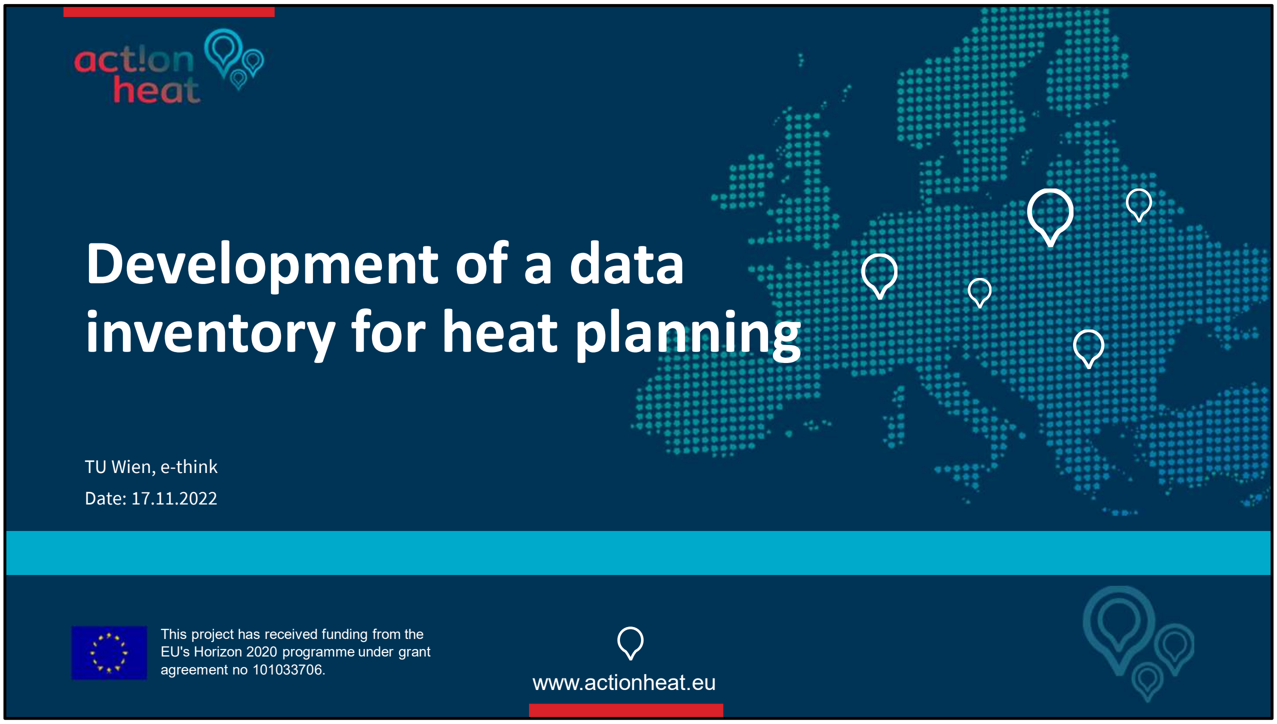
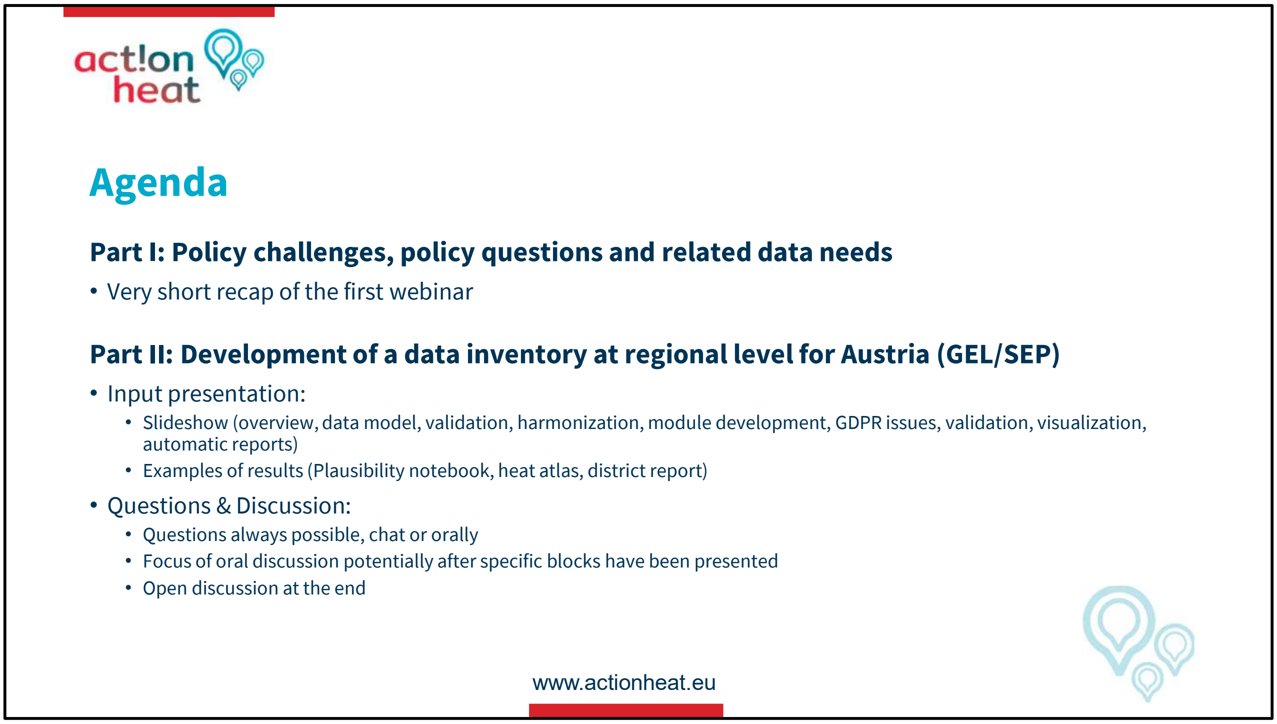


Webinar 2:
Development of a data inventory for heat planning

Act!onHeat SF1 — Time: 154 min

- Serial 1:
  - Webinar 2
    - Strategical Heating & Cooling planning
    - Group support for municipalities and stakeholders

- Presented by:
  - e-think / Austria
  - TU-Wien / Austria



Part 1

- Recapitulation of Webinar 1:
  - Heating & Cooling policy parameters for strategical planning.

Part 2

- Presentation of Austria data inventory developed at the regional level.
  - Platform that joins together many data sources, with the idea to use it for Heating & Cooling planning at different levels for decision-making.

PART I

Policy challenges, questions and data needs

action heat

Case 1: Strategic Decision Making

Area	Objective	Data Used
EU – all MS	**Objective**: Improve database on current and potential future demand and supply for H/C **Activity**: Mapping H/C current and future demand and scenario for supply until 2030 (Fraunhofer ISI et al. 2017)	• heating demand on a national level split up to different building archetypes • heating and cooling energy demand for different industries (national) • National GDP, employment, investment costs, benefits- baseline) • existing subsides for H&C in place • current national level energy mix • solar thermal potential (national)
EU – selected MS	**Objective**: Develop efficient and effective policy instruments for driving implementation of nZEB standard, find replicable solutions for different countries in the EU **Activity**: Policy evaluation and optimisation for developing strategies to uptake nZEBs (TUW-EEG,2016)	• information regarding market development and characteristics of nZEBs was collected • renovation activities and quantity on national level • national level building stock data
National level	**Objective**: Provide a scenario of full decarbonisation of EU heating and cooling until 2050 **Activity**: A scenario of an EU with net-zero greenhouse gas emissions and its implications (UBA 2019)	• Baseline emission data • Total residential GFA • Specific heating and cooling demand for residential (average)
Regional / local level	**Objective**: Develop local and regional H&C strategies **Activity**: Hotmaps – Open-Source Tool for mapping and planning in Heating and Cooling	• Hectare level data on heat and cold demand generated for all EU-27, updated with local data based on estimated demand in buildings for case studies • Estimation of resource potentials based on EU studies and other local studies • Costs and prices from national level discussed with stakeholders

Four different cases

Case 1

For solid policy decisions access to data is necessary:

- Strategic policy decision requires having a clear long-term vision.
- This vision can be developed/assessed based on technical scenarios, which in turn require data (reliable data..)

The strategic decision can be at different levels:

- European Union (EU)
- Member State (MS)
- National
- Regional

The levels determine the direction and extent of the decisions.

Case 2: Specific Decisions on Priority Zones

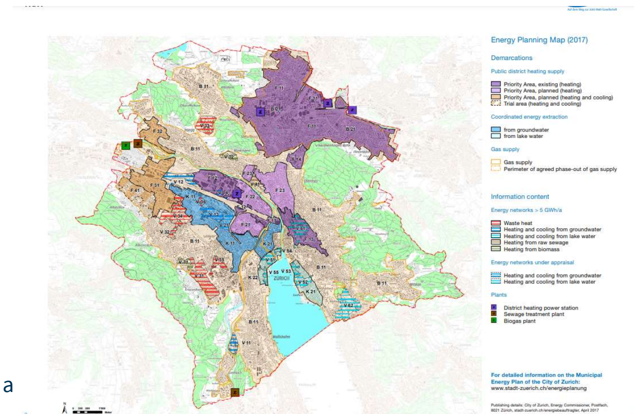
Objective

- Identify District Heating Zones
- Identify areas for retrofitting focus
- Local RE utilization (geothermal, solar)

Data Inputs—geospatial data

- Public district heating supply
- Gas Supply
- Resource potentials in the region
  - Ground water
  - Raw Sewage
  - Lake Water
  - Industrial waste heat
  - Biomass

Examples: **Zurich** identification of priority zones, **Denmark** to achieve low cost heating resulting from a high connection rate.



Source: [6]

Case 2

Priority of zones is needed for policy.

- Different zones should be compared.
  - Data reliability on a level not only allows solid policy decisions, but also assures holding a decision in case district heating in a zone is challenged in a court.
  - Ideally, compare calculated/estimated data with (normalized) measured consumption data.

Case 3: Detailed technical design of network

City	Jelgava	Berlin	Alba Iulia
Scale	Entire City	16 buildings	Few neighboring buildings
Objectives	Reduce CO2 emissions and increase energy efficiency and RE supply.	Phase out coal powered district heating by 2030	Reduce building Energy demand
Data used (Source; Type)	• Building footprint (OSM; Public) • Network Path (OSM; Public) • LIDAR (Municipality; Private) • Building demand (Thermos Default) • Heating Tariff (Heating Service Provider; Public) • Pipe costs (Fortum and external experts; Private)	• Building footprint (Data from district heating provider; Private) • Network Path (OSM; Public) • LIDAR (Berlin Lidar Data) • Building demand (Calculation based on VDI 2067; Private) • Heating Tariff (Heating Service Provider; Private) • Pipe costs (Thermos Default Data)	• Building footprint (OSM; Public) • Network Path (OSM; Public) • Building demand (Thermos Default) • Heating Tariff (Real data; Private) • Pipe costs (Thermos data; Public)

Source: [5]

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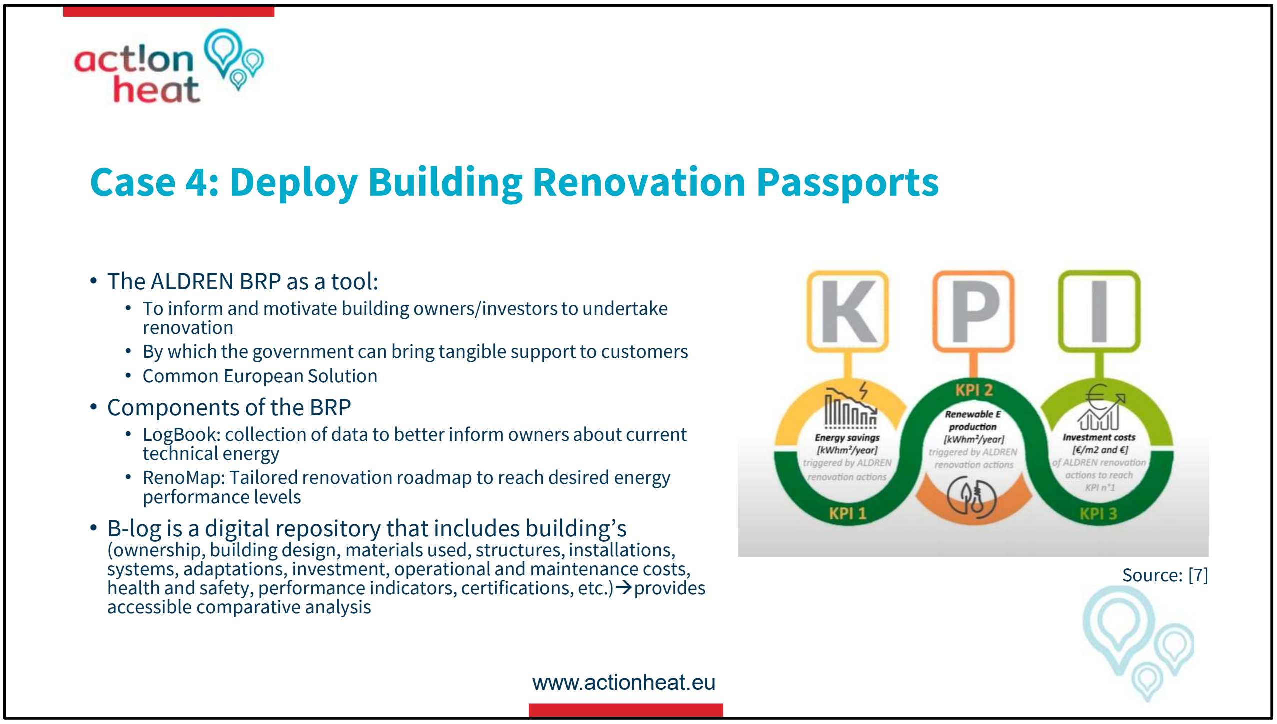
Case 3

Technical design is needed for policy.

- Comparison of design for different development projects
  - Scale:
    - Shows how a district heating network in a specific area looks like.
  - Objectives:
    - Depending on the time projection of the policy
  - Data:
    - Different levels of data affect the final analyses and results



Case 4

Specifications of (building-related) local conditions are needed for a policy.

- Single building level
    - Data collection of single buildings for policy development
- The ALDREN BRP:
    - The core concept consists of the building renovation passport (BRP): ALDREN LogBook and the ALDREN RenoMap, which make the BRP a sort of complementary tool to the EPC to increase owners' awareness about the technical energy performance of their building and support them for regular daily operations, coupled with a tailored made renovation roadmap which provides an assessment of three main KPIs as shown in the Figure.

	Case 1: Strategic decisions	Case 2: Setting priority zones	Case 3: DH technical planning	Case 4: building renovation passports
Data on existing heat / cold demand	• Regional energy balance (aggregated) • Hectare level data for assessing district heating potentials • (Calculated / measured demand data on single building level)	• Calculated demand data on single building level • Calculated demand data validated with measured consumption data		

Costs of heat distribution / DH vs. individual supply	• Estimation on hectare level based in heat demand density, gross floor area
	• Comparison of DH supply costs with individual supply costs
		• Estimation of heat distribution costs:
		  • Estimation based on type of district
		  • Estimation on hectare level based in heat demand density, gross floor area
		  • Estimation based on street level
		  • Account for location of currently existing network
		• Comparison of DH supply costs with individual supply costs
		  • for a single area vs. for entire city
		  • Using estimations of future prices vs. current prices
		  • …		

Data on resource potentials (renewable energy [RE] and heat sources)	• Total RE potential in the region available • Profiles for solar irradiance, temperatures of heat sources, …	• Location of potential resources and estimation based on literature study • Potential estimation based on measurements and (pre-feasibility studies) • Mix of both		
Data on demand reduction potentials	• Costs and potentials for heat demand savings in different building archetypes	• Costs and potentials for heat demand savings in different building archetypes allocated over the city area • …		

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Hotmaps has default data sets that can be used to start Heating & Cooling planning.

- Data for existing Heating & Cooling demand.
- Data on the cost of heat distribution vs. individual supply
- Data on resource potential
- Demand reduction potential

And can be applied for:

- Case 1: Strategic decisions (explained in Webinar 1)
- Case 2: Priority zones (explained in Webinar 1)
- Case 3: Technical planning
- Case 4: Building renovation

PART II

Development of a data inventory at regional level for Austria (GEL/SEP)

Experiences from other projects

- Project: Spatial Energy Planning (SEP) – An Austrian flagship project in heating and cooling planning in three Federal States of Vienna, Styria and Salzburg
- Objective of the presentation: Share experiences about Heating and Cooling planning in other regions.

What to expect from this presentation?

- Introduction to the Spatial Energy Plan (SEP) project
  - Overview & expected results
  - Use-cases
  - Project steps
- Data model for SEP & data management plan
- Harmonization of data and methods
- Plausibility check of results
- GDPR aspects
- Validation process
- Exemplary project results:
  - Heat atlas
  - Automatic reports

Relevant information for the presentation

Overview of the expectation

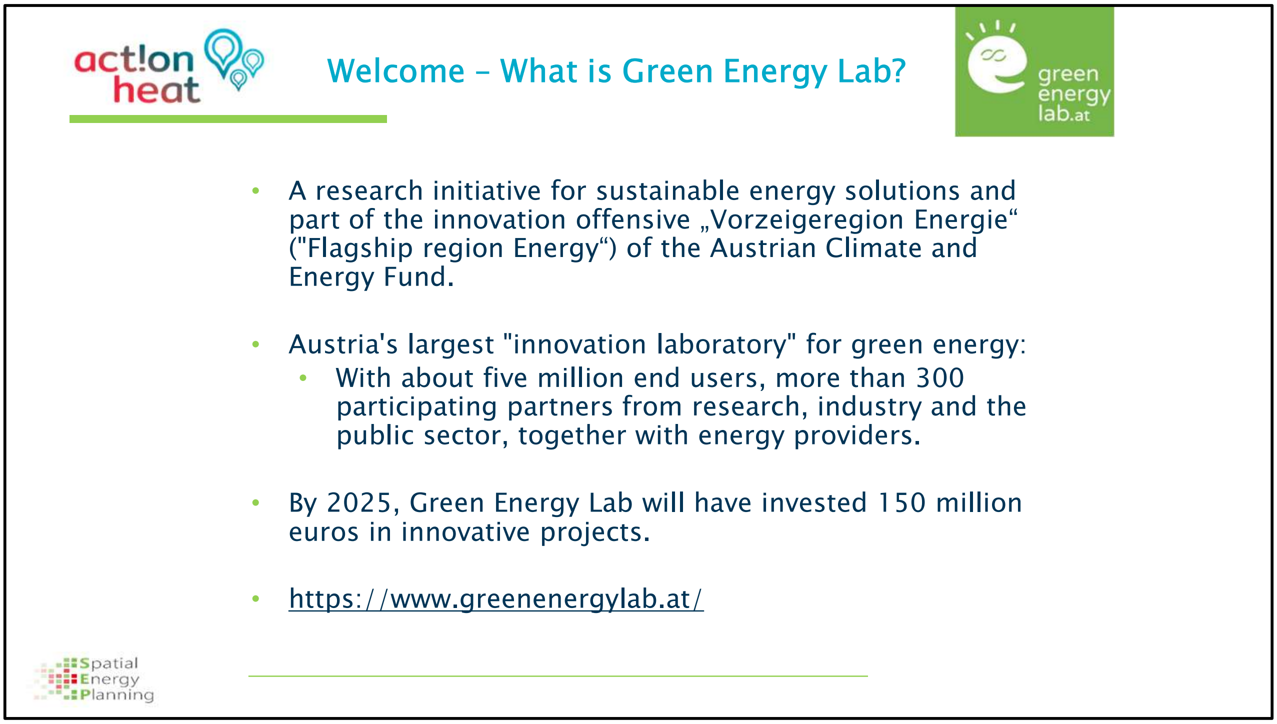
- Expected result of the project
- The use cases
- Expectations of the Stakeholders and steps to meet the expectations

Overview of the steps:

- Data model and DMP
- Harmonization of the data and methodology
- Plausibility check
- GDPR aspects
- Validation process

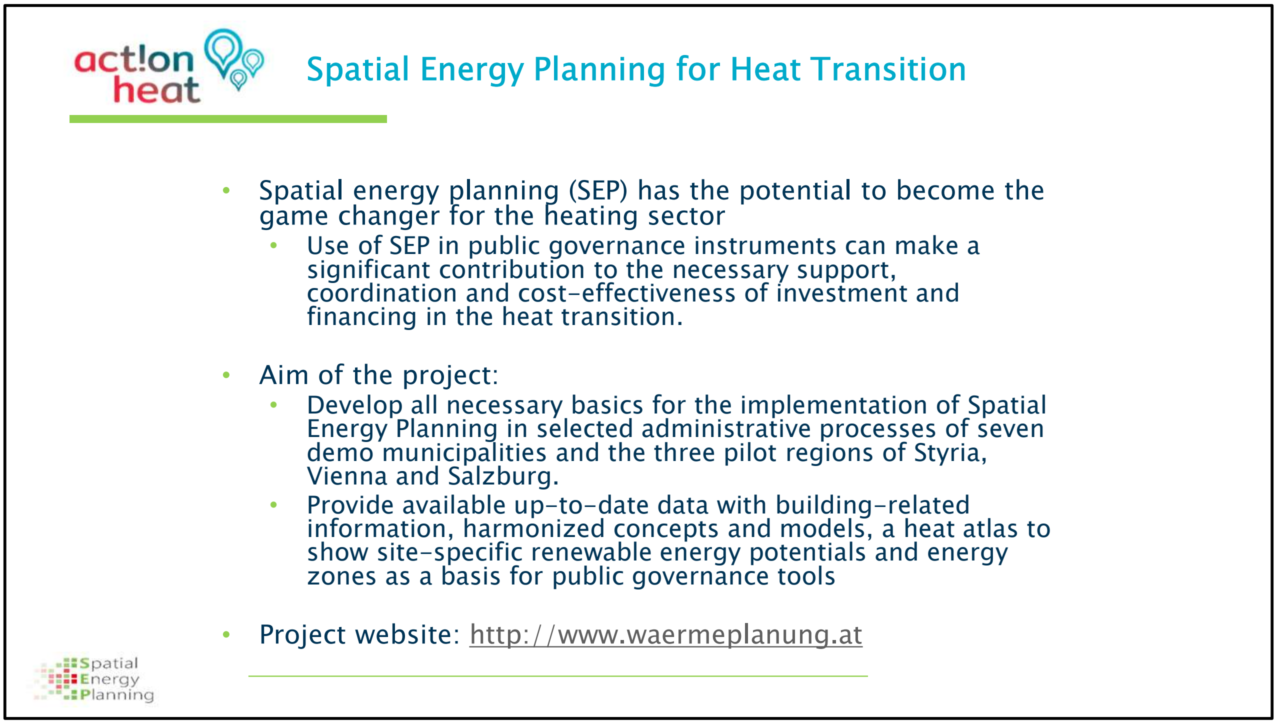
Exemplary project results

- Heat atlas
- Automatic reports



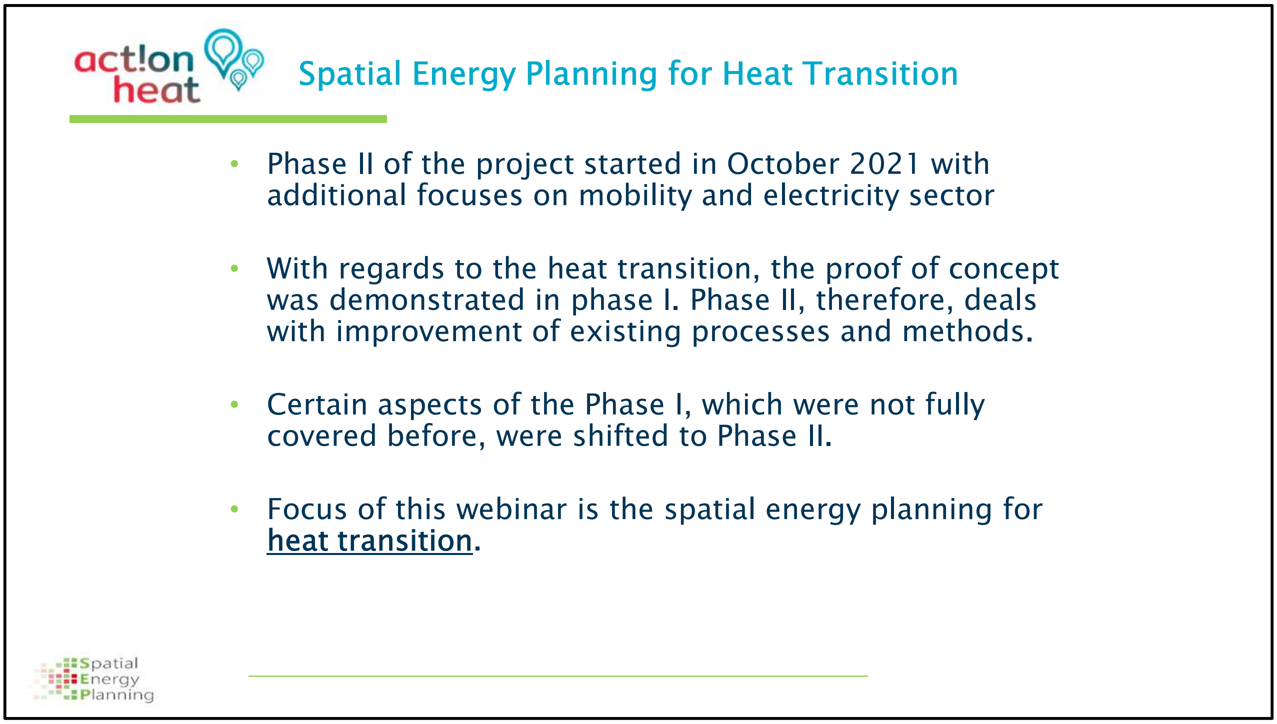
Green Energy Lab: Spatial Energy Planning (GEL-SEP)

- What is Green Energy Lab:
  - A research initiative for sustainable energy solutions and part of the innovation offensive „Vorzeigeregion Energie“ ("Flagship region Energy“) of the Austrian Climate and Energy Fund.
  - Austria's largest "innovation laboratory" for green energy:
    - With about five million end users, more than 300 participating partners from research, industry and the public sector, together with energy providers.
  - By 2025, Green Energy Lab will have invested 150 million euros in innovative projects.



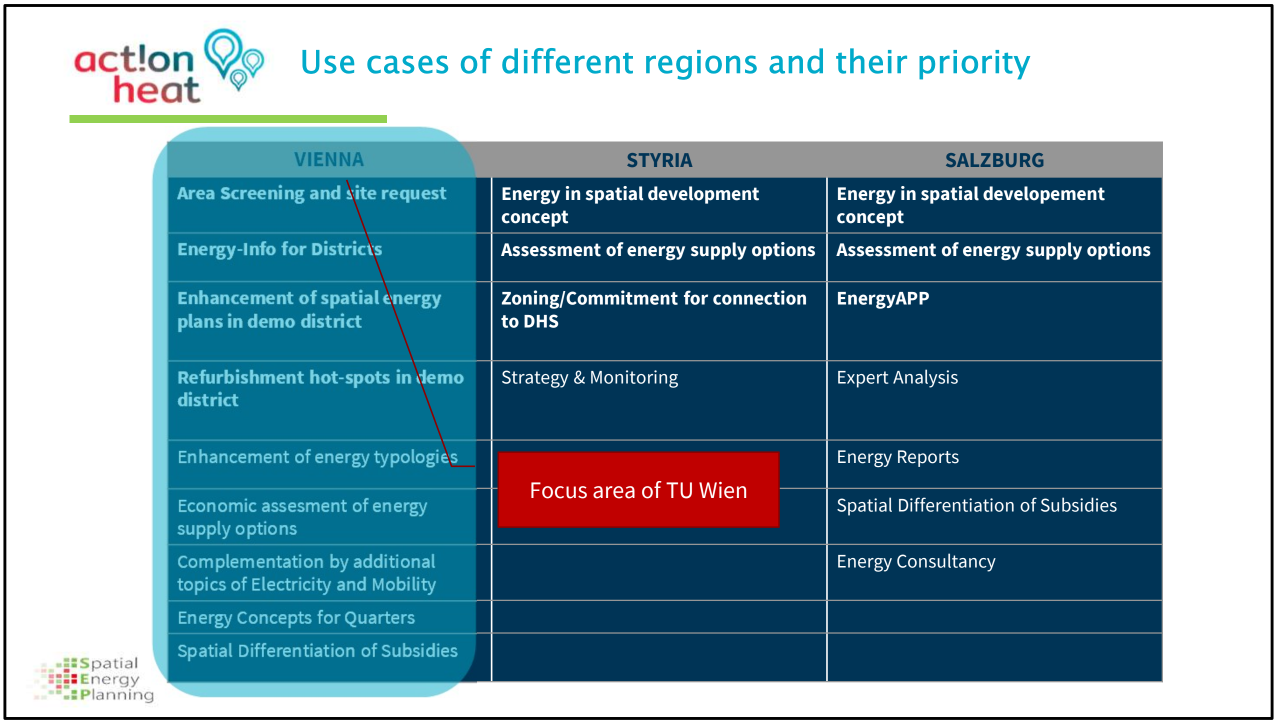
Spatial Energy Planning for Heat Transition

Besides the content of the slide, further information can be extracted from the project website: http://www.waermeplanung.at



The project started in 2018

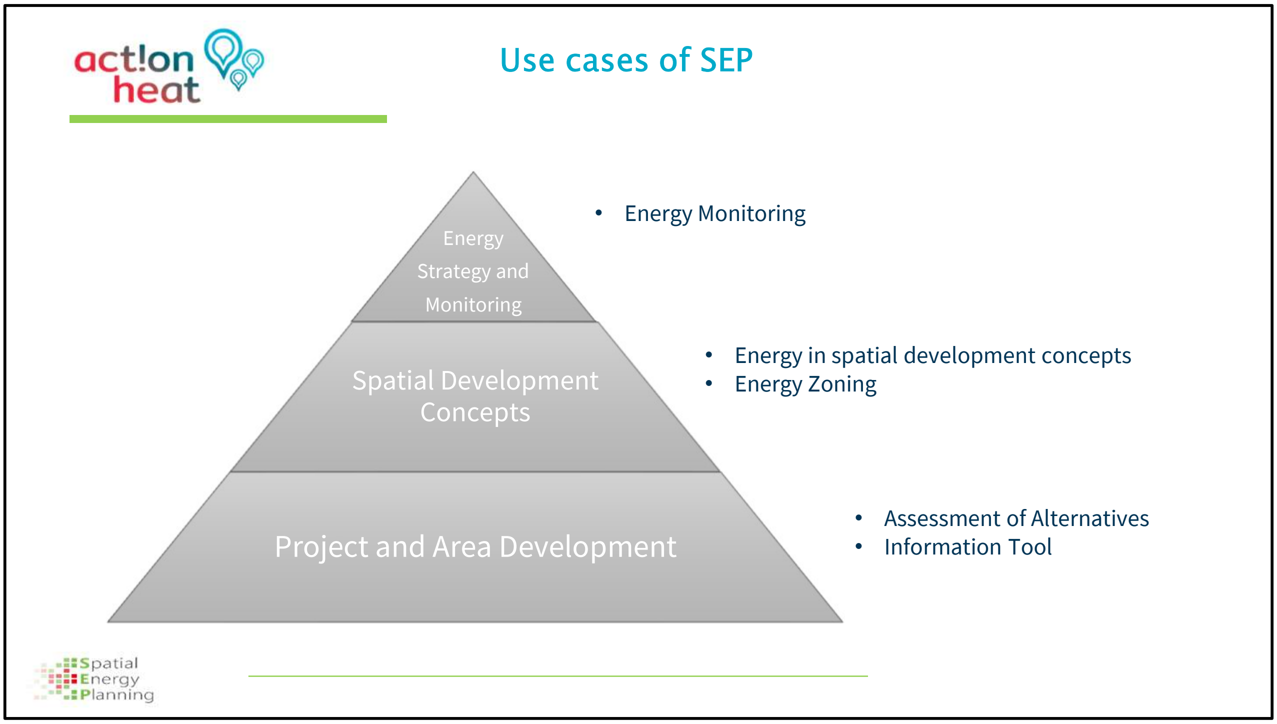
- The project started in 2018 and currently is run in its second phase.
- First phase of the project dealt with heat transition and partially is followed in the second phase.
- Focus of this webinar is the heat transition part.



VIENNA	STYRIA	SALZBURG
Area Screening and site request	Energy in spatial development concept	Energy in spatial developement concept
Energy-Info for Districts	Assessment of energy supply options	Assessment of energy supply options
Enhancement of spatial energy plans in demo district	Zoning/Commitment for connection to DHS	EnergyAPP
Refurbishment hot-spots in demo district	Strategy & Monitoring	Expert Analysis
Enhancement of energy typologies		Energy Reports
Economic assesment of energy supply options		Spatial Differentiation of Subsidies
Complementation by additional topics of Electricity and Mobility		Energy Consultancy
Energy Concepts for Quarters		
Spatial Differentiation of Subsidies		

Users of the project

- Public authorities were the focus group of the study.
- TU Wien was in charge of the authorities of Vienna.
- The table shows the user needs and expectations from the project.



Pyramid of SEP user cases

The pyramid shows the importance and priorities in SEP.

Energy Strategy and Monitoring:

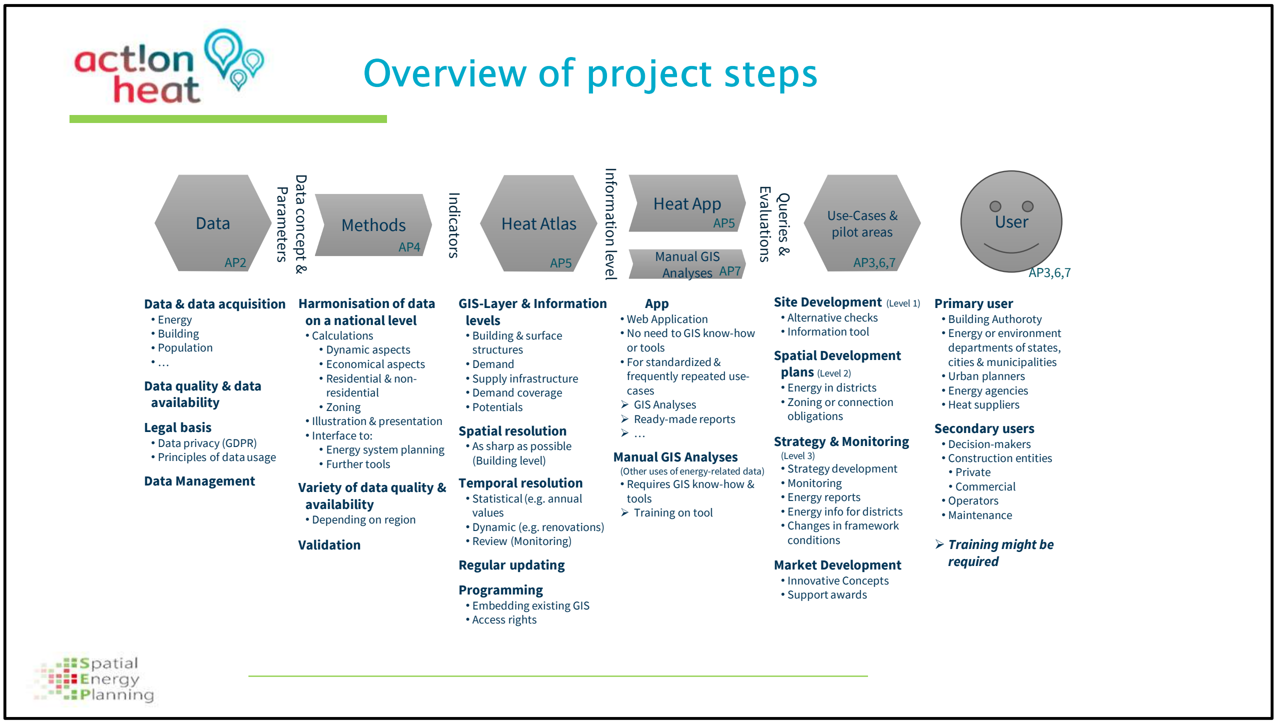
- Analyze the status of Heating and Cooling demand in an area and what the plans are there.

Spatial Development and concepts:

- Discover which areas could be relevant for district heating and if it is possible to define district heating zones.

Project and Area Development:

- Provide information to assist or give alternatives to the stakeholders.



To answer the use cases questions:

Several steps were developed, starting with data and ending with user needs.

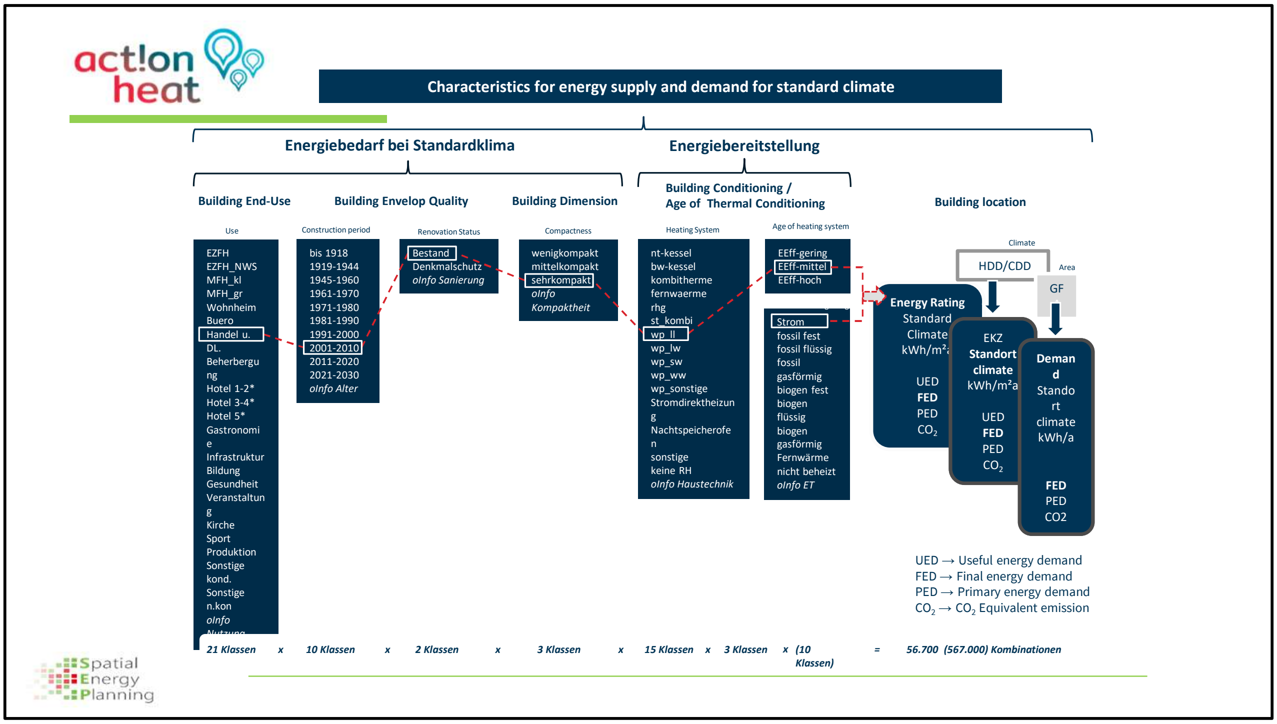
- Data: All relevant information for the state‘s Energy Planning.
  Different resolutions and formats, legal parameters to use them, and data quality was understood and compere to know how to update and join together.

- Methodology: Develop a methodology to use the data for the user‘s interest. Considering different background data in different states, the method should harmonize data. To use the data, the method should provide also a harmonized outputs.

- Heat Atlas: The data were ordered and visualized for the users.
  Different data were shown for different uses in different forms. Different accessibility levels can be defined.

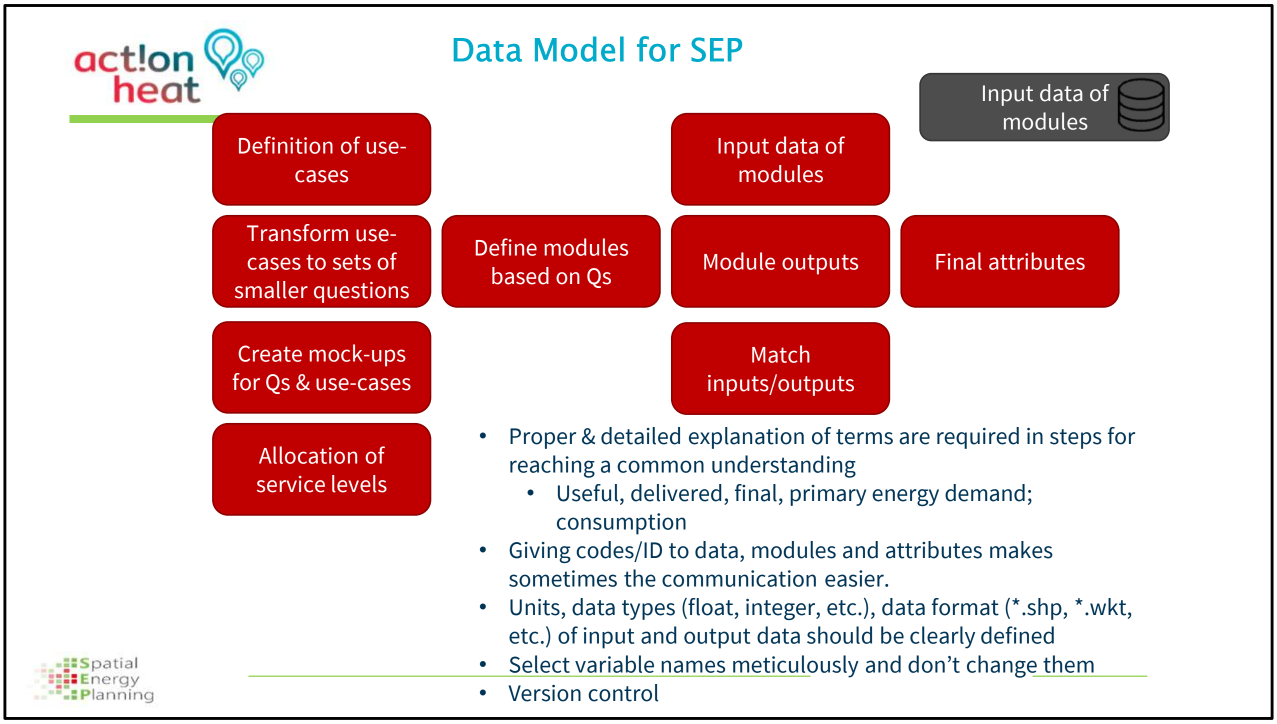
- Heat App: Application to generate standard reports.

- Use cases and users: can be defined for different parts and functionalities in Heat Atlas and Heat App.



How to know the energy demand?

Wide range of data sets needs to be combined to come up with the estimation of heat demand in a building.



Data model to answer the user needs and cover use-cases

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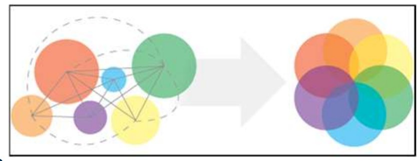
Harmonization



- Data are not available uniformly every where.
- Some regions may also have additional data sets
- Outputs might be expected on different levels (point/polygon)
- Harmonization of methods
    - *Similar calculation approach for diverse aspects*
        - Heat demand and heat density
        - RES potentials
        - Grid infrastructure
        - Dynamic aspects, Zoning und Economics
    - *Possible usage of similar data sets on a national level*
        - Adaptation of methodologies based on the use-cases in each state
    - *Gathering ideas on methods from experts*
- Harmonisation of illustrations
    - *Similar units, intervals and colours*
    - *Comparison of GIS Systems in each state and possibility for harmonising outputs for them.*

Spatial Energy Planning

Importance of the harmonization of results

It is necessary to harmonize the input/output data, approach, and results presentation.

This will bring interoperability and common understanding of the outcomes.

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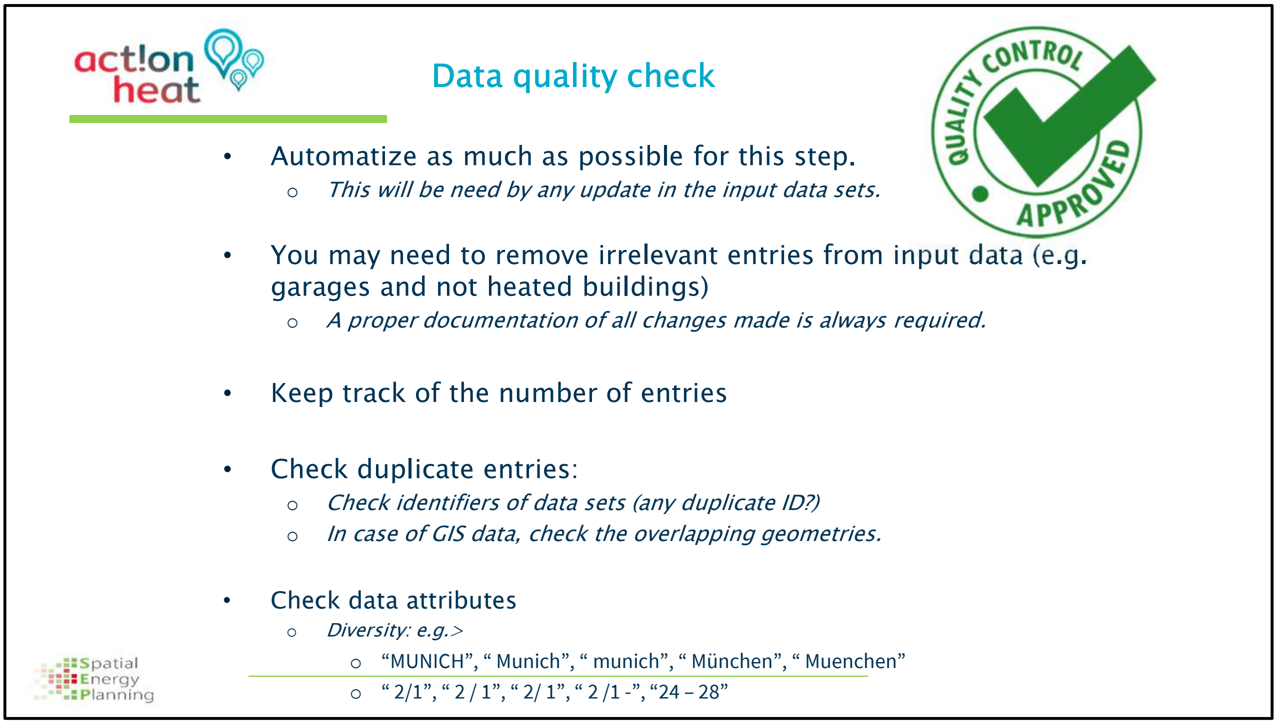
Data Management

- A data management plan would help to structure the whole data processes.
    - *Data inventory:*
        - Where to save all data?
        - Metadata (Data package)
    - *Naming conventions:*
        - How to name the files in the database so that they can be easily findable?
    - *Data Formats*
    - *Spatial and temporal resolutions*
    - *License*

Credit: Image: WrightStudio - stock.adobe.com

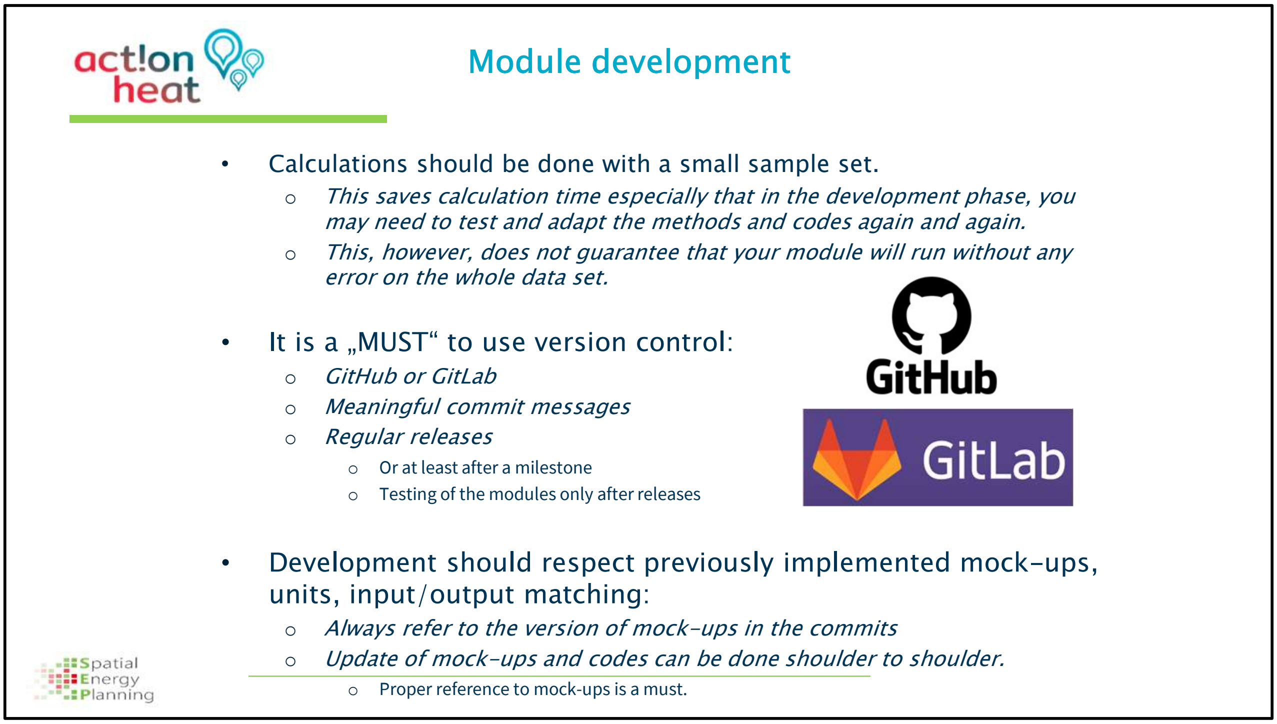
Spatial
Energy
Planning

Data management plan contributes in structuring the data processing and can help to save available resources.



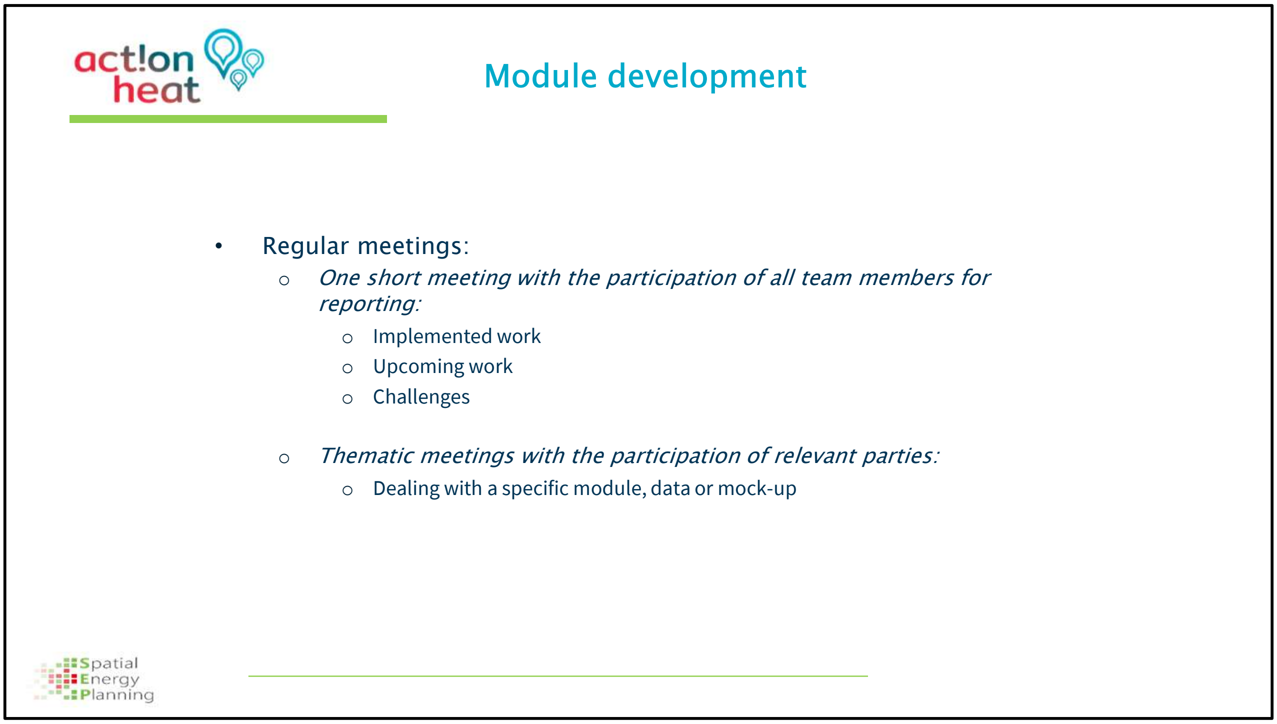
Garbage in -> Garbate out

Not only the methodology and output results should be proofed, but, more importantly, the input data has to be checked for any possible mistakes.



Good practice for developing modules:

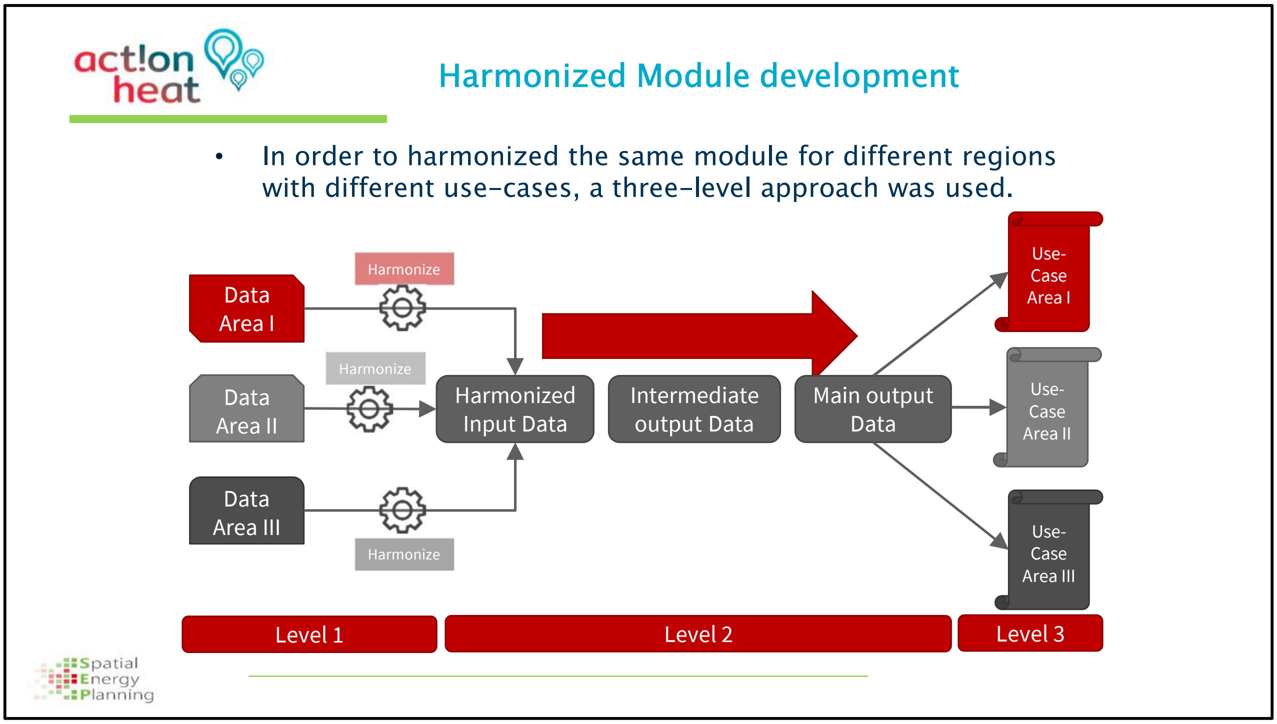
- Run your module on a small sample set of data to check the functionalities and once smaller errors were resolved, apply the tool to a larger data set.
- Version controlling in tool development is a must. Provide regular releases as you advance.
- Mock-ups helps to bring everyone to the same level of understanding.



Common understanding

Necessary for the module development phase:

- Regular group meeting update
- Discussion about problems in meetings
- Understanding other approaches
- Specific topics/problems can be addressed bilaterally in smaller round of people

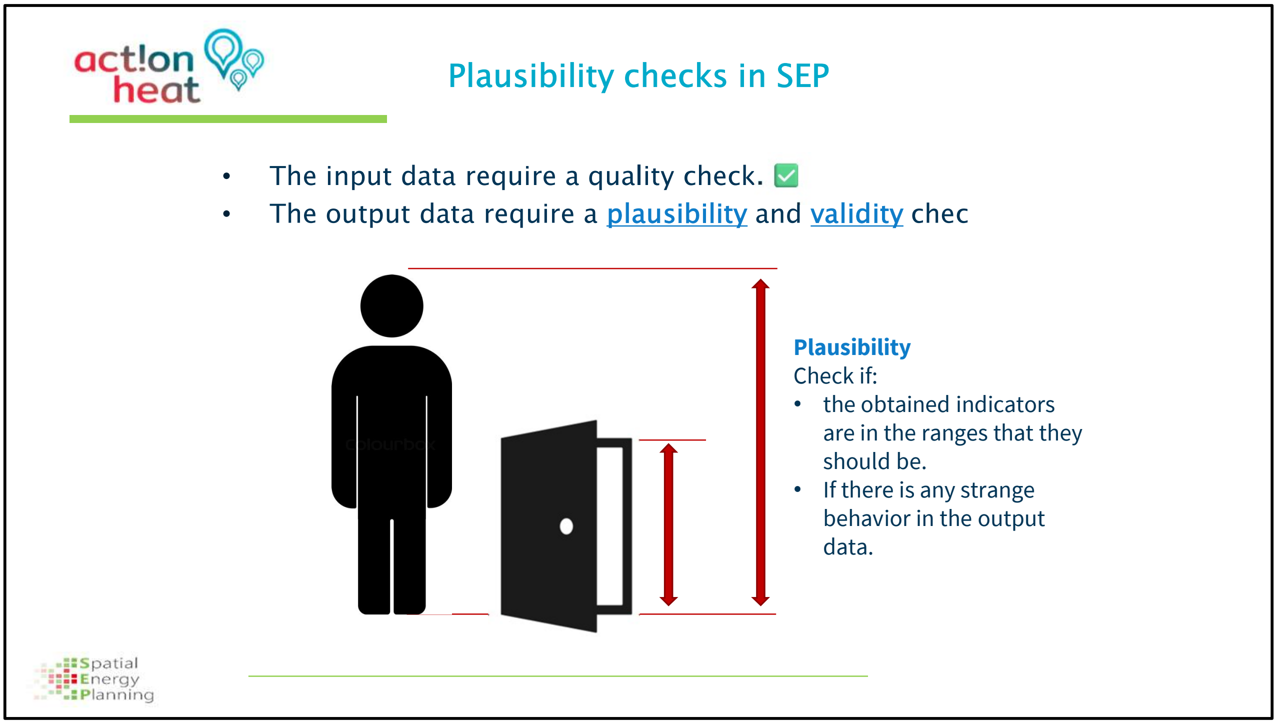


Harmonization of the module development

Level 1
Generate harmonized data out of different data sets.

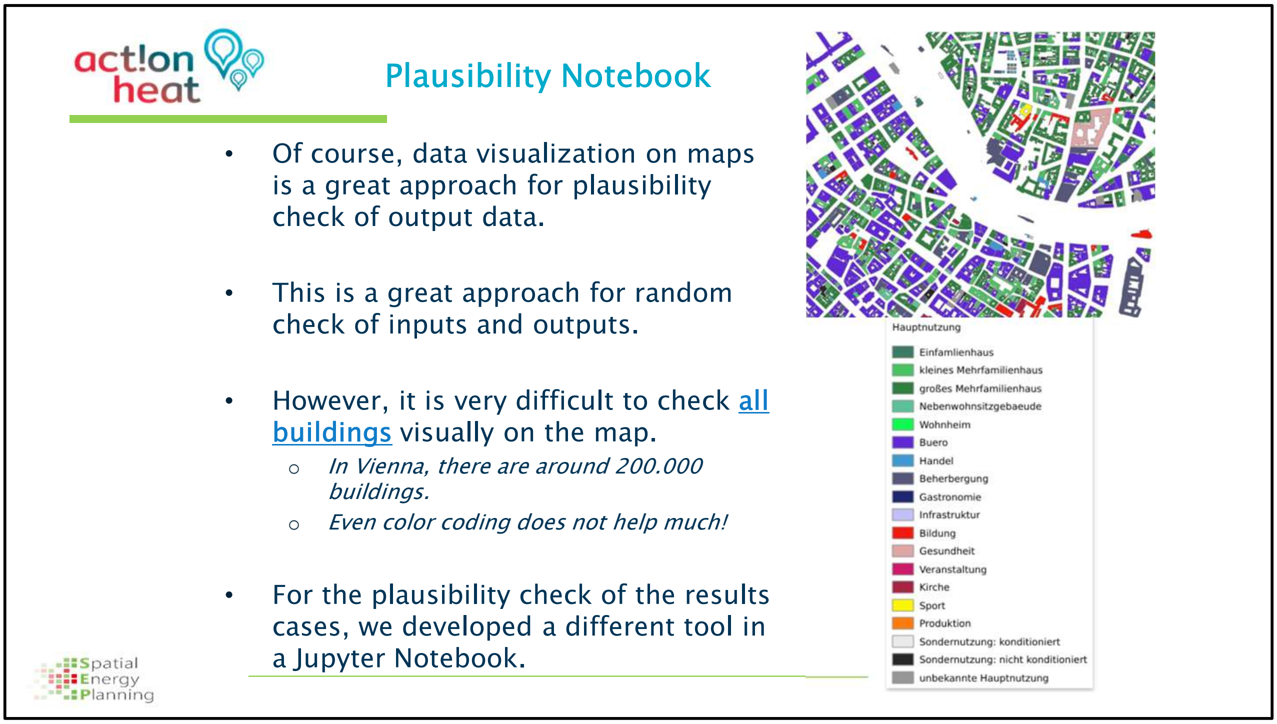
Level 2
Apply same methodology on the data

Level 3
Address the use-cases in the outputs



Plausibility checks

Before validating the outputs, they should be checked for plausibility.

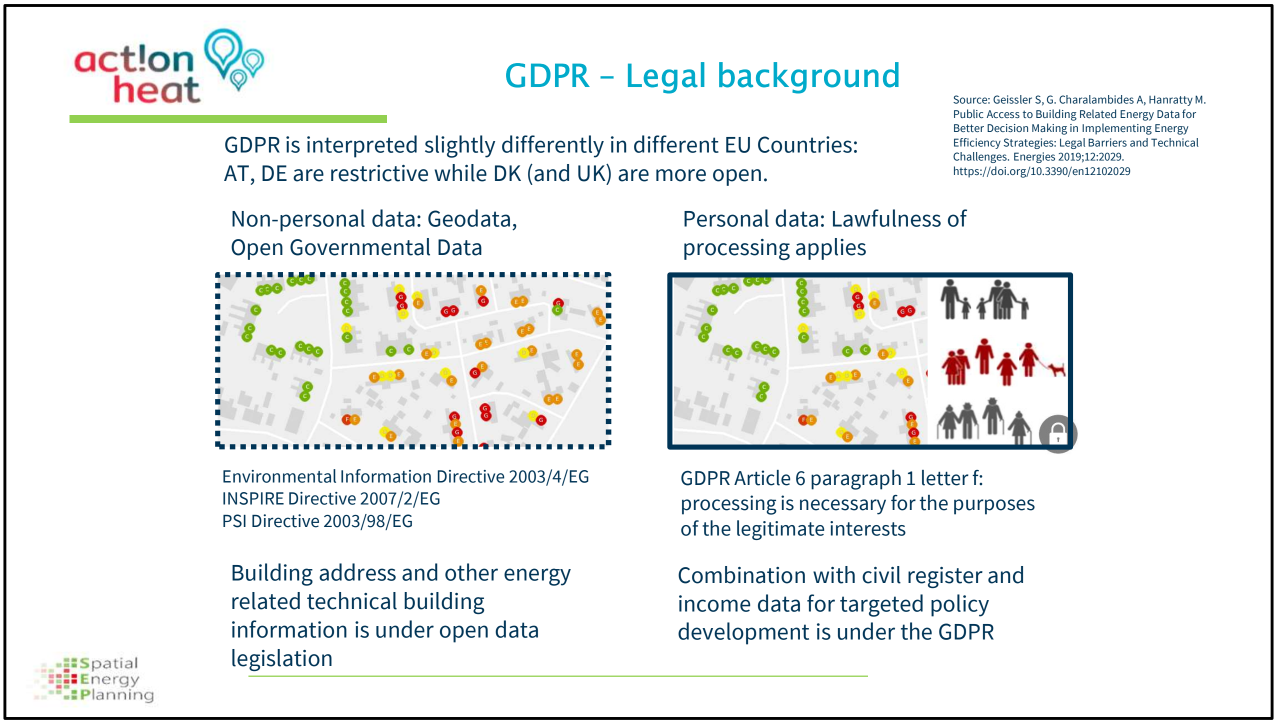


Approach to visualize data

TU Wien developed a tool to generate graphics dynamically.

This was implemented in a Jupyter Notebook.

Thanks to the dynamic development approach, the notebook could be kept brief, but still very rich.



GDPR

The interpretation of the General Data Protection Regulation GDPR differs in European countries.

- Some are more restrictive, like Austria
- Some more open, like Denmark

Building-related information is not part of GDPR; when combined with other data, it is considered protected data. Nevertheless, it can still be used in some instances.

GDPR Aspects

Source: Geissler S, G. Charalambides A, Hanratty M. Public Access to Building Related Energy Data for Better Decision Making in Implementing Energy Efficiency Strategies: Legal Barriers and Technical Challenges. Energies 2019;12:2029. https://doi.org/10.3390/en12102029

- Questions:
  - *When is a data under the GDPR?*
  - *If a data is under GDPR, which of the conditions for legal data processing applies?*

- The principles of data protection should apply to any information concerning an **identified or identifiable natural person**
- The principles of data protection should therefore **not apply to anonymous information**, namely information which does not relate to an identified or identifiable natural person or to personal data rendered anonymous in such a manner that the data subject is
- An **identifiable natural person** is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological of that natural person.
- **range of interpretation regarding "identifiable"** interpretation
- Address of the building is linked with the building → geodata
- Registered address of a person in the civil register → personal data
- → building related EPC data are open data

Spatial Energy Planning

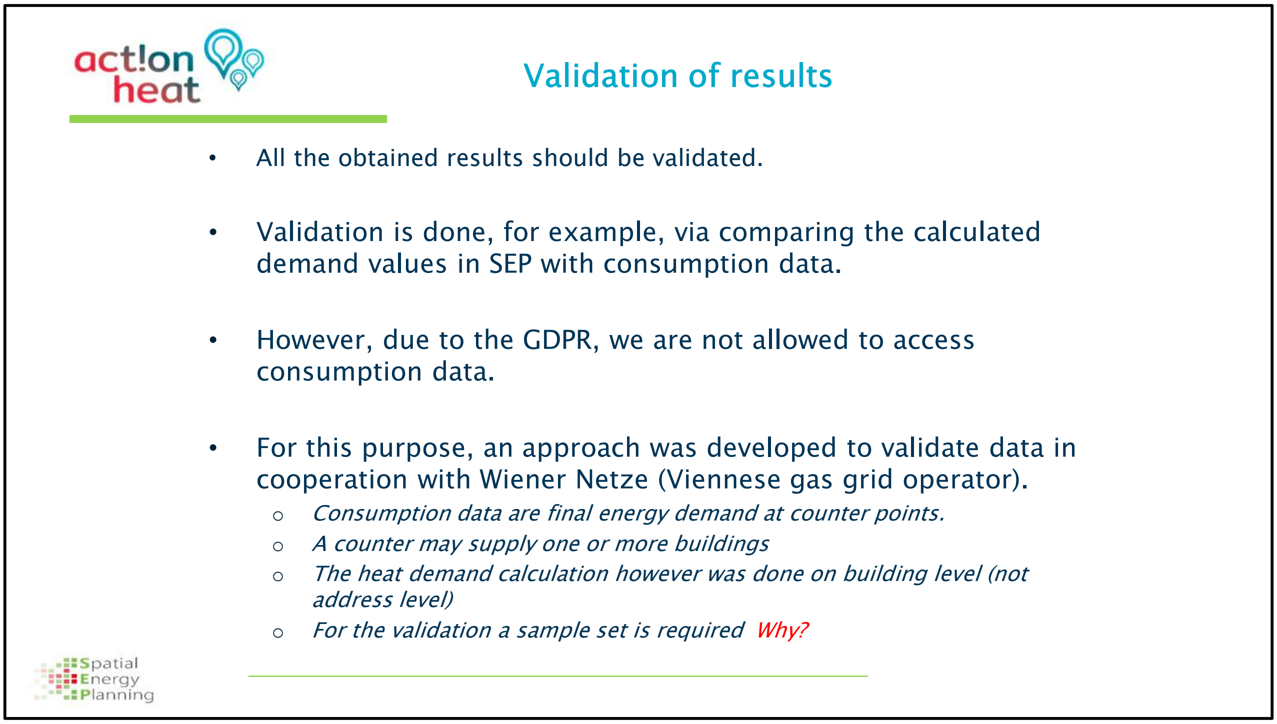
GDPR Aspects

In general:

- GDPR does not apply to the building data.

In particular:

- Each country has interpretation parameters for personal data.
- If you have personal identifiable data, then this data is protected.



Validation of results

Following the plausibility checks, the outputs should be validated as well.

In Austria, heat supplier companies do not provide consumption data of their customers due to the GDPR.

In such cases, alternative, less-accurate approaches needs to be developed.

Validation of results

	Count	Share
Total entries	231.552	100%
filtered out buildings	157.472	68%
After cleaning	74.080	32%
with mixed use	15.416	6%
with single use	58.664	25,3%

- To compare the demand data from SEP with the consumption data of Wiener Netze, we should prepare a sample that:
  - *Composed of buildings that are solely supplied with natural gas.*
  - *Make sure that those buildings have only a single use type (e.g. only residential or only commercial; but not combined)*
- The building data set was cleaned to keep only relevant data:
  - *Footprint > 50 m2*
  - *Heated gross floor area > 50 m2*
  - *Nr. Of floors < 65*
  - *No missing information for:*
    - Construction period,
    - Main use
    - No “NaN” values.

Validation of results

For the validation of data, constructive cooperation with all relevant parties, especially the energy suppliers and grid operators is necessary.

In this slide and the next few ones, the steps for the validation of results of SEP tools are presented.

In this process, the Wiener Netze, the gas grid operator in Vienna, was involved.

Validation of results – Classification

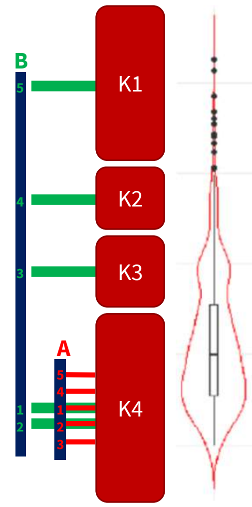
PARAMETER FOR CLASSIFICATION	UNIQUE CASES
CONSTRUCTION PERIOD	10
USE	14
RENOVATION STATUS	3
FOOTPRINT	5
COMBINATIONS	2100

- The 2100 combinations are not existing the the data set.
  - *Only 76 combinations with more than 100 entries*
  - *Only 219 combinations with more than 10 entries*
  - *Only 318 combinations with more than 5 entries*
    - From which 26 combinations with just 5 entries

Validation of results – Classification

- Sample ID X:
  - Construction period CP1, Use type U1, Renovation status R1, Footprint F1
  - Use natural break algorithm for breaking the entries under ID X to 4 categories
  - Sample Set A:
    - Find the category with highest number of entries.
    - Selection of median and 4 of its immediate neighbours
  - Stichprobe Set B:
    - Selection of Median of each category
    - 2 entries from largest category

Sample ID X
(heated GFA - distribution)



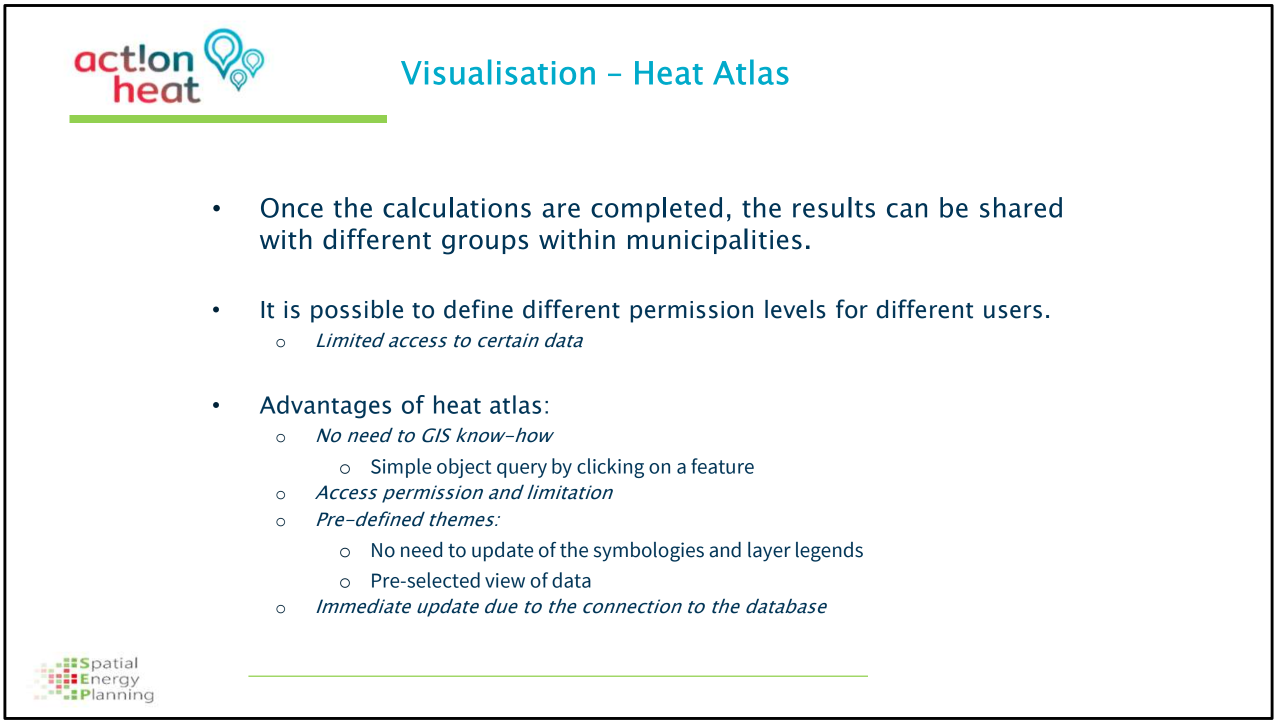
Validation of results – join and aggregate

- The selected entries of each class (building polygons) should join the gas counters (address points).
- Calibration on HDD is required afterwards.

Sample ID	Sample Set	Building ID	Wiener Netze Identifier	Demand [MWh]
1	A	BWID0	OLAVID0	D0
1	A	BWID1	OLAVID1	D1
1	A	BWID2	OLAVID2	D2
1	A	BWID3	OLAVID3	D3
1	A	BWID4	OLAVID4	D4
1	B	BWID5	OLAVID5	D5
1	B	BWID6	OLAVID6	D6
1	B	BWID7	OLAVID7	D7
1	B	BWID8	OLAVID8	D8
1	B	BWID9	OLAVID9	D9
...	...	...	...	...

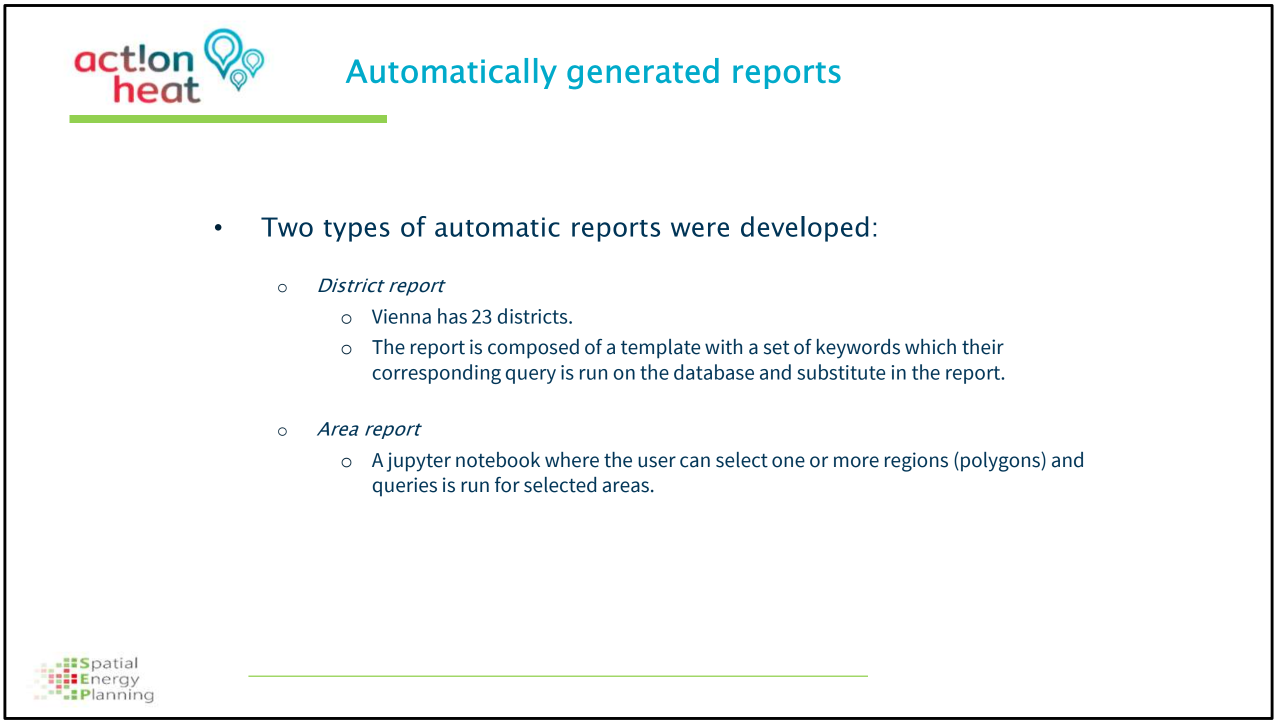
Sample ID	Sample Set	Agg. demand (SEP) [MWh]	Agg. Consumption (Wiener Netze) [MWh]						
			2015	2016	2017	2018	2019	2020	2021
1	A	X	X1	X2	X3	X4	X5	X6	X7
1	B	Y	Y1	Y2	Y3	Y4	Y5	Y6	Y7
...	...	...	...	...	...	...	...	...	...

Spatial Energy Planning



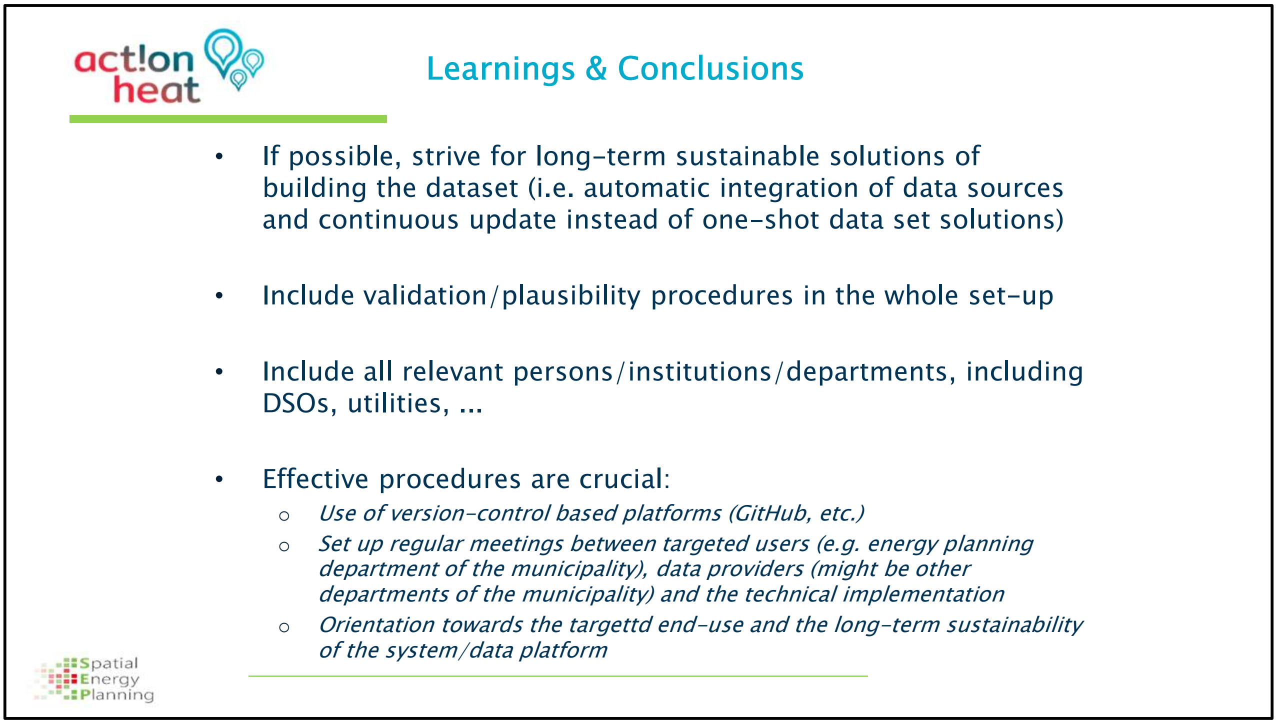
Heat Atlas as output

Once the calculations are completed, and all necessary plausibility and validity checks were finished, the results can be shared with different groups within municipalities



Automatically generated reports

The idea is that police makers can access the information to monitor different zones or areas without dealing with the knowledge of codes, data, or methodology.



Lessens learned from the SEP project

As stated in the slide.

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Thank you.

This project has received funding from the EU's Horizon 2020 programme under grant agreement no 101033706.

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