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Global Carbon Finance (GLOCAF) model

PMR Technical Workshop on
Post-2020 Mitigation Scenarios and Carbon Pricing Modelling

Brasilia, 03 February 2016

Contents

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Introduction

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- About 40 different models being used in UK's DECC
- Some standalone (e.g. UK emissions projections)
- Some sitting next to policy colleagues (e.g. GLOCAF model)
- GLOCAF has dedicated analytical support using and developing it
- GLOCAF used to cost targets
- GLOCAF used to model international carbon markets

Global Carbon Finance (GLOCAF) model overview

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24 regions in GLOCAF

GLOCAF region	Number of countries in GLOCAF region
Brazil	1
Canada	1
China	1
EU	28
India	1
Indonesia	1
Japan	1
Mexico	1
Middle East	13
Northern Africa	5
Oceania	9
Rest of Central America	19
Rest of Europe	7
Rest of Former Soviet Union	10
Rest of South America	11
Rest of South Asia	7
Rest of South East Asia	12
Rest of Sub Saharan Africa	45
Russia	1
South Africa	1
South Korea	1
Turkey	1
Ukraine	1
USA	1

Global Carbon Finance (GLOCAF) model overview

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24 regions in GLOCAF

GLOCAF region (Implementing Country Participants)	Number of countries in GLOCAF region
Brazil	1
Canada	1
China	1
EU	28
India	1
Indonesia	1
Japan	1
Mexico	1
Middle East (includes Jordan)	13
Northern Africa (includes Morocco, Tunisia)	5
Oceania	9
Rest of Central America (includes Costa Rica)	19
Rest of Europe	7
Rest of Former Soviet Union (includes Kazakhstan)	10
Rest of South America (includes Chile, Colombia, Peru)	11
Rest of South Asia	7
Rest of South East Asia (includes Thailand, Vietnam)	12
Rest of Sub Saharan Africa	45
Russia	1
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South Korea	1
Turkey	1
Ukraine	1
USA	1

Global Carbon Finance (GLOCAF) model overview

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GLOCAF sector	Type
Agriculture	Energy CO2
Chemical	Energy CO2
Domestic aviation	Energy CO2
International aviation	Energy CO2
Non-Metallic Materials	Energy CO2
Other Industry	Energy CO2
Other transformation	Energy CO2
Other transport	Energy CO2
Power	Energy CO2
Rail transport	Energy CO2
Residential	Energy CO2
Road transport	Energy CO2
Services	Energy CO2
Steel	Energy CO2

Energy CO2 input data from Enerdata's POLES model

GLOCAF sector	Type
Afforestation	LULUCF gases
Deforestation	LULUCF gases
Forestry Management	LULUCF gases

LULUCF gases input data from International Institute for Applied Systems Analysis models

GLOCAF sector	Type
CH4 Agriculture	Non-CO2
CH4 Energy & Industry	Non-CO2
CH4 Waste	Non-CO2
HFC	Non-CO2
N2O Agriculture	Non-CO2
N2O Energy & Industry	Non-CO2
N2O Waste	Non-CO2
Other F-gases	Non-CO2

Non-CO2 input data from PBL Netherlands Environmental Assessment Agency

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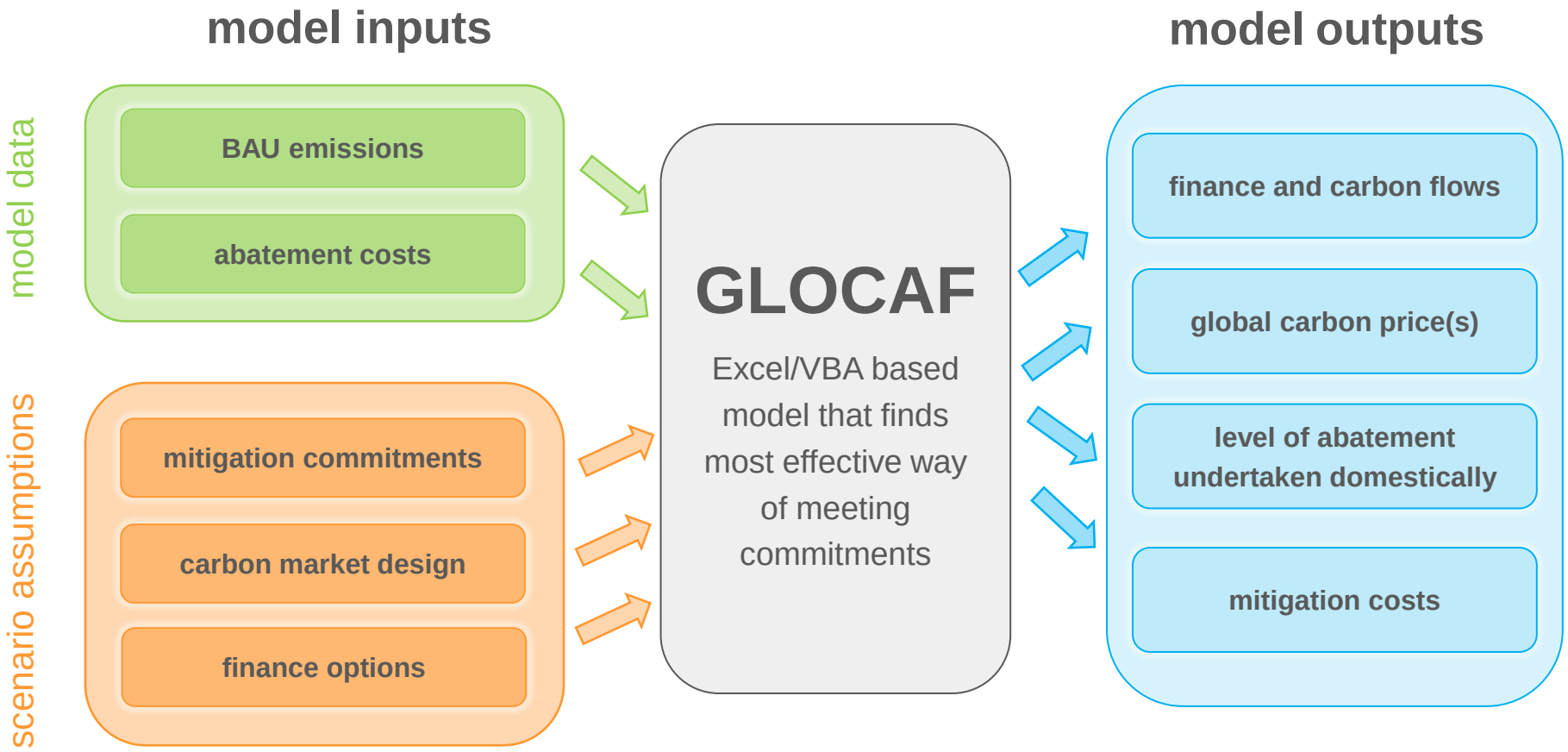

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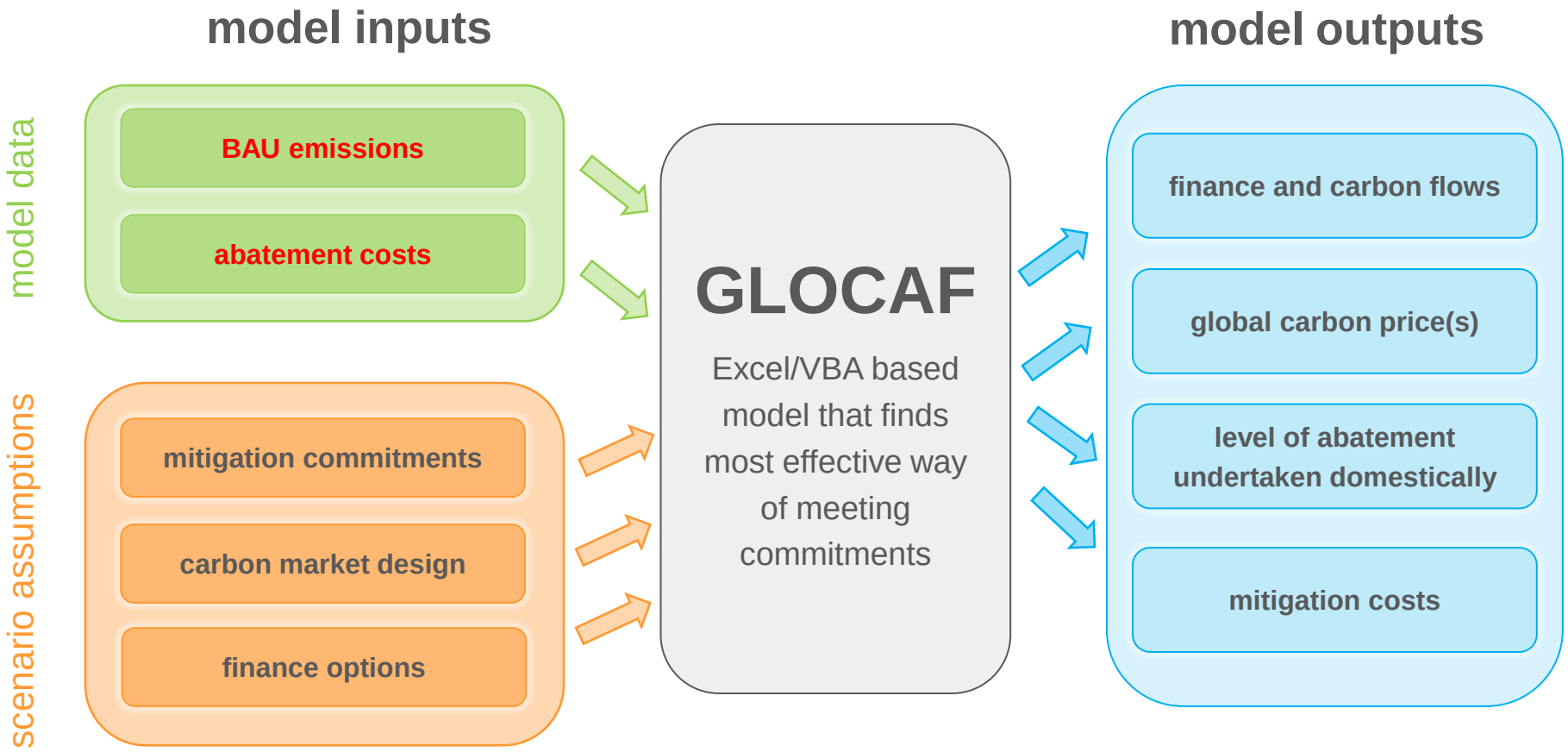

Model data: BAU emissions

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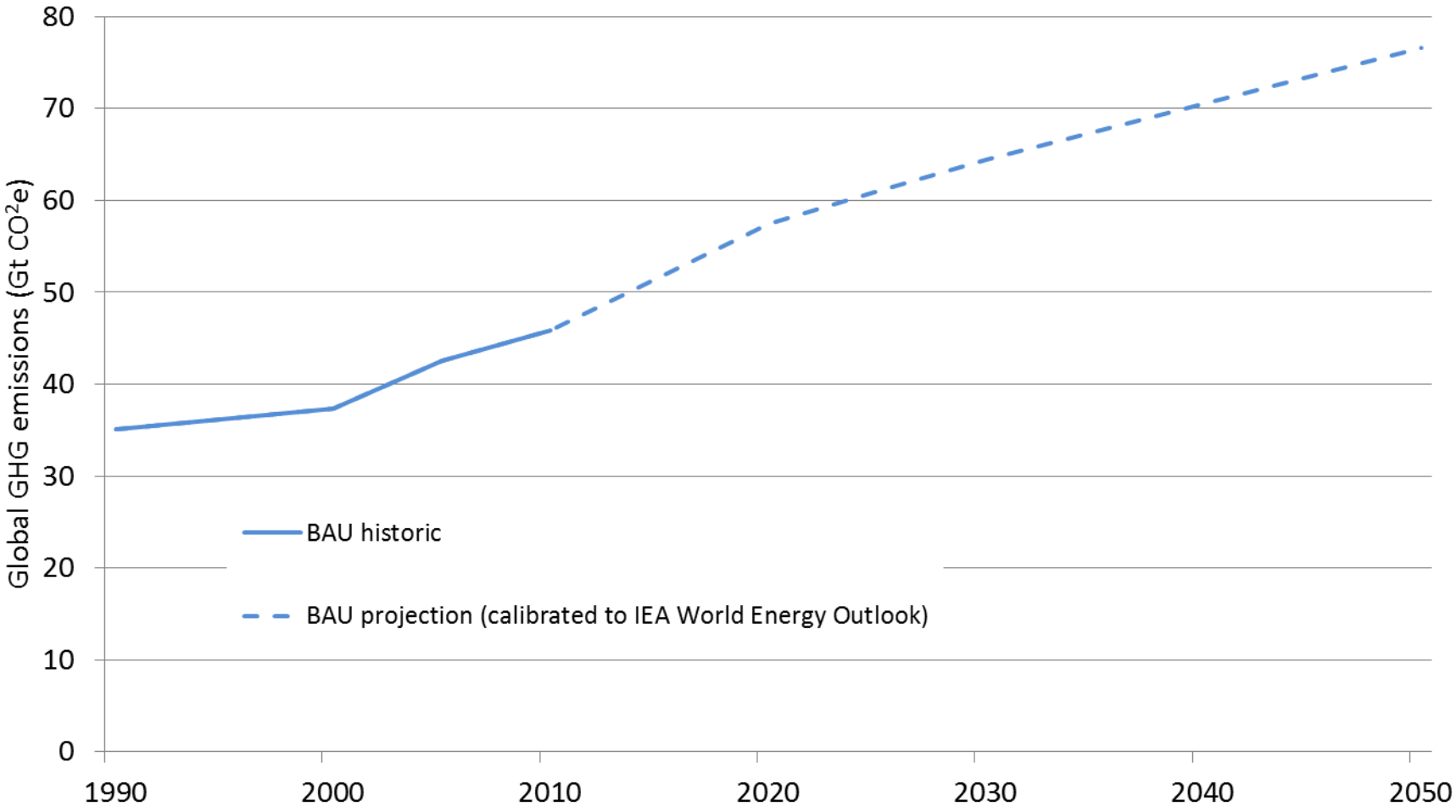

Model data: marginal abatement cost curves

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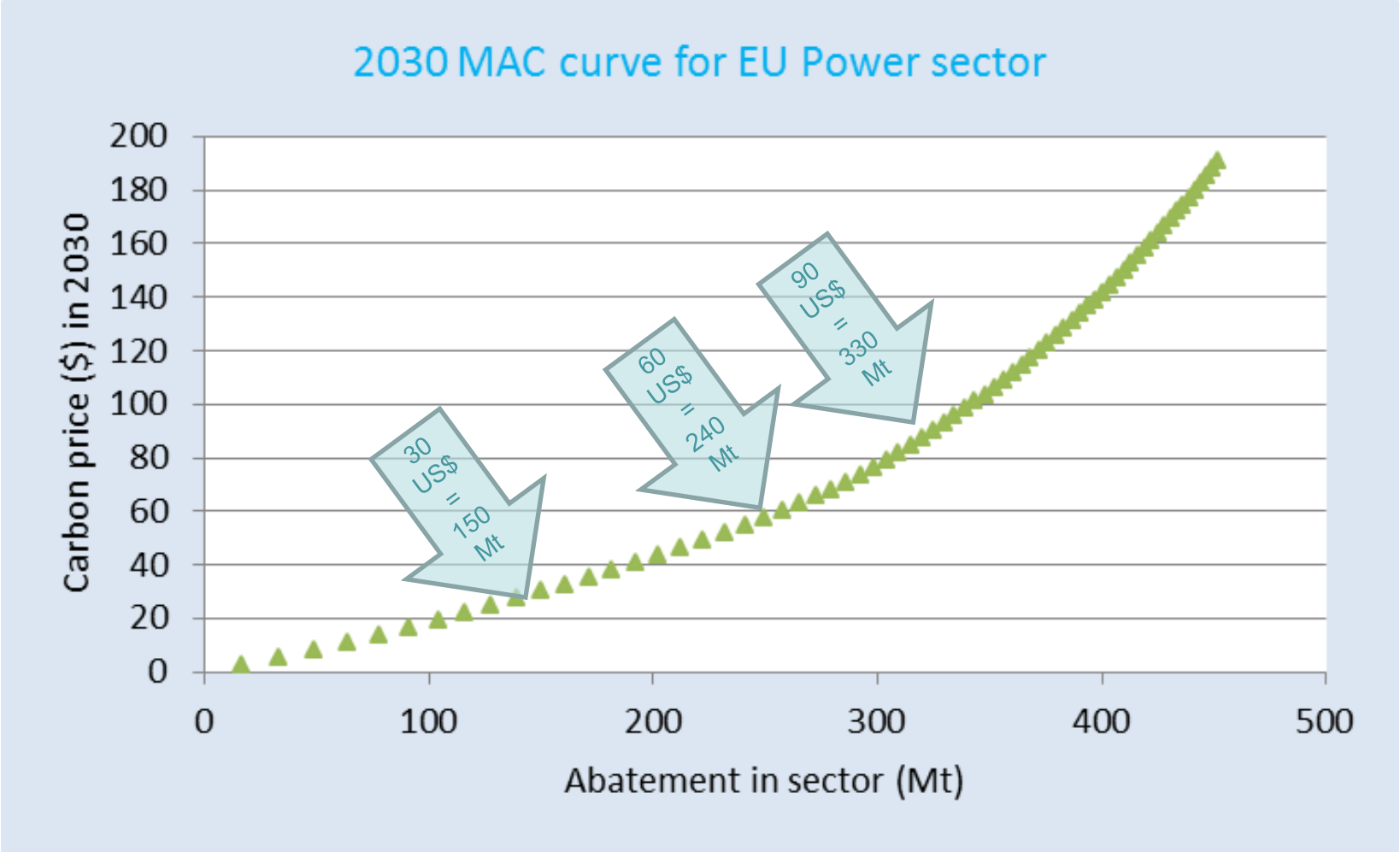

Model data: marginal abatement cost curves

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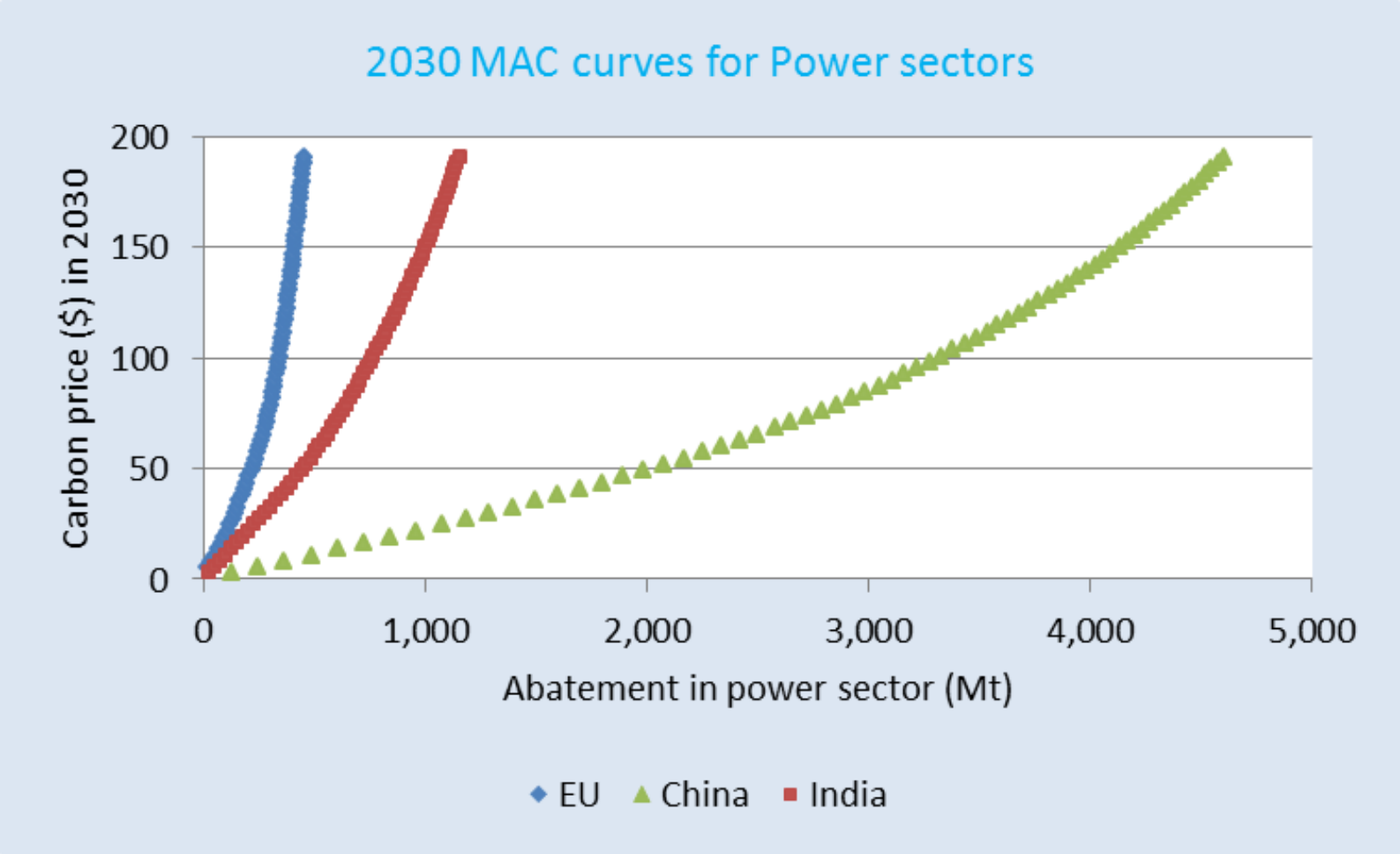

Model data: abatement options

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GLOCAF sector	Type
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Model data: abatement options

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Steel	Energy CO2

GLOCAF sector	Abatement option
International aviation	Biofuels Efficiency Mobility change
Power	Production Fossil fuel switch Carbon Capture and Storage Energy Efficiency Nuclear Wind Solar Biomass Other renewables
Road Transport	Biofuels Efficiency Electrification Mobility change

Model data: abatement options

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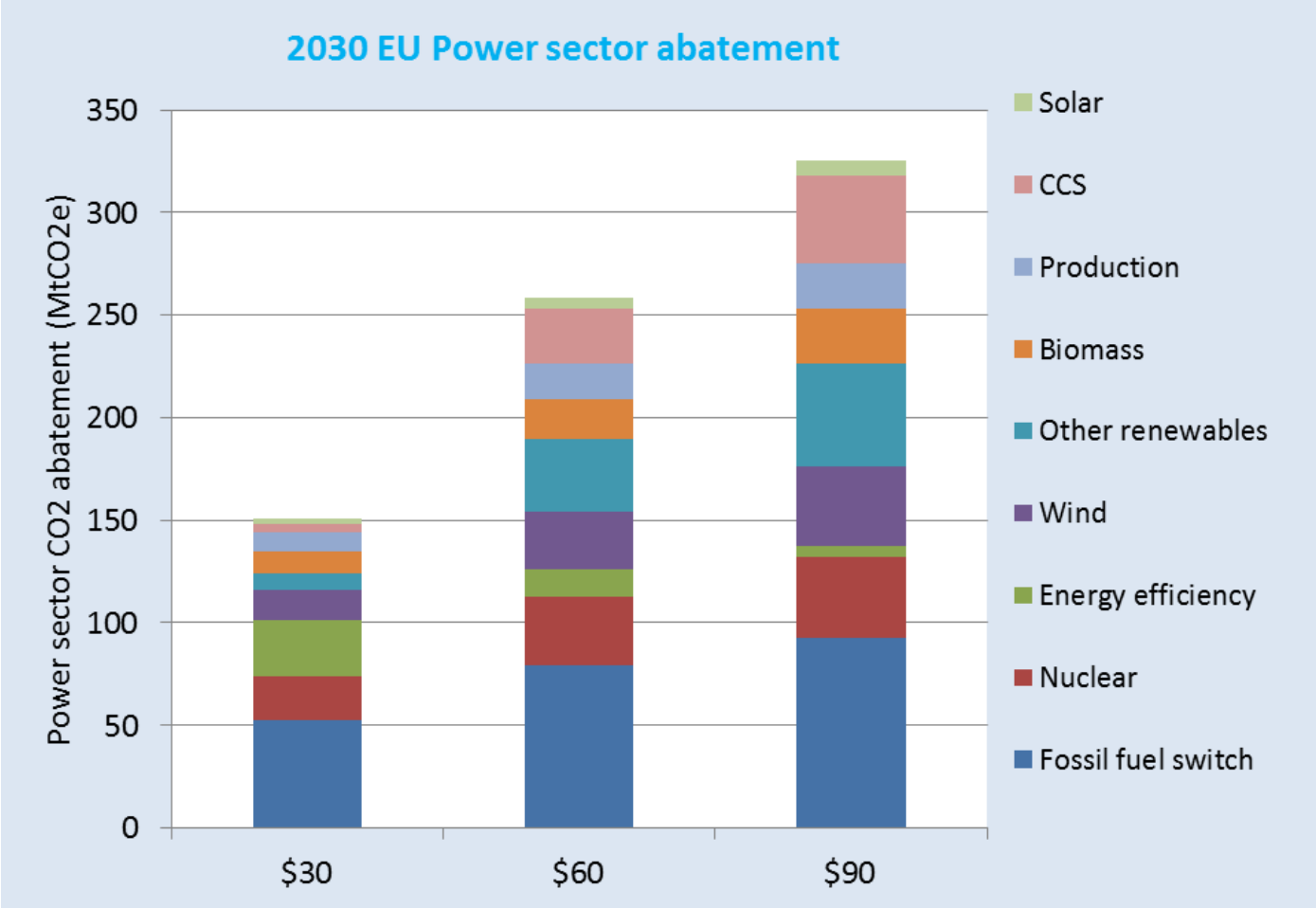

Source: Enerdata POLES model

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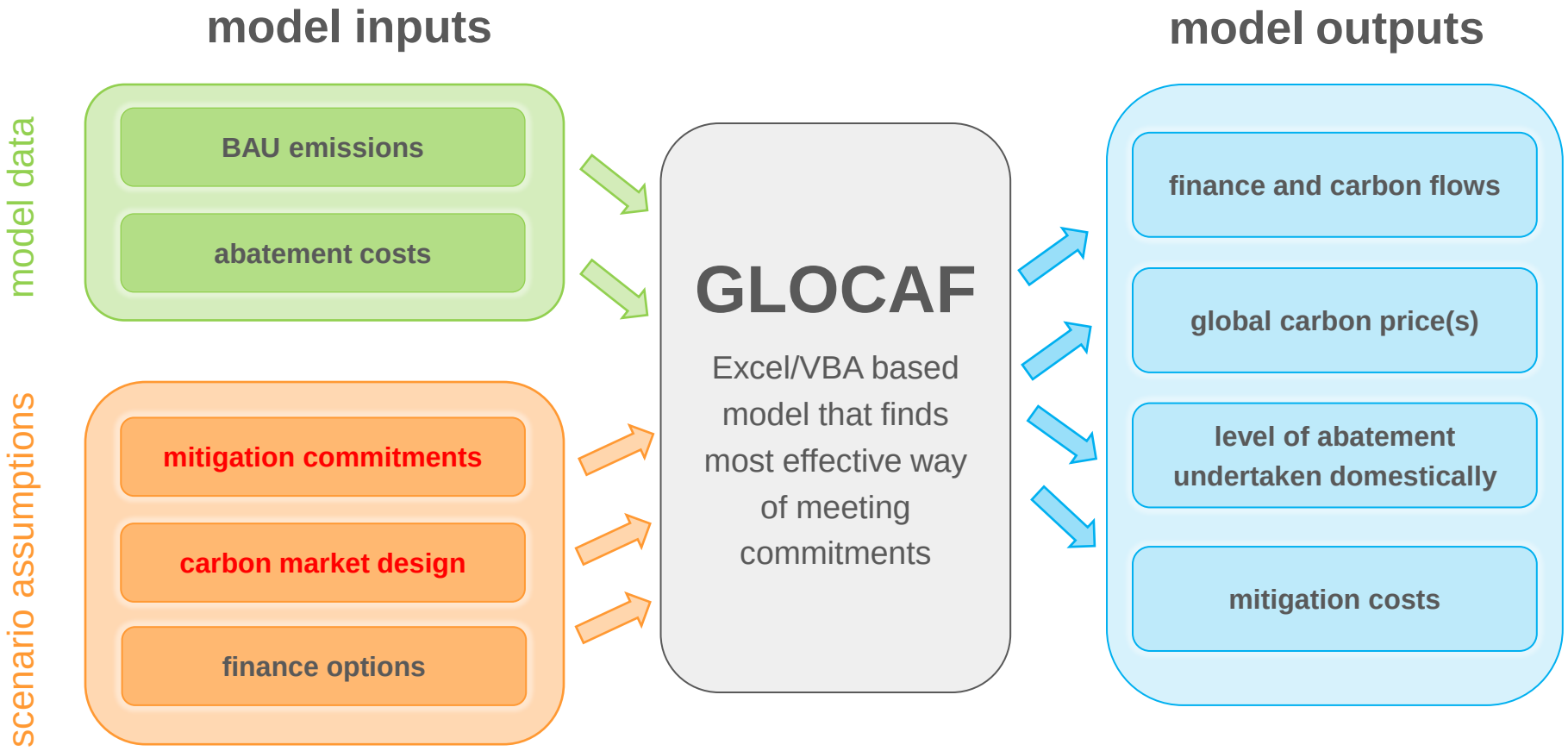

Scenario assumptions: mitigation commitments

Top-down method

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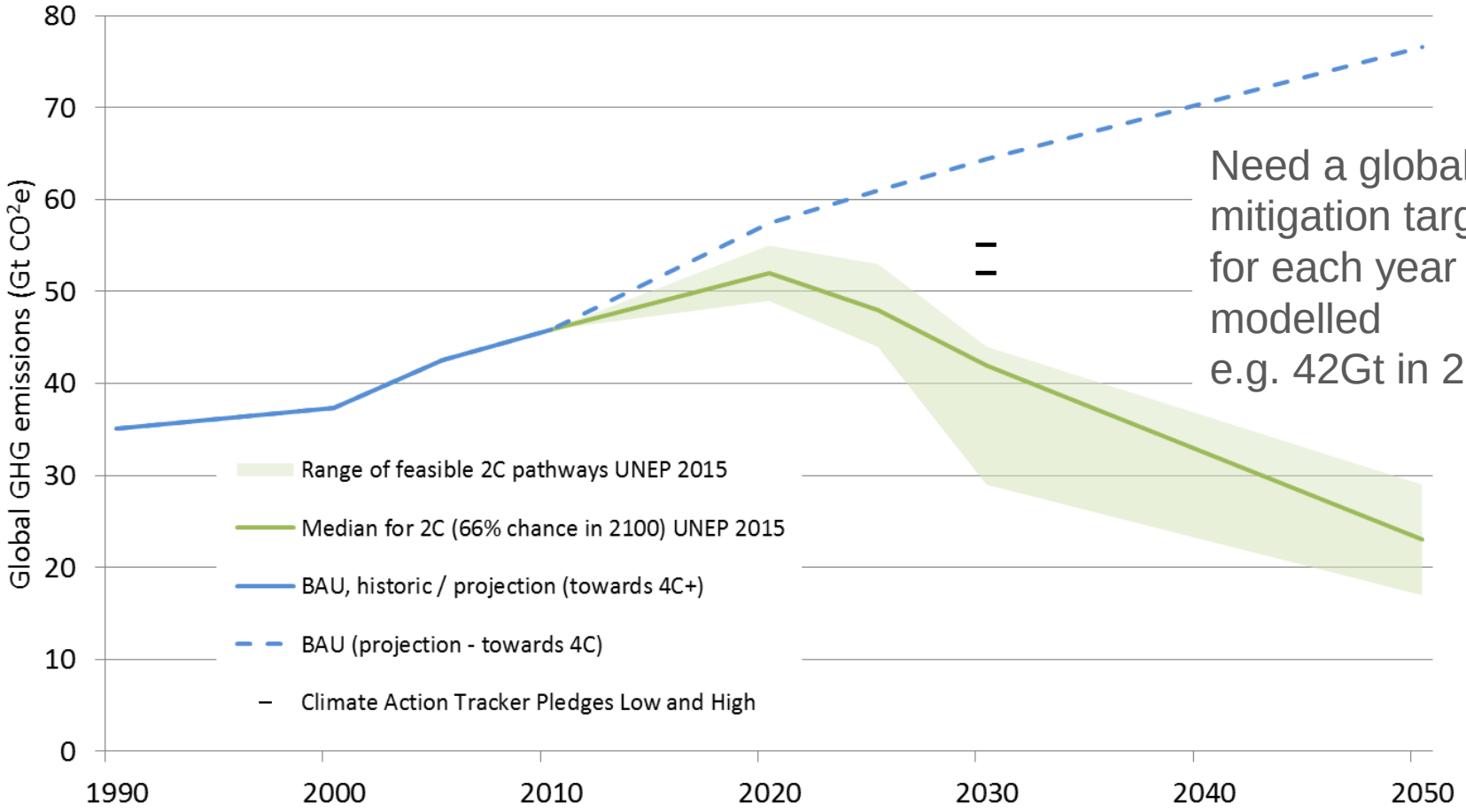

Need a global mitigation target for each year modelled
e.g. 42Gt in 2030

Sources: **UNEP Emissions Gap Report 2015 Annex A** A.2. Supplementary Tables
Climate Action Tracker http://climateactiontracker.org/

Scenario assumptions: mitigation commitments

Top-down method

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We may consider many different effort sharing method, which can be based on historic emissions, future emissions, population, or mitigation costs.
Two examples:

Contraction and Convergence method
Convergence from 2020 emissions to equal per capita emission in 2050.

Equal GDP cost method
All country targets cost the same as a percentage of GDP.

Scenario assumptions: mitigation commitments

Bottom-up method

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INDCs assessed by the Climate Action Tracker	
Brazil	37% for 2025 below 2005
Canada	30% below 2005 levels in 2030
China	peak by 2030 or earlier
EU	40% domestic below 1990 by 2030
Indonesia	29% below BAU by 2030
Japan	26% below 2013 emission levels by 2030
Mexico	22% reduction on 2030 BAU in 2030
Norway	40% below 1990 by 2030
Peru	reduce emissions by 20% of BAU levels by 2030
South Korea	37% below BAU by 2030
Switzerland	50% below 1990 by 2030
Ukraine	40% below 1990 levels by 2030
USA	26% to 28% below 2005

Scenario assumptions: mitigation commitments

Bottom-up method

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Brazil	37% for 2025 below 2005
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Switzerland	50% below 1990 by 2030
Ukraine	40% below 1990 levels by 2030
USA	26% to 28% below 2005

Scenario assumptions: carbon market design

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Need to make assumptions about future structure of carbon markets:

Who can trade in 2030?

Does China and S Korea develop their carbon markets independently? Will the EU and Australia be trading in 2030? Will there be a market in maritime emissions?

Any limits on trade in 2030?

What will be the limit on be using credits? 5% of country target can be international credits? 10%?

How efficient are sector markets in 2030?

How efficient are carbon market mechanisms? Are some sectors – such as Power or Agriculture – more likely to lead to successful projects than others?

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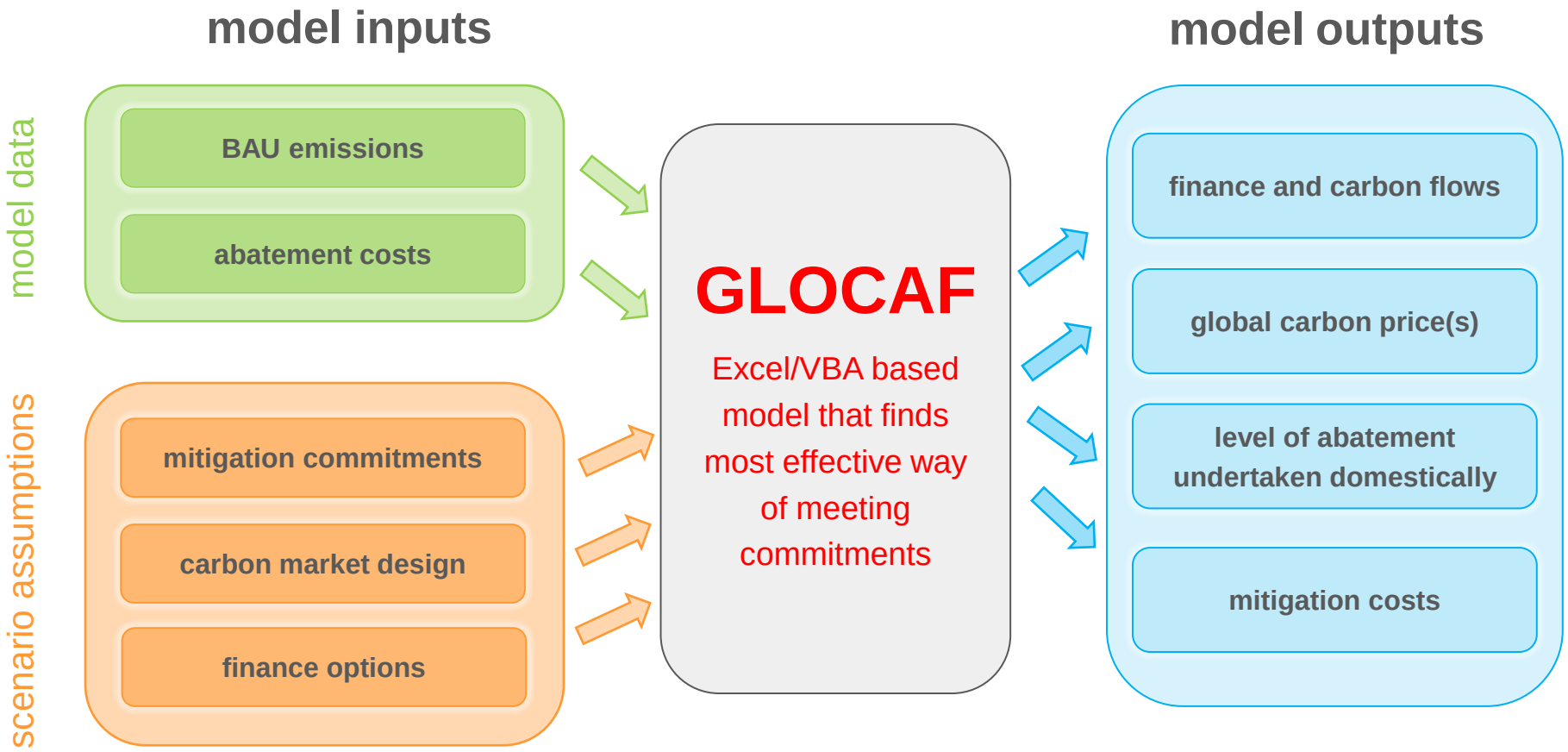

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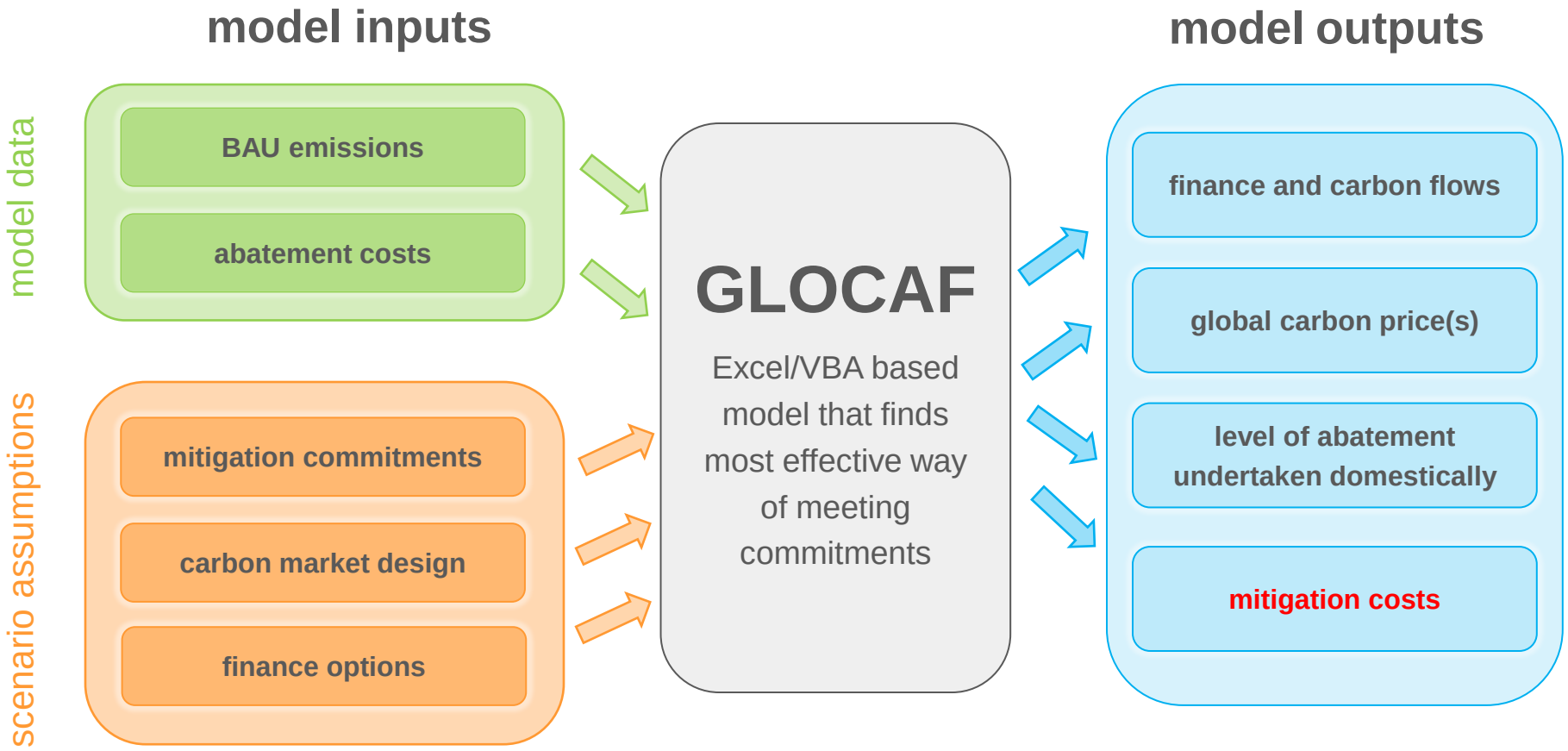

Model outputs: mitigation costs
Top-down method 2 degrees goal using
Equal cost effort share approach

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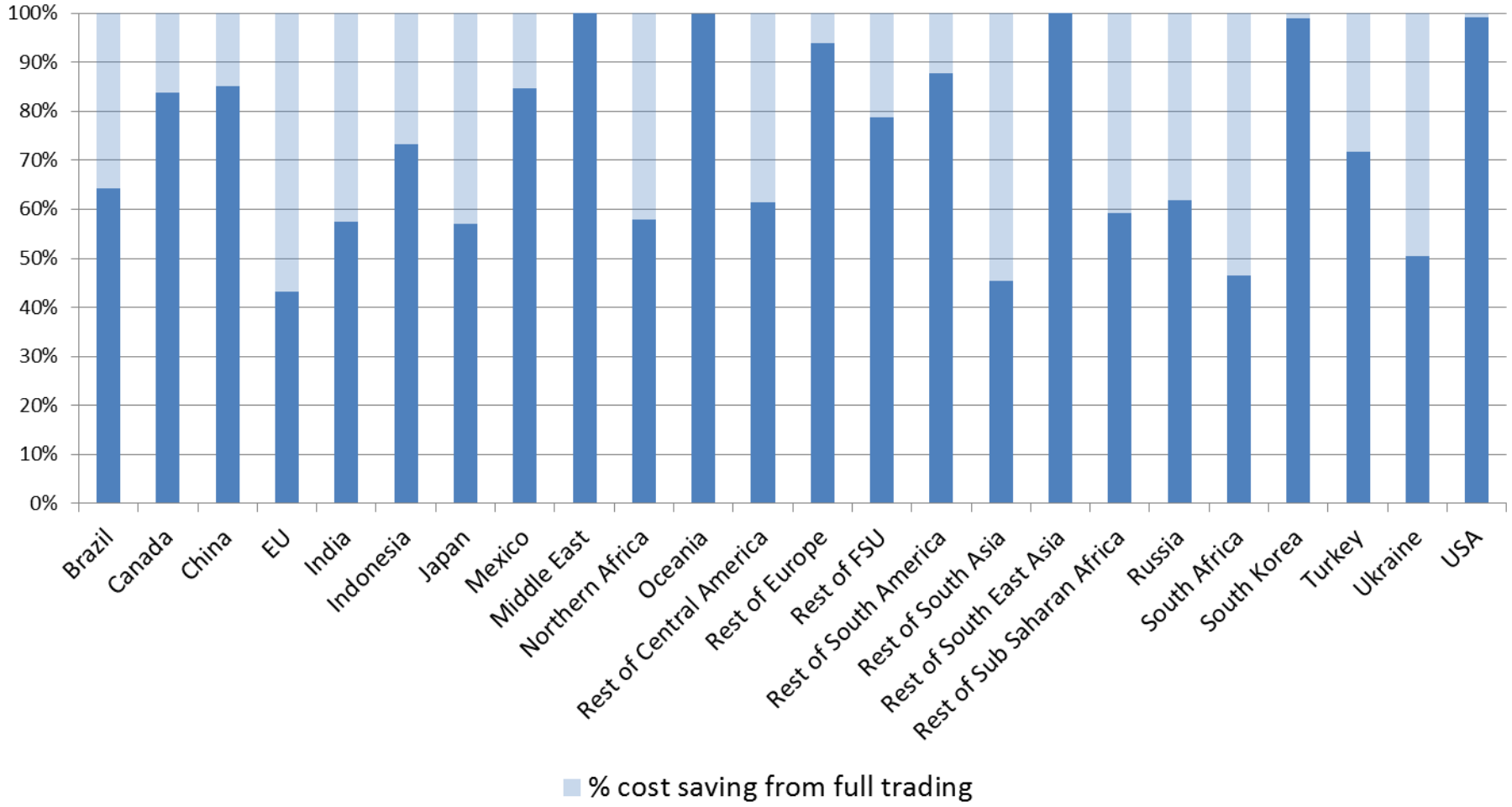

Model outputs: mitigation costs
Bottom-up method Looking at some example countries

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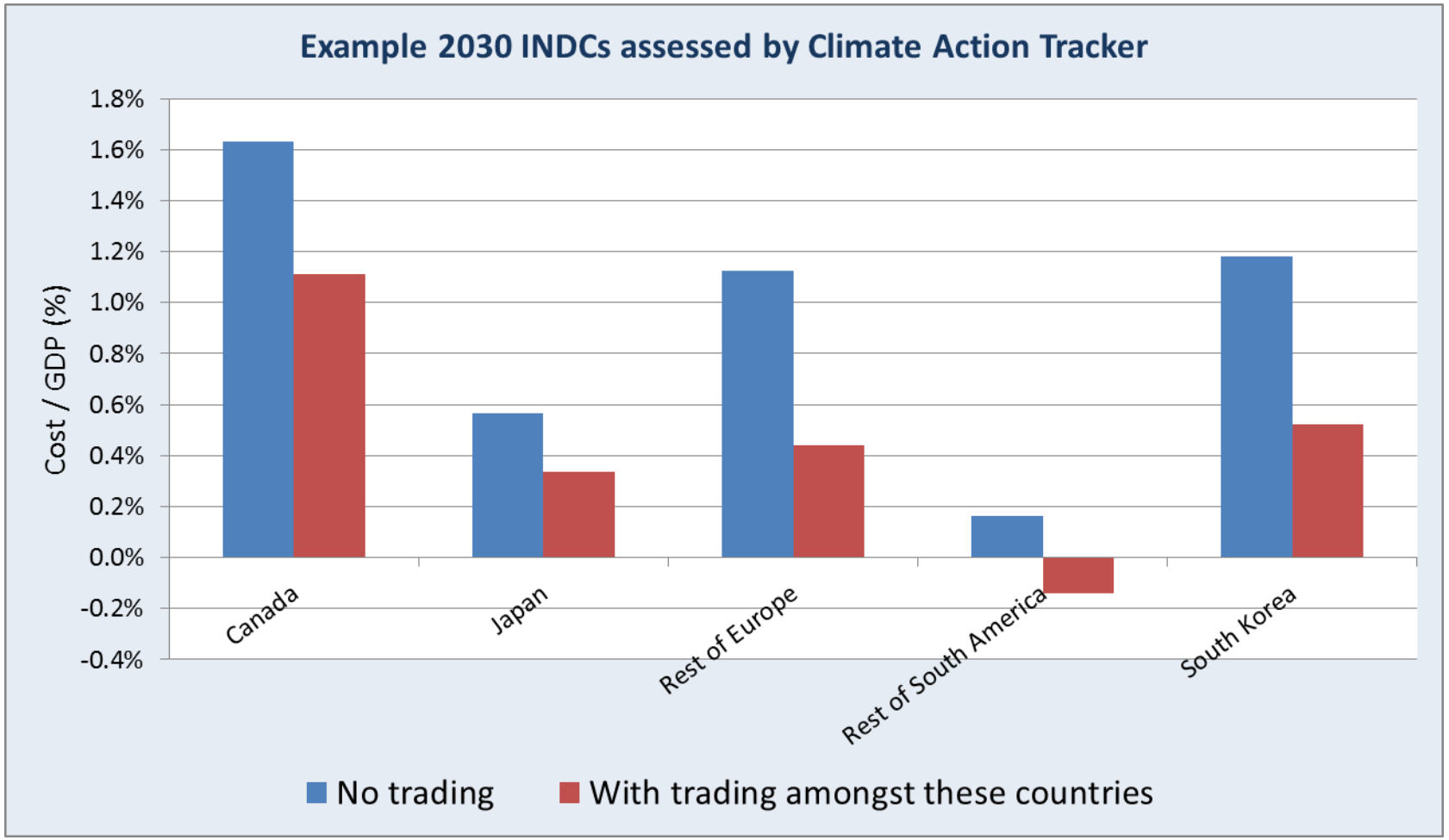

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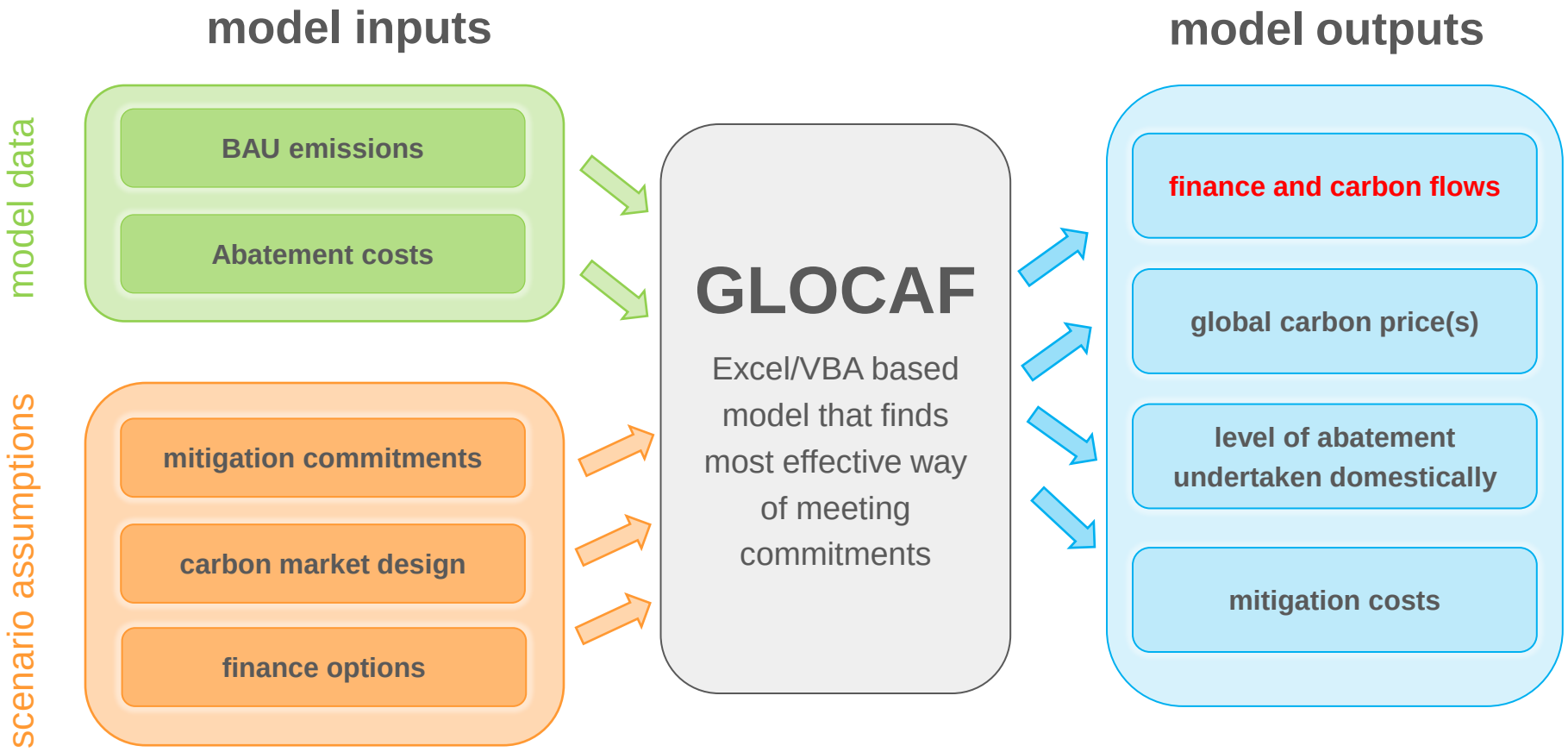

Model outputs: finance flows
Bottom-up method Looking at some example countries

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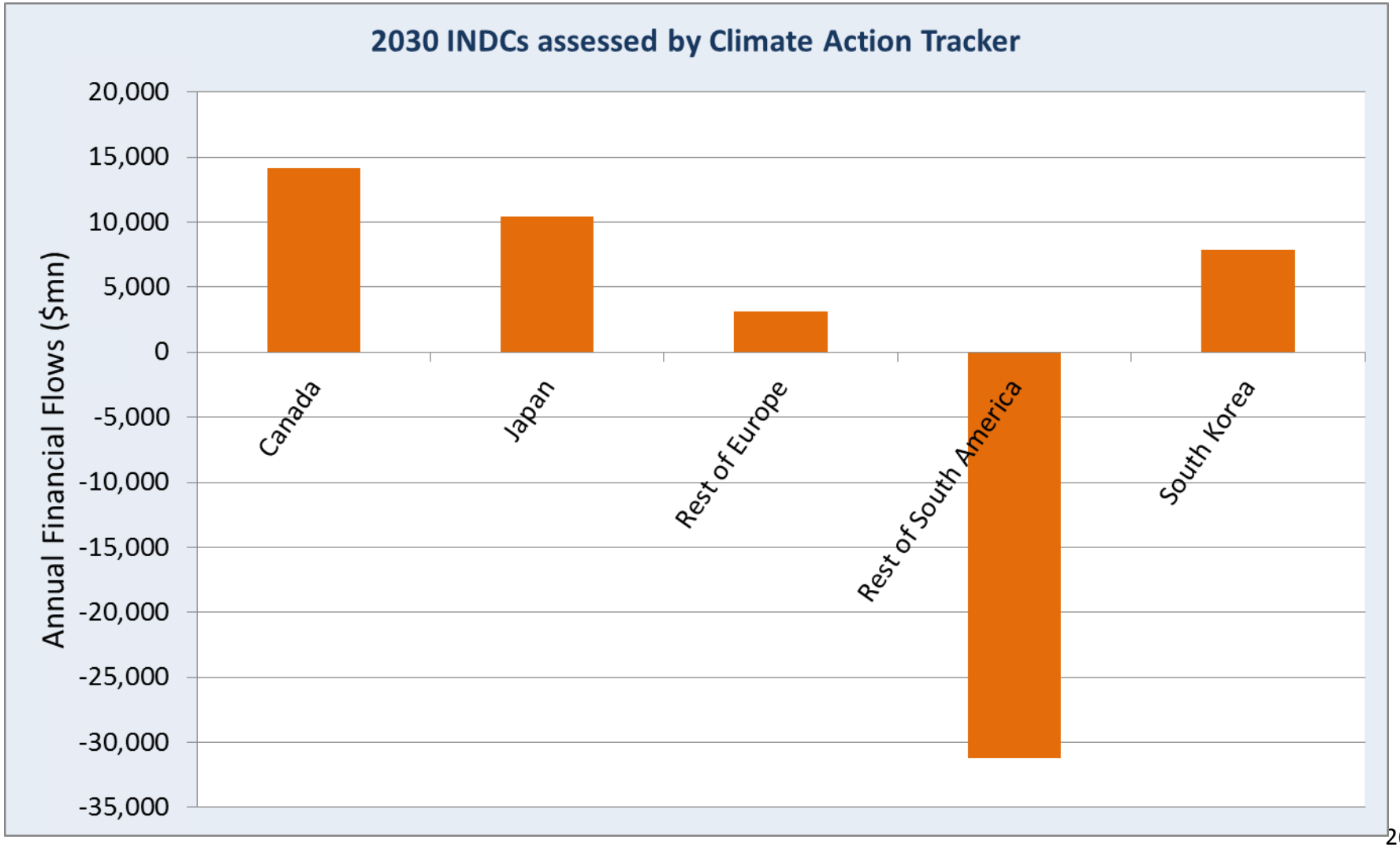

Other possible work areas

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- Model sectors markets (but need emissions target for each market)
- Introducing a market in international aviation
- Model EU ETS and possible use of sector-specific credits
- Model markets linking – look at carbon prices and abatement costs before linking and afterwards

GLOCAF limitations

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- GLOCAF is a scenario modelling tool rather than a forecasting tool
- Uncertainty over abatement costs and BAU emissions projections
- Assumes rational decision making (i.e. least cost abatement pursued first which might not always happen in practice)
- Macroeconomic effects, any co-benefits (e.g. local air pollution, health, energy security) or the avoided impacts are not captured by GLOCAF
- GLOCAF only models specific individual years

Some overall conclusions….

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- GLOCAF provides insight but must make assumptions
- If using top-down method need to select an effort sharing approach
- If using bottom-up method need to interpret INDCs
- Carbon markets reduce overall cost of meeting mitigation targets
- Carbon markets will result in financial flows

Thank you.

Any questions?