

SSAB:n matka kohti fossiilivapaata terästä

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VUORIMIESYHDISTYS —
BERGSMANNAFÖRENINGEN r.y.

SSAB

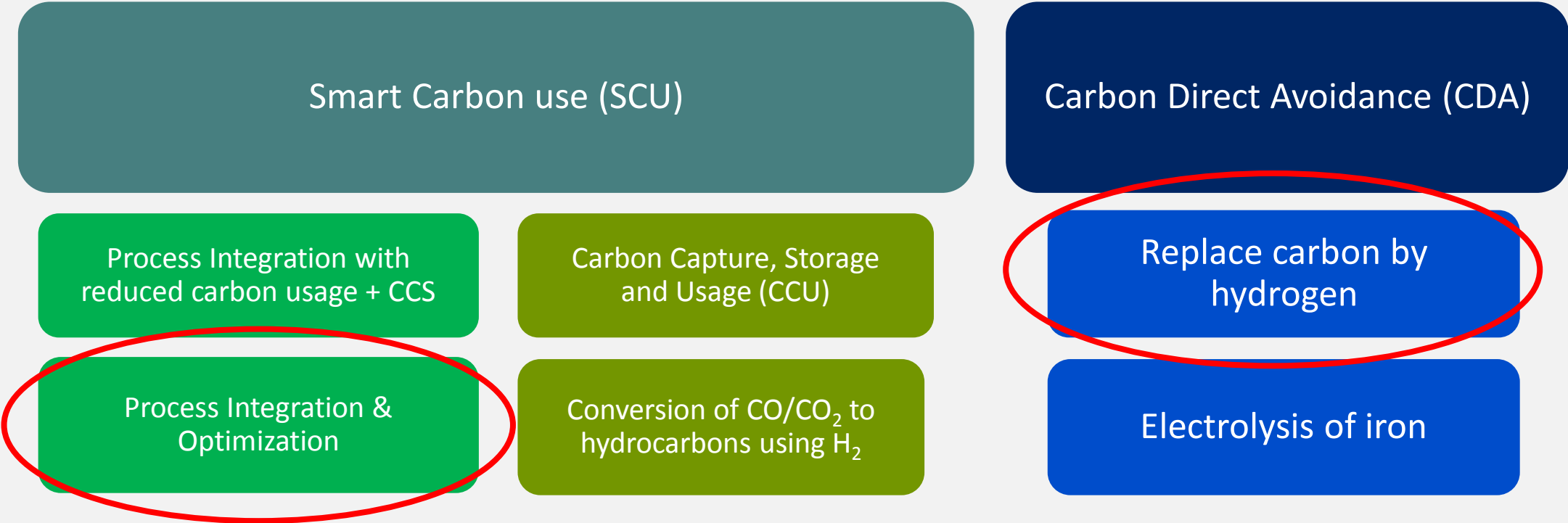
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An aerial photograph of a densely populated city at night, with numerous skyscrapers and buildings illuminated. A semi-transparent blue rectangular overlay covers the center of the image, containing white text. The city lights create a vibrant, textured background.

Fossil-free steel in 2026
Fossil-free company by 2045

FIRST IN
F  **SSIL**
FREE
STEEL

Pathways of European Steel Industry to low CO₂ steelmaking



SSAB first to launch hydrogen based DRI-EAF technology initiative, others in Europe are now following the same path

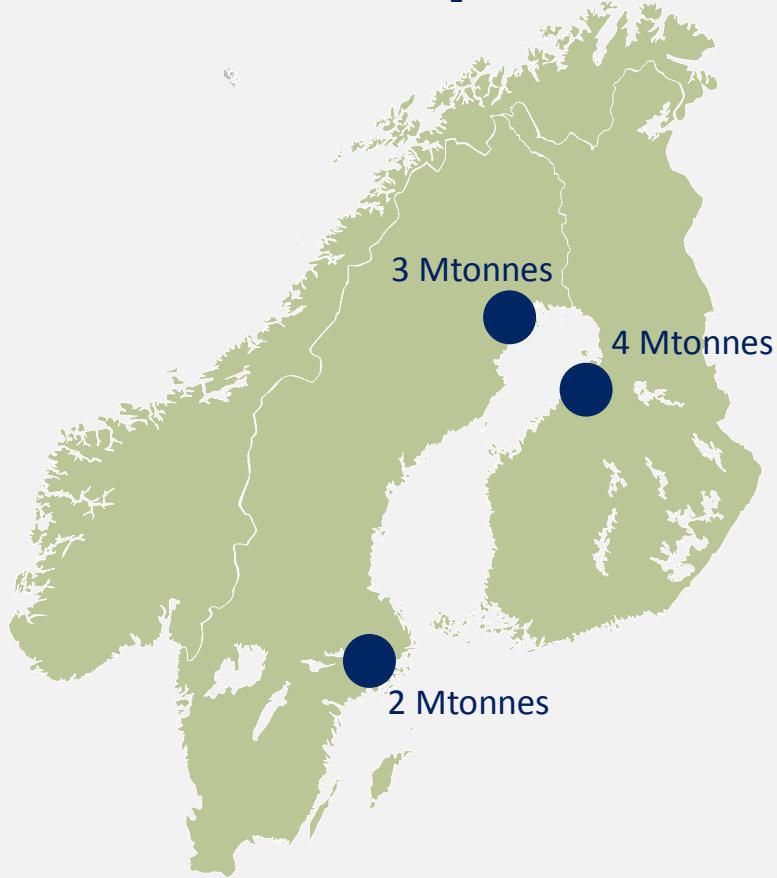
HYBRIT

▶▶▶ FOSSIL-FREE STEEL

A joint venture between SSAB, LKAB and Vattenfall

HYBRIT – Hydrogen Breakthrough Ironmaking Technology

SSAB blast furnaces – CO₂ emissions



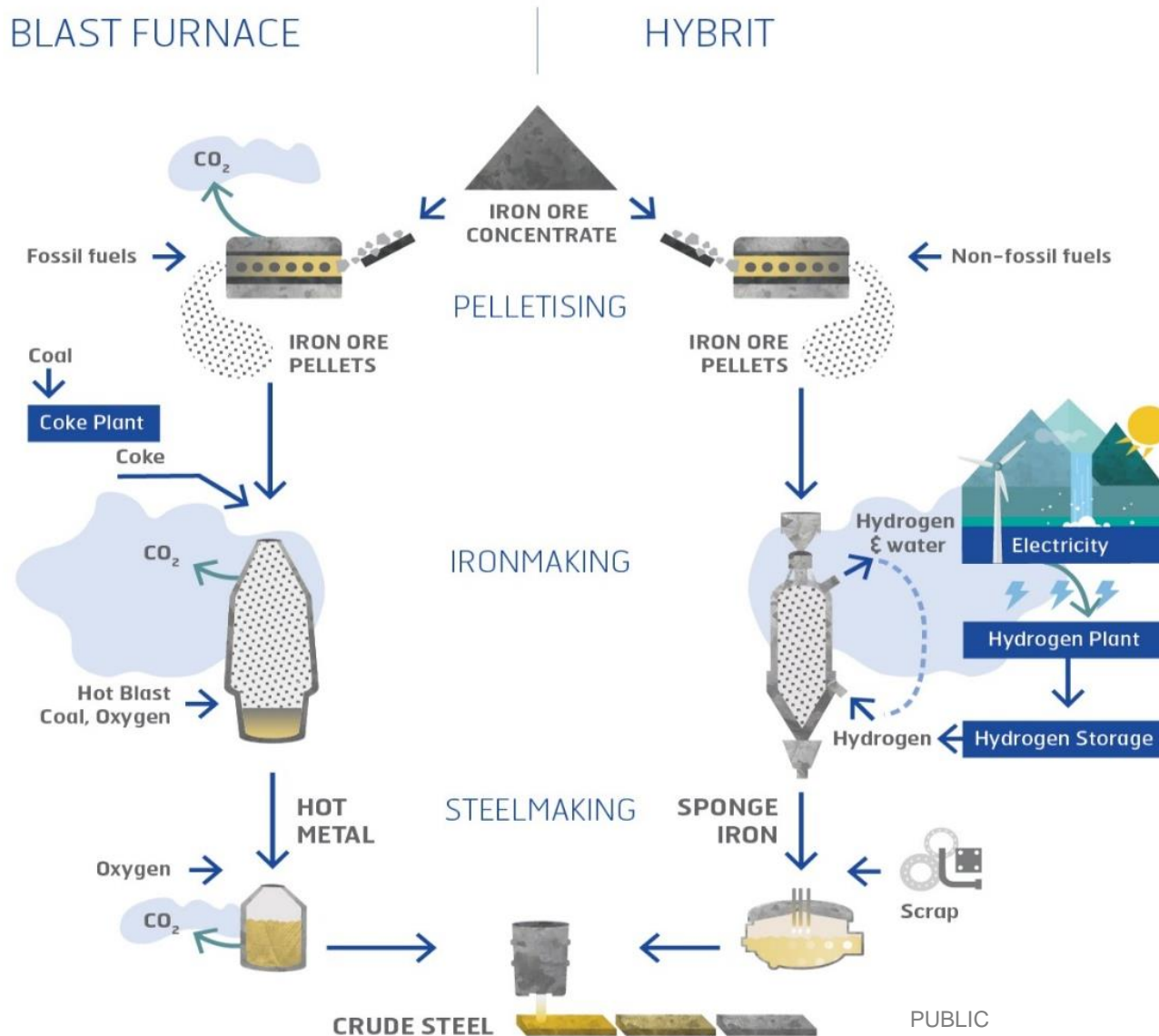
Background

- ▶ Despite being the world's most CO₂-efficient steelmaker, SSAB still accounts for 10% of Sweden's and 7% of Finland's total CO₂ emissions
- ▶ Sweden has a large surplus of fossil-free electricity, and a large potential to build more
- ▶ Sweden and Finland – world-leading R&D competence

Breakthrough low-CO₂ iron and steel production initiatives with CDA pathway

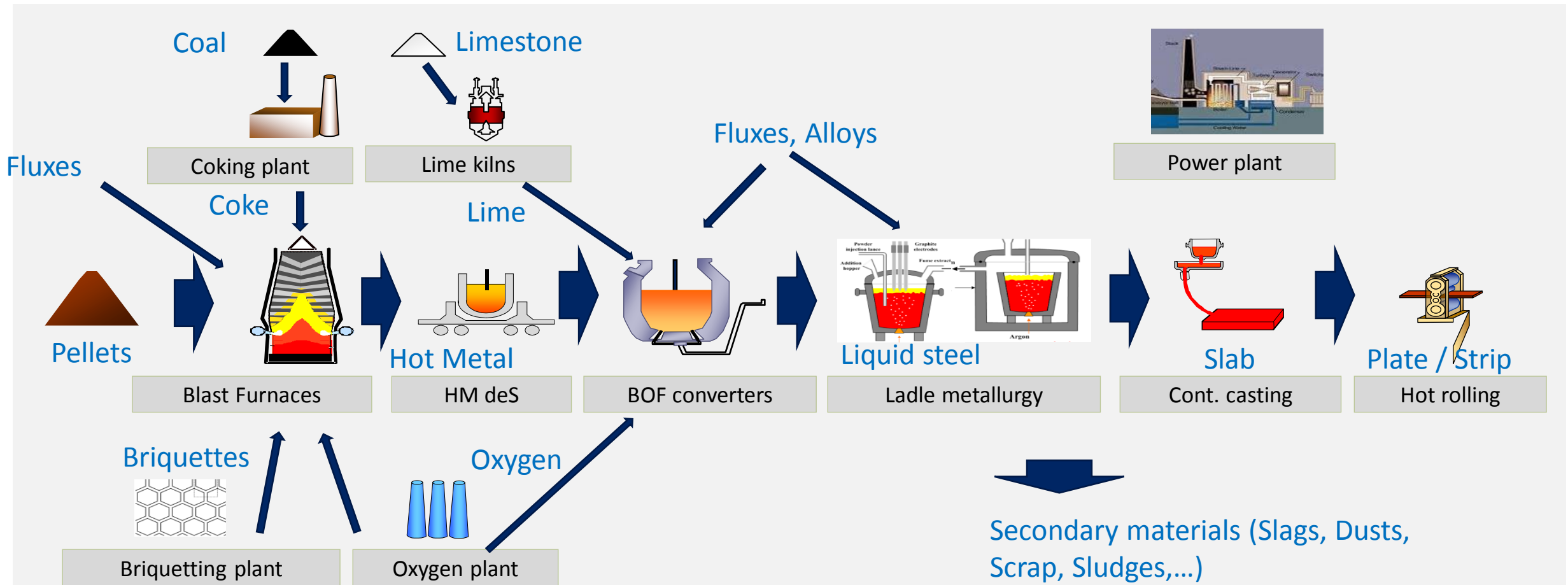
| Initiative | Description | Actors | Actions |
|--------------------|--|------------------------------------|--|
| HYBRIT | Direct reduction of iron ore with H ₂ , EAF steelmaking | SSAB, LKAB, Vattenfall | Demo plant under construction at Luleå, Sweden |
| SALCOS | H ₂ based DRI-EAF steelmaking, linked with GrInHy H ₂ production project | Saltzgitter, Fraunhofer | Demo plant under construction in Saltzgitter, Germany |
| SUSTEEL / H2FUTURE | DRI-EAF steelmaking, Hydrogen Plasma Smelting Reduction (HPSR process) | Voestalpine, K1-MET Primetals, MUL | Laboratory scale tests at voestalpine Donawitz, PEM H ₂ electrolysis plant at Linz, Austria |
| IN4Climate | BF process with H ₂ reduction, DR-EAF route | Thyssen, AirLiquide | Tests at Thyssen Duisburg, Germany |
| SIDERWIN | Steelmaking through reduction of iron oxides with electrolysis | ArcelorMittal, 12 research units | H2020 project |

Concept of HYBRIT hydrogen based steelmaking

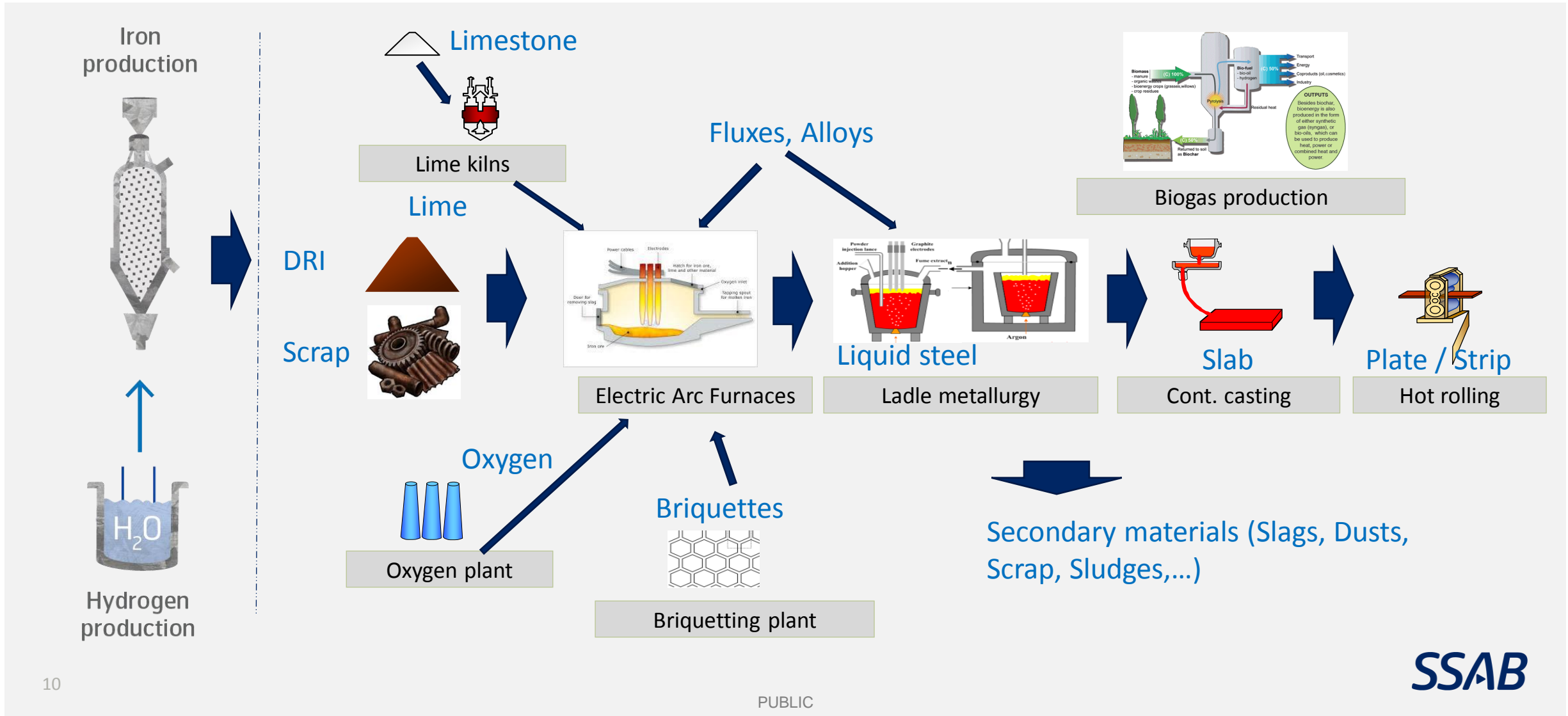


| SSAB Raahе | Today | Future |
|---|-------|----------|
| Fossil CO ₂ emissions, Mt/a | 4 | 0 |
| % of CO ₂ emissions in Finland | 7 | 0 |
| Electricity, TWh/a | 0,8 | 2-12 |
| Coal, kt/a | 1560 | 0 |
| Biogas, TWh/a | 0 | 0,4-1,4 |
| Biocarbon, kt/a | 0 | 43 |
| Hydrogen, MNm ³ /a | 0 | 0 - 1300 |

SSAB Raahe Iron and Steelmaking Process

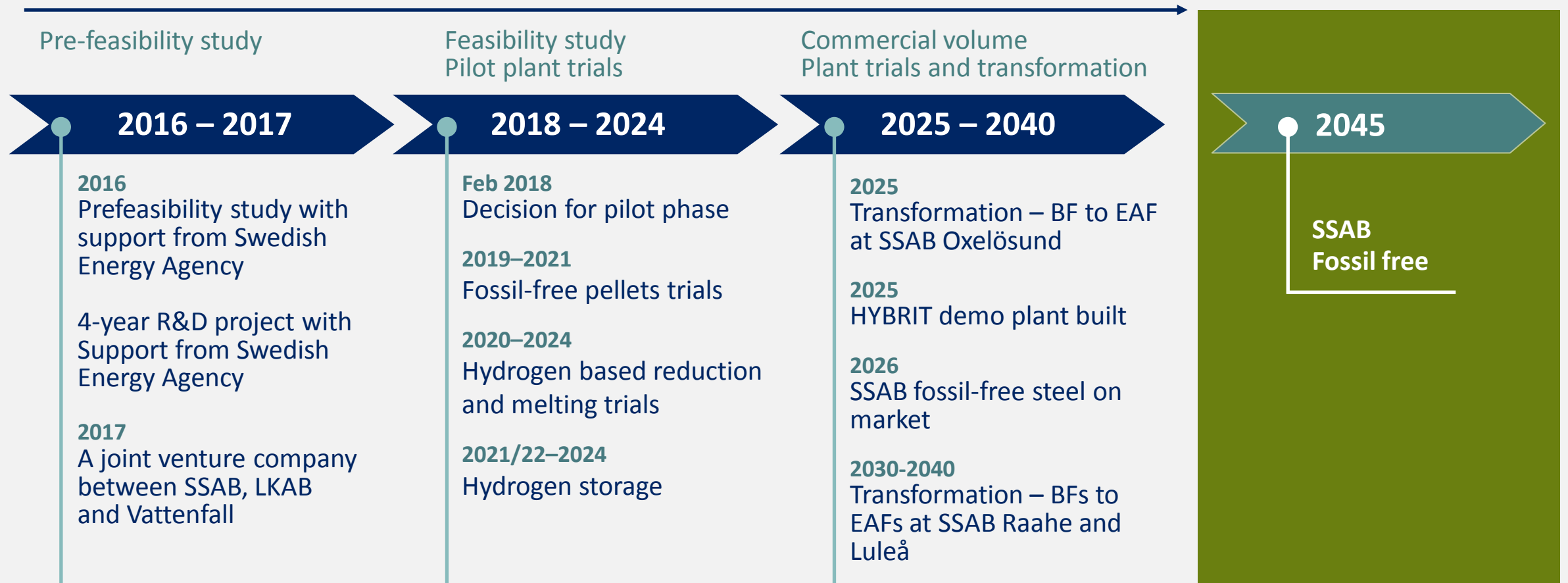


SSAB Raahe process with HYBRIT concept



Roadmap to be first in fossil-free steel

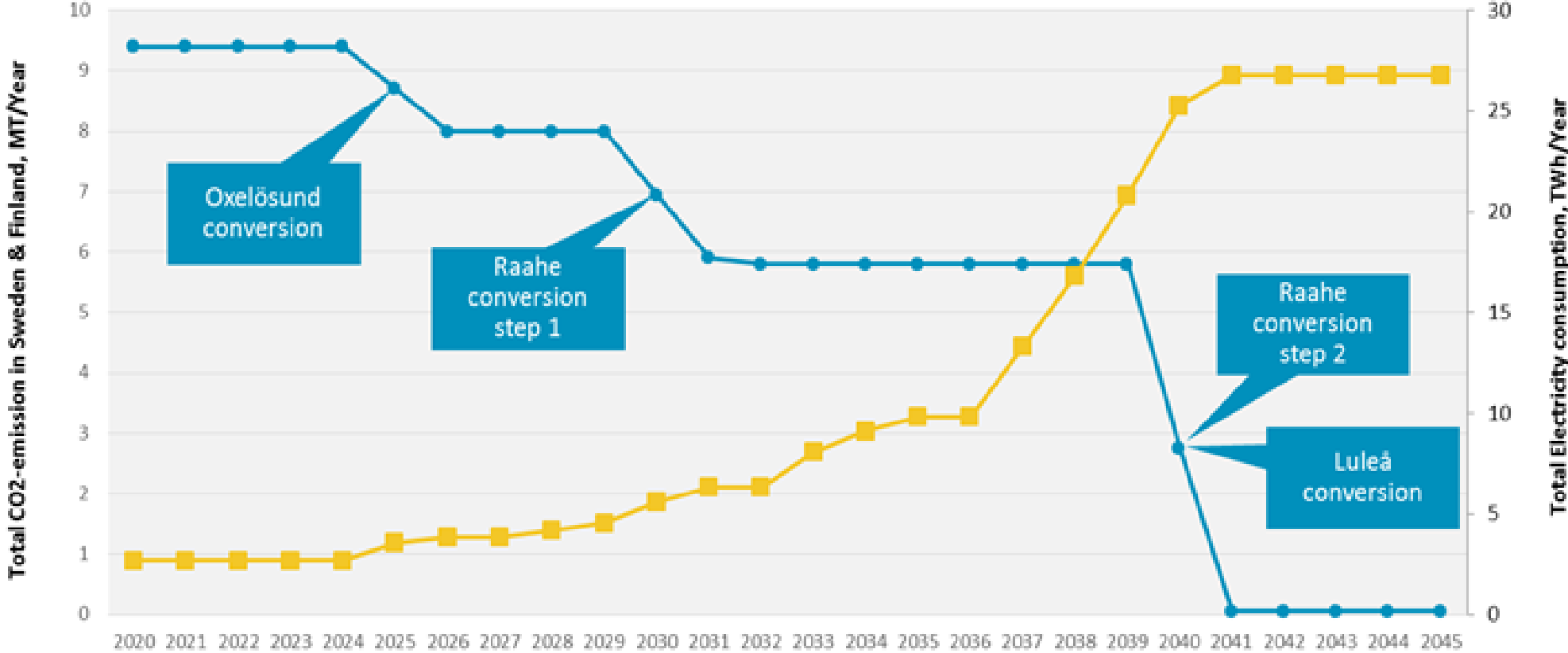
Faster transition possible depending on customer demand



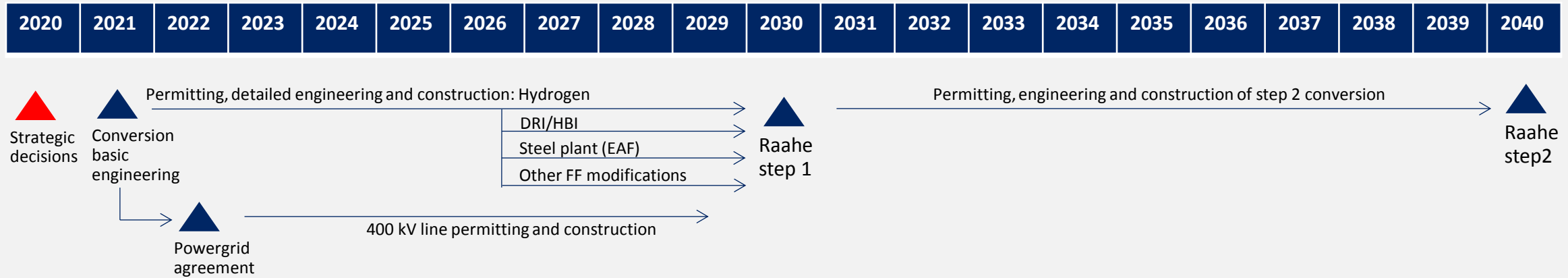
BF = blast furnace, EAF = electric arc furnace

SSAB's timeline to be fossil free by 2045

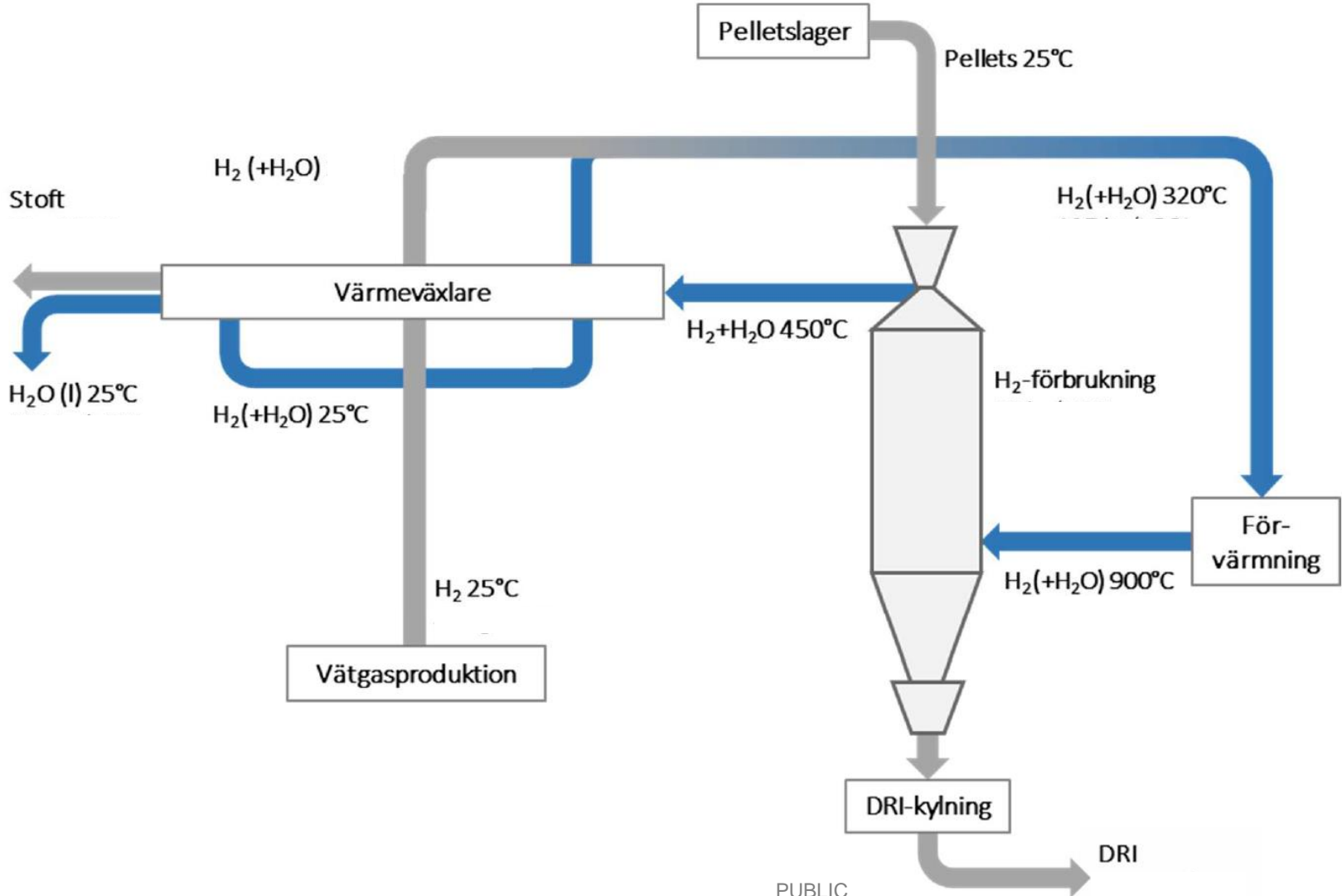
Fossil-free electricity replaces coal & coke



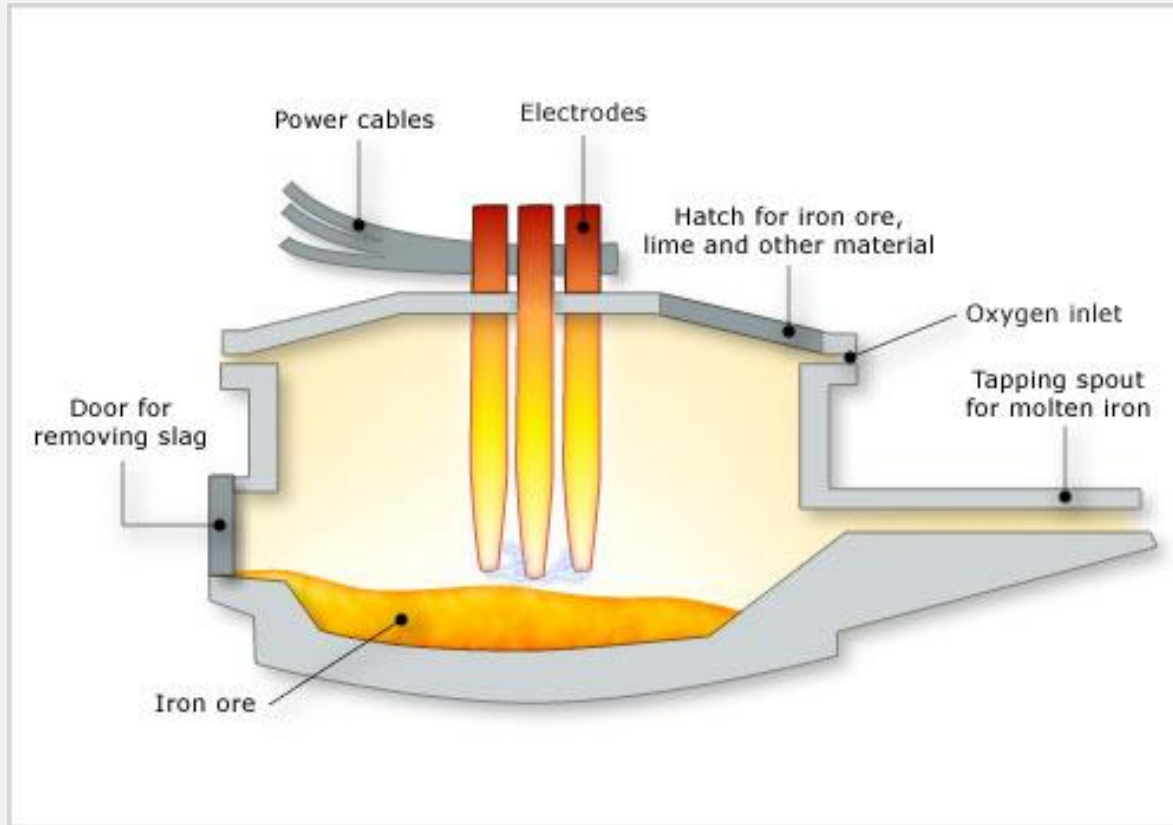
Raahe conversion



Shaft Furnace for direct reduction of iron ore with H2



Electric Arc Furnace (EAF) for smelting of scrap & DRI



2040 need for biogas

| Process | Current gas source |
|--|--------------------|
| Slab reheating for plate rolling | COG |
| Slab reheating for strip rolling | COG + LNG |
| Continuous casting and slab delivery | LPG |
| EAF gas burners, scrap preheating | - |
| Steelmaking, reheating of refractories | COG |
| Lime kilns (Nordkalk) | COG |
| Power plant | BFG, COG, LNG |
| Total | 1.4 TWh |

Need for biogas can be reduced by electrification of processes

COG – coke oven gas

LNG – liquid natural gas

LPG – liquid petroleum gas

BFG – blast furnace gas

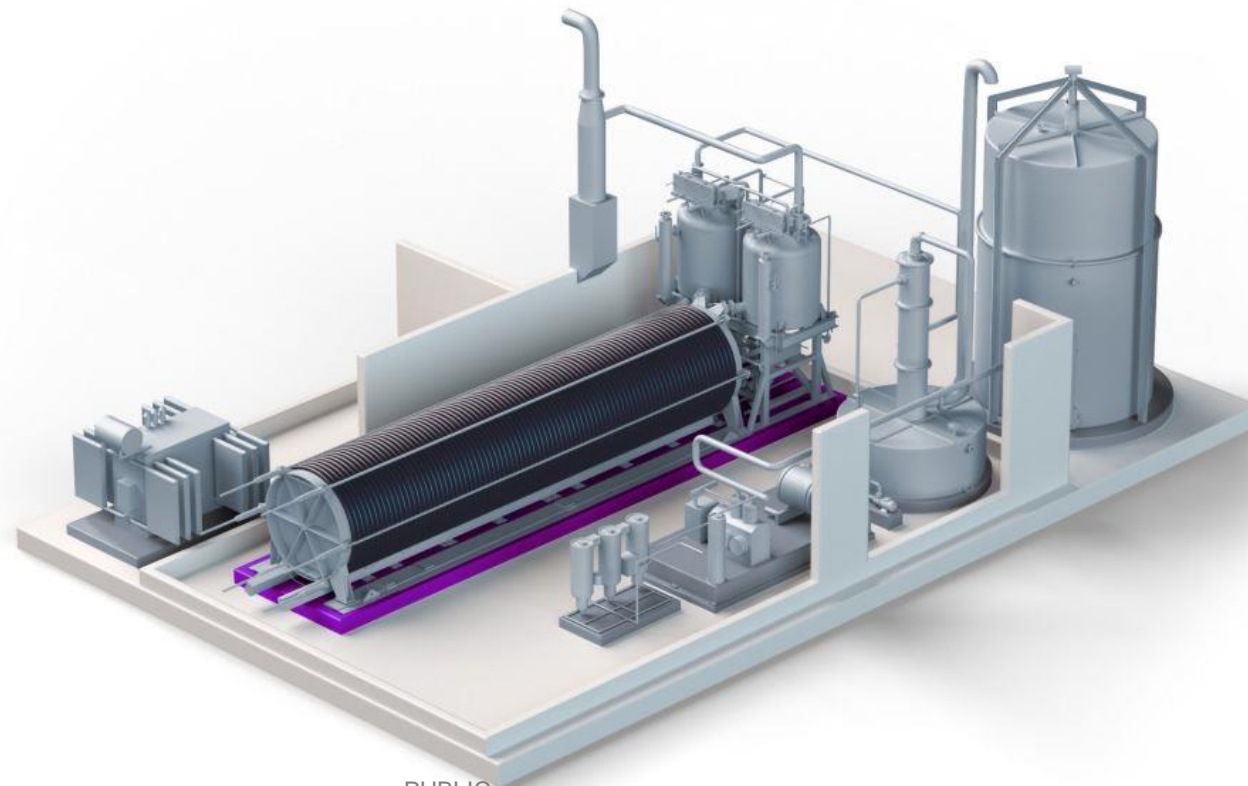
Largest available electrolyser unit 2020

1,3 Mt DRI
production
consumes
120000 Nm³/h

This can be
reached with
250pcs
A485 units by nel

Typical delivery / typical layout

A485 – 1 unit – 485 Nm³/hour / 2,2 MW



nel

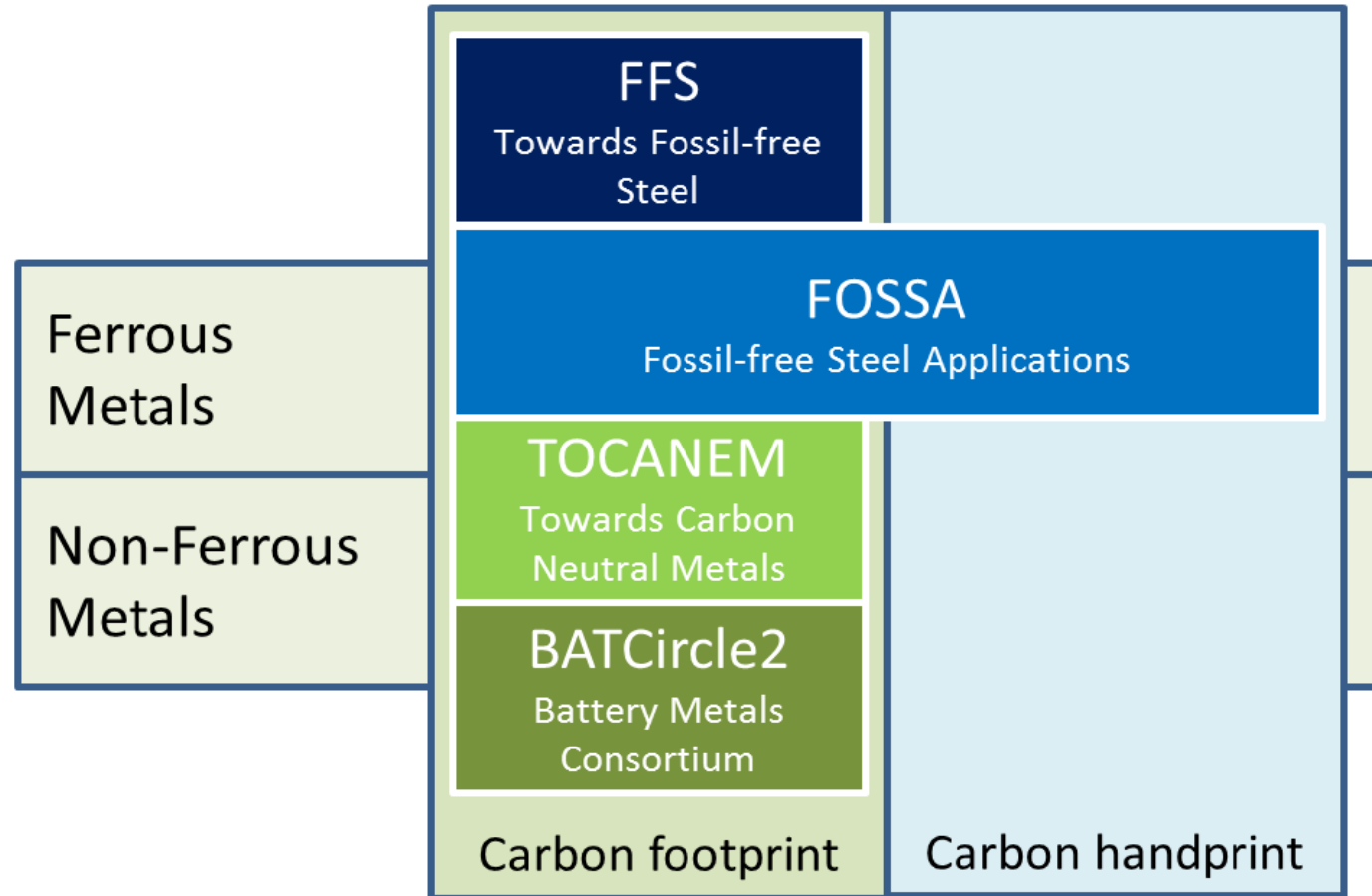
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Hydrogen production for 1,3 Mt/a DRI production

Basic facts based on the study

| | Design parameters |
|---------------------------------|---|
| Hot DRI production | 1,3 Mton/a |
| Nominal hydrogen consumption | 700 Nm ³ /tDRI = 116 000 Nm ³ /h |
| Large scale ALK plant | 250 pcs electrolysers |
| Power consumption | 4,4 kWh/Nm ³ H ₂ , 560 MW |
| Power supply | 600MVA/20 kV, 4.2 TWh/a |
| Buildings (no heating needed) | 40 000 m ² (200x200m) |
| Hydrogen compression to 10 bar | Multiple compressors |
| Power supply 400kV->110kV->20kV | Trafos + switchgears |
| Water treatment plant | 1litre/Nm ³ H ₂ =120m ³ /h |

Metallinjalostajat Strategic Research Agenda



SSAB's R&D in fossil free steelmaking planned in FFS and FOSSA projects 2021-2024

**HYBRIT pilot plant opened
in Luleå, Sweden in
summer of 2020**



SSAB



*A stronger,
lighter and more
sustainable world*