



Design Your City's Net Zero Strategy: Online Planning Lab

NetZeroCities online course for all cities

September 16th- December 11th 2025





7.11.2025

Module 4 Spotlight Session 4

Data-driven Approaches to Energy Transition in Buildings and Districts

Innovative technologies enhancing urban climate resilience

“Without data, you're just another person with an opinion”

W. Edwards Deming





Icebreaker questions

(1) What's one "smart" feature you wish every building had?

(2) If you could name your city's first fully AI-powered building, what would you call it?





MODULE 1	Core The NetZeroCities program, service offering, systemic approach, what works for Mission Cities	Spotlight 1 NetZeroCities Orientation	Spotlight 2 Shaping Climate Narratives	Spotlight 3 Climate City Contracts		
MODULE 2	Core Developing a transition team, mapping and activating the ecosystem	Spotlight 1 Transition team & climate leadership	Spotlight 2 Engaging the private sector	Spotlight 3 Citizen engagement for systemic climate action		
MODULE 3	Core Developing the city's action plan for climate neutrality	Spotlight 1 Reporting and MEL	Spotlight 2 Co-Designing a Climate Portfolio	Spotlight 3 Using NetZeroPlanner to Support Climate Planning, MEL, and Implementation Management to Achieve Net Zero Goals		
MODULE 4	Core Levers of change: Technical solutions, social innovation and multi-actor collaborations	Spotlight 1 Passive solutions to reduce energy demand in buildings	Spotlight 2 Systemic energy transition at buildings, districts and city level	Spotlight 3 Data-driven approaches to energy transition in buildings and districts	Spotlight 4 Mobility: Behavioural change and digital solutions	Spotlight 5 Scope 3 and other emission domains
MODULE 5	Core Increase finance knowledge of the public administration & learn about options to finance projects	Spotlight 1 Preparing a pipeline of projects for external financing	Spotlight 2 Different investor groups and the key priorities and returns profiles for each and instruments	Spotlight 3 Financing the ambition: Learning from Mission Cities		
MODULE 6	Core Multilevel governance, national platforms and policy strategies	Spotlight 1 Policy and regulations innovation	Spotlight 2 Public procurement – national specificities	Spotlight 3 Just transition		

NetZeroCity Learning programme





Housekeeping



Stay muted unless you are invited to speak.



Raise your hand before speaking.



Stay engaged: We invite you to keep your camera on.



Use the chat for questions and to introduce yourself.



Change your Zoom name to include your city.





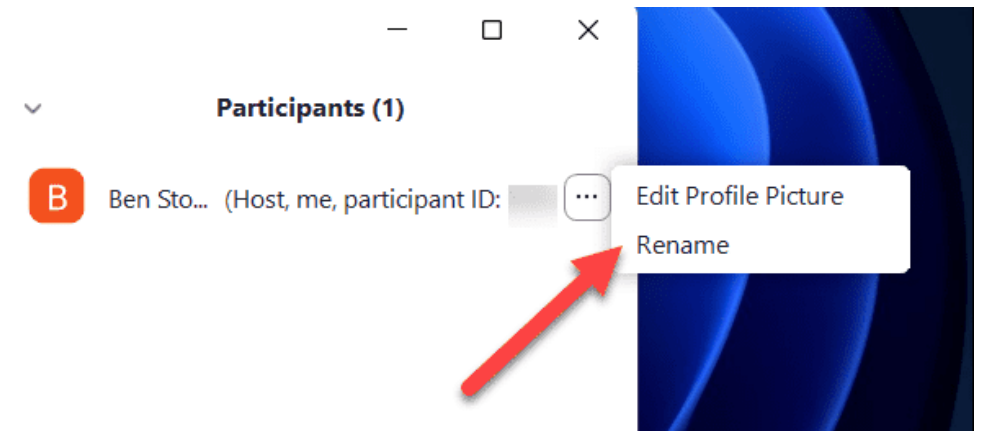
Activate Closed Captions to keep up with the speakers.






Renaming

- In the meeting controls toolbar, click on **Participants**. 
- Hover your mouse over your name, then click **More** or the **ellipsis icon**. ()
- Click **Rename**. A pop-up box will appear.
- In the pop-up box, enter your display name.
- Click **Change**.

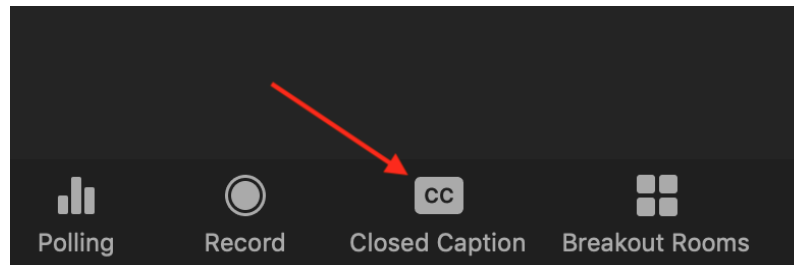




Activating Closed Captions

- In the meeting controls toolbar, click the **Show captions** icon. ()
- Captions will automatically appear above the meeting controls toolbar.

***Caption language:** Please do not change the spoken language of the meeting, as captions will change for everyone.





Participation

This course is intended for all EU (and Horizon affiliated countries) cities that do not yet have (or aim to improve) a climate Action Plan for the city

- It's open to any municipality as well as to consultants, experts, regional authorities, etc.
- The course guides cities into developing a climate action plan | No funding available for participating cities
- This course is NOT for students
- After each session, facilitators remain online for Q&A

26 online sessions
of which 6 are core
sessions

Tuesday 9.15-11.00 and
Thursday 13.15-15.00

Participation is **free**





Certification

Free

Municipalities that **attend all 6 core sessions** will obtain a certificate of attendance for the city issued by the NetZeroCities project

30€

Participants who **attend all 6 core sessions can obtain** a certificate of attendance issued by **Universidad Politecnica de Madrid**



Online ceremony on December 11th 2025

In-person ceremony at the City Conference in Turin May 2026





Recordings and activities

- All participants who sign up for the program receive an email **after each module with the video recording** of the sessions and additional useful information.
- Before joining each session, you will be requested to agree with the course privacy policy, provide **permission for recording** and details of your municipality or profile to be able to issue the attendance certificates.
- The program is structured into **six modules**, each offering 4-6 hands-on sessions led by expert practitioners and cities. Each session will have an interactive component, in which you can share your questions and experiences.

Q: Can you participate in single sessions?

A: Yes! If you sign up for the course, you will receive communications and links to all the sessions. All sessions are held on Zoom (online). All participants who sign up for the program receive an email after each module with the video recording of the session and additional useful information.

Q: What is the level of English proficiency required?

A: Participants can ask questions in their own (European) language in the chat.

DISCLAIMER: Before joining each session, you will be requested to agree with the course privacy policy, provide **permission for recording** and details of your municipality or profile to be able to issue the attendance certificates.





Sign-up and Portal Group

What should you do now?

There is **no deadline** for applying to the course. All sessions are held on Zoom, and you can join the Zoom meeting through the link provided in this email or in the course program page on the NetZeroCities portal.

1. **[SIGN UP NOW](#)** for Zoom sessions and **ADD** them to your **CALENDAR**
2. Read carefully the [online pages for each session](#) and register in advance for each of the sessions on the Zoom platform.
3. Join the dedicated group for this course to interact with other participants: [Design Your City's Net Zero Strategy: Online Planning Lab](#)





Session Agenda

1. Energy transition: Built environment in focus, why data matters & Impact
2. Data enablers (EU Regulatory Frameworks & Tools)
3. Foundations of data and AI for Energy Aware Built Environment
4. Examples of data-driven energy applications
 - One smart building in Espoo, Finland
5. Data Challenges and how to overcome them
 - Tools, interoperability and partnership
 - PPP Service Model, **Caverion – City of Helsinki** case
 - The collaborative governance tool for climate neutral cities, **SuperUrbanity, Bergamo**
6. Sharing data development experience – cities speak
 - Energy Map Leipzig: a decision-making tool for the energy transition, **City of Leipzig**
 - Helsinki Energy and Climate Atlas, **City of Helsinki**
 - The Intelligent Energy Management System (IEMS) Profit, **City of Rivne**
 - NEEST multi-city Pilot towards turning residential and service buildings into nearly zero-emission buildings, **City of Krakow**
7. Future outlook and Emerging trends
8. Q&A





Speakers



Julia Schließauf
City of Leipzig



Konrad Szpak
Municipality of Krakow



Enni Airaksinen MSc (Civ.Eng)
City of Helsinki



Andrii Hrytsevych
NGO "Net Zero Ukraine"





Speakers



Rodolfo Pinto

CEO Superurbanity



Aleksi Vuorenmaa

Caverion Suomi Oy



Julia Kantorovitch, PhD

VTT, Technical Research Center of Finland, Built Environment and Mobility





Why this session



2050

- **80%** of the buildings today will exist in 2050
- **6 billion** people will be living in cities in 2050
- **ZERO** GHG emissions targeted by 2050

2025

- Buildings are responsible for approximately **40%** of global **energy-related greenhouse gas (GHG) emissions**

Data based solutions can help to achieve **low carbon** and at the same time **quality living**

Why Better Buildings Data Matters?

- **“It is a capital mistake to theorize before one has data.”**
— *Sir Arthur Conan Doyle (Sherlock Holmes)*





Examples and Impact

Alkmaar, Netherlands



AI can predict energy demand patterns, integrate renewable technology and adjust operations dynamically

- Population ~ 112.896
- 940 solar panels installed at the "De Meent" sport complex generating 300,000 kWh of green electricity annually, reduced gas consumption
- Deployed electricity storage 362 kWh
- Deployed energy flexibility solutions in the Sport complex
- Reducing 120 tons of CO2 annually.

Roses, Spain



- Population ~20.362
- Real-time data platform to monitor energy generation and consumption
- 3,000 photovoltaic panels installed on 30 municipal buildings, generating 2.4 GWh annually
- Project saves 30% electricity in public buildings incl. schools and sports centers, avoiding 600 tons of CO₂ emissions yearly.

Lahti, Finland

Population ~ 121.622



Liked by Ivstennis and others

lahdentennisjasquashkeskus ☀️ Aurinkovoimaa Kispi-areenalle! ☀️

Kispi-areenan katolle asennettiin lokakuun alussa paikallisen Lemkem Oy:n toimesta uusi 40 kWp aurinkovoimala 😊

Voimalan vuosituotannon arvioidaan olevan noin 38 MWh, mikä vähentää hiilidioksidipäästöjä jopa 4,6 tonnia vuodessa! 🌍💚

Kesäkaudella aurinkovoimala tuottaa lähes kaiken hallin tarvitseman sähkön – ja aurinkoisimpina päivinä sähköä jää jopa myytäväksi eteenpäin ⚡





Energy and Costs saving with AI analytics

Case study: Poland

- 3 floors office building, wide range of sensors: energy consumption, indoor conditions, weather, HVAC sensors, smart thermostats to adjust heating and cooling -> **optimize overall energy efficiency**

Key results (Rojek et al. 2025, <https://www.mdpi.com/1996-1073/18/7/1706>)

- **Energy savings:**
 - 29.7% reduction in electricity consumption due to AI-based HVAC optimization;
 - 23.4% reduction in lighting energy consumption due to presence-based intelligent lighting;
 - Overall energy savings of 20.9–33.8% depending on various factors
- **Cost optimization (simulation):**
 - Annual reduction in electricity costs of 18–35%, depending on building size and occupancy patterns;
 - Predictive maintenance reduced unexpected equipment failures by 40%, lowering repair costs.
 - **Estimated return** on investment (ROI) achieved within 2.7 years due to lower utility bills.
- Various studies report, depend on the technology, smart building investments can **realize returns** through cost savings and efficiencies
 - **AI-driven energy optimization** can have a payback period as short as **6 to 18 months**,
 - Other features like **predictive maintenance** have longer paybacks **as 18 to 36 month**

Examples and Impact

ENERGY TIMES

November 4, 2025

FUELING THE FUTURE: HOW DATA POWERES CITIES

Insights from industry leaders & innovators

SMART GRIDS



Real-time monitoring and predictive maintenance

- Demand response optimization
 - Bi-directional power flows
- GE Vernova
Renewable Energy World

BUILDING ANALYTICS



Improving energy efficiency

- Identifying cost-saving opportunities
 - Enhancing occupant comfort
- Smart Cities Dive
Buildings

Powering Progress

"Data is the new oil."
— Clive Humby

"Data is a precious thing and will last longer than the systems themselves."
— Tim Berners-Lee

AI-DRIVEN INFRASTRUCTURE



Digital twins for grid simulation
Edge computing for real-time decisions

- AI optimizing energy distribution
- IEA NRI

DATA GOVERNANCE & INNOVATION



Federated data governance

- Reusable data products
- Transparency and trust in energy systems.

"Without data, you are just another person with an opinion"
W. Edwards Deming

"Data is the new soil—cultivate it wisely to grow a sustainable future"
— W. Edwards Deming





Examples and Impact



Smart buildings act as nodes in a larger city energy network
aggregated data can enable:

- **Grid optimization** (e.g., demand-response programs), **infrastructure planning**, **policy making**

Co-benefits

Improve Comfort, Safety, Happiness

- Smart sensors, data-/AI & intelligent controls can adjust indoor environments (temperature, air quality, lighting) for **occupant comfort**
 - Studies show that **improving thermal comfort** can lead to 3–7% **productivity gains** in office settings [1](#)
- Analysis combining **IMD Smart City Index** and **Happy City Index** shows a positive correlation between smart city rankings and happiness rankings (though tech alone does not guarantee happiness) [2](#)
- Top Happy Cities 2025 (Copenhagen, Zurich, Singapore) also rank high in smart city performance, suggesting **synergy between digital innovation and well-being** [3](#)

Economic and Social Impact

- Investing in digital infrastructure improves city **reputation** and **attract investment**, tech-driven **businesses** and **talent**, examples from Barcelona, Stockholm, Amsterdam [4](#).



EU data enabling initiatives EPBD

European Union's Energy Performance of Buildings Directive (EPBD)





EPBD in nutshell

Energy Performance of Buildings Directive (EPBD)

Data & digitisation in EPBD recast

RENOVATION

- Minimum Energy Performance Standards
- National trajectories for the progressive renovation of the residential building stock
- National Building Renovation Plans

ENABLING FRAMEWORK

- Strengthened Energy Performance Certificates
- Renovation passports
- Sustainable finance & energy poverty
- One-stop-shops
- Deep renovation standard
- National energy performance databases



DECARBONISATION

- Introduction of zero-emission buildings as standard for new buildings
- Solar deployment in buildings
- Calculation of whole life cycle carbon
- Phasing out incentives for fossil fuels and new legal basis for national bans

MODERNISATION & SYSTEM INTEGRATION



- Infrastructure for sustainable mobility
- Smart Readiness Indicator
- Indoor air quality: ventilation and other technical building systems
- Digitisation, data access and exchange





Relevant EU Regulatory Frameworks (EPBD)

Energy Performance of Buildings Directive (EPBD)

2002 Directive (EU) 2002/91/EC 	2018 Directive (EU) 2018/844 
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- **2002: Energy performance certificates (EPCs)** are first introduced as a tool to promote transparency and information regarding the energy performance of a building (under Article 7 in the EPBD)
- **2010:** EPBD recast covers **EPCs** (Article 11) and mandates additional requirements related to **renovation measures** + cover how EPCs can be used, displayed, etc. (articles 12-20)
- **2018: Building renovation passports (BRPs)** are **mentioned** for the first time as an example of an optional scheme under the long-term renovation strategy (Article 2a).

• **Smart Readiness Indicators (SRI) Framework defined in 2020**

2024 Directive (EU) 2024/1275

- **2024 EPBD recast: tighten provisions for EPCs**
 - Introduces **a framework for renovation passports as an additional voluntary tool** to provide a clear roadmap for staged deep renovations (Article 12).
 - Member States **must implement BRP** schemes by **29 May 2026**
- **SRI will become mandatory** for large non-residential buildings (>290 kW heating systems) **from July 2027**



- **2025: EPBD Article 22 - Implementing Act** – Common templates for transfer national building information to EU **Building Stock Observatory (BSO)**. Annual transfer, **first time by March 2027**





EU Building Stock Observatory

So far, a building data repository

Established in 2016 and announced in Clean Energy for All Europeans Package

Updated in 2019

Revisited and revamped in 2023 with support of DIGIT and CINEA BSO contract

...strengthened by EPBD

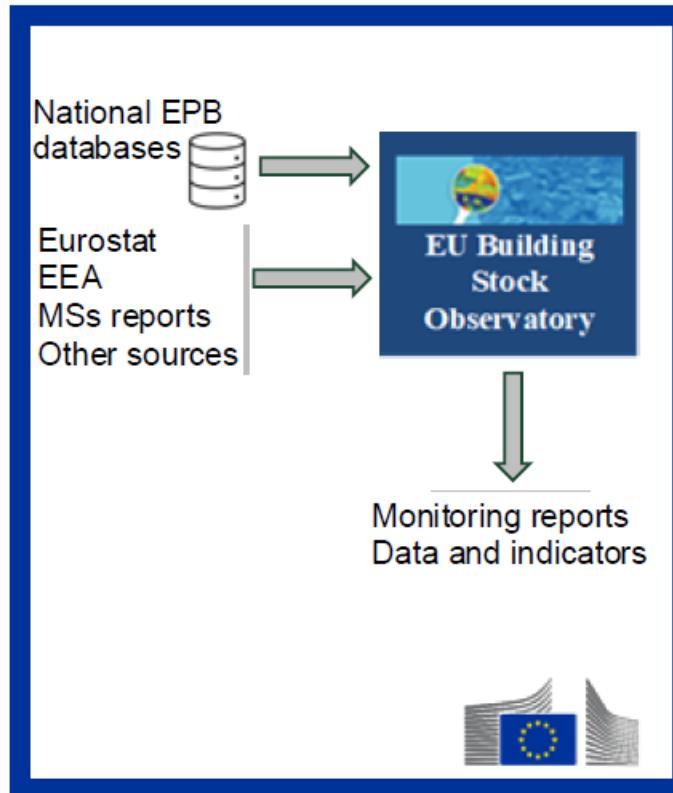
Article 22(5):

“At least once per year, Member States shall ensure the transfer of the information in the national database to the EU Building Stock Observatory.”

Article 3(9):

“The Commission shall monitor annually the evolution of the energy performance of the Union building stock [...] and publish the information through the EU Building Stock Observatory.”

...soon emerging into an EU data hub for policy monitoring



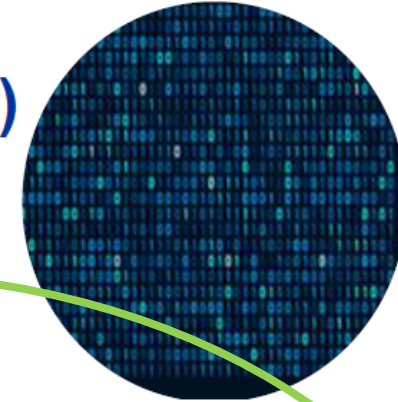


What, When and How

Implementing Act - common templates for the transfer to the EU BSO (Article 22, EPBD)

Article 22: Member States “shall set up a national database for the energy performance of buildings”.

Article 22(6): The Commission shall adopt implementing acts to establish common templates, the first by 30 June 2025.



How to transfer the information:

- (At least) **once a year: first time by 15 March 2027**
- **Aggregated data at national level, GDPR proofed,**
- Several degrees of importance: **mandatory, mandatory if available, mandatory if appropriate or voluntary**
- **Commission to develop a platform for transfer of information** (i.e. on the e-platform currently used for NECPs)

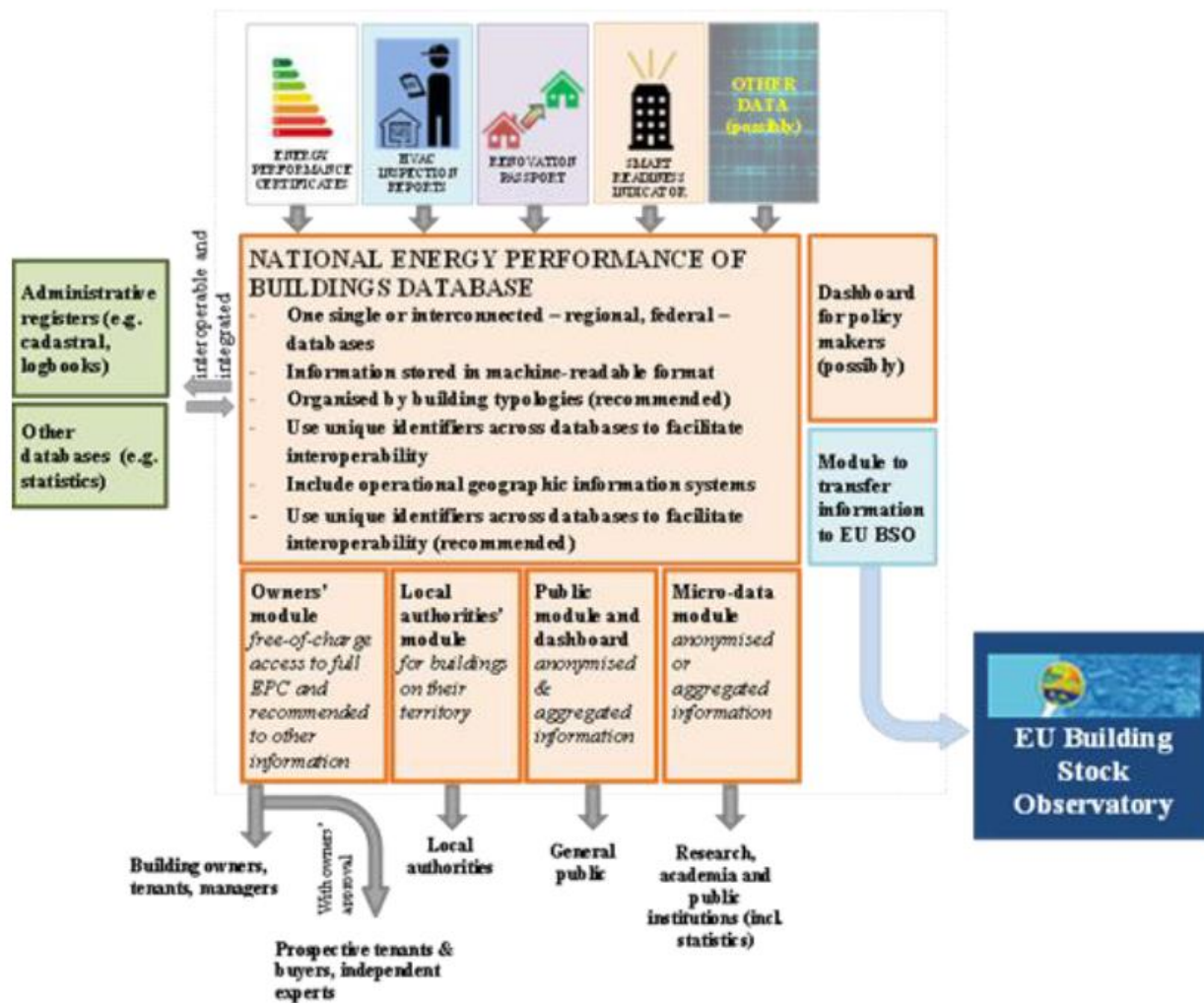
What information to transfer:

- **General building stock data** (buildings/building units/floor area)
- **Number of EPCs, compulsory EPC data as in Annex V EPBD** and few necessary accompanying data (by type of buildings and energy classes)
- **Number of HVAC inspections, following Art 23, 24** (by type of main fuel used, power ranges and residential/non-residential)
- **Number of renovation passports**, and some additional information as indicated in Annex VIII
- Where relevant: **number of SRIs**, value of indicator and by main type of key functionalities





Article 22



Example from the Guidance document on energy performance of buildings databases

Article 22: Energy performance of buildings databases

Provide better management and use of information from EPBD instruments and integration with other relevant repositories

Allow for quantitative assessments and estimates of impacts of policies and measures on buildings

Benefits: once setup, will ease significantly the administrative burden and will contribute to the improvement of policy making process





Putting all together - Going Digital

Data Enablers / Tools

- **EPC - Energy Performance Certificates** - provides snapshot of a building's energy performance incl. rating A to G.
- **BRP – Building Renovation Passport** – outlines staged renovation plans (timeline, cost estimates, expected energy savings, environment impact)
- **Building Digital Logbook(s)** - centralized repository for building data, supports integration of EPC and BRP, ensure interoperability

Example Workflow

- **EPC Issued** → Building gets an energy rating and performance report.
- **BRP Created** → Uses EPC data as a Baseline to generate a tailored renovation roadmap.
- **Simulation Tools** → Model energy savings and cost-effectiveness of different renovation actions.
- **Digital Logbook** → Stores both EPC and BRP for future reference and updates.
- **Renovation Progress** → BRP updated as actions are implemented; EPC reissued if needed.

Intelligence

 **SRI – Smart Readiness (Building) Indicator** – measures **building's smartness** i.e., ability to interact with grid, adapt to occupants' needs, enables energy efficiency through energy flexibility and other smart energy analytics





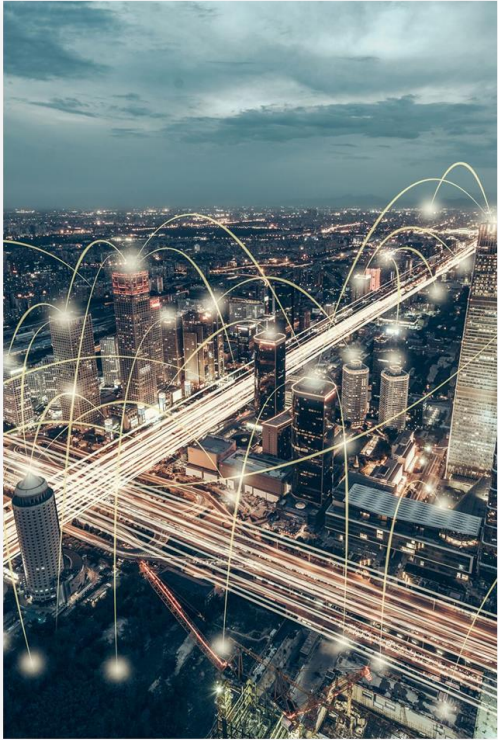
Data - AI - Intelligence

“Data is a precious thing and will last longer than the systems themselves.”
— *Tim Berners-Lee*





Making building smart: data, AI and Digital Twin



complexity ↓

Key Data types examples

- **Energy** data (energy consumption and production, energy price, RES generation)
- **Weather** data (temperature, solar radiation)
- Building indoor conditions, **air quality**, temperature, humidity
- Building **occupancy** and comfort levels
- Building and equipment data (**HVAC** performance data, **building envelope** characteristics)
- Other data (building designs, retrofit information)

AI algorithms rely on data

- Predictions for planning and scheduling.
- Detect anomalies & inefficiencies

AI applications

- Adjusts HVAC to real-time occupancy and reduce energy use accordingly

Digital Twin and how it is different from BIM

- BIM – Building Information Modelling – a collaborative process, **static** digital 3D models of building (building specifications, material properties, costs, etc.)
- A Digital Twin - a **dynamic** virtual model that represents physical building (or its systems) integrating **real-time data** (sometimes simulated) and **analytics**.





AI techniques in nutshell – connecting research and practice



✓ 1. Supervised Learning

What it is: Algorithms learn from labeled historical/training data

- **Energy Demand Prediction:** Predict future energy consumption based on weather, occupancy, and past usage.
- **Fault Detection:** Classify whether equipment is operating normally or inefficiently.
- Usually better accuracy

✓ 2. Unsupervised Learning

What it is: Finds patterns in unlabeled data (no predefined outputs).

- **Anomaly Detection:** Identify unusual energy consumption patterns that may indicate faults.
- **Clustering:** Group similar usage profiles to optimize building schedules.
- Detecting that one floor uses significantly more energy than others without prior labels.

✓ 3. Reinforcement Learning (RL)

What it is: An agent learns by interacting with the environment, receiving rewards for good actions

- **Dynamic HVAC Control:** RL adjusts temperature setpoints to minimize energy while maintaining comfort.
- **Energy Demand Response Optimization:** Learns when to shift loads to reduce costs and emissions..





One smart building.. in Espoo... Finland

“If you want truly to understand something, try to change it”
— *Kurt Lewin*





Example: Future Hub premises in Otaniemi

Heavily sensed LivingLab with fast electricity measurements and HVAC flexibility

Energy and power:

data of district heating, cooling, electricity, PV, EV charging, batteries, main HVAC devices, lifts, demand response etc.

HVAC system measurements:

e.g. air condition system, heat pumps, radiator & floor heating, cooling, domestic hot water and water system related process values.

Indoor Air Quality:

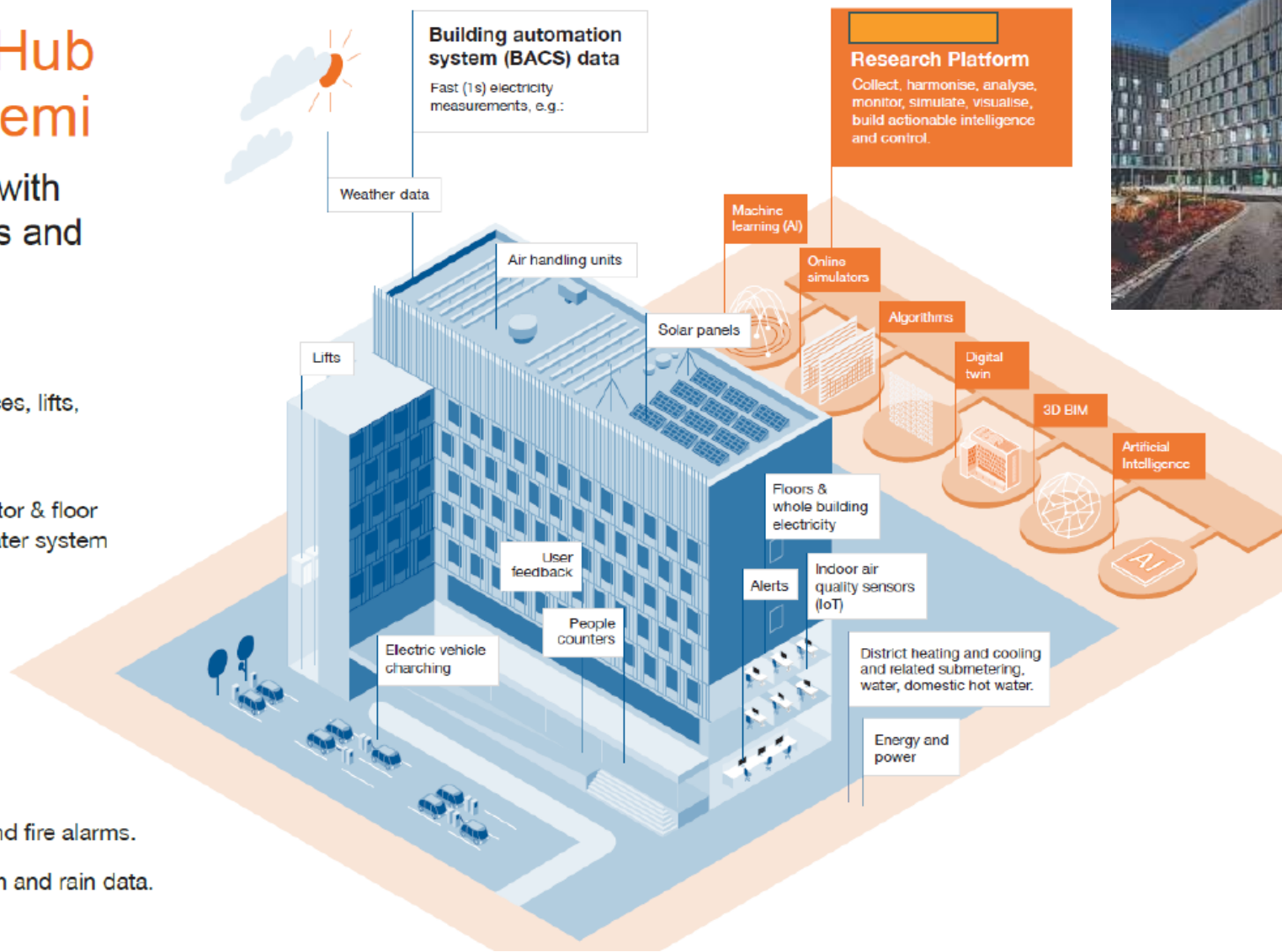
Room air temperatures, CO2, relative humidity, TVOCs, particles, lighting levels, presence, sound level, setpoint values etc.

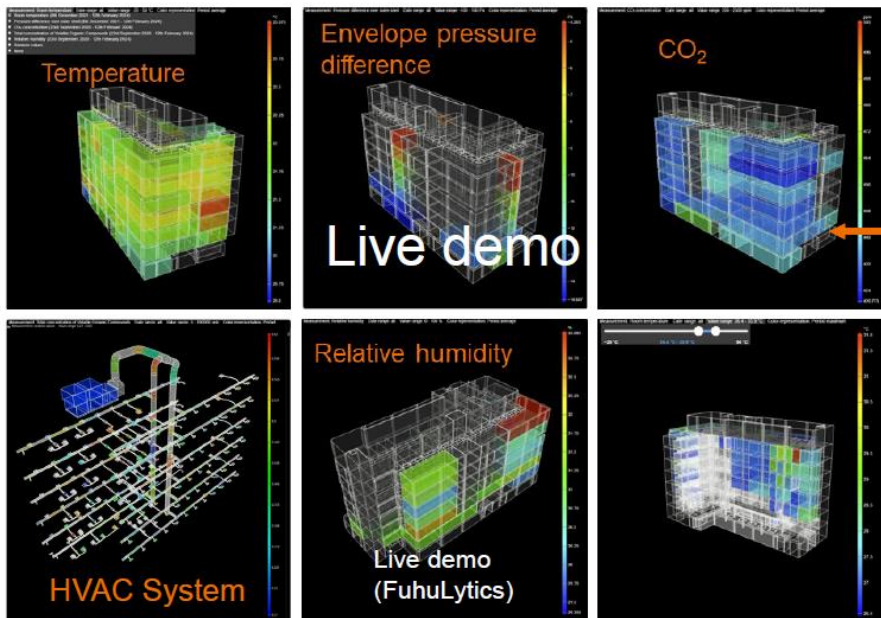
People counters

Alerts:

e.g. heat recovery freezing, water leakage and fire alarms.

Local weather data including solar radiation and rain data.

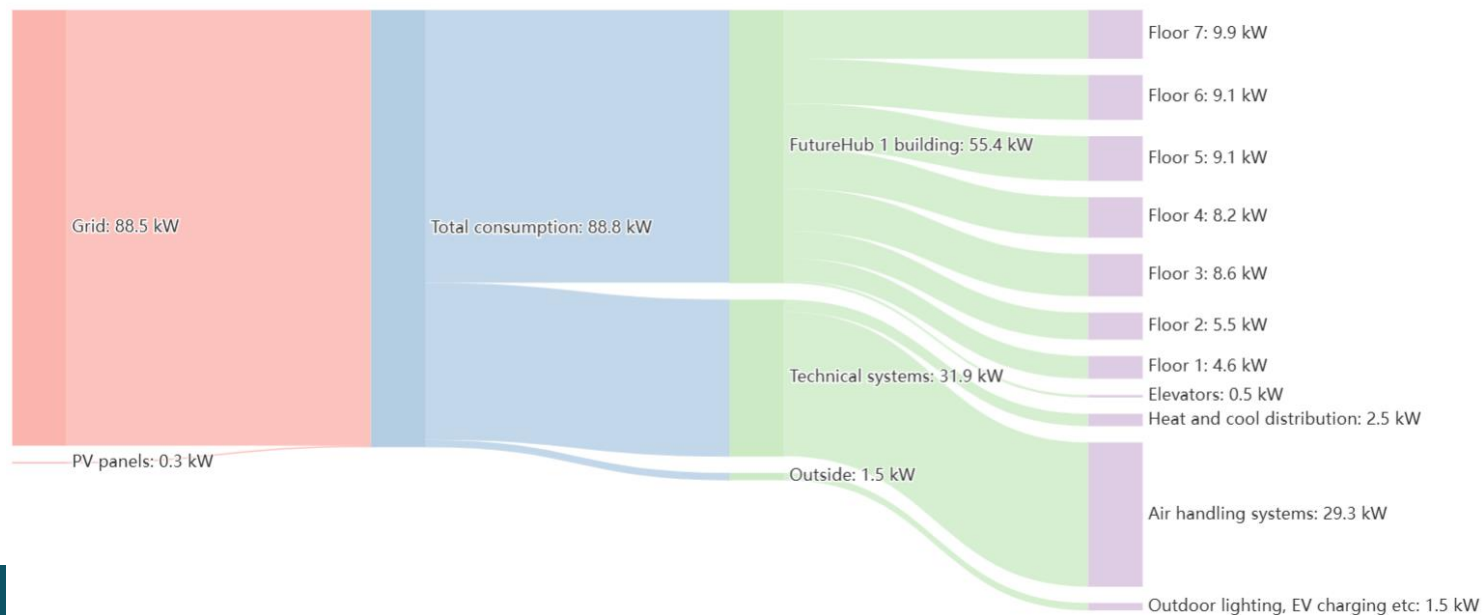




Selected applications

Building Digital Twin

3D BIM based digital twin for monitoring and visual analysing energy, HVAC, IAQ & AI analyzed data



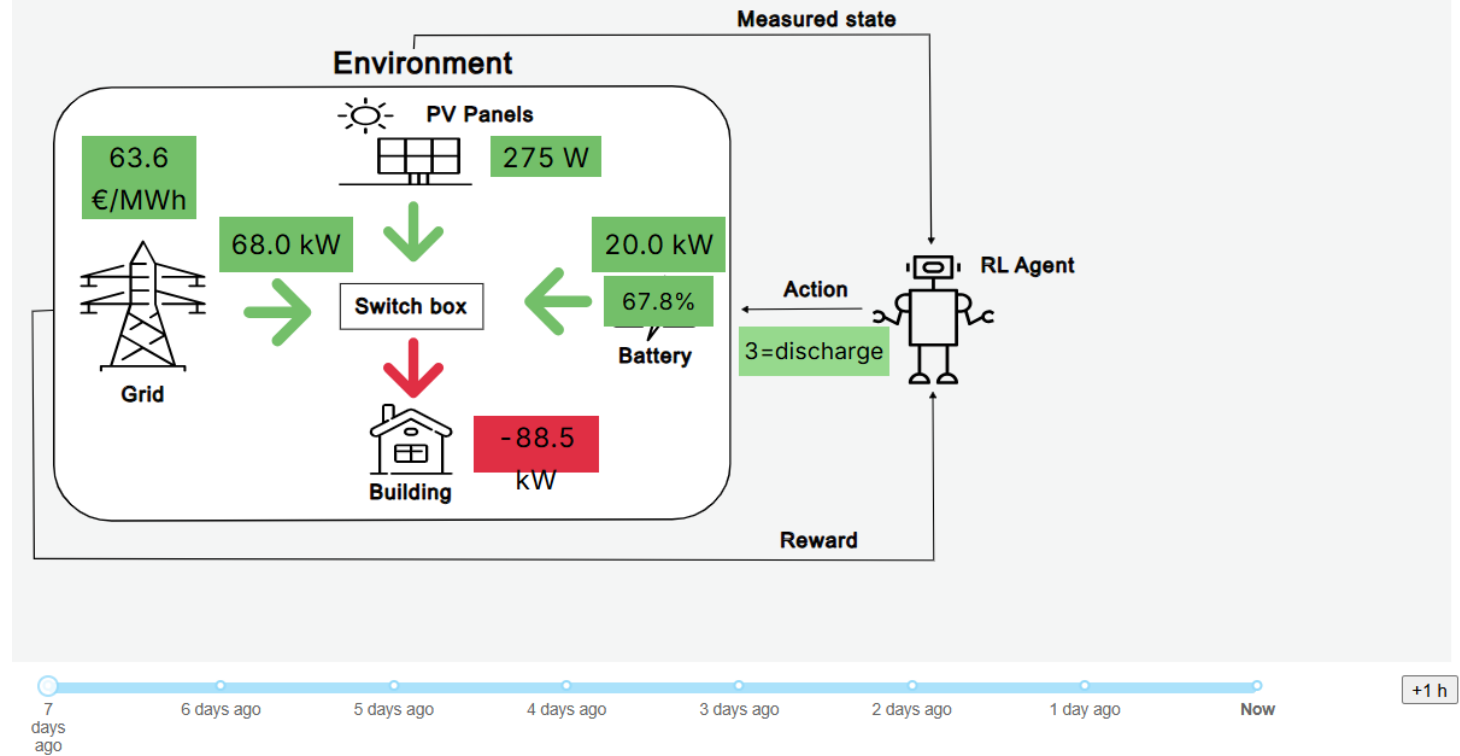


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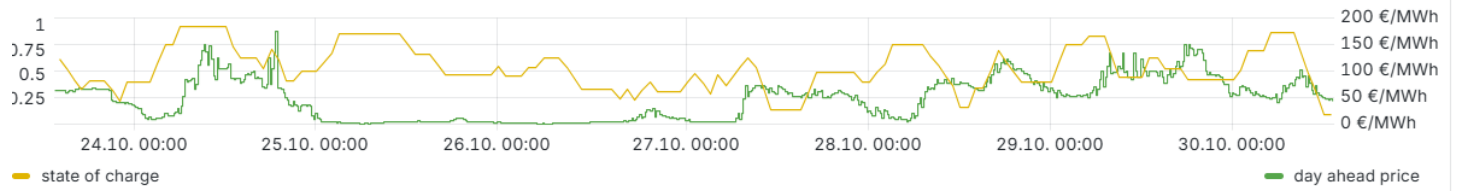
Selected application

Integration with Renewables

Self-learning AI minimizes a building's electricity bill with the help of electricity storage



elec Price & Battery State of Charge





Selected application

Energy Renovation decision support

AI supported building renovation decision planning

■ Finding most potential energy retrofitting scenarios for the building

- Example new ground source heat pump, new windows, etc.
- -> Achieved energy savings, energy & investment costs, payback time, carbon footprint

■ AI learns not known building digital twin parameters by energy and weather data

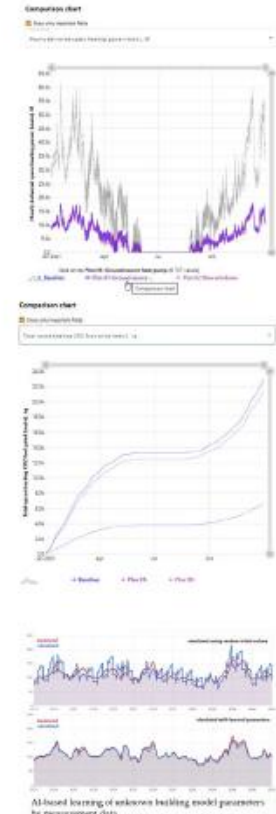
- e.g. external wall U-values, building heat capacity, air tightness n50, heat recovery efficiency

Unit type: Abs. Norm. (per floor-m²)

Gross Floor Area: 170 m²

OPTIONS		Space heating and hot water	Appliance electricity	Space cooling	Carbon footprint	Energy cost	Investment	Payback time	
		kWh/a	kWh/a	kWh/a	tCO ₂ /a	€/a	€	a(year)	
⋮	Baseline	Before	16,486.25	7,057.81	518.26	6.07	4,204.78		
⋮	Plan 1: New ground source heat pump	After	16,259.88	7,057.81	547.95	1.61	1,754.97	17,875.50	7.3
		Savings	226.37	0	-29.69	4.47	2,449.81		
⋮	Plan 2: Replace windows	After	15,594.73	7,057.81	313.47	5.79	4,014.77	5,657.50	29.8
		Savings	891.52	0	204.78	0.28	190.01		
⋮	Plan 3: New ground source heat pump & replace windows	After	15,362.21	7,057.81	339.31	1.56	1,696.3	23,533.00	9.4
		Savings	1,124.04	0	178.95	4.51	2,508.48		

More info: Piira et al., <https://www.mdpi.com/1996-1073/15/15/5408>



Effective data governance is essential to maximize AI benefits

There are challenges..

System Interoperability

- **Technical:** Integrating building legacy systems with **new data** technologies requires interoperability for scalable and efficient urban energy solutions
- **Governance:** Sharing building data among building stakeholders requires **trust**, clear **data policies** and sound **business cases**

But also, solutions

Collaborative Partnerships

Fostering **public-private partnerships** facilitates trust, data sharing, innovation- and resource sharing for climate transition.

Technical Capacity Building

Investing in **staff training** strengthens city teams' ability to implement and manage advanced data-/AI projects.

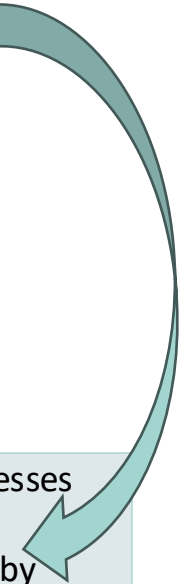
H2020 RESPONSE PED development project with Turku and Dijon

An effective data governance in cities is challenging due to the **complexity of the ecosystem** i.e., actors, their interests and powers

- Government, academia, industry, citizens with **diverging interests and roles**
- The **relationships** between different actors are becoming increasingly **complex**. e.g. citizens are not simply using city services, but data producer and consumers
- **Public sector** does not have a leading **control over** data or the data tools; it is frequently **dominated by private sector**

Municipality of Dijon solution – several governance processes setup:

- Municipality enforced their role in data management by **internalizing knowledge** on the regulation of territorial data, driving **legal analysis**, and **forming a governance committee** to manage data applications, reviewing access right and IPRs
- Ensure a **fair access to data** to citizens and other stakeholders, while guaranteeing law, regulation, and intellectual property of data producers.
- **Facilitates** the creation of streams of data, using city's right by law to **access data from energy providers** with more recent and precise data and **negotiated access to this data**





Data governance in NetZeroCities



Policy & Partnerships

Forging alliances to scale and speed up the impact of the Cities Mission EU

https://linktr.ee/nzc_theme6



MISSION CITIES' POLICY BRIEF BUILT ENVIRONMENT POLICY LAB

This policy brief presents recommendations for EU decision-makers and European national authorities on built environment formulated by cities participating in the EU Cities Mission (Mission Cities). NetZeroCities held its 5th thematic Policy Lab at the EU level on Built Environment, in person and in the context of the Cities Mission Conference in Valencia on 25 June 2024.

NetZeroCities is a consortium consisting of 34 partners from 27 European countries, managing the Mission Platform for the EU Cities Mission "100 Climate-Neutral and Smart Cities by 2030".

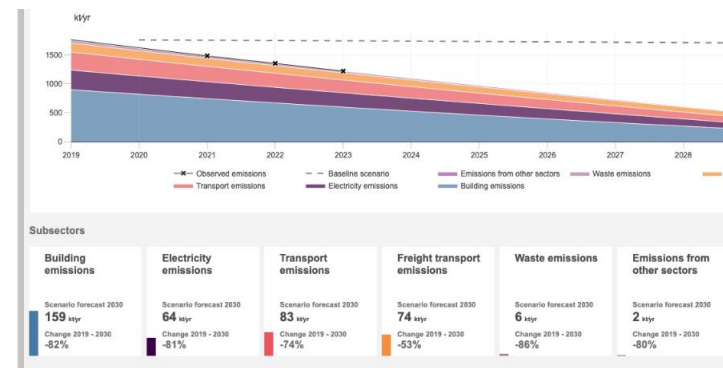
Stakeholder Consultation Panel (SCP) #2 Report on Urban Data Governance Panel

This document summarises discussions from the two dialogues organised by NetZeroCities with the support of Living-in-EU and the Smart Cities Marketplace. One dialogue took place online and the second in-person with pan-European actors from business, research and civil society reflecting on challenges and opportunities for the EU to support the transition to climate neutrality in cities via policies, directives and funding.

NetZeroCities is a consortium consisting of 34 partners from 27 European countries, managing the Mission Platform for the EU Cities Mission "100 Climate-Neutral and Smart Cities by 2030". The Cities Mission involves local authorities, citizens, businesses, investors

Data Tools for Climate Action Planning

<https://netzerocities.app/resource-4876>



- NZPlanner (Free Tool)
- ClimateView
- Superurbanity
- Kausal Platform





Public Private Partnership

Caverion – City of Helsinki Case: PPP Service Model for Sustainable Cities





PPP Service Model for Sustainable Cities: Caverion – City of Helsinki Case

Aleksi Vuorenmaa

Development Engineer, Caverion Suomi Oy

www.linkedin.com/in/aleksi-vuorenmaa





1. Public-Private Partnerships in nutshell – Lifecycle Model
2. Leveraging Data Across the Entire Building Life-Cycle
3. Why should cities consider lifecycle agreements?
4. Caverion-Helsinki PPP case
5. Caverion-Helsinki PPP case – Lessons learned





Public-Private Partnerships in nutshell – Lifecycle Model (design-build-finance-maintain)

- Contractual structure where design, construction, and maintenance of a building are procured as one integrated package
 - Lifecycle provider (private partner) assumes extended and comprehensive responsibility beyond the traditional warranty period
- Client (public entity) is only responsible for a monthly service fee

Key features

- Broad responsibility:
 - Planning, design and construction
 - Maintenance, operation, and upkeep
 - Energy consumption (water, heating, electricity)
 - Renovation and handover condition at the end of the contract
- Duration: 10-30 years
- Financing: Client, external or lifecycle provider
- Additional services: May include user services and bonus/penalty mechanisms





Leveraging Data Across the Entire Building Life-Cycle

- Lifecycle model is a very data-driven operating model, as the provider wants to ensure that the building meets the client's specified KPIs throughout its entire lifecycle
 - Energy efficiency, indoor climate, functionality, maintenance, environmental footprint, handover condition
- By integrating data from design, construction, operation, and maintenance, buildings are transformed into continuously optimized assets

Key Data Leverage Points

1. Construction phase
 - BIM models for accurate design and installation
 - Material and equipment data for future maintenance planning
2. Operation & Maintenance
 - IoT sensors and BMS for real-time monitoring (Caverion Remote Services¹)
 - Predictive analytics for proactive maintenance and energy optimization
 - Digital building management platforms for real-time visibility and control over building performance (Caverion SmartView²)
3. Renovation & upgrade
 - Historical performance data to guide retrofit decisions and further energy efficiency measures
 - Cost and energy impact simulations
4. End-of-Life / Demolition
 - Material traceability for recycling and circular economy
 - Data-driven decommission planning

¹ <https://www.caverion.com/catalog/services/remote-services/>

² <https://www.caverion.com/catalog/services/data-visualisation-by-caverion-smartview/>





Why should a city consider a lifecycle agreement?

1

Building users are guaranteed the same, **excellent conditions** for the entire lifecycle

2

Sustainability: shared responsibility and emphasis on a long lifecycle

3

Enhanced **risk management** and reduced total cost of ownership (up to 30 %³)

4

Smooth **transfer** from project to maintenance phase

5

One partner throughout the entire lifecycle enables **service model** development and true, long-term collaboration

6

You can focus on your **core competence** and leave the responsibility of your building to specialists

7

Ensures long-term “Best for the building” decisions and enables the use of **best technology and innovations** available

8

As building owner, you know the **full costs upfront** both in the investment and throughout the maintenance period

³ <https://www.caverion.com/smart-city/construction-project/>



Caverion-Helsinki PPP case Helsinki Vocational College - Myllypuro Campus

Project Overview

- **Client:** City of Helsinki
- **Partners:** Caverion & Fira
- **Model:** PPP using lifecycle model (20 yrs)
- **Scope:**
 - Design & Build (Fira)
 - Technical solutions & Maintenance (Caverion)
- **Investment:** ~€46M total (Construction + 20 year service period)
 - Property & cleaning services, calculated energy costs and long-term renovation planning
- **Completion:** Summer 2023
- **Profile:** Designed as a next-generation learning environment as part of Helsinki's "smart construction hub" alongside a University of applied sciences

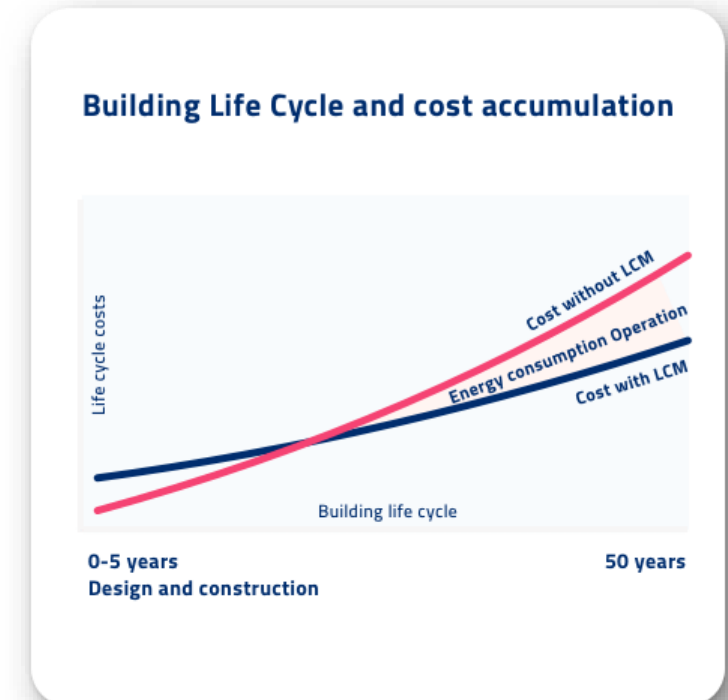
Finland's first vocational college





Caverion-Helsinki PPP case – Lessons learned Myllypuro Kampus

1. Build bridges early
 - Design phase collaboration between all parties to ensure alignment and smooth transition through all stages
2. Define measurable outcomes
 - Energy targets, comfort standards, response times...
3. Think and implement in the long run
 - Invest in durable and efficient systems upfront
4. Digital tools are non-negotiable
 - Platforms like Caverion SmartView enable real-time monitoring and predictive maintenance
 - Builds trust with public stakeholders
5. Talk, Talk, Talk
 - Gather feedback, discuss challenges, share information
 - Effective communication ensures satisfactory outcome for all related stakeholders







City of Bergamo

The collaborative governance tool for climate neutral cities

hello@superurbanity.com

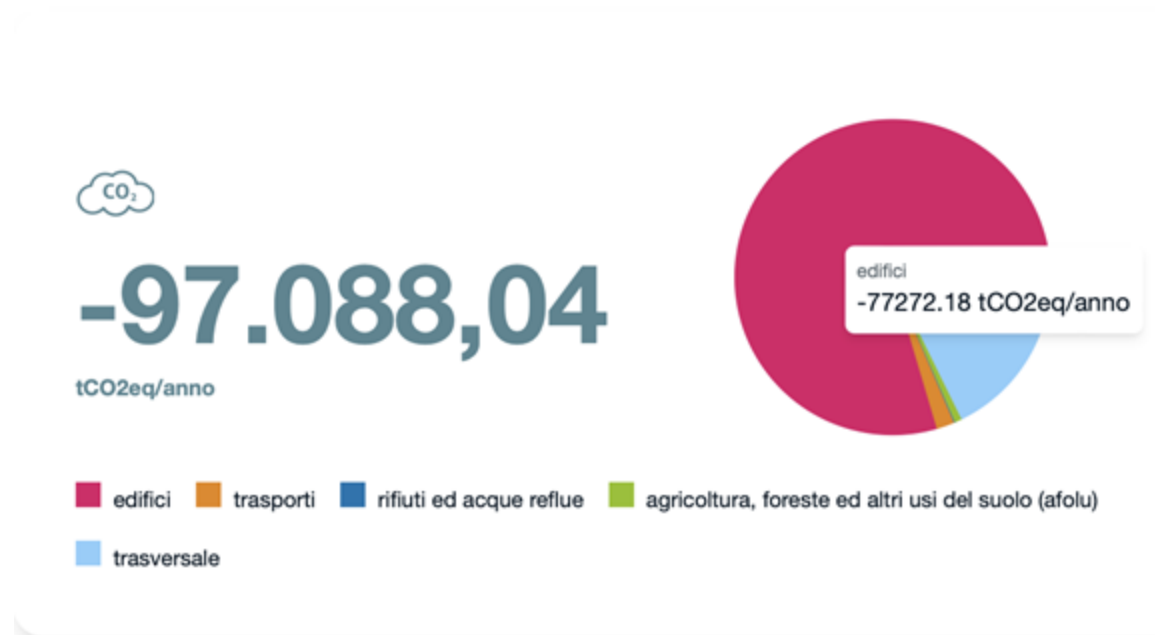




Buildings efficiency is part of the process towards carbon neutrality

Public and Private Buildings are responsible for **70%+** of Co2 Emissions

Meaning that investing in energy efficiency, old buildings renewal and responsible consumption behaviors is a **key goal for climate strategy** and neutrality.





Key goals and priorities

Key goals and priorities are:

- **Measure and understand to act effectively.**
ForImpact.AI helps cities collect and analyze key data — from energy use to emissions — turning information into actionable insights. This enables administrations to target interventions, track progress, and guide decisions toward Net Zero goals.
- **Engage private stakeholders to boost collective impact.**
The Climate City Contract thrives on collaboration. ForImpact.AI creates a shared governance framework where public and private actors align projects, KPIs, and investments, increasing synergy, efficiency, and shared responsibility.
- **Translate data into meaning for citizens.**
Through AI-driven storytelling, ForImpact.AI turns complex metrics into tangible stories — showing real-life benefits in energy savings, well-being, and sustainability, and fostering a sense of collective participation.





AI Analytics

- **Algorithms for Renewable Energy Communities (RECs):**
Machine learning models to forecast and optimize **energy sharing, self-consumption ratios, and emission savings** within RECs, enabling impact measurement in terms of CO₂ reduction
- **Algorithms for Building Energy Efficiency:**
AI-based analytics to **forecast consumption**, quantifying potential **CO₂ reductions and economic returns**.
- **Generative AI for Co-benefits Extraction:**
Natural-language and generative models process unstructured data (reports, surveys, open datasets) to **identify and quantify co-benefits** such as air-quality improvements, health impacts, and social cohesion indicators.
- **AI for Stakeholder Management and Governance:**
Network analysis and recommendation algorithms map and cluster stakeholders, **predict collaboration dynamics**, and support **data-driven engagement strategies** across institutions, citizens, and private actors.



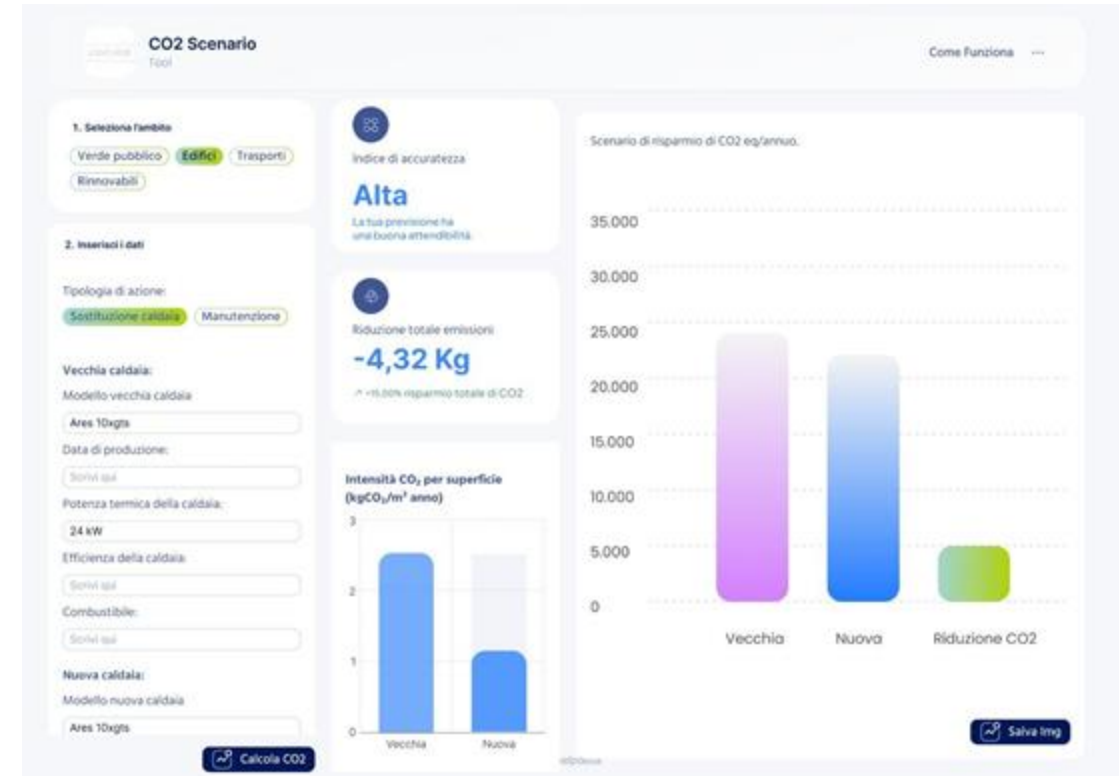


Co2 scenario and prediction

Forimpact AI helps measuring through indicators, taxonomy and interactive graphs the status quo but it also implements AI Algorithms to forecast Co2 reduction.

Conversion factors are included for:

- Methane
- Electricity
- District Heating
- LPG
- Diesel for Heating
- Diesel Fuel for Transport
- Gasoline
- Gasoline for Transport
- Biomass
- Biofuels





Data used

All the data, KPI's and Taxonomy from Net Zero Cities

is included into the forimpact AI framework.

Data can be collected in three ways:

1. Dynamic fulfillment by stakeholders and municipality's offices
2. AI extraction from technical documents
3. API's and Sensors when available





RECs Register

A powerful way to build energy-efficient districts and fight energy poverty is through **Renewable Energy Communities (RECs)**.

ForImpact.AI enables the City of Bergamo to **monitor, register, and assess** all active RECs — tracking their **benefits, CO₂ reductions, and collective impact**, while promoting **replicable models that inspire citizens** to take part in the transition.

The screenshot shows the 'Registro CACER' section of the website. At the top, there is a navigation bar with links for 'Climate city contract', 'Impegni', 'Azioni', 'Registro CACER' (highlighted), 'Open Call', 'Ecosystem', 'SDG', 'Glossario', and 'Area Riservata'. Below the navigation bar, a banner states: 'Il Climate City Contract è aperto a enti, organizzazioni e aziende che hanno a cuore lo sviluppo sostenibile del territorio: [unisciti a noi!](#)'. The main heading is 'CACER - Energy Communities'. Underneath, there is a section for 'Contatti referente configurazione' listing 'Mario Rossi' with contact details: 'mario.rossi@email.com' and '+035 123 345 56'. Below this is a 'Contatta il Referente' button. A section titled 'Allegati scaricabili della CER' lists documents: 'Atto Costitutivo', 'Statuto', 'Regolamento', 'Business Plan', and 'Dichiarazione Sostitutiva di atto di Notorietà'. On the right side, there is a map titled 'CACER - Quartiere di Longuelo' showing the geographical location of the district in Bergamo, with a green pin marking the specific area.





Governance

Building ownership is fragmented between public and private actors, each with different roles and responsibilities.

To align them, **governance and community engagement tools** are essential — enabling shared data entry, common KPIs, and unified taxonomies within a single collaborative framework.

ForImpact.AI automates these governance processes, creating **one simple digital environment** where measurement and management converge, ensuring clarity, accountability, and impact.

The screenshot displays the 'Tutte le azioni' (All actions) interface. On the left, a search bar is followed by a list of actions, each with a title, organization name, and publication date. The first action is 'Riquilificazione sede' by 'CENTRO SERVIZI AZIENDALI COESI SOC. COOP. IMPRESA SOCIALE'. The right panel shows the details for this action, including a description, a photo of solar panels, and sections for 'Organizzazione' and 'Impegni associati'.

Tutte le azioni Proprietario Stato + Nuova azione

Q Cerca azione...

Comune di Bergamo
Pubblicato 7 marzo 2024 12:28

Riquilificazione sede +
CENTRO SERVIZI AZIENDALI COESI SOC. COOP. IMPRESA SOCIALE
Pubblicato 7 marzo 2024 12:28

Progetto Skift +
CENTRO SERVIZI AZIENDALI COESI SOC. COOP. IMPRESA SOCIALE
Pubblicato 7 marzo 2024 12:28

Smartworking aziendale +
CENTRO SERVIZI AZIENDALI COESI SOC. COOP. IMPRESA SOCIALE
Pubblicato 7 marzo 2024 12:28

Riquilificazione sede Social 📌

Dettagli

Riquilificazione sede Copertina azione

Descrizione dell'azione
Questa azione di riqualificazione della sede prevede l'installazione di pannelli fotovoltaici (90 kW), sistemi di illuminazione intelligenti e soluzioni domestiche per migliorare l'efficienza energetica dell'edificio. Settore coinvolto: Edifici. Inizio: 2022-01-01, Fine: 2023-01-01. Obiettivo: riduzione delle emissioni di CO2 di 35 tonnellate/anno.

Organizzazione

Organizzazione/Ente
CENTRO SERVIZI AZIENDALI COESI SOC. COOP. IMPRESA SOCIALE

Impegni associati

Titolo impegno	Contratto	Owner

forImpact platform by superUrbanity





Impact & Key benefits

- **A unified digital framework** of data, KPIs, and taxonomies makes communication with stakeholders seamless, transparent, and effective.
- **AI-powered translation** turns complex technical documents into a shared language and structure, aligning everyone around common goals.
- **Smart governance tools** streamline procedures, automate repetitive tasks, and free up time for strategic action.
- **Impact forecasting algorithms** support evidence-based planning and help decision-makers choose the most effective paths.
- **Simple, engaging digital tools** foster collaboration, empower participation, and bring citizens and new stakeholders on board within the Climate City Contract.





Thanks





Cities speak



- City of Leipzig
- City of Helsinki
- City of Rivne
- City of Krakow





City of Leipzig

Energy Map Leipzig: a decision-making tool for the energy transition

Julia Schließauf

julia.schliessauf@leipzig.de

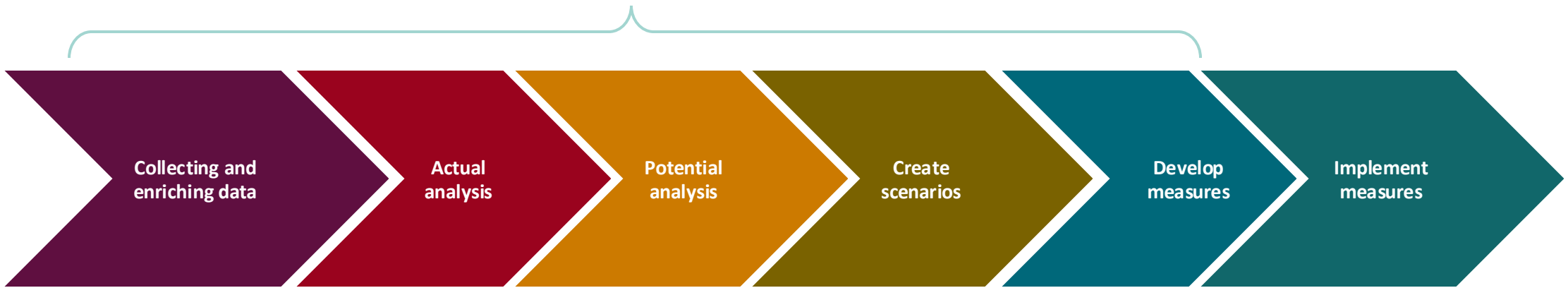




"How does municipal climate protection work?"

Status quo

External service providers



Goal

As a city, we must own and analyse the data ourselves.



This enables us to develop and implement measures more quickly.





Why are we doing this as municipality?



More agile and faster



More independent



Building up knowledge





Vision

The Energy Atlas is intended to provide **transparent** information about how far Leipzig has progressed with the energy transition and what measures are planned in the city. All information is to be presented **in a single view**.



Target

- Leipzig city authorities



Challenge/ requirement

- Clear presentation of areas with renewable energy potential and their current status
- Option for simple data analysis, visualisation and export



Product

- Internal city digital platform with map visualisation for renewable energies
- Analysis and planning tool for identifying and utilising renewable energy potential



Objectives

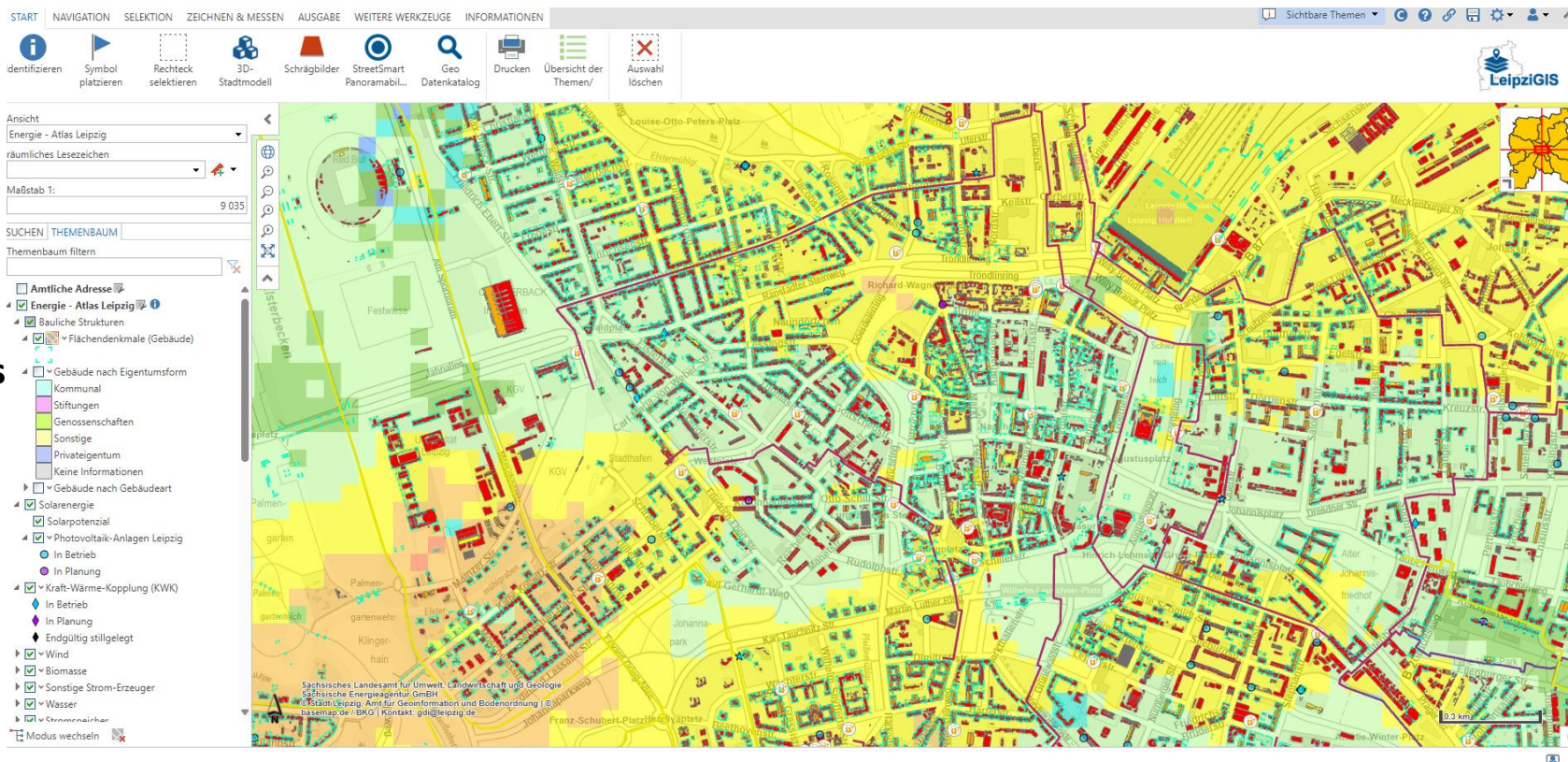
- Tapping into potential areas for promoting renewable energy
- Strengthening dynamic and cross-departmental cooperation





Energy Map: Implementation in LeipziGIS

Internal Tool



Selection of renewable energy producers in existing and planned facilities (photovoltaics, wind, CHP, etc.)

Location and type of electric charging stations

Information on site suitability (photovoltaics, solar thermal, geothermal)

City-specific characteristics (listed buildings)



Energy Map: Implementation in LeipziGIS

Internal Tool

Photovoltaik-Anlagen Leipzig (1 von 2)

mastr_einheit	SEE956930448163
Einheit	WSL Wohnen & Service Leipzig GmbH
Adresse	Ranstädter Steinweg 7
Status	In Betrieb
Energieträger	Solare Strahlungsenergie
Bruttowatt	29.9
Nettowatt	29
Inbetriebnahme	14.06.2012
Registrierung	20.09.2021
Anzahl der Solarmodule	120
Richtung Solarmodul	699
Einspeisung	688
Spannungsebene	Niederspannung (= Hausanschluss/Haushaltsstrom)
Leistung	29.9
Straße	Ranstädter Steinweg
Zusatz	Wohnhaus
PLZ	04109
Nr. Stadtbezirk	0
Stadtbezirk	Mitte
Nr. Ortsteil	04
Ortsteil	Zentrum-West
statistischer Bezirk	042
Block	042011
Blockseite	04201106

Selection of renewable energy producers in existing and planned facilities: (photovoltaics, wind, CHP, etc.)





Energy Map: Implementation in LeipziGIS

Internal Tool

The screenshot shows the LeipziGIS interface with a map of Leipzig. The map displays various energy-related data points, including solar potential, wind, and biomass. A table titled "Standort E-Ladesäulen" (E-Charging Station Location) is overlaid on the right side of the map, providing details for a specific charging station. The table contains the following information:

ID	63791012
Betreiber	Stadwerke Leipzig GmbH
Standort	Lortzingstraße 3, 04105 Leipzig
Längengrad (WGS84)	12.370883999999998
Breitengrad (WGS84)	51.344578
Anzahl der Ladepunkte	2
Art des Ladepunktes	Normalladepunkt
AC Steckdose Typ 2 (1)	AC Steckdose Typ 2
Nennleistung Ladepunkt (1)	22
Art des Ladepunktes (2)	Normalladepunkt
AC Steckdose Typ 2 (2)	AC Steckdose Typ 2
Nennleistung Ladepunkt (2)	22



Location and type of electric charging stations





Energy Map: Implementation in LeipziGIS

Internal Tool

The screenshot shows the LeipziGIS interface with a map of Leipzig. The left sidebar contains navigation and search tools. The main map area displays various data layers. Two data tables are visible at the bottom of the map:

Solardachpotenzial (2 von 2)	
Nettokollektorfläche der Module (m ²)	171
modarea	160
Anzahl der Module	104
Bruttokollektorfläche der Module (m ²)	180
Möglicher Stromertrag (kWh/a)	34492
Mögliche zu installierende kWp-Leistung	33.3
Absoluter Neigungswert in°	0
Absoluter Ausrichtungswert in°	-1
mittlere jährliche Globalstrahlung pro m ² in kWh/m ² *a	1293

Flächendenkmale (Gebäude) (1 von 2)	
ID	1888327
Objekt	09306791
Typ	Kulturdenkmal (Typ 1)
Bezeichnung	Umgestaltungsgebiet Innere Westvorstadt am Dorotheenplatz (Sachgesamtheit)
Kreis	Leipzig, Stadt
Gemeinde	Leipzig, Stadt
Ortsteil	Zentrum-West
Straße	Dorotheenplatz
Hnr.	2; 4
Gemarkung	Leipzig
Flurstück(e)	2247; 2247b; 4896
Zeitschiene	1983-1989 (Mehrfamilienwohnhaus)
weitere Informationen	https://cardomap.idu.de/ffds/details.aspx?baseMapId=-1&themeld=3.1&layerName=L16&id=09306791
Beschreibung	Einzeldenkmal der Sachgesamt Umgestaltungsgebiet Innere Westvorstadt am Dorotheenplatz: Mehrfamilienhaus (siehe Sachgesamtheitsliste - Obj.-Nr. 09306509)



Information on site suitability
(photovoltaics, solar thermal, geothermal)

City-specific characteristics (listed buildings)



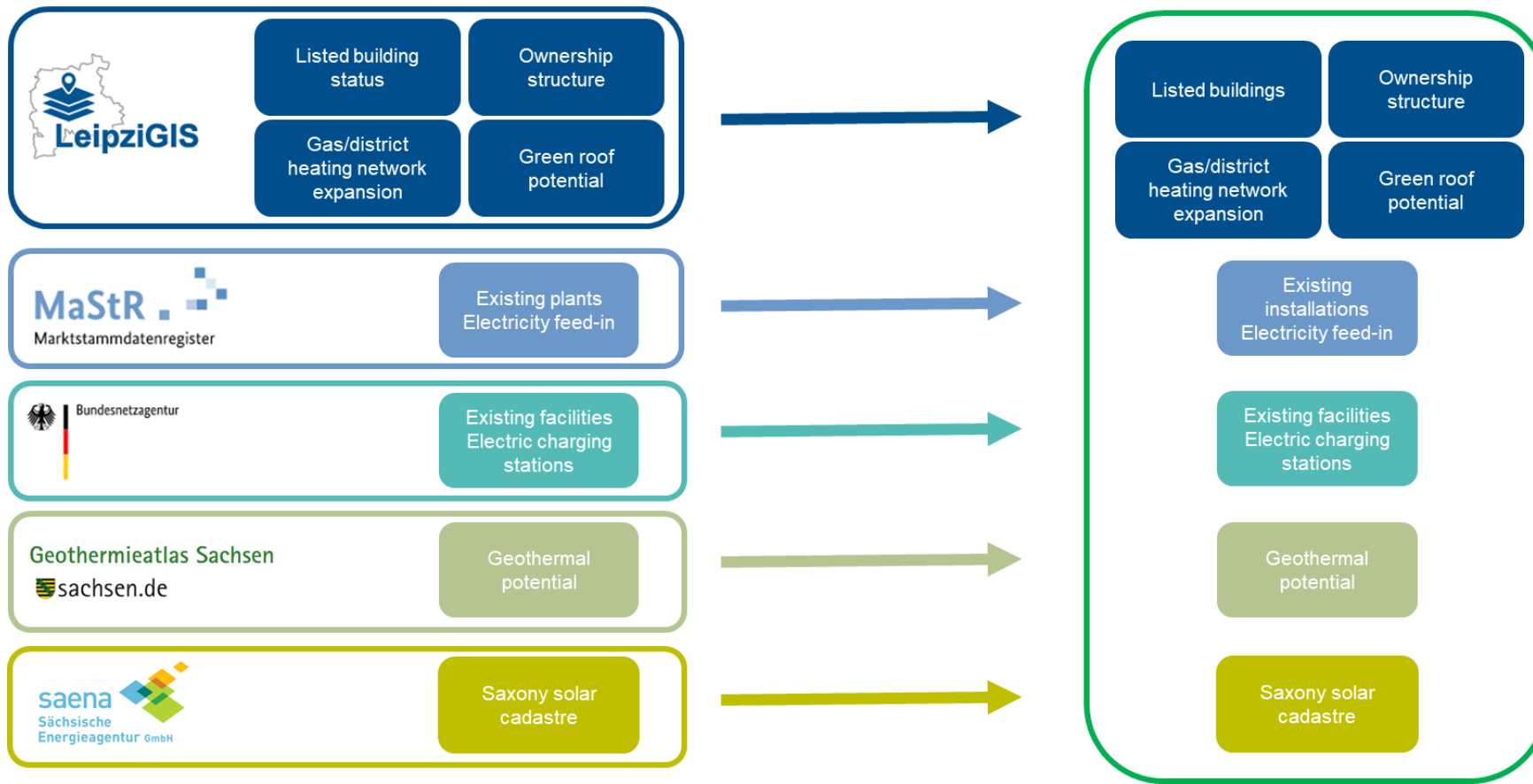


Energy Map: Data

Automatic data interfaces

Many data rooms

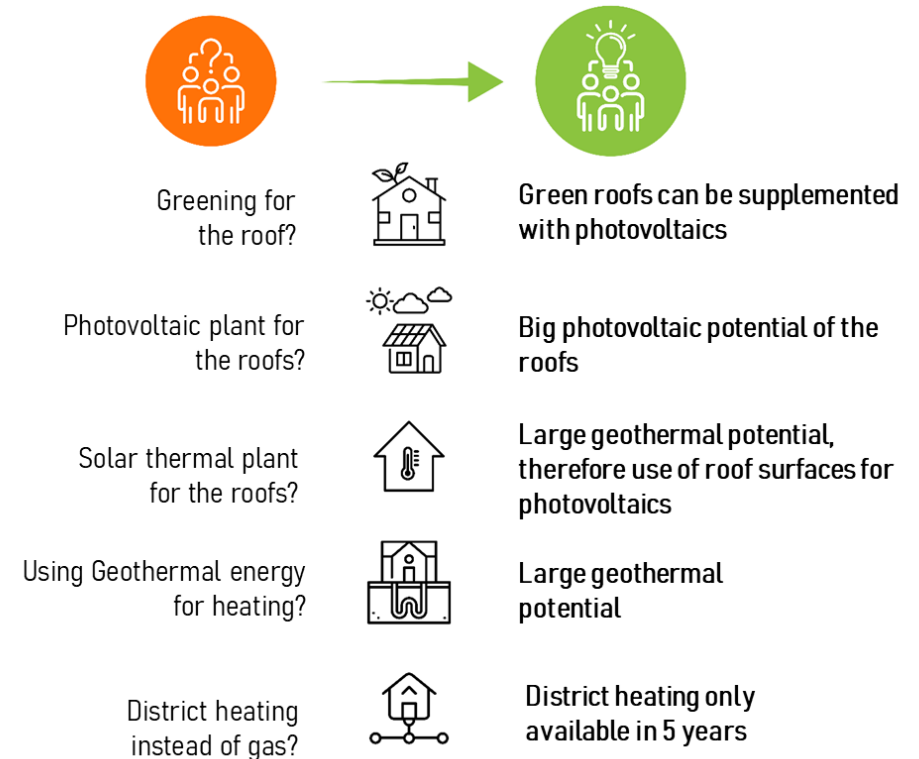
A data room



Energy Map

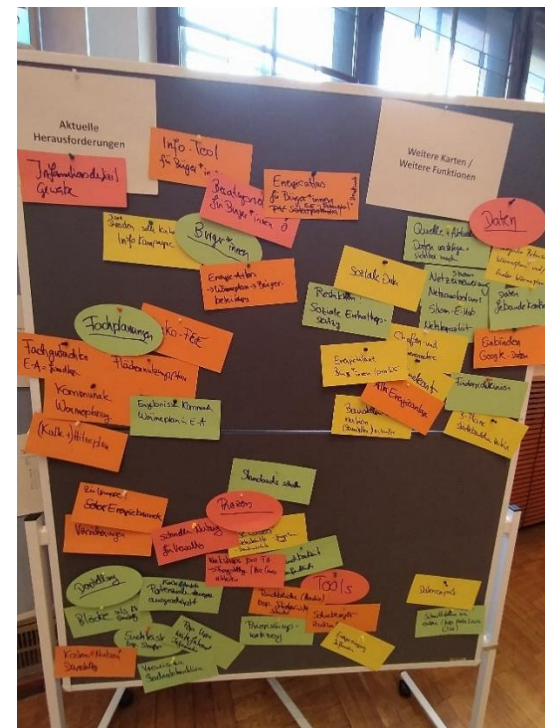
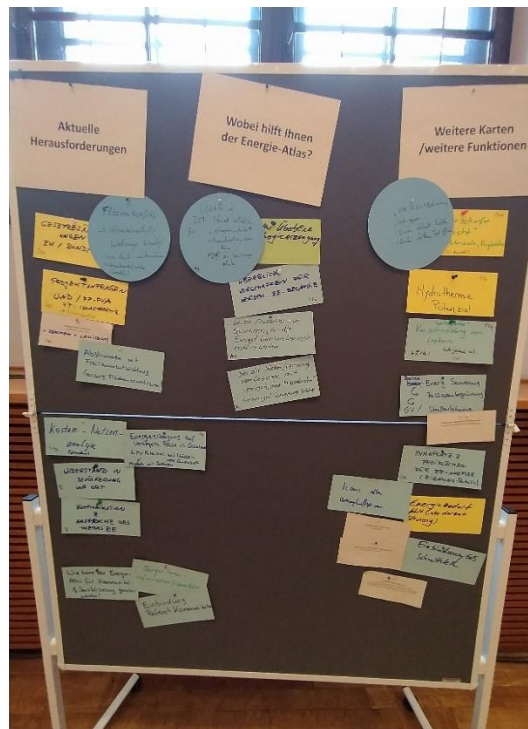
- All data is stored **in one place**
- All participants look at **one tool**
- Thinking about **EE expansion and monument protection** together
- **Joint** planning, development of ideas

Building-specific potential analysis





Requirements Workshops





Energie-Atlas Energiewende im eigenen Haus

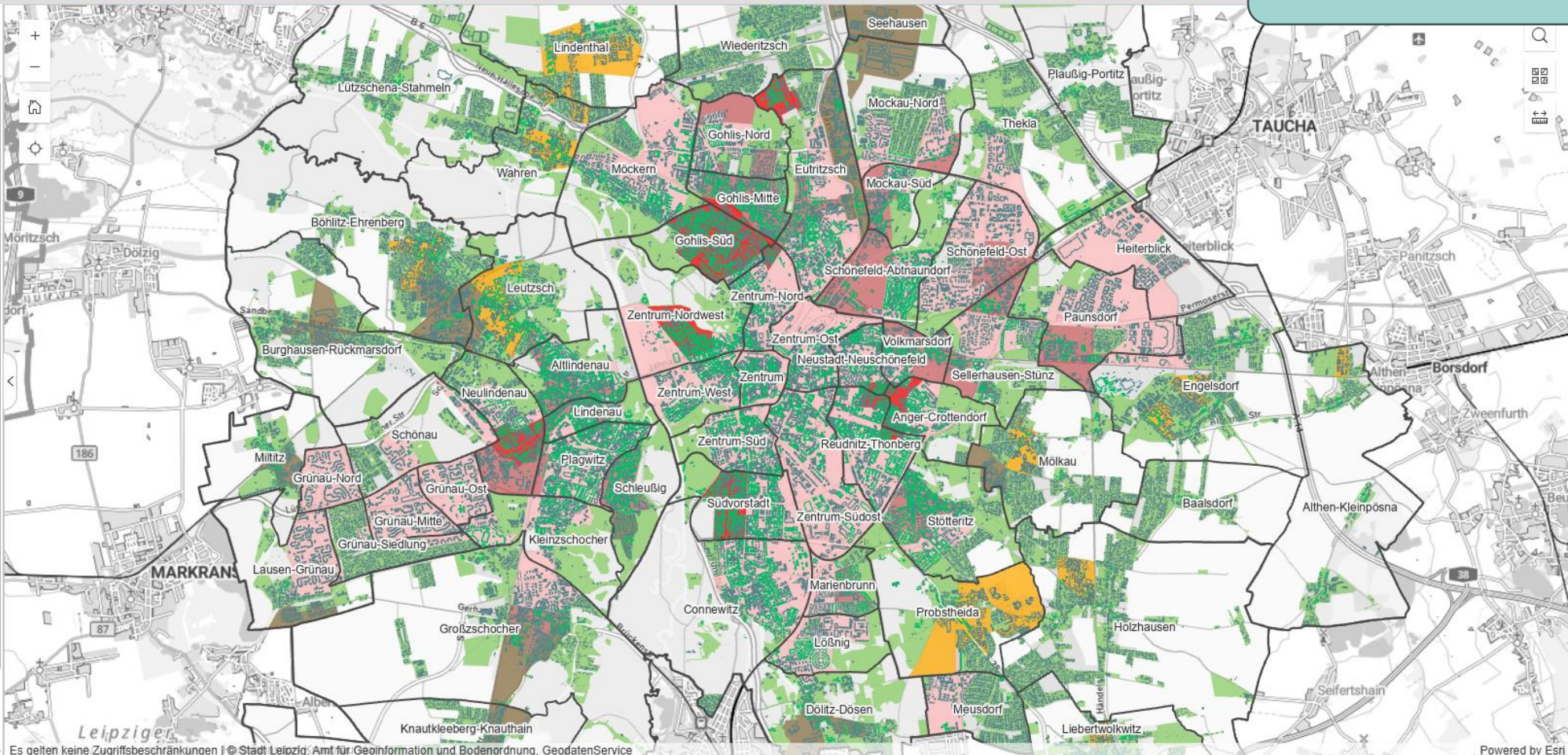
Leipziger Wärmewende-Kompass

Public Energy Map

- Energiewende im eigenen Haus
- Erneuerbare Energien
- Elektromobilität
- Alle Parameter

Themen

- Ortsteile
- Photovoltaik
 - Photovoltaik geeignet
 - sehr gut geeignet
 - gut geeignet
 - bedingt geeignet
 - zu gering
 - Ungeeignet
- Gebäude
 - Denkmalschutz
 - vorhanden
 - nicht vorhanden
- Wärmeversorgung
 - Versorgungsgebiet
 - Fernwärmebestandsgebiet
 - Fernwärmeausbaubereich ab 2025
 - Fernwärmeausbaubereich ab 2030
 - Fernwärmeprüfgebiet



Es gelten keine Zugriffsbeschränkungen | © Stadt Leipzig, Amt für Geoinformation und Bodenordnung, GeodatenService

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Impressum, Datenschutz und Barrierefreiheit



Heritage Protection in the Energy Map

- **Presenting the heritage protection** and the potential of renewable energies together
- Presenting the content in an **easy-to-understand way**
 - Providing **guidance** for the application process
 - The advice offered is part of the **overall advice provided by the City of Leipzig**
- **Reducing prejudices**
 - Motivation to also implement energy system transformation in listed buildings





Energie-Atlas Elektromobilität

Energiewende im eigenen Haus

Erneuerbare Energien

Elektromobilität

Alle Parameter

Weitere Informationen

Public Energy Map

Kartenlegende

E-Ladeinfrastruktur Auto

Ladesäule



E-Ladeinfrastruktur Fahrrad

Ladesäule



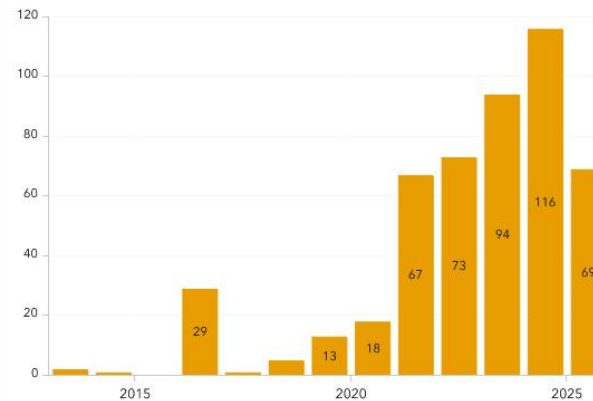
Stand: 03.11.2025

1 km

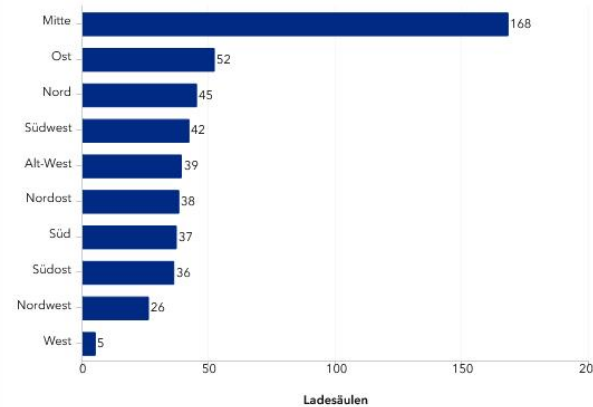
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Neue E-Ladesäulen pro Jahr in Leipzig



E-Ladesäulen in den Stadtbezirken



Hilfe

Impressum, Datenschutz und Barrierefreiheit



Funded by
the European Union



Energy Map –Mock Up

Next step:

Public Energy Map

Energie-Atlas

Alle Parameter
Erneuerbare Energien
Elektromobilität
Kommunale Strukturen

Themen Karten Auswahl

Suche nach Adresse...

Windkraft

- Windkraftanlagen
- In Betrieb
- In Planung
- Freiflächen

Solarenergie

- PV-Anlagen
- In Betrieb
- In Planung
- Solarpotenziale
- PV-Freiflächen

Energienetz

- Stromspeicher
- Fernwärme oberirdisch
- Fernwärme unterirdisch

Gebäude

- Flächendenkmale

Flächeneignung

- Wind 1
- Wind 2
- Solar 1
- Solar 2
- Solar 3
- Solar 4

Legende
V

Jährlicher PV-Zubau

2022 2023 2024

Arten von PV

Erklärungstext

MWp	167,29	20,80	13,82	0,10
GWh/a	171,91			

Erklärungstext

Aktueller Stand der erneuerbaren Energien

Anteilige Stromerzeugung in %





City of Helsinki

Helsinki Energy and Climate Atlas

Enni Airaksinen, 3D Specialist/ MSc (Civ.Eng)
enni.airaksinen@hel.fi



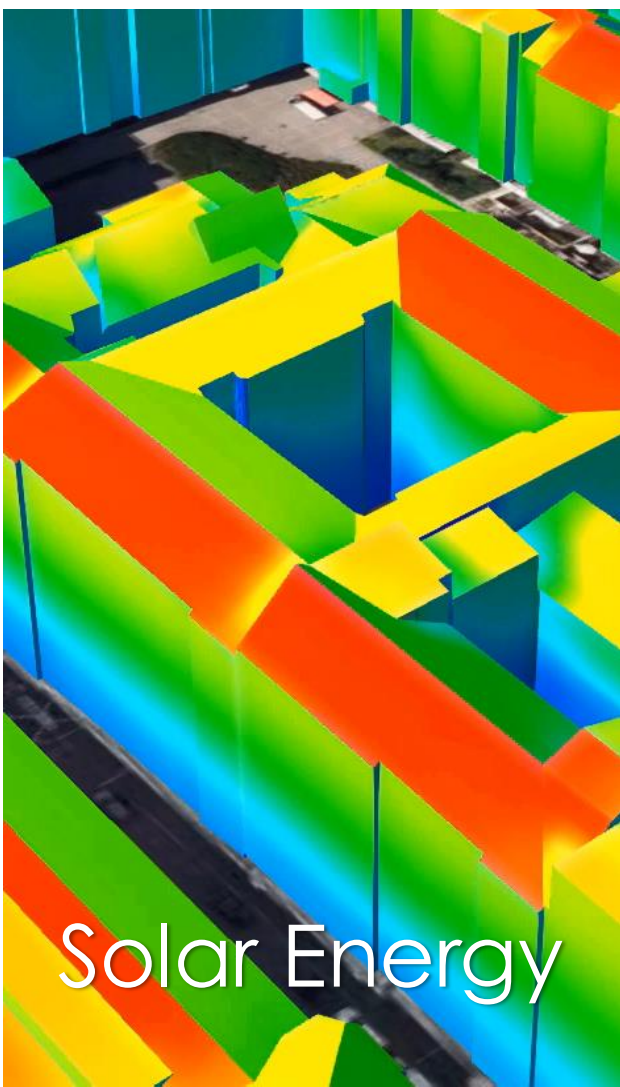


Helsinki Energy and Climate Atlas

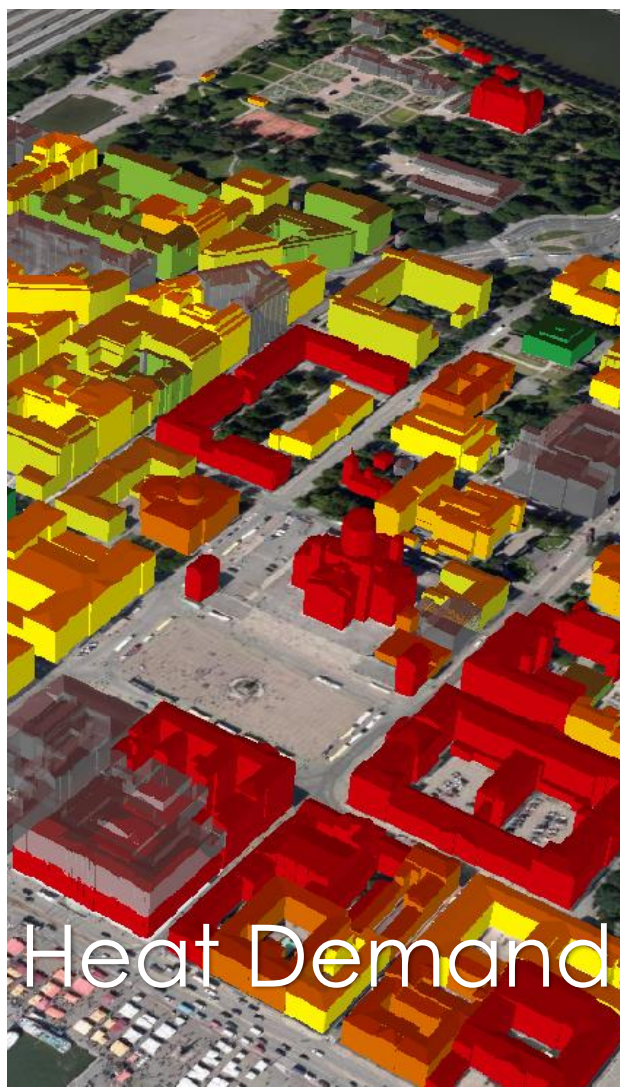
hel.fi/3D



Energy Data



Solar Energy



Heat Demand



Geoenergy

City Executive Office
Strategies Division
Data and New Technologies
Digital Twins



3D Specialist/ MSc (Civ.Eng)
Enni Airaksinen
enni.airaksinen@hel.fi

Helsinki

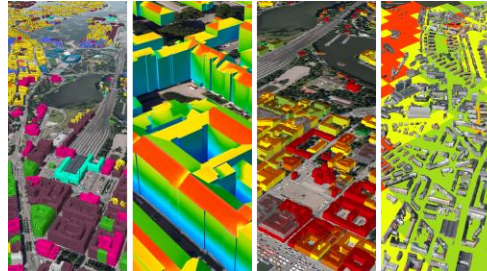
Helsinki 3D+
2016 – 2020

Master's thesis, 2017
*Three-dimensional city
modelling methods*

The Kalasatama Digital
Twins Project, 2019



Helsinki Energy and
Climate Atlas, 2017-2020



career break
2021 – 2025

Helsinki

Digital Twins
09/2025 –

Energy and
Climate Atlas

Developing
3D city models

3D city models
and AI

City model into
game engine



An AI-generated image
of Helsinki Cathedral
recreated entirely out of
colorful DUPLO bricks,
viewed from above.

Perustietoa rakennuksesta

Katuosoite : Kalevankatu 22
RATU : 628
VTJ-PRT : 103056057X
Käyttötarkoitus : Asuinrakennus (Muut kerrostalot)
Rakennuksen korkeus : 19.47 m
Kerroksia : 5
Kerroskorkeus : n. 3.9 m
Bruttosala : 4301 m²
Bruttoala : 4640 m²
Tilavuus : 16650 m³
Rakennusaine : Tiili
Rakennusvuosi : 1881

Energietietoja

Lämmitystapa : Vesikeskuslämmitys (Kauko- tai aluelämpö)

Korjaustietoja

Ikkuna-/ovi-/porttimuutos : Kaupunkikuvallinen lausunto (Rakennuslupa: 17-1571-KL 4)

Ikkunoiden uusiminen

Suojeltu rakennus

Laskennallinen kulutus (kWh/bm²/vuosi)

Lämmitys yhteensä : 130
(Tilojen lämmitys : 93, veden lämmitys : 37)
Kiinteistösähkö : 12
Käyttäjäsähkö : 40

Energy Data, Renovation History and Real Consumption Data

Content

Aurinkoenergiälaskenta: kartta.hel.fi/3d/solar

Helsingin 3d-kaupunkitietomalli: kartta.hel.fi/3d

Kartat ja 3d-mallit



Rakennusaineistot

Rakennusten perustietoja



Rakennusten energia- ja korjaustietoja



Rakennusten kulutustietoja

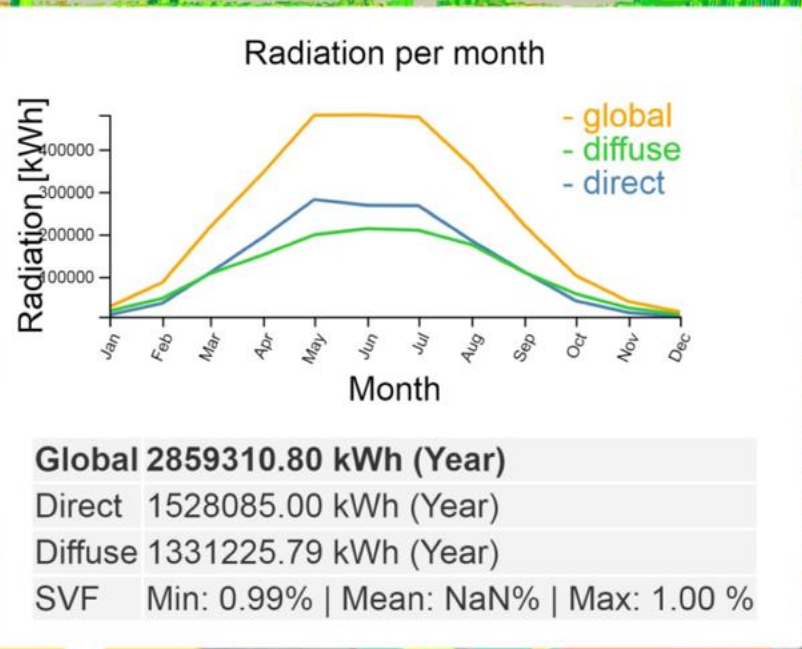
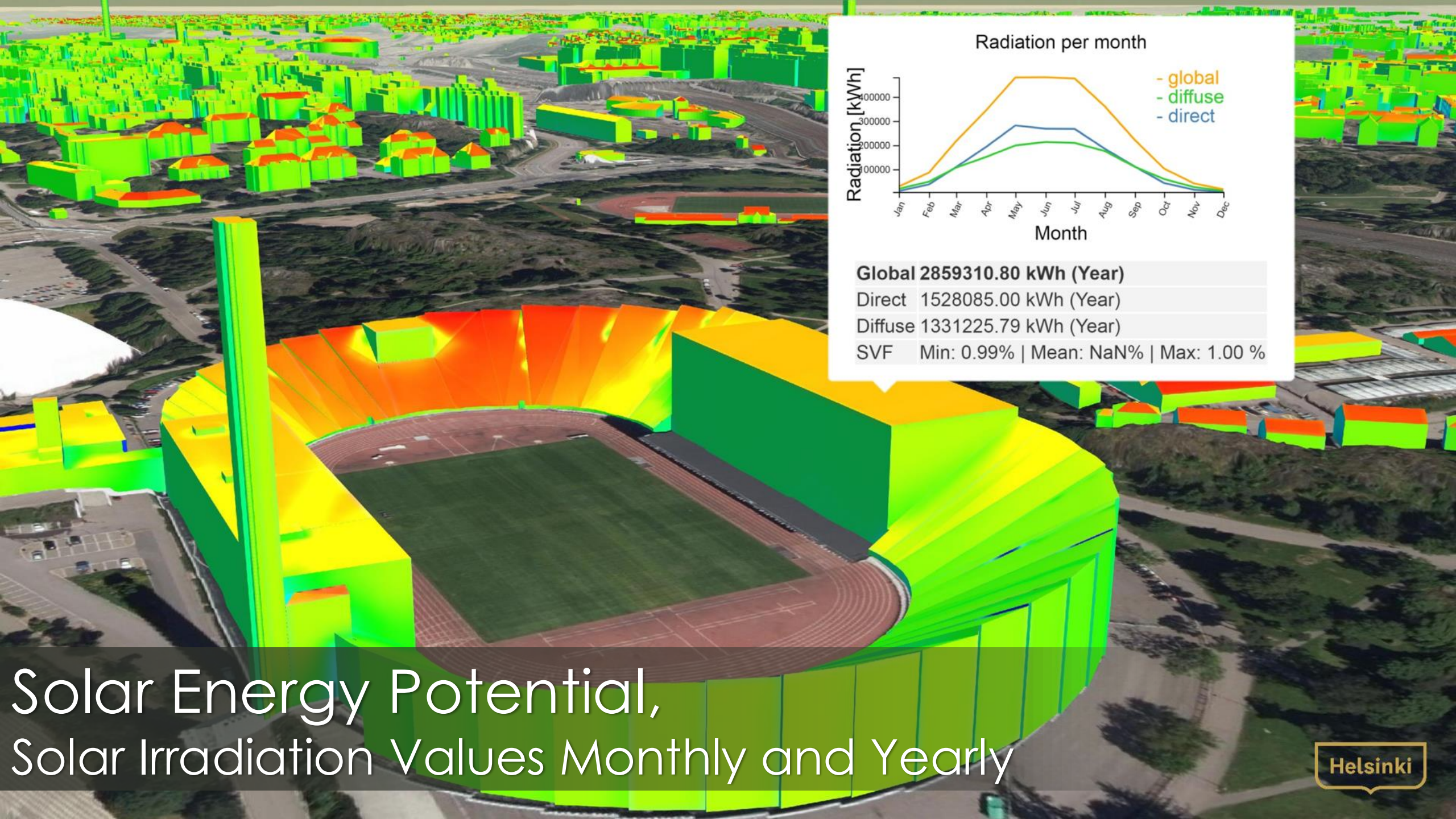


Create PDF

Create Link

Reset settings

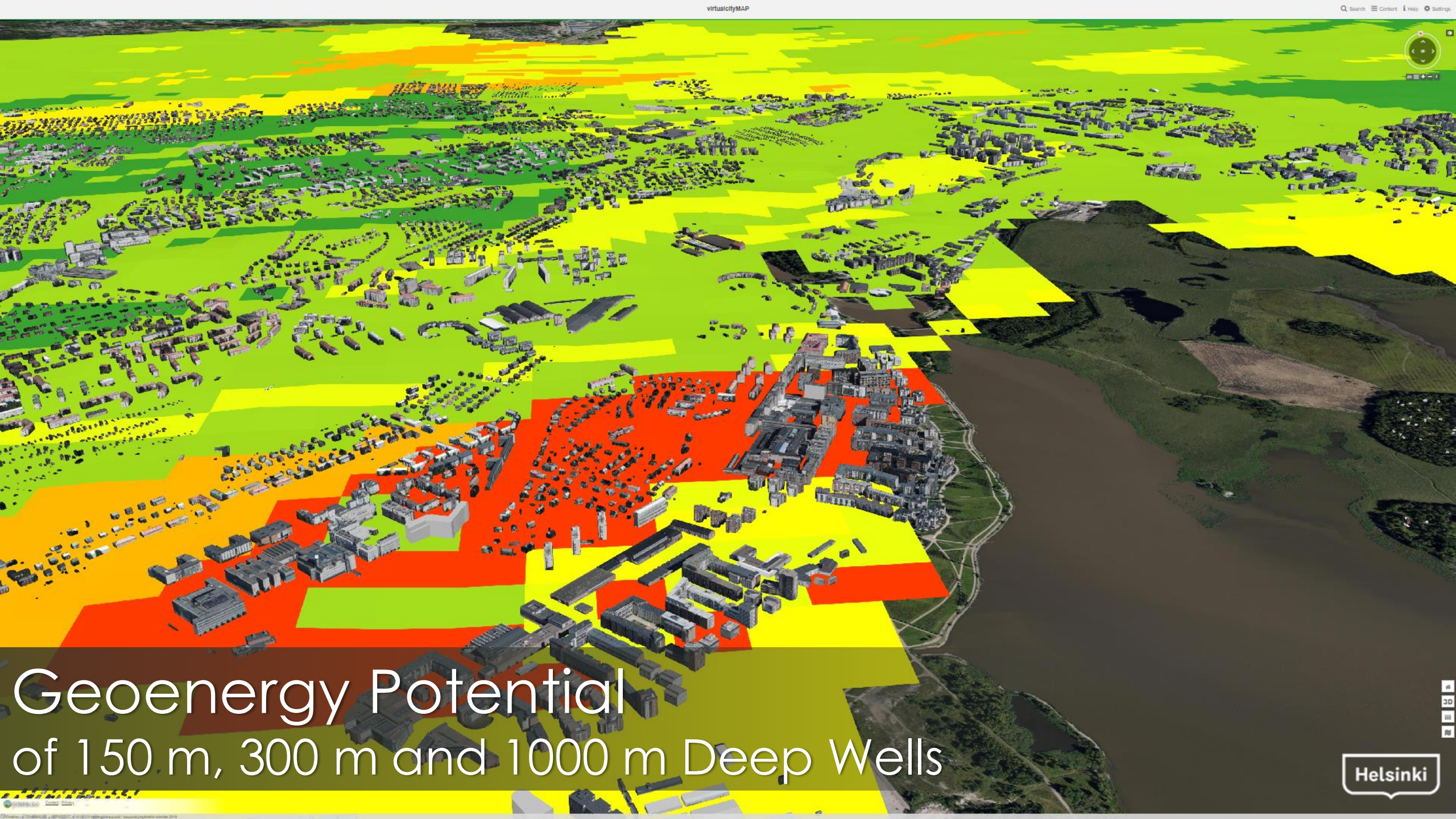




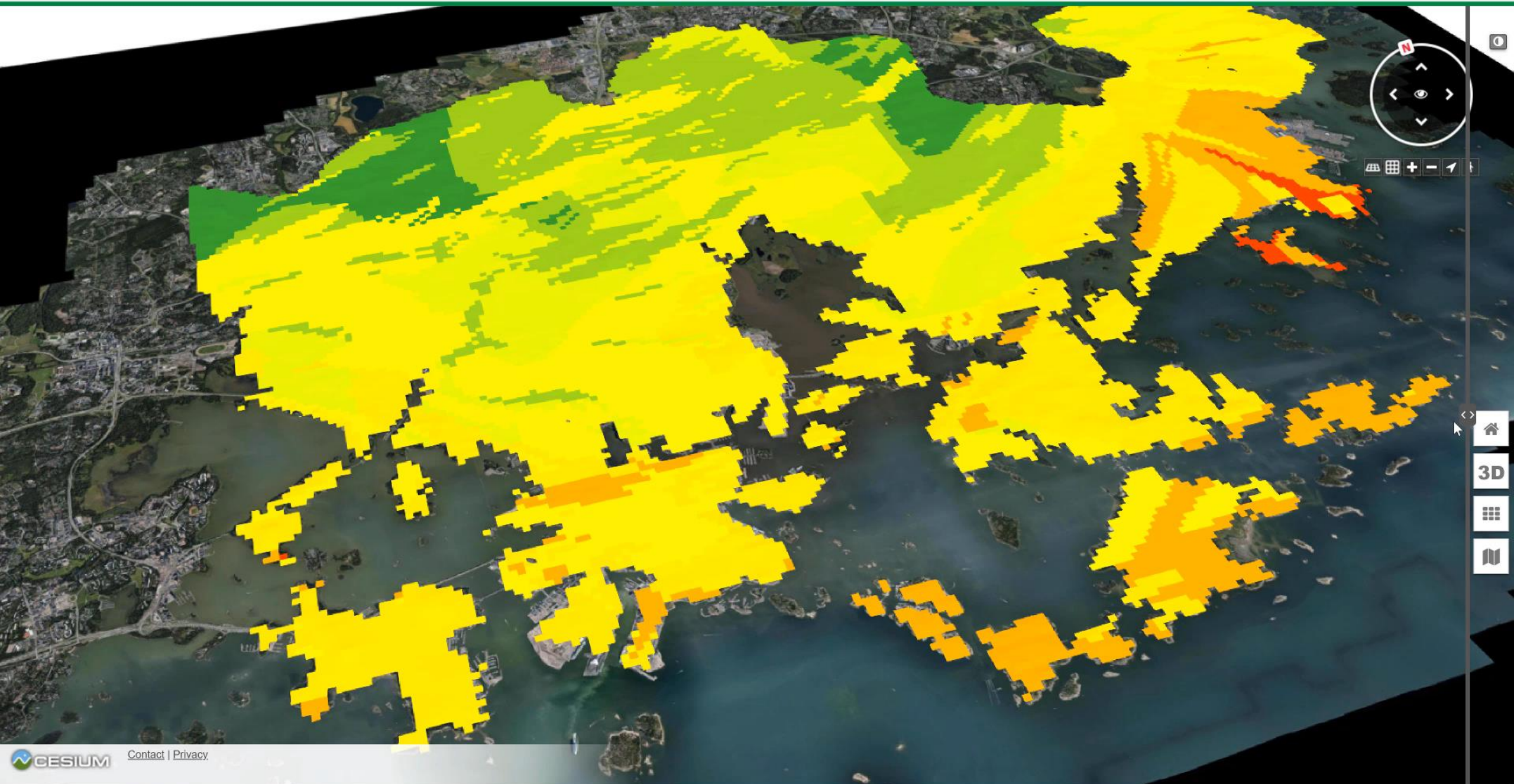
Solar Energy Potential,
Solar Irradiation Values Monthly and Yearly

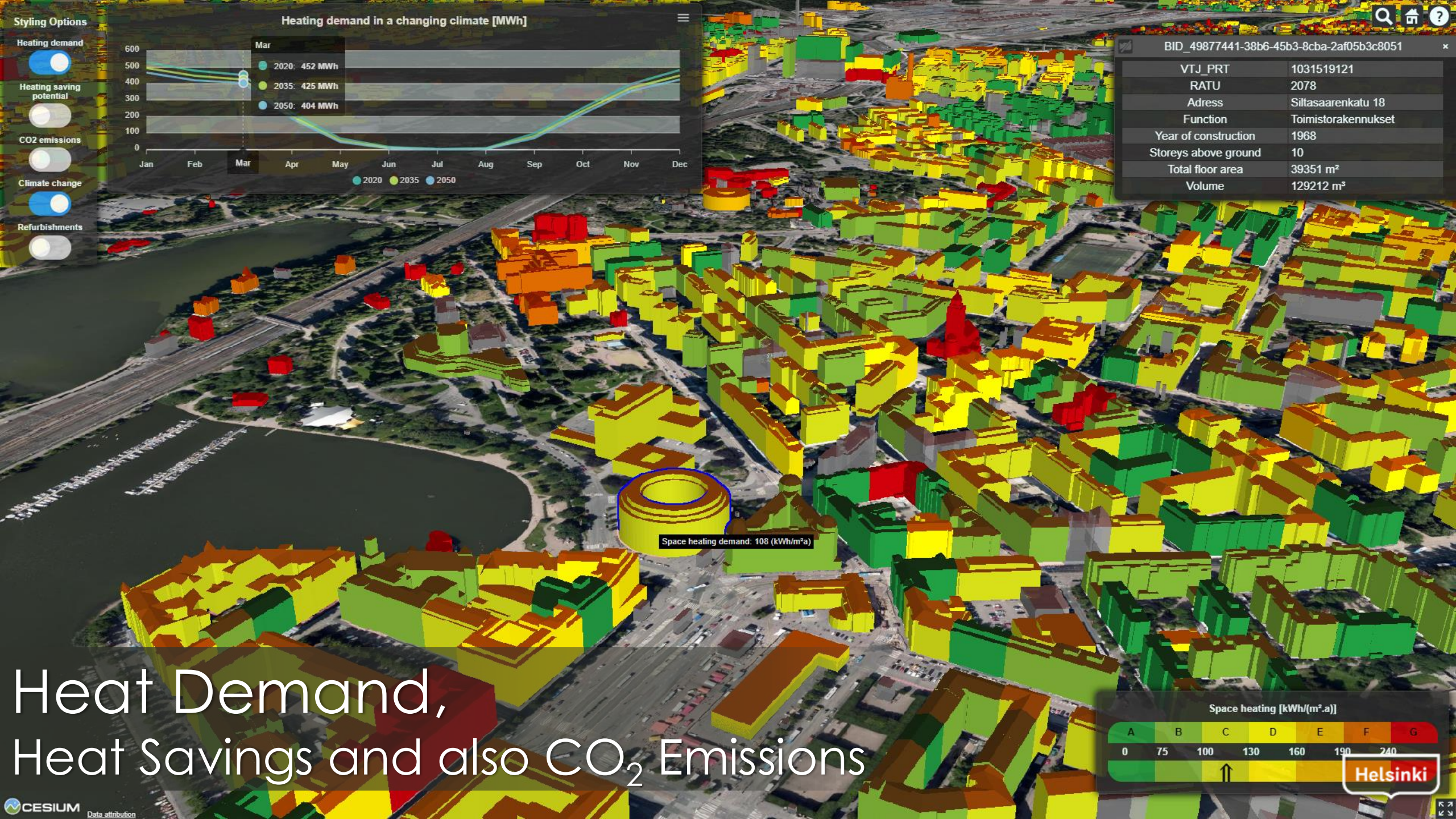


Helsinki Solar Energy Potential

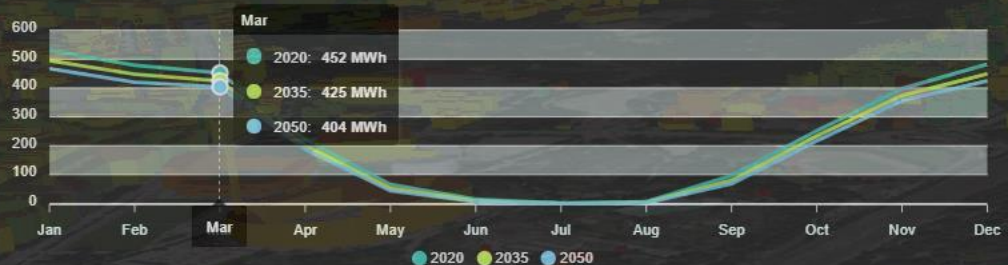


Geoenery Potential of 150 m, 300 m and 1000 m Deep Wells





Heating demand in a changing climate [MWh]



Property Details	
BID_49877441-38b6-45b3-8cba-2af05b3c8051	
VTJ_PRT	1031519121
RATU	2078
Address	Siltasaarekatu 18
Function	Toimistorakennukset
Year of construction	1968
Storeys above ground	10
Total floor area	39351 m ²
Volume	129212 m ³

Space heating demand: 108 (kWh/m².a)



Heat Demand, Heat Savings and also CO₂ Emissions

Styling Options

Heating demand



Heating saving potential



CO2 emissions



Climate change



Refurbishments



Helsinki Heat Demand Prediction



Future Directions 2025 – 2027

Ideas and Opportunities for Development

- **Data:** Building-specific, real-time, continuously updated
- **Standards:** CityGML & EnergyADE compliance
- **Renewables:** Solar potential analysis including trees
- **UX & Visualization:** Intuitive interfaces, expert-approved glossary
- **Scenarios & Forecasts:** Building's real energy data, the feasibility of different energy renovations, emissions, cost simulations
- **Climate Adaptation:** Stormwater, heat islands, surface modelling
- **IoT Integration:** Air quality, noise, water, traffic

Enhancing Communication and Awareness among Different Stakeholders

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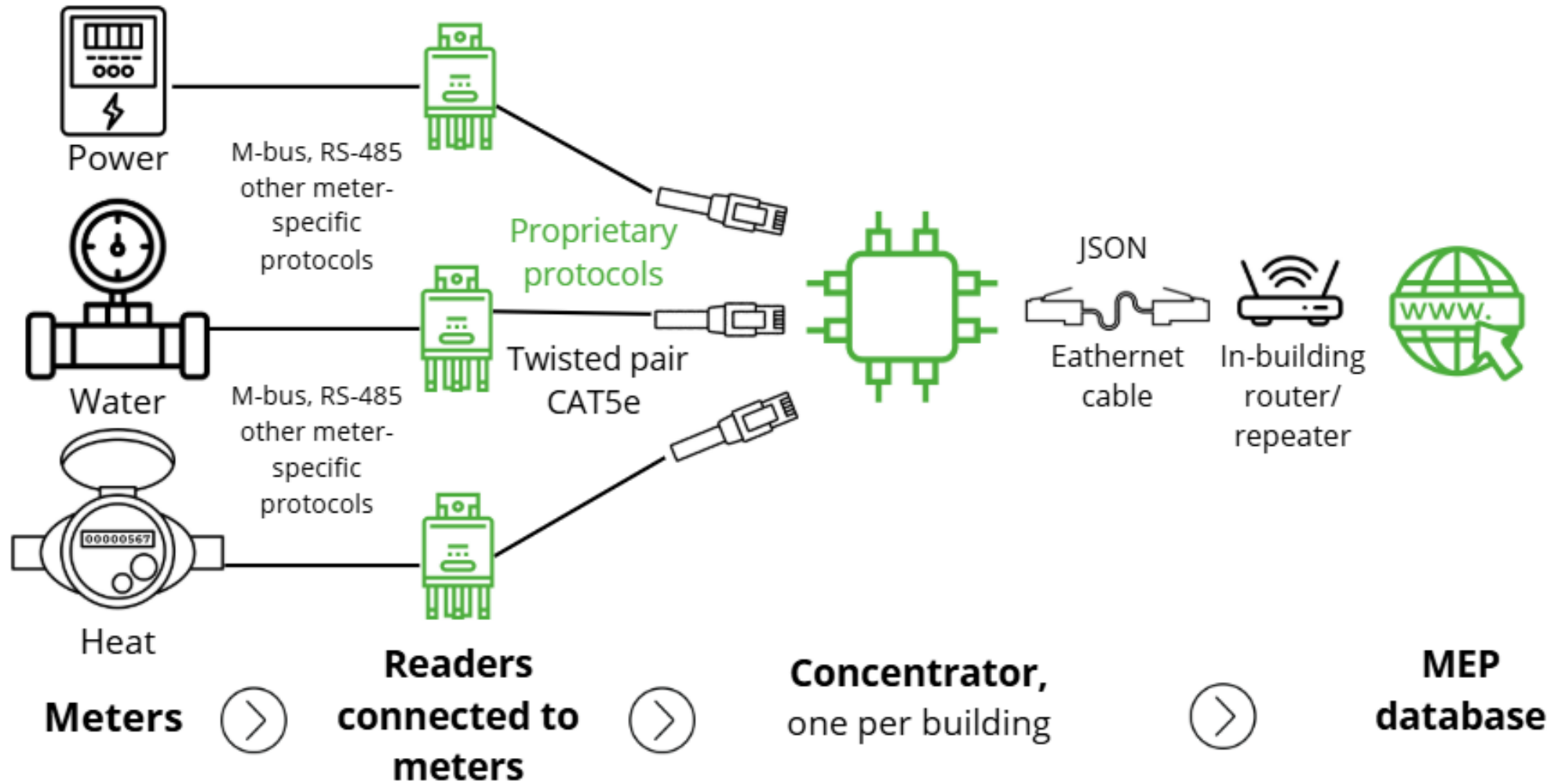
City of Rivne

The Intelligent Energy Management System (IEMS) Profit

Andrii Hrytsevych. 380687099334,

ukrainenetzero@gmail.com

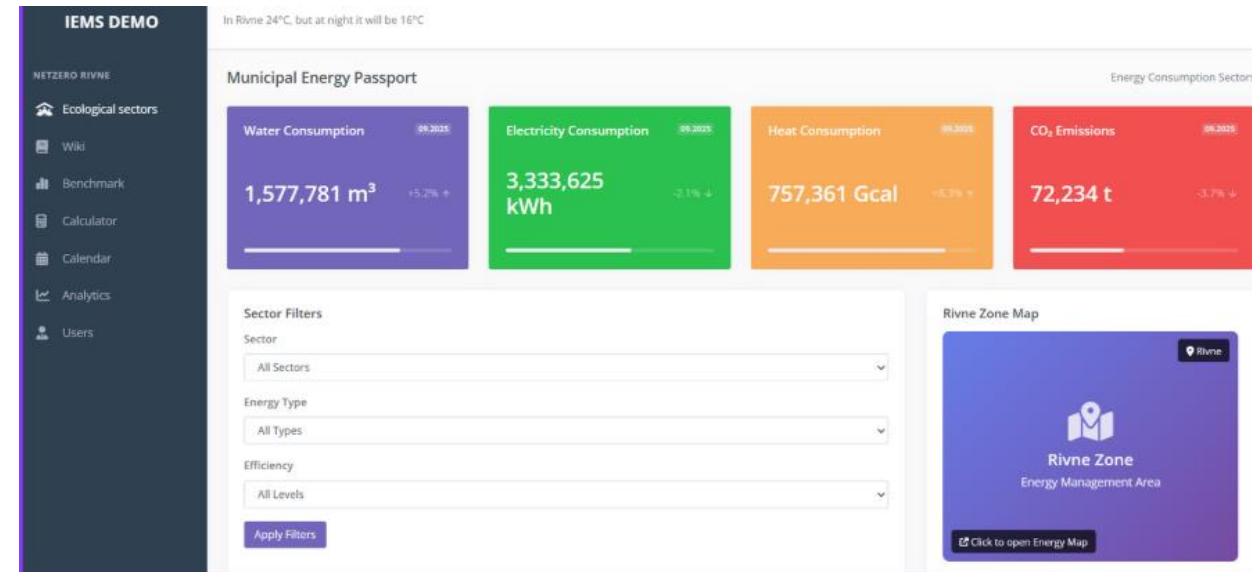






IEMS “Profit”

- Data on the energy consumption of 250 consolidated for the city energy efficiency center. Currently 157 electricity meters (82 buildings) and 115 water meters (92 buildings) have been installed, installation work continues System functions:
 - a) Real-time energy consumption analysis
 - b) Response to overconsumption and accidents
 - c) Forecasting energy and climate trends
- Cost estimation of the energy efficiency and RES measures





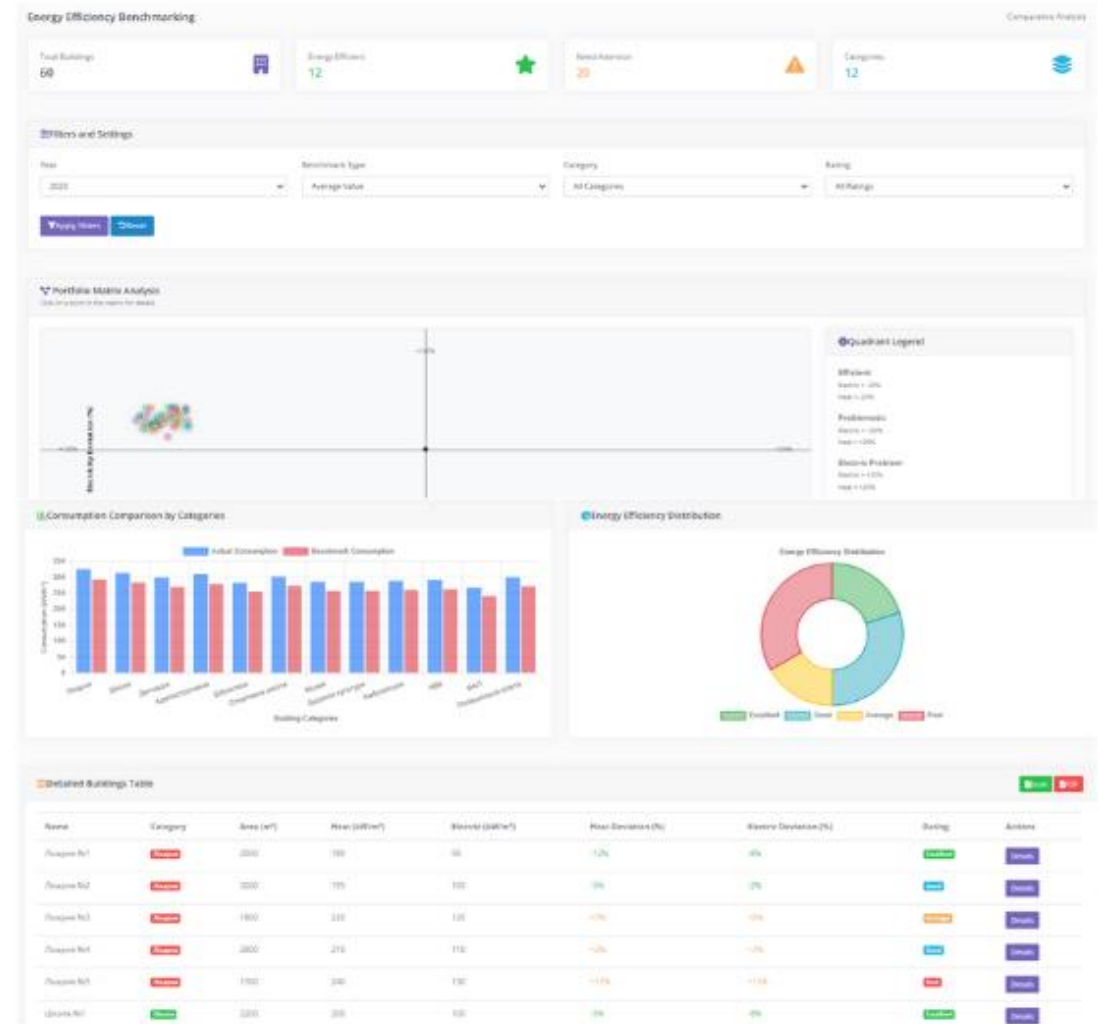
- Designed to scale across city sectors (municipal, HOAs/condominiums, private, transport, industry, utilities/monopolies, ecology & waste).
- Currently fully operational in municipal buildings as a pilot; scaling planned; demo pages for other sectors are in development.
- Supports filtering by energy quality and type; generates decision support to prioritize energy-efficiency investments by sector.

Energy Consumption Sectors									
#	Sector	Number of Objects	Water Consumption (m ³)	Electricity Consumption (kWh)	Heat Consumption (Gcal)	CO ₂ Emissions (t)	Costs (UAH)	Savings Potential (%)	Efficiency
1	Municipal Sector	7	82500	1205000	2080	720	10050000	27%	Medium
2	OSBB	128	456789	234567	123456	18234	4567890	35%	Low
3	Private Sector	89	345678	189234	89123	12456	3456789	40%	Low
4	Transport System	23	12345	45678	5678	8234	2345678	30%	Medium
5	Industrial Sector	34	567890	1234567	456789	23456	8234567	20%	High
6	Monopolies	12	89123	345678	67890	5678	1567890	15%	High
7	Ecology & Waste	18	23456	78901	12345	3456	567890	45%	Medium



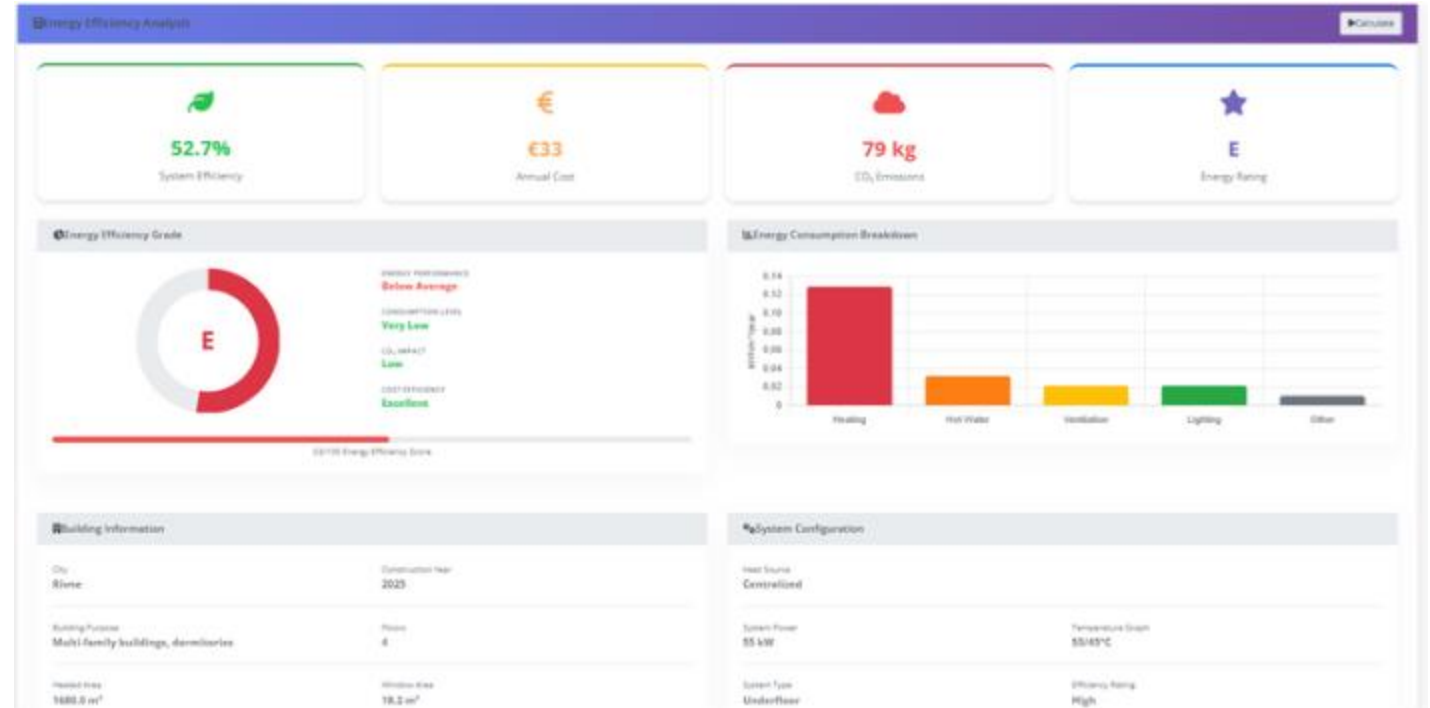


- The "Benchmarking" module makes it possible to rank buildings by deviations in heat and electricity, identify risk groups ("Need Attention", "Heat/Electric Problem"), apply benchmarking scenarios (Top 10%, Median, Bottom 25%) and export management registers for targeted energy audits and modernization projects.





- Dynamic Calculator shifts PROFIT from monitoring to design and analysis; models change effects; outputs data for investment and decarbonization planning.
- Users enter building data to view current energy-efficiency status.
- Adjustable parameters show the impact of measures and support retrofit decisions.





Challenges

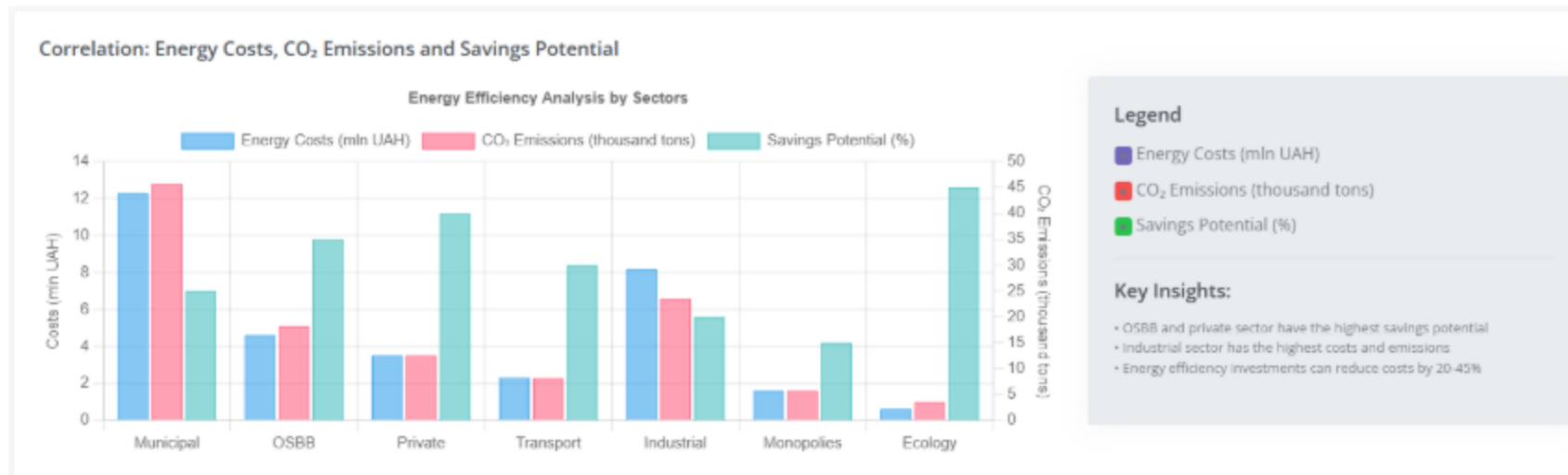
- Many meters were outdated and incompatible with solutions existing on market -> we developed own device for them
- Energy utilities do not share data with the municipality -> we collect data separately and offer better quality data to utilities to create mutual benefits of exchanging data
- Composition and development of large data-base delays final deployment of the system
- The AI-supported functions are very resource-demanding, high operational costs for servers etc.





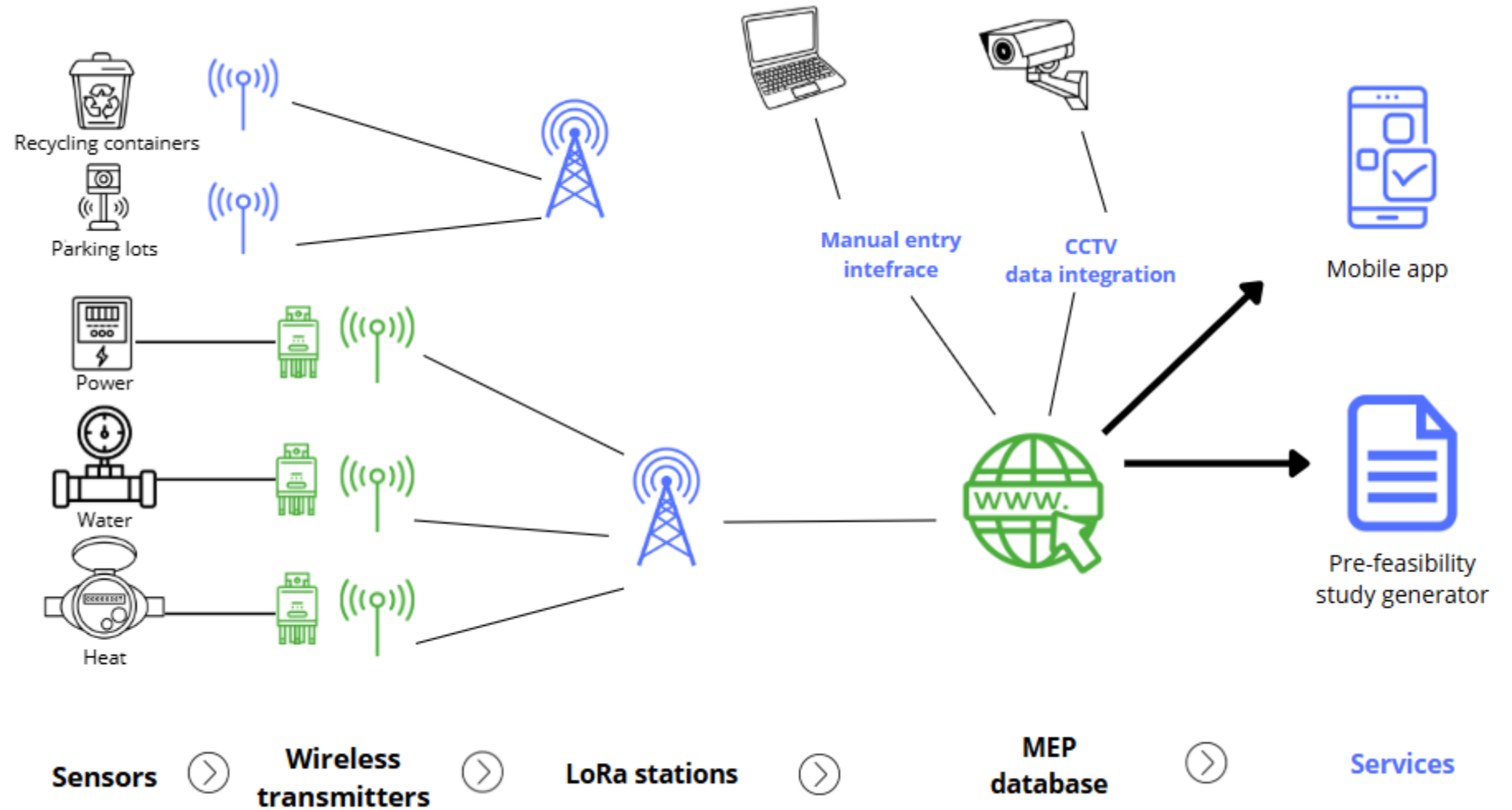
Impact

- Information support - providing citizens with access to energy data
- Decision-making support - identifying effective energy efficiency and renewable energy measures
- Facilitating Investment - preparing data to attract investments in infrastructure upgrade
- Forecasting and monitoring - reducing greenhouse gas emissions, modeling energy development





Nearest plans





Positive impact and benefits

- Positive impact for the city
- Data-driven decisions, not intuition.
- Clear modernization priorities for savings and CO₂.
- Transparency (maps, dashboards, open metrics).
- Benefits for the city
- Easier to convince deputies thanks to scenarios and payback.
- Easier to attract investments and grants.
- Stronger incentives for condominiums and businesses to reduce emissions.





Kraków

NEEST – NetZero Emission and Environmentally Sustainable Territories

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NEEST
NetZero Emission
and Environmentally
Sustainable Territories



This project has received funding through NetZeroCities from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101036519.





CHALLENGES

- in Poland, almost 70% out of 5 mln single-family houses, do not meet energy efficiency standards
- social-economic challenges: aging of society, stratification, energy poverty, migration, etc.





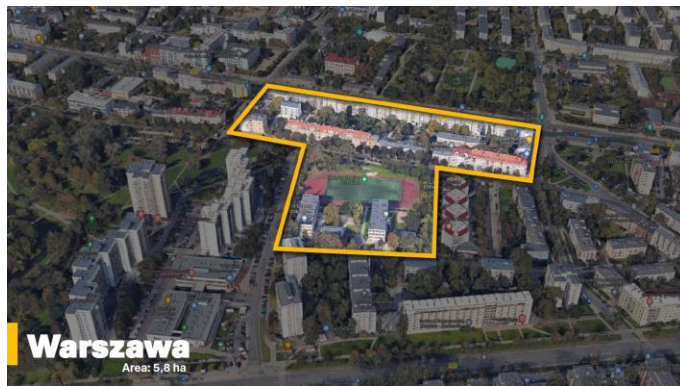
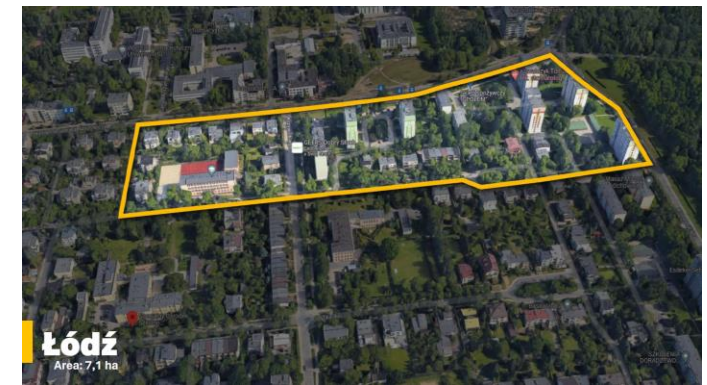
NEEST OBJECTIVES

- To prepare a set of innovative climate and energy solutions that can be implemented, and accelerate climate transformation efforts
- Providing new knowledge, tools, and a way to guide local investments in the decarbonisation process





NEEST: 5 urban areas





NEEST: 5 types of buildings

Tenement house (pre-1918)



Multi-family residential building (1970–1990)



Commercial building (post-1945)



Single-family house (1960–1990)



“Millennium Memorial” school (1960–1980)





APPROACH: SINGLE BUILDING





APPROACH: SIMILAR BUILDINGS





APPROACH: BUILDING + SURROUNDINGS





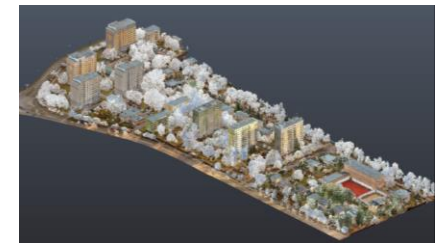
AREAS OF CHANGE





3D SCANNING

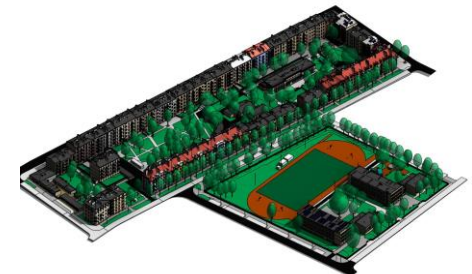
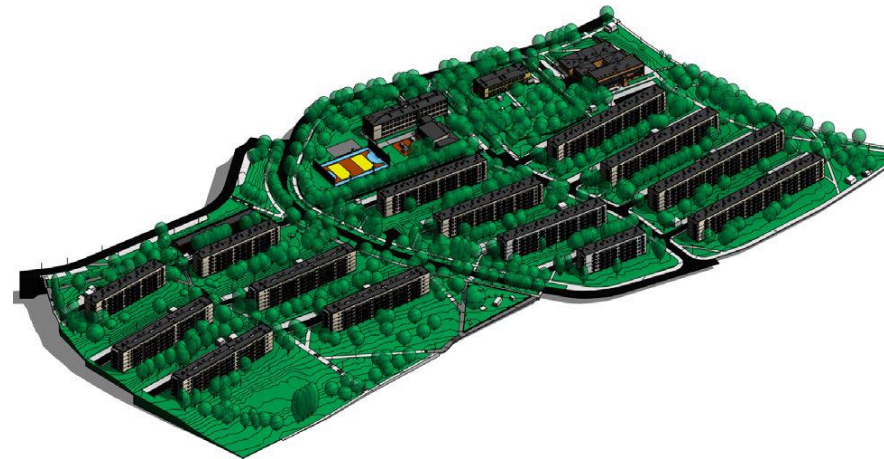
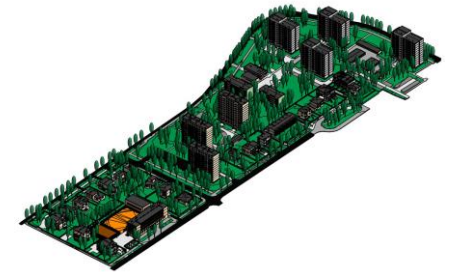
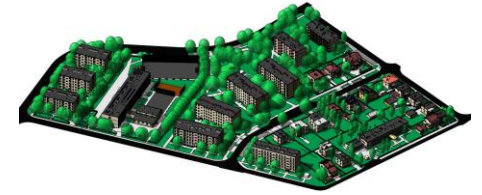
- Point clouds with a resolution not worse than 2-3 cm
- It gives the possibility of identifying individual elements of land development (e.g. curb, small architecture, lighting) and building elements (e.g. window, window frame, balcony railing, roof exhaust)





3D MODELLING

- On the basis of the previously prepared point cloud, a 3D model of the buildings and their surroundings was made.
- Process => importing the point cloud into Autodesk Revit => create a virtual model.
- We can include architectural details and other elements to get a complete and realistic picture of the building.
- The finished model: various file formats and used in design, visualisation or analysis.
- It is possible to precisely transform data scanned with a 3D scanner into virtual models of buildings.





ANALYSES

URBAN

- **Buildings & surroundings:** Building Function / Condition of buildings / Functional areas around buildings
- **Transport analyses:** Traffic / Public transport / Parking spaces and garages
- **Utilities Analytics:** Central heating network / Water / sewerage network / Gas network / Power / Telecom Network
- **Greenery Analysis**

PARAMETRIC

- Insolation Analysis
- Daylight Potential Analysis
- Solar potential analysis
- Wind Analysis
- Wind comfort analyses
- Microclimate analysis

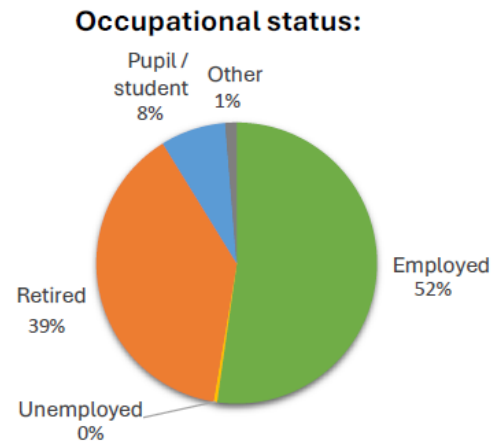
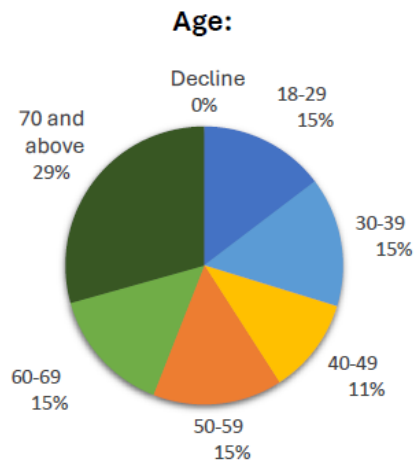




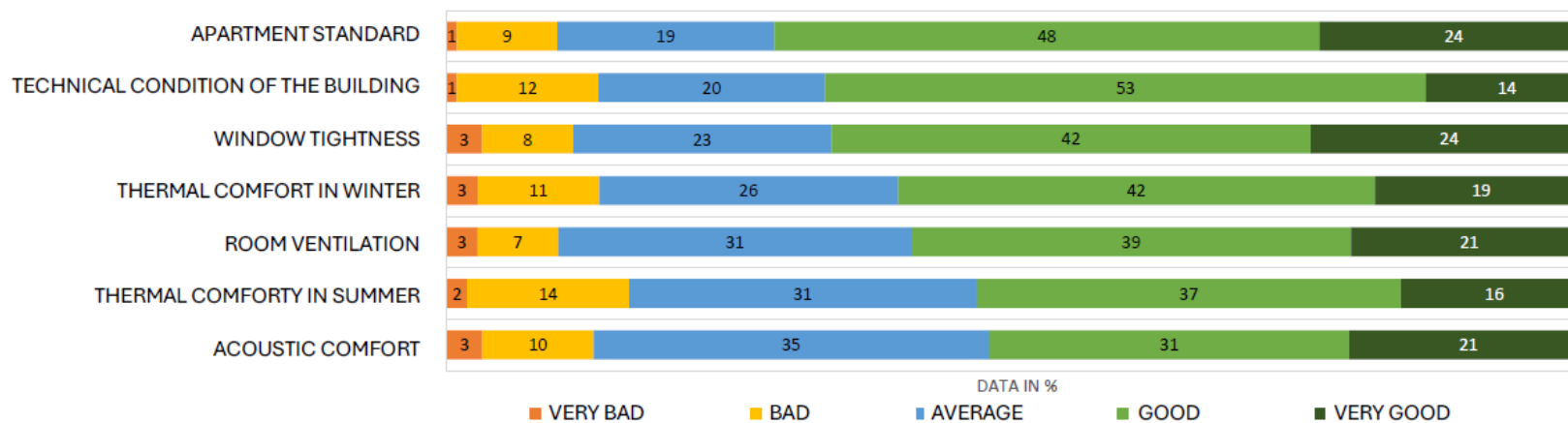
SOCIAL SURVEYS

Characteristics of the studied sample:

Household Quantity:	226
Average number of people per household:	1,9
People over 50 years of age:	59%
Women:	58%
Has children:	15%
Has a car:	48%



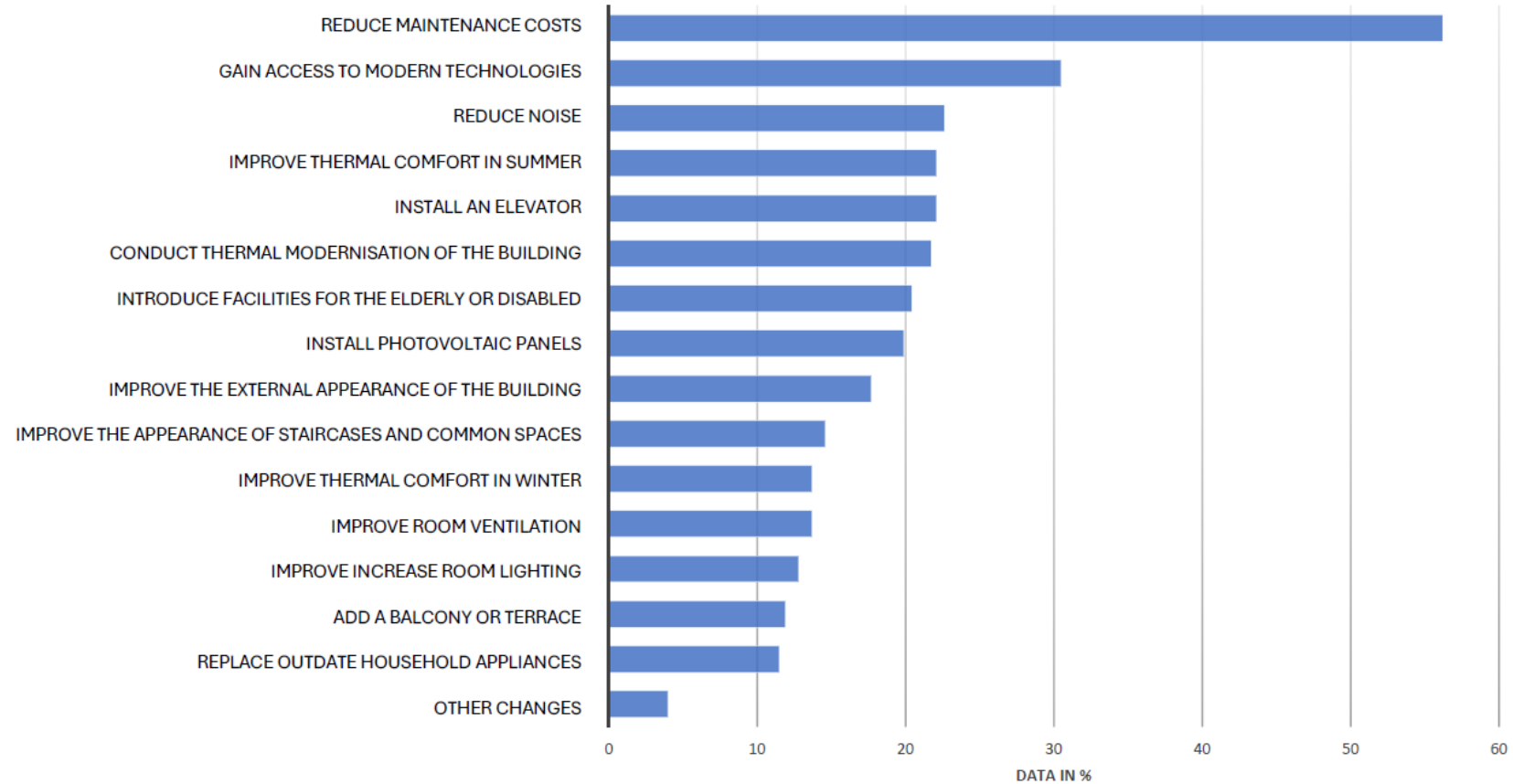
Assessment of the place of residence:





SOCIAL SURVEYS

What should be changed or corrected in the first place in the house/flat or its surroundings:





URBAN / ARCHITECTURAL CONCEPT





SOLUTION CATALOGUE





Data in cities' energy transformation

Data

From the cities:

- Land-use plans
- Urban strategies and policies
- Surveys and community feedback

Central Databases:

- CEEB
- BDOT
- CSO
- KIUT

Weather models

Digital twins of five city quarters

Distribution System Operator and District Heating Companies

Developments

- Development of transport and electromobility
- The pace of urbanisation and urban development
- Parameters of future zero-emission technologies
- Fuel and technology price paths





Data in cities' energy transformation

- Legal reasons
- Stakeholders: no interests / time
- No data / no accurate date
- Poor reporting
- No visualisation





Data in cities' energy transformation

Proposed changes to the CEEB system



Interactive map with location of buildings and emissions information, with the ability to filter data (e.g., by fuel type, emissions level).



Notification system (SMS, e-mail) for building owners About the need to update data or submit a declaration.



API to integrate ZONE with local government and government applications and government applications.



District data and advanced analytical features, including chart downloads and visualizations of changes over time.



Consistent naming of heat sources.



Regulated by law, the possibility of using the data contained in CEEB by local governments for analytical and scientific purposes and scientific purposes.





NEEST: set of solutions & proposed change





Kraków

NEEST – NetZero Emission and Environmentally Sustainable Territories

Konrad Szpak

Konrad.Szpak@um.krakow.pl

Thank you for your attention!



Future Outlook and Emerging trends



“Powered by joy, driven by data”



Advanced Data Analytics & AI to support Urban Climate Work

- Cities will increasingly use **deep learning** and **ensemble models** to optimize energy systems and **predict** various patterns

Generative Design for Green Retrofits

- Cities will improve energy efficiency and sustainability in urban buildings by using data & AI-driven algorithms to create **optimal retrofit solutions**

Energy Technology Innovations

- Cities will adopt various types of **new energy storage solutions** (perovskite solar cells, solid-state batteries, gravitational energy storage) to enhance renewable energy deployment and grid stability.
- Microgrids and virtual power plants will enable **localized energy resilience**.

Automated Compliance & Reporting

- **GenAI** will streamline reporting (e.g., GHG inventories) and regulatory compliance with energy codes and climate targets

And much more!..... 😊

- Everyone will have a GenAI-powered **energy assistant**—a holographic companion that helps manage personal energy use, suggests eco-friendly habits and
- These companions may have **personalities**, like a 🌞 *Cheerful Sunny Spark*, 🌿 *Zen Nature Spirit* or 🧑‍🚒 *Glamorous Grid Guardian*





Q&A



Feedback

Online Planning Lab. Feedback
form Module 4 Spotlight 3



Please give your feedback that we can improve!

[LINK](#)





Next Sessions

<https://netzerocities.app/resource-4501>

MODULE 1	<p>Core</p> <p>The NetZeroCities program, service offering, systemic approach, what works for Mission Cities</p>	<p>Spotlight 1</p> <p>NetZeroCities Orientation</p>	<p>Spotlight 2</p> <p>Shaping Climate Narratives</p>	<p>Spotlight 3</p> <p>Climate City Contracts</p>		
MODULE 2	<p>Core</p> <p>Developing a transition team, mapping and activating the ecosystem</p>	<p>Spotlight 1</p> <p>Transition team & climate leadership</p>	<p>Spotlight 2</p> <p>Engaging the private sector</p>	<p>Spotlight 3</p> <p>Citizen engagement for systemic climate action</p>		
MODULE 3	<p>Core</p> <p>Developing the city's action plan for climate neutrality</p>	<p>Spotlight 1</p> <p>Reporting and MEL</p>	<p>Spotlight 2</p> <p>Co-Designing a Climate Portfolio</p>	<p>Spotlight 3</p> <p>Using NetZeroPlanner to Support Climate Planning, MEL, and Implementation Management to Achieve Net Zero Goals</p>		
MODULE 4	<p>Core</p> <p>Levers of change: Technical solutions, social innovation and multi-actor collaborations</p>	<p>Spotlight 1</p> <p>Passive solutions to reduce energy demand in buildings</p>	<p>Spotlight 2</p> <p>Systemic energy transition at buildings, districts and city level</p>	<p>Spotlight 3</p> <p>Data-driven approaches to energy transition in buildings and districts</p>	<p>Spotlight 4</p> <p>Mobility</p>	<p>Spotlight 5</p> <p>Scope 3 and other emission domains</p>
MODULE 5	<p>Core</p> <p>Increase finance knowledge of the public administration & learn about options to finance projects</p>	<p>Spotlight 1</p> <p>Preparing a pipeline of projects for external financing</p>	<p>Spotlight 2</p> <p>Different investor groups and the key priorities and returns profiles for each and instruments</p>	<p>Spotlight 3</p> <p>Financing the ambition: Learning from Mission Cities</p>		
MODULE 6	<p>Core</p> <p>Multilevel governance, national platforms and policy strategies</p>	<p>Spotlight 1</p> <p>Policy and regulations innovation</p>	<p>Spotlight 2</p> <p>Public procurement – national specificities</p>	<p>Spotlight 3</p> <p>Just transition</p>		





NetZeroCities map of learning resources

		Learning Online (Self-paced)		Online (synchronous)	
		Topic	In-depth resources	Tools	
ALL CITIES	THE NZC SYSTEMIC INNOVATION APPROACH	The Systemic Approach		Climate transition map	Hybrid Online Course The NetZeroCities program, service offering, systemic approach, what works for Mission Cities Climate City Contracts Developing a transition team, mapping and activating the ecosystem Core Session: City planning for climate neutrality, Spotlight Session: Climate Action Plan in the urban planning system Spotlight Session: Reporting and MEL Levers of change: Technical solutions and multi-actor collaborations Passive solutions to reduce energy demand in buildings Systemic energy transition at buildings, districts and city level Mobility, behavioural change, public transport Other emission domains and scope 3 Levers of change: Technical solutions, social innovation and multi-actor collaborations Data-driven approaches to energy transition in buildings and districts Citizen engagement for systemic climate action Engaging the private sector Levers of change: Technical solutions, social innovation and multi-actor collaborations Introduction to finance Preparing a pipeline of projects for external financing Multilevel governance, national platforms and policy strategies Policy and regulation innovation Just transition
		Climate City Contracts			
		Climate Transition team			
		Climate Action Planning <small>Integrated planning Adaptation</small>		NetZero Planner	
		Impact Pathways and Monitoring <small>GHG baseline, monitoring and co-benefits Impact pathways</small>		Barometer	
		Solution themes related to Emission domains		Solution Outliner	
		Buildings (Stationary energy)			
		Energy systems (Stationary energy)			
		Mobility and Transport			
		Waste and Circular economy		Solution bundles	
Green industry (IPPU)					
NBS, green infrastructure and agriculture (AFOLU)					
Other scope 3					
EU National coordination platforms and learning opportunities	N/ZC Portal Resources	Levers of change		Solution Outliner	
		Technology and infrastructures			
		Digitalisation Smart Cities		Engagement Strategy Tools	
		Stakeholder Engagement <small>Citizen engagement Private sector engagement Communication / Climate narrative</small>		Social Innovation pathways	
		Social Innovation Stakeholder-led innovations			
		Financing the Ambition <small>Pipeline of projects Typology of investors Business models Green public procurement</small>		Finance Guidance Tool	
		Governance and policies			
		Inclusivity <small>Just transition Energy poverty</small>		Partnership Map	
		Other projects and initiatives <small>NEB, SDGs</small>			
		MISSION CITIES PILOTS	TWIN CITIES	Portal Page	Twinning Learning Programme - YouTube Playlist
Pilot projects Page	Pilot Handbook			Bootcamps Group	Sensemaking
		Portal Page	Best Practices session videos	Seasonal Schools Group	Policy Labs

<https://view.genially.com/68874cdf80e624684e8e031c>



Get in touch with NetZeroCities!

NetZeroCities Help Desk: infocities@netzerocities.eu



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[NetZeroCities EU](https://www.youtube.com/NetZeroCitiesEU)



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