IAM COMPACT

Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action

IAM COMPACT Modelling Seminars

Model Presentation: AIM/Enduse India

Indian Institute of Management Ahmedabad

The IAM COMPACT project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056306.

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The Asia-Pacific Integrated Model (AIM) is a large-scale computer simulation model developed by the National Institute for Environmental Studies in collaboration with Kyoto University (Professor Matsuoko), Mizuho Information & Research Institute and several research institutes in the Asia-Pacific region in 1990.

Around 1997, they collaborated developing nations in Asia to build AIM/CGE and AIM/Enduse country model.

AIM/Enduse India version 1.0 and 2.0 were built in late 90s and early 2000s.

Today, I will be presenting the AIM/Enduse India version 3.2

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Bottom-up type model with detailed technology selection framework with optimization

Recursive dynamic model

Assessing technological transition over time

Analyzing effect of policies such as carbon/energy tax, subsidy, regulation and so on.

Target Gas : Multiple gases

CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, SO_2, NO_x, CFCs, HCFCs, etc

Target Sectors : multiple sectors

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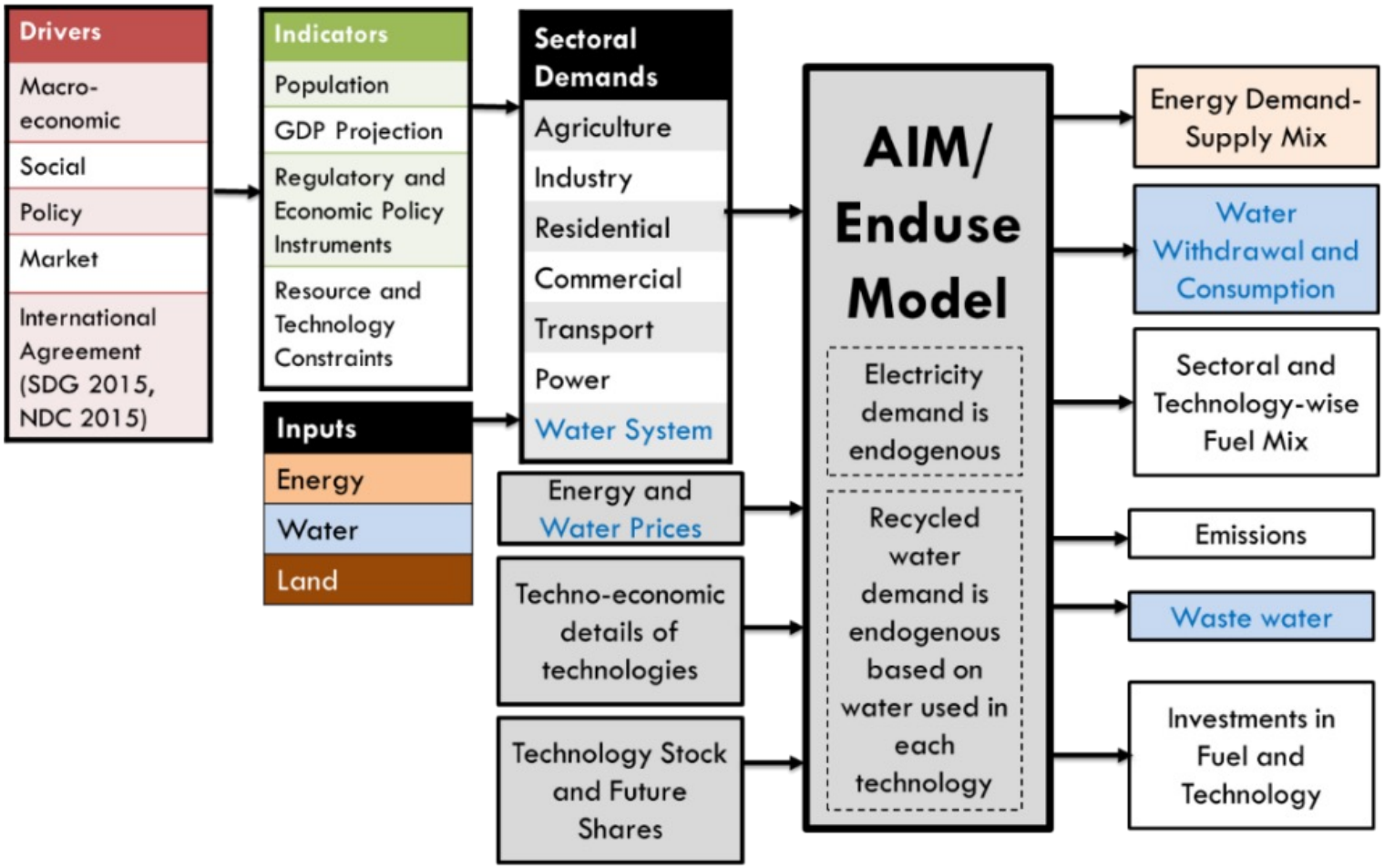

Figure 1: Modified AIM/Enduse Water-Energy-Land (W-E-L) Modelling Framework
Source: Vishwanathan et al. 2020, Vishwanathan et al. 2021

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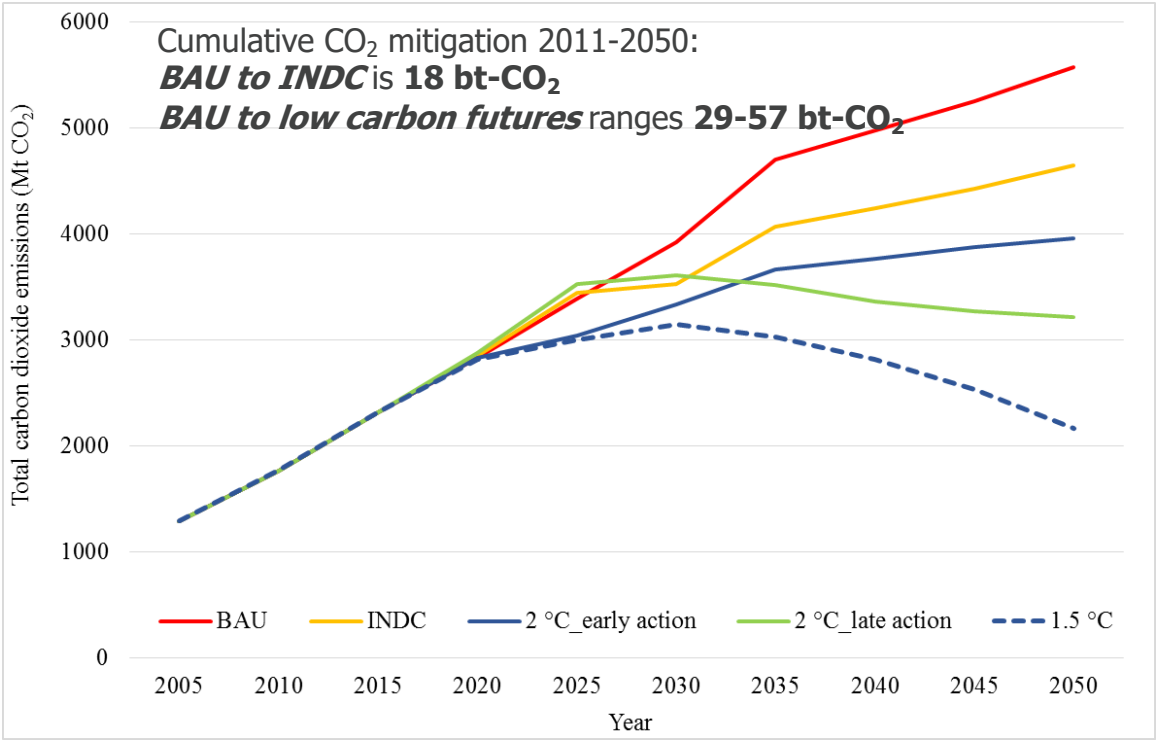
Indian CO_2 Emissions



Scenario	Budget	CO_2/capita (2050)
BAU (NPi)	165	3.2
INDC	147	2.7
2 °C_early action (NPi2020_high)	136	2.3
2 °C_late action (INDC2030_low)	128	1.9
1.5 °C (NPi2020_verylow)	108	1.2

Notes:
Carbon budget 2011-2050 in billion ton-CO_2
(scenario name) denote CDLINKS name

Scenarios	Bt-CO_2 (% reduction)	Energy Efficiency (bt-CO_2)	Renewables (bt-CO_2)	Demand Reduction (bt-CO_2)	CCS (bt-CO_2)
BAU to INDC	18 (11%)	10	7	1	0
INDC to 2 °C	11-19 (8-13%)	1-2	3-5	3-4	4-8
INDC to 1.5 °C	39 (27%)	4	6	6	23

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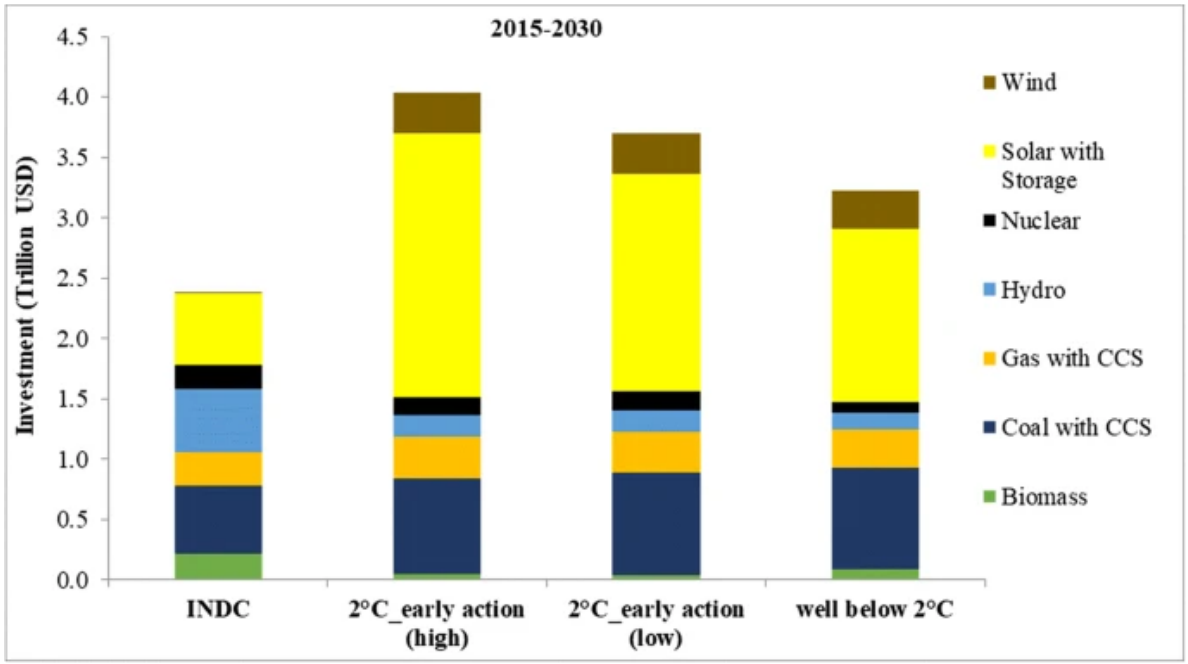
Cumulative CO_2 budget: India needs room for development, results within **higher range of global models.**

Source: Vishwanathan, S.S., Tiwari, V., Garg, A. and Shukla, P.R. (2018)

These transformations will likely need investments of **US$ 6–8 trillion**



39–52% shared by power sector

19–25% shared by industry sector

13–17% shared by transport sector

11–14% shared by building sector

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Source: Vishwanathan and Garg (2020)

SDG implications of water-energy transitions in India

ENVIRONMENTAL RESEARCH
LETTERS

LETTER

SDG implications of water-energy system transitions in India, for NDC, 2 °C, and well below 2 °C scenarios

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Keywords: SDG-NDC linkages, water-energy nexus, India, well below 2 °C, integrated approach

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Abstract

India needs to address the immediate concerns of water supply and demand, due to its increasing population, rapid urbanization, and growing industrialization. Additionally, the changing climate will influence water resources, which will subsequently impact the overall sectoral end-use demand patterns. In this study, we have integrated a water module with the existing bottom-up, techno-economic Asia–Pacific Integrated Model/End-use energy system model for India to estimate the future water demand in major end-use sectors under business-as-usual (BAU), nationally determined contribution (NDC), and low-carbon futures (2 °C and 'well below 2 °C') up to 2050. We also simulate the effects of water constraints on major sectors under different climate-change regimes. Our results show that water-intensive end-use sectors, specifically agriculture and power, will face major impacts under water-constrained scenarios. Over the period between 2020 and 2050, policy measures taken under the NDC scenario can cumulatively save up to 14[6] billion cubic metres (bcm) of water, while low-carbon scenarios can save 20–21 bcm of water between 2020 and 2050, compared with BAU. In a water-constrained future, NDC and low-carbon futures can save 28–30 bcm of water. There is a need to increase the current water supply by 200–400 bcm. The marginal cost of installing dry cooling systems in the power sector is considerably higher than the cost and benefits of installing micro-irrigation systems with solar PV. Integrated policy coherence is required to achieve sustainable development goals, e.g., NDC and Paris Agreement goals, in both water and energy sectors. Concurrently, regulatory and economic instruments will play an essential role in improving resource-use efficiency at a systemic level, to reduce the overall water demand.

Journal: ***Environmental Research Letters (2021)***

Type: *India specific*

Research: SDG-NDC linkages, Water- Energy Transitions

Key Insights:

- The need to increase the water supply (in the non-water-constrained scenarios)
- Stranded coal assets (in the water-constrained scenarios)
- Impacts on system costs and future investments

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National

IMACLIM-India (2019 - Present)

TIMES-India (2020 - Present)

Forestry, Land use, and Agricultural Model (2020 - Present)

International

GEM3 (2018, 2021, 2022)

GAINS (2019, 2022)

AIM/Enduse Global (2022)

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National decision making

Net Zero target decision making (2021)

Updated NDC (2022)

Long Term Strategy (2022)

International dialogue and discussions

COP24

COP26

Global Stocktake

UNFCCC Bonn 2022

COP27

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