Evaluating Energy Use at Two Passive House Plus Dwellings in the UK

May 2020 - April 2021

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Introduction

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

Lark Rise, Buckinghamshire, 2015

PHI Database ID #5535

175m^2 single-family dwelling

12.4 kWp PV array conected to Tesla Home Battery with a 4 kW limit on grid export

Brambles, Hertfordshire, 2020

PHI Database ID #6613

150m^2 single-family dwelling

10kWp PV array connected to Tesla Home Battery with no limit on grid export

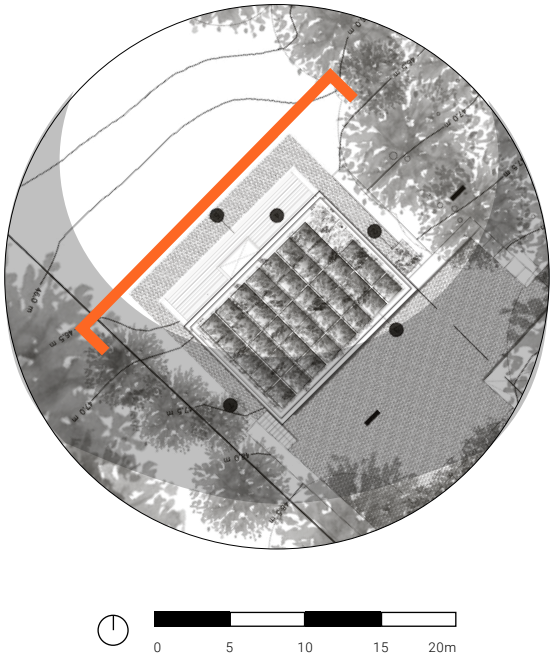
On Tesla Octopus Energy Tariff since November 2020

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

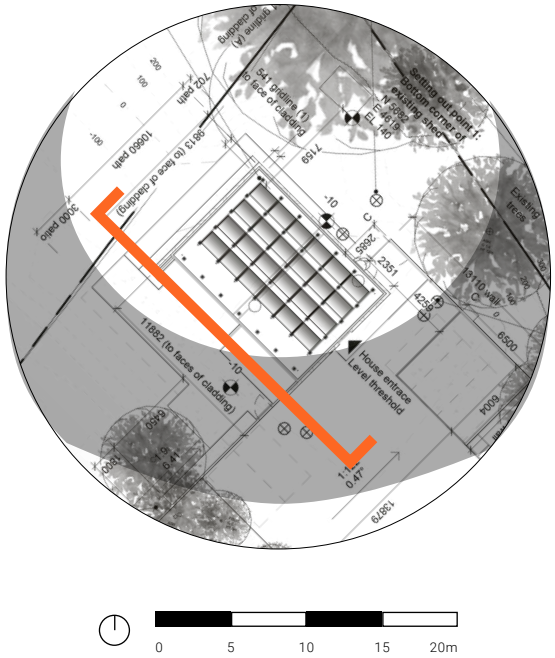
Roof Plans

Garden Elevations & Sun Paths



Lark Rise, Buckinghamshire
#5535

Northwest-facing garden elevation
Large canopy of trees to the southwest of PV array



Brambles, Hertfordshire
#6613

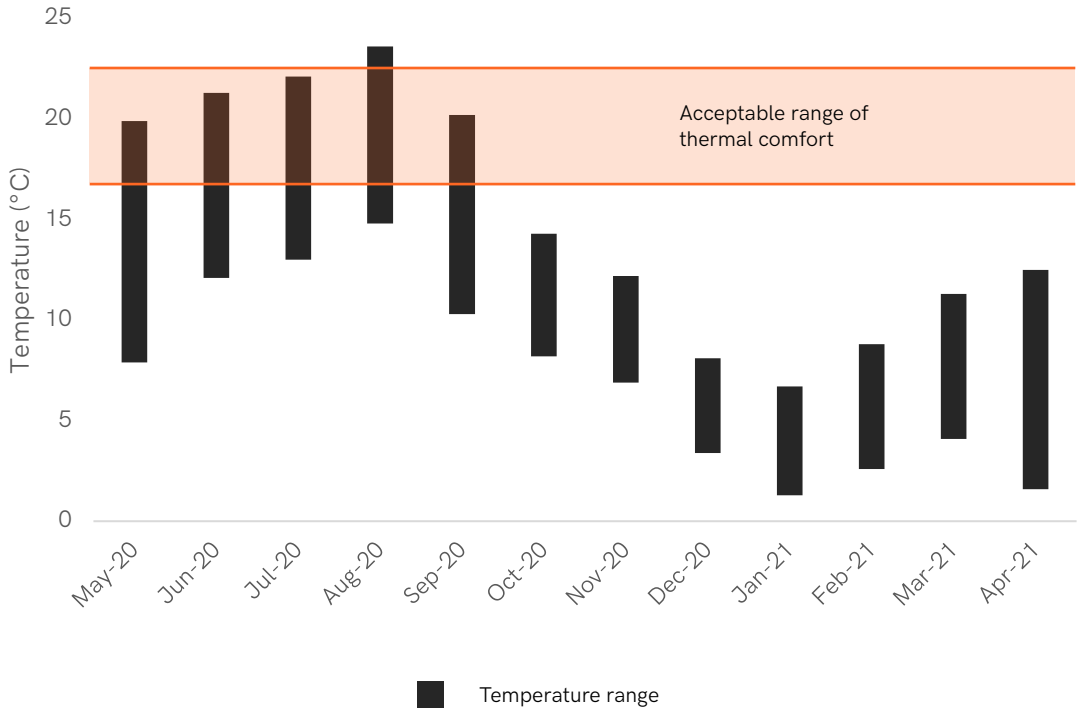
Southwest-facing garden elevation
Hardly any obstructions shading the PV array

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Monthly Temperature

Oxford Station Met Office

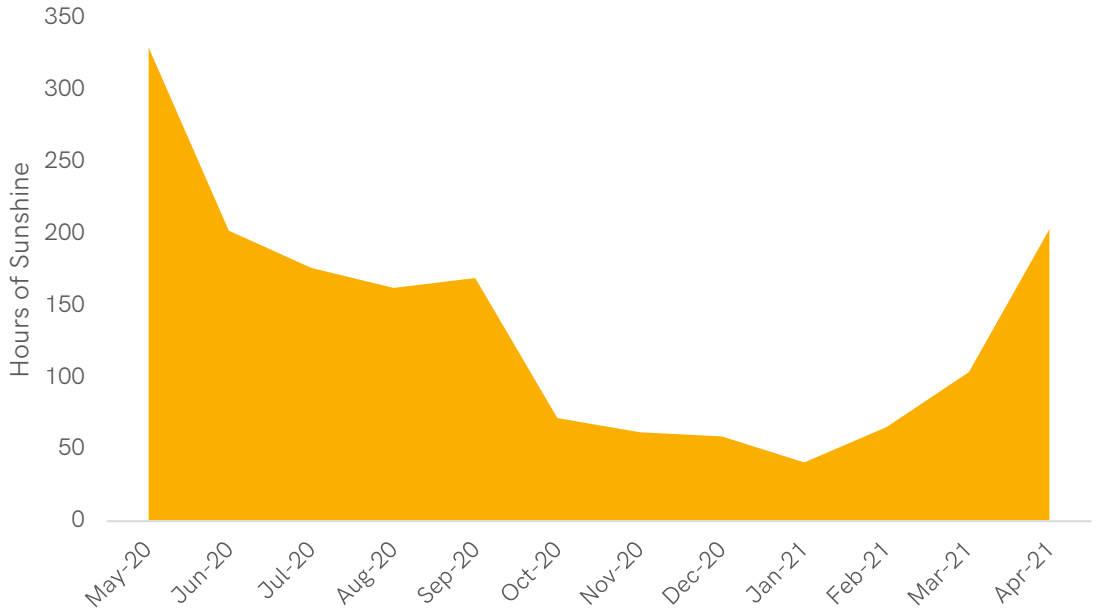


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Monthly Sunshine

Oxford Station Met Office

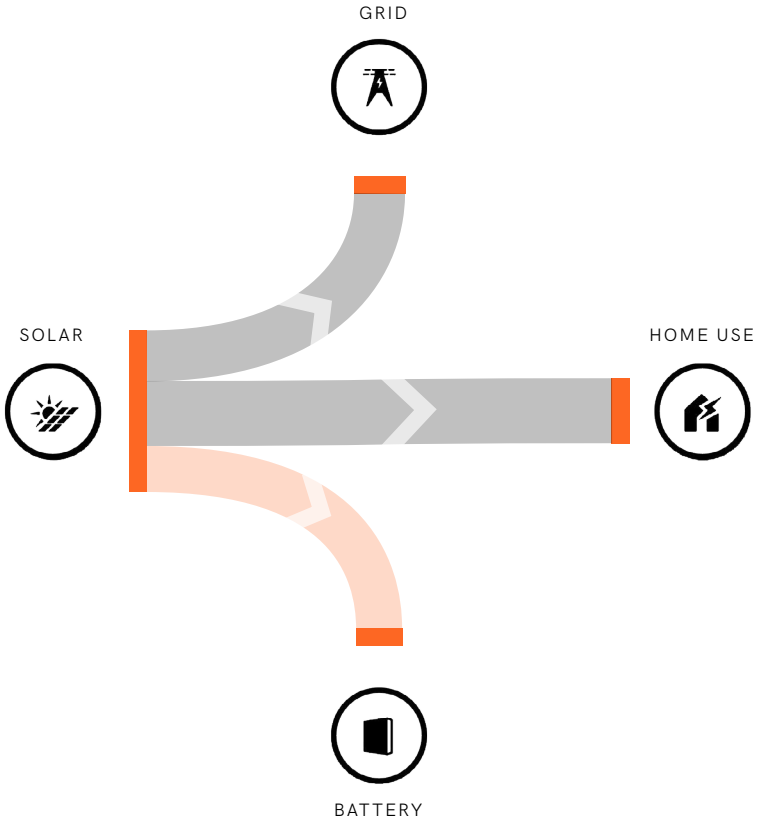


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Charging Battery

During the Day

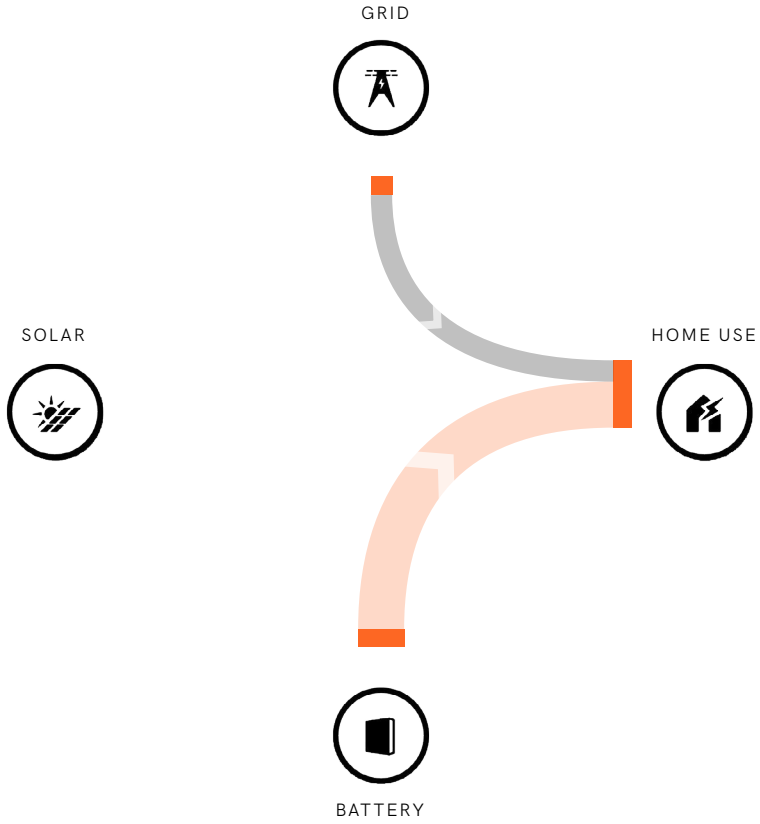


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Discharging Battery

Throughout the Night

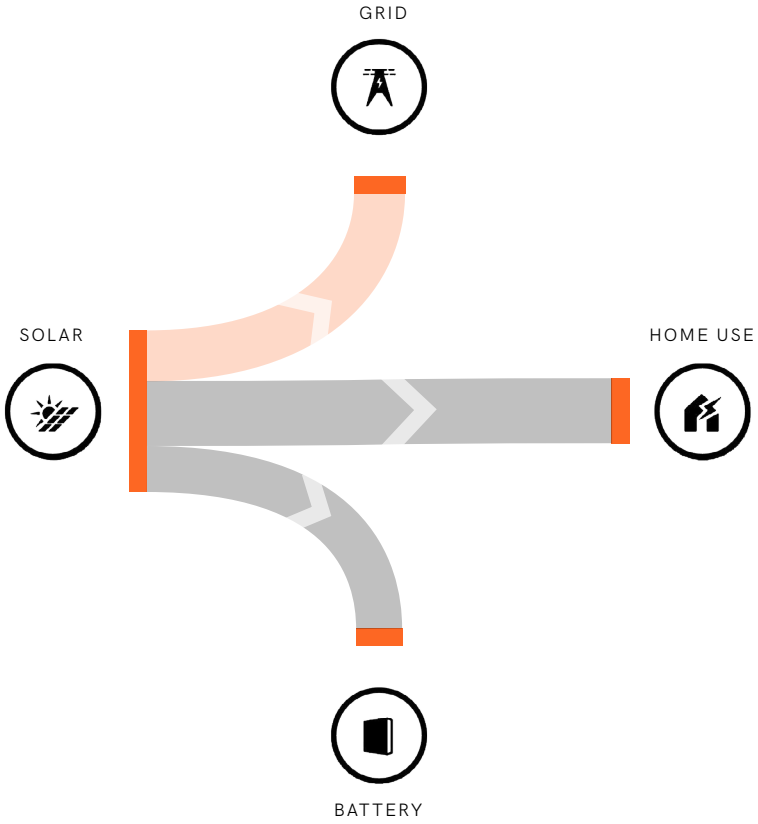


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Exporting to Grid

With Excess Solar Energy

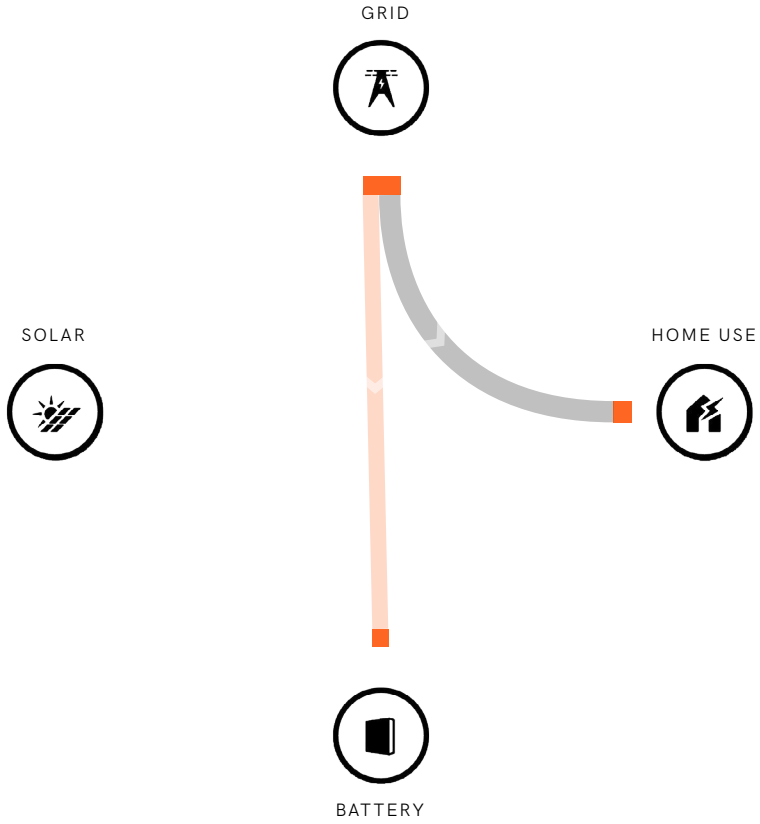


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Tesla-Octopus Smart Tariff

Off-Peak Imports from Grid

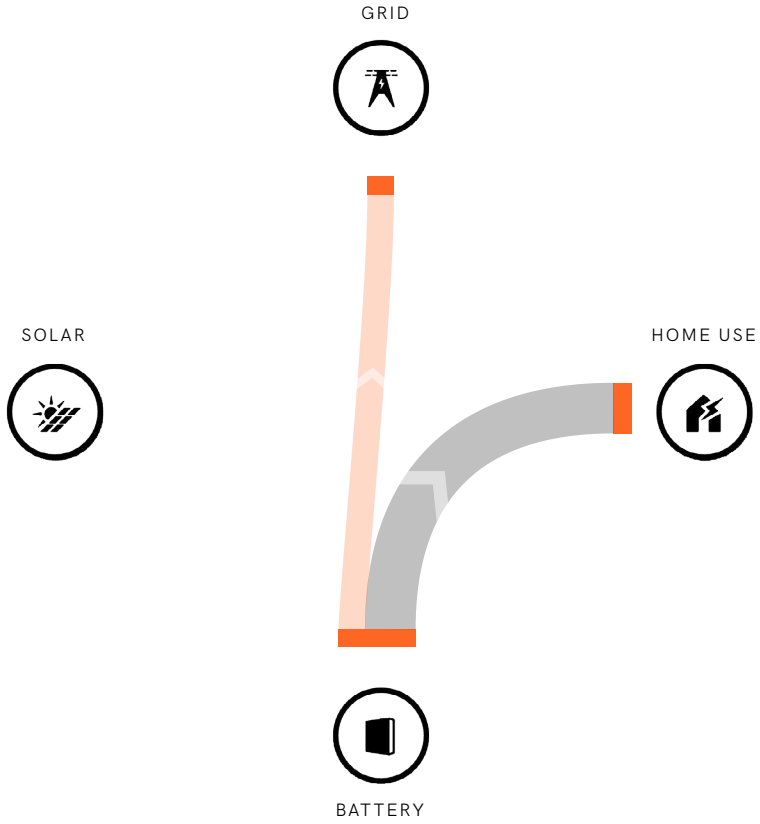


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Tesla-Octopus Smart Tariff

Peak Exports to Grid



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Project Aims

- To assess **energy-use against a typical UK home** as per the Department of Business, Energy & Industry's data (ECUK data available on-line).
- To **compare Lark Rise and Brambles' energy consumption and generation** on an overall scale.
- To **study energy usage behaviour over the scale of a single day** and their effect on overall energy usage.

Overall Energy Performance

- To compare **energy consumption and PV generation in relation to seasons.**
- To assess the **solar energy self-production** of the homes in view of energy self-sufficiency.
- To appraise the **effectiveness of the Tesla Powerwall battery** that is operational in both homes.

Energy Self-Production & Self-Sufficiency

- To evaluate the dwellings' **energy performance during winter**, when the environmental conditions did not favour on-site PV generation.
- To understand the **renewable/ non-renewable energy balance** with a view to further optimise energy decarbonisation in future projects.
- To consider the effect of the **Tesla-Octopus Smart Tariff** as a advocate for off-site renewables.

Net- Zero Energy & Renewable Balance

- To **speculate about a future** with similarly performing Passive House Plus homes.

A Future of Renewables

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Project Aims

- To assess **energy-use against a typical UK home** as per the Department of Business, Energy & Industry's data (ECUK data available on-line).
- To **compare Lark Rise and Brambles' energy consumption and generation** on an overall scale.
- To **study energy usage behaviour over the scale of a single day** and their effect on overall energy usage.
- To compare **energy consumption and PV generation in relation to seasons.**
- To assess the **solar energy self-production** of the homes in view of energy self-sufficiency.
- To appraise the **effectiveness of the Tesla Powerwall battery** that is operational in both homes.
- To evaluate the dwellings' **energy performance during winter**, when the environmental conditions did not favour on-site PV generation.
- To understand the **renewable/ non-renewable energy balance** with a view to further optimise energy decarbonisation in future projects.
- To consider the effect of the **Tesla-Octopus Smart Tariff** as a advocate for off-site renewables.
- To **speculate about a future** with similarly performing Passive House Plus homes.

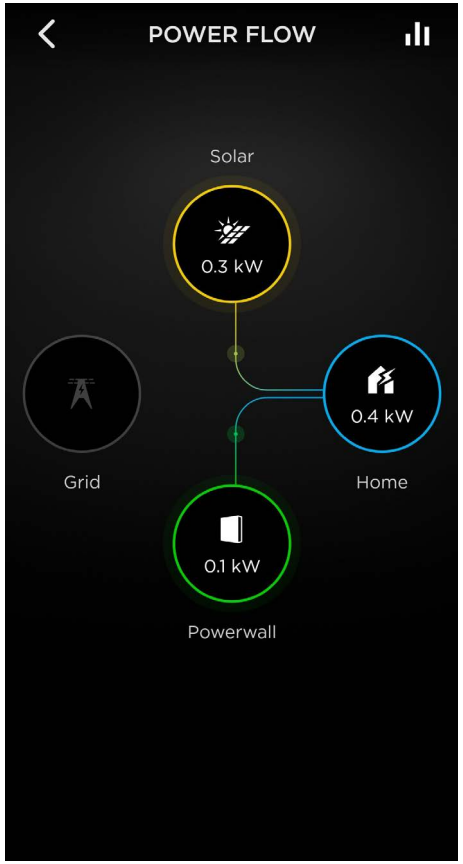
Hypotheses

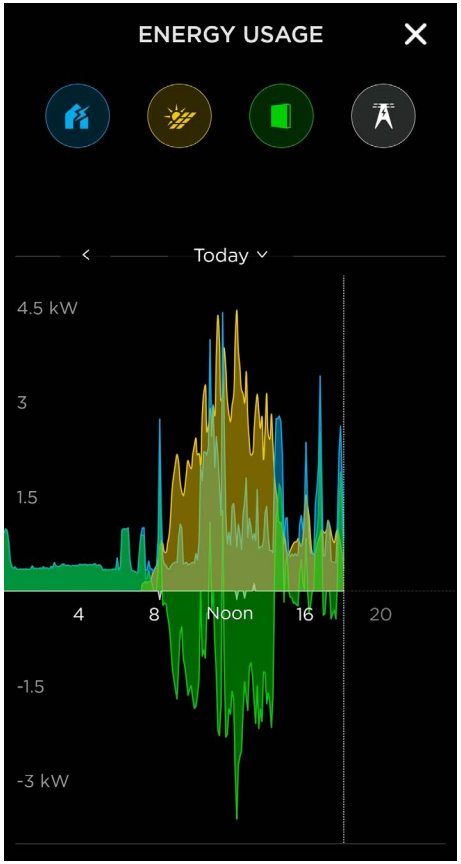
- **80-90% energy saving** compared to a typical UK home.
- **Brambles will generate more solar energy and have lower energy demand** due to less overshadowing, uninhibited solar power generation and more optimal orientation.
- A **mismatch between demand and supply could be to the energy performance's disadvantage,** affecting the effectiveness of having an on-site solar array and battery.
- **Brambles will be more energy self-sufficient and will be able to export more to the grid.**
- The **Tesla Powerwall home battery will be invaluable to ensuring that the houses make the most of their solar arrays.**
- There will be **challenges in the winter** with regards to low renewable energy supply and high energy demand.
- The **Octopus Energy Plan at Brambles will keep the house running renewably,** through off-site renewables.
- It is **easier to be net-positive with the Octopus Energy Plan**, where the grid energy is 100% renewable.
- We need to **encourage deep-retrofit/ low-energy new-builds on a large scale** to meet UK decarbonisation goals.

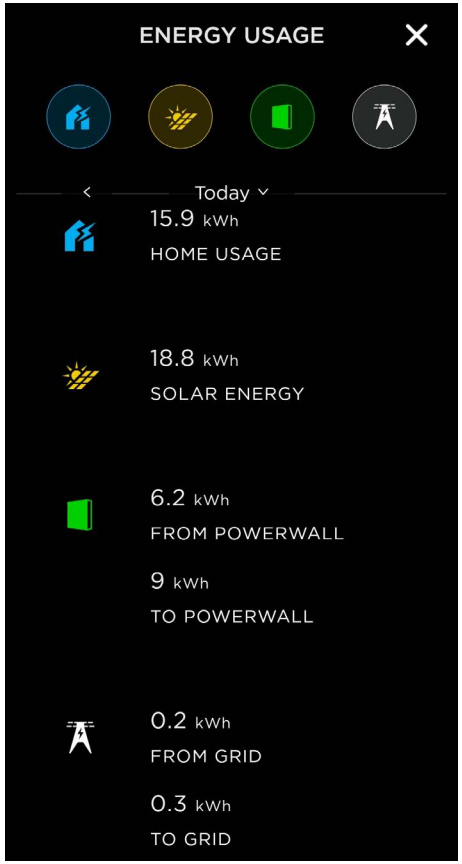
bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Data Collection

Tesla Powerwall Mobile App





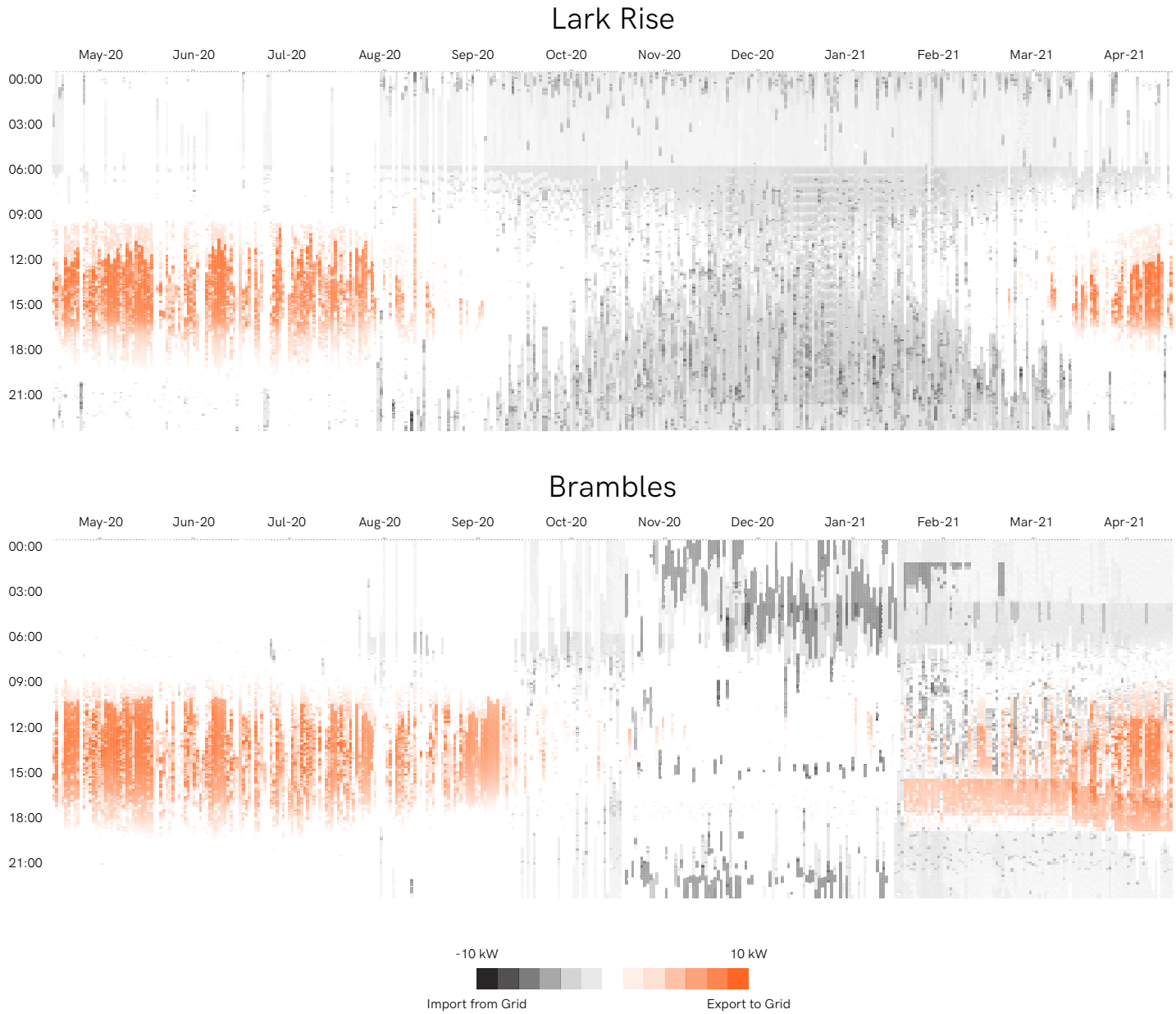


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Data Collation

5-Minute Grid Import/ Export in kW, May 2020 - April 2021



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

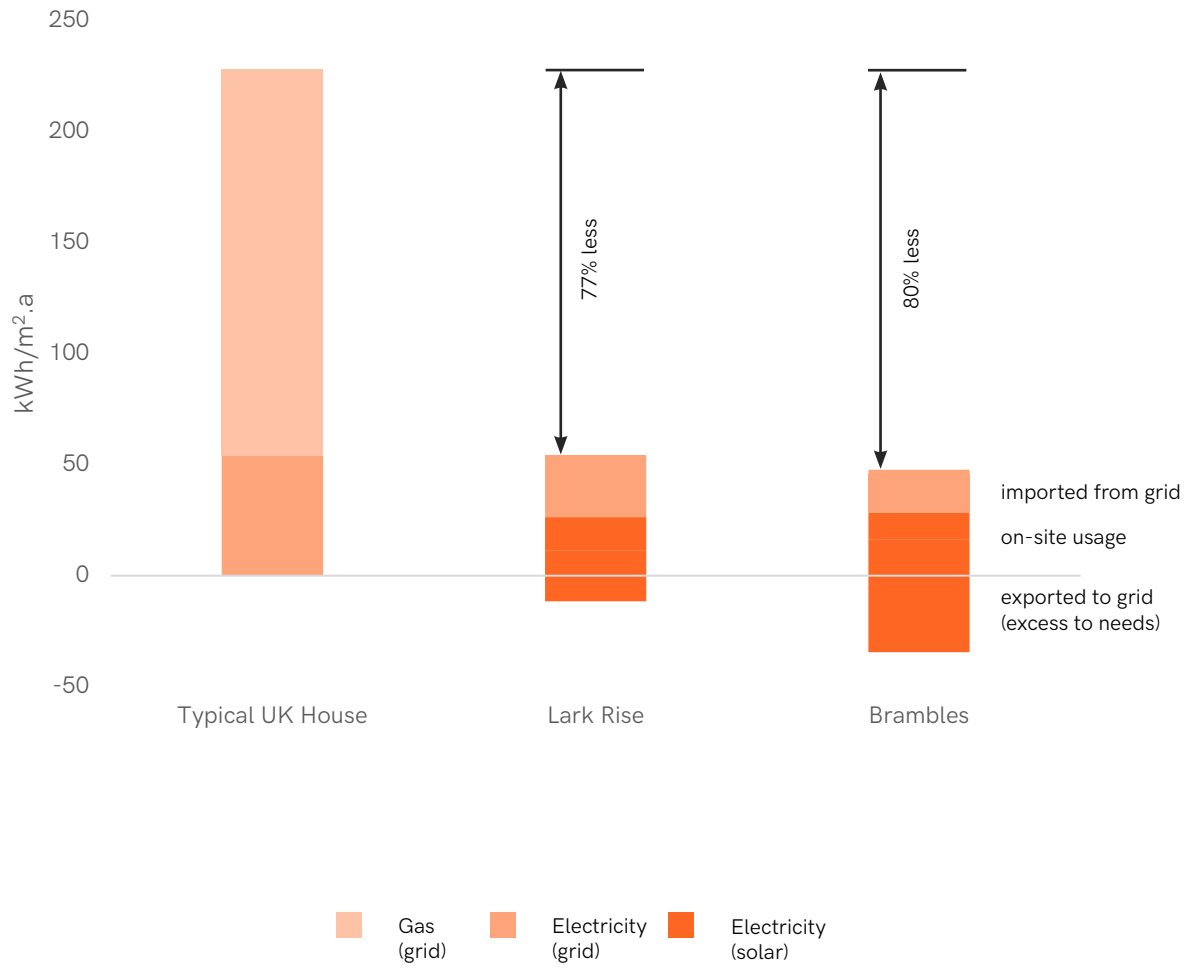
To assess **energy-use against a typical UK home** as per the Department of Business, Energy & Industry's data (ECUK data available on-line).

Typical vs. Passive House Plus

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

Final Energy Usage

Typical UK Home vs Passive House Plus

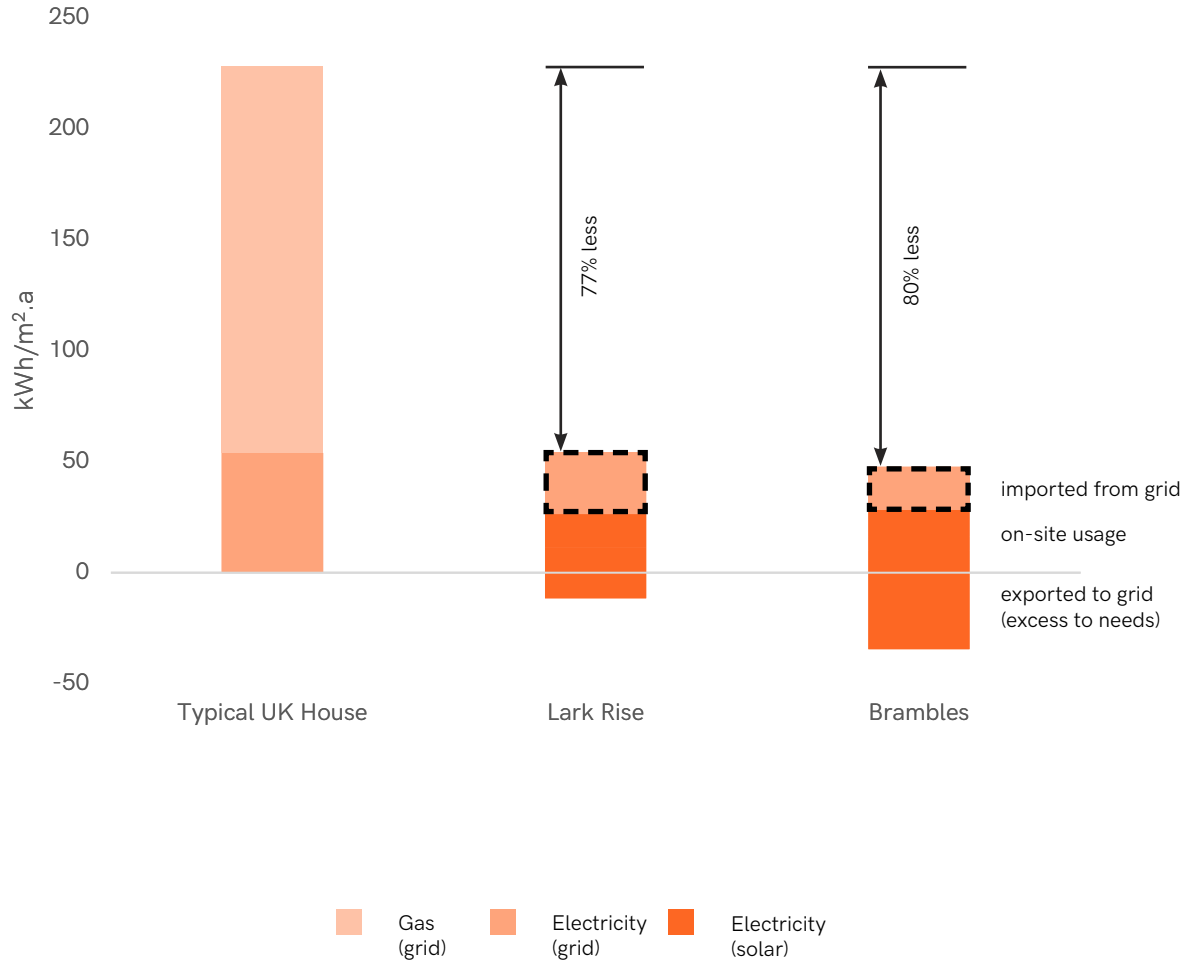


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Final Energy Usage

Typical UK Home vs Passive House Plus

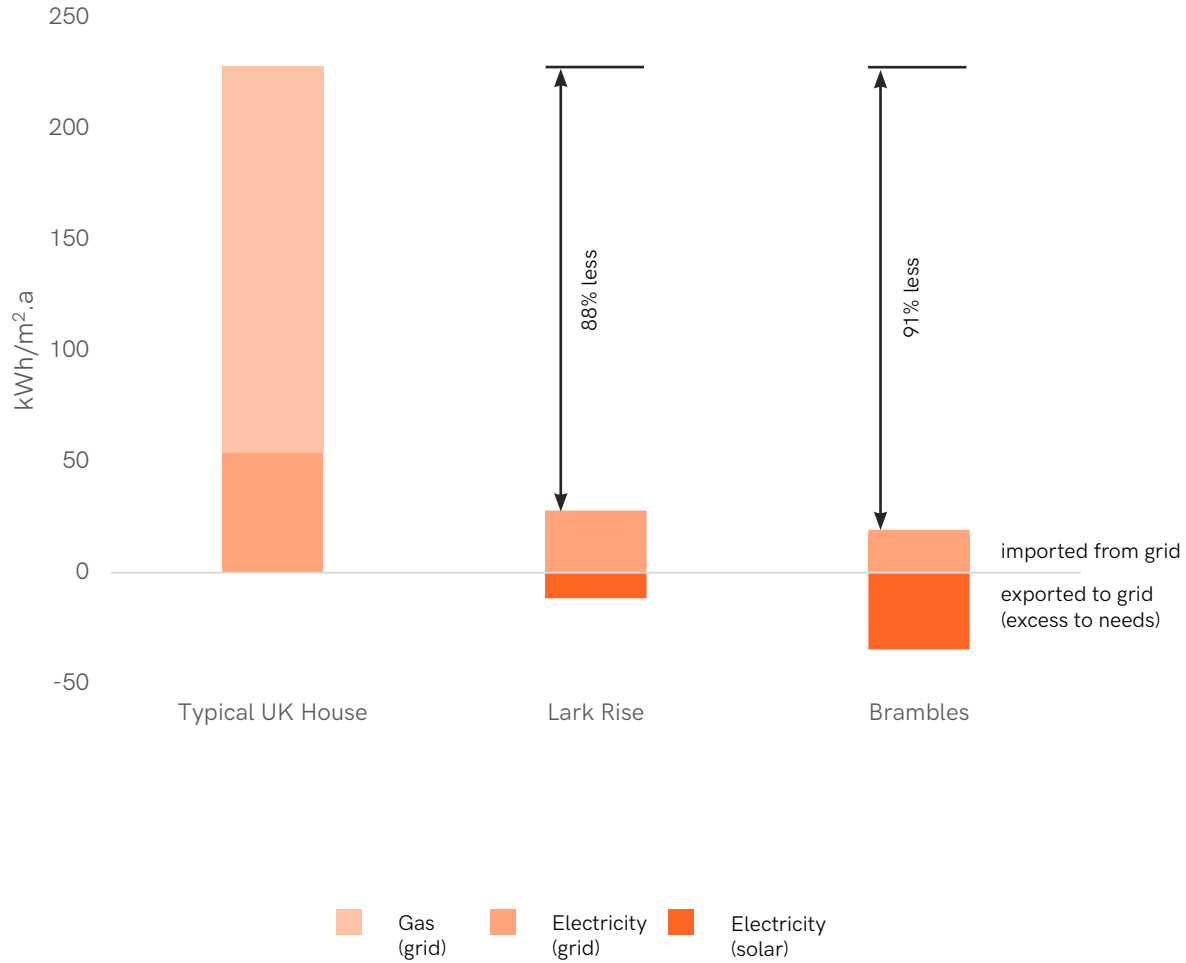


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Final Grid Energy Import & Export

Typical UK Home vs Passive House Plus



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

To assess **energy-use against a typical UK home** as per the Department of Business, Energy & Industry's data (ECUK data available on-line).

Passive House Plus homes use 80% less energy than a typical UK home.

With on-site renewables and a home battery, they draw 90% less energy from the grid.

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

To **compare Lark Rise and Brambles' energy consumption and generation** on an overall scale.

To study **energy usage behaviour over the scale of a single day** and their effect on overall energy usage.

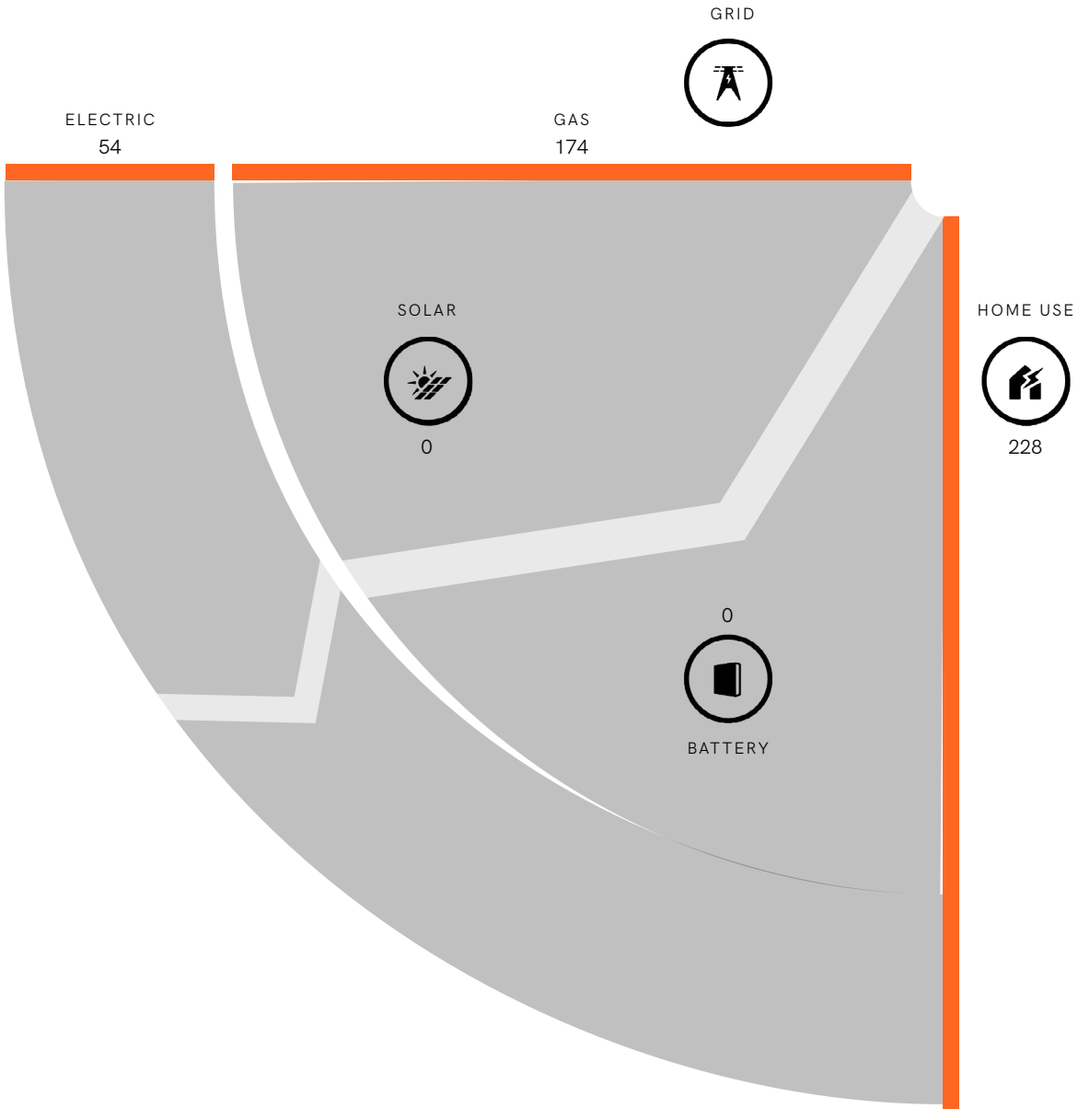
To compare **energy consumption and PV generation in relation to seasons.**

Lark Rise vs Brambles

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

TYPICAL UK HOME

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

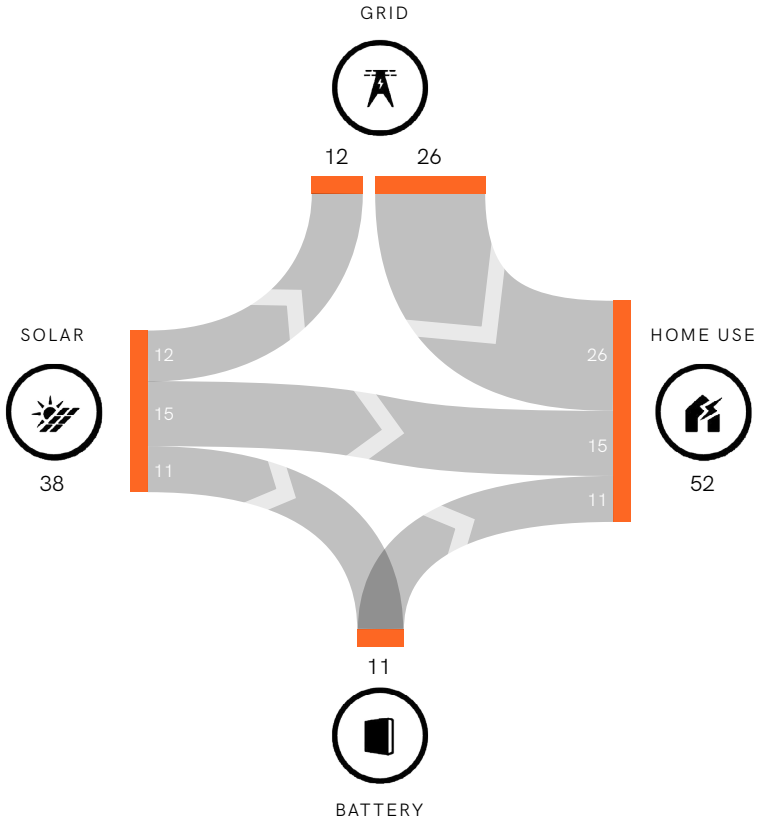


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

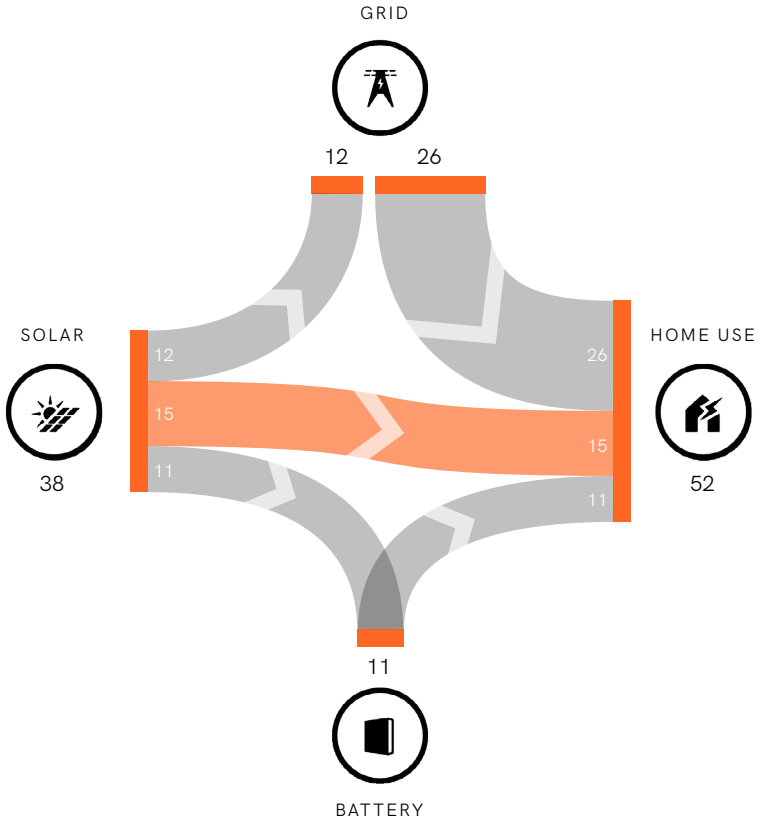


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

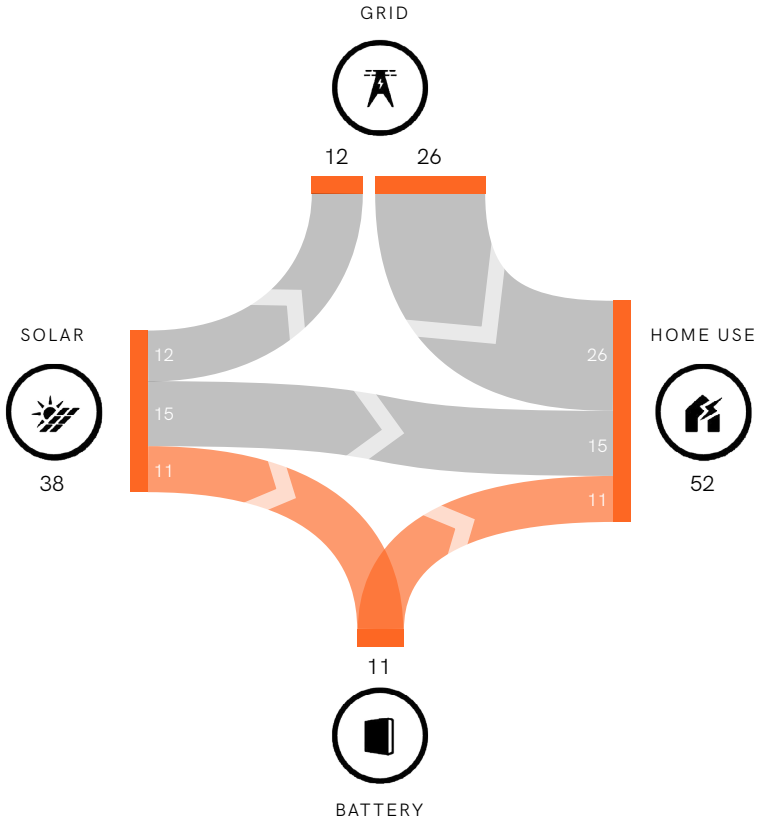


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

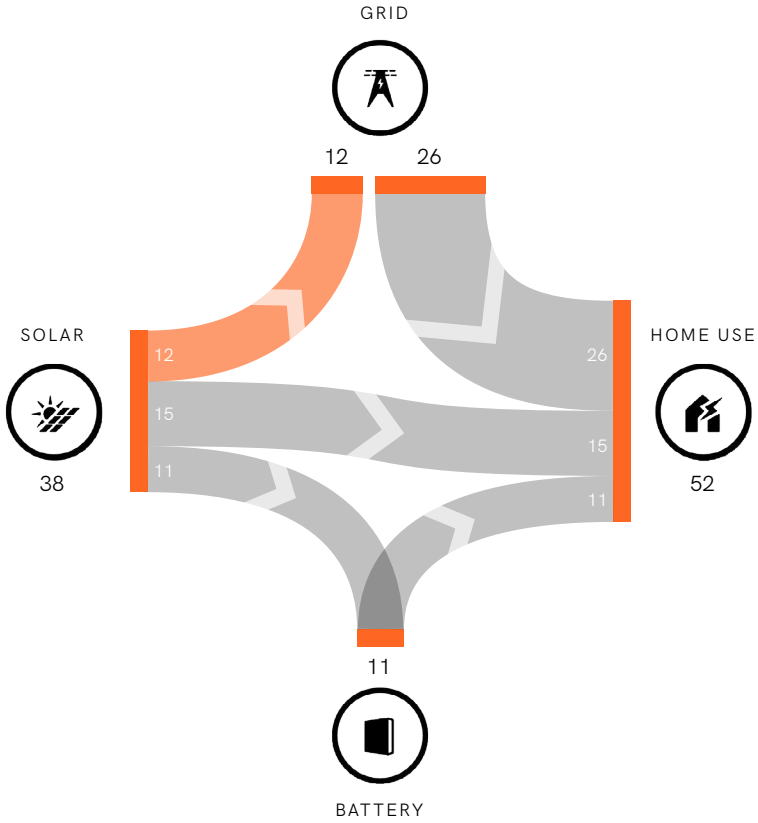


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

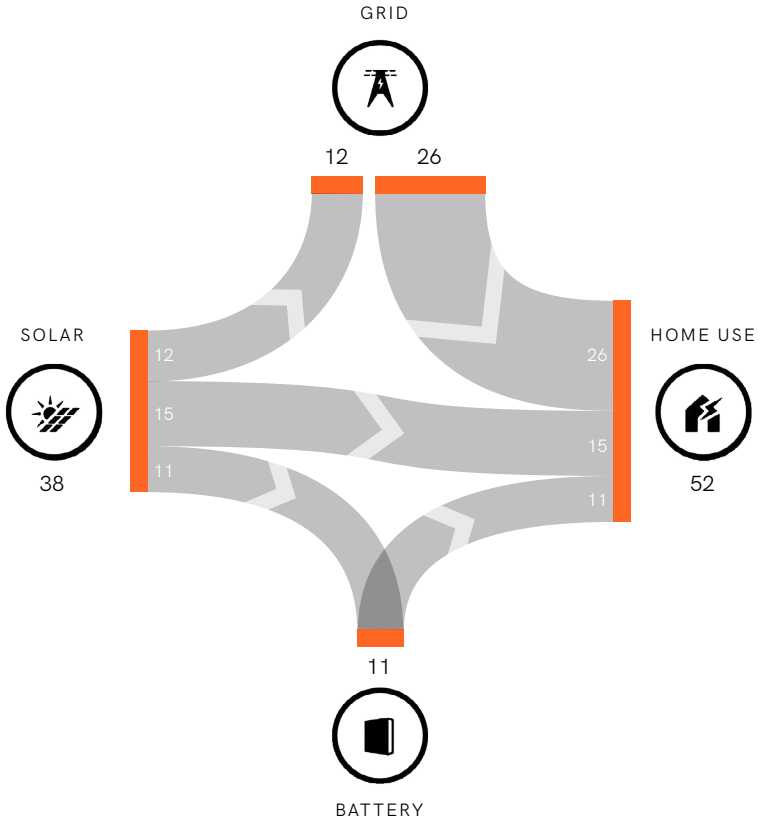


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

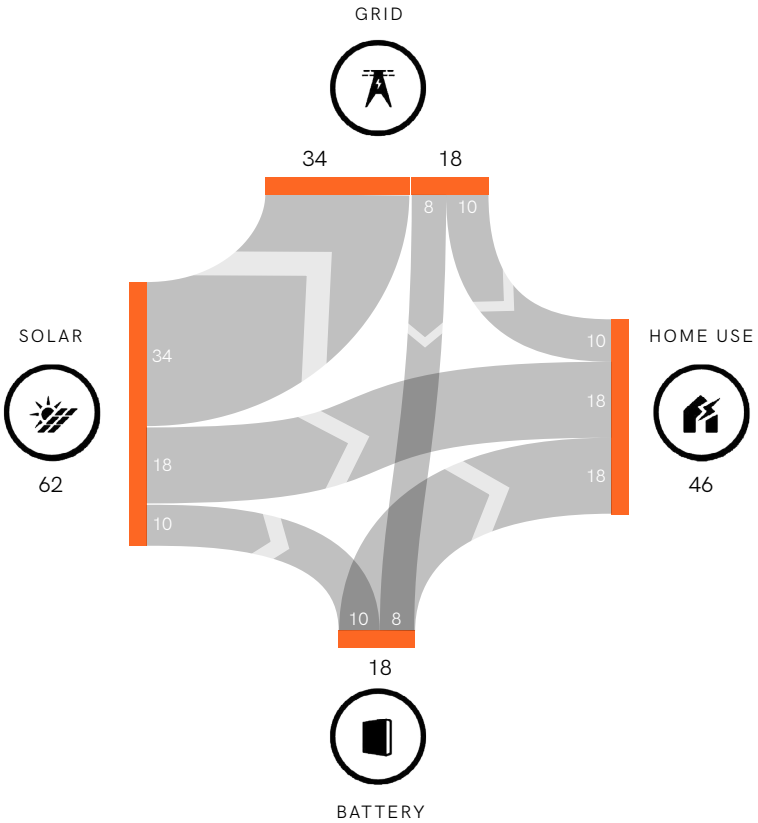


bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

BRAMBLES

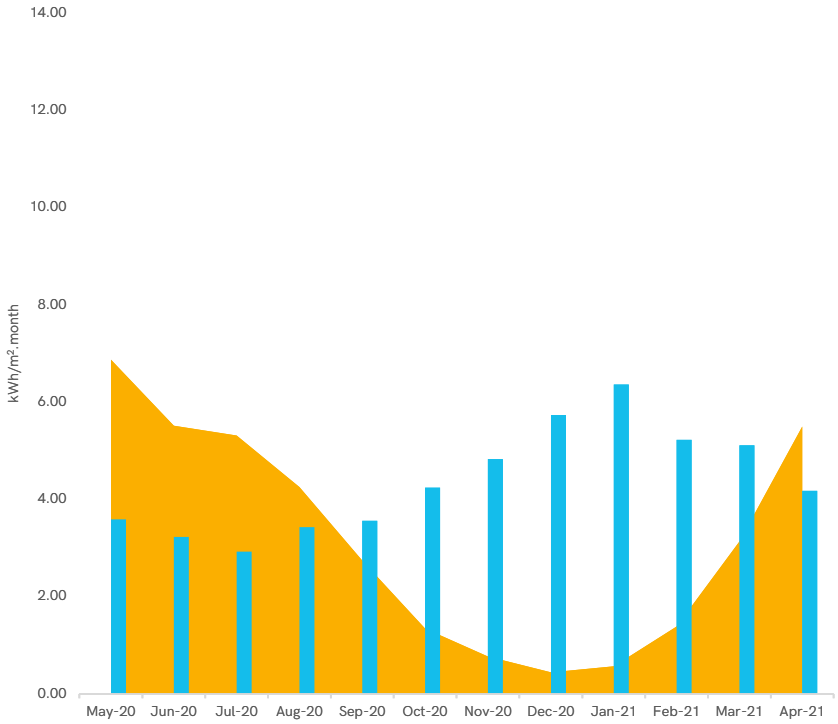
ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020



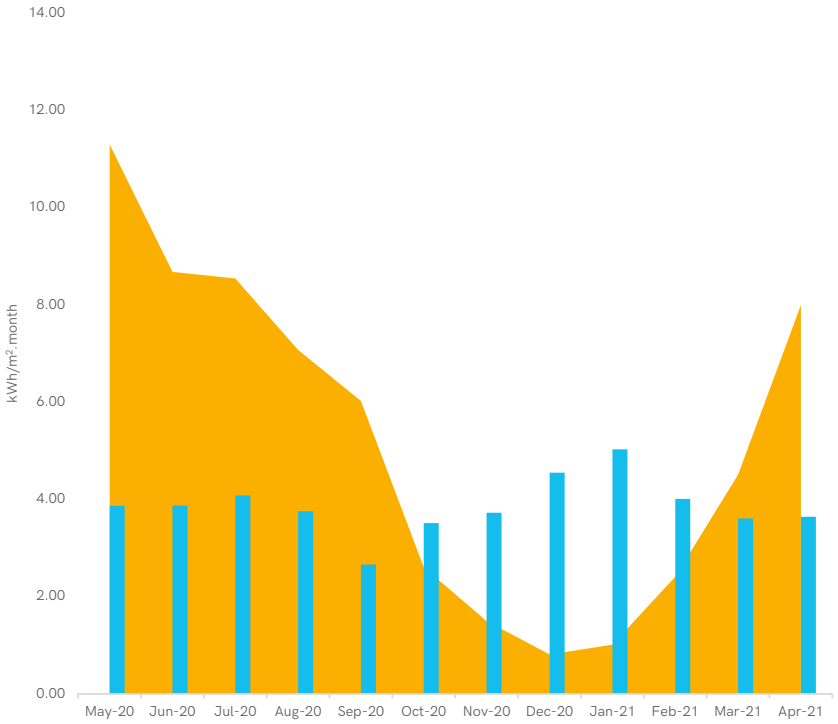
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Lark Rise



Brambles

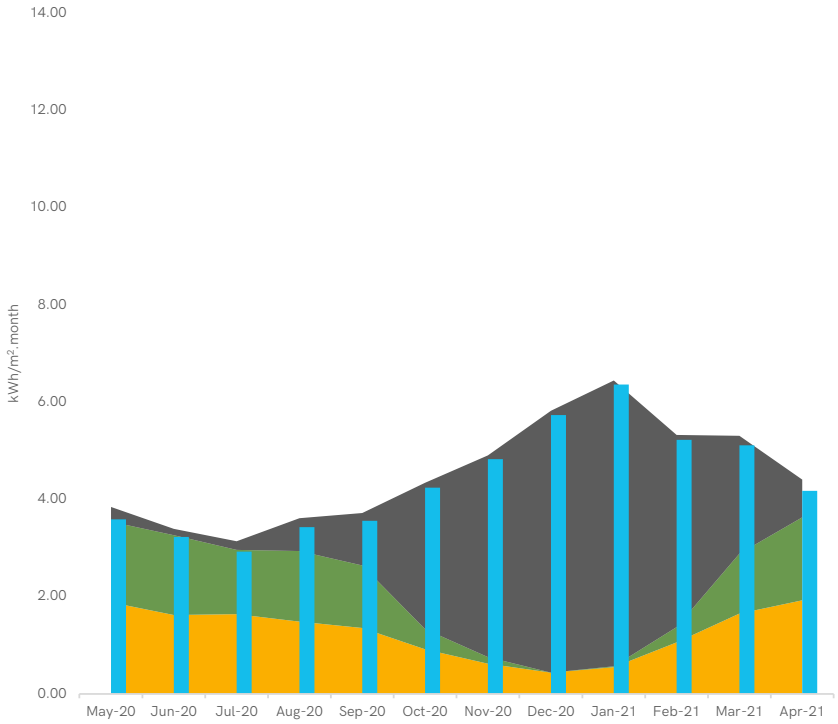


Recorded

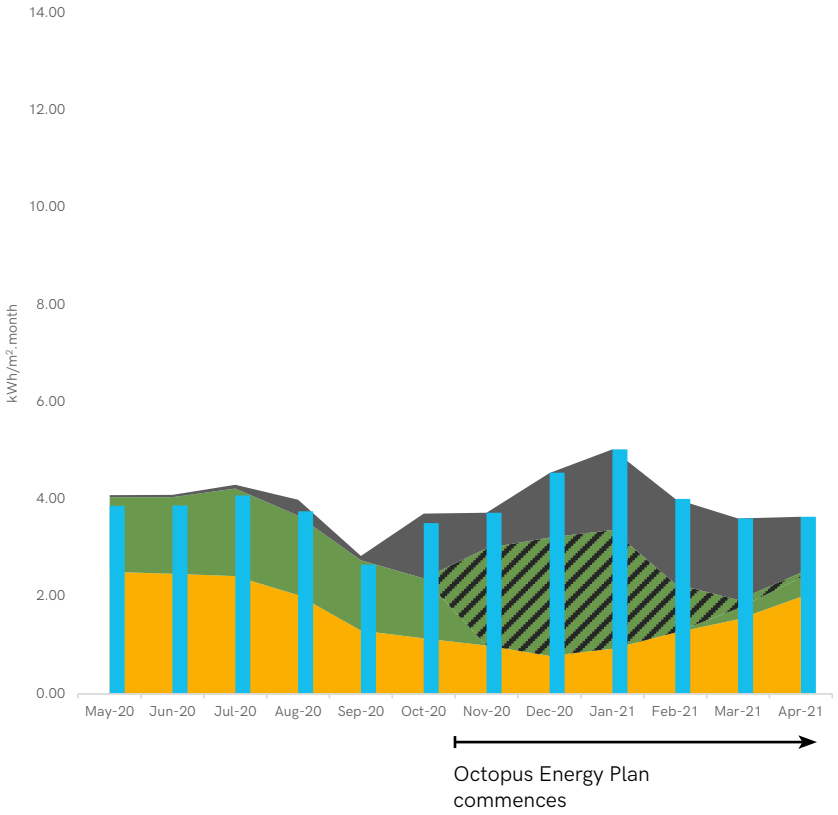
Solar Energy Final Home Use

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Lark Rise



Brambles



DEMAND

- Final Energy Use

ON-SITE SUPPLY

- Direct Solar Autoconsumption
- Solar Energy via Battery

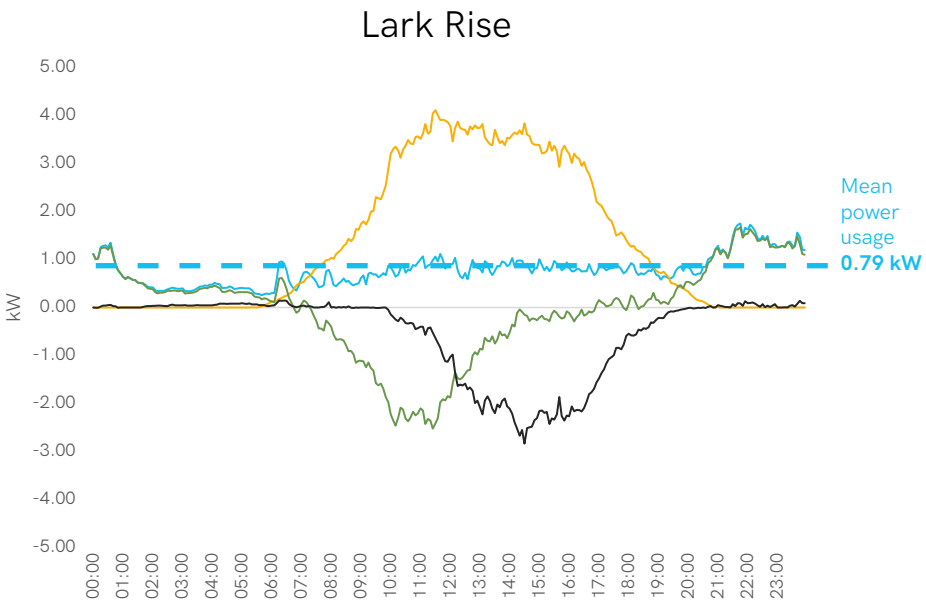
OFF-SITE SUPPLY

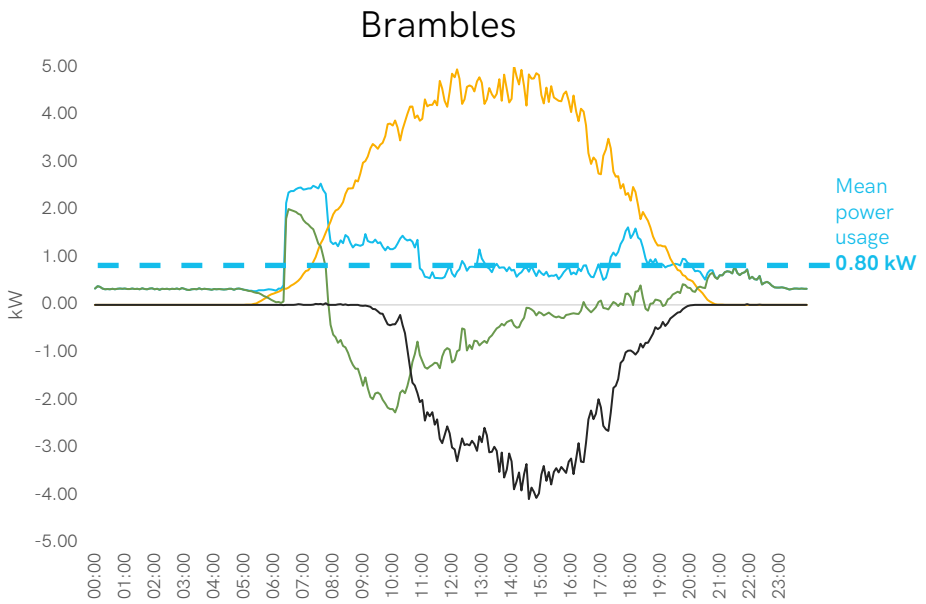
- Direct Grid Renewables Consumption
- Grid Renewables via Battery
- Direct Grid Non-Renewables Consumption

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Occupant Behaviour

'Average' Summer Day at Lark Rise and Brambles





Solar Power
From rooftop PV array

Home Usage
Unregulated & Regulated Loads

Battery
(+) Discharging and (-) Charging

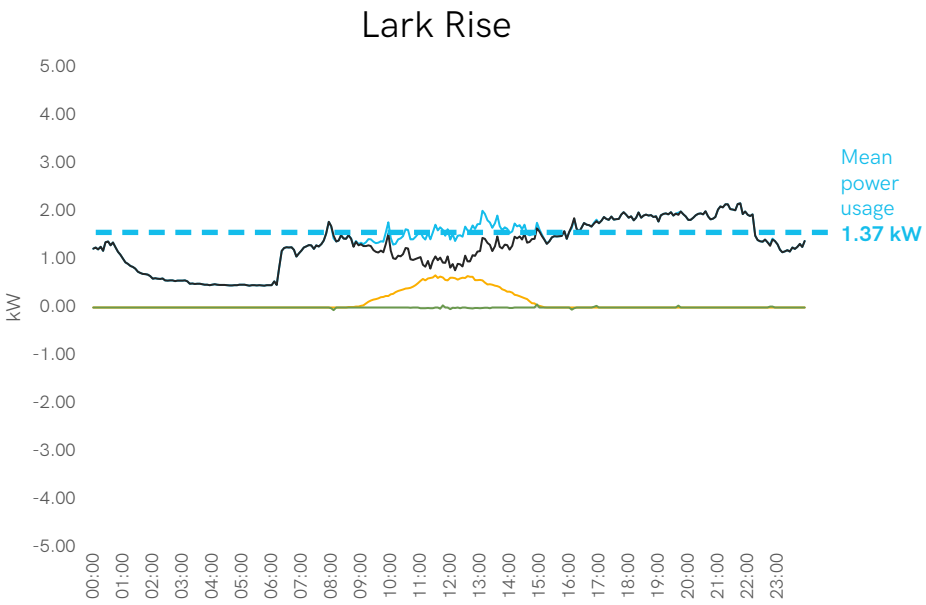
Grid
(+) Importing from and (-) Exporting to

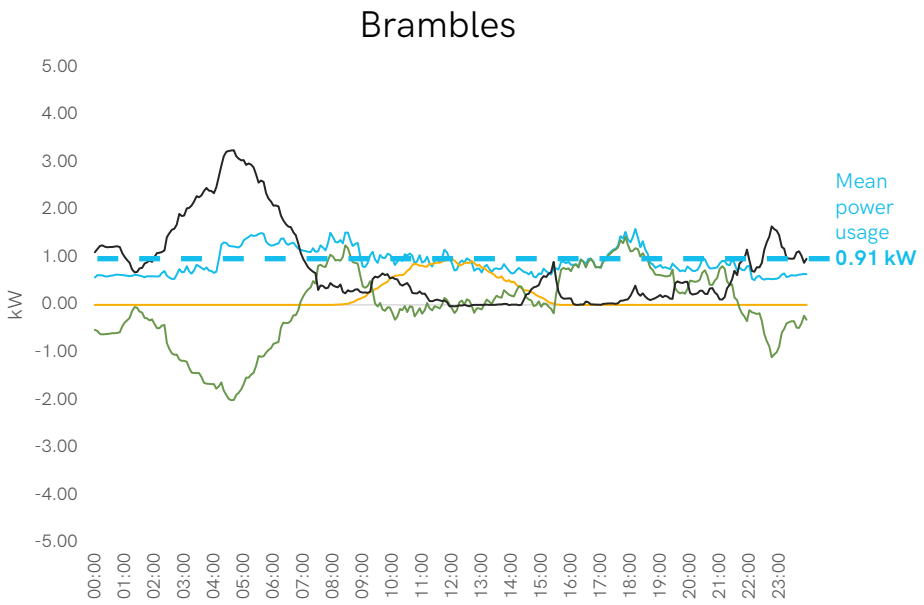
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Occupant Behaviour

'Average' Winter Day at Lark Rise and Brambles





Solar Power
From rooftop PV array

Home Usage
Unregulated & Regulated Loads

Battery
(+) Discharging and (-) Charging

Grid
(+) Importing from and (-) Exporting to

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

To **compare Lark Rise and Brambles' energy consumption and generation** on an overall scale.

To study **energy usage behaviour over the scale of a single day** and their effect on overall energy usage.

To compare **energy consumption and PV generation in relation to seasons.**

Brambles has better overall performance due to:

- more favourable orientation
- lack of overshadowing on the solar array
- uninhibited energy exports to the grid
- occupant behaviour
- and a complementary energy tariff.

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

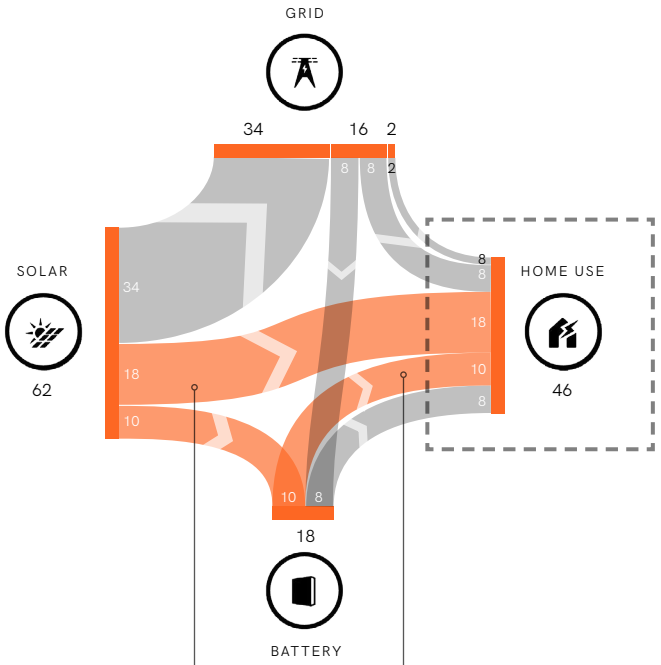
To examine the **energy sources and destinations** of the houses.

To assess the **energy self-production** of the homes in view of energy self-sufficiency.

To appraise the **effectiveness of the home battery** that is operational in both homes.

Energy Self-Production

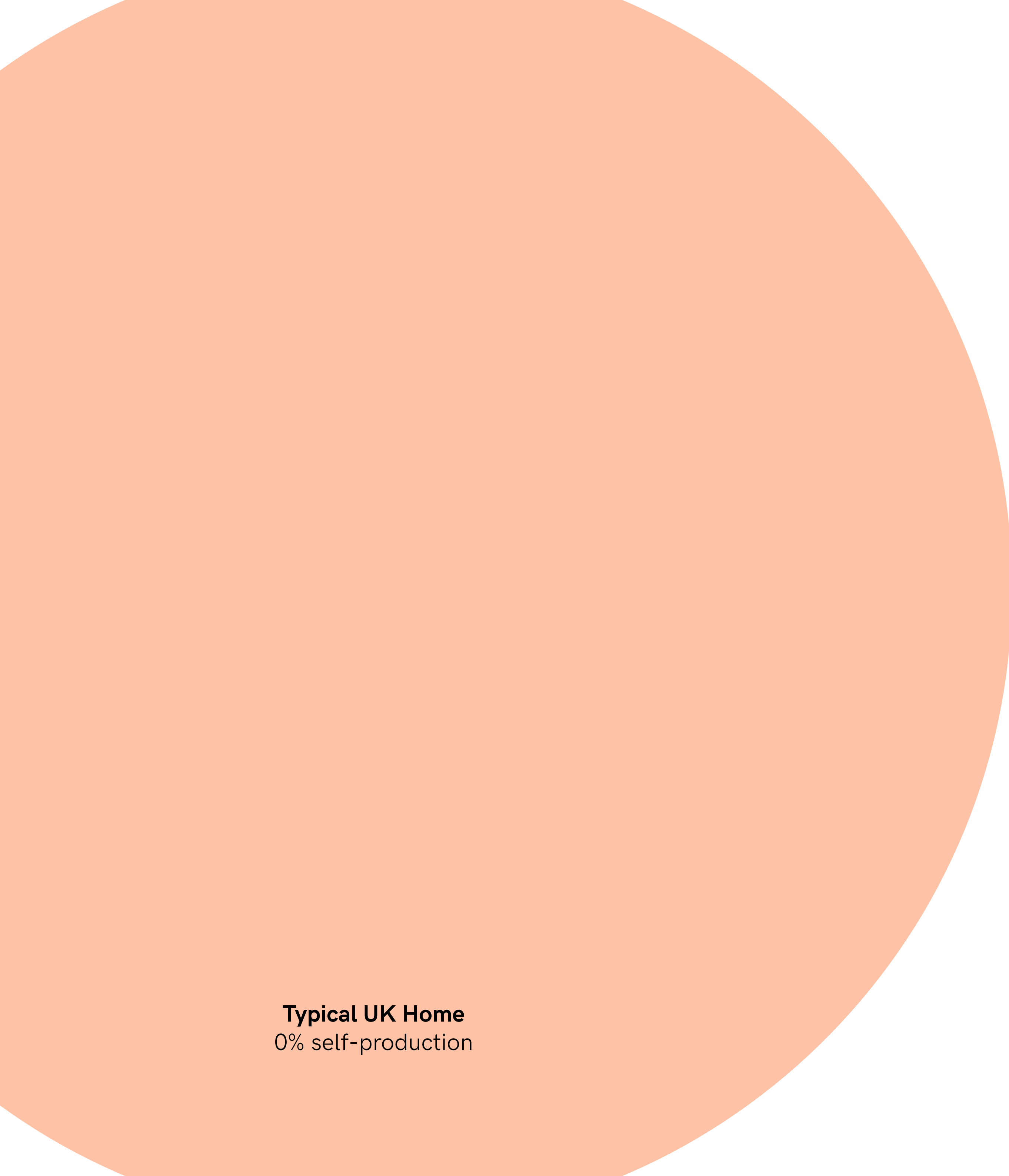
bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk



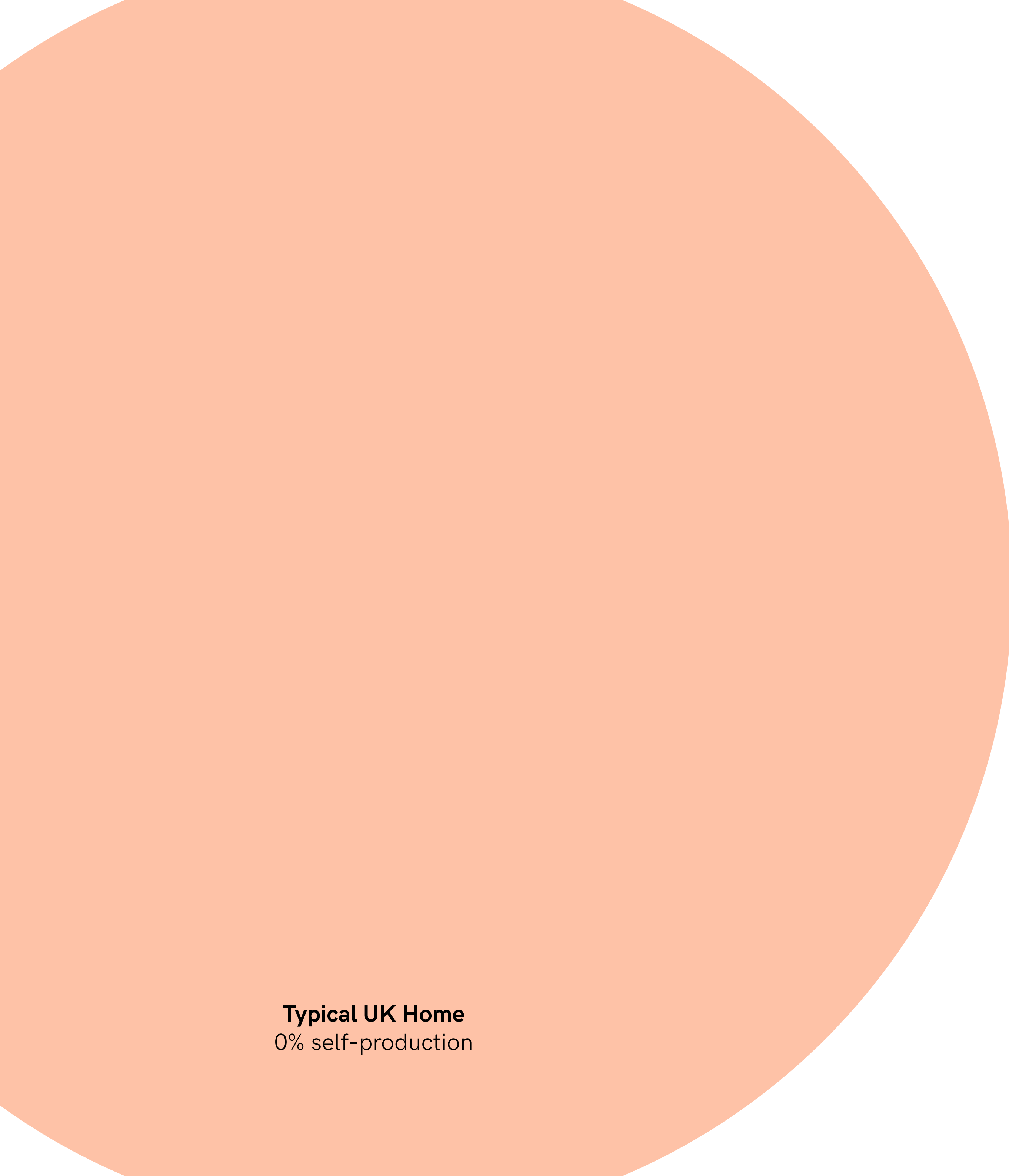
$$\text{Energy Self-Production} = \frac{\text{Solar energy directly consumed} + \text{Solar energy consumed via battery}}{\text{Overall energy demand of house}}$$

How independent is the house from the grid?

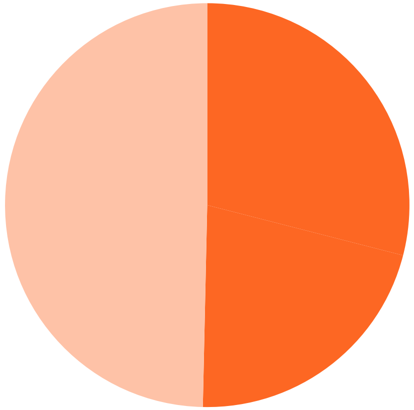
bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk



bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

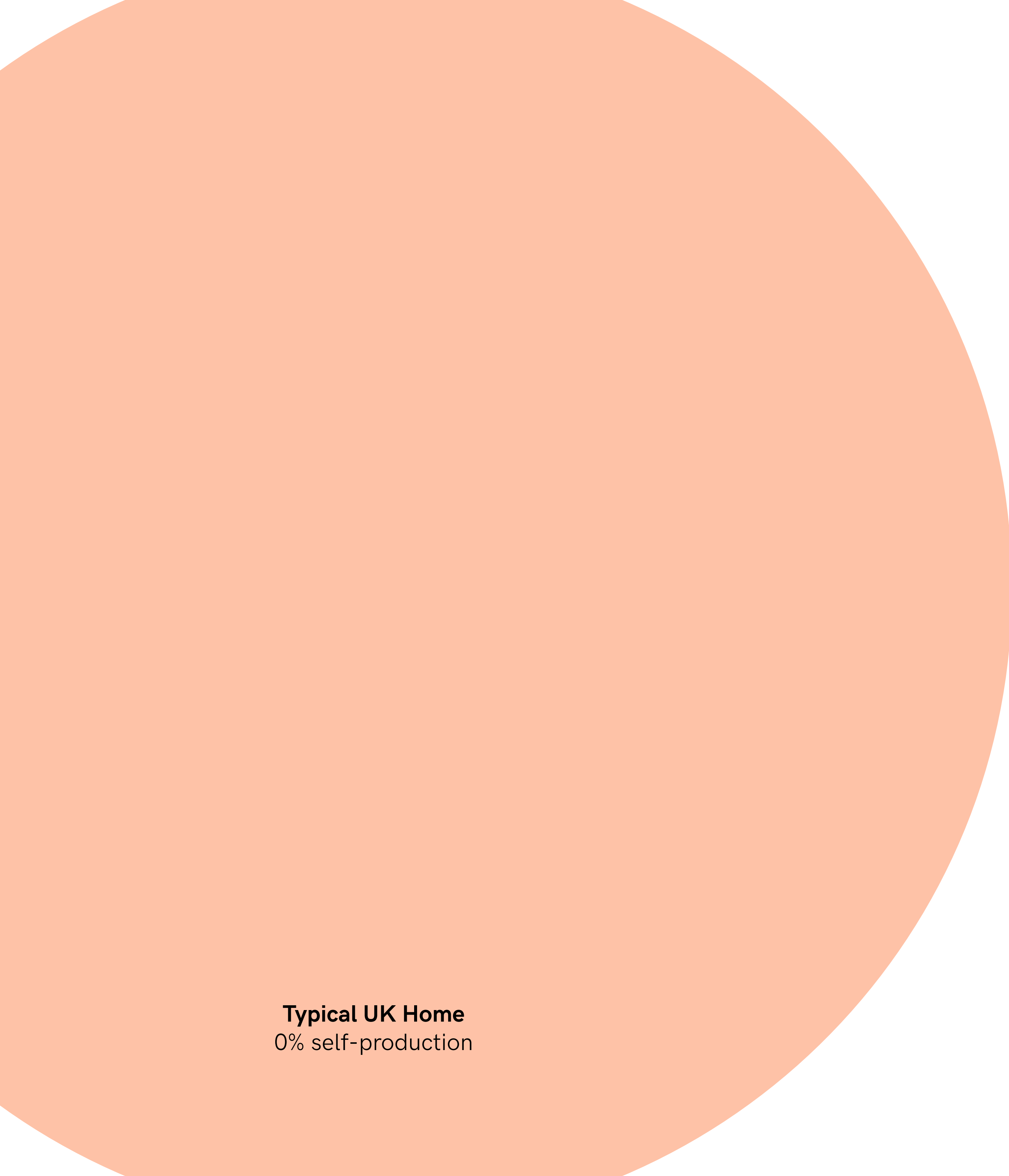


Typical UK Home
0% self-production

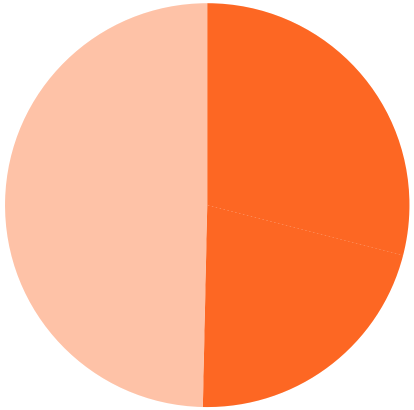


Lark Rise
50% self-production

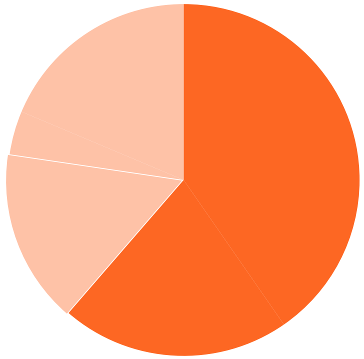
bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk



Typical UK Home
0% self-production



Lark Rise
50% self-production

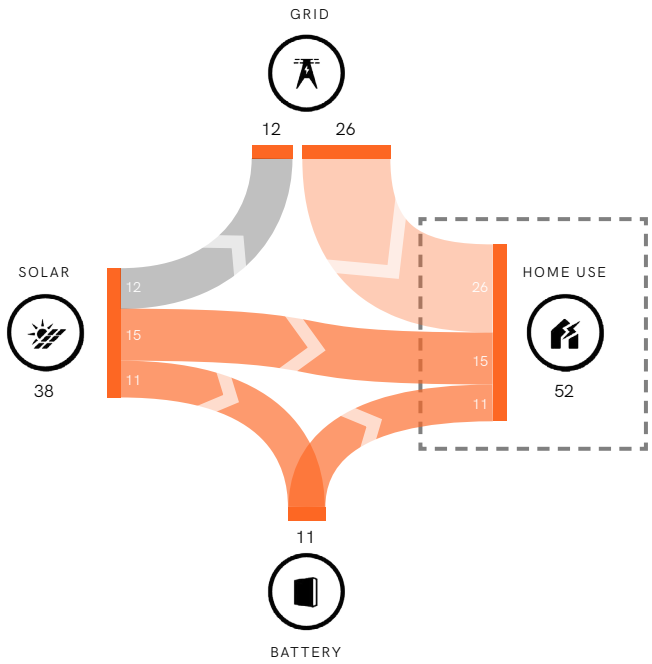


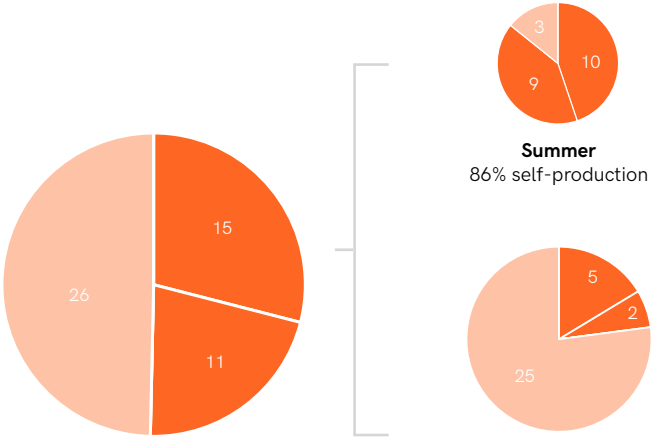
Brambles
61% self-production

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: SELF-PRODUCTION

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





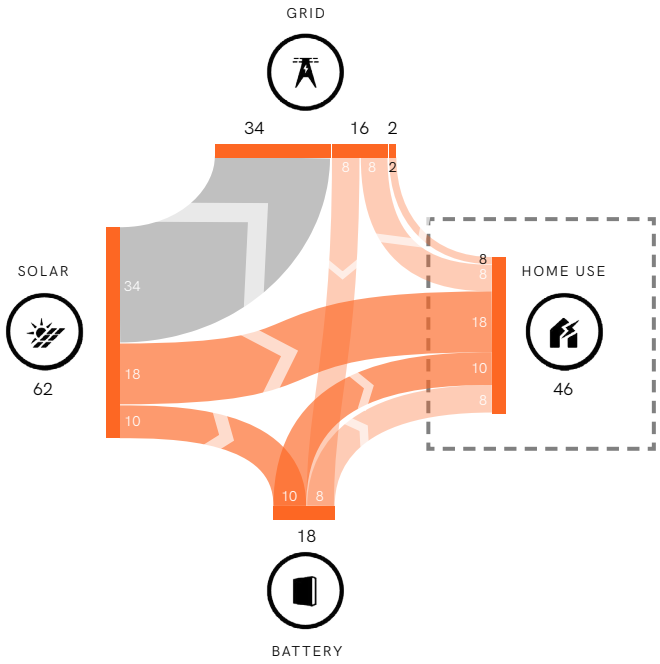
Annual
50% self-production

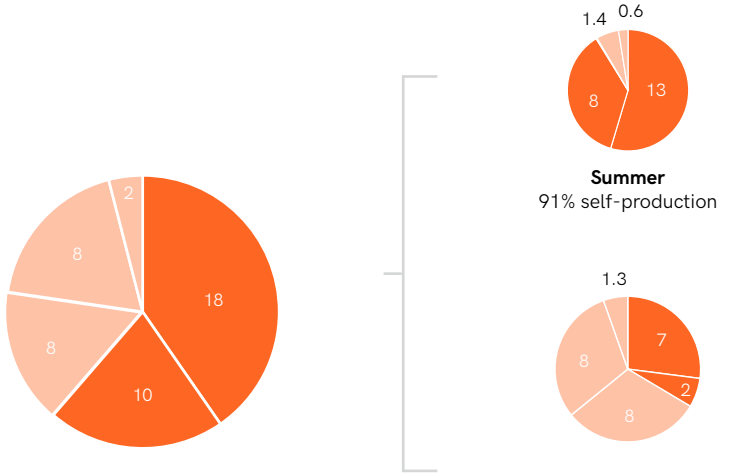
Summer
86% self-production

Winter
23% self-production

BRAMBLES: SELF-PRODUCTION

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





Annual
61% self-production

Summer
91% self-production

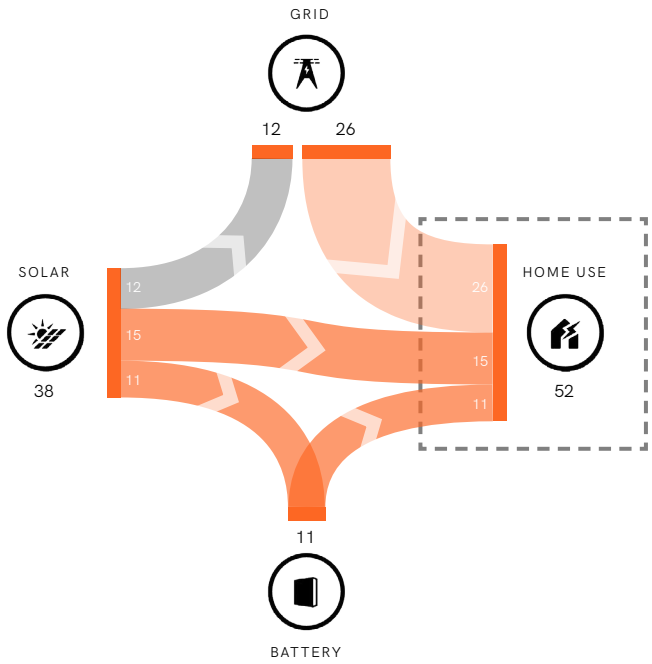
Winter
34% renewable energy

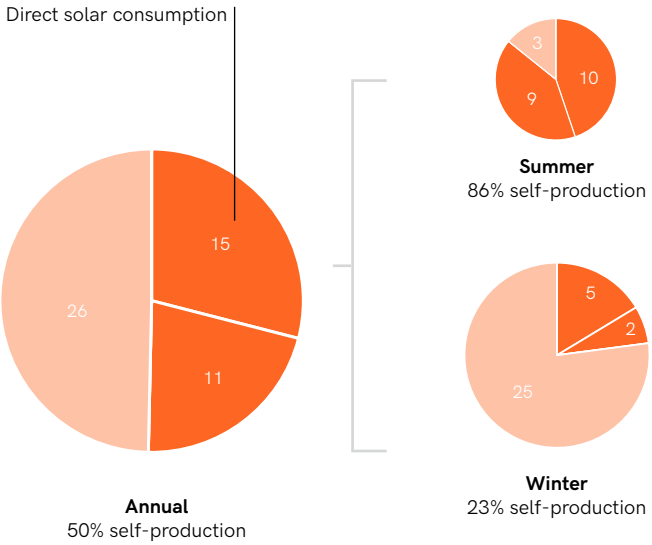
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: SELF-PRODUCTION

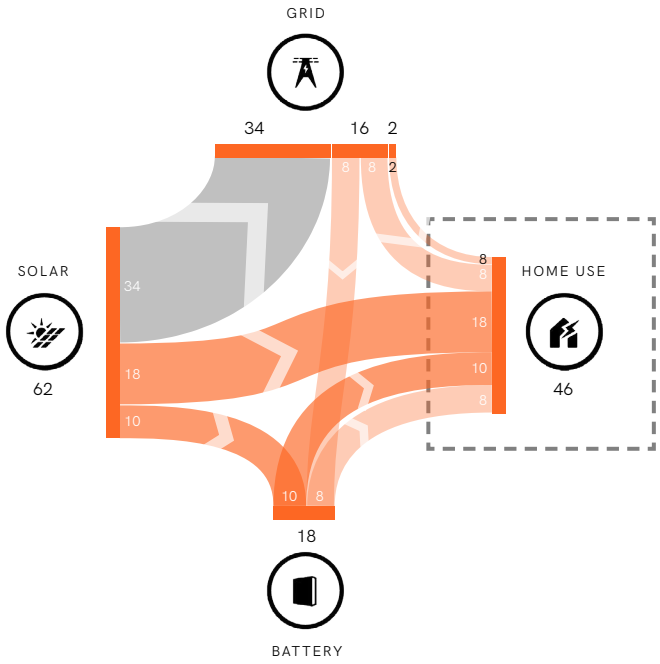
ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

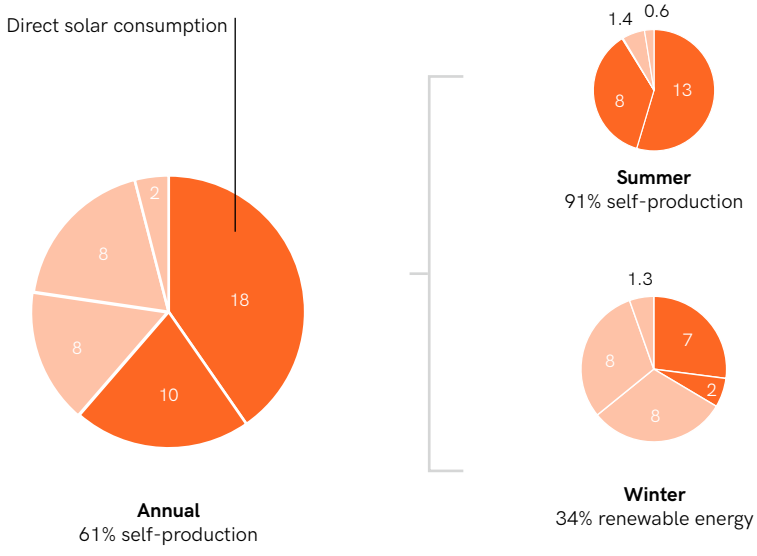




BRAMBLES: SELF-PRODUCTION

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020



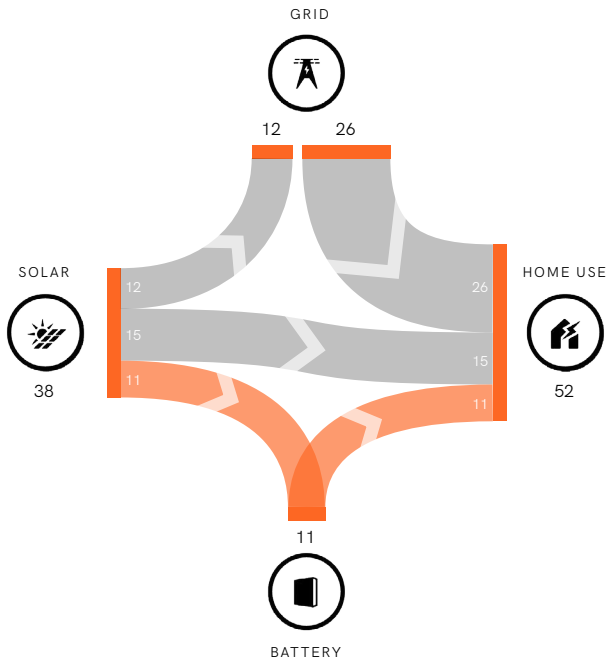


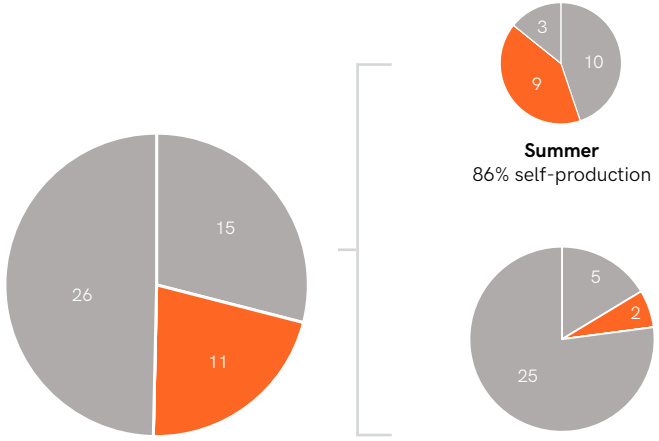
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: BATTERY CONTRIBUTION

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





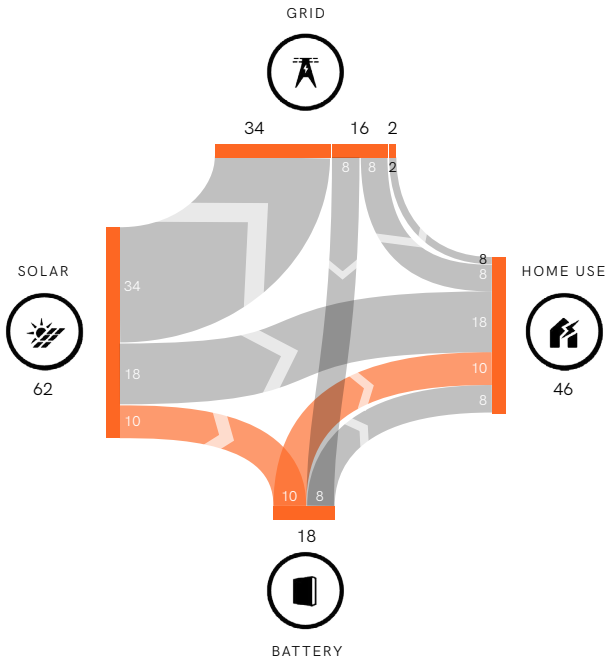
Annual
50% self-production

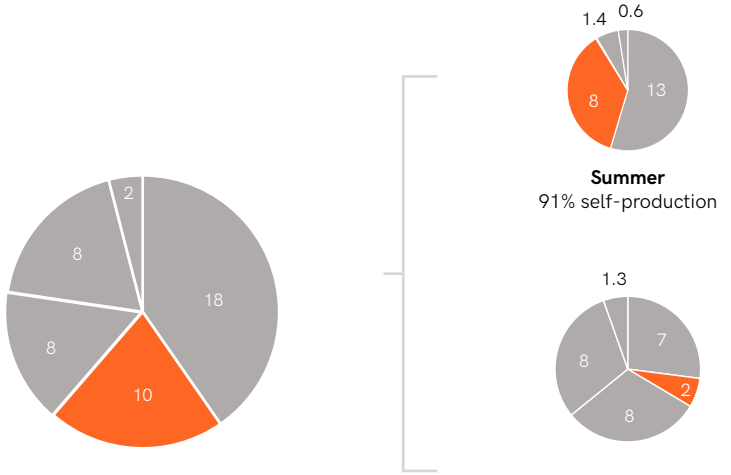
Summer
86% self-production

Winter
23% self-production

BRAMBLES: BATTERY CONTRIBUTION

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





Annual
61% self-production

Summer
91% self-production

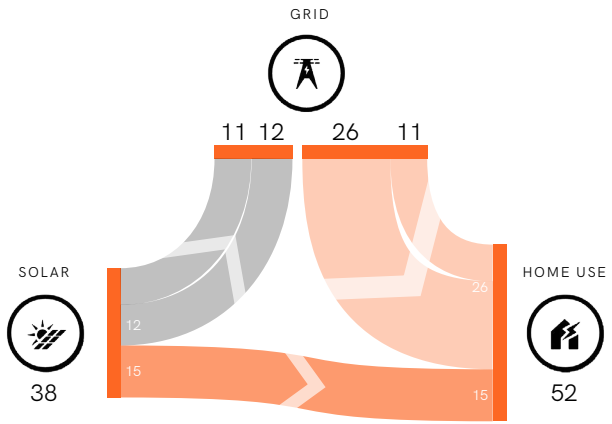
Winter
34% renewable energy

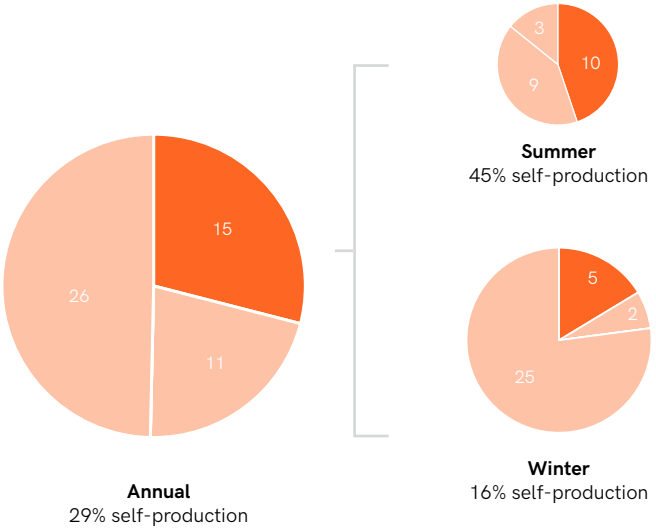
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: BATTERY ABSENCE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





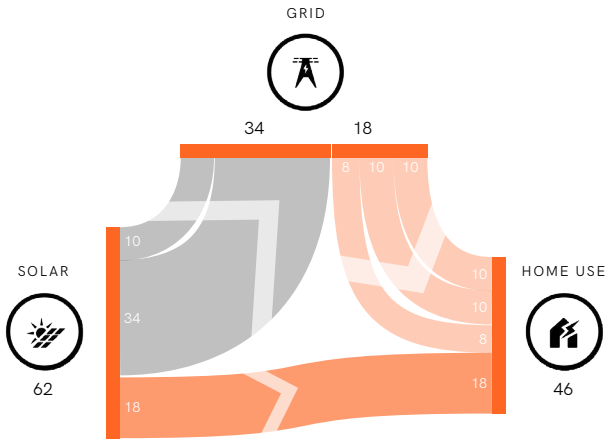
Annual
29% self-production

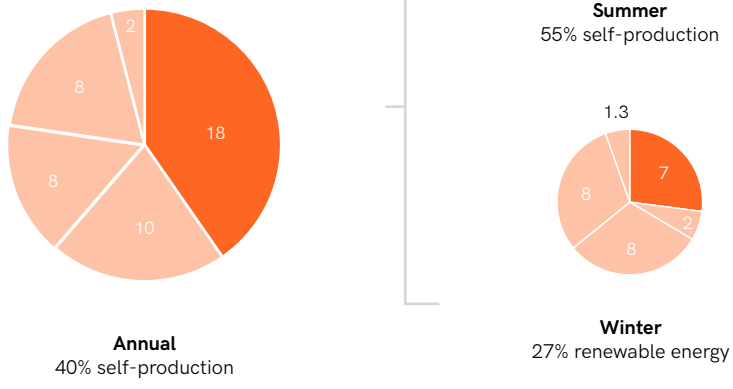
Summer
45% self-production

Winter
16% self-production

BRAMBLES: BATTERY ABSENCE

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





Annual
40% self-production

Summer
55% self-production

Winter
27% renewable energy

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

To examine the **energy sources and destinations** of the houses.

To assess the **solar energy self-production** of the homes in view of energy self-sufficiency.

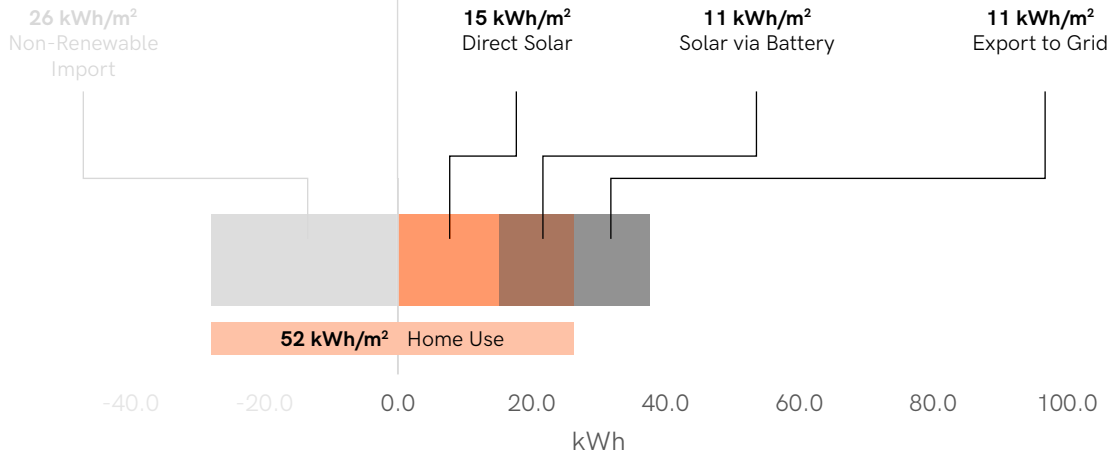
To appraise the **effectiveness of the home battery** that is operational in both homes.

The Tesla Battery augments the solar self-production ratio throughout the year.

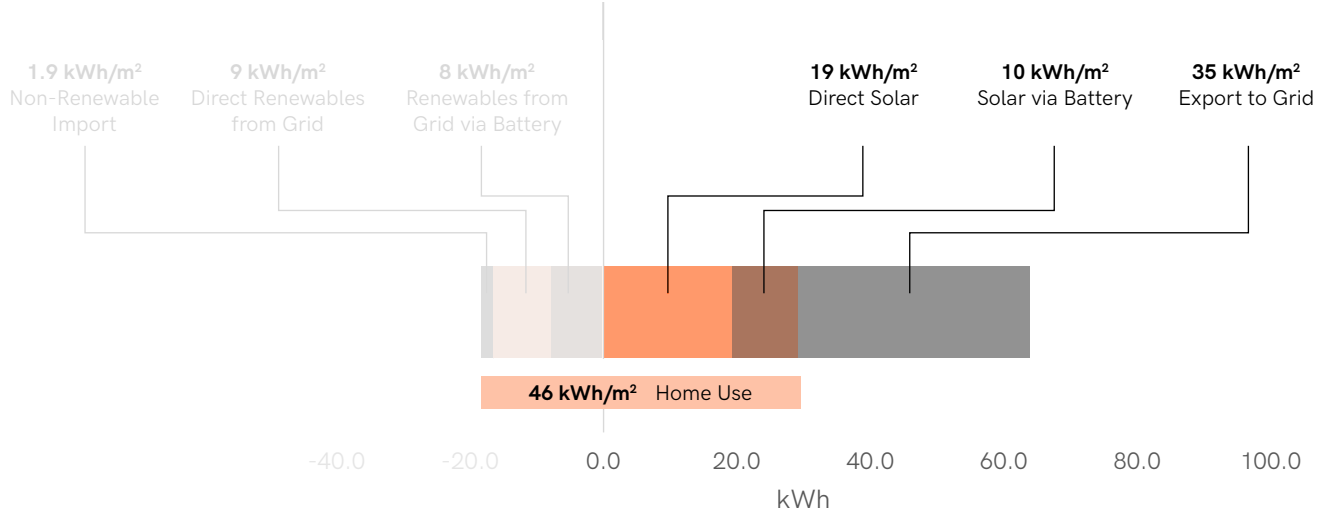
bere:architects

The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

LARK RISE



BRAMBLES



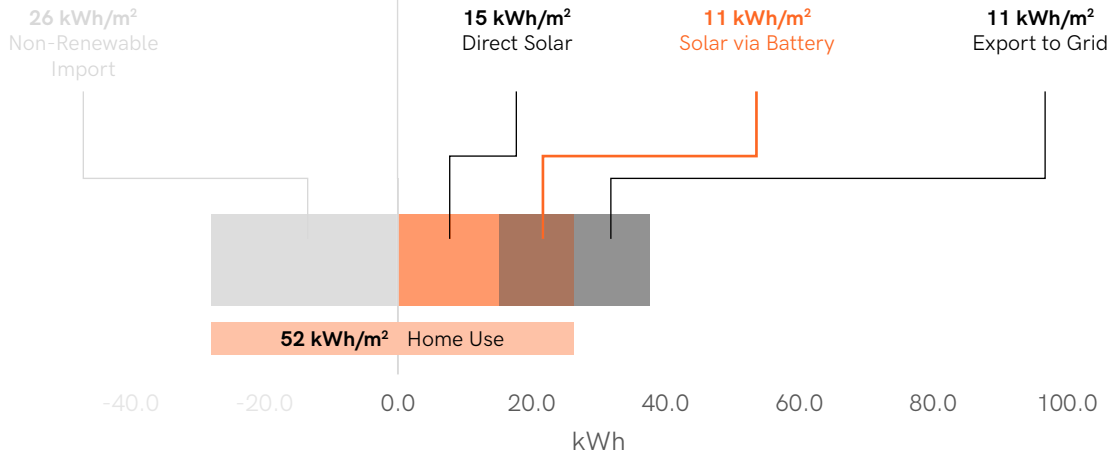
(-) GRID ENERGY

ON-SITE SOLAR ENERGY (+)

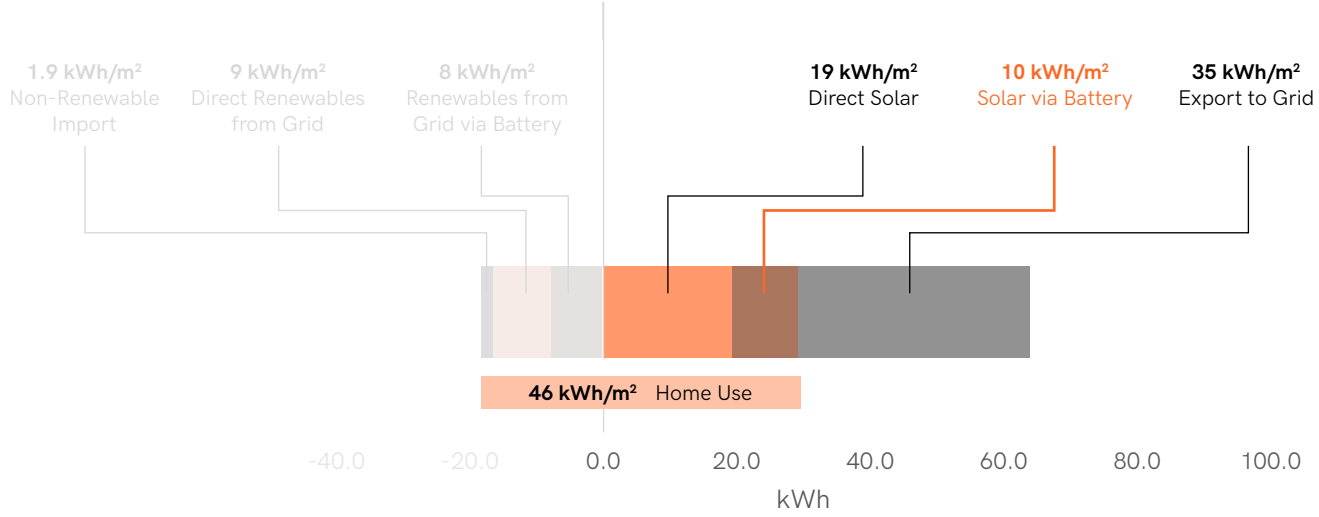
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE



BRAMBLES



(-) GRID ENERGY

ON-SITE SOLAR ENERGY (+)

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

To understand the **renewable/ non-renewable energy balance** with a view to further optimisation of energy decarbonisation in future projects.

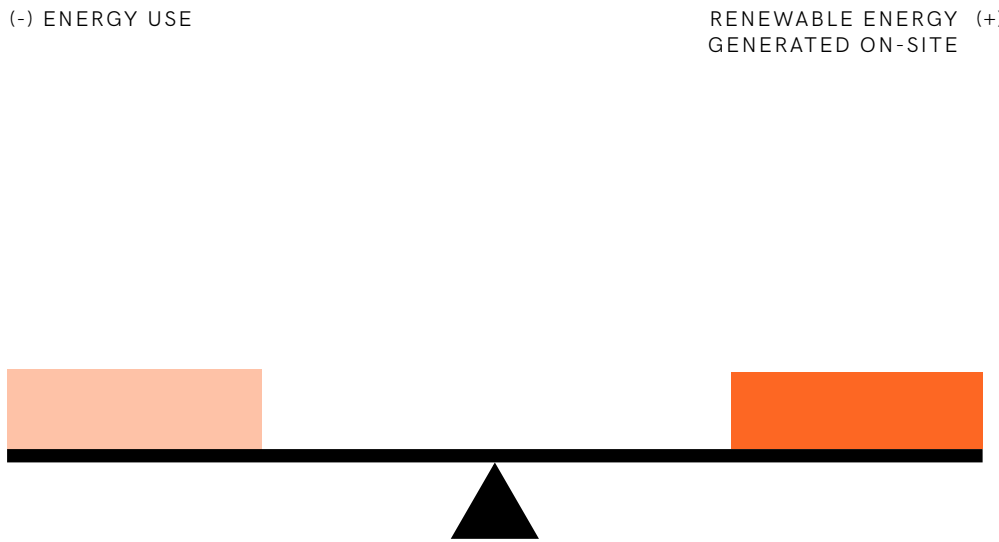
To consider the **effect of the Tesla-Octopus Smart Tariff** as a advocate for off-site renewables.

To compare **energy consumption and PV generation in relation to seasons.**

Renewables vs. Non-Renewables

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

Net-Zero Energy

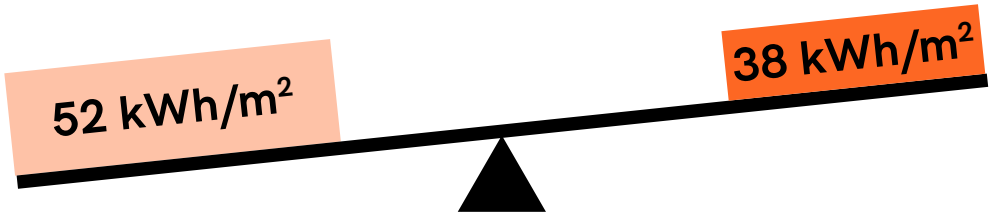


bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Lark Rise
Net-Negative

(-) ENERGY USE

RENEWABLE ENERGY (+)
GENERATED ON-SITE



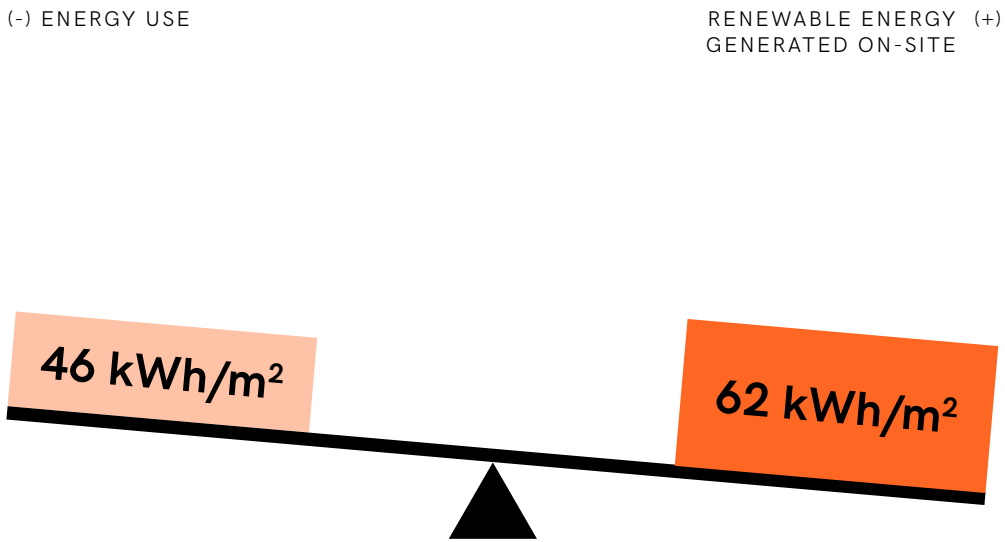
Total energy used including unregulated

Total renewable energy generated on-site

bere:architects

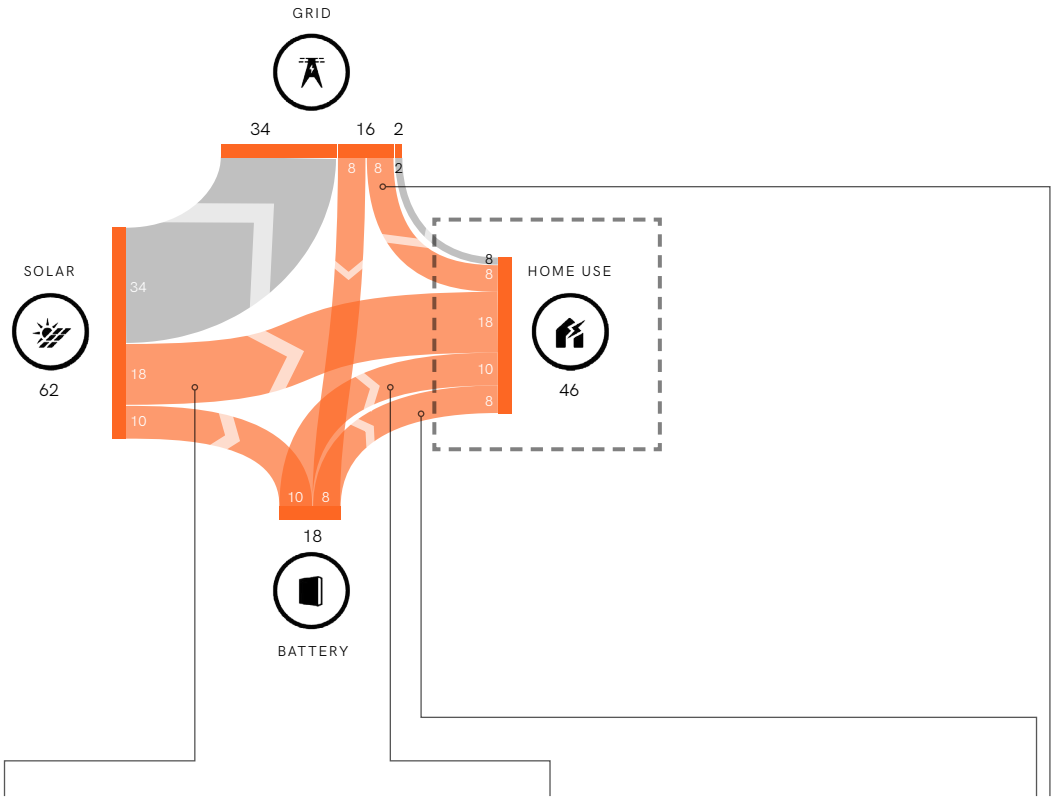
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Brambles
Net-Positive



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk



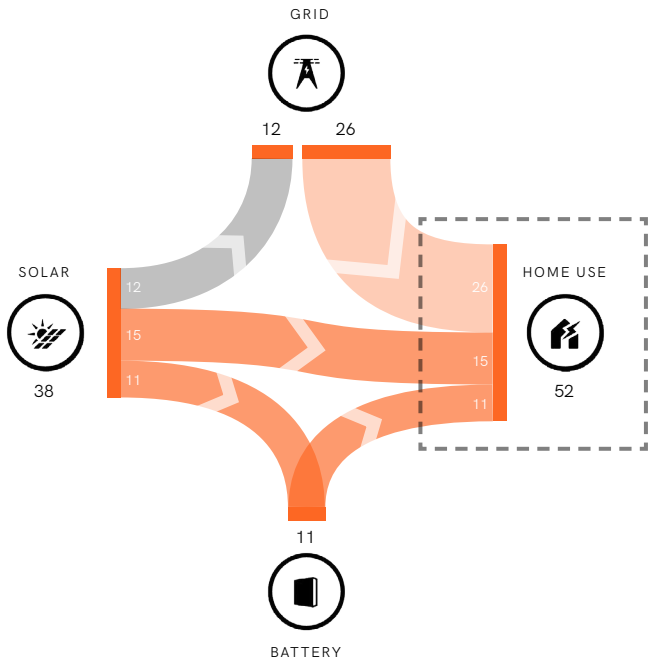
Ratio of Renewble Energy Used = (On-site solar energy directly consumed + On-site solar energy consumed via battery + Off-site renewables consumed) / Overall energy demand of house

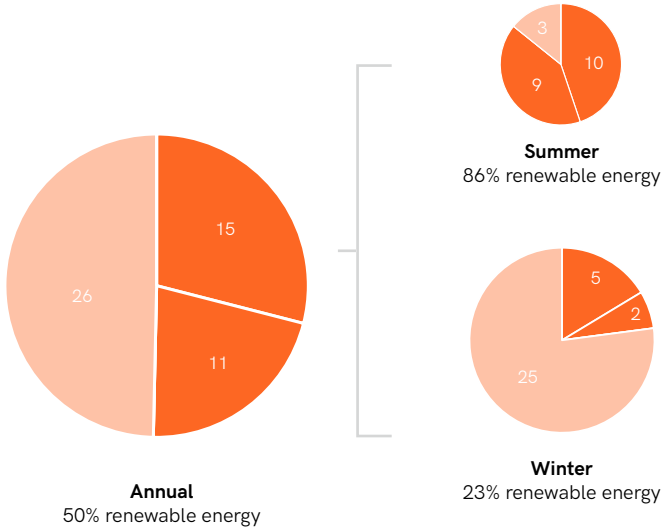
How much of its energy needs are met renewably?

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





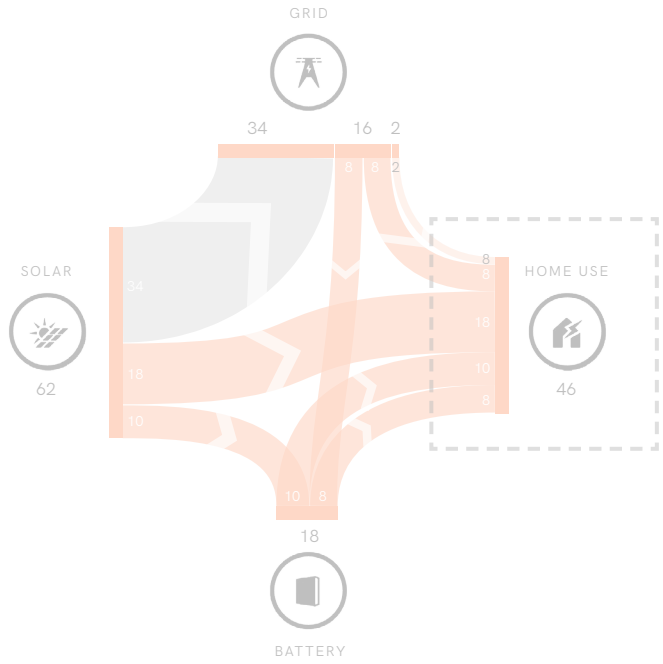
Annual
50% renewable energy

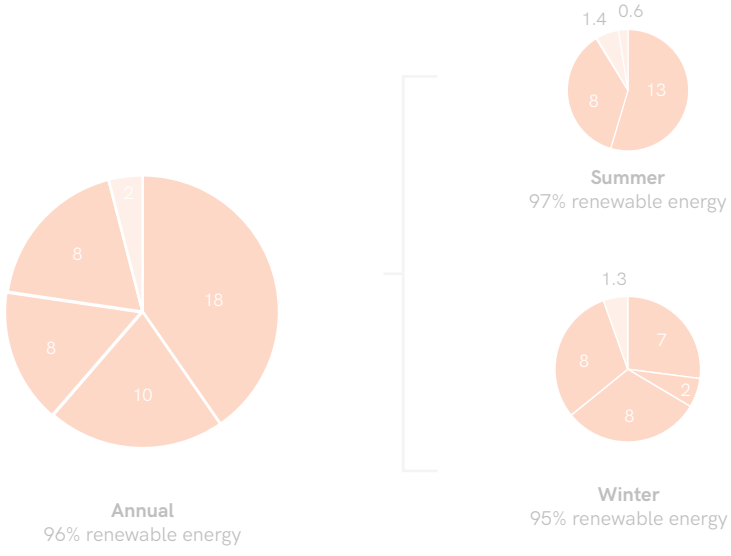
Summer
86% renewable energy

Winter
23% renewable energy

BRAMBLES: RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





Annual
96% renewable energy

Summer
97% renewable energy

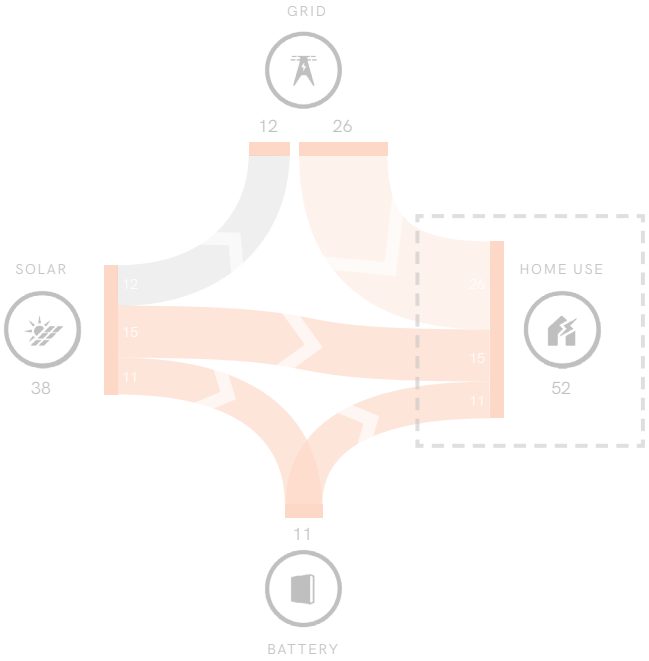
Winter
95% renewable energy

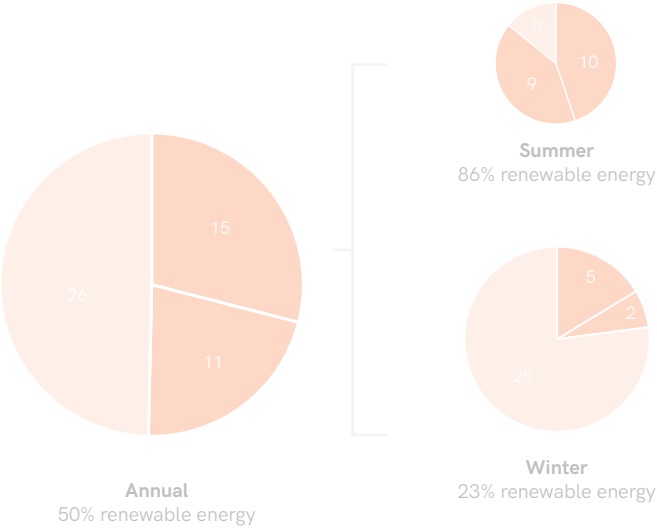
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: RENEWABLES

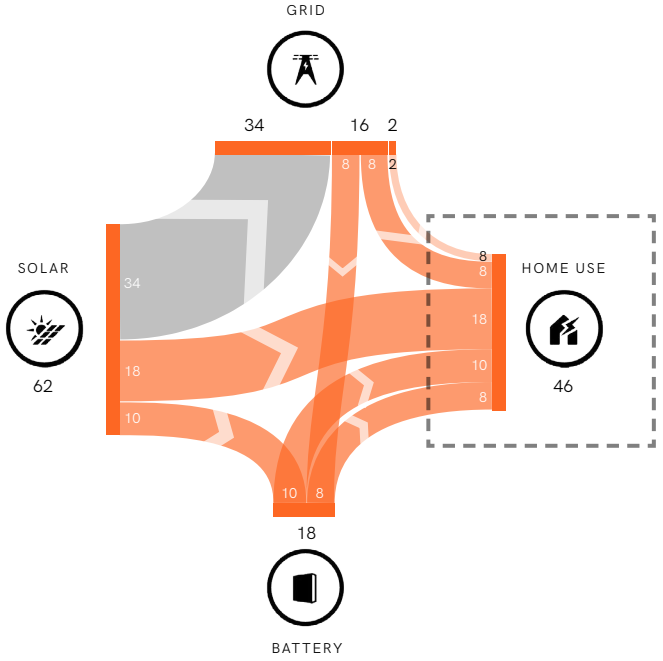
ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

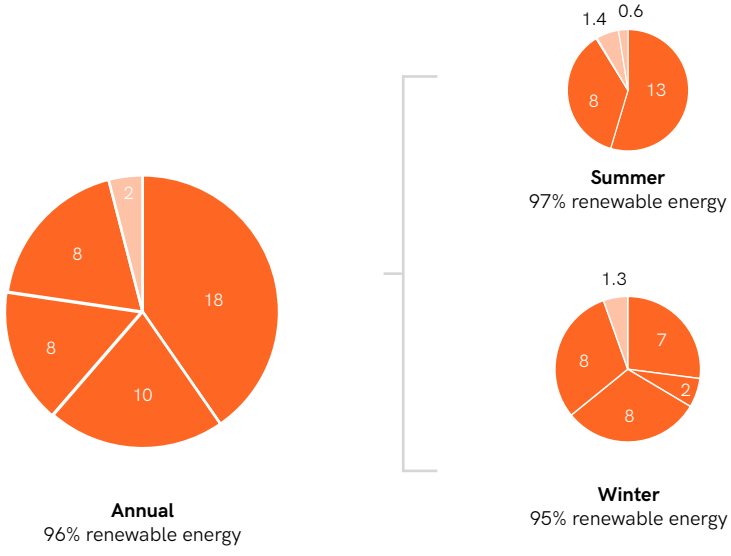




BRAMBLES: RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020



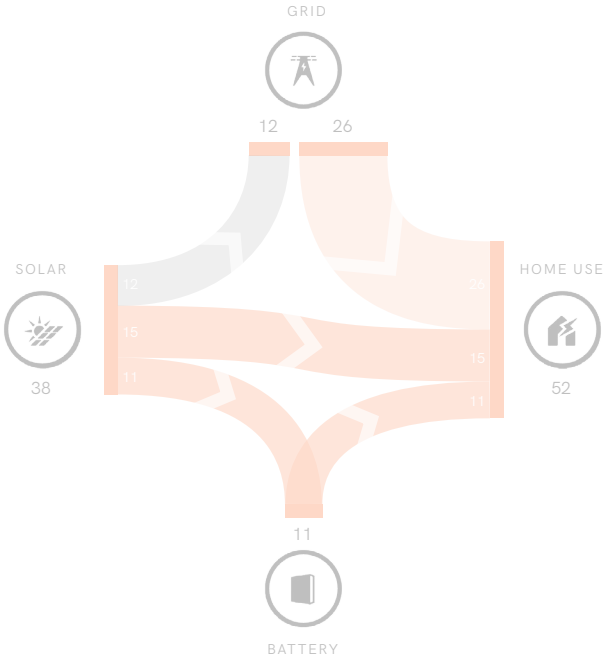


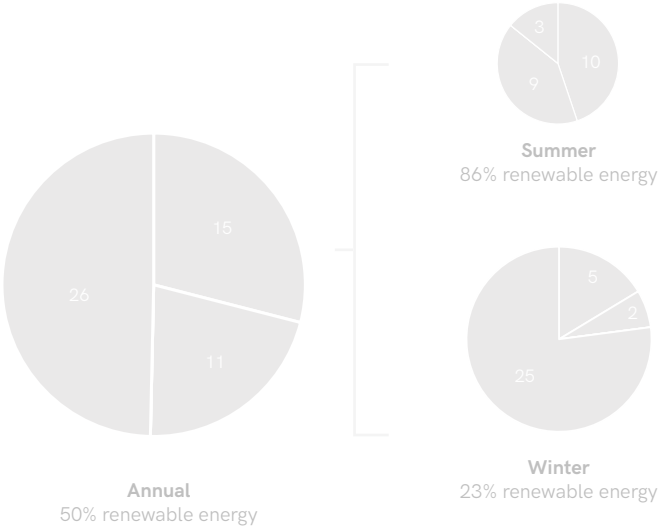
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: RENEWABLES

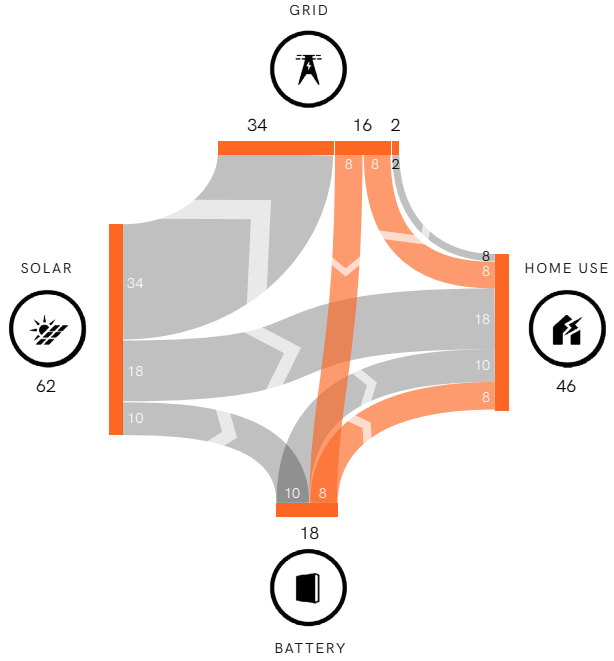
ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

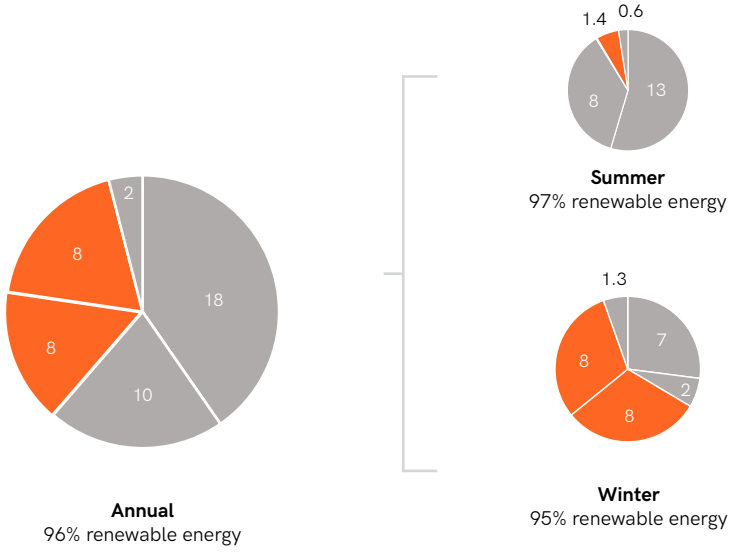




BRAMBLES: OFF-SITE RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020

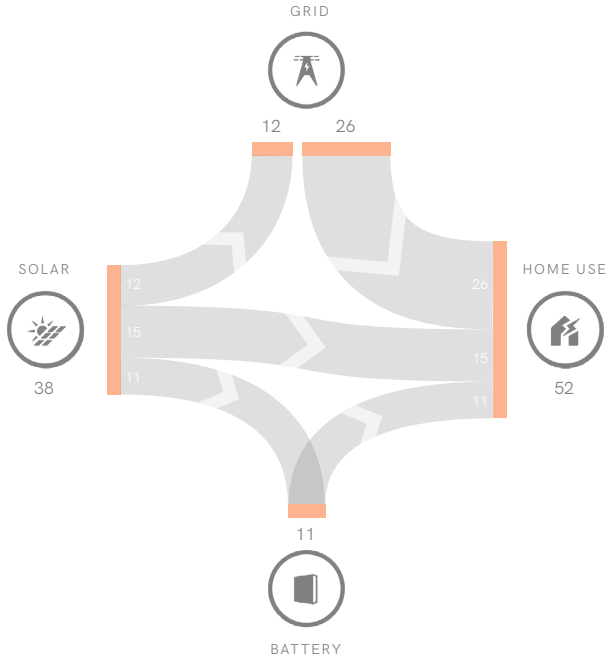


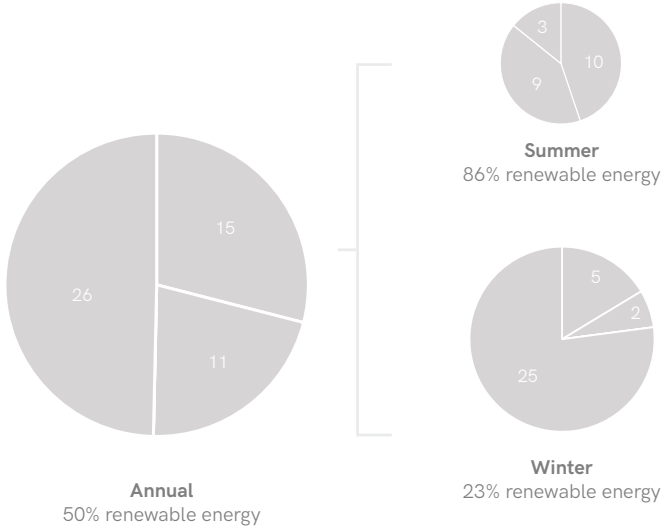


bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE: RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





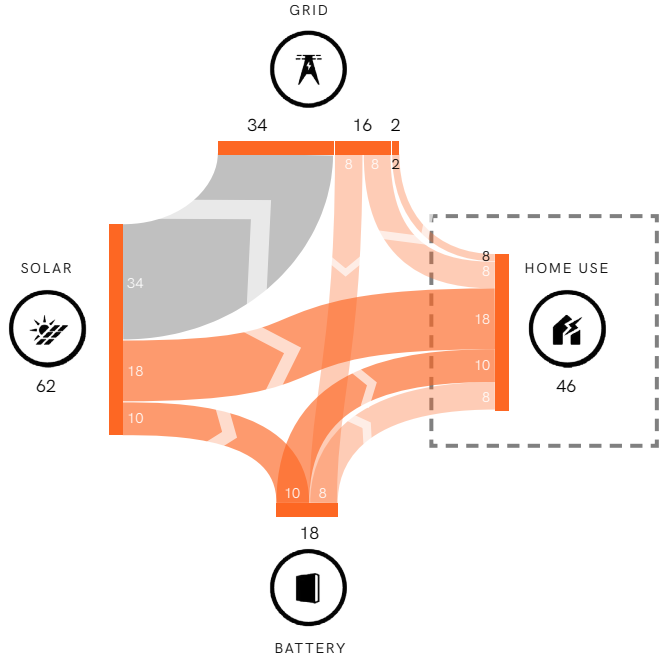
Annual
50% renewable energy

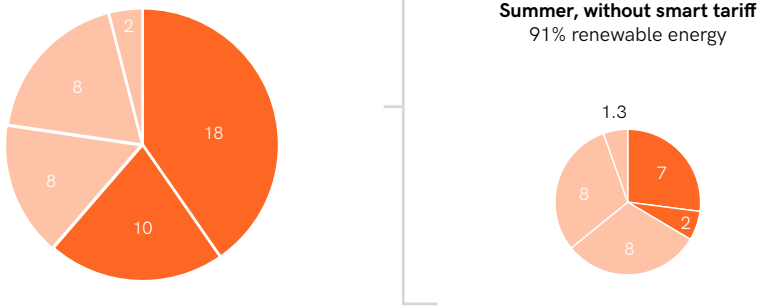
Summer
86% renewable energy

Winter
23% renewable energy

BRAMBLES: NO OFF-SITE RENEWABLES

ENERGY FLOWS (kWh/m².a) // MAY 2020 - APRIL 2020





Annual, without smart tariff
61% renewable energy

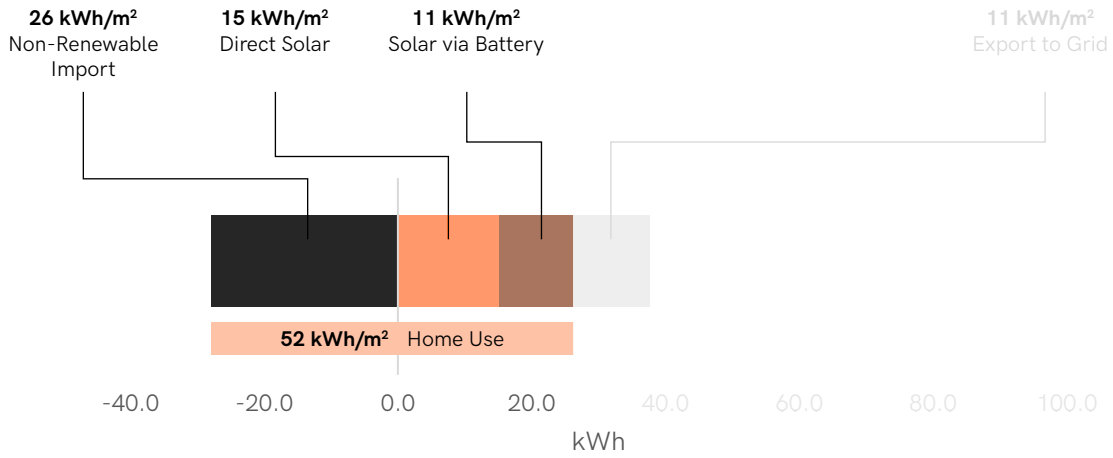
Summer, without smart tariff
91% renewable energy

Winter, without smart tariff
34% renewable energy

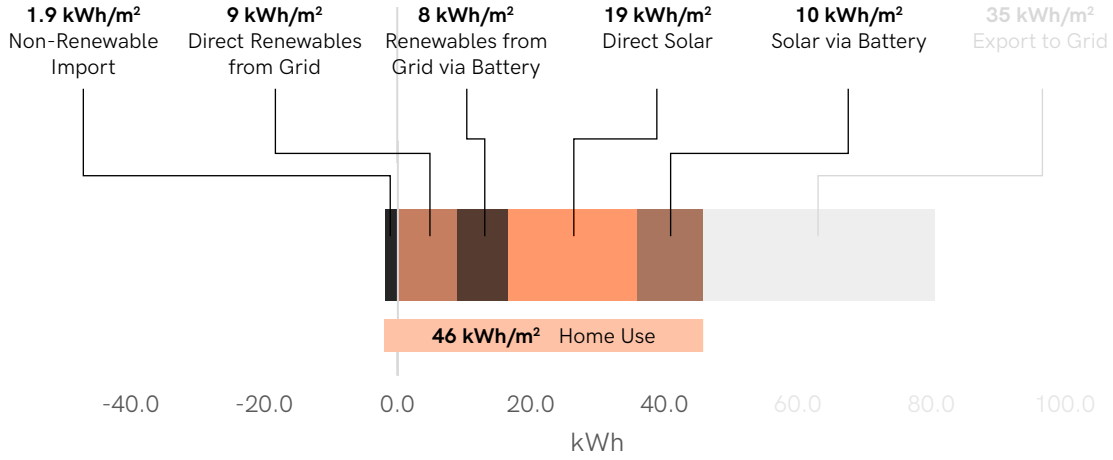
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE



BRAMBLES



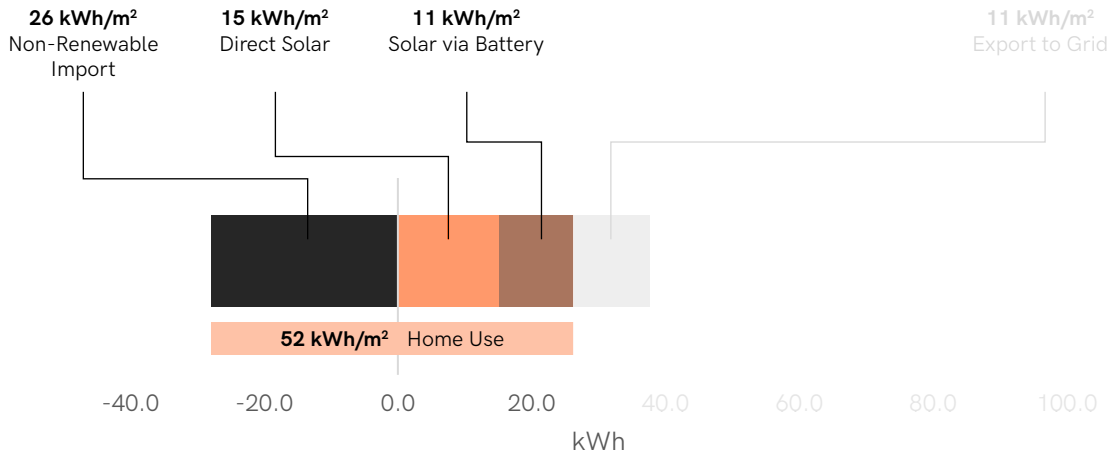
(-) NON-RENEWABLE

RENEWABLE (+)

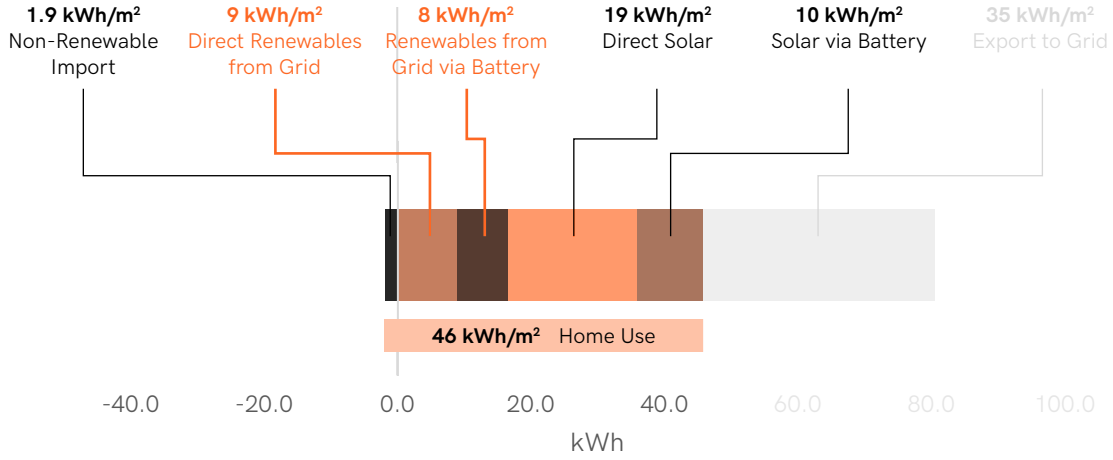
bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

LARK RISE



BRAMBLES



(-) NON-RENEWABLE

RENEWABLE (+)

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

To understand the **renewable/ non-renewable energy balance** with a view to further optimisation of energy decarbonisation in future projects.

To consider the **effect of the Tesla-Octopus Smart Tariff** as a advocate for off-site renewables.

The Tesla-Octopus Smart Tariff enables Brambles to source its energy almost 100% renewably - which is crucial in winter - demonstrating the efficacy of a decarbonised community grid all-year-round.

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

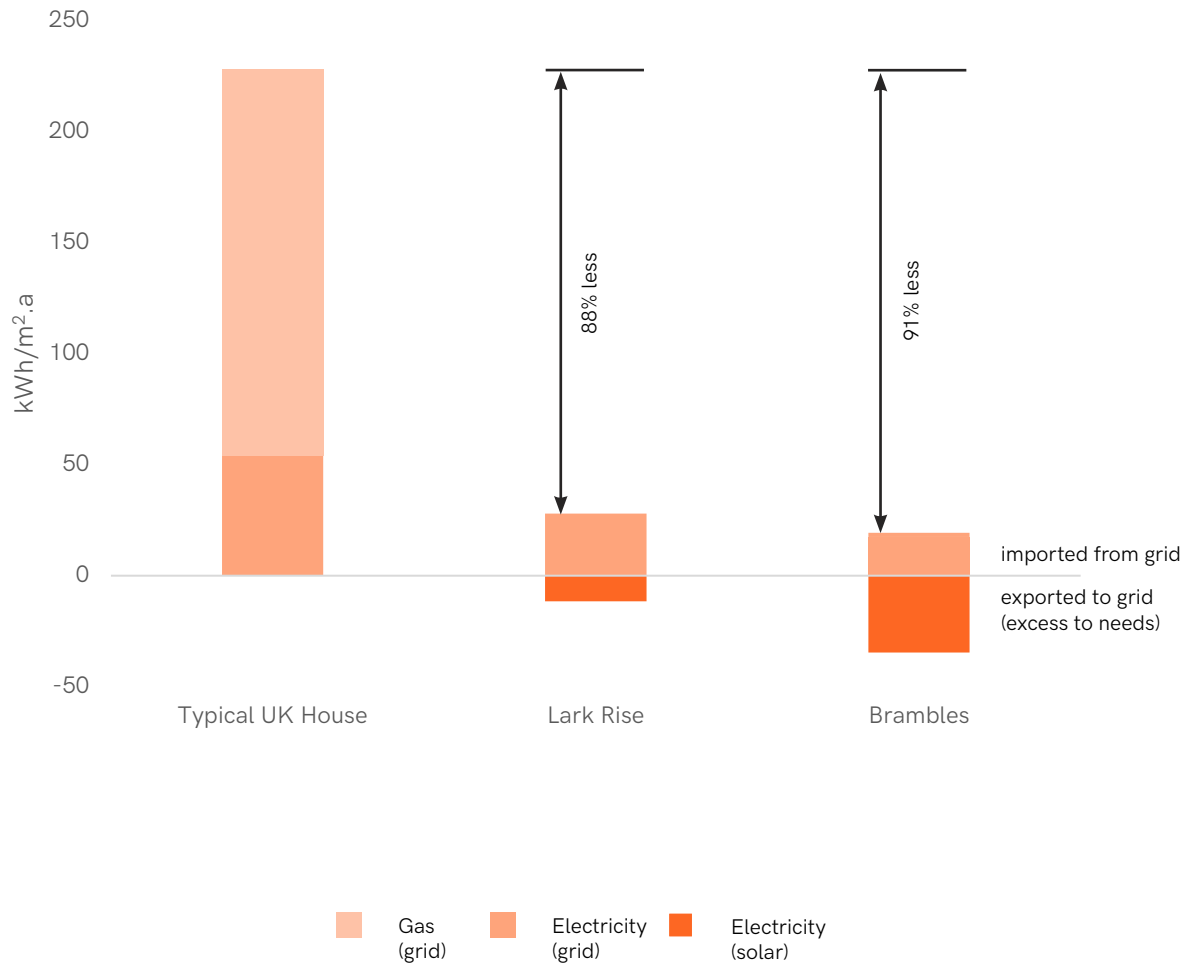
To **speculate about a future** with similarly performing Passive House Plus homes.

Going Forth

bere:architects
The Muse, 54A Newington Green, London N16 9PX +44(0)20 7241 1064
www.bere.co.uk

Final Grid Energy Import & Export

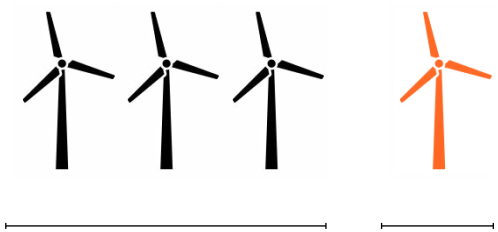
Typical UK Home vs Passive House Plus



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Johnson's Renewables Plan

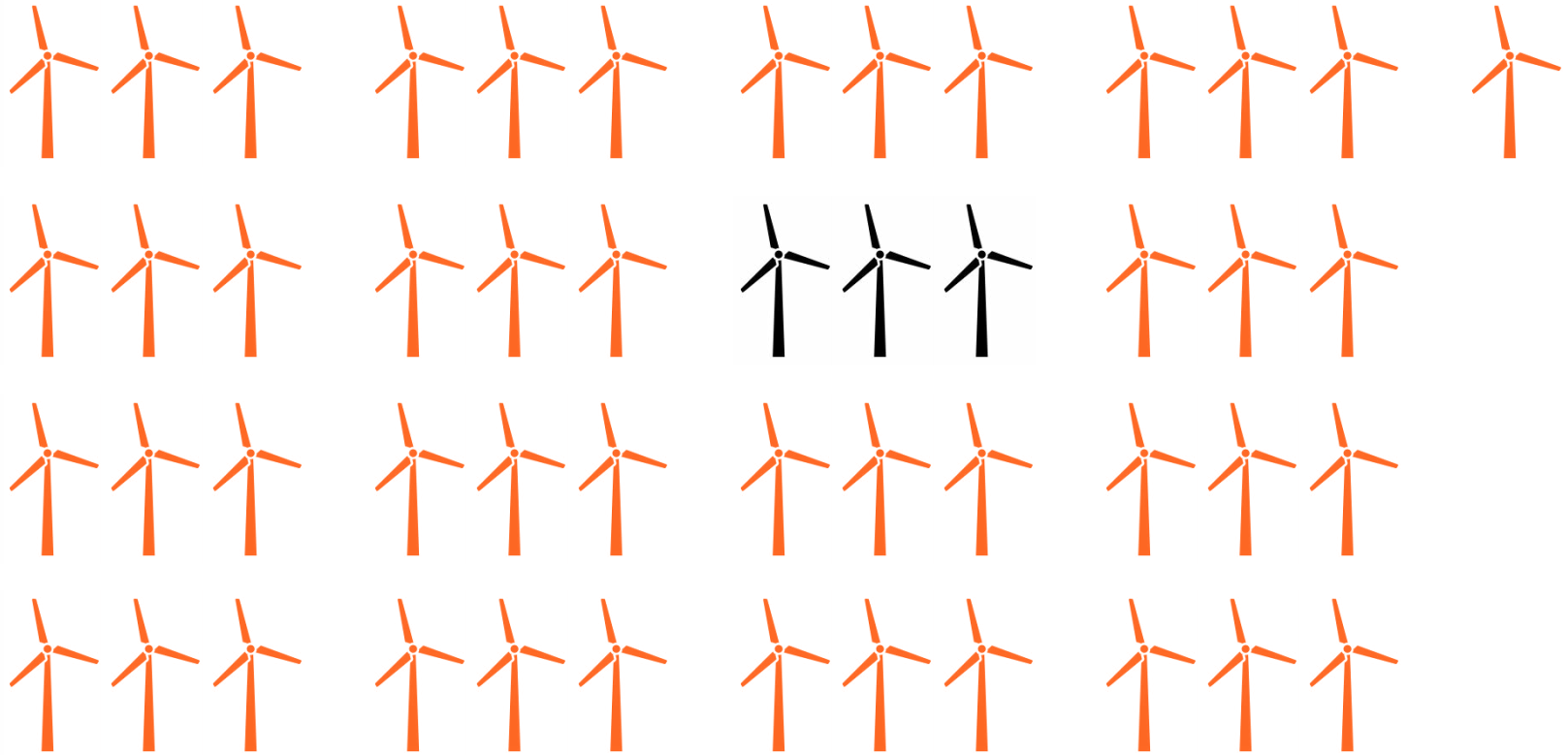


1.3x

"We believe that, in 10 years' time, **offshore wind will be powering every home in the country**, with our target rising from 30 gigawatts to 40 gigawatts."

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

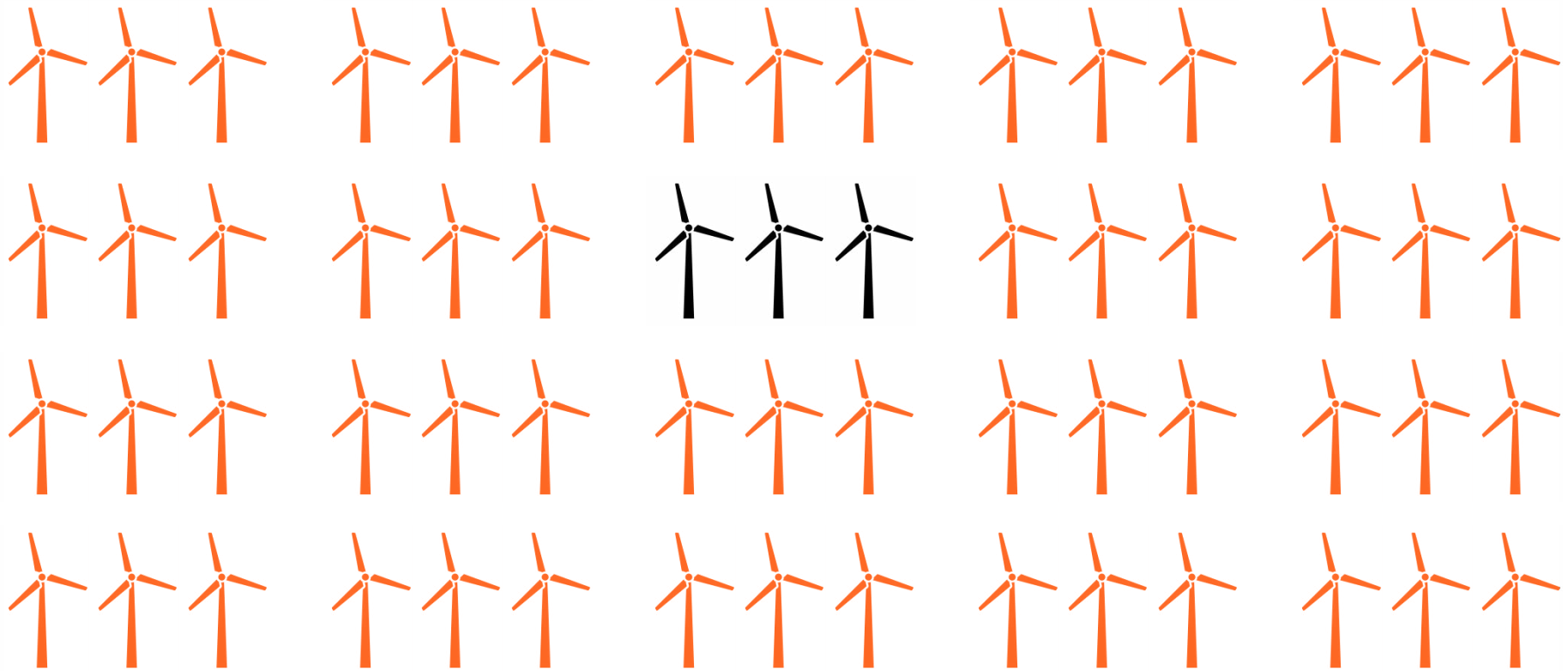
Current Domestic Heating & Electrical Loads Decarbonised



16.4x increase in current offshore wind generating capacity needed **to decarbonise current final electricity demand for ~25 years**

bere:architects
The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Current Domestic Heating & Electrical Loads, Transport Decarbonised



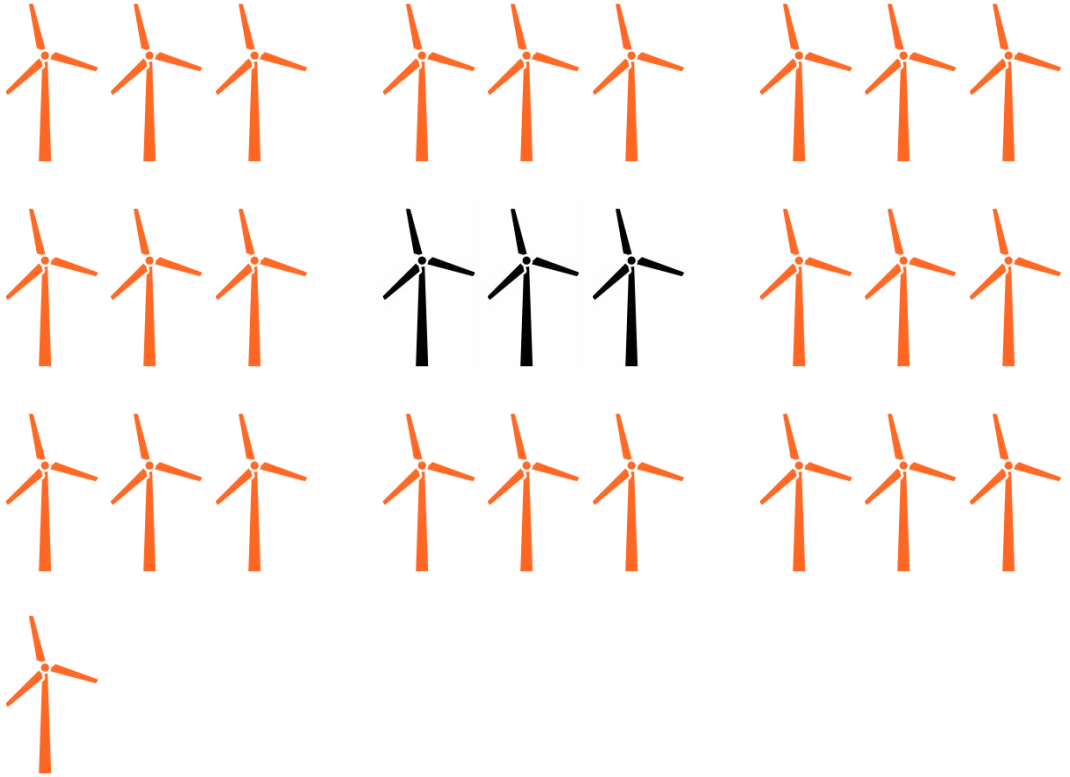
20.9x

increase in current offshore wind generating capacity needed to decarbonise current final electricity demand for ~25 years **and to decarbonise transport demand**

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Deep Fabric-First Retrofit of Homes

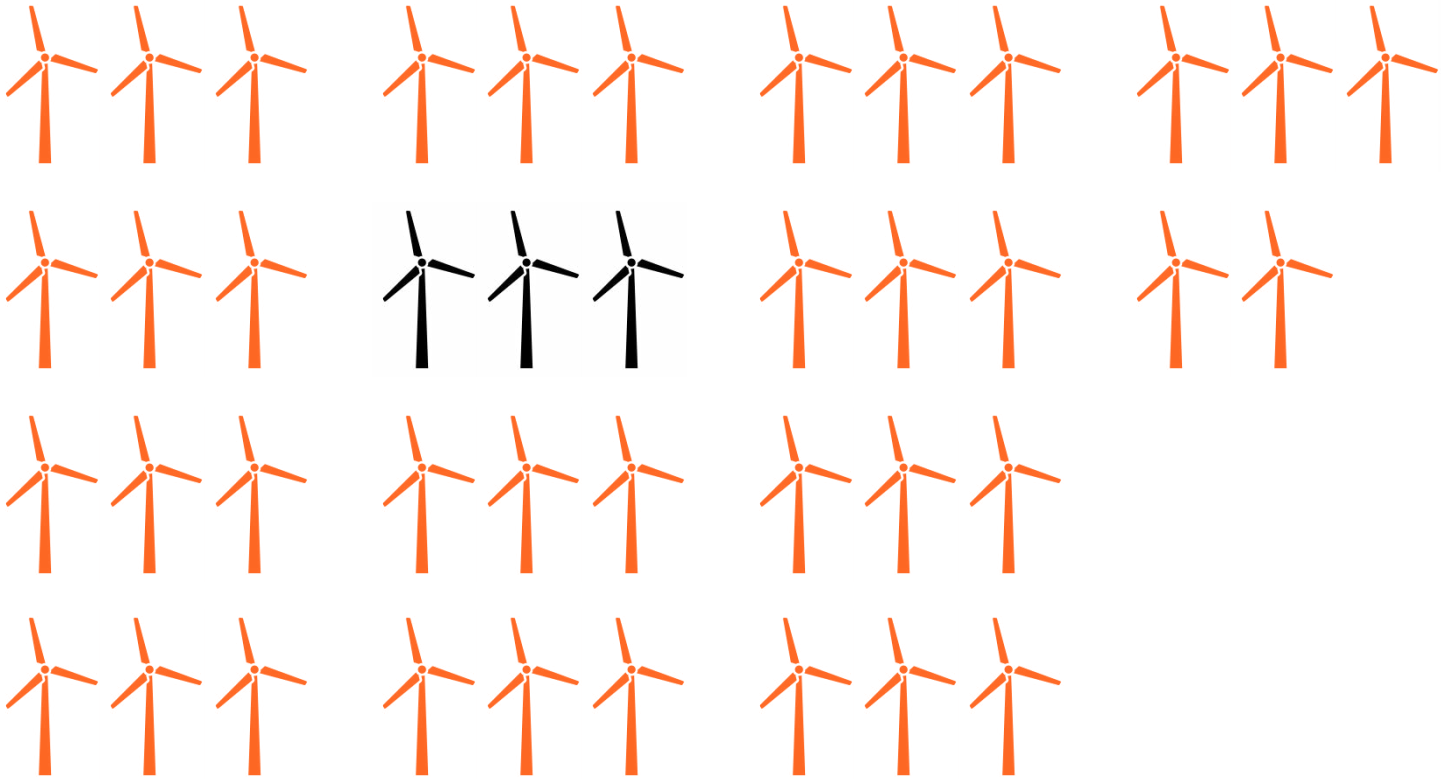


9.3x increase in current offshore wind generating capacity needed to decarbonise current final electricity demand for ~25 years **if all homes undergo deep fabric-first retrofit with 80% reduction in heating demand.**

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Deep Fabric-First Retrofit, Transport Decarbonised



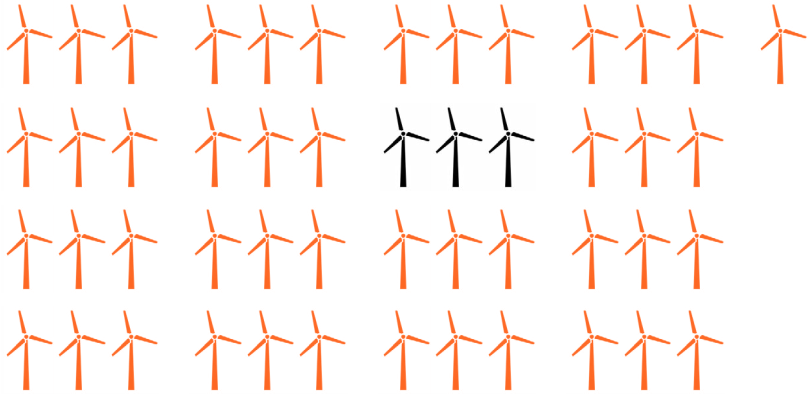
13.8x

increase in current offshore wind generating capacity needed to decarbonise current final electricity demand for ~25 years **and to decarbonise transport demand**

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Current Patterns of Domestic Heating
& Electrical Loads



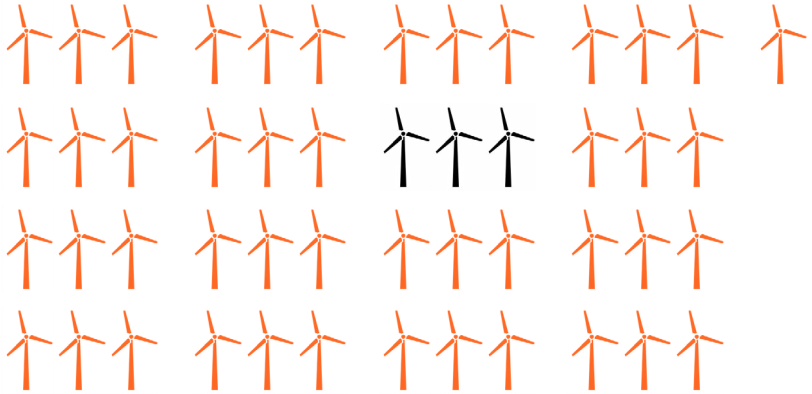
16.4x

Doing more…

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

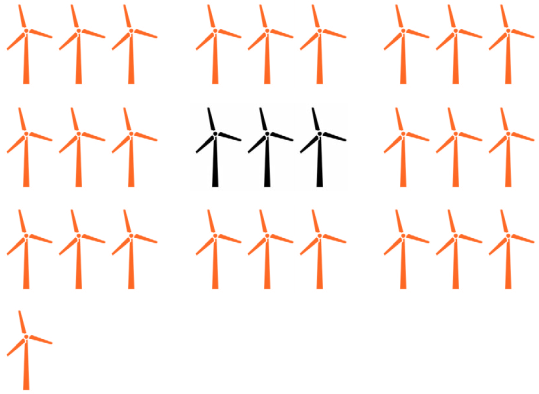
Current Patterns of Domestic Heating
& Electrical Loads



16.4x

Doing more…

Deep Fabric-First Retrofit

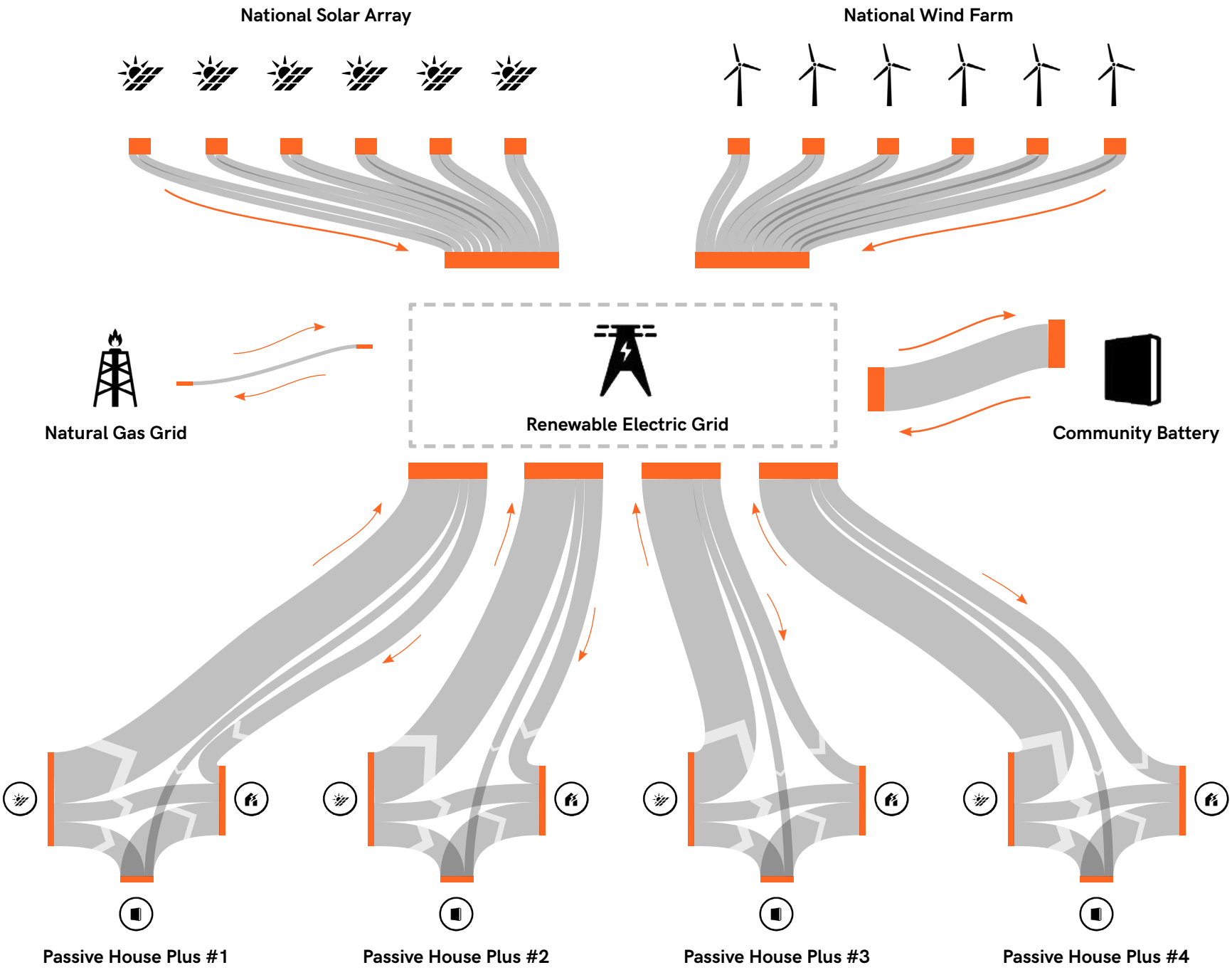


9.3x

…with less

bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk



bere:architects

The Muse, 54A Newington Green, London N16 9PX
+44(0)20 7241 1064
www.bere.co.uk

Thank You

bere:architects

The Muse
54A Newington Green
London N16 9PX
+44 (0)20 7241 1064
www.bere.co.uk