

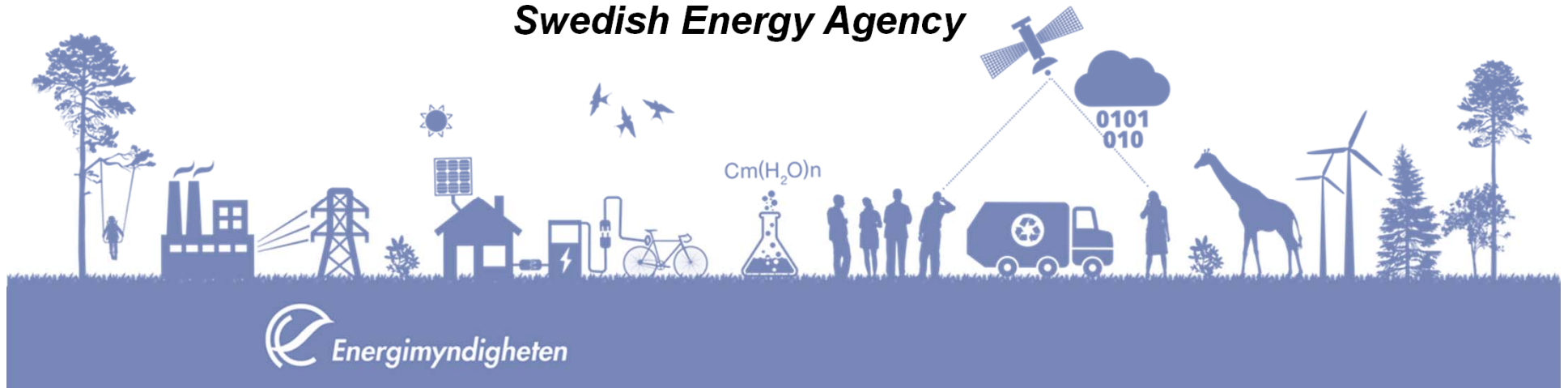
# Electrification of Industries – Swedish examples

29 Nov 2016

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***Head Sustainable Industry unit  
Dept. of Research & Innovation***

***Swedish Energy Agency***



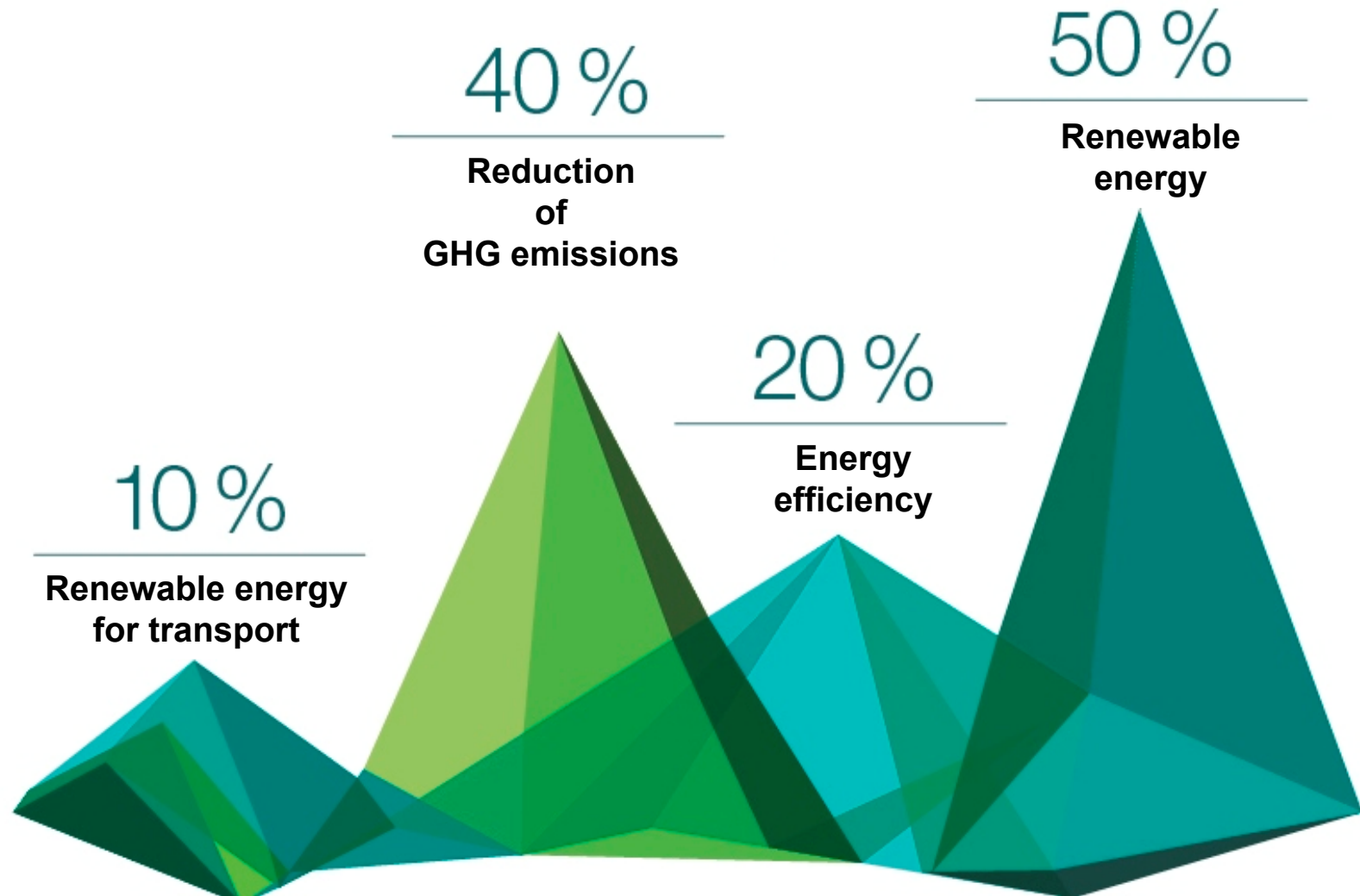
# About the Swedish Energy Agency

- National authority for energy policy issues
- Sorts under Ministry of the Environment and Energy
- The Director-General is appointed by the Government
- Government funded
- Around 370 employees, Eskilstuna

# Roles: Steering, supporting and expert

- **Steering** – enforces governmental and parliamentary decisions
- **Supporting** – disseminates information within the energy and climate area and grants financial support to research and innovation
- **Expert** – provides the public, the Government and the research domain with data (statistics, analyses, scenarios and forecasts)

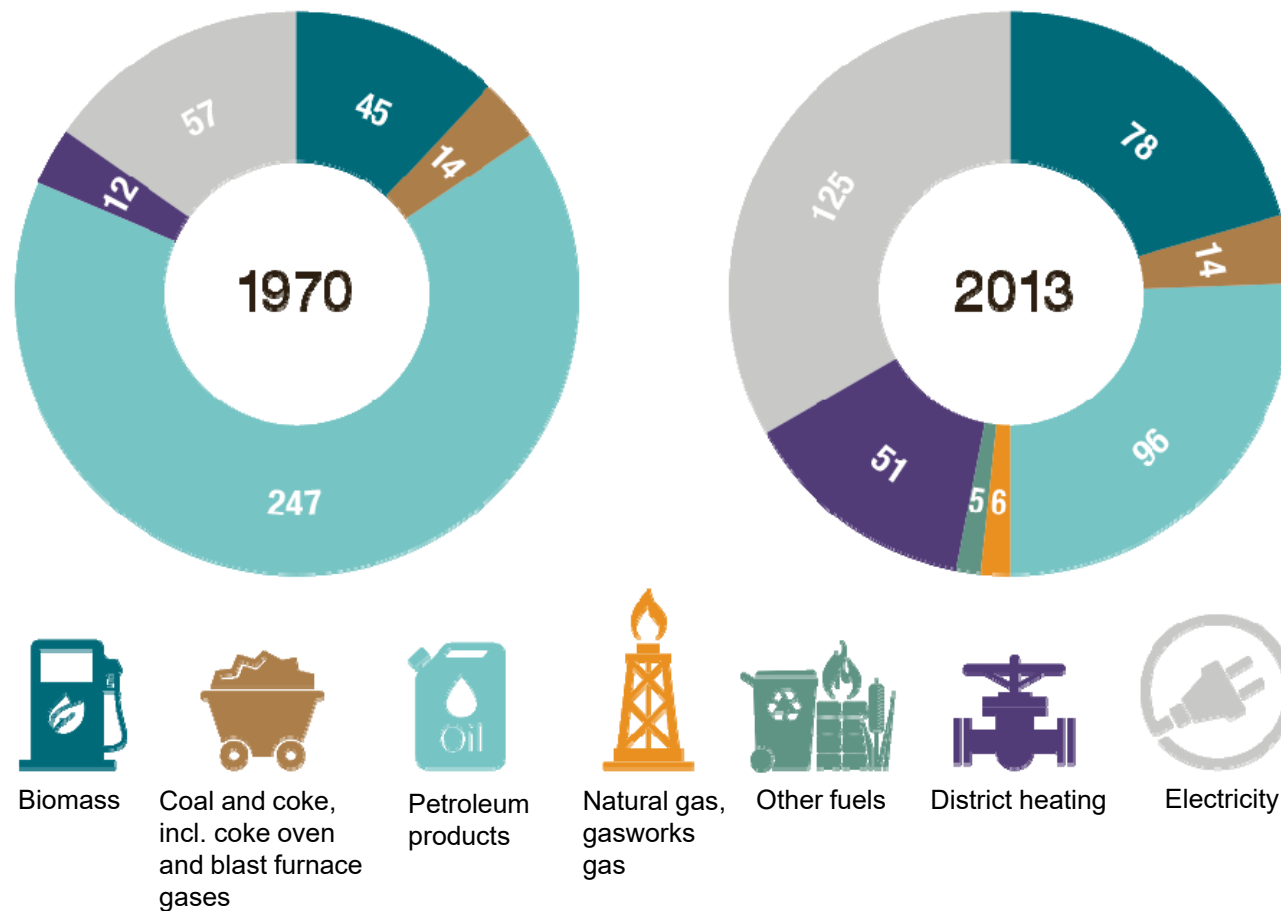
# Swedish energy policy targets for 2020



# Sweden today

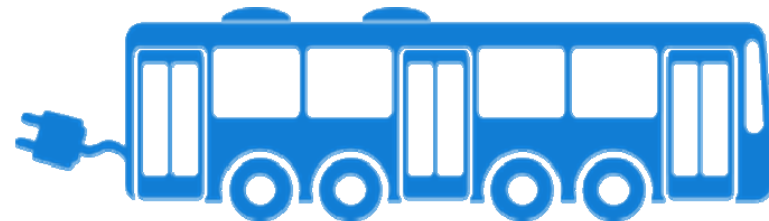
- Almost fossil-free electricity production
- Almost fossil-free heat production
- Energy intensive industry, energy use per value has decreased

# Comparison of energy use, 1970 and 2013



# Future challenges for Sweden

1. 2050 vision: No net GHG emissions
2. Fossil independent vehicle fleet 2030
3. Energy efficiency 2030: NEW goal **50 % more efficient compared to 2005**
4. Secure energy supply
5. More diversified electricity supply
6. Electricity market for "prosumers"





# Energy Decarbonisation is Underway but Needs to Be Boosted



Foto: Volvo

Technology innovation  
is central to accelerate  
the energy transition





# Research and innovation funding

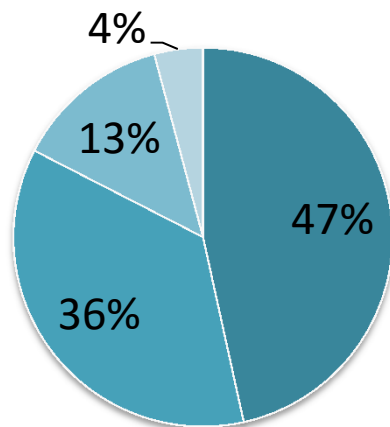
From basic research to demonstration and business development support

Annual budget approximately 140 million €

Almost doubled through private sector co-funding

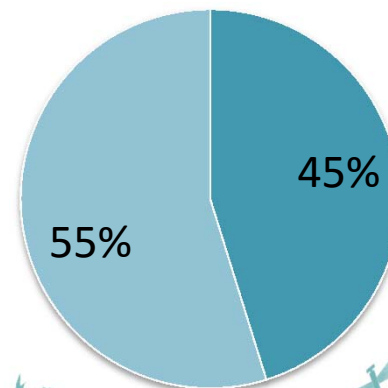
55 programmes and 1 000 projects running

In-house priority settings and strategy for public R&DD fundings



■ University  
■ Industry  
■ Research institute  
■ International projects

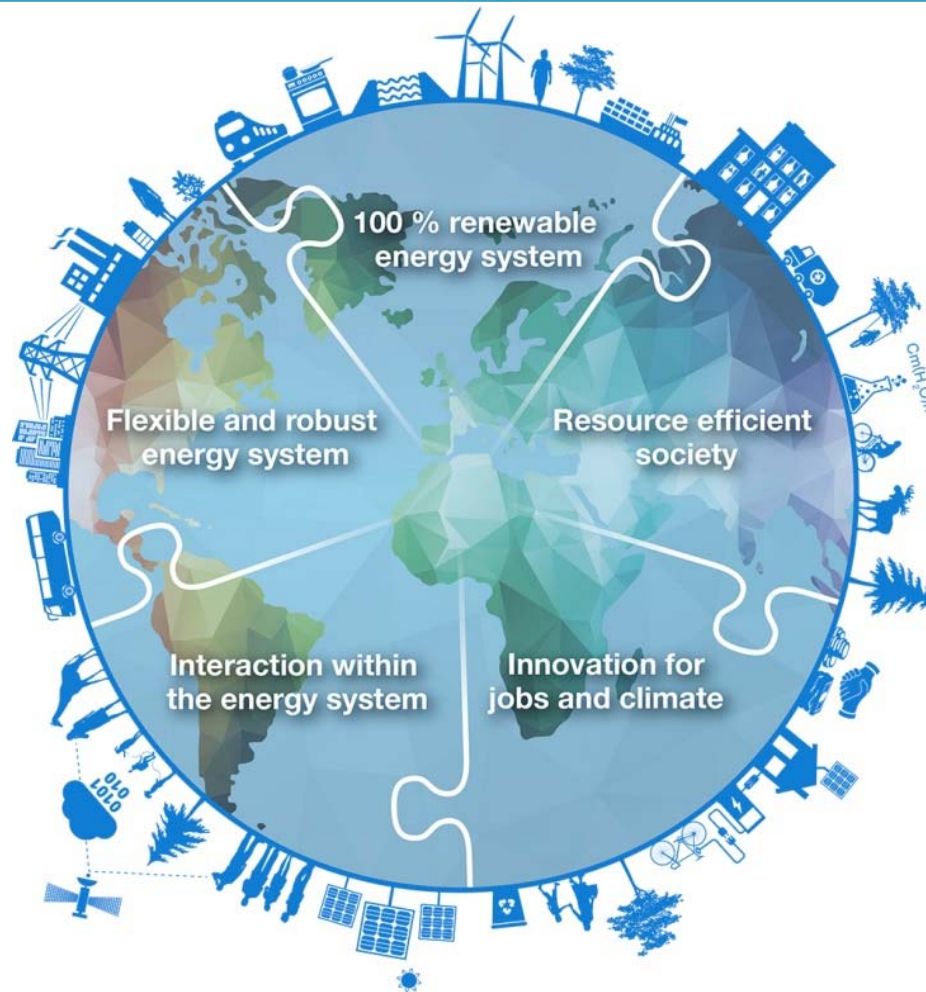
2014



■ Industry  
■ Swedish Energy Agency



# Energy Research & Innovation Grand Challenges





# HYBRIT – A Swedish national development project for CO<sub>2</sub>-free ironmaking

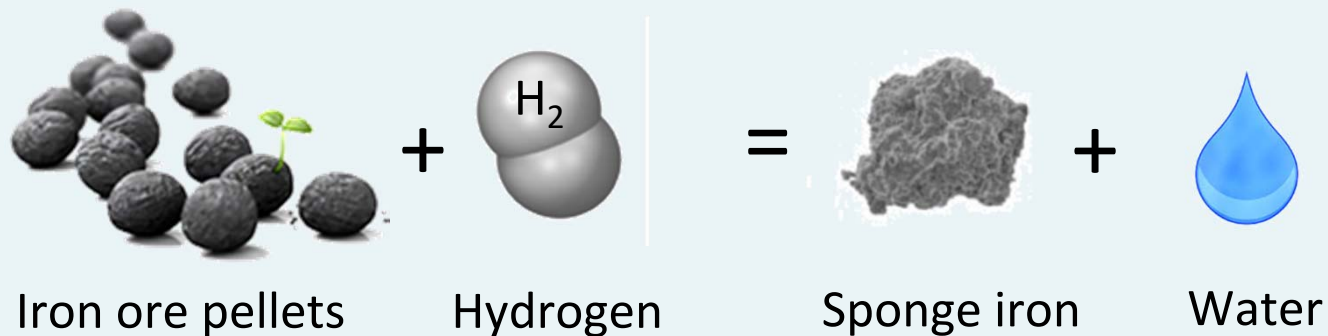
Martin Pei, EVP & CTO  
SSAB AB

November 14, 2016

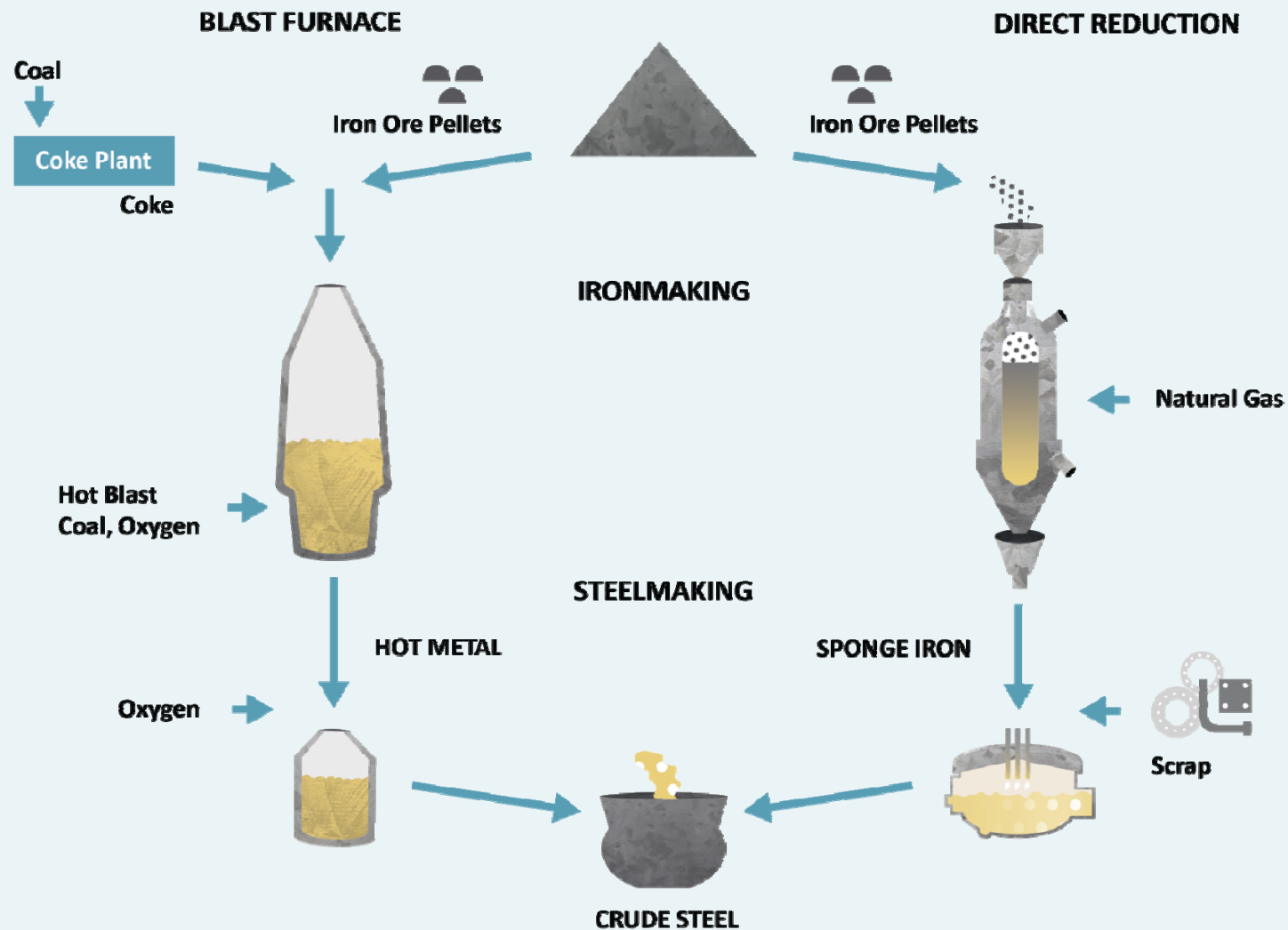
**SSAB**

# The HYBRIT-project

- CEOs of SSAB, LKAB and Vattenfall launched on April 4, 2016, a joint development project that, if proven feasible, can solve the root cause of the steel industry's CO<sub>2</sub> challenge.
- The aim is to replace the blast furnace and eliminate CO<sub>2</sub> emissions from ironmaking, by using hydrogen produced from “clean” electricity.
- The by-product from iron ore reduction would be **water**:



# Two main ways to make steel from iron ore today

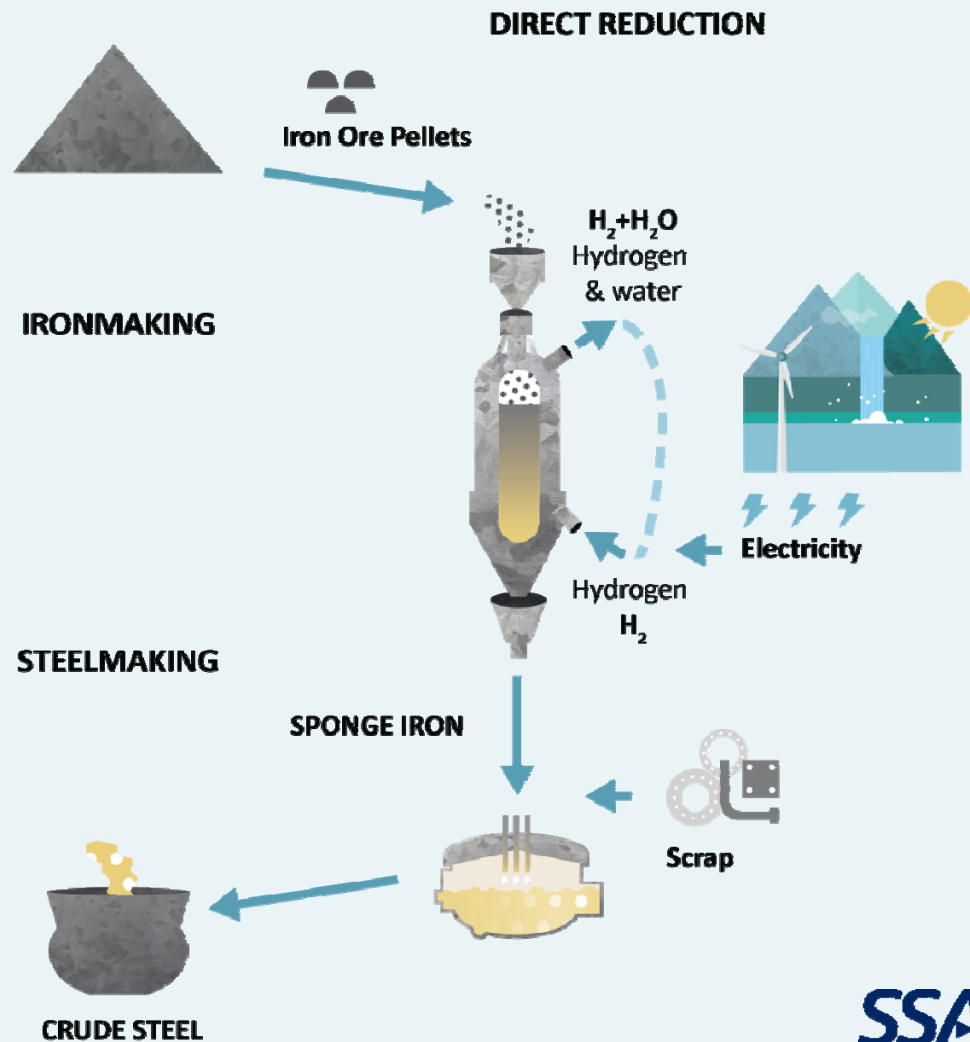


# HYBRIT: CO<sub>2</sub>-emission free ironmaking

Pre-feasibility study (PFS)  
2016-2017

Feasibility study:  
pilot plant trials  
2018-2024

Demonstration plant trials  
2025-2035



**SSAB**

# Important drivers behind the project

- A long tradition of developing iron ore reduction technologies
- An innovative steel industry specialized in high end products requiring clean raw material
- A leading iron ore mining industry delivering advanced BF- and DR-pellets
- A fossil-free electricity system with excess capacity
- A suitable R&D environment with universities, research institutes and efficient coordination through branch organizations
- A nation with high ambition to drastically reduce CO<sub>2</sub>-emissions: Sweden has the ambition to become the first welfare nation reaching zero emission already 2045



# Long term support is needed to succeed

Long term support is needed in all phases of development work, as well as in enabling competitive conditions and energy policy

- ▶ The Pre-Feasibility Study (HYBRIT PFS):
  - Ongoing project of 13.4 MSEK, July 2016-December 2017, with 50% financial support from Swedish Energy Agency
  
- ▶ Application at MISTRA - The Swedish Foundation for Strategic Environmental Research's funding call "Transformative changes in society to achieve challenging climate goals":
  - HYBRIT RP1, currently under evaluation, 4 year research program of 102 MSEK
  
- ▶ Pilot plant trials planned during 2018-2024:
  - Significant needs for financial support expected
  - Both at national level in Sweden and at European Union level necessary

# Probiostål – biomass gasification in powder steel production

- Project owner: Cortus AB
- 6 MW demo plant will be built at Höganäs
- Biomass to replace coke and natural gas
- Project cost: around 90 million SEK
- 8 companies involved (forest companies, suppliers, steel industries)

# WoodRoll® – Versatile green Energy gas

WoodRoll® is a unique technology that replaces fossil energy by efficient gasification of biomass that produces green energy for vehicles, industry and power generation.

## Feedstock

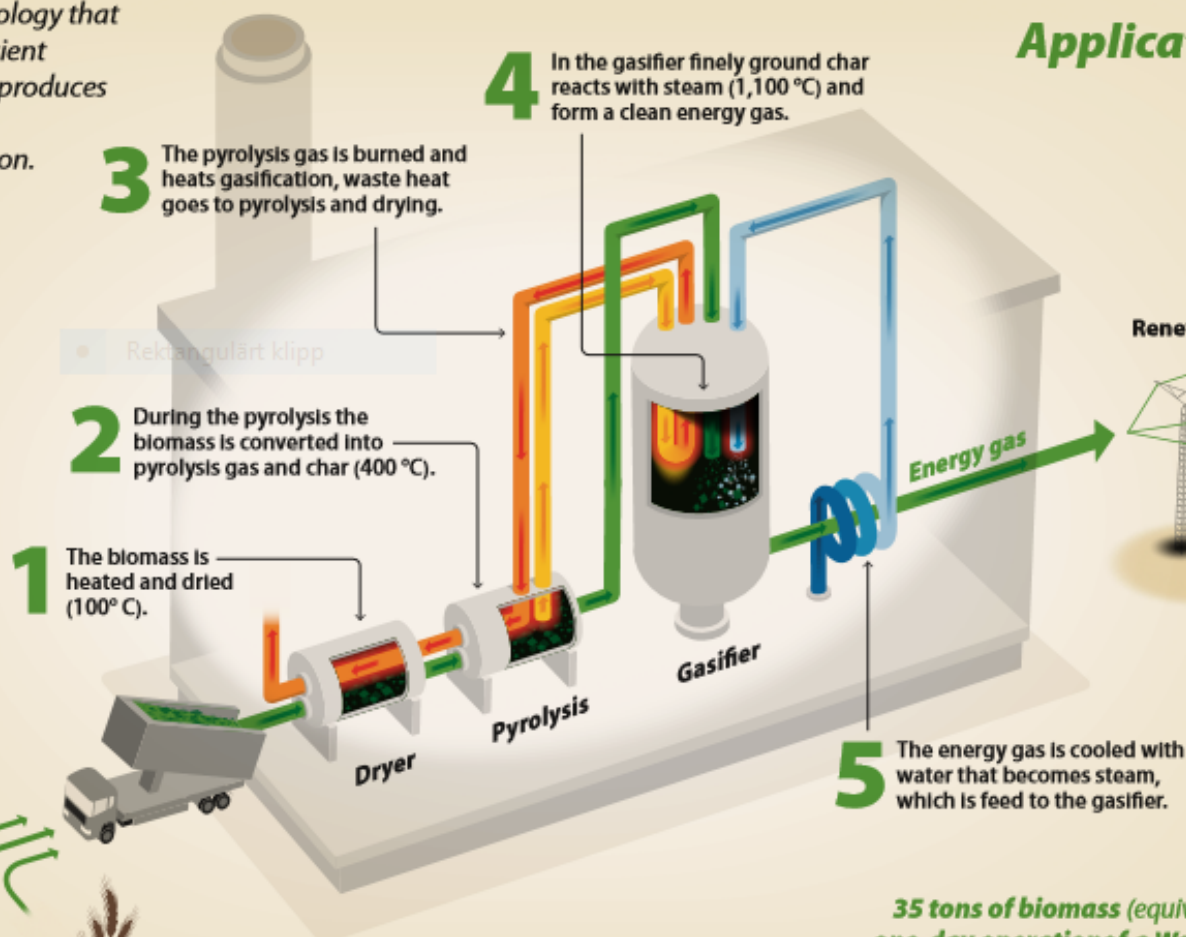
**Forest-based feedstock**  
such as forest residues  
and energy crops.



**Waste from industry**  
such as fiber sludge and  
construction waste.



**Agricultural waste**  
such as animal manure  
and crop residues.



## Applications

**Biogas**



**Renewable power**



**Hydrogen**



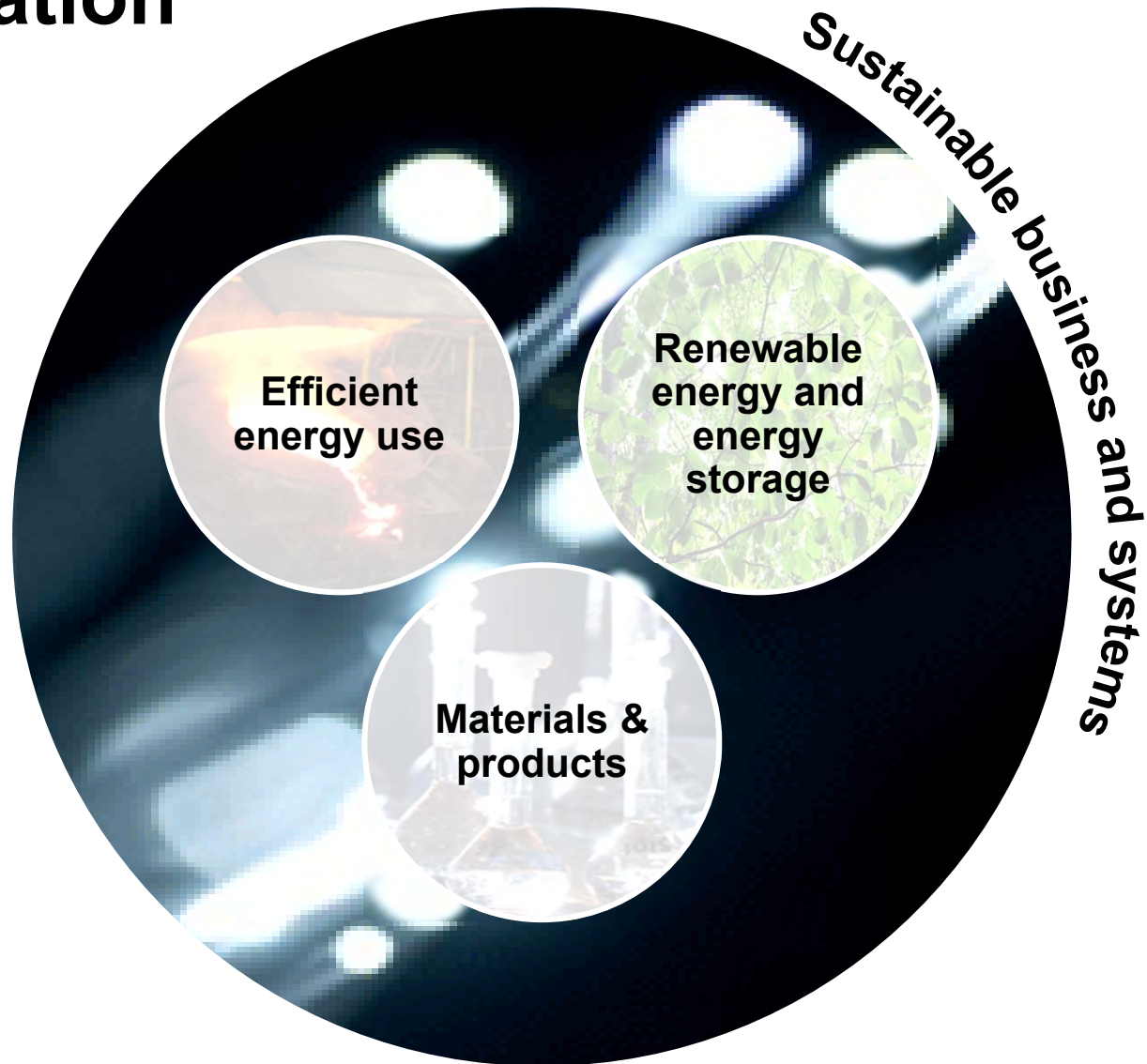
**Industry**



**35 tons of biomass (equivalent to a lorry with trailer)  
one-day operation of a WoodRoll® = 100 oil barrels**



# Top priorities Industry research and innovation





# Thank you!

