Unpacking India's Energy and Emissions Future

Overview of Research and Policy

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OXFORD INDIA CENTRE FOR SUSTAINABLE DEVELOPMENT

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Two Questions

- What are India's medium term energy and emissions projections?
- How can Indian policy address development and climate change?

Outline

- Context of India’s energy and climate policy
- Indian energy and emissions projections
- Factors that will shape future trends
- Conclusions and policy implications

Context: Why India matters

- India is in top 5 economies in GDP-PPP terms
- India is 3rd largest GHG emitter with predictions for growth

→ India matters to global climate change outcomes

	GDP-PPP (current International $) 2014 $ billion	Total GHG Emissions – 2012 (Including LUCF) % of total	Cumulative CO_2 Emissions (excluding LUCF) from 1850 to 2010-12 - % of total
US	17,419	12	27
EU (28)	18,645	9	24
China	18,017	22	11
Russia	3,745	5	7
Germany	3,704	2	6
India	7,384	6	3
Brazil	3,263	4	1
South Africa	704	1	1
Bangladesh	496	0.4	0.1

Source: World Bank http://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD. WRI CAIT http://cait.wri.org/. (From Dubash, 2016 Princeton STEP Seminar)

Context: India as an emerging economy

- Low GDP per capita
- Low GHG per capita (38% of global average of 6.5 tCO_2 in 2012)
- Electricity consumption: 1,000 KWh/cap (2015)
  - Global average: 3,000KWh/cap; US average: 13,000 KWh/cap
- Very low MDPI rank

	GDP-PPP per capita, (current international $) 2014	GHG Emissions per capita (including LUCF) in 2012 - tCO_2e	Population in multidimensional poverty (%) [Multidimensional Poverty Index*]
US	54,629	19	NA
EU (28)	36,326	8	NA
China	13,206	8	5
Russia	25,636	16	NA
Germany	45,802	10	NA
India	5,701	2	55
Brazil	15,838	9	3
South Africa	13,046	9	10
Bangladesh	3,123	1	50

Source: World Bank http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD. WRI CAIT http://cait.wri.org/.; UNDP Human Development Report 2015. (From Dubash, 2016 Princeton STEP Seminar)

India’s duality

- Two problems:
  - Starting from a low base of development with significant needs
  - Large emitter in cumulative terms

- Two policy objectives:
  - Development needs
  - Addressing climate change

Given these objectives, what is the knowledge base for energy and emissions planning?

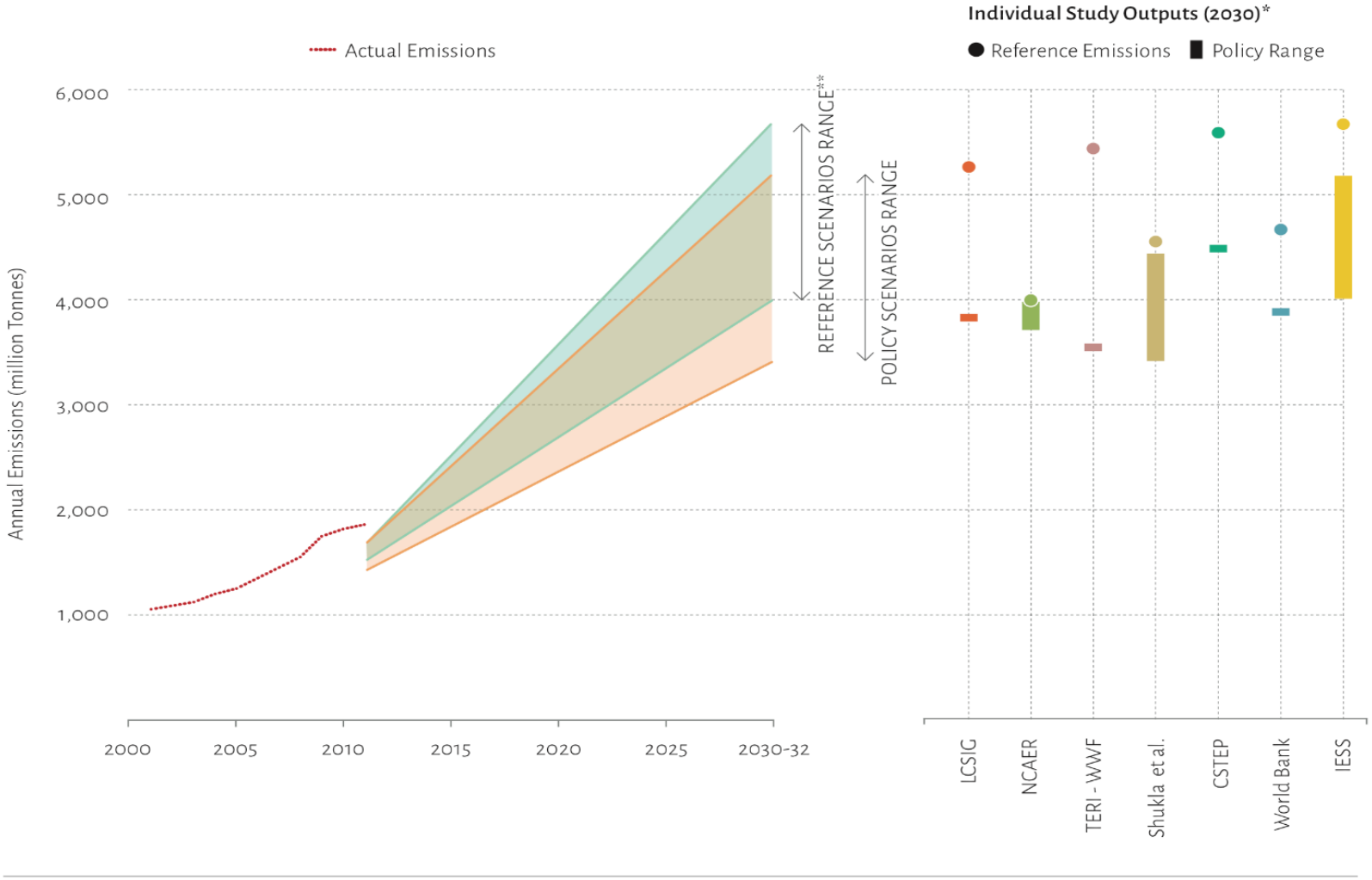
Examining energy and emissions trends

Compare 7 energy/climate scenario studies

- Recent India-specific studies with policy salience (>2013)
- CO_2 from energy and industry
- Synthesize results in consistent, comparable form (for 2030)
- Use reference or baseline scenarios (current policy) to distill implications

India's 2030 CO_2 projections

- CO_2 emissions could increase 2X to 3X
- Per capita emissions of 2.8-3.6 tons (in 2030), less than global average of 4.8 tons (in 2012)



* The range of study end-years is 2030/31/32. See Appendix, Table A4.

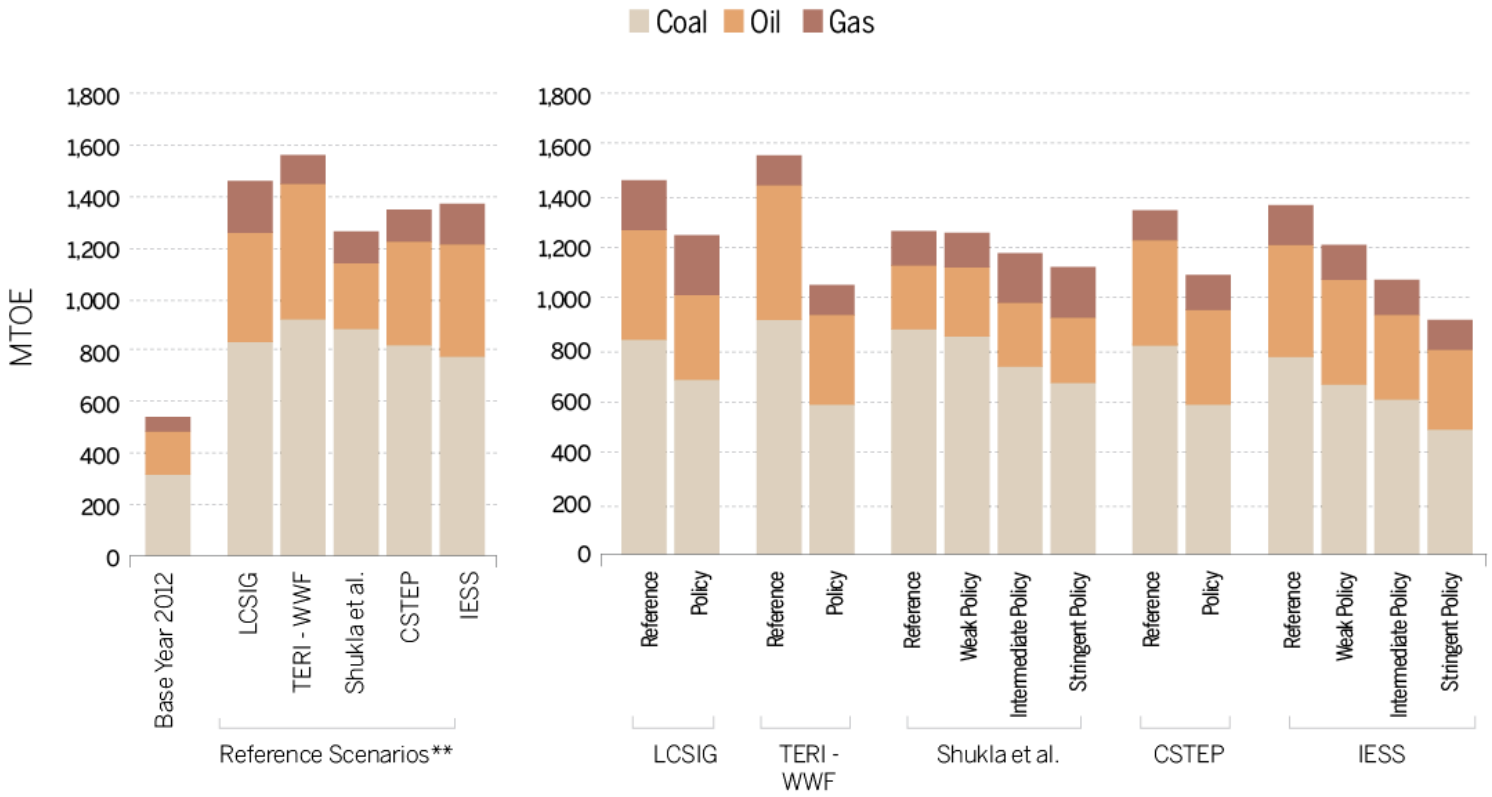
** Reference scenarios are not equivalently defined, but in general, attempt to reflect full implementation of currently committed policies.

Source: N. Dubash, R. Khosla, N. Rao, K.R. Sharma. CPR-IIASA Research Report 2015

India's 2030 fossil fuel use projections

- Coal consumption increases 2.5 – 3X
- Oil use increases 1.5 – 3X
- Gas increases 2.1 – 3.5X

	Import Share 2012 (%)	Import share 2030 (%)
Coal	26	40-52
Oil	78	88-93
Gas	30	40-70



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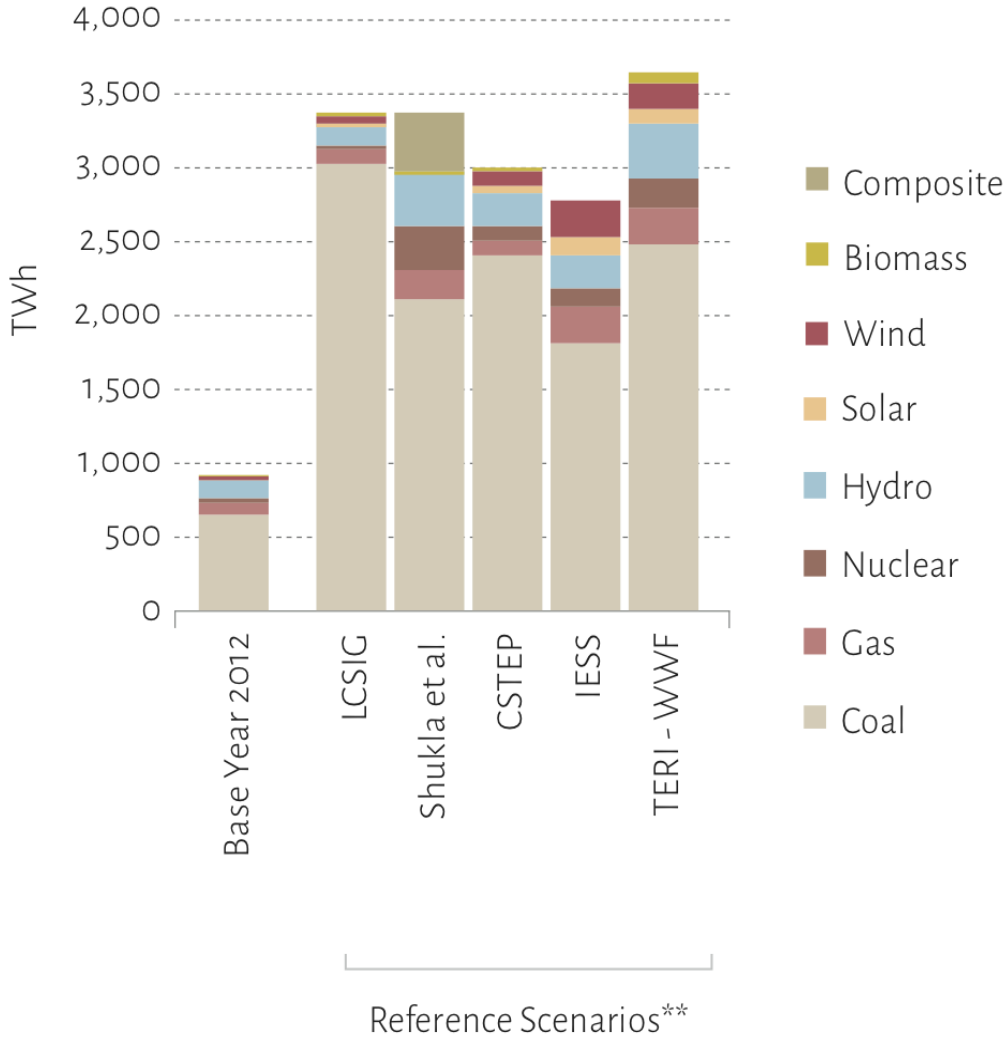
^ The range of study end-years is 2030-32

Source: N. Dubash, R. Khosla, N. Rao, K.R. Sharma. CPR-IIASA Research Report 2015

India's 2030 electricity supply mix projections

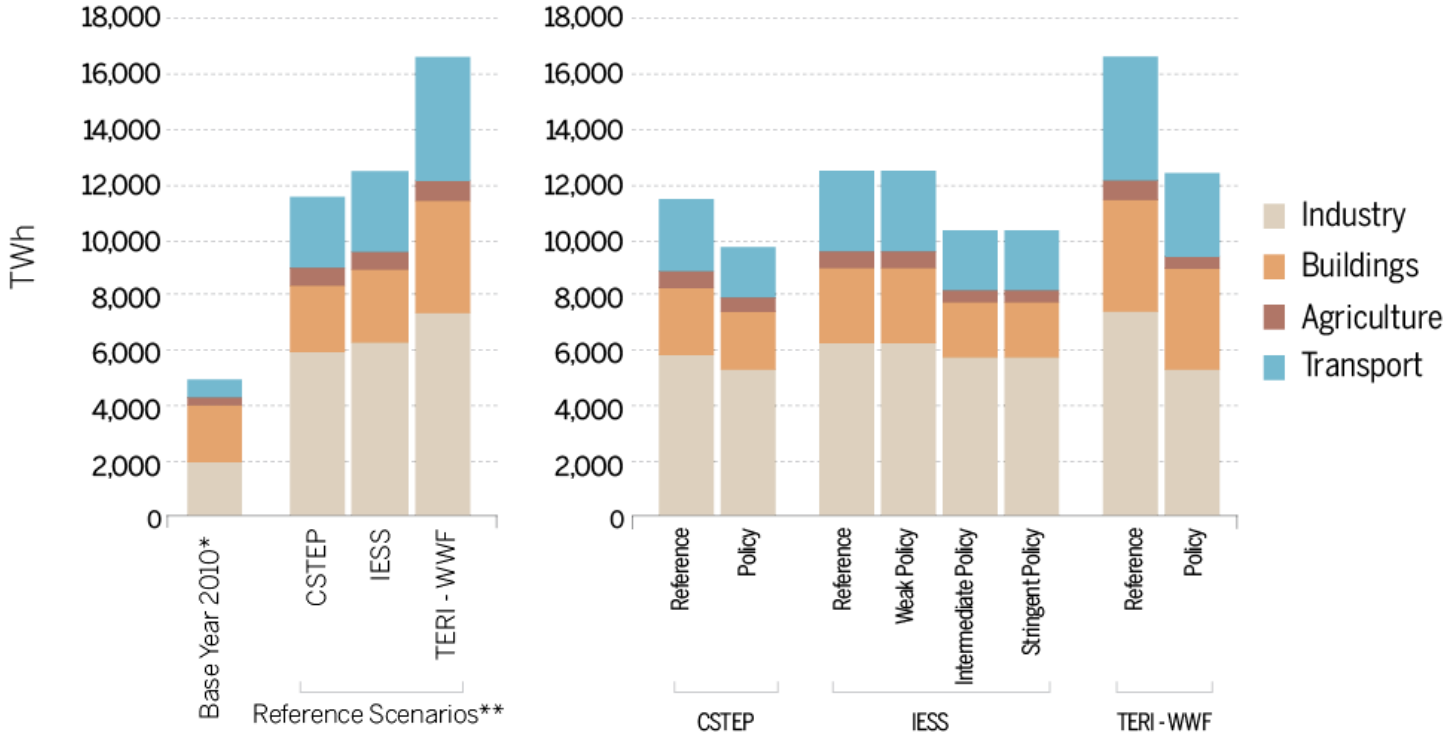
- Estimates inconsistent with history
  - Coal varies from 56-90% (70% in 2012)
  - Fossil fuel free share could rise 20-31% or fall to 7% (21% in 2012)
- Nuclear higher than trend
  - 15-42 GW capacity addition predicted vs. 5 GW today
- Renewables lower than trend
  - 2-12% share of 2030 mix (4% in 2012)



Source: N. Dubash, R. Khosla, N. Rao, K.R. Sharma. CPR-IIASA Research Report 2015

India's 2030 energy demand projections

- Only 3 of 7 studies comprehensively characterize final energy demand
- Uncertain and widely ranging projections
- Limited treatment of non-commercial biomass energy
  - ~70% of Indian rely on non-commercial fuels for cooking



* Data for 2010-2011
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Source: N. Dubash, R. Khosla, N. Rao, K.R. Sharma. CPR-IIASA Research Report 2015

Coverage of development and climate objectives

Objectives		LCSIG	NCAER	TERI-WWF	Shukla et al.	CSTEP	World Bank	IESS
Energy for growth	Supply	●	●	●	●	●	●	●
	Demand	o		●		●		●
Energy Security				●		●		●
Inclusive growth		o						
Local environmental objectives					o	o		
CO_2 mitigation	Emissions	●	●	●	●	●	●	●
	Intensity	●	●					
Costs		●	●	o			o	

● Full coverage: Reasonably comprehensive and transparent treatment

o Partial coverage: Addressed to an extent, but falls short in some respects, including accessibility

Source: N. Dubash, R. Khosla, N. Rao, K.R. Sharma. CPR-IIASA Research Report 2015

Interpreting Indian projections

Credible projections difficult

- No sensitivity analysis
- Weak demand forecasts
- Minimal consideration of supply constraints or environmental harm
- Inadequate comparison, review and policy dialogue

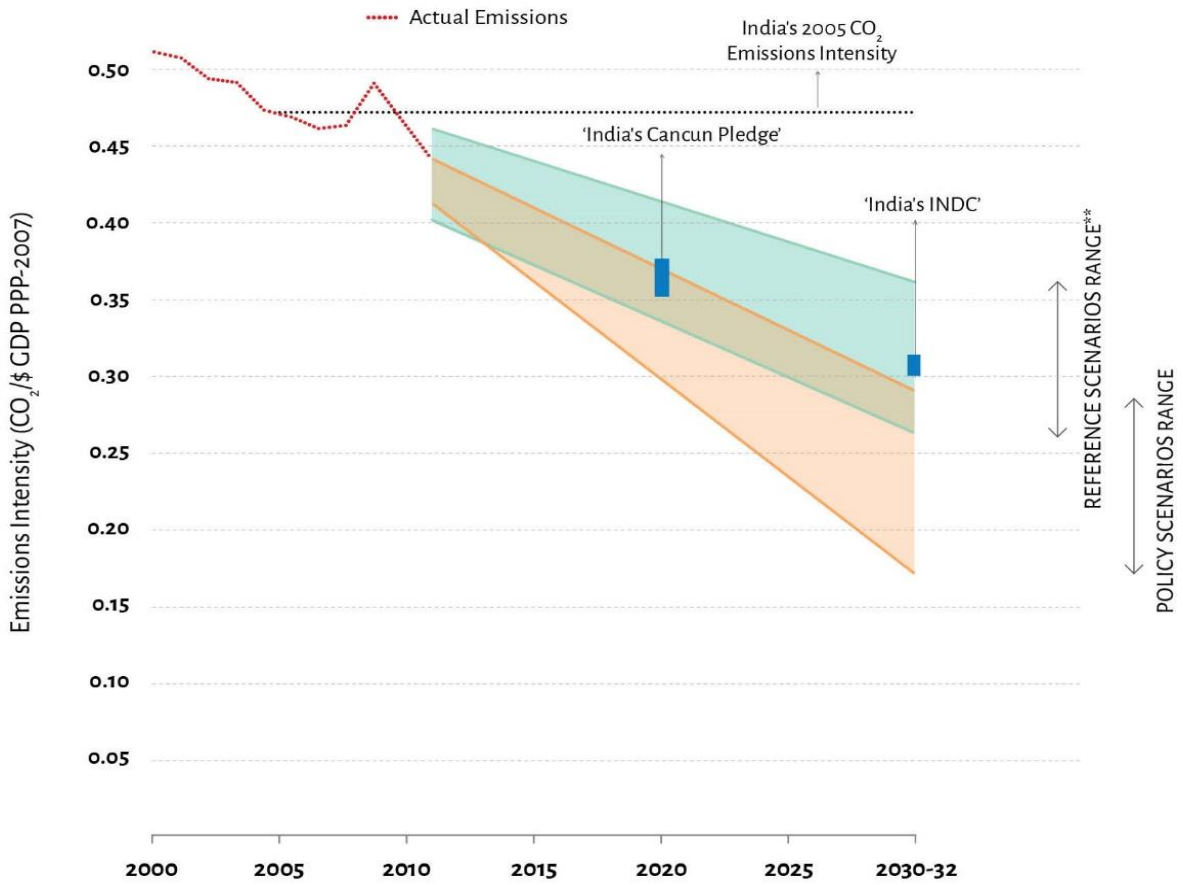
A source of divergent projections: GDP growth

- Models reviewed use GDP assumptions of 7-8.75%
- India's Paris pledge assumes 8.6%
- Historical trends:
  - 6.1% from 1991-2000
  - 7.1% from 2001-2010
  - 5.5% from 2011-2013

GDP growth rate to 2030	6.5%	7.5%	8.6% (Paris pledge projection)
Total emissions in 2030 (MT CO_2e)	4644-4787	5867-6047	7567-7800
Per capita emissions in 2030 (Tonnes CO_2e) (Global 2012: 6.6)	3.1-3.2	3.9-4.0	5.0-5.2

Source: Dubash and Khosla (2015) Economic and Political Weekly

Energy needs and emissions will grow – but with reduced rate of emissions increase



Source: Dubash and Khosla (2015) Economic and Political Weekly

How can India reduce rate of emissions growth?

Four key domains for policy and research:

- Structural changes
- Co-benefits
- Renewables
- Energy demand

Structural transitions

- Urbanization
  - Largest shifts to urban centres in world history (UN, 2011)
  - From 30% now to 50% in 2030
- Infrastructure growth
  - Buildings: 2/3rd of 2030 building stock unbuilt
- Demographic change
  - Middle class will grow from 31m in 2013 to 114m in 2025
  - 10m new young entrants to the work force each year
- Limited planning for structural changes
  - E.g. urban planning; growth in appliance and vehicle ownership

Potential of co-benefits

- Co-benefits emphasized in the IPCC and India's National Climate Plan
- South Asia results of global models show synergy across climate mitigation, air pollution and energy security (IIASA 2015)
- But limited analogous Indian studies that assess the scope of synergies and tradeoffs between development and climate
  - What impact does increased investment in renewables have on jobs?
  - What is the tradeoff of investing in coal for increased energy access and worsening air pollution?

Renewable energy policy

- India's Paris pledge includes 40% fossil fuel free target
  - Implies 150-276 GW RE by 2030
  - Current grid is 280 GW
  - Favourable policy and technology conditions

- Translate 2030 target to emissions terms
  - Domestic impact: displaces close to 5% of India's 2030 emissions
  - Global impact: about half of South Africa's 2030 emissions

Unexplored Potential of Energy demand

- Buildings, transport, industry can reduce emissions intensity by 23-25% by 2020 from 2005 levels (GoI, 2011)
- Lack of demand side knowledge fuels further uncertainty in projections
- Difficult to predict fossil fuel supply and imports without realistic demand
- Implications for India's Paris pledge
  - Investment for 40% FFF target depends on size of future grid (700 vs. 1000 GW)
- Examples of demand side research (buildings sector):
  - Buildings account for over 30% of India's electricity consumption
  - Study of the adoption of building energy codes in Indian states as a way to manage energy demand
  - Creating a baseline of energy use in commercial and residential buildings to monitor and manage energy consumption

To Recap

- India’s duality: large emitter at a low base of development
- Within this context, India’s analytical base for policymaking is poor
- Research and policy domains that can impact the rate of emissions growth:
  - Addressing structural changes
  - Co-benefits based policy
  - Renewable energy policy
  - Managing energy demand
- Demand side as a key opportunity to reduce lock-in

Conclusions for Effective Policy

- Indian energy and climate policymaking is complex given uncertainty of projections
- Complexity requires strategic and analytical coordination within government
  - Weak state capacity
  - Limited integration across sectoral work
  - Limited focus on maximising synergies between climate and development
- Significant opportunity for researches to help build a robust knowledge base and inform effective policy

Thank You

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http://cprindia.org/projects/climate-initiative

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