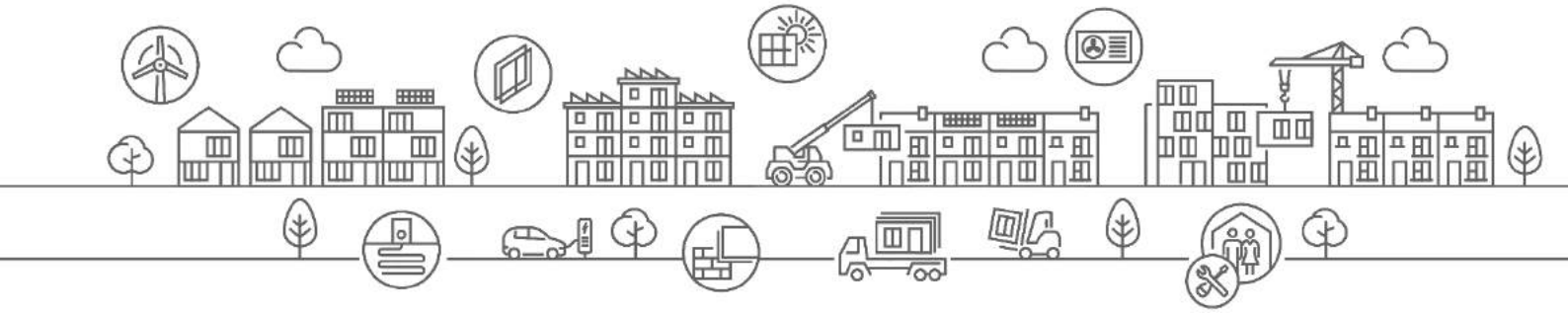
SOCIAL HOUSING RETROFIT ACCELERATOR

Data for retrofit projects

Toolkit

30th March 2022



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Summary

Good quality data is the foundation for any retrofit project and developing good practices to manage and improve your data quality are valuable skills. Confidence in your underlying stock portfolio data will aid you in retrofit programme decisions and prioritisation of which homes you'll target with which retrofit measures.

Who is this toolkit for?

This toolkit is relevant to senior management and all key project participants. It is particularly relevant for team members who manage your housing stock data and/or are focused on planning retrofit projects.

What will this toolkit help with?

This toolkit describes the recommended best practices for how to better manage your existing quality housing stock data. It will help you to:

- Understand the processes needed to collect data and calculate your homes' energy performance
- Conduct a self-assessment to understand your current position on data governance and management, data quality and existing energy performance data
- Understand how to:
    - Collect data
    - Aggregate data
    - Improve data quality
    - Calculate energy performance (baseline and expected)
    - Validate your data.

How do I use this toolkit?

- **Level 1** – Outlines current challenges, solutions, and processes around housing stock data
- **Level 2** – Provides a framework for achieving good quality housing stock data
- **Level 3** – Complete a self-assessment to understand your current state and understand what actions you can take.

When should I use the toolkit?

This toolkit should be used at the very start of planning a retrofit programme and you should refer to it as the programme develops. The data will help you to target and scope properties for your desired retrofit projects, leading to the development of a strong business case.

Level 1 – Introduction

Challenges

Some of the common challenges housing providers face in acquiring and managing portfolio data for retrofit projects are:

- Adequate resource availability – Lack of internal resource with the proficient data analysis experience
- Incomplete, inconsistent and poor-quality housing stock data, leading to errors in stock modelling scenario's – *'Garbage in, Garbage out'*
- Limited access to valid and reliable data sources or tools to calculate energy performance.

These challenges, if unresolved, can cause:

- Increased costs to business operations
- Project delays
- Poor quality outcomes
- Poor value for money
- Failure to meet strategic objectives.

Good data management and governance practices within a housing provider can enable significant benefits:

- Reduced time, costs and complexity for your organisation by using tools and software to analyse and model your stock
- Target the right measures early in your retrofit programme
- Better management and transparency of retrofit project risks and reduced costs to rectify poor performing projects
- Making better informed decisions on quality and measurable outcomes in your stock upgrade estimates
- Improved business process efficiencies around use of data
- Capability to monitor organisation and programme performance to deliver continuous improvement
- Build stronger business cases to present to senior management team for capital investment

Solutions

An established data management and governance policy will help to overcome the challenges mentioned above, ensuring data is of the right quality, ready to use and fit for purpose. In addition to continuous data improvements, it is recommended to use an application and/or software to analyse your data.

Level 2 – Framework

Figure 1 illustrates the process to achieve good quality housing stock data. There are 9 steps within this process. As you progress through them you will need to cycle through earlier steps to gradually improve your data quality and support your final business case. Within this toolkit we discuss how you complete each of the steps.

Underpinning the process is the requirement for good data management and governance practices.

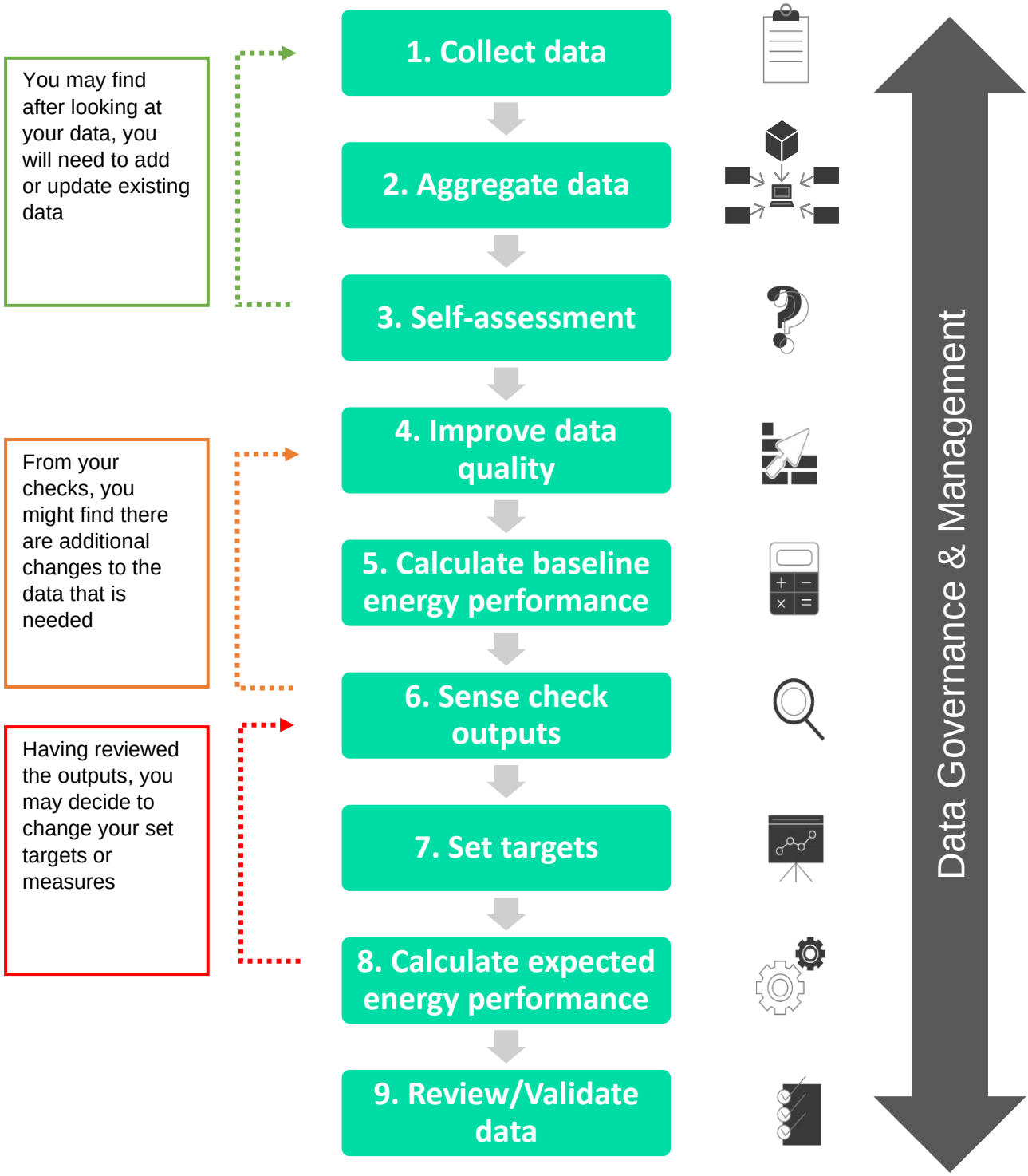


Figure 1. Process to improve data quality and analyse data for a retrofit project

Data governance and management

Data governance is the practice of how data is used and processed through the organisation. It lays out the rules within your organisation to help keep your data secure, up to date, reliable and usable.

Collect data

Detailed home attribute data is required to calculate your homes' energy performance. Different data types and calculation methods provide varying outputs and accuracy. It is worth knowing what they are, how they differ and how they will influence your retrofit approach.

Aggregate data

As a housing provider you'll need to aggregate data from various sources:

- EPC data
- Stock condition data
- Asset renewals and repair records
- Planned maintenance opportunities and budgets
- Complaints analysis and housing health and safety rating system (HHSRS)
- Demographics and funding data.

It is important to manage this appropriately to ensure there is no ambiguity in the data being used.

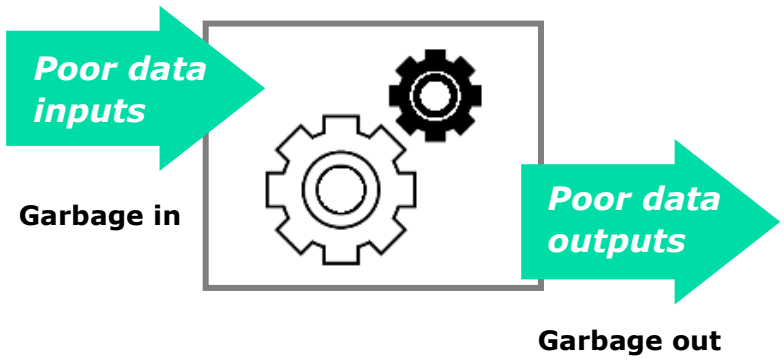
Self-assessment

Download the self-assessment in this toolkit to determine your current position on:

- Data governance and management
- Data quality
- Energy performance data.

Improve data quality

Good quality data will improve decision-making and increase the quality of planning for retrofit programmes. A well-known phrase within data science is "Garbage in, Garbage out". If you start with poor quality data, you can expect poor quality results.



Calculate baseline energy performance

Baseline energy performance is the measure of how your home is currently performing. It is important to have detailed home level data for various energy performance metrics.

Sense check outputs

Sense check your baseline energy performance to identify any major errors or gaps within your datasets. Make any data improvements before moving on to the next stage.

Set targets

Set targets based on your desired retrofit outcomes. These targets should be aligned to your organisation's ambition as well as policy and legislation and any funding bids requirements. Test various targets against a range of energy performance metrics.

Calculate expected energy performance

As part of the process of planning and designing a retrofit project, you should model how you expect your home to perform after installing energy efficiency measures. There are different methods for doing this with varying levels of ease, accuracy, cost and time.

Review/validate data

Finally, review all the data you have collected and analysed to check you are confident with the outputs. Gauge whether your data provides a good understanding of your homes pre-retrofit. It should help to identify the proposed retrofit approach and indicate how the homes will perform post-retrofit.

Level 3

Data governance & management

Data governance is a collection of processes, roles and responsibilities, policies and standards, that ensure data is used effectively and securely by an organisation. Data management is the enactment of data governance policies and procedures.

Data governance helps to answer:

- Who has ownership of the data?
- Who can access what data?
- What security measures are in place to protect data and privacy?
- How much of our data is compliant with new regulations?
- Which data sources are approved to use?

Data governance requires:

1. Designing a set of processes to ensure data is being handled and managed correctly
2. An understanding of who is responsible for updating and managing the data
3. Commitment to ensuring the processes, controls and responsibilities are enforced.

Establish good data governance practices to ensure your data is frequently updated and maintained consistently, and individuals are clear on their responsibilities. This will help to avoid delays and reduce confusion or ambiguity.

It is best to store your data in a **central database**. This can be done through shared servers or folders that are accessible by different teams. The ‘Aggregating data’ section will show you how to achieve better practices in data management.

Collecting data

The more information you hold about your homes, the more reliable your stock analysis results will be. If you have data gaps, the default way to fill them is to create assumptions based on similar property archetypes. However, with more assumptions you run the risk of lower data accuracy.

Therefore, it is important to have enough data to identify the problem areas of the home and understand occupant behaviours to assure you about the correct retrofit approach.

You may already hold enough data for each of your homes. It is worth checking what data you have from your **asset management systems** before looking at collecting new data. Collecting new data

can take significant time and cost, so try and ensure your data doesn't have any gaps when collected. Try to account for data collection time when developing your retrofit project plan.

Data should be collected at a detailed home level, including component parts shows in Figure 2, to better understand the makeup of the home and to calculate its energy performance.

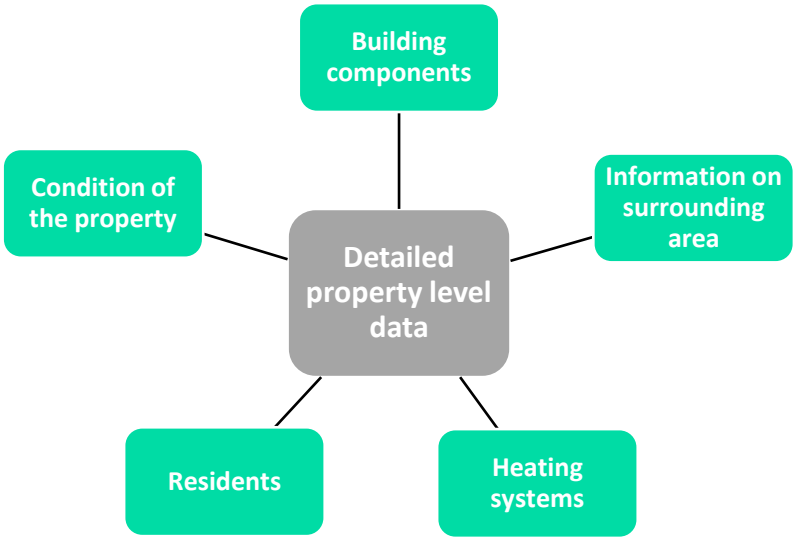


Figure 1. Data components that make up detailed information about a home

There are various methods for collecting detailed home level data:

Stock condition survey:

- Collect detailed information on the internal and external building components to determine the energy performance of the home
- Data can be used for the Decent Home Standard. It can help to target properties that require immediate attention
- To calculate the energy performance of a home using data from stock condition surveys will require **stock modelling software or a calculator tool** (see 'Calculating energy performance' for more information').

SAP data:

- ***Full SAP*** data is the more complete dataset for a home. It uses floor plans, drawings and specifications from design stage. Full SAP is required for new buildings under the building regulations
- ***RdSAP*** data is the 'reduced' version of SAP for use in assessments of existing homes. RdSAP uses some default data for certain data points where information is not as easy to collect (e.g. u-values for building fabrics). RdSAP is not as accurate as full SAP

- Collecting additional data points such as u-values will improve the accuracy of your RdSAP results.

Thermal imaging surveys:

- Thermal imaging indicates where there are cold spots within the home. This data provides evidence to justify recommended fabric measures and your retrofit approach
- Although useful, they alone will not give you the required figures to calculate energy performance.

Retrofit assessment:

- These are detailed surveys of the home carried out prior to any measures being installed. These lead to recommended measures and detailed information on material choices and installation methods. Consider PAS2035 requirements when undertaking retrofit assessments
- Most retrofit assessments will not give you the expected energy performance data and should be coupled with additional energy assessments.

In some instances, carrying out these more intensive forms of data collection may not be possible due to time, capacity and capital restraints. Below are some additional methods which are more cost effective and less-time consuming. However, **proceed with caution** and only use them if necessary, as they typically result in **poorer data quality**.

Cloning data:

- Cloning is the process of copying the existing data inputs from a home of a similar archetype and using it to fill data gaps
- This takes less time, but it is far **less reliable** as it assumes the home you have copied data from is identical, which isn't true in most cases
- If cloning data, be confident with the source data and check your database for planned works or efficiency improvements that may have taken place – this will improve data quality.

Registered EPC:

- You can collect data from the EPC register (https://www.gov.uk/find-energy-certificate). Usually, the data from EPC certificates alone are not adequate for retrofit planning because:
    - They are often out of date
    - EPCs were not designed for net zero carbon planning
    - There are well-known data quality issues.

- If possible, collect the raw data such as the full SAP or RdSAP that is used to calculate EPCs. You can request the full data from your EPC assessor.

Aggregating data

Two areas that will help to ensure you have the foundations to store and manage your housing stock data are having a **single version of the truth** and **consistent formatting**.

Single version of the truth

This is a succinct way of saying that data should be consistent without any ambiguity about which version to use. This is achieved by aggregating all the data that exists within different departments. Figure 3 shows the various datasets that may exist within your organisation:

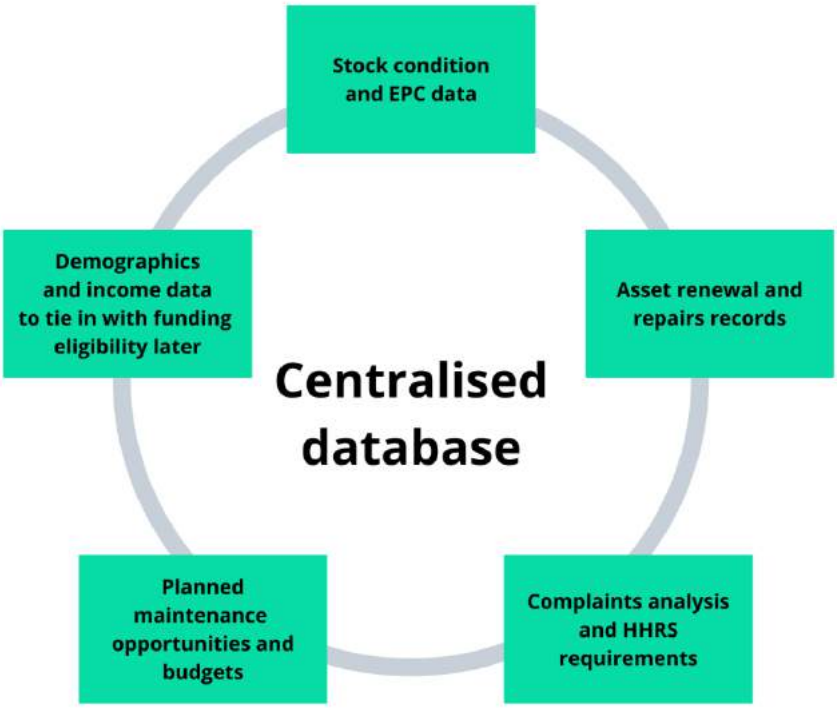


Figure 2. Representation of a centralised database by collating data from different departments

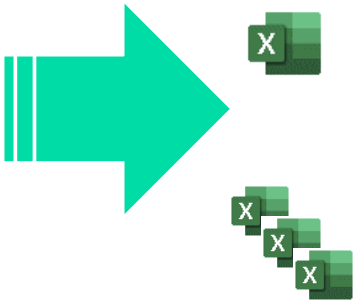
Work with colleagues to store these datasets in a central database, accessible to all. If you are using different software or applications for your housing data, such as asset management systems and/or home energy analytic software, it is important that the data comes from the same source.

Consistent formatting

Once your data is in one central location, you should consistently format it to allow your datasets to be easily pulled together when needed. To do this you'll need to make sure that:

1. **All your data is digitised and in the same format**
    - Having your home data attributes stored in PDF documents or as hard copies will slow down any analysis, as it is not in the same format

Data may be in disparate formats and different locations



Choose a consistent file type to store data. Whether that be through Microsoft Excel or Microsoft Access.

Note: This includes the different file types in Excel such as csv. xlm. xls.

Note: *You cannot move onto the next stage without ensuring the first is completed*

2. **Use consistent variable labels**
    - Have one common variable to link the homes across all the different datasets. This is usually a unique property reference number (UPRN)
    - Ensure consistent naming of variables across datasets. Here's an example of inconsistent variable labels for the same building element variable:

	A	B	C	D	E
		Data from 'Source 1'	Common variable		Data from 'Source 2'
	UPRN	Wall type		UPRN	Wall_construction
	ABC123	System built		ABC123	system_built
	ABC124	System built		ABC124	system_built
	ABC125	System built		ABC125	system_built
	ABC126	System built		ABC126	system_built
	ABC127	System built		ABC127	system_built
	ABC128	System built		ABC128	system_built
	ABC129	System built		ABC129	system_built
	ABC130	System built		ABC130	system_built
	ABC131	System built		ABC131	system_built
	ABC132	System built		ABC132	system_built
	ABC133	System built		ABC133	system_built
	ABC134	Solid mansonary brick wall		ABC134	solid_brick
	ABC135	Solid mansonary brick wall		ABC135	solid_brick
	ABC136	Solid mansonary brick wall		ABC136	solid_brick
	ABC137	Solid mansonary brick wall		ABC137	solid_brick
	ABC138	Solid mansonary brick wall		ABC138	solid_brick
	ABC139	Solid mansonary brick wall		ABC139	solid_brick
	ABC140	Solid mansonary brick wall		ABC140	solid_brick
	ABC141	System built		ABC141	system_built
	ABC142	System built		ABC142	system_built
	ABC143	Solid mansonary brick wall		FDC 143	cavity_fill
	ABC144	Solid mansonary brick wall		GKO 144	cavity_fill

Ensure consistent variable labels

Ensure consistent naming of variables

Figure 3. Two data sources that contain the same information but inconsistent formats

3. **Version control and file labelling**
    - Implement and communicate a file labelling and version control process for your data. You could include initials in the file name to show who last updated the file.

For example: On the 16 February 2022, Emma Williams updated the planned works dataset to show a new window had been fitted. She then saves the file as ***Planned works_16.02.22 (EW).xlsx*** and moves the old version to an archive folder.

Improving data quality

There are six key attributes to data quality you should consider:

Accuracy	Correct, precise and up to date
Completeness	All possible data is present (no gaps or blanks)
Consistency	No conflicting information within or between systems and attributes
Timeliness	Data is created, maintained and available when required
Uniqueness	Where appropriate, there are no duplicates or redundant data elements
Validity	Data is authentic, proven to be valid, and derived from good, reliable sources

The processes to improve data quality starts with your raw data. Reviewing your data can be a long, painstaking process so it is important to be realistic about how much time and effort you are prepared to commit to it. It is unlikely you'll be able spot all the errors and mistakes, but the more data improvements you make, the better quality your data is, and the more effective your retrofit projects are likely to be.

There are two potential methods you could use to check data quality:

1) Home energy analytic software

Some software automatically calculates a data quality score. This is based on the data sources and if there are any data gaps. Review data with a quality score below 60% or equivalent (anything below average) and look to improve the score of that data.

2) Manual checks

Manual checks can evaluate the quality of your data. This can be done regardless of whether you have software or not. See Appendix 1 for how you can use Pivot Tables to manually check your data.

- **Gaps/ missing information**

  Some variables are key to accurately calculating the energy performance of your homes:
    - Property type

- Property age
- Wall construction
- Roof insulation
- Heating systems
- Windows and doors
- Floor area
- No. habitable rooms.

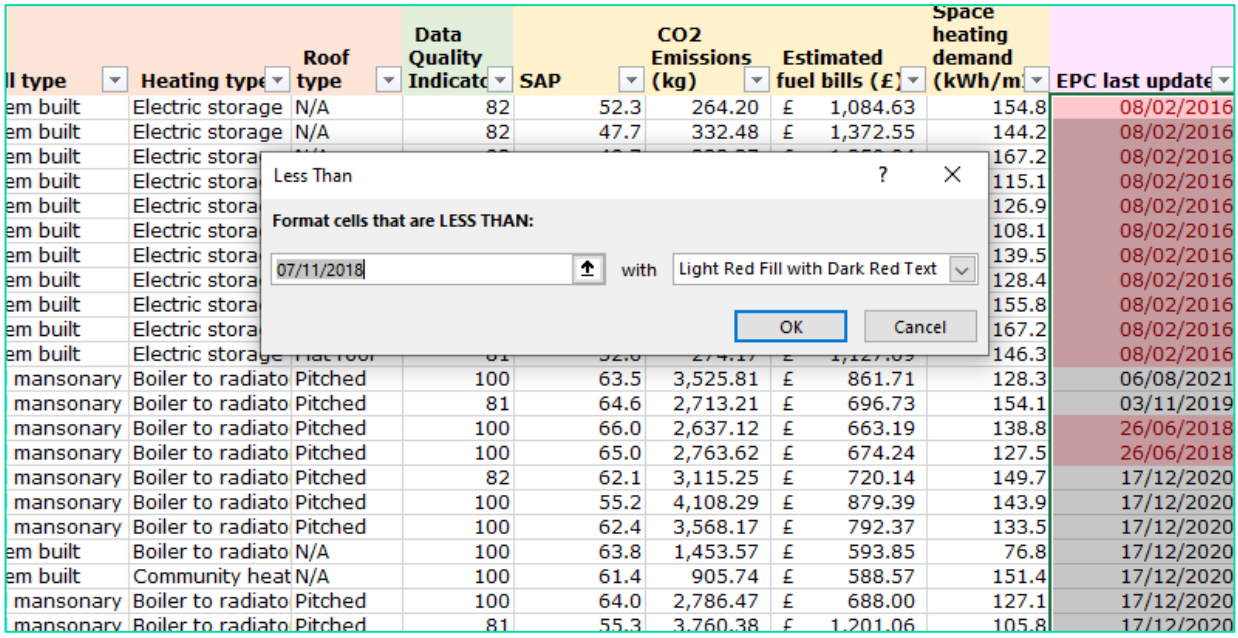
If there is any missing information or gaps for any of the key variables listed above, work towards completing the data.

- **Data sources**

  Different sources of data have different levels of reliability. Refer to 'Collect data' section on the recommended data sources.

- **When was the data last updated?**

  More recent data can improve overall data quality. To check this, you should have a column within your database which indicates the date for when the survey, EPC, or works was last carried out. Use conditional formatting in Excel to highlight cells where data is more than 4 years old (See Figure 5).



l type	Heating type	Roof type	Data Quality Indicato	SAP	CO2 Emissions (kg)	Estimated fuel bills (£)	Space heating demand (kWh/m	EPC last update
em built	Electric storage	N/A	82	52.3	264.20	£ 1,084.63	154.8	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	144.2	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	167.2	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	115.1	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	126.9	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	108.1	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	139.5	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	128.4	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	155.8	08/02/2016
em built	Electric storage	N/A	82	47.7	332.48	£ 1,372.55	167.2	08/02/2016
em built	Electric storage	Flat roof	81	52.0	274.17	£ 1,127.69	146.3	08/02/2016
mansonary	Boiler to radiato	Pitched	100	63.5	3,525.81	£ 861.71	128.3	06/08/2021
mansonary	Boiler to radiato	Pitched	81	64.6	2,713.21	£ 696.73	154.1	03/11/2019
mansonary	Boiler to radiato	Pitched	100	66.0	2,637.12	£ 663.19	138.8	26/06/2018
mansonary	Boiler to radiato	Pitched	100	65.0	2,763.62	£ 674.24	127.5	26/06/2018
mansonary	Boiler to radiato	Pitched	82	62.1	3,115.25	£ 720.14	149.7	17/12/2020
mansonary	Boiler to radiato	Pitched	100	55.2	4,108.29	£ 879.39	143.9	17/12/2020
mansonary	Boiler to radiato	Pitched	100	62.4	3,568.17	£ 792.37	133.5	17/12/2020
em built	Boiler to radiato	N/A	100	63.8	1,453.57	£ 593.85	76.8	17/12/2020
em built	Community heat	N/A	100	61.4	905.74	£ 588.57	151.4	17/12/2020
mansonary	Boiler to radiato	Pitched	100	64.0	2,786.47	£ 688.00	127.1	17/12/2020
mansonary	Boiler to radiato	Pitched	81	55.3	3,760.38	£ 1,201.06	105.8	17/12/2020

Figure 4. Conditional formatting to highlight old EPCs

How to improve your data quality?

The best way to improve the quality of your data is through data checking and cleaning (fixing or removing incorrect information). This is usually a manual process. No one knows your housing stock better than you. Therefore, sense check your data to weed out obvious errors.

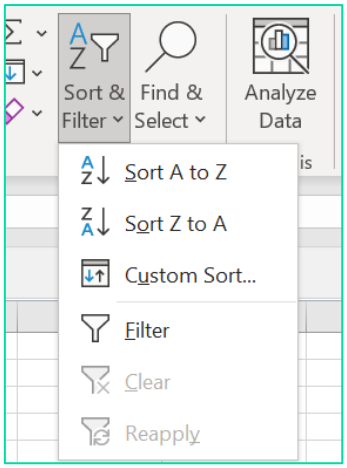


Figure 5. Filter function in MS Excel

Data checks: The most powerful way to check data is using a simple function on Excel, called sort and filter. There are three different kinds of data checks you can undertake:

Check Type	Examples
Logic checks Where a combination of dataset points is not logical	• Does the data show cavity wall for properties with a property age Pre 1900? Cavity walls were introduced in 1920s so check to see if it is viable. • Repair records showing roof repairs for a mid-floor flat. Unlikely to be true.
Consistency checks To determine whether dataset points are consistent from different datasets	• You have 20 properties that are in the same block of flats, but the construction age of the flats is different. • Duplicate entries (Consistency check)
Plausibility checks To determine whether the dataset points are reasonable within the dataset range	• Sort very low/high SAP scores – at a glance, is this likely to be correct? • Sort very low/high floor areas – are these realistic? • Filter options for heating types – are there any unusual heating types you don't have knowledge of for your stock? For example, oil boilers. Is this likely to be a mistake?

Tip: Create a copy of your dataset in a new sheet in Excel for your different archetypes: houses, flats, maisonettes, balconies. Add a filter to your column or row headings. Start interrogating the data by looking at the filter results.

Data cleaning

When you find a mistake, manually correct the data and keep a log of the changes made. If you are not confident that it is an error, do not change it but do seek advice. If there are several data points that look incorrect, it might be worth collecting new data for these properties.

Calculating energy performance

It is important you have energy performance data for the following metrics:

- EPC rating and SAP score
- Estimated fuel bills (£)
- CO_2 emissions (tonnes/year)
- Heating demand (kWh/m^2/year).

For more information on each of these metrics see Appendix 2.

To calculate your home's baseline energy performance, you'll also need detailed home level data (building components, information on surrounding area, residents, heating systems and condition of the property).

The different approaches that housing providers could use to calculate baseline and expected energy performance are:

1. Using home energy analytics software
2. Making desktop calculations
3. Appointing sub-contractors.

Home energy analytics software

Using home energy analytics software gives you the ability to:

- Calculate your baseline energy performance (before retrofit interventions)
- Model a retrofit approach
- Calculate the expected energy performance (after retrofit interventions)
- Estimate the cost needed to retrofit the home.

Investing in software will improve the efficiency in acquiring data and allow better intelligence to understand your stock, the retrofit approach, and the measures recommended to meet set targets. To find out more about procuring software and the considerations, see Appendix 3.

Baseline energy performance

The first step is to upload your housing stock data onto the home energy analytics platform. This should automatically calculate your baseline energy performance. It is worth carrying out data checks and reviewing the outputs to inform any data improvements prior to modelling retrofit scenarios or plans. If the outputs do not include all the required energy performance metrics, work with the software provider to find a solution.

Tip: *After completing this you may want to take a deeper dive into your data to scope out potential retrofit projects. This could include identifying homes which are worst performing or in geographical clusters. You can also target properties which need further data collection or surveys or find common archetypes where similar retrofit approaches are required.*

Expected energy performance

Work with your provider to understand how to set parameters for various targets and measures.

1) **Set targets**
   - Use different metrics such as heating demand (kWh/m^2), EPC / SAP or CO_2 targets
   - You may choose to set cost caps per home to reach that target.
2) **Select measures and retrofit approach**
   - Focus on fabric-first and a no-regrets approach where possible
   - Be selective with the measures you are modelling and choose measures fit for the residents and building archetype.
   - For example, you may choose not to install internal wall insulation (IWI) due to the disruption to residents.
3) **Run model and verify outputs**
   - The outputs will recommend measures for each property, based on the parameters set in steps 1 and 2, which you'll need to review. See *'Reviewing and validating'* for more information
   - After reviewing, you may wish to adjust your targets or measures. This will then require re-running the model to find the best retrofit approach.

Use these outputs in conjunction with other supporting evidence such as retrofit assessments. This helps to show how your chosen retrofit approach is specific to the archetype and residents, and how the project meets compliance with PAS2035.

Desktop calculations

Manual desktop calculations are possible, however, manually calculating the performance for each home can be time consuming and resource intensive.

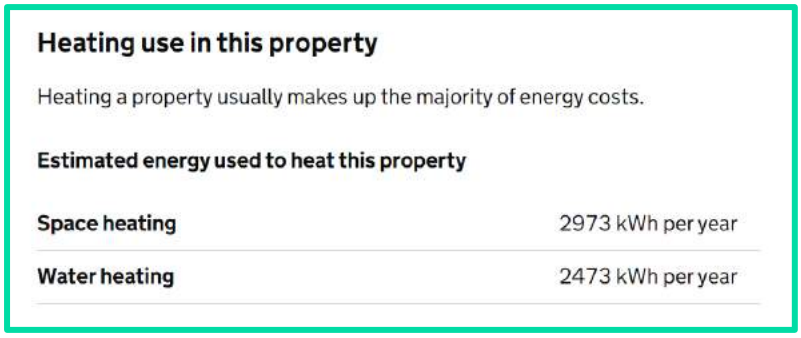
There are two desktop calculation methods. The first is to use an **energy performance certificate (EPC)**. Caution is advised when using EPCs as it will not provide you with all the data required and there are known data quality issues. The second method requires an application such as asset management system or a SAP calculation tool, to **manually recalculate energy performance**.

a) EPCs

The EPC for a home can be found via the EPC register: https://www.gov.uk/find-energy-certificate

Baseline energy performance

EPCs contain all the energy performance metrics apart from heating demand (kWh/m^2/year). However, you can derive the heating demand from values on the EPC: take the space heating (kWh) as shown in Figure 6 and divide this by the total floor area (m^2), to give heating demand.



Heating use in this property

Heating a property usually makes up the majority of energy costs.

Estimated energy used to heat this property

Space heating	2973 kWh per year
Water heating	2473 kWh per year

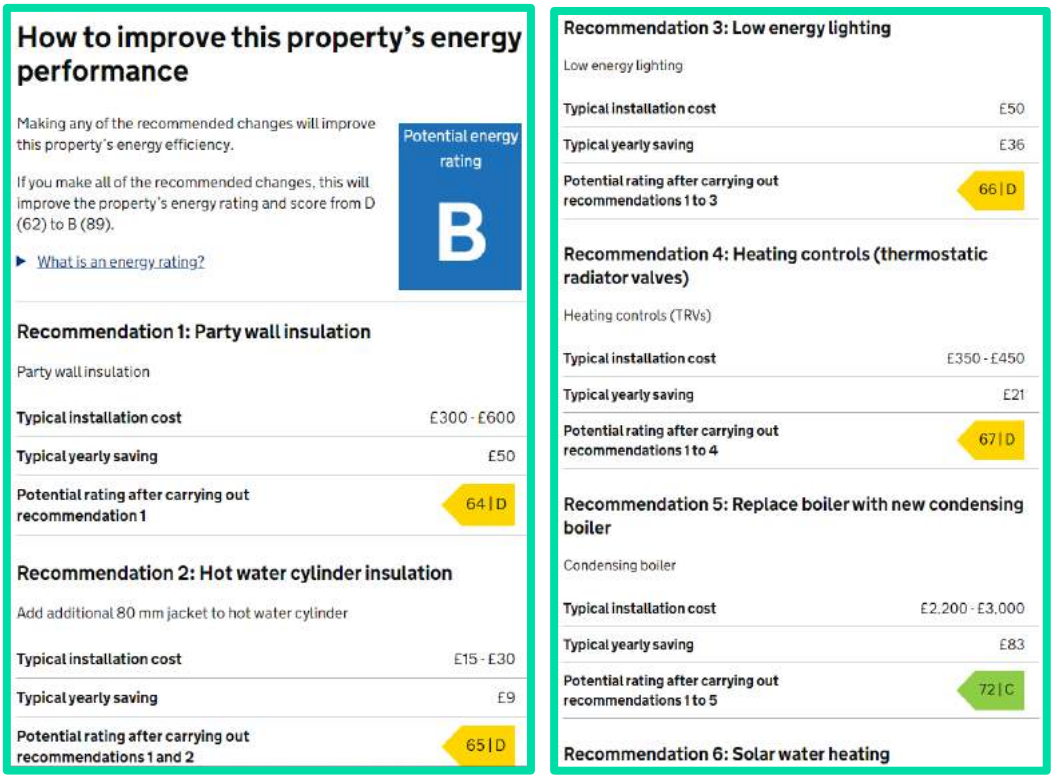
Figure 6. Extract from an example EPC

Expected energy performance

EPCs contain recommended improvement measures for the home, as well as the potential SAP score and estimated fuel saving (see Figure 7). However, there are limitations to using this method:

- The expected energy performance is only calculated for the potential SAP score and estimated fuel bill saving (£). It **does not** include the expected CO_2 saving or heating demand saving
- The recommended measures and outcomes must be taken in the order that they are listed because the SAP calculations are also done in that order. For example, if for some reason you choose not to install recommendation 1, the potential energy rating from recommendation 2 would then be incorrect.

EPCs also provide estimated costs; however these will need to be verified to ensure they are reflective of current market prices.



How to improve this property's energy performance

Making any of the recommended changes will improve this property's energy efficiency.

If you make all of the recommended changes, this will improve the property's energy rating and score from D (62) to B (89).

▶ What is an energy rating?

Potential energy rating: **B**

Recommendation 1: Party wall insulation

Party wall insulation

Typical installation cost	£300 - £600
Typical yearly saving	£50
Potential rating after carrying out recommendation 1	64 | D

Recommendation 2: Hot water cylinder insulation

Add additional 80 mm jacket to hot water cylinder

Typical installation cost	£15 - £30
Typical yearly saving	£9
Potential rating after carrying out recommendations 1 and 2	65 | D

Recommendation 3: Low energy lighting

Low energy lighting

Typical installation cost	£50
Typical yearly saving	£36
Potential rating after carrying out recommendations 1 to 3	66 | D

Recommendation 4: Heating controls (thermostatic radiator valves)

Heating controls (TRVs)

Typical installation cost	£350 - £450
Typical yearly saving	£21
Potential rating after carrying out recommendations 1 to 4	67 | D

Recommendation 5: Replace boiler with new condensing boiler

Condensing boiler

Typical installation cost	£2,200 - £3,000
Typical yearly saving	£83
Potential rating after carrying out recommendations 1 to 5	72 | C

Recommendation 6: Solar water heating

Figure 7. EPC certificate recommendations

b) Manually recalculate energy performance

Asset management tools or SAP calculators will take the detailed home level data to calculate the energy performance of a home.

Baseline energy performance

Input the detailed home level data to your asset management systems or SAP calculation tool to give you the baseline energy performance of your homes. Depending on the systems you use, there may be limitations to which energy performance metrics are available.

Expected energy performance

To calculate the expected energy performance, you must first decide on the retrofit approach. Work with a Retrofit Coordinator to decide the appropriate energy efficiency improvements to install.

Once you have chosen your energy efficiency measures, you'll need to update each of the home's raw data to account for those measures. For example, you may propose external wall insulation (EWI). You'll need to amend the raw data to add EWI as an insulation building element, then use your asset management tool or SAP calculator to determine the new energy performance.

You'll then have to separately cost up each of the measures based on supplier quotes or using estimated cost data from a previous retrofit project.

It is then worth *'Reviewing and validating'* these outputs.

Sub-contracting

You may also choose to **sub-contract** the detailed analysis. If so, it is important to be closely involved to ensure you are getting the right information and understand what processes were followed to carry out the analysis.

Baseline energy performance

Work closely with the sub-contractor to acquire the energy performance data you need under the different metrics. Consult with them to understand:

- what work can they carry out?
- will it involve collecting better quality data?
- will they help to identifying potential retrofit projects?
- what methodologies or data are they using to calculate the performance?
- how will outputs be supplied and what will the outputs look like?

Expected energy performance

Work closely with the sub-contractor to set the parameters of the modelling and analysis, discussing them early to avoid delays. This includes your chosen targets, budget and preferred retrofit measures.

You may decide to omit certain measures due to disruption to tenants or lack of skills within your supply chain.

Take time to understand what methodologies they are using, as you may be required to detail this within a funding application.

Ensure you review their findings to verify the approach they have taken. You may find after reviewing the outputs that you need to adjust the parameters. Refer to *'Reviewing and validating data'* for how to review the data outputs.

Reviewing and validating data

Data validation happens towards the beginning of the process ***and*** at the end of the process. This is to ensure you have all the information you need to undertake a retrofit project, and that you are confident with the information you are presenting.

Although validating your data requires additional time and potentially additional costs, it is important not to overlook this step. Validating your data and collecting additional information could:

- Provide more accurate costs
- Reduce risk
- Help to comply with PAS2035
- Give a better understanding of installation and material requirements
- Provide additional proof of achieving required energy performance
- Ensure you are undertaking best practice fabric-first and no-regrets approach.

Beginning of process

You need to start with good data to ensure more reliable outputs. Remember - 'Garbage in, Garbage out'. When looking at your datasets ask yourself the following questions:

- Have I checked to see if there is any missing information from my datasets?
- Have I checked for errors and made any changes where there are obvious errors?
- Am I confident that the data collected will result in accurate and reliable outputs?
- Could I benefit from collecting more information to validate other data points?

End of process

- Do I have all the data outputs needed to calculate expected energy performance?
- Are the costs reflective of current market prices or costs I am used to seeing?
- Does the recommended set of measures follow a fabric-first and no-regrets approach?
- Am I confident I have collected enough data to justify the proposed retrofit approach?

- Are there any properties that do not meet my targets?
- Should I consider collecting additional data to support? This could include:
    - Supplier quotes
    - Additional surveys
    - Additional assessments
    - Examples of past successful retrofit assessments.

By completing this exercise, you'll better understand the level of information you have provided and have more confidence in the data you are presenting.

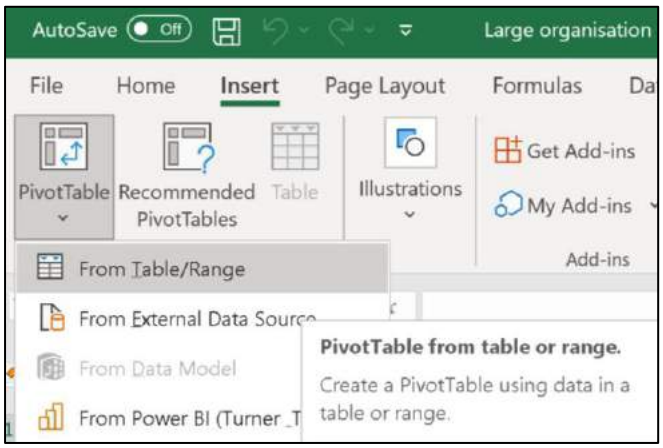
Appendices

Appendix 1: How to use Pivot tables to review your data

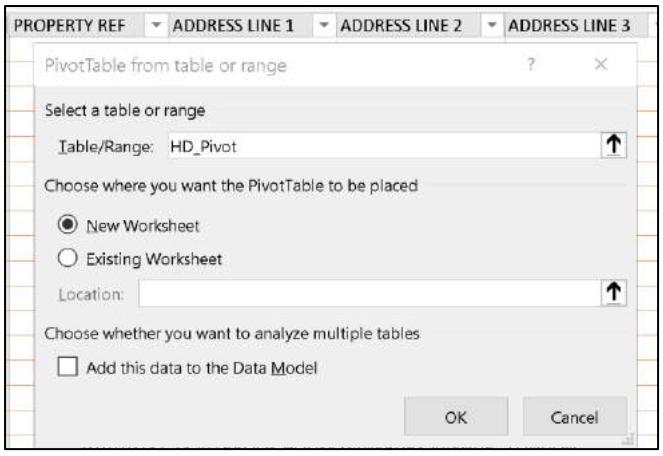
A PivotTable is a powerful tool to calculate, summarise, and analyse data that lets you see comparisons, patterns, and trends in your data. It can aid you in finding data gaps and inconsistencies.

1. Select the cells you want to analyse by pressing Ctrl + A on your dataset, this selects all the data on the Excel sheet

Note: Your data should be organised in columns in a tabular format with a single header row like the example above



2. Once this is done you'll be presented with the below. Ensure the button for 'New Worksheet' is checked

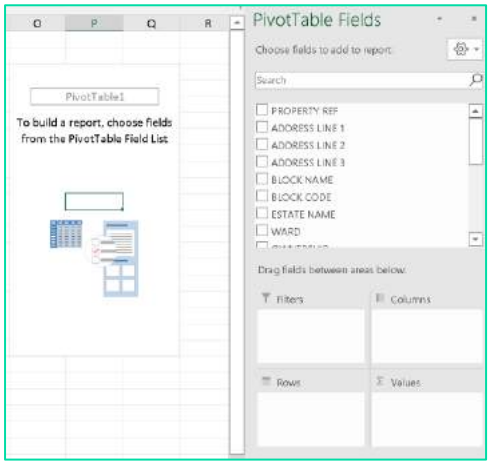


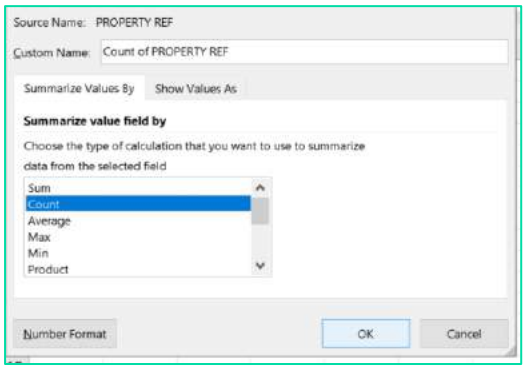
3. The pivot will be blank at first. Using the PivotTable fields pane (as below right) you can add your fields to the PivotTable:
    - Filter – The dynamic dimension you want to slice your data by to look at a subset i.e. housing type of flats only

- Columns – Typically the values you are looking to compare numerically i.e. count/average/sum but can also be attributes if you wish depending on the visualisation required
- Columns – The columns should include variables that detail the home such as building elements
- Rows – The number of rows will be dictated by the number of different entries in the column in your mainsheet. This is best used to look at attributes your data share for example Property Type could be House, Flat, Maisonette. You would not use it for something with many values such as Property Reference.

Note: It is important that you have cleaned your data beforehand and it is consistent

- Values - This will be the key data in your table. It will show the sum, count or average of the values sliced between columns and rows.

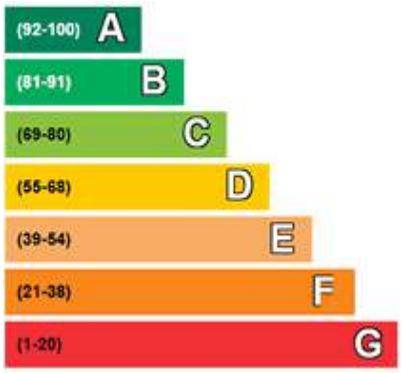




Row Labels	Count of PROPERTY REF
BNW	113
FLT	11177
HSE	2469
HSL	16
MAS	3105
Grand Total	**16880**

Appendix 2. Energy performance metrics

This table describes each of the energy performance metrics:

EPC rating and SAP score 	EPC stands for 'Energy Performance Certificate' and SAP stands for 'Standard Assessment Procedure'. EPCs and SAP are national performance measurement standard. SAP is based on mathematical model that estimates annual energy consumption based on characteristics, heating systems, lighting, and renewable technology. SAP scores range from 1 (lowest efficiency) to 100 (highest efficiency). EPC scores range from G (lowest efficiency) to A (highest efficiency).
Estimated fuel bills (£)	The heating bill is the total cost in pounds (£) to heat the home to a decent standard, usually calculated per annum. Temperature assumptions for a decent standard of heat used to calculate fuel poverty are: 21 degrees Celsius in living areas and 18 degrees Celsius in all other areas.
CO_2 emissions (tonnes/year)	Carbon dioxide (CO_2) is the main greenhouse gas contributing to climate change and in a domestic context is mainly created when we heat our homes or use hot water. CO_2 in housing data is commonly measured as tonnes of CO_2 and is also used in national net zero targets.
Heating demand (kWh/m^2/year)	Heat demand is a measure of how much energy is required to heat a space. The metric used is kilowatt hours per square metre per year (kWh/m^2/yr). A common target for deep retrofit is at least 50 kWh/m^2/yr. This target emphasises a fabric-first approach by focusing on reducing demand in the home.

Appendix 3. Housing energy analytics software considerations

To build the business case for procuring software you can write an options appraisal to take to senior management. Consider the areas below and ask some of the following questions:

- **Costs**
    - Different cost models may be suitable for you dependent on your stock holding size i.e., annual subscriptions or price per home
    - Engage with providers to understand their cost models.
- **Functionalities**
    - A platform to upload your housing stock data to and potentially identify any data quality concerns – how user friendly is this? Can it be used alongside existing asset management systems?
    - Calculate energy performance baseline – what metrics does this cover? How do they present the data?
    - A function to run scenarios to model retrofit investments for your properties. Does it allow you to set targets and estimate the costs to retrofit? This facility should also show energy efficiency performance.
        - How do you set up the models?
        - What targets can you set?
        - What measures can be included?
        - Where do the costs come from?
        - Can the costs be adjusted to reflect market prices you are seeing?
        - What will the expected outputs look like?
- **Improved efficiencies**
    - It is worth noting who currently manages the database you have, what your current data governance processes are, and what efficiencies are needed
    - How much time could be saved? i.e. How long do desktop calculations usually take versus modelling via software?
    - Will software allow you to identify particular issues? i.e. poor data quality, poorly performing properties, areas where fuel bills are particularly high, etc.
    - Will software allow you to do multiple calculations at once and provide suggested improvement recommendations?
- **Data accuracy**
    - Emphasise the importance of needing good quality data, and how software like this can improve your data
- **Challenges/Risks**
    - From the providers you have researched and spoken to, what are the common challenges or risks? Also:
        - How long does it take to get set up?

- How long will it take to improve the data quality?
- How do you update data on to the platform, will it require training or additional time?
- Are there certain functionalities that are not available? If so, which? Can these be provided elsewhere?

The table shows some home energy analytic software tools currently on the market. This is not an exhaustive list. It is worth doing some research to find the software that fits best with your organisation.

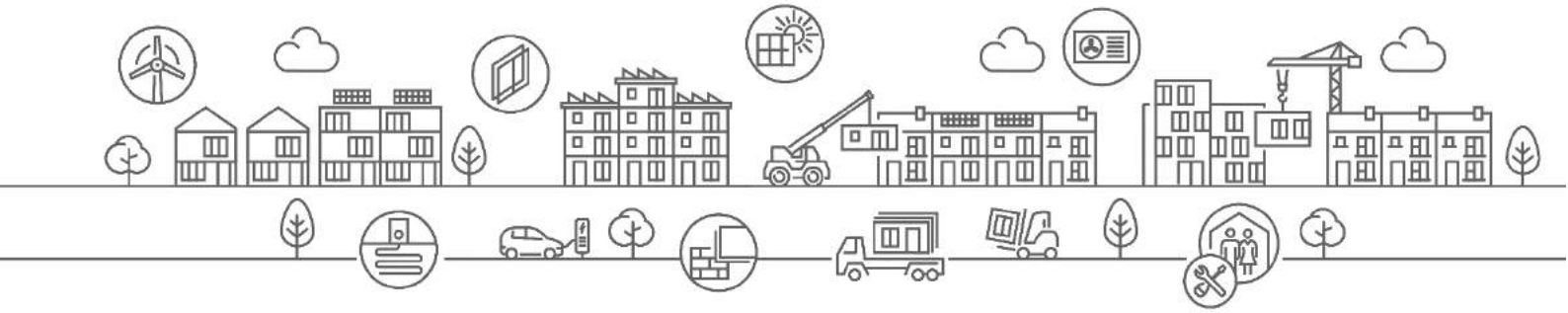
Company		Product
	BRE Group	HSDC
	Elmhurst Energy	Streamline
	Sava	Intelligent Energy
	Energy Saving Trust	Home Analytics
	IRT Surveys	DREam
	Parity Projects	Portfolio
	Energy Audit Company	Uno

The different products on the market offer different functionalities at varying costs. It is important to understand which systems are available, their functionality, costs, and subscription models. Talk to other social housing providers and share experiences of using different software.

SHRA Toolkits available online

The full selection of SHRA Toolkits are available at:

www.socialhousingretrofit.org.uk/knowledge-hub



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