Up close and dynamic: why we need – and how we can deliver – a new understanding of the energy efficiency opportunity in Europe's homes

Will Rivers
EST
21 Dartmouth Street
London, SW1H 9BP
UK
will.rivers@est.org.uk

David Weatherall
EST
21 Dartmouth Street
London, SW1H 9BP
UK
david.weatherall@est.org.uk

Frances Downy
EST
21 Dartmouth Street
London, SW1H 9BP
UK
frances.downy@est.org.uk

Nuno Climaco
ADENE
Portugal
nuno.climaco@adene.pt

Keywords

actors, national energy efficiency plans, big data, housing refurbishment, market surveillance

Abstract

Across Europe, there is limited access to quality data on the energy efficiency of the building stock for governments and the supply chain. A recent report by the Buildings Performance Institute Europe (BPIE) summarised that: "In Europe, availability of building data is rather poor which results both from data gaps but also from lower transparency and limited access to data."[1]

This has several negative consequences for the retrofit market in Europe:

- Governments are less able to put in place robust targets and policies for carbon reduction.
- Manufacturers have lower confidence to invest without evidence as to the scale of the market.
- Installers do not have an efficient means of targeting their markets leading to a higher overall cost of delivery.
- Households have limited routes to access key energy efficiency information on their own homes to inform decisions and inspire action.

Simultaneously, across the retrofit landscape, many of the mass marketed, quick win measures have been completed. For example, in the UK is estimated that only 0.5 % of lofts have no insulation[2]. The challenge is therefore moving towards opportunities specific to each home, such as solid wall insulation and micro renewable technologies. Identifying these market opportunities relies to a greater extent on good quality data to target the right homes with the right measures.

The good news is that energy efficiency data is now being produced on an unprecedented scale across the EU. In 2014, 24 countries have an operational energy performance certificate (EPC) register[3]. Data is available on up to 40 % of homes depending on the member state[4]. The challenge is therefore in making that data accessible in a useful format.

Through the use of statistical models, big data analytical tools and geo-spatial mapping it is increasingly becoming possible to make data available in intuitive and powerful formats that enables users to gain valuable insight and improve decision making.

This paper highlights good practice examples of member states collecting, analysing and making data available to a range of market actors to facilitate a step change in the delivery of energy efficiency retrofit.

1. Energy Performance Certificates Across the EU, BPEI (2014) http://bpie.eu/epc_2014.html#.VQm1aY6sWuk.

2. Analysis from Department of Energy and Climate Change Quarterly Insulation Statistics https://www.gov.uk/government/statistical-data-sets/estimates-of-home-insulation-levels-in-great-britain.

3. Energy Performance Certificates Across the EU, BPEI (2014) http://bpie.eu/epc_2014.html#.VQm1aY6sWuk.

4. From interviews undertaken for EU Request 2 Action project.

Why we need a better understanding of the energy efficiency of the building stock and the potential for measures

There are a variety of reasons why data on the building stock is essential to the successful implementation of policies and programmes to improve the energy efficiency of the building stock.

DEVELOPING EFFECTIVE TARGETS FOR LEVELS OF ENERGY EFFICIENCY IN THE BUILDING STOCK AND MONITORING PROGRESS

In order to meet EU carbon reduction targets, member states need to develop national targets for carbon reduction. In order for these targets to be achievable, it is essential that they are based on a robust evidence base of the potential carbon reductions within the economy. In all sectors, gathering accurate data on the potential for savings is a challenge but this can be a particular challenge for the building stock which is characterised by a large volume of diverse units with different owners and ownership structures.

However, as the building stock accounts for 36 %[5] of the EU's total end use energy consumption it is imperative that a robust understanding is achieved of the remaining potential for measures.

An example of the importance of gaining an evidence base on the potential for measures in the housing stock can be seen with the UK Committee on Climate Change (CCC). The CCC was established in 2008 by the UK Parliament to advise and monitor the UK government on its progress toward meeting the legally binding target of 80 % emissions reduction by 2050. The CCC is also responsible for setting the legally binding 5 yearly carbon budgets within which the UK must operate in order to progressively reduce emissions to the overall 2050 target.

The CCC systematically analyse the available evidence on the remaining potential for measures in order to inform Marginal Abatement Cost Curve analysis. This analysis feeds in to both the overall level of the Carbon budgets set for the government to achieve and also the recommendations provided to government on how to achieve the carbon budgets.

An example of the evidence base feeding in to the 4th Carbon budget covering the period 2017–2022 period can be found in the Element Energy/Energy Saving Trust: Review of energy efficiency evidence base for 4th Carbon budget[6].

This analysis enables the CCC to make solid recommendations to government and set targets that are deliverable. This is particularly important when the government questions the deliverability of targets. This situation arose in 2013 when the UK government questioned the deliverability of the 4th Carbon budget. Analysis from the CCC was able to demonstrate the deliverability of the target and the carbon budget remains unchanged.[7]

Through this example we can see the importance of having robust data on the building stock to underpin targets at the national and local levels.

THE IMPORTANCE OF DATA FOR LOCAL AUTHORITIES AND SCHEME MANAGERS

Access to good quality data on the housing stock is of equal importance to local authorities and other bodies responsible for planning schemes, appointing delivery agents, raising investment and securing funding for schemes.

In the UK, in Scotland, local authorities are required to bid for a proportion of a total pot for retrofit: The Home Energy Efficiency Programme Scotland: Area Based Schemes (HEEPS ABS)[8]. In order to help them do this, the Scottish Government has funded for EPC data plus other datasets to be made available to local authorities in Scotland to enable the local authorities to identify areas in greatest need of measures and design a project accordingly. The Scottish Government then allocates the HEEPS:ABS funding based on these applications from the local authorities.

Without the EPC data, the local authorities would often rely on local knowledge of their stock to identify the potential. Therefore, systematic access to data allows a fuller assessment of the opportunity and the areas of greatest need.

Access to good quality data allows local authorities and scheme managers to plan schemes that are deliverable, to provide evidence to finance bodies as to the scale and deliverability of the project and to develop a robust delivery plan with the delivery partners, directing them to the areas and households to be targeted.

THE IMPORTANCE OF ENERGY DATA FOR FINANCIERS

A recent report by the Energy Efficiency Financial Institution Group (EEFIG) highlighted the key importance of good quality data to the long term challenges of obtaining long term financing for energy efficiency. In 'Energy Efficiency, the first fuel for the EU Economy: How to drive new finance for energy efficiency investment'[9] EEFIG makes several key recommendations in order to ensure a sustained impact on the EU 2030 Climate and Energy Strategy including:

- "More Proactive Engagement and Continuous Improvement and Usage of Energy Performance Certificates (EPCs) from Financial Institutions: There is increasing evidence that EPCs are positively impacting the value for investors in residential and commercial property portfolios. The building and finance industry should engage in the process of improving and strengthening the quality of Energy Performance Certificates across the EU, using successful examples like KfW-Energieeffizienzhaus for German residential homes. This can be achieved through the input of higher quality and more detailed data, internal verification of EPCs, making EPCs publicly available and providing feedback to policy makers on EPC upgrades from investors."
- "Operational" Energy Performance Database: "Better quality data" for energy efficiency investments has been an underlying, yet slightly generic, request from many financial institutions and industry stakeholders. An "operational" buildings energy performance database in each of the EU-

5. European Climate Foundation: http://europeanclimate.org/bpie/.

6. Committee on Climate Change (2013) http://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf.

7. Committee on Climate Change (2013) http://www.theccc.org.uk/pressreleases/ccc-concludes-that-there-is-no-basis-to-change-the-fourth-carbon-budget-11-december-2013/.

8. Energy Action Scotland (2014) www.eas.org.uk/page.php?id=3206.

9.Energy Efficiciency Financial Institution Group (2014) https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report%20EEFIG%20v%209.1%2024022015%20clean%20FINAL%20sent.pdf.

28 Member States which conforms to shared data standards and collection protocols and can be accessed and supported by bespoke portfolio benchmarking analysis such as those being piloted in the UK by JLL and in France and Germany by the Green Rating Alliance.

THE IMPORTANCE OF DATA FOR THE SUPPLY CHAIN

The supply chain needs access to good quality data for a number of reasons:

- Macro data enables them to identify strategic markets and opportunities for product development.
- Macro data enables them to identify areas for investment in staff and facilities.
- Micro level data enables them to more effectively target the right customers with the right measures thereby reducing the costs of marketing and lead generation.

Feedback from the industry in the UK has suggested that lead costs for solid wall insulation can be anywhere in the region of £100–£600[10]. Therefore, the cost of finding and converting a lead is a key cost to the industry and one that increases as the right opportunities become harder to identify. Although not all of this cost can be mitigated by the use of data, it is clear that targeted marketing and targeted delivery of schemes can work to reduce the level of investment required in finding suitable properties. This is evidenced by the large market for data on the housing stock and the propensity of householders to fund measures in the UK.

THE IMPORTANCE OF DATA FOR HOUSEHOLDERS

Householders need access to good quality data for a variety of reasons: The EPC is designed primarily as an information resource for householders, yet at present, there are very few ways in which the householder can access or interact with their homes data in meaningful way, beyond the initial presentation of a certificate. Allowing wider access to data will enable more organisations to provide useful data to householders in a variety of formats. Where EPC data is made available on a wider scale, it can be used as a tool to engage and enthuse communities and individual householders. For example, by comparing the energy ratings of homes within a street or community, homeowners can be prompted to take action to improve their energy efficiency. The Meer Met Minder Energy Label Atlas project in the Netherlands (discussed further on in this report) is an excellent example of this.

The current availability and use of data across the EU

WHICH COUNTRIES HAVE AN EPC DATABASE AND WHAT INFORMATION IS COLLECTED?

The Buildings Performance Institute Europe[11] recently published a report on the implementation status of EU legislation regarding EPCs and found that "there are 24 countries that have an EPC database, of which 19 are central databases and five are regional databases. The regional databases are in Spain, Austria, Italy, UK and Belgium and this approach makes national analysis difficult, however, Spain, Austria and Italy are currently developing a national EPC register that will allow national level analysis."

The scope of information collected varies and BPIE identified the following types of data that are commonly included in the EPC database:

- Reference information e.g. registration number, building type, name of the owner, year built.
- Buildings geometry e.g. useful floor area, heated floor area.
- Type of EPC, i.e. calculated or measured, period of validity.
- Energy performance information e.g. energy label, annual energy consumption per end-use.
- Recommendations and expected energy savings.
- Other e.g. GHG emissions, share of RES, energy losses, the transaction price, etc.
- Energy assessor details e.g. name, registration number.

To highlight the variances between different registers the following examples from BPIE demonstrate both different approaches and interpretations of the legislation, but also different stages of development.

Germany has a database that includes the identification number of the EPC, the building type, the calculation method, region where the building is located, the responsible assessor (who needs to provide detailed information when requested). However it is the only database that does not collect specific information regarding the energy performance of buildings. **Romania** only a scan (a .pdf or .jpg) of the EPC which is uploaded to the database, therefore any analysis would require manually extracting information from all EPCs. **Bulgaria** had an original database from 2005–2010 that was in Excel (xls) format but since 2010 a MSQL database has been in place allowing for greater analysis of EPCs. All information from the EPC is captured in the database. **Portugal** is more advance and has an SQL database with 250 input parameters per EPC for over a million EPCs.

The Request2Action project[12] has examined the EPC databases available in 9 countries in detail and identified the following key features and differences between them (Figure 1).

Therefore there are wide variations in the format of the data and the scope of the information that is stored in an EPC database. This will have an impact on the ease and type of analysis that can be done with a database and how it can be used as a tool to promote uptake of energy efficiency measures.

10. Energy Saving Trust consultation with industry partners.

11. Energy Performance Certificates Across the EU, BPEI (2014) http://bpie.eu/epc_2014.html#.VQm1aY6sWuk.

12. Request2Action is a European Commission co-financed project across 9 countries that focuses on how data from Energy Performance Certificates (EPCs), alongside other data, can be used to drive home energy efficiency improvements. We are piloting new approaches to make EPC data useful for governments, private companies and individuals. Then, building from these pilot projects, we are creating national home energy data hubs, bringing together demand and supply-side actors. http://building-request.eu.

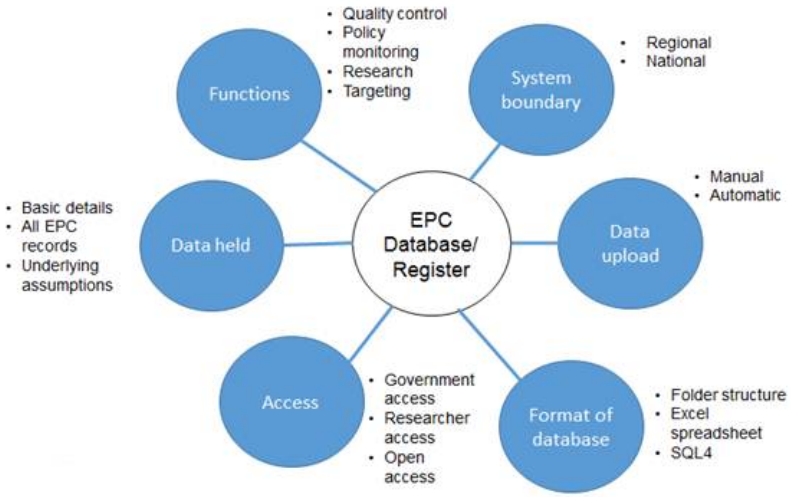


Figure 1. Key differences between EPC databases between member states. Findings from partners on the Request 2 Action project.

FOR WHAT PURPOSES IS EPC DATA BEING USED IN DIFFERENT MEMBER STATES?

Through interviews with the 9 Request2Action partner countries, we found the primary users of EPC data are national and regional/local governments, reflecting the fact that these bodies are often the only ones to whom EPC data is available. Common ways in which the data is being used are:

- Policy analysis – assessing the impact of policies and programmes and helping to plan new ones.
- Adapting building regulations and codes.
- Research and statistical institutions analyse the state of the building stock.

In **Austria** the Zeus database for the Salzburg, Styria and Carinthia region the EPC data is being used for quality assurance of energy performance certificates, and applying for subsidies or construction permits. The insights gained from new construction or refurbishment projects have helped to improve the promotion of schemes and also influenced changes to the Building Code and regulations. Since its establishment, the database system has been extended to collect the information based on on-site home energy consultation and energy accounting for comparing the calculated energy demand with the actual energy consumption. In the Vorarlberg region the Energieausweis-Zentrale EPC database has been used for several research projects, for infrastructure planning, and to influence subsidy programmes. In addition statistical evaluation has been undertaken using the information of the EPC database system to analyse the building stock.

In **Belgium** the EPB databank for new build properties has been used by the region to track the evolution of energy performance of new residential buildings in Flanders since 2012. Data from the EPC database for existing buildings is being used to evaluate the building stock, and assess the impact of regulation and subsidy programmes.

In **Greece** the EPCs that have been issued through the national programme "Energy Efficiency at Household buildings" which is approximately 33,000 EPCs, have been utilized to review and update the energy efficiency targets of the NEEAP. The actions identified in the EPC and recommendations regarding retrofitting activities are used to partially cover the needs of Article 4 of the Energy Efficiency Directive (2012/27/EU) to develop a building renovation and investment roadmap. The data is also being used in the development of the new "National Strategic Reference Framework" (ESPA), a programme which subsidises projects including several energy efficiency related projects.

In **Portugal** EPC data is used to analyse and develop policy in several ways. It is used to verify the effectiveness of some NEEAP measures, for example:

- To verify the measures implemented through the Energy Efficiency Fund (part of NEEAP) as an energy certificate is produced before and after the retrofit works takes place.
- To measure energy performance of public buildings and improvement measures (ECO-AP Project).
- To monitor the number of EPCs produced.

EPC data has been used for further policy analysis and development in the following areas:

- EPC database was used to define the baseline of building performance. This baseline was used to establish energy policies and strategies by the Secretary of State of Energy (Ministry of Environment Urban Planning and Energy). The information from the EPC database helped the government to design funding schemes for building refurbishment.
- This baseline was also used as instrument for implementation of some financing instruments, such as the National Strategic Reference Framework, regarding energy efficiency investments.
- The data was also used to map energy efficiency measures based on target typologies and measures, costs and savings.

Municipalities have used the data to plan their retrofit strategies and priority intervention areas. They also use the database for calculation of the tax exemption which applies to EPC bands A+/A. The tax offices can also access the EPC database to validate the retrofit works associated with tax deduction

and collect information to validate the energy class (A+/A) of houses with higher tax deduction incentives. The real estate market association uses the data to produce a market study and a website to check the EPC label used in rental or sale adverts uses credible data. Finally, universities and research institutes use the database for their studies and characterisation of buildings by typology and/or region.

In **Slovakia** the data collected is partly used for NEEAP, but together with the information from other sources, for example the monitoring system for efficiency in energy use. This monitoring was developed for the purposes of the NEEAP evaluation and includes information about the energy consumption of defined types of buildings. It is also used to develop policy and helped to create the strategy for the refurbishment of residential and non-residential buildings in Slovakia. The combination of EPC data with other related instruments and data is important, for example it is used alongside data from a project that is focused on energy audits of public buildings. The combined information helps to identify the priority order in which the public buildings should be according to their energy consumption.

In the **Netherlands** EPC data has been used for policy development, policy evaluation, rent legislation, scientific research, providing information for customers and to access financial instruments such as loans. Because the EPC values are publically available, this has enabled those outside government to make use of the data. For example the commercial sector have taken the EPC rating and combined it with publically available information on building characteristics to estimate an EPC rating for all properties in the Netherlands. This information is then displayed on a map for the whole country and anyone is able to zoom in and check the EPC rating (actual or estimated) for any building.

In **England & Wales** Local Authorities can access the EPC data and use it to help plan local policies/strategies for renovation of their building stock. As the database is held by a private company it is not known how many organisations paid for and accessed the EPC data, but it is likely to have been used by large private companies (who are authorised users) to plan their supplier obligation requirements or targeting. In Scotland the Energy Saving Trust has combined EPC data with a range of other data sources and through statistical analysis has address level data on the potential for low carbon retrofit. This is used by energy suppliers, Scottish Government, installers, manufacturers to understand and target the market for low carbon retrofit.

HOW OPENLY IS EPC DATA BEING MADE AVAILABLE WITHIN MEMBER STATES?

Several countries have 'open access' to EPC data, however the format, scope and way the data is made available has a big impact on how that data can be used by different market actors such as governments, installers, home owners or financiers. Very few countries have access to all data from the EPCs in a format that can be used for analysis. Looking at the 9 countries involved in the Request2Action project the majority release aggregated statistics, sometimes for particular audiences, buildings elements but only one region in Italy has a truly open access database. A brief summary of the level of access of EPC data is outlined below for the Request2Action partners except for Poland who do not have a database that holds a significant number of EPCs.

Austria has regional EPC databases which take different approaches. In the Salzburg, Styria and Carinthia region the Zeus database access is limited to selected organisations, mainly the municipalities in the public sector. The owner of the property has also access to the database but only to the data on his own property. In the Vorarlberg region the "Energieausweis-Zentrale EPC database is also available for the municipalities as well as building facility managers. Parts of the information (for example own EPC) can be made available for the private citizens.

Uses: Many research projects, infrastructure planning, subsidy programmes as well as statistical evaluations have been undertaken using the information of the EPC database system.

In Flanders, **Belgium** there are separate registers for the new and existing buildings – the EPB databank and the EPC databank, respectively. For the new buildings EPB database the raw data is not publicly available, but statistics and trends are analysed and published for research purposes. Likewise for the EPC database for existing buildings the raw data isn't available to the public but is currently being used by "Steunpunt Wonen" (https://steunpuntwonen.be/) to generate statistics and trends and for research purposes.

Greece has had a central EPC database system since 2011 and a new digital platform for control and analysis of EPCs is currently being finalised. There is an annual public statistical release of aggregated data that gives detail about areas such as the number of EPCs per year, the number of EPCs distributed per decade, the distribution of EPCs according to the type of building and energy consumption (kWh/m^2) according the climatic zone and type of building. Access can be granted to EPC data (excluding personal data) if a formal request is made to the relevant ministry department outlining the reasons for having access to the data.

Italy has 12 regional EPC databases, and 7 regions have their own EPCs. A national EPC information system which gathers data from regional registers is being developed. Each region makes different data available to different market actors but in general data from EPC registers is generally accessible by regional and municipal authorities but is rarely used for statistics and research. Only some sections of some registers are available to subjects that are not experts or authorities. Two regions have their EPC database open to agencies for studies, to notary officials or on demand (including for trade organisations). Lombardy is the only region to have adopted an open data approach allowing full access through the web. Other regions mainly allow limited access to experts and agencies.

Portugal has had a national EPC database since 2007 which is managed by ADENE. The database holds data for around 10 % of buildings in Portugal and a large amount of data is collected per EPC – around 250 values.

All individual EPCs are available to homeowners but in pdf format meaning that little analysis can be done by anyone without significant manual effort. ADENE does provide monthly technical, generic and specific data for different Portuguese entities on statistics, benchmarking and financial reports. In some cases some sectors are provided access to partial information from the database, for example the real estate sector can access the EPC data to see the EPC value to include in the selling or renting of properties. Additionally municipalities and universities and research institutions can use the data.

In **Slovakia** a national EPC database has been established since 2010 and access to the raw data is only available to certified experts who require a log in. However the EPC rating is available to anyone to look up if one has been done. Additionally general information such as number of EPCs per region and per energy class, is publicly available.

The Netherlands has a national EPC database which has been in place since 2007 and the public has access to the individual EPC rating for each buildings plus aggregated statistics such as number of EPCs per class, age band and building type which can be downloaded in a table format. Access to individual EPCs is also possible by entering the number of EPC, postcode and address. However, the government has started a new campaign to issue a provisional, estimated EPC for all buildings in the Netherlands and sending it to the owner starting in January 2015. This provisional EPC has been based on statistical analysis of building typology of the neighbourhood. This aim of this campaign is to increase the energy improvement of the building stock.

The **United Kingdom** has 3 regional EPC databases for England & Wales, Scotland and Northern Ireland. In England and Wales, the Energy Performance of Buildings register, for which the Department for Communities and Local Government is responsible, holds all of the data for:

- Energy Performance Certificates (domestic and non-domestic);
- Display Energy Certificates;
- Air Conditioning Inspection Reports.

A quarterly public statistical release of aggregated data is available to the public and individual EPCs are publically available and searchable by address. Individual EPCs are only available as a pdf, limiting any analysis that can be done. It is possible to obtain access to bulk EPC data if you are an approved organisations (which does include accredited private sector companies as EPCs are linked to the Government's flagship energy efficiency policy Green Deal which is market led). However there are significant fees to access the data, particularly at a very granular level which means in practice it is not accessible to the majority of market actors. The Government do have a commitment to open data and are looking to make England & Welsh EPC data more widely available. In Scotland the data is only accessible to approved organisations, primarily Local Authorities.

BEST PRACTICE IN OPEN DATA INITIATIVES – IRELAND AND LOMBARDY

Based on the experiences of the Request 2 Action project we have identified two examples of where high quality data has been made available in a genuinely open fashion.

Ireland

The Sustainable Energy Authority of Ireland (SEAI) which was established as Ireland's national energy authority under the Sustainable Energy Act 2002 collects and evaluates the data on EPCs. There more than 682,000 EPCs collected in the database. In 2012, SEAI launched a national BER (building energy rating which equals EPC) research tool which is an open platform that gives access to all data from the EPC database (excluding personal information). This tool is designed primarily for researchers who can generate and download the sample of row date per location, age band, energy class, rating type, etc.

The EPC and labelling information of the buildings do not fall under data privacy law of Ireland. The individuals can look up an Energy Performance Certificate online via the register website, comparing the energy performance of their property with that of similar buildings. The authorised organisations, EPC assessors, real estate agent and building owner can have access to the Energy Performance Certificate bulk data or extracts from the EPC register.

The statistical data is updated every night and can be seen on the EPC data base website. The data can be used in combination with other data sources including census data. The grants for homeowners to their homes with energy efficiency measures can be supported by the information of the EPC of that building. The data is starting to be used by other organisations for strategic energy planning, for example another IEE project EPISCOPE has developed a mapping tool using the EPC data to show building energy information such as U-values, heating controls, energy band A–G building plus additional information such as building age, population census data including age and economic affluence.

Lombardy

The EPC database in Lombardy (called CENED[13]) was established for the Lombardy region in 2007. Host and manager of the database is Finlombarda, a regional in-house company. EPCs are directly uploaded by energy experts using the regional software. More than 1.5 million EPCs are collected in this database. The quality of the EPCs is controlled regularly on a statistical basis. Trades associations are developing a GIS to boost a wider use of the CENED database from their members. The CENED EPC register is open to all interested parties: Lombardy region has adopted an open data approach allowing use of EPC data also by trades. Every building or building unit with an EPC is listed in the database and its relevant information on quality of the building elements, heating system and energy performance is disclosed. Only the owners' data are protected for privacy reasons.

The CENED register is linked to the building cadastre (land tax register) and is integrated, together with the regional Cadastre of Building Heating/Cooling systems (CURIT)[14] and the Ground Source Heat Pumps[15] register, into a wider Information System for Energy and Environment (SIRENA20). This system feeds and updates the regional energy balance and the regional emission monitoring system.

Thousands of building operators, experts, installers and maintainers, managers and authorities use and provide input data into this system that facilitates simplification of bureaucracy that go beyond time and cost savings.

Moreover, as a result, the statistical evaluation of these data helps the region in updating its climate goals. The elaboration of scenarios in new Regional Energy and Environmental Plan (PEAR) including the evaluation of the potential energy saving in the residential sector in Lombardy[16] is also done based on the inputs of the EPC database, crossed with other information within this regional system intelligence.

13. http://www.cened.it/home
14. http://www.curit.it/home
15. http://www.rinnovabililombardia.it/home
16. http://www.energialombardia.eu/pear/documenti

Table 1. Address level outputs provided to Scottish local authorities from the Scotland EPC/Home Analytics project.

Home Analytics Scotland EPC modelling list of variables	
UPRN, address and location	Property type
Property tenure	Habitable rooms
Main fuel type	Total floor area (m2)
Property age of construction	Number of dwellings within building (blocks of flats)
Boiler efficiency band (A- G)	Wall insulation
Wall construction	Glazing type
Loft insulation	Environmental Impact Rating band (A-G)
Energy Efficiency Rating band (A-G)	Estimated RDSAP Co2 emissions (tCO2 per annum)
Estimated RDAP fuel bill (£ per annum)	Hard to Treat Cavity wall risk
HTTC - Exposure to wind driven rain zone	Distance to nearest gas meter
Listed Building grade	Roof orientation (E, SE, S, SW, W)
Distance to nearest biofuels supplier	Wind speed at 10m above ground level
Solar PV potential output	Garden size
Distance to nearest dwelling	ECO HHCRO eligibility
ECO CSCO eligibility	ECO CSCO Rural eligibility
Likelihood of income deprivation	Fuel bill (percentage of median)
High fuel cost, low income indicator	High fuel cost, low income, vulnerable circumstances indicator

Many municipalities in Lombardy have been able to estimate potential impact of actions on buildings stock in their territories by relying also on EPC data, including public buildings. The required monitoring is also based on the trend of energy performance certificates. Access to CENED and use of SIRENA also helped them to draft the sustainable energy action plans required to signatories of the Covenant of Mayors.

Finally a crossed analysis with the database of national incentives to building renovation established from the Ministry of Economic Development and the Ministry of Finance in 2007 is being tried. Host of the incentives database (55–56 % tax deduction) is the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) 20.

Within the Request2Action Lombardy and ENEA (Italian project partner) will develop a model methodology for monitoring building retrofit by analysing and integrating the CENED EPC database with other significant data. Feasibility of collecting evidence from the regional EPC database CENED in a centralised information system will be analysed and validated within the same pilot project.

Overcoming barriers to the usefulness of EPC data – a case study from Scotland

The systematic collecting, storing, processing and making available of key data assets, such as EPC data, is the first fundamental step in gaining value from the information. However, this data in its raw format often requires additional analysis and processing before it can be utilised to gain insight, inform policy and improve the targeting of measures.

This chapter focusses on the experience of making EPC data available in Scotland and the processes undertaken to address the systemic weaknesses and errors in the raw source data.

The Scottish Government funds the Energy Saving Trust to make EPC data available to local authorities in Scotland, alongside other datasets, so that the local authorities can:

- Plan energy efficiency schemes under the government's HEEPS:ABS programme.
- Plan energy efficiency schemes that bring in UK national funding to Scotland.
- Target the homes in greatest need of improvement, including those in fuel poverty.
- Develop robust targets and strategies for improving the energy efficiency of the housing stock.

The total list of data items available to local authorities for every address in Scotland is provided in Table 1.

Analysis of the EPC register in Scotland revealed that there are four key areas of weakness in the raw EPC record that needed addressing before data could be put to use by the Scottish local authorities.

- Data will routinely go out of data and is not updated when measures are installed.
- The data is not representative and there are biases and skews toward certain categories.
- There a number of errors in the data through poor data collection or processing.
- The EPC record in Scotland is approximately 28 % complete. Values need to be calculated for the other 72 % so that the data can be used for address level targeting and analysis of the whole stock.

These challenges were overcome as follows.

BRINGING DATA UP TO DATE

As EPC databases are a collection of data over time, they will naturally contain both recent and old information. For example in Scotland, records from 2007–2015 are currently held in the database. Major changes to the housing stock have taken place

over this time period. For example, in Scotland market insight shows that inefficient boilers are replaced at a rate of approximately 5 % per annum.[17]

It is therefore essential that data on the installation of measures is overlaid on the EPC data to understand the current state of the housing stock. In Scotland, this was achieved by overlaying the Home Energy Efficiency Database (HEED) on to the EPC data. HEED is a collection of energy efficiency installation data from a wide variety of government funded and independent schemes. Data is collected on cavity wall insulation, loft insulation, double glazing, condensing boilers and heating systems.

Combining the two datasets enables us to understand the changes that have happened at the individual address level, for example where a cavity wall has been insulated post EPC.

As a further method of ensuring that the final dataset is contemporary, the data in Scotland is also cross referenced with national housing survey data. In particular, the Scottish House Condition Survey (SHCS). The SHCS is an annual survey of 7,000 dwellings across Scotland that provides a statistically robust sample of the current state of the housing stock. The final numbers from the updated EPC database are cross checked with the SHCS to ensure that the address level database is representative of the wider stock. This is important because it is rarely possible to capture every instance of an installation in the housing stock. For example, a high proportion of the loft insulation market in the UK is undertaken by homeowners themselves and not officially recorded but these changes are picked up by a representative sample of the stock.

ADDRESSING SKEWS AND BIASES IN THE DATA

EPC data in Scotland is registered at the point of sale or rent. As such it is not collected in a way that is designed to be representative of the wider housing stock and there are certain skews and biases that exist in the dataset making it unsuitable for uses that require a representative picture of the stock. For example, in Scotland, it was found that the proportion of private rented and social rented housing was higher in the EPC data than it was in the wider housing stock. Therefore, it is necessary to cross reference the raw data with statistically representative sample data such as national housing surveys or Census data.

In the Scotland EPC data project, data on the tenure of the stock from the 2011 Census was used to calibrate the raw EPC data within small geographic areas (Census Output Areas) covering approximately 125 homes each.

ACCOUNTING FOR ERRORS IN THE DATASET

Detailed analysis of the Scotland EPC data has shown that there are a number of errors in the raw data. The source of these errors is, in most cases, unclear. However, it is thought to be a combination of error on the part of Domestic Energy Assessors, who complete the EPC, and potentially fraudulent registration of EPCs with higher ratings than the property should achieve for the purpose of qualifying for funding schemes such as the UK Feed In Tariff for Solar PV systems (which requires a minimum EPC rating of a D).

To identify and account for these errors, we cross referenced the EPC data with other robust sources of information where available. A particularly valuable dataset was data on the presence of gas meters in Scottish homes which was provided by Scotia Gas Networks (SGN). This identified 9.1 %[18] of EPCs as having an erroneous fuel type record. In many cases, a fuel type of 'mains gas' had been recorded even though the house was many miles from the nearest mains gas connection. The SGN data enabled us to overwrite what were believed to be erroneous fuel type records.

FILLING IN GAPS IN THE DATA

At present, across the EU, the Request 2 Action project has found that the population of EPC databases can range from 5 % to 40 % across member states. In Scotland, the volume of EPC data available for the Home Analytics project is 28 %. These volumes of data will increase over time, however, at present, EPC data does not provide a comprehensive profile of the housing stock. This limits the applications that data can be used for. For example, in Scotland, a key policy focus for local authorities using the Home Analytics Scotland dataset is to identify homes likely to be suffering from fuel poverty. In this policy objective, the local authority cannot ignore the potential vulnerability of 72 % of the housing stock on the basis that an EPC has not yet been completed. Therefore, a key part of the Home Analytics Scotland is to develop statistical models, geospatial models and tested assumptions that impute values for addresses where no EPC is currently available.

Table 2 shows the percentage of real data available for each dataset and the overall accuracy of the dataset including predictive models. The 'real data' column in this table includes additional datasets to the EPC data, such as HEED data.

Geo-spatial models can also be used to gain valuable insight that is not collected as part of the EPC process. For example, in the Scotland Home Analytics project, Ordnance Survey MasterMap is used to derive key information regarding the housing stock such as the roof orientation, m^2 footprint of the dwelling and the garden size.

Additional datasets are also used in Home Analytics Scotland to add value to the EPC data. For example, wind speed data is added to help inform the address level potential for small scale wind turbines and socio-demographic data is used to understand the potential for funding.

Presenting and communicating data to users

The quality of the data collected, processed, stored, analysed and improved will ultimately count for nothing unless an effective method of communication is employed to make the data available to those who need it and in a format that is useful to them.

Databases often require specialist software and skills in order to access and analyse data. Typically these skills can be in short supply within organisations and there is often a disconnect between those responsible for processing the data and those who would benefit the most from the insight.

However, there are examples of good practice where data is made easily available to users through non-specialist software

17. Committee on Climate Change (2013) http://www.theccc.org.uk/wp-content/uploads/2013/12/Review-of-potential-for-carbon-savings-from-residential-energy-efficiency-Final-report-A-160114.pdf.

18. Analysis undertaken as part of Home Analytics Scotland project by Energy Saving Trust for Scottish Government.

Table 2. Levels of real data vs. modelled data in Home Analytics Scotland outputs and overall levels of accuracy.

Home Analytics Scotland v3.0	% of total from real data	% modelled data	% Predictive accuracy	% Predictive accuracy to within 1 band*
Property type	92%	8%	98%	
Property age	28%	72%	89%	
Property tenure (Social/Private)	50%	50%	94%	
Property tenure Private (Rented/Owned)	52%	48%	96%	
Property tenure Social (Local Authority / Housing Association)	24%	76%	95%	
Wall Construction	44%	56%	92%	
Wall Insulation	37%	63%	94%	
Glazing type	33%	67%	95%	
Loft Insulation	37%	63%	78%	83%
Habitable Rooms	27%	73%	73%	92%
Boiler efficiency Band (A-G)	18%	82%	73%	82%
Energy Rating Band (A-G)	27%	73%	75%	96%
Environmental Impact Rating (A-G)	27%	73%	75%	96%

*loft insulation: correctly predicts less than 100mm / greater than 100mm rather than to within 1 band

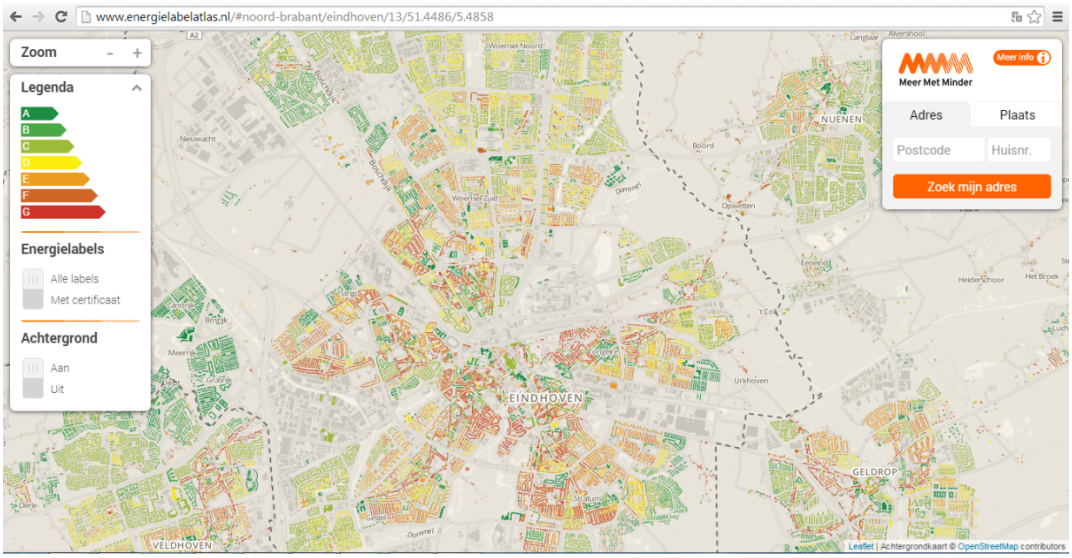


Figure 2. Screenshot of the Meer Met Minder Dutch Energy Label Atlas showing energy labels in Amsterdam.

and accessible formats. Geo-spatial mapping has long been employed as a technique for communicating data to a wider audience in a format that is more readily accessible for non-technical users. Modern data analysis and Business Intelligence Platforms can provide highly intuitive ways of manipulating and visualising data enable more effective decision making.

In this Chapter we will analyse some examples of good practice from across the EU of sophisticated data platforms that overcome the barriers of accessibility and interpretation of data.

NETHERLANDS – ENERGIE LABEL ATLAS

The EPC rating of every dwelling with an EPC is publicly available in the Netherlands. This has enabled various third party organisations to develop insights and tools using the EPC rating information. An example of this is the Energie Label Atlas developed by Meer Met Minder ('More with Less'), an organisation promoting energy efficiency in the Netherlands.[19]

The Energie Label Atlas utilises open source data platforms such as Open StreetMap so that no licence fees are associated with use of the tool. This is a key element of the tool being open access and free for all to use.

The Energie Label Atlas includes layers for

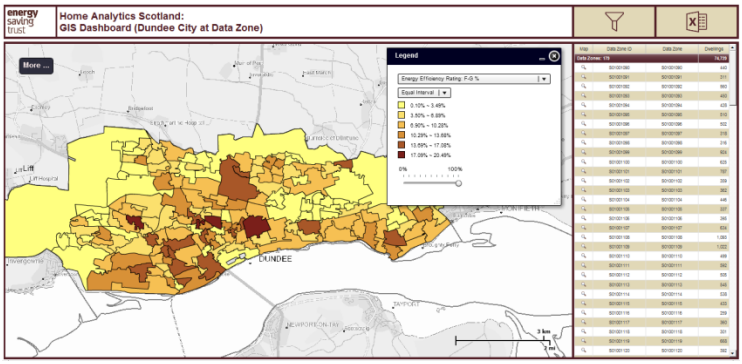
- Real Energy Labels (EPCs) only.
- Real and modelled Energy Labels.

Modelled EPC are based on calculations relating to the age of the property. This Atlas provides a free to use open map of every address in the Netherlands (Figure 2).

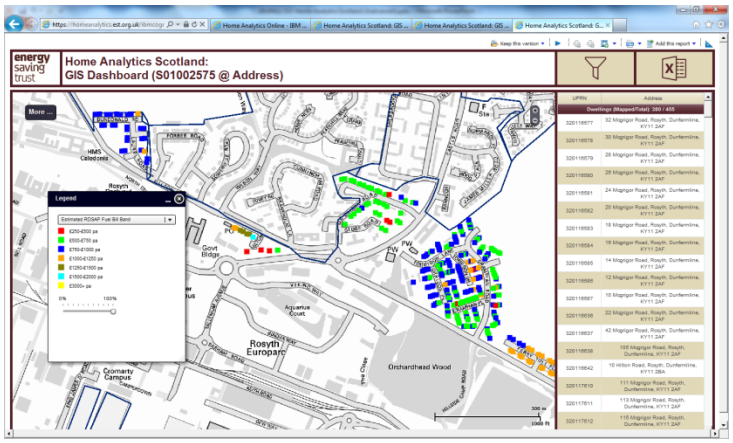
Users can zoom in to any city or town and view data on every individual address in the Netherlands. Users can differentiate between the actual EPC labels provided vs. the modelled EPC labels.

The key asset of the tool is that it is open for any individual or organisation to use, meaning there are a very wide variety of beneficiaries:

19. www.energielabelatlas.nl/



Figures 3. Screenshot of the EST Home Analytics Scotland Portal (fuel poverty).



Figures 4. Screenshots of the EST Home Analytics Scotland Portal.

- Individuals can easily see the rating of their home or any home they may wish to purchase or rent.
- Communities and householders can easily compare their energy efficiency to that of neighbours or neighbouring communities.
- Tradespeople can quickly identify potential areas that require energy efficiency upgrades so that they can target their market activity better.
- Local authorities can quickly identify areas that require the most energy efficiency upgrades.

The former Vice President of the Netherlands, Maxime Verhagen, said about the tool: "All homeowners, installers and contractors can now be directed to the Battle of the improvement of … private homes." It is hoped that such open access platforms can lead to greater co-operation between municipalities, industry, community groups and banks as they share a platform for understanding the housing stock.

HOME ANALYTICS SCOTLAND GEO-SPATIAL PORTAL

In Scotland, the roll out of the EPC dataset to local authorities encounters a wide variety of capabilities for analysing and interpreting large datasets amongst local authority officers. Many local authority officers are comfortable manipulating datasets of up to 250,000 rows in spreadsheet, however, in some cases, spreadsheet skills are very limited. Therefore, it was deemed by the Energy Saving Trust and the Scottish Government that a more intuitive and engaging platform is required.

A key consideration highlighted by many local authority officers is the need for data to be displayed on maps. Maps provide two key functions in assisting in the delivery of local energy efficiency programmes:

- They enable a spatial analysis of the opportunity to assist in the logistical planning of the programme.
- They provide an easy way for political decision makers to engage with a programme and understand the benefits to the wider area.

In Scotland, the focus has been on providing enhanced functionality within a GIS based portal to enable all local authority users to access and interpret the data intuitively and effectively.

Users can:

- Filter the data by a range of measures to target suitable properties,
- Output data to spreadsheet for a wide range of geographies,
- Alternate between different maps showing the potential for different measures, and
- Drill down within the map right down to the address level.

Figures 3 and 4 show screen shots of the portal for the City of Dundee. Figure 3 shows the presence of fuel poverty.