Battery storage and financial models

James Miller, Green Acorn Energy Solutions

Supported by edisonenergy shaping sustainable energy

green acorn
ENERGY STORAGE & BACK UP SYSTEMS

APSE presentation Edinburgh

James Miller
Green Acorn Energy Solutions

SONNEN®
BATTERIE

Secondary school and civic building

- Secondary school
  - Electricity use - 250,000kWh per year
  - Generation - 30kWp PV installation generating 25,500kWh per year

- Civic building (modelled with and without PV)
  - Electricity use - 630,000kWh per year
  - Generation - 30kWp PV installation generating 25,500kWh per year

Battery charges with excess solar generation or cheap electricity and discharges in the evening after peak solar generation or during higher rate electricity prices

Findings

Self consumption of solar PV

- Energy use coincides with PV generation and is much higher than generation
- No excess for battery
- Previous modelling indicates that energy prices are currently too low for increased self consumption to offer viable returns

Electricity arbitrage

- Battery charges with cheap electricity at night and discharges during expensive evening electricity rates from 4 – 7pm
- Energy use typically not high at peak rate times
- Efficiency losses in battery
- Paybacks in excess of 20 years*
- *Sub-10 year paybacks expected from next year with new technologies

Frequency response

- Helps balance grid frequency by charging and discharging depending on immediate grid frequency
- Uses spare import and export grid capacity (headroom) between import/export and capacity at any given time
- Payments made for power availability rather than energy offsetting
- Doesn’t offset imports
- Provides and income only
- Can be aggregated with other frequency response batteries

Frequency response examples

- High quality lead-carbon battery - 27kW charge – 45kW discharge – 100kWh
- Installed price - £73,000 *(cheaper, less robust, lead systems also available)*

	School with PV	Civic building with PV	Civic building without PV
Typical first year income	£4,400	£5,200	£3,400
Payback	14 years	13 years	> 15 years

- *Sub-10 year paybacks expected from next year with new technologies
- Load profile important for payback
- Civic building with no PV assumes there is no export capacity and therefore reduced potential income
- Economy of scale and reduced paybacks for larger connection agreements
- Batteries can be aggregated into a virtual power station

Sonnenbatterie domestic energy storage

- Can charge from on-site renewables and offer frequency services to the grid
- Energy offsetting typically not viable at current energy prices
- Aggregated frequency services can provide a return on investment
- Smart control unit future proofs the battery for upcoming energy services
- Can be aggregated so that hundreds of batteries can act as a single unit to increase the rate of return from each unit
- Modular power and energy so batteries can be scaled to each situation
- Made from lithium-iron Phosphate which is the safest lithium technology

Domestic energy frequency response

Energy storage can be aggregated – minimum aggregation is 200kW

Assuming 500 houses have a Sonnenbatterie

CAPEX – £6,200 x 500 = £3.1M

OPEX - £0

Typical first year income = £400, x 500 = £200,000

Typical payback = 14 years

- Frequency response and energy offsetting could be combined to offer reduced bills to homeowners and viable income streams

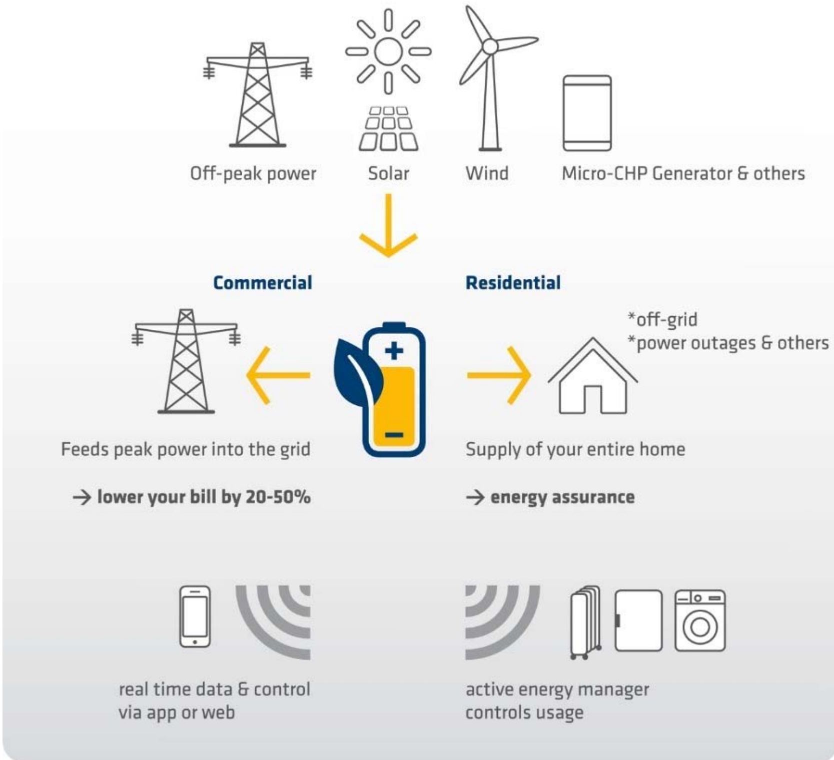
Next steps

- Detailed energy monitoring is vital as every site is different
- Combining energy offsetting and frequency response
- Increasing the amount of PV relative to demand so there is excess electricity generation to charge a battery

- Battery prices are reducing very rapidly
- Energy prices are expected to rise
- New services specifically for batteries will be created
- A decentralised renewable energy based electricity grid requires energy storage

Intelligent Lithium-ion Energy Storage Systems for every home

- ✓ Safe and reliable Lithium-iron Phosphate Technology - Developed for long lifetime
- ✓ Solar power around the clock
- ✓ Self-consumption with own electric power
- ✓ Economies by arbitrage effects
- ✓ Virtual Power Plants / Grid Services



The future……MW and beyond!

- ✓Zinc/Copper battery - well understood chemistry, established application and abundant materials
- ✓Grid scale - design means individual cells can be added in series to meet the desired voltage requirement
- ✓Long life, low maintenance – the target lifecycle of 30 years
- ✓Low cost – making it suitable for distributed energy storage applications
- ✓Low stress, low energy density, low voltage couple – low energy density is a desirable property for grid-scale energy storage because the cells will not be put under stress and will be inherently reliable

www.greenacornenergy.co.uk

green acorn
ENERGY STORAGE & BACK UP SYSTEMS