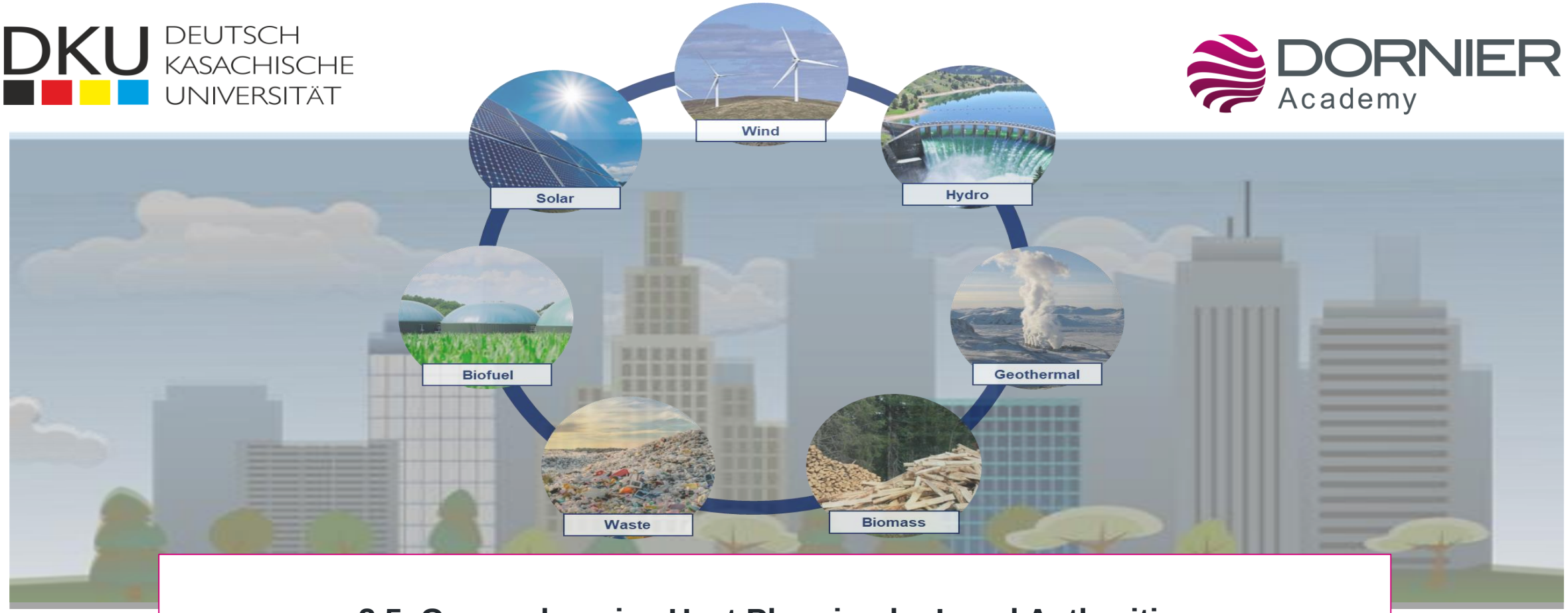


2.5. Comprehensive Heat Planning by Local Authorities

Dr. Ilka Lewington

Introduction

- Seminar "Integrated planning of heating systems by local executive bodies" completes the Module "Planning of thermal power systems"
- In the previous 4 workshops of this Module, planning and modeling issues were considered in all 3 segments of the thermal power sector:
  - public district heating systems
  - local district heating systems
  - individual heating systems
- The main goal of this seminar is to start preparing representatives of local executive authorities and specialists from the thermal power sector for the upcoming planning tasks.

- Introduction
- International experience ofmunicipal planing of heating systems
- Concept of heat sector planning proposed in the draft Law „On Heating“

Introduction

- International donor organizations have highlighted the high importance of municipal – i.e. local, local – heat supply planning
- When financing activities by donors, the developed municipal Heat Supply Development Plan is the main criterion
- Municipal heat supply planning is a necessary tool for optimizing all heat supply systems in the area, providing high quality heat supply at the lowest total cost, taking into account environmental goals.
- Issues to be resolved through planning
  - Whether to leave heat networks in the existing configuration or transfer to local systems, or vice versa - to combine local
  - What measures to rehabilitate or modernize centralized systems are economically viable
  - What sources can be translated into alternative sources
  - Priority and contribution to energy efficiency improvement
  - What organizational models should be implemented
  - How will costs and prices evolve?

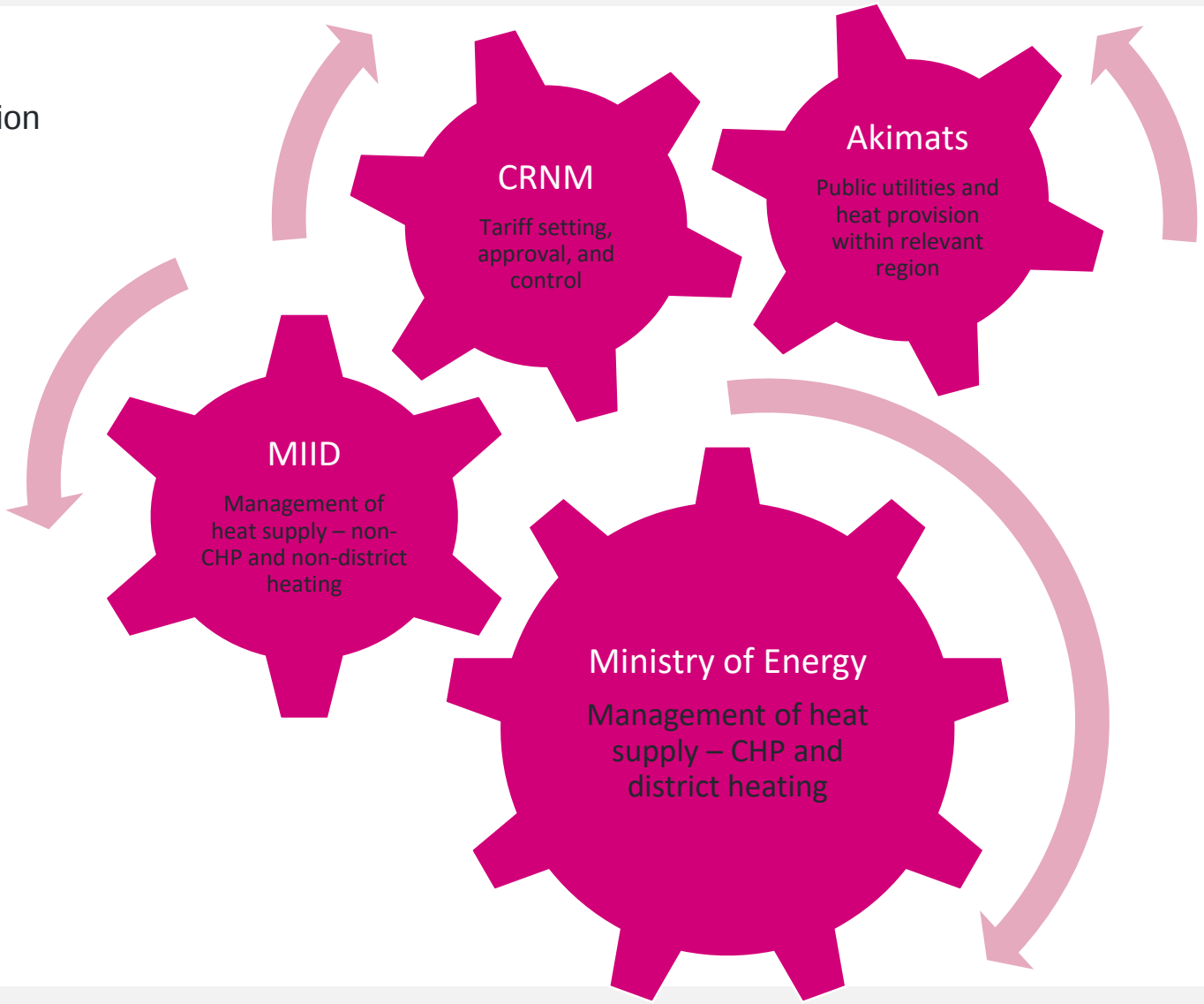
Introduction

- Separate planning of the thermal power sector is not mandatory - as a rule, the development plan for the thermal power sector is considered to be a section of the master plan for the development of the territory
- Heat supply schemes for settlements are developed by design organizations by order of interested organizations exclusively for public district heating systems
- Local district heating systems are designed as part of the main facility (residential complexes, hospital complexes, schools, etc.) without taking into account the possibility of connecting other (external) consumers of thermal energy
- Individual heat supply systems are planned by the owners of these systems themselves and indirectly - as part of the gasification program for settlements
- Even in large cities (for example, in Shymkent, Ust-Kamenogorsk, Semey) there are no current plans for the development of heating

Meanwhile, as, for example, the “survey” during the training showed that the vast majority consider planning to be extremely important for thermal power engineering. Many of the problems from the “Problem Matrix” are rooted in the lack of comprehensive plans for the development of the heat sector

Introduction

Current situation



Investments $$$

International Experience

Central level planning

Central regulator with a national view of the whole sector
- However note: limited role of district central heating

Municipal level planning муниципалитетов

Local authorities with clear understanding of the local conditions and potentials

Hybrid form of planning

Municipal plans are developed on the basis of the central strategic plan/targets

International Experience

- Planning at three levels, with increasing specificity and commitment:
  - at the national level
  - regionally (14 counties)
  - at the municipal level (275 municipalities)
- A plan at any level must not conflict with a plan at a higher level.
- Municipalities have a very large autonomy in the planning and development of their thermal power systems.
- Heat system planning integrated into land use planning

Under the Planning Law, municipalities are required to develop 12-year integrated land use plans that include plans for the development of heating

- Planning on two levels :
  - At the national level and
  - At the municipal level
- The „National Heat Sector Development Program“, updated every 7 years, sets the directions for the municipal heating plans
- In addition to the directives set out in the “National Heat Development Programme”, municipal plans must ensure the implementation of the “National Energy Independence Strategy”
- The main goal of municipal plans is to meet the needs of local consumers of thermal energy at a minimum cost and without exceeding the permitted environmental impact limits.

- Heat sector planning happens
  - At the municopal level
- Based on the federal legislation prohibiting CO2 emissions from heating by 2050
- For some federal states, there is a legal obligation to develop and approve – and update annually – a “Municipal Heat Sector Development Plan”
- There is an Instruction or Methodology for the development of the Municipal Plan
- The main goal of municipal plans is to find the best way to transition to carbon neutral meeting the needs of local consumers of thermal energy at the lowest cost.

Detailed example – Germany
Land Baden-Württemberg

2021: The updated **„Climate Protection Law“** introduces the obligation to undertake comprehensiev heat sector planning for municipalities with more than 20 000 people, and recommends it for all others **§ 7c Municipal Heat Planning**

- Municipal heat supply planning is an important process for municipalities in achieving climate protection goals in the heat sector. With the help of municipal heat supply planning, municipalities are developing a strategy to achieve climate-neutral heat supply by 2040.
- Municipal heat supply plans must provide for the entire territory of the respective municipality:
  - a systematic and qualified study of the current demand or consumption of heat and the resulting greenhouse gas emissions, including information on existing building types and age classes of buildings, as well as on the current supply structure (inventory analysis),
  - Leverage the existing potential in the municipality to reduce heat demand through energy efficiency of buildings and for climate-neutral heat supply from renewable energy sources, as well as from waste heat and cogeneration (potential analysis)
  - a climate-neutral scenario for 2040 with interim targets for 2030 for the future development of heating demand and an integrated view of the supply mix planned for climate-neutral demand coverage. Based on this, the municipal heating plan develops possible action strategies and measures to improve energy efficiency and thus to reduce and meet the demand for heat energy in a climate-neutral way. **At least five measures** need to have a implementation period within five years after publication of the plan. The municipal heat supply plan is the basis for linking energy efficient building renovations with climate neutral heat supply within the municipality's strategic heat supply planning and forms the basis for implementation.

Detailed example – Germany
Land Baden-Württemberg

§ 7d Development of the Municipal Heat Supply Plan

- The first plan needs to be developed by 31 December 2023, and it needs to be updated at least once every 7 years.
- The plans must be published on the Internet and within three months after the completion of the preparation work, the following information, relating to the entire municipal area, must be entered into the electronic database of the Earth:
- current annual final energy demand for heat supply, broken down by energy source and sector,
- Estimated annual final energy demand for heat supply for 2030 and 2040, broken down by energy source and sector,
- useful end-energy potential for climate-neutral heat supply from renewable energy sources, as well as waste heat and combined heat and power generation.
- For the first four years, starting in 2020, urban districts and major district cities receive an annual one-time allocation of €12,000 plus 19 cents per inhabitant to fund development costs incurred. Starting in 2024, 3,000 euros plus 6 cents per inhabitant will be allocated annually.
- The competent regional council checks the conformity of the obligated municipalities with the requirements and may require the elimination of violations..

Detailed example – Germany
Land Baden-Württemberg

§ 7e Obligation to provide information

- To the extent necessary, municipalities have the right to collect existing data **from natural and legal persons**, this also applies to personal data. Data constituting commercial and business secrets must be marked as confidential upon transmission.

- **Energy companies** are obliged to provide municipalities, upon request, in **particular, information on meters or specific buildings** on the type, volume and location of energy or fuel consumption by buildings or groups of buildings, as well as electricity consumption for heating, ... **Public authorities,** as well as **authorized District chimney** sweeps are required to provide the municipalities, upon request, in particular with information on the type, fuel, rated heat output and age of the heat generating installations, as well as information on their operation, location and connection to the flue gas system and information necessary for compiling emission inventories

- **Commercial and industrial enterprises**, as well as the public sector, are obliged, upon request, to provide municipalities with **information on the volume of their final energy consumption, demand or consumption of thermal energy**, type of coverage of thermal energy demand, including the share of renewable energy and combined heat and power generation, as well as produced waste heat.

- To the extent necessary, municipalities have the right to process data existing in the municipal administration, such as, in particular, **the address of the building, the use of the building, living space or total floor area, number of storeys, source of energy for heat production and age of the building**; this also applies in so far as personal data is concerned and such data has been collected for other purposes. The state government has the right to determine by legislative order what other data may be collected and processed

- Personal data and data constituting commercial and official secrets collected by the municipality for the preparation of municipal heating plans may not be processed for purposes other than those for which they were collected.

Detailed example – Germany
Land Baden-Württemberg

- There are guidelines („Handlungsleitfaden Kommunale Wärmeplanung“)
- Many webianrs and trainings
- Guidelines include a template for ToR for a Consultant to help the municipality

KSG BW 2020

https://www.youtube.com/watch?v=0YNjgBC9998&t=51s

https://www.kea-bw.de/waermewende/wissensportal/klimaschutzgesetz-kommunale-waermeplanung

https://www.youtube.com/watch?v=MAMK6i16xJs

Detailed example – Germany
Land Baden-Württemberg

Step 1 : Sitation Analysis

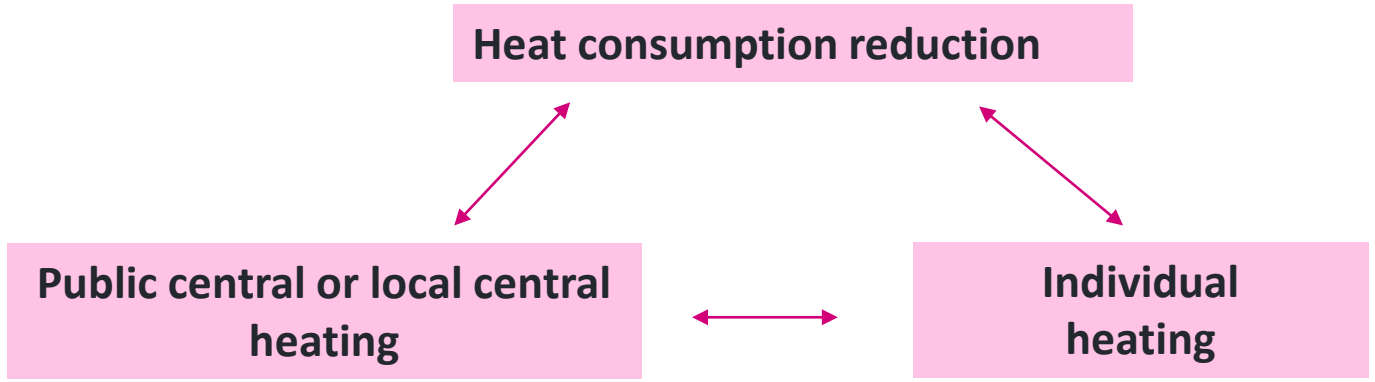
Step 2: Potential for CO2 neutral heating

Step 3: Determination of scenarios for heat consumption and supply

Step 4: Determination of heat supply zones

Step 5: Municipal Heat Sector Transformation Strategy and Action Plan

Implementation and link with other planning documents, such as land use plan etc.



Task: To determine the optimal combination of investments to reduce end consumption, losses, and determining the zones for public centralised, local centralised and individual heating, respectively.

Detailed example – Germany
Land Baden-Württemberg

Step 1: Situation analysis

- The entire territory within its administrative boundaries is considered. Perhaps the so-called. "planning by escort" for territories in the neighborhood.
- Initial information: existing maps, statistics of communal housing and business registrations, existing heating networks, sources
- A **balance of heat and emissions** is compiled by sectors (housing, industry, public sector, other business) and primary energy sources. There are different methods. The law gives the right to receive and use information.
- Balance data must be entered into a common database within a certain period and in a format.
- A heat consumption density map is drawn up.
- To protect personal data, aggregation must be in the context of at least 5 buildings.

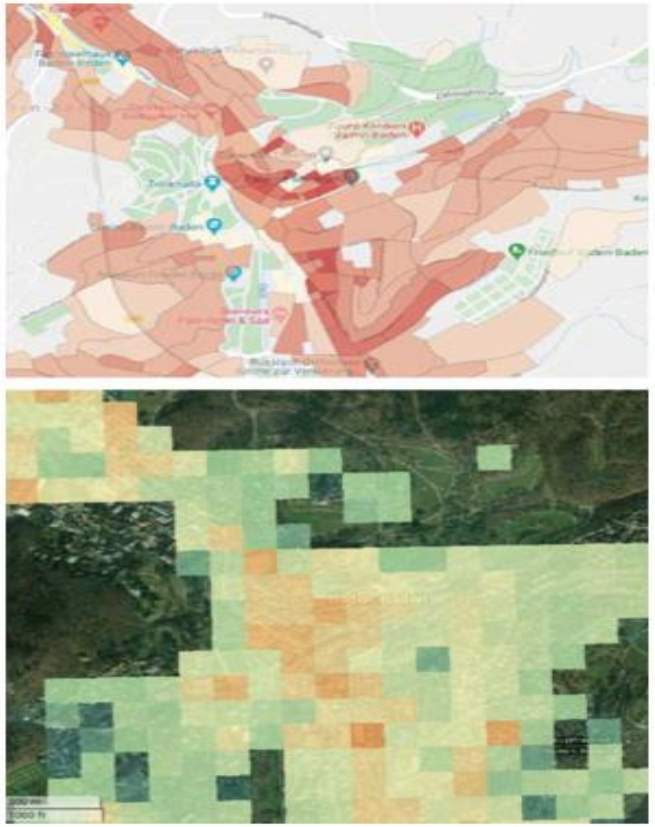


Abbildung 8: Beispiele für aggregierte Darstellung der Wärmebedarfsdichte auf Baublockebene (oben) und in einem 100x100 m Raster (unten). Quellen: Oben: Energieatlas BW, unten: Hotmaps.

Detailed example – Germany
Land Baden-Württemberg

Step 2: Potential analysis for CO2 neutral heat production

- Systematic consideration of the entire theoretical potential for the use of renewable sources and waste heat, namely
  - Biomass - many varieties
  - Geothermal - different technologies
  - Solar thermal - on the ground or rooftops
  - Ambient heat – industry, data centres, wastewater, waste
  - Electricity from RES

Indicator model

- Registration of the structure of the settlement and the exclusion of all undeveloped areas,
- Geothermal heat recovery capacity, taking into account exclusion zones, for example, zones for the protection of water and medical sources,
- Determination of the proportion of built-up area per plot,
- Exclusion of commercial and industrial zones,
- Selection of buildings built in the 60s and 70s, 90s and building areas,
- Identification of potential areas for the use of small geothermal energy in accordance with the priority of feasibility.

Detailed example – Germany
Land Baden-Württemberg

Step 3: Determining scenarios for production and supply of heat

Similar to the analysis of the current situation, a **target heat balance** for 2040 with an intermediate state for 2030 should be drawn up. This happens using several iterations.

- According to the "top down" method, it is possible to assume a decrease in consumption and an increase in the use of alternative sources - in the context of several scenarios.
- On this basis, a discussion is held with all interested parties and reconciliation with the bottom-up analysis.
- It is important to take into account the effect of the electricity sector

Assumptions about reduction of consumption through full thermal modernisation depending on building age and type

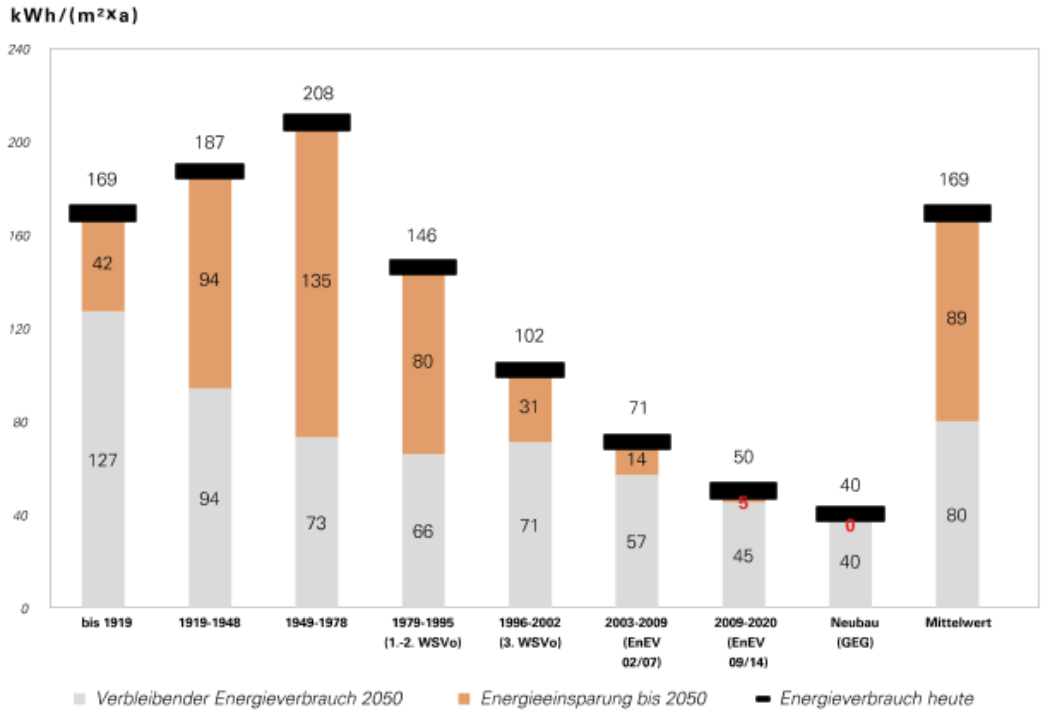


Abbildung 14: Flächenbezogener Endenergieverbrauch nach Altersklassen für den Ist-Zustand (teilsaniert) und nach energetischer (Voll-)Sanierung bis 2050. Für Neubauten nach GEG (2020) wird keine Einsparung bis 2050 erwartet. Quelle: Verändert und erweitert nach BMWi, 2014.

Detailed example – Germany
Land Baden-Württemberg

Step 4: Determination of terrotorial zones for the respective heat sector segments

- The goal is to define the suitability zone of district heating
- Starting point: consumption density expected after consumption reduction by energy efficiency measures

WÄRMEDICHTE [MWh/ha×a]	EINSCHÄTZUNG DER EIGNUNG ZUR ERRICHTUNG VON WÄRMENETZEN
0 – 70	Нет технического потенциала
70 – 175	Рекоммендуется центр. теплоснабжение для новостроек
175 – 415	Рекоммендуется низкотемп. системы для существующих построек
415 – 1.050	Стандартная плотность для централизованного теплоснабжения
> 1.050	Очень высокая пригодность для централизованного теплоснабжения

- The situation is different in different localities. Consumption density is only one of the factors. The question of "forced connection"
- It is necessary to determine “with what to compare” - that is, an alternative
- It is necessary to conduct a technical and economic analysis of heating systems

Examples for public central heating priority zones depending on heat density thresholds 400 MWh/ha x a (top picture) or 600 MWh/ha x a (bottom picture)

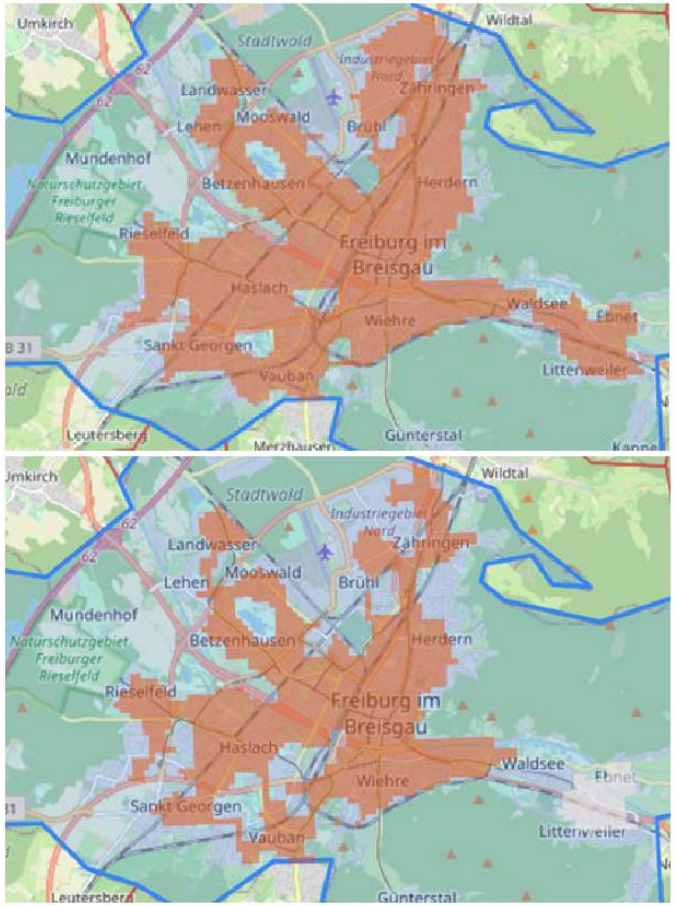


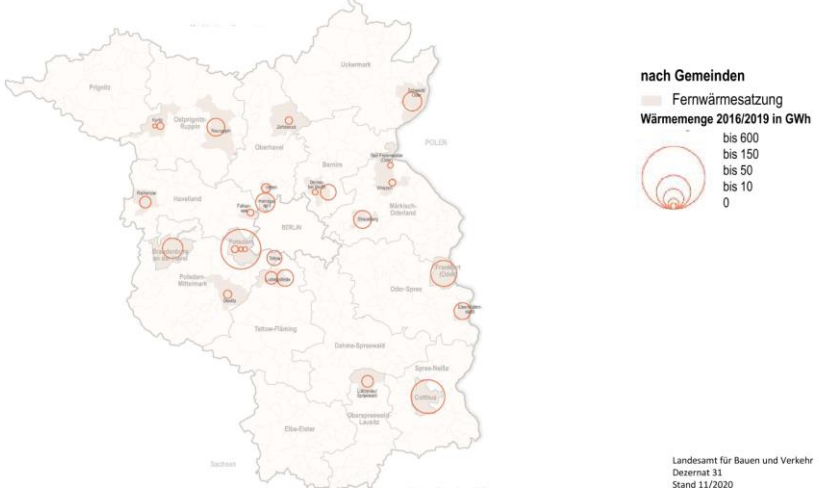
Abbildung 18: Beispiel 1) Großstadt: Vergleich der Ausdehnung von Wärmenetz-Eignungsgebieten bei Anwendung eines unteren Wärmedichte-Grenzwerts von 400 MWh/haxa (oben) und 600 MWh/haxa (unten). Blaue Linie: Gemarkungsgrenze.

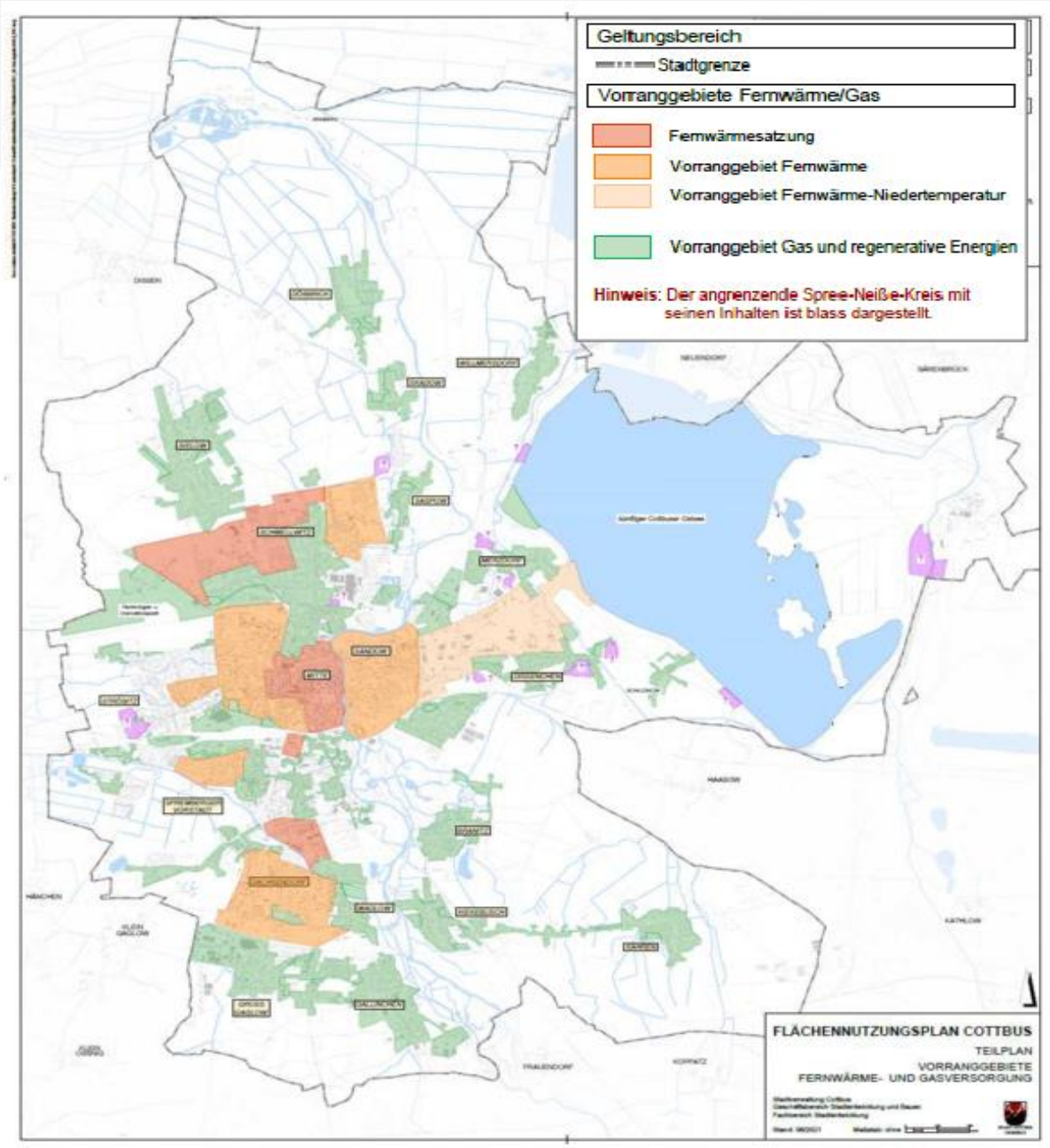
Detailed example – Germany
Land Baden-Württemberg

Step 4: Determination of zones: Variation „ Fernwärmesatzung“

- **«Fernwärmesatzung»** is a binding piece of local legislation which determines the public district heating zone within a municipality
- Within the zone «Fernwärmesatzung» it is not allowed to install or use other heating systems, except CO2 neutral ones
- This system is used extensively in East Germany. Lituania and some other transition countries also used a similar system for stopping the ad hoc process of disconnection of customers from the centralised heating system during the transformation period.

Towns with «Fernwärmesatzung» in the Land Brandenburg





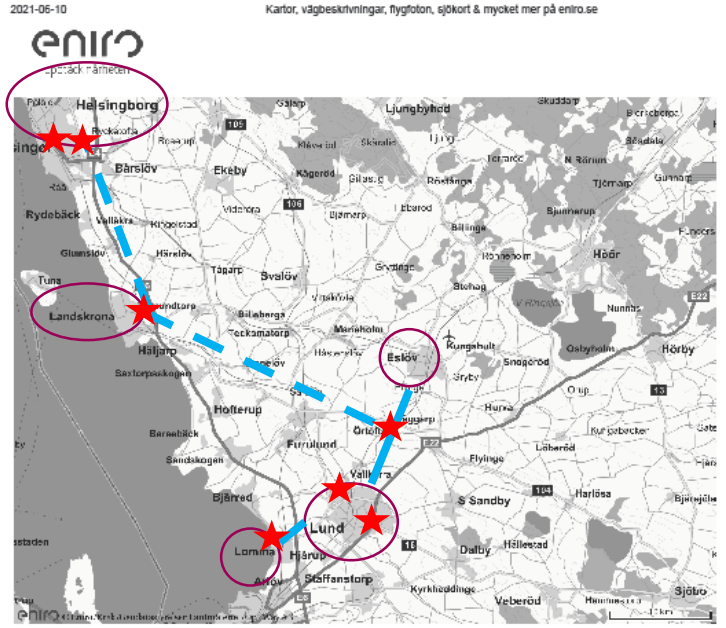
Detailed example – Germany
Land Baden-Württemberg

Step 4 : Determination of zones: Variation «Connected cities»

The approach of looking at the heating systems of several neighboring towns together is not yet very common in Germany, but the guidelines already refer to the process of Heat Planning in Konvoi (Wärmeplan im Konvoi)

In Sweden and Denmark, the approach is already common – see the example of the cities Lund, Eslöv and Lomma

- The integrated district heating system supplies 3 cities in southern Sweden (Eslöv, Lomma and Lund).
- Lund is located between Eslöv, 20 km. to the north, and the city of Lomma, 10 km. west.
- The system also has an import/export pipeline to two other cities (Landskrona and Helsingborg) about 25 and 40 km away.



★ Main heat plants

Connecting pipes within a complex system

Import-export pipes linking with other systems

Detailed example – Germany
Land Baden-Württemberg

Iteration – Step 3 and Step 4: Determination of scenarios for consumption and production-supply and refining of supply zones

- Potential of renewable energy sources
- Use of waste heat
- Land sites for renewable energy sources
- The requirement for the temperature level of heating networks
- Analysis of costs and estimated prices

It is necessary to clarify the initially rough division into suitability zones. Urban planning and energy companies are involved in this process.

Outcome of the planning process:

- Professional preliminary classification into districts for centralized and decentralized individual heating networks and individual heating
- Indicative description and quantification of the future supply structure for decentralized and district heating, broken down into sub-areas
- Reconciliation of the future supply structure with the existing potential of local renewable energy sources

Detailed example – Germany
Land Baden-Württemberg

Step 5: Municipal strategy for the Heat Sector Transition with Action Plan

- Clarification of the transition strategy from the current situation to the target in certain areas
- Designation of individual events
- Priority of activities
- Event funding
- Annual Plans

Maßnahmenempfehlung kommunale Wämeplanung

Priorität: **A**

Empfehlung 1

Kategorie: Kalte Wärmenetze

Erstellt am: 01.07.2020

Gebiets-ID: **1**

CO_2-Emissionen Status Quo: **396,38** t/a

Maßnahme a):

Nutzung industrieller Abwärme

CO_2-Emissionen Einsparung: **275,39** t/a

Beschreibung:

Zwei vorhanden Unternehmen zur Nutzung von industrieller Abwärme und Installation eines kalten Nahwärmenetzes. Vorhandene Industrie:

- Metall und Anlagenbearbeitung ...
- Mineral- und Betonlabor ...

Nächster Schritt:

1. Abfrage an Unternehmen nach Wärmeträger, Wärmeleistung, Wärmemenge, Abnehmer, Auskopplungsaufwand, Verfügbarkeit, Temperaturniveau
2. Wenn Abwärme verfügbar Kontakt zu potenziellem Wärmenetzbetreiber herstellen und über Maßnahme informieren

Andere Möglichkeiten:

Maßnahme b) Versorgung dezentrale EE

CO_2-Emissionen Einsparung: **176,95** t/a

Beschreibung:

Aufgrund der geringen Bebauungsdichte kann die Versorgung der Gebäude mit dezentralen Wärmepumpen erfolgen. Da es sich um ein Wasser-/Heilquellenschutzgebiet handelt wird die Verwendung von Erdwärmepumpen empfohlen.

Detailed example – Germany
Land Baden-Württemberg

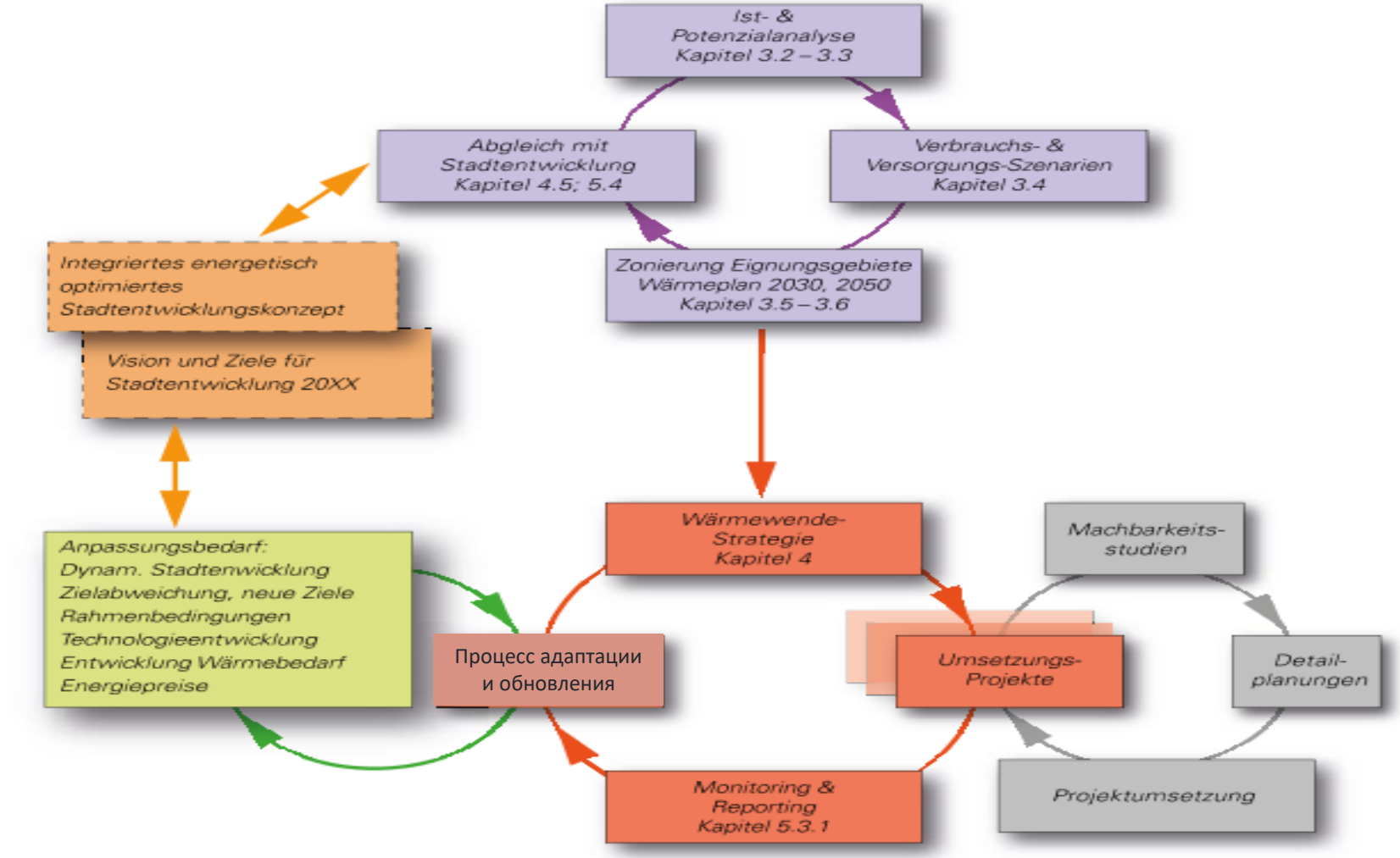


Abbildung 6: Übersicht über den Planungsprozess und die Prozessorganisation während der Erstellung und Fort-schreibung eines kommunalen Wärmeplans.

There is no straightness.

The steps must be repeated.

The plan becomes a dynamic and socially accepted strategic guideline for all stakeholders

Planning concepts within the Draft Law «On Heating»

- Thermal power industry functions and develops on the basis of documents of the strategic planning system of the Republic of Kazakhstan
- “The Government of the Republic of Kazakhstan is developing the main directions of the state policy in the field of thermal power engineering
- The **authorized body** determines the value of the **target strategic planned indicators** of heating sector **by territories**, including by sectors of production, transportation, supply and consumption of thermal energy
- The functioning and development of the heating sector of the territories is carried out on the basis of long-term (for a period of more than 5 years) and medium-term (for a period of 3 to 5 years) **master plans** for the development of heating sector, developed by local executive bodies and approved by local representative bodies of the respective territories
- The authorized body approves the rules for the development and approval of master plans for the development of the heating sector in **the territories**

??? Only the list of target indicators or a whole „National Programme of Heat Sector Development“

??? What kind of indicators and their hirarchy

??? What kind of territories?

The concept of the Masterplan

Master plan for the development of the heating sector - a document describing and substantiating a set of actions for the development of heating in the relevant territory in order to meet the long-term need for the provision of services for the provision of thermal energy, taking into account the characteristics of the relevant territory, developed and approved in accordance with the Law "On Heating";

Master plans for the development of the heating sector should:

- Take into account the actual state - measured by the actual values of key performance indicators achieved by the subjects
- Establish a set of measures to achieve the strategic goals brought to the territories, including through the optimal combination of various heat supply systems, taking into account the characteristics of the territory, while ensuring that the current and future demand for the service of providing thermal energy is met
- Establish planned values of key performance indicators of heat supply for heat sector entities;
- Prescribe optimal solutions, taking into account the requirements for ensuring reliability, safety of heat supply, minimal harmful impact on the environment, development of energy-saving and resource-saving technologies, expansion of the use of renewable energy sources, provision of financing and other factors, in accordance with the Law “On Heating” and other regulatory legal acts of the Republic of Kazakhstan.
- Determine methods for achieving strategic goals and key performance indicators, including through tariff regulation, financial support, determination of mandatory areas for the use of district heating, organizational measures - as the creation of a single heat and power company

Questions for discussion

- In Soviet times, very thorough and comprehensive planning of heat supply was carried out. Why hasn't this tradition been continued in the last 20 years?
- In the Republic of Kazakhstan, as well as in the Russian Federation, Belarus, Ukraine, there was and is the concept of "Heat supply scheme". In the Draft Law “On Heating”, planning at the level of territories uses the term “Master Plan”
  - to distinguish from the notion of "heat supply scheme" which traditionally focuses only on the centralized segment
  - to indicate that the approach is new and the scope is wider

  What do you think: is this new meaning conveyed?
- In Germany - also Sweden or Denmark - each Plan can have its own "look", modeling methods... diversity. Is it acceptable for RK? Or is it worth unifying the process "from above"?
- Difficulties in developing a master plan
  - lack of updated information
  - lack of qualified specialists
  - the need to collect information from various owners
  - different interests in the development and approval of the master plan (low tariffs and the need for development)

Survey

1. What should be the time horizon for Municipal Heating Plans?
   - 3-5 years
   - 5-7 years
   - More than 7 years
2. Is it necessary to enshrine the obligation to provide data for the Masterplan development in primary legislation?
   - Yes, it needs to be stated specifically in the Law «On Heating»
   - No, it is sufficient to provide an overall obligation to provide data
3. In Germany Municipalities are allowed 2 years to develop their first Heat Sector Development Plan. How much time should be allowed in RK?
   - 2 years
   - 1 year
   - 3 years
4. In Germany, the central (federal) budget gives the Municipalities a certain amount of funds to develop the plans. What should the approach be in Kazakhstan?
   - The funds should be provided to the Municipalities – and they then organise the work
   - Support for the development of the Plans should be procured centrally
   - Both schemes – the Municipalities can choose themselves
5. In the example of Germany, the whole process is oriented towards one single target indicator – to reach «0» in terms of CO2 emissions. Is this approach feasible in RK?
   - yes
   - No
   - Not now, but in 5 years time

Government

Setting social economic and ecological targets and being responsible for reaching them

The right of citicens to affordable heat supply
Targets for emissions
Which sector should contribute how much to the environmental aims
снижении выбросов

«The energy sector should decrease CO2 emissions by X %, of which in the heating sector Y%, while satisfying the heat needs of citizens and the economy»

Ministry of Energy

Ministry of Industry (ЖКХ)

Ministry of Environment

CRNM

Government

Setting social economic and ecological targets and being responsible for reaching them

The right of citicens to affordable heat supply
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«The energy sector should decrease CO2 emissions by X %, of which in the heating sector Y%, while satisfying the heat needs of citizens and the economy»

Ministry of Energy	Ministry of Industry (ЖКХ)	Ministry of Environment	CRNM
• Strategic targets for reducing emissions – distributed by akimats • Technical standards • KPI for heating companies • Heat market Rules • Targetted Programmes for the heat sector	• Building norms and standards • Target indicators for heat consumption • Rules for organising Ownwrs' Associations	• Environmental standards • Targets for emission reductions by sectors • Emission quota allocations • Metering standards	Tariff Methodology

«Akimat 1 needs to decrease emissions of CO2 in the heating sector by X % while satisfying the needs of citizens and economy and keeping to all technical norms and standards»

Akimat

Government

Setting social economic and ecological targets and being responsible for reaching them

The right of citicens to affordable heat supply
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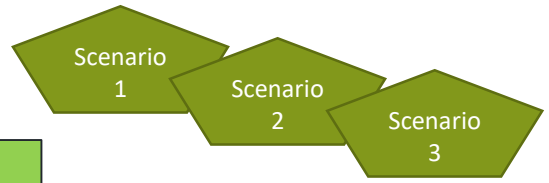
«Akimat 1 needs to decrease emissions of CO2 in the heating sector by X % while satisfying the needs of citizens and economy and keeping to all technical norms and standards»

Akimat

Masterplan for the development of the heating sector for the territory – Chosen scenario



Large CHPs

- Zones for public district heating
- Schemes for heat supply
- Financing: Tariffs, budget funds, other funds
- Support measures

«Heating companies, other heat generation sources and customers must fulfil key efficiency parameters while implementing the respective measures and ensuring the financing»

Heat companies

Other heat generators

Customers

Planning concepts within the Draft Law «On Heating»

Possible set of documents regulating the Masterplan obligations:

1. Law «On Heating». The Law introduces the term Masterplan, allocates the authority of state bodies for the development of Rules as well as responsibility for development and authority for approving the plans.

2. Rules for the development and approval of Masterplans for heat sector development Rules regulate the process of development and approval of Masterplans for development of heat sector in the regions and cities. Sets the required structure of indicators and targets.

3. Guidelines for the development of Masterplan. Guidelines for developing the documents, unifying the structure and approach for all relevant entities involved in the Masterplan process

Thank you for attention!

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