M9

Energy Planning

Source: StMUG et al. 2010

Content

Introduction

1. Introduction

1.1 Motivation for energy planning

Climate change

- Every region in Europe is affected by the impact of climate change, but each region in a different way (e.g. Northern Europe gets warmer, Southern Europe gets more arid).

Limited fossil energies

- About 80-90% of electricity generated by fossil energies (incl. nuclear power).
- Most energy is used in urban areas, for housing, mobility and economy
- Very high current dependency on non-renewable energies and their imports

1. Introduction

1.2 Goals of energy planning

Energy saving and efficiency

Expansion of renewable energy systems

Sustainable energy supply

Rapid implementation of energy transitions

Reduced dependence on fossil energy

Renewable energies as stimulus for local economy and employment

2. Procedure of energy planning

2.1 Urban planning: who are the stakeholders?

Energy planning is a cross sectoral task and involves a variety of different professional capabilities:

- Energy sector
- Environment issues
- City building and urban planners
- Architecture
- Logistics

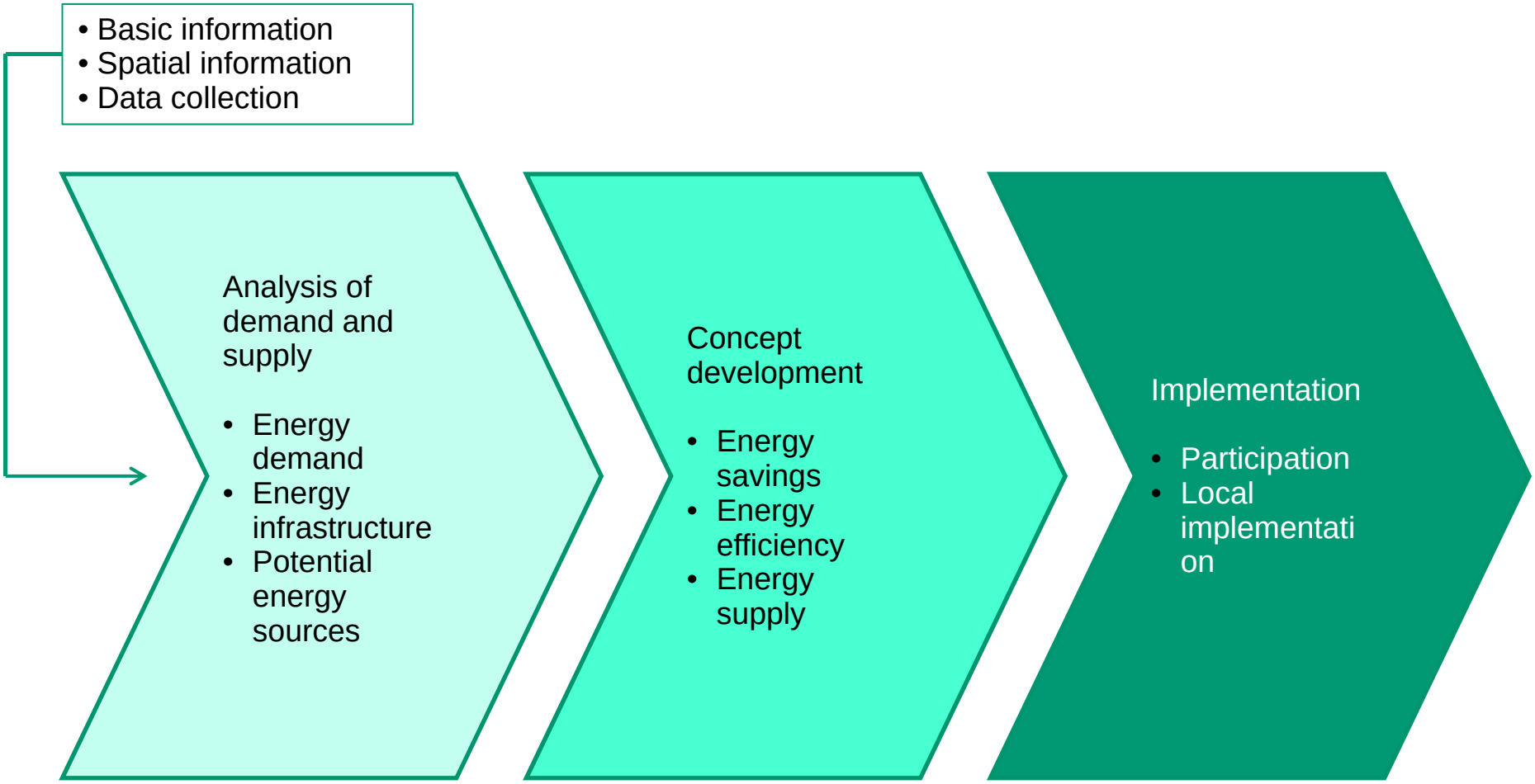
Energy planning comprises many elements:

- Planning
- Coordination
- Analyzing
- Process management
- Consulting
- Law issues
- Education
- Engineering

Procedures for Energy Planning

2. Procedures for energy planning

2.2 Stages of energy planning

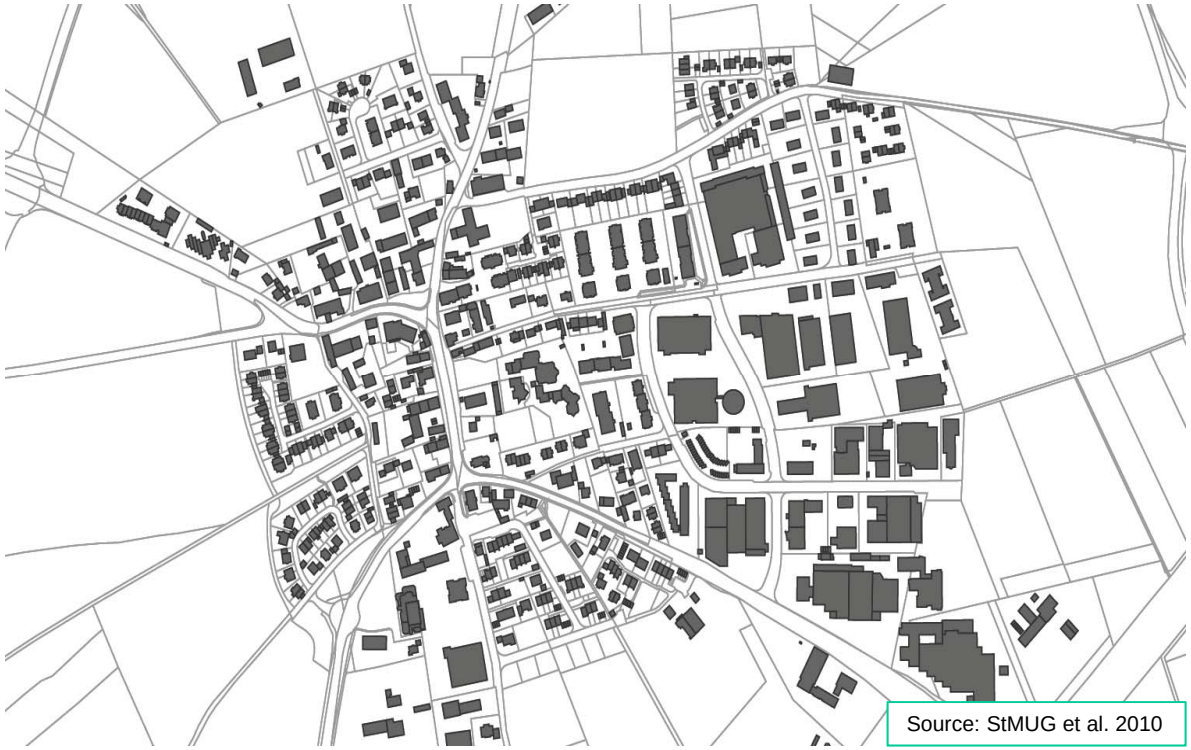


2. Procedures for energy planning

2.2 Stages of energy planning – Basic information

For example information is needed for GIS-based applications

- Materials for visualisation: **digital maps**



Source: StMUG et al. 2010

Content of digital maps:

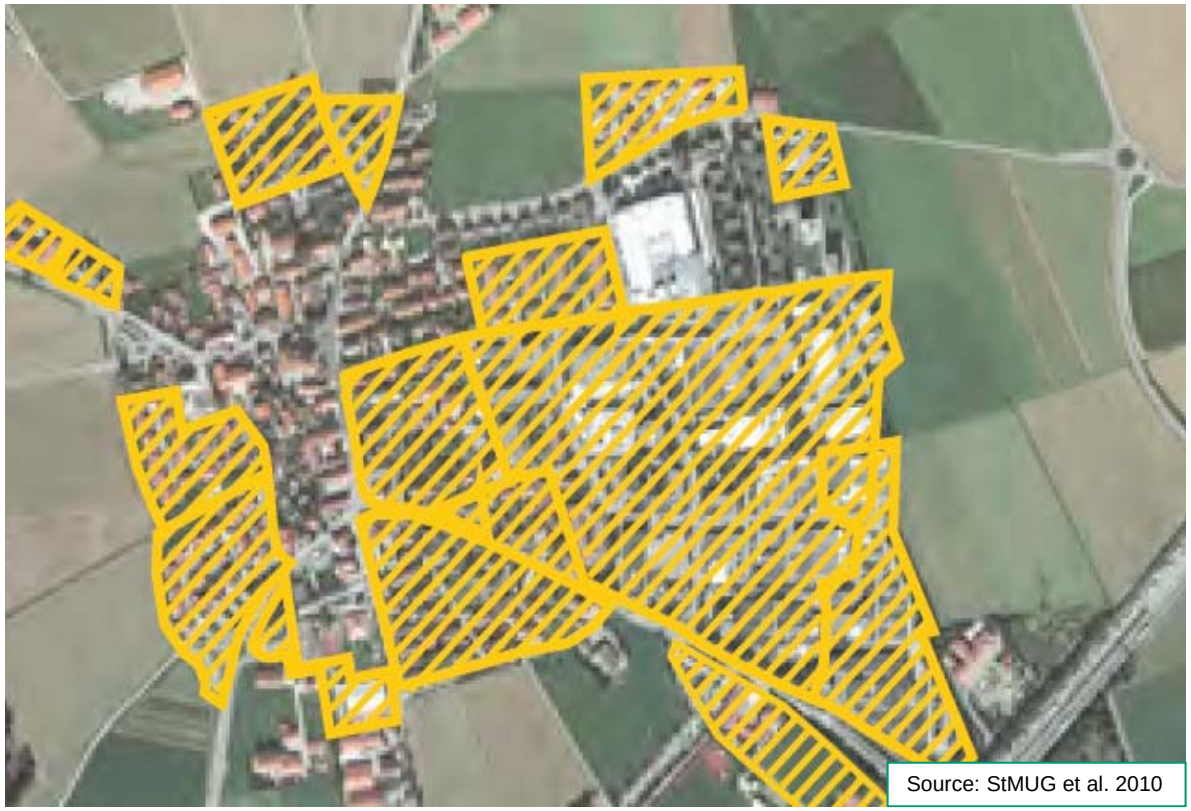
- Borders of land parcels
- Buildings (with number)
- Names of streets
- Types of land use
- Water courses and natural structures

2. Procedures for energy planning

2.2 Stages of energy planning – Basic information

For example information is needed for GIS-based applications

- Materials for visualisation: **aerial image**



Source: StMUG et al. 2010

Content of aerial image:

- Waters and natural structures
- Land use
- Housing, infrastructure and agriculture

2. Procedures for energy planning

2.2 Stages of energy planning – Information of space

For example information is needed for GIS-based applications

- Materials for visualisation: **plan of types of buildings**

Source: StMUG et al. 2010

Content of plans:

- Land use for housing
- Structure of buildings
- Density and height

2. Procedures for energy planning

2.2 Stages of energy planning – data collection

There are several possibilities to collect data, either public or private source:

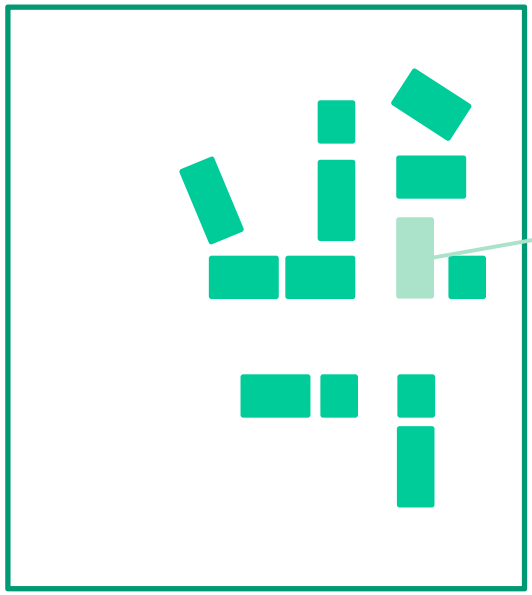
- Local departments of housing, citizens, trade and industry
- Building authority
- General supplier (energy, water)
- Promotion of economy
- Private housebuilding (companies, architects)

2. Procedures for energy planning

2.2 Stages of energy planning – Collecting data

For example information is needed for GIS-based applications

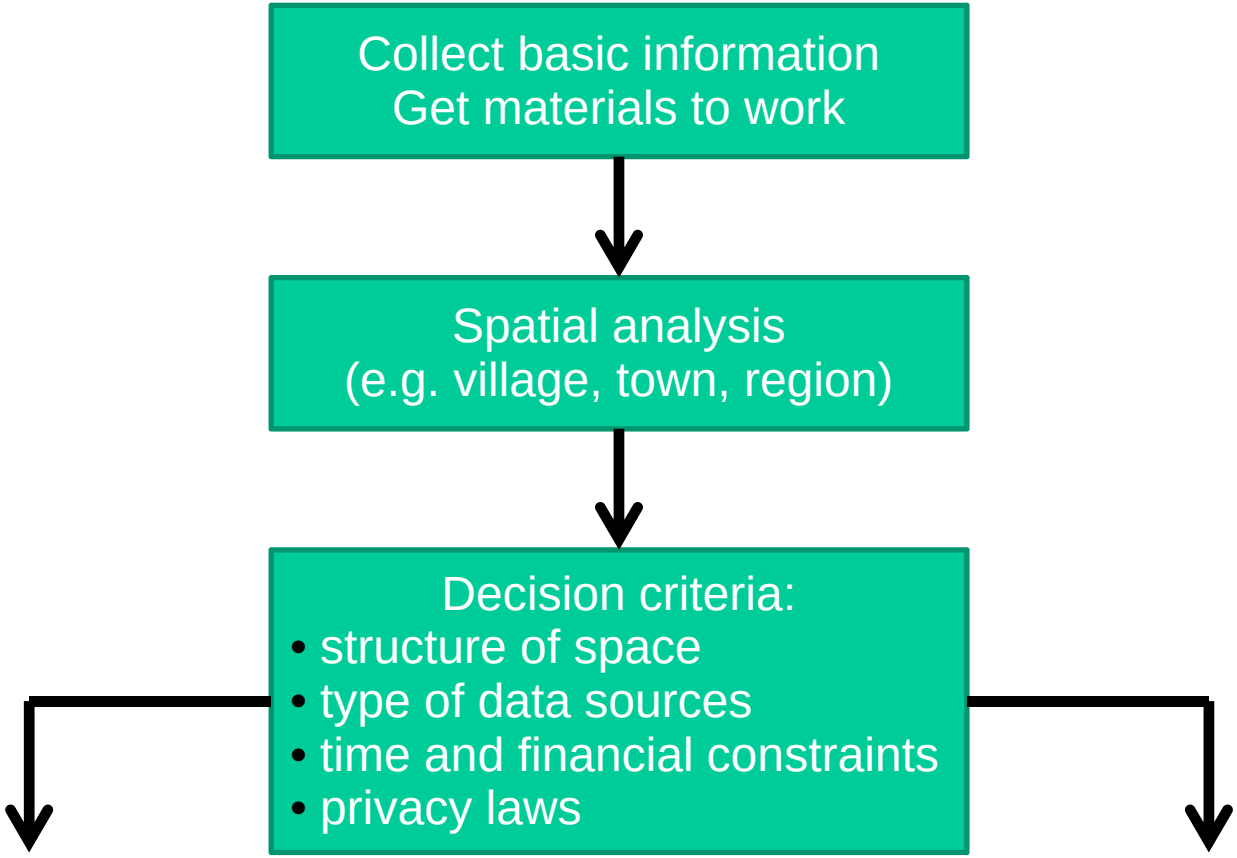
- Data to analyse (e.g. **energy consumption**, energy infrastructure)



ID	Street	Number	Consumption (kWh/a)
1	Mainstreet	5	45.000
2	Mainstreet	7	50.000
3	Mainstreet	9	30.000
4	Longstreet	2	70.000
5	Longstreet	4	55.000
6	Longstreet	6	45.000

2. Procedures for energy planning

2.2 Stages of energy planning – Step 1: Analysis of stock and potentials



2. Procedures for energy planning

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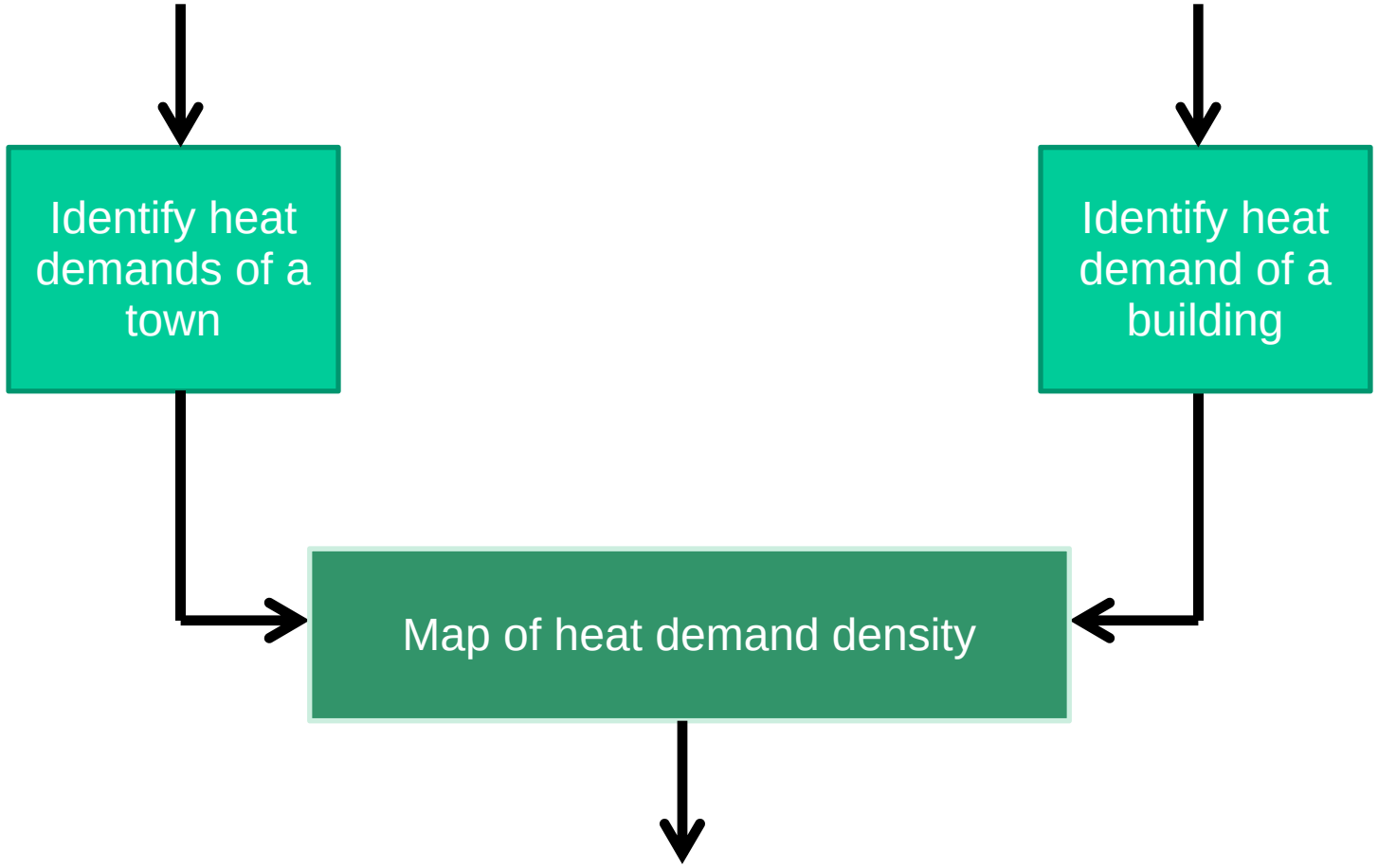
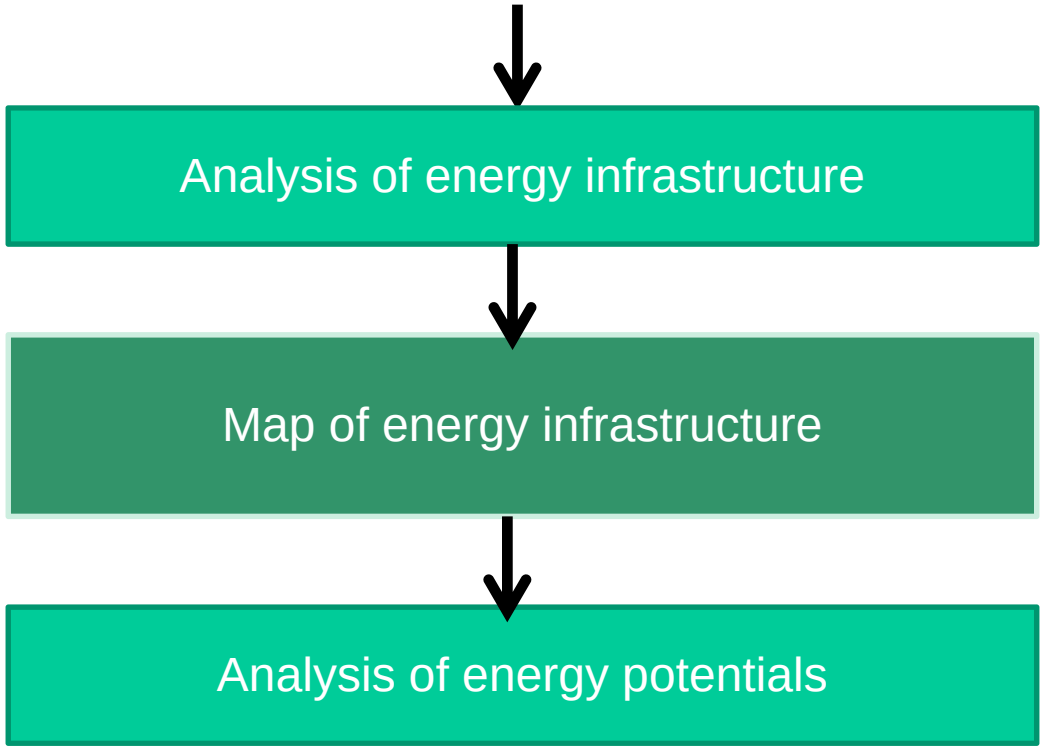


2. Procedures for energy planning

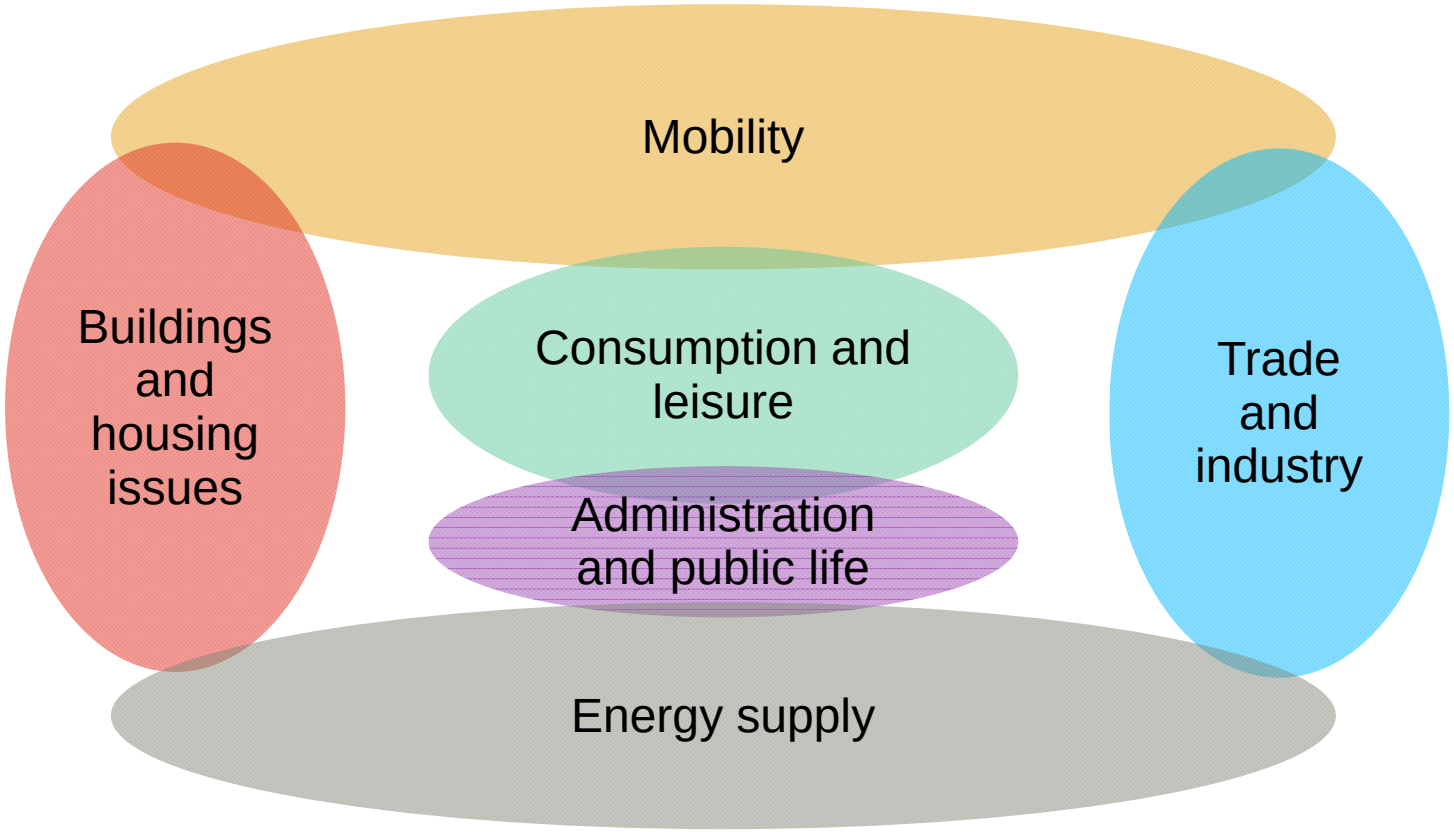
2.2 Stages of energy planning – Step 1: Analysis of stock and potentials



2. Procedures for energy planning

2.2 Stages of energy planning – Step 2: Development of a concept

Energy planning concerns several sectors of a city, which cause most of the carbon dioxide emissions:



Developing an energy concept includes fields of action and measures
(Selection of possibilities)

Buildings and housing (state):
- Regularly consulting
- Remediation of buildings
- Modernization
- Financial support

Buildings and housing (new):
- Criteria for sustainability
- Techniques for low energy demand
- Controlling energy demand

Developing a energy concept includes fields of action and measures
(Selection of possibilities)

Mobility:
- Integrated transport management (e.g. individual, public mobility)
- Cars: intelligent concepts for moving and parking traffic
- Public traffic: connection with individual mobility
- Information service and image campaign

Trade and industry:
- Network sustainable companies
- Self-sufficiency and energy sharing
- Deriving the maximum amount of useful energy output (heat and electricity)

Developing an energy concept includes fields of action and measures
(Selection of possibilities)

Energy supply:
- Efficient supply of public and private space
- Full use of CHP by consulting and connecting stakeholders
- Information campaigns: renewable energies in urban space
- Modernization of infrastructure and techniques
- Efficient utilization of space

2. Procedures for energy planning

2.2 Stages of energy planning – Step 3: Implementation

The concept is still tentative / not legal. It deals with

- **Long term concept to reduce energy consumption**
- **Ensure permanent energy supply while extention of renewable energies**

Therefore, the concept has to become obligatory:

- **Formal (legal) instrument of urban planning**
- **Contracts with responsible actors, e.g. administration, institutions, companies.**
- **Participation of citicens, stakeholders**
- **Planning of objects (buildings)**
- **Behaviour of the consumers: energy consumtion of the daily use**

➔ **Accepted strategy has to become binding law!**

Energy Planning with GIS

3. Energy planning with GIS

3.1 GIS-based possibilities

What is GIS?

- GIS (geographic information system) is a computer-based system with the necessary hardware, software and data.

What is GIS?

- GIS enables the presentation of all sorts of spatial information.

Why GIS in energy planning?

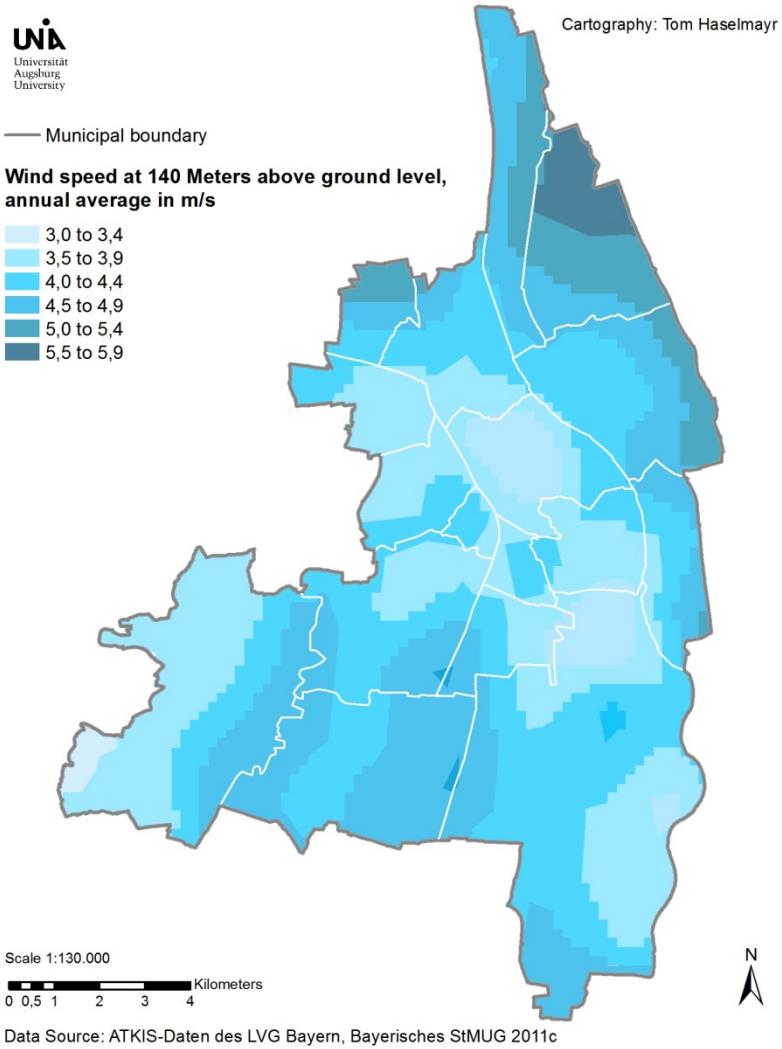
- Specific energy planning issues are assisted by connecting geographical, public or private statistics, spatially and temporally
- For example, GIS can display structures, capacities and locations of renewable energy sources.

How to use GIS (in general)?

- Step 1: Gathering and archiving data
- Step 2: Data transformion and illustration
- Step 3: Spatial analysis and processing information

3. Energy planning with GIS

3.2 Example: Planning of wind energy in Augsburg/Germany



1. Analysis of wind conditions

Quantify avarage wind speed

Influence parameters:

- Density of buildings
- Thermal activities (turbulence)
- Mirco climate advantages and disadvantages (locally)

2. Definition of exclusion areas:

- Natural reserve
- (Natural) conservation area

➔ Prohibition of wind energy

Different land use prioirites competing with each other:

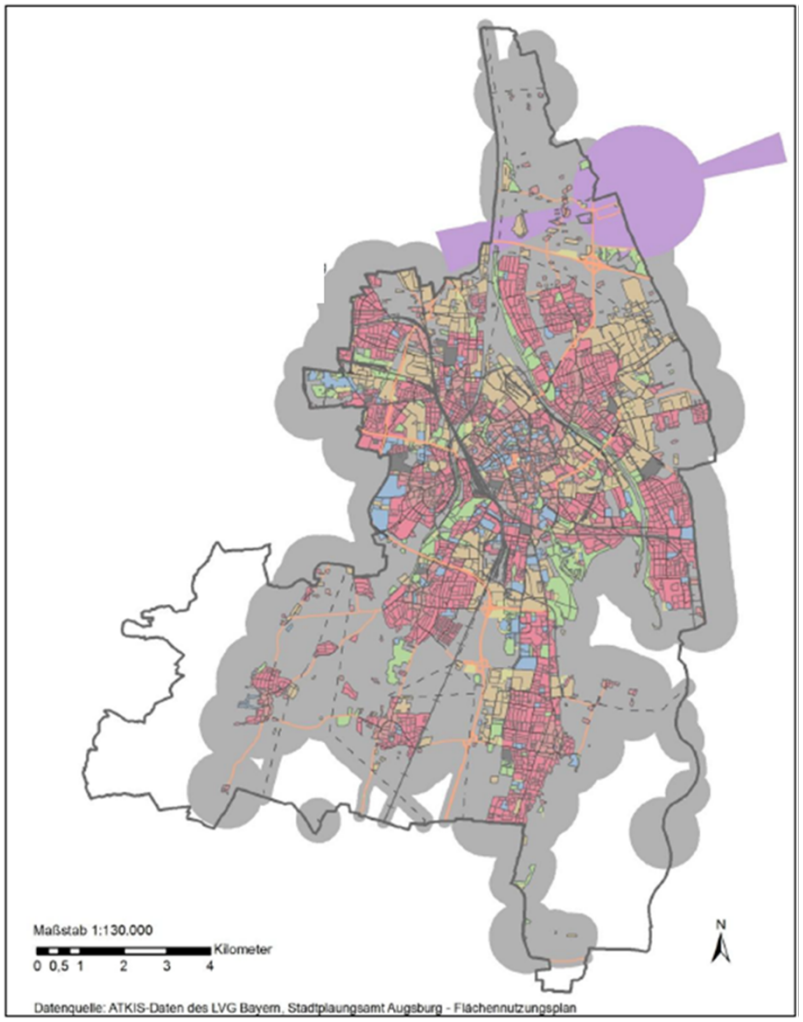
- Areas designated for protection of birds
- Wind power plants

Regional plans designate permission for wind energy exploitation

➔ Restricted or preferred area

3. Energy planning with GIS

3.2 Example: Planning of wind energy in Augsburg/Germany



3. Mapping the available space

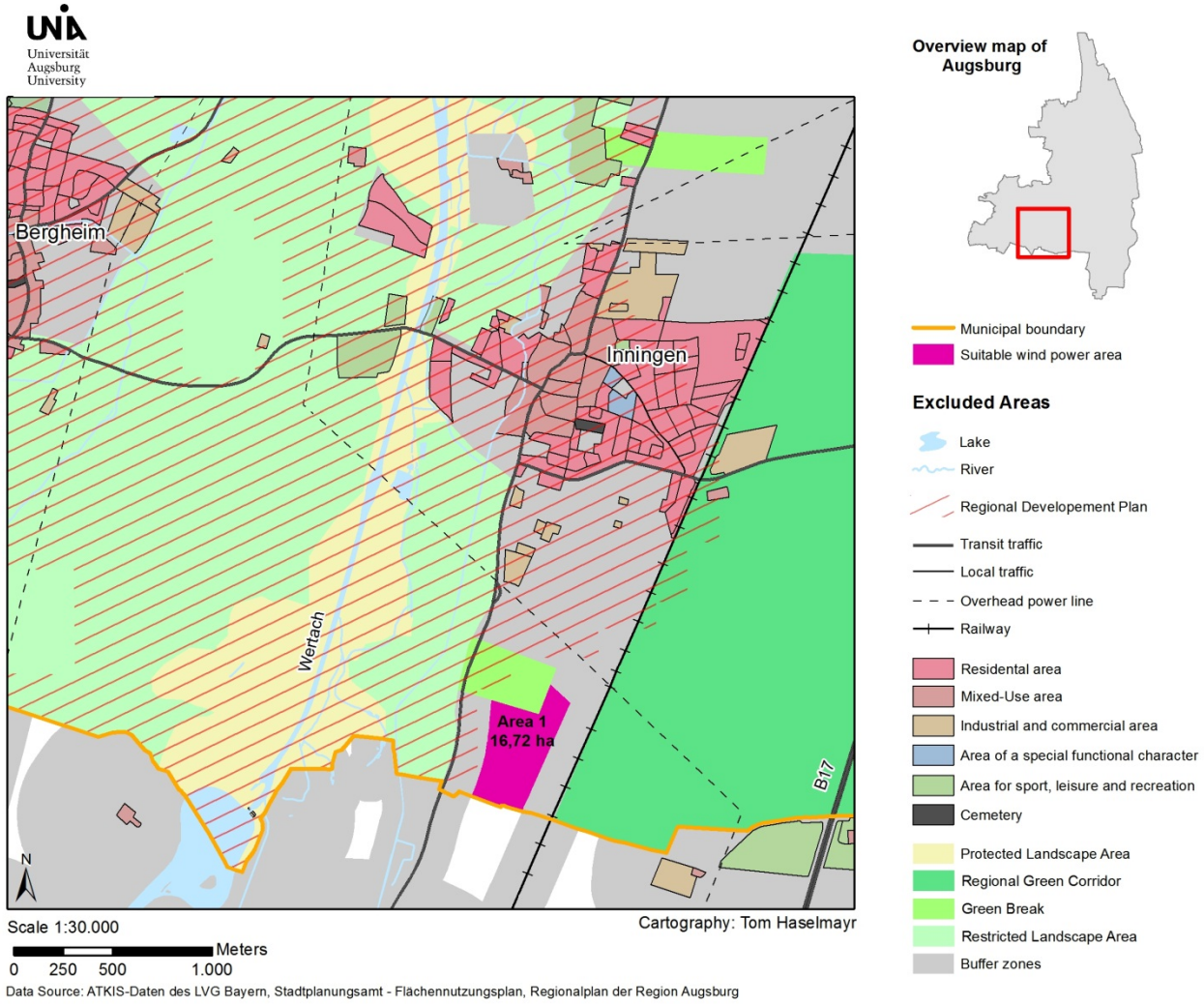
Summary of land use:

Map shows areas where wind energy facilities are forbidden **(method of elimination)**

- No housing areas
- No industrial areas
- No infrastructure (traffic)
- No natural reserve
- No transition zone

3. Energy planning with GIS

3.2 Example: Planning of wind energy in Augsburg/Germany



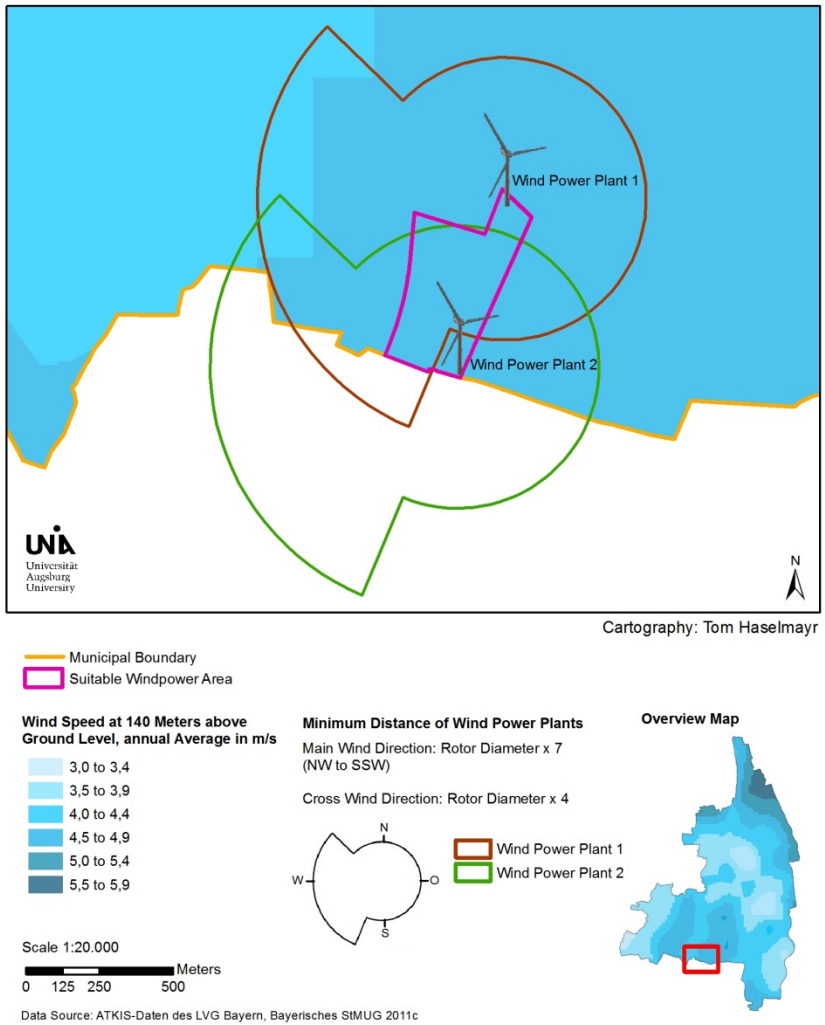
4. Calculation of annual energy yield:

- Average wind speed
- Usable space
- Efficiency of wind power plants

➔ Potential for wind energy

3. Energy planning with GIS

3.2 Example: Planning of wind energy in Augsburg/Germany



Energy planning:

- Compare usable space and available technology
- Pay attention to legal issues

➔ Two wind turbines are realizable

5. Next steps:

- Implementation at municipal level
- Authorization procedure; environmental impact assessment
- Implementation in local (urban) plans
- Set permission for wind energy facilities in binding law

The UP-RES Consortium

Contact institutions for this module: **Universität Augsburg**

- **Finland : Aalto University School of science and technology**
  www.aalto.fi/en/school/technology/
- **Spain : SaAS Sabaté associats Arquitectura i Sostenibilitat**
  www.saas.cat
- **United Kingdom: BRE Building Research Establishment Ltd.**
  www.bre.co.uk
- **Germany :**

  AGFW - German Association for Heating, Cooling, CHP
  www.agfw.de

  UA - Universität Augsburg www.uni-augsburg.de/en

  TUM - Technische Universität München http://portal.mytum.de
- **Hungary : UD University Debrecen**

  www.unideb.hu/portal/en