

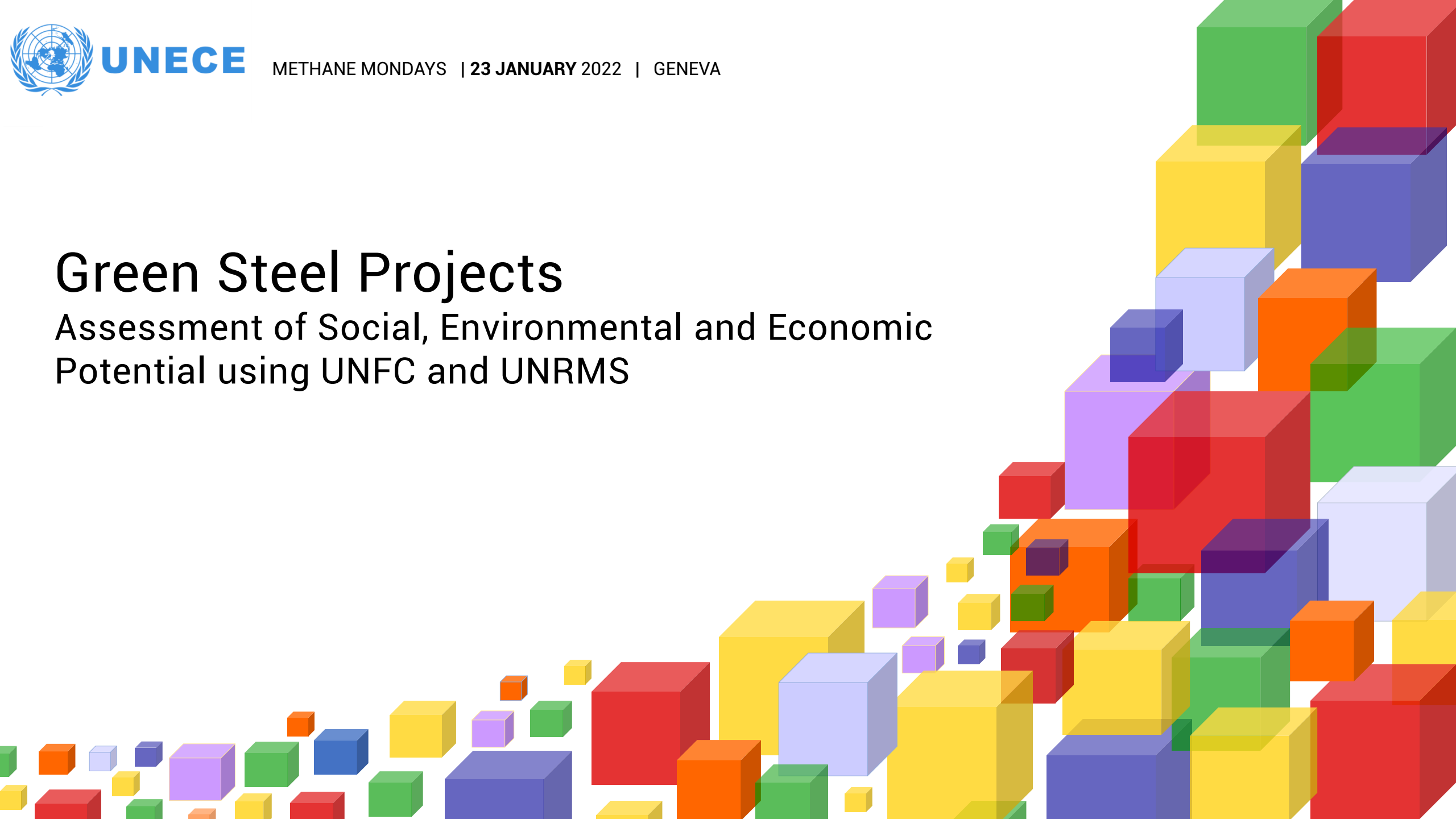


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METHANE MONDAYS | 23 JANUARY 2022 | GENEVA

Green Steel Projects

Assessment of Social, Environmental and Economic Potential using UNFC and UNRMS



Green steel production processes

Reduce environmental impact.

-
- Electric Arc Furnace (EAF) steelmaking
 - Direct reduced iron (DRI) production
 - Carbon capture and storage (CCS)
 - Hydrogen-based steelmaking
 - Recycling and circular economy



Where have projects been announced?



Amount of projects per company and country

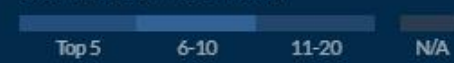


Project scale

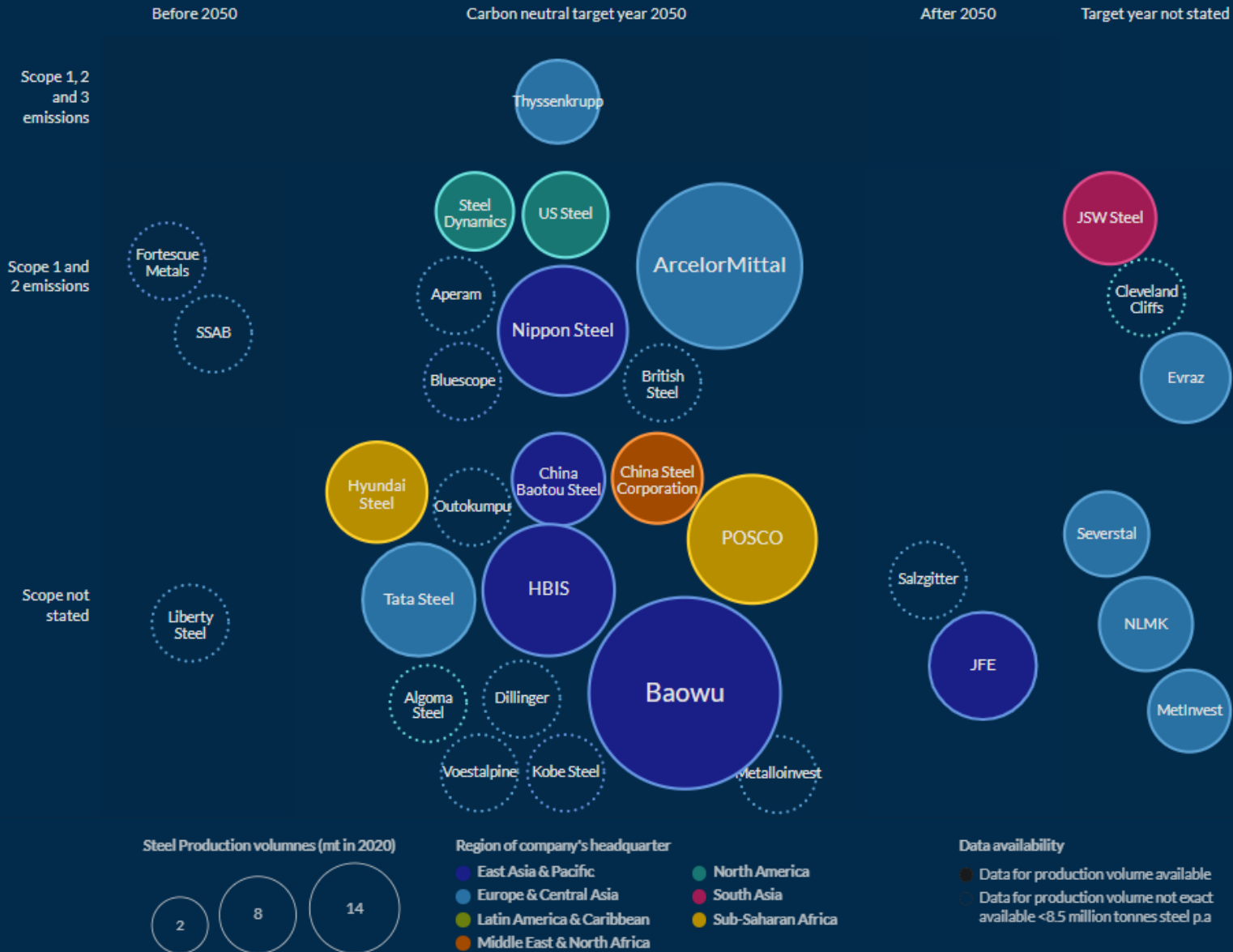
- Full scale
- Pilot

- Demonstration plant
- R&D partnership

Amount of projects per country



When is the steel industry carbon neutral?



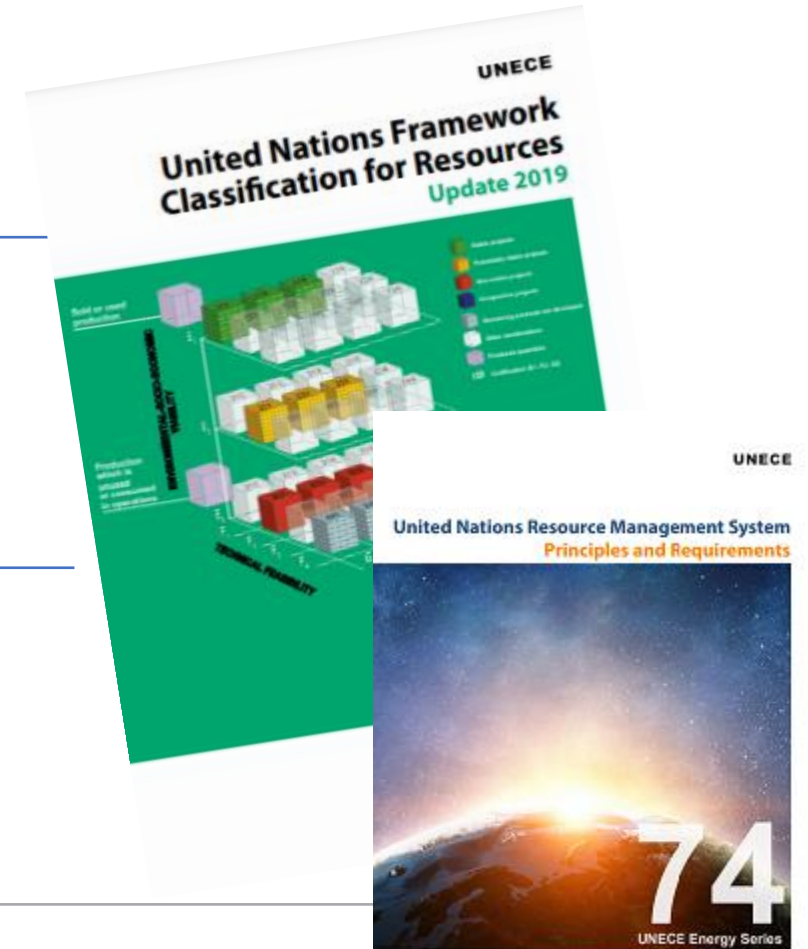
UNFC & UNRMS Toolkit

Build Forward Better, Manage Sustainably

Integrated and sustainable management of natural resources is critical to meeting universal needs.

Resources must be managed as a **public good** to achieve key SDGs.

UNFC and UMRMS provide the right information and tools to **manage natural resources**.



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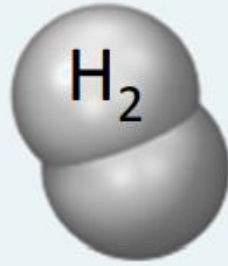


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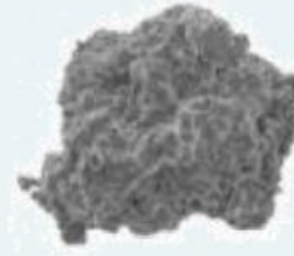
Iron ore pellets

+



Hydrogen

=



Sponge iron

+



Water

SSAB HYBRIT Project, Sweden

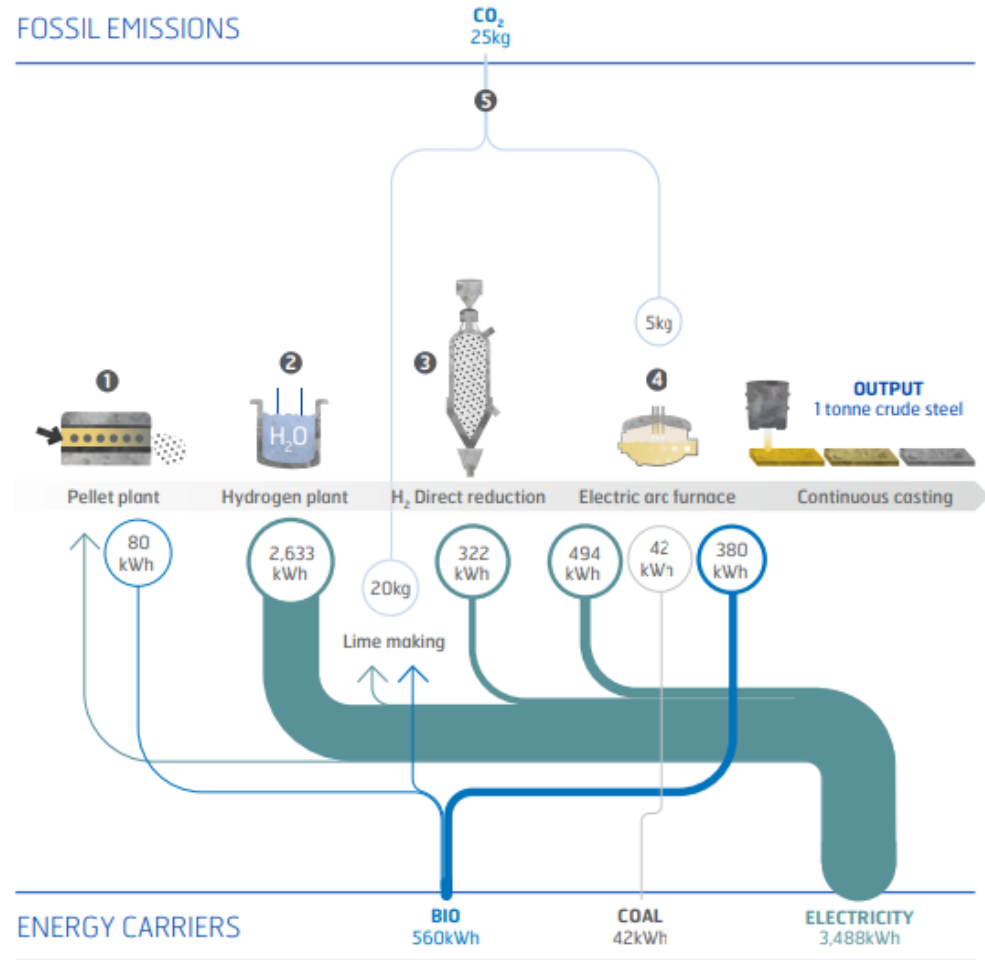
- HYBRIT, acronym for Hydrogen Breakthrough Ironmaking Technology, is a development project with the aim of implementing fossil-free steelmaking in all stages of production; from iron-ore extraction, through pelletisation and reduction (iron-making), to the final steelmaking (in electric arc furnaces).
- Fossil free electricity production for hydrogen production for
 - parts of the mining and processing of iron ore (pelletisation).
 - direct reduction of iron ore
 - electric arc furnaces (for melting of sponge iron and adding materials, most notably carbon, to make steel)

E axis

- PRODUCTION COSTS SEEM VIABLE Considering current cost levels, an iron- and steelmaking value chain based on the HYBRIT concept would result in a **20 to 30 per cent increase in the cost of producing crude steel.**
- This innovation is **probably only viable under conditions of (global) ambitious climate policies, which require more than 80 % reduction of greenhouse gas emissions before 2050**, since that would require that at least CCS be implemented on all primary steelmaking.
- **No unintended consequences can be identified at this stage.**
- E 2

HYBRIT

FOSSIL EMISSIONS



All numbers per tonne of crude steel.

F axis

- The prefeasibility study results underline that **no major, previously unknown technical obstacles have been identified.**
 - Nevertheless, considerable **future development efforts will be required** to realise and verify the concept, and to handle risks. These include fundamental research projects using models and laboratory scale experiments, as well as trials in pilot and demonstration plants.
 - Considering current cost levels, an iron- and steelmaking value chain based on the HYBRIT concept would result in a **20 to 30 per cent increase in the cost of producing crude steel**
 - Large-scale hydrogen production and storage is also planned to be built and following the pilot plants, 2 demonstration plants are envisioned before commercialisation in 2042.
 - The mining and pelletisation is not envisioned to be fossil free until 2045.
- F 2.1

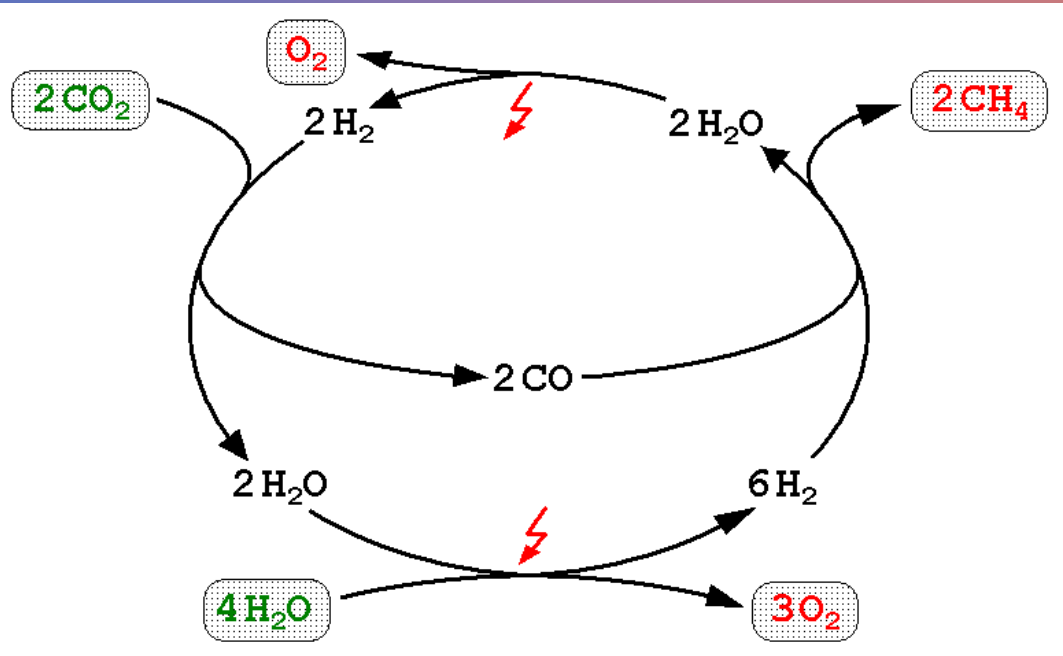
G Axis

- 3 plants to be converted to HYBRIT process by 2045
- EAC at SASB Oxelösund and Demo of HYBRIT at Oxelösund by 2025 – 1 million tonnes/a (G2)
- SSAB Raabe conversion to HYBRIT by 2045– 4.9 million tonnes/a (G3)
- SSAB Luleå conversion to HYBRIT by 2045 – 3.6 million tonnes/a (G3)



Revolutionizing Steel Production

Takeaways from UNFC-UNRMS case study



P2G technologies

Produce more energy than they consume through the development of clean technologies – e.g waste energy to H₂, SNG etc.

Cost-Savings

“Comprehensive resource recovery” – fewer virgin materials, carbon offsets advantages etc.

Diverse locations

Smaller capacities, availability of RE, H₂, recycled materials, possibilities for P2G, and rise of new megacities.

Please Join

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- UNRMS: Sustainable Resource Management Transformation Pathway
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25-28 April 2023

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Thank you!

Hari Tulsidas
Economic Affairs Officer

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Date 23 | 01 | 2023, Geneva

