



ABB Smart Green Ammonia

Lessons learned delivering power design and management, energy optimization and asset wide monitoring and control for ammonia production

ENGINEERED
TO OUTFIT

“It’s not easy being **green**”

- Kermit the Frog,
entertainer

REDDAP – 10 MW dynamic Power-to-Ammonia plant

Integrated electrical and automation solution for demonstration project producing certified green ammonia

ABB deliverables

- Electrical design studies
- Full automation control and management of the plant's electrolysis and ammonia synthesis process
- Full electrical distribution from the electrolysis to further processing of hydrogen to ammonia
- Delivery & commissioning: Transformers, MV/LV switchgear, Drives, UPS & ICSS



Customer: Skovgaard Energy
Topsoe



Location: Lemvig, Denmark



Completion: 2024



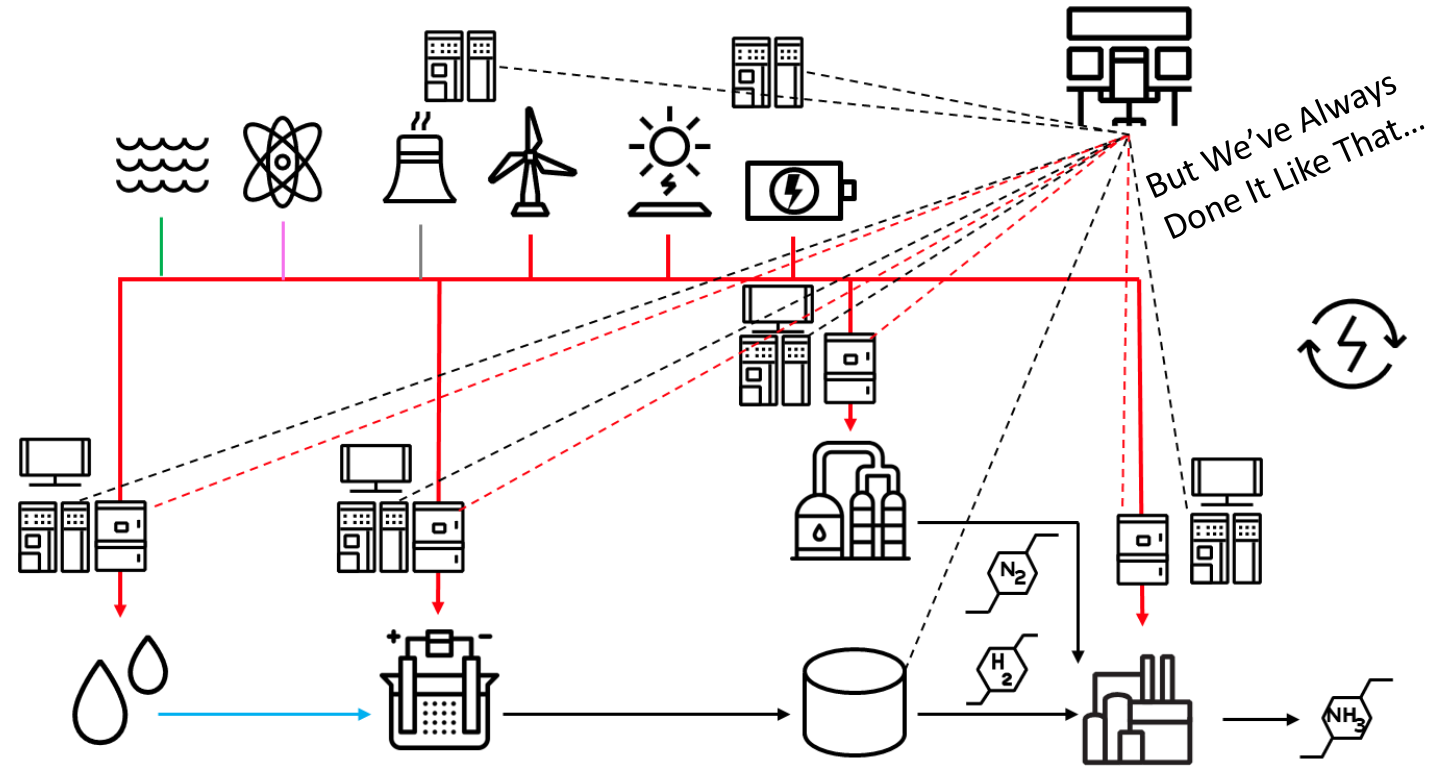
Customer Benefit

Proof of concept of fully dynamic production facility for hydrogen and ammonia based on own renewable power

Package Controls, Electrical Design, DCS, PCS, SIS, PMS, Historian, Optimization.....

“We know how to build wind farms, electrolyzers, and ammonia synthesis loops.

The complexity is managing the interfaces and the intermittency...”



Complete integrated ammonia project solution

In the past, “built to last”
was a guiding principle.

Today, “built to adapt”
delivers optimal results.

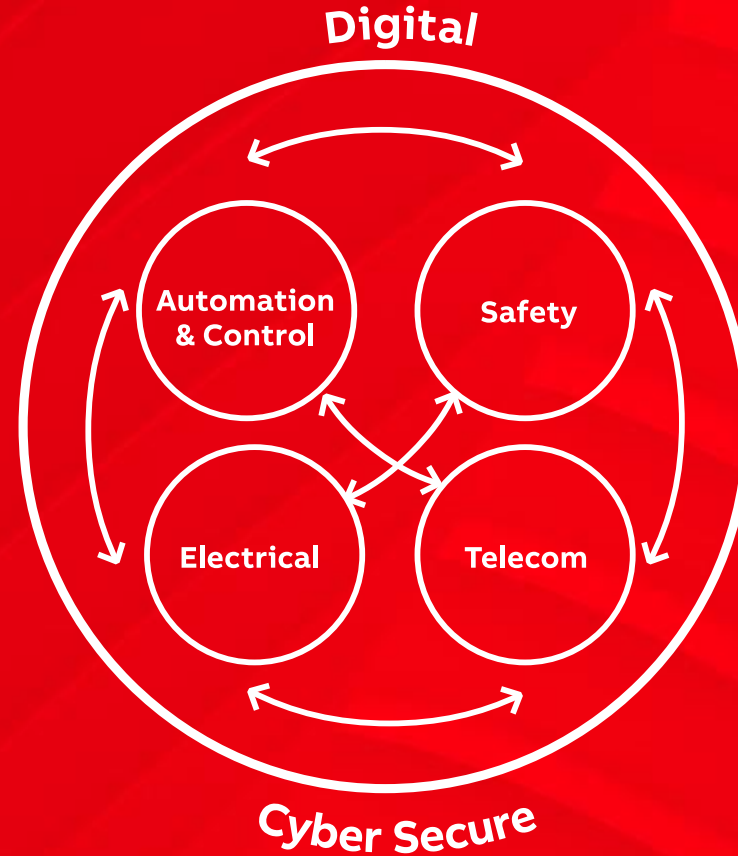
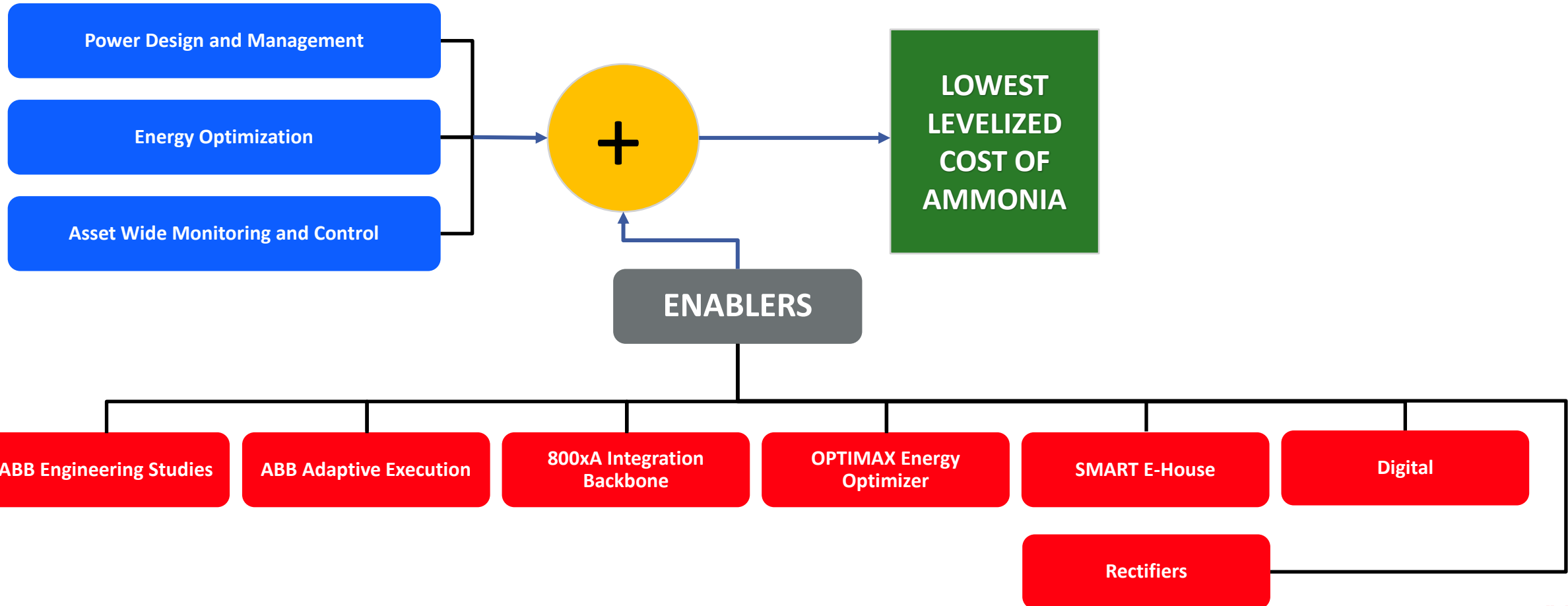


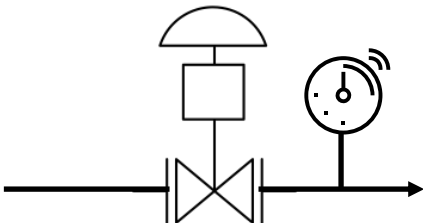
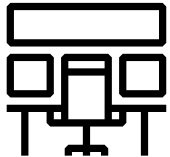
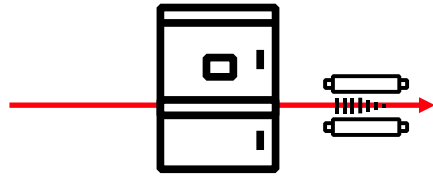
ABB SMART Green NH3 Solution For Skovgaard

Delivering the Lowest Levelized Cost of NH3 through Predictability & Profitability

Three Pillars and Enablers of the ABB SMART Green NH3 Solution

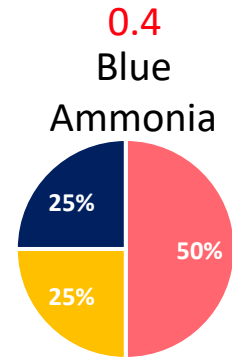
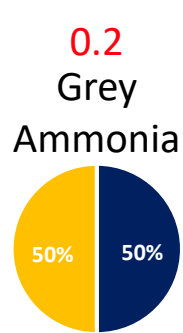


Designing For Process Control or Power Management?

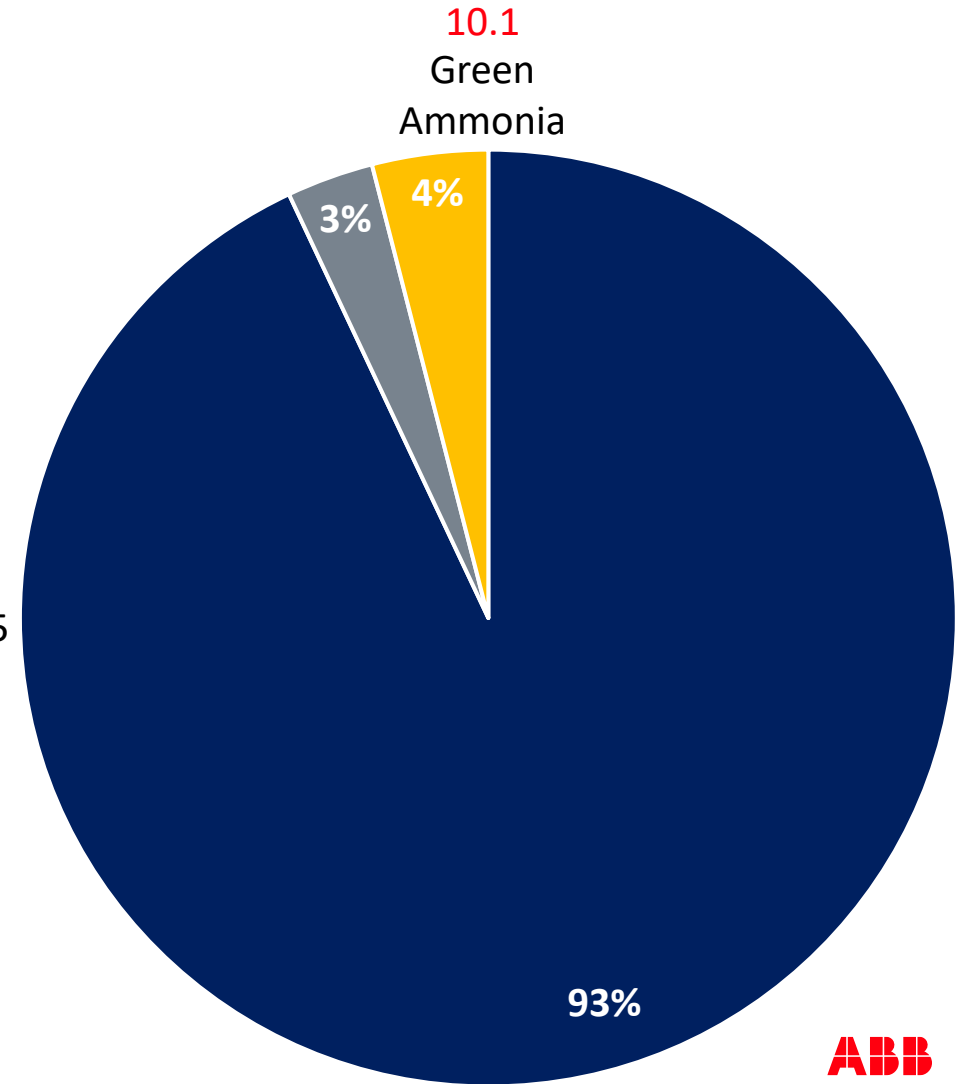


2020 Power Requirements MW/t NH3

- Hydrogen Production
- Ammonia Synthesis
- Nitrogen Separation
- Carbon Capture



x25



Why Energy Management and Optimization

- 1 Reduce CAPEX and OPEX via optimal asset orchestration. Enable integrated circular processes (H2, electricity, thermal, etc.) – to optimize the total value of energy
- 2 Forecast of energy demand and supply, including renewables
- 3 Take advantage of opportunities on energy market

Established technology -
providing stability,
reliability, predictability
and profitability

Skovgaard Sustainability Software Portfolio

OPTIMAX Suite of applications

What

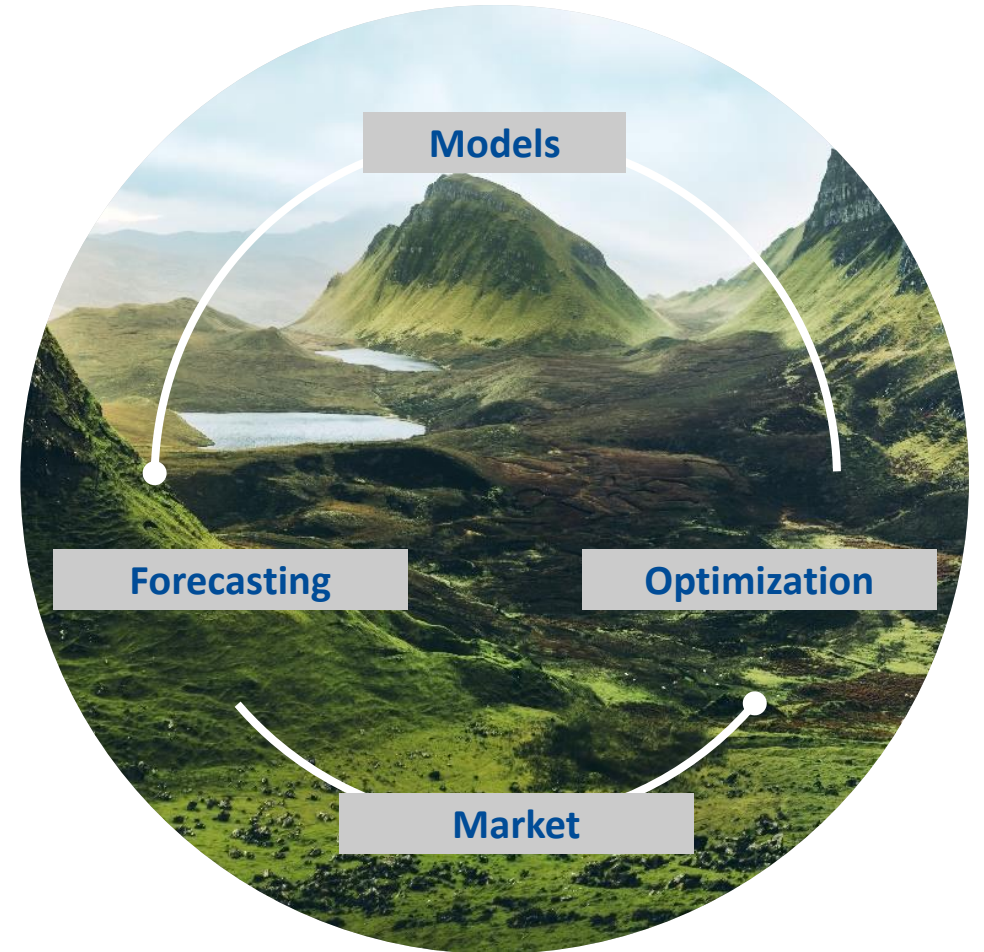
- Provide coordinated control of multiple assets targeting energy efficiency increase and **carbon management**

Solution

- Forecasting
- Market Interaction
- Simulation
- Model Predictive Control/Advanced Process Control
- Real Time Optimization
- Site and Multi-Site management – Single Pane of Glass

Connectivity

- Automation systems/historians (process and terminal)
- Equipment (e.g. power and fuel metering)
- Energy Markets
- Weather systems
- Forecasting support data



OPTIMAX is designed to unlock the value of industrial optimization by modern digital technologies with modular solutions for a wide range of applications

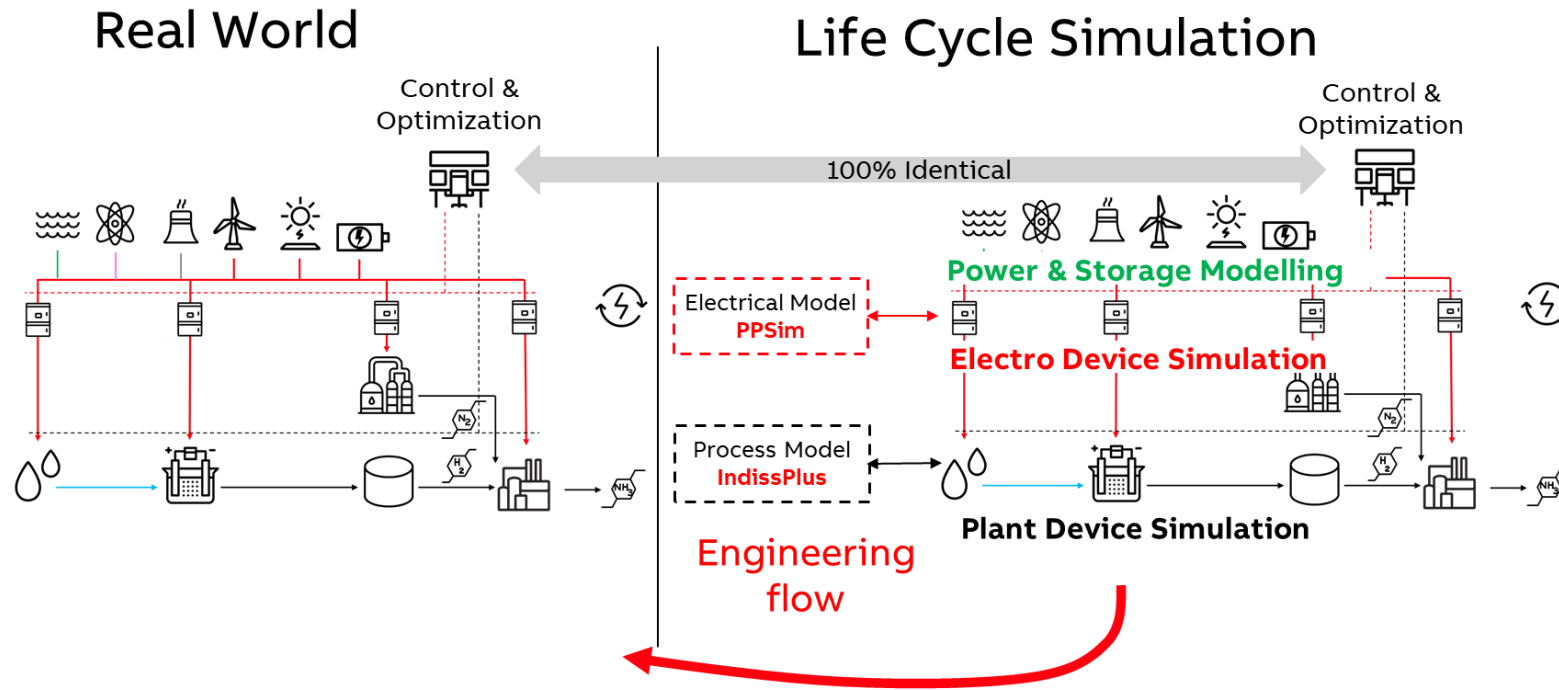
Lifecycle Simulator – Design it, Build it, Operate it!

ABB Lifecycle Simulator – Optimization in every phase of your project.

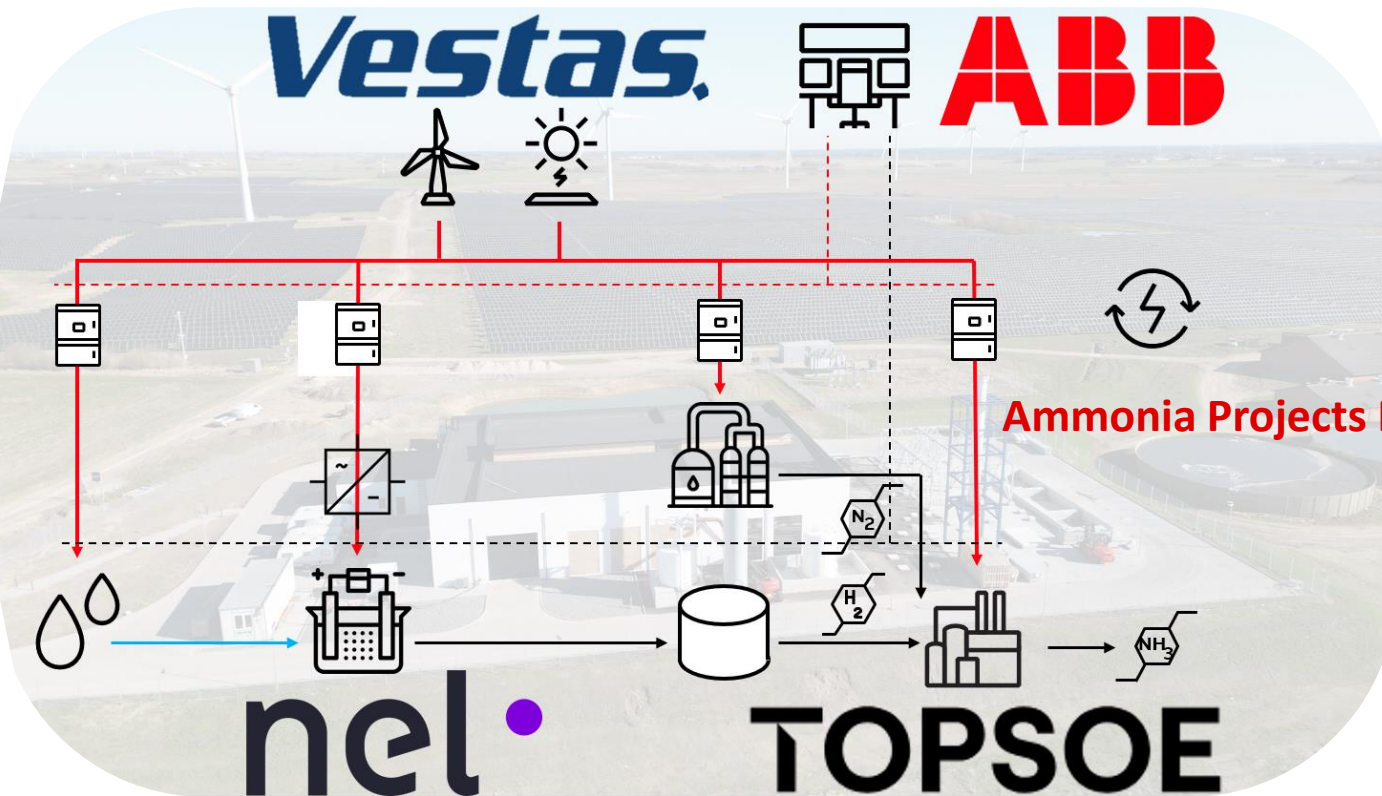
If you can't model it, you can't understand it...

If you can't understand it, you can't improve it...

If you can't improve it, you won't have a profitable/efficient plant...



Seek collaborative partners aligned with you to help you succeed Before, during and after

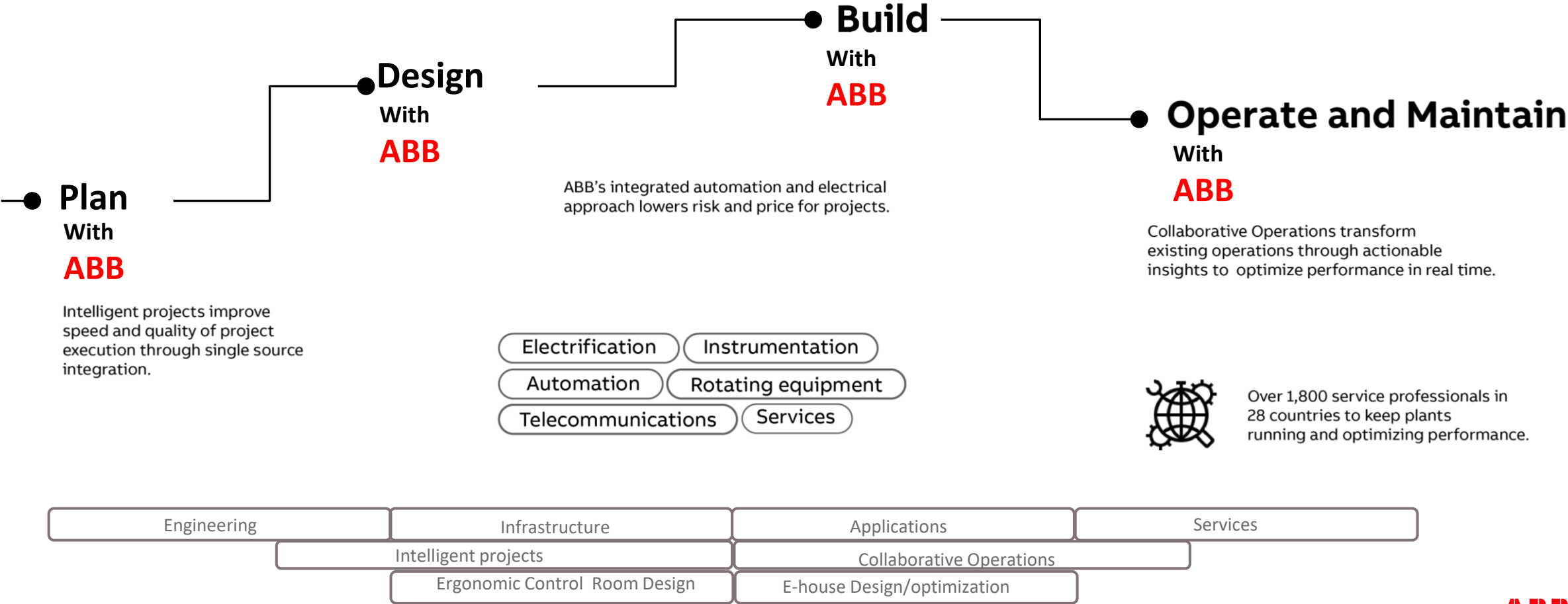


Ammonia Projects Require:

- Open communications, transparency in operations and costs
- Shared risk and reward
- Collaborative partnerships with licensors, suppliers and engineering houses and more
- Specialized domain and technology expertise
- Increased attention to regulations
- Support to operate and maintain

Skovgaard -Leveraging collaborative partners for the projects lifecycle

Proven technologies for minimizing cost, schedule and risk



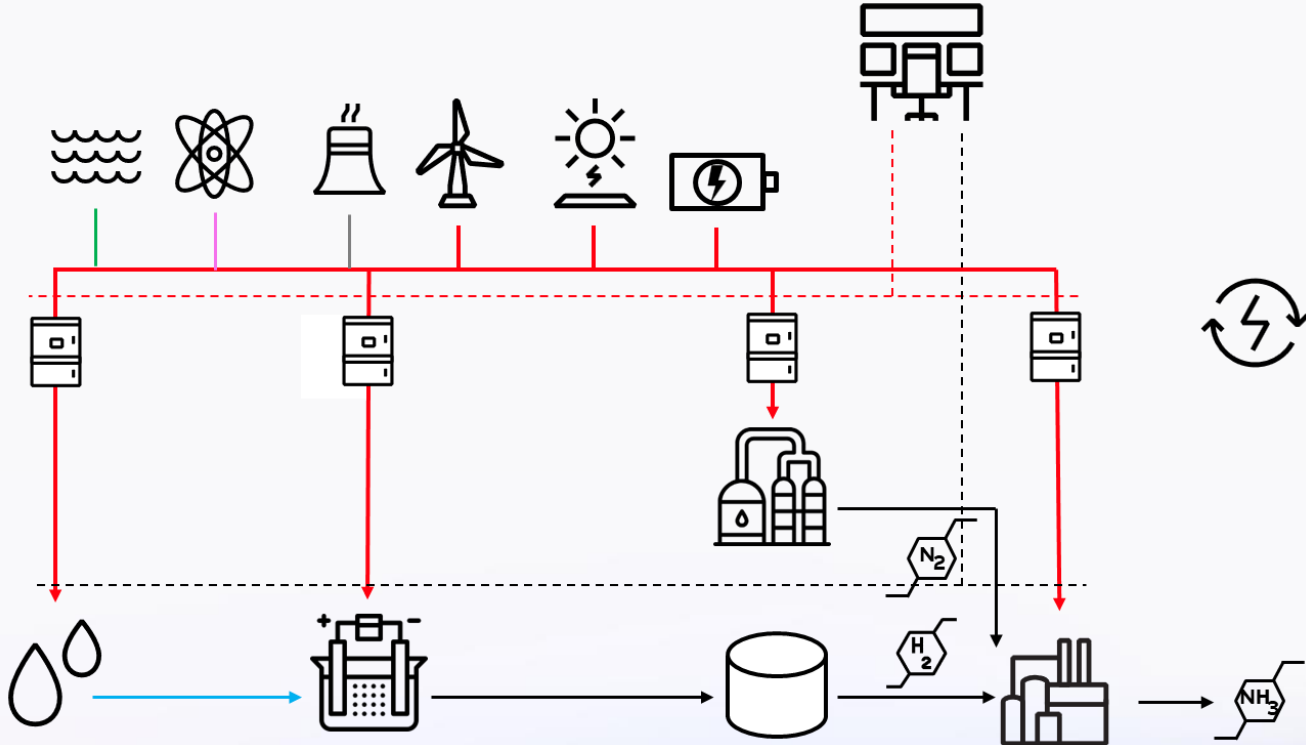
What's your challenge? We'll find a solution!

So, let's talk....



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