District Energy in Indian Cities

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

Supported by:

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DANIDA

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India 2050 BAU cooling

• 45% of peak demand
• 28% of power demand
• 10% of all emissions

Based on IEA’s 2050 baseline
Delhi’s Cooling Demand

- Space cooling already 25-30% of annual demand
- Half of annual network capacity increases is for space cooling

Data sourced from State Load Dispatch Centre
THE ROLE OF CITIES IN TACKLING COOLING

- 380 million more people by 2050
- ~3x increase in building area by 2037
- Impacts of cooling felt in cities: grid stress, water, urban heat island, costs
- Can integrate multiple systems for increased efficiency
WHAT IS DISTRICT ENERGY?
WHAT IS DISTRICT ENERGY?
PLANT ROOM
CONTROL CENTRE
THERMAL STORAGE
* The above chart is reflecting the impact of District Cooling on Peak demand for 10,000 TR.
WHAT IS DISTRICT ENERGY?
WHAT IS DISTRICT ENERGY?
WHAT IS DISTRICT ENERGY?
IT IS MORE THAN JUST COOLING
BUILDINGS

CONNECTING RENEWABLE ELECTRICITY GENERATION

WASTE INCINERATION

CONNECTING SOURCES OF "FREE COOLING"

CONNECTING COMMERCIAL DEMAND

CONNECTING INDUSTRIAL DEMAND

SOLAR THERMAL CONNECTED TO DISTRICT HEATING

CAPTURING WASTE HEAT FROM SEWAGE AND WASTEWATER

ABSORPTION CHILLER CAPTURING WASTE HEAT

COMBINED HEAT AND POWER (CHP) PLANT

Source: IEA
WHY DISTRICT COOLING IS IMPORTANT TO INDIA?

- CO₂ emissions decrease by 30-50%
- Reduce power demand for cooling by 30-50%
- Shift peak cooling demand to night
- Lower refrigerant emissions by up to 100%
- Lower cost of cooling to end-users
- Reduction in urban heat island impact
- Reduced potable water consumption for cooling
SIGNIFICANT BARRIERS TO DISTRICT ENERGY DEVELOPMENT

- Lack of awareness and misperceptions
- Local and institutional capacity for coordinating DES development.
- Lack of holistic planning policies that integrate energy and DES
- Incentives and accounting methods that are not harmonized
- Commercial viability of DES unproven in some markets.
- Lack of data on cooling consumption
THE ROLE OF LOCAL GOVERNMENT

KEY PARTNER

- Planner and regulator
- Coordinator and advocate
- Local Government roles
- Facilitator of Finance
- Provider and Consumer
1970 response to air pollution from building level solutions

Target: Reduce energy consumption and renewable energy use by 20% by 2025

2009 earthquake and 2011 Fukushima

“1) district-wide energy planning and 2) energy consideration in the early stages of planning are necessary to further promote the design of energy efficient buildings and to introduce renewable energy.” Yuko Nishida, City of Tokyo, 2014

RESULTS

• 20 large-scale developments per year leading to district energy development or connection
• USD $150 million in capital investment (2010-2015)
• DHC Use 44% less primary energy and 50% less CO2
• DHC - waste incineration, excess heat from metro station, transformers, sewage, solar thermal, heat pumps connected to local water sources, ground water and ground source heat pump
Principles for starting projects in India:

- No direct subsidies
- No increase in costs for consumer compared to same level of service
- Cleaner and more reliable cooling
- Does not need capital investment from city or government
But support is needed:

- National and state-level direction
- Stakeholder coordination
- District cooling into area planning
- Development costs and tendering
- Long-term contracts with building owners
- Land for district cooling plant
- Fair power price
- Connect public buildings
DISTRICT ENERGY IN CITIES INITIATIVE

GLOBAL ENERGY EFFICIENCY ACCELERATOR PLATFORM

Accelerators: Buildings, Transport, **District Energy**, Lighting, Appliances and Equipment, Industry

Objective: Double Global Rate of Improvement of Energy Efficiency by 2030

Funded by:

Key figures:

- 4 PILOT COUNTRIES
- 10 REPLICATION COUNTRIES
- 45 PARTNERS

National Coordinator for India
<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>Total Funding</td>
<td>3.9</td>
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<tr>
<td>Total Co-finance Unlocked</td>
<td>9.7</td>
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<tr>
<td>Number of Cities</td>
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<tr>
<td>Number of Partners</td>
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<td>Investment Committed ($M)</td>
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<td>Investment Achieved ($M)</td>
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<td>CO₂ Projected Reductions</td>
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**Sustainable Energy for All**

2018
ONGOING ACTIVITIES IN INDIA

LIGHT TOUCH

- 5 city rapid assessments (Bhopal, Coimbatore, Pune, Rajkot, Thane)
- Methodologies and tools developed and made for all cities
- Additional cities of Chennai and Amaravati to be supported

PILOTS

- Rajkot and Thane supported as pilot cities
- Support for long-term planning district cooling and policy development
- Capacity building, energy mapping, Monitoring and Reporting framework
- Technical support for pilot projects

NATIONAL

- Virtual Platform & Outreach
- National potentials study for district cooling
- Close cooperation and training of EESL on district cooling
CASE STUDY: GIFT CITY, INDIA

- Full system planned: 180,000 TR
- First 10,000 TR installed in 2013
- Electricity demand reduction: 44%
- Water savings: 20%
- Thermal storage to cut peak demand
- Multi-utility tunnels alongside other utilities

Multi-utility tunnel in GIFT
Trigeneration District Cooling

- 10 buildings
- 18 million sqft
- Power demand of 186MW served by trigeneration
- Cooling demand of 78,000 TR
- Total primary energy efficiency: 85%

Benefits

- Lower cost cooling for customers
- 100MW of power demand avoided
- 36,000tCO₂ saved per year
- High reliability and resilience
- No harmful refrigerants
HIRANANDANI ESTATE - THANE

- 2000m network
- 6 buildings
- Two phases

- 9754 TR assessed
- Trigeneration and electric chillers
- 55% reduction in CO2
- IRR 20%; payback 7 years
- INR 200 crore investment
GHODBUNGER ROAD - THANE

- 9754 TR assessed
- Trigeneration and electric chillers
- 55% reduction in CO2
- IRR 31%; payback 4 years
- INR 160 crore investment
• $49 million investment phased over 5 years

• 32,000 TR

• Electricity from waste-to-energy plant

• All public, commercial, institutional and high-end residential

• Will be developed as PPP model with city supporting investment in the network
• 20,000 TR system in first phase to government buildings

• High share of electricity from renewables

• Plans for connection of commercial and residential buildings.

• City-led tendering process and awarded complete investment to Tabreed
THANK YOU!

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

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http://www.districtenergyinitiative.org