

Resilient Cities through Resource Efficiency: Implications towards SDG

3 E Nexus towards building resilient societies and implications to SDGs in Asia-Pacific region,
18-19 January, 2017, University of Tokyo, Tokyo, Japan

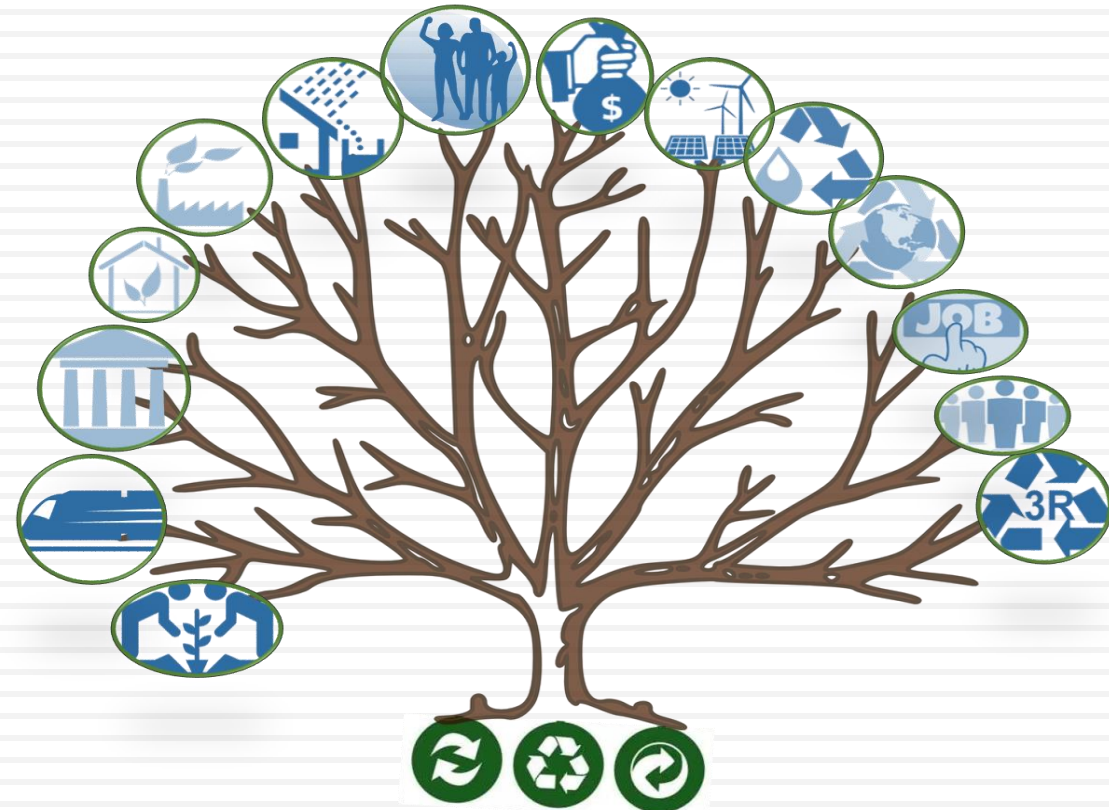


C. Visvanathan

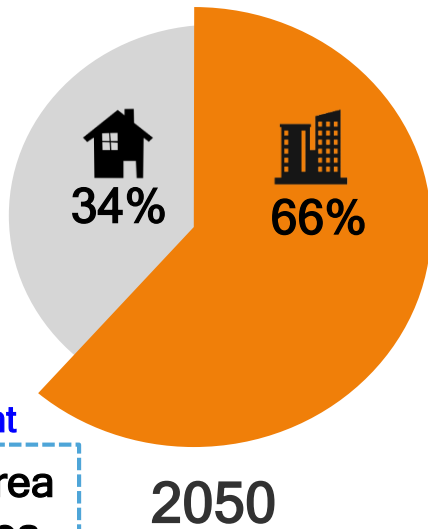
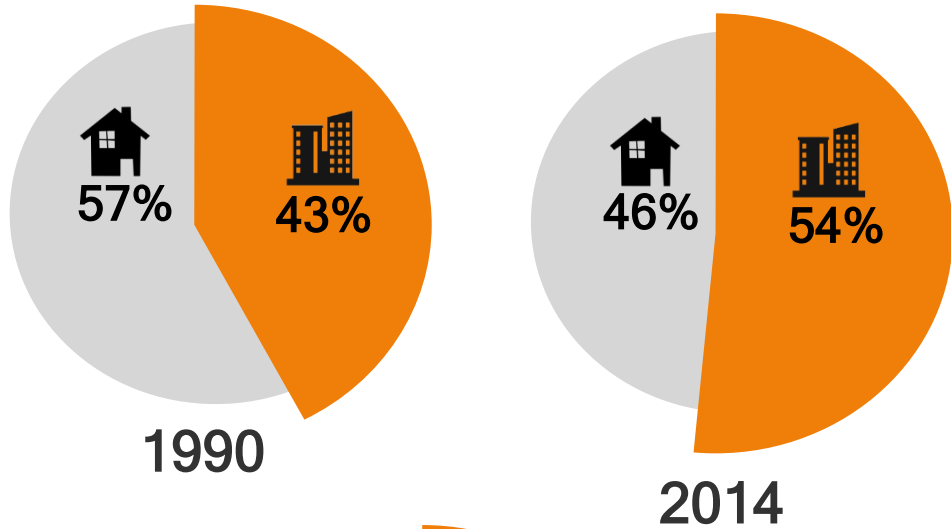
Environmental Engineering and Management
Asian Institute of Technology
Thailand

Email: visu@ait.asia

Webpage: <http://www.faculty.ait.ac.th/visu/>

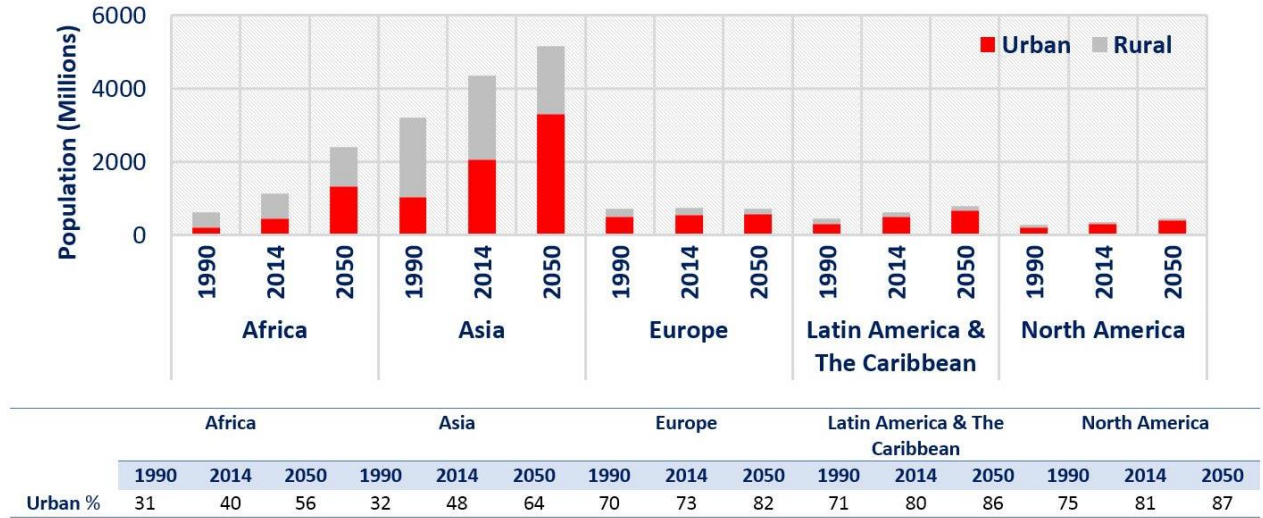


Global Urbanization Trend



World Settlement

- Urban area
- Rural area



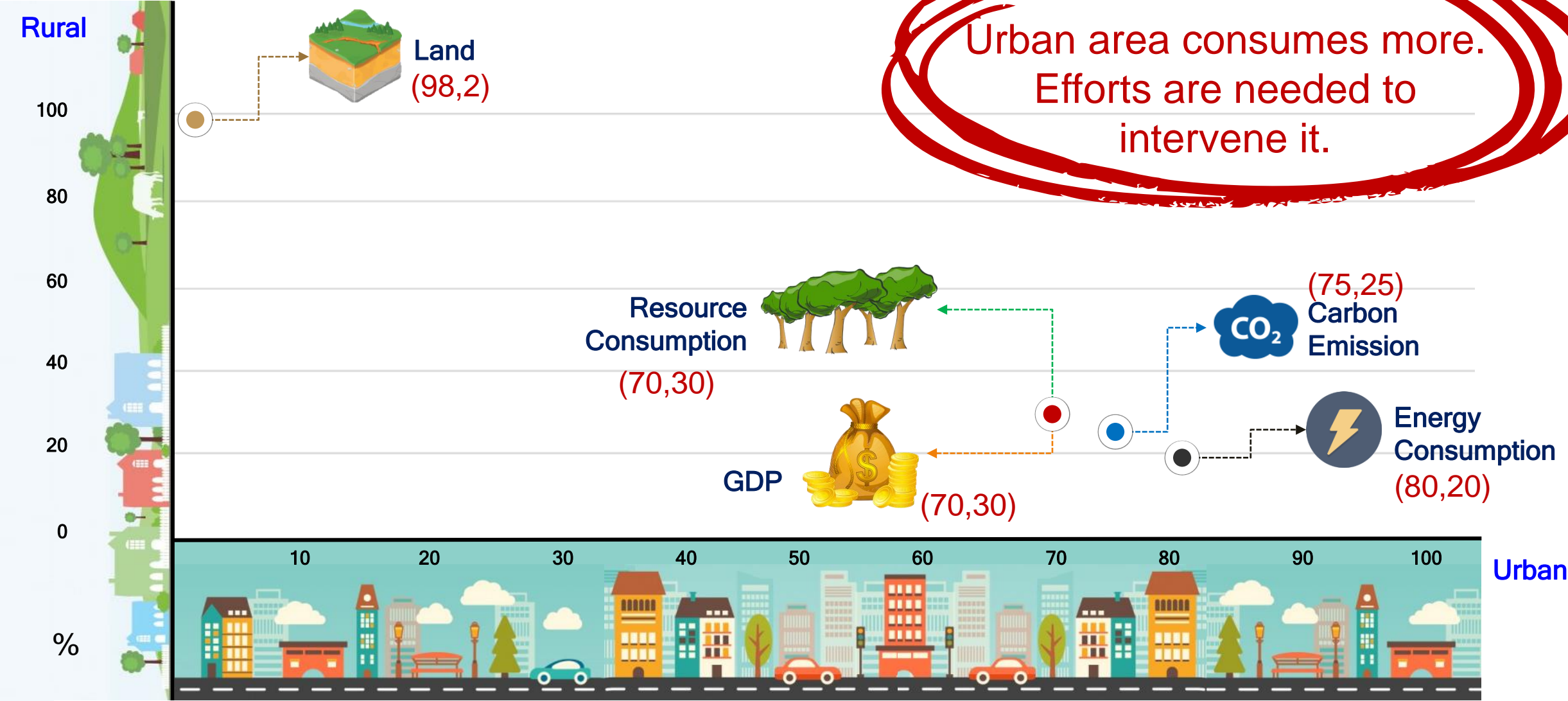
66% of the population will reside in urban areas by 2050

In Asia 64% will reside in cities by 2050

Are We Prepared Yet?

Are We Growing Sustainably?

Resource Consumption of Cities



Poor Resilience: Bad for Business & Communities

 **\$3.3 Billions**
Economic loss

 **\$19 Billions**
Economic loss



100,000 residents
Permanently relocated from Louisiana to Texas



Flooding

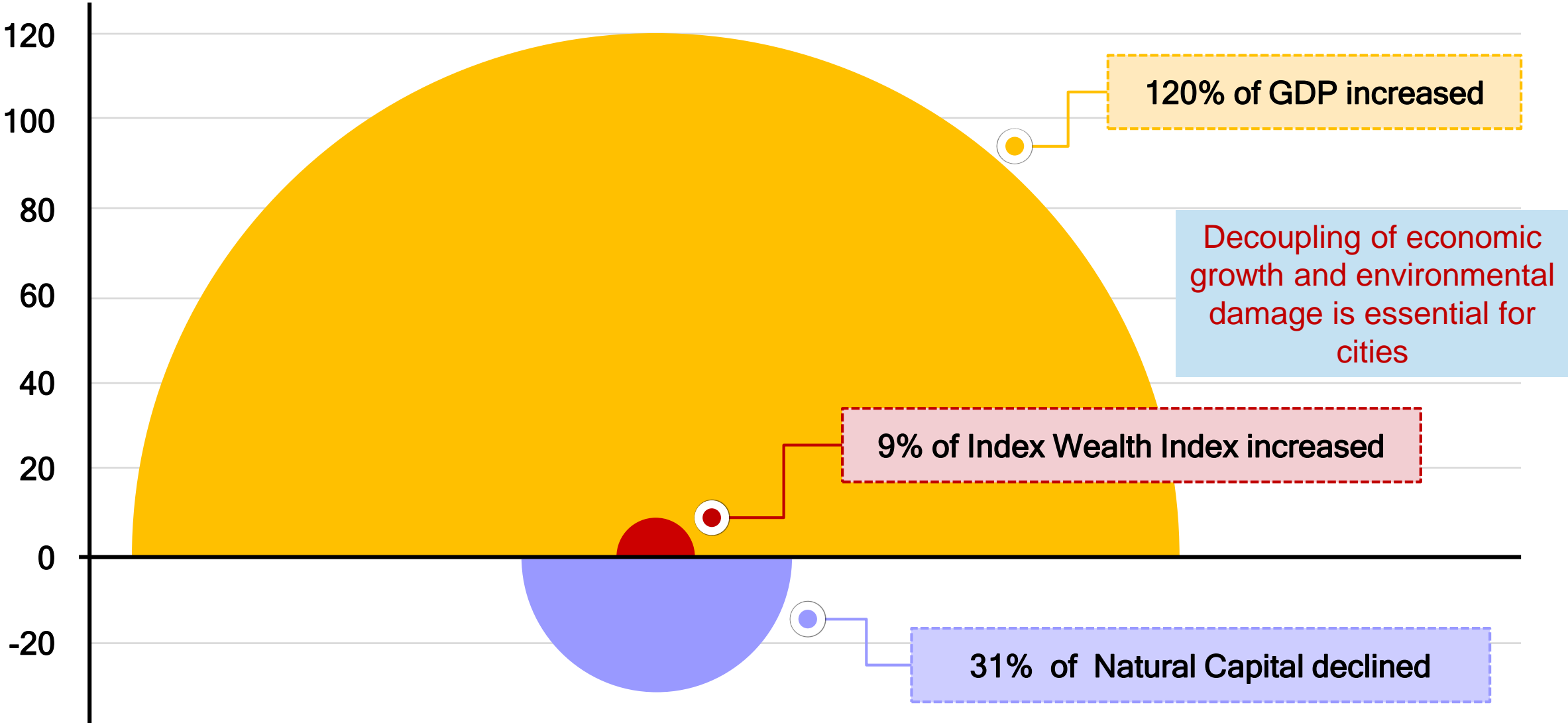
Superstorm Sandy

Hurricane Katrina



- Population of Louisiana **fell by 5%**.
- The city of New Orleans **lost 50% of its population** immediately following the storm.
- 7 years later, the city **remained at around 80% of its pre-Katrina population**.


Economic Growth in India 1990-2008... at the sacrifice of natural capital



Decoupling of economic growth and environmental damage is essential for cities

3R, Resource Efficiency Resilience and SDG Goals

GOAL 11



MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

GOAL 12



ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal



RESOURCE EFFICIENCY
Using less, living better



An illustration featuring a blue gear with a globe of the Earth inside it, and a green gear with a tree inside it. The background is a light blue gradient.

Thailand Floods: Economic Resilience



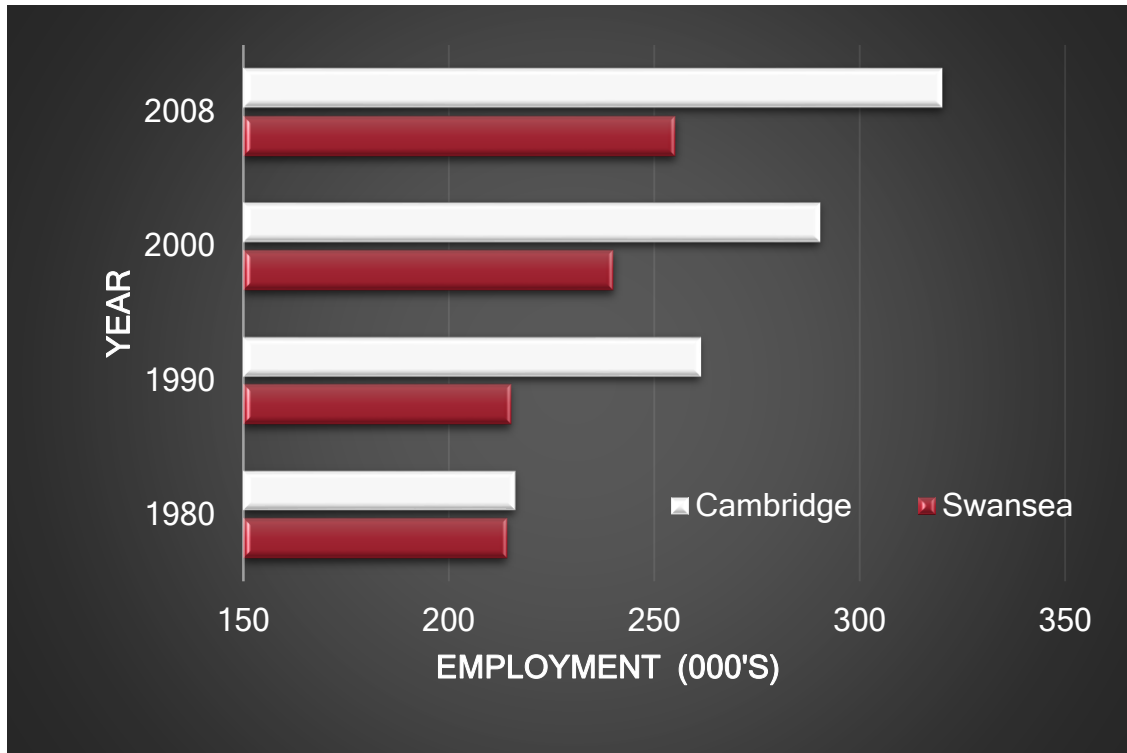
**Resilience is Important
to stabilize the economy**

- Thailand is a 7th most flood-prone country in the world and flooding has frequent occurrence.
- In 2011, Thailand experienced one of the worst flood disasters which affected 13 million people and caused a damage of over USD 45 billion.
- The devastating flood in 2011 occurred in the fourth quarter, i.e., in October during which the GDP of Thailand was reported to be negative 8.9%.
- The impacts were seen in many sectors like housing, transportation, electricity supply, agriculture, tourism, water supply, financial institutes
- The global industrial production reduced by 2.5%
- Long-term technology-led adaptation and transformation strategies is needed

Resilience of A City



Socio-Ecological Resilience: Transformation of Cities

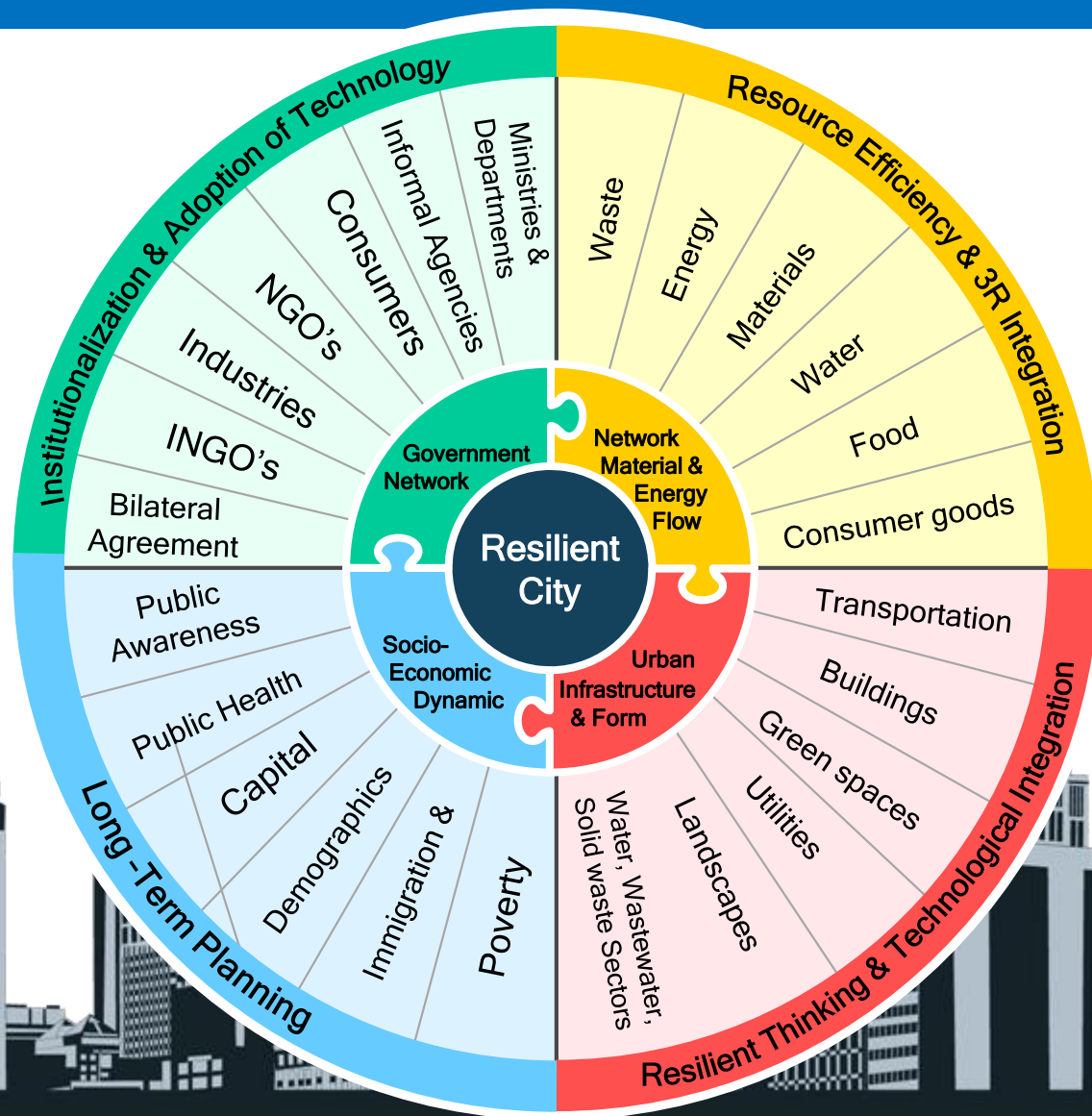


- Hard hit by the declining mining industries in 1980s
- Cambridge and Swansea decided to move to the technology-based economy but took a different approach.
- Swansea invited the Foreign Direct Investment (FDI) from Japanese technological giants
- Cambridge built a science park and capitalized on local entrepreneurship and universities' capacity to innovate.
- Cambridge developed more successfully as a high-tech economy and provided more jobs

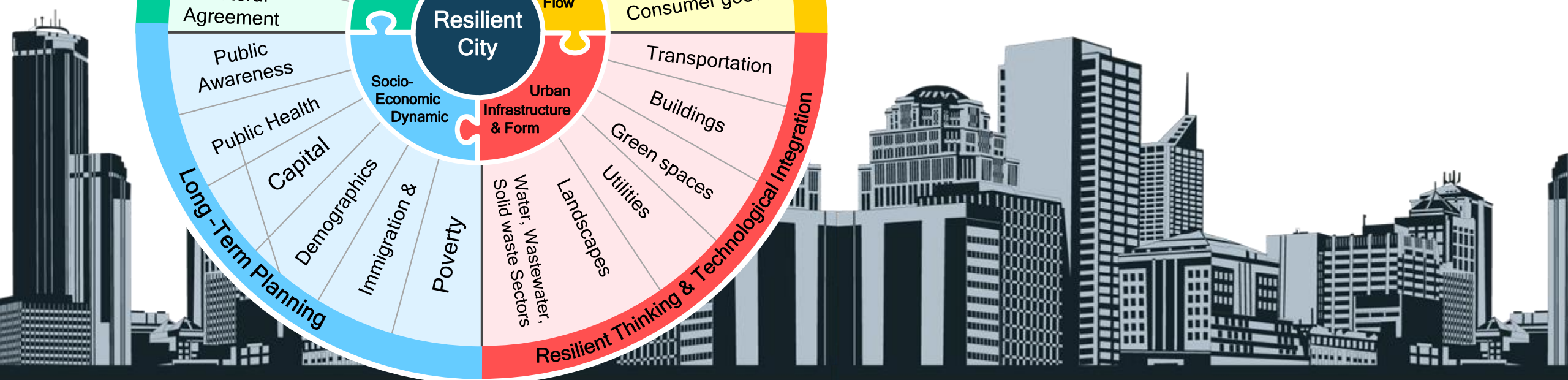


Transformation will be the key for the cities to develop resilience.

Components of Resilient City



- In addition of a strong 3R policies and plans, cities also need a long term vision.
- Technological integration and capacity to absorb the technology in the existing framework is needed.
- Institutionalization further needs long term leadership role

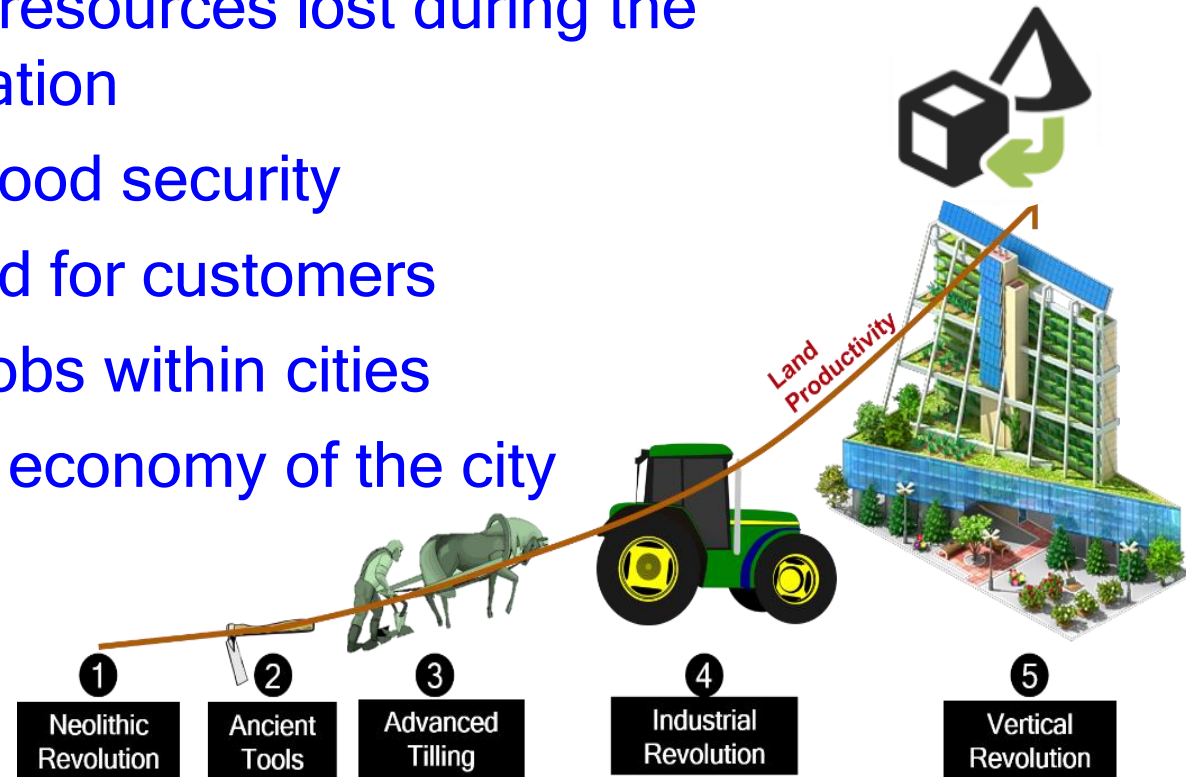


Vertical Farming: Sustainable solution to Cities Food Security



- Sky Green in Singapore runs a vertical farm
- Reduces 95% water and 75% pesticides compared to traditional farming

- Farming in cities has advantages
- Firstly it reduces dependency over resources
- Reduces resources lost during the transportation
- Ensures food security
- Fresh food for customers
- Creates jobs within cities
- Improves economy of the city



Challenges to Cities: Resource Scarcity



Vehicles waiting for fuel during the fuel crisis in Kathmandu

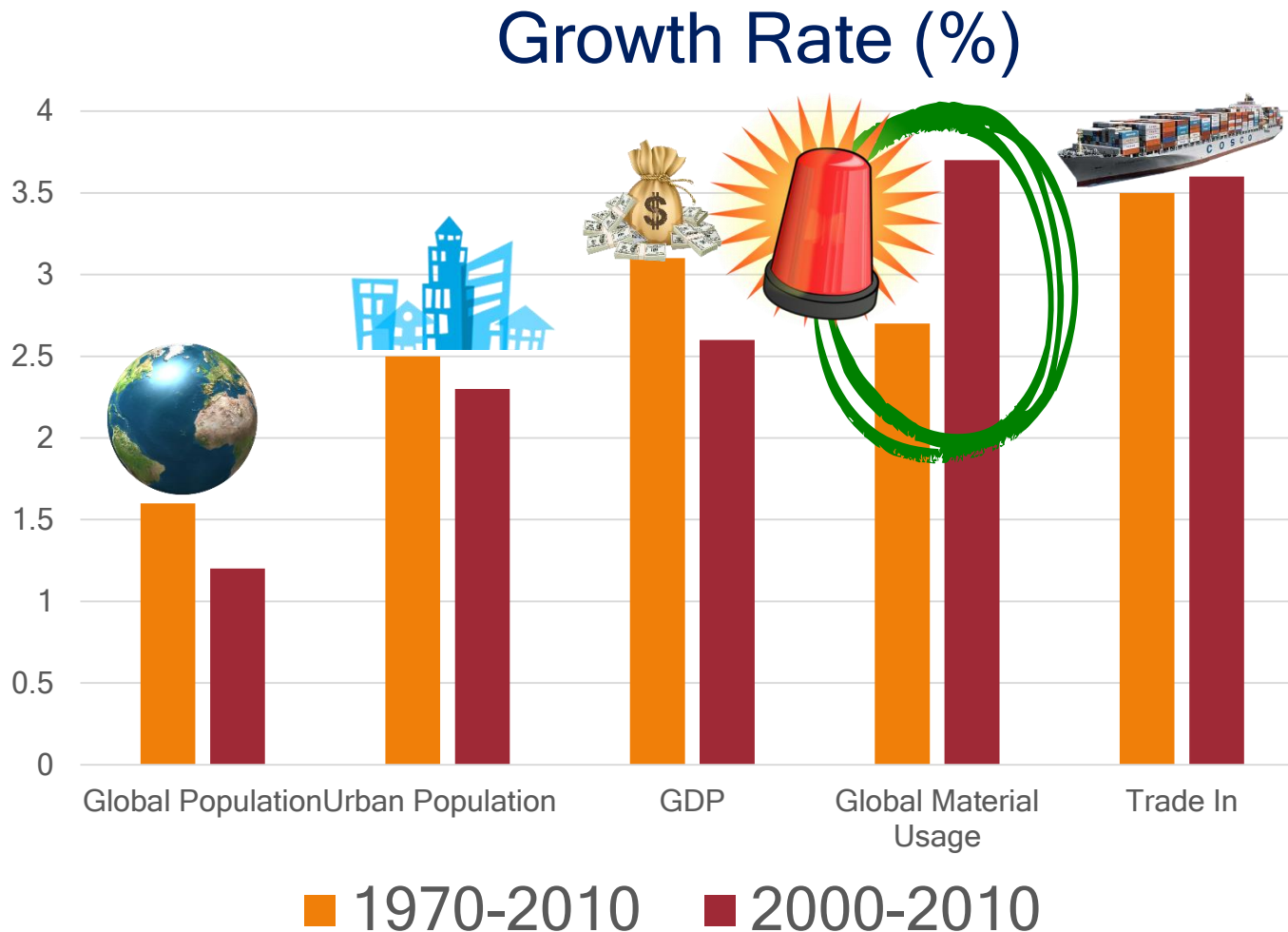
- Five month long trade block in Nepal lead to the severe impact in the transportations.
- It was hard even to find public vehicles
- Cooking of food in household was a big problem
- People started cutting trees for fuel wood
- Resource scarcity can be severe for cities

Independence
from the virgin
resources

Possible solution for cities is to be independent of resource needs from outside its city boundary or at least national boundary



Unsustainable Usage of Resources



- Urban population is increasing at the higher rate than the global rate
- Global material usage is increasing at higher rate in recent years (2000-2010) due to urbanization
- In the recent years the rate of materials usage has outpaced and is more unsustainable.
- Trade of materials is also unsustainable as more amount of materials are lost as indirect trade volume

Taiwan: Waste Management



Restricting Weight of Packaging

Banning disposable tableware in educational institutes and offices.

Imposing fine on supermarkets who fail to reduce their packaging waste to governmental target

Household's segregation of recyclable waste in a government certified bags

Taiwan Waste Management

- Waste generation reduced from 8.7 to 7.95 million tons from 2000 to 2010 while there was 47% GDP during the same interval
- Recycling rate in 2015 was 55%

Using reusable chopsticks inside Supermarkets and stores by law

Bring your own cup and get discount on it

Discarded E-waste needs to be mandatorily taken back by the manufacturer

Extended Producers Responsibility: Imposing tax on manufacturers

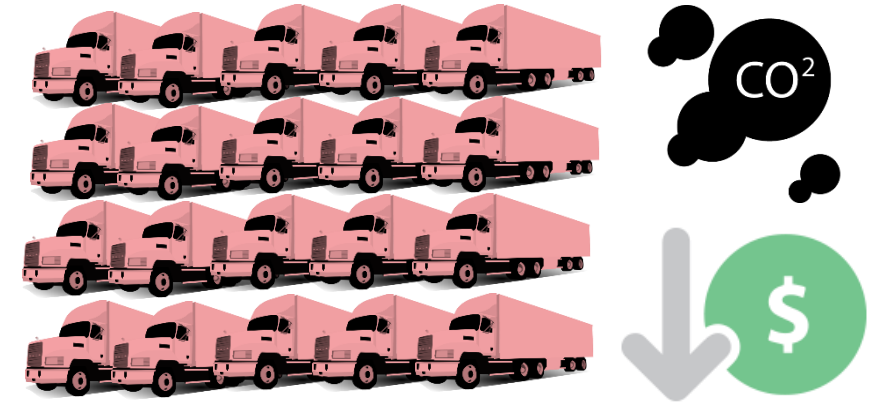
The segregated food waste is sold to the piggery farms or composted



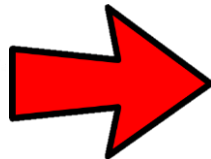
Technological Transformation: Railport of Gothenburg



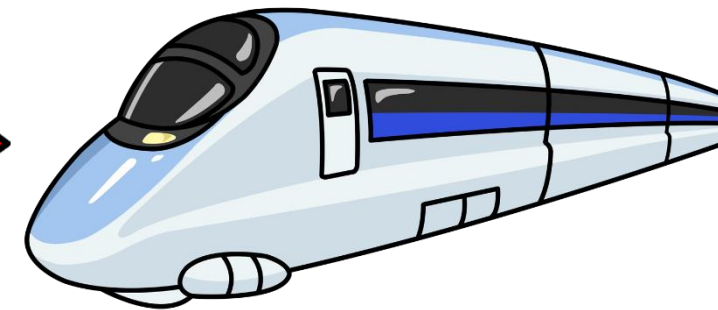
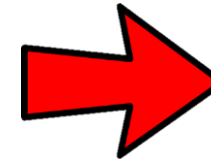
- Port of Gothenburg handles 60% of Sweden container traffic
- Use of rail port has reduced the energy usage by 70%
- 700 trucks has been replaced
- Co-benefit: Cleaner environment, reduced traffic congestion, better commuters health



Trade In



Port of Gothenburg



Transportation of
goods by Electric Train

Opportunity of 3R

Opportunities of Resource Efficiency and 3R

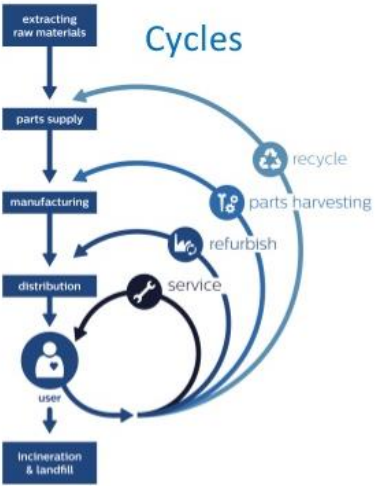
Increased Jobs



Reduced Environmental Impacts



New Business Models



Sustainable Consumption & Production



Independency over Virgin Materials



Increased Jobs



Landfill

6
Jobs

36
Jobs



Methane Emission

Bad Odor

Leachate Management

10,000 tons of Waste

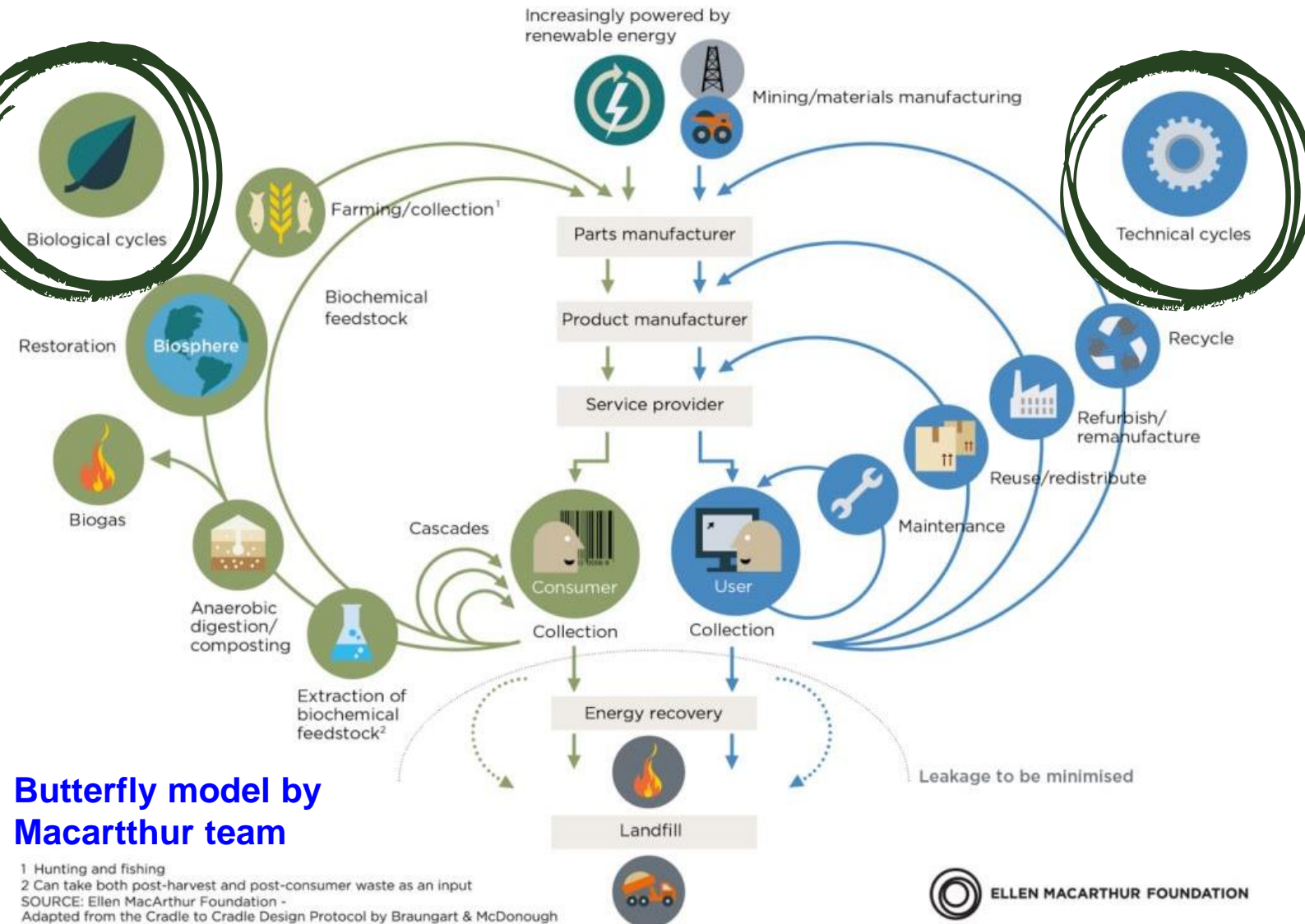
Recycling

Recycling

Reduce Resource Dependency

Low Environmental Pollution

What is Circular Economy?



- CE focuses on:
- Minimizing the use of resources
 - Reusing the product, service
 - Sustainably designing the product and services
 - Improving the system efficiency
 - Minimizing the system externalities

Butterfly model by MacArthur team
 1 Hunting and fishing
 2 Can take both post-harvest and post-consumer waste as an input
 SOURCE: Ellen MacArthur Foundation - Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough



Dragon Bridge, Vietnam: Product as a service

- In Asian culture Dragon is the symbol of power
- Locate in Da Nang: The bridge is in the shape of the dragon and is 610 meter long
- Lighting cost?
- Logistic management cost?
- Maintenance cost?
- Energy cost?
- Location of failed light?
- Skill manpower?



Solution:

Circular Business Model



<http://www.lighting.philips.com/main/cases/cases/bridges-monuments-facades/dragon-bridge.html>

Dragon Bridge: Vietnam



- Da Nang authorities collaborated with Philip to solve this issue
- Philip has installed 2500 intelligent LED lights to lighten the Dragon in different colors
- The dragon can be lighted differently for holidays and festivals
- Philip provided energy efficient and long lasting solution to the Da Nang
- Philip uses remote monitoring, smart asset management, smart dimming by scene setting and intelligent energy metering
- Lighting as a service: Pay for performance

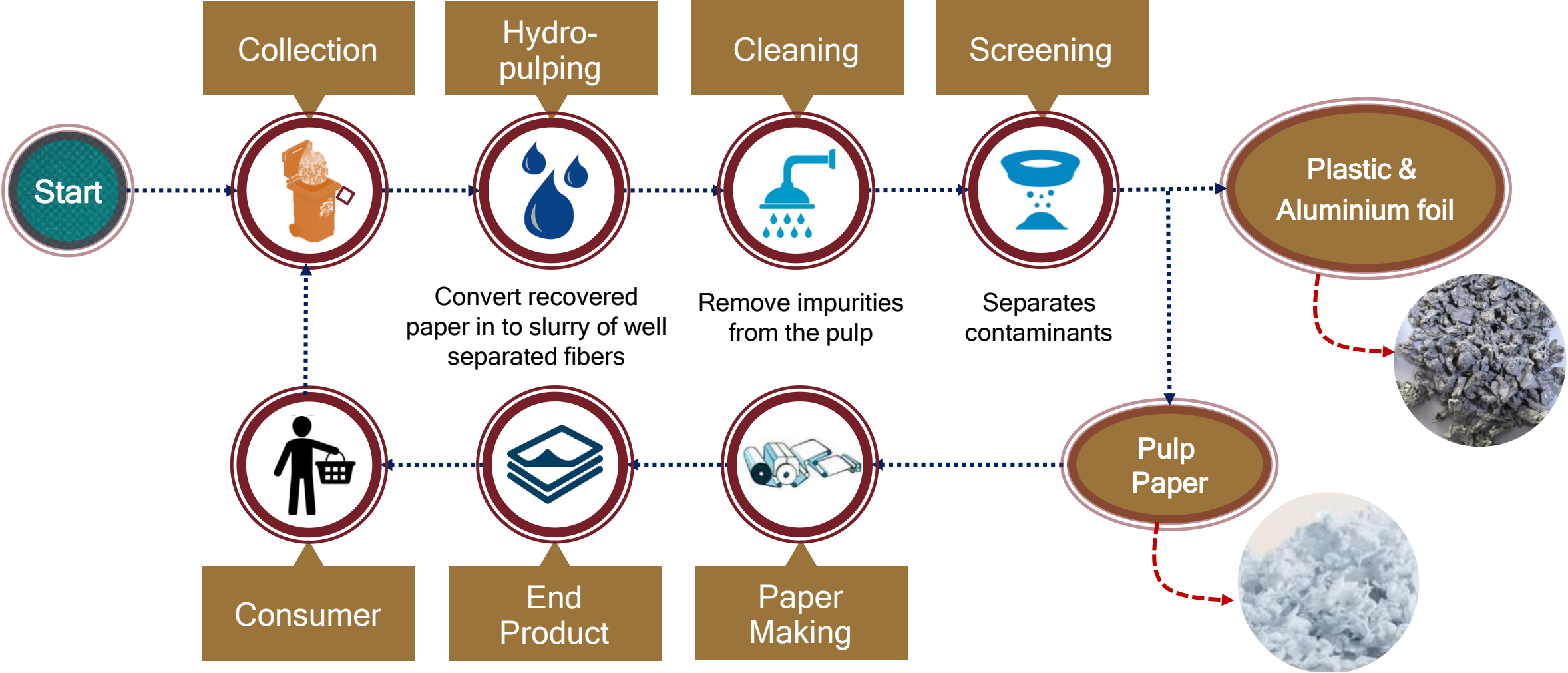
<http://www.telegraph.co.uk/sponsored/lifestyle/innovations/11015933/dragon-bridge-da-nang-vietnam.html>



Beverage Carton Recycling Technology



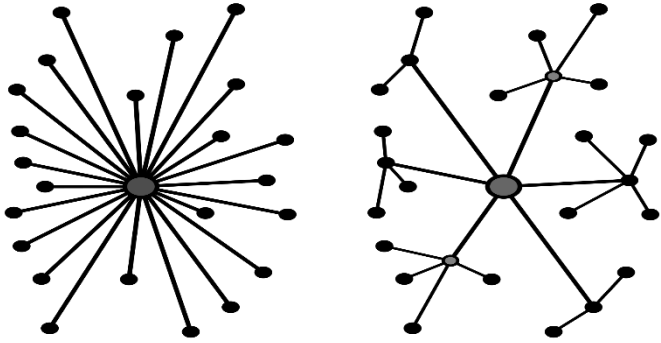
- Beverage Carton Recycling Process (Fiber Part)**



Resilience Model for Cities



Renewable-Energy City



Distributed City



Carbon Neutral City



Eco-Efficient City



Biophilic City

Renewable-Energy City: City of Adelaide



28% GDP growth



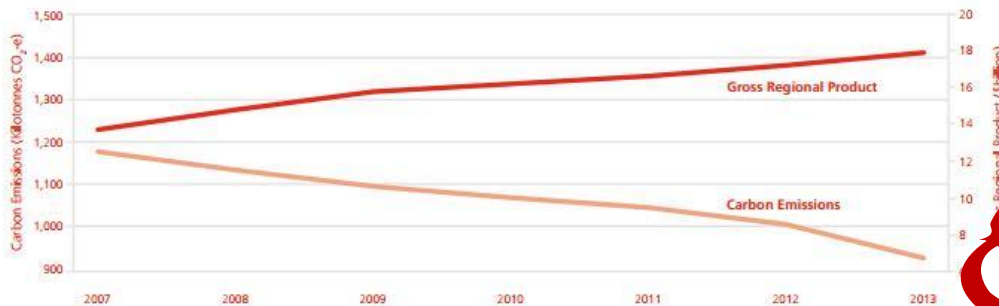
20% GHG reduction



27% Population growth

From 2007 to 2013

CITY OF ADELAIDE 2007 TO 2013 CARBON EMISSIONS AND GROSS REGIONAL PRODUCT



- City focuses on the renewable energy
- Strategy to use clean energy for stationary and transportation sector
- Electric railway
- Community bicycle
- Gas and biodiesel in the bus
- Electric bus
- City produce 41% of electricity from renewable energy

Renewable Energy City focuses on the renewable energy

Carbon Neutral City: Masdar City



- Designed to flourish clean-tech companies



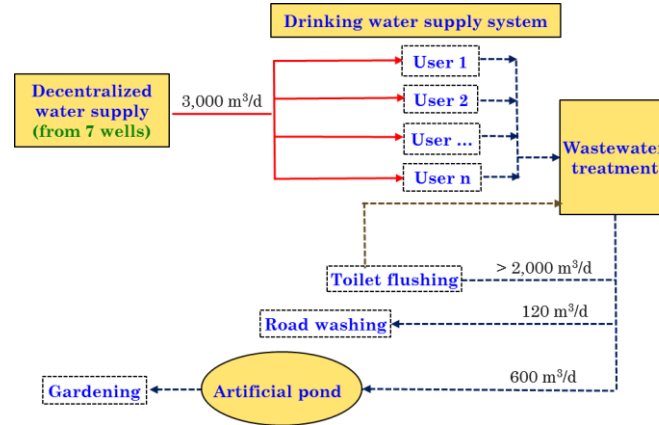
- Energy: Solar and Wind power
- Food: Soil less vertical farming
- Waste: Composting, incinerating and recycling
- Transportation: Underground transportation, electric cars, prohibition of conventional cars, metro rails connecting to Abu Dhabi
- Water: Reduce water consumption by 60%, desalination plant powered by solar energy, gray water recycling

As cities are growing, urban fringes could be built with hi-tech technology

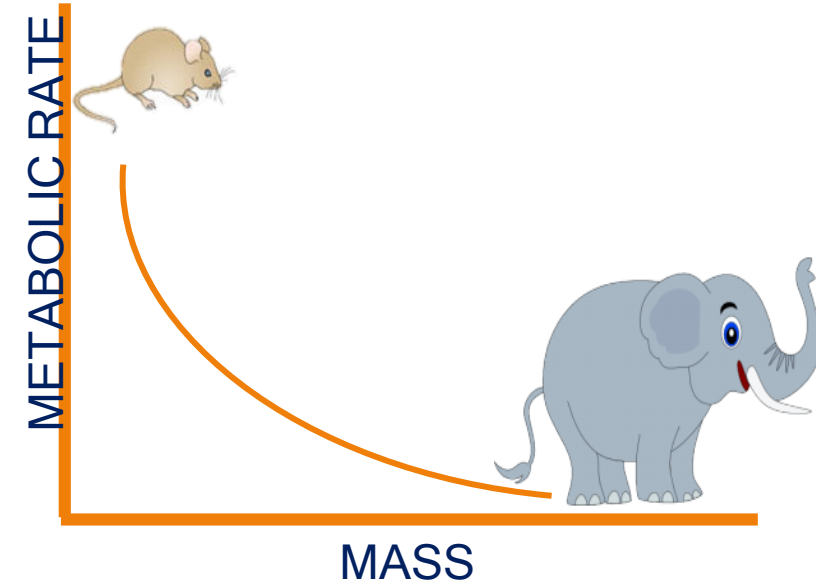
Distributed City: Decentralizing utilities



Household Composting of Organic Waste in Nepal



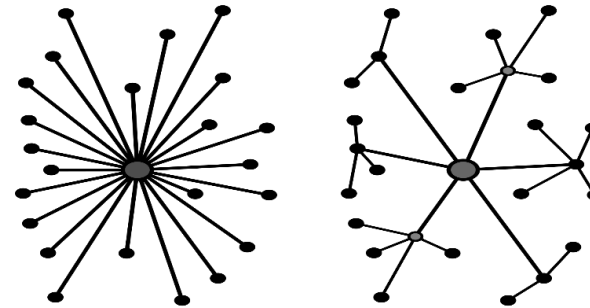
Reuse and recycling of water at Siyuan College



Advanced water treatment



Japan's Fujisawa Sustainable Smart Town



Decentralizing to increase efficiency and reduce risk and cost

Biophillic City



City of Vaxjo

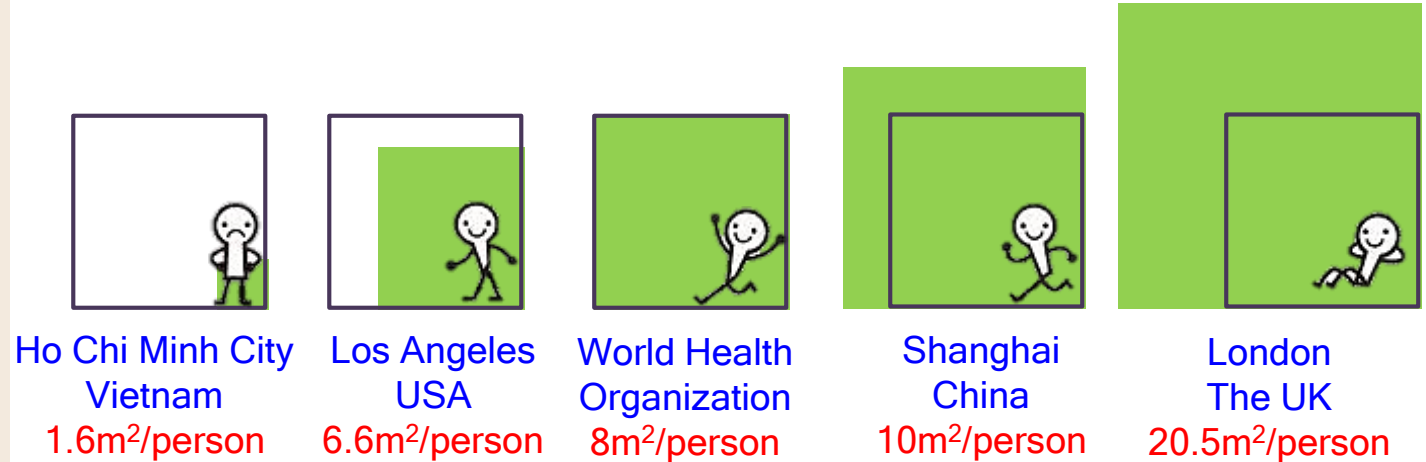
- Biofuels have been utilized in the heating and transportation sector
- Waste from timber industries is used for city heating
- Biofuels like ethanol, biogas, etc., are used for the transportation sector
- Carbon dioxide emission reduced by 32% per capita between 1993 and 2007



By 2030 Vaxjo targets to be a 'Fossil fuel free city' and 'Reutilization City'

BBC documented it as greenest city in the Europe

Green space in urban areas



Source: *Water resilience for cities - ARUP, 2011*

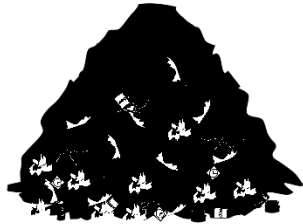
What can the world learn from Växjö, Europe's self-styled greenest city?

In 1991, the southern Swedish city became the first in the world to declare its intention to become fossil fuel free. So how much progress has been made, and does Växjö offer a blueprint for bigger cities to? www.theguardian.com

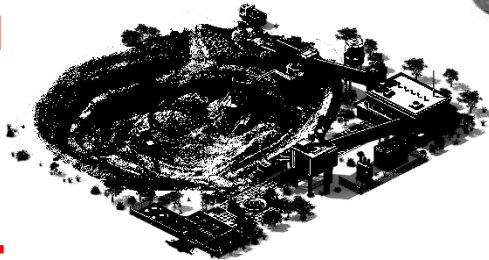
Way Forward... From 3E to 3 R



Elevate consumption



Eliminate used goods to landfill



Exhaust raw resources



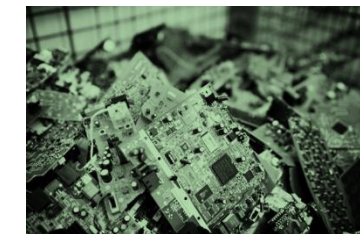
Reduce Consumption



Reuse the goods



Recycle Waste



3E → Vulnerable, polluted and unhealthy Cities

3R → Resilient, clean and healthy Cities

Way Forward: Hurdles to 3R and RE in cities

Behavioral Changes and Policy Developments

Institutionalization

Replication of Technology

Mapping of Resources and Integration of Resource Efficiency

Supporting the Role of Private Sectors



Thank You!