GLOBAL GEOTHERMAL ALLIANCE

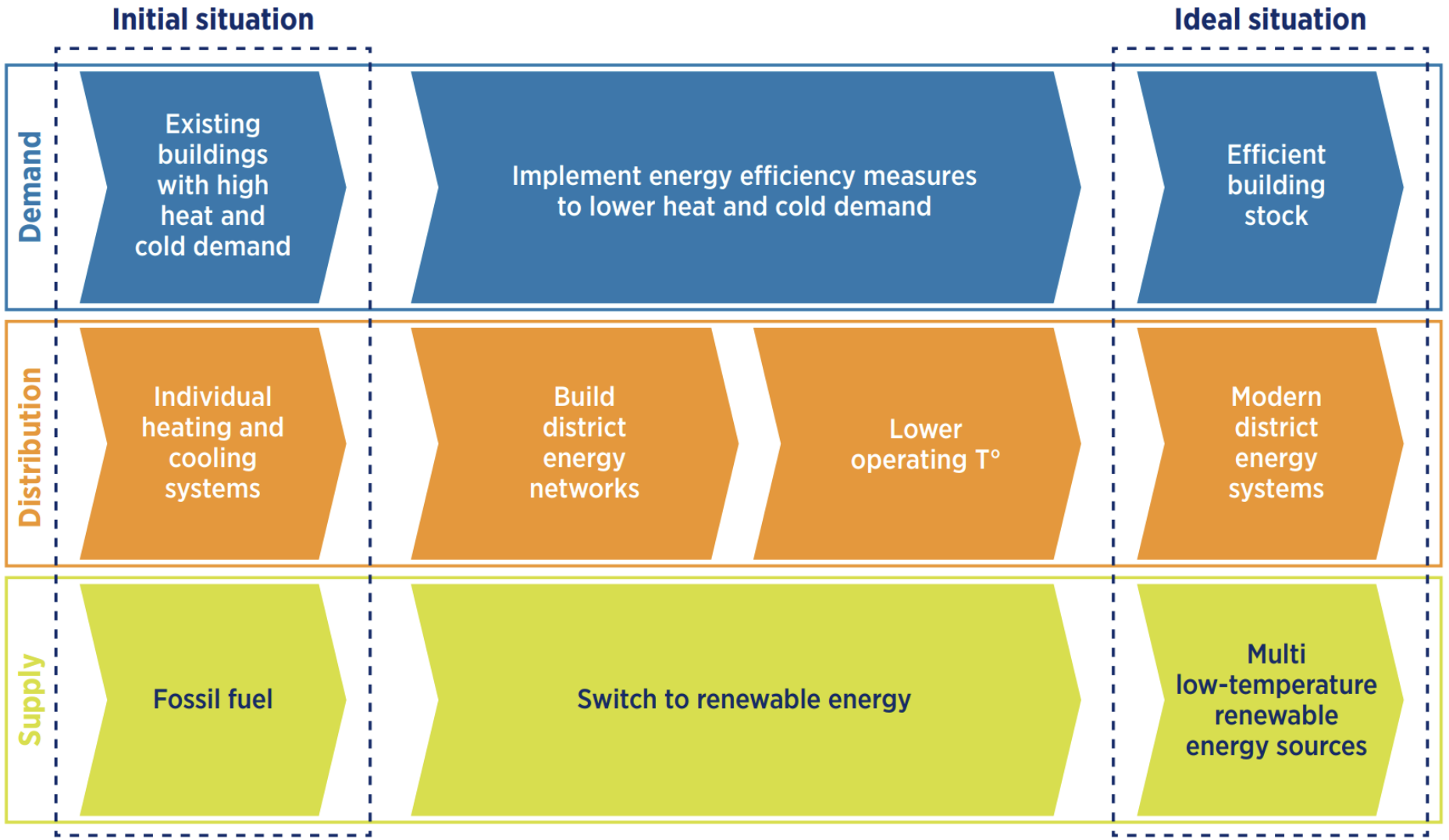
IRENA
International Renewable Energy Agency

Strategic Heating and cooling Planning

Integrating Renewables in District Heating and Cooling Systems

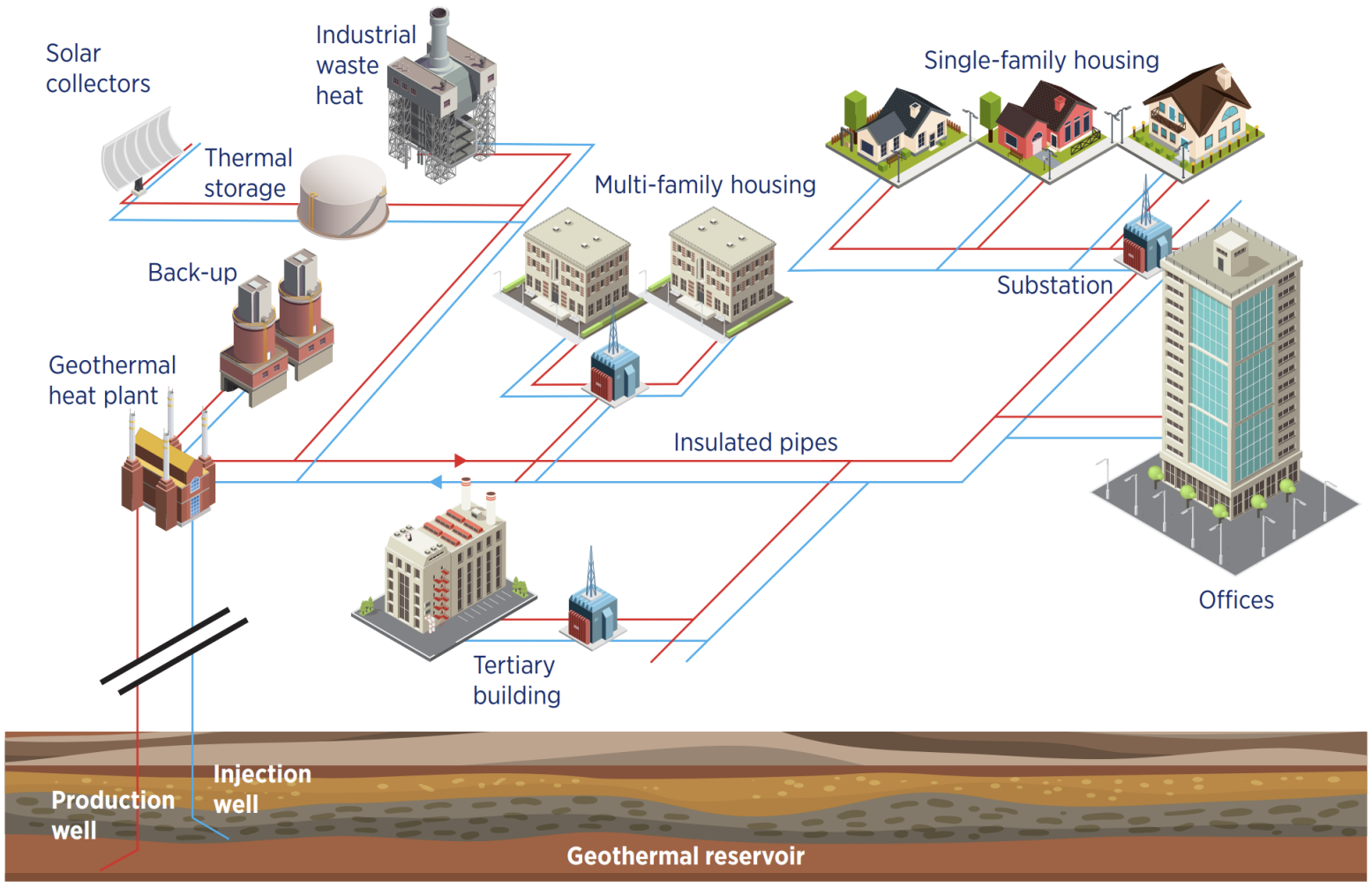
19 April 2023

Moving towards renewable-based district energy systems



Note: District energy systems can replace most, but not all, individual heating and cooling systems in high density areas (see Part B, Section 6.4).

What is envisaged?



Note: These are only examples of possible energy sources for a district heating network.

- **District Energy Systems**
  - District heating
  - District cooling
- **Configuration**
- **Advantages**
  - Low temp. RE
  - Higher efficiency

Strategic Heating and Cooling Planning

Objective

- Coordinated, informed manner with term perspective
  - Existing issues and formulate strategy
  - Multi-dimensional (economic, technical, environmental, social)

- Local perspective due to local nature of heating
  - Supports achievement of national objectives

- System perspective
  - Policies and regulations
  - Synergy with thermal, electric and gas grids
  - Urban planning

- Challenges
  - Multidisciplinary
  - Long-time frame

Best practice model for developing cost effective heating and cooling systems

Strategic Heating and Cooling Planning

Involves defining a feasible size of project and its organisation and rules

- Objective, scoping and stakeholder identification
- Mapping of heating and cooling demand and supply
- Technical challenges and solutions
- Regulatory framework conditions

Iterative process to ensure long-term investments balance with heat supply and energy savings

Step 1: Defining Objectives and scope

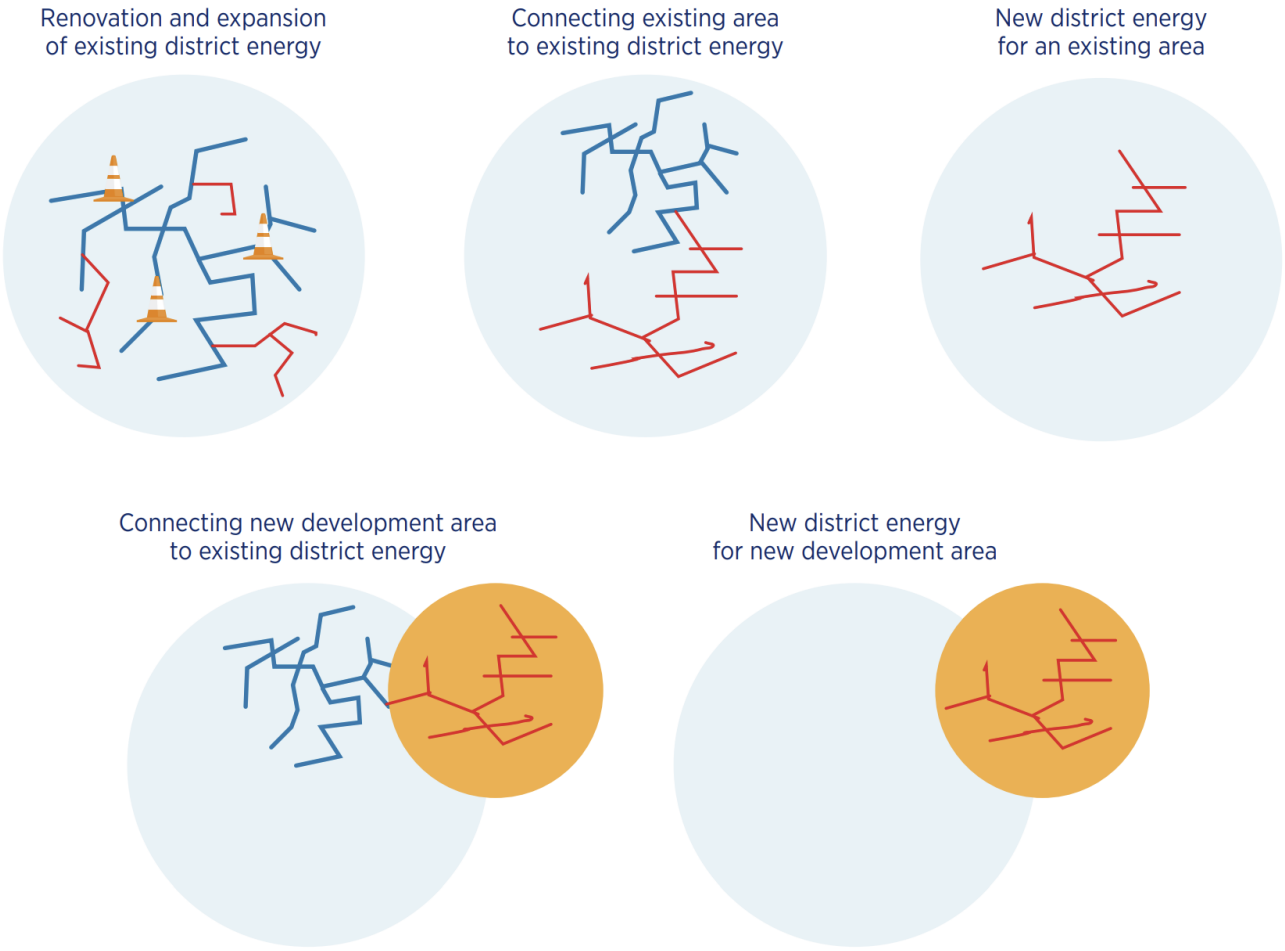
Objectives

Purpose of changing the thinking around heating and cooling

- Reduce pollution
- Reducing GHG emissions
- Affordable heating supply
- Security of heat supply

View of central Aalborg and waterfront from Nørre Sundby

Scope



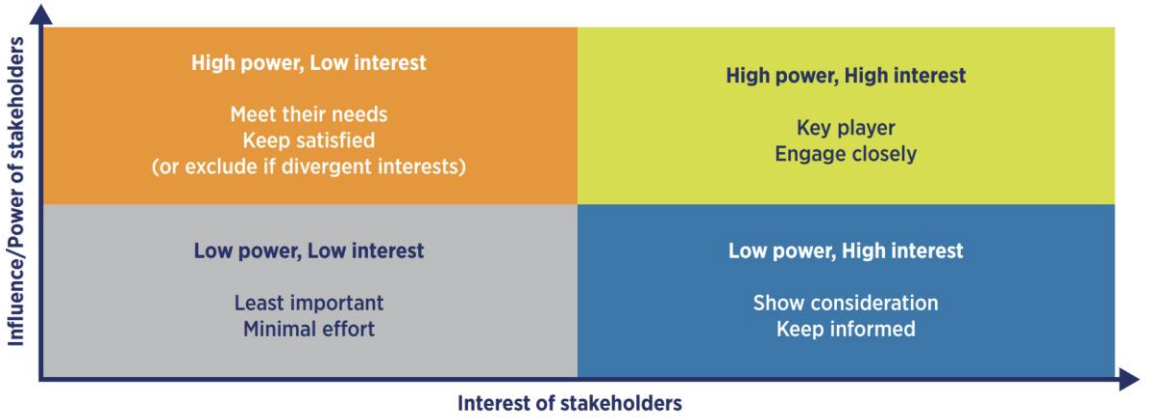
Based on: IRENA (2017b) and Olsen (2014)

Step 1: Scoping of stakeholders

- Identify the relevant stakeholders, their interest and level of influence
- Raise awareness and promote public acceptance
- Promote transparency by engaging stakeholders in the development process

Geothermal project in Groß-Gerau (Germany)

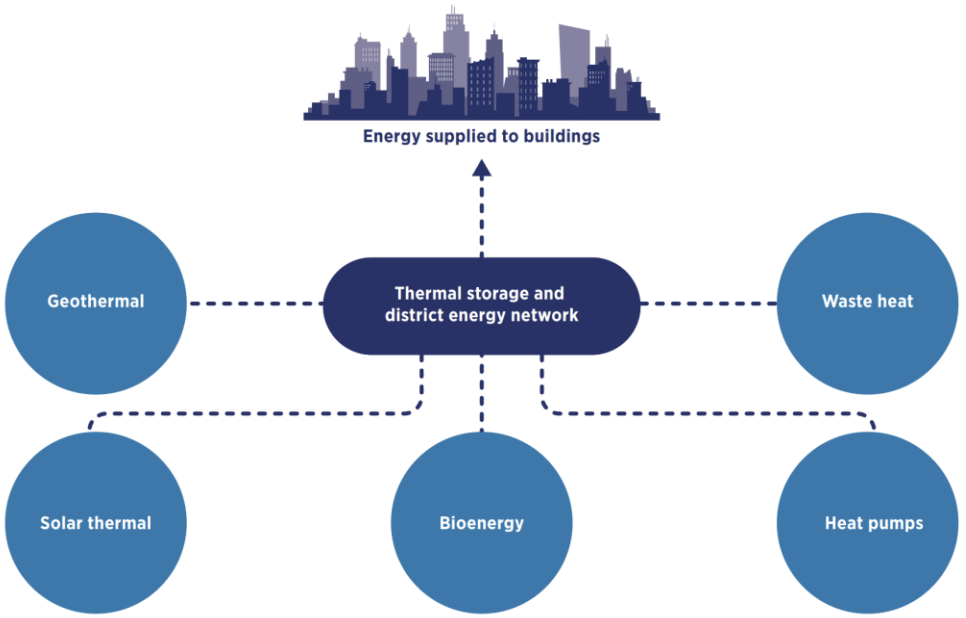
Stakeholder engagement



Source: UNIGE; based on Mendelow (1981)

- **Consumer owned district heating system in Viborg, Denmark**

Step 2: Mapping of the heating and cooling demand and RE Supply



- Quantify actual demand for heating and cooling
  - Actual measurement
  - Bottom-up modelling of building energy performance & consumption
  - Top-down modelling of spatial distribution heat demand

- SHP requires data about heat demand, supply options, state of building stock
  - Gap in data availability
- Location is critical
  - Distance between supply and demand

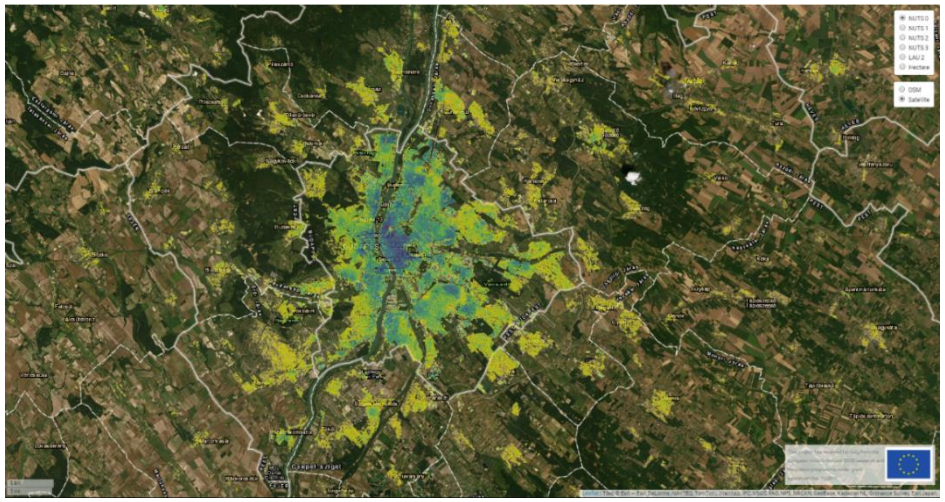
- Identify and quantify renewable energy resources

- Consider the energy saving potential of the existing energy system

Step 2: Mapping of the heating and cooling demand: Tool

Hot Maps toolbox: Heating demand Budapest

Cooling demand Budapest



- Individual metering
- Open data (Switzerland)
- Hot Maps Toolbox
- PETA 4: Pan European Thermal Atlas
- Thermos: Thermal Energy Resource Modelling and Optimisation System

Step 2: Mapping of RE Supply

- Strategic heat sources
  - Renewable Energy heat sources
  - Sustainable waste heat

- Possibility for exploitation depends on
  - Location
  - Temperature
  - Temporal fluctuation
  - Sustainability of the reosurce

- Distributed (decentralized) over a wide area; DHC network

- Usually low temperature hence restriction on network

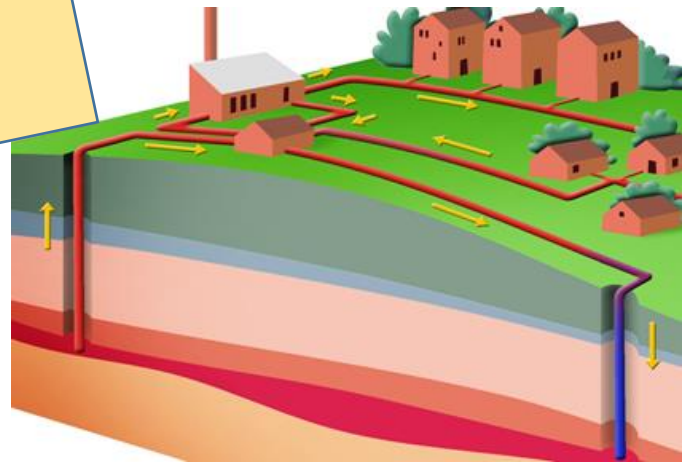
Strategic heat sources

Solar Thermal: Salaspils, Latvia,
Drake Landing solar community, Canada

Industry, data centers, many sources

Cannot efficiently exploit these sources without district heating and cooling infrastructure

Low- temp. Geothermal



Water sources: Gothenburg, sweden,
Climespace, Paris

https://www.veks.dk/da/om-veks/varmeproduktion/geotermi
https://www.licitationen.dk/project/view/1704/facebook_datacenter_odense
http://dk.arcon-sunmark.com/nyhederogmedier/vojens-district-heating-denmark

Strategic heat sources– example of geothermal applications

Deep and shallow geo resource (Iceland, France, China)

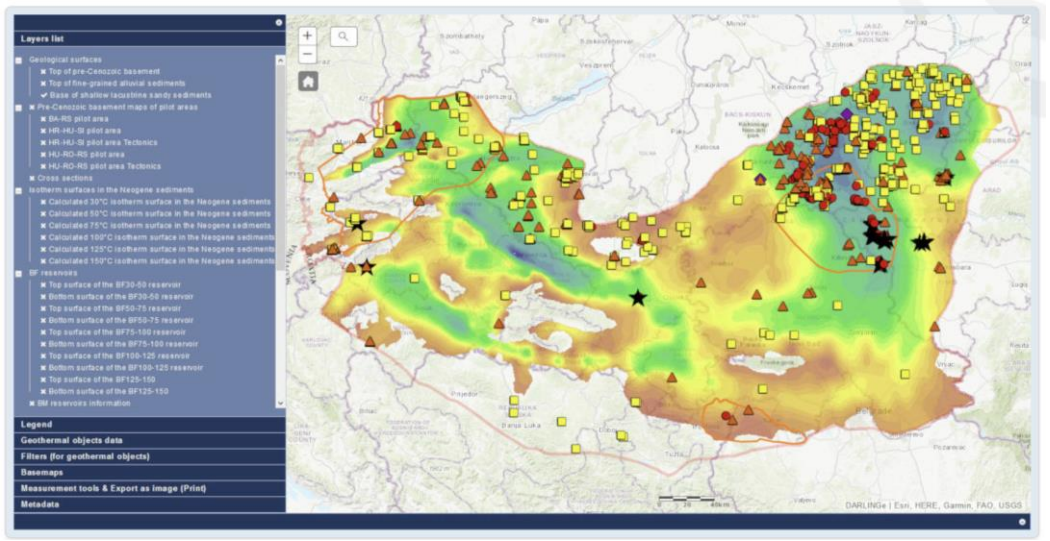
Ultra low-temperature geothermal resources (Paris Saclay)

Abandoned coal mines: Mine water, Netherlands;
Mieres (Barredo colliery), Asturias, Spain

Co-production from oil and gas wells (La-Teste, France)

Step 2: Mapping heating and cooling Supply: Tools

Danube Region Geothermal Information Platform (DRGIP)



Geothermal

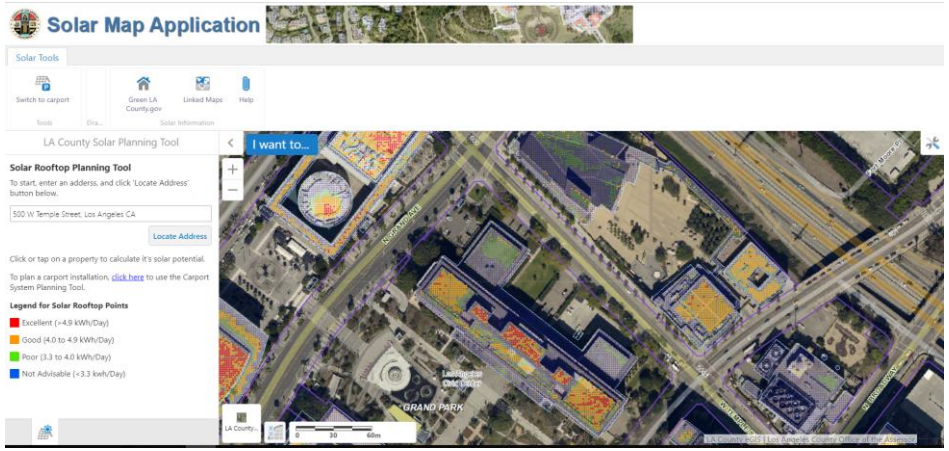
- Database of wells drilled in Geneva
- Coal Authority's Interactive Viewer and web services

Waste heat

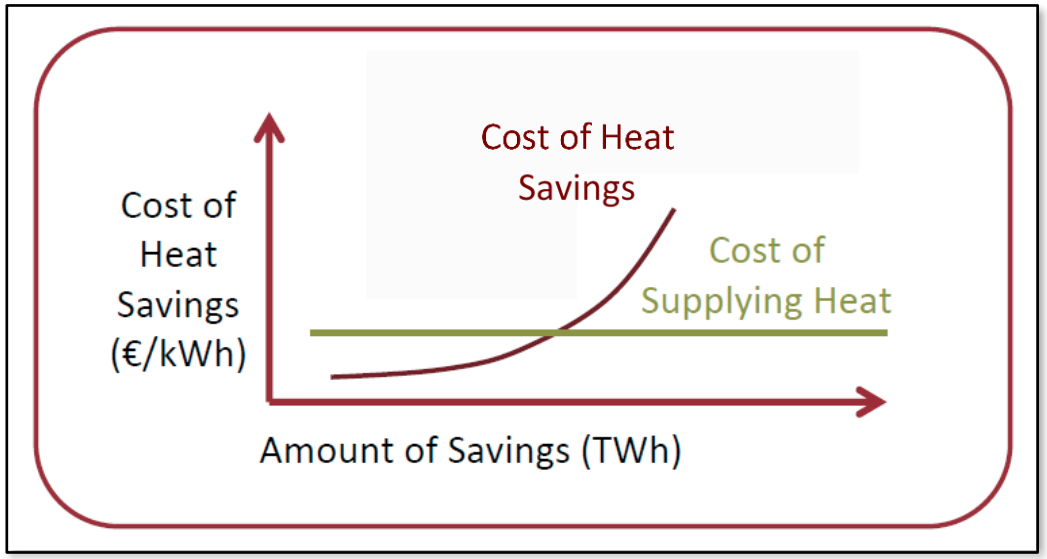
- Pan-European Thermal Atlas
- EU-funded project Waste heat
- EU-funded project ReUseHeat
- Project Memphis tool

Solar

- IRENA's Global Atlas for Renewable Energy
- The Photovoltaic Geographical Information System (PV GIS)
- Power Data Access Viewer



Step 2: Assessing and quantifying heat saving potential

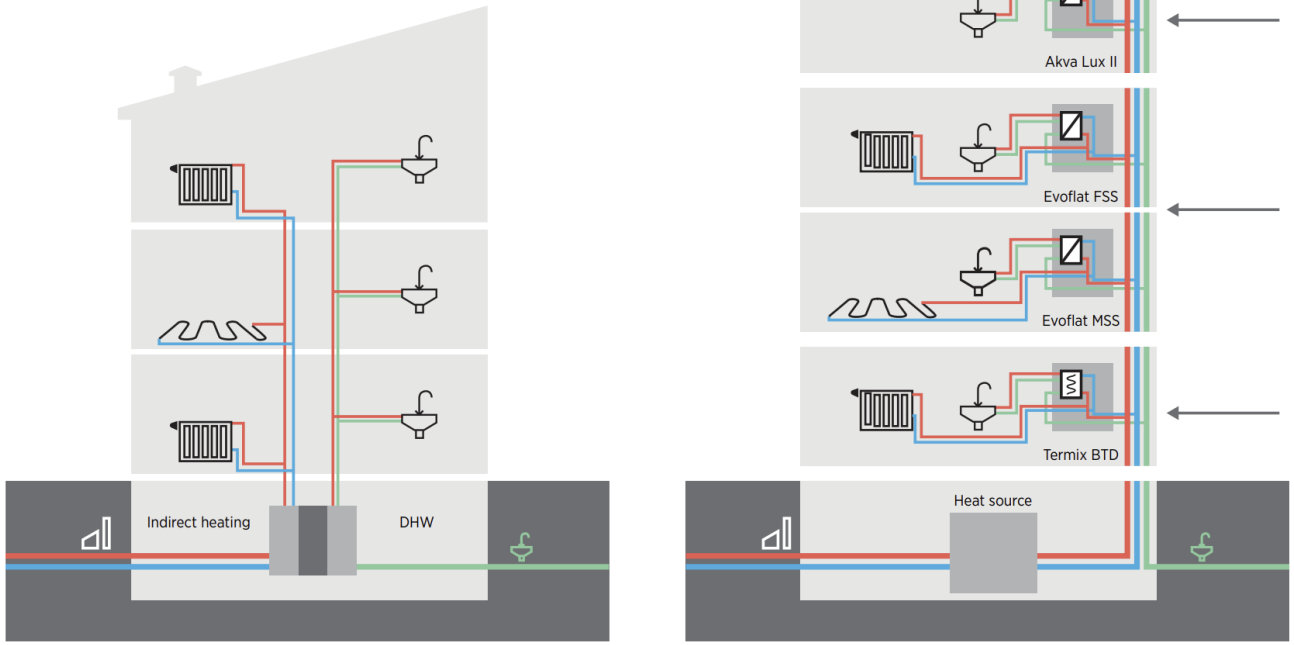


- It might be cheaper to save 1kWh than generate one
- Energy efficiency measures lead to a reduction in demand
- Establish scenarios

Tools

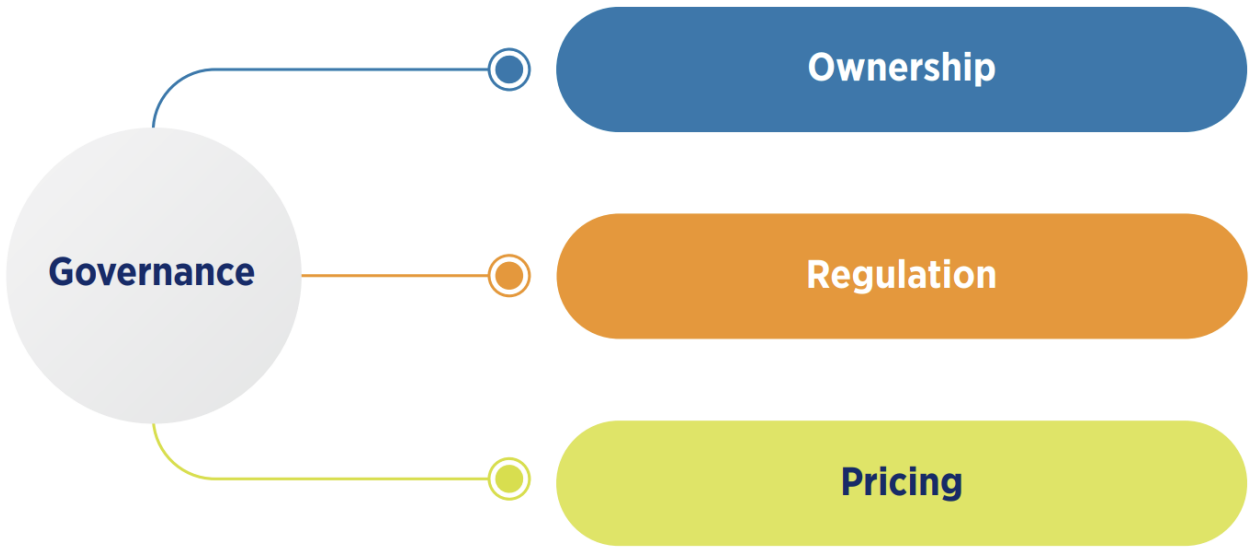
- EnergyPLAN
- EnergyPRO
- KOPTI
- TIMES Local
- INDIGO Planning tool – IndPT

Step 3: Addressing Technical Challenges and Compatibility



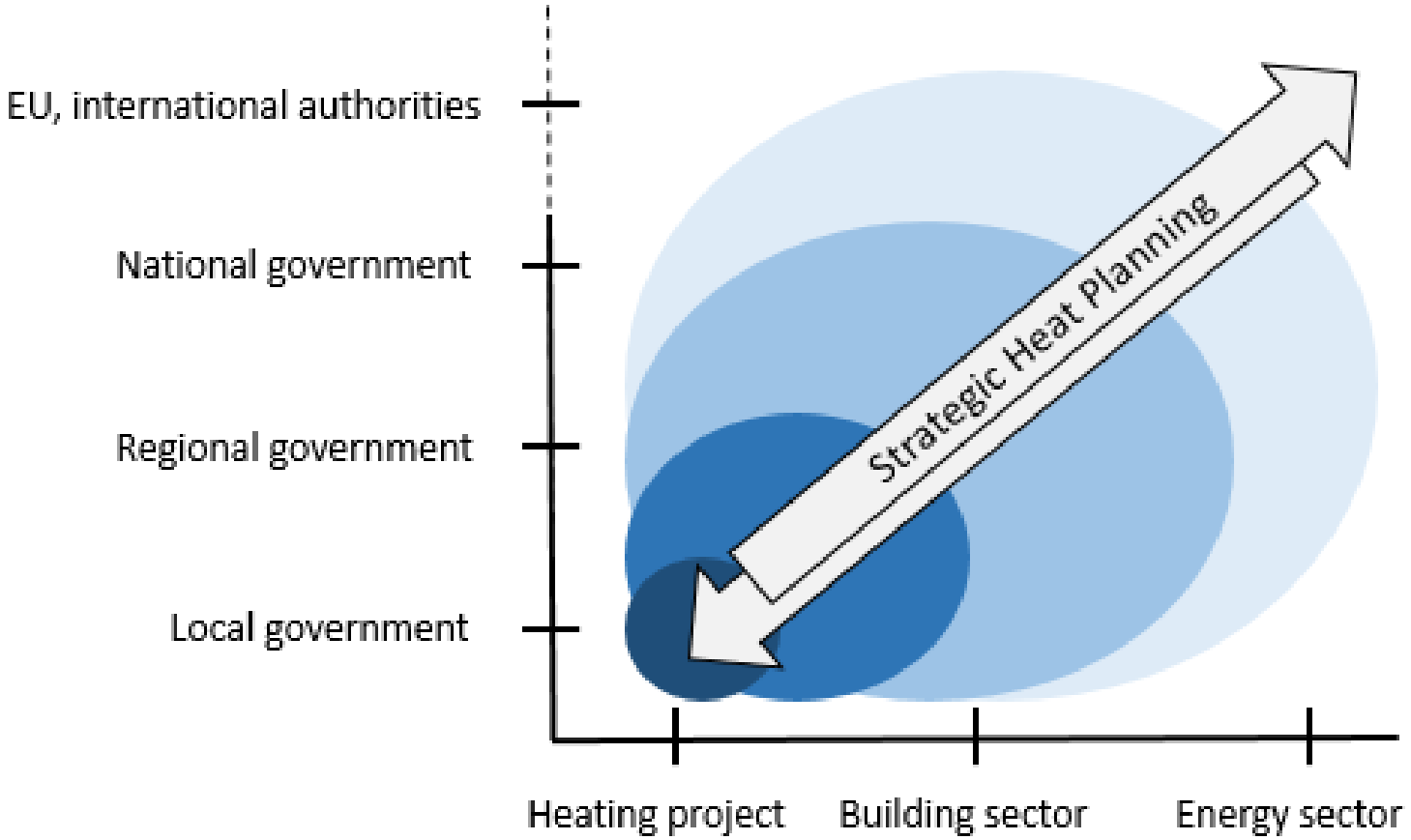
- Integrate building renovation and change of supply and modernisation of the network
- Assess and enable compatibility with the existing buildings and heat network
- Build local capacity to address technical challenges
- Deploy solutions to manage fluctuations in the supply of VRE

Step 4: Enabling regulatory conditions, financing and business models

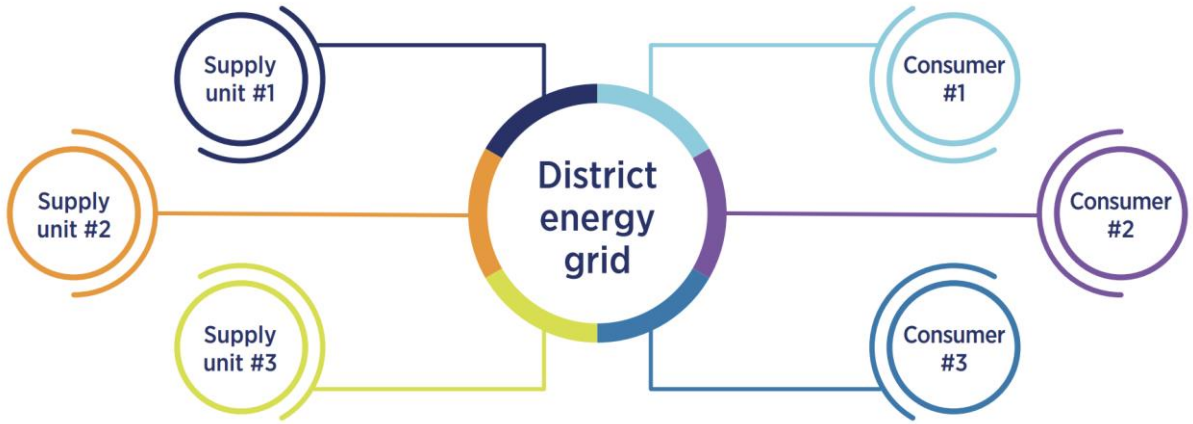


- Set up a comprehensive district energy governance scheme
- Address barriers to investment to enable a capital-intensive transition
- Ensure a level playing field for RE-based systems

Step 4: Enabling regulatory conditions



Step 4: Business models

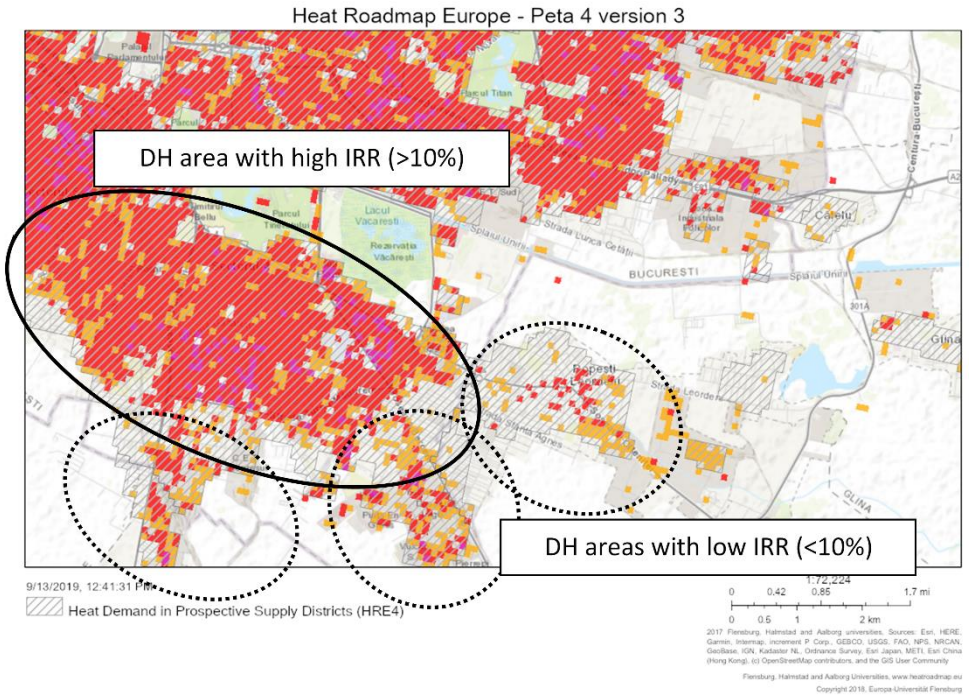


- Different types of ownership models
  - Consumer
  - Public
  - Private
  - PPP
- Market structure
  - Competitive
  - monopoly
- Ownership of transmission and distribution network
- Ownership of production plants

Step 4: Pricing

- To protect consumers from monopoly situations
- Pricing should cover the following
  - Fixed cost
  - Operation cost
  - Others (plant efficiency, network losses, taxes)
- Models for price regulation
  - True cost pricing (Denmark)
  - Price cap (Netherlands)
  - No price regulation (Sweden)
- Right pricing
  - Reflect utility received
  - Transparent to maintain trust

Step 4: Financing



Challenges to financing

- DHC projects require high upfront costs to set up
- Take long time to pay back and realise profits
- Uncertainty of demand, supply, connection
- Resource risk

Solutions

- Government action to support financing
- Risk mitigation instruments
- Programmes by development partners: ReDeWeb
- Innovative financing
  - District heating company/ESCO
  - Crowd funding

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THANK YOU

For further information:
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