UK GBC

BUILD UPON²

Build Upon Framework

Capturing the many benefits of building renovation

September 2021

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BUILD UPON²

GBCe green building council españa

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IGBC IRISH GREEN BUILDING COUNCIL

Green Building Council Italia

PLGBC Polskie Stowarzyszenie Budownictwa Ekologicznego

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The BUILD UPON² Project

We are in a state of climate emergency. We must act now to reach net zero carbon by 2050 - and municipalities can lead the way. To get there, local authorities must unlock the huge potential of their buildings - with building renovation in particular.

Deep building renovation has far-reaching benefits for society as improving indoor comfort and air quality avoids illnesses and premature deaths associated with living in cold and damp homes. This in turn reduces pressure on healthcare and social services.

The EU Horizon 2020 funded BUILD UPON² project will empower municipalities across Europe to join forces with national governments and industry to decarbonise their existing building stock by 2050. BUILD UPON² will strengthen the local effectiveness and implementation of the national building renovation strategies required by the EU Energy Performance of Buildings Directive (EPBD).

www.worldgbc.org/build-upon

About the UK Building Council

A charity with over 600 member organisations spanning the entire sector, the UK Green Building Councl represents the voice of the industry's current and future leaders who are striving for transformational change.

Our mission is to radically improve the sustainability of the built environment, by transforming the way it is planned, designed, constructed, maintained and operated.

"The BUILD UPON Framework allows local authorities to measure and record the impacts of their retrofit projects in a holistic manner, looking at CO_2 emissions reductions, but also at the wider impacts, such as the benefits to people's health and wellbeing and indeed reduction in energy poverty. In future the BUILD UPON Framework will help us in better considering and communicating the multiple benefits of retrofit, which in turn should increase the rate of retrofit."

- Ali Grehan
City Architect - Dublin City Council

UK QUOTES????

"The Framework will help to communicate the benefits of energy renovation, including health and comfort in homes, cost savings, climate mitigation and opportunities for local employment."

- Orla Hegarty
University College Dublin

"Cork City Council will retrofit 2,700 social houses by 2030. The Build Upon² Framework is a fantastic opportunity to better monitor the impact of this programme on our climate targets and to exchange best practices with fellow European Local Authorities."

- Brian Cassidy
Senior Engineer - Cork City Council

About This Document

The objective of this technical manual is to support UK local authorities in using the core EU and UK indicators of the Build Upon² Energy Renovation Framework (the Framework).

This document was developed based on the feedback received from eight pilot local authorities and eight National Steering Groups across Europe - during an extensive testing phase.

An Excel spreadsheet and train
developed to help local authori
future, these may be replaced b

The UK Green Building Council
thank the members of the UK's
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Acronyms

EPC	Energy Performance Certificate
DHW	Domestic Hot Water
EU	European Union
FTE	Full Time Equivalent
HVAC	Heating, Ventilation and Air Conditioning
IAQ	Indoor Air Quality
SECAP	Sustainable Energy and Climate Action Plan
VOCs	Volatile Organic Compounds
WTC	Winter Thermal Comfort

Glossary

Within the Framework, **building professionals** are defined as those involved in the design of energy renovation. In the UK, these are ARB registered architects, chartered engineers, chartered and registered building surveyors, architectural technologists, project managers, site managers and supervisors, building and facilities managers, as well as Retrofit Coordinators.

Completion date is the issue date of the EPC post renovation or contract practical completion.

Within the Framework, **construction workers** are defined as those involved in the installation of energy renovation. In the UK, these are electricians, plumbers, bricklayers and stone layers, carpenters and joiners, plasterers, glaziers, PV and solar installers, biomass boiler installers, heat pump installers, and insulation installers.

Direct local jobs are jobs supported as a result of the intervention (e.g. designing renovation projects and working on the construction site) – Source: Definition adapted from C40 Cities, The Multiple benefits of deep retrofits - A toolkit for cities.

Energy Renovation refers to works that improve the energy efficiency of a building. Energy renovation works typically improves building envelope and/or technical building systems, such as heating, cooling, ventilation, hot water and lighting. European Commission, 2019. For further information on energy renovation works see appendix 1.

Energy Performance Certificate (EPC) is a certificate which notes the standardised calculation of the operational regulated energy. In the UK, this is the energy used for heating, cooling, hot water, ventilation and fixed lighting. It does not calculate consumption for cooking, appliances or plug loads related to portable devices such as computers / table lamps.

Final/Delivered energy is the total energy consumed by end users, such as households, industry and businesses. It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself. It is the energy that is metered at the property.

Energy poverty can be defined as “a situation where a household or an individual is unable to afford basic energy services (heating, cooling, lighting, mobility and power) to guarantee a decent standard of living due to a combination of low-income, high-energy expenditure and low energy efficiency of their homes”. European Commission, Citizens’ Energy Forum 2016 - Definition used by the Covenant of Mayors.

It is defined differently between the UK's home nations.

England uses the Low Income Low Energy Efficiency (LILEE) indicator. A household is fuel poor if: they are living in a property with a fuel poverty energy efficiency rating of band D or worse AND when they spend the required amount to heat their home, they are left with a residual income below the official poverty line.

In Wales and Northern Ireland, a household is fuel poor if: in order to maintain an acceptable level of temperature throughout the home, the occupants would have to spend >10% of their income on all household fuel use

In Scotland, a household is fuel poor if: after housing costs have been deducted, >10% (20% for extreme fuel poverty) of their net income is required to pay for their reasonable fuel needs AND after further adjustments are made to deduct childcare costs and any benefits received for a disability or care need, their remaining income is insufficient to maintain an acceptable standard of living, defined as being at least 90% of the UK Minimum Income Standard (MIS).

Heating System is the mechanical system that supplies space heating to the building.

Investment in energy renovation refers to all investments to improve the energy efficiency of a building. It includes investments in light, medium and deep renovations. For further information on what may constitute an energy renovation investment, see Appendix 1.

Net floor area is the total useful floor area of the property measured in metre squared as per the EPC.

Onsite renewable refers to the energy, electrical and thermal, generated by renewables within the site boundary to cover the building energy demand.

Overheating Risk is defined as "the phenomenon of a person experiencing excessive or prolonged high temperatures within a building, resulting from internal and/or external heat gains, and which leads to adverse effects on their comfort health or productivity".

Source: ZeroCarbon HUB, 2015, Defining Overheating – Evidence Review

Primary Energy takes account of the energy losses due to energy transformation such as electricity generation and also the losses from transmission and distribution.

Renewable energy are energy sources that can be used without depleting their reserves. Common sources of renewable energy are bioenergy, geothermal, hydropower, ocean, solar and wind. The national definitions and methods for procurement in relation to renewables take precedence over the principles and methods listed above.

According to the EN ISO 7730, **thermal comfort** is that condition of mind which expresses satisfaction with the thermal environment.

Ventilation is the supply of fresh outside air and the removal of stale indoor air to or from spaces in a building.

About The Framework

The objective of the Framework is to track and monitor holistically the impact of energy renovation
to better link local and national initiatives. This in turn should support greater citizen engagement a
while driving investment.

The Framework is not intended to rank cities with regard to their renovation strategies, but to suppo
better strategies, and in identifying best practices.

Building Types

All indicators (apart from Soc. 1) can be used on all building typologies:

PRIVATE RESIDENTIAL

SOCIAL HOUSING

PUBLIC BUILDINGS

TERTIARY BUILDINGS

Soc. 1 can be used on Private Residential and Social Housing only.

For ease and given the exemplary role that must be played by public bodies, it is suggested to use the indicators initially to gather data on public buildings and/or social housing owned and managed by the municipality.

at municipality level and
nd better policymaking

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Baseline

The baseline year is the year included as baseline in the municipality's Sustainable Energy & Carbon Action Plan (SECAP). For municipalities which are not signatories to the Covenant of Mayors, a baseline agreed at municipal level should be used. The municipality must be transparent on the selected baseline year. This should be recorded in the spreadsheet developed to use the Framework.

Reporting Period

The public administrations that signed up to the Covenant of Mayors, are committed to submitting monitoring reports at least every second year after submission of the action plan. The monitoring of the indicators of the Framework should complement the SECAP's indicators and therefore the two monitoring procedures are supposed to be aligned. Monitoring and communicating progress on indicators related to energy and CO_2 emissions reductions, should hence be aligned to the monitoring activity of SECAPs (where possible).

A standard reporting period should be agreed on when using the Framework. Ideally, reporting should be done on a continuous basis and at the very least on an annual basis.

Further information on reporting can be found in BU2 project deliverable, D3.3. "Definition of a methodology for reporting and monitoring the implementation of the Framework".

Indicators Methodology

The methodology presented below is a general methodology to be used in Europe - with two additional UK-specific indicators noted. Country specific indicators have also been developed at national level in Croatia, Hungary, Ireland, Italy, Poland, Spain and Turkey.

The indicators methodology should be read alongside the methodology for reporting and monitoring the implementation of the Framework (D3.3).

BUILD UPON²	INDICATOR	METRIC	LEVEL: PROJECT	LEVEL: CITY
ENVIRONMENTAL	Env. 1 Energy Renovation Rate	%		✓
	Env. 2 CO2 emissions	Ton CO2/yr	✓	✓
	Env. 3 Energy Consumption	kWh/yr	✓	✓
	Env. 4 Renewable Energy Production	kWh/yr	✓	✓
	Env. UK1 EPC Ratings	no. of dwellings / m² of non-residential	✓	✓

BUILD UPON²	INDICATOR	METRIC	LEVEL: PROJECT	LEVEL: CITY
SOCIAL — HEALTH & WELLBEING	Soc. 1 Energy Poverty	% of households	✓	✓
	Soc. 2 Indoor Air Quality	# of residential units or non-residential floor area	✓	✓
	Soc. 3 Winter Thermal Comfort		✓	✓
	Soc. 4 Summer Thermal Comfort		✓	✓
	Soc. UK1 Climate Resilience	no. of dwellings / m^2 of non-residential	✓	✓

BUILD UPON²	INDICATOR	METRIC	LEVEL: PROJECT	LEVEL: CITY
ECONOMIC	Eco. 1 Investment in energy renovation	€	✓	✓
	Eco. 2 Energy efficiency of investment	kWh/€	✓	✓
	Eco. 3 Jobs in energy renovation	#FTE	✓	✓
	Eco. 4 Upskilling in energy renovation	# Building professionals / construction workers		✓
	Eco. 4 Financial savings from energy renovation	€	✓	

Env. 1: Energy Renovation Rate

DEFINITION

Percentage of the building stock that has completed energy renovations, breakdown of the depth of renovations and percentage of renovations reaching nZEB standard

UNIT OF MEASURE

Main Metric: Percentage per year of energy renovations completed

Sub Metric 01: Percentage breakdown of depth of energy renovations completed

Sub metric 02: Percentage of energy renovations completed achieving nZEB standard

RELEVANCE

The energy renovation of the building stock is key to reaching the 2050 climate neutrality target. The renovated buildings must meet at least the minimum energy performance requirements. Therefore, it is important to be aware of the energy consumption reduction achieved. That is why the renovation rate is split up by building type and by depth of renovation. With that regard, it is also relevant to monitor the percentage of renovated buildings that are compliant with the nation's nearly Zero Energy Building's standard.

OBJECTIVE

EUROPEAN UNION

The increased rate of energy renovation is a key objective at EU level for the decarbonisation of the building stock. More specifically, the following targets have been set:

- 3 % of the total floor area of heated and/or cooled buildings owned and occupied by central government to be renovated each year

  Source: Article 5 of Directive 2012/27/EU (Under the EU Renovation Wave Strategy (2020), it is anticipated that the revised Energy Efficiency Directive will extend that requirement to all public administration levels and increase that rate).

- Under the EU green deal, annual renovation rate must double to 2.4% per year.

  Source: EU Renovation Wave

COUNTRY

The UK has no renovation rate target and no numerical NZEB definition. However, the four nations do have varying home retrofit programmes and EPC ratings are targeted - refer to indicator Env.UK1.

LOCAL AUTHORITY

Targets vary between Local Authorities.

Does your Local Authority have a renovation rate target?

METHODOLOGY

Calculate the buildings renovated during the reporting period (ideally annually) as a percentage rate of the overall building stock.

Three levels of renovation, light, medium and deep are defined in the options below.

CALCULATION

Main metric – Renovation Rate

- Residential

$$\text{Renovation rate over reporting period} = \frac{\text{Residential units renovated during reporting period}}{\text{Total residential units}} \times 100$$

- Non-Residential

$$\text{Renovation rate over reporting period} = \frac{\text{Net floor area renovated (m}^2\text{) during reporting period}}{\text{Total non-residential net floor area (m}^2\text{)}} \times 100$$

Sub metric 01 - Percentage breakdown by depth of energy renovations completed (See Env. 1 - Table below)

To assess the depth of energy renovation a pre works and post works EPC is required. If final energy is not available/used in the context of nZEB in your jurisdiction, primary energy may be used.

Municipalities must be fully transparent on the source of data and methodology used.

Step 01 - Define depth of renovation

Option A - Post Renovation Improvement (Renovation Depth)

$$\text{Depth of renovation} = \frac{\text{Pre works final energy} - \text{post works final energy}}{\text{Post works final energy}} \times 100$$

This method defines the renovation in terms of the improvement in delivered (final) energy. A light renovation is an improvement of 3-30%. A medium renovation is an improvement of 30%-60%. A deep renovation is an improvement of greater than 60%.

*Source: **Commission Recommendation (EU) 2019/786** of 8 May 2019 on building renovation.*

Option B - National nZEB Renovation Methodology

Light renovation = Post works final energy > nZEB final energy (for renovation where applicable)
Medium renovation = Post works final energy < nZEB final energy (for renovation where applicable)
Deep renovation = Post works final energy < 0.7 x nZEB final energy (for renovation where applicable)

METHODOLOGY (cont.)

This method defines the nZEB renovation target as a medium renovation and is appropriate in countries where a specific nZEB renovation target exists. A light renovation is below this target and a deep renovation is a 30% improvement above this target in terms of final energy.

Step 02 - Percentage breakdown

$$\text{Percentage breakdown (light/medium/deep)} = \frac{\text{Number of buildings achieving light/medium/deep}}{\text{Total number of buildings being renovated}} \times 100$$

Sub metric 02 – nZEB renovation uptake

- Residential

$$\text{nZEB renovation uptake} = \frac{\Sigma \text{ Residential units renovated that reach nZEB standard per year}}{\Sigma \text{Residential units renovated per year}} \times 100$$

- Non-Residential

$$\text{nZEB renovation uptake} = \frac{\Sigma \text{ Net floor area renovated (m}^2\text{) to nZEB standard per year}}{\Sigma \text{Net floor area renovated (m}^2\text{) per year}} \times 100$$

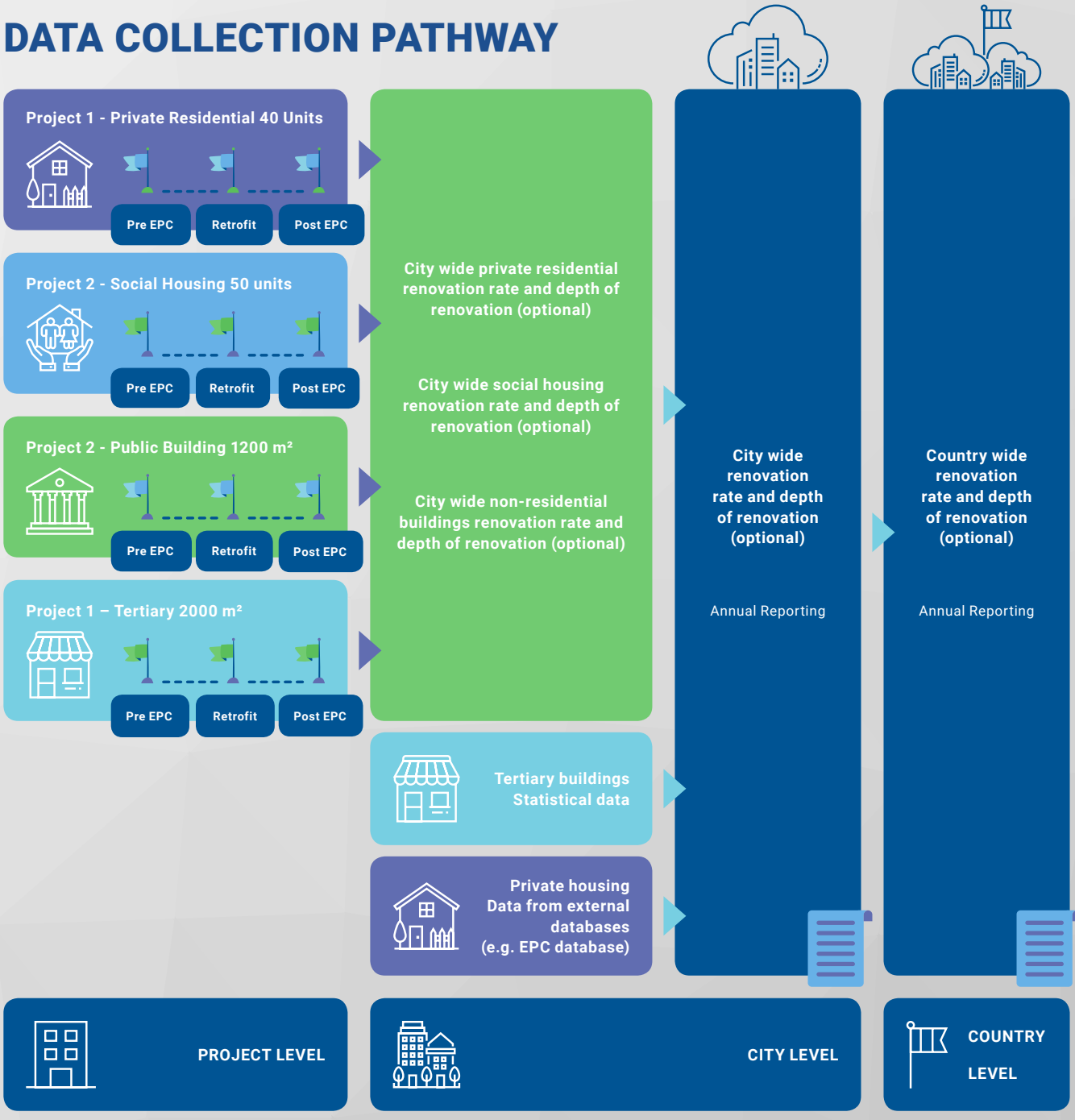
Source Of Data

For both the main metric and sub metrics: it is important to have figures for the existing property stock in terms of residential units and non-residential floor area. These figures should be available as part of SECAP reporting or collated in line with SECAP requirements for non-signatories.

For the main metric - Renovation rate: the number of renovated homes completed during the reporting period and the m² of renovated non-residential completed during the reporting period must be recorded. The project figures must be added together to get the city-wide data. If this data is not recorded at project level (e.g., for private residential and tertiary buildings), this may be estimated based on external databases such as EPC databases or grants databases.

Sub metric 01 will require a pre works and post works EPC. Municipalities should require EPCs at least for municipal buildings and social housing that they own and manage. This will provide a calculated figure for the proposed reduction in final energy at a project level which can be used to define the depth of renovation as light/medium/deep. If final energy is not available through the National EPC methodology, primary energy may be used.

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

Env. 1 - Table

TERTIARY AND PUBLIC (based on m²)

				TOTAL
MAIN METRIC: ENERGY RENOVATION RATE		**2.2 %**	**1.8 %**	**2.0 %**
SUB METRIC 01: of which	**light**	29.8 %	54.5 %	43.1%
	medium	2.1 %	27.3 %	15.7 %
	deep	68.1 %	18.2 %	41.2 %
SUB METRIC 02: nZEB uptake		80.2%	45.5%	56.9 %

RESIDENTIAL (based on # dwellings)

				TOTAL
MAIN METRIC: ENERGY RENOVATION RATE		**2.3 %**	**1.3 %**	**1.4 %**
SUB METRIC 01: of which	**light**	32.6 %	20.0 %	22.4 %
	medium	2.2 %	30.0 %	24.0 %
	deep	65.2 %	50.0 %	52.8 %
SUB METRIC 02: nZEB uptake		67.4 %	80.0 %	76.8 %

The table above is an example of potential outputs for a local authority. It shows what % of the local authority's buildings have been renovated during the reporting period (Main Metric). It also indicates the depth of renovation achieved across the renovated building stock (Sub Metric 01) and what % of those renovated buildings meet nZEB standards (Sub Metric 02). Note: Sub Metrics 01 & 02 refer to the renovated building stock, not the total building stock.

ADDITIONAL GUIDANCE

Private residential & tertiary buildings

- For private residential and tertiary buildings, encourage owners to have pre and post EPC as per above methodology.
- Grants can include a condition by making pre and post EPC a requirement to access public funding.

Actual data

As a result of considerable variables, it is better to calculate the renovation works based on calculated agreed national methodology for EPC. Actual energy use will vary significantly depending on occupation levels, internal temperature requirements, time settings, degree days and other factors which are outside the scope of energy renovation and may skew results for before and after renovation.

Env. 2: CO_2 Emissions Reduction

DEFINITION

Reduction in the direct annual CO_2 emissions equivalent achieved through renovation - operational energy only

UNIT OF MEASURE

Main Metric: Ton CO_2 eq/year

Sub Metric: % Reduction in CO_2 eq/year

RELEVANCE

CO_2 is a major contributor to global warming. CO_2 is emitted into the atmosphere by burning fossils to heat and cool, as well as to produce Domestic Hot Water (DHW) and produce electricity for use in the building. Buildings are responsible for 36% of CO_2 emissions in the European Union (EU).

OBJECTIVE

EUROPEAN UNION

The objective of the indicator is to identify the CO_2 emissions reductions from renovations at a project level and to track overall progress at a municipal level towards the EU's objective of reducing CO_2 emissions by at least 55% by 2030 and to reach carbon neutrality by 2050. **Read more**.

COUNTRY

The UK aims to achieve net Zero Carbon by 2050.

The UK's 6th carbon budget targets a 78% reduction in total UK CO_2 eq emissions by 2035, compared to 1990 levels. The UK government's 10-point plan seeks reductions in public sector direct emissions by 50% compared to a 2017 baseline.

MUNICIPALITY

Municipal targets vary.

What CO_2 emissions target does your Local Authority have?

METHODOLOGY

Calculate the difference between the emissions before and after the renovation works. The calculation must be done over an agreed reporting period, ideally on a yearly basis.

CALCULATION REDUCTION OF CO_2 EMISSIONS

Main metric

CO_2 emissions reduction (Ton CO eq. / year) = Σ (Pre-renovation CO_2 Emissions - Post renovation CO_2 emissions)

Sub metric - Percentage reduction of CO_2 emissions

$$\text{Percentage reduction of } CO_2 \text{ emissions} = \frac{CO_2 \text{ emissions reduction}}{\text{Total sector } CO_2 \text{ emissions}} \times 100$$

Source of data

Municipalities may use option A, B or C or a mix of them. For instance, a municipality may use option A to gather data on energy renovation of municipal buildings and option B to gather data on the private residential sector.

Option A – Starting from data at project level

Municipalities require pre works and post works EPCs* for specific projects (or actual monitoring of final energy consumption for a minimum of 12 months pre and post retrofit) multiplied by the CO_2 emission factors (tCO_2/MWh) for the forms of energy used in the building**.

For ease, it is suggested municipalities initially use it for municipal buildings and social housing that they own and manage. This will provide a calculated – or actual - figure for the proposed reduction in CO_2 emissions at a project level which should be centrally recorded.

Option B – Calculated from Env. 3

In countries where the EPC does not include data on CO_2 emissions, municipalities can calculate it based on Env. 3 (Energy Consumption) using the appropriate CO_2 emission factors (tCO_2/MWh) for the forms of energy used in the building**.

METHODOLOGY (cont.)

Option C – Starting from data at municipal level

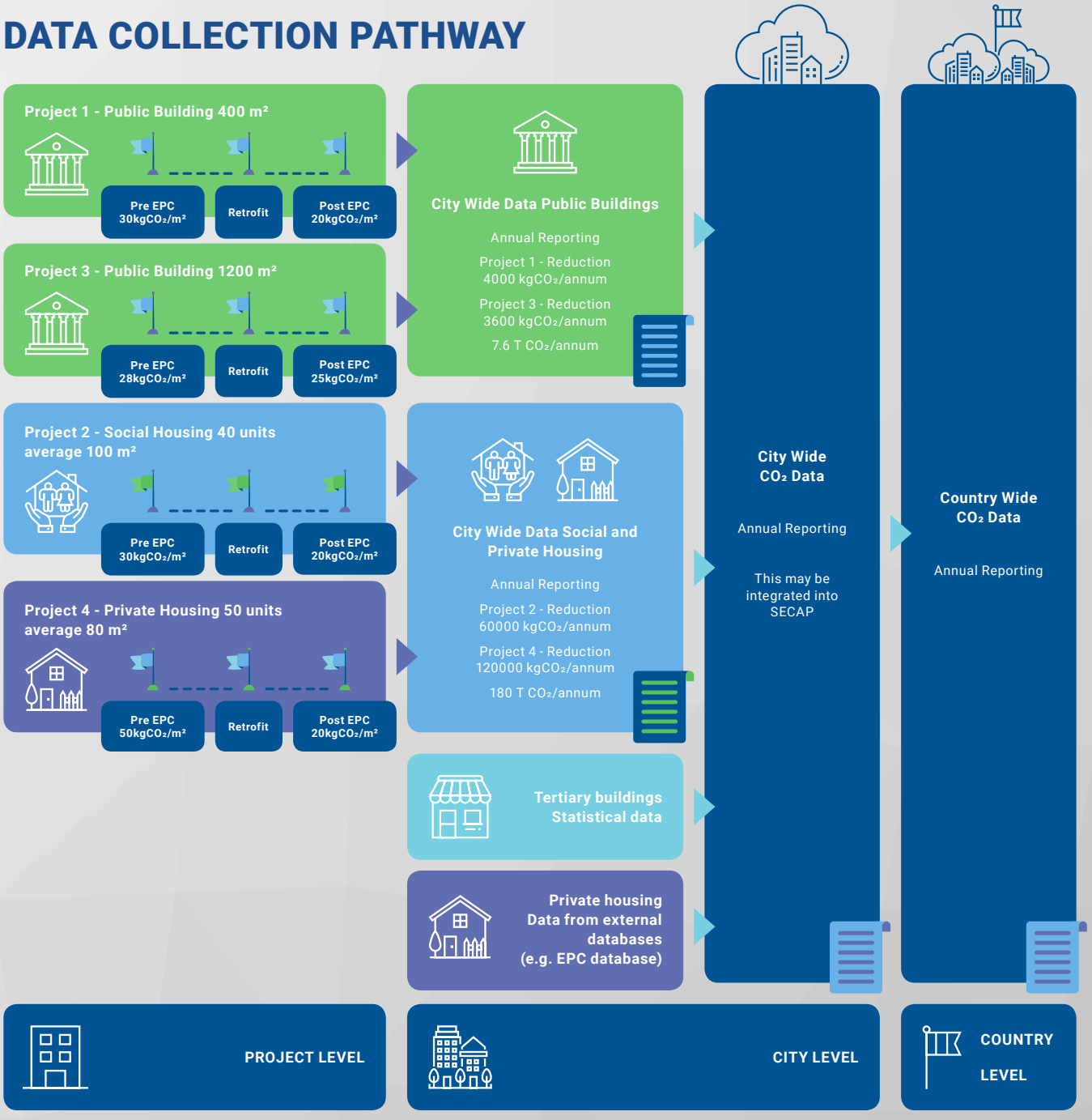
If gathering data at municipal level, the following methodologies may be used:

- Desegregation of national statistics to the municipal level
- Using data from your local / regional cadastre
- Using your national EPC database
  - Tertiary buildings: Any renovation works will generally be followed by a new lease, in which case a new EPC should be provided.
  - Private homes that are renovated with grant funding are likely to have a post renovation EPC with a calculated savings. This and the EPC database can be used to estimate CO_2 emissions reduction in private residential.

**CO_2 emissions are usually displayed on the cover page of the EPC as CO_2/sqm. This will need to be cross referenced against the EPC Building Report which will state the floor area.*

***For CO_2 emission factors, local figures can be used, or default national figures, which are provided at national level, especially for electricity, which depend on the national electricity production annual mix. Certain countries have different electricity conversion factors depending on the region. The Covenant of Mayors for Climate and Energy Reporting Guidelines also include tables for default emissions factors for fuel combustion (fossil and renewable) and for electricity by country and year.*

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

Private residential & tertiary buildings

- For private residential and tertiary buildings, encourage owners to have pre and post EPC as per above methodology.
- Grants can include a condition by making pre and post EPC a requirement to access public funding.

Actual data

- Once the Framework has been established the use of actual consumption data from projects should be recorded in the Framework. If using actual data, the CO_2 emissions can be obtained by applying conversion factors to the actual energy consumption measured through monitoring or from energy bills (energy utility could provide this data).
- Depending on how Article 13 of Directive 2010/31/EC has been transposed in your country, you may be able to use Display Energy Certificates (DECs) to capture information on actual energy use of public buildings. The gathering of data should also be facilitated in the future by the introduction of smart meters across member states.

Env. 3: Final Energy Consumption Reduction

DEFINITION

Reduction in final (delivered) energy consumption through renovation

UNIT OF MEASURE

Main Metric: kWh/yr - Final (delivered) energy

Sub Metric: % reduction in kWh

RELEVANCE

The final energy consumption (also called delivered energy) reflects the consumed energy by the end-user and depends on the energy needs of the building and the efficiencies of its technical systems. Measuring and assessing the final energy consumption of renovation encourages a fabric first approach to energy renovation.

OBJECTIVE

EUROPEAN UNION

At least 32.5% improvement in energy efficiency by 2030 - relative to the 2007 modelling projections for 2030.

*Source: **Energy Efficiency Directive (2018/2002)**.*

To achieve the 55% emission reduction target by 2030, the EU should reduce buildings' final energy consumption by 14% and energy consumption for heating and cooling by 18% (Compared to 2015 levels).

*Source: **EU's Renovation Wave Strategy**.*

COUNTRY

The UK has no defined energy efficiency targets. (EPC ratings are targeted - refer to indicator Env.UK1)

CITY

Municipal targets vary.

Does your Local Authority have building energy consumption or reduction targets?

METHODOLOGY

Calculate the difference between the kWhr/yr consumption before renovation works and after the renovation works. All the forms of energy usage must be considered for HVAC, DHW, ventilation and lighting (or in line with the National Methodology for EPCs). The calculation must be done over an agreed reporting period, ideally annually.

CALCULATION

Main Metric - Final energy consumption reduction

Final (delivered) energy consumption reduction (kWh/yr) = Σ (Pre-renovation final energy (kWh/yr) - Post renovation final energy (kWh/yr))

Sub metric - Percentage reduction of final energy consumption over the reporting period

$$\text{Percentage reduction of final energy consumption} = \frac{\Sigma \text{ Final energy consumption reduction}}{\text{Total sector final energy consumption}} \times 100$$

Source of data

Municipalities may use option A or B or a mix of both. For instance, a municipality may use option A to gather data on energy renovation of municipal buildings and option B to gather data on the private residential sector. Municipalities must be transparent on the source of data used.

Option A – Starting from data at project level

Municipalities require pre works and post works EPCs* for specific projects – or actual monitored data for a minimum of 12 months. For ease, it is suggested municipalities initially use it for municipal buildings and social housing that they own and manage. This will provide a calculated – or actual - figure for the proposed reduction in final energy kWh at a project level which should be centrally recorded.

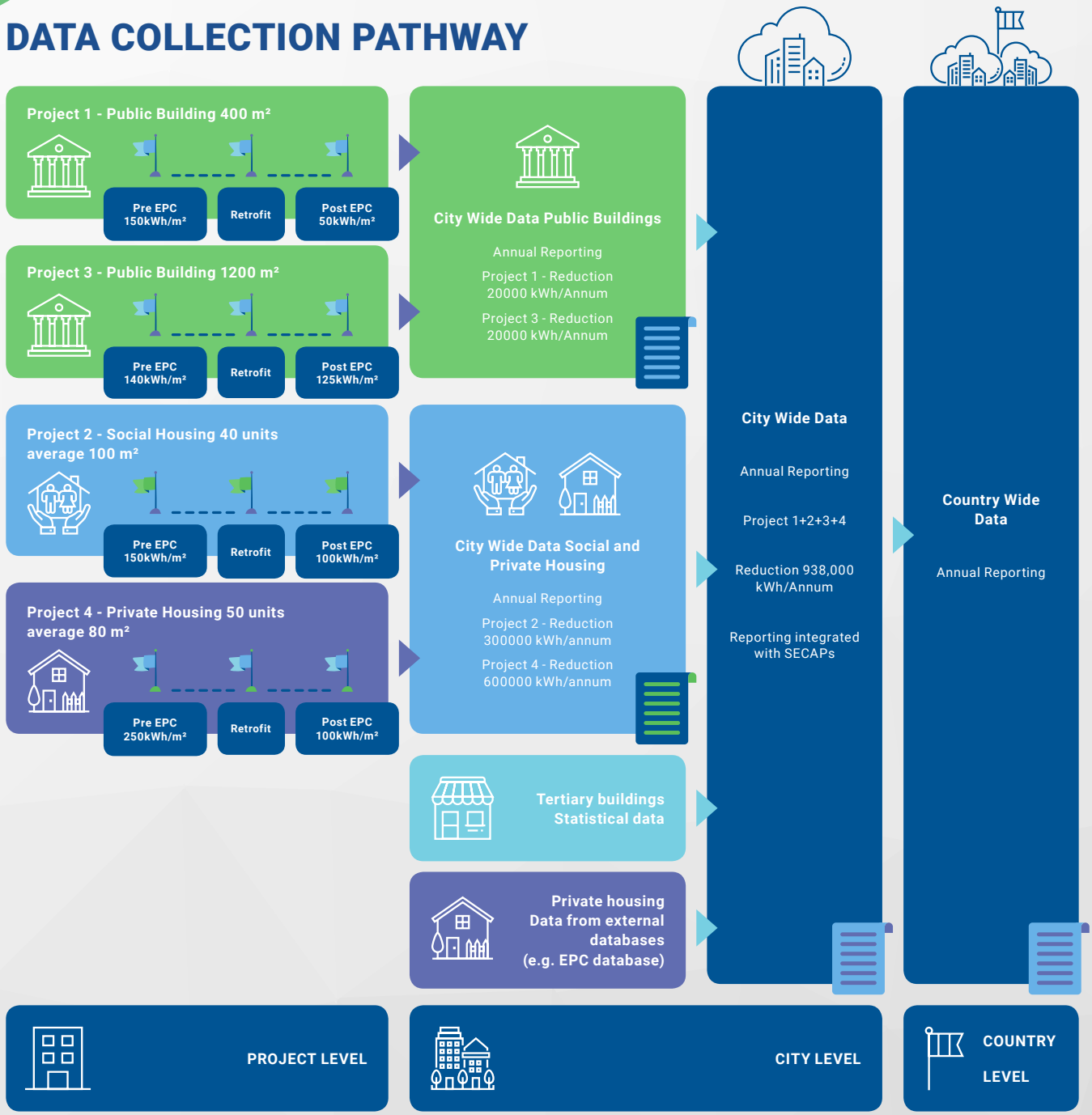
**Final (delivered) energy by source of energy is usually displayed on the results page of the EPC as kWh/sqm year (total and per usage). This will need to be cross referenced against the EPC Building Report which will state the floor area. If final energy is not available through the National EPC methodology primary energy may be used.*

Option B – Starting from data at municipal level

If gathering data at municipal level, the following methodologies may be used:

- Desegregation of national statistics to the municipal level
- Using data from your local / regional cadastre
- Using your national EPC database
  - Tertiary buildings: Any renovation works will generally be followed by a new lease, in which case a new EPC should be provided.
  - Private homes that are renovated with grant funding are likely to have a post renovation EPC with a calculated savings. This and the EPC database can be used to estimate reduction in kWh in private residential.

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

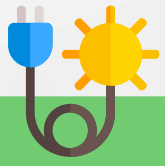
Private residential & tertiary buildings

- For private residential and tertiary buildings, encourage owners to have pre and post EPC as per above methodology.
- Grants can include a condition by making pre and post EPC a requirement to access public funding.

Actual data

- Once the Framework has been established the use of actual consumption data from projects should be recorded in the Framework. If using actual data, the energy consumption prior to the renovation works should be assessed (from actual meter readings on bills) for at least 12 months and compared against the energy consumption post works for another 12 months.
- Depending on how Article 13 of Directive 2010/31/EC has been transposed in your country, you may be able to use Display Energy Certificates (DECs) to capture information on actual energy use of public buildings. The gathering of data should also be facilitated in the future by the introduction of smart meters across member states.

Env. 4: Additional Renewable Energy Production



DEFINITION

Increase in renewable energy generated and used on site as a result of energy renovation

EPBD 2018/844 Annex I, Point 2

UNIT OF MEASURE

Main Metric: kWh/yr from renewables as part of renovation projects

Sub Metric: % increase in kWh/yr from renewables as part of renovation projects

RELEVANCE

The provision of additional renewables for both electricity and heating will replace fossil fuels and associated CO_2 emissions with clean renewable energy. It also reduces energy dependence and provides security and diversification of energy supply.

OBJECTIVE

EUROPEAN UNION

The objective of the indicator is to capture data on the additional energy produced from renewable resources on site or nearby as a result of energy renovation.

The overall goal is to increase renewable energy sources consumption to 32% by 2030 - *Directive (EU) 2018/2001*.

COUNTRY

The UK has no overall targets for on-building renewables.

Scotland: 50% of overall energy consumption to be from renewable sources by 2030.

Wales & N Ireland: 70% of electricity to be from renewable sources by 2030.

CITY

Municipal targets vary.

Does your Local Authority have targets for renewable energy production?

METHODOLOGY

Calculate as the difference between the kWh generation from renewable resources on site or nearby before renovation works and after the renovation works. The calculation must be done over the agreed reporting period, ideally annually.

CALCULATION

Main Metric - Increase in kWh/year from renewables

Increase in kWh/year from renewables = Σ (Post Renovation kWh/year from renewables produced onsite or nearby - Pre renovation kWh/year from renewables produced onsite or nearby)

Sub metric - Percentage increase in kWh/year from renewables

$$\text{Percentage increase in kWh/year from renewables} = \frac{\text{Increase in kWh/year from renewables produced on site or nearby}}{\text{Total energy production kWh/year from renewables produced onsite or nearby}} \times 100$$

Source of data

Municipalities may use option A or B or a mix of both. For instance, a municipality may use option A to gather data on energy renovation of municipal buildings and option B to gather data on the private residential sector.

Option A – Starting from data at project level

Municipalities require pre works and post works EPCs* for specific projects – or actual monitored data for a minimum of 12 months pre and post renovation. For ease, it is suggested municipalities initially use it for municipal buildings and social housing that they own and manage. This will provide a calculated – or actual - figure for the proposed renewable energy in kWh at a project level which should be centrally recorded.

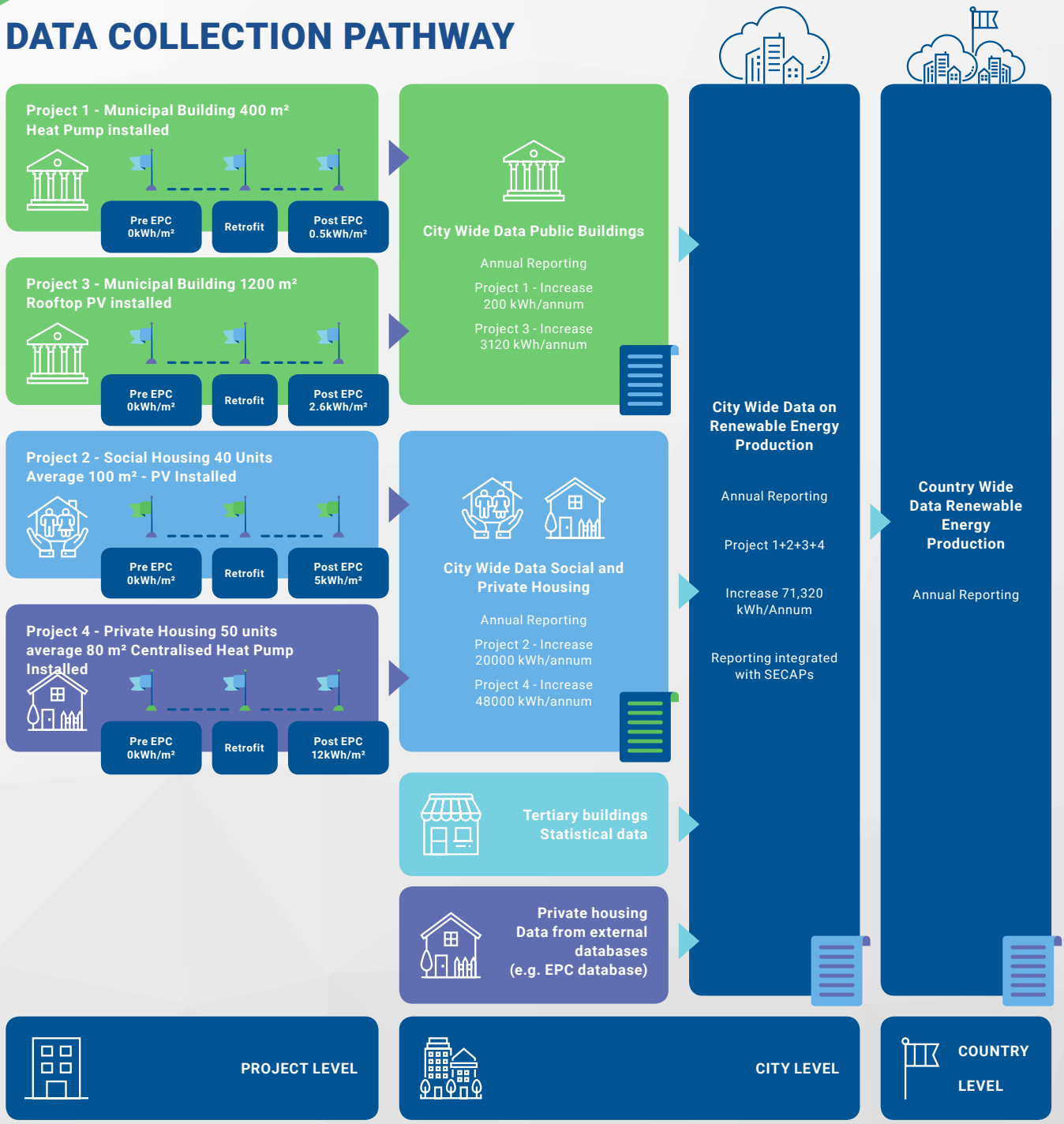
Option B – Starting from data at municipal level

If gathering data at municipal level, the following methodologies may be used:

- Desegregation of national statistics to the municipal level
- Using data from your local / regional cadastre
- Using your national EPC database
  - Tertiary buildings: Any renovation works will generally be followed by a new lease, in which case a new EPC should be provided.
  - Private homes that are renovated with grant funding are likely to have a post renovation EPC with a calculated savings. This and the EPC database can be used to estimate reduction in kWh in private residential.

**Renewables energy is usually displayed on the results page of the EPC as kWh/sqm. This will need to be cross referenced against the EPC Building Report which will state the floor area.*

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

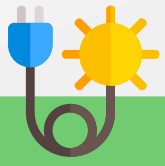
Private residential & tertiary buildings

- For private residential and tertiary buildings, encourage owners to have pre and post EPC as per above methodology.
- Grants can include a condition by making pre and post EPC a requirement to access public funding.

Actual data

- Once the Framework has been established the use of actual consumption data from projects should be recorded in the Framework.
- If using actual data, the energy consumption prior to the renovation works should be assessed (from actual meter readings on bills) for at least 12 months and compared against the energy consumption post works for another 12 months. Depending on how Article 13 of Directive 2010/31/EC has been transposed in your country, you may be able to use Display Energy Certificates (DECs) to capture information on actual energy use of public buildings. The gathering of data should also be facilitated in the future by the introduction of smart meters across member states.

Env. UK1: EPC Ratings



DEFINITION

Tally of different EPC Ratings for all buildings including SAP scores and Environmental Impact Ratings

UNIT OF MEASURE

Main Metric: No. of dwellings / m2 of non-residential floor area for each EPC rating (A-G)

Sub Metric 1: Average SAP Score (1-100)

Sub Metric 2: Average EIR Score (1-100)

RELEVANCE

EPC ratings are used in UK energy efficiency and fuel poverty targets and EPCs are required in the UK when a building is constructed, sold or let. Whilst flawed - because they rely on modelled (not measured) data and use broad-brush assumptions - they do provide a crude assessment of a building's carbon emissions, irrespective of its location or occupancy, allowing buildings to be compared.

OBJECTIVE

EUROPEAN UNION

n/a

COUNTRY

England & Wales: All fuel poor and privately rented households to be EPC C by 2030. All households to be EPC C by 2035.

Scotland: All households to be EPC C by 2040.

CITY

Municipal targets vary.

Does your Local Authority have EPC targets beyond the national aims?

METHODOLOGY

This indicator can be used at a project or city level. At project leve the reporting period = pre renovation & post renvoation. At city level, the reporting period = annual. Obtain pre & post EPCs for all buildings renovated. Calculate number of dwellings / m2 of non-residential buildings for each ECP rating (A-G), average SAP and EIR scores across all buildings – and compare pre & post renovation results.

CALCULATION

Main indicator – EPC Rating

Impact on EPC ratings over reporting period to be shown in a table or graph as follows:

no. of residential units / m2 of non-residential floor area with EPC rating A at start and end of reporting period

no. of residential units / m2 of non-residential floor area with EPC rating B at start and end of reporting period

etc. up to EPC rating G

Sub indicator 1 – SAP Score (energy efficiency rating)

Impact on SAP score over reporting period = **Average SAP score of all buildings at end of reporting period** - **Average SAP score of all buildings at start of reporting period**

Sub indicator 2 – EIR Score (environmental impact rating)

Impact on EIR score over reporting period = **Average EIR score of all buildings at end of reporting period** - **Average EIR score of all buildings at start of reporting period**

Source of data

For both the main indicator and sub indicator, data can be found from EPC certificates, all of which are logged on the UK national Energy Performance of Buildings register: https://find-energy-certificate.digital.communities.gov.uk/ In the UK, EPCs are only legally required when a building is constructed, sold or rented. Not all properties therefore have an EPC.

When renovating a property, the framework requires EPCs to be obtained pre and post renovation. To encourage this, renovation grants/funding and any municipality led projects should demand pre & post EPCs.

Soc. 1: Energy Poverty Reduction

DEFINITION

Percentage of households living in renovated homes removed from risk of energy poverty post energy renovation

UNIT OF MEASURE

Percentage

RELEVANCE

As Recital 59 of the recast ***Electricity Directive*** recapitulates, energy poverty arises from a combination of low income, high expenditure on energy, and poor energy efficiency of dwellings. Therefore, it is a multidimensional phenomenon that must be approached comprehensively, where improving the building thermal quality through renovation is one of the key elements to tackle. With nearly34 million Europeans unable to afford to keep their homes adequately warm in 2018, energy poverty is a major challenge for the EU. Source:2018. Eurostat, Statistics on Income and Living Conditions (SILC).

OBJECTIVE

EUROPEAN UNION

The objective of the indicator is to assess the impact of energy efficiency renovation on reducing the risk of energy poverty.

COUNTRY

England: by 2030, all fuel poor households as reasonably practical to have an EPC C rating by 2030.

Wales: by 2035, not more than 5% of households to be living in fuel poverty at any one time as far as reasonably practicable.

Scotland: by 2040, not more than 5% of households to be living in fuel poverty.

CITY

Municipal targets vary.

Does your Local Authority have an energy poverty target?

METHODOLOGY

Calculate the percentage of energy renovation works which lead to a decrease in the number of households at risk of energy poverty. Ideally, this data should be compiled at municipal level on an annual basis. Municipalities are also encouraged to capture city-wide data within the Framework where they exist.

CALCULATION

$$\text{Percentage of households living in renovated homes removed from risk of energy poverty} = \frac{\Sigma\,(\text{Number of households at risk of energy poverty pre-renovation work} - \text{Number of households at risk of energy poverty post-renovation work})}{\text{Number of residential units renovated}} \times 100$$

Source of data

The definition of Energy Poverty varies between the four home nations - refer to glossary on p8 above.

EPC certificates will provide information about likely expenditure on fuel bills. Local Authorities can access postcode level household income information through the Office for National Statistics and organisations like Experian.

Municipalities may use options A or B or a mix of both. For instance, a municipality may use option A to gather data on energy renovation of the social housing stock they own and manage and option B to gather data at city level. The methodology used and any assumptions made must be fully disclosed and recorded.

Option A – Starting from data at project level

The municipality should collect the following data:

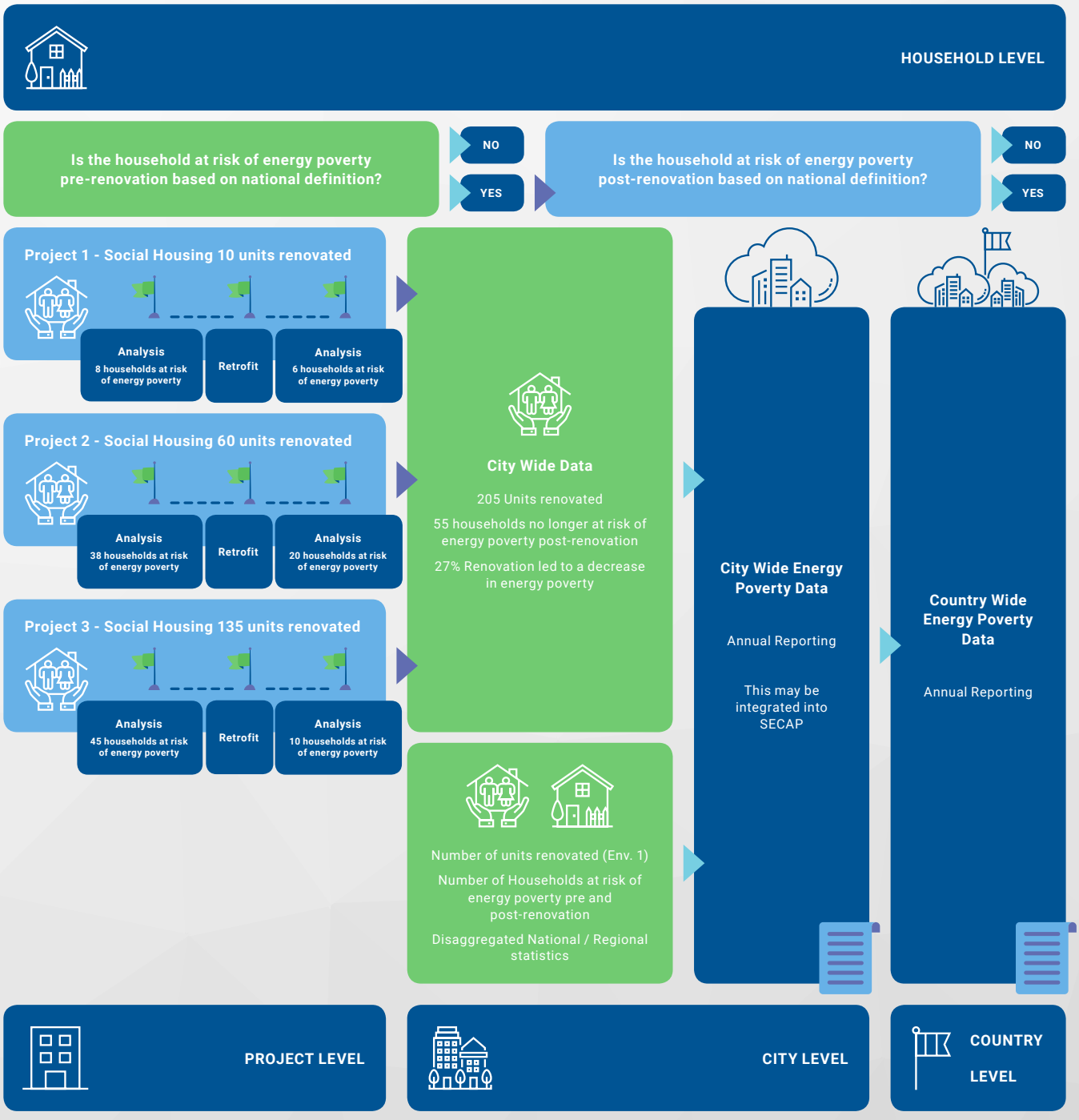
- number of residential units renovated during the project
- pre and post renovation EPCs for all units
- pre and post renovation postcode-level data on household income.

Option B – Starting from data at municipal level

The municipality should collect the following municipality-wide data:

- number of residential units renovated in a given reporting period
- number of households at risk of fuel poverty at start and end of reporting period (from Local Authority/national data)

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on both social housing and private residential buildings. For ease, municipalities may only use it initially on the social housing stock they own and manage.

ADDITIONAL GUIDANCE

Ensure the methodology used in the Framework to define households at risk of energy poverty remains fully aligned with the methodology developed and used at national level.

Encourage private social housing providers to capture data at project level when renovating their own stock.

Encourage municipalities to capture data on actual energy use (utility bills) and income for a minimum of 12 months pre and post energy renovation for the social housing they own (where possible).

Soc. 2: Indoor Air Quality

DEFINITION

Renovated building stock with improved Indoor Air Quality (IAQ) in the conditioned spaces.

UNIT OF MEASURE

Main Metric: No. of residential units or Non-residential floor area (m^2)

Sub Metric: Percentage improvement

RELEVANCE

Europeans spend up to 90% of their time indoors. Indoor air pollution is a major environmental health and well-being concern as it can lead to serious health effects. The contaminants that are critical to IAQ are CO_2, carbon monoxide, particulate matter and volatile organic compounds (VOCs). Most indoor air pollution comes from sources inside the building. It is therefore key to control the sources of these contaminants and to ensure their removal through proper ventilation. Good ventilation is critical in well insulated and airtight buildings and must be considered as part of any energy renovation works.

OBJECTIVE

EUROPEAN UNION

The objective of the indicator is to provide safe buildings for people by eliminating the risks that might result in unintentionally reducing the indoor air quality as a result of carrying out energy renovation works.

To achieve the 55% emission reduction target by 2030, the EU should reduce buildings' final energy consumption by 14% and energy consumption for heating and cooling by 18% (Compared to 2015 levels).

Source: EU's Renovation Wave Strategy.

COUNTRY

The UK has no IAQ targets.

CITY

Municipal targets vary.

Does your Local Authority have targets for Indoor Air Quality?

METHODOLOGY

Calculate improvement in IAQ post energy renovation. This must be reported over an agreed reporting period, ideally annually. This indicator can be used initially at project level. Once it has been adopted and reported across a sufficient number of projects it can be reported at a city level.

CALCULATION

Main Metric - Renovated building stock with improved IAQ

No. of residential units with improved IAQ = Σ renovated units with adequate IAQ

Non-residential floor area (m²) with improved IAQ = Σ area of renovated buildings (m²) with adequate IAQ

Sub metric – Percentage of renovated building stock with improved IAQ

$$\text{Percentage of residential units with improved IAQ} = \frac{\Sigma \text{ renovated units with adequate IAQ}}{\text{Total no of units renovated}} \times 100$$

$$\text{Percentage of non-residential floor area (m²) with improved IAQ} = \frac{\Sigma \text{ area of renovated buildings (m²) with adequate IAQ}}{\text{Floor area (m²)}} \times 100$$

Source of data

Municipalities may use option A, B, C, or a mix of them. In all cases, municipalities must be transparent on the methodology used and assumptions made.

Option A – Ventilation systems in compliance with National Building standards and PAS 2035/38

Count the dwellings and spaces in renovated buildings that comply with the predefined (theoretical) airflow rates required in the national building codes as well as PAS 2035 (for residential buildings) and PAS 2038 (for non residential buildings)*. The ventilation system should be commissioned to ensure it functions correctly - as per requirements in PAS 2035/38. This applies to both natural and mechanical ventilation systems.

**PAS 2035:2019 and PAS 2038:2021 are standards on retrofitting energy efficiency measures in buildings from the British Standards Institute.*

METHODOLOGY (cont.)

Option B – Occupant Survey

The indoor air quality is measured by occupant surveys pre and post renovations – ideally, 12 months post-renovation, once the building is occupied. Count the dwellings or area (m²) with improved air quality post energy renovation. The main reference standards for post occupancy surveys of indoor environments and user perceptions of comfort and well-being are ISO 10551 and ISO 28802. The survey methodology should clearly state the metrics of improvement.

References and examples:

- Survey developed by UKGBC for Leeds City Council as part of the Build Upon project (see Appendix 3 – Tenant's questionnaire)
- BusMethodology
- *Center for the Built Environment - Harnessing Occupant's Insights - What we measure*
- *Survey developed for synikia project. (See appendix G of the document)*

Option C – In-situ monitoring on a sampling basis

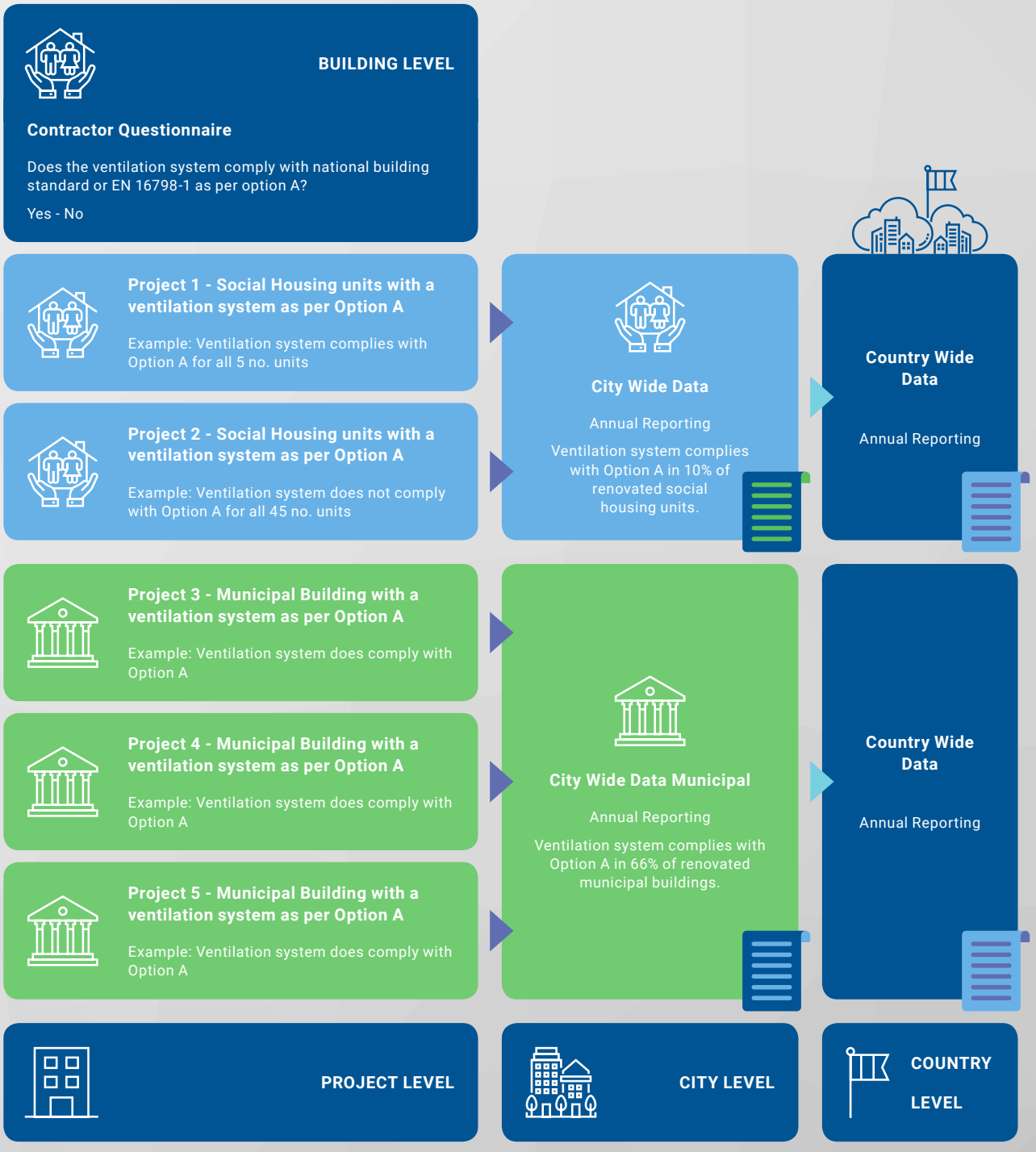
CO_2 is a good proxy for IAQ as it can provide an indication of the ventilation rate in spaces used by people. In-situ monitoring measures the CO_2 level in units of parts per million (ppm). To consider that a space has an adequate IAQ, the measurements of CO_2 should not exceed the defined range (IEQII in table 1 or national requirement) by more than 5% of the occupied time**.

***Based on "Methodology framework for plus energy buildings and neighbourhood" (synikia innovation project)*

Table 1. CO2 concentrations per category assuming a standard CO2 emission of 20L/h per person (Source: EN ISO 16798-1-2019)

CATEGORY	CO_2 Concentrations above outdoor during full occupancy (outdoor levels assumed to be equal to 400 ppm)
IEQ I	≤ 550 ppm
IEQ II	> 550 ppm and ≤ 800 ppm
IEQ III	> 800 ppm and ≤ 1350 ppm
IEQ IV	> 1350

DATA COLLECTION PATHWAY



This is an example of how the Framework works using option A. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

Encourage municipalities as per option A to carry out design of ventilation systems as per the National Building Code and PAS 2035/2038 and commissioned where applicable and include in the scope of works to the design team and installers.

Encourage municipalities as per option C to carry out in-situ monitoring on a sample of buildings, in particular a reasonable sample of social housing that do not have commissioned ventilation systems.

Soc. 3: Winter Thermal Comfort

DEFINITION

Renovated building stock with an improved winter thermal comfort (WTC) in all the conditioned spaces

UNIT OF MEASURE

Main Metric: no. of residential units or non-residential floor area (m²)

Sub Metric: Percentage improvement

RELEVANCE

Thermal comfort can improve people's health and well-being. Thermal comfort is defined by environmental parameters, like temperature, relative humidity and air velocity, and by personal parameters such as clothing, level of activity,gender and age, which affect a person's metabolic rate.

OBJECTIVE

EUROPEAN UNION

In 2018, nearly 34 million Europeans were unable to afford to keep their homes adequately warm. People in inefficient buildings are more exposed to cold spells, heatwaves and other impacts of climate change. Inadequate comfort in housing and work environments, such as inadequate indoor temperatures and deficient air quality, contribute to lower productivity, health problems and higher mortality and morbidity.

Source: EU's Renovation Wave Strategy.

COUNTRY

The UK has no thermal comfort targets, although the Housing Health & Safety Rating System addresses excessive cold in rented housing.

CITY

Municipal targets vary.

Does your Local Authority have thermal comfort targets?

METHODOLOGY

Calculate the number of renovated dwellings and areas (m², for non-residential) with adequate winter thermal comfort conditions established through the options below.

This must be done over an agreed reporting period, ideally annually. This indicator can be used initially at project level. Once it has been adopted and reported across a sufficient number of projects it can be reported at a city level.

CALCULATION

Main Metric - Renovated building stock with improved winter thermal comfort

- Residential

  No. of residential units with improved WTC = Σ renovated units with adequate WTC

- Non-Residential

$$\text{Non-residential floor area (m}^2\text{) with improved WTC} = \frac{\Sigma \text{ area of renovated buildings (m}^2\text{) with adequate WTC}}{\text{Total building renovated}} \times 100$$

Sub metric – Percentage of renovated building stock with improved winter thermal comfort

$$\text{Percentage of residential units with improved WTC} = \frac{\Sigma \text{ renovated units with adequate WTC}}{\text{Total area (m}^2\text{) of renovated buildings}} \times 100$$

$$\text{Percentage of non-residential floor (m}^2\text{) with improved WTC} = \frac{\Sigma \text{ area of renovated buildings (m}^2\text{) with adequate WTC}}{\text{Total area (m}^2\text{) of renovated buildings x 100}} \times 100$$

Source of data

Municipalities can use one or more of the following methods. In all cases, they must be transparent on the methodology used and the assumptions made.

METHODOLOGY (cont.)

Option A – Heating systems to National Building Code or EN 16798-1:2019
Count the number of renovated dwellings and m² in non-residential buildings that comply with the predefined (theoretical) indoor winter thermal comfort conditions as set in the national building code at design stage.

If the national building code has no clear requirements to ensure the winter thermal comfort at design stage, EN 16798-1:2019 reference can be taken, according to the Category II temperature ranges**. There is no standard stating the acceptable hours outside the comfort temperatures but 5% of annual occupied hours is sometimes referenced*****.

Option B – Occupant Survey

In this case the winter thermal comfort is determined based on the level of dissatisfaction with the thermal comfort conditions from post-occupancy surveys. These should be completed 12 months post-completion, once the buildings are occupied.

The main reference standards for post occupancy surveys of indoor environments and user perceptions of comfort and well-being are ISO 10551 and ISO 28802***.

References and examples:

- Survey developed by UKGBC for Leeds City Council as part of the Build Upon2 project (see Appendix 3 – Tenant's questionnaire)
- *https://busmethodology.org.uk*
- *https://cbe.berkeley.edu/resources/occupant-survey/what-we-measure/*
- *Survey developed for synikia project*.

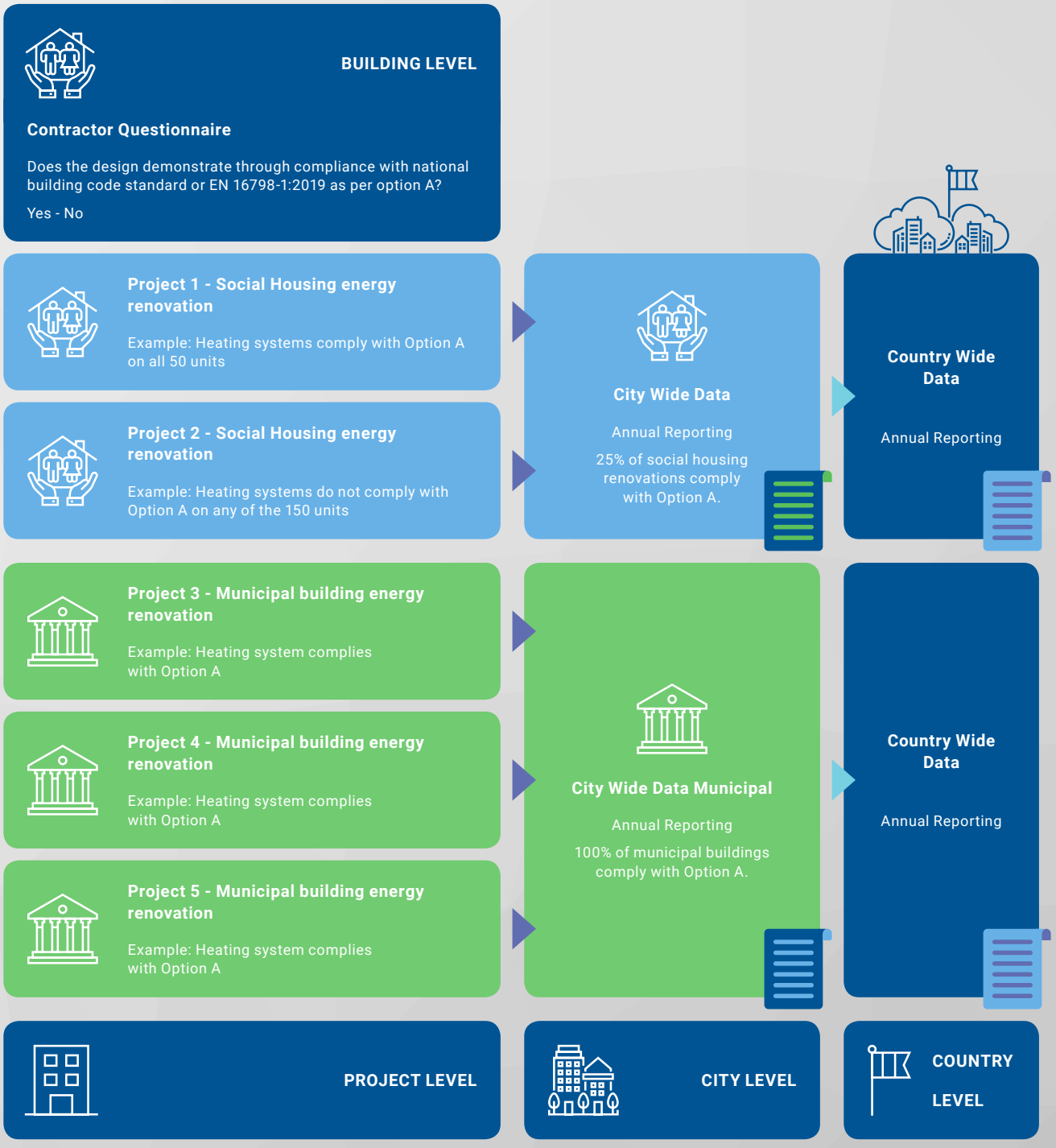
Option C – In-Situ monitoring on a sampling basis**

Monitoring (hourly) data on the thermal conditions in a building can be used to assess the winter thermal comfort over a complete heating season. If the national building code establishes minimum requirements in relation to winter thermal comfort, they should be taken as reference for the monitoring.

As in option A, if the national building code has no clear requirements to ensure the winter thermal comfort at project stage, EN 16798-1:2019 reference can be taken according to the Category II temperature ranges. There is no standard stating the acceptable hours outside the comfort temperatures but 5% of annual occupied hours is sometimes referenced*****.

**The EN 16798-1:2019 is a non-obligatory standard and was developed to guarantee that well-being and comfort of building occupants is systematically taken into account when new and existing buildings are (re)designed to improve their energy efficiency.[1]*
***Based on Level(s) indicator 4.2 for Level 2*
****Level(s) indicator 4.1*
*****Based on Level(s) indicator 4.2 for Level 3*
******Regnier, Cindy. Guide to Setting Thermal Comfort Criteria and Minimizing Energy Use in Delivering Thermal Comfort. United States: N. p., 2012. Web. doi:10.2172/1169480*

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings using option A. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

It must be assumed that if there is no data on design of heating systems that no design and commissioning of the system took place and winter thermal comfort may be compromised post renovation.

Encourage municipalities as per option A to carry out an assessment of the requirements to ensure the winter thermal comfort at project stage.

Encourage municipalities as per option C to carry out on site testing on a sample of buildings to ensure adequate internal temperature is achieved. Thermal probes installed at sampling locations inside the building or for each representative residential property type. In residential buildings, at least the living rooms should be considered. For multi-family buildings, a sample of each distinctive configuration and orientation of apartments shall be assessed. In tertiary and public buildings, the reported performance shall apply to those spaces or zones that account for >10% of the total useful floor area of the building. Data shall be collected for 12-month post-renovation once the building is occupied******.

*******Based on Level(s) indicator 4.2 for Level 3*

Soc. 4: Summer Thermal Comfort

DEFINITION

Summer Thermal Comfort refers to the renovated building stock with limited overheating risks.

UNIT OF MEASURE

Main Metric: No. of residential units or non-residential floor area (m²)

Sub Metric: Percentage improvement

RELEVANCE

The frequency and severity of climate and weather extremes is increasing in Europe. Excess heat affects the health and well-being of occupants, especially if sleep is degraded. Factors such as climate change, increased urbanisation, high rise apartments and winter energy efficiency measures increase the overheating risk. To protect people's health and well-being, the objective of this indicator is to ensure energy renovation does not lead to an increase in overheating risk. The thermal performance of buildings during summertime is usually measured against a benchmark temperature that should not be exceeded for a certain number of hours during an annual occupied period.

OBJECTIVE

EUROPEAN UNION

Extreme weather and long-lasting climatic changes can damage buildings and their mitigation potential, e.g., solar panels after hailstorms. It can also impact people's comfort and well-being. The Commission is exploring options to better predict climate-induced stress on buildings and to integrate climate resilience considerations into the construction and renovation of buildings.

Source: EU Climate Adaptation Strategy (2020).

COUNTRY

The UK has no thermal comfort targets, although the Housing Health & Safety Rating System addresses excessive heat in rented housing.

CITY

Municipal targets vary.

Does your Local Authority have thermal comfort targets?

METHODOLOGY

Count the number of renovated dwellings and (m²) in non-residential buildings that achieve adequate summer thermal comfort as per options below.

This should be done over an agreed reporting period, ideally annually.

This indicator can be used initially at project level. Once it has been adopted and reported across a sufficient number of projects it can be reported at a city level.

CALCULATION

Main Metric – Renovated building stock with improved summer thermal comfort

- Residential

  No. of renovated residential units assessed with improved summer thermal comfort = Σ renovated units achieving adequate summer thermal comfort

- Non-Residential

  Non-residential floor area (m²) with improved summer thermal comfort = Σ area of renovated buildings (m²) achieving adequate summer thermal comfort.

Sub metric

$$\text{Percentage of residential units assessed with improved summer thermal comfort} = \frac{\Sigma \text{ residential units assessed which achieve adequate summer thermal comfort}}{\text{Total building renovated}} \times 100$$

$$\text{Percentage of Non-residential floor (m²) assessed with improved summer thermal comfort} = \frac{\Sigma \text{ area of renovated buildings which achieve adequate summer thermal comfort}}{\text{Total area of renovated buildings x 100}} \times 100$$

Source of data

Municipalities can use one or more of the following methods. In all cases, municipalities must be transparent on the methodology used and any assumptions made.

METHODOLOGY (cont.)

Option A – National Building Code Standard / CIBSE TM52

This option is based on the assessment of the theoretical overheating risk at design stage. Compliant dwellings and spaces (m²) in renovated buildings are those below the benchmark (theoretical) of overheating criterion establishedin the national building code. If there is no definition in the national building code, CIBSE TM52 reference (TM59 for homes) can be used.

Option B – Occupant questionnaire

In this case post-occupancy surveys are used to determine the level of dissatisfaction with summer thermal comfort post energy renovation. These should be completed 12 months after renovation, once the building is occupied.

The main reference standards for post occupancy surveys of indoor environments and user perceptions of comfort and well-being are ISO 10551 and ISO 28802*.

References and examples:

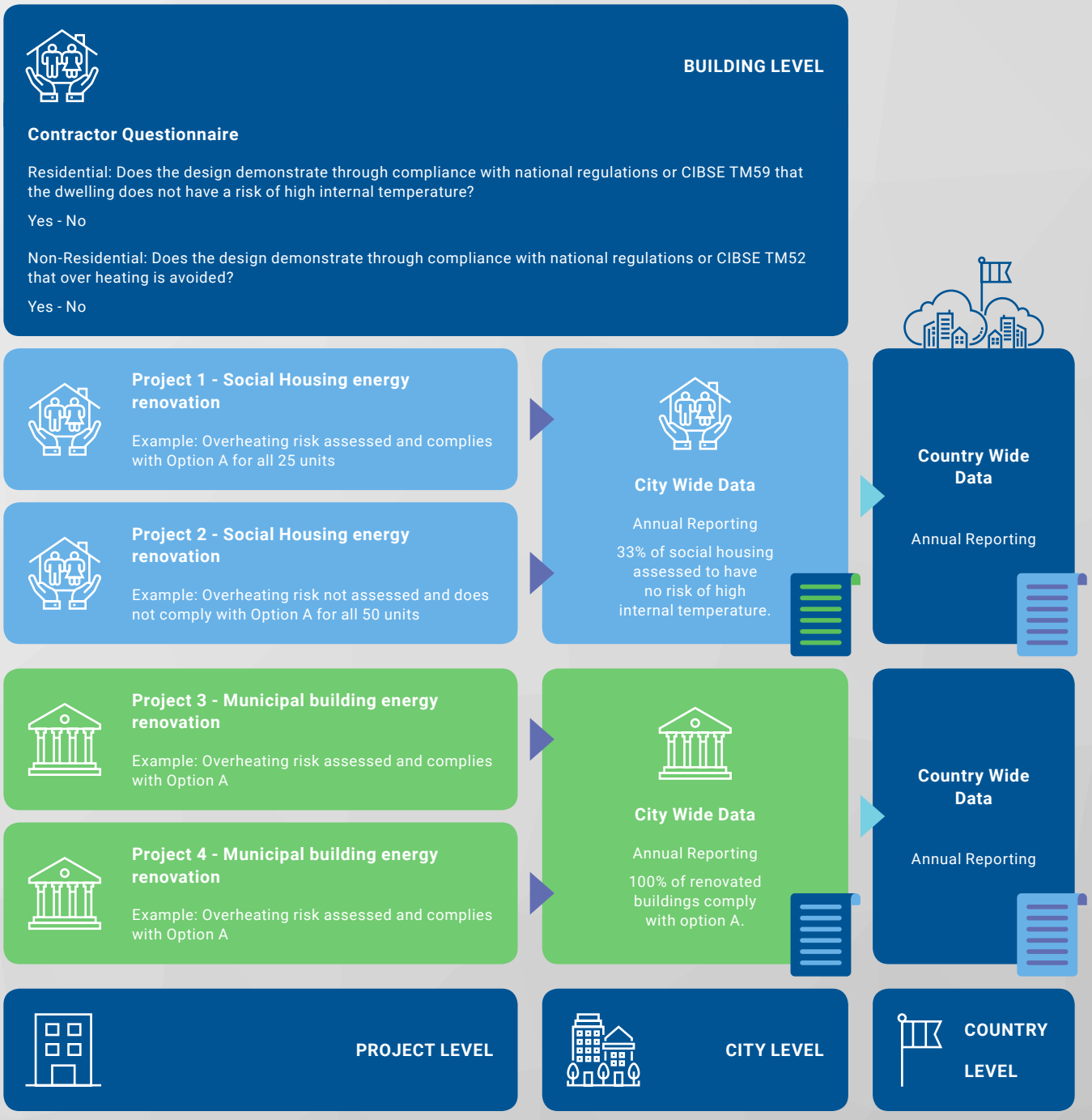
- Survey developed by UKGBC for Leeds City Council as part of the Build Upon2 project (see Appendix 3 – Tenant's questionnaire)
- *https://busmethodology.org.uk*
- *https://cbe.berkeley.edu/resources/occupant-survey/what-we-measure/*
- *Survey developed for synikia project. Appendix G*

Option C – In-situ monitoring on a sampling basis

(Hourly) monitoring of the thermal conditions in a building can be used to assess if overheating is occurring. National criteria should be taken as reference for defining when overheating occurs. If there is no definition in the national building code, CIBSE TM 52 reference (TM59 for homes) can be used.

**Level(s) indicator 4.1*

DATA COLLECTION PATHWAY



This is an example of how the Framework works using option A.

ADDITIONAL GUIDANCE

It must be assumed that if there is no data on design of heating systems that no design and commissioning of the system took place and summer thermal comfort may be compromised post renovation.

Encourage municipalities as per option A to assess limiting heat gains to national regulations or CIBSE TM59 for Residential units / CIBSE TM52 for non-residential buildings.

Encourage municipalities as per Option C to carry out on site testing on a sample of buildings to ensure adequate internal temperature is achieved. Thermal probes should be installed at sampling locations inside the building or each representative residential property type. In residential buildings, at least the living rooms should be considered. For multi-family buildings, a sample of each apartment's distinctive configuration and orientation shall be assessed. In tertiary and public buildings, the reported performance shall apply to those spaces or zones that account for >10% of the total useful floor area of the building. Data shall be collected for 12-month post-renovation once the building is occupied**.

***Based on Level(s) indicator 4.2 for Level 3.*

Soc. UK1: Climate Resilience

DEFINITION

Number and % of buildings where flood resilience has been addressed as part of a retrofit.

UNIT OF MEASURE

Main Metric: No. of residential units or non-residential floor area (m^2)

Sub Metric: Percentage of residential units or non-residential floor area (m^2)

RELEVANCE

In the UK, 1 in 6 homes are considered at risk of flooding. This is predicted to rise to 1 in 3 by 2050. Energy efficiency renovation provides an opportunity to address the three R's of flood resilience: reduction (reducing the likelihood of flooding), resilience (ensuring buildings are more robust if flooded) and reinstatement (ensuring buildings can be easily reinstated post flooding). Similarly, repairing a building that has been flooded provides an opportunity to address not just flood resilience but improved energy efficiency and comfort.

OBJECTIVE

EUROPEAN UNION

The new EU Strategy on Adaptation to Climate Change (2021) highlights the need to do more to prepare Europe's building stock to withstand the impacts of climate change. More specifically, it states that the Commission will explore options to better predict climate-induced stress on buildings and to integrate climate resilience considerations into the construction and renovation of buildings through Green Public Procurement criteria for public buildings, the Digital Building Logbook, and as part of the process to revise the Energy Performance of Buildings Directive and the Construction Products Regulation.

The Renovation Wave (2020) also identifies climate resilience as a key principle.

COUNTRY

The UK has no flood resilience targets.

CITY

Municipal targets vary. Does your Local Authority have flood resilience targets or strategies?

METHODOLOGY

Flood resilience is deemed to have been addressed if a property has been assessed in accordance with the CIRIA Code of Practice for Property Flood Resilience (February 2020) - and measures implemented where necessary.

This indicator can be used at a project or city level. At a project level, a contractor questionnaire can be used to determine whether the CIRIA Code of Practice has been employed. The reporting period is pre and post renovation.

At a city level, the reporting period is defined by the Local Authority and is ideally annually. Data can be collated from multiple individual projects across the Local Authority to build up a city-wide picture of flood resilience over time.

CALCULATION

Main Metric – renovated building stock with flood resilience

Soc UK1 Indicator, main residential metric = **No. of renovated dwellings where flood resilience has been addressed**

Soc UK1 Indicator, main non-domestic metric = **Area of renovated non-domestic buildings where flood resilience has been addressed**

Sub metric - % of renovated building stock with flood resilience

$$\text{Percentage of renovated dwellings where flood resilience has been addressed} = \frac{\text{No. of renovated dwellings where flood resilience has been addressed}}{\text{Total no. of dwellings renovated}} \times 100$$

$$\text{Percentage of non-residential floor area (m}^2\text{) where flood resilience has been addressed} = \frac{\Sigma \text{ area of renovated non-domestic buildings where flood resilience has been addressed}}{\text{Total area of renovated buildings}} \times 100$$

Eco. 1: Investment costs in energy renovation

DEFINITION

Total amount of money invested in energy renovation projects within the boundary of a municipality each year (or in a specific project/initiative).

UNIT OF MEASURE

Main Metric: £ – with breakdown of private/public investment

Sub Metric:

- £/residential unit (and/or m²) renovated
- £/m² of non-residential space renovated

RELEVANCE

In economic terms it is very relevant to capture accurate information on how much money is invested annually in energy renovation at municipal and national level, and where this money comes from (public or private investment).

OBJECTIVE

EUROPEAN UNION

To meet the 2050 climate targets, the European Commission estimates that €185 bn must be invested annually in energy renovation in the EU.

COUNTRY

The National governments have between them committed £bns of retrofit funding and the UK government expects around £11bn of private investment in 'greening buildings' during the 2020s *

** HM Government: The Ten Point Plan for a Green Industrial Revolution, November 2020*

CITY

Municipal funding varies.

Does your Local Authority have targets for public and private investment in building renovation?

METHODOLOGY

Calculate investment/money spent on renovation projects that have been completed within a given reporting period, ideally a year. All energy renovation costs associated with the projects are to be included. Appendix 1 sets out what should/should not be included as energy renovation costs.

Investment/money spent on projects not completed during that reporting period/year should not be included. Large projects with phased completion stages can include the different stages if that section of the project is fully complete and the costs can be itemised.

VAT may be included or excluded and this needs to be clearly stated.

Municipalities must be fully transparent on the methodology used and assumptions made.

CALCULATION

Main Metric

Total investment in energy renovation (£*) = Σ £ spent on completed energy renovation projects

Provide the following breakdowns:

- where money comes from - private and public (including subsidies) investment
- where money is spent - local (regional), national (UK) and international spending

Sub metric

- Residential

$$\text{Investment costs of energy renovation per residential unit and/or m}^2 = \frac{\Sigma\ £\text{ spent on energy renovation of residential buildings}}{\Sigma\ \text{Units and/or m}^2\ \text{renovated}} \times 100$$

With breakdown for social and private housing.

- Non-Residential

$$\text{Investment costs of energy renovation per m}^2\ \text{renovated} = \frac{\Sigma\ \text{Investments on energy renovation of non-residential buildings}}{\Sigma\ \text{renovated area (m}^2\text{)}} \times 100$$

With breakdown for public and tertiary buildings.

**When using national currency, please convert the total amount into €, at the average of the daily exchange rates published in the C series of the Official Journal of the European Union, calculated over the corresponding reporting period. Please see Appendix 1 for further information.*

METHODOLOGY (cont.)

Source of data

Municipalities may use option A or B or a mix of both. For instance, a municipality may use option A to gather data on projects of municipal buildings and option B to gather data on the private residential sector. Municipalities must be transparent on the methodology used and any assumptions made.

Option A – Starting from data at a project level

Municipalities will pay for completed works (municipal buildings and social housing) and should use these figures to calculate the investment in renovation projects.

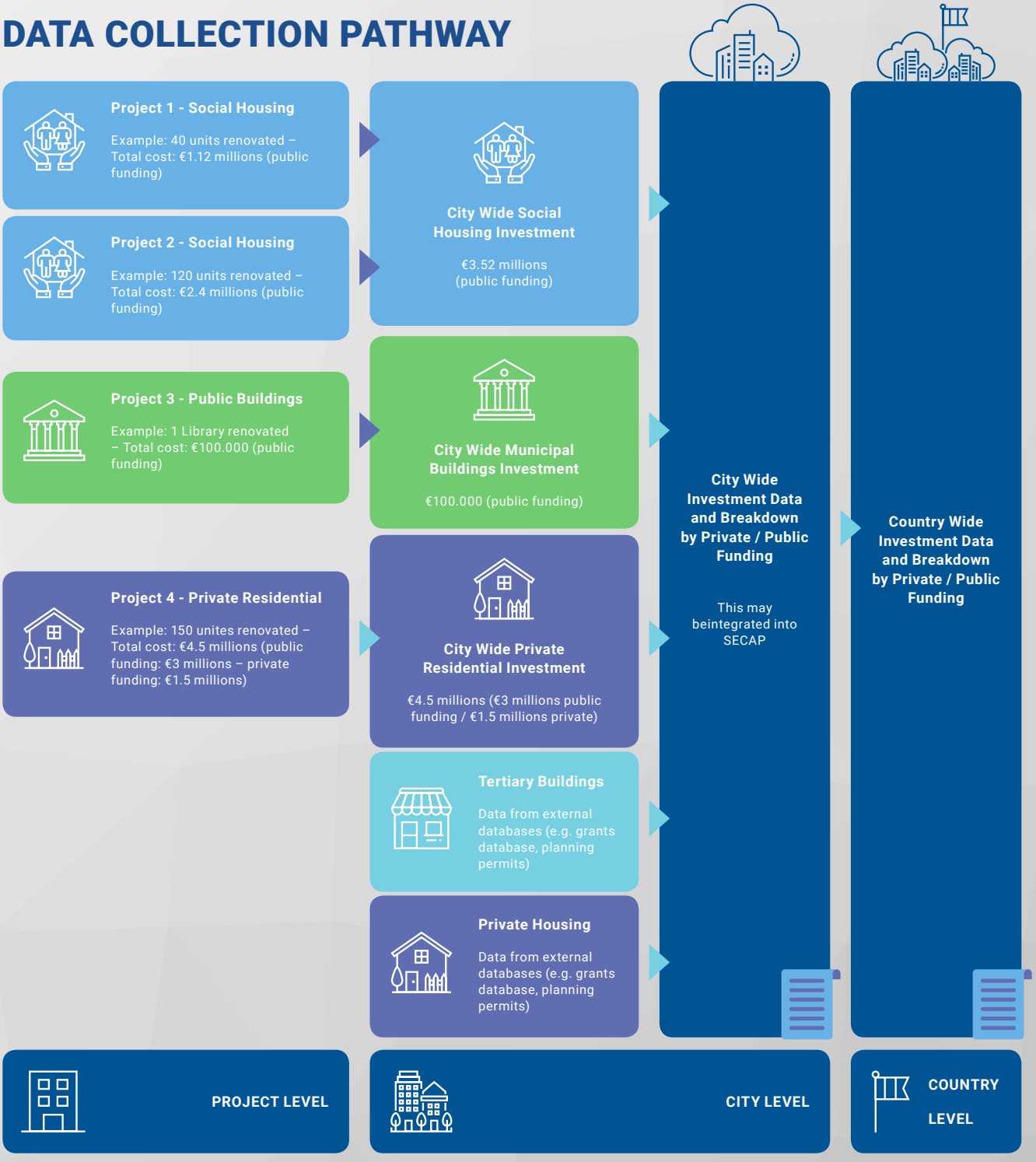
Private homes and tertiary buildings that are renovated with grant funding are likely to have total costs available too.

Option B – Starting from data at municipal level

If gathering data at municipal level, the following methodologies may be used:

- Desegregation of national statistics to the municipal level (this may require an agreement with your national statistics office and/or energy agency).
- Using data from your local / regional cadastre and/or data from planning permits.

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

Social Housing

All renovation works, and associated costs should be centrally recorded within the local authority.

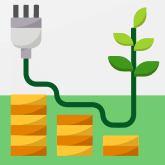
Public Buildings

All renovation works, and associated costs should be centrally recorded within the local authority.

Private housing and tertiary buildings

- Where possible, municipalities and central government are encouraged to capture accurate data on private energy renovation investment, including on the financial mechanisms used. E.g., low interest loans, green mortgages, and bonds.
- Depending on countries, two alternative methodologies could be used to estimate these investments. The exact methodology may vary depending on local and national circumstances.
  - Option 1 is to capture data on grants allocated for renovation of these buildings and to estimate what percentage of contractors' renovation works relate to energy renovation projects which have received state or municipal subsidies and to extrapolate from there.
  - Option 2 is to retrieve this information from planning permits (this may only work in some jurisdictions).
- In future, municipalities may consider tracking where the money goes. I.e., if it is spent locally, nationally, or on imports. At a project level, this information can be gathered from the contractors and consultants. E.g., through the use of a contractor questionnaire (See appendix 2 for an example).

Eco. 2: Cost efficiency of the energy consumption reduction



DEFINITION

Energy consumption saved for each thousand £ invested in energy renovation.

UNIT OF MEASURE

Main Metric: kWh saved for each thousand £ invested

Sub Metric: kWh/m²/yr saved for each thousand £ invested

RELEVANCE

Linking two key parameters of an energy renovation, energy savings (Env. 3) and monetary investment (Eco. 1) allows analysis of the energy efficiency of an investment and its cost-effectiveness. This indicator is critical to ensure value for money is delivered. It should also support municipalities in making a better business case for energy renovation. Furthermore, it will capture any reduction in energy renovation cost.

OBJECTIVE

Although no specific targets have been set at European, national or municipal level, the overall objective is to ensure a highly competitive and innovative energy renovation sector is developed and maintained.

A 2020's report by the European Court of Auditors highlighted that greater focus on cost-effectiveness is needed in relation to energy efficiency in buildings. Read more.

METHODOLOGY

Calculate the final energy saved (Env. 3) in a given reporting period (ideally annually) through energy renovation per thousands of £ invested (Eco. 1).

CALCULATION

Main Metric

$$\text{Energy efficiency of investment (kWh saved for each thousand £ invested)} = \frac{\Sigma \text{ Final energy consumption reduction (Env. 3) in kWh/year}}{\Sigma \text{ Investment in energy renovation (Eco. 1 in £) / 1000}}$$

With breakdown per building type.

Sub metric (Optional)

$$\text{Energy efficiency of the investment per m² (kWh/m²/year saved for each thousand £ invested)} = \frac{\Sigma \text{ Final energy consumption reduction (Env.3) in kWh/year / } \Sigma \text{ Renovated floor area (m²)}}{\Sigma \text{ Investment in energy renovation (Eco. 1 in £) / 1000}}$$

With breakdown per building type.

Source of data

When using the Framework, this figure will be automatically calculated based on the data inputted in Env. 3 (Energy Consumption) and Eco. 1 (Investment in Energy Renovation).

** When using national currency, please convert the total amount into €, at the average of the daily exchange rates published in the C series of the Official Journal of the European Union, calculated over the corresponding reporting period. Please see Appendix 1 for further information.*

ADDITIONAL GUIDANCE

See additional guidance for Env. 3 (Energy Consumption) and Eco. 1 (Investment in Energy Renovation).

Eco. 3: Jobs in energy renovation

DEFINITION

Direct jobs in energy renovation

UNIT OF MEASURE

Full time equivalent (FTE)

RELEVANCE

Supporting jobs is a key benefit of investing in energy renovation. Increased demand for energy efficiency services and technologies have proven to create a large number of local jobs*. For every €1 million invested in energy renovation of buildings, an average of 18 jobs are created in the EU**. The objective of the indicator is to support municipalities and central government in making a better business case for renovation, by showing the positive impact of energy renovation programmes on the jobs market. This is highly relevant in the context of the Covid-19 pandemic and as part of the economic recovery plans.

Sources:

** Burr, A. Majersik, C. Stelburg, S. and Garrett-Peltier, H. (2012). Analysis of job creation and energy cost savings: from building energy rational and disclosure policy.*

*** Renovate Europe - **Building Renovation: a kick-starter for the EU economy – Renovate Europe** (renovate-europe.eu).*

OBJECTIVE

There are no specific targets set at European, national or local level for this indicator. However the UK government anticipates that 'greening buildings' will support 50,000 jobs by 2030.*

** HM Government: The Ten Point Plan for a Green Industrial Revolution, November 2020*

METHODOLOGY

Calculate the direct jobs (FTE) in energy renovation in a given reporting period. Ideally, this should be a year.

CALCULATION

Depending on the municipality's objectives and resources available, municipalities may use option A or B or a mix of both. In all cases, municipalities must be transparent on the methodology and data set used. Any assumptions made should be fully disclosed and recorded.

Option A – Starting from data collected at project level

Direct jobs in energy renovation (FTE) in a reporting period = Σ Labour days (FTE) for energy renovation projects in the reporting period.

Option B – Starting from data at municipal level

$$\text{Direct jobs in energy renovation (FTE) in a reporting period} = \frac{\text{Eco.1 - Investment in energy renovation in the reporting period}}{1000} \times \text{Direct jobs proportion} \times \text{Direct jobs in energy renovation multiplier}$$

Direct jobs proportion = 0.33

Direct jobs in energy renovation multiplier = varies (use values from local studies or C40 default values noted below)

Option B is aligned with the C40 indicator (and methodology) on energy renovation and job creation. See below for further details.

Source of data

Option 1 – Starting from data at project level
Municipalities collect data on number of FTE working on specific projects through a contractor questionnaire – See Appendix 2. Appendix 1 may also be used to track what relates to energy renovation. For ease, it is suggested that municipalities initially use it for municipal buildings and social housing that they own and manage. This will provide a figure at a project level which should be centrally recorded.

METHODOLOGY (cont.)

Option 2 – Starting from data at municipal level

The effect on jobs can be calculated by applying multipliers to investment in energy renovation (Eco. 1). This methodology is based on the *C40, 2020 - The multiple benefits of deep retrofits - A tool kit for cities.*

The indicator used to calculate job creation is based on full-time equivalent (FTE) jobs per million £ spent. Employment creation is calculated across all building typologies. Expenditure is based on the capital cost of the energy renovation programme (Eco. 1) and employment opportunities have been proportioned between direct, indirect and induced job creation.

Direct jobs proportion

- The focus in the Build Upon Framework is on direct local jobs, i.e., jobs created as a result of the intervention (e.g., working on the construction site). C40 have estimated that direct jobs proportion is approximately 33% (0.33 in above calculation).

Direct jobs in energy renovation multiplier

- Where local studies detailing the impact of energy renovation on jobs creation are available, data from these studies should be used and inputted as multiplier numbers.
- Where a municipality does not have local studies detailing the impact of energy renovation on jobs creation, the following default values should be used:
  - Total jobs created - lower bound (FTE per million €): 12.8
  - Total jobs created - median (FTE per million €): 17.12
  - Total jobs created - upper bound (FTE per million €): 26.3

(These values come from C40 literature review)

This will allow a municipality to obtain an estimate range of the direct jobs created (between the lower and the upper band).

Example:

A municipality invests £30 million in energy renovation. Using the default values, direct jobs in energy renovation in the reporting period can be estimated to be between 127 and 260 FTE.

Calculation:

- Lower bound: (30,000,000/1,000,000) x 0.33 x 12.18 = 127
- Upper bound: (30,000,000/1,000,000) x 0.33 x 26.3 = 260

Please see the Framework spreadsheet for further details.

Source: The methodology is based on the C40, 2020 - The multiple benefits of deep retrofits - A toolkit for cities.

DATA COLLECTION PATHWAY

This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

Eco. 4: Upskilling in Energy Renovation

Main metric to be used at national or regional level – Please check with your national GBC. Sub-metric to be used at municipal level.

DEFINITION

Number of building professionals and construction workers who upskill in energy renovation annually, including municipal staff.

UNIT OF MEASURE

Main Metric: Number of building professionals and construction workers upskilled in energy renovation

Sub Metric: Number of municipal employees upskilled in energy renovation

RELEVANCE

The building sector offers a large untapped potential for cost-effective energy savings. The most challenging aspect of reducing energy use in the building sector lies in increasing the rate, quality and effectiveness of building renovation, since the current rate of renovation is only 1.2 % per year. One significant barrier that hampers the development of effective renovations is the lack of adequate construction skills. Improving the skills of middle- and senior-level building professionals as well as the various trade professionals in the area of sustainable energy-efficient construction is therefore of key importance.

Source: Construction skills: Equipping building professionals with new skills to achieve European energy targets | H2020 | Results Pack | CORDIS | European Commission (europa.eu).

OBJECTIVE

There are no specific targets set at European, national or local level for this indicator.

METHODOLOGY

This indicator cannot be used at a project level. The information is to be captured at national or regional level. What constitutes 'upskilling in energy renovation' has been defined by the Irish Green Building Council. Refer to Appendix 9 of *Developing a comprehensive Energy Renovation Register" (IGBC, LIT, 2020).*

Main metric: Calculate the number of building professionals and construction workers who have upskilled in energy renovation in a reporting period, ideally annually.

Sub-metric: Calculate the number of building professionals and construction workers employed by the municipality who have upskilled in energy renovation in a reporting period, ideally annually.

CALCULATION

Main Metric

$$\text{Upskilling in energy renovation} = \Sigma \text{ building professionals and construction workers who have upskilled in energy renovation in the reporting period}$$

Sub Metric

$$\text{Upskilling in energy renovation (municipality employees)} = \Sigma \text{ building professionals and construction workers employed by the municipality who have upskilled in energy renovation in the reporting period}$$

Source of data

Local Authorities can obtain some information from

- Trustmark: provides nation-wide information on TrustMark Scheme Providers
- Retrofit Academy: provides nation-wide information on Retrofit Coodinators

In addition, Local Authorities can obtain information through business surveys run by LEPs or city authorities and liaise with local training and higher education providers.

Municipalities must be fully transparent on methodology and data source, if any assumptions are made these must be fully disclosed and recorded.

As an example, the process followed in Ireland is described below (Case Study - How this data is captured in Ireland).

CASE STUDY – HOW THIS DATA IS CAPTURED IN IRELAND

This section details the step-by-step approach that was taken in Ireland to gather this data.

Step 1: Develop a comprehensive list of building professionals and construction workers involved in energy renovation.

Step 2: Identify key skills and competences for each category of building professionals and construction workers identified in step 1*.

Step 3: Identify training courses that allow building professionals and construction workers to gain these skills and competences. In Ireland, it was agreed to only capture data on accredited courses. **

Step 4:

- Main metric: Central/regional government to liaise with providers of courses identified in step 3 to get number of building professionals and construction workers who have completed them in a reporting period.
- Sub metric: Municipality (HR Department) to capture data on number of construction workers and building professionals employed by the municipality who have completed these courses in a reporting period.

Note: A multidisciplinary steering group made up of central government representatives, professional bodies, industry and academia was set up to support the Irish Green Building Council with steps 1, 2 and 3.

For further information on key skills and competencies identified for each category of building professionals and construction workers in Ireland. please see appendix 9.a of "Developing a comprehensive Energy Renovation Register**" (IGBC, LIT, 2020)*

***See appendices 9.b and 9.c of "**Developing a comprehensive Energy Renovation Register**" (IGBC,LIT, 2020) for further information.*

Eco. 5: Financial savings from energy renovation

DEFINITION

Total financial cost savings for end-users per year based on savings on heating, cooling and DHW, carbon tax (when applicable), and the usable contribution from renewable energy systems.

UNIT OF MEASURE

Main Metric: £

Sub Metric:

- £ / number of residential unit renovated
- £ /m² of non-residential buildings renovated

RELEVANCE

One dimension of value creation by renovation is the extent to which the project generates cost savings for end-users. Energy renovation should not be only presented and perceived as a cost but as a financial benefit, which can be an important trigger for the user acceptance and the market uptake.

OBJECTIVE

No specific targets set at European, national or municipal level. A 2020's report by the European Court of Auditors highlighted that greater focus on cost-effectiveness is needed in relation to energy efficiency in buildings. ***Read more***.

METHODOLOGY

Calculate the total financial savings as a result of the energy renovation. This methodology can be cross referenced to the Env. 3 – Final Energy Consumption Indicator.

Only projects completed during the reporting period (ideally annually) should be included. Large projects with phased completion stages can include the different stages if that section of the project is fully complete and the costs can be itemised.

This indicator can be used initially at project level. Once it has been adopted and reported across a sufficient number of projects it can be reported at a city level.

Savings in energy bills and carbon taxes, as well as any incomes made from newly installed renewables should be included where applicable. Municipalities must be fully transparent on the methodology and data set used. Any assumptions made must be fully disclosed and recorded.

Main Metric

$$\text{Total financial savings in £ from energy renovation projects} = \Sigma\,£\text{ savings on utility bills} + \Sigma\,£\text{ savings on carbon taxes} + \Sigma\,£\text{ income from on-site renewables}$$

With breakdown for residential, social housing, public and tertiary buildings.

Sub metric

- Residential (private and social):

$$\text{Average financial savings from energy renovations per residential unit} = \frac{\Sigma\text{ Savings from energy renovated residential buildings}}{\Sigma\text{ Units renovated}}$$

With breakdown for social and private housing.

- Non-Residential

$$\text{Average financial savings from energy renovations per m}^2 = \frac{\Sigma\text{ Savings from energy renovated non-residential buildings}}{\Sigma\text{ Units renovated (m}^2\text{)}}$$

With breakdown for public and private buildings.

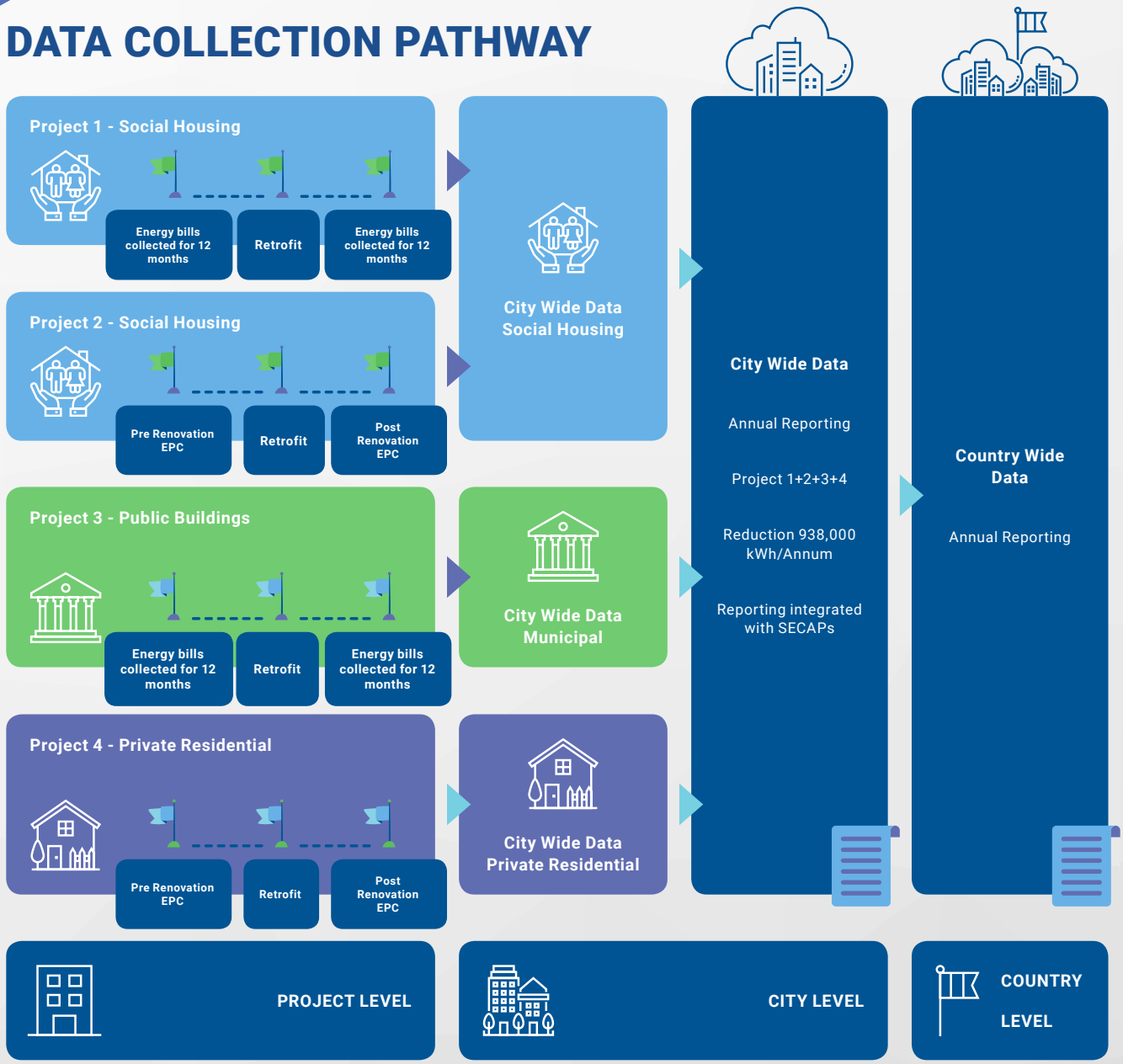
Source of data

Data at project level

Ideally, actual energy bills over a 12-month period pre and post renovation (once the building is occupied) should be used. This will cover all savings on heating, cooling and DHW, carbon tax (when applicable), and the usable contribution from renewable energy systems.

Alternatively, data on delivered energy (disaggregated per type, e.g., electricity, natural gas and biomass) should be available from the pre and post renovation EPCs. Data on any energy exported to the grid should also be calculated based on the EPCs. National average energy tariffs for each type of energy applied to the corresponding energy import/export, and carbon tax rates - where applicable, should then be used to calculate the financial savings.

DATA COLLECTION PATHWAY



This is an example of how the Framework works if used on all buildings. For ease, municipalities may only use it initially on their municipal and/or social housing stock.

ADDITIONAL GUIDANCE

Social Housing

A sample of house types should be assessed for 12 months pre and post renovation (once the homes are occupied) to ensure that actual energy bills reduction is in line with calculated figures from EPCs.

Public Buildings

Actual energy bills should be monitored for 12 months pre and post-renovation (once the buildings are occupied) to ensure that financial savings are realised.

Private housing and tertiary buildings

Actual energy bills pre and post renovation should be assessed (once the buildings are occupied) on a sample of buildings to verify the calculated savings.

Degree Days

Once established a financial saving sub metric should be introduced which will include reference to degree days. Weather data will be required for 12 months pre retrofit and post retrofit using the same base temperature. Corresponding meter readings over the same period will be used to calculate € saved per/year. The following data can then be extrapolated:

$$\text{Savings in €/degree day} = \frac{\text{(pre-retrofit €/degree day) - (post-retrofit €)}}{\text{degree day}}$$

This information can be used to verify that the actual savings are not skewed by extreme weather events which are more likely going forward.

Appendices

Appendix 1: Energy Efficiency Investment

TAX	**VAT**	Please state clearly if VAT is included or excluded from all stated costs
CURRENCY	**Exchange Rate**	"When using other currency than the €, please convert the total amount into € European Union, calculated over the corresponding reporting period. To do th 1. Use the following link: http://www.ecb.europa.eu/stats/exchange/eurofxre 2. Find your currency 3. Click the "chart" on the far right of your currency 4. Input the reporting period date range to receive the average rate"

		To be included in energy renovation works	Likely to be included i renovation works
ENERGY RENOVATION WORKS	**Fabric**	Wall Insulation - Internal, External and Cavity	
		Roof Insulation	
		Floor Insulation	
		Window Upgrade	
		External Door Upgrade	
		Airtightness Upgrades	
		External Solar Shading	
	Heating System	Heating System Upgrade	
		Heating Control Upgrade	
		Fitting Pipe Insulation	
	Ventilation	Ventilation System Upgrade	
	DHW	Low Flow Restrictors	
		Fitting Pipe Insulation	
	Lighting	Lighting Upgrade	

	COMMENT

€, at the average of the daily exchange rates published in the C series of the Official Journal of the is, please do the following: f/html/index.en.html	

n energy	Unlikely to be included in energy renovation works	Not to be included in energy renovation works	COMMENT

		To be included in energy renovation works	Likely to be included i renovation works
	Associated Works		All additional works require of the energy efficiency me example: redecoration and services and windows wher internal/external wall insula upgrading of electrics to ac heat pumps, repairs to floor skirting if required, making decoration
	Maintenance Works		
Construction Works	Construction Works		

Design Team Costs	Include any applicable design team costs paid to staff/external consultants to design and oversee the er If the renovation project involves non energy renovation works, the proportion of design team costs can renovation. The method for calculating design team costs should be clearly stated and recorded.

Admin Costs	Internal staff hours should be recorded according to the hours spent on the renovation projects. If the renovation project involves non energy renovation works, the proportion of admin costs can be est renovation. The method for calculating admin costs should be clearly stated.

n energy	Unlikely to be included in energy renovation works	Not to be included in energy renovation works	COMMENT
d as a result asure. For moving n installing ation, comadate ring and good of			
	Planned Decoration		
	Roof Repair		
	Upgrade of Rainwater Goods		
	Repairs to Walls/Masonary		
	Groundworks for Damp Issues		
	Repairs to windows and Doors		
	Appliance Upgrade		
		Kitchen Install	
		Bathroom Install	
		Fitted Furniture	
		New Builds	
		Flood Resilience Works	
		Extensions	

It is suggested that if any of the maintenance works listed are greater than 10% of the overall projects costs they can be considered as maintenance works and not part of the energy renovation works.

nergy renovation projects. be estimated or can be based on the percentage of the construction costs applicable to energy	
imated or can be based on the percentage of the construction costs applicable to energy	

Working Example

	PROJECT 1
4 Terrace properties	**Itemised Project Costs**
External insulation	72,000
New windows and doors	60,000
New heat pumps	60,000
Demand control ventilation	16,000
2 ground floor accessible bathrooms	36,000
2 Ground floor accessible ramps	8,000
1 new kitchen fit out	12,000

Total Construction Costs	**264,000**

Renovation Percentage = Renovation Costs/Total Construction Costs	
Total Design Team Fees	60,000
"Energy renovation Design Team Fees 60,000*.79"	
Total Admin Costs (Source: Internal Timesheets and Accounting)	35,000
"Energy renovation Admin Costs 35000*.79"	

Total Project Costs	**359,000**

	Energy Renovation Works
	72,000
	60,000
	60,000
	16,000
	208,000

	79%
	47,273
	27,576
	282,848

Appendix 2: Contractor Questionnaire

This contractor questionnaire was developed by the UK Green Building Council, in partnership with Leeds City Council (pilot city) as part of the Build Upon² project.

BUILD UPON 2 - INFORMATION REQUIRED FROM CONTRACTOR

when collating data at a project level

Env.1 Energy Renovation Rate – not applicable at a project level

Env.2 CO_2 emissions – pre & post EPC, historic fuel bills & meter readings

Env.3 Energy consumption – as Env.2

Env.4 Renewable Energy Production – MCS calculations

Env.UK1 EPCs – pre & post EPC

Soc.1 Fuel Poverty – pre & post EPC, modelling carried out by council

Soc.2 Indoor Air Quality – occupant questionnaire/onsite monitoring + contractor questionnaire

Soc.3 Winter Thermal Comfort – as Soc.2

Soc.4 Winter Thermal Comfort – as Soc.2

Soc.UK1 Climate Change Resilience – contractor questionnaire

Eco.1 Investment in Energy Renovation – contractors information

Eco.2 Energy Efficiency of Investment – calculated automatically

Eco.3 Jobs in Energy Renovation – contractors information

Eco.4 Upskilling in Energy Renovation – n/a at a project level

Eco.5 Financial Savings from Energy Renovation – pre & post EPC, MCS calculations

Natural touch points with occupants, useful for carrying out occupant questionnaires, obtaining historic fuel bills and taking meter readings:

- Pre-retrofit EPC assessment
- Pre-retrofit survey (typically min 3months before retrofit)
- Pre-retrofit induction (typically just before retrofit)
- Practical completion & handover (at end of retrofit)
- End of defects liability period check-up (min 12 months post practical completion)

CONTRACTOR QUESTIONNAIRE (FOR EVERY INDIVIDUAL BUILDING)

Desktop analysis - could be inputted directly into a spreadsheet

Generally – Does this retrofit follow PAS 2035:2019? (Yes/No)

Soc.2 Indoor Air Quality

Criteria 1 – have measures been taken to ensure adequate ventilation? (Yes/No)

This can be assessed on completion of the retrofit through yes/no questions asked of the contractor? In the UK, these could be:

- Has the property's existing ventilation system been assessed & deemed either adequate or where deemed inadequate, upgraded in accordance with Annex C of PAS 2035:2019 Retrofitting dwellings for improved energy efficiency – Specification and guidance? YES/NO
- Has all new ventilation equipment been tested and commissioned in accordance with the relevant part of BS EN 13141 Ventilation for buildings – Performance testing of components/products for residential ventilation? YES/NO/Not Applicable
- Where changes have been made, have the building owner and occupant been provided with guidance on how to maintain and use their ventilation system? YES/NO/Not Applicable

Must answer YES (or not applicable) to all questions to meet Criteria 1.

Criteria 2 – has the retrofit had an impact on IAQ? (IAQ is better, IAQ is worse, IAQ is neither better nor worse)

This can be assessed minimum 12 months following completion of the retrofit through occupant surveys and/or IAQ monitoring.

Soc. 3 Winter Thermal Comfort

Criteria 1 – have measures been taken to ensure adequate winter comfort? (Yes/No)

This can be assessed on completion of the retrofit through yes/no questions asked of the contractor? In the UK, these could be:

- Has the property's existing heating system been assessed in relation to calculated post-retrofit heat losses & deemed either adequate or where deemed inadequate, upgraded? YES/NO
- Has all new heating system equipment been installed and commissioned in accordance with PAS 2030:2019 Specification for the installation of energy efficiency measures in existing dwellings and insulation in residential park homes and where renewables are used the relevant MCS standards? YES/NO/Not Applicable
- Where changes to the heating system have been made, have the building owner and occupant been provided with guidance on how to maintain and use their heating system? YES/NO/Not Applicable

Must answer YES (or Not Applicable) to all 3 questions to meet Criteria 1.

Criteria 2 – has the retrofit had an impact on winter thermal comfort? (Building is more comfortable in winter, building is less comfortable in winter, building is neither more nor less comfortable in winter)

This can be assessed minimum 12 months following completion of the retrofit through occupant surveys and/or indoor temperature & RH monitoring.

Soc.4 Summer Thermal Comfort

Criteria 1 – have measures been taken to minimise summer overheating risk? (Yes/No)

This can be assessed on completion of the retrofit through yes/no questions asked of the contractor. In the UK, these could be:

- Has the property been modelled using dynamic simulation software to assess overheating risk? YES/NO
- According to the thermal model, does the property meet the criteria of CIBSE's TM59 Design methodology for the assessment of overheating risk in homes or CIBSE's TM52 The Limits of Thermal comfort: Avoiding Overheating in European Buidings for non-residential buildings? YES/NO
- Where the thermal model relies on opening windows for night-time cooling, can they be securely left sufficiently open at night? YES/NO/Not Applicable

Must answer YES (or not applicable) to all three questions to meet Criteria 1.

Criteria 2 – has the retrofit had an impact on summer thermal comfort? (Building is more comfortable in summer, building is less comfortable in summer, building is neither more nor less comfortable in summer)

This can be assessed minimum 12months following completion of the retrofit through occupant surveys and/or indoor temperature & RH monitoring.

CONTRACTOR DATA (FOR PROJECT AS A WHOLE)

Desktop analysis - could be inputted directly into a spreadsheet

Eco.1 Investment in Energy Renovation

This can be assessed on completion of the retrofit through the following data:

- Amount of money spent (not anticipated budget)
- Breakdown by funding type (public, private)
- Breakdown by where money was spent (tax, energy renovation works, associated works, maintenance works, uplift, project team costs)
- Breakdown by whether money was spent locally, nationally or internationally

Eco. 3 Jobs in Energy Renovation

This can be assessed on completion of the retrofit through the following data. It will need updating 12 months post completion to allow for work carried out post-practical completion:

- no. of FTE labour days supported during the project (consultants, main contractor, sub-contractors)
- no. & type of businesses involved in the project (consultants, main contractor, sub-contractors, suppliers, manufacturers)

Appendix 3:
Tenant Questionnaire

UKGBC & LEEDS CITY COUNCIL – BUILD UPON 2

POST-RETROFIT OCCUPANT QUESTIONNAIRE

HOUSING EVALUATION

This survey is being conducted to help understand the impact of retrofit on this home. The information collected will be treated as completely confidential by the survey team. Survey reports will summarise information and not reveal identities of individuals. **Who should fill this in?** Anyone over the age of 18 currently living in the residence. This will normally be one person from single-family households. For HMOs, fill in one form per bedsit.

BACKGROUND

Name of person filling out this side of the survey:

Retrofit Programme Name:

Date of questionnaire:

Date retrofit works commenced on this site:

Date retrofit works finished on this site:

Property Address:

Property Unique Reference Number:

Gas Meter Type & Reading: Standard | Pre-payment | Smart | Reading

Elec Meter Type & Reading: Standard | Pre-payment | Smart | Reading

Have photos been taken of utility bills for the last 12 months? Yes | No

Have occupants signed the utility bill disclaimer? Yes | No

Is this home ...? detached | semi-detached | terrace | flat | other

Is this home ...? owner occupied | social tenancy | private tenancy | HMO

What fuel is used for cooking: gas, electricity or other.....? hob | oven

Questionnaire Version 5, 14.09.21, developed by UKGBC

VENTILATION & DA

this property, it is not nece

What rooms does this hom

Do any rooms have signs
C *for condensation,* L *for*

What ventilation equipmen
room: N *for no equipment;*
PSV; T *for air inlet or trickl*
MEV = continuous mechar
recovery, PSV = passive s

Which rooms have min 10

Which rooms have windo

	WC	Bathroom 1
Rooms		
Damp		
Ventilation		
Door Undercuts		
Windows		

Please note any other com
inlets, disfunctional fans, b

CONTRACTOR/COUNCIL TO COMPLETE THIS SIDE

AMP If a PAS 2035 Ventilation Assessment has been undertaken for ssary to fill in this section. If in doubt, fill in this section.

ne have? *In the table below, tick all that apply.*

of damp? *Note one of the following options for each room:* N *for none, eaks,* D *for damp,* M *for mould.*

t is installed in each room? *Note one of the following options for each* F *for intermittent extract fan;* E *for air extract linked to MEV, MVHR or e vent;* P *for PIV fan;* S *for single room ventilator with heat recovery. nical extract ventilation, MVHR = mechanical ventilation with heat tack ventilation (not common), PIV = positive input ventilation*

mm undercuts on doors? *In the table below, tick all rooms that apply.*

ws that can be opened? *In the table below, tick all rooms that apply.*

Bathroom 1	Bathroom 2	Bedroom 1	Bedroom 2	Bedroom 3	Bedroom 4	Living/Dining	Kitchen	Stair	Hall/Corridor	Other

mments here or on an additional sheet, if necessary: *eg. blocked air locked or open chimneys, more detail about moisture problems*

This tenant questionnaire was developed by the UK Green Building Council, in partnership with Leeds City Council (pilot city) as part of the Build Upon² project.

UKGBC & LEEDS CITY COUNCIL – BUILD UPON 2

POST-RETROFIT OCCUPANT QUESTIONNAIRE

BACKGROUND *This information helps us understand your energy usage and comfort needs*

What is your name? *first name, surname*

What is your age? | under 30 | 30-60 | over 60 | prefer not say

What is your sex? | male | female | prefer not say

How long have you lived here? | less than 1yr | more than 1yr

How many other people live with you? | number under 18yrs old | number over 18yrs old

Is someone normally at home...? | most of the time | evenings & weekends only | other

ENERGY USE & CONTR

Since the retrofit...how much co
rating on each scale. Tick the s

Heating System: No Control

Ventilation System: No Control

If you have anything else to add
appliances like hottubs/aquariu

Have you received a heating &

WINTER COMFORT

Since the retrofit...how would you describe typical conditions in WINTER. If you have not lived here in winter leave these questions blank. *Please tick your rating on each scale.*

Temperature in Winter

	1	2		3	4	5	
Uncomfortably hot/cold							Comfortable
Variable							Stable

If uncomfortable, is it generally...? | too hot | too cold

Air in Winter

	1	2		3	4	5	
Uncomfortably dry/humid							Comfortable
Stuffy/smelly							Fresh/odourless
Uncomfortably Draughty							Still

If uncomfortable, is it generally...? | too dry | too humid

Conditions in Winter generally

	1	2		3	4	5	
Unsatisfactory overall							Satisfactory overall

SUMMER COMFORT

Since the retrofit...how would yo
summer leave these questions b

Temperature in Summer

Uncomfortably hot/cold

Variable

Air in Summer

Uncomfortably dry/humid

Stuffy/smelly

Uncomfortably Draughty

Conditions in Summer genera

Unsatisfactory overall

OCCUPANT TO COMPLETE THIS SIDE

OLS

ntrol do you personally have over the following? *Please tick your ide boxes if having control is important to you.*

						Is having control important to you?
12		3	45		Full Control	
12		3	45		Full Control	heating / ventilation

about your energy or comfort needs please write it here: *eg. unusual ns, activities like cooking often for others, vulnerable occupants.*

ventilation guide since completion of the retofit / when you moved in.

yes / no

u describe typical conditions in SUMMER. If you have not lived here in lank. *Please tick your rating on each scale.*

						If uncomfortable, is it generally...?
2		3	45		Comfortable	
2		3	45		Stable	too hot / too cold
2		3	45		Comfortable	If uncomfortable, is it generally...?
2		3	45		Fresh/odourless	too dry / too humid
2		3	45		Still/welcome breeze	

lly

2		3	45		Satisfactory overall

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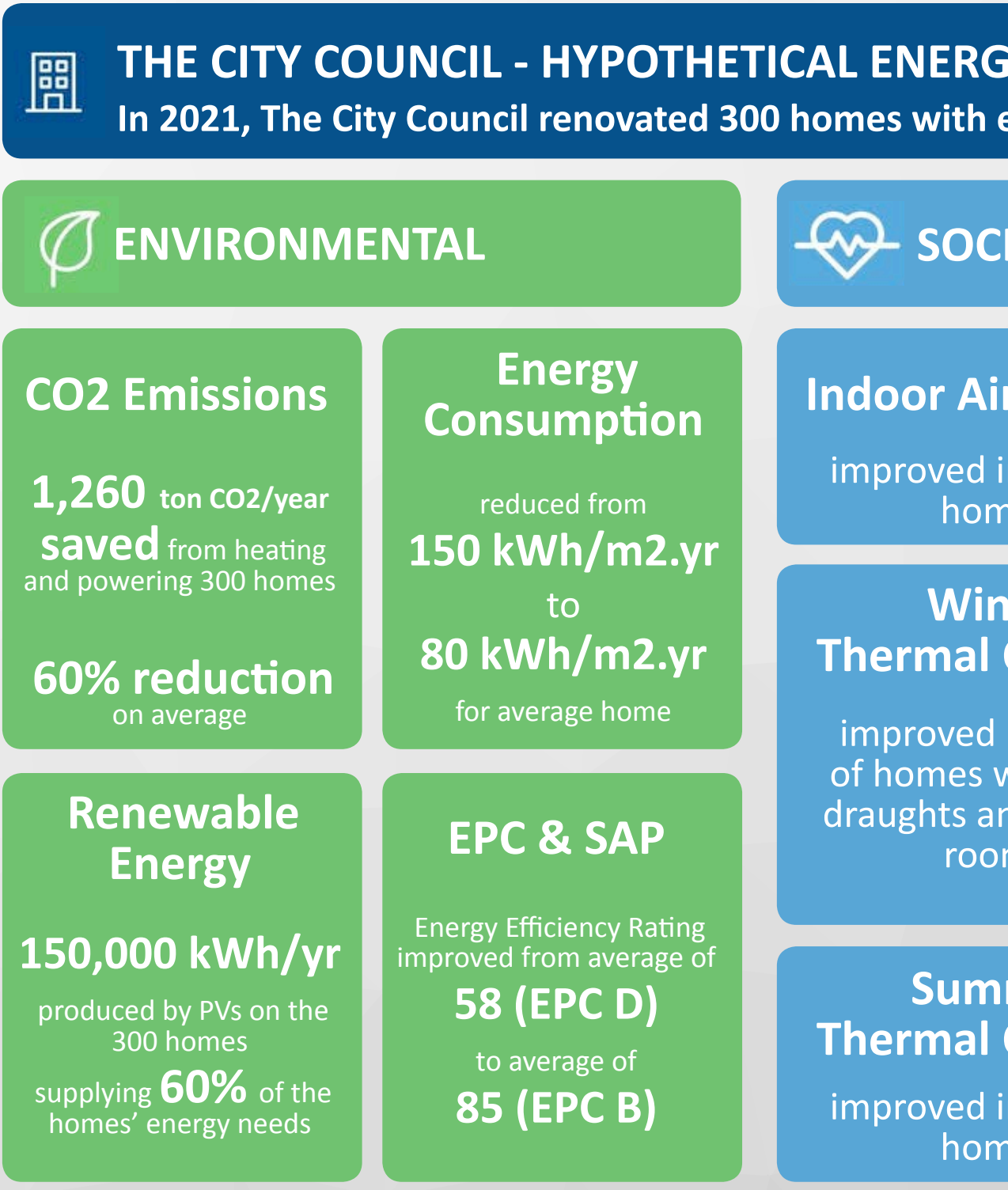
Appendix 4:
Sample summary report from a repo



Example of how annual impact of energy renovation could be presented to the general public if the Framework was us

rting period

Y RENOVATION PROJECT

energy efficiency measures. What was the impact?

IAL

r Quality

n **65%** of
nes

ter Comfort

in **100%**
vith fewer
nd warmer
ms

mer Comfort

n **50%** of
nes

ECONOMIC

Investment in Energy Renovation

£7.5m total project cost

£25,000 spent per home on average

Financial Savings

Energy Bills reduced	Income from PVs
by **£400/yr**	
to **£900/yr**	**£85/yr**
per home on average	**per home** on average

Jobs

60 FTE jobs directly supported throughout the 18 month project

sed at scale.

BUILD UPON²

The 2020s is a decade of climate action. We are inviting all cities, regions and companies to work with us on solutions in the building sector and would love to hear more about impactful renovation initiatives you are running in your city or Local Authority - which we can put on the European stage.

We are calling on leaders across the public and private sector to join the Net Zero Carbon Buildings Commitment to really make Europe's renovation wave a reality. Read more about the project and get in touch with the team via the links and details below.

With many thanks to the twelve pilot cities and 30 follower cities who helped us develop the Build Upon 2 framework. The pilot cities were: Velika Gorica, Croatia - Budaörs, Hungary - Dublin, Ireland - Padova, Italy - Wroclaw, Poland - Valladolid, Spain - Eskişehir, Turkey - Leeds, UK.

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