The Global Comeback of Coal-to-Liquids (CTL) Technologies
The Impact of CCS on the Economic and Environmental Performance of CTL

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Structures
Drivers and Barriers for CTL

**Barriers**

- **High CO₂ intensity**
  - High capital costs, high water demand

- **Coal Gasification**
  - CO₂ Capture and Storage
    - Broad availability of coal; high feedstock flexibility
  - No additional energy demand / capture-ready
  - H₂ + CO “Syngas”

- **Liquefaction**
  - Poly-Generation (e.g. power, H₂, chemicals, SNG)
  - Applicable at large scales
  - High fuel quality (e.g. essentially sulphur-free)

**Drivers**

- Coal
  - Broad availability of coal; high feedstock flexibility

- Hydrocarbons (Synfuels)
  - High fuel quality (e.g. essentially sulphur-free)
CTL Well-to-Tank (WTT) Emissions

Well-to-Tank (WTT) Emissions of CTL (with/without CCS)

- Conventional Diesel
- CTL (Hard Coal)
- CTL & CCS (Hard Coal)

$\text{g CO}_2\text{eq}/\text{MJ final fuel}$
CTL Production Costs with and without CCS

- Crude Oil Price 2009 (May 09)
- ICL Gross Prod. Costs w/o CCS
- ICL Gross Prod. Costs w CCS (SA)
- ICL Gross Prod. Costs w CCS (EOR)

$/BBL

Low
High
Announced CTL Plants in the U.S.

**Number/capacity of announced plants:**
17 Fischer-Tropsch plants have been announced; total capacity:
107 – 178 million barrels per year

**Involved players:**

**Locations:**
Mainly major coal-producing States, e.g. Kentucky, West Virginia, Wyoming
Projections for CTL Production in the U.S.

Total 2030 fuel demand road transportation in the U.S.: 4,672 mill. bbl oil eq.

=> Projected amounts of CTL may cover niche markets for transportation
GHG Emissions Resulting from CTL Production Scenarios for the U.S.

⇒ Total WTT CTL emissions without CCS: Up to 2,175 million tons of CO₂ eq. (projected total U.S. GHG emissions in 2030: About 6,900 million tons of CO₂eq/a)

⇒ Total WTT CTL emissions with CCS: Up to 500 million tons of CO₂eq. per year
Announced CTL Plants in China

**Plants under Construction:**
2 Fischer-Tropsch plants (total capacity: 2.6 mill. bbl/a), 1 direct liquefaction plant (6.4-21.2 mill. bbl/a)

**Plants at Planning Stage:**
1 Fischer-Tropsch plant (25.7 mill. bbl/a), 1 hybrid plant (1.3 mill. bbl/a)

**Uncertain CTL Projects:**
2 Fischer Tropsch plants (32.8-95.8 mill. bbl/a), 2 direct liquefaction plants (6.6 mill. bbl/a)

**Involved Players:**
Coal-mining companies, especially Shenhua

**Locations:**
Coal-producing provinces, esp. Inner Mongolia, Shanxi
Projections for CTL Production in China

Total oil demand of China’s transport sector in 2030: 3,312 mill. bbl/a

=> Compared to projected levels of oil demand for transport, CTL could cover a niche level of future fuel demand.
GHG Emissions Resulting From CTL Production Scenarios for China

⇒ **Total CTL WTT emissions without CCS:** Up to 444 million tons of CO$_2$ eq. (projected total energy-related CO$_2$ emissions in 2030: 11,448 million tons of CO$_2$)

⇒ **Total CTL WTT emissions with CCS:** Up to 102 million tons of CO$_2$ eq. per year
Conclusions

- Carbon mitigation requirements increase high economic uncertainty of large-scale CTL projects

- CCS is not sufficient to make CTL climate-compatible. Additional steps, such as biomass co-firing, are needed.

- Additional mitigation measures further complicate the implementation of CTL projects.
Many thanks for your attention!

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Global Investments in Fuel Production Capacities until 2050

- Biofuels: Approx. € 640 Bill.
- GTL: Approx. € 830 Bill.
- CTL: Approx. € 320 Bill.
- Raffinerien: Approx. € 830 Bill.

Total: Approx. € 2.620 Bill.