DISTRICT ENERGY IN CITIES INITIATIVE

E-TRAINING PROGRAM
DISTRICT ENERGY DEVELOPMENT

MODULE 5. POLICY DEVELOPMENT: INTEGRATING DES INTO URBAN PLANNING

gef

UN environment programme 50 1972-2022

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LEARNING OUTCOMES

Objective: share insights on policy development to incorporate district energy into urban planning

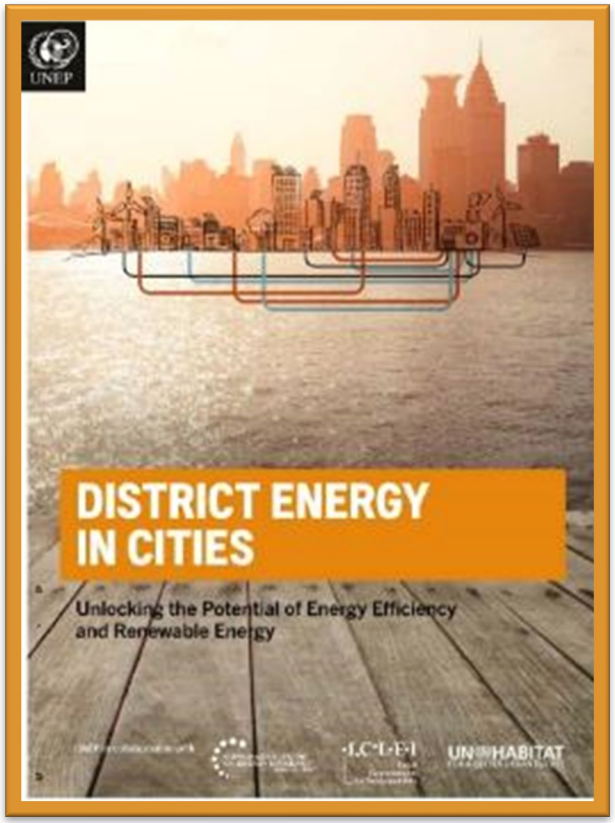
By the end of this module, you will be able to:

- Describe, understand and discuss the role of integrating DES in urban planning
- Recognise key steps to integrate DES in urban planning
- Define key actions from local authorities to ensure the integration in the process
- List the strengths and limitations of integrating DES into urban planning

DISTRICT ENERGY PLANNING

Key Steps in District Energy planning

1. **Assess** existing energy and climate policy objectives, strategies and targets and identify catalysts
2. **Strengthen** or develop the institutional multi-stakeholder coordination framework
3. **Integrate** district energy into national and/or local energy strategy and planning
4. **Map** local energy demand and evaluate local energy resources
5. Determine relevant **policy design** considerations
6. Carry out **project pre-feasibility** and viability
7. Develop **business plan**
8. Analyse **procurement options**
9. Facilitate **finance**
10. **Replicate**



Source: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

ITS RELEVANCE

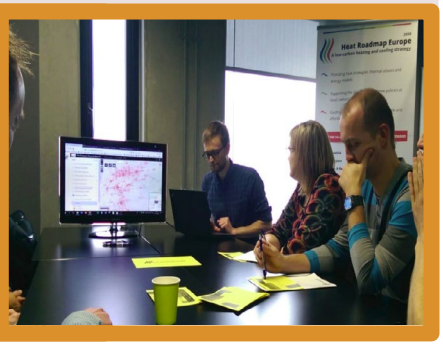
From an energy system perspective

- Integrating energy infrastructure with urban planning is key for sustainable urban development.
- Update the city's energy infrastructure to develop in a sustainable and efficient way.


Source: Deltares, Unsplash

From a process perspective

- Ensure cost-effective district energy in cities, addressing the interaction between energy, land use and infrastructure – including power, waste, water, buildings and transport.

Source: Heat Roadmap Europe

DEFINITION

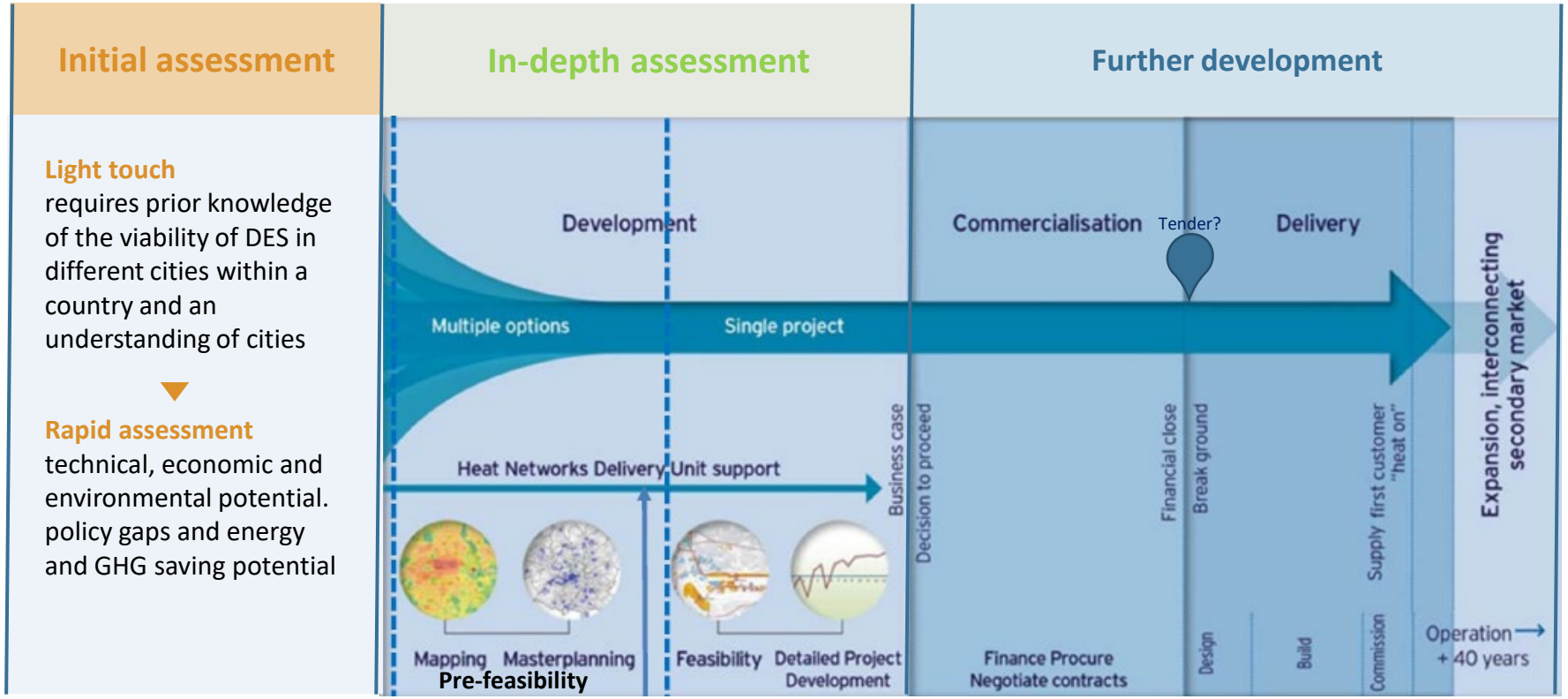
What is urban planning?

- Also know as regional planning, town planning or city planning
- It is a **technical and political process** concerned with the development and design of land use and the built environment.
- Includes **air, water, energy, and the infrastructure** passing into and out of urban areas, such as transportation, communications, and distribution networks.

Source: maps.london.gov.uk, 880cities.com

MAIN PHASES

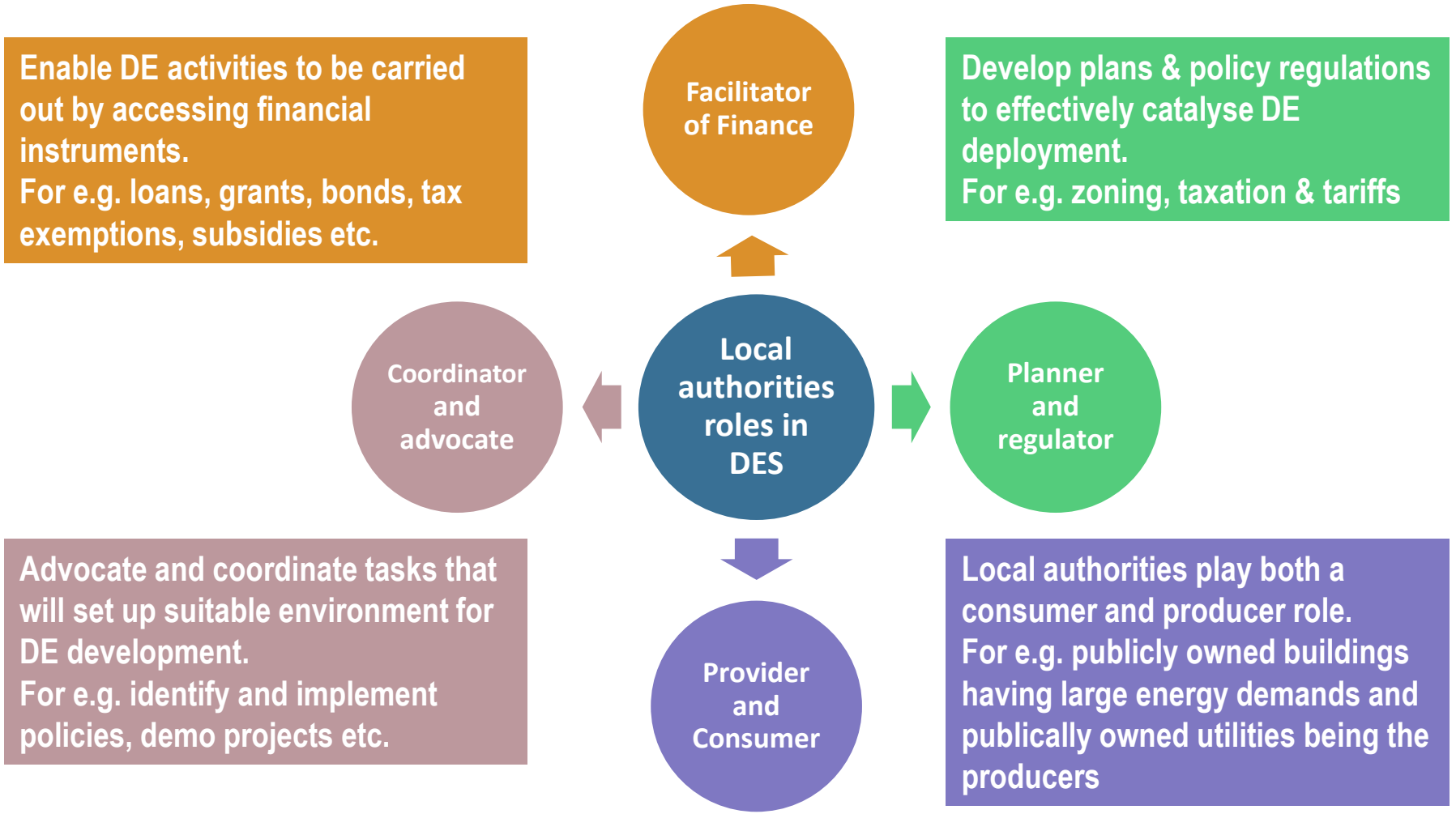
Main phases and assessments in DES planning



Source: Adapted from Carbon Trust

THE ROLE OF LOCAL AUTHORITIES

Local authorities have the following main roles in DES planning



THE ROLE OF LOCAL AUTHORITIES

**As planners and regulators,
local authorities have three main areas for policy intervention:**

1. Energy policy objectives, strategy and targets

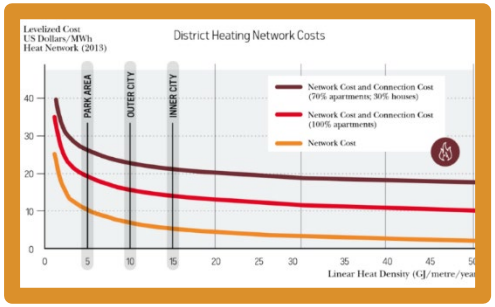
2. Holistic energy mapping

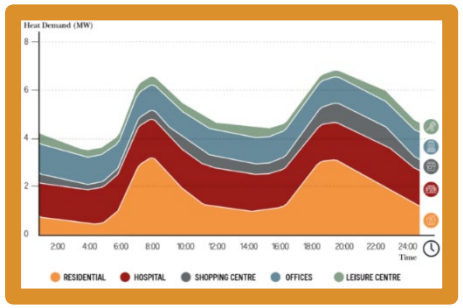
3. Policy development

MODULE 5. POLICY DEVELOPMENT IN DE

CHARACTERIZATION OF ENERGY MAPPING

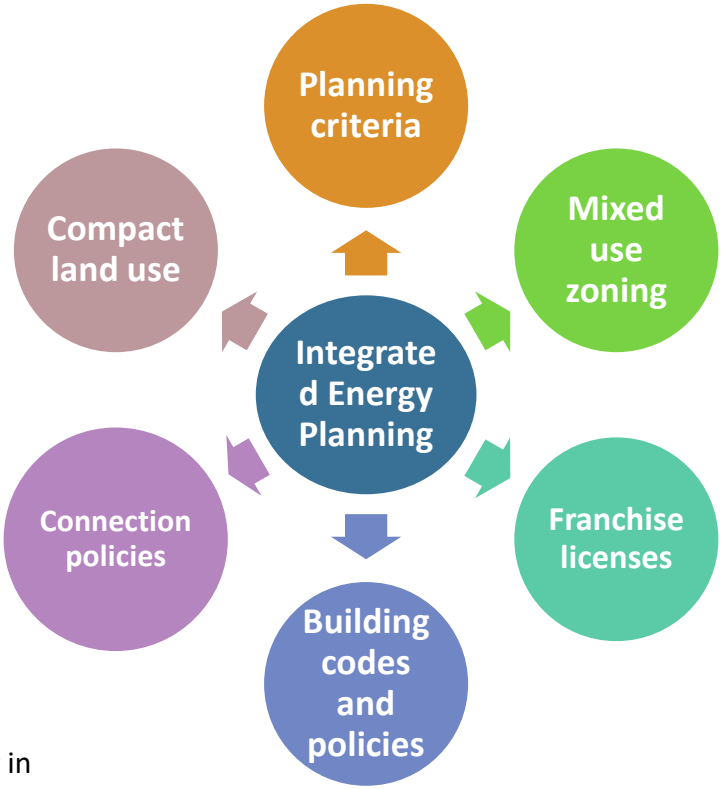
1. Energy policy objectives, strategy and targets





- Zonal or city-wide mandatory connections
- Density bonus
- Connect (unless)
- Subsidies for connection

- Building compatibility requirements
- Green certification

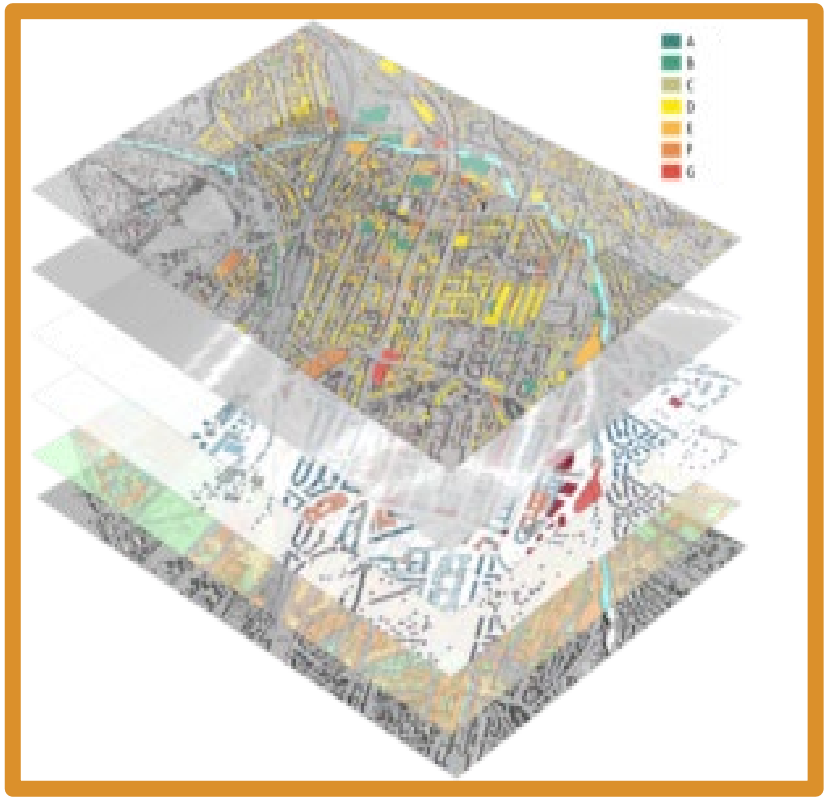


- Zoning
- New development policies

- Control development
- Mandate connection
- Regulate tariffs
- Protect consumers
- Competition to win franchise

Source of both images: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

2. Holistic energy mapping



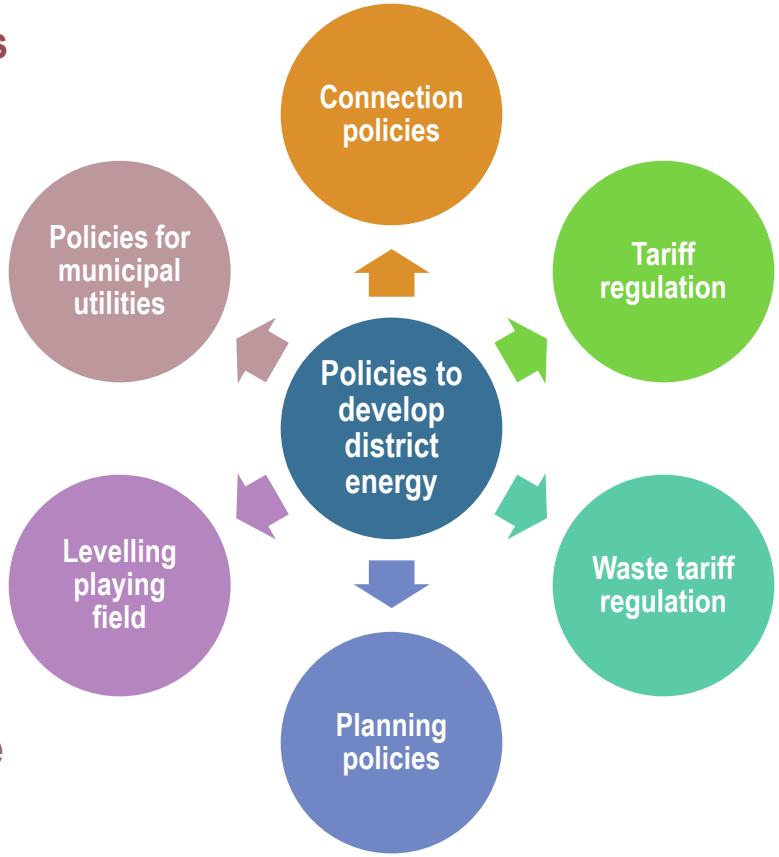
Source: CityLab.com

- An **energy plan** is a **road map** of project developments and policy interventions **to help a city realize the articulated goals of its energy strategy.**
- It helps to **identify synergies and opportunities for cost-effective district energy**, such plans needed to analyse the impact of (and interaction between) energy, land use and infrastructure – including waste, water, buildings and transport.
- **Holistic energy planning** can allow a city to **promote and/or designate areas or zones** that have favourable conditions **for district energy development or expansion,** and to apply tailored policies or financial incentives on a case-by-case basis.

THE ROLE OF LOCAL AUTHORITIES

3. Policy development

- Mandates for renewables and waste heat
- Social housing focus
- Interconnection and transmission



- Protect consumers
- Limit profits and pass on costs
- Next available technology
- Other policies may come from national level

- CHP FiT
- Municipal subsidies or fiscal benefits
- Pass through of national energy subsidies
- Other policies may come from national level

- Encourage waste heat connection
- Cost of connection and cost of redundancy
- Ability to guarantee supply

THE ROLE OF LOCAL AUTHORITIES

3. Policy development: Connection Policies

Classified by enforcement type:

Mandatory

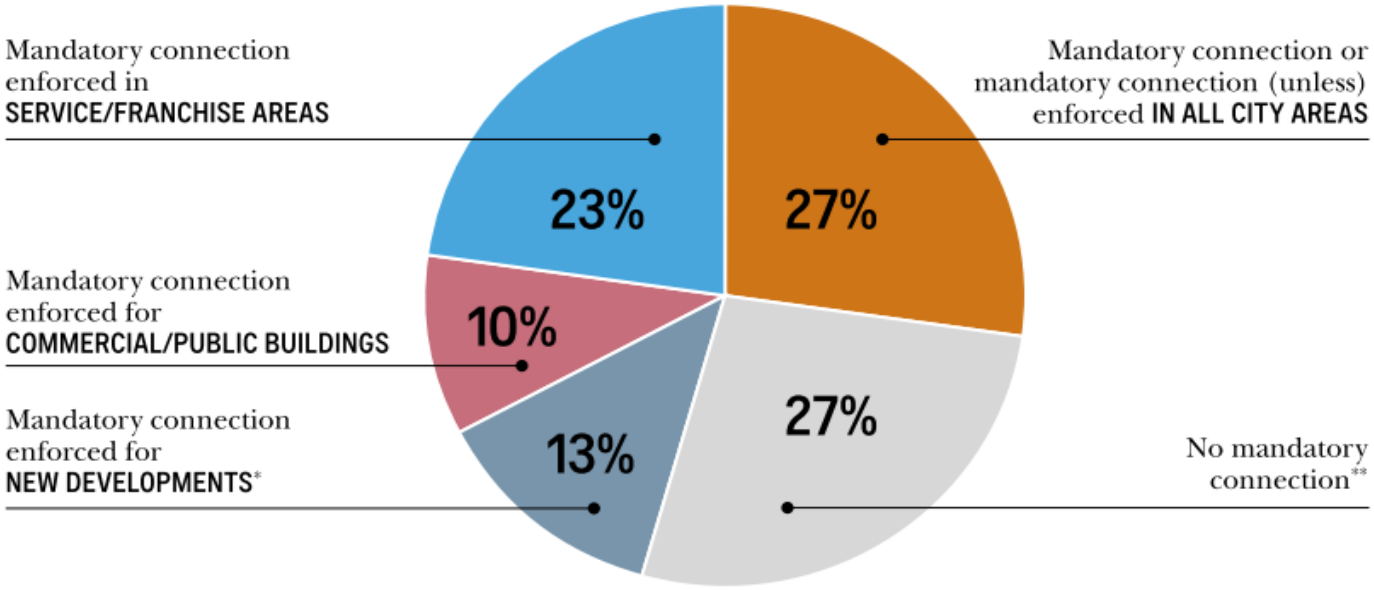
- City-wide mandatory connections
- Zonal mandatory connection policies
- Mandatory connection (unless) policies
- Mandatory district energy development through zoning policies

Encouraged

- Density bonus
- Access to rights-of-way
- Take or pay
- Bans
- Regulated and transparent tariffs
- Building compatibility requirements
- Inclusion in local green building standards
- Financial assistance

THE ROLE OF LOCAL AUTHORITIES

3. Connection policies, by type in 45 champion cities (1)



* Vancouver and Tokyo have this policy, but only for new developments over a certain size, and were not counted for this.

** Cities that are still developing their first district energy network are not included here because their connection policy is undecided.

Source: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

THE ROLE OF LOCAL AUTHORITIES

3. Connection policies: Tariff regulation and consumer protection

Pass though costs

- More regulated
- Profits capped or reinvested
- Stable business model
- Competition comes from consumers ability to disconnect

Next alternative technology

- Regulated or unregulated
- Consumer protection high
- Could limit innovation in some markets by using the same fuel as the alternative technology

Controlled tariffs

- Ensures population receives affordable heat by fixing tariffs at specific level
- Found in many 'refurbishment' cities
- Municipal or national subsidies or 'top-up' ensures sufficient revenues

- **Tariff regulation** may come from the **national level** but many cities also exert control.
- **Three broad categories of tariff regulation**, very dependent on the 'culture' of energy price regulation in a country and/or city.
- Objective: **protect consumers & ensure stable business model** (incl. load certainty).

3. Connection policies: Connecting Waste Heat

Lessons from other cities

- Connect waste heat and **set a tariff** for it.
- Cities can encourage connection of waste heat and **provide pricing guidelines**.
- Cities could **mandate utilities to connect** waste heat where economically and technically viable.
- Waste heat **important in 'refurbishment' cities** due to lower costs and reduction of fossil fuel imports
- Waste heat **tariffs will depend on the technology** and will differ significantly between a waste incinerator or CHP and industrial waste heat.
- Waste heat is like electricity generation from variable renewables

- Waste heat tariffs should consider:
  - The ability to guarantee supply
  - Redundant 'back-up' plants required
  - Impact on operations of supplier
  - Cost of connection

In Anshan, China refurbishment is centred around connecting 1GW of industrial waste heat. This will:

- **Reduce air pollution**
- **Reduce coal consumption**
- **Cost 1.8 US Cents per kWh**
- **Have a payback period of three years**

DISTRICT ENERGY IN CITIES

CASE STUDIES

Kai Tak, China, Source: Unsplash

CASE STUDY: THE EU PERSPECTIVE

EU Policy on heat planning

EU LEGISLATION ON HEAT PLANNING

"EU legislation on energy efficiency requires that regional and local authorities plan and design an urban heating and cooling infrastructure that utilizes all available renewable energy sources and CHP in their region."

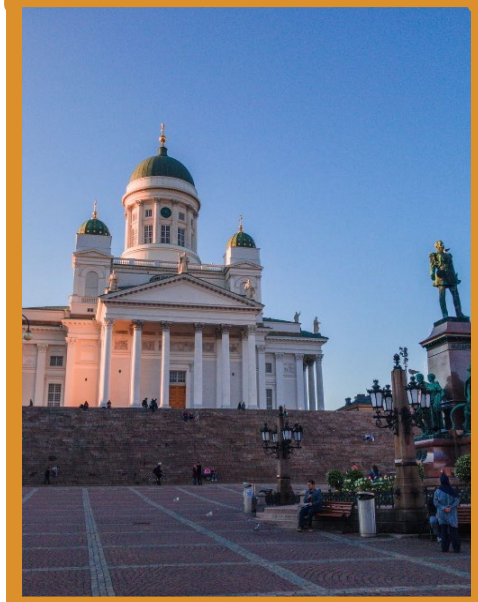
UNEP, District Energy in Cities

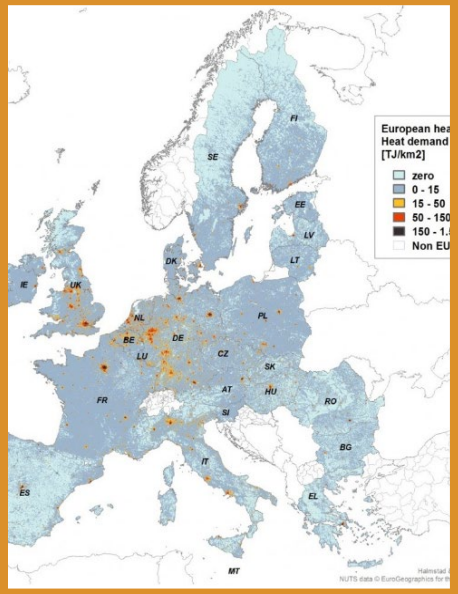
Source: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

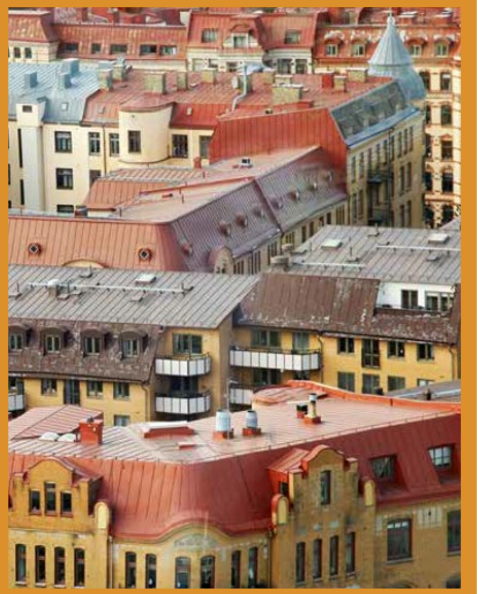
CASE STUDY: THE EU PERSPECTIVE

Overview of DE cases within the European Union

Finland: Building code and EPBD	Heat Roadmap: Planning for districts	Norway: Licensing of DH	Sweden: Levelling the playing field







Source: image 1: Unsplash, image 2: EnergyPLAN, image 3 & 4: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

CASE STUDY: THE EU PERSPECTIVE

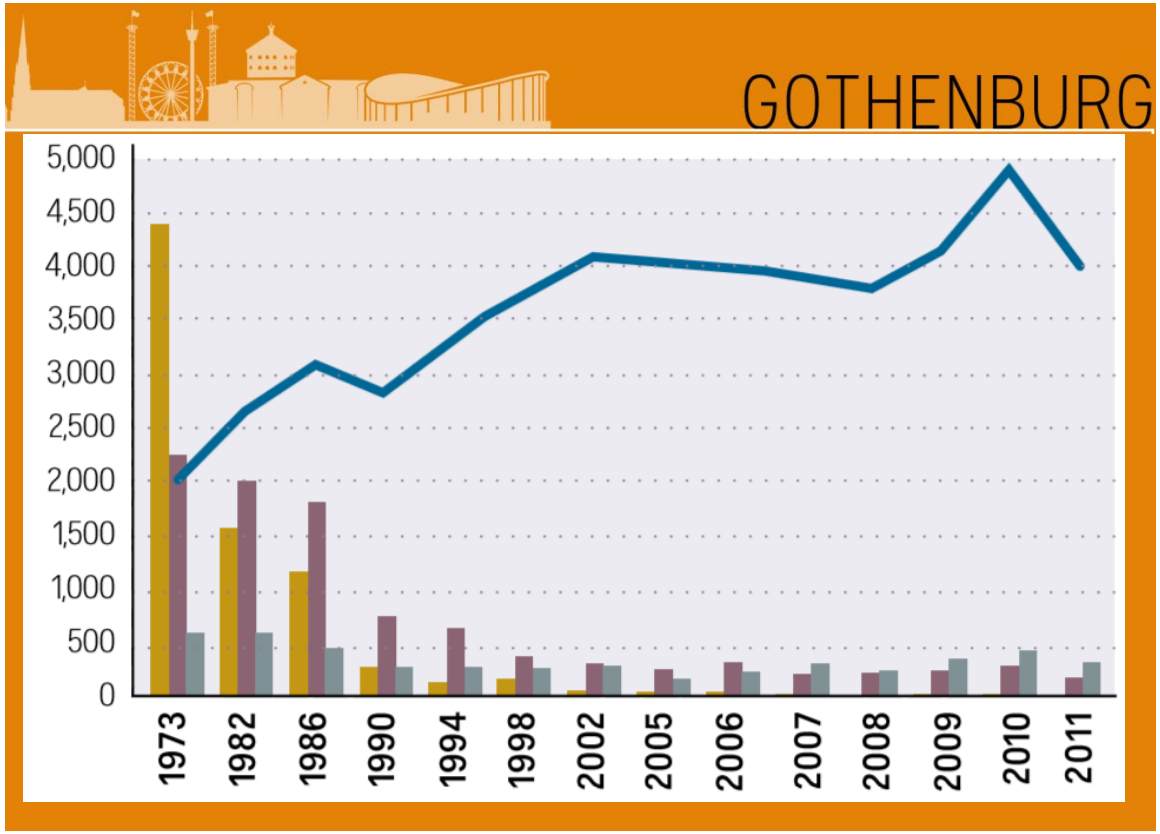
The greater London authority: encouraging connection through planning

Source: Bunhill CHP plant in Islington, London. The tower is a large heat storage unit that reduces the need to provide heat from the district heating system', Ianvisits

- The **Greater London Authority's** (GLA's) energy planning started with a focus on **climate change**, but it now also takes into account the **city's rapid growth and ageing infrastructure**, including the electricity grid.
- London uses its **land-use planning authority** to promote district energy development.
- Current GLA planning policies require **all new developments** to include energy assessments that detail efforts to **minimize the associated CO_2 emissions.**

CASE STUDY: THE EU PERSPECTIVE

Best practice national policies: Gothenburg (Sweden)



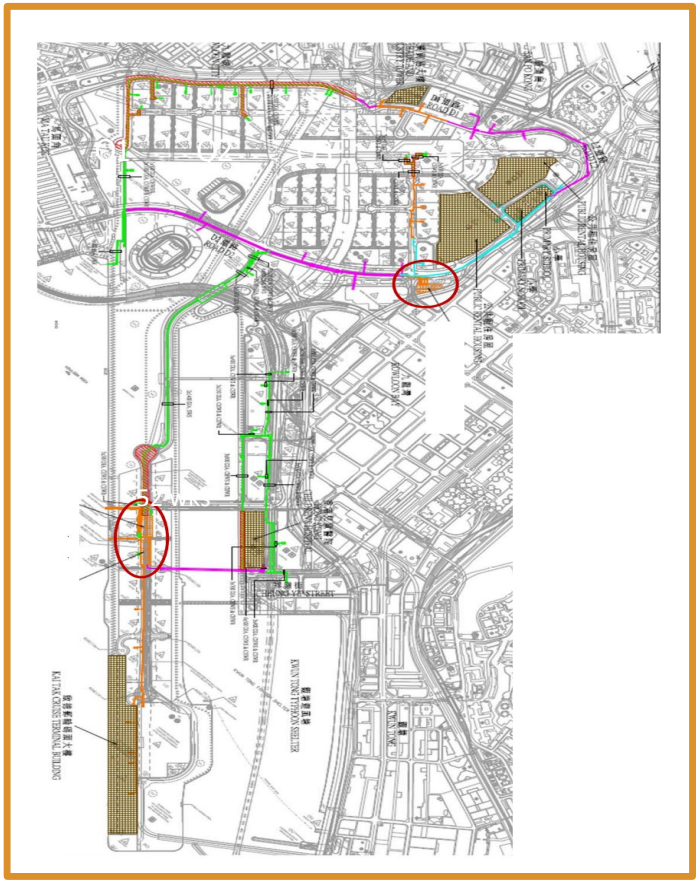
"In Sweden, a CO_2 tax was critical to the country's energy transition strategy and Gothenburg identified the CO2 tax as the most important national policy for district energy in the city"

UNEP, District Energy in Cities

Source: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

CASE STUDY: KAI TAK, CHINA

The case of Kai Tak Development: mandatory connection through planning



- District cooling developed as new buildings are constructed: phased development
  - Phase 1 (2011-2013)
  - Phase 2 (2011-2014)

  } 3298 TR
  - Phase 3 (2013-2017): 5000 TR
  - Remaining (2017-2021): 40,000 – 73,000 TR

Development area: 3.2 million m^2
Full load: 81,000 RT
Pipe length: 40km
Number of consumers: 60
Technology: Electric chillers and seawater cooling
Electricity savings: 85 GWh per year (equivalent to $1.7 million)
CO_2 reduction : 59,500 tons of CO_2 per year

Source: Implementation of District Cooling System at Kai Tak Development. Electrical and Mechanical Services Department

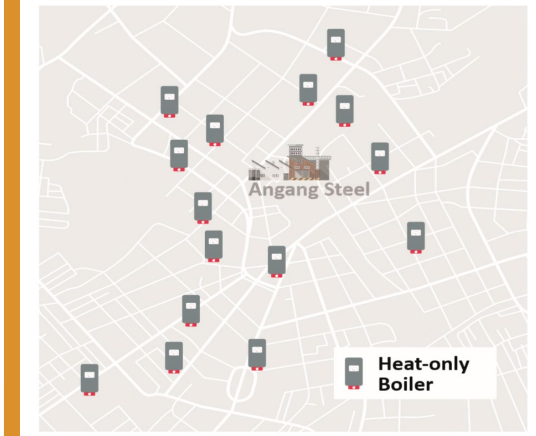
CASE STUDY: ANSHAN, CHINA

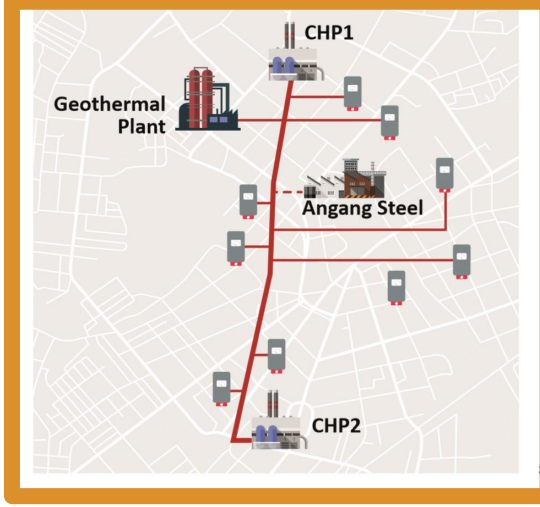
Anshan – Heat planning based on macro-economic benefits

Based on the Danish experience

- Heat planning
- Renewables integration
- Maximising efficiency
- Waste heat connection
- Stakeholder coordination

- **Heat planning for city**: transmission, pooling networks, waste heat connection, hot water connections and renewables
- **Pollution fines and coal savings** between 60-90% leads to macro-economic benefits → payback of <2.5 years
- Nordic → China **best practice transfer** that is highly replicable approach across province and China





Source of both images: District Energy in Cities. Unlocking the Potential of Energy Efficiency and Renewable Energy

CASE STUDY: TOKYO, JAPAN

Tokyo: the case of mandatory connection (unless) policy

Tokyo Sky Tree District in Tokyo
Source: TOBU Railway Co.

- 1970 **response to air pollution** from building level solutions and 2009 earthquake and 2011 Fukishima led to use of **DES for resilience and independence**, greater focus on CHP and RE
- Today **20 large-scale developments** per year on district energy development or connection are undertaken
- Using waste incineration, waste heat, solar thermal, and heat pumps connected to local water sources
- **Mandatory connection for developments**
- **>10 000m2 along with exclusive service areas should connect unless** they are able to prove it is not feasible
- If an economic barrier exists to connect a new large building the city will seek to overcome this barrier

KEY TAKEAWAYS (I/II)

Some of the main aspects we have seen in this module are:

- Urban planning is a **technical and political process** concerned with the development and design of land use and the built environment.
- From an energy system perspective, the purpose of integrating urban planning in the development of DES is to ensure a **sustainable urban development.**
- For each of the steps of urban planning, specific actions need to be undertaken towards the development of the DES network to ensure an **integrated process.**
- As planners and regulators, local authorities have **three main areas for policy intervention**:
    1. Energy policy objectives, strategy and targets
    2. Holistic energy mapping
    3. Connection policies
- **Integrated energy planning** entails: planning criteria, mixed use zoning, franchise licenses, building codes and policies, connection policies, and compact land use

KEY TAKEAWAYS (II/II)

Some of the main aspects we have seen in this module are:

- An energy plan is a **road map of project developments** and policy interventions to help a city realize the articulated goals of its energy strategy.
- **Holistic energy mapping** helps to identify synergies and opportunities for cost-effective district energy,
- **Connection Policies**, can be classified by enforcement type;
  - **Mandatory:** city-wide mandatory connections, zonal mandatory connection policies, mandatory connection (unless) policies, mandatory district energy development through zoning policies
  - **Encouraged**: density bonus, access to rights-of-way, take or pay, bans, regulated and transparent tariffs, building compatibility requirements, inclusion in local green building standards, financial assistance

- Each city or municipality should identify the **best policy instruments** to develop DES based on its framework conditions.

RECOMMENDATIONS

Some recommendation for policy development are:

- **Characterise business-as-usual**, analysing socio-economic, technical, policy and urban planning framework
- **Develop a DES potential analysis** (rapid assessment and city-wide deep assessment)
- Assess the **other technical alternatives** and cross against DES solution
- Present benefits of DES to the energy plan and requirements to the urban planning
- Strengthen know-how of DES technical capacity in the energy department
- **Provide policy instrument gaps** to stimulate demand (i.e. mandatory and/or encouraged measures)

THANK YOU FOR COMPLETING THIS MODULE!

For more information about the initiative or this Training, please visit the following websites or contact:

www.districtenergyinitiative.org

unep.org

c2e2.unepdtu.org

E-TRAINING PROGRAM

DISTRICT ENERGY DEVELOPMENT

In the upcoming modules, you will learn about …

Module 6

- Business models for sound sustainable district energy systems