University of Nottingham
Energy Institute

Could electric vehicles help decarbonise our cities?

Prof Lucelia Rodrigues

CHAdeMO V2G Webinar #8

2 March 2023

University of Nottingham
Energy Institute

£9m business support funds

Over **150** academics working in energy

With a **£100m** research portfolio

Energy Research Accelerator (ERA)
British Geological Survey and universities of Aston, Birmingham, Cranfield, Keele, Leicester, Loughborough and Warwick

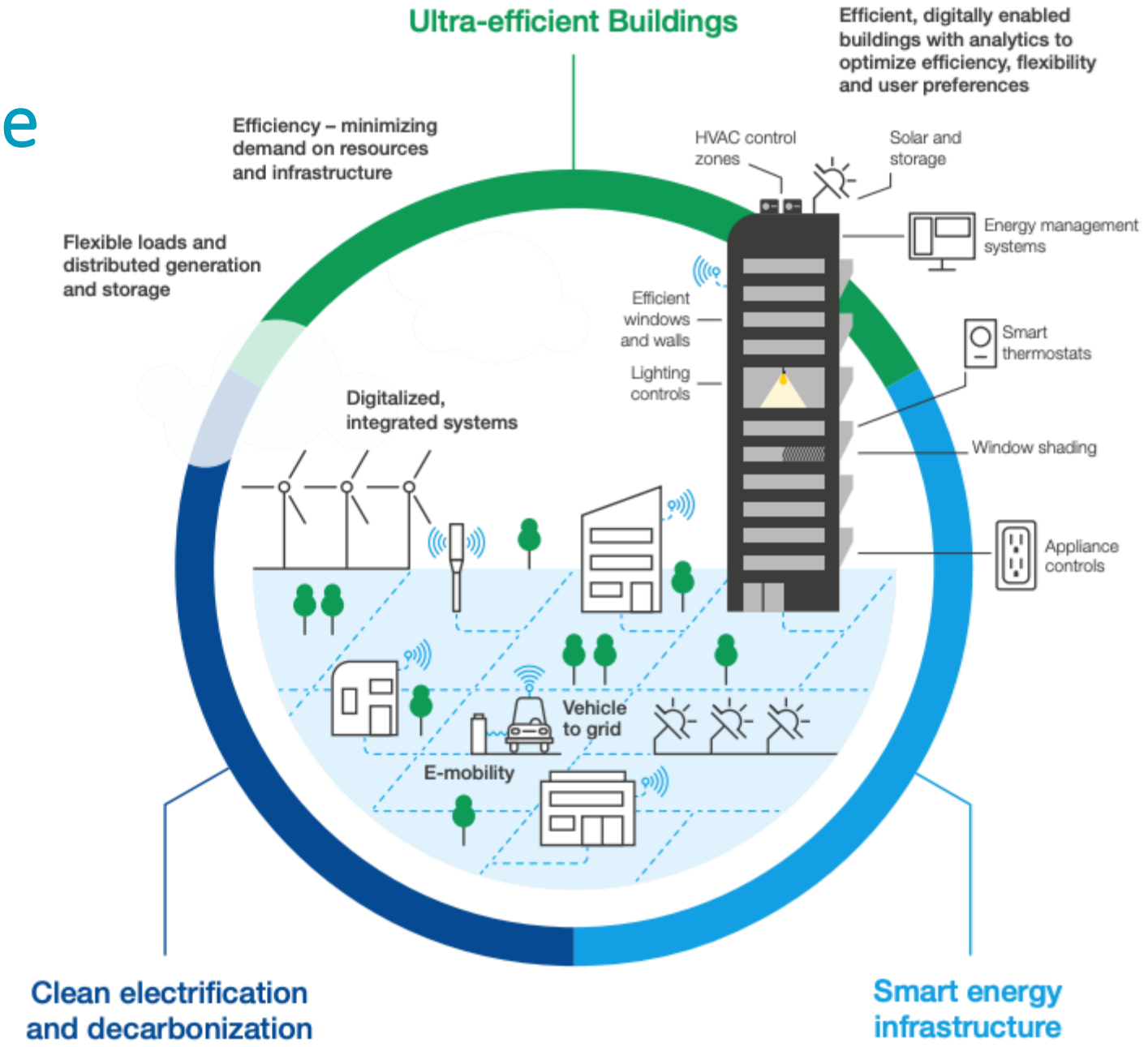
University of Nottingham Energy Institute

www.nottingham.ac.uk/research/research-areas/energy-institute/

Rationalise

Smartify

Electrify



World Economic Forum

University of Nottingham
Energy Institute

Electrifying Everything

University of Nottingham
Energy Institute

Trent Basin: Collaborative Planning

By applying Blueprint's Footprint Policy urban design principles and low-energy principles to the building fabric, Blueprint and a team of industry and University of Nottingham academic experts came up with a vision for this new neighbourhood back in 2013

University of Nottingham
Energy Institute

Project SCENe

Innovate UK

ERA ENERGY RESEARCH ACCELERATOR

Funded by Innovate UK and the
Energy Research Accelerator

SCENe
Sustainable Community
Energy Networks

TRENT BASIN
WATERSIDE

SCENe looks to accelerate the adoption of community energy schemes, which can help promote the infrastructural, social and cultural changes we need to reduce the impact of climate change and increase energy security

University of Nottingham
UK | CHINA | MALAYSIA

ATKearney

SMARTKLUB
Empowering Cities Together

SOLAR READY

Loughborough University

blueprint

SIEMENS

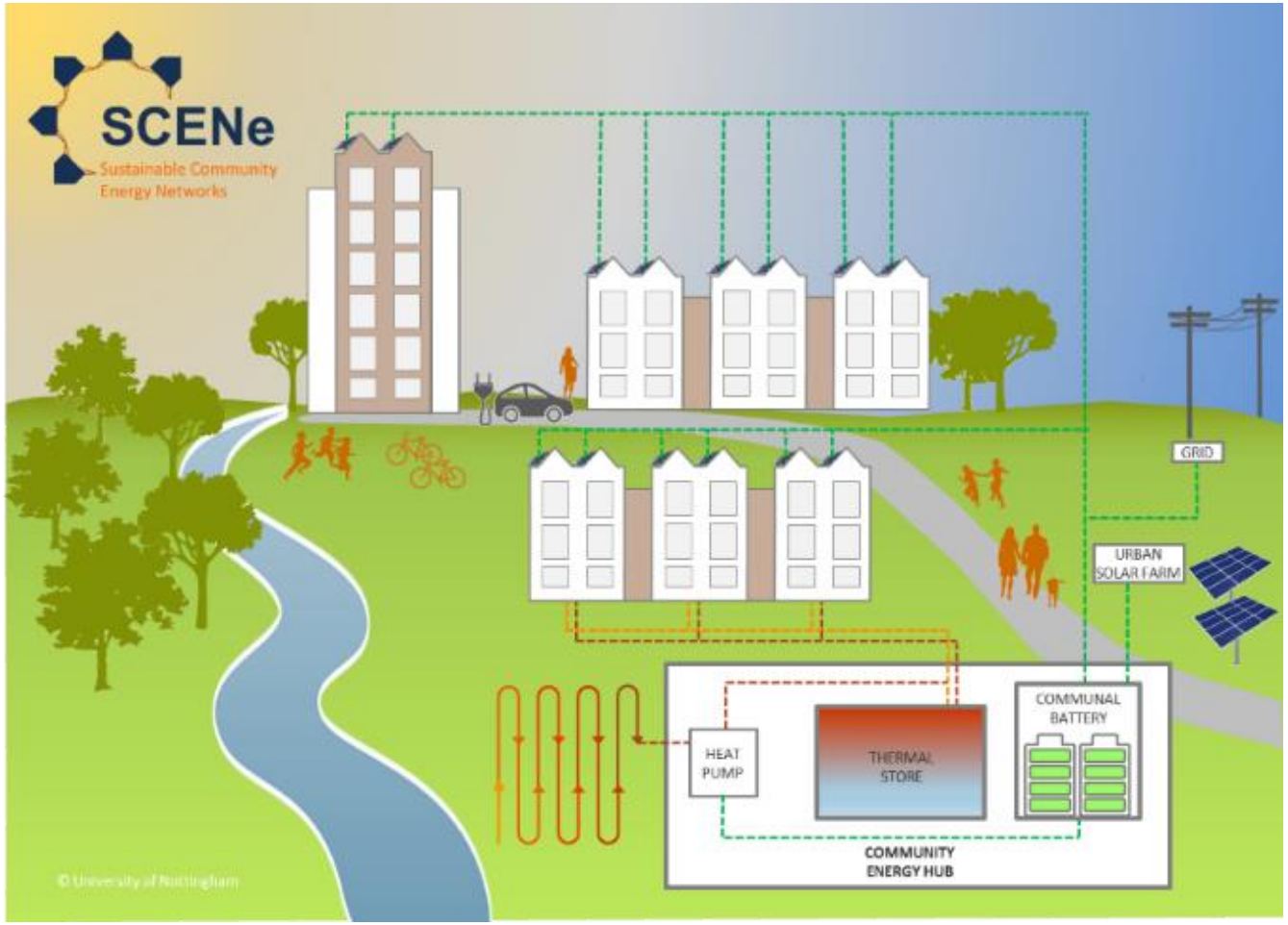
Stickyworld

urbed

Slam Jam

SCENe at the Trent Basin

- It includes:
  - an urban solar farm (200 KWp),
  - rooftop solar panels,
  - Europe's largest community energy battery (Tesla 2.1MWh),
  - and local thermal energy production, distribution and storage.
- The aim is to generate renewable energy and deliver grid services to the National grid, increasing efficiencies, reducing costs and decreasing the overall carbon emissions from the energy system



RODRIGUES, L., GILLOTT, M., WALDRON, J., CAMERON, L., TUBELO, R., SHIPMAN, R., EBBS, N., BRADSHAW-SMITH, C., 2020. User engagement in community energy schemes: A case study at the Trent Basin in Nottingham, UK. Sustainable Cities and Society, Volume 61, 2020, 102187, ISSN 2210-6707.
WALDRON, J., RODRIGUES, L., GILLOTT, M., NAYLOR, S., SHIPMAN, R., 2020. "Decarbonising Our Transport System: Vehicle Use Behaviour Analysis to Assess the Potential of Transitioning to Electric Mobility". *In*: 35th Passive and Low Energy Architecture Conference (PLEA): Planning post Carbon Cities, 1-3 September 2020, Coruna, Spain.

University of Nottingham
Energy Institute

The Realisation

3D Energy Interactive Model: http://uk.ies-icl.com/UoNTrentBasin

University of Nottingham
Energy Institute

Active Building Centre

The Active Building Centre's vision is to transform the UK construction and energy sectors through the deployment of Active Buildings contributing to more efficient energy use and decarbonisation.

INDUSTRIAL STRATEGY

UK Research and Innovation

ACTIVE BUILDING CENTRE RESEARCH PROGRAMME

CONSTRUCTION INNOVATION HUB

TRANSFORMING CONSTRUCTION NETWORK PLUS

University partners:

- Swansea University
- Cardiff University
- Imperial College London
- University of Sheffield
- Newcastle University
- Loughborough University
- University College London
- University of Birmingham
- University of Nottingham

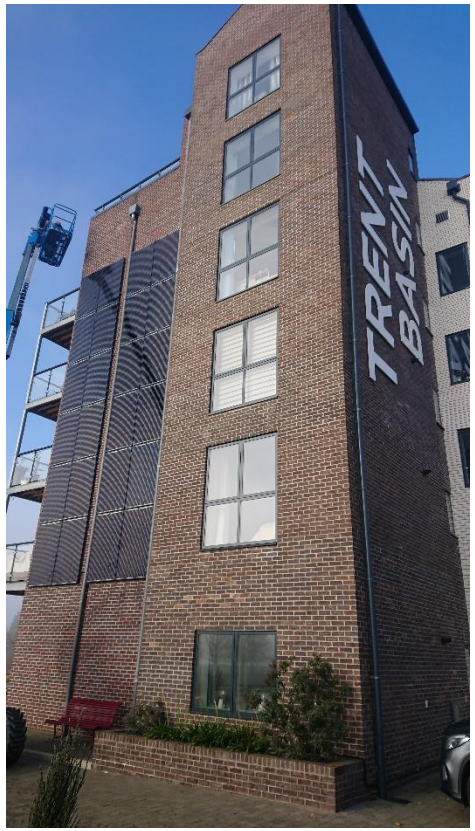
Commercial collaborators:

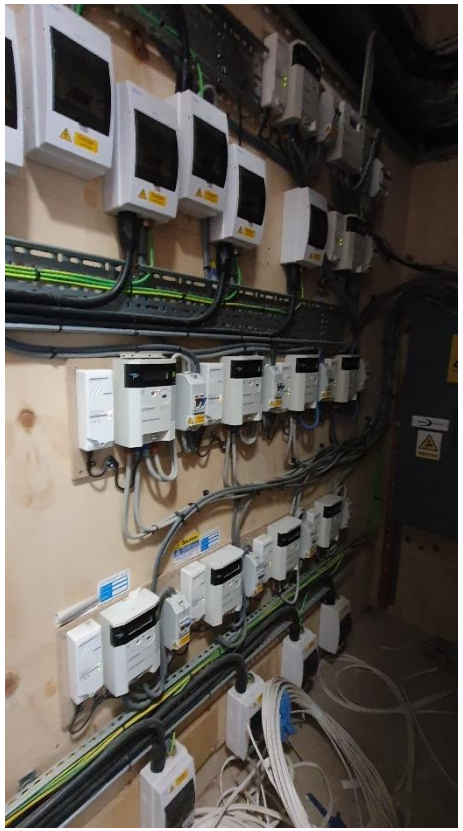
- Tata Steel UK
- Pilkington Group Ltd
- Hale
- BIPVCo
- Wernick
- City and County of Swansea
- United Welsh
- AkzoNobel UK
- Cisco Systems UK
- PA Consulting Group
- Sero Energy
- Arup (Ove Arup and Partners Ltd) (UK)
- Powell Dobson
- Neath Port Talbot County
- Coastal Housing Group
- GridDuck
- HTA Design LLP
- Siemens PLC
- Sheffield City Council
- Welsh Government
- Greater London Authority (GLA)
- Bere Architects

University of Nottingham
Energy Institute

The Active Building Centre at the Trent Basin

- Behind the Meter Billing: optimise the mix of locally-generated and utility provided energy for residents



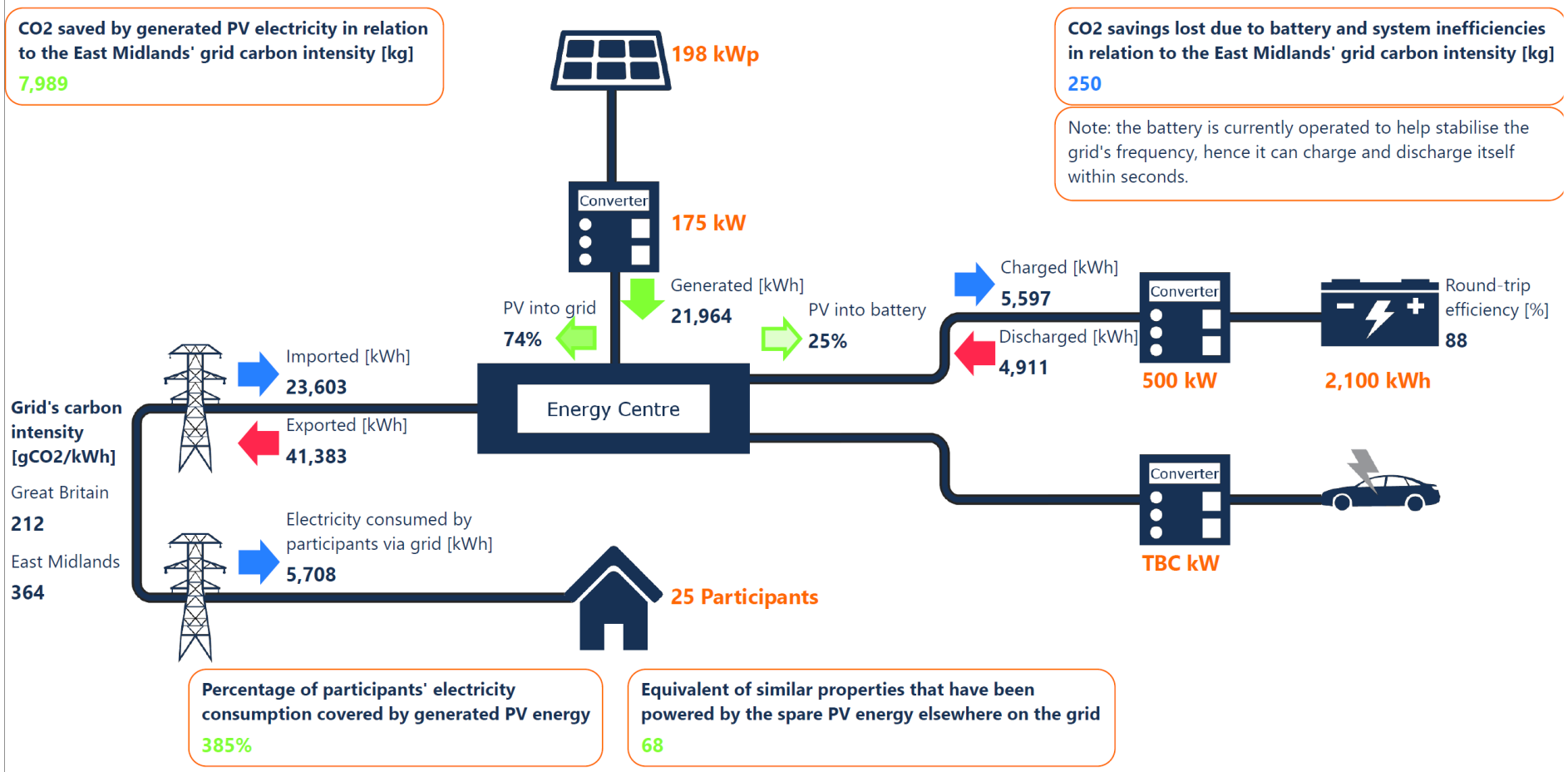


Smart Energy Systems

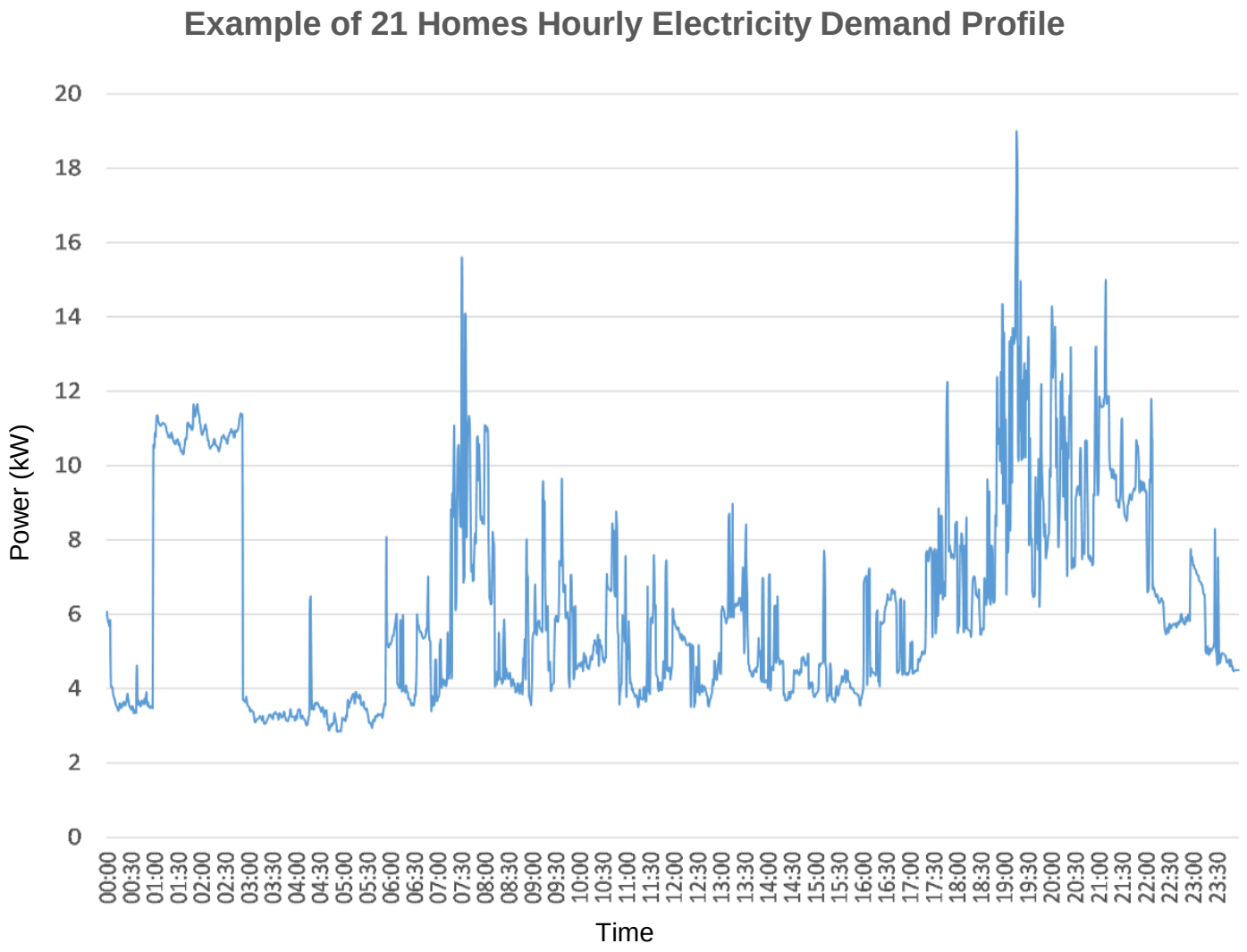
University of Nottingham
UK | CHINA | MALAYSIA

Community - System Overview

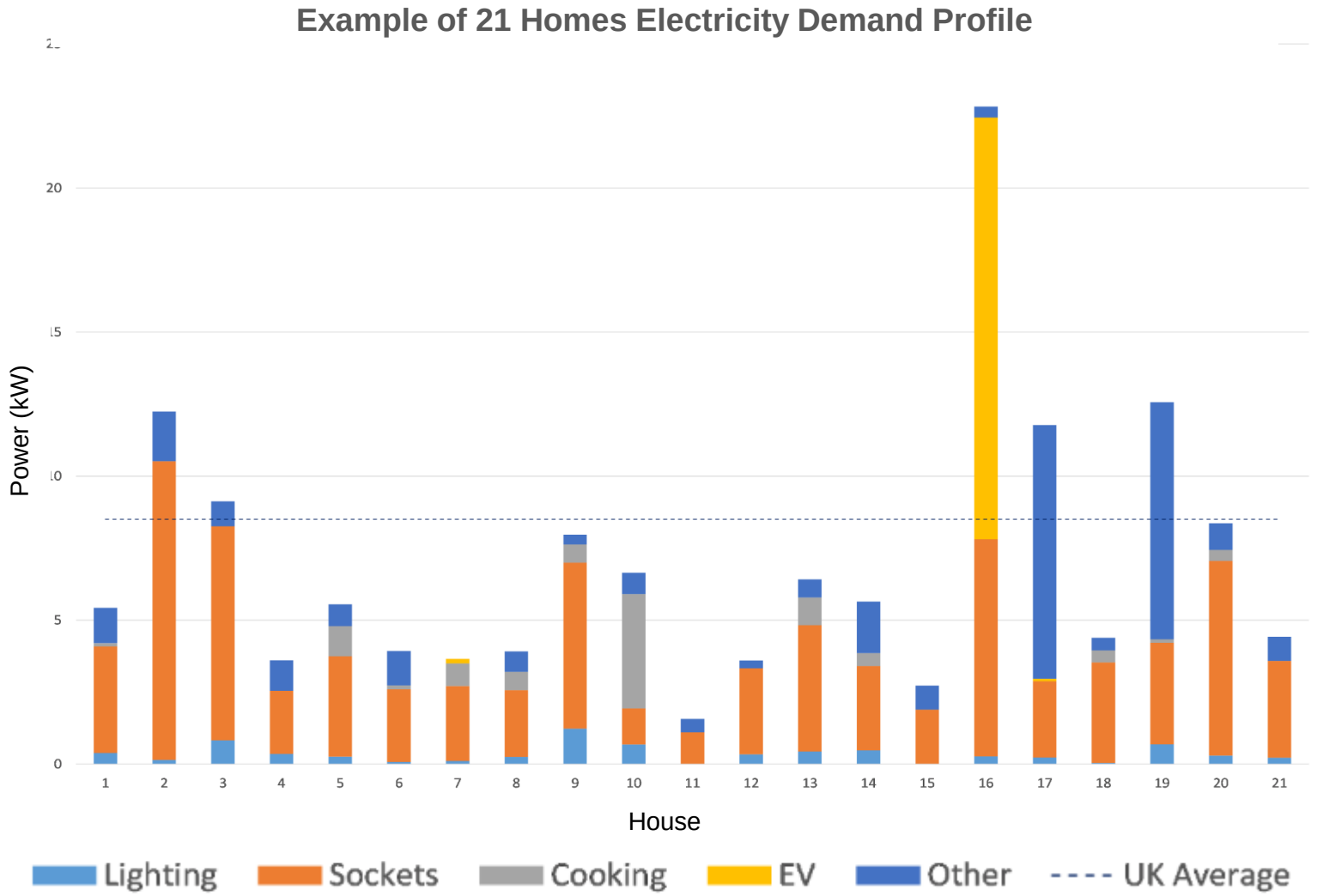
Report showing
April 2019



Home Monitoring: Community Profile



Home Monitoring: Disaggregated Data



University of Nottingham Energy Institute

EV-elocity project

EV-elocity was a research and development project looking at increasing the uptake of electric vehicles through helping consumers to monetise their investment using vehicle-to-grid (V2G) innovation.

Funded by:

Department for Business, Energy & Industrial Strategy

Office for Low Emission Vehicles

Innovate UK

Partners:

cenex

CrowdCharge

Leeds City Council

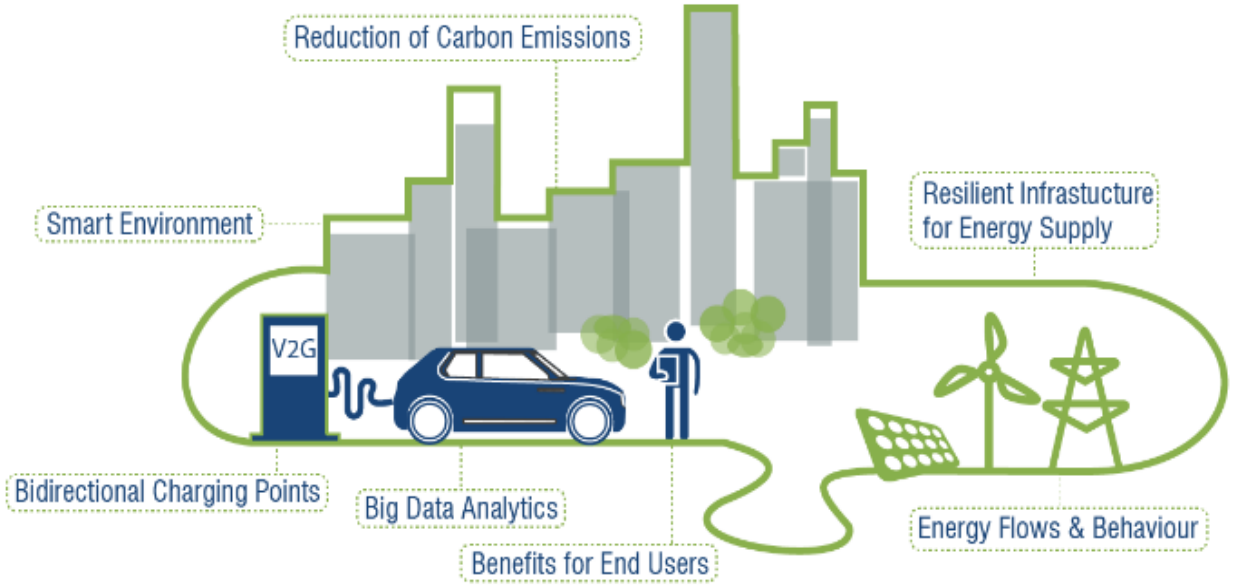
Nottingham City Council

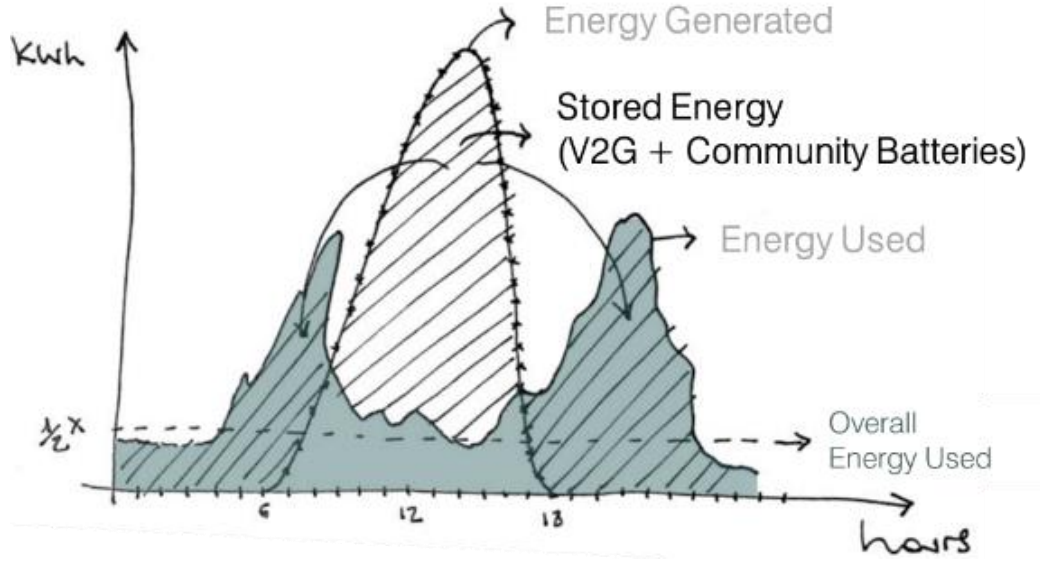
University of Nottingham UK | CHINA | MALAYSIA

WMG THE UNIVERSITY OF WARWICK

University of Nottingham
Energy Institute

Can we power your home from your car?





SHIPMAN, R.; WALDRON, J.; NAYLOR, S.; PINCHIN, J.; RODRIGUES, L.; GILLOTT, M., 2020. Where Will You Park? Predicting Vehicle Locations for Vehicle-to-Grid. *Energies* 2020, *13*, 1933.

WALDRON, J., RODRIGUES, L., GILLOTT, M., NAYLOR, S., SHIPMAN, R., 2020. "Decarbonising Our Transport System: Vehicle Use Behaviour Analysis to Assess the Potential of Transitioning to Electric Mobility". *In*: 35th Passive and Low Energy Architecture Conference (PLEA): Planning post Carbon Cities, 1-3 September 2020, Coruna, Spain.

SALAZAR, J., WALDRON, J., RODRIGUES, L., 2019. Regulatory and policy framework for the uptake of renewable energy in the United Kingdom. In 18th International Conference on Sustainable Energy Technologies - SET2019, 20th – 22nd August 2019, Kuala Lumpur, Malaysia.

WALDRON, J., RODRIGUES, L., GILLOTT, M., NAYLOR, S., SHIPMAN, R., 2019. Towards an electric revolution: a review on vehicle-to-grid, smart charging and user behaviour. In 18th International Conference on Sustainable Energy Technologies - SET2019, 20th – 22nd August 2019, Kuala Lumpur, Malaysia.

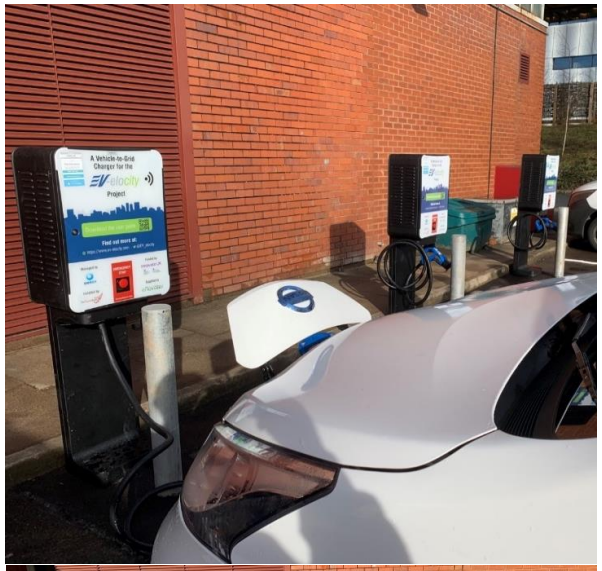
University of Nottingham
Energy Institute

EV-elocity Case Studies

Leeds City Council

University of Nottingham

West Midlands Police
Worcestershire County Council

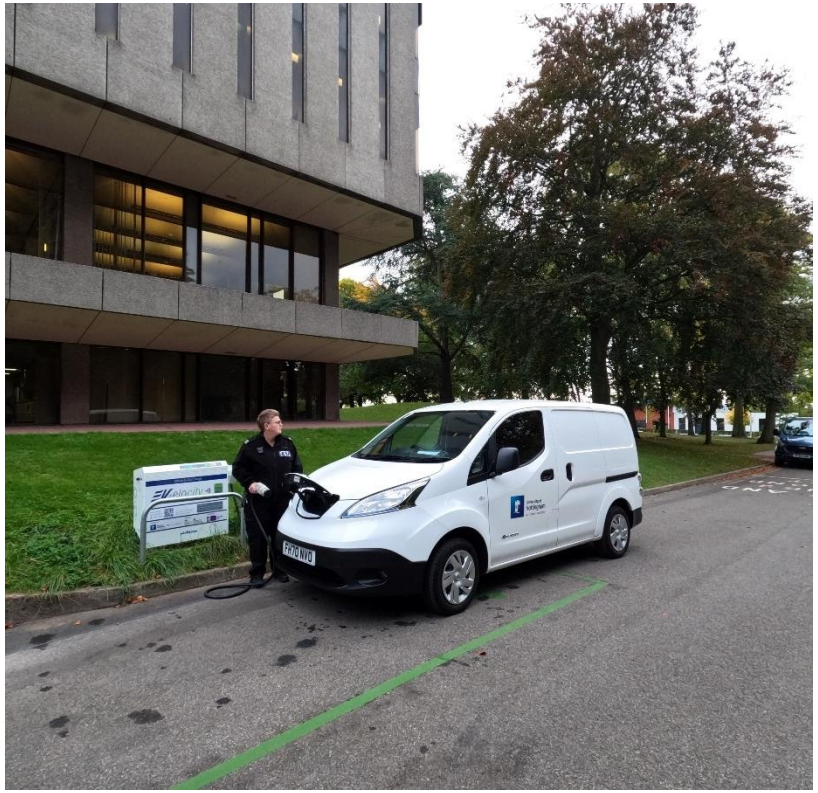


University of Warwick

University of Nottingham
Energy Institute

University of Nottingham V2G demonstrators

Location: Hallward Library
Use: University fleet

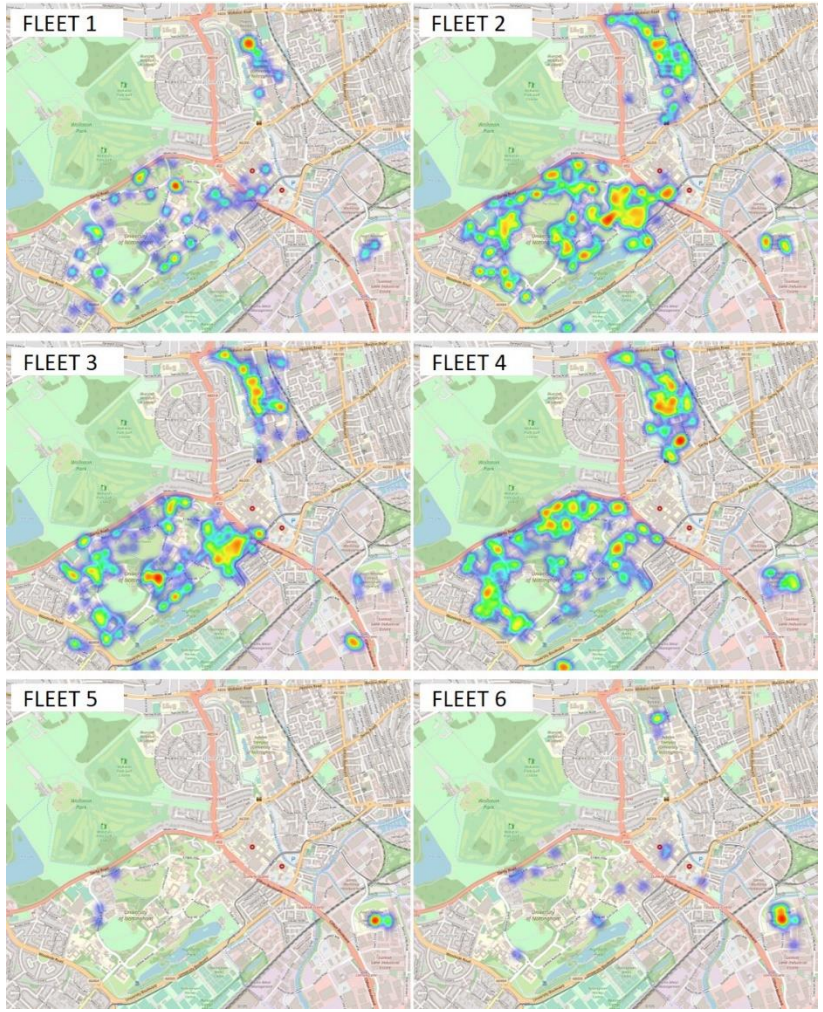


Location: Creative Energy Homes
Use: Integrating V2G & renewable energy generation

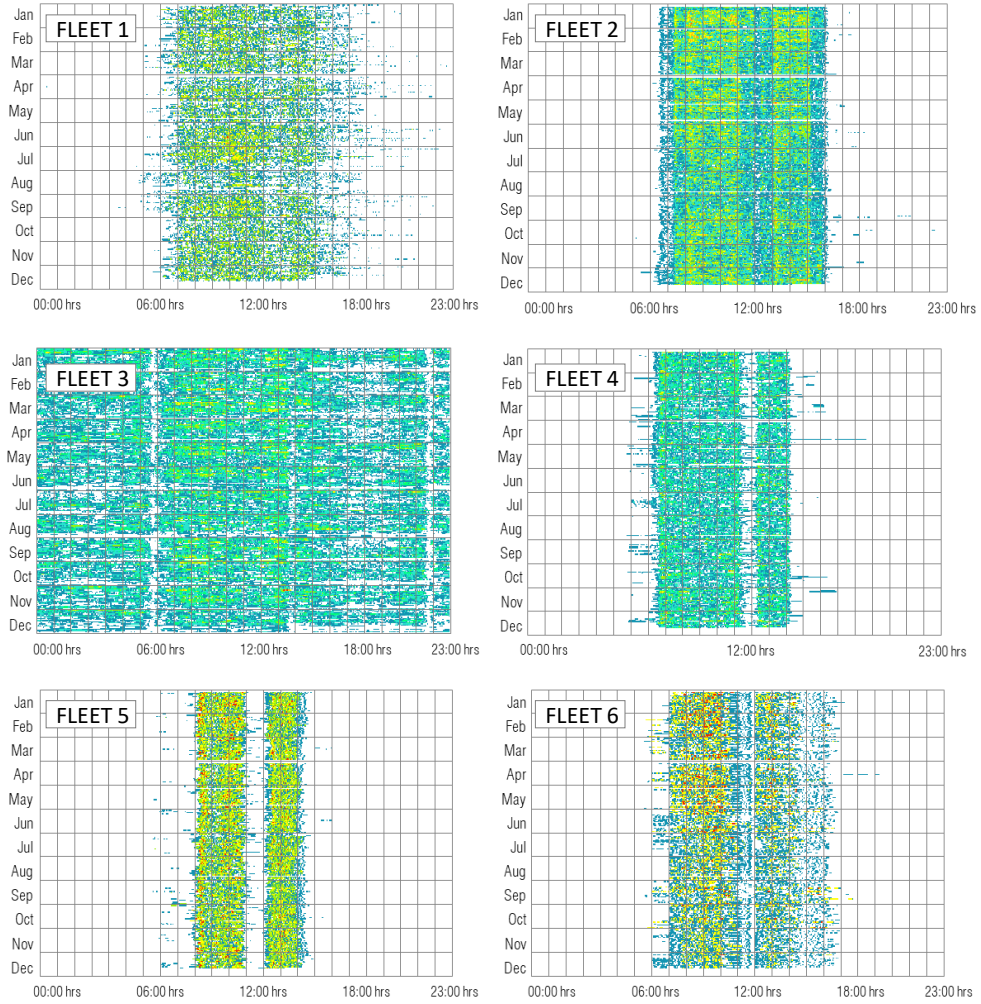
University of Nottingham
Energy Institute

Behaviour data analysis

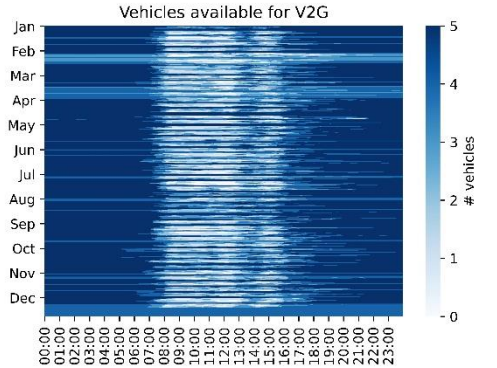
Long dwell location analysis
(stops over 1 hr)



Fleet use patterns
(simultaneous use of vehicles)

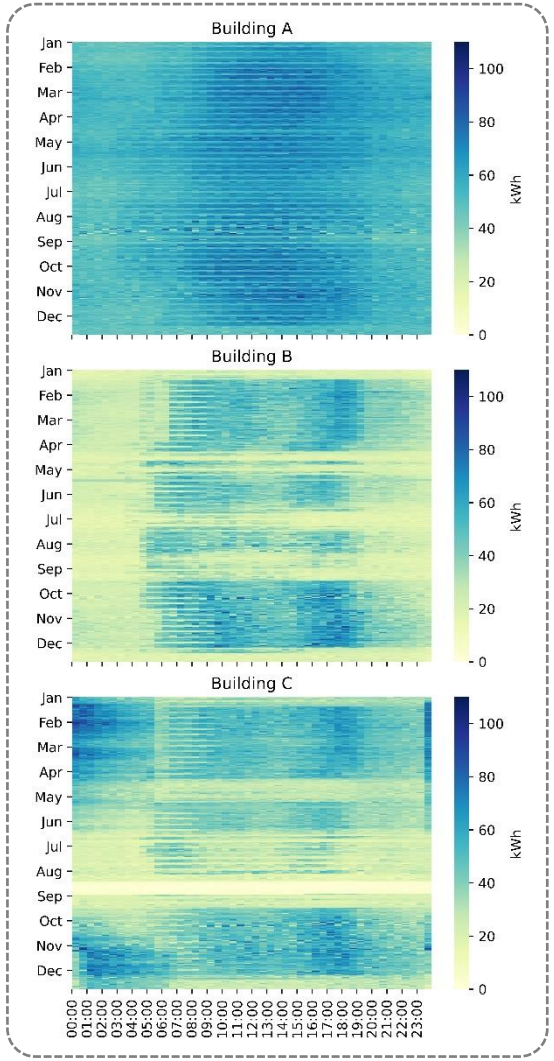


Vehicles Availability/ User Requirements



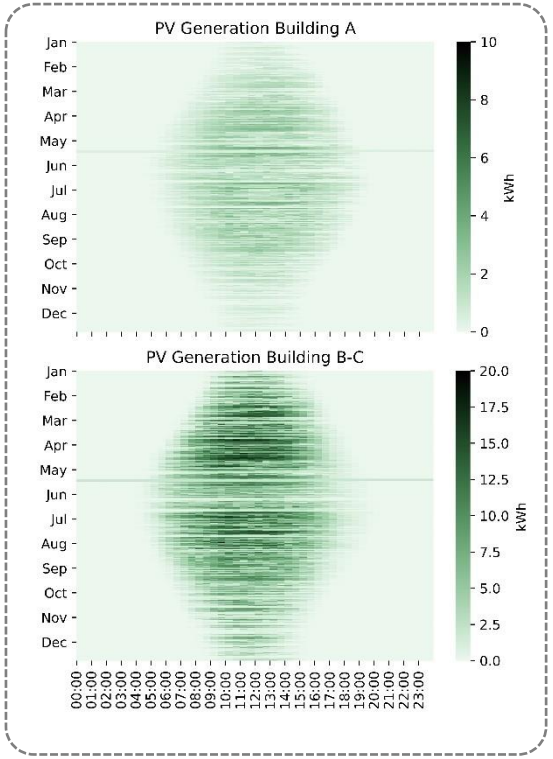
+

Building Energy Consumption



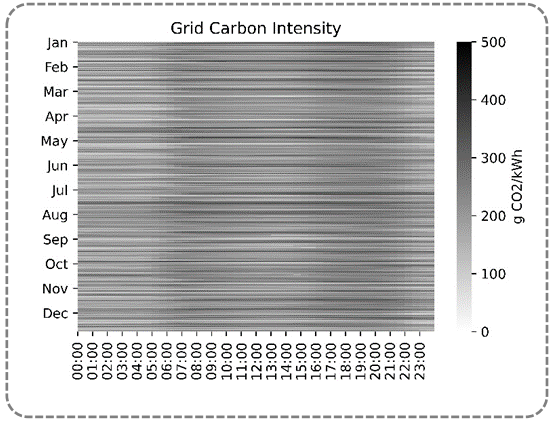
+

Renewable Energy Generation



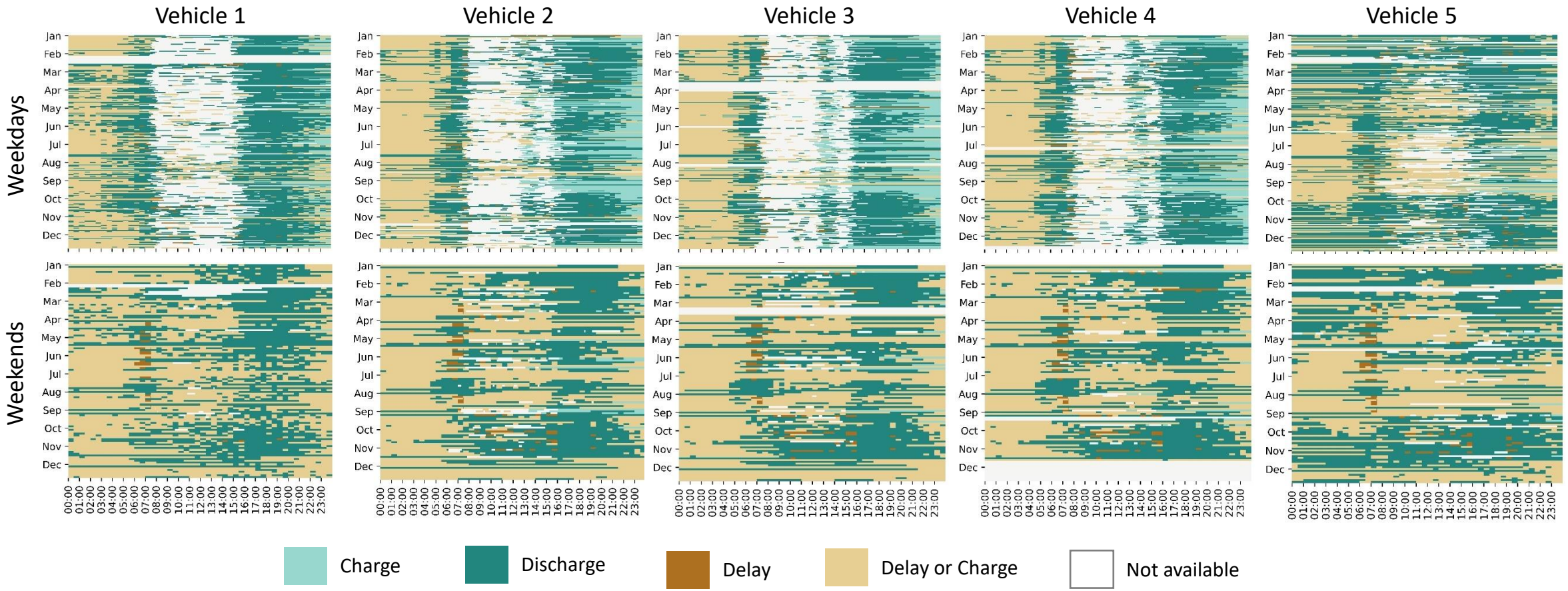
+

Carbon Intensity

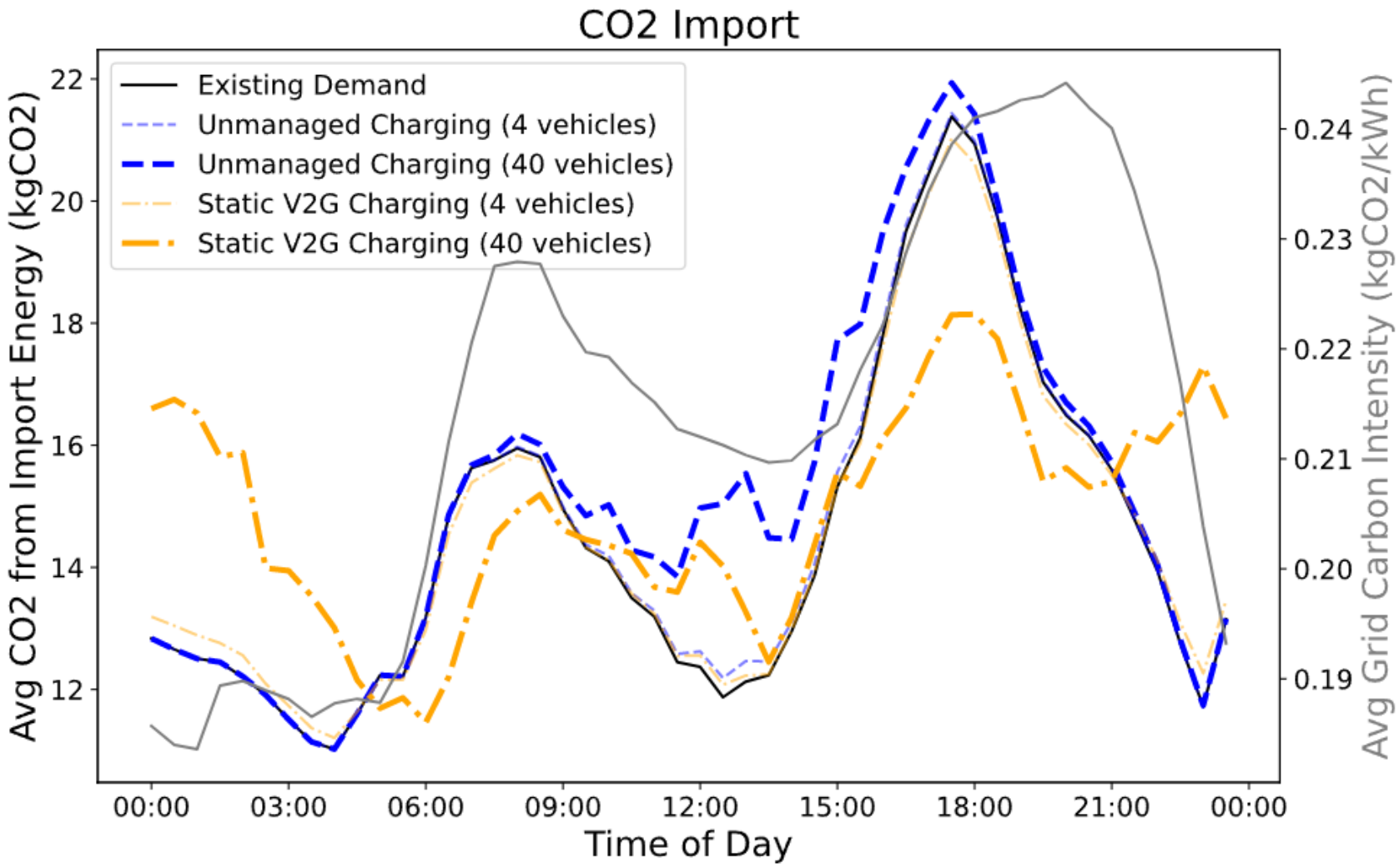


University of Nottingham
Energy Institute

Charging/discharging to optimise environmental benefits

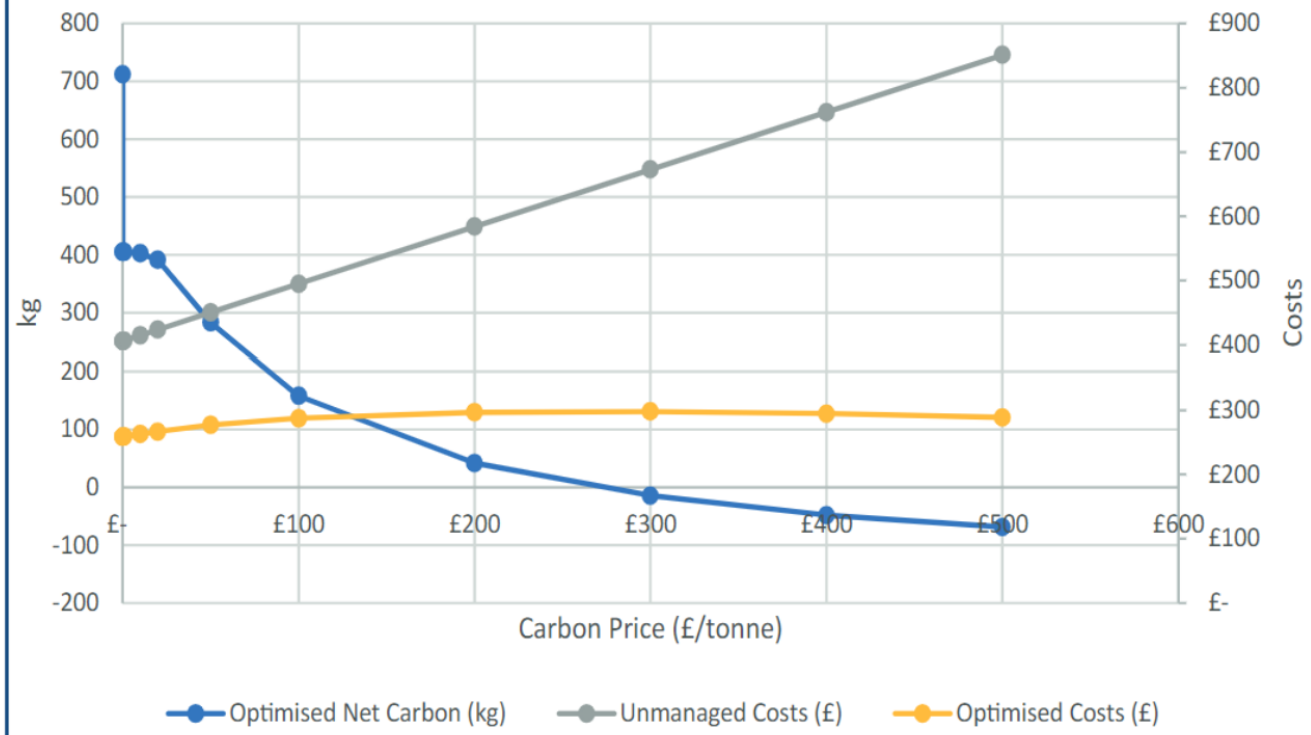


Carbon savings



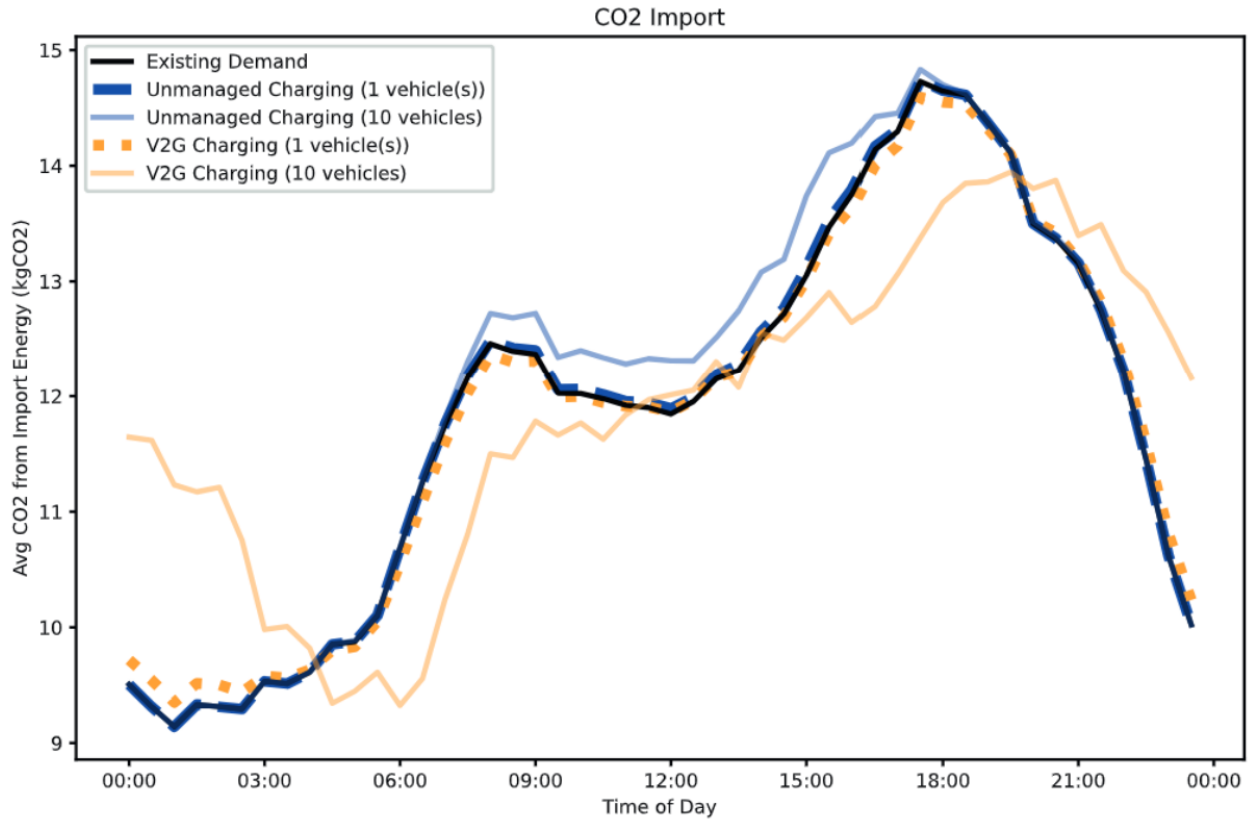
Cost

On a simple two rate tariff, a V2G tariff optimisation can save around £100 per year per chargepoint. However, with the use of a smarter tariff (e.g. varying half hourly) savings can be around £400 per year per chargepoint.



Carbon

Carbon savings can be up to around 450kg per V2G chargepoint per year when a carbon optimisation is used. Significant carbon savings (>180kg) can be made (at virtually no energy cost) when carbon is optimised as well as tariff costs.



University of Nottingham
Energy Institute

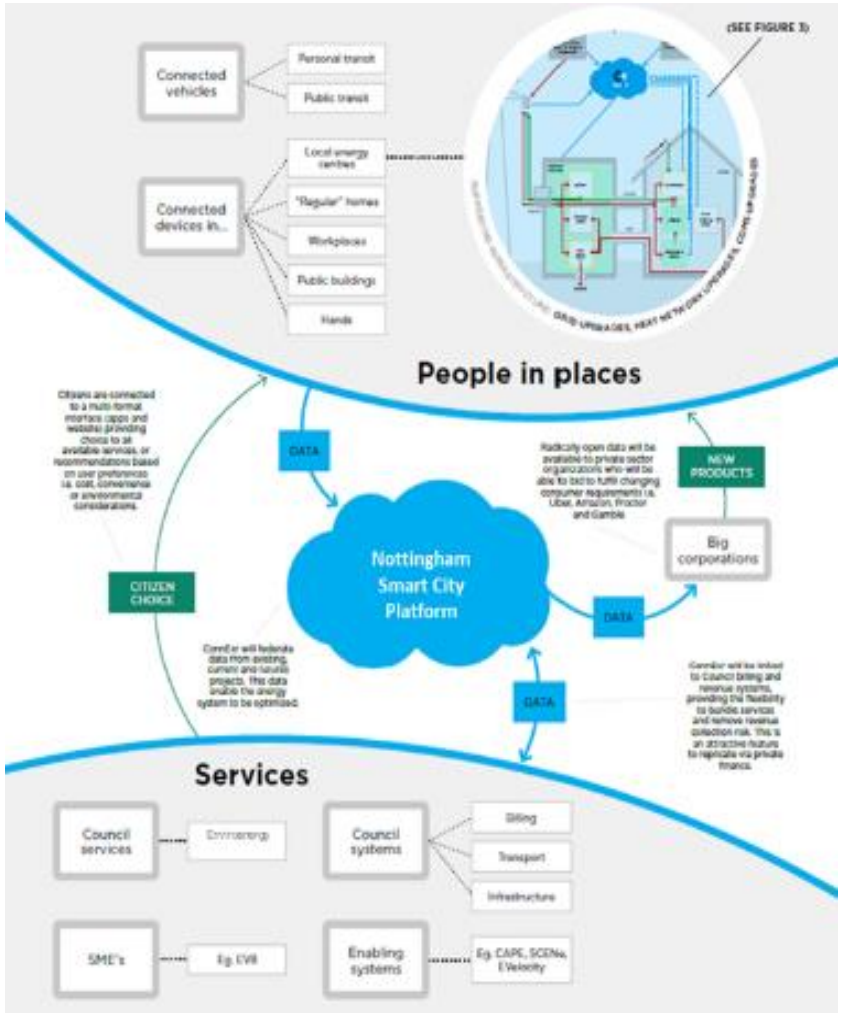
EV-ShAIR

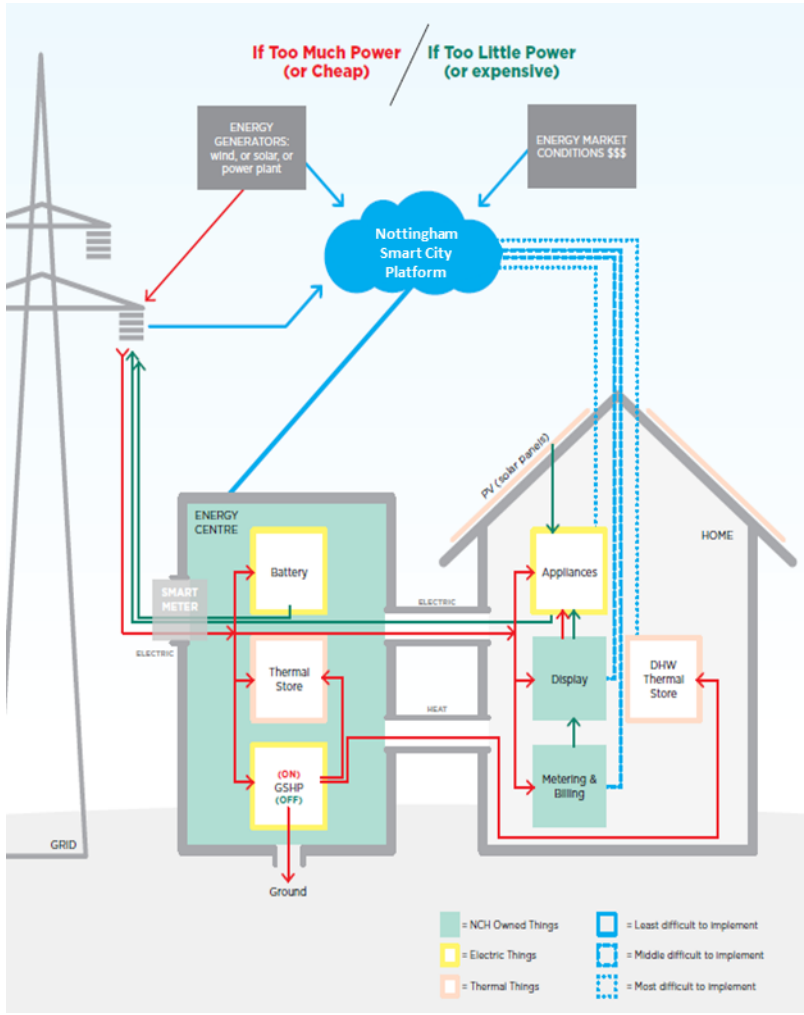
Department for Energy Security & Net Zero

- 12-month feasibility study on Vehicle-to-everything (V2X) bi-directional charging
- Developing business models that will enable the creation of value from V2X technologies for the benefit of the **electricity operations at airports by using the collective battery capacity of parked EVs**
- Will establish the best ways for airports to manage and where necessary **incentivise passengers to drive and park their EVs at the airport and use the collective virtual EV battery array through the latest V2X technology to power the airport operations** and where feasible to share in the value generated
- V2X Innovation Programme, funded by the Department for Energy Security and Net Zero (DESNZ), delivered by Innovate-UK - V2X is part of the up to £65m Flexibility Innovation Programme, funded from the £1 billion DESNZ Net Zero Innovation Portfolio.

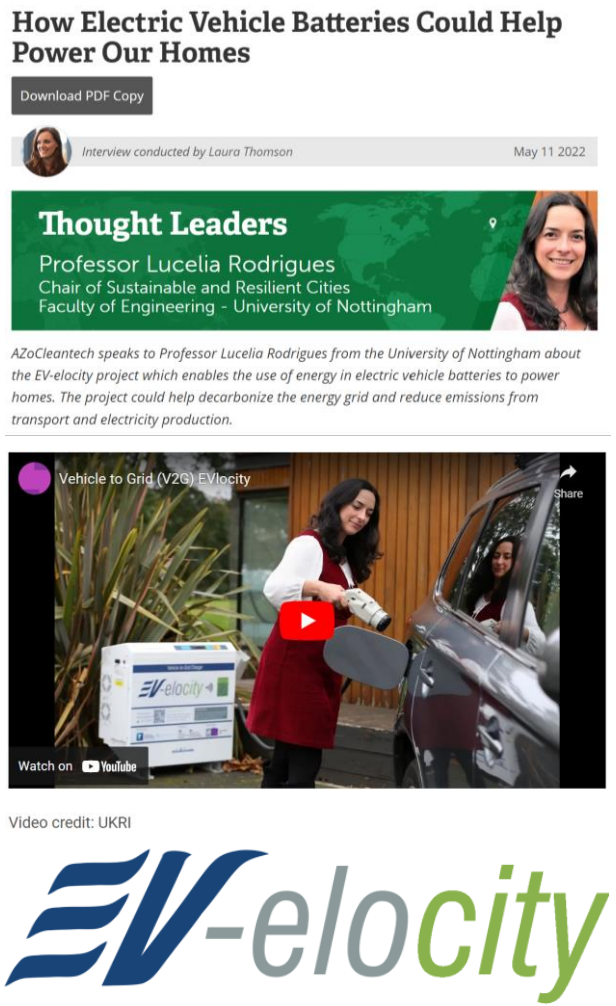
University of Nottingham
Energy Institute

What next?





To find out more…



Video credit: UKRI

- How Electric Vehicle Batteries Could Help Power Our Homes https://www.azocleantech.com/article.aspx?ArticleID=1529
- Two-way charging demo achieves EV battery care breakthrough https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/innovate-uk/two-way-charging-demo-achieves-ev-battery-care-breakthrough/
- EV-elocity https://www.ev-elocity.com/

University of Nottingham
Energy Institute

Thank you!

Lucelia.Rodrigues@nottingham.ac.uk