ZEEBURG P+R

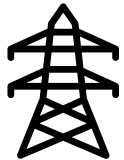# WHATS GOING ON?

P+R system with 8 charge points

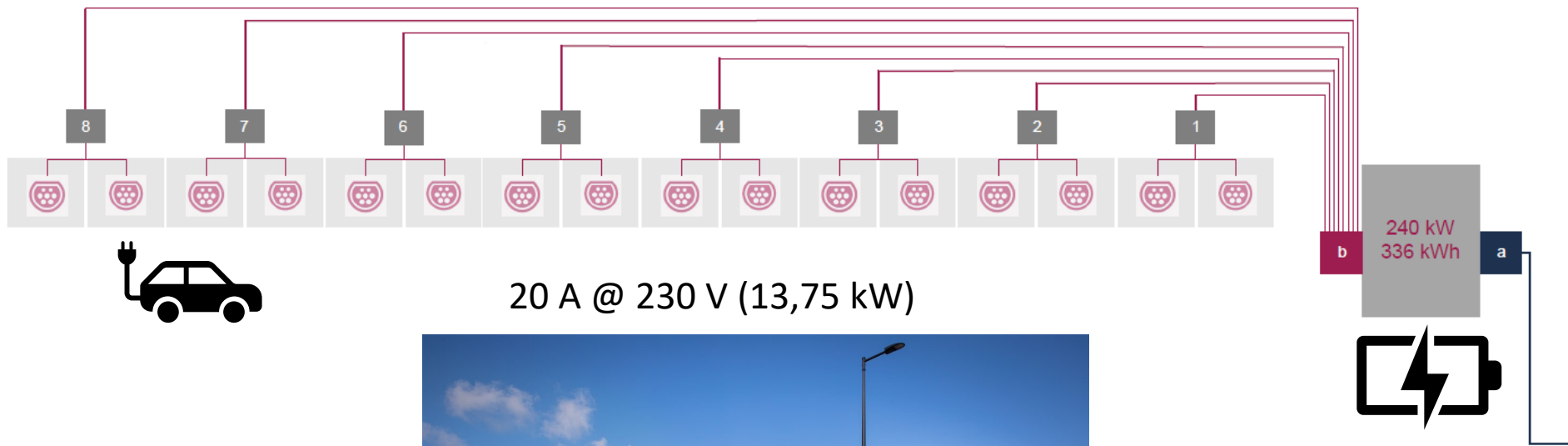Limited capacity grid connection (3×80 A)

On-site battery to support charging (240 kW, 336 kWh)

Short term solution to electricity network capacity issues

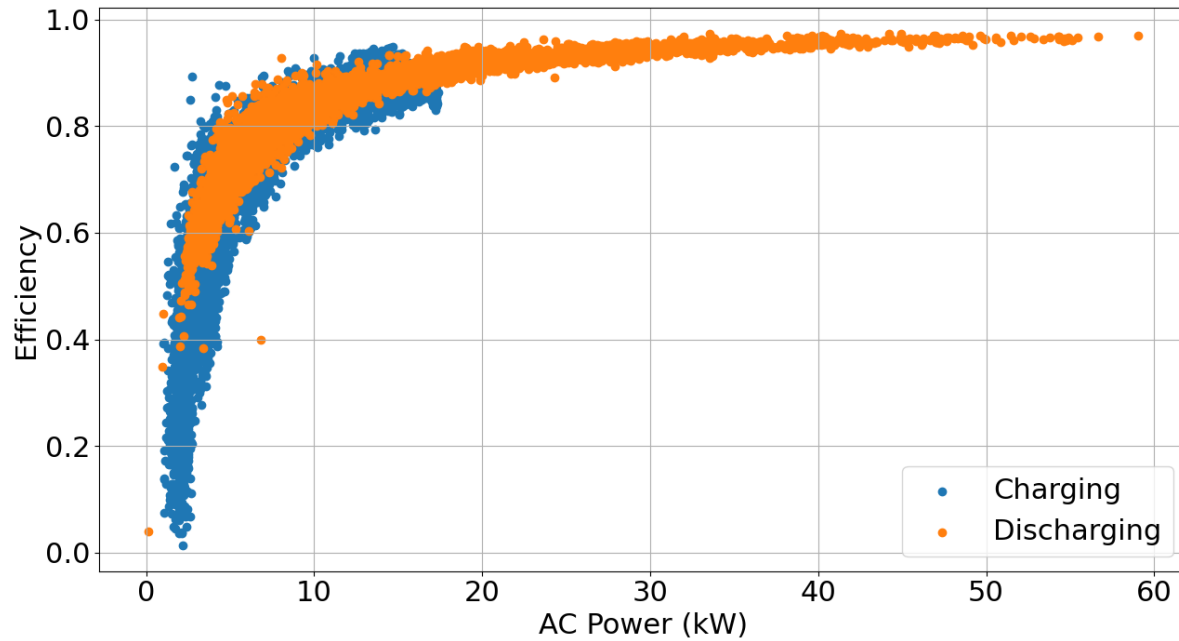**Destination charging stations & charging points**

Battery system

20 A @ 230 V (13,75 kW)

240 kW
336 kWh

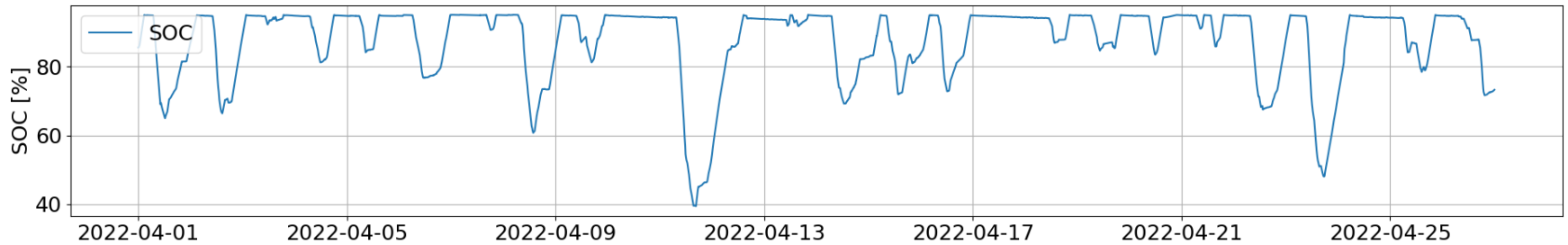b   a

8 7 6 5 4 3 2 1

INVERTER EFFICIENCY

High conversion losses from AC to DC and vice-versa

BESS USAGE
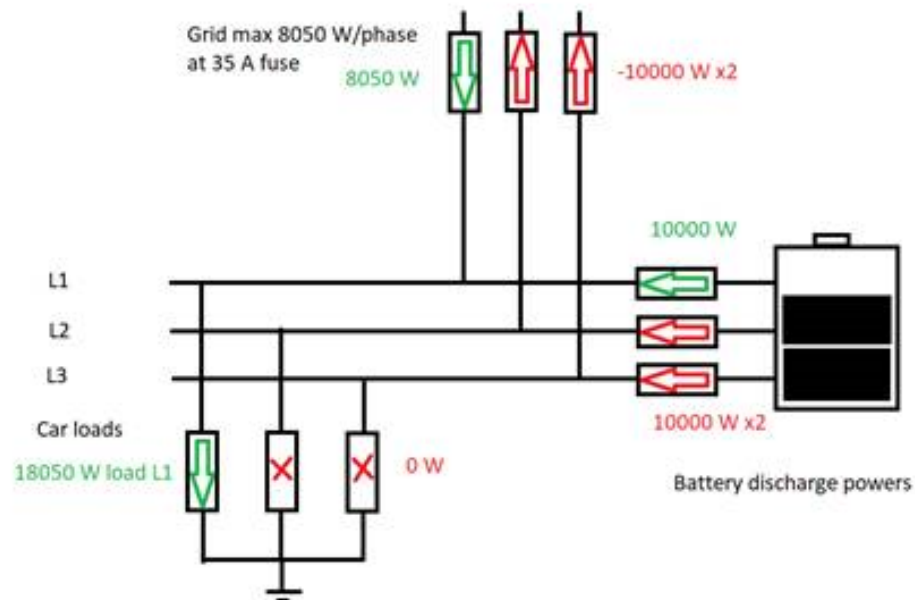

BESS is oversized or underutilised for current operation

GRID FEEDBACK

BESS continued feeding power back to the grid when phases were unbalanced

	Initial operation (June & July)	**After feedback protection update (October & November)**
Minimum inverter efficiency	4 %	5 %
System round trip efficiency	71 %	57 %
Battery idle	50 %	69 %

RECOMENDATIONS

► Program a battery charge/discharge deadband of 10 kW

► Increase the programmed grid connection to 3 × 35 A (24.2 kW)

	Initial operation (June & July)	After feedback protection update (October & November)	After BESS control updates (January & February)
Minimum inverter efficiency	4 %	5 %	76 %
System round trip efficiency	71 %	57 %	68 %
Battery idle	50 %	69 %	89 %

OPTIMISATION PROBLEM

► Minimise annual system cost

► Function included BESS sizing, grid connection, loss of revenue from undelivered load

► Considered future proof load profile of 7 MWh, compared to currently observed 5 MWh

► Used a Genetic Algorithm, repeatedly using the same load profile

OPTIMISATION RESULTS

	Zeeburg P+R	Optimal sizing
Grid connection capacity	3×25 A	3×80 A
Battery energy storage capacity	336 kWh	69 kWh
Battery power capacity	240 kW	45 kW
Annualised cost	€9518 / year	€7101 / year
Loss of potential load	452 kWh	81 kWh

TAKEAWAYS

► The inverter must be adequately sized

► The BESS must be able to operate on all 3 phases individually

► BESS must be able to deliver power back to the grid

► BESS requires improved control depending on the intended function

  ► Peak shaving?

  ► Grid ancilliary services?

  ► Energy arbitrage?

  ► Smart charging?

► Is there a possibility of a solar roof installation? Would that be cheaper?