

QualyGridS Workshop

June 2020

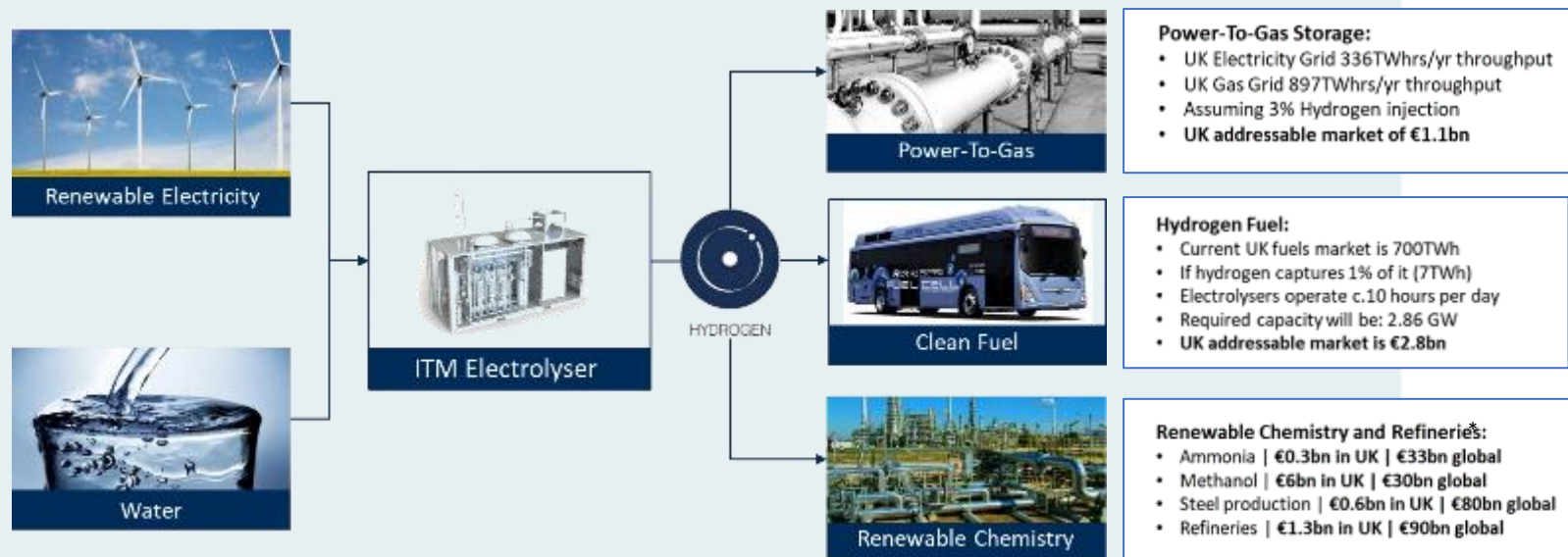
Ben Green – ITM

Shi You - DTU

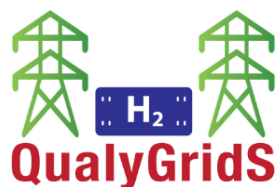


Commercial Rationale:

- RE reducing in cost significantly
- RE needs energy storage
- Green Hydrogen now cost competitive
- Multi £bn global addressable markets
- Refinery electrolyser market is ~€90bn*
- Market pull for green hydrogen
- Regulatory push for green hydrogen



*potential electrolyser sales based on 10% of global market requirements met by low-carbon hydrogen

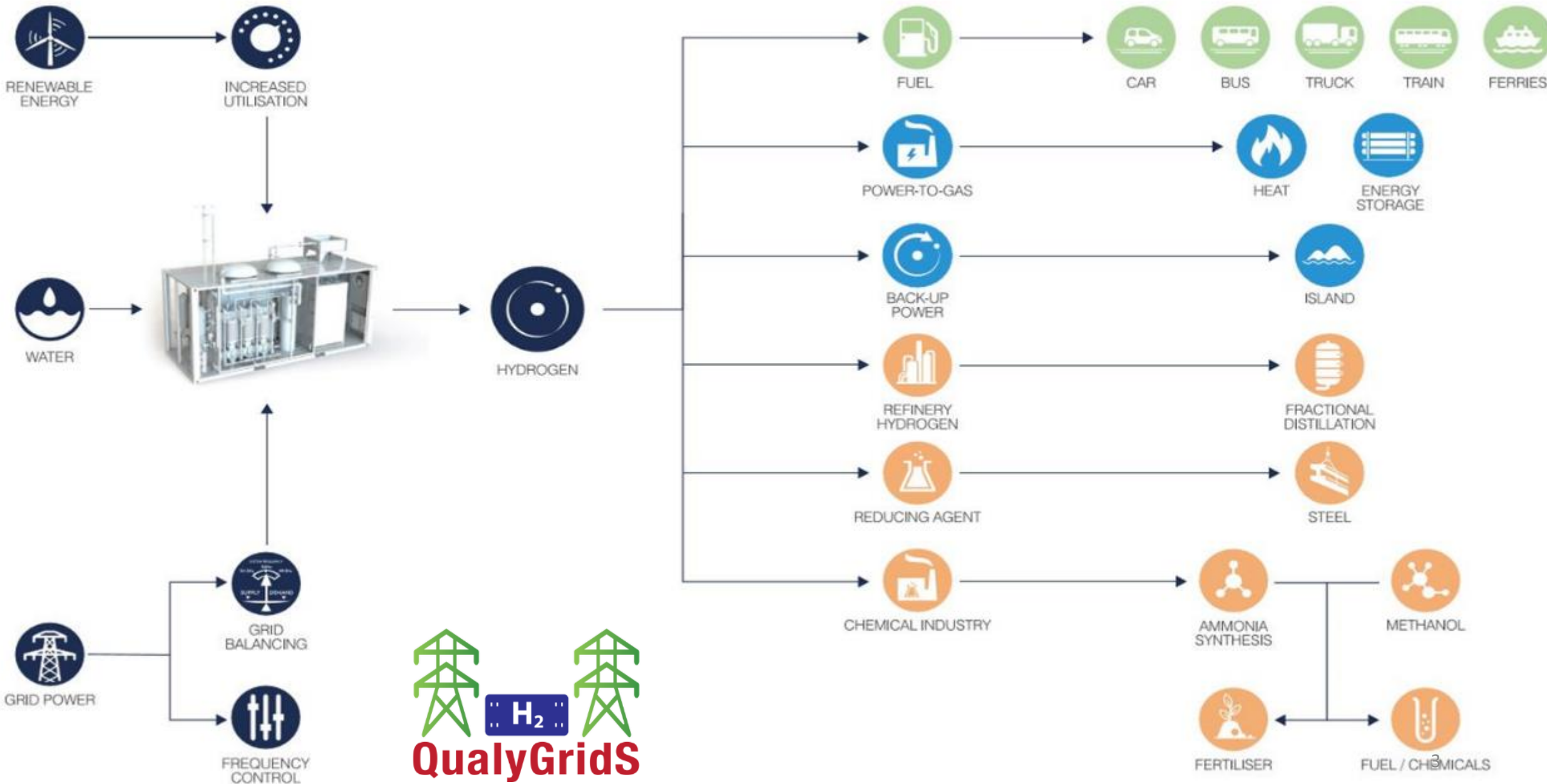


INPUT

VECTOR CONVERSION

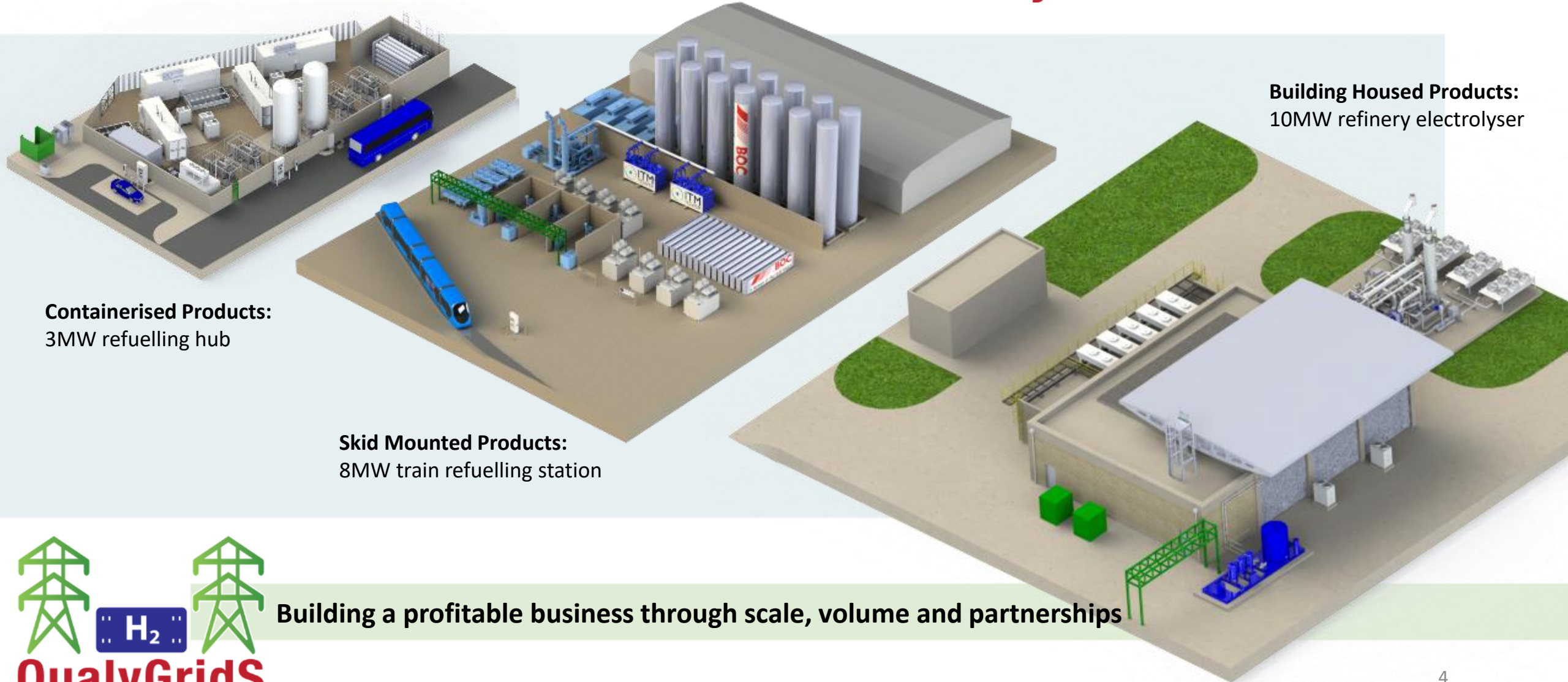
PROCESS APPLICATION

INDUSTRY



MARKET OFFERING | 2MW TO 10MW

HYDROGEN ENERGY SYSTEMS



Containerised Products:
3MW refuelling hub

Skid Mounted Products:
8MW train refuelling station

Building Housed Products:
10MW refinery electrolyser

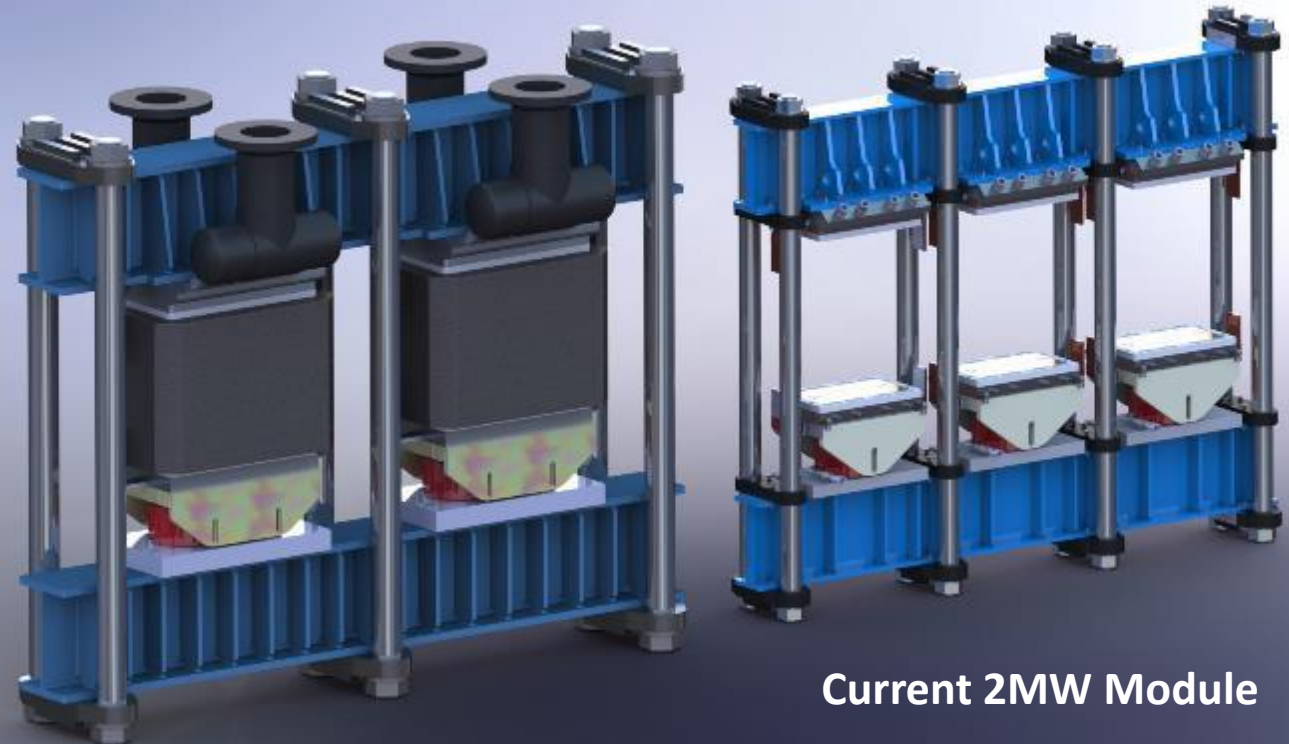
Building a profitable business through scale, volume and partnerships



5MW Module Development:

- Provisional spec is 2.1 tonne of H₂ per day
- Developed in parallel with manufacturing processes
- From 15 stacks to 4 stacks for 10MW module
- Design integration techniques reduce BoP costs
- Developed for 50, 100, 500MW plants
- First hydrogen scheduled for Q4 2020

5MW Module Development



Current 2MW Module

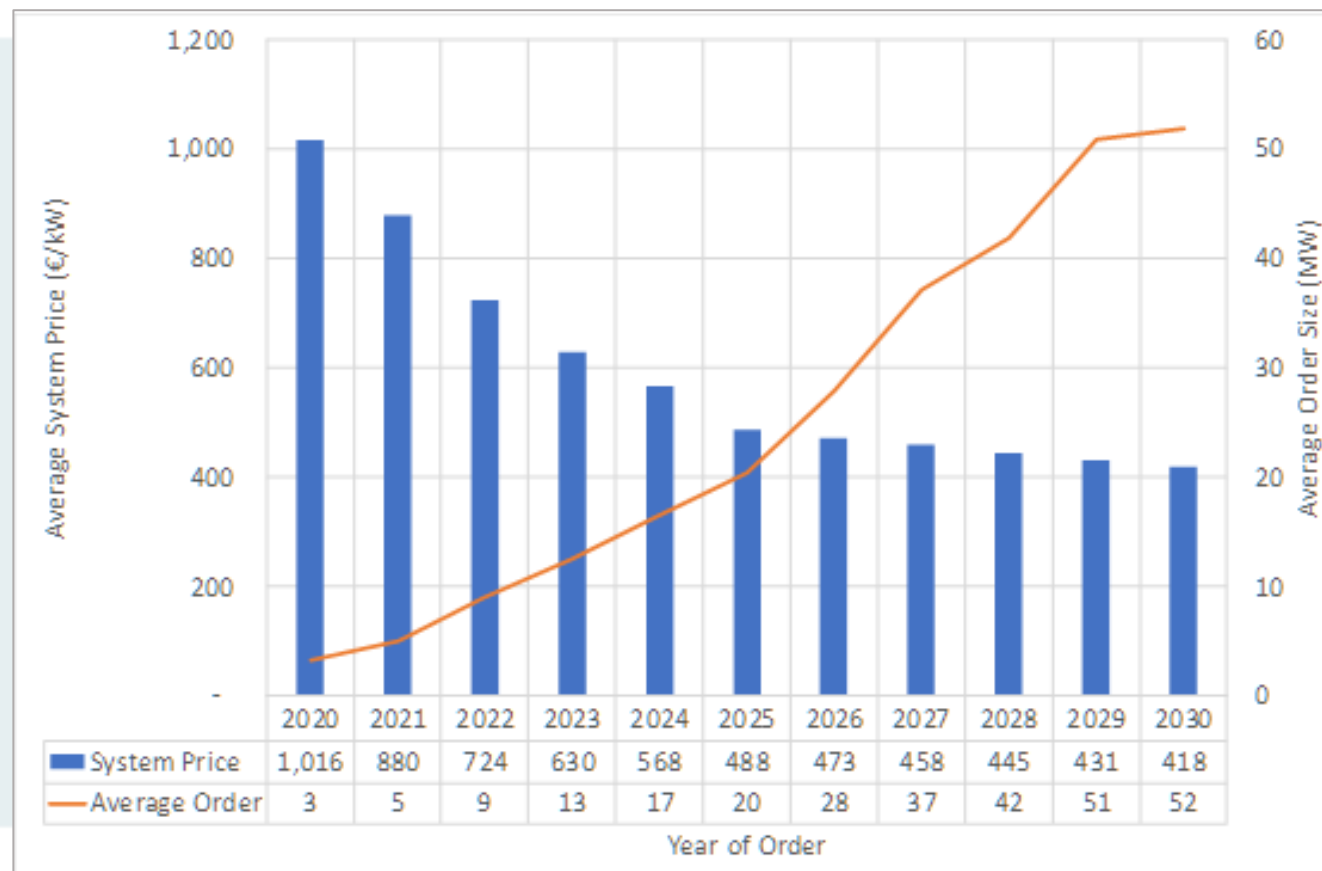


ITM Electrolyser Cost Projections

- Based on standardised modular system

Enablers for cost reduction:

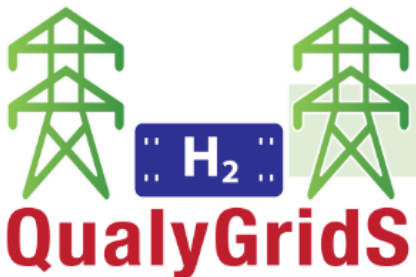
- Manufacturing volume
- Factory semi-automation
- System sizes to grow over time
- Continuous technology improvements



<€1,000/kW today @ MW scale | <€800/kW @ 10MW | <€500/kW by mid 2020's



SYSTEM FOR FREQUENCY TESTING HYDROGEN ENERGY SYSTEMS



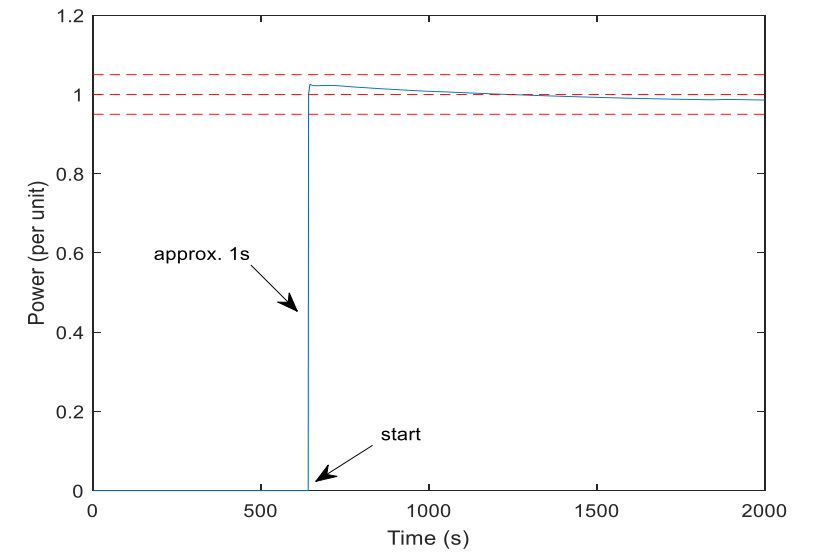
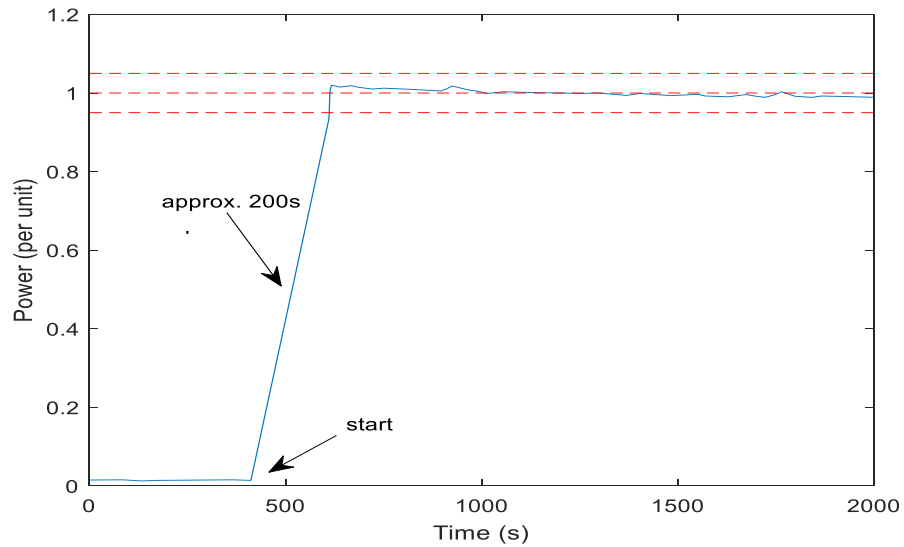
QualyGridS deployment

Results of characterisation protocol

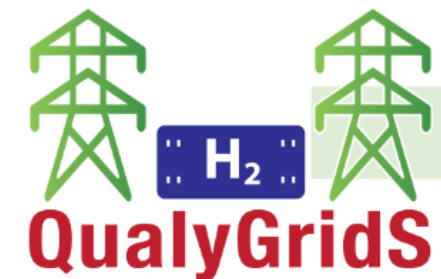
Start up time from standby to nominal power

1. Rectifier output in DC
2. Grid power input to the entire system

* $I_{norm} = 2200A$

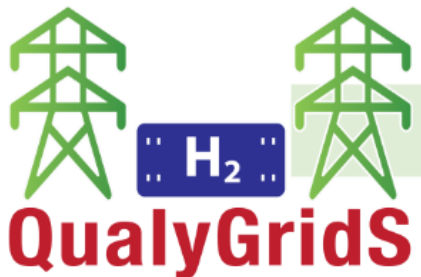
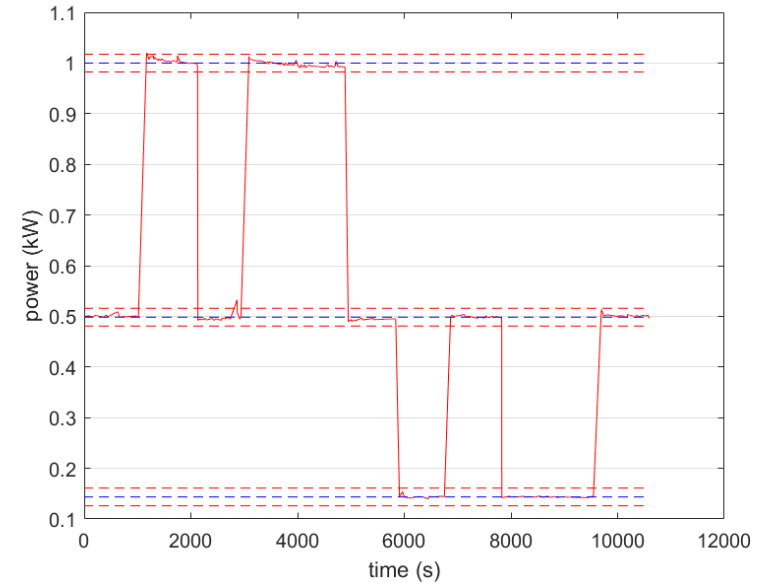
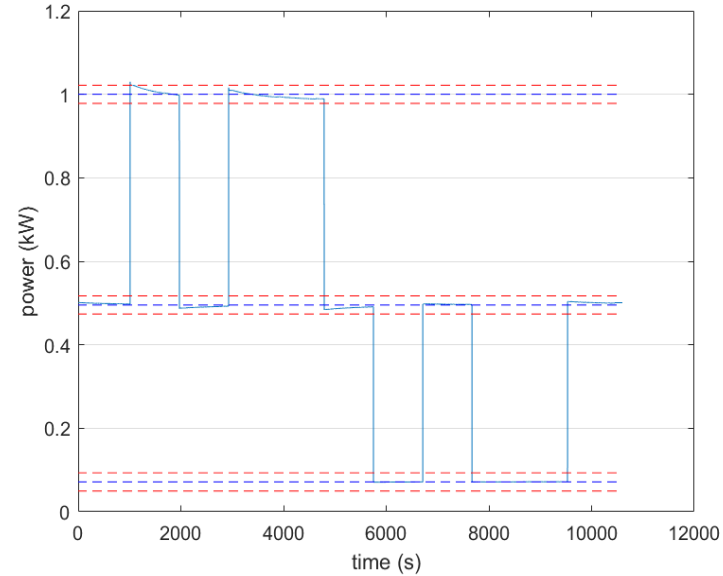


QualyGridS Test Results



Results of FCR first test

1. Rectifier output in DC power
 2. Grid power input to the entire system
- $I_{up} = 2200A$
 - $I_{low} = 200A$
 - $I_{med} = 1200A$

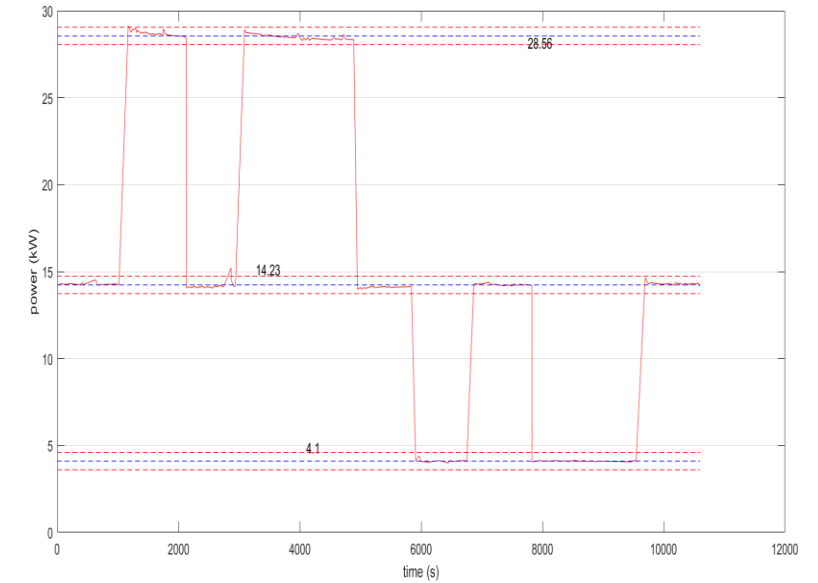
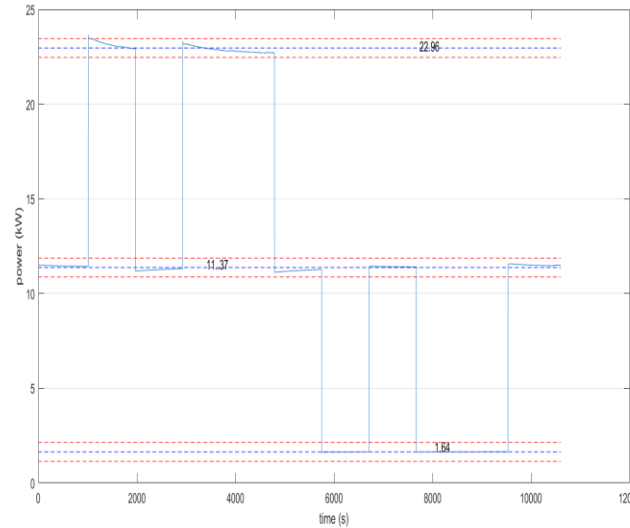


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