

CATAPULT
Offshore Renewable Energy

**ScotCLUE Demonstrator:
Smarter Energy Controllers for Future
Offshore Wind Energy Systems**

John Nwobu

smarter
grid solutions

University of
Strathclyde

Community
Energy
Scotland
Empowering Communities



Concepts, Planning, Demonstration and Replication of Local User-friendly Energy Communities (CLUE) – Project Summary

€6M project funded by ERA-Net



- CLUE is an EU wide project acquiring knowledge on design, planning and operation of Local Energy Communities (LECs) and developing concepts for successful replication and upscaling of LECs
- ORE Catapult is the lead partner in the Scottish CLUE consortium, providing local energy system and stakeholder knowledge. Our Levenmouth Demonstration Turbine will be used to show how energy produced from offshore wind could be distributed through a network architecture that offers the potential for local communities to maximise their energy use with one another.

Project Partners – Scottish Consortium



ORE Catapult Development Services Limited

University of Strathclyde

Smarter Grid Solutions Limited

Project Partners – German Consortium



Fraunhofer Institute for Solar Energy Systems ISE

E.ON Energy Solutions GmbH

Fakt AG

Project Partners – Austrian Consortium



Institute of Computer Technology, TU Wien

AIT Austrian Institute of Technology GmbH

Energienetze Steiermark GmbH

Energie Steiermark Kunden GmbH

Siemens AG Österreich



Fachhochschule Technikum Wien

lab10 collective eG

Klima- und Energie-Modellregion

Naturpark Almenland

Project Partners – Swedish Consortium



Malmö stad

E.ON Energidistribution Aktieföretag

E.ON Energiöningar Aktieföretag

Rise Research Institutes of Sweden AB

Lunds universitet



Malmö kommun parkeringsbolag

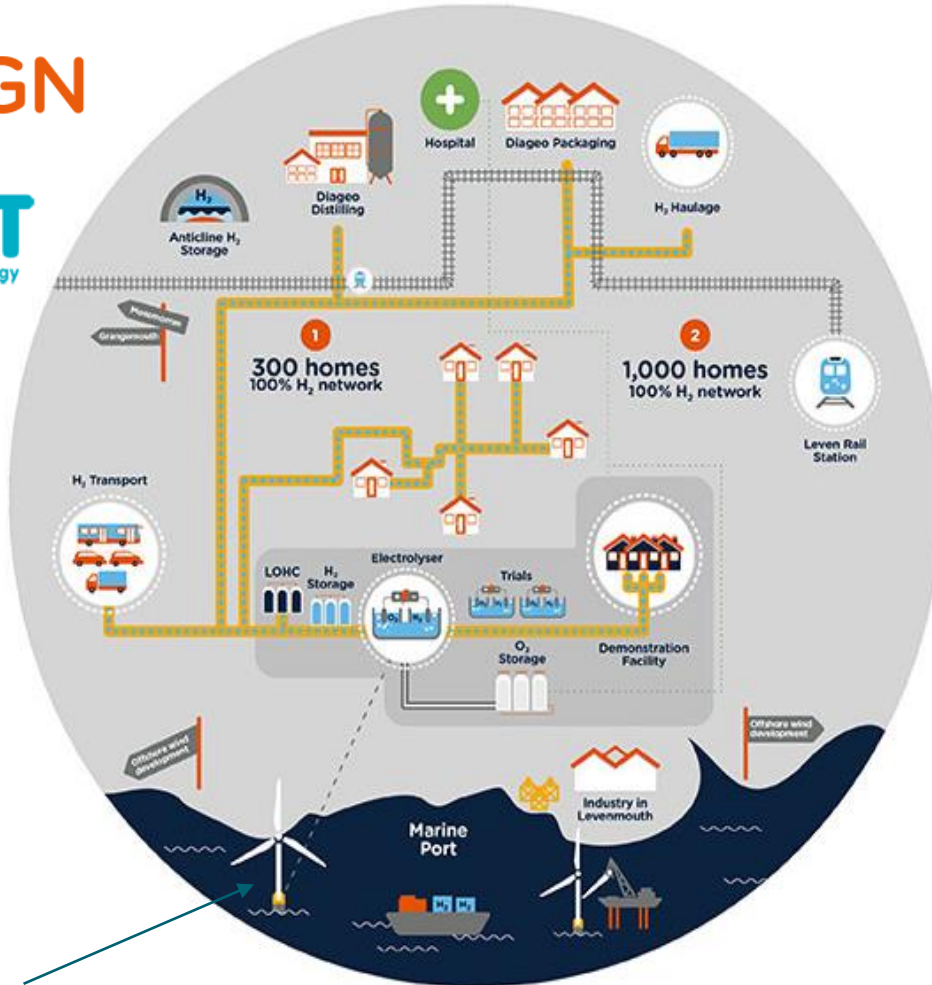
Vasakronan AB

Serneke Group AB



H100 Fife Project

The first 100% H2 to homes, zero carbon network in the world.

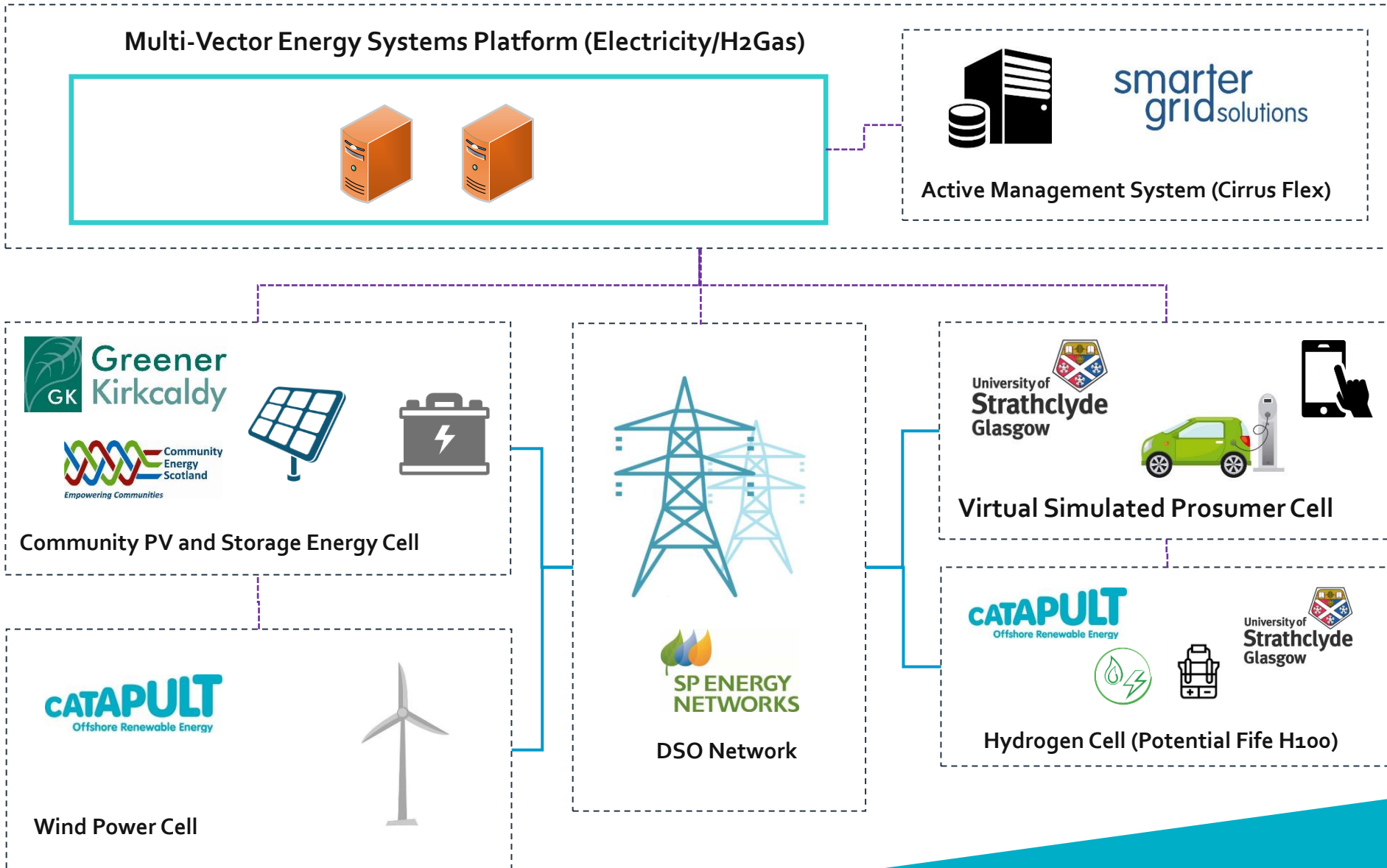


Levenmouth
Demonstration
Turbine (LDT);

Source: Scottish Gas Network (SGN) H100 Fife

- Development of a world-first 100% hydrogen gas network in Levenmouth that will **bring renewable hydrogen into homes** in 2022.
- Green Hydrogen gas **produced** from offshore wind using an electrolyser installed at **ORE Catapult's Levenmouth Demonstration Turbine**
- In the project's **first phase**, the network will connect around **300 local homes to hydrogen** and **second stage** would be a new network with around **1000/2000 homes**.
- **Customers** will be able to interact with hydrogen appliances at a demonstration facility and will be **given option to swap their natural gas supply**
- Undertake studies that measure the technical, social and commercial performance of the hydrogen network

ScotCLUE Demonstrator (Local Energy Community)



ORE Catapult – Monitoring and control of the 7MW LDT turbine used for electricity and H2 gas production.

University of Strathclyde – Modelling to ensure web-of-cells architecture, **virtual electrolyser** and prosumer cells

Smarter Grid Solutions (SGS) – Provider of commercial active management system software and will develop an integrated platform with their cloud based ANM Strata platform and ANM elements.

Supporting Partners
 Community Energy Scotland
 Greener Kirkcaldy
 - Providing access to the community centres for demo.

Device Integration



Overview of Selected Use Cases

Mode 1: Maximise Renewables



The priority on this mode is to use all renewable sources (PV/storage community centres, wind turbine) to maximise local electrical generation into the network.

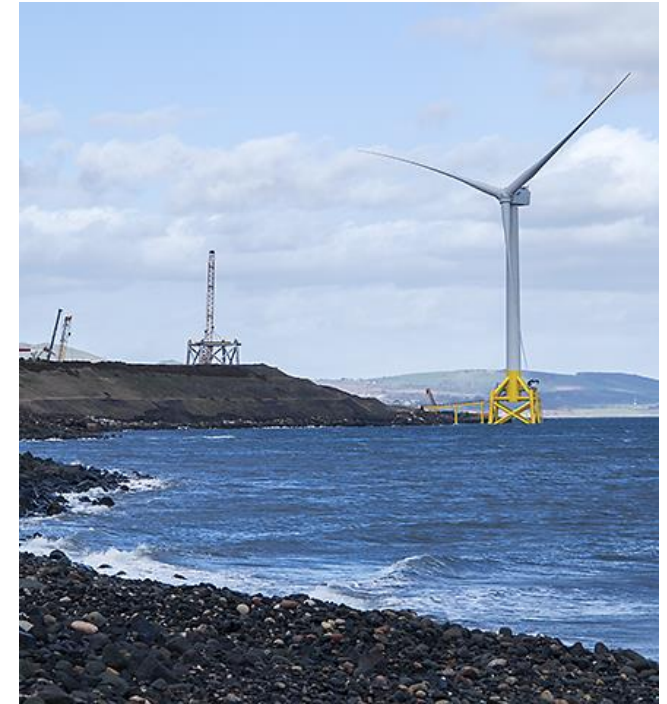
Mode 2: Maximise Hydrogen Production



Source: <https://creouk.com>

The priority on this mode is to use all renewables sources (PV/storage community centres, wind turbine) to maximise hydrogen production.

Mode 3: Grid Network Constraint



In this mode, the priority is to avoid curtailing wind turbine during a grid constraint, instead transfer the excess wind generation to the electrolyser, if the electrolyser consumption is low—curtail the turbine

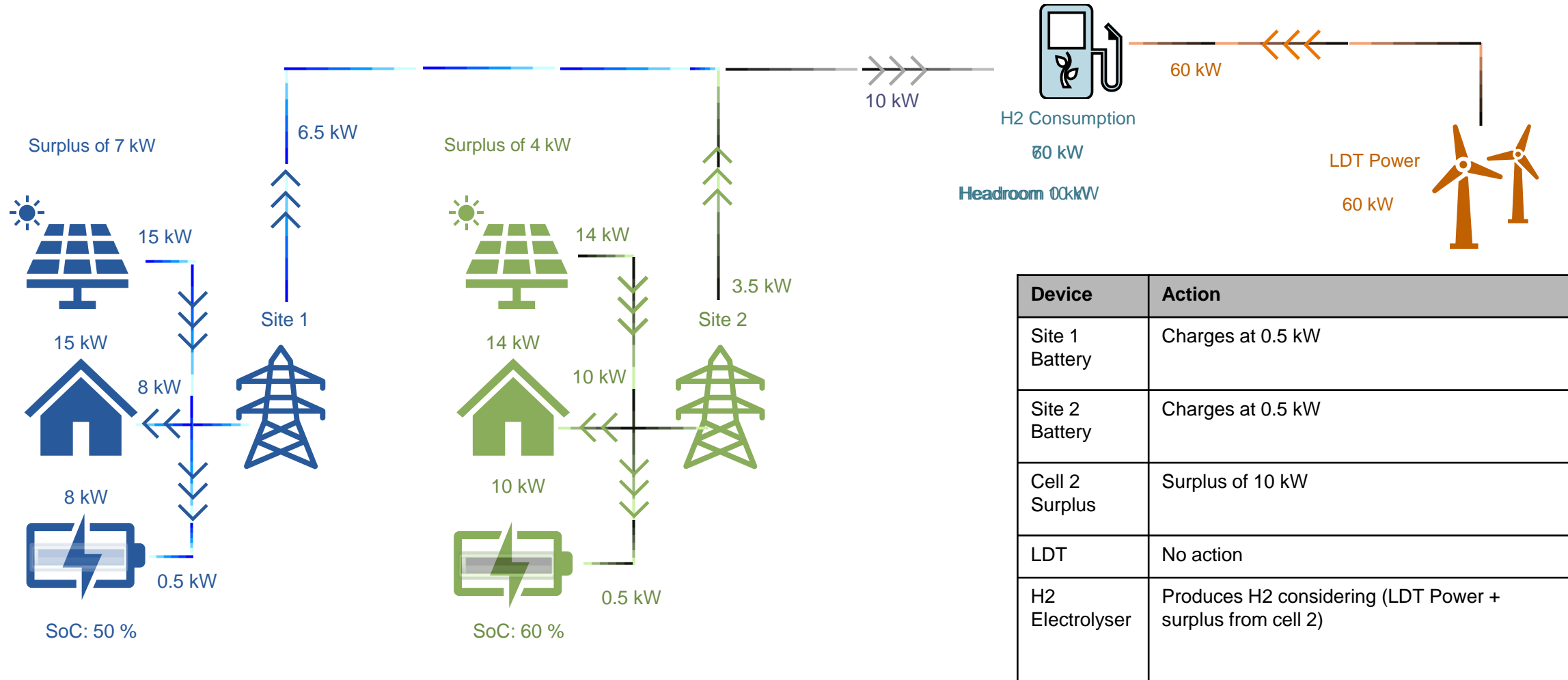
WoC Mode 2 – Maximise Hydrogen Production

- › In this mode, maximising the hydrogen production will be having the priority by focusing on power sent from all renewable sources (PV/storage community centers, wind turbine) to the electrolyser



WoC Mode 2 – Demo Case 1

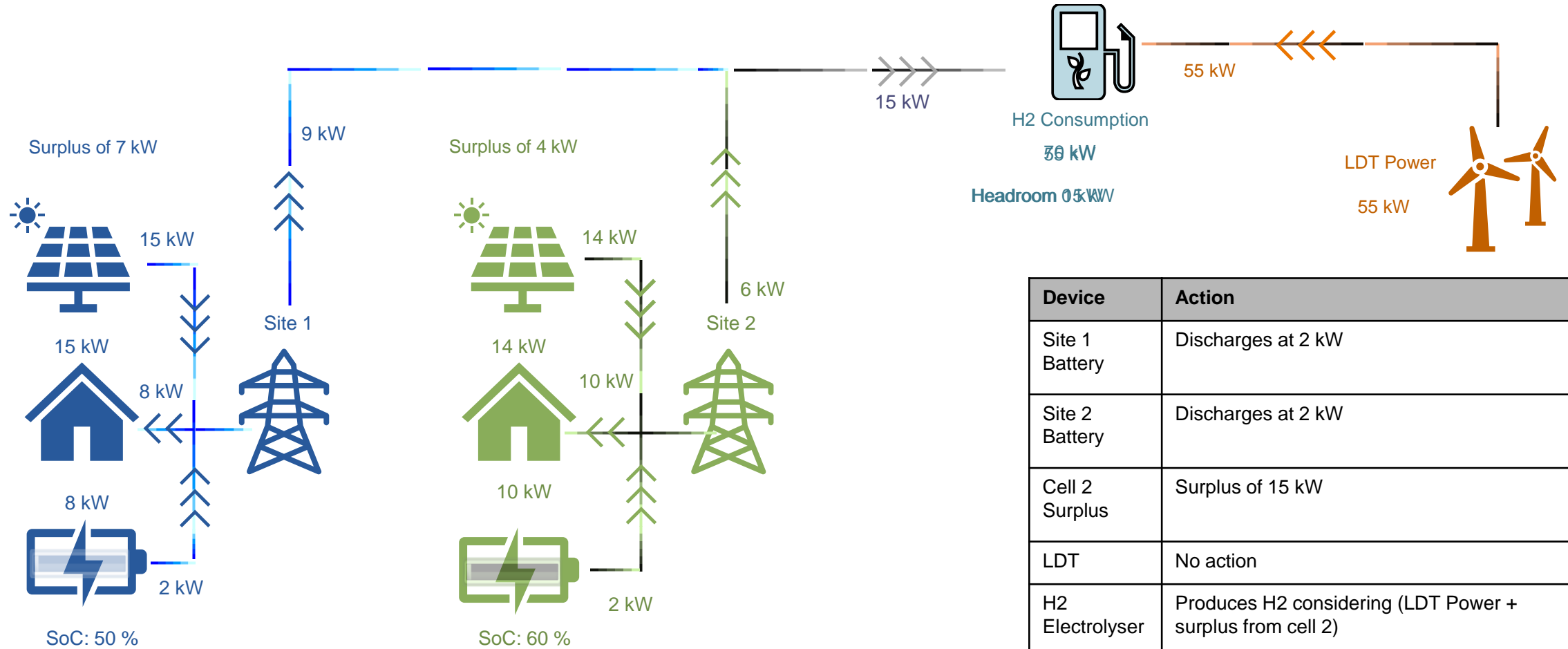
Site 1 – Surplus and Site 2 – Surplus and the Battery SoC is within high and low limits and H2 headroom available



C5.20

WoC Mode 2 – Demo Case 2

Site 1 – Surplus and Site 2 – Surplus and the Battery SoC is within high and low limits and H2 headroom available



| Device | Action |
|-----------------|---|
| Site 1 Battery | Discharges at 2 kW |
| Site 2 Battery | Discharges at 2 kW |
| Cell 2 Surplus | Surplus of 15 kW |
| LDT | No action |
| H2 Electrolyser | Produces H2 considering (LDT Power + surplus from cell 2) |

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Web of Cells Modes

WoC - Mode 1 Control
 MODE 1 INACTIVE
Maximise Local Generation

WoC - Mode 2 Control
 MODE 2 INACTIVE
Maximise Hydrogen Production

WoC - Mode 3 Control
 MODE 3 INACTIVE
Grid Network Constraint

Algorithm1 - Topology Name: Algorithm1-NormalMode

Cell 1 (Scaled Value)

| | |
|-------------------------------------|-----------------------------------|
| WoC - LDT - Current Production (kW) | 58.03 |
| WoC - LDT - Surplus Available (kW) | 58.03 |
| WoC - LDT Run Status | RUNNING |
| WoC - LDT Wind Speed (m/s) | 9.56 |
| Grid Connection - Real Power (kW) | 41.71 |
| WoC - Network Limit Active | <input type="checkbox"/> INACTIVE |
| WoC - Network Limit Value (W) | 25000 |

Cell 2

| | |
|---|------|
| WoC - Community Centers - Current Total Production (kW) | 0.00 |
| WoC - Community Centers - Total Surplus Available (kW) | 0.00 |

Cell 3

| | |
|--|-------|
| WoC - H2 - Available Power Headroom (kW) | 53.68 |
| WoC - H2 - Current Consumption (kW) | 16.32 |

Simulation/Live Data

WoC - Simulation

WoC - LDT Real Power (kW): 70

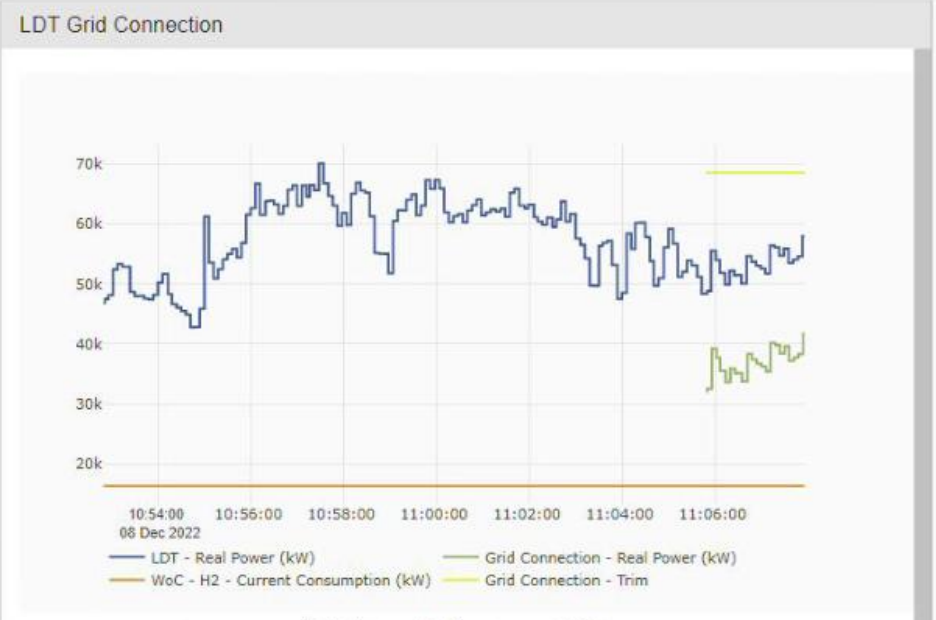
Simulation Real Power

Communications Status

Measurement Point: 100%

Devices: 100%

LCS: 100%



CONTACT ME

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Engage with us:



GLASGOW

BLYTH

LEVENMOUTH

GRIMSBY

ABERDEEN

CHINA

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PEMBROKESHIRE

CORNWALL