2. Energy efficient urban planning

John Dulac

Paris, 21 May 2019

IEA #energyefficientworld

2. Energy efficient urban planning

Trainer(s): John Dulac

Scenario: There is increasing urbanisation and increasing demand for urban services

Question: How can we design a more energy efficient urban system?

Training Overview

1. **Urban planning and design**
   - Role of urban design and energy use
   - What designs allow you to consume energy less?

25 mins

2. **How to get there?**
   - Development and planning concepts

3. **Additional strategies to reduce urban energy use**
   - Policy options for more energy efficient urban design
   - Demand-side management

35 mins

1. Urban planning and design

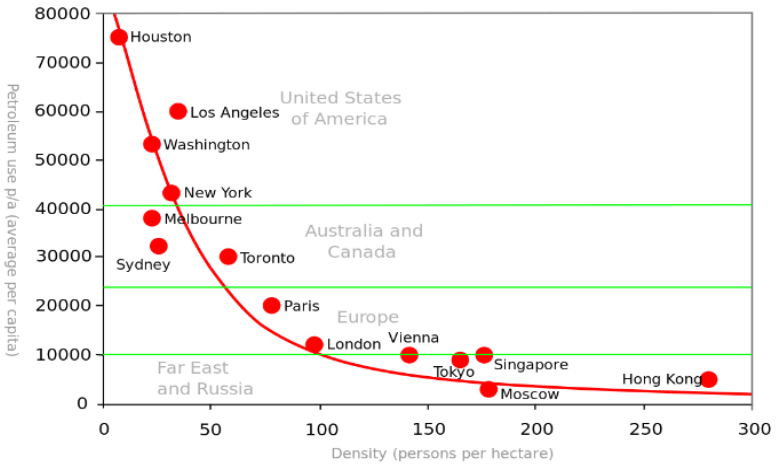
Role of urban planning and design in energy use

Which designs consume energy less?

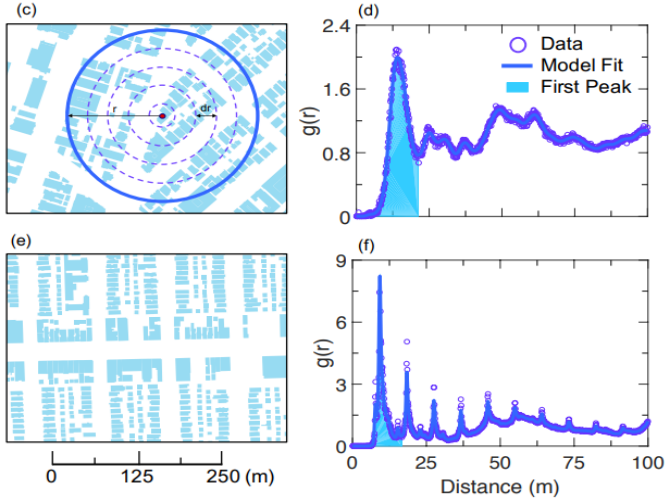
1. Urban planning and design. Role of urban design

- As discussed in Session 1, structural aspects from urban design affect energy use

- **More sprawled cities use more energy than dense ones**



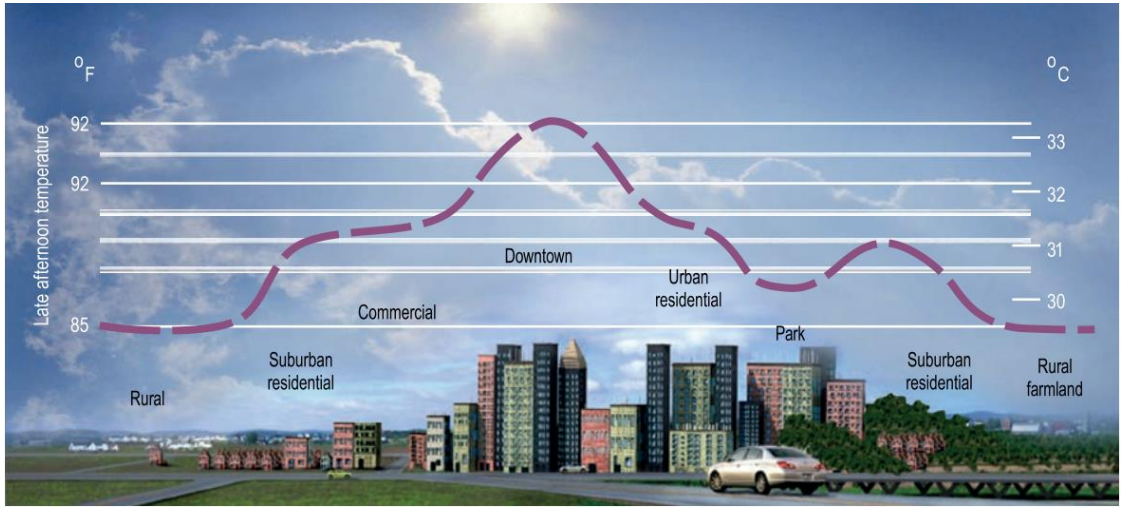
- **The more grid-like, the more it traps heat**



Source http://cshub.mit.edu/sites/default/files/documents/CityTextureUHI_Feb2018.pdf

1. Urban planning and design. Role of urban design

- For example: **Trapped heat** aggravates **urban heat island effect**, increases **air conditioning** use



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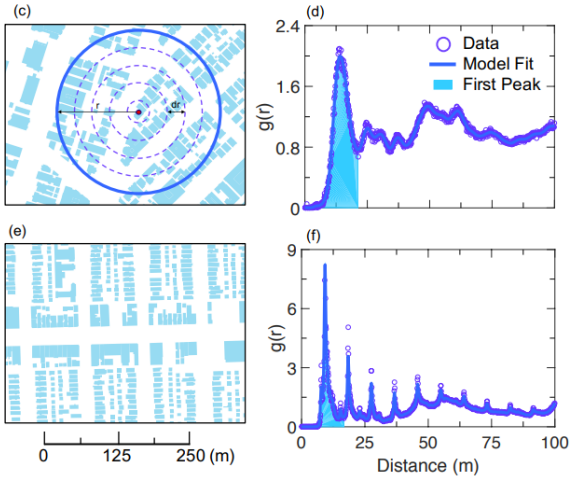


Source
http://cshub.mit.edu/sites/default/files/documents/CityTextureUHI_Feb2018.pdf

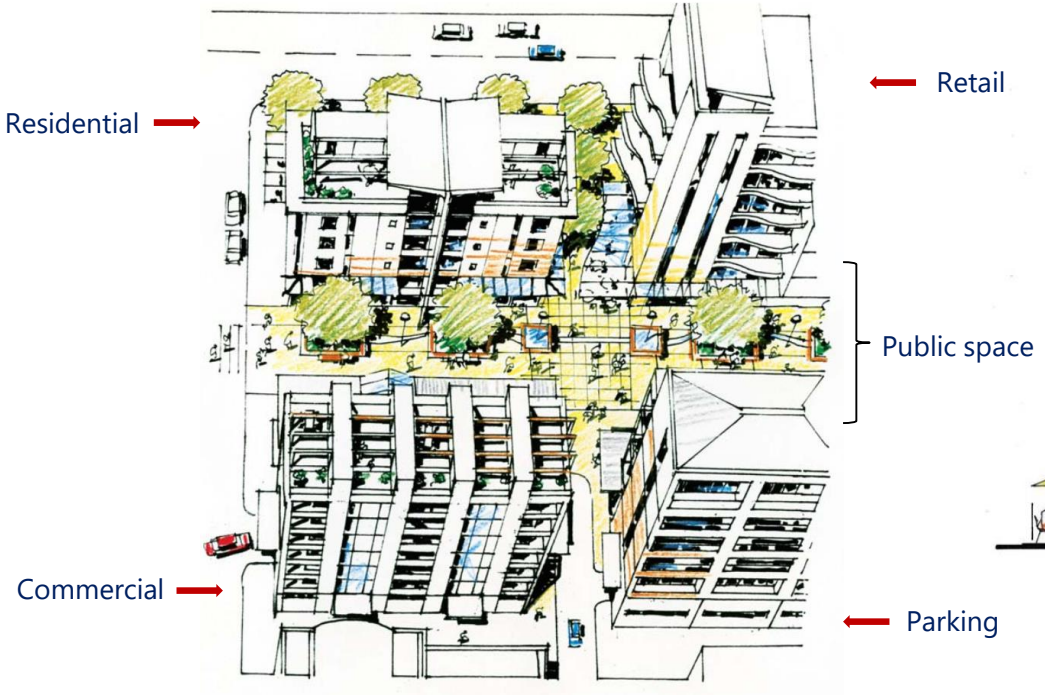
Source: LBNL (2013), Heat Island Group, http://heatisland.lbl.gov/

1. Urban planning and design

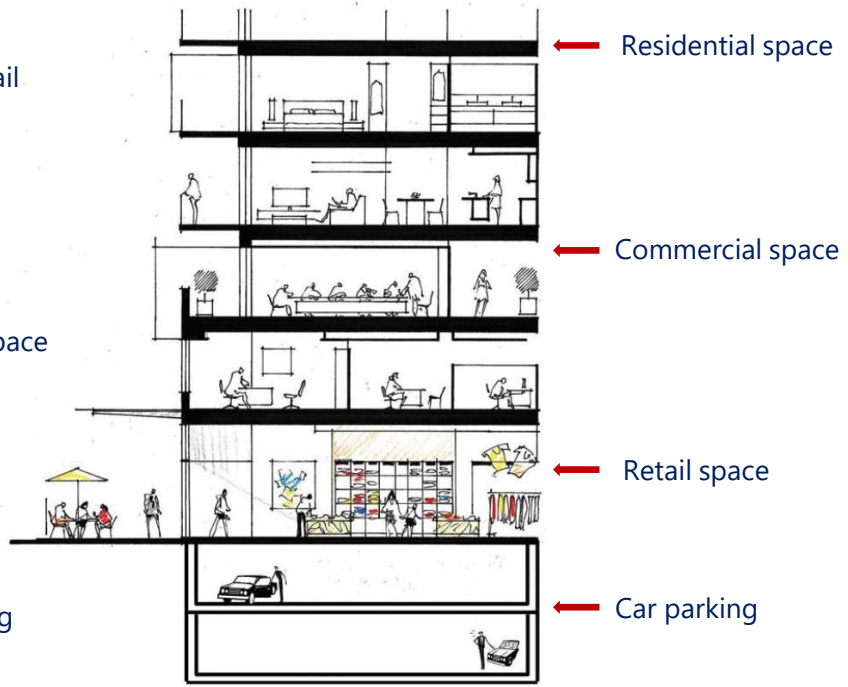
So what designs are better?

1. Urban planning and design. What designs work?

- **Mixed-use design instead of sprawled design**



Horizontal mixed-use



Vertical mixed-use

Source: https://www.cityofadelaide.com.au/assets/documents/ACC-DIGS-mixed-use-development-guide.pdf

1. Urban planning and design. What designs work?

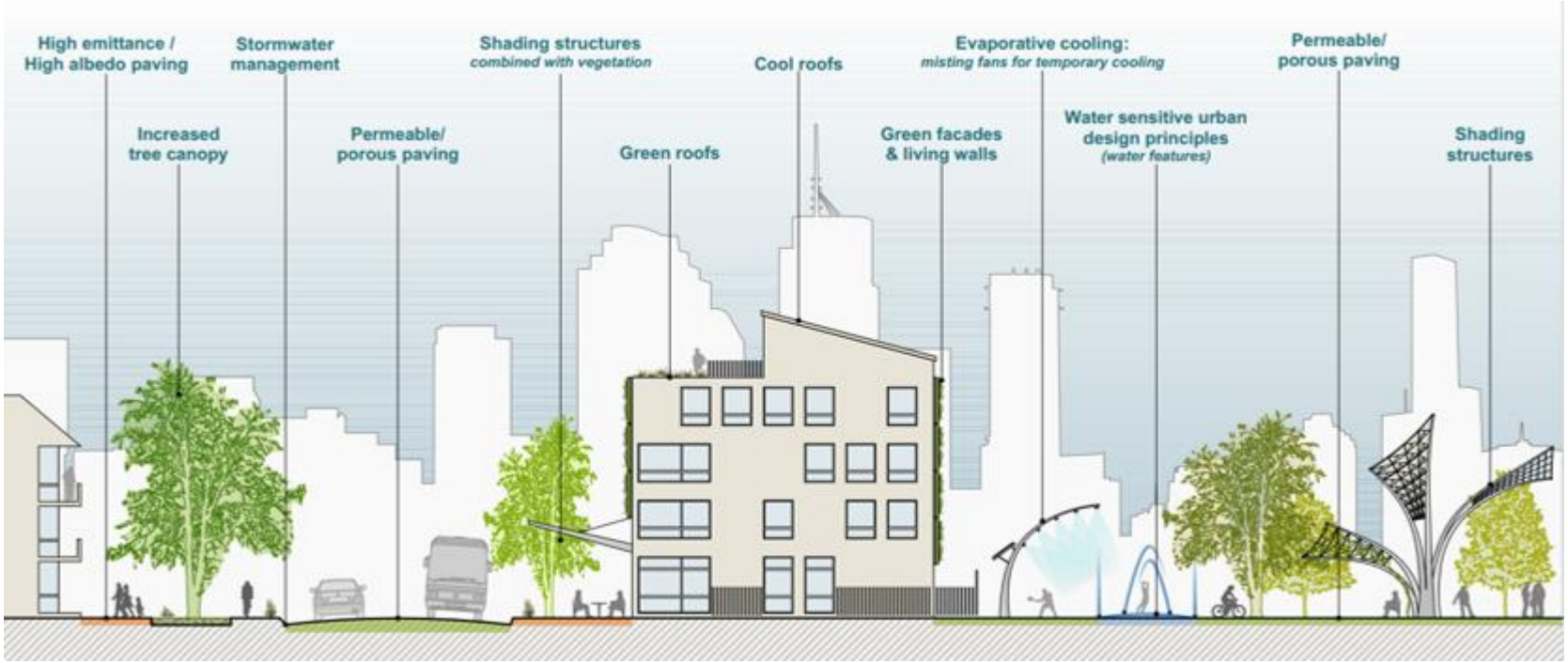
- **Mixed-use design instead of sprawled design**

Horizontal mixed-use development in Auckland, New Zealand

Source: https://www.cityofadelaide.com.au/assets/documents/ACC-DIGS-mixed-use-development-guide.pdf

1. Urban planning and design. What designs work?

- **Natural design (trees, colours, shading, spacing) instead of concrete jungles**



Source: http://www.lowcarbonlivingcrc.com.au/sites/all/files/publications_file_attachments/rp2024_guide_to_urban_cooling_strategies_2017_web.pdf

1. Urban planning and design. What designs work?

- **Natural design (trees, colours, shading, spacing) instead of concrete jungles**

Vertical greenery and green roofs in Singapore

Permeable and reflective block pavers for cool surfaces

White reflective coating for cool roofs in New York, USA

Sources: http://www.lowcarbonlivingcrc.com.au/sites/all/files/publications_file_attachments/rp2024_guide_to_urban_cooling_strategies_2017_web.pdf ; http://www.lowcarbonlivingcrc.com.au/sites/all/files/publications_file_attachments/rp2024_guide_to_urban_cooling_strategies_2017_web.pdf

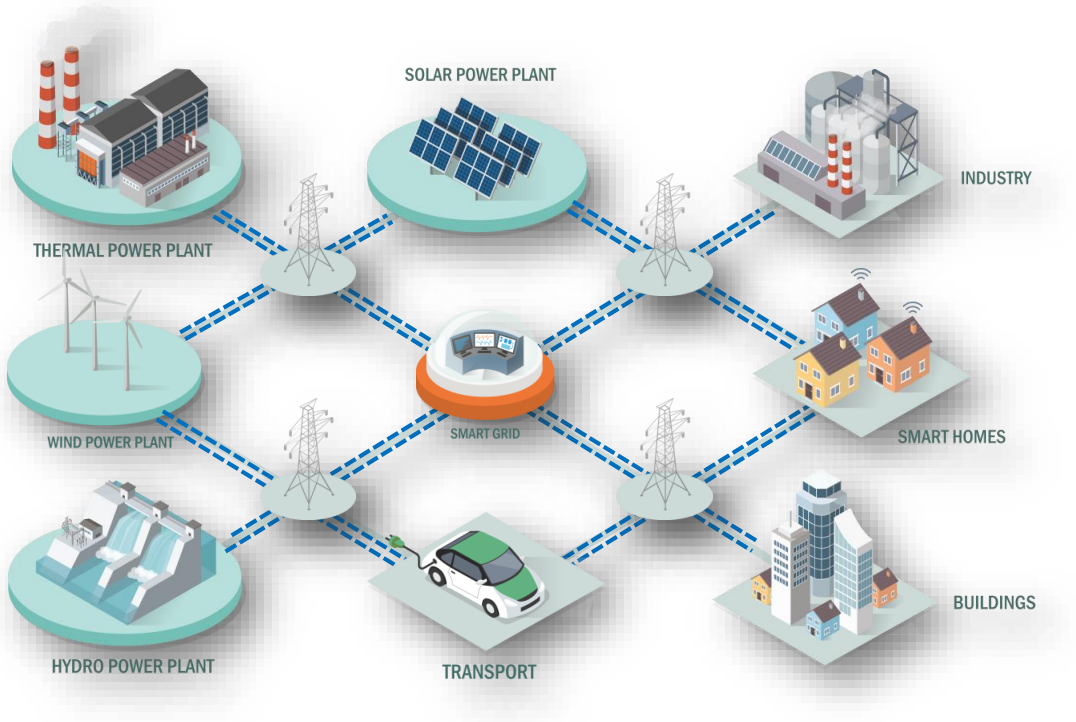
1. Urban planning and design. What designs work?

- **Case study: Amsterdam**

Sources: https://www.ryerson.ca/content/dam/cue/pdfs/White%20Paper%20-%20Urban%20and%20Energy%20Planning.pdf ; https://www.c40.org/profiles/2014-amsterdam ; https://interestingengineering.com/11-most-eco-friendly-cities-of-the-world

1. **Urban planning and design.** What designs work?

- What does an energy efficient energy system look like?



 Source: IEA Digitalisation and Energy Efficiency Presentation 2019

2. How to get there?

Development and planning concepts

Additional strategies to reduce urban energy use

2. How to get there?

Land use planning

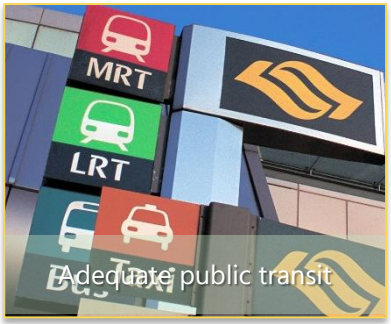
Mixed-use development

Transit-Oriented Development

Integrated Urban Energy Planning

Land-use planning > reserving areas for public transit

Promoting walkable cities with **non-motorised options** and **increased public transport** use



Land-use: Sustainable Streets

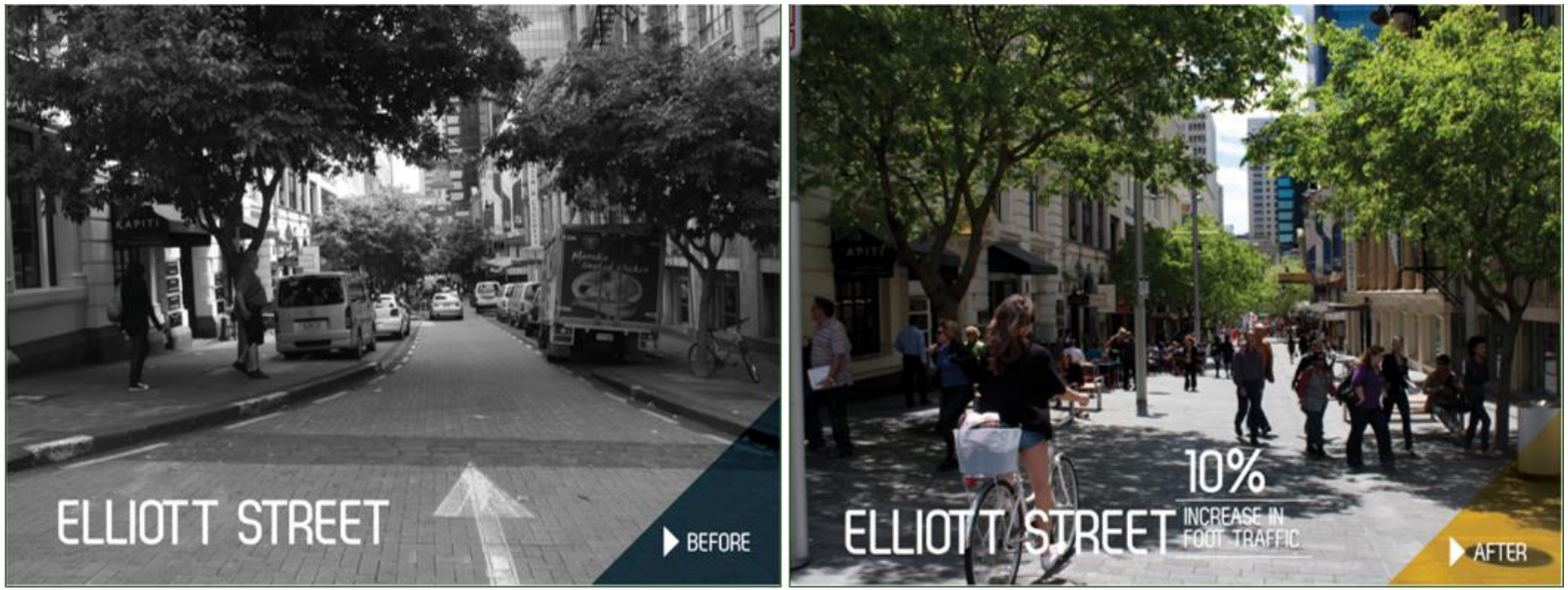
Where to start? | Tools | What are the steps?

Sustainable streets on Times Square

Source: http://www.earthpowernews.com/humans-make-comeback-battle-cars/

Land-use: Sustainable Streets

Shared Streets Program in Auckland, New Zealand



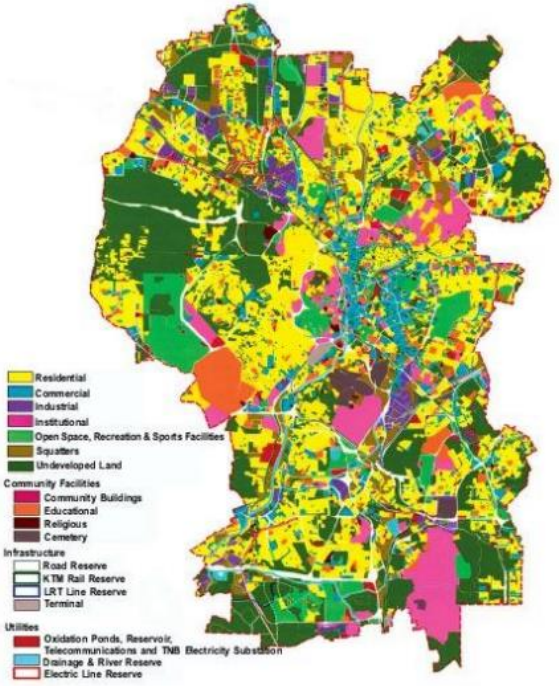
Source: https://www.vienncouver.com/2015/01/aucklands-city-centre-shared-space-programme/

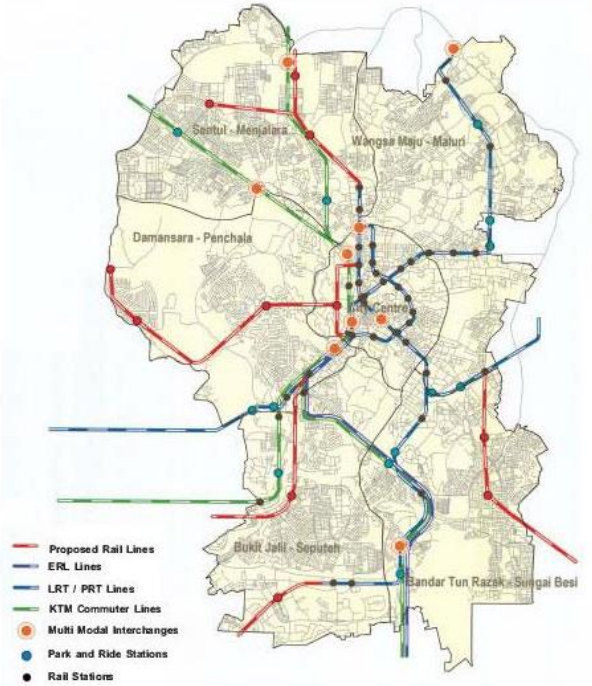
Land-use: Sustainable Streets (encouraging public transport)

Dublinbikes located close to residential homes and alternative public transport

Land-use > Mixed-use > Transit-Oriented Development

Where to start? | Tools | What are the steps?





Kuala Lumpur embraces Transit-Oriented Development in its 2020 City Plan. Mixed-use planning to be done around stations to promote public transport.

Land-use > Mixed-use > Transit-Oriented Development

Kuala Lumpur embraces Transit-Oriented Development in its 2020 City Plan. Mixed-use planning to be done around stations to promote public transport.

Land-use > Mixed-use > Transit-Oriented Development

- 2008/2009: massive traffic jams in KL, currently 30% public transport 70% private-> goal set is 60% public to 40% private,
- **Park and ride schemes:** 30% developer discount on zones near train stations if they build parking areas to encourage Park and Ride
- **Direct planning requirements:** Zones must be placed between 200m to 400m of the train stations (similar to Singapore model)
- **Direct development guidelines:** Residential zones to build homes at 800 sq. ft. (~75sq. m), at USD 112 600
- More Transit-Oriented-Development Focus for Bandar: although recently there has been **no successful bids** so far

Transit-oriented development: the context of cities

- Travel demand management programmes

- Improved travel-managed technologies

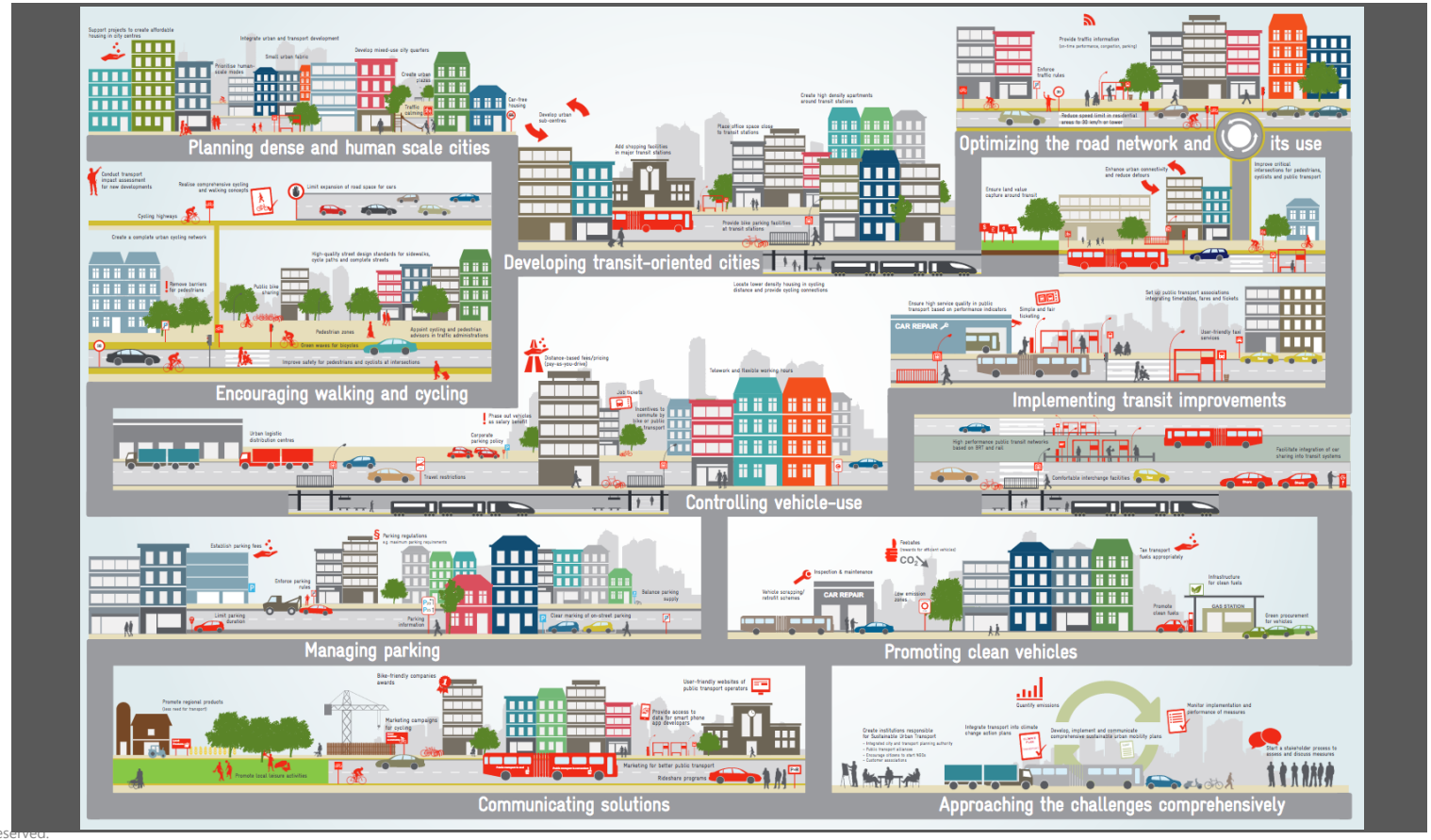
City contexts within the urban land-use and travel framework

- Discouraging private motorised travel

- Dedicated facilities for bus/cycling lanes

Specific opportunities for cities

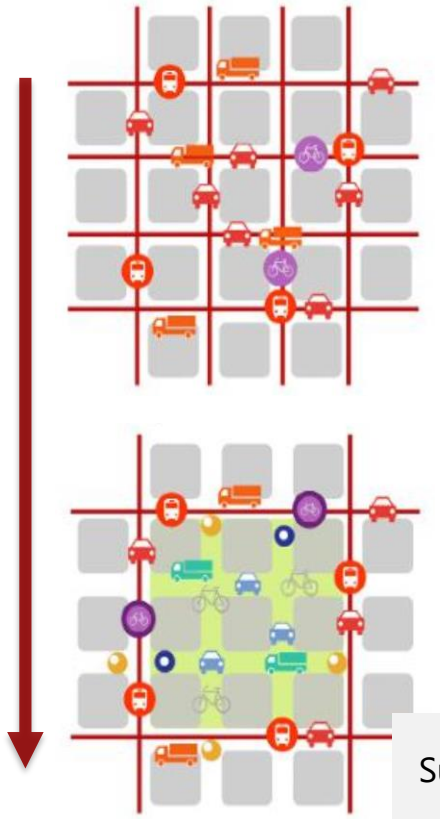
Where to start? | Tools | What are the steps?



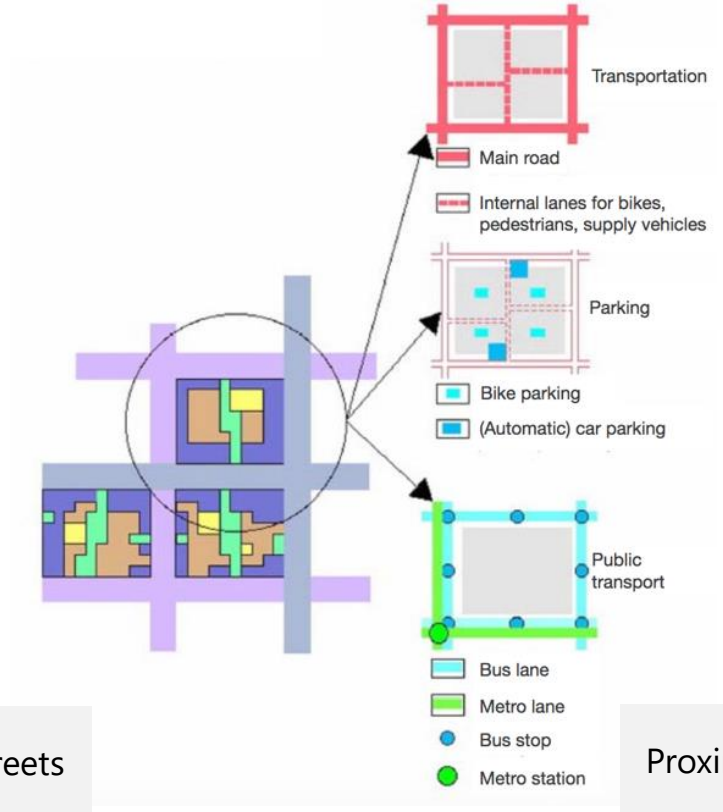
Source: https://www.sutp.org/files/contents/documents/resources/J_Others/10_principles_english.pdf

Sustainable streets & access and proximity to transit

Where to start? | Tools | What are the steps?



Sustainable Streets



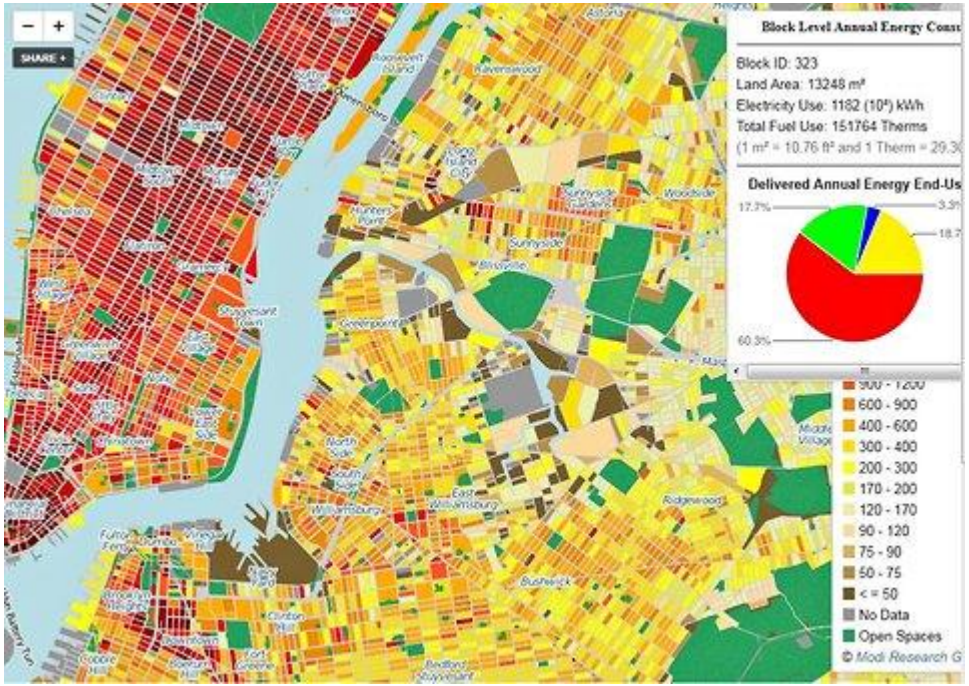
Proximity to Transit

Source: http://www.uncrd.or.jp/content/documents/711420190924_EST_LUT_Final(1).pdf

Integrated urban design and planning

Mapping of energy intense areas if cities for more informed planning

Map of energy balance in municipalities through an E-City platform



Spatial distribution of urban building energy consumption by end use using GIS

 Sources: file:///C:/Users/Mbazima_N/Downloads/energies-11-01857%20(4).pdf ; https://green.blogs.nytimes.com/2012/01/31/is-your-building-gobbling-energy/

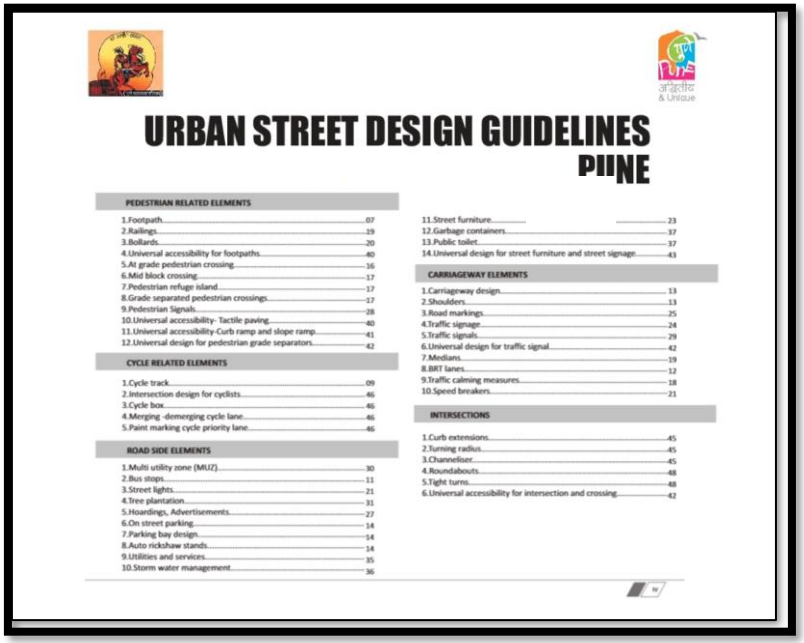
Get smart: travel demand management

- Improved ICT connections for virtual mobility, e.g. teleworking

Additional strategies to reduce urban energy use

Policy options for more energy efficient urban design

- Mixed-use development and sustainable streets
  - Zoning **by-laws** and **development regulations**
  - Urban planning and street design **guidelines**
  - Street **codes** to favour walking and cycling



URBAN STREET DESIGN GUIDELINES

PUNE

PEDESTRIAN RELATED ELEMENTS

CYCLE RELATED ELEMENTS

ROAD SIDE ELEMENTS

CARRIAGEWAY ELEMENTS

INTERSECTIONS

Policy options for more energy efficient urban design

- Sustainable transport
  - Travel demand management
  - Development **standards** to address transp
  - **Subsidies/tax incentives** for low-carbon
  - Freight logistics

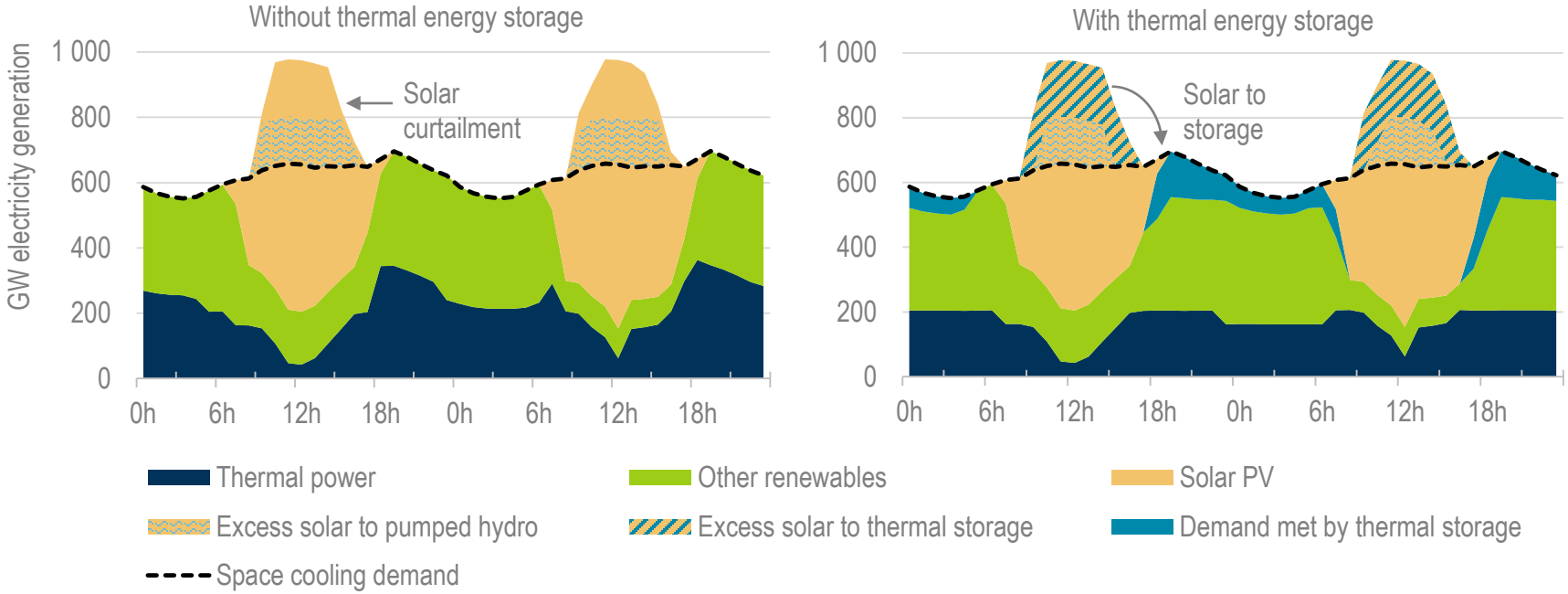
Policy options for more energy efficient urban design

- Improved ICT
  - **Mobility management** & marketing (e.g. IT-based communications)

- **Information tools** to raise awareness of real travel costs

Demand-side management: what is the potential?

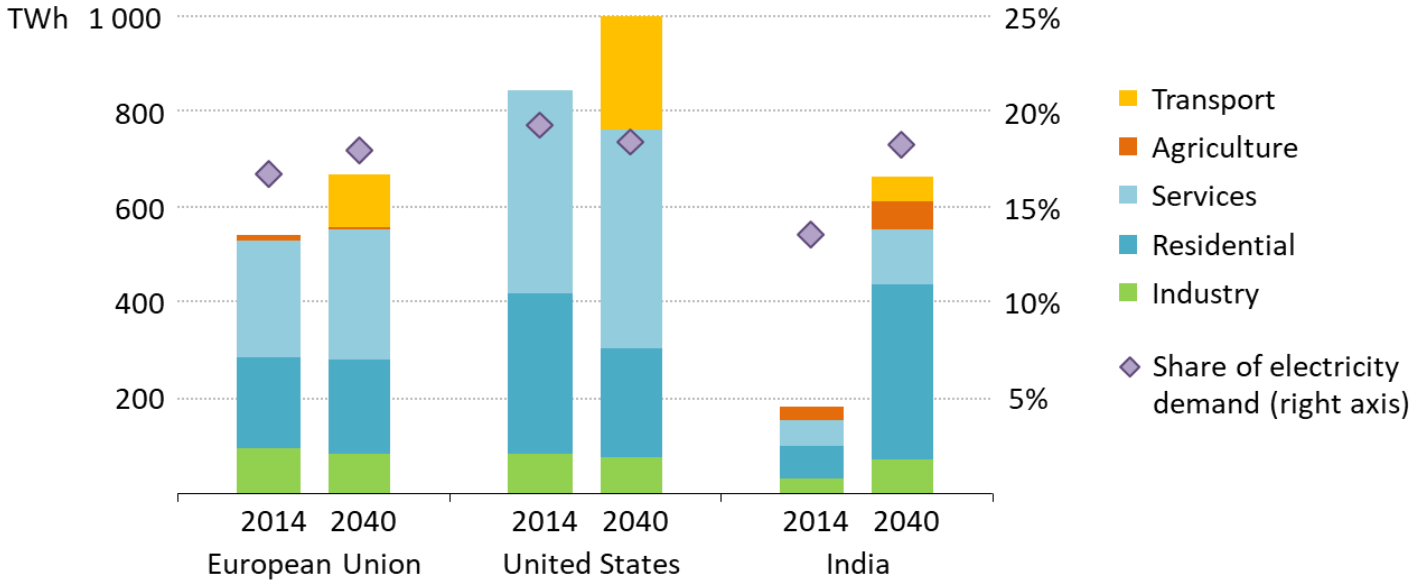
The potential role of storage and renewables in India



Thermal storage – for example using a district cooling network – could take advantage of solar output to meet cooling energy demand and alleviate peak strain on the power system

Demand-side management: what is the potential?

Technical potential of demand-side response by region in the 2 °C scenario

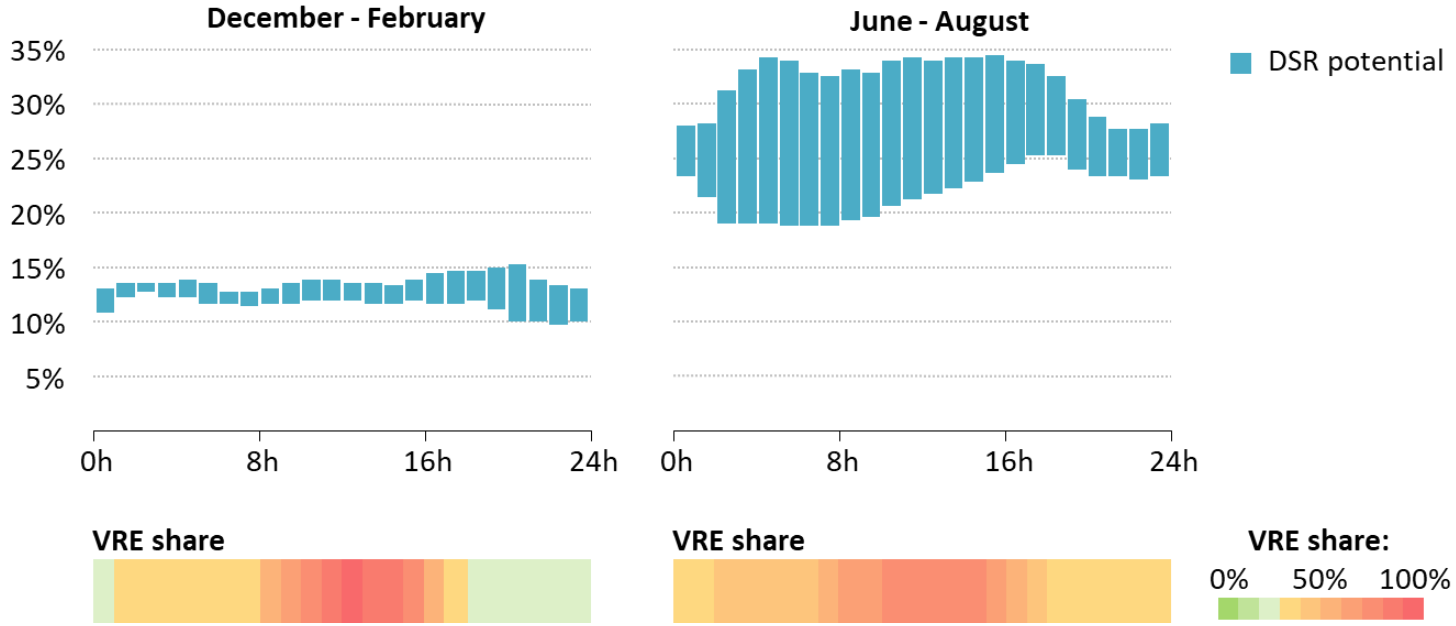


The technical potential for demand-side response is up to 20% of demand, with electric vehicles set to play a larger role through 2040

Source: WEO 2016 Renewable Energy Webinar

Demand-side management: what is the potential?

Share of load that can be shifted for typical days in two seasonal periods in India in the 2°C scenario, 2040

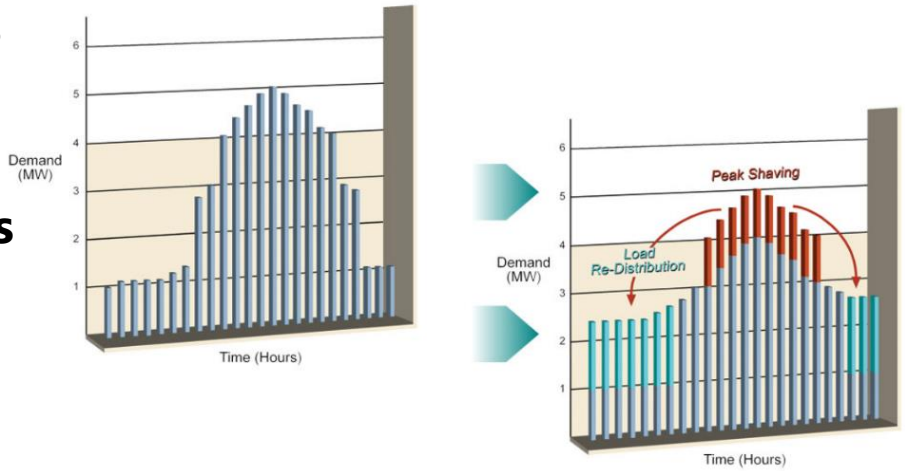


Almost a third of electricity demand in India could be shifted in summer, while highest VRE share are observed in winter

Source: WEO 2016 Renewable Energy Webinar

Demand-side management programmes

- Utilities can implement demand-side management programmes:
  - Strong **institutional capacities**
  - Sufficient **technical/admin capabilities**
  - Sufficient **implementation capacity**
  - Thorough **understanding of customers**
  - **Incentivised** to manage peak load, electricity demand



Demand-side management programmes

Demand side management opportunities:

Demand Response	**Rate-induced** demand response
	Incentive-based demand response
End use energy efficiency	**Incentives** to customers/manufacturers to purchase/provide energy efficient products
Distributed generation close to consumption	E.g. roof mounted solar PV systems

Source: https://openknowledge.worldbank.org/bitstream/handle/10986/26316/113214-WP-P147807-Utility-Scale-Opportunities-PUBLIC.pdf?sequence=1&isAllowed=y

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