# DER Potential

## Demand side perspective

## INPUTS

## CAPABILITIES

## OUTPUTS

**MARKET**

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

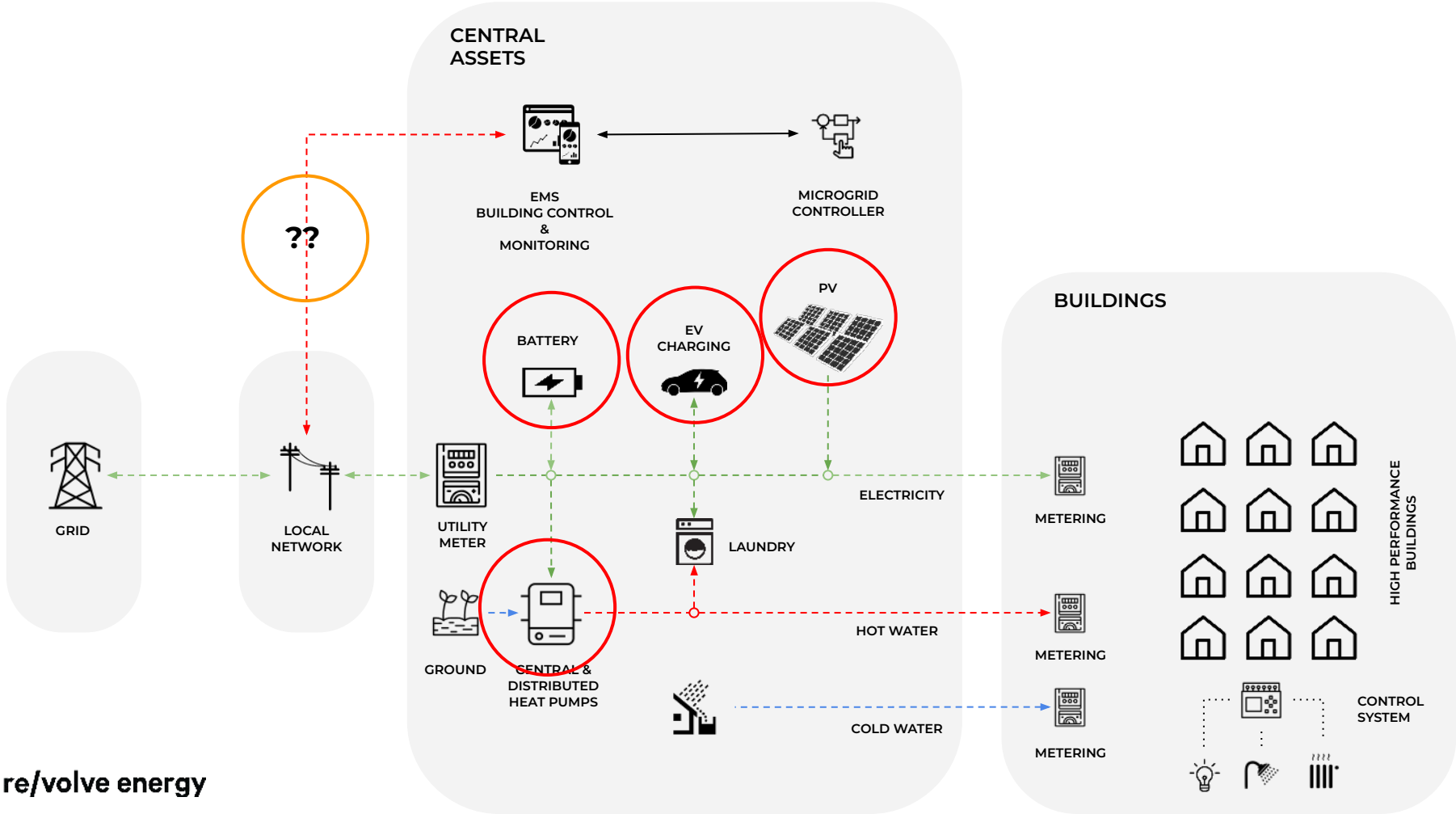
**TECHNICAL**

- Frequency
- Voltage
- Power factor
- Standard comms protocols

- Increase load
- Reduce load
- Supply/absorb kVars

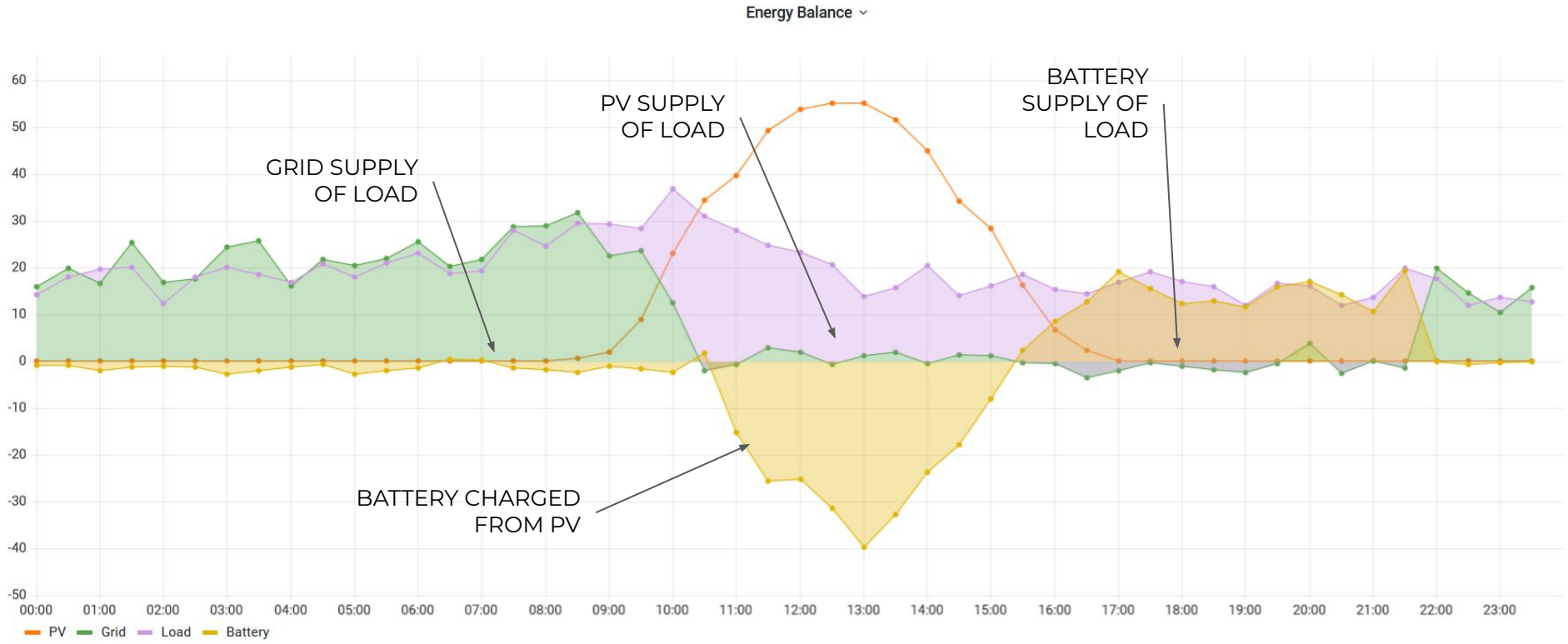
- Load shedding
- Load shifting
- Voltage support
- Reactive power support
- Energy arbitrage
- Reduce operating cost (TOU, zero marginal cost onsite generation)

# Micro-grid
## (Tourist accommodation)




re/volve energy

# June

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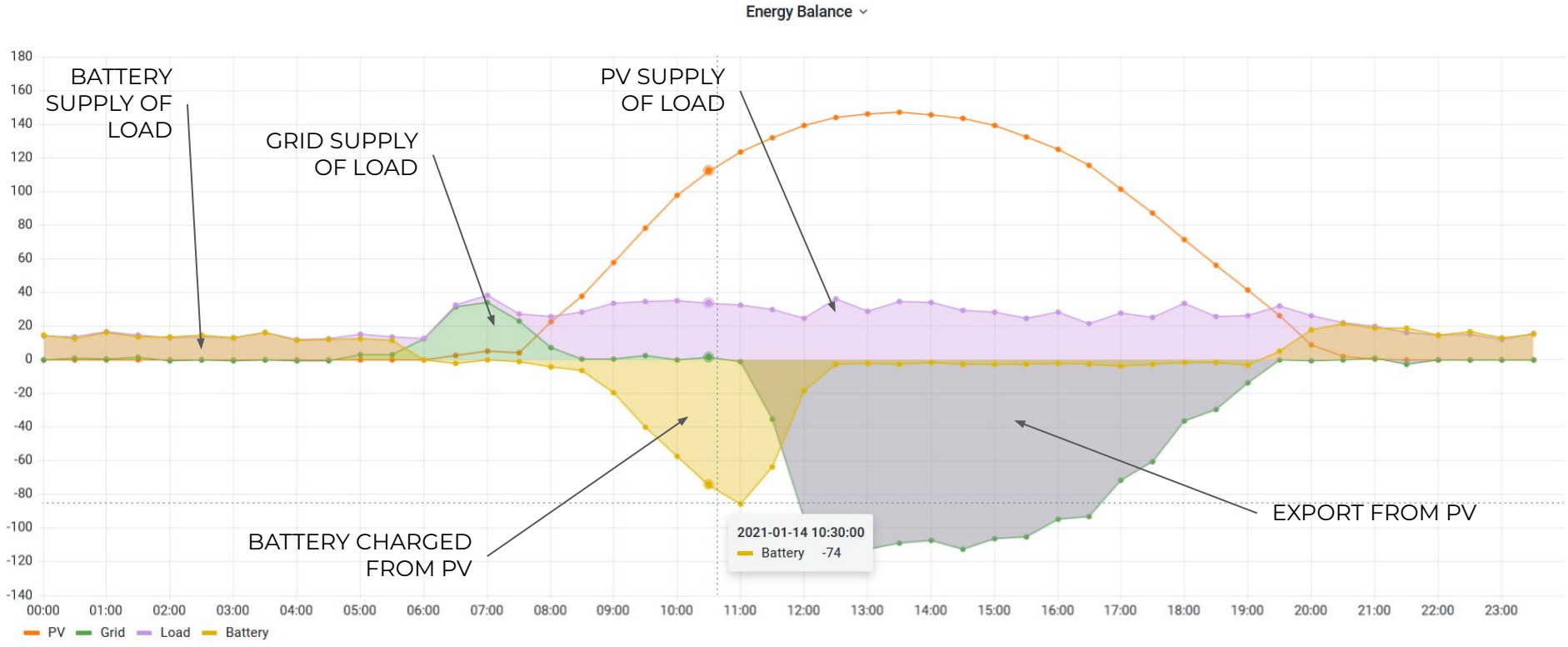
# Jan

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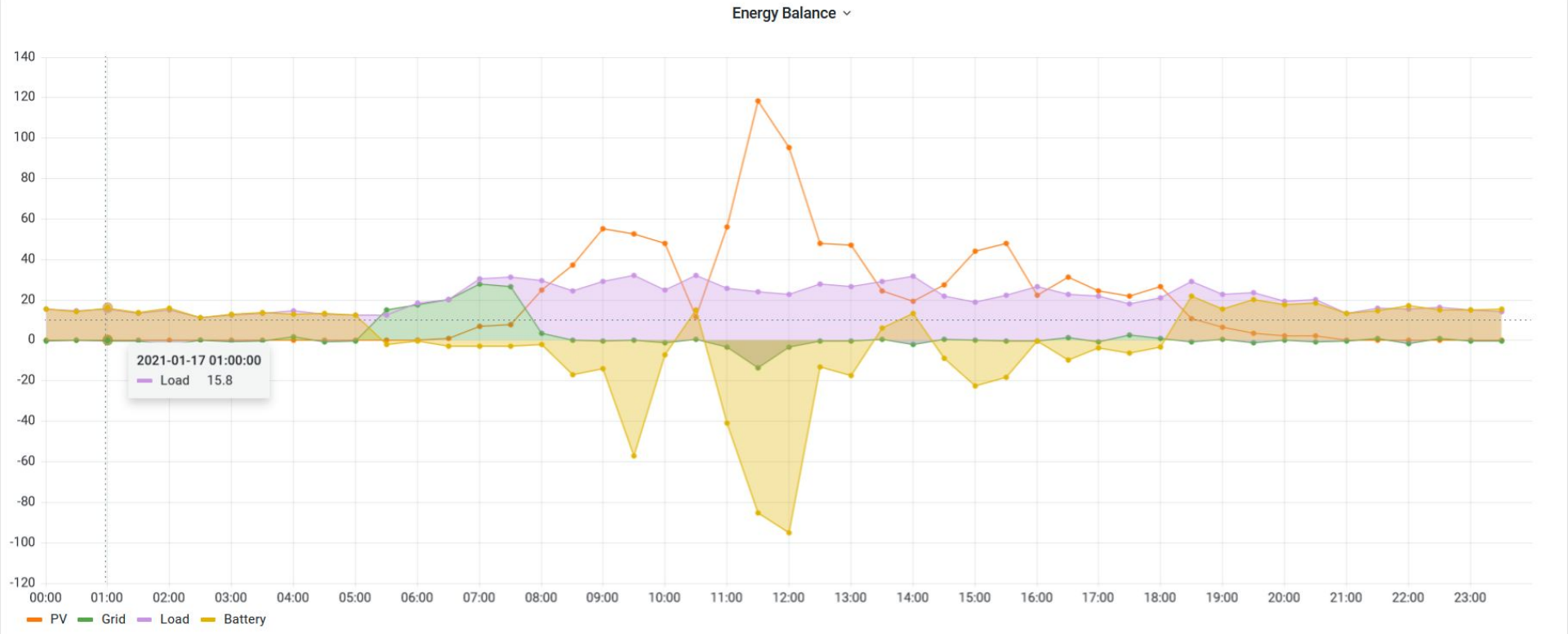
# Jan (with less generation)

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# 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)

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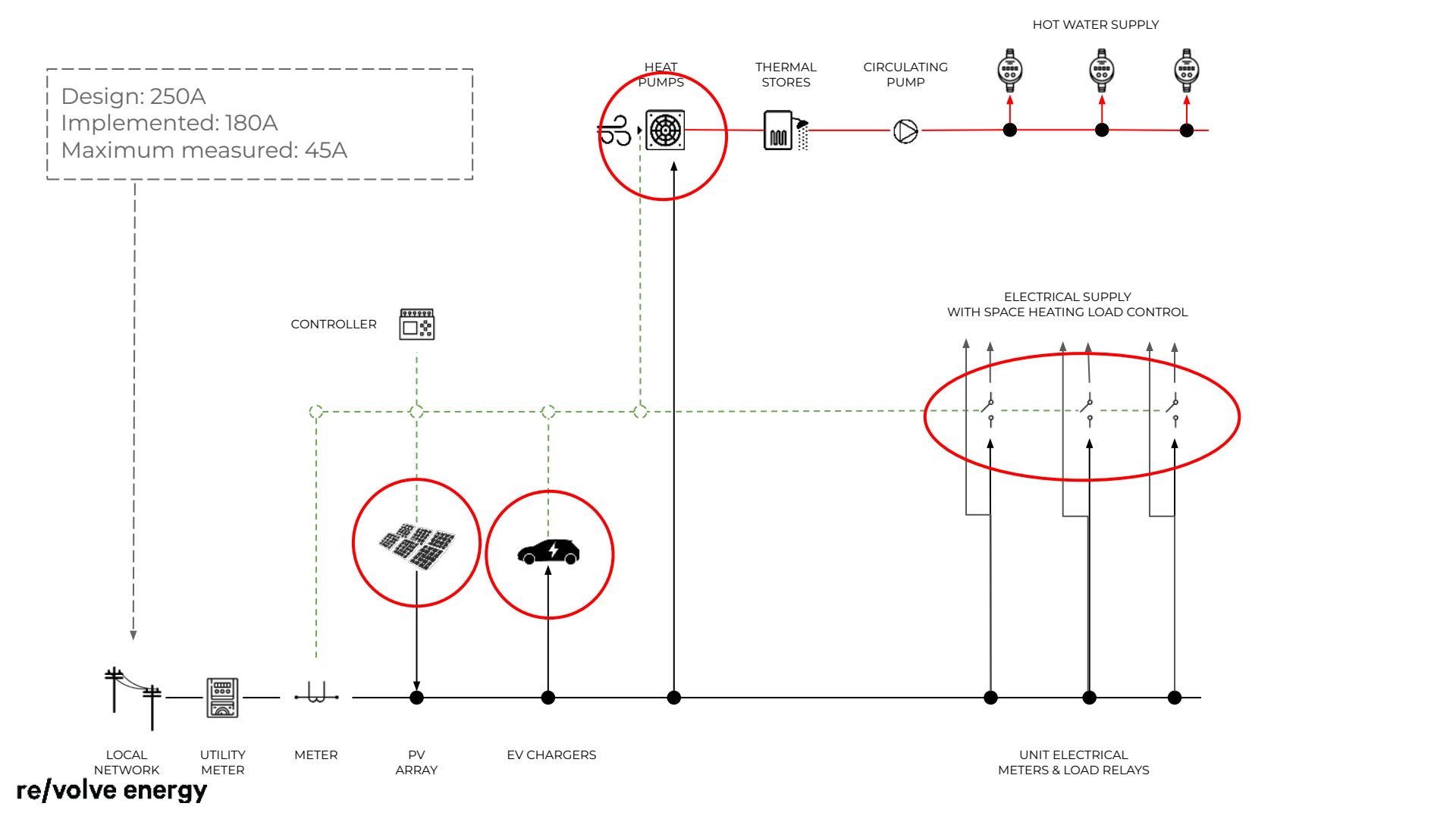
* Assuming generator operating at a power factor of 0.8

# Customer network
## (Multi-unit Residential)

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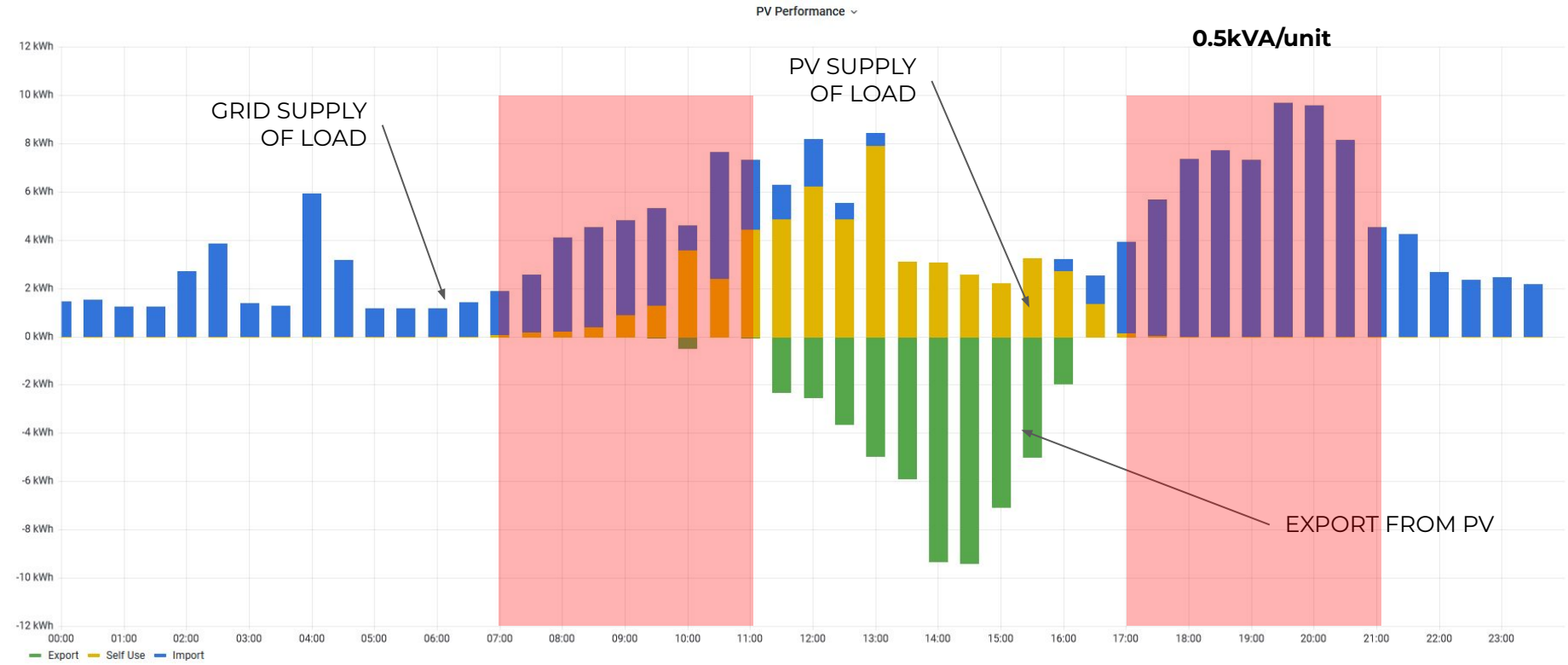
# September

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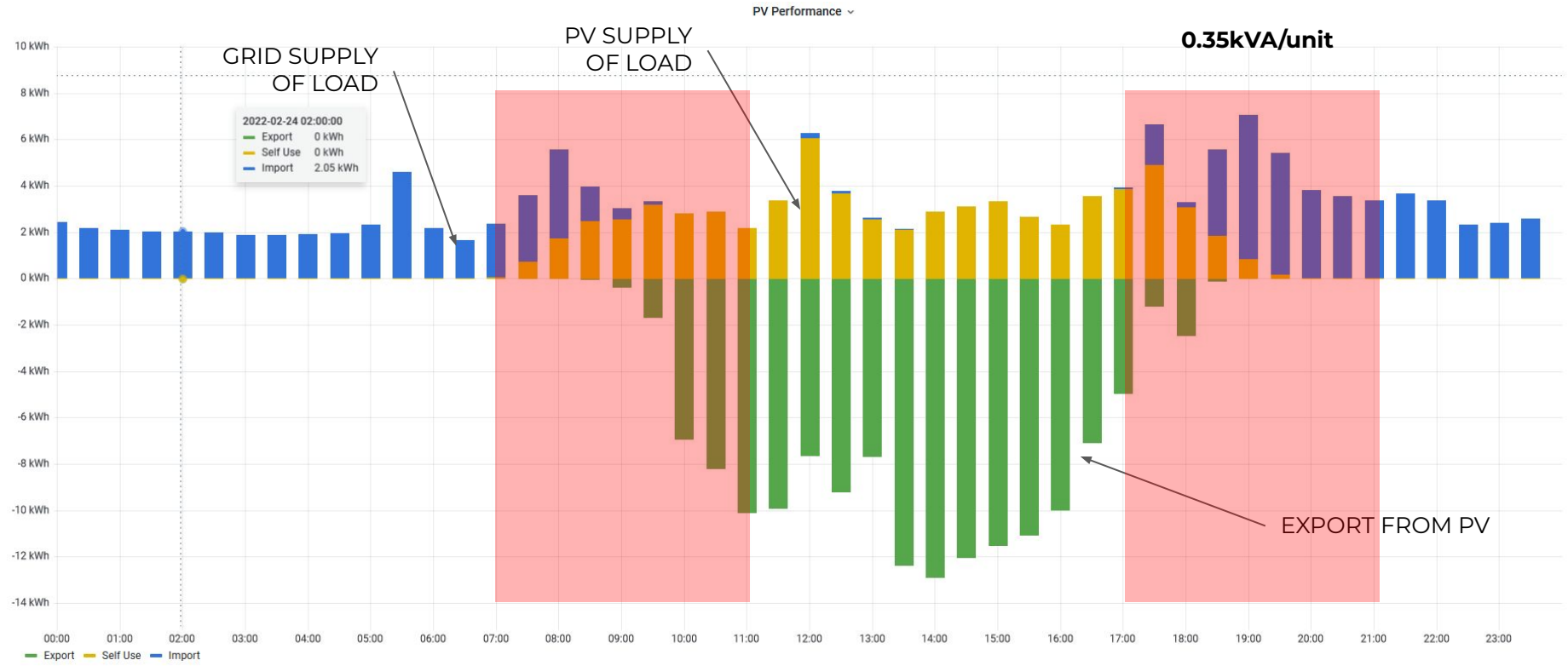
# February

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# INPUTS

## AVAILABLE

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

## NOT AVAILABLE

- DER service required
- Service price offered
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# CAPABILITIES

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

# OUTPUTS

## 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

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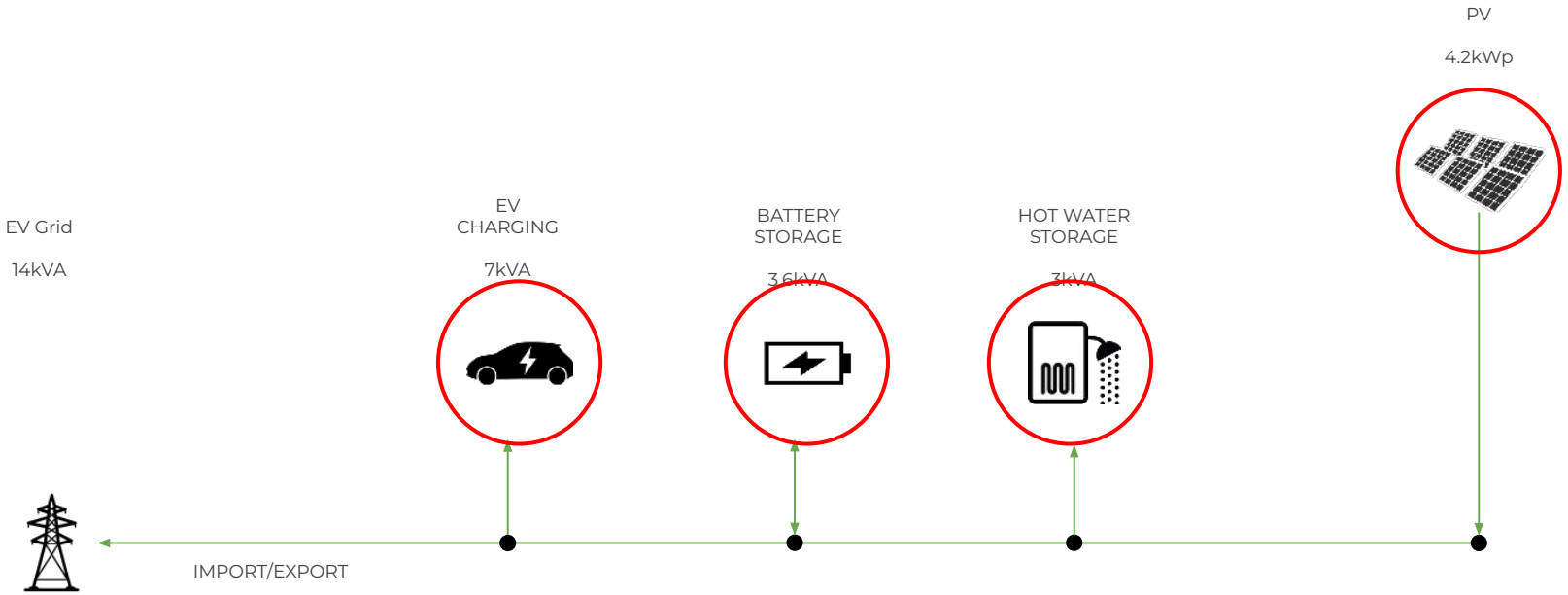
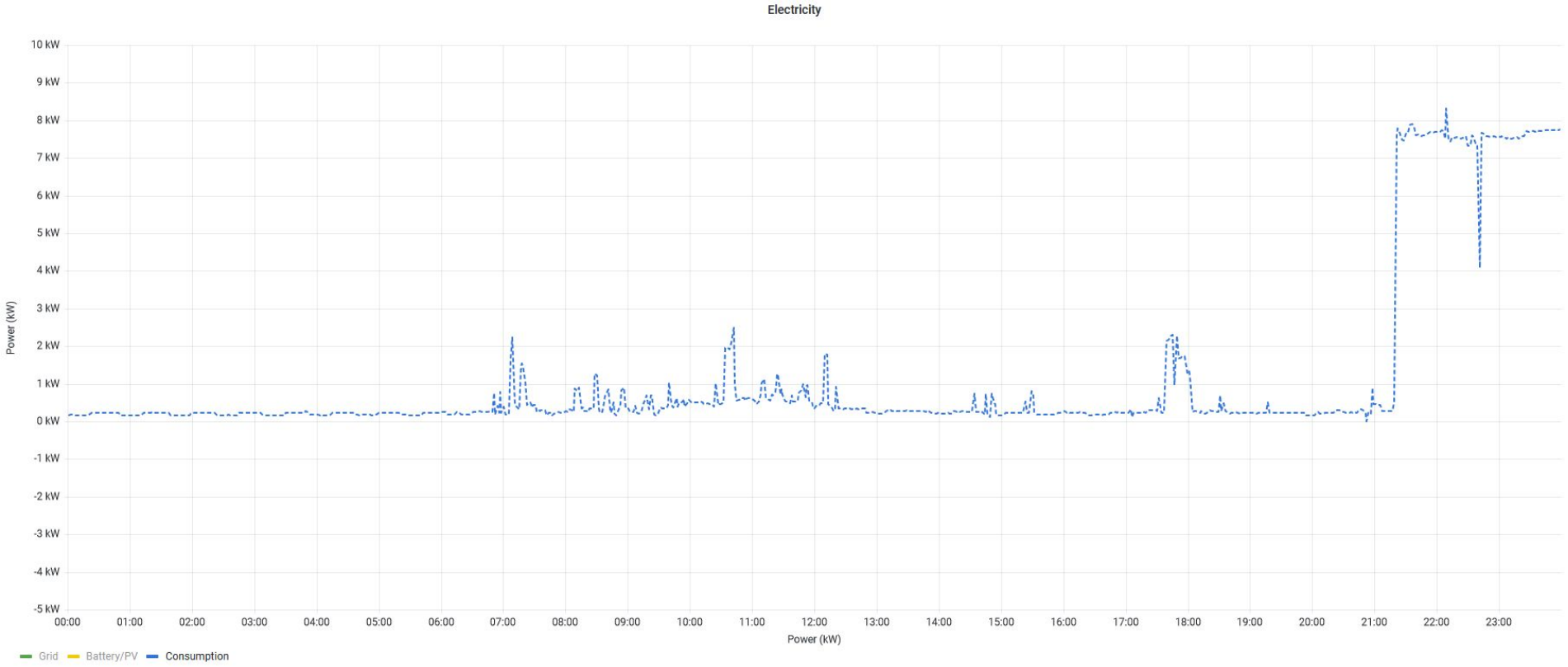
# Residential Dwelling




No space heating = no winter peak

# Consumption (when charging overnight)

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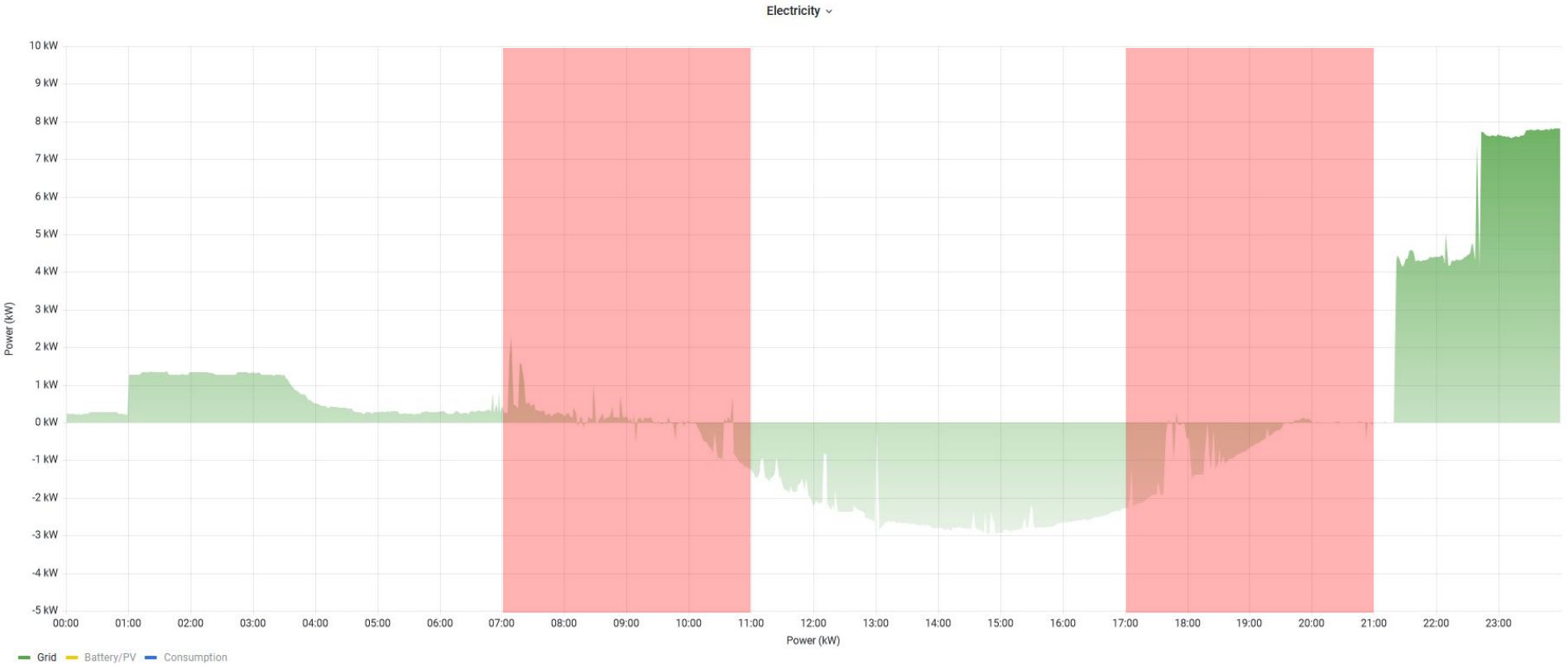
# Grid demand profile

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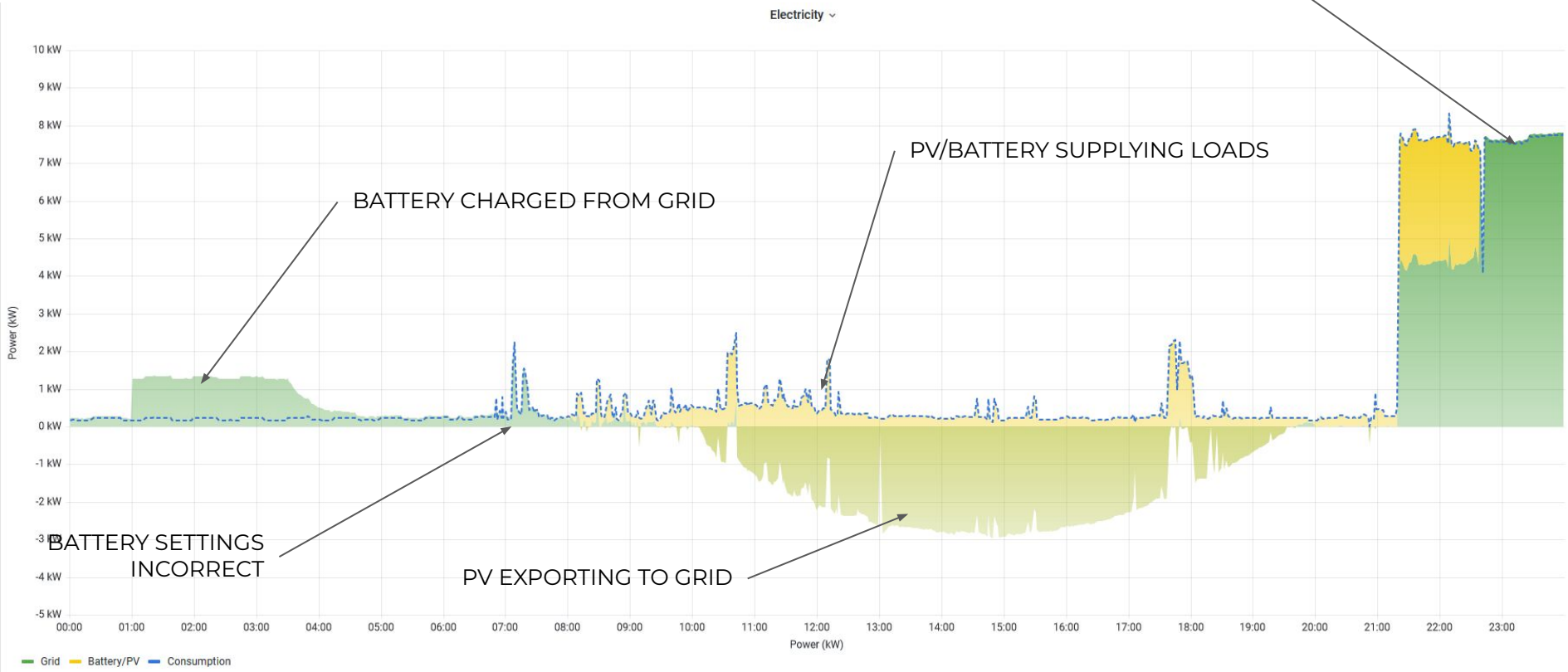
3% of demand at peak times

| 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

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# INPUTS

# CAPABILITIES

# OUTPUTS

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| | □ 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
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# 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.