Electric Mobility and Smart Connected Cities

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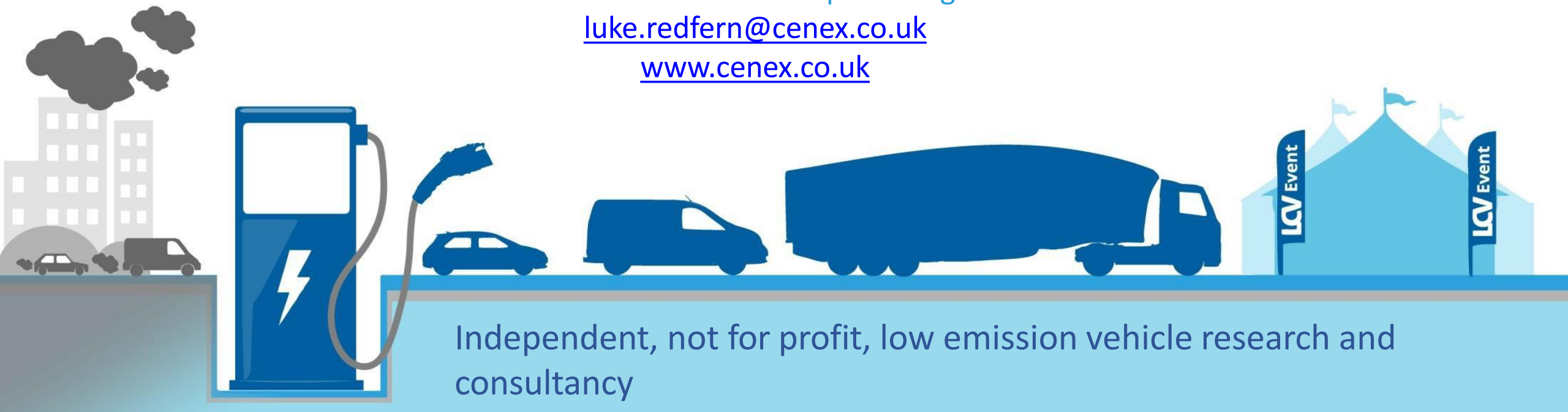

Independent, not for profit, low emission vehicle research and consultancy

Cenex Overview

- Not-for-profit independent research and consultancy organisation established in 2005.
- Specialists in low emission vehicles, associated infrastructure, energy systems and community/supply chain development.
- Operate across Europe through research collaboration and partnership working.
- Manage the UK's largest low carbon vehicle event (www.cenex-lcv.co.uk).
- Help clients to assess, validate and apply low emissions automotive strategies and technologies.

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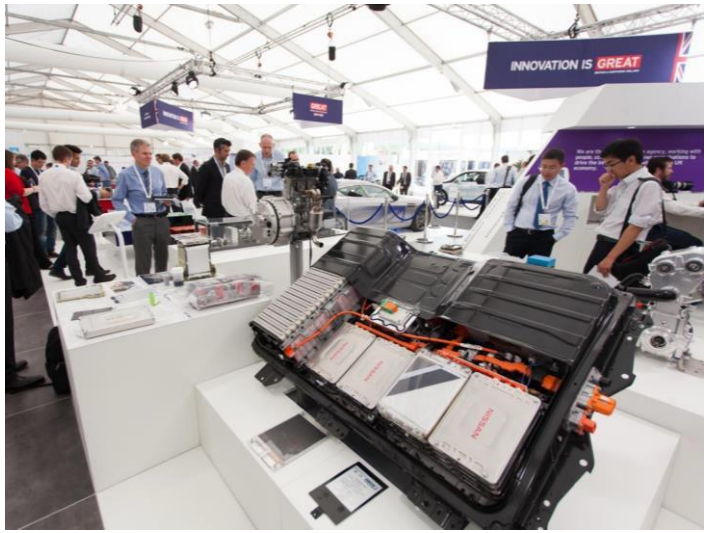
Cenex Clients

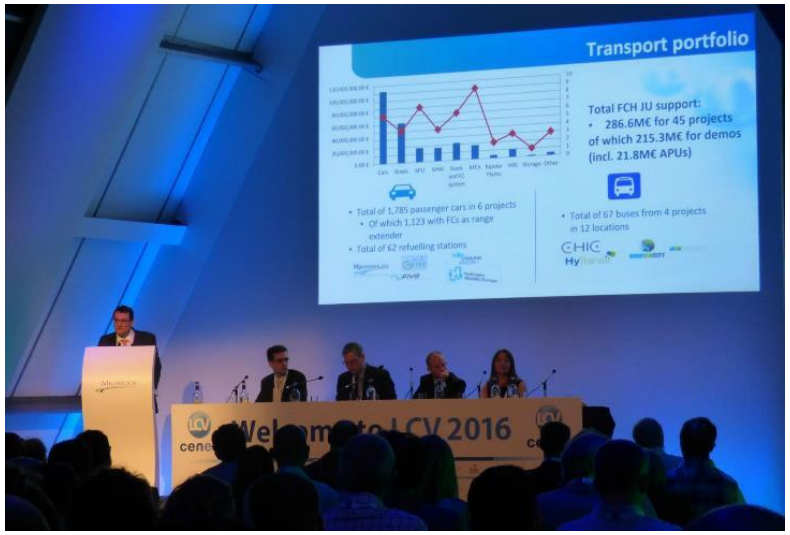
Low Carbon Vehicle Event

www.cenex-lcv.co.uk



Technology Showcase

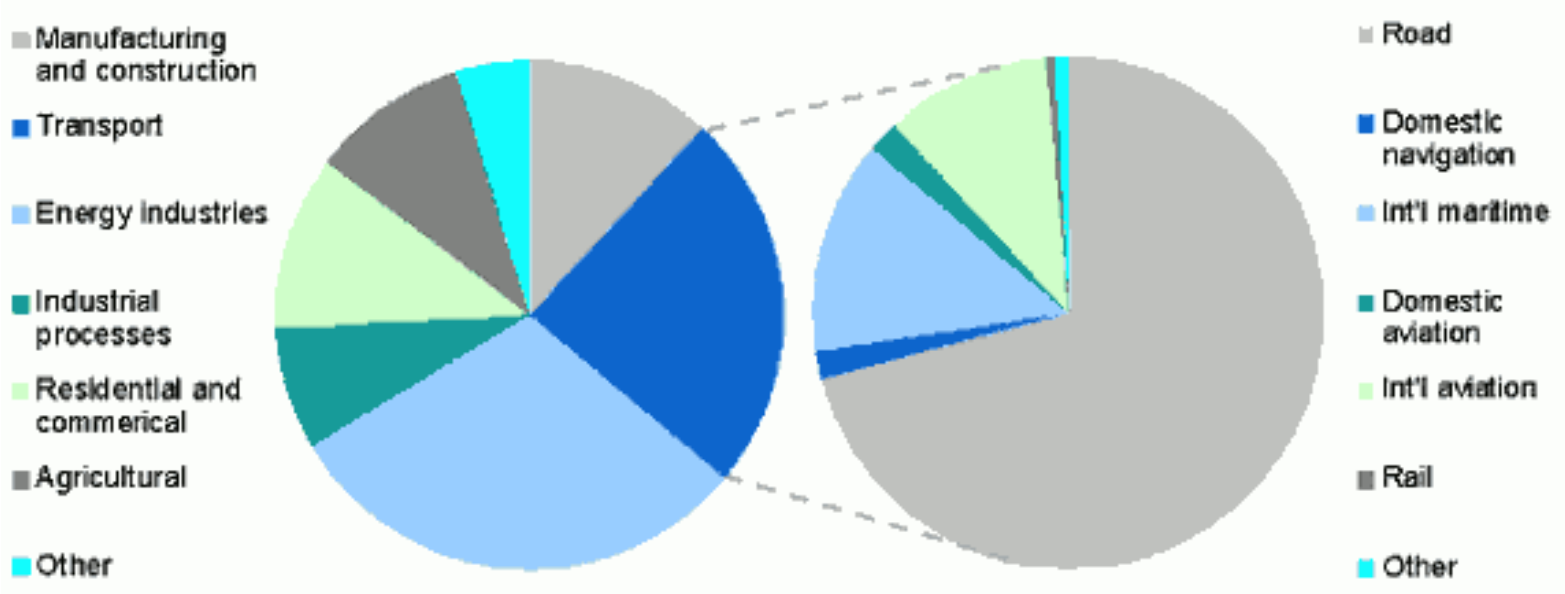
Ride & Drive



Extensive Seminar Programme

- 3,137 visitors
- 226 exhibiting organisations
- 1,180 organisations attending
- 122 vehicles

Transport emissions up 36% since 1990



Greenhouse gas emissions in other sectors decreased 15% between 1990 and 2007 but emissions from transport increased 36% during the same period. This increase has happened despite improved vehicle efficiency because the amount of personal and freight transport has increased.

Demand for goods will increase by approx. 30% between 2010 and 2030

Transport is the main contributor to poor air quality

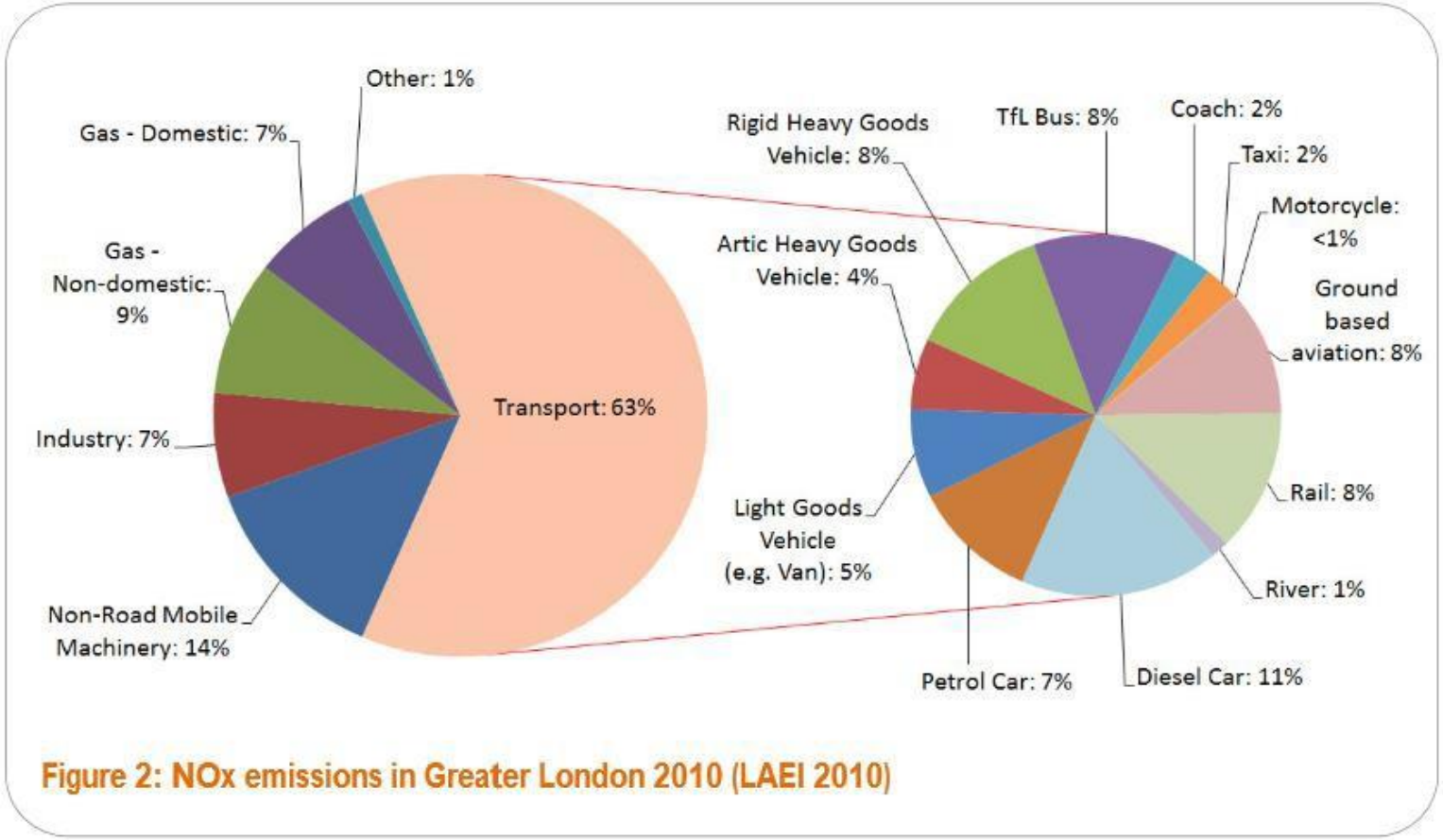


Figure 2: NOx emissions in Greater London 2010 (LAEI 2010)

Source: Transport Emissions Roadmap 2014

There is still some work to be done…

Eight carmakers on course to miss European CO2 targets

Auto industry faces fines for failing to meet EU 2021 goals, consultancy says

Californian regulators test a VW Golf for emissions last year © Bloomberg

PEUGEOT CITROËN

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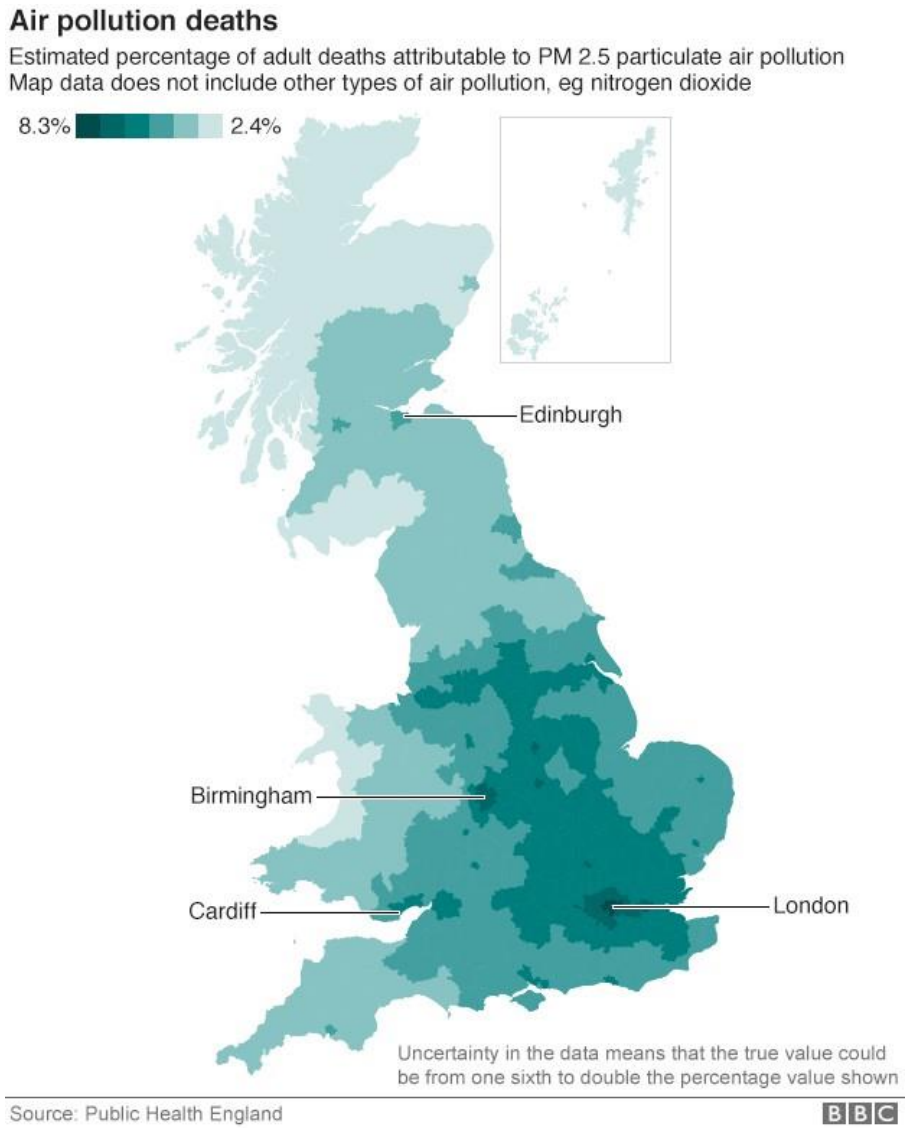
Air quality

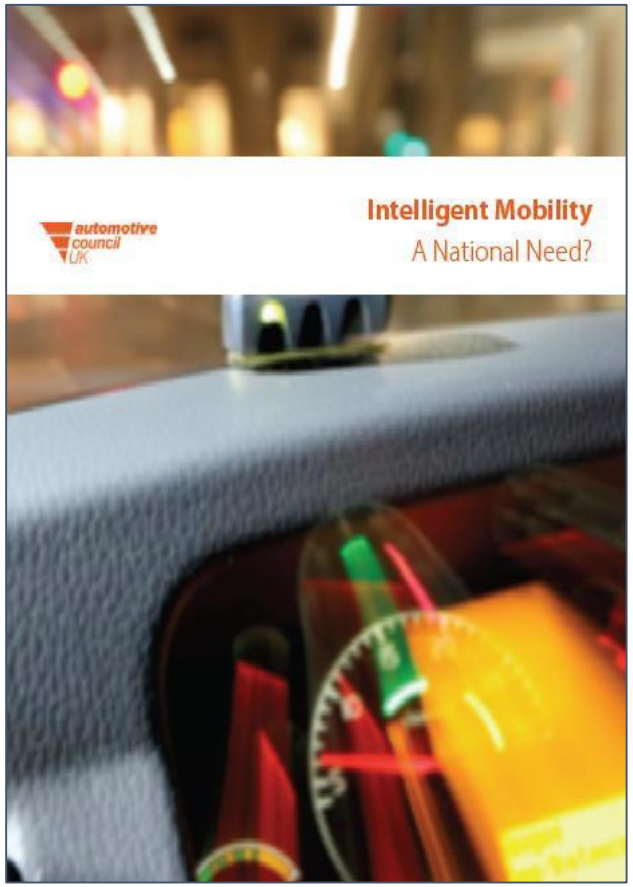
Outdoor air pollution is contributing to about 40,000 early deaths a year in the UK

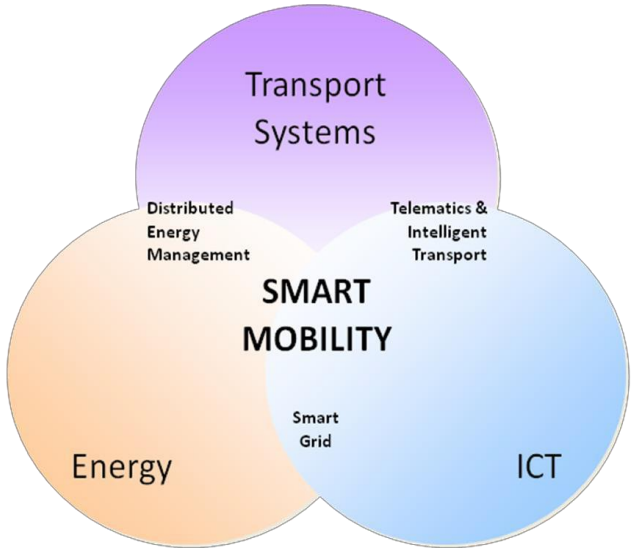
(Royal Colleges of Physicians and of Paediatrics and Child Health)



Electric Mobility and Smart Connected Cities

Intelligent Mobility, Smart Energy, Smart Cities





Electric Vehicle Context

The EV charging infrastructure?

One of the strong near-term drivers for change in the world of ITS is likely to come from the arrival of electric vehicles on our streets. With the general levels of interest in these vehicles rapidly increasing, a whole new range of customer requirements is beginning to emerge. These include:

- Online information about the location of charging points in the public domain
- Vehicle-to-Grid communication and control
- Automated billing
- Future SmartGrid vehicle interface.

Sources: www.automotivecouncil.co.uk/wp-content/uploads/2011/12/ITS_Report_15_11_11.pdf, J Murray, Scottish Enterprise, Smart Mobility Opportunity for TAE Companies, 21 Jun 2013

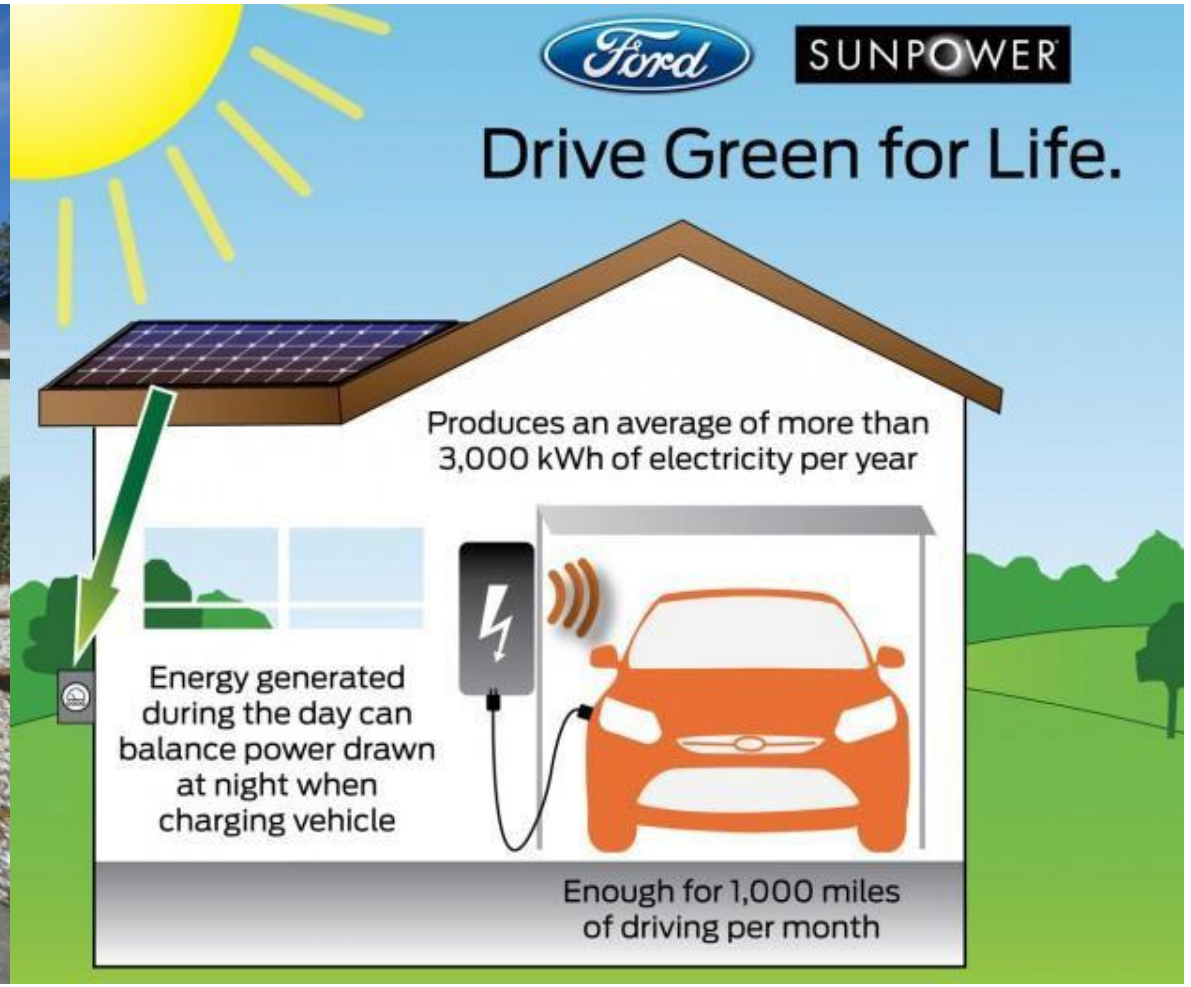
Electric cars and consumer demand

Electric cars and consumer demand

Tesla Model 3

373,000 pre-orders with $1,000/£1,000 deposit paid

Electric car and home PV



Need for Smart charging at depots to avoid cost of grid reinforcement

Electric Vehicles: The Solution?

Constraints

•Electric vehicles (EV) projected to contribute up to 60% of total new car sales by 2030.

•By 2035 EV charging could represent up to a 20GW increase in peak demand.

Opportunities

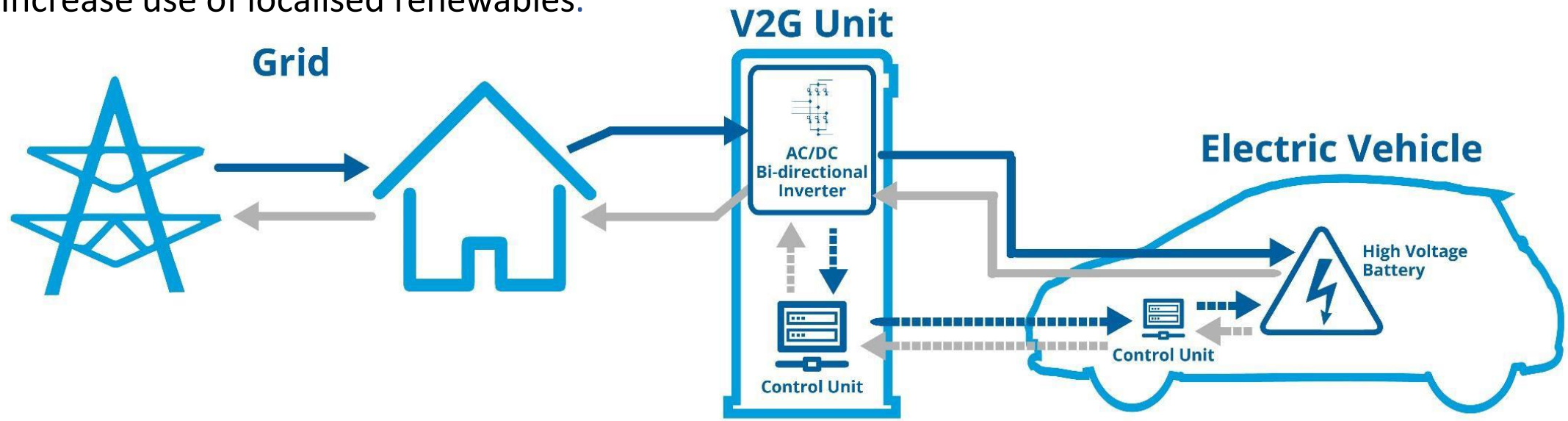
- Assuming ~16.2kWh per vehicle is available for grid support, this represents ~11.3GWh energy storage capacity by 2020.
- **But what does this mean and how does it work?**

Vehicle-to-Grid – What is it?

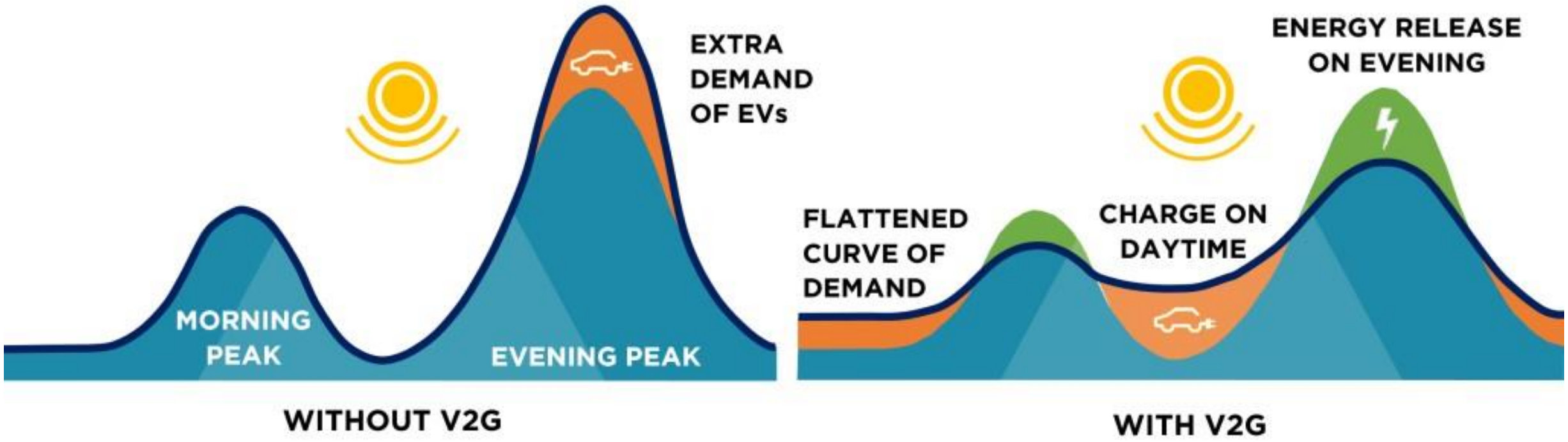
- Acts (and looks) very similar to a standard charging point.
- The difference is that energy flows both to and from the vehicle, turning it into a portable battery store.

Why is this helpful?

- Use the EV battery to provide demand shifting and reduce electricity costs.
- Supply energy to energy markets.
- Increase use of localised renewables.



Electric Mobility and Smart Connected Cities



itheca

Supported by Innovate UK Technology Strategy Board

V2G with Combined Heat and Power (CHP)

V2G supporting CHP plant at Aston University:

- The first commercial small-scale bioenergy generation with a city wide heat network.
- Implemented a control strategy to manage EV charge and discharge.
  - Charge when demand on CHP drops below viable operational threshold.
  - Discharge when demand on CHP increases above viable operational threshold.
- Shows an additional potential market for V2G at a more industrial level.

Aston University

cenex

ENGIE

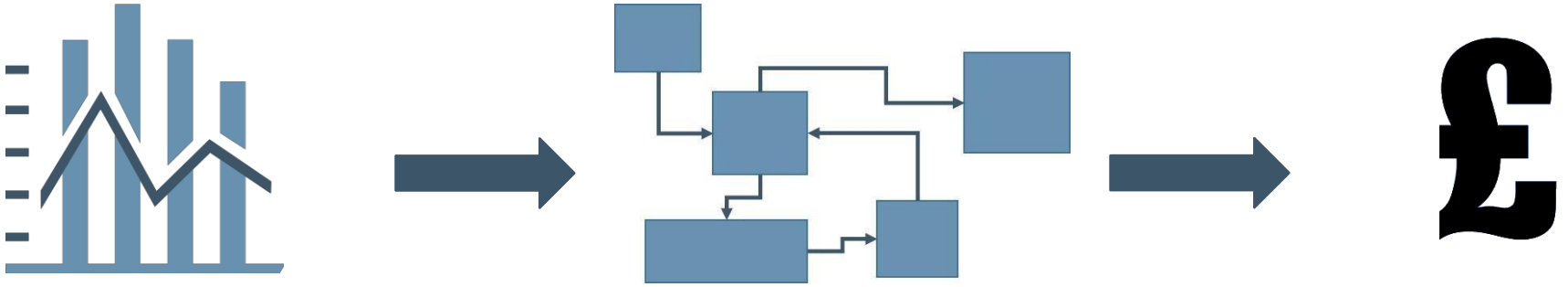
open energi

What about boats?

The houseboat increased its energy independence or, **zero Emission energy autonomy** (from 34 to 65% with V2G)

Electric Vehicle Analysis Environment (eva^e)

The V2G related element of eva^e assesses the suitability of V2G within a specific energy scenario.



Take data in:

- Vehicle journey information
- Building demand information
- Renewable generation
- Market demand

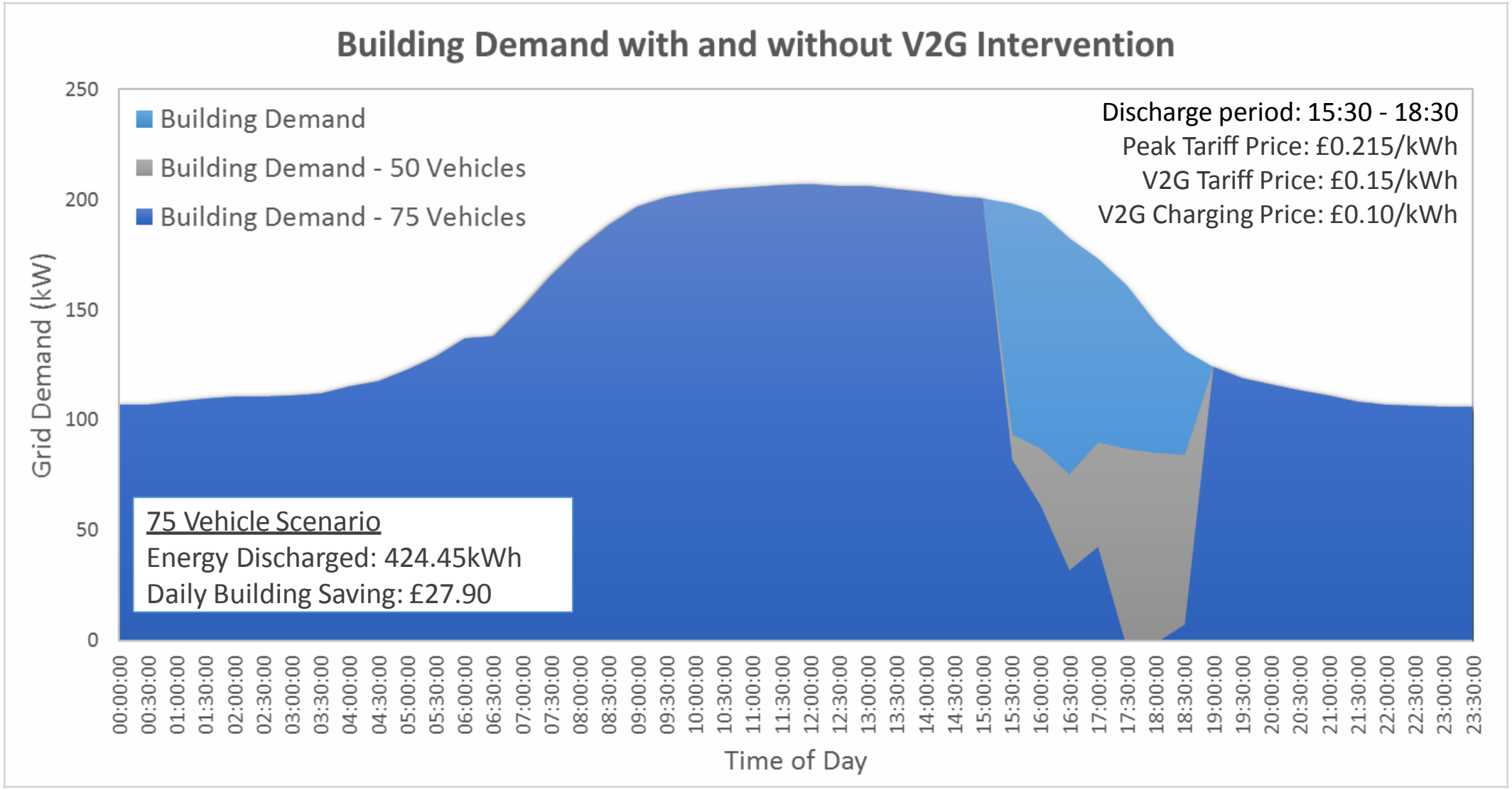
Simulate Results:

- Vehicle model
- Building model
- PV model
- Market model
- Cost model

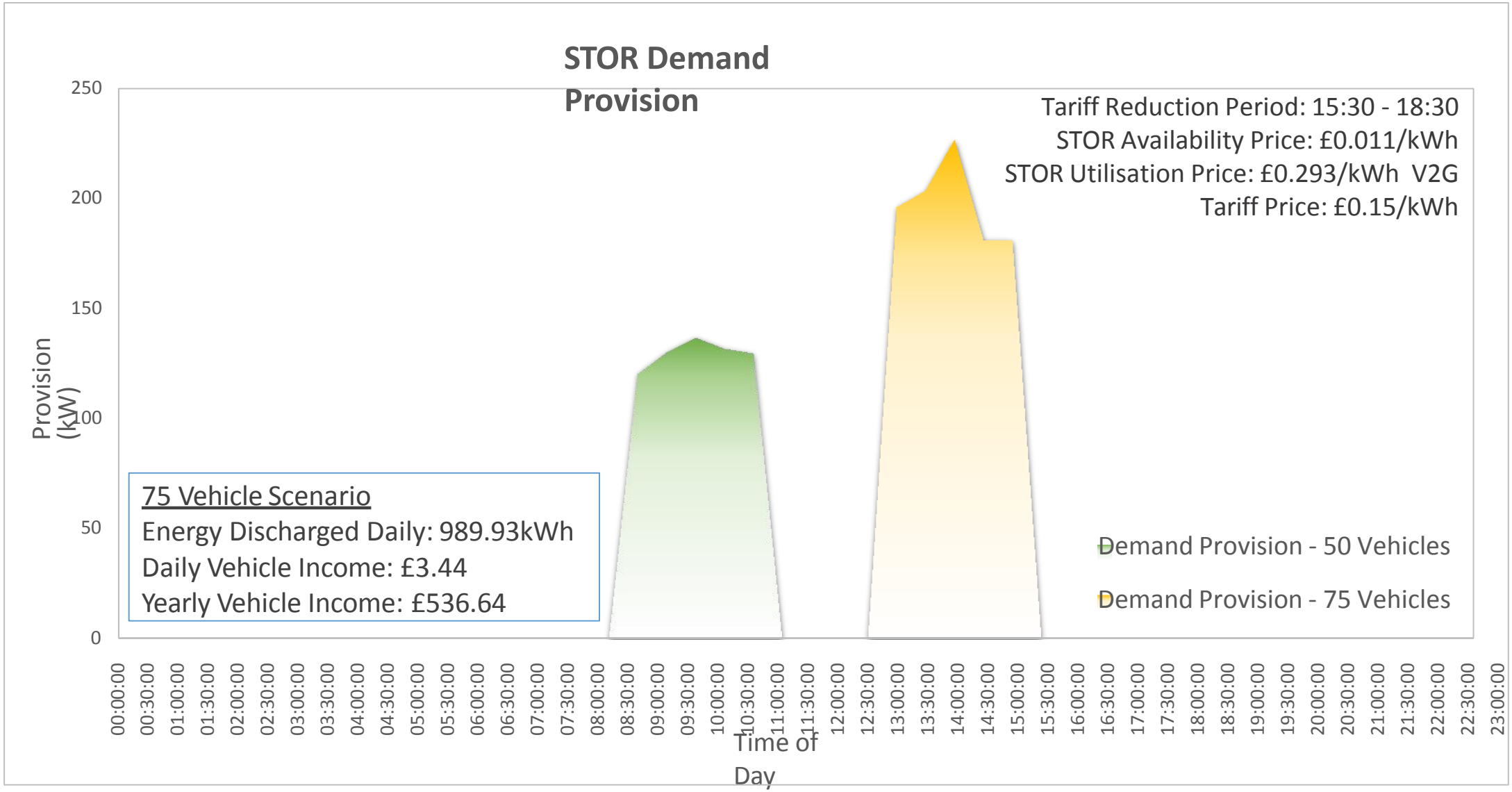
Output Cost Analysis:

- Provide output summary relating to building, vehicle and market economics

Time of Use Building Demand Reduction



Using your vehicle as an income stream

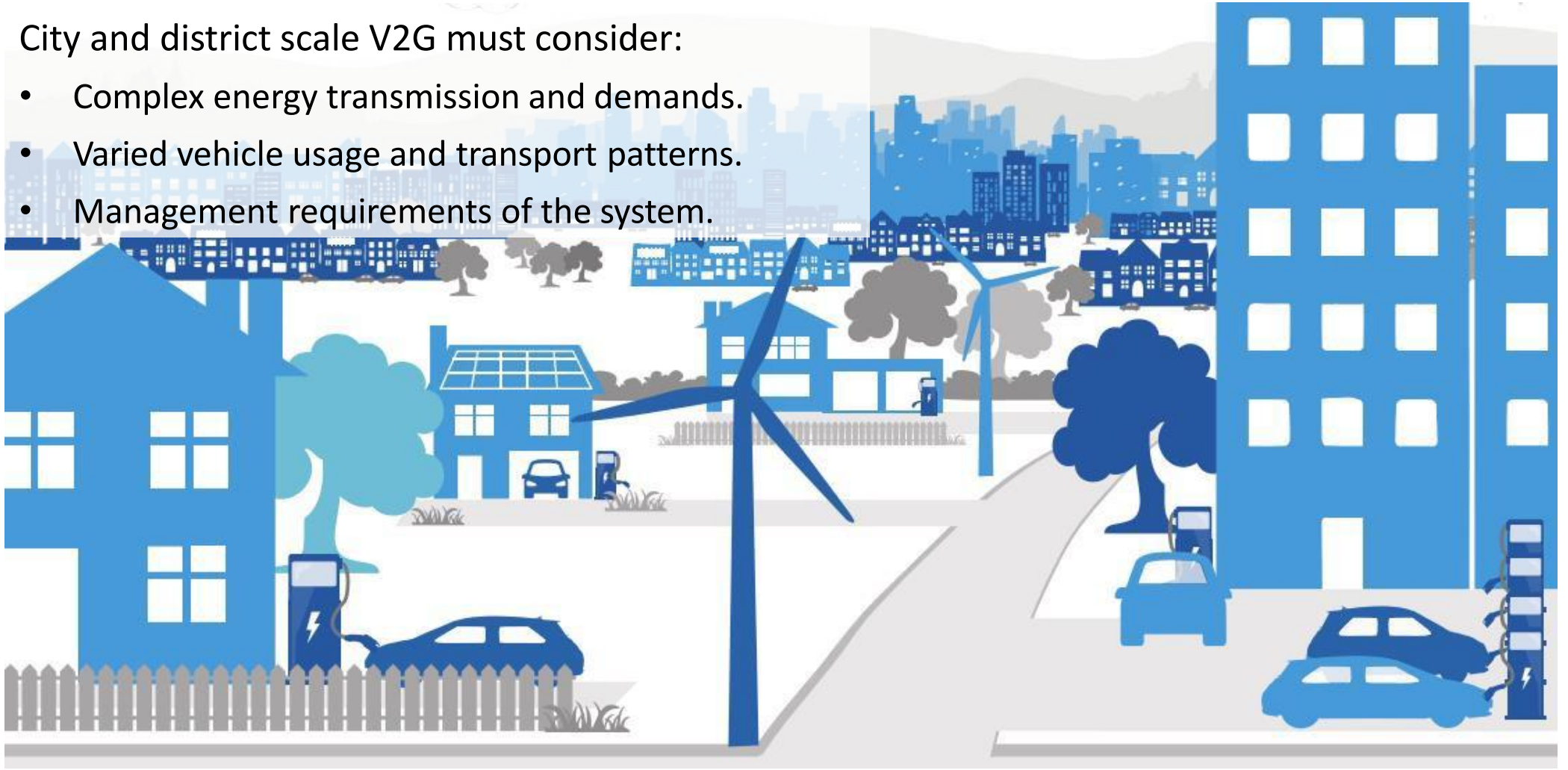


City Scale Vehicle-to-Grid

Smart Mobile Energy

City and district scale V2G must consider:

- Complex energy transmission and demands.
- Varied vehicle usage and transport patterns.
- Management requirements of the system.



Robin Hood - Integrated multi model E-mobility and Green Energy

Nottingham City Council

RobinHoodenergy
A not for profit company

ROBIN HOOD
PAY AS YOU GO TRAVEL

Thank you for listening

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