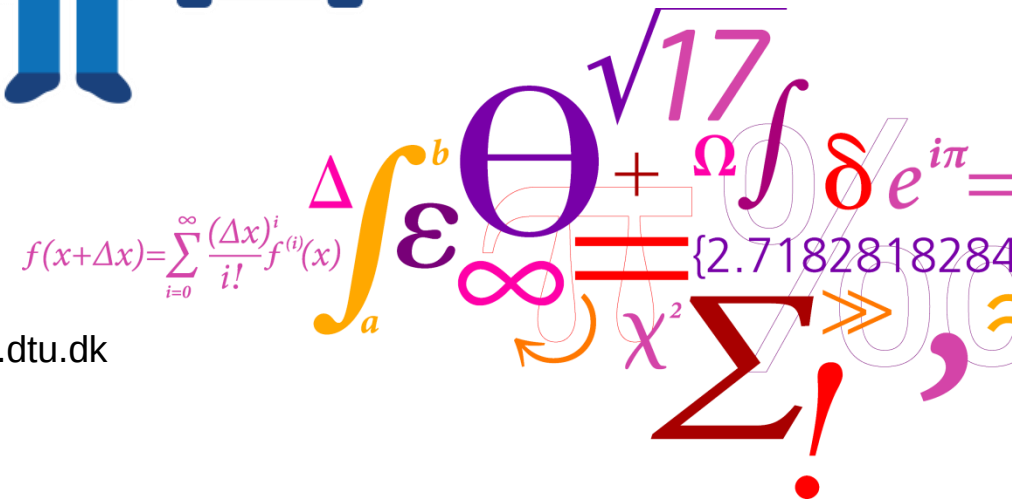
THE PARKER PROJECT –
GRID INTEGRATED ELECTRIC VEHICLES

***European Utility Week**, Amsterdam, 2017*



Peter Bach Andersen

PhD, Senior scientific researcher, pba@elektro.dtu.dk

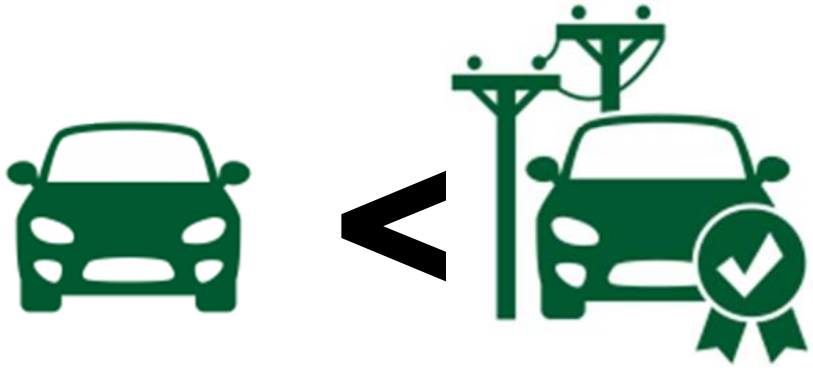
DTU Electrical Engineering

Department of Electrical Engineering

ELECTRIC VEHICLE LAB

PowerLab DK

- **Electrification** a new demand for power and energy.
- **Grid integration** *active support of the power system*



Grid Integrated Electric Vehicle (GIV):

A vehicle that, together with its supply equipment, is **purposely designed** with **capabilities and performance** allowing for advanced **grid services**

parker

Thomas Parker, 1843 – 1915

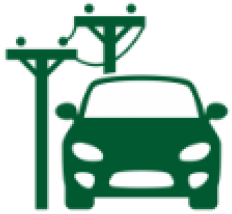
Demonstrate that **contemporary** electrical vehicles can participate in **advanced** smart grid services.

Partners: Nissan, Mitsubishi Corporation, Mitsubishi Motors Corporation, PSA ID, NUVVE, Frederiksberg Forsyning A/S, Insero A/S, Enel and DTU.

Duration: August 2016 to July 2018.

Budget: Two million euros, funding by ForskEl

A close cooperation with vehicle and EVSE OEMs



Grid Applications

Explore and **demonstrate** new EV services using state-of-the-art vehicles and chargers.

Grid Readiness Certificate

A **Common definition** of technical capabilities needed to support services

Scalability and replicability

Understand scalability in terms of system and market impacts and **replicability** across users and regions.

Grid Applications

The act of altering the **timing**, **size** or **direction** of the **power and energy** exchanged between the **battery** and the **grid**.

- **Frequency containment**
- **Voltage support**
- **Emission reduction**
- **Stacked services**

Lab

- ✓ Cross-brand technical feasibility
- ✓ Battery usage

Field Pilot

- ✓ User patterns
- ✓ Technical/economic barriers

Grid Readiness Certificate

1. Grid Keys

Controllability
+
Performance
+
Observability

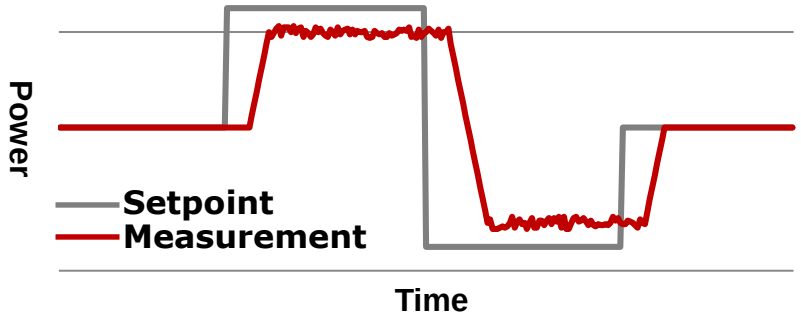
Active power

Reactive power

Grid formation

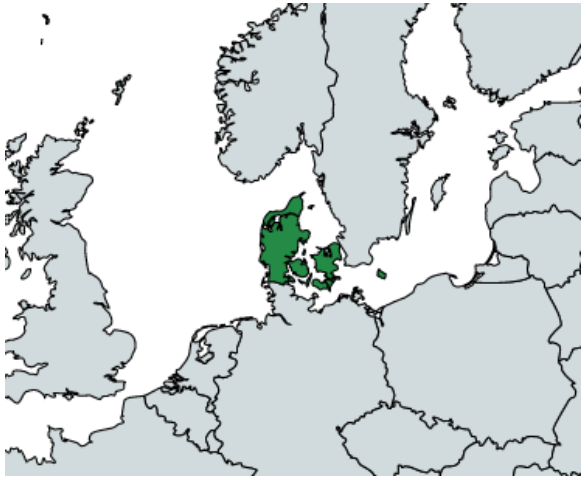
- Emission reduction
- Frequency containment
- …
- Voltage support
- …
- Vehicle-to-Building
- Vehicle-to-Tools
- …

2. Test



3. Evaluation

Scalability and replicability



Scalability

- Market volume analysis
- Power system impact
- Market barriers

Replicability

- Markets and services
- User segments
- Standards and charging options

Worlds first V2G hub

Photo: Nissan DK

Frederiksberg Forsyning

- Utility company – domestic gas, tap water, district heating and sewage
- Approximately 100.000 Residents
- Part of greater Copenhagen

Partner:

NUVVE

NISSAN Innovation that excites

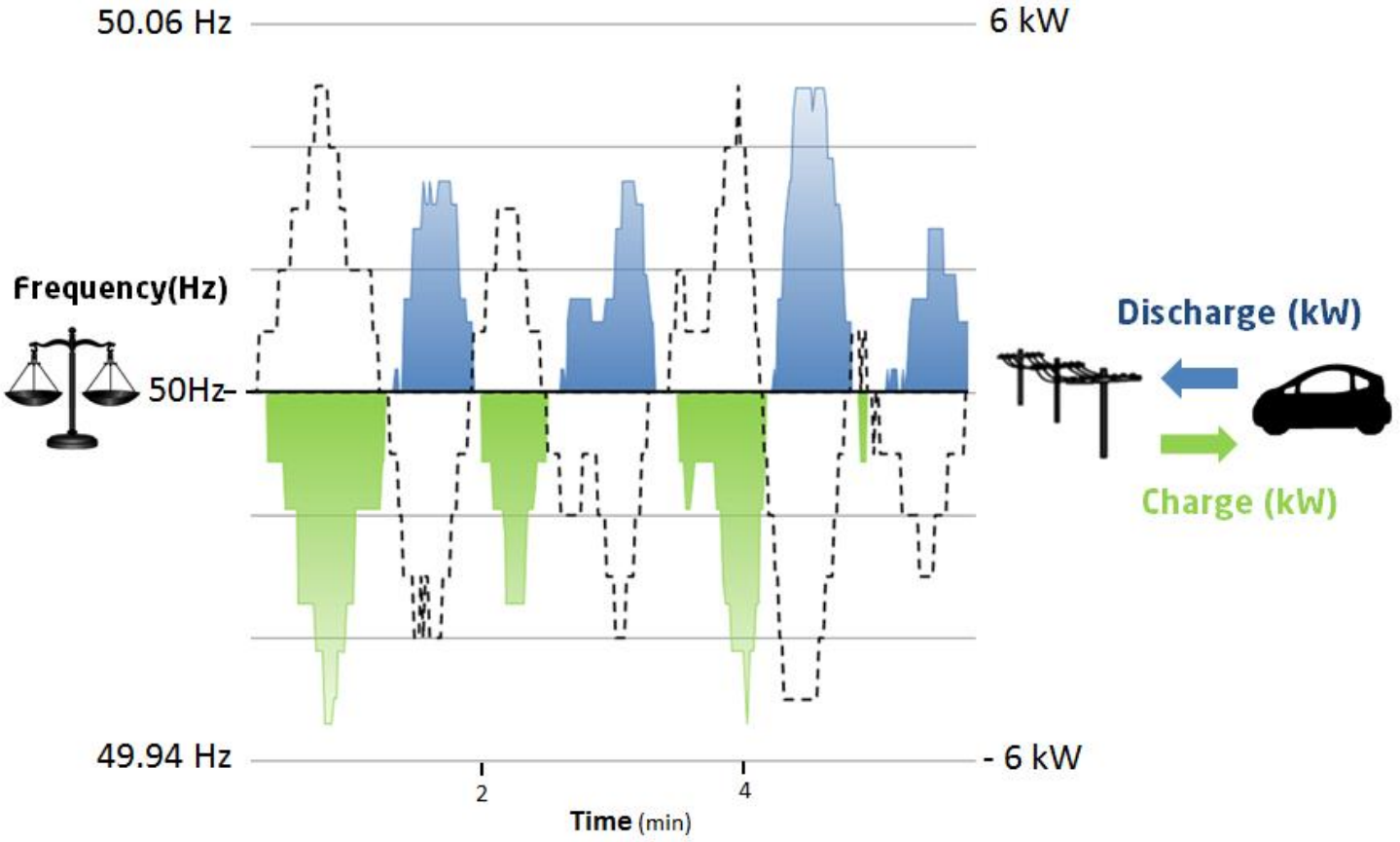
enel

Services – Frequency regulation

Photo: Nissan DK

- 10x Nissan eNV200 electric Vans
- 10x ENEL V2G units (bidirectional 10 kW)
- Used mainly for maintenance and service tasks.
- Usage hours = Work day 7 AM – 4 PM

Services – Frequency regulation



Current DK challenges
(and how they can be overcome)

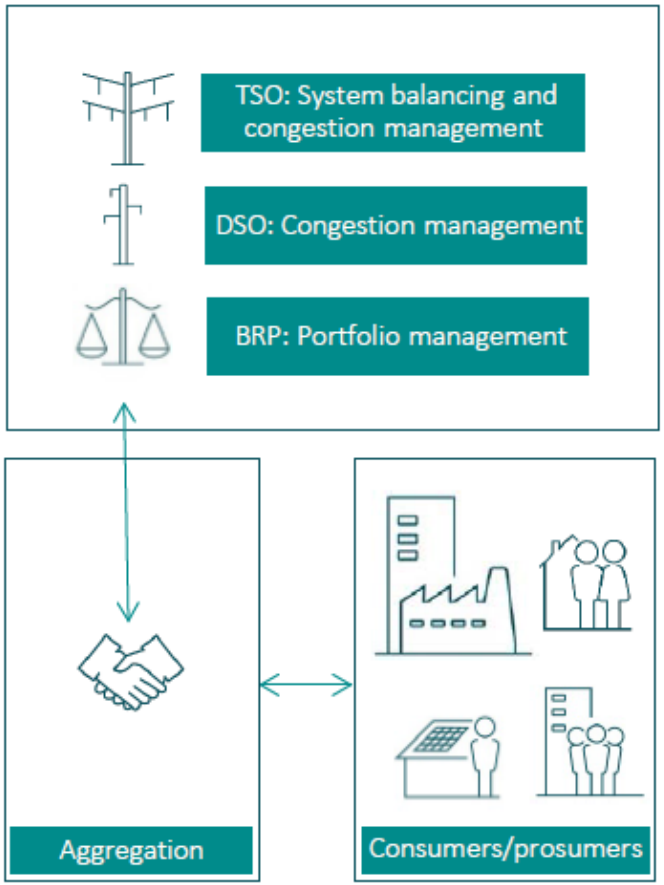
Challenge	Action
Energy tariffs and taxation	Differentiate between energy used for driving and energy used for services.
Requirement for settlement meters	Consider a whitelist for EVSE meters approved for settlement
Frequency energy bias	Allow dynamic operation points or relaxation periods for storage based providers
Two-way energy loss	Technical improvements
Battery degradation	Technical improvements
Market model for aggregators	New market models that define the aggregator role and grant equal access to markets.

Current market solution

Workgroup:

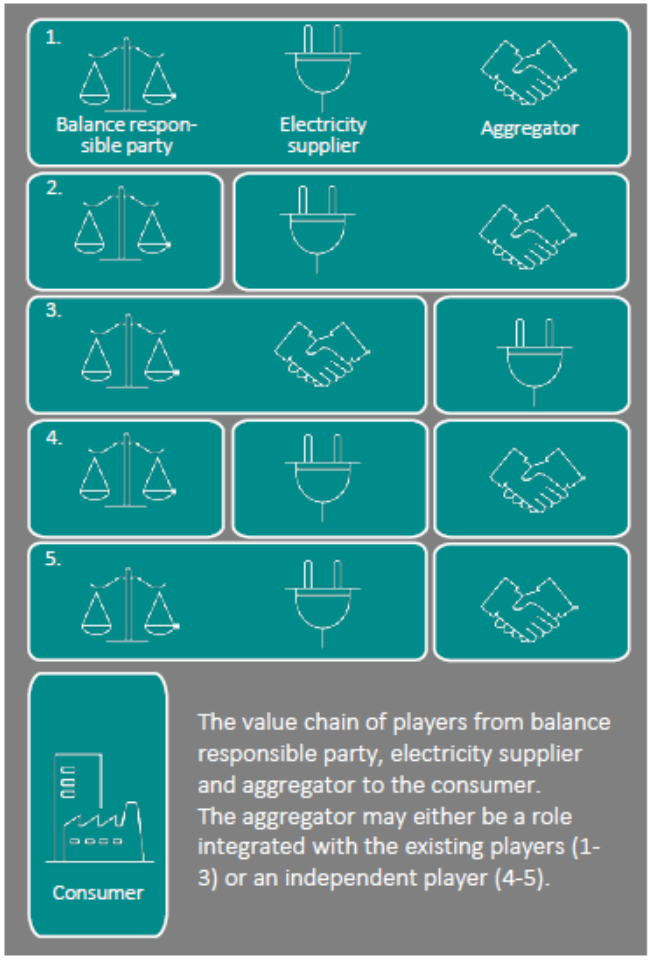
Market Models for Aggregators

– Activation of flexibility



Source: Workgroup - Market Models for Aggregators

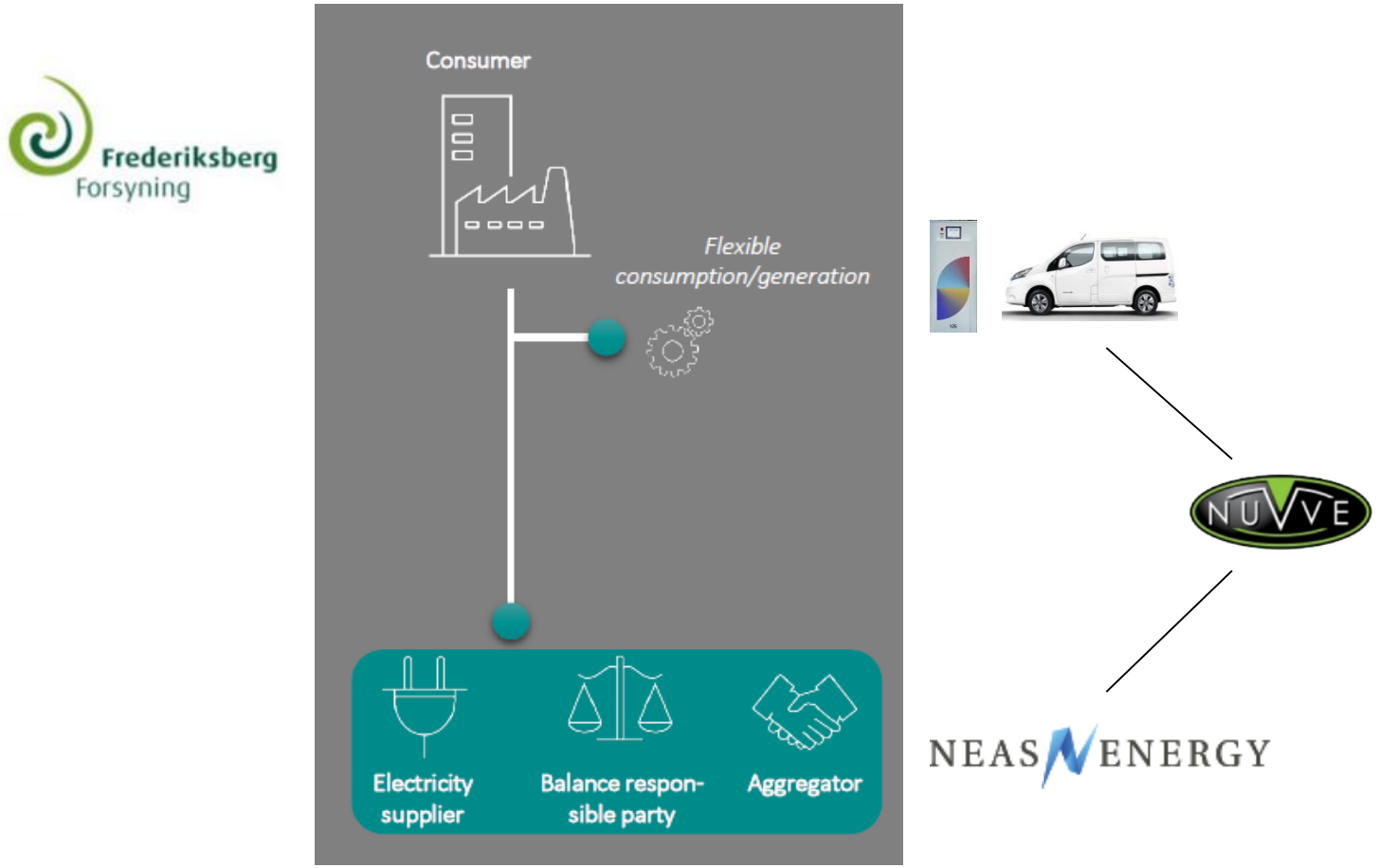
Current market solution



The Frederiksberg pilot

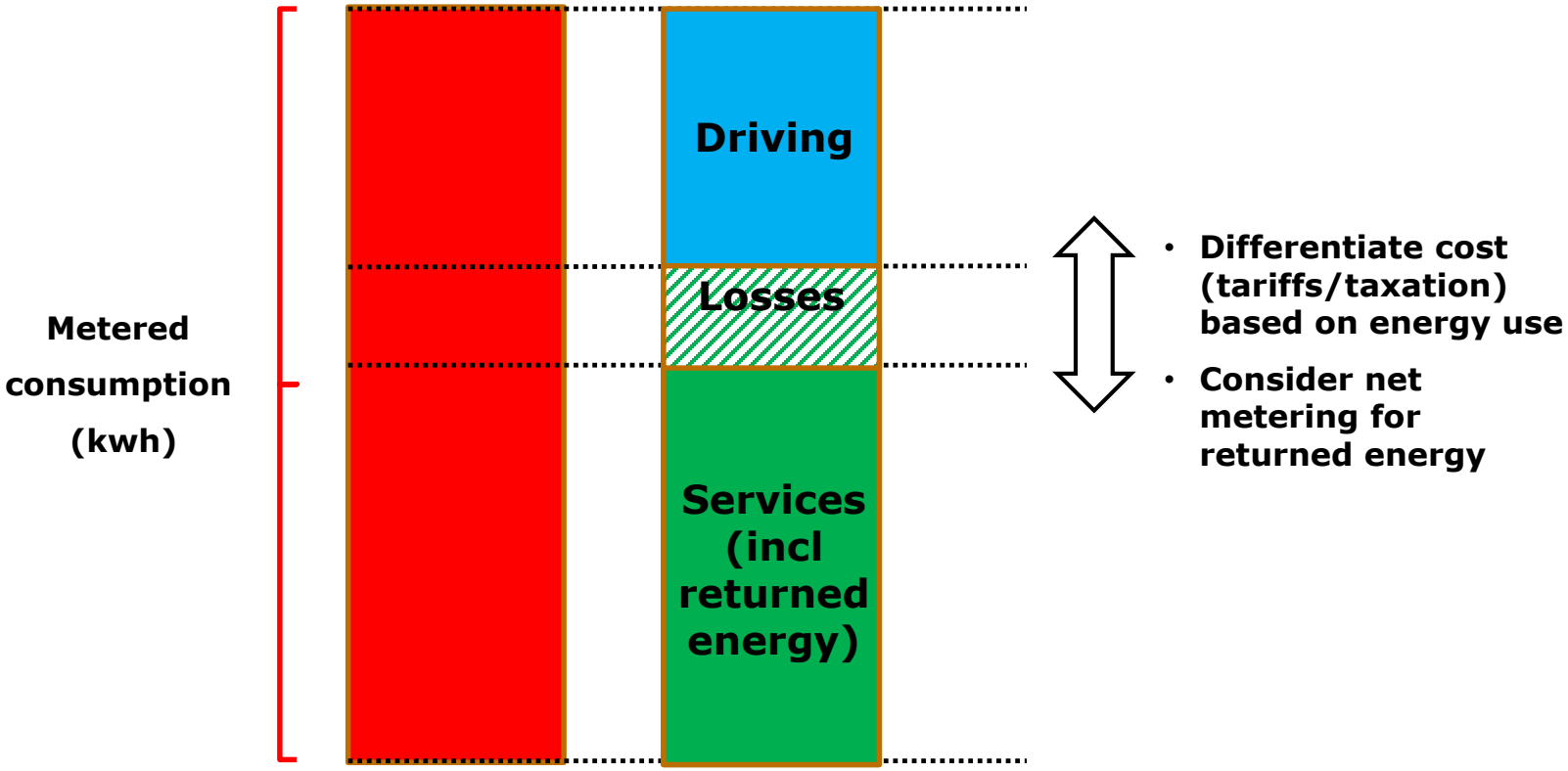
Source: Workgroup - Market Models for Aggregators

Current market solution



Source: Workgroup - Market Models for Aggregators

Solution – energy tariffs and taxation



Source: NUVVE

Questions?

More info:

www.parker-project.com