



Our Flexible 1960s home: Retrofitting For the Electric Age – Oakington

An Open Eco Homes online tour



Mole



Ecology
Building Society



Timeline

- Oct 2016 - I moved back to my family home
- Nov 2016 - I become an EV early adopter
- 2016/2017 - I found out about openecohomes
- 2018 - got architects involved
- 2019 - joined a Vehicle-To-Grid trial
- 2020 - plans are decided, but...covid
- Jun 2021 - Icynene Sprayfoam installed, utilising Green Homes Grant
- Aug 2021 - 4.76kWp solar PV array installed, utilising solartogether scheme
- Dec 2021 - ASHP installed, utilising Renewable Heat Incentive
- May 2022 - builder available to start

Project Aims

- Considered Quality of Living Design
- Eco-Friendly
- Energy Efficiency

The property

- built in 1968



The property

- built in 1968



The property

- built in 1968
- middle of a terrace of three



The property

- built in 1968
- middle of a terrace of three
- brick and block build, standard 50mm cavity walls & concrete roof tiles



Ground Floor

Existing

First Floor



Ground Floor

Existing

First Floor



Caption



Caption

Ground Floor Existing



Ground Floor Proposed



First Floor Existing



First Floor Proposed



Considered Quality of Living Design

- Universal Living, Dementia Awareness
- Same-level access with wider doorways and easy to use handles
- Easy to clean - inc water softener
- Assisted bathing facilities by design, not a later eyesore addition
- Broken-plan living, with soundproofing
- Air quality - ventilation, low VOC's
- Comfortable environment - heating & cooling



Eco-Friendly

- reconfigure layout within existing, no extension
- Natural materials - flooring - cork, marmoleum, wool carpet; EWI - cork blocks to rear, wood fibre & larch cladding to front; clay paint
- reuse of materials - windows, hardcore, insulation
- green roof
- provision for grey water system
- water saving shower & taps
- cutting off the methane
- LED lighting

Eco-Friendly compromises

clay plaster - clay paint

- only twice the price of gypsum plaster, but shipping costs are eye-watering

has the same benefits of clay plaster but in a thinner layer

- natural & ecological
- cool in summer and warm in winter
- breathable and hygroscopic material and so helps to manage damp and regulate humidity
- absorbs odours
- emits no VOC's

Eco-Friendly compromises

green roof - sedum roof

- cost for structural support and maintenance

intensive - replicates ground level

biodiverse - brown roof of rubble, gravel, rubber, logs, to encourage bees & insects

semi-intensive - shrubs, forbs and grasses (has substrate and requires more maintenance)

extensive - sedum carpet

Energy Efficiency

INSULATION
AND
VENTILATION

underlined, in bold, red font colour



External Wall Insulation

wood fibre board - front of property
(larch cladding)

robust & durable
water repellent & vapour permeable
excellent thermal properties in winter & summer
eco friendly



Caption

External Wall Insulation



windows pushed out to fit the new layer of EWI

Pitched Roof Insulation

Icynene Open-Cell Sprayfoam



Pitched Roof Insulation

Icynene Open-Cell Sprayfoam

efficient

creates healthier environment

sustainable

free through Green Homes Grant (approx £5000)



Pitched Roof Insulation

Humidity



Temperature



Pitched Roof Insulation

Humidity



Temperature



Pitched Roof Insulation



Ventilation

MVHR

best option but too expensive

Ventilation

Aereco Demand Control Ventilation

Better air renewal for greater comfort

Protection against moisture

Reduced and controlled heating consumption

Lower materials cost

Lower installation costs

Lower running costs



Ventilation

main exhaust unit
fitted in bathroom



Ventilation

main exhaust unit
fitted in bathroom

sensor-activated
extracts located in
the four wet rooms



Ventilation

air inflow through
humidity activated
vents replacing
standard trickle vents



Ventilation

air inflow through
humidity activated
vents replacing
standard trickle vents

or wall vents



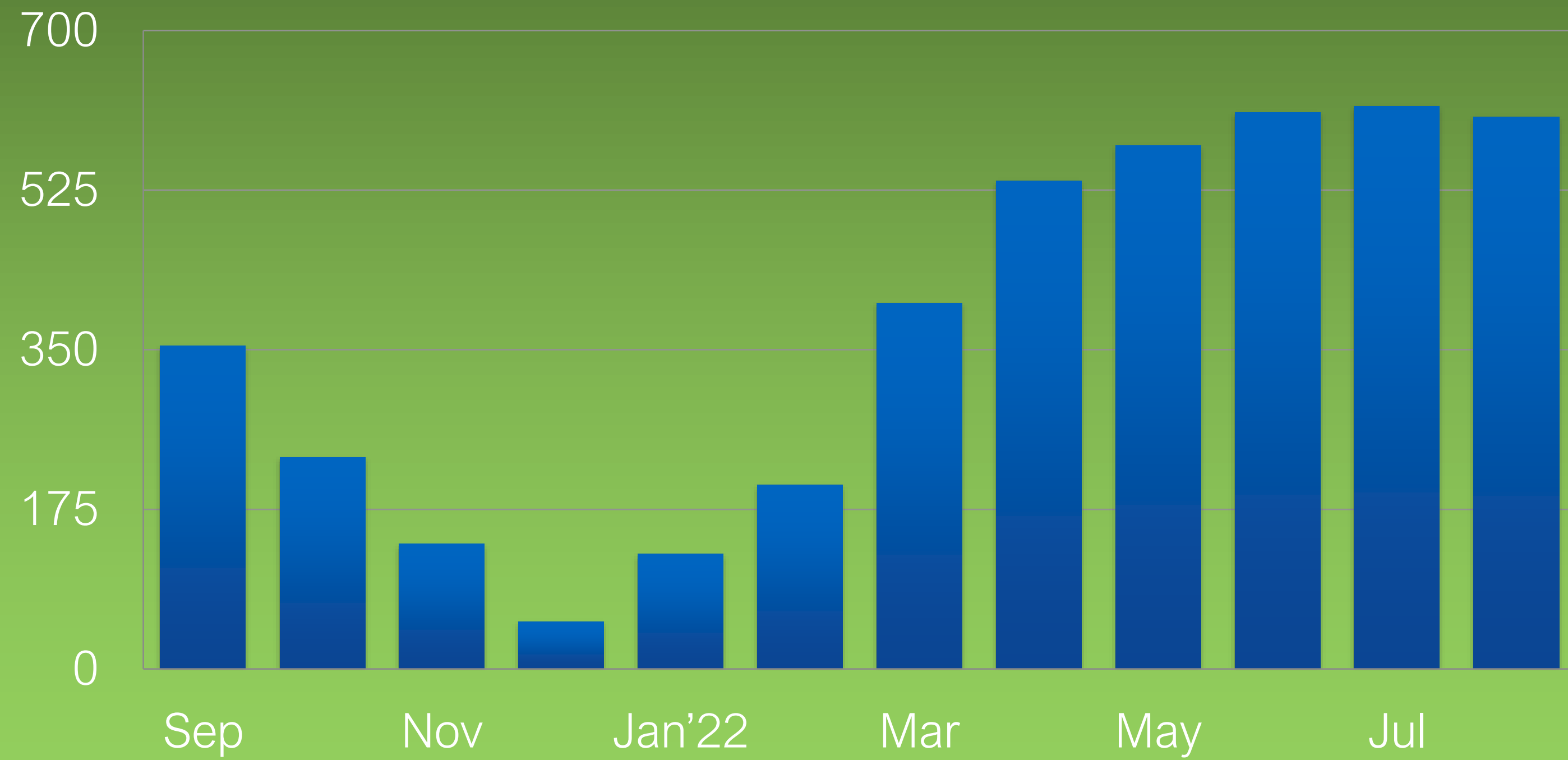
Solar PV

- Installed Aug 2021
- Utilising the solartogether scheme
- 4.76kW array, DNO approved (G99)
- south-east facing
- didn't install a home battery as had an EV
- £4k inc installation



Solar PV

- 4.5mWh
- House demand with EV but not ASHP, approx 5mWh (2018)



Air Source Heat Pump (ASHP)

ASHP

How does it work?

It takes heat from the air and transfers it to your home.

How?

Heat is transferred to a coolant which is then compressed, then decompressed and that action intensifies the heat which then passes through an exchanger to heat the liquid in your wet heating system.

So for every kW of energy input, you get about 3-5 kW of heat output.

Ever heard of the First Law of Thermodynamics?

Okay, you got me. There's actually a dragon kept in the box outside that is cooled by the fan and it breathes fire to combat the cold air and keep itself warm.

Now that makes more sense.

ASHP





Mixergy Tank

- Can heat from mains elec or gas, diverted solar PV, heat pump.
- Heats from the top.

Smart Features

- Only heats as much as you regularly use (except from heat pump).
- Can link to Time-Of-Use tariffs.

ASHP


HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

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Fully Charged Show
50K views · 1 year ago


ASHP

HOME VIDEOS PLAYLISTS COMMUNITY CHANNELS ABOUT

#lessismore Heat  Geek #nopanacea

Reduce the Heating Industry

The seven SI units: **kWh** is a measurement of _____ - calculated by power x hours

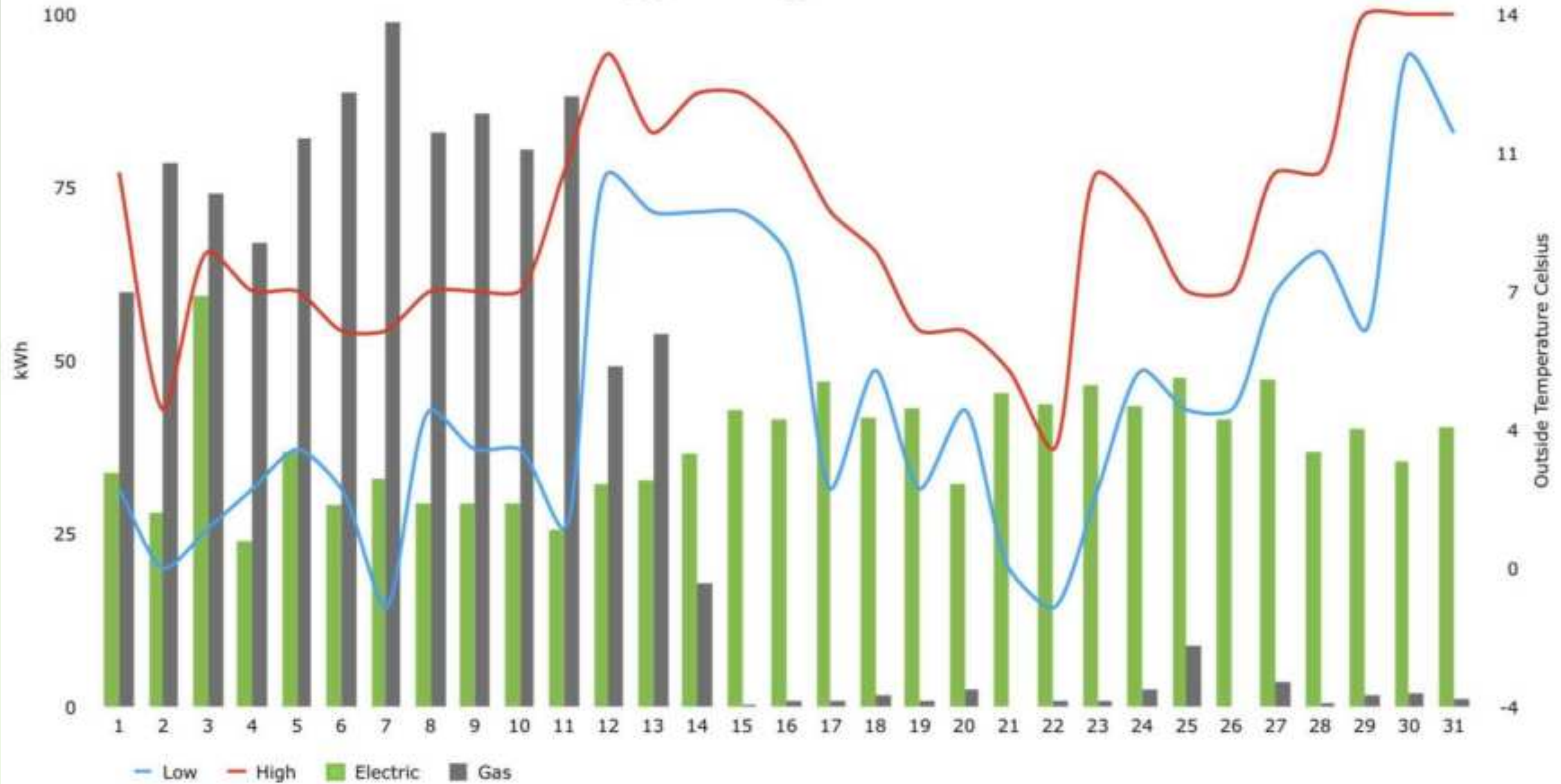
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ASHP

December 2021 Energy Usage



Vehicle-To Grid | V2G

- Helps to balance the National Grid by storing power in EV's when demand is low, and feeding back into grid during peak demand
- This bi-directional capability was only available in Nissan EV's, as they used CHAdeMO chargers
- Two year trial that commenced in 2019
- Energy company/National Grid determines the timings for import/export
- Export can be overruled by the owner if EV is needed



Vehicle-To Grid | V2G

10:47

MY V2G CHARGER

Idle

Waiting for the best time to charge

37%

Ready by 05:00 tomorrow

Change schedule

Today's charging data

Figures are updated every 30 minutes

Plug-in duration	17h 23m
Charging duration	5h 24m
Energy imported to car	27.4 kWh
Energy exported from car	17.1 kWh

Dashboard Home

Mon 4 22.5 kWh 17.1 kWh

Plug-in duration 16h 42m

Charging duration 4h 28m

Energy imported to car 22.5 kWh

Energy exported from car 17.1 kWh

Daily Charging Profile

1h 30m

Imported Exported

The chart displays energy flow over a 24-hour period. The y-axis represents energy in kWh, with markers at 0, 3.7, and 7.4. The x-axis shows time intervals from 00:00 to 24:00. Blue bars represent energy imported to the car, and green bars represent energy exported from the car. Imported energy peaks in the morning (around 01:00-05:00) and again in the evening (around 20:00-23:00). Exported energy occurs during the day (around 07:00-18:00).

← CHARGE RANGE

Set your battery level range

Recommended range

Min charge 25%

Max charge 90-95%

Why is the minimum 25%?

Kaluzza will not export below 25%, to protect your battery and ensure you can drive in an emergency.

← SCHEDULE

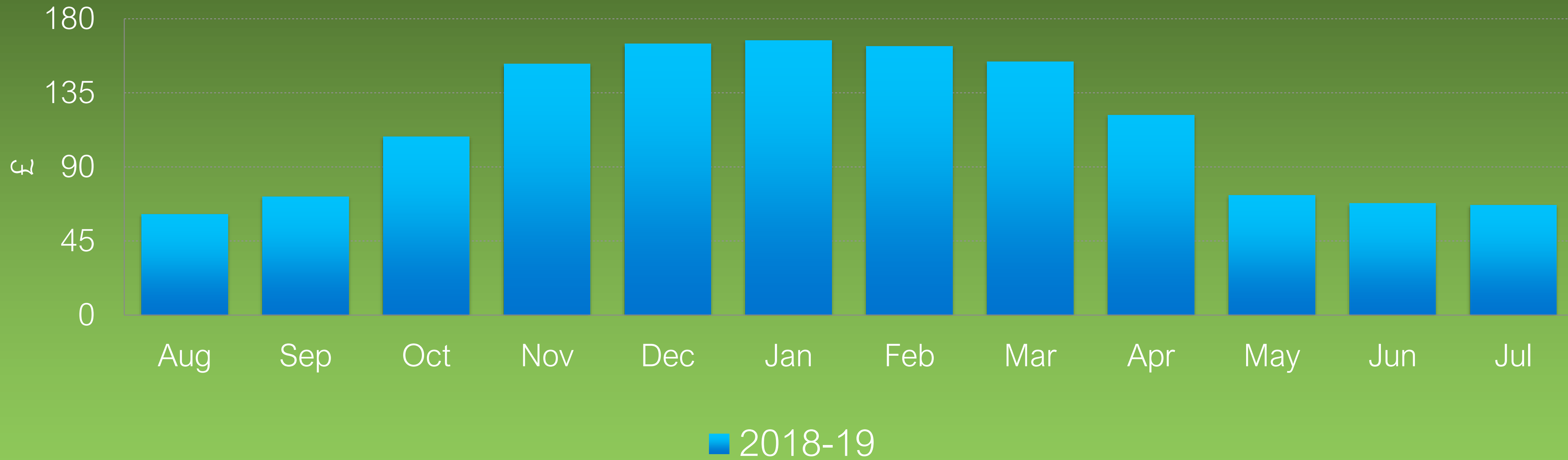
Your vehicle will be ready by 07:00 tomorrow

If you leave the car plugged in after your ready-time, the V2G charger will wait for 2 hours before potentially exporting again from the battery.

Day	Ready by
Monday	07:00
Tuesday	07:00
Wednesday	07:00
Thursday	07:00
Friday	07:00
Saturday	09:00
Sunday	09:00

Vehicle-To Grid | V2G

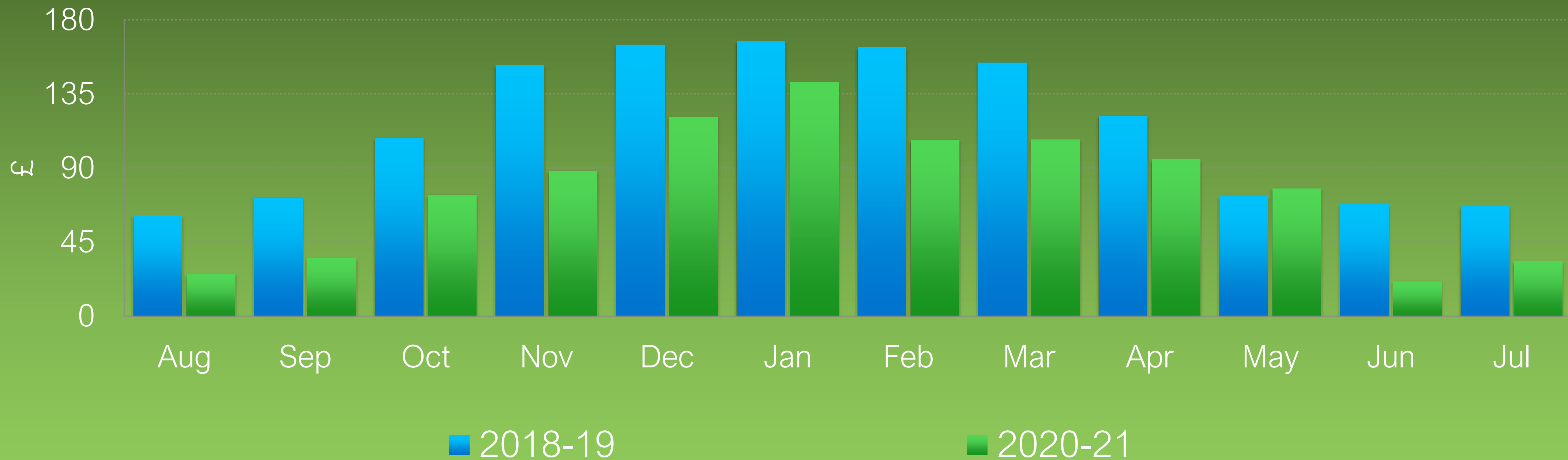
Energy Bills



Total £1,372
13.5p kWh 20p SC

Vehicle-To Grid | V2G

Energy Bills



Total £1,372
13.5p kWh 20p SC

Total £927
16.9p kWh 27.4p SC

Vehicle-To Grid | V2G

Energy Bills



Total £1,372
13.5p kWh 20p SC

Total £927
16.9p kWh 27.4p SC.

Total **-£459**
13.7p kWh 28.1p SC

Vehicle-To Grid | V2G



Paul Kershaw sells energy he stores back to the Grid

'I save hundreds storing electricity in my car'

Lily Russell-Jones

Paul Kershaw spends just £20 a month on his energy bills, even with the cost of charging his electric car.

Kershaw, 58, from Cambridge, almost completely offsets his energy costs using surplus power that he stores in his car, and made an average of £384 a month last year by exporting it to the Grid.

"I'm very environmentally minded so I chose an electric car," said Kershaw, who signed up for a five-year Vehicle-to-Grid deal in 2020 that supplied him with a special charger that allowed him to harness power and sell it back to his supplier, E.ON Energy.

At the end of the trial E.ON let him buy the charger for a penny and he continues to use it to make money from his extra power.

"I travel a couple of miles a day. The rest of the time the car is sitting there doing nothing but it has a massive

battery so it seemed like a no-brainer."

At night the charger powers up his electric car while demand on the national grid is low. When demand for electricity increases, excess energy from his car's battery is sent back to the Grid.

Kershaw switched his electric vehicle to a Nissan Leaf that has a suitable battery so that he could take part in the trial. He was already paying off his electric vehicle in monthly instalments and switching



My car has a massive battery. It was a no-brainer

cars raised his bills from £20 to £200 a month, which has been eating into the savings he makes on electricity.

"It's more a case of paying pounds and saving pence, but the pounds matter a lot right now," he said. He has been feeling the effects of spiralling prices, but the scheme has helped.

"I'm now receiving money on a monthly basis from the energy company, which is unbelievable. It has put me in a very fortunate position."

The money he gets from the scheme has been a lifeline during the cost of living crisis as prices, particularly for energy, rise at their fastest rate since 1972.

"I am using the money for basic survival," Kershaw said. "I've been out of work for 15 years so it's very financially precarious position to be in. Having this setup takes a lot of the anxiety away."

E.ON Energy is considering operating a further trial. Octopus and British Gas have run similar trials.

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One Answer to Europe's Energy Crisis? More Electric Cars

Like soldiers in an electron battlefield, EVs en masse are great for storing renewable electricity and sending it back to the grid during peak demand.



Vehicle-To Home | V2H

- Energy from an off-peak rate (eg Octopus Go) or from solar is stored in the EV battery, then used to power the home, avoiding peak rate prices
- Trial starts late 2022
- User has control



ASHP

- we chose early installation to take advantage of the RHI
- this led to us receiving a 9kW heat pump, minimum 2kW oversized; following the retrofit it will be grossly oversized
- DO NOT OVERSIZE YOUR HEAT PUMP
- primary pipes to/from heat pump not lagged, this is now or will be a standard; this led to my bedroom being overheated
- we were provided with a Hive thermostat, DO NOT BUY

Conclusion

Retrofitting for the aged

- time of year is crucial
- live in or out?
- stress, physical & emotional, can have a lasting effect on health
- take it slow, but steady
- very happy with the way things are now, thank you
- on balance, my retrofit will be beneficial, but I am constantly questioning the decision

Conclusion

When should you retrofit?

- as our aim was a better quality of living, the time was now
- ecological reasons - 10+ years ago
- economic reasons - savings can be made now; if you're waiting for grants, good luck

What Benefits Have We Seen?

- If the rest of the retrofit realises the intended benefits the same as we are experiencing in the bathroom, they will be immense

Conclusion

Educate yourself

- retrofit remains a niche, suppliers and trades are not ready

Plan

- work out what can be done as a stand-alone improvement, so that you can take advantage of any grants/deals if they become available

Stand firm to your values and ideals

- that's the path to contentment

Can you help us?

- Make a donation to help us run more Open Eco Homes tours:
cambridgecarbonfootprint.org/donate
- Share your experiences on social media: **#OEH2022**

Thank you for your support!



Mole



Ecology
Building Society



Your next steps

- Find out how you can get started with your retrofit
- Book another tour or talk
- Get personal advice at the Human Library on Home Energy, Sat 24 Sep
- Research our past case studies
- Book a training session and borrow a thermal imaging camera
- Use Transition Cambridge's personalised home energy advice tool