Energy Technology Perspectives

Transition for Industry

Nathalie Trudeau and Cecilia Tam

Energy Technology Transition for Industry

- **Industry is a key actor in the fight against climate change**
- **Some progress to date, but more is needed**
- **Technology can help bring about a low-carbon industrial revolution**
- **Global action is needed**

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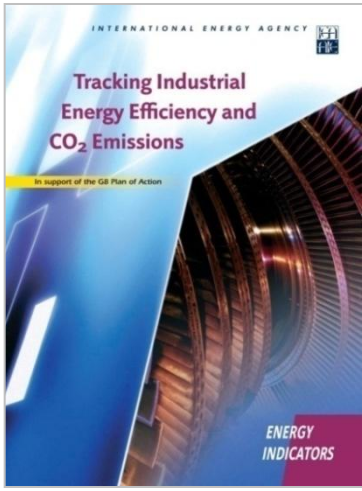
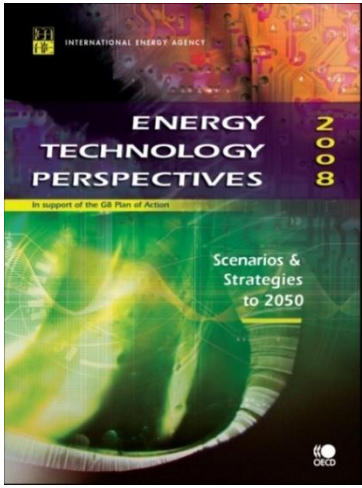
Energy Technology Transitions for Industry

- "ETP for Industry"
- Request by countries to expand on ETP 2008 results for industry
- Indicators and scenarios by sector, greater regional detail
- Potentials for energy and CO_2 reductions
- Input to ETP 2010 (to be released July 2010)
- Publication released September 2009





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Modelling Framework

- Spreadsheet-based sector models
- Time horizon: 2007-2050, time steps: 2007, 2015, 2030, 2050
- 23 world regions/countries in model
- 5 industry sectors modeled in detail: iron and steel, cement, chemicals and petrochemicals, pulp and paper and aluminum
- Low and high demand variants for materials production

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Industry Scenarios

- **Baseline scenario:**
  - **Following the WEO 2009 Reference Scenario**
  - **World GDP grows 3.1% per year between 2007 and 2050, Europe's GDP rises 1.1%**
  - **Slower rates of efficiency, new build based on mix of old and best available technology (BAT)**
- **BLUE scenario:**
  - **Direct energy and process emissions decline 21% in industry to achieve a halving in global energy related CO_2 by 2050**
  - **Energy efficiency reaches BAT levels worldwide by 2030, new build is based on BAT**
  - **Biomass use rises three to four fold**
  - **Decarbonised power sector critical to eliminate indirect emissions**

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Key Findings

- **Global deployment of BAT could improve energy efficiency by 20 to 30%**
- **… but this is not enough – energy demand will double or triple by 2050**
- **New technologies are needed for deep CO_2 reductions**
  - **CCS is a key option of the sector**
  - **Biomass will play an important role**
- **De-carbonised power sector is critical**
- **Total additional investments needed for BLUE are estimated at USD 2.0 to 2.5 trillion**

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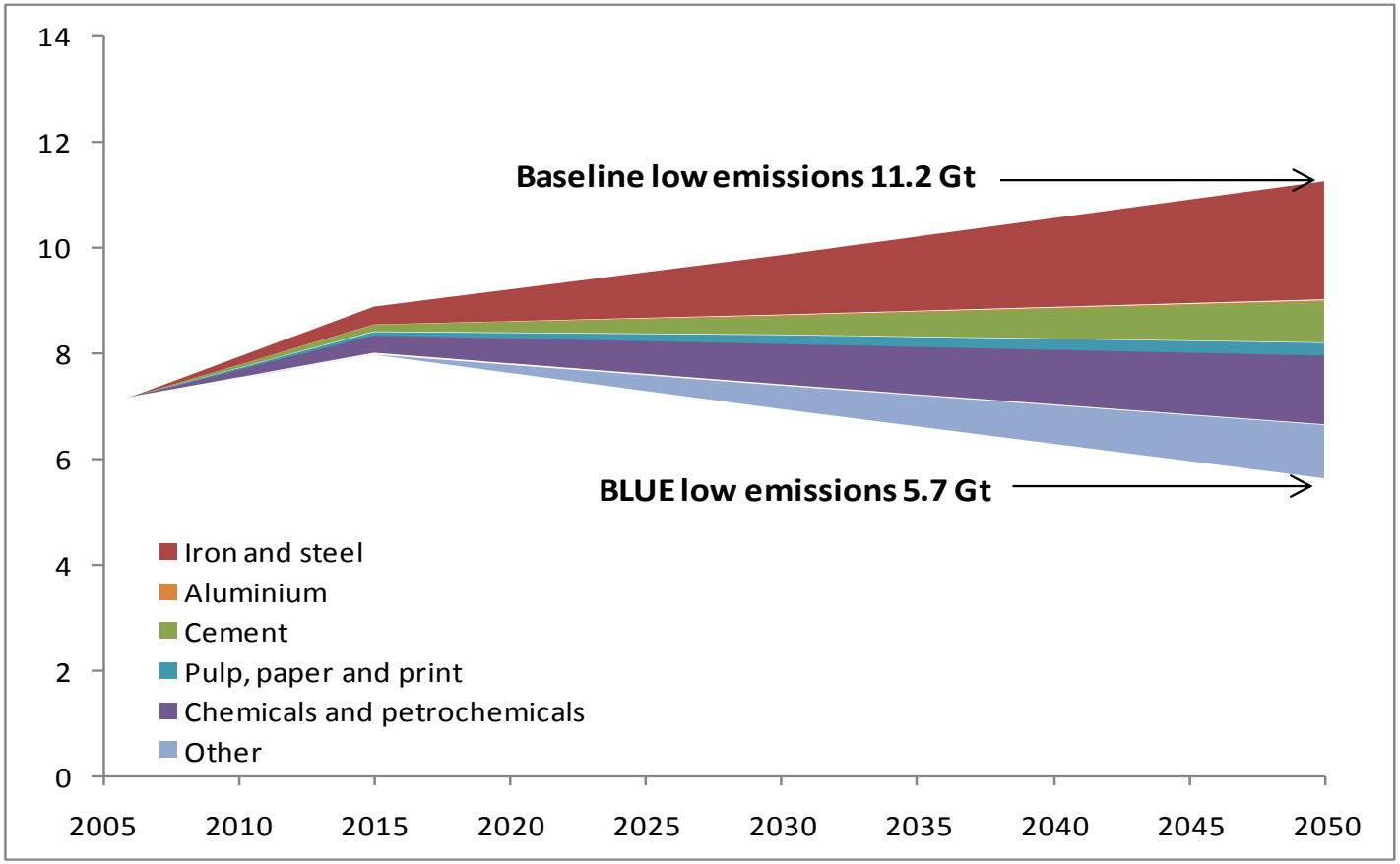
CO_2 Emissions in Industry



All sectors have the potential to significantly reduce emissions

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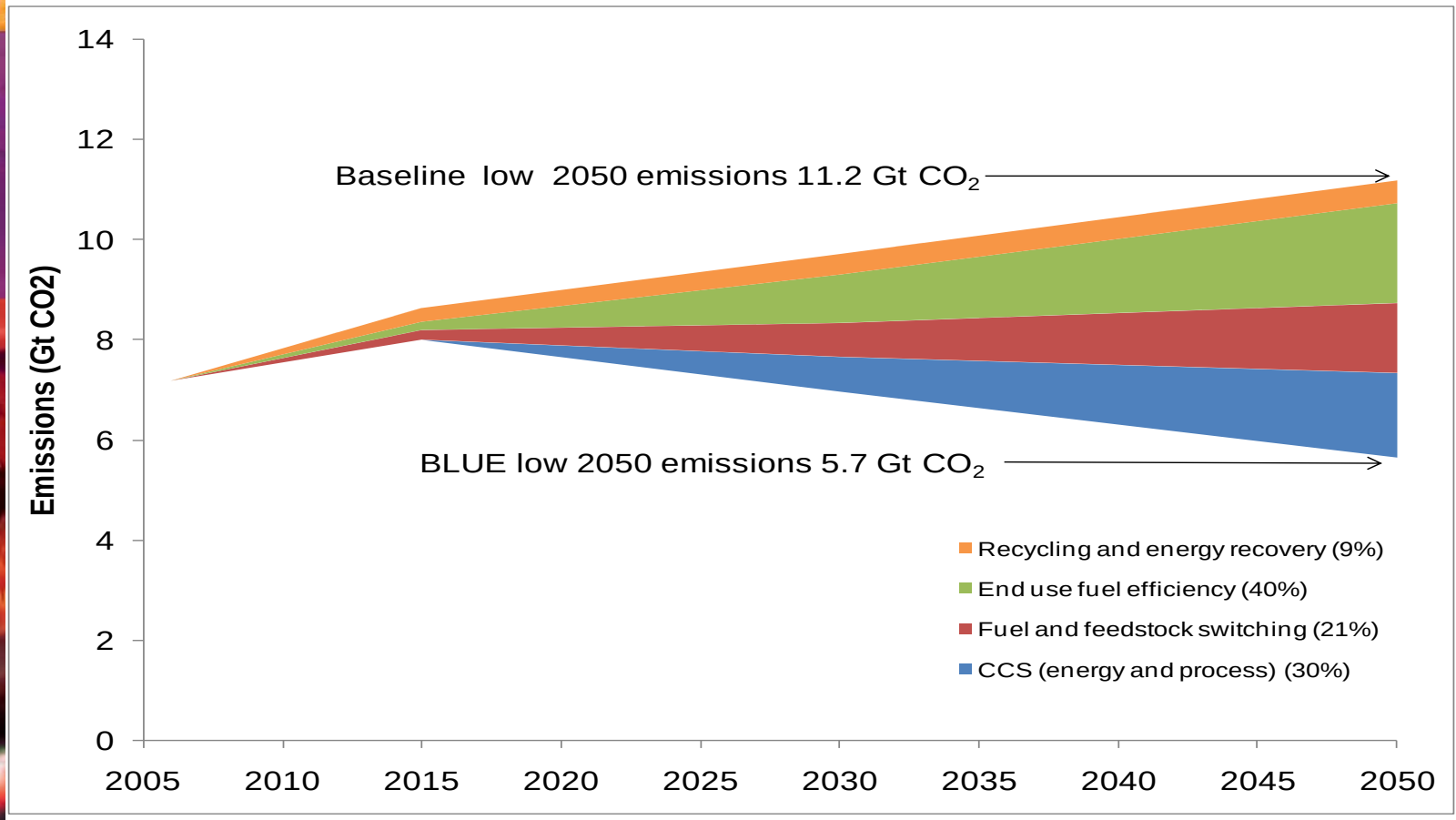
CO_2 Emissions in Industry



Direct emissions in industry can be significantly reduced through a combination of energy efficiency, fuel and feedstock switching, recycling and energy recovery, and CCS

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Chemicals and petrochemicals

- **Largest industrial energy user accounting for about 10% of total final energy demand**
- **For most chemicals, global production is expected to at least double from today to 2050**
- **The application of best practice technologies could save around 5.2 EJ/year;**
- **The application of CHP, recycling, energy recovery, process intensification and process integration could save another 5.0 EJ/year**

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Chemicals and petrochemicals

- **In order to achieve more substantial savings, a range of new technologies must be developed and applied**
- **CCS in ammonia, HVCs and large-scale CHP plants could save approximately 300 Mt CO_2 per year**
- **It is challenging for the chemical and petrochemical sector to reduce emissions due to a high share of feedstock energy**
- **In the BLUE scenario, direct emissions are 50% lower than in the Baseline scenario**
- **Total additional investments needed for BLUE are estimated at USD 0.4 to 0.5 trillion**

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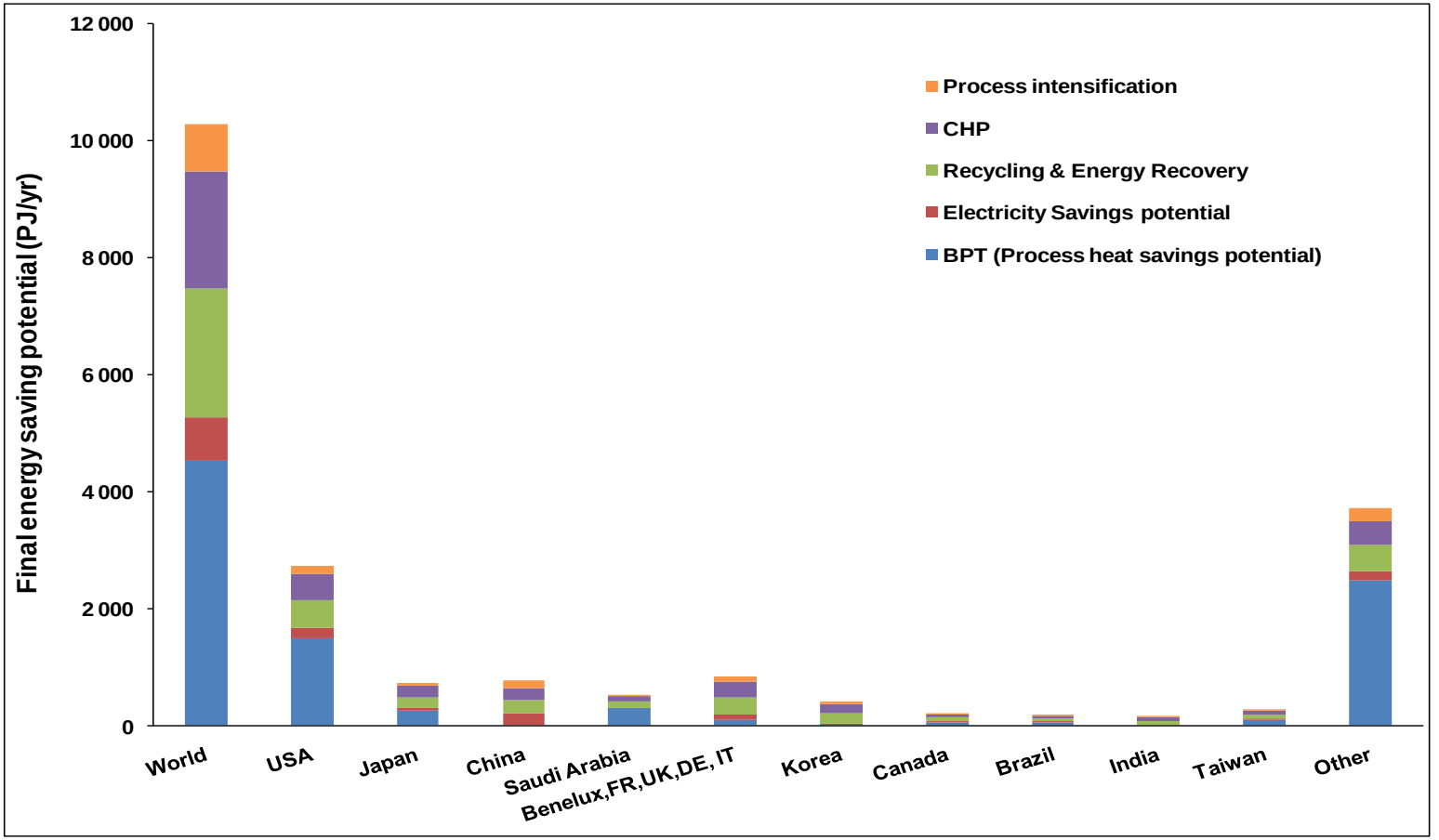
Regional breakdown of current final energy savings potential



The current technical potential for global energy savings in the chemical and petrochemical sector is estimated at 10 EJ

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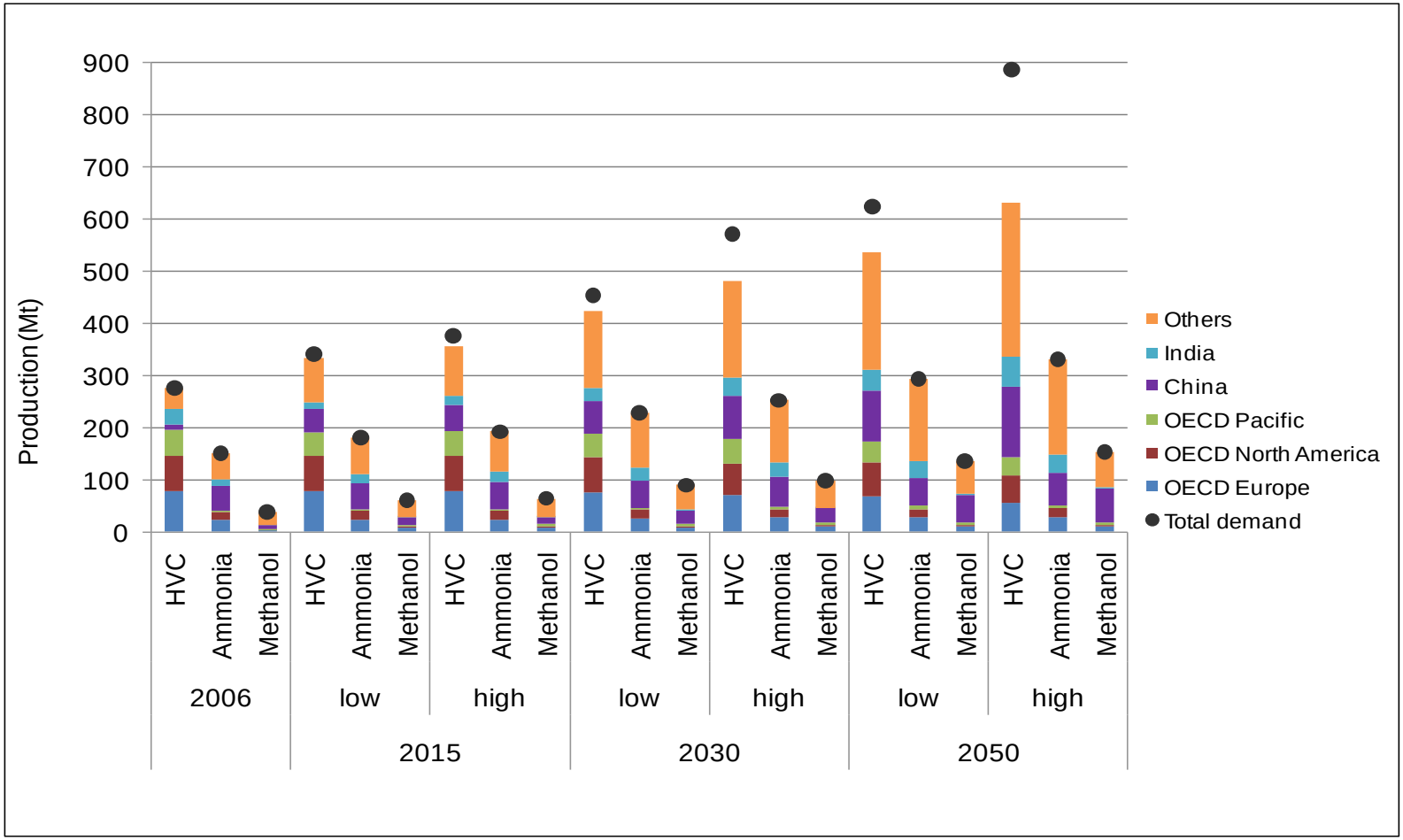
Regional production and total consumption in the BLUE scenario



Future production growth will be dominated by China, India and other non-OECD countries

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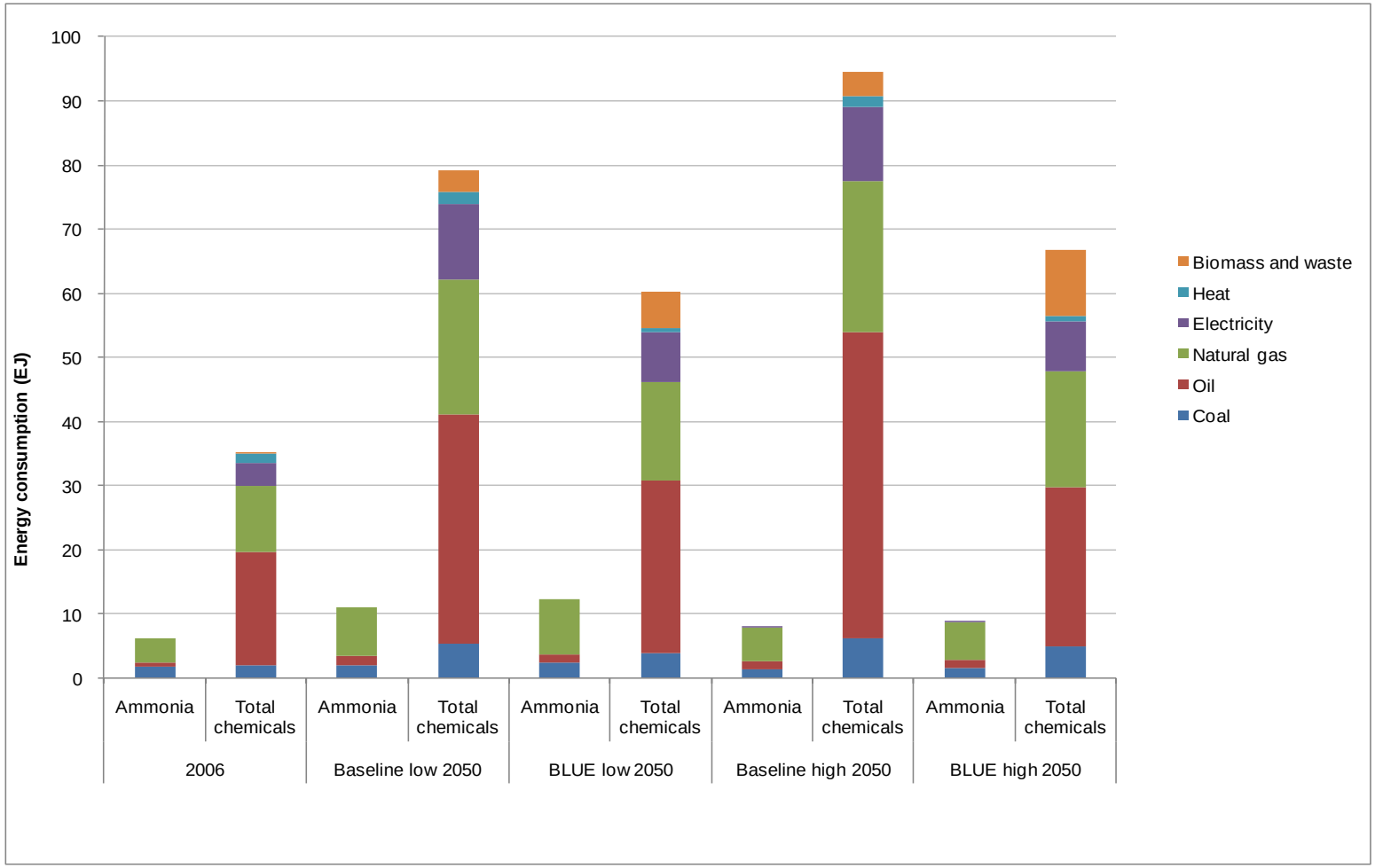
Final energy consumption by scenario



Energy consumption will rise sharply under the baseline 2050 and BLUE 2050 scenarios compared to 2006 energy use

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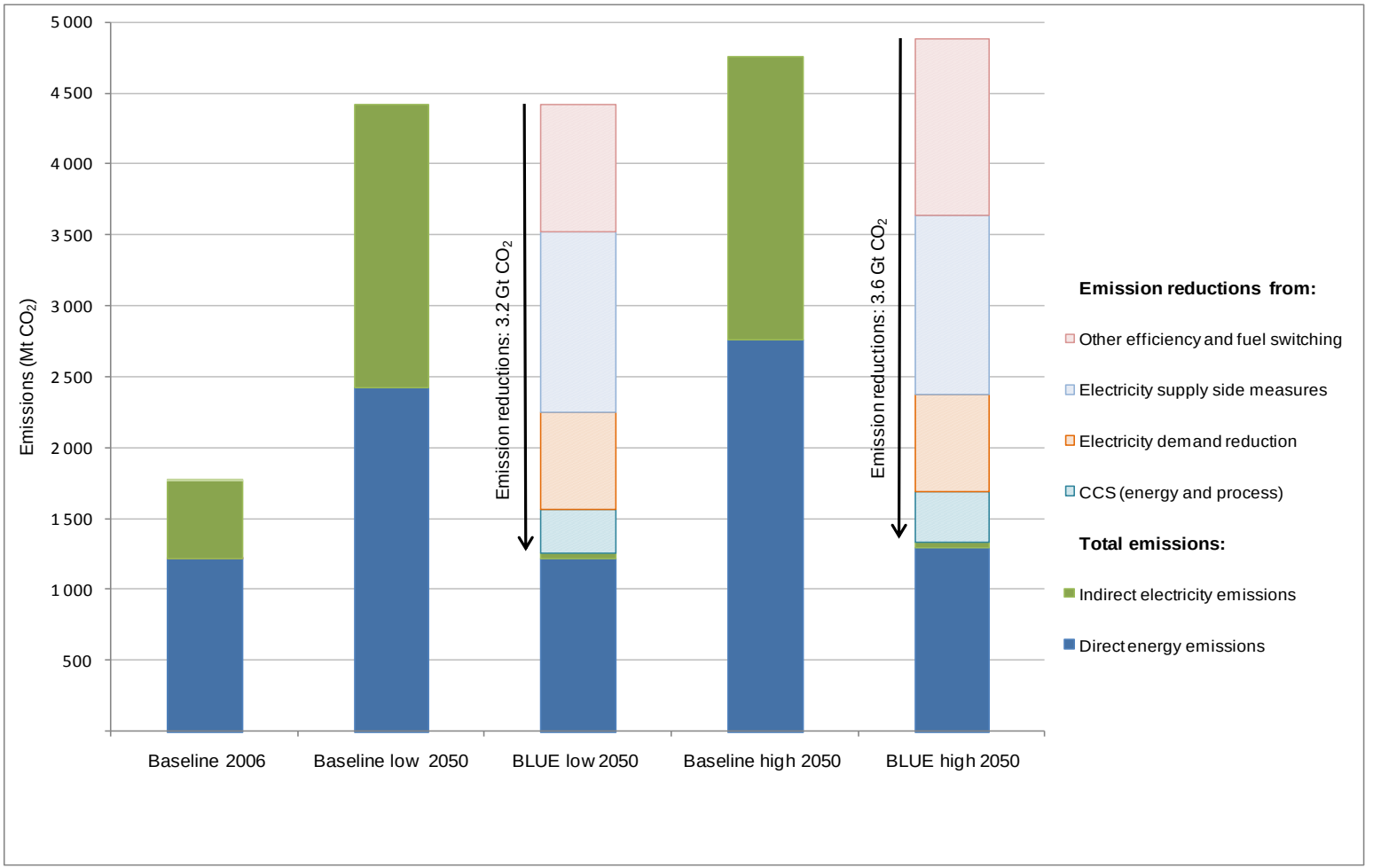
CO_2 emissions by scenario, 2006 and 2050



CO_2 emissions can be reduced through a combination of measures

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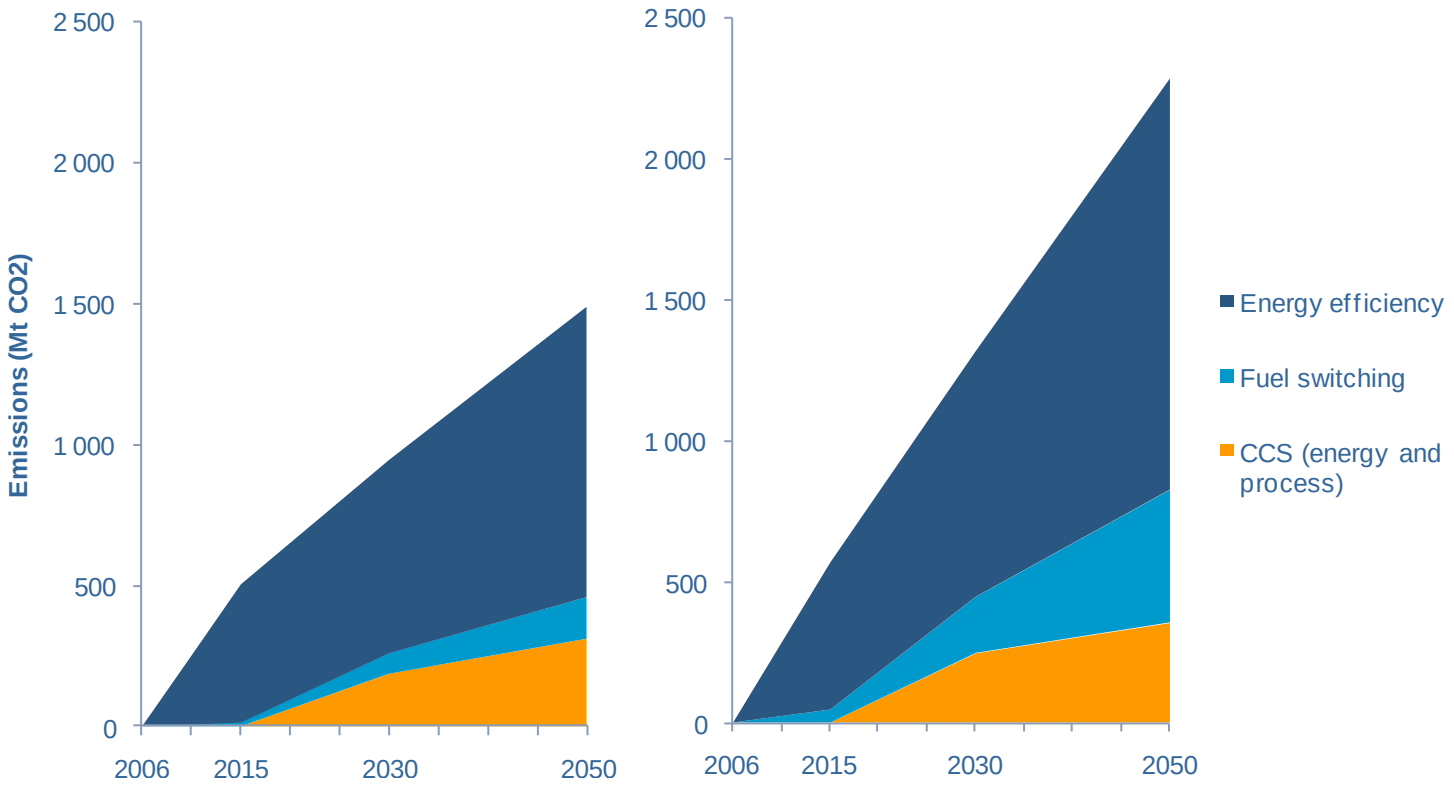
CO_2 emission reductions below the Baseline scenario



Energy efficiency offers the largest opportunities for CO_2 savings in the chemical and petrochemical sector

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Key Options

Iron and steel	Cement	Chemicals	Pulp and paper	Aluminium
Application of current best available technologies Including CHP, efficient motor and steam systems, waste heat recovery and recycling				
Fuel and feedstock switching				
DRI, charcoal and waste plastics injection	Alternative fuels, clinker substitutes	Biomass feedstocks	Increased biomass	
New technologies				
Smelt reduction		Membranes	Lignin removal	Wetted drained cathodes
Electrification (MOE)		New olefin processes	Black liquor gasification	Inert anodes
Hydrogen		Process intensification	Biomass gasification	Carbothermic reduction
CCS for blast furnaces	CCS post-combustion	CCS for ammonia	CCS for black liquor gasification	
CCS for DRI	CCS oxyfuel	CCS for large scale CHP		
CCS for smelt reduction	CCS pre-combustion	CCS for ethylene		

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IEA Technology Roadmaps

- **G8 leaders in Hokkaido committed to establish a technology roadmap initiative with the support of the IEA**
- **"A technology roadmap is a dynamic set of technical, policy, legal, financial, market & organizational requirements identified by all stakeholders involved in its development. The effort shall lead to improved and enhanced sharing and collaboration of all related technology-specific RDD&D information among participants"**

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Cement Roadmap Process

- Cement roadmap developed in collaboration with WBCSD Cement Sustainability Initiative
- A set of 33 technology papers are at the foundation of the roadmap
- Draft roadmap circulated to stakeholders Summer 2009
- Final publication October 2009
- Input for IEA Ministerial and COP 15 Copenhagen
- ETP 2010 – Washington

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Thank You!