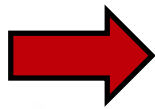


Community Battery Storage

Eberhard Waffenschmidt
IRENC 2022, 10. June 2022

Individual vs. Community Storage



Community Battery



■ Use case:

Storage in combination with photovoltaics (PV)

- Store excess PV energy
- Provide energy in case of darkness

■ Aims:

- Increase grade of autarky (use green energy)
- Reduce need for grid power (grey energy)

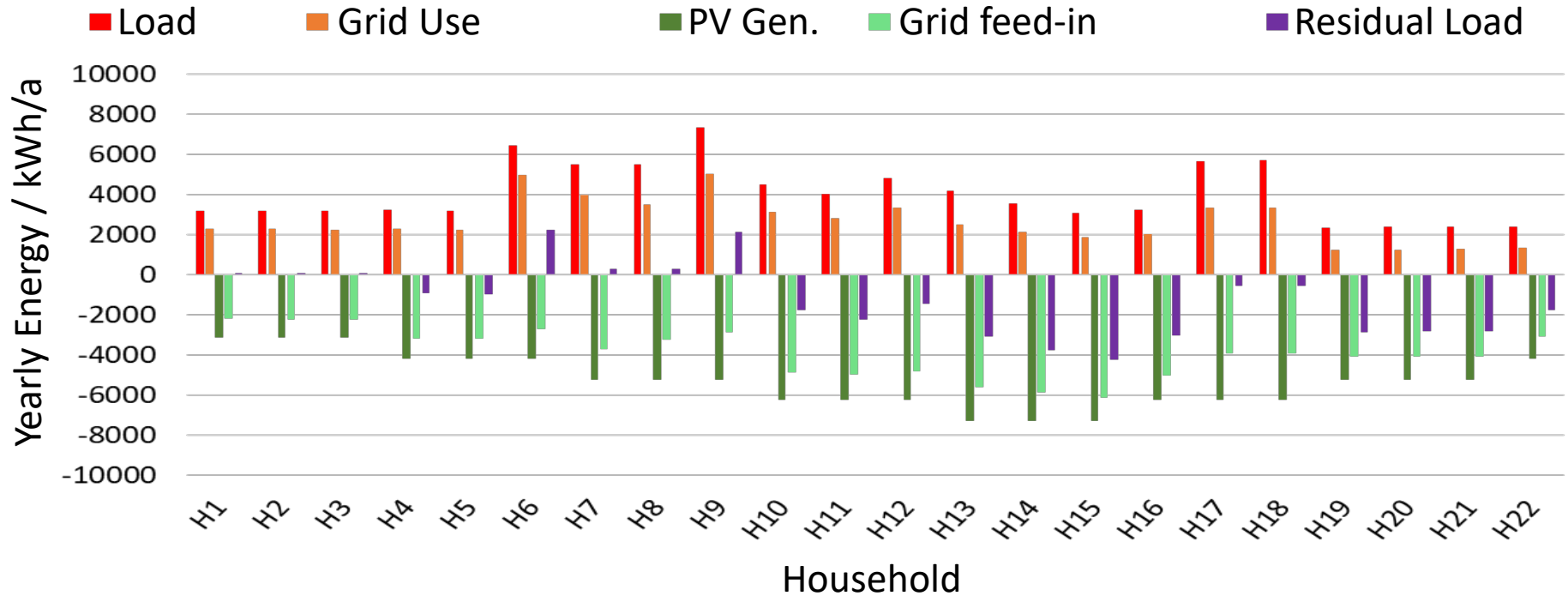


Fictive Exemplary Community



- 22 Households
- Individual load and PV power profiles
- Loads:
3000...7000 kWh/a
- PV:
3...7 kWpk
- Storage size varied:
typically 120 kWh

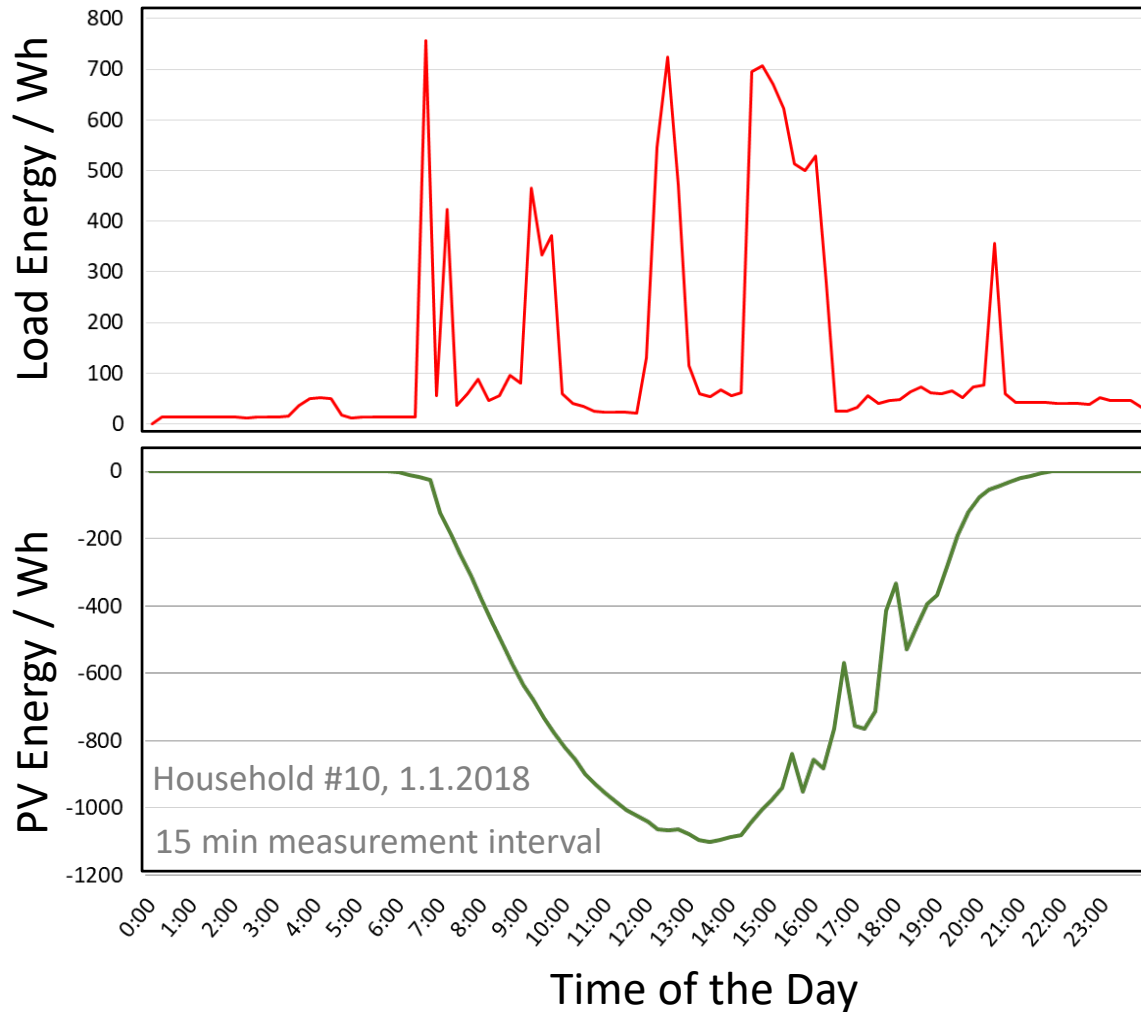
Use Case



■ Arbitrary distribution for yearly

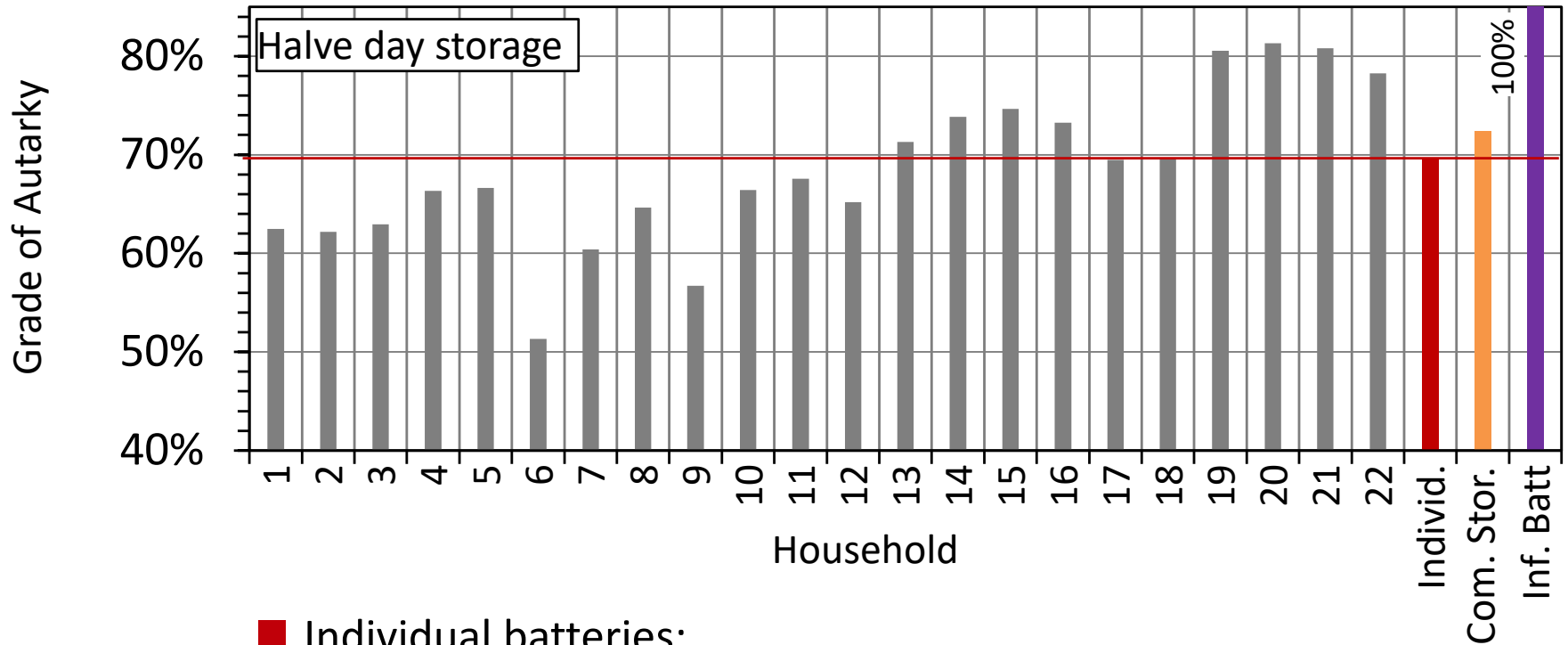
- Consumption
- PV-Generation

Exemplary Power Profiles



- Individual Load profiles based on
 - Simulation
 - Behavioural model
 - Assumed inhabitants
- PV-Profiles based on
 - Measured data
 - For cologne area
 - Scaled to individual roof sizes

Grade of Autarky



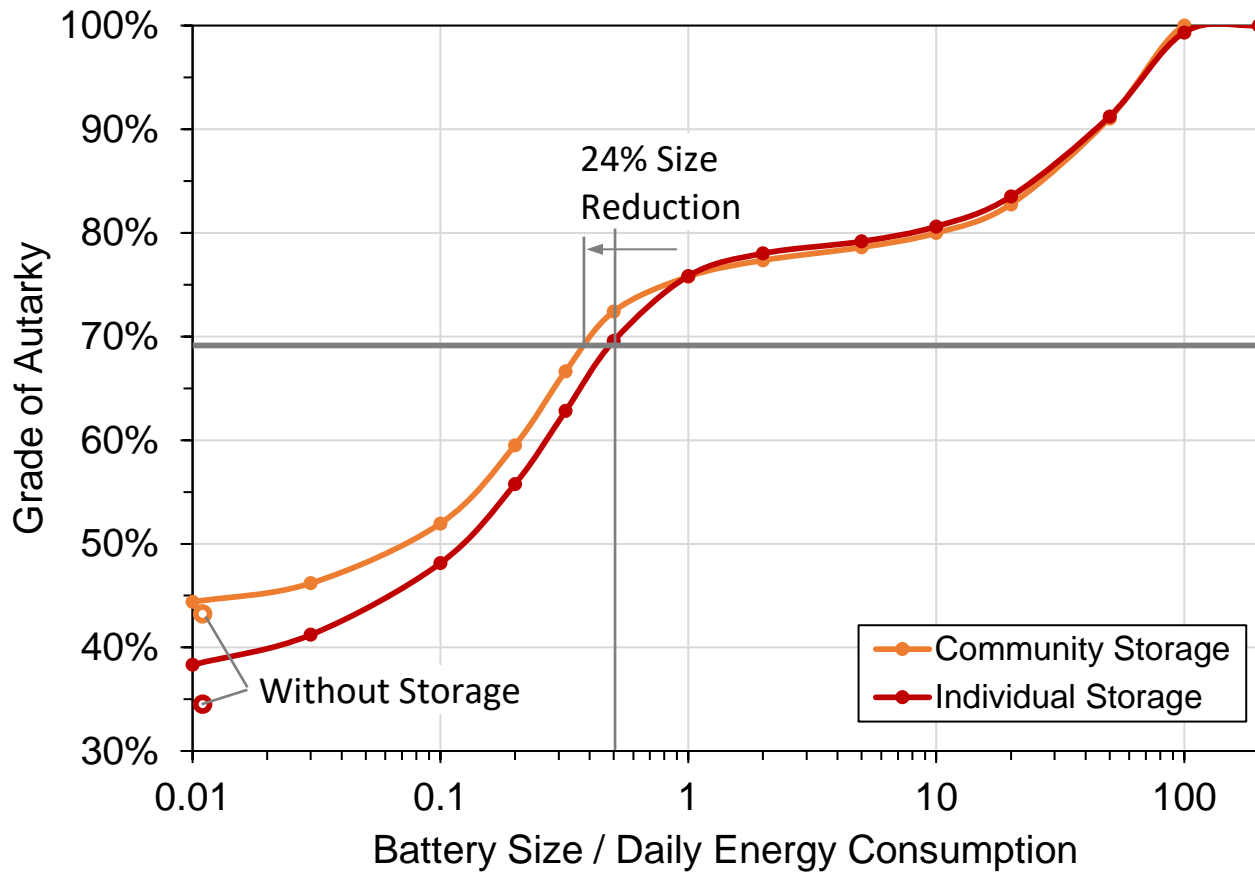
■ Individual batteries:

- Grade of autarky varies

■ Community storage:

- Grade of autarky better than average with individual storages
- Winners and losers

Battery Size



■ Optimal size:

- Halve day storage
- 24% size reduction with same grade of autarky

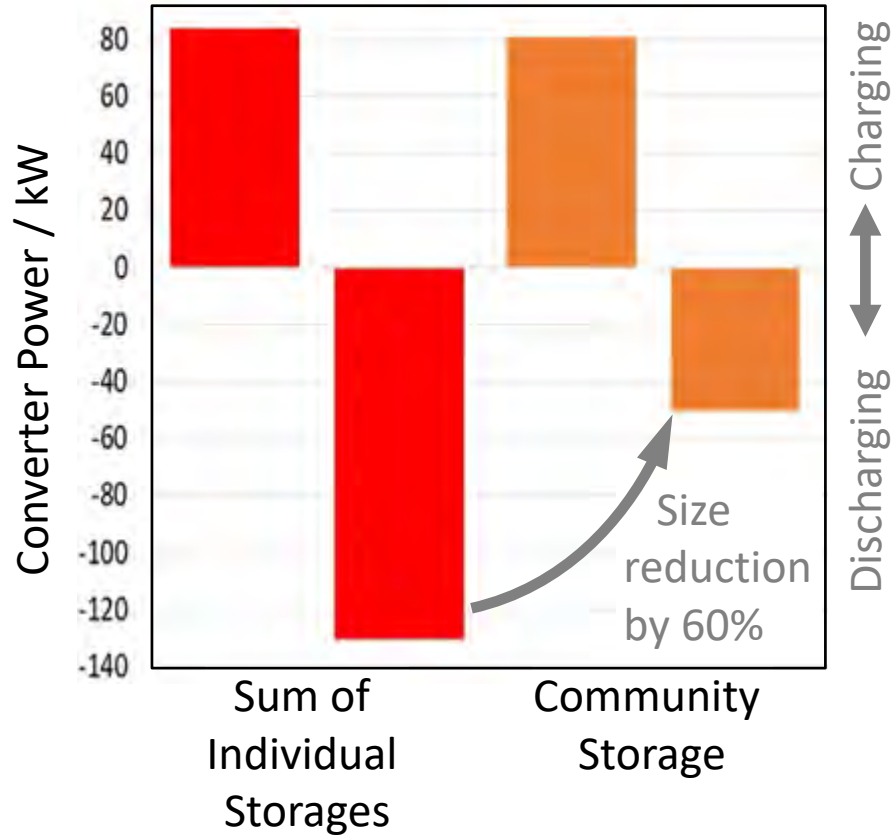
■ Without storage:

- Improvement by mutual energy use
- from 35% to 44% grade of autarky

■ Full autarky

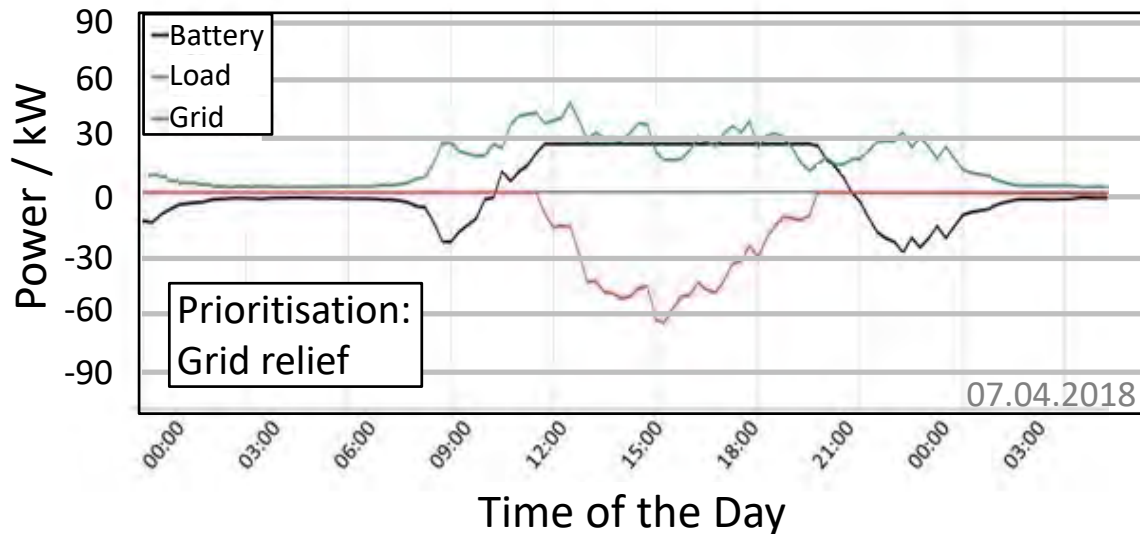
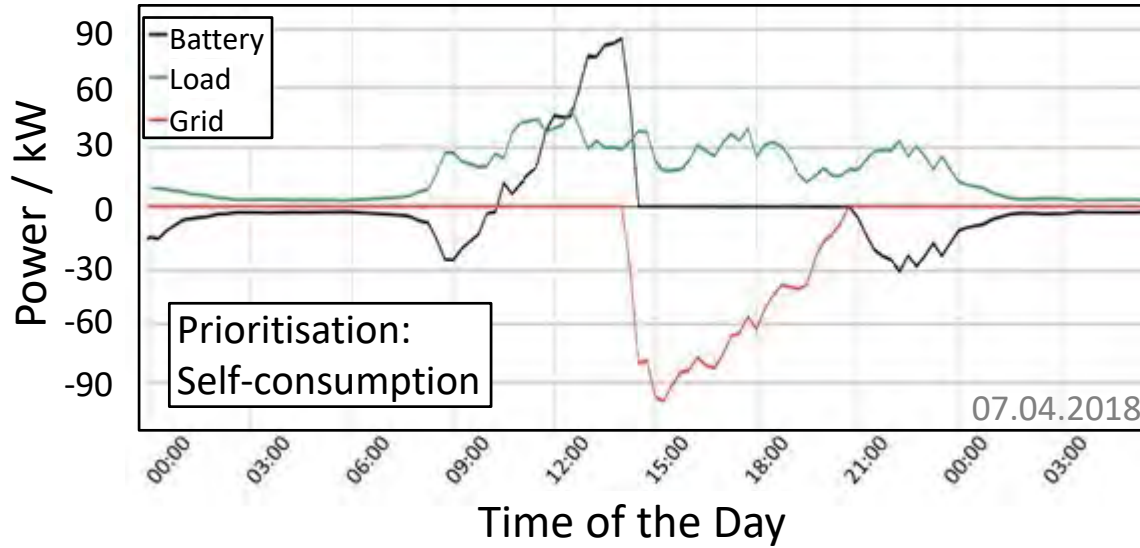
- Only with seasonal storage
- Commercially not suitable

Converter Size



- Discharging power:
 - Reduced by 60%
 - Due to energy sharing
- Charging power
 - No reduction
 - Due to high simultaneous factor of PV

Operation Mode



Prioritisation:

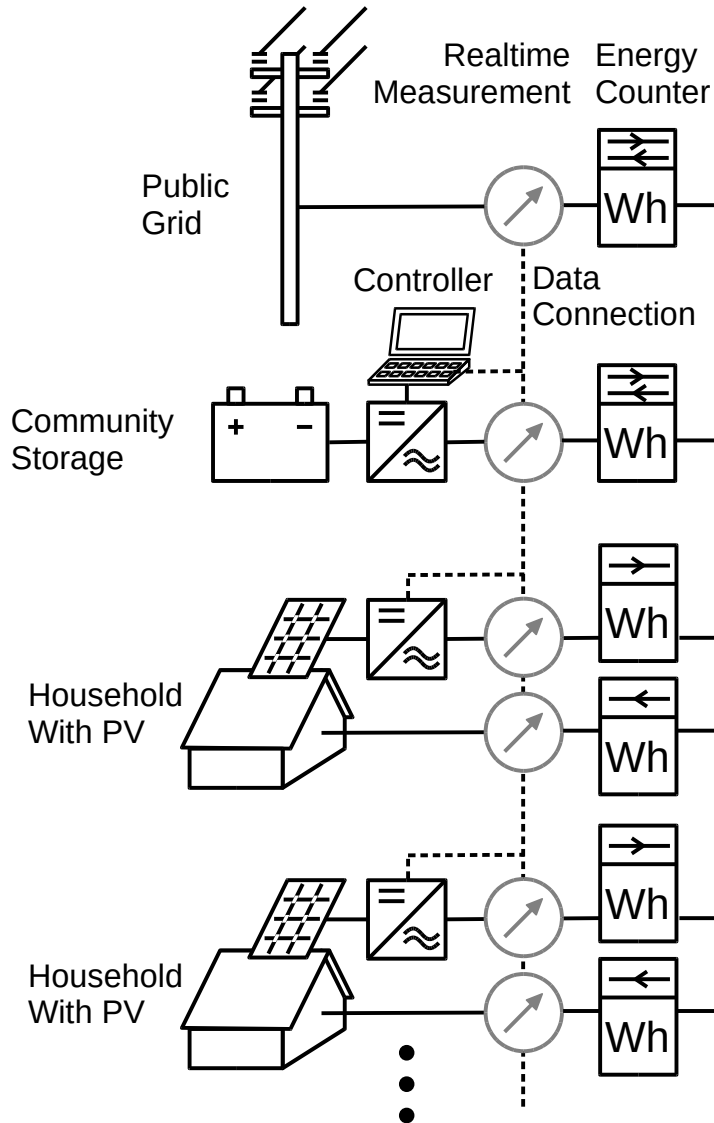
■ Self-consumption

- Storage as full as possible
- Strong power peak if storage is full at noon

■ Grid relief

- Feed-in power capped

General Measuring Equipment



Measuring devices for

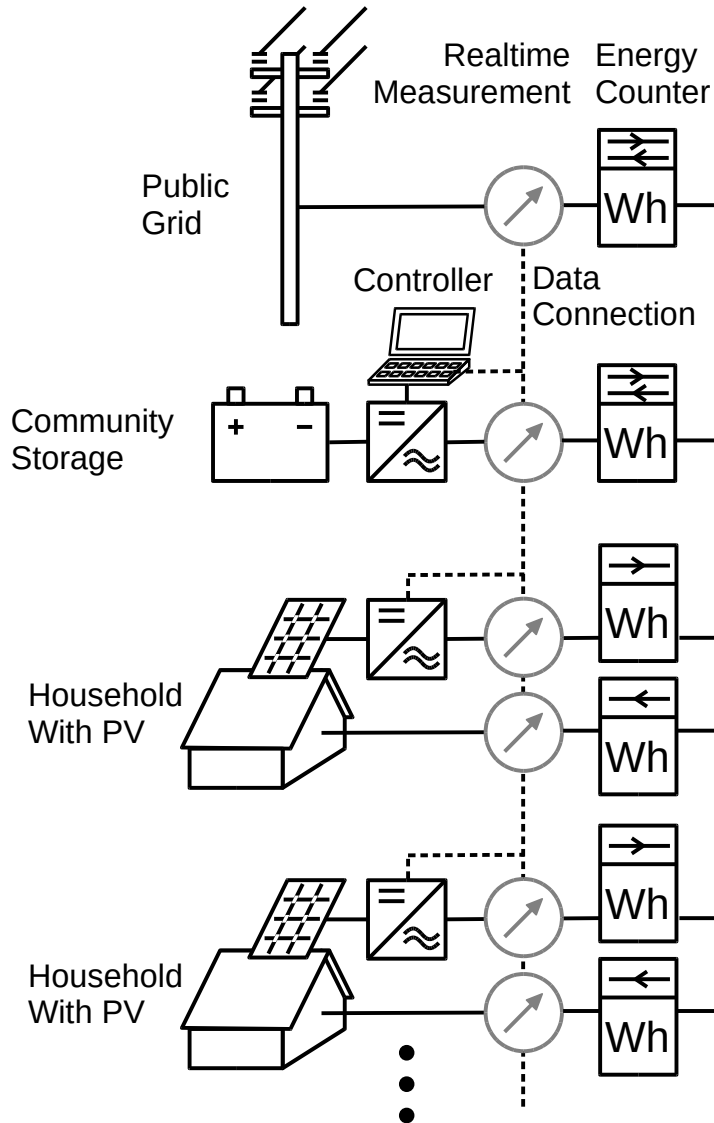
■ Legal aspects

- Proof of renewable feed-in
- Taxes and fees

■ Fair billing for

- House owners
- Contractor
- Mains grid operator

General Measuring Equipment



Measuring devices for

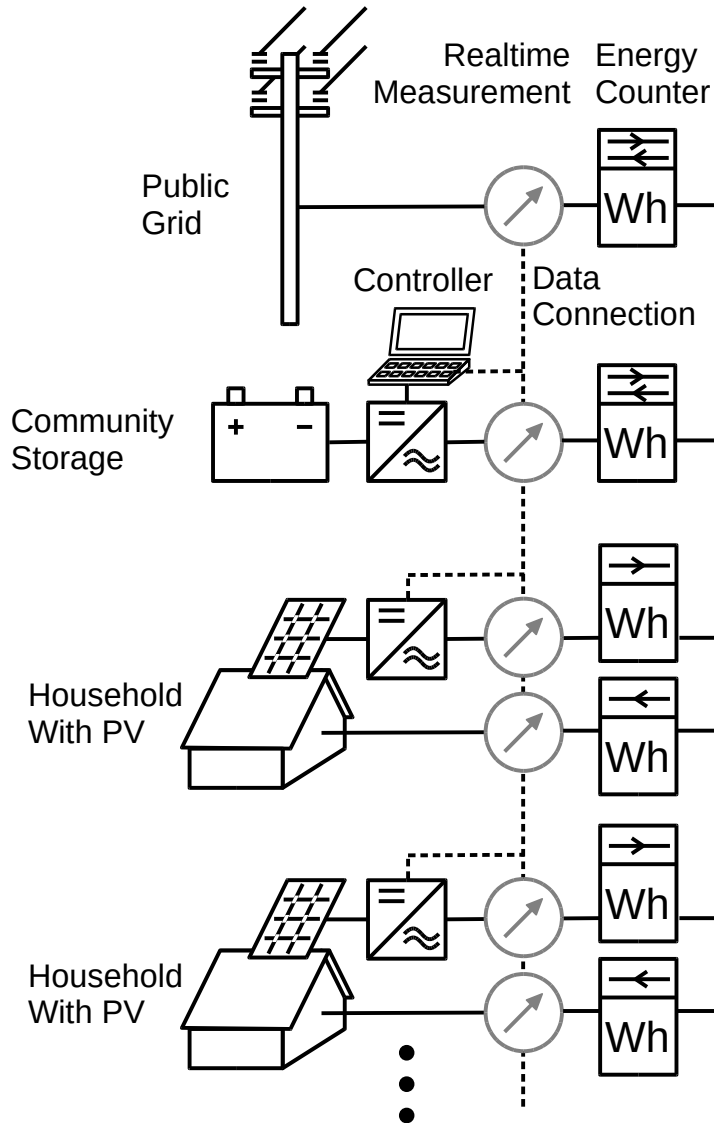
■ Operation

- Real-Time
- Reliability
- No public data network

■ Billing

- Each 15 min or yearly
- Public data network
- Data security

Measuring Equipment



■ Use case: Peer-to-peer trading

■ Organisational Aspects

- Community storage operated like individual storages for each participant
- Households own PV
- and trade energy between each other
- Controller to manage trading
- Investor to install and operate storage

■ Technical Aspects

- Battery control based on Real time measurements of
 - All households
 - All PV
 - Grid connection
- 15 min recording for billing
- Complex data processing

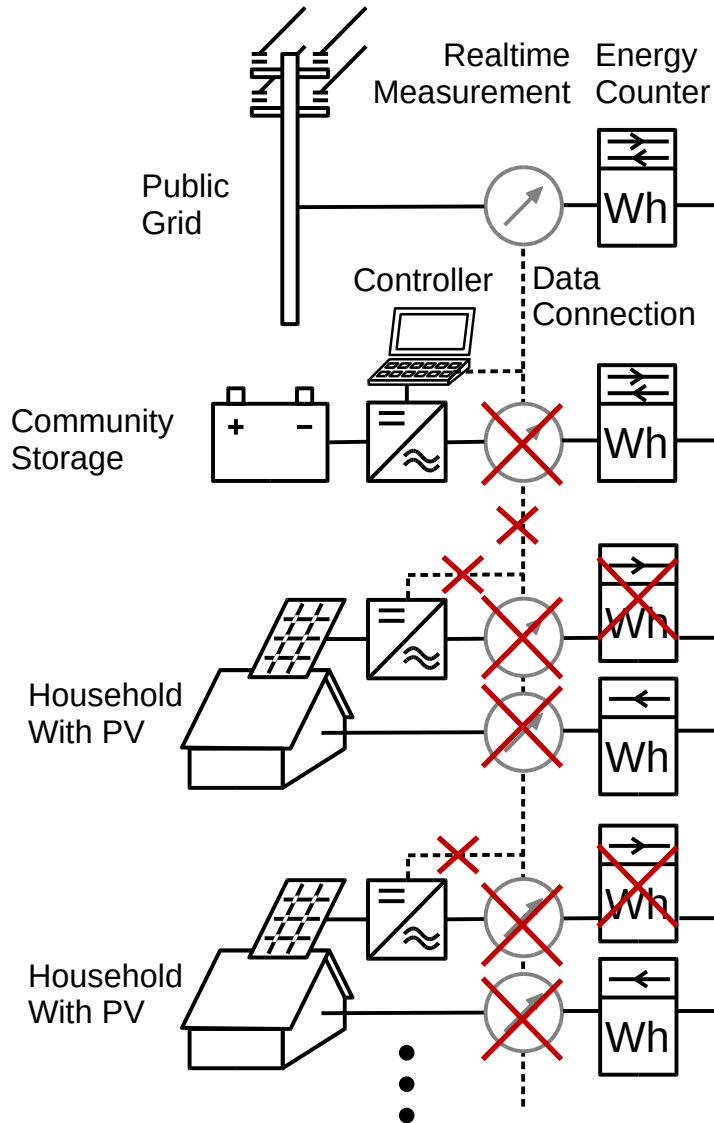
■ Financial Aspects

- Households benefit from
 - PV self-consumption
 - PV feed-in tariff
- Controller and investor makes profit from
 - Service provision

■ Legal Aspects

- Who operates the grid?
- PV feed-in tariff for stored energy?
- Which fees apply?

Measuring Equipment



■ Use case: Contractor

■ Organisational Aspects

- Contractor owns
 - Community storage
 - PV-systems
 - Local grid
- Fixed, average electricity cost for households includes
 - Direct PV-energy
 - Stored PV-energy
 - Mains grid energy

■ Technical Aspects

- Battery control:
 - No charging, if power is delivered from the mains grid
- Realtime measurement only at mains grid connection
- Yearly recording for billing
- Simple data processing

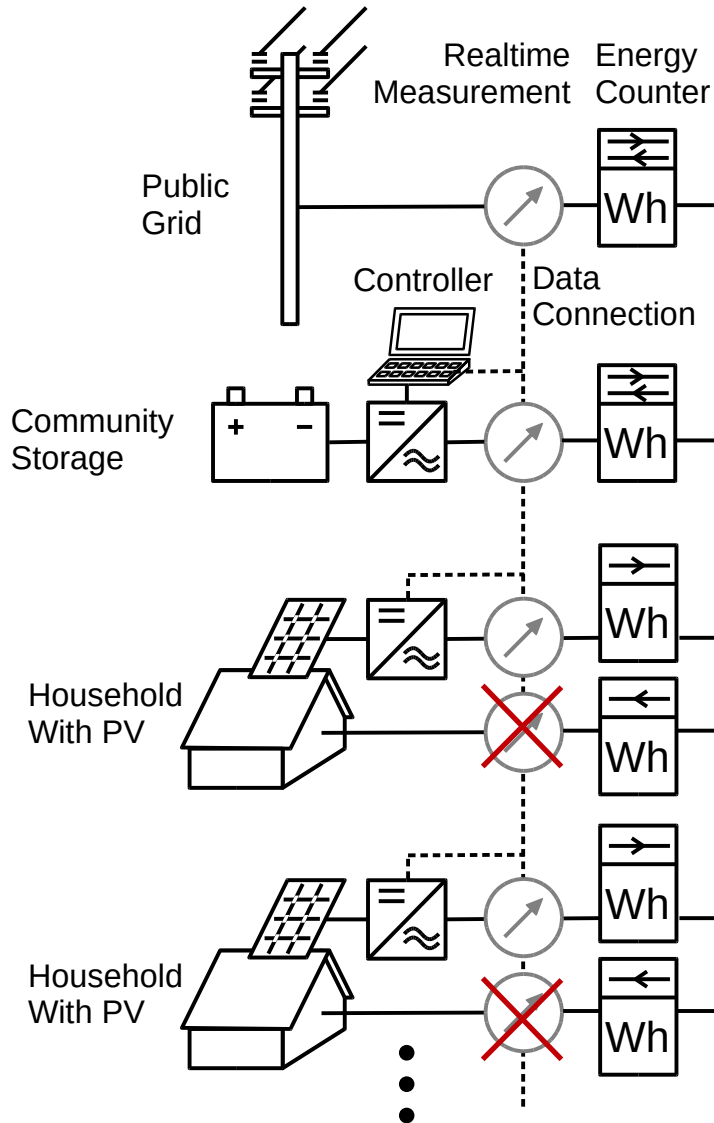
■ Financial Aspects

- Households benefit from
 - Low and predictable electricity price
- Contractor makes profit from
 - Cost margin for electric energy

■ Legal Aspects

- Contractor as official grid operator?
- Feed-in-tariff for contractor?

Measuring Equipment



■ Use case: Contractor with multiple use

■ Organisational Aspects

- Contractor owns
 - Community storage
 - PV-systems
 - Local grid
- Fixed, average electricity cost for households includes
 - Direct PV-energy
 - Stored PV-energy
 - Mains grid energy

■ Technical Aspects

- Battery control:
- Based on PV realtime measurements and further use
- 15 min recording for billing to prove PV origin
- Complex data processing

■ Financial Aspects

- Households benefit from
 - Low and predictable electricity price
- Contractor makes profit from
 - Cost margin for electric energy
 - Further use options

■ Legal Aspects

- Contractor as official grid operator?
- Feed-in-tariff for contractor?

What is fair?

■ Individual fairness:

- Each person gets and pays exactly for each item
- *Example:* Restaurant (in Germany), market

■ Flat fairness:

- Items can be used by paying a flat-rate
- *Example:* Telephone bill

■ Solidary fairness:

- Regular payment, support in case of exceptional event
- *Example:* Insurance

■ Social fairness:

- Each person gets what needed
- *Example:* Family

Summary

Community storages

- Have technical advantages
 - Less capacity
 - Less converter power
- Are difficult to organize

Contact and further Information

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