Benefits of using models in development of emission inventories and projections

Example: *GAINS model used for air pollution assessment in the ASEAN region*

Zbigniew (Zig) Klimont

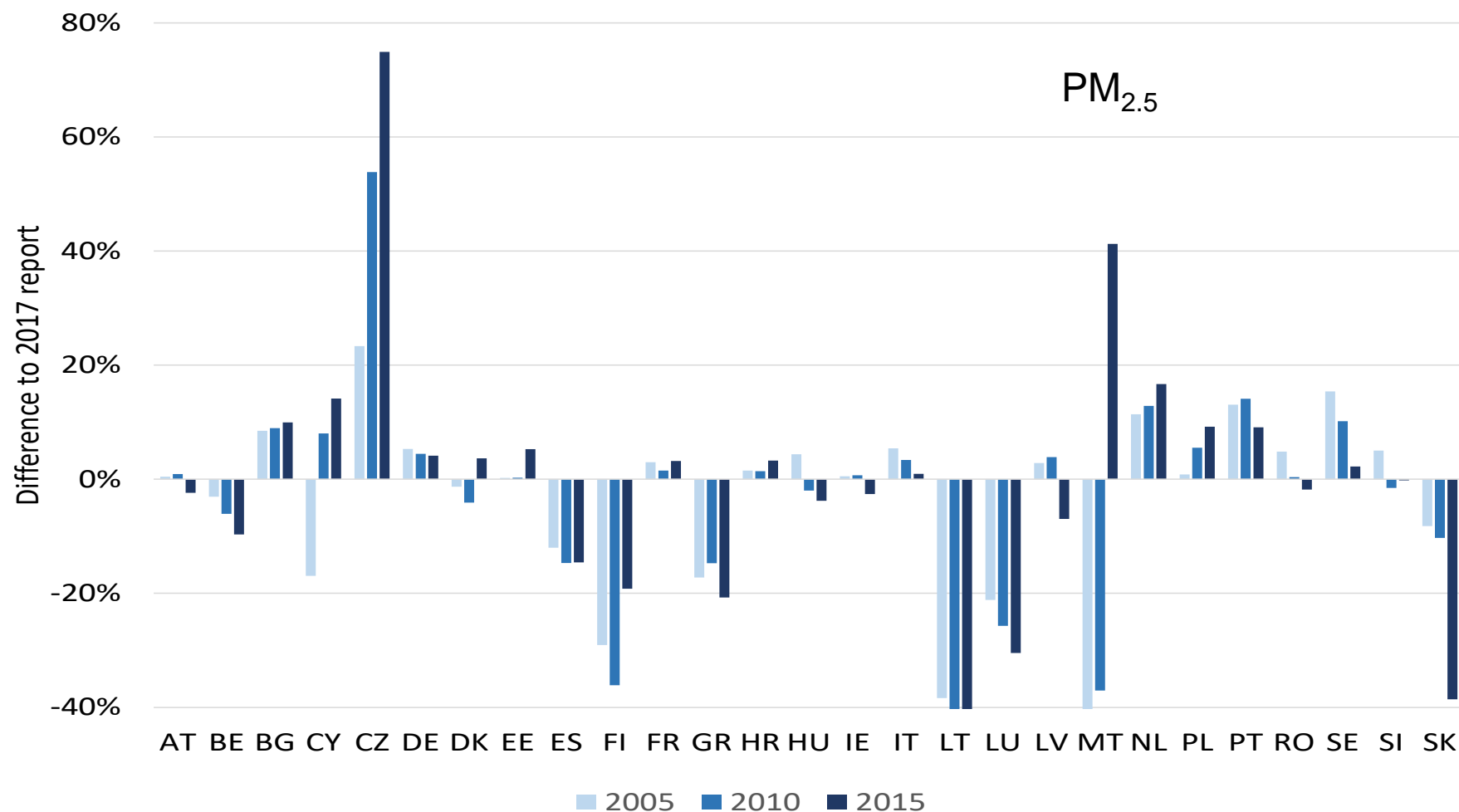*Pollution Management Group (klimont@iiasa.ac.at)*

UNESCAP Sub Regional Dialogue 'Regional Cooperation For Air Pollution In Asia And The Pacific': South-East Asia
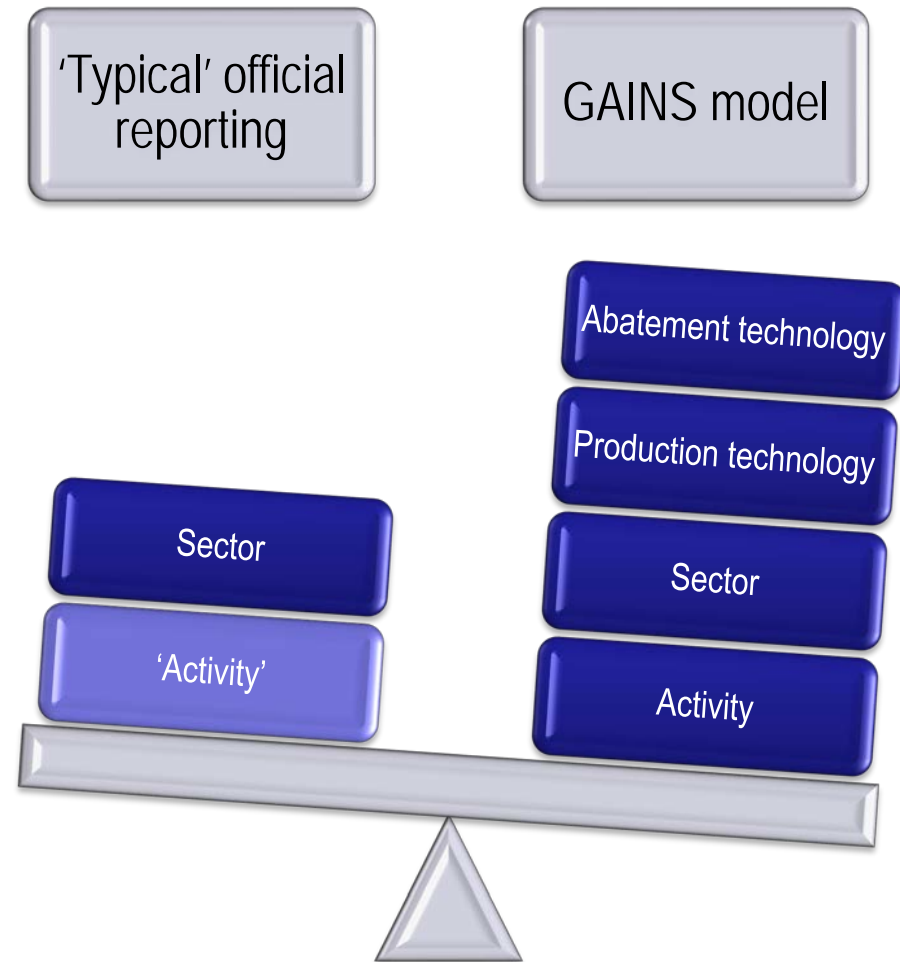*January 19, 2022 [virtual]*

Updates of emission inventories for 2005/2010/2015 in Europe:
Reporting in 2019 relative to reporting in 2017

- Example for PM2.5 emissions, which are among most uncertain,

- Estimates for SO_2 and NO_x more robust,

- Most recent years most affected.

- While it might look 'shocking', it is a positive development reflecting new data and methods applied across increasing number of countries

Comparing emissions and building blocks of the 'inventories'

'Typical' official reporting

GAINS model

'Typical' official reporting:
- Sector
- 'Activity'

GAINS model:
- Abatement technology
- Production technology
- Sector
- Activity

- Models require often more data, including data that is not ('yet') available,

- However, such methods allow for improved consistency and allow for identification of 'white spots',

- Such approach also allows better monitoring of progress in implementation of policies and discussion of future mitigation potential,

- Making use of formal models in development of inventories leads to improved inventory quality in mid-term,

- The completeness and quality of official inventories has been steadily improving.
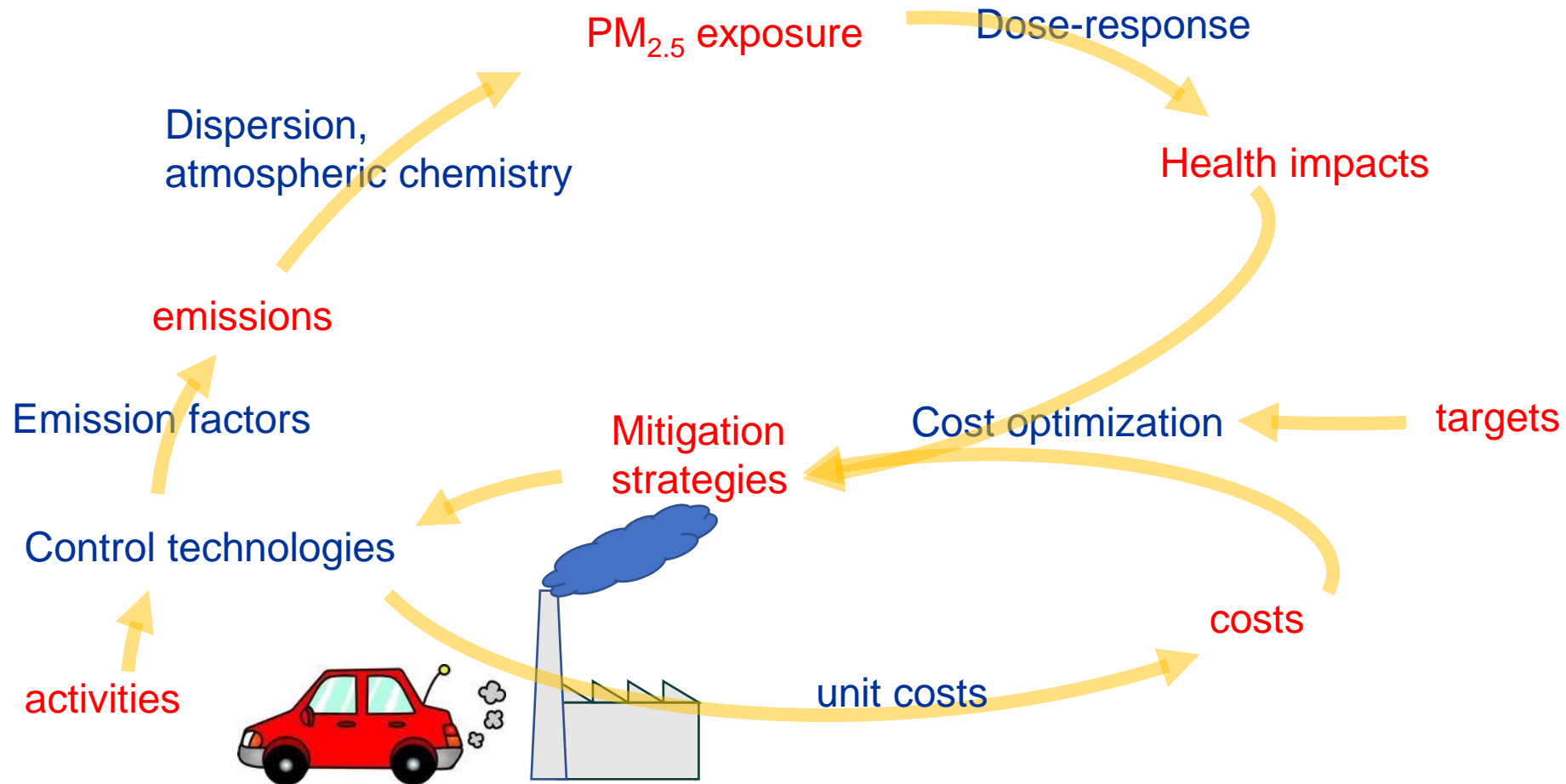
GAINS: A tool for a systematic assessment of the cost-effectiveness of emission control strategies

https://gains.iiasa.ac.at/models/index.html

- GAINS quantifies sectoral emission control potentials and costs, for exogenous (governmental, international agencies, scientific) activity projections,

- Search for least-cost mix of mitigation measures to meet air quality and/or GHG targets,

- GAINS has global coverage (several model implementations exist, including continental, country and province/states scales).

GAINS model
## (Greenhouse gas–Air pollution INteractions and Synergies)

PM$_{2.5}$ exposure — Dose-response

Dispersion, atmospheric chemistry

Health impacts

emissions

Emission factors

Cost optimization — targets

Mitigation strategies

Control technologies

costs

activities

unit costs

https://gains.iiasa.ac.at/models/index.html

Application of GAINS is a collaborative effort

| Data needs	Initial IIASA version (international data)	Improved with input from national experts
Base year & projections of economic activities	Data already implemented in GAINS (IEA, FAO, UN, IPCC, etc.)	National data and projections
Emission factors	Current GAINS database (peer reviewed and grey literature)	Refinements based on local measurements
Emission controls; efficiencies, costs	Current GAINS database (peer reviewed and grey literature)	Refinement based on national information
Current/maximum application of emission controls	Current GAINS databases, including published info about legislation	Local information
Atmospheric dispersion	GAINS modelling based on global & regional atmospheric dispersion model	Local fine scale model utilizing local monitoring campaigns; updated with findings from monitoring and source apportionment studies (if available)
Health impacts	Global WHO methodology	Local health statistics

Key elements relevant for development of emission inventory and baseline projections

Clean Air Solutions for ASEAN
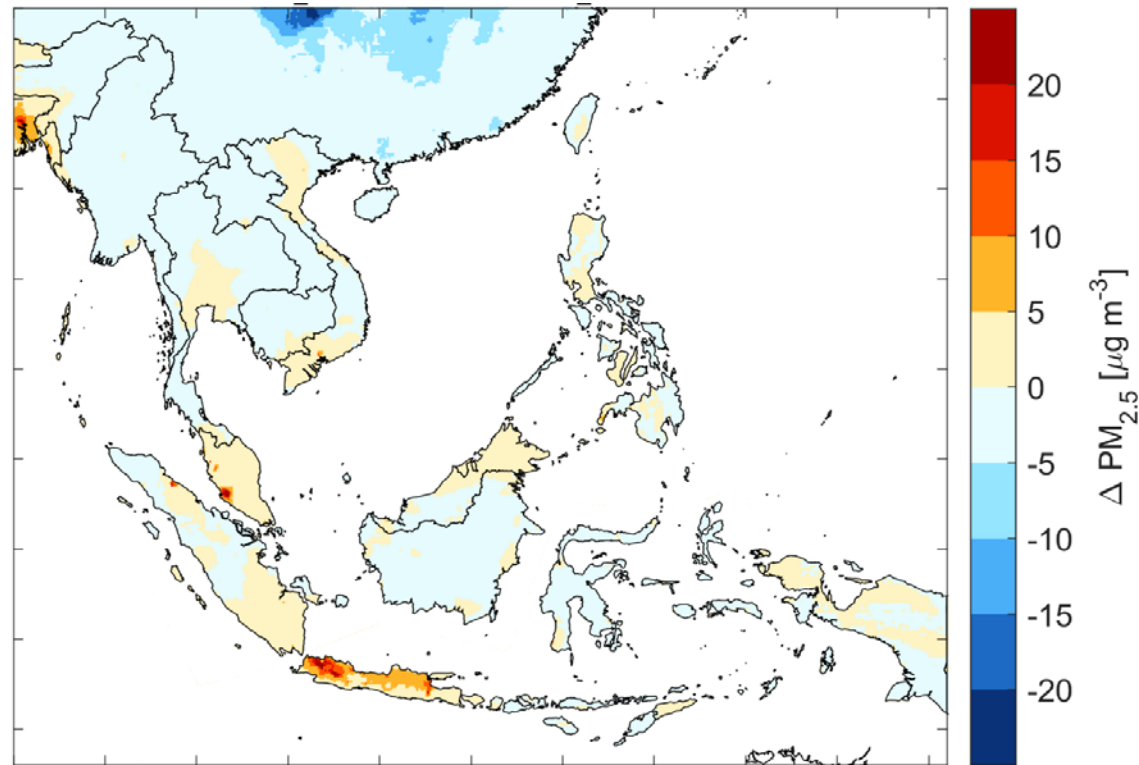
Change in PM2.5 concentrations in the 2030 current policy scenarios compared to 2015;
Source: GAINS model (IIASA); Clean Air Solutions for ASEAN (2022) - *report in preparation*

Implementing priority solutions could more than double the population breathing clean air (PM$_{2.5}$ less than 10ug/m3) in ASEAN

Source: GAINS model (IIASA); Clean Air Solutions for ASEAN (in preparation)
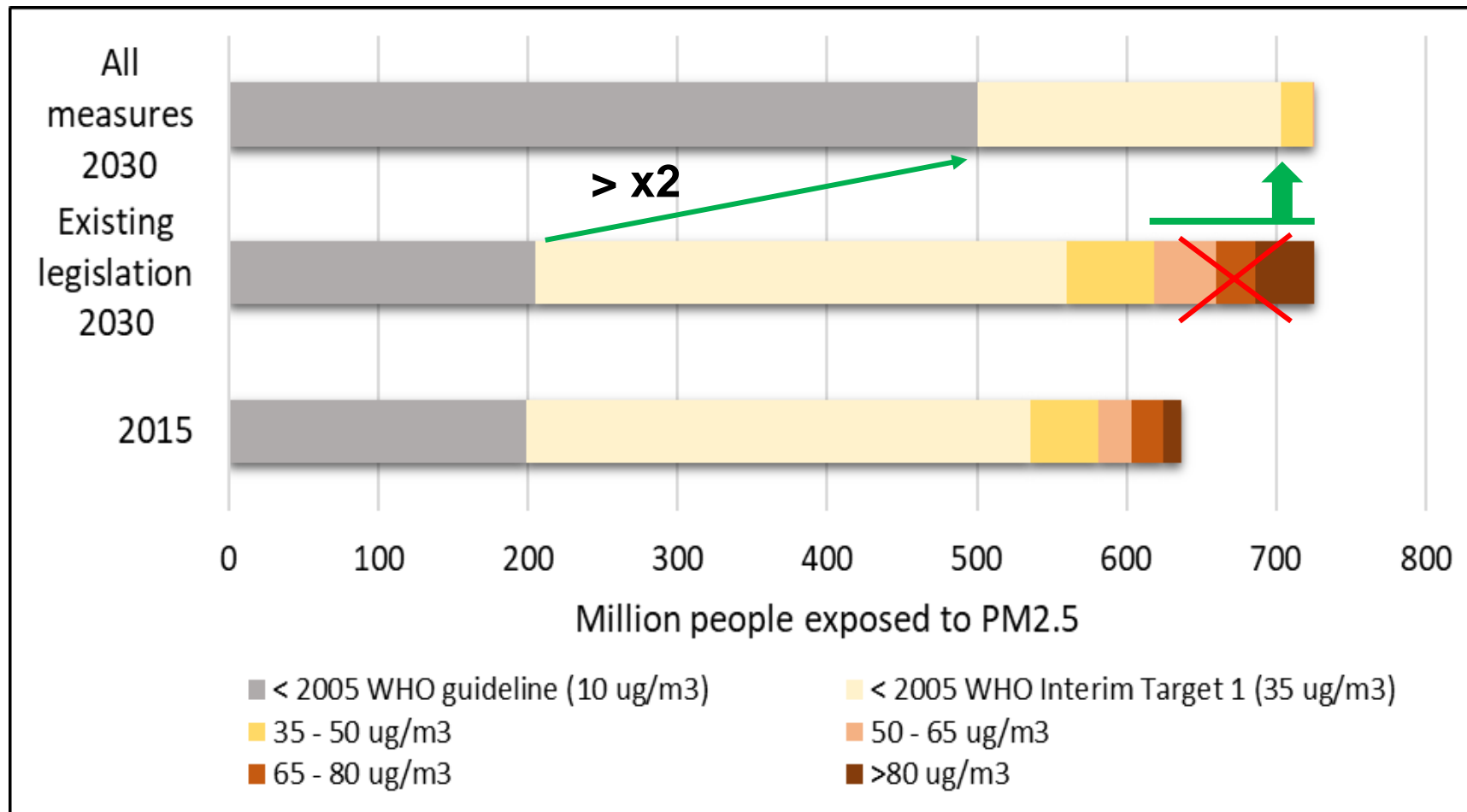
# The priority solutions in ASEAN by 2030
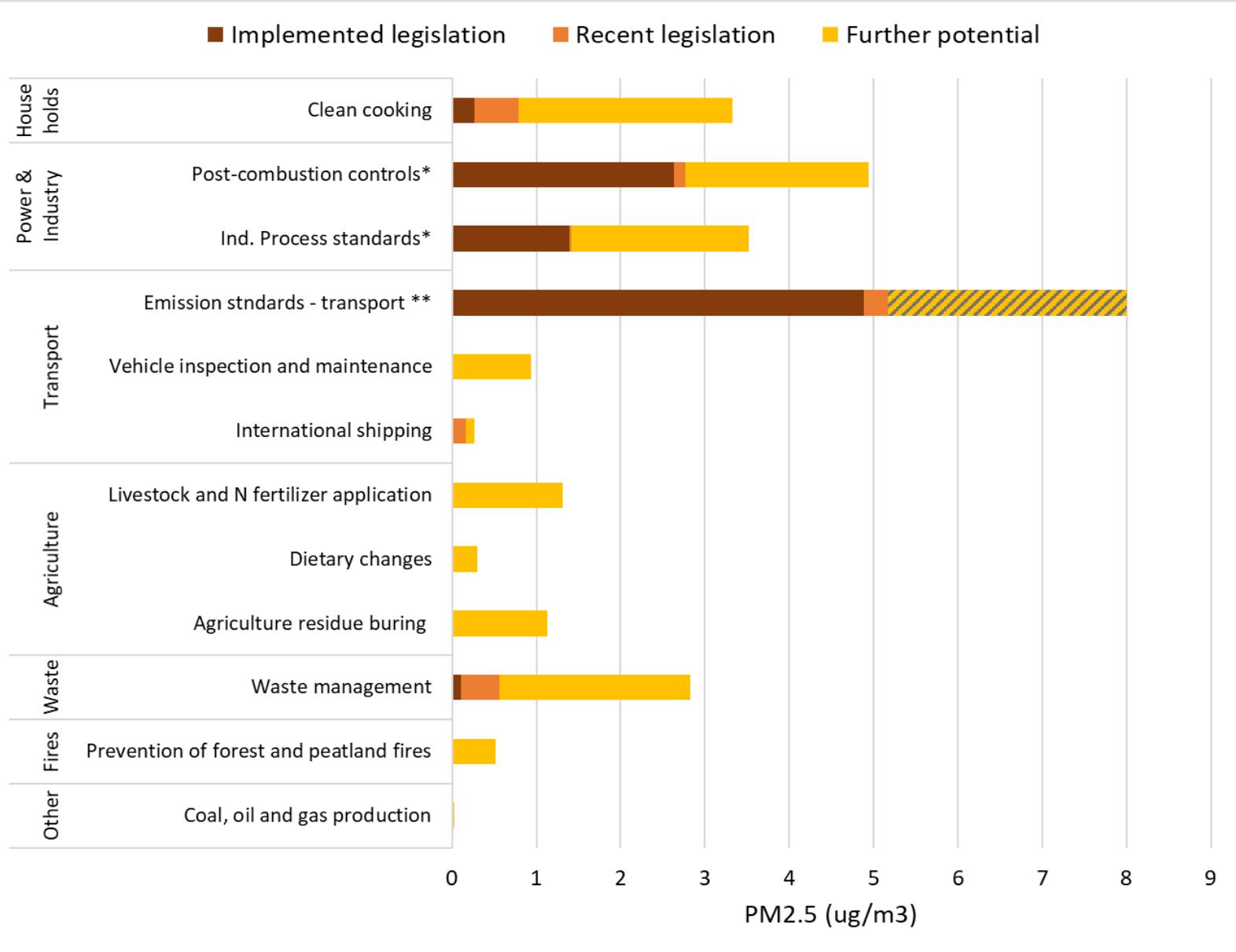
Nearly 40% (20-60% at the country level) of identified potential is associated with existing legislation – implementing existing solutions is critical!

Indicates maximum potential for either introduction of Euro VI equivalent vehicle emission standards or rapid electrification of vehicle fleet

Source: GAINS model (IIASA); Clean Air Solutions for ASEAN (in preparation)

Co-benefits of air quality policy and priority solutions on SLCP emissions in ASEAN region

Source: GAINS model (IIASA); Clean Air Solutions for ASEAN (in preparation)
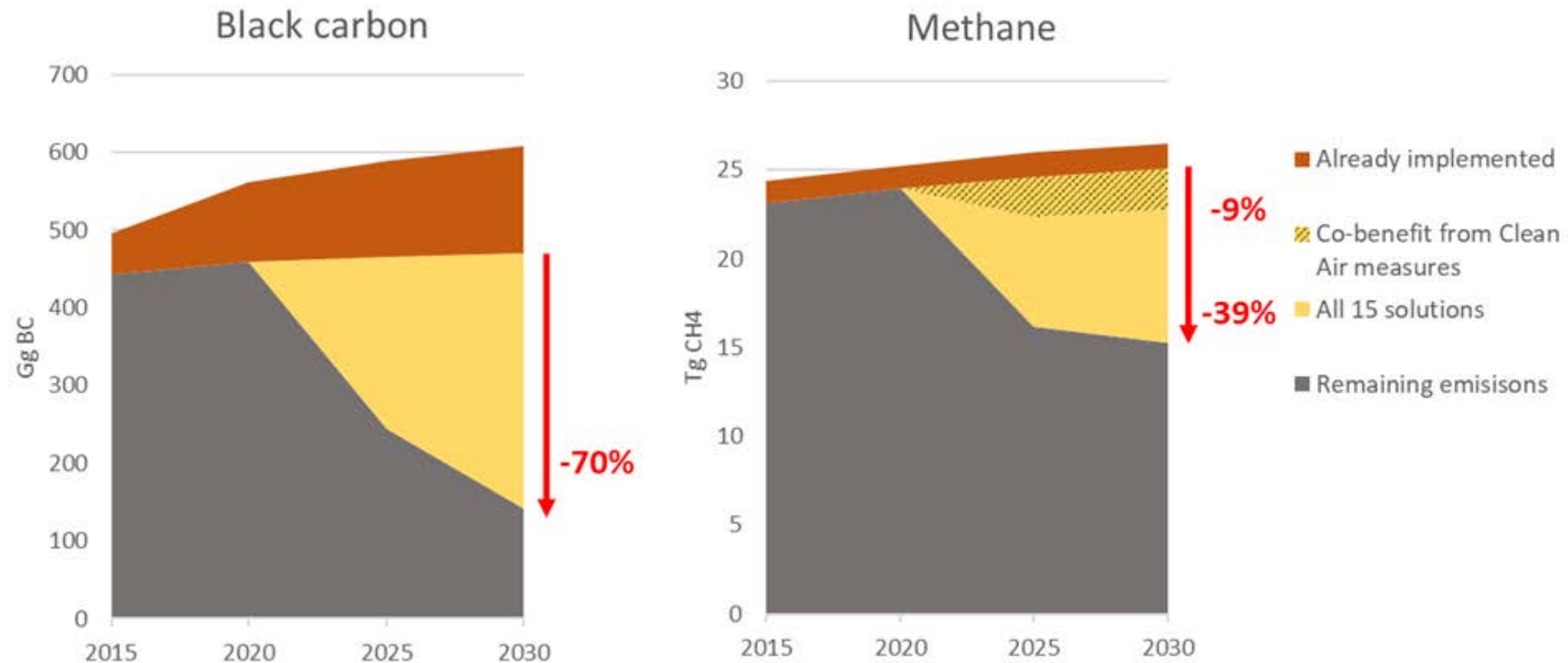
Concluding remarks

- Use of **formal models in development of inventories** leads to improved inventory quality in mid-term,

  - Models require often more data, including data that is not ('yet') available,

  - However, such methods allow for improved consistency and allow for identification of 'white spots',

  - Such approach allows better monitoring of progress in implementation of policies and discussion of future mitigation potential,

- Effective policy to reduce PM exposure needs to **address multiple policy domains** (*energy efficiency and climate, air pollution, agriculture, waste management, food consumption patterns, local vs regional/national policy*), **resulting in multiple benefits**

- Many measures represent **no regret polices addressing air quality/climate nexus**

- The **GAINS model** allows **to assess further mitigation potential** at a regional and local level, **including cost-effectiveness analysis** of respective measures to reduce PM exposure

- Development of the tool and analysis strongly relies and benefits from **collaboration with local partners**