

CONNECTED ENERGY

**INNOVATIVE
BATTERY STORAGE
SYSTEMS**



Who we are.....

World leading innovators in energy storage & circular economy

- Dedicated to the design, manufacture and operation of world class energy storage systems.
- Management team with mature experience from automotive and energy sectors.
- Aiming to achieve ambitious international growth



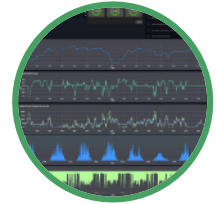
Hardware and software
system integrators



Manufacturing supply
chain developers



Sales, operation and
customer service
providers



Project development
and finance

What we do? Extending the usable life of EV batteries



Increase
security of
supply

Reduce
embedded
CO2 in EVs

**Reuse EV
batteries in
stationary
energy
storage**

Reduce
energy
costs

Reduce
cost of EVs
– increase
uptake

Help
decarbonise
grid

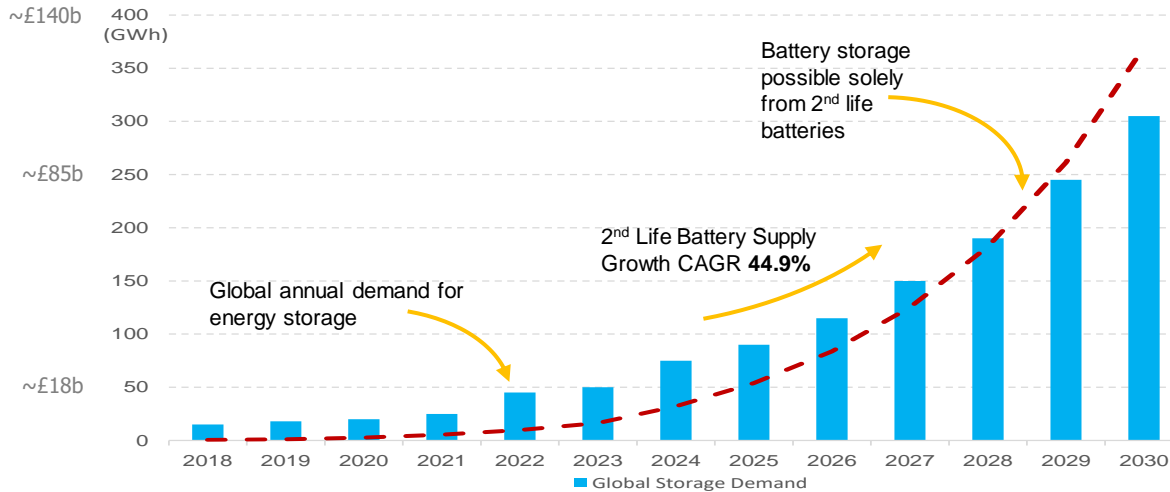


Why we do it? Market opportunity



The benefits of using 2nd life batteries and further harnessing their embedded natural resources is immense when compared with manufacturing new batteries

Projected Energy Storage Growth (GWh)



- £18bn global energy storage market by 2023
- By 2029 the global demand for energy storage could be met by 2nd life EV batteries

Note 1: Global Storage Demand – BNEF, Nov 2017: <https://about.bnef.com/blog/global-storage-market-double-six-times-2030/>

Note 2: EV battery Forecast – IEA, 2018: <https://lnkd.in/fMaCYwa>

Leveraging development to date

CE has developed its technology with a focus on creating and proving the building blocks for scale up.

It has established international partnerships to enable international expansion.

2015-18

2021

2025

System scale-up



Multi-battery scale up and validation



Modularisation Multi-MWh deployment



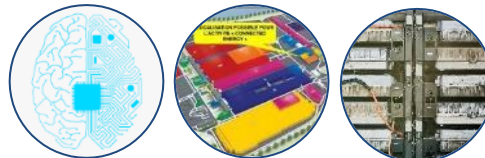
Scale-up to large systems

Value - Added



Control and monitoring

Offshore low cost assembly



Data enabled optimisation

Supply chain integration

Batteries as a Service



Market compliance

Large system development & operation

International scale-up and replication

OEM integration



Forward battery supply

Additional OEM battery integration

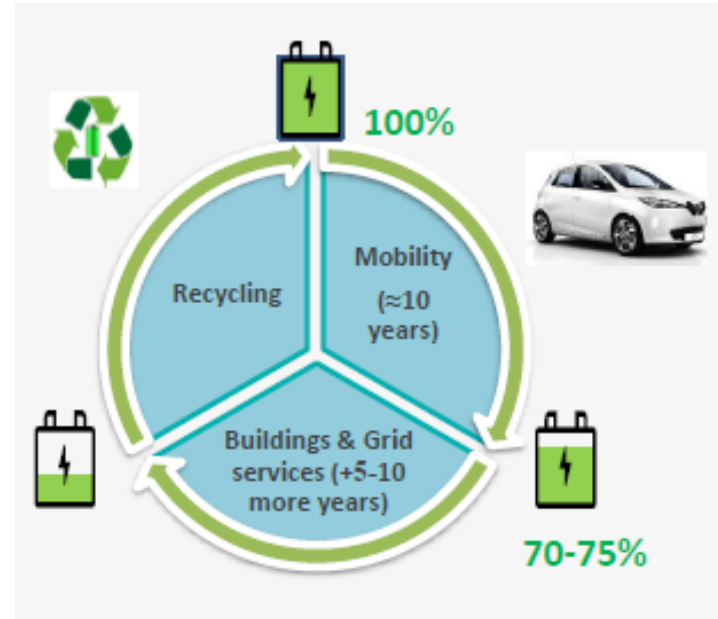
Battery flow optimisation





Using EV 2nd life batteries: an attractive solution

- High Safety level
- Technical performance
- Affordable: lower price than a new battery
- Better environmental impact of the EV
- Less use of resources
- Less emissions
- Ability to work the batteries harder for additional revenue benefit



Benefits of using a battery

- Avoid or minimise costly infrastructure upgrades
- Provide extra flexibility to your site
- A source of revenue when there is spare time
- Allows for growth of sites and an EV network

Going a second step further:

From a joint study with Lancaster University, a 300 kW E-STOR system could save an extra 144t CO₂e when compared to a first life system

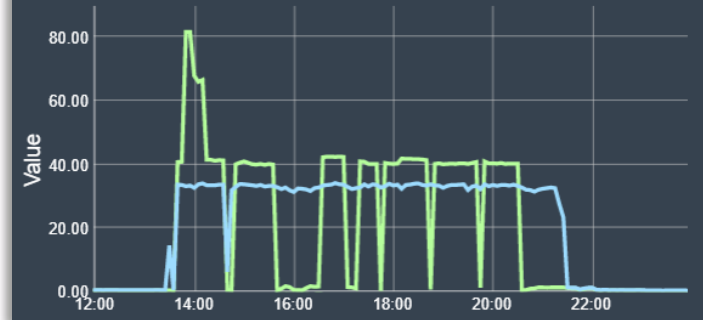


EV charger management

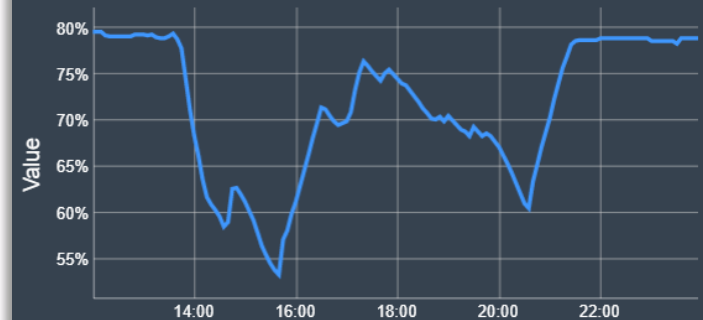
ALLEGRO: Active battery management of rapid chargers on a constrained network

- Site has a maximum import size of 35 kW
- Installed 2 x 50 kW rapid chargers installed
- Will cause a trip and blackout to the service station
- No option for reasonable grid upgrades or generation
- The battery discharges to provide support power when needed
- When there is capacity available the battery recharges

NATURAL SITE LOAD VS MANAGE SITE LOAD (KW)



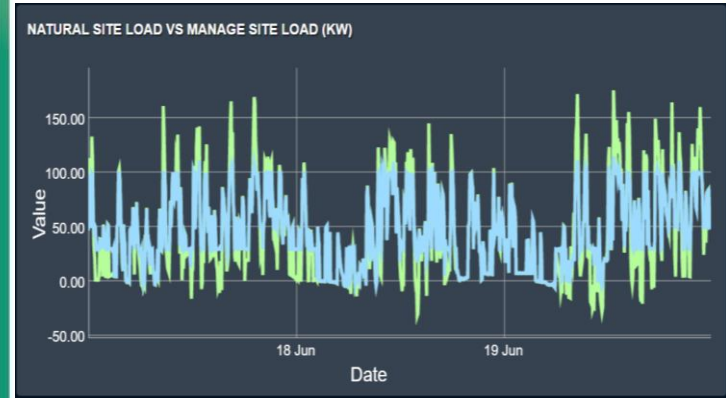
STATE OF CHARGE (%)



Optimise Onsite Renewables

Solar Capture

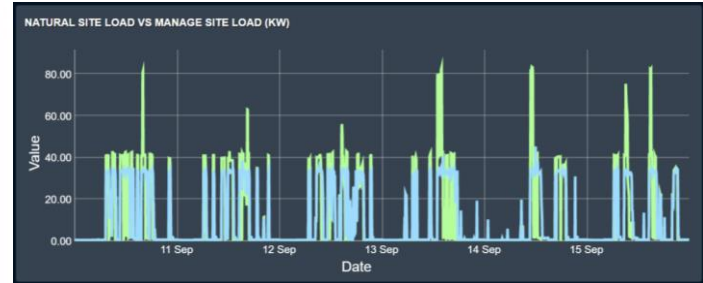
- This graph shows how a sites energy load has been changed by an E-STOR charging and discharging. The green line shows the natural site load that would have been used if the E-STOR had not been operating on the site. Whilst the blue line shows the actual output.
- With solar panels installed, periods of export would have occurred during these three days (seen by the 'Natural Site Load' being negative).
- The E-STOR system charges from this surplus energy. This charge energy is then used to reduce the peaks of energy usage on site (Combining both Renewable Enhancement and Import Constraint Management)



Reduce peak loads

Import management

- In cases where a limit to the amount of power can be drawn from the grid, an E-STOR is able to provide the shortfall required.
- The E-STOR charges the battery when there is available load and discharges into the site knocking off the peak loads.
- A predetermined limit can be agreed and can be managed with CE BESS and thus remove any breaching charges or need for additional capacity.



TRADE ENERGY + GENERATE REVENUE

GRID Services operating modes

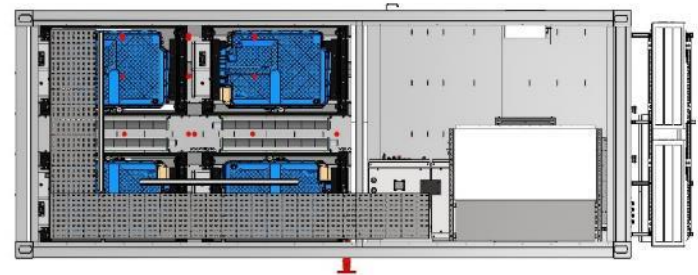
- Frequency response service. The power output of a system will track the fluctuations in the National Grid.
- Through an aggregator the BESS is traded and can generate long term revenue stream
- State of charge will generally remain close to 50% so that it is able to both charge and discharge to meet the demands of the grid.
- With an aggregator the customer can benefit from a number of different dynamic revenue streams that all support national grid imbalance.



SYSTEM SIZING

300kW / 360kWh

- 20' container modules
- 300kW & 360kWh (Renault Kangoo)
- BtM systems
- Site integration
- Multi-function – multi-value stream

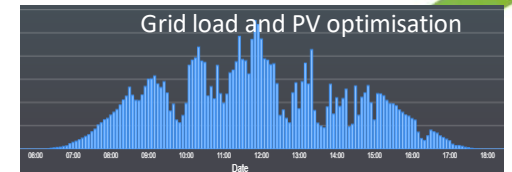
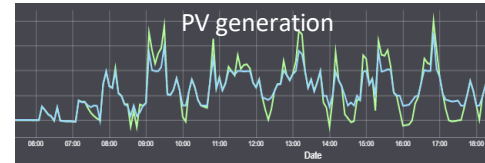


Managing EV charging load – Flagship project with Dundee City Council & Swarco

Project 1 - 60kW / 90kWh

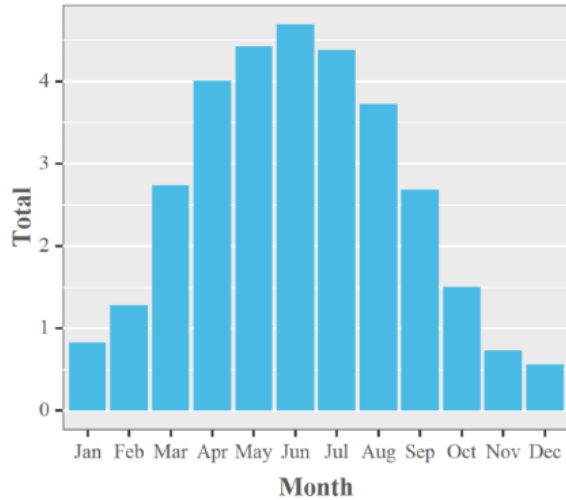
Project 2 – additional 600kW/720kWh

- Location: Princess Street, Dundee
- EV charging Hub with solar PV canopy
- Services:
 - Renewable Energy optimisation
 - EV charging
 - Time of Use energy shifting
- Solar canopy size: 22kW
- No. of EV chargers – 5x 50kW DC/ 40kW AC triple chargers and 3x 7kW chargers
- Commissioned: June 2018



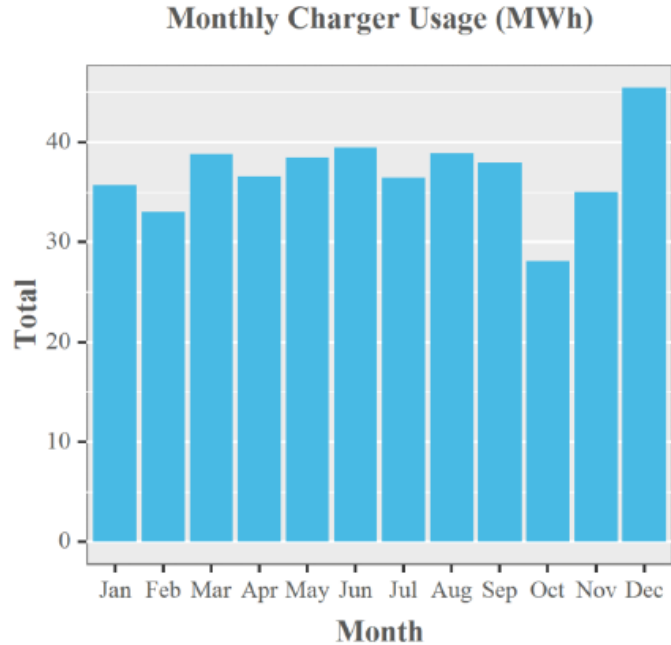
Solar Generation

Monthly Solar Generation (MWh)



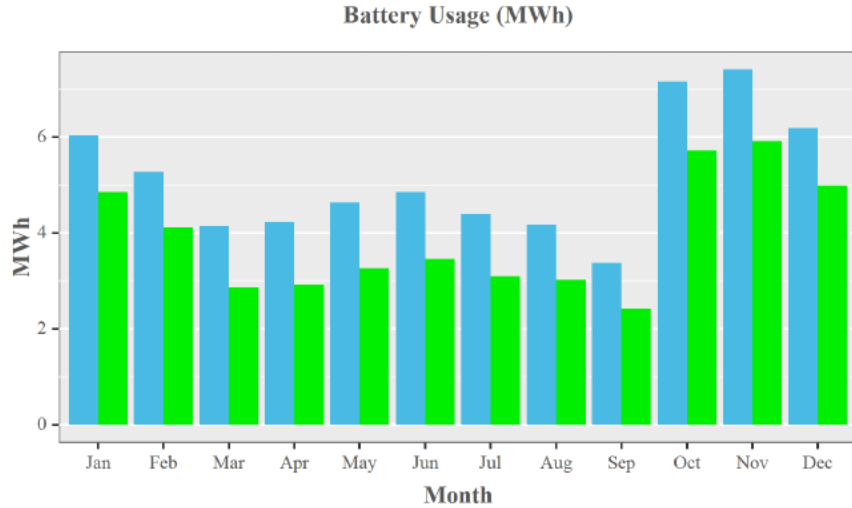
Month	Total (MWh)
Jan	0.83
Feb	1.28
Mar	2.74
Apr	4.01
May	4.42
Jun	4.70
Jul	4.38
Aug	3.73
Sep	2.69
Oct	1.51
Nov	0.74
Dec	0.56
-	31.58

Monthly Charger Usage

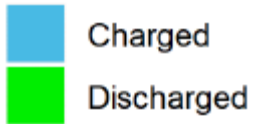


Month	Total (MWh)
Jan	35.72
Feb	33.02
Mar	38.81
Apr	36.59
May	38.47
Jun	39.48
Jul	36.45
Aug	38.89
Sep	37.99
Oct	28.08
Nov	35.03
Dec	45.50
-	444.03

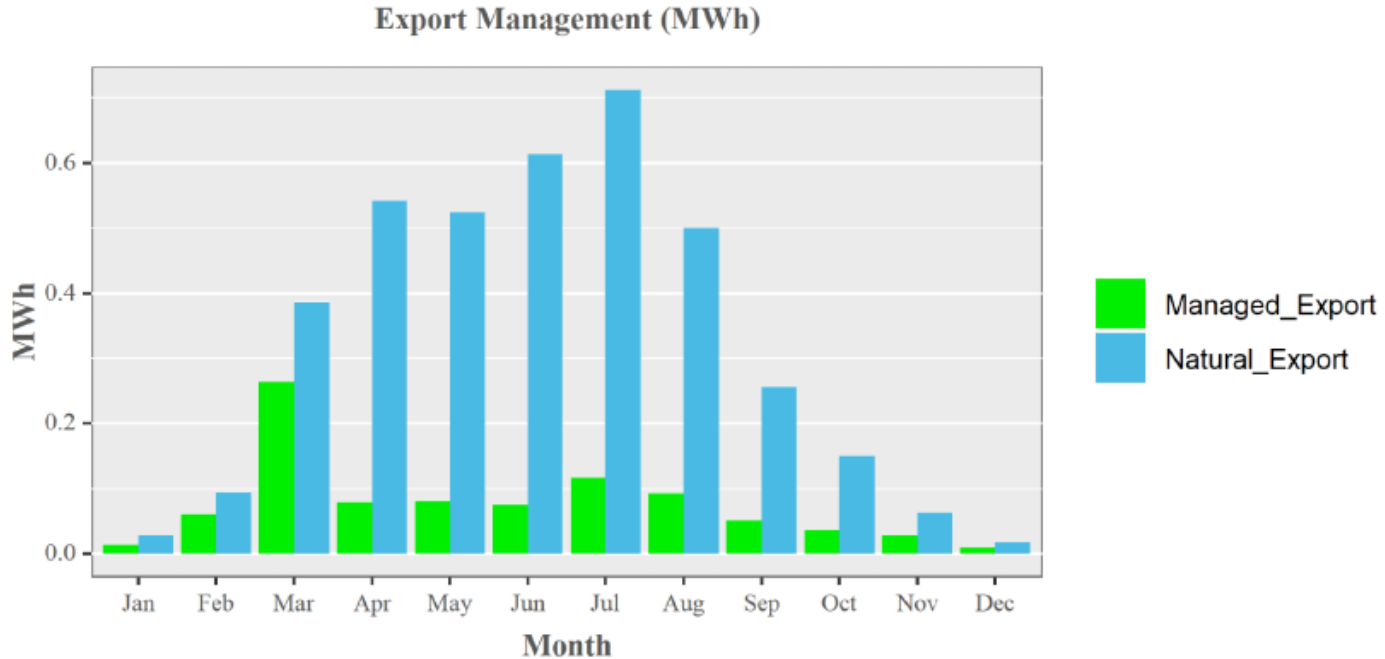
Battery Usage



Month	Charged (MWh)	Discharged (MWh)	Efficiency (%)
Jan	6.03	4.85	80%
Feb	5.28	4.12	78%
Mar	4.14	2.87	69%
Apr	4.23	2.93	69%
May	4.63	3.27	71%
Jun	4.85	3.46	71%
Jul	4.39	3.10	71%
Aug	4.17	3.03	73%
Sep	3.37	2.43	72%
Oct	7.15	5.73	80%
Nov	7.41	5.91	80%
Dec	6.19	4.99	81%
-	61.86	46.69	75%



Solar Utilisation



Increasing Solar Utilisation by 9%

Month	Natural Export (MWh)	% of Solar Used	Managed Export (MWh)	% of Solar Used
Jan	0.03	97%	0.01	98%
Feb	0.09	93%	0.06	95%
Mar	0.39	86%	0.26	90%
Apr	0.54	86%	0.08	98%
May	0.52	88%	0.08	98%
Jun	0.61	87%	0.08	98%
Jul	0.71	84%	0.12	97%
Aug	0.50	87%	0.09	98%
Sep	0.26	90%	0.05	98%
Oct	0.15	90%	0.04	98%
Nov	0.06	91%	0.03	96%
Dec	0.02	97%	0.01	98%
-	3.89	88%	0.91	97%

Dundee Story so far

- Solar generation over the last year (total of 31.58MWh)
- EV Charging demand over the last year (total of 444.03MWh)
- Battery charging and discharging usage over the year
(total of 45.66MWh of additional solar has discharged to the EV chargers)
- The storage has increased the Solar utilisation for the year from 88% to 97%
(reducing wasted export from 3.89MWh to 0.91MWh)
- The KVA demand from the EV chargers is being supported to bring it under 150KW (as much as the battery can provide)
- New Clepington Road site – 2x 300kW/360kWh systems supporting solar PV & EV chargers – due to be installed July 2022.
- Potential Bell Street site – 2x 300kW/360kWh

Business Case for battery storage

- 60kW/90kWh battery storage system – scalable in size to meet EV demand
- Solar yield increase by 9%
- 45MWh of solar used for EV charging that would have otherwise been spilled out to the grid
- There is no requirement for expensive infrastructure cost upgrades due to the battery system monitoring and controlling 150KVA import
- Battery storage system is an enabler for additional EV infrastructure with high infrastructure cost upgrades
- Battery storage system utilises renewable assets on site before using carbon intensive grid electricity

Thank you



CONNECTED
ENERGY Advanced Energy
Storage Solutions

Nigel Dent
Head of Sales
Connected Energy Limited

Nigel.dent@c-e-int.com
07961562727

www.c-e-int.com