

Tools for analysing climate mitigation and development impacts

Advancing PROSPECTS+ tool and integrating it in the ICAT Toolbox

Report of activities carried out under Grant number:
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September 2020



Overview



Introducing the COMPASS toolbox



Expansion of PROSPECTS+ to align with IPCC categories



Initial user guidance for tool application



Introducing the COMPASS toolbox



Overview of tools; their inputs, calculations and outputs; and internal and external interlinkages

COMPASS: NewClimate's tool offering to navigate climate action impacts

Climate action Outcomes and mitigation policy assessment toolbox

Selection of **climate scenario modelling tools** developed by NewClimate Institute to support decision-makers, analysts and civil society to **assess and understand the impacts of climate action and policies**

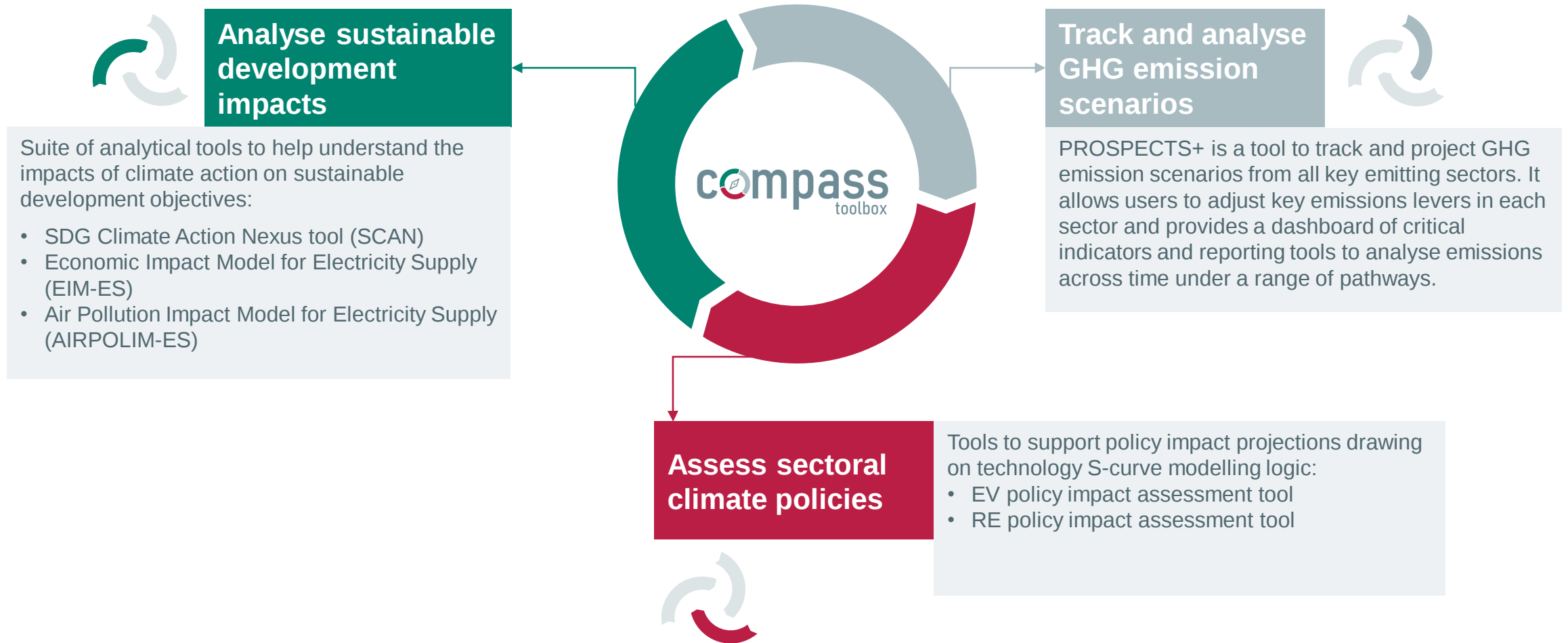
Principles of tool development

- **Publicly available** // free // open-source
- **Accessible** to a range of users with different levels of technical expertise
- **Transparent** inputs, assumptions, calculations and outputs
- **Improve access to information** to assist informed, evidence-based decisions
- **Address modelling gaps**; avoid duplication
- **Enable raising climate ambition** by exploring opportunities and barriers

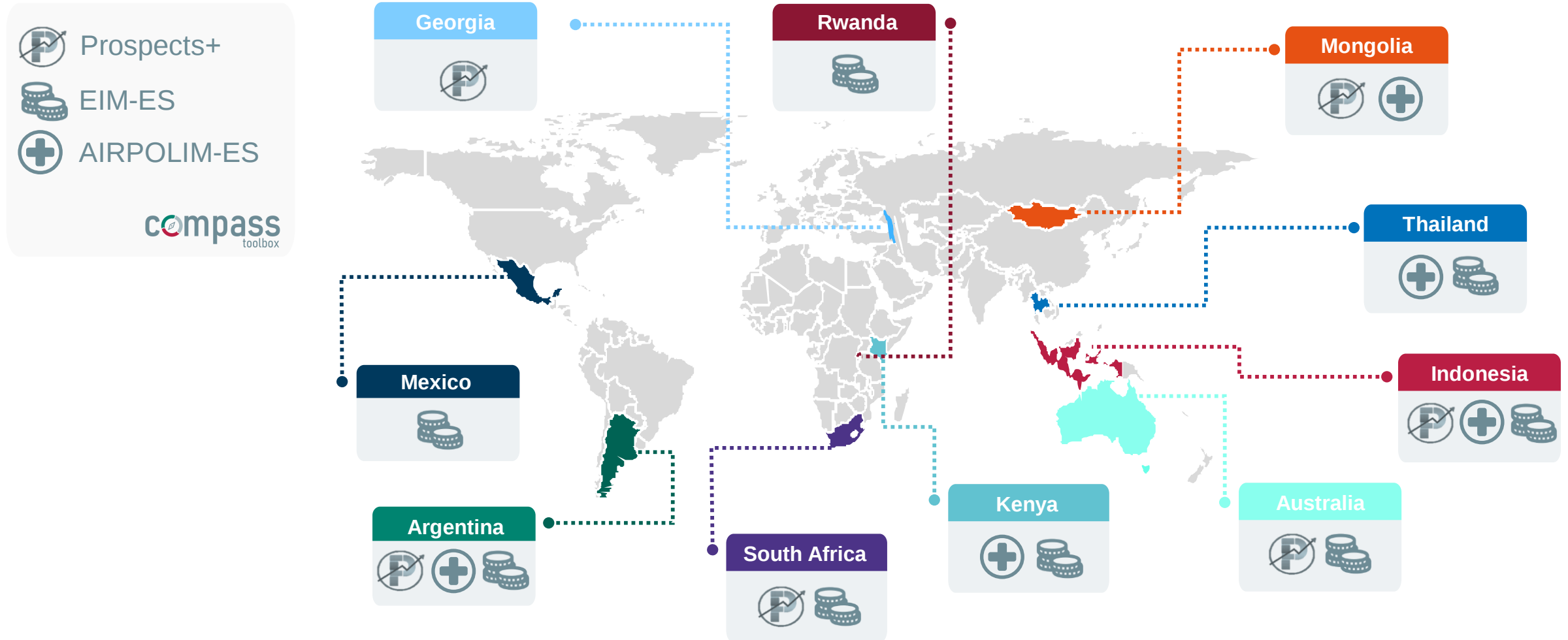
Common features across tools

- **Focused on impacts** of actions and policies to mitigate climate change
- **Modular setup**, designed to be used either as *standalone* tools; or with *soft links* to other Compass tools and/or third party models
- **Excel-based** analytical tools
- **Facilitate comparison** across different scenarios / policies / outcomes
- **Explore** potential opportunities and barriers to raise climate ambition

COMPASS: navigating climate action impacts



Examples of application of tools to date





Tool to track and calculate overall and sectoral GHG emissions trends of a country



Based on the historic and future development of relevant decarbonisation indicators



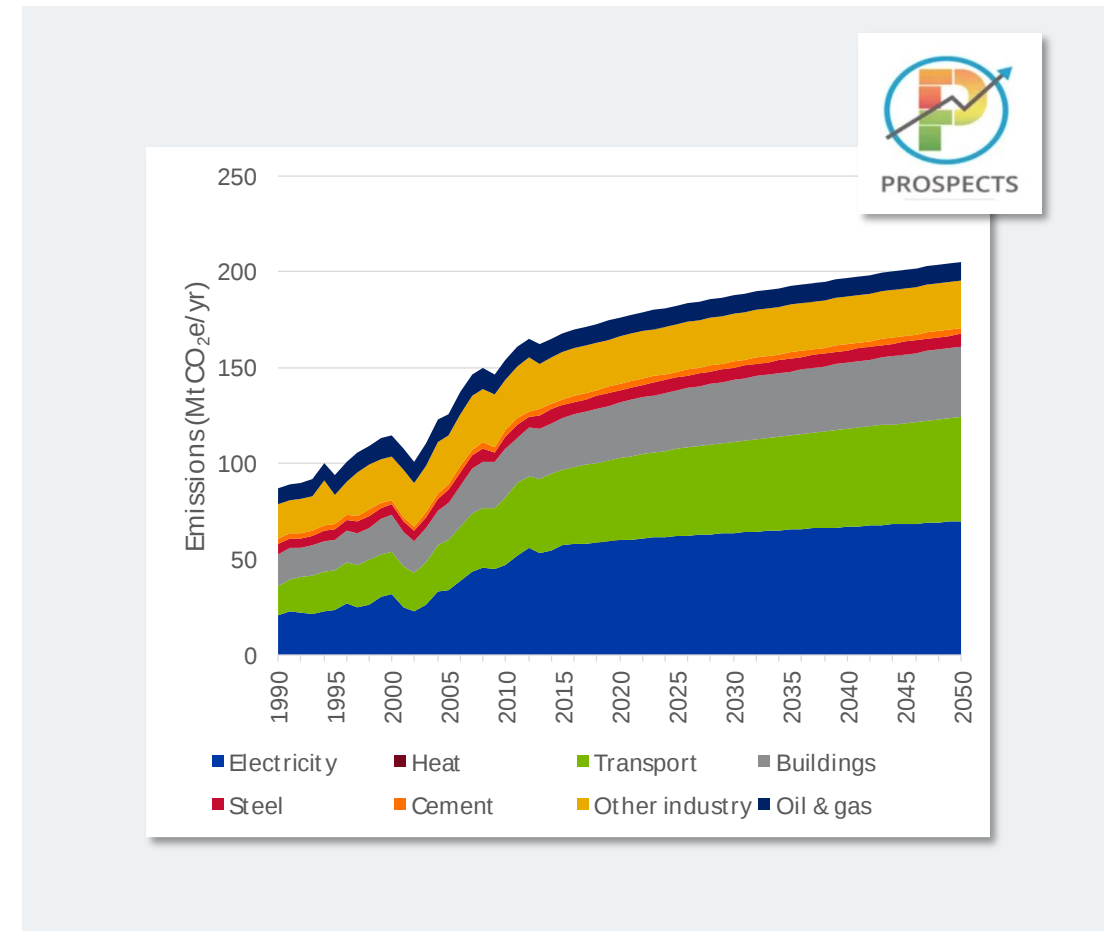
Allows users to adjust key emissions levers in each sector



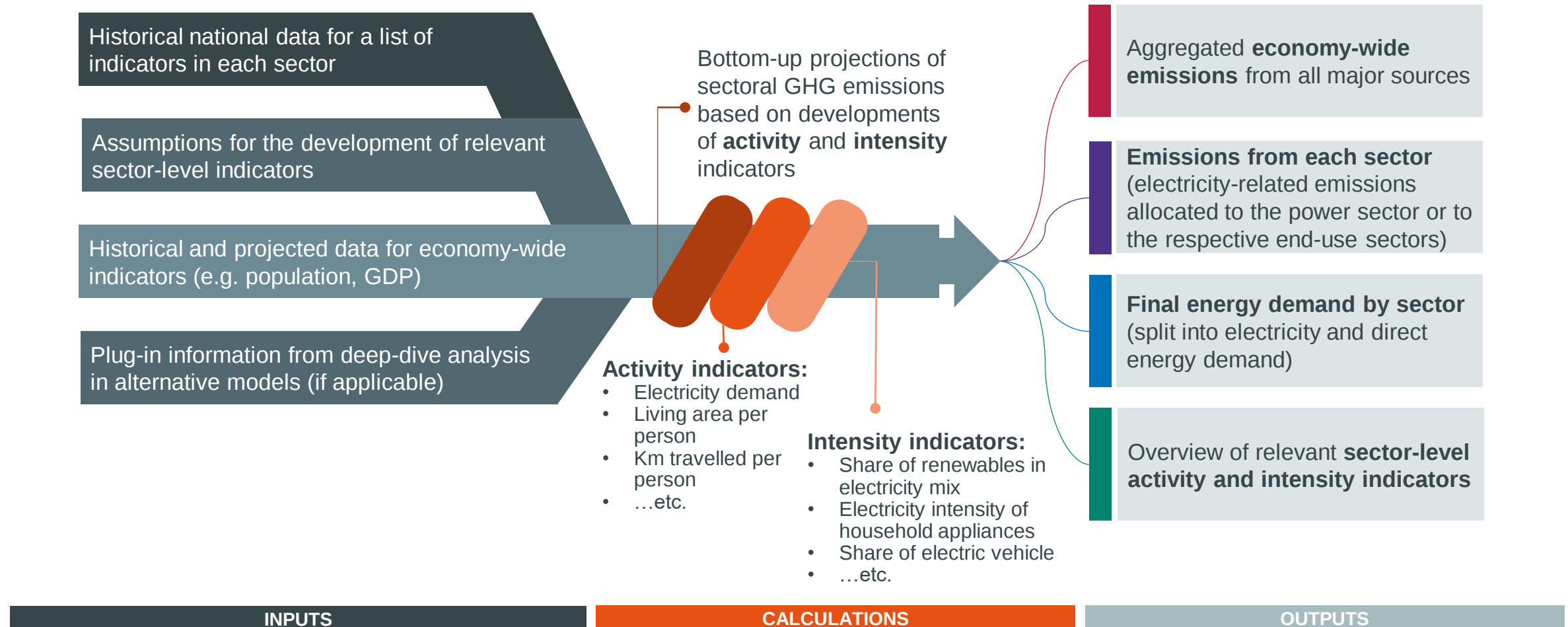
Can be used to aggregate outputs from more detailed sectoral modelling efforts or policy analysis



Can be used to aggregate outputs from more detailed sectoral modelling efforts or policy analysis



PROSPECTS+ inputs, calcs and outputs



Air Pollution Impact Model for Electricity Supply // AIRPOLIM-ES



Tool to estimate the health impacts of air pollution from different sources of electricity generation



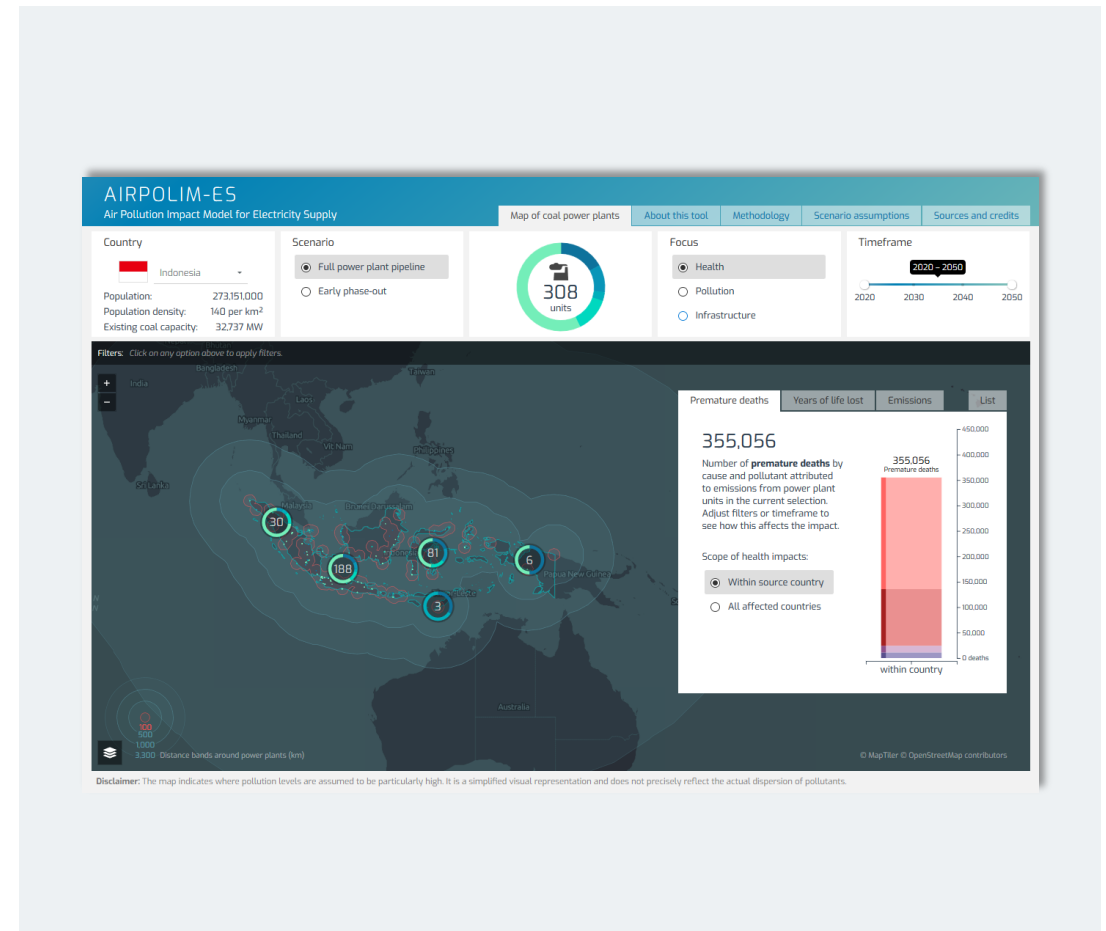
Focuses on air pollution caused by electricity generation from coal- and gas-fired power plants



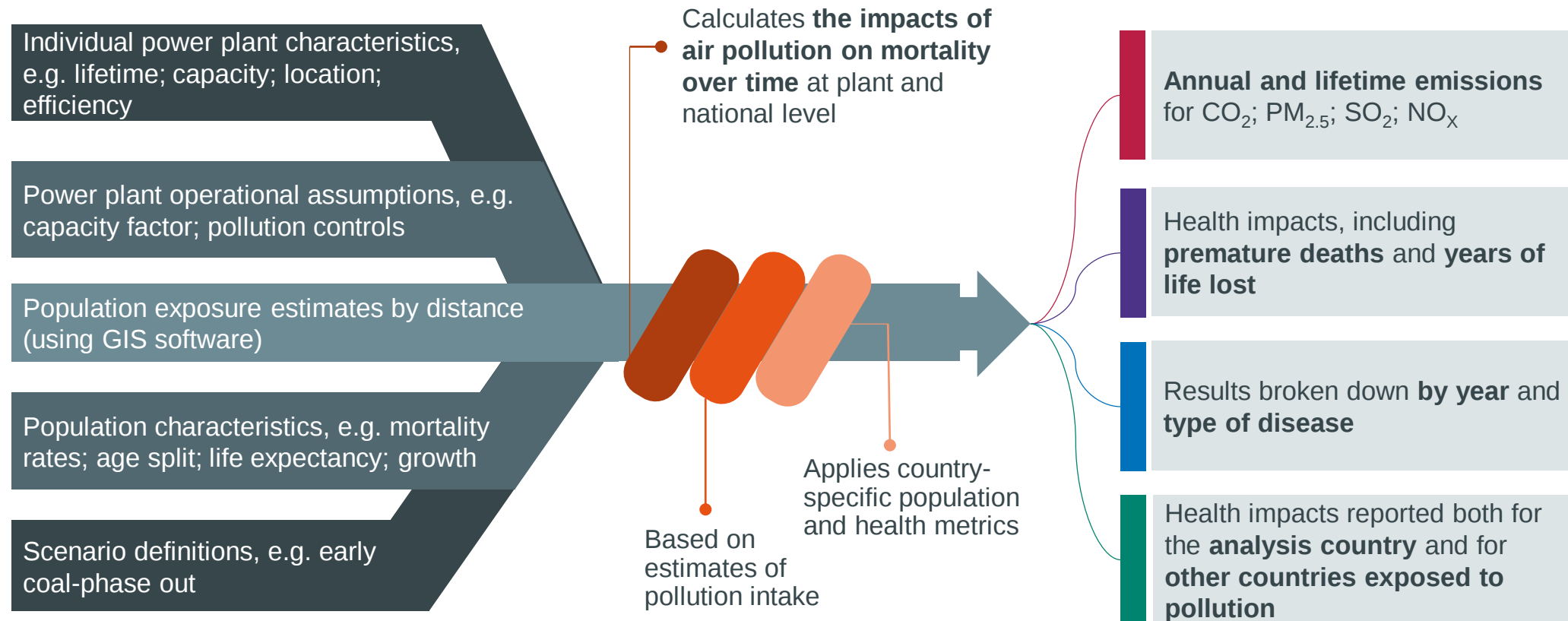
Compares the magnitude of health impacts under different scenarios across both existing and planned plants



Interactive web application available for a number of countries



AIRPOLIM-ES inputs, calcs and outputs



INPUTS

CALCULATIONS

OUTPUTS

Economic Impact Model for Electricity Supply // EIM-ES

compass
toolbox



Tool to estimate the health impacts of air pollution from different sources of electricity generation



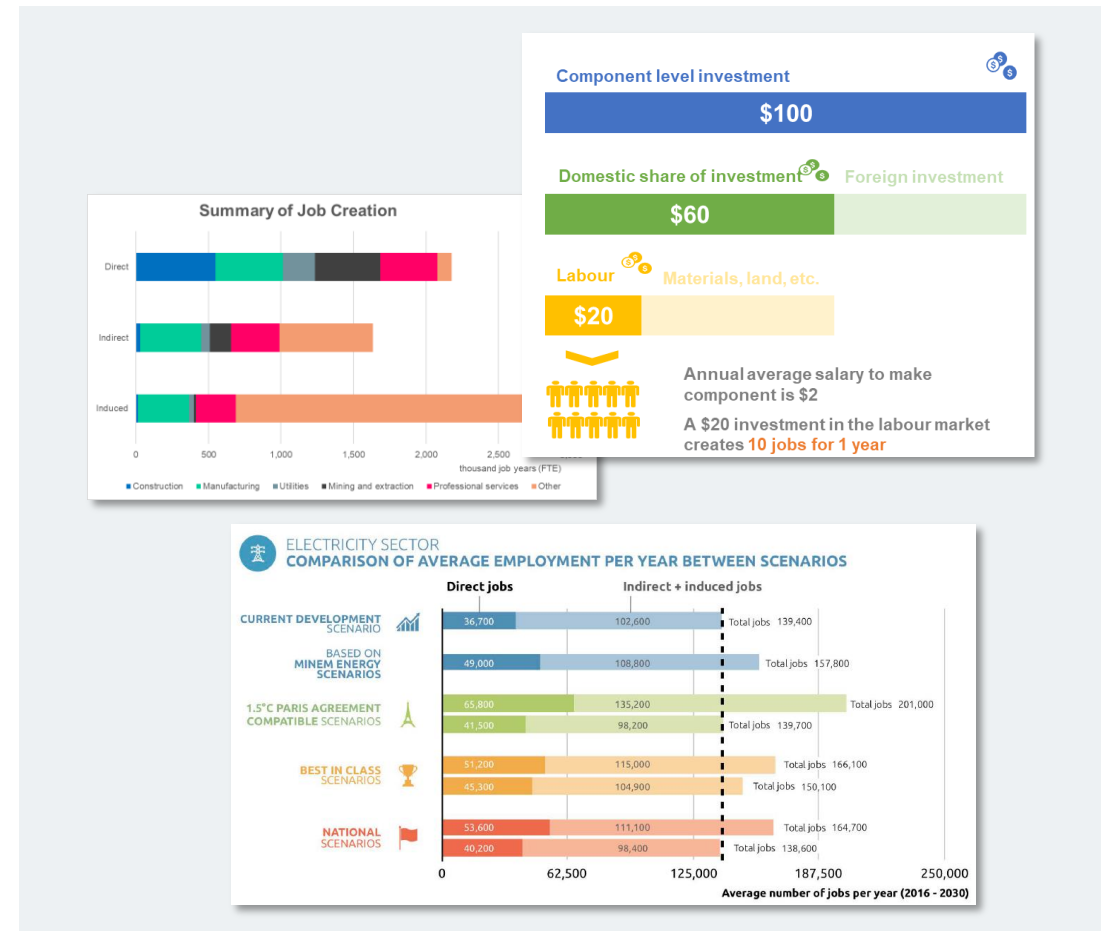
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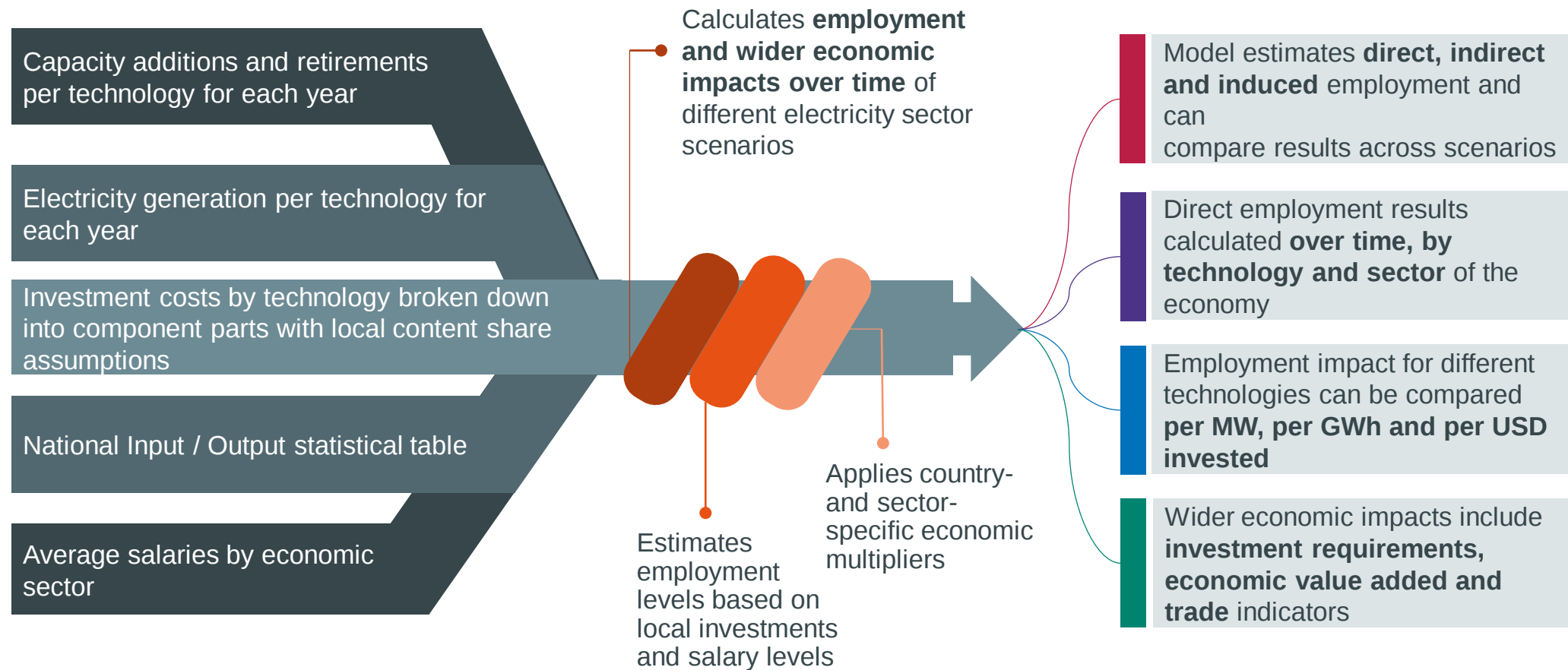
Compares the magnitude of health impacts under different scenarios across both existing and planned plants



Interactive web application available for a number of countries



EIM-ES inputs, calcs and outputs



EV policy impact assessment tool

compass
toolbox



Tool to estimate future share of new electric vehicles sales and share of EVs in the light duty vehicle fleet



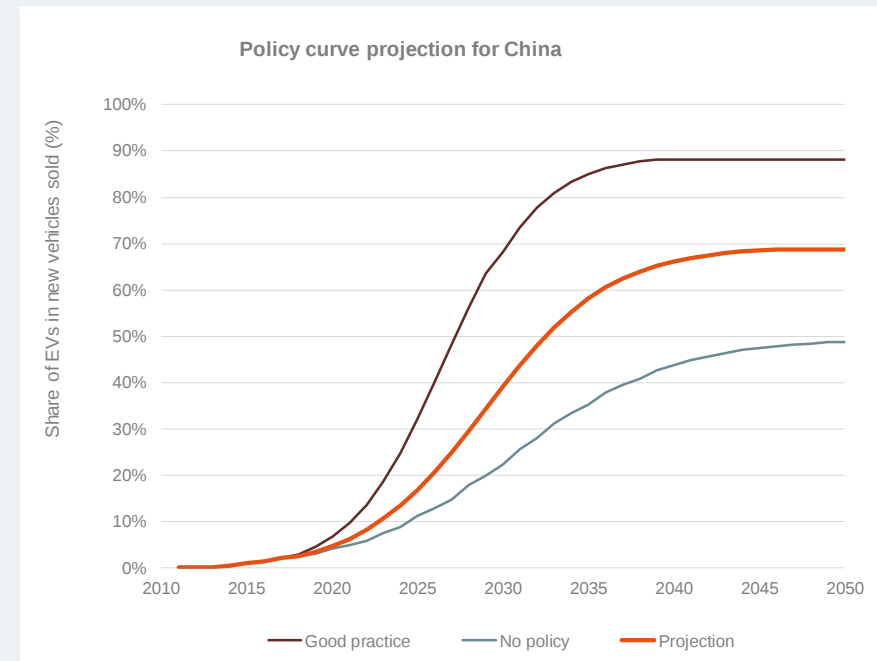
Based on an assessment on the status of policy implementation



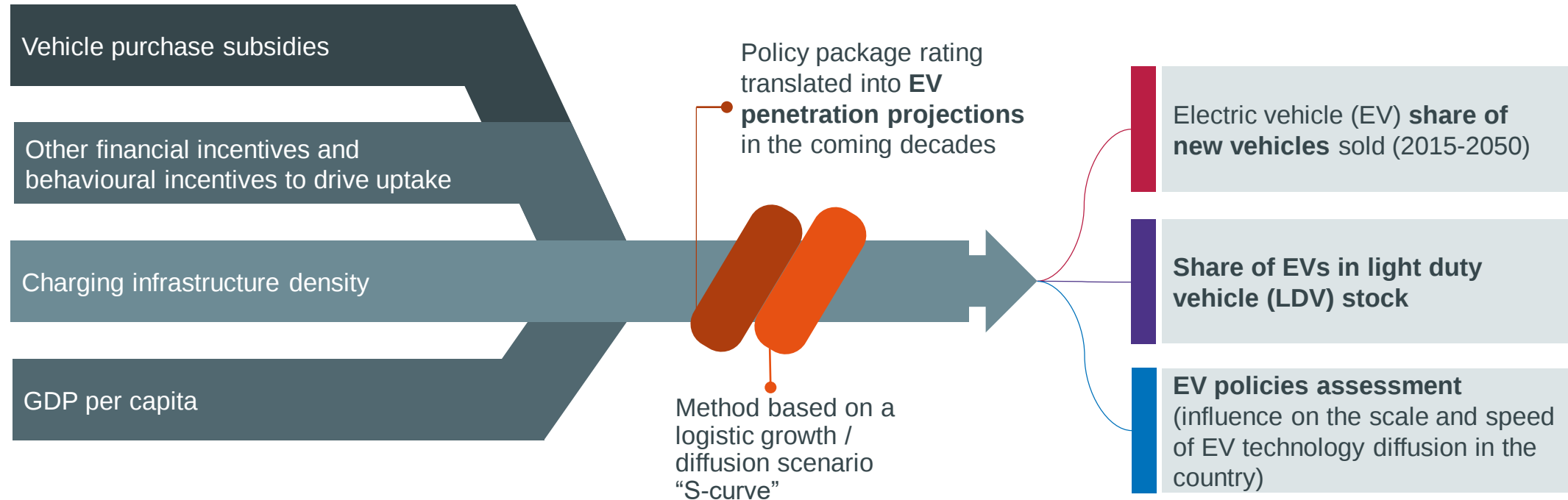
Contains an interactive dashboard that allows users to adjust settings that describe the policies driving EV penetration in a country



Results can be used in PROSPECTS+



EV policy impact tool inputs, calcs and outputs



INPUTS

CALCULATIONS

OUTPUTS

RE policy impact assessment tool

compass
toolbox



Tool that supports estimation of future share of variable renewables in electricity generation mix



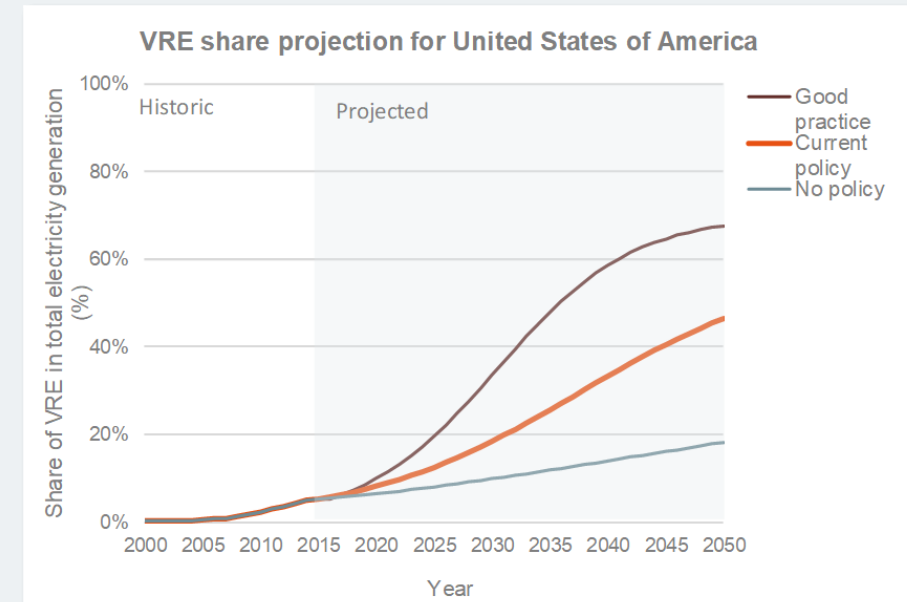
Based on an assessment on the status of policy implementation in a country



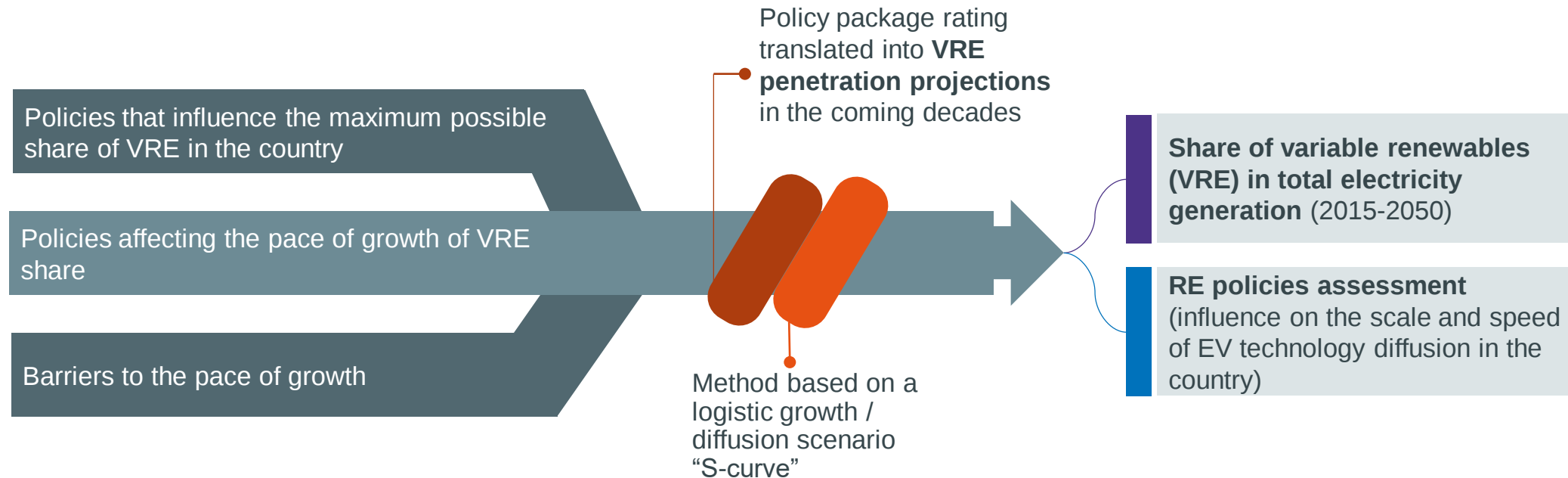
Contains an interactive dashboard that allows the user to adjust settings that describe the policies driving RE development in a country



Results can be used in PROSPECTS+



RE policy impact tool inputs, calcs and outputs



INPUTS

CALCULATIONS

OUTPUTS

SDG Climate Action Nexus

// SCAN-tool



Provides high-level guidance on how mitigation actions can impact achievement of the SDGs



User-friendly, interactive web tool that does not require any inputs



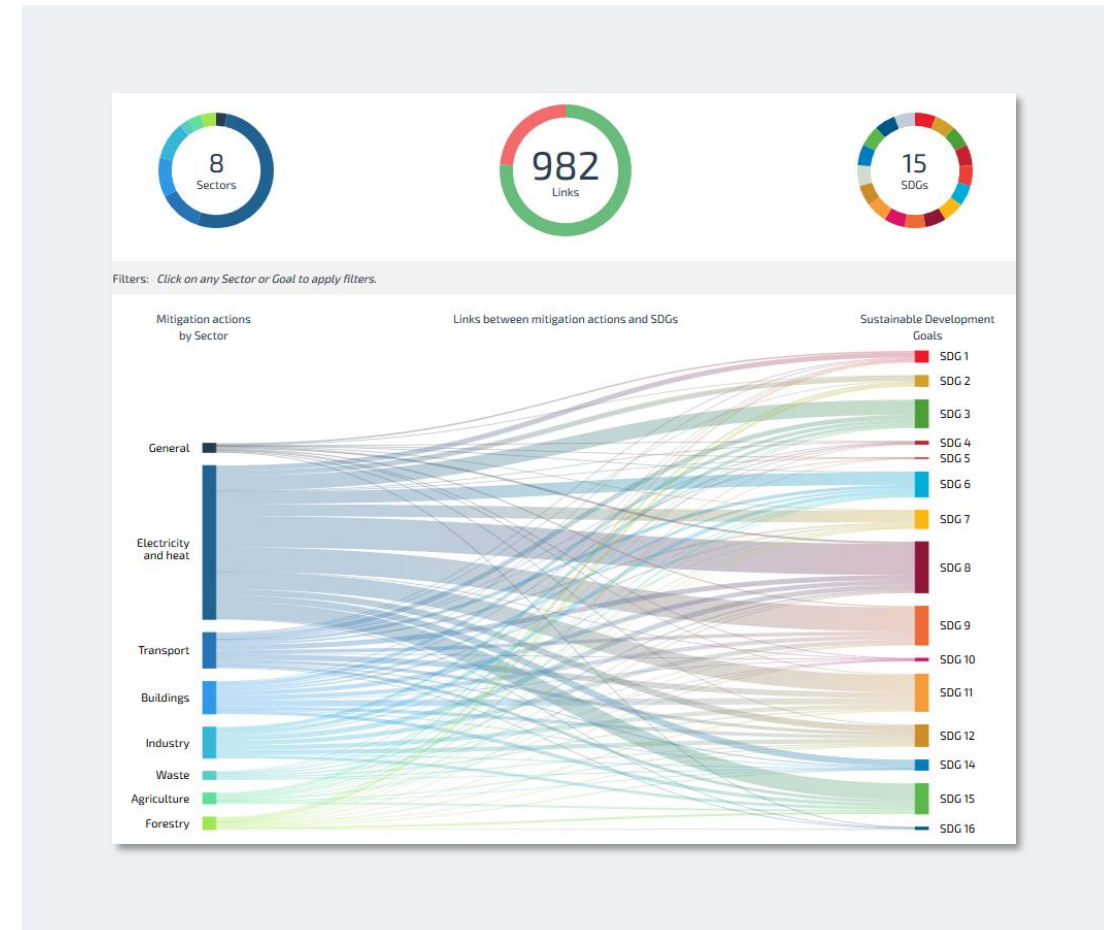
Highlights synergies with the development agenda to improve political buy-in for climate action



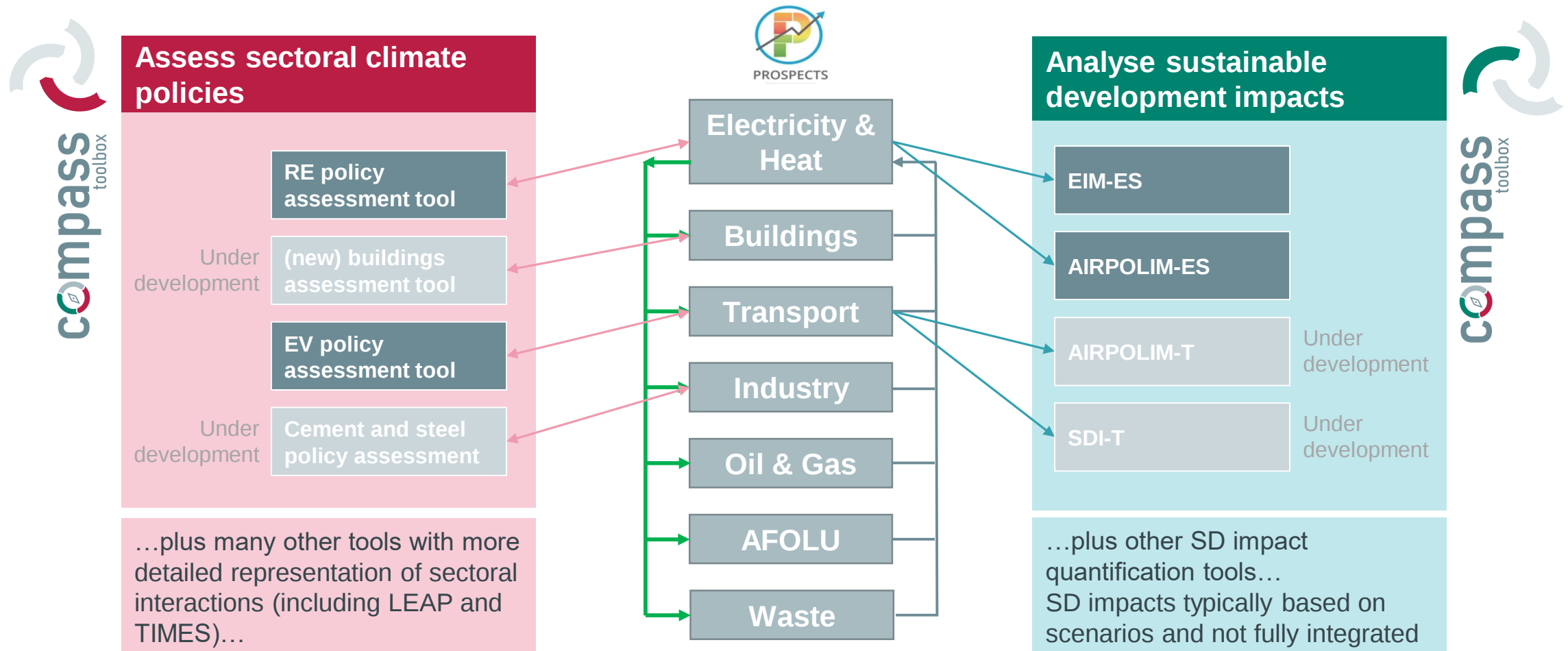
Can support policy makers to achieve greater policy coherence



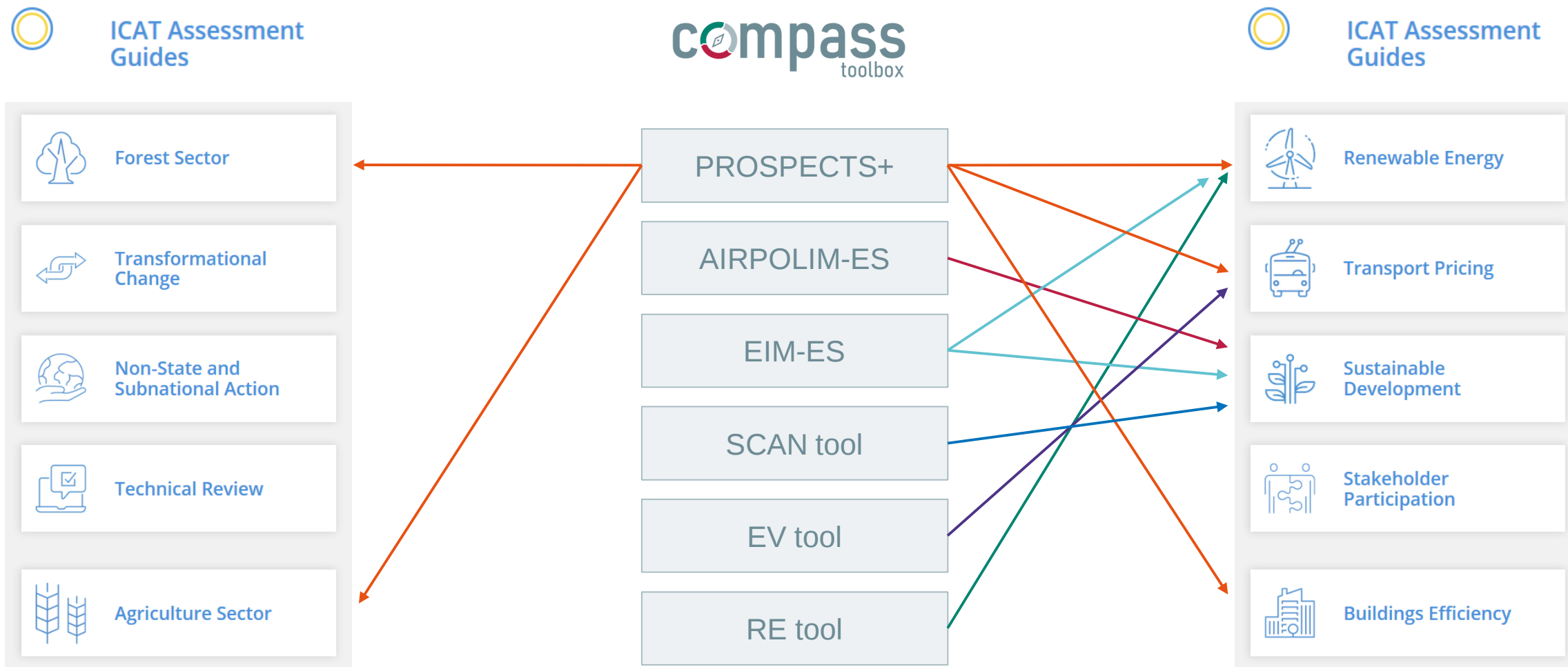
Can support policy makers to achieve greater policy coherence



PROSPECTS+ can act as a shell tool for linking sectoral and non-climate deep-dive analysis



Links between ICAT guides and compass tools





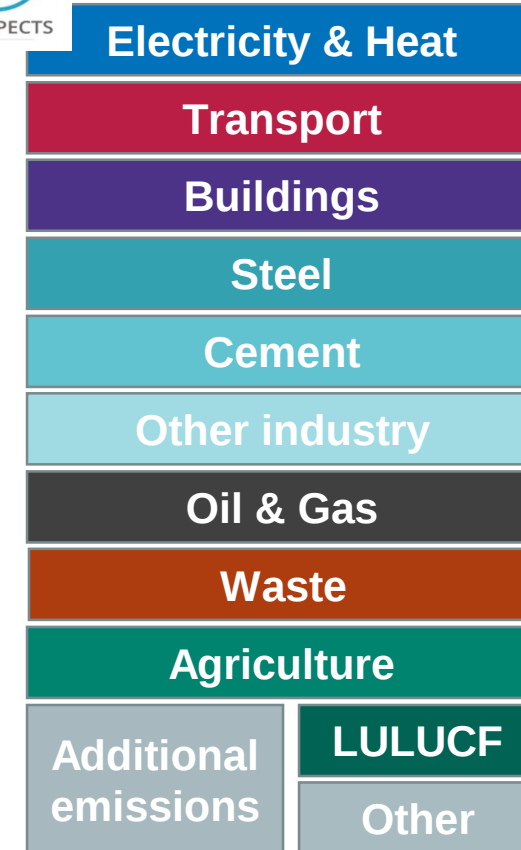
Expansion of PROSPECTS+



Alignment with IPCC reporting
categories and improved representation
of AFOLU sector

Alignment of PROSPECTS+ to IPCC reporting categories

- » PROSPECTS+ is structured around the following key GHG emitting sectors (right)
- » Availability of calculation options for emissions analysis and their granularity varies across the different sectors
- » Updated version of PROSPECTS+ includes option of incorporating **LULUCF emissions**, broken down into the following categories (IPCC 2006 / FAO):
 - Forest land; Cropland; Grassland; Wetlands; Settlements; Other land; Harvested wood products; Other
- » These can be input by the user, potentially informed by analysis conducted in other more detailed sectoral modelling tools (no calculation options in PROSPECTS+)
- » A table for **Other emissions** is also included which allows the user to add IPCC emissions source categories not otherwise covered in the main sectors of the model
- » Both **LULUCF** and **Other** emission categories are also integrated into the main results dashboard to compare their relative importance with emissions from other sectors (Note: LULUCF appears as a line which can be net positive or negative)



★ New
★ New

IPCC category ID	IPCC categories of emissions	In PROSPECTS+	PROSPECTS sector	Comments
1	Energy	Partial	Various, see sub-categories	
1A	Fuel combustion activities	Partial	Various, see sub-categories	
1A1	Energy industries	Partial	Various, see sub-categories	
1A1a	a. Public electricity and heat production	Yes	Electricity & heat sector	Including autoproducers, which is partly covered in industry in IPCC reporting
1A1b	b. Petroleum refining	Yes	Industry	
1A1c	c. Manufacture of solid fuels and other energy industries	Partial	Iron & steel	Coke emissions/production included in steel sector; other category emissions can be entered via the 'Additional emissions' Wizard
1A2	Manufacturing industries and construction	Yes	Various, see sub-categories	
1A2a	a. Iron and steel	Yes	Iron & steel	
1A2b	b. Non-ferrous metals	Yes	Heavy industry	
1A2c	c. Chemicals	Yes	Heavy industry	
1A2d	d. Pulp, paper and print	Yes	Heavy industry	
1A2e	e. Food processing, beverages and tobacco	Yes	Light industry	
1A2f	f. Non-metallic minerals	Yes	Cement	Process emissions from cement industry
1A2g	g. Other (please specify)	Yes	Light industry	
1A3	Transport	Yes		
1A3a	a. Domestic aviation	Yes		
1A3b	b. Road transportation	Yes		
1A3c	c. Railways	Yes	Passenger transport/ Freight transport	Breakdown included in non-simplified approach. In the simplified approach, transport is one sector.
1A3d	d. Domestic navigation	Yes		
1A3e	e. Other transportation	Yes		
1A4	Other sectors	Yes	Various, see sub-categories	
1A4a	a. Commercial/institutional	Yes	Buildings: Residential	In non-simplified approach. In the simplified approach, buildings is one sector.
1A4b	b. Residential	Yes	Buildings: Commercial	
1A4c	c. Agriculture/forestry/fishing	Partial	Agriculture	Only agriculture included; fishing and forestry can be entered via the 'Additional emissions' Wizard
1A5	Other	No		Can be entered via the 'Additional emissions' Wizard
1A5a	a. Stationary	No		Can be entered via the 'Additional emissions' Wizard
1A5b	b. Mobile	No		Can be entered via the 'Additional emissions' Wizard
1B	Fugitive emissions from fuels	Partial	Oil & Gas	
1B1	Solid fuels	No		Can be entered via the 'Additional emissions' Wizard
1B1a	a. Coal mining and handling	No		Can be entered via the 'Additional emissions' Wizard
1B1b	b. Solid fuel transformation	No		Can be entered via the 'Additional emissions' Wizard
1B1c	c. Other	No		Can be entered via the 'Additional emissions' Wizard
1B2	Oil and natural gas and other emissions from energy production	Partial		
1B2a	a. Oil	Yes	Oil & Gas	
1B2b	b. Natural gas	Yes		
1B2c	c. Venting and flaring	Yes		
1B2d	d. Other	No		Can be entered via the 'Additional emissions' Wizard
1C	Carbon dioxide transport and storage	No		Can be entered via the 'Additional emissions' Wizard
1D	Bunkers	Partial		
	International aviation (aviation bunkers)	Yes	Transport: International aviation	
	International navigation (marine bunkers)	No		Can be entered via the 'Additional emissions' Wizard

IPCC category ID	IPCC categories of emissions	In PROSPECTS+	PROSPECTS sector	Comments
2	Industrial processes and product use	Yes	Various, see sub-categories	
2A	A. Mineral industry	Yes	Cement Other industry (Light and Heavy)	Other industry is not broken down into sub-categories 2B-2H in PROSPECTS+
2B	B. Chemical industry	Yes		
2C	C. Metal industry	Yes		
2D	D. Non-energy products from fuels and solvent use	Yes		
2E	E. Electronics industry	Yes		
2F	F. Product uses as substitutes for ODS	Yes		
2G	G. Other product manufacture and use	Yes		
2H	H. Other	Yes		
3	Agriculture	Partial	Agriculture	
3A	A. Enteric fermentation	Yes	Agriculture	
3B	B. Manure management	Yes		
3C	C. Rice cultivation	Yes		
3D	D. Agricultural soils	Yes		
3E	E. Prescribed burning of savannas	No		Can be entered via the 'Additional emissions' Wizard
3F	F. Field burning of agricultural residues	No		Can be entered via the 'Additional emissions' Wizard
3G	G. Liming	No		Can be entered via the 'Additional emissions' Wizard
3H	H. Urea application	No		Can be entered via the 'Additional emissions' Wizard
3I	I. Other carbon-containing fertilizers	No		Can be entered via the 'Additional emissions' Wizard
3J	J. Other (please specify)	No		Can be entered via the 'Additional emissions' Wizard
4	LULUCF	No		
4A	A. Forest land	No		Can be entered via the 'Additional emissions' Wizard
4B	B. Cropland	No		Can be entered via the 'Additional emissions' Wizard
4C	C. Grassland	No		Can be entered via the 'Additional emissions' Wizard
4D	D. Wetlands	No		Can be entered via the 'Additional emissions' Wizard
4E	E. Settlements	No		Can be entered via the 'Additional emissions' Wizard
4F	F. Other land	No		Can be entered via the 'Additional emissions' Wizard
4G	G. Harvested wood products	No		Can be entered via the 'Additional emissions' Wizard
4H	H. Other (please specify)	No		Can be entered via the 'Additional emissions' Wizard
5	Waste	Partial	Waste	
5A	A. Solid waste disposal	Yes	Waste	
5B	B. Biological treatment of solid waste	Yes	Waste	
5C	C. Incineration and open burning of waste	No		Can be entered via the 'Additional emissions' Wizard
5D	D. Wastewater treatment and discharge	Yes	Waste	
5E	E. Other	No		Can be entered via the 'Additional emissions' Wizard
6	Other	No		Can be entered via the 'Additional emissions' Wizard

Representation of the AFOLU sector in PROSPECTS+

» **Agriculture emissions** already represented in PROSPECTS+ covering main sources of emissions:

- Rice cultivation
- Soils management
- Meat and dairy demand (i.e. livestock production)
- Fertiliser use
- Manure management
- Energy use in agriculture (forestry and fishing sector energy use can also be included)

» **LULUCF net emissions** can now be included in PROSPECTS+ as exogenous entries (no calculations)

» **Remaining AFOLU sources of emissions and sinks** can also be included as exogenous data entries to provide a complete picture of national emissions, including:

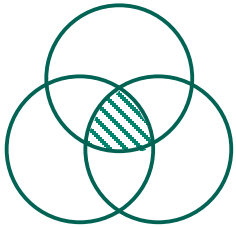
- Energy use in forestry and fishing
- Prescribed burning of savannas
- Field burning of agricultural residues
- Liming / urea application / and other fertilizers

Existing tools for modelling agriculture and forestry emissions scenarios



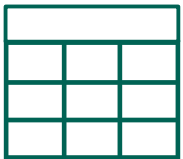
» Several tools exist for both agriculture and forestry

- AFOLU carbon calculator, FABLE, EX-ACT, ALU, AFD Carbon Footprint tool for projects, Carbon Farming Group Calculator, CFF Carbon Calculator, FarmGas, Holos etc.



» Common characteristics:

- Starting point: follow the IPCC GHG inventory method for GHG emissions quantification
- Designed for application to specific project/land response option (inadequate for global or multi-country emission quantification)
- Scenarios for food demand and drivers of LUC/deforestation limited



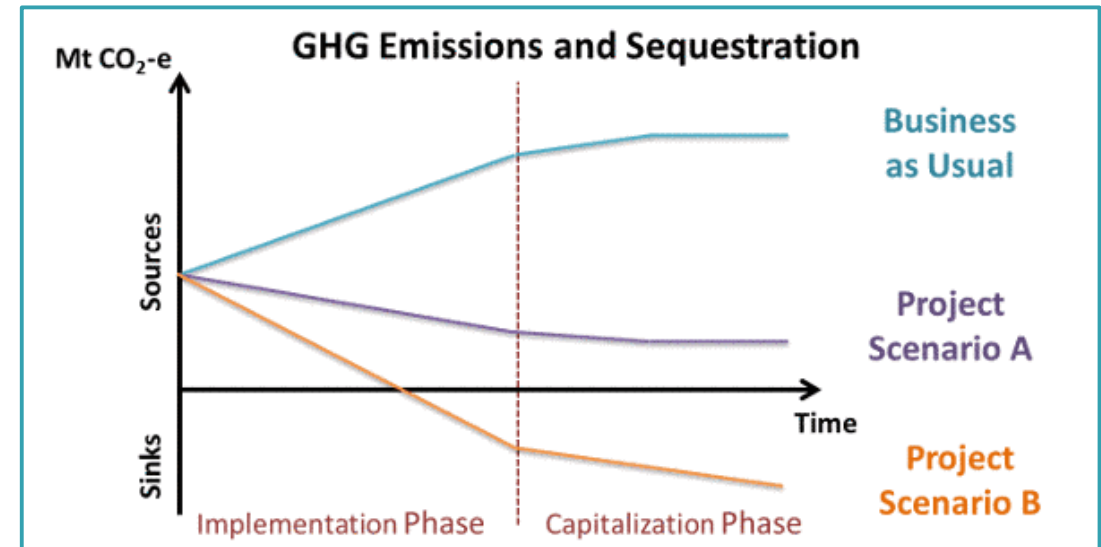
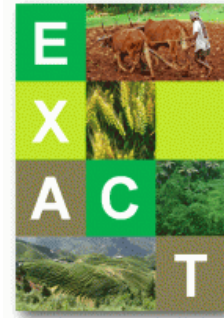
» Two excel-based tools stand out for evaluating the effects of various land response options and alternative agriculture and land use policy scenarios:

FABLE calculator developed by the FABLE consortium led by IIASA

EX-Ante Carbon-balance Tool (EX-ACT) developed by FAO

Ex-Ante Carbon-balance Tool // EX-ACT

- » EX-ACT is a land-based accounting system, estimating C stock changes (emissions or sinks of CO₂) and GHG emissions
- » Used for ex-ante evaluations of projects, programmes and policies
- » While mostly used at project level it may be up-scaled to the programme or sector level
- » Compares a project outcome to a business as usual (BAU) scenario looking at two different time horizons: implementation phase and capitalisation phase
- » Can be applied to a wide range of projects from all AFOLU sub-sectors including specific fishery or agroforestry projects



Comparison of land response coverage between tools

Response options		PROSPECTS+	FABLE	EX-ACT
Agriculture	Increased food productivity			
	Agroforestry			
	Improved cropland management			
	Improved livestock management			
	Agricultural diversification			
	Improved grazing land management			
	Integrated water management (inc. rice cultivation)			
	Reduced grassland conversion to cropland			
Forest	Forest management			
	Reduced deforestation and forest degradation			
Soils	Increased soil organic carbon content			
	Reduced soil erosion			
	Reduced soil salinisation			
	Reduced soil compaction			
Other ecosystems	Fire management			
	Reduced landslides and natural hazards			
	Reduced pollution including acidification			
	Restoration & reduced conversion of coastal wetlands			
	Restoration & reduced conversion of peatlands			
Demand	Reduced post-harvest losses			
	Dietary change			BAU demand trends
	Reduced food waste (consumer or retailer)			
Supply	Sustainable sourcing		trade scenarios	
	Improved food processing and retailing		unclear	
	Improved energy use in food systems			
Land use change	Bioenergy and BECCS		may be added	
	Reforestation and forest restoration			
	Afforestation			

» Scenarios for food demand and diets

- FABLE: several scenarios based on population projections, GDP, food loss and diet...etc.
- Ex-Act: simple food demand projections for 2030 and 2050 based on BAU trends

» Scenarios for forestry and LULCC

- FABLE: limited to land expansion (allowed, not allowed, limited)
- Ex-Act: projection based on BAU trends

» Demand for non-food commodities (e.g. bioenergy crops, wood)

- FABLE: fixed to 2010
- Ex-Act: not represented

Representation in tool

Low Medium High No

Potential scale of impact (FAO)

Large mitigation impact

Moderate mitigation impact

Small mitigation impact

Negligible mitigation impact

No data on mitigation impact

PROSPECTS+ land response functionality is limited but allows users to input data for missing items

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	Reforestation and forest restoration			
	Afforestation			

» PROSPECTS+ does not provide calculation options for the following important response options:

- Agroforestry
- Forests
- Fire management
- Wetland and peatland protection and restoration
- Demand-side mitigation options (diet, food waste, post-harvest losses)
- Bioenergy
- Reforestation and afforestation

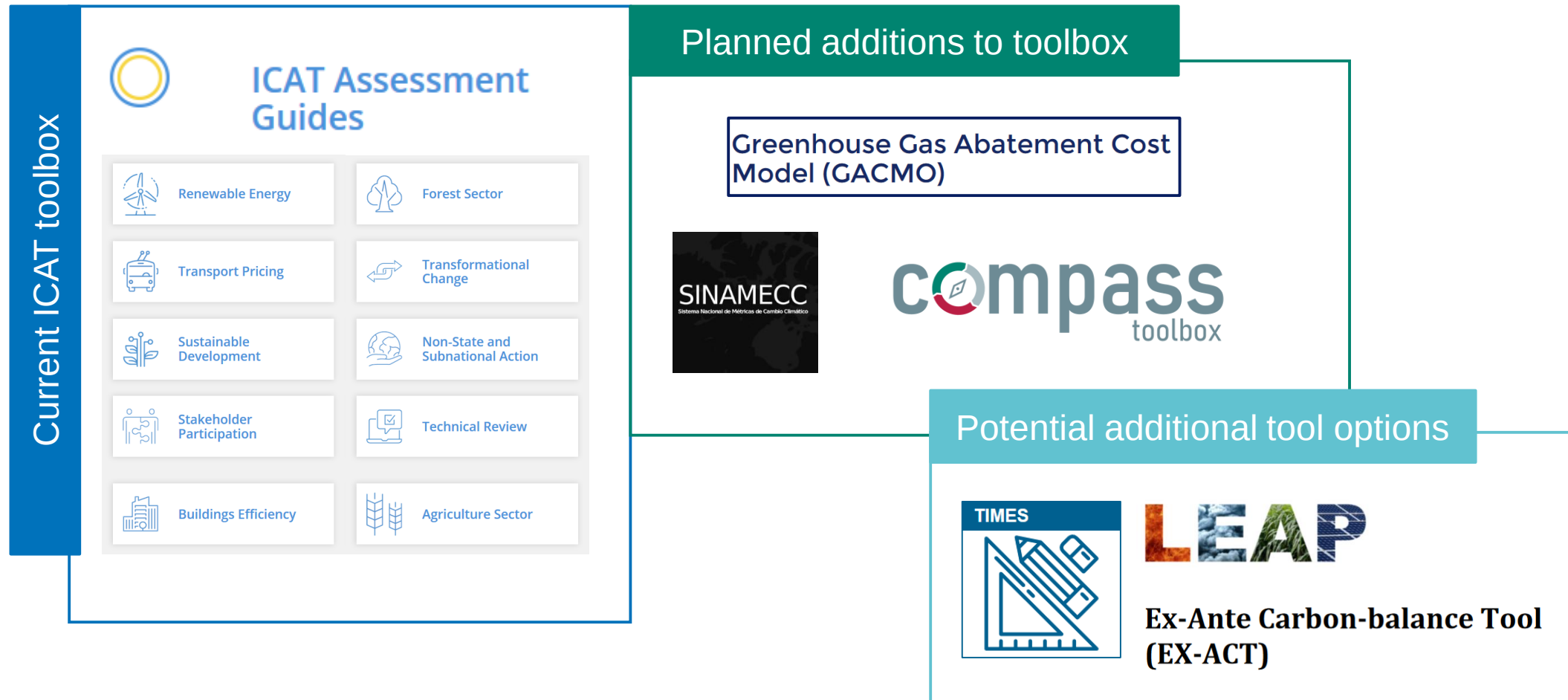
» Latest version of model allows user to insert (net) emission data for all AFOLU categories not covered by calculations from external sources / exogenous modelling

Initial user guidance for tool application

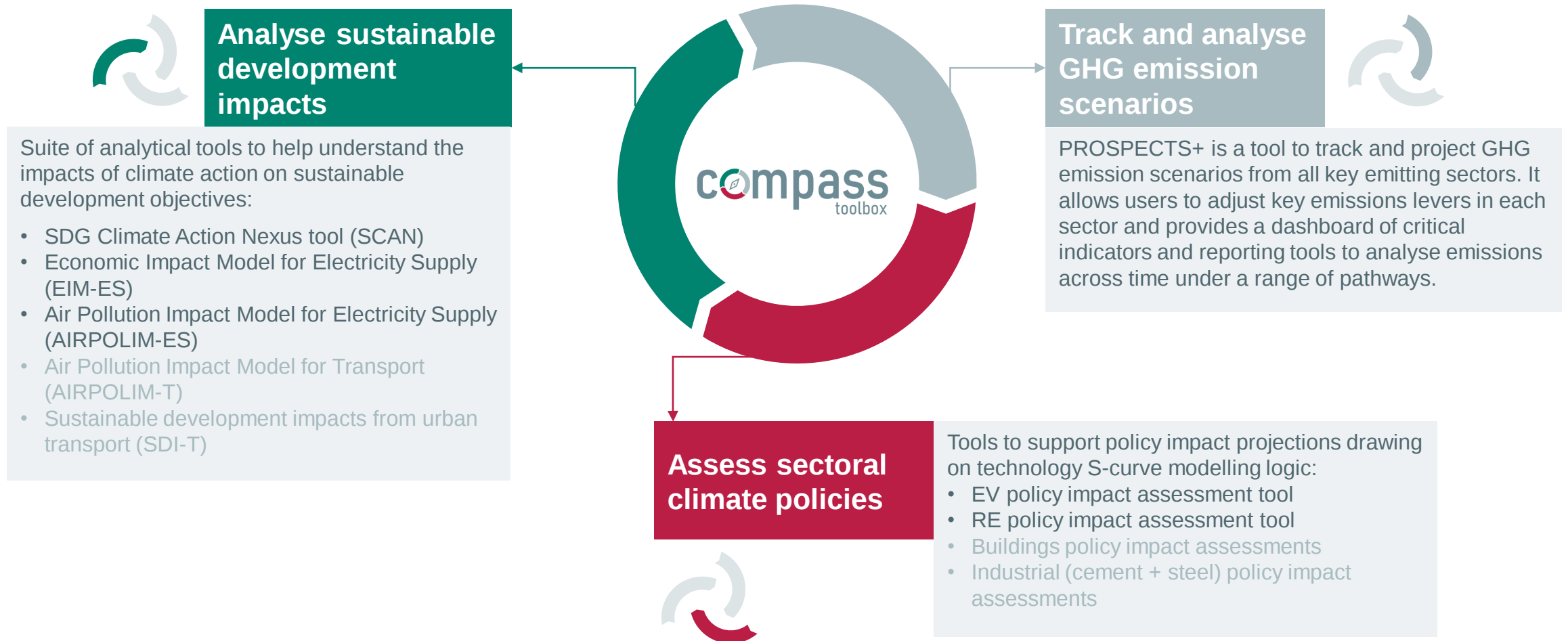


Selecting tools for modelling climate scenarios

Overview of ICAT toolbox



COMPASS: navigating climate action impacts

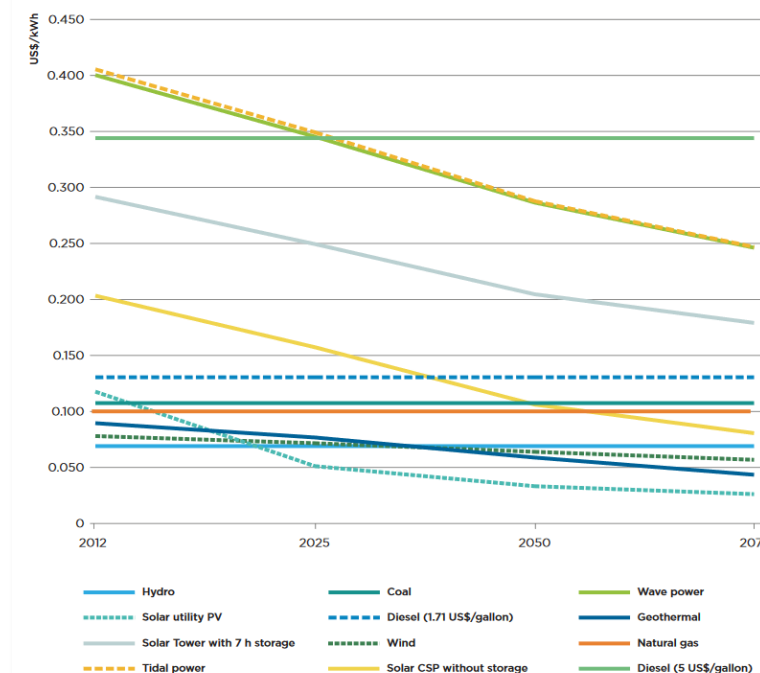


» Greenhouse gas Abatement Cost Model

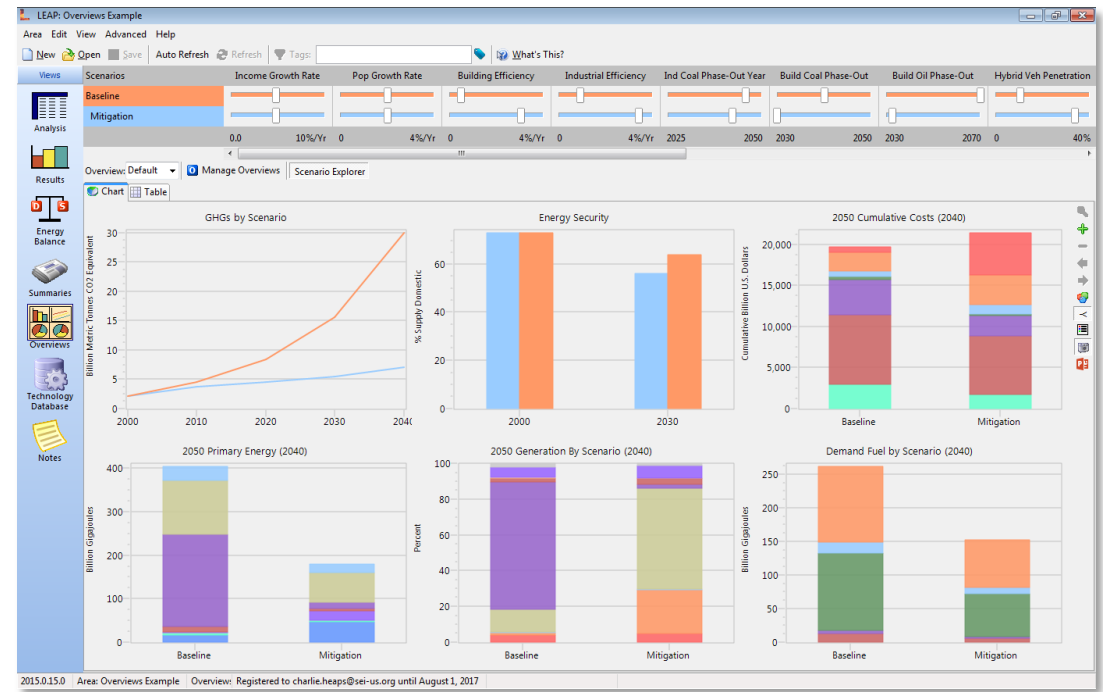
- » Using the latest data on energy consumption of fossil fuels and electricity, divided into sectors, the model calculates the greenhouse gas emissions for a “start year”, with growth factors for each sector a baseline for BAU scenario until 2020, 2025, 2030, and 2050
- » Based on this model, countries can then calculate and track the GHG reduction and economic effects of about 100 climate mitigation actions organised in the 24 types that have been used in the CDM Pipeline



Figure 2.7 – Estimated learning curves for renewables expressed in projected LCOEs.



- » Scenario-based energy-environment modeling tool that accounts for how energy is consumed, converted and produced in a given energy system
- » LEAP supports energy demand analyses as well as detailed stock-turnover modeling for transportation
- » LEAP models both capacity expansion and plant dispatch in the power sector.
- » LEAP can be used to calculate the emissions profiles and to create scenarios of non-energy sector emissions and sinks (e.g. cement production, LULUCF, waste, etc.)

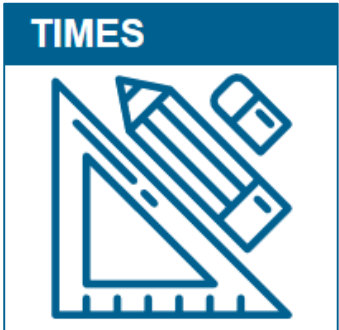


LEAP Integrated Benefits Calculator

- » LEAP add-on module called the Integrated Benefits Calculator (IBC)
- » Translates LEAP's existing emissions scenarios into
 - air pollution-associated health (premature mortality)
 - air pollution-associated ecosystem (crop yield loss) impacts
 - climate (global temperature change) impacts
- » Estimations are based on emissions inventories and projections developed in LEAP for one or more particular countries



Other models

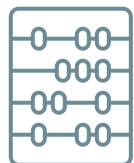


- » The TIMES (The Integrated MARKAL-EFOM System) model is a technology rich, bottom-up model generator, which uses linear-programming to produce a least-cost energy system
- » Combines a technical engineering and economic approach
- » Used for "the exploration of possible energy futures based on contrasted scenarios"



- » SINAMECC is a data box for the collection, monitoring, and reporting of data related to climate change at the national, territorial, sectoral, and climate action level
- » Objectives: 1) Monitoring and accountability, 2) Facilitate decision-making based on data; 3) Facilitate access to climate change data
- » Includes data on mitigation, adaptation, climate finance and co-benefits

Users have a range of different headline aims...



Understanding GHG emissions and their key drivers

Support the construction of GHG inventories across key emitting sectors; enable an overview of national emissions by source; and provide a basic set of tools to show the impact of adjusting key levers over time, such as economic growth, activity levels or sectoral energy and emissions intensities



Developing and comparing emission pathways

Build emission projections by sector / source with linkages (e.g. electricity and transport sectors) to compare a range of future pathways informed by scenarios, policies or targets, e.g. LTS development



Assessing the wider sustainable development impacts of emission pathways

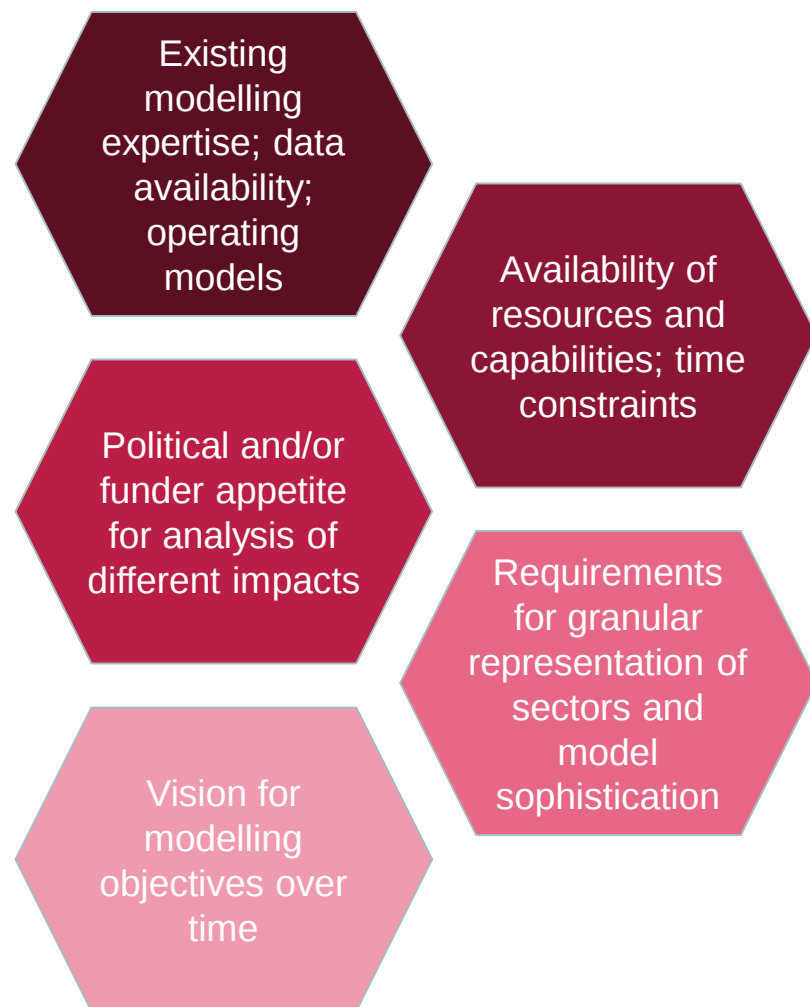
Identify and analyse the wider sustainable development impacts of emission pathways to enable a more comprehensive assessment of socioeconomic and environmental indicators



Integrated cost benefit analysis of climate policies and scenarios

Fully integrated emission pathway analyses with in-built sector linkages, optimisation of deployment, user defined technological and timing constraints and monetary quantification of an extensive range of socioeconomic and environmental indicators and implementation costs

As well as a number of constraints to consider...



Considerations

- **Match expertise and available data to models:** Using / building sophisticated tools with limited data can be resource intensive whilst providing limited or no advantages to using simpler models
- **Assess internal and external modelling resources:** Selecting models should take into account government-based expertise (including depth of resources) as well as national experts, from academia, consultancy and industry, who may be involved in providing technical assistance, data, review and validation
- **Understand the objectives for modelling over time can help inform the best tools to invest in today:** Building up expertise and stakeholder buy-in takes time and effort – switching between models as needs develop can be costly
- **Aligning impact assessment with national priorities:** Focusing on impact indicators that relate directly to national development priorities can channel resources effectively and facilitate engagement

Method and limitations

- **Guidance is based on desk-based research** without consultation of tool developers or extensive engagement from users
- **Experience of individuals working extensively with a range of different tools is limited**, which makes comparison difficult. In addition, existing studies typically consider high-level functionality of models with limited examination of their relative suitability for specific use cases.
- **Tool selection can often be a bespoke choice, based on individual preferences**, peer recommendations, marketing efforts, etc.; it is not necessarily driven by suitability to address national priorities, data availability and long term objectives
- **Guidance here considers a non-exhaustive selection of multi-sector tools.** A wide selection of “off-the-shelf” and “bespoke” tools are available that vary in terms of approach, sophistication (including data and expertise requirements) and sector representation. Government representatives responsible for climate change measures should consider sector specific tools used in other departments, e.g. transport, buildings, energy, agriculture and land use...etc.

Proposed 3-step approach to guide users in tool selection



Comparative mapping of tool features

Identification of main strengths and weaknesses amongst tools



Description of inputs / outputs and potential links between tools

Identification of potential synergies and information challenges



Representative user objectives across stages of policy cycle

Suitability matching and highlighting key considerations

Mapping of tool features provides insight into their relative advantages and trade-offs



Comparative mapping of tool features

Identification of main strengths and weaknesses amongst tools

We assess a **selection of attributes** covering the following themes:

FUNCTIONALITY

REPORTING

ACCESSIBILITY

ANALYTICAL OPTIONS

Colour coding offers an indicative assessment of the respective credentials of **GACMO**, **PROSPECTS+** and **LEAP** for each attribute.

Lowest suitability
match of the three

Middle option

Highest suitability
match of the three

Note, the shading **does not reflect any assessment of the relative importance of the individual attribute**. In some cases suitability will depend on user preferences and specific use cases.

We exclude **TIMES** from the colour coding as it has a more focused (energy sector) remit to the other tools.



Attribute comparison: FUNCTIONALITY



FUNCTIONALITY	Coverage of emission sources	High-level	Mid / High-level	More detailed, particularly for energy sector	Detailed focus on energy sector
	Breadth/ granularity of technology	Mid breadth / limited granularity	Low-Mid	Low to high (user defined)	High
	Sectoral interlinkages	No	Energy supply and demand	Energy and some material flows	Energy and some material flows
	Temporal granularity	2020, 2025, 2030, 2050	Annual to 2050	Annual, unlimited timeframe. Within-year breakdown for seasonal and hourly variations.	Annual / multi-year time steps. Within-year breakdown for seasonal and hourly variations.
	Representation of costs	Yes (limited variation over time)	No	Yes (annual variation)	Yes
	Optimisation functionality	No	No	Within electricity supply sector	Yes, within energy system
	Summary	Low	Low	Mid	High

Attribute comparison: ACCESSIBILITY (1)



ACCESSIBILITY	Platform	Excel, open-source	Excel, open-source	Windows relational database; requires licence	Windows; requires licence (for GAMS)
	User fee	Free	Free; optional use of IEA input data requires licence	Free to certain users in low & middle-income countries; fee charged for others	Fee charged for GAMS license and user tools (e.g. interface)
	User guidance	Limited	Limited	Extensive	Limited
	User community	Limited	None	Extensive	Mid
	Language options	English	English	Multiple: English, French, Spanish, Chinese, Portuguese + others under development	English
	Ease of navigation	High	Mid	High	Mid

Attribute comparison: ACCESSIBILITY (2)



ACCESSIBILITY	Training requirements	Low	Low-Mid	Mid	High
	Data input requirements	Low	Low-Mid	Low-Mid-High	High
	Expertise required	Low-intermediate knowledge of GHG mitigation options	Intermediate sectoral knowledge and Excel skills	Low-high, depending on level of use and application of technical options	Low
	Level of effort to conduct analysis	Low	Mid	Low-High	Mid
	Calculation transparency	High	High	Mid	Low
	Summary	High accessibility; limited guidance support	High-Mid accessibility; limited guidance support	Mid accessibility; extensive guidance support	Low-mid accessibility; mid guidance support

Attribute comparison: REPORTING



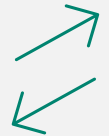
REPORTING	Addresses UNFCCC reporting	Mid	High-Mid	High-Mid	Limited to energy sector
	Output dashboard	Low	Mid	High	Mid
	Granularity of output	Low	Mid-High	High	High
	Transparent input references	High, in Excel	High, in Excel	High, Notes View	Limited
	Summary	Limited granularity and summary outputs	Mid granularity with high-level summary outputs	High-Mid granularity with wide range of output options	Limited to energy sector

Attribute comparison: ANALYTICAL OPTIONS



ANALYTICAL OPTIONS	Scenario building and analysis	Limited to BAU and one alternative	Facilitates multi-scenario analysis (simulation possible)	Facilitates multi-scenario analysis and simulation	Facilitates multi-scenario analysis and simulation
	Assessment of non-climate SD impacts	None	None (energy security indicators under development)	Air pollution-related impacts on health and agriculture; energy security indicators	Energy security indicators
	Analysis of carbon pricing policies	No	No	In energy sector	In energy sector
	Analysis of other policy instruments	No	Limited to simple representation of emission standards or national/sector carbon budgets	Limited to emission standards for some technologies or national/sector carbon budgets	Emission standards, carbon budgets and additional flow constraints
	Linkages to other models	Low granularity limits linkage options	Yes, soft links to sector deep-dive modules and SD impact assessments	Yes, with API (programming code), or soft-links via Excel	High granularity facilitates many options for hard and soft links
	Summary	Analytical options limited to specific abatement measures	Facilitates multi-scenario analysis; deep-dive analysis requires links to other tools	Facilitates multi-scenario analysis and energy sector planning	Extensive analysis of energy sector and options for linking to other tools

Understanding links between climate mitigation and SD impact tools can help build synergies



Description of inputs / outputs and potential links between tools

Identification of potential synergies and information challenges

We focus on the **COMPASS** toolbox, including potential linkages with other tools as well as the potential use of PROSPECTS+ as a shell tool.

Analysis in GACMO, PROSPECTS+, LEAP, TIMES and many other tools can be fed into the EIM-ES and AIRPOLIM-ES (one way flow) to assess economic and health impacts for electricity supply scenarios.

PROSPECTS+ can also be used as a hub for more detailed sectoral analysis to show the national overview and high-level intensity and activity based indicators.

A wide range of sectoral specific and multi-sector analytical tools exist across all key emitting sectors, which we do not explore here. Potential linkages should be considered on a case-by-case basis.

compass
toolbox



GACMO



PROSPECTS

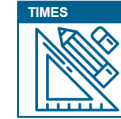
LEAP



Potential linkages between EIM-ES and selected climate mitigation modelling tools



INPUTS:



New capacity by tech and year

derived from gen / inter-year interpolation

derived from generation

Generation by tech and year

Inter-year interpolation

Investment by tech and type of cost

Some manipulation of costs required

external input

Local share of cost item

external input

external input

external input

external input

Sector of cost item

model default values or user defined

model default values or user defined

model default values or user defined

model default values or user defined

Input Output table

national statistics / OECD database

national statistics / OECD database

national statistics / OECD database

national statistics / OECD database

Salaries by sector

national statistics / UNIDO database

national statistics / UNIDO database

national statistics / UNIDO database

national statistics / UNIDO database

Potential linkages between AIRPOLIM-ES and selected climate mitigation modelling tools



INPUTS:

Individual power plant characteristics
Power plant operational assumptions
Population exposure estimates
Population characteristics
Scenario definitions



- coal plant tracker database + scen alignment
- can be informed by generation data
- GIS mapping
- public international sources
- Limited to one alternative scenario



- coal plant tracker database + scen alignment
- can be informed by generation data
- GIS mapping
- public international sources
-

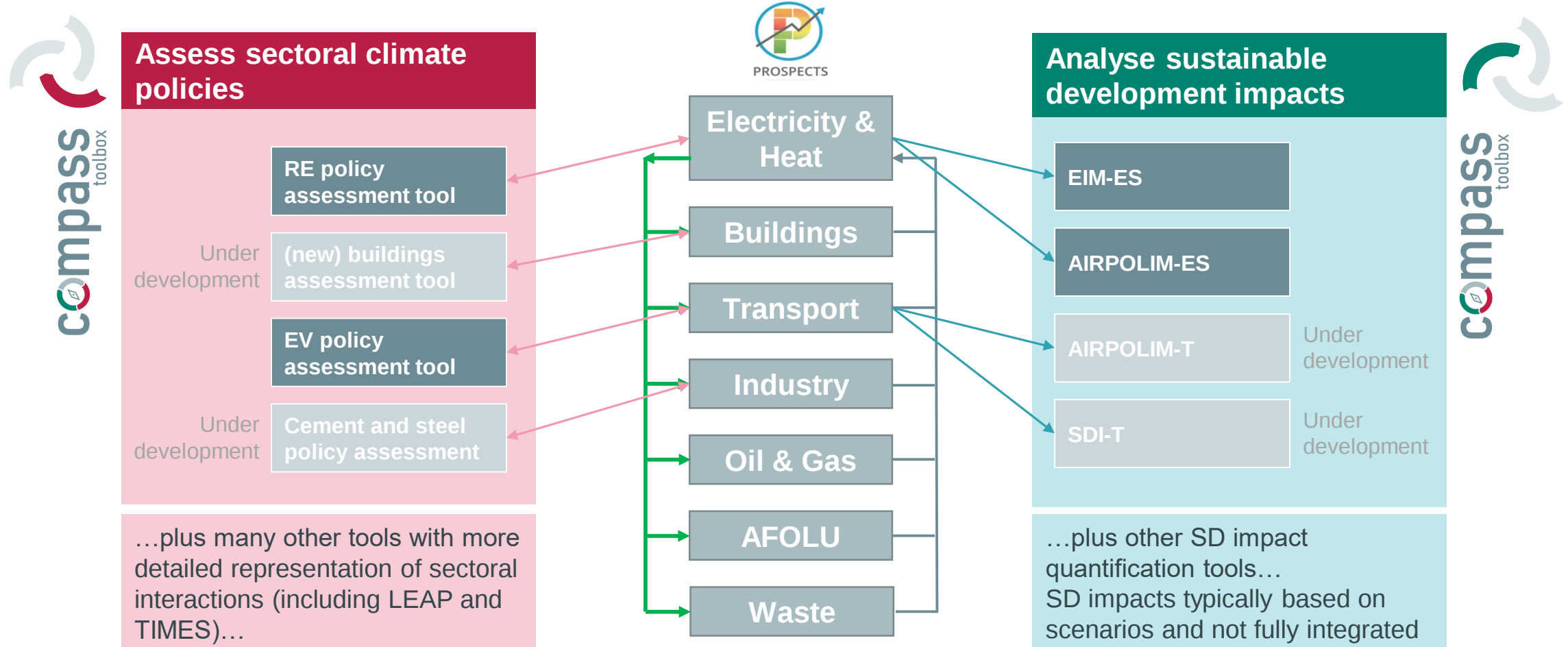


- coal plant tracker database + scen alignment
- can be informed by generation data
- GIS mapping
- public international sources
-



- depends on set up plant level representation
- depends on set up plant level representation
- GIS mapping
- public international sources
-

PROSPECTS+ can act as a shell tool for linking sectoral and non-climate deep-dive analysis



Use cases provide examples of suitability of tool applications in different contexts



Representative user objectives
across stages of policy cycle

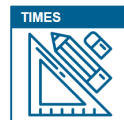
Suitability matching and
highlighting key considerations

We set out a number of use cases across different stages of the **climate change mitigation policy cycle**.

For each use case we indicate which of the selected tools can provide valuable contributions and set out some of their respective strengths.

Use cases are identified to provide a **representative set of key questions and challenges** facing government representatives responsible for coordinating national efforts to address climate change through mitigation measures.

They are **non-exhaustive and focus on relatively high-level considerations**. More detailed sub-levels of these use cases and sector specific questions are beyond the scope of this indicative guidance.

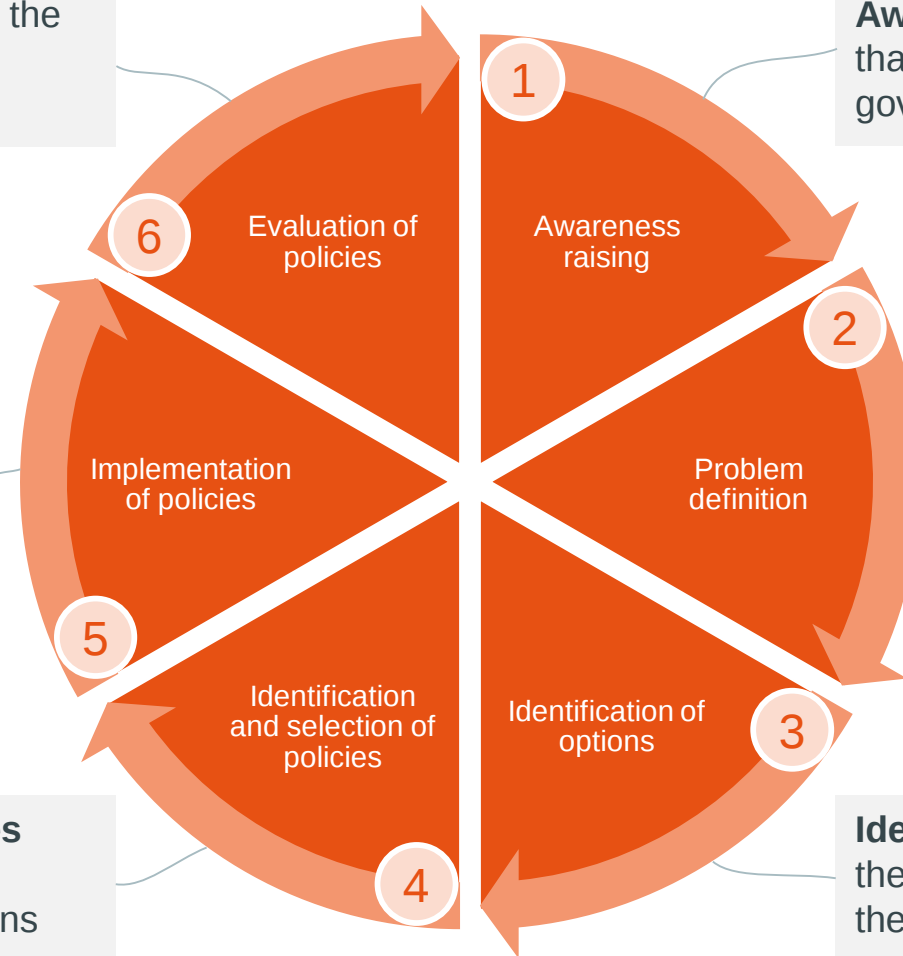


Different tools are more suited to different stages of the policy cycle



Evaluation of policies stage assesses the efficiency and effectiveness of policy instruments in addressing the problem

Awareness raising stage identifies issues that may need to be addressed by government action



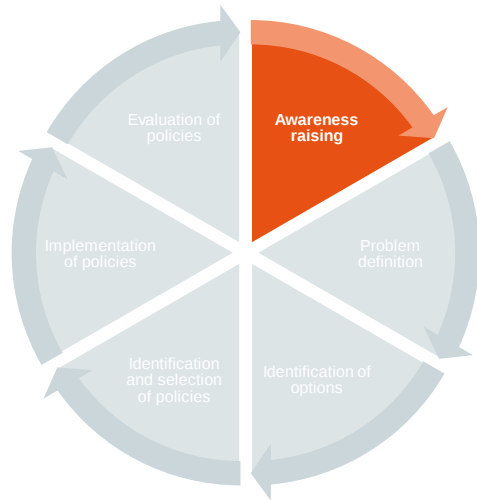
Implementation of policies stage puts in place the policies that facilitate the most attractive solutions to the problem

Problem definition stage clarifies what needs to be achieved, when and across which sectors

Identification and selection of policies stage assesses the role for policy instruments to facilitate potential solutions

Identification of options stage evaluates the range of possible solutions to address the problem

Awareness raising stage identifies issues that may need to be addressed by government action

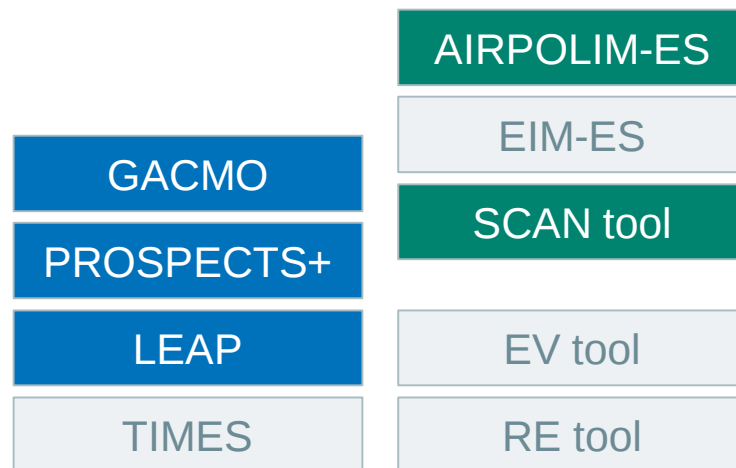


Use cases

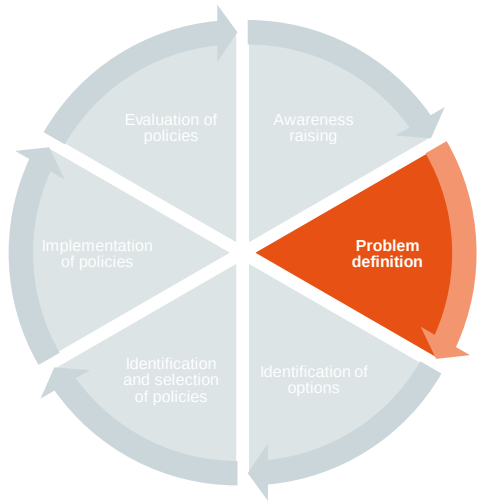
- Construction of GHG inventories
- Overview of national emissions by sector
- Track developments of emissions and progress towards targets (NDCs)
- Identify sustainable development impacts associated with emissions intensive activities

Tool insights

- **GACMO**, **PROSPECTS+** and **LEAP** can all assist in building GHG inventories and providing an overview of national emissions.
- **LEAP** and **PROSPECTS+** capture historic data and can help in tracking developments over time. **LEAP** offers a wider range of indicators across sectors.
- **SCAN tool** provides interactive (web tool) high-level identification of potential non-climate impacts associated with sources of GHG emissions.
- **AIRPOLIM-ES** can show health impacts of power plants across affected populations via web tool (limited country coverage) or country-level Excel tool analysis (relatively easy set up).



Problem definition stage clarifies what needs to be achieved, when and across which sectors

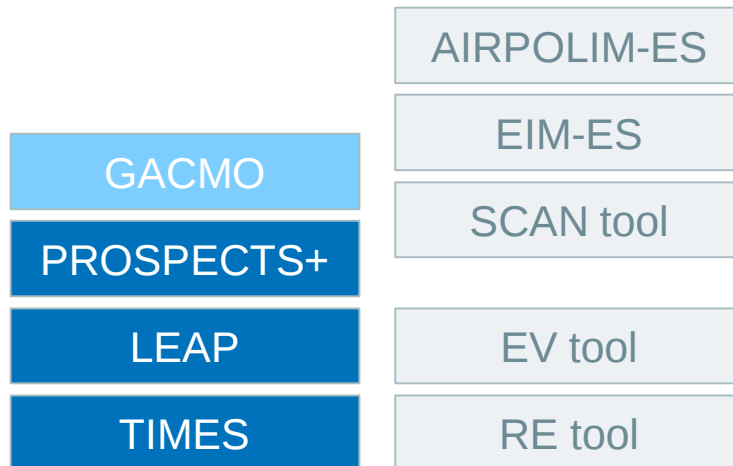


Use cases

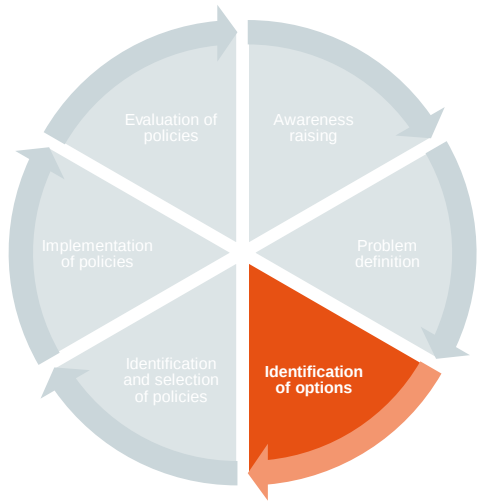
- Define ambitious GHG emission reduction pathways and targets, e.g. LTS and NDC
- Develop and compare different GHG emission scenario projections
- Identification of key emissions drivers and sector interdependencies

Tool insights

- **GACMO** provides an accessible means to consider mitigation action specific, sectoral and national targets.
- **LEAP** and **PROSPECTS+** offer functionality to conduct more sophisticated pathway analysis across all emission sources (e.g. current policy or Paris compatible trajectories); identify emission drivers; and understand sector interdependencies (e.g. electrification of energy demand).
- **TIMES** provides a further level of sophistication to explore GHG emission drivers within energy supply and demand sectors, but excludes non-energy sector emissions.



Identification of options stage evaluates the range of possible solutions to address the problem

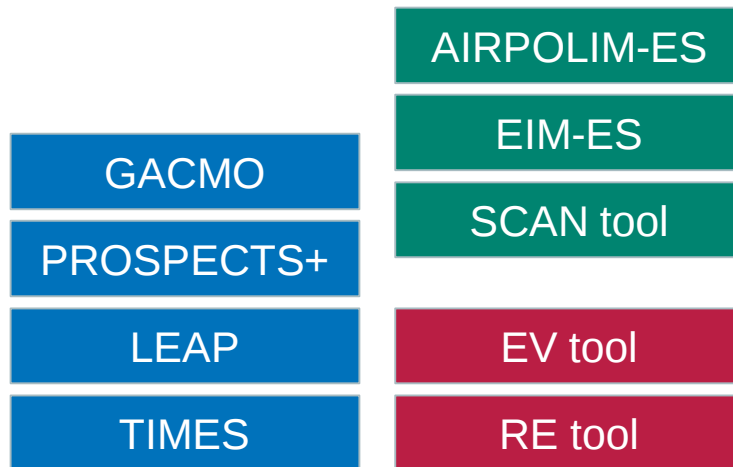


Use cases

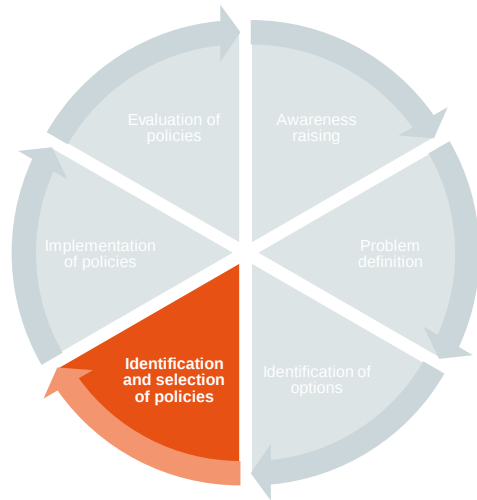
- Exploration and quantification of mitigation options
- Scenario analysis for range of alternative decarbonisation pathways
 - Identification of costs, resource requirements and other barriers
 - Optimised planning to minimise emissions and/or costs
 - Identification of non-climate sustainable development impacts

Tool insights

- **GACMO** allows users to focus on emissions and cost implications for specific mitigation options.
- **PROSPECTS+** is more suited to scenario analysis and understanding activity/intensity levers. No consideration of cost and sector granularity is limited.
- **LEAP** offers more comprehensive planning options which can generate least cost pathways (energy sector); and **TIMES** provides a further level of energy system analytical sophistication.
- **EV and RE policy assessment tools** offer sector analysis of uptake under different policy interventions.
- **Sustainable development impact tools** can inform non-climate impacts of different interventions.



Identification and selection of policies stage assesses the role for policy instruments to facilitate potential solutions

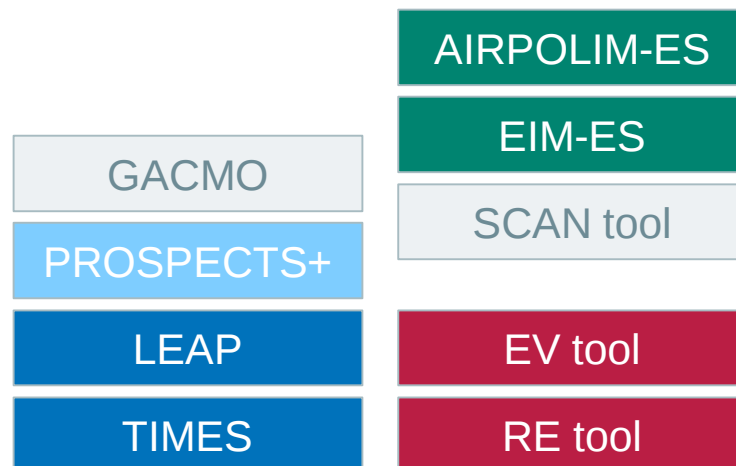


Use cases

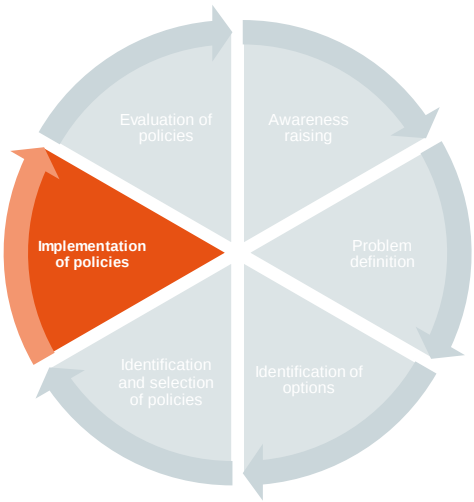
- Analyse the potential impact of policy instruments on emissions
- Analyse the potential impact of policy instruments on sustainable development indicators
- Compare different policy options and selection of instruments
- Quantify costs of policy instruments (+ which stakeholders bear the costs)
- Understand other non-cost barriers to adopting policy instruments

- **LEAP** and **TIMES** can incorporate standards (e.g. emission caps) as well as carbon pricing policies and scenarios can be linked to **AIRPOLIM-ES** and **EIM-ES**.
- **PROSPECTS+** can be used as a hub to aggregate sector deep-dive analytical outputs from other tools (e.g. **EV** and **RE policy assessment tools**), but in itself offers limited support at this stage.
- A wide range of other **sector-specific** tools exist to support policy selection that provide the detailed representation of sector characteristics typically needed to inform policy choices.
- **Guidance documents** that qualitatively explore incentives, consumer and firm behaviour and implementation challenges are also useful at this stage.

Tool insights



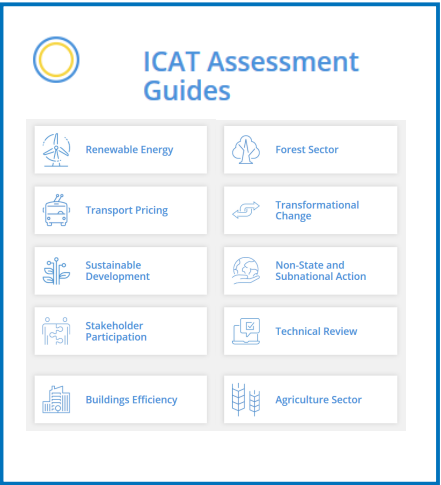
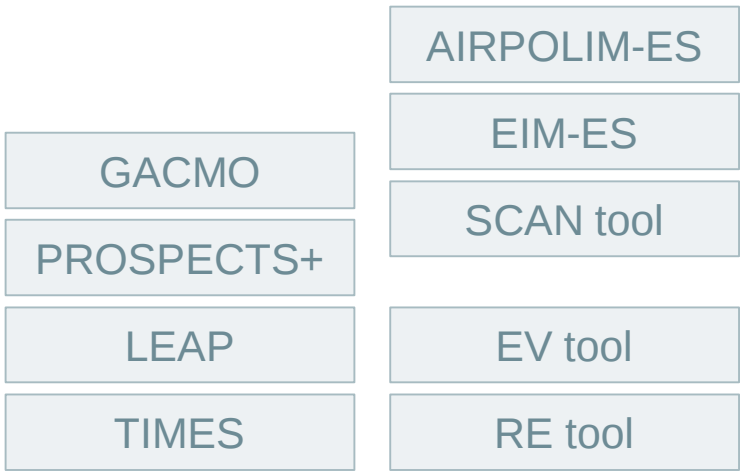
Implementation of policies stage puts in place the policies that facilitate the most attractive solutions to the problem



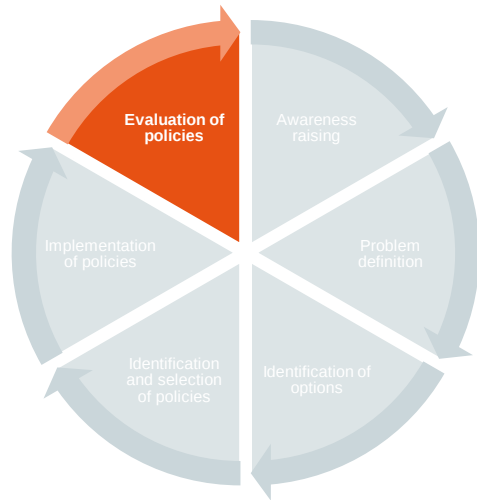
Use cases

This stage relies less on tools to quantify climate mitigation and development impacts and more on process guidance, including:

- stakeholder engagement;
- administrative procedures; and
- information dissemination.



Evaluation of policies stage assesses the efficiency and effectiveness of policy instruments in addressing the problem

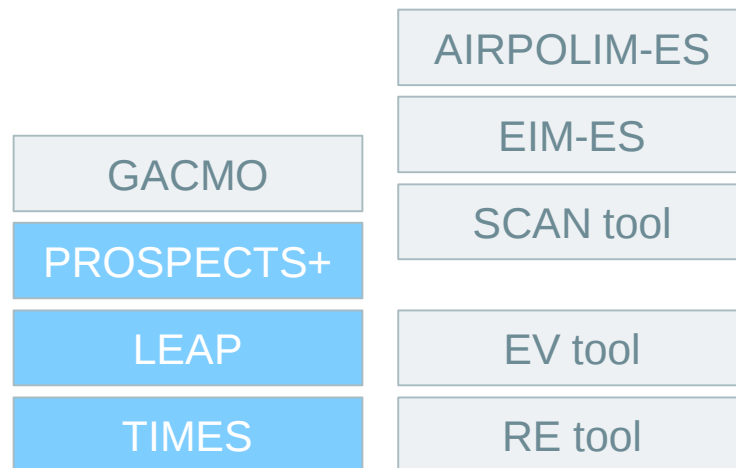


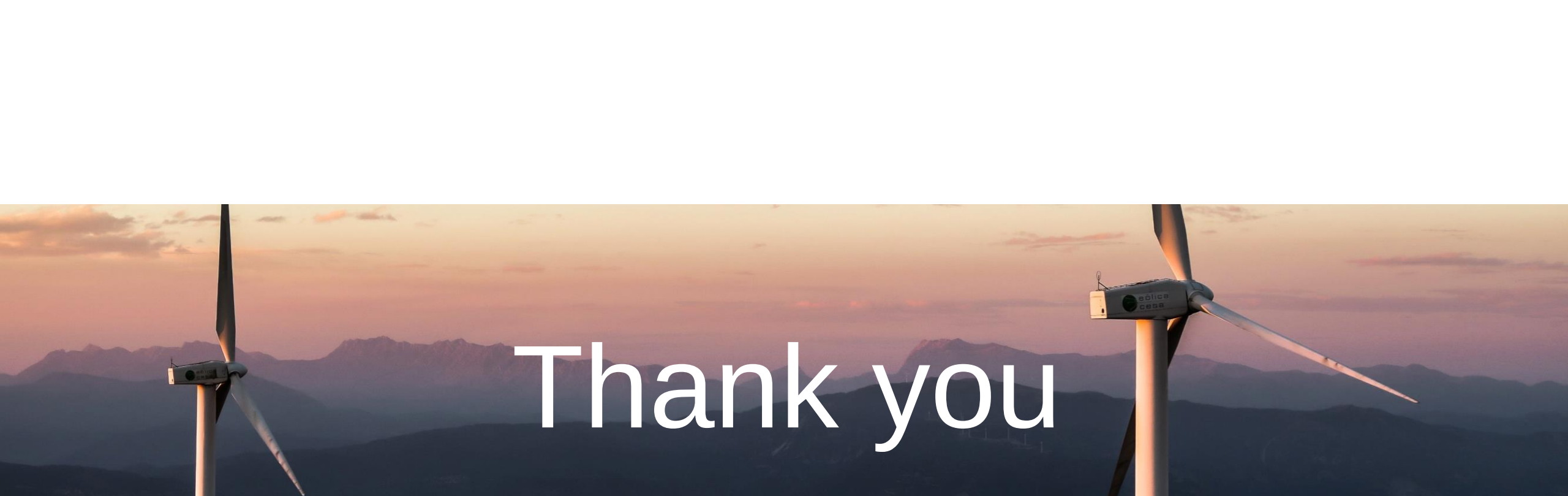
Use cases

- Identify the impact on emissions at national and/or sector levels
- Identify the economic costs of policy intervention
- Understand the role of the policy instruments and their interaction with other drivers of change (e.g. global technology developments)
- Identify and assess non-climate, sustainable development impacts

Tool insights

- This step relies more on information collection and qualitative and quantitative assessment of **historic data**.
- **Bookkeeping functionalities** of tools such as **LEAP**, **TIMES** and **PROSPECTS+** can offer some assistance in visualising historic annual emissions across sources / technologies and broken down to activities, intensities and other metrics.
- **Guidance documents** that set out generic analytical and process-based approaches to policy evaluation also offer assistance at this stage, coupled with bespoke assessment tools.



A wide-angle photograph of two wind turbines in the foreground, with a range of mountains in the background under a sunset sky. The text "Thank you" is centered over the image.

Thank you

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