Vehicle-to-Grid Innovation Projects

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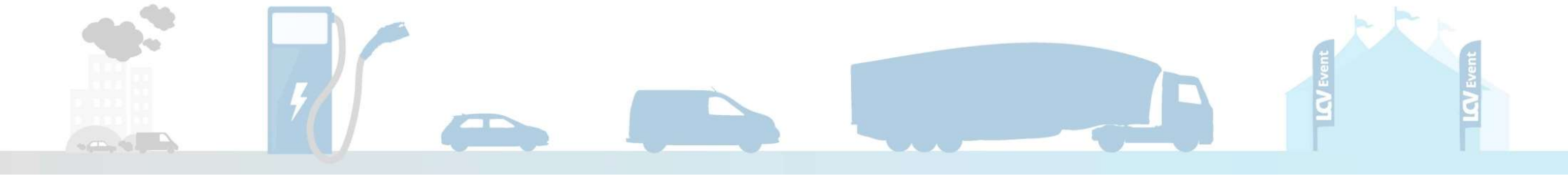
Independent, not for profit, low carbon technology experts

Presentation Overview

1. V2G research projects – EFES and ITHECA
2. Assessing the business case for vehicle-to-grid
3. Vehicle-to-Grid support case studies
4. Where next?



Electric Vehicle Overview

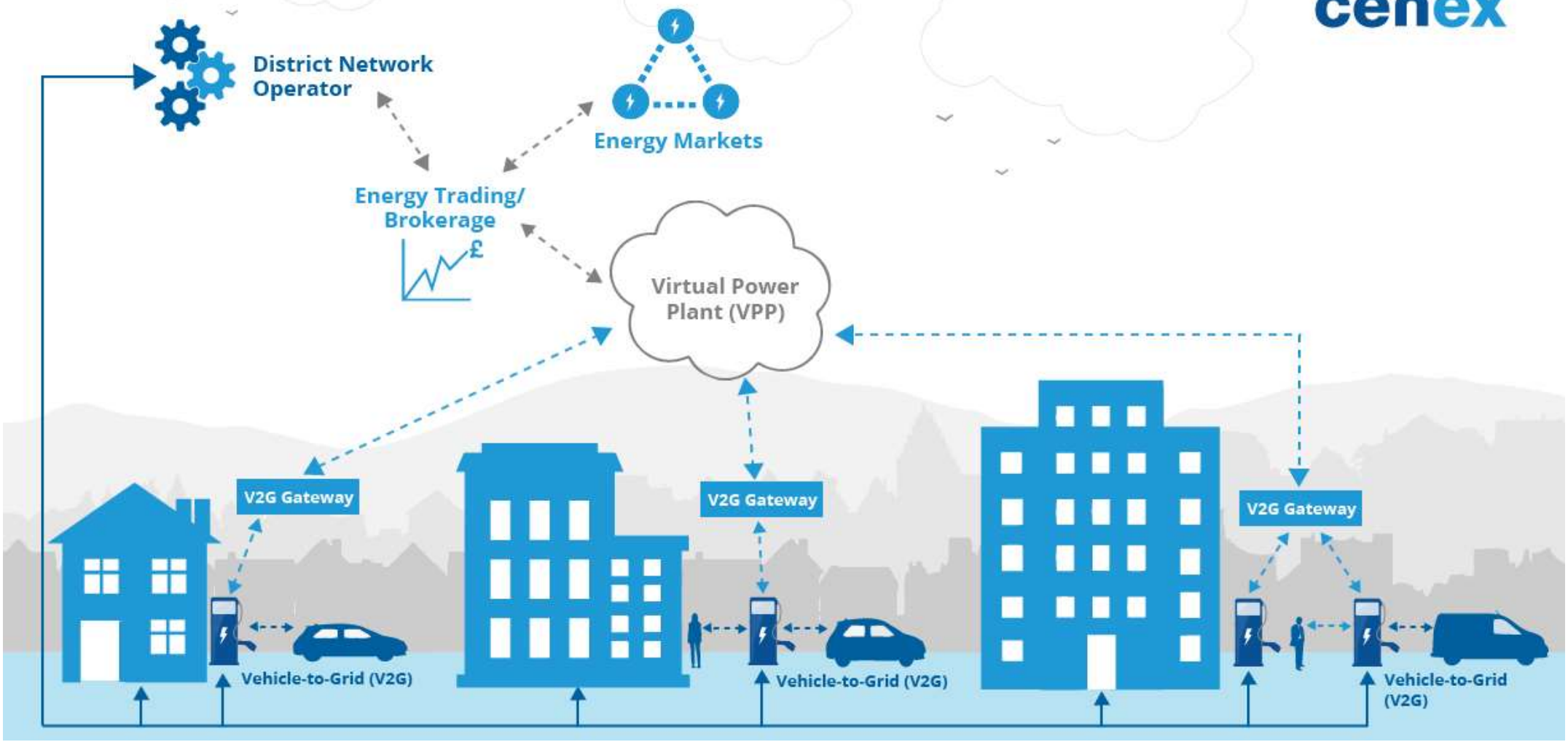
Constraints

- Electric vehicles (EVs) are 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?**

Ebbs and Flows of Energy Systems (EFES)



Vehicle-to-Grid Innovation Projects

Ebbs and Flows of Energy Systems (EFES)

Development of three key technologies:

- Virtual Power Plant (VPP)
- Vehicle-to-Grid (V2G) Unit
- Vehicle-to-Grid Gateway

Other work within the project includes;

- Stakeholder analysis
- Scenario feasibility evaluation
- Business case exploration

Partners

Sub-Contractors

Advisory Board

Vehicle-to-Grid Innovation Projects

Intelligent Transport, Heating and Electrical Control Agent (ITHECA)

Project demonstrates several key technologies:

- The first commercial small-scale bioenergy generation with a city wide heat network.
- Vehicle-to-grid (V2G) infrastructure in supporting intelligent localised energy systems.
- The increasingly important role of localised energy systems in supporting the traditional energy system through demand side grid management.
- Integrate the project innovations into an intelligent control agent that will continuously maximise the system efficiency, service and profit.

Aston University

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ENGIE

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Electric Vehicle Analysis Environment (eva^e)

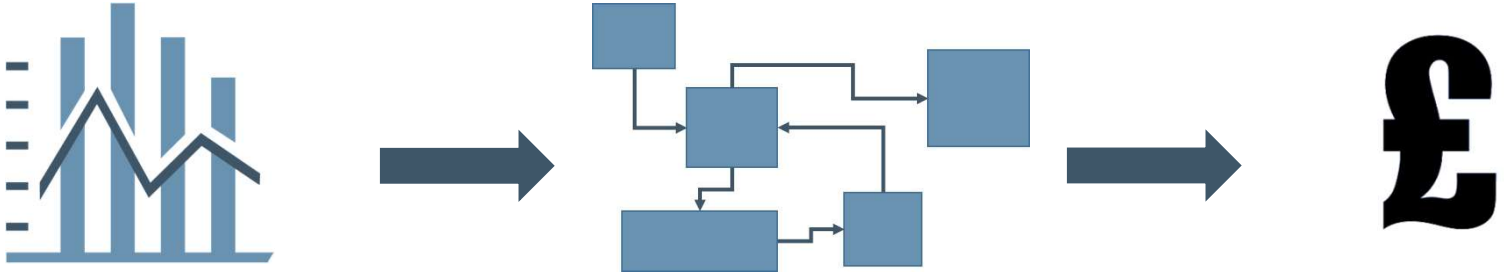
eva^e is a Matlab based simulation tool developed in-house by the technical team at Cenex.

The software tool has three key elements of functionality:

1. Journey summaries tool – data collected from vehicle telemetry, standard charge post data and V2G system data is automated and summarised into tables for further analysis.
2. Economic analysis tool – this is the V2G energy scenario feasibility element of the software. Using the data summaries from part 1, the data can be analysed through a number of EV/ V2G support scenarios.
3. EV battery analysis tool – (still under development) provides optimised battery usage data for V2G operation that is then fed into the economic analysis tool. This allows for greater understanding of the impact V2G operation will have on battery degradation.

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 (from journey trip summary element of eva^e)
- Building demand information
- PV 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

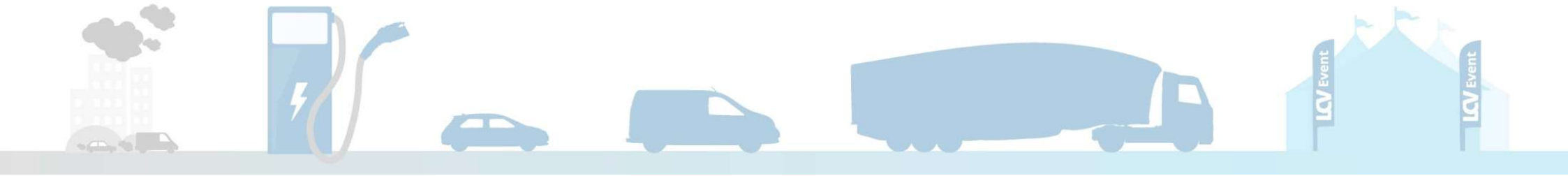
eva^{e} Energy Scenario Evaluation

The software can evaluate the following potential support scenarios:

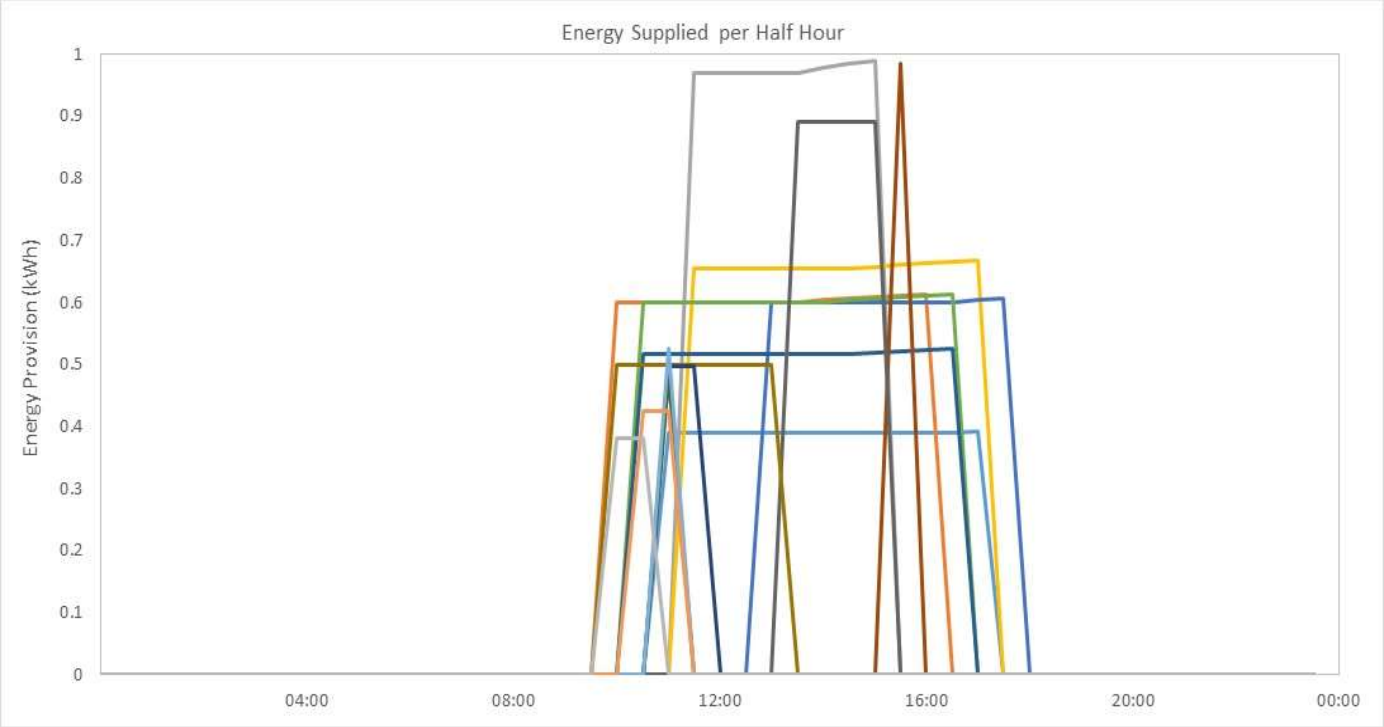
1. Building peak shaving to reduce overall demand.

2. Building time of use tariff demand reduction.

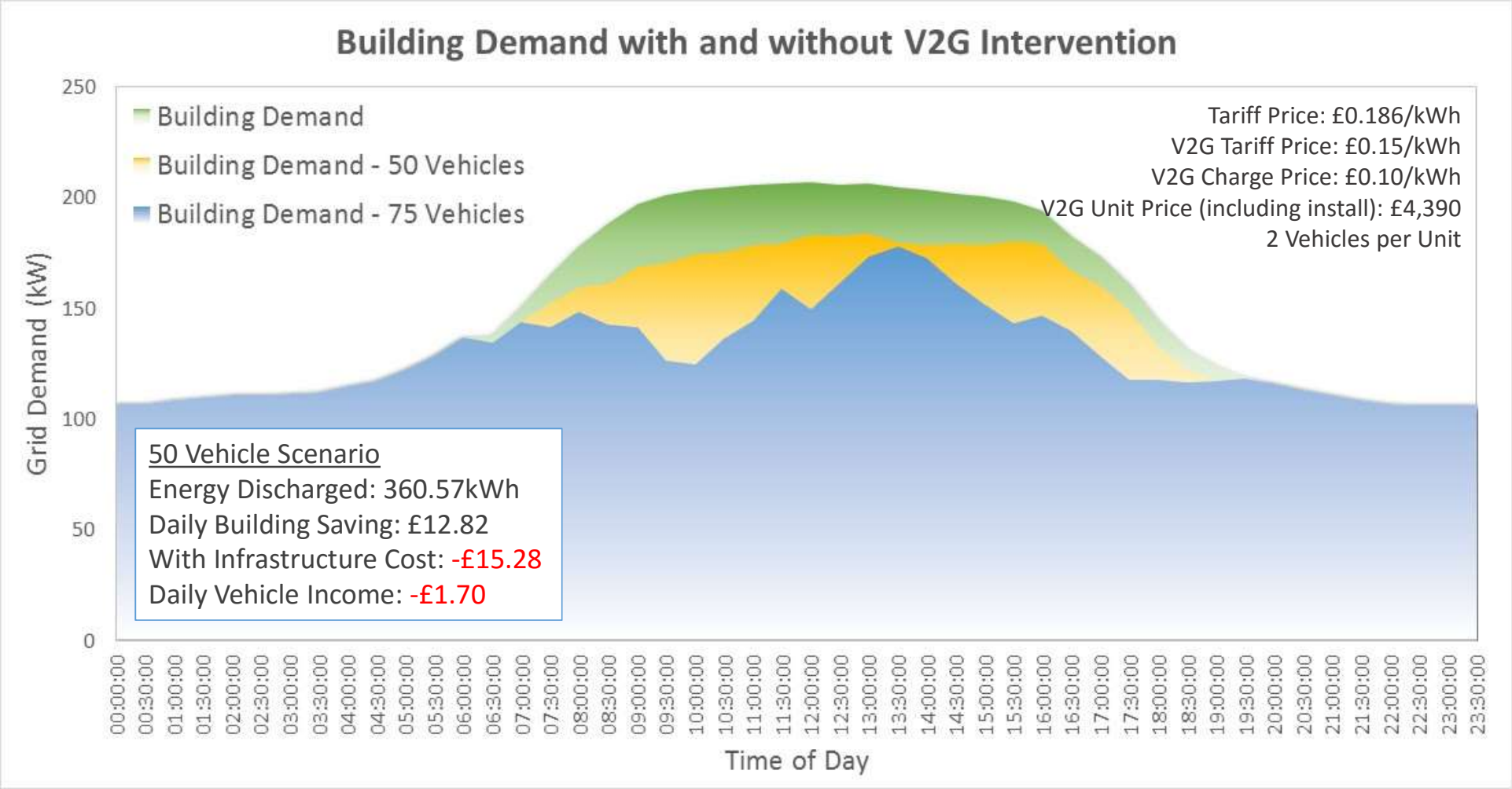
3. Vehicles discharge when called upon for energy market support such as Short Term Operating Reserve (STOR) or the Capacity Market.



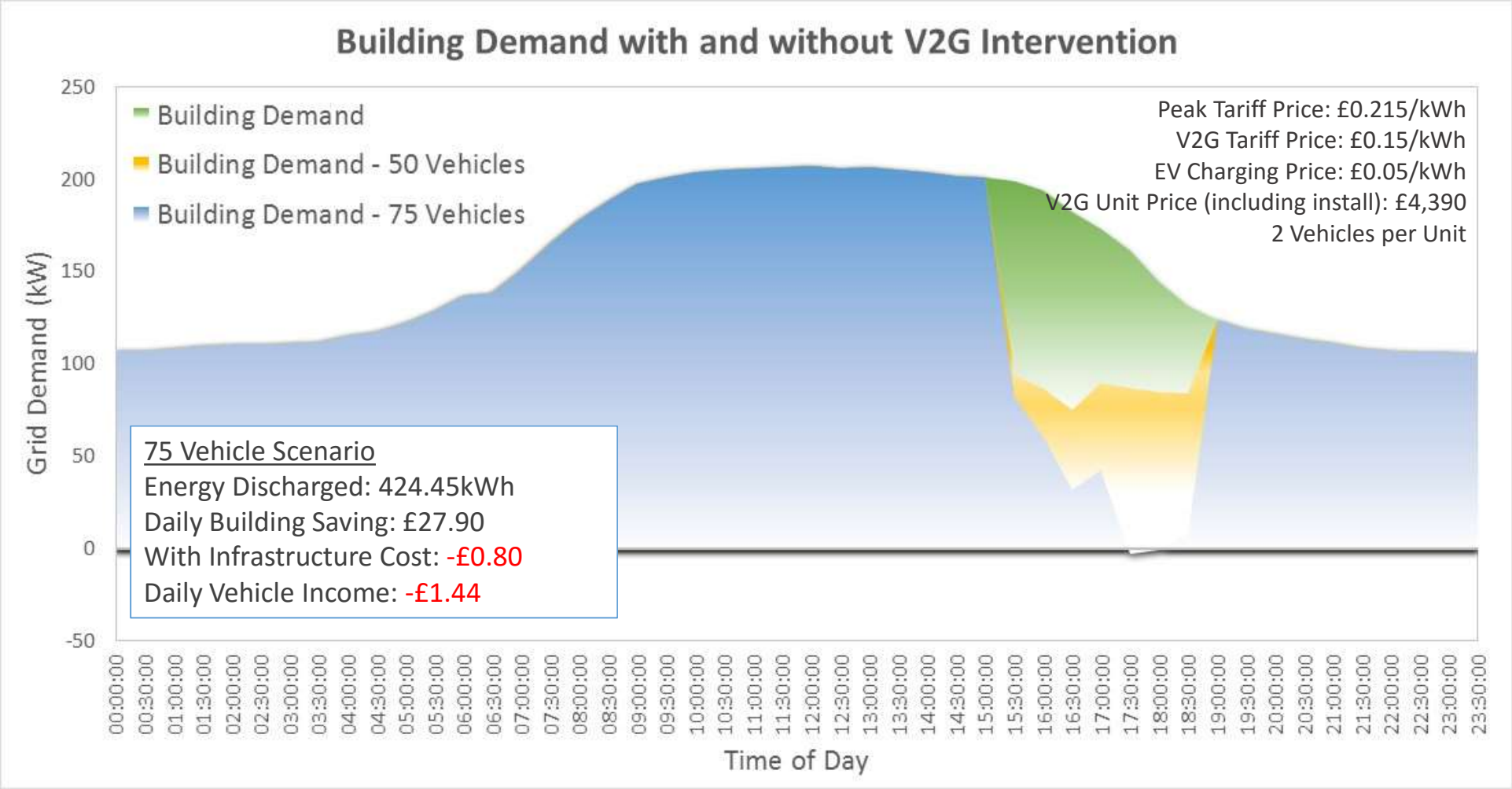
eva^{e} Energy Scenario Evaluation



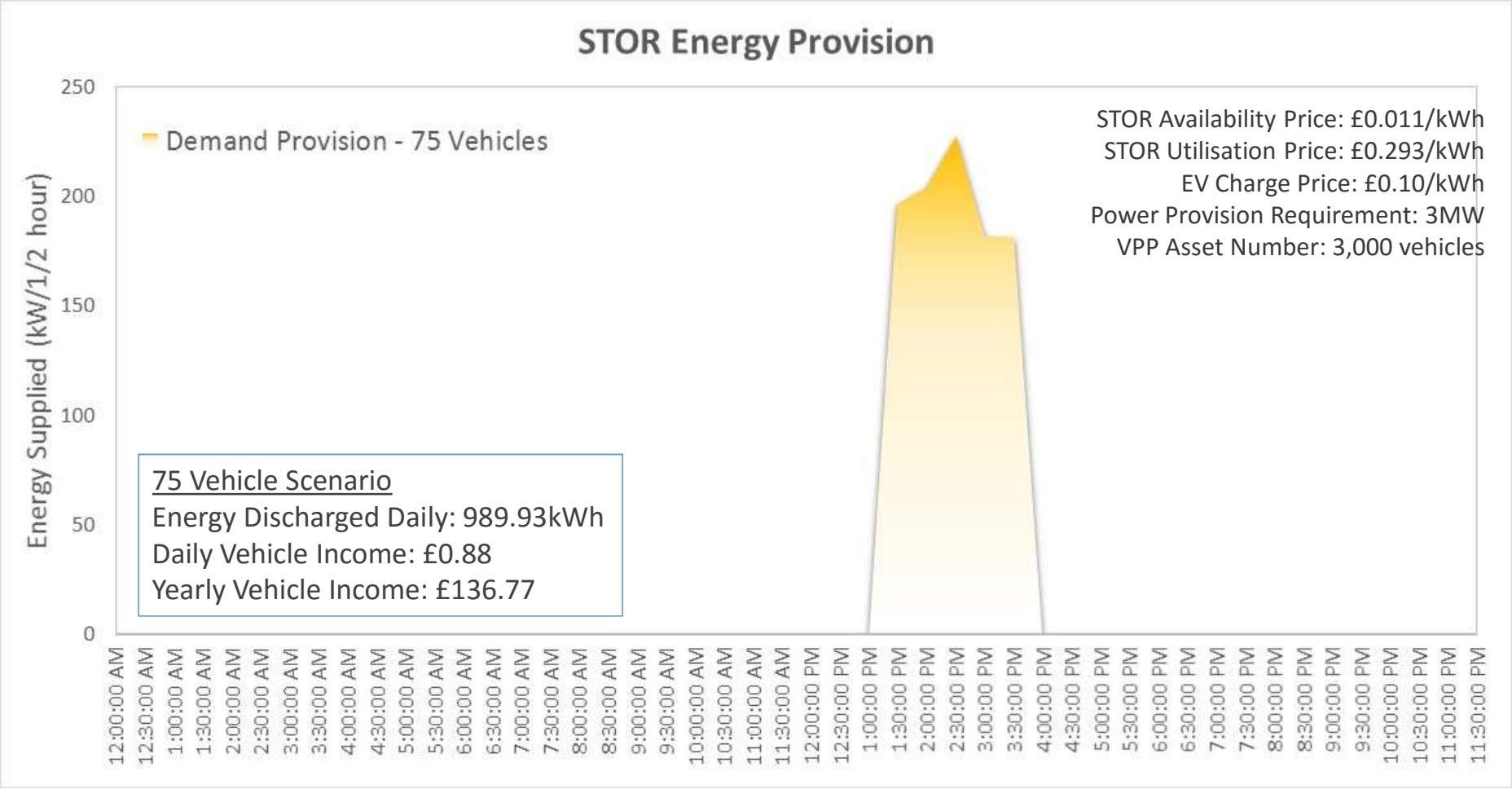
Scenario 1: Building Demand Reduction



Scenario 2: Time of Use Tariff Demand Reduction

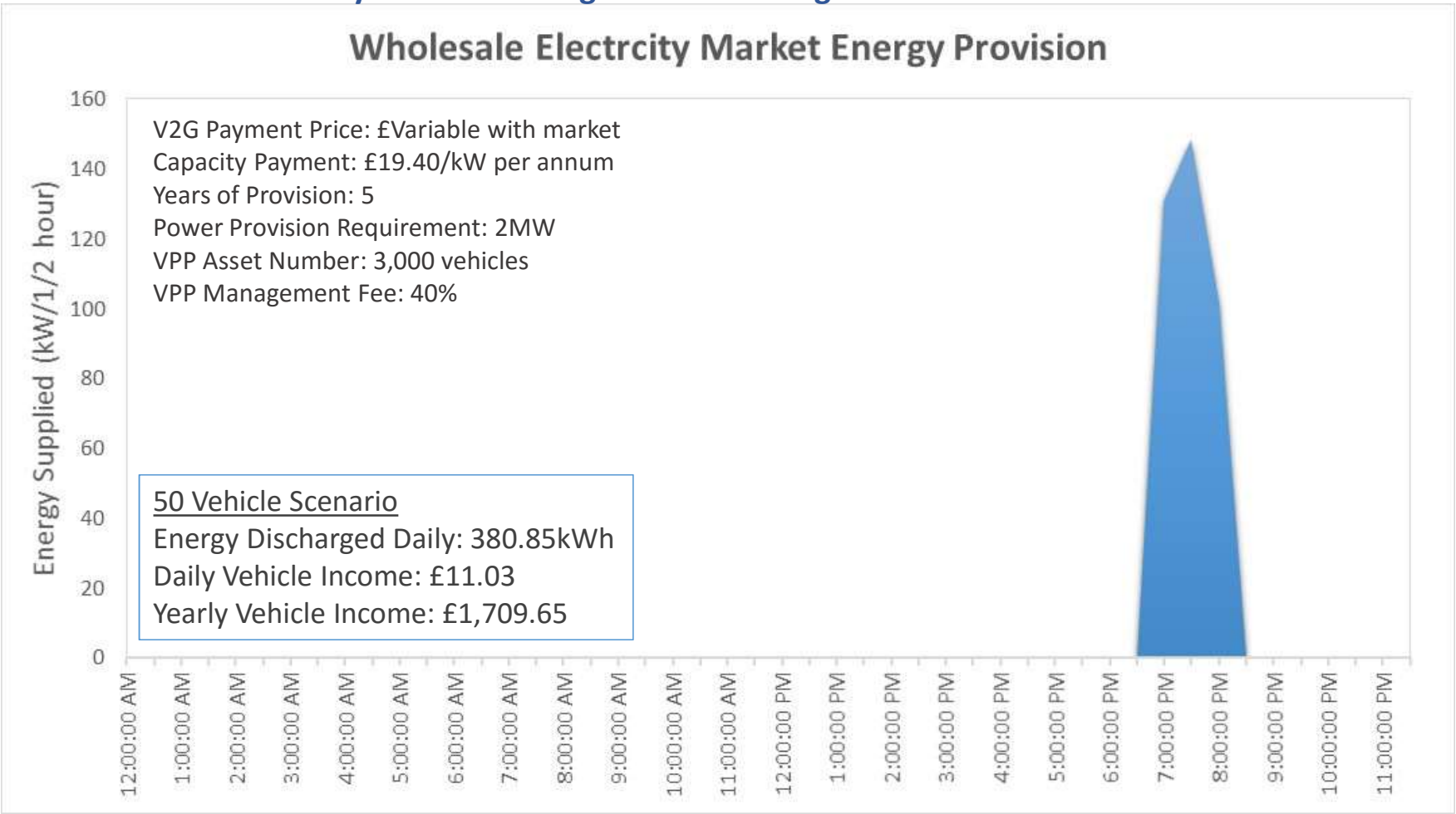


Scenario 3: STOR in collaboration with VPP management

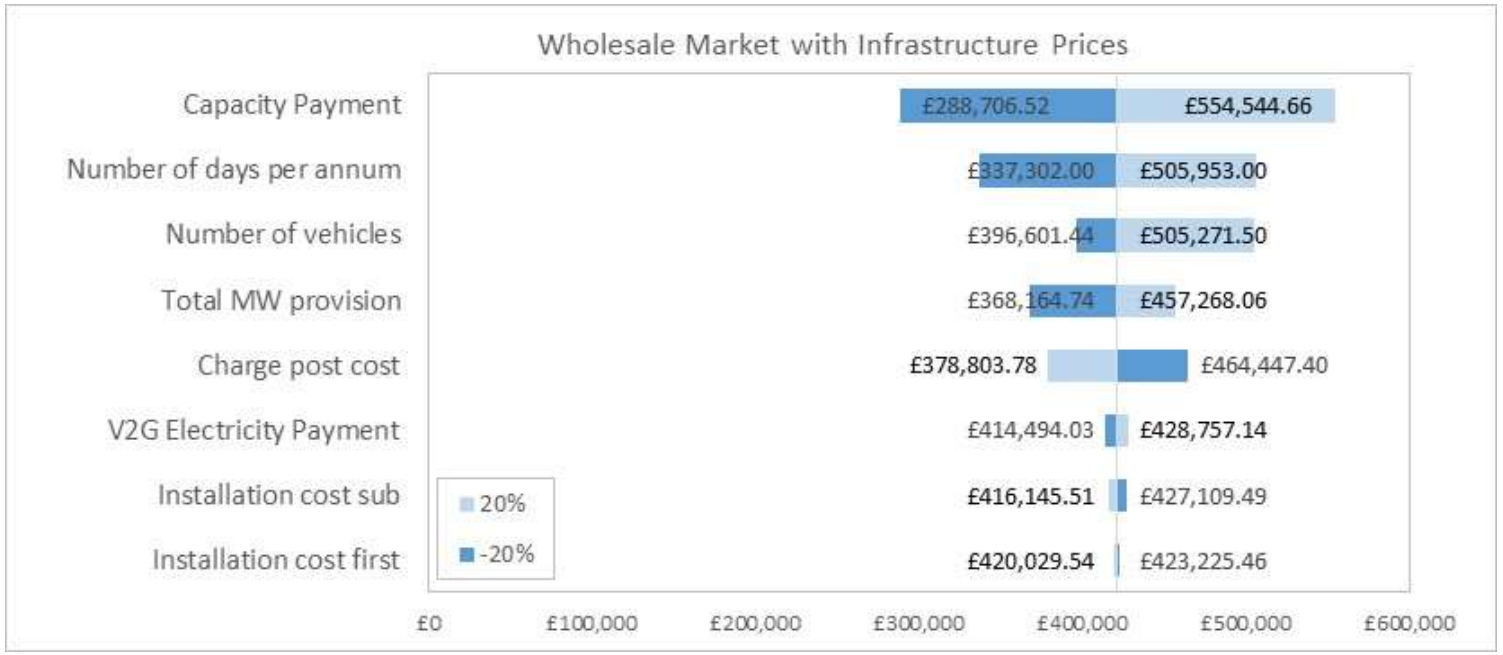


Scenario 3: Capacity Market

with Wholesale Electricity Market Trading and VPP management



Net Present Value Sensitivity Analysis

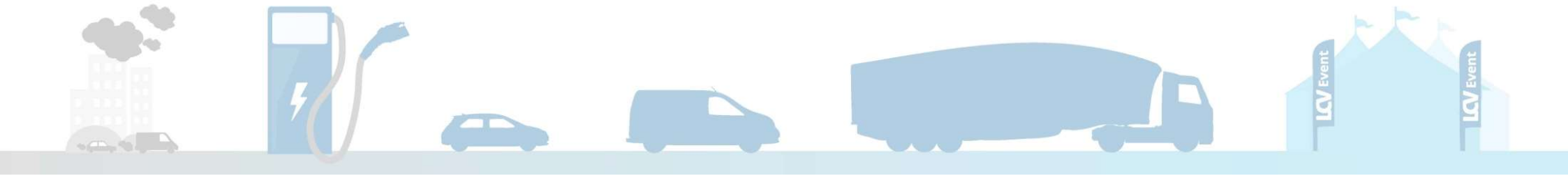


Additional Analysis Functionality

- In addition to the scenario analysis demonstrated here, the analysis environment can also perform the following additional scenarios;
  1. Buildings with PV. Charge the vehicles during periods of excess PV generation and discharge during a time of use tariff.
  2. Capacity market. Operates similarly to the STOR model but follows Capacity Market requirements.

- The minimum required infrastructure costs to ensure the building receives a profit.

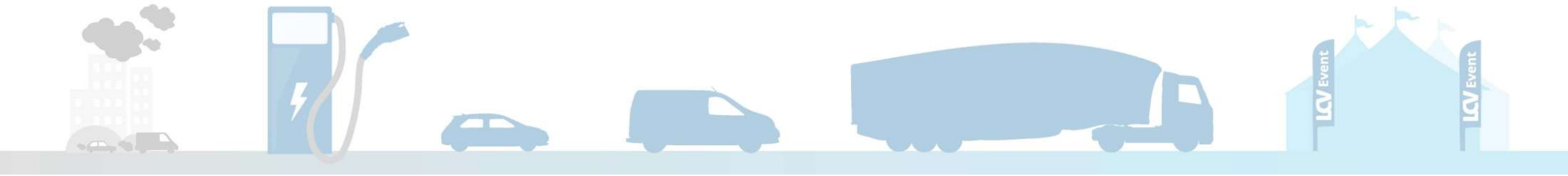
- The minimum tariff required by the vehicle to break even.



Where Next?

The success of electric vehicles in providing the support options demonstrated here is dependent upon a few key areas:

1. EV uptake must increase in order to meet the minimum demand requirements for STOR and the Capacity Market.
2. Evaluation of the impact V2G has on the lifetime of the battery.
3. Cost of the technology must reduce.
4. Payment tariffs for EV users/ owners must be adequate in order to facilitate buy-in.
5. Opportunities for other energy markets such as FFR



Thank you for listening

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