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JIGSAW Model Webinar

Assessing a multi-vector energy system and control

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WELCOME TO THE JIGSAW WEBINAR

- We'll talk about JIGSAW
- Talk about a case study and show example outputs
- Demo part of JIGSAW to give an insight into its capabilities
- Summarize the uses and features

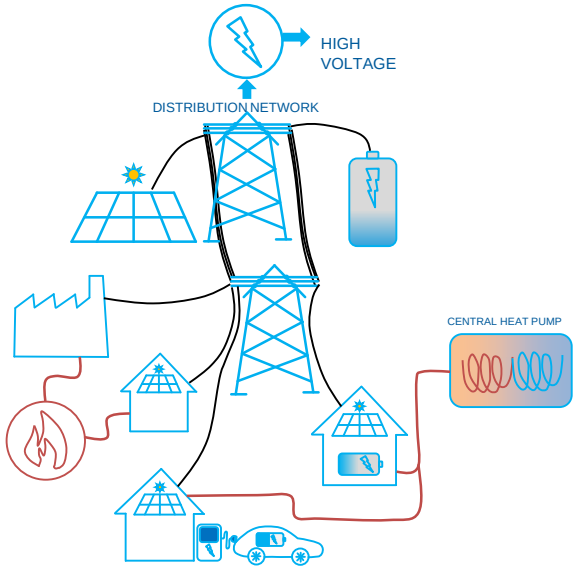
What is JIGSAW?

INTRODUCTION

It is a modular simulation environment built to explore:

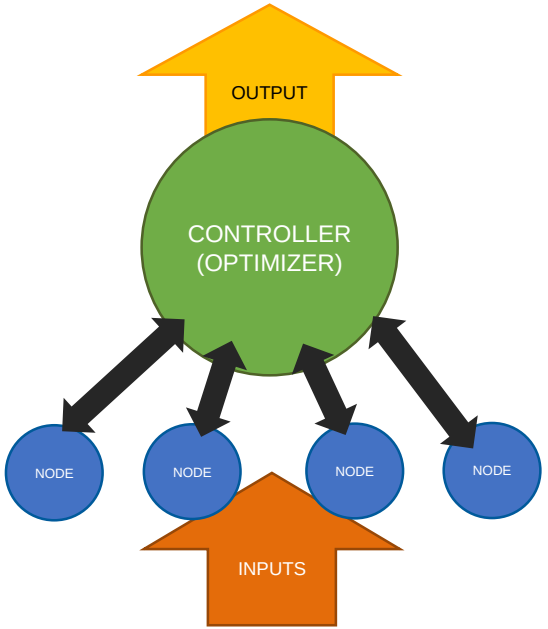
What are the synergies in a multi-vector energy system?

- It is a set of energy demand and generation modules with different technologies
- Modules can be put together to create an energy network
- It can explore the architecture of the electricity network, distribution and transmission
- It allows the testing of control algorithms for the network

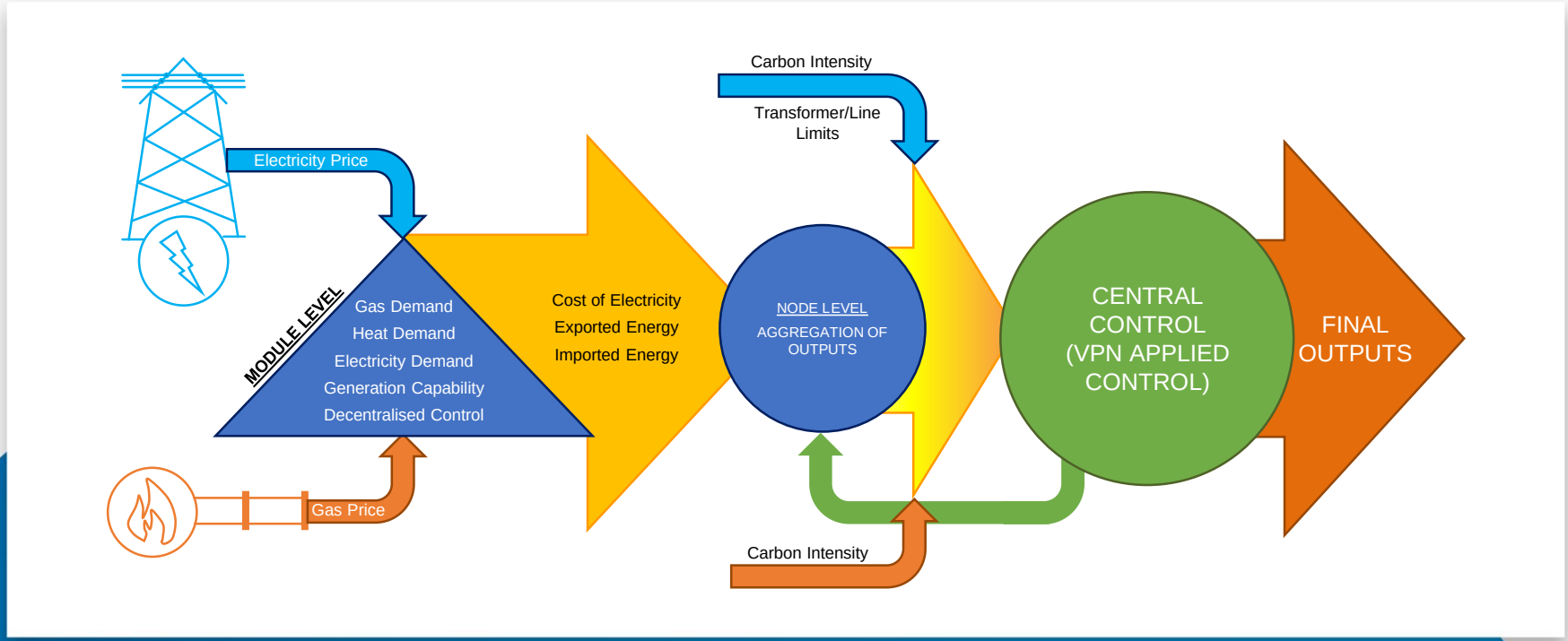


HOW CAN WE BUILD A NETWORK IN JIGSAW?

- We define the size of the network
  - Single site or under a single transformer
  - Multi-transformer (Regional)
- Each transformer or site is built as a node
- Each node contains modules
- Define, build and/or interface an existing controller algorithm for the network
- Provide inputs like energy prices, CO2 emissions per technology, building demand profiles, vehicle profiles
- Run the model and assess the network and controller
- Change parameters to achieve goals: more efficiency, less carbon output, less cost, grid balancing etc.



THE BOTTOM–UP APPROACH



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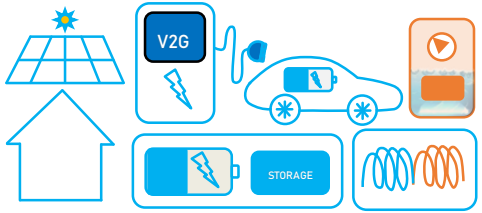
TECHNOLOGIES COVERED & OUTPUTS

- It calculates total demand, export, line utilisation and CO_2 generated every half an hour for any length of time (days, months, years)
- It calculates gas and electricity prices, can calculate import savings/earnings per module or collection of modules
- Outputs can be tailored to suit the project or customer



CURRENT MODULES LIST

1. Home or site Demand
2. Photovoltaic Panels (home mode, PV farm mode)
3. EV charger (V2G compatible)
4. Storage Battery at home (export or self consumption modes)
5. Grid Storage Battery
6. Electric Heat Pump with Hot Water Storage
7. Transformer Loss Module

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Case Study

Energy Revolution for Caldicot

CASE STUDY –ENERGY REVOLUTION FOR CALDICOT

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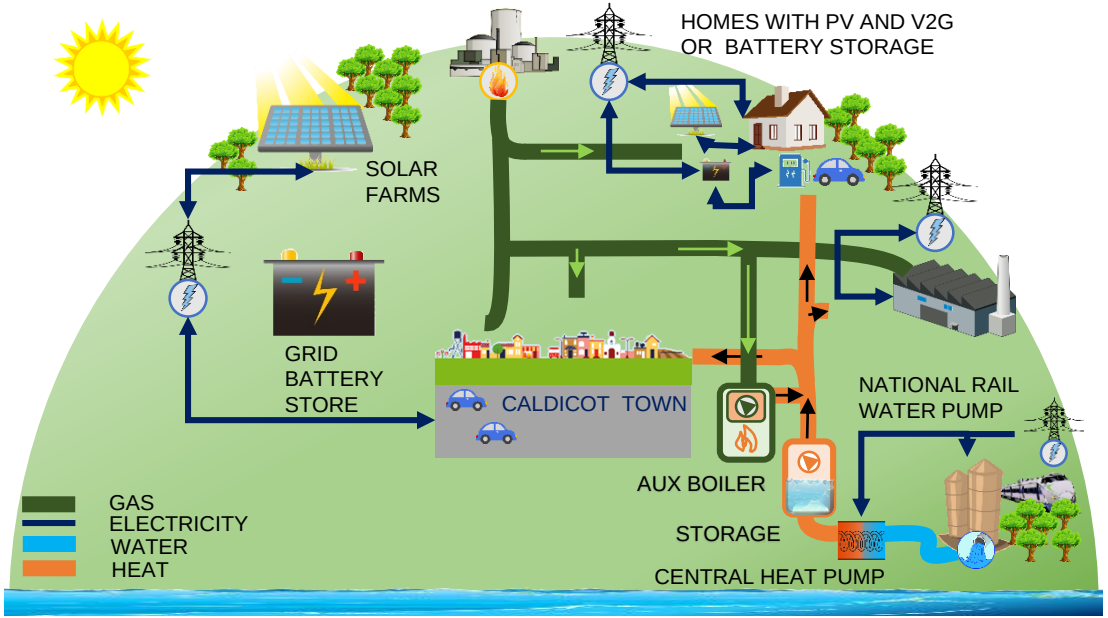
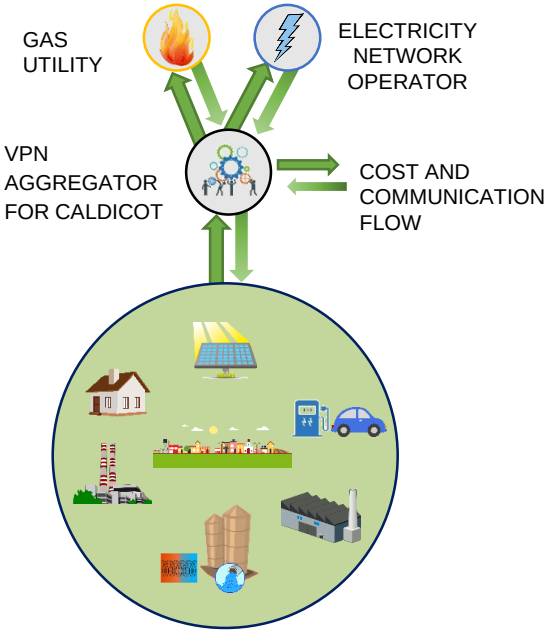


The project aimed to explore:

- 2020, 2025, 2030 year scenarios for the town
- Including uptake of technology like PV, EV, battery storage, waste water heat pump
- In tandem with gas heating looking forward to an auxiliary boiler option with heat pumps as a main source

CASE STUDY –CENTRAL CONTROLLER OPTIONS



JIGSAW was used to build the network of Caldicot in its current state, using maps from the DNO.

- One of the goals was to assess the value of a single aggregator controlling the flexible assets
- Three control strategies which became part of the Caldicot JIGSAW network
- The model included transformer loss models at low, medium and high voltage levels
- Metering at each level to calculate DuOS and import costs, losses and CO_2

The outputs of the model informed the client's business analysis and considerations for detailed design.

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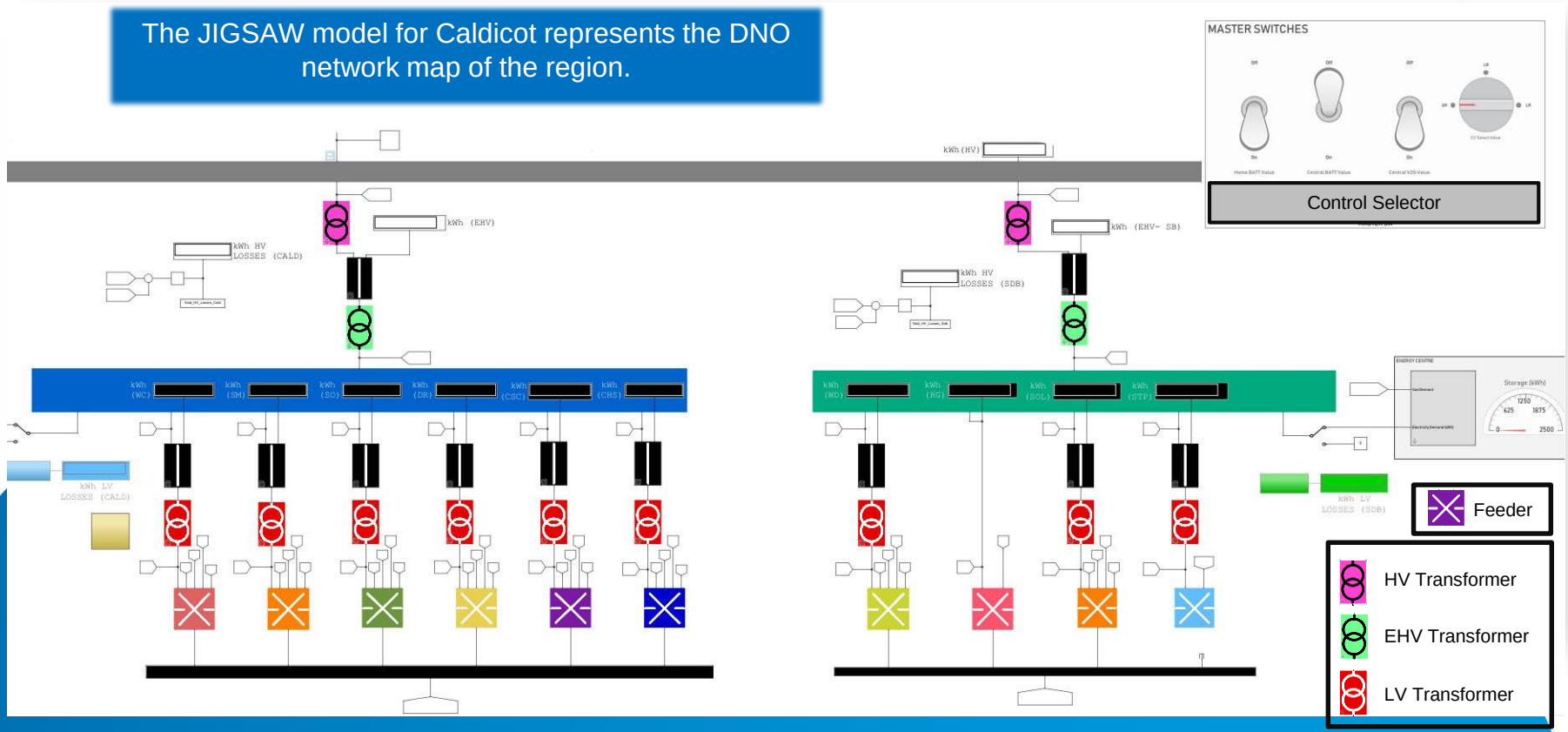
CASE STUDY –JIGSAW Network Model for Caldicot

The JIGSAW model for Caldicot represents the DNO network map of the region.



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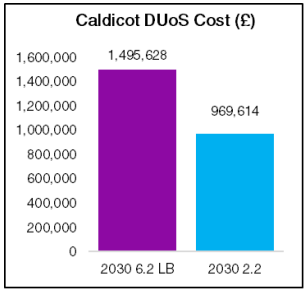
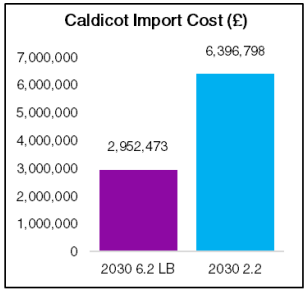
CASE STUDY – EXAMPLE TOP LEVEL OUTPUTS

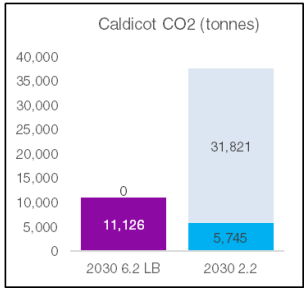
30+ scenarios were tested with the model

- 2020, 2025, 2030: Change in population, energy prices
- Change in technology uptake for each area of Caldicot
- 3 controllers/optimisers for each scenario

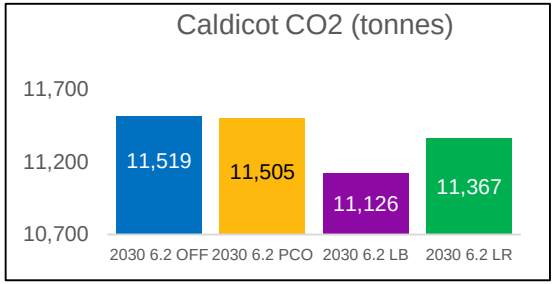
2030 year example: Gas versus Central Heat Pumps (CHP)







Controller Comparison for 2030 with CHP



1. No control
2. Power Cost Optimisation
3. Local Balancing
4. Loss Reduction

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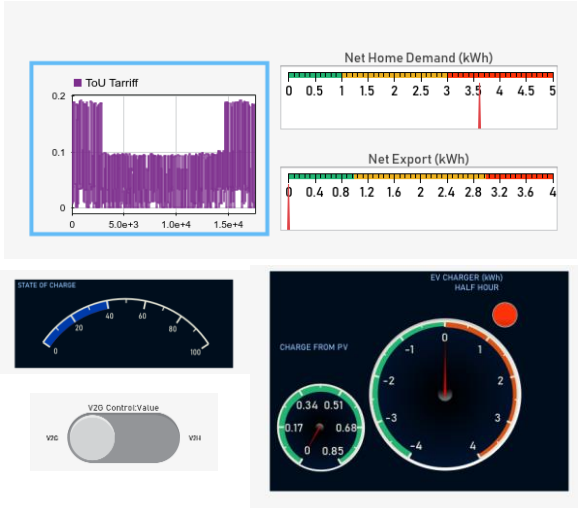
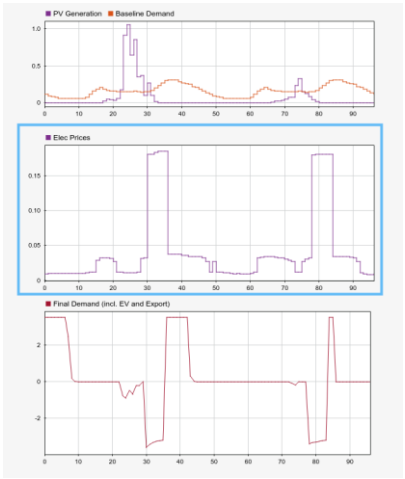
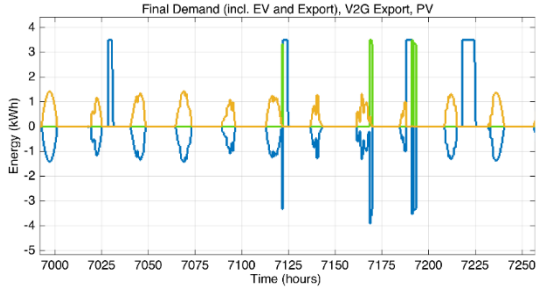
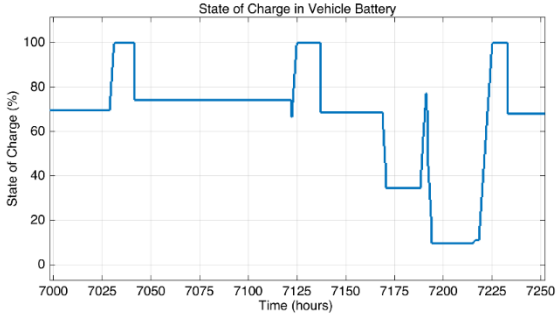
CASE STUDY – EXAMPLE MODULE LEVEL OUTPUTS

In addition to top level outputs, JIGSAW outputs can be tailored to the needs of the client. Module level and node level outputs and dashboards can be implemented.









Uses and Summary

How can JIGSAW be useful?

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HOW CAN YOU BENEFIT FROM JIGSAW?

Meet Targets

Build & Test

Analyse Potential

Design Intelligent Control

- JIGSAW can help you find out how you can meet your targets
- It can be used to build and test a concept network
- The potential of a multi-vector network can be analysed
- It can be used to design system logic and network control

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SUMMARY

- JIGSAW is a modular simulation environment
- It is a network model, so it is capable of exploring the synergy in the whole system
- Various optimisers and controllers can be tested in varied scenarios
- The outputs can be tailored to the project and customer
- It is modular and can fit your application, research or development project

Meet Targets

Build & Test

Analyse Potential

Design Intelligent Control

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Thank you for listening

Sagar Mody

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