

# Solar Homes Sales Premium Scoping Study

*Executive Summary*

*January 2016*

This is the executive summary of a scoping study undertaken by Think Three Ltd on behalf of the Solar Trade Association during 2015.

## Background

The STA has commissioned a scoping study to test the premise that the addition of solar panels on homes creates value and derives a sales premium. This scoping study is designed to determine what research would be required to inform the following key objectives:

- To provide evidence to the construction sector (developers & housebuilders of newbuild homes), Government, relevant professional bodies and the general home buying public, that adding to the build costs of new homes through the installation of solar PV panels will be rewarded with higher property values
- To provide evidence to industry that consumers are willing to pay more for homes with solar PV
- To provide evidence to home owners that homes with solar PV will be cheaper to run and be worth more (than equivalents without solar PV)

The scoping study has focussed on three key areas in support of the recommended scope for a more comprehensive research project:

1. **Literature Review** - A review of existing literature both within the UK and abroad has been conducted where this is relevant to the premise and can inform the possible future scope.
2. **Data Analysis** - In order to understand the potential premium that PV systems add to home sales values, a number of datasets have been assessed for their suitability and statistical rigour.
3. **Industry Practice** - To support the three key objectives, it would be useful to test whether market research into professional and consumer experience and expectations would support the premise that homes with solar PV are valued higher.

### 1. Literature Review

The literature review has identified over 50 publications from around the world (mostly from the UK, the EU and the USA), which are relevant to the scoping study. Approximately 10 are considered highly relevant and summaries of their findings and therefore relevance are detailed in the scoping study.

Much of the proposed scope has been drawn from a recent study from the USA<sup>i</sup> which conducted detailed analysis of the value of Solar Home Premiums in eight states and found a correlation between the presence of solar and higher sales values (averaging \$4,000/kW). This study by the Lawrence Berkeley National Laboratory in January 2015 (and recently updated in November 2015<sup>ii</sup>) has drawn on previous studies in the state of California, where useful insight into the methodology, data analysis and

statistical approach used have informed this research and could largely be replicated here in the UK (subject to availability of similar datasets).

Similar reports from the UK have been researched and referenced, where similar statistical analysis has been carried out on property characteristics. The DECC<sup>iii</sup> and Scotland 2020<sup>iv</sup> studies looked for correlations between the energy efficiency ratings of homes and their sales values using hedonic regression analysis, which indicates that it is possible to statistically show correlations between a property's characteristics and its value in the market.

Other relevant literature by the Eindhoven University<sup>v</sup> has cited other methodologies for testing the value placed on solar homes or 'willingness to pay' by consumers using hypothetical discrete choice experiments. Whilst this showed no evidence of willingness to pay from consumers tested, it has posed interesting questions about how this attitude may change as the penetration of solar increases in the housing market.

In November 2015 Barclays Mortgages published the results<sup>vi</sup> of an online survey they carried out with YouGov (Digital Homes Report) showing that solar panels rank highest in desirable technology, with homeowners saying they would pay on average £2,000 more for a property equipped with them.

The literature review has shown that there is strong academic interest in this scope as well as evidence of solar sales premiums at least in the USA, and therefore has provided a useful set of precedents for further research here in the UK. It also shows that there is significant interest in solar energy (cf. other renewable energy sources) and its impact on property values, given the number of academic and commercial papers on the subject. If the quantity of literature on the subject is a proxy for market success, we might infer that more studies will emerge from other countries proving that solar homes derive additional value.

It is also evident that solar energy is almost as ubiquitous as something like broadband technology, given interest from around the world. The ability to use this technology in almost any country regardless of the differences in building stock, the features of the residential property market, or the solar irradiation levels and therefore cost-effectiveness of solar systems is evident in the literature reviewed and implies the UK is no different to many other countries or markets.

## 2. Data Analysis

It has been important to assess the availability and quality of data in the UK to support the premise and inform the scope of a more comprehensive study. The intention was to analyse both homes transaction data and data on solar installations in the UK with a view to running a hedonic regression on a sample of these two datasets to determine what might be possible with full access and suitable processing capacity.

### *Data Availability*

A number of datasets have been identified and assessed for completeness and quality of content. They hail from two main sources: Land Registry Home Transaction data for England and Wales; and the government supported Microgeneration Certification Scheme database (property and solar installations in England, Wales and Scotland).

Home transaction data in England and Wales is freely available under Open Government License and data on home transactions from 1995 to 2014 can be accessed very easily<sup>vii</sup>. The dataset is very large and contains full addresses (including full postcodes) of every home sold in the period covered, with some rudimentary data on property type and age. Home transaction data in Scotland and Northern Ireland is not freely available and can only be accessed under license from the respective government departments through existing commercial terms and has not been analysed as part of this scoping study.

The Microgeneration Certification Scheme (MCS) is the biggest source of data for residential scale solar energy systems in the UK. MCS registration is a requirement of any grant funding for solar systems and therefore collation and management of the data is a function of the government's market transformation activities designed to encourage take-up of solar energy and other micro-renewable generating technologies. Given most of the solar installations in the UK have been supported by the availability of financial incentives (grants and feed-in tariffs) this data source is seen as the most comprehensive dataset of its kind.

Gemserv is the current organisation responsible for managing the MCS database and were approached to supply the data to support this scoping study. Following several weeks of negotiation Gemserv were able to release the current dataset for solar energy with partial postcodes as address identifiers.

The MCS data is used to inform the Feed-in Tariff reports produced by Ofgem (the energy regulator) as part of the total policy support for renewable energy (small & large-scale) in England and Wales. Ofgem produce regular reports detailing the take-up of a range of renewable energy technologies under the Feed-in tariff and Renewables Obligation. Datasets of all recorded and grant supported installations (with partial postcodes only) are available from Ofgem under Open License agreements.

Other data on property characteristics has been investigated to determine the availability and usefulness of the data in support of any hedonic regression analysis. Sources such as the Office of National Statistics and UK census data were explored.

Data on in-situ solar performance is not freely available, although a number of large property/solar system portfolio holders now monitor the performance of solar systems on their housing stock and may be available for analysis under commercial terms.

Energy Performance Certificates (EPCs) data which collects information on the energy ratings of all homes sold, including the presence of solar systems, is not freely available and only made available under strict license agreements and in any case only contains minimal information on solar systems.

### *Data Quality*

Home Transaction data in England and Wales is made available as Comma Separated Values (CSV) files which can be easily downloaded and analysed using conventional software like MC Excel, albeit the files are extremely large with hundreds of thousands of records. The data contains prices paid for all homes sold between 1995 and 2014 with details of the full address, the property type, whether the property is new or old and how many times the property has been sold. Data from the years 2009 to 2015 was analysed to coincide with collected data on solar installations and broken down into manageable datasets for each calendar year.

The data from the MCS database supplied by Gemserv contained over 700,000 records with information on residential scale solar PV installations dating from 2009 to June 2015 making up the majority of records. The data provided details of solar PV installations including the date of installation and registration; the capacity (kWp) and estimated annual generation (kWh/year); and partial postcodes as address identifiers. The data supplied has not been cleaned for input errors and contained many examples of over estimates of generation capacity and installed capacity, which led to erroneous total capacities for each year recorded.

The other source of solar installation data was obtained from the Ofgem FiT Installation Reports<sup>viii</sup> and it is understood that the MCS supplies details of residential scale installations to Ofgem for this database. The latest report (up to 31<sup>st</sup> March 2015) contains just under 600,000 records of FiT supported renewable energy installations at all scales supported under the policy. Of the 600,000 records covering Anaerobic Digestion, Hydro, Micro CHP, Wind and Solar PV, 591,600 (>98%) are for solar PV installations. The dataset provides details of the installed capacity, the commissioning dates and applicable tariff bands with partial postcodes as address identifiers.

The Ofgem data is cleaner and contains considerably less mistakes and has been used as the main reliable source of solar installation data for the statistics analysed and cross referencing with the home transaction data.

### *Data analysis*

Due to the miss-match in datasets where home transaction data (in England and Wales) is supplied with full address details and the solar installation data only contains partial postcodes (Outward Code), it has not been possible to directly compare the two sets of data using regression analysis. Although partial postcodes have been matched for the sales/installation years of 2009 and 2015, no meaningful conclusions can be drawn, since there can be up to 10,000 homes within a partial postcode area. Although some areas with and without solar installations showed higher than average sales prices on partial post-codes with solar installed, it was equally apparent that average sale prices were also lower in other areas where solar was installed.

To test the premise fully, **full address details would be required for the solar installation data** to ensure these can be matched to the homes transaction data for the years 2009 to 2015. The scoping study sets out details of the minimum data requirements for testing the premise fully.

### 3. Industry Practice

Discussions have been held with two groups of industry professionals to understand current practice with regard to the valuation of homes with solar systems; and to understand the sales and marketing of new homes with solar systems installed:

- Those involved in the process of valuing property - Valuation surveyors, Royal Institution of Chartered Surveyors (RICS), Council of Mortgage Lender (CML) and mortgage lenders.
- Those involved in developing or constructing new homes - Housing developers and housebuilders.

It was clear from the discussions with industry professionals involved in the process of valuing residential property that there was a poor understanding of the cost/benefits that it provided. There is

no formal process for assessing the value of a solar systems installed on residential properties, unlike the practice of valuing commercial properties using asset appraisal methods.

Whilst the Royal Institution of Chartered Surveyors (RICS) are aware of the increasing use of renewable energy technologies in both the residential and commercial sectors, their guidance and advice to their members is out of date and very generic. The Council of Mortgage Lenders (CML) only provide advice to its members on the legal rights of homeowners and lenders where 3<sup>rd</sup> parties hold a lease on installed solar systems hosted by mortgage holders. Mortgage lenders surveyed do not recognise any additional value (e.g. in reduced energy costs) that solar systems may derive for homeowners where they are installed on their home when assessing their ability to repay a mortgage (i.e. improved credit risk).

A number of housebuilders were polled to understand whether the new homes with installed solar panels derive a higher value in the market. The overriding response from this group was that solar systems did not appear to them to add value but simply added to their build cost. As such developers and housebuilders do not yet market any of the additional benefits new solar homes offer over their competition (existing homes without solar) and adopt a very risk averse approach to the provision of information to the customer (to avoid over-promising any potential benefit or where any benefit accrued is down to the user).

### Recommended Scope

Given evidence of sales premiums elsewhere and a growing UK solar market, further research to test the premise that there is evidence of solar sales premiums in the UK residential property market is recommended and a detailed report to the STA sets out the methodological approach and minimum data requirements to test the premise fully.

A number of key questions should be informed by the methodological approach and statistical analysis, which would then provide evidence to conduct further market research with industry professionals and consumers. i.e. where the statistical analysis pointed to evidence of a correlation between solar homes and additional sales value, this could be tested for the causes using market research to determine why this might be the case.

Subject to the availability of robust data, the scope should seek to address the following questions:

1. Are solar home premiums evident for all countries in the UK (England, Scotland and Wales)?
2. Where PV home premiums are evident, do they differ from region to region, especially where generation yields are expected to be better than the average for the UK as a whole?
3. Do any observed sales premiums from the installation of solar PV differ to estimated contributory values using cost and income appraisal methods?
4. How does the size of any premium change over the study period (2009 to 2015), as PV system prices have decreased and during housing market swings (housing crash post-2008)?
5. Are premiums for new PV homes similar to existing solar PV home premiums?
6. How does the age of the PV system influence the size of the solar PV premium?

7. Is there evidence of a “green cachet” for solar PV homes where the sales premium is above the amount paid for each additional watt added?

### Conclusions

The policy context would infer that government support for low and zero carbon energy technologies is likely to diminish (certainly over the current parliament) as evidenced in recent announcements on zero carbon new homes and solar subsidies.

This suggests that take-up of solar going forward will largely be driven by market forces and therefore evidence of solar sales premiums is partially dependent on greater take-up of the technology. Solar subsidies have significantly influenced take-up of solar technology, especially since 2010 with the introduction of Feed-in Tariffs. Their reduction is likely to have a big impact on sales volumes in the UK and therefore close monitoring of take-up levels in the next few years will be required where any take-up is now reliant on market forces.

The scoping study has identified a number of issues to be resolved before demonstrating the presence of solar sales premiums in the residential property market. Therefore it provides areas to target for the STA and others with a vested interest in the solar sector, and are broadly broken down into issues related to: availability of data; and issues related to the valuation of property in the UK.

### Data Collection and Analysis

It has not been possible to verify whether or not solar sales premiums exist in the UK through this scoping exercise, due to the inadequacies of the available data. This is not to say that relevant data does not exist, simply that access to the data is constrained and/or subject to commercial or legal terms and conditions. Where full access to all the data is provided, details of the statistical analysis have been drawn from precedents of similar studies in the US and elsewhere.

There are sufficient volumes of data for both homes sales and solar installations to conduct a statistically relevant analysis for England, Scotland and Wales, where the total quantum of solar installations between 2009 and 2015 represents ~12% of the total homes sales transactions in England & Wales over the same period.

With the reduction of government subsidies for solar energy and therefore possibly funding for data collection of solar installations, it is vital that industry supports this function either through commercial arrangements or as part of a co-operative approach that benefits all stakeholders. STA is well placed to coordinate this activity and will consider options for managing the collection of data on solar installations.

### Industry Awareness

It is clear from the discussions with industry that information on solar systems is typically provided by the suppliers of systems. This is generally the case whether selling solar systems to existing homeowners or for systems sold on new homes by housebuilders or developers.

Housebuilders do not provide much detail of the solar systems installed within their developments – at least not voluntarily and rely on information provided to them from suppliers. Generally they do not market the benefits of solar systems since there is no hard evidence that the addition of solar systems adds value – this is what needs to be demonstrated.

Whilst information on the performance of solar systems is well understood and mostly well communicated by suppliers to existing homeowners once engaged, there is a lack of standardised information provided to professionals working on the valuation of properties, particularly residential property.

Discussions with estate agents and wholesale property information brokers indicate a significant lack of understanding of solar systems. Information on the energy performance of the property is provided on the EPC which must be produced for every residential sales transaction. Anecdotal evidence suggests this is rarely asked for or scrutinised by the prospective buyer and therefore even if it contained useful information on the presence of local energy generation, buyers may not be aware of it.

Discussions with the Royal Institute of Chartered Surveyors exposed a lack of understanding of the potential value of solar systems as assets that derive a return on investment. The Council of Mortgage Lenders (CML) does not provide any guidance on the potential value that solar systems may derive for the occupant and therefore whether this improves their credit worthiness.

Therefore there appears to be justification for investing in the following activities to support the property valuation sector to better understand solar assets on residential buildings:

- **Collection and publication of performance data** for solar PV (new & existing residential properties)
- **Develop and disseminate** transparent use of **asset appraisal methodologies**
- Seek **representation** on selected **working forums and panels**
- **Influencing key decision makers** throughout the residential property value chain

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<sup>i</sup> Selling Into the Sun: Price Premium Analysis of a Multi-State Dataset of Solar Homes: <https://emp.lbl.gov/publications/selling-sun-price-premium>

<sup>ii</sup> Appraising into the Sun – Six State Solar Home Paired-Sale analysis:

<sup>iii</sup> An investigation into the effect of EPC rating on house prices (DECC): [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/207196/20130613\\_-\\_Hedonic\\_Pricing\\_study\\_-\\_DECC\\_template\\_2\\_.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/207196/20130613_-_Hedonic_Pricing_study_-_DECC_template_2_.pdf)

<sup>iv</sup> Scoping Study on the performance and market value of energy efficient homes through analysis of Energy Performance Certificates (Scotland 2020): <http://www.2020climategroup.org.uk/wp-content/uploads/2014/11/EPC-Scoping-Study-doc-Scot-2020-Climate-Group.pdf>

<sup>v</sup> Home buyers appreciation of installed photovoltaic systems -a discrete choice experiment (Eindhoven University of Technology): <http://www.kenwib.nl/en/studyresults/home-buyers-appreciation-of-installed-photovoltaic-systems/>

<sup>vi</sup> “Barclays Mortgages reveals the top technology that can attract homebuyers”: [http://www.newsroom.barclays.com/r/3261/barclays\\_mortgages\\_reveals\\_the\\_top\\_technology\\_that\\_can](http://www.newsroom.barclays.com/r/3261/barclays_mortgages_reveals_the_top_technology_that_can)

<sup>vii</sup> Home transaction data in England and Wales are available from <http://landregistry.data.gov.uk/>

<sup>viii</sup> The Ofgem Feed-in Tariff Installation Reports are available from: <https://www.ofgem.gov.uk/environmental-programmes/feed-tariff-fit-scheme/feed-tariff-reports-and-statistics/installation-reports>