



Hydro REIN – Energy Solutions

For more sustainable industries

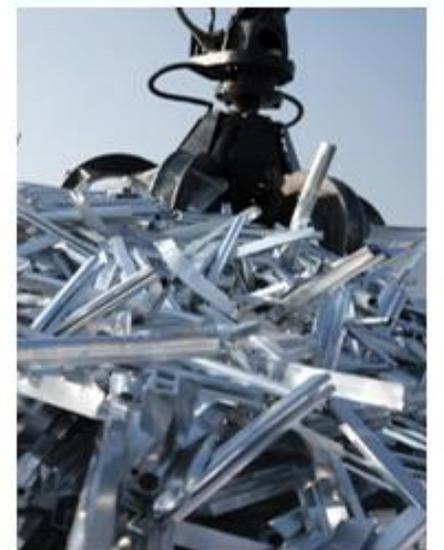
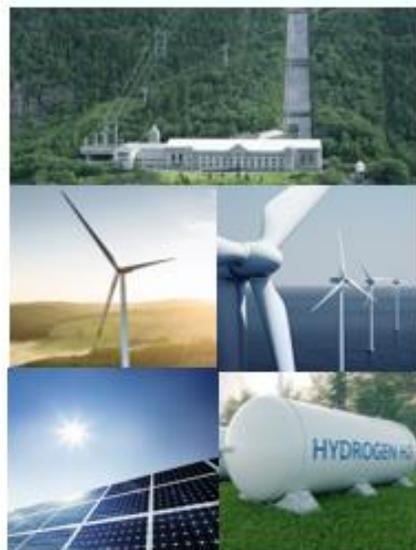
enspired conference
September 18-19th 2023

Nicholas Martin

Building batteries

What made an aluminium company chose to specialize in renewables and ESS

- Strategy and ambitions in the renewable space
- Building the know how and defining our space
- How we build and scale



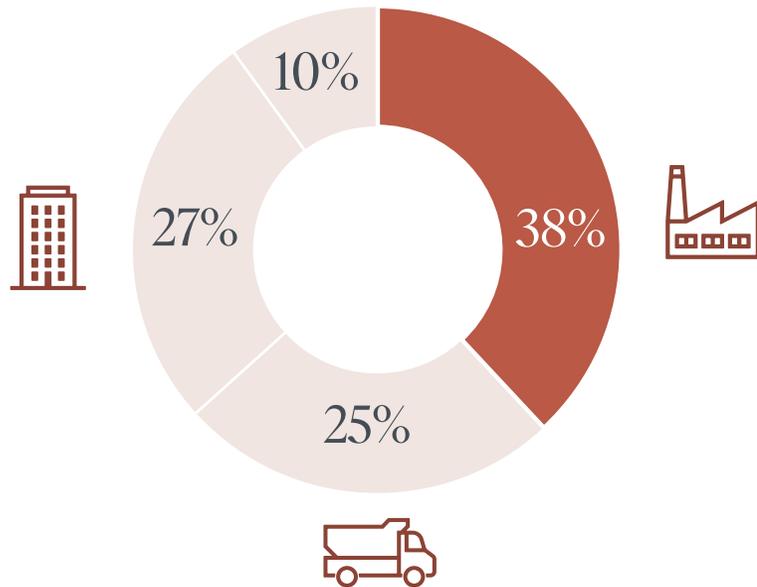
Delivering on Hydro's renewable growth ambitions ...



Pioneering the green aluminium transition, powered by renewable energy



The Challenge



Global emissions
(Scope 1 + 2) 2021

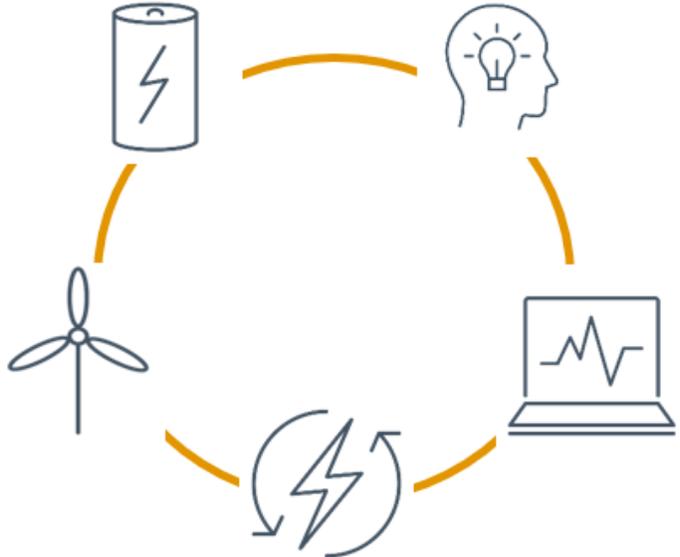
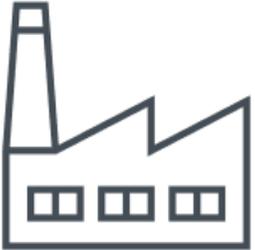
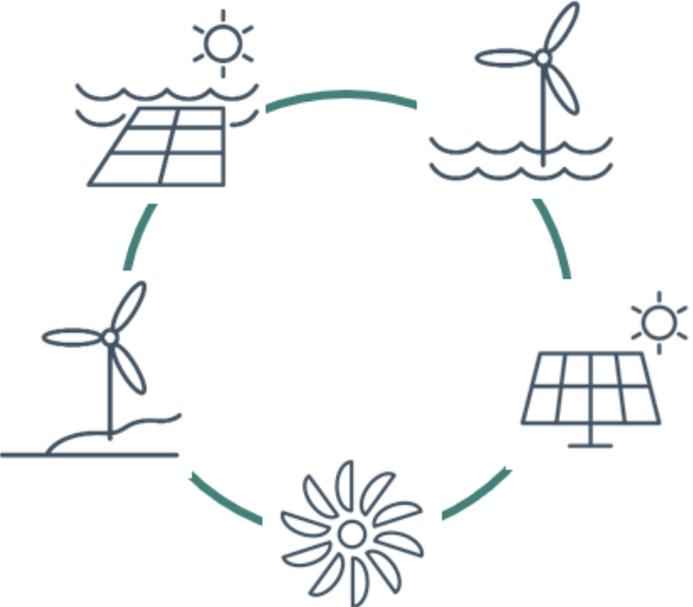


Our Solution

-  Renewable power
-  Energy efficiency & optimisation
-  Energy storage and flexibility management

Helping industry succeed
through the energy transition

Hydro Rein offers renewable energy solutions for more sustainable industries



Source power from captive portfolio of renewable assets

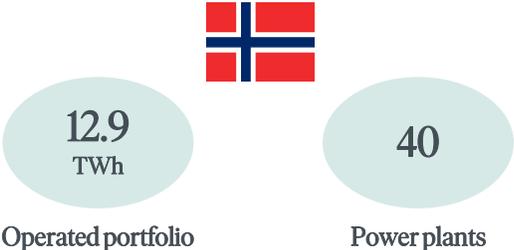
Offer range of green energy sourcing, efficiency and energy management solutions



Hydro Rein: building on Hydro's 117 years of energy and industry expertise

Renewable operational management

Portfolio (illustrative for Norway)

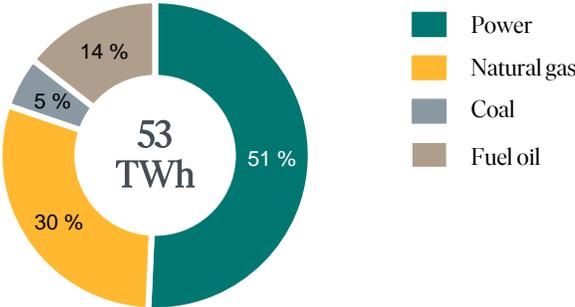


Deep renewable knowledge from operating various technologies

Third largest power producer in Norway

Energy demand

Hydro's annual energy demand by source

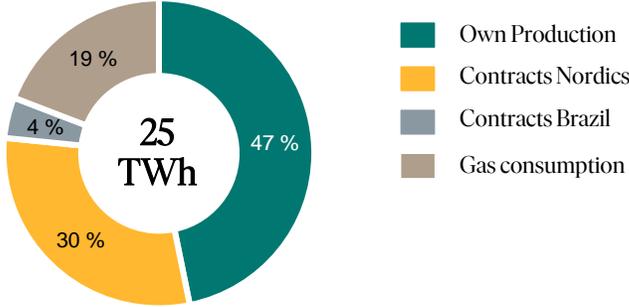


Distributed power demand across ~100 Hydro plants globally

9.5 TWh sourced under PPAs in 2022

Energy markets expertise

Annual volumes under commercial management by Hydro



Comprehensive in-house commercial capabilities related to power markets

Large power sourcing & trading operations across Nordics, Europe and the Americas

Two years of rapid growth across the Nordics & Brazil



CUSTOMERS



PORTFOLIO



PEOPLE

<p>3.6 TWh p.a. signed under long-term EUR & USD PPAs</p>	<p>1.7 GW gross capacity in construction</p>	<p>24 total # of renewable projects in portfolio</p>	<p>75 Hydro Rein FTEs</p>
<p>US\$ 2.7bn in contracted revenues</p>	<p>30 total # of sites in scope for Energy Solutions pipeline</p>	<p>6.1 GW gross capacity in pipeline</p>	<p>4 offices in Oslo, London, Germany, NL, and Rio de Janeiro</p>

We built our car while driving

Our Energy as a Service offering provided internal sites as excellent piloting for us



1st battery, Canada



Solar Fence, Offenburg



Solar Rooftop, Rackwitz



Batteries, Vetlanda

PHASE 1: VALIDATE

Learning, track record & systems
2022 to 2023

PHASE 2: BUILD

Investment and integration
Q3 2023 – Q2 2024

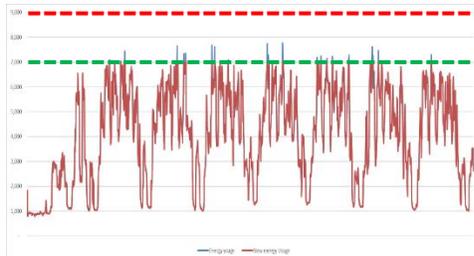
PHASE 3: SCALE

Running towards scale
Q3 2024+

BESS revenue streams

Three mutually exclusive revenue streams available, with different risk / return profiles

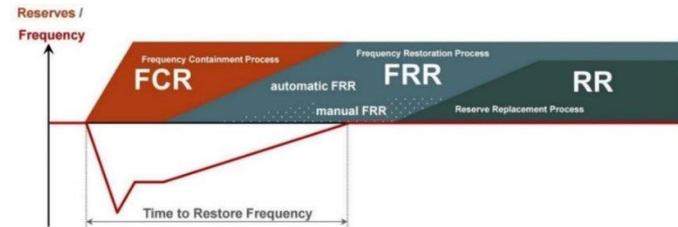
Peak shaving ('cost avoidance')



Use battery to reduce import from the grid during peak settlement periods, thereby reducing or eliminating grid charges that are linked to consumption during these periods

- Predictable, near-certain revenue stream (**low risk**)
- Return profile and share of total revenues varies significantly across markets

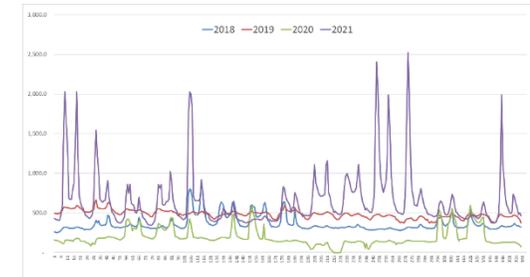
Ancillary services



Use battery to offer various services to the national transmission network to help keep frequency balanced and ensure stability of the system

- Unpredictable revenue stream driven by market pricing & volatility (**med-high risk**)
- Return profile and share of total revenues varies significantly across markets

Price arbitrage

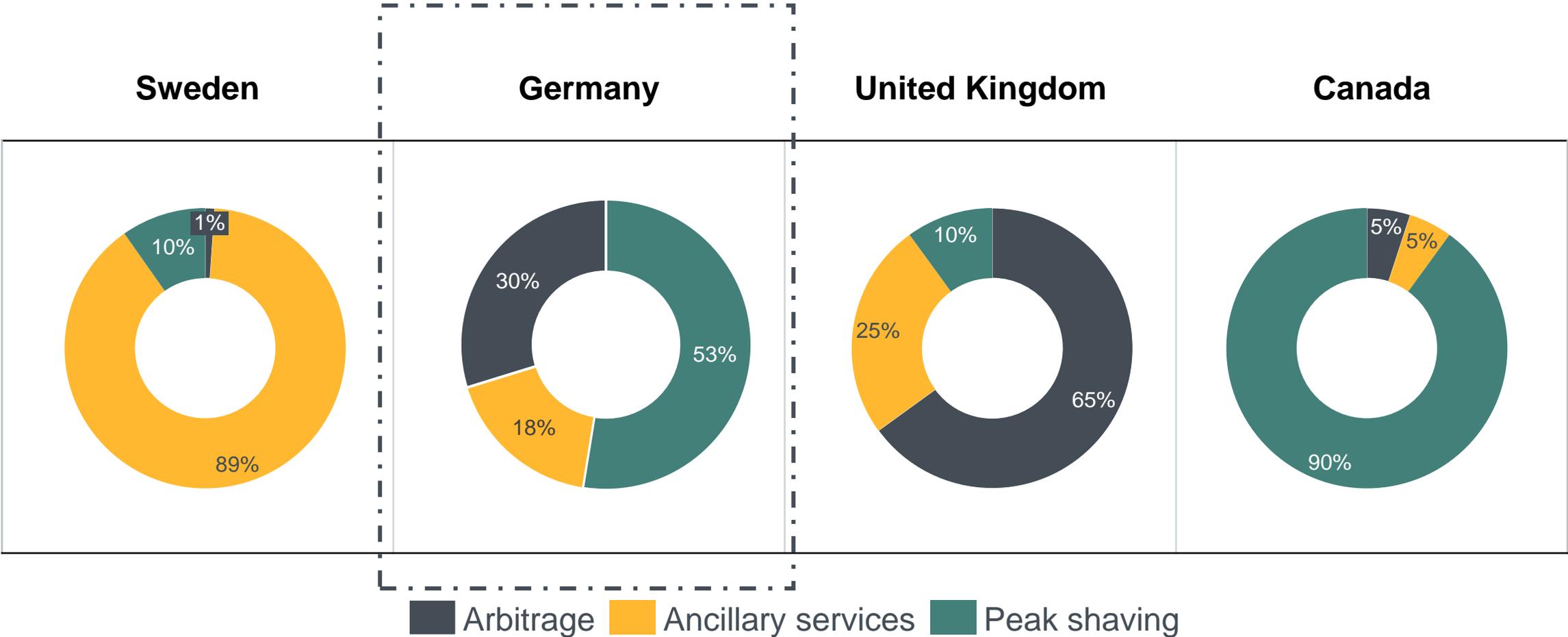


Generate revenues through arbitrage in the power markets: charge the battery during periods of low demand (low prices), release that energy during peak times (high prices)

- Unpredictable revenue stream driven by market pricing & volatility (**med-high risk**)
- Return profile and share of total revenues varies significantly across markets

BESS revenue streams – variations across markets

Market conditions & local regulations impact split, and hence the overall risk profile

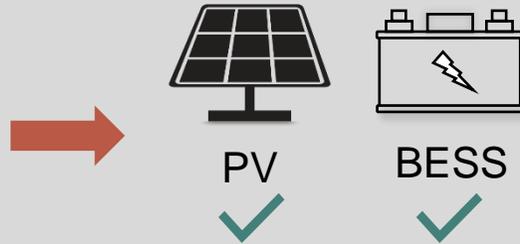


Green Deal Germany – under construction (COD Oct.)

Project Summary

Project name	Green Deal Germany
Customer	Hydro Extrusions (3 Sites) and Hydro Remelt (1 site)
Project type	Multi Asset

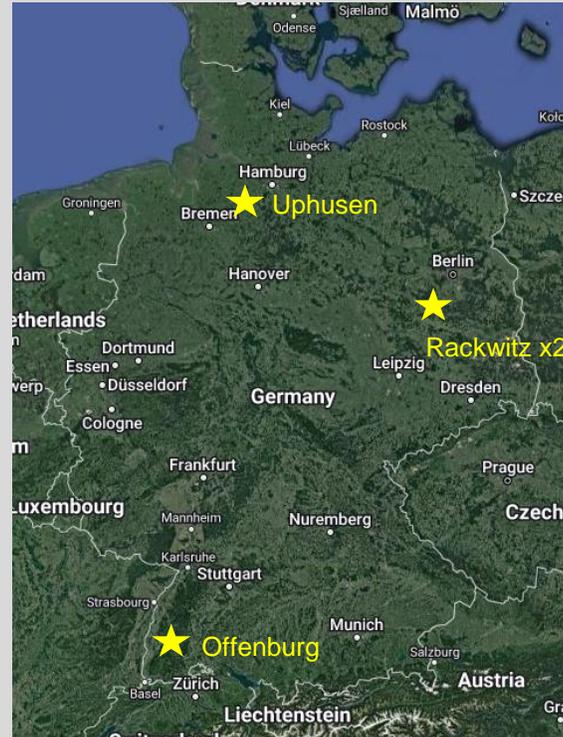
Full Energy Solutions delivery



Project Summary

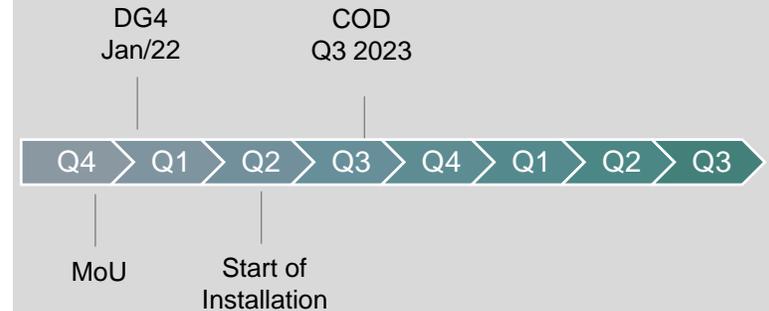
LFP Battery for all sites 2x1,5 MW/1,5 MWh 1C 2x1,5 MW/2,5 MWh 0,5C	Cash income or reduced PPA from peak shaving, ancillary services or intraday arbitrage
Uphusen	Roof (available land ph. 2)
Rackwitz *2	Roof + Roof / Ground
Offenburg	Fence installed, more roof

Project Location



Location	Germany
Hydro BA's	Extrusion DACH + AM re-melt
Hydro Sites	Offenburg/Uphusen/Rackwitz

Timeline



Selected features

- ~MEUR xx Capex in decentralized renewables assets
- A bundled pricing offer for solar and BESS
- Hassle free – REIN Capex

BESS use cases in Germany

Current use cases and distribution of large-scale BESS

Main use cases in Germany

- **Ancillary Services** (750 MWh). Still primary use case for batteries, main market is Frequency Containment Reserve (FCR), saturated market. aFRR launched, market 3-4 times larger and only 60MW prequalified.
- **RE integration** (250 MWh). Usually large scale PV plus BESS or Wind plus BESS.
- **Industrial energy supply** (50 MWh). Various applications including peak shaving, self-consumption and on-site generation optimization.
- **Multi-use operations** (150 MWh). Switch between market and front-of-meter and behind-the-meter applications such as: Energy arbitrage, load management, peak shaving, voltage stability, FCR. **Increased focus on arbitrage trading in 2022.**
- **Grid boosters** (450 MWh). Developed by TSOs (TenneT 2x100 MWh – planned for 2023, TransnetBW 250 MWh – planned for 2025) to resolve grid bottlenecks, also referred to as “storage as transmission”. Exclusive use for grid operations.
- **Others** (8 MWh). EV charging, blackstart and others.

Value stacking

- Lithium-Ion batteries as “swiss army knife” of the power system
- Allows value stacking of battery services both in-front and behind the meter
 - Ancillary markets (FCR, aFRR)
 - Peak shaving
 - Energy arbitrage
 - Energy bill savings
 - Black start
 - Backup power
- Focus on multi-market optimization for revenue maximization

Large-scale BESS in Europe

Securing land and suitable grid connection

United Kingdom

UK arguably the most mature market for utility-scale batteries, with many large-scale installations and Europe's currently largest battery



196 MWh battery

Largest BESS in Europe, with total investment of 75 mGBP. Commissioned in 2023, using Tesla MegaPacks. Company aims expansion in UK to 1 GWh



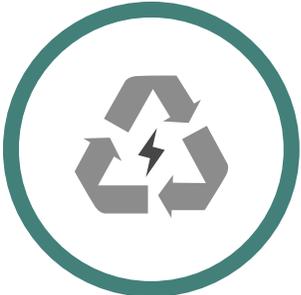
Germany

Massive growth in large-scale BESS in Germany in 2022, with over 450MWh installed, a 9-fold increase to the previous year.

Most installations below 20MWh, largest installation at 72MWh. Many projects announced, including Europe's currently largest project at 250 MW to serve Storage-as-Transmission.

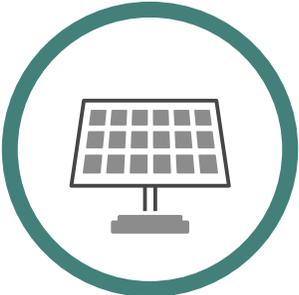


Four core business segments – supported by our proprietary digital platform



Energy efficiency and demand mgmt.

Implement measures to reduce energy demand and steer demand for energy



On-site generation

Renewable capacity located on-site, typically coupled with on-site battery installations



Energy storage systems

Battery or thermal storage installations, usually meant for peak-shaving or demand response



Green sourcing

Contracts with physical green traceability, often covering residual needs beyond on-site generation to show 100% renewable scope II emissions



REIN-Hub is the end-to-end digital home for industrial customers



Addressing key customer pain points

- ! Increasing energy market complexity
- ! Little/no experience of operating energy assets
- ! Not equipped to harness value from technology advances
- ! Time-consuming measurement & reporting vs targets

Scalable platform, developed with industry-leading partners



Delivering the full suite of services from a simple, unified digital home



Visualise

Energy data & GHG by product/process, in real time



Optimise

Generation and storage assets, incl. via digital twins



Improve

Monitor & improve energy efficiency (incl. air, lighting)



Retrieve

Retrieve, benchmark & export data



Navigate

Monitor and retrieve diagrams & data via 3D maps



Document

Secure repository for all energy-related documentation

A black and white photograph of a hand held palm up, with a single drop of water falling from the index finger into a body of water. The background shows a blurred landscape with reeds and a sunset or sunrise sky.

**WE MAKE RENEWABLE
ENERGY WORK FOR YOU!**

REIN | 
Hydro