



Universiteit Utrecht

LomboXnet



Copernicus Institute of
Sustainable Development

Smart solar charging

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(Robin Berg and the SSC consortium)

HU, Utrecht, 14 June 2017



Hier wordt geïnvesteerd in uw toekomst. Dit project wordt mede mogelijk gemaakt door het Europees Fonds voor Regionale Ontwikkeling.



Copernicus Institute of Sustainable Development

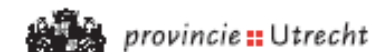


Motivation

- More photovoltaic solar energy installations due to decreasing prices (303 GWp globally)
 - Consumers: grid parity
 - Commercial: feasible only with SDE+ subsidy (>15 kWp)
- Link with electric mobility
- Business case: charge EV with solar
- Lombok district → Station area → 5 demo regions →?

Rendement **smartgrid** voor iedereen!

Projectpartners



Smart Grid – Value4All

2012-2015

**Creating business
by developing smart energy services**



Smart energy management provides the solution

- Bidirectional power
- Potentially highly variable
- Link with demand developments?
 - Demand side management
(poor on household level, ~10%)
 - Electrical mobility
 - Heat pumps (gas-free heating scenario)



Pilot Lombok: E-car4all en Storage4all

Objective

Develop and evaluate **algorithms** for a smart grid system that can **increase self-consumption** of PV-power by storing electricity in EVs in the residential sector while **meeting the demands** by the use of the **EVs**

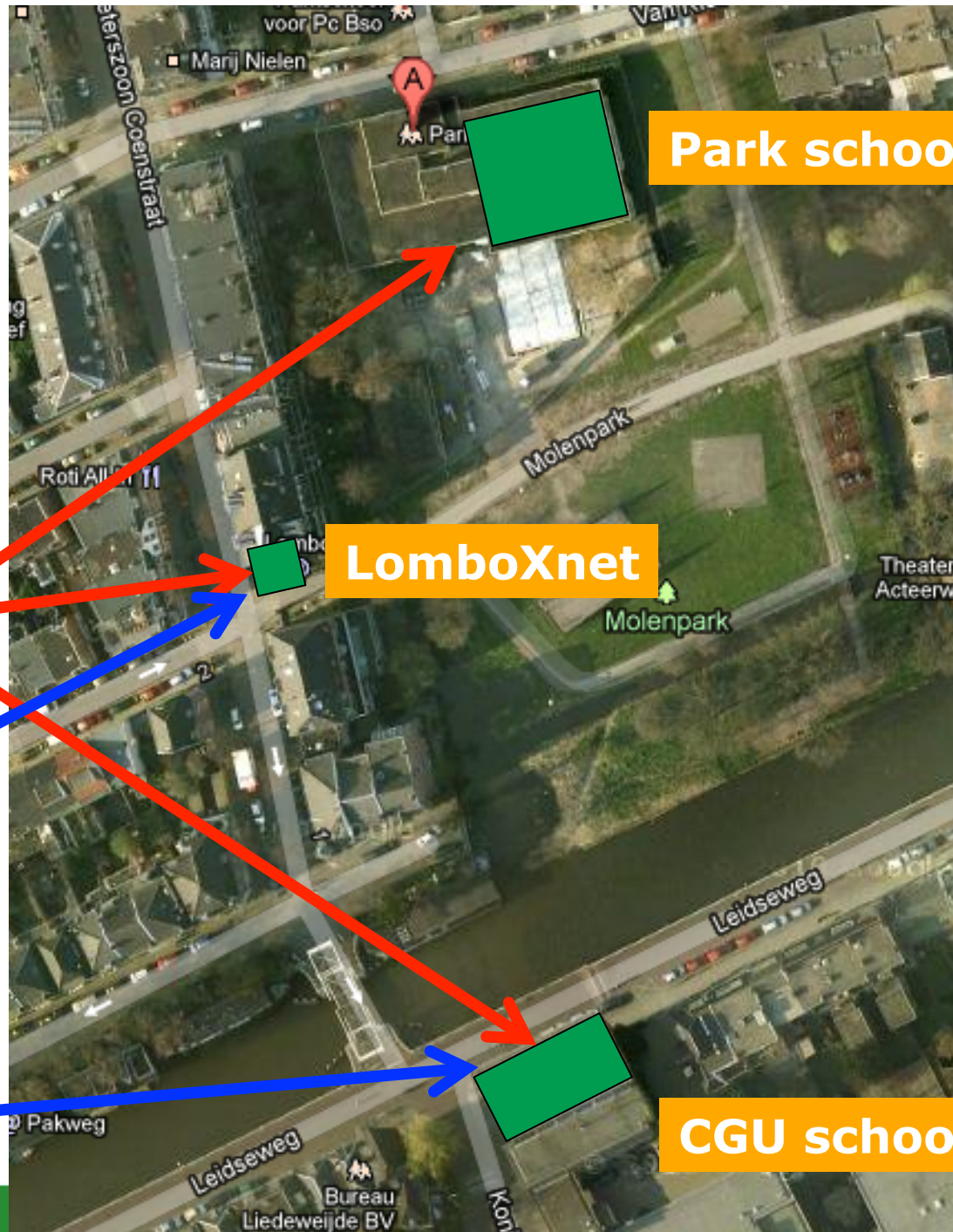




PV panels

E-car
charger

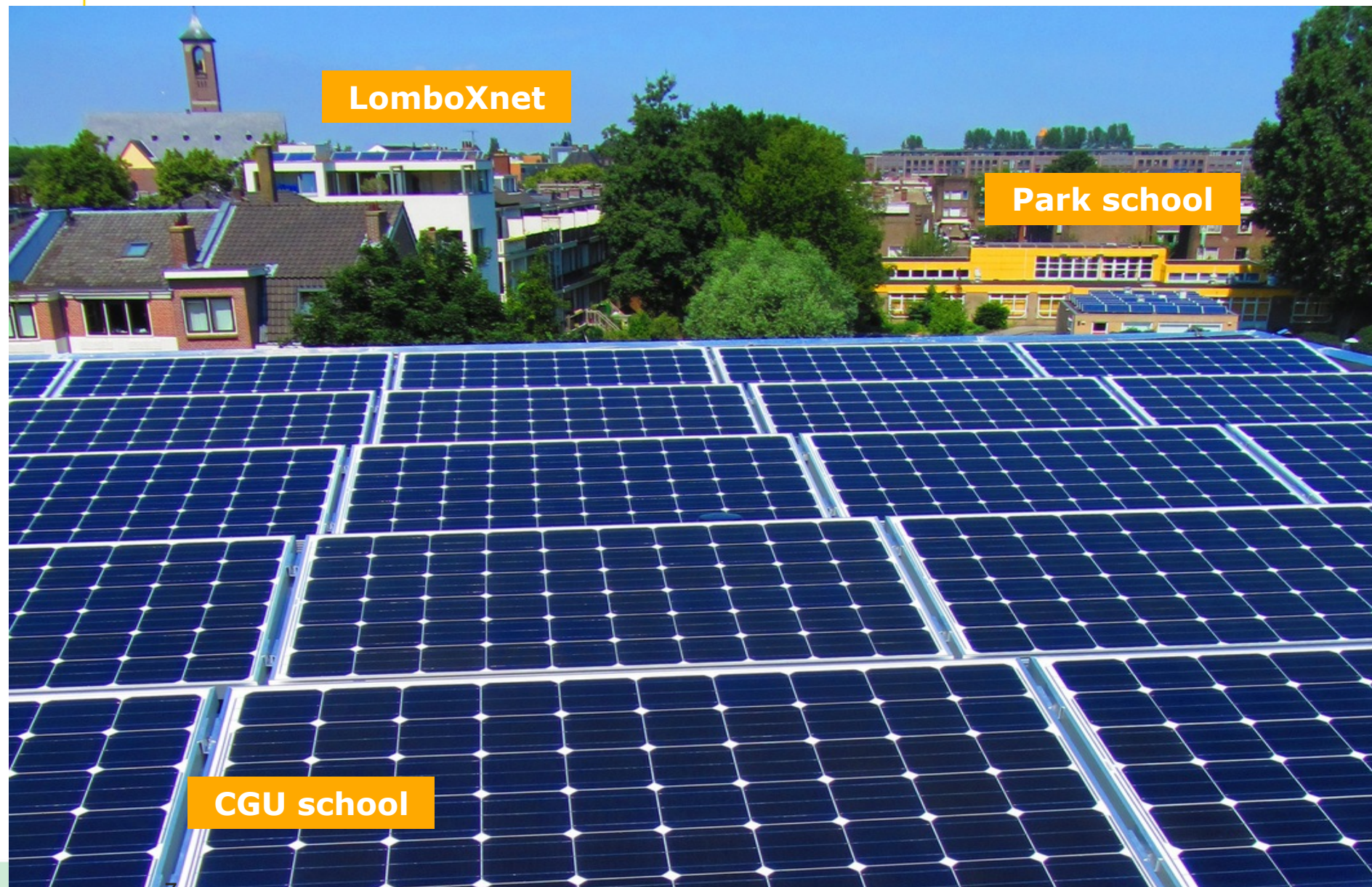
NEW: bidirectional
charger/discharger



Park school

Lomboxnet

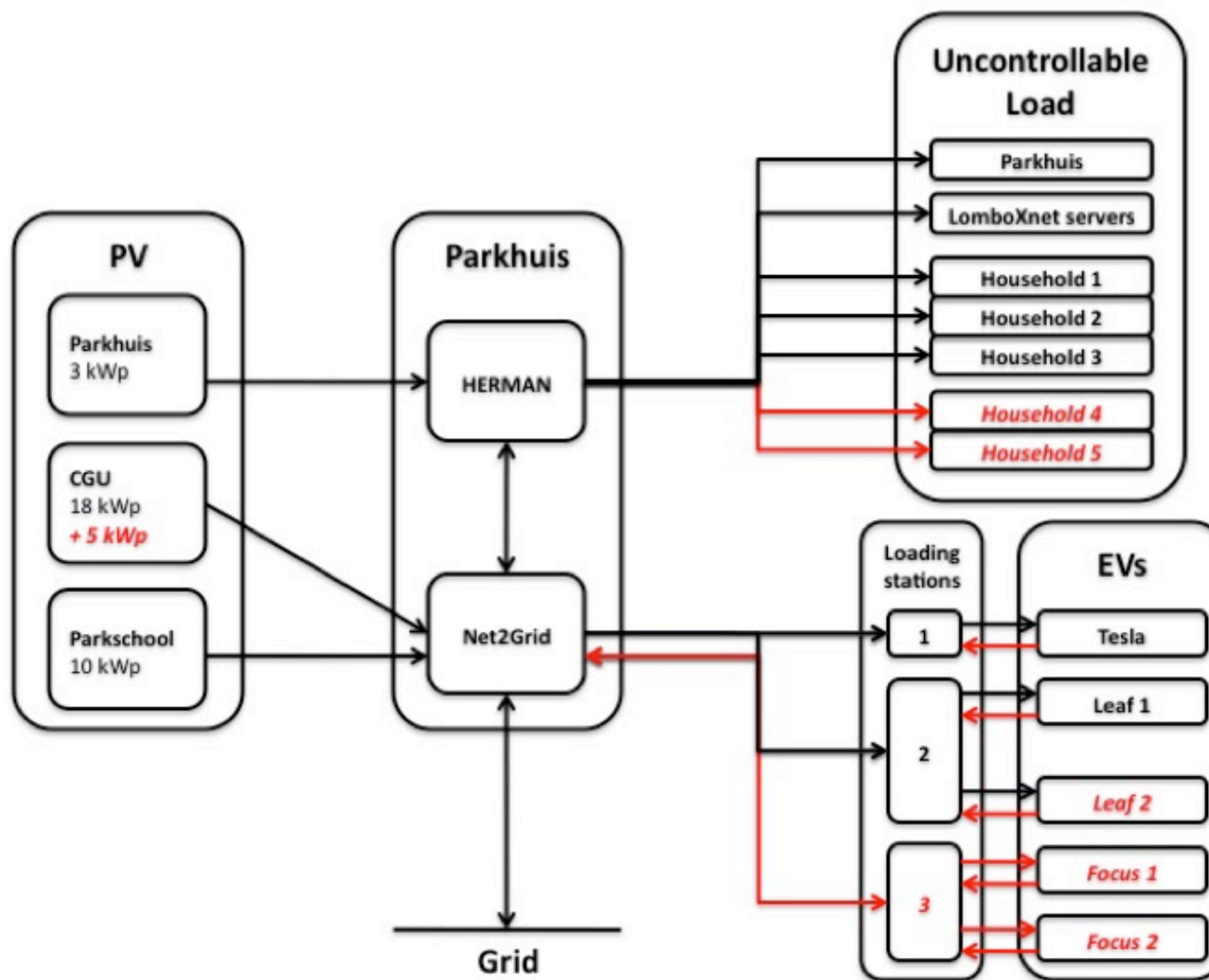
CGU school





Utrecht
8 Lombok

Model development



Van der Kam, 2015

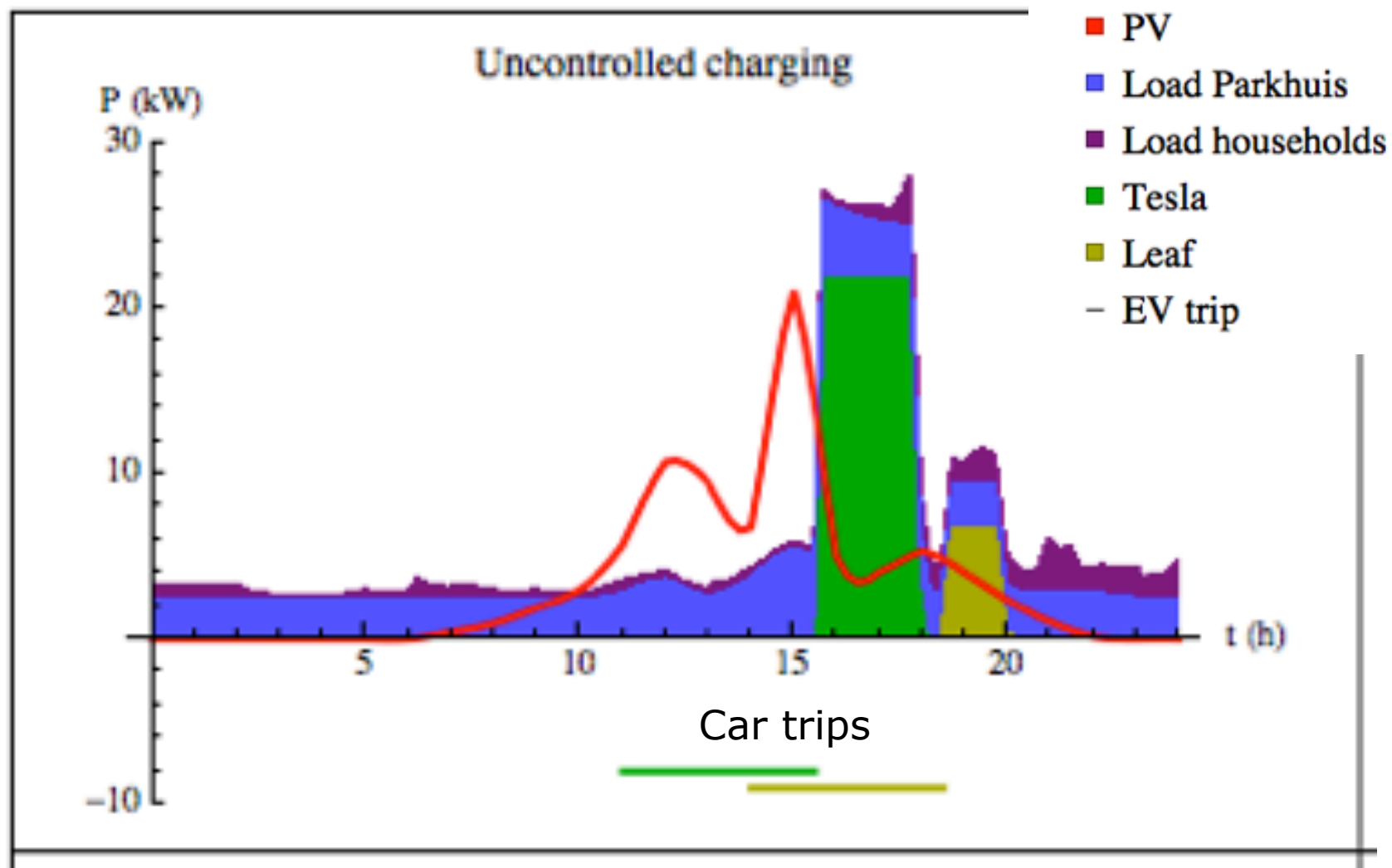


Strategies EV-charging

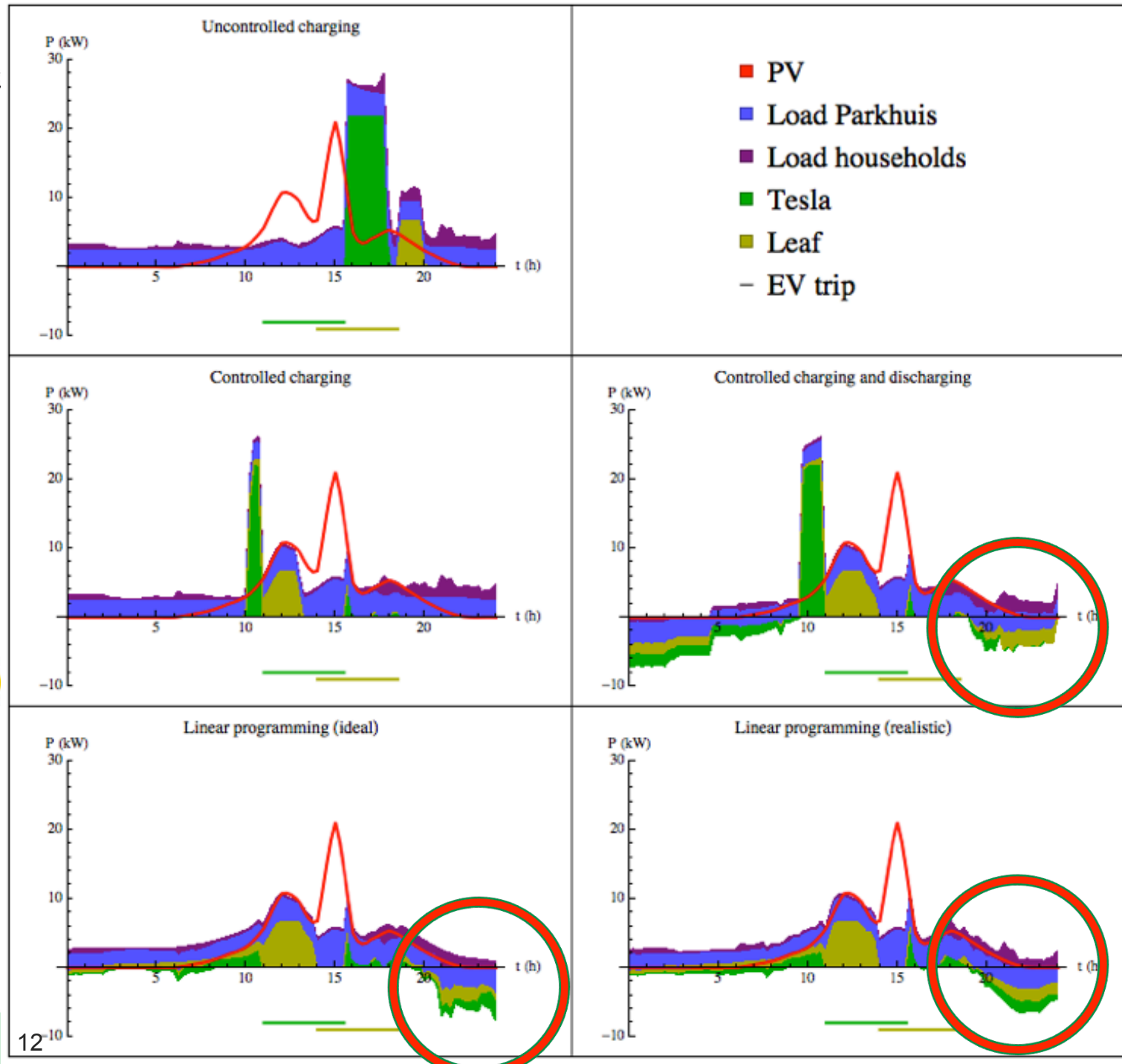
- Uncontrolled charging: “plug&charge”
- Controlled charging
- Controlled charging and discharging
- Linear optimization
 - (Dis-)charging profile established through mathematical optimisation
 - Good predictions for PV and demand necessary
 - Evaluation with and without perfect information (ideal vs. realistic)



Results: uncontrolled charging



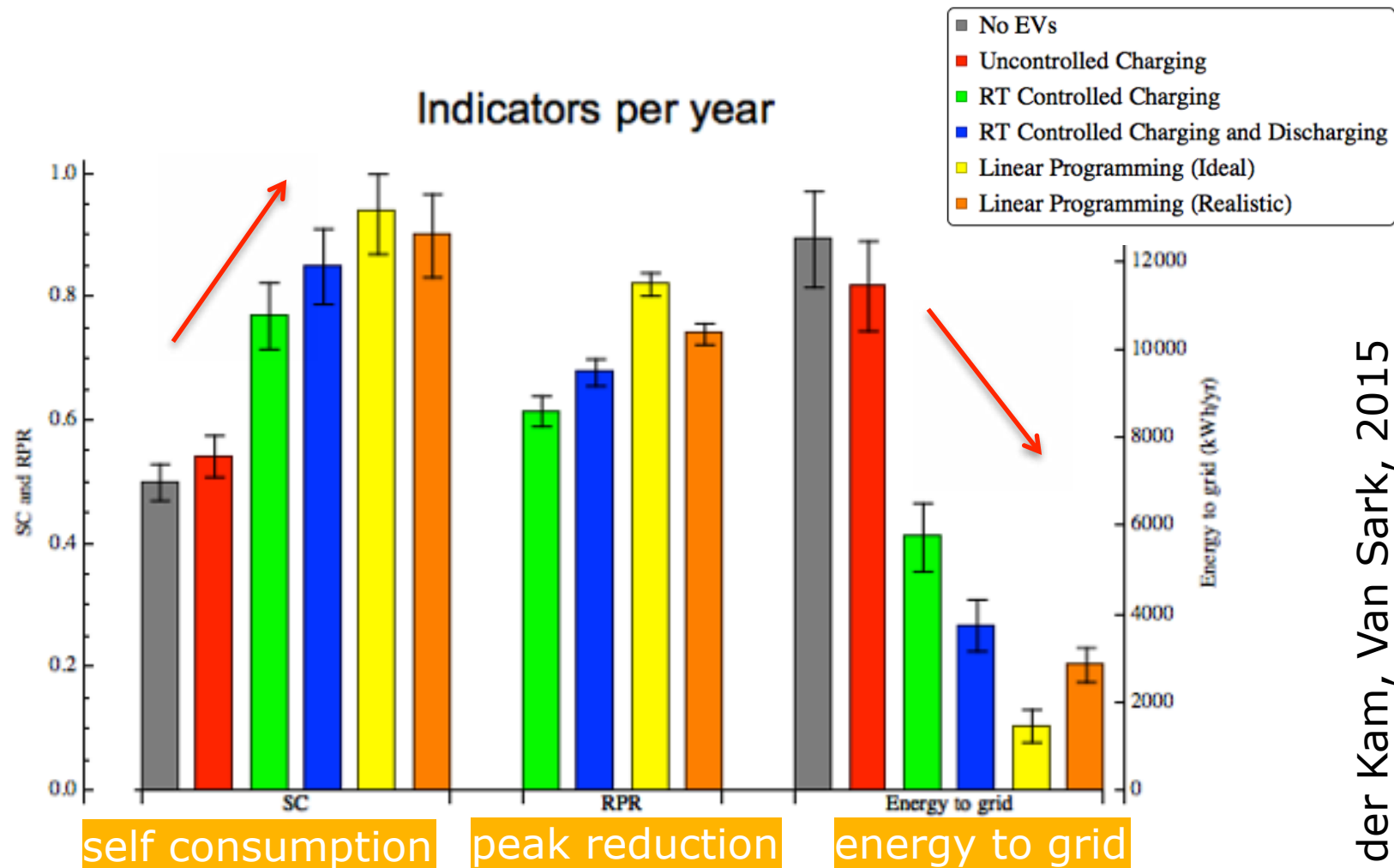
Van der Kam, Van Sark, 2015



Van der Kam, Van Sark, 2015



Results: self consumption, peak reduction, energy to grid



Van der Kam, Van Sark, 2015



Summary

- Smart grid **control algorithms** for managing the (dis)charging profile of multiple EVs, either in real-time or using linear optimization with predictions for PV-power and electricity demand
- Results show that **smart storage of (solar) electricity in EVs** can increase self-consumption with 23% to 38%, reduce energy sent to the main grid with 3 to 9 MWh per year and reduce peaks with 27% to 67% (in this case study)

NOW: time for experimental data (bidirectional chargers)

→ **WE DRIVE SOLAR**

WE DRIVE SOLAR



MOBILITY HEROES



JEDLIX



RENAULT Z.E.



UTRECHT 10



last mile <> solutions®



DirectLease

UTRECHT
SUSTAINABILITY
INSTITUTE



provincie :: Utrecht



LomboXnet

- ISP with own fiber network
- 4.000 costumers in Utrecht



2016: 4.000 new panels on 10 roofs in the region



First bidirectional charging station in Europe



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June 9th 2015:

First solar-controlled, V2G
public AC charging station in
the world

44 kW grid connection



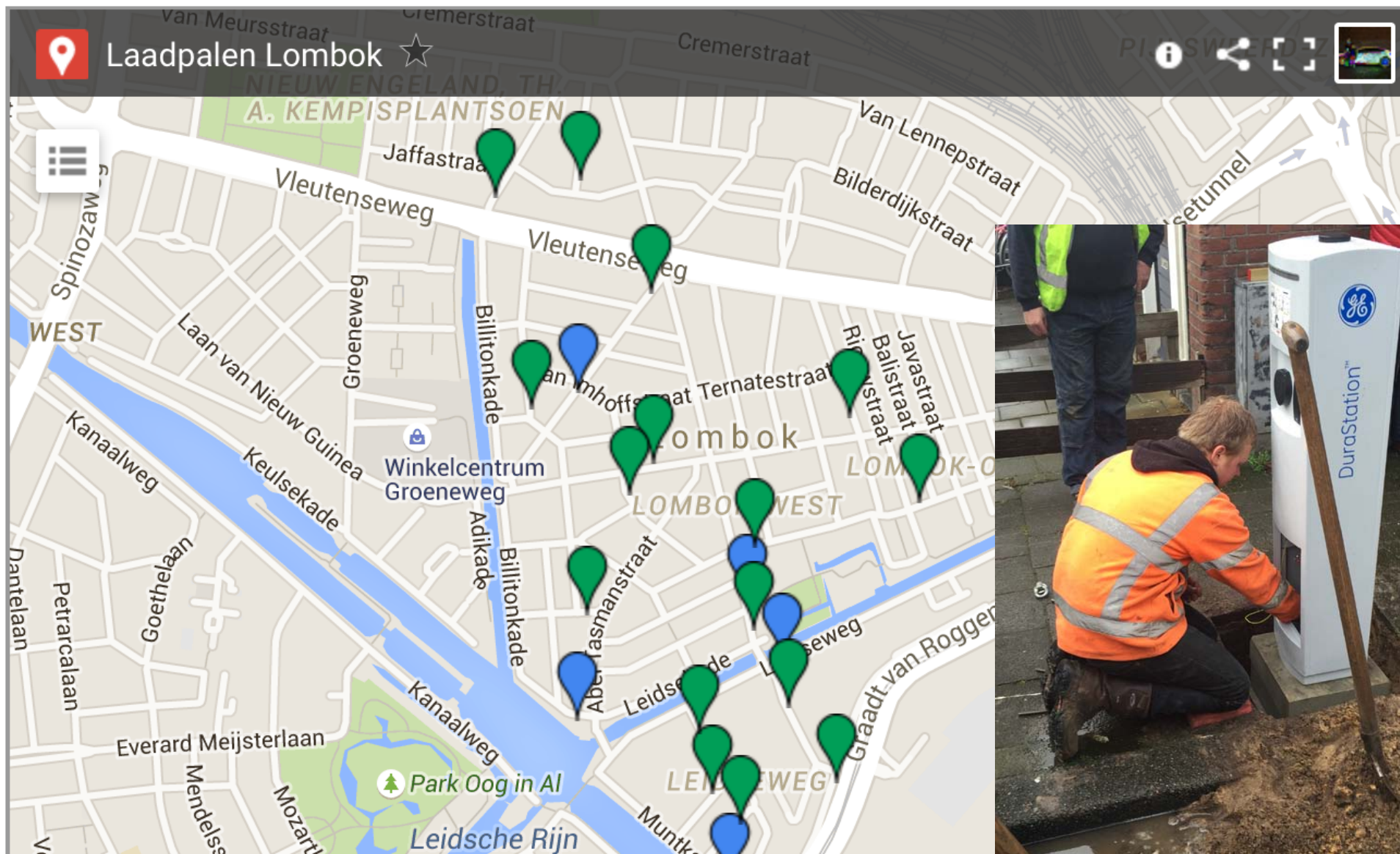
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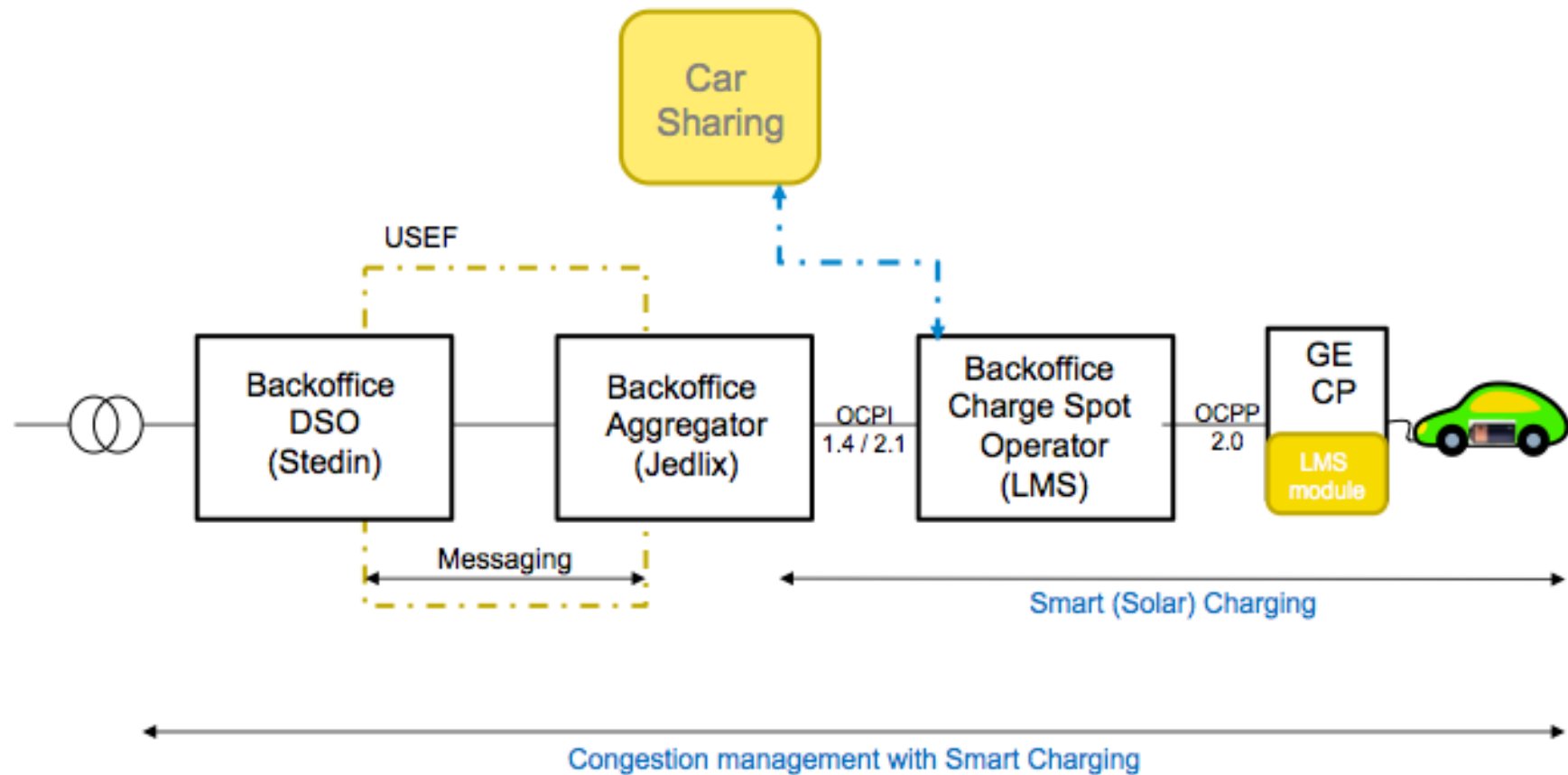
June 9th 2015: live demonstration during international V2G-meeting Nissan



Living Lab Lombok:

- 22 Smart Solar Chargingstations
- 100 kW new solar

Organize the business case





Universiteit Utrecht

Ambition Utrecht Region 2018/2019

1.000 solar chargers, 1.000 shared EV's, 10.000 new solar panels, 100.000 users

First region in Europe with clean energy- and mobility system based on solar





Scale-up Smart Solar Charging

Station area: Healthy Urban Living



Europese Unie
Europees Fonds voor
Regionale Ontwikkeling



Paris March 11 2016, royal visit
150 Renault ZOE's



22 kW AC bidirectional charging
Standards together with Elaad

300 km range

Entry price € 99,-/month

Includes km and insurance

Licence plate based parking lot with Smart Solar Charging

App for reservation and opening

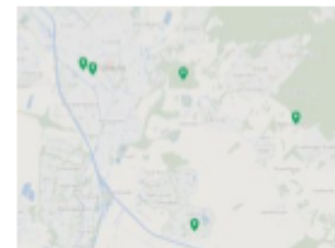
Support Province of Utrecht

WE **DRIVE** SOLAR





Smart Solar Charging



Smart Solar Charging

A sustainable energy system at district level. Locally produced solar energy is stored in (pool) cars. This energy can be released to the district at a later time, via a smart charging station.

[Read more](#)

The project

The experiences in Lombok will be developed further and tested over the next four years in five linked pilot areas in the Utrecht region. This will result in marketable product-service combinations for various types of areas.

[Read more](#)

Five pilot areas in the Utrecht region

All areas combine the production of renewable energy with Vehicle2Grid-charging points and car sharing systems. Each pilot area has its own user profile, type of customer and specific market.

[Read more](#)