

Sustainable Development, Uncertainties, and India's Climate Policy



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Energy Access



Renewables



Power Sector



Industrial
Sustainability &
Competitiveness



Low-Carbon Pathways



Risks & Adaptation



Technology,
Finance, & Trade

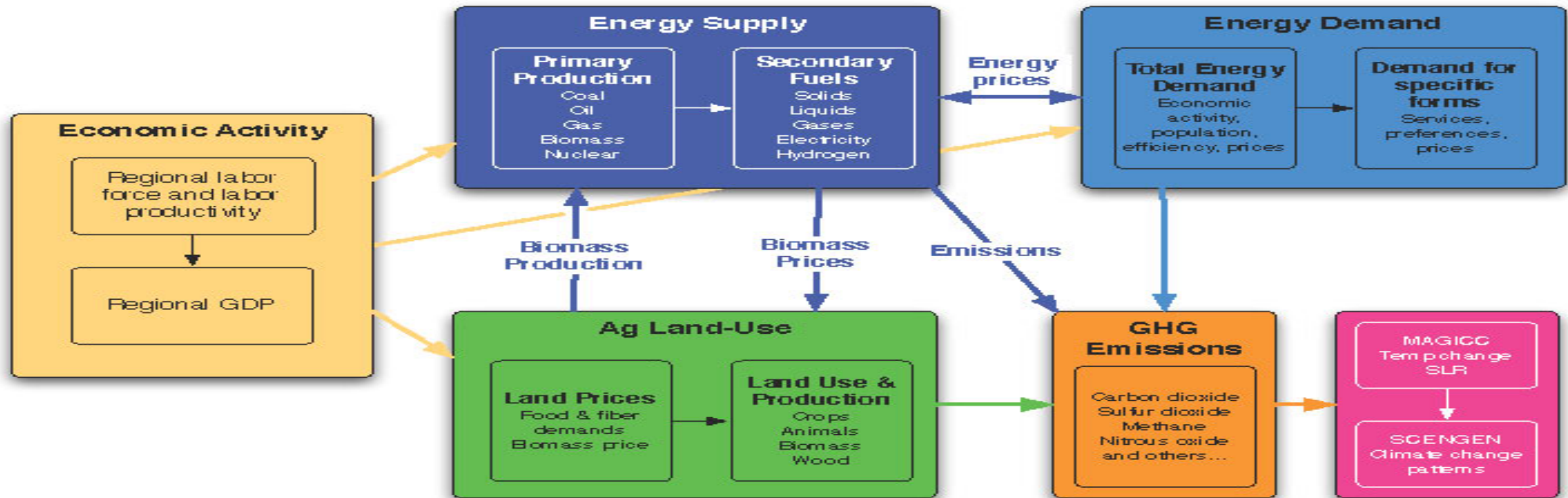
The Larger Context

- Nationally Determined Contribution and Mid-Century Strategy
- Uncertainties: Lack of India specific literature
- Sustainable Development and National Priorities

Research Objectives related to..

- Electricity generation
- Emissions and Emissions Intensity
- Mid-Century Strategy and Sustainable Development

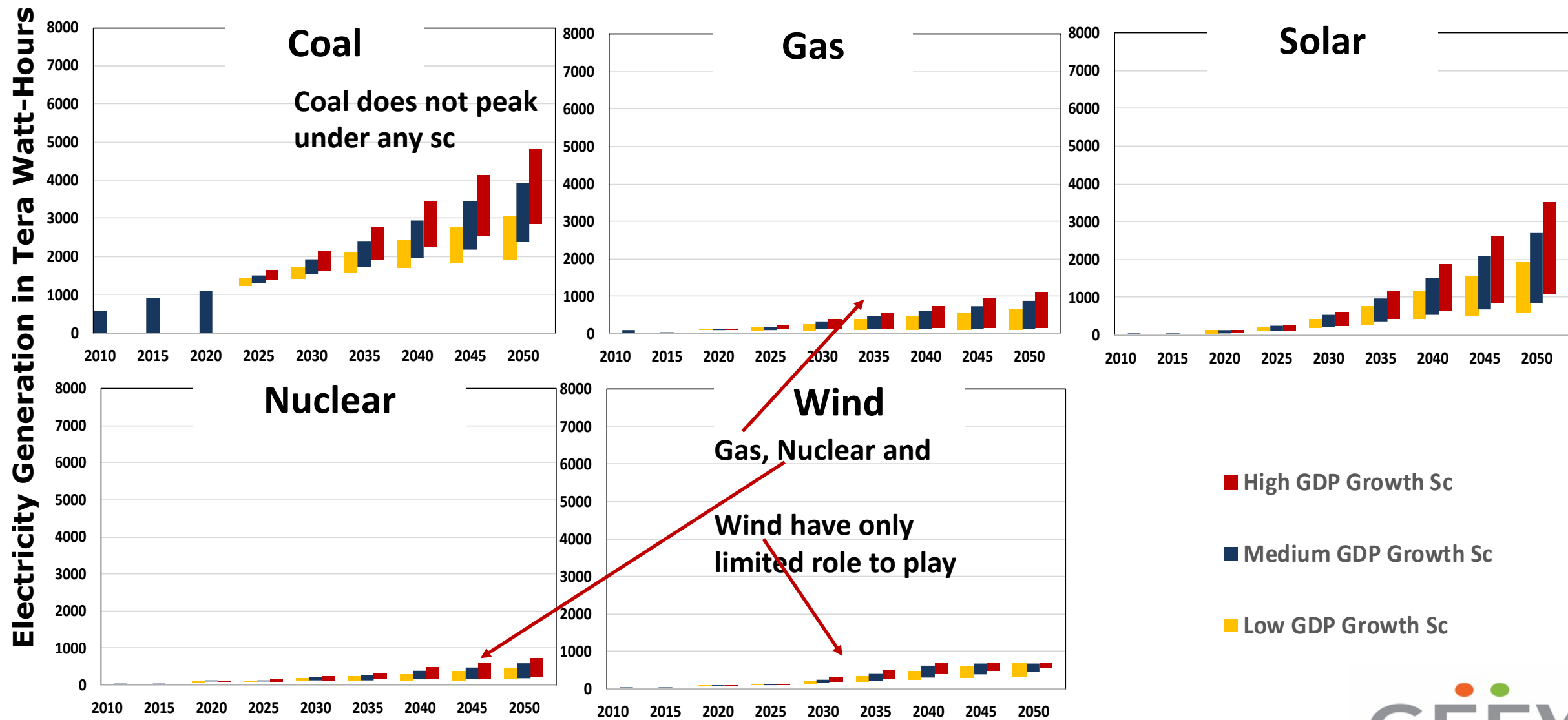
Global Change Assessment Model- IIM Ahmedabad version



- 222 unique scenarios exploring generation technology cost, economic growth, energy efficiency, and energy demand behaviour
- A stakeholder driven exercise
- Cost of integration included (though there is no India specific detailed study on this topic)
- Transparency of key assumptions

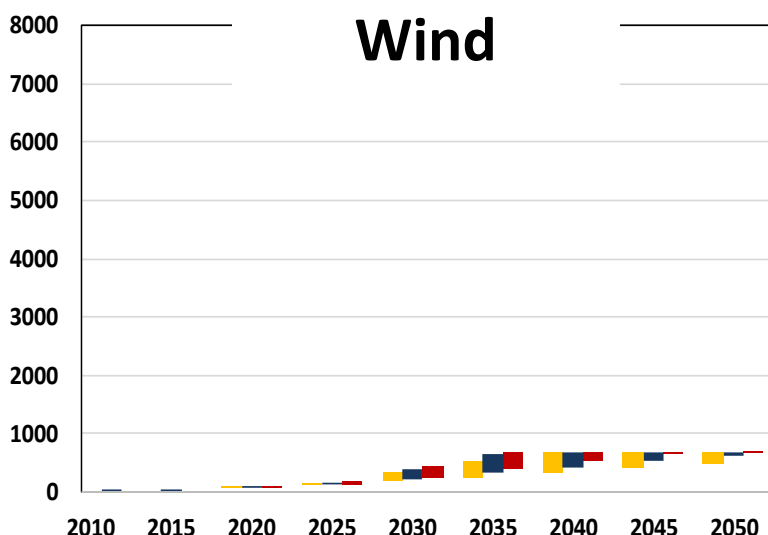
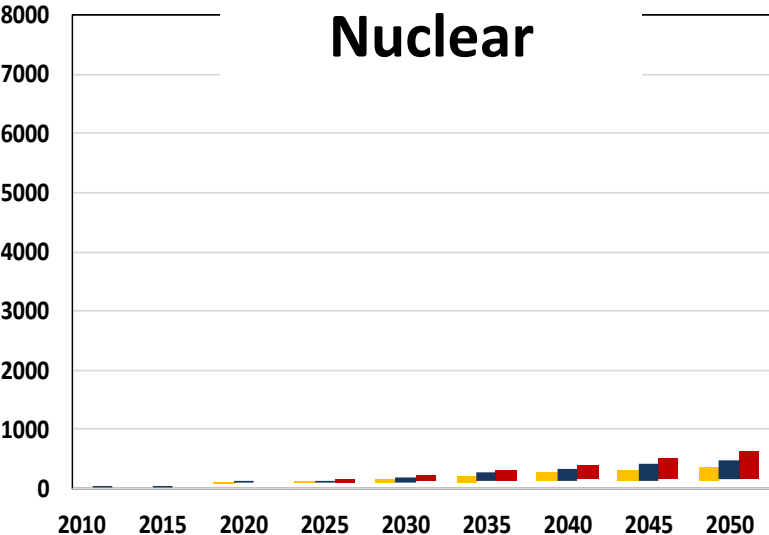
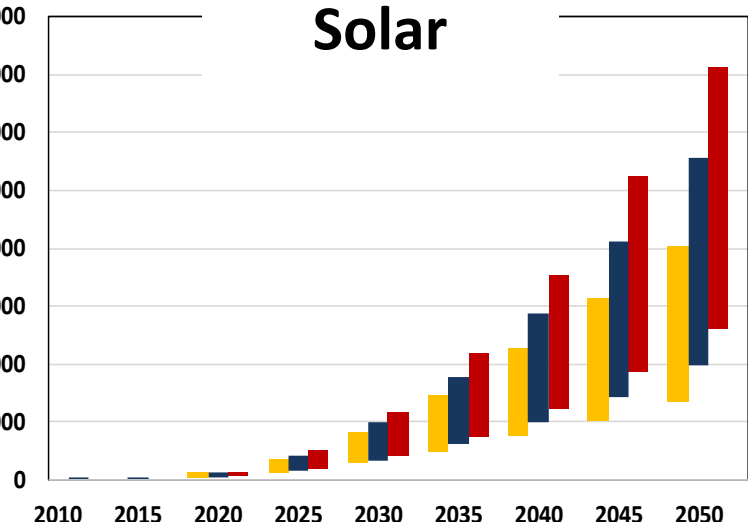
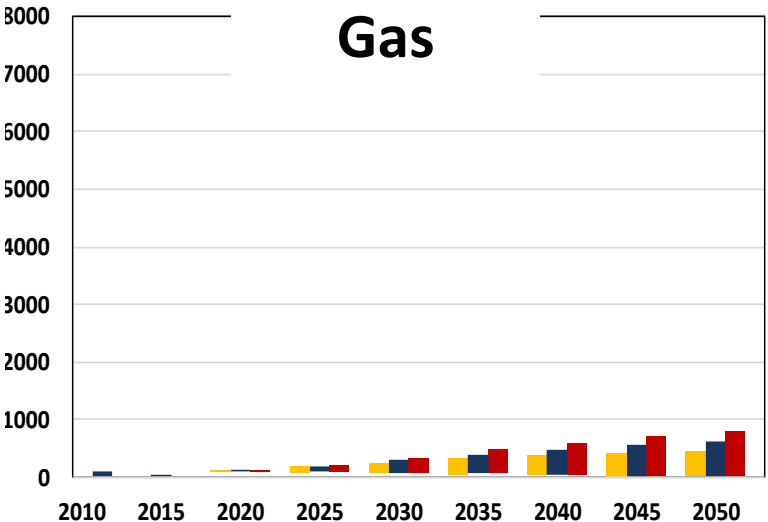
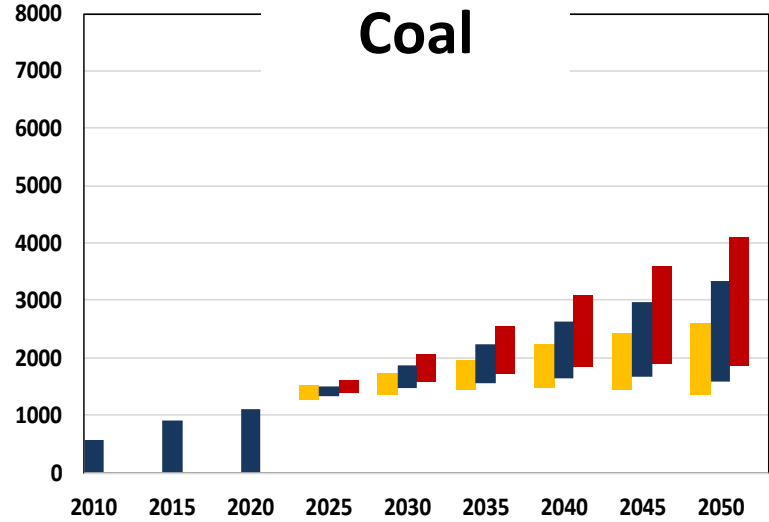
RESULTS

Electricity generation technology outlook



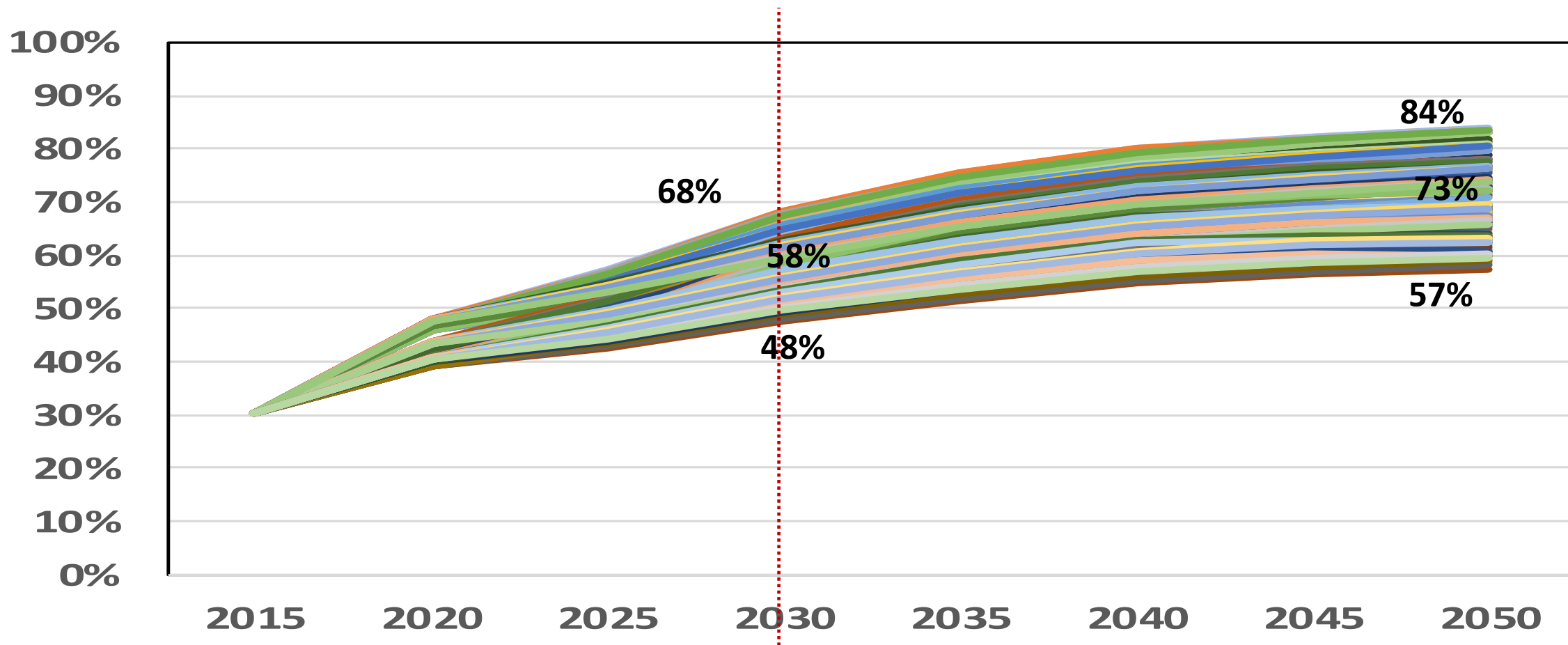
Electricity generation technology outlook- WITHOUT VRE Integration Cost

Electricity Generation in Tera Watt-Hours



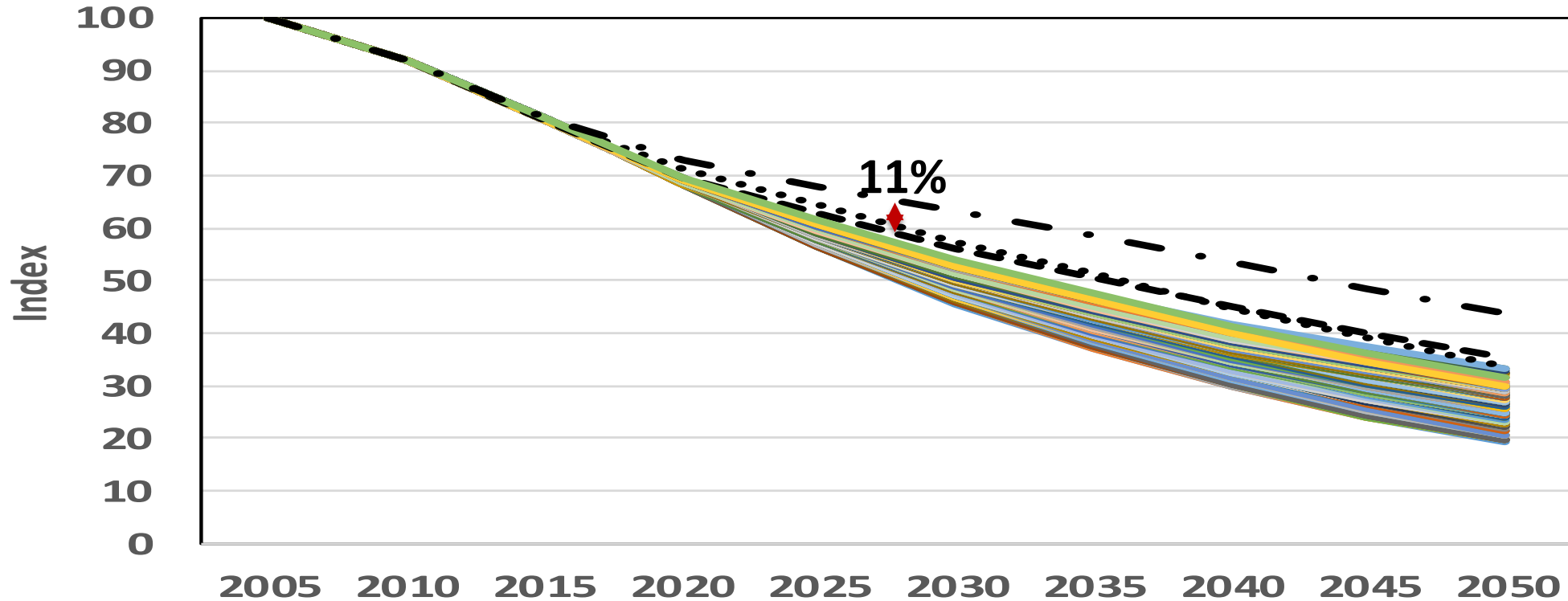
- High GDP Growth Sc
- Medium GDP Growth Sc
- Low GDP Growth Sc

Is there room for enhancing India's NDC?



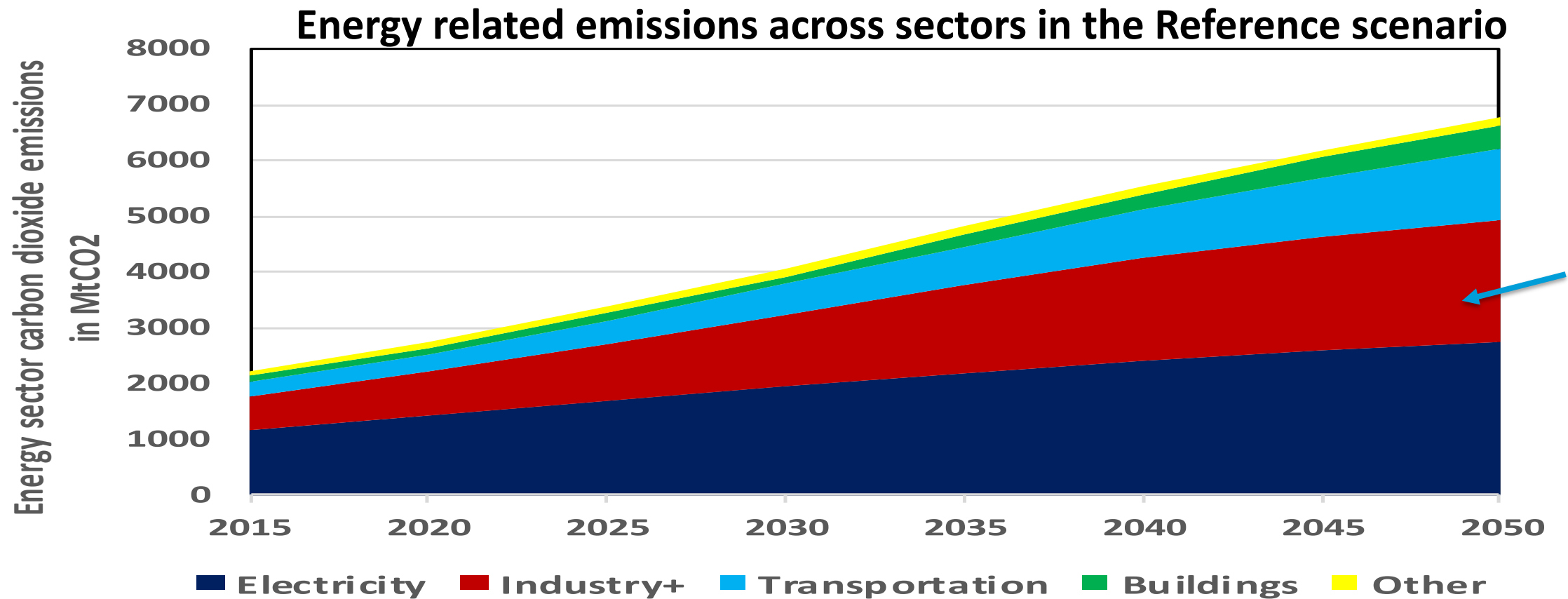
- Cost of integration appears to be a key uncertainty
- Lack of reform in India's power sector is going to be a big bottleneck

Will 33-35% EI reduction be achieved under all scenarios?



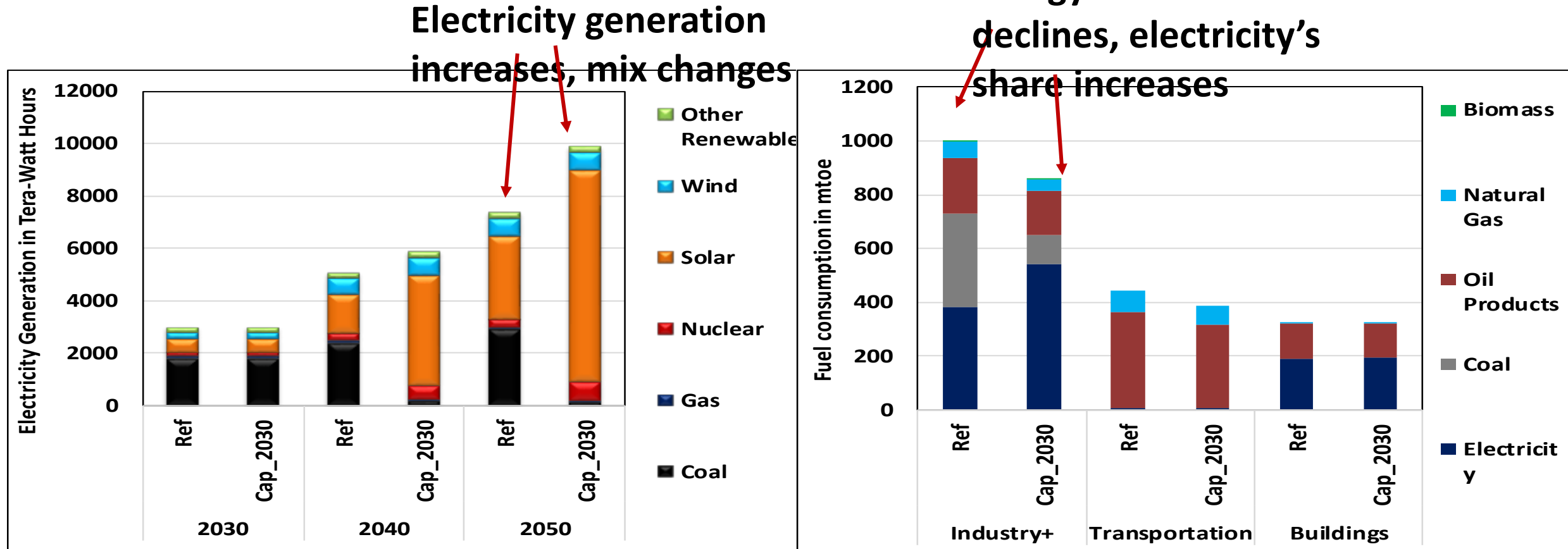
- EI of GDP relative to 2005 declines by 48-54% across all 216 scenarios by 2030, and by 70-81% by 2050
- Highly sensitive to developments in the industrial sector- high energy demand growth (Make In India), lower rate of energy efficiency improvements, and small increase in the share of electricity increases EI of GDP

Industrial sector emissions are going to be critical



- Share of electricity sector and industrial sector in India's CO₂ emissions would be 40% and 32% respectively in 2050, transport only 19%
- Electricity's share in the industrial sector's fuel mix is going to be critical, currently it is less than 17%

The pace of transformation required for a 2 DegC consistent pathway is going to be huge



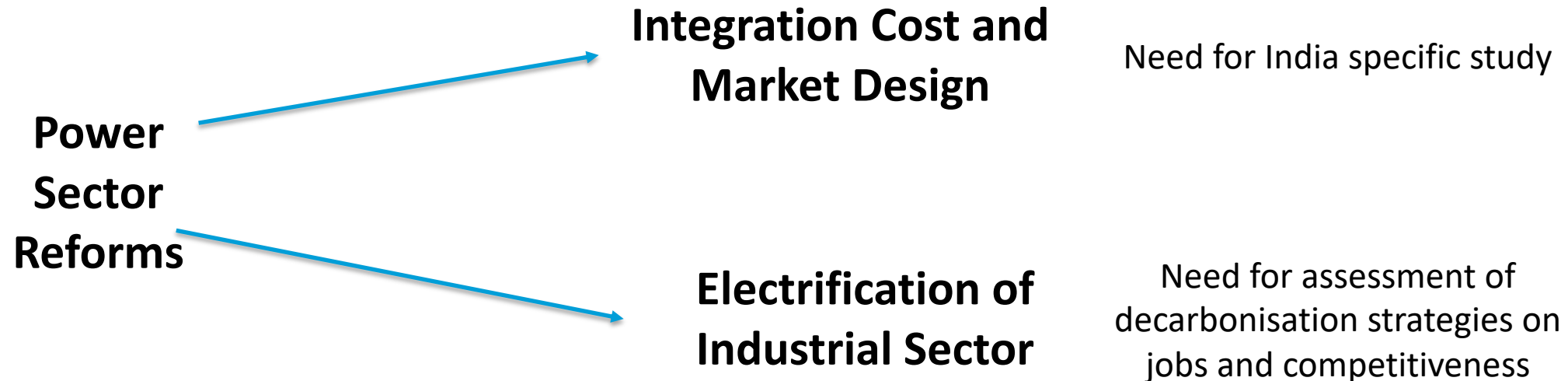
- Non-fossil energy capacity increases to 98% in 2050, for a 2 DegC compatible pathway
- The share of electricity in the industrial sector increases to 55% in 2050

A matrix for understanding ‘Sustainable Development’ synergies and trade-offs?

CEEW Synergies and Trade-Off Matrix		Reference Sc	Cap_2030 Sc	
Emissions	Total Emissions	6785	1663	MtCO ₂
	Per capita emissions	4.09	1.00	tCO ₂ /capita
Electricity Access →	Per capita urban residential electricity consumption	1.38	1.41	MWh/capita
	Per capita rural residential electricity consumption	0.46	0.46	MWh/capita
Electricity Cost	Average generation cost for new investments	2.63	2.31	INR/kWh (2015 prices)
Jobs →	Total jobs related to energy generation sector	13.10	27.51	Million FTE
	Wind related jobs	0.35	0.36	Million FTE
	Ground mounted solar jobs	5.77	15.20	Million FTE
	Solar PV module manufacturing jobs	4.35	11.45	Million FTE
	Coal	2.43	0.15	Million FTE
	Gas	0.02	0.00	Million FTE
	Nuclear	0.17	0.34	Million FTE
Water →	Water withdrawal-Electricity	8.28	2.13	Billion Cubic Metres
Land →	Land Requirement	17398	31235	Thousand Acres
	PV	8366	22024	Thousand Acres
	CSP	63	173	Thousand Acres
	Wind	8350	8574	Thousand Acres
	Coal, oil and gas	619	464	Thousand Acres
Coal	Coal consumption (2021-50)	37.80	18.15	Billion tonnes

To summarise

- **Uncertainty based assessment** helps in deriving a robust understanding of the future
- Our assessment shows that solar is going to grow hugely, but this is very sensitive to the **cost of integration** and who bears this cost. Has implications for NDC and MCS
- Industrial sector is where some important uncertainties are present



For their intellectual inputs in shaping the study

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Thank you

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