Contributos para a Transição Energética

Sustainable Decarbonization Strategy for Bahia and Brazil

SENAI CIMATEC

Sistema FIEB

SENAI CIMATEC

SENAI CIMATEC PARK

PELO FUTURO DA INOVAÇÃO

Pathways to a carbon-free world

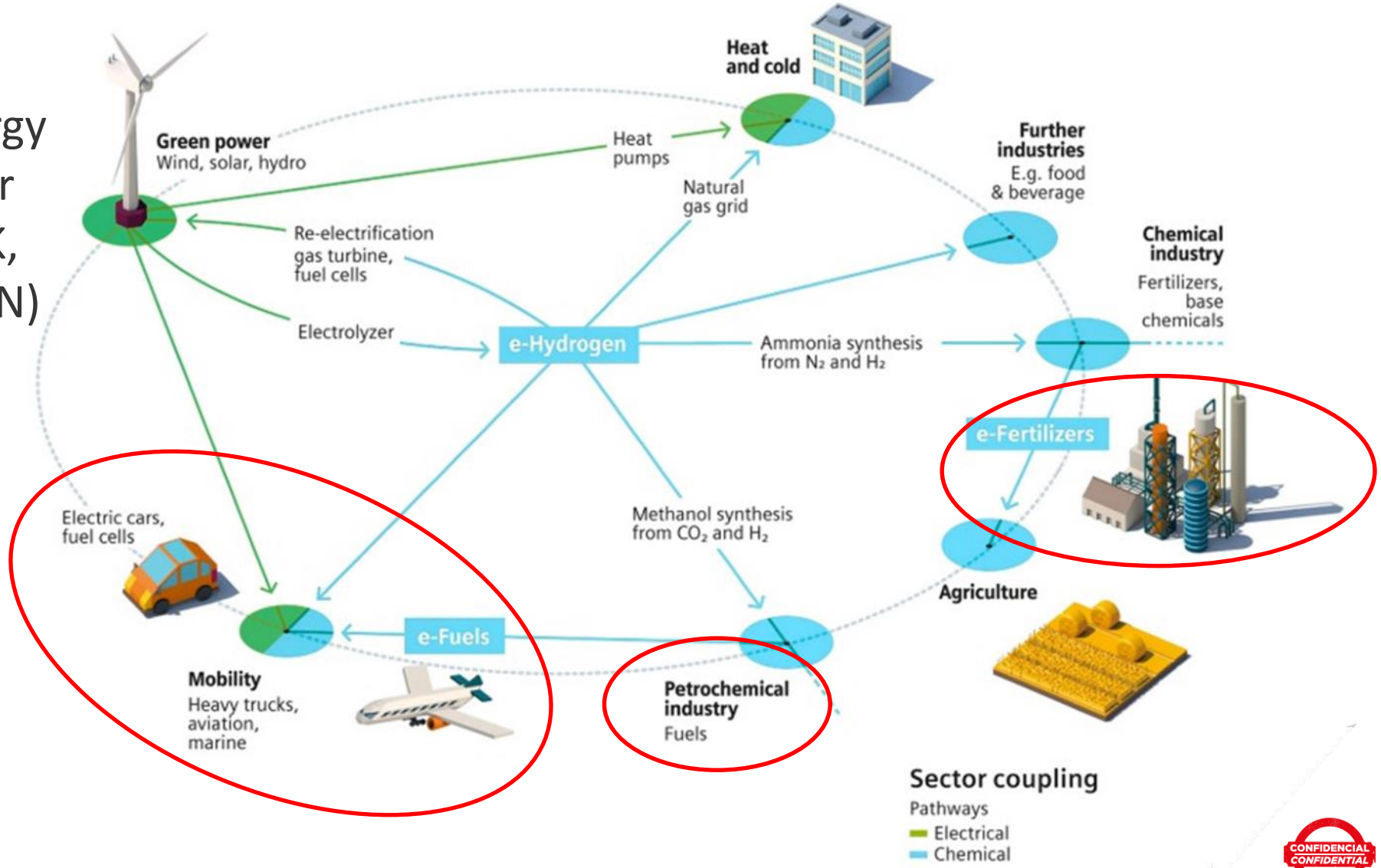
Sistema FIEB | SENAI CIMATEC
PELO FUTURO DA INOVAÇÃO

Fonte: Siemens Energy

Power-to-X

- Conversion of clean energy into green **e-Hydrogen** or synthetic **e-Fuels** (FT-SPK, HEFA-SPK, ATJ/LTJ-SPK/AN)

- **e-Hydrogen** is also the basis for other syntheses in carbon-free **e-Ammonia** and **carbon-neutral e-Hydrocarbons** or **e-Methanol**.



WIND MAPS

ANALYSIS AND DIAGNOSTICS

CAMARGO SCHUBERT

FIEB SENAI

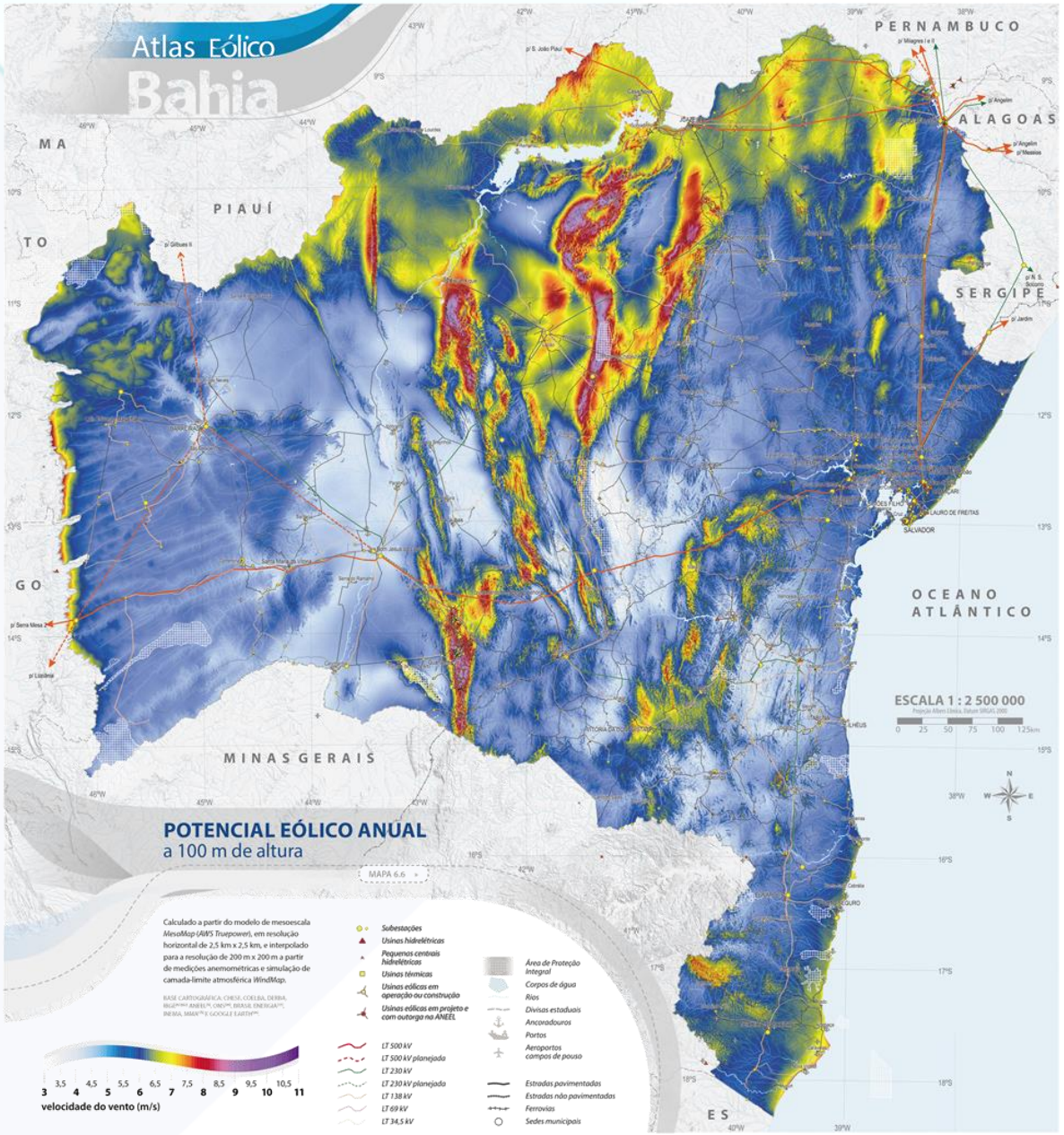
CIMATEC

SECRETARIA DE CIÊNCIA, TECNOLOGIA E INOVAÇÃO

SECRETARIA DE INFRAESTRUTURA

Bahia GOVERNO

Bahia's wind energy potential is world class



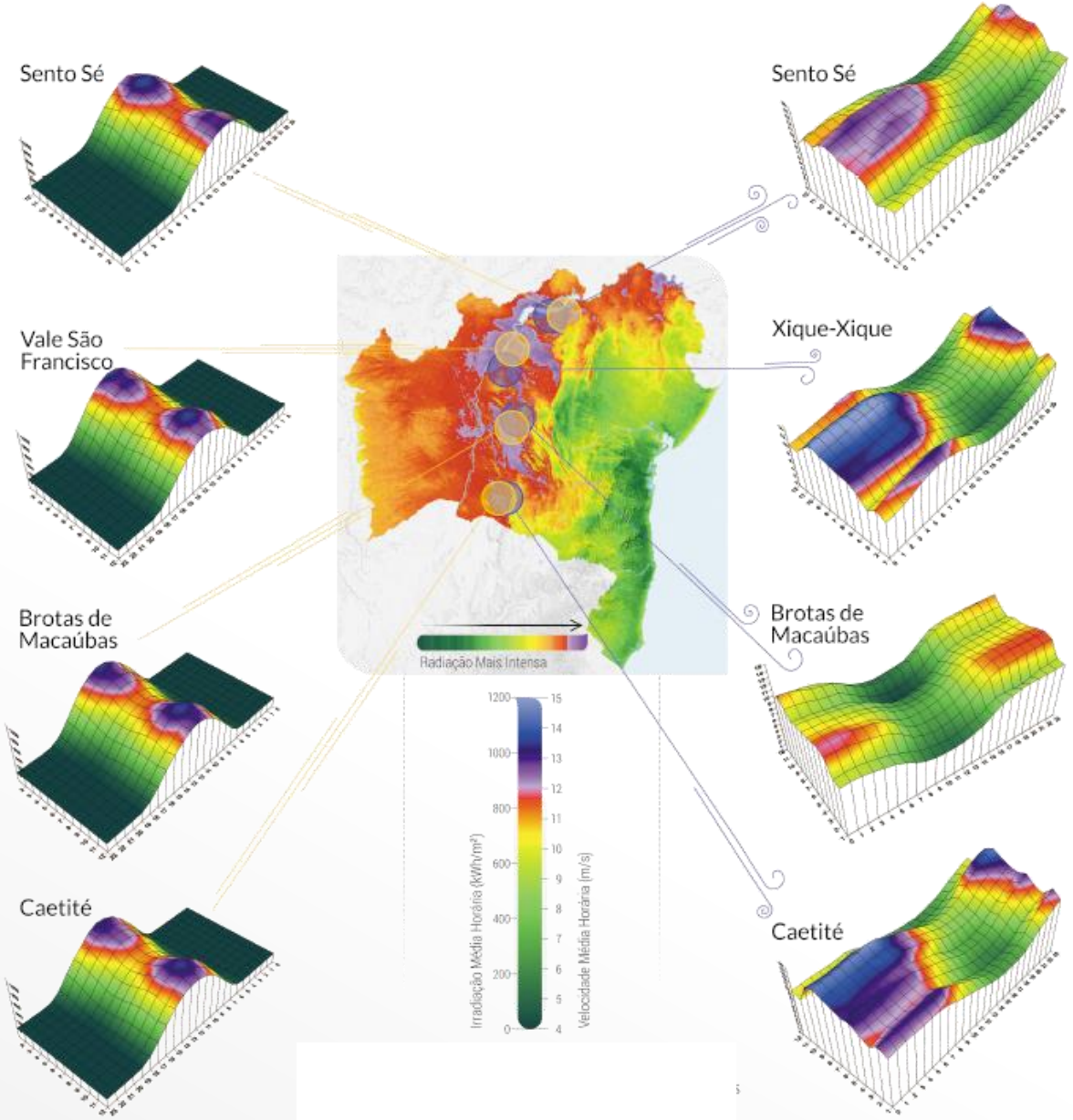
- ✓ The state's wind potential is ***70.1 GW*** for speeds greater than 7 m/s at ***100 meters height.***
- ✓ The state's wind potential is ***115.2 GW*** for speeds greater than 7 m/s at ***120 meters high.***
- ✓ The state's wind potential is 195.2 GW for speeds greater than 7 m/s at ***150 meters height.***

Source: Bahia Wind Atlas

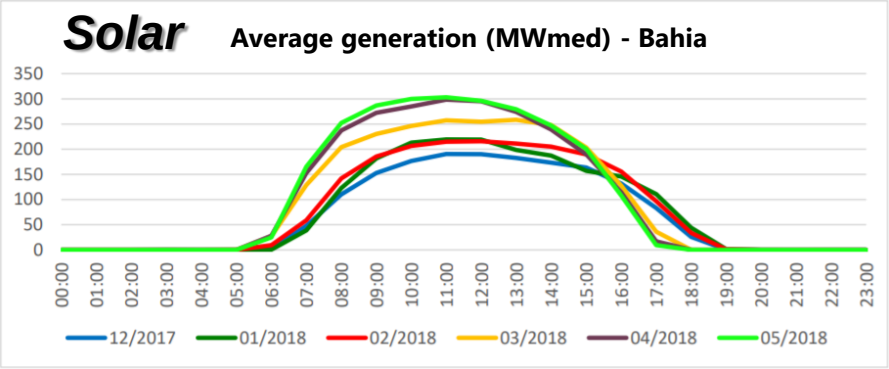
Atlas Solar Bahia

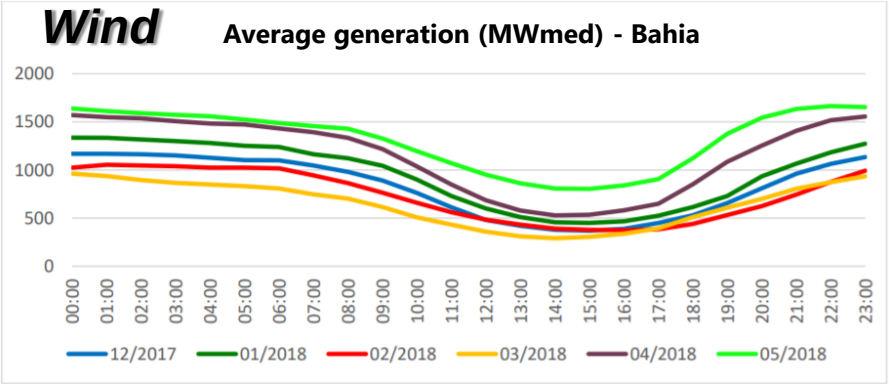
Untapped Solar & Wind will provide enough clean energy

Renewable Energy Sources are complementary and diversified



Bahia has the ***best levels*** of solar radiation in Brazil: above ***2,200kWh/m²/year***. In the figure on the side it is possible to notice the complementarity of the two sources.

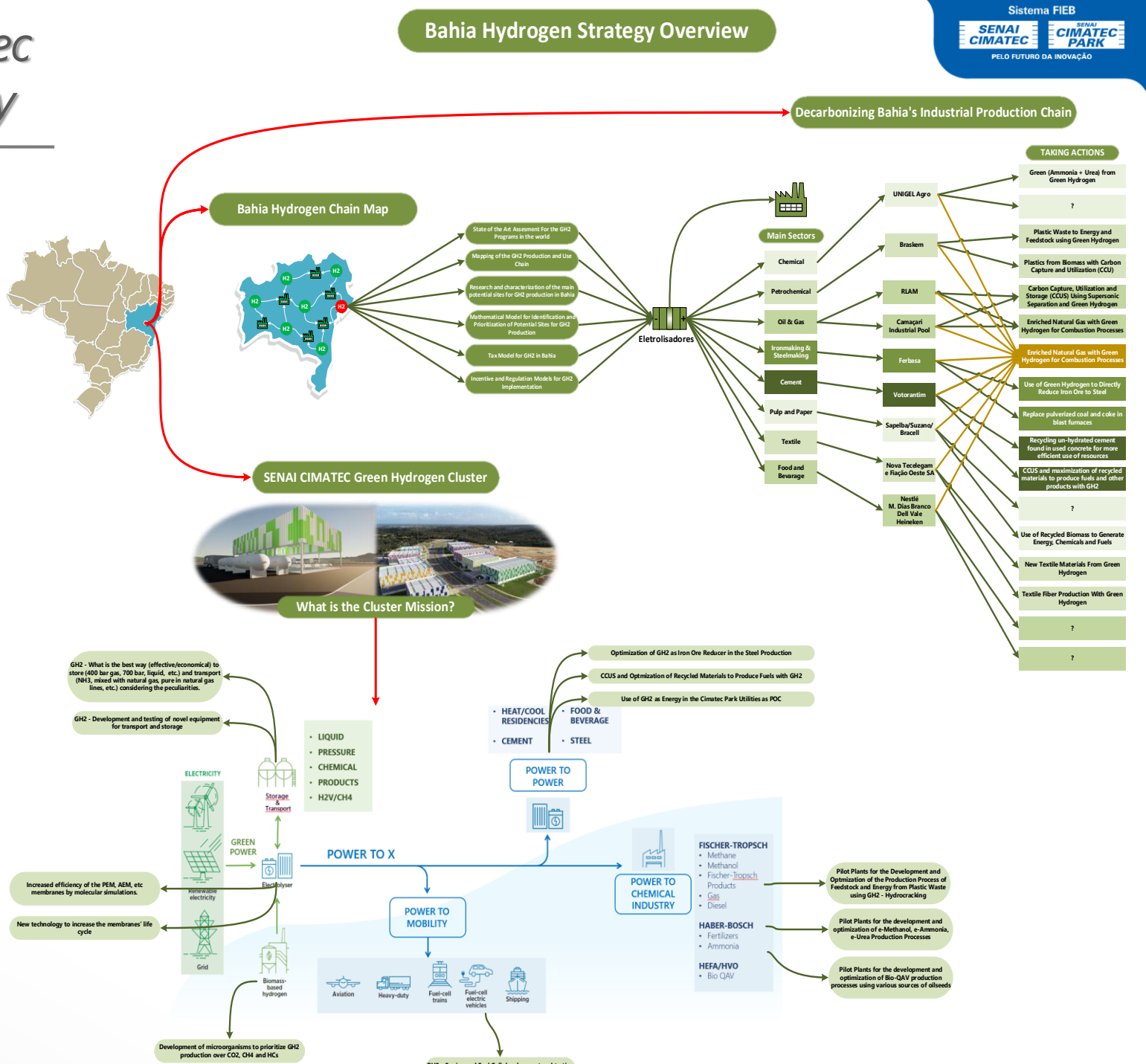




Source: Bahia Solar Atlas

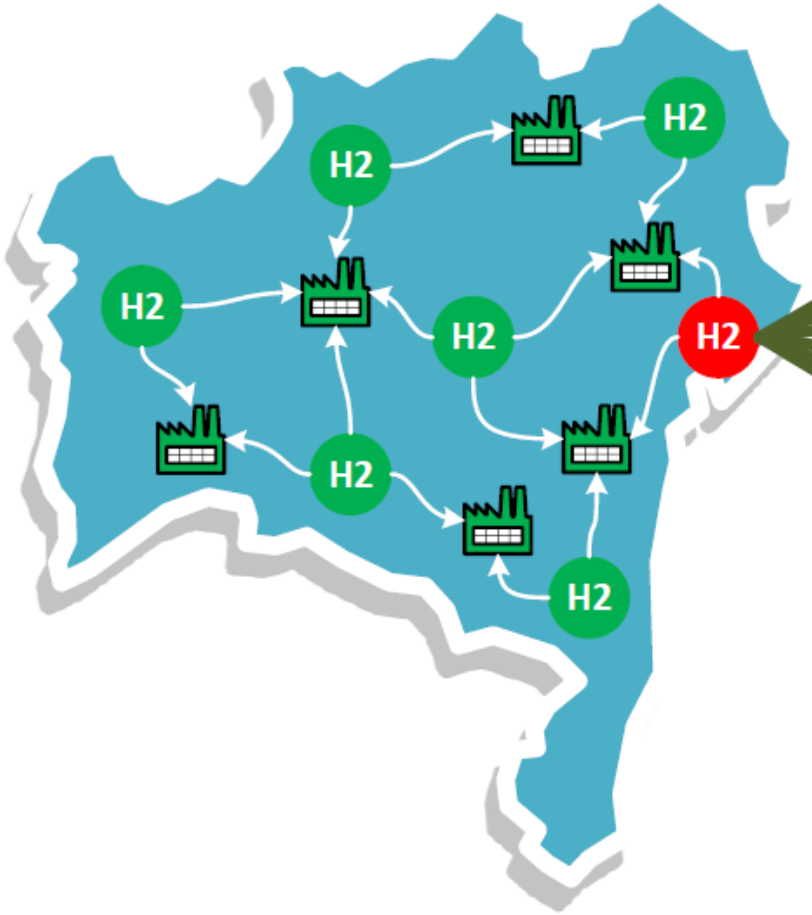
The four dimensions of *Senai Cimatec Sustainable Decarbonization Strategy*

1. Bahia Green Hydrogen Chain Map;
2. The Decarbonization of the Various Sectors of Bahia and Brazilian Industry;
3. Green Hydrogen Cluster at CIMATEC PARK;
4. Green Hydrogen Competence Center.



Bahia Hydrogen Chain Map

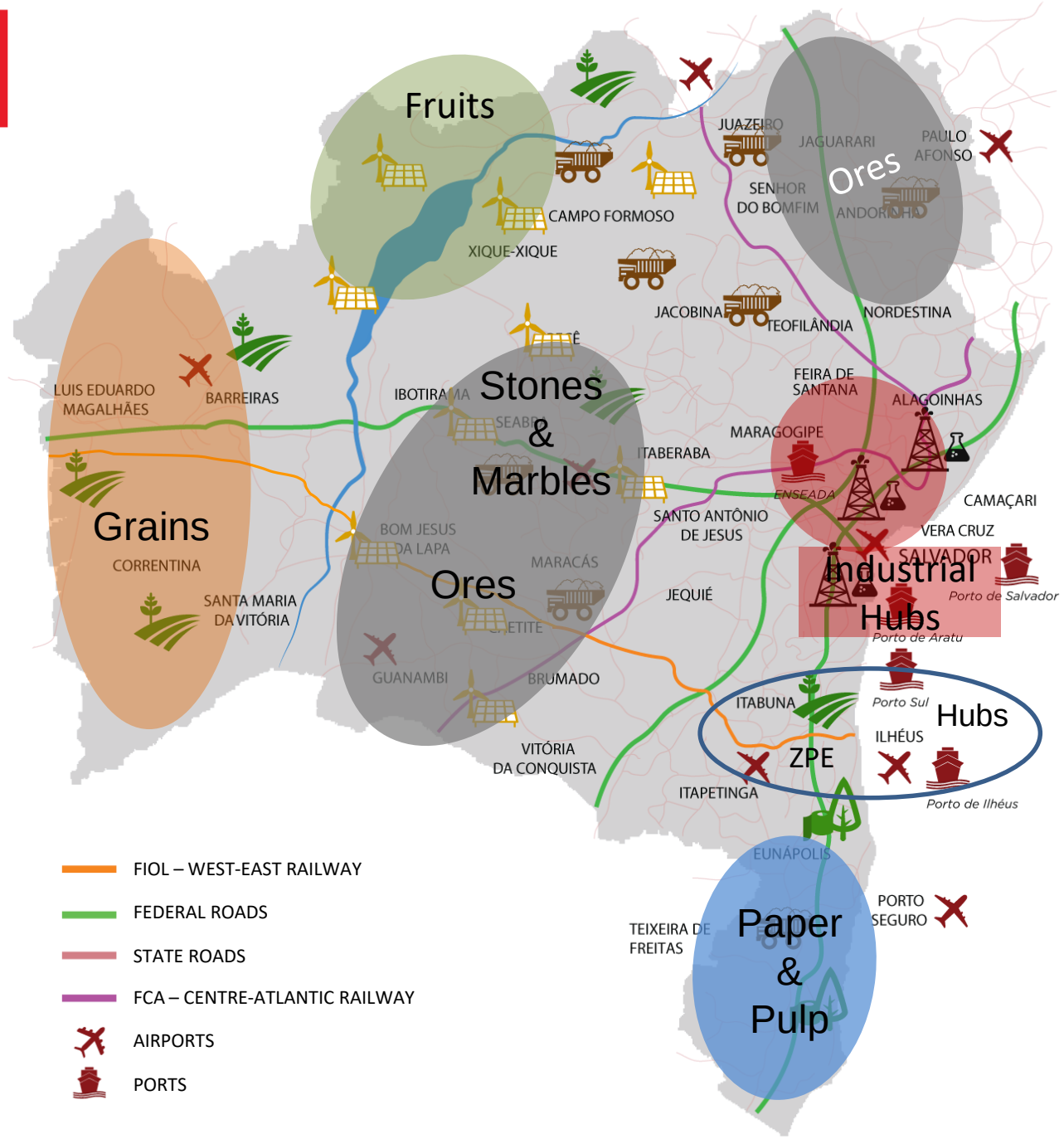
Senai Cimatec Sustainable Decarbonization Strategy



- State of the Art Assesment For the GH2 Programs in the world
- Mapping of the GH2 Production and Use Chain
- Research and characterization of the main potential sites for GH2 production in Bahia
- Mathematical Model for Identification and Prioritization of Potential Sites for GH2 Production
- Tax Model for GH2 in Bahia
- Incentive and Regulation Models for GH2 Implementation

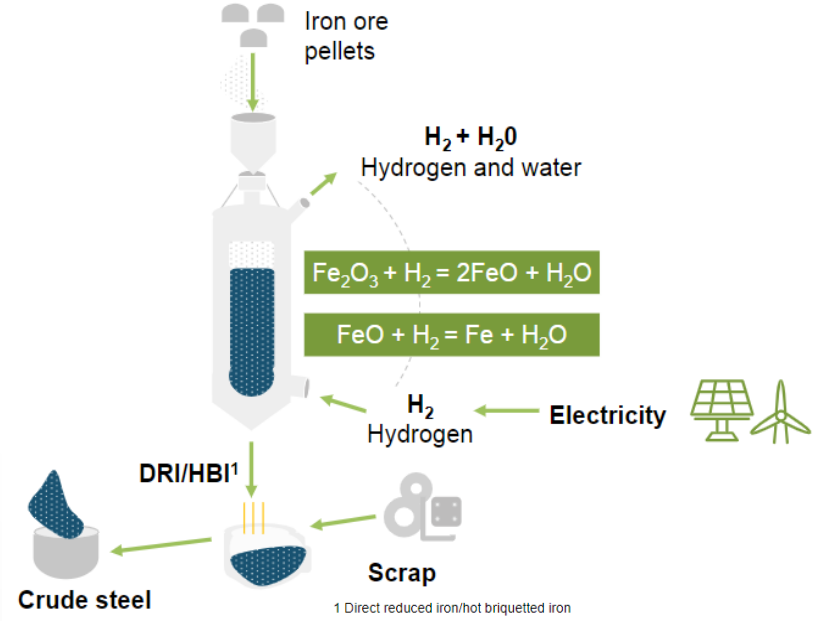
MAIN ECONOMIC SECTORS - VALLEYS

- AGRIBUSINESS
- PAPER & PULP
- RENEWABLE ENERGY – WIND & SOLAR
- OIL & GAS AND PETROCHEMICALS
- MINING
- AUTOMOTIVE
- INFRASTRUCTURE
- FOOD & BEVERAGE
- LEATHER & SHOES
- HEALTH
- COSMETICS
- METAL MECHANIC
- TRADE & SERVICES



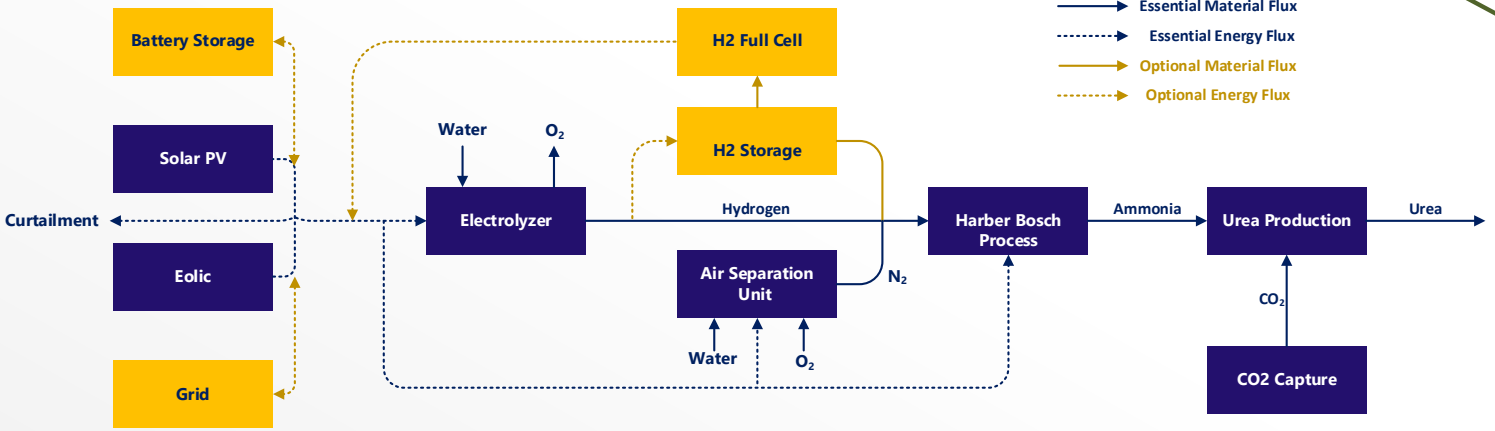
Senai Cimatec Sustainable Decarbonization Strategy

Hydrogen-based reduction allows emission-free ironmaking

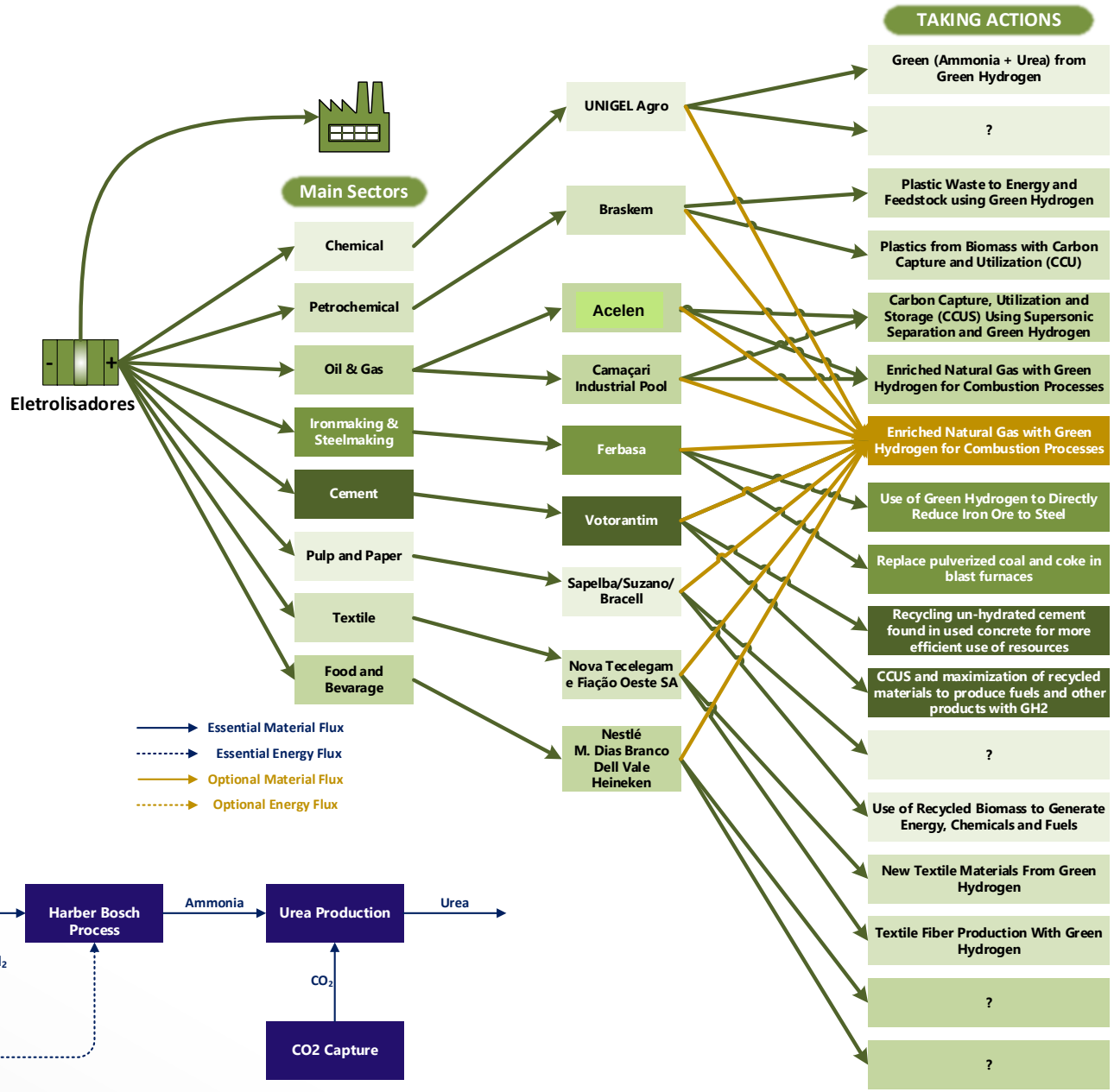


1 Direct reduced iron/hot briquetted iron

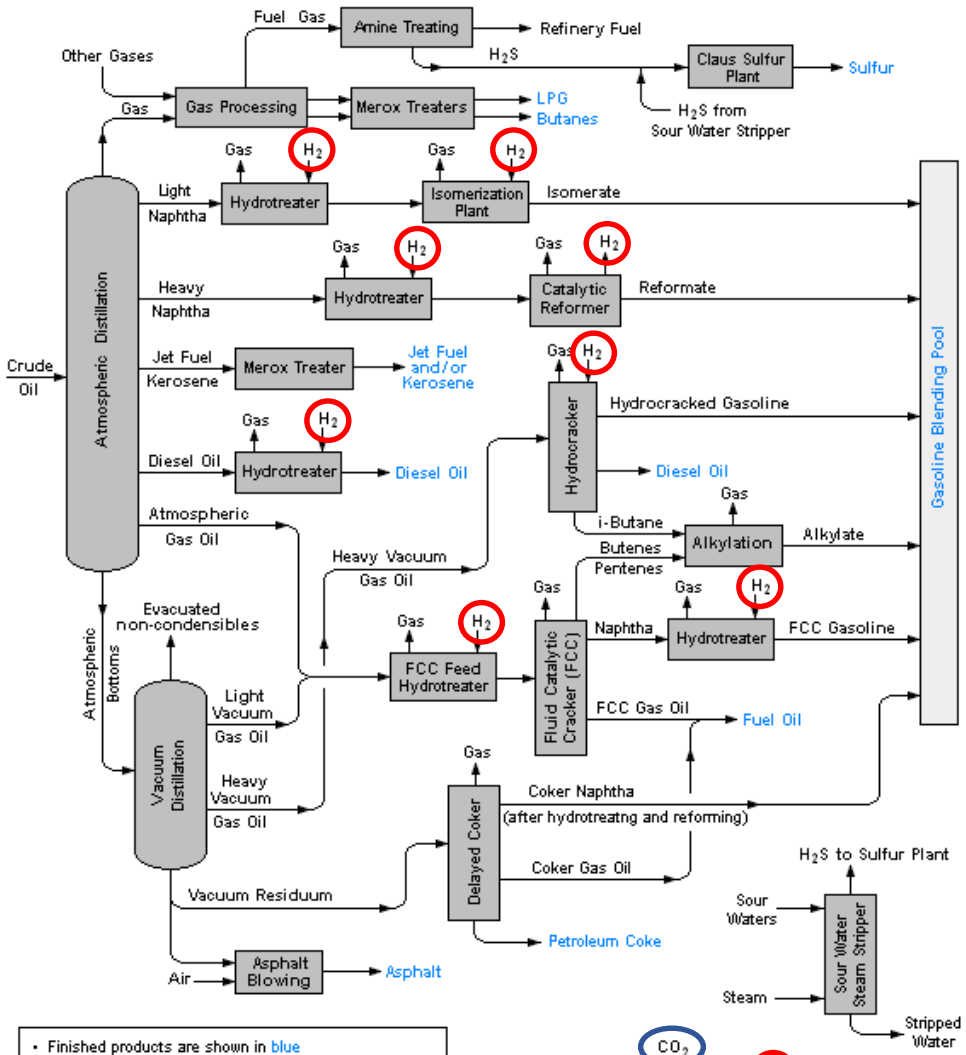
SOURCE: LKAB: HYBRIT – Iron Ore to Steel based on Hydrogen; Lulea, 2016



Decarbonizing Bahia's Industrial Production Chain



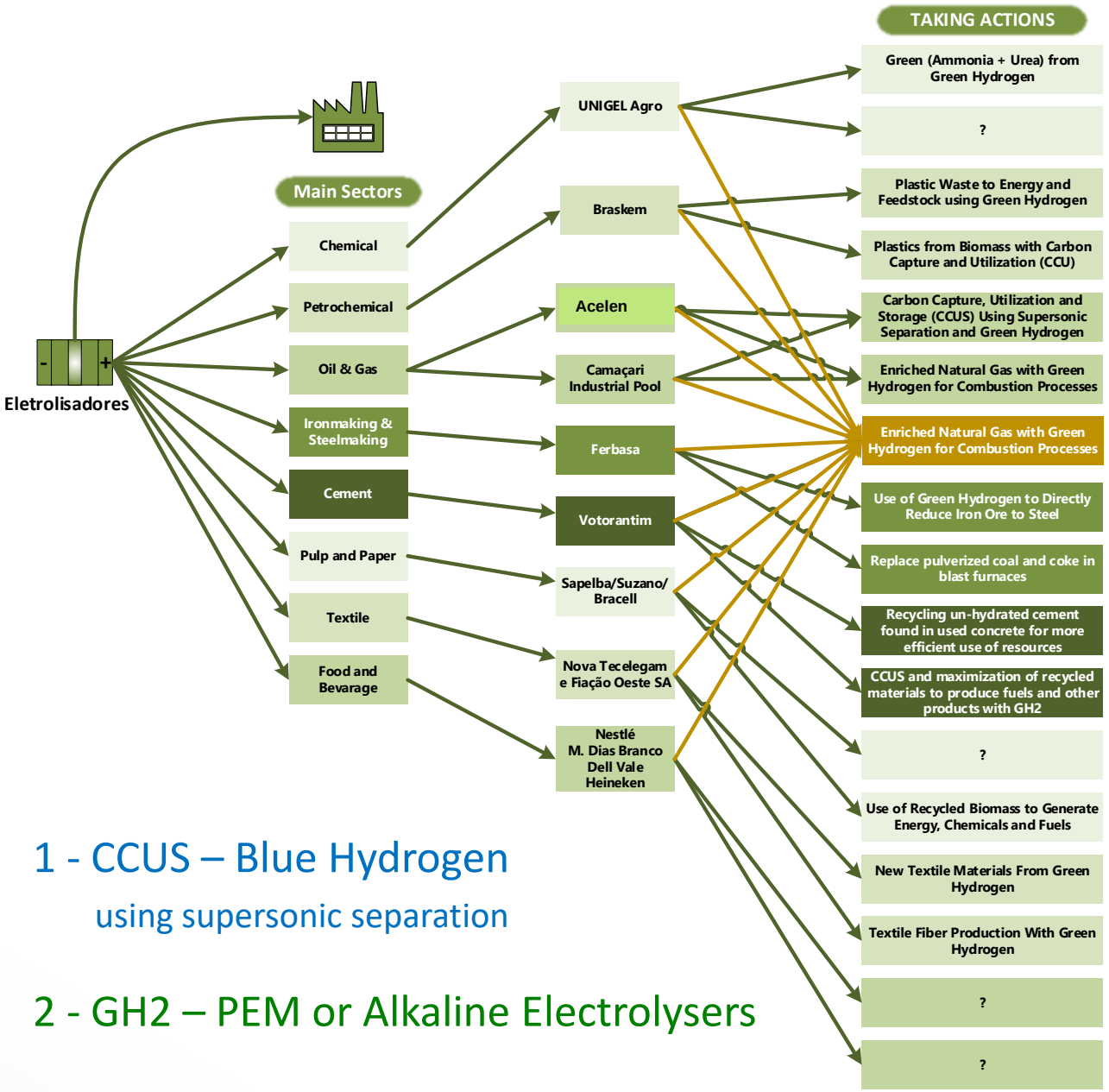
Senai Cimatec Sustainable Decarbonization Strategy



- Finished products are shown in blue
- Sour waters are derived from various distillation tower reflux drums in the refinery
- The "other gases" entering the gas processing unit includes all the gas streams from the various process units

Steam Reforming

Decarbonizing Bahia's Industrial Production Chain



1 - CCUS – Blue Hydrogen

using supersonic separation

2 - GH2 – PEM or Alkaline Electrolysers

SENAI CIMATEC Green Hydrogen Cluster

What is the Cluster Mission?

Senai Cimatec Sustainable Decarbonization Strategy

GH2 - What is the best way (effective/economical) to store (400 bar gas, 700 bar, liquid, etc.) and transport (NH3, mixed with natural gas, pure in natural gas lines, etc.) considering the peculiarities.

GH2 - Development and testing of novel equipment for transport and storage

- LIQUID
- PRESSURE
- CHEMICAL
- PRODUCTS
- H2V/CH4

Storage & Transport

ELECTRICITY

GREEN POWER

Renewable electricity

Grid

Electrolyser

Biomass-based hydrogen

Increased efficiency of the PEM, AEM, etc membranes by molecular simulations.

New technology to increase the membranes' life cycle

Development of microorganisms to prioritize GH2 production over CO2, CH4 and HCs

POWER TO X

POWER TO MOBILITY

Aviation | Heavy-duty | Fuel-cell trains | Fuel-cell electric vehicles | Shipping

GH2 – Engine and Fuel Cell development and testing using dynamometer infrastructure

POWER TO POWER

- HEAT/COOL RESIDENCIES
- FOOD & BEVERAGE
- CEMENT
- STEEL

Optimization of GH2 as Iron Ore Reducer in the Steel Production

CCUS and Optmization of Recycled Materials to Produce Fuels with GH2

Use of GH2 as Energy in the Cimatec Park Utilities as POC

POWER TO CHEMICAL INDUSTRY

FISCHER-TROPSCH
- Methane
- Methanol
- Fischer-Tropsch Products
- Gas
- Diesel

HABER-BOSCH
- Fertilizers
- Ammonia

HEFA/HVO
- Bio QAV

Pilot Plants for the Development and Optmization of the Production Process of Feedstock and Energy from Plastic Waste using GH2 - Hydrocracking

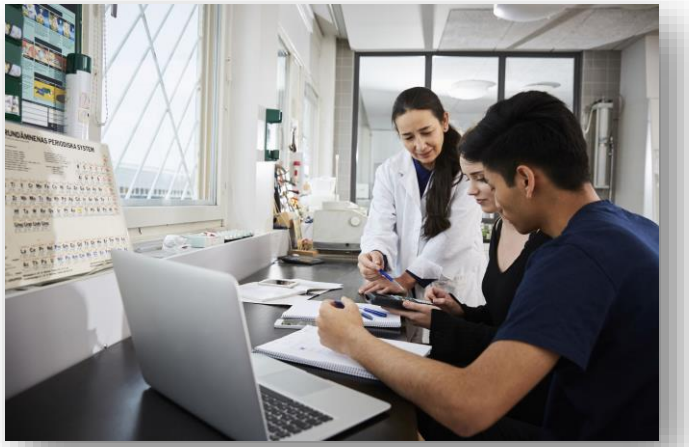
Pilot Plants for the development and optimization of e-Methanol, e-Ammonia, e-Urea Production Processes

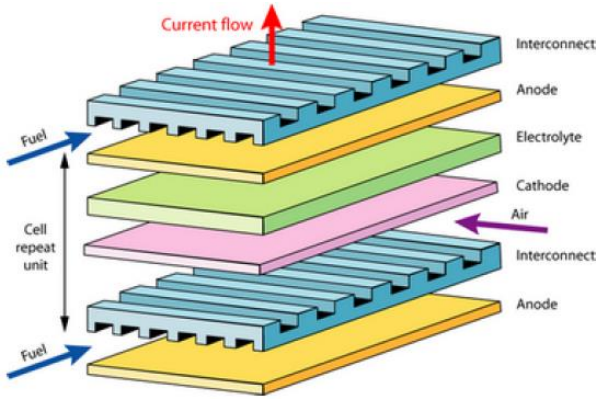
Pilot Plants for the development and optimization of Bio-QAV production processes using various sources of oilseeds

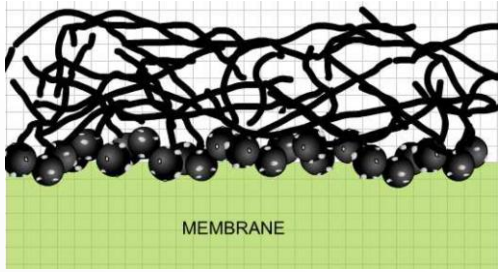
(Modified from the website green hydrogen - Bremerhaven)

The Green Hydrogen Competence Center

Excellence in Training for the Brazilian Green Hydrogen Production Chain







Projects Themes:

1. Mathematical Model for Decision Making of the Production and Distribution Chain of the Green Hydrogen.
2. Modeling and Optimization of the PEM Electrolysis Membrane.
3. Green Hydrogen Purification Process in PEM Electrolysis.
4. Hydrocracking of Waste Plastics with Green Hydrogen.
5. Theoretical-Experimental Study for Bio H_2 Production - Via Biomass.
6. Theoretical-Experimental Study for Bio H_2 Production - Via Effluent.
7. Green Ammonia and Urea Synthesis with CO_2 capture.
8. Green Hydrogen Production from Wastewater.

I hope you enjoyed it.
Thank you!