1.5 °C steel energy transitions

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Steel & climate change

- 8% of global greenhouse gas emissions
- ~90% of which from coal
- Peak steel emissions not yet reached
a) Global GHG emissions

- Limit warming to 2°C (>67%) or 1.5°C (>50%) after high overshoot with NDCs until 2030
- Limit warming to 1.5°C (>50%) with no or limited overshoot

b) 2030

- +5% limit warming
- -4% limit warming
- -26% past GHG emissions
- -43% uncertainty for 2015 and 2019

Decarbonisation timeline

50% chance to meet 1.5%
-43% by 2030 (v. 2019)
-69% by 2040
-82% by 2050

Key dynamics
- Sectoral interdependencies
- Responsibilities and capacities
- Leaders & laggards

Mission steel decarbonisation

- Pace of Chinese steel expansion
- Decarbonisation pace for 1.5 °C
Steel decarbonisation as an energy transition

1. Steel is not the problem, fossil energy is

2. Transition in two overlapping phases:
   - Overcoming coal lock-in
   - Electrification and phasing in hydrogen

3. Energy transitions are fundamentally non-linear
Energy demand for iron and steel by fuel in the Net Zero Scenario, 2010–2030

Energy options

- Hydrogen
- Direct electrification
- Biomass
- Fossil fuels + CCS

Final energy consumption, iron and steel, NZE

Source: IEA (2022), World Energy Outlook 2022, IEA, Paris
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A two-phased model for the steel energy transition

- Carbon lock-in
- The age of coal in steel is ending
- Power sector decarbonisation as key enabler
Blast from the past

- Decarbonising the BF would require a combination of
  - CCS with high capture rates...
  - ...on several exhaust pipes (incl. sinter/pellet, coal mine, lime kiln)
  - Long-term reliable CO2 storage
  - Stable supply of low emission, sustainable biomass

- Cost logic: CCS an added cost v. Large learning potential in electrification

→ Large business risk of “blast furnace CCS” (stranded asset risk)
Phasing out coal

- Metallurgical coal so far sheltered from phase-out politics
- Thermal coal phase-out starting to spill over
  - Shared infrastructures
  - Divestment
  - Permitting
  - Pressure from civil society

**Source:** IEA (2022), World Energy Outlook 2022, IEA, Paris
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Leaping into renewables

- Renewables-based steelmaking already an option
  - Exciting start-ups
  - Green iron trade partnerships
  - “Green steel” has become a thing
- Gas-CCS a potential short-term option
- Plethora of new pathways emerging

Conclusions

- 1.5 °C requires breaking carbon lock-in: **phasing out blast furnaces**
- Breaking lock-in opens wide range of pathways
- Non-linear transitions:
  - Tipping points
  - Economic restructuring
  - Fossil phase-out politics

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**Steelmaking technology diffusion rates**


Based on data by Worldsteel and Jernkontoret.
Thank you for your attention