

**A new development revolution**

**from the industrial age  
to the ecological age**

**waste, climate change and  
sustainable development**

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Director Arup  
1<sup>st</sup> February 2008**

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- 1. Global response to climate change**
- 2. Low carbon eco-city planning and retrofitting**
- 3. Policy frameworks for the transition**
- 4. Resource management infrastructure**

# **1. global response to climate change**

The issues we face and the global initiatives by governments to address them

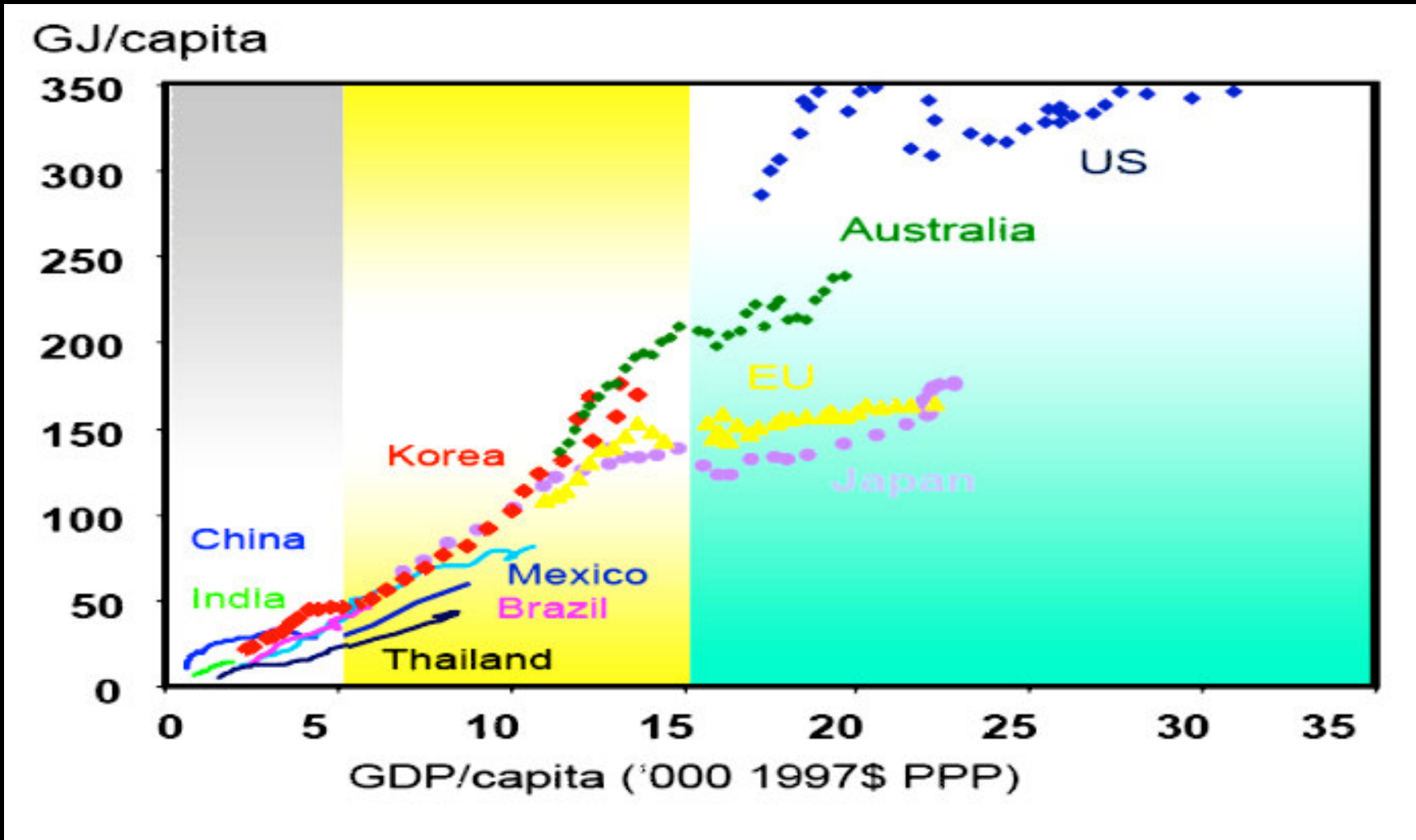
# Drivers **OF** Change: **Land Security**

- **Our shrinking Earth**



Year...	1900	1950	1987	2005	2030	2050
hectares of land per capita...	7.91	5.15	2.60	2.02	1.69	1.63

the mitigation challenge:  
**global ‘energy hunger’**

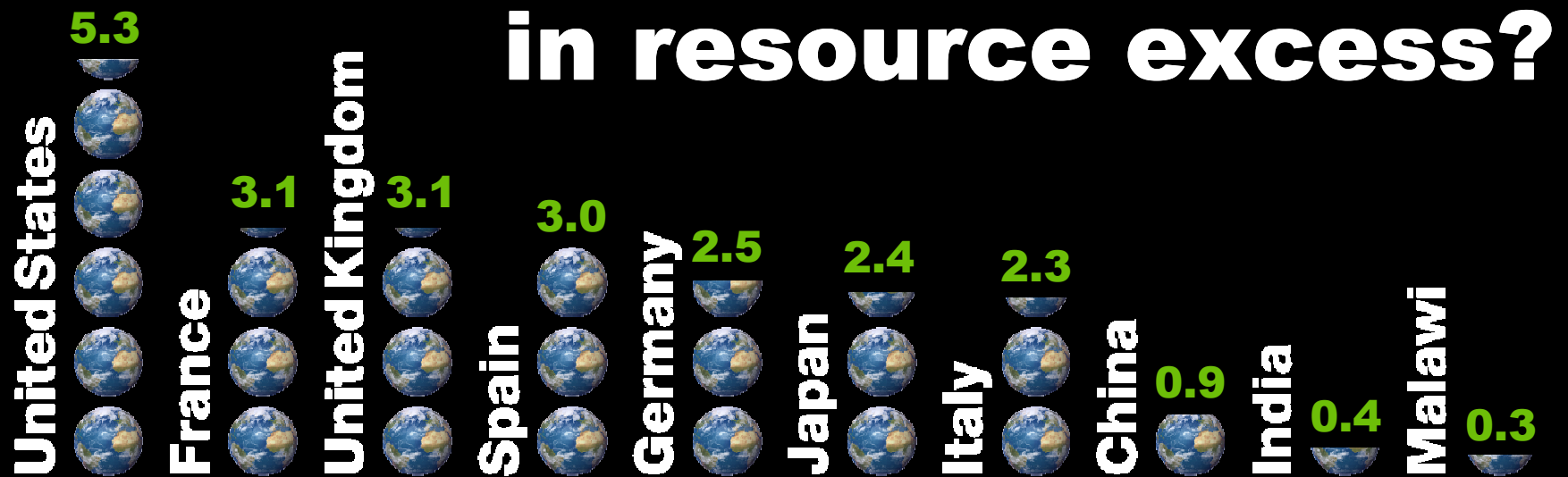


# Population growth

- **Urbanisation rates increasing**
- **Resource inefficient cities**
- **Resource inefficient agriculture**
- **Lack of connection between urban and rural resource use**

# Drivers **FOR** Change

- **What if the rest of the world wanted to live like us -**



# **New Economic Model**

**Living within our Ecological Footprint**

## **RESOURCE EFFICIENCY**

**“ The costs of stabilising the climate are **significant but manageable**; delay would be dangerous and much more costly ”**

**Stern Report**



# vision and leadership

**‘China’s current development is ecologically unsustainable, and the damage will not be reversible once higher GDP has been achieved’.**

*Zhenhua Xie, Minister of State Environmental Protection Agency*

——建设生态文明，基本形成节约能源资源和保护生态环境的产业结构、增长方式、消费模式。循环经济形成较大规模，可再生能源比重显著上升。主要污染物排放得到有效控制，生态环境质量明显改善。生态文明观念在全社会牢固树立。——胡锦涛总书记在十七大上的报告 2007年10月15日

- Towards an **ecological civilisation**
- We must develop a new focus on service industry and research and design
- We must create a more resource efficient society
- We must develop a circular economy and enhance the use of renewable energy
- We must control the emissions effectively and improve the ecological environment
- We must make the society ecologically aware

President Hu Jintao, 17th Party Congress  
15th October 2007

# Japan's National targets for a sound material-cycle society from 2000 to 2010

- **Resource Productivity**      GDP / input of natural resource  
**40% increase**
- **Recycle Use Rate**      Proportion of recycled materials  
**Increase from 10% to 14%**
- **Final disposal amount**  
**Reduction of 50%**

## **2. low carbon city planning and retrofitting**

Methodology, integrated resource modelling, master-planning, land-use efficiency, water, energy, accessibility, resource management

## Winning Strategies for the 'ecological age'

1. Use waste as a resource
2. Diversify and co-operate
3. Gather and use energy efficiently
4. Optimise not maximise
5. Use materials sparingly
6. Clean up, not pollute
7. Do not draw down resources
8. Remain in balance with the biosphere
9. Run on information
10. Shop locally



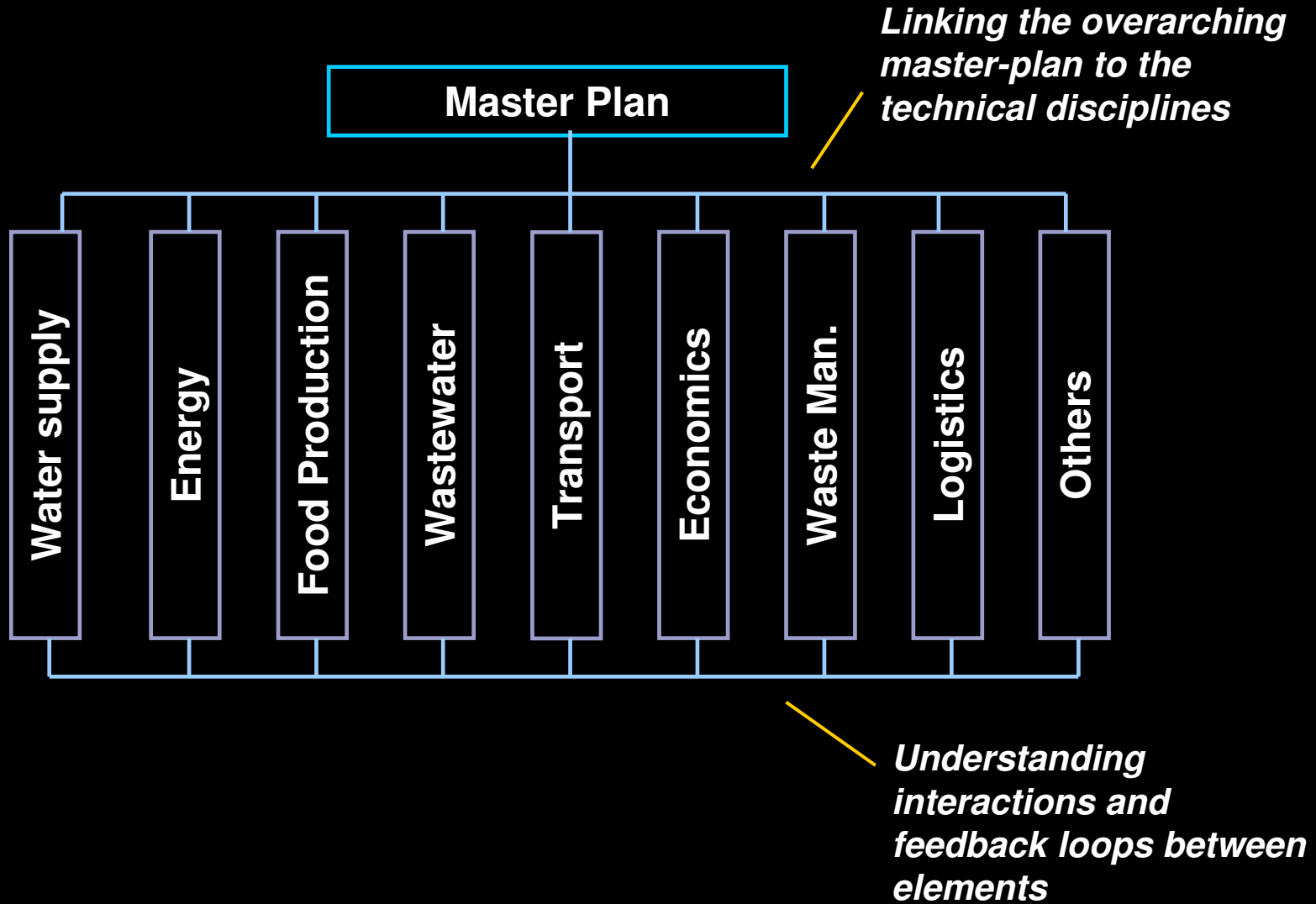
Janine Benyus  
Biomimicry

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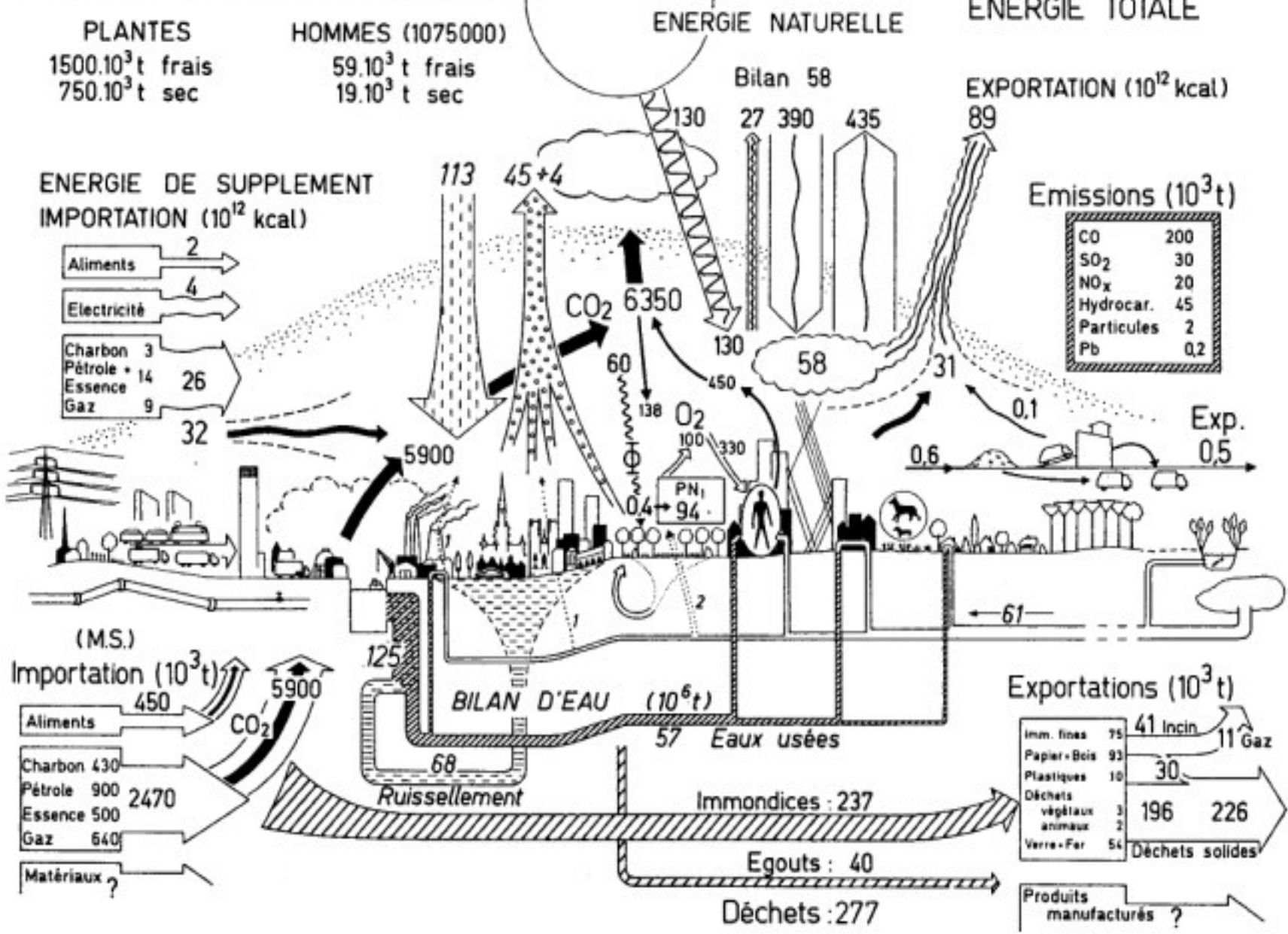
# **integrated** urbanism

- **Human and Environmental Health**
- **Economic Vitality and Individual Prosperity**
- **Energy**
- **Housing**
- **Nutrition and Urban Rural Linkages**
- **Mobility and Access**
- **Communications**
- **Education and Culture**
- **Governance and Civic Engagement**
- **Water**
- **Materials and Waste**
- **Ecological Footprint**

# Integrated **Resource Management**



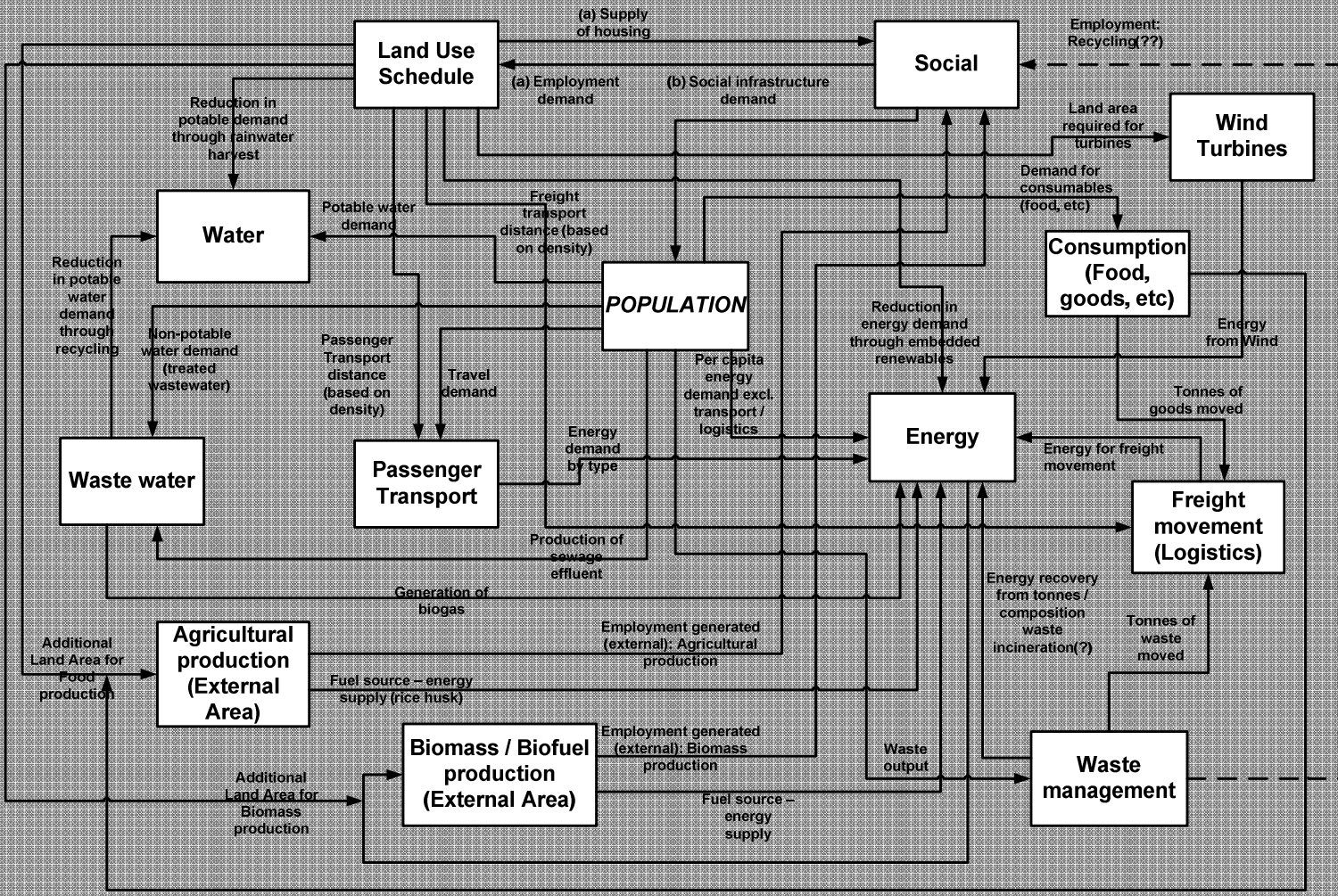
# ECOSYSTEME BRUXELLES (16.178 ha)



Source: Duvigneaud, DeSmet 1977



# the system of city life





An aerial photograph of the Dongtan eco-city in China, showing a dense grid of buildings and infrastructure. The city is situated on a peninsula or near a large body of water, with a prominent road network and various industrial or commercial structures. The surrounding landscape is a mix of urban development and natural terrain.

**the world's first eco-city:**

# Dongtan

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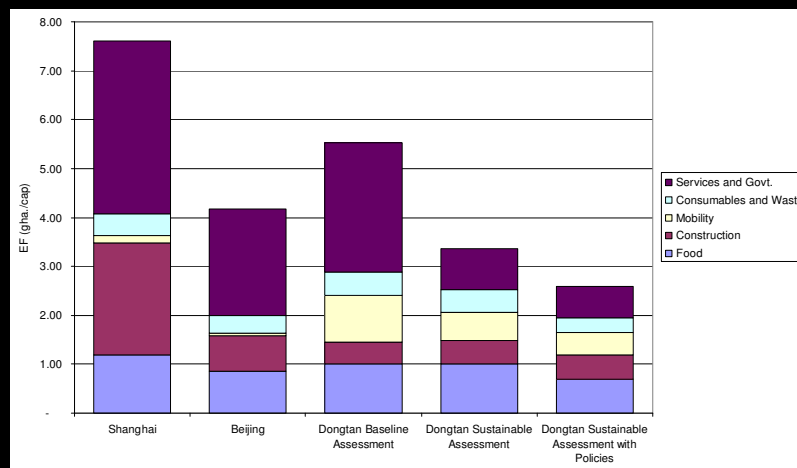
# control plan

630 ha start-up area



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# At **2.6** global hectares/person, Dongtan will have a low ecological footprint

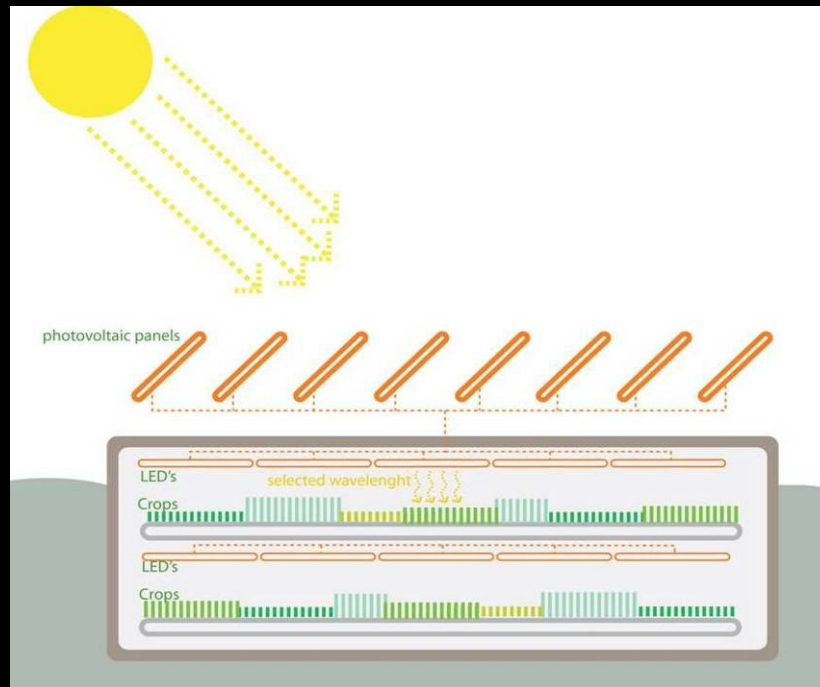


**Conventional approach city footprint**

**5.5 global hectares/person**

it provides **9 hectares**

of plant factories, with **no loss** of productive land



**Conventional approach city:** Loss of 1000 hectares of productive land

**64% reduction in energy demand with no emissions from energy for power / heat, saves**

**350,000 tonnes of CO2 per year**



### **Sustainable eco-city**

- Energy demand 600 GWh/year
- No CO2 emission from energy for power and heat

### **Conventional approach city**

- Energy demand 1650 GWh/year
- 350,000 tonnes of CO2 emission





**Rice mill in Thailand**



**Husk silo and boiler**



**Vestas turbines China**



**Burning rice straw Thailand**



**McBurney boiler burners**



**1.2 MW Goldwind turbine China**

**Improved accessibility reduces travel distances by 1.8M km. With zero emission transportation this reduces CO2 emissions by**

**400,000 tonnes per year**



### **Sustainable eco-city**

- Daily travel: 4.2 million km
- Zero CO2 emissions
- Average trip length 24 km

### **Conventional approach city**

- Daily travel: 6.0 million km
- 400,000 tonnes CO2 emissions/year
- Average trip length 56 km

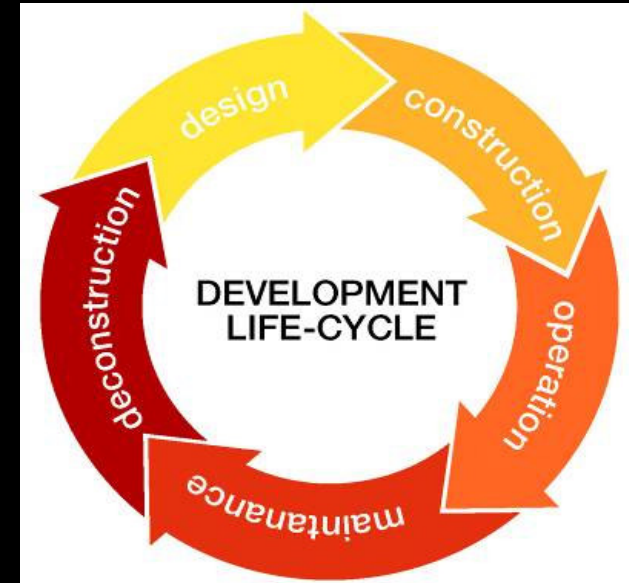


# Resource and Waste Management

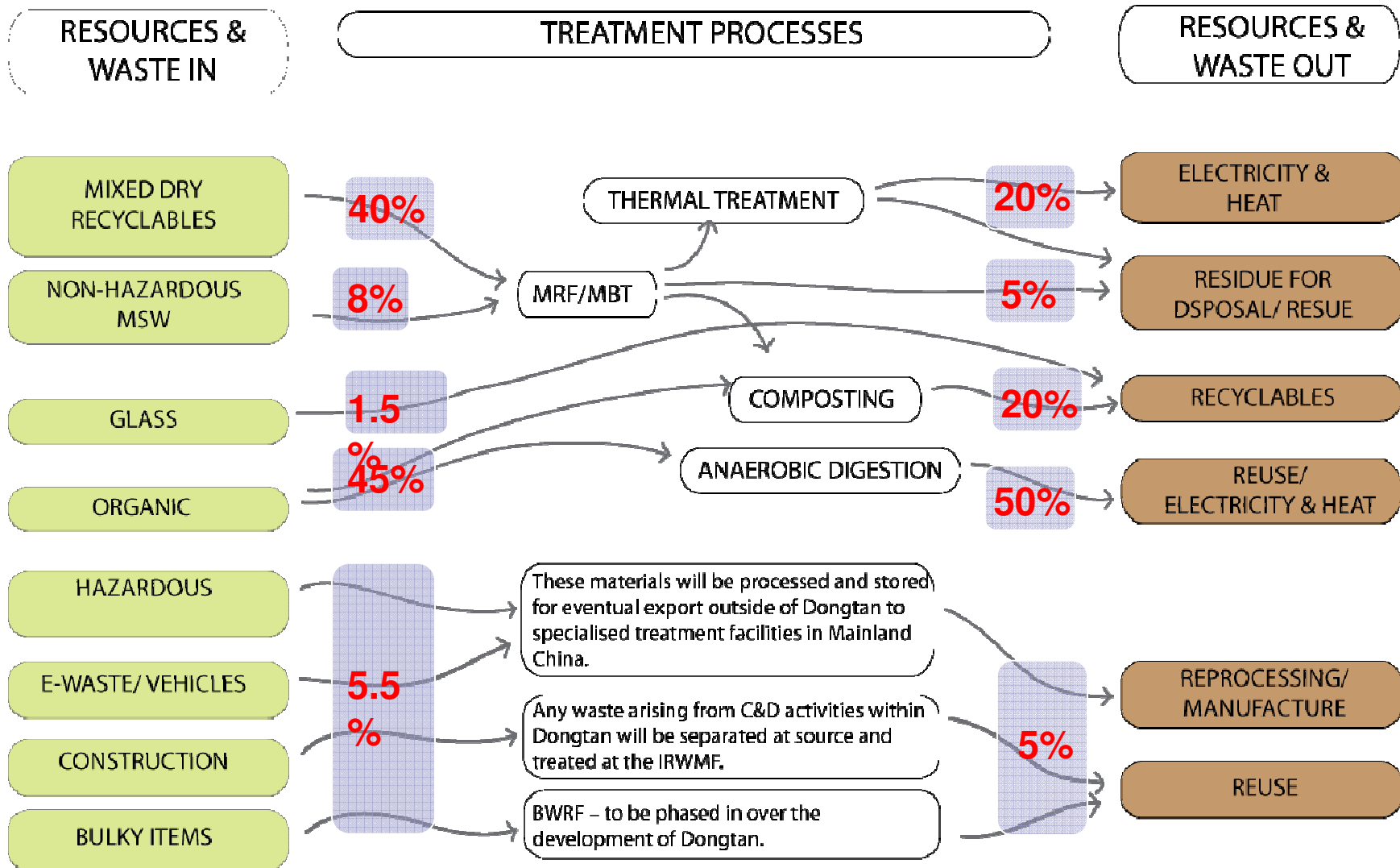
## WASTE MINIMISATION & EDUCATION ARE KEY

### Targets:

- To recover 90% of construction waste.
- To decouple the link between economic prosperity and an increase in waste generation.
- To achieve 100% collection of all operational waste within the Dongtan.
- To achieve 100% participation from all waste producers (domestic and non-domestic).
- To recover up to 90% of collected operational waste.
- To dispose of no more than 10% of residual waste with eventual aspirations of creating the first “zero waste” city.

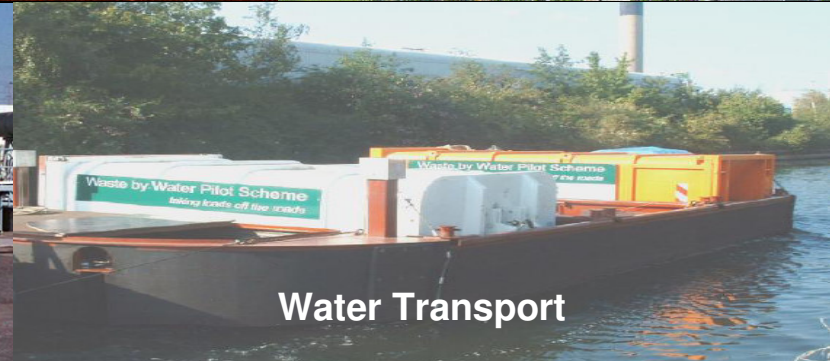


# Proposed Technical Solution



# Transport

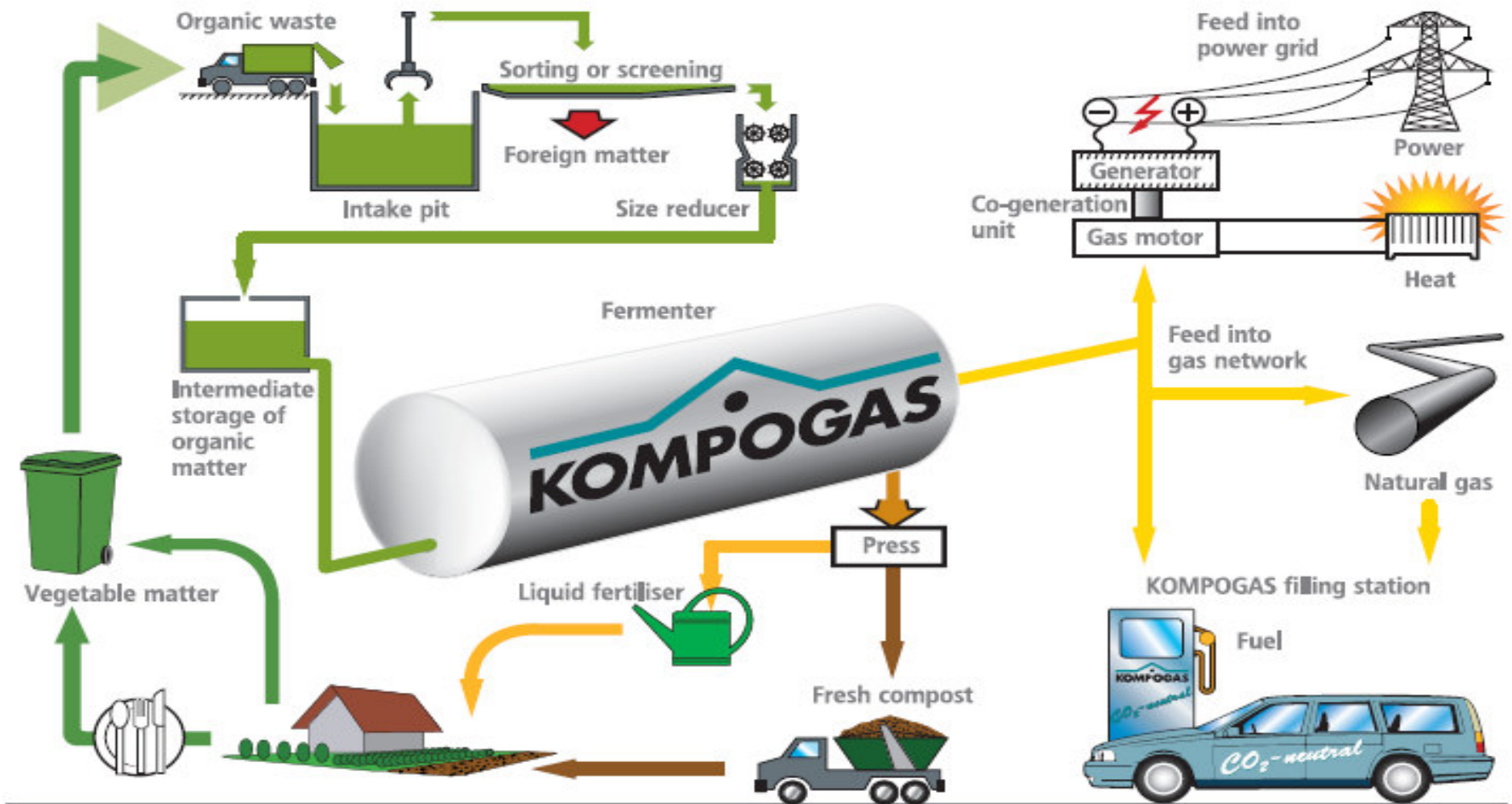
Transportation of resources & waste using a combination of underground, road and water based transport.





# Processes (Anaerobic Digestion/Composting)

## The complete ecological cycle



# **3. Policy frameworks for the transition**

**What should Governments be doing to provide policy frameworks that support the transition to low/zero carbon cities**

## **Policies and frameworks**

- **Leadership and vision**
- **Clear national and regional targets for improved resource efficiency and incentives for delivery**
- **Energy feeder legislation**
- **Energy from waste recognised as key renewable source**
- **Sustainability as a legal requirement of land use planning**
- **Circular economy laws and special economic/environmental investment zones**
- **Policy links between urban development and food production**
- **Long term PPP models for delivery and operation including NGO's and communities**
- **Education, training and research into living in the ecological age**
- **Global partnerships**

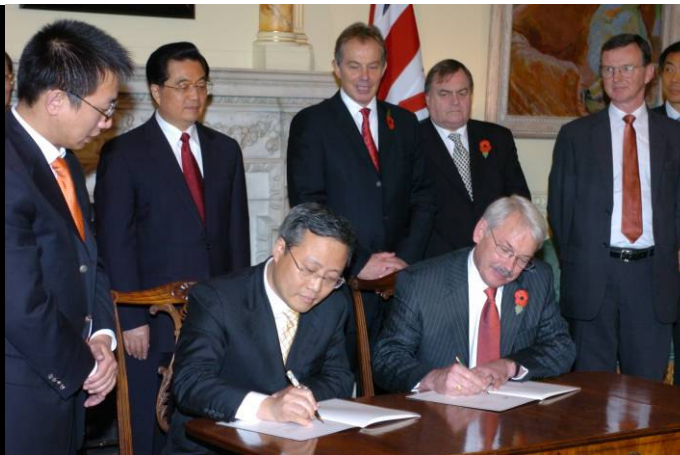
# **4. Resource management infrastructure**

The infrastructure needed for the ecological age

# Infrastructure for the ecological age

- Efficient comfortable zero emissions mass transport systems in cities
- Walking and cycling routes connected to services
- **Underground waste collection to energy from waste plants**
- **Decentralised renewable energy power and heat using biomass fuel**
- Recycling of waste water, and local rainwater capture
- High speed intercity rail passenger and freight
- Centralised city green logistics from freight hubs
- Carbon capture at power stations
- Real time information and communication systems
- **Intensive city food production and resource links to rural production**
- **Construction materials for compact mixed use cities mined from industrial age development**





learning from the west

CHINA

SIIC/ ARUP

PARTNERSHIP



UK

learning from the east

DEVELOPMENT  
RESEARCH  
TRAINING

Institute for sustainability

Institute for sustainability





Which future ?



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SIIC  
DONGTAN