DEPARTMENT OF ENGINEERING SCIENCE

Battery storage and behaviour (Lessons from e-Mobility)

Malcolm.mcculloch@eng.ox.ac.uk

Energy and Power Group
July 2017

Interesting question…

- Can you rank that capital valuation of the following companies this week?

The people of EPG

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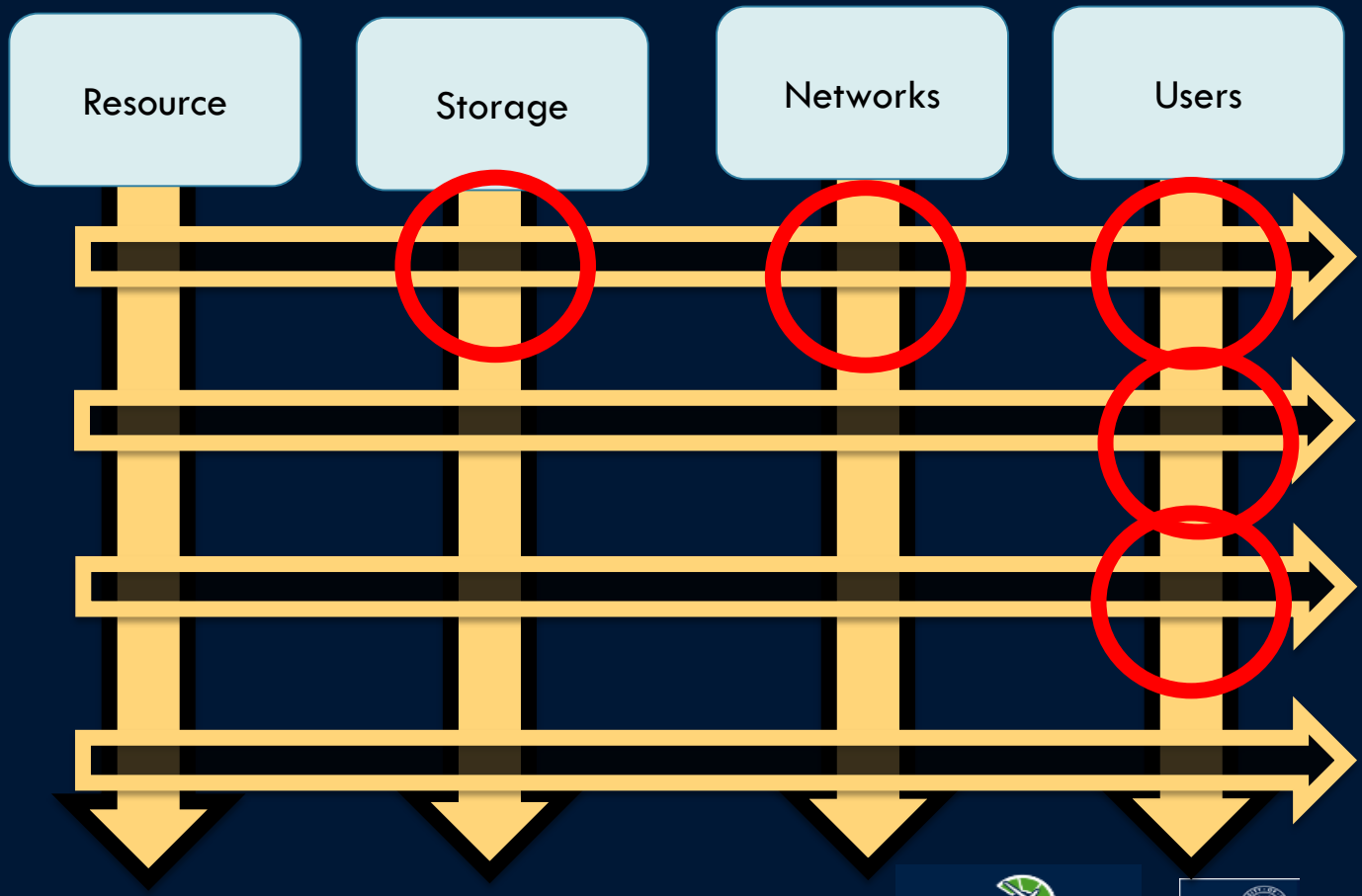
Mission

- To develop the underpinning technologies to create value for the emerging energy systems.

Integrate

Options for integrating renewables



Challenges

- Technology development
- Market arrangement
- Social engagement
- Governance and policy

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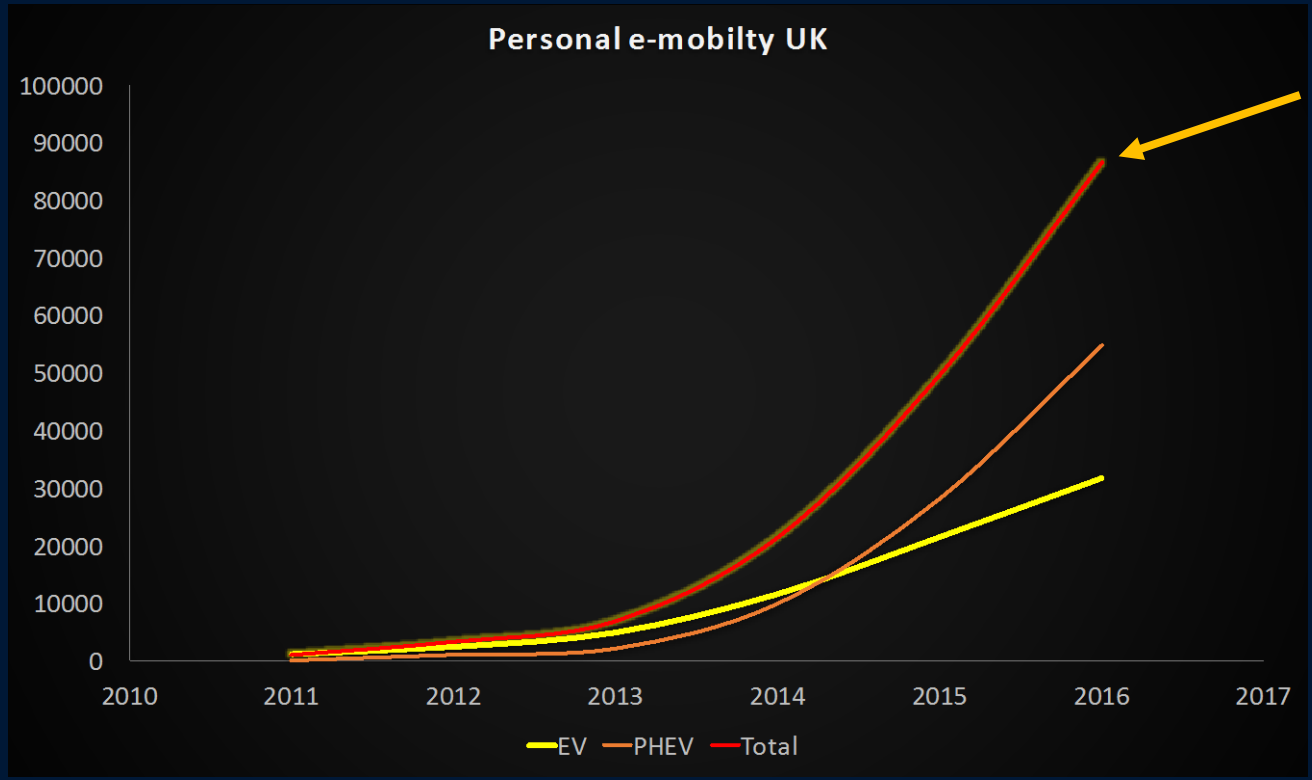
Rise of the electric vehicle



~ 2 GWh

Source: SMMT

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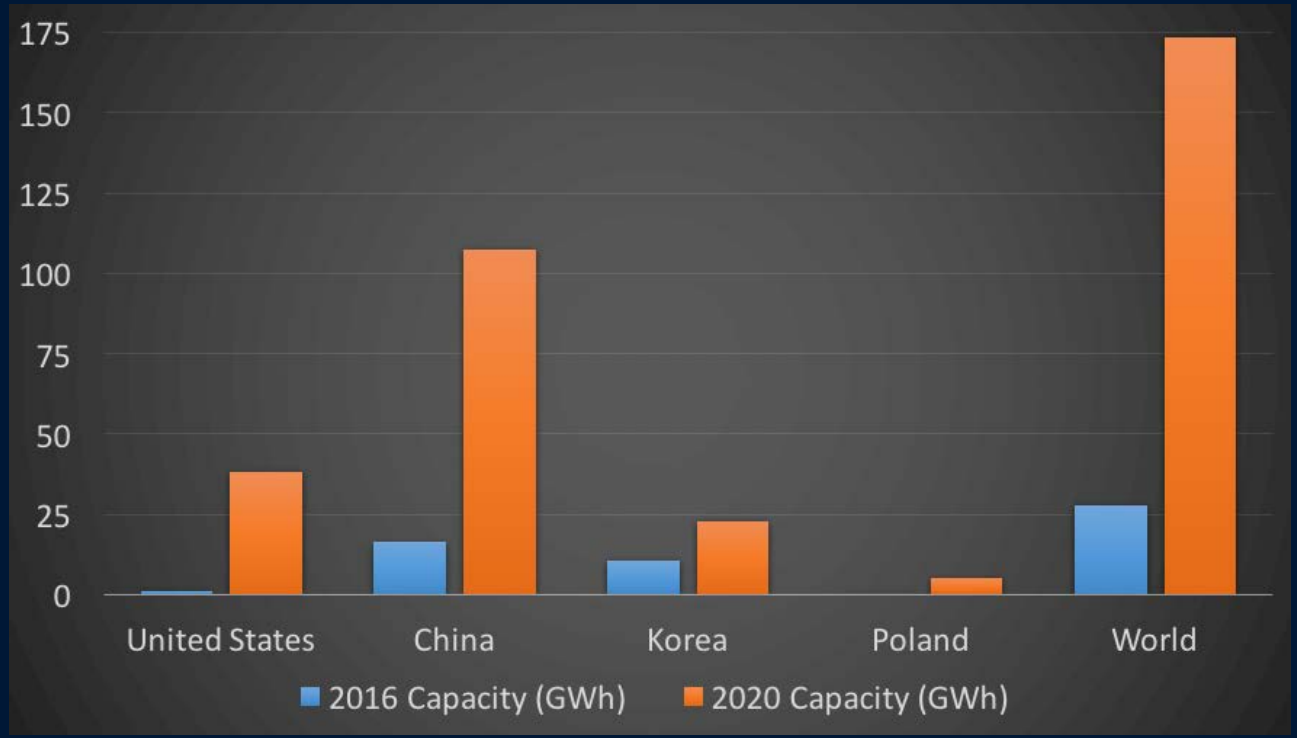
Lithium ion battery production capacity (GWh)



Source: Benchmark Mineral Intelligence

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Interesting question

- $60bn

- $54bn

- $46bn

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Model 3 – Production starts Friday

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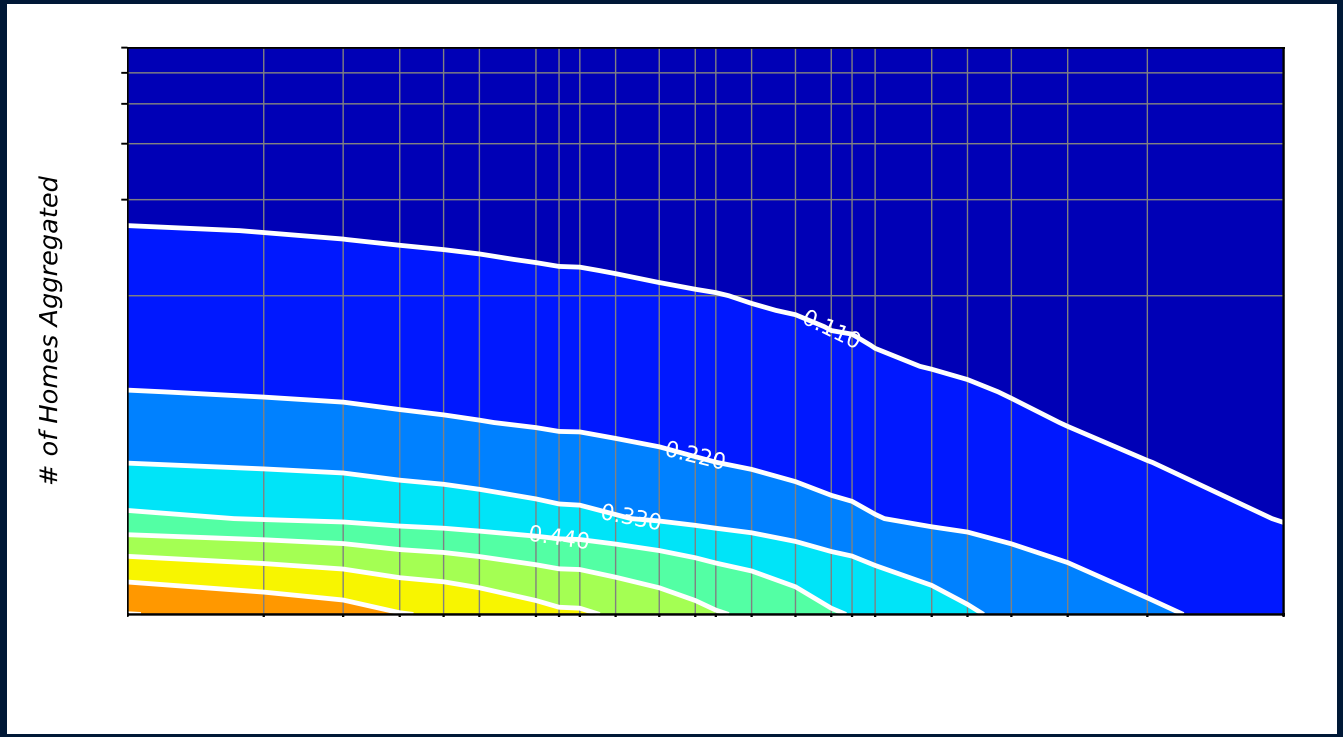
Impact

- What will be the impact on the UK Power System?

Load uncertainty *normally* varies time and scale.



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Understand mobility behaviour

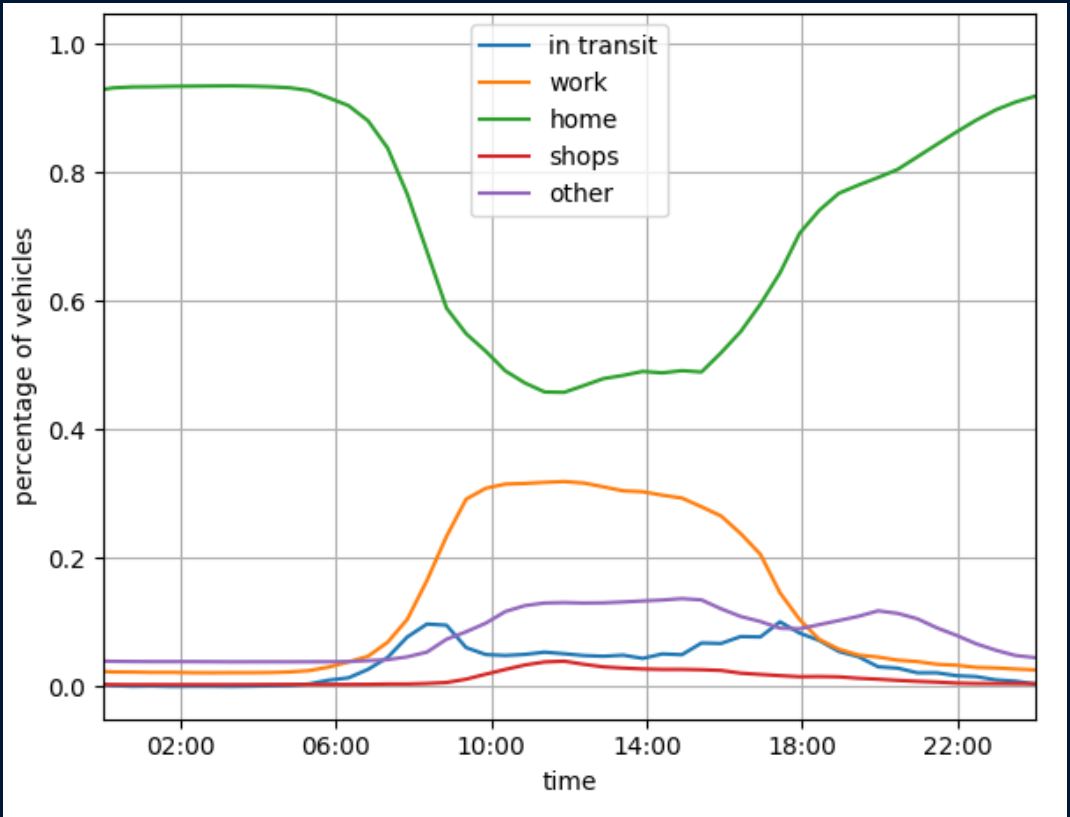
National Travel Survey monitors existing travel habits for personal mobility.

We will consider case where all cars are electric:

Assume mainly slow charging (~3.5 kW)

Ignore changes due to autonomous vehicles (for now).

Travel habits



Predicted vehicle location on a **Wednesday** in **May** in **England**

Using data from the National Travel Survey:
https://www.gov.uk/government/statistics/national-travel-survey-2014

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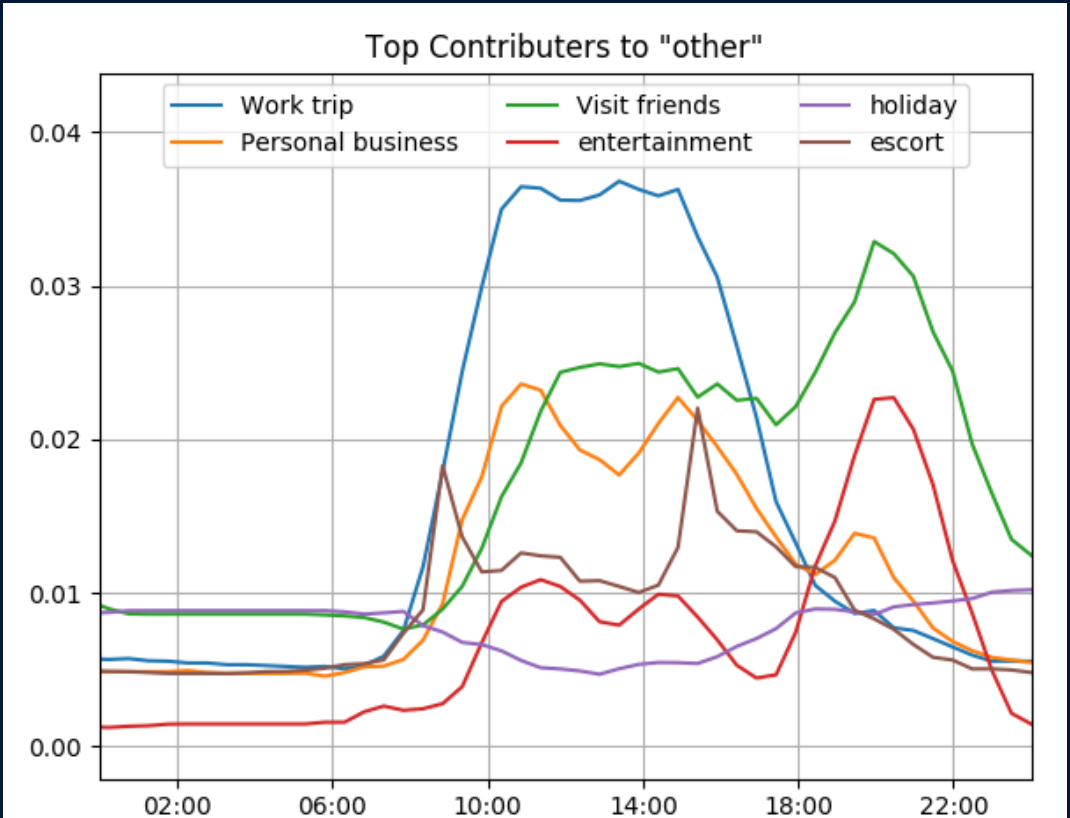
Travel habits



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Modeled vehicles as Nissan Leaf

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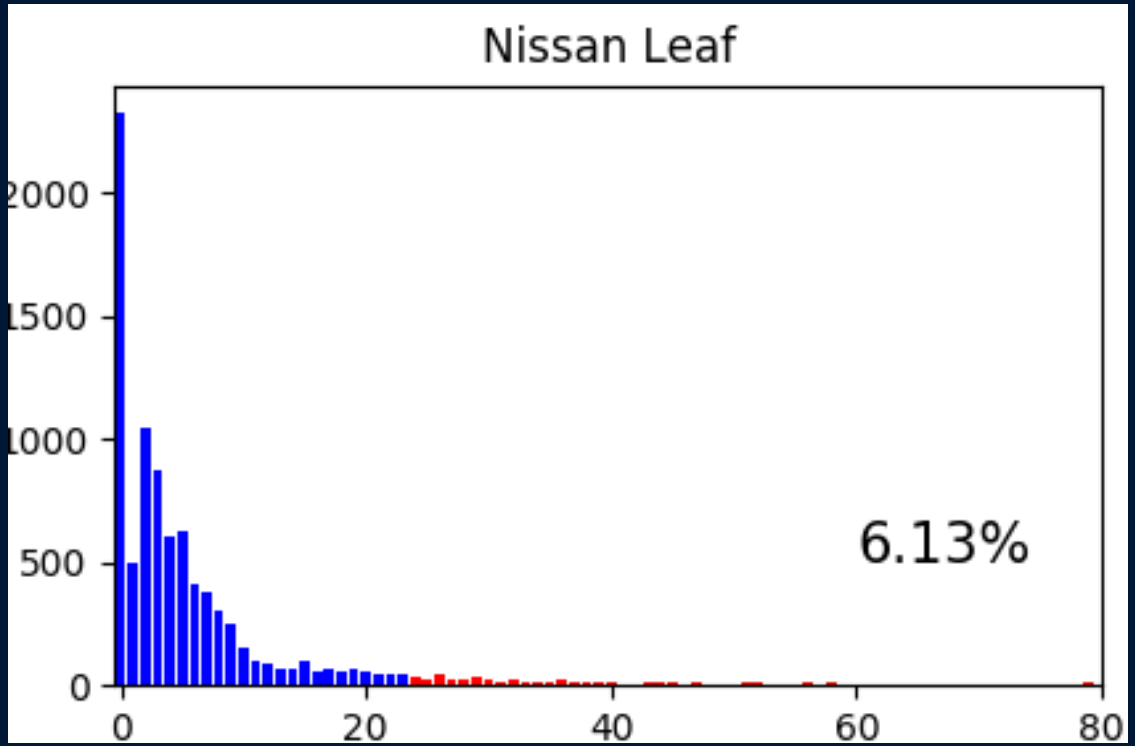
Energy (kWh) required for journeys



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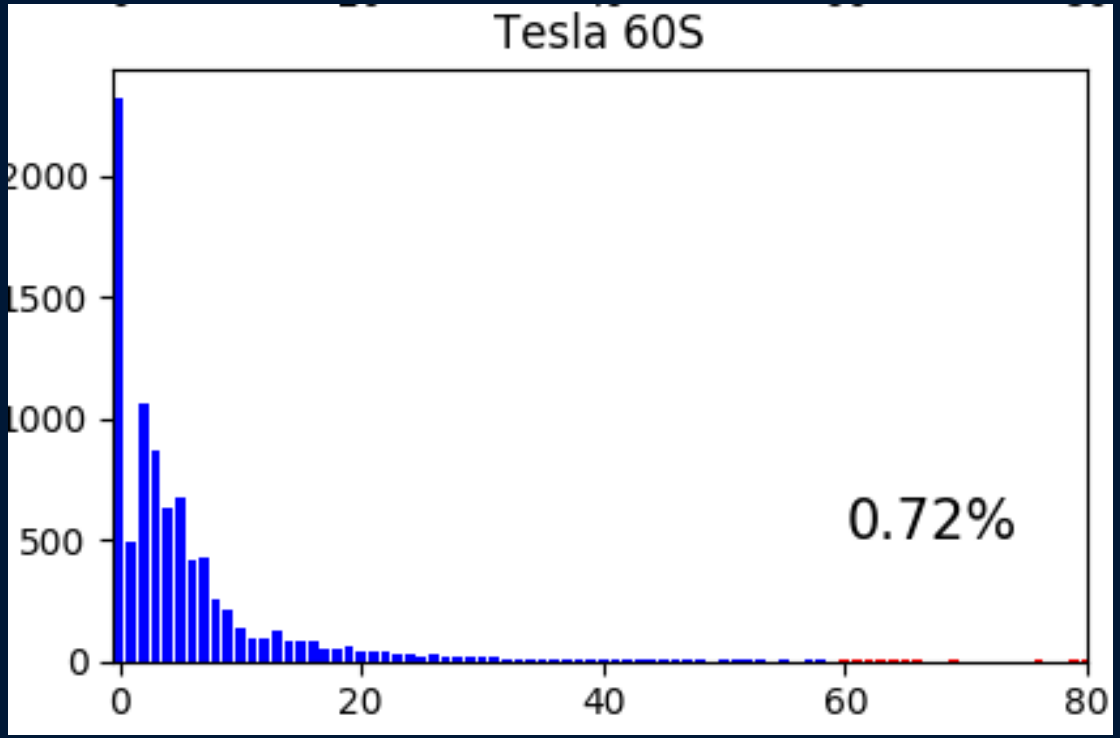
Energy (kWh) required for journeys



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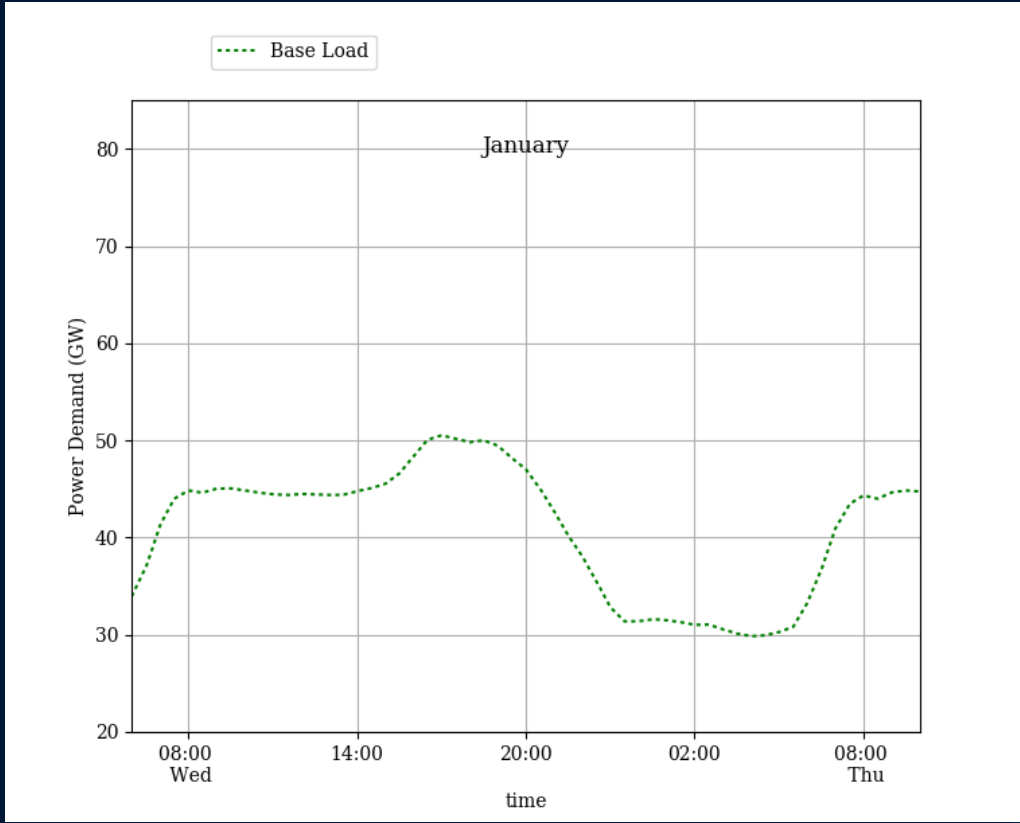
Impact on grid



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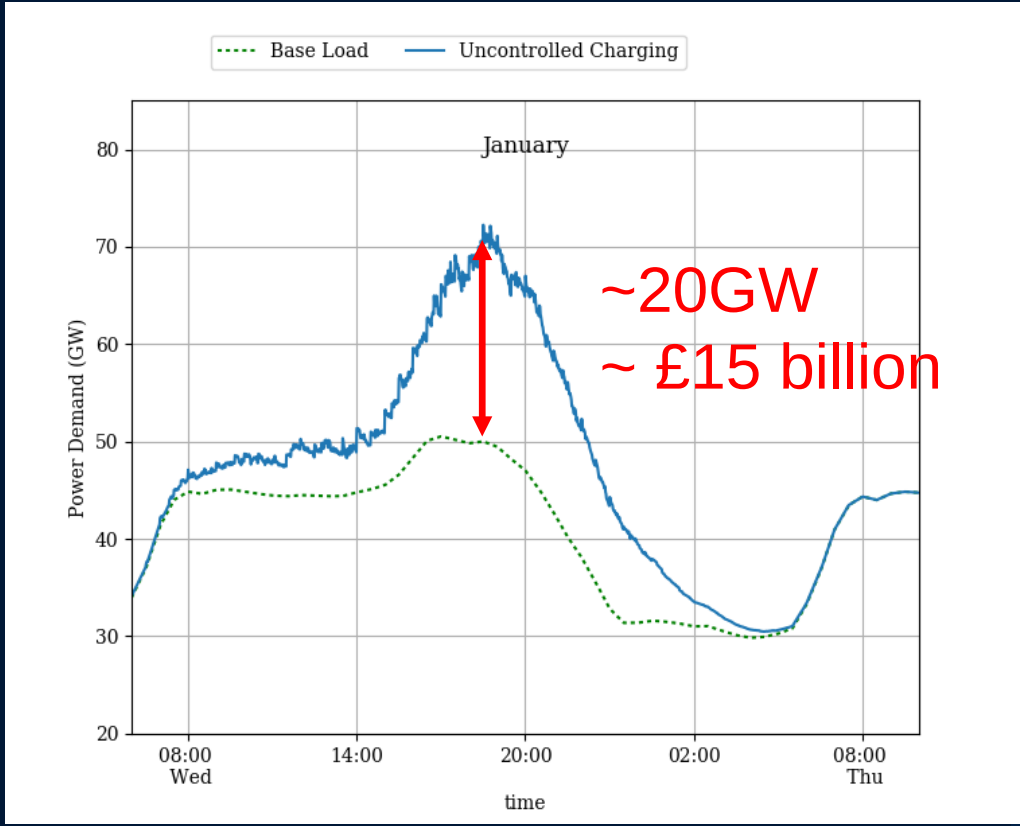

Charge when last journey complete

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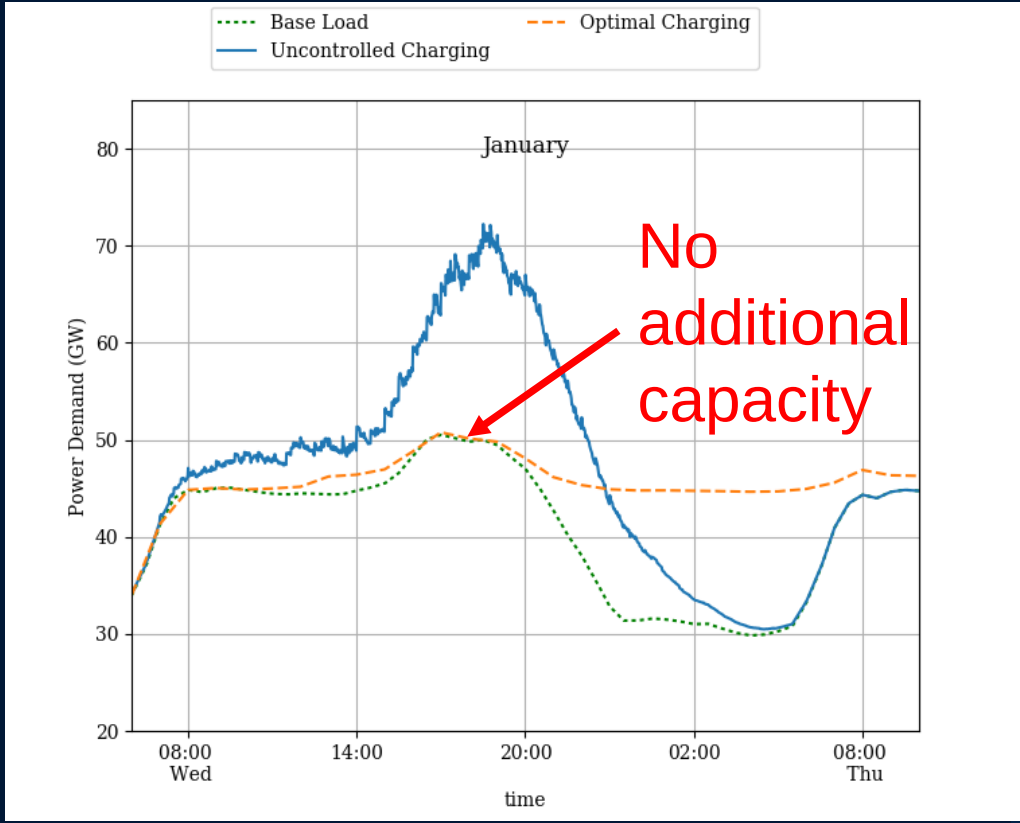
Impact on grid



Best valley fill.

But impractical

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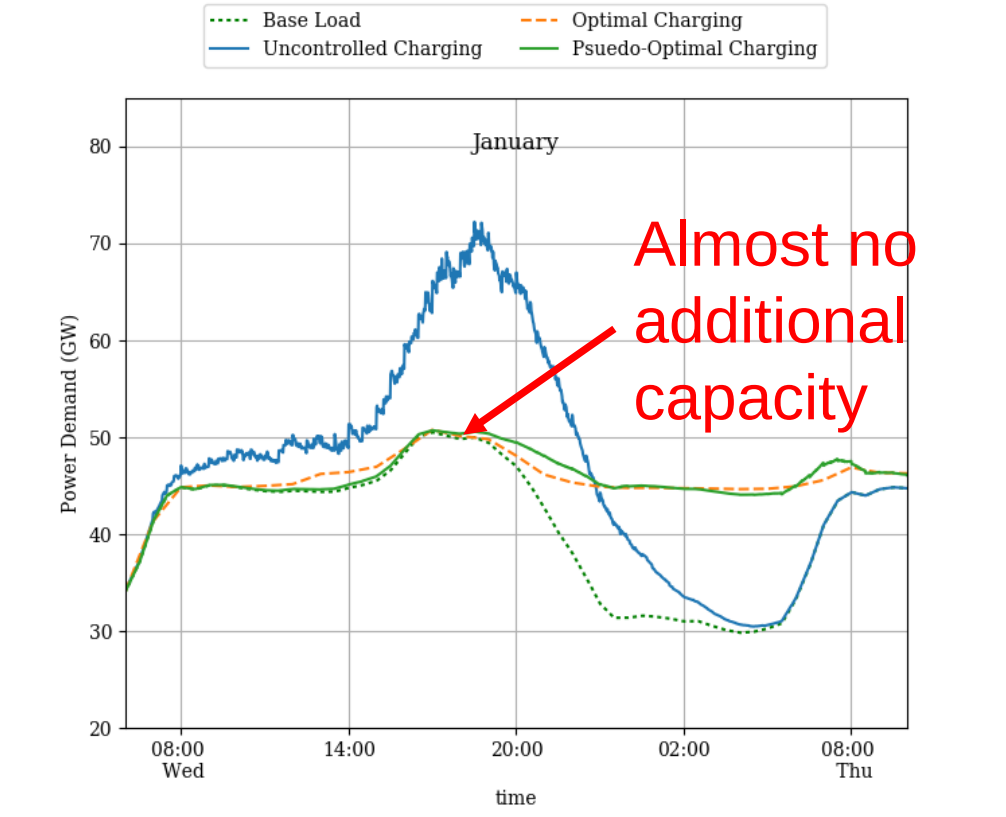
Impact on grid



Simplified valley fill.

Scale charge profile based on last weeks available capacity

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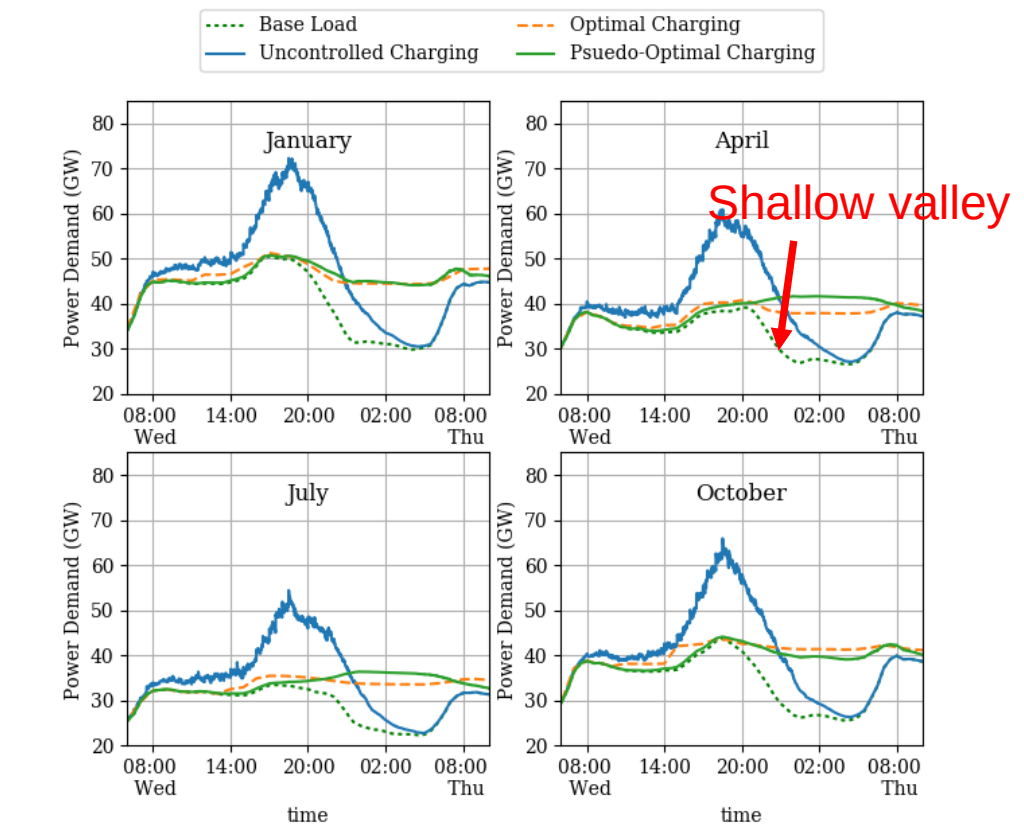
Rest of the year…



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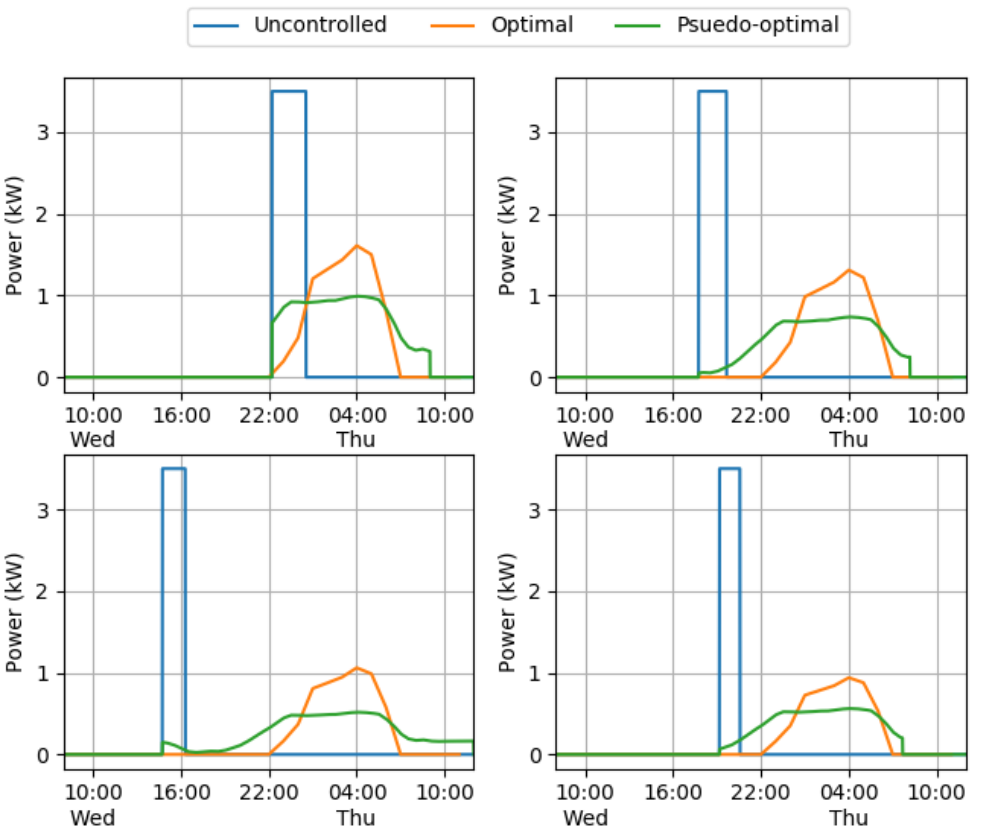
Individual charging profiles



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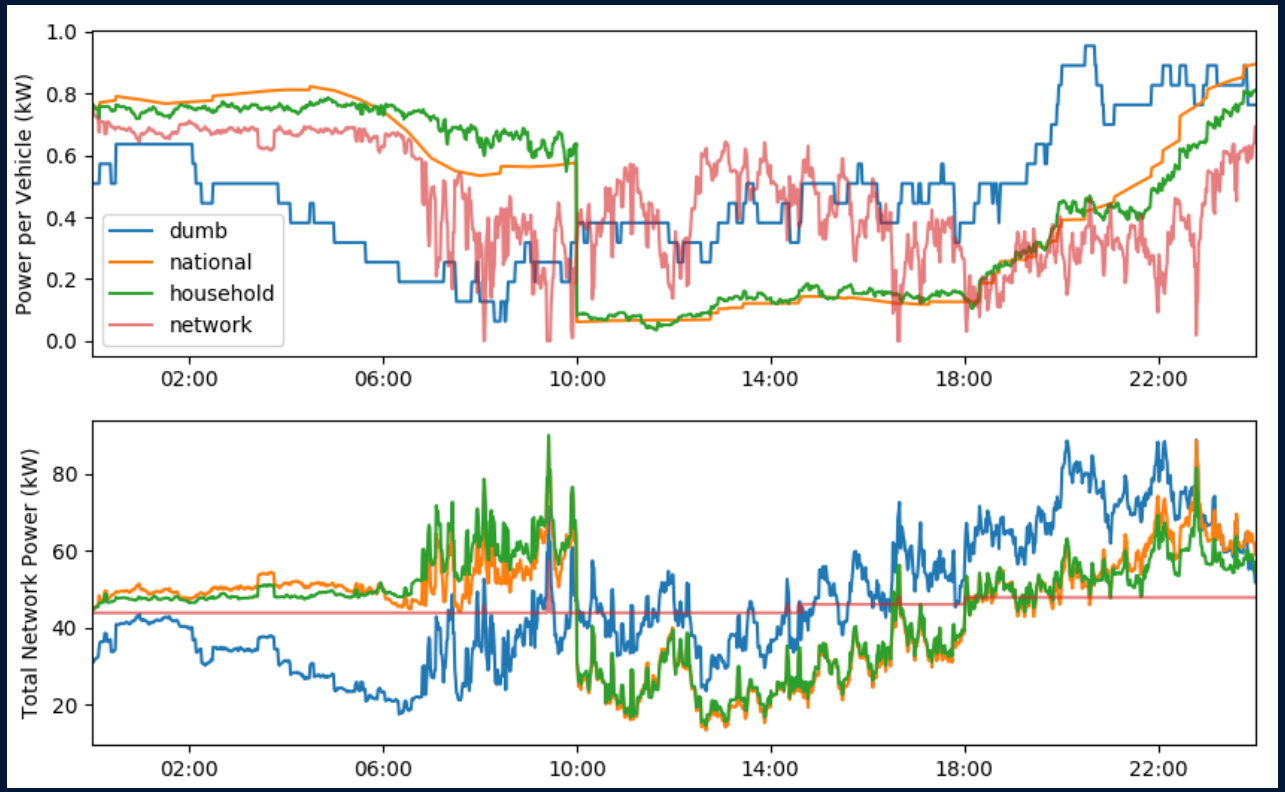
Impact on distribution (early results)



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Learnings

- EV will be dominant domestic battery source in the near term.
- Energy constraints intersects with mobility requirements.
- ‘Smart’ can add **system value**.
- Use **direct** technical solution rather than pricing.
- Be **smart** to **simplify** the solution.
- ‘Do no evil’ before making money.

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Thank you.

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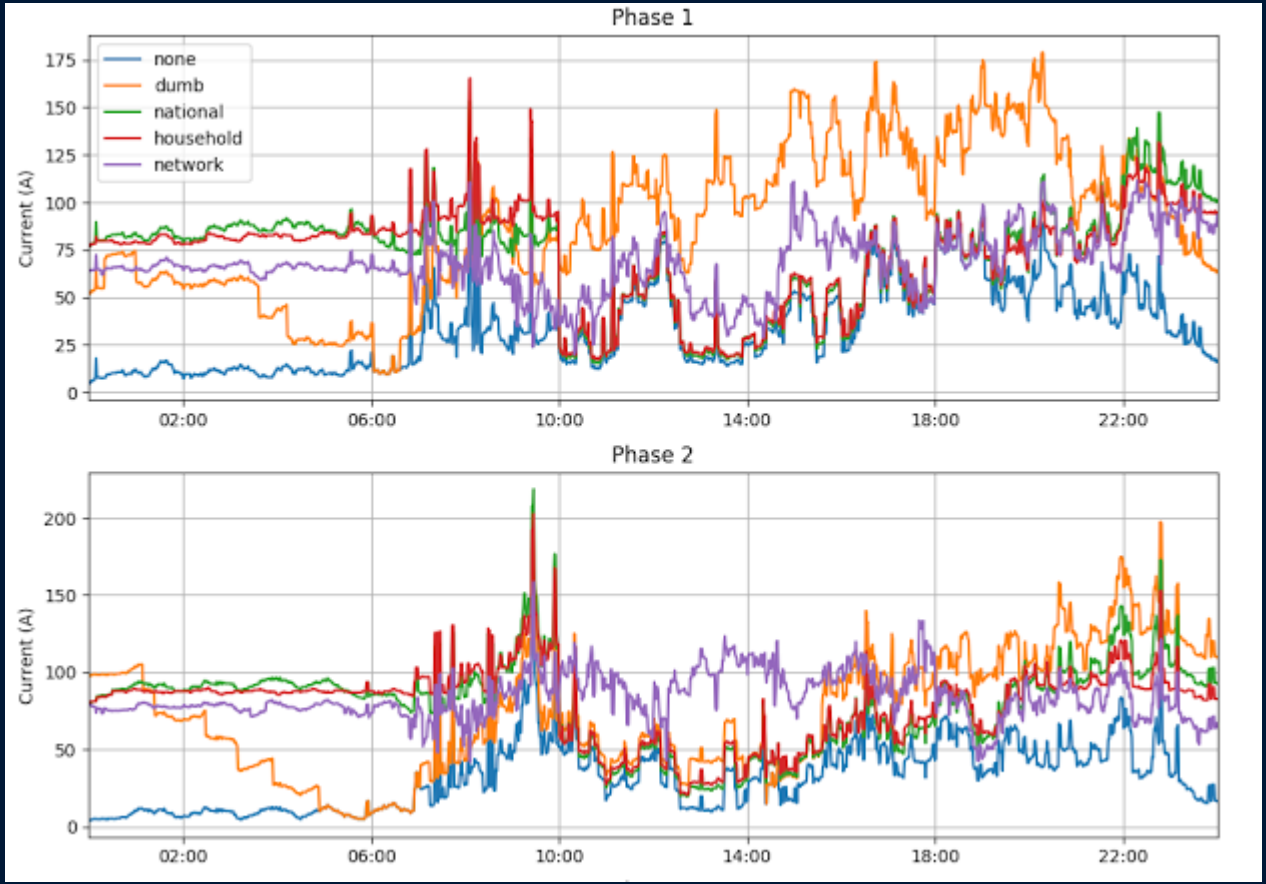

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