elektro

Scan Charge & GO!

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Problem

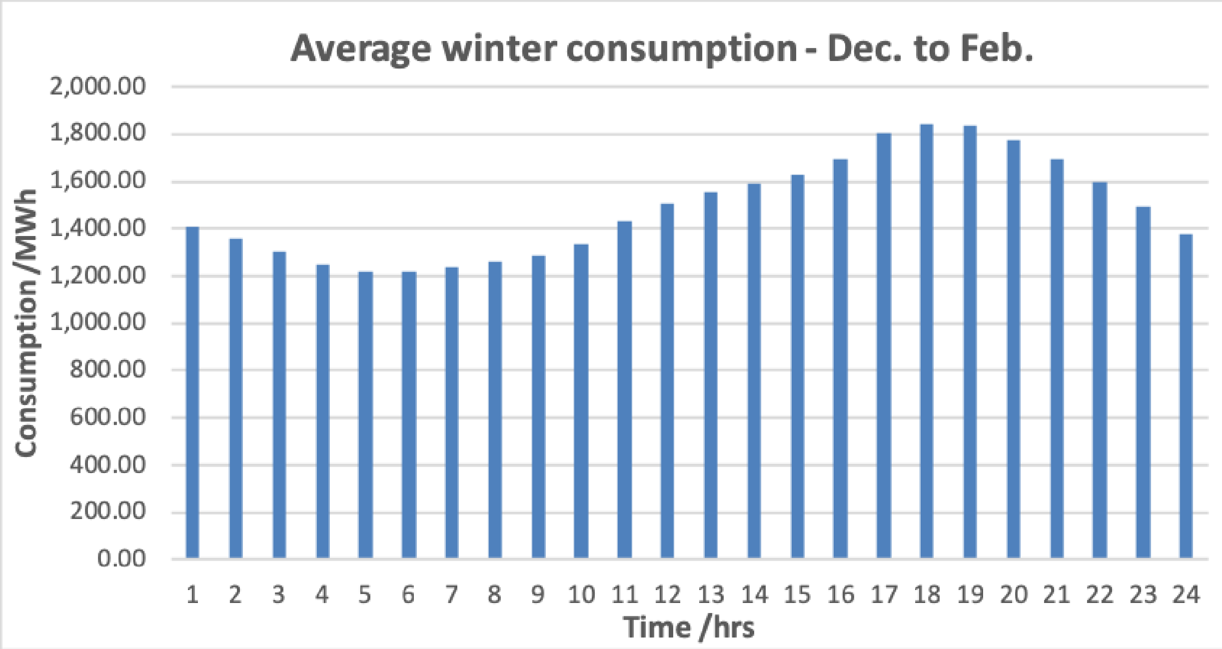
- Power **consumption** far outgrows the **production.**
- Capacity available from the national grid is limited and will not be expanded until **2027.**
- Scandinavian country is committed to having a **<u>100% fossil fuel-free vehicle fleet by 2030.</u>**
- High EV penetration level.

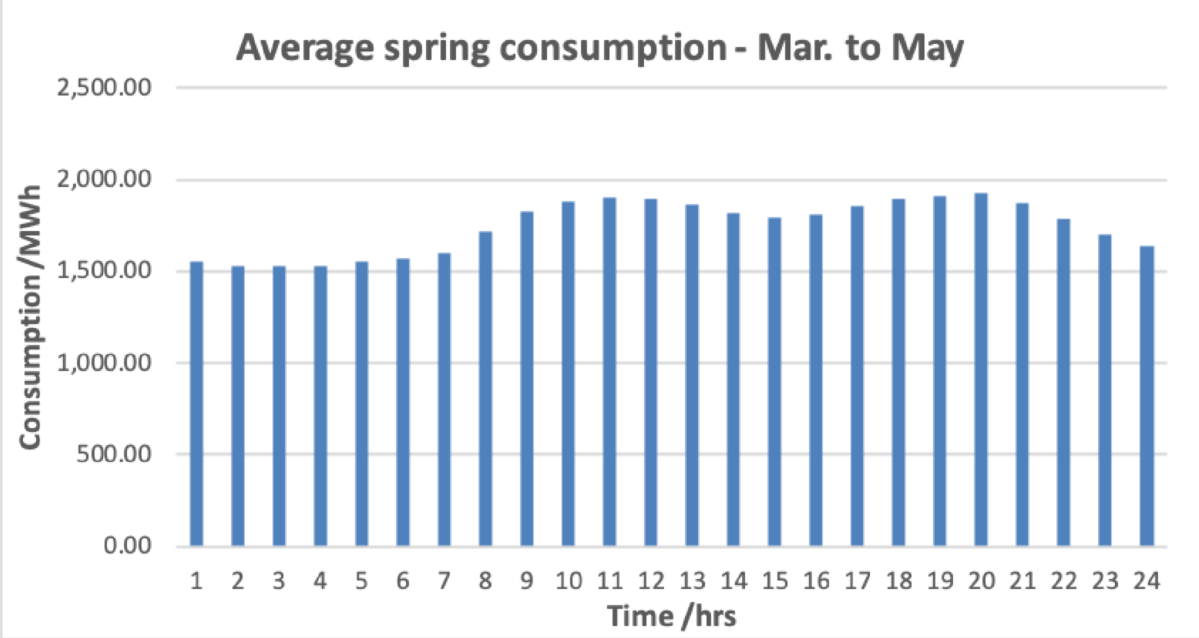
High EV penetration → More chargers → More load on grid → Power shortage & fluctuations

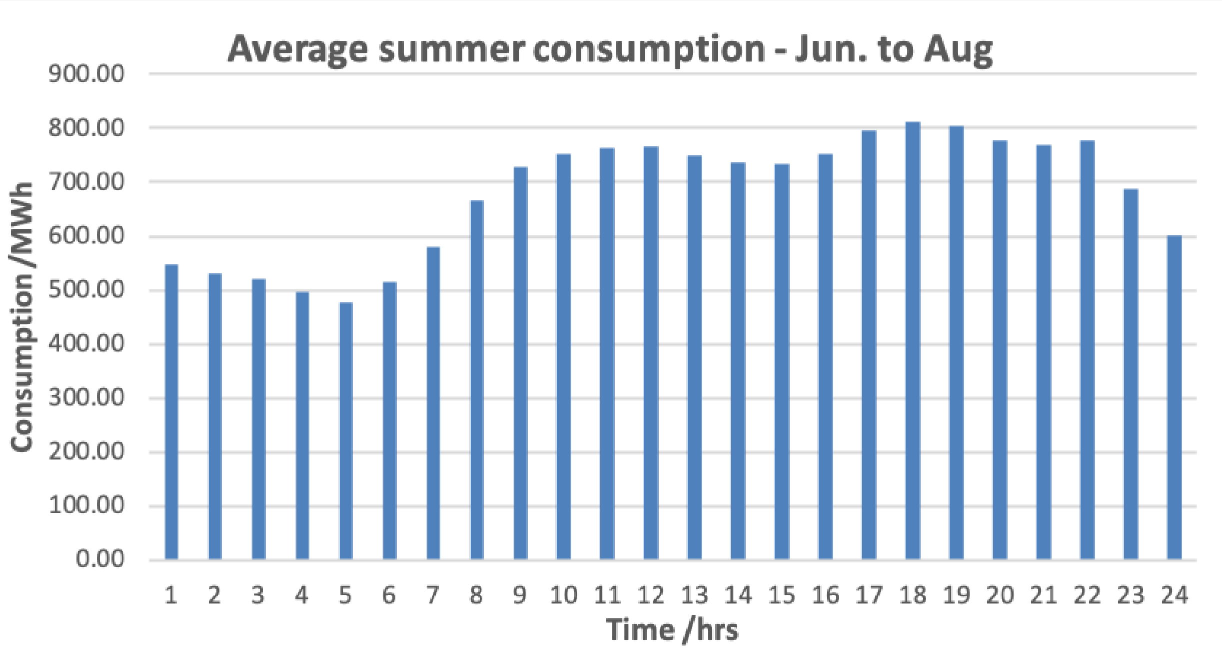
Plan

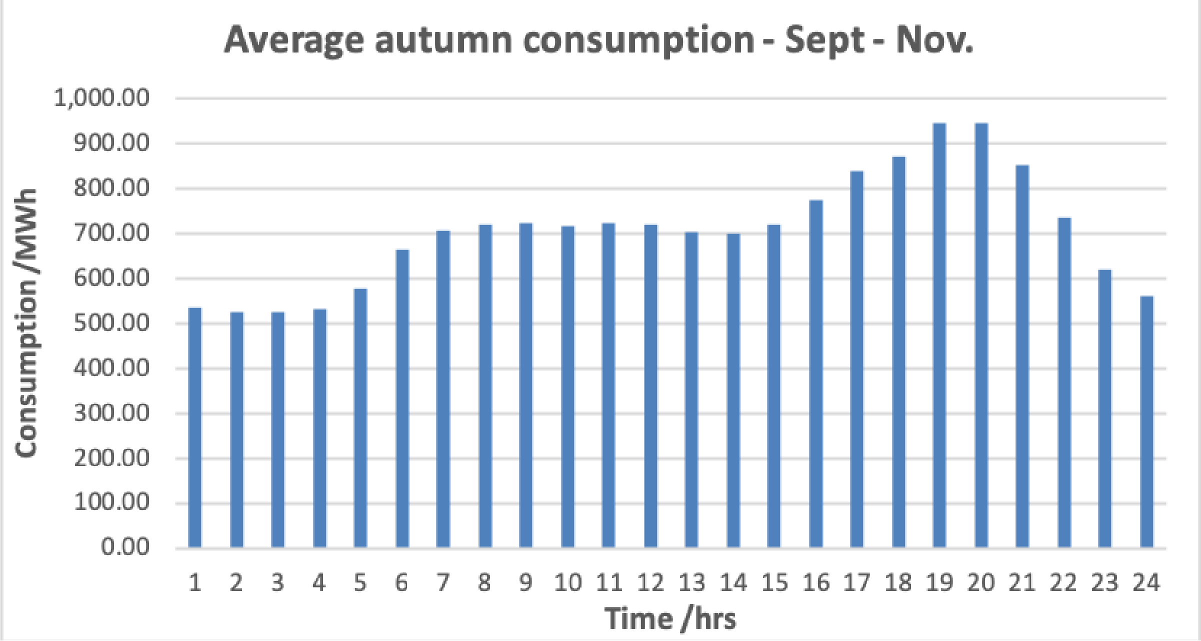
- Energy consumption and production.
- Peak demand.
- Constant loads (lighting, elevator, etc.) , and connecting it to the grid.
- Identifying extra energy sources and output.
- Charging strategy (Algorithm).
- Setting time of use (TOU) pricing scheme.
- Financial Analysis.

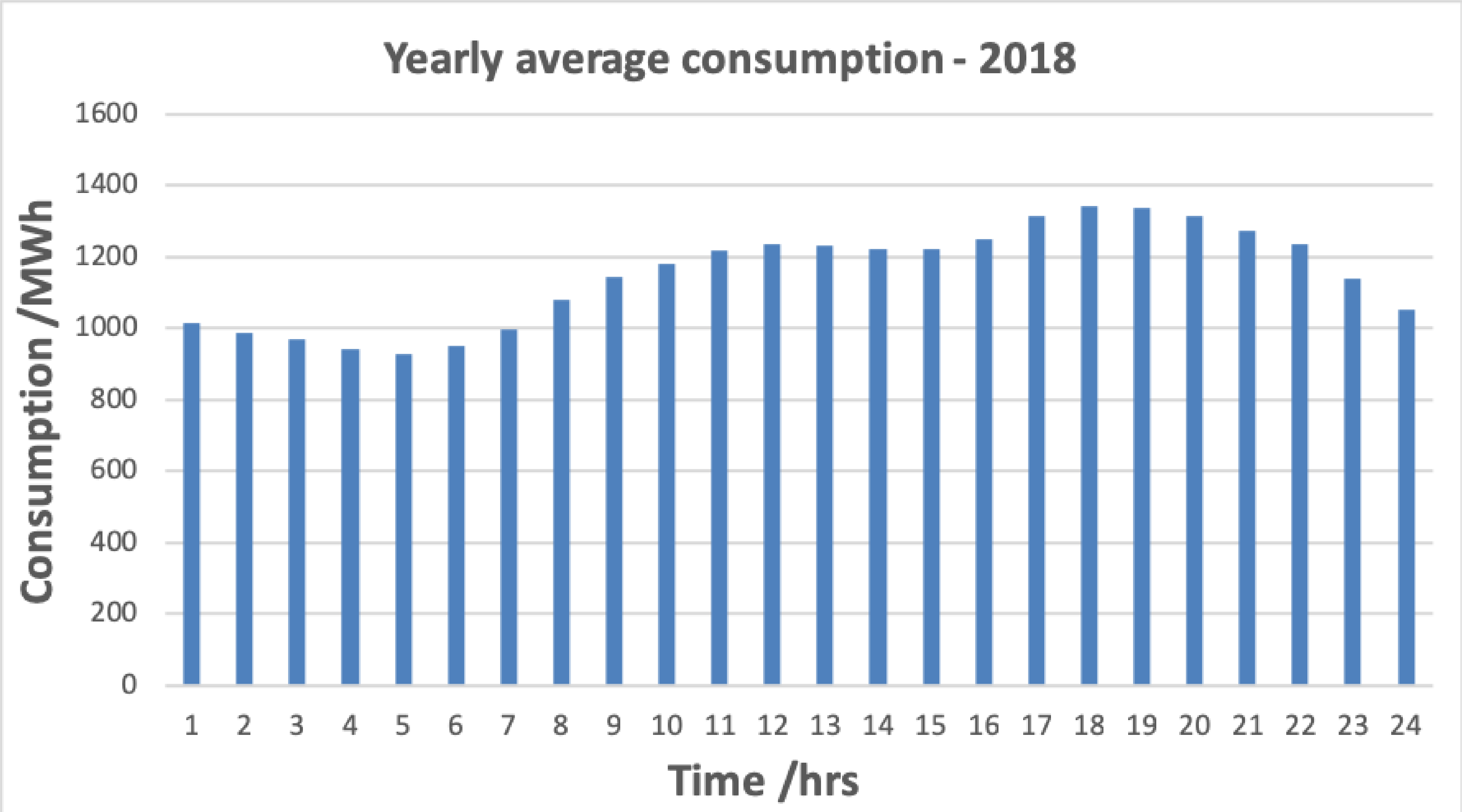
Electricity area 4, Malmo average consumption











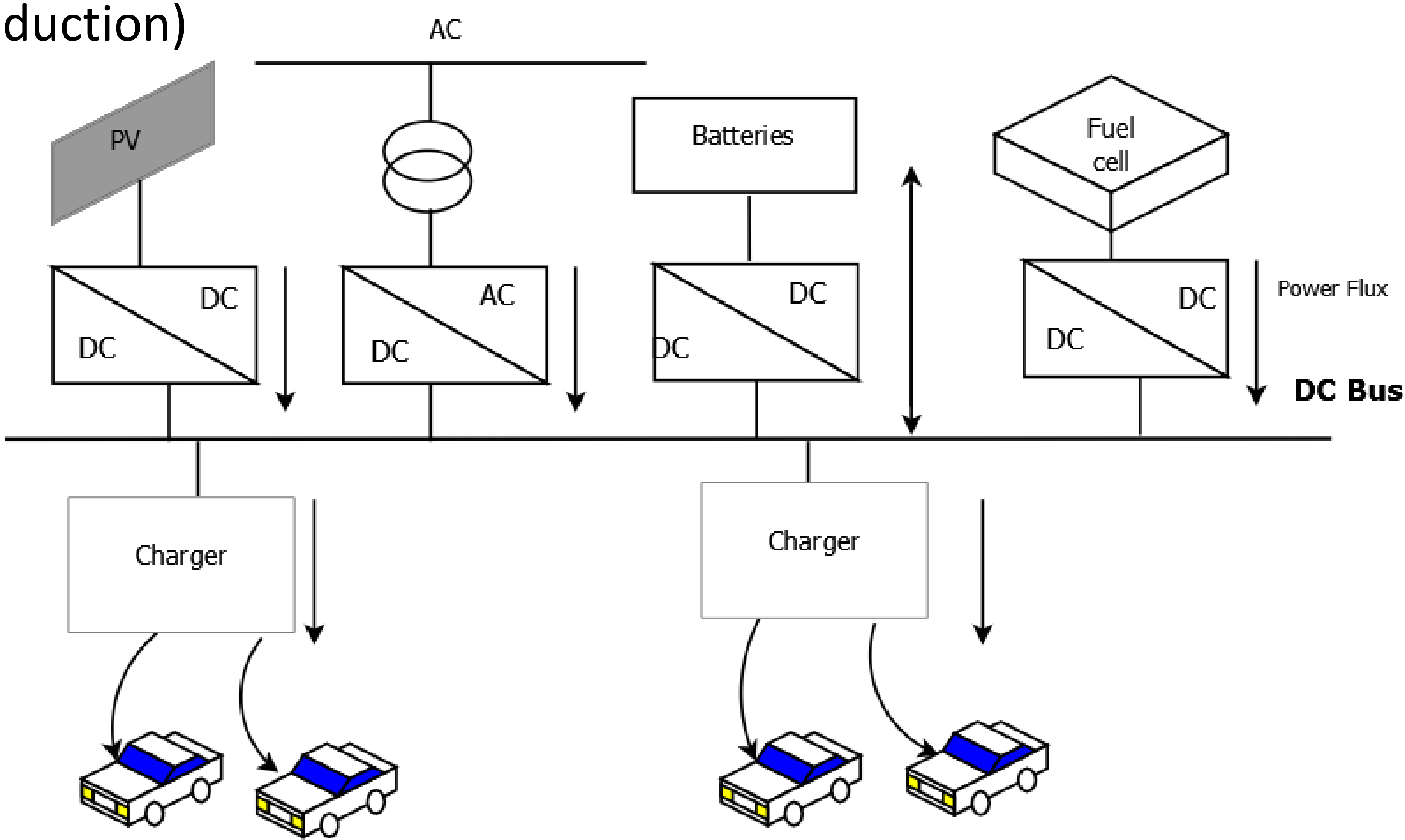
https://mimer.svk.se/

Common PHEV & BEV in Sweden

1. Mitsubishi Outlander P-HEV
2. Volkswagen Passat GTE
3. Volvo V60 PHEV
4. Nissan Leaf
5. Tesla Model S

System Architecture

- DC bus rather than AC bus
- Higher efficiency (about 10% reduction) and lower hardware costs.
- Grid depends on power of:
  - Solar panel
  - Fuel cells
  - Battery



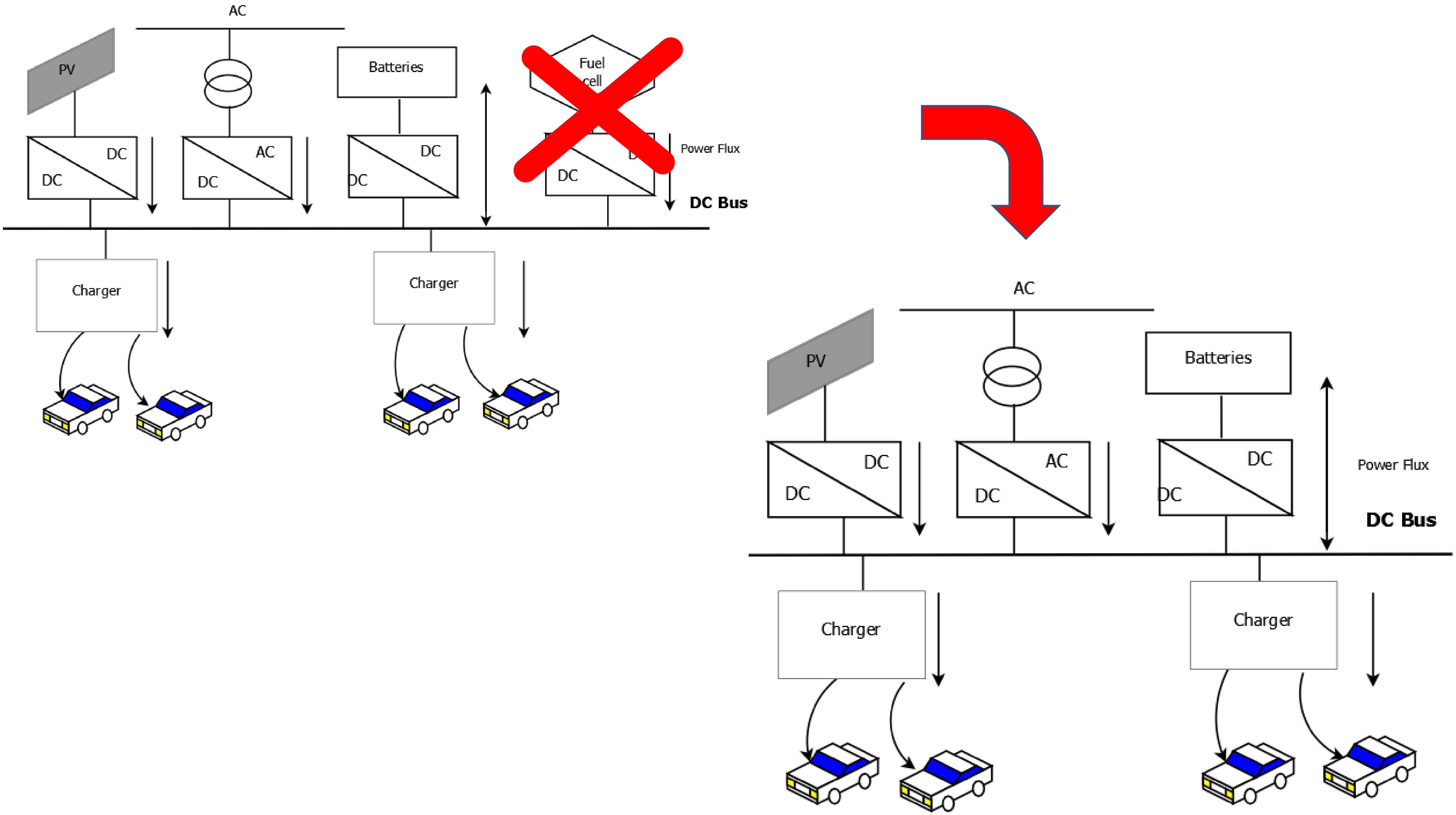
Fuel Cell

- Zero emissions.
- Fair efficiency.
- Renewable Source.

"The devil hides in the details "

- Fuel cell is very expensive.
- Requires continuous hydrogen supply.
- Hydrogen **tank volume size** or **electrolyzes operation.**

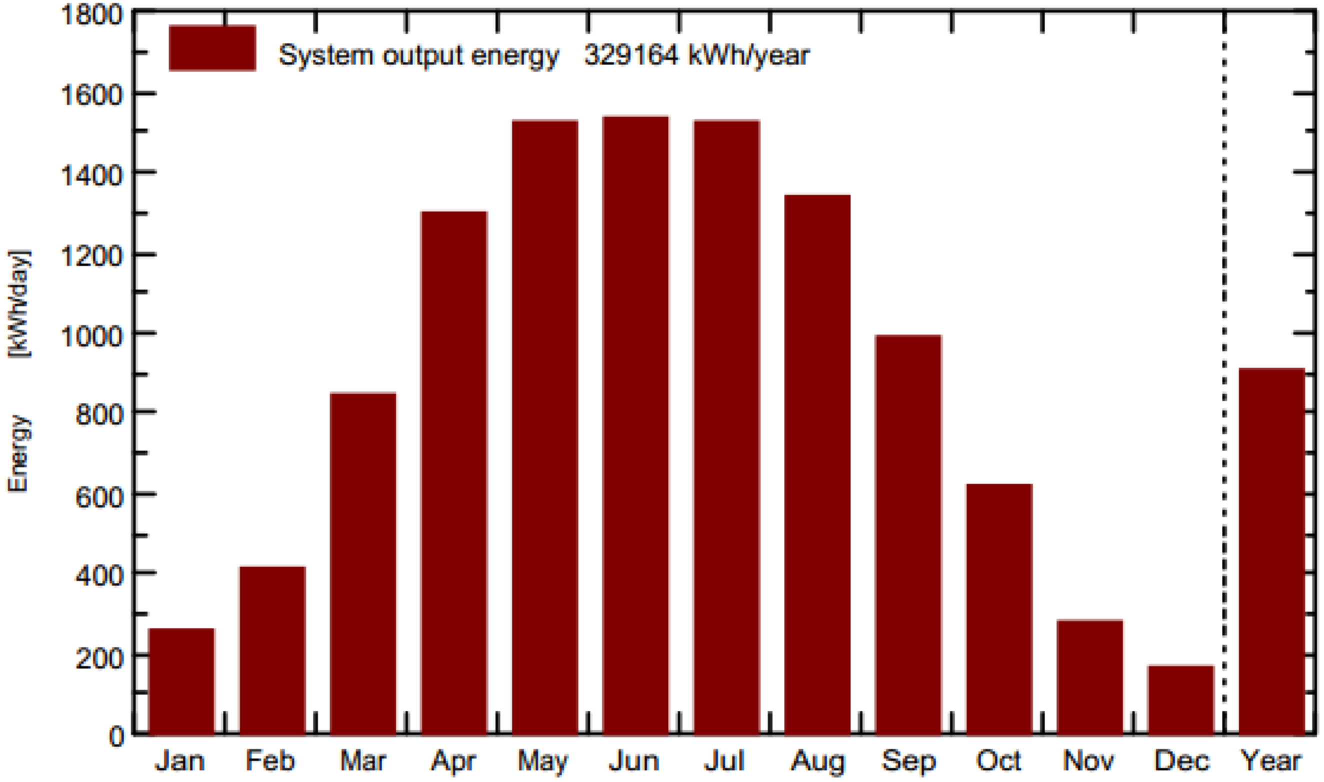
Technology not mature yet at the moment!

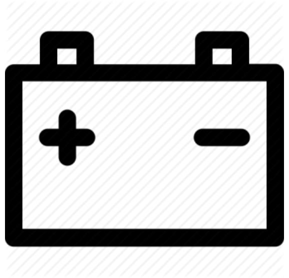

AC
PV
Batteries
Fuel cell
DC
DC
AC
DC
DC
DC
DC
DC
Power Flux
DC Bus
Charger
Charger
AC
PV
Batteries
DC
DC
AC
DC
DC
DC
Power Flux
DC Bus
Charger
Charger

PV system

- Area = 2000 m^2
- Simulation of Malmo on **PVsyst.**
- Monocrystalline Solar cells
- 320 kWp

- Estimated Output = 330,000 kWh/year





Batteries

- **Capacity** = 500 kWh
- **Area** = 35 m^2
- **Life expectancy** = 7 years

Dual Charger

- DC-DC charger (DC-DAS) , *DC NOT FAST CHARGER!*
- Connected directly to the DC bus.
- Power = 12 kW Current =32A   Volt = 400V

Charging Zones

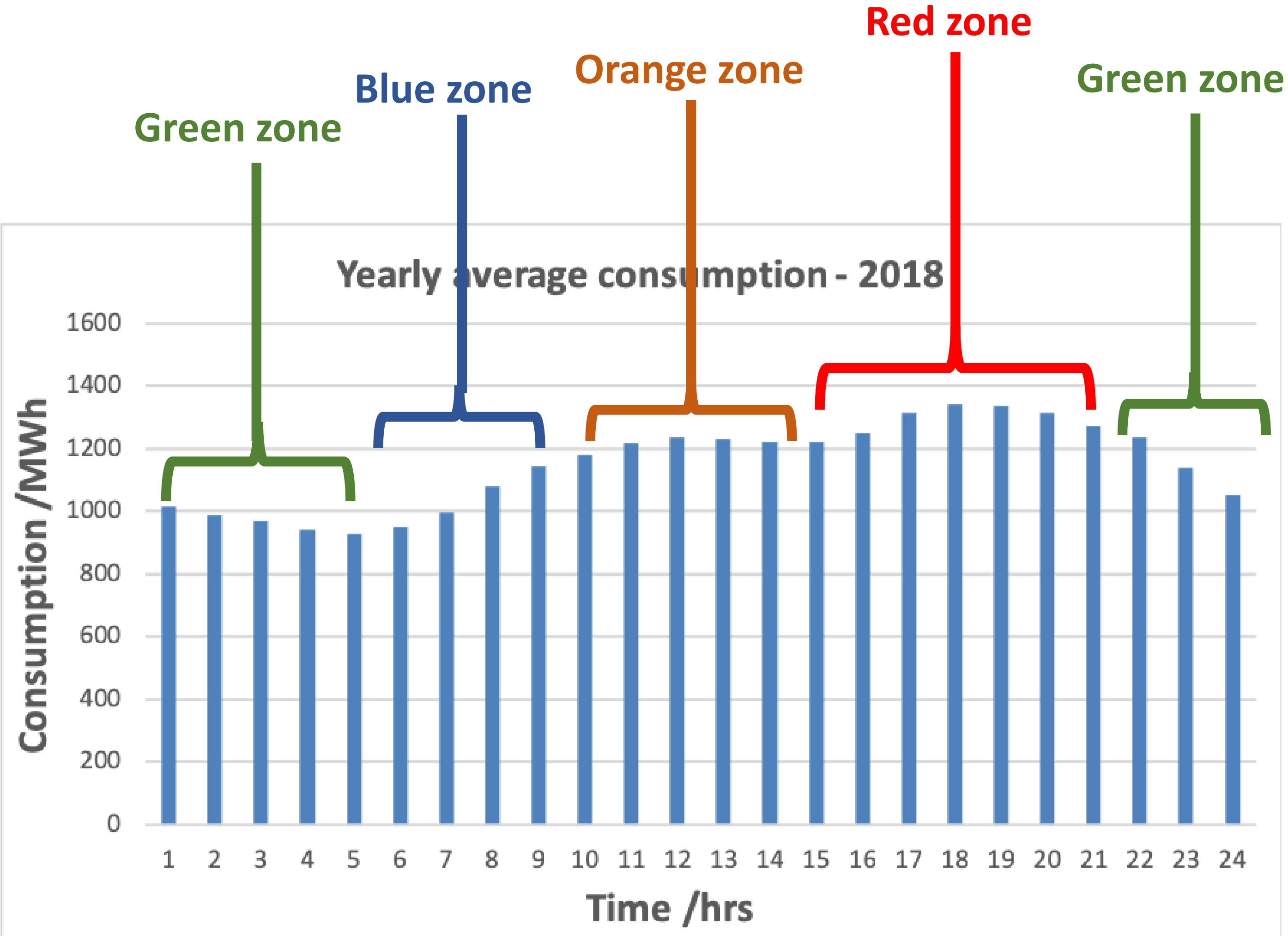
Green charging zone (22:00 – 7:00 h)

Blue charging zone (7:00 – 10:00 h)

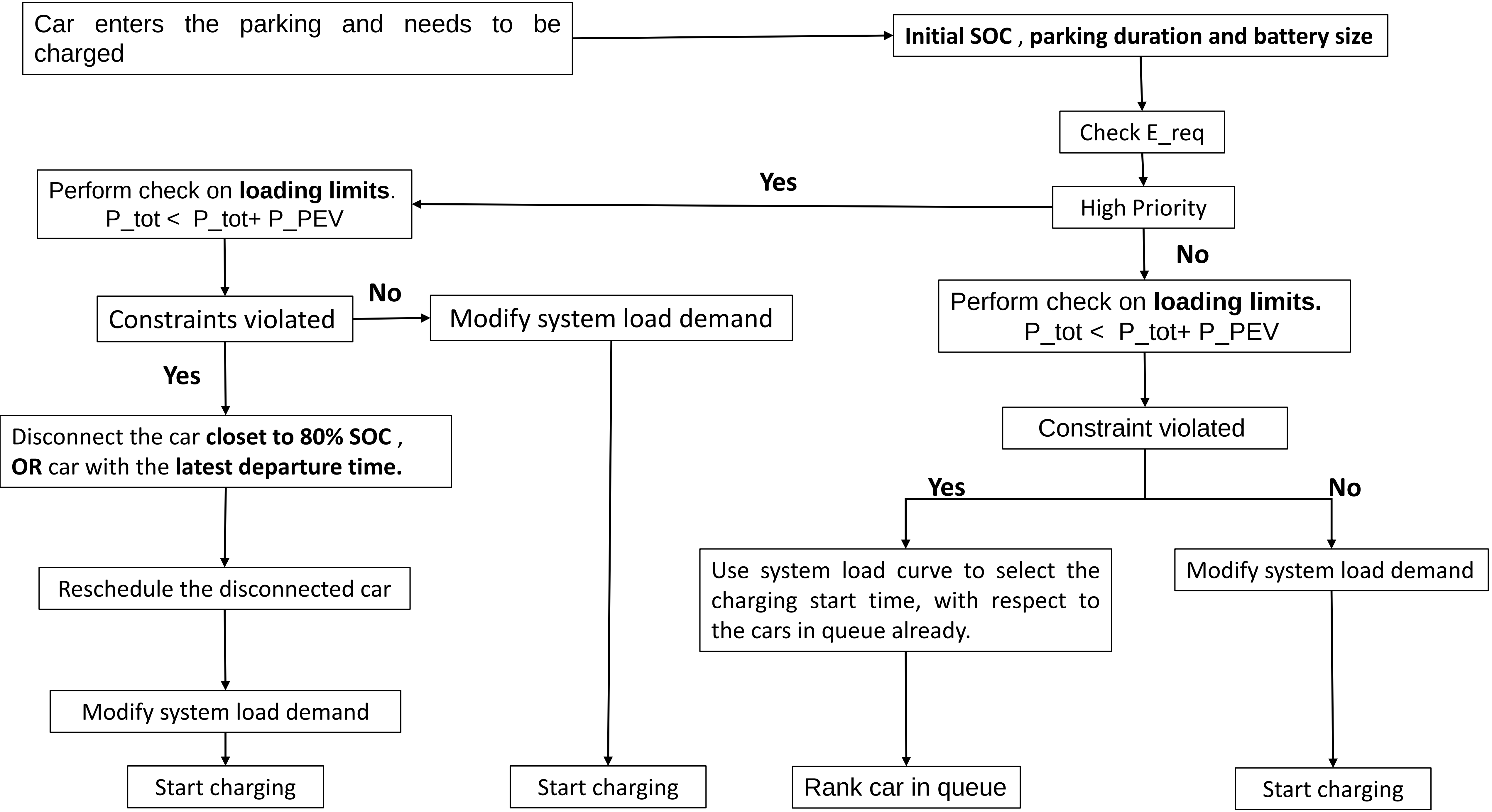
Orange charging zone (10:00 – 15.00 h)

Red charging zone (15:00 – 21:00 h)

High Priority (not time determined)



Charging Algorithm



Car enters the parking and needs to be charged
Initial SOC , parking duration and battery size
Check E_req
High Priority
Yes
Perform check on loading limits. P_tot < P_tot+ P_PEV
Constraints violated
No
Modify system load demand
Yes
Disconnect the car closet to 80% SOC , OR car with the latest departure time.
Reschedule the disconnected car
Modify system load demand
Start charging
Start charging
No
Perform check on loading limits. P_tot < P_tot+ P_PEV
Constraint violated
Yes
No
Use system load curve to select the charging start time, with respect to the cars in queue already.
Modify system load demand
Rank car in queue
Start charging

Time of Use pricing scheme (TOU)

Average charging price in Malmo = 0.55 € /kWh

Charging Zone	€/kWh
Green	0.40
Blue	0.45
Orange	0.50
Red	0.60
High Priority (Outside the Red zone)	0.65
High Priority (In the red zone)	0.75

Financial Model

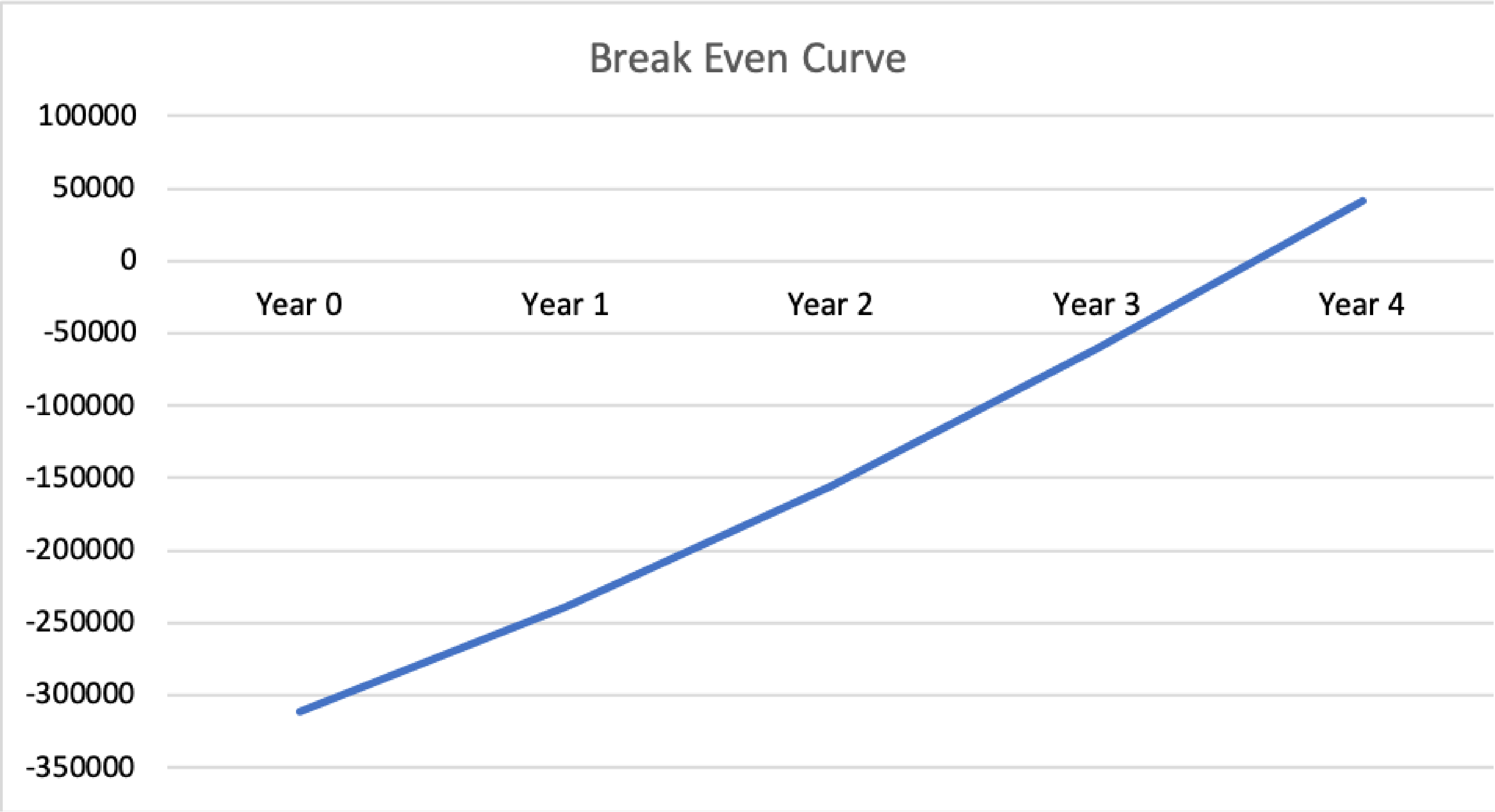
Component	Amount (€)
PV	120,000
Batteries	65,000
Installation/Connections	30,000
Chargers	25,000
Converters/Rectifier	60,000
Control instrumentation	20,000
Total	**330,000**

Assumptions to calculate break-even

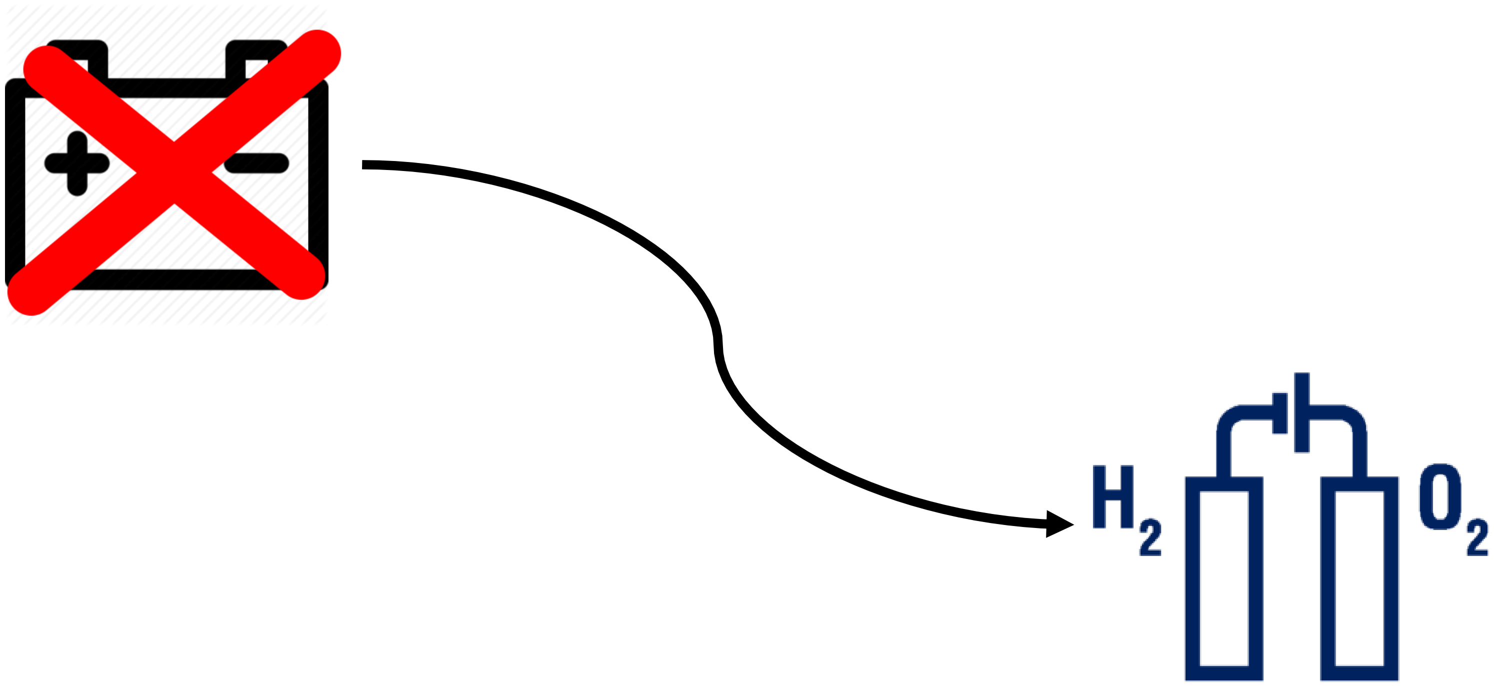
	kWh/day	Average profit margin (€)	Operation cost (€)
Year 1	500	0.45	10,000
Year 2	600	0.45	15,000
Year 3	650	0.45	20,000
Year 4	700	0.45	30,000

Break-Even point

3 Years, 6 Months

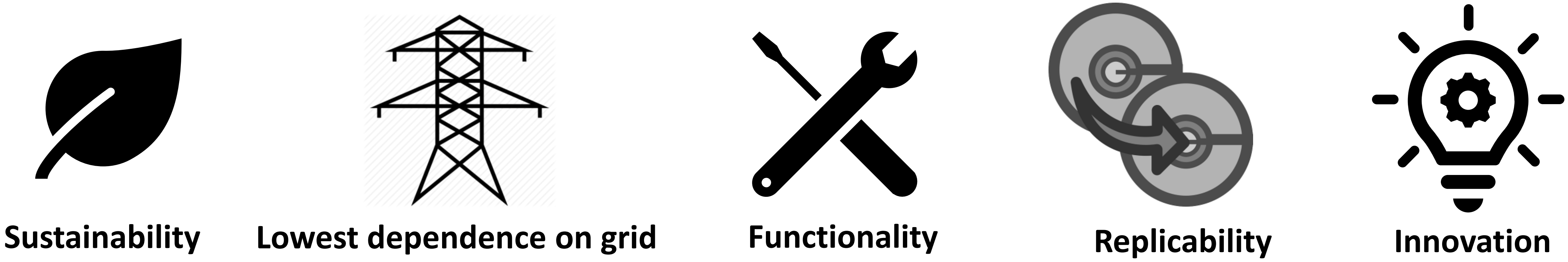


After 7 Years, batteries are dead



Technology becomes more mature leading to

- Cheaper
- Higher Efficiency


Sustainability
Lowest dependence on grid
Functionality
Replicability
Innovation

Thank You

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