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Unpacking India's Climate Policy Modelling Tools: A Framework

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Relevance of energy-economy models for policy making in India

- Used to inform mitigation priorities, goals, targets
- Aid understanding of costs and benefits
- Elucidate development co-benefits and trade-offs
- Arrive at estimates for investment and finance needs
- Aid estimates of technology needs

Headlines from modelling studies in India

The costs of a net zero emission target

Consider the political risk of accelerated decarbonisation. It will require additional investment, which will be diverted from other productive investments

Mint

India's Gdp To Rise By $406 Bn By 2050 In Net-zero Scenario: Orf I Mint

"India's net-zero carbon emissions target of 2070 is momentous and praiseworthy, ... According to the quantitative modelling conducted on decarbonisation...

11-Nov-2021

BS Business Standard

India needs $10.1 trn investments for net zero emissions by 2070: CEEW

India would need cumulative investments of $10.1 trillion to achieve net-zero emissions by 2070, according to an independent study released on Thursday by CEE-...

19-Nov-2021

Problems with the design and use of modelling studies

Policy maker:

Conflicting outcomes and implications from different studies

Are studies asking ‘relevant’ questions?

Academic:

How transparent and suitable (for purpose) are they?

Is their framing limiting?

How do they handle uncertainty?

The objectives of our initiative

ASSESS, COMPARE, AND INTERPRET THE RESULTS OF VARIOUS MODELLING STUDIES

FOSTER INFORMED AND MEASURED COMMUNICATION AND USE OF MODELLING STUDIES

AIMED AT INFORMING POLICY MAKERS, JOURNALISTS, SCIENTISTS, AND THE CONCERNED CITIZEN.

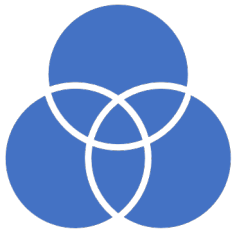
Our key outputs

Present ‘factsheets’ per modelling study

Assess: Are the model and scenarios transparently described and justified for their stated purpose?

Compare: How do the study results compare with those of other, similar studies?

Interpret: What are the implications for science and policymakers?



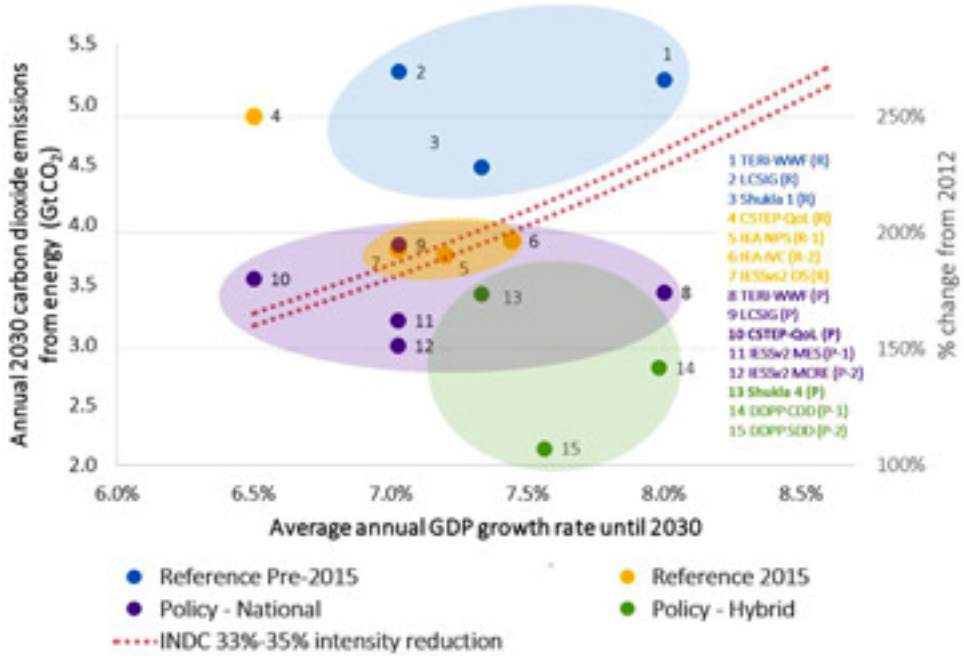
Present an inter-model comparison and interpretation.

What are the major drivers of emissions?

What are the key uncertainties and ensuing vulnerabilities or opportunities?

Our approach for assessment and interpretation is inspired on

- Literature on computational models for decision making or public policy
- Earlier studies which performed an interpretive analysis of model scenarios for India's energy and emissions futures.



Sources:

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- Gilbert, Nigel, Petra Ahrweiler, Pete Barbrook-Johnson, Kavin Preethi Narasimhan, and Helen Wilkinson. 2018. "Computational Modelling of Public Policy: Reflections on Practice." *Journal of Artificial Societies and Social Simulation* 21 (1): 14. https://doi.org/10.18564/jasss.3669.
- Dubash, Navroz K, Radhika Khosla, Narasimha D Rao, and Ankit Bhardwaj. 2018. "India's Energy and Emissions Future: An Interpretive Analysis of Model Scenarios." *Environmental Research Letters* 13 (7): 074018. https://doi.org/10.1088/1748-9326/aacc74.

Assessment – Level 1

Si. No.	Assessment Criteria	Description	Assessment Score (Adequate/Partially Adequate/ Inadequate)
1.	Transparency and credibility of inputs to the model	Assessment of whether key inputs are transparent and have adequate empirical basis, or where projections are justified.	
2.	Appropriateness of model choice to research objective	Assessment of whether the purpose of the study is aligned with the choice of model and whether this can be transparently assessed.	
3.	Assessment of scenario construction process	Assessment of whether the scenario construction is transparently and well-designed to evaluate policy actions and outcomes across a range of high-impact, high-uncertainty contextual factors	
4.	Approach to uncertainty	Assessment of the study's approach to addressing and communicating uncertainty across the various criteria identified above.	
5.	Transparency and validation of outputs	Assessment of whether the key outputs are presented transparently and validated.	

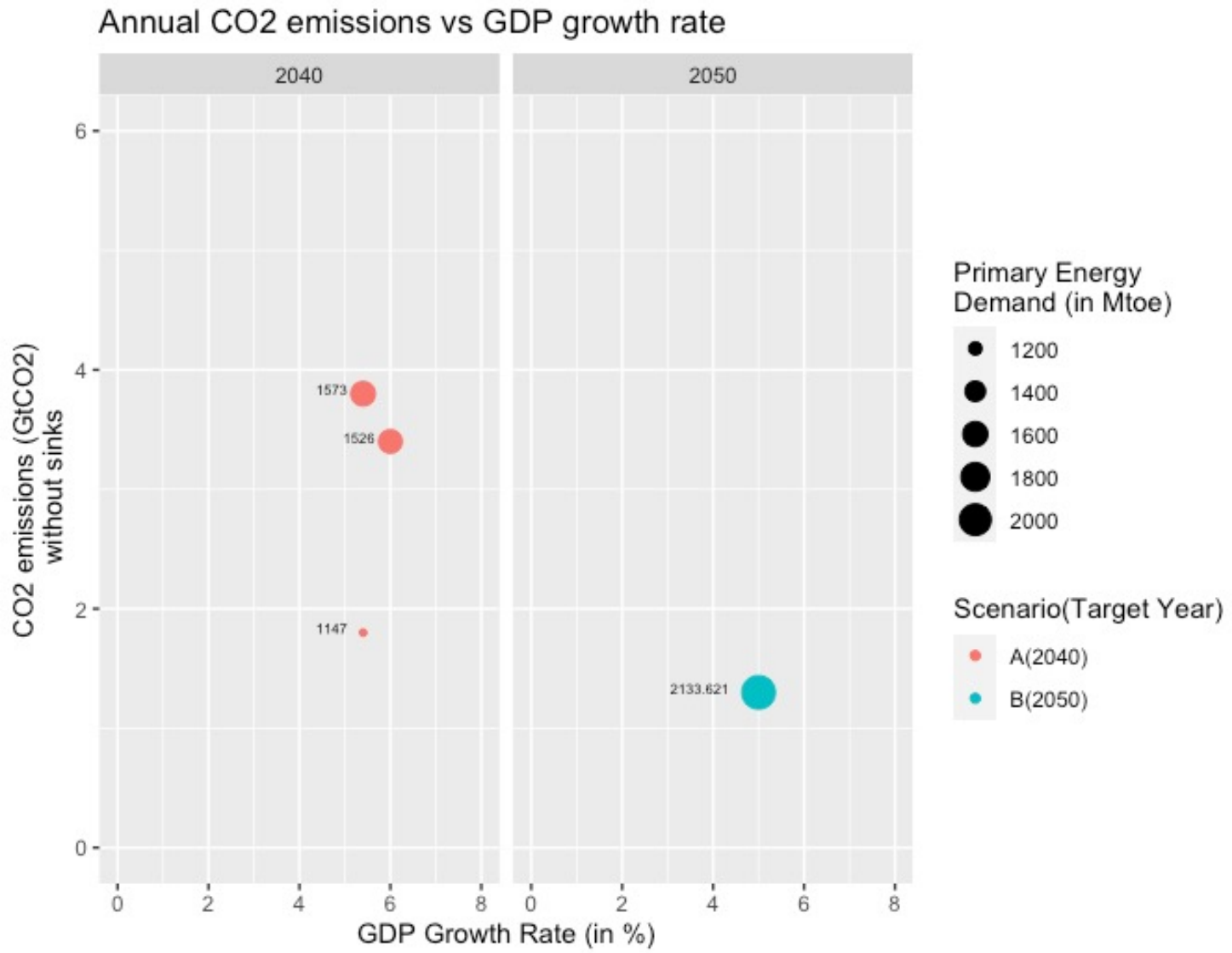
Assessment – Level 2

Si. No.	Assessment Criteria	Assessment sub-criteria	Sub-criteria score	Assessment Score (Adequate/Partially adequate/ Inadequate)
1.	Transparency and credibility of inputs to the model	• Data source transparent and credible? • Projections justified?	• Yes/No • Yes/No	
2.	Appropriateness of model choice to research objective	• Model structure transparent? • Fit for purpose justified?	• Yes/No • Yes/No	
3.	Assessment of scenario construction process	• Rationale for scenarios explained? • Process of developing scenarios explained? • Alternative socio-economic pathways explained?	• Yes/No • Yes/No	
4.	Approach to uncertainty	• Uncertainties in inputs transparent? • Uncertainties with model's causal mechanisms transparent? • Change in uncertainty with time?	• Yes/No • Yes/No • Yes/No	
5.	Transparency and validation of outputs	• Explanation of how outputs are shaped by inputs, model mechanisms • Implications of uncertainties considered in results and policy implications • Validation efforts presented clearly?	• Yes/No • Yes/No • Yes/No	

Comparison – how do study results compare with those of other models?

Indicators for comparison:

- Emissions and GDP
- Final energy demand, by sector
- Installed capacity and electricity generation by source
- Cost assumptions for emerging technologies



Interpretation: What do the study-outcomes imply for key policy considerations?

Development Pathway

What do macro-structural assumptions imply for patterns of development and how do they diverge from current trends?

Energy Transition Pathway

What does the study imply for sectoral energy needs, the composition of the energy mix, institutional needs, and other enabling considerations?

Emissions

What do technological and demand trends, and associated uncertainties, imply about (i) robustness of emissions estimates (ii) policy strategies

Investments

How do investment estimates relate to cost and growth assumptions?

Equity and justice

How does the study explore variations in economic outcomes across socioeconomic classes, sectors, or regions?

Energy Security

Does the study factor fuel and material import dependence into its energy capacity and investment estimates?

Implications for policy and science from inter-model comparison and review

- Policy Implications:
  - Which technologies to subsidize and when?
  - What are implications of uncertainties in terms of vulnerabilities and opportunities of mitigation strategies?
  - Analyse Implications of choice of mitigation strategy on ensuring development co-benefits (e.g., access, importance of urban planning, public transportation)
  - Impacts of model structures on policy recommendations: optimization based models susceptible to underestimating costs of lock-in and path dependency.

- Future avenues for modelling approaches:
  - *Uncertainty and path dependency:* Importance of incorporating path dependency, innovation processes.
  - *Social Equity*: Need to unpack impacts of different development pathways on different income groups and vulnerable populations (informal sector, poverty traps)

Next steps

- Launch website with factsheets for three modelling studies in June ‘22
- Analyse and incorporate modelling studies as and when they are released.
- Analyse implications for policy and science from inter-model comparison and review.
- Explore relevance to other (developing) countries.
- Conduct workshops for outreach and engagement.

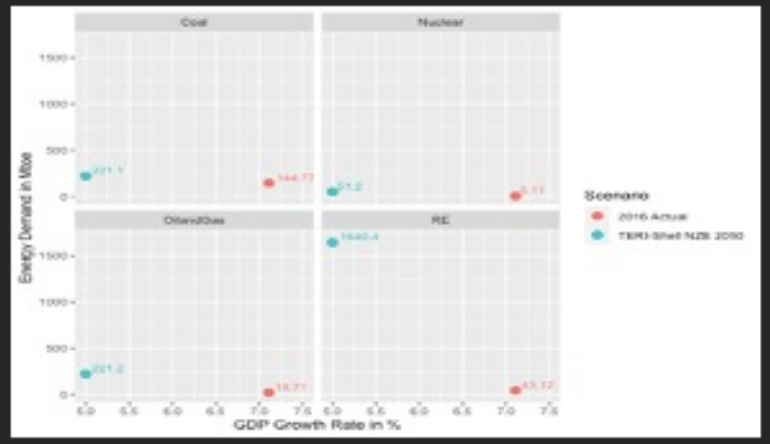
Thank you for your attention.

ASSESSMENT CRITERA				
Transparency and credibility of inputs **INADEQUATE**	Appropriateness of model choice to research objective **INADEQUATE**	Assessment of scenario construction process **INADEQUATE**	Approach to uncertainty **INADEQUATE**	Transparency and validation of outputs **INADEQUATE**

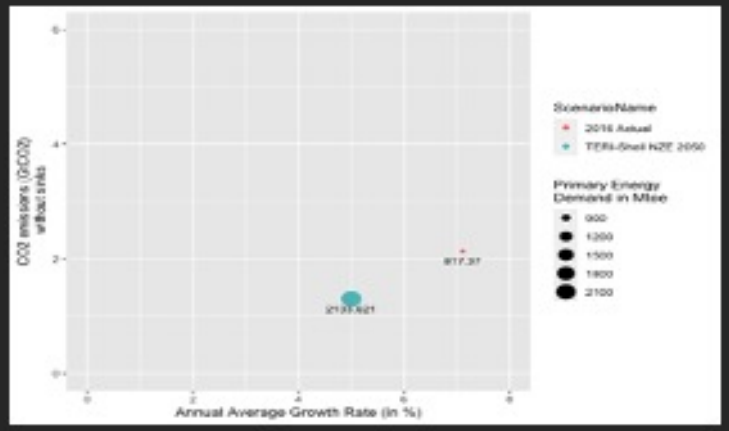
KEY VARIABLES				
GDP Growth: **UNCLEAR, APPROXIMATELY 5% ANNUALLY**	Job Growth Outcome: **DATA NOT LISTED, BUT JOB INCREASES EXPECTED IN RENEWABLES**	Peaking Year: **2025 (ENERGY SYSTEM)** Emissions in Peaking Year: **3 GT PER YEAR**	RE Share in Electricity Generation and in Primary Energy (%): **90% (DEPENDS ON GRID AND STORAGE DEPLOYMENT)**	Energy Investment (2019 USD): **DATA NOT LISTED, EXCEPT A REFERENCE TO THE IEA PROJECTION**

KEY OUTPUTS

Primary energy demand vs GDP growth in 2050, by source, across scenarios



2050 CO2 emissions vs real average 2016-2050 GDP growth



INTERPRETING RESULTS

Click to skip to section

ENERGY TRANSITION PATHWAY

EMISSIONS

DEVELOPMENT PATHWAY

INVESTMENTS

EQUITY

ENERGY SECURITY