DER Potential

Demand side perspective

INPUTS

MARKET

- Service required
- Price offered
- Current tariff
- Current wholesale price

TECHNICAL

- Frequency
- Voltage
- Power factor
- Standard comms protocols

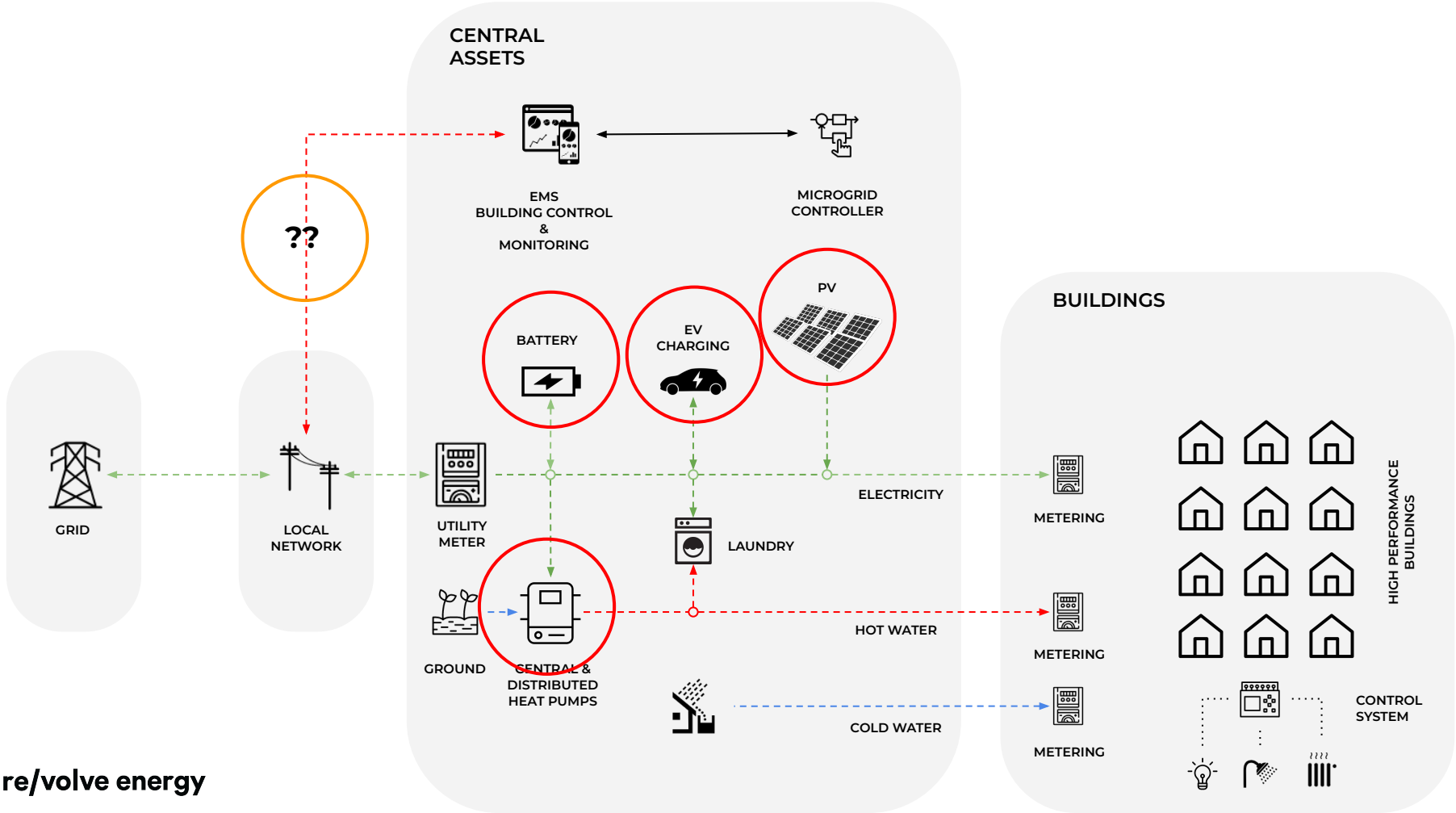
CAPABILITIES

- Increase load
- Reduce load
- Supply/absorb kVars

OUTPUTS

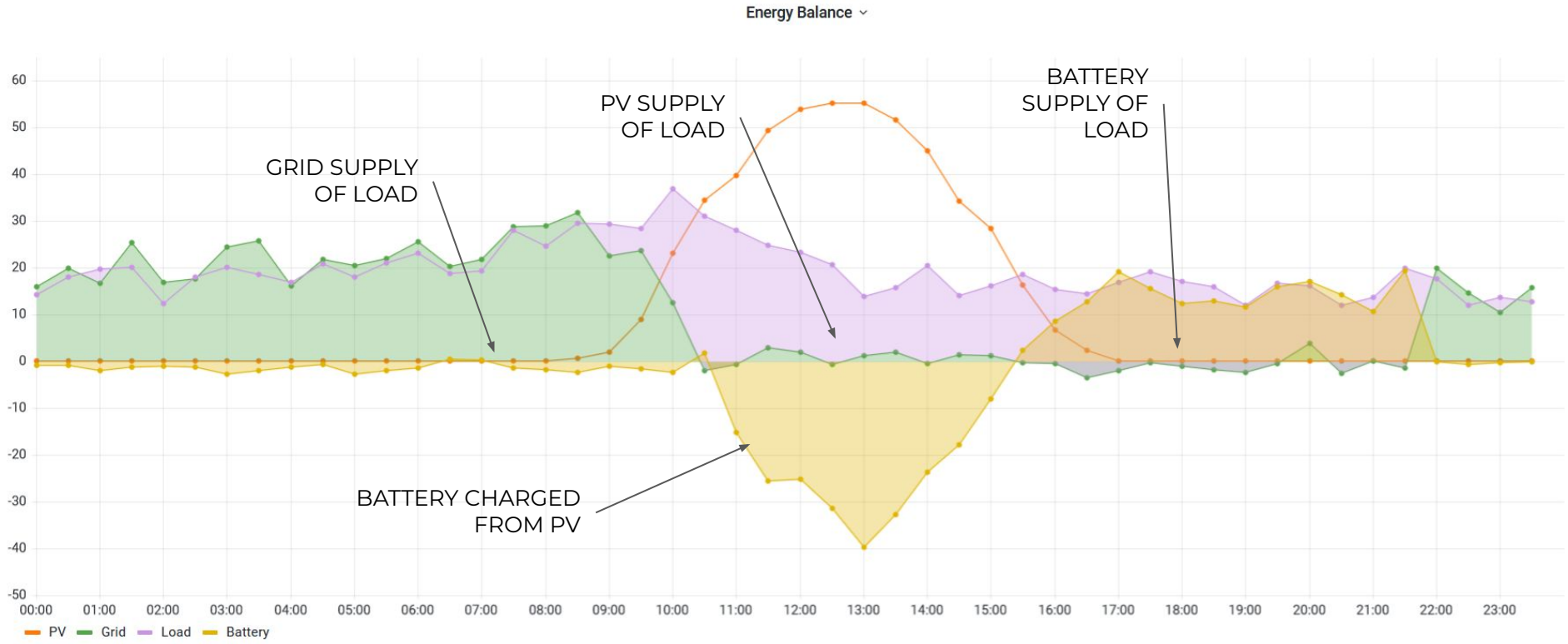
- Load shedding
- Load shifting
- Voltage support
- Reactive power support
- Energy arbitrage
- Reduce operating cost (TOU, zero marginal cost onsite generation)

Micro-grid
(Tourist accommodation)



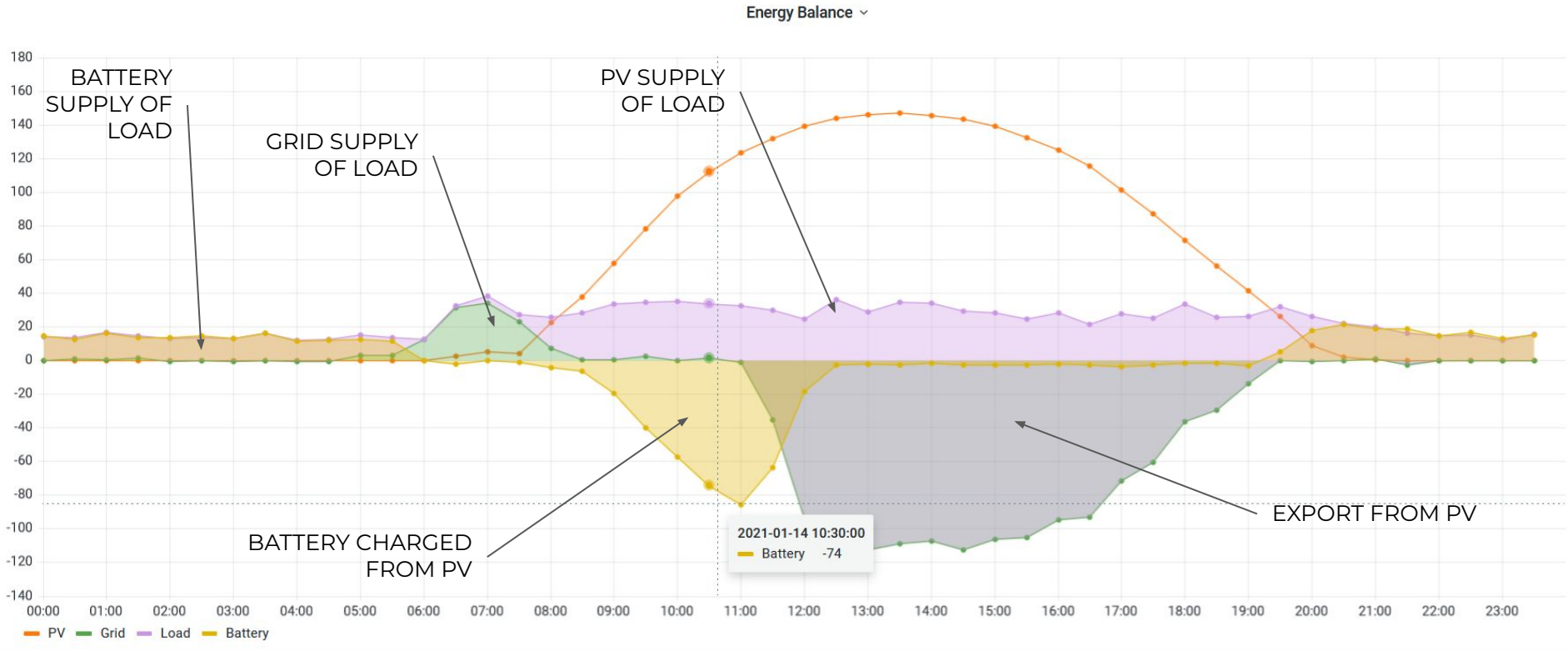
re/volve energy

June

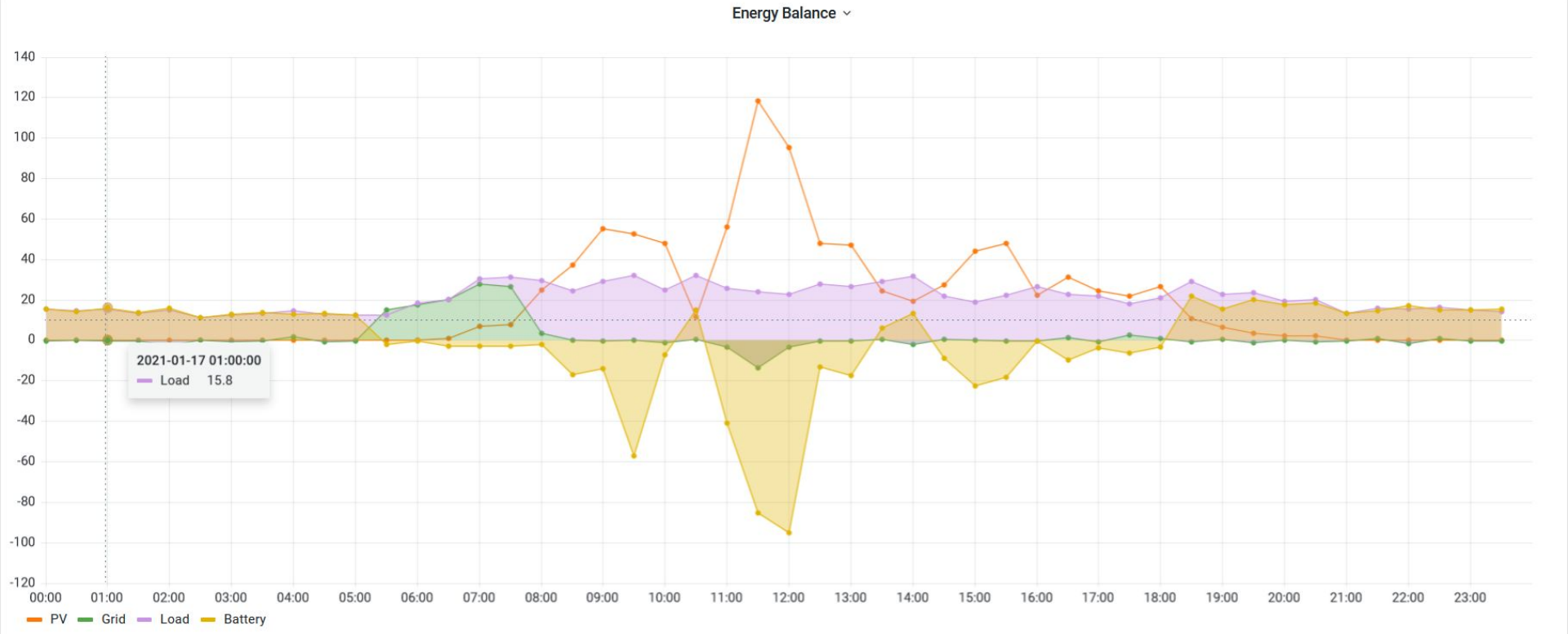


re/volve energy

Jan


Energy Balance
BATTERY SUPPLY OF LOAD
GRID SUPPLY OF LOAD
PV SUPPLY OF LOAD
BATTERY CHARGED FROM PV
EXPORT FROM PV
2021-01-14 10:30:00
Battery -74
180
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
PV
Grid
Load
Battery

Jan (with less generation)



INPUTS

CAPABILITIES

OUTPUTS

AVAILABLE

- Frequency
- Voltage
- Power factor
- Current wholesale market price (not representative of cost to customer).

NOT AVAILABLE

- DER service required
- Service price offered
- API feed of current tariff
- Standard comms protocols
- DER demand response signal

	□ Load	□ Load	kVAr
PV	✅		✅
Battery	✅	✅	✅
Heat pump	✅	✅	
EV	✅	✅	
Genset		✅	✅*
	365 kVA	**385 kVA**	**350 kVAr**

REALISED

- Reduce operating cost (zero marginal cost onsite generation)
- Backup in grid outage

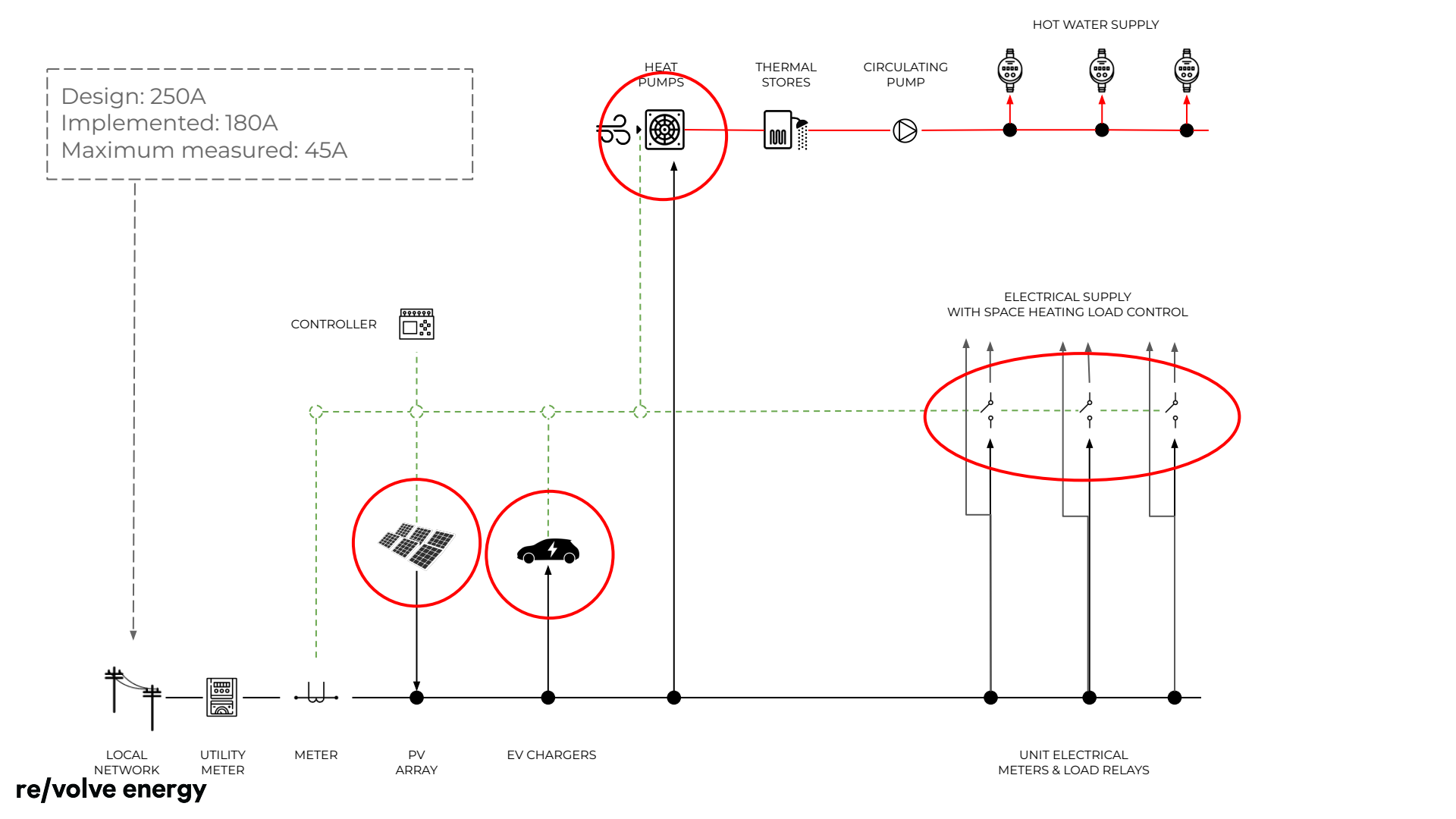
NOT REALISED

- Load shedding
- Load shifting
- Voltage support
- Reactive power support
- Energy arbitrage (for other parties)

re/volve energy

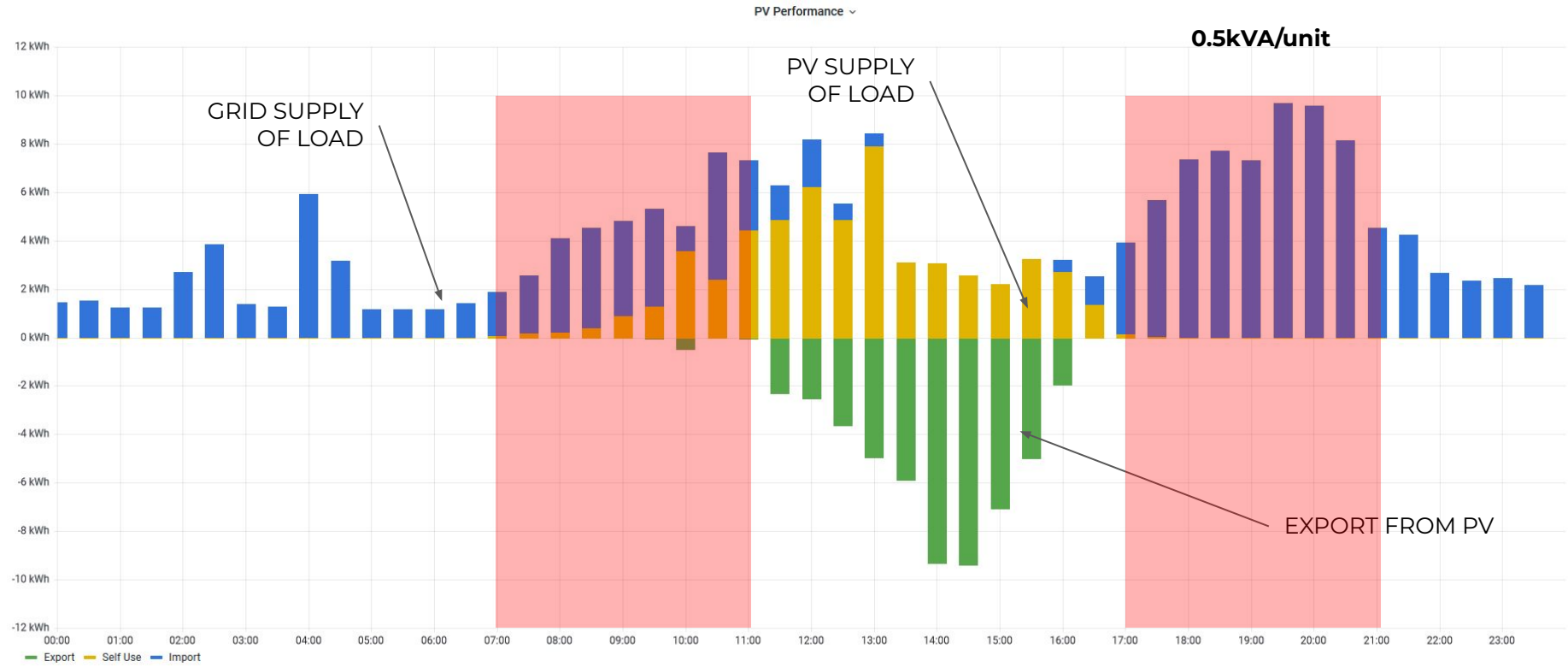
* Assuming generator operating at a power factor of 0.8

Customer network
(Multi-unit Residential)



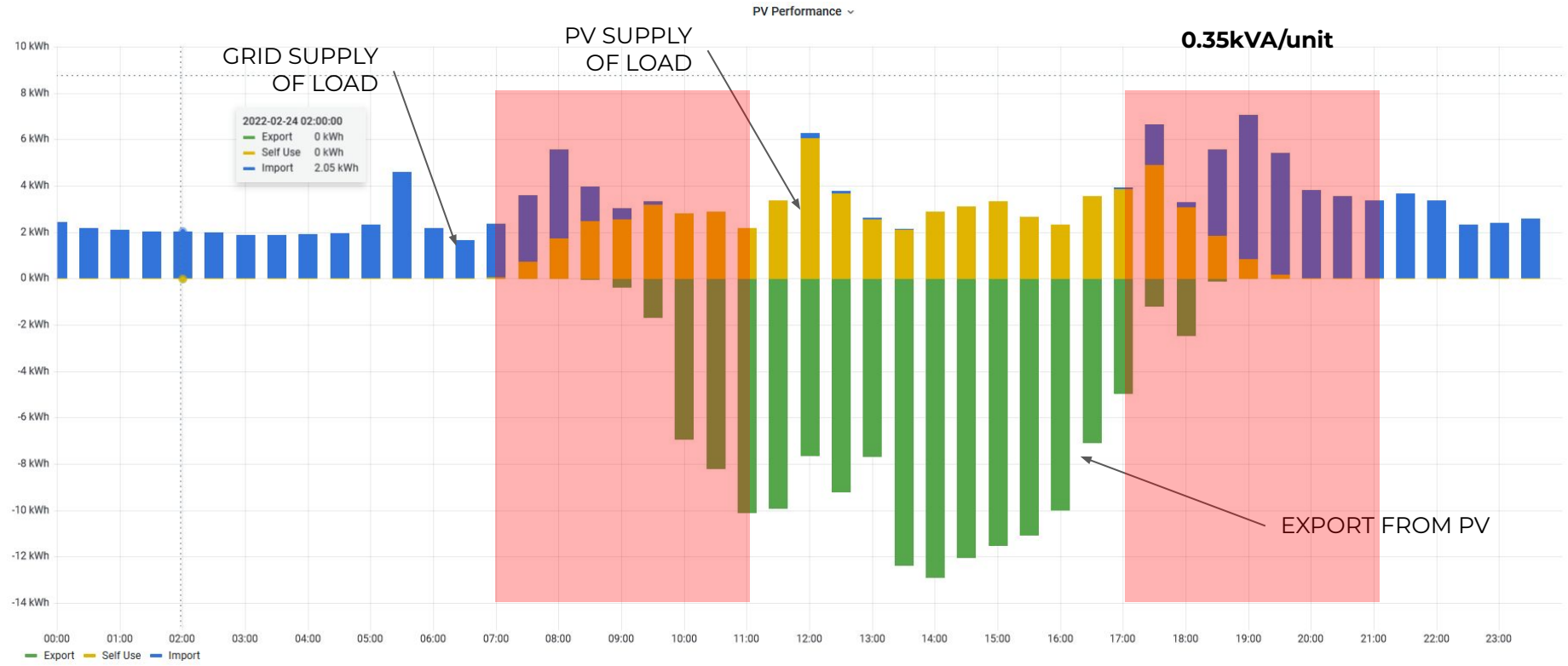
re/volve energy

September



re/volve energy

February



re/volve energy

INPUTS

CAPABILITIES

OUTPUTS

AVAILABLE

- Frequency
- Voltage
- Power factor
- Current wholesale market price (not representative of cost to customer).

NOT AVAILABLE

- DER service required
- Service price offered
- API feed of current tariff
- Standard comms protocols
- DER demand response signal

	□ Load	□ Load	kVAr
PV	✅		✅
Heat pump	✅	✅	
EV	✅	✅	
	58 kVA	23kVA	35 kVAr

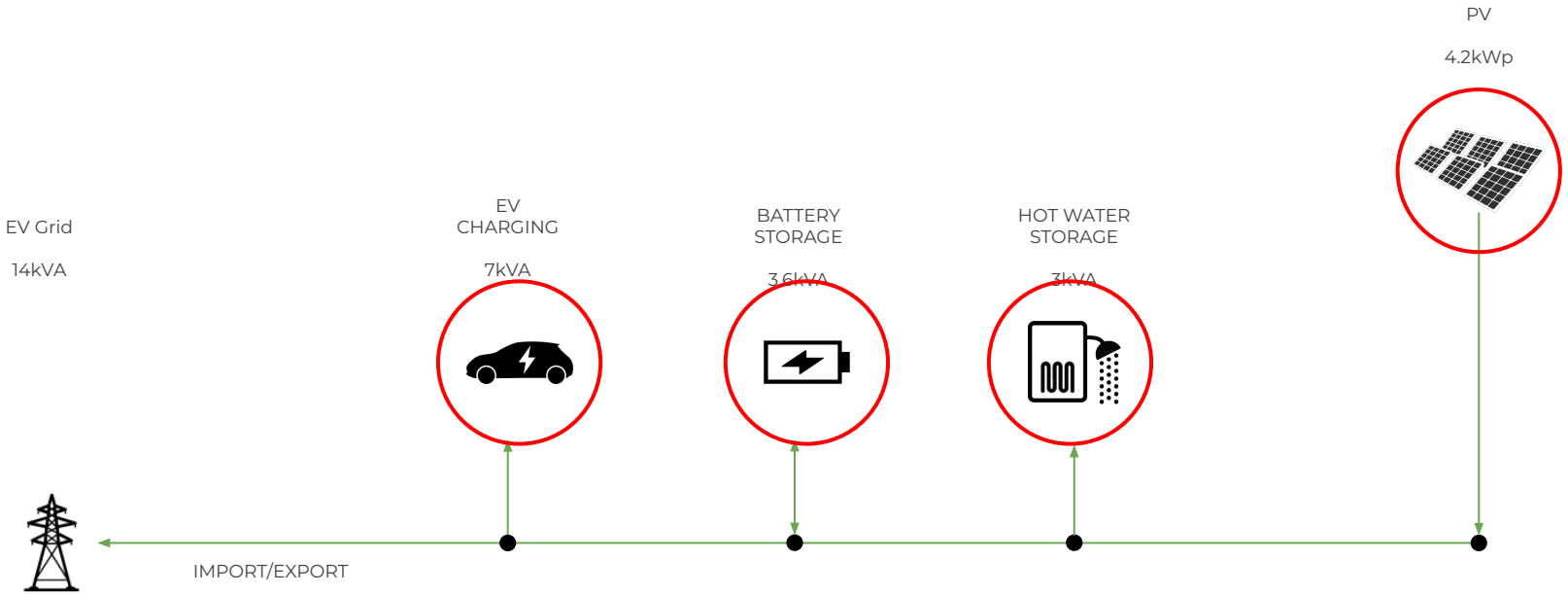
REALISED

- Reduce operating cost (TOU, zero marginal cost onsite generation)

NOT REALISED

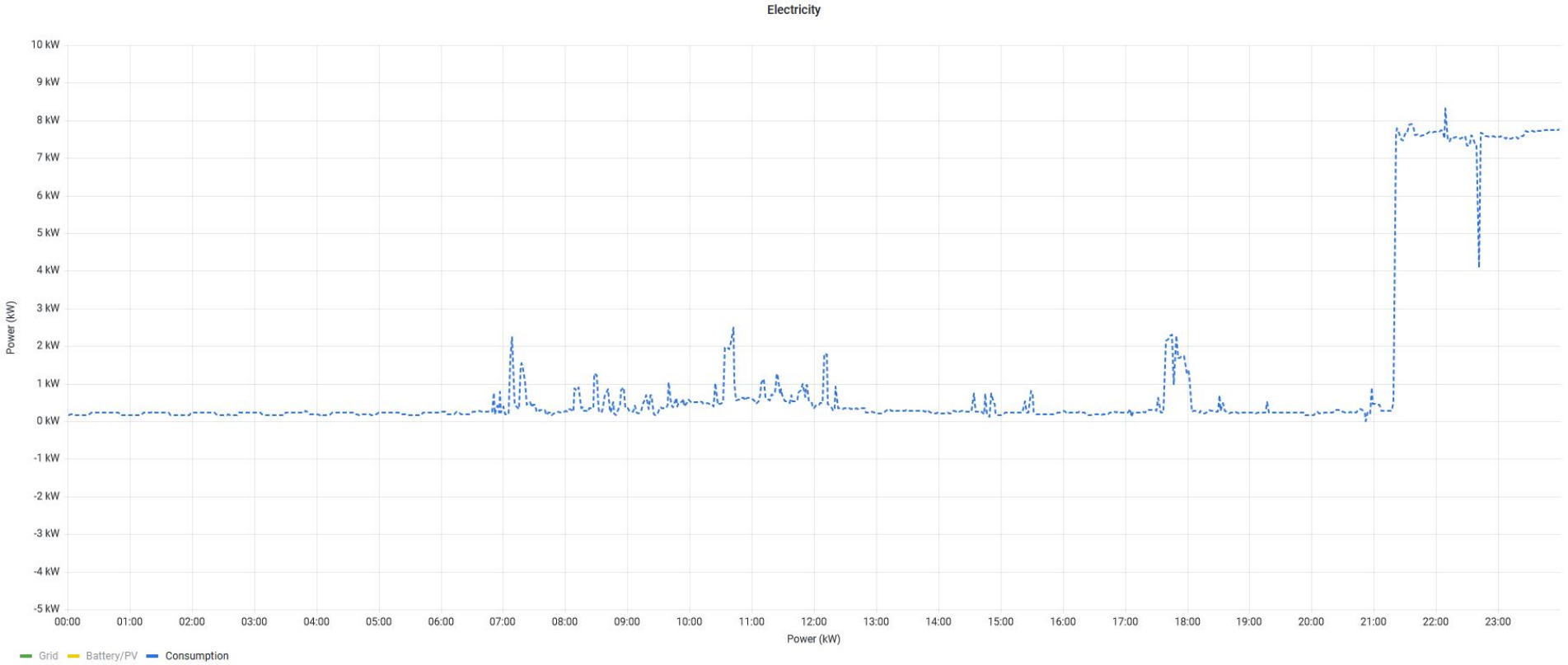
- Load shedding
- Load shifting
- Voltage support
- Reactive power support
- Energy arbitrage (for other parties)
- Backup in grid outage

Residential Dwelling



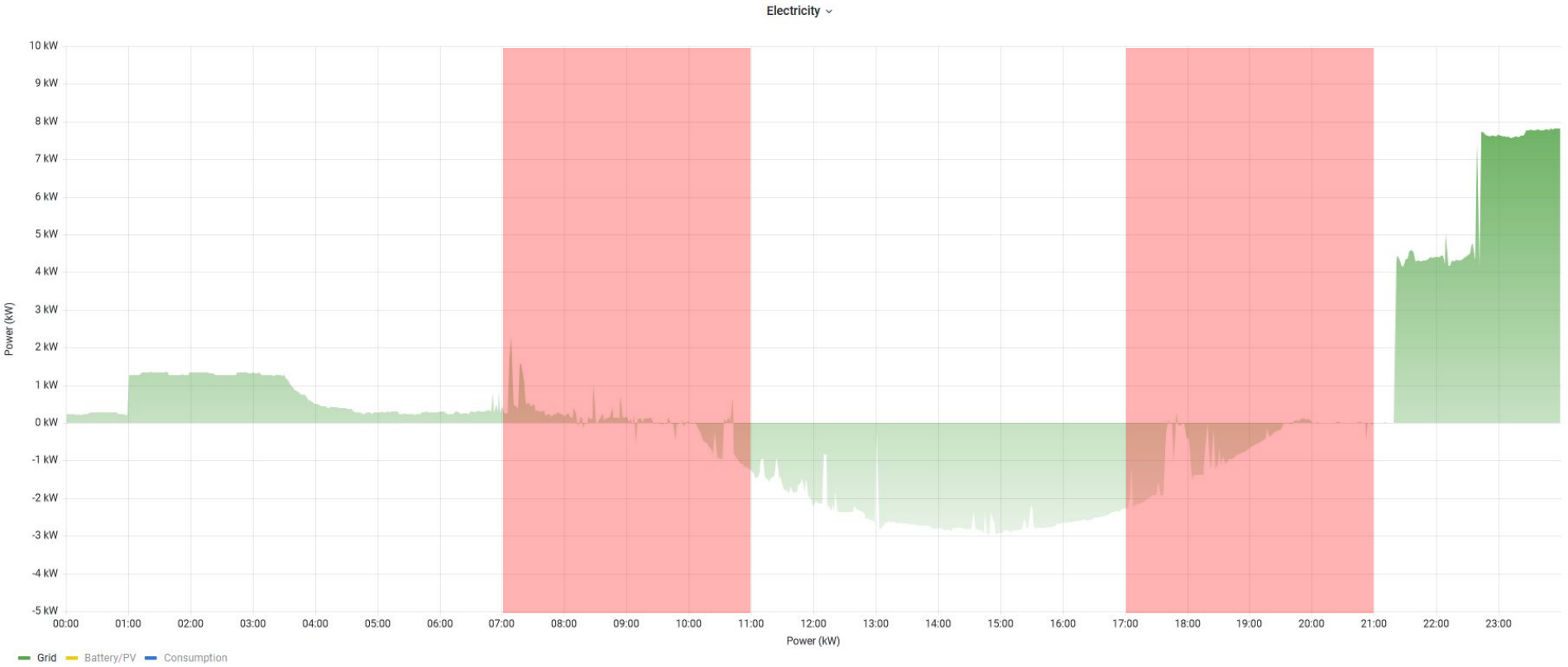
No space heating = no winter peak

Consumption (when charging overnight)



re/volve energy

Grid demand profile

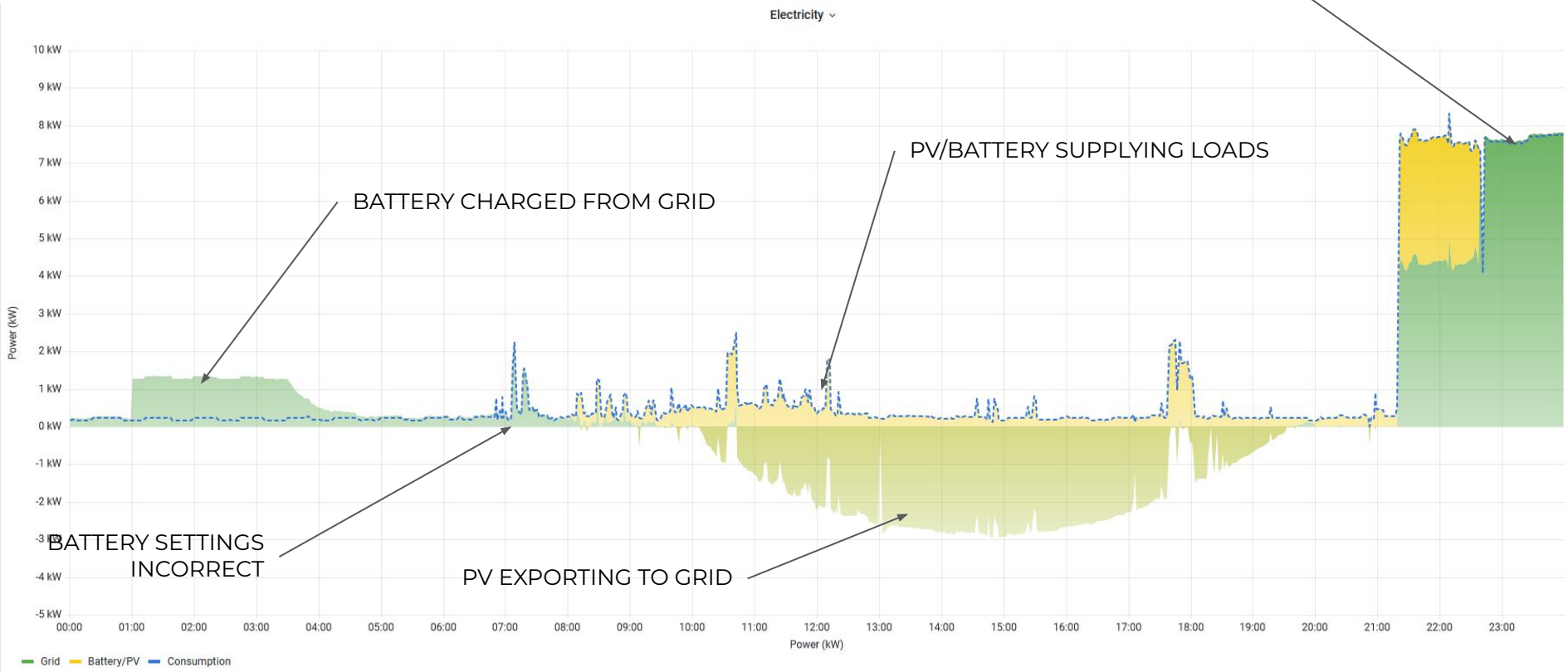


re/volve energy

3% of demand at peak times

Network Charges [Vector]				
Peak Usage	11.05 kWh		0.1647 $ per kWh	$1.82
Off Peak Usage	335.40 kWh		0.0658 $ per kWh	$22.07
VECT + Daily charges		31 days @	0.15 $ per day	$4.65
Total Network Charges				**$28.54**
Energy Charges				
Peak Usage	11.05 kWh		0.1815 $ per kWh	$2.01
Off Peak Usage	335.40 kWh		0.1486 $ per kWh	$49.84
Export	394.97 kWh		(0.1126) $ per kWh	($44.47)

Combined



re/volve energy

INPUTS

CAPABILITIES

OUTPUTS

AVAILABLE

- Frequency
- Voltage
- Power factor
- Current wholesale market price (not representative of cost to customer).

NOT AVAILABLE

- DER service required
- Service price offered
- API feed of current tariff
- Standard comms protocols
- DER demand response signal

	□ Load	□ Load	kVAr
PV/Batt	✅		✅
Hot H_2O	✅	✅	
EV	✅	✅	
	14 kVA	10 kVA	3.6 kVA

REALISED

- Reduce operating cost (TOU, zero marginal cost onsite generation)
- Backup in grid outage

NOT REALISED

- Load shedding
- Load shifting
- Voltage support
- Reactive power support
- Energy arbitrage (for other parties)

My conclusion

1. DER can offer **significant value** to customers who can be incentivised to invest.
2. To realise the value stack for all parties **local optimisation** is required, central command and control alone will realise limited benefits.
3. Local optimisation **requires automation** to be successful.
4. Automation requires **good information** to avoid perverse outcomes.