ESIG Webinar
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EV Smart Charging Trial

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On behalf of project team including Andre Botha, Julia Li, Leon Hayward, Louise Murphy, Rafferty Parker, Tabitha Samuel, and many other Vector colleagues

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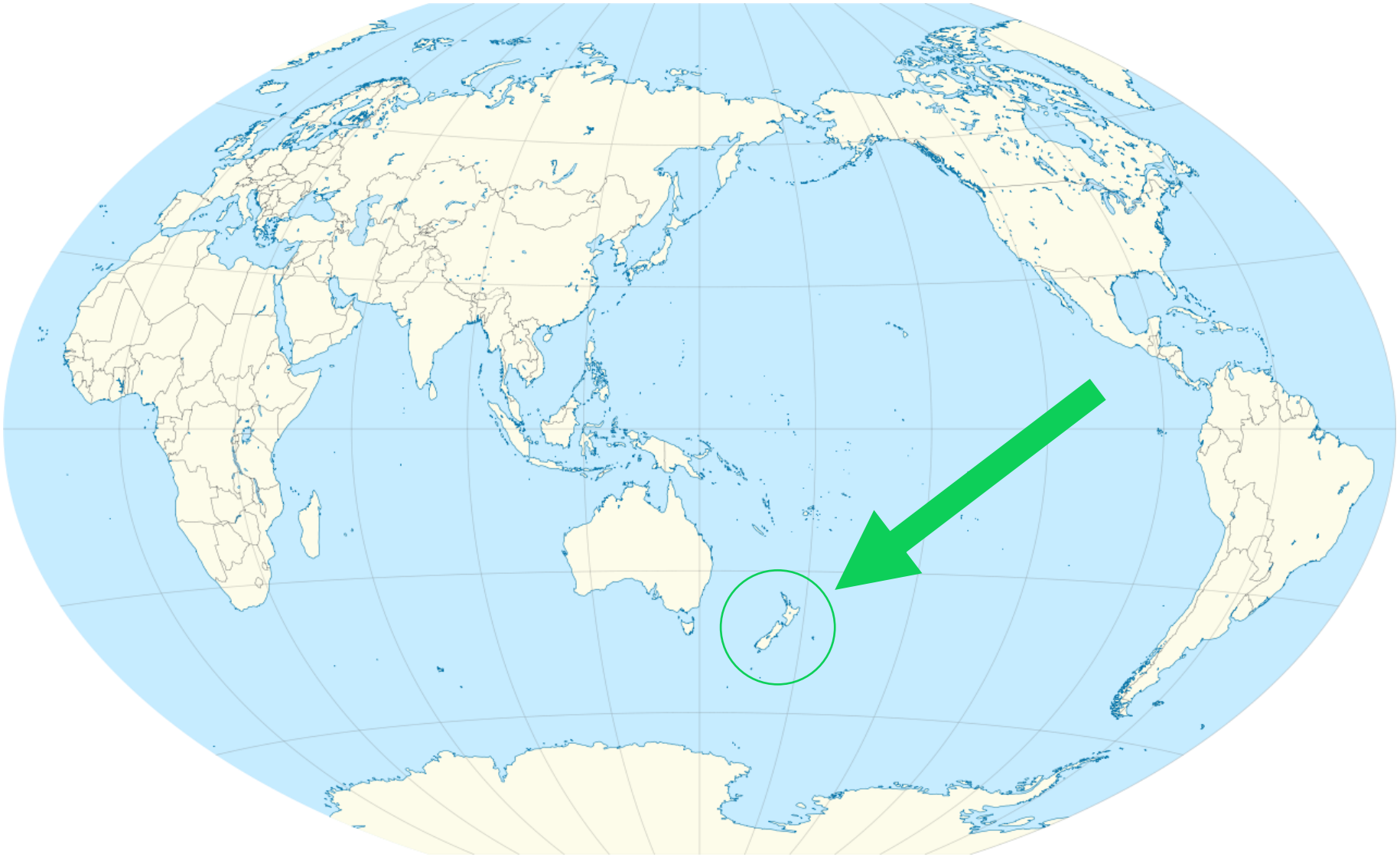
New Zealand is ‘down under’ in the Pacific and a long way from most places



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Vector is New Zealand's largest energy portfolio business

- Operates in NZ, Australia and the Pacific
- Listed on the New Zealand stock exchange, with a market capitalisation of $4.4b NZD

REGULATED 60%

vector electricity

vector gas

UNREGULATED 40%

vector metering

vector ongas

vector fibre

vector powersmart

vector technology services

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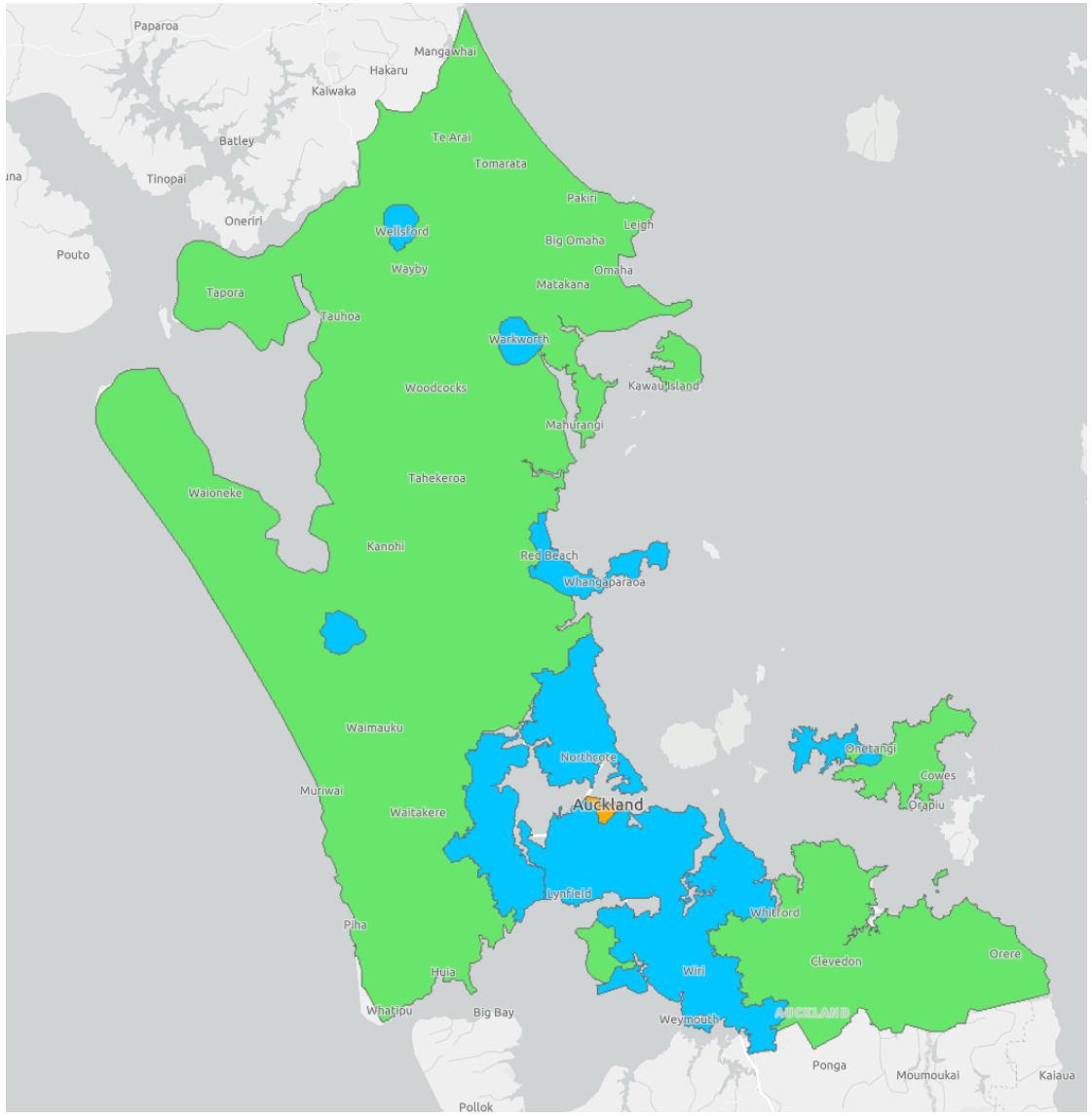
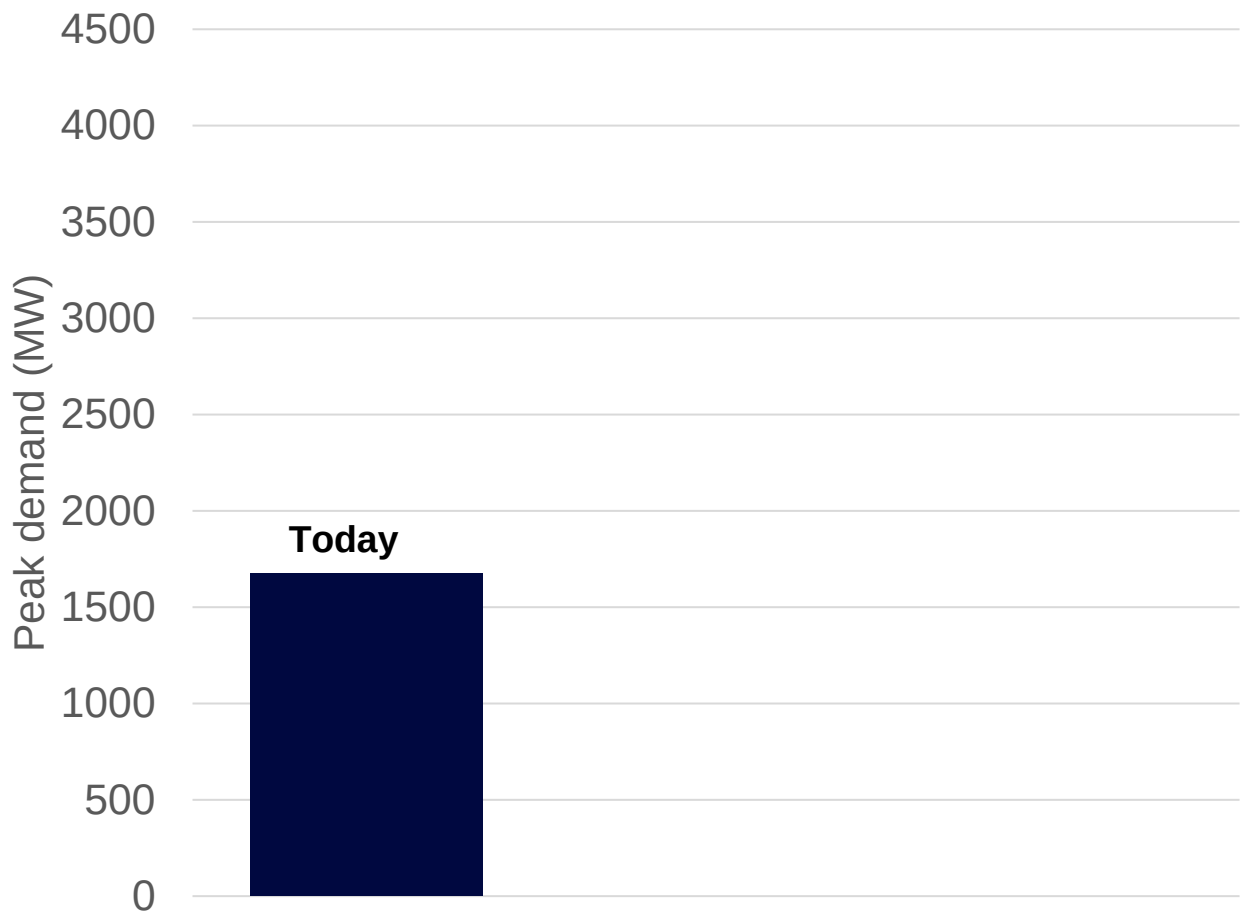
Auckland Electricity Network

- 1.7m people & 595k connections
- Growth 2% per annum since 2000
- 19,000 km of network
- 1,700MW peak load (winter)
- 1.3m light vehicles
- 81% homes on HWLC tariff

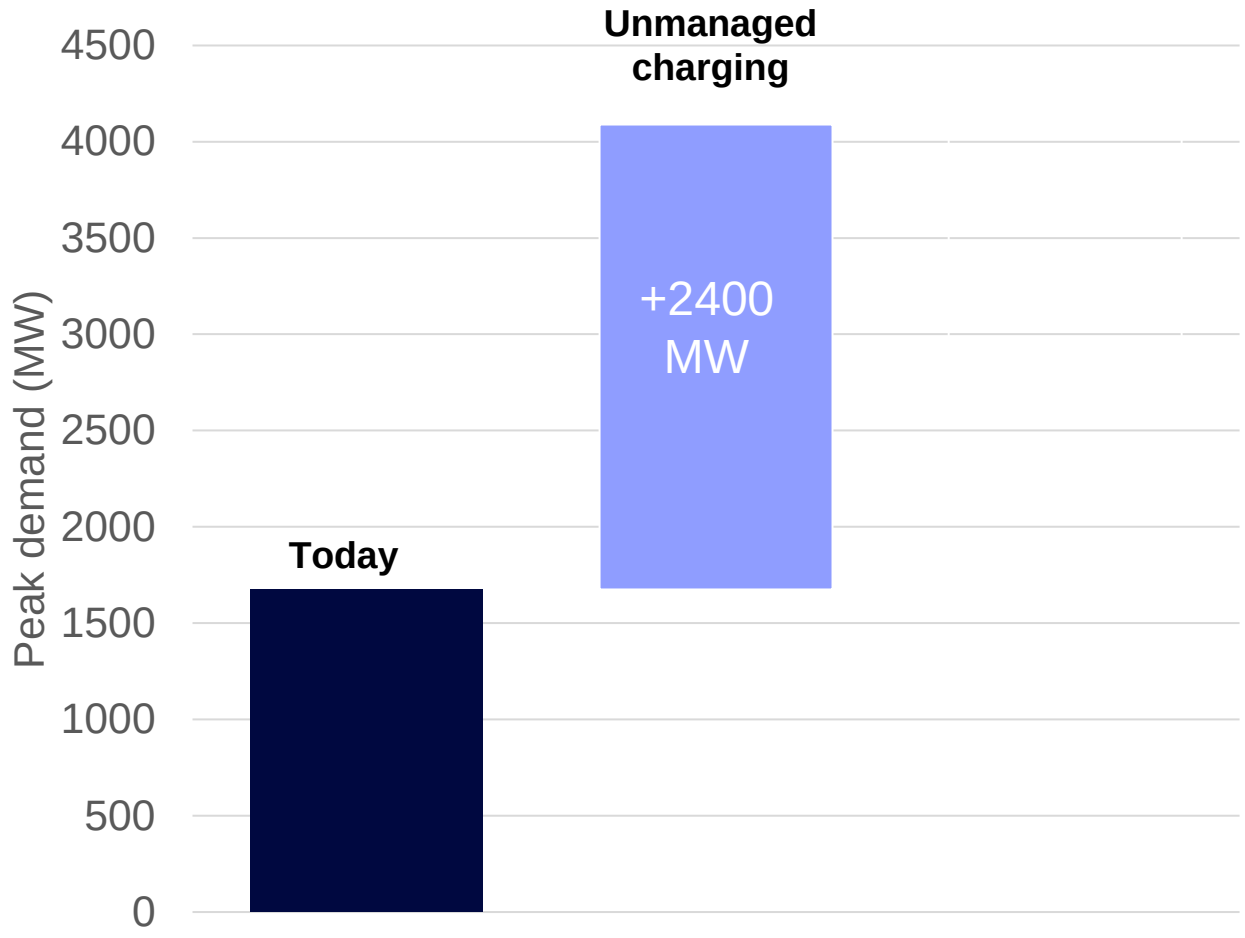


Pre-trial modelling – starting point



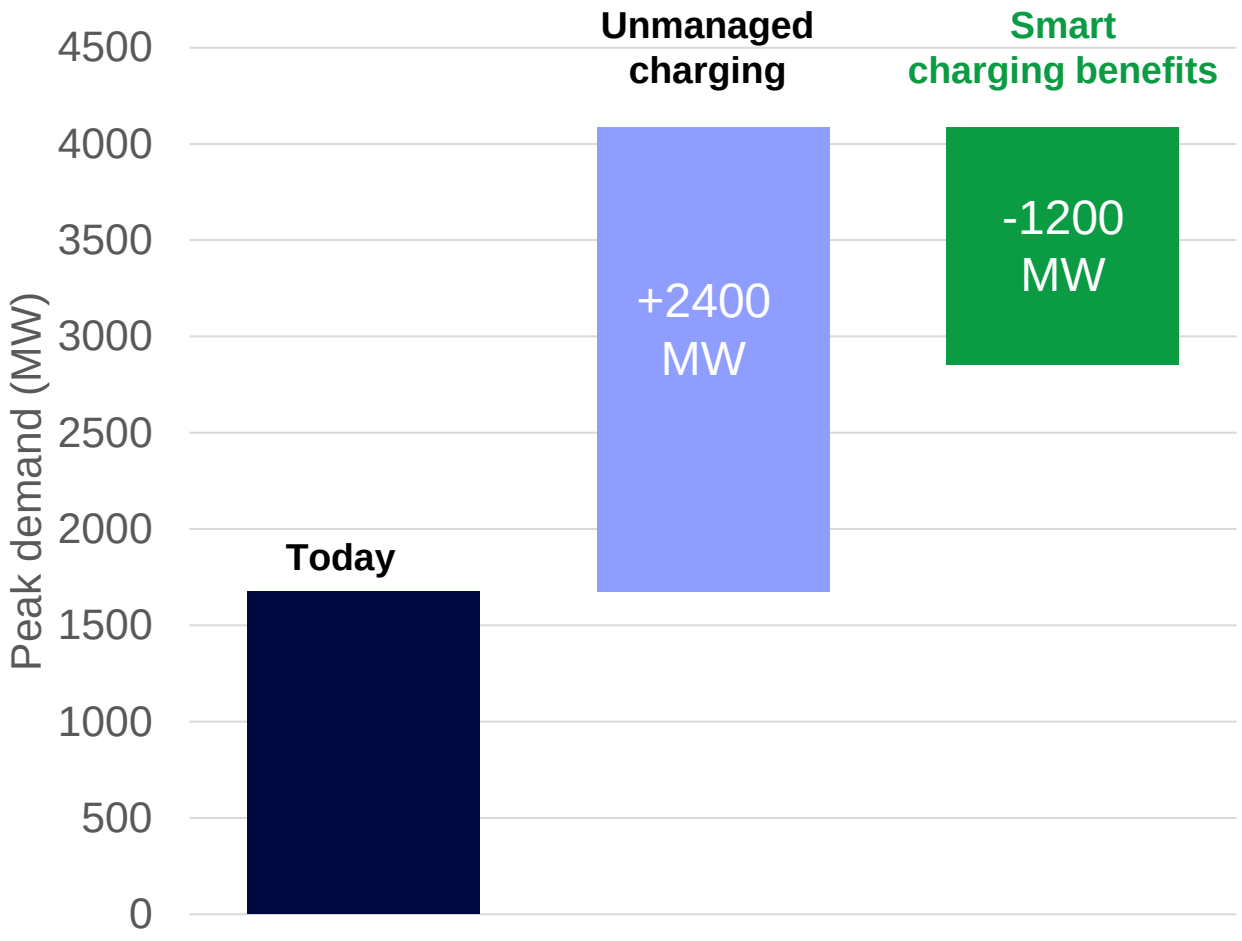
2050 peak demand forecast with 1.3M light-duty EVs in Auckland

Pre-trial modelling - significant network investment required if EV unmanaged



2050 peak demand forecast with 1.3M light-duty EVs in Auckland

Pre-trial modelling – Optimising EV charging can materially reduce network capacity requirements



2050 peak demand forecast with 1.3M light-duty EVs in Auckland

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Recruitment & profiling of trialists

~200 trialists

60%
Drive more than 200 kms per week

95%
Charge at home at least weekly

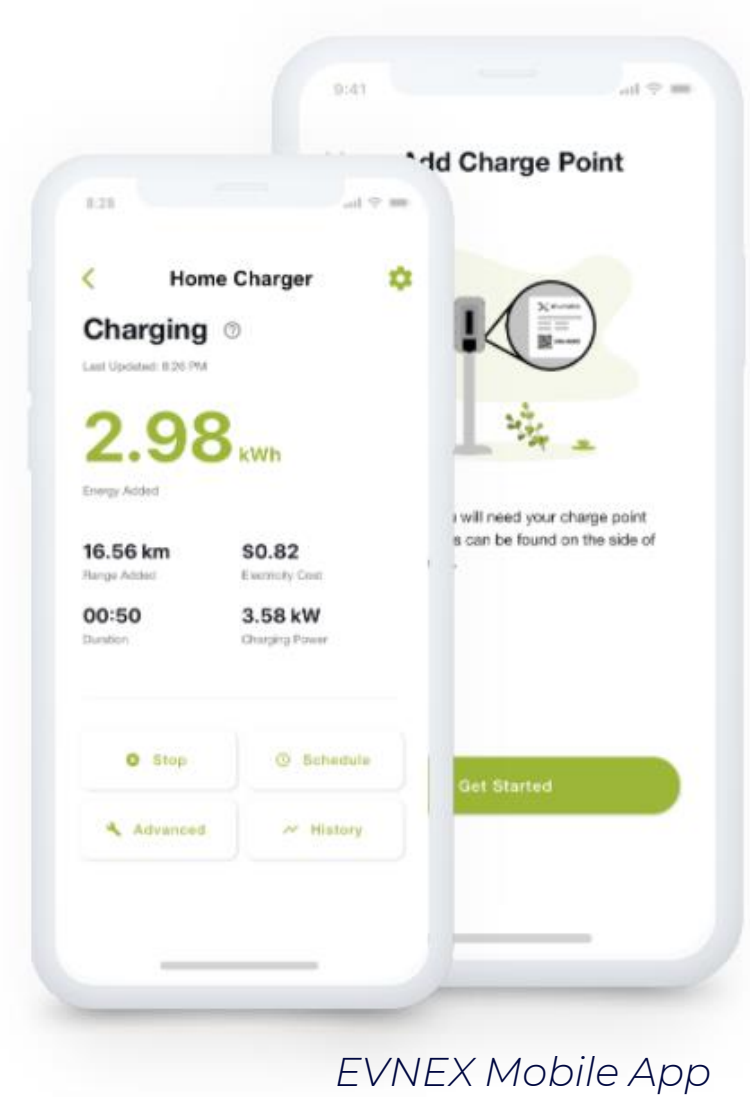
65%
Live close to a public charging station

94%
Mostly use or exclusively use their EV

40%
Are on a TOU retail tariff

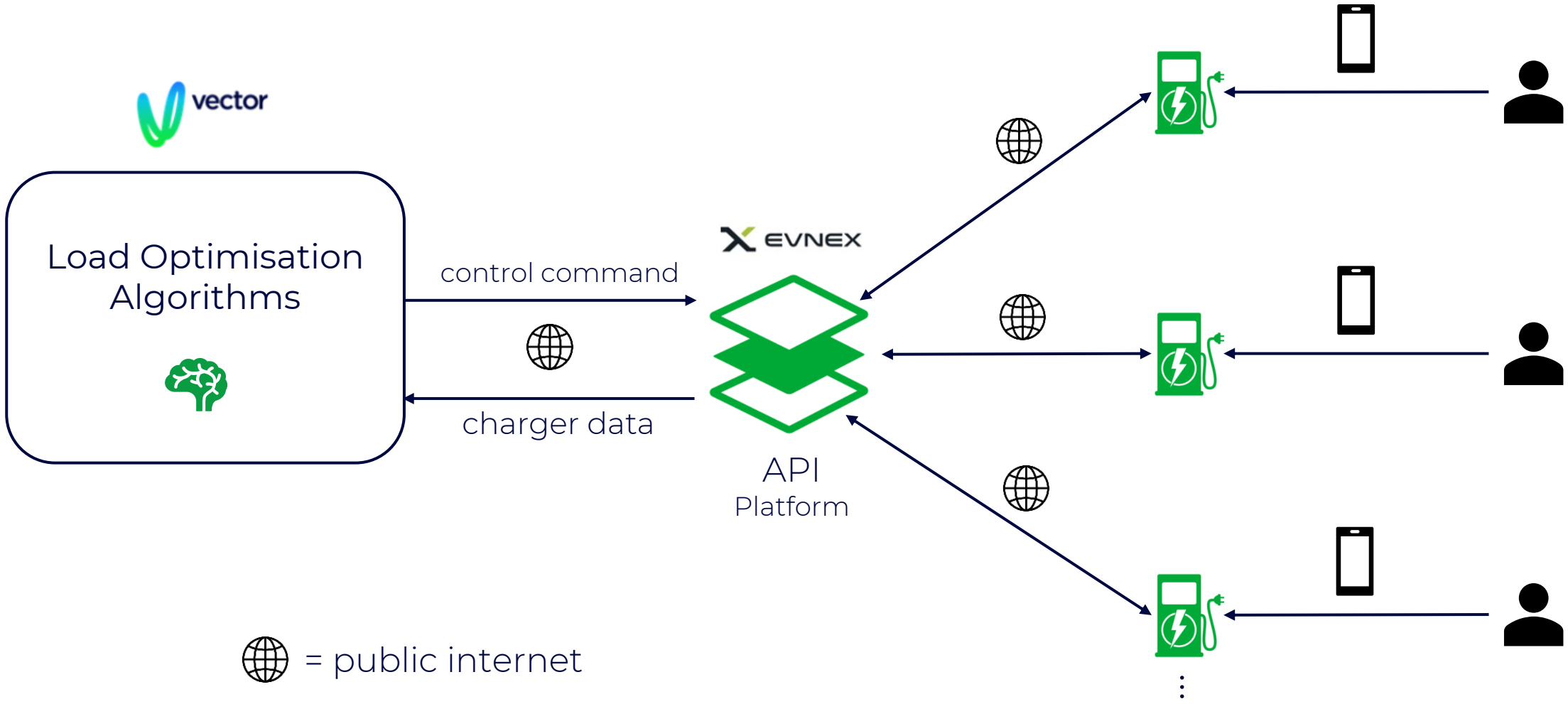
What does the equipment look like?

Charger Installations at trialist premises



EVNEX Mobile App

Overview of the setup



Real customer feedback drives design

1. Establish reference charging behaviour	**OBSERVE**			
2. Identify managed charging levels affecting customer acceptability with fixed charging limits	**TEST**	5pm-9pm Mon – Thu	**20% or 35%** of max capacity	Always limited during managed period
3. maintain customer satisfaction & optimise network outcomes with smart charging	**OPTIMISE**	5pm-12am Mon – Thu	**20-100%** of max capacity	**Static:** Control schedule is set a day ahead **Dynamic:** RT feedback to optimise every 20 min

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OBSERVE

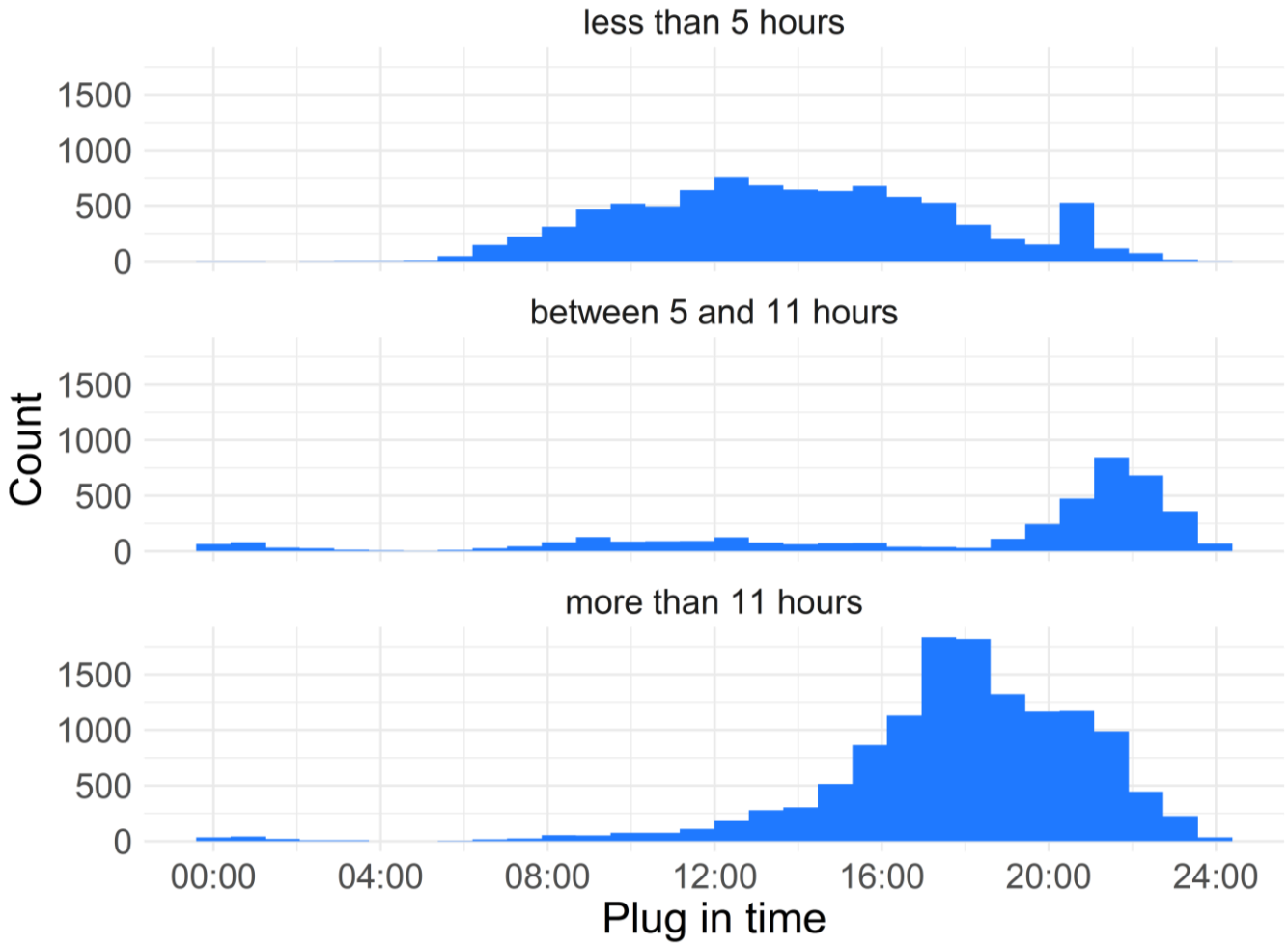
OBSERVE

Three dominant charging behaviours

Day-time chargers

Before-bed chargers

After-work chargers



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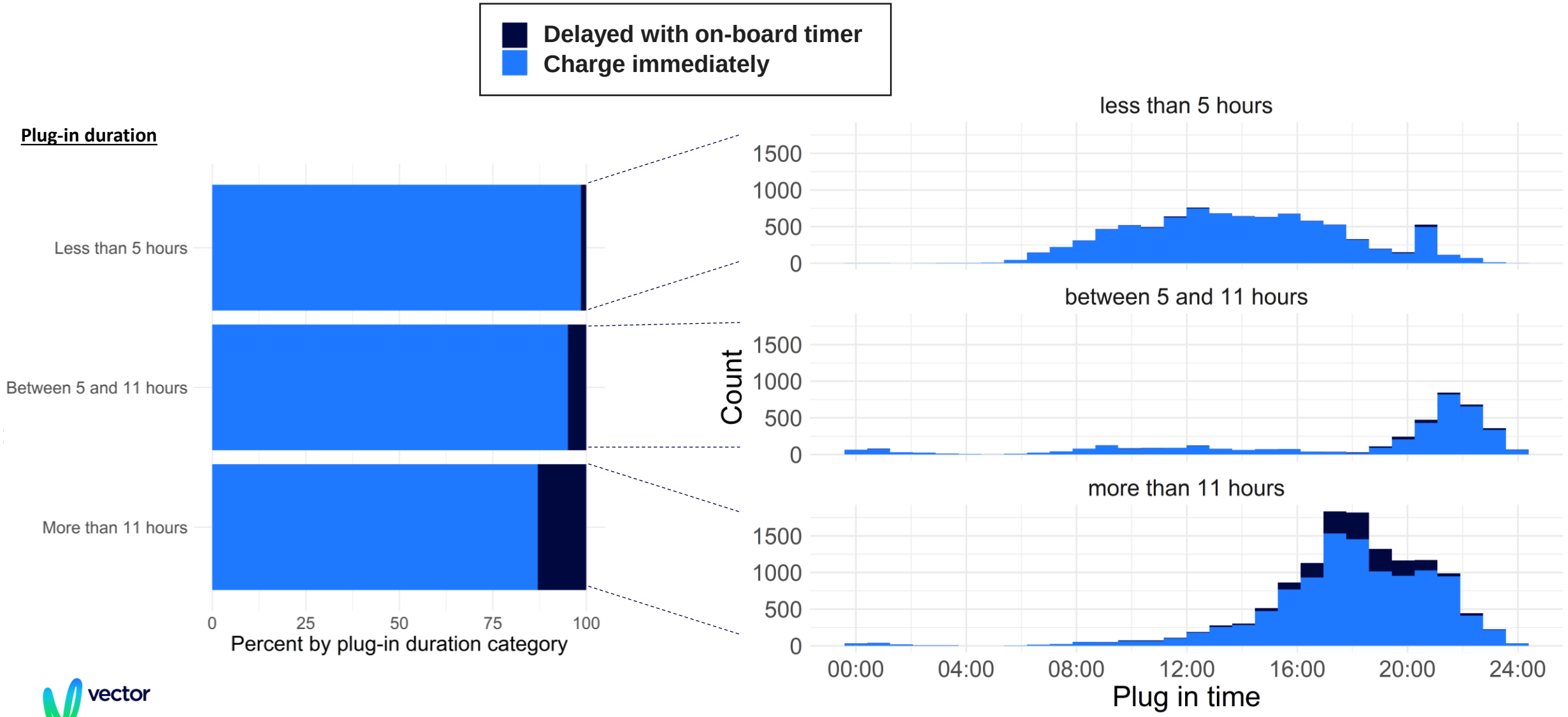
OBSERVE

Three dominant charging behaviours



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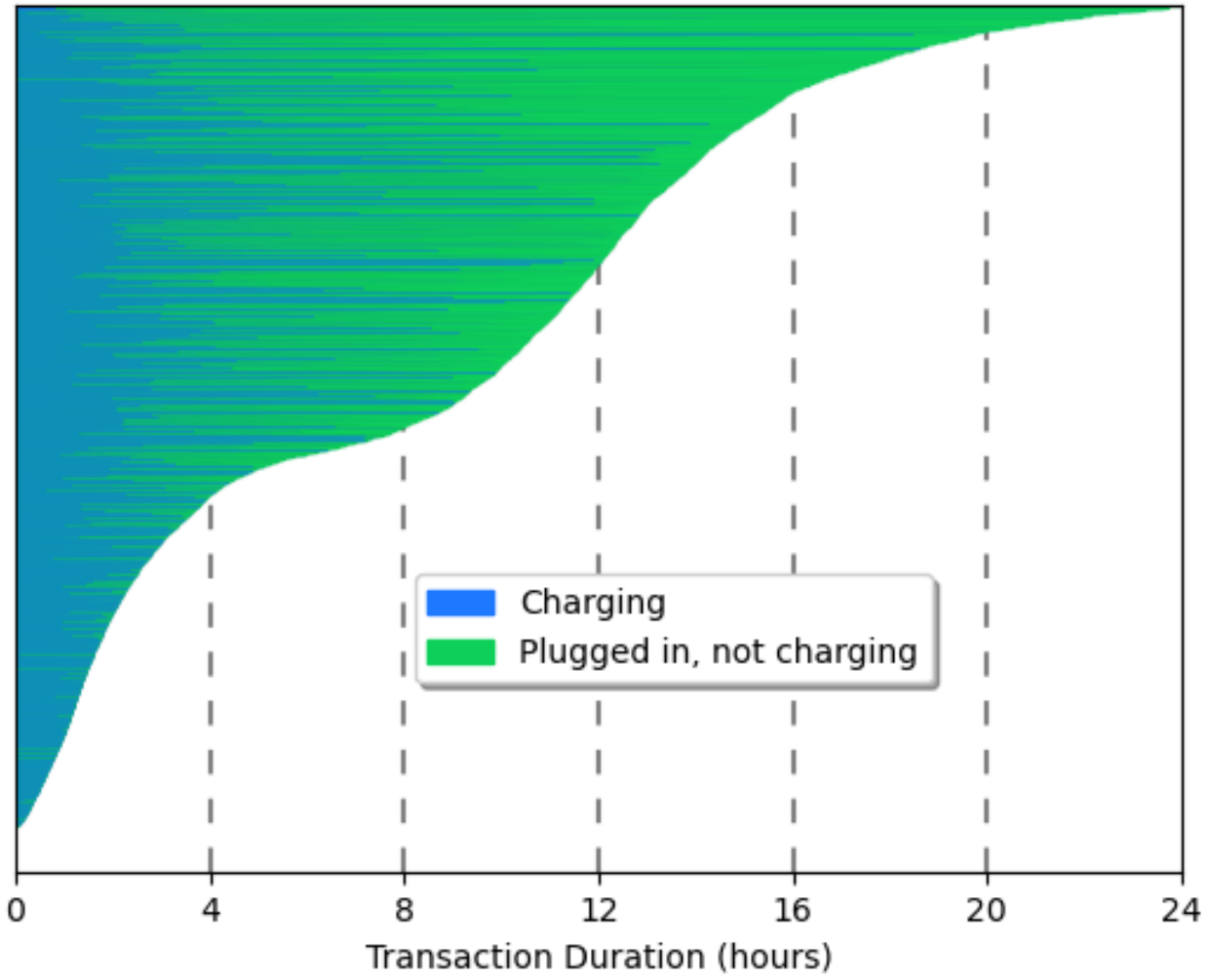
Potential for charging flexibility is large

OBSERVE



EVs are actively charging between 3-4 hours per session on average.

Longer sessions support shifted charging for flexibility while still delivering a full vehicle charge.

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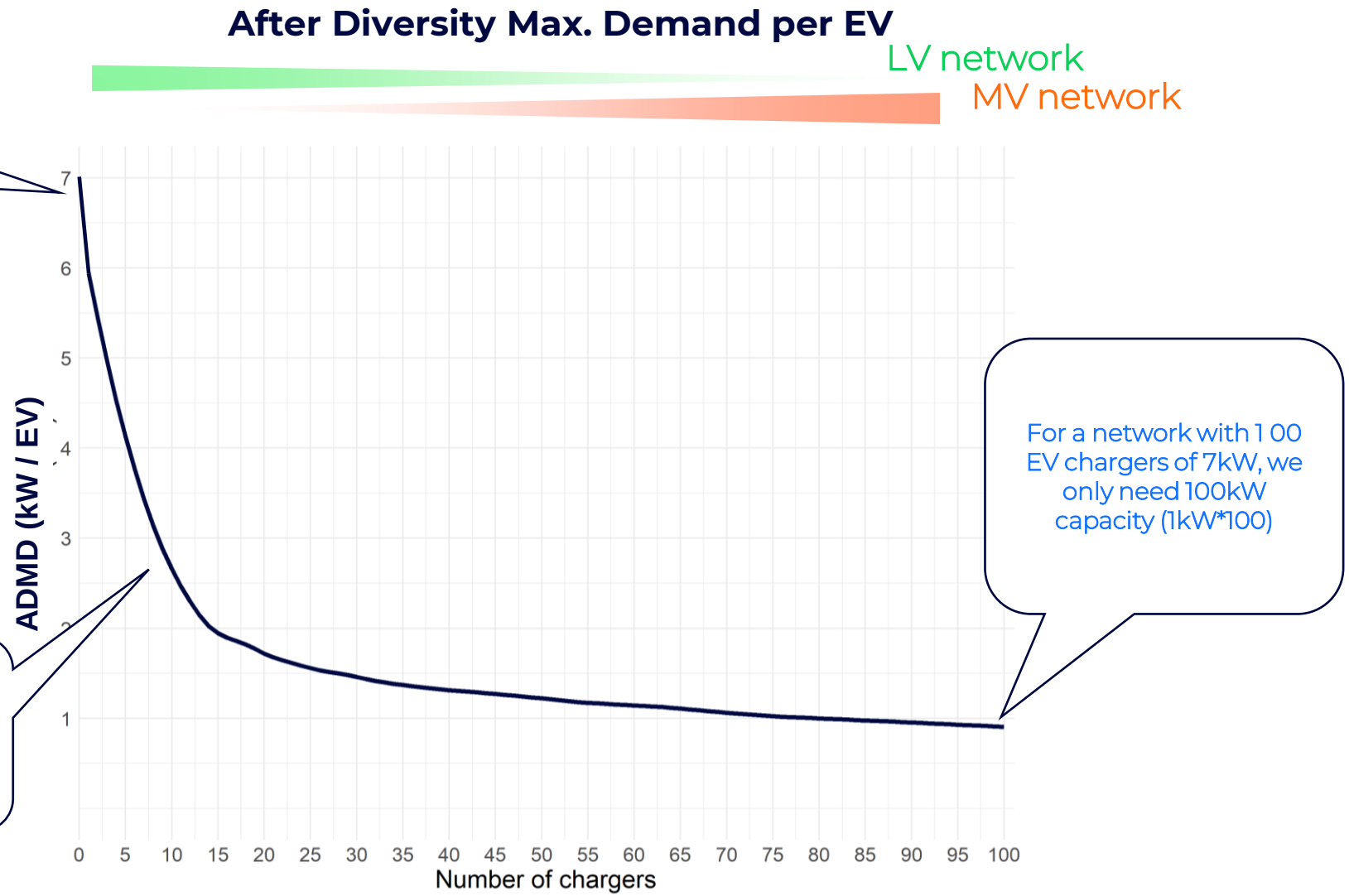
We have built a better understanding of the diversity that occurs with increasing volumes of EVs

For a network with 1 EV charger of 7kW, we need a 7kW network

For a network with 10 EV chargers of 7kW, we need a 10*3kW=30kW of network capacity

For a network with 1 00 EV chargers of 7kW, we only need 100kW capacity (1kW*100)



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TEST

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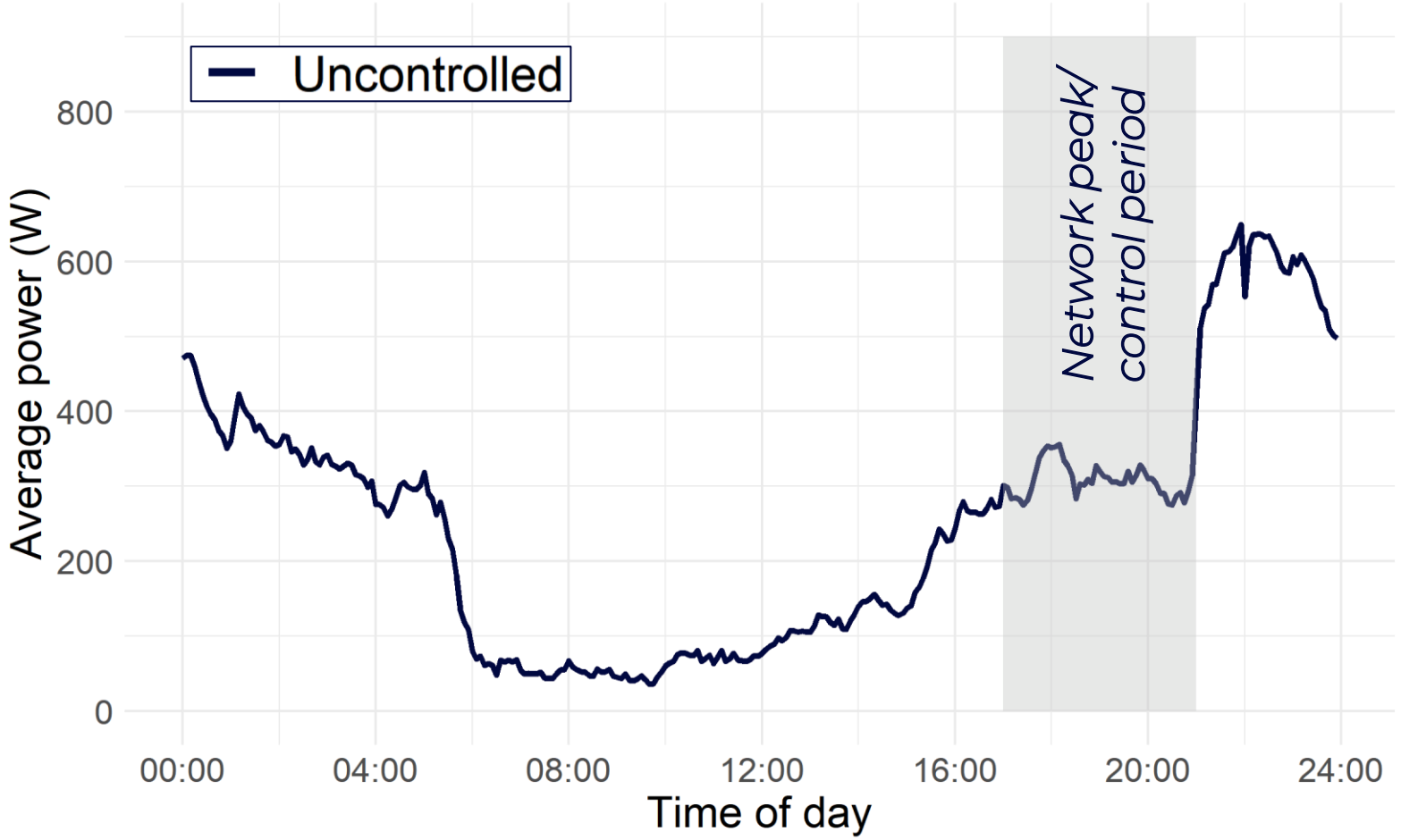
How charging management affects customer satisfaction



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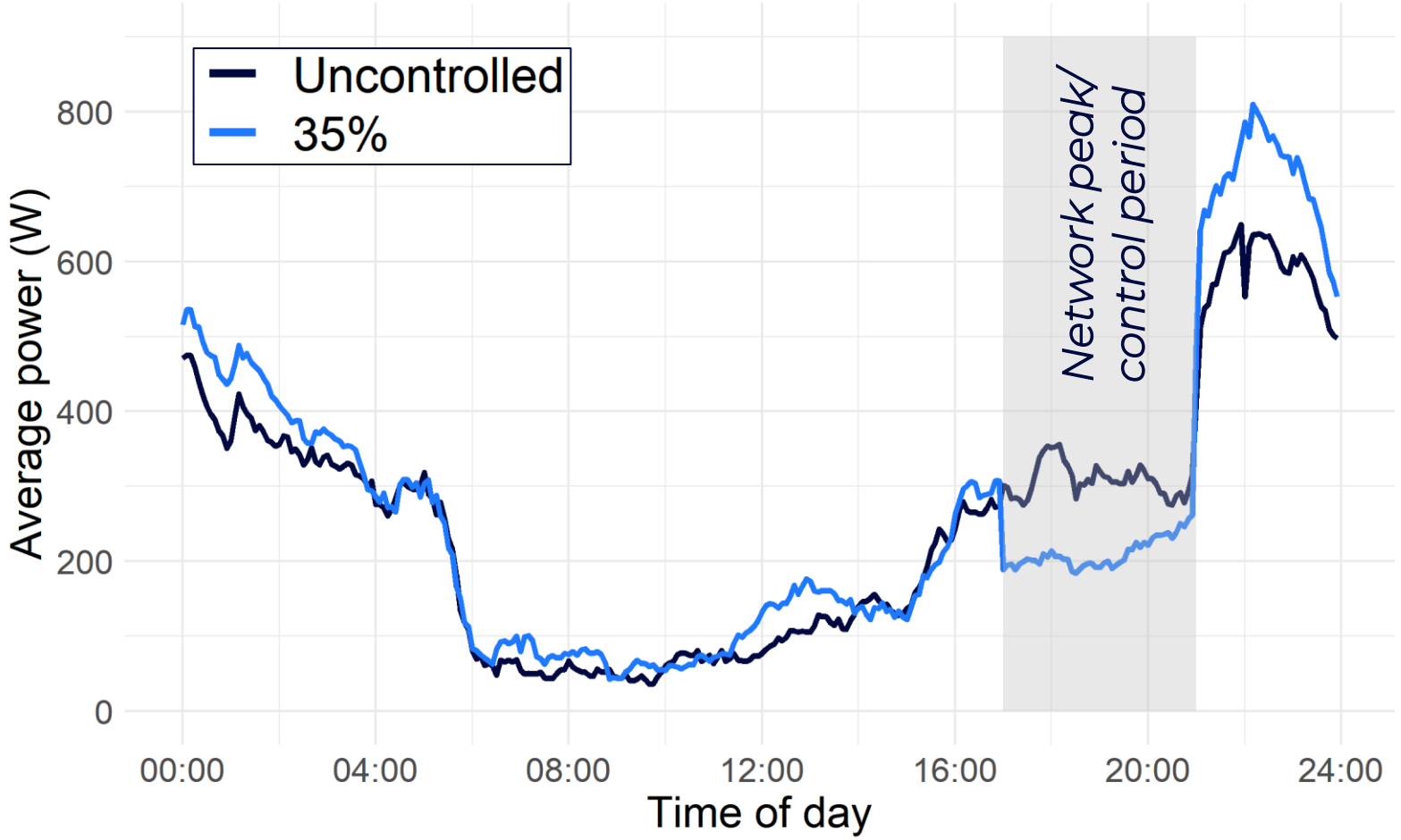

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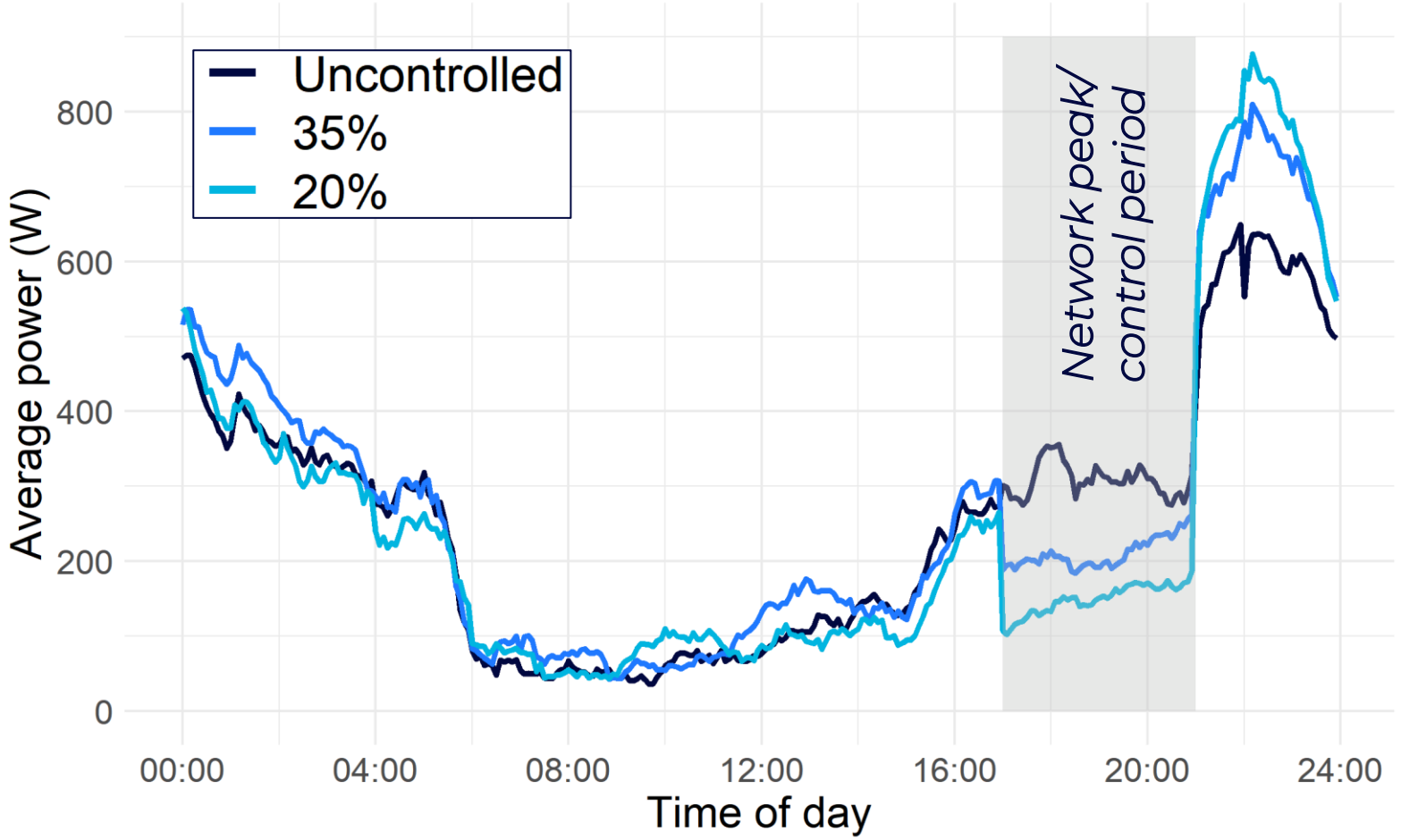

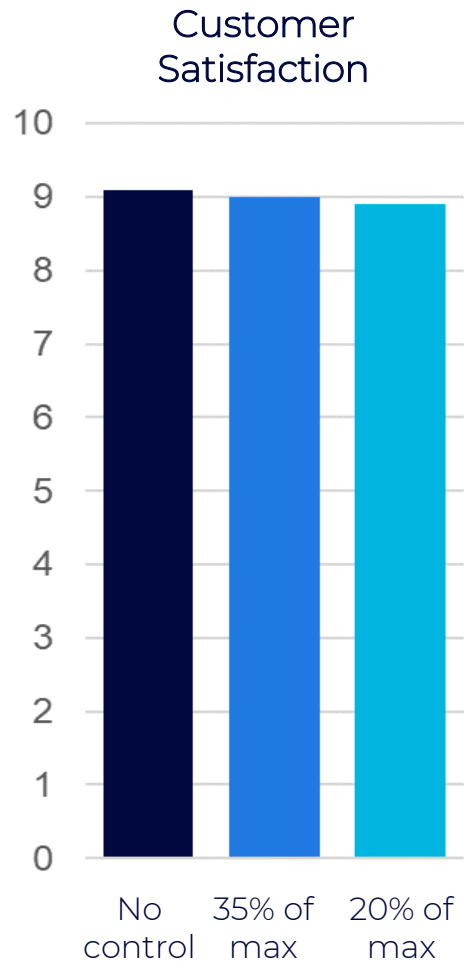

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OPTIMISE

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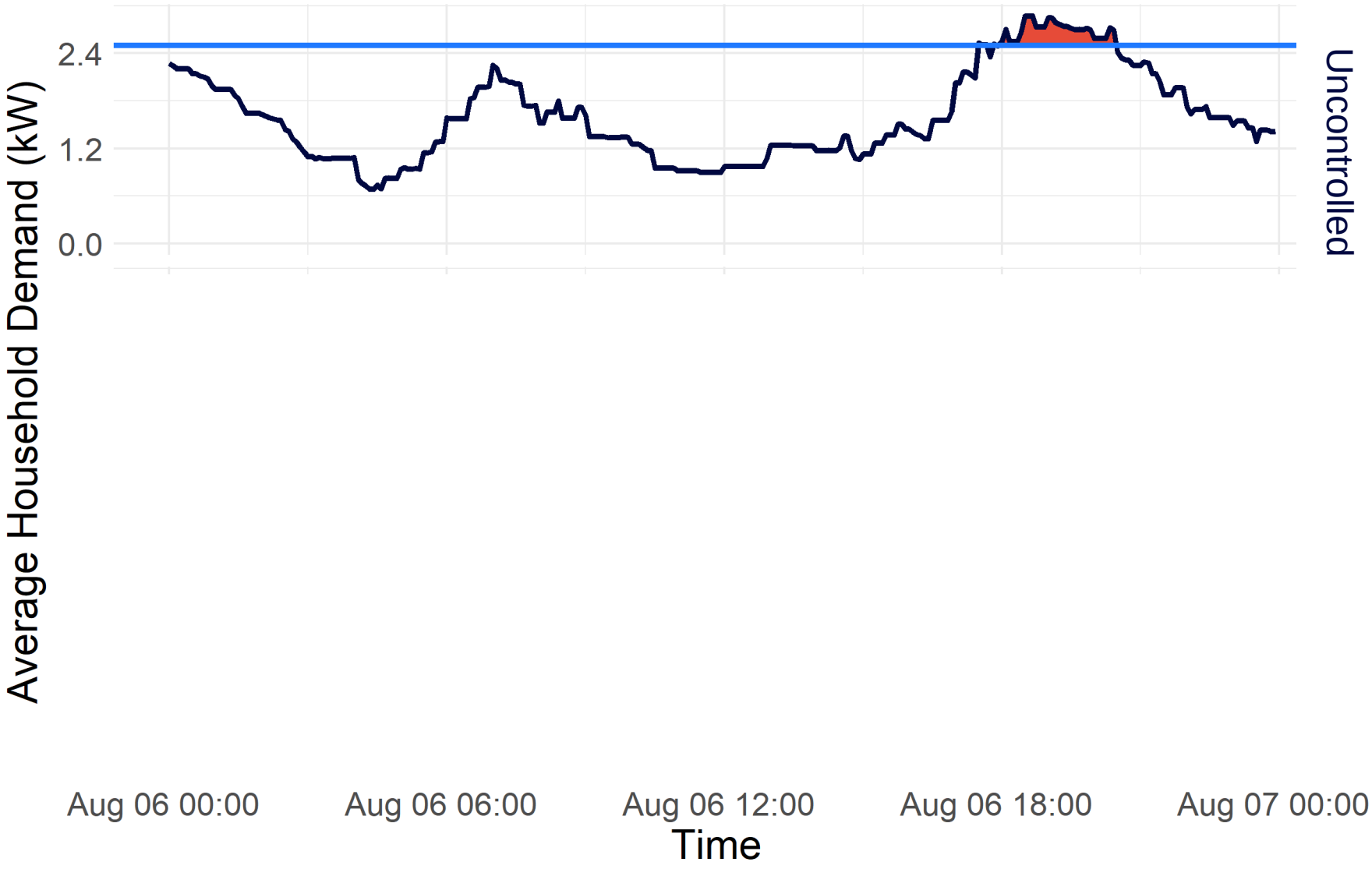
Smart charging algorithms in action

OPTIMISE

Distribution Feeder Design Limit (per connection)



August = Winter in New Zealand

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Smart charging algorithms in action

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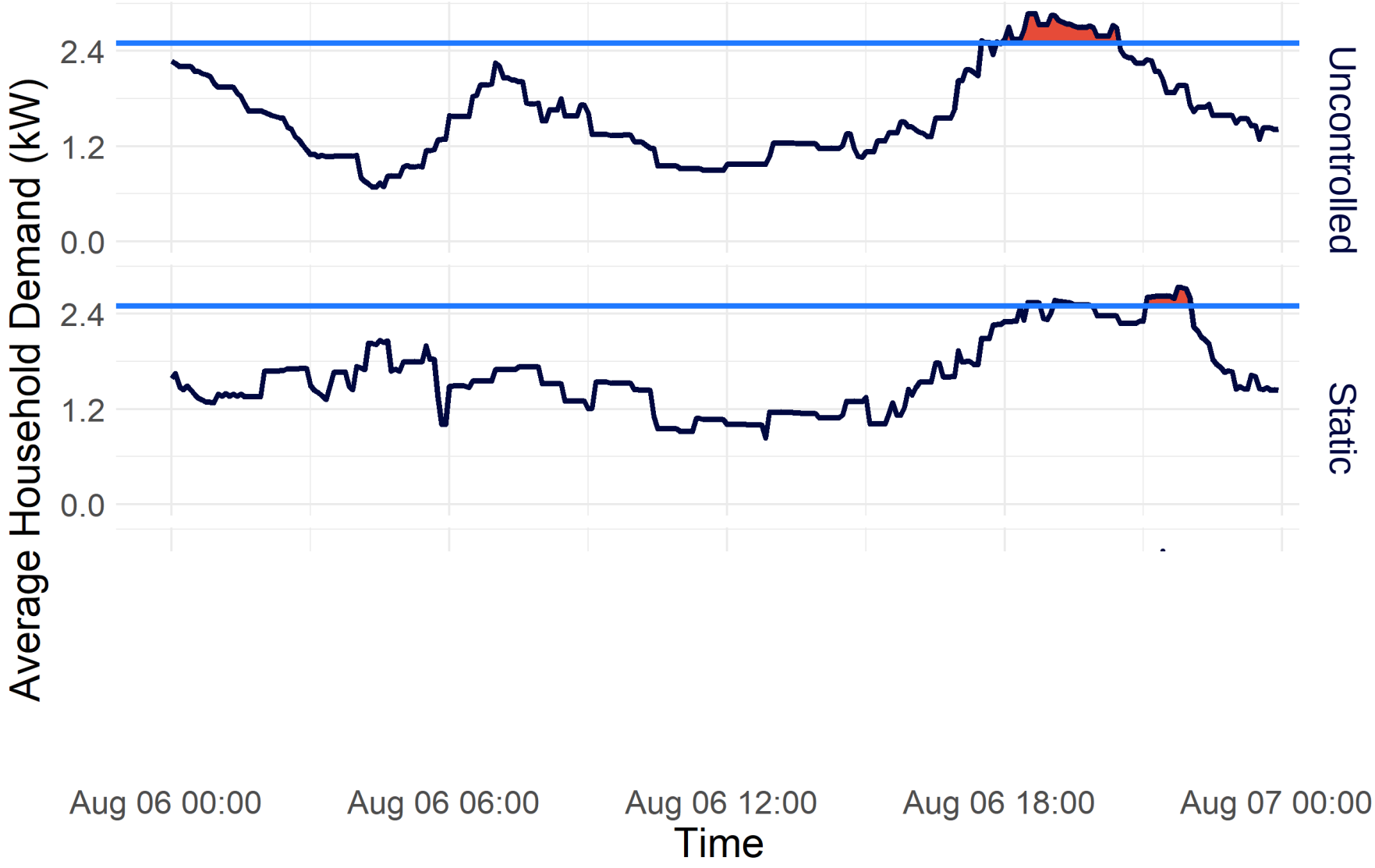

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Smart charging algorithms in action

OPTIMISE

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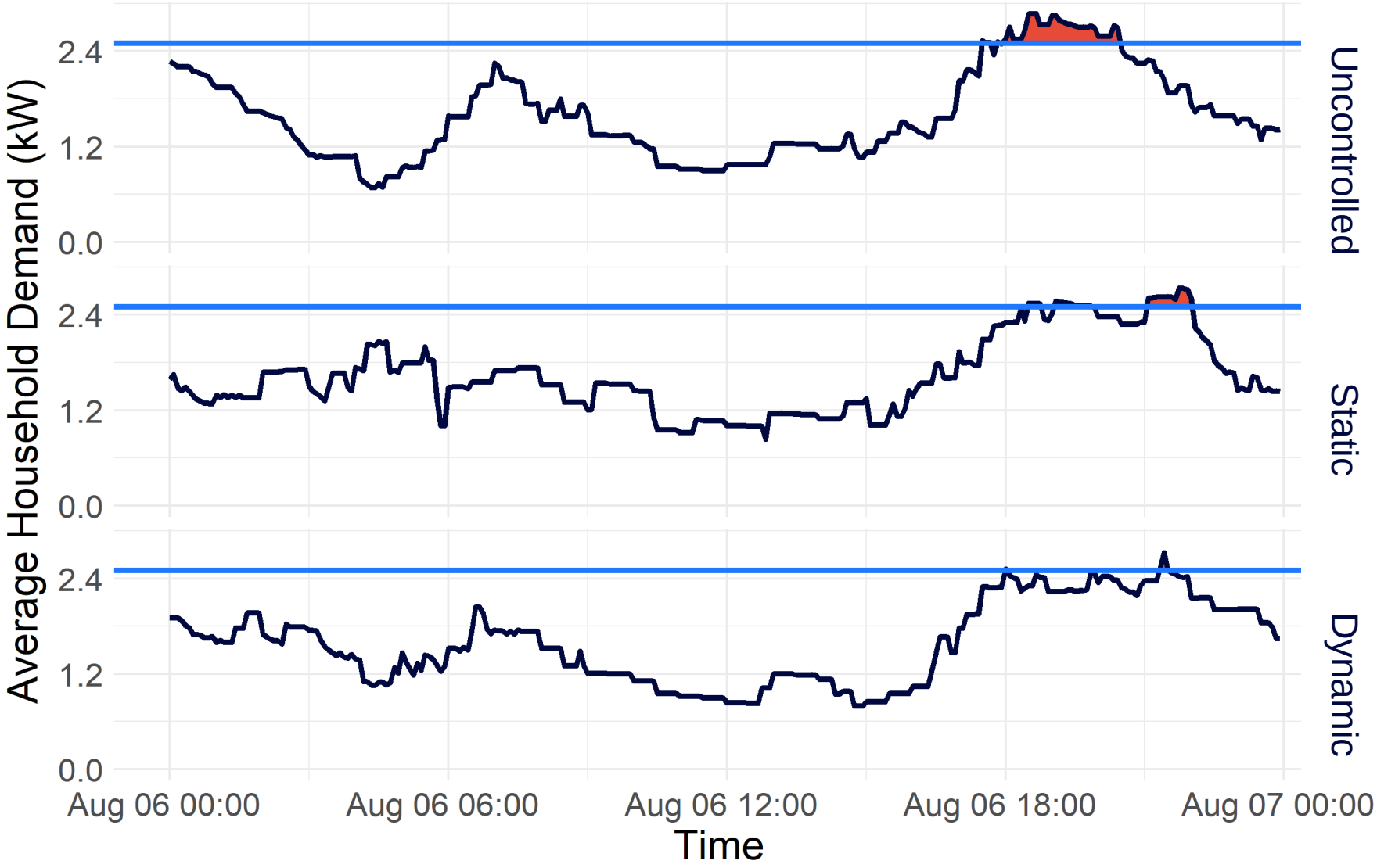

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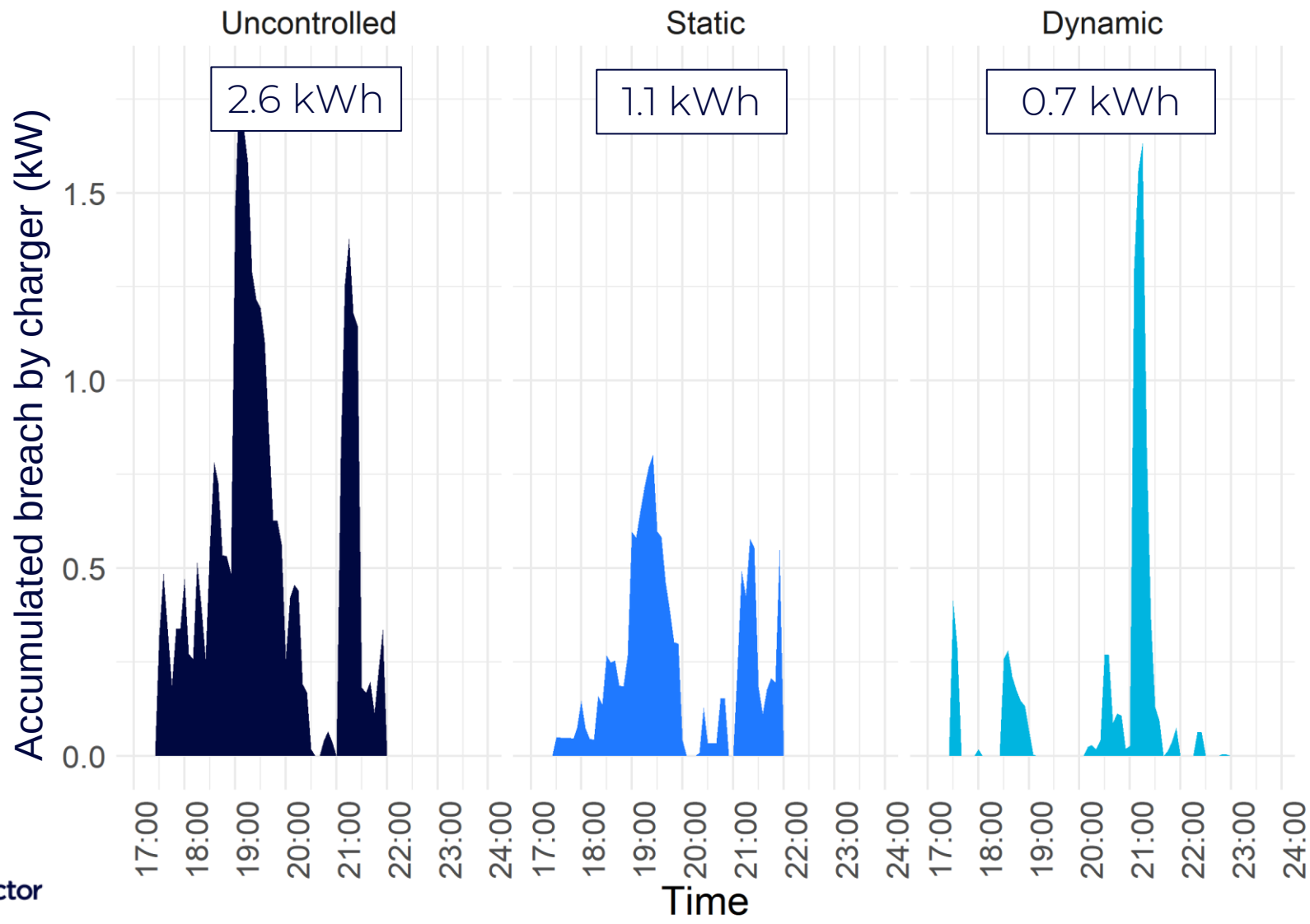
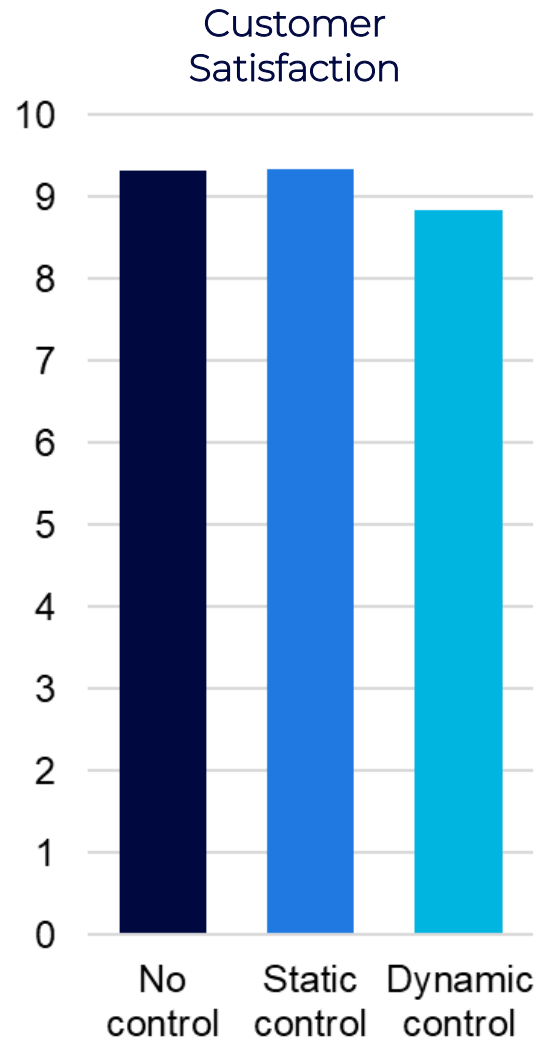
Smart charging algorithms performance





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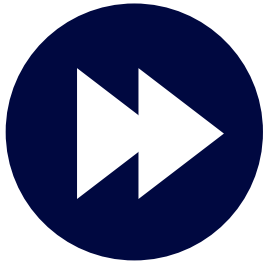
Summary of Key Findings

Customers are using EV on-board timers to delay the start of charging until 9pm. This risks creating secondary peaks

Access to smart meter data and EV registration data will help networks manage early adoption on the LV network

Flexibility to shift charging is available for charging sessions longer than 4 hours



Integrate learning into business processes

Network impacts are lower than expected on MV/HV. LV impact will be more pronounced as loads less diversified.

Smart charging can successfully reduce peak demand, while keeping customers very satisfied

Coordination with demand flexibility programmes will be needed (e.g. HWLC)

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