

District cooling for residential buildings and its applications



DISTRICT ENERGY IN CITIES

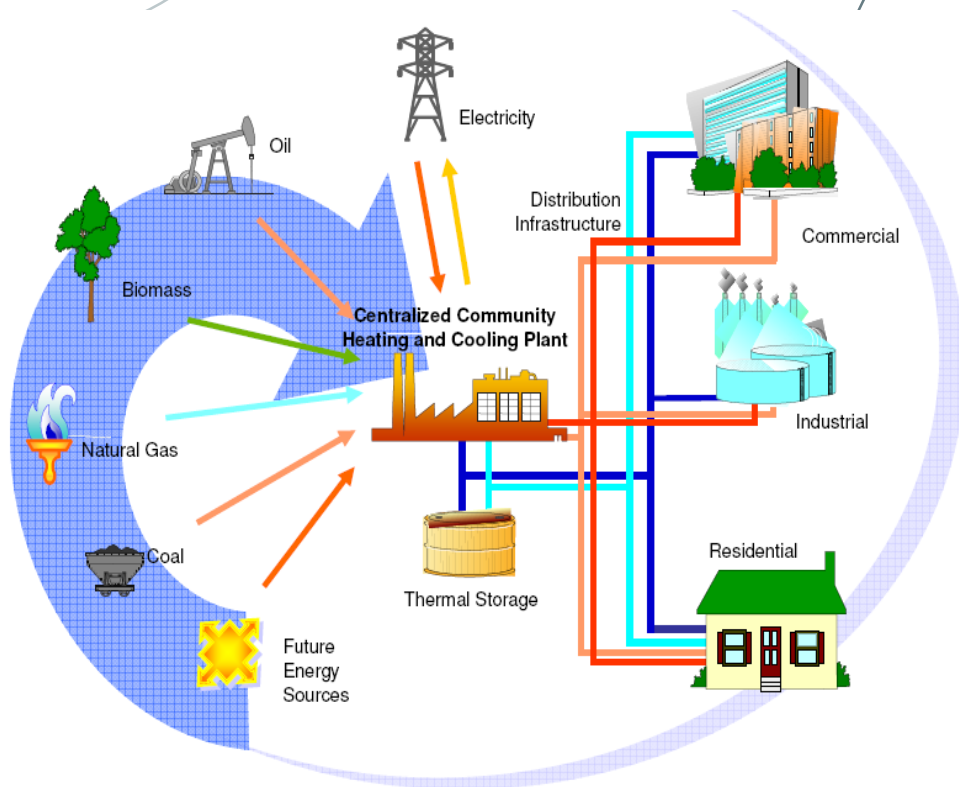
A GLOBAL INITIATIVE TO UNLOCK THE POTENTIAL OF ENERGY EFFICIENCY AND RENEWABLE ENERGY



INTRODUCTION



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IN CITIES
INITIATIVE



The idea of district energy is to have an efficient and often large-scale production of heating or cooling in a **centralized plant**.

Most times the heating or cooling is **co-generated** with electrical power, which yields a very high efficiency utilisation of the energy input.

The district energy system is unique in the way that it lends itself to an endless range of fuels – it is in other words a **multifuel energy system**.

Any energy source, renewable, present or future
can be used in the District Energy system

INTRODUCTION

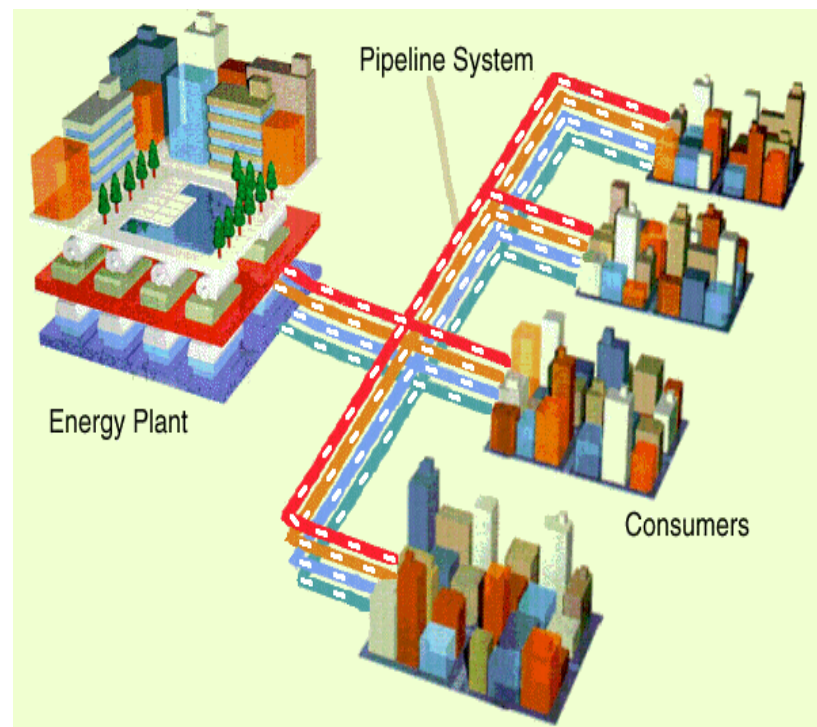


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Definition of District Cooling:

- A system to combine heating/cooling station and end-users through pipeline network
- Belongs to public service, similar to electricity, water, gas etc.
- Cooling sources could include waste heat, electrical cooling, free cooling etc.
- To satisfy the heating and/or cooling demand in order to enhance indoor thermal comfort



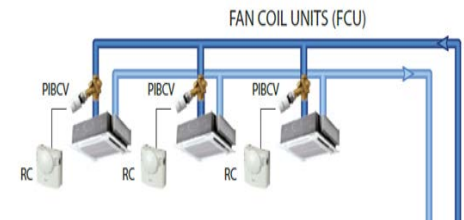
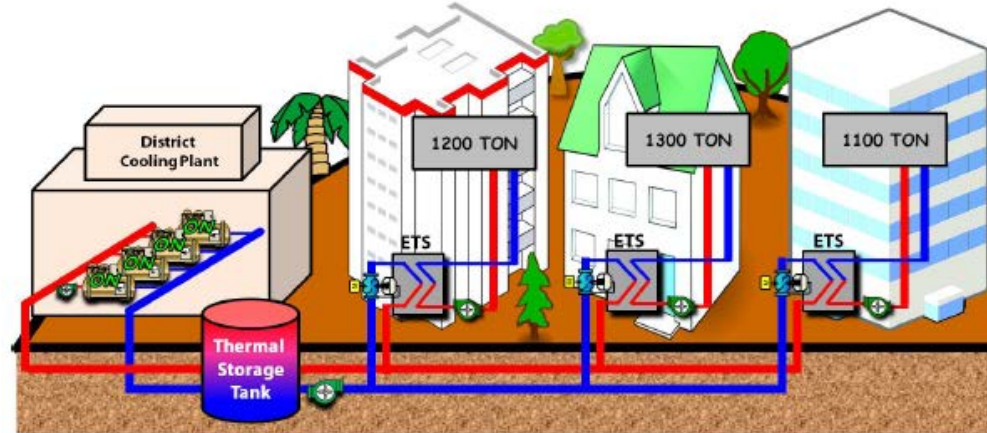
INTRODUCTION



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What is included in a District Cooling system ?



Supply source
(DC plant)

Distribution System
(Network)

End-users
(Metering systems,
internal AC)

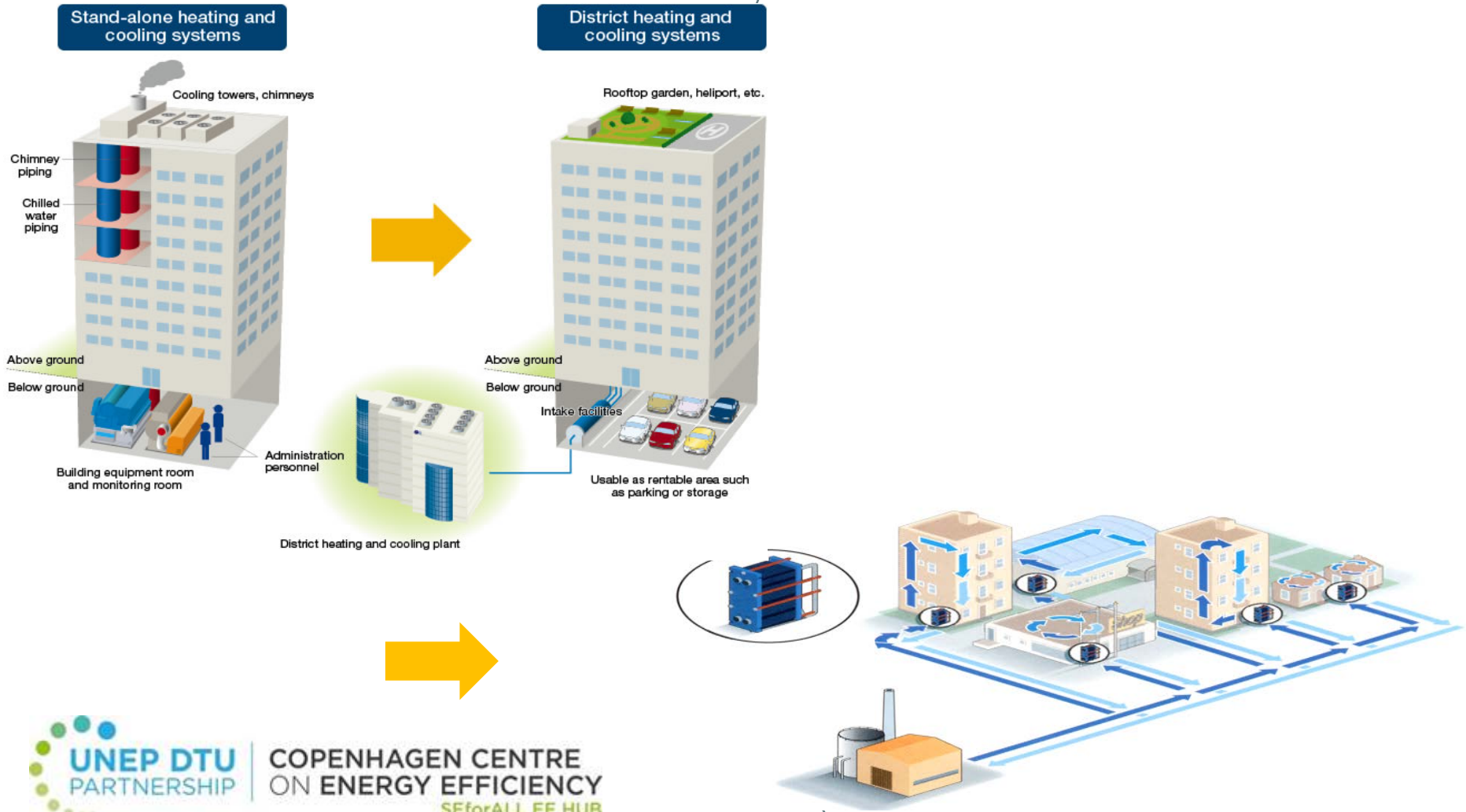
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What does a District Cooling system change?

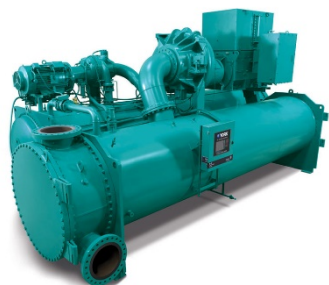




CONNECTING TO DC

WHAT HAPPEN INSIDE THE BUILDING?

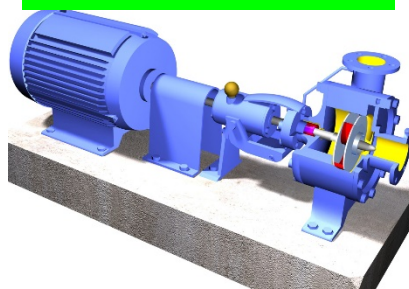
1. Cooling sources: cooling towers, chillers, condensed water pumps



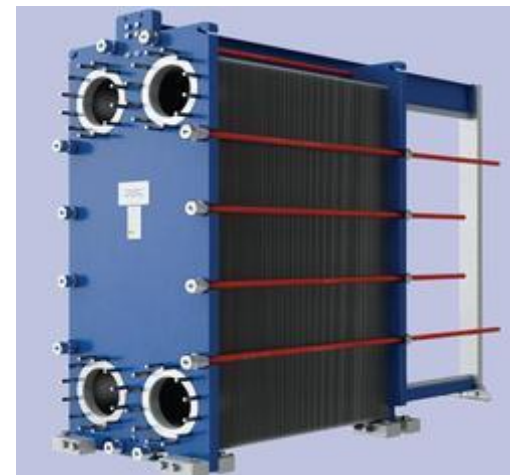
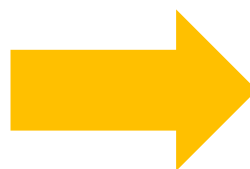
Chiller



Cooling tower &
circulated pump



Change

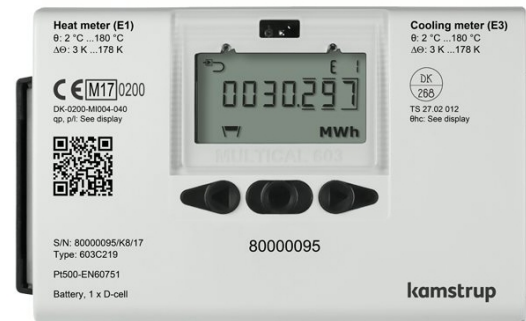


Heat
exchanger



Electric
transformer for
cooling sources

Metering system



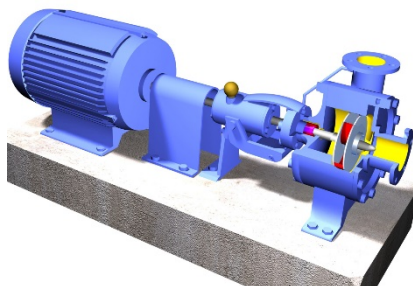


CONNECTING TO DC

WHAT HAPPEN INSIDE THE BUILDING?

2. Interior AC system: chilled water pump, AHU/FC

Chilled water
pump

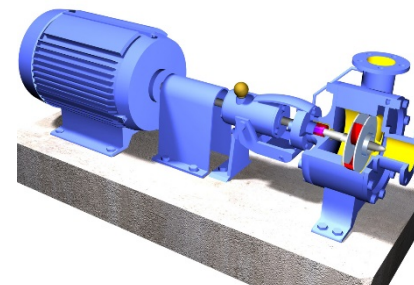


Calibrate with
flow rate, head



Change or keep

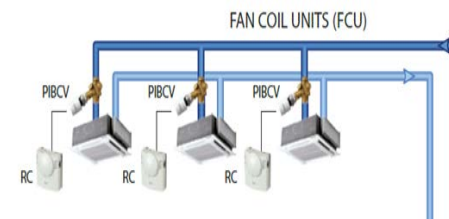
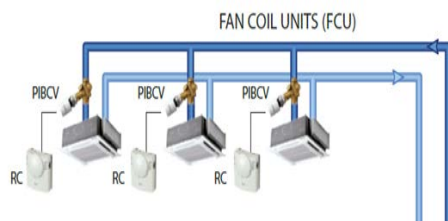
Chilled water
pump



Calibrate with supply
and return temperature



Should be the
same in most
conditions





CONNECTING TO DC

WHAT HAPPEN INSIDE THE BUILDING?

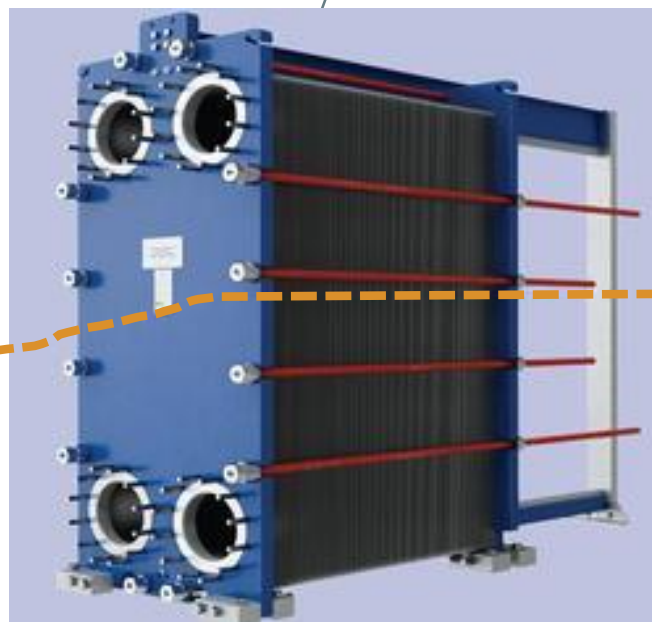
3. Control system

DC side

End-user side

Guaranteed supply temperature, T_1

Controlled return temperature, T_2'



Maintain delta T for high efficient operation



Extra metering installed

BENEFITS DISTRICT COOLING CAN BRING TO RESIDENTS



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For luxury apartments and communities:

- Higher quality of public service for the whole community
 - Electricity, water, heating, cooling, domestic hot water etc.
- Higher quality of indoor thermal environment
 - Treated fresh air
 - High air exchange ratio
 - No mold walls

DISTRICT COOLING VS. OTHER COOLING TECH



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		DC+Central End (FC, AHU)	Conventional Central (FC, AHU)	Split AC	VRF/VRV
Indoor Environment Parameters	Temperature				
	Humidity			Not humidify, but dehumidify	
	Wind speed				
	Fresh Air ratio				
Indoor Air Quality (IAQ)	VOC (CO, CO2)				
	PM10, PM2.5				

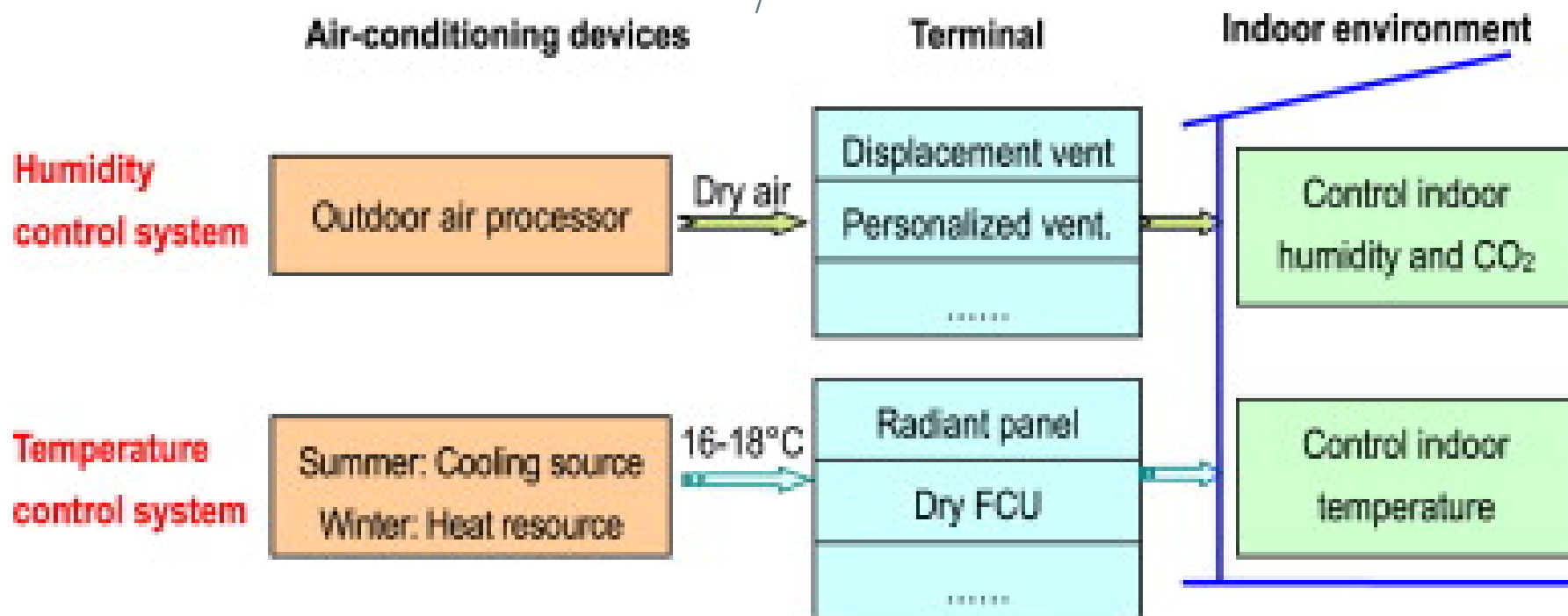
POTENTIAL TECHNICAL SOLUTIONS FOR LUXURY APARTMENTS



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- Temperature and Humidity Independent Control System



BENEFITS DISTRICT COOLING CAN BRING TO RESIDENTS



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For conventional apartments and communities:

- Replace split AC with simple Fan Coil system (without fresh air)
- Provide relative cheap way to protect public from heat stroke in developing countries
- Increase district energy efficiency



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ON ENERGY EFFICIENCY
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DISTRICT COOLING VS. OTHER COOLING TECH



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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 (Tri generation)	60%-80%	30%-50%
District cooling (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

POTENTIAL TECHNICAL SOLUTIONS



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FOR CONVENTIONAL APARTMENTS



- Normal Fan Coil system (without outdoor air processor)
 - Installed in bedrooms, can be turned on whenever needed
 - Directly replace split AC
 - Only provide cooling, but not control indoor air quality
 - Suitable for apartments for middle-class people and social house for public health



BARRIERS AND CHALLENGERS



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- Price: Residents may not aware of how much they pay for cooling when they only pay for the bill of electricity. Residential buildings have lower electricity tariff than commercial building
- Regulation: There is no regulation to prevent installation of competing split AC systems
- Extra space and maintenance: FC system normally requires min. 300mm for chilled water pipes and FC. Maintenance for pipes and FC is required.

Municipalities should publish incentive policies to encourage DC in residential buildings for the purpose of public health



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THANK YOU!



For more information on the Global District Energy in Cities Initiative, please visit the website or contact:

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

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