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

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

DTU Technical University of Denmark

DTU Climate Centre

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 improvments, 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

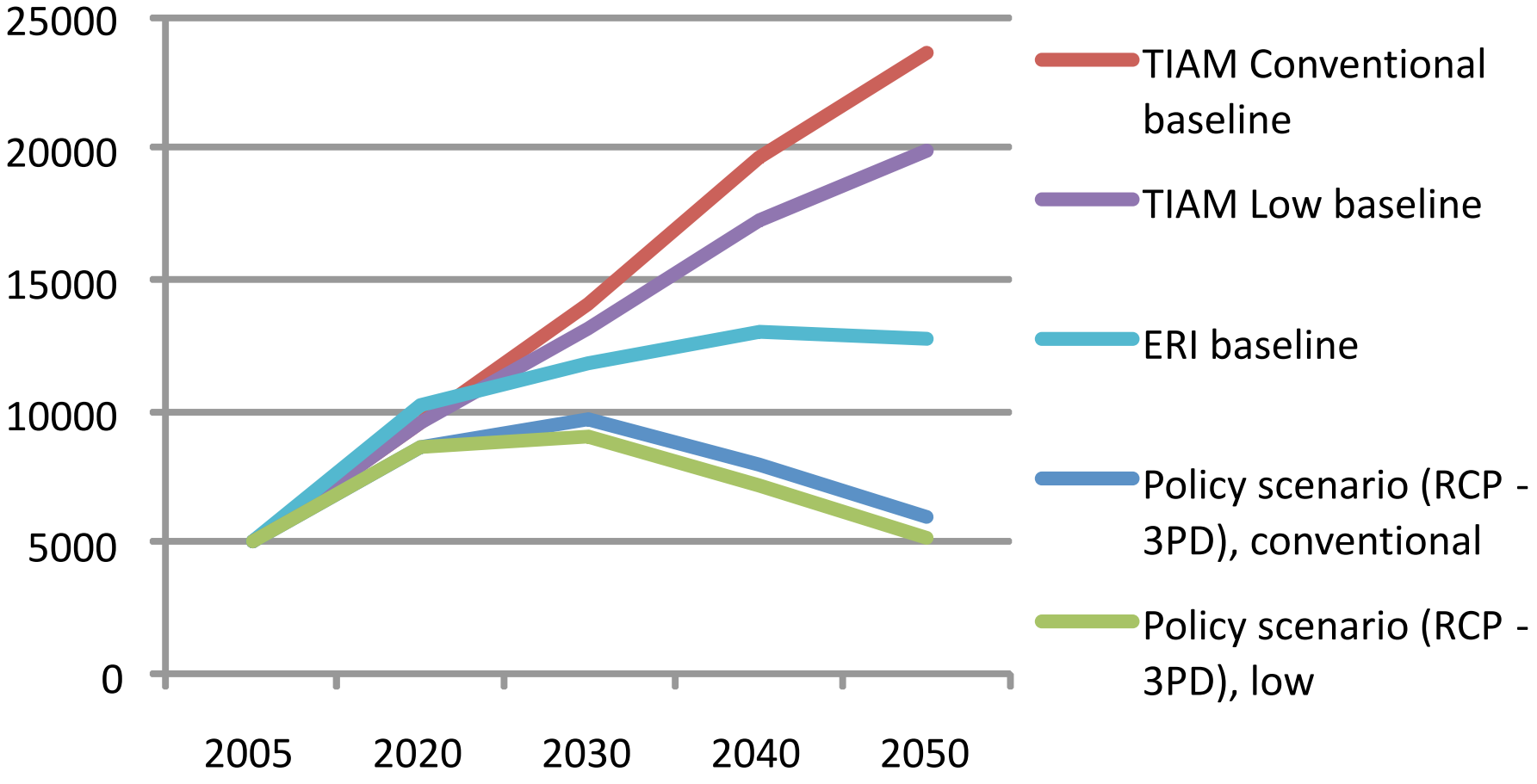
Baseline Policy Categories

- 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

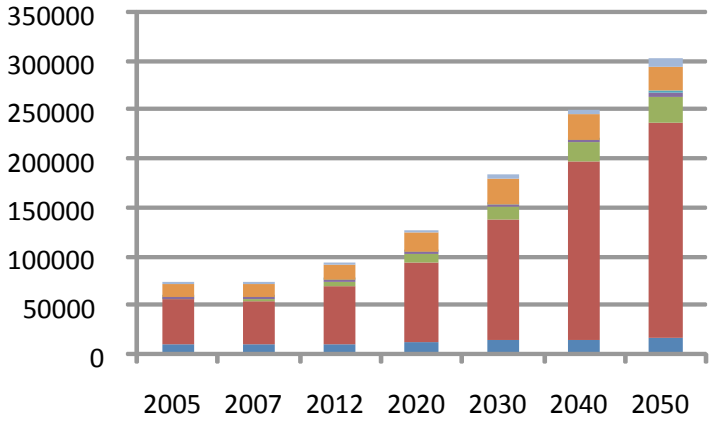
Study coverage

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

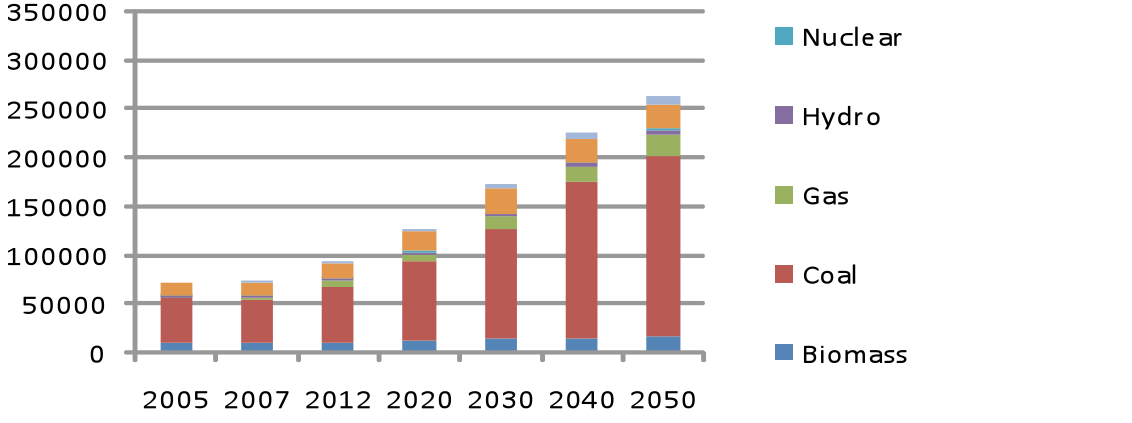
Chinese CO_2 emissions (Mt)

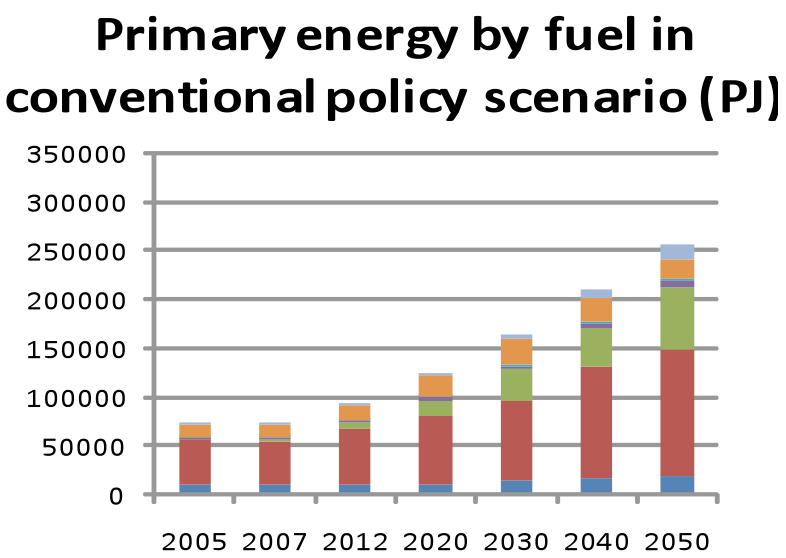


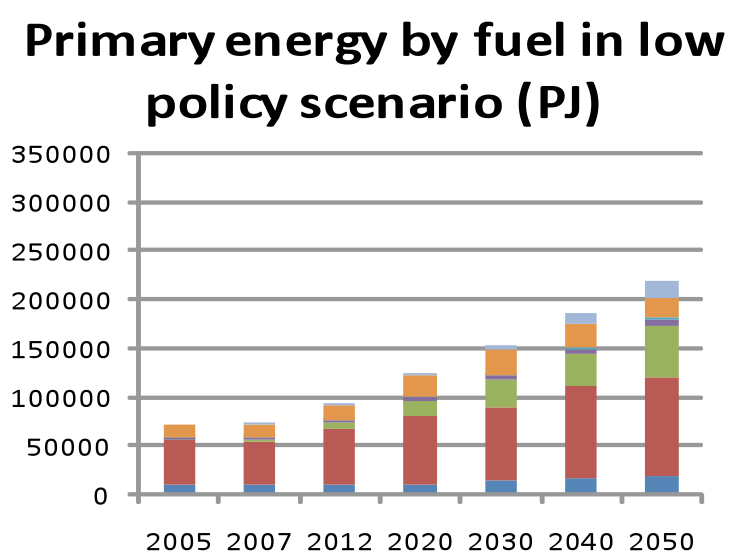
Primary energy by fuel in conventional baseline (PJ)

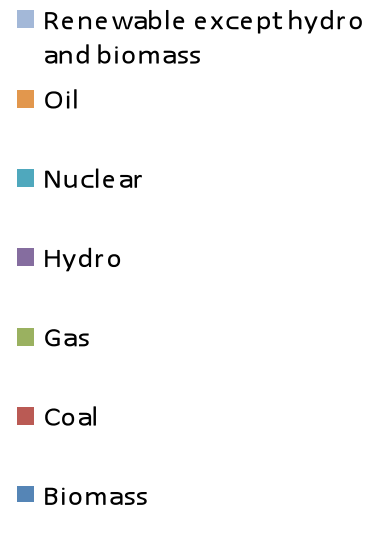


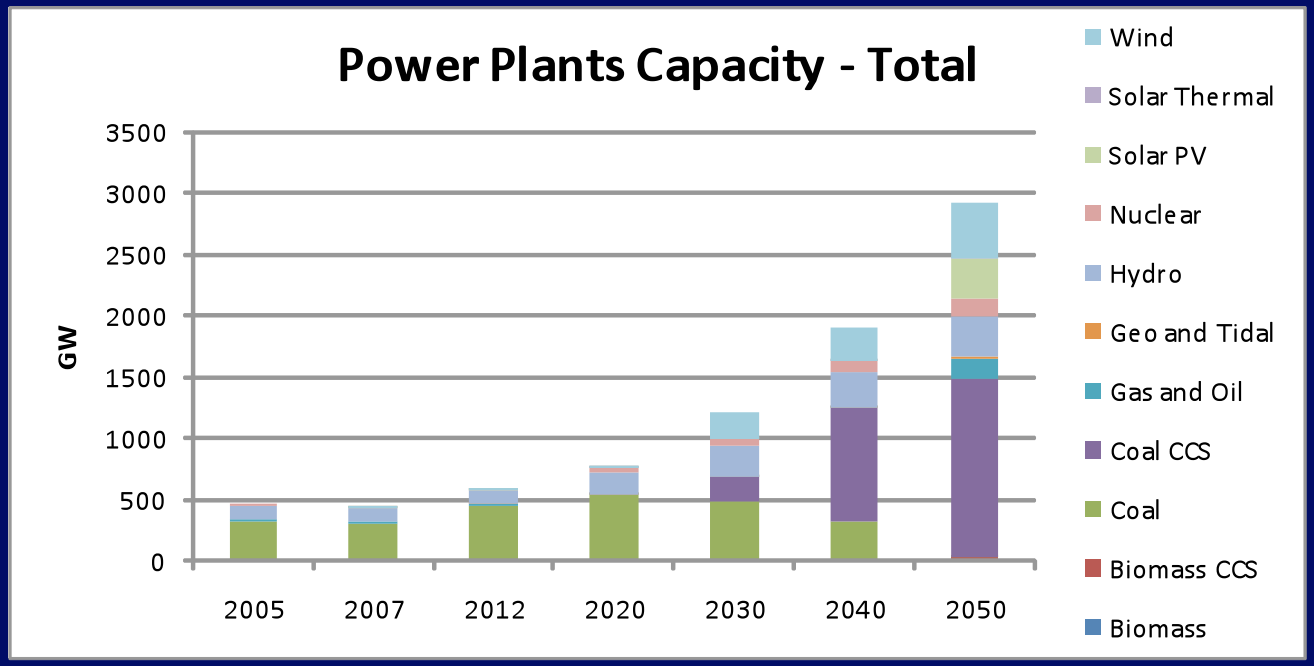
Primary energy by fuel in low baseline (PJ)




Primary energy by fuel in conventional policy scenario (PJ)
350000
300000
250000
200000
150000
100000
50000
0
2005 2007 2012 2020 2030 2040 2050

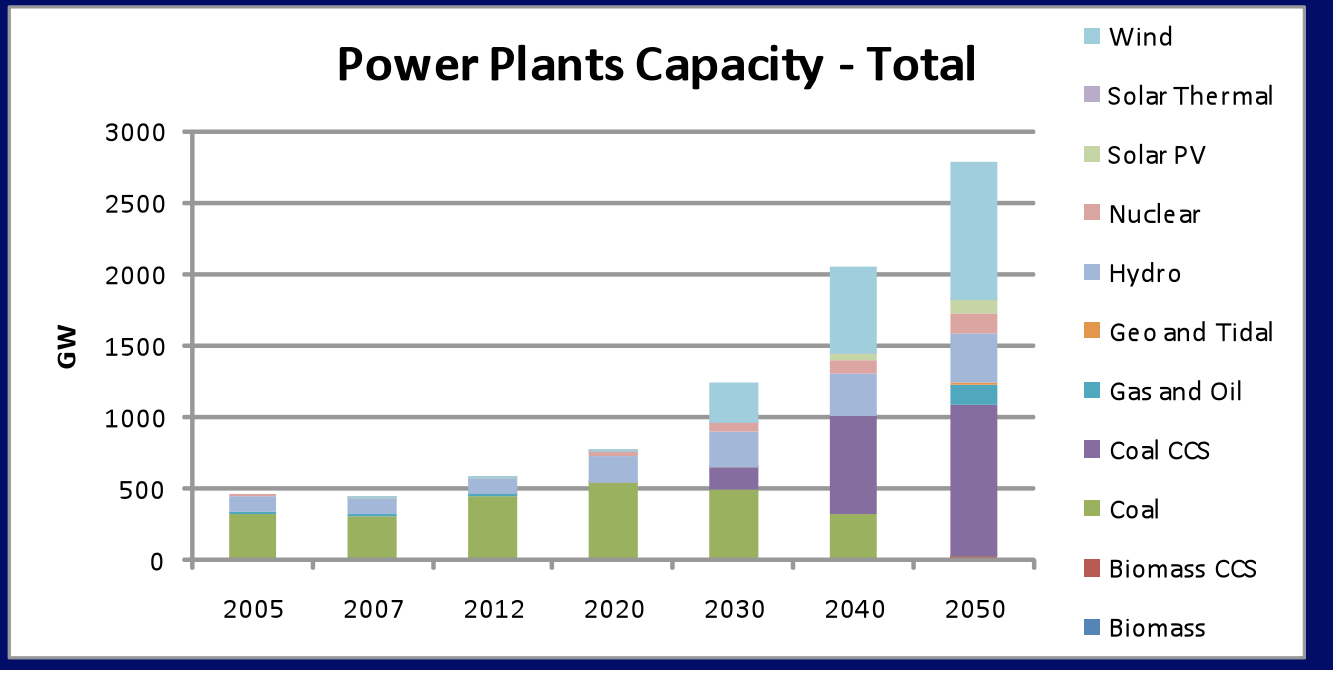

Primary energy by fuel in low policy scenario (PJ)
350000
300000
250000
200000
150000
100000
50000
0
2005 2007 2012 2020 2030 2040 2050

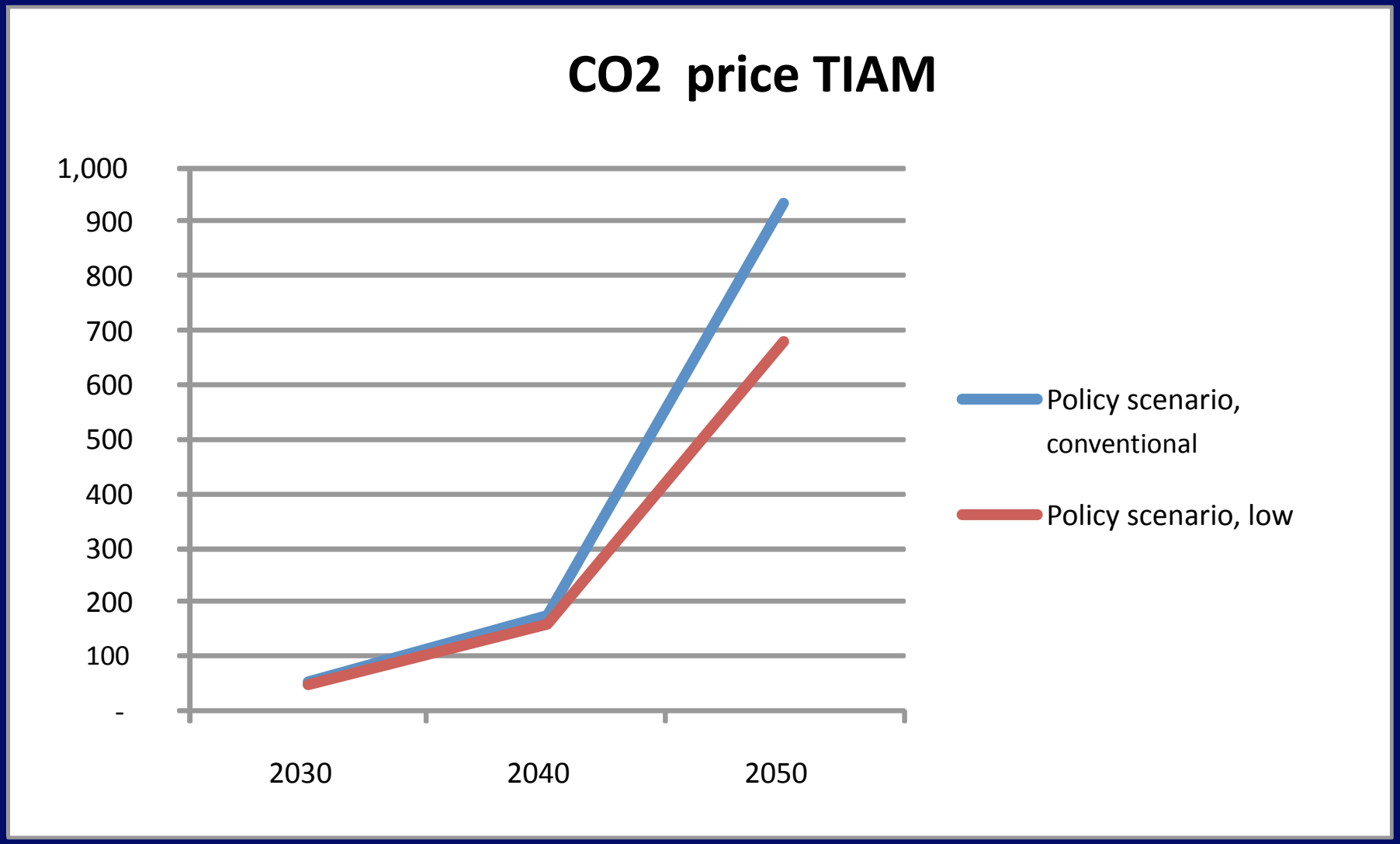

Renewable except hydro and biomass
Oil
Nuclear
Hydro
Gas
Coal
Biomass



Conventional PS

Low PS




CO2 price TIAM
1,000
900
800
700
600
500
400
300
200
100
-
2030
2040
2050
Policy scenario, conventional
Policy scenario, low

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

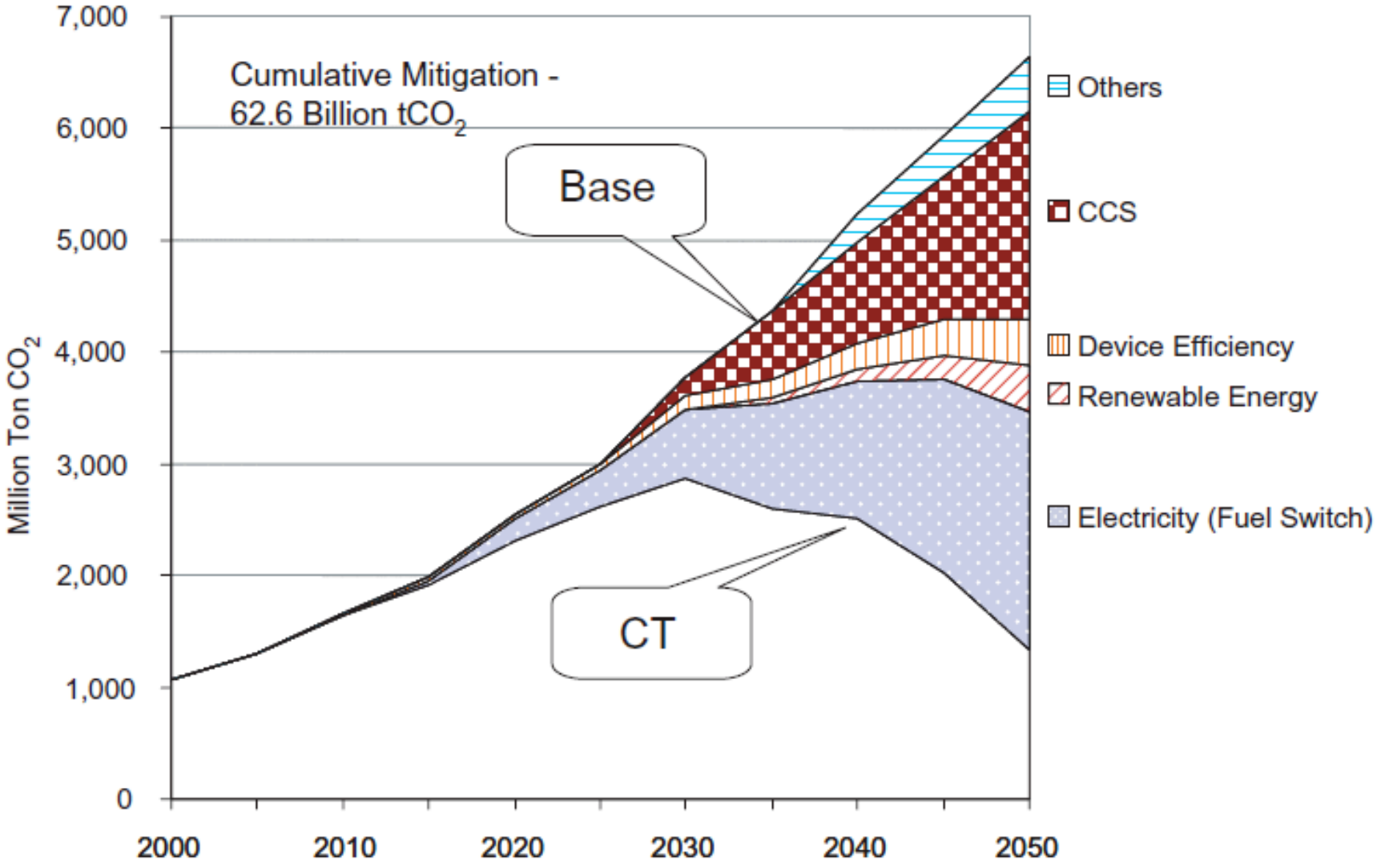


FIGURE 5 Mitigation options in the Carbon tax scenario.

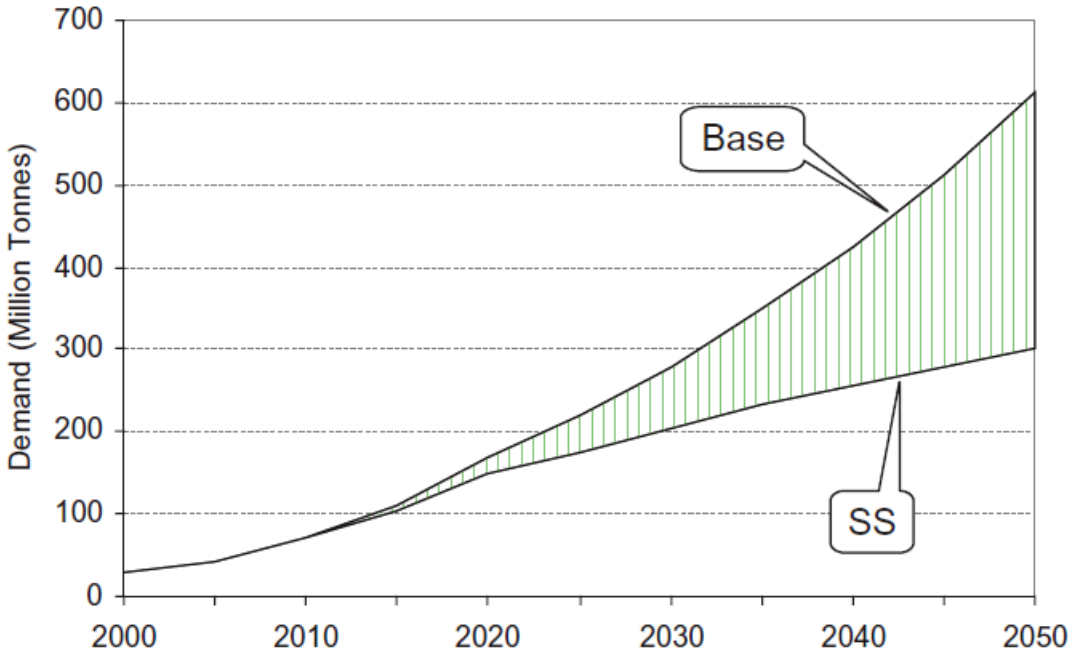


FIGURE 7 Carbon demand of steel industry 2000–2050 under the Base case and Sustainable society scenarios.

TABLE 3 Impact of sustainable drivers on steel demand

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

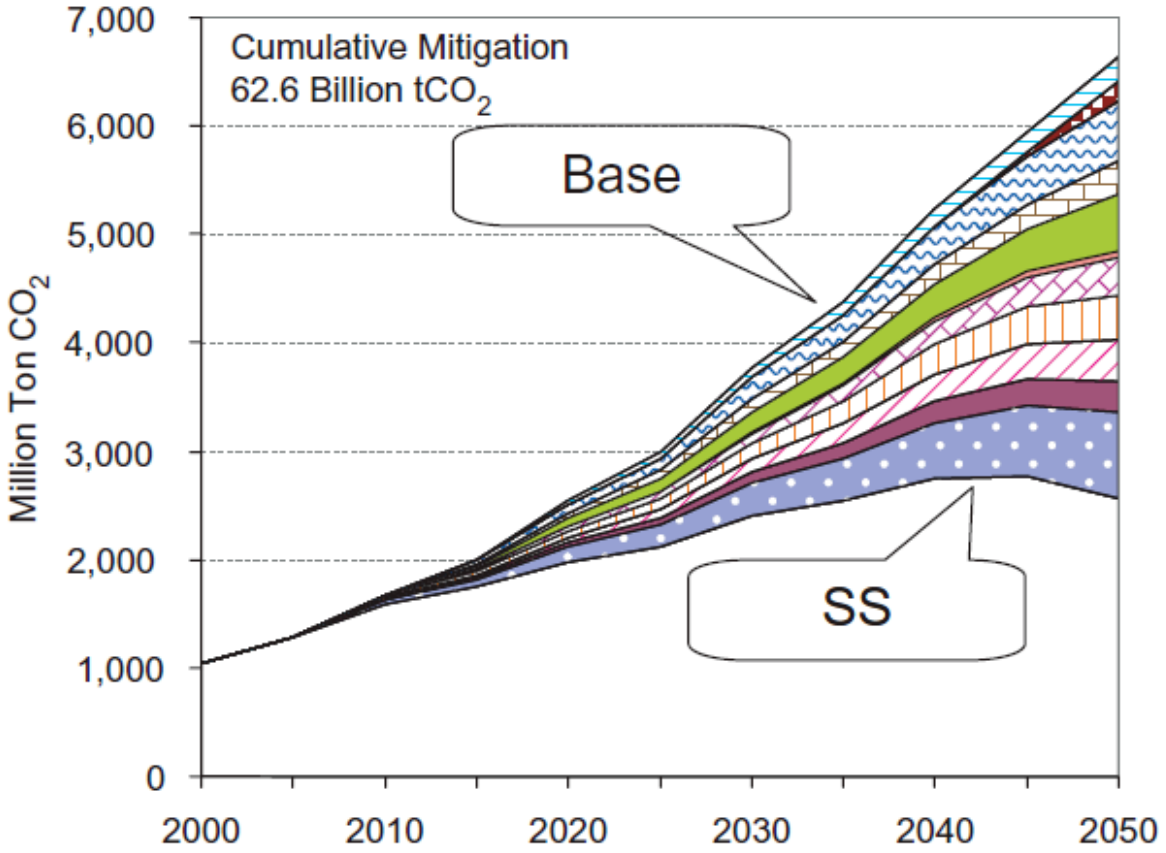


FIGURE 8 Mitigation options in the Sustainable society (SS) scenario.

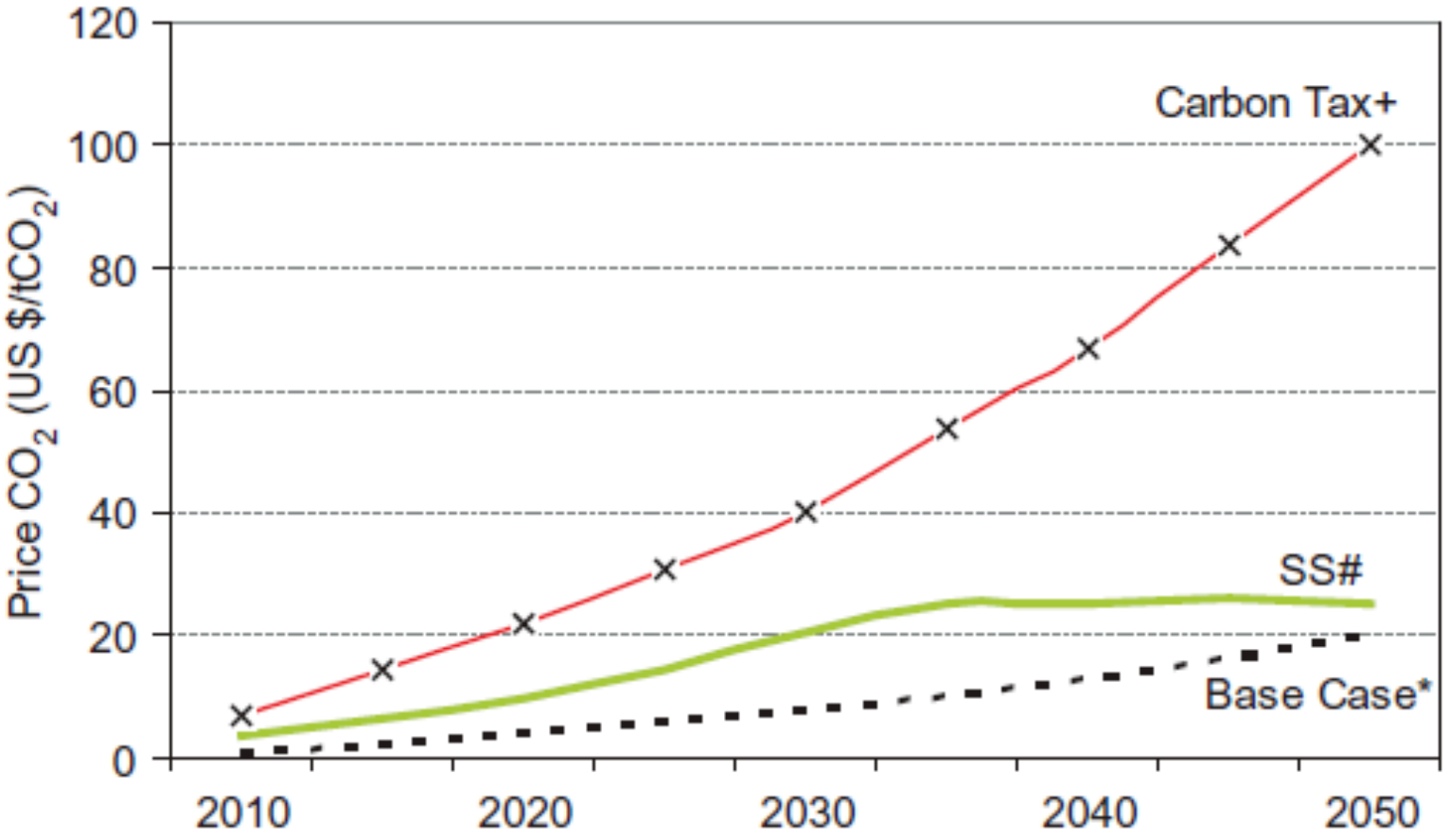


FIGURE 12 Carbon price in the LCS and Base case scenarios.

(*) Carbon price conforms to the global tax trajectory for 650 ppmv stabilization of CO_2e.
(#) 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 CO_2e.

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