Potential NEACAP approaches and activities on Integrated Assessment Modeling (IAM)

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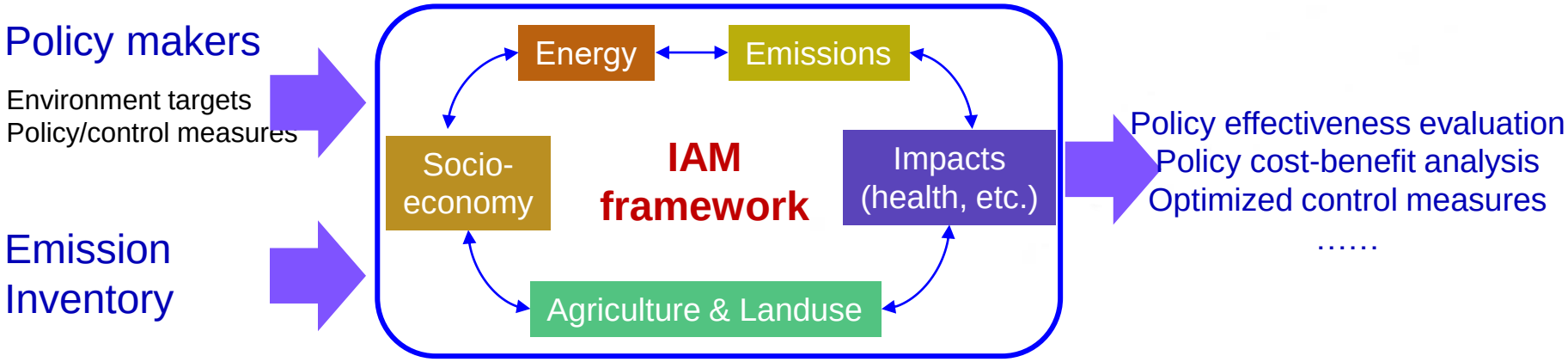
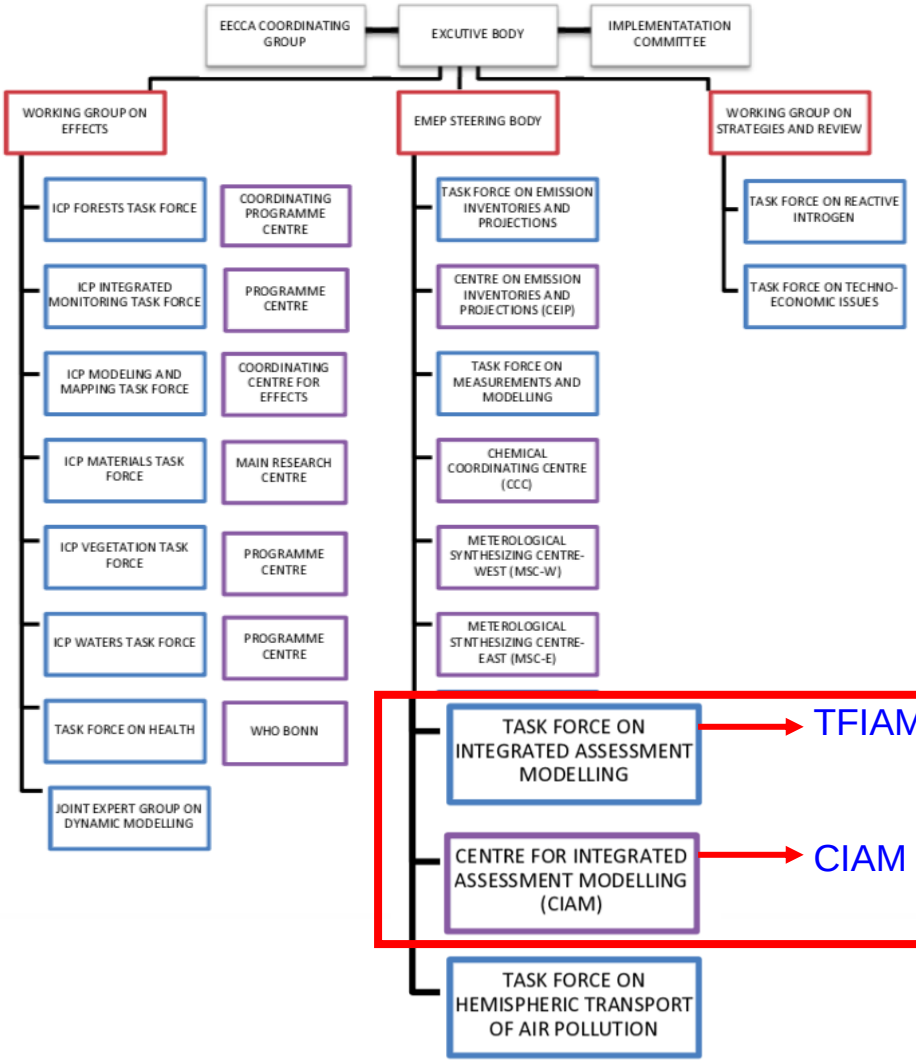
Overview of IAMs

- **The IAMs of air pollution are developed worldwide in order to build consistent frameworks for the analysis of the emission abatement strategies.**
- **The IAMs can help NEACAP members in at least two ways,**
  - **To provide estimates of the costs and environmental or health benefits of alternative emission control strategies.**
  - **To explore the costs-optimal allocations of emission reduction in order to achieve specified targets.**



IAM in international mechanisms: CLRTAP

- **Institutional arrangement regarding IAM in CLRTAP**



The achievements of CLRTAP are:

- **Emissions and economic growth have been decoupled.**
- **Emissions decreased by 40-80%.**
- **Forest soils and lakes have recovered from acidification.**
- **600,000 premature deaths have been avoided annually.**

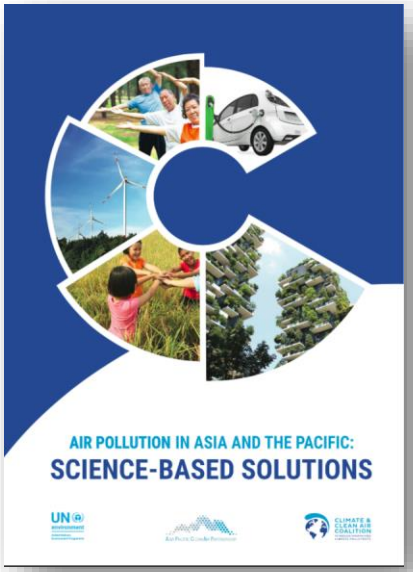
TFIAM: gather information from the Parties and other bodies of the Convention, carry on assessments

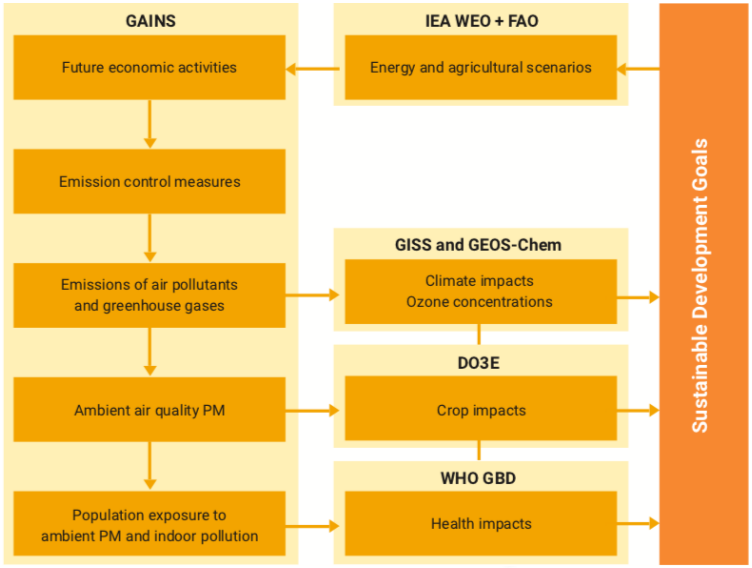
CIAM : hosted by IIASA, develop GAINS model, carry on relevant researches

Source: Laurence ROUÏL, 2016

IAM in international mechanisms: Asia

- Asia Pacific Clean Air Partnership (APCAP) released report *Air Pollution in Asia and the Pacific: Science-based Solutions*, 2019, based on IAM methodologies.
- IAM tools: GAINS (IIASA) + GISS/GEOS-Chem + GDB (WHO)





- EANET proposed to engage integrated assessment after 2016
- LTP project conducted $PM_{2.5}$ source apportionment

Existing IAM frameworks

Air pollution based IAMs: GAINS, ABaCAS, GUIDE, extended beyond;

Macro-economy based IAMs: REACH, IMED, extended to air pollutants.

IAM	Emission scenario model	Air quality model	Advantages	Limits
GAINS	Exogenous	EMEP	Propose rich control measures on air pollutants or GHGs; cost + benefit	Exogenous socio-economy and energy pathways
ABaCAS	GCAM	RSM	Generate emission pathways under socio-economic assumptions & policies; cost + benefit; optimization under certain air quality goal.	Insufficient consideration on non-CO2 GHGs
GUIDE		RSM-Korea	2 modes: scenario analysis & optimization; cost + benefit; GHGs included	Initial development will be finished within 2020
REACH	CREM (CGE)	WRF-Chem/CMAQ	Interaction with macro-economy (e.g. %GDP loss); cost + benefit	no optimization, lack of technology representation
IMED	AIM (CGE)	GAINS-China	Interaction with macro-economy; cost + benefit	no optimization, lack of technology representation

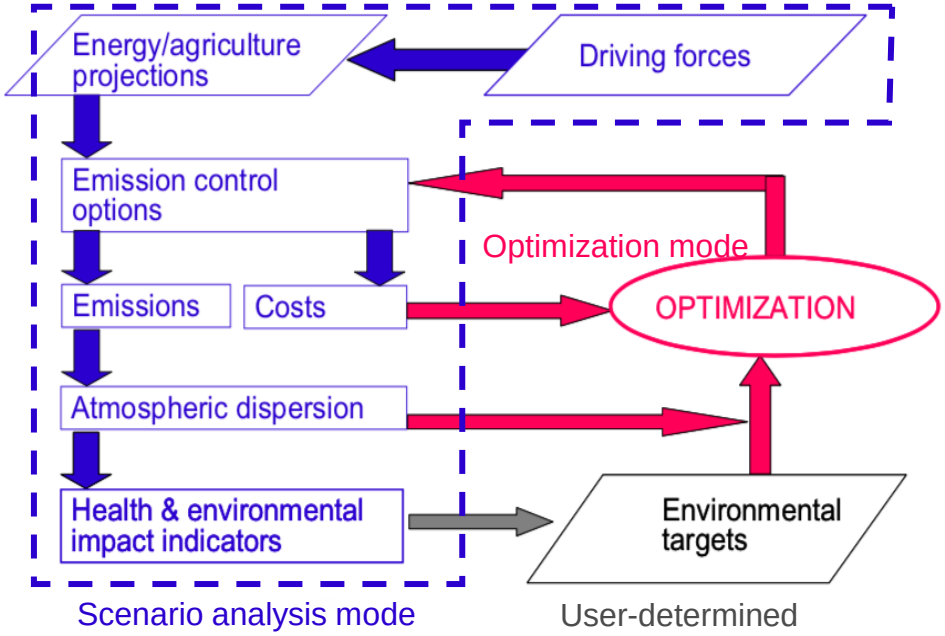
GAINS -- IIASA

- GAINS provides support for the cost-effectiveness of alternative emission control strategies and distribution of economic burdens and environmental benefits.

- GAINS in North-East Asia

GAINS-Asia

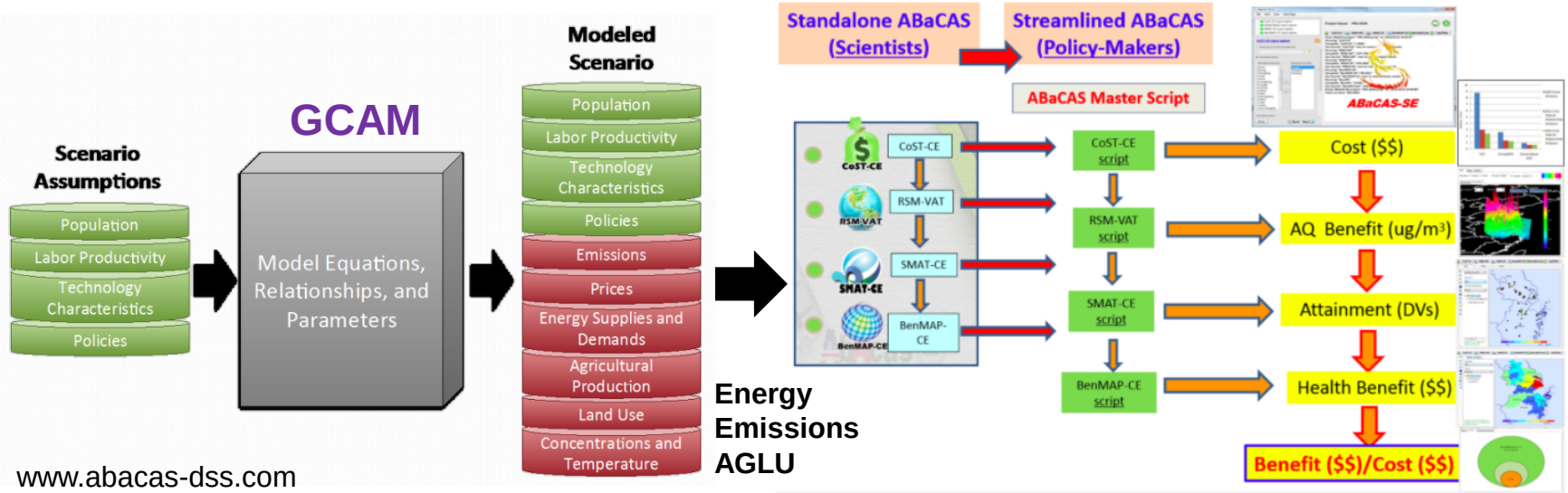
- GAINS framework



Source: IIASA

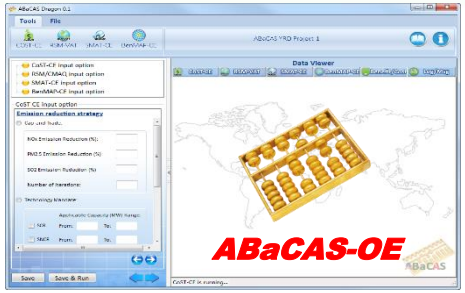
ABaCAS – Tsinghua University/EPA

- **ABaCAS is an integrated system for scientific and policy assessment, providing cost-benefit analysis for pollution control scenarios, and optimization at given environmental target.**
- **ABaCAS-SE: economy→energy→emission→cost-benefit analysis**



- **Inputs: socio-economic assumptions and policy measures**
- **Outputs: 1) future energy & emissions; 2) emission control costs; 3) air quality improvements; 4) health benefits.**

ABaCAS – Tsinghua University/EPA



Attainment Goals

Pollutant A: PM2.5 attains 35 ug/m^3 (annual)

Pollutant B: O3 attains 80 ppb (MDA8)

SMAT-CE

LE-CO

Control Cost Optimizer

ICET

pf-RSM

Control & Cost Estimate

Air Quality Benefit

BenMAP-CE

Attainment Target

Optimized Control & Cost for Attaining AQ Goals

Health Benefit ($$)

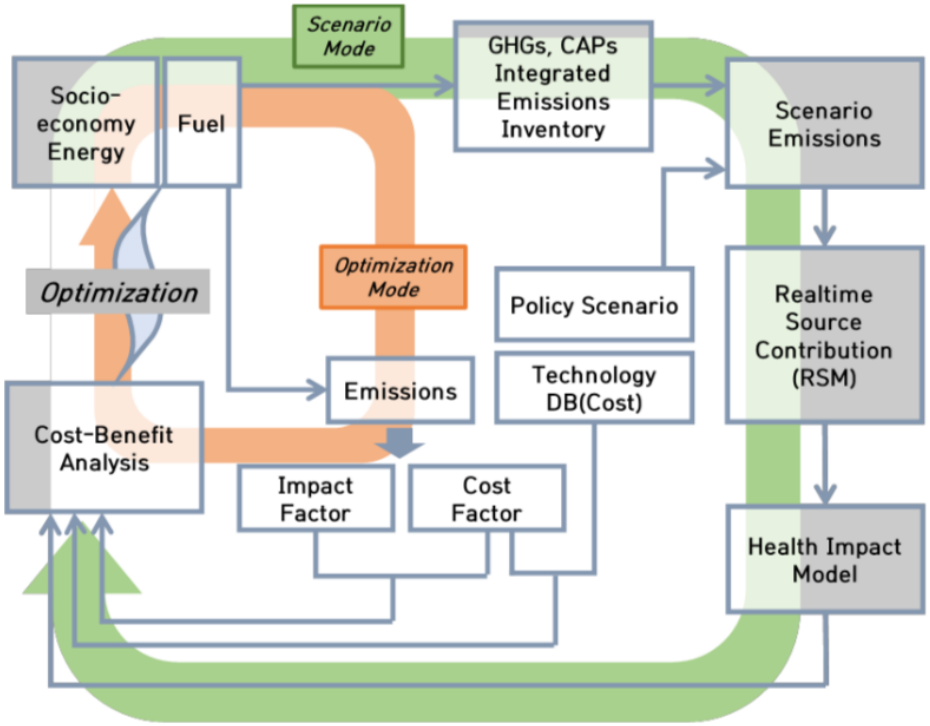
Benefit/Cost

ABaCAS-OE: Optimized Control Strategy

GUIDE – Konkuk University

- **GUIDE aims to establish a decision-making system for Korea to manage GHGs and air pollutants simultaneously.**

GUIDE model framework



Source: J.-H. Woo, 2020

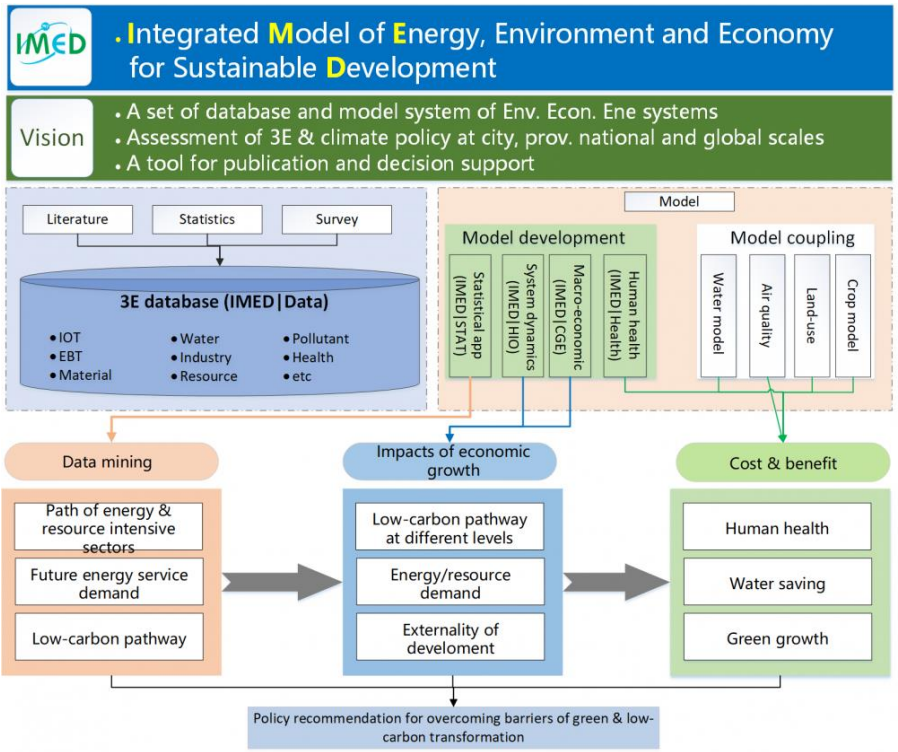
GUIDE design

- It implements emissions inventory for 7 air pollutants (CO, NOx, NH_3, SO_2, PM_{10}, $PM_{2.5}$, VOC) and six greenhouse gases (CO_2, CH_4, N_2O, 3 F-gases).
- It includes RSM model for air quality simulation.
- It divides Republic of Korea into 17 regions, and can assess source-receptor relationships
- Incorporation of China and North Korea emission inventories to quantify out-of-region contribution
- The simultaneous optimization for bi-directional co-control/co-benefits

AIM/IMED – NIES/Peking University

- **IMED is a system of databases and models analyzing economic, energy, environmental and climate policies at the city, provincial, national and global scales.**

IMED model framework



Source: LEEEP website

IMED functional modules

- **Emission projection: AIM/CGE (NIES, Japan) or hybrid Input-Output Analysis: IMED|HIO**
- **Air quality: linking with GAINS-China**
- **Health impact: IMED|HEL, including ambient pollution, indoor pollution, labor loss, health expenditure and life value.**
- **Applications:**

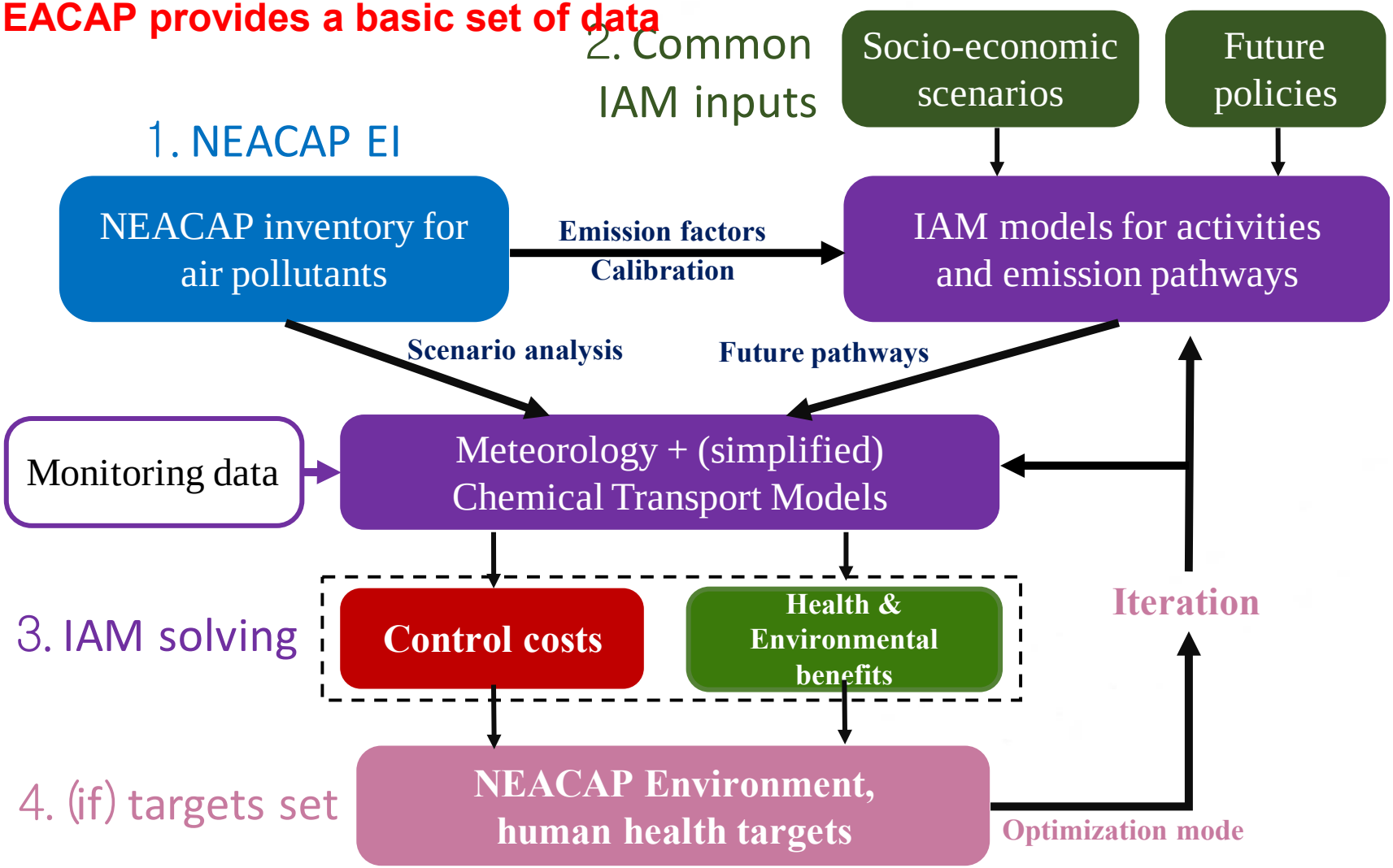
  Environmental economic analysis: export restructuring with emission; US withdraw of Paris Agreement; Mitigation co-benefit

Potential IAM approaches for NEACAP

- **Aims**
  - **Available IAMs can be used as a scientific and practical tool to help members identify cost-effective emission reduction pathways and measures of air pollution and assist the mitigation of air pollutants both at nations and in the sub-region.**
- **Approaches: Development of science-based clean air solutions utilizing multiple IAMs**
  - **An open call for participation/proposal can be made and 2-4 teams may be selected.**
  - **Small funding will be granted to cover the basic costs (travels, meetings, etc) of the chosen teams. This process will also require to set up a coordination team, e.g. WGIAM.**
  - **An "ensemble" approach that builds on model results from multi-models/multi-teams to propose the cost-effective policies.**

Potential IAM approaches for NEACAP

NEACAP provides a basic set of data



Potential IAM approaches for NEACAP

Major future work:

- **Development of future emission scenarios in North-East Asia:**

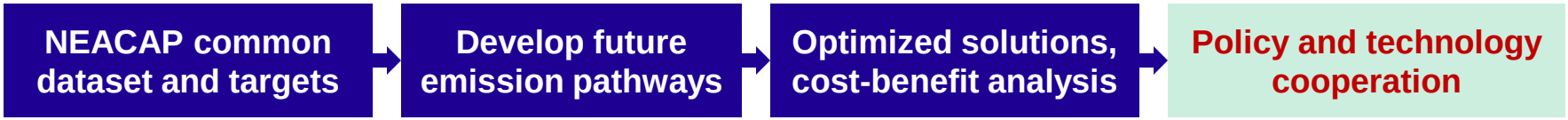
  A multidisciplinary approach involving experts from diverse fields, interaction with up-to-date information on emission group (NEACAP EI), socio-economic pathways, and government policies.

- **Development of an overall approach to IAMs and comparative analyses:**

  Model comparison will be conducted by synergizing with existing efforts (e.g., MICS-Asia, CAAC).

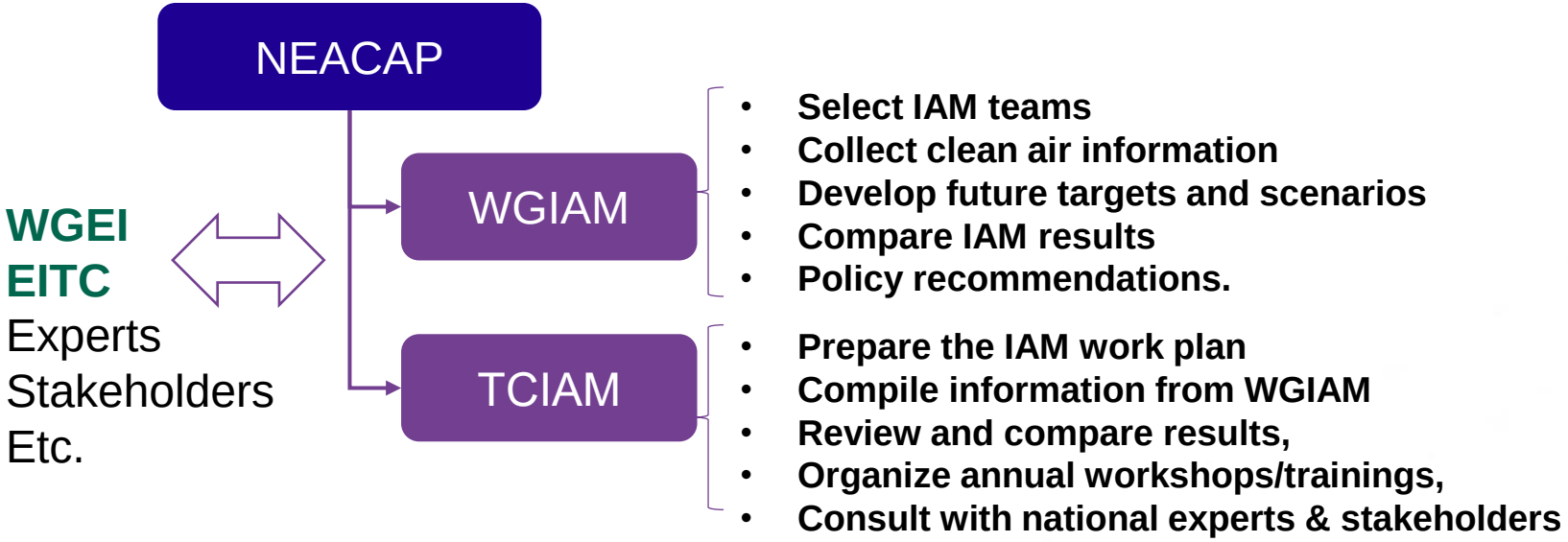
- **Development of science-based clean air solutions utilizing multiple IAMs and taking into account of national circumstances**

  IAM can facilitate the policy and technology cooperation by sharing common goals and identifying specific cooperation areas, as well as SAR.



Institutional arrangements and practical work

- **Establishing a Working Group on IAMs (WGIAM)**
  - A flexible and practical approach without limiting the number of members
  - The nomination will be made by SPC members.
- **Establishing a Technical Center on IAMs (TCIAM)**



- **Prepare IAM work plan**
- **Facilitate IAM participants and budget allocation (~200k US$?)**
- **Annual workshop and reporting as a ref. of policy cooperation**

Thanks for your attention!

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