



IAMC – Integrated Assessment Modeling Consortium

JST Social Science Research Project

National Models and Scenarios on short-term and long-term climate policies

IAMC SWG on National Scenarios: Current Status

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Shinichiro Fujimori (KU, NIES, IIASA), Roberto Schaeffer (COPPE/UFRJ)

Acknowledgement:

Scenario data: Modelling Teams [National, Regional, Global, Subnational]

Vetting process: Anuj Pathak (PhD Student, KU), Shoyeb Khan (Research Associate, IIMA)

Registration: Phillip Hackstock (Research Software Programmer and Data Steward, IIASA)

David Almeida (Research Software Programmer, IIASA)

Date: 12th March 2025 [14:00 – 15:00 Japan Time]

Outline

Background

Open Call

Data Quality Check

Initial Analyses

Summary

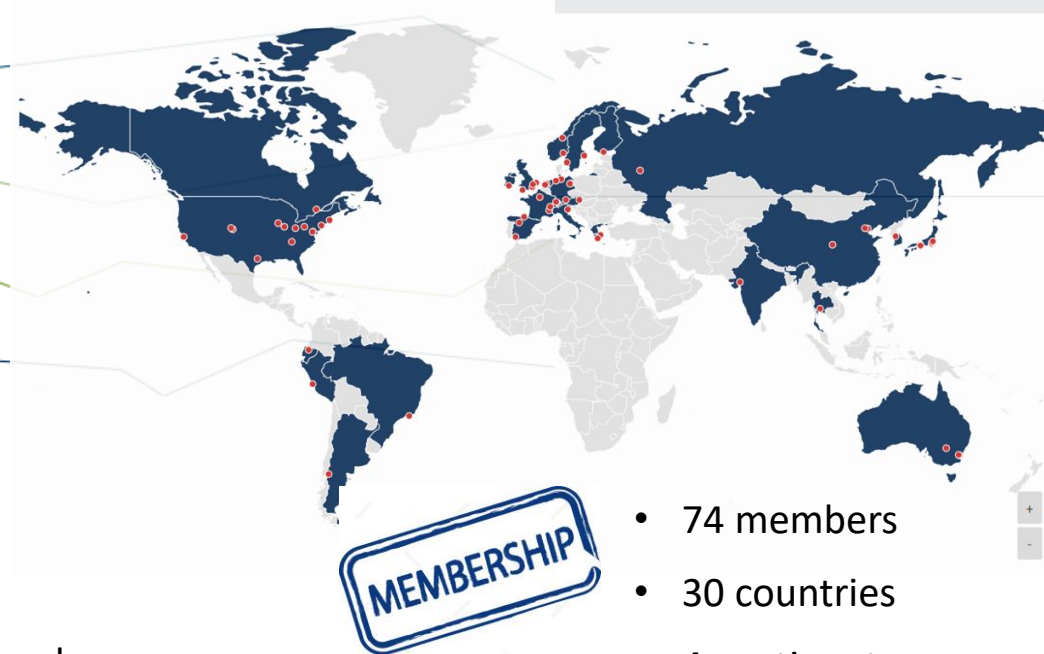
@ IAMC



IAMC – Integrated Assessment Modeling Consortium

Mission:

- ✓ Facilitate and foster the development of integrated assessment models (IAMs), and the conduct of research employing IAMs, including model diagnosis, inter-comparison, and coordinated studies.
- ✓ Facilitate and coordinate IAM research with research conducted in both the Climate Modeling (CM) and the Impact, Adaptation, and Vulnerability (IAV) research communities.
- ✓ Provide a point of contact with other institutions and organizations interacting with the IAM community



www.iamconsortium.org

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- SWGs bring together a subset of members of the IAMC, and possibly external participants, to carry out activities of the IAMC.
- We have **5 active SWGs**
 - Scenarios
 - Data Protocols and Management
 - Evaluation and Diagnostics
 - Climate Finance, and
 - National Scenarios (our newest SWG)
- Our 5 SWG's meet during the annual meeting to review activities during the year and to plan for the next year's work.



**Working Group on
Scenarios**



**Working Group on
Data Protocol and
Management**



**Working Group on
Evaluation and
Diagnostics**



**Working Group on
Scenarios for Climate-
related Financial Analysis**



**Working Group on
National Scenarios**

IAMC 2024

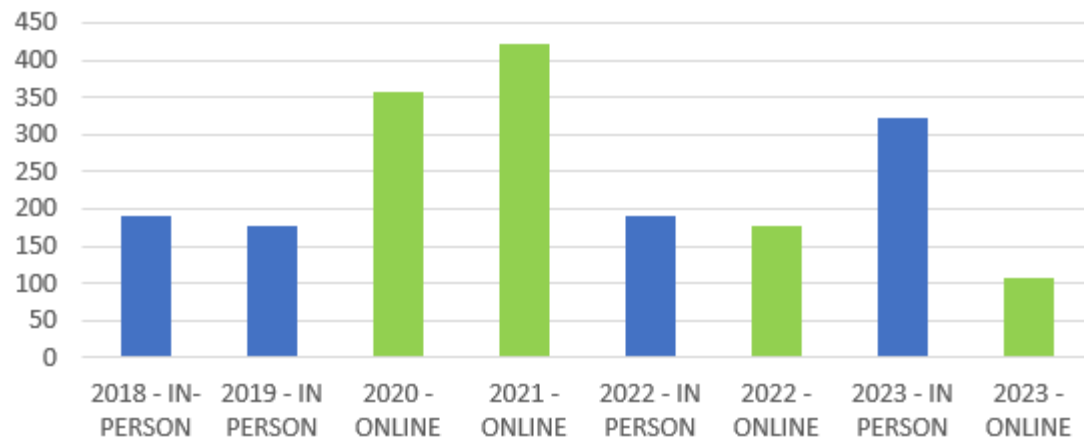
Seoul, South Korea, 6-8 November 2024

Submissions: 500+

Participants: 384 (301 in-person), 83 online

Countries: 37

IAMC Annual Meetings - Participants



IAMC Annual Meeting recordings available on the [IAMC YouTube channel](#).

STAY TUNED!

IAMC 2025 Brazil:
more information soon!

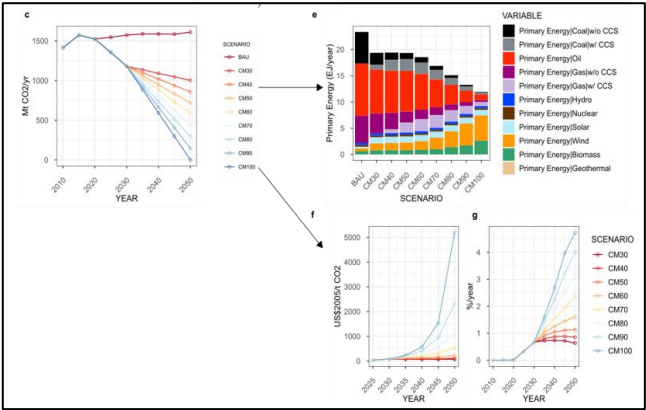
Background

IPCC AR6 WGIII Chapter 4: Main Insights

- There is broad literature on global mitigation pathways and **decent literature on country level pathways** published in the last decade.
- **Different methods and models** exist to analyze the implications of current policies and NDCs on country-level emissions.
- The country level studies differ across **different dimensions**. These include:
 - (i) sectoral coverage (single, multiple),
 - (ii) the emission coverage (only CO₂, CO₂, and non-CO₂),
 - (iii) the type of scenarios (current policy, business as usual, based on SSPs),
 - (iv) policy coverage (representation of policies differ based on the model archetype).

Peer-reviewed articles

International Project/s

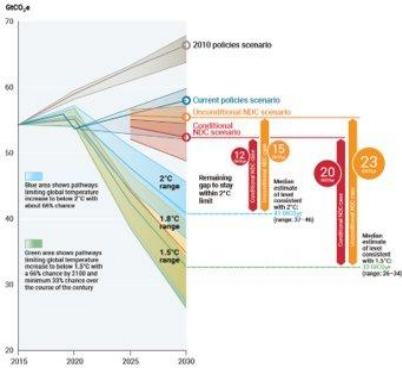


Phase I: Incremental emission reduction

Source: Fujimori et al. 2021

1-2 country teams per project

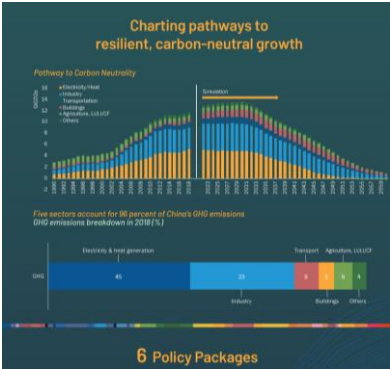
UNEP Gap report



Source: EGR 2024

Grey Literature

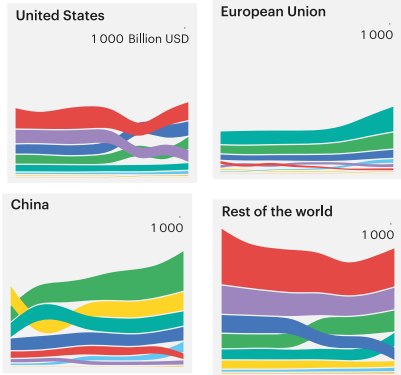
World Bank



Source: CCDR 2023

Low and middle- income economies

IEA



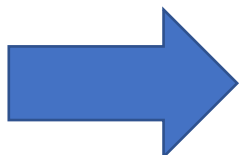
Source: IEA 2024

Country Climate and Energy Modelling Forum/s

Country/region	Number of models	GHG coverage	Time horizon
Europe	10 models	Full GHGs/energy related CO2	2050 (some are 2100)
Germany	6 Models	All GHGs	2050
Japan	5 models	Energy related CO2	2050
United States	6 models	Energy related CO2	2050
Korea	6 models	Energy related CO2	2050
China	4-5 models, 30+ models (Only CGEs)	Energy related CO2	2050
India	4-5 models -> 12 models	Energy related CO2	2050

IAMC SWG on National Scenarios

- No communities or organizations
 - Multiple national and international projects
 - Need to collect the information on national scenarios at one location
- Comparability of scenarios are expected but ...
- How should we map with global picture consistently from **national perspective**?
- Need to tackle with uncertainties
 - Climate policies are revised and launched frequently
 - National circumstances can change drastically
 - Global scenarios are also revised based on WG3 and WG1 state-of-the-art knowledge



IAMC SWG can provide a required platform to explore national climate actions

Objectives: SWG National Scenarios



- Promote **standardization** among national scenario development activities to **increase comparability and use in assessment** of international climate policy
 - This can include linkages to common reporting databases
- **Inter-linking national** activities to global activities
 - This can include the assessment of global and national/regional emissions, and climate consequences
- Provide a **platform for sharing best practices** to build capacity through the exchange of information. This includes (but is not restricted to) national scenario development, model inter-comparison and assistance with common reporting databases.
- **Facilitate and support dialogue** between IAMC community (global, regional, national) and national scenario users through outreach and communication activities.
- Coordinate on **archiving, documentation and communication** of national scenario data and publications

WIP: Models (IPCC AR6 and After IPCC)....

will increase

Region	IPCC AR6 WGIII	Since IPCC AR6 WGIII*	Total
Africa	4	+5	9
Asia	21 [7]	+72	93
Europe	9	+15	24
North America	4	+20	24
South America	5	+10	15
	50	115	165

Note

- [] country represented as regions in global models
- Includes national models (IAMs, ESM, sectoral, hybrid)
- Independent national models
- *Data collected based on secondary literature, country MIPs/EMFs, modelling networks such as AIM, GCAM, IMACLIM, MESSAGEix and so on.

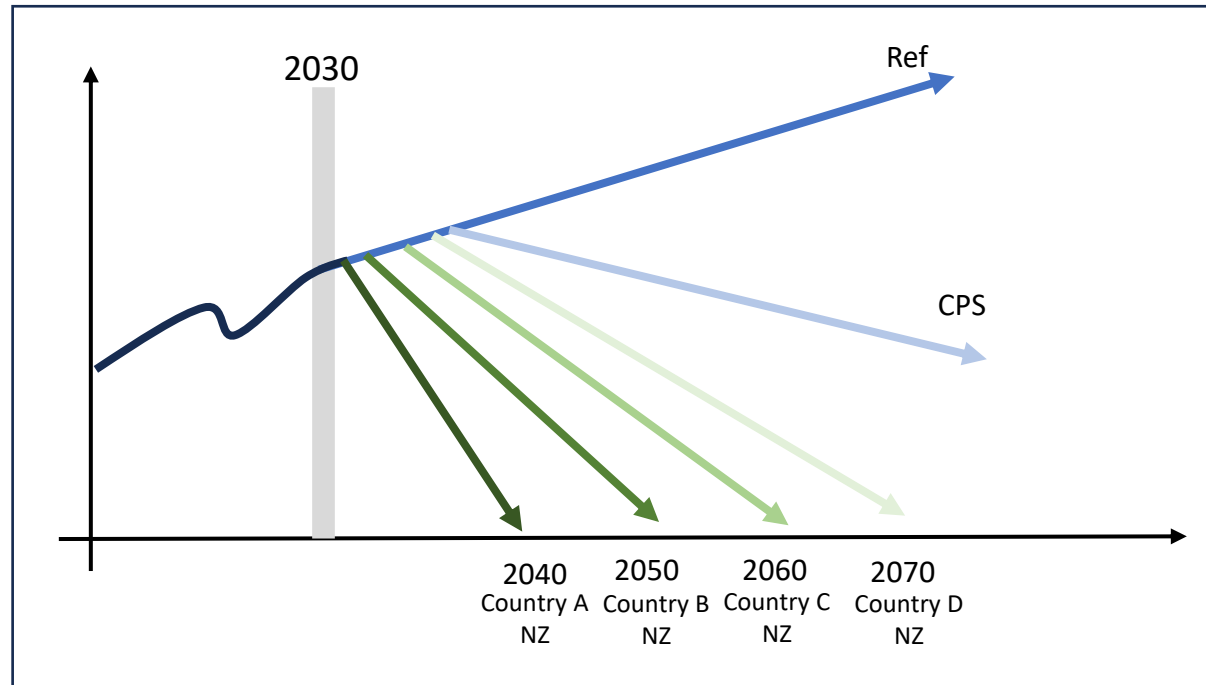
Open Call

**National Modelling
Scenarios Forum (NMSF)**

Purpose of the Study

- Build on the work compiled in IPCC WGIII AR6 Chapter 4 (mitigation and development pathways in the near and medium term).
- Plan to evaluate the gap between the current policies being implemented and the measures required to reach the Net Zero targets at national level.
- The **main objectives** of the first exercise are to:
 1. **Consolidate** modelling exercises taking place across international and national projects, activities explored under national and regional climate and energy modelling forums,
 2. **Facilitate** discussion of the national scenarios, and coordinate the scenario intercomparisons within and across countries or region,
 3. **Align** the Long-Term Strategies (LTS) and Net Zero (NZ) targets with short term policy measures (updated NDCs and implemented current policies).

IAMC SWG : National Scenario Protocol



Illustrative Pathways
(Authors, WIP)

Reference/BAU: Also known as baseline/business as usual scenario. This scenario assumes policies or measures implemented before 2015. Baseline scenarios are not intended to be predictions of the future, but rather counterfactual constructions that can serve to highlight the level of emissions that would occur without further policy effort .

Current policies Scenario (CPS): includes currently implemented policies adopted by governments (through legislation) or non-binding targets backed by effective policy instruments and planned policies in the pipeline to be adopted.

Net Zero scenario (NZS): The NZ scenario could capture the planned policies (including updated NDC), ratcheted implemented policies in addition to policies mentioned in each country's Long-Term Strategies (LTS) and/or Net Zero plans. Ambitions and pledges are considered in this scenario.

Processes

- There will be **an initial set of scenario variables** shared with national modelling teams. The scenario data collection and vetting process ensure that the data collected is transparent, consistent, complete, and comparable.
- The **compilation** of national models and scenarios data will be hosted on a Scenario Explorer by the *International Institute for Applied Systems Analysis (IIASA)* as a part of cooperation agreement with IAMC SWG on national scenarios.
 - We will share the scenario database excel along with final scenario protocol shared with country teams.
 - **NOTE:** For those who cannot transform the currently available scenario data into so-called IAMC template, please contact us. We will assist you with data processing.
- The **vetting** of scenario process constitutes of verification and validation of model results in this study. This will include (not limited to) historical data validation (hindcasting), unit checks and clarification on issues in model results.

Progress Status [# of teams]

	Information	Registered	Submission	Vetting Process
December 2023	30			
January 2024	46			
February 2024	51			
March 2024	68	38		
April 2024	81	65	~10	
May 2024	86	73	~18	
June 2024	86	77	21	21
October 2024	90	77	32	32
February 2025	98 (As on 28 th February 2025)	90 (70 completed) (As on 28 th February 2025)	40 (57% registration complete) (As on 28 th February 2025)	40

There could tentative 10-15 more teams, who may register [Example: India (+4), UK, and so on

- **Interest** to participate in the SWG National Scenarios study: **84% (Yes)**, 15% (Maybe)

IIASA DB and Scenario data template

- **Awareness** of IAMC Template to submit scenario data: **51% (Yes)**, 49% (No)
- **Registered** to IIASA Database: 39.5% (Yes), **57% (No)**

Model Information

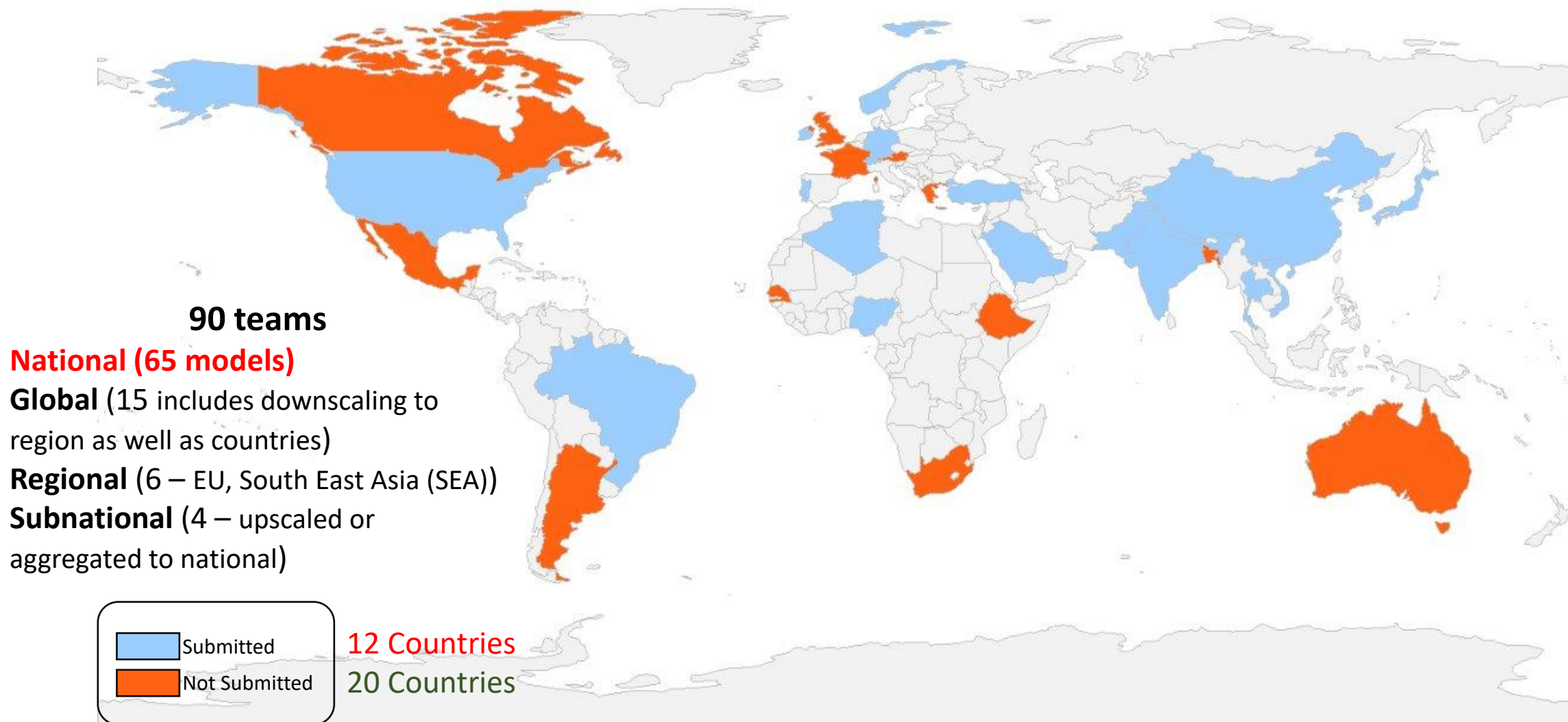
- **Emission profile:** **CO2 (44%)**; CO2, CH4, N2O (39.5%); GHG (16%)
- **Model types:** IAMs including soft-linked (global, national, soft-linked) (31%), Energy Systems Model (27%), CGE (22%), Sectoral (10%)
- **Modelling Network:** AIM, GCAM, TIMES, IMACLIM, MESSAGE-ix were found to be active

Scenario Submission

- **Scenarios:** **Preliminary (44%)**, Peer reviewed (22%), Grey literature(13%), Others (21%)
- **Scenarios:** BAU(67 models), CPS (62), **Net Zero (72)**
- **Sectors:** **Energy Supply (80 models)**, Energy Demand (70), **Agriculture (40)**, **Land and LUC (36)**

Registration and Submission

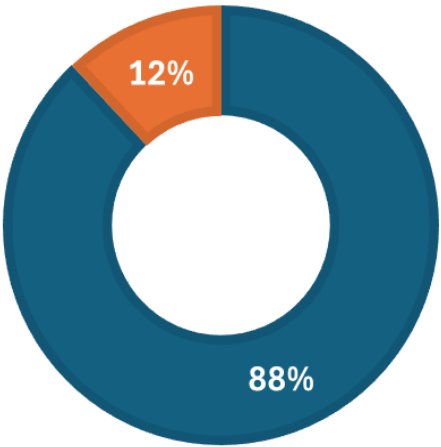
Countries with National Model



Emission coverage [Fossil CO2]

NET ZERO COMMITMENT

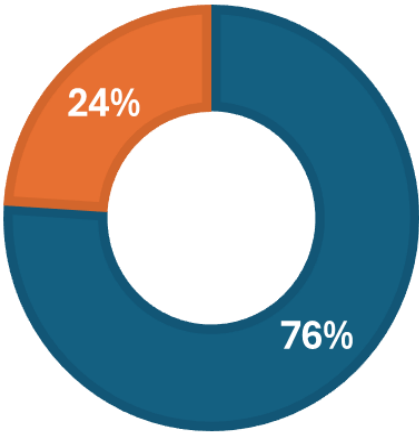
■ Countries covered ■ Remaining



140 countries

G20

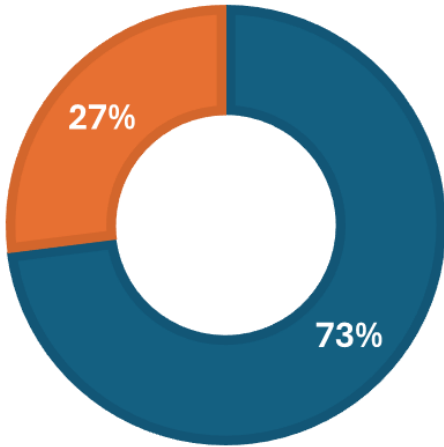
■ Countries covered ■ Remaining



20 countries

IAMC SWG REGISTRATION

■ Countries covered ■ Remaining

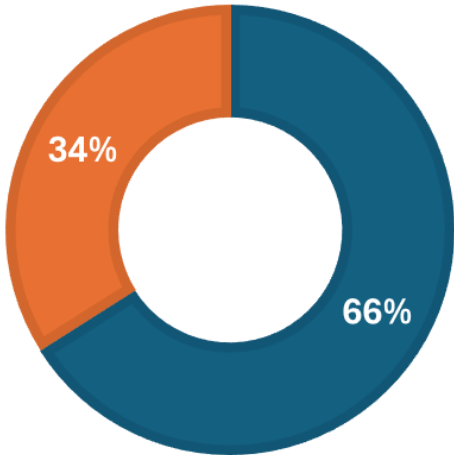


31 countries

- 32 with UK – 74%
- Including + EU and + ASEAN – slightly more [?]

IAMC SWG SUBMISSION

■ Countries covered ■ Remaining



19 countries

Submission Process [back-end processes]

Acknowledgement:

Scenario data: 40 teams from 20 countries

Registration: 70 teams

Registration: Phillip Hackstock (Research Software Programmer and Data Steward, IIASA)
David Almeida (Research Software Programmer, IIASA)

Common issues

1. Model registration

- Common issues

2. Submission of data

- Scenario variables: Tier systems
- Common issues

3. Processes

- Individual access to national teams
- Working on verification process [Anuj – WIP]

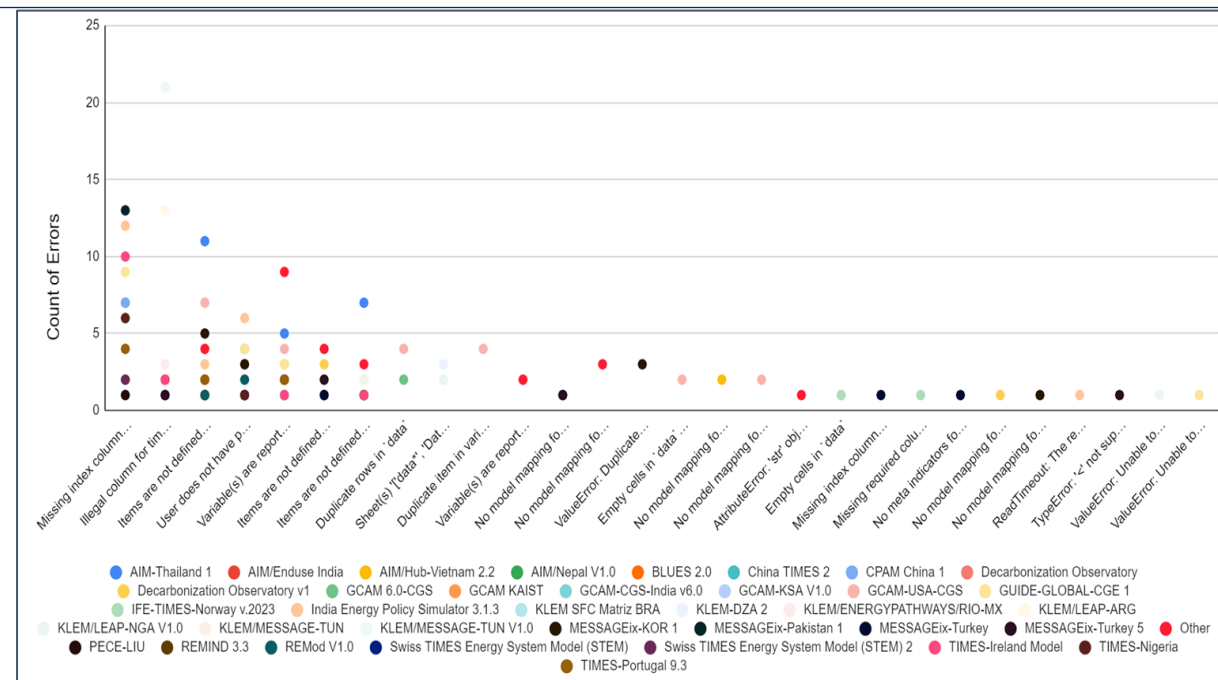
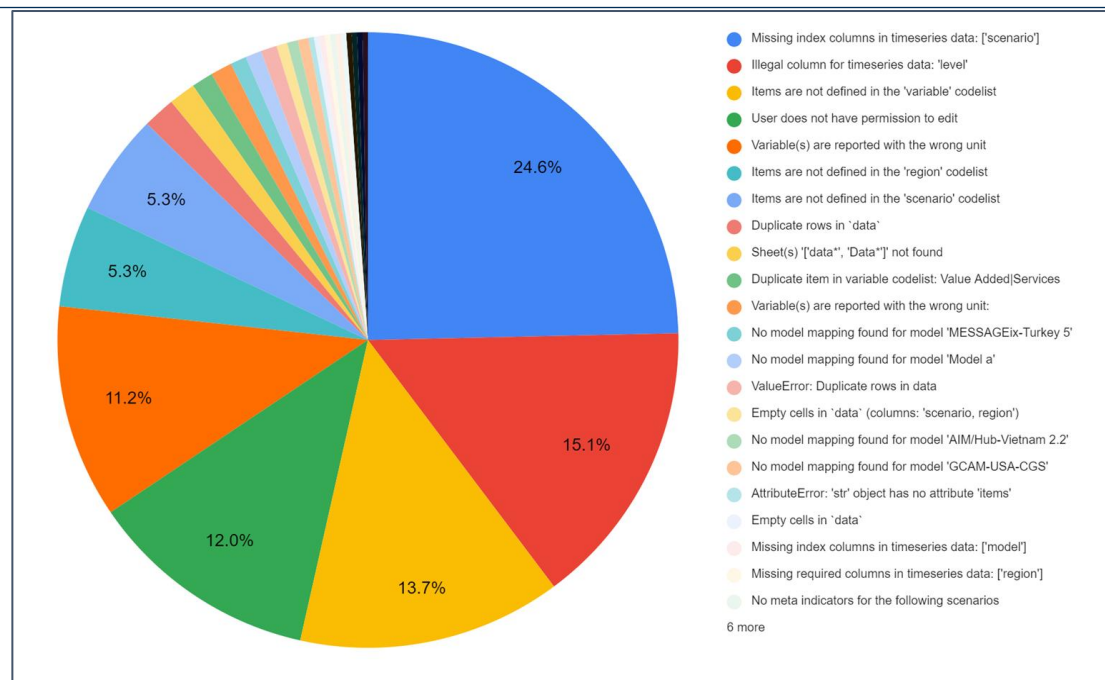
• Registration issues include

- Having multiple account -> shift to one
- Global models took more time [Need regional sheet]
- Data transfer -> lesser variables

• Submission issues include

Error Title	Error Type	Error ID	Description	Remark
QC check	Illegal column	1	ValueError: Illegal column for timeseries data: 'level'	
QC check	Illegal format	2	ValueError: Sheet(s) '['data*', 'Data*']' not found in file	
QC check	Units	3	variable(s) are reported with the wrong unit	Emissions N2O - expected: 'kt N2O/yr', found: 'Mt N2O/yr' (standard format is 'Mt N2O/yr' but the reference data in NMSF has 'kt N2O/yr')
QC check	Variables	4	items are not defined in the 'variable' codelist	

Common issues [Error Logs]



Missing index columns in timeseries data: ['scenario']

Illegal column for timeseries data: 'level'

Items are not defined in the 'variable' codelist

User does not have permission to edit

Variable(s) are reported with the wrong unit

Items are not defined in the 'region' codelist

Items are not defined in the 'scenario' codelist

Duplicate rows in `data`

Work in progress

Feedback to IIASA Database to
improve the back-end

Other Discussion points

- **New Indicators – Coordination with SWG Data and Protocol**
 - Inform SWG Data Management – Units [PJ, MtCO2 and so on], socio-economic indicators
 - Process
 - Adhoc [Quick process for the study if required] - To be added in the next round
 - **GDP** [Private Consumption, Public Consumption and so on]
 - **Non-Energy | Fossil fuels** to Non-Energy | Coal, Non-Energy | Gas
 - IAMC Common definitions and inform the group on github [Longer process]
- **Several NZ scenarios**
 - Timing of collection – Study 1, IPCC AR7 cycle by next year
 - NZ as per team selection or maximum reduction feasible?
 - Teams request submission of multiple NZ scenarios
- **Region – EU 27/ EU 28 in global models**
 - Regional models will be included

Data Quality Checks

Acknowledgement:

Scenario data: 40 teams from 20 countries

Vetting process: Anuj Pathak (PhD, KU), Shoyeb Khan (RA, IIMA)

IIASA pyam package

PIK R package

Vetting Process

- a. Resolution checks [National boundary]
- b. Submission checks – Socio-economic GDP, Population, Emissions, Land)
- c. Historical data check – 2015, 2020
- d. Baseline data check – Summation [Emissions, PE, SE, FE, Land]
- e. Projection checks [Not included in the first study]
 - i. 2030 [?]
 - ii. 2035 [?]

Submission [Pop, GDP..]

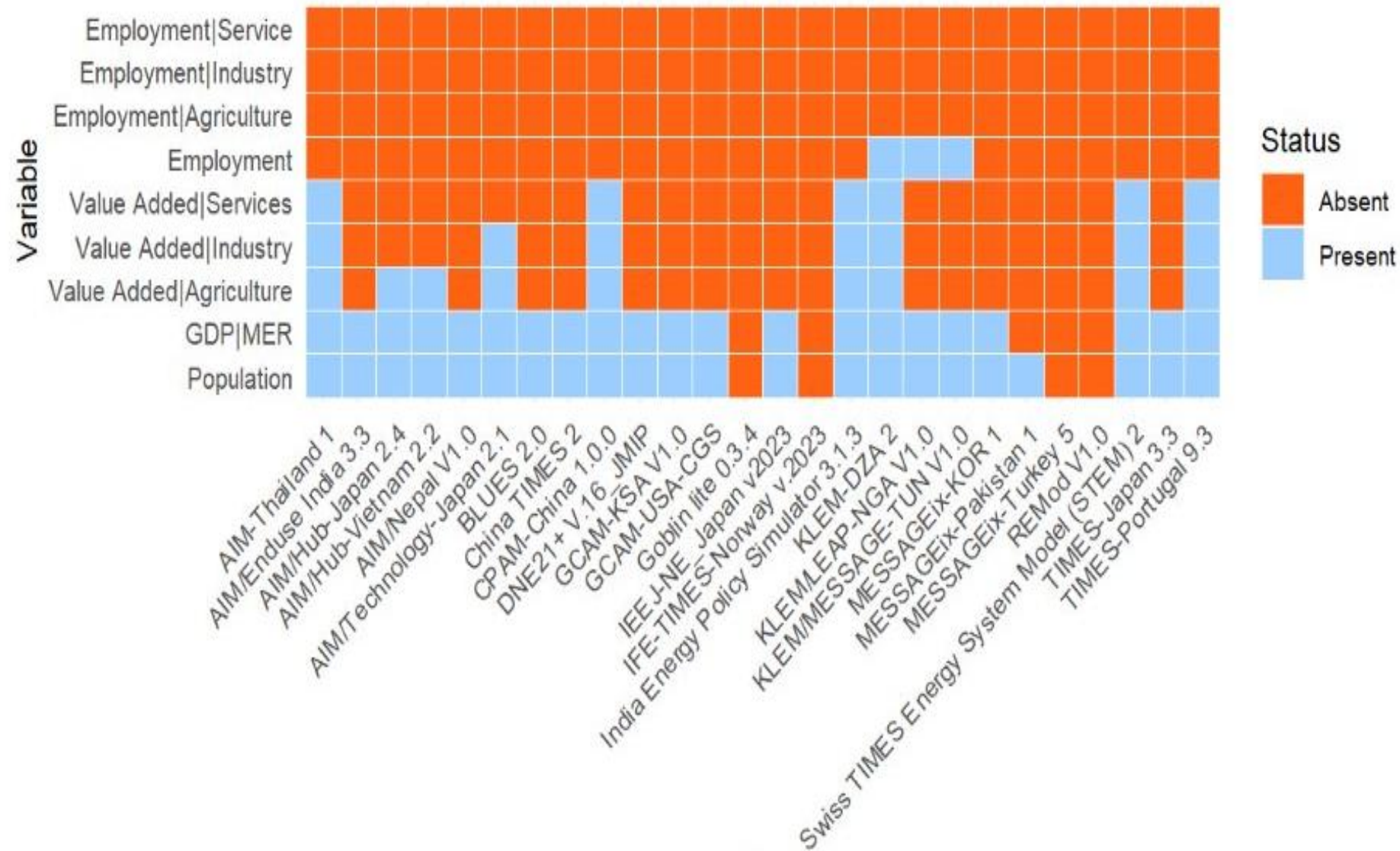
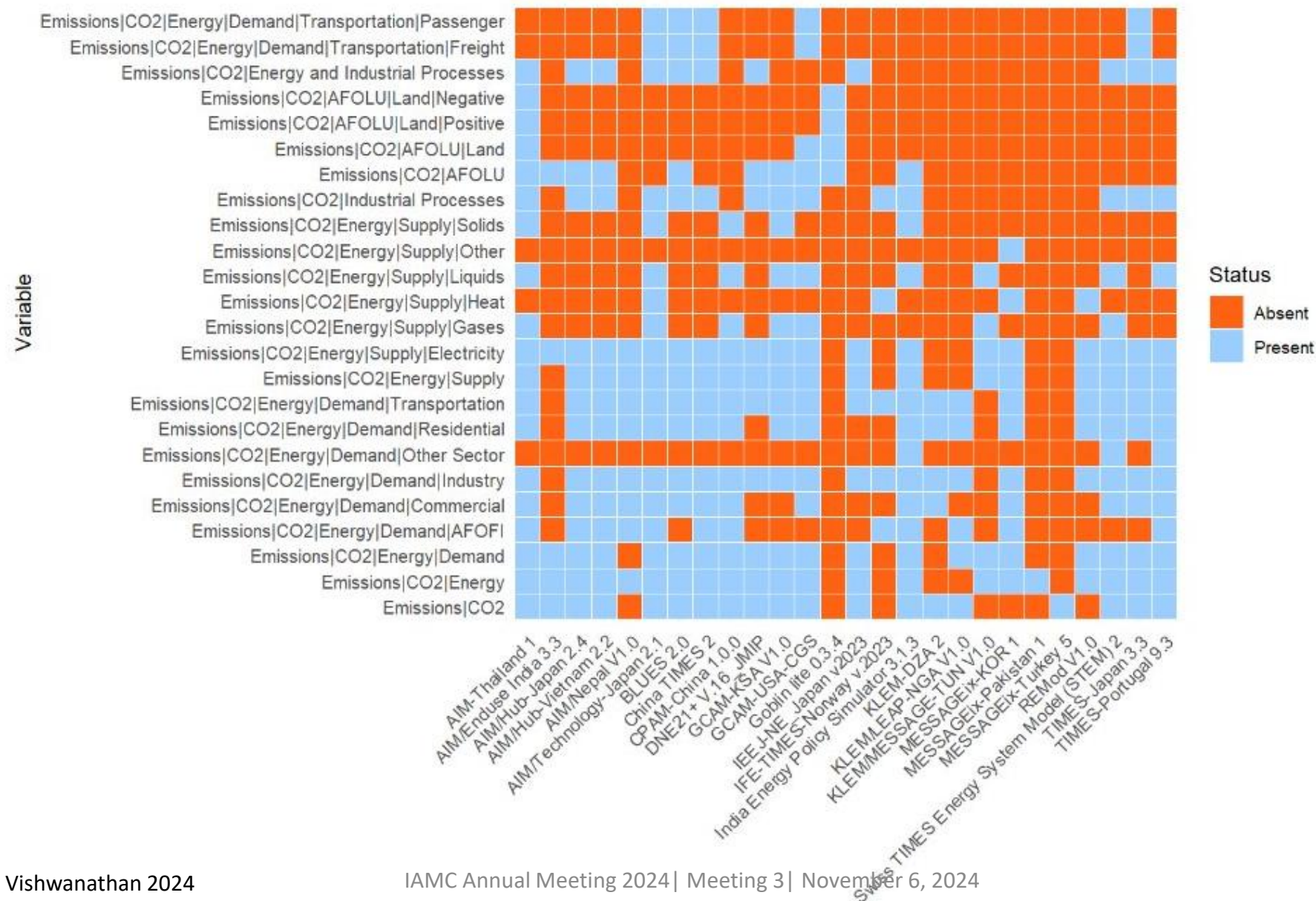
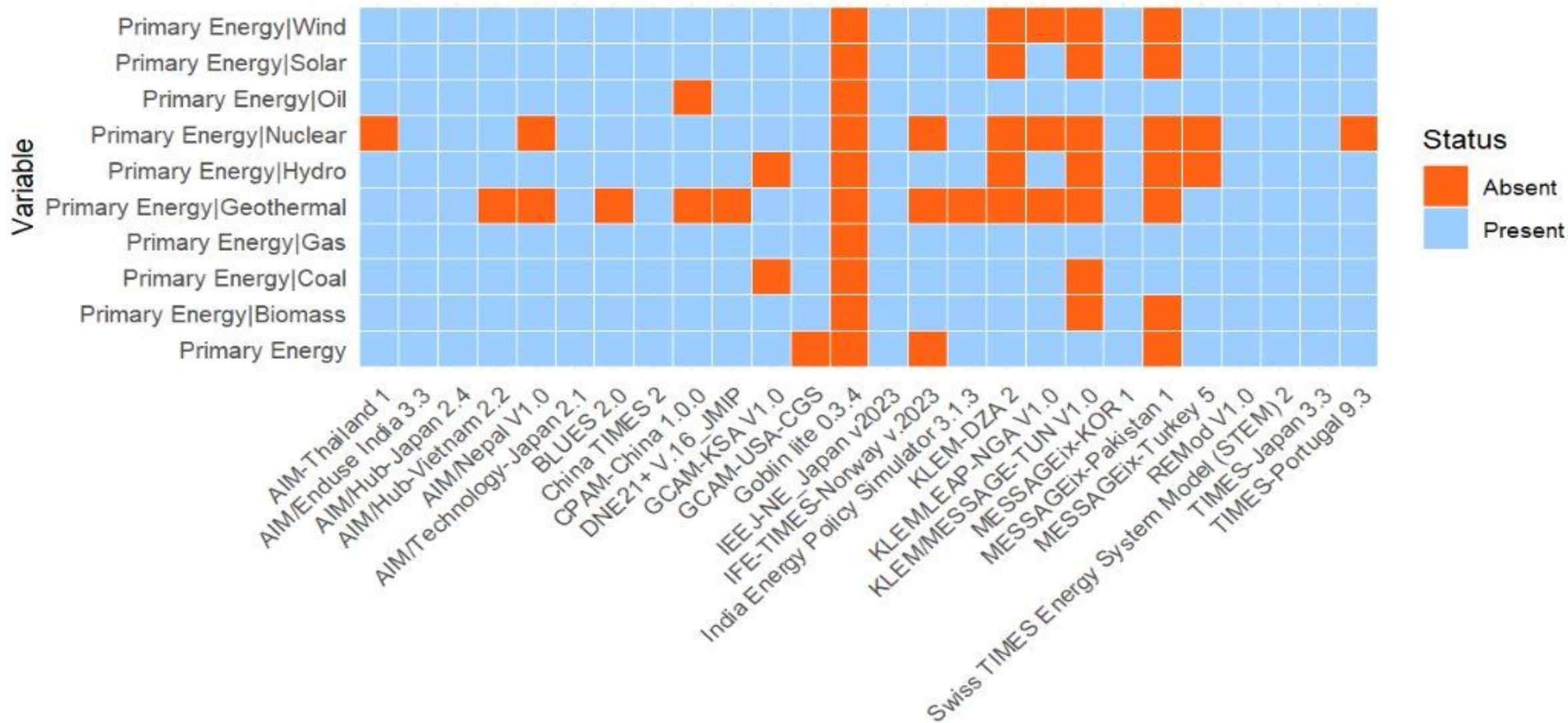


Figure courtesy: Pathak and Vishwanathan 2024

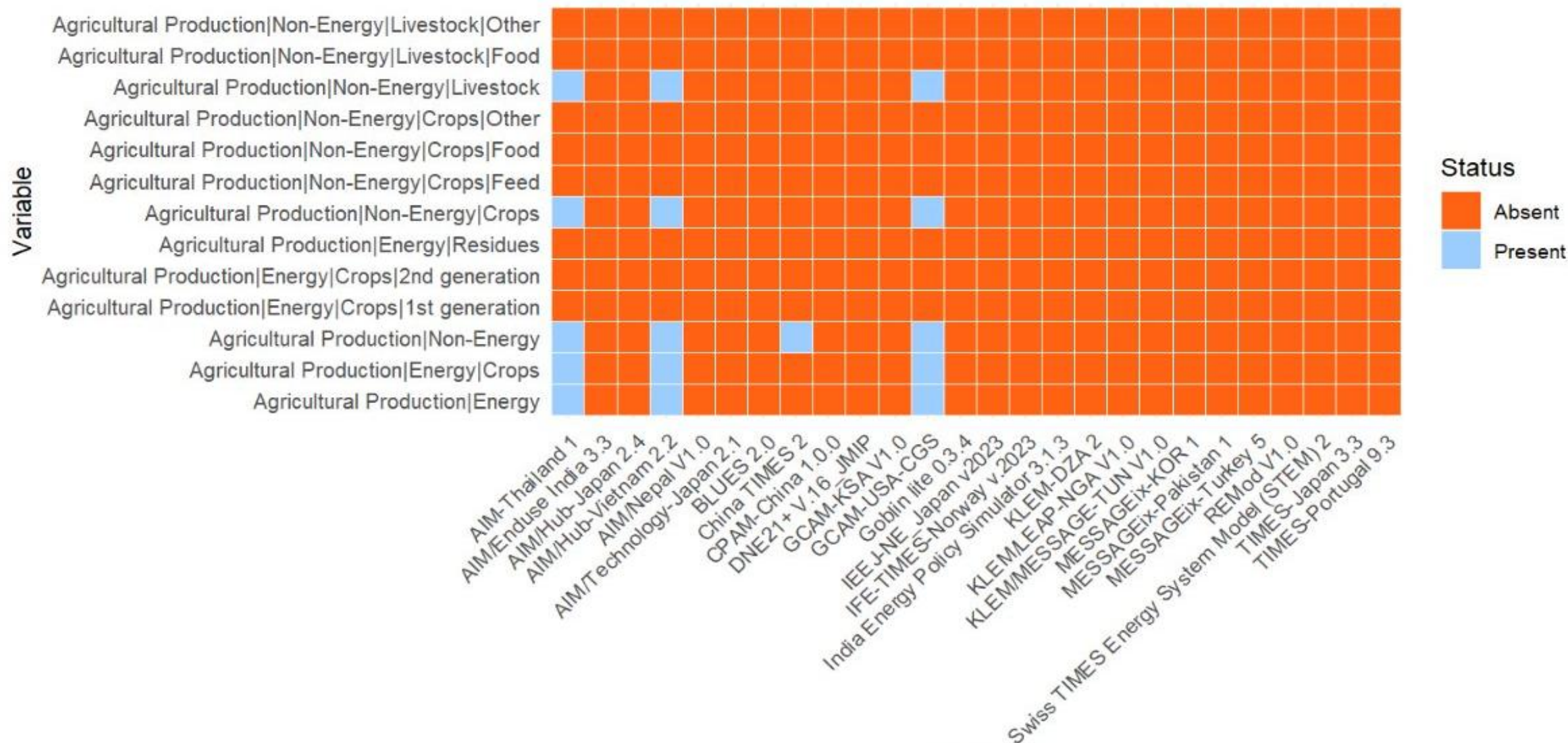
Submission [Emissions CO2]



Submission [Primary Energy]



Submission [Agriculture]



Revise Vetting Criteria [IAMC SWG National]

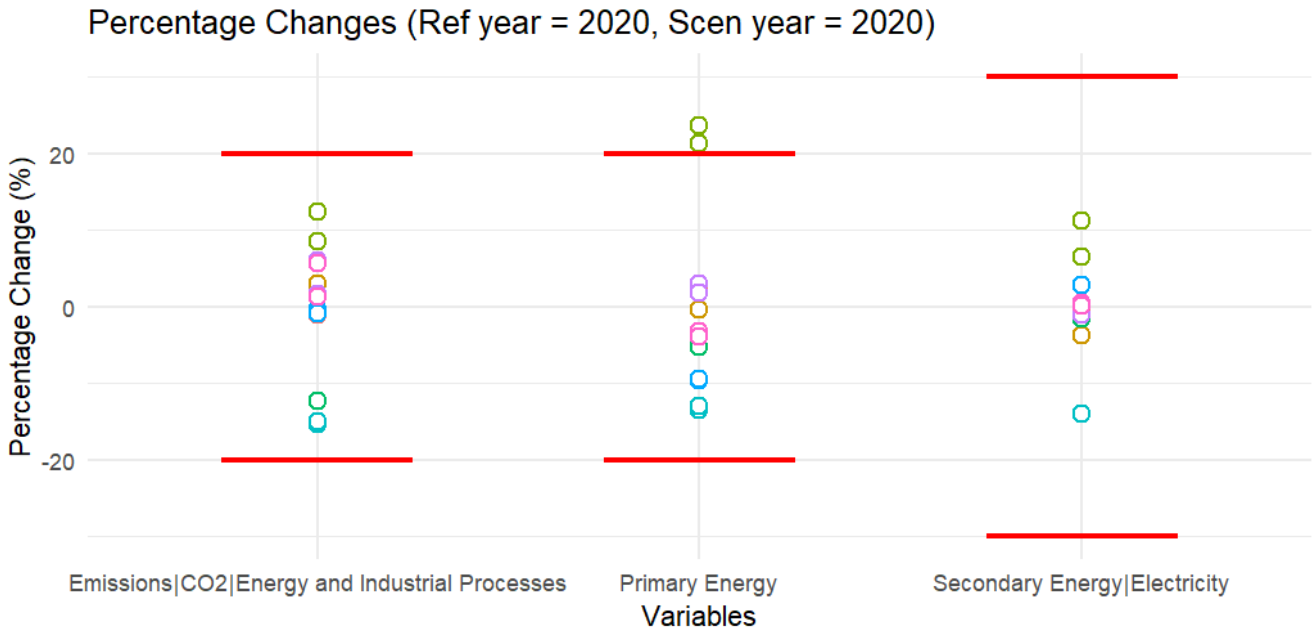
Key Parameter	Emissions	IPCC AR6 WGIII, EU EMF	Threshold Criteria	SWG National Scenarios NMSF 1	Threshold Criteria
Database		EDGAR DB 2019		Update the DB PRIMAP 2015, 2020	
Historical	CO2 – Energy & industrial processes (fossil CO2)	Included	+/- 20%	Removed as vetting indicator, threshold remains the same Based on submission from country teams	+/- 20%
Historical	CO2 – Emissions (fossil CO2)	Not Included	+/- 20%	Added, threshold to be discussed	+/- 10/20/30 %
Historical	CO2 – Energy & industrial processes (fossil CO2) - % change 2015-2020	Present		Removed as vetting indicator	
Historical	CO2 – Energy (fossil CO2) - % change 2015-2020	Present		Removed as vetting indicator	
Historical	CO2 – Emissions Land (fossil CO2)	Absent	+/- 50%	Mandatory for AFOLU submission	+/- 50%
Historical	CH4 – Emissions AFOLU (Mt CH4/yr)	Present	+/- 50%	Mandatory for AFOLU submission	+/- 50%

Revise Vetting Criteria [IAMC SWG National]

Key Parameter	Energy	IPCC AR6 WGIII, EU EMF	Threshold Criteria	IAMC NMSF 1	Threshold Criteria
Database		IEA Energy 2022, IRENA 2022		Update to IEA Energy 2024, IRENA 2024, National DB?	
Historical	Primary Energy (EJ/yr)	Included	+/- 20%	Same as earlier studies	+/- 20%
Historical	Primary Energy – Coal (EJ/yr)	Not Included		Added; Based on national circumstances; Check on threshold	+/- 20%
Historical	Primary Energy – Oil (EJ/yr)	Not Included		Added; Based on national circumstances; Check on threshold	+/- 20%
Historical	Primary Energy – Gas (EJ/yr)	Not Included		Added; Based on national circumstances; Check on threshold	+/- 20%
Historical	Primary Energy – Nuclear (EJ/yr)	Included	+/- 30%	Should it be included?	+/- 30%
Historical	Secondary Energy Electricity (EJ/yr)	Included	+/- 30%	Same as earlier studies	+/- 30%
Historical	Secondary Energy Electricity – Nuclear (EJ/yr)	Included	+/- 30%	Should it be included?	+/- 30%
Historical	Secondary Energy Electricity – Solar + Wind (EJ/yr)	Included	+/- 50%	Same as earlier studies	+/- 50%

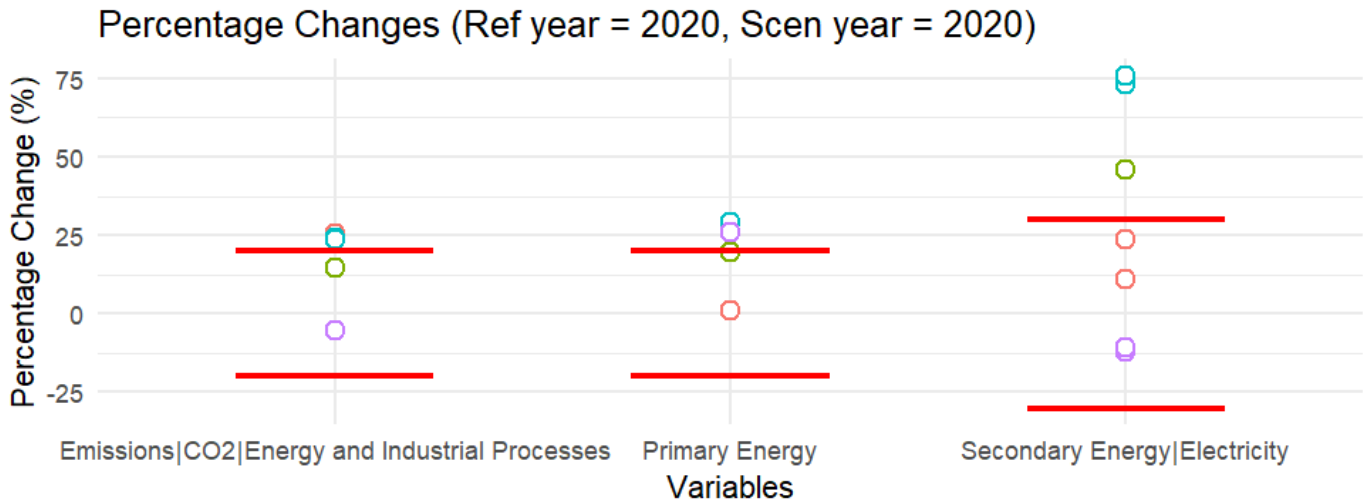
Key Parameter		Criteria	IPCC AR6 WGIII, EU EMF	SWG National Scenarios NMSF 1
	Emissions: Net negative CO2	Unit		
Future	CO2 – Energy & industrial processes (fossil CO2) in 2030	MtCO2/yr	Included	Not included for the first study
Future	CO2 – Energy (fossil CO2) in 2030	MtCO2/yr	Included	Not included for the first study
Historical	CO2 – Carbon sequestration from Energy (incl. BECCS) in 2020	MtCO2/yr	Included	Not included for the first study
Future	CO2 – Carbon sequestration from Energy (incl. BECCS) in 2030	MtCO2/yr	Included	Not included for the first study
	Low carbon electricity production			
Future	Secondary Energy Electricity – Nuclear in 2030	EJ/yr	Included	Not included for the first study

Vetting : Historical Check [WIP]



Red lines are the upper and lower criteria.

Historical: Japan

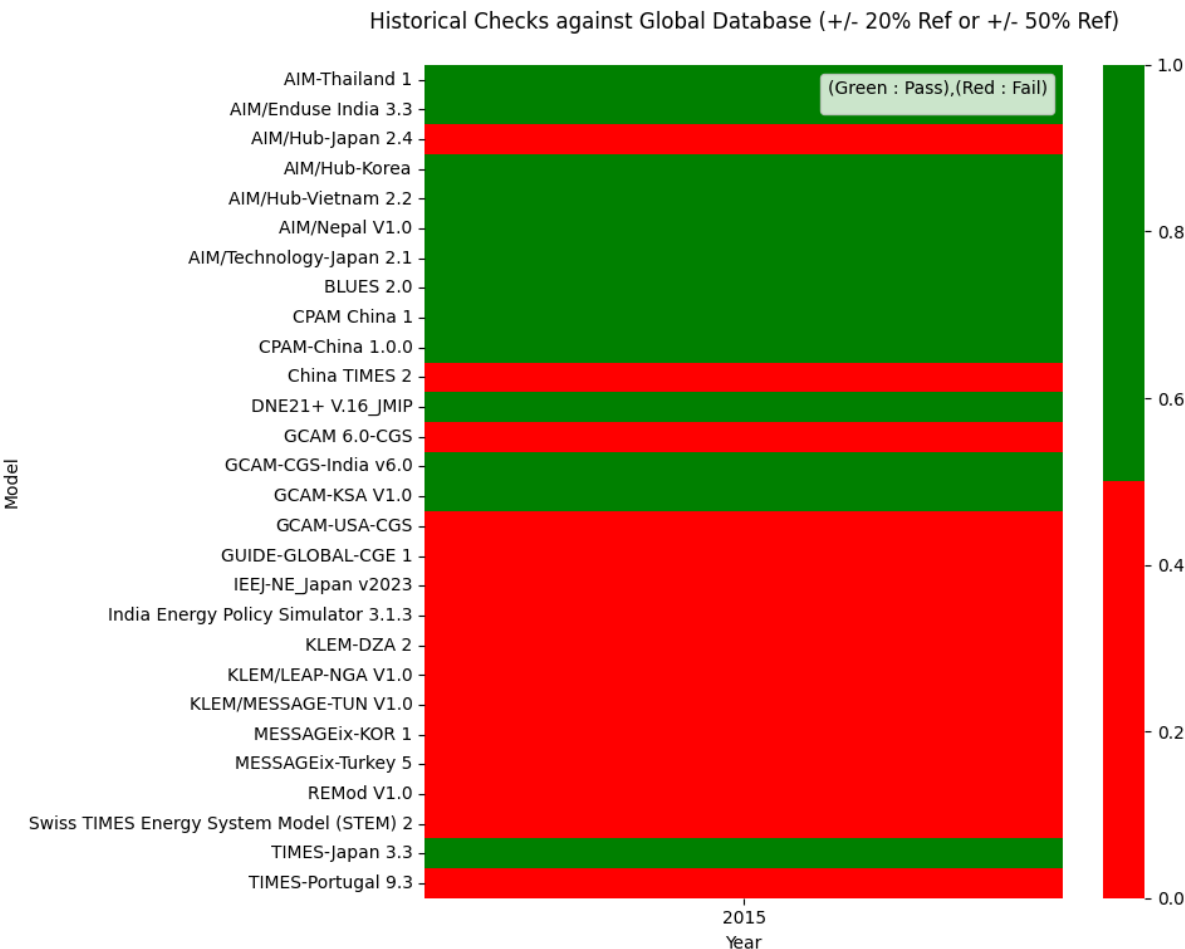


Historical: India

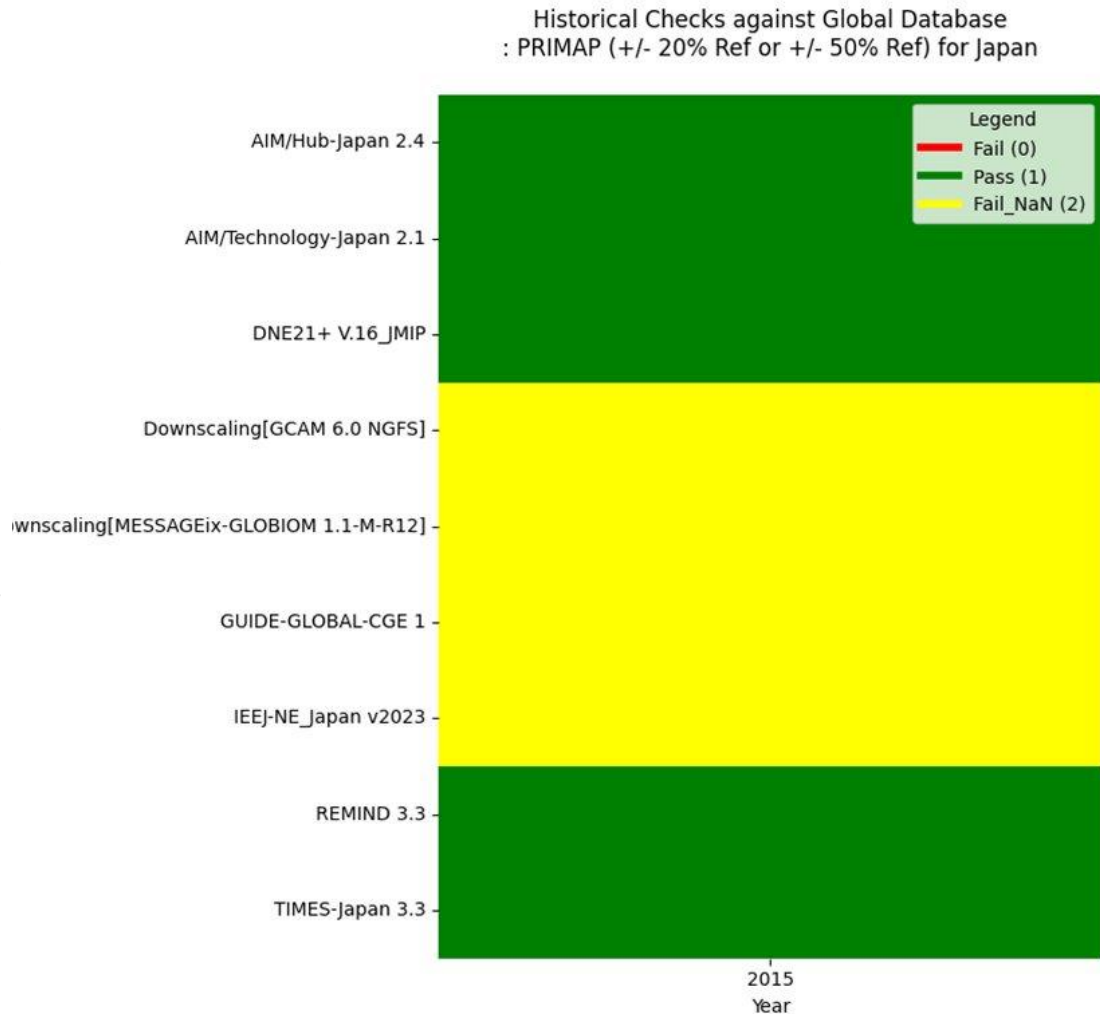
Vetted Scenarios [Year 2015]

Scenario Data: 36 modelling teams

Historical: All submitted models



Historical: PRIMAP, IEA, IRENA [Japan]



Results

Acknowledgement:

Scenario data: 36 teams from 19 countries

Study Objectives

Scenario Users:

- i. Collect and validate national scenarios to generate evidence base that could be used by national and international stakeholders [policy makers, negotiators, consultancies, global/regional modelling teams, business and so on]
- ii. Generate a validated national scenarios database to compare with national NDC, LT-LEDS policy targets at country level and global climate targets by assessing/aggregating the outputs
- iii. Align short term NDC with LT-LEDS and NZ scenarios
- iv. Identify common and different aspects across model and scenarios at country-level

Illustrative Results: Emissions | CO2 [by scenario]

Scenario Data: 36 modelling teams

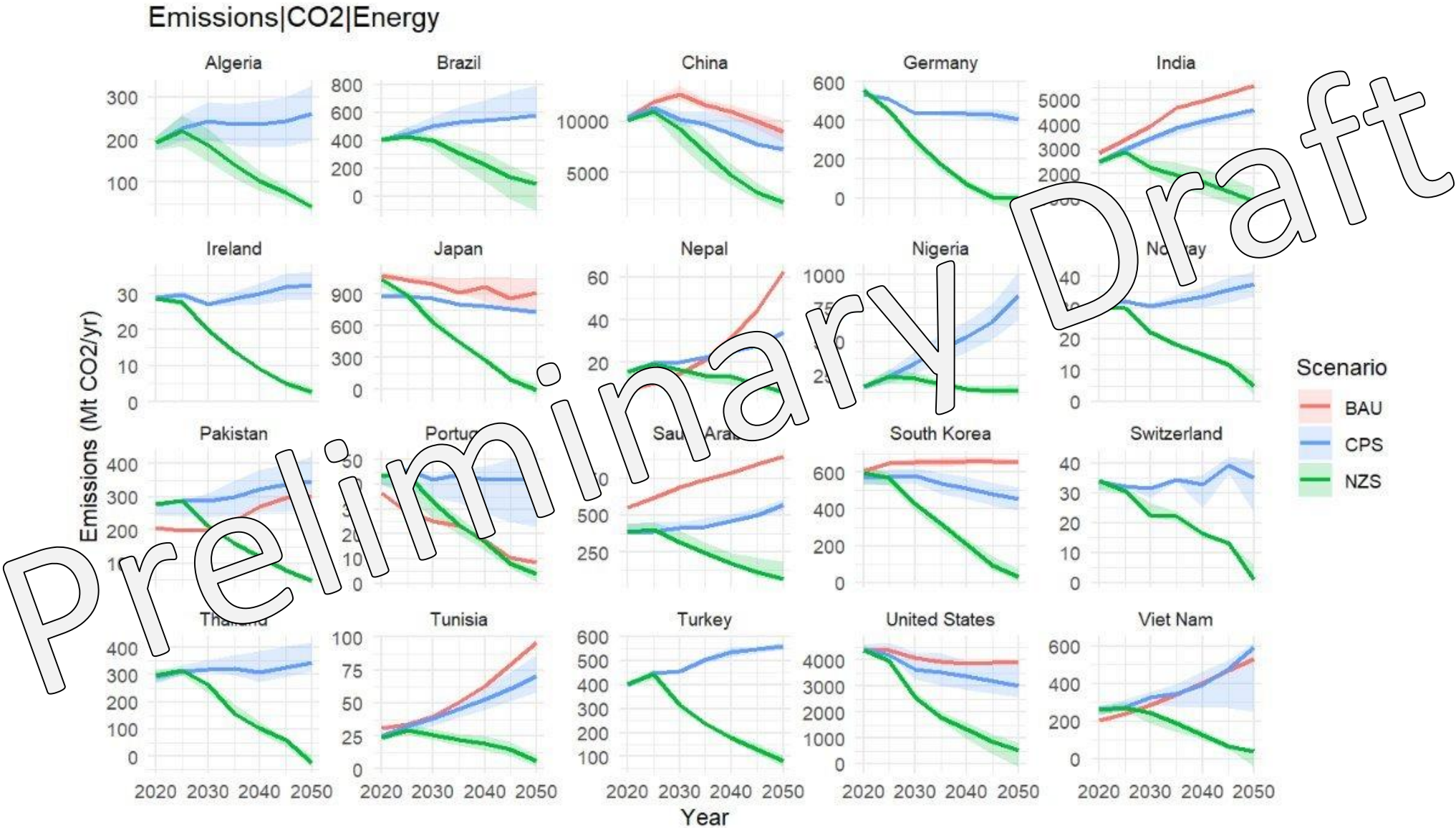
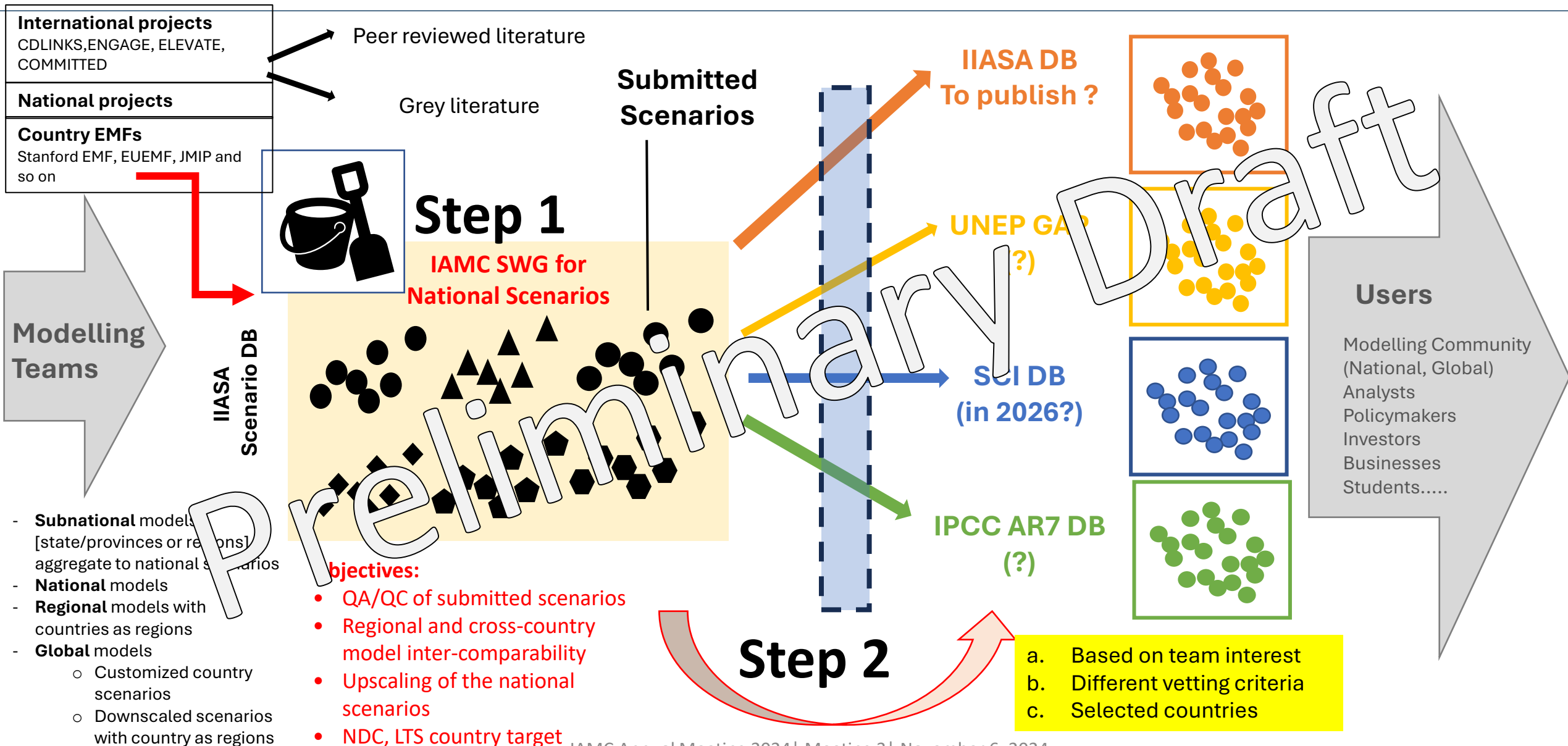


Figure courtesy: Pathak and Vishwanathan 2024

Draft -IAMC SWG National Scenarios

Initial figure courtesy:
Scenario Compass Initiative
Figure updated to understand
IAMC SWG National work-flow



Summary

Progress on main objectives

Objective 1: Promote **standardization** among national scenario development activities to **increase comparability and use in assessment** of international climate policy

Progress:

- **Phase I in progress** [98+ teams, 32+ countries]
- IAMC Template with **180 variables**
- **Vetting variables** – Emissions, Energy, AFOLU
- **Increase** scenario data variables?
- **Reference Data Change** discussion need at country level [PRIMAP]

Objective 2: Inter-linking national activities to global activities

Progress:

Work in progress

Scenario Compass

[Discussion on process to make it convenient for national teams]

Additional contribution:

Global level:

UNEP Gap ?

Network for Greening the Financial Systems (NGFS) ?

IPCC AR7 WGIII processes?

National level

NDC processes

LTS processes

Progress on main objectives

Objective 3: Provide a platform for sharing best practices to build capacity through the exchange of information. This includes (but is not restricted to) national scenario development, model inter-comparison and assistance with common reporting DBs.

Progress:

Completed: China, IAMC Global, India, DDP Network, IAMC Registration, IAMC Annual Meeting, IAMC Global

Completed: Initial Registration, Submission
Registration will be open

New Survey of **National Sectoral Submissions Survey**

Objective 4: Facilitate and support dialogue between IAMC community (global, regional, national) and national scenario users through outreach and communication activities.

Progress:

Webinars [IAMC website]

Feedback: India [First phase completed]

Planned: Feedback S. Korea (Nov. 2024)

Work in progress

China, South East Asia, Australia, South Asia, Middle East, Africa, Europe, North America, South America

Objective 5: Coordinate on **archiving, documentation and communication** of national scenario data and publications

Progress:

Work in progress

Registration on IIASA DB

Publication/s – Under consideration

Possible journals

1. Nature series
2. Energy and Climate Change
3. Climate Policy

Synthesis Report

Timeline

	Tasks	Deadline
1	Feedback on national scenario protocol version 0	December 15, 2023
2	Call for national scenarios based on finalized national scenario protocol	January 15, 2023
3	International webinar: IAMC SWG on national scenarios	January 30, 2023
4	Initial deadline of national scenarios	April 01, 2024 July 31, 2024
5	Feedback and discussion with country modelling teams Webinar with teams on registration and submission AIM Workshop 2024	April - August 2024 June 2024 August 2024
6	Initial presentation of results at IAMC 2024	November 6, 2024
7	Second deadline of national scenarios	June 30, 2024 November 30, 2024
8	Feedback to modelling teams	November 2024 – January 2025
9	Tentative Final deadline of national scenarios	January 31, 2025 March 31, 2025
10	First draft of the paper/s shared with co-authors for review and feedback	October 31, 2024 January 15, 2025
11	Tentative webinar on paper and synthesis report	January/February 2025
12	Submission of feedback by co-authors	February 2025
13	Final draft/s submitted to journal (tentative)	May/June 2025
14	IAMC SWG Synthesis Report 2025 - Draft	June/July 2025
15	IAMC SWG Synthesis Report 2025 - Final	October/November 2025?

National SECTORAL Interest Survey

AIM Workshop 2024 – Feedback

Contributors, stakeholders, subscription

- Google Form or Scan bar code
- Country
- Institute Name
- Model Name
- Model Type: national IAM, ESM, CGE
- Geographical coverage: National, subnational
- Project: International, National
- Country EMF
- *Latest developed scenarios (NDC, CPS, NZ, other)*
- *Model documentation*
- *Relevant literature (4-5 articles if possible)*
- Contact person
- *Main developer of the model*
- Used IAMC template



**Thank you for your
time and patience!**

Please contact for further information

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sarithasv@iima.ac.in