

V2G EXTRAPOLATION STUDY AMSTERDAM

CREATING TOMORROW

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AMSTERDAM V2G INSTALLATION (HUGO NIESING)

[HTTP://WWW.AMSTERDAMVEHICLE2GRID.NL/](http://www.amsterdamvehicle2grid.nl/)



Overview technical components
'Amsterdam vehicle 2 grid'



Storage and e-mobility

Inverter



Solar Energy generation



Combi
'central'



Electricity
Grid



DC current

AC current

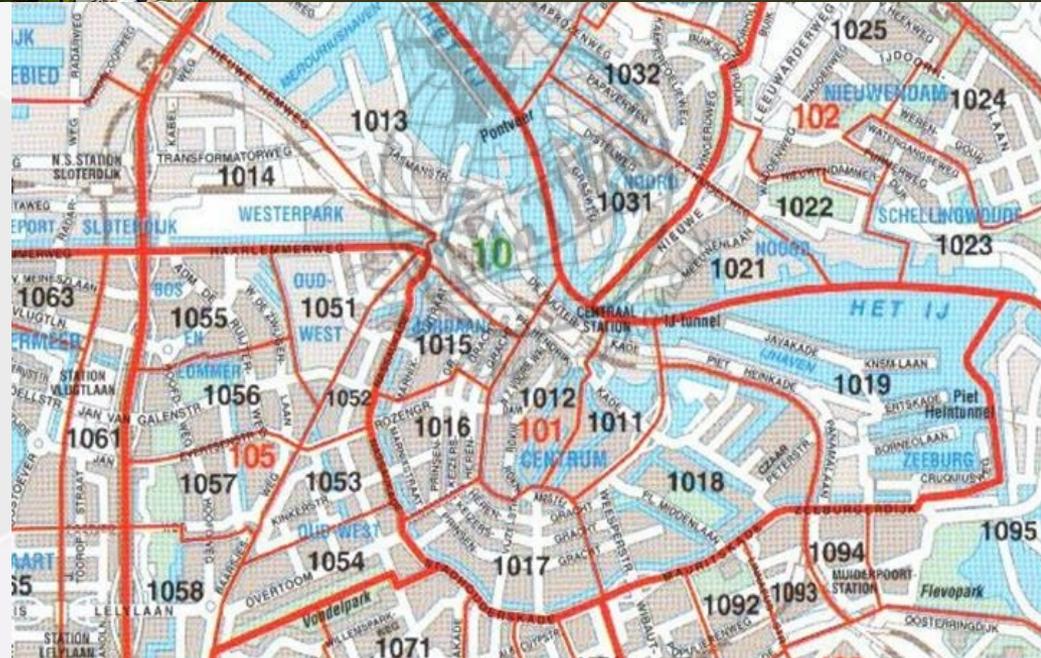
Household
devices



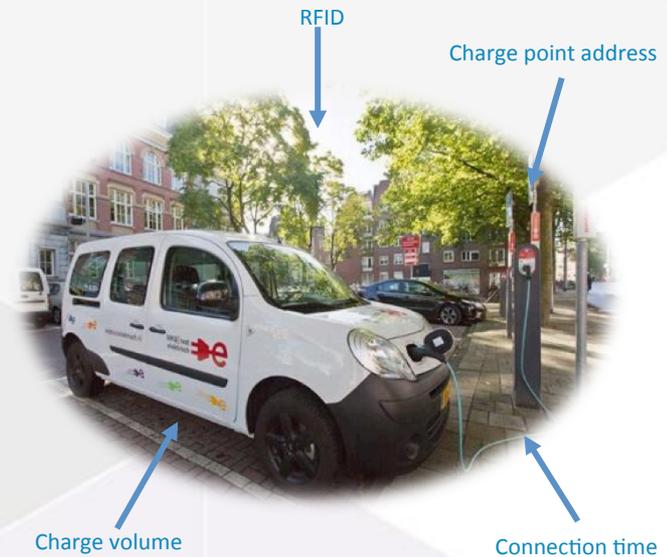
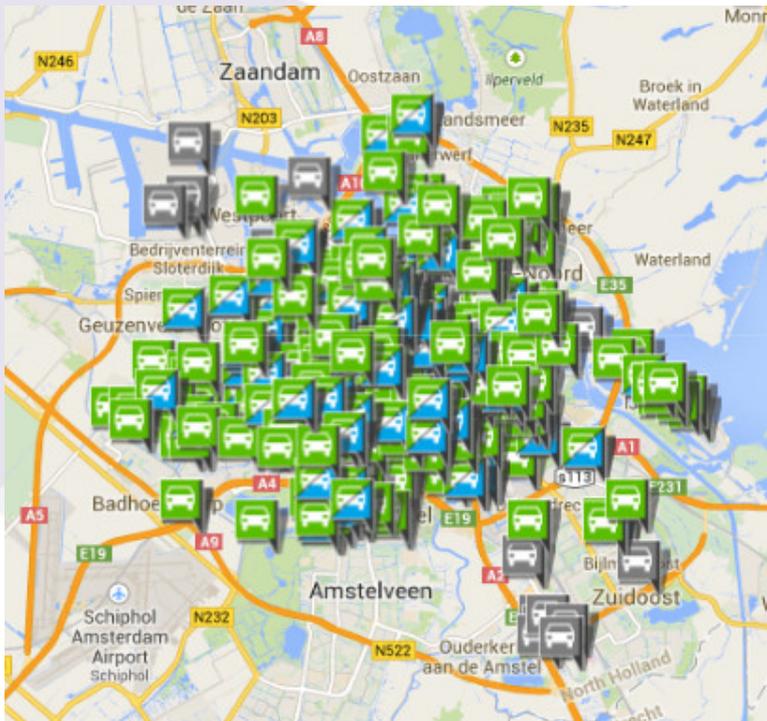
ROOFTOP SOLAR PANELS



EXPLORING AN EXTRAPOLATION TO SOLAR ENERGY V2G INSTALLATIONS FOR THE 1019 REGION AMSTERDAM?

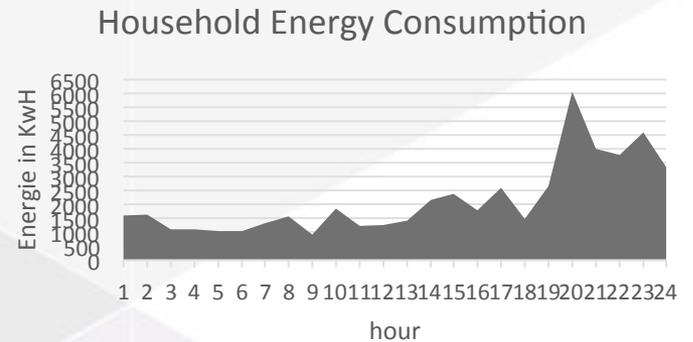
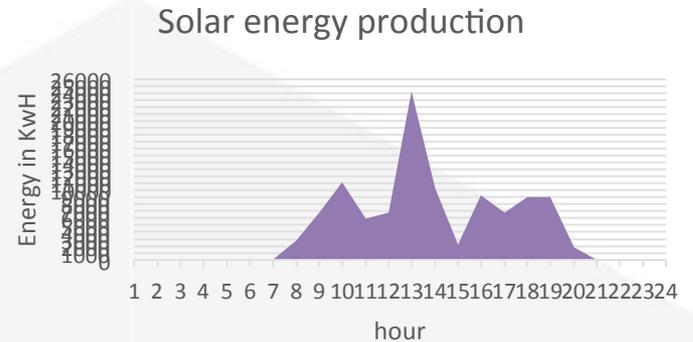
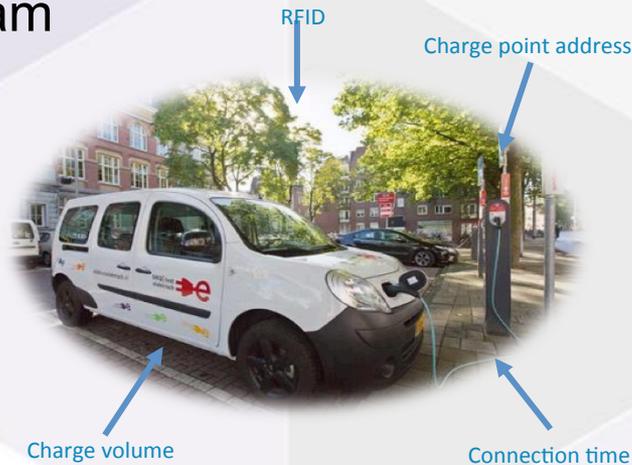


USING THE AMSTERDAM EV CHARGE INFRASTRUCTURE :1132 CHARGE POLES 16 IN AREA 1019



DATA DRIVEN EXTRAPOLATION

Household energy consumption
(Resourcefully, Nuon open data)
Solar energy production (Resourcefully)
CHIEF:EV charge records 2012-2015
Amsterdam



DATA DRIVEN EXTRAPOLATION CASE STUDY AMSTERDAM AREA 1019

1. Extrapolation from one V2G installation to the entire area 1019 with
 - solar panels on every rooftop
 - unlimited possibility for energy storage (house/car batteries)
 - average energy consumption per household.
2. Simulation per day/hour of entire area 1019 with
 - limited possibilities for energy storage in “house” batteries
 - limited possibilities for energy storage in car batteries
 - solar panels on 50% of the rooftops

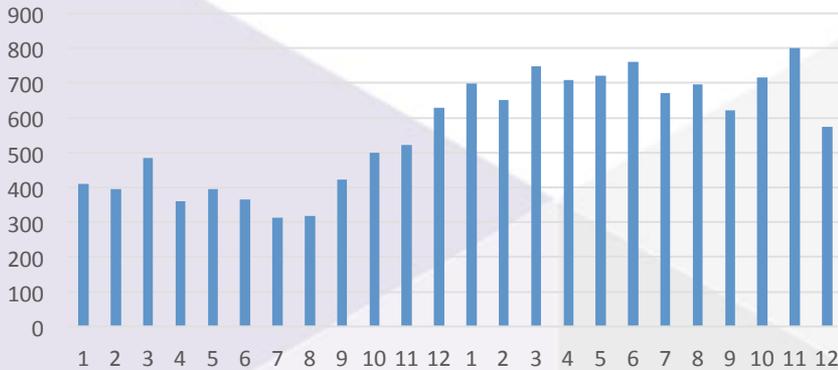
Succes indicator:

amount of energy loaded to the grid and downloaded from the grid

AREA STATS



CHARGE SESSIONS AREA 1019
2013-2014

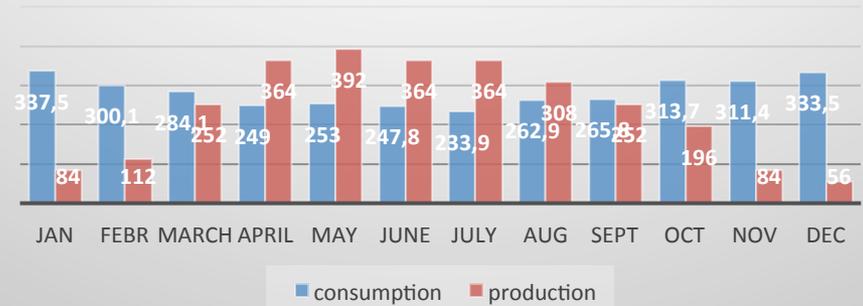


8805 households
(19.790 inhabitants)

- 43% 1 person
- 24% 2 persons
- 33% multiple persons

Area rooftop size: 346.255 m²
32 Charge points

Monthly production & consumption 2014

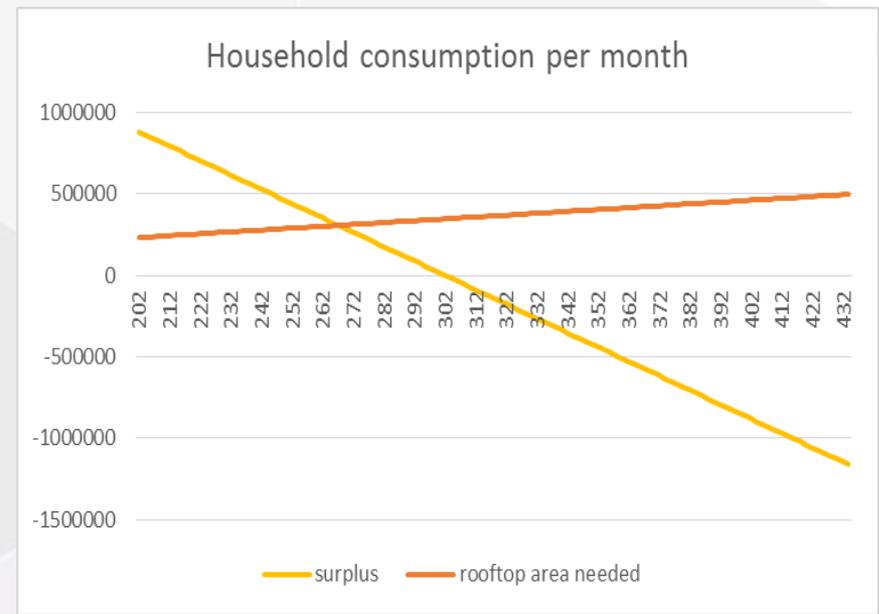
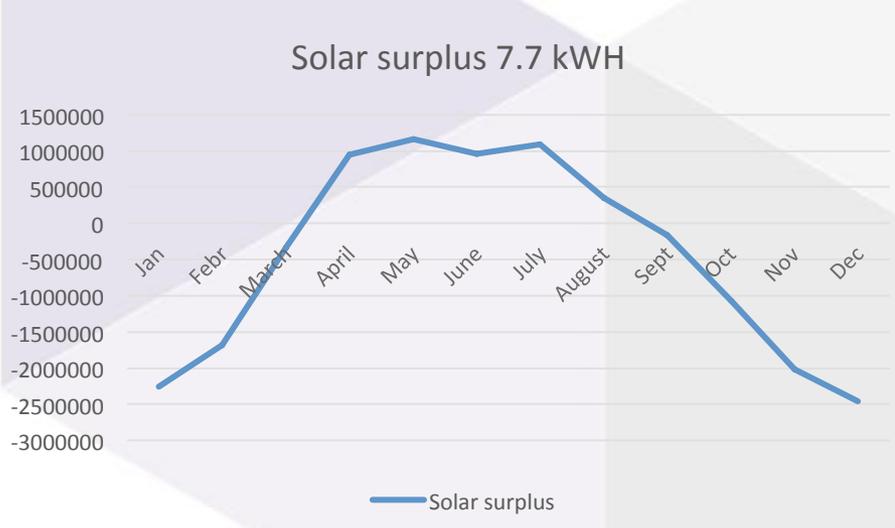


EXTRAPOLATION TO AREA 1019

ASSUMPTIONS	Summer 2014	Average month 2014
Solar panel production per m2	7,7 kWh (total 2.6 million kWh/month)	5,9 kWh (total 2,04 million kWh/month)
Energy consumption per household/month (based on V2G installation)	216 kWh (total 1,9 million kWh/month)	283 kWh (2,5 million kWh/month)
EV charge consumption per month based on Charge Data	6.366 kWh	7.000 kWh/month
All energy produced can be stored		

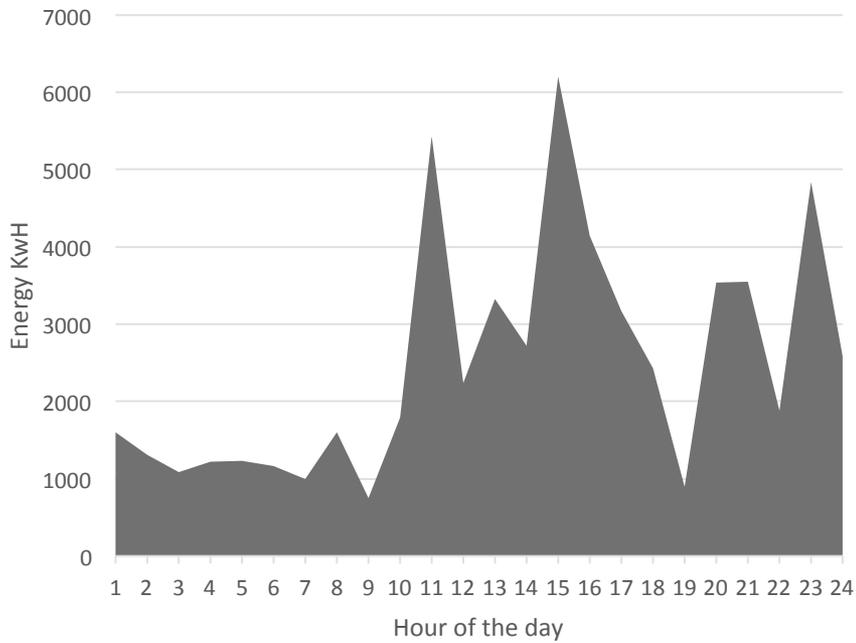
MONTH PATTERN

Solar production 7,7 kWh m2	SUMMER 2014 7,7 kWh m2	AV. MONTH 2014 5,9 kWh
SOLAR-SURPLUS per month	224.060 kWh (+11 % of monthly consumption)	-453.769 kWh (-23% of monthly consumption)
Rooftop area required to fulfill consumption	71,6%	122,2%

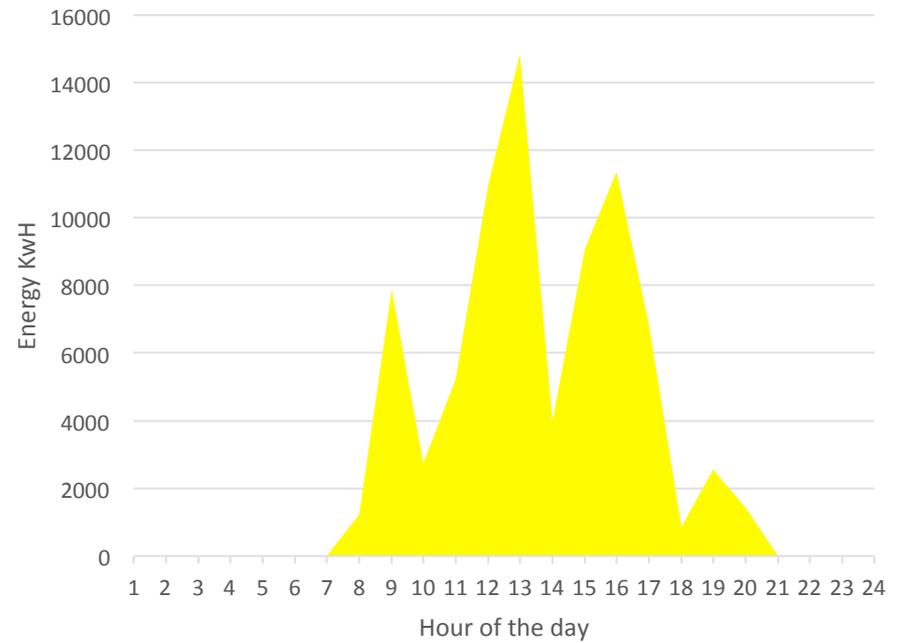


DAY PATTERNS

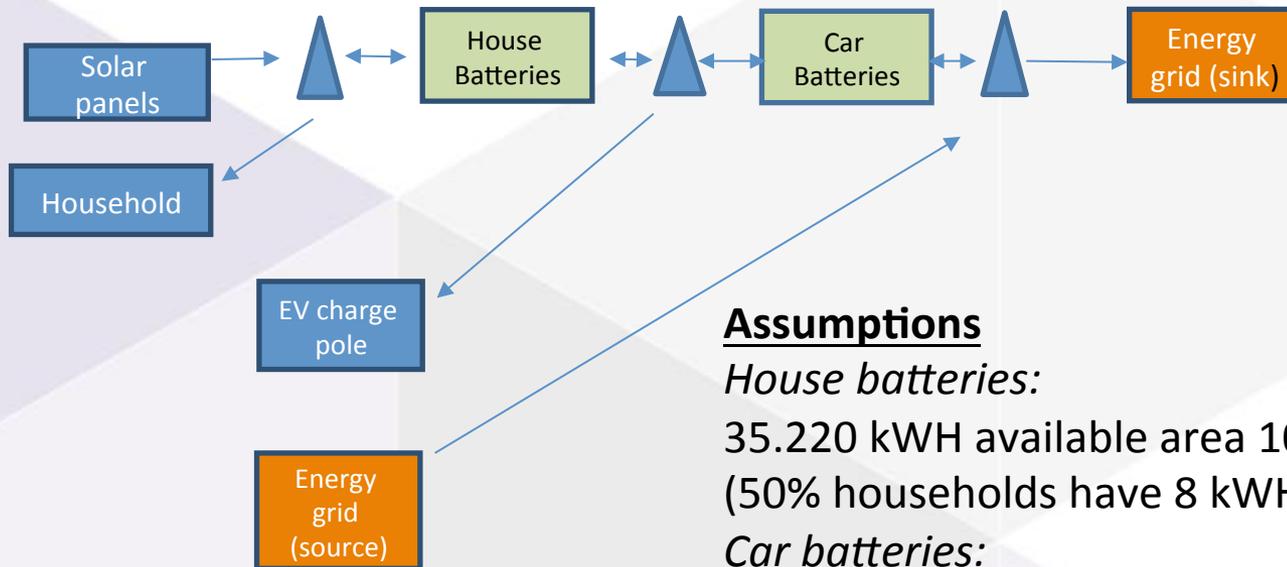
Household Consumption



Solar Production



SIMULATION MODEL FOR HOURLY PRODUCTION AND CONSUMPTION



Assumptions

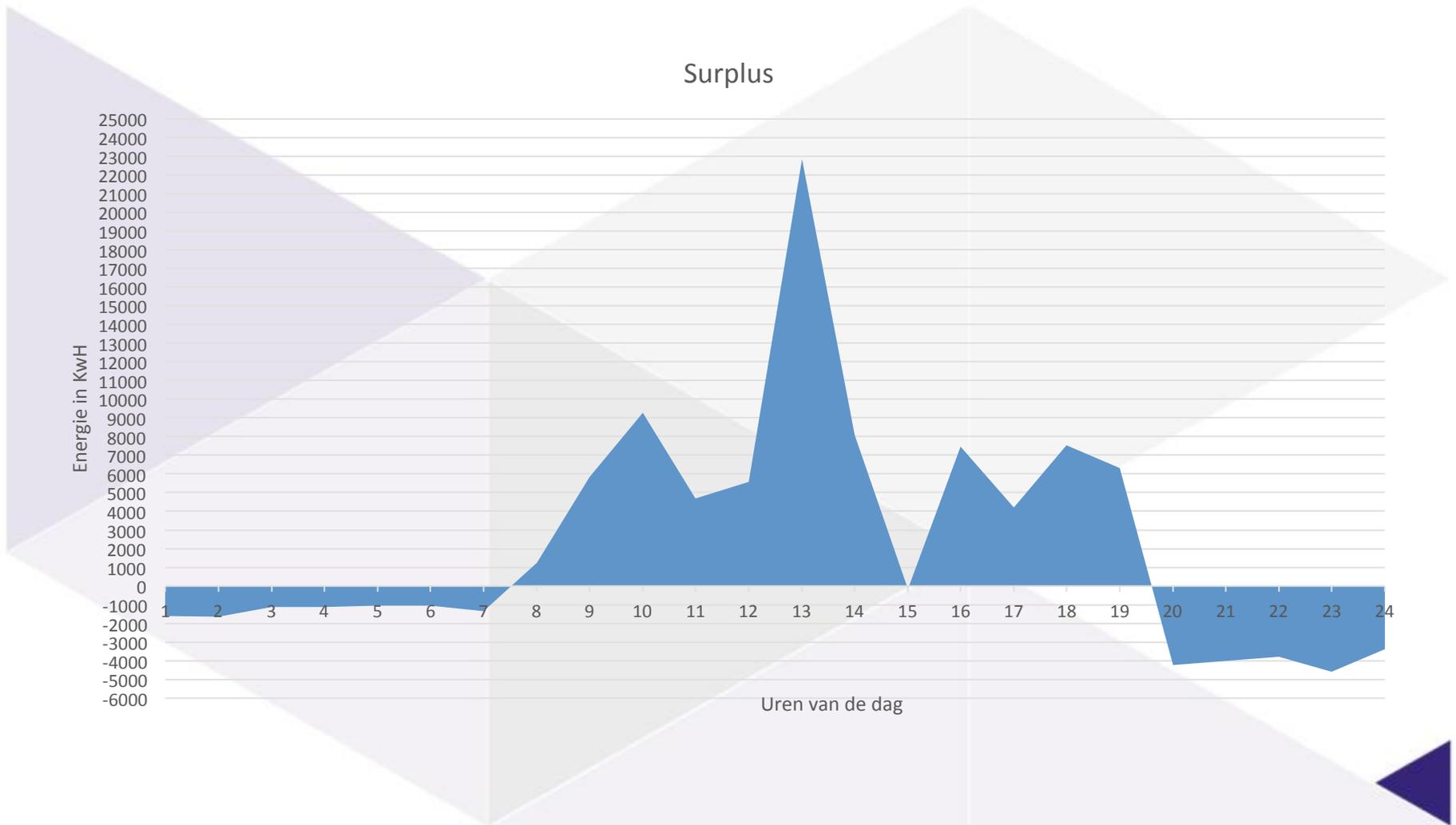
House batteries:

35.220 kWh available area 1019
(50% households have 8 kWh battery)

Car batteries:

10 kWh available per car,
maximum 32 charge points available at
the same time

TYPICAL DAY PATTERNS



(PRELIMINARY) RESULTS AUGUST 2014

	Household consumption	Solar production	House battery	Energy needed during the evening
August 2014	100%	100%	35.220 kWh	0 kWh
No house batteries, 32 charge points	100%	100%	0 kWh	20.011 kWh/day (i.e. 2,25 kWh per household)
40% Increased solar production	100%	140%	0 kWh	19.281 kWh
20% decreased solar production	100%	80%	0 kWh	20.736 kWh
20% Increased consumption	120%	100%	0 kWh	24.371 kWh
100% increased # charge points (64)	100%	100%	0 kWh	14.706 kWh

RESULTS SIMULATION

- Energy autonomy on neighborhood level:
Solar panels (7.7 kWh) can cover day time energy consumption in summer, but not in other months and not for household consumption > 300 kWh/month
- Storage over production:
Potential is in extra batteries rather than extra solar production (but both are needed!)
- MORE SIMULATIONS needed (realistic data household consumptions pattern??)
- YOUR CITY NEIGHBORHOOD?