the structure of the Maldivian economy: the Social Accounting Matrix for 2019 in 100 million Rufiyaa, a matrix of income (row) shares and a matrix of expenditure (column) shares of the SAM.

To populate the data tabs, click on Load data in the left-hand panel, choose the unfccc_gams_admin: default scenario from the drop-down menu, and click Import.

The structure of the SAM is shown in Table D-2. The accounts of the SAM matrices follow the syntax format shown in the dropdown box accessed via the arrow circled in red below:

c_	Commodity accounts
m_	Margin accounts
a_	Activity accounts
h_	Household accounts
f_	Factor tax accounts
VATTAX	Value added taxes
IMPTAX	Import duties
EXPTAX	Export taxes
ECTAX	Excise duty
SALTAX	Sales taxes
INDTAX	Production taxes

FACTTAX	Factor taxes
DIRTAX	Direct income taxes
GOVT	Government
ENT	Enterprises
KAP	Savings/Investment
DSTOC	Stock Changes
ROW	Rest of World

In addition to scrolling through the matrices, users can search for the data of specific accounts using the search box (see the full list of SAM accounts in Annex 3). As each matrix is large, the interface also includes a set of predefined views that display sub-matrices of each matrix. The views are accessed via the *Load view* drop down menu:

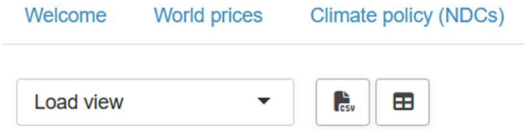


Table D-2 Social Accounting Matrix structure

	Commodities	Activities	Factors	Households	Enterprises	Government	Capital	Rest of the World	Total
Commodities	-	Intermediate input demand (use matrix)	-	Household consumption demand	-	Government consumption demand	Investment demand	Export demand by Rest of the World	Commodity demand
Activities	Domestic commodity supply (make matrix)	-	-	-	-	-	-	-	Domestic commodity supply
Factors	-	Value added	-	-	-	-	-	Factor income from abroad	Factor demand
Households	-	-	Factor payments to households	-	Enterprise payments to households	Government transfers to households	-	Remittances from abroad	Household income
Enterprises	-	-	Factor payments to enterprises	-	-	Government transfers to enterprises	-	Enterprise income from abroad	Enterprise income
Government	Import, export and sales taxes	Production taxes	Factor payments to government and factor taxes	Household income taxes	Enterprise payments to government and enterprise taxes	Intra-government transfers	-	Rest of the world transfers to government	Government income
Capital	-	-	-	Household savings	Enterprise savings	Government balance	-	External balance	Total savings
Rest of the World	Import supply by Rest of the World	-	Factor payments to Rest of the World	-	-	-	-	-	Payments to the Rest of the World
Total	Commodity supply	Domestic output	Factor payments	Household expenditure	Enterprise expenditure	Government expenditure	Total investment	Income from Rest of the World	

Scenario levers: World prices

Two types of scenario levers are included in the national interface: world prices and climate policy (NDCs). The *World prices* tab is used to capture changes in import and export prices and the exchange rate. The *Climate policy (NDCs)* tab includes policy levers that may be used to help the Maldives meet its Nationally Determined Contributions (NDCS).

Scenarios to examine the impact of changes in world prices arising from climate response measures are implemented in the national interface via the *World prices* tab. The user can vary the world prices of 9 import commodity groups and 6 export commodity groups, the membership of which is shown in Table D-3.

Table D-3 Commodity groups for world price scenarios

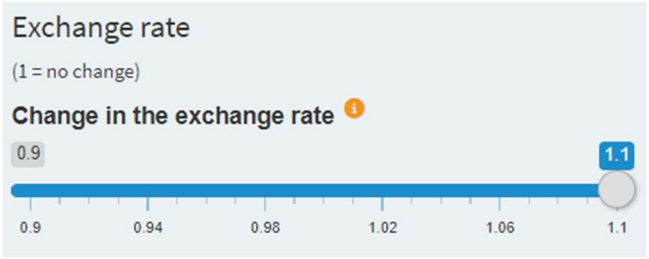
Commodity group	Commodities
Agriculture	Agriculture, livestock, forestry, fishing
Food	Food processing including fish processing, beverages and tobacco
Industry	Manufacturing
Other services	Other services including telecommunications, post, health, and education
Minerals†	Stone, sand, clay, coal, lignite, peat
Construction†	Construction
Transport services	Air, water and other transport
Tourism services	Accommodation, food, and beverage services
Fuel†	Diesel and petroleum

† Imports only

The user defines a scenario by changing the world prices of one or more import and/or export commodity groups. The size and sign of the change is informed either by the user's expectation of the impact of global response measures on world prices or populated by importing scenario results from the global interface.

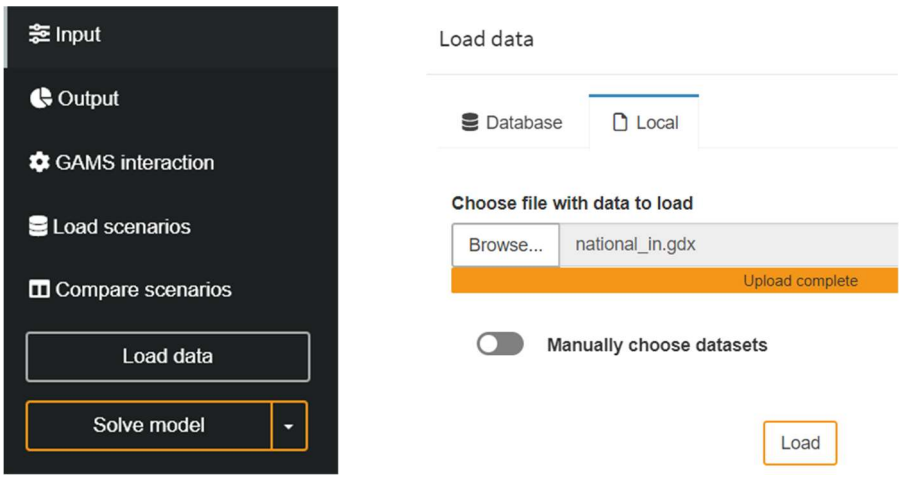
Where the user is basing the scenario on their expectation of the impact of global response measures on world prices, the magnitude of the price changes is set manually via the levers e.g., for a 10% increase in the world price of agricultural imports, move the slider below to 1.1:

The user can also change the exchange rate via the slider below. A 10% increase corresponds to a 10% depreciation of the currency as the exchange rate is defined as domestic currency units per unit of world currency.



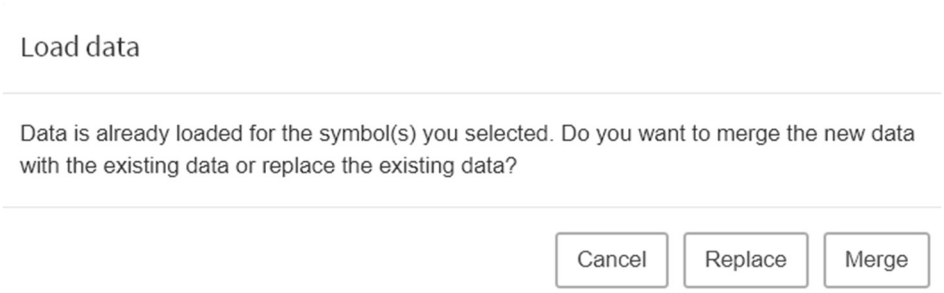
The MIRO_UNFCCC interface also allows the global and national models to be 'soft-linked'[2] whereby price changes in the global scenario outputs are used as inputs to scenarios in the national model. This approach is used to evaluate cross-border impacts in which global response measures impact countries by changing global economic conditions i.e., world commodity prices.

To load price changes generated in the global interface, click on the *Load data* button on the left-hand panel, select *Local* and browse for the exported file, national_in.gdx, and click Load:

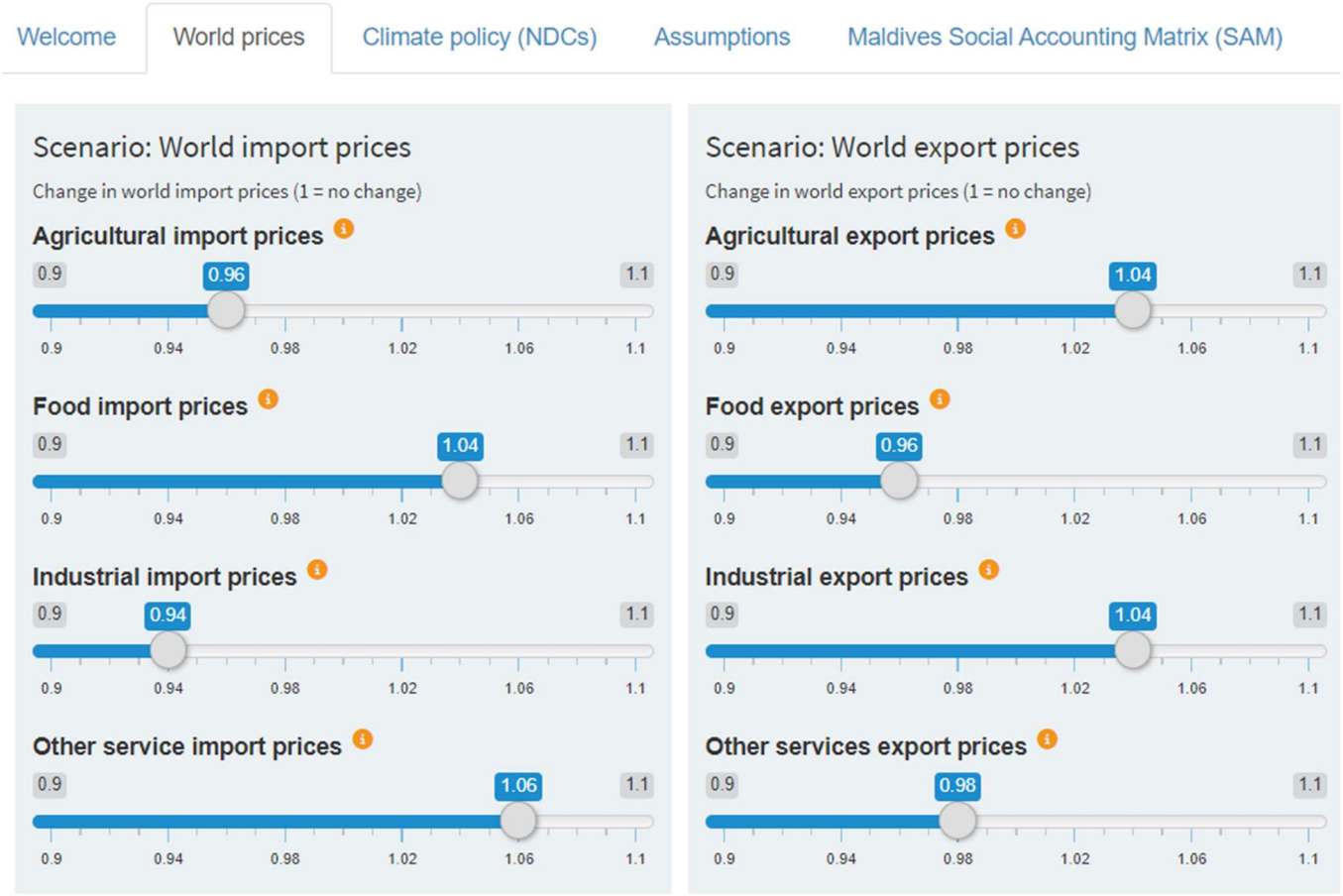


Select *replace* when the dialogue box below appears and observe the change to the slider values on the World prices tab:

[2] A one-way link from the global model to the national model without feedback effects.



An example of how the sliders change from the default value of 1 is shown below. Note that not all sliders are shown and the actual values will depend upon the results of the global scenario:



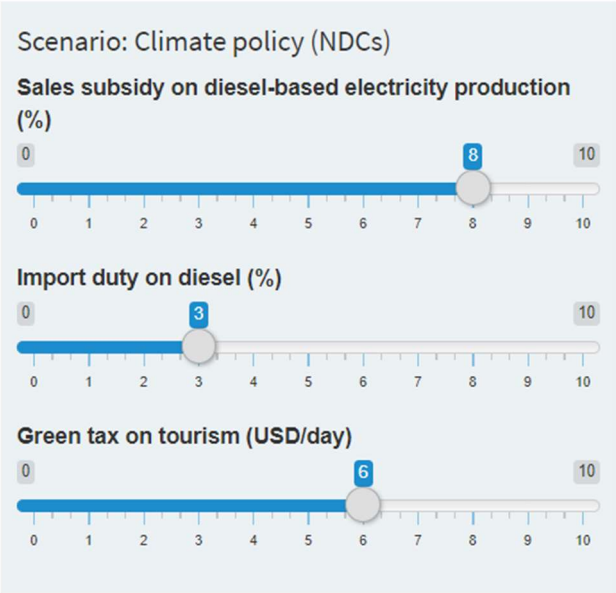
A mapping between the commodities in the global model and commodities used in the national interface is given in Annex 3.

Save the scenario by selecting *Scenario>Save* as via the drop-down menu on the top right-hand side. Choose a name for the scenario and add tags if you would like, e.g., for the above example, *imports* and *agricultural* are suitable tags. The tags can be used to filter for similar scenarios in the results database.

An option to reset all sliders to the default position is included to the right of the screen.

Scenario levers: Climate policy (NDCs)

A range of domestic policy instruments aimed at meeting the NDCs is available in the national interface. The exact policy instruments will vary by country; those for Maldives are shown below:



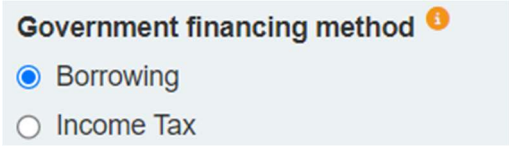
Unlike the world price levers, the domestic policy levers include the actual subsidy, duty, and day rates as the default values. The sales subsidy on diesel-based electricity production is 8% in 2019 which benefits all consumers of fossil-based electricity. Import duty on diesel stands at 3% and the Green tax on tourism, which is a daily fixed amount paid by all tourists, is $6 per day. The user can vary the rates to examine the impact of changes in one or more policy lever(s) e.g., to remove the subsidy on diesel-based electricity production, set the slider to 0.

An option to reset all sliders to the default position is included to the right of the screen.

Assumptions

Choices made under the Assumptions tab apply to whichever changes have been made in the scenario levers tabs. The user can specify how government maintains fixed spending commitments when government revenues vary and users should revise the choice made for each scenario to check that it is appropriate.

Two government financing methods are available: borrowing and income tax:



Under the *borrowing* assumption, any decrease (increase) in government revenue is compensated for by an increase (decrease) in government borrowing. Under the *Income tax* assumption, any decrease

(increase) in government revenue is compensated for by an increase (decrease) in the income tax rate on enterprises[3].

It is useful to save scenarios using suffixes or tags that reflect the assumptions made e.g., _B for borrowing or _YT for income tax.

D.1.2. Output

The output section contains a dashboard of results arising from the last scenario run in – or loaded into- the interface including results for selected SDG indicators.

Navigating the dashboard

The dashboard is navigated via the 'tiles' on the right-hand side of the screen. The tiles show headline results for the current scenario. More detailed results are accessed by clicking on each tile.

[3] There is no income tax on households in Maldives.

Table D-4 Outputs in the national modelling interface dashboard

Indicator	Description	Type
Macroeconomic indicators	Percentage change in real macroeconomic indicators GDP, absorption, production, exports and imports in the scenario compared to the base.	Graph, table
Emissions (percentage change)	Percentage change in CO_2 equivalent emissions from fuel combustion.	Tile
GDP (percentage change)	Percentage change in real Gross Domestic Product (GDP) in the scenario compared to the base.	Tile
Composition of GDP (percentage change)	Percentage change in the components of nominal and real GDP in the scenario compared to the base. The structure follows the equation for GDP from the expenditure side: GDP = C (private consumption) + I (investment) + G (government consumption) + (X (exports) – M (imports)).	Graphs, table
Absorption (percentage change)	Percentage change in real absorption in the scenario compared to the base.	Tile
Composition of absorption (percentage change)	Percentage change in the components of nominal and real absorption in the scenario compared to the base. The structure follows the equation for absorption: Absorption = C (private consumption) + I (investment) + G (government consumption). Absorption can be used as measure of whether welfare has increased or decreased in the country.	Graphs, table
Production (percentage change)	Percentage change in real production in the scenario compared to the base.	Tile
Production by sector and activity (percentage change)	Percentage change in the output of each activity, grouped by sector in the scenario compared to the base.	Graph, table

Exports (percentage change)	Percentage change in real exports in the scenario compared to the base.	Tile
Imports (percentage change)	Percentage change in real imports in the scenario compared to the base.	Tile
Trade (percentage change)	Percentage change in real imports and exports by commodity group in the scenario compared to the base.	Graph, table, list of commodity groups
Government savings (percentage change)	Percentage change in government savings in the scenario compared to the base.	Tile
Income tax rate (percentage change)	Percentage change in the income tax rate on enterprises in the scenario compared to the base. Note that this is a percentage change applied to the initial tax rate of 19.4% in 2019.	Tile
Government indicators (percentage change)	Percentage change in nominal government income, tax revenue, consumption and savings, and real consumption in the scenario compared to the base.	Graph, table
Returns to capital (percentage change)	Percentage change in the average return to capital in the scenario compared to the base.	Tile
Average wage (percentage change)	Percentage change in the average wage in the scenario compared to the base.	Tile
Returns to capital and labour (wages) (percentage change)	Percentage change in returns to capital and labour (wages) by type in the scenario compared to the base.	Graph
Labour demand by sector (real, percentage change)	Percentage change in labour demand by activity groups in the scenario compared to the base.	Graph, list of activity groups
Average household consumption (percentage change)	Percentage change in real average household consumption in the scenario compared to the base.	Tile
Household consumption by product group (percentage change)	Percentage change in real household consumption by commodity group in the scenario compared to the base.	Graph, list of commodity groups

Household consumption by household (percentage change)	Percentage change in real household consumption by household group. The household group definition is included in the glossary on the welcome page.	Radar plot
Average household income (percentage change)	Percentage change in real average household income in the scenario compared to the base.	Tile
Household income by region and household group (percentage change)	Percentage change in real household income by region and household group in the scenario compared to the base. The household group definition is included in the glossary on the welcome page.	Graph, table
Simulation shocks	Shows the shocks applied in the current scenario in terms of world prices, the exchange rate and climate policies, together with the assumptions on the government financing method.	Table

Navigating the SDG results

The results for selected Sustainable Development Goal indicator results are accessed via the SDG indicators tile. Indicators with larger percentage changes are shown in (deeper) shades of blue while indicators with negative percentage changes are shown in (deeper) shades of orange. Note that care should be given to the interpretation of the SDG results as an increase(decrease) in an SDG indicator does not necessarily correspond to an improvement in (worsening of) the indicator e.g. an increase in Domestic Material Consumption is worsening of the indicator as it suggests more pressure on environmental resources. Results for specific SDGs can be viewed alone using the Search box e.g., searching for SDG7 returns a table of SDG7 related indicators.

The results can also be used to assess progress or regression in the three pillars of sustainability: social, economic, and environmental. A description of each indicator, together with the pillar to which it pertains, is provided in Table D-5.

Table D-5 Outputs in the national modelling interface: SDG indicators

SDG/Indicator	Related UN SDG Indicator	Sustainability Pillar
SDG1 No poverty		
Share of Population Below National Poverty Line	1.2.1 Proportion of population living below the national poverty line	Social
SDG7 Affordable and clean energy		
Renewable Energy Share	7.2.1 Renewable energy share in the total final energy consumption	Environmental
Fossil Energy Share	Auxiliary indicator of fossil in total energy	
LNG Energy Share	Auxiliary indicator of LNG in total energy	
Fossil Energy Share - Non Resorts	Auxiliary indicator of fossil in non-resort energy	
PV Energy Share - Non Resorts	Auxiliary indicator of PV in non-resort energy	
LNG Energy Share - Non Resorts	Auxiliary indicator of LNG in non-resort energy	
Fossil Energy Share - Resorts	Auxiliary indicator of fossil in resort energy	
PV Energy Share - Resorts	Auxiliary indicator of PV in resort energy	
SDG8 Decent work and economic growth		
GDP Growth Per Worker (Real)	8.2.1 Annual growth rate of real GDP per employed person	Economic
Domestic Material Consumption (DMC)	8.4.2 Domestic material consumption	Environmental
DMC Per Capita	8.4.2 Domestic material consumption per capita	
DMC Per Unit GDP	8.4.2 Domestic material consumption per GDP	
Tourism Share Of GDP	8.9.1 Tourism direct GDP as a proportion of total GDP	Economic
SDG9 Industry, innovation and infrastructure		
Manufacturing Value Added Share Of GDP	9.2.1 Manufacturing value added as a proportion of GDP	Economic
Manufacturing Value Added Per Capita	9.2.1 Manufacturing value added per capita	
Manufacturing Share of Employment	9.2.2 Manufacturing employment as a proportion of total employment	
CO2 Emissions from Fuel	Auxiliary indicator of CO2 emissions from fuel combustion (millions of tonnes)	Environmental
CO2 Emissions Per Unit GDP	Auxiliary indicator of CO2 emissions per unit of GDP	Environmental

SDG10 Reduced inequalities		
Low Income Household Consumption Per Capita	10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population	Social
Average Household Consumption Per Capita	10.1.1 Growth rates of household expenditure or income per capita among the total population	
Labour Share of GDP - Wages	10.4.1 Labour share of GDP, comprising wages	
Labour Share of GDP - Wages And Transfers	10.4.1 Labour share of GDP, comprising wages and social protection transfers	

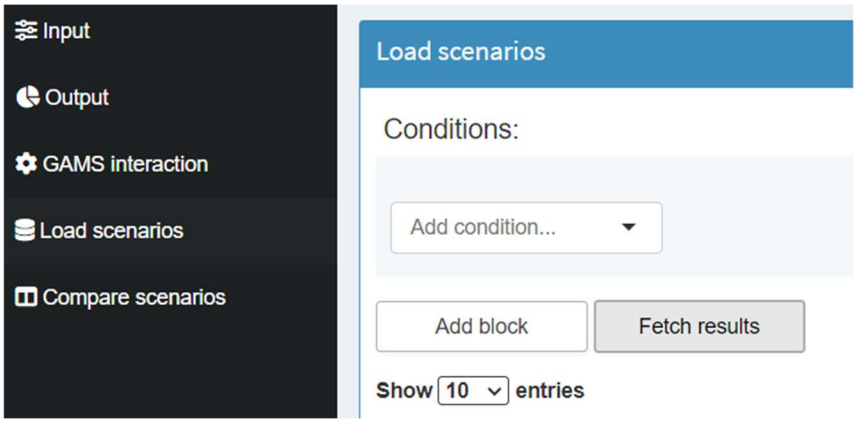
D.1.3. GAMS interaction

The GAMS interaction section of MIRO_UNFCCC provides information during and after the solving of the model. The Model Status bar shows the status of the model run while the GAMS output section provides information on the solution of the model.

The user can stop an active model run by pressing the *Stop* button. Further information on this section is available at https://www.gams.com/miro/start.html in the *Solve the model* section.

D.1.4. Load scenarios

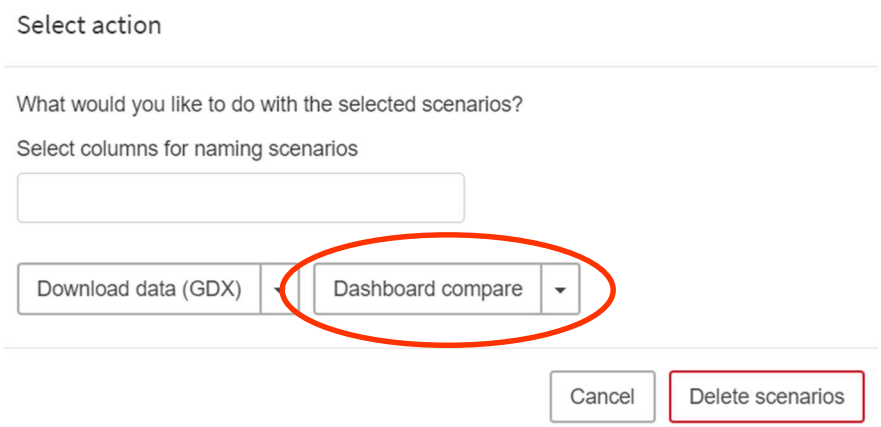
The *Load scenarios* section allows the user to load scenarios from the MIRO_UNFCCC database of their saved scenarios. Selecting *Fetch results* returns a list of all saved scenarios which can be ordered by time created, tags and all scenario settings.



Alternatively, the user can restrict the scenarios fetched by using conditions to specify tags or lever values. Further information on this section is available at https://www.gams.com/miro/start.html in the *Finding and loading scenarios* section.

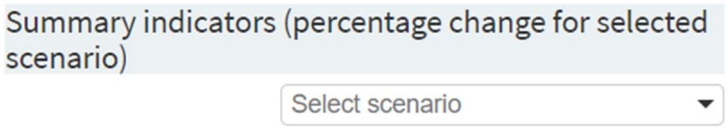
D.1.5. Compare scenarios

The *Compare scenarios* section is similar to the *Output* section but with comparisons across multiple scenarios. To load scenarios, select *Compare scenarios* and then *Load*. Choose which scenarios you want to include, click *Choose selected scenarios* and then *Dashboard compare*:



By default, the scenarios are named according to their saved name. The user can specify other fields to name the scenarios using the *Select columns for naming scenarios* option above.

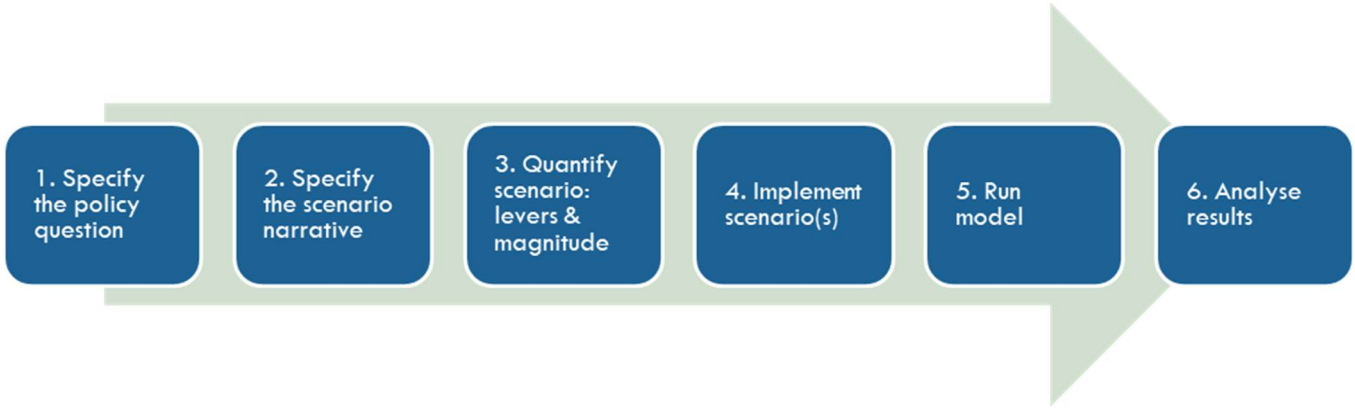
The indicators in the *Compare scenarios* section follow those in the *Output* section. The user can populate the tiles on the right-hand side using the drop-down menu:



E. A step-by-step guide to implementing scenarios in MIRO_UNFCCC

The MIRO_UNFCCC interface allows users to conduct their own (simple) climate policy impact assessments. The process of conducting an impact assessment is shown in Figure 1.

Figure 1 The process of impact assessment



The policy question is fleshed out through the definition of the scenario narrative. The scenario narrative is then quantified by specifying which policy levers will be changed and by how much. The model is run with the values of the policy instruments and the impact on the economy is evaluated by viewing the set of results and graphs produced in the user interface.

This section provides a step-by-step guide to the process of running and analysing the results of a climate related policy scenario via MIRO_UNFCCC. Instructions are provided for both the global and national modelling interfaces.

E.1.1. Specify the policy question

A wide range of policy scenarios can be explored using the MIRO_UNFCCC modelling interface. Defining the policy question is the first step in the analysis. Examples of policy questions include:

> How is the implementation of global response measures likely to impact the economy of a participating country?
>
> How is the implementation of global response measures likely to impact the economy of a non-participating country?
>
> How is the implementation of global response measures likely to impact Maldives?
>
> How might energy tax reforms as part of NDC policies impact Maldives?

The nature of the policy question determines which interface should be used (global or national) or whether both interfaces should be used sequentially (global then national). The global interface is used

for global carbon-tax related response measures. Investigations into climate related NDC policies use the national interface. Investigations into the cross-border impacts of the implementation of global response measures begin in the global interface. Where a national user interface is also available, as in the case of Maldives, regional economic changes can be brought into the national user interface to explore cross-border impacts.

E.1.2. Define the scenario narrative

Once the policy question has been specified, the next step is to construct a policy scenario to investigate the question. The process of defining a policy scenario has two stages: specifying the scenario narrative (qualitative step 2 of Figure 1**Error! Reference source not found.**) and quantifying the narrative (quantitative step 3 of Figure 1).

Specify the scenario narrative

A scenario narrative is the qualitative description of the scenario. It provides a sense of the world in which the policies are taking place and how the economy is assumed to operate. An example scenario description is given below:

> *As part of efforts to limit global temperature rise, a carbon price is introduced that reduces worldwide CO_2 emissions by 20%. It is expected that the actions, taken by participating countries, will have impacts in non-participating countries via changes in global trade. The government is keen to understand how the implementation of this global response measure is likely to affect the economy of Maldives. The government is undecided as to whether any change in government revenue should be financed by changes in government borrowing or tax rates.*

E.1.3. Quantify the scenario

Decide which levers to move

Policy makers typically have a range of instruments available to bring about policy changes including taxes, subsidies, investment incentives etc. The policy instruments (direct levers) in the global and national interfaces are:

- Reduction in emissions via an international carbon price (global model)
- Subsidy on diesel-based electricity production (national model)
- Import duty on diesel (national model)
- Green tax on tourism (national model)

In the case of cross-border impacts, policy changes outside a country lead to domestic impacts through changes in global economic conditions. In this case, the indirect ‘levers’ to quantify the scenario in the national interface are world import and export prices:

- World import prices: agriculture, minerals, food, fuel, industrial, construction, transport services, tourism services, other services.
- World export prices: agriculture, food, industrial, transport services, tourism services, other services.

Additionally, there may be interest in alternative options including transfers and government financing. To this end, further levers are included:

- Share of carbon revenue to transfer to recipient countries from donor regions (global)
- Government financing: borrowing, income tax on corporations (national)

The levers included in MIRO_UNFCCC are a subset of those available in the models themselves. This is a deliberate choice to maintain the user-friendliness of the interfaces and avoid overcomplication.

Decide by how much to move the lever(s)

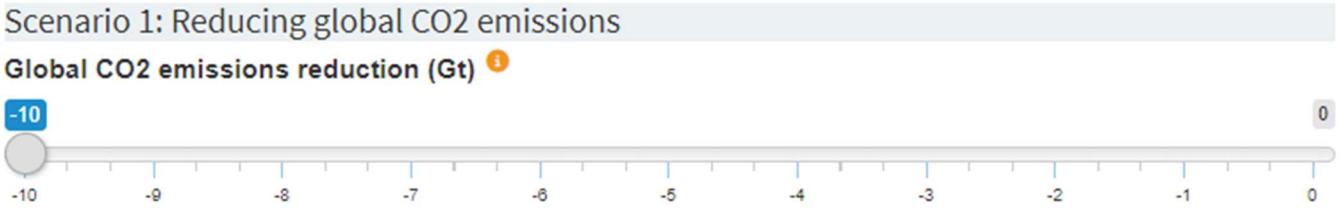
Once the lever(s) to move have been decided, the question is by how much they should move. MIRO_UNFCCC provides a sandbox environment to explore a wide range of scenarios. As such, the scenarios are stylized, and the exact magnitude isn't crucial. Rather, consideration should be given as to whether a small, medium or large change is expected under the climate policy based on the scenario narrative.

E.1.4. Implement the scenario(s)

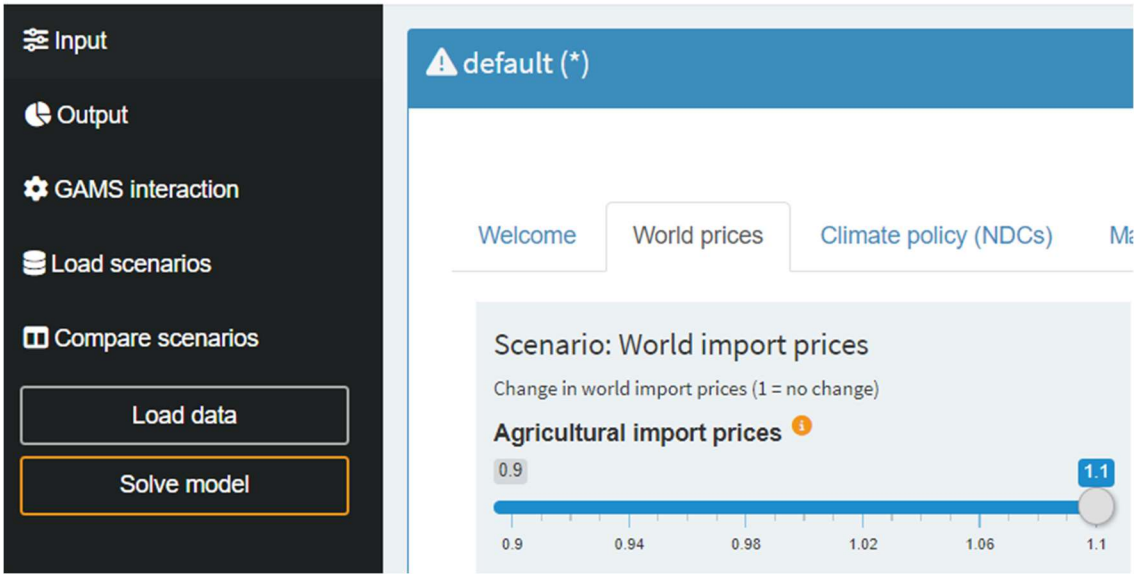
The MIRO_UNFCCC program should be accessed via the hosting website. Select either the global or national user interface depending on the scenario.

Implementing scenario(s) in MIRO_UNFCCC

Set the magnitude of the levers in the tabs on the *Input* screen. For example, to reduce annual carbon emissions in the global model, move the emissions slider:



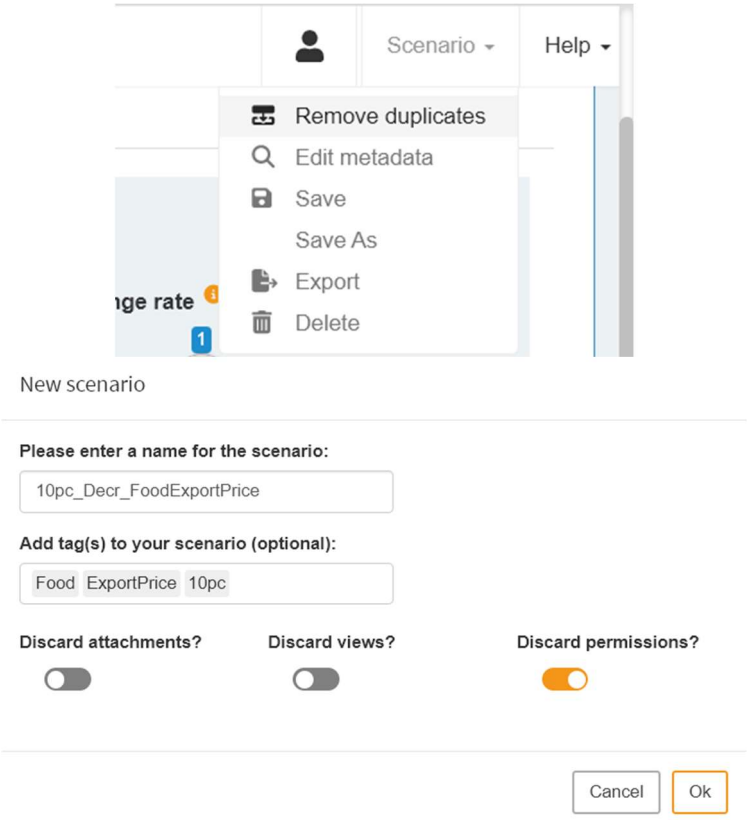
or for a 10% increase in the world price of agricultural imports in the national model, move the relevant slider on the Scenario: World import prices tab to 1.1:



For import price changes arising from global response measures using the process described in section D.1.1.

Once all levers have been set, click on the *Solve model* button in the left-hand panel to run the model. The model will run with the new values for the levers. The interface will switch to the Output tab when the scenario run is complete.

Save the scenario results by selecting Scenario>Save as via the drop-down menu in the top right-hand side. Choose a name for the scenario and add tags if you would like, e.g., for the above national scenario, *imports* and *agricultural* are suitable tags while *emissions* would be a suitable tag for the global scenario.



E.1.5. Run the model

Press the Solve model button. Click on the scenario shocks tile and verify that the scenario is implemented correctly. Make a first, quick check that the results are in line with your expectations (from step 1).

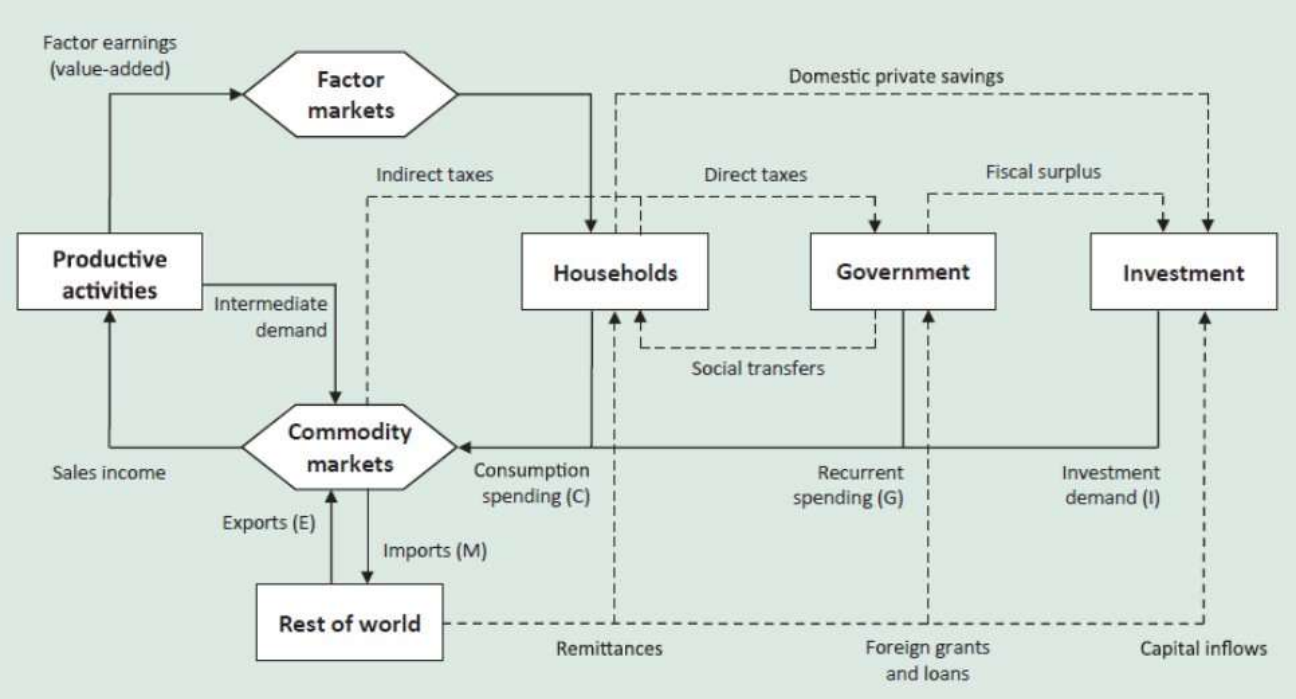
E.1.6. Analyse results

MIRO_UNFCCC allows for two ways of analysing scenario results. First, via the dashboard (including selected SDG indicators in the national model) in *Output* and second, via the dashboard in *Compare Scenarios*. The former shows the results of a single scenario, while the latter allows for the results of more than one scenario to be compared.

A wide range of results covering GDP, exchange rates, trade and world prices is reported in the user interface. The nature of CGE models is that these results arise from both the initial change in policy/economic conditions (first round effects) and subsequent changes in prices, production, incomes, and consumption etc. (higher-order effects). As the model is used in comparative static mode, percentage change results show the percentage change in the variable compared to the base value (starting point with no policy shock).

The circular flow of income shown in Figure 2 is commonly used in economics and provides an overview of the economy/economies in the models behind the interfaces. As such, the circular flow provides a useful framework for interpreting and understanding scenario results.

Figure 2 Circular flow of income



Source: Breisinger et al. (2009)

Consider:

- Which part of the economy will be affected first by the change in economic conditions or policies?
- Which part of the economy will be affected second, third etc.

A useful pathway through the results is to consider the impact at the point of entry first and then look through the results of the parts of the economy that are impacted second, third etc. For example, an increase in the fuel import price enters the circular flow at *Imports,* affecting the price on *Commodity markets,* which in turn affect consumption spending and intermediate demand for inputs, which in turn affects *Productive activities*, *Factor markets* and *Households* (via the impact on wages and capital returns). The following questions serve as a scaffold for such analysis:

- What sign are the impacts (positive, negative, no change)?
- How large are the impacts?
- Are the impacts in line with your expectations?
- How do the results suggest the economy (-ies) would differ under the implementation of this policy?
- Are some sectors/factors/households/indicators impacted more positively/negatively than others? What drives these impacts?

Note that CGE models capture higher order effects, i.e., both the direct impact of changes in economic conditions or policies and the indirect impacts that arise because of the initial changes. As such, the effects of the policy may ripple through the circular flow economy more than once.

The following questions are pertinent for the SDG indicators in the national interface:

- What is the general impact on the SDG indicators: positive, negative, mixed? Note: remember to consider what is a positive or negative change for each indicator
- How does the global/domestic policy affect social SDG indicators in Maldives (see graphic below)?
- How does the global/domestic affect economic SDG indicators in Maldives?
- How does the global/domestic policy affect environmental SDG indicators in Maldives?

Figure 3 SDGs and the three pillars of sustainable development

E.1.7. Compare scenarios

MIRO_UNFCCC allows for 'what-if' type analysis. Additional scenarios can easily be run to evaluate other scenarios under alternative assumptions such as different magnitudes of policy/world price changes, other domestic policy options, and/or different government financing options and carbon revenue transfers. Multiple scenarios can also be run to decompose the observed impacts e.g., an initial scenario in which all import prices rise by 10% could be decomposed into a 10% rise in the import price of each commodity group separately, thus identifying the main drivers of the impacts.

The process of specifying alternative scenarios follows the same process as the initial scenario and viewed via the Compare Scenarios screen. It is useful when exploring further scenarios to consider how you would expect the results of the additional scenario to differ from the original scenario.

F. Summary

MIRO_UNFCCC is a suite of global and national user-friendly interfaces that enables users to explore impacts of climate policies using toolkit models without extensive training. The interface provides a

window into global and national CGE modelling (UNFCCC *et al*., 2024). It includes multiple policy instruments and produces a comprehensive set of modelling results. MIRO_UNFCCC is intended for use by policy advisors and stakeholders alongside in-depth assessment by policy analysts using the models directly.

G. References

Breisinger, C., M. Thomas, and J. Thurlow. 2009. Social accounting matrices and multiplier analysis: An introduction with exercises. Food Security in Practice technical guide 5. Washington, D.C.: International Food Policy Research Institute.

Chepeliev, M. (2020). GTAP-Power Data Base: Version 10. Journal of Global Economic Analysis, 5(2), 110–137. https://www.jgea.org/ojs/index.php/jgea/article/view/108

GAMS Software GmbH (2023). GAMS MIRO. https://www.gams.com/sales/miro_facts/

Mainar Causapé A.J., Flaig, D., & Shutes, L. (2023). A Social Accounting Matrix and Satellite Accounts for Maldives. Deliverable 8 prepared for UNFCCC.

UNFCCC, Flaig, Shutes & Mainar Causapé (2024). Modelling the Global & Maldivian economy: extensions to the GLOBE & GLOBE_SINGLE models. UNFCCC report.

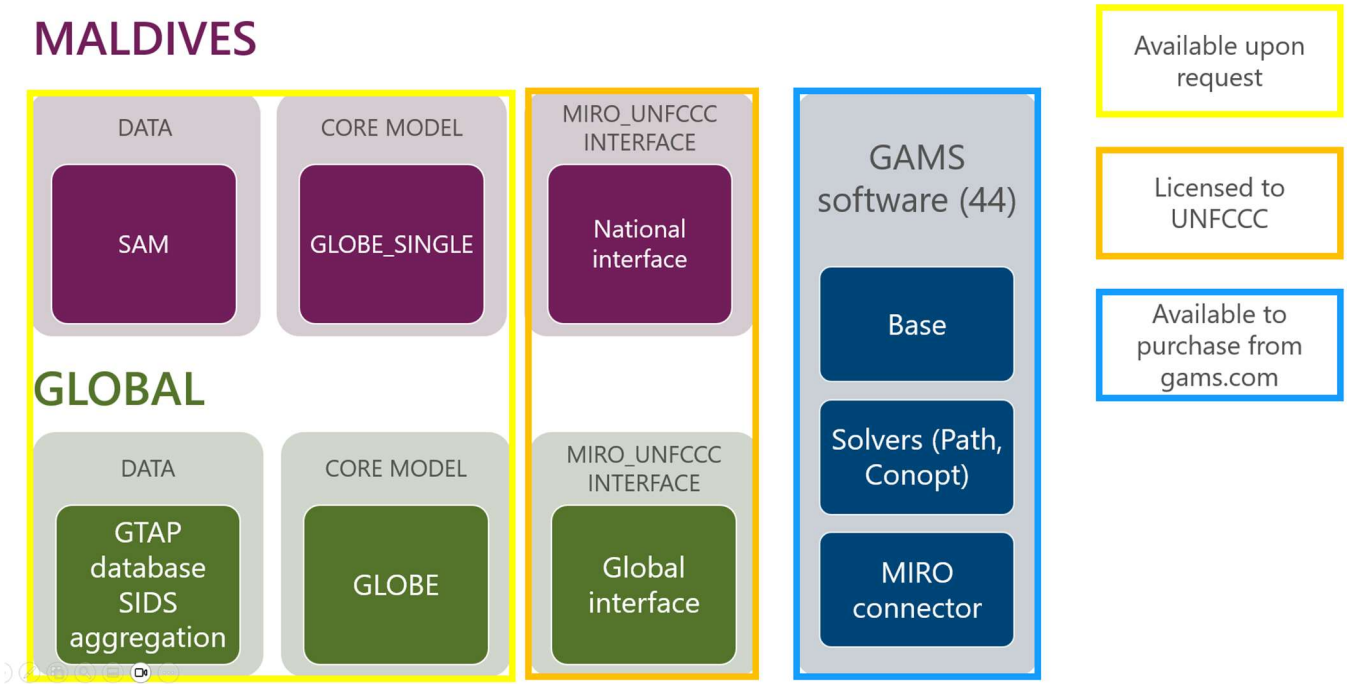
Thierfelder, K., (2024a). A Standard Applied General Equilibrium Model: Technical Documentation – GLOBE. mimeo (www.usna.edu).

Thierfelder, K., (2024b). A Standard Applied General Equilibrium Model: Technical Documentation - GLOBE-SINGLE. mimeo (www.usna.edu).

H. Annex 1: Licencing

The structure of availability and licensing for the data, model, interface and software is shown in Figure 4.

Figure 4 Structure of availability and licensing



GAMS (General Algebraic Modelling System) software is available for purchase from GAMS Development Corp. GAMS Software GmbH at https://www.gams.com/sales/pricing_regular/. A demo version of GAMS can be requested at: https://www.gams.com/try_gams/.

The GAMS MIRO Desktop is open source and available from https://www.gams.com/miro/download.html. A GAMS Connector license available for purchase at https://www.gams.com/sales/pricing_regular/. A demo version of GAMS which includes GAMS Connector can be requested at https://www.gams.com/try_gams/.

I. Annex 2: GLOBE accounts

Table E-1 SAM accounts, aggregation of GTAP Power database

SAM Account Name	Description
cagr	Agriculture livestock forestry fishing
ccoal	Coal
coil	Oil
cgas	Gas
comin	Other minerals
cfd	Food processing including fish processing beverages and tobacco
cind	Industrial
cpetc	Petroleum & coal products
cwater	Water
ctrdis	Trade and Distribution
cel_nuc	Nuclear electricity
cel_coal	Coal electricity
cel_gas	Gas electricity
cel_win	Wind electricity
cel_hyd	Hydro electricity
cel_oil	Oil electricity
cel_oth	Other electricity
cgasdis	Gas manufacture distribution
celec	Electricity
ccon	Construction
ctourser	Accommodation, Food, and Beverage Services
ctranser	Transport Services
coser	Other services including telecommunications, post, health, and education
aagr	Agriculture livestock forestry fishing
acoal	Coal
aoil	Oil
agas	Gas
aomin	Other minerals
afd	Food processing including fish processing beverages and tobacco
aind	Industrial
apetc	Petroleum & coal products
awater	Water
atrdis	Transmission and Distribution
ael_nuc	Nuclear electricity
ael_coal	Coal electricity
ael_gas	Gas electricity
ael_win	Wind electricity

ael_hyd	Hydro electricity
ael_oil	Oil electricity
ael_oth	Other electricity
agasdis	Gas manufacture distribution
aelec	Electricity
acon	Construction
atourser	Accommodation, Food, and Beverage Services
atranser	Transport Services
aoser	Other services including telecommunications, post, health, and education
fnld	Land
fltech	Technicians and Skilled
flclerk	Clerks
flserv	Service and shop
floff	Office Managerial and Professional
flagr	Agriculture and Other workers
fkap	Capital
fnres	Natural Resources
tm_reg	Ad valorem import duty by region
tms_reg	Specific Import duty by region
te_reg	Export tax by region
ts_comm	Sales tax by commodity
tf_factor	Factor taxes by factor
owatp_reg	Margins on imports by region
wanz	Australia and New Zealand
wpacif	Pacific Islands
wchnhk	China and Hong Kong
wjpnkor	Japan and Korea
wrow	Rest of the World
wseasia	South East Asia
wsasia	South Asia
windi	India
wusacan	USA and Canada
wcamer	Central America
wsamer	South America
wbraz	Brazil
wcarib	Carribean Islands
weu	European Union
wreur	Rest of Europe
wfsu	Former Soviet Union
wruss	Russia
wgulf	Gulf States
wnafr	North Africa
wwafr	West Africa
weafr	East Africa
wsacu	Southern African Customs Union

wglb	Globe
hous	Household
saltax	Sales taxes
vattax	Value added taxes
prodtax	Indirect Production Taxes paid by activities
dirtax	Direct Taxes
govt	Government
i_s	Capital
dstoc	Stock changes

J. Annex 3: GLOBE-SINGLE accounts

SAM accounts

Table J-1 SAM accounts, Maldives SAM 2019

SAM Account Name	Description
c_1	Products of Agriculture, Horticulture, and Market Gardening
c_2	Live Animals and Animal Products, Excluding Meat
c_3	Forestry and Logging Products
c_4	Fish and Other Fishing Products
c_5	Coal and Lignite; and Peat
c_6	Stone, Sand, and Clay
c_7	Other Minerals
c_8	Electricity, Town Gas, Steam, and Hot Water
c_9	Natural Water
c_10	Meat, Fish, Fruits, Vegetables, Oils, and Fats
c_11	Dairy Products and Egg Products
c_12	Grain Mill Products, Starches and Starch Products; and Other Food Products
c_13	Beverages
c_14	Tobacco Products
c_15	Textiles and Wearing Apparel
c_16	Leather and Leather Products; and Footwear
c_17	Products of Wood, Cork, Straw, and Plaiting Materials
c_18	Pulp, Paper, and Paper Products; and Printed Matter and Related Articles
c_19	Coke Oven Products; Refined Petroleum Products; and Nuclear Fuel
c_20	Chemical and Rubber Products
c_21	Glass and Glass Products, and Other Non-metallic Products, n.e.c.[4]
c_22	Furniture; and Other Transportable Goods, n.e.c.
c_23	Wastes or Scraps
c_24	Basic Metal and Fabricated Metal Products, except Machinery and Equipment
c_25	General and Special Purpose Machinery

[4] Not elsewhere classified

c_26	Office, Accounting, and Computing Machinery
c_27	Electrical Machinery and Apparatus
c_28	Radio, Television, and Communication Equipment and Apparatus
c_29	Medical Appliances, Precision, and Optical Instruments; Watches and Clocks
c_30	Transport Equipment
c_31	Construction
c_32	Wholesale and Retail Trade Services
c_33	Accommodation, Food, and Beverage Services
c_34	Passenger Transport Services
c_35	Freight Transport Services
c_36	Rental Services of Transport Vehicles with Operators
c_37	Supporting Transport Services
c_38	Postal and Courier Services
c_39	Financial and Related Services
c_40	Real Estate Services
c_41	Leasing or Rental Services without Operator
c_42	Research, Professional, and Business Services
c_43	Telecommunications, Broadcasting, and Information Supply Services and Support Services
c_44	Public Administration and Other Services Provided to the Community as a Whole; and Compulsory Social Security Services
c_45	Education Services
c_46	Human Health and Social Care Services
c_47	Sewage and Waste Collection, Treatment and Disposal, and Other Environmental Protection Services
c_48	Other Services
Margins	Margins
a_1	Agriculture
a_2	Forestry and Logging
a_3	Fishing and Aquaculture
a_4	Processing and Preserving of Fish, Crustaceans, and Molluscs
a_5	Manufacture of Other Food Products
a_6	Manufacture of Beverages
a_7	Manufacture of Textiles, Wearing Apparel, and Leather Goods
a_8	Manufacture of Wood and Wood Products
a_9	Printing and Service Activities Related to Printing
a_10	Manufacture of Other Non-metallic Mineral Products
a_11	Manufacture of Fabricated Metal Products, except Machinery and Equipment
a_12	Manufacture of Other Transport Equipment
a_13	Manufacture of Furniture
a_14	Other Manufacturing Products
a_15	Electric Power Generation, Transmission, and Distribution
a_16	Water Collection, Treatment, and Supply; and Sewage
a_17	Construction
a_18	Wholesale and Retail Trade; and Repair of Motor Vehicles and Motorcycles
a_19	Land Transport and Transport via Pipelines

a_20	Water Transport
a_21	Air Transport
a_22	Warehousing and Support Activities for Transportation
a_23	Postal and Courier Activities
a_24	Resorts
a_25	Other Accommodation Services
a_26	Food and Beverage Service Activities
a_27	Publishing, Motion Picture, and Broadcasting
a_28	Programming and Broadcasting Activities, Telecommunications, Computer Programming, and Information
a_29	Financial Intermediation, except Insurance and Pension Funding
a_30	Insurance and Pension Funding, except Compulsory Social Security; and Activities Auxiliary to Financial Intermediation
a_31	Real Estate Activities
a_32	Professional, Scientific, and Technical Activities
a_33	Administrative and Support Service Activities
a_34	Administration of The State and The Economic and Social Policy of The Community
a_35	Provision of Services to the Community as a Whole
a_36	Education
a_37	Human Health and Social Work Activities
a_38	Arts, Entertainment, and Recreation; and Other Service Activities
L-A-SKL	L-Atoll-Skilled
L-A-SSK	L-Atoll-Semi-Skilled
L-A-USK	L-Atoll-Unskilled
L-M-SKL	L-Malé-Skilled
L-M-SSK	L-Malé-Semi-Skilled
L-M-USK	L-Malé-Unskilled
K	Capital
Indtax	Taxes less subsidies on production
Saltax	Taxes less subsidies on commodities
A-Q1	Household Atoll Quintile 1
A-Q2	Household Atoll Quintile 2
A-Q3	Household Atoll Quintile 3
A-Q4	Household Atoll Quintile 4
A-Q5	Household Atoll Quintile 5
M-Q1	Household Malé Quintile 1
M-Q2	Household Malé Quintile 2
M-Q3	Household Malé Quintile 3
M-Q4	Household Malé Quintile 4
M-Q5	Household Malé Quintile 5
ENT	Corporations
Dirtax	Direct taxes
govt	Government
i_s	I-S
RoW	Rest of the World

Mapping global and national commodities

Table J-2 Mapping between global commodities and national commodity groups

Global model commodity groups	Global model short name	National interface commodity group
Agriculture livestock forestry fishing	cagr	Agriculture
Other minerals	comin	Minerals
Food processing including fish processing beverages and tobacco	cfd	Food
Petroleum & coal products	cpetc	Fuel
Industrial	cind	Industry
Accommodation, Food, and Beverage Services	ctourser	Transport services
Transport Services	ctranser	Tourism services
Other services including telecommunications, post, health, and education	coser	Other services