



AUGUST 13TH, 2024, FIEC: FEDERATION OF INDUSTRIES OF THE STATE OF CEARA, BRAZIL.

Technical session: Gh2 and its derivatives

Design Principles and Technology selection criteria for the optimization of LCOH

Jorge Batarce - Industry Business Manager



Enhancing GH2 & PTX Financial Viability

Design Principles and Technology selection criteria
for the optimization of LCOH

Agenda:

1. Markets Overview & Trends
2. Projects considerations
3. Green Ammonia case
4. ABB Offering
5. ABB Value Proposition

August 12th, 2024



Jorge Batarce

**Global Industry Business Manager
Hydrogen and PtX**

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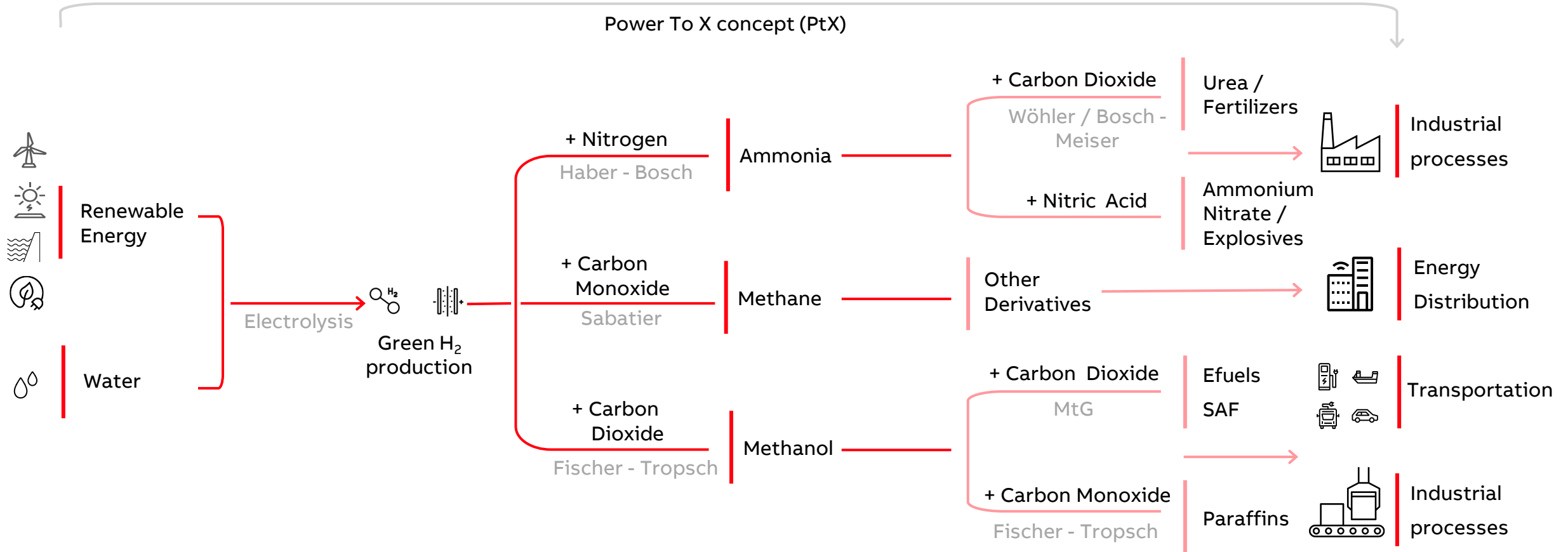
Jorge Batarce T. Is the global lead for Hydrogen and PtX for ABB.

He possesses ~20 years of experience in engineering projects, technology development and business units' managements.

Jorge is a Civil Engineer and holds a Master degree in Engineering, and MBA and a Master in Finance.

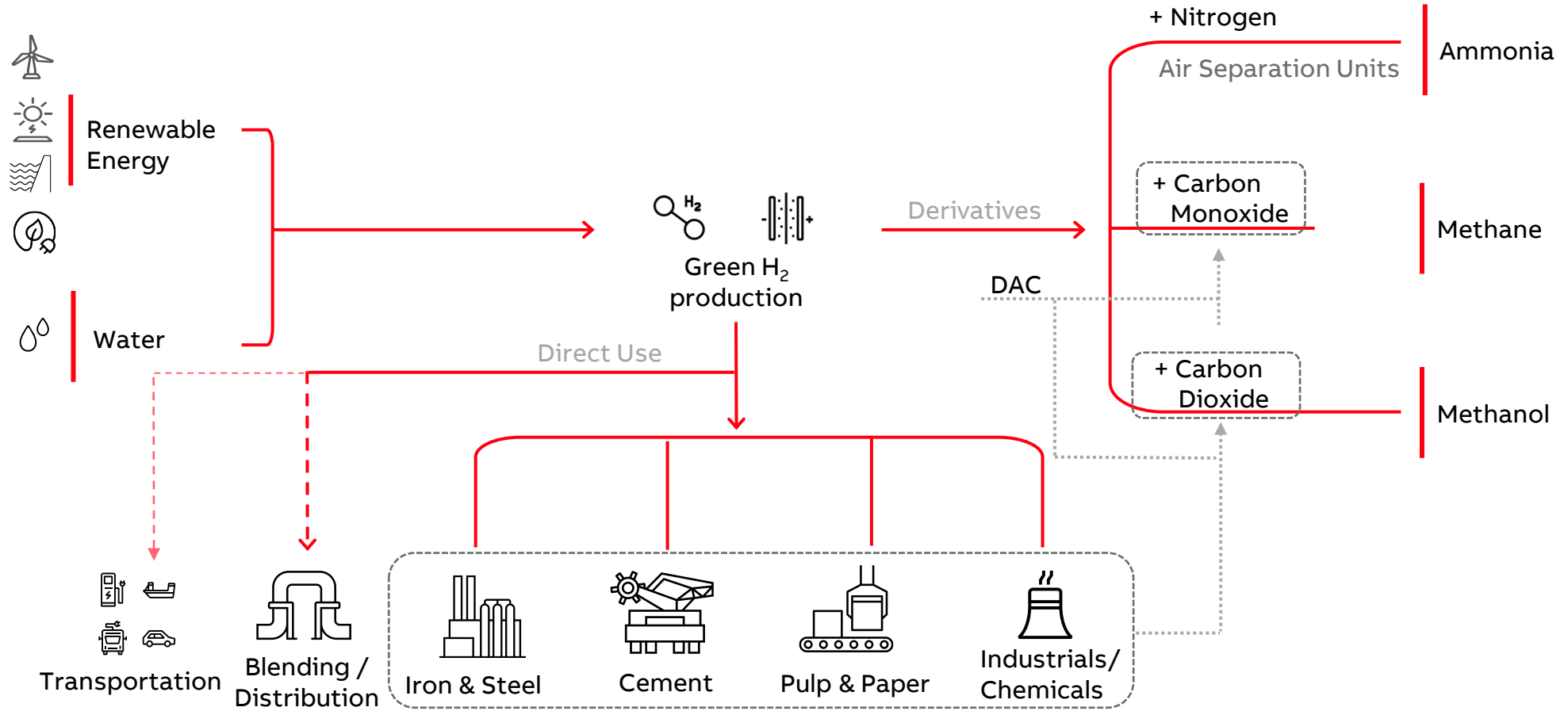
1. Market Overview and Trends

Steps and challenges of each path



1. Market Overview and Trends

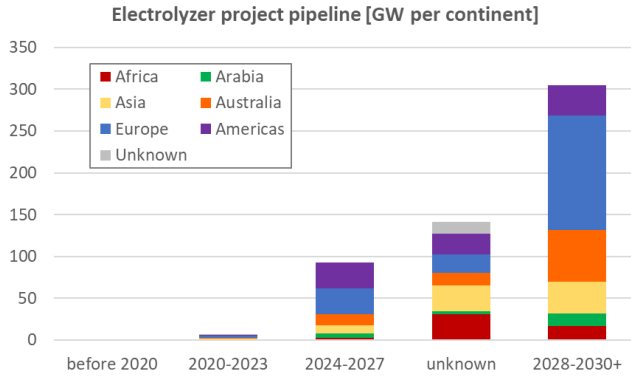
Decarbonization paths with hydrogen and its derivatives



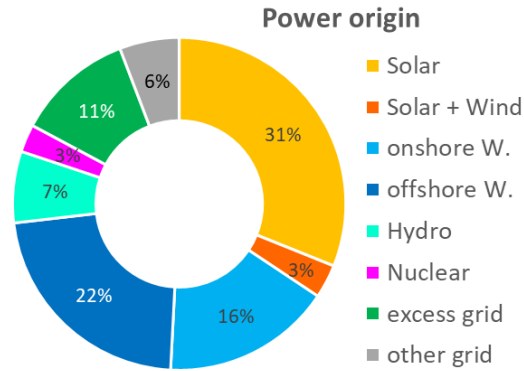
1. Market Overview and Trends

Industry Trends and Data (1990 – 2040)

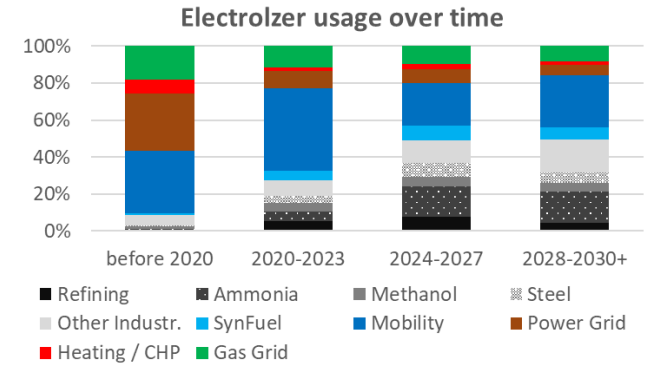
1. Geographically diversify market



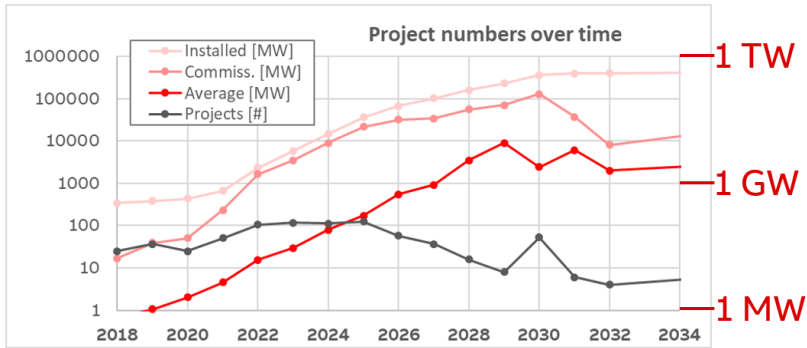
2. +80% presents volatile energy profile



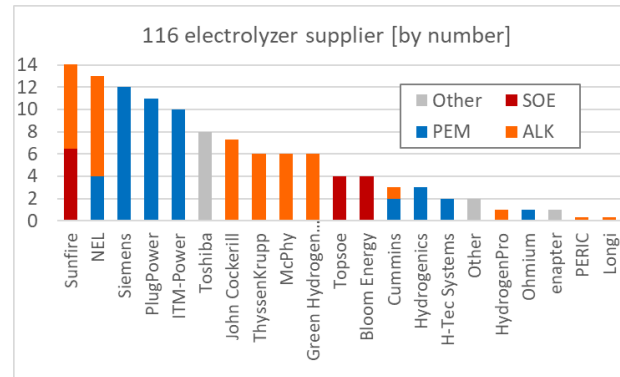
3. >50% represents derivatives paths



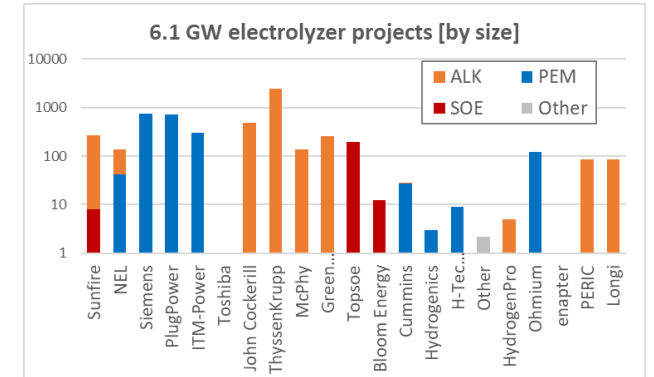
4. Annual project size increase, efficiency



5. Electrolyzer market, competitive



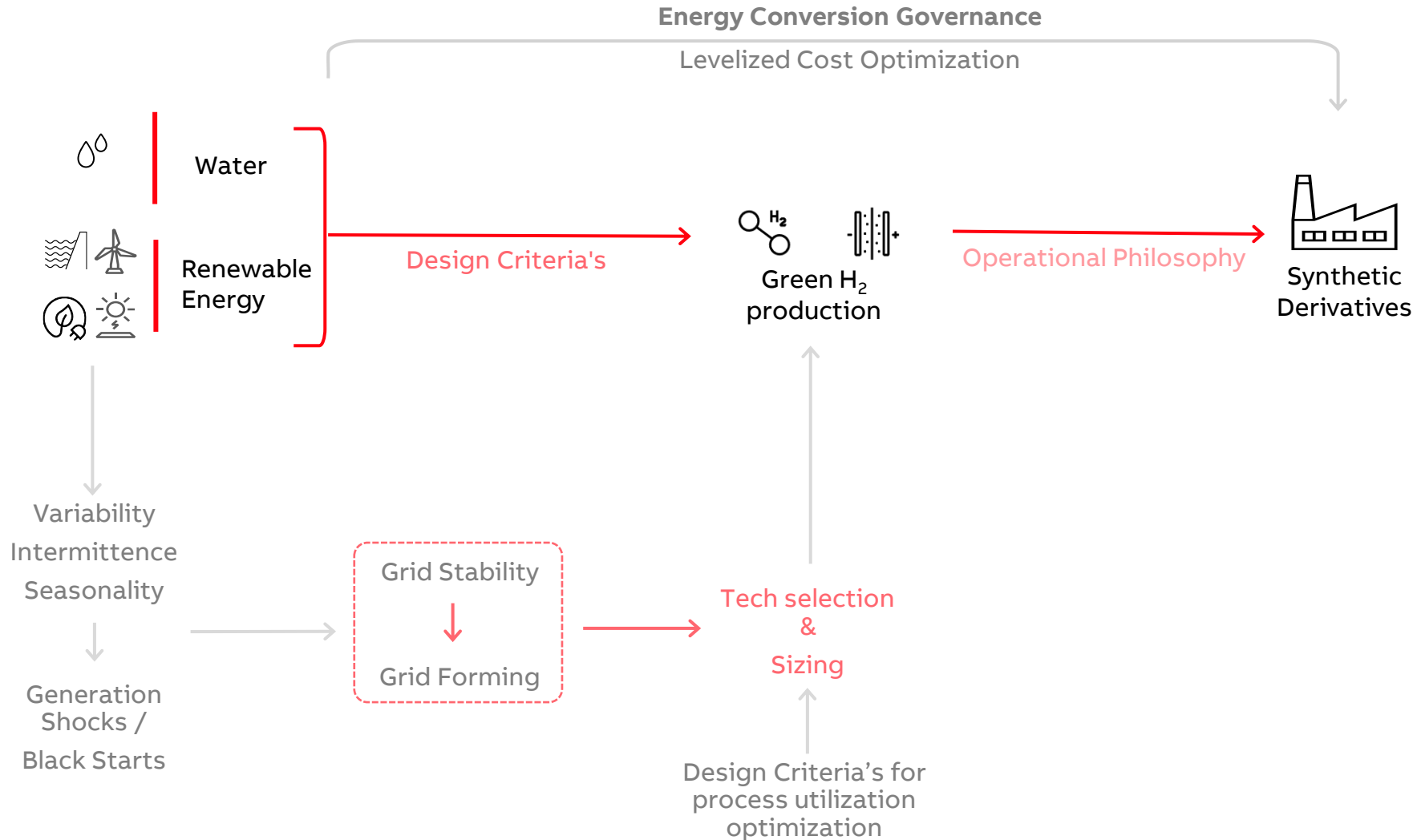
6. > 6GW (4AE / 2PEM) price sensitive



Based on IEA (2022-10) plus own entries (2023)

2. Projects considerations

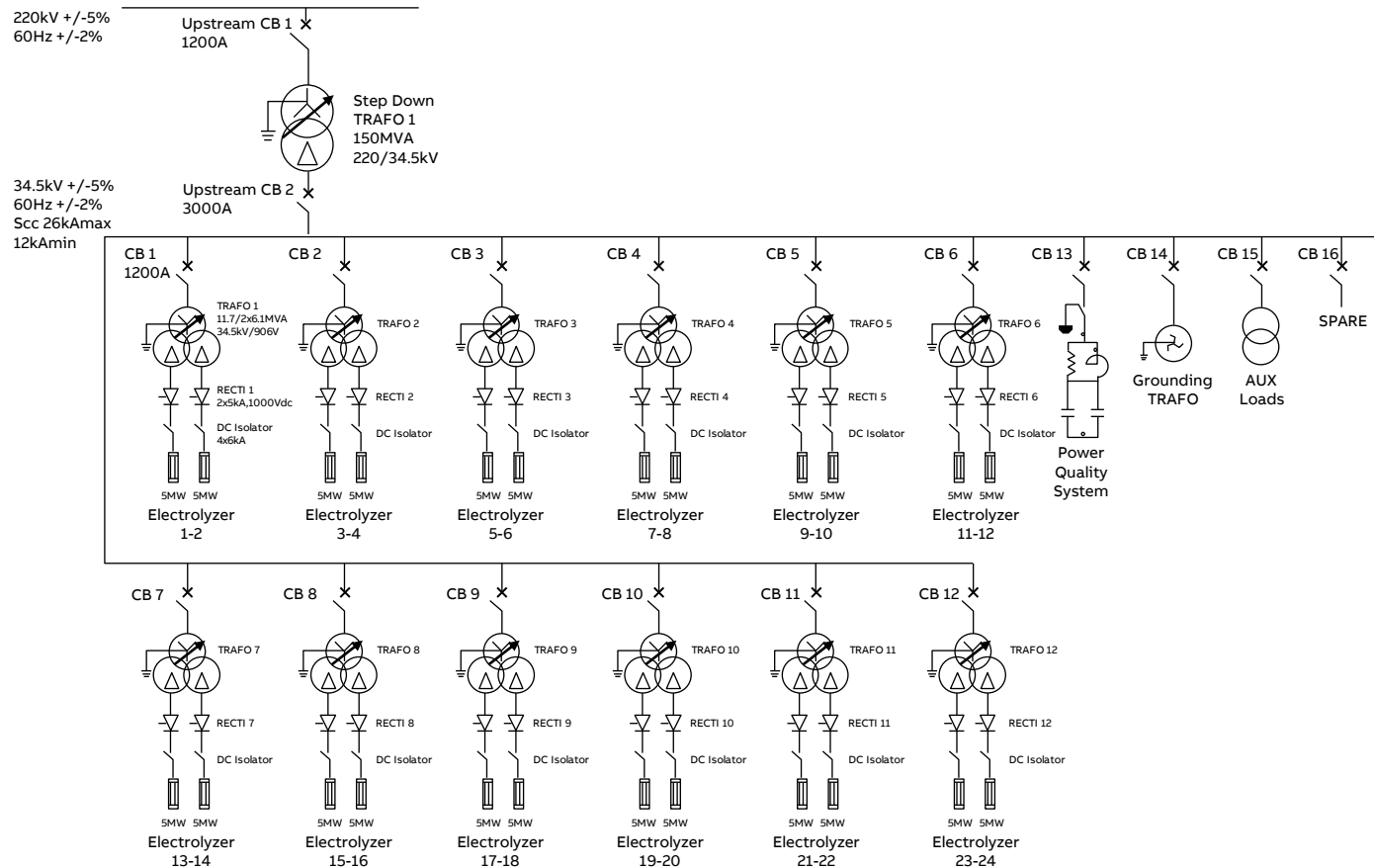
Development challenges of a green hydrogen project



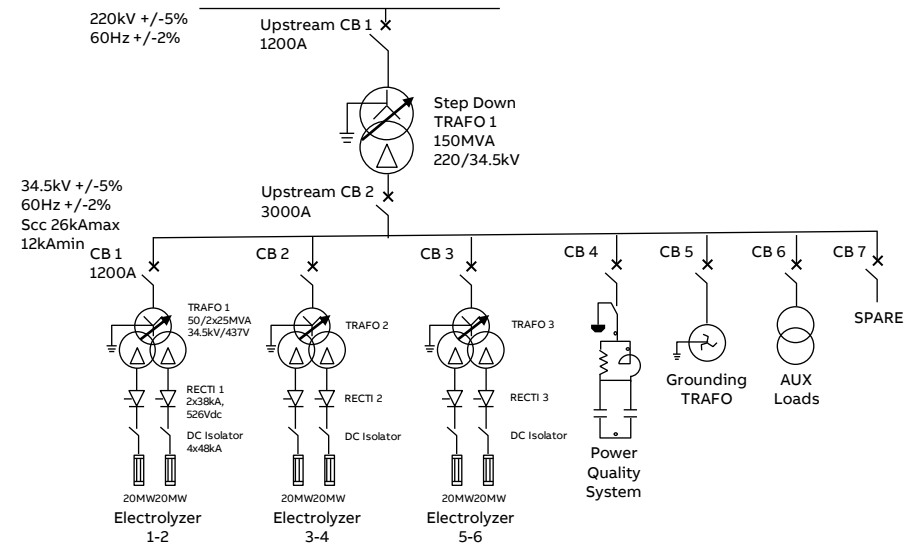
3. Green Ammonia Case

Large Scale H₂ Plants – 2 Approaches, Both Achieves GW Plants!

120MW Block – 24 x 5MW Electrolyzer



120MW Block – 6 x 20MW Electrolyzer



3. Green Ammonia Case

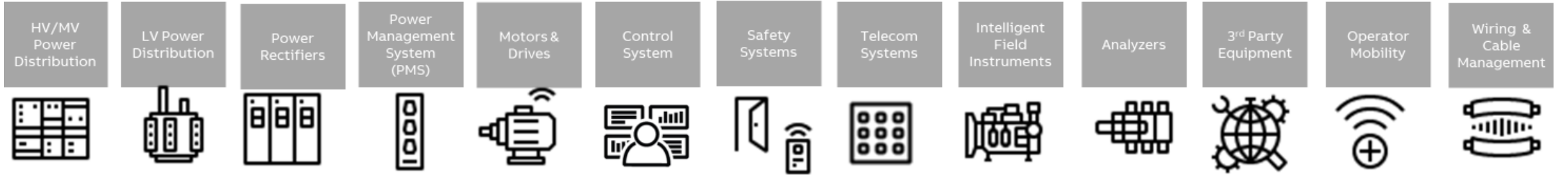
Getting into Giga Scale – 960MW

Parameters	192 x 5 MW Electrolyzers	48 x 20 MW Electrolyzers
Plant Capacity / Incoming Voltage	960 MW / 220 kV	960 MW / 220 kV
HV Switchgear	8 X AIS / GIS	8 X AIS / GIS
Step Down Transformer HV→MV	8 units @220/34.5 kV, 150 MVA each	8 units @220/34.5 kV, 150 MVA each
MV Switchgear for DC Power Supply	96 x AIS / GIS	24 x AIS / GIS
Rectifier Transformer	96 units @ 34.5/0.906 kV, 12MVA each (12 pulse)	24 units @ 34.5/0.437 kV 50MVA(12 pulse)
Rectifier	96 units @ 10 MW 2 x 5kA, 1000Vdc	24 units @ 40 MW 2 x 38kA, 526Vdc (30-60kA; 667 – 333Vdc)
Harmonic Filter	Filters and dynamic compensator connected to MV bus depending on chosen rectifier topology	Filters connected to MV bus + dynamic compensator depending on renewable power fluctuations and operating scenarios

4. ABB Offering

MEC + MAC

Lifecycle Management



Main Electrical Contractor (MEC)

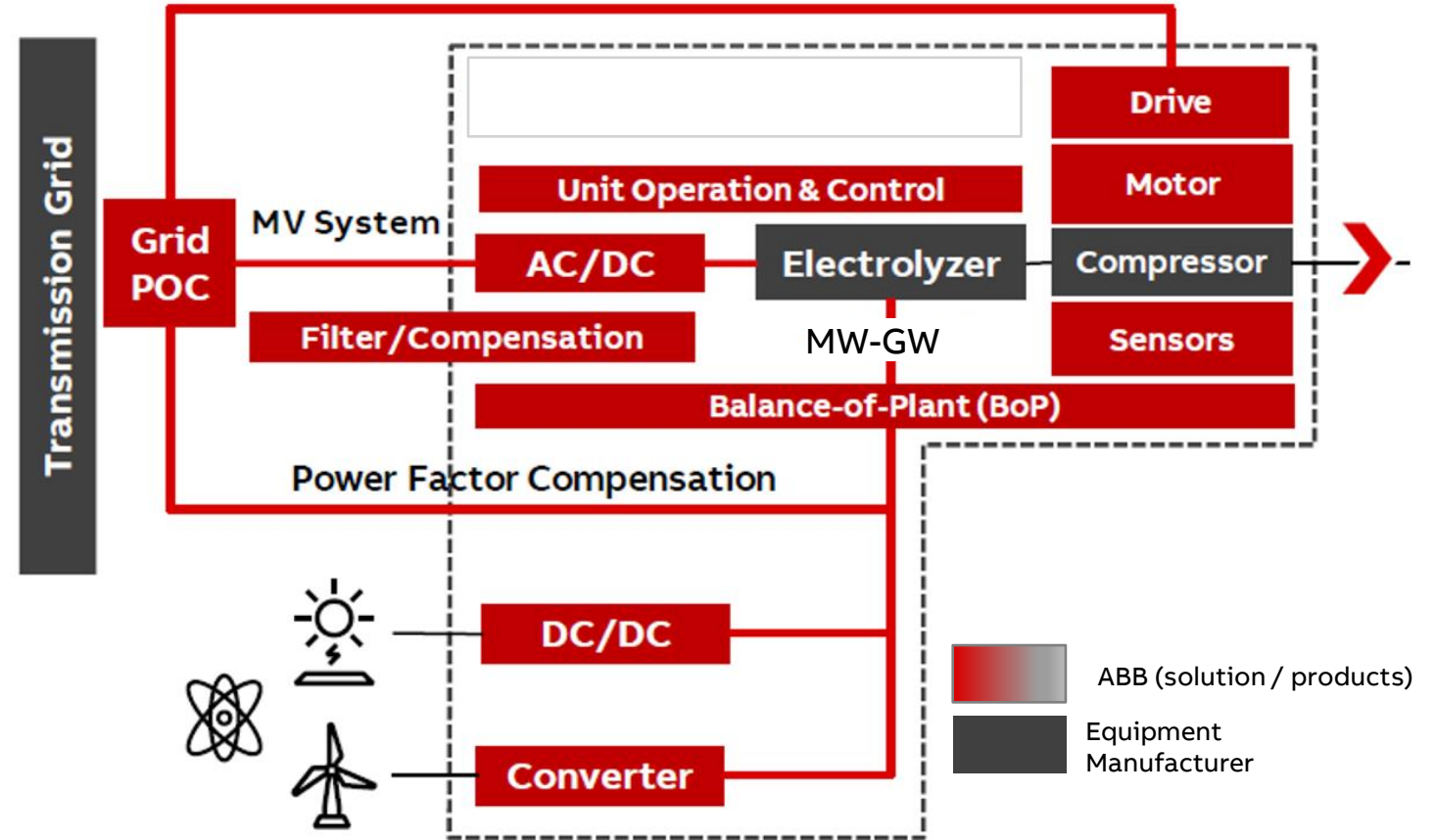
Main Automation Contractor (MAC)

ABB's Integrated solutions can reduce OPEX and CAPEX by 20%

4. ABB Offering

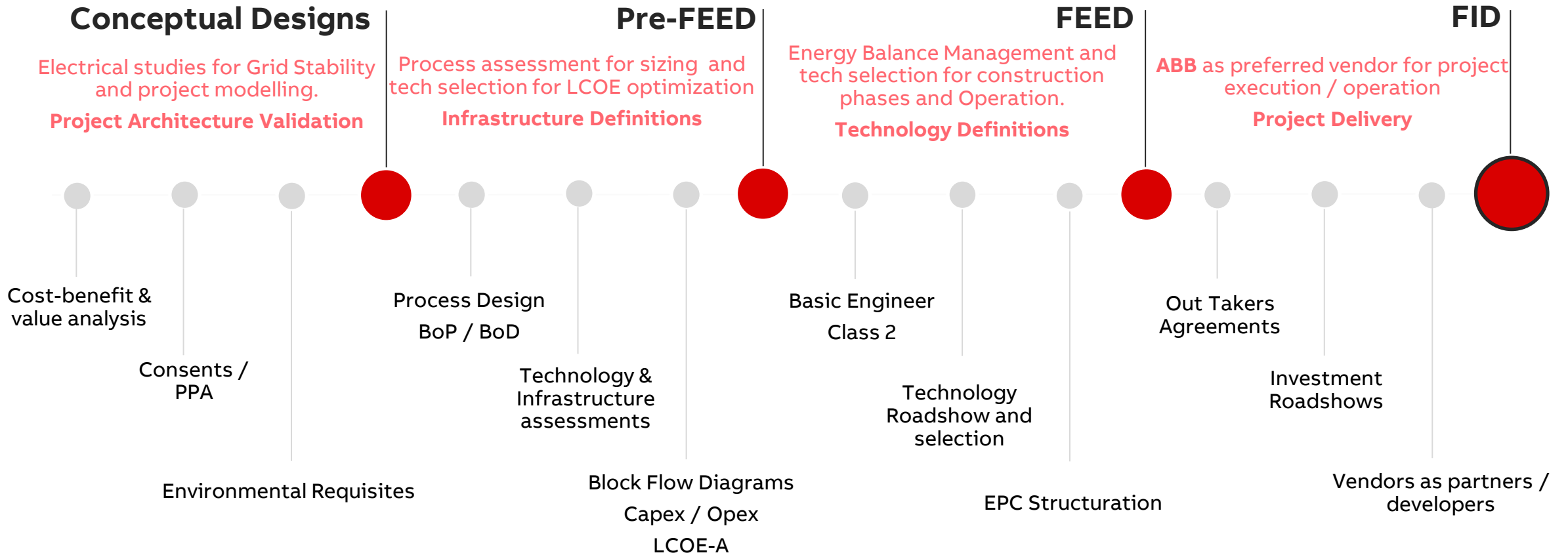
Optimized Design and Optimized Secure Operations

- ABB
- Support for design and validation
- Support for Operations optimization
- Electrical, Control, Telecoms & Digital
- E-Houses
- Cyber Security
- Full Lifecycle support



5. ABB value proposition

Early Engagement with Electrical Studies



References

GHI

ABB signs agreement to support major Power-to-X green hydrogen project in the US

Press release | Houston, United States | 2024-03-19

- ABB collaborates with Green Hydrogen International on the Hydrogen City project in Texas, set to produce 280,000 tons of green hydrogen per year
- Hydrogen to be used to produce one million tons of green ammonia annually to serve global export demand
- Facility will be powered by behind-the-meter solar and onshore wind energy, allowing for IRA and RFNBO compliant production

ABB has already completed a feasibility study to develop an electrical system architecture that optimizes return on investment for the project and supports compliance with EU legislation governing Renewable Fuels of Non-Biological Origin (RFNBO)² and the US Inflation Reduction Act (IRA). ABB plans to supply its Integrated Control Safety System with the distributed control system ABB Ability™ System 800xA® to improve efficiency, operator performance and asset utilization. MoU scope also includes electrical motors and drives, measurement and analytics solutions, and power and process optimization solutions.

Source:

<https://new.abb.com/news/detail/113736/abb-signs-agreement-to-support-major-power-to-x-green-hydrogen-project-in-the-us>

References

Esbjerg

ABB applies electrical expertise at major green hydrogen site in Denmark

Group press release | Zürich, Switzerland | 2023-10-11

- ABB will provide electrical engineering support for the H2 Energy Esbjerg hydrogen production facility in Denmark
- The 1 GW plant will produce 90,000 tons of green hydrogen per year, the equivalent of about 1.9 million barrels of oil per year
- Output to support decarbonization of heavy industry and road transportation

ABB has been contracted by Danish company H2 Energy Esbjerg ApS to provide basic electrical engineering for the power distribution from grid point of connection to electrolyzers, and for other process equipment at its 1 GW hydrogen production facility in Esbjerg and hydrogen distribution hub in Fredericia, Denmark. The plant, among the largest hydrogen developments in Europe, will produce up to 90,000 tons of hydrogen per year – the equivalent of about 1.9 million barrels of oil per year.

Source:

<https://new.abb.com/news/detail/108246/abb-applies-electrical-expertise-at-major-green-hydrogen-site-in-denmark>

ABB