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# **BENEFITS AND CHALLENGES OF DISTRICT COOLING IN URBAN ASIA**

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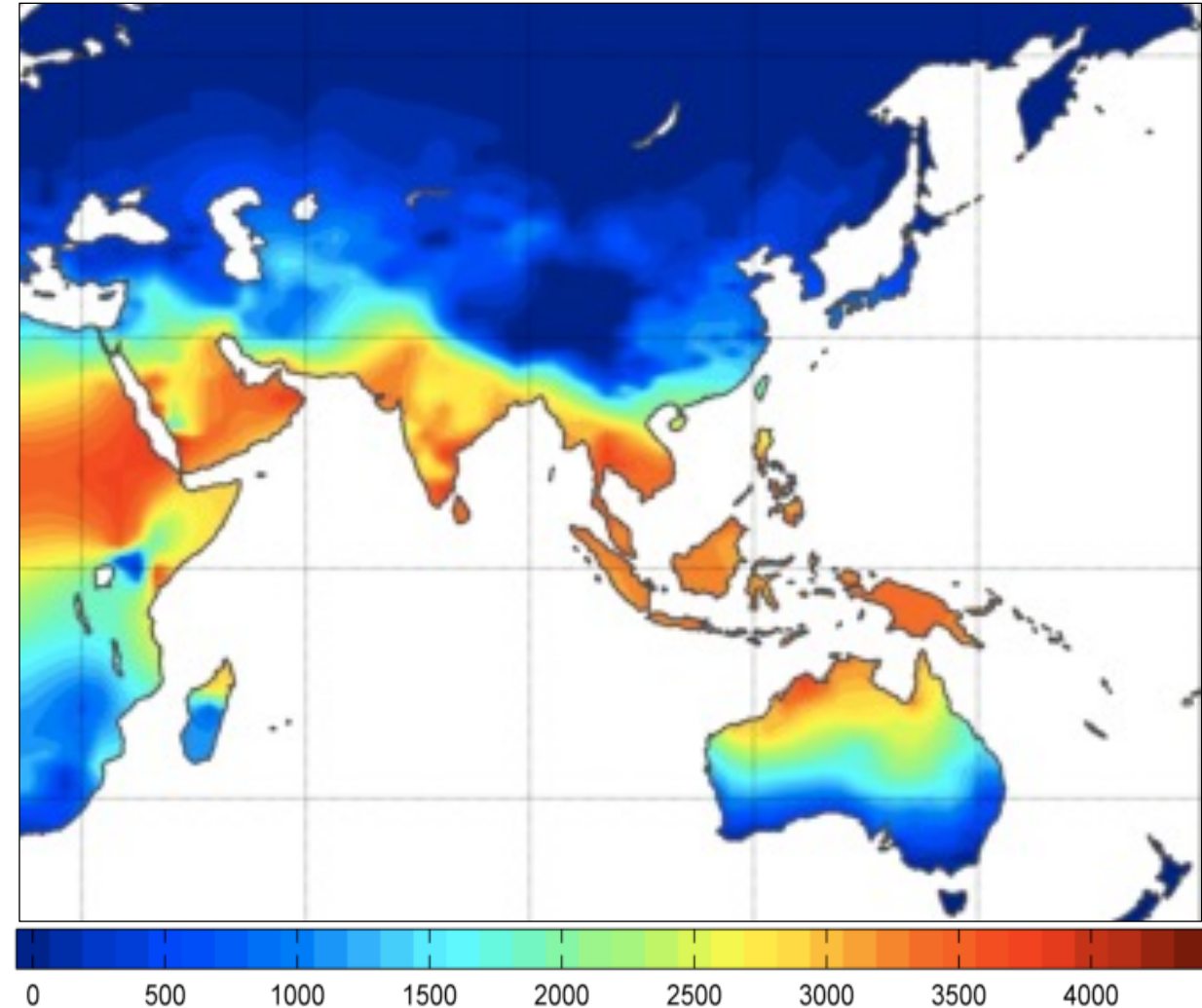
**SUSTAINABLE INFRASTRUCTURE DIVISION, EARD**

**ASIAN DEVELOPMENT BANK**

# Where do we mostly need cooling?

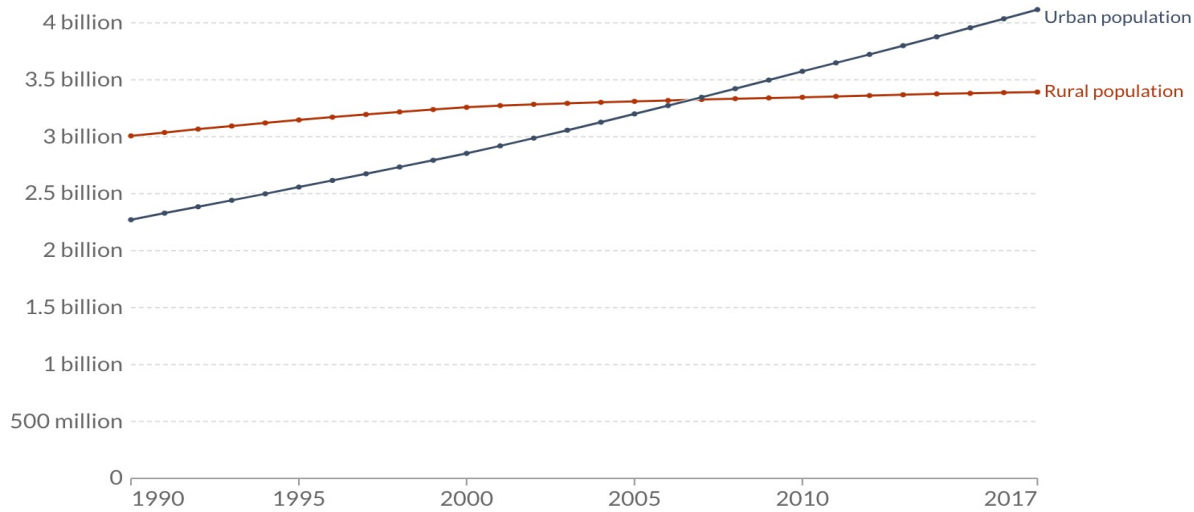
- In the so-called **Torrid Zone** (intertropical area), where...
  - the majority of ADB's Developing Member Countries are
  - over 2 billion people that need cooling during most part of the year live
  - some areas reach temperatures higher than 35°C in the hottest months

Distribution of annual cooling degree-days at 18.3°C



# Growing Urbanization

World's Rural and Urban Population 1990-2017 (billions)



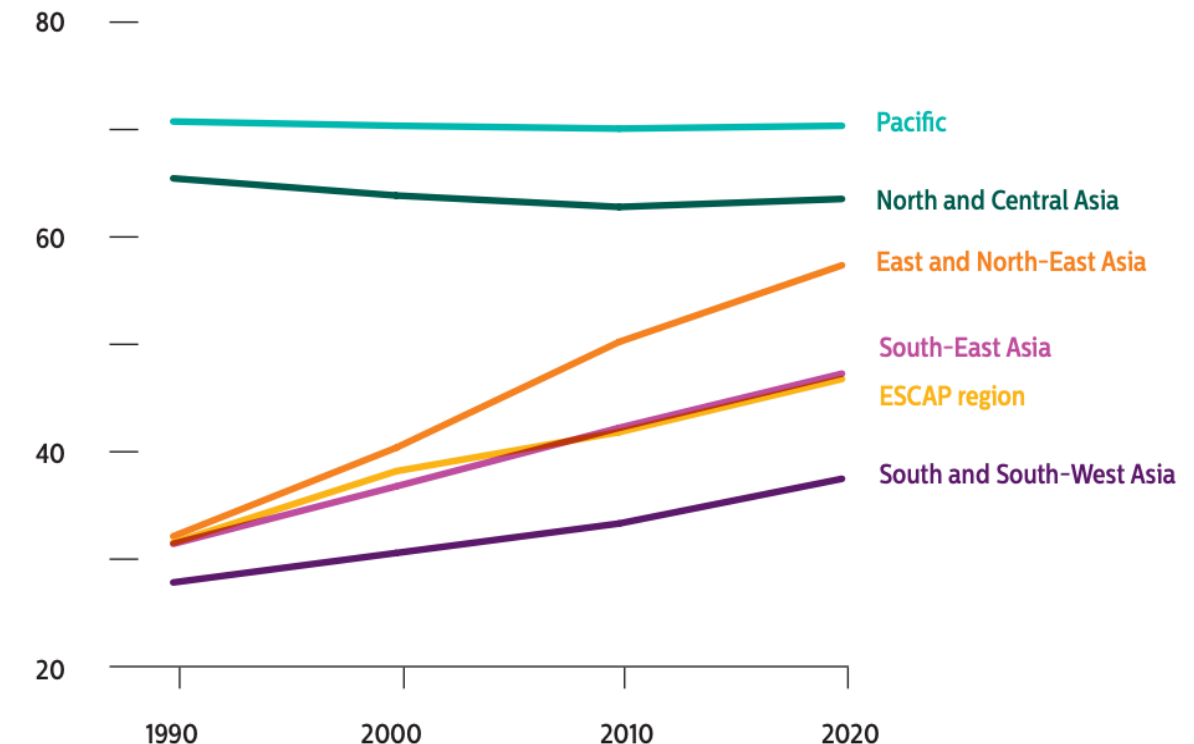
Source: World Bank based on data from the UN Population Division

Note: Urban populations are defined based on the definition of urban areas by national statistical offices.

OurWorldInData.org/urbanization • CC BY

- 21 out of 32 megacities (>10 million people) are in Asia
- 68% of the world population projected to live in urban areas by 2050

Figure 1 Urbanization in Asia and the Pacific across subregions, 1990–2020



Note  
Source

The trends for *South-East Asia* and *ESCAP region*, as a whole, are very similar. United Nations, Department of Economic and Social Affairs, Population Division (2012). *World Urbanization Prospects: The 2011 Revision*. CD-ROM Edition - Data in digital form (POP/ DB/WUP/Rev.2011).

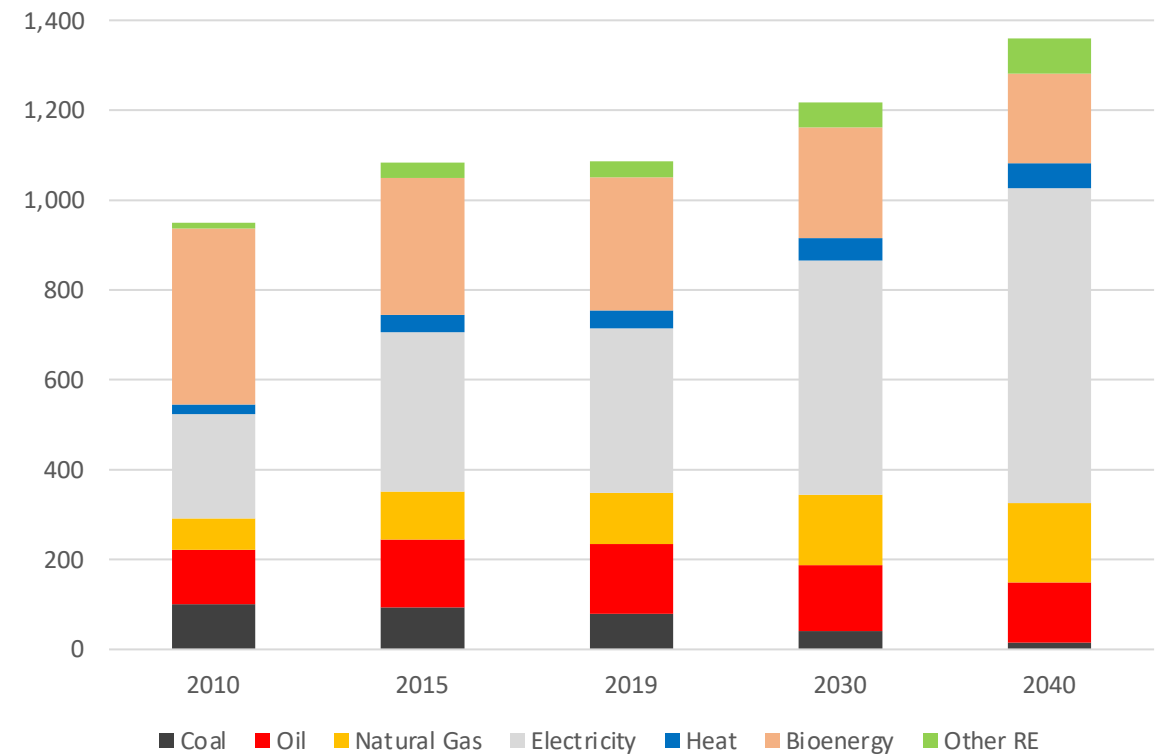
# Urban Energy

## ➤ In 2013:

- the world's cities consumed about **64% of global primary energy**; and
- produced **70% of CO<sub>2</sub> emissions** globally— IEA

## ➤ Buildings consume about 1/3 of all urban energy, and is expected to increase due to growing demand for cooling

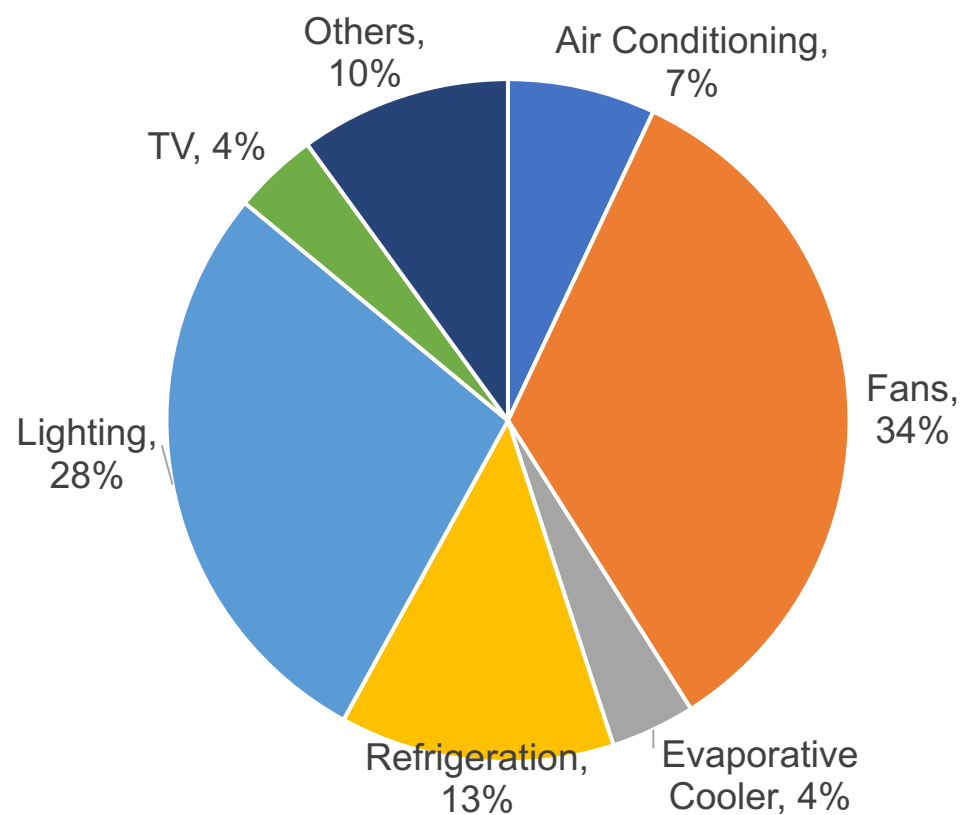
**Final Energy Consumption in Buildings Sector in Asia Pacific, 2010-2040e (Mtoe)**



Source: IEA World Energy Outlook 2020

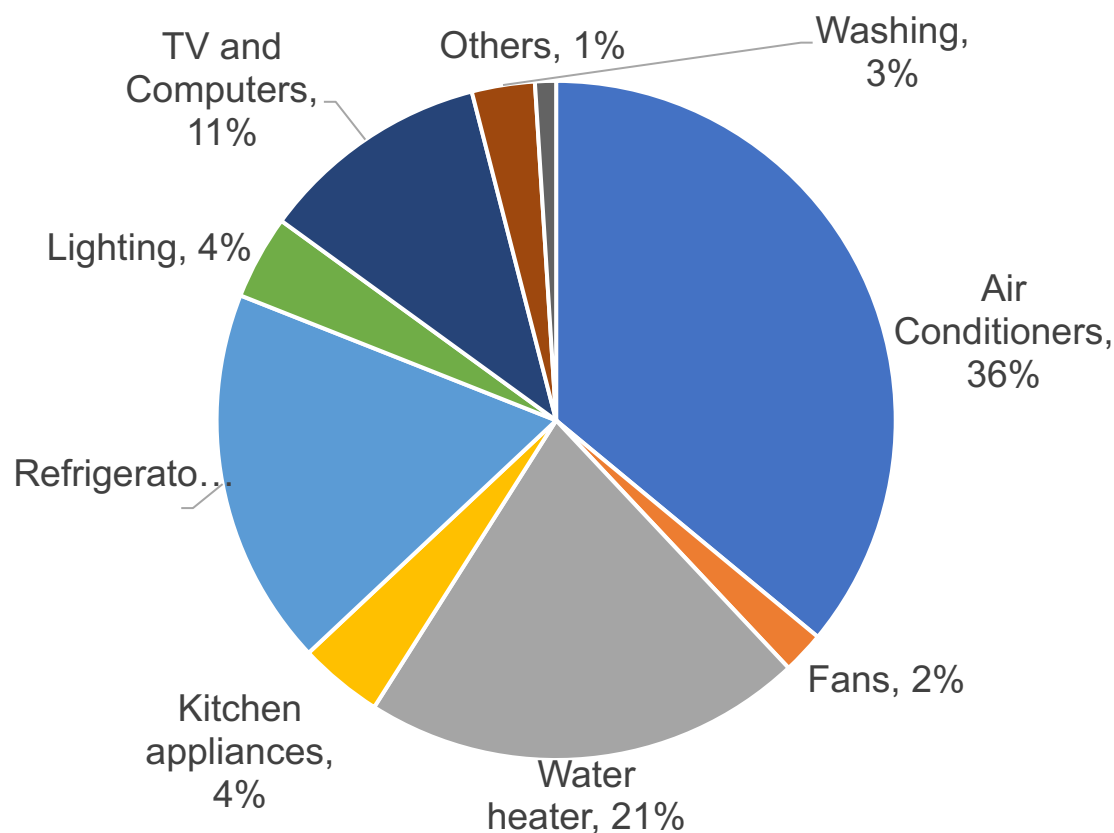
# Buildings Energy Use (examples)

Electricity Consumption Pattern in Residential Buildings in India (2014)



Source: Bureau of Energy Efficiency, Ministry of Power, Government of India.

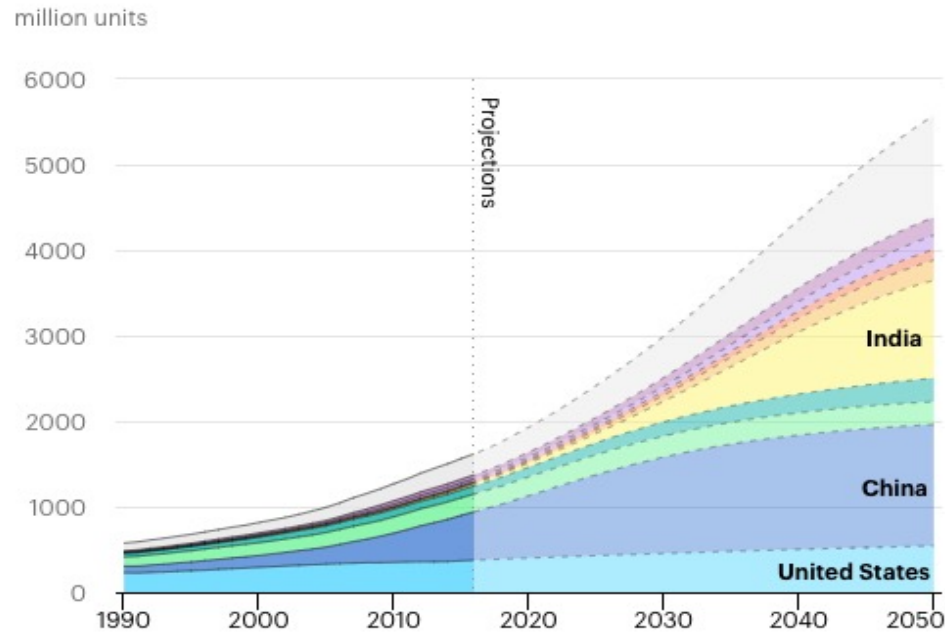
Electricity Consumption Pattern in Residential Buildings in Singapore (2012)



Source: Household Consumption Survey 2012  
[www.e2singapore.gov.sg](http://www.e2singapore.gov.sg)

# Cooling Buildings

Global air conditioner stock, 1990-2050

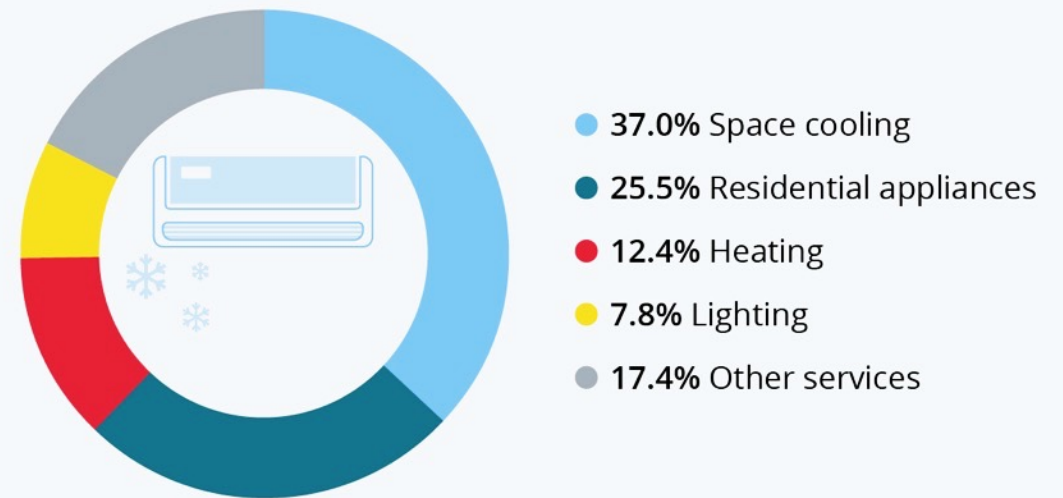


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United States China Japan and Korea European Union India Indonesia Mexico Brazil Middle East Rest of world

## Air Conditioning Biggest Factor in Growing Electricity Demand

Global electricity demand growth from 2018 to 2050, by energy use category



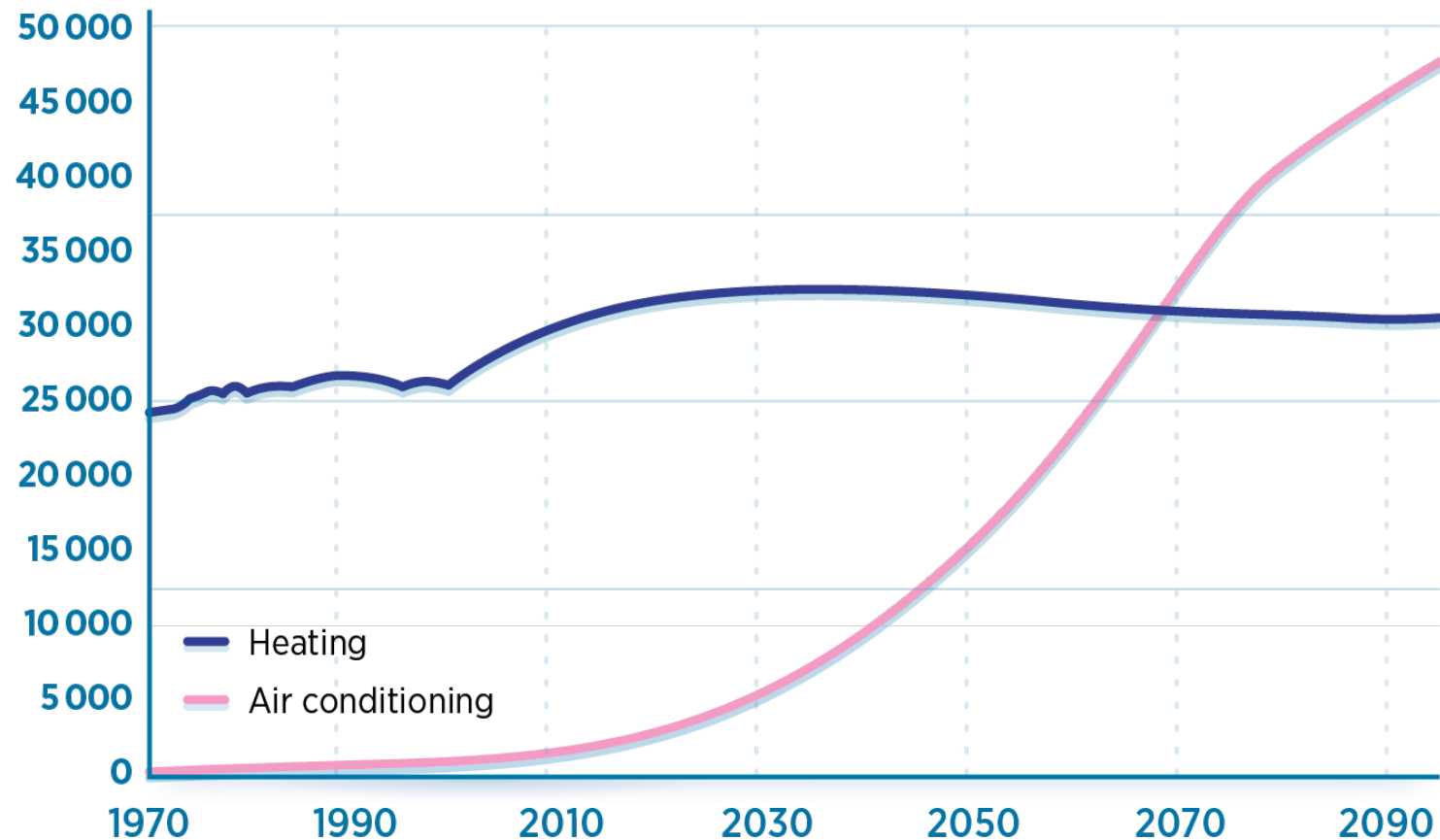
Source: International Energy Agency



statista

# Impact on Energy Demand

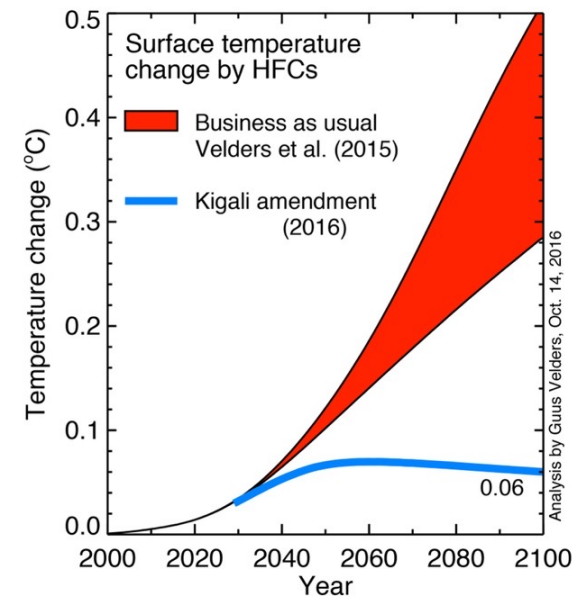
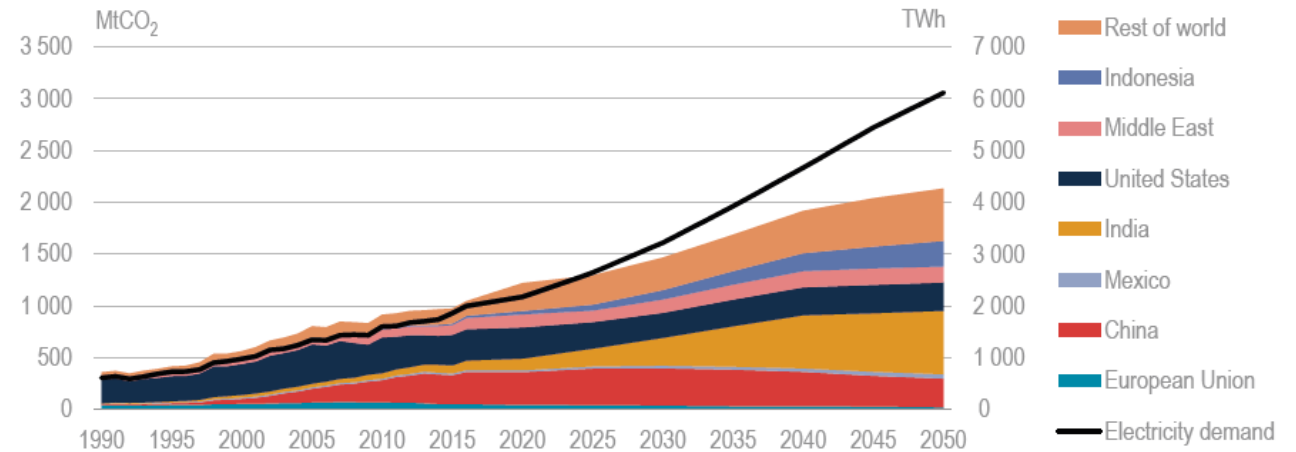
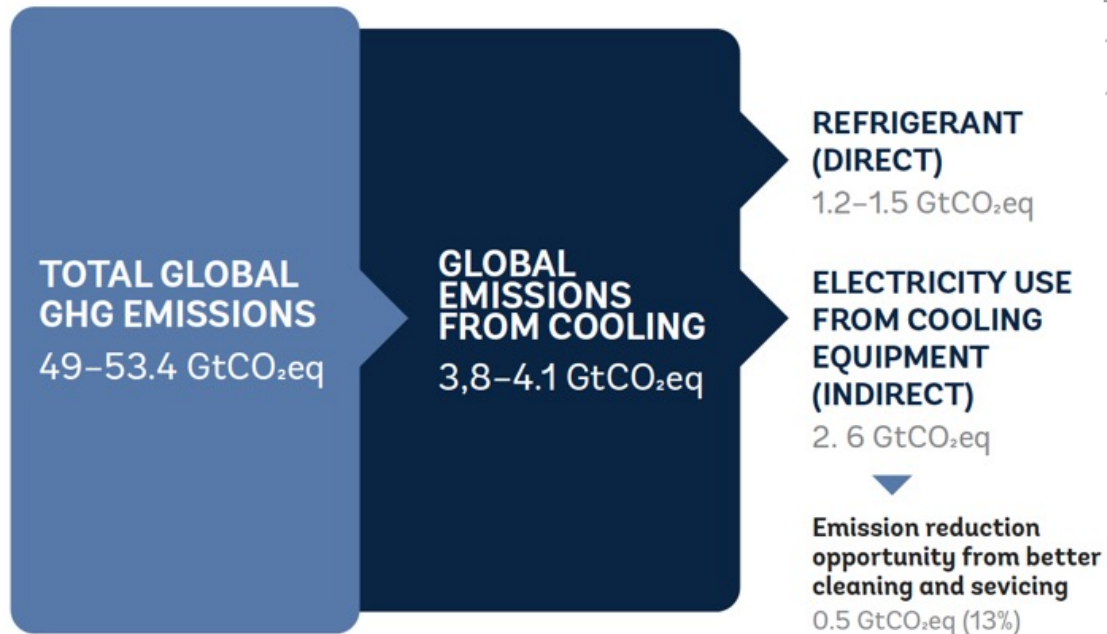
Projected global energy demand for heating vs. cooling, 1970-2100  
(PJ/year)



Source: IRENA. Key Statistics.



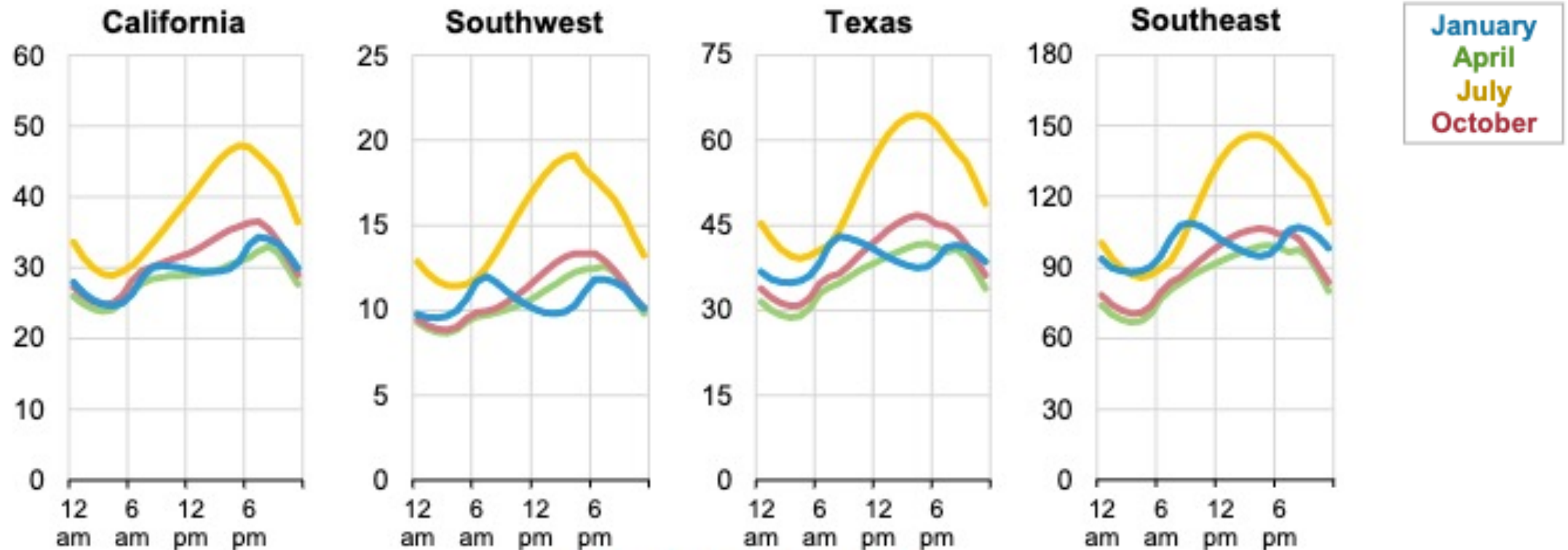
# Cooling-induced Environmental Impacts





# Impact on Power Load Curve

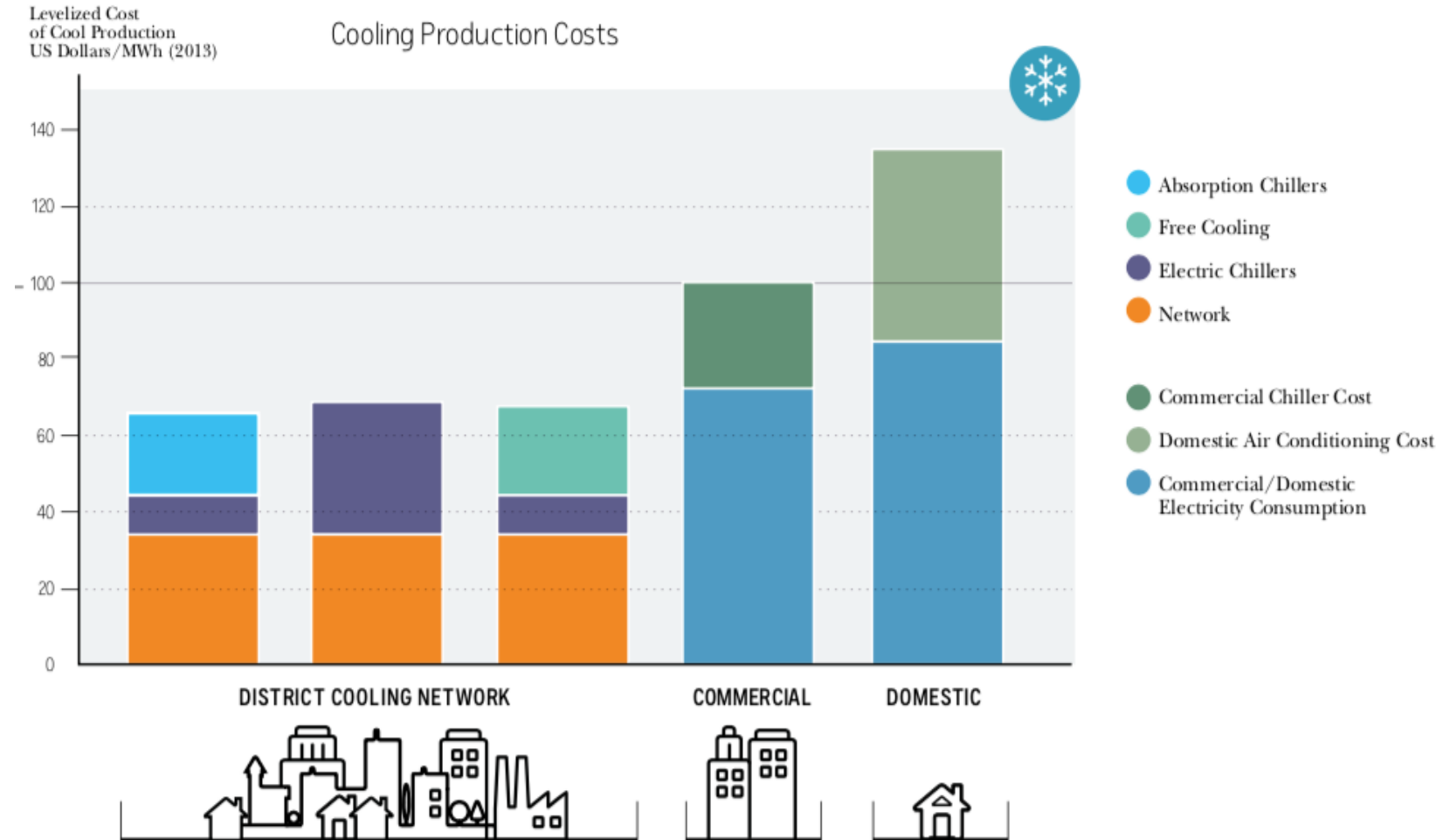
United States Average Hourly Electricity Load on a typical day by region, selected months (GWh)



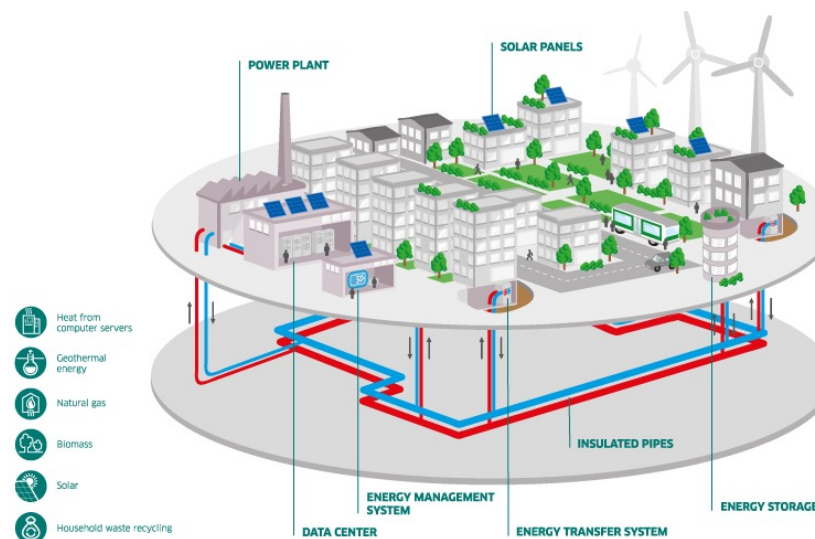
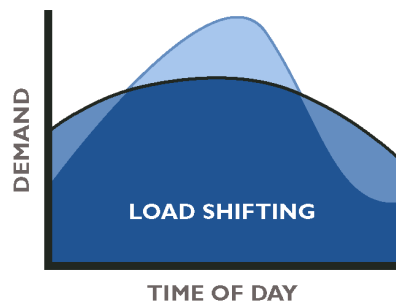
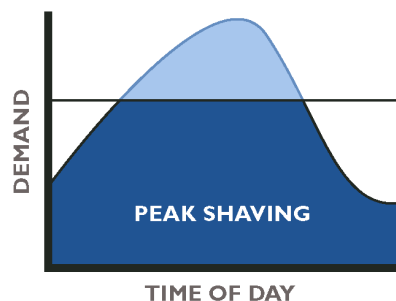
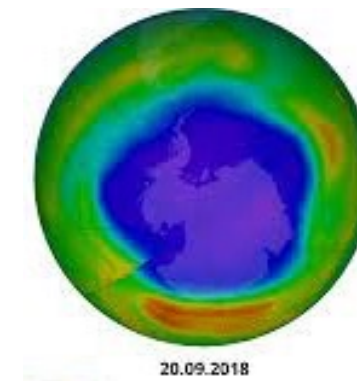
Source: U.S. Energy Information Administration, [U.S. Hourly Electric Grid Monitor](#)

# District vs Decentralized

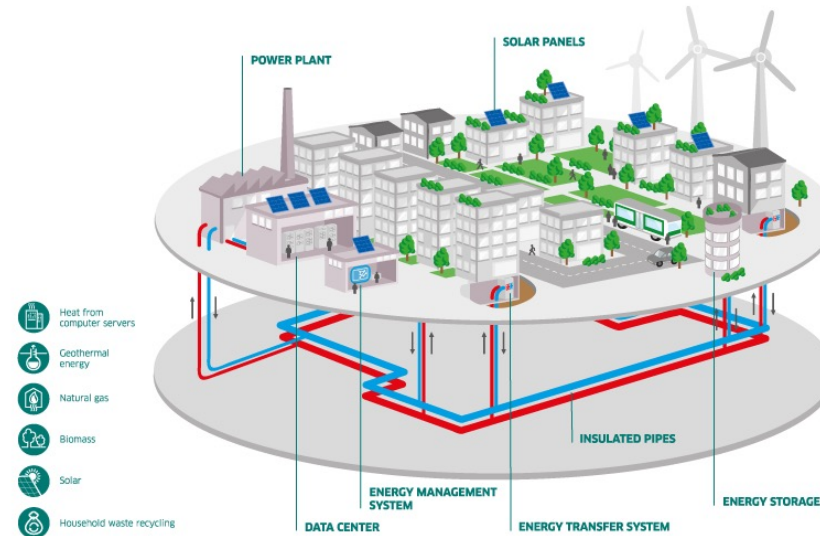
## Levelized Costs of District Cooling vs. Decentralized Production (US\$/MWh, 2013)



# District Cooling have several benefits



# But it requires...

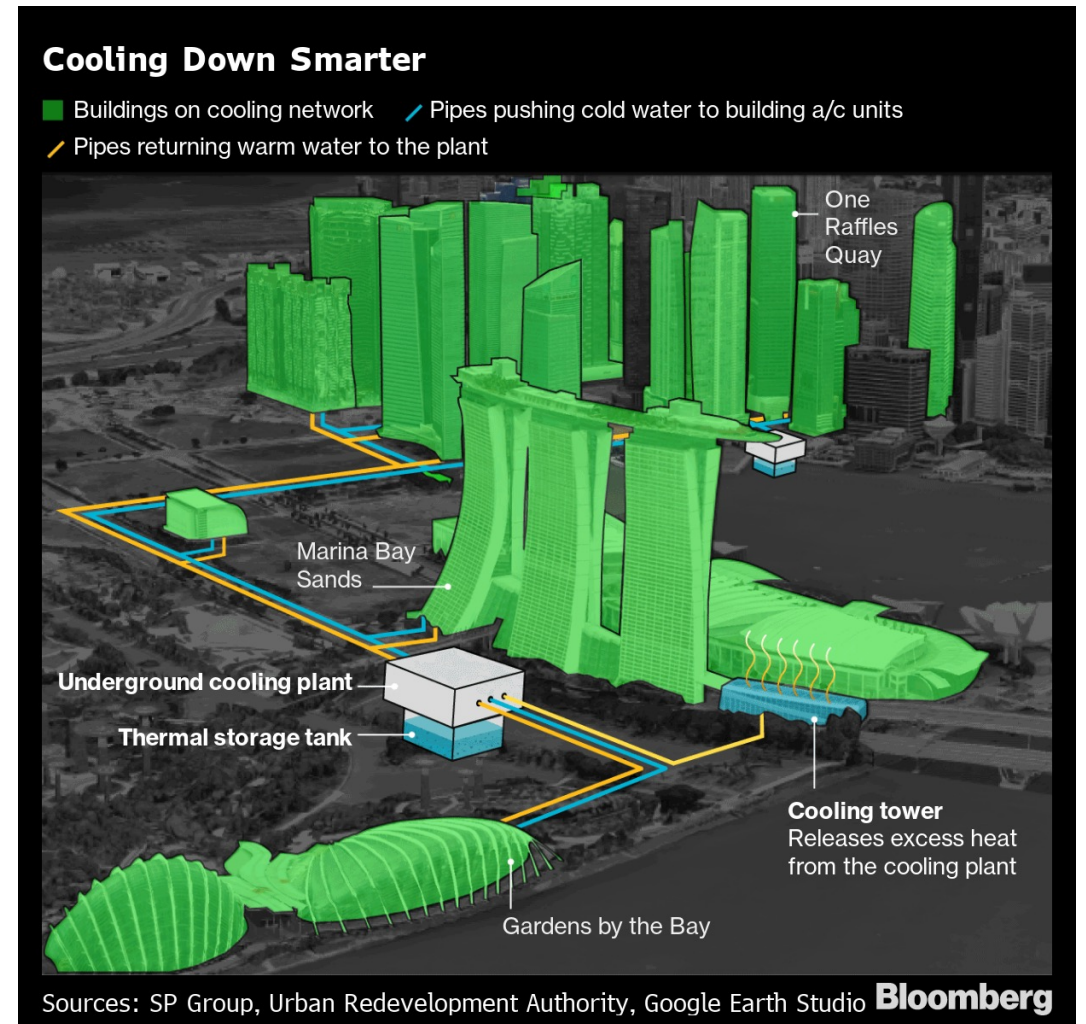




# Uncool or Cool Buildings?



House in Singapore. 2013



Marina Bay District, Singapore



**THANK  
YOU  
FOR  
SAVING  
ENERGY**