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Prof. Cedric De Cauwer



INNOVATION FOR SUSTAINABLE TRANSPORT & ENERGY SYSTEMS

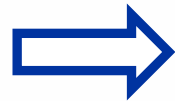
With our multidisciplinary team our
research focuses on five domains:



IMMINENT CHALLENGES

ELECTRIFICATION OF FLEETS – EV TRANSITION

How to go from here

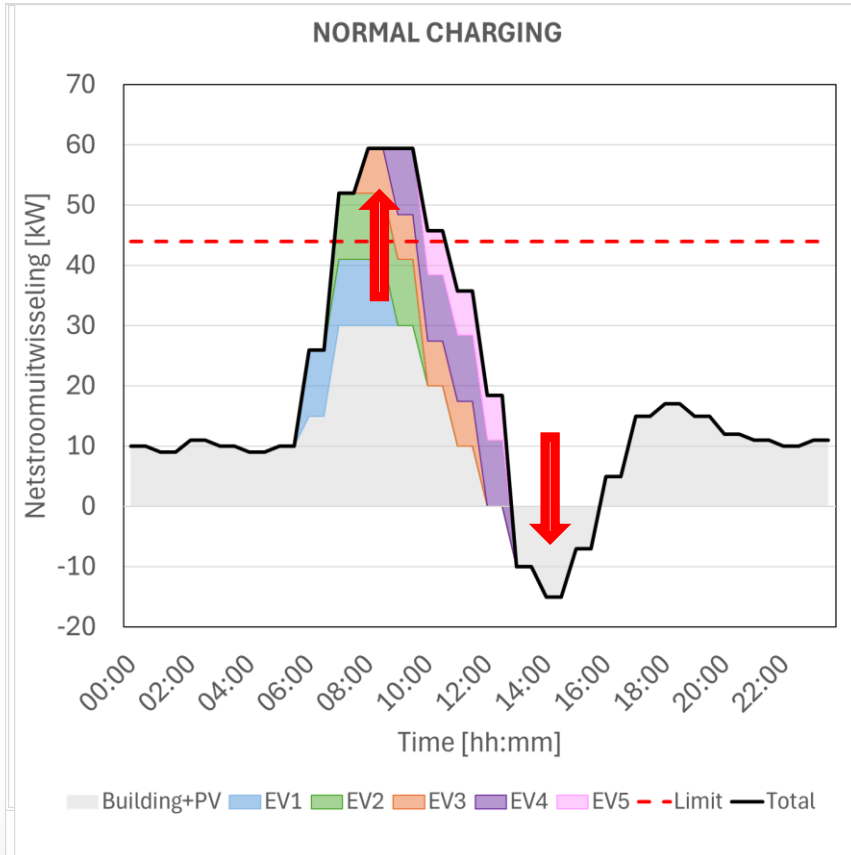


to here ...



EFFECT ELECTRIC VEHICLE CHARGING

ON LOCAL ENERGY SYSTEM



- Increase in consumption (order of magnitude average family with 1 electricity meter* ~3500kWh/jaar)



- Peak consumptions



- Capacity tariff cost
- Physical capacity grid connection

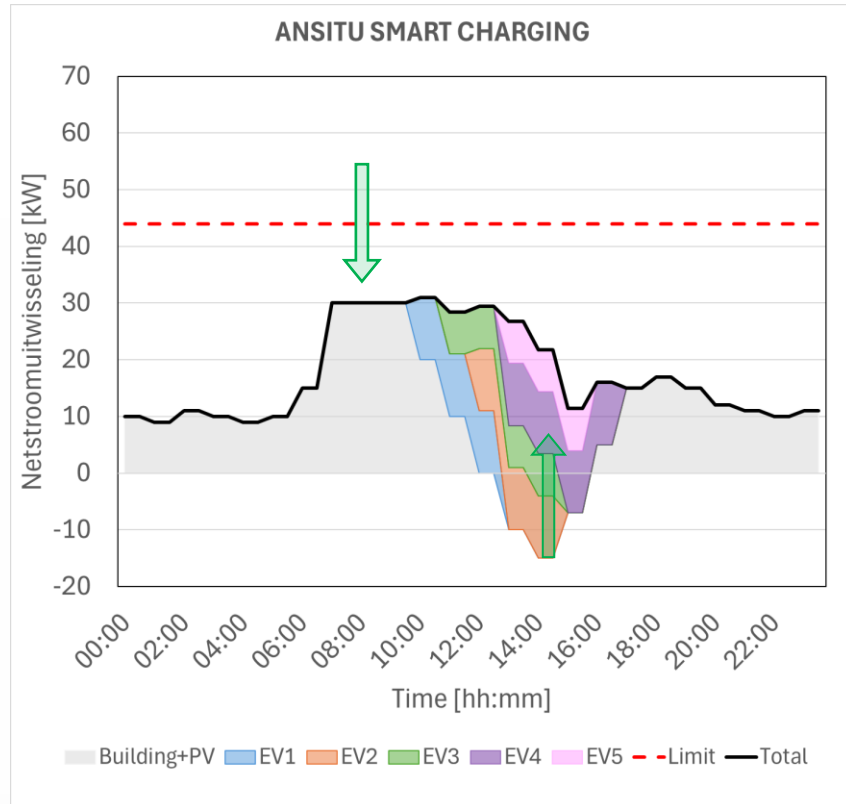


- Self-consumption not guaranteed



SMART CHARGING

CONCEPT



- Reduce peaks
- Increase self consumption
- Dynamic tariff optimization
- (grid services)



SMART CHARGING

DEFINITIONS

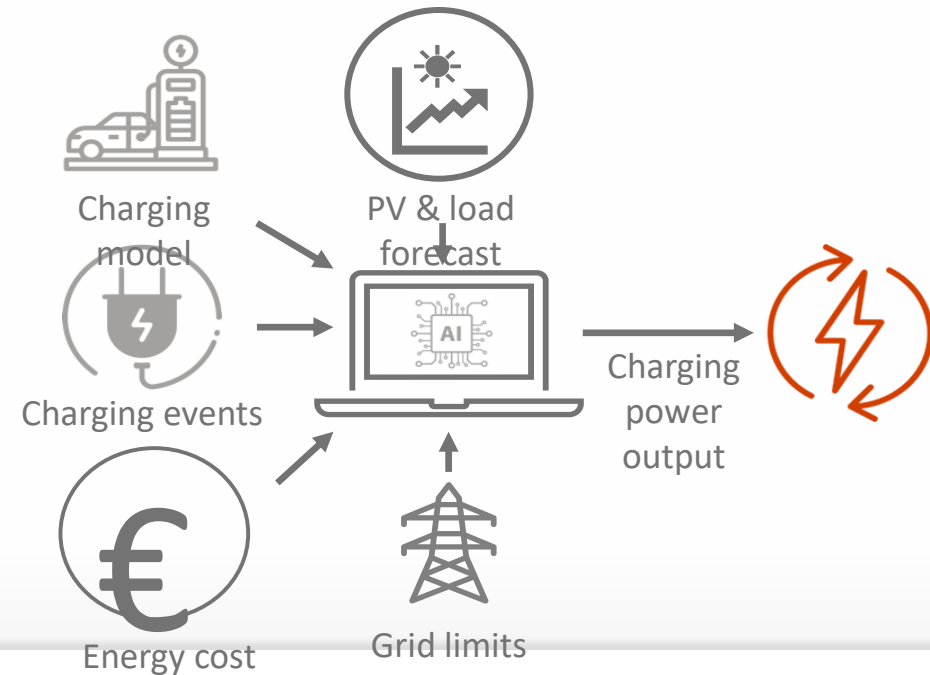
Load balancing = control the speed of charging (charging power) to respect a static or dynamic power limit

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Smart charging = manage the moment and speed of charging in a controlled and conscious way.

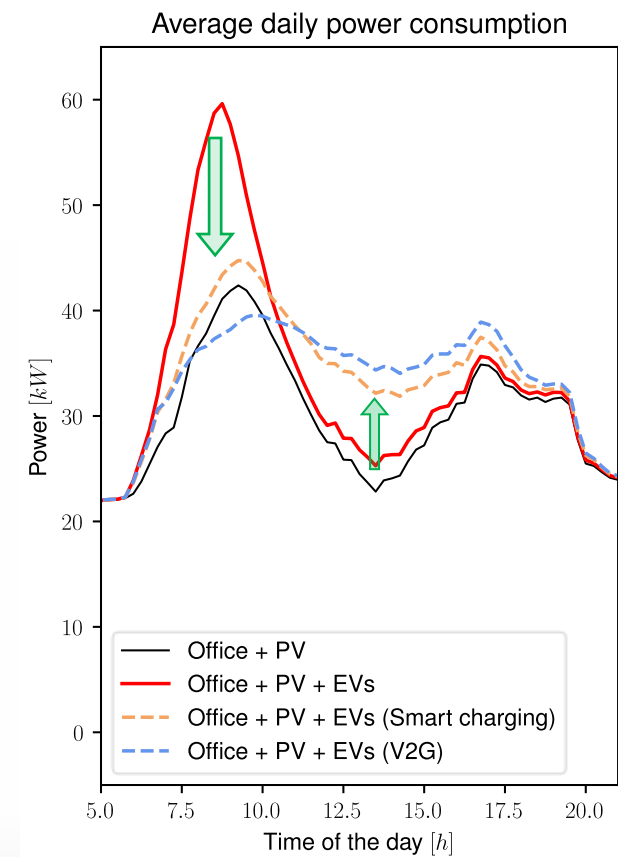
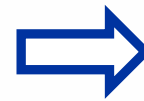
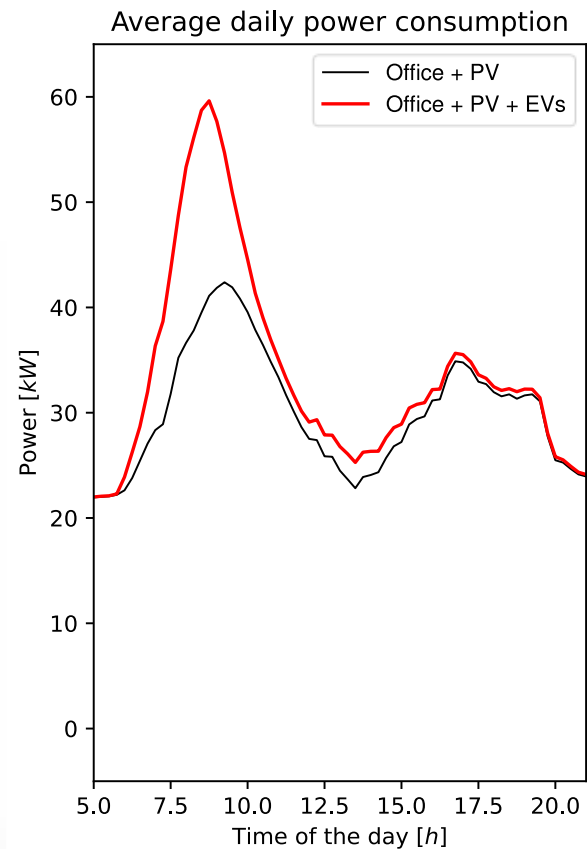
Conscious = considering:

- Charging need of individual drivers(s)
- Local consumption and production
- Charging needs of the full parking
- Energy cost
- Vehicle characteristics



SMART CHARGING

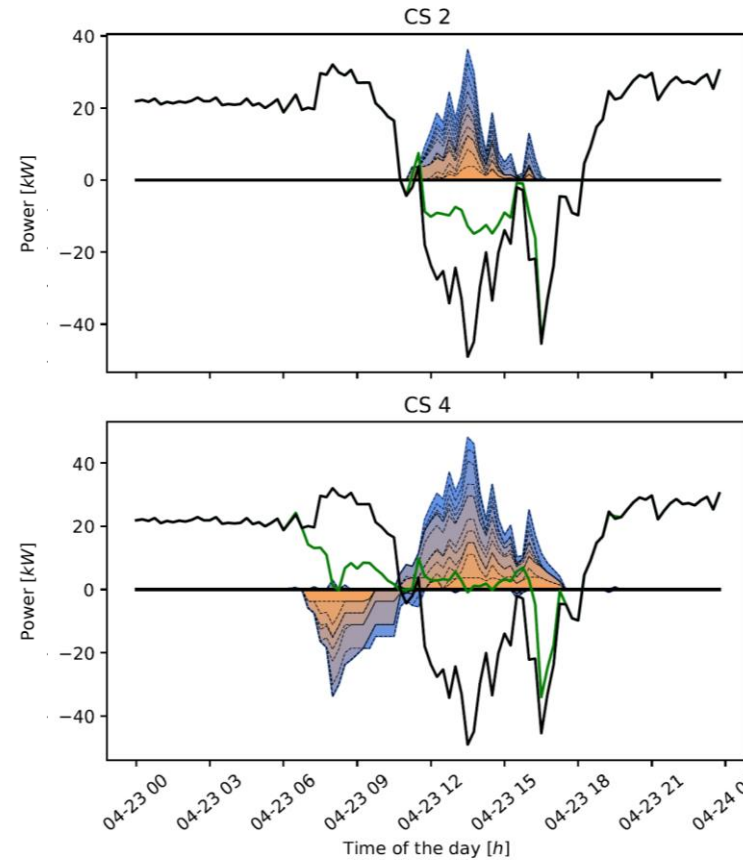
SIMULATION RESULTS



SMART CHARGING

WITH AND WITHOUT VEHICLE-TO-GRID (V2G)

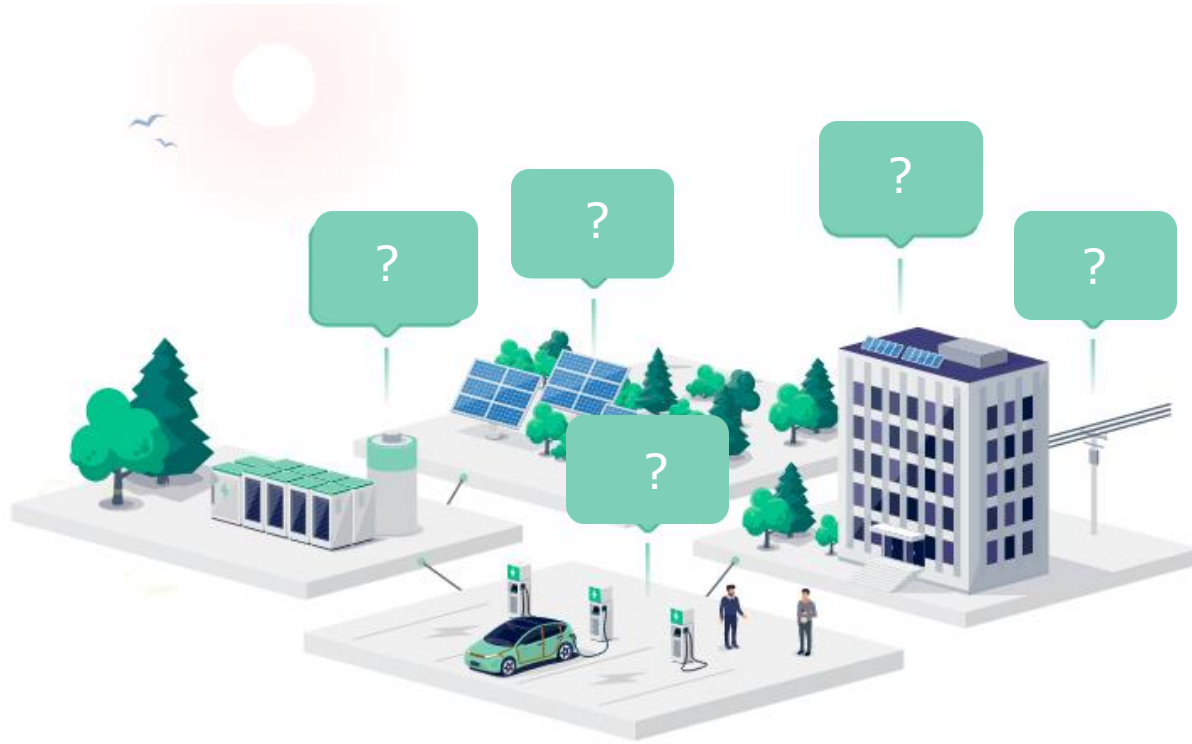
Uni-directional smart charging



Bi-directional smart charging
/ Vehicle-to-grid

DESIGN OF A SOLAR SMART CHARGING HUB

COMPONENTS OF THE LOCAL ENERGY SYSTEM



DESIGN OF A SOLAR SMART CHARGING HUB





STEP 1: MAP THE MOBILITY DEMAND

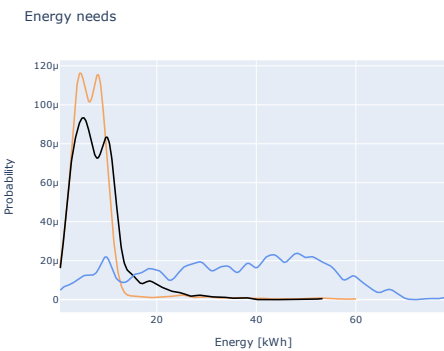
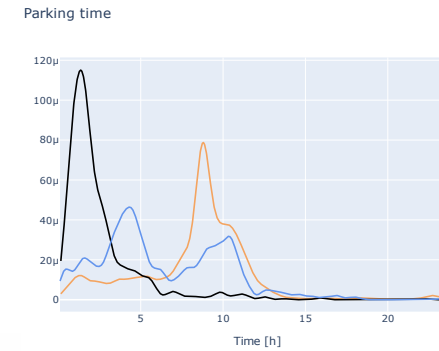
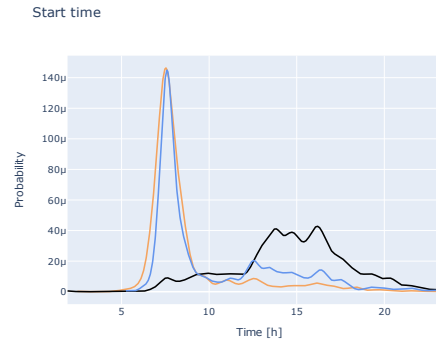
DEFINE YOUR EV FLEET

Compose your fleet of electric vehicle drivers based on the company driver profiles. The fleet composition is used by ANSITU to estimate the charging need.

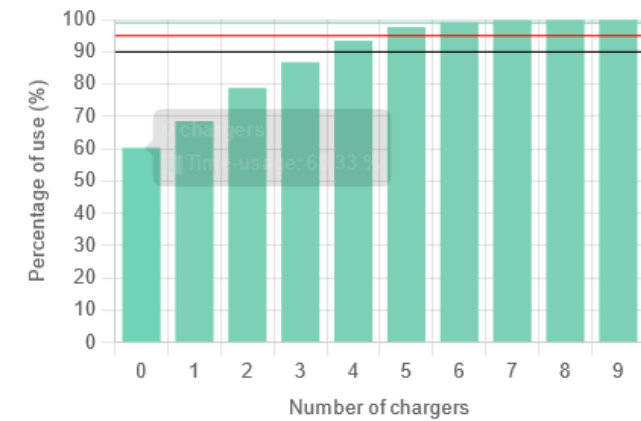


Manage driver profiles

 Morning shift 5 drivers	 Afternoon shift 5 drivers	 Sales people 5 drivers	 Visitors 10 weekly visits
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Cumulative time-usage ?



DESIGN OF A SOLAR SMART CHARGING HUB

COMPONENTS OF THE LOCAL ENERGY SYSTEM



DESIGN OF A SOLAR SMART CHARGING HUB

STEP 2: MAP ENERGY COMPONENTS

What is the current solar installed capacity and available space to expand?

What is the energy consumption

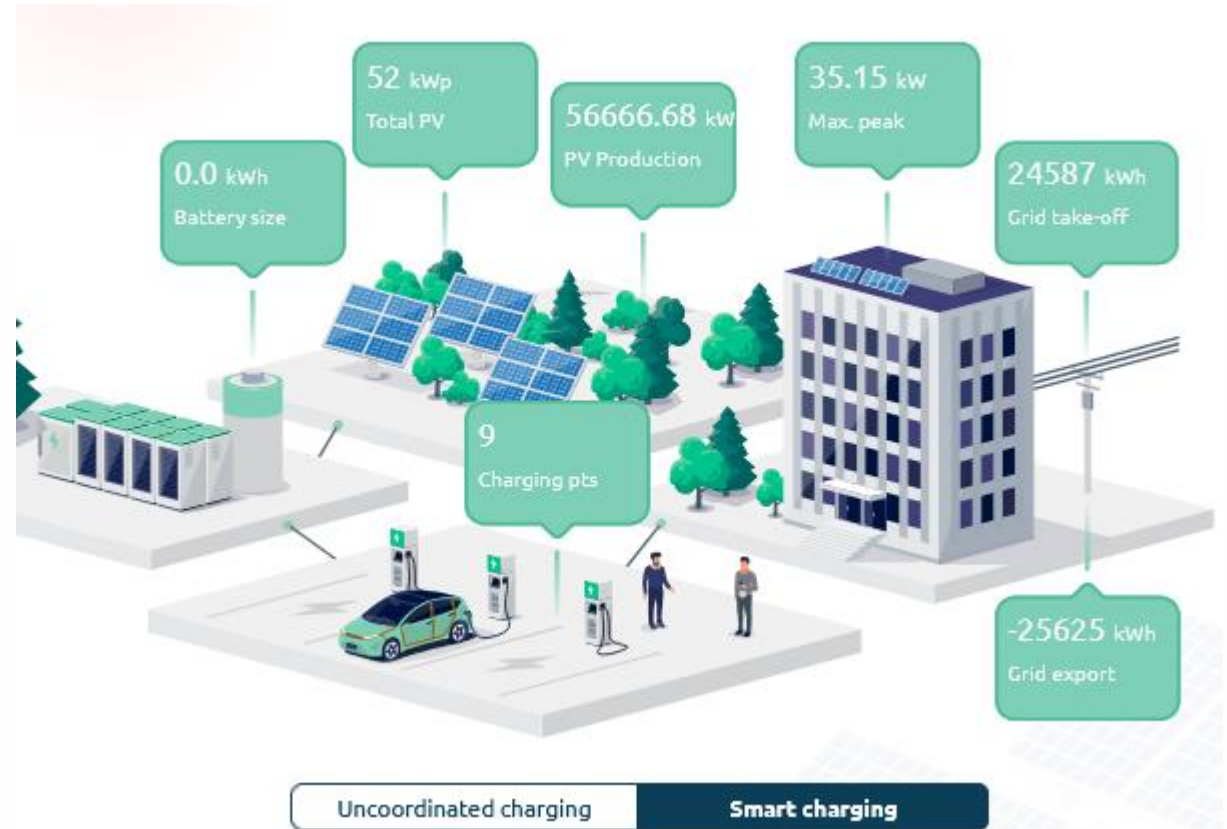
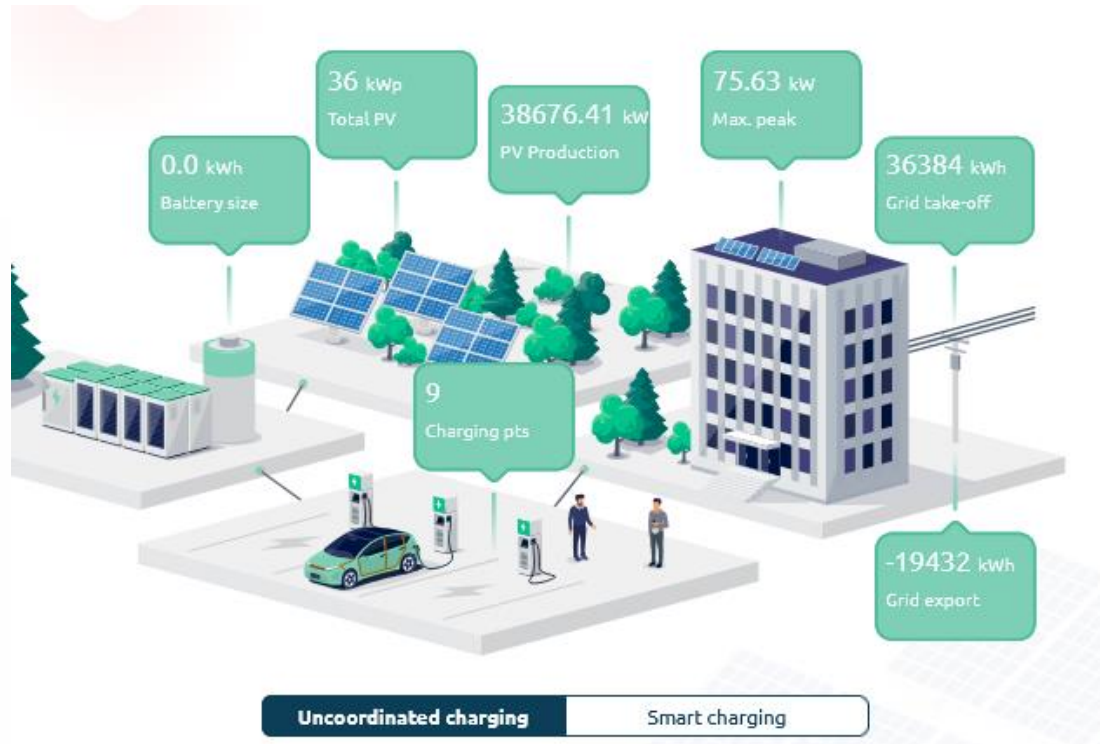
Do I want to invest in BESS?


Grid connection capacity & energy contract



DESIGN OF A SOLAR SMART CHARGING HUB

STAP 3: EVALUATION OF DESIGN

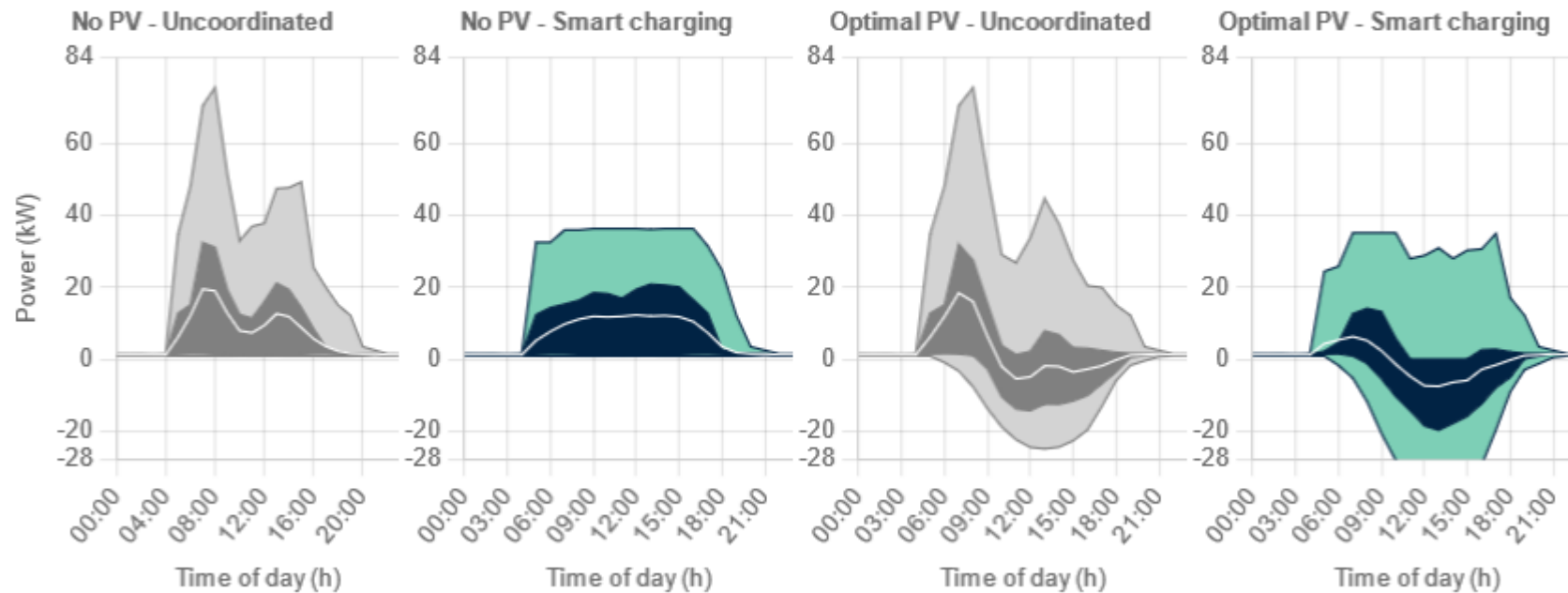



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DESIGN OF A SOLAR SMART CHARGING HUB

STAP 3: EVALUATION OF DESIGN

Power charts [?]

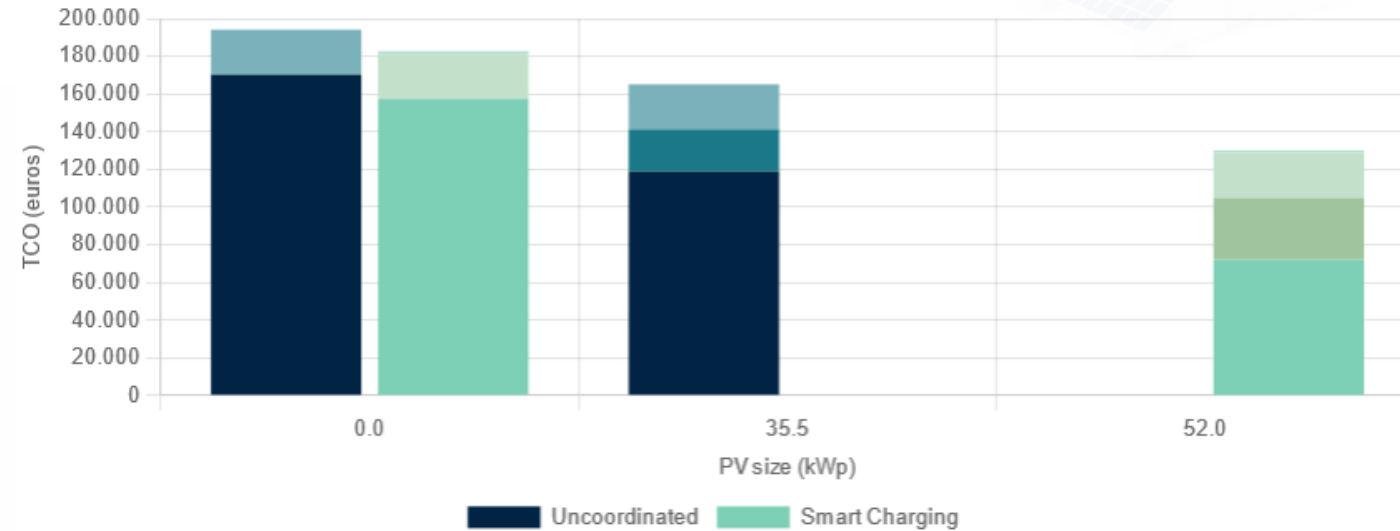


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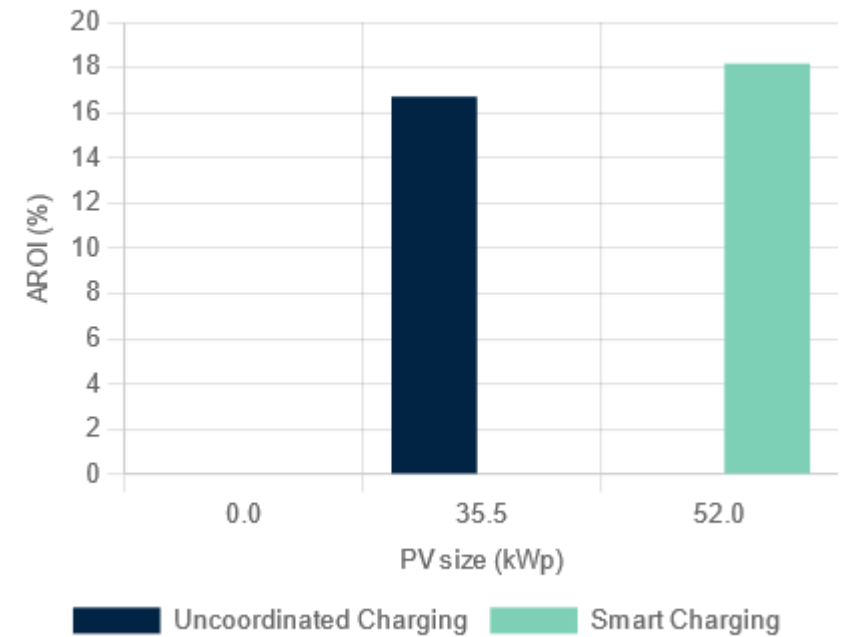
DESIGN OF A SOLAR SMART CHARGING HUB

STAP 3: EVALUATION OF DESIGN (BASE CASE)

Total Cost of Ownership [?]



Annualized ROI [?]



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DESIGN OF A SOLAR SMART CHARGING HUB

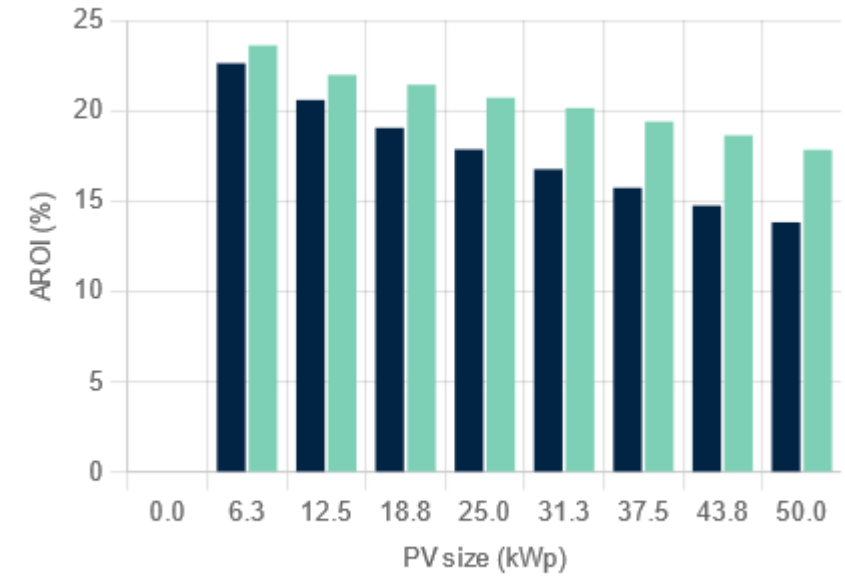
STAP 4: RUN SIMULATION WITH REALISTIC EMS



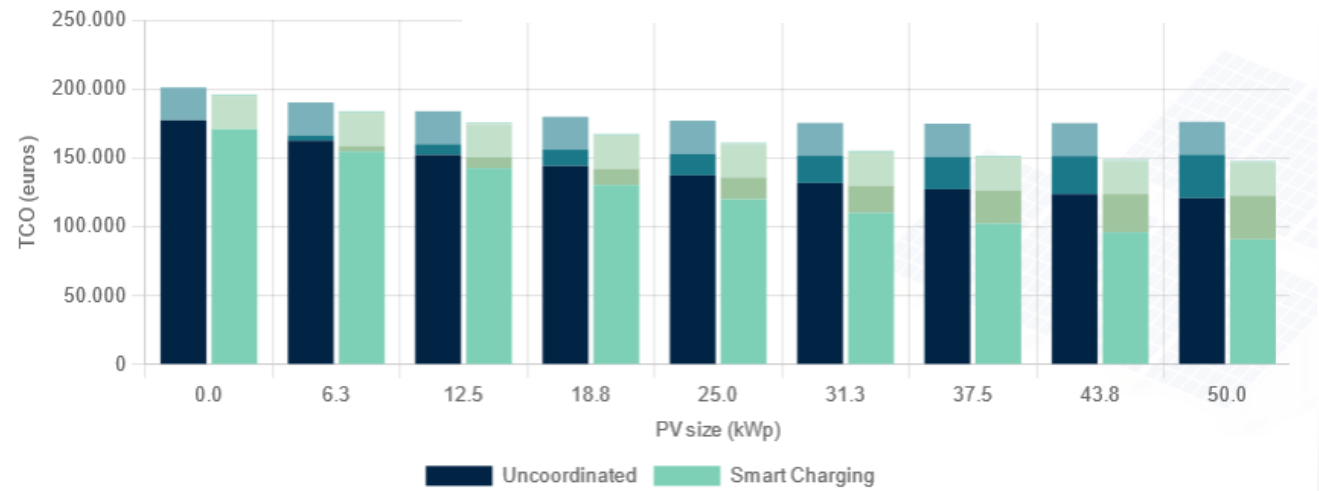
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Annualized ROI ?

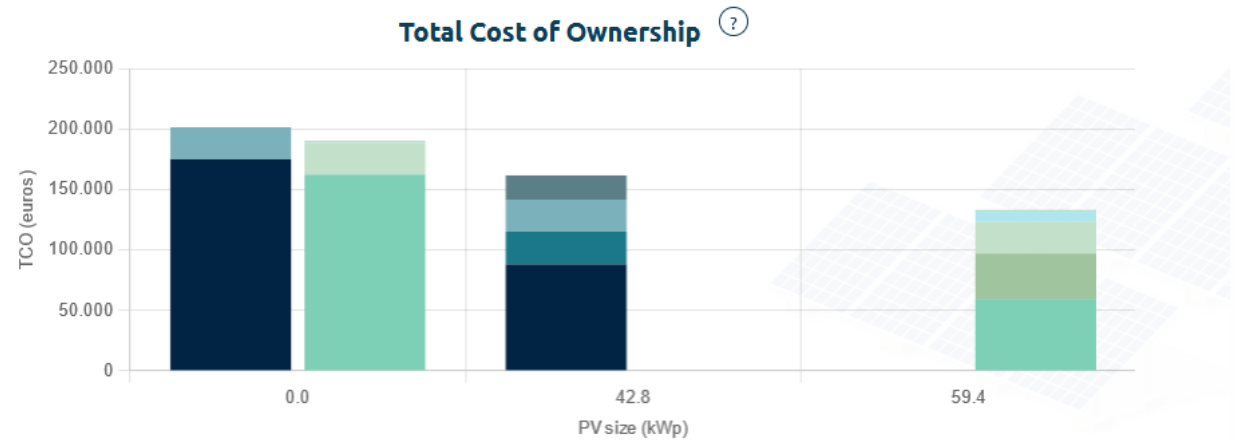


1 ■ Uncoordinated Charging ■ Smart Charging

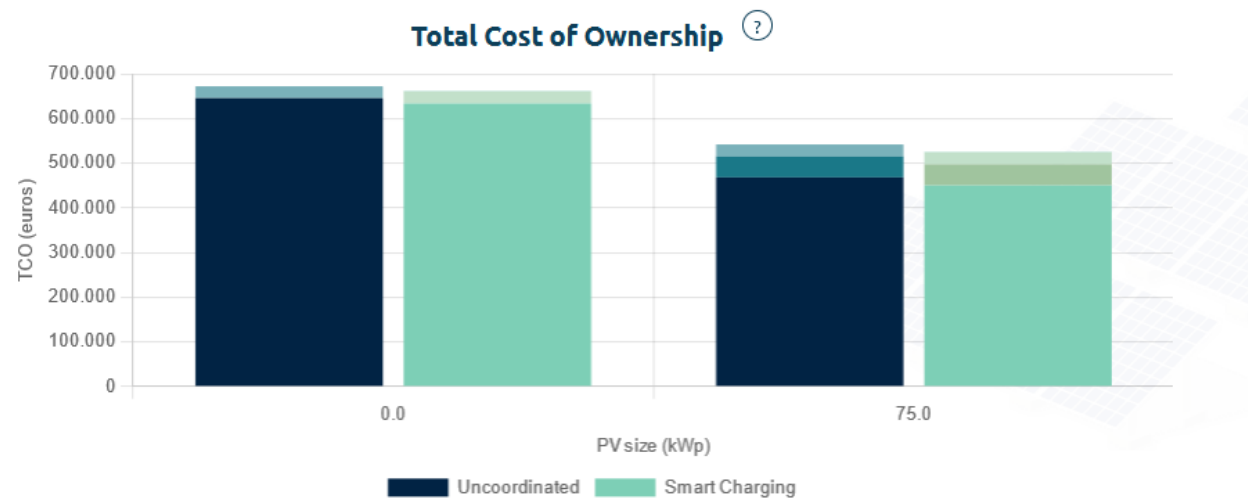


SOME OTHER SIMULATED SCENARIOS

WITH "CHEAP" BATTERY



SOME OTHER SIMULATED CASES WITH HIGH BUILDING CONSUMPTION



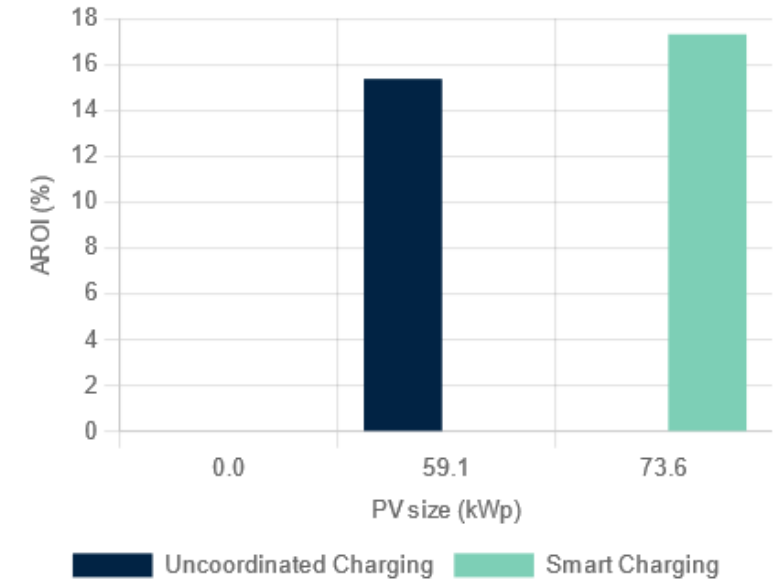
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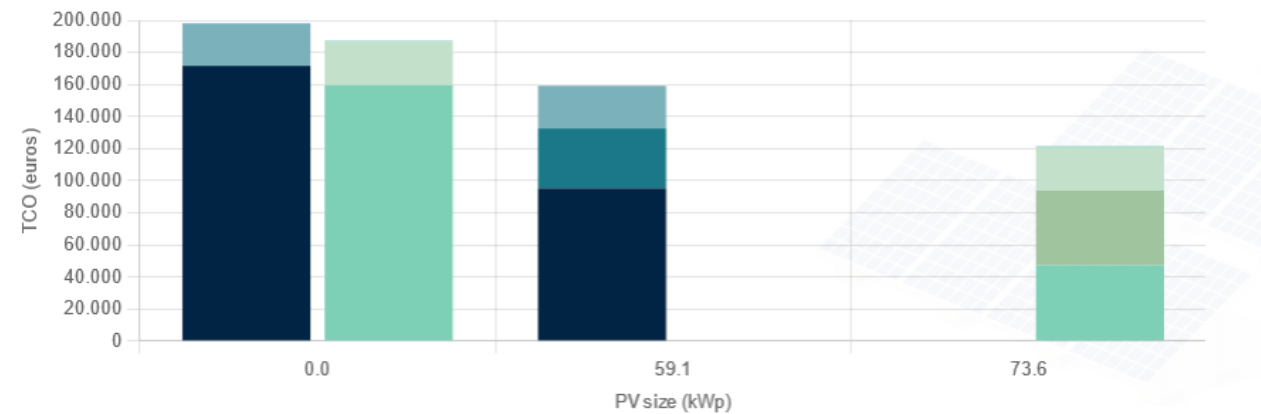
SOME OTHER SIMULATED CASES WITH INJECTION TARIFF



Annualized ROI [?]



Total Cost of Ownership [?]



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DESIGN OF A SOLAR SMART CHARGING HUB

LESSONS LEARNED & OUTLOOK

- Electric vehicle charging **increases consumption, induce consumption peaks, and does not guarantee self-consumption** in a local energy system
- A charging **HUB is a mix of energy producers and consumers** which design is highly dependent behaviour of its components:
 - Specific charging profiles linked to the mobility demand
 - Other consumers (such as office building,...)
 - Solar production
- Smart charging **reduces the Total-cost-of-ownership** for a charging HUB:
 - **Increase of cost effectiveness** of solar installation through **increase of self-consumption:**
 - => Increase size of solar installation
 - Reducing peak powers
 - (dynamic) tariff optimization



VRAGEN?

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