Cost-optimized Production of Green Hydrogen for the Steel Industry

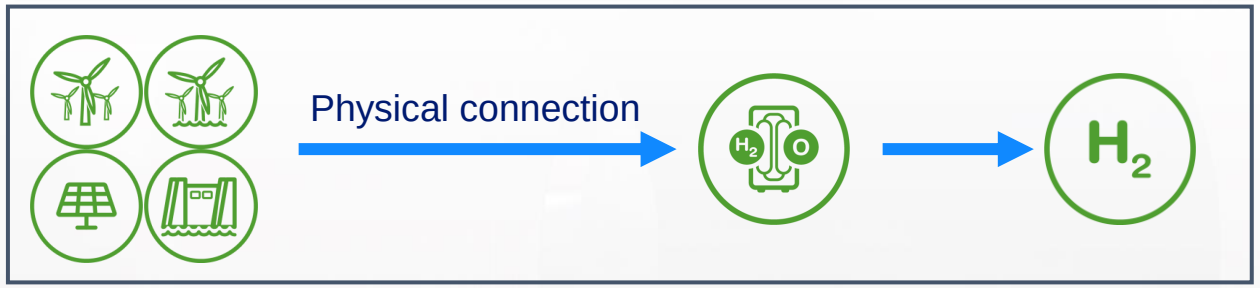
Producing green hydrogen is a complex task

Green H2 or **renewable H2** can be produced by

A) reforming biogas

B) biochemical conversion of biomass

C) **electrolysis** based on renewable electricity (except from biomass)
→ renewable fuels of non-biological origin (RFNBO) as per Art. 27(6) and 29a from Renewable Energy Directive (RED3) + Delegated Acts 2023/1184 and 2023/1185



GHG Threshold
The average carbon content of the H2 production must reach at least -70% of CO2eq compared to 94gCO2/MJ (monthly, later hourly)

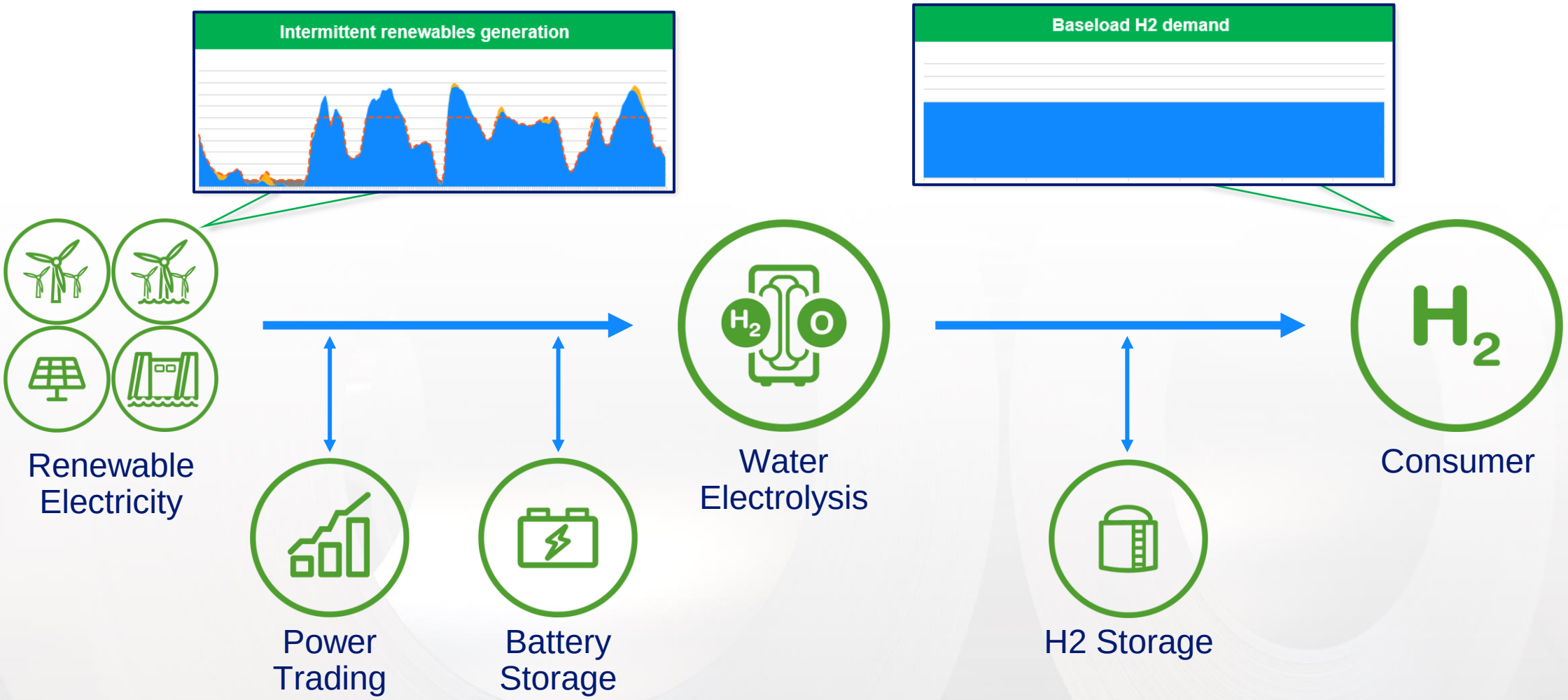
Additionality
No more than 36 months between power plants and electrolyzer commissioning (after 2028)

No State Aids
Renewable energy production may not benefit from any net investment or operating aid

Spatial Correlation
Power plants and electrolyzers need to be in the same bidding zone

Temporal Correlation
Renewable energy production and consumption need to be balanced within one month until 2030, after that within one hour

Producing baseload green hydrogen for steel industry is even more complex



Optimization considering various input parameters and constraints enables lowest cost H2 production schemes

Power
- Renewables portfolio
- Surplus capacities
- Production forecast
- Market price projection
- Grid emissions intensity

Technical
- Capacities
- Efficiencies
- Min. load
- Ramping rates
- Un-/loading rates
- Degradation

Funding
- Quality requirements
- Quantity requirements

Regulatory
- Temporal correlation
- Additionality
- Re-dispatch exemption
- Low-price exemption

Demand
- Flexibility
- Maintenance periods
- Co-products

Commercial
- CAPEX
- Pricing schemes
- Costing schemes
- Project lifetime
- Hurdle rate
- Liabilities

Output

- OPTIMIZED H2 COST
- BASIC PLANT SIZING
- POWER COMPOSITION
- TECHNOLOGY EVALUATION
- PPA COMPOSITION
- OPERATIONAL STRATEGY
- …and more