



# Post occupancy monitoring report

In use data of the first 12 months of Elmsbrook Phase 1

June 2017



Bioregional

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## Executive summary

This report forms the first in a series of annual reports showing the real-life results from monitoring the ground breaking Elmsbrook development – the UK’s first ecotown. Data has been collated from a range of sources as part of a planning requirement to compare how the development is performing against the targets set as part of Ecotown Planning Policy Statement (PPS).

In April 2016, the first residents began to move in, gradually filling the 87 homes of the first phase. With only a handful of homes occupied at the start of the monitoring period, some data is incomplete and other data was not submitted in time to be included. These teething problems were to be expected in the first year of monitoring. The resident survey had very few responses, with only eleven questionnaires completed. The first figures on energy usage are promising, with heat and electricity figures only slightly higher than the design benchmark and water even outperforming its target slightly. Travel targets appear to be the most difficult to achieve with model share figures some way off the target, requiring a concerted effort over the coming years.

Overall the development is performing very close to its expectations, showing that a more sustainable, healthy lifestyle within a fair share of the earth’s resources is both viable and popular.



# Post occupancy monitoring report

## 1. Introduction

This report provides the first monitoring results from Elmsbrook covering a period of 12 months (1 April 2017 to 31 March 2016) and 87 dwellings of the first phase. Information was collated from two main sources, survey questionnaires and from monitoring equipment providing numerical evidence.

Although nominally a full years' reporting, some data only covers a few months (e.g. the transport data) and other data is incomplete (energy, water) because some homes were only occupied in January 2017. By autumn 2016, around half the dwellings were occupied, meaning that the more complete data is concentrated around the colder winter months. For this reason, figures on electricity are probably slightly higher (lighting) as well as heat (heating) and lower for PV generation (less sun). It was decided to include an additional month of data (April 2017), to enable a more accurate analysis. No figures on waste were submitted on time by the local authority. On average, for most categories of data and dwellings, there are seven to nine months' worth of data.

The Elmsbrook flats share a communal roof space and PV array which is not sub metered. The electricity figures for these plots cannot be separated or used so the data set for PV, electricity and electricity export is reduced from 87 plots to 63.

Data is generally presented in headline figures (bullet points) followed by a more detailed summary including graphs. Further important notes on the data analysis can be found in Appendix A. Lastly the report provides conclusions and recommendation for how future rounds of reporting can be approved upon.

## 2. In house monitoring

Every house on Elmsbrook is provided with a shimmy - a tablet based information system for the home owner. The system collates daily figures on

- PV generation
- Electricity import
- Electricity export
- Water consumption

for every household on the development.

### 2.1 Electricity

Dwellings on Elmsbrook are designed to require less electricity, with energy efficient appliances and lighting fitted as standard. Each house utilises its roof space carefully to generate electricity from photovoltaics (PV). Metered data on PV generation, import and export can then be used to calculate electricity consumption for each dwelling.

The headline figures:

- The estimated average annual household electricity consumption at Elmsbrook was 2,966 KWh.
- This compares with a Bicester household average 4,311KWh<sup>1</sup>.
- Elmsbrook residents used 31% less electricity than their neighbours in Bicester.
- The design stage benchmark figures for electricity consumption were 30.79 KWh/m<sup>2</sup> annually.
- Elmsbrook achieved 31.79 KWh/m<sup>2</sup>, 3% more than the design stage benchmark.

Summary of results:

The graph overleaf (Fig. 1) compares annual electricity consumption by house type (in red) with the equivalent design stage benchmark (in green). The daily average consumption per household was 8.13 KWh, slightly above the design benchmark.

The monitoring period was from 20<sup>th</sup> May 2016 to 30<sup>th</sup> April 2017. As some dwellings were occupied late, on average there were 234 days of usable data. The average daily consumption was multiplied up by 365 to provide annual figures.

More data was available for the colder/ darker months, meaning the electricity component for lighting may be slightly skewed towards higher usage.

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<sup>1</sup> "Postcode Level Electricity Estimates: 2015 (Experimental) - GOV.UK". *Gov.uk*. N.p., 2017. Web. 6 June 2017.

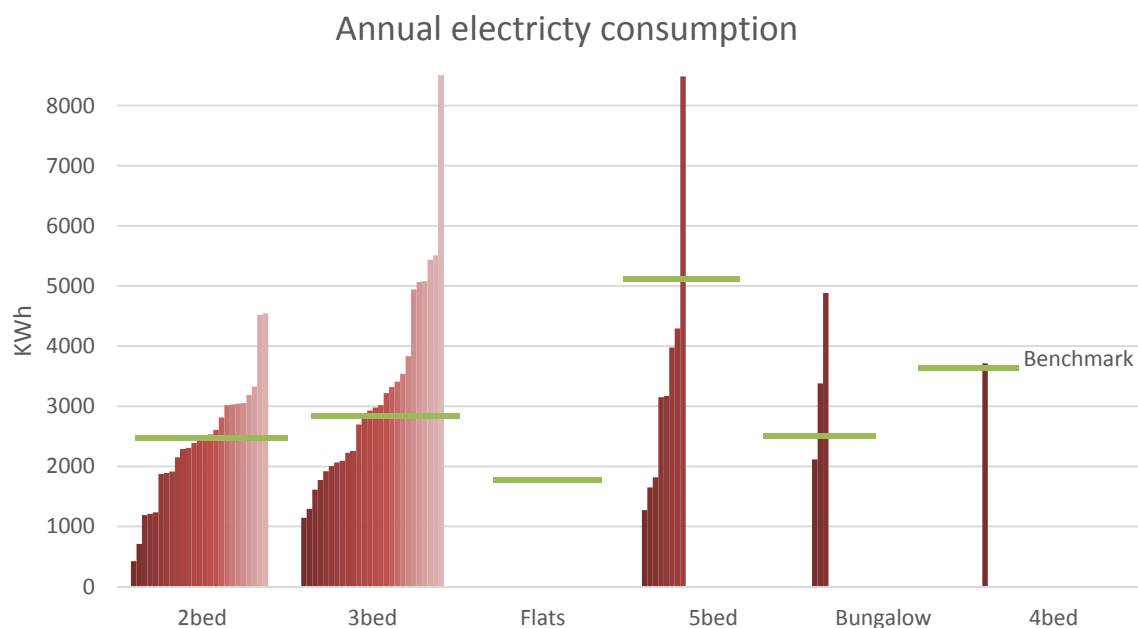


Fig. 1 – Annual dwelling electricity use by house type against benchmark. Green = benchmark; red = individual dwellings. No data available on flats.

## 2.2 PV generation

This data refers to the electricity generated by the PV solar panels on each house.

The headline figures:

- 63 households in Elmsbrook produced 108,549KWh of electricity through their roof PV system over the monitoring period (NB: 24 flats were not metered).
- 1,723KWh per monitored dwelling.
- On average that is 7.38KWh per day per dwelling over the monitored period.

Summary of results:

The graph overleaf (Fig. 2) compares daily average PV generation (in yellow) with average electricity consumption (in brown) by house type.

As the flats are not set up to process PV data on the shimmy, the data series does only include 63 dwellings.

The monitoring period was from 20 May 2016 to 30 April 2017. On average, there were 234 days of usable data available.

Because residents moved in gradually there were a higher number of occupied dwellings (i.e. more data) in darker winter months. Therefore, the PV generation component may be slightly skewed downwards.

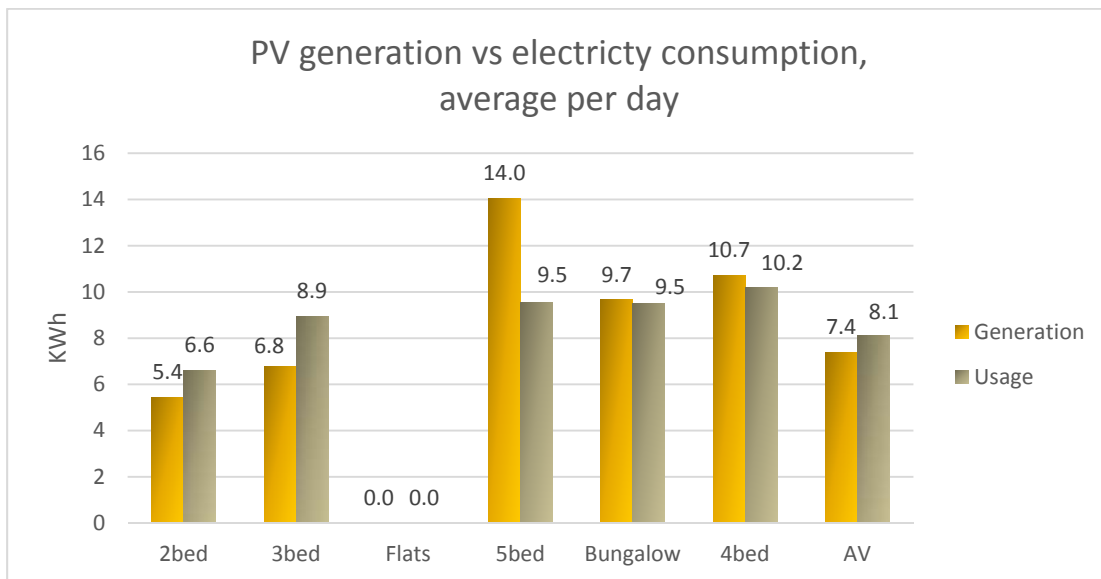


Fig. 2 – Average daily PV generation vs electricity consumption by house type

### 2.3 Electricity export and import

Export refers to times when households generate more electricity than they need and therefore have capacity to export their surplus to the grid.

Import refers to times when households import electricity from the grid, for example at peak usage or at night time when the PV panels are not generating.

The headline figures:

- The 63 monitored dwellings on Elmsbrook exported 76,200 KWh of electricity to the grid (20 May 2016 to 30 April 2017).
- That was on average 1,210KWh of electricity per household.
- 24 flats are unmetered for export and PV, so the overall figure for Elmsbrook is higher. Import is metered.
- Together the 87 dwellings imported 104,092KWh of electricity from the grid over the monitoring period (20 May 2016 to 30 April 2017).
- That was on average 1,196 KWh of electricity per household (including the flats).

Summary of results:

The graph overleaf (Fig. 3) compares the average household PV generation, electricity import and export over the monitored period (63 dwellings).

The export data set includes 63 dwellings, monitoring from 20 May 2016 to 30 April 2017 (on average 234 days of usable data).



The import data set includes 87 dwellings, monitoring from 20 May 2016 to 30 April 2017 (on average 234 days of usable data).

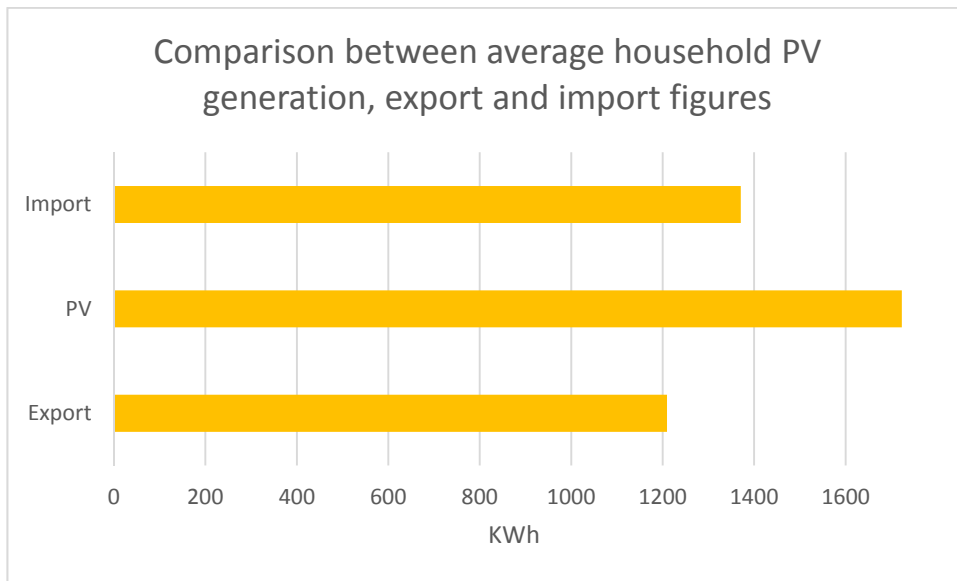


Fig. 3 – Comparison between, average PV generation, electricity import and export

## 2.4 Heat

Elmsbrook is served by an energy centre supplying dwellings with heat for their heating and hot water needs via a district heating system. Data is collected at the point of use in the household (at the heat exchanger unit), not at the energy centre.

The headline figures:

- The estimated average household heat usage at Elmsbrook was 4,023KWh per year.
- This compares with average Bicester household consumption of 12,755KWh annually (gas data only)<sup>2</sup>.
- Elmsbrook residents used 68% less heat than their neighbours in Bicester (Caveat: not all systems were operational)
- The design stage benchmark figure for heat consumption was 44.83KWh/m<sup>2</sup> annually.
- Elmsbrook achieved 48.03KWh/m<sup>2</sup> - 7% more than the design stage benchmark.

Summary of results:

The graph below (Fig. 4) shows the yearly estimated average heat use by house type (in orange) compared against the design benchmark (in green).

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<sup>2</sup> "Postcode Level Gas Estimates: 2015 (Experimental) - GOV.UK". Gov.uk. N.p., 2017. Web. 6 June 2017.



The data set includes 87 dwellings, monitoring from 20 May 2016 to 30 April 2017 (on average 258 days of usable data). Some heating systems were only operating correctly in spring 2017, so heating loads might be lower than normal.

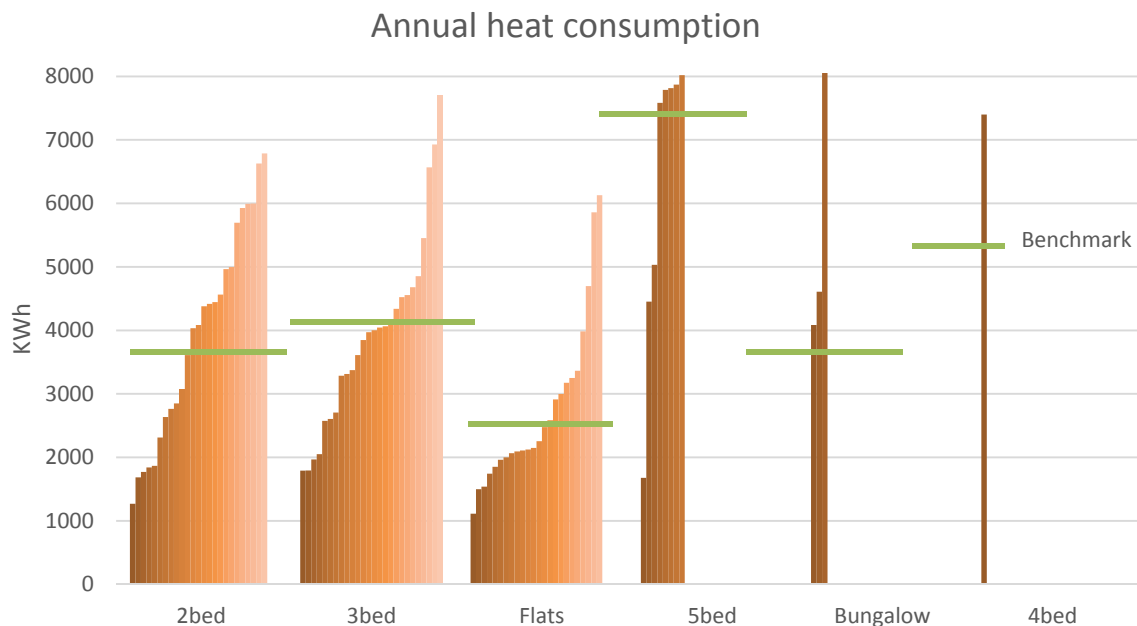


Fig. 4 – Annual estimated heat consumption by house type against benchmark. Green = benchmark; orange = individual dwellings.

## 2.5 Water

Dwellings are designed to be water efficient through use of low flow taps, smaller baths, low flush toilets and rainwater harvesting.

The headline figures:

- Average household consumption is 192 litres per day.
- Estimated daily average consumption per person is 76 litres.
- Elmsbrook residents are currently beating their target of 80 litres per person per day.
- The average water usage in the UK is currently 150 litres per person per day<sup>3</sup>.

Summary of results:

The two graphs below (Fig. 5) show the average daily household water use by dwelling type over the monitored period, and the estimated daily water usage per person (Fig. 6).

<sup>3</sup> N.p., [http://www.waterwise.org.uk/data/resources/25/Water\\_factsheet\\_2012.pdf](http://www.waterwise.org.uk/data/resources/25/Water_factsheet_2012.pdf). Web. 6 June 2017.

The data set includes 87 dwellings, monitoring from 20 May 2016 to 30 April 2017 (on average 254 days of usable data).

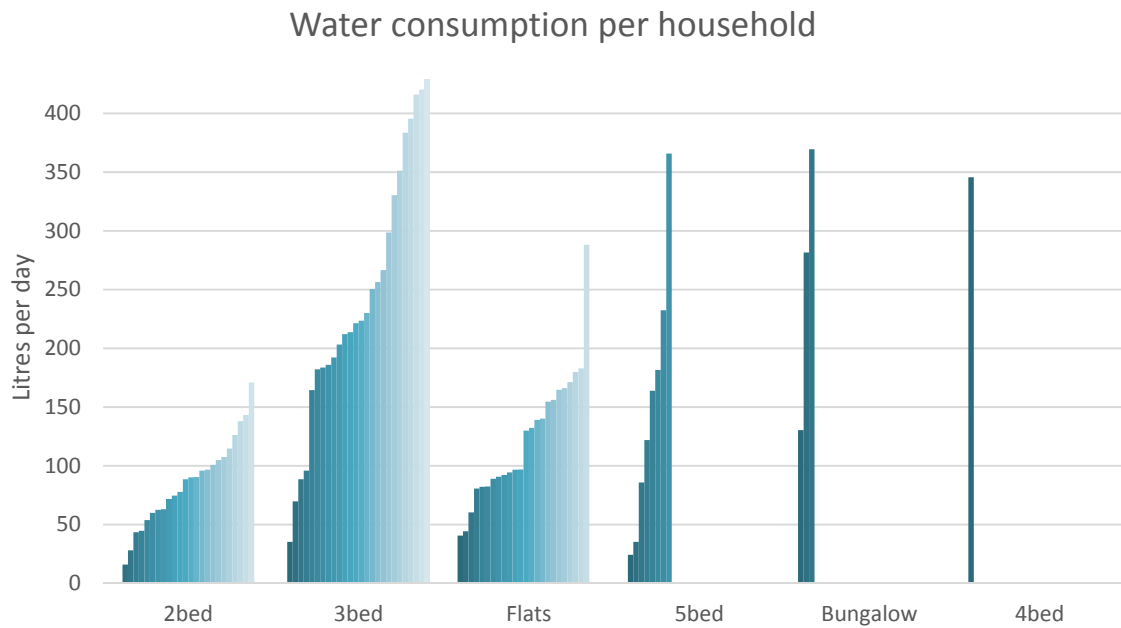


Fig. 5 – Daily household water use by house type

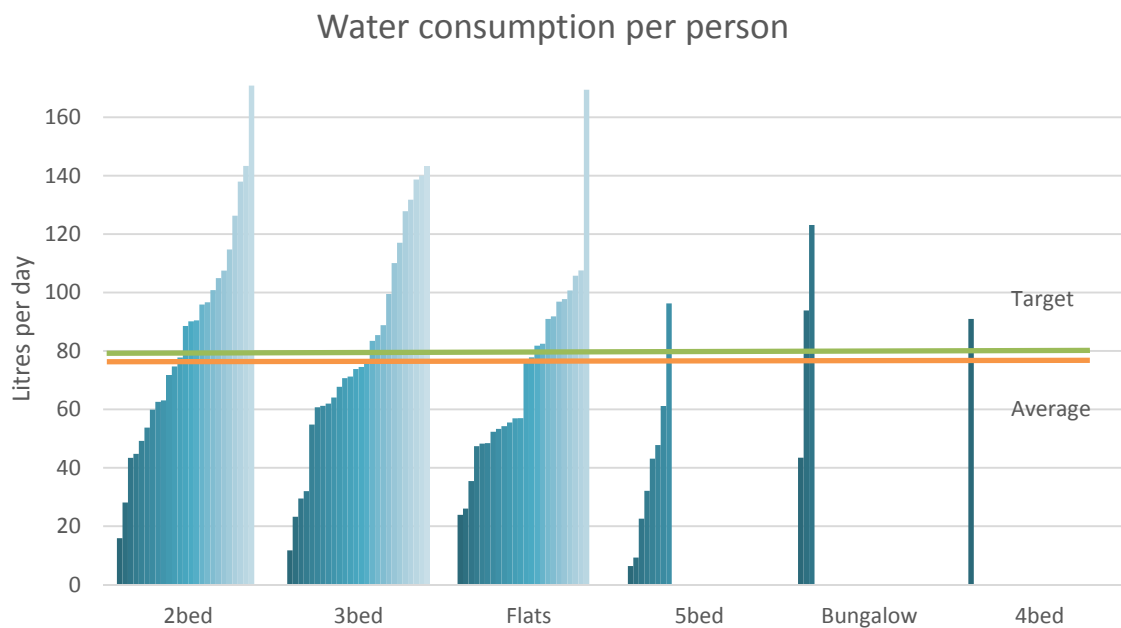


Fig. 6 – Estimated water use per person per day against target and average. Green= target, orange= average all dwellings, blue= actual per person.

### 3. Transport

Elmsbrook has an ambitious modal shift target of 50% non- car journeys by year five of occupancy (currently 67% for Bicester). To encourage uptake of sustainable travel options, the developer has arranged a new bus service, an electric car club and brompton folding bike hire. The modal share based on counter data currently sits at 88%, as compared with 64% from the 11 resident surveys. Because of the very short monitoring period for the counters, this result should not be treated as very robust.

#### 3.1 Cars

Car data has been provided by counters installed on site. Data covers the period 13 March to 13 May 2017. There is currently no way to separate cars journeys from those made by electric vehicle or car club cars, these all appear as one.

The headlines:

- 18,587 car journeys off site were recorded over the monitored period.
- That's 304 journeys per day on average, 3.5 journeys per household.
- 25 journeys per household per week (the weekly average given in the resident survey was 9.4).
- Other factors may be inflating the car readings (e.g. journeys by non-residents such as construction traffic, deliveries, sales staff, visitors).

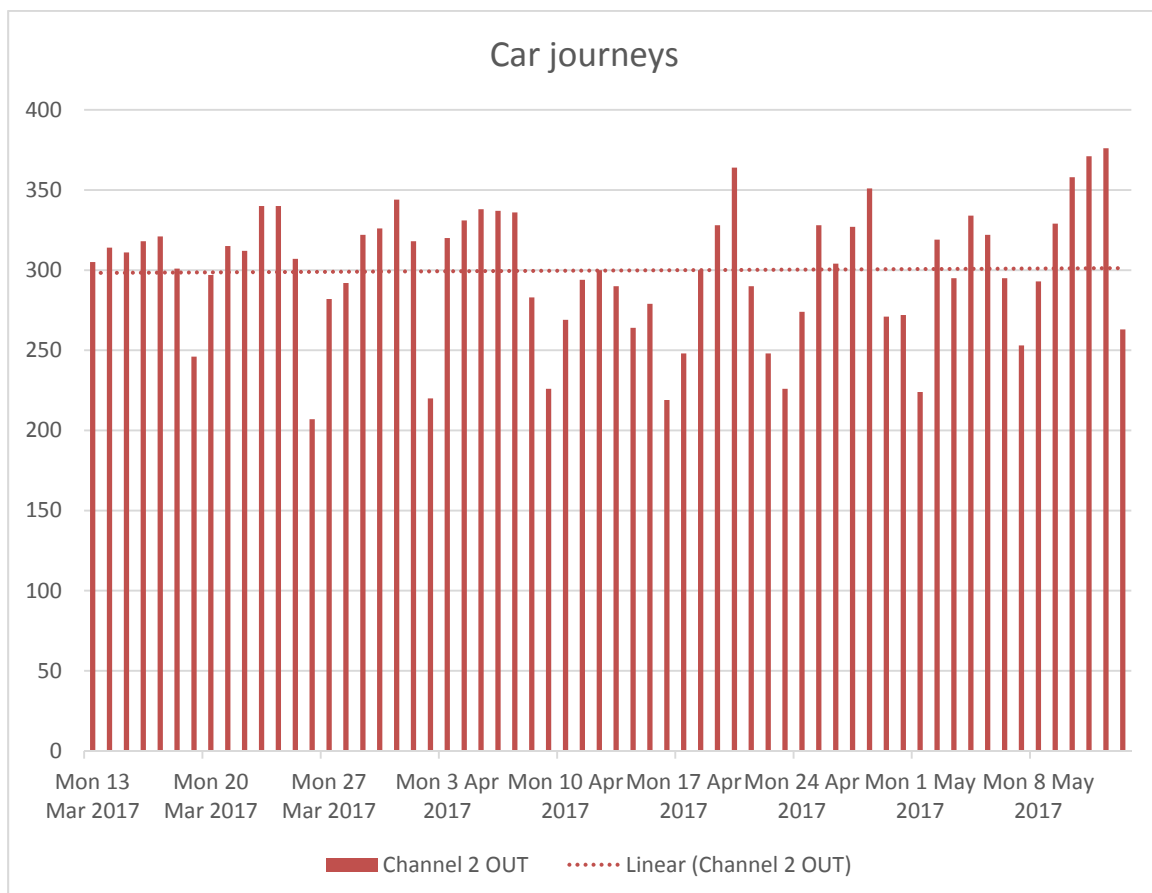


Fig. 10 – Car journeys at Elmsbrook over 13 March to 13 May

### 3.2 Pedestrians

Pedestrian data has been provided by counters installed on site. Data covers the period 13 March to 13 May 2017.

The headlines:

- 1,197 pedestrian journeys off site were recorded.
- That's 20 journeys per day on average, 0.3 per household.
- Resident surveys indicated an average of 3 pedestrian journeys per week, or 0.43 per day. The low counter numbers could indicate a problem with the data.

Summary of data:

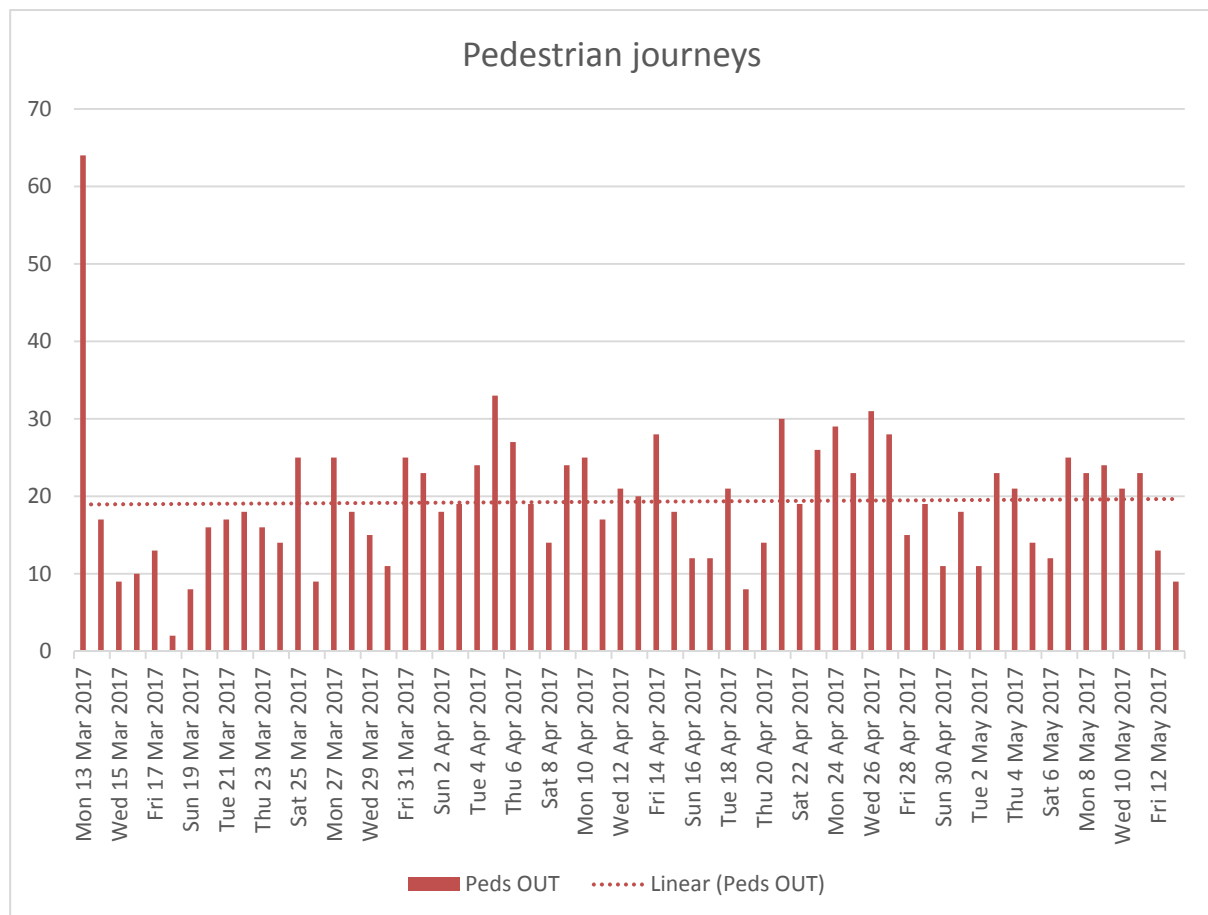


Fig. 11 – Pedestrian journeys at Elmsbrook over 13 March to 13 May

### 3.3 Bicycles

Bike data has been provided by counters installed on site. Data covers the period 13 March to 13 May 2017.

The headlines:

- 497 bicycle journeys were recorded.
- That's eight cycle journeys per day on average, 0.1 journeys per household.
- From the resident survey the average response was 0.2 per week, so the counter data is slightly high but not far off.

Summary of data:

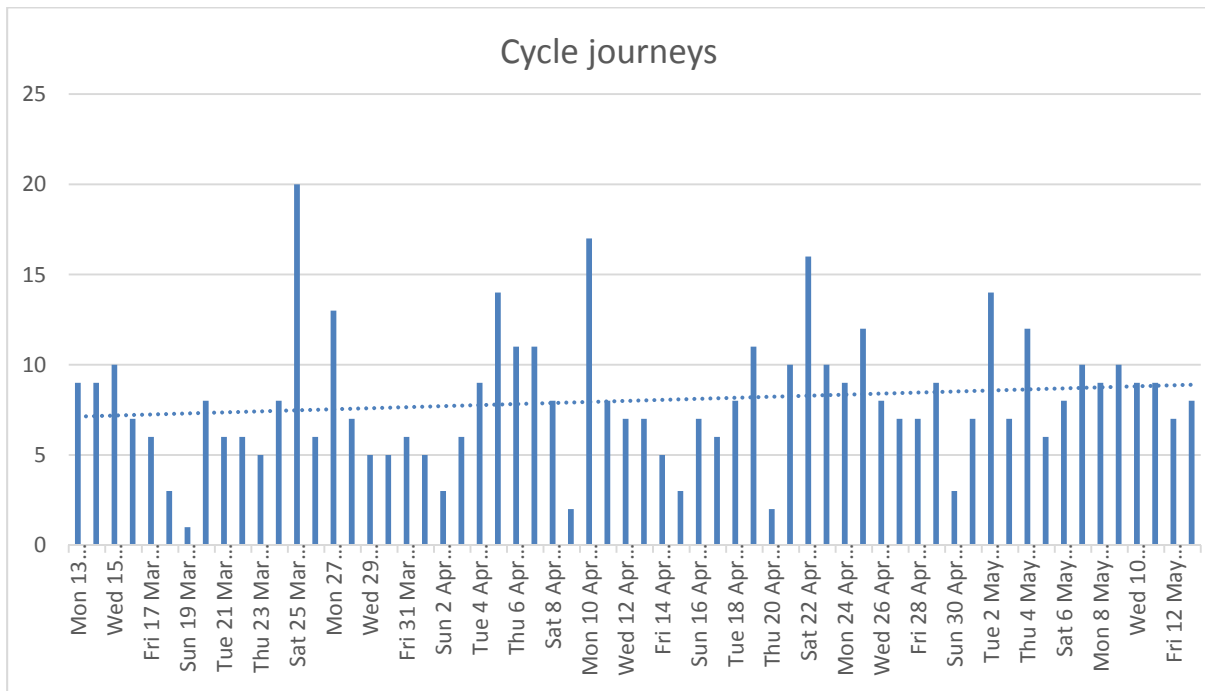


Fig. 12 – Cycle journeys at Elmsbrook over 13 March to 13 May

### 3.4 Electric cars

Car club figures have been provided by E-Car company who provides the service at Elmsbrook. Data covers the period July 2016 to February 2017 (8 months).

The headlines:

- Car club membership has been taken up by about a quarter of households to date (20 out of 87).
- Less than half (9 out of 20) are active members (one or more bookings).
- In total 76 bookings have been made.
- The total mileage is 2,031 which is an average of 27 miles per journey.
- On average e-cars were in use for eleven hours per booking.

### 3.5 Buses

The passenger numbers have been supplied by Grayline who operate the bus service to Elmsbrook. Data covers the period June 16 to March 17.

The headline figures:

- Bus passenger numbers have been growing consistently since June 2016.

- Bicester wide usage has been increasing the most (i.e. journeys other than from Elmsbrook).
- Usage originating from Elmsbrook has levelled out at 430 passengers per month. This matches the data from the residents survey relatively well, when extrapolated (487).
- The monthly passenger average has been 1,392 for all stops served (not just Elmsbrook) over the monitored period.

Summary of results:



Fig. 13 – Bus passenger numbers from June 2016 to March 2017. Blue= total passengers, red= from Elmsbrook.

## 4. Waste

No data was provided by the local authority on waste collection.

## 5. Energy centre

The Elmsbrook energy centre consists of a gas powered combined heat and power (CHP) unit with backup gas boilers. Operators Scottish and Southern Energy (SSE) have provided their metering figures below. It is not clear what period this data covers, so has only been summarised without further analysis.

Table 1 – Elmsbrook energy center data

What	Units	Notes	Input
Electricity generated on site CHP	kWh/year	Total annual electrical output from the on-site CHP	180,895

Heat output from on-site generating technology - CHP	kWh/year	Annual heat produced by each heat-generating technology, including system heat losses and heat dumped.	210,400
Heat output from on-site generating technology - Boiler	kWh/year	Annual heat produced by each heat-generating technology, including system heat losses and heat dumped.	860,600
Gas consumption by generating technology - CHP	kWh/year		490,443
Gas consumption by generating technology - Boiler	kWh/year		939,439
Gas CHP running hours	hrs	Monthly log	226
Gas boiler running hours	hrs	Monthly log	Not recorded

## 6. Resident survey

The Elmsbrook resident survey was sent out to all 87 phase 1 households by post and available online on the shimmy device. A total of 11 responses were received, eight by post and three completed online. An example survey can be found in Appendix 2.

The low response rate can be partially explained by a misunderstanding at the time around resident billing that will have impacted engagement levels.

The headline figures

- From the collected responses, we can derive a very crude current modal share of 64%, 3% below Bicester average. The ecotown PPS modal shift target is 50% (sample 11 of 87).
- Health and happiness strongly correlate with each other i.e. those that indicate good health also rate their perceived well-being highly.
- Those residents that rate their health and perceived wellbeing the highest also make use of the green spaces at least once a week. Those with the lowest perceived health levels use the green spaces only monthly or on an ad hoc basis.



- 91% of respondents indicated they feel healthy to very healthy (above neutral), compared to 58% UK wide who feel somewhat, mostly or completely satisfied with health (above neutral)<sup>4</sup>.

Summary of results:

Table 2 – Summary of survey responses

Ref.	Question	Responses	Results
<b>Health and Well-being</b>			
1.1	Number of adults (over 18)	11	The average response was two adults per household. No single residency or single parent household took part in the survey.
1.2	Number of children (under 18)	11	The average response was 0.7 children per household. Five households had no children, one household had three children and the others had one per household.
2.0	On a scale from 1-10, how healthy do you feel? <i>1 = very unhealthy</i> <i>10 = very healthy</i>	11	The average response was 7.4. Most people see themselves as healthy to very healthy, with a single negative response.
3.0	On a scale from 1-10, how would you rate your perceived well-being? <i>1 = lowest well-being</i> <i>10 = highest well-being</i>	11	The average response was 7.6, most people rate their wellbeing high. There were no negative responses.
4.0	During the last 7 days, how many days have you taken part in vigorous, moderate or light exercise over a period of 10 minutes or longer? <i>For example: lifting, digging, cycling or walking, playing sport for longer than 10 minutes consecutively?</i>	10	The average response was that occupants spent 4.5 days where vigorous, moderate or light exercise took place for longer than 10 minutes. One response was left blank, but could've been interpreted as not met.
5.0	Which of the following parks or green spaces does your household make use of locally (if any)?	10	Respondents gave the following answers: Nature reserves x 6, play parks x 3, open countryside x 3, country park x 2, sports greens x 1.
6.0	If yes, how often does your household use these green spaces?	9	Respondents gave the following replies: Never x 1, monthly x 3, fortnightly x 1, weekly x 3, daily x 1.
7.0	If you are in employment (including self-employed), how frequently do you have the ability to work from home?	9	Respondents gave the following replies: 1 x not currently in employment, 4 x never work from home, 3 x less than three times per week, 1 x every day.

<sup>4</sup> "Measuring National Well-Being: Life In The UK- Office For National Statistics". *Ons.gov.uk*. N.p., 2017. Web. 6 June 2017.

8.0	How many neighbours at Elmsbrook do you know to say "hello" to?	9	The average response was between five to eight neighbours (7 being the midpoint).
9.0	Does your household compost your green and/or food waste?	10	Three respondents answered with yes, seven answered with no. The question could have been made clearer, some answered no but said 'it all goes in the food waste bin'.
<b>Transport &amp; Travel</b>			
10.0	In an average week, as a household, approximately how many journeys do you make from Elmsbrook by (vehicle, walk, cycle, bus, train, car club):	10	The average respondent indicated that in a week they make 14.7 journeys as a household. Of that, 9.4 journeys were made by vehicle – 64% 3 journeys were made by foot – 20% 0.2 journeys were made by bicycle – 1% 1.4 journeys were made by bus – 10% 0.7 journeys were made by train – 5% 0 journeys were made by car club – 0% <i>(Results also produced as graph)</i>
11.0	In an average week, as a household, approximately how many times do you travel to (Bicester town centre, other Bicester locations, Oxford, Banbury, Oxfordshire destinations, London, Birmingham, elsewhere nationally):	11	The average household response was 10.4 times. Of those, 2.5 times to Bicester town centre in a week – 11% 4 times to other Bicester locations – 19% 0.9 times to Oxford – 4% 0.1 times to Banbury – 0% 2.5 times to Oxfordshire destinations – 12% 0.5 times to London – 2% 0 times to Birmingham – 0% 11 times to elsewhere nationally – 51% <i>(Results also produced as graph)</i>
12.0	In an average week, as a household, approximately how many journeys do you make for (Commuting to work, employer's business, educational attendance, escorting, shopping, recreation/leisure, visiting friends and relatives, personal business):	11	The average respondent indicated that in a week they make the following journeys for 4.6 journeys were made for commuting to work - 36% 0 journeys were made for employer's business - 0% 0.9 journeys were made for educational attendance – 7% 0.9 journeys were made for escorting – 7% 2.0 journeys were made for shopping – 16% 1.8 journeys were made for recreation/leisure - 14% 2.1 journeys were made for visiting friends and relatives – 16% 0.6 journeys were made for personal business – 5%
13.0	How many vehicles do you own?	10	The average of the households that responded was 1.5 cars.

	<i>*include vehicles which you have permanent use of i.e. if owned by employer or if leased from a third party:</i>		
14.1	What is the model, fuel type and tax band of each of your vehicles (vehicle 1)?	8	Model: VW Golf, Renault Laguna, BMW M3, BMW unspecified, Ford Fiesta, Skoda Roadster, Vauxhall Corsa, Kia Sportage Fuel type: 4 Diesel, 3 Petrol, 1 LPG Tax band: Only one tax band given with £135 per
14.2	As above for vehicle 2?	8	Model: Toyota Aygo, Mercedes E- class Fuel type: 1 Diesel, 1 Petrol Tax band: None given
15.0	What is the approximate annual mileage of each vehicle?	8	The approximate average mileage for the first vehicle was 26,000 miles and 20,000 miles for the second vehicle.
16.0	Are you a member of the e car club?	9	Two households answered with yes (22%), both own vehicles. Seven households answered with no (or 77%).
17.0	If yes, have you used the 6 free hours available with the e car club membership?	2	Both respondents with e car club membership answered with no.
18.0	If yes, how often do you use the e car club?	0	Not applicable.
19.0	How many bicycles are there in your household?	10	The average respondent had 1.3 bicycles in their household.
20.0	On average, how often do residents at your household make trips by bicycle?	10	Five respondents answered with never, four respondents answered they use their bike 3-6 times a year and one respondent answered they use theirs on a weekly basis (3-4 times a week).
21.1	On average, approximately how many miles do residents at your household travel in a year by bicycle? (Bicycle 1)	5	Five respondents answered with 100miles or less. One respondent used their bike significantly with 1000-2000 miles.
21.2	Using the same mileage bands, please estimate for Bicycle 2?	2	All four respondents answered with less than 100 miles for bike number two.
21.3	Using the same mileage bands, please estimate for Bicycle 3	2	Both respondents answered with less than 50 miles for bike number three.
21.4	Using the same mileage bands, please estimate for Bicycle 4	0	Not applicable.
22.0	What transport related measures provided at Elmsbrook has your household found useful? (e.g. Brompton bike hire, E1 bus service, E car club, Electric vehicle trials, events, cycle routes)	9	Most respondents mentioned the bus service as very useful, followed by electric car club and Brompton hire.
23.0	What additional transport facilities would	9	Respondents' answers ranged widely from a Sunday bus service through

	help you to reduce your personal car use?		electric bikes to a nursery. Some responded that due to work reasons, they are unlikely to change their mode of transport.
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Below a selection of responses (10, 11, 12) also illustrated in graph form.

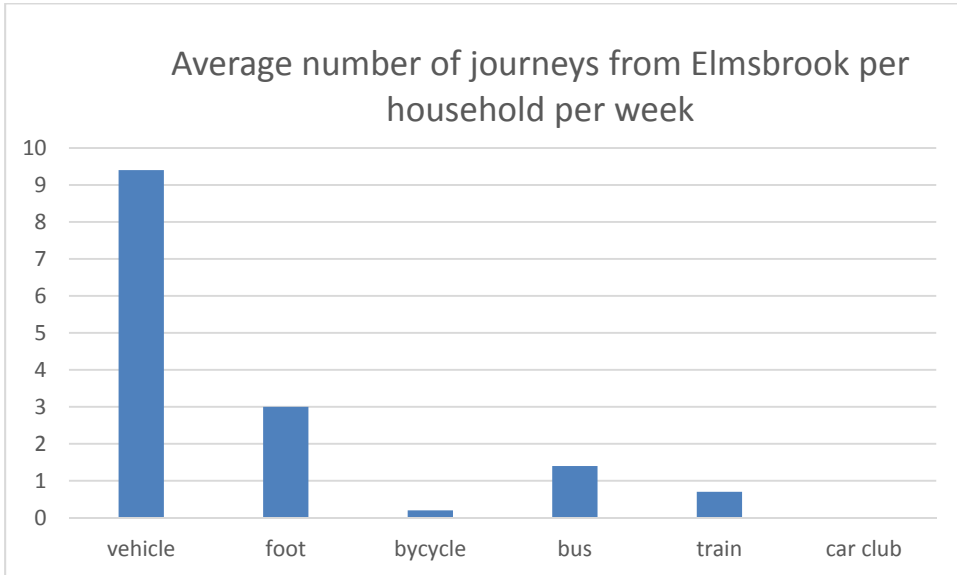


Fig. 7 – Average number of household journeys from Elmsbrook per week

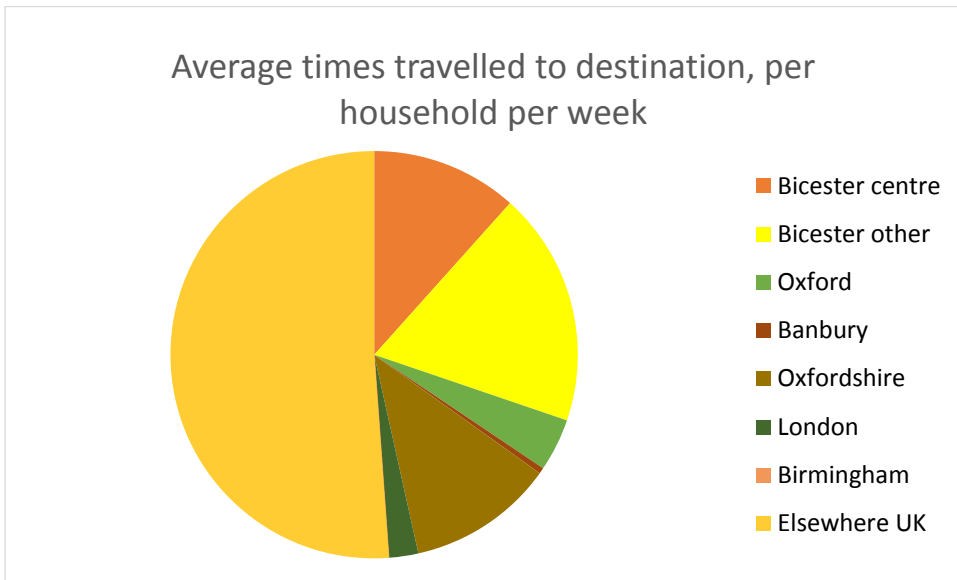


Fig. 8 – Average number of household journeys to destination per week

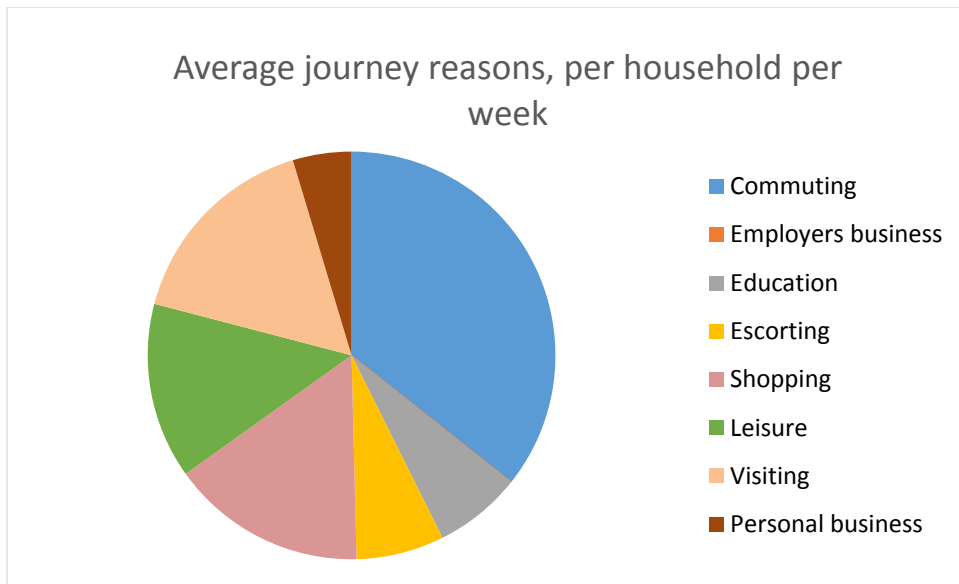


Fig. 9 – Average journey reasons per household per week (NB: Escorting refers to parental/ guardian duties, such as school or nursery runs for children).

## 7. Other data

This category holds any other data submitted by A2Dominion as part of the monitoring requirements.

On community and governance:

Two welcome to your Home events were delivered by A2Dominion in April and October 2016, attracting 57 households (122 people).

A community management organisation taster workshop with Stakeholders and Elmsbrook residents was held on 29th March. The workshop was attended by 10 residents and 8 stakeholders. No roles and responsibilities have been established on the governance structure at this stage. A2Dominion will be working with CDC to deliver a series of workshops with residents throughout 2017 to establish the first stage of this organisation.

A sustainable transport event was held on 7 July 2016 to launch the Electric E Car Club and the free Brompton Bike Loan Scheme. The event was attended by 14 residents from 20 occupied homes who obtained information and cycling maps. 3 residents signed up to the Electric Car Club that day, 2 residents hired out Brompton Bikes for a week at the event, and 4 residents went out on an electric vehicle test drive.

## 8. Conclusion and recommendations

Below a summary of the conclusions from the monitoring process, structured by category. Recommendations appear in the appropriate section in italics and are aimed at improving the collection process and robustness of the data.

In house monitoring:

In general, the first-years' worth of post occupancy monitoring data has shown that the systems are working well, producing results that are useful.

Whilst impossible to draw too many conclusions on the numerical values as the data is incomplete, initial results are pointing in the right direction. None of the figures are widely out, generally slightly above set benchmarks, except for water usage which is already meeting targets.

Because of staggered dwelling handovers more households were monitored over the colder, darker periods of the year, influencing PV, lighting, water use and heating. Heating energy should be further treated with care as some systems were only operating correctly in spring 2017, possibly resulting in lower than normal loads. The format of the raw data made the analysis more difficult than necessary.

*We therefore recommended to provide all shimmy based data pre- sorted by house type, with all newly occupied dwellings having a start of occupancy date included. Units and data labels should be provided on the top of all columns to ease analysis.*

The flats have shared PV infrastructure and as individual meters were not connected to the shimmy device, there was effectively no data on PV generation, export and electricity usage for 24 properties (of 87 total).

*We recommend addressing this issue before the next set of reporting. Without data from the flats it will be difficult to draw any site wide conclusion on the zero-carbon status.*

Occupancy data is important for estimating the per person water consumption and electricity consumption by household. Further it would allow to understand very high or low electricity consumption figures which could be influenced by occupancy. Currently there is no such data available and occupancy numbers have been estimated. Designed occupancy figures were adjusted using statistical evidence of real life occupancy figures but results should be treated with some caution.

*We recommend collecting anonymised occupancy data in a way that it can be correlated back to house type and tenure.*

## Residents survey:

The survey questionnaires response rate was lower than anticipated, resulting in only 11 returned forms. Whilst too small to provide a clear picture of the developments household make up and behaviours, it was possible to extract some common themes and emerging trends from the sample.

*We recommend exploring a range of ways to increase the survey response rate. Breaking down the surveys into smaller more regular questionnaires (e.g. bi annual) might encourage uptake. Perhaps the surveys can also be better publicised and promoted, with incentives such as prize draws or money to charity.*

From some of the answers given, it can be assumed that respondents did not always understand the question fully or the type of information needed. For example, a question around vehicle ownership was designed to capture the tax band required to calculate carbon emissions, failing to do so with only the car make given.

*We recommend checking the wording of questions to improve clarity and to make the process more engaging to the participant. For example, a better online utility that provides context and feedback to some of the answers might be more fun and informative (you scored x that compares to average of y).*

## Transport:

There is very little data on travel and transport as the required counters were only recently installed on site (two months' worth of data). In addition, there is also a question about whether data is being logged correctly. Some car and pedestrian figures look high but could be influenced by construction workers refurbishing the nearby show homes during the monitoring period. Data appears to show an emerging trend of high car usage and low cycling uptake. However, there is not enough data to get a clear picture on modal share. Counter data shows 88% and survey responses 64% (Bicester average is 67%).

*We recommend checking the counter data with the logging provider for accuracy, perhaps against manually derived hourly surveys. If a large impact through construction activity is evident perhaps that needs to be captured.*

The bus service is proving popular with average monthly passenger number stable at above 400. It is currently difficult to separate between town wide and Elmsbrook bus use, as ticketing information does not distinguish between the two. There is currently no way to separate journeys made by electric vehicle or car club cars (which are not classed as 'car' under the 106 definition), against normal car usage.



*We recommend exploring ways to separate these journeys or modes of travel for accuracy of monitoring, but accept this might not be technically feasible at this stage. Another worthwhile inclusion would be to check where people are commuting too.*

Other:

Other data such as waste collection figures and detailed energy centre operating information was not available for this round of reporting. It is expected that those systems will be set up and data available for next year's reporting.

*We recommend to evaluate all suggestions in this report soon, so that any changes can be incorporated in ongoing monitoring and upcoming resident surveys. It would be good to engage with both the NWB PhD student and travel plan coordinator when considering any changes to the process.*

Next year's report will be published in May 2018 and will hold the first complete set of data for phase 1 of the development.

## Appendix 1 – Notes on the data analysis

### General:

In the absence of occupancy start dates, generally the first non-zero values in a data set were treated as the start of reporting. Subsequent non-zero values were ignored as these could be explained through periods of absence, for example occupants on holiday away from home. The exception to this rule was PV, as even in overcast conditions, some small amount of electricity will be generated. Some small anomalies in the data remain, for example one large water reading indicating a leak.

### Electricity:

The electricity consumption was derived by adding PV and Import figures and subtracting the Export. Because it is highly unlikely for the PV system not to generate any electricity at all (even on overcast days), zero values have been excluded as it is assumed the metering system was not operational. There was no electricity data available for the flats, as PV generation is shared infrastructure and not split by property.

Electricity comparison data for Bicester has been obtained from UK national statistics data by postcode (2015) and covers meter readings from 17,447 households. Electricity benchmark figures have been obtained from the NW Bicester Exemplar energy strategy document, Table 3 Advanced practice energy efficiency demand.

Electricity intensity data (kWh/m<sup>2</sup>) required the figures for Gross Internal Area (GIA) by house type. This was taken from the A2D Master schedule of housing, see table 1. Variations within types or tenures were simplified for this analysis.

Table 3 – Assumed floor areas from A2D Master schedule of housing

By house type	2 bed*	3 bed*	4 bed	5 bed	1 bed flat	2 bed flat	Bungalow
Floor area (m <sup>2</sup> )	81	91	119	165	53	61	81
					Average flat: 57		
*Average floor area between affordable and private tenure house type							

On average, there were 234 days of usable data available. Because the monitoring period was less than a complete year, daily averages were extrapolated to 365 days. Because of staggered dwelling handovers, more data was available for the colder/ darker months, meaning the electricity component for lighting might be slightly skewed towards higher usage

### PV generation:

The flats are not set up to process PV data on the shimmy, therefore the data series does only include 63 dwellings. On average, there were 234 days of usable data available. Because the monitoring period was less than a complete year and there were more handovers (i.e. more data) in darker months, the PV generation component might be slightly skewed downwards.

Heat:

UK national statistical data for Bicester only provides heat data in form of gas consumption. This therefore excludes any heat generated by electric means. The actual heat figure might lie somewhat higher. No difference between primary energy and heat delivered has been assumed in the analysis.

The data set for a majority of dwellings was less than 12 months, so daily averages were extrapolated to 365 days. Because of staggered dwelling handovers, more data is available for the colder months, meaning the heating component is slightly skewed towards higher usage. Domestic hot water (making up 36% of the overall heat) demand is relatively unaffected by seasonal influence.

From the start of September 2016, the majority of dwellings were providing data (48 out of 87 dwellings). The last two dwellings started providing monitoring data for heat in mid-January 2017, meaning the data from January to April (3.5 months) is complete data.

Heat intensity (kWh/m<sup>2</sup>) data required figures on GIA by house type, see xx section for further details.

Water:

The data does not include a full year of water usage, because of staggered dwelling handovers. The useful data period is different for every plot but averages 254 days.

water usage has been generated by identifying the start of the occupancy from the first non- zero value in the dated range of values. zero readings further on in the data set (for example as part of holidays away from the dwelling), have been counted as part of normal occupancy fluctuations.

There was no information available on number of persons per household. Therefore, an estimation was required to determine water consumption per person. Designed occupancy numbers were taken from the A2D schedule of housing and statistical occupancy information was applied (e.g. average number of empty bedrooms). Tenure was also considered. Naturally, it would have been much preferable to have actual occupancy data.

Table 4 – Assumed occupancy average for per person water usage

	Flats	2B	3B	4B	5B	Bungalow
Designed occupancy	3	4	3	6	9	3
Assumed occupancy	1.7	2.4	3	3.8	3.8	3

Transport- car and pedestrian data:

There are still some anomalies in the data between journeys to and from site (these don't match up). The travel plan coordinator liaised with the monitoring company who recommended to look at the out journeys only at this time which was followed. There is no information on the location of the counters.

Electric car data:

The following details were excluded from the main body of the report

Two types of e cars are offered:

- Renault Zoe = 0kgCO2/mile
- BMW i3 = 0kgCO2/mile

Car club membership 20

Car club mileage 2031

Total number of bookings 76

Total hours booked 840.25

No. members to make bookings 9

## Appendix 2 – Example of resident survey



### Elmsbrook Monitoring Survey

Elmsbrook is the first development in the UK to be built to the Government's eco-town planning standards. A2Dominion has to undertake annual monitoring of the development on a range of subjects including: energy, water, biodiversity, sustainable travel, waste and health for submission to Cherwell District Council in accordance with our planning permission. Some of this data is collected automatically through meters in the homes and public realm and some of it we aim to capture through resident surveys. All data is anonymised and used to measure performance and improvements against targets year on year. In addition, the results will be shared with the community to help encourage sustainable lifestyles.

We would be most grateful if you could please take the time to review and complete the survey below and return it to us by **Friday 31<sup>st</sup> March** using either the prepaid envelope enclosed, or alternatively, by dropping your completed survey through the letter box of the Community House, 1 Bramley Avenue, Elmsbrook. If you prefer to complete the survey on-line please go to: <https://www.surveymonkey.co.uk/n/elmsbrookmonitoring>. You will also be sent this link via your Shimmy to access and complete.

We would like to thank you for your time in assisting us with our monitoring survey.

The survey is designed for one person to complete in the household. Where questions specify, your responses will be on behalf of the whole household, otherwise please complete based on your own individual experiences.

### Health and Well-being

#### Question 1

How many people aged over 18 years live in the property

How many people aged under 18 years live in your property

#### Question 2

On a scale from 1-10, how healthy do you feel? (1 = very unhealthy - 10 = very healthy). Please circle your answer

1   2   3   4   5   6   7   8   9   10

#### Question 3

On a scale from 1-10, how would you rate your perceived well-being? When considering your well-being think about your comfort, happiness, and prosperity (1 = the lowest well-being - 10 = the highest well-being)

Please circle your answer

1   2   3   4   5   6   7   8   9   10



**Question 4**

During the last 7 days, how many days have you taken part in vigorous, moderate or light exercise over a period of 10 minutes or longer? For example: lifting, digging, cycling or walking, playing sport for longer than 10 minutes consecutively?

5/6

**Question 5**

Which of the following parks or green spaces does your household make use of locally (if any)? Please circle your answer.

Open countryside   nature reserves   country park   play parks  
sports greens   allotments   none

**Question 6**

If yes, how often does your household use these green spaces? Please circle your answer

Daily   weekly   fortnightly   monthly   ad hoc

**Question 7**

If you are in employment (including self-employed), how frequently do you have the ability to work from home?

Not currently in employment  every day  more than 3 times a week   
less than 3 times a week  never work from home

**Question 8**

How many neighbours at Elmsbrook do you know to say "hello" to? Please circle your answer

None   1-3   4-7   8-11   12-15   More than 15

**Question 9**

Does your household compost your green and/or food waste? Please circle your answer

Yes   No

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**Transport and Travel:**

Please answer these questions for the adults in the household. If two residents are going into Bicester, count this as two journeys. Please only include journeys which start at Emsbrook.

**Question 10**

In an average week, as a household, approximately how many journeys do you make from Emsbrook by:

Personal vehicle (car/motorbike/van) (include driver and passenger journeys)

Walk

Bicycle

Bus

Train

Car club

**Question 11**

In an average week, as a household, approximately how many times do you travel to:

Bicester town centre

Other Bicester locations

Oxford

Banbury

Oxfordshire destinations

London

Birmingham

Elsewhere nationally (please give details):

**Question 12**

In an average week, as a household, approximately how many journeys do you make for:

Commuting to work

Employer's business

Educational attendance



- Escorting (to school, doctors etc)
- Shopping
- Recreation/leisure
- Visiting friends and relatives
- Personal business

**Question 13**

How many vehicles do you own? \* Include vehicles which you have permanent use of i.e. if owned by employer or if leased from a third party

2

**Question 14**

What is the Manufacturer / Model / year / fuel type / tax band of each of your vehicles?

Vehicle 1: *Citroen Spacecar 2010 Diesel*

Vehicle 2: *Mercedes Vito Diesel 2016*

Vehicle 3:

**Question 15**

What is the approximate annual mileage of each vehicle?

Vehicle 1: *6,000 PM*

Vehicle 2: *30,000 PM*

Vehicle 3:

**Question 16**

Are you a member of the e-car club? Please circle your answer

Yes /  No

**Question 17**

If you answered yes to question 16, have you used the 6 free hours available with the e-car club membership?

Yes / No

**Question 18**

If you answered yes to question 16, how often do you use the e-car club? Please circle your answer

Never    daily    weekly    fortnightly    monthly    only as & when you need it

**Question 19**

How many bicycles are there in your household?

2

**Question 20**

On average, how often do residents at your household make trips by bicycle? Please circle your answer

More than once a day      once a day      3-4 times a week      once a week  
1-2 times a month      3-6 times a year      never

**Question 21**

On average, approximately how many miles do residents at your household travel in a year by bicycle? Please circle your answer

Bicycle 1: None / less than 50 / 50-100 / 100-200 / 200-500 / 500-1,000 / 1,000-2,000 / over 2,000

Bicycle 2: None / less than 50 / 50-100 / 100-200 / 200-500 / 500-1,000 / 1,000-2,000 / over 2,000

Bicycle 3: None / less than 50 / 50-100 / 100-200 / 200-500 / 500-1,000 / 1,000-2,000 / over 2,000

Bicycle 4: None / less than 50 / 50-100 / 100-200 / 200-500 / 500-1,000 / 1,000-2,000 / over 2,000

**Question 22**

What transport related measures provided at Elmbrook has your household found useful? (e.g. Brompton bike hire, E1 bus service, E car club, Electric vehicle trials, events, cycle routes)

Bus service - I use this every week to go to Bicester university. It's a nice day, I walk to town

**Question 23**

What additional transport facilities would help you to reduce your personal car use?

None - husband travels to London regularly for work in work van as needed!  
I have to drop off child at Childcare then go to work x3pm

**Thank you.**