

Sustainable energy transitions for carbon neutrality in cities of MENA region

- An outlook on district and building energy systems

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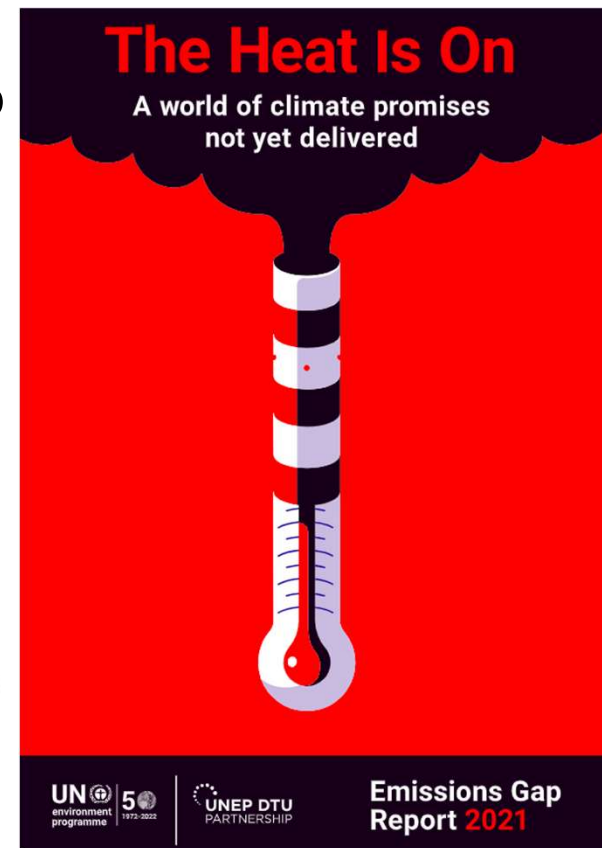
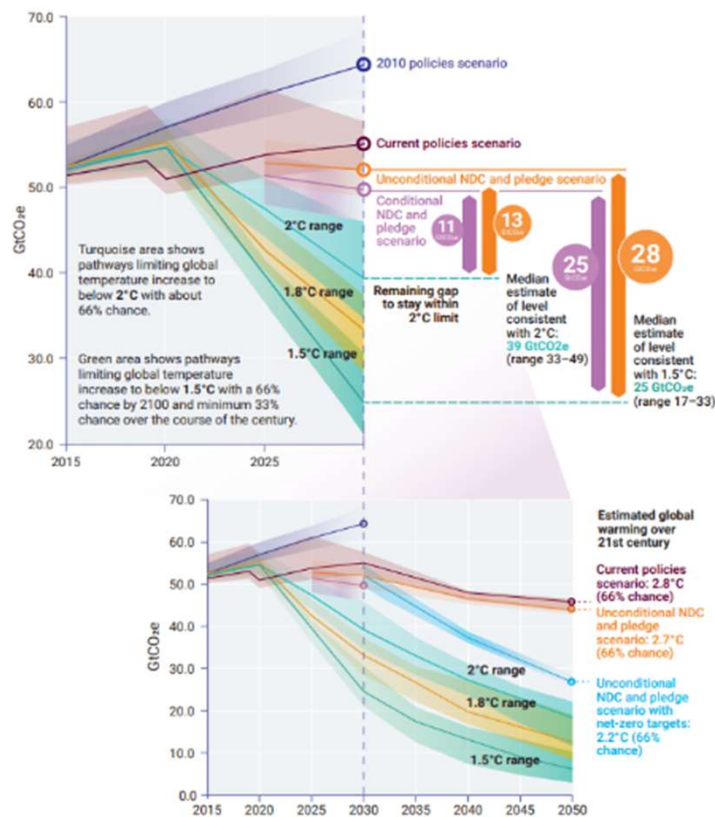
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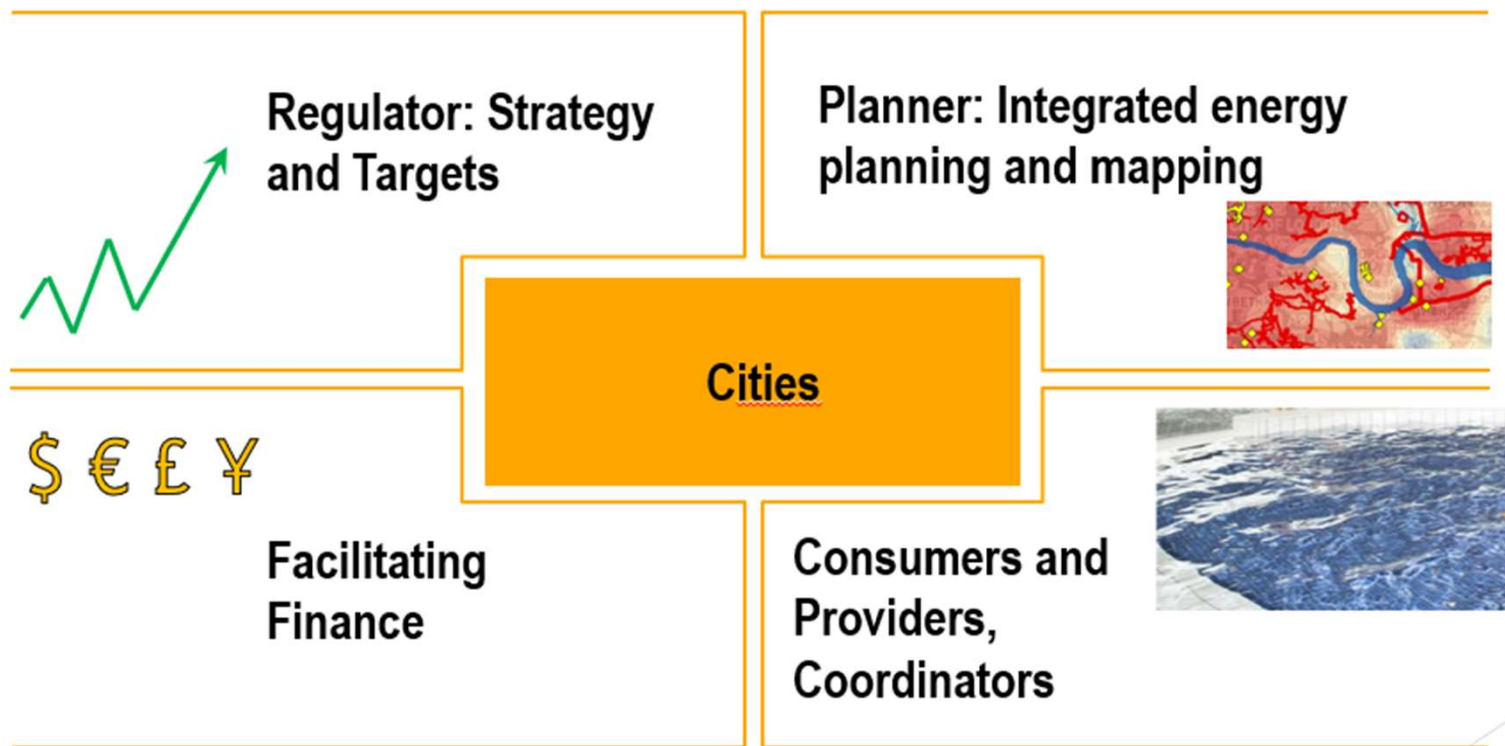
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Introduction: Why carbon neutrality?

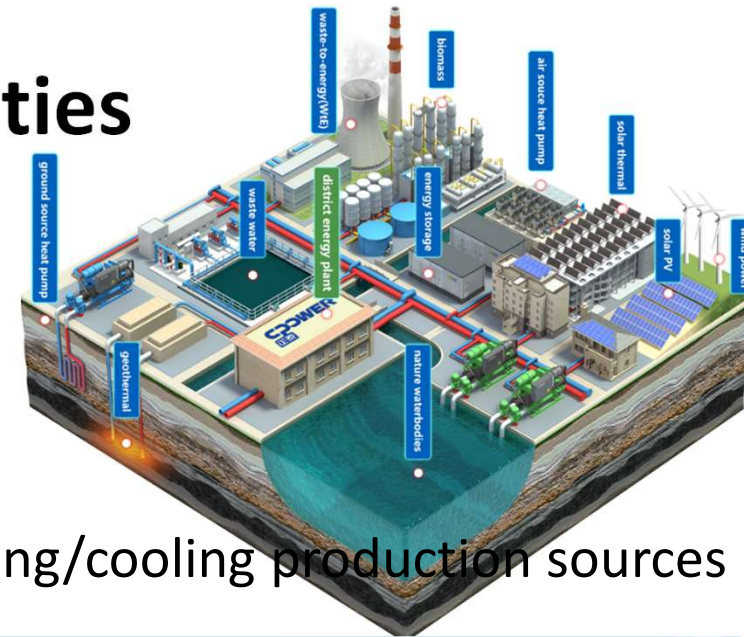
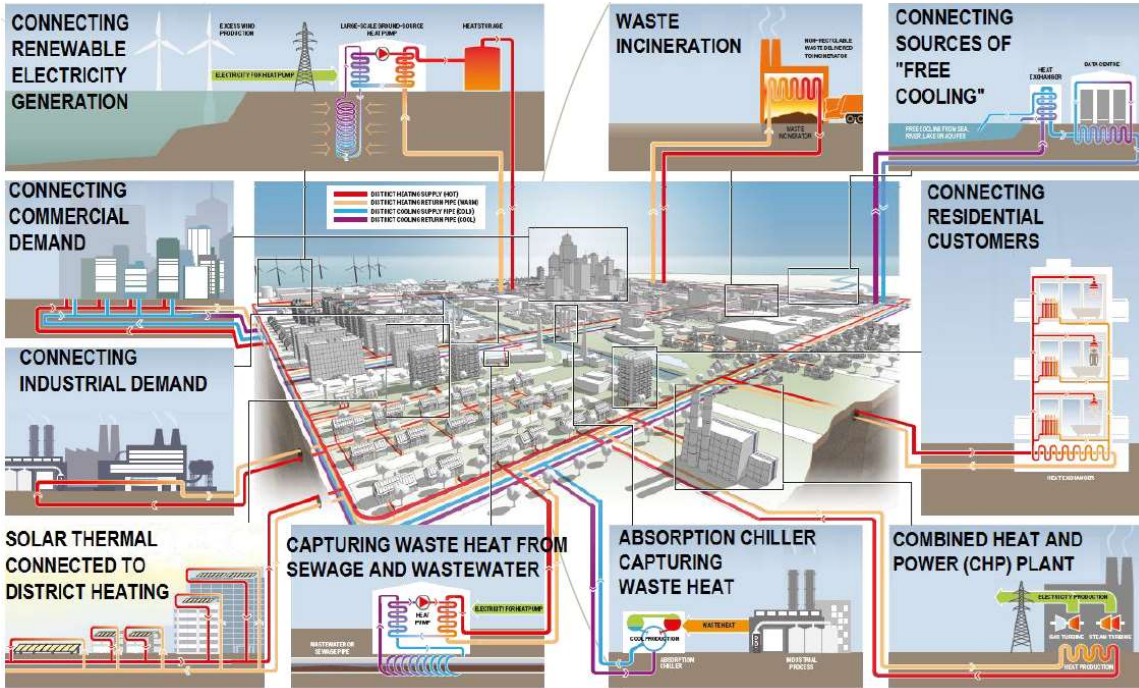
The new Nationally Determined Contributions (NDCs), combined with other mitigation pledges, put the world on track for a global temperature rise of 2.7°C by end of the century, even if all new unconditional commitments are met.



Introduction: Why cities?



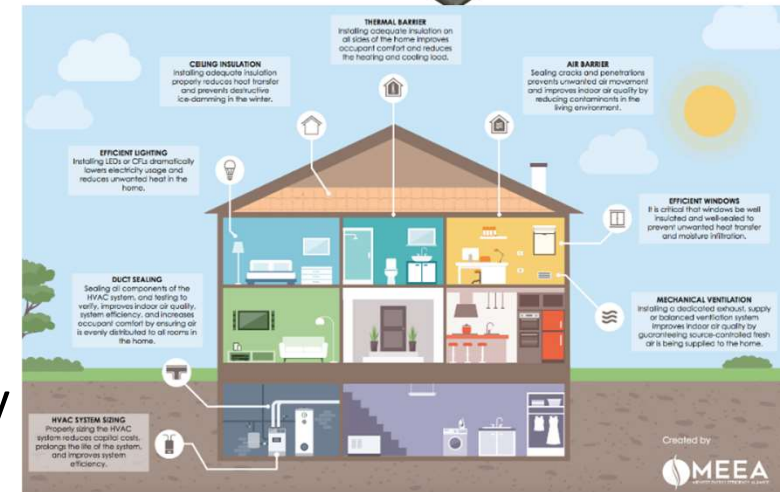
Introduction: Energy systems in cities



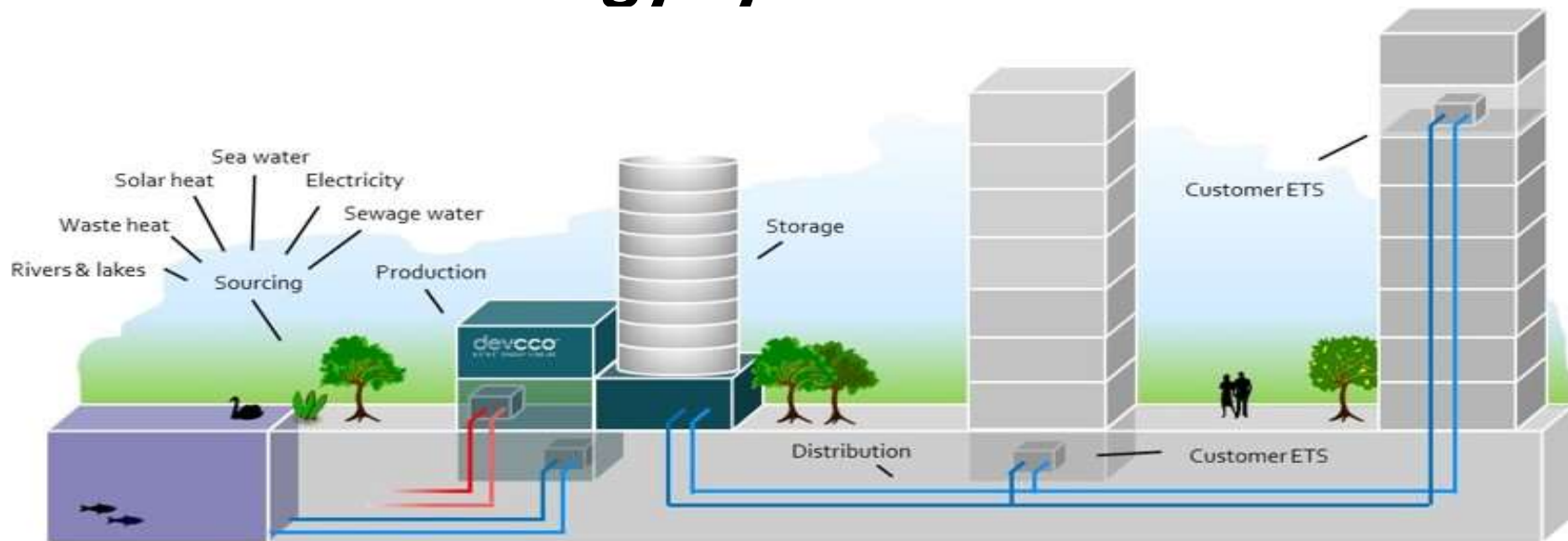
Heating/cooling production sources

District energy systems for heating & cooling

Building energy system



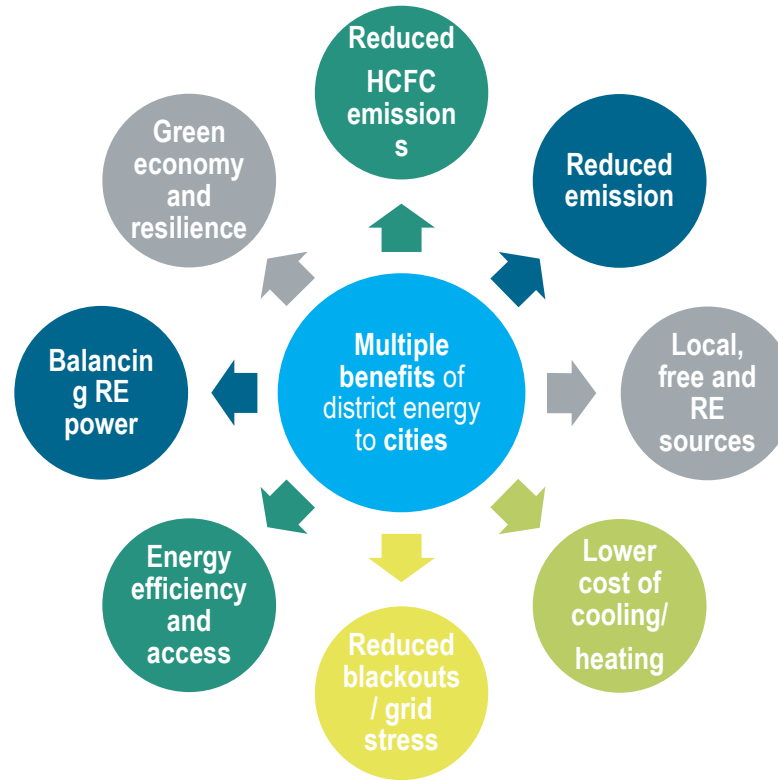
Introduction: Energy systems in cities



District energy aims to use **local energy sources** that otherwise would be wasted or not used, in order to offer for the local market a **competitive and high-energy-efficient alternative** to the traditional heating and/or cooling solutions.

Multiple benefits of district cooling for cities

Most DC systems shift peak electricity demand using cold storage lowering power transmission investment



350K tons of CO2 reduced per year by powering 50% of Paris' district heating with renewable energy

Paris reduced refrigerant emissions from cooling by 90%

Dubai provides cooling that is 30-40% cheaper than stand-alone systems

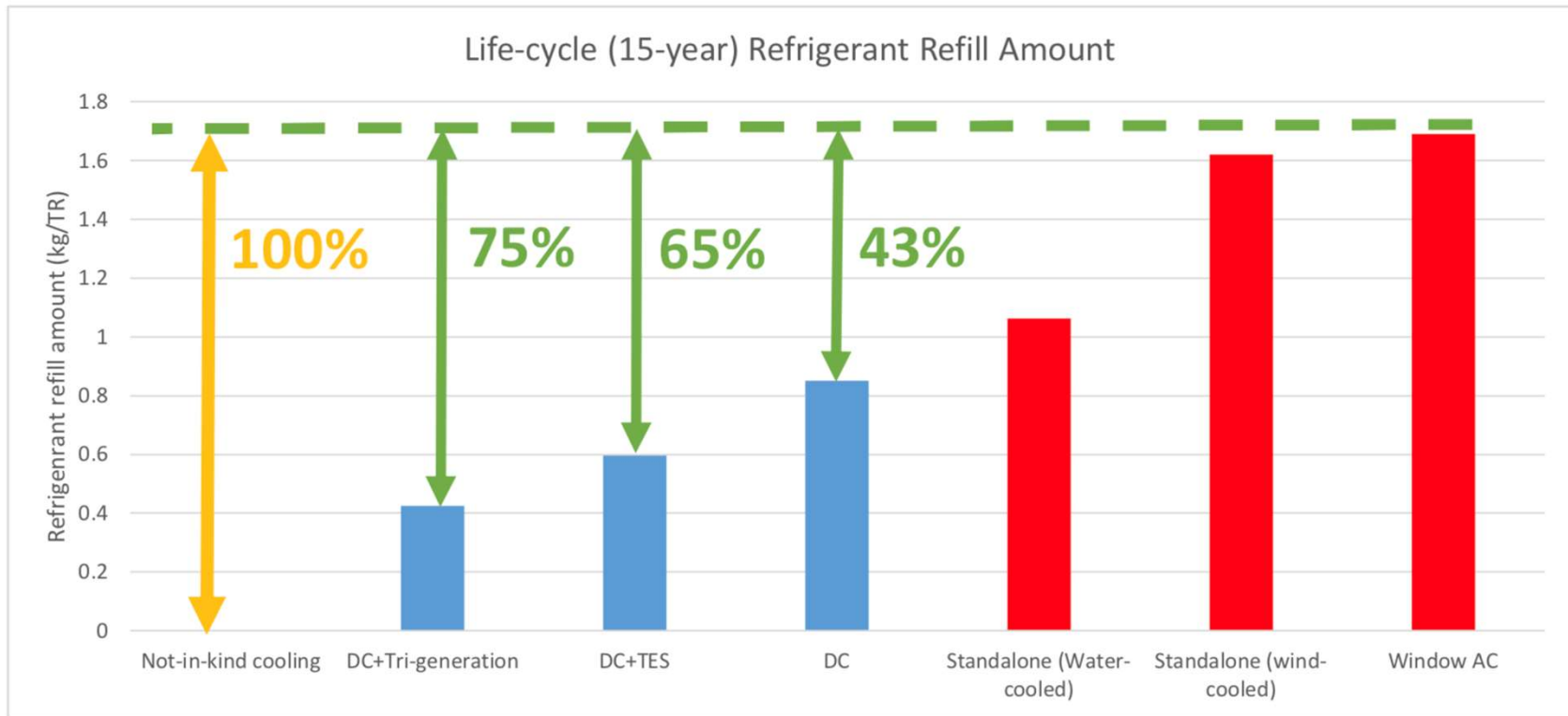
GIFT City could lower electricity consumption for cooling by 65-80%

District cooling VS. other cooling technologies

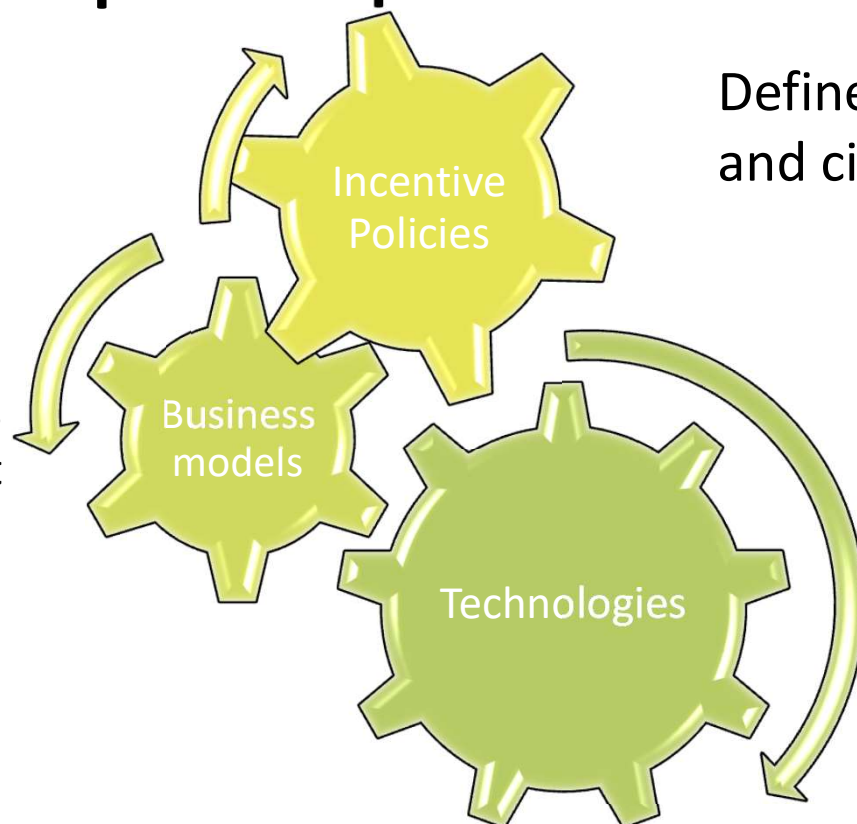
Cooling system type	Primary Energy Efficiency	Peak load shifting factor-Electricity
Split AC, VRF/VRV	25%-30%	0
Conventional Central (water-cooled elec. chiller+ FC/AHU)	20%-30%	10%-15%
Conventional Central (air-cooled elec. chiller+ FC/AHU)	15%-30%	10%-15%
District cooling (all elec. chiller)	25%-30%	15%-25%
District cooling (free cooling+elec. chiller)	30%-60%	30%-50%
Tri generation (electricity, district cooling, domestic hot water)	60%-80%	30%-50%
Tri generation (30%TES)	55%-75%	40%-60%

*Assumption: Grid electricity PEF=35%, cooling factor=0.15, heating factor=0.2, electricity=0.5, all equipment reaches A-level under Energy Star or ASHRAE/ASME

District cooling VS. other cooling technologies



How to develop and implement district energy projects?



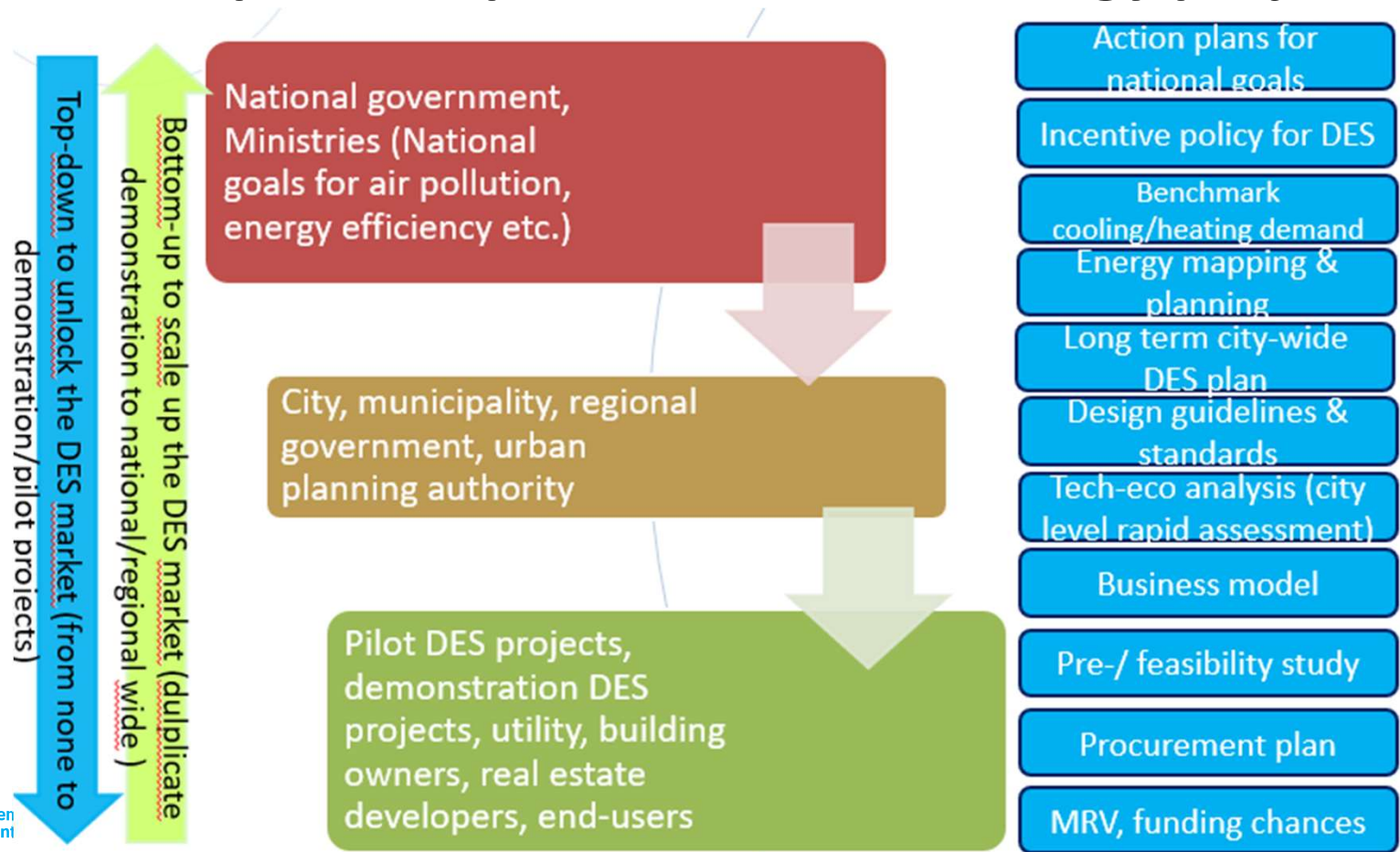
Define the roles of municipalities and cities

Suitable business models to enable the investment environment

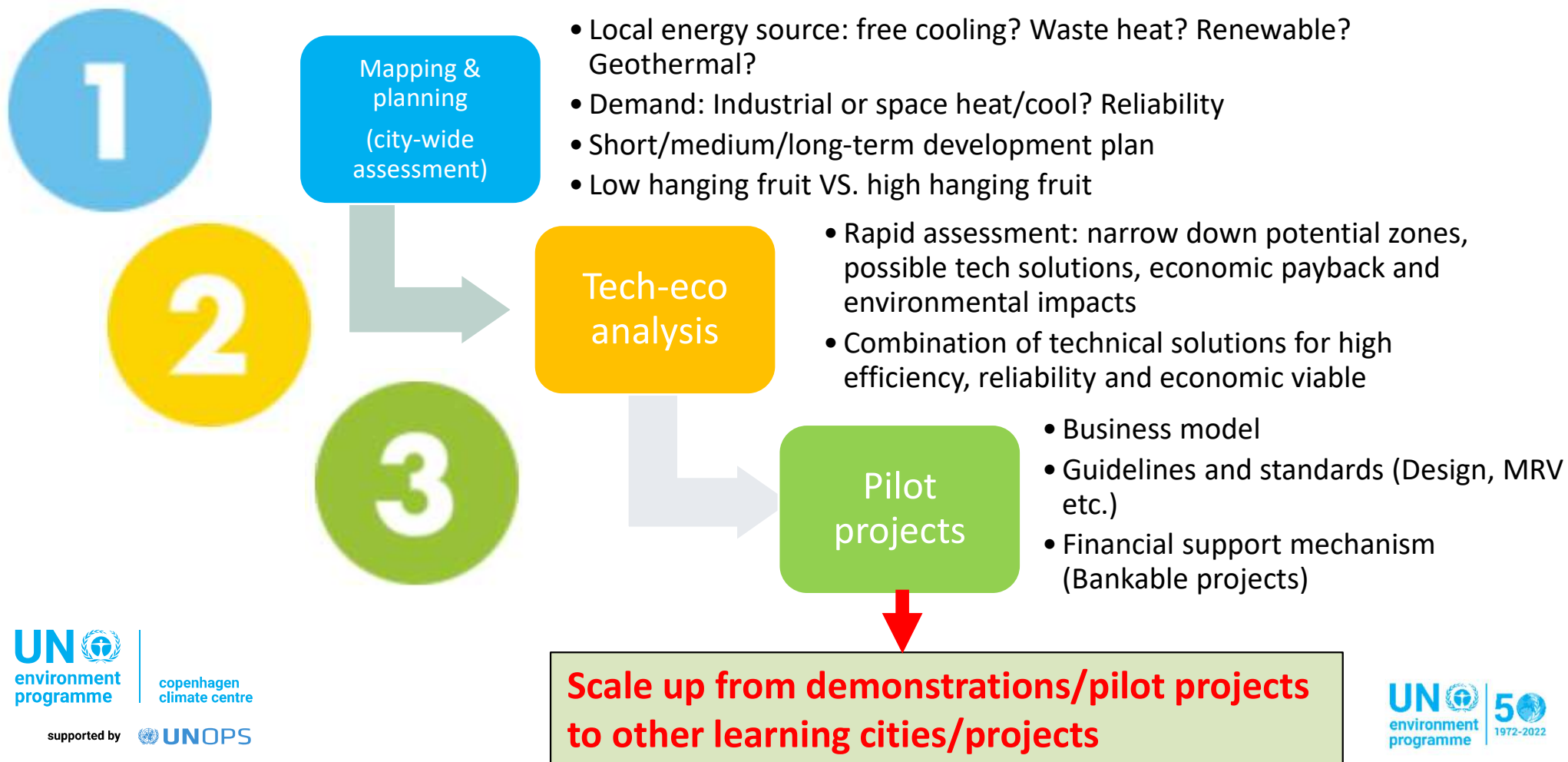
Cost-effective technologies to integrate multiple sectors for higher systemic efficiency

Combining suitable incentive policies, business models and cost-effective technologies can accelerate the implementation of carbon neutral communities and scale up after demonstration.

How to develop and implement district energy projects?



How to develop and implement district energy projects?



What are the challenges?



Lack of local capacity



Lack of data



Design bankable projects



Bridging the gap between the regulatory level and ground level



Long-term support to local authorities



Communication and awareness raising



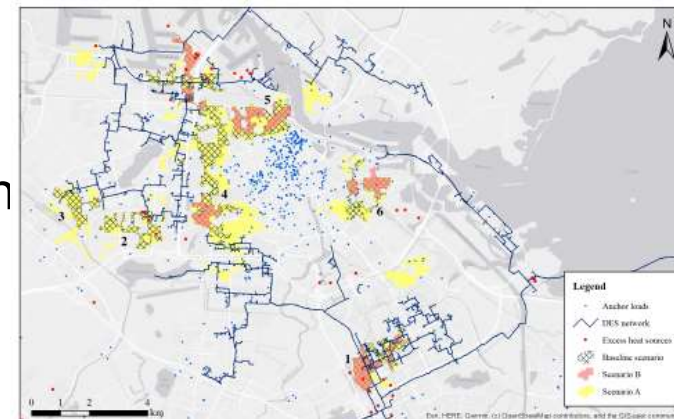
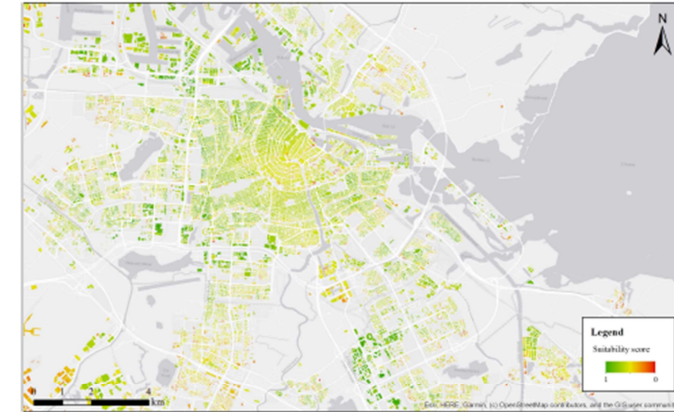
Standardisation and transferability

Recommendations: How we take actions in MENA?

- Integrate cool mapping and planning into long-term urban planning

Use GIS data to

- 1) Assist urban planners in master planning
 - Decide locations of DC plant
 - Integrate land-use of DC to other utilities
 - Phasing of DC
 - Implementing pipeline routines
- 2) Expand or upgrade existing DC
- 3) Optimize DC and building energy systems operation through connection with smart city platforms
- 4) Facilitate feasibility studies, incentive policies and business plans in later stage



Recommendations: How we take actions in MENA?

➤ Integrate cool mapping and planning into long-term urban planning

New developments above 50,000m² must provide an “Energy Plan for Effective Utilization” in order to obtain a building permit. This energy plan requires:

- (1) Setting targets for energy saving performance in newly constructed buildings;
- (2) Study of introduction of unused energy and renewable energy;
- (3) Study of introduction of district heating and cooling.

New developments that exceed 10,000m² (20,000m² residential) must do a technical assessment of district energy and demonstrate consultation with district energy suppliers.

Tokyo



- Integrated Energy and Land Use Plan

Large building developers must develop district heating if connection unavailable

London required its 32 boroughs to carry out energy master planning

- Encouraging Connection

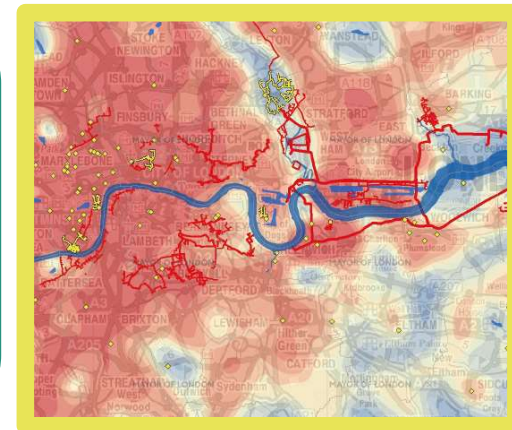
Connect unless policy

Large new waste heat sources must accommodate connection to district energy

- Tariff Regulation and Customer Protection

Tariffs unregulated but city makes recommendations on methodology and contract length

London



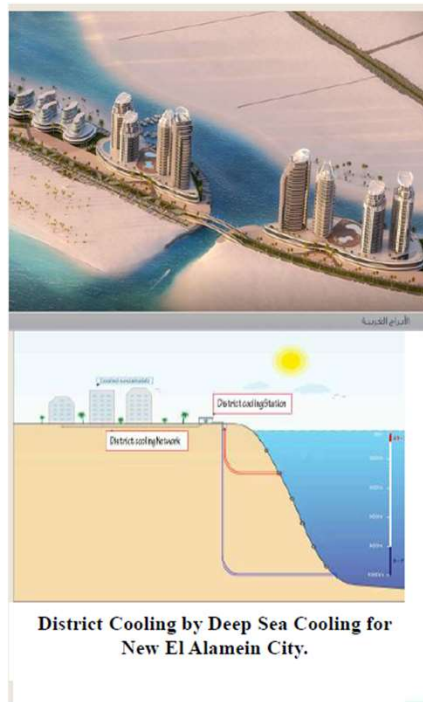
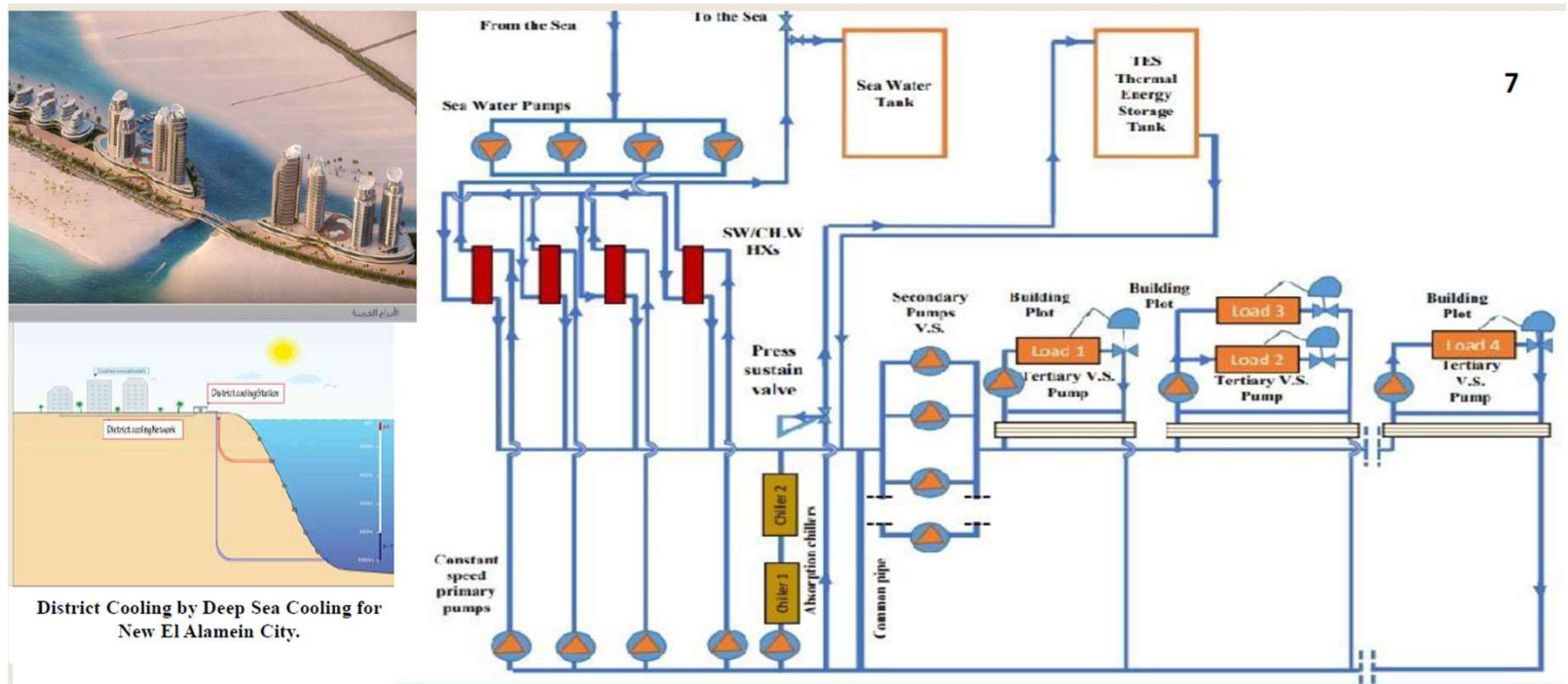
Recommendations: How we take actions in MENA?

- Innovative technologies for cooling
 - 1) Passive cooling technologies in buildings
 - Building envelope efficiency
 - Green building certification (e.g. LEED, BREEAM)
 - Cool roof, green roof
 - Nature ventilation
 - 2) Active cooling technologies
 - Free cooling (e.g. deep sea water, direct condensation)
 - Low-GWP refrigerant (e.g. R717)
 - Thermal storage of ice and/chilled water
 - Multi-sector energy systems integration (e.g. waste heat from industry, IDC & super market)
 - 3) BMS for building/district energy system monitor and control
 - AI-aided control method

Recommendations: How we take actions in MENA?

➤ Innovative technologies for cooling

Example 1: District cooling system with deep sea water in El Alamein, Egypt



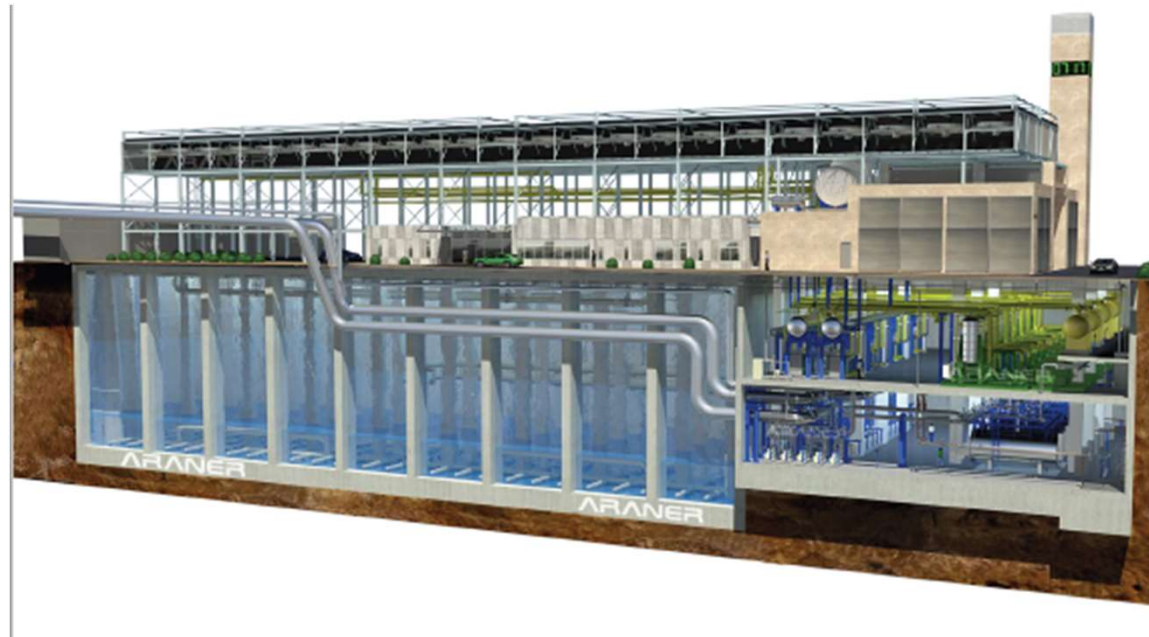
District Cooling by Deep Sea Cooling for New El Alamein City.

Source: KCEP Egypt project

Recommendations: How we take actions in MENA?

➤ Innovative technologies for cooling

Example 2: District cooling system with direct condensation chillers in Jordan



Recommendations: How we take actions in MENA?

➤ Innovative business models to bring long-term financial support

1) Business models for cooling

- Cooling as a Service (CaaS)
- ESCO
- Design-Build-Finance-Operation-Own/Transfer (DBFOO/DBFOT)

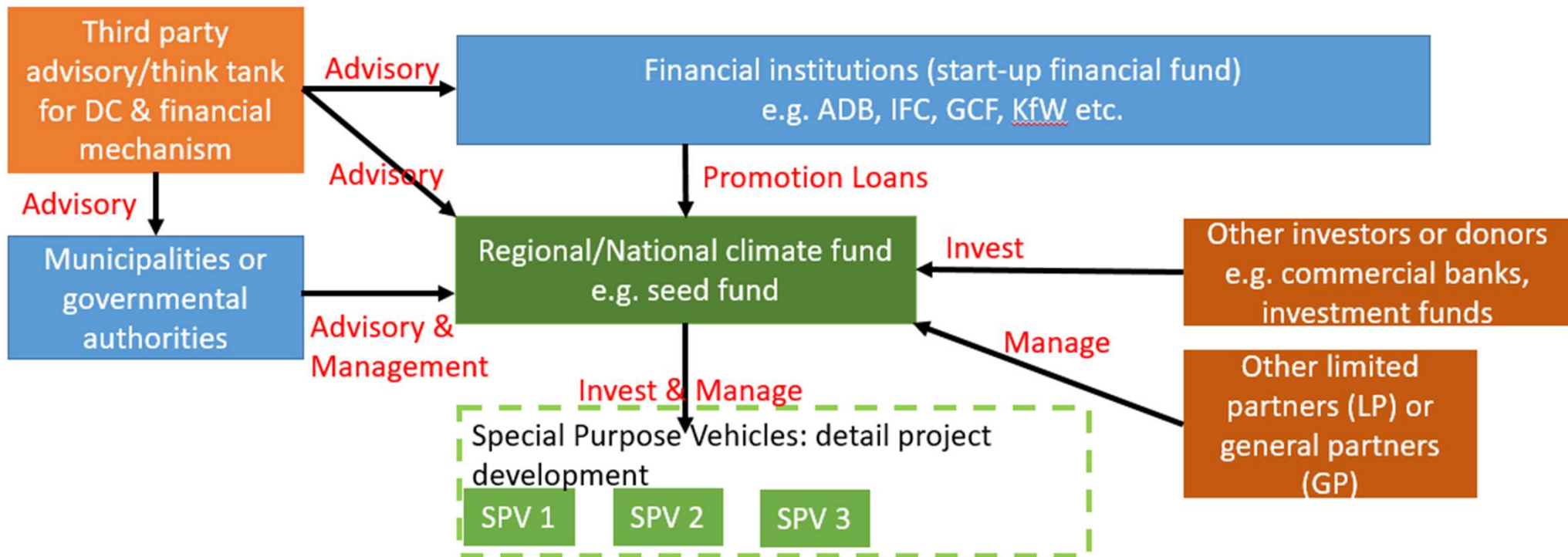
2) City climate fund

3) Seed funding for carbon neutrality in cities

Recommendations: How we take actions in MENA?

- Innovative business models to bring long-term financial support

2) City climate fund

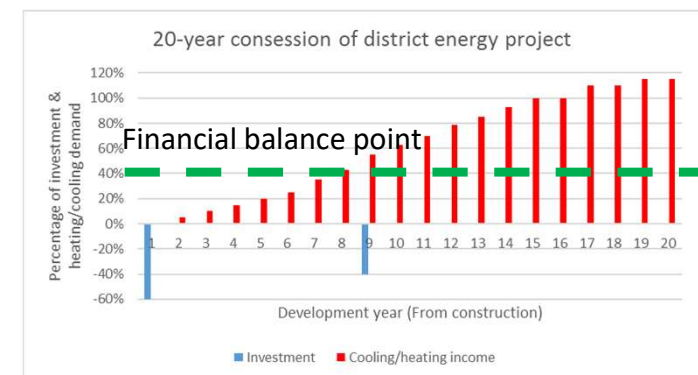


Recommendations: How we take actions in MENA?

➤ Innovative business models to bring long-term financial support

3) Seed funding

- District cooling **needs more time (normally 5-7 years from beginning) for the demand to grow**, and the benefits become steady and secure afterwards.
- **Seed funding idea:** Financial institutions buy-in in first year, bought out in 8th-9th year with higher price by SPV. Funding **reverts back to the seed funding pool and invests in other** district cooling projects.
- **Win-win situation:** Municipalities achieve their energy saving targets, end-users get cheaper heating/cooling, financial institutions get steady payback.



Recommendations: How we take actions in MENA?

➤ Long-term capacity building for cities (e.g. 'Train the trainers' program) by UNEP CCC

1) Toolkits for evaluating energy efficiency



Recommendations: How we take actions in MENA?

➤ Long-term capacity building for cities (e.g. 'Train the trainers' program)

2) Knowledge Management System (KMS): Virtual knowledge sharing platform

<https://c2e2.unepdtu.org/collection/district-cooling-systems-ettraining-india/>



Who We Are

C2E2 Publications

Knowledge Management System

News

Toolbox



This training covers the basics of district cooling systems (DCS). It shares valuable insights of the key aspects of District Cooling Systems planning, as well as tools and skills to successfully implement District Cooling Systems at a city and district scale. By following this training you will also be able to learn more about real cases across the globe and unlock the potential of centralized energy solutions to increase the rate of energy efficiency improvements for cooling in buildings while meeting sustainable development targets. The training is formulated considering specific local conditions in India, hence the target audience are:

- National and local authorities, including project managers, project sponsors and technical experts
- Local utilities or services
- Professionals involved or interested in underwriting, research, consultancy or other professional services for District Cooling Systems
- Other individuals/institutions with an interest in District Cooling Systems planning in India

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Sector: District energy

Country / Region: India

People

Recommendations: How we take actions in MENA?

Knowledge management system:

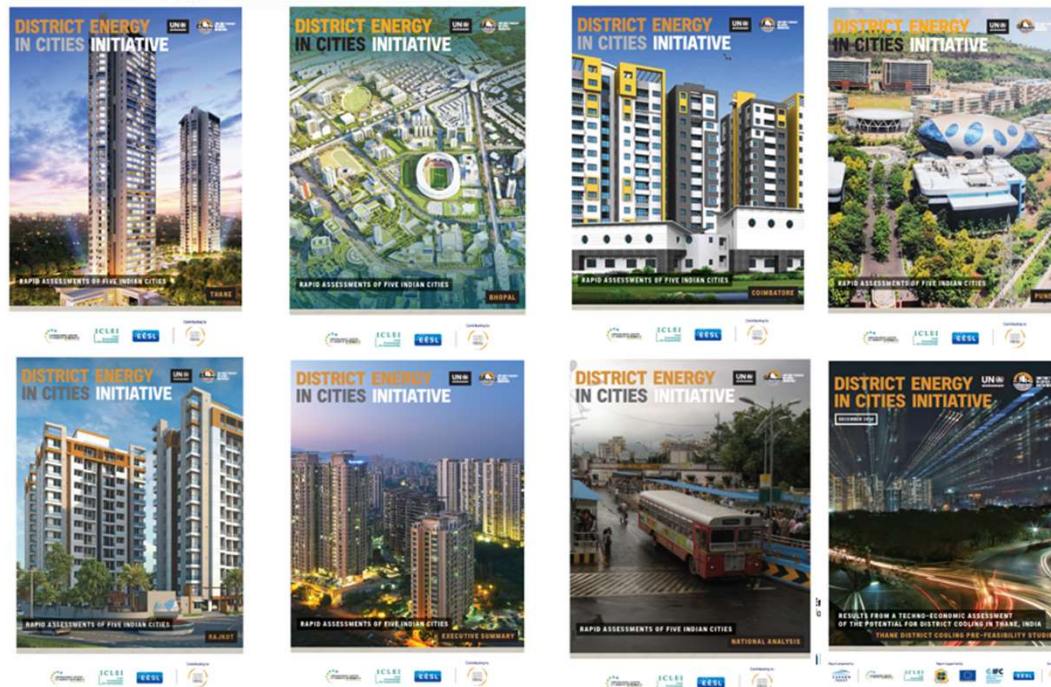
- Hosts the training modules for district energy systems
 - Introduction to District Energy
 - Stakeholder coordination for district energy development
 - Energy mapping and data collection
 - Strategy development
 - Policy development
 - Business models
- Contains best practices and case studies of district heating and cooling projects from both developed and developing countries as well as emerging economics

Recommendations: How we take actions in MENA?

➤ Long-term capacity building for cities (e.g. 'Train the trainers' program)

3) District energy project development reports in District Energy in Cities Initiative

<https://www.districtenergyinitiative.org/>





Thank you very much

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