



DISTRICT ENERGY
IN CITIES
INITIATIVE

E-TRAINING PROGRAM DISTRICT COOLING DEVELOPMENT



MODULE 4. STRATEGY DEVELOPMENT: INCORPORATING DC INTO LOCAL ENERGY & LOW-CARBON HEAT/COOL STRATEGIES



MODULE 4. STRATEGY DEVELOPMENT IN DC

LEARNING OUTCOMES

Objective: share insights on strategy development to incorporate district cooling into a local energy and low-carbon heat/cool strategies

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



Describe, understand and discuss the role of district cooling strategy development in local energy and low-carbon heating and cooling strategies;



Recognise and apply key steps to integrate district cooling in local energy and low-carbon heating and cooling strategies;



Identify best case practices in incorporating district cooling planning in local energy strategies;

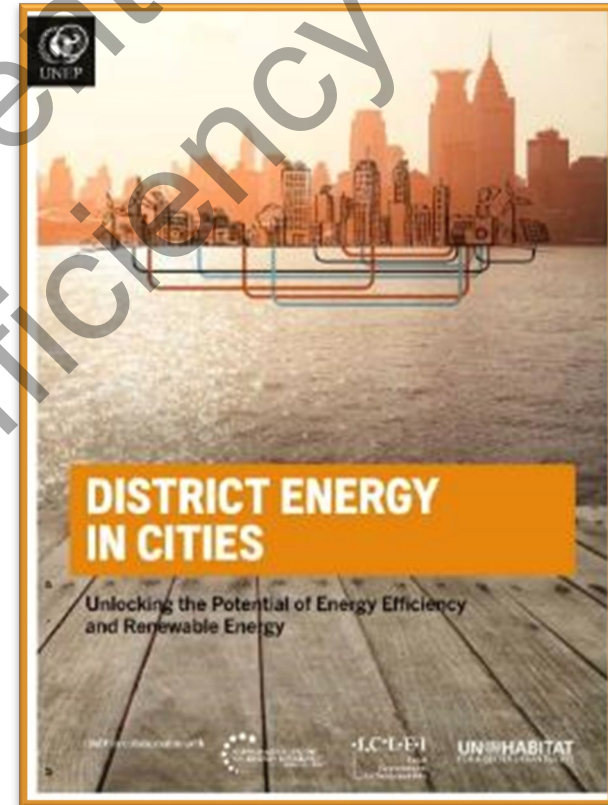


MODULE 4. STRATEGY DEVELOPMENT IN DC

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



MODULE 4. STRATEGY DEVELOPMENT IN DC

WHY IS THIS IMPORTANT?

Incorporating DC into local energy and low carbon heating and/or cooling strategies ...

- **Most efficient and measurable way to meeting city objectives**
- Provide a coherent vision around which to **mobilize project champions**
- **Reassure investors**, making possible longer-term infrastructure developments such as DC
- Resources **spent justified against the potential benefits**
- A city can shape the low-carbon pathways of its services, capture synergies across business segments, and **direct the local DC strategy towards social and economic objectives**
- In essence, **to tackle energy-related challenges** in a coordinated and informed manner, **with a long-term perspective**



Image: EnergyLab Nordhavn

MODULE 4. STRATEGY DEVELOPMENT IN DC DEFINITION

An energy and low-carbon cooling strategy implies...

- Identify and apply the **practical steps** required to develop the “portfolio” of projects and actions.
- **Coordination and monitoring of progress** and the engagement of stakeholders.
- Setting **delivery mechanisms** and enabling mechanisms in order to facilitate and stimulate investment in the “portfolio”.
- **Strategic cooling planning** differs from planning for other energy carriers due to the local nature of cooling supply.
- It is necessary to include **technical, economic, environmental and societal contexts** in the assessment.

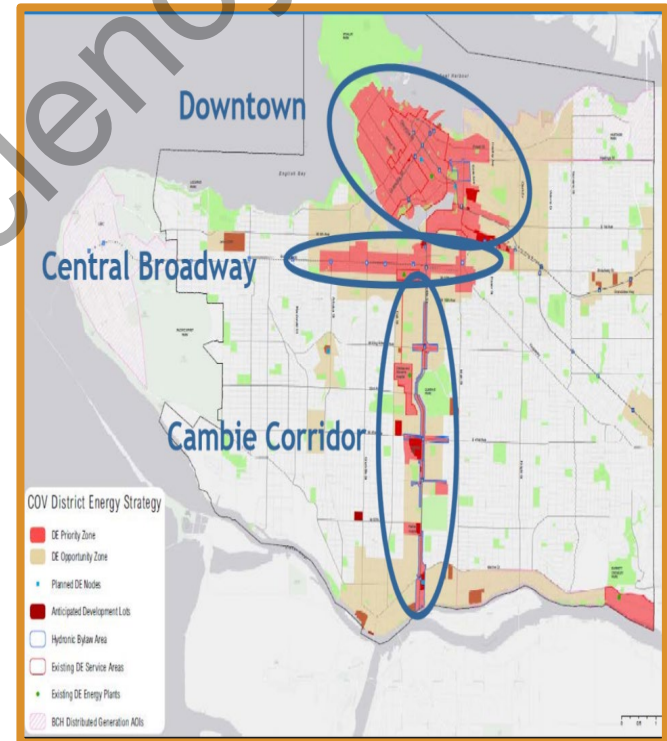
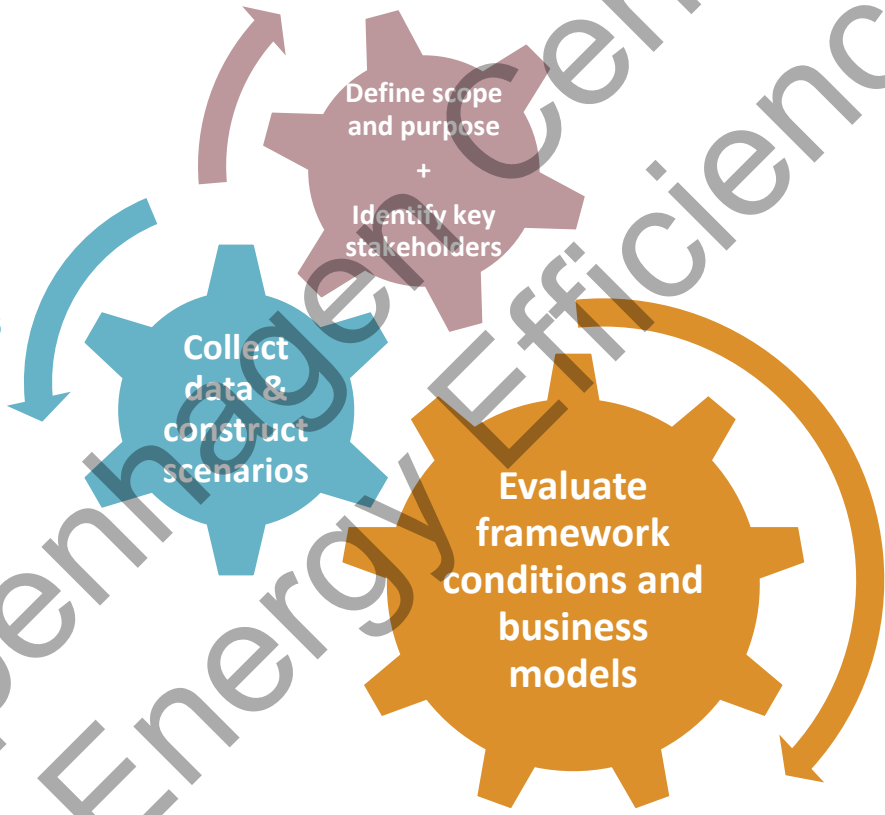


Image: Vancouver Authorities

MODULE 4. STRATEGY DEVELOPMENT IN DC DEFINITION

An energy and low-carbon cooling strategy...

- Elaborate technical scenarios
- Assess compatibility with existing cooling networks in buildings
- Address technical challenges when implementing low-temperature heat sources (e.g. excess heat/cooling, etc.)



- Objectives
- Scope
- Identify and engage stakeholders

- Regulation
- Ownership
- Pricing
- Financing

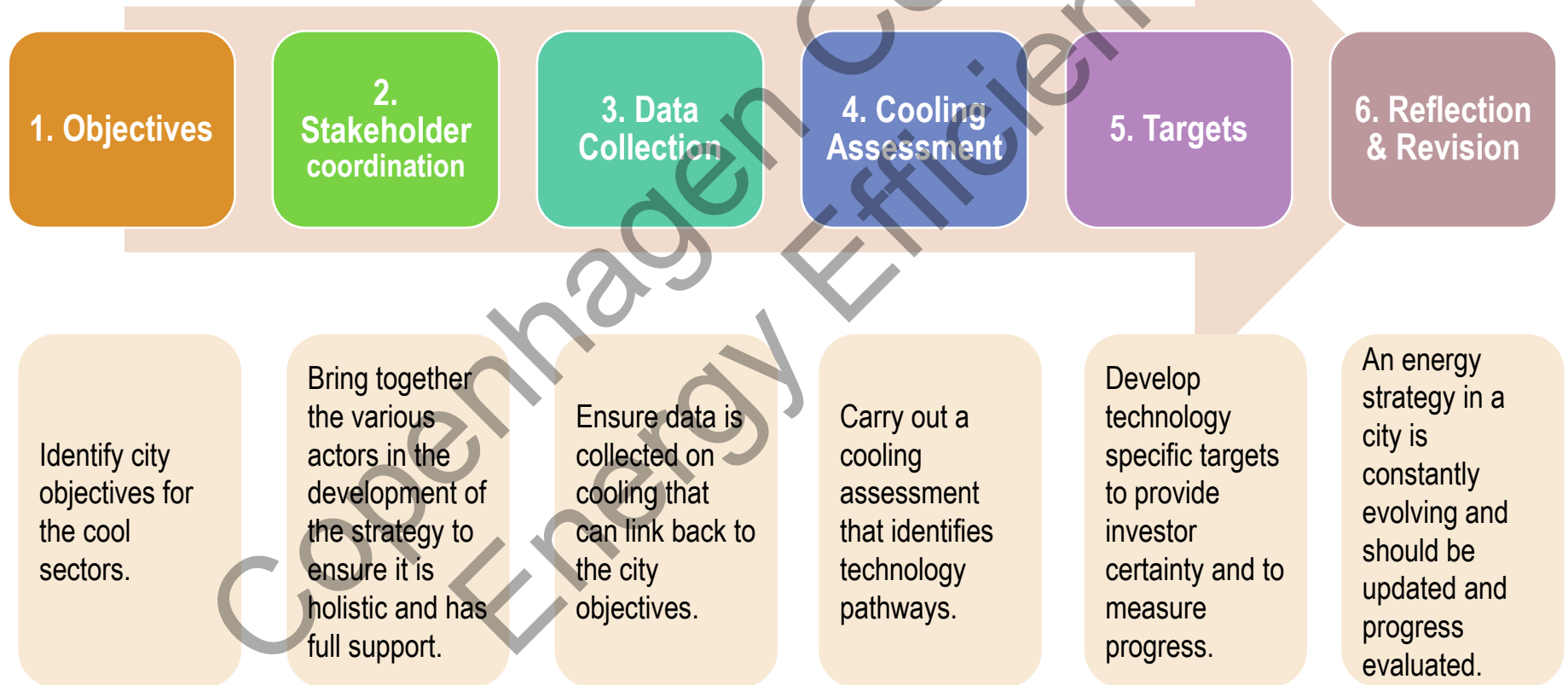
Strategy development in local energy and low-carbon cooling is not solely an engineering, economic or political activity but it is **interdisciplinary** in its nature



MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

Six steps in incorporating DC into a local energy and low-carbon cool strategies





MODULE 4. STRATEGY DEVELOPMENT IN DC

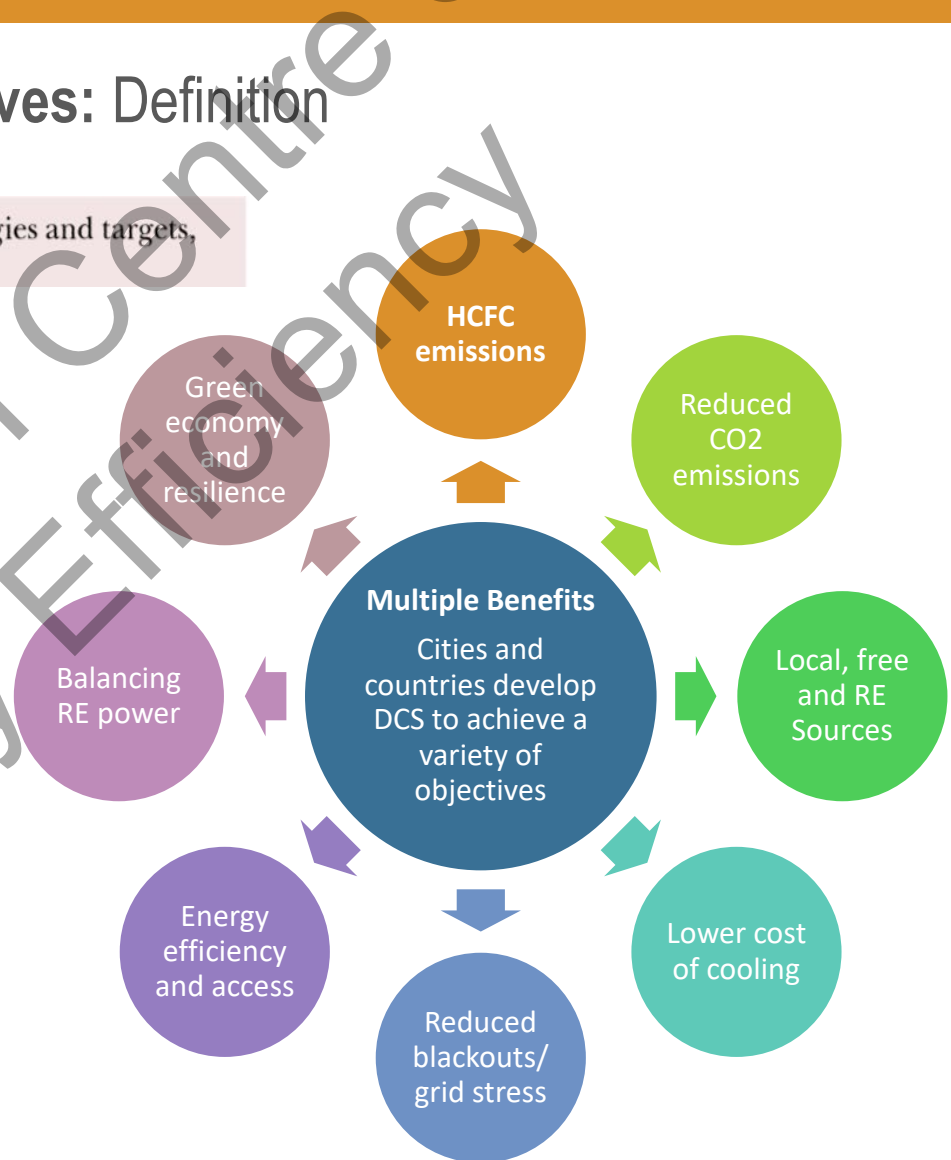
HOW TO DEVELOP STRATEGY IN DCS?

1. Objectives: Definition

1. ASSESS existing energy and climate policy objectives, strategies and targets, and identify catalysts

Cities develop district cooling to achieve a variety of objectives

- Understanding and articulating these objectives is key to get 'buy-in' from different actors and the community.
- It also provides a focus for the strategy development.





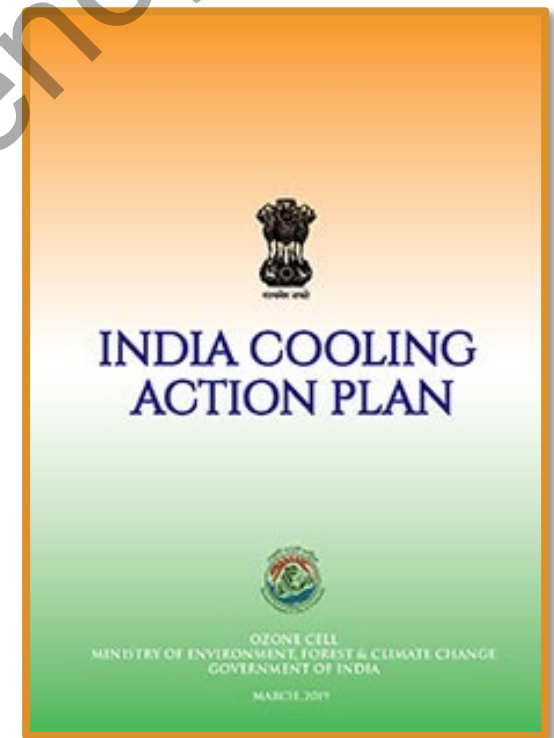
MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

1. Objectives: An example

India Cooling Action Plan (ICAP)

- In February 2019 the government of India prioritized district cooling in the ICAP, a long-term country-wide strategy to provide thermal comfort for all citizens while minimizing negative impacts to the power sector and the environment.
- The report recommends a two pronged approach for space cooling i.e. firstly, reducing the need for active cooling in buildings using energy efficiency as a foundational building strategy, followed by meeting the reduced cooling demand using efficient cooling technologies

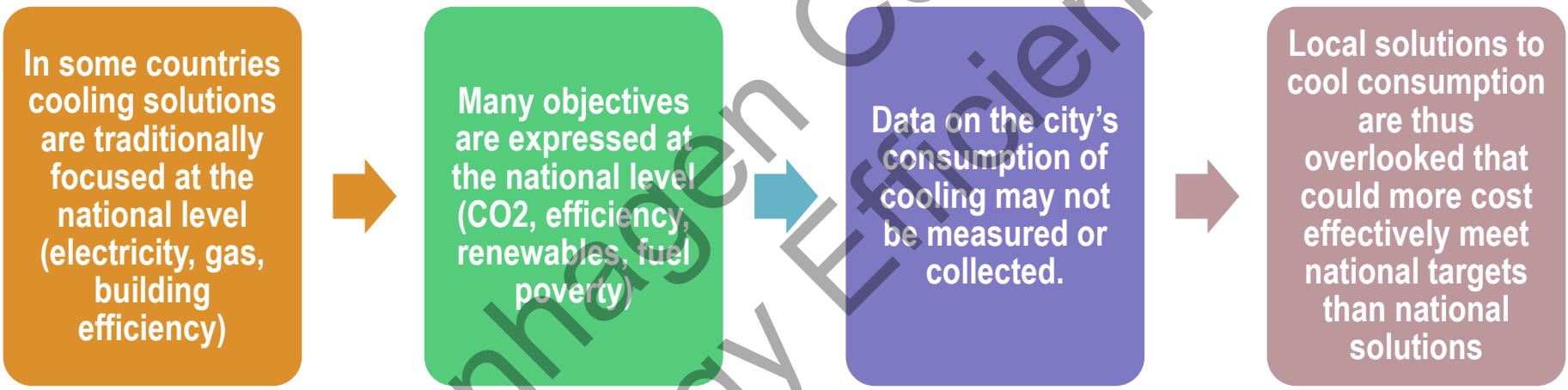


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HOW TO DEVELOP STRATEGY IN DCS?

1. Objectives: Challenges & Opportunities

Cooling not being considered at the city level



Development of a **local energy strategy**, particularly **data collection** at the city level, can shift the discourse of energy policy to the local level.

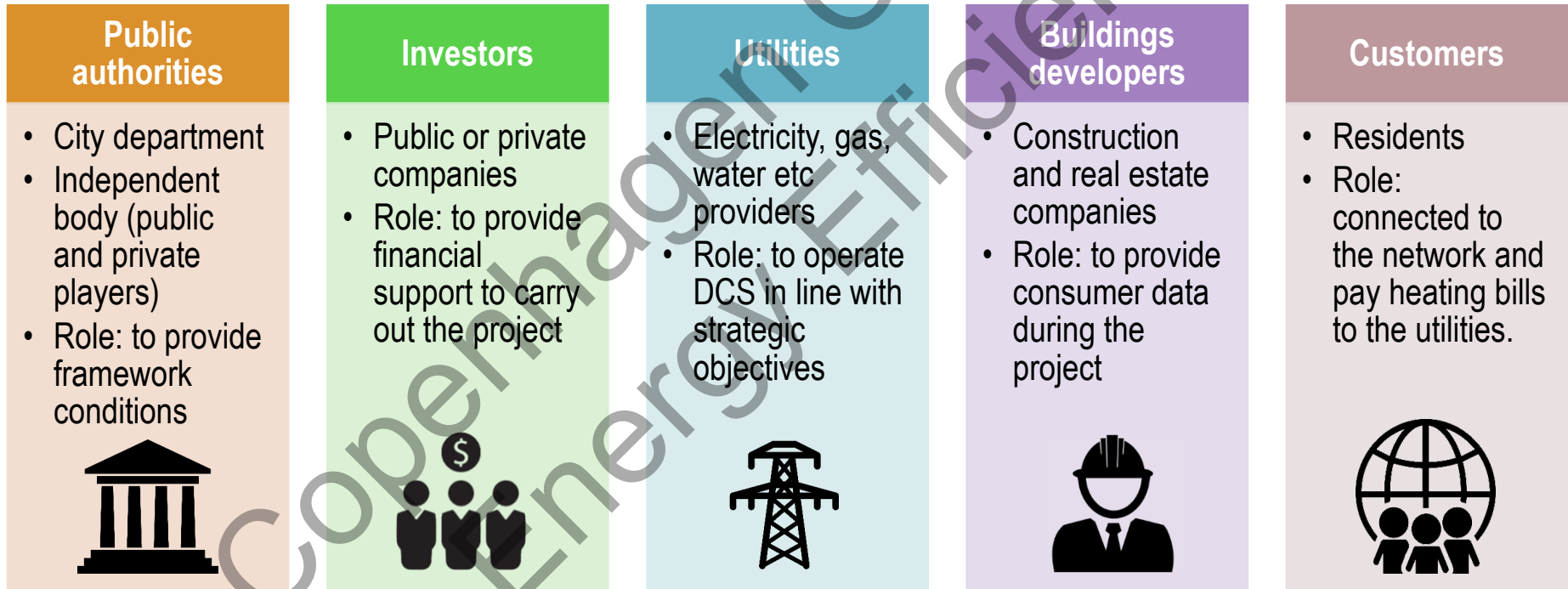
A **cooling assessment** as part of the development of an energy strategy may demonstrate that local solutions such as utilizing a city's waste heat in district cooling systems is best.

MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

2. Stakeholder coordination

Bring together the various actors in the development of the strategy to ensure it is holistic and has full support



[Further details in Module 2!]

MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

3. Data Collection

Ensure data is collected on heating and cooling that can link back to the city objectives. This step is called energy mapping and refers to the **visual representation** of energy and material flow distribution along the system, **related to its geographical location**



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

[Further details in Module 3!]

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HOW TO DEVELOP STRATEGY IN DCS?

4. Cooling Assessment

Carry out a cooling assessment that identifies **technology pathways** to achieve city objectives. These technology pathways must account for **costs, fuel price risks, timescales, changing regulatory environments and local economic benefits**

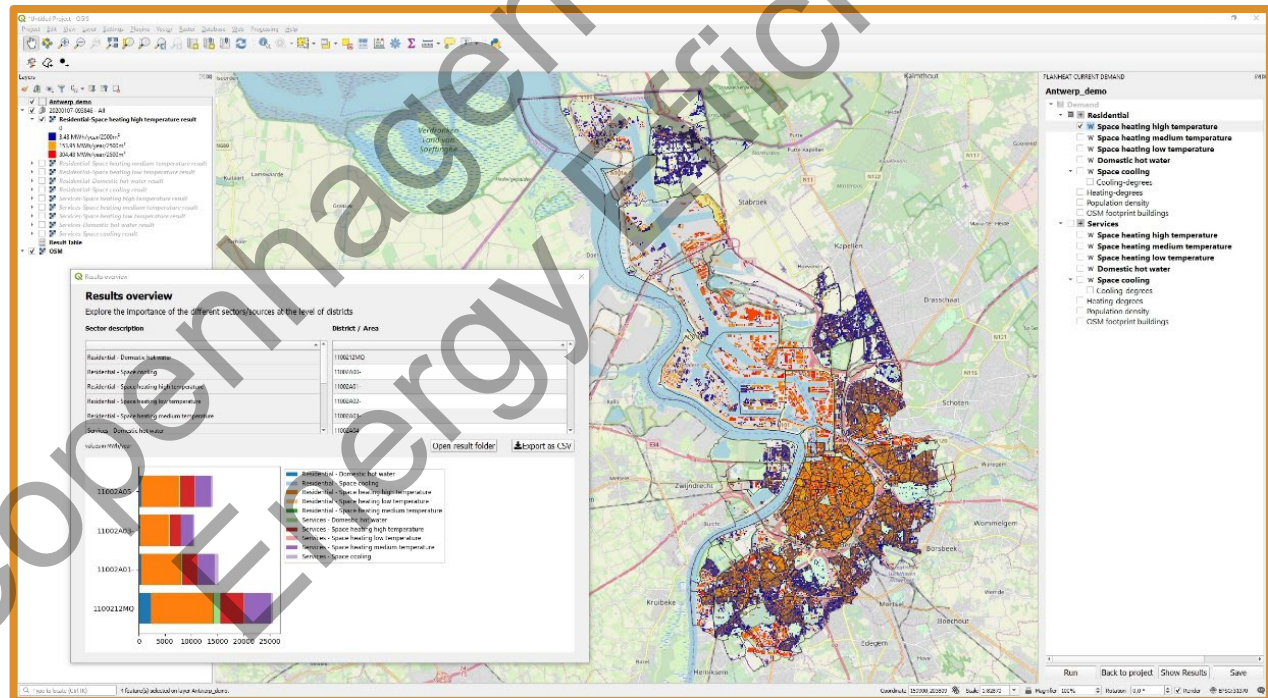


Image: PLANHEAT Tool



MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

5. Targets in development for project type

New

- Not commit to large scale DC development immediately;
- **Capacity building**, development and testing of appropriate policies and 'proving the technology' takes time;
- **Can later refine energy strategy to reflect lessons learned** in the local authority and the increased **investor confidence**;

Consolidation

- Keeping the **business model stable** and **customers connected** is a **priority**;
- Lessons learned from the initial development should be collected and implemented;
- **Staged development allows periodic refining of the energy strategy and slowly increasing the ambition** of the development;

Refurbishment

- Cities will **target reduced losses, high efficiency and cheap cool in the long term**;
- Cities may not be available to upgrade the whole network at once;
- Proving the cost savings and financial viability of new technologies is important;
- Best practise is to demonstrate new policies before expanding to the whole network;

Expansion

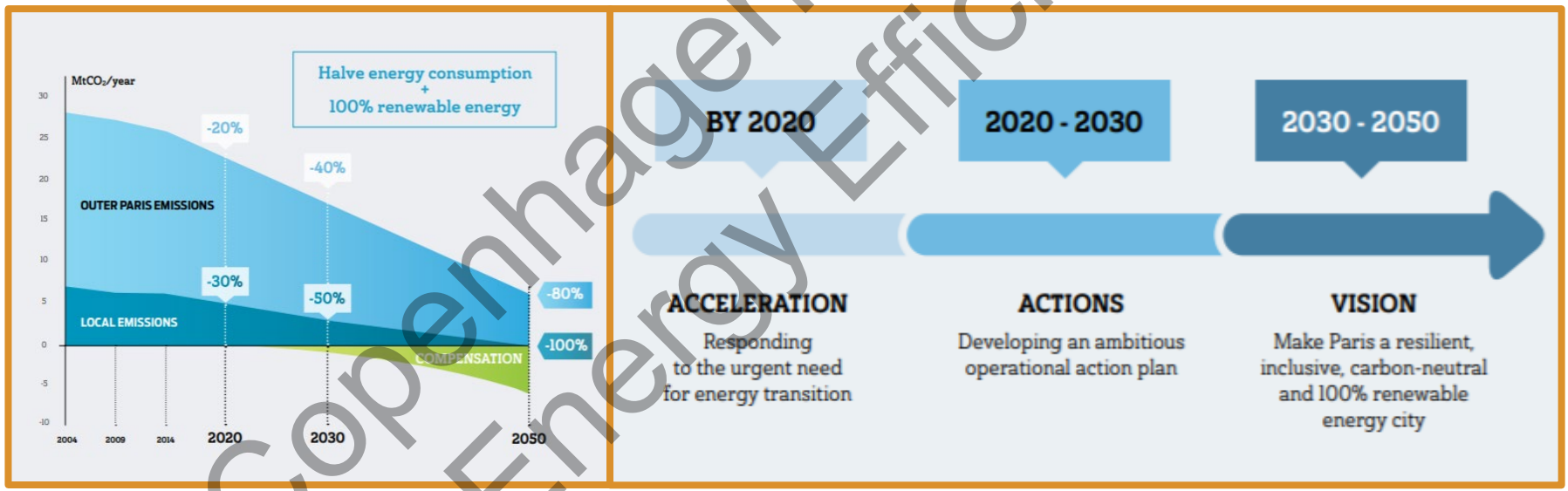
- **Lessons learned from the initial development should be collected and implemented**;
- Again, staged development allows periodic refining of the energy strategy and slowly increasing the ambition of the development as benefits are proven, risks reduced and working capital increased

MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

6. Reflection and revision

An energy strategy in a city is constantly evolving and should be updated after a period (e.g. 5 years) and progress evaluated.



Source: Paris Climate Action Plan. City of Paris, 2012



ROLE OF GOVERNMENT IN DEVELOPMENT

Designation of appropriate zones

- Governments should **mandate DC in defined areas** where density levels render it appropriate by making DC an element of urban planning.
- To achieve this, a **systematic approach needs to be taken to assess the suitability of DC** in new developments, simultaneous with urban planning.
- The power to mandate network zones implies also the power to **define exclusive concession areas, to require off-take commitments** from developers, and to establish the **award terms for the concessions** — terms that could include stipulations about allowable tariffs, service standards, and future capacity investments.

Tariff regulation

- Governments should **establish a consistent national tariff framework for DC**.
- That means defining **the allocation model of up-front**, recurrent, and consumption **charges** to property developers, individual property owners, and tenants and enforce the consistent use of such charging models across projects.
- The charging models should seek **to align the charges paid by users with actual cooling consumption**. In some cases, price regulation will be required to provide equitable tariffs to users, while granting returns to DC utilities commensurate with industry risks.

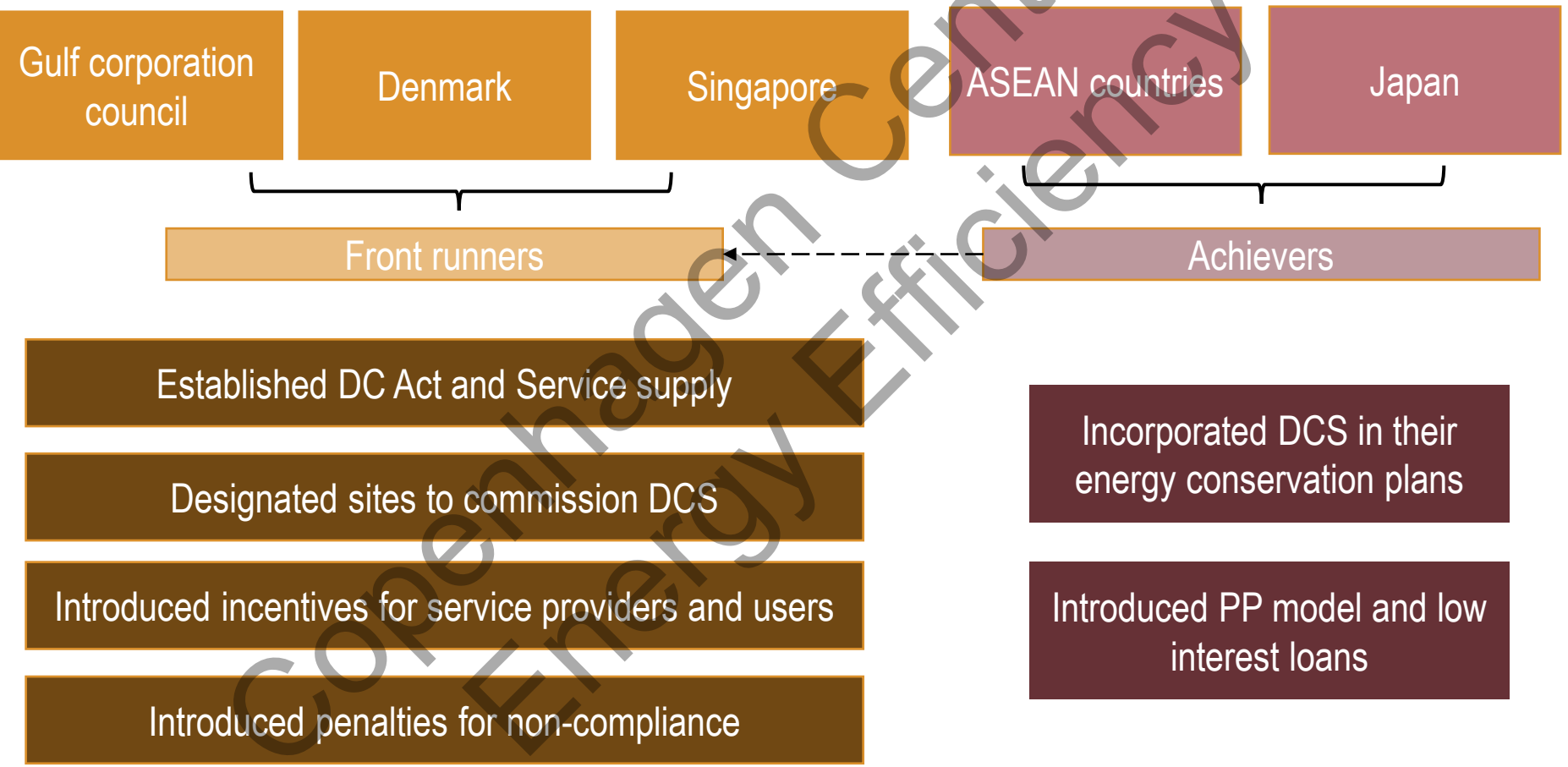
Service standards and technical codes

- Governments **should define the basic levels of reliability and performance** required of DC providers.
- They should accompany these requirements with **technical codes to ensure quality** in the design and installation of assets.
- There is also a need for codes governing the **operational interface** between DC providers and building owners.
- Clarifying these **rules of competition** can give DC the chance to become a competitive industry.

Source: Strategy&: Unlocking the potential of DC, the need for GCC governments to take action

MODULE 4. STRATEGY DEVELOPMENT IN DC

ROLE OF GOVERNMENT IN DEVELOPMENT



Source: GIZ



SMART CITY PLAN

- Align district cooling to key themes and sub-goals under Smart City Plan and its role in meeting Smart City objectives on: smart metering and monitoring of water, increase share of renewable energy; reuse of wastewater etc.
- Incorporate smart solutions to space cooling more explicitly including DC and justify this inclusion against smart city objectives such as sustainable buildings and future-proofed infrastructure.

SOLAR CITY PROGRAM

- Solar City Master Plan's combined approach of improving energy efficiency and increasing renewables is a fundamental tenet of DC.
- Given this shared approach, the Master Plan could provide a strong policy framework to take action on DC and could include DC justifying its inclusion as a technology that aligns well with the Solar City Program's objectives



DISTRICT
ENERGY
IN CITIES

CASE STUDIES



Shenzhen, China. Image: Unsplash



MODULE 4. STRATEGY DEVELOPMENT IN DC

CASE STUDY: KAI TAK, CHINA

Setting Objectives

CHALLENGES

- 32% of Hong Kong's electricity is for AC.
- Lack of experience in district cooling

OBJECTIVES

- Cut down coal consumption for electricity.
- Demonstrate district cooling in Hong Kong to kick-off other projects
- By 2020 improve refrigeration performance by 50% for all commercial buildings

PROJECT IDENTIFICATION

- Identified redevelopment of old airport: dense, mixed, public anchor loads.
- Project's proximity to seawater for cooling
- Hong Kong had authority over design and development of zone



Image: airport2park.org



MODULE 4. STRATEGY DEVELOPMENT IN DC

CASE STUDY: KAI TAK, CHINA

Setting Objectives

DEVELOPMENT INFORMATION

- Connect malls, cruise terminal, offices, schools, hotels, sports complexes
- Phased approach to match real estate development
- Full system will serve 1.7 million m² of floor-space with 80,000 TR and 39km pipes
- Demonstrating technology, helping identify new district cooling projects in Hong Kong

BENEFITS

- **35% less electricity demand** than air-cooled stand-alone systems
- Reduced capital costs, noise, thermal plume and vibration for buildings as well as space saving
- Full system benefits:
 - Electricity savings: 85 GWh per year;
 - CO₂ reductions of 59,500tCO₂/year



Image: ktd.gov.hk

MODULE 4. STRATEGY DEVELOPMENT IN DC

CASE STUDY: SHENZHEN QIANHAI, CHINA

Setting City targets

- Energy saving rate: 12.3%
- Electricity saving: 0.13 billion kWh
- Reduction of standard coal: 16000 tons
- Reduce peak electric power: 0.12 mkWh
- Reducing thermal island effect
- CO₂ emission reduction: 123,000 tons
- Reduce water: 3 million tons



Image: Renderings of urban planning document in Shenzhen, Urban planning document municipality

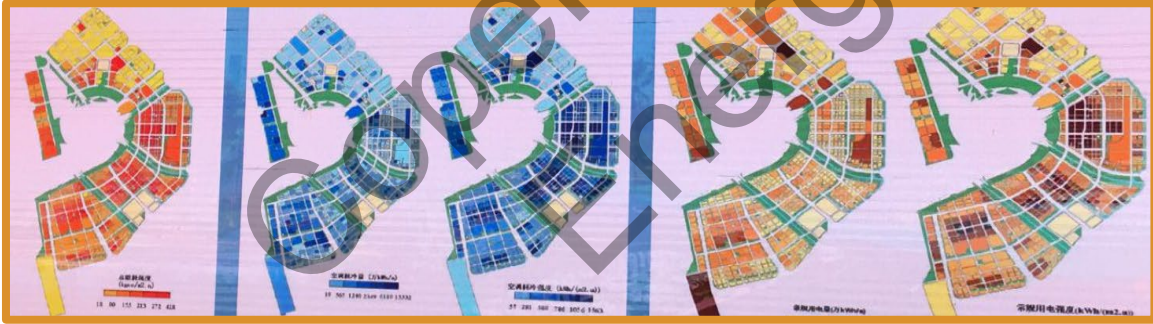


Image: Urban plans for Qianhai, Urban planning document municipality



MODULE 4. STRATEGY DEVELOPMENT IN DC

CASE STUDY: RAJKOT, INDIA

Incorporating DC in master plan

- A detailed evaluation of DC for the area-based development under its Smart City Plan concluded that DC is **commercially viable** without the need for separate viability gap funding or other policy measures
- RMC has acted fast and with **engineering support from UNEP** prepared design for DCS pipeline network with a **dedicated corridor for DCS pipelines**
- They also integrated DCS in their overall '**integrated infrastructure tender**' for the smart city area, prepared for laying out pipes for the other utilities like waste water supply pipelines, drinking water pipelines, electrical ducts etc.



Image: Rajkot smart city master plan, RMC

The key lesson is that **early-stage analysis of DCS, strong leadership** from a city and **inclusion of DCS in a city's long-term strategy and plan** are crucial for DCS development led by a city.



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CASE STUDY: ANSHAN, CHINA

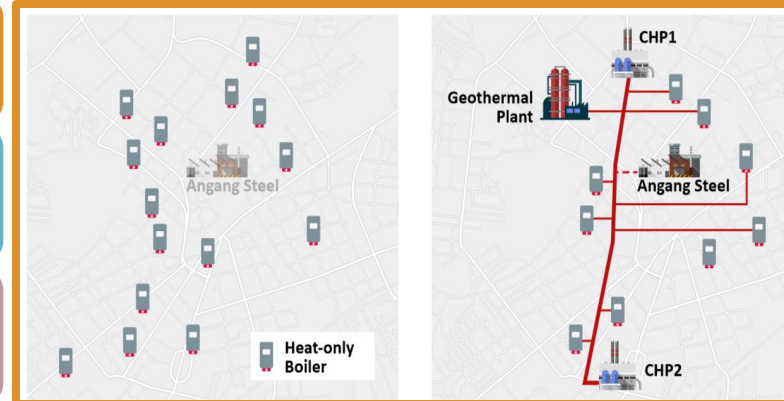
Developing a strategy in existing systems



Pooling of networks, connection of waste heat and removal of small coal-fired boilers.

Connection to a large transmission line and pooling of networks is being achieved in stages connecting and upgrading individual districts at approximately 200MW each stage

Short payback period of less that 2.5 years



Source: “District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy”. UNEP, 2018



KEY TAKEAWAYS

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

- District cooling planning should be **consistently integrated with local energy and low-carbon cool strategies**
 - Ensure a stable and sustainable development, maintenance and operation of the network, throughout its complete life-cycle
 - Cities to assess and demonstrate the benefits of district cooling in the context of local objectives and its potential.
 - Enable the support for stakeholder buy-in and reassure investors
- Key steps are: (1) defining objectives, (2) stakeholder coordination, (3) data collection, (4) heating and cooling assessment, (5) setting targets, (6) reflection and revision
- There are **different levels of strategy development** depending on the **pre-existing infrastructure**: New, Consolidation, Refurbishment , Expansion
- The **various levels of local or city engagements** in each phase to capture synergies across business segments, and direct the local district cooling strategy towards social and economic objectives.



MODULE 4. STRATEGY DEVELOPMENT IN DC RECOMMENDATIONS

Recommendations for India for strategy development:

- Large government development organizations like NBCC and CPWD should consider district cooling as a strategy in their projects. The potential developments under NBCC and CPWD can support smart city initiatives of MoHUA. Systematic approach during planning stage, with focused technical expertise is needed in green field developments in smart cities.
- GRIHA, LEED, IGBC etc. can work in integrating DCS in design for campus and large developments, as energy saving strategy. State and city level governments can offer incentives linked to green development with district cooling for thermal comfort in buildings (commercial and residential)



MODULE 4. STRATEGY DEVELOPMENT IN DC

RECOMMENDATIONS

Some recommendation for strategy development are:

- Incorporating district cooling into a local energy and low-carbon cool strategies will **ensure that the city can shape the low-carbon pathways of its services**, capture synergies across business segments, and direct the local DC strategy towards social and economic objectives
- It allows to **tackle energy-related challenges** in a coordinated and informed manner, with a long-term perspective
- It should be done from the start following the steps that were shared in this module
- Development of a local energy strategy, particularly data collection at the city level, can **shift the discourse of energy policy to the local level**
- A **cooling assessment** as part of the development of an energy strategy may demonstrate that local solutions such as utilizing a city's waste heat in district cooling systems is best.



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 COOLING DEVELOPMENT

In the upcoming modules, you will learn about ...

Module 5

- Carbon heating and cooling strategies

Module 6

- Business models for sound sustainable district cooling systems



MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

5. Targets in Latvia: Refurbishing and keeping heat tariffs low

The **objective of refurbishment** is to **reduce the subsidies required** to district heat networks and make them more efficient whilst keeping heat affordable.

Many municipalities do not have the capital for large scale improvements. **A lack of investment can push tariffs up making it harder to retain customers**, which makes the problem even worse.

For many municipalities **the solution will be slow and long-term with small incremental improvements** made that do not impact the business model significantly.



Source: Laima Gūtmane

73%	577,409	2,254
Share of CHP in DE	Residents served by DE	MWth installed capacity



MODULE 4. STRATEGY DEVELOPMENT IN DC

HOW TO DEVELOP STRATEGY IN DCS?

5. Targets in Vancouver: Transitioning from 'new' to 'expanding'

Between 2006 and 2010 Vancouver developed Southeast False Creek Neighbourhood Energy Utility (SEFC NEU).

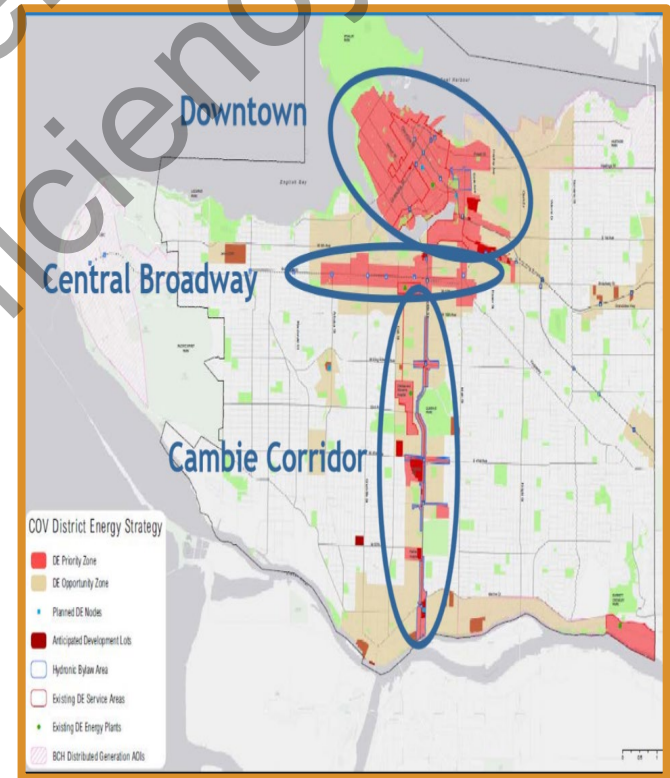
SEFC NEU tested new policies such as service area by-laws requiring connection and proved the benefits of district energy.

In 2010 the city developed the 'Greenest City Action Plan' in 2010.

Vancouver consulted with utilities, NGOs, building developers and other levels of government on new district energy strategy.

City now has district energy strategy targeting specific network development up to 2020.

Current strategy and vision based on SEFC NEU and the lessons learned.



Source: Neighbourhood Energy in Vancouver -- Strategic Approach and Guidelines



MODULE 4. STRATEGY DEVELOPMENT IN DC

CASE STUDY: GOTHENBURG, SWEDEN

Consolidation: from oil to waste heat

- From 8 isolated heat island to an interconnected sustainable network reaching 60% of the city
- The oil crisis in the 70's lead the shift towards a decarbonisation of the generation mix
- The network optimizes available heat from its surroundings, reducing the dependency on imports



Source: Göteborg Energi