



IEA Bioenergy
Technology Collaboration Programme



Session: Pathways for bio-based hydrogen production

Joakim Lundgren

Luleå University of Technology

IEA Bioenergy Task 33, ITP WP2-lead

Berlin, March 29

The IEA Bioenergy Technology Collaboration Programme (TCP) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Bioenergy TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

Technology Collaboration Programme

by **iea**

Agenda

- Background
- Opportunities for bio-H₂ in the industrial transition
- Objectives of H₂-ITP WP2
- Overview bio-H₂ production pathways
 - Gasification of biomass (Torgas)
 - Ethanol reforming (Hytron)
 - Methane pyrolysis (Oulu University)

Background

- Fossil-free hydrogen is a **key energy carrier** in a net-zero society - foremost in **hard-to-abate sectors**
- Biomass-based H₂ has great potential to accelerate the realization of the hydrogen economy - **currently overlooked**
- Brings **important benefits**
 - Non-weather dependent fossil-free hydrogen production
 - Negative emissions
 - Process integration opportunities

Figure 4. An Illustrative Hydrogen Colour Spectrum

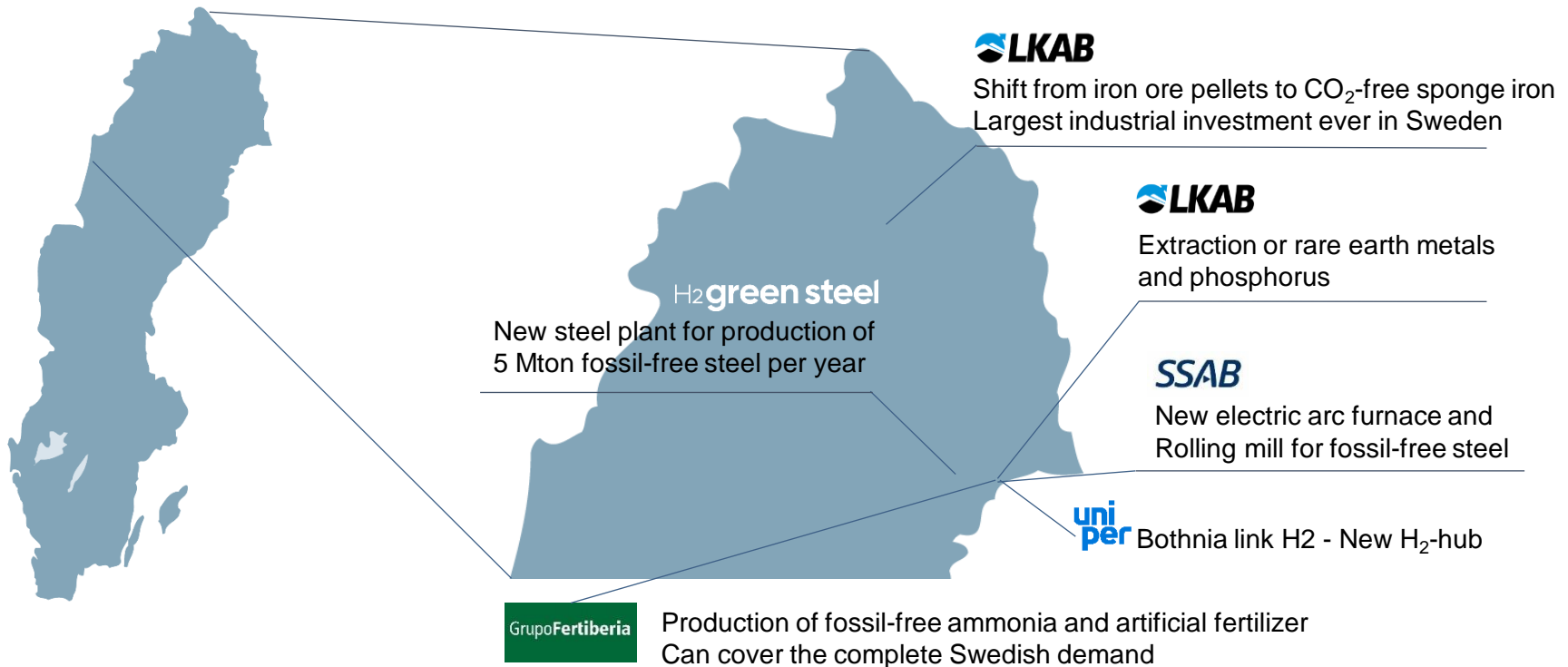
	Terminology	Technology
PRODUCTION VIA ELECTRICITY	Green Hydrogen	Electrolysis
	Purple/Pink Hydrogen	
	Yellow Hydrogen	
PRODUCTION VIA FOSSIL FUELS	Blue Hydrogen	Natural gas reforming + CCUS gasification + CCUS
	Turquoise Hydrogen	Pyrolysis
	Grey Hydrogen	Natural gas reforming
	Brown Hydrogen	Gasification
	Black Hydrogen	

*GCG footprint given as a general guide but it is accepted that each cate

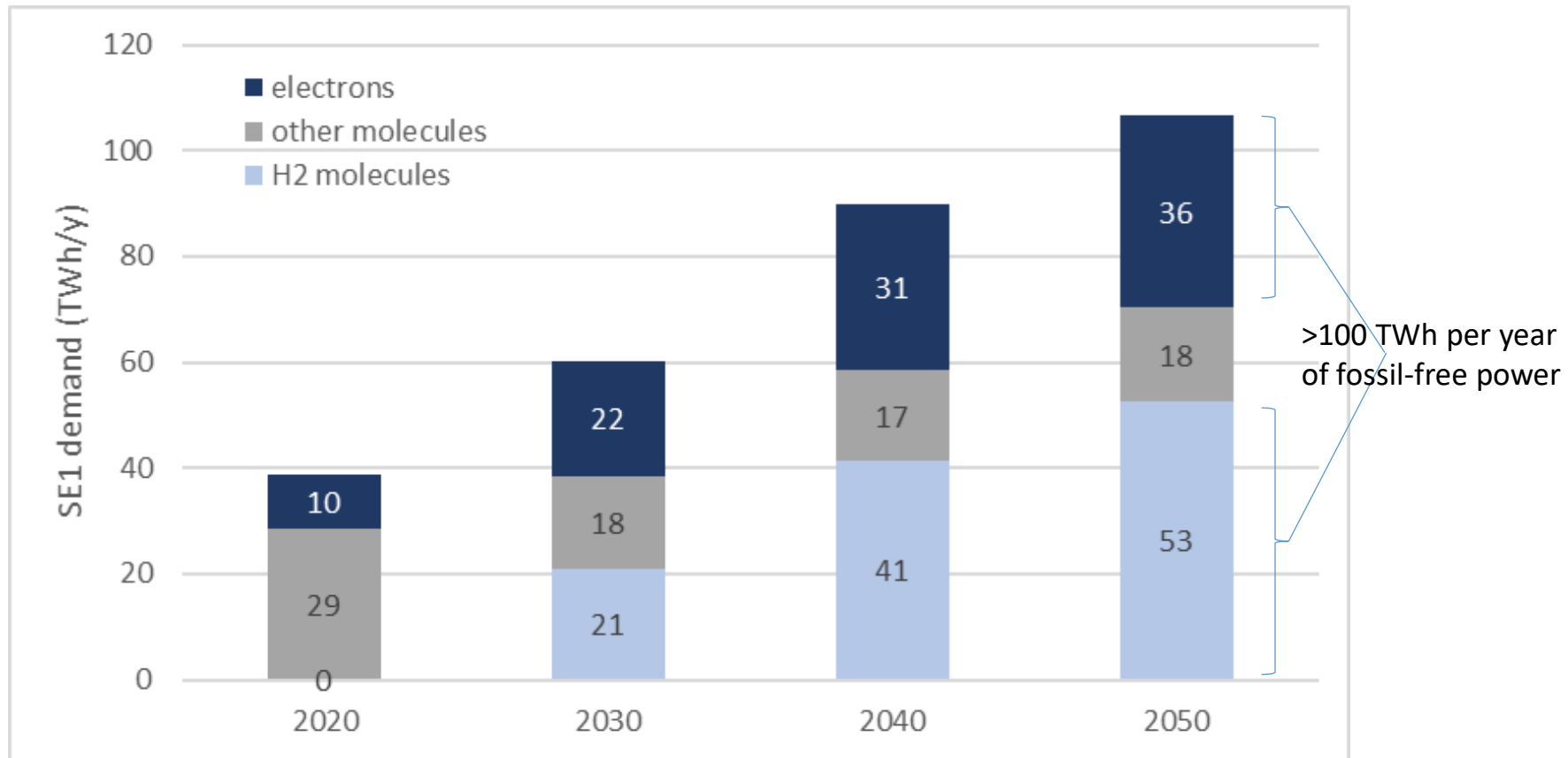
Source: Global Energy Infrastructure (GEI), 2021

Investments of more than 100 billion €

County of Norrbotten
25 % of the land area of Sweden
250 000 inhabitants



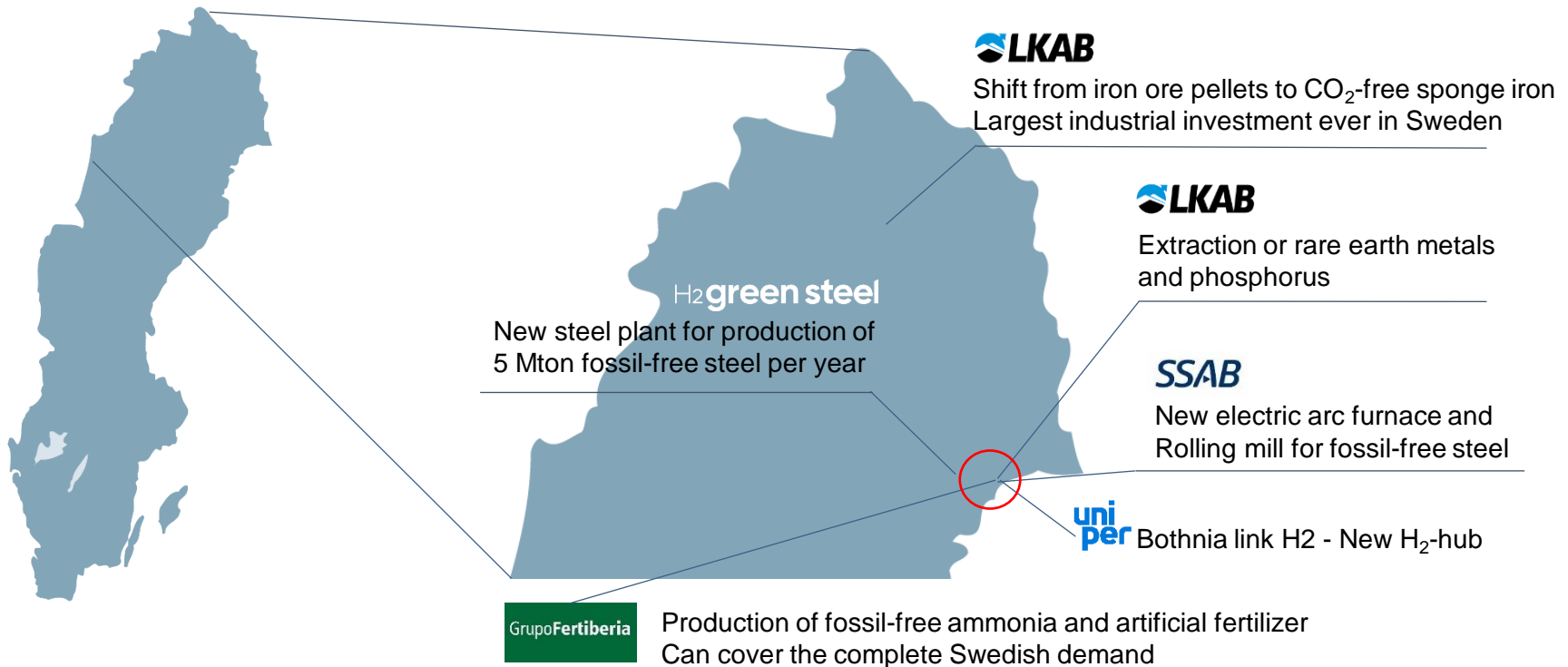
Huge increase in energy demand ...



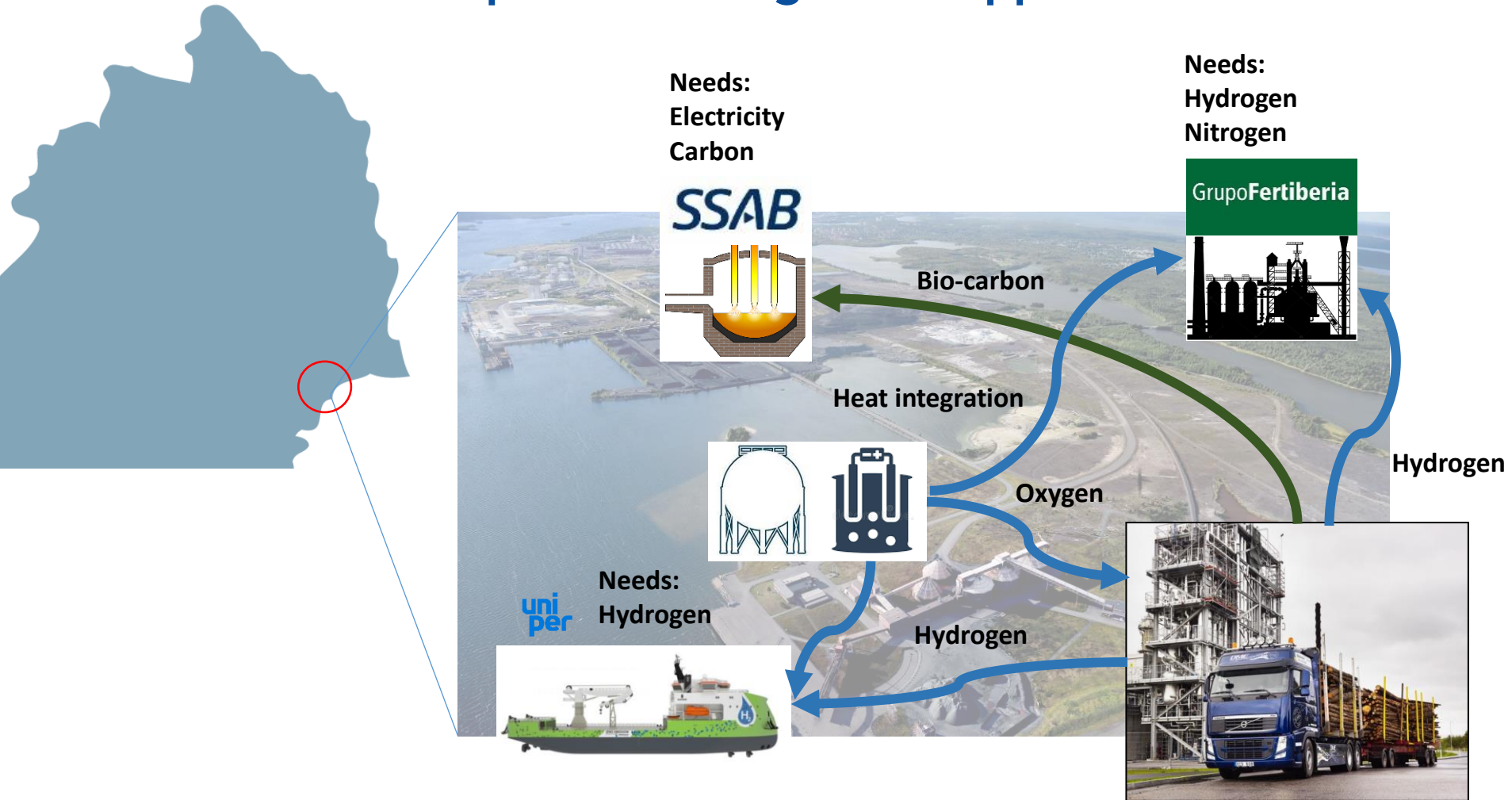
160 TWh per year is produced in Sweden in total today

Investments of more than 100 billion €

County of Norrbotten
25 % of the land area of Sweden
250 000 inhabitants



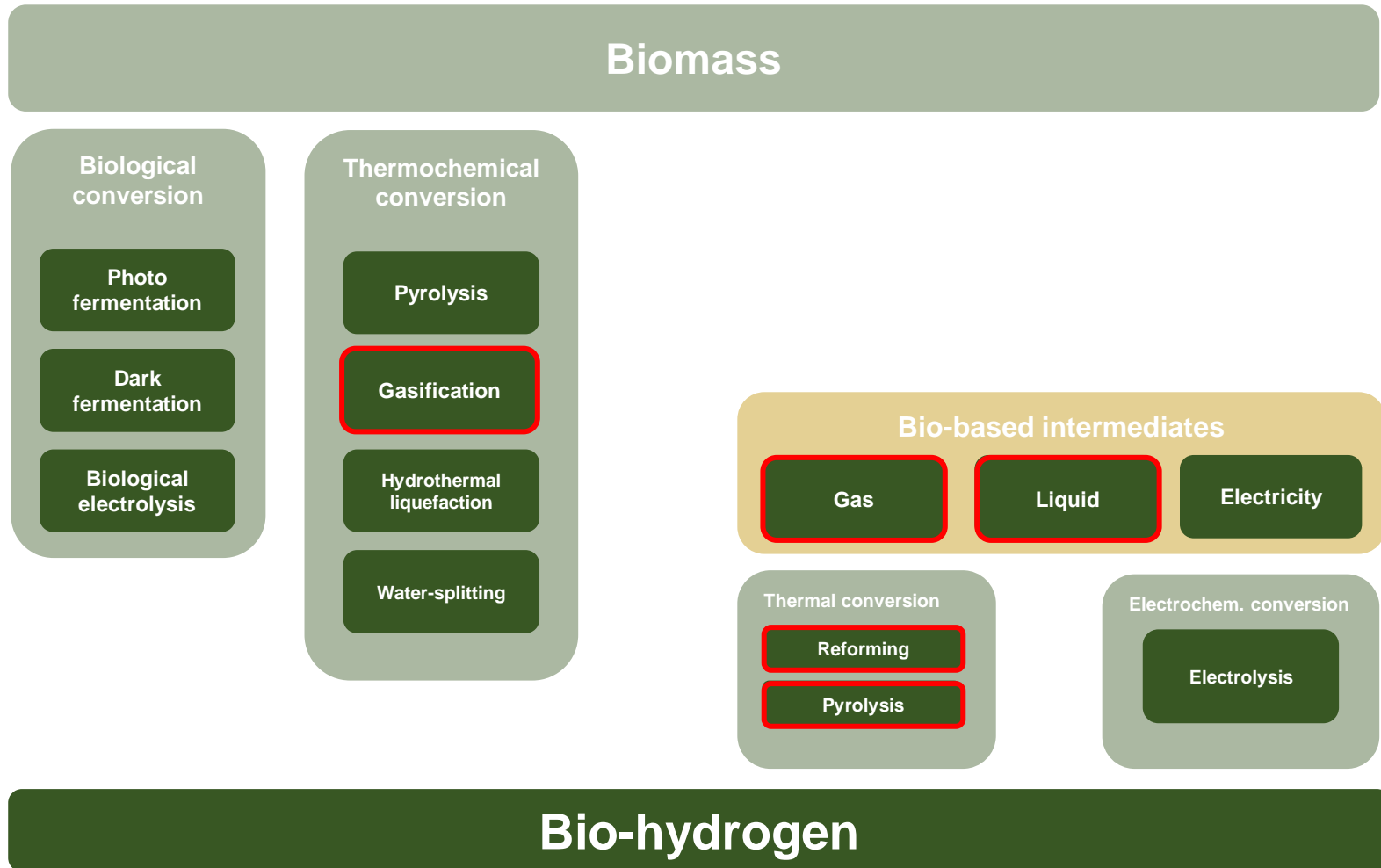
Bio-H2 enables process integration opportunities



Objectives H2-ITP WP2

- Describe and explore hydrogen production pathways based on biomass
- Present the techno-economic performance and TRL-levels for these pathways
- Identify and explain potential synergies with electrolysis-based hydrogen production

Many options to produce bio H₂



Thanks!

Joakim Lundgren

Luleå University of Technology

IEA Bioenergy Task 33, ITP WP2-lead



IEA Bioenergy
Technology Collaboration Programme

www.ieabioenergy.com