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# DISTRICT ENERGY IN CITIES

A GLOBAL INITIATIVE TO UNLOCK THE POTENTIAL OF ENERGY EFFICIENCY AND RENEWABLE ENERGY





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DENMARK

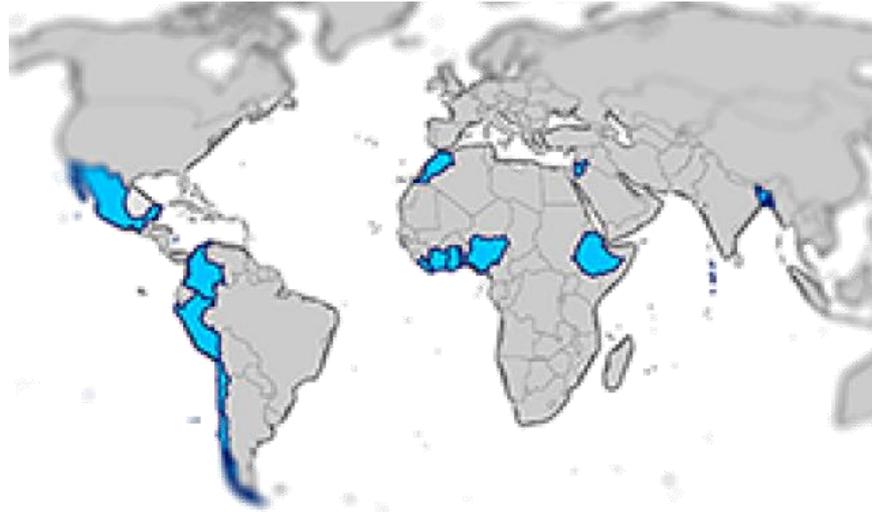
2nd International Conference on Smart Energy Systems and  
4th Generation District Heating, Aalborg, 27-28 September 2016



# Low-GWP Alternatives in Commercial Refrigeration: Propane, CO<sub>2</sub> and HFO Case Studies



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DENMARK



**4DH**  
4th Generation District Heating Technologies and Systems



2nd International Conference on Smart Energy Systems and 4th Generation District Heating, Aalborg, 27-28 September 2016

# Country club





GLOBAL ENERGY EFFICIENCY ACCELERATOR PLATFORM



AALBORG UNIVERSITY DENMARK

2nd International Conference on Smart Energy Systems and 4th Generation District Heating, Aalborg, 27-28 September 2016

# Where was district energy?



4th Generation District Heating Technologies and Systems

HEAT ROADMAP EUROPE 2050

STUDY FOR THE EU27



Aalborg University  
David Connolly  
Brian Vad Mathiesen  
Poul Alberg Østergaard



The need for GCC governments to take action



Look for wasted urban heat and you see it everywhere. Cities worldwide are finally starting to address this with collective methods to stay toasty

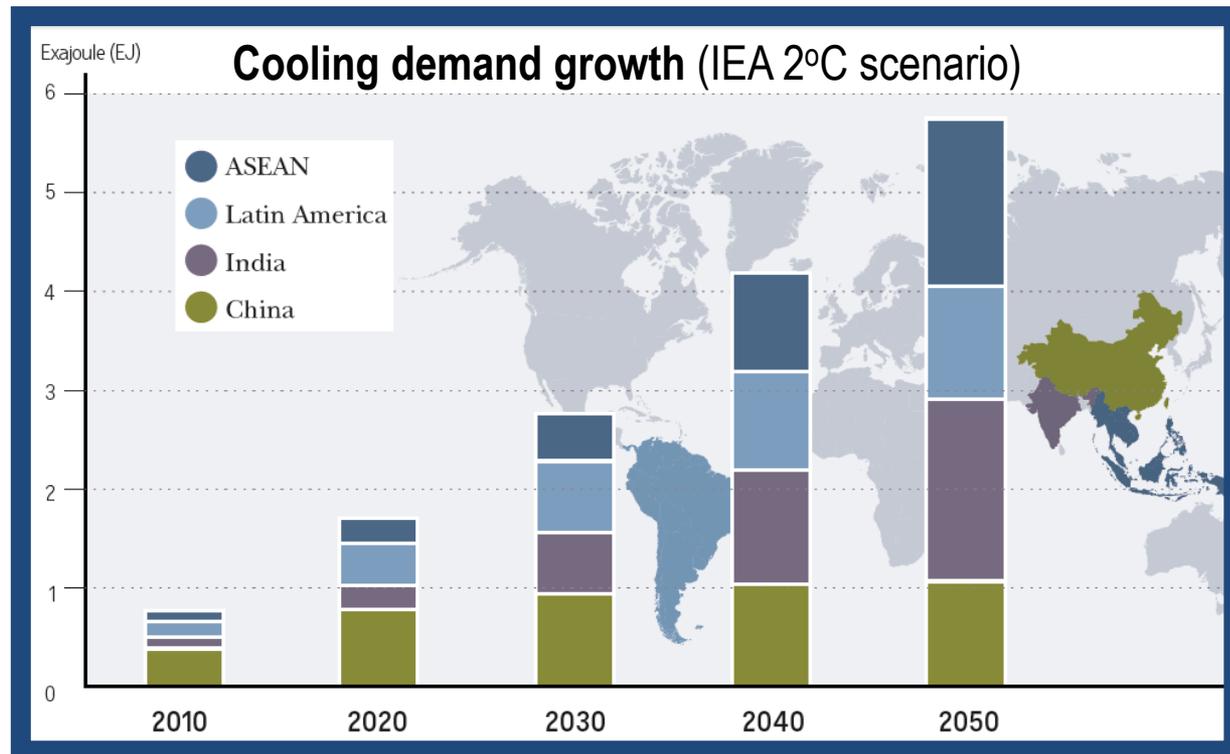
# Making the case: Why is district energy important?



Heating, hot water and cooling account for **60% of the global energy consumption** in buildings, largely met by fossil fuels

Connects waste heat and large scale renewables that **cannot be used** on an individual building level

Achieves **30-50% reductions** in primary energy consumption for heating and cooling



# Making the case: Energy efficiency

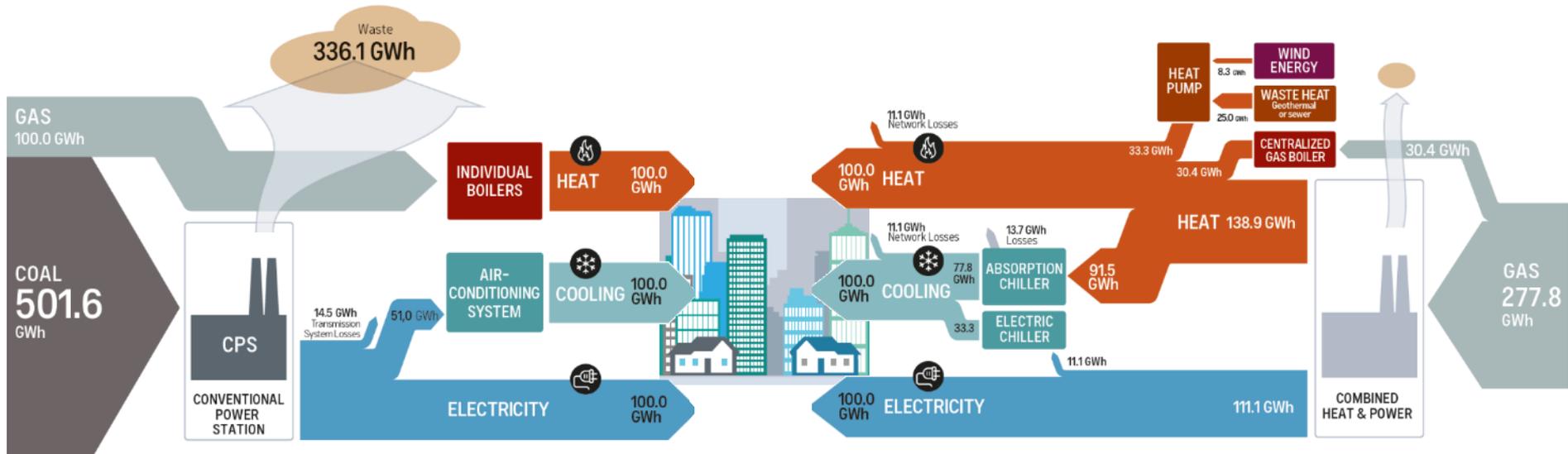


**4DH**

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## BUSINESS AS USUAL

## MODERN DISTRICT ENERGY SYSTEM



**TOTAL PRIMARY ENERGY 601.6 GWh**

**TOTAL PRIMARY ENERGY 308.2 GWh**

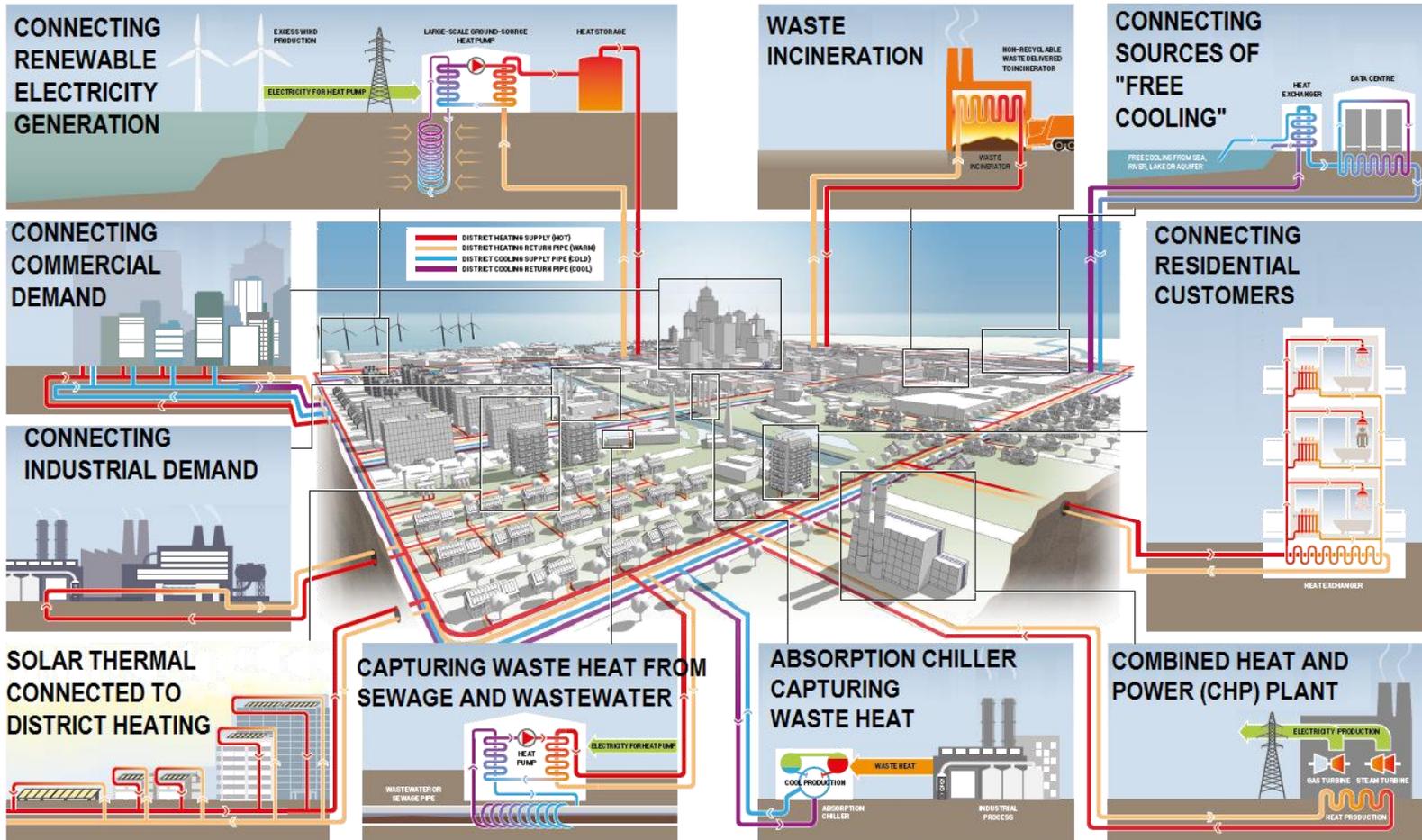


# Making the case: Integrates Renewables



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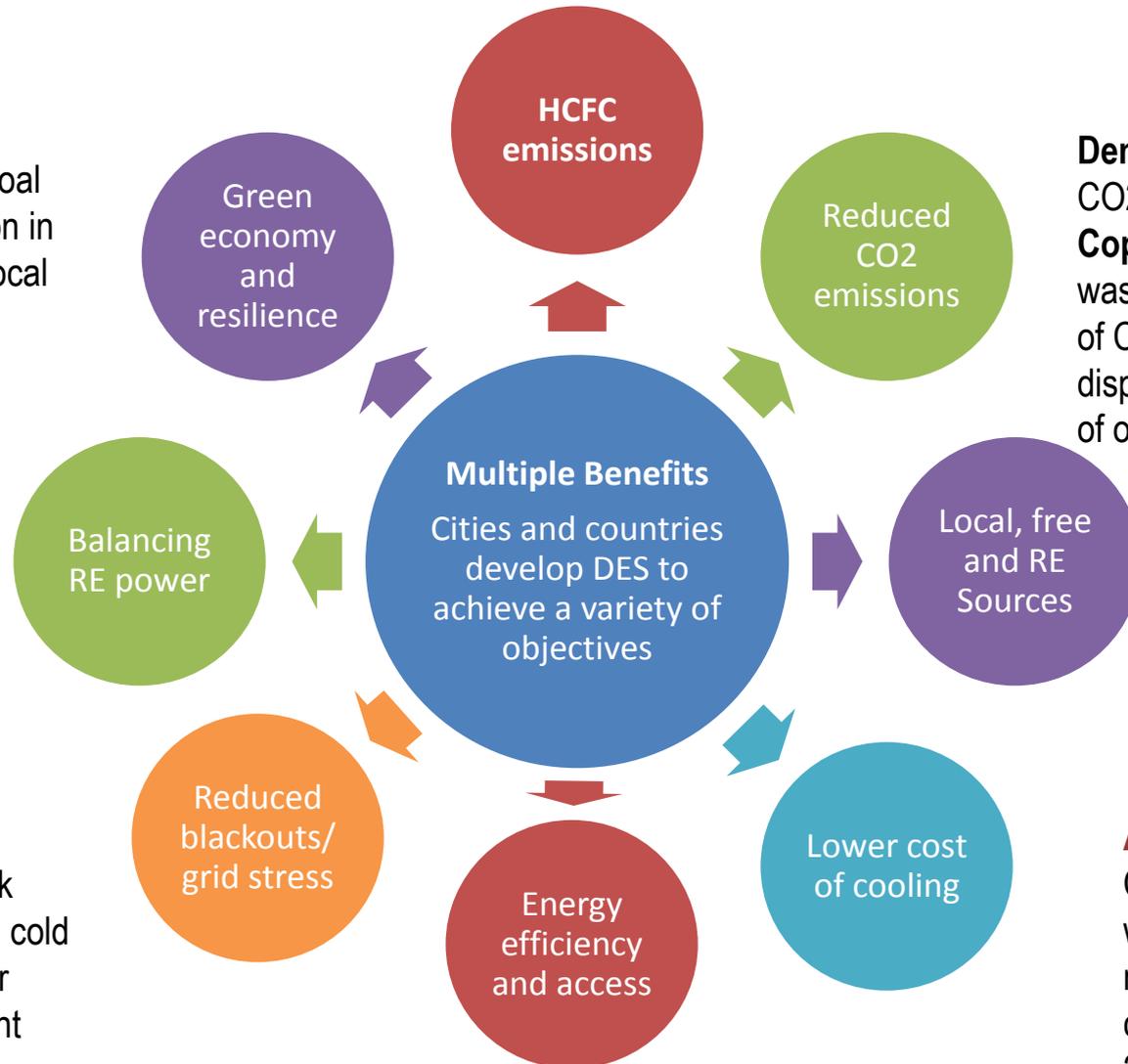
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# Making the case: Multiple benefits

## St. Paul, USA

Reduce 275,000t of coal annually US\$12 million in energy dollars kept local

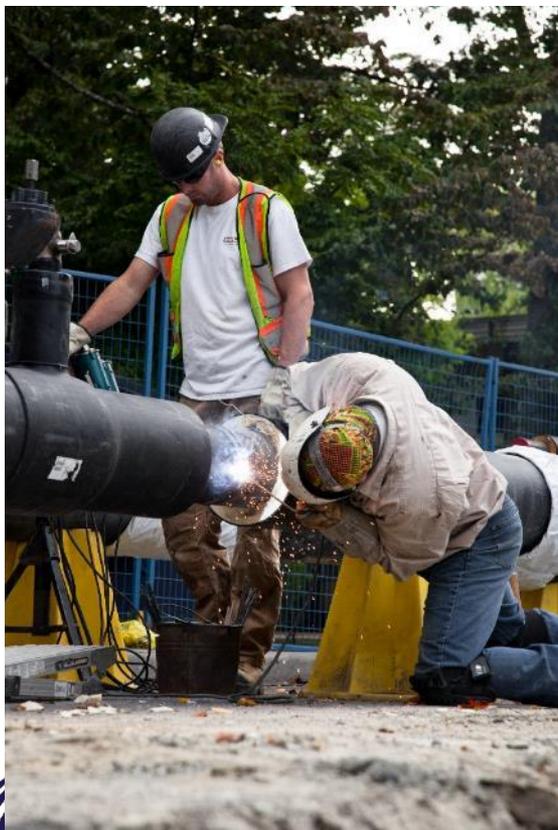
**Denmark** 20% reduction in CO2 since 1990. In **Copenhagen**, recycling waste heat leads to 655,000t of CO2 reductions while also displacing 1.4 million barrels of oil annually.



**Dubai, UAE** shifts peak electricity demand with cold storage lowering power transmission investment

**Anshan, China**  
Connecting 2000MW of waste heat- a 1.2m ton reduction in coal consumption/year and 2m ton of CO2/yr

# Barriers to Unlock the Potential of district Energy



Lack of awareness and misperceptions

Local and institutional capacity for coordinating DES development.

Lack of holistic planning policies that integrate energy and DES.

Regulatory environment

Commercial viability of DES unproven in some markets.

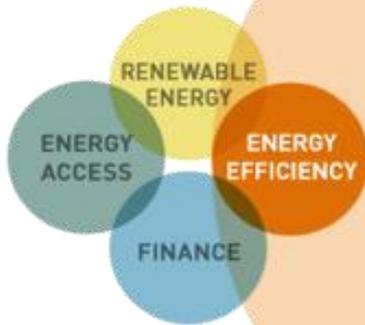
Lack of data on heating and cooling consumption



# Launch at the Climate Summit



Sustainable Energy for All (SE4All) Sub-Committee's



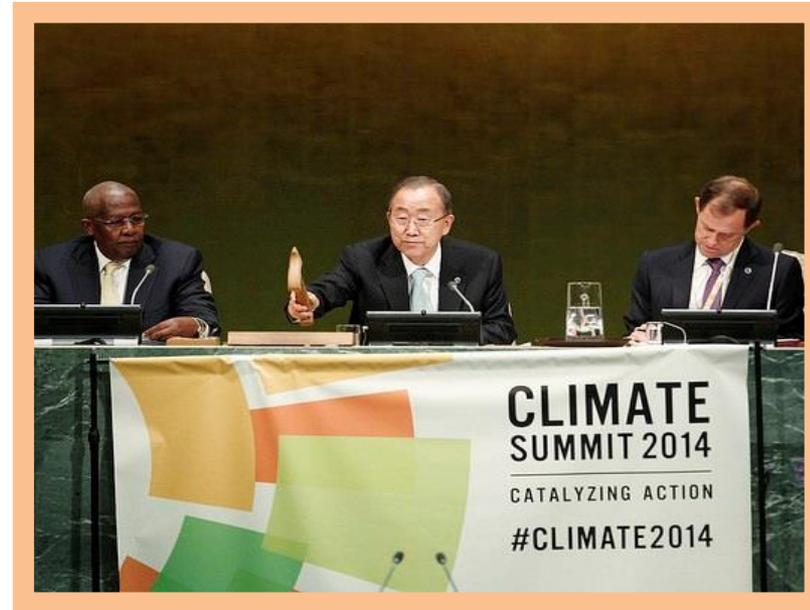
Co-chairs:

- UNEP Executive Director
- CEO Accenture
- Minister for Trade and Development Cooperation, Denmark

Global Energy Efficiency Accelerator Platform: to scale up efficiency gains and investments at the national, sub-national and city levels through technical assistance, support and public-private sector collaboration

Individual accelerators focus on specific energy efficiency sectors

- Buildings
- Transport
- **DISTRICT ENERGY**
- Lighting
- Appliances & Equipment



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SUSTAINABLE  
ENERGY FOR ALL



**GLOBAL ENERGY EFFICIENCY  
ACCELERATOR PLATFORM**

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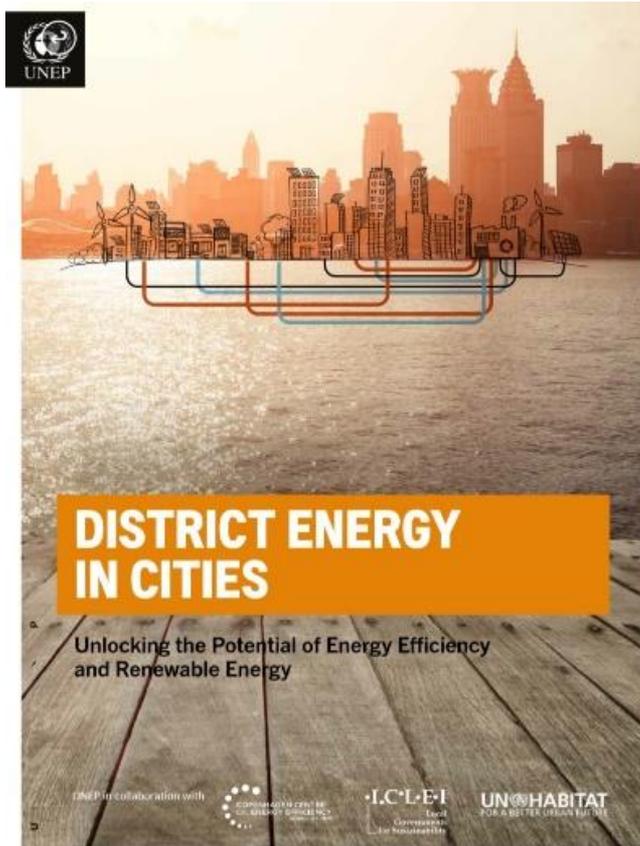
# A Global Partnership on District Energy



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**7** COUNTRIES  
**40** CITIES  
**36** PARTNERS

# Launch of a Technical Guide



*“In launching this report we want to draw the **attention of the world’s decision makers**, mayors and leaders at the community level **to the importance of district energy systems.**”*



# International Agenda



**PARIS2015**  
UN CLIMATE CHANGE CONFERENCE  
COP21·CMP11

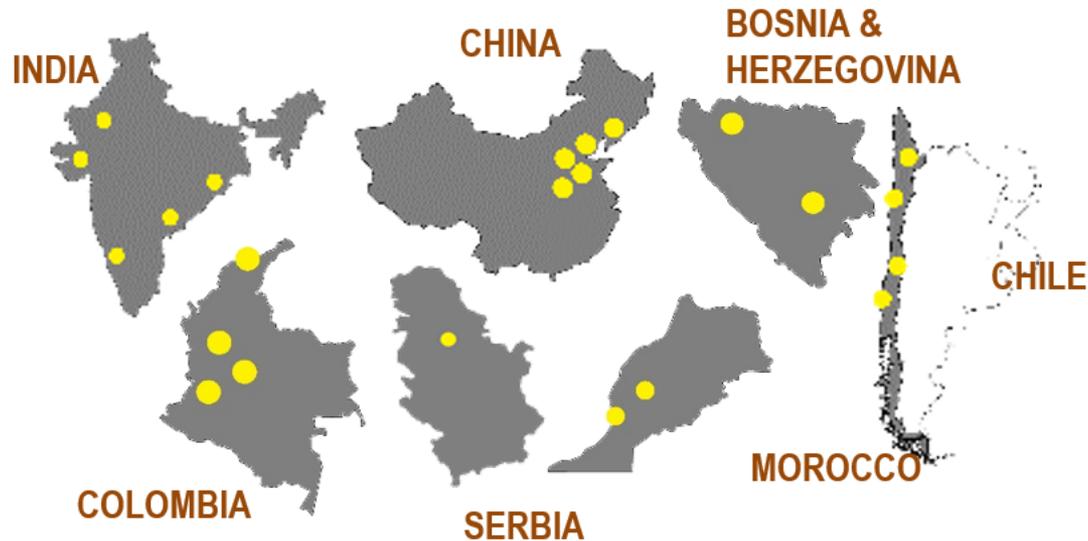


(Compilation Text as of 06 June 2016) Habitat III Zero Draft Outcome Document

122. We recognize that even for cities that do not directly control power generation, they may control local infrastructure and codes that can drive sustainable energy in end-use sectors, such as buildings, industry, transport, waste, or sanitation. We note the effectiveness of net metering standards, portfolio standards, and public procurement policies on energy, among other instruments, to support deployment. Smart grid and district energy systems should also be prioritized to improve synergies between renewable energy and energy efficiency.



# Inspires Country Interest



**Major ministries in 7 countries engaged to adopt and replicate best practice**

**Other countries being engaged: Malaysia, Mexico, Albania, Pakistan, Mongolia, Panama.**



# Building Interest in Eastern Europe



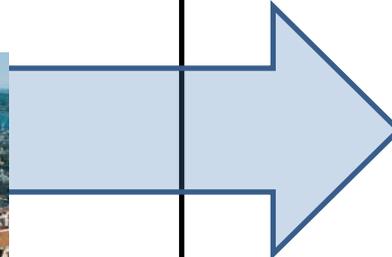
## Tallinn Workshop

### Private Sector Participation in District Heating



**IFC**

International  
Finance Corporation  
WORLD BANK GROUP



### Country interest and sign-up

- Serbia
- Bosnia & Herzegovina
- Croatia
- Kosovo
- Mongolia



# Banja Luka: Inefficient network



Water losses, oil, inefficient piping  
= Energy Efficiency: 56-65%

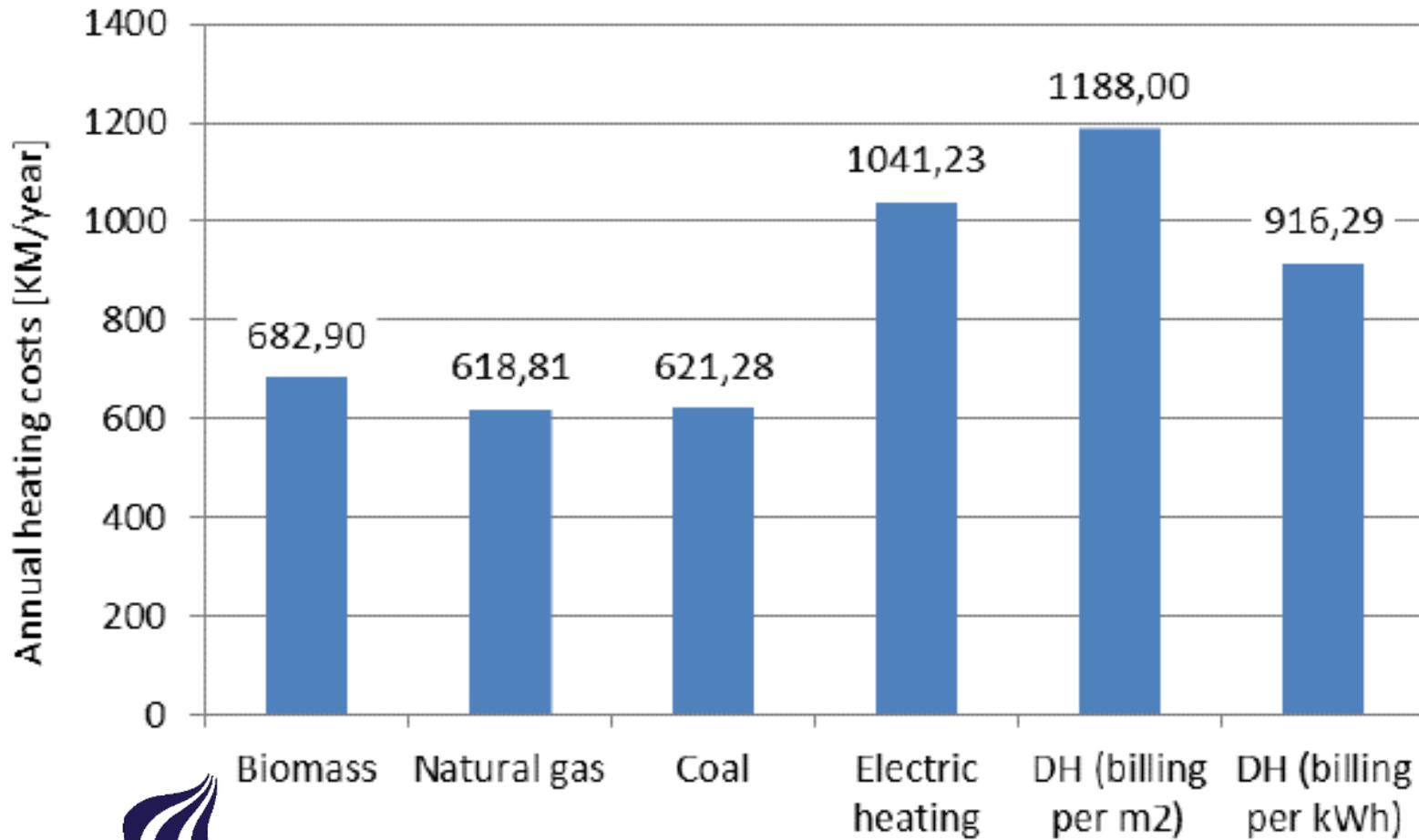


# Banja Luka: High DH Prices

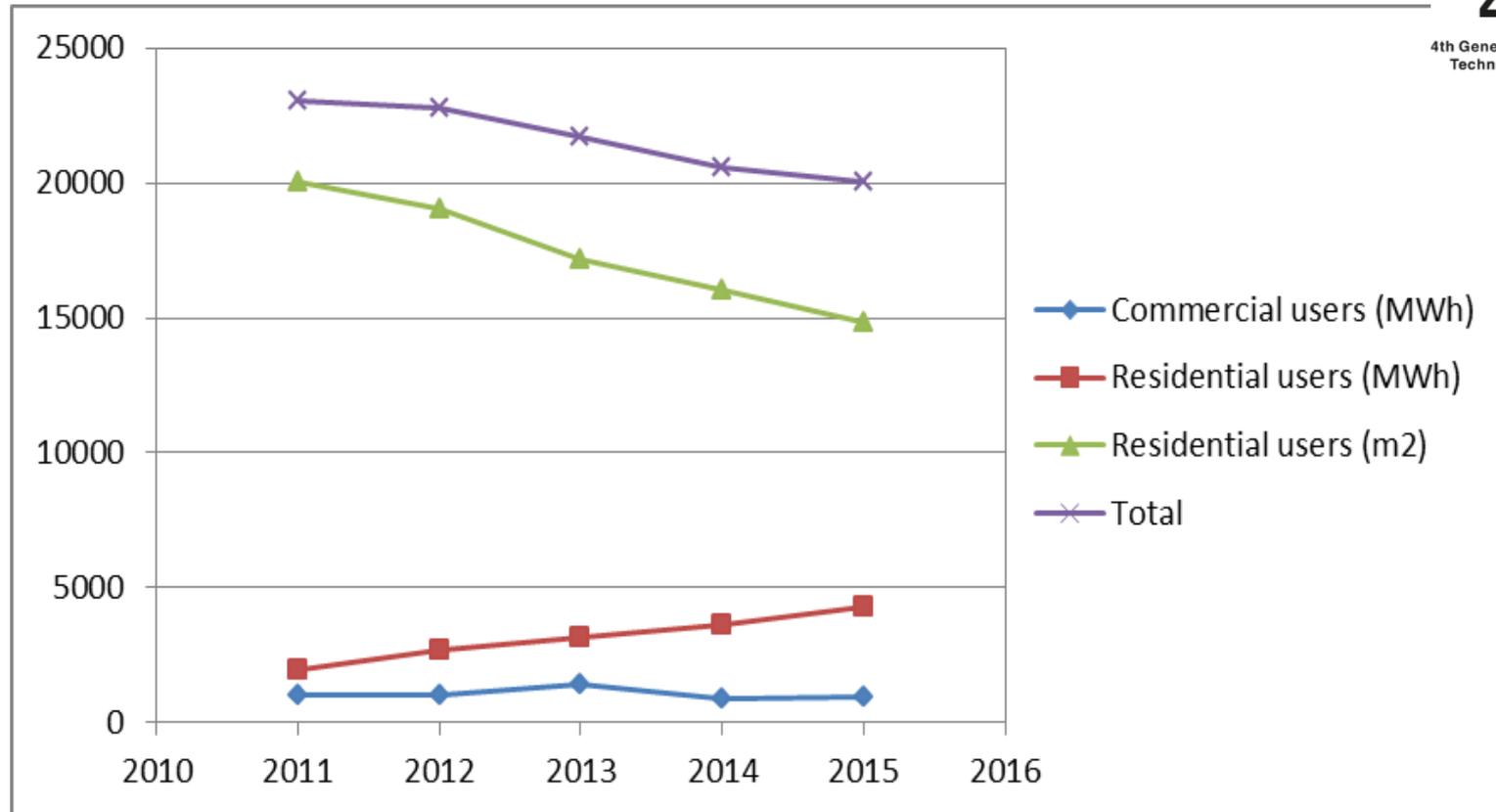


**4DH**

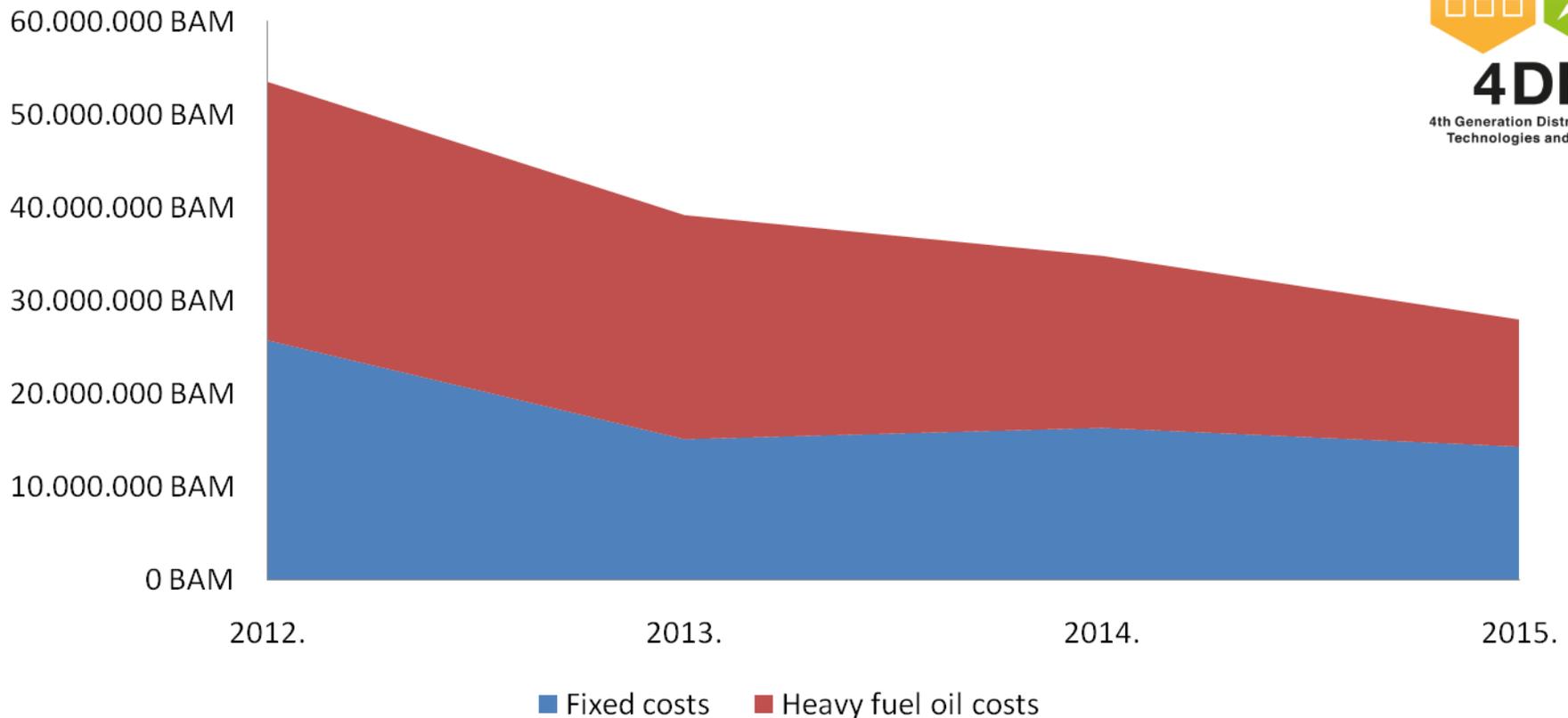
4th Generation District Heating  
Technologies and Systems



# Banja Luka: Customer Disconnections



# Banja Luka: Financial Losses



**Losses (2012): ~\$16 million**

**Losses (2015): ~\$2.5 million**



# Banja Luka: Technical Assistance



**Support for intervention established – Mayor, DH company, National Government, Development Banks**

**City-wide assessment**

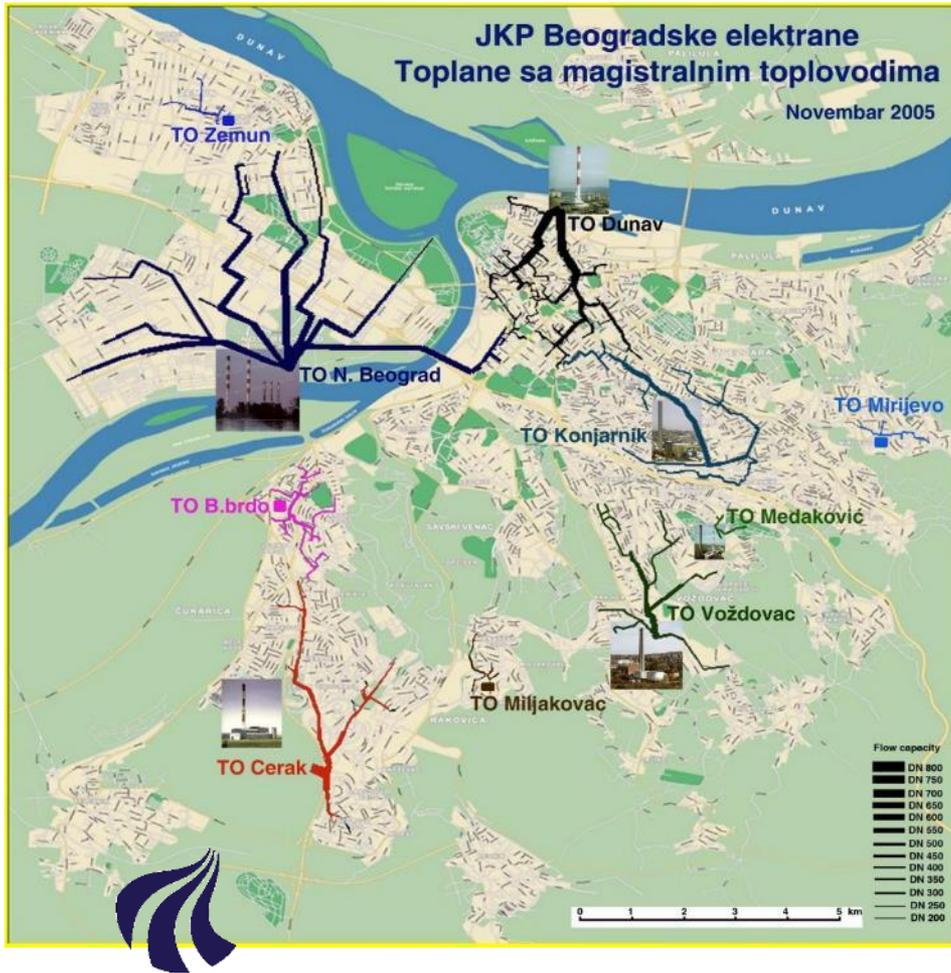
**Priority investment program ~\$30 million**

- **New biomass boilers (24MW)**
- **Reconstruction of oil boiler**
- **Network rehabilitation**
- **Switching metering**

**Attracted new loans and refinancing from banks  
~ 42 million euros**



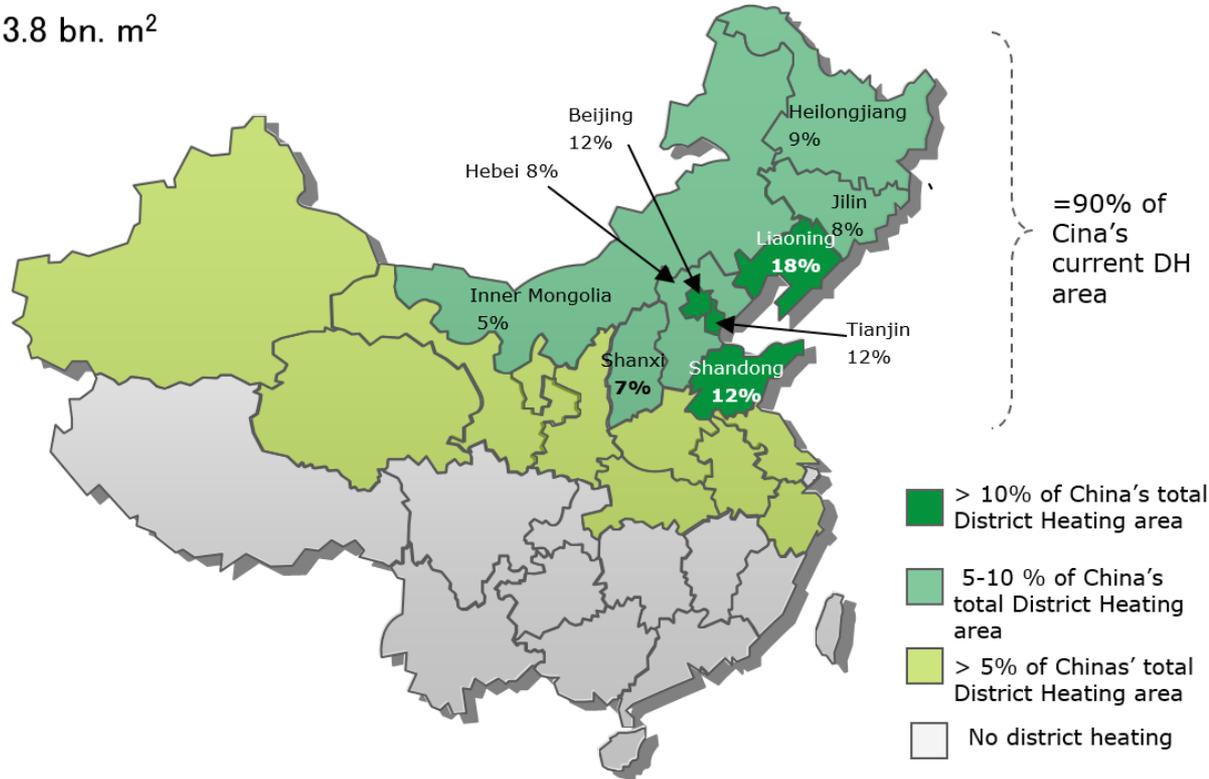
# Support to Belgrade



- Uses more than 50% of the country's natural gas supply that is being imported
- City wants support to switch heat sources, improve management, increase connections and assess new business model options
- Belgrade will benefit from capacity building, assessments, demonstration project and strategy development DH system

# China: Huge potential for DH modernisation

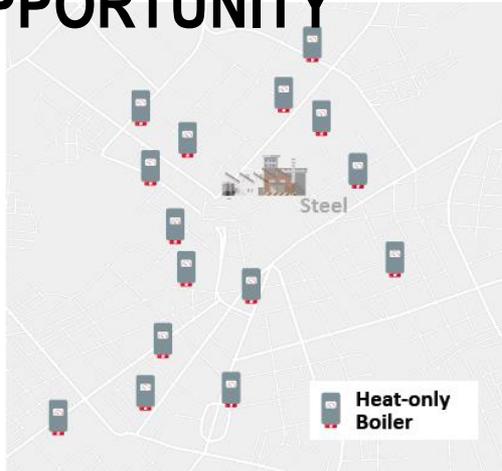
Σ 3.8 bn. m<sup>2</sup>



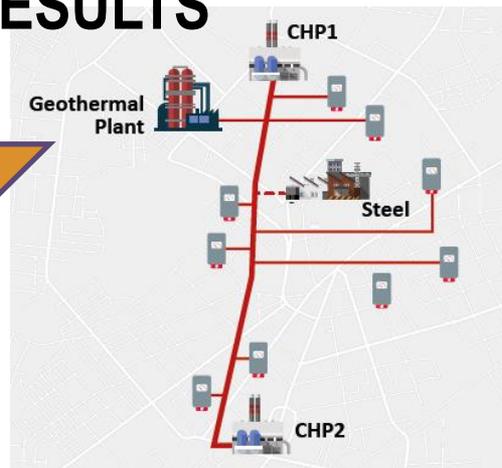
- Fastest growing market worldwide - 3 fold growth
- 3.2% of national energy consumption (2010)
- Half of all major cities have DH ½ residential and commercial buildings
- Boilers and CHPs in near equal amounts, largest CHP capacity in the world
- Industrial waste heat close to cities
- Local air pollution due to high use of coal

# China: from Opportunities to Results

## OPPORTUNITY



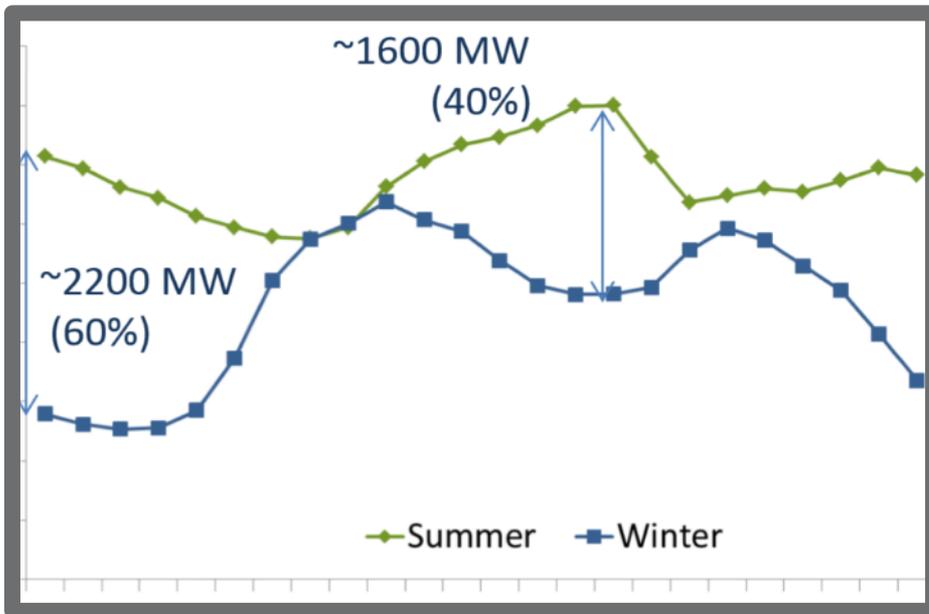
## RESULTS



- Select 1-2 focal cities
- City-wide techno-economic assessment
- Mapping waste heat sources
- Waste heat and integrated energy planning
- City-wide development plan for district heating
- Business model support and pricing
- Capacity building
- Results replicated to 3-10 participating cities

# India: Huge potential for district cooling

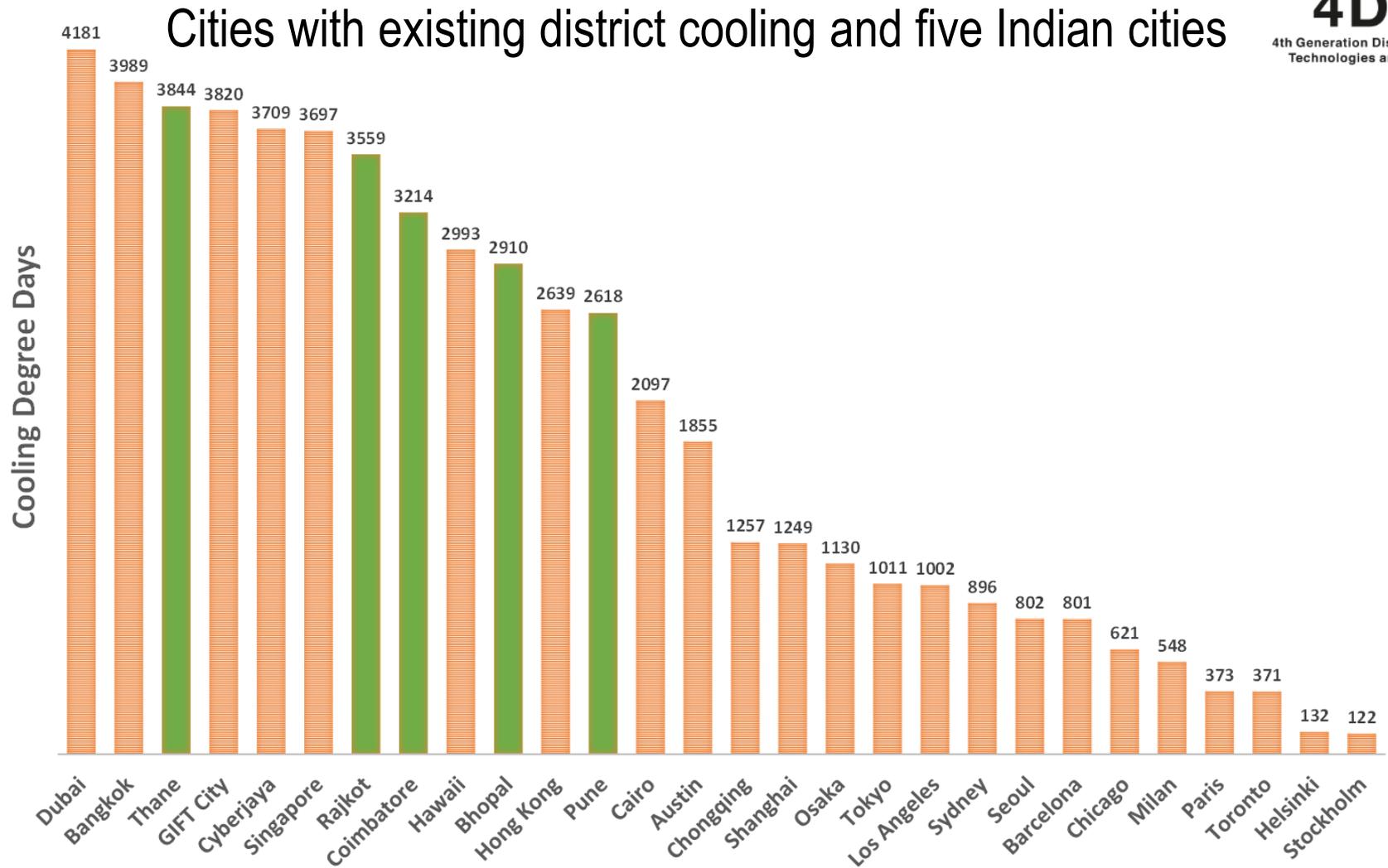
Delhi Summer and Winter Electricity Demand Profile



- India to require 83GW of additional power capacity from 2016 to 2022
- Commercial demand for electricity to increase 50% from 2016 to 2022
- In many cities such as Delhi, cooling already contributes 40% -60% of peak electricity demand
- 
- Cooling demand in India is projected by the IEA to grow 18 times by 2050



# India: Huge potential for district cooling



\*Average of 2014 and 2015 cooling degree days for locations in selected cities using 18 degrees Celsius as reference temperature.

# Chile District Energy Potential



- Improve air quality in high polluted areas of central and southern Chile by up to 90%.
- Substitute individual wood-stoves by district heating networks.
- Chile imports 60% of its primary energy. District energy would help reduce energy consumption and gain energy independence.
- Connect large scale renewables to buildings (e.g. geothermal, solar thermal).

# Activities in Chile 2016

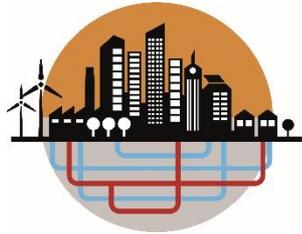


- Preparatory phase
- National Steering Committee
- Consultation with Project Partners to identify areas of interest
- National roadmap for the development of district heating
- Call for city expression of interest
- National workshop to select cities and define next steps for the national roadmap (Sept 2016)

Coyhaique, Chile



# Collaboration possibilities



## DISTRICT ENERGY IN CITIES INITIATIVE



### Addressing this huge potential through sharing expertise:

- Review policy, regulatory and technical guidance
- Provide capacity building to city planners, engineers and technicians
- Provide support to development or adaption of modelling tools
- Direct advice to cities and countries
- University exchange programmes
- Incorporation of developing country case studies into research programmes and PhDs



**For more information on the Global District Energy in Cities Initiative and to become a partner, please visit the website or contact:**

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