



ABENGOA

ABENGOA
Hidrógeno

June 2020

Hydrogen Division

EPC Vision

- ✓ Abengoa is a **world EPC leader** in renewable and conventional energy (more than 12GW installed)
- ✓ Global presence, **in-house engineering** and **O&M** capabilities
- ✓ Abengoa offers **technological consulting** and **advisory services** in addition to the EPC to accompany its clients from the start

+ 15 years in H₂

- ✓ H₂ production by **electrolysis** and **steam reforming**
- ✓ Power generation **by fuel cells**
- ✓ **Hydrogen Refueling stations** for H₂ vehicles
- ✓ **Energy storage** combining electrolysis, compression, storage and power generation
- ✓ Renewable gas production (**Power to Gas**)
- ✓ **Defense** and **aerospace** special projects



Product Vision

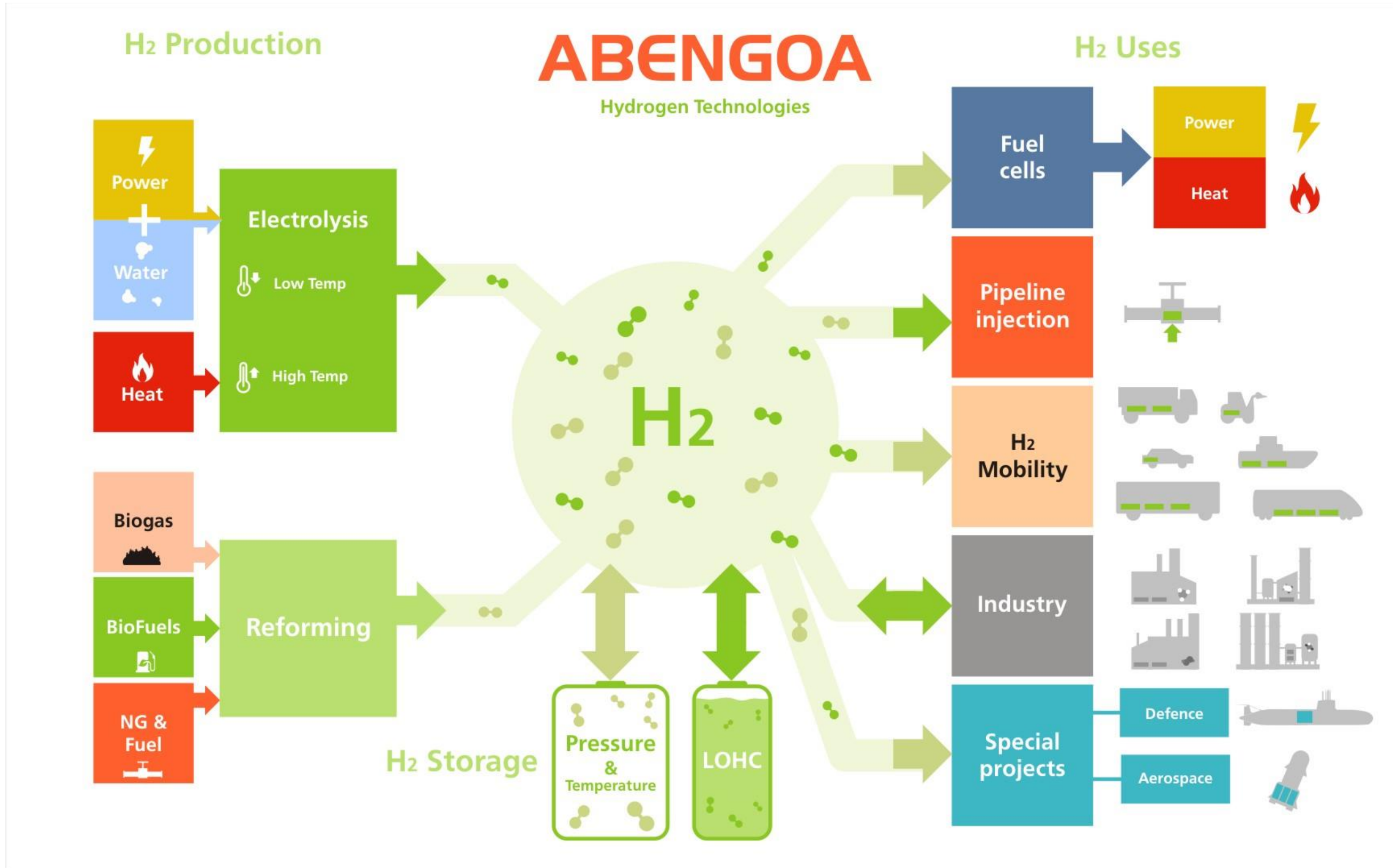
- ✓ Abengoa's strategy contemplates the development of **innovative products** in the hydrogen sector, through **strategic alliances** with the main manufacturers and technologists

Decarbonization

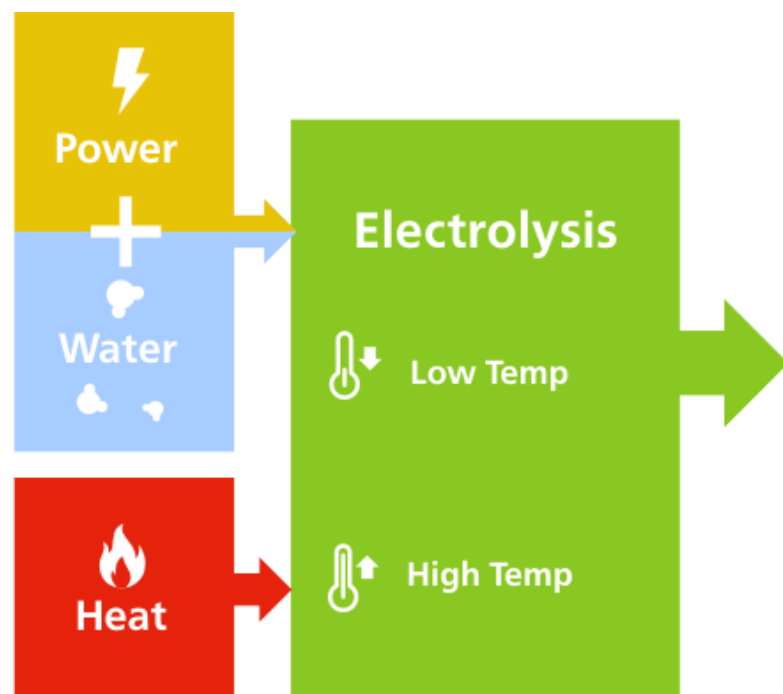
- ✓ Abengoa has a wide portfolio of **hybrid solutions** for **decarbonization** and the energy transition
- ✓ Solutions for the production of **renewable energy, green hydrogen** and its derivatives (ammonia, alcohols, biofuels, renewable gas)
- ✓ **Hybridization Specialist** (Renewable, Conventional, Storage, Smart Plant)
- ✓ **Connects the different sectors** of energy, transport and industrial

Presence in H₂

- ✓ Member of Spanish Hydrogen Association (**AeH2**) and **Hydrogen Europe**
- ✓ **References** in different hydrogen technologies
- ✓ Abengoa is in permanent contact with the "**supply chain**" and can provide its customer with innovative solutions



Electrolysis



Abengoa is an **expert** in the different electrolysis technologies to produce **Green H₂**.

Innovation: since almost 20 years, we **develop our own solutions** using innovative technologies (strategic alliance with stack suppliers).

Hybridization: as an **EPC contractor**, we connect **Renewable Energy** with **Green Hydrogen** production integrating the different technologies & players.

Technology Scale

100 kW to Multi MW

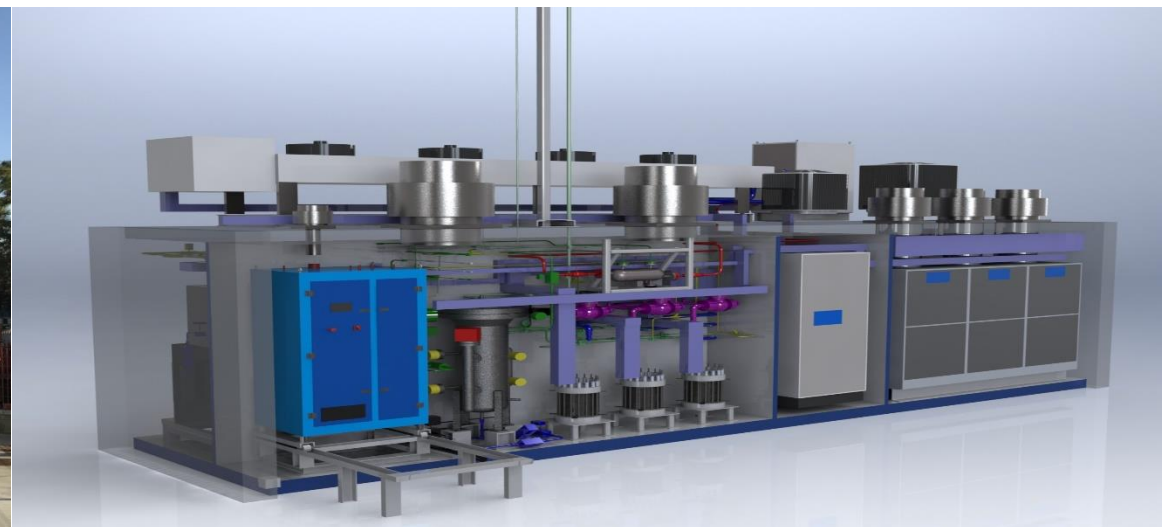


Competitive Advantages

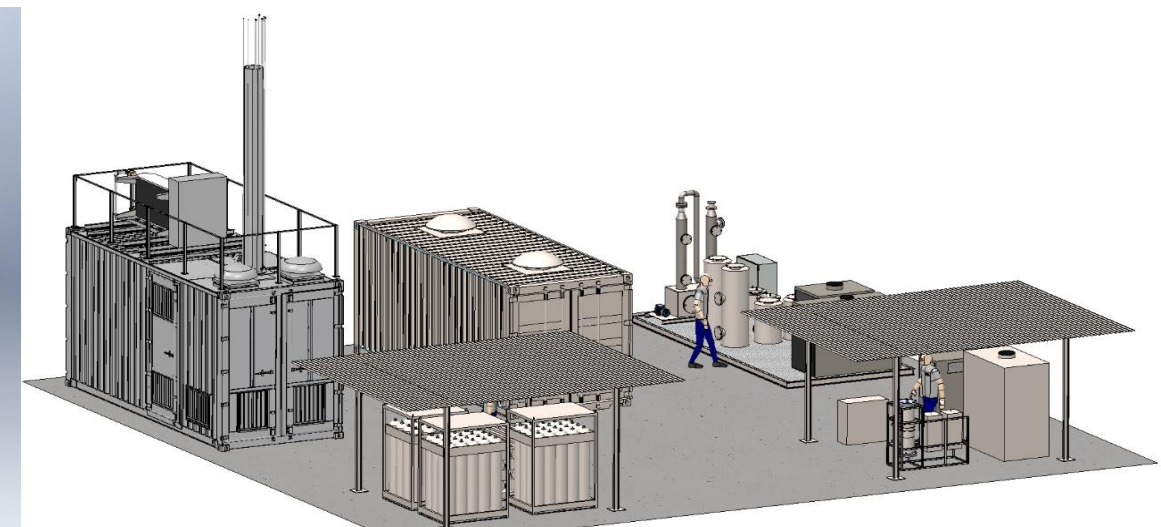
Modular units, scalable technology, efficiency and lower emissions



EL30N
30 Nm³/h Electrolysis Unit

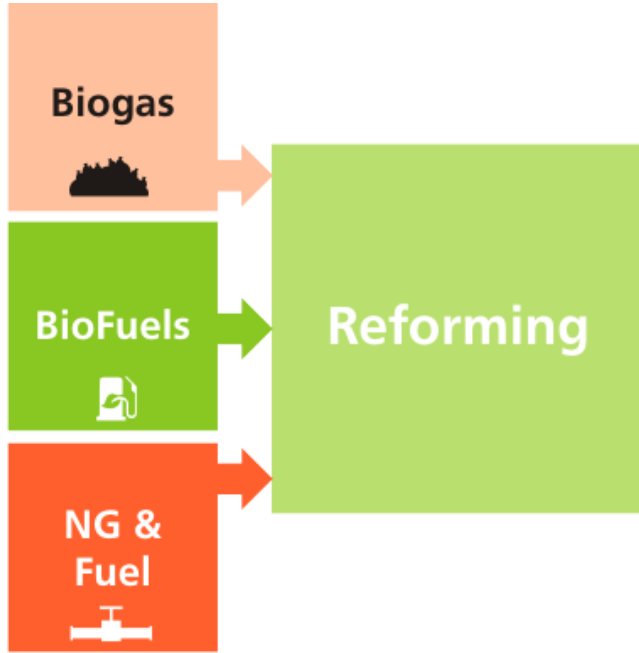


EL90N
90 Nm³/h Electrolysis Unit



Renovagas
Electrolysis + Methanation (Power to Gas)

Reforming



Abengoa produce **hydrogen** using **reforming technologies** for **special applications**

Abengoa has developed **reforming plants** with a production up to **250 Nm³/h** of **hydrogen** for **stationary** applications and **special projects**.

Abengoa is committed with the **innovation** and **new product** development for **stationary** applications and transport: **maritime** and **rails**.

Technology Scale

50 Nm³/h - 500 Nm³/h



Competitive Advantages

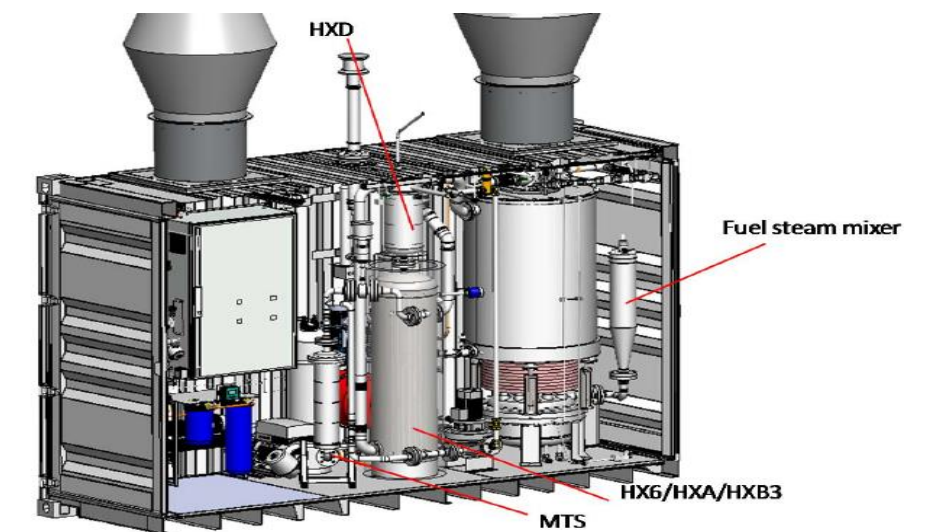
Compactness, modularity, scalability, link between hydrogen-based fuels and PEMFC



250 Nm³/h H₂
Natural gas reforming unit

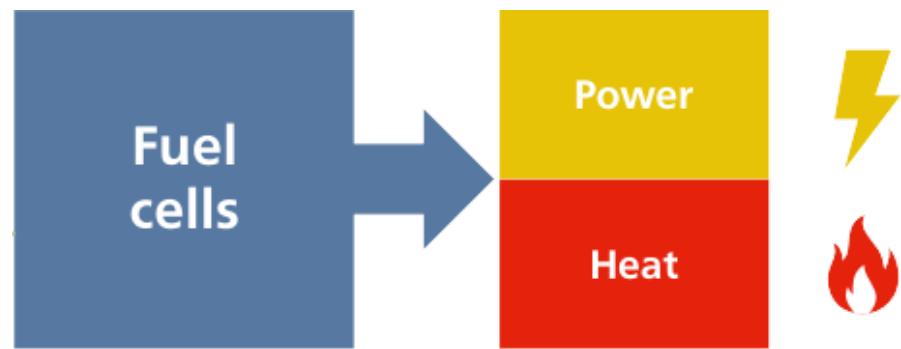


250 Nm³/h H₂
Bioethanol reforming unit



Nemesis2⁺
Reforming unit for a HRS

Fuel Cell



Abengoa is an expert in **Heat and Power** production from **H₂** with **Fuel Cell** technologies.

Hybridization: as an **EPC contractor**, we integrate Fuel Cell technologies in complex projects (Gas to Power, Power to Power)

Product vision: **Abengoa** develop **fuel cell power plants** integrating different stack technologies.

Technology Scale

100 kW - Multi MW



Competitive Advantages

Modular units, scalable technology, efficiency and lower emissions



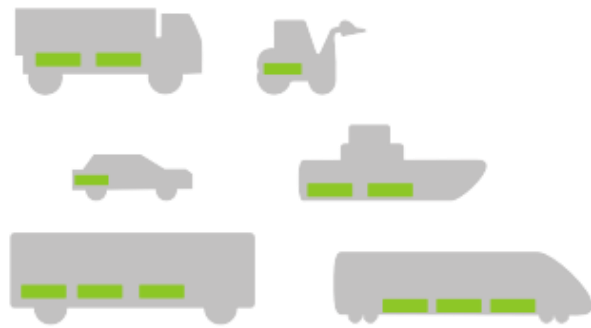
Grasshopper
PEM Fuel Cell Power Plant



Procyon
Molten Carbonate Fuel Cell

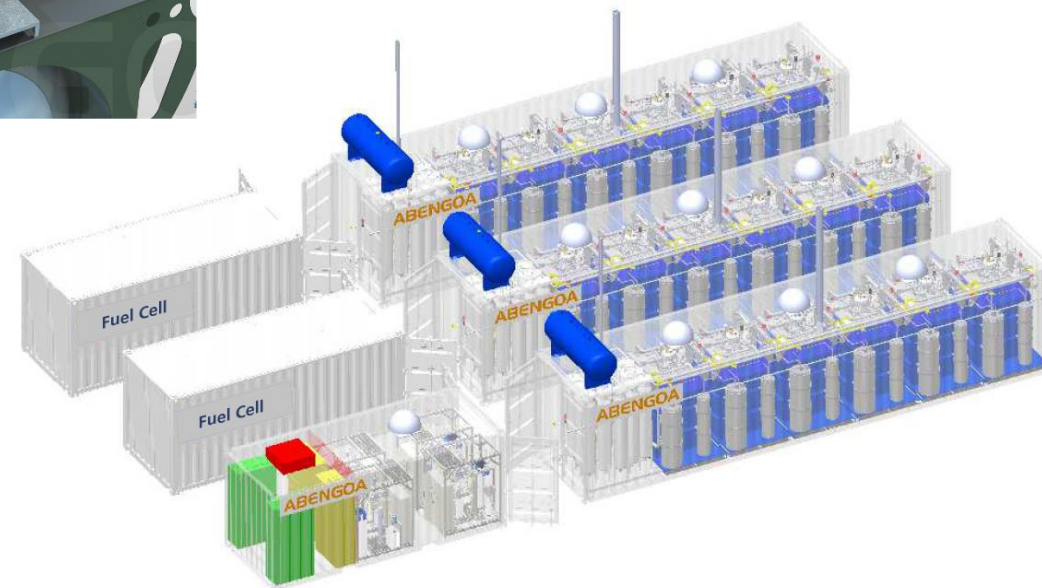
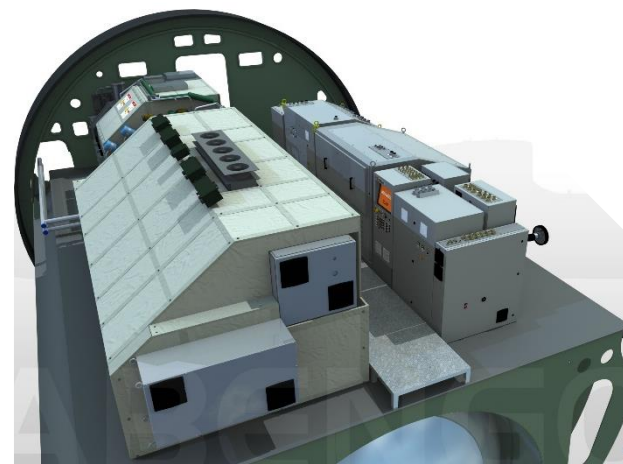
Mobility

H₂
Mobility



Abengoa brings **decarbonization solutions** to **Mobility Sector**

Abengoa is a **integrator of complex and on board systems**, where **compactness, safety, reliability** and compliance with the most stringent military requirements is crucial.



Abengoa has a **clear product vision** to **leverage** this **know-how** in applications with **similar integration needs** such as **ships** and **trains**.

Abengoa as a **strategic partner** to develop **tailored made** solutions or more **commercial modular** and **scalable containerized** solutions.

Abengoa has developed **two refueling stations** in **Seville** (Sanlúcar y Torrecuéllar) in combination with **on-site hydrogen production** by **electrolysis**.

Abengoa as **system integrator** and **EPC** company for **Refueling stations** infrastructure, collaborating with key technological players for the **compression**, **storage** and **dispensing** units.

Technology Scale

Sizing depends on the fleet size, type of vehicles and use pattern.



Competitive Advantages

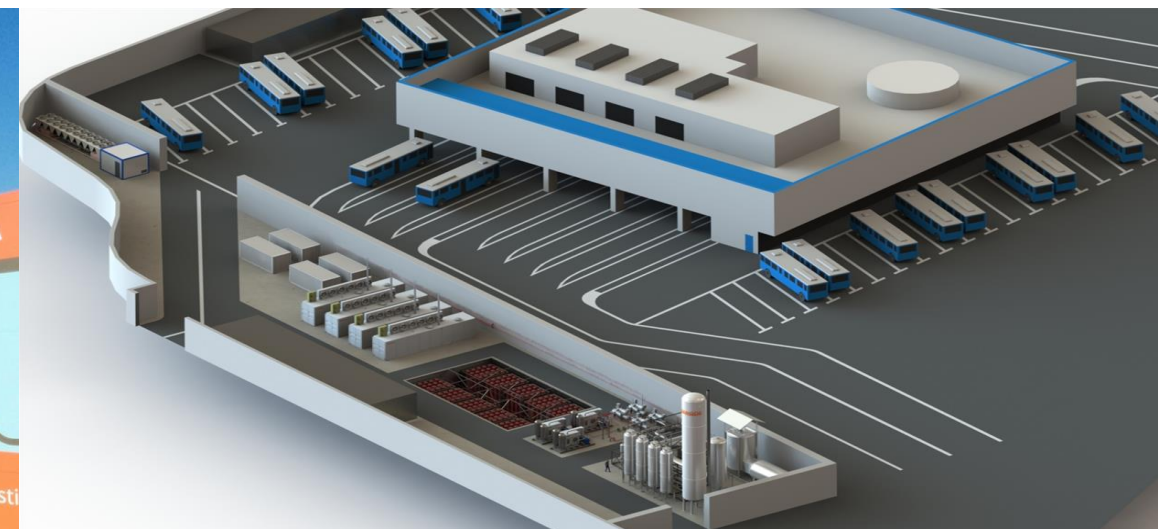
Zero tailpipe emissions. Faster recharge than battery electric vehicles



Las Columnas
HRS with onsite production of 30 Nm³/h



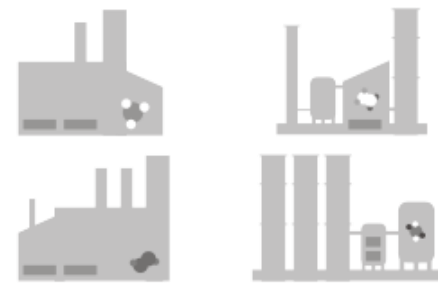
Torrecuéllar
HRS with onsite production of 30 Nm³/h

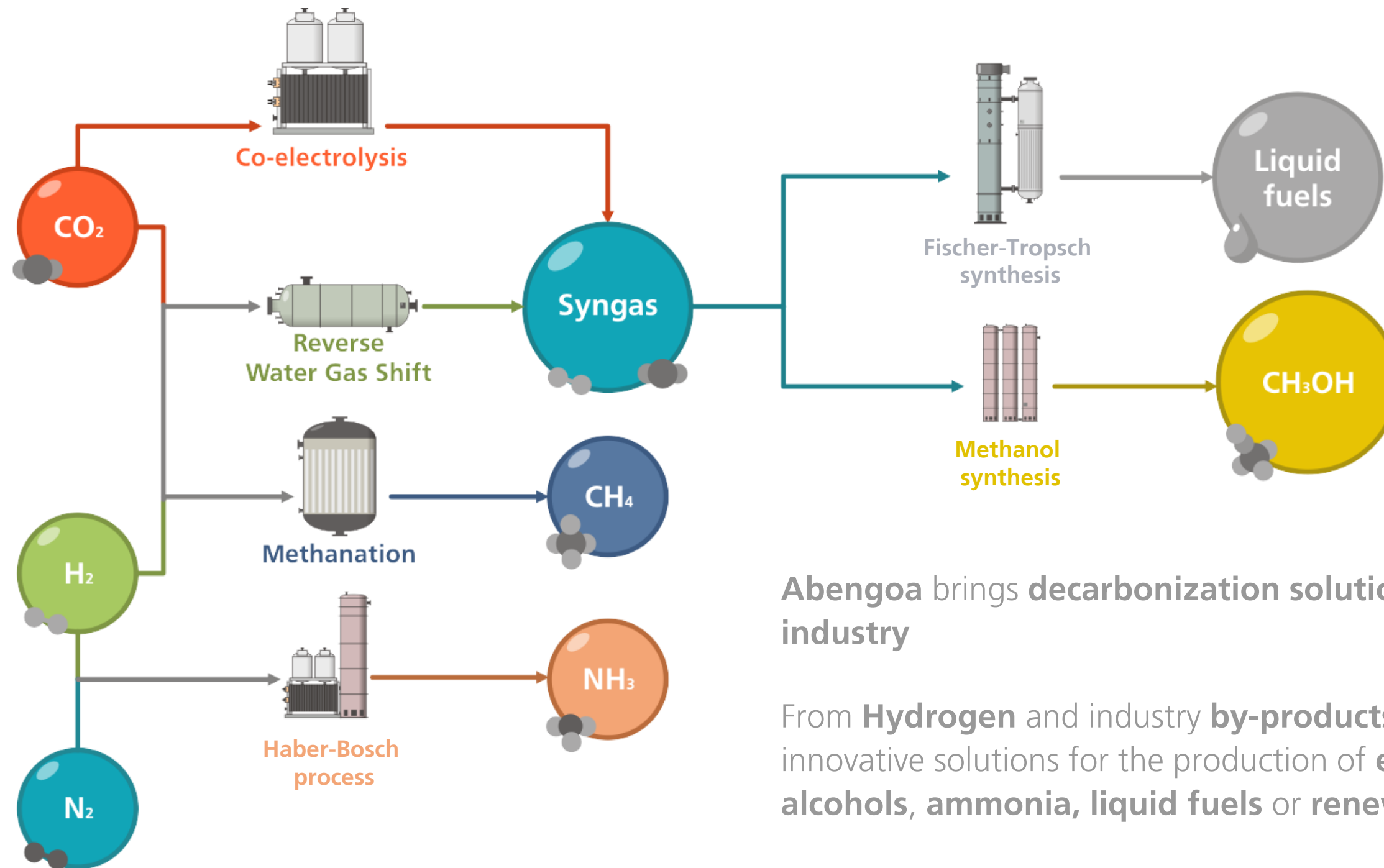


Newbusfuel
HRS for busses and onsite production

Industry

Industry

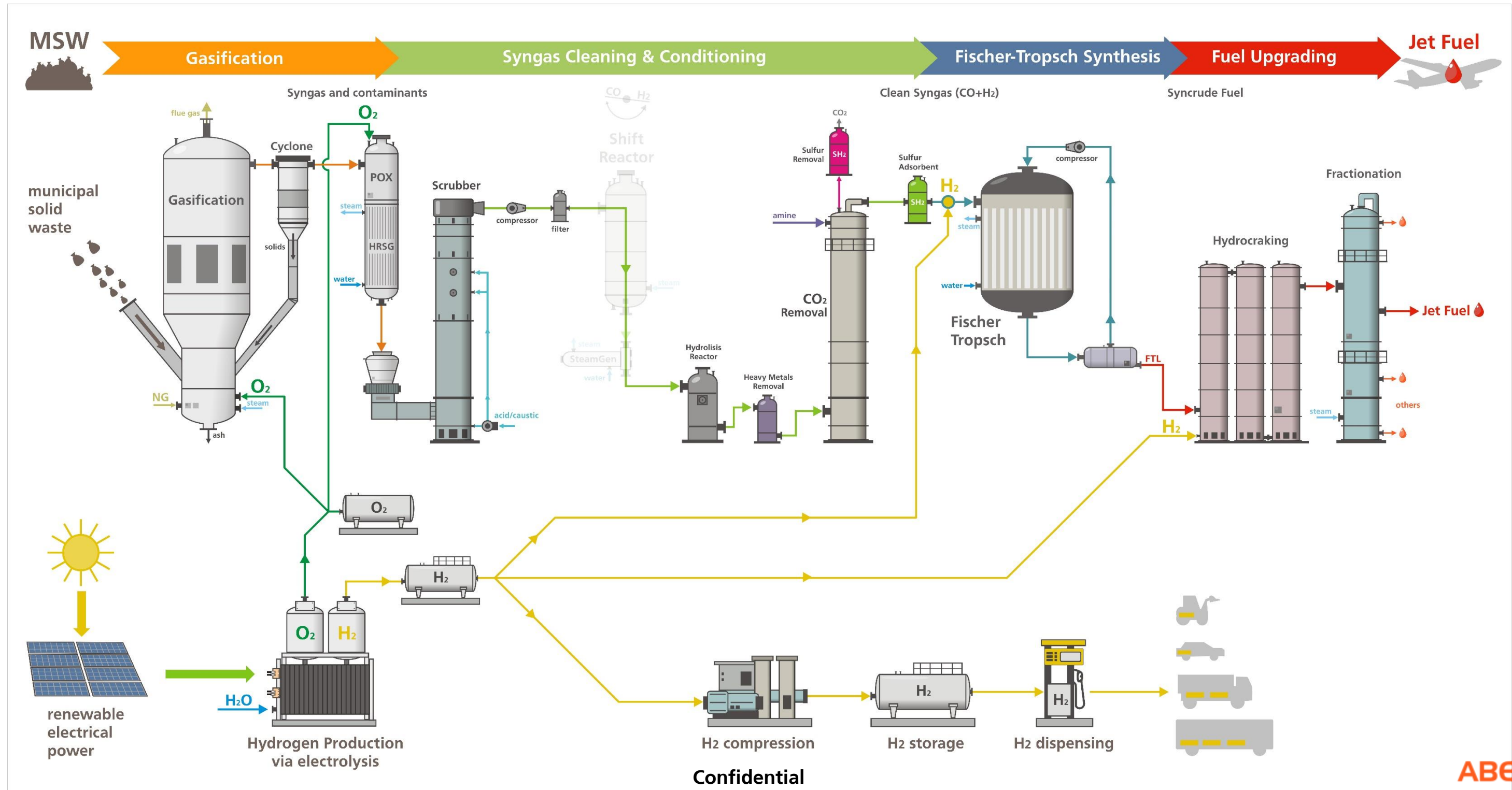




Abengoa brings **decarbonization solutions** to the industry

From **Hydrogen** and industry **by-products**, Abengoa offers innovative solutions for the production of **e-fuels** such as **alcohols**, **ammonia**, **liquid fuels** or **renewable gases**.

Green hydrogen can be integrated into Abengoa's **Waste to Biofuels** products to **reduce emissions** and **increase efficiency**

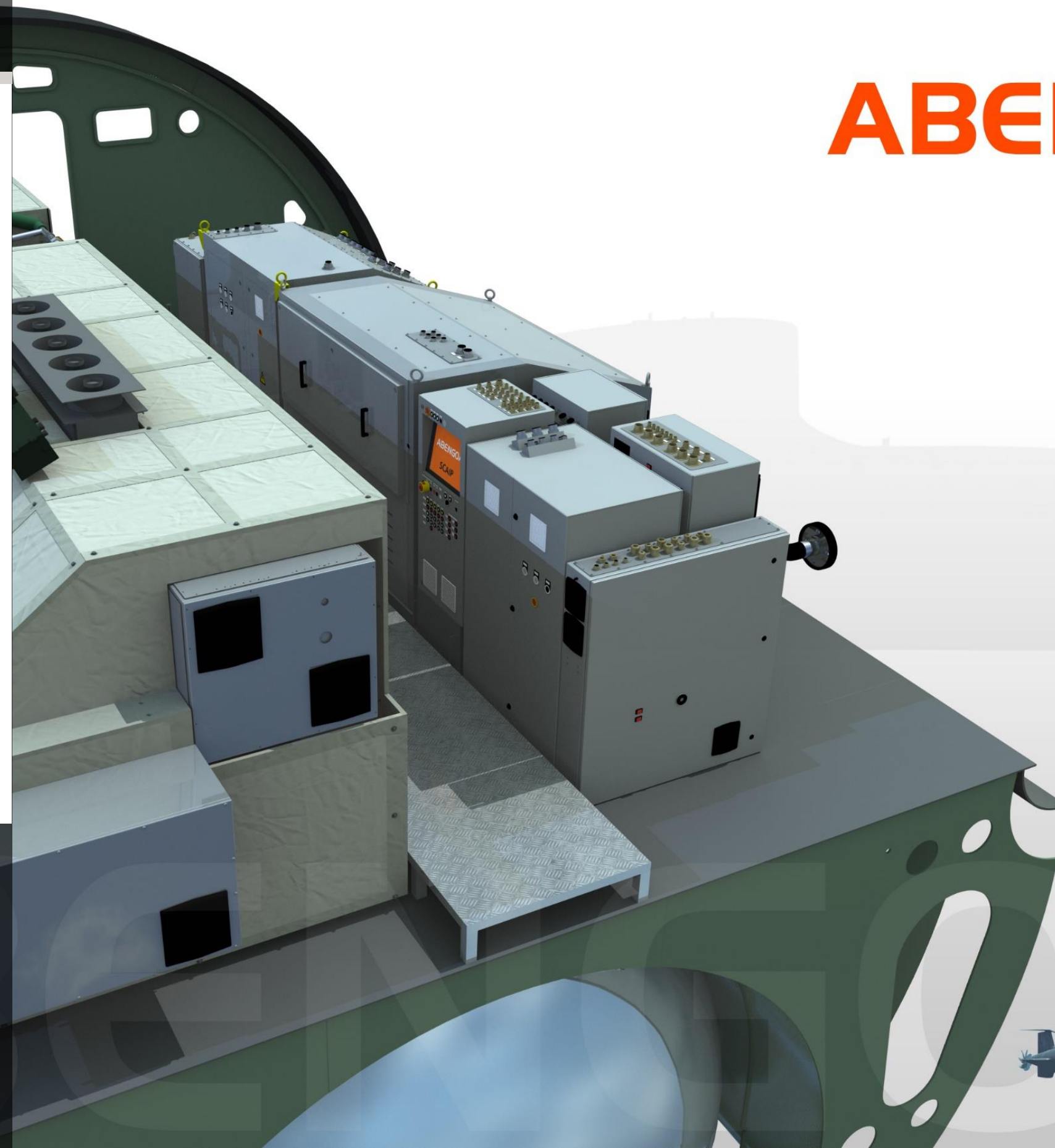


Special Projects

Special projects

Defence

Aerospace



S-80 Sistema AIP

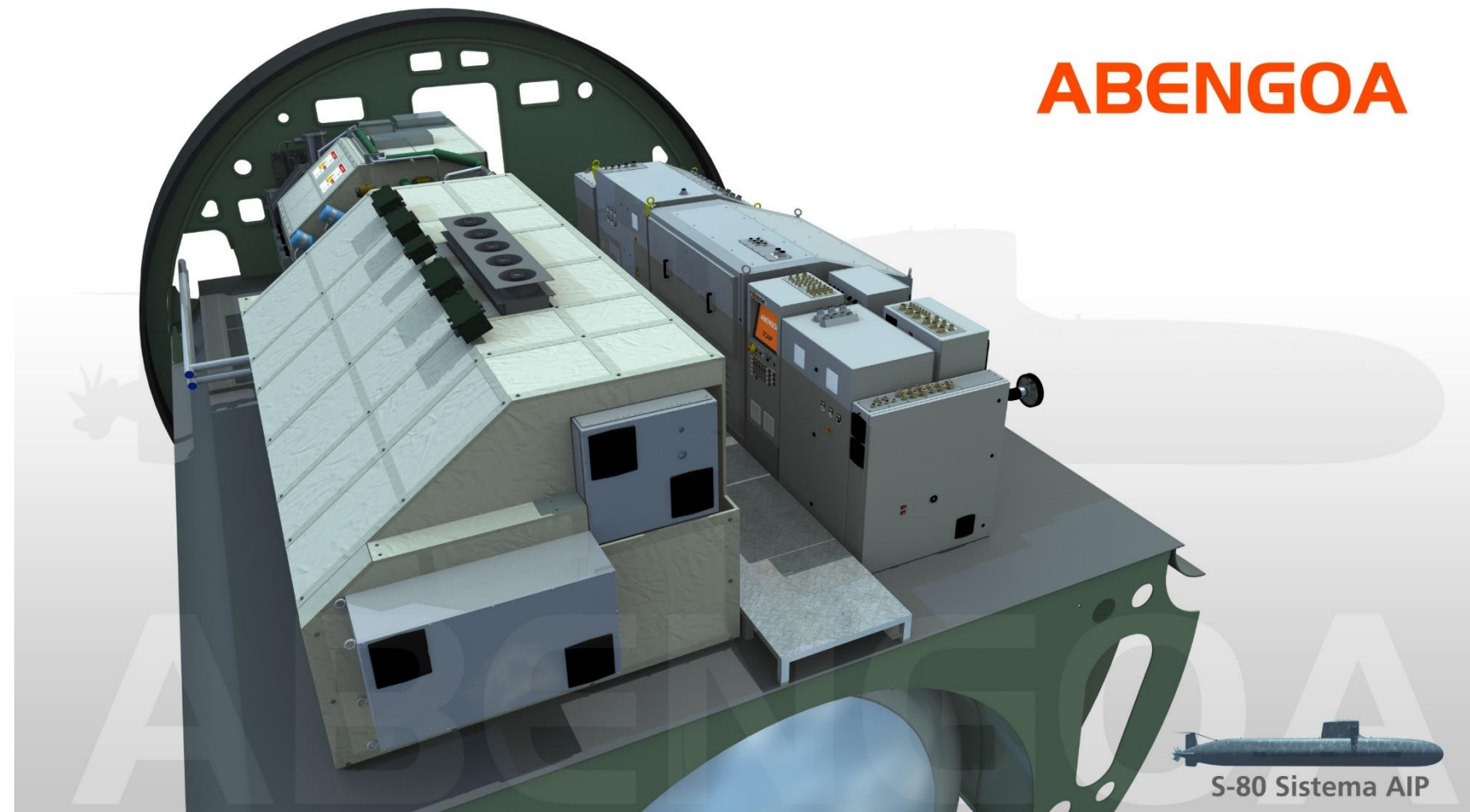
Abengoa as **technologist** and **main supplier** of the **AIP** System for **S80 submarines**.

The **AIP** System consists of: **Bioethanol Processor** System, **Fuel Cell Power** Module, **Power Conditioning** System, **CO2 Disposal** System and **AIP Control** System.

Abengoa is in charge of the **design, manufacture** and **validation** of:

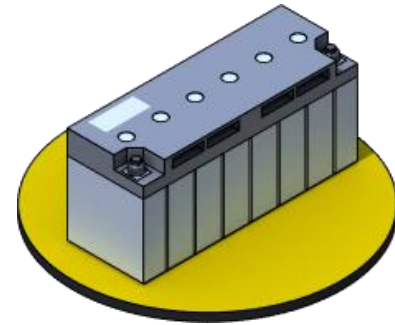
- ✓ **Bioethanol Processor** System
- ✓ **Power Conditioning** System
- ✓ **AIP Control** System

Abengoa is also in charge of the **integration** of the **Fuel Cell** and **CO2 Disposal** systems in the **AIP System** to guarantee the required performance, functionality and operability.





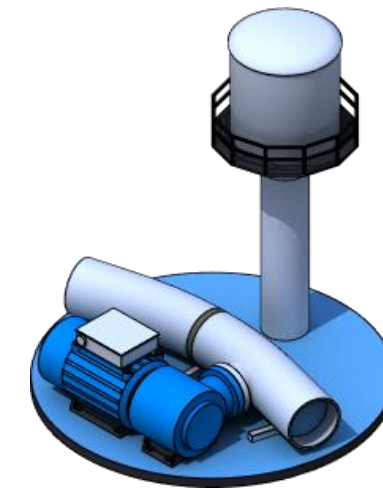
Solar PV
469 MW



14MW
BESS (Energy Storage)



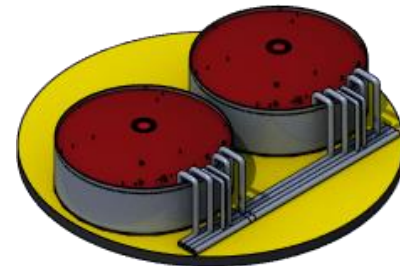
160MW
Engines



300+
References
1,100 Km
Hydraulic
Infrastructures



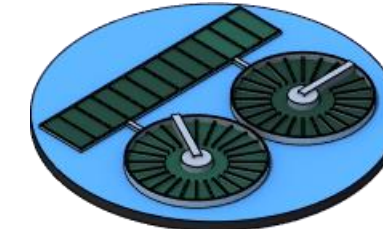
Solar Thermal
1,700MW



4,000MWth
TESS (Thermal
Energy Storage)



9,000MW
Combined Cycle
Gas Turbines



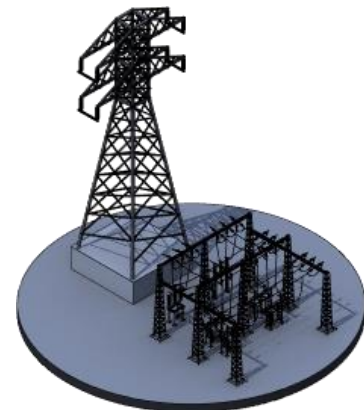
15+
References
2.2 M m³/d
Water Treatment



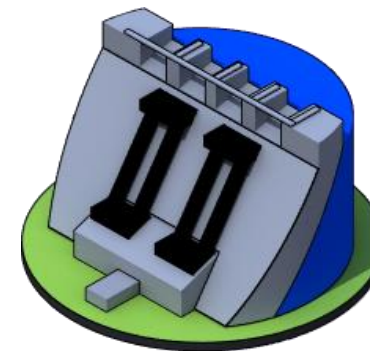
254 MW
Wind Power



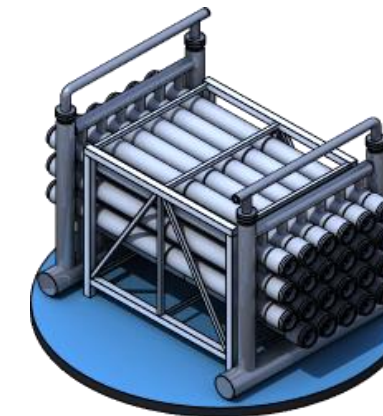
515MW
Biomass/Cogen



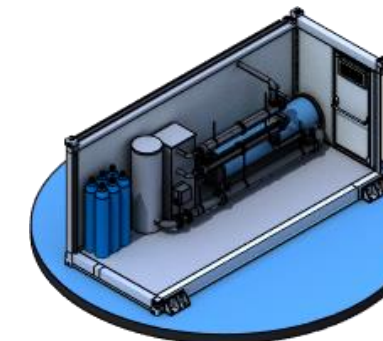
27,000 Km
Transmission Lines



400MW
HydroPower
40+
References



20+
References
3.7 M m³/d
Desalination



15+
References
500,000 m³/d
Industrial
WasteWater
ABENGOA



Abengoa is able to provide a full wrap EPC Plus service, integrating a wide range of technologies and providing all the necessary guarantees, optimizing technical and commercial solutions to suit a client's specific operating requirements and needs.

- 1 Abengoa has an **EPC & Product vision**
- 2 Abengoa has real experience on **commercial applications**
- 3 Abengoa is specialist in **Hybridization & Decarbonization solutions**
- 4 **Strategic Partner** for the Hydrogen applications

Thank you

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