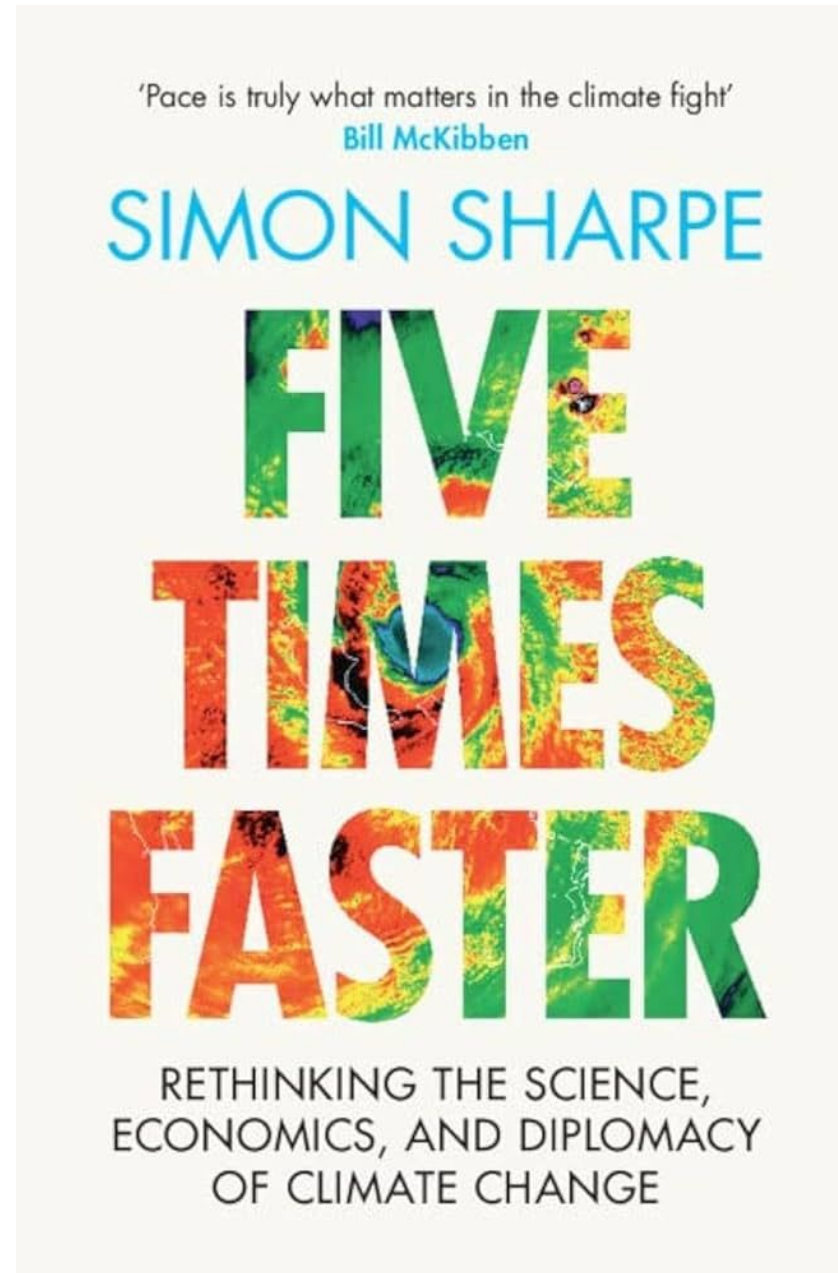
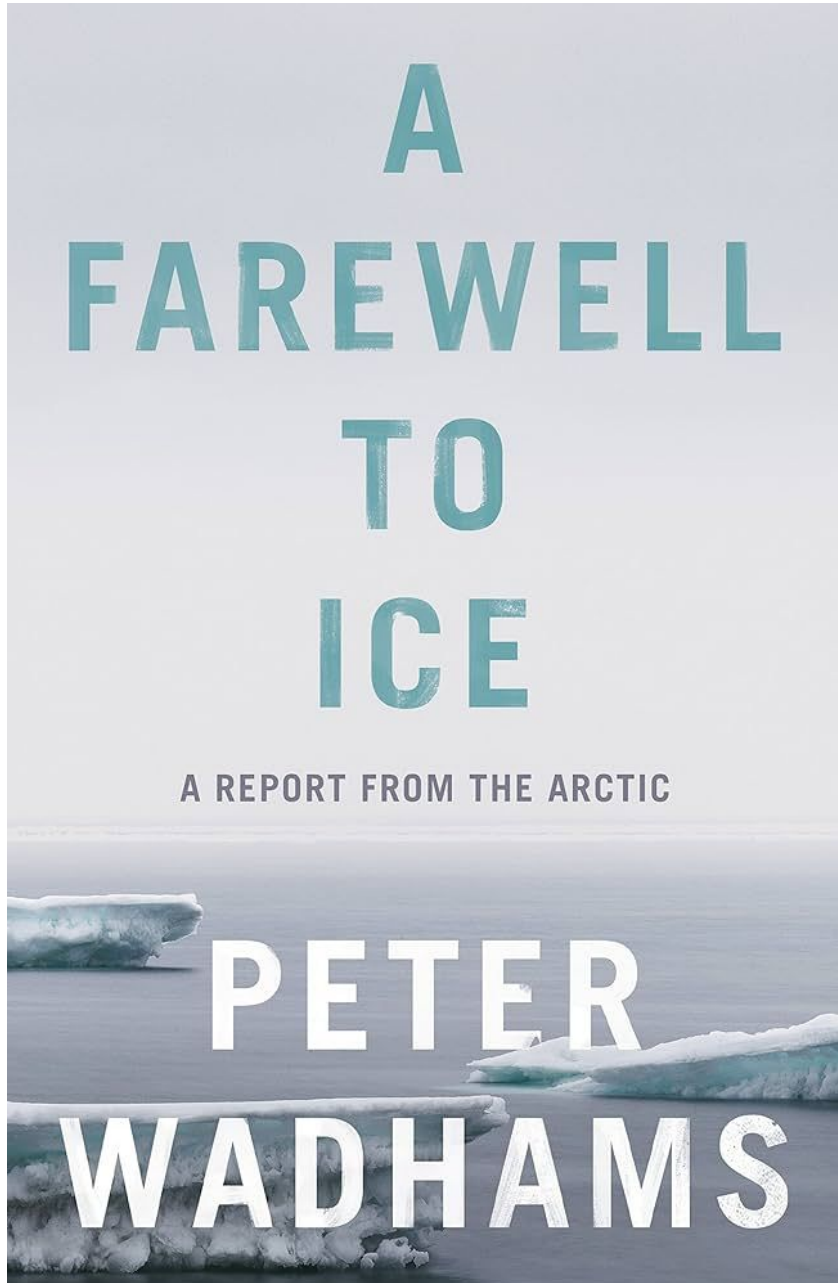
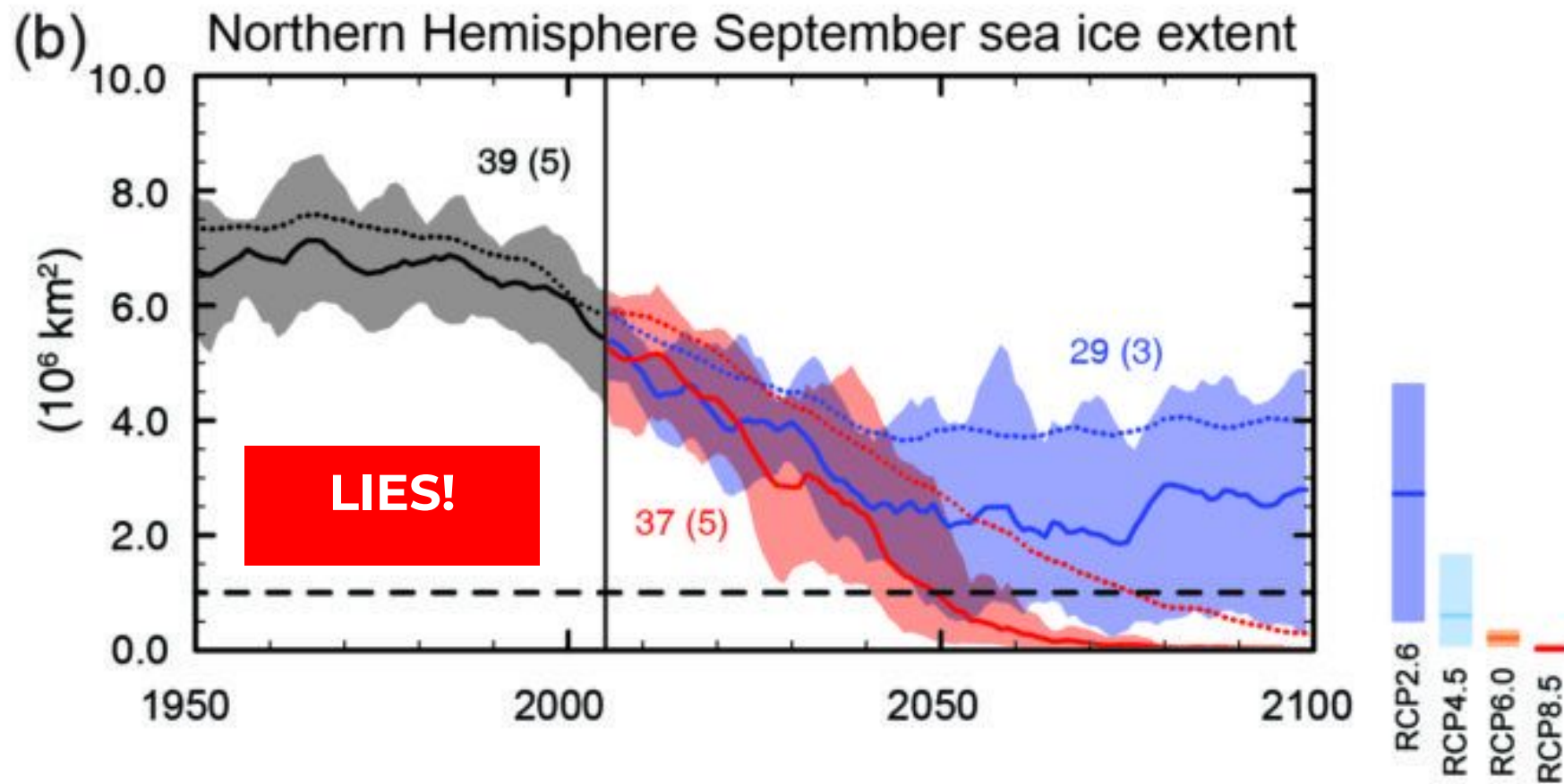




solarZero and Heatio Introduction

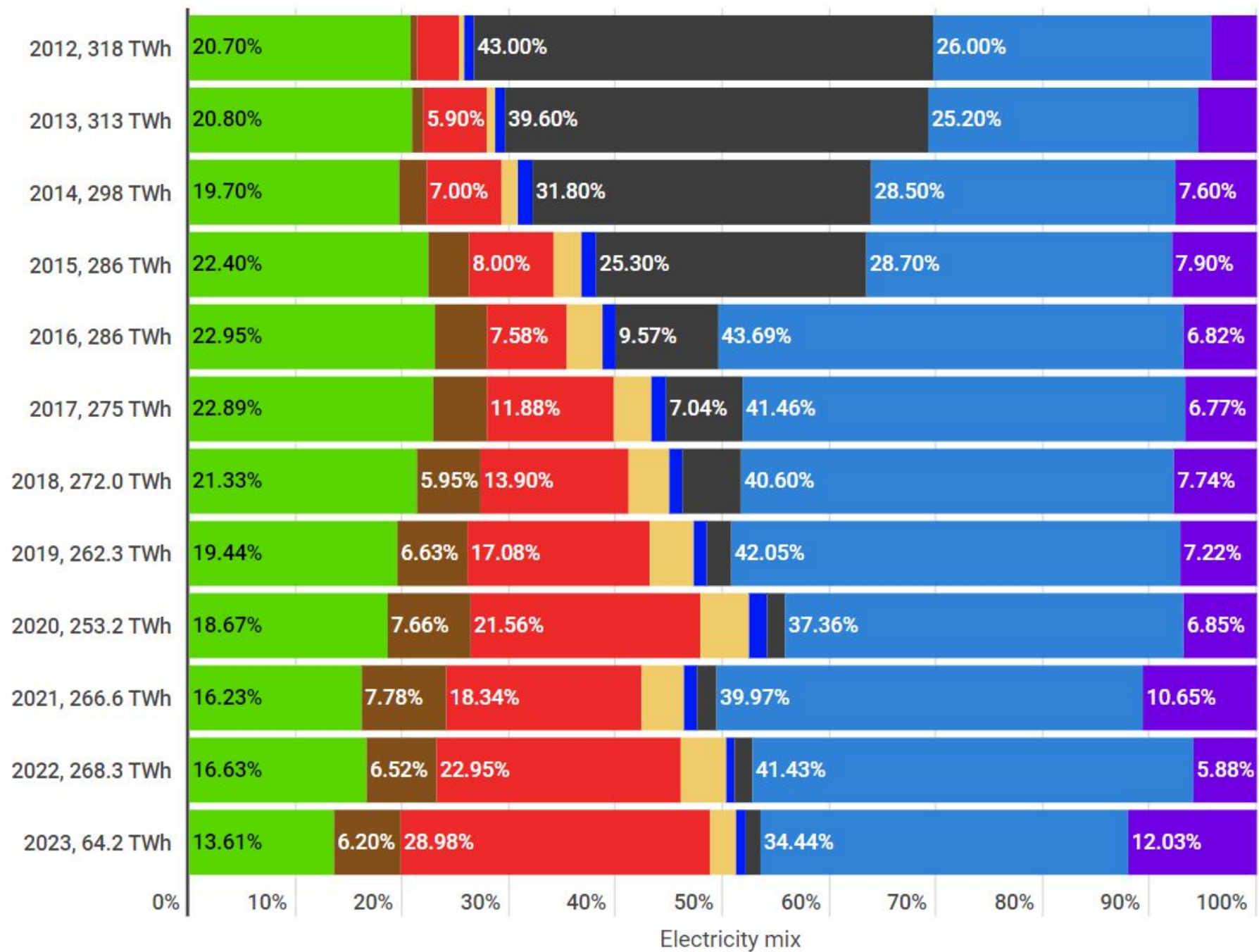
Welcome to Hack8





<https://www.ipcc.ch/report/ar5/wg1/summary-for-policymakers/>

Further Reading: A Farewell To Ice, A Report from The Arctic. Peter Wadhams



About solarZero

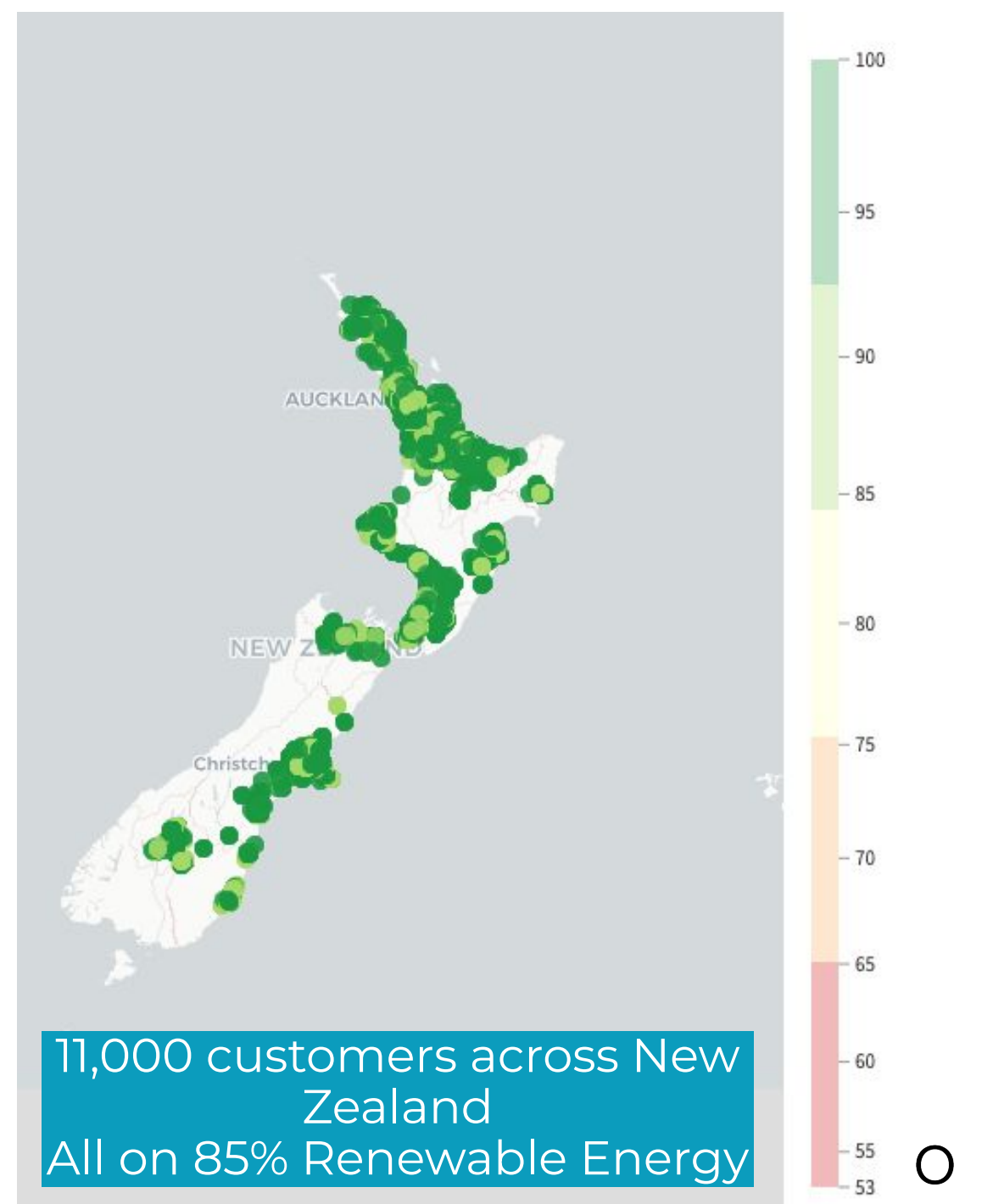
Mission driven, New Zealand based solar company

Each house gets:

- Solar
- Battery
- Backup power
- Monitoring and support
- Lower cost grid electricity and a guaranteed saving

Own and manage solar/battery on 11,000 houses in the country, 50% of all solar in New Zealand is ours! For 20 years, we:

- Manage the battery
- Help customers reduce electricity consumption
- Always reduce energy costs



Who are Heatio?

Clean Tech Start-Up - mission to make clean energy affordable and accessible to everyone.

Developing a Smart Home Energy Management System which advises on the best ways to reduce energy bills and optimises energy devices in the home

Founders since 2010 - first business taken through to acquisition in 2015.

Experts in Renewable Energy Industry, Engineering and Smart Home Energy Modelling with an ambitious and exciting plan.

A dedicated team of ten experts with experience across renewable energy, software development, hardware development and deep tech and investment which will ensure we deliver a patented technology for home energy optimisation.

Innovation Partners of E.ON Energy Solutions

3 Government research contracts under the £1b Net zero innovation portfolio

Supported by Innovate UK under the Innovate Edge Programme



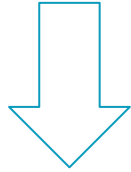
Thomas Farquhar



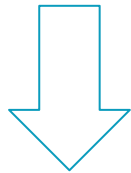
Simon Roberts

Why Hack8

271,871,475 rows of data on weather, energy consumption, generation and cost



Which can help 11,000 Kiwis save money and reduce carbon emissions



If only we had really good insights



Challenges

Challenge 1: Better Batteries

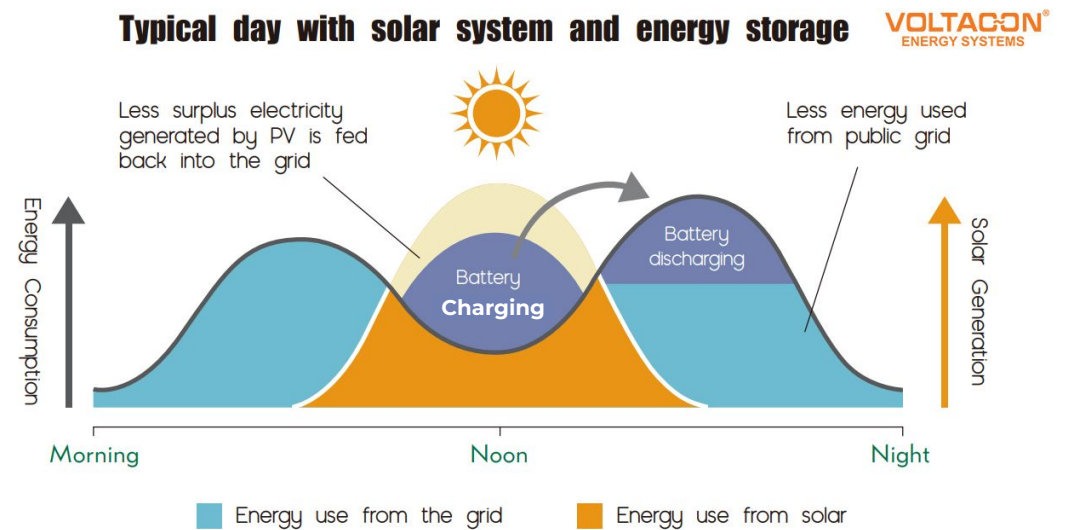
Objective: Simulate the behaviour of a behind the meter battery tied to solar, and work out how to minimise energy costs.

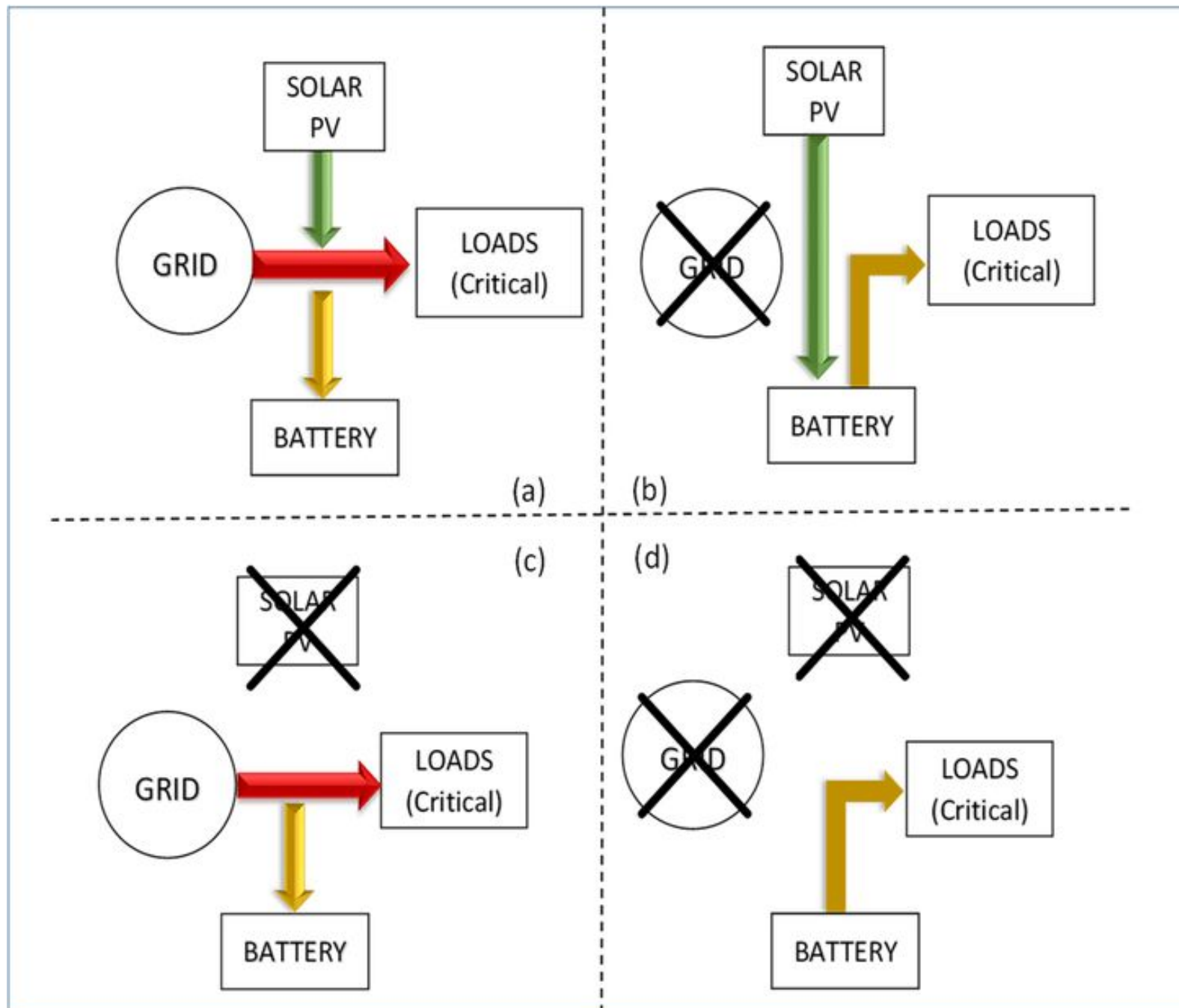
Details:

- You are provided with an Excel customer saving model produced by Heatio and solarZero. We will also provide load and generation data from 100 customers. You have cost information.
- You are to codify the model in Python and can change the following to minimise customer bills:
 - The size of the battery in kWh
 - The charge/discharge pattern of the battery
 - When the battery charges

Submission and judgement:

- In the middle of Sunday we will request your battery profile for 5 randomly selected customers. You will be judged on these. The 5 customers with the lowest bill and highest renewable fraction wins.
- An Excel sheet provides the output format for the results. Please copy your answer into the tables provided.





Day time

Night time

AR ZERO

Challenge 2: Understand load

Objective: to produce the best understanding of customer load using machine learning

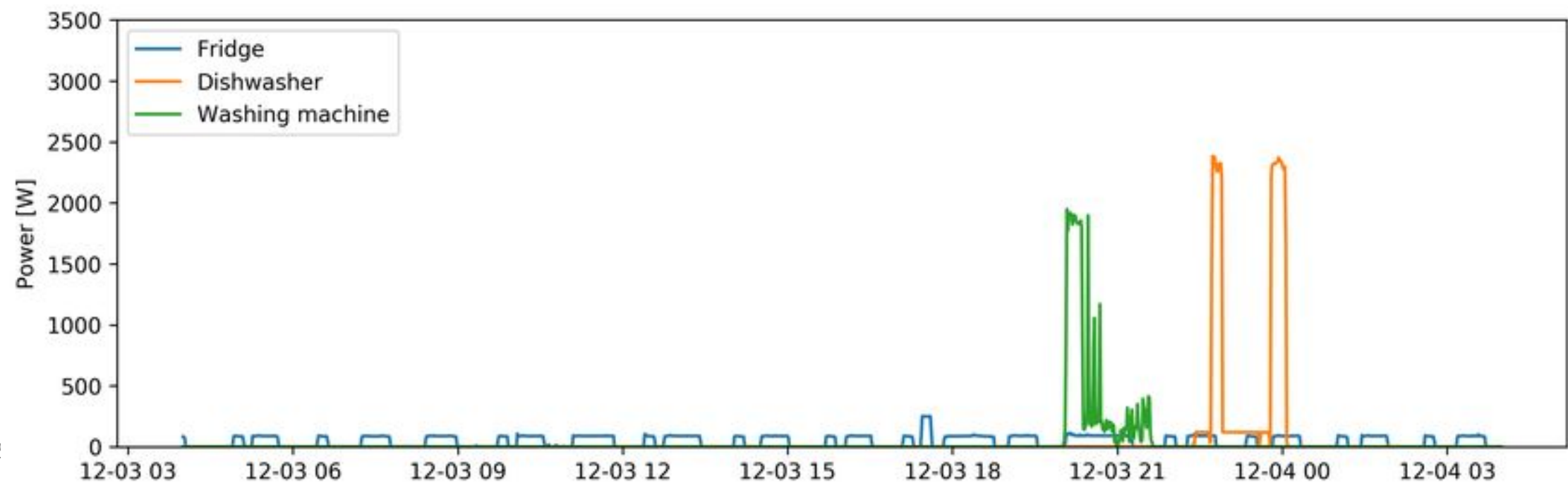
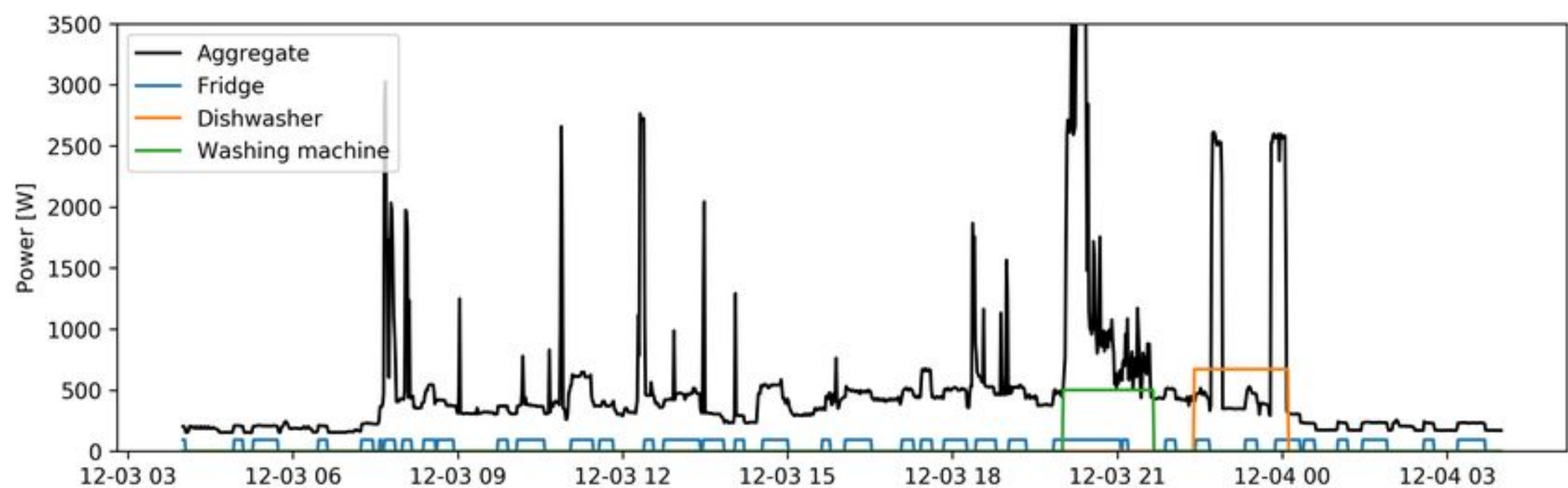
1. Produce the most accurate forecast of the **total load** and the **load per cluster** for the next 7 days.
2. From the load data, research “load disaggregation” and break down the loads for each customer into different parts. Most imaginative breakup of the load wins - but it must be done using code

Details:

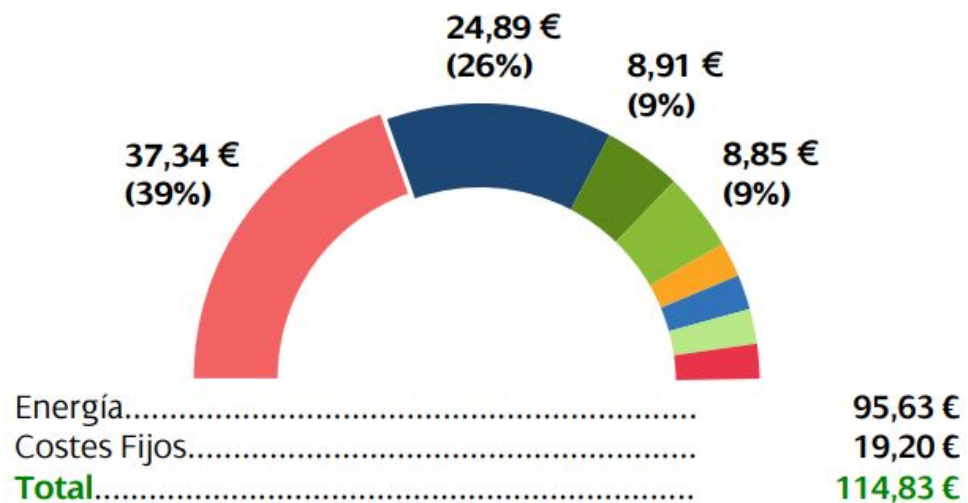
- Load data is provided at 15 minute intervals. You have the consumption in W. This is the total electricity that each house is using, adding up all of the appliances.
- There is some missing and erroneous data, a good sort of the data is needed.
- Forecasts:
 - You have some of the data we think is needed to produce good forecasts, but not all. You can also do some reading on what other data can make a good forecast and go out and find it yourself - or to talk to us about it.
 - There are loads of Machine Learning methods available for load forecasts (e.g. search NILM). Think about what type of model you might need before committing time programming it up.
- There's lots of information online on load desegregation.
 - Tip 1: you need to think how detailed you want to go - down to individual appliances or sticking to base load and peak load. There is a balance between what is achievable and what is ambitious enough.
 - Tip 2: New Zealand houses generally have a hot water tank which is heated up with lots of power once or twice a day. They also have a heat pump for heating in the winter (May - Sept) and possibly for cooling in the summer (Nov-Feb)

Submission and judgement:

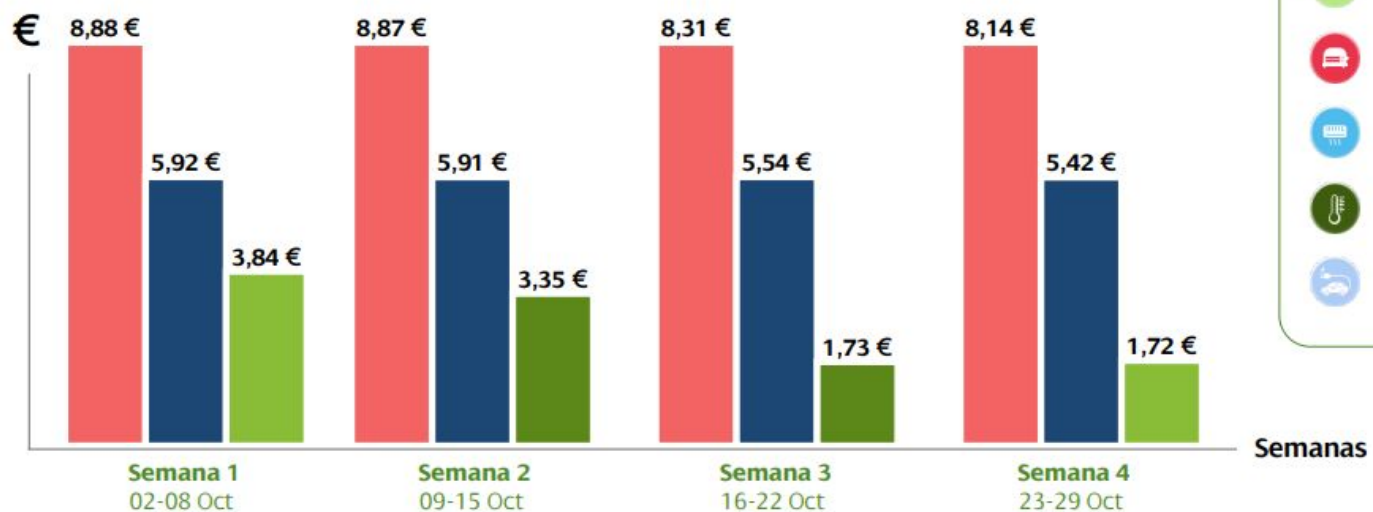
- An Excel sheet provides the output format for the forecast. Please copy your answer into the table provided. We will compare your forecast to the actual data and the lowest MAPE wins.
- The load desegregation is to be submitted via a 5 page presentation describing your key results, plus a spreadsheet with any data.
- You must do all of the work using code and submit that code with your response



Desagregación de consumos



Evolución semanal - Top 3 categorías



- Frigorífico / Congelador
- Siempre encendido
- Entretenimiento
- Lavadora y lavavajillas
- Agua caliente
- Cocinando
- Iluminación
- Otros electrodomésticos
- Aire Acondicionado
- Calefacción
- Vehículo eléctrico

Challenge 3: Simulate net zero electricity

Objective: to produce a digital twin of the power grid and see how to get to 100% renewable energy. This means simulating the grid of the future with wind, solar and battery working to meet demand.

Details:

- We have provided a paper which tells you what a digital twin is and how to build one. You will need to recreate this logic to simulate the grid.
- You are provided with historic hourly generation profiles from NZ. This tells you what every power station did for (**almost all of**) the last year.
- The total generation in each hour tells you how much electricity needs to be generated. In your digital twin, you will add wind and solar and battery to replace the other power stations.
- You also have a datebook showing the price of different power stations. These are \$/MWh, and tell you how much it costs for each MWh of electricity produced by the power station.
- No cheating! You can only make wind electricity when the wind blows. You also can only add wind, solar and battery.

Submission and judgement:

- An Excel sheet provides the output format for the model. Please copy your answer into the table provided.
- We will judge the answers based on the one that gets to 100% renewable electricity for the lowest cost.
- You must do all of the work using code and submit that code with your response



Article

Assessment of Electricity Decarbonization Scenarios for New Zealand and Great Britain using a Plant Dispatch and Electrical Energy Storage Modelling Framework

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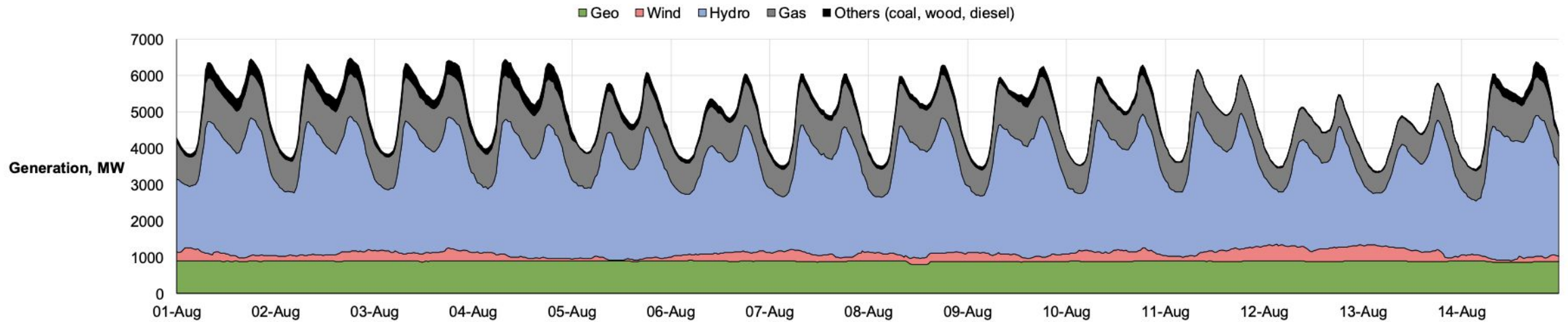
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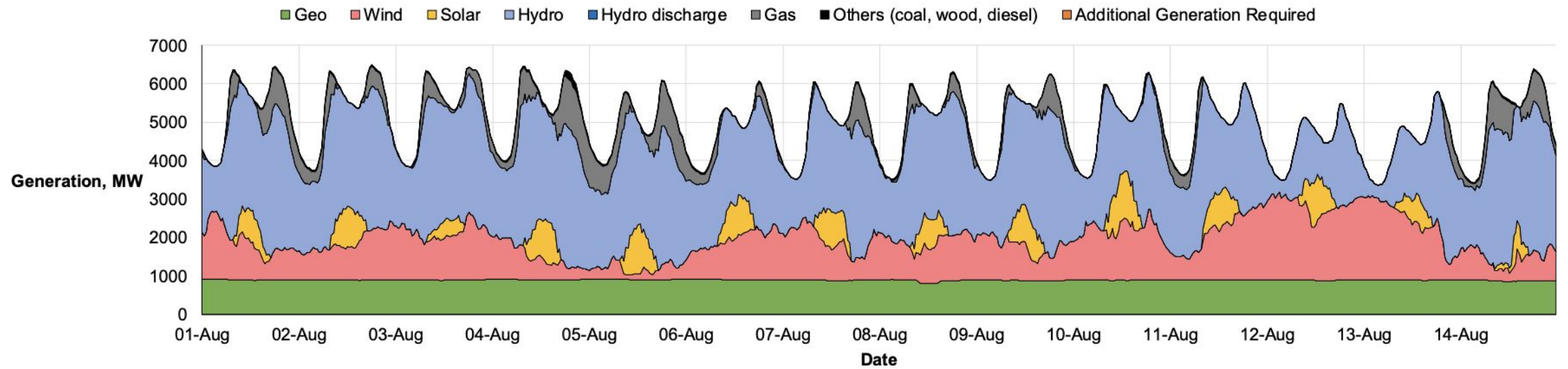


Half Hourly Plant dispatch, New Zealand



(a)

Half Hourly Plant dispatch, New Zealand: Alternative Scenario



(b)

If you get bored... we have plenty of additional challenges

We are here to help... speak to any one of us for pointers and tips

I'm more interested in creativity than accuracy. There's a small prize for the most creative hack.

Please leave some vegetarian pizza!

SOLAR ZERO

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