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Climate Change Mitigation Policies Conventional Versus Sustainable Development Scenarios in Emerging Economies

Kirsten Halsnæs (DTU) and P. Shukla (IIM India)



SD Framing of Climate Policies

- The paper explores how bottom up driven sustainable development policies can support climate change mitigation as an alternative to the COP process
- SD policies with large indirect impacts on CC mitigation includes energy efficiency improvements, renewable energy, environmental policies, and economic growth patterns:
 - recognizing that models are structured to assess optimal global CC mitigation policies (e.g. with a uniform carbon tax)
- Our approach is to change the baseline scenario and include various policies that support SD objectives and compare mitigation costs and options with conventional baselines
- Focus on China and India based on studies with:
 - TIAM
 - IPAC for China by Jiang Kejun, ERI
 - ANSWER MARKAL for India by P. Shukla, IIAM
- CC mitigation is assessed in relation to conventional baseline and to SD baseline

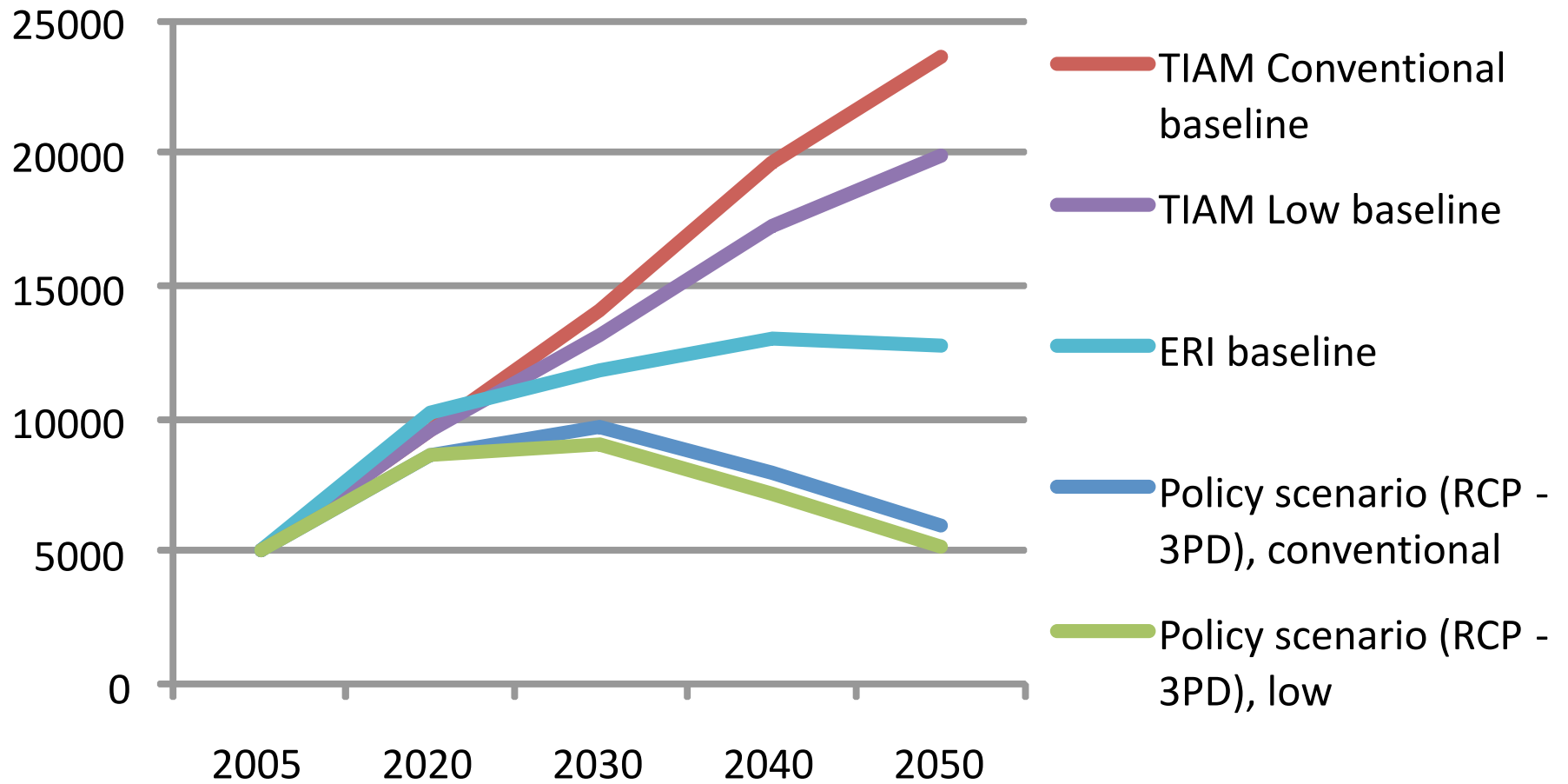
Baseline Policy Categories

- GDP growth and sectoral structure (TD):
 - Continuation of high economic growth rates in China and India
 - Industrialisation towards less energy intensive sectors
- Energy intensity of growth (TD):
 - Industry and other business
 - Households
- Technological change (BU):
 - Energy supply
 - End use technologies
- Renewable energy (BU):
 - Targets
 - Potentials

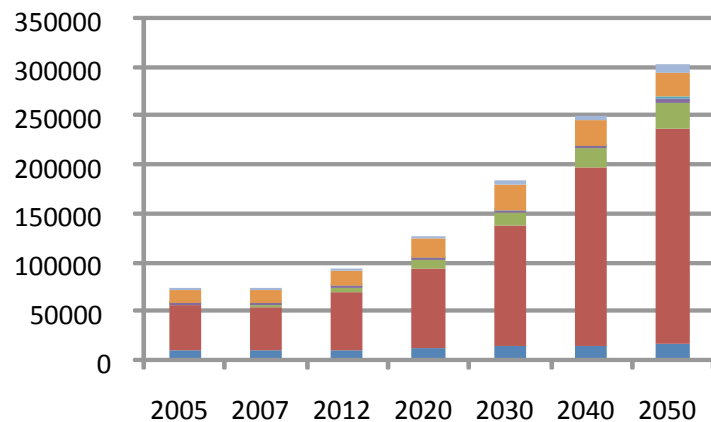
Study coverage

- IPAC China:
 - High GDP growth rate
 - Efficiency improvements in industry, households and transportation
 - Renewable energy targets
 - Technological change in supply technologies
- TIAM:
 - Medium growth rates assumed for China and India
 - Efficiency improvements in industrial processes
 - IPAC renewable energy potentials
- ANSWER-MARKAL India:
 - High GDP growth rate
 - Changed sectoral structure
 - Efficiency improvements in industry, households and transportation
 - Renewable energy targets
 - Technological change in supply technologies

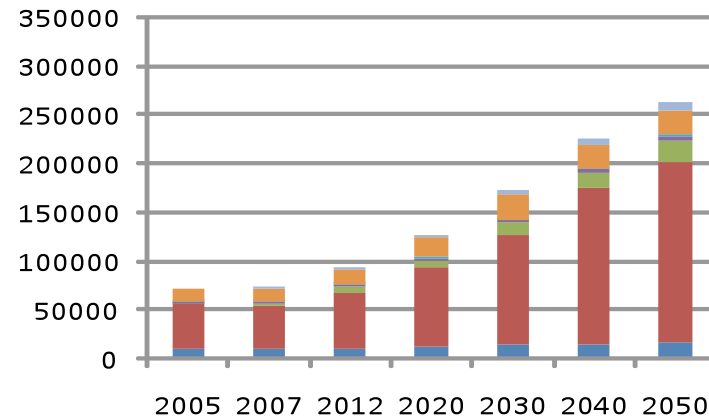
Chinese CO₂ emissions (Mt)



Primary energy by fuel in conventional baseline (PJ)



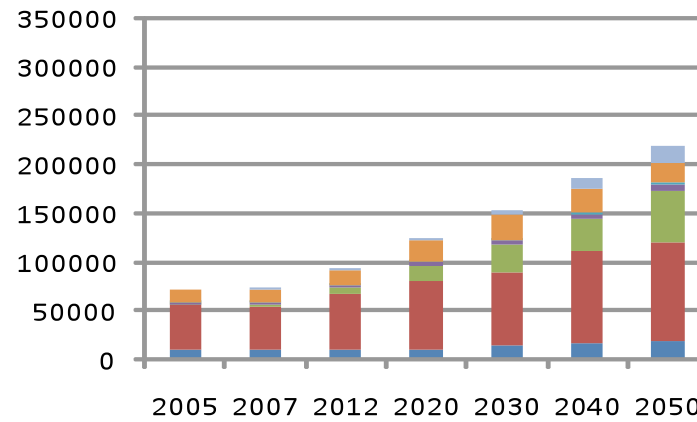
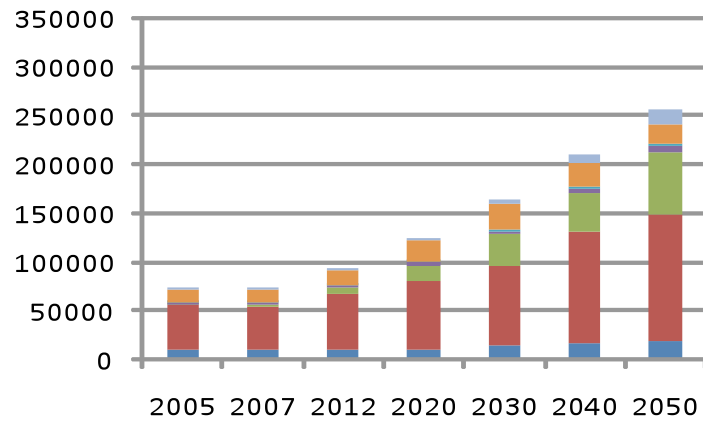
Primary energy by fuel in low baseline (PJ)



- Renewable except hydro and biomass
- Oil
- Nuclear
- Hydro
- Gas
- Coal
- Biomass

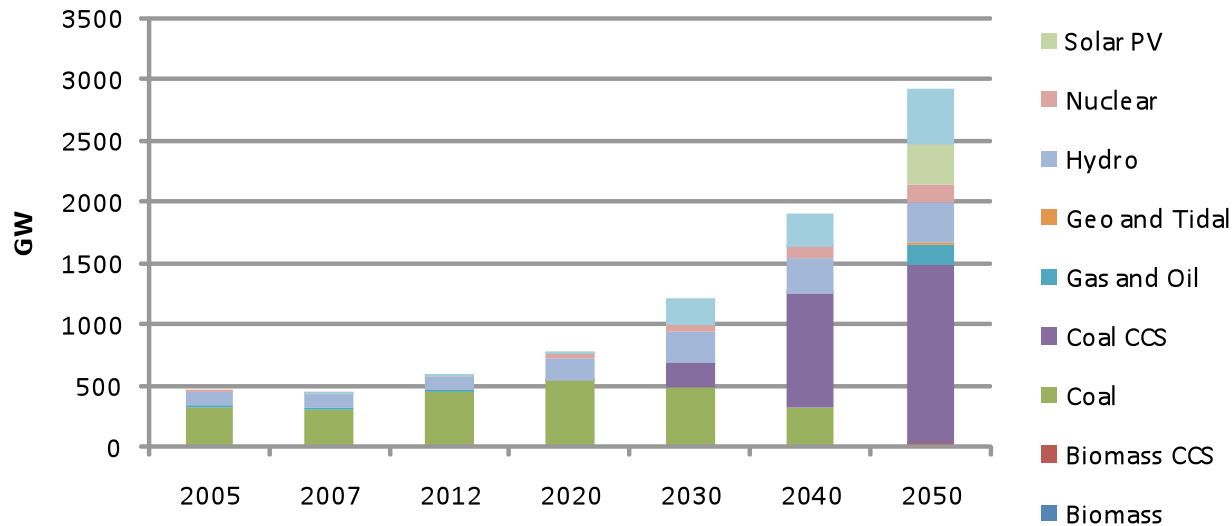
Primary energy by fuel in conventional policy scenario (PJ)

Primary energy by fuel in low policy scenario (PJ)



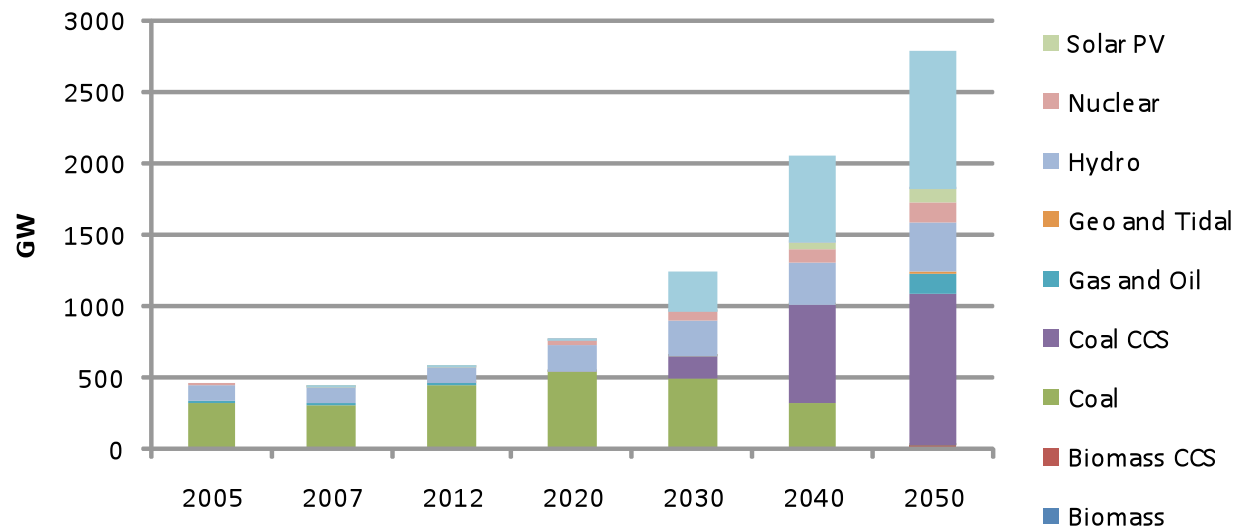
- Renewable except hydro and biomass
- Oil
- Nuclear
- Hydro
- Gas
- Coal
- Biomass

Power Plants Capacity - Total



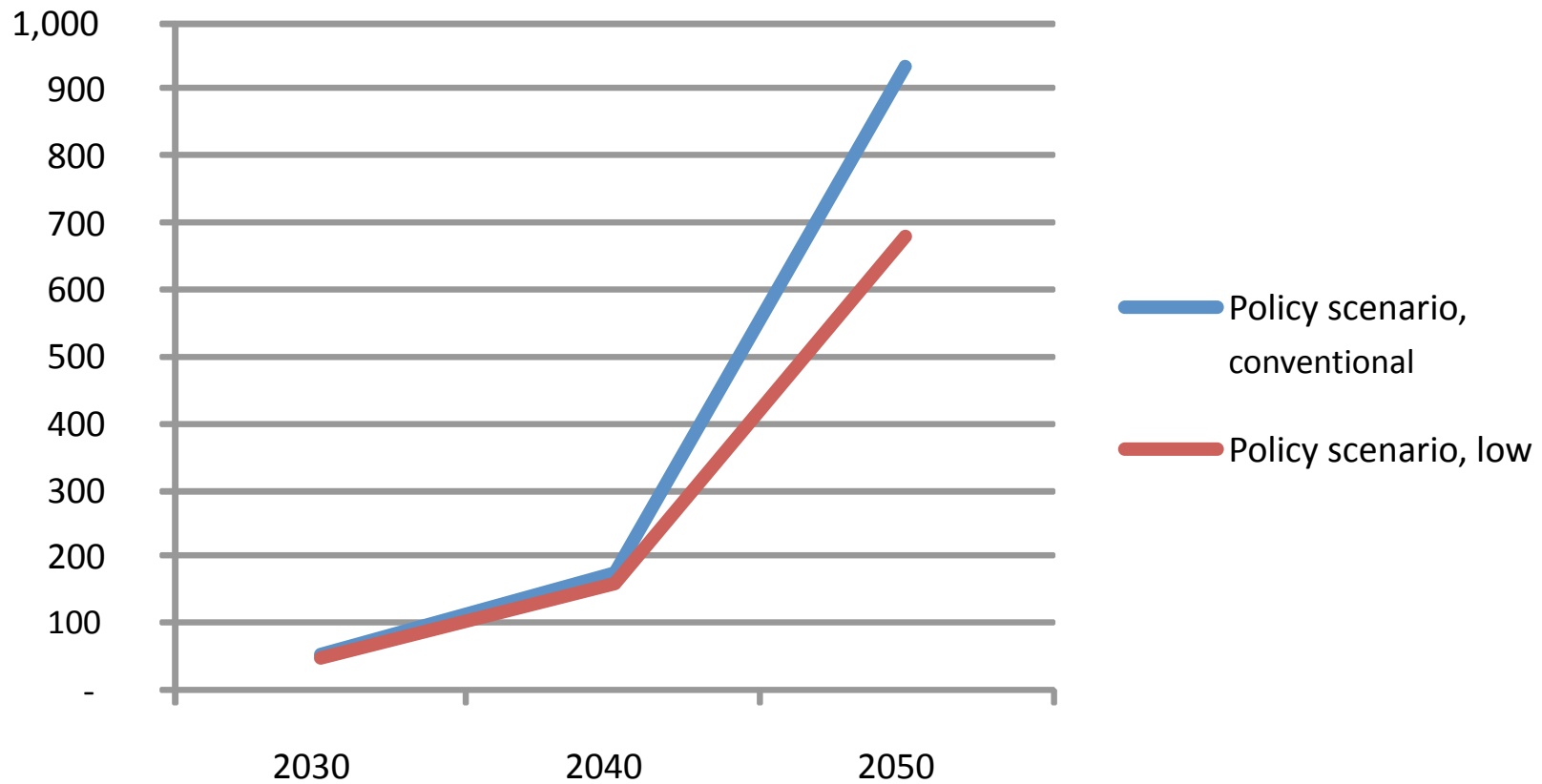
Conventional PS

Power Plants Capacity - Total



Low PS

CO2 price TIAM



Indian SD Scenario

- **Focus on:**
 - Mainstreaming climate actions in development plans/policies/processes
 - Lower energy and carbon intensity of development
 - Up-front decisions to avoid long-term lock-ins
- **Elements:**
 - Behavioral, technological, and institutional change which promote resource conservation
 - Dematerialization
 - Demand substitution (e.g. information for transport)
 - Urban planning and sustainable transportation
 - Sustainable land use
 - Regional collaboration about energy, water, and forest resources

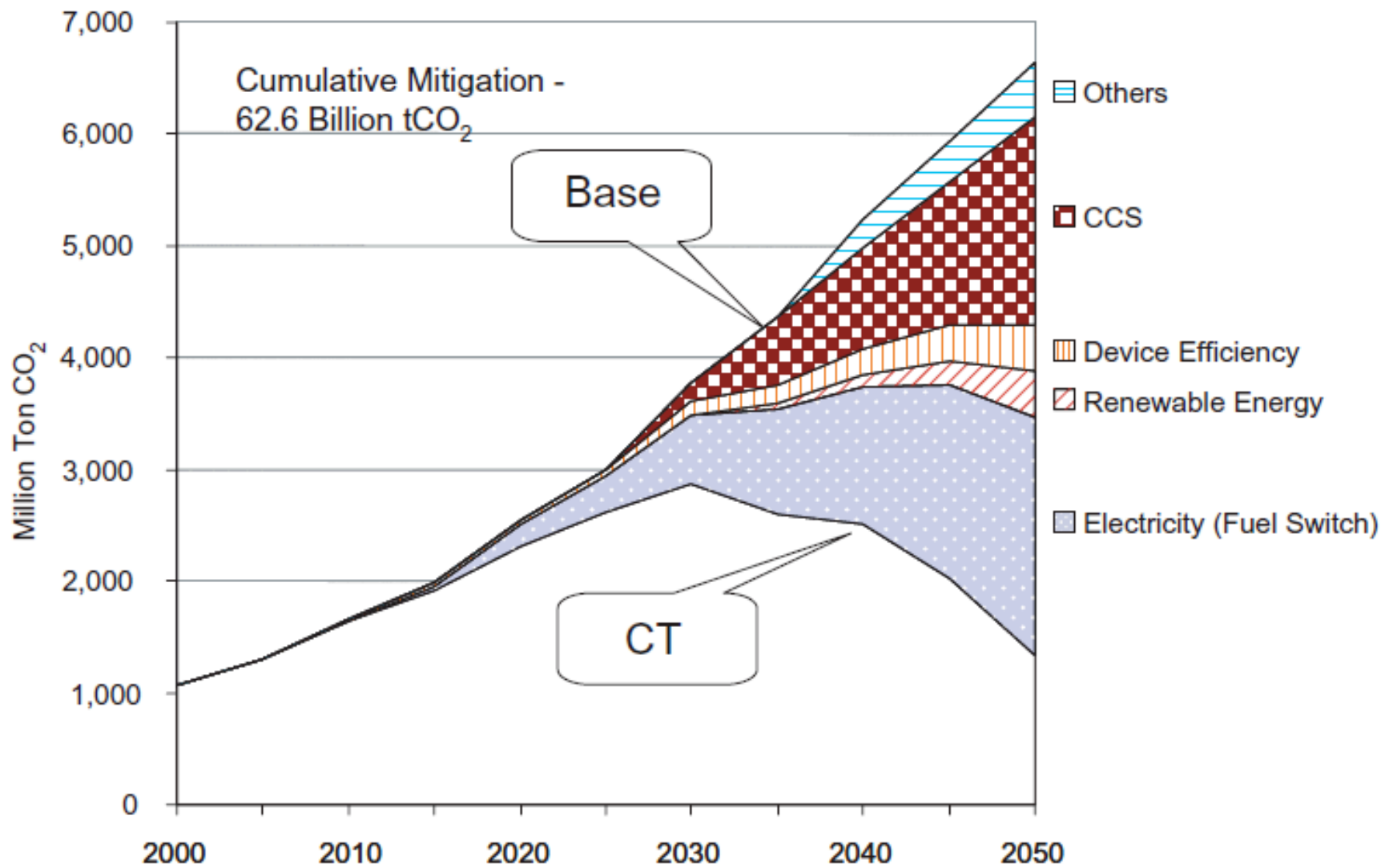


FIGURE 5 Mitigation options in the Carbon tax scenario.

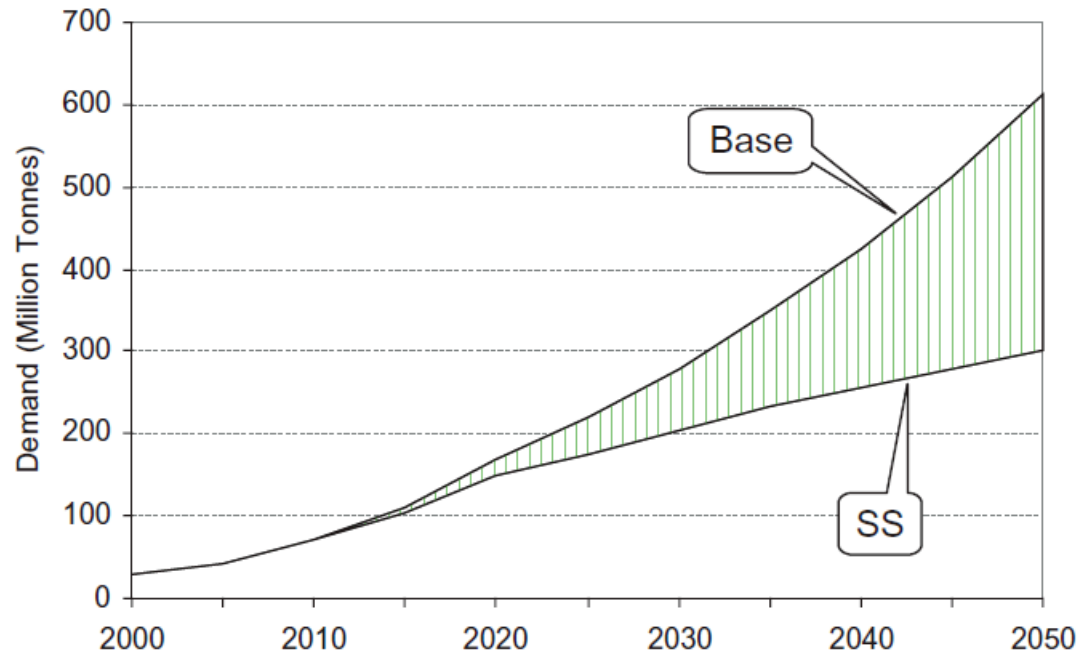


FIGURE 7 Carbon demand of steel industry 2000–2050 under the Base case and Sustainable society scenarios.

TABLE 3 Impact of sustainable drivers on steel demand

| Sector | Driver | Impact on steel demand |
|-----------|-----------------------|---|
| Transport | Urban planning | Fewer automobiles, Less road transport infrastructure |
| | Modal shift | |
| | Substitution | |
| Building | Building design | More local materials, Low-rise buildings |
| | Material substitution | |

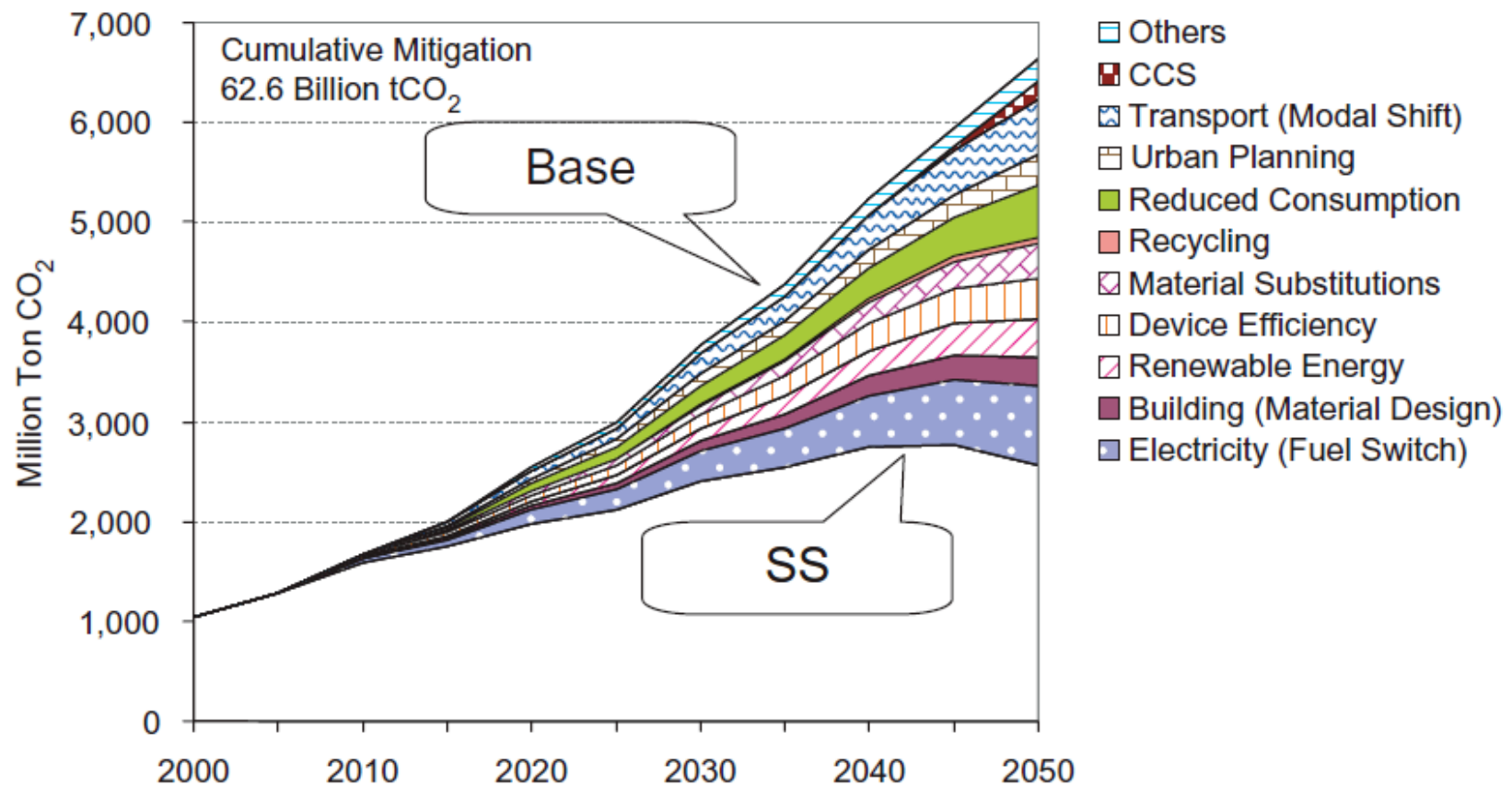


FIGURE 8 Mitigation options in the Sustainable society (SS) scenario.

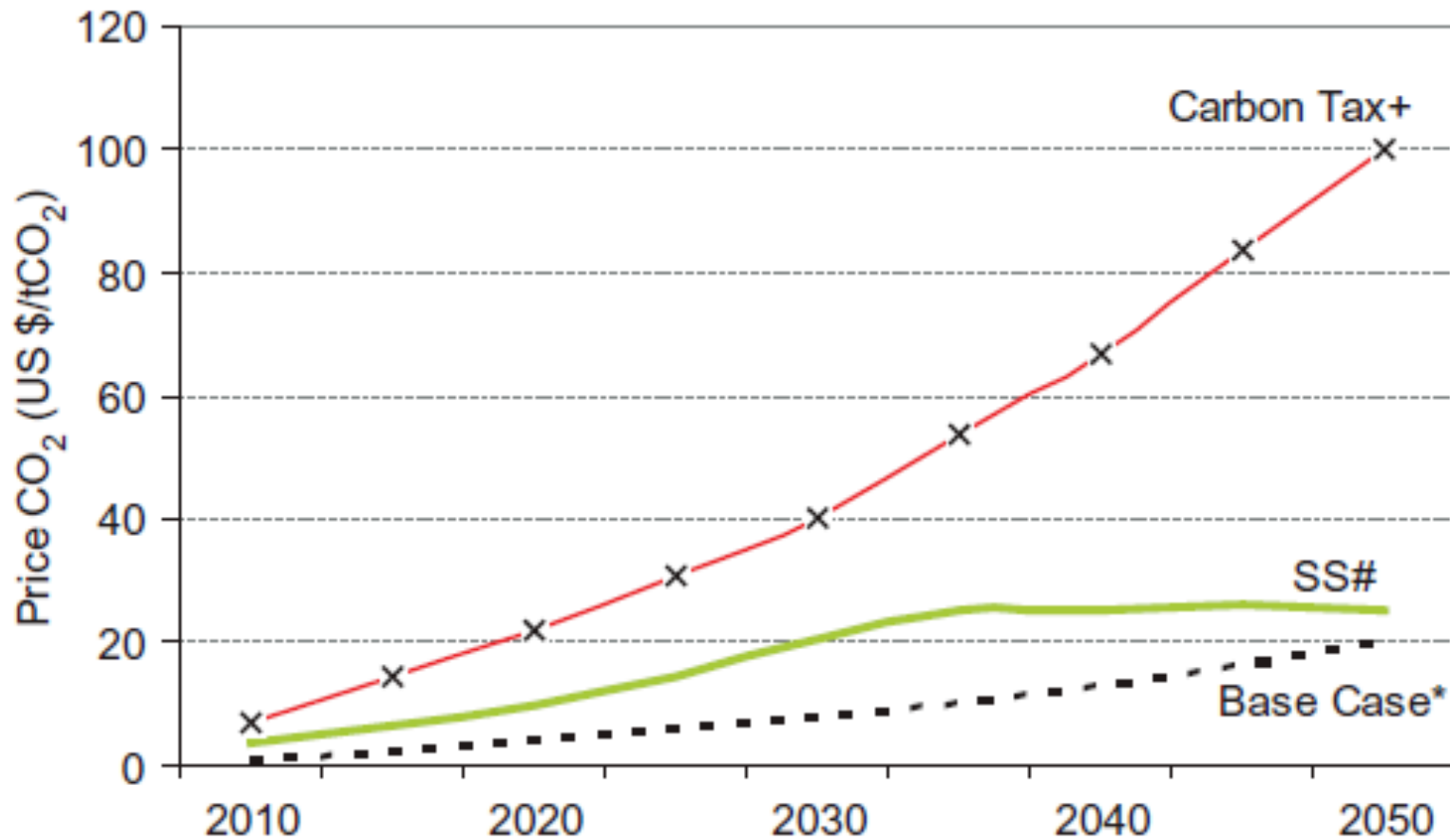


FIGURE 12 Carbon price in the LCS and Base case scenarios.

(*) Carbon price conforms to the global tax trajectory for 650 ppmv stabilization of CO₂e.

(#) Carbon price is the shadow price when for mitigation equivalent to CT scenario in the SS scenario.

(+) Carbon price conforms to the global tax trajectory for 550 ppmv stabilization of CO₂e.

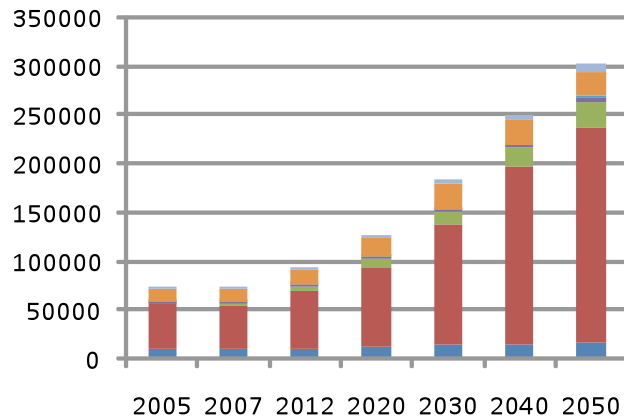
Conclusions

- Studies with TIAM, IPAC China, and Answer MARKAL India show very large differences between mitigation policies assessed in relation to a conventional baseline and in relation to a SD baseline
- Portfolio of mitigation options change with baseline
- Marginal cc mitigation costs change with baseline, but these costs become less important in relation to policy making. Baseline SD policy costs become relevant
- Models are not well developed in order to reflect SD policies in terms of alternative economic growth patterns, energy intensity, and efficiency improvements on a global and regional scale
- Potentials for renewable energy have a large impacts on the results e.g. wind in China

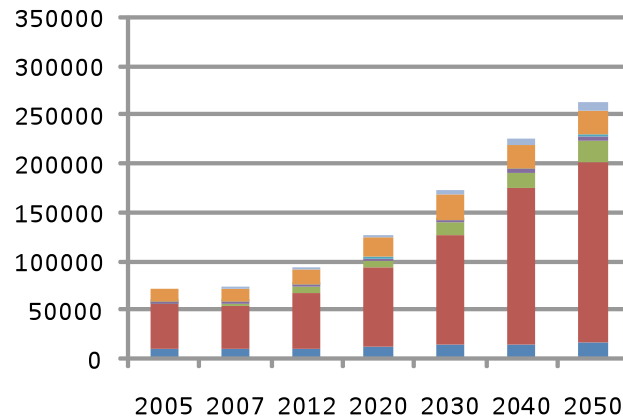


Primary energy, CHI, baseline

Primary energy by fuel in conventional baseline (PJ)

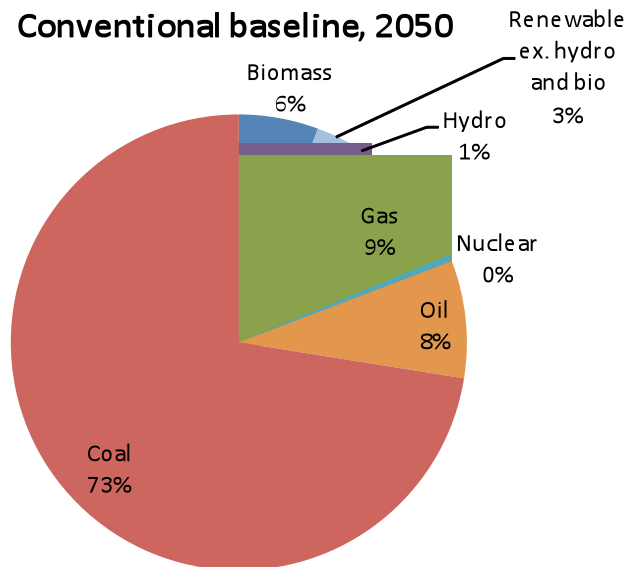


Primary energy by fuel in low baseline (PJ)



- Renewable except hydro and biomass
- Oil
- Nuclear
- Hydro
- Gas
- Coal
- Biomass

Conventional baseline, 2050



Low baseline, 2050

