



Bureau of Energy Efficiency



सत्यमेव जयते  
Government of India  
Ministry of Power



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# ANGAN

## Augmenting Nature by Green Affordable New-habitat

A Courtyard for Revolutionary Change in Building Energy Efficiency

An International Conference on Building Energy Efficiency

9<sup>th</sup>-11<sup>th</sup> September, 2019 | Hotel The LaLiT, New Delhi





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THIS PRESENTATION WAS SHARED BY

**Mr. Rajeev Ralhan**

Executive Director, Clean Energy, PwC India

FOR THE SESSION:

*State-of-the-art Cooling Systems, including District Cooling System*

DURING ANGAN 2019

# *District Cooling Systems – Opportunities in India*

*Strictly Private  
and Confidential*

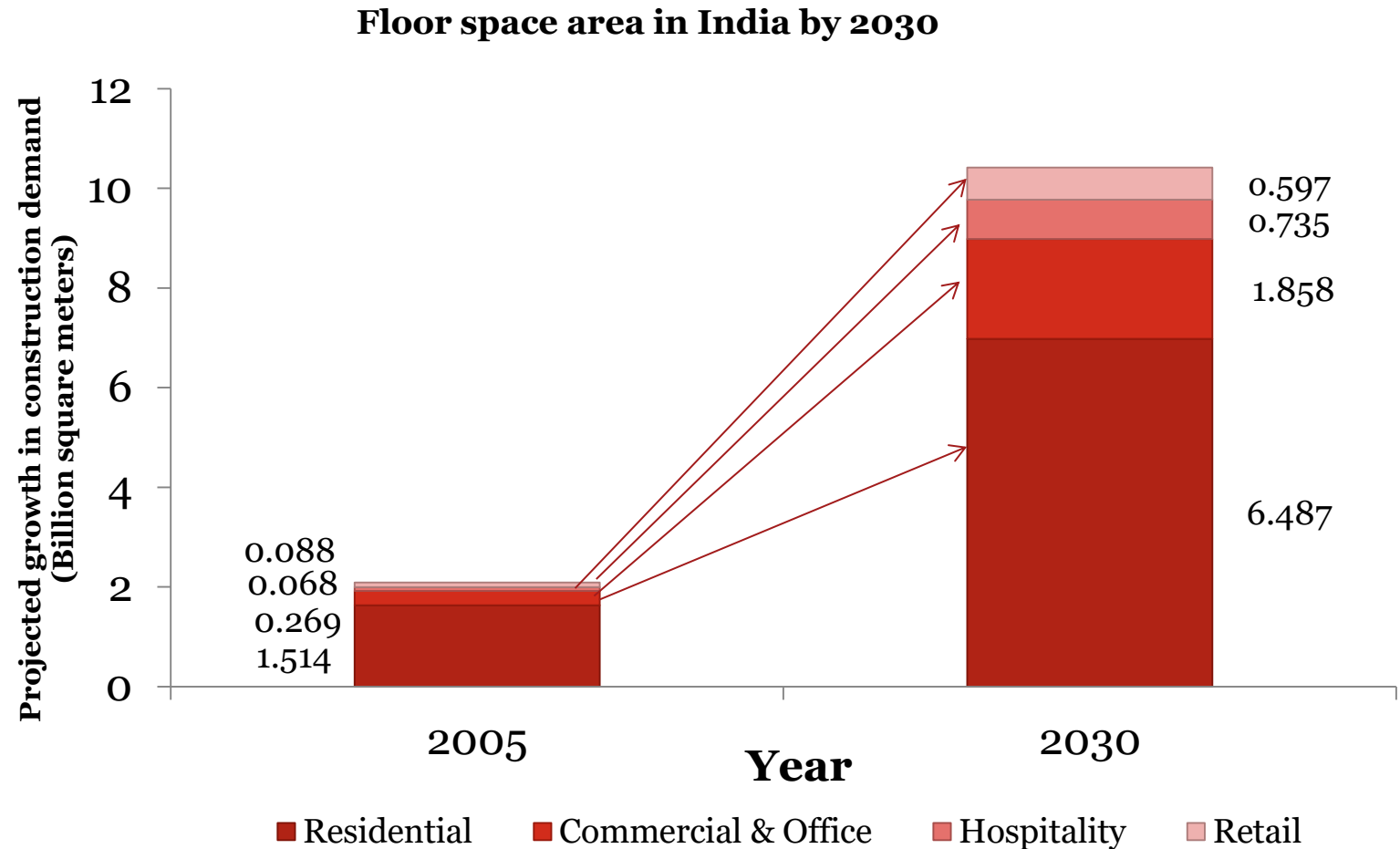
*10 September 2019*

## ANGAN 2019



# Projected growth in building sector

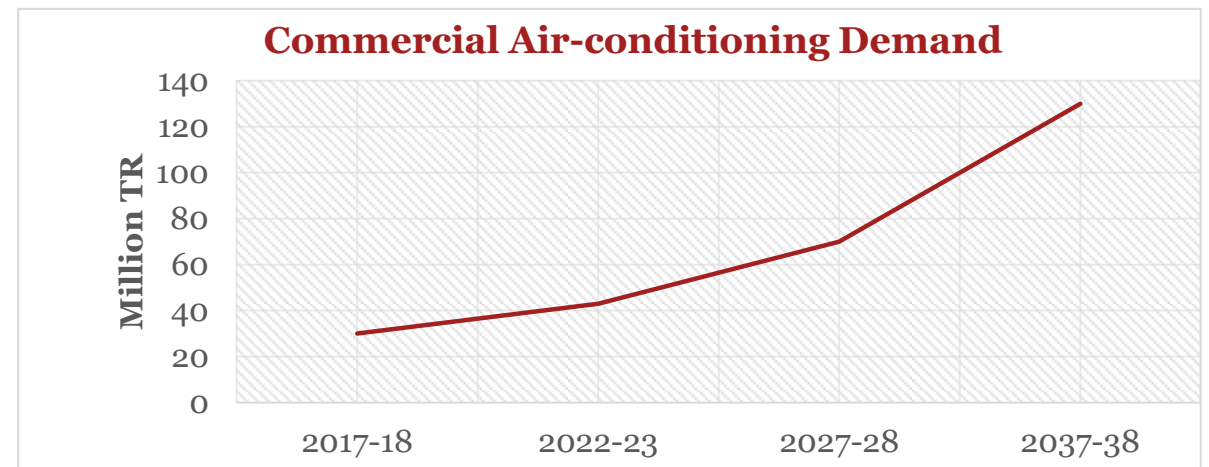
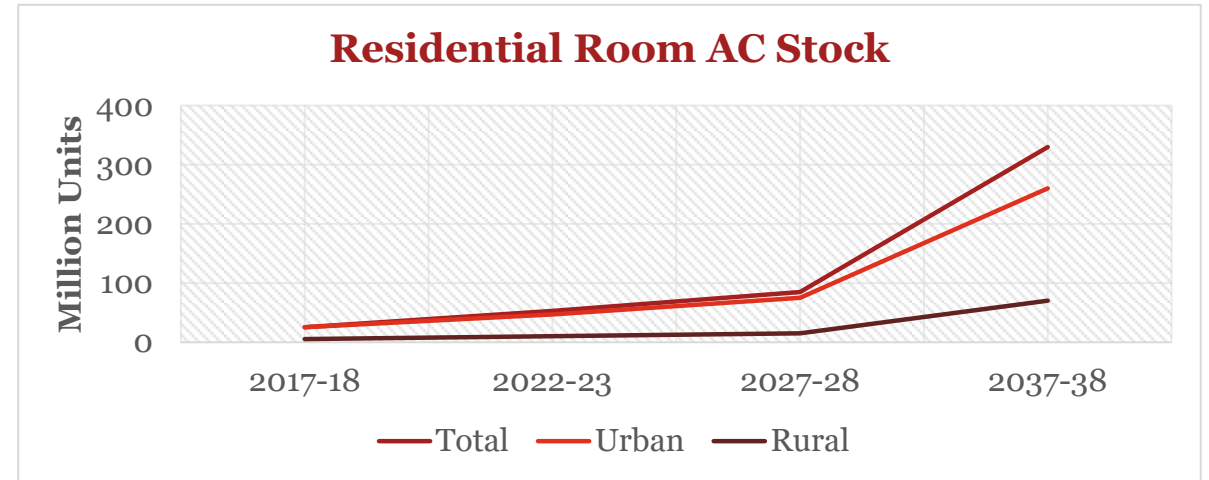
- India will add 0.7 billion m<sup>2</sup> of New Commercial Buildings and 4.9 billion m<sup>2</sup> of New Residential Buildings by 2030.



# Cooling eco-system in India: India cooling action plan

**Residential:** According to the ICAP, approximately **8%** of the current households have room air conditioners. This is anticipated to rise to **21% and 40%** in 2027-28 and 2037-38 respectively.

**Commercial:** The current (2017-18) commercial cooling demand is around **30 million TR**. This is expected to grow around **4.3 times by 2037-38**



## Commercial Air Conditioning

- Chillers (Air cooled/water cooled), VRF/VRV, Package Dx

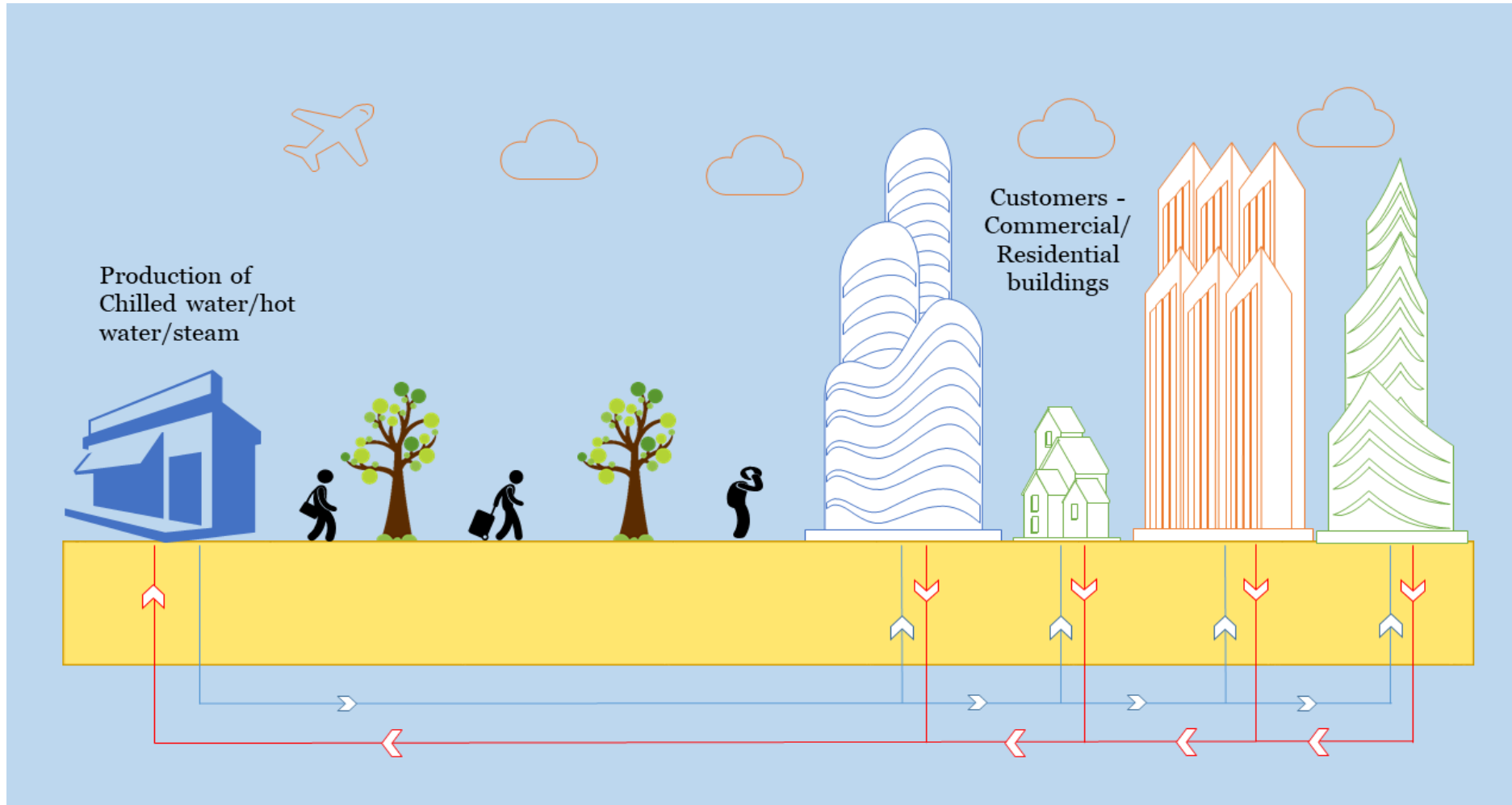
## Residential Air Conditioning

- Room air conditioning (VRF/VRV, split, cassette, window, concealed etc.)

## Low energy comfort systems

- Radiant cooling, evaporative cooling, solar air conditioning, ground source heat pump, adiabatic cooling system etc.

# District Cooling System



**District Cooling System (DCS)** distributes the thermal energy in the form of chilled water/ hot water or other media from a centralized location to multiple buildings through a network of underground pipes for cooling/heating applications.

# Re-defining District Cooling System

## Stand Alone Type

- Developers
- End Users
- Townships
- Government Building Complex

## Merchant Type

- Smart City
- Food Parks
- SEZ
- High Density Commercial Developments

1. Delhi Airport – Approx. 20,000 TR capacity
2. Mumbai Airport – Approx. 20,000 TR capacity
3. Chennai Airport – Approx. 12,000 TR capacity
4. Kolkata Airport – Approx. 12,000 TR capacity
5. Dhirubhai Ambani Knowledge City, Navi Mumbai- Approx. 12,000 TR capacity
6. Infosys (various campuses) – Approx. 50,000 TR (approx.)
7. Pragati Maidan, Delhi - Approx. 12,000 TR capacity (In Construction)
8. India International Convention Centre, Delhi – Approx. 10,000 TR capacity (In Construction)

**A key point to note is that these DCS are ‘Standalone’ and not ‘merchant district cooling’.**

**Stand alone and Merchant District Cooling need to be viewed separately.**

# *Growth drivers for District Cooling System in India & recent developments in the field*

## **Rapid Urbanization**

- Rapid urbanization has led to requirement of air conditioners in commercial and residential sector

## **Growth in cooling demand**

- In cities, cooling already contributes 40% -60% of peak electricity demand
- **Tapping air cooled chiller market with water cooled district cooling**

## **Electricity demand**

- Proportion of electricity demand in the cities for cooling: 25%-40 %

## **Policy mandate on CC**

- Commitment to NDC

- Rapid assessment of 6 cities Amaravati, Bhopal, Coimbatore, Pune, Rajkot and Thane.
- Thane was opted as “India’s first district energy pilot city.
- Rajkot become the first Indian city to incorporate the district cooling in the smart city plan, after the rapid assessment initiative by UNEP.

# Overall benefits of DCS

## Infrastructure Benefits

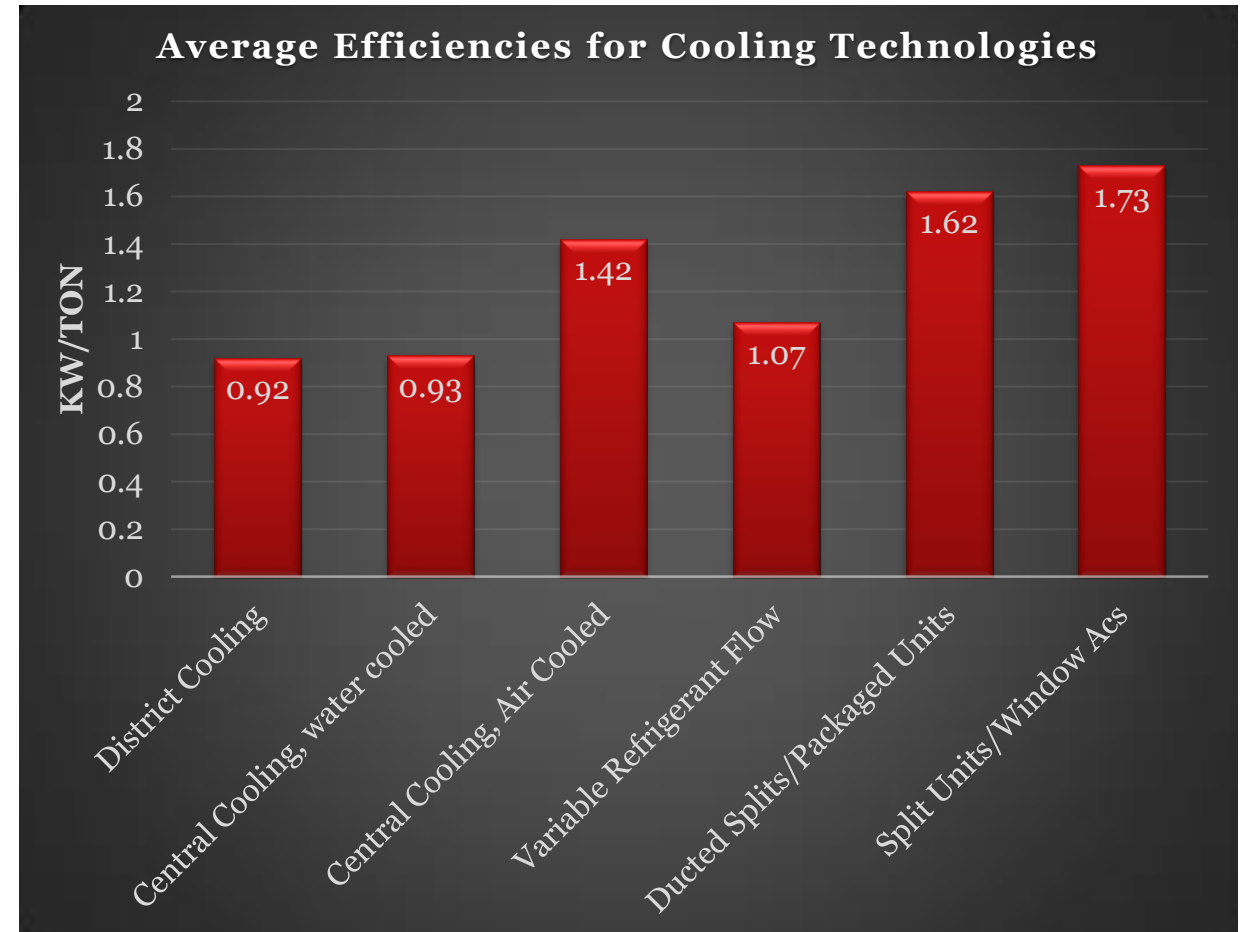
- Peak power demand reduction
- Reduction in cost to DISCOM
- Capital cost reduction (diversity factor, TES, load reduction)

## End user Benefits

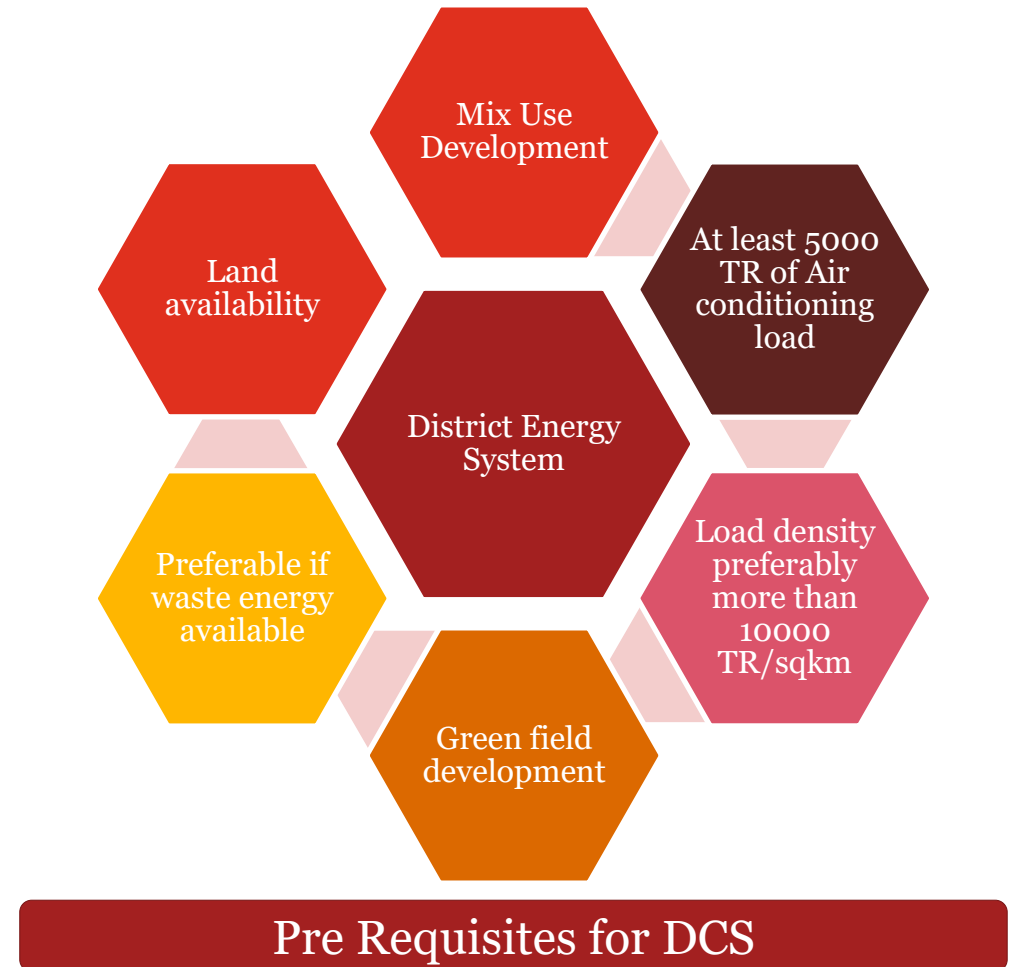
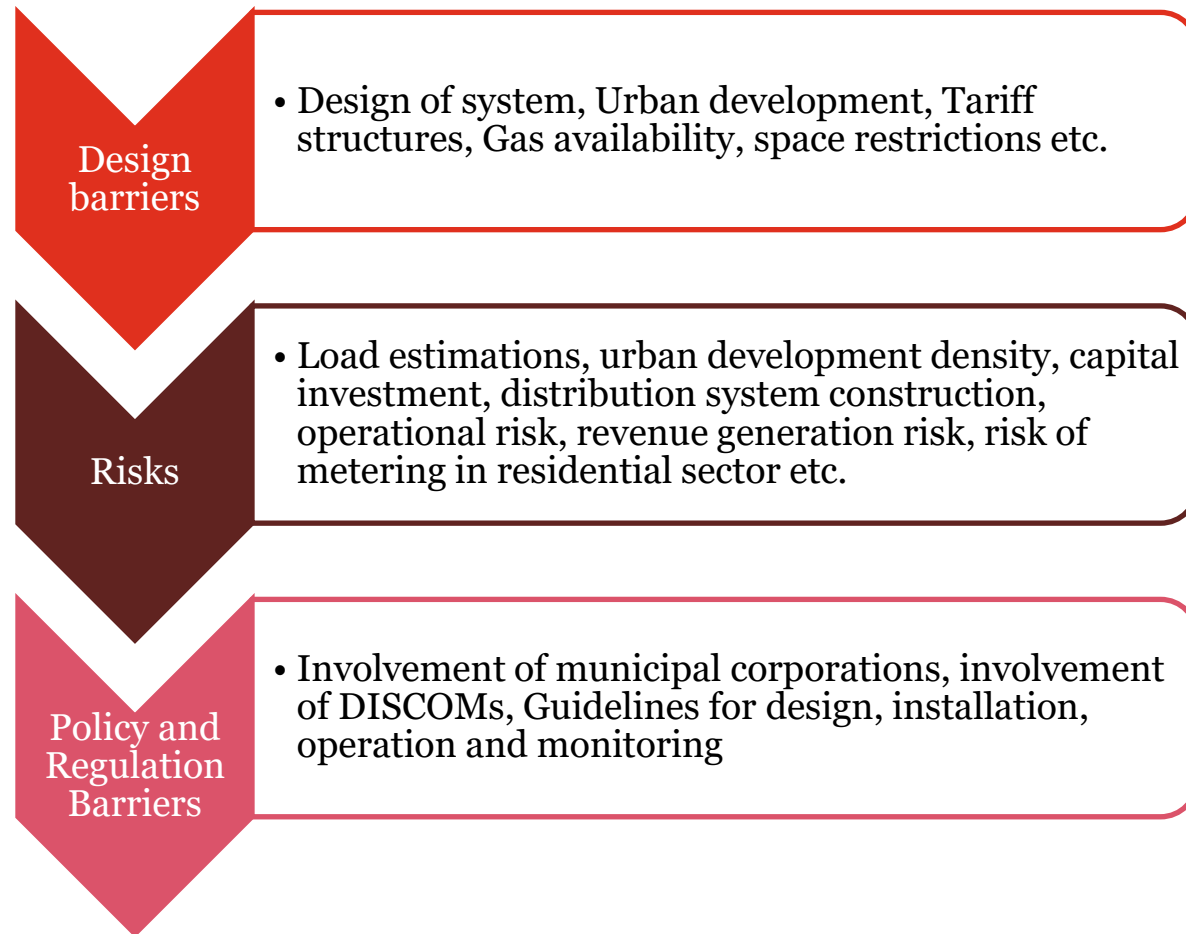
- Comfort, Convenience, flexibility, Reliability
- Lower Energy Bills

## Environmental Benefits

- Energy Efficiency
- Climate Change
- Water savings by using STP/ETP water in cooling towers



# Barriers for DCS in India



# *Learnings from International best practices*

## **Egypt**

- Spread out development (low density areas) leads to extra cost for piping
- Not considering residential as potential consumer
- Not feasible for only residential sector

## **Shenzhen - Hong Kong**

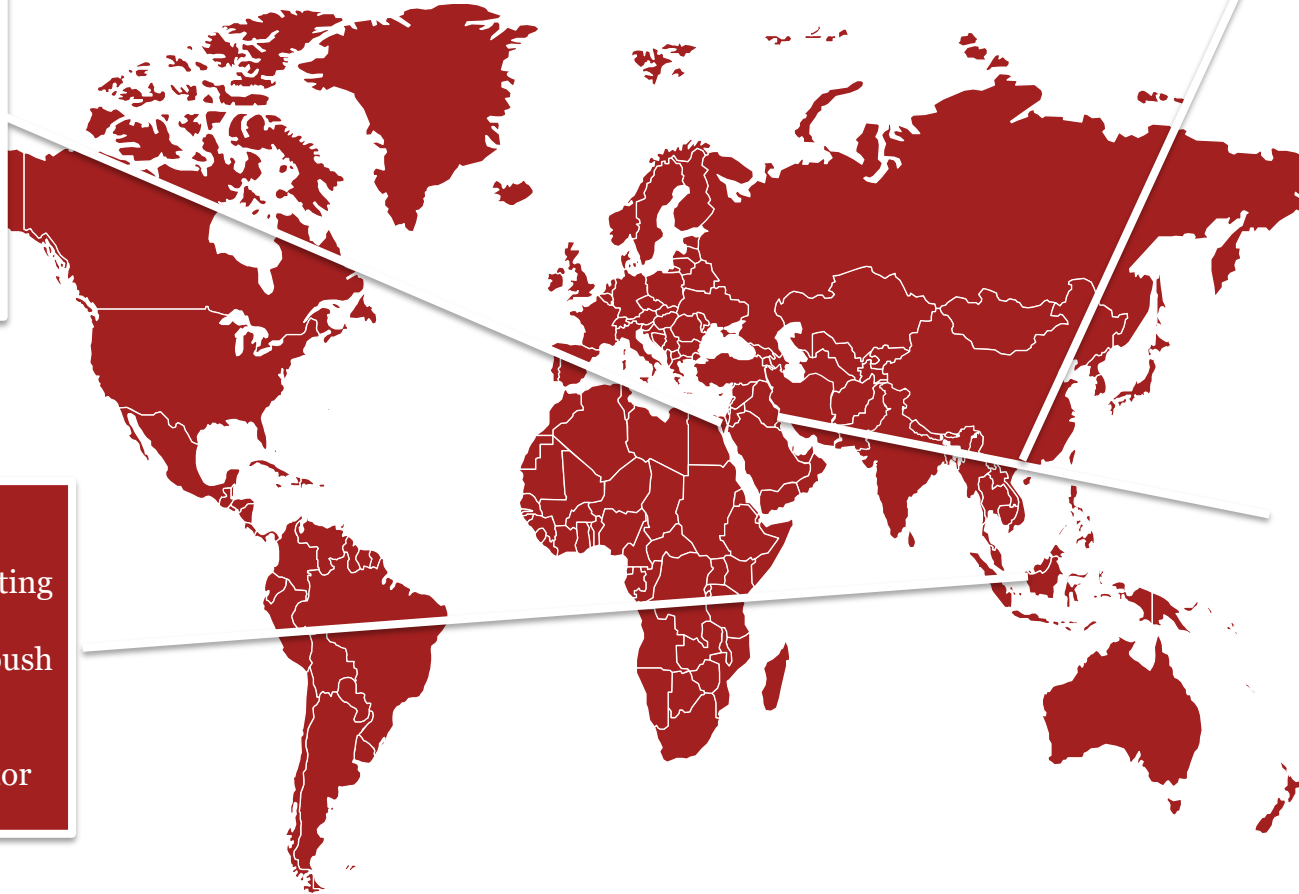
- Prioritise DCS for commercial sector
- Use of sea water for heat rejection
- Potential consumers in high density area
- Not feasible for only residential sector

## **Singapore**

- Policy development for supporting DCS in country (DC Act)
- Formation of regulatory body to push DCS adoption in India
- Awareness and training programs
- Not feasible for only residential sector

## **Dubai**

- Policy framework supporting DCS adoption
- Municipal level involvement in water supply
- **Capturing market of air cooled chiller as potential consumer for DCS**



# *KPIs of Indian cities for DCS implementation*



**GDP**



**GDP Growth Rate**



**Real Estate Growth Rate**



Availability of cleaner fuel gas/bio gas  
for decentralized electricity  
generation



**Smart Metering**

Smart grid & metering,  
Smart street lighting,  
Distribution system with  
SCADA, Solar energy  
initiatives



**Smart Spaces**

Automation in buildings  
Urban heating & Cooling  
network  
Advanced HVAC & lighting



**Smart Environment**

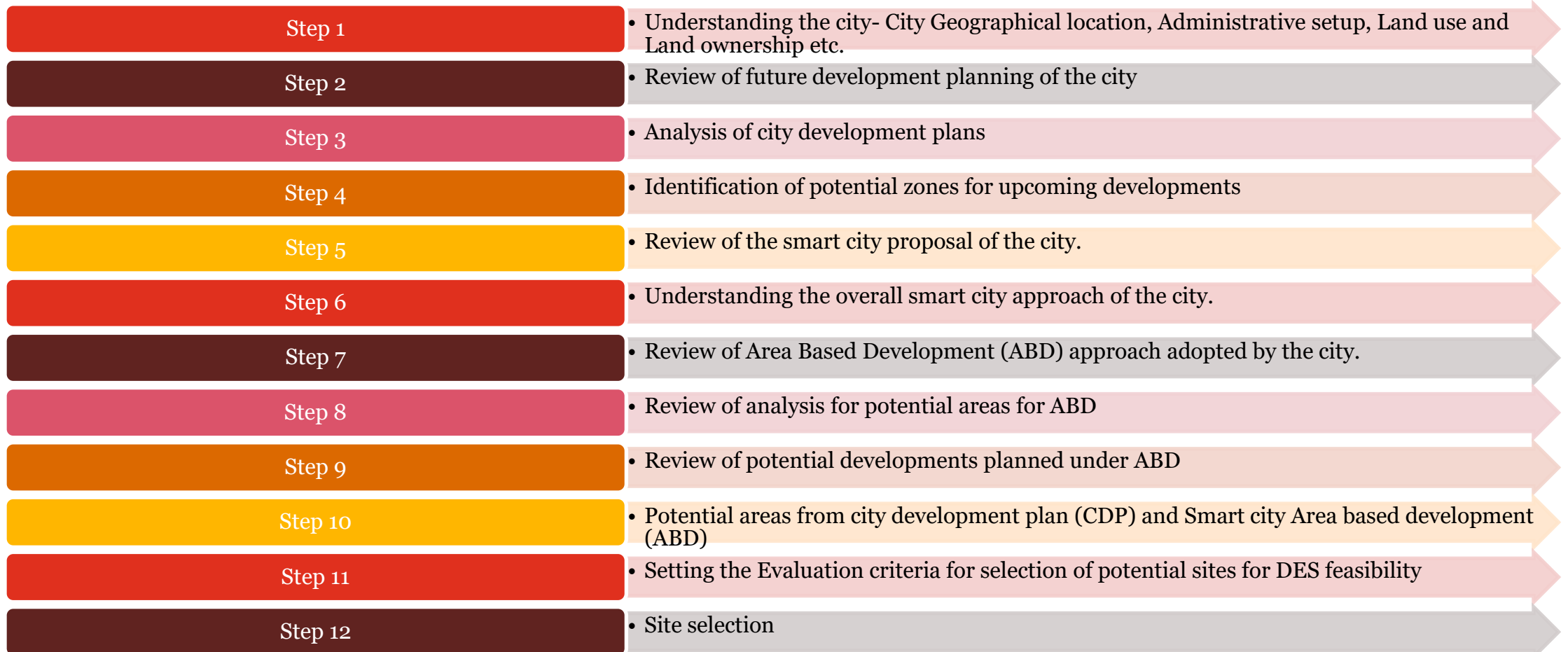
Green buildings  
Pollution control centre  
Forest fire detection etc.



**E Governance**

Availability of  
government data in  
electronic mode

# Rapid assessment of Bhubaneswar – Key highlights



# Identification of areas for Area Based Development (ABD)

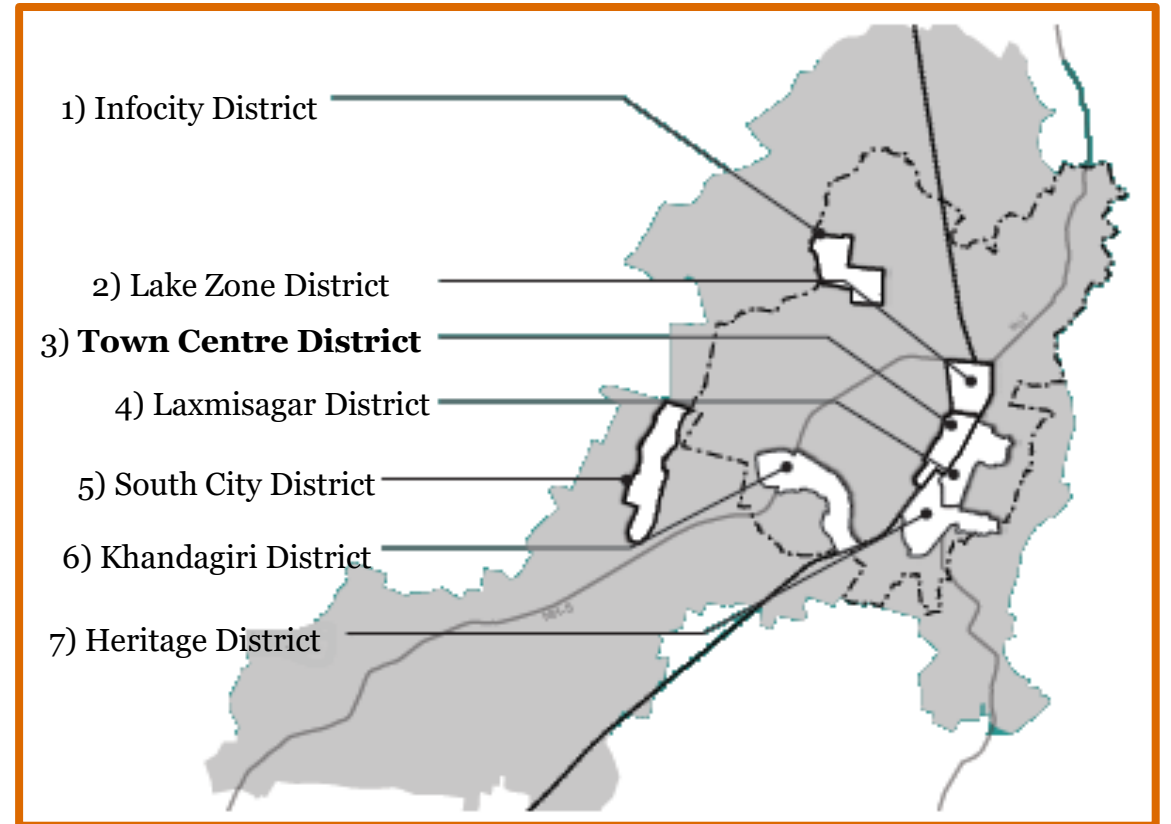
The potential areas for the Area Based Development (ABD), based on potential areas **where strategic investments made under Mission will enhance city's image, address major problems faced by city and provide thrust to economic opportunities.**

The approach for the identification of areas included CDP reviews, GIS mapping, City Profiling and Stakeholder discussions.

The areas identified for ABD were termed as districts for easy identification and for creating a sense of boundary.

## Overlapping of Smart Districts with BDPA Development Zones

Smart City Potential Districts	Zones under BDPA
Heritage District	Old Bhubaneswar (Zn 18)
Laxmisagar District	Bhubaneswar New Town (Zn 17)
Bhubaneswar Town Centre District	Bhubaneswar New Town (Zn 17)
Lake Zone District	Bhubaneswar New Town (Zn 17)
Khandagiri District	Overlaps in two zones i.e. Bhubaneswar New Town (Zn 17) & Aigania (Zn 20)
South City District	Tamando (Zn 21)
Infocity District	Chandrasekharpur (Zn 13)



# Upcoming developments in BTCD under Smart City Mission



## Railway Station Multimodal Hub

Redevelopment of existing railway station area of 12 acres as a mixed use project including railway station terminal building redevelopment.

## Satyanagar Institutional Core

Redevelopment of 40 acres of underutilized public land into a commercial, business and educational hub.

## Janpath Govt. Housing Redevelopment Project

Redevelopment project to provide 3800 houses in 30 acres of government land. The average carpet area is 1000 sqft.

## Mission ABBAS

4 slum redevelopment project – Bapuji nagar, Kharavela, Shanti nagar, Saheed nagar Abaas yojana with 6000 EWS units and 1200 nos. of HIG/MIG units

# About- Bhubaneswar Town Centre District (BTCD)

Area : 985 Acres / 3.9 Sq.km.

Demography (2015) : 46,000

2.4% BMC | 0.3% BDA

Households : 11,167

Road Network: 70.5 Km



# *Selection of potential sites for DES (district energy systems) feasibility*

Potential areas	Zone	Development time period	Mixed use development	Willingness of client	Single Agency involved	TR requirement
Satyanagar Institutional Core	Bhubaneswar New Town	2~3 years	Yes	Yes	Yes	>3000 TR
Railway station Multimodal Hub	Bhubaneswar New Town	2~3 years	Yes	Yes	Yes	>3000 TR
Knowledge City	Chandrasekharpur	>5 years	Not known	No	No	Not known
Infocity	Chandrasekharpur	>5 years	Not known	No	No	Not known
South City	Tamando	>5 years	No	No	No	Not known

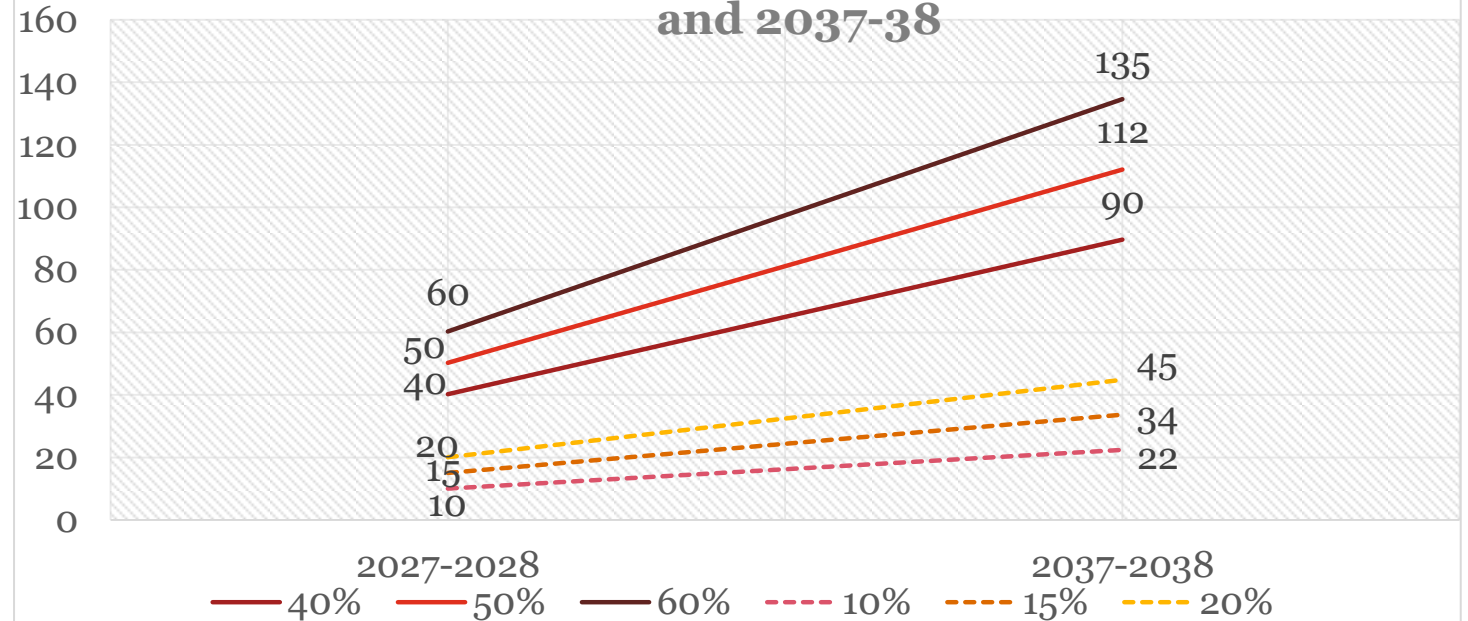
# Potential of DCS in India – Approach and estimations (WIP)

Approach 1: Total electricity consumption in space cooling

Approach 2: Total commercial air conditioned area and air conditioning requirements

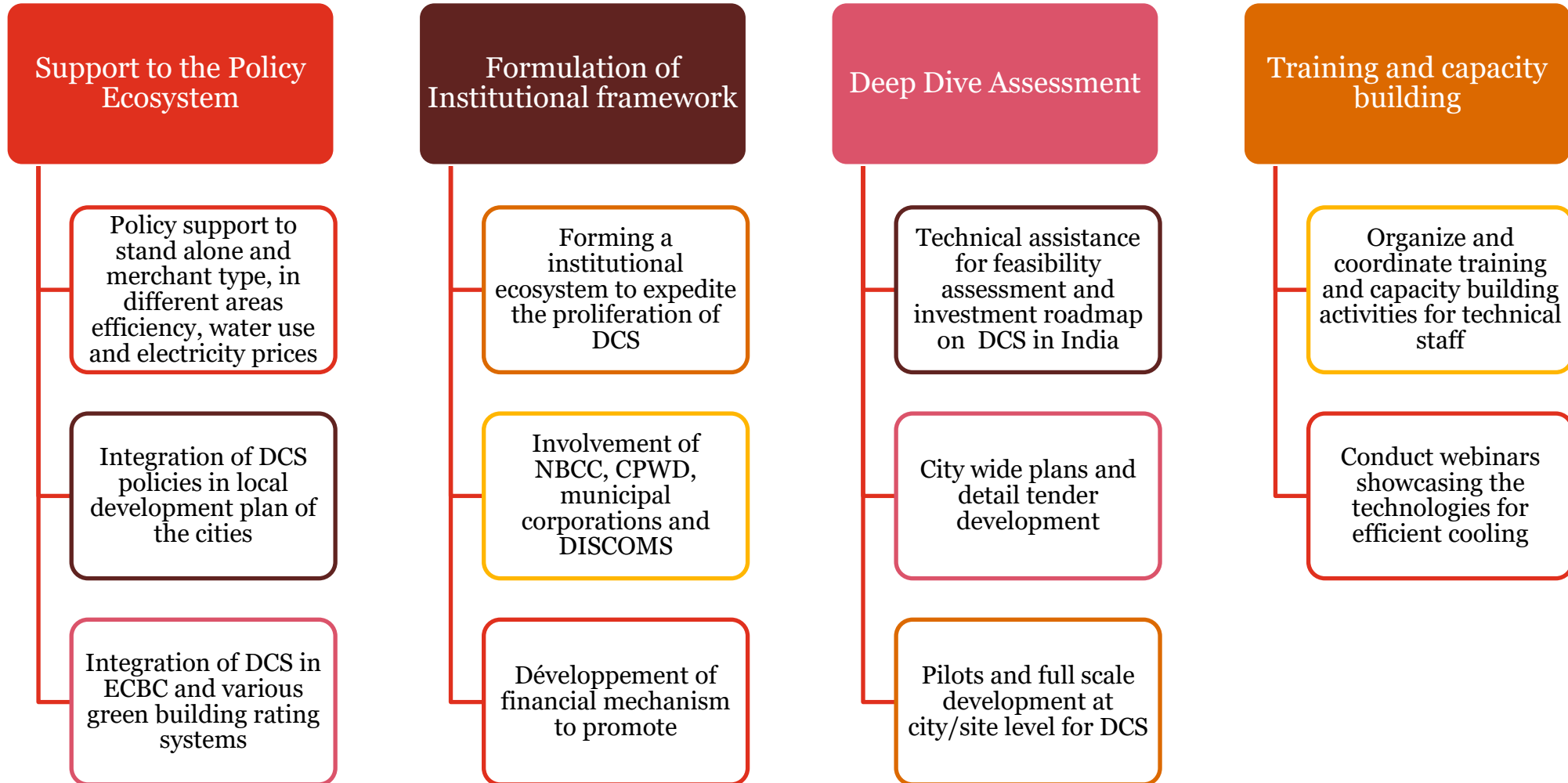
Approach 3: Stock of refrigerant based equipments

No of DCS plants in tier 1 & 2 Cities, in 2027-28 and 2037-38



It can be projected that by adopting any of the lenient, moderate or ambitious approach, number of district cooling plants (considering 20000 TR each plant), may vary from 10 to 20 by 2027-28 and 22 to 45 by 2037-38.

# Way Forward to drive DCS in India



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# ***Business models***

## **1. Public Private Partnership (PPP)**

- Ownership is split b/w public & private sector
- Public sector is responsible for risks related to regulatory barriers like land acquisition, ensuring reliable water & power supply
- Private sector is responsible for planning, construction & operational aspects of the project
- Model works well with user types like government buildings, food parks, SEZs & end user

## **2. Wholly Public Business Model**

- Most prevalent business model in the world
- Government authorities have full ownership over the system
- Ability to manage finance through grants and MLF (multi lateral funding)

## **3. Private Business Model**

- Considered in projects with high rate of return
- Financing is provided wholly by the private sector
- Applicable to user types like IT Parks, educational campuses, private townships like BHEL Township

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*Thank you  
Building Relationships...*



Rajeev Ralhan  
Executive Director  
Advisory-GRID  
T: 0124 – 330 6259  
M: +919910063775  
[rajeev.ralhan@pwc.com](mailto:rajeev.ralhan@pwc.com)



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