Auroville Green Practices

Vision Workshop
Auroville, 7-9 September 2011

REGENERATIVE TOWNSHIPS OF TOMORROW

Session on ENERGY

Town Hall Conference Room

09h00-12h30

Workshop objectives

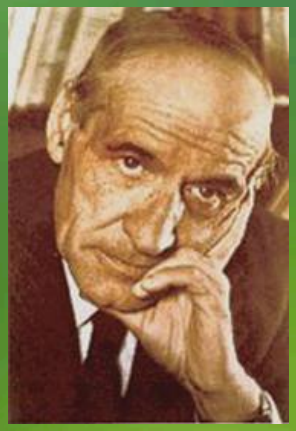
- Address 2 key questions
  - What characterizes a regenerative township?
  - How can we move towards regenerative townships from where we are now?

Dictionary definition of "REGENERATIVE":

1. **Renewal or restoration of a body, bodily part, or biological system (as a forest) after injury or as a normal process**
2. **Spiritual renewal or revival**

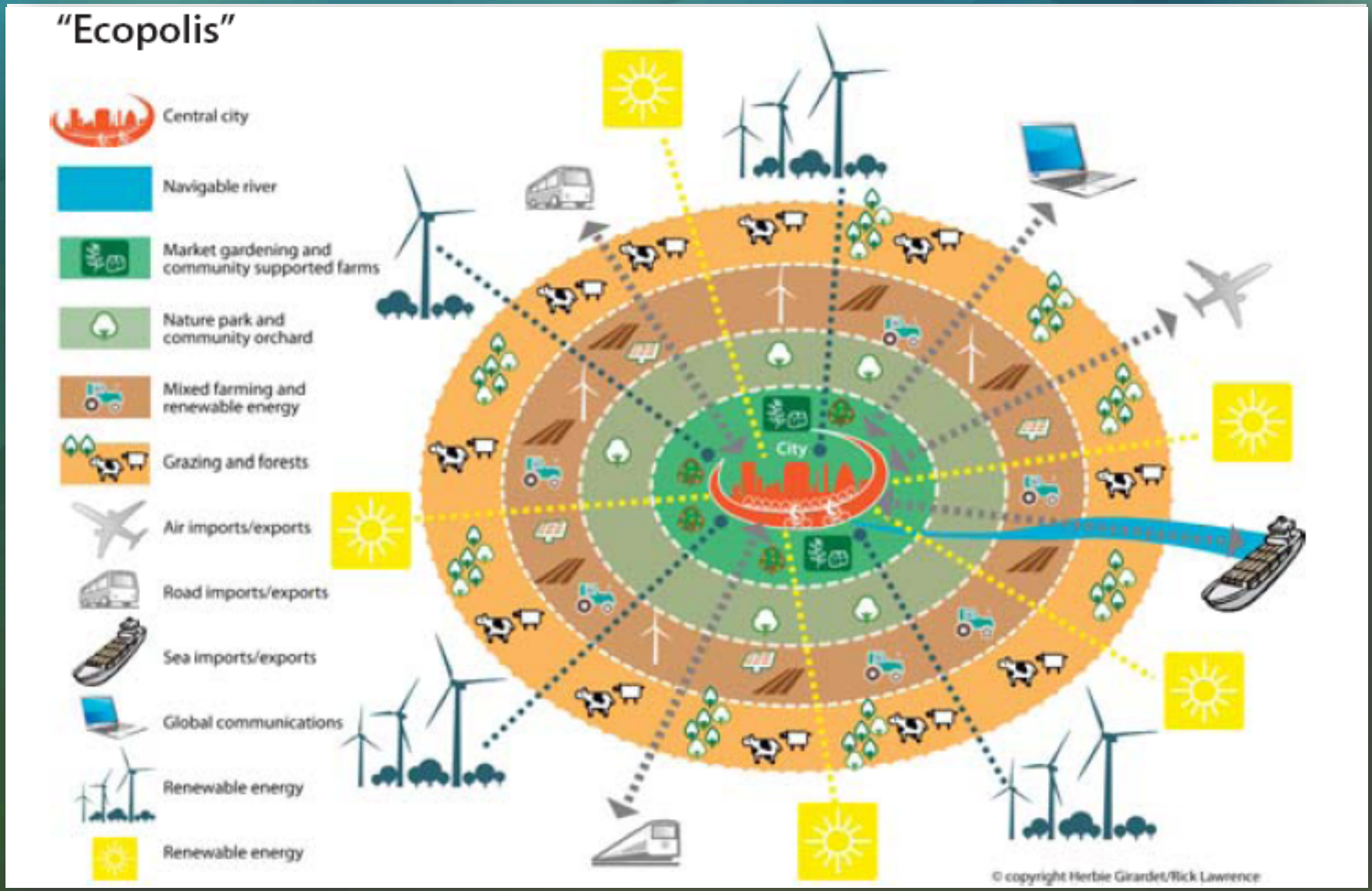
Why regenerative township?

"I am I plus my surroundings
and if I do not preserve the latter,
I do not preserve myself."



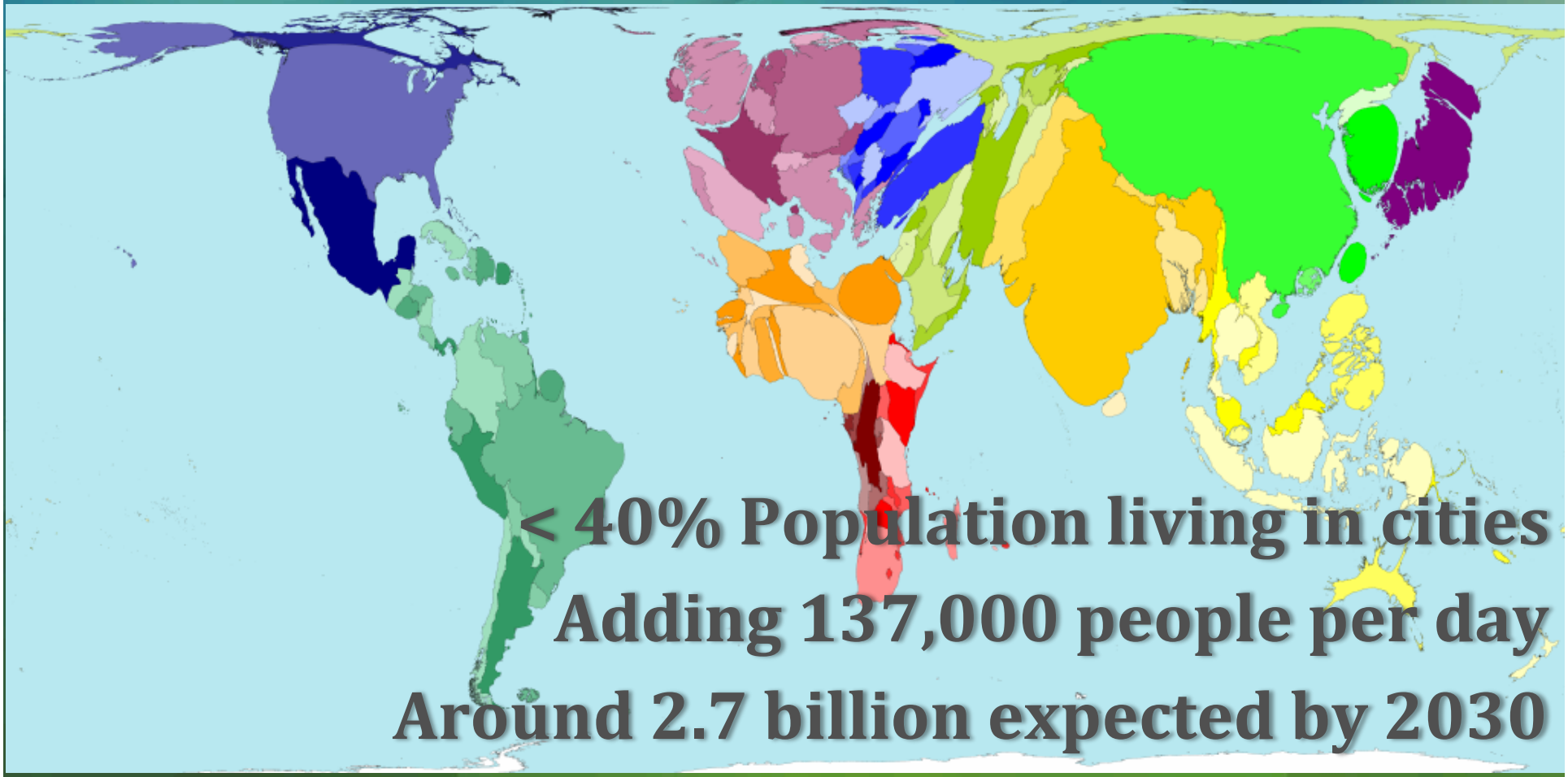
Jose Ortega Y Gassez
Spanish Philosopher

Creating regenerative cities



Source: Herbert Girardet, Regenerative cities

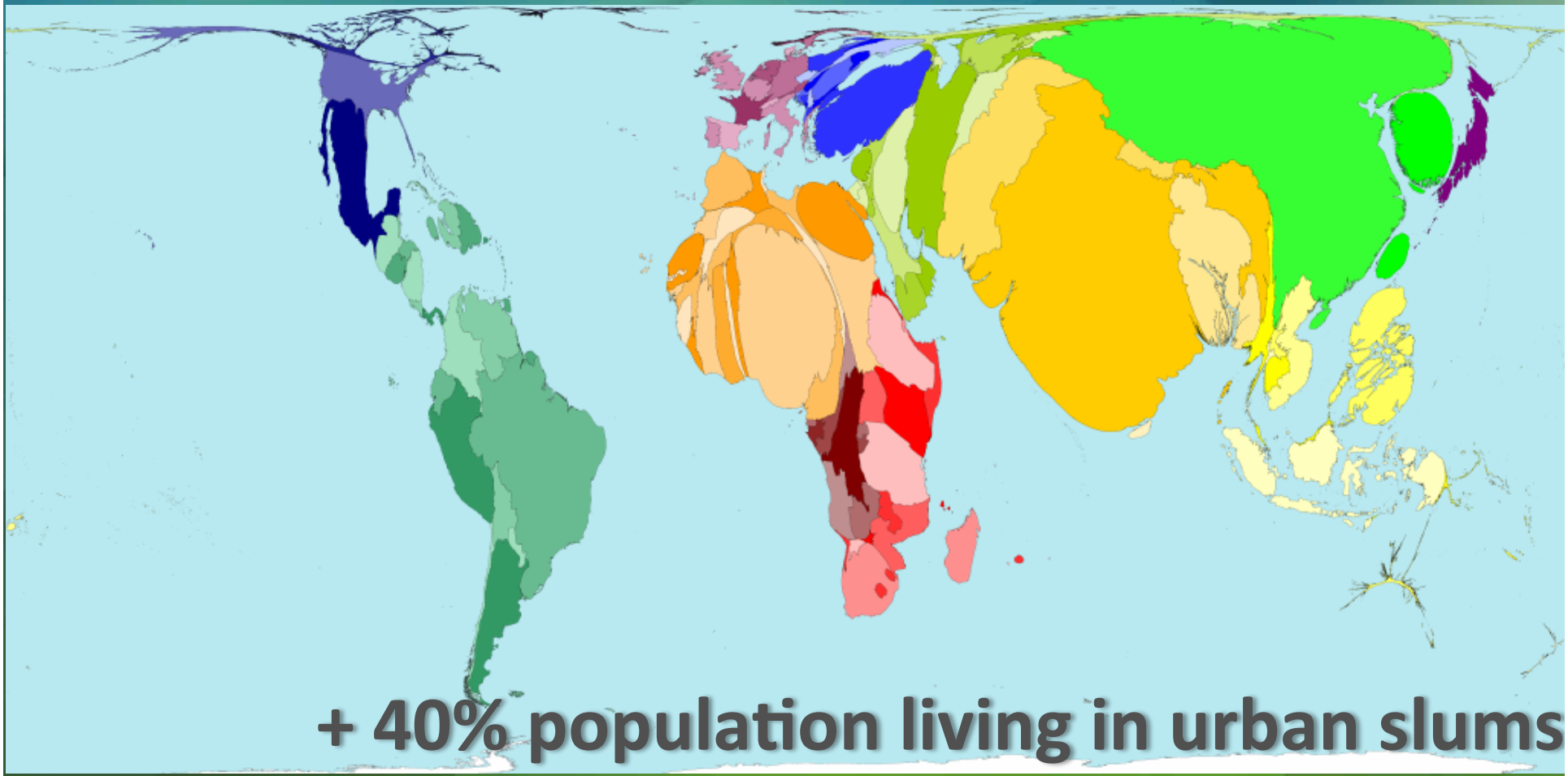
Rapidly urbanizing Asia



Twin forces of industrialization and globalization have accelerated urbanization in Asia at a faster rate than it happened in the western world.

Source: http://www.worldmapper.org/index.html

Inequitable growth in Asia



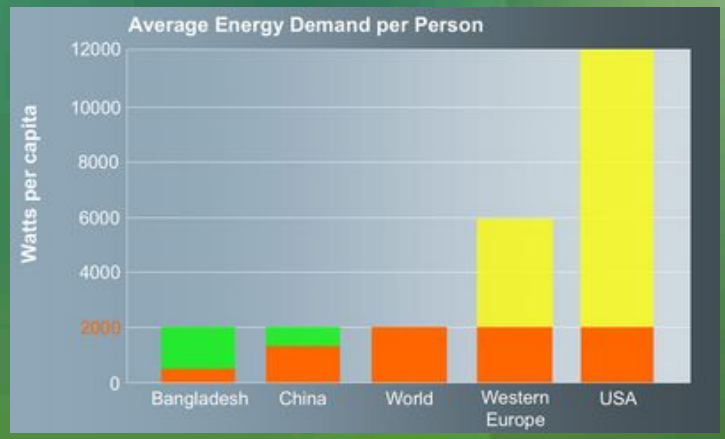
Rich hiding behind the poor:

The urban population accounts for 87% of India's electricity.

More than 30% of the urban population in South-Asia do not have electricity.

Limits to growth

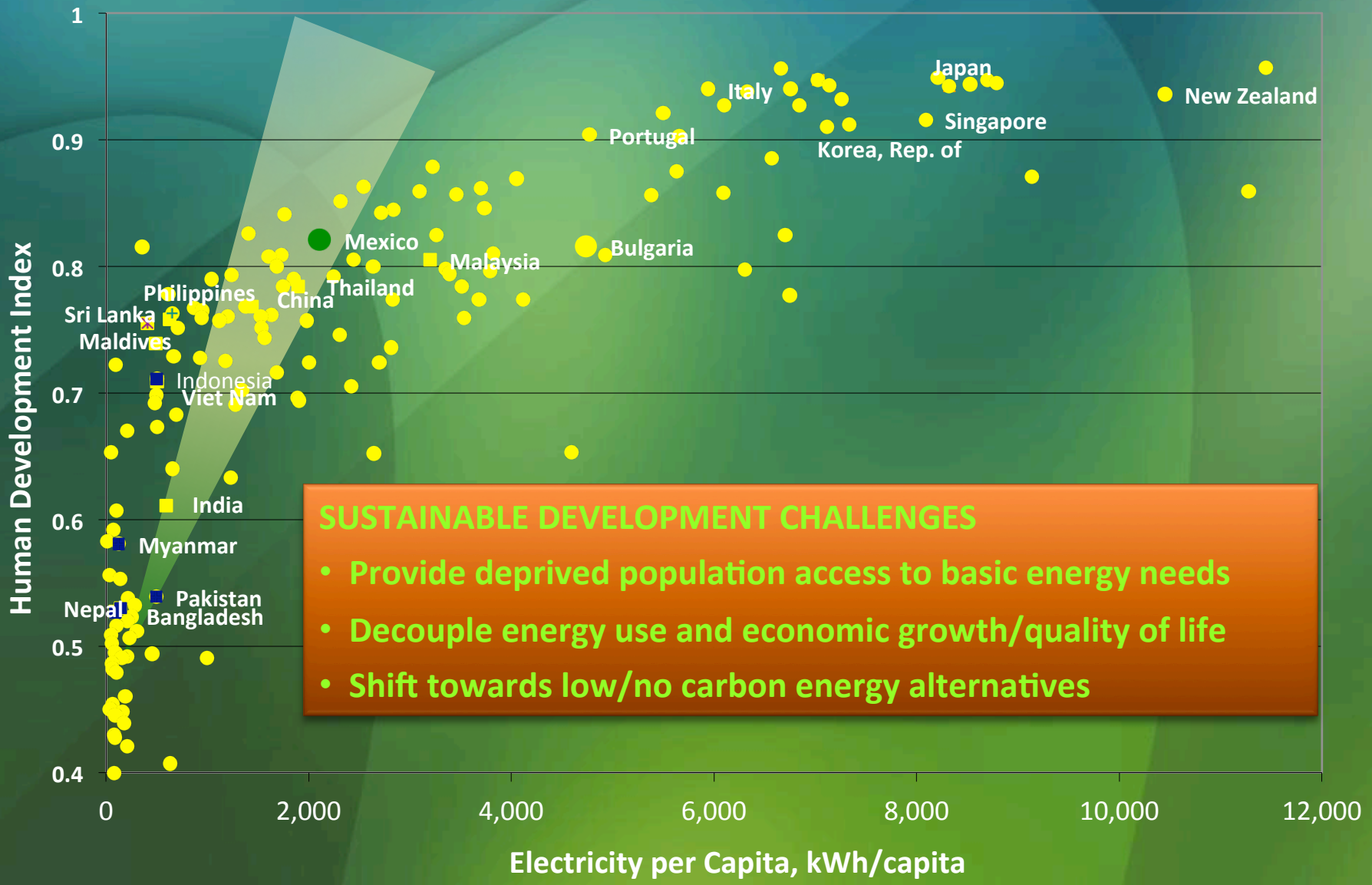
- **Carrying capacity and ecological footprint**
  - Each nation should consume less than 1.8 hectare per capita of the ecological footprint available, while being granted an HDI of 0.8 or better (example: Cuba)
  - To live like Cubans, we need to decrease our numbers by 1 billion!
- **Energy consumption and dependence on fossil fuels**
  - Current world energy consumption is around 420 EJ/year (≈13 TW; 2 kW per person)



- **When there is very little fossil fuel left**
  - Alternative energies available may add up to 1 kW per person

The longer we continue in our current exponential growth pattern, the more painful the subsequent adjustment will be.

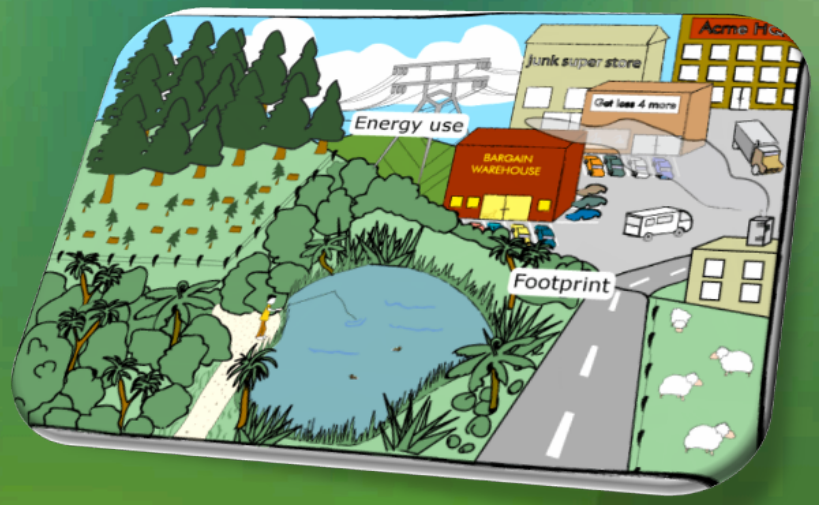
Challenges for Asian cities



Energy is all pervasive in cities

All essentials of modern-day urban living depend on energy:

- Housing, industry, transportation, water supply, waste management, and running of commercial or social enterprises



- **Energy services form the backbone for growing urban centres**

How can cities with linear metabolism transform

Resources from the hinterland

Production and services

Distribution

Usage

Waste Generation

Waste Disposed off in the hinterland

… into cities with circular metabolism

Resources

Production & Services

Distribution

Usage

Recover & Recycle

Tapping resources & closing the loop within the city

Demand for less resources from the hinterland

Less waste dumped in the hinterland

Energy sustainability challenges

Sufficiency

+

Conservation & Efficiency

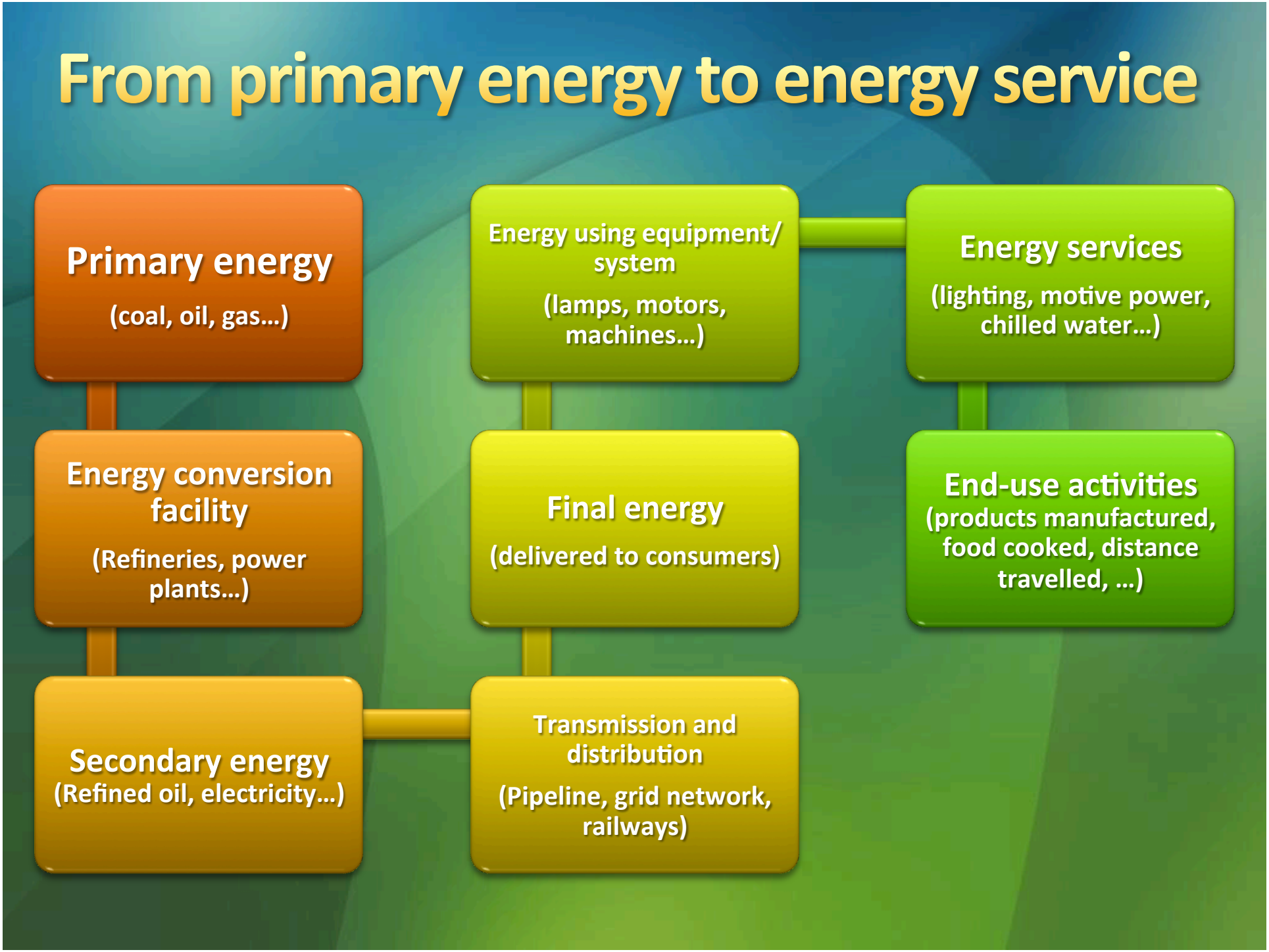
+

Renewables + Advanced Tech.

→ Energy Sustainability

How can we build SMART CITIES that are high on energy sustainability?

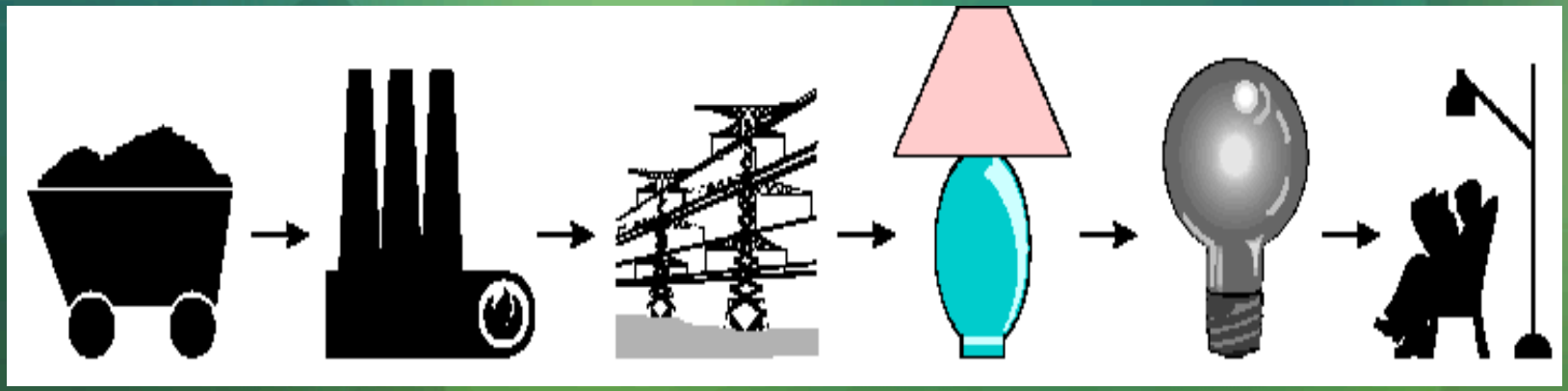
From primary energy to energy service



Infrastructure for energy service

The example of lighting

Lighting consumes about 19% of the world electricity production (Source: IEA)

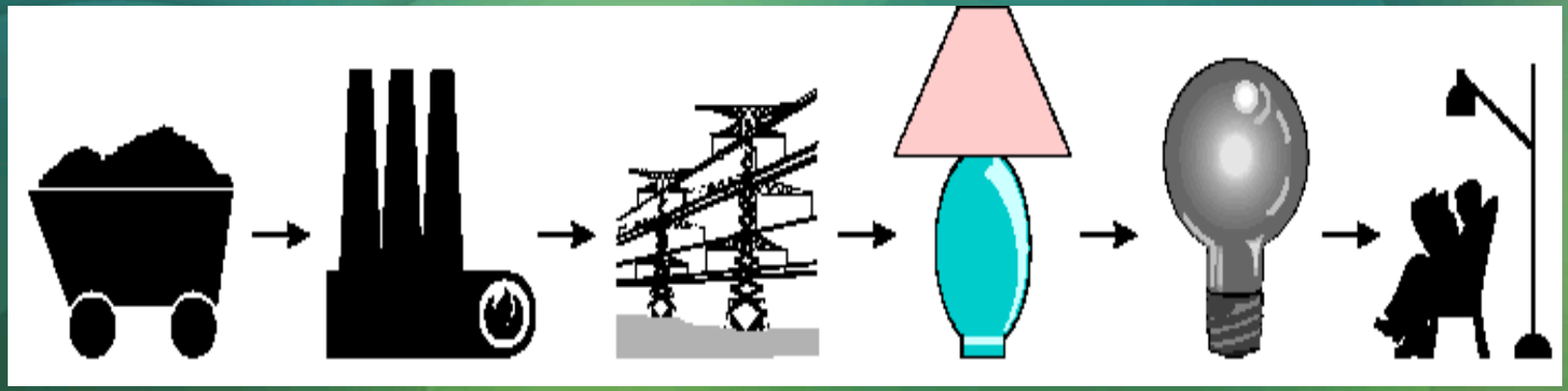


Coal → Power Plant → Transmission Grid → Lamp → Radiant Energy → Illumination

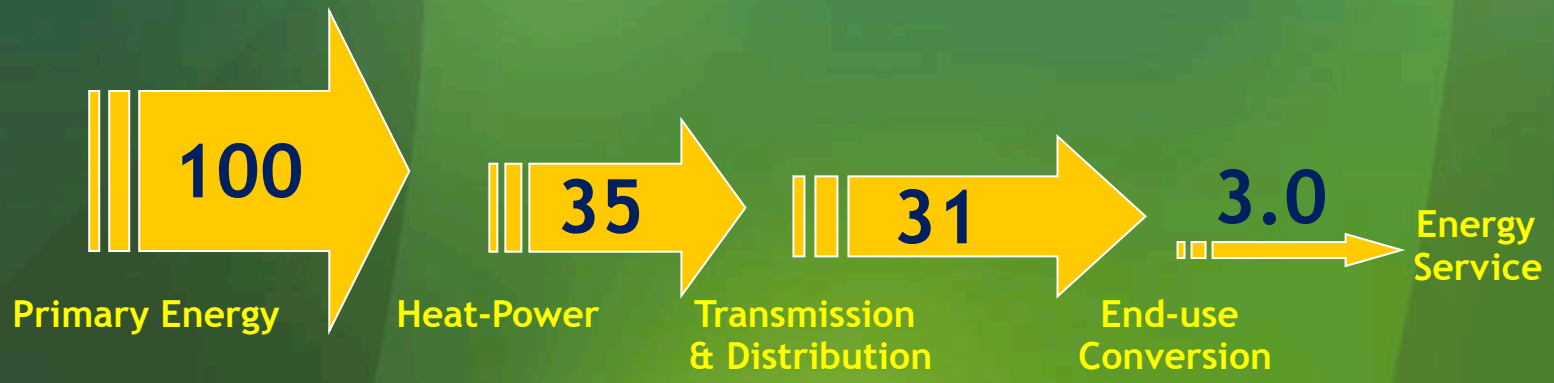
Thermal power plant conversion efficiency	35%
Transmission and distribution losses	12%
Incandescent lamp conversion efficiency	10%

Grossly inefficient energy infrastructure

From energy supply to lighting service

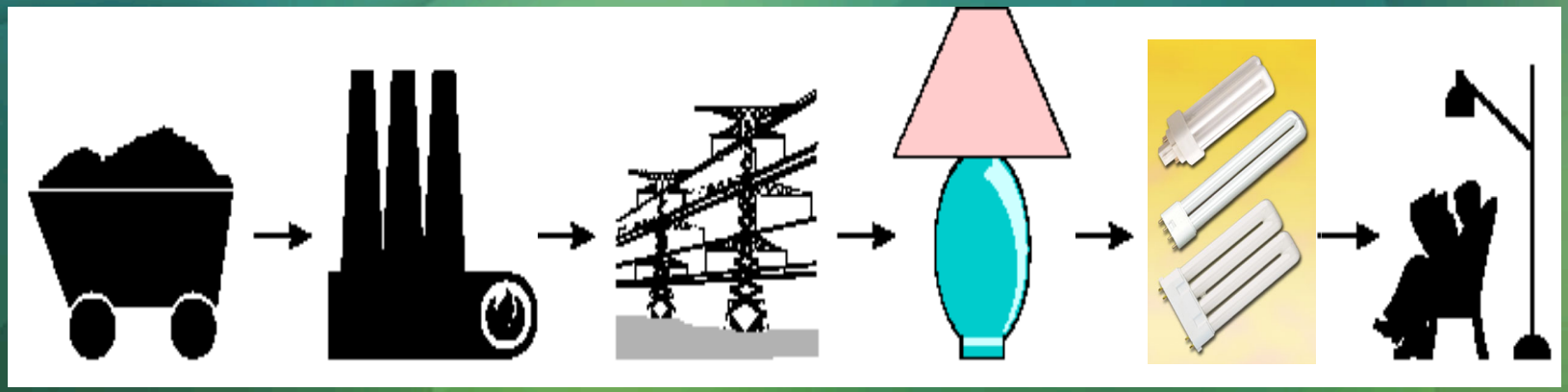


Coal | Power Plant | Transmission Grid | Lamp | Radiant Energy | Illumination

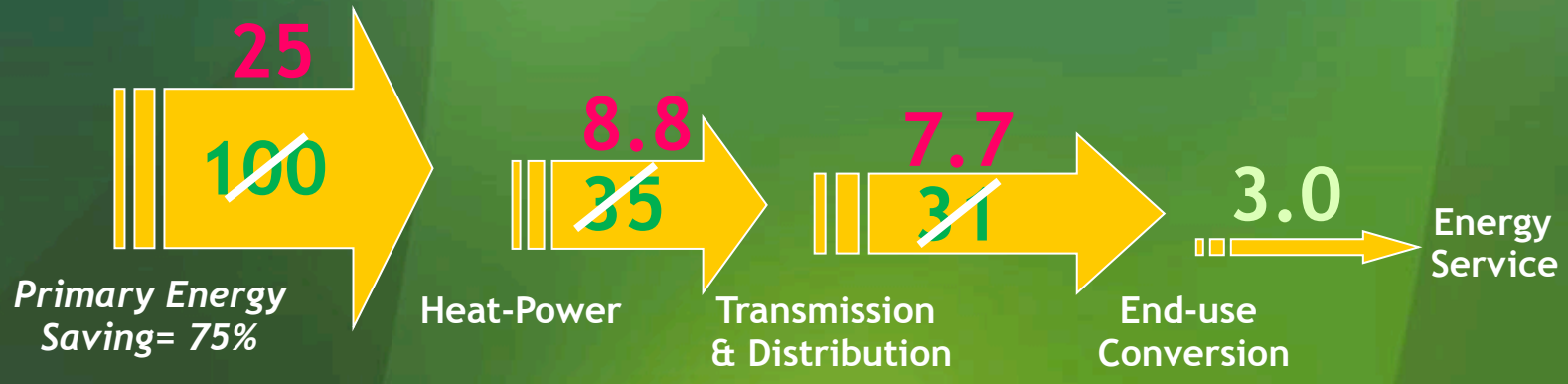


Small local action for large global benefit

Doing more with less: Achieving Factor-Four Objectives



Coal Power Plant Transmission Grid Lamp Radiant Energy Illumination



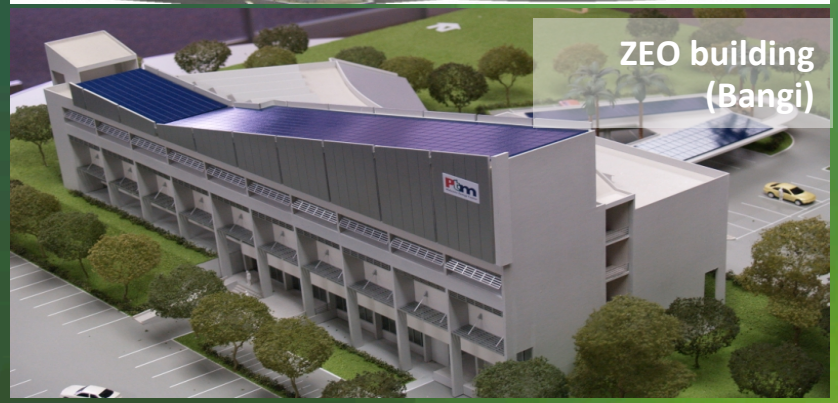
Green energy infrastructure

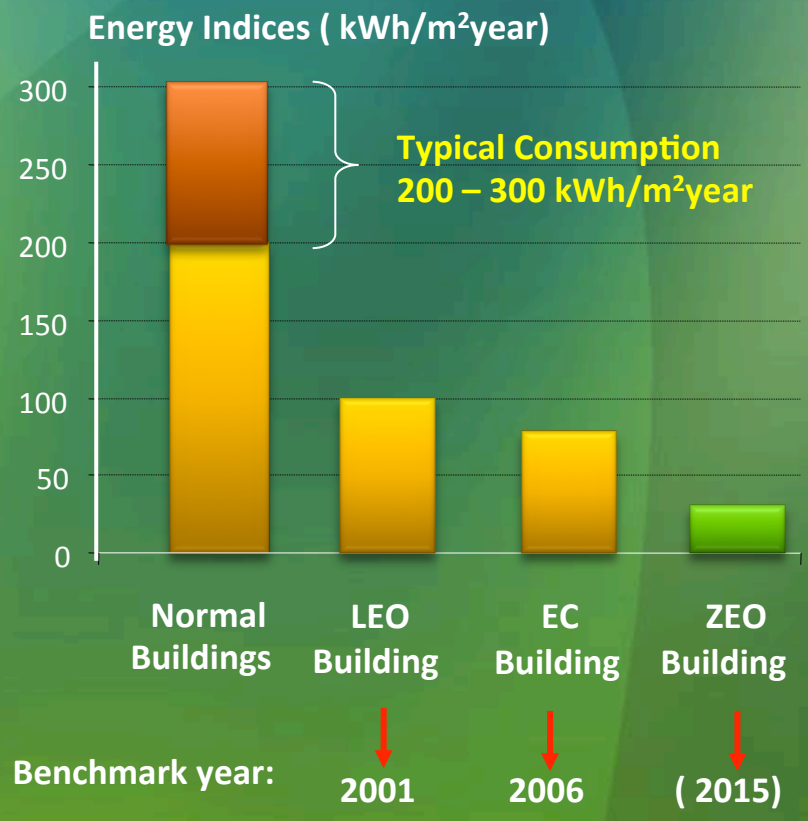
- **End user (demand-side)**
  - Investment to avoid the demand for a kW: ***< 4,000 Rs***
- **Power utility (supply-side)**
  - Investment to increase generation capacity by a kW: ***40,000 Rs***

- **CFL Production Facility (Virtual power plant)**
  - Production: 3 million CFL per year
  - Avoided demand: 1,350 MW (during 10 years production)
  - Investment: ***0.75-1.0 billion Rs***
  - **Operating cost: ???**

- **Fossil-fuel based thermal power plant**
  - Production: 1,350 MW
  - Investment: ***60 billion Rs***
  - **Operating cost: ???** (mainly fuel cost)

Factor-IV for the building sector

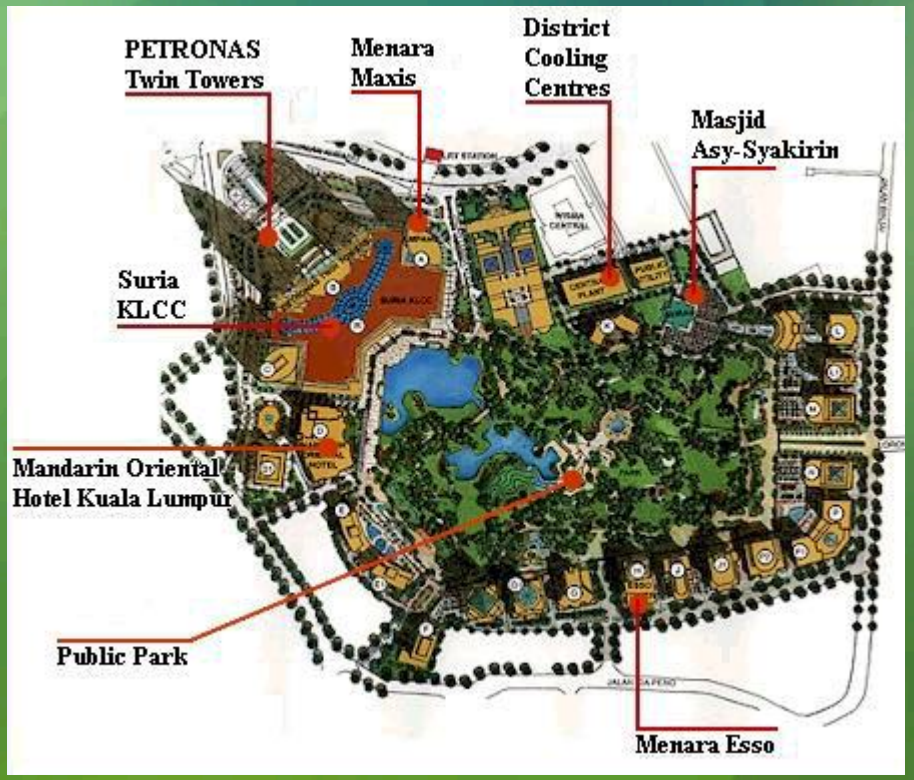




Malaysia: Progressive energy efficiency improvement of office buildings

Transition from Factor-IV to Factor-VIII

- **Further options to close the loop**
  - ***Integrated strategic energy management***
  - ***Cogeneration***



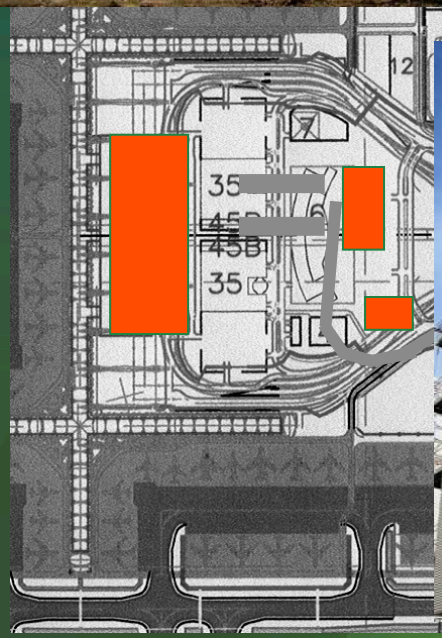
Cogeneration and district cooling for over 600 000 m^2 of floor space in the KLCC North West Development area.

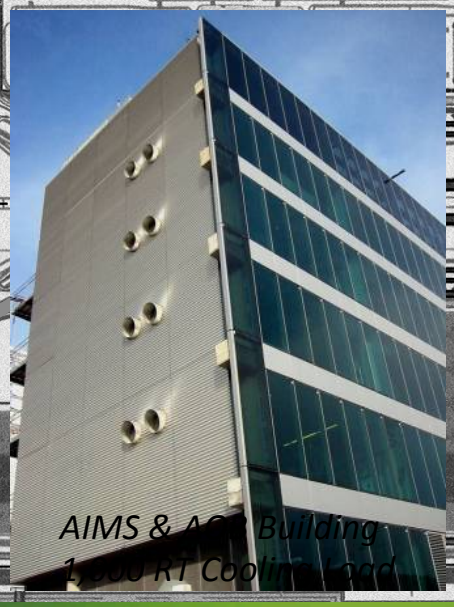
Transition from Factor-VIII to Factor-X

- **Trigeneration**

Suwarnabhumi Airport Hotel
500 RT Cooling Load, 0.5 Ton/h Steam

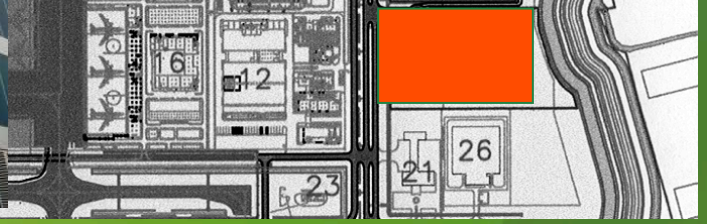
Airport Terminal and Concourse
50 MW of Electricity and 12,500 RT Cooling Load





AIMS & ACI Building
1,000 RT Cooling Load

TG Catering Building
2,500 RT Cooling Load, 5 Ton/h Steam



Achieving Factor-X objectives

Buildings

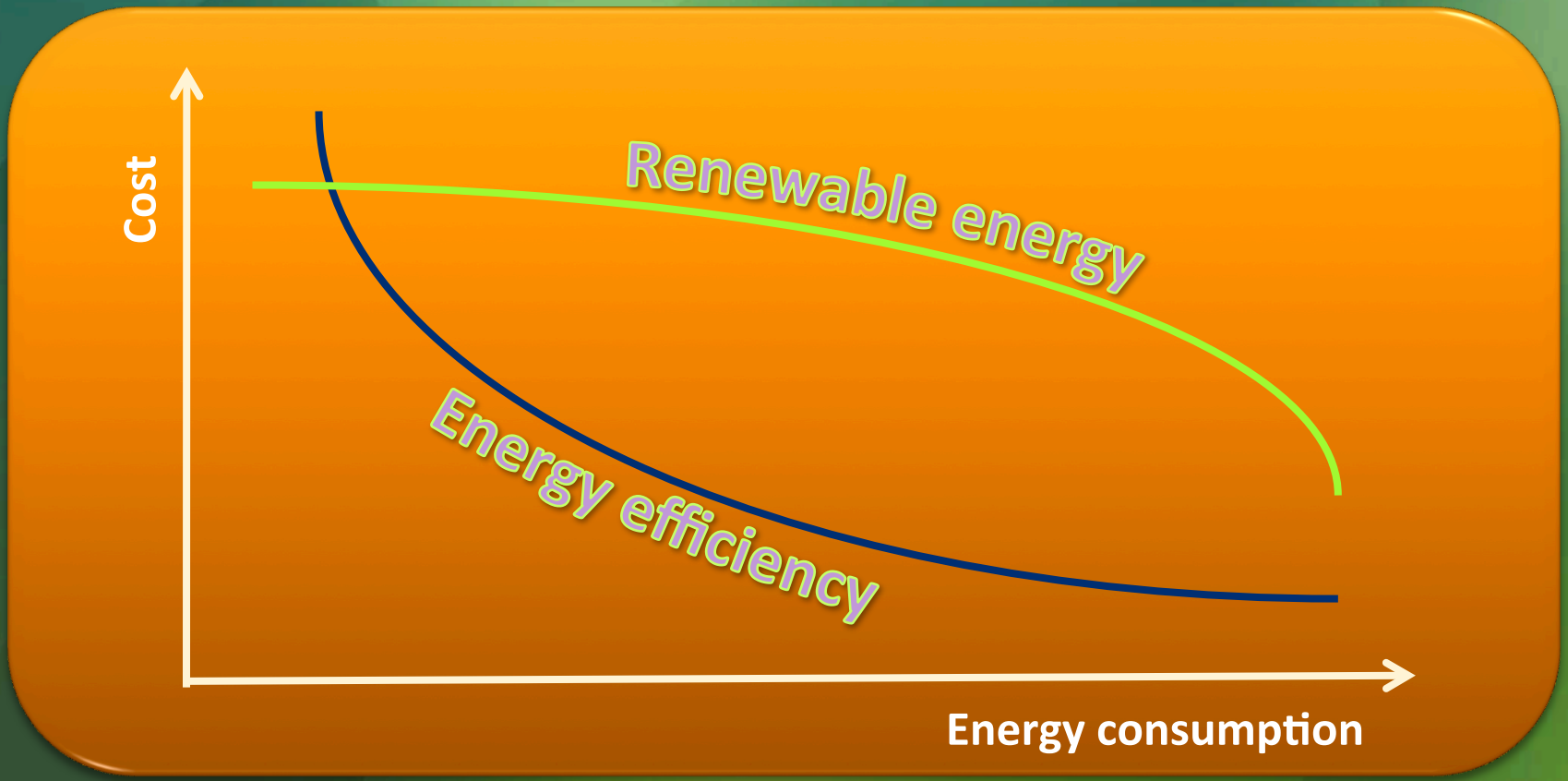
Industry & Commerce

Transport

Agriculture

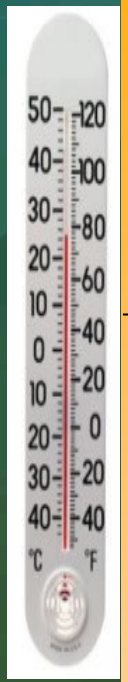
Moving from demand to supply side

- Renewable energy options to lower the dependence on dwindling fossil resources
- Protection from possible future fossil energy hikes



Transition from standard buildings to...

Example of standard building practices in tropical climates



HOTTER THAN OUTDOOR TEMPERATURE

Too much paving, "Urban heat island" effect

CLIMATE

COOLER THAN OUTDOOR TEMPERATURE

Micro Climate

Improper building form, orientation, excessive glazing, etc.

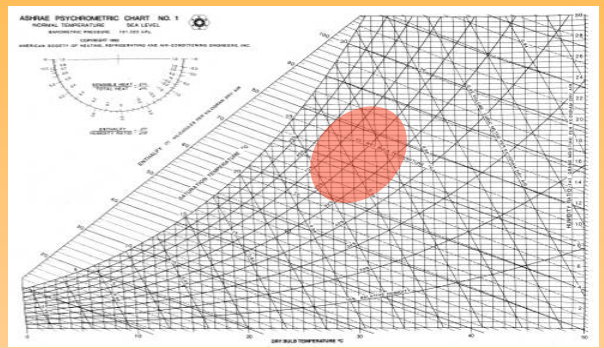
Building Configuration

Use of unsuitable building materials

Building Envelope

Poor indoor environment & inefficient appliances

Standard building



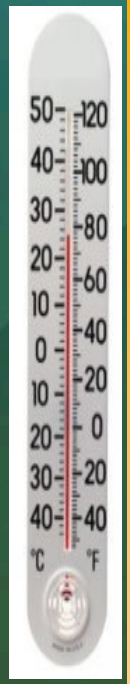
High energy consumption in inefficient air conditioning systems

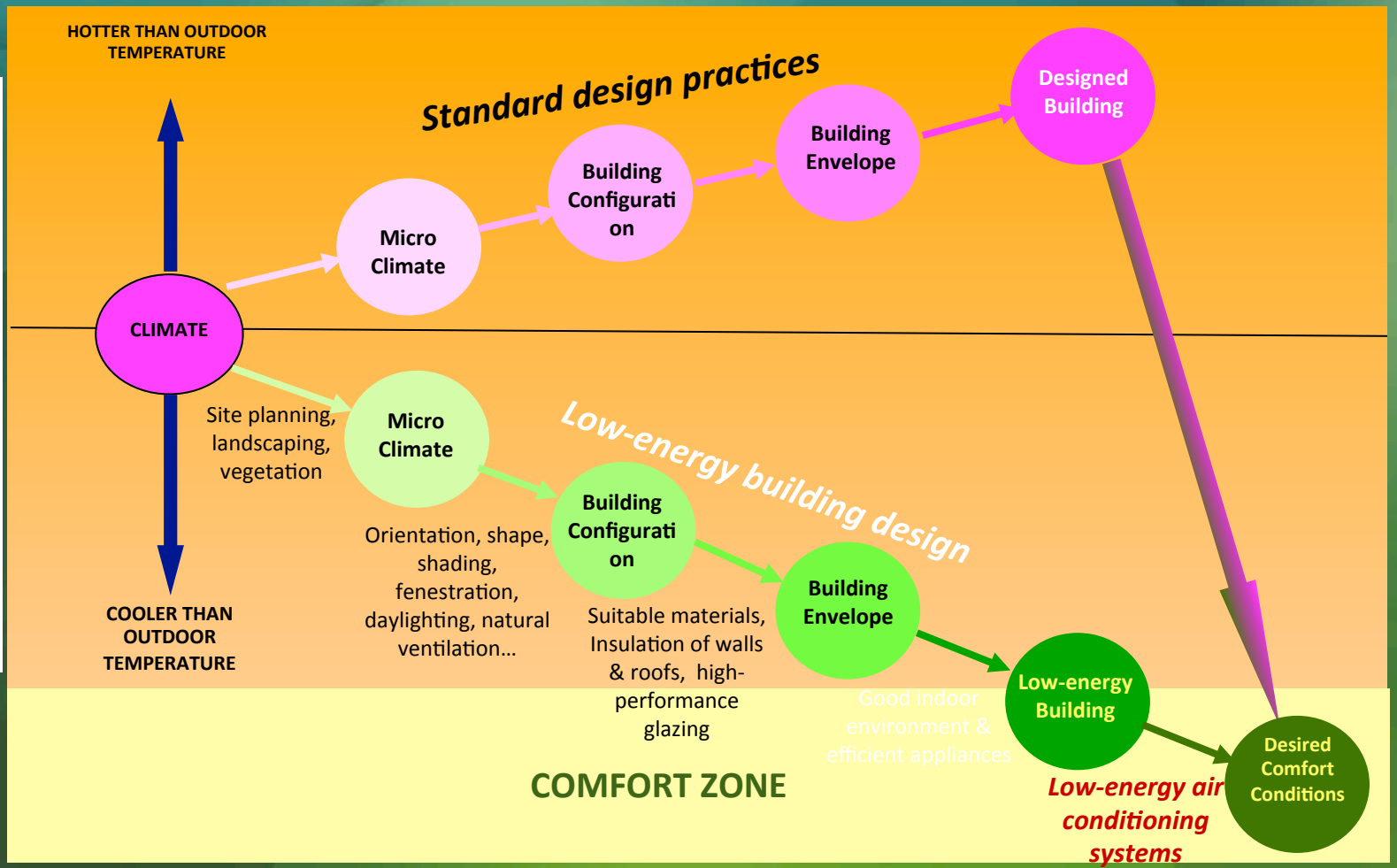
COMFORT ZONE

Desired Comfort Conditions

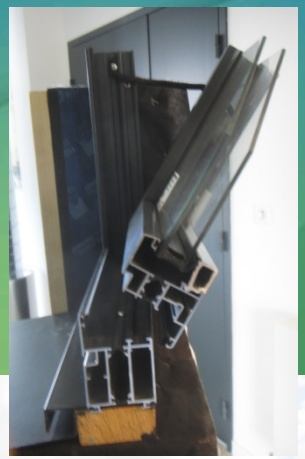
… Designing of low energy buildings

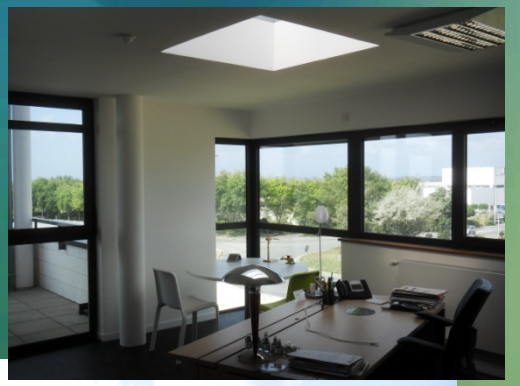
Example of low-energy building design in tropical climates





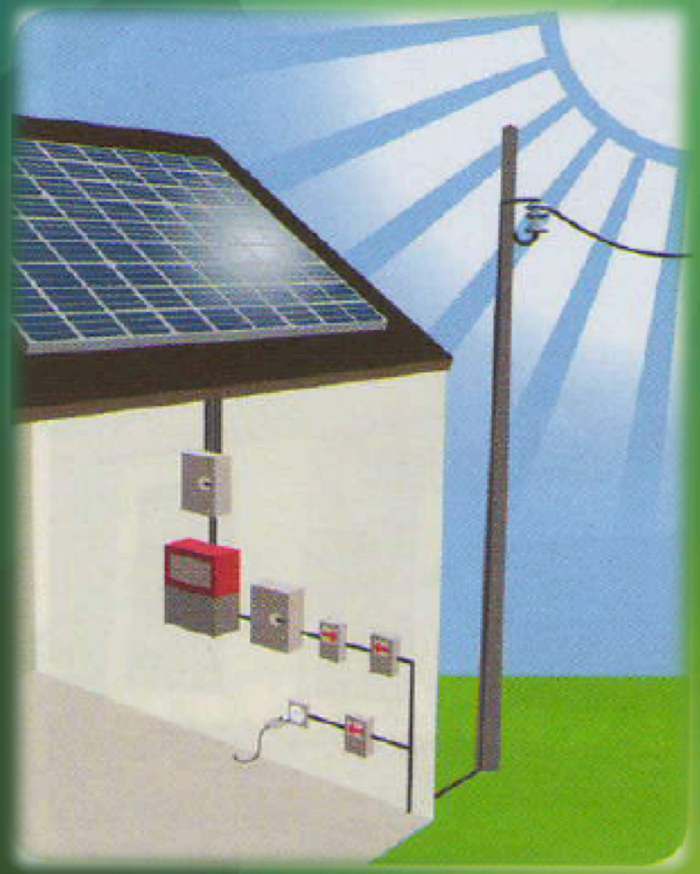
Features of an energy-positive building





Solar power generation in buildings

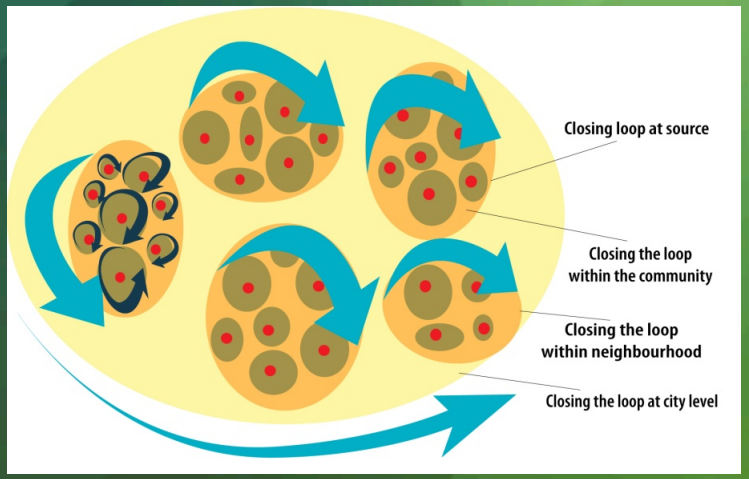
- Solar power system
  - Low operating costs
  - Greater independence from fossil energies

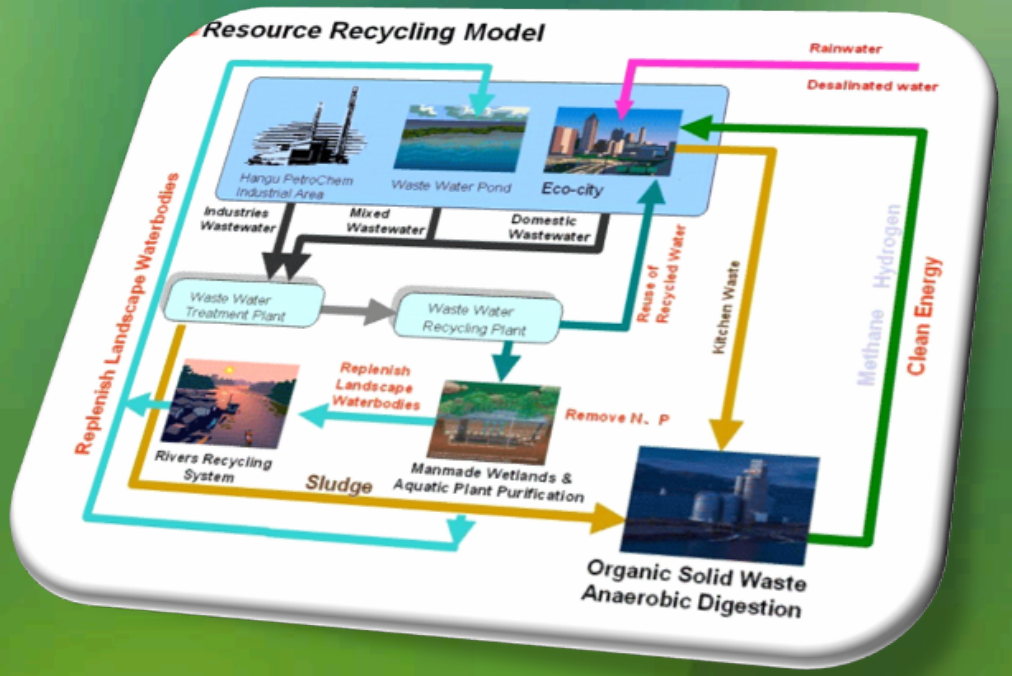


Energy sustainability: 4-step approach

Concept of working with closed loop

- Starting at ***individual level***, moving onto ***neighborhood and community levels*** instead of linear functioning of energy systems





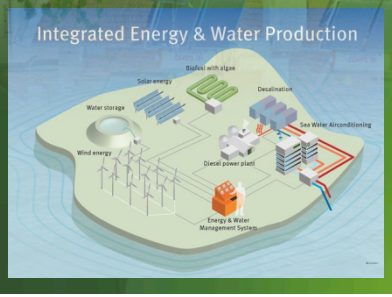
Favorable policies nurturing "prosumption"

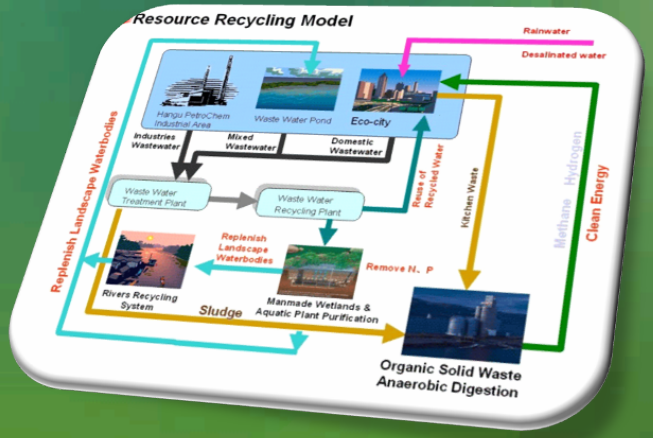
Example of buildings that

- Provide comfort and improve well-being
- Generate energy
- Harvest water
- Convert organic waste into compost
- Produce food
- Treat waste water for reuse, etc.

Favorable public policies

- Provide incentives to
  - **Close the loop**, starting at individual level, moving onto **neighborhood and community levels**
  - **Consumers** who opt to become "**Prosumers**" producing a share of what they consume





Examples:

- Renewable Portfolio Standards
- Development of Solar cities
- Investment in Wind farms

Further options to close the loop

Local authorities can lead the way to urban energy sustainability

- Choose right policy instruments and introduce effective policies (e.g. construction permits, vehicle quota system…)
- Adopt integrated energy planning tools to assess energy service needs, energy saving and efficiency interventions, and supply-side options
- Strengthen the collective awareness and decision-making of urban dwellers
- Say “no” to mega projects and focus on innovative localized solutions to gain social and environmental benefits

Good practice of urban governance

- Make resource use more efficient by addressing demand in a manner that system wastages are minimized
- Make transition towards alternative solutions that lower the pressure on the environment and provide livelihood opportunity to the disadvantaged population through social empowerment
- make reforms in spatial planning, closing material and energy loops, and changing the way mobility is handled in a city
- Sensitize and encourage urban consumers in becoming prosumers through suitable policies, regulations and incentives
- Promote smart growth that reduces the demand for resources greatly without any drastic change in lifestyles
- Influence changes in the mind-set of urban dwellers so that they seek solutions that are decentralized, democratic and pro-poor

"The rich should live simply, so that the poor may simply live."

- Mahatma Gandhi