ETIP HYDROPOWER

RheEnergise High-Density Hydro®

Innovations from Industry

RheEnergise High-Density Hydro

Funded by the European Union

Agenda

5 minutes

- Introduction

25 minutes

- High-Density Hydro value proposition
- Leveraging the established global hydro industry knowledge base
- Technology Validation
- What comes next

15 minutes

- Question and Answer

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The LDES Problem
The RheEnergise Solution

Long Duration Energy Storage is Critical to Energy Transition

A Problem of Scale

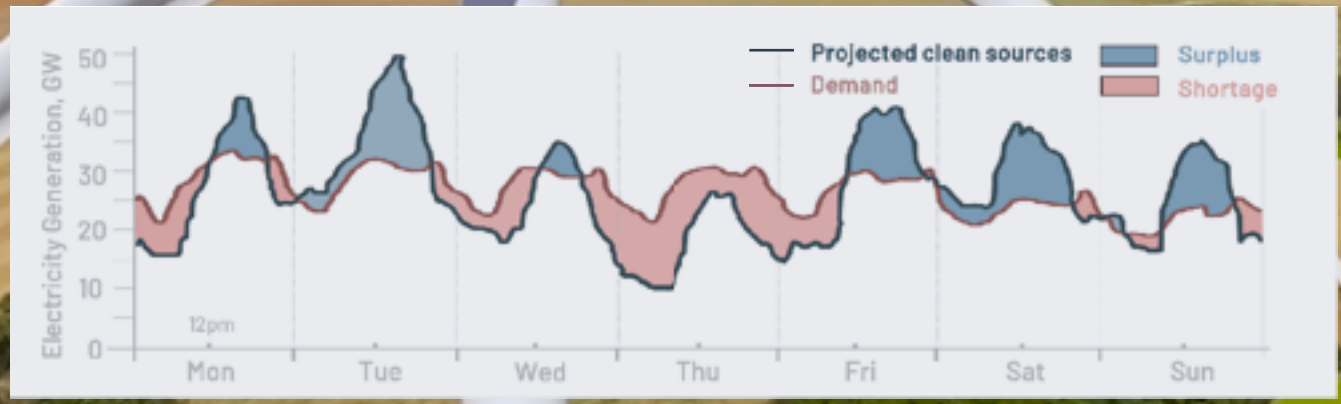
To meet 2040 climate targets (less than 15 years away!) society needs:

50x increase in LDES rate of deployment

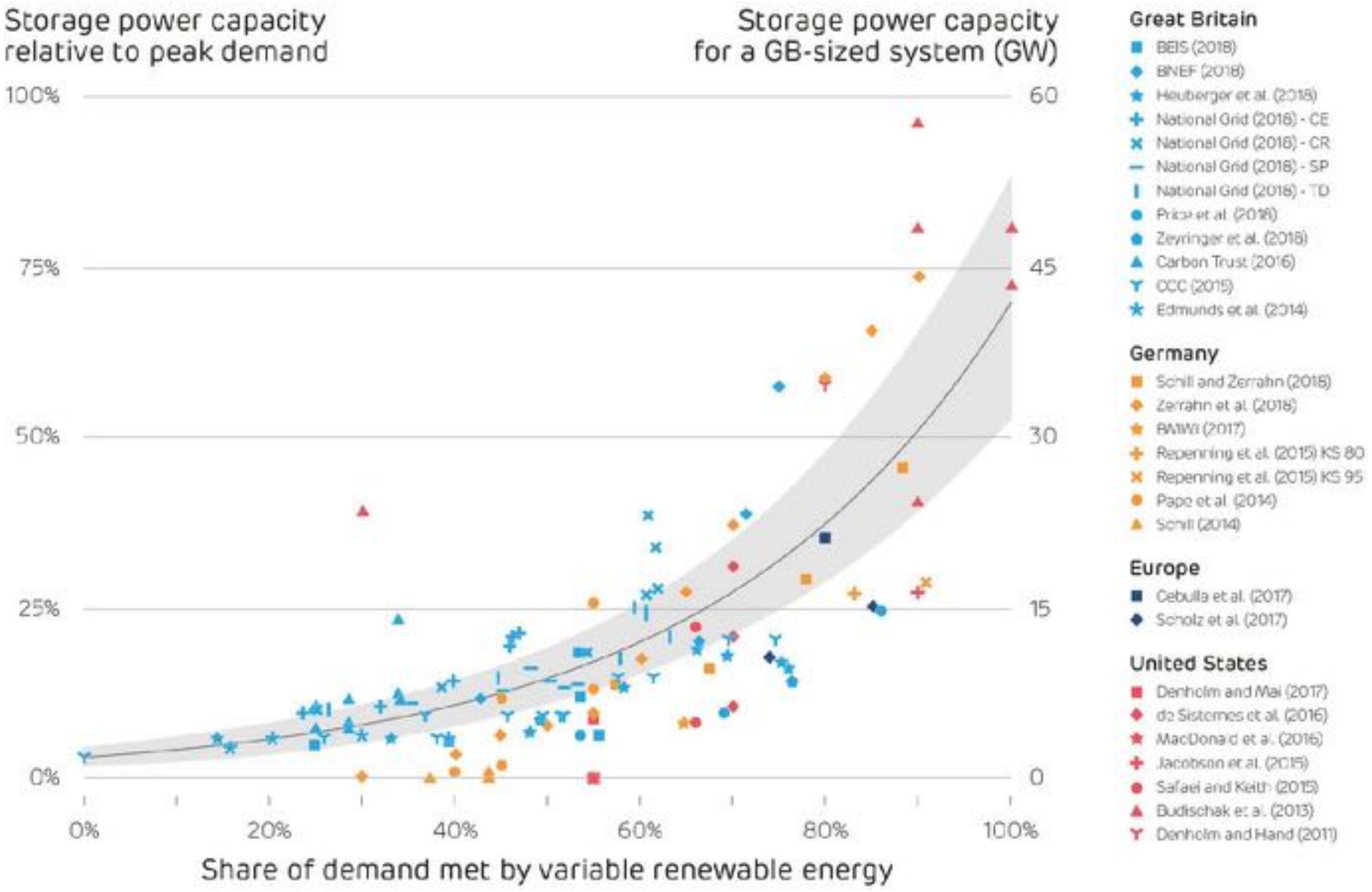
$4T in LDES projects

8,000GW of LDES operational needed, versus 120GW available today and 113GW planned.

- **Volumes**
- **Speed of delivery**
- **Globally**



Graph from Future Clean Architects, based on data from Spain's Power Grid (Red Eléctrica Española, 2022)



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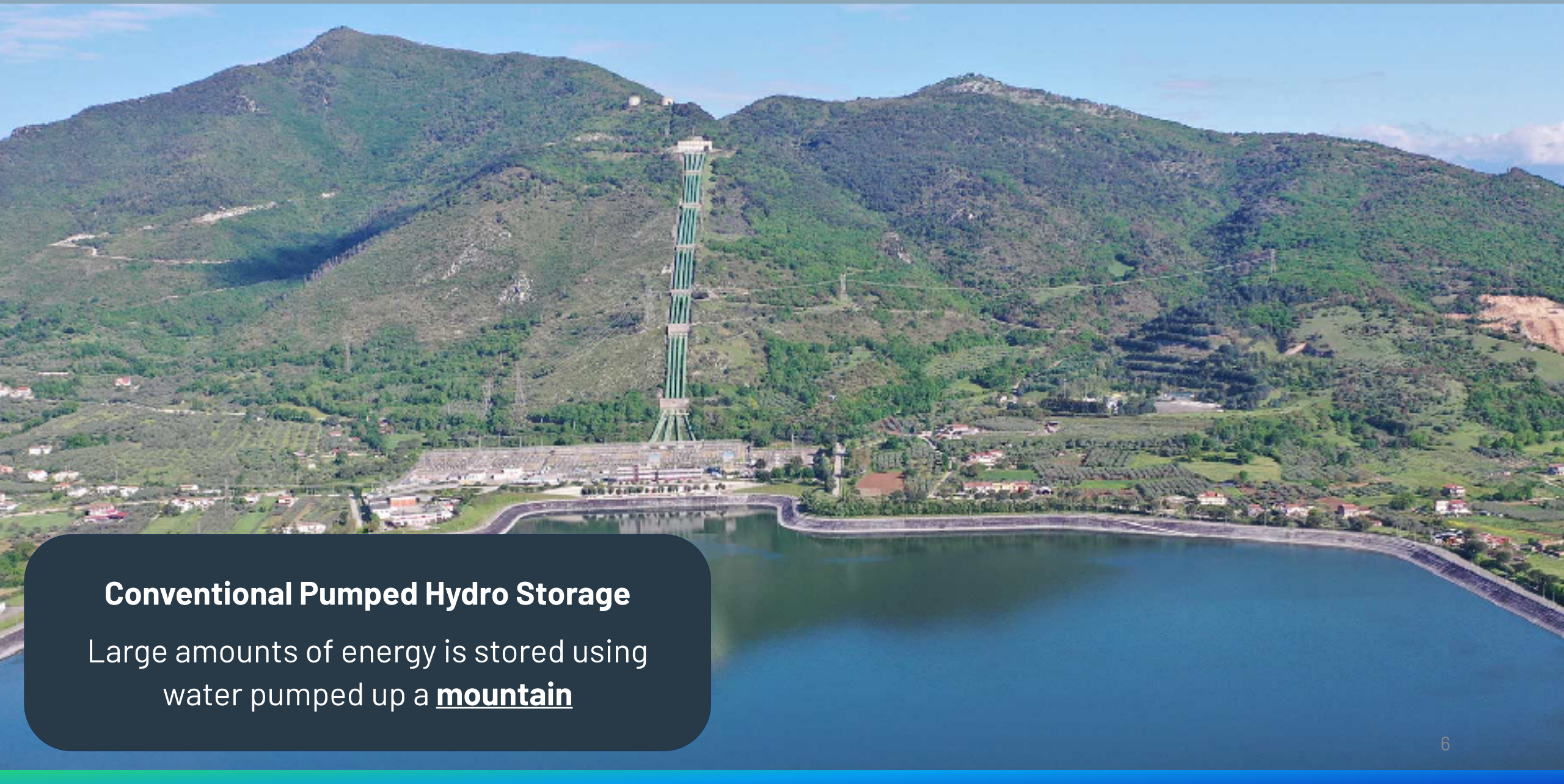
Dr Iain Staffell – Imperial College London, “Electric Insights: How much energy storage will we need?”

Conventional Pumped Hydro Storage: Mature Technology



Conventional Pumped Hydro Storage

Large amounts of energy is stored using water pumped up a **mountain**

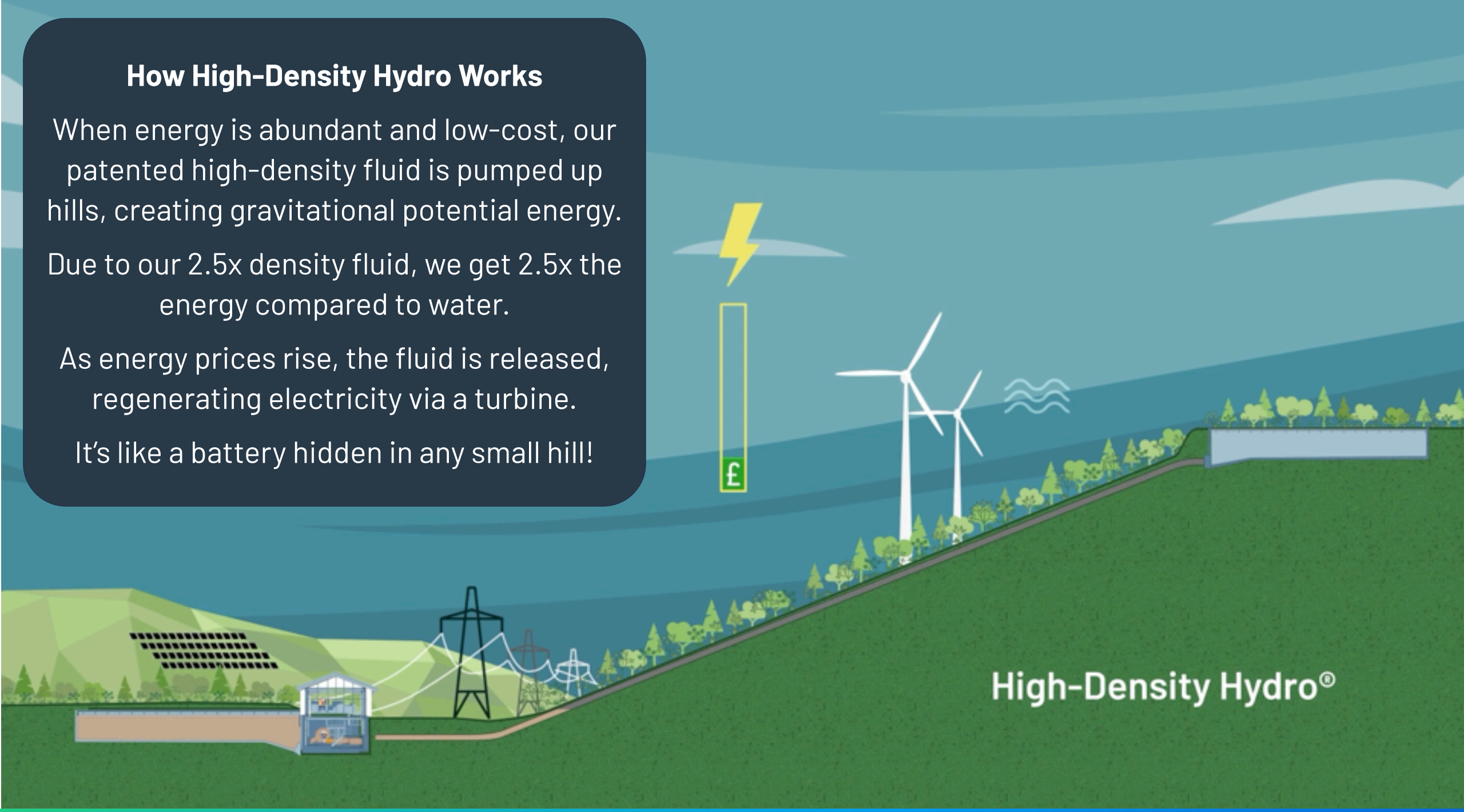
How High-Density Hydro Works

When energy is abundant and low-cost, our patented high-density fluid is pumped up hills, creating gravitational potential energy.

Due to our 2.5x density fluid, we get 2.5x the energy compared to water.

As energy prices rise, the fluid is released, regenerating electricity via a turbine.

It's like a battery hidden in any small hill!



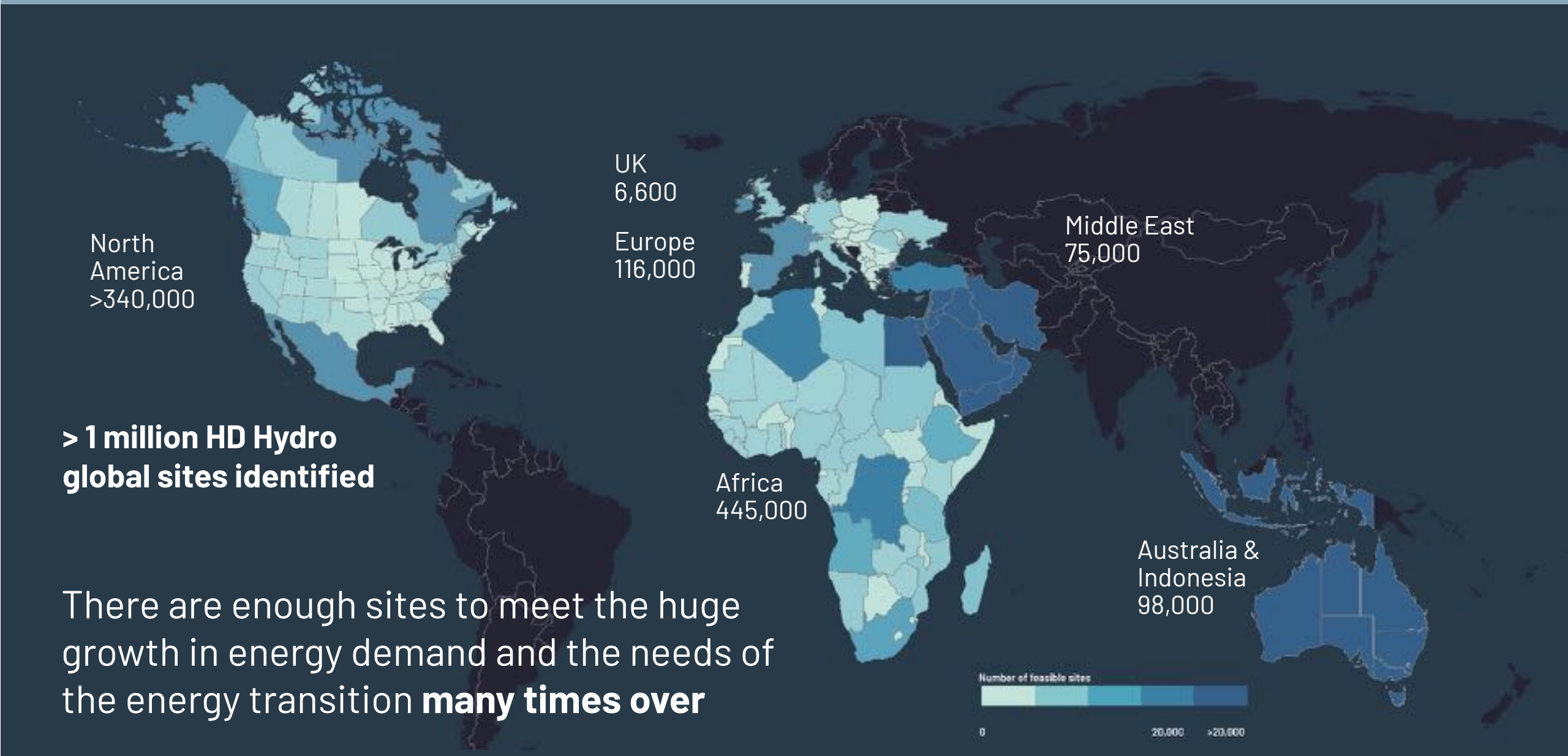
Our Technology

RheEnenergise High-Density Fluid is a suspension of dense mineral in water

- **High density** (2.5 x that of water)
- **Low viscosity** (high efficiency)
- **Stable** composition
- **Minimal abrasion** and erosion
- **Non-toxic** and **non-reactive** (independently tested by 3rd party laboratories)
- **Low-cost**




Scalability: HD Hydro Sites Available Everywhere



> 1 million HD Hydro global sites identified

There are enough sites to meet the huge growth in energy demand and the needs of the energy transition **many times over**

HD Hydro® Customers and Pipeline

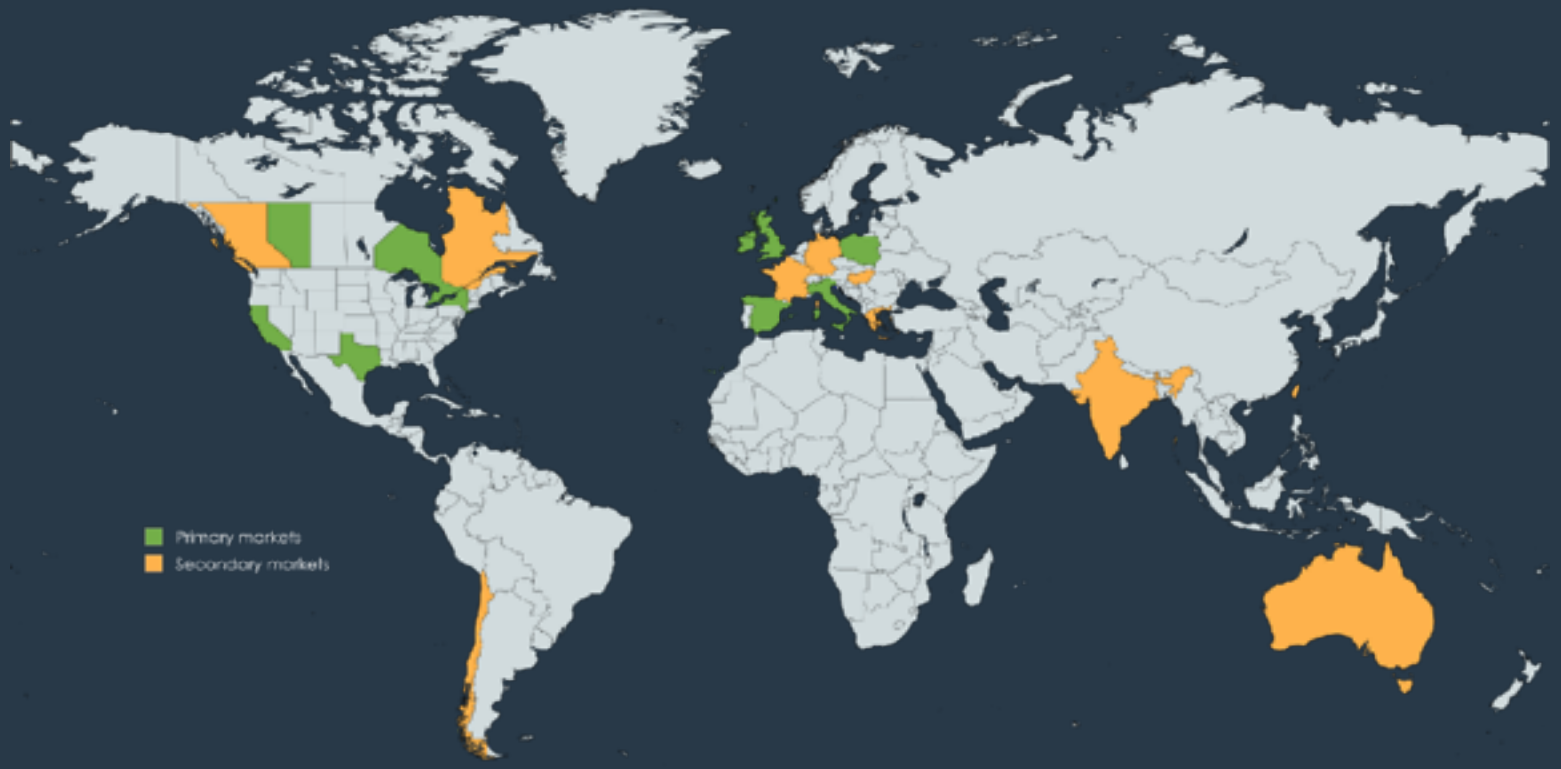
Our $1.75 bn project pipeline

Customers are companies that wish to own energy infrastructure assets

Pipeline **only** top 35 deals.

Key markets: USA, Canada, UK & Ireland, Poland, Spain & Italy

Projects from 10MW to 100MW (Inquiries for up to 500MW)



MoUs with utilities, IPPs and developers:

CANADA
CoTec iron-ore mine

USA
Ortus, 1GW pipeline of projects

UK
Mercia Power Response

CHILE
Colbún, a major Chilean utility

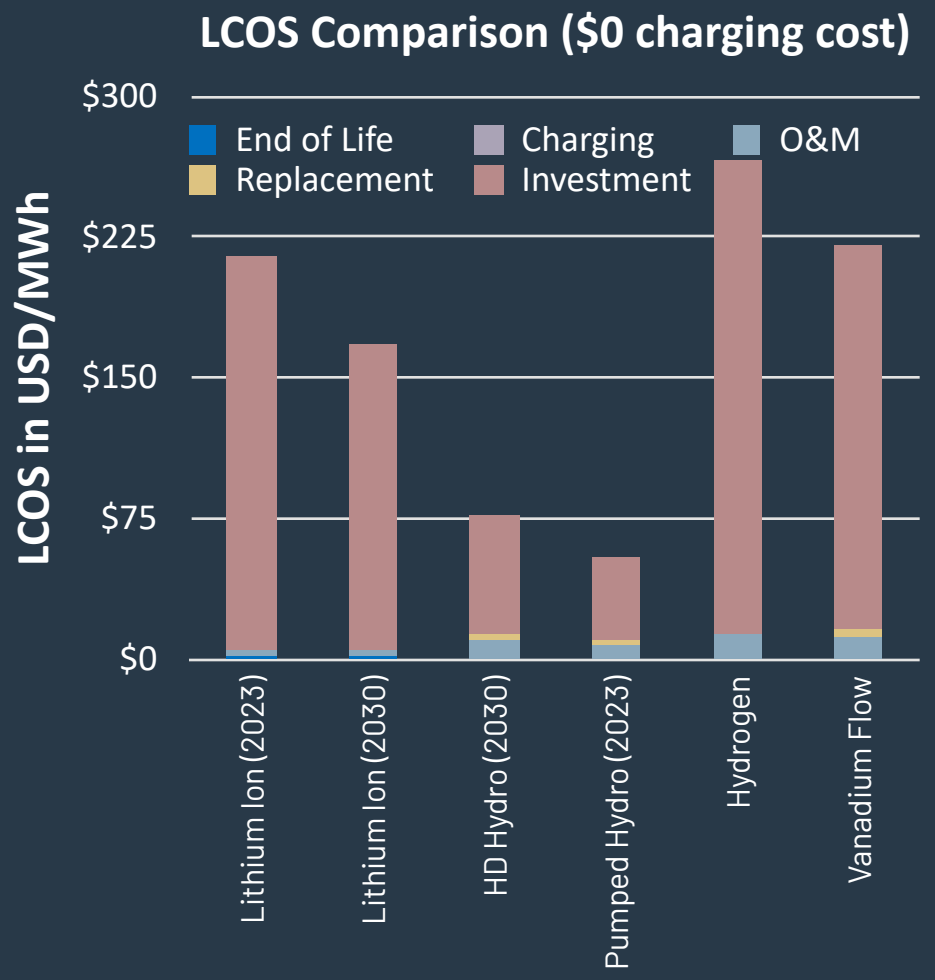
AUSTRALIA
System build-out

UK
Anglesey Mining plc

Baseline Commercial Project

Headline Figures

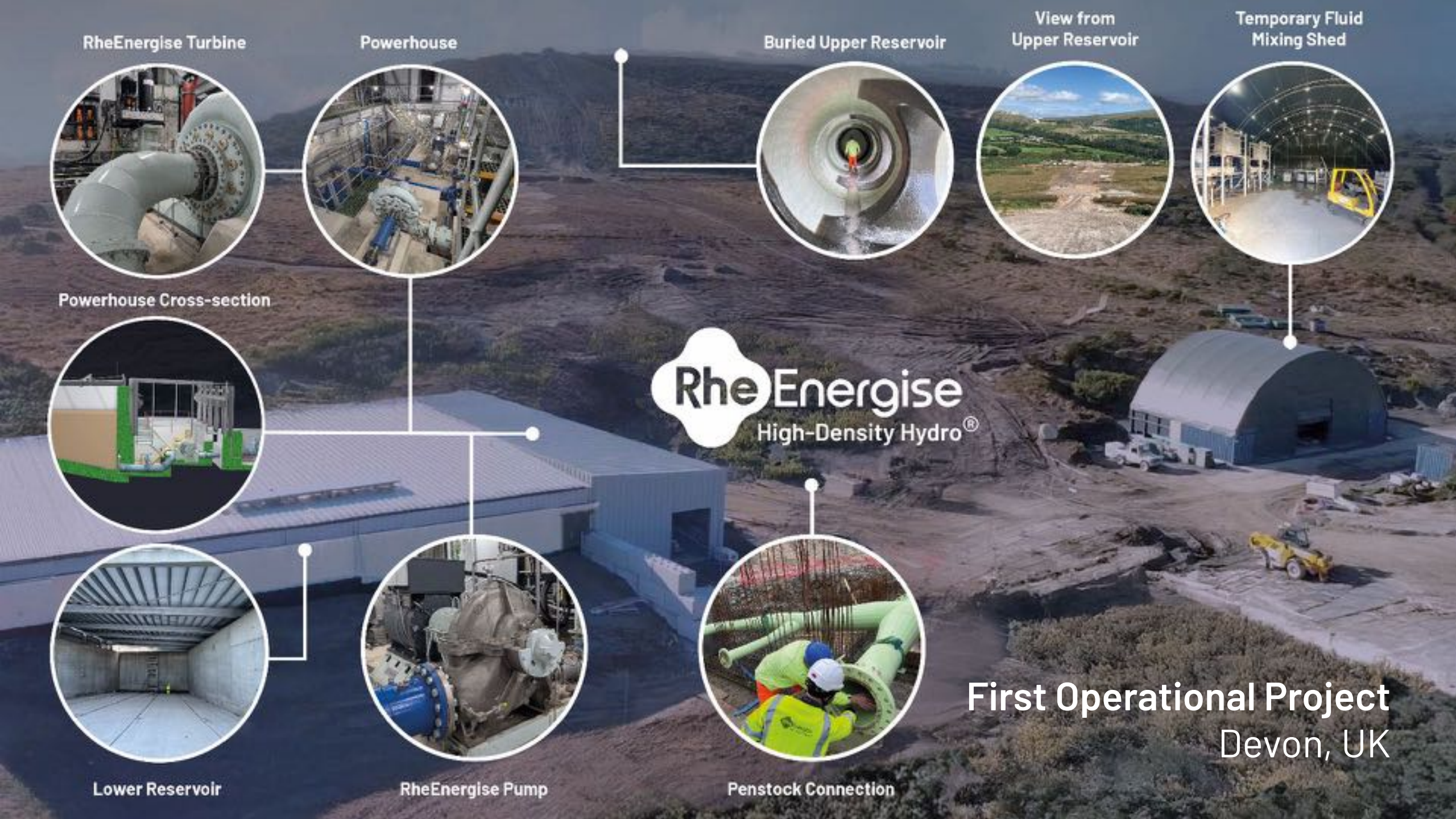
- 20MW (4 x 5MW modular size)
- 10 hours of storage
- 130m head
- 60+ years life
- 100,000 m^3 volume
- 3 years to deploy
- $50 million
- Half the cost of Li-Ion BESS



At $0 charge cost (e.g. representative of charging with curtailed renewable generation), **HD Hydro's cost is 55% that of Li ion.**
HD Hydro is the lowest-cost scalable solution for renewables integration.

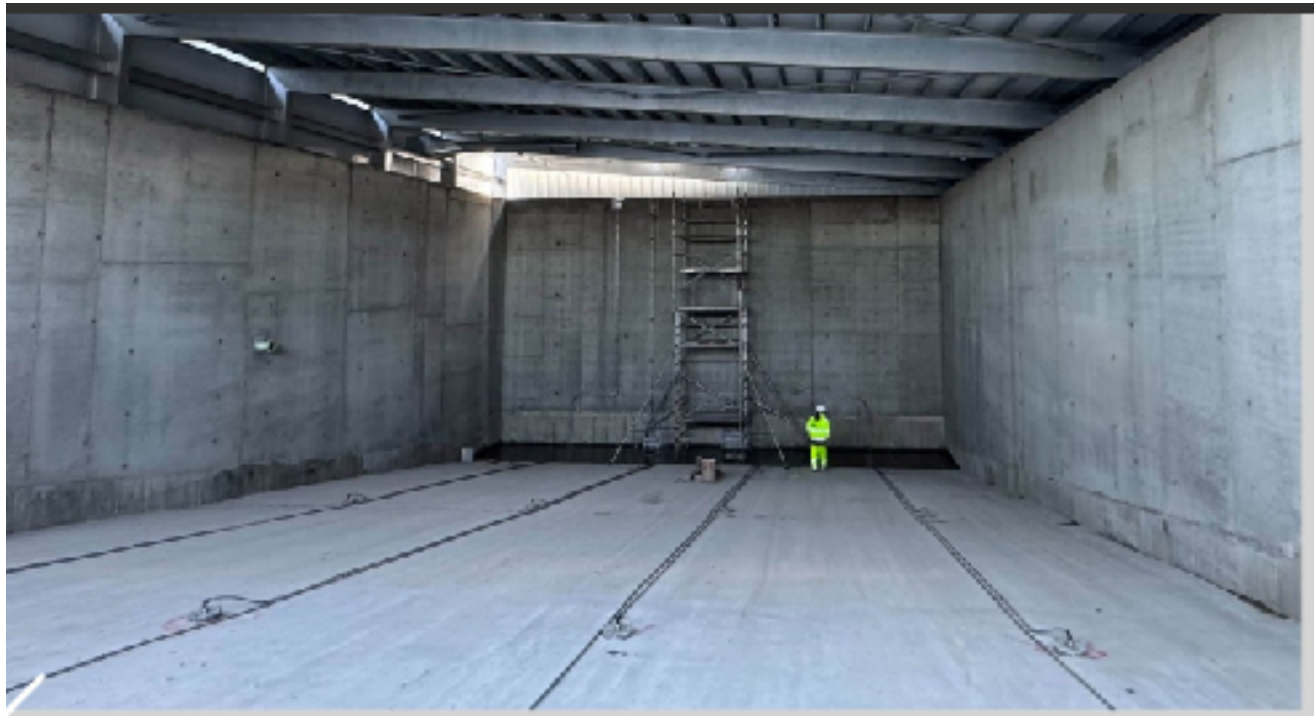
First Operational Project

Devon, UK


RheEnergise Turbine
Powerhouse
Buried Upper Reservoir
View from Upper Reservoir
Temporary Fluid Mixing Shed
Powerhouse Cross-section
RheEnergise
High-Density Hydro®
Lower Reservoir
RheEnergise Pump
Penstock Connection
First Operational Project
Devon, UK


RheEnergise


RheEnergise
HYSTER 2.0
FORTENS



HD-Hydro

Leveraging the existing global hydro knowledge base

Designed For Scale

- 2.5x energy density means more sites
- Quick to build (3 years)
- No need for water abstraction (suitable for dry climates)
- Smaller projects (faster permitting)
- Building on established hydro technology - manufacturing capacity and supply chain
- Partnering with established hydro companies - existing customers, sales and support

500kW HD Turbine

500kW HD Turbine

Technology Validation

HD-Hydro works, and it works very well


VACON
Power kW
-500 kW

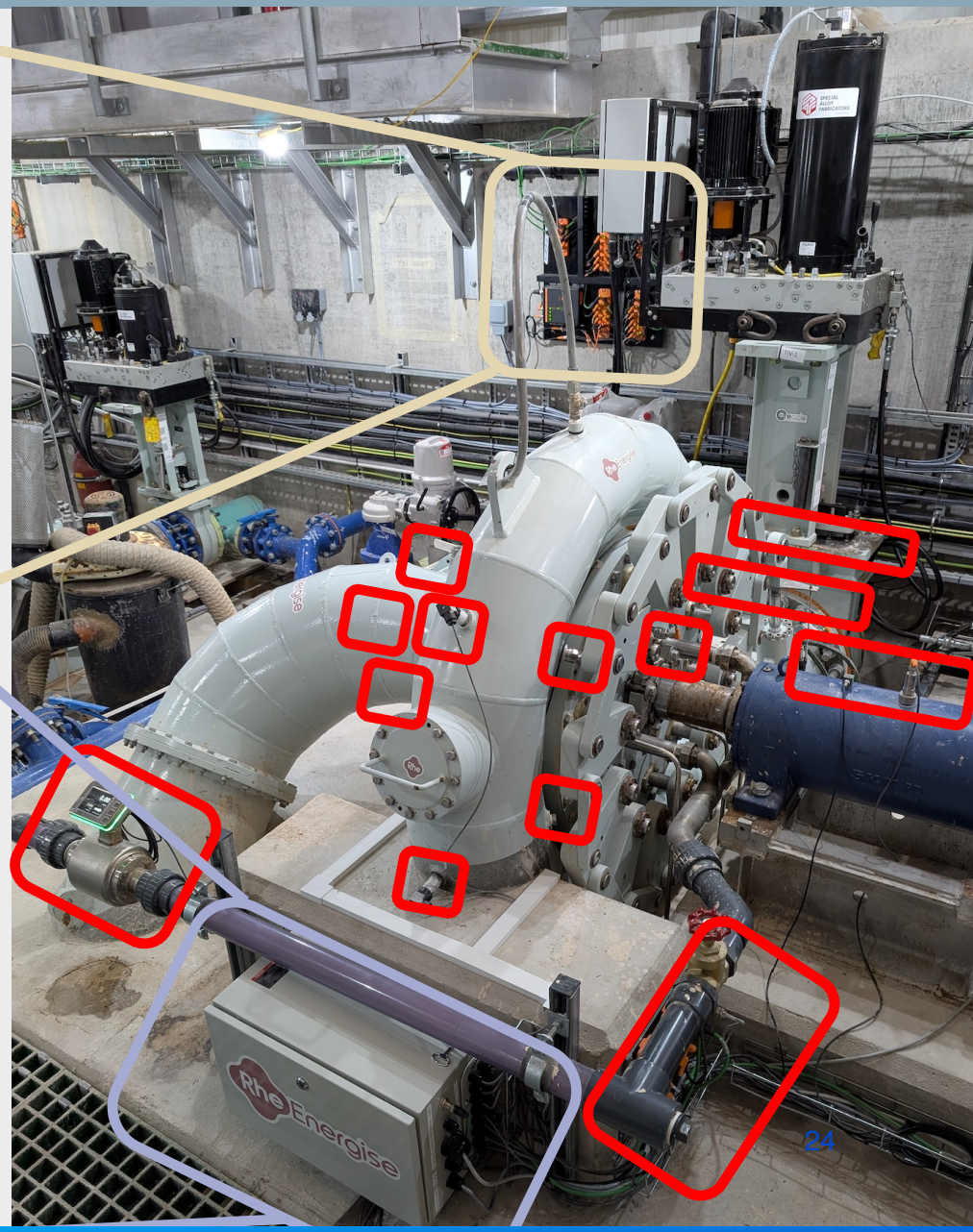
Demonstrator Turbine: Data-Data-Data

Main Control System

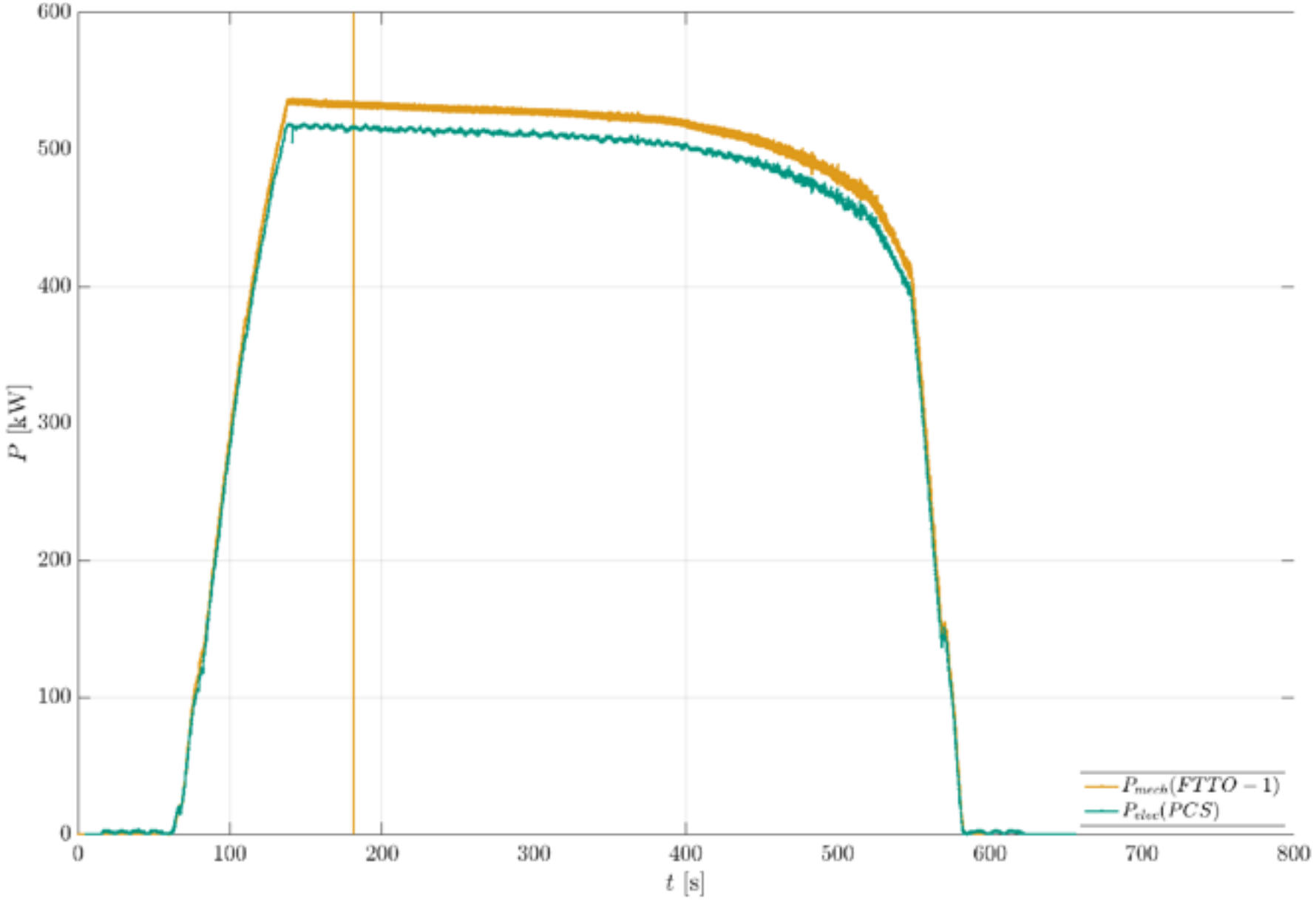
- 31 Sensors in powerhouse
- Flexible SCADA system for complex operation procedures

Test and Instrumentation

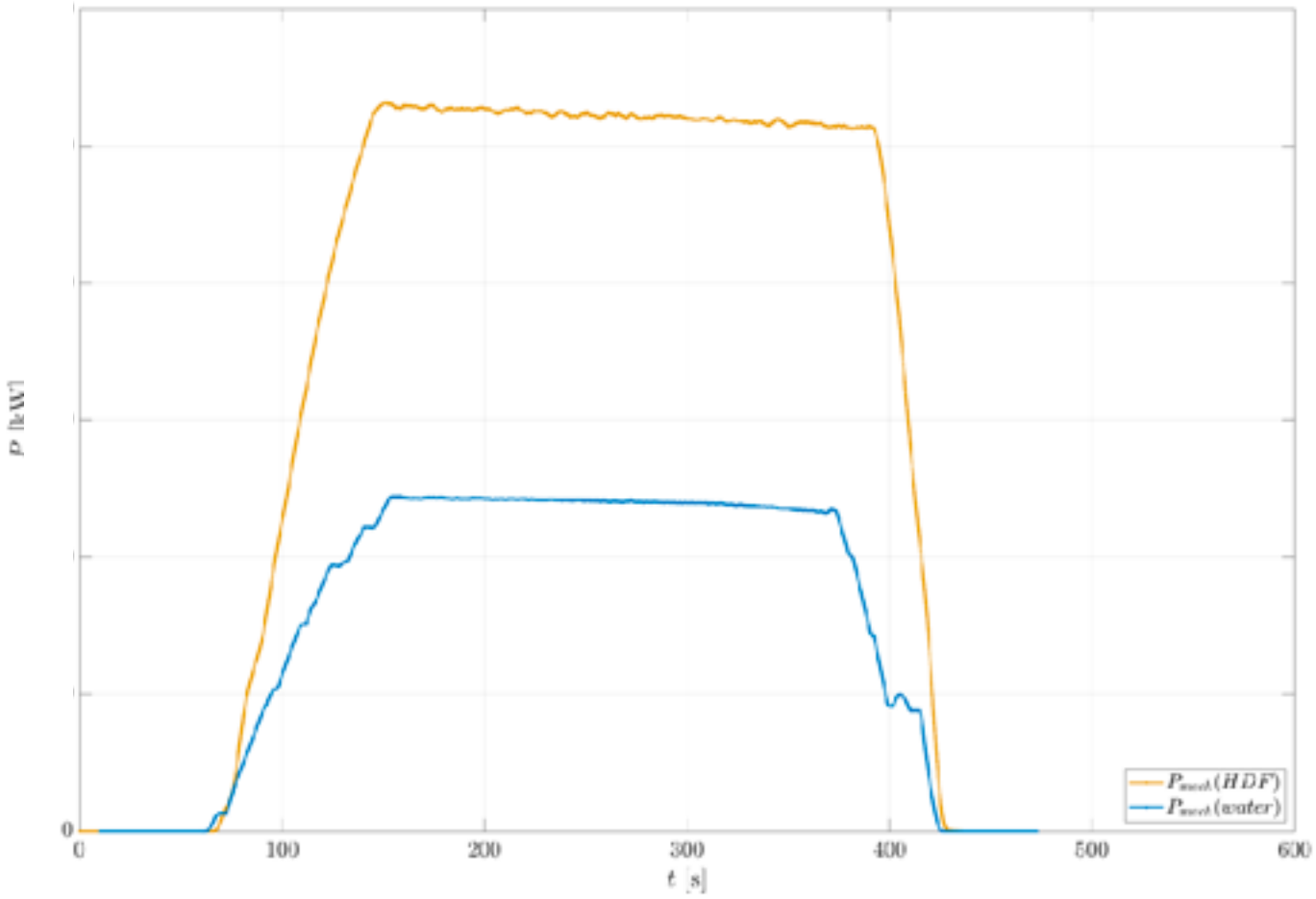
- 42 Sensors
- Time resolved measurements
- Detailed turbine assessment
- Test-chambers along penstock

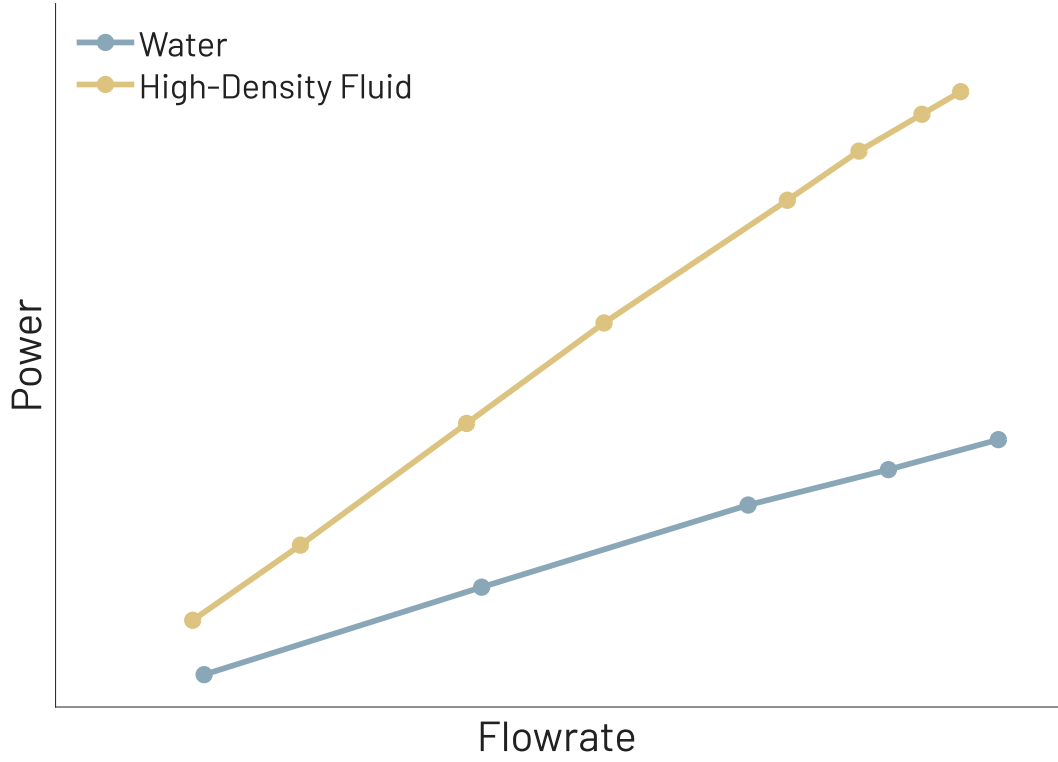


Turbine Operations

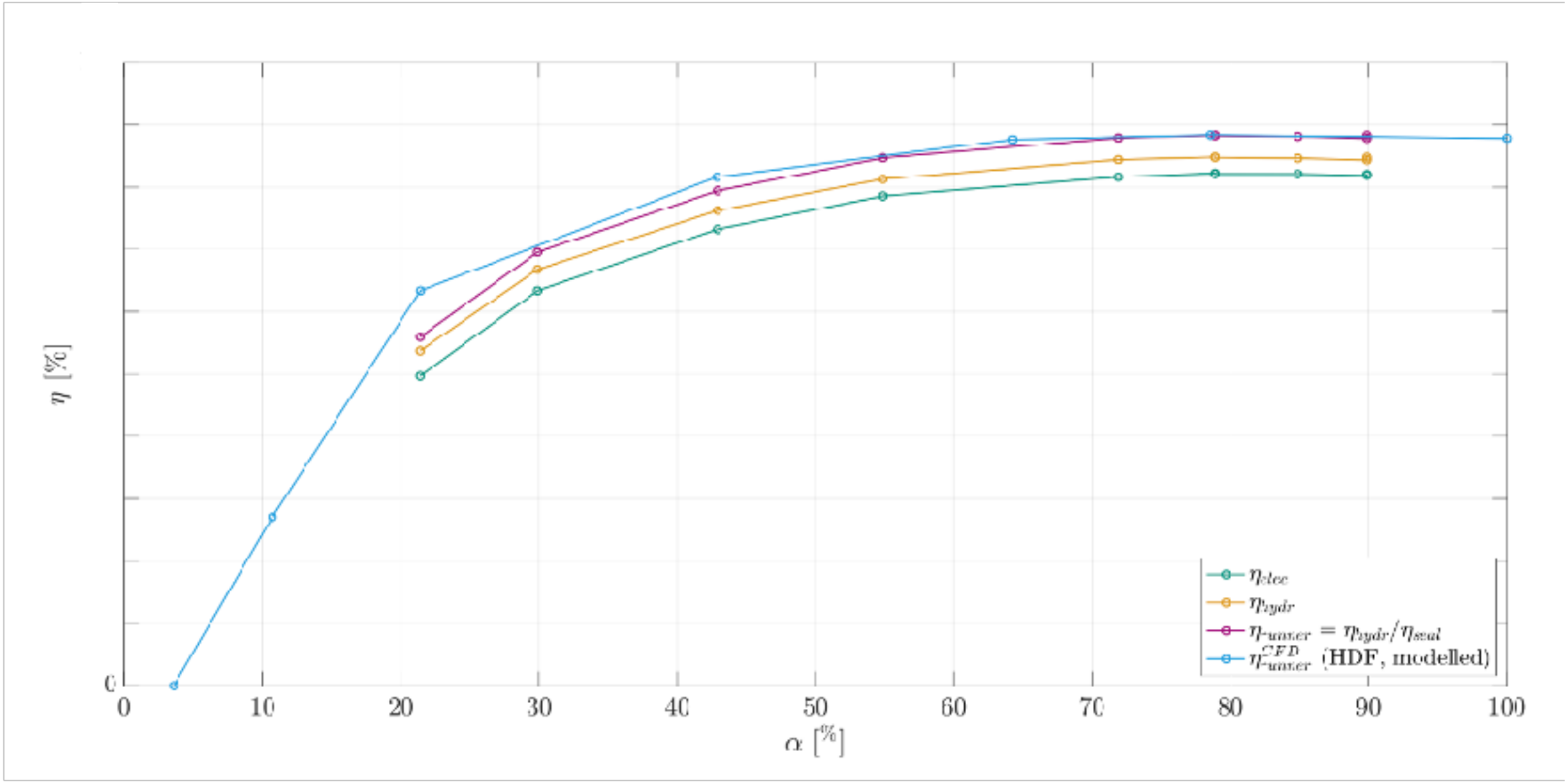


HD Fluid - Efficient and Dense

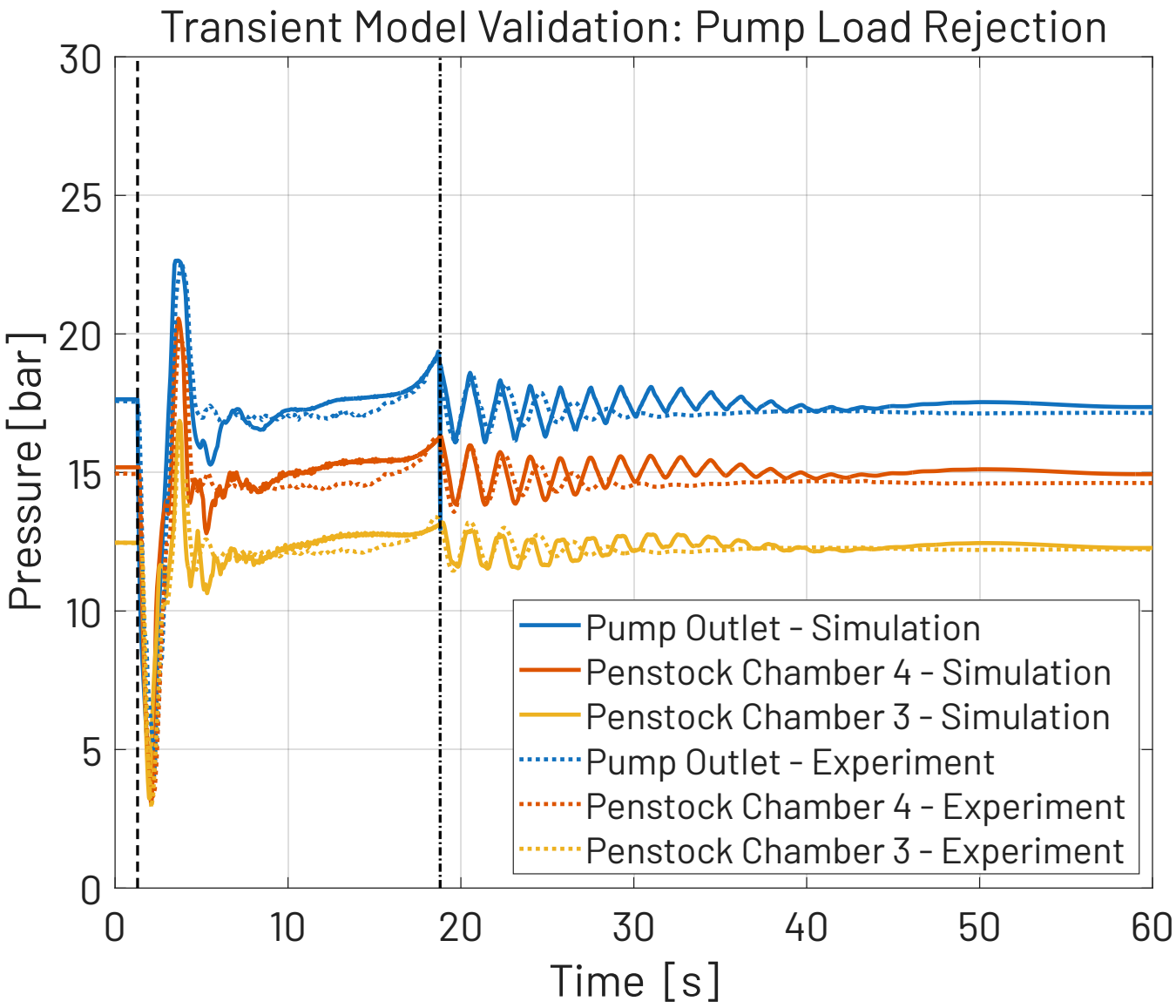




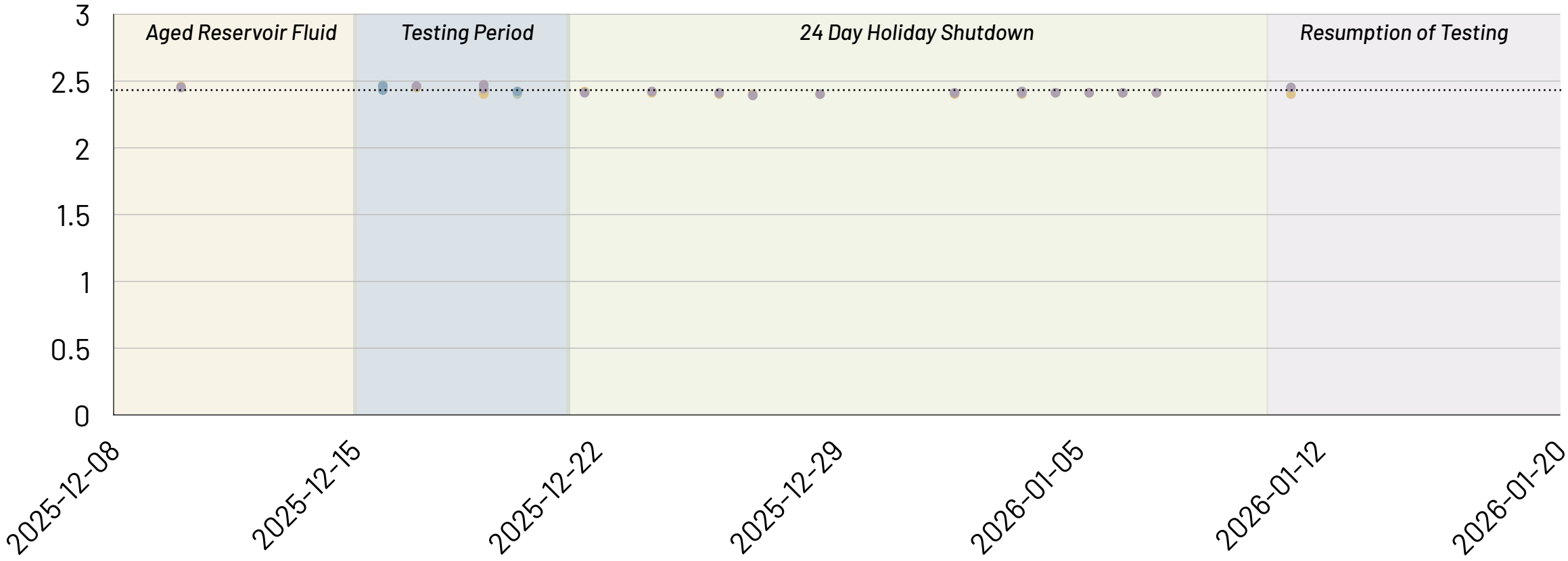
Validation of RheEnergise Design Codes



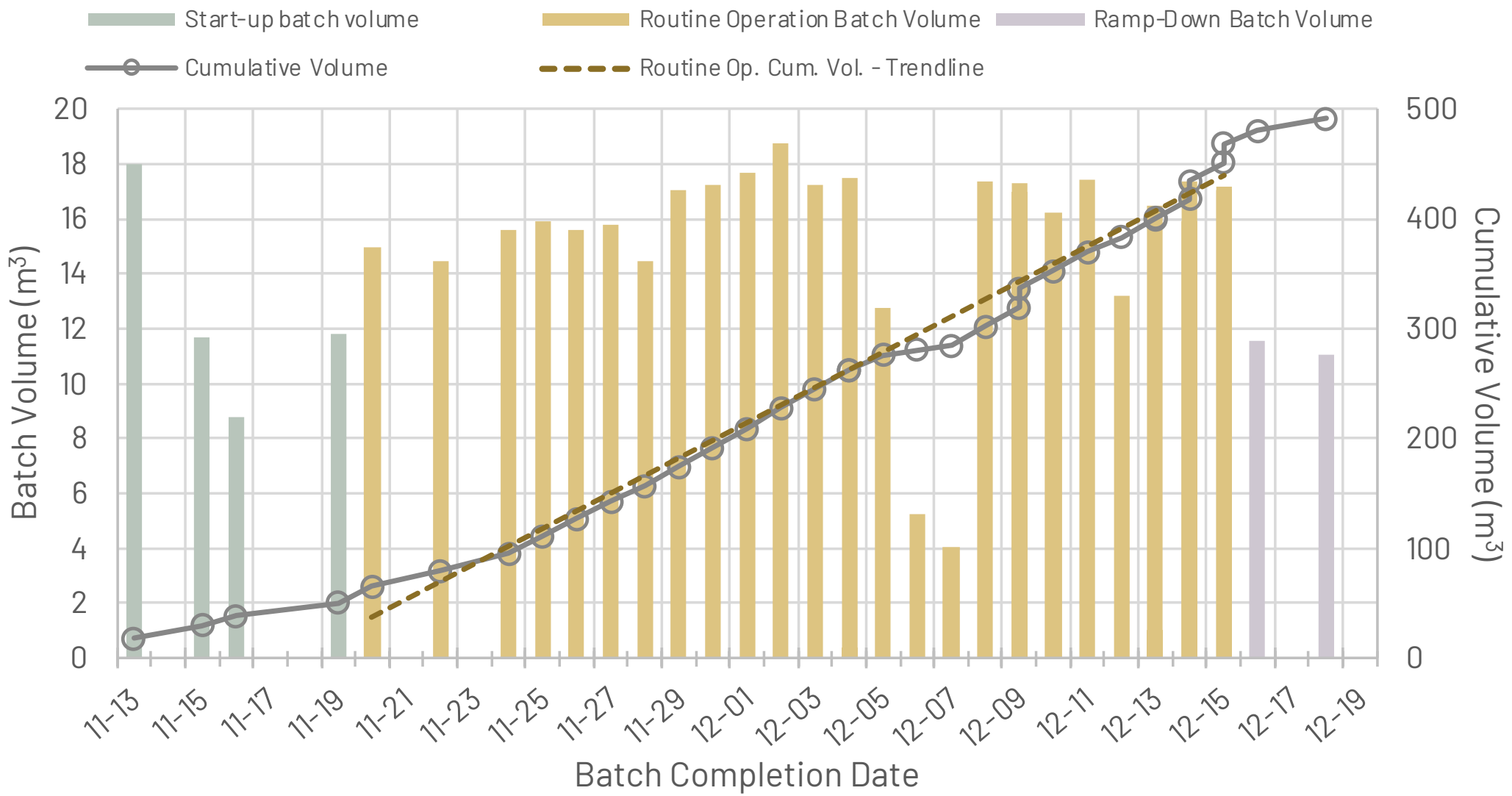
Transient Modelling & Performance



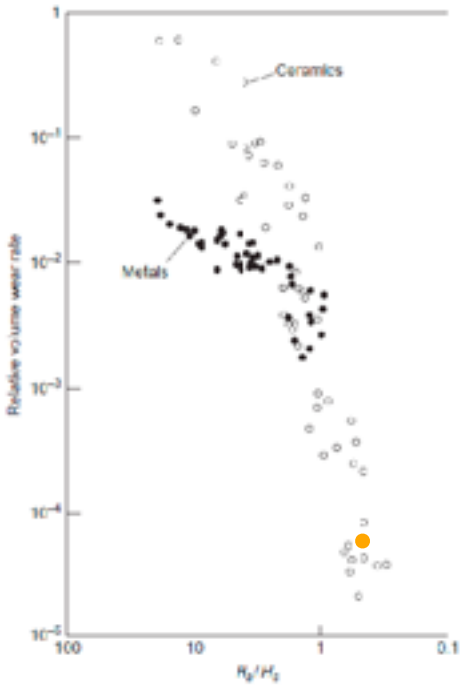
Fluid Stability

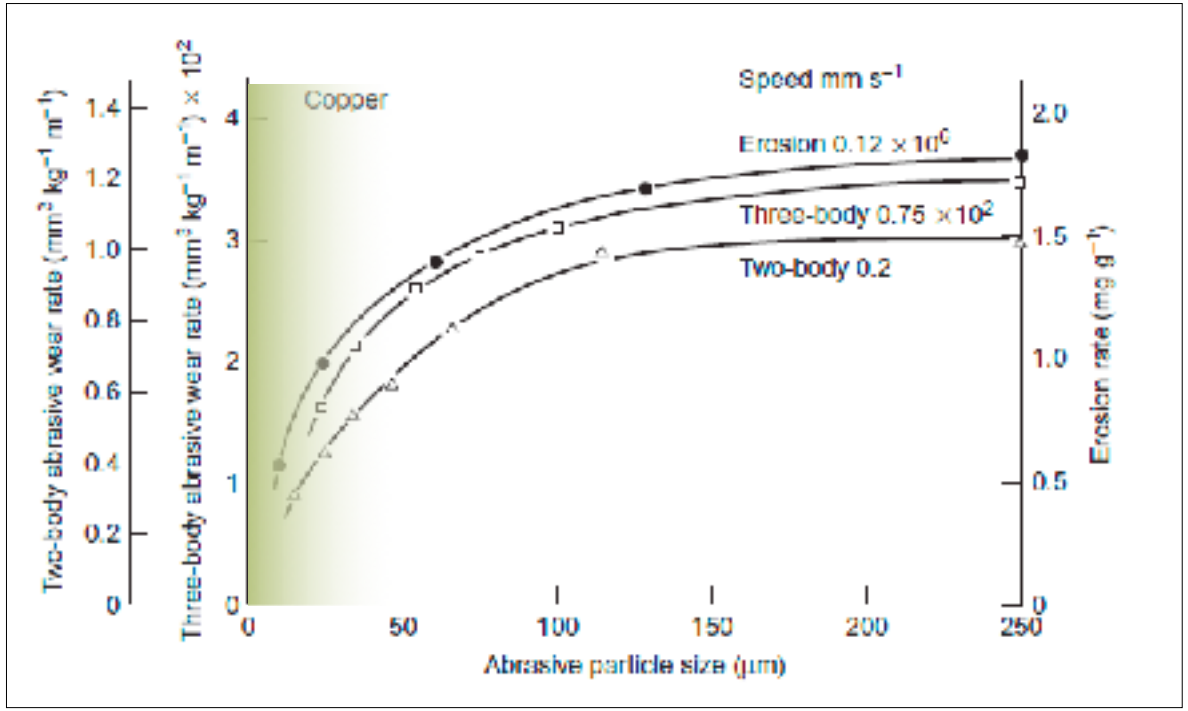


Delivery at Scale



Abrasion & Erosion





HD-Hydro: What comes next?

- FOAK Project by Q1 2029
  - 2 x 5MW
  - Currently in discussions on final site selection
- Develop partnerships and collaborations within the hydro industry
- A European solution for a European Problem built in Europe

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