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Low-carbon energy transitions in the Chinese power sector



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dependency on fossil fuels, climate change implications
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1.1 Problem definition: China's dependency on fossil fuels

- Population: 1.3 billion
- GDP growth: 12% in 2007

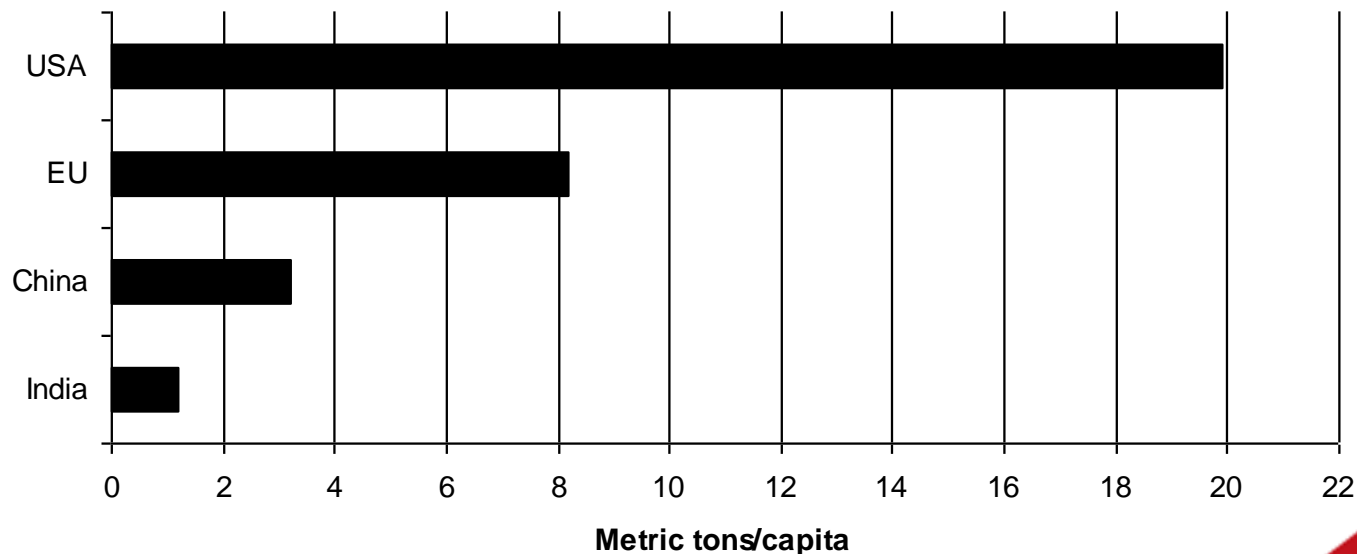
- High reliance on fossil fuels, mainly coal:
- Fossil fuels: 85% of primary energy supply in 2005
- Power sector accounts for 50% of China's emissions

- Consequences:
- High greenhouse gas emissions → climate change
- Struggles for energy security
- Resource depletion
- Air pollution

1.1 Problem definition: Climate change implications

- China is one of the world's top energy consumers / greenhouse gas emitters in absolute terms
- Low per capita energy use / greenhouse gas emissions compared to OECD countries → right to growth → sustainable growth?

CO2 emissions/capita



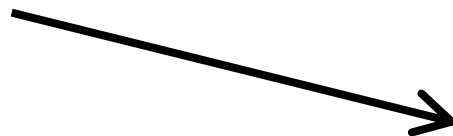
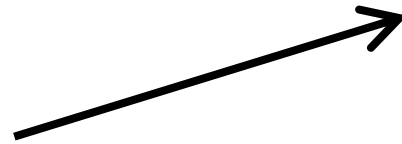
Source: World Bank, 2008.

1.2 Research description

- Sustainable growth in the power sector: low-carbon energy transitions sustaining economic growth
- Research question: Could low-carbon energy transitions partially replace fossil fuels in the Chinese power sector? Effects? Implications?
- Definition low-carbon energy transitions: shifts from a country's economic activities based on fossil fuels to an economy based on low-carbon energy
- Low-carbon energy: renewable energy (wind, solar, hydro, biofuels) & cleaner energy (nuclear, carbon capture and storage)

2. Methods

- Energy modelling: Computer-based simulation model PowerPlan simulates a countries' power sector and its emissions
- Scenario-making: can answer 'what if' questions
- Time frame: 2005-2030

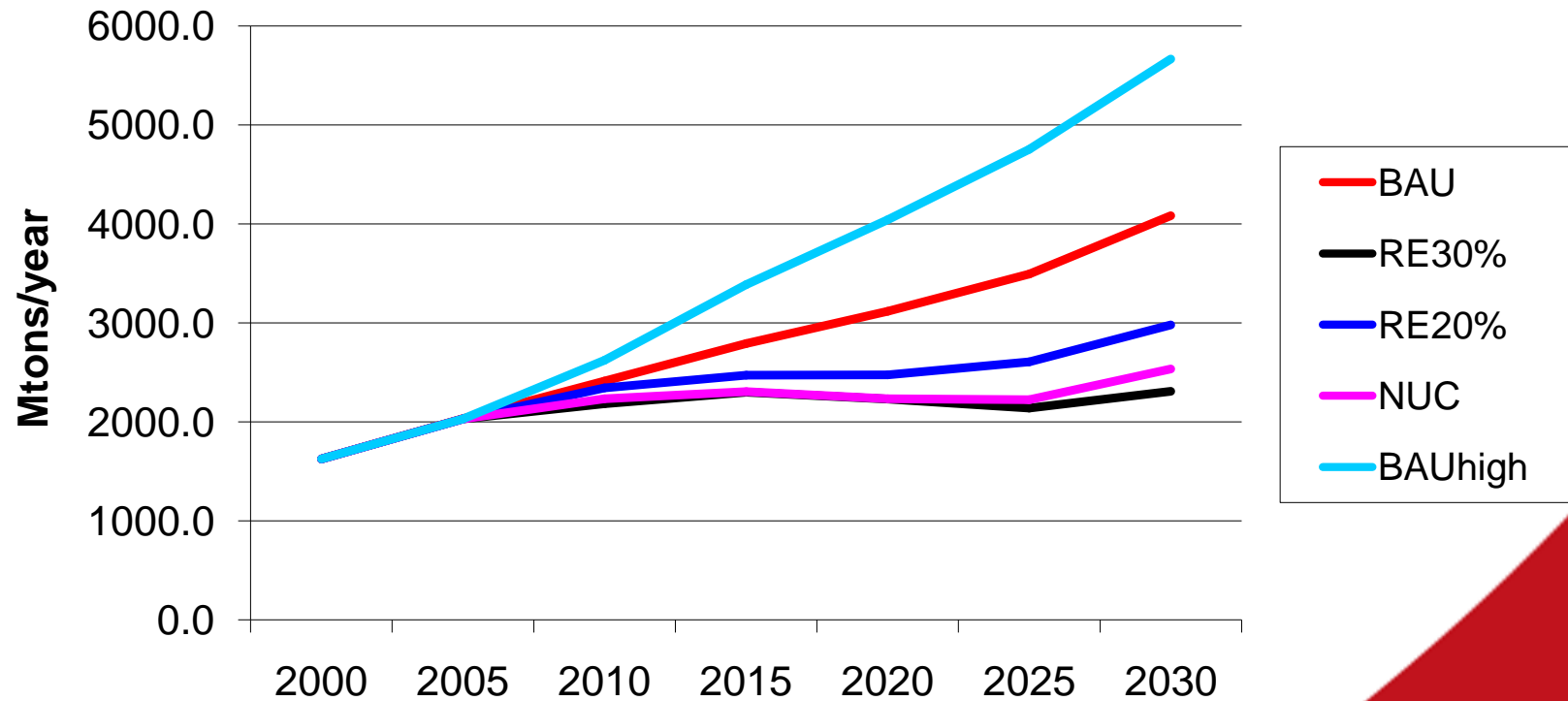


3. Results for the Chinese power sector: Scenarios

- Business-as-usual scenarios (BAU): only slight changes in policy and technology
- Renewable energy scenarios (RE): major changes in policy and technology: 20% and 30% share of renewable energy among total installed capacity in 2030
- Nuclear scenario (NUC): major changes in policy and technology: 20% share of nuclear energy among total installed capacity in 2030
- RE scenarios based on Chinese policy goals: Five-Year Plans, Renewable Energy Law, NDRC's Medium and Long-Term Development Plan for Renewable Energy → renewable energy targets

3. Results for the Chinese power sector

CO2 emissions for China's power sector



3. Results for the Chinese power sector: CO₂ mitigation potential

- If no action is taken: doubling /tripling of CO₂ emissions until 2030
- If low-carbon energy transitions are implemented:
 - When fossil fuels are replaced by 30% renewable energy among the installed capacity, this could mitigate CO₂ emissions by up to 60% in 2030 compared to business-as-usual
 - When fossil fuels are replaced by 20% renewable energy, this could mitigate CO₂ emissions by up to 30%
 - When fossil fuels are replaced by 20% nuclear energy, this could mitigate CO₂ emissions by up to 40%
- CO₂ saving of about 1,100 - 2,300 mio t
- Problem with nuclear waste in the nuclear scenario
- High cost increases in the low-carbon scenarios
- The electricity systems stays stable in all scenarios

4. Implications

- High potential for climate change mitigation by low-carbon energy transitions in the Chinese power sector
- Implementation now to avoid carbon-lock in and dangerous climate change
- Low-carbon energy also reduces air pollution, reduces fossil resource depletion and increases energy security
- Policies with measurable results needed to support low-carbon energy transitions → strict implementation

4. Conclusions

- Doubling / tripling of CO₂ emissions until 2030 if no action is taken
- Transitions to low-carbon energy are possible in the Chinese power sector
- Climate change mitigation potential is high (up to 60% CO₂ mitigation possible) → sectoral agreement for power sector
- Costs: higher mitigation is more expensive than moderate mitigation → how sustainable can China be?
- Financial assistance needed → responsibility of Annex I countries
- Technology transfer needed → strengthen CDM
- Acting now → national energy planning, committing to international agreements

Thank you for your attention

