Energy Technology Perspectives 2014

IEA Global Industry Dialogue and Expert Review Workshop

Paris, October 7
Iron & Steel break out group

- ETP 2014 preliminary results feedback
  - Production, energy use, fuel mix shifts
- Energy market changes and impact in
  - Fuel mix
  - Regional production shifts
  - Regional industrial competitiveness
- Views on BATs values
- Emerging technologies status, expected progress
  - Sector specific emerging technologies
  - CCS demonstration and deployment needs and prospects
  - Which role H2 can play in the future?
- ETP Industry model improvement ➔ data availability
- ETP 2015 potential topic discussion ➔ The role of industry in the climate negotiations
## Iron & Steel BATs

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<tbody>
<tr>
<td><strong>Current BAT Tracking Clean Energy Progress</strong></td>
<td>2013</td>
<td>-</td>
<td>2.0</td>
<td>1.0</td>
<td>3.7</td>
<td>10.4</td>
<td>10.4</td>
<td>20.0</td>
<td>-</td>
<td>1.1</td>
</tr>
<tr>
<td>Worrell, et al. Berkeley National Laboratory¹</td>
<td>2008</td>
<td>1.4</td>
<td>2.7</td>
<td>1.5</td>
<td>0.6</td>
<td>12.3</td>
<td>11.7</td>
<td>17.7</td>
<td>17.3</td>
<td>2.5</td>
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<tr>
<td>EU BAT Reference Report²</td>
<td>2012</td>
<td>1.4-2.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10.5-14.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.8 *EU average</td>
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¹ “World Best Practice Energy Intensity Values for Selected Industrial Sectors”
Iron & Steel

- Smelt reduction deployment 2DS target: 31.1 Mt by 2025 (2% of expected total crude steel production in 2025).
  - Several processes commercially available: Finex®, Corex®, HISmelt® but with very low adoption rate
  - Others at pilot scale testing stage such as HIsarna® (integrating HIsmelt® and Isarna® processes)

- Blast furnace with top gas recycling is expected to deploy in 2020. Full-scale demonstration plant operational by 2016.
Sector specific CCS deployment needs

- 2DS 2050 CCS targets:
  - Iron & Steel: 848 Mt CO2 captured (29% of direct CO2 sector emissions without capture)
  - IEA CCS Roadmap analyses actions to accelerate deployment
The role of Hydrogen

Is there room for a greater use of H2 in Industry?

- Current H2 generation cost makes it too valuable to be used as fuel

- Additional burdens: H2 combustion impact on process operating parameters, requirements for equipment modification leading to a significant investment

- Iron & Steel: H2 reduction Iron and Steel making process
  - H2 produced by amplifying technique using BFG and COG and then used as reducing agent reducing the process coke needs.
  - Research progress, process potential?
Model improvement: data requirements

- Start conversion to a different platform, future structural changes:
  - Capacity vs production $\rightarrow$ level of capacity utilisation
  - Capacity characterization by plant size categories
  - Full segregation of energy use by process requirements, heat/elec generation (CHP) and separate heat generation
  - Separate modeling of waste heat recovery potentials
  - Segregation of biomass, waste and renewable energy sources
  - Improve technologies capital and operational costs assessment

- Waste heat recovery potential by sector
  - Cement industry analysis through IEA India Cement Roadmap $\rightarrow$ 550 MW existing potential
Back up slides
Iron & Steel - Production

Major Crude Steel production growth

<table>
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<tr>
<th>Region</th>
<th>2050 vs 2011 low demand</th>
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<tbody>
<tr>
<td>Developing Asia</td>
<td>53%</td>
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<tr>
<td>OECD Europe</td>
<td>11%</td>
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<tr>
<td>EITs</td>
<td>8%</td>
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Iron & Steel - Energy use

Fuel share in energy use change

<table>
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<tr>
<th>Fuel</th>
<th>2050 2DS vs 6DS</th>
<th>Low demand</th>
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<tbody>
<tr>
<td>Coal</td>
<td>-6%</td>
<td></td>
</tr>
<tr>
<td>Oil</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>+1%</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>+5%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
<td></td>
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Note 1: Other includes: heat, combustible biomass, waste and other renewables.
Note 2: Energy use includes blast furnaces and coke ovens.
Iron & Steel - Direct CO\textsubscript{2} emission reductions

**Iron & Steel - CO\textsubscript{2} emissions 6DS vs 2DS**

- China
- India
- Other Developing Asia
- Non-OECD Latin America
- Africa
- Mideast
- OECD America
- OECD Europe & Israel
- OECD Pacific
- Economies in Transition (including Russia)

<table>
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<tr>
<th>Major CO\textsubscript{2} emission reduction contributions</th>
<th>6DS vs 2DS (2050) low demand</th>
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<tbody>
<tr>
<td>China</td>
<td>27%</td>
</tr>
<tr>
<td>India</td>
<td>20%</td>
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<tr>
<td>EITs</td>
<td>15%</td>
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