



14th European Round Table on Coal

Coal to Liquid Fuels, Natural Gas & Chemicals: A Global Perspective



World CTL

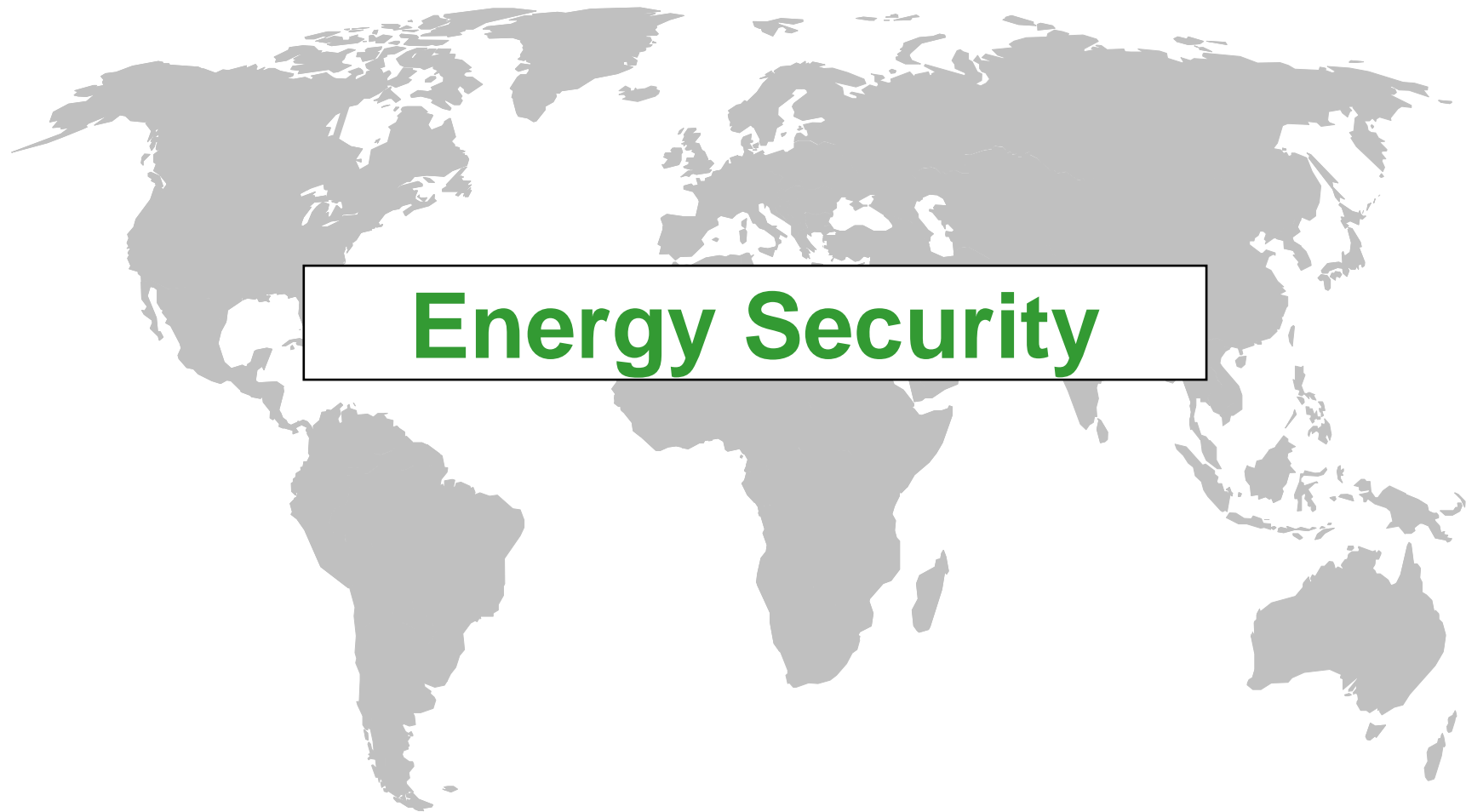
Serge Périneau



Coal to Fluid Hydrocarbons

- **Framework**
 - Energy Security
 - Technologies
 - Environment
 - Economics

- **Current Development**
 - Commercial Units
 - Projects
 - International Co-operation



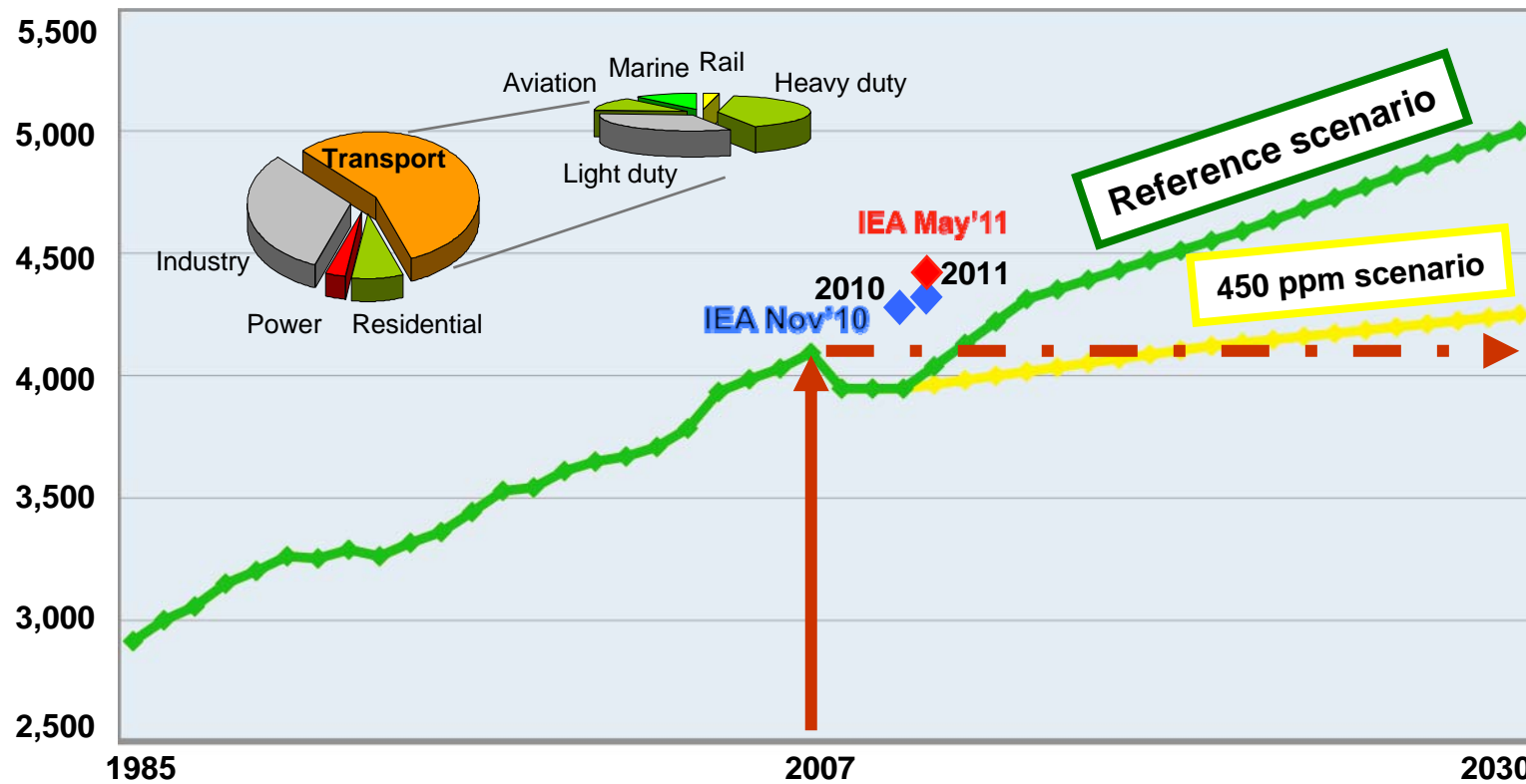
Energy Security



A Growing Demand in Oil, whatever IEA scenario



Oil consumption forecast (Mt/year)

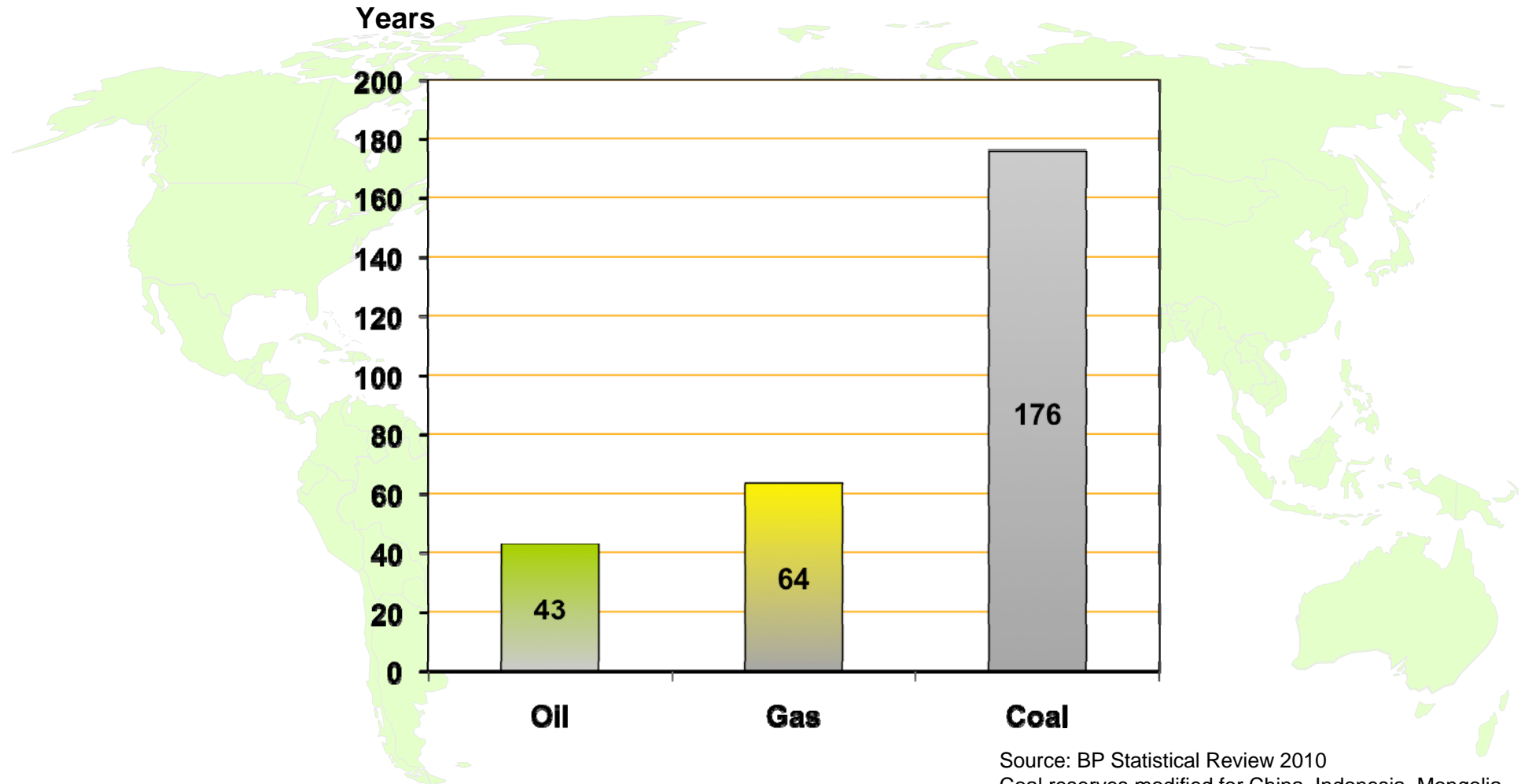


Source: IEA's World Energy Outlook 2009



Oil, Gas and Coal: Reserves

BP Statistics - 2010 Annual Report



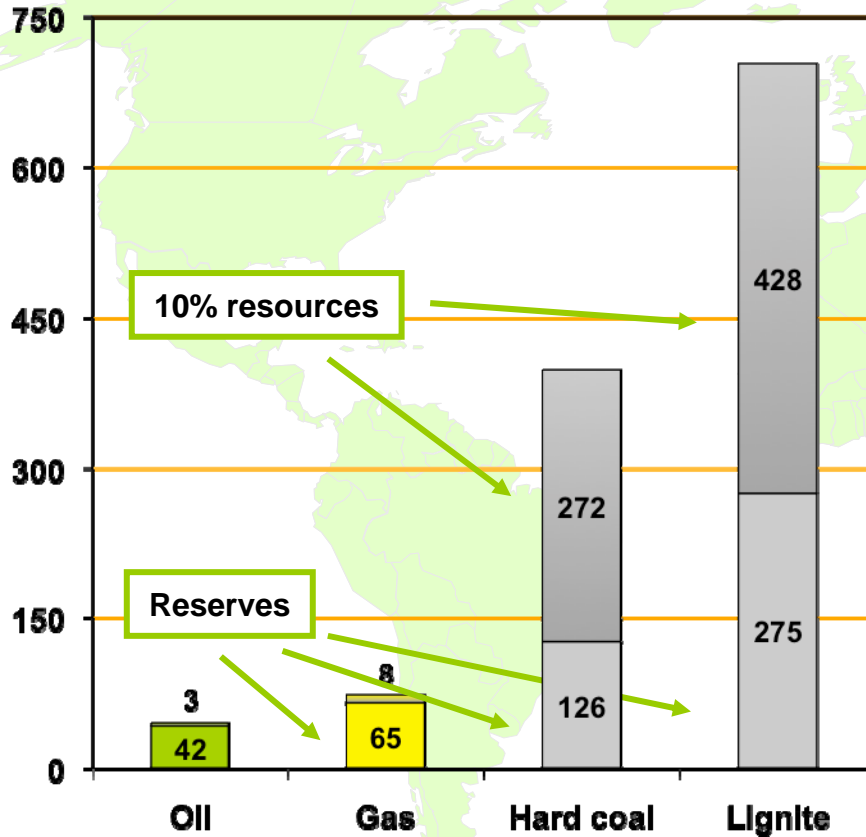
Source: BP Statistical Review 2010
Coal reserves modified for China, Indonesia, Mongolia



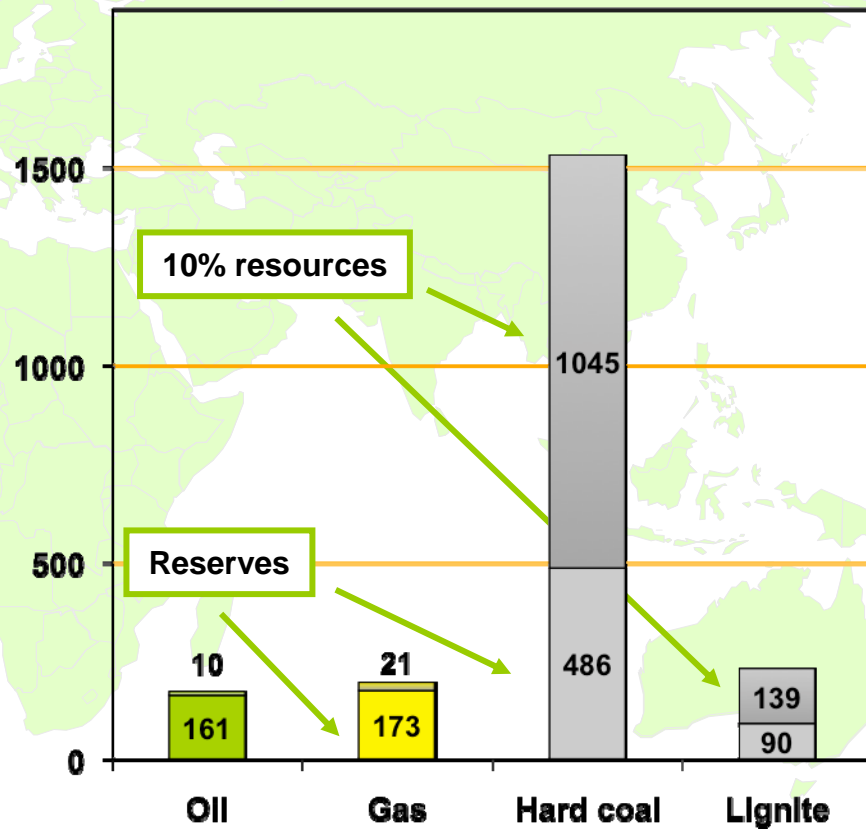
Oil, Gas and Coal: Reserves + 10% of Resources

2010 Annual Report (BGR)

Years



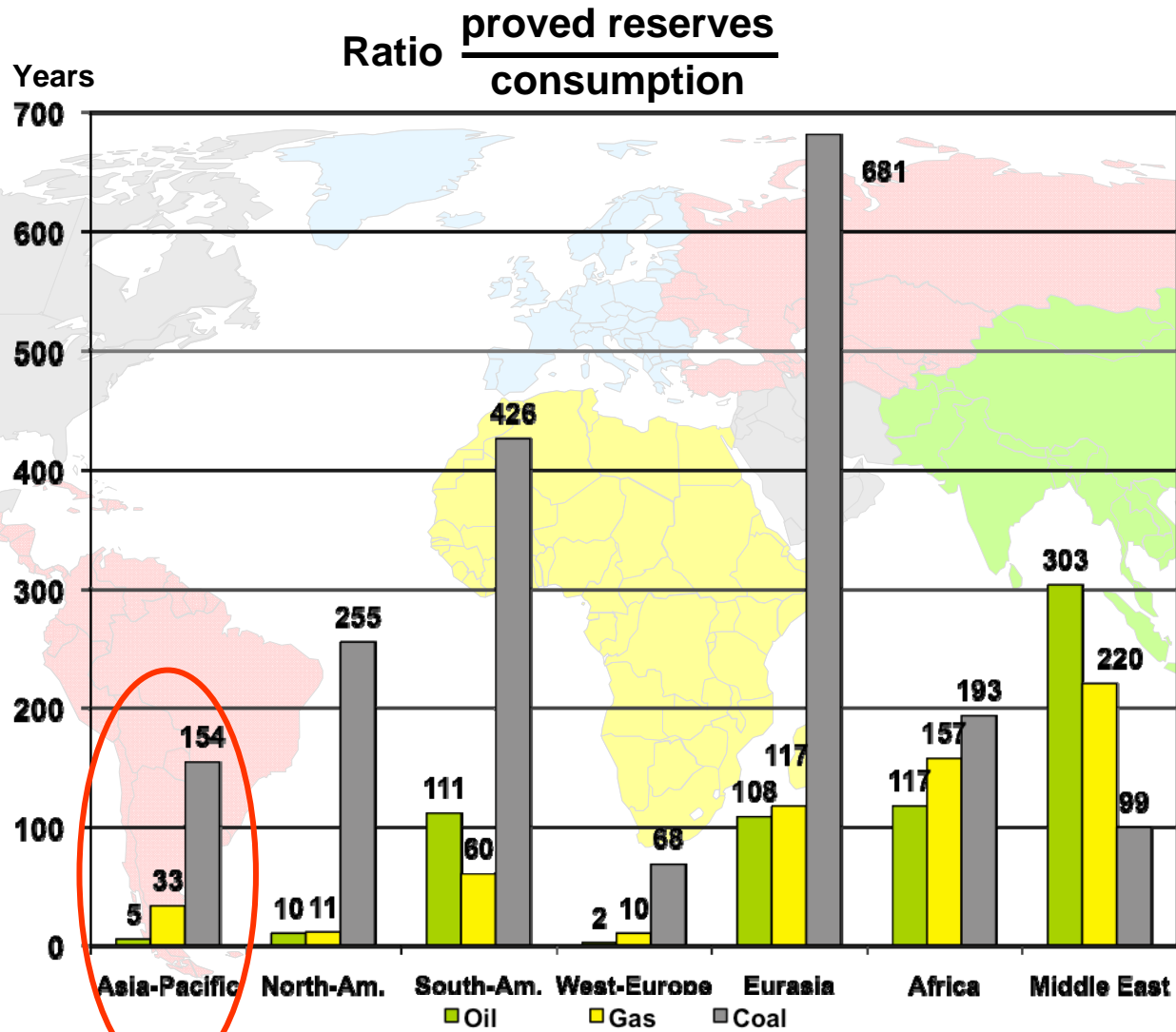
Energy unit: Gt Oil equivalent



Source: BGR Annual report (2010)



A major energy security stake



Source: BP Statistical Review 2010
Coal reserves modified for China, Indonesia, Mongolia

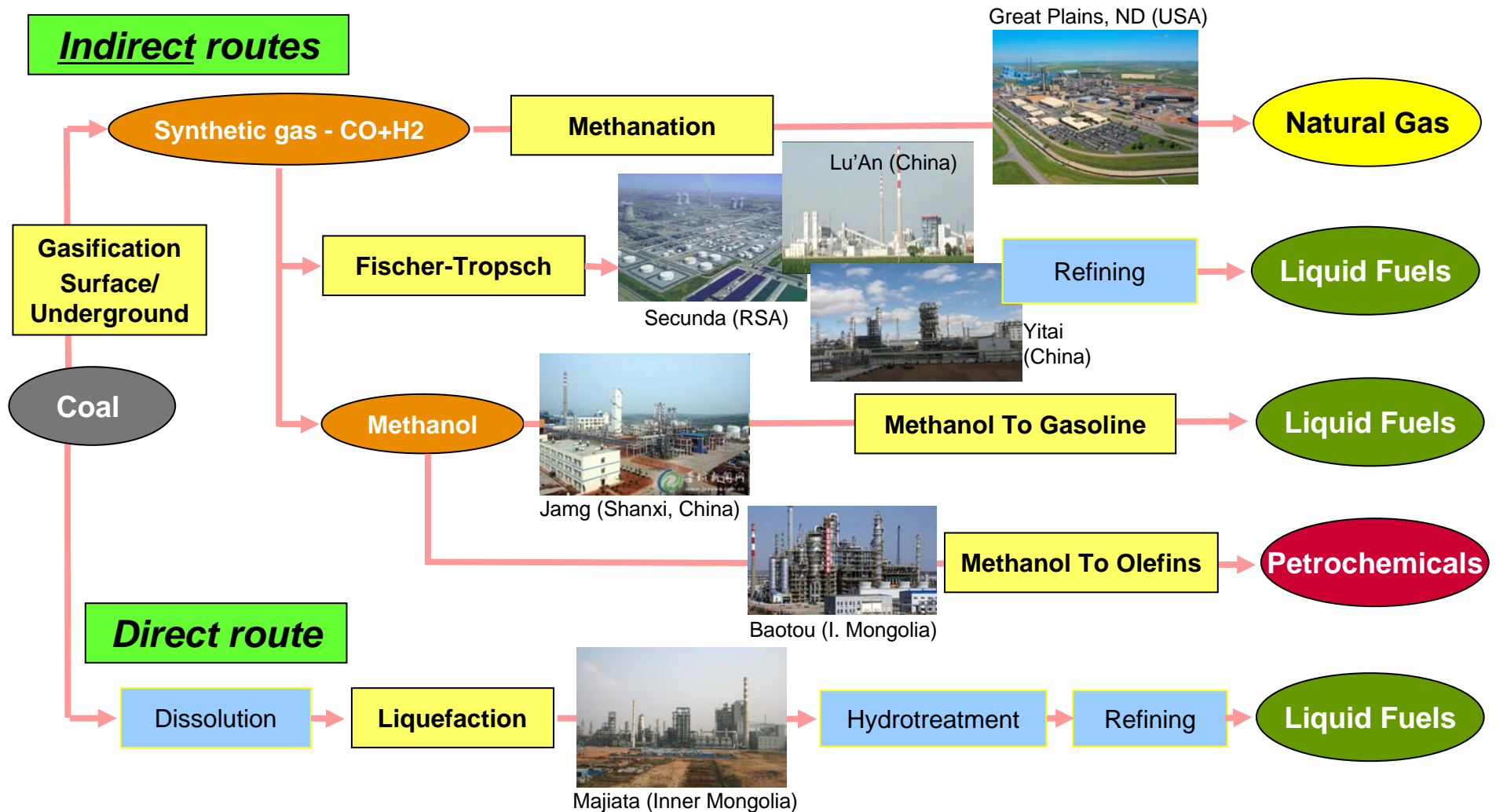


Coal Conversion



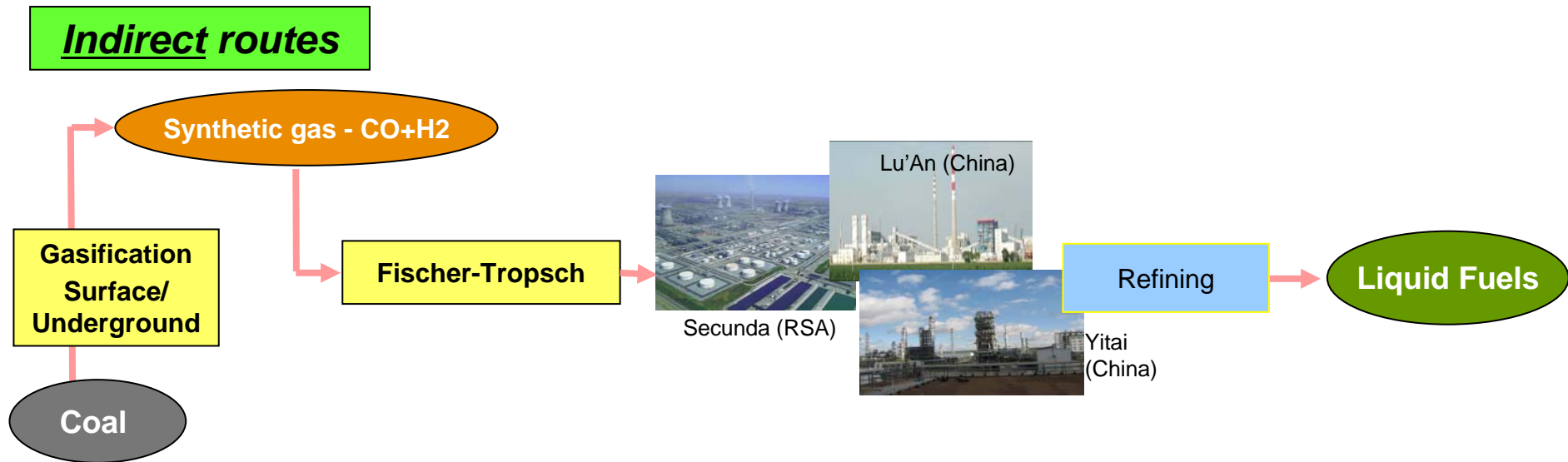


Technologies: conventional conversion routes





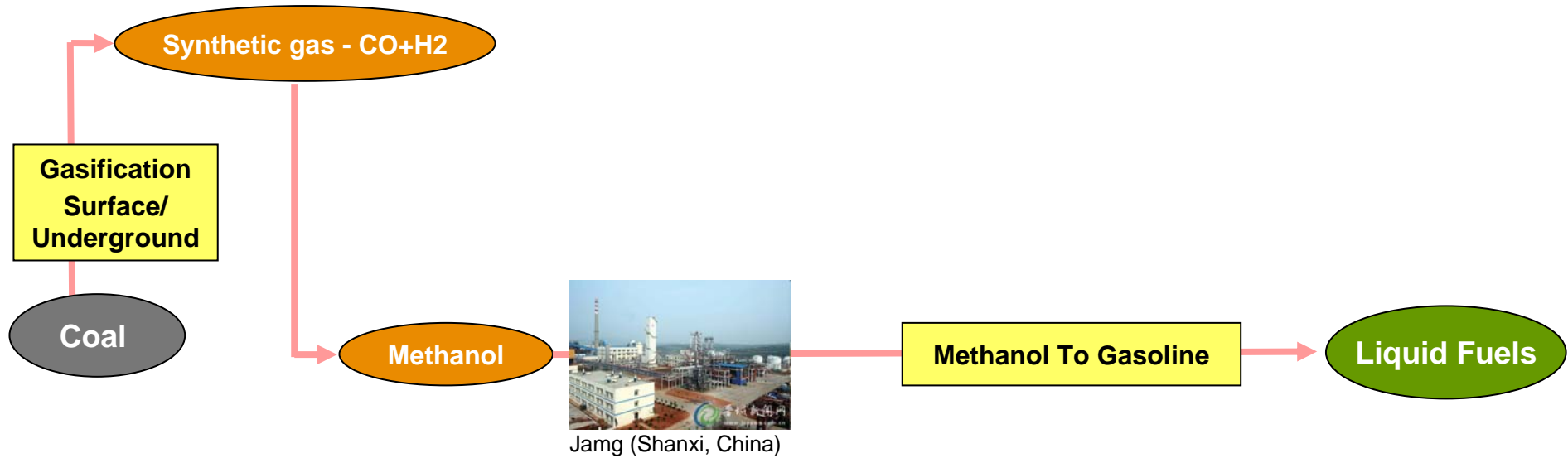
Technologies: conventional conversion routes





Technologies: conventional conversion routes

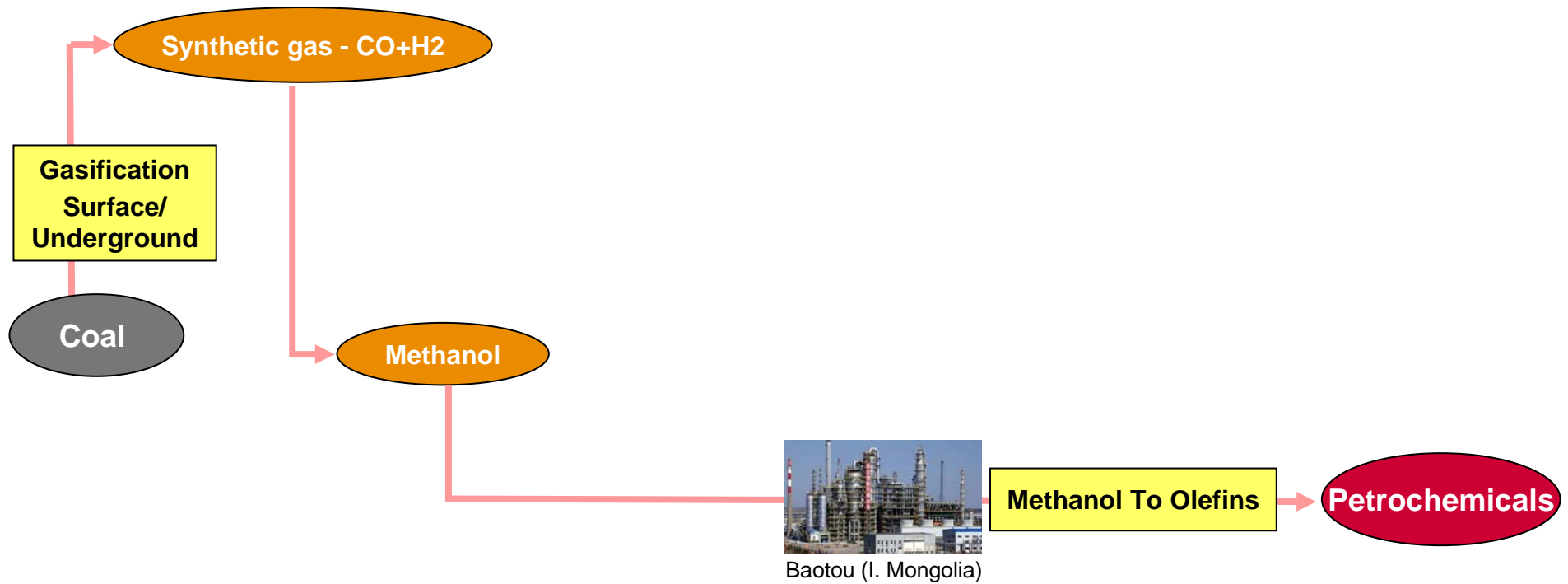
Indirect routes





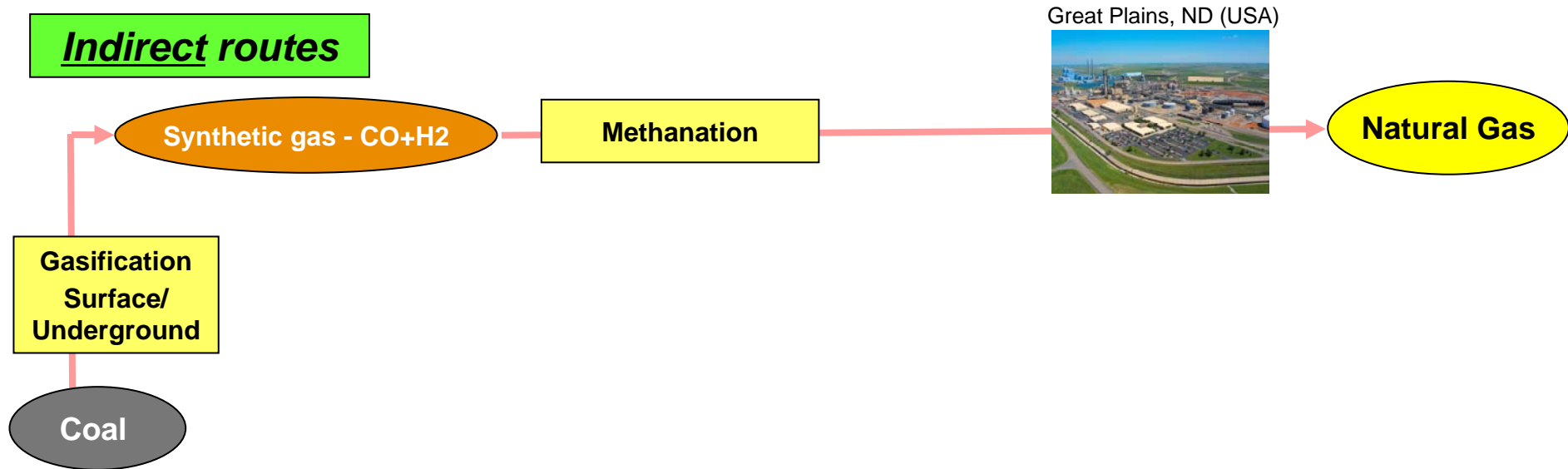
Technologies: conventional conversion routes

Indirect routes



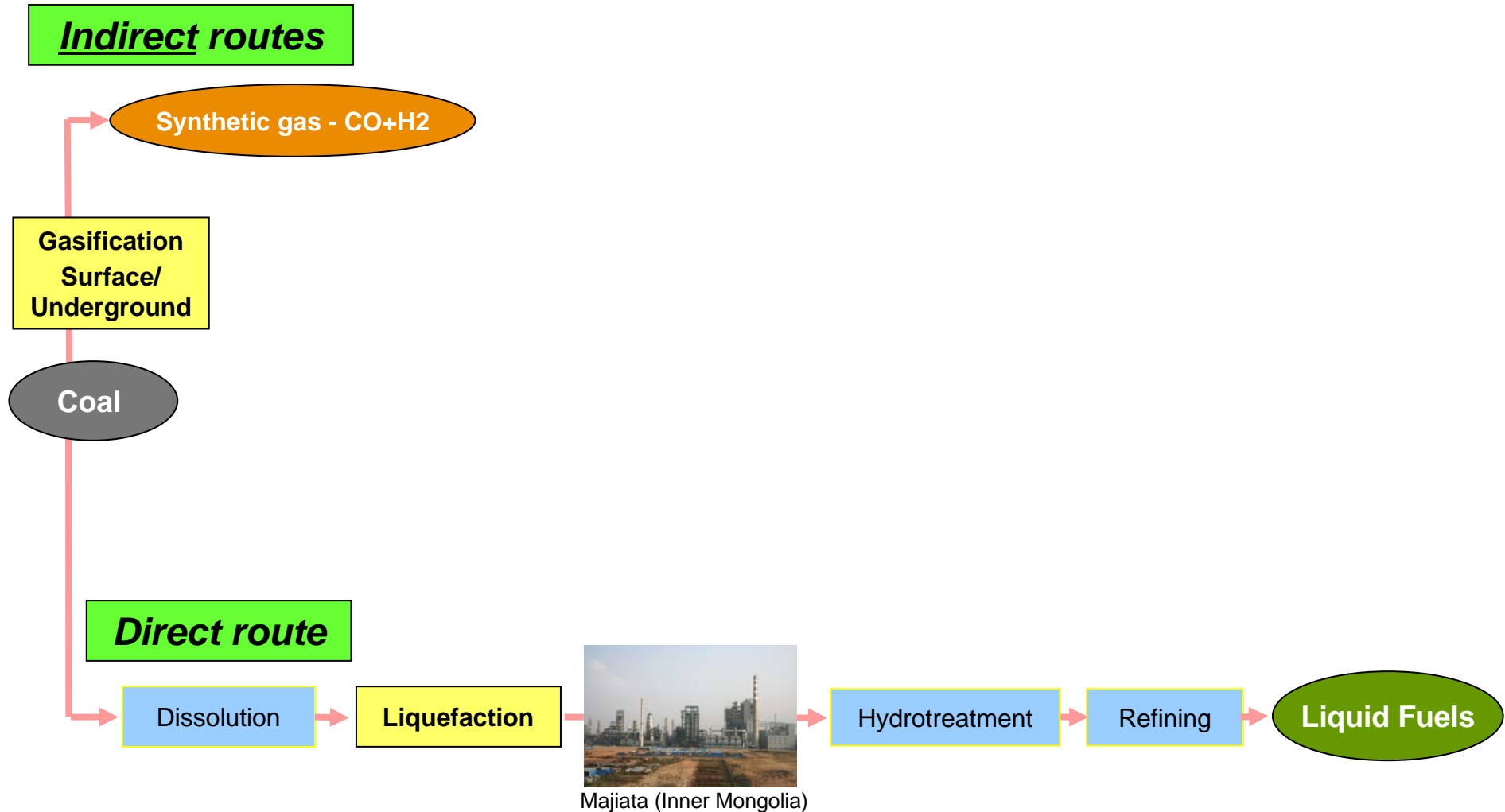


Technologies: conventional conversion routes



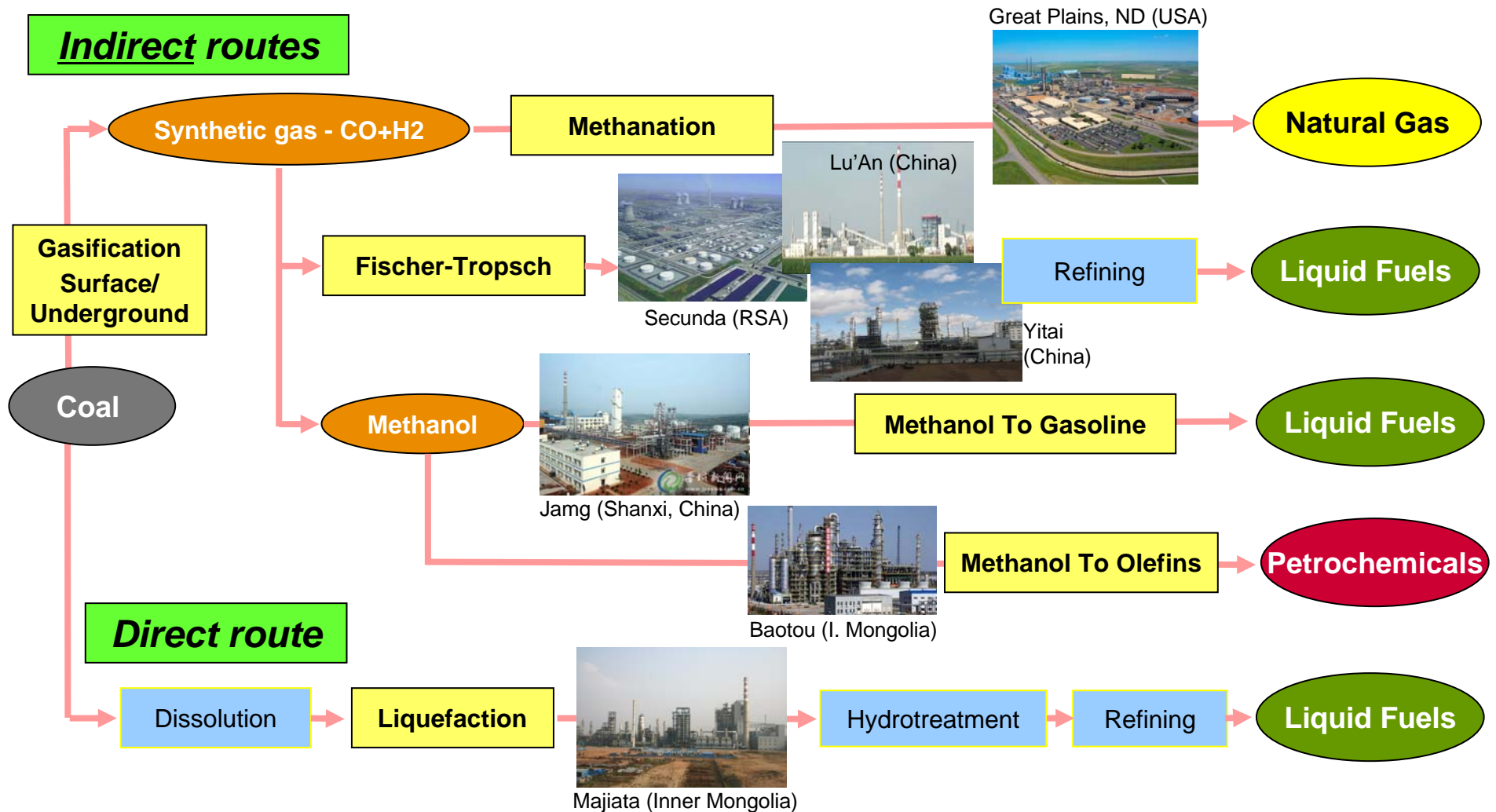


Technologies: conventional conversion routes





Technologies: conventional conversion routes





Environment



Environment: Coal is most controversial



March 2, 2009, Washington DC (Reuters)



March 26, 2009, World CTL Conference



« *Coal is My Worst Nightmare* »

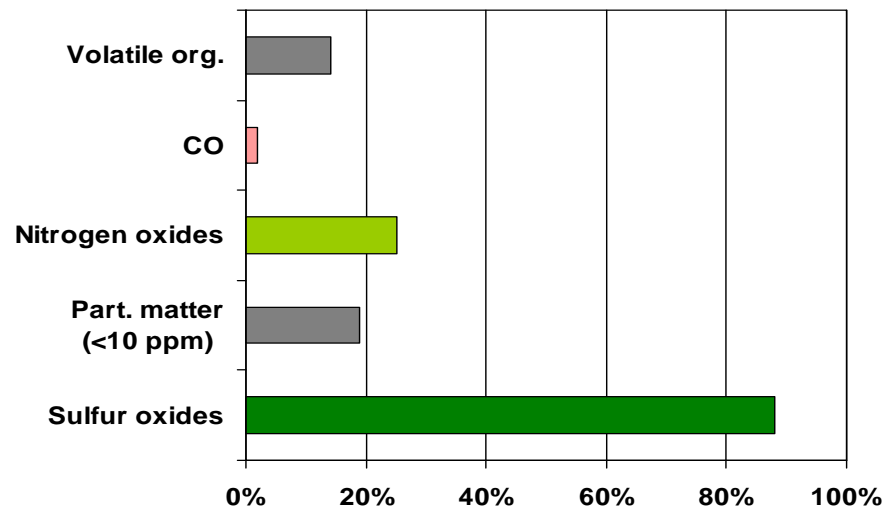
Steven Chu, Nobel physicist, U.S. Energy Secretary



Environment: Local Stakes

Three steps:

- Coal mining: need for a responsible sourcing
- Conversion itself
 - **Need for water: 1 to 2 m3 per barrel: an issue in several regions**
 - Ashes, gaseous and liquid noxious emissions: managed through classical chemical processes
- Combustion: synthetic fuels are purer than from conventional fuels.



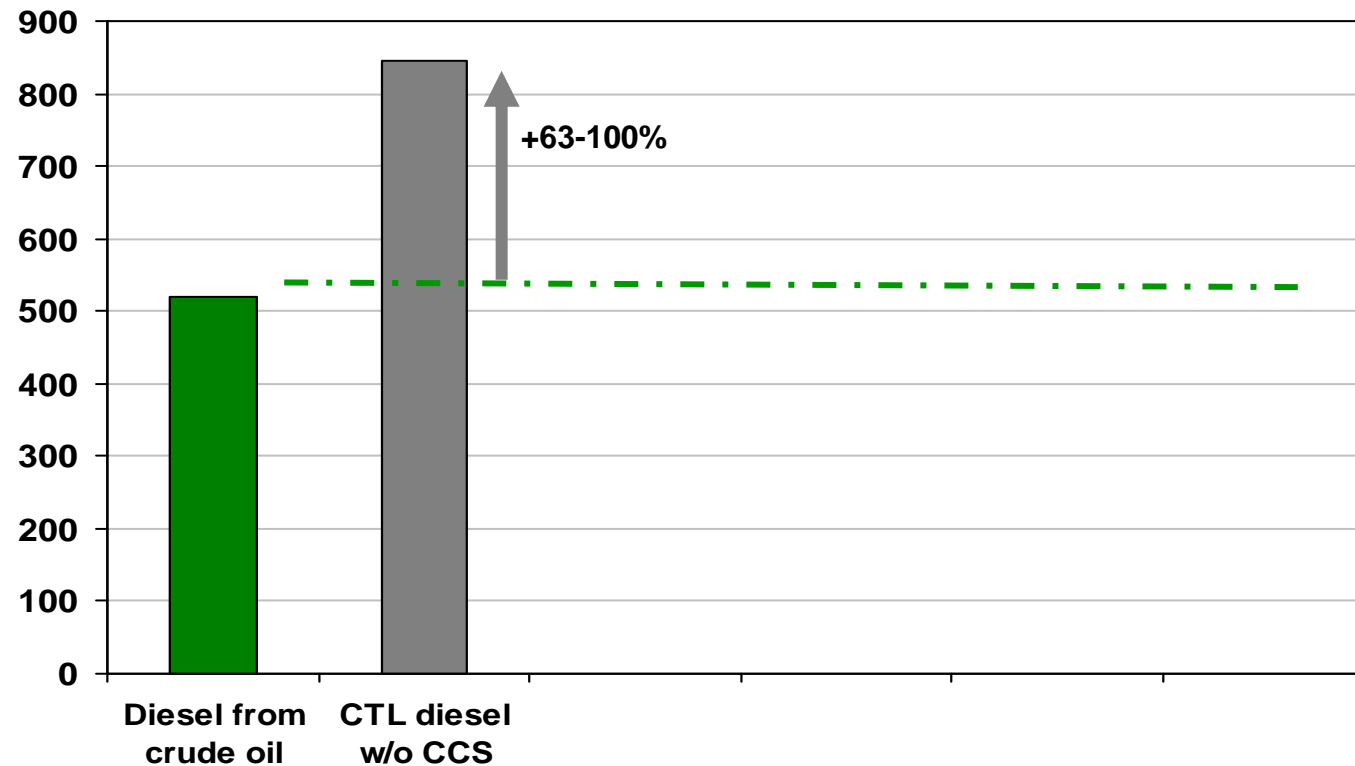
Source: Idaho National Laboratory (2007)



Global Issue: GreenHouse Gas Emissions

Case 1: Diesel produces from coal without CCS (Carbon Capture & Storage)

Well to Wheels emissions (grams of CO2 equivalent per mile):



Sources: Idaho National Laboratory (2007) and U.S. DOE (2009) (marked *)

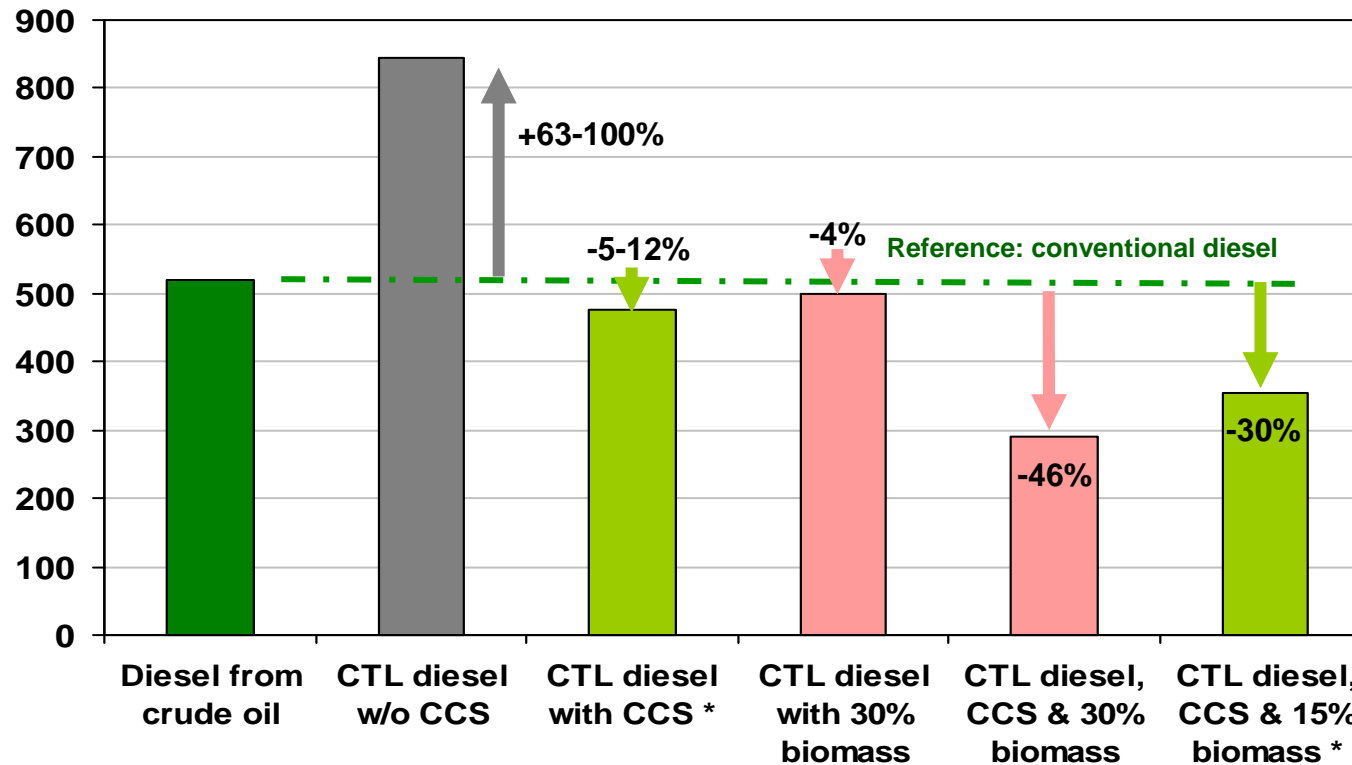


Global Issue: CCS & Biomass are CTL's best allies

Case 2: Diesel produced from coal with CCS:

- CCS reduces by 90-95% the CO₂ emissions within the CTL plant
- CCS is now included in most CTL projects.

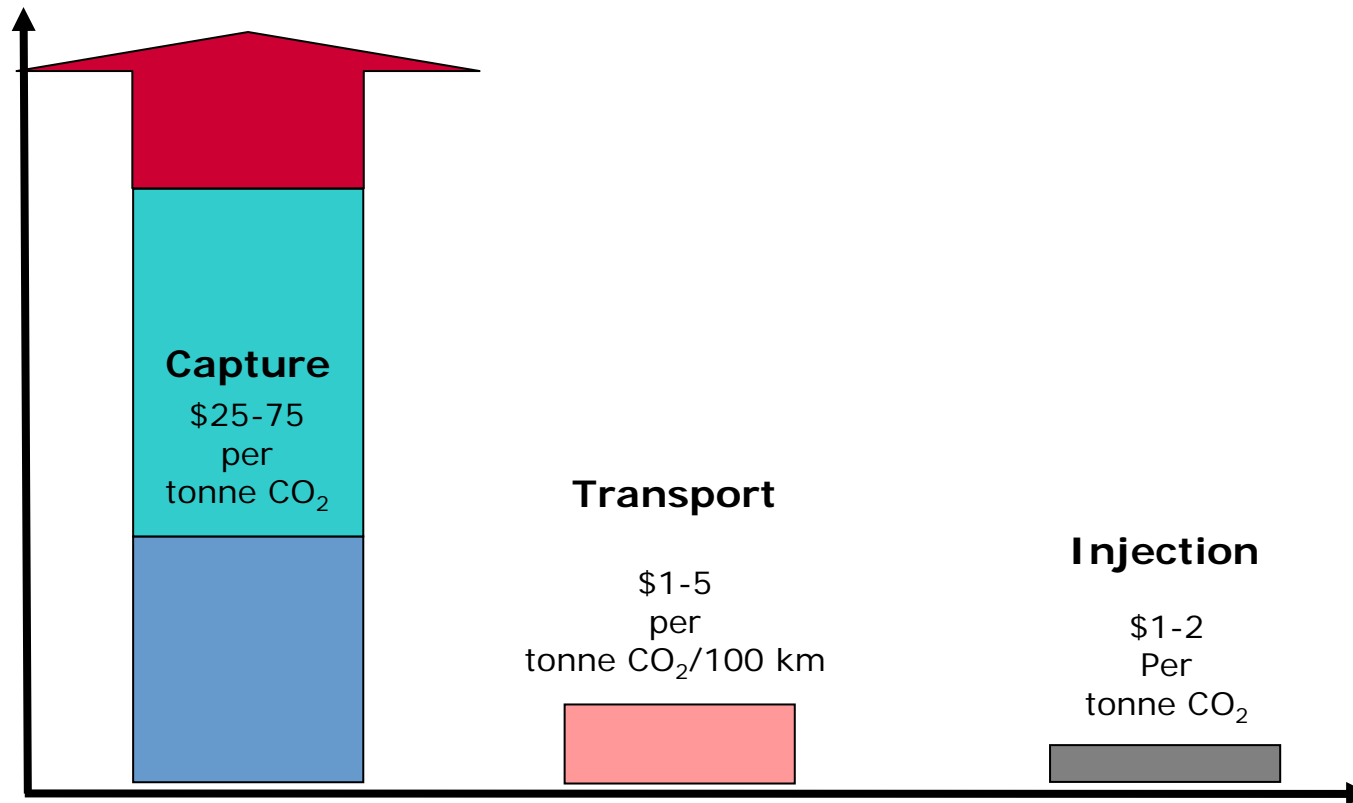
Well to Wheels emissions (grams of CO₂ equivalent per mile):



Sources: Idaho National Laboratory (2007) and U.S. DOE (2009) (marked *)



CCS: Cost Breakdown



Source: IPCC - Intergovernmental Panel on Climate Change - 2005

In a CTL plant, CO₂ is already captured

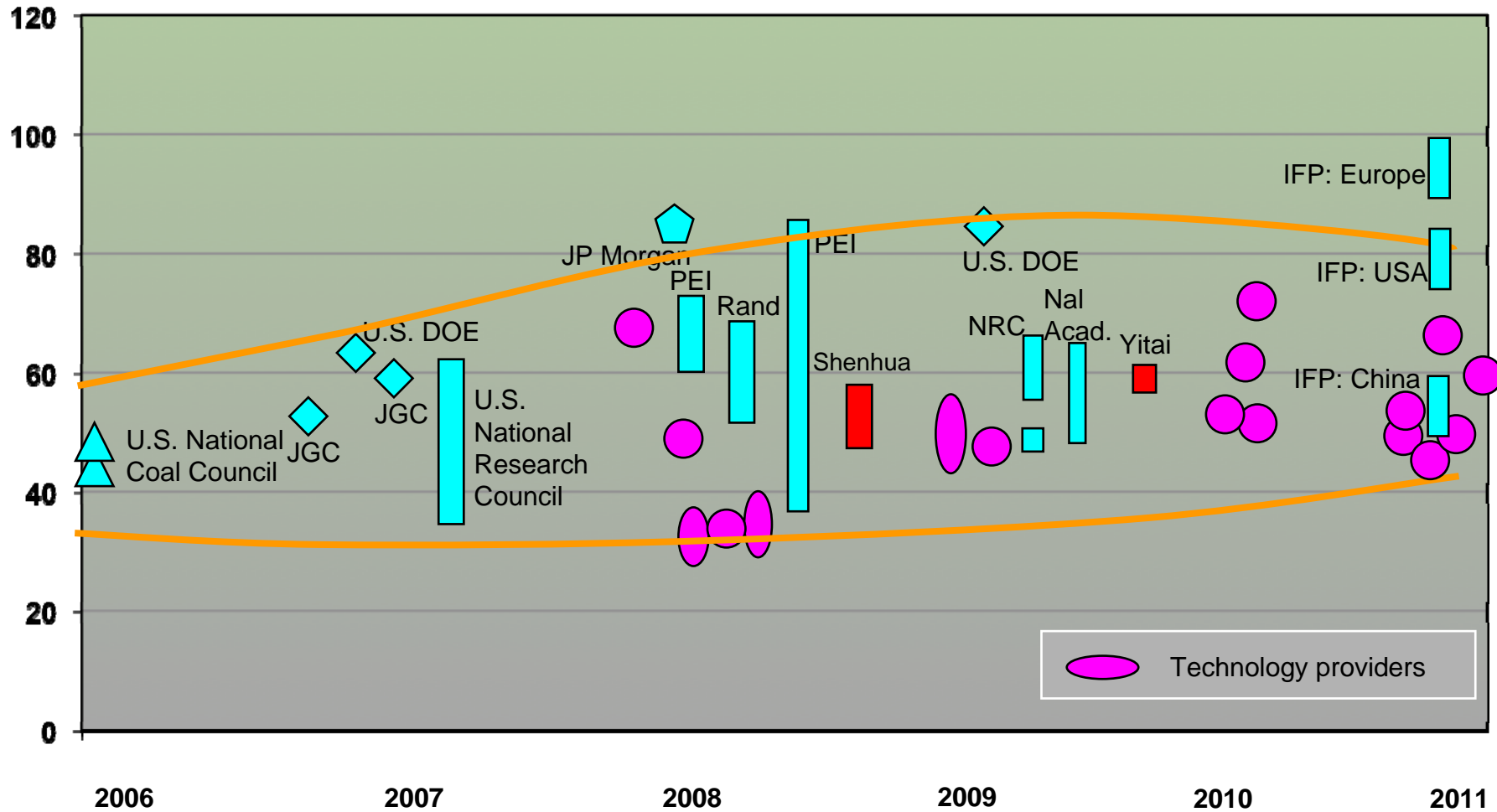


Economics



At Present Barrel Price, a Profitable Activity

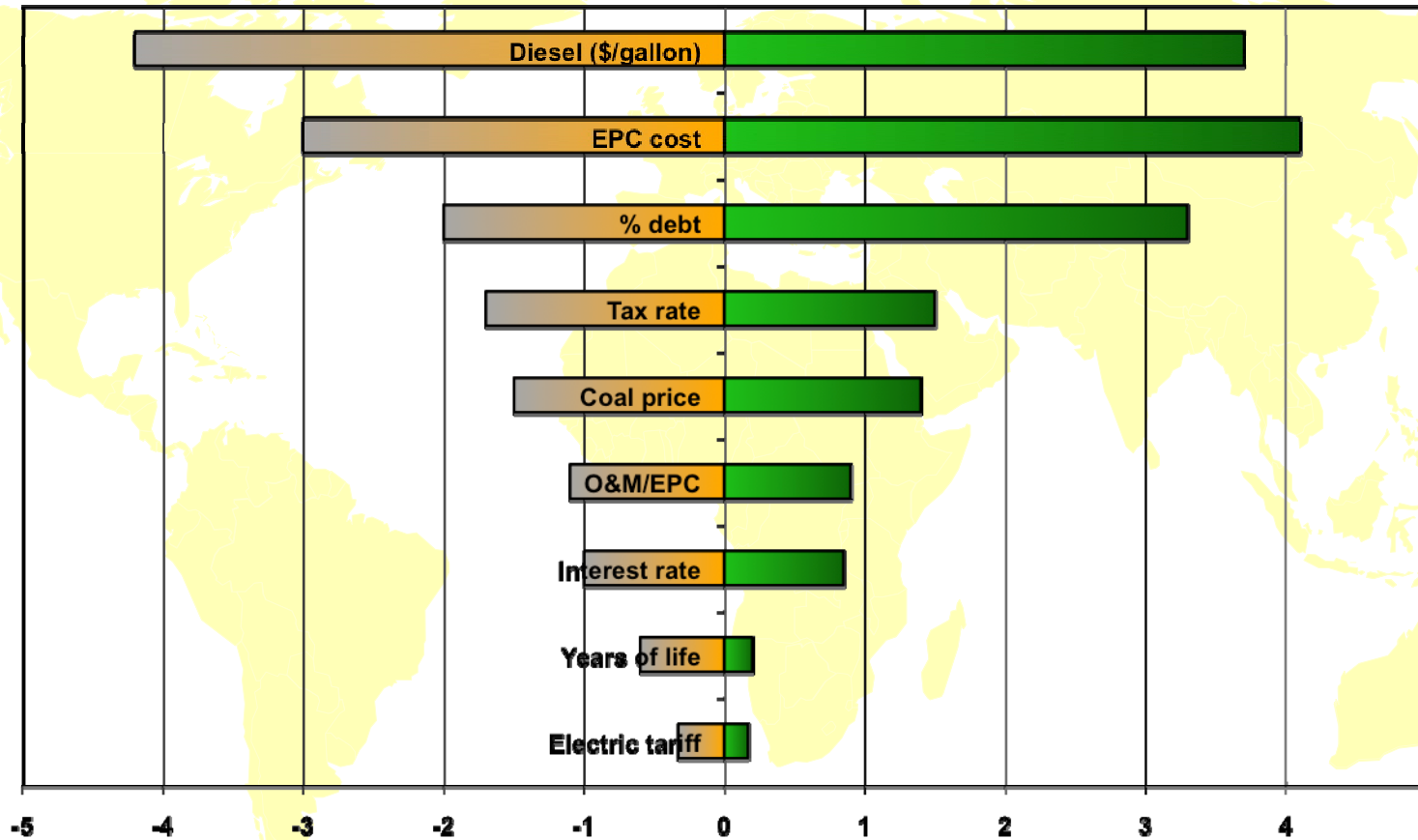
\$/bbl - Crude Oil Equivalent





Sensitivity Analysis

Variation of the Return on Investment in % for +/-25% variation of...



Other parameters: CO2 impact, subsidies, discount rate,...

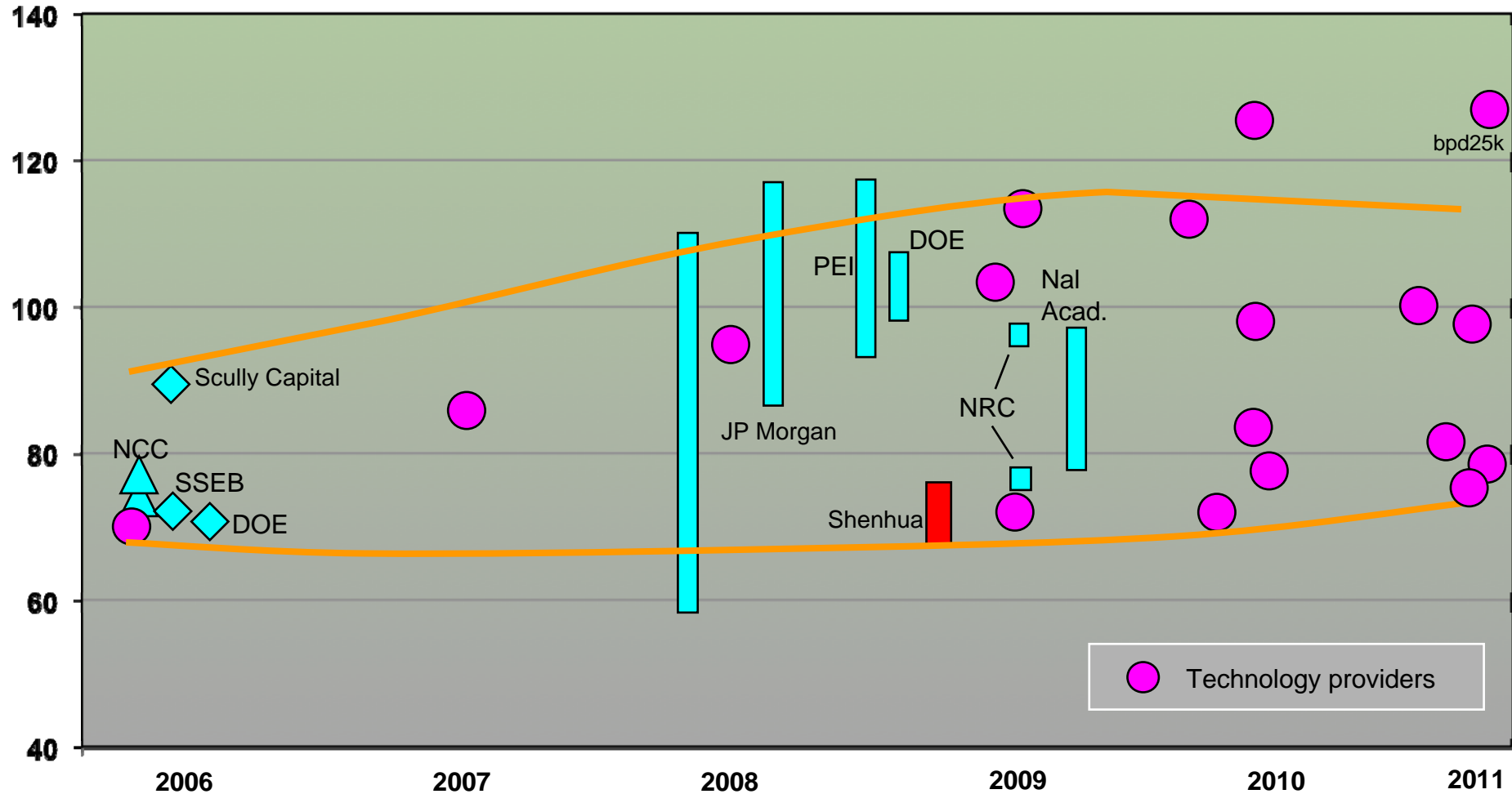
Source: U.S. DOE 2007



A Capital Intensive Industry (40-50,000 bpd unit)

Reported Capital Expenditure - 40-50,000 bpd unit

x000\$ / daily bbl

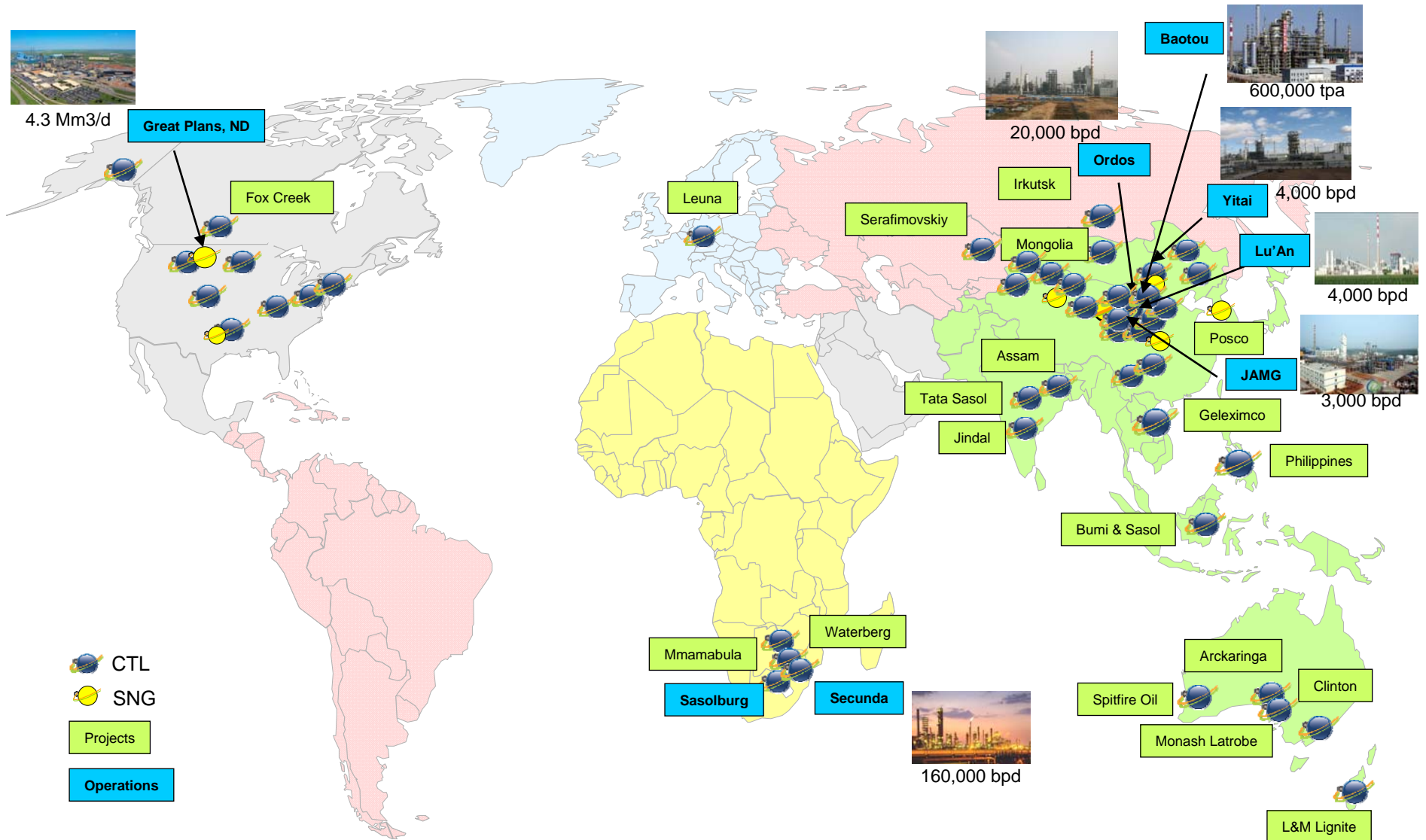




Current Developments



Many Projects, Several Demonstration Plants

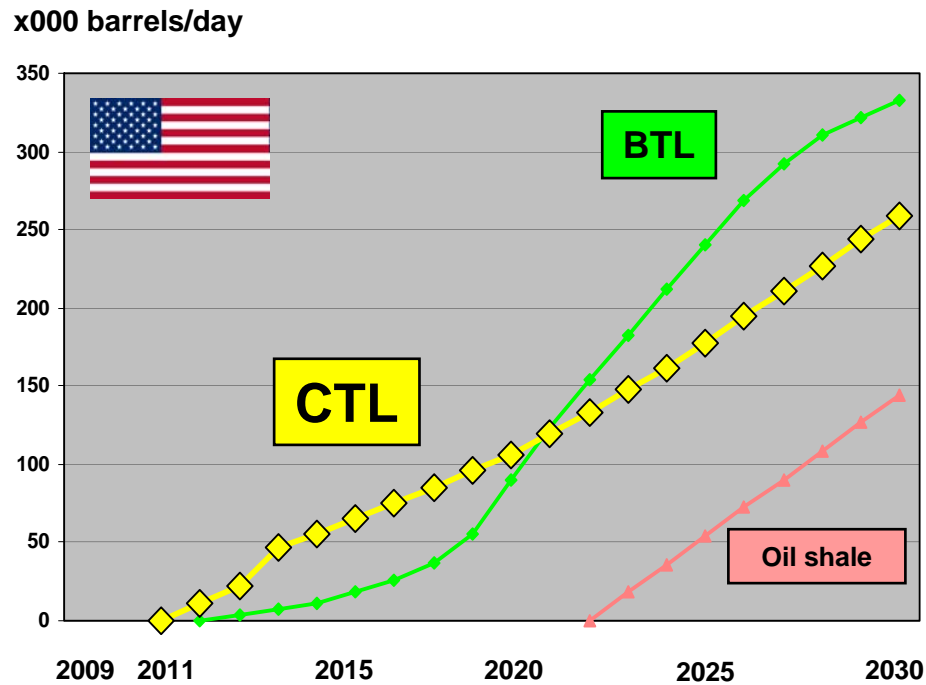




CTL projections

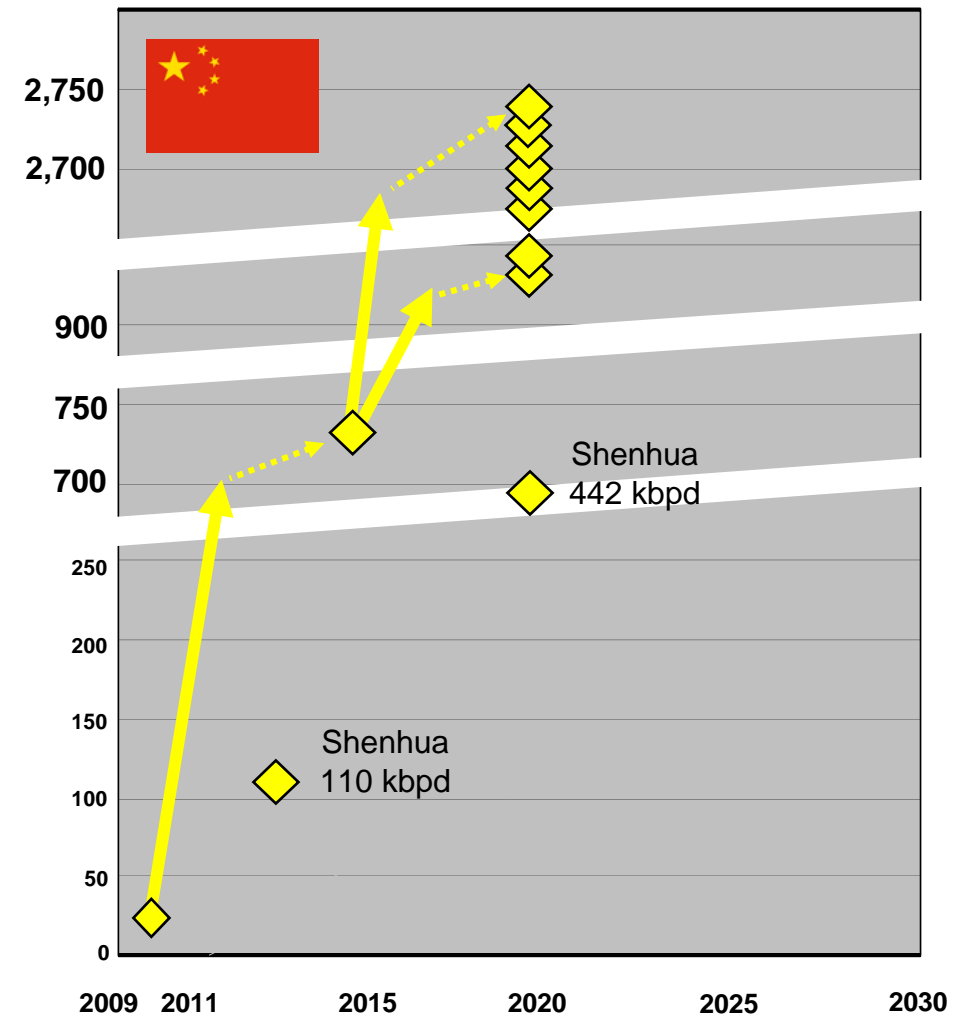
Forecasts published in

- the U.S.A.
- the P.R. China



Source: U.S. Energy Intelligence Agency (2009)

x000 barrels/day

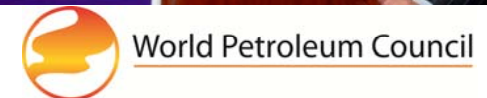


Sources: China Coal Information Institute (2009) and Shenhua (2010)



World CTL, a European Initiative to Boost Co-operations

Presentations, networking, appraisal





Conclusion

- **Coal** is fully available.
- The predominant role of conversion is **energy security**.
- **Environment is a key issue**. Technology, CCS and Biomass are the best allies of CTL.
- **Several Demonstration Plants** are now in operation.
- **CTL is highly competitive** at current energy prices, although **capital intensive**.
- **China** has taken the lead.
- **International Co-Operation** keeps developing.

GAP & Coal Chemicals Conference

Upgrading fossil fuels & biomass for a low carbon economy

June 8 & 9, 2011 Beijing, China



Thank you.

Our next events:

Gasification Asia Pacific 2011

Beijing, June 8-9, 2011

World CTL 2012

Delhi, January 18-20, 2012

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