Nationally Appropriate Mitigation Actions in India towards achieving 2^0C global stabilization target

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Presentation Agenda

1. **Nationally Appropriate Mitigation Actions (NAMAs)**
   - *India's National Climate Change Action Plan*
   - *Technology Cooperation, Transfer and Finance*
2. **Integrated Assessment of India's Climate Change Actions**
   - *Aligning development and climate policies and actions*
   - *Aligning spatial, temporal and sector policies and actions*
3. **Low Energy Carbon Technology Choices**
   - *Issues with technology targets (examples: nuclear & solar)*
   - *Avenues for technology transfer and investment*
4. **Low Carbon Infrastructure Choices**
   - *Co-benefits, Risks and Policies*
   - *Opportunities for Investments and Technology Transfer*
5. **Aligning National and Local Policies**

Nationally Appropriate Mitigation Actions (NAMAs)

- **The Bali Action Plan 2008:** Enhanced action on mitigation of climate change, including, ***Nationally Appropriate Mitigation Actions (NAMAs)*** in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner.
- **The Cancun Agreement (UNFCCC COP16, December 2010):** *"Developing country parties will take nationally appropriate mitigation actions in the context of sustainable development,* ***supported and enabled by technology, financing and capacity-building****, aimed at achieving a deviation in emissions relative to 'business as usual' emissions in 2020."*

India's Voluntary Commitment to UNFCCC

1.20-25% reduction in emission intensity relative to 2005

2.Per Capita Emissions Below OECD Average

3.MRV/ICA of Domestic Actions (India's Proposal at Cancun)

- The **integrated assessment research** shows that sustainable development strategies that align national development and global climate goals deliver mitigation at lower ***'social cost of carbon'*** compared to mitigation done from a 'conventional' business-as-usual development pathway.
- **NAMAs** are the key part of the roadmap that **aligns national development and global climate goals**.

India's National Climate Change Action Plan: Implementation Strategy

India's Climate Change National Action Plan (NCCAP): Implementation Strategy

8 National Missions of NCCAP

1. **Solar Energy** (20 GW Grid Solar by 2022; 20 million sq. meter collectors)
2. **Enhanced Energy Efficiency** (Avoided capacity: 19000 MW by 2014-15)
3. **Sustainable Habitat**
4. **Water Sector** (20% water use efficiency improvement)
5. **Sustaining the Himalayan eco system**
6. **A "Green India"** (20 Mil. Hectare forestation by 2020; Forest cover from 23 to 33%)
7. **Sustainable Agriculture** (Micro irrigation promotion in 40 Mil. Hectare)
8. **Strategic Knowledge for Climate Change**

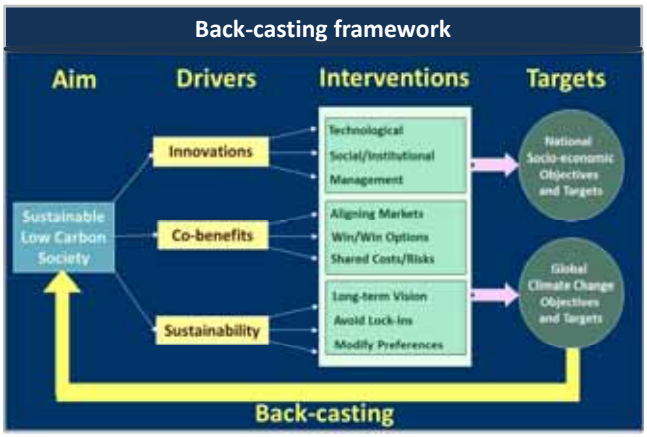
Implementation of Domestic Actions

- **Carbon tax on coal to fund clean energy**
  - US $1/ton on domestic & imported coal; fund to be used for Clean Energy
- **Enhanced Energy Efficiency measures**
  - Mandate to reduce specific energy consumption;
  - Energy savings certificates & trading
  - Energy efficiency ratings mandatory for 4 key appliances from Jan 2010
  - Reduction of 6 GW of electricity demand through mass distribution of CFLs
- **Renewable Energy Push**
  - Capital Subsidies and/or Preferential Feed-in Tariff
  - Renewable Energy Certificates Market
- **Mission on sustainable habitat**
  - Energy efficiency in residential, commercial and urban transportation
  - Managing water, wastewater and solid waste with recycling, reuse and energy creation

Integrated Assessment of India's Climate Change Actions

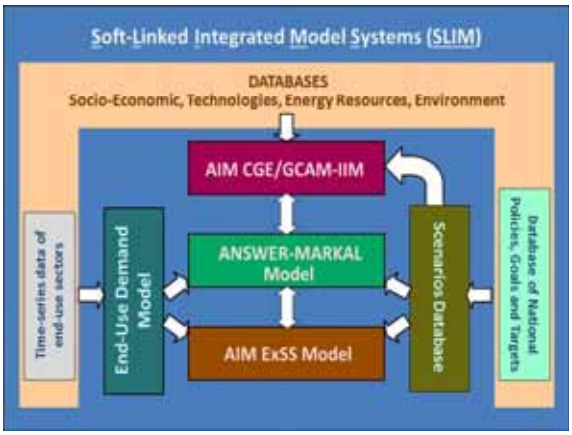
Perspective & Framework

Aligning development and climate policies and actions

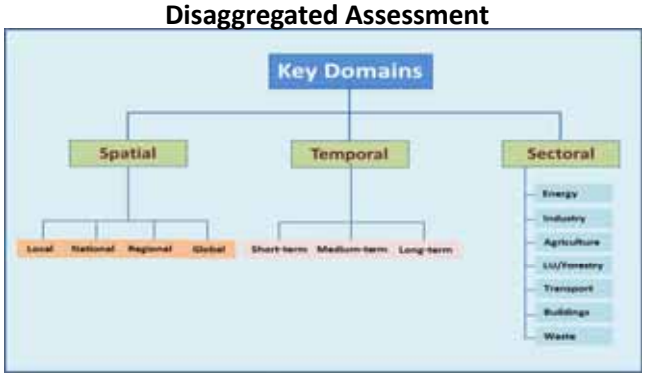


Model System for Integrated Assessment

Soft linking spatial, temporal and sector policies and actions



Disaggregated Assessment

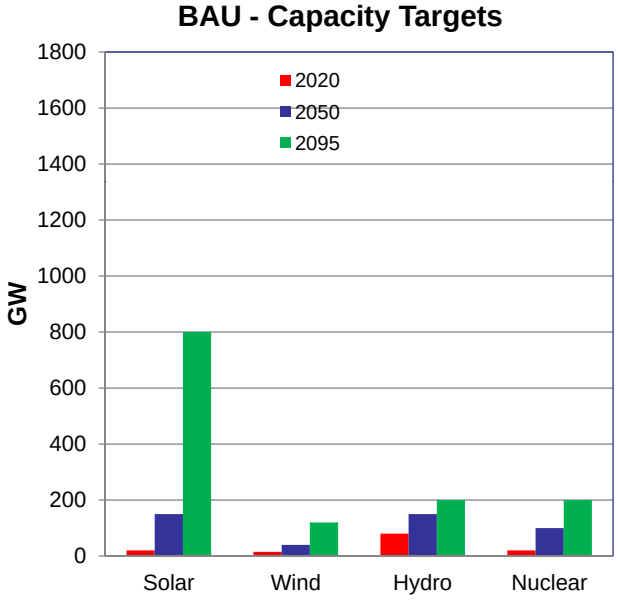


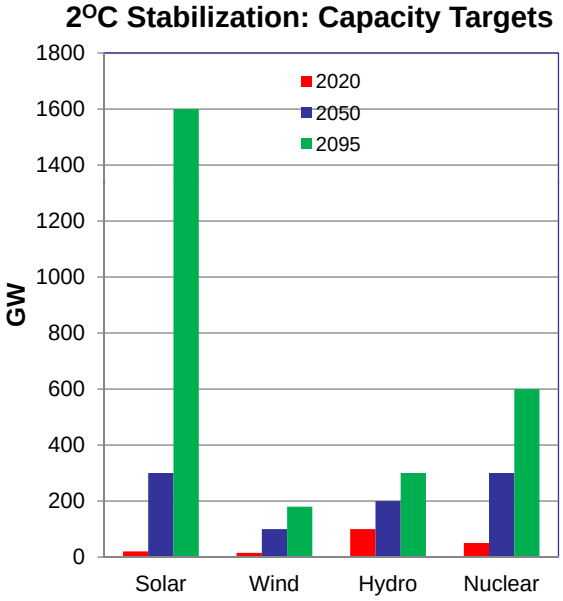
- **Perspective and Framework:** ***To Align National Development and Global Carbon Objectives and Targets***
- **Model System for Integrated Assessment:** ***Soft-linking global, national and sector models***
- **Disaggregated Assessment:** ***At different Spatial, temporal and sector levels***

Low Energy Carbon Technology Choices:

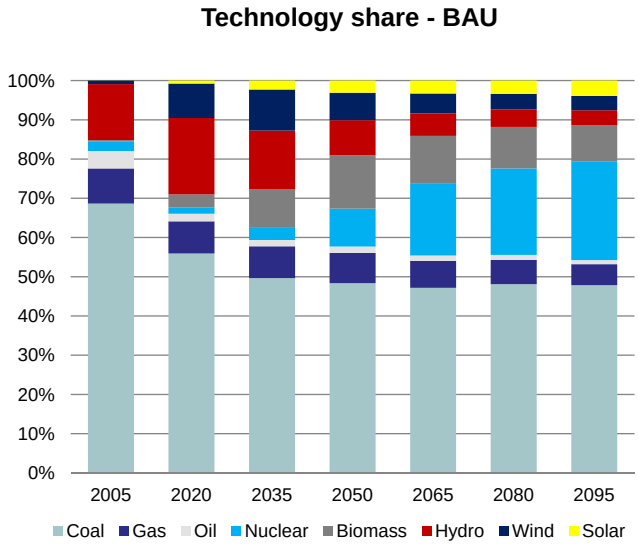
- ***Issues with technology targets (examples: nuclear & solar)***
- ***Avenues for technology transfer and investment***

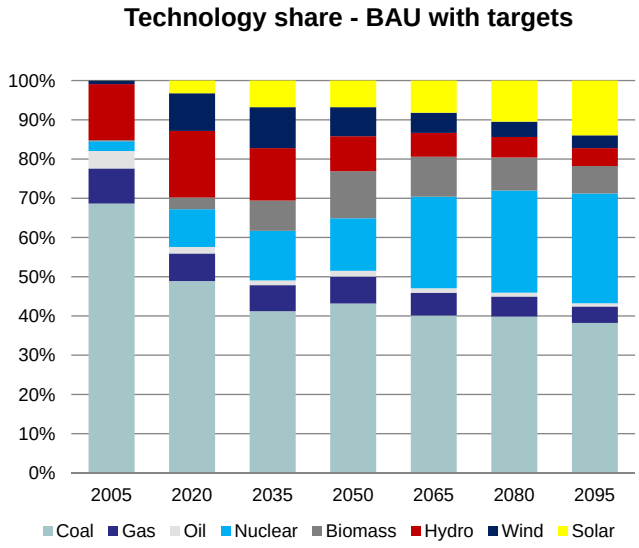
Low Carbon Technology Targets Policy





BAU Scenario with & without Technology Targets

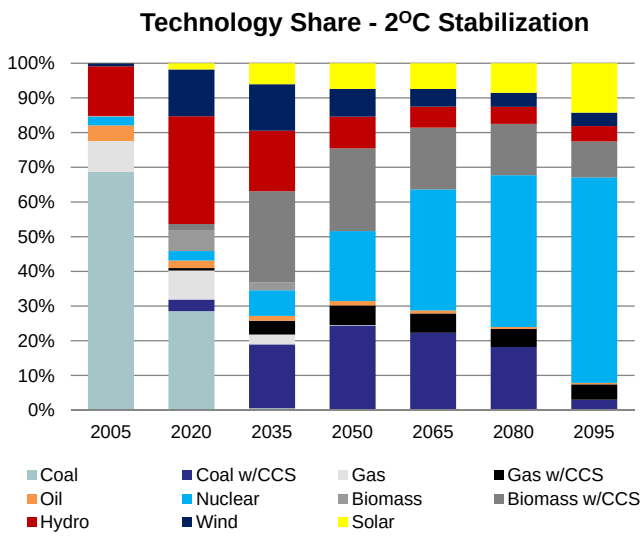


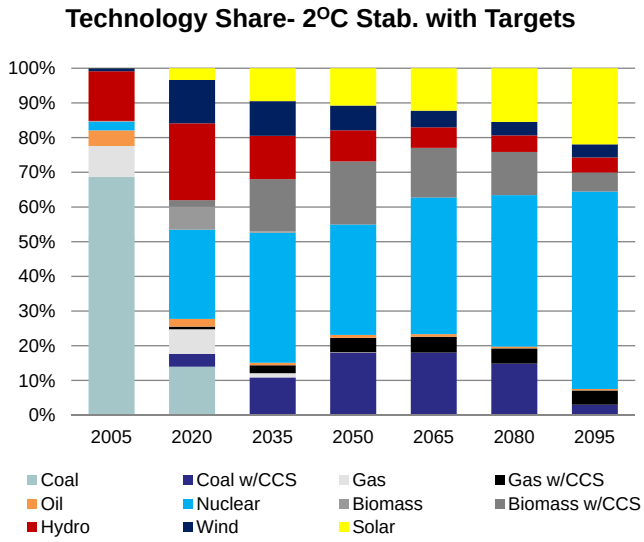


Under BAU

- In case of share of **Nuclear**, the ***technology targets*** have strong effect in the short to medium-run (2035) but little influence in the long-run
- In case of solar, the ***technology targets*** are important *to* drive the penetration through the century
- The ***technology specific targets*** create competition among the low carbon technologies rather than competition with fossil technologies

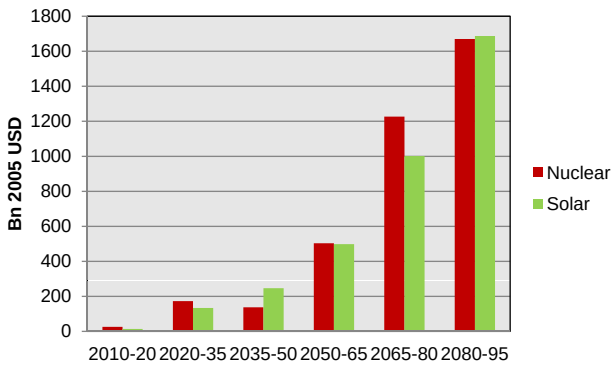
2°C Stabilization Policy with & without Technology Targets

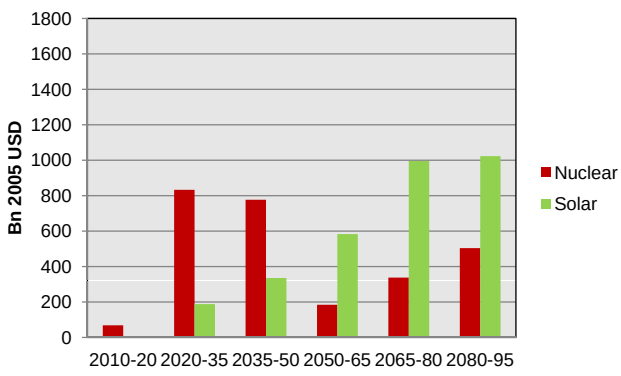




- 2°C Stabilization policy alters significantly the share of Low Carbon Technologies; i.e. renewables, nuclear and CCS
- Under 2°C Stabilization policy, targets have little effect on share of technologies
- Carbon price hence has greater impact on technology penetration than subsidies

Cumulative Subsidy for Low Carbon Technologies

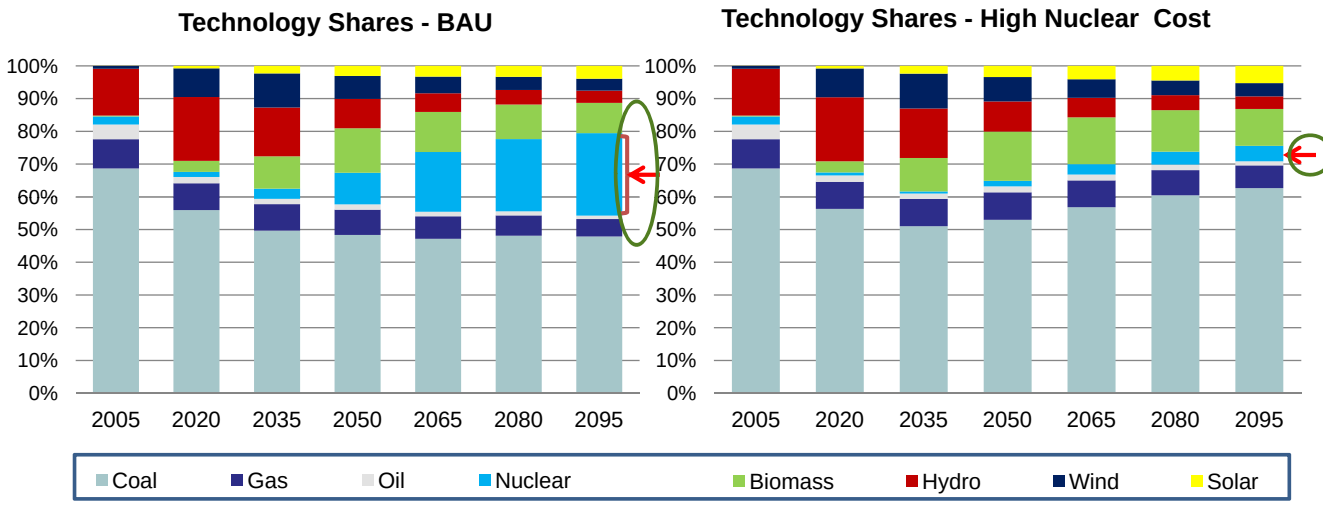




- In BAU: Very high subsidy to push Nuclear and Solar through the century
- In 2°C Scenario: Subsidies are lower than in BAU; Nuclear needs more than Solar

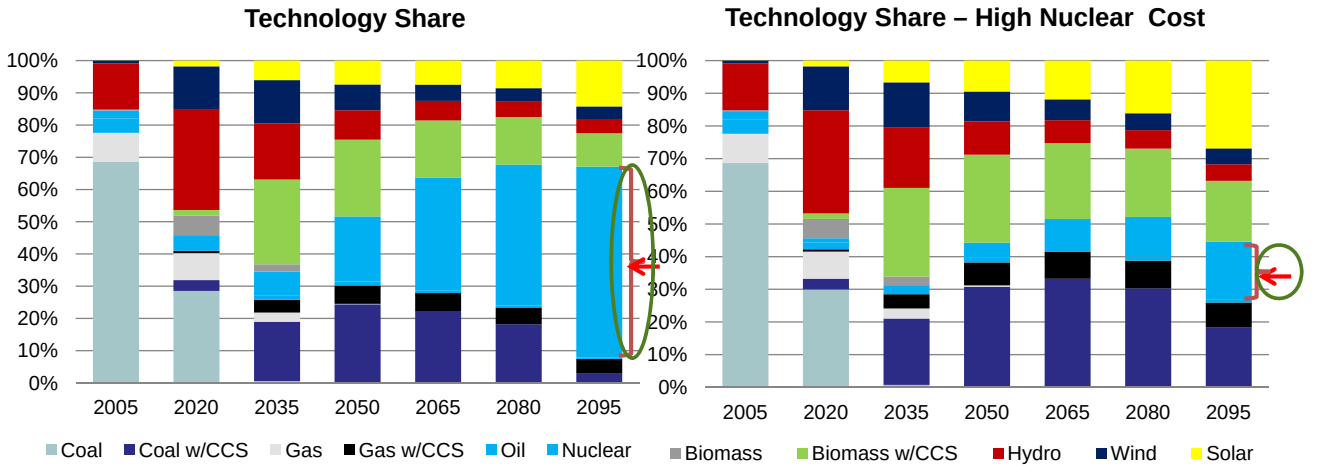
- In the short run (2010 to 2020), cumulative subsidy for Nuclear and Solar shall be:
  - BAU: 40 Bn USD
  - 2°C scenario: 73 Bn USD

Post- Fukushima Nuclear Price Sensitivity - BAU



- Assumes 50% higher capital cost of nuclear plant to account for unforeseen risks
- Higher nuclear capital cost reduces share of Nuclear significantly in BAU

Post Fukushima Nuclear Price Sensitivity – 2^{O}C Stabilization



- Higher capital cost reduce share of Nuclear significantly also in the 2^{O}C Scenario
- Solar technology share increases considerably under this scenario
- These results are sensitive to the feasibility (i.e. risks) of Biomass with CCS

Low Carbon Energy Technologies
Avenues for Technology Transfer and Investment

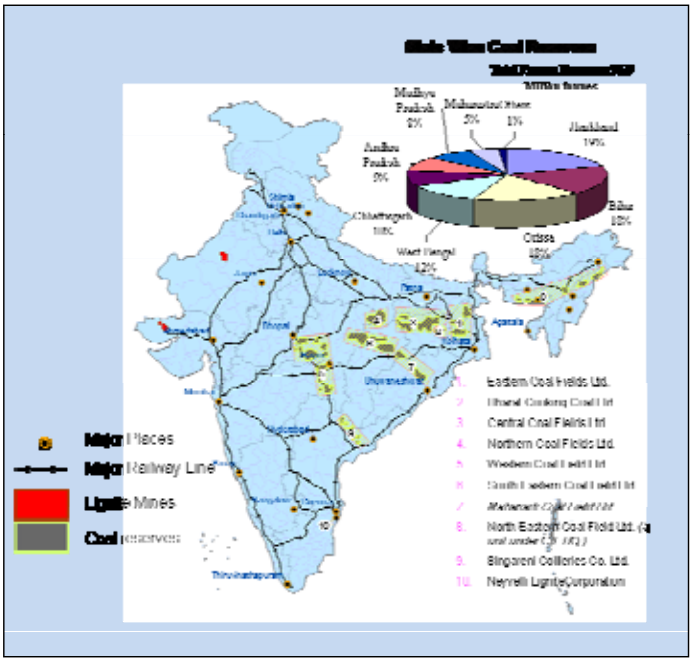
1. **Solar Energy Mission**
   - Investment needed by 2022 in Solar Power Projects (+Smart grid): **US$40 billion**
2. **Energy Efficiency Mission**
   - Energy efficiency products market: **US$20-50 Billion annual market by 2020**
3. **Sustainable Agriculture, Water Sector and Green India Missions**
   - Micro irrigation products, Seeds etc.: **US$10-40 Billion annual market by 2020**
   - Water Projects: **Sustainable hydro-electric Technologies, Water Transport**
   - Green India Projects: **Technologies to manage forests; forest produce market**
4. **Sustainable habitat**
   - Micro irrigation products, Seeds etc.: **US$10-40 Billion annual market by 2020**
5. **A "Green India" Strategic knowledge for climate change**
   - Knowledge Partnership across Nations: **Cooperation on joint research; information exchange**

Low Carbon Infrastructure Choices:

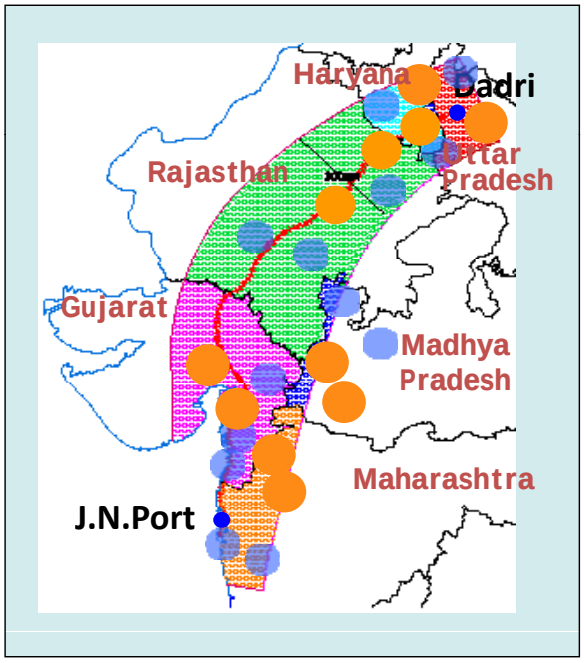
- *Co-benefits, Risks and Policies*
- *Opportunities for Investments and Technology Transfer*

Overcoming Infrastructures Lock-ins: Transport

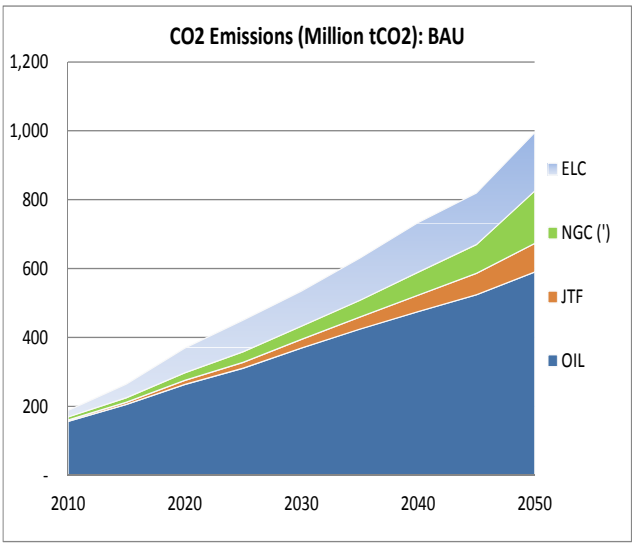
Moving Coal by Wire

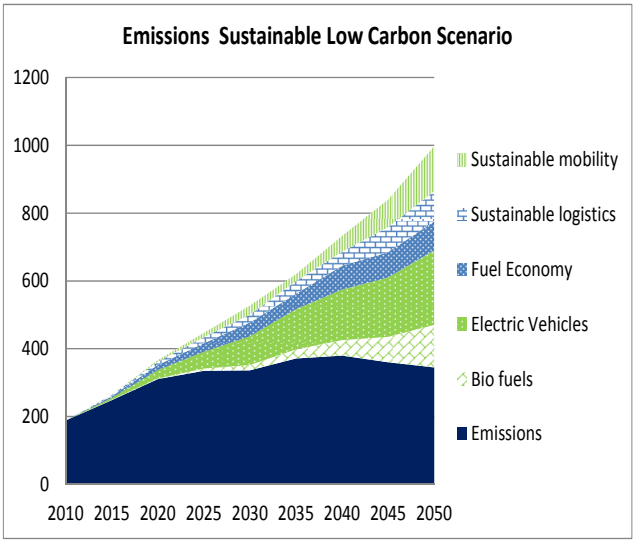


Train Corridors



CO_2 Emissions Reductions in Transport Sector



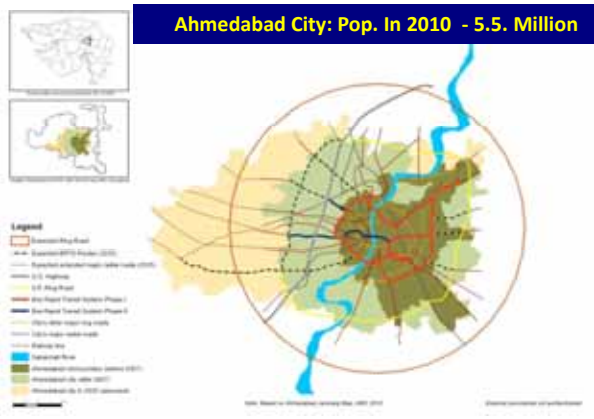


Emission Intensity of Grid ($KgCO_2/KWh$)

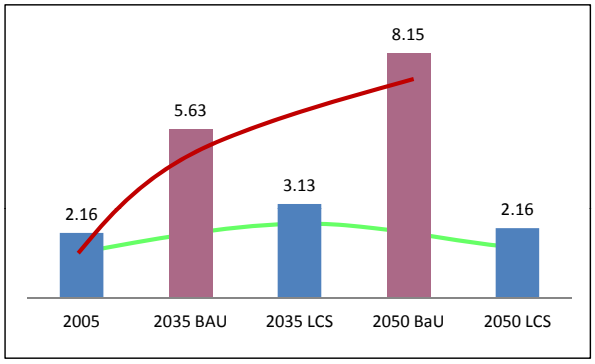
Scenario	2010	2020	2030	2040	2050
Base Scenario (BAU)	0.99	0.94	0.86	0.74	0.69
Sustainable Low Carbon Scenario	0.99	0.71	0.28	0.14	0.08

City Planning: Aligning National and Local Policies

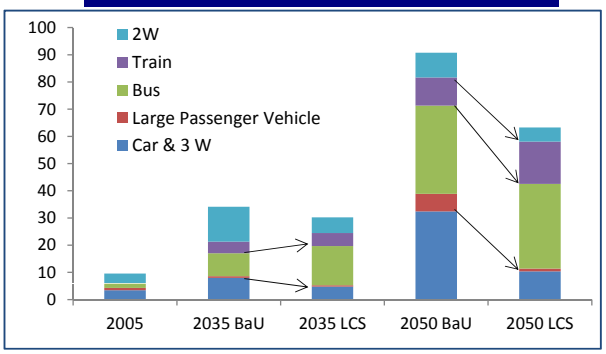
Ahmedabad City: Pop. In 2010 - 5.5. Million



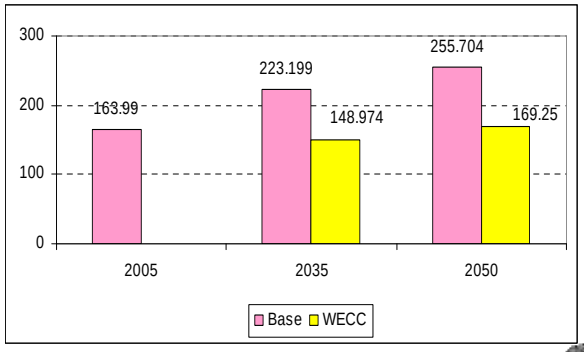
Per Capita CO2 Emissions (Ton)



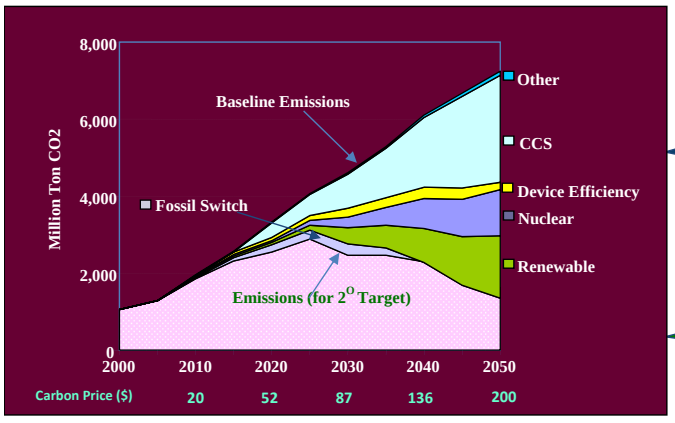
Co-benefits: Transport Transitions



Co-benefits: Water per capita (ML/million)



Mitigation Options: Conventional vs. Sustainable



Conventional Approach: transition with conventional path and carbon price

- High Carbon Price
- Climate Focused Technology Push
- Top-down/Supply-side actions

Technology Co-operation Areas

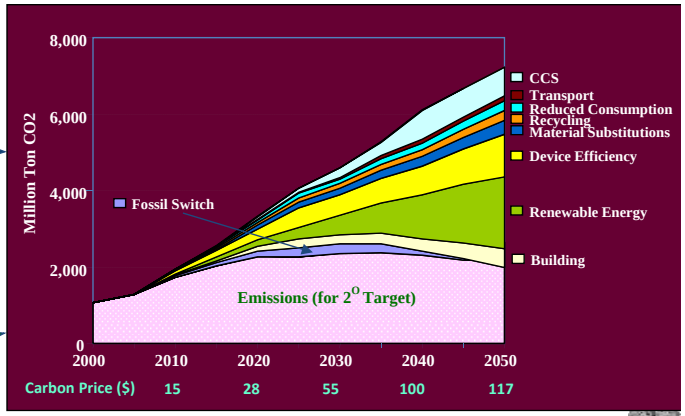
- Energy Efficiency
- Wind/Solar/Biomass/Small Hydro
- Nuclear/CCS

Sustainability Approach: aligning climate and sustainable development actions

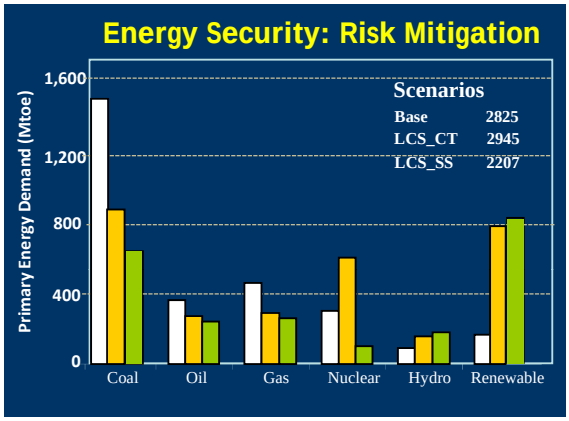
- Low Carbon Price
- Bottom-up/Demand-side actions
- Behavioural change
- Diverse Technology portfolio

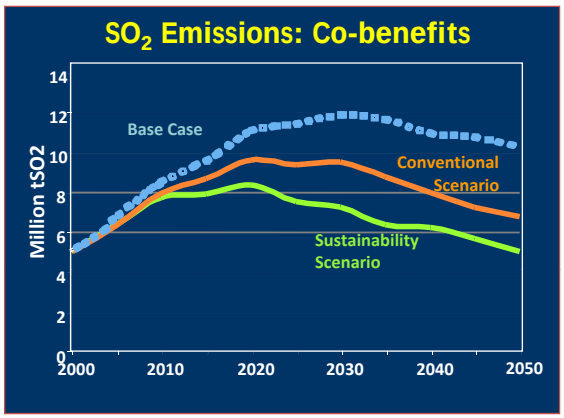
Technology Co-operation Areas

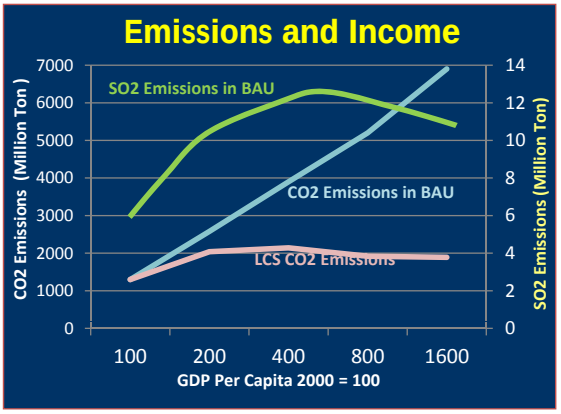
- Transport Infrastructure Technologies
- 3R, Material Substitutes, Renewable Energy
- Process Technologies
- Urban Planning, Behavioral Changes

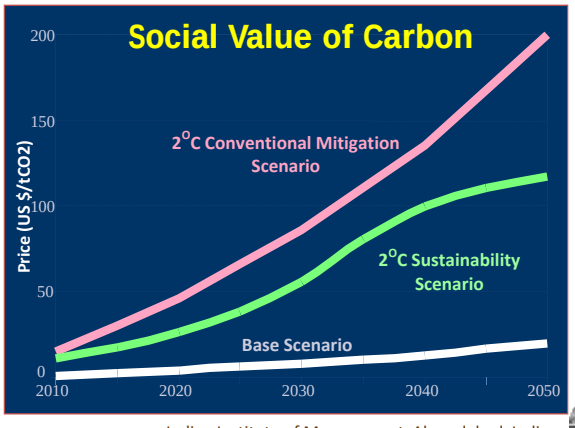


Co-benefits, Risks and Social Value of Carbon









Analysis with ANSWER-MARKAL Model

Mitigation Options and Avenues for Cooperation

Domain	Mitigation Options (Examples)	Avenues for Cooperation: Technology Transfer, Investments & JVs: (Examples)
Energy	Efficiency: Appliances, Vehicles Low Carbon Energy: Renewable, Nuclear Air Quality: FGD, Catalytic Converters End-of-pipe Low Carbon: CCS	• Hybrid/Electric Vehicles • Solar PV • Air Pollution Control Equipments • CCS
Infrastructure	T&D: Electricity; ICTs Transport: Urban Mass Transport; Dedicated Rail corridors, Bullet Trains, Pipelines	• Dedicated Train Corridor • Super-fast trains • Smart grid
Industrial Processes	Process Efficiency: Metal Production Product Efficiency: Solar PV	• Energy intensive industries • Product RD&D
Conservation	3R: Reduce, Recycle and Reuse resources Dematerialization:	• Drip irrigation, Water treatment • Green buildings
Behavioural	Consumption: Cool Biz, Car Share, Bicycle	• Information and Capacity Building
Planning	Urban Land-use: Vertical vs. Horizontal city, Green spaces, Industry location	• Planning Methods and Models • Greening solutions
Economic Instruments	Market: Carbon Tax, Emissions Trading, CDM C&C: Technology mandates (e.g. Fuel efficiency standards; capacity targets)	• Software for Trading Platforms • Assessment of technology learning • MRV information systems

Conclusions: National Roadmap for Actions

1. **Link Low Carbon Actions and Development Targets to identify NAMAs**
   - *Delineate NAMAs that align Sustainable Development & Climate Change Mitigation & Adaptation Actions*
2. **Many low carbon technology options deliver co-benefits; some may pose high risks (e.g. nuclear, CCS)**
   - *Assess full range of benefits, risks and co-costs of low carbon actions*
   - *Institute policies & measures to maximize co-benefits and minimize risks and co-costs*
3. **Low Energy Carbon Technology and Infrastructure Choices**
   - *Avoid technology, infrastructure, institutional & policy lock-ins into high emissions*
   - *Immense win-win opportunities exist for technology transfer and investment*
4. **Paradigm Shift towards Global 'Co-benefits' and 'Co-operation'**
   - *Global Cooperation helps spatial/temporal/sector policy coordination and delivers co-benefits (especially when markets are incomplete or inefficient)*
   - *Co-benefits reduce 'Social Cost of Carbon'*

Thank you

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