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

Operationalising the "Energy Efficiency first Principle" on a municipal and regional level

Concerted Action EED, 14.10.2021

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Project Coordinator

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847101

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EERAdata Project

- EERAdata will operationalise the EEfP on a municipal and regional level
- It assesses the multiple benefits that arise through energy efficiency measures applied on single buildings
- It will create a software solution and related database which helps municipalities and regions to perform these assessments

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Operationalising the EEfP on local level

- Broader justification for energy efficiency investments
- Identifying economic and monetary benefits for various stakeholders
- Argument and motivation for more comprehensive energy efficiency measures
- Changing the role of buildings
- Increasing well beeing and health
- Quantifying the impact of building renovation on societal issues (fuel poverty, envrionmental pollution, climate change, etc)

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Operationalising the EEfP on local level
Barriers of EE implementation

- Assessment only focus on energy savings
- High initial investment costs

} **Long payback periods**

- Decision based on political or personal drivers
- Short term planning
- Lack of capacity and resources for detailed cost-benefit analysis supporting decision-making
- Complex funding procedures
- Low knowledge, time, experience, motivation of staff
- EE investments are considered high risk investments.
- Scattered projects, which are often limited to shallow renovation with small measures.

→ Public decision makers are mostly not aware of the multiple benefits (health, productivity, etc.) of deep renovation and energy efficiency measures and cannot evaluate ecological, employment or societal benefits.

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Operationalise the EEfP
EERAdata outputs

1. Scientific calculation methodologies to assess EE in the economic, social and environmental sectors
2. Parameter and indicator list for socio-economic and LCA assessment
3. Data collection guidelines and templates
4. Assessment and Decision making tool
5. Comprehensive database with default and proxy values
6. Implementing Guidelines

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EERAdata Implementation

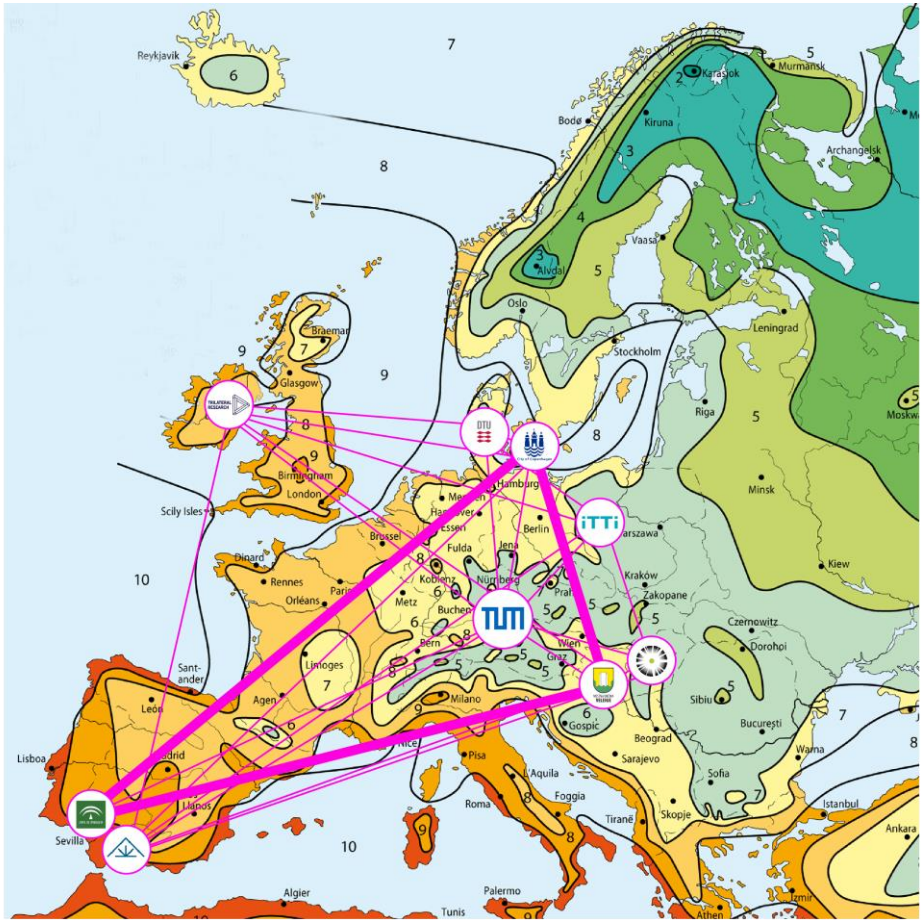
3 Clusters for Implementation

Strong Stakeholder network

Collaboration outside the consortium

Workshops

Symbiosis with other projects



Partner municipalities will **participate** to the design of the tool and test its application in **regional pilots**.

The pilots will be part of a **wider process of stakeholder engagement** aimed at ensuring the usefulness of the different instruments, their applicability across different geographical and economic contexts, and its adoption **beyond the life-span of the project**.

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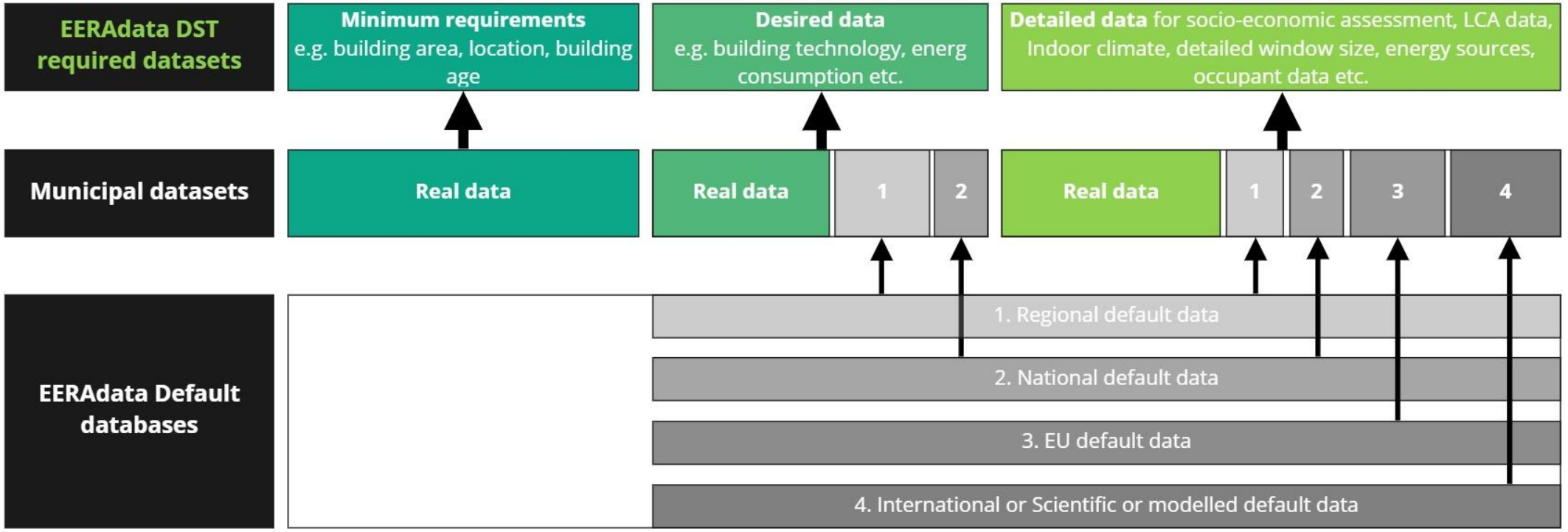
Data gaps and default data



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Definition of minimum required data

Variables	Data Type	Description
Building_ID	Integer	Building identification number
Building_Use	String	Building category (administrative, educational, healthcare, cultural and sport)
BuildingAge	Datetime	Year in which building was constructed
FloorArea	Integer	Used area of the building
BuildingWidth	Float	Width of the building
BuildingLength	Float	Length of the building
NumberofStoreys	Integer	Number of storeys in the building
RoomorBuildingHeight	Float	Room height or building height
GroundSurfaceArea	Integer	Surface area of the base plate

Variables	Data Type	Description
Timezone	Integer	Timezone for each municipality
Location	Integer	Coordinates of each municipality
WeatherData	Integer	Weather data 365 days a year for each municipality
MonthlyMeanGroundTemperature	Float	The mean ground temperature for every month for each municipality
ShieldingClass	String	Shielding classification for buildings in each municipality
TerrainClass	String	Terrain categories for buildings in each municipality (TC1, TC 1.5, TC 2, TC 2.5, TC 3)

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Definition of desired data

Variables	Data Type	Description
Area	Integer	Net Floor area
Name	String	Address, Identifier used by User
buildingVolume	Integer	Building Volume
groundSurfaceArea	Integer	Ground Surface Area
averageStoreyHeight	Float	Average Ceiling Height
buildingHeight	Float	Building Height
buildingperimeter	Float	Building perimeter
externalWallSurfaceArea	Integer	External wall surface area
ratioWindowToWall	Integer	Window to wall ratio
ratioWindowToFloor	Integer	Window to floor area ratio
gValueWindows	Integer	g value of existing windows
frametypeofwindow	String	Frame type of existing window
glazingofwindow	String	type of glazing of existing window
sharedWallArea	Integer	Shared external wall area
uValueExternalWall	Float	U Value external wall
uValueWindows	Float	U value windows
uValueBasePlate	Float	U value base plate

55 Parameter on building characteristics and surroundings

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Default and proxy data

- **Building specific, municipal/Local default data**
  24 parameters on building characteristics, location, building technology, energy sources
- **Climate and Weather Data**
  7 parameters on average outdoor temperatures, heating and cooling degree days, outdoor air speed, terrain, etc
- **Renovation Measure Data**
  24 parameters on renovation measures like insulation of roof, walls, basement, exchange of windows, upgrade of heating system, integration of ventilation, etc.
- **Life Cycle Assessment Data**
  117 LCA datasets on materials, embedded energy, primary energy consumption, building technology, construction elements, etc.
- **Socio-economic data**
  Over 60 datasets on job creation, construction economy, tax rates, household income, labour cost, particulate matter emissions, emission cost, procurement processes, etc.

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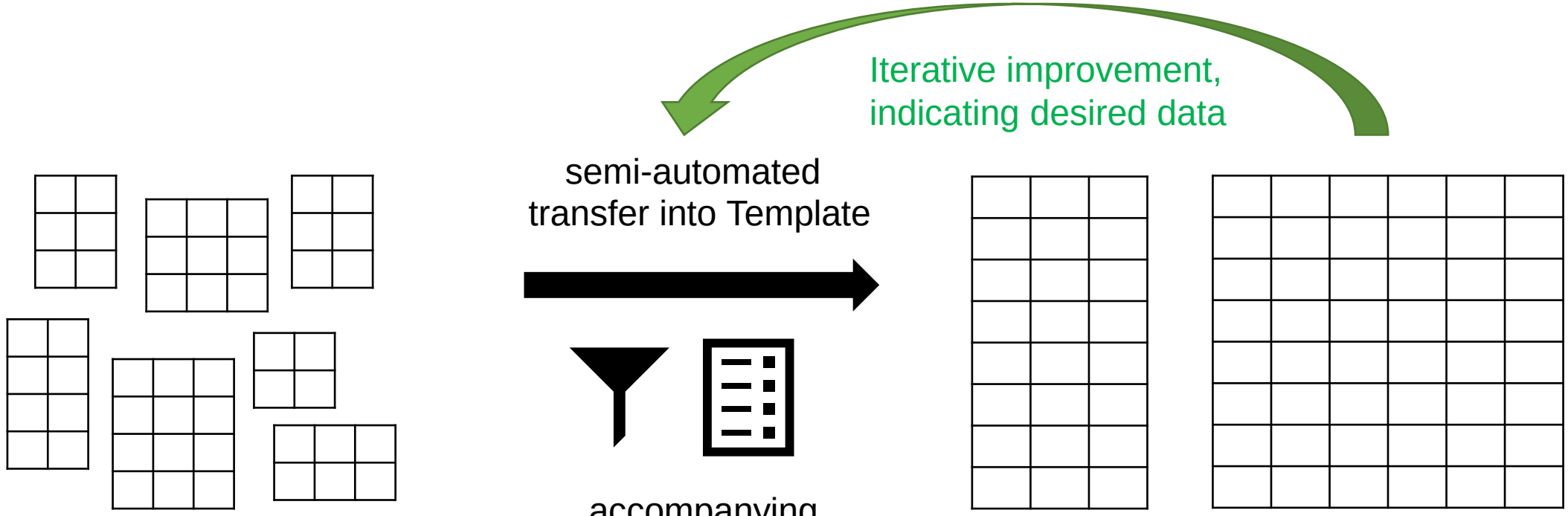
Data collection support



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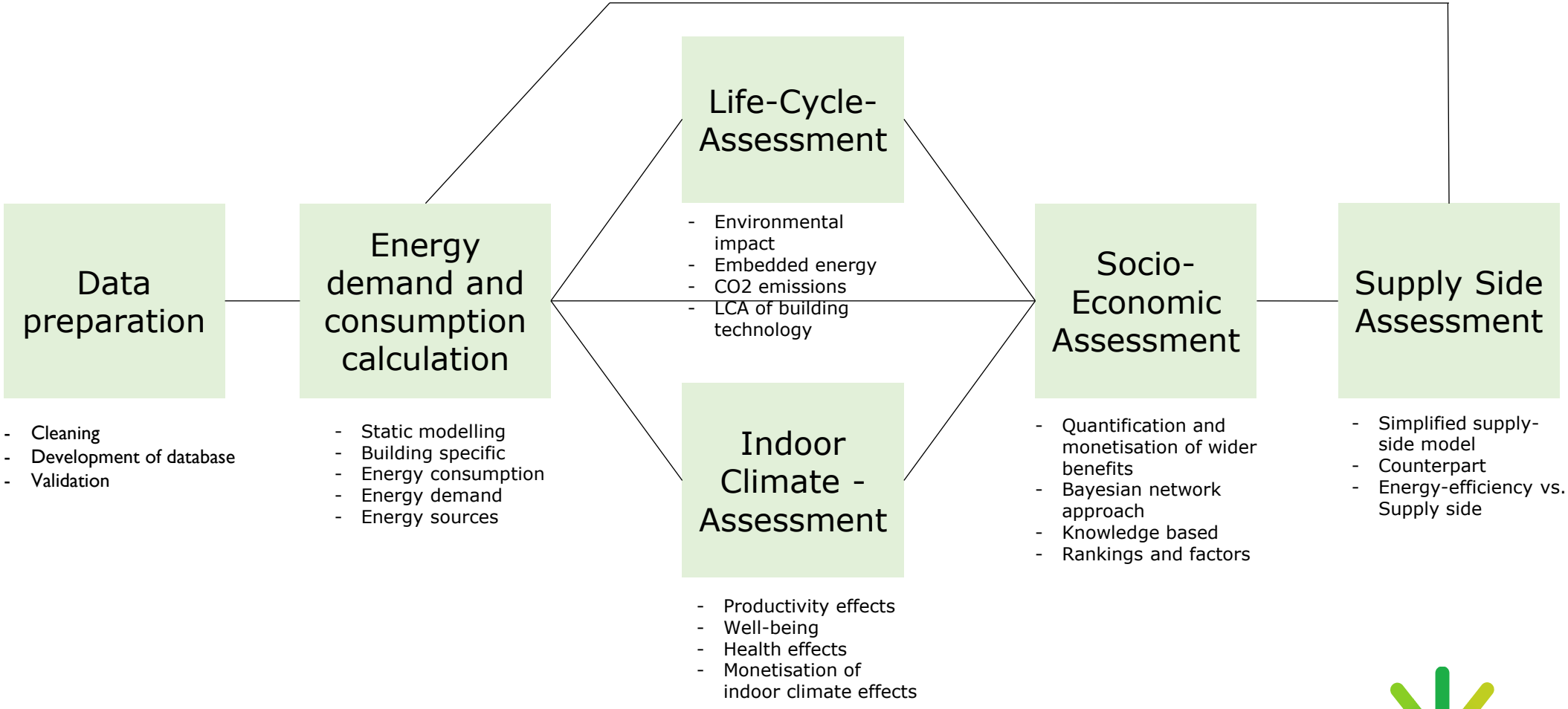
What do we assess?



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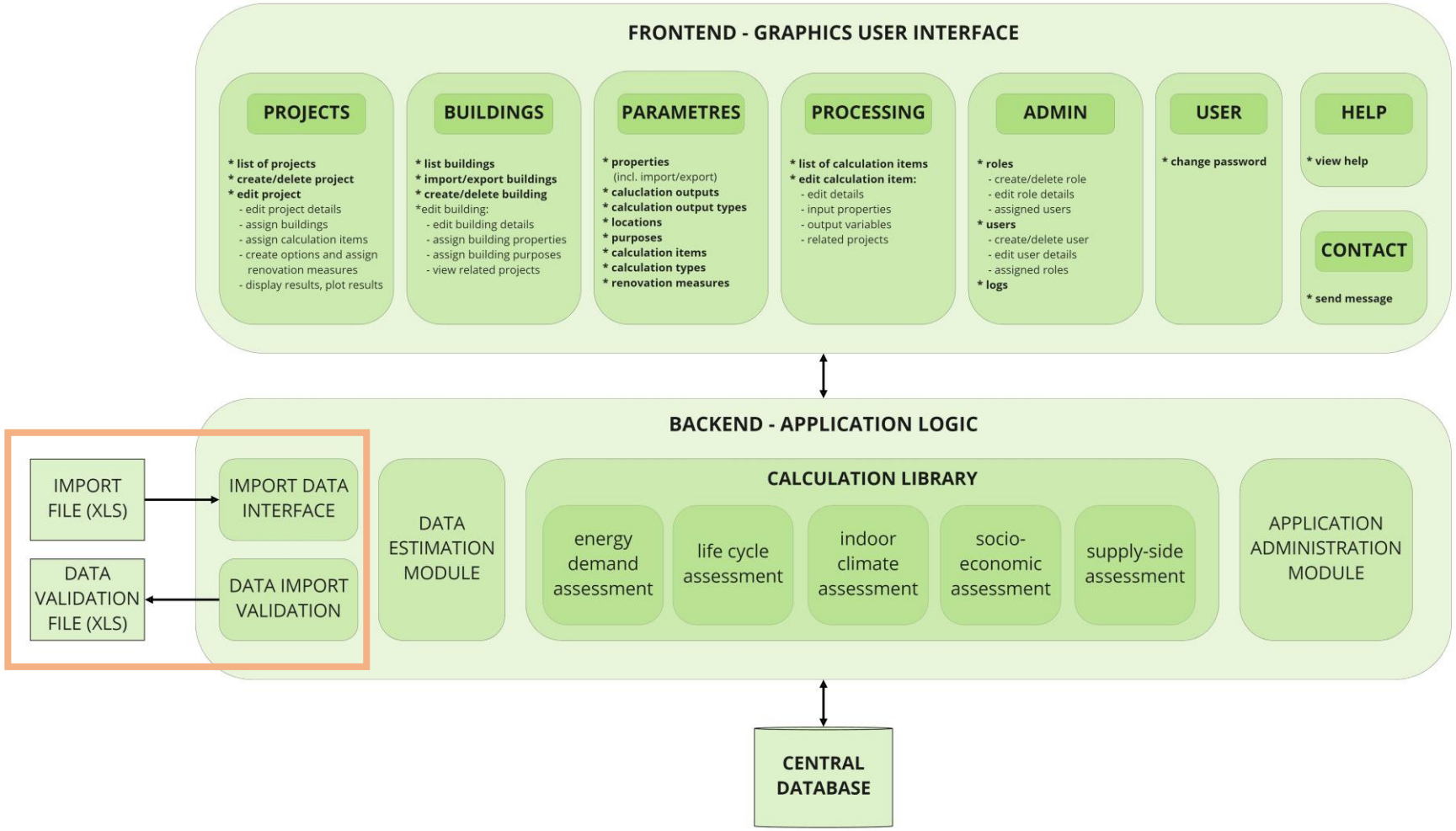
Tool architecture



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Case Study – Renovation case

Status quo

- Location: Velenje, Savinja, Slovenia
- Building use: School
- Year of Construction: 1970
- Relatively good energy performance
- Location of Building: Urban
- Net Building Area: 6.510 m²
- Number of floors: 5
- Heating: District heating, non-renewable

Weather / Climate:

- Lowest Outer Temperature: -16 °C
- Average Outer Temperature: 7.9 °C
- Set Indoor Temperature: 20°C

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Case Study – Renovation case

Renovation measures

Envelope

Add insulation to roof	U-Value: 0,2 W/m²K, Material: XPS
Add insulation to exterior walls	U-Value: 0,19 W/m²K, Material: XPS
Exchange windows	U-Value: 0,8 W/m²K . g-Value: 0,4
Add External shading devices	Blinds between panes, Shading factor: 0,15

Building Technology

Add ventilation and air conditioning system	Quality class 2, fan efficiency increased
Upgrade heating system	Biomass (10% share of non-renewable energy to harvest biomass)
Upgrade water heating system	Biomass (10% share of non-renewable energy to harvest biomass)
Upgrade lighting system	LED + Lighting Controls for all areas

Estimated specific investment Cost / m²	-40.80 €
Estimated total investment Cost	-236,395.20 €

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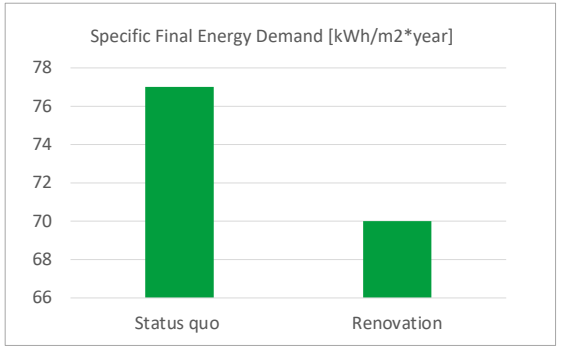
Results: Energy Demand Module

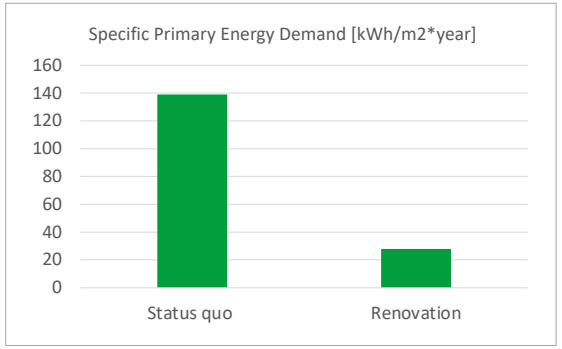
Final Energy Demand (kWh/m²*year)



Data tables

Final Energy demand	kWh/m²*year	kWh/year
Status quo	77	501,270
Renovation	70	455,700

Primary Energy Demand (kWh/m²*year)



Data tables

Primary Energy demand	kWh/m²*year	kWh/year
Status quo	139	904,890
Renovation	28	182,280

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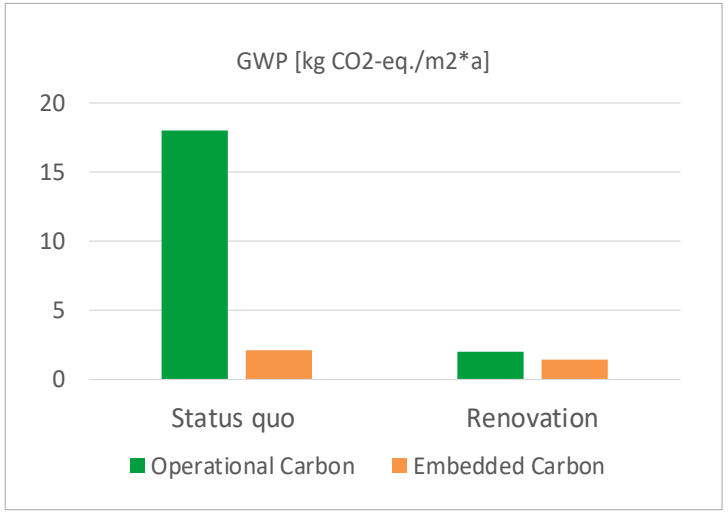
Results – LCA benefits

CO_2 Emissions (kg CO_2-eq./m^2*year)



Data tables

	Kg CO_2-eq./m^2*year	
Emissions	Operational	Embedded
Status quo	18	2
Renovation	2.1	1.4

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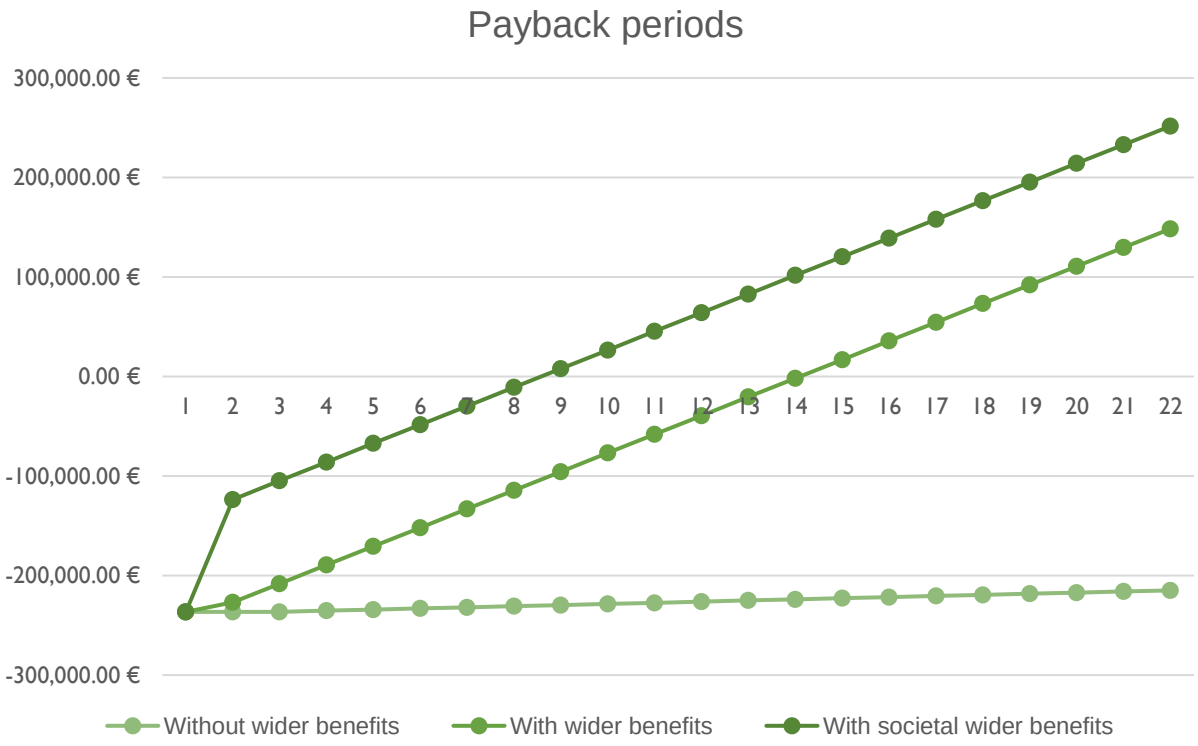
Results – Monetary benefits



Including energy price development, emission cost and discount rates per country

Without benefits

- Energy cost reduction

With wider benefits

- Reduction of sick-days
- Tax returns (income and trade tax)
- Reduction of CO2 emission cost (tax, ETS, social)

With societal benefits

- Increase of performance
- Job creation
- Reduction of unemployment expenditure
- Reduction of fuel poverty

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Thank you

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