



EERAdata

DATA-DRIVEN DECISION-SUPPORT TO INCREASE ENERGY
EFFICIENCY THROUGH RENOVATION IN EUROPEAN
BUILDING STOCK

D2.1 – Policy and partner review Three Country specific factsheets

[WP2 – Key EE and supply-side policies indicators and
variables]



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About the project

The EERAdata project will develop and test a decision-support tool to help local administrations in the collection and processing of their building and demographic data towards an assessment and prioritisation of Energy Efficiency measures in planning, renovating, and constructing buildings.

While EU policy assigns a primary role to Energy Efficiency (EE), the lack of a holistic understanding of the impact of EE investments has hindered its integration in the policy-making process. Coordination between demand and supply side of energy policy is not targeted, and there is need to gather the evidence on the benefits of EE in ecological and socio-economic terms as well as on its interactions with the broader policy context and energy market.



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Project's goals

The project aims to develop:

- Guidelines and roadmaps for the advancement of the clean energy transition
- Joint thematic studies and analyses reports on territorial needs and decarbonisation pathways
- A fully developed and tested decision-support tool to help local administrations in the collection and processing of their building and demographic data towards an assessment and prioritization of EE measures in planning, renovating, and constructing buildings

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FACT SHEETS

FACT SHEET COPENHAGEN



DENMARK



Implementing Partner: Copenhagen

The city of Copenhagen is located on the island of Zealand in the Baltic Sea. It is a sustainable, modern harbour city and one of the economic centres of Scandinavia.

Administration: The Administration is responsible for a wide variety of public services, which include land use planning, environmental planning, public housing, management and maintenance of local roads, and social security. It has access to 3.8 million people in the metropolitan area.

- **Inhabitants:** 794,128 (632,340 in Copenhagen Municipality, 104,305 in Frederiksberg Municipality)
- **Population density:** 4,600 /km²
- **Buildings:** 52096
- **Public Buildings:** 13174
 - ➔ 20% population growth by 2025
 - ➔ 45,000 new housing units by 2025
 - ➔ Housing overcrowding rate: 10 % (2019, Europe: 17,1%)

Climate: Copenhagen is in the oceanic climate zone. Its weather is unstable throughout the year, precipitation is moderate (10-15 days a month).

- **Summer:** 12,5°C-18,1°C mean Temp / *Warmest month:* July 21°C / *Daylight max:* 17 hours 32 minutes / *Cooling Degree days* (2019/20, base 24°C): 16 d
- **Winter:** 1,4°C-3,5°C mean Temp / *Coldest month:* January -0,7°C / *Daylight low:* 7 hours and 1 minute / *Heating Degree days* (2019/20, base 17°C): 2711 d
- **Humidity:** 72%-86%

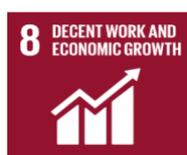
Economy: (Denmark)

- Jobs maintained by building renovation: 52.111
- Construction output increase 2,3 % in 2020 due to Covid 19n
- Construction sector growth over the last 3 years 5: 3,5%
- GDP per capita (PPP), 59830 \$ (2019)

Sustainability:

- OECD: World leader in green growth
- On its way to become carbon neutral by 2025
- Sustainable development goals (SDG) Index 2019: 85% (World Leader)
- 88% of public food in Copenhagen is organic

EERAdata Challenges and related SDGs: (Survey data)



1. Increase productivity and well-being of employers



2. Better indoor comfort and environment



3. Improve energy systems (Renewables, energy grid)

Furthermore: Innovation and market benefits, Individual health improvements, Increased property asset values, Reduced greenhouse gas emissions

BUILDING DATA

Building stock information:

Administrative buildings	Educational buildings	Healthcare buildings	Residential buildings
425	998	85	41048

Renovation rate: Deep renovation: 0,2% (2019, Denmark); Other energy related renovation: 8,9%

Most recurrent renovation measures in the past years:

- Roof insulation/ reparation
- Integration of energy efficient ventilation system
- Improvement of heating system (energy efficient technology)
- Improvement of hot water generation system (new boiler, energy efficient technology)
- Replacement and improvement of electrical appliances (energy efficient freezers, light system, security systems etc.)

Minimum requirements for building renovation

General rules: U-values for new construction are not necessarily representing the minimum requirements, since the total calculated energy use which is main criteria, might demand much lower values.

Construction requirements:

Minimum U-Values New construction

Top floor ceiling or roof	Exterior walls	Bottom floor against soil	Windows	Exterior doors
0,2 W/m ² K	0,3 W/m ² K	0,2 W/m ² K	0,0 kWh/m ² loss in heat balance	0,8 W/m ² K

Minimum U-Values Renovation (no total calculated energy use (energy frame) required)

Top floor ceiling or roof	Exterior walls	Bottom floor against soil	Windows	Exterior doors
0,12 W/m ² K	0,18 W/m ² K	0,1 W/m ² K	0,0 kWh/m ² loss in heat balance	0,8 W/m ² K

Available Datasets:

Topic	Availability of data	Main Gaps (status quo)	Existing Databases
Demographics	75%	Employers in public buildings, age structure of employers	Statistics denmark, www.statbank.dk kbhkort.kk.dk/spatialmap
Political agenda	100%	No panel or workgroup on climate change or EE	Lokalplan kbhkort.kk.dk , SDGs, Regional growth and development strategy
Environment	50%	Specific data on building related environmental pollution and resource consumption	Klimatilpasning kbhkort.kk.dk/
Economy	22%	Renovation and EE related companies, tax flows, income, R&D spending	KASA
Building codes	100%	-	BBR
Building stock quality	80%	Renovation circles, overview of cost	KASA
Building energy use	100%	Decentralised renewables on-site	Energimærke
Socio-economy	38%	Occupant health, sick-days, well-being, indoor comfort	Socioøkonomisk kort kbhkort.kk.dk/t
LCA	53%	Window to wall ratio, referenced service life,	EPD Danmark LCAP verktøj
Energy systems	81%	-	KASA

EERADATA DST

Specific functionality and data

- Batch simulation, single building assessment and adding the results up for a group of buildings.
- Making batch-simulations/calculations looplike to generate scenarios (like In GIS systems)
- 2 layers of detail: Rough fast estimates based on defaults for preassessment
- Detailed assessment of single buildings or multiple buildings in batch calculation
- Possibility to create different scenarios with different measures and their impacts (easy change between scenarios, switching off and on measures, increase and reduce effort (cost, efficiency, etc) with controllers

Specific Data

- Local costs and key figures need to be integrated
- Variety of default values for fast pre-assessment based on Copenhagen data
- Integrate typical measures (additionally to EDGE measures), costs, frameworks and key figures from the municipality into the DST
- Default values
- Priorities (towards certain measures and strategies) also within a fixed budget have (e.g. on indoor climate)

User Types

 <p>#1 Potential user Copenhagen properties Main task: Preparation of business cases</p>	 <p>#2 Potential user Copenhagen properties Main task: Writing budget proposals for renovation projects</p>
<p>Use:</p> <p>Persona #1 will use the DST when calculating the business case. He needs to document a payback time on less than 6 years. So, the more factors he can capitalize the better BC he gets. It is important to separate the saving in operation cost such as energy consumption or lost manpower due to indoor climate related diseases with other savings/benefits such as better learning environment and concentration. It would be cool if it was possible for him to make scenarios, so he could turn up and down for different parameters and see which effect it has.</p>	<p>Use:</p> <p>Persona #2 will use the DST to try to expand the budget proposal. If he can show in his proposal that with x-times more money on the budget it is possible to create renovation impacts that are much more sustainable and profitable since they integrate environmental and socio-economic effects that can also lead to high profit.</p>
<p>Special functions:</p> <ul style="list-style-type: none"> ▪ Focus on prizes and savings ▪ More soft values and descriptions would be good for argumentation and reporting ▪ Results of DST should be ready to be implemented in documentation for further discussion with other departments and budget owners ▪ Creation and calculation in different scenarios is a must for planning <ul style="list-style-type: none"> ▪ Data must be validated ▪ Transparent calculations and methodology ▪ Transparent assumptions 	<p>Special functions:</p> <ul style="list-style-type: none"> ▪ Focus on scenarios and renovation options with an holistic impact assessment ▪ A lot of possibilities to change budget, investment and measures in order to test different combinations and its outcomes <ul style="list-style-type: none"> ▪ Benefits/savings: Energy consumption, better indoor climate, better health, better building condition and maintenance level etc. ▪ He must be able to show this to the politicians, so they choose to allocate funding for it
<p>Level of detail:</p> <p>High: expert mode detailed visualisation and full report. Access to all metrics</p>	<p>Level of detail:</p> <p>Middle: Full transparency but access to all metrics not necessary. It is important that there is an overview - very simple and very specific in order to present to grant holders and decision makers</p>

CASE STUDIES

Copenhagen properties knows 4 different frameworks for public building renovation and assessment. These different approaches as well as the use of the EERAdata DST is briefly described below. The two potential users also will work in one of the below cases (2-4).

1.	<p>Emergency Renovation Description: this renovation plan fixes current and unavoidable damages, failures and errors, it is an emergency plan Planning horizon: extremely short term, emergency, no political decision needed Budget: fixed EERAdata DST: No application</p>
2.	<p>Scheduled Maintenance Renovation Description: preventive governance model with a fixed budget every year. Buildings get checked every 4 years and their condition gets assessed. The buildings and their constructive and technical condition need to fulfil certain criteria. If this is not fulfilled, they get refurbished and, in some cases, also modernised. There is specific thresholds for specific building types. Other criteria could be the amount of people working in the building, the location, political agendas, social focus points, etc. There is no political approval (by the city council) needed, the decision is solely based on technical assessment, key figures, renovation goals and predefined criteria. Planning horizon: 10-year maintenance plan, with 4 year building assessment cycles Budget: 200 000 000 DK, no political approval (by the city council) needed EERAdata DST: building assessment, preassessment, and support the selection of building, identify potential</p>
3.	<p>Long-Term deep renovation strategy Description: Deployment of profound energy efficiency and renovation measures. Every project is individual and undergoes an individual assessment, planning and financing process. This is the renovation plan which includes major projects with high costs and comprehensive measures. A preassessment defines measures and depth of implementation and the related costs (costs and key figures are to be selected in a database, table). There is always a political decision needed to get the project budget granted. The lower the cost with a higher efficiency or impact the better the chances to get the political approval for implementation. After the political decision the measures gets planned in detail. Planning horizon: unlimited. Program needs to be accelerated and extended (EERAdata) Budget: high budget, complex and comprehensive projects, tbd. by each project, needs a political decision, approval EERAdata DST: The DST plays two roles: 1. Fast and rough assessment based on mostly defaults: Support for preassessment, rough estimate of cost and impact of measures on particular buildings. Ranking of renovation potential based on the social and environmental impact and payback periods due to a batch processing of several buildings that are of interest for the planning entity. Scenario building, with different layers of measures, cost and efficiency. 2. Detailed and project specific analysis for one project/ building. The input data is mostly project specific, the tool assesses the building, the planned measures and their specific impact, e.g. on the improvement of indoor climate, embedded energy, the environment, local economy, etc. It gives profound insights on the benefit by cost invested and will serve as an indicator on the amount and extend of the implemented measures (and will be a strong argument to increase the measures and their depth).</p>
4.	<p>Business case: building renovation Description: The city government asks all departments to save on administrative budget every year by 2% in order to make the administration more efficient. The building sector with high energy and maintenance costs plays a major role in these plans. Every employer can propose solutions that will become these business cases. The implementation of a BMS system or the integration of more efficient heating setting or even renovation measures can deliver long-term savings by creating multiple benefits as a bonus to the financial improvement. Due to the clear focus on saving money, the projects in this plan are almost only placed on financial indicators, of which the payback time is the most important one. All business cases need to be accepted by the economic department of the city and the political level will formally agree with this decision. Planning horizon: 1 year, after the approval of the city's budget, Budget: open, goal now: save 2% of yearly administrative budget with projects, additional to daily business. maximum payback time for acceptance of proposal is 6 years. Eligible cost are direct operating costs such as energy consumption. EERAdata DST: The DST plays two roles: 1. Fast and rough assessment of business case idea, based on mostly defaults: a first estimation of the payback time, including socio-economic and environmental factors 2. Detailed and project specific analysis for the business case: details impact assessment of business case. Integrating mall modules of the EERAdata DST. Provides insides and scenarios for the deployment of the measures which are planned in the business case</p>

FACT SHEET ANDALUSIA



SPAIN



Implementing Partner: Andalusian Energy Agency

The region of Andalusia is the most southern state in the peninsula of Spain and its hottest area. It is the most populous, and second largest autonomous community in the country with its capital Seville.

Administration: The Andalusian Autonomous Government (Junta de Andalucía) and especially the Council of Government are the highest political and administrative organ of the Community, exercises regulatory and executive power. The Andalusian Energy Agency is a public entity which offers technical consultancy, assessments and planning services to impulse the sustainable energy development.

- **Inhabitants:** 8.392.000
- **Population density:** 92 /km²
- **Buildings:** 6.719.515
- **Public Buildings:**9051
 - ➔ 0,4% population growth by 2025
 - ➔ 40,000 new housing units by 2025
 - ➔ Housing overcrowding rate: 5,9 % (2019, Europe: 17,1%)

Climate: Climate in Andalusia varies a lot with the different zones like on the shore or mountain area, it is the hottest area in Spain, average precipitation is low (0-6,6 days a month).

- **Summer:** 23,0°C - 26,0°C mean Temp / *Warmest month:* August 30,8°C /daylight max: 14 hours 41 minutes, / *Cooling Degree days* (2019, base 24°C): 400-800d
- **Winter:** 12,1°C-14,7°C mean Temp, *Coldest month:* January 7,4°C / daylight low: 9 hours, 39 minutes / *Heating Degree days* (2019/20, base 18°C): 1298 d
- **Humidity:** 58% - 72%

Economy: (Spain)

- Jobs maintained by building renovation: 118.868
- Construction output decreased -12 % in 2020 due to Covid 19
- Construction sector growth over the last 3 years: 4,8%
- GDP per capita (PPP), 40883 \$ (2019)

Sustainability:

- City 21 Environmental Sustainability Programme
- Andalusian Circular Bioeconomy Strategy
- The Sustainable Construction Programme in Andalusia (PICSA)

EERAdata Challenges and related SDGs: (Survey data)



1. Improved well-being, quality of life



2. Better indoor comfort and environment



3. Poverty alleviation, energy affordability, and infrastructure

Furthermore: Energy import, improve local, regional energy production, Energy system (renewables, energy grid, supply), Individual health improvements, less sick days, Reduced healthcare costs, reduced mortality

BUILDING DATA

Building stock information:

Administrative buildings	Educational buildings	Healthcare buildings	Residential buildings
515	6815	1721	4029352

Renovation rate: 6% (CSCAE, 2020), non-residential 0,3%

Most recurrent renovation measures in the past years:

1. Replacement of windows
2. Improvement of hot water generation system (new boiler, energy efficient technology)
3. Replacement and improvement of electrical appliances (energy efficient freezers, lights systems)

Minimum requirements for building renovation

General rules: Any building which is new, or change their use, or goes through a renovation of at least 25% of its envelope, has to follow the most updated version of the Spanish TCC (Technical Code of Construction)

Construction requirements:

Minimum U-Values Renovation and New construction

Element	Winter climatic zone					
	α	A	B	C	D	E
External walls and floors	0,80	0,70	0,56	0,49	0,41	0,37
External roof and covers	0,55	0,5	0,44	0,40	0,35	0,33
Gaps, windows, drawer blinds	3,2	2,7	2,3	2,1	1,8	1,8
External walls and covers to soil	0,9	0,8	0,75	0,70	0,65	0,59

- **Building Technology:** Standard boilers run by fossil fuel that do not meet state of the art features are prohibited, minimum energy efficiency requirements for cold generators (EER and COP)
- **Indoor air quality:** sufficient flow of external air must be provided to achieve that in each local the average annual concentration of CO₂ is maintained below the acceptable threshold. Depending on the use, the building must hold a certain indoor air quality category.
- **Funding and grants:** Funding is applicable for measures to improve energy efficiency in the renovation of existing buildings if the subsidised measure exceeds the requirements of the laws for building renovation
- **Energy consumption:** (total primary energy consumption, thresholds, kWh/m²year)

Winter climatic zone	α	A	B	C	D	E
Renovated residential buildings	55	75	80	90	105	115

Available Datasets:

Topic	Availability of data	Main Gaps (status quo)	Existing Databases
Demographics	87,5	Public employee, occupant specific data	Instituto Nacional de Estadística (INE) Andalusian Demographic Information System
Political agenda	100%	Specificity of indicators of the Agenda 2030	Boletín Oficial de la Junta de Andalucía
Environment	70%	Specific data on building induced environmental pollution and resource consumption	REDIAM Junta de Andalucía
Economy	77%	R&D data, renovation company and details on tax flows	Instituto de Estadística y Cartografía de Andalucía
Building codes	100%	Monitoring	Código Técnico de la Edificación (CTE)
Building stock quality	58%	Quality of buildings, indoor climate, occupant info, energy system	Observatorio ITE INE
Building energy use	100%	Share of combined building energy use	-
Socio-economy	15%	Occupant information, health, well-being etc.	
LCA	30%	Materials, service life, 3d building models	GBC España, DAP construction, AENOR
Energy systems	100%	-	-

EERADATA DST

Specific functionality and data

- Integration of European and National KPIs in order to receive renovation funds
- Detailed and transparent data and calculation outputs for external consultants and researchers for further calculations, processing and reporting
- Integration in, and extension of existing databases
- Batch assessment of multiple buildings to perform a preassessment of potential renovation objects with multiple indicators
- Particular focus on energy systems and supply side measures to justify energy efficiency measures as energy agency
- Overview and transparent analysis of all indicators for integration and extension of regional policies and the selection process of regional ministries

Specific Data

- Local, national and regional costs, KPI and key figures need to be integrated
- Specific focus on supply side and energy system data
- Consider the different climate zones of Andalusia
- Data should be able to be collected and exported to external databases to enrich their data-stock

User Types

 <p>#1 Potential user Public administration Malaga Main task: Architecture and Infrastructures Manager, is responsible of the of the building renovation activities</p>	 <p>#2 Potential user Agency for social housing Main task: The renovation team is taking care of the design of the complete building renovation process</p>
<p>Use: Persona #1 AID is taking care of the complete building renovation process: 1) Based on the available budget and the urgency of renovation of each building, they select the renovation measures and the buildings; 2) Tender preparation and publication; 3) Works assignment to subcontractor; Budget for building renovation is limited for these processes.</p> <p>The AID knows which buildings have to be renovated. They would like to ask for a larger budget and they need to allocate the current budget to the measures that produce the largest impact in social, environmental, and economic sense. They have a list of topics and challenges that need to be addressed by the renovation measures in order to get more budget and satisfy the political goals.</p>	<p>Use: Persona #2 1) Based on the available budget and the urgency of renovation of each building, decide the renovation measures and where to implement it. 2) Tender preparation and publication; 3) Works assignment to subcontractor; 4) Renovation evolution works surveillance; 5) End of works approval.</p> <p>Special goals: Implementation of energy generation on site for tenants in energy poverty. Building renovation to maintain healthy and comfortable buildings</p>
<p>Special functions:</p> <ul style="list-style-type: none"> ▪ The AID needs to integrate a weighting for the topics that are of higher importance for the decision makers to rank the impact of specific measures <ul style="list-style-type: none"> ▪ They need the ability to create scenarios by combining certain measures and see the different outcomes ▪ They need to know the cost of the set of measures in every step of the tool, from selecting measures to selecting the intensity of each measure. 	<p>Special functions:</p> <ul style="list-style-type: none"> ▪ Define the available budget for the selected buildings to maximise the impact of the renovation ▪ Detailed reports including interactive scenarios where they can play around to generate different results. <ul style="list-style-type: none"> ▪ Detailed list of measures and their dedicated impact. ▪ Ranking of impact depending on a set of measure and its intensity (scenario)
<p>Level of detail: High: Detailed access to municipal building data. Can use all functions of the tool</p>	<p>Level of detail: Middle: Detailed access. But not to municipal data. Only to Social Housing from de Andalusia Administration. Can use all functions of the tool</p>

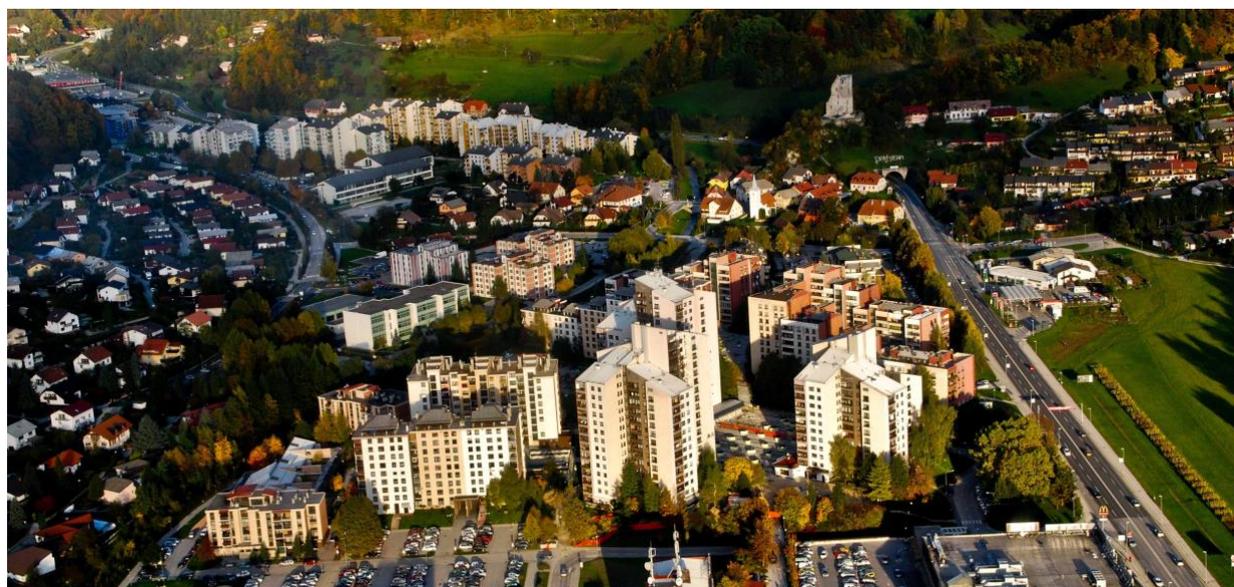
CASE STUDIES

As an Energy Agency the Andalusian Energy Agency is not involved in internal political and municipal renovation strategies. However, it has influence on renovation projects, data collection and energy auditing. These activities are also reflected in the two case studies below.

<p>1.</p>	<p>Deep building renovation</p> <p>Description: This deep renovation process is divided into five consecutive steps and various players:</p> <ol style="list-style-type: none"> 1. REDEJA, a sub-department of the AEA, is assessing the building stock based on the energy consumption and documentations of conducted energy audits. They are then recommending buildings with a high potential for energy efficiency measures like building renovation. 2. The regional ministries select buildings that have to be renovated, this can be due to the recommendation of REDEJA but usually a lot of other, less technical, arguments can decide for the building to be renovated. The selection process however is very untransparent, political and publicity related projects have a high chance to get funded. 3. An external company performs energy audits on the selected buildings and assesses the building energy performance and overall condition. They recommend a set of measures (out of a mostly predefined catalogue of measures with related costs) and the related budget to conduct these measures. 4. REDEJA is assessing these energy audits, and the related measures, on their compliance with the Key Performance Indicators by the European Union (main source of funds). These are mostly energy efficiency and CO2 reduction targets. Based on this assessment, REDEJA, decides for an optimised and minimised combination of measures from the energy audit s to be implemented. (There are always more measures recommended in step 3 that can be implemented). 5. REDEJA starts the procurement and contracting process. <p>Planning horizon: varies with each project</p> <p>Budget: Budget is determined by the preassessment of the building via the energy audit (mostly performed by external companies), They recommend 10 or more energy efficiency measures.</p> <p>The Cost of these measures is fixed and determines the related budget. in short. The energy audit defines the measures, and the measures define the budget.</p> <p>The budget (European Funds) for the regional ministries in Andalusia is distributed with fixed shares based on energy consumption. E.g. the Health ministry consumes 20% of electricity, it gets 20% of the funds. REDEJA is distributing the budget.</p> <p>Users: REDEJA, AEA, Regional ministries, external companies (energy audits)</p> <p>EERAdata DST:</p> <ul style="list-style-type: none"> ▪ The DST could help the regional ministries to select the buildings with the most potential within all sustainability indicators. Furthermore, the DST can help to create the selection process more transparent and based on a set of indicators instead of personal decisions. ▪ REDEJA will use the DST to check compliance with EU regulations (especially when they will include LCA and socio- economics in the future) and most important it can rank and select the measures with the highest potential within ecological, social, environmental and economic criteria. ▪ External companies can use the DST to increase the budget for the renovation of a building by using the output of the DST with its holistic cost/benefit assessment to recommend more measures than usual and therefore get more budget for a significant better renovation quality. ▪ REDEJA can use the DST to pre-assess the potential of energy efficiency on buildings with multiple indicators, like LCA, construction, environmental performance, socio-economic performance and, based on that, is able to recommend potential buildings to the regional ministries for renovation. Due to the EERAdata DST the arguments and multiple benefits will increase the probability for a decision in favour of the most sustainable solution ▪ The DST could change the distribution of European funds to the regional ministries to a more objective, indicator based, sustainable and holistic distribution of funds (Prioritisation of high potential projects)
<p>2.</p>	<p>Extension of existing databases</p> <p>Description: This is a not existing process so far. In the future the DST will help to generate questionnaires or define data intake processes to enrich and fill the building directory that will be merged with the REDEJA electricity consumption data. The so developed database could also be sent to external clients and included into energy audits.</p> <p>Planning horizon: future, long term framework</p> <p>Users: REDEJA, external companies, portfolio managers, public administration (regional ministries and institutes)</p> <p>Budget: not relevant</p> <p>EERAdata DST: The DST provides a selection of indicators and datasets that need to be collected to provide a proper socio-economic and environmental building assessment. Thus, the DST will help to extend existing databases and data frameworks with crucial information about sustainability issues and future topics. It furthermore will encourage the users to deploy more measurements and increase the monitoring of social and environmental indicators.</p>

FACT SHEET

VELENJE



SLOVENIA



Implementing Partner: Municipality of Velenje

The young (built in 1950) municipality of Velenje is the fifth largest city in Slovenia. It is located in the northeast of the country. The city is highly influenced by its mining and coal tradition and its one of the strong economic centres of Slovenia.

Administration: The municipal administration together with the regional energy agency KSENA are constantly developing energy efficiency, sustainability project to vitalise the cities future.

Responsible departments: Department of Development and Investment, Department for the Environment and Spatial Planning, Department of Public Utilities, Department of Public Finance and General Affairs.

- **Inhabitants:** 32959 (2018)
- **Population density:** 392 / km²
- **Buildings:** 9000
- **Public Buildings:**59
 - ➔ 0% population growth by 2025
 - ➔ Housing overcrowding rate: 11,6 % (2019, Europe: 17,1%)

Climate: Velenje lies in the so-called Marine West Coast Climate, which is moderate with few extremes and frequent precipitation events (124 days per year)

- **Summer:** 14°C-18,1°C mean Temp / *Warmest month:* July 22,0°C / *Daylight max:* 15 hours 48 min / *Cooling Degree days* (2019, base 24°C): 67 d
- **Winter:** -2,0°C- 4°C mean Temp / *Coldest month:* December -3,0°C/ *Daylight low:* 8 hours and 36 min / *Heating Degree days* (2019, base 15°C): 25589 d
- **Humidity:** 55%-84%

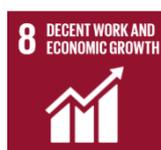
Economy: (Slovenia)

- Jobs maintained by building renovation: 5431
- Construction output decreased 1,8 % in 2020 due to Covid 19
- Construction sector growth over the last 3 years 5: 11,9 %
- GDP per capita (PPP), 40656 \$ (2019)

Sustainability:

- Green destination bronze award 2019
- Planet earth friendly municipality 2012-2020, Greenest metropolitan municipality
- Energy efficient Municipality En.Občina 2010, 2011, 2016
- Free of charge public transport since 2008

EERAdata Challenges and related SDGs: (Survey data)



1. Reducing unemployment job creation in building sector



2. Economic growth, wages, jobs, GDP, taxes



3. Energy system (Renewables, energy grid, supply)

Furthermore: Poverty alleviation, Energy affordability, access and infrastructure, Better indoor comfort, environment, Reduced water consumption, reduced greenhouse gas emissions

BUILDING DATA

Building stock information:

Administrative buildings	Educational buildings	Healthcare buildings	Residential buildings
9	31	1	Approx. 6000

Renovation rate: Deep renovation: 0,3% (2019, Slovenia); Other energy related renovation: 8,5%, Renovation rate goal: 3% (15.000-25.000 m²)

Building age distribution: The majority (>80%) of buildings both public and residential were constructed between 1960 and 1990 when the city of Velenje documented its highest rate of growth.

Most recurrent renovation measures in the past years:

- Improvement of the building envelope: Thermal insulation of walls/facade, basement
- Replacement of windows, Replacement of inefficient lighting systems
- Improvement of heating and hot water generation system (energy efficient technology)
- 2nd and 3rd most: Roof insulation, energy efficient ventilation system

Minimum requirements for building renovation

General rules: From 31. December 2020 all public buildings (newly constructed or implementing energy renovation) will be required to have an annual supply of energy equal to or less than 25 kWh/m²a.

Construction requirements: Minimum U-Values Renovation

Top floor ceiling or roof	Exterior walls	Bottom floor against soil	Windows	Exterior doors
0,20 W/m ² K	0,28 W/m ² K	0,35 W/m ² K	1,30 – 1,60 W/(m ² K)	1,60 W/m ² K

Mean heat transfer coefficient

TL= annual external temp of location,
f₀ = shape factor, z = window/wall ratio

$$H_T \leq 0,28 + T_L/300 + 0,04/f_0 + z/4 \text{ [W/m}^2\text{K]}$$

Energy consumption:

(Q_{NH}= annual heating of the building,
V_e= heated volume)

$$Q_{NH}/V_e \leq 0,29(45 + 60f_0 - 4,4T_L \text{ [kWh/m}^3\text{a]}$$

Energy supply: at least 25 percent of the total final energy required for the operation of systems in the building is provided from renewable energy sources.

Political goals: By 2050 Strategy for mobilizing Investment in the energy renovation of buildings for public buildings up to 2050, 74% of single-dwelling and 91% of multiapartment buildings will demonstrate high energy efficiency.

Available Datasets:

Topic	Availability of data	Main Gaps (status quo)	Existing Databases
Demographics	62,5%	Employees in public sector, occupants of public buildings	SiStat (database of the Statistical Office of the Republic of Slovenia)
Political agenda	100%	-	PISRS (Legal information system of the Republic of Slovenia)
Environment	100%	Specific data on building related environmental pollution and resource consumption	Ecological monitoring system of the City municipality of Velenje, Emission monitoring system for TEŠ (EIMV)
Economy	30%	Planners, companies, R&D, employees in the construction sector	SiStat (database of the Statistical Office of the Republic of Slovenia)
Building codes	100%	-	PURES, TSG-1-004: 2010, Building Act (GZ)
Building stock quality	78%	Indoor air quality, renovation and climate change budget data, health occupant data	Energy certificate repository
Building energy use	100%	-	Energy certificate repository
Socio-economy	30%	Health, well-being, occupant data (schedules) and demographic data on municipal level	SiStat, local and regional surveys
LCA	73%	3D Building Models	ZAG EPD
Energy systems	72%	Share of renewables, cooling systems	Local Energy Concepts of municipalities (LEKs), Energy audits of organizations, National surveys

EERADATA DST

Specific functionality and data

- Time-function that assesses measures and their impact on a long-term basis also when implemented after each other
- Batch simulation of multiple buildings of the same or various uses
- Seamless integration into existing reports and processes
- User-friendly also for non-expert users, accompanied with guidelines and detailed onboarding
- Generate detailed and professional outcomes and datasets, which can be processed and used by external experts and consultants

Specific Data

- Long-term time-related data
- Input format or database for fund related criteria or KPIs
- Input format for political frameworks and goals
- Guidelines and help functions explaining results and input forms for non-specialist users

User Types

 <p>#1 Potential user Head of Department of Development and Investment Main task: Leadership and decision-making on the department level, proposing decisions to the director of the municipality and city council</p>	 <p>#2 Potential user Employee of Department of Development and Investment Main task: Preparation of accurate, transparent data for decision making.</p>
<p>Use: Persona #1 will use the DST for better argumentation and persuasion of decision makers. With the help of real numbers for a variety of topics (for example, savings in energy consumption, creation, taxes, health, productivity, etc.), the new investment (Proposed by the head of the department to the director of the municipality and city council) will be easier and faster to realise.</p> <p>Focus data: savings, justification of the investment, cost-effectiveness of the investment (one building compared to another)</p>	<p>Use: Persona #2 will use the DST to prepare the necessary data for decision-making in short and concise reports, also equipped with graphical representations. The Employee also keeps records of buildings owned by the municipality, takes care of their current maintenance and repairs. He needs a faster and easier comparison of data (for example several different buildings), selection of only necessary / desired data for more transparent reports. Create different reports quickly - data in one place.</p> <p>Focus data: Benefits and savings; energy consumption, better indoor climate, better health, better building condition.</p>
<p>Special functions:</p> <ul style="list-style-type: none"> ▪ Accurate and transparent display of savings <ul style="list-style-type: none"> ▪ possibility of graphic display ▪ possibility of comparison of several buildings <ul style="list-style-type: none"> ▪ transparent printout, easy documentation. <p>The added value of the tool will be:</p> <ul style="list-style-type: none"> ▪ display / impact assessment effects on human health and well-being ▪ display / impact assessment effects on employee productivity 	<p>Special functions:</p> <ul style="list-style-type: none"> ▪ Accurate and transparent display of savings <ul style="list-style-type: none"> ▪ possibility of graphic display ▪ possibility of comparison of several buildings <ul style="list-style-type: none"> ▪ transparent printout, easy documentation. <p>The added value of the tool will be:</p> <ul style="list-style-type: none"> ▪ display / impact assessment effects on human health and well-being ▪ display / impact assessment effects on employee productivity
<p>Level of detail: High: full access, Accurate and transparent display of savings, possibility of graphic display, possibility of comparison of several buildings with each other, transparent printout, easy documentation</p>	<p>Level of detail: Middle: Accurate and transparent display of savings, possibility of graphic display, possibility of comparison of several buildings with each other, transparent printout, easy documentation</p>

CASE STUDIES

Velenje is a small municipality with a limited amount of public buildings. Building renovation serves mainly to keep the buildings operative. Deep renovation and energy efficiency measures are usually performed when National or European Funding could be acquired.

<p>1.</p>	<p>Integrate energy efficiency renovation into long term political decision-making Description: This is a not existing process so far. But in the future the DST will help to generate questionnaires or define data intake processes to enrich and fill the building directory, renovation plans and regular reports with socio-economic and environmental impact analysis. This information should be accessible for political decision makers, departments that are not necessarily connected to building renovation and the general public through public strategies, that will be influenced by data from the DST. Planning horizon: long-term Budget: no specific budget planned Users: Municipal departments, City council, Decision makers, External consultants (KSENA) EERAdata DST: The DST provides a selection of indicators and datasets to provide a proper socio-economic and environmental building assessment. Thus, the DST will help to extend existing reporting schemes, budget plans, long-term strategies, strategy papers. databases, etc with crucial information about sustainability issues and future topics. It should improve political decisions for building renovations: by showing different scenarios, assessing multiple buildings, show the cost/impact/ benefit of each scenario on a long-term timeline to show the positive effects of building renovation</p>
<p>2.</p>	<p>Maintenance renovation Description: The municipality has a limited budget, that is agreed on every year to keep the buildings operative. It does not foresee long-term planning or deeper renovation plans to keep the building futureproof. Mainly it is covering repairs, exchanges or the measures that are necessary to get a building operative when its functions are about to fail. Planning horizon: yearly Budget: Defined by each case but rather small Users: Municipal investment and Development Office (or Municipality of Velenje) EERAdata DST: no application foreseen</p>
<p>3.</p>	<p>Application for EU/ National funds Description: The municipality of Velenje obtains the most of its budget for building renovation from national (Slovenian) or European funds. These funds comprise a comprehensive application scheme that demands an assessment of the building stock and related, suitable renovation measures in a profound detail. Main decision criteria are the compliance with energy efficiency and CO2 emission goals. The department for investment and development therefore assesses the building stock together with external experts from KSENA to select buildings and related measures which will meet these criteria after the renovation with the best cost/benefit ratio. Planning horizon: yearly to long term Budget: depends on fund, low budget for preassessment for the application Users: Municipality of Velenje, KSENA EERAdata DST: The DST will help to perform this early assessment and extend the range of impact topics to environmental, social, and economic factors without stressing the municipalities budget. In the best case it will substitute the first round of building selection and rough assessment of the impact of renovation measures which is at the moment complicated and only possible with the help of external consultants. The DST could assist the staff of the municipality to provide a certain amount of data by themselves before starting an in-depth analysis with the external experts. Furthermore, the wide scope of benefits will show shorter payback periods and a higher return of investment which is important for funding applications.</p>
<p>4.</p>	<p>Business case: building renovation Description: After the funds (state or EU) were granted, the buildings and related measures need to be finally selected according to an optimised cost/benefit scheme based on the granted budget. Most funds are related to a certain group of buildings, e.g. there is a fund to renovate educational institutions or health facilities, which limits the selection of buildings. The preassessment in the previous process will help to select a scenario and a group of buildings for which the efficiency of the investment is the highest. Planning horizon: semester, year and long term Budget: Budget is determined by the preassessment of the building via an energy audit (mostly performed by external companies), they recommend 10 or more energy efficiency measures. The Cost of these measures is fixed and determines the related budget. Users: Co-financiers (state or EU), Ministries, Municipality, energy audits EERAdata DST: The DST will provide in-depth information on the impact of certain renovation measures on a certain building and will provide a batch assessment on multiple buildings to show various building renovation measures and their impacts. It will create scenarios for one building with a different combination of measures. The DST will highlight the different outputs of each measure on the selected building in socio-economic, environmental means. It will show the revenue based on this holistic assessment.</p>

DATA SOURCES

Copenhagen

- EERAdata User research and survey (see Deliverable 2.2)
- EERAdata wider benefit survey results
- Eurostat 2020. “Statistics, Demographics, Climate data, etc.”: <https://ec.europa.eu/eurostat>
- Statistikbanken. “Danish statistics, Demographics, Buildings, Economy, etc.”: <https://statistikbanken.dk/>
- Danish meteorological institute. “Weather, Climate, Degree days, etc.”: <https://www.dmi.dk/>
- kk.dk. “Copenhagen website. Political goals, Legal sources, Laws, Economy, SDG, etc”.: <https://www.kk.dk/>
- Degreedays.net. “heating and cooling degree days”: www.degreedays.net
- Worldbank. “Economy, Market Growth, GDP statistics”: <https://data.worldbank.org/>
- Atradius market monitor construction 2019. “Construction economy and employment statistics”. <https://group.atradius.com/publications/market-monitor-construction-denmark-2019.html>
- Esser, Anna et al. (2019): Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU. Final report. Ipsos Belgium; Navigant; European Commission. Gent. 11/2019

Andalusia

- EERAdata User research and survey (see Deliverable 2.2)
- EERAdata wider benefit survey results
- Junta de Andalucía. ““Andalusian statistics, Demographics, Environment, Pollution, Buildings, Economy, etc.”: <https://www.juntadeandalucia.es/datosabiertos/portal.html>
- Spanish National Meteorological Agency. “Weather, Climate, Degree days, etc.”: <http://www.aemet.es/en/eltiempo>
- Atradius market monitor construction 2019. “Construction economy and employment statistics”. <https://group.atradius.com/publications/market-monitor-construction-spain-2020.html>
- Trading economics. “market indicators, construction economy, employment, etc”. <https://tradingeconomics.com/>
- Worldbank. “Economy, Market Growth, GDP statistics”: <https://data.worldbank.org/>
- Esser, Anna et al. (2019): Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU. Final report. Ipsos Belgium; Navigant; European Commission. Gent. 11/2019
- Superior Council of Colleges of Architects of Spain. “building data, building requirements and legislation”.
- Enerdata. “energy research, energy and building data, building codes, etc.”: www.enerdata.net

Velenje

- EERAdata User research and survey (see Deliverable 2.2)
- EERAdata wider benefit survey results
- Meteo SI. “Climate data, weather data, heating and cooling degree days, etc.” www.meteo.si
- Trading economics. “market indicators, construction economy, employment, etc”. <https://tradingeconomics.com/>
- Worldbank. “Economy, Market Growth, GDP statistics”: <https://data.worldbank.org/>
- Esser, Anna et al. (2019): Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU. Final report. Ipsos Belgium; Navigant; European Commission. Gent. 11/2019