

System Level Integration - Dongtan and Thames Gateway

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**Sustainable Innovation: Building
& Construction Technologies**
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Systems are Everywhere

- Buildings
- Infrastructure
- Industries
- Supply chains
- Economic development
- Production & Consumption systems
- Cities
- Factories
- Products
- Politics

Systems – over domains, over time –
processes



Total Design - A Systems Approach

- Sir Ove Arup - 1946
- diverse disciplines – highest quality.
- integrated and holistic approach called 'total design'.
- team-working, creativity, sustainability, global nature.
- working with our clients and collaborators, in shaping new environments.
- technical excellence and continuing development.



A very special kind of firm.

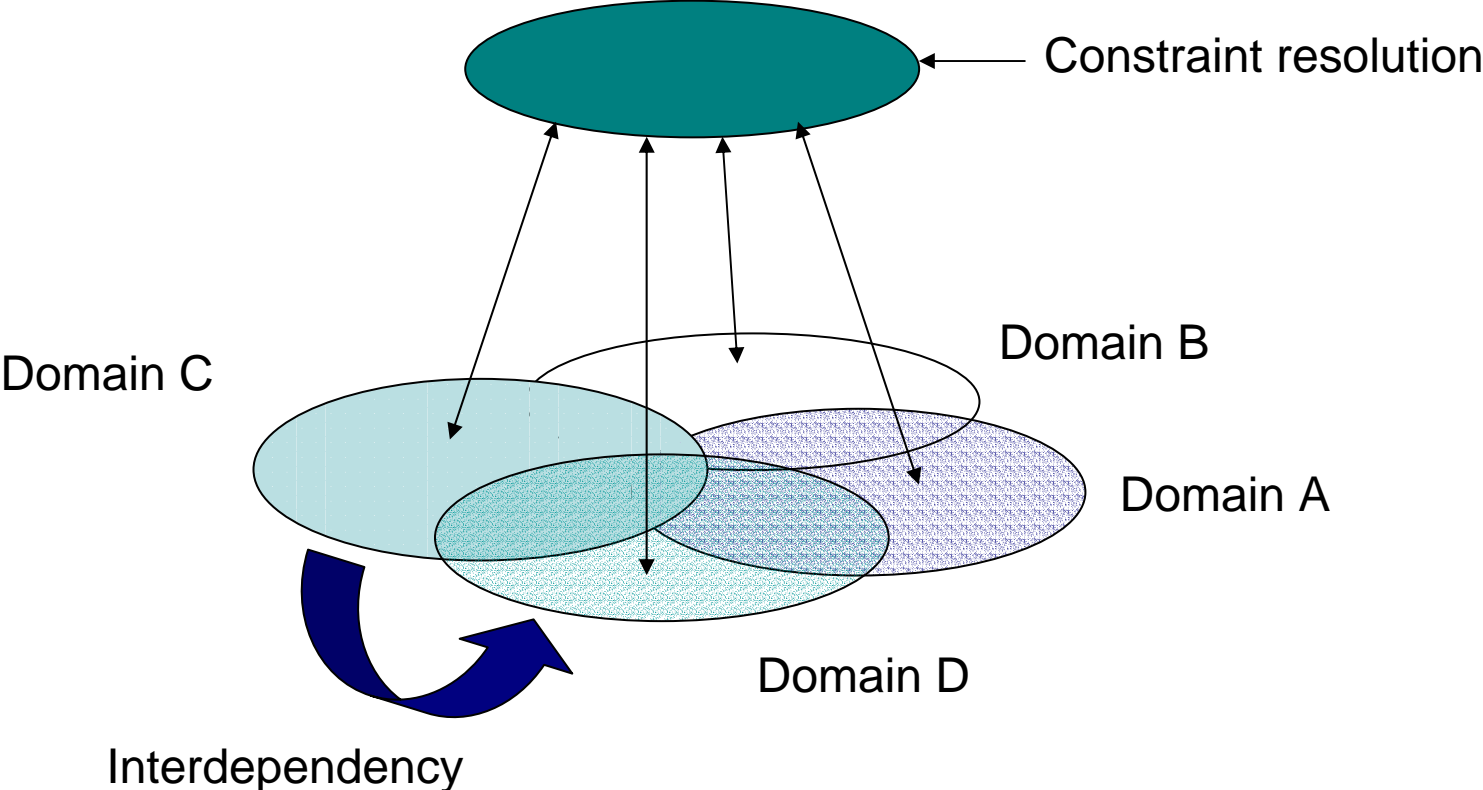
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Systems Thinking

- About variables...
 - design variables
 - independent & dependent variables
 - interactions & dependencies
 - people & decisions



Constraint Based Modelling



Global Production & Consumption

Carbon dioxide emissions penalties can drive manufacturing to developing countries, increase global CO₂ emissions.



“U.S. Trade Policy Shifts Its CO₂ Emissions to China “

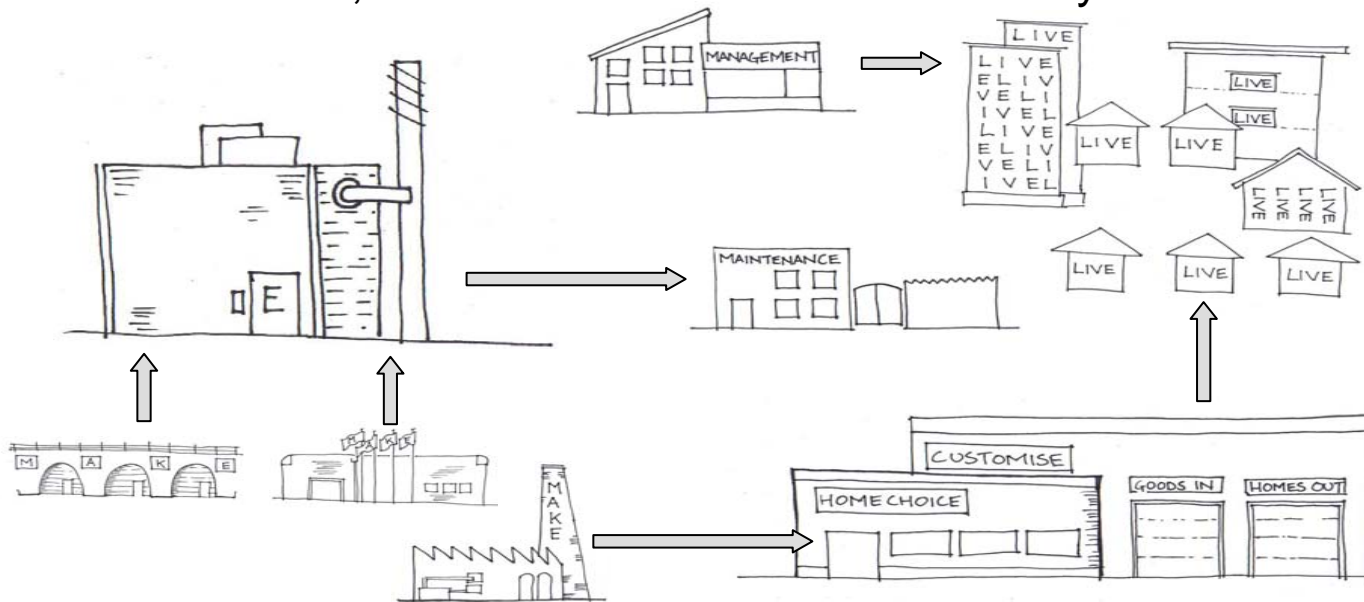
Source: [National Centre for Atmospheric Research](#)
Dec 06, 2005]

SYNOPSIS: Outsourcing U.S. manufacturing to cheap labour markets with inefficient energy systems is resulting in an increase in greenhouse emissions from those markets.

We must take responsibility for the production of the goods we consume.

Manufacturing Sustainable Communities - a collaborative project, private sector, government and NGOs.

- Objective
 - To create a sustainable off-site manufacturing capability in the Thames Gateway, London.
 - Economic regeneration through sustainable OSM.
 - Environmental, economic and social sustainability.



Local Context – London Borough of Barking & Dagenham

- Once a major automotive manufacturing area
- OEM now reduced operations because of worldwide overcapacity
- Many local suppliers now struggling to get enough orders
- Innovation is stifled
- Local economy declined

But.....

- Identified as a major expansion area for next 15 years, over 1M homes needed in area
- 2012 Olympics will bring more development opportunity

Off-Site Manufacture of sustainable dwellings – the opportunity

- OSM inherently more sustainable than traditional construction.
- Skills shortage in traditional construction.
- Higher construction standards mean traditional construction will find it harder / more expensive to meet than OSM.
- OSM limited by construction products optimised for traditional construction methods.
- Many OSM suppliers now entering market, none focus on holistic sustainability.



Off-Site Manufacture of sustainable dwellings – the project



- Engage local manufacturers in sustainable dwelling design.
- Assist companies to develop sustainable products for OSM sector.
- Provide route to market.
- Favour local sourcing.
- Introduce new skills in sustainable design and manufacturing.
- Develop supply chain interoperability.
- Attract inward investment in sustainable technologies and products.
- Transferable model.

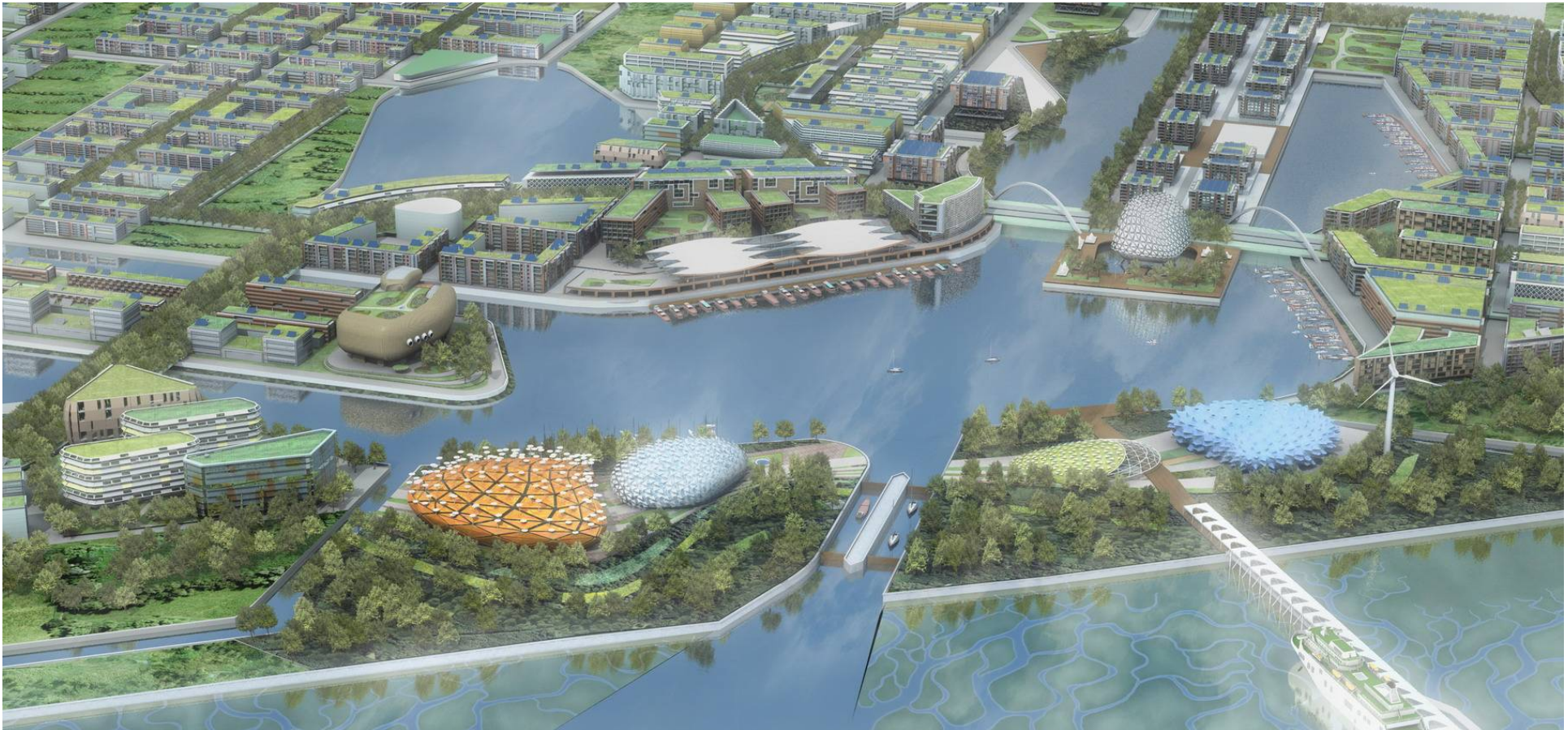
Manufacturing Sustainable Communities - a new paradigm

- Sustainable dwellings
- manufactured locally
- by local labour
- using locally sourced materials, and
- local product innovation,
- configured in sustainable neighbourhoods
- to enhance quality of life and build sustainable communities



Achieving systemic change through effective partnership.

Dongtan Eco City

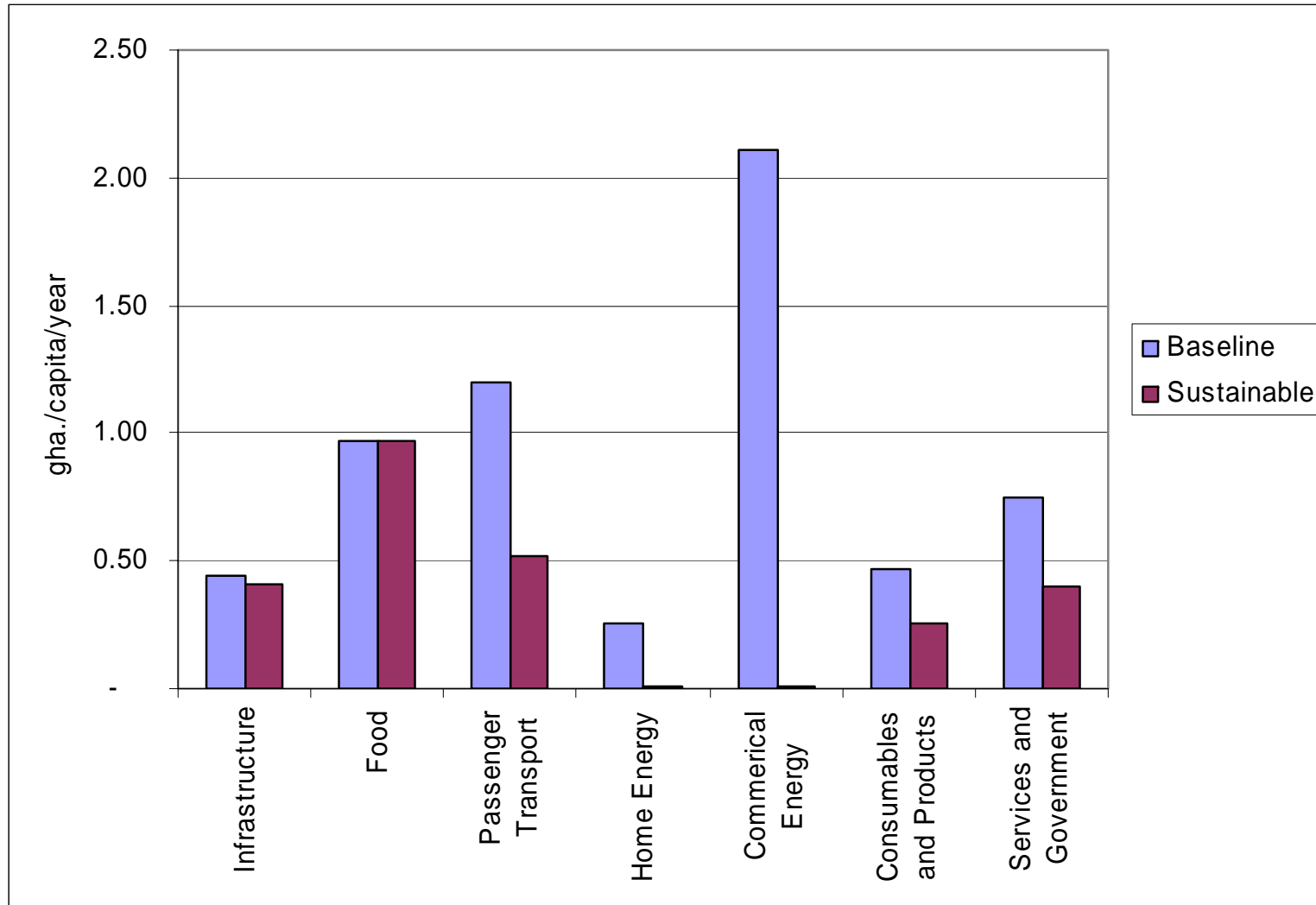


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Dongtan - Summary Comparison Ecological Footprint



Dongtan Energy Strategy



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Energy Production, Use and Emission Reduction

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

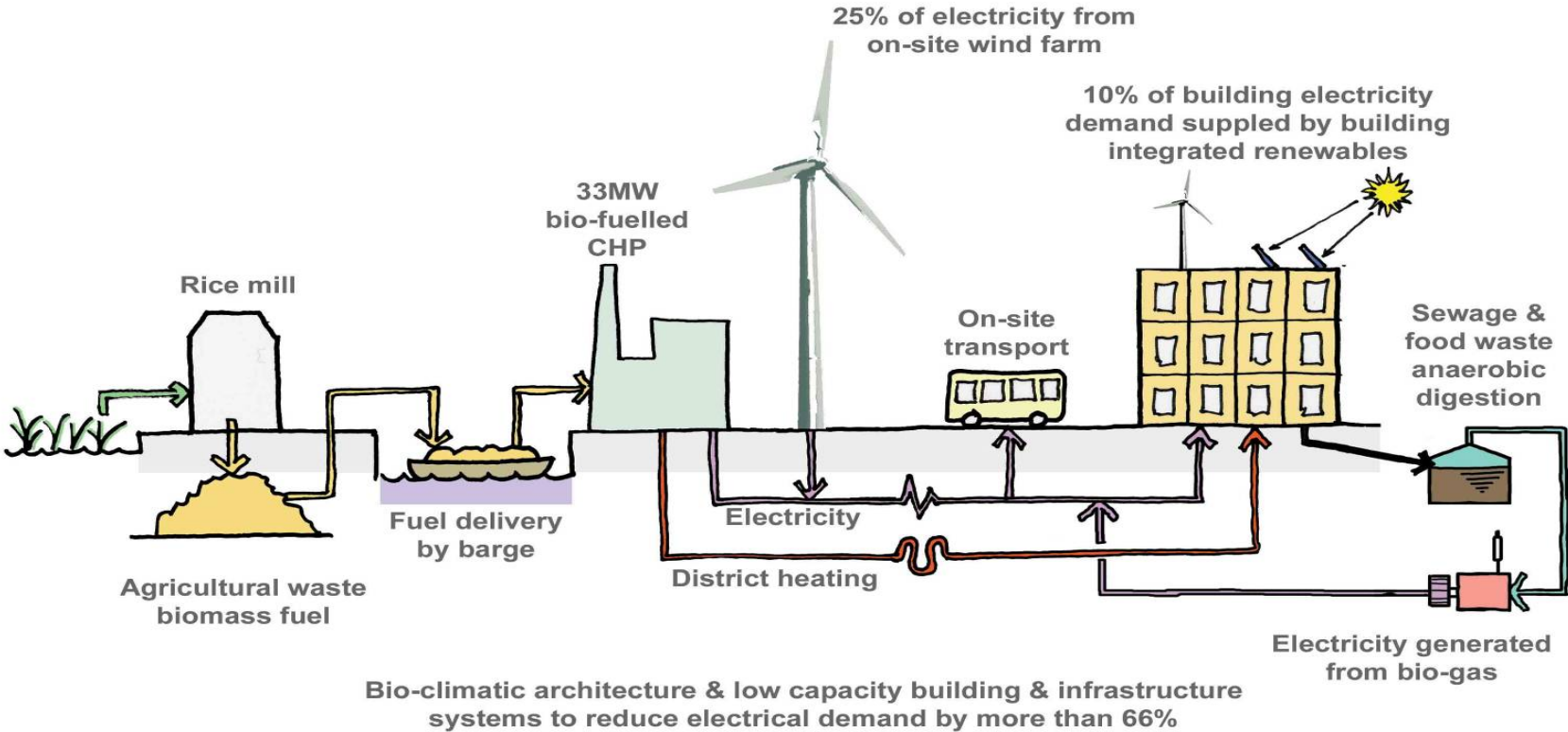
CO₂ Emission of 350,000 tons per year



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Dongtan Energy Centre

SITE WIDE ENERGY STRATEGY



Dongtan Carbon Dioxide Sequestration requirements

- BaU case – 253,000ha - based on fossil CO₂ emissions.
- Sustainable scenario – 4,000 ha - only significant source of fossil CO₂ is from external vehicle transport, assumed conventional.



Sustainable Agriculture - Dongtan

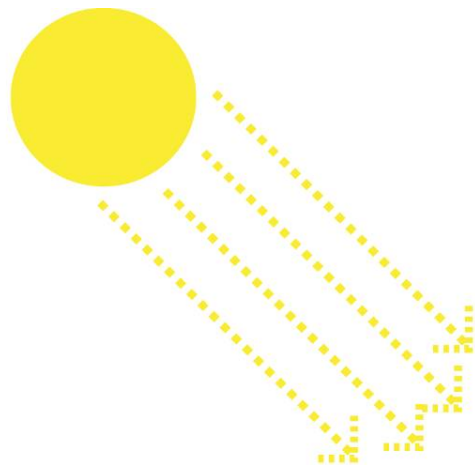
- Dongtan city will reduce land available for agriculture whilst increasing demand for food crops.

- Sustainable Plant Factories (SPFs) increase food production capacity by factor of 130.

- SPFs can use CO₂ from biomass CHP.



Sustainable Plant Factory

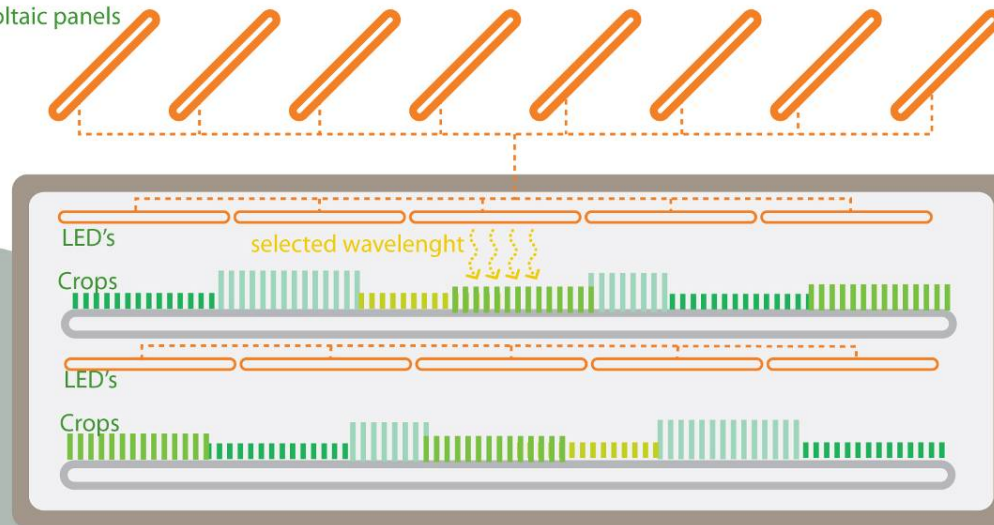


Sustainable Eco-City - 9Ha of city factory, no loss of production

Conventional Approach City - Loss of 1170 ha of productive land

Industrial symbiosis

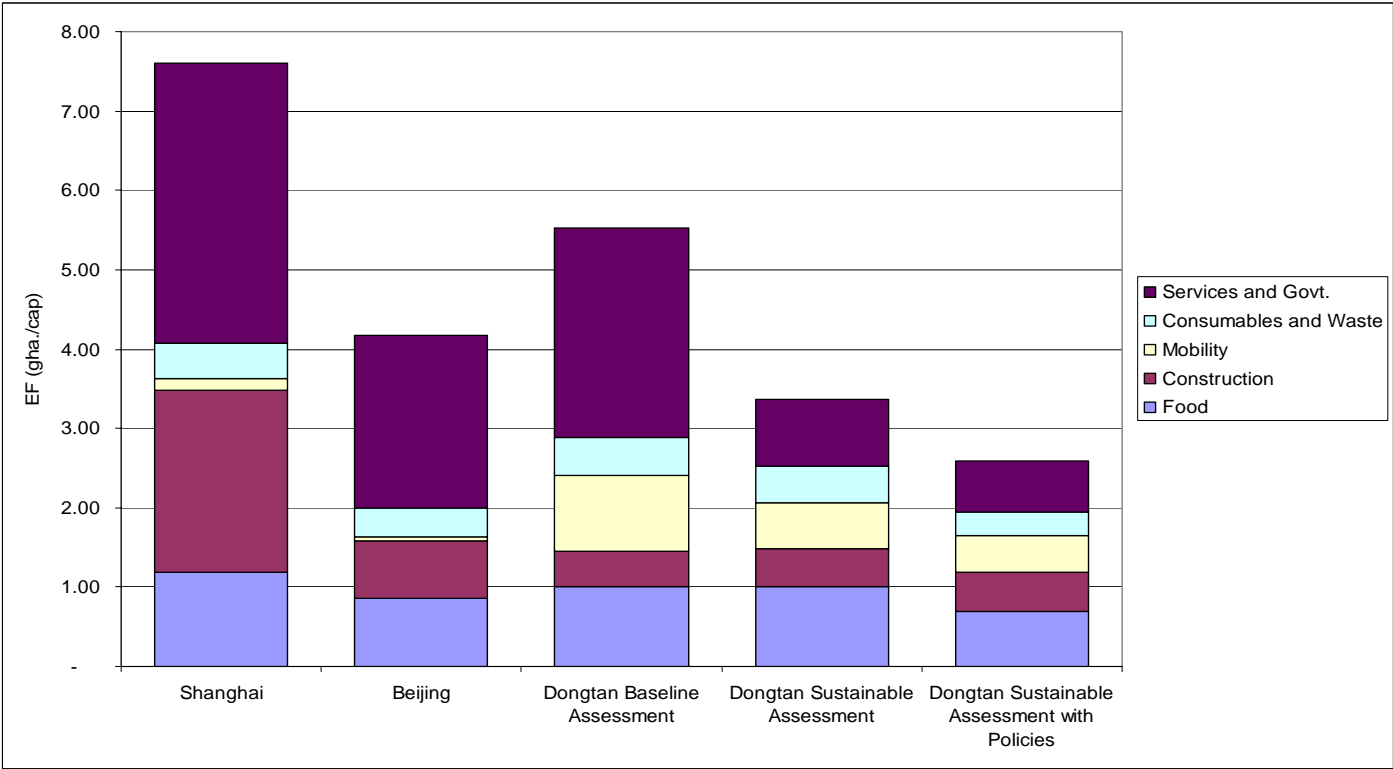
photovoltaic panels



Dongtan achieves lower Ecological Footprint

Eco-City Footprint 2.6 gh/person

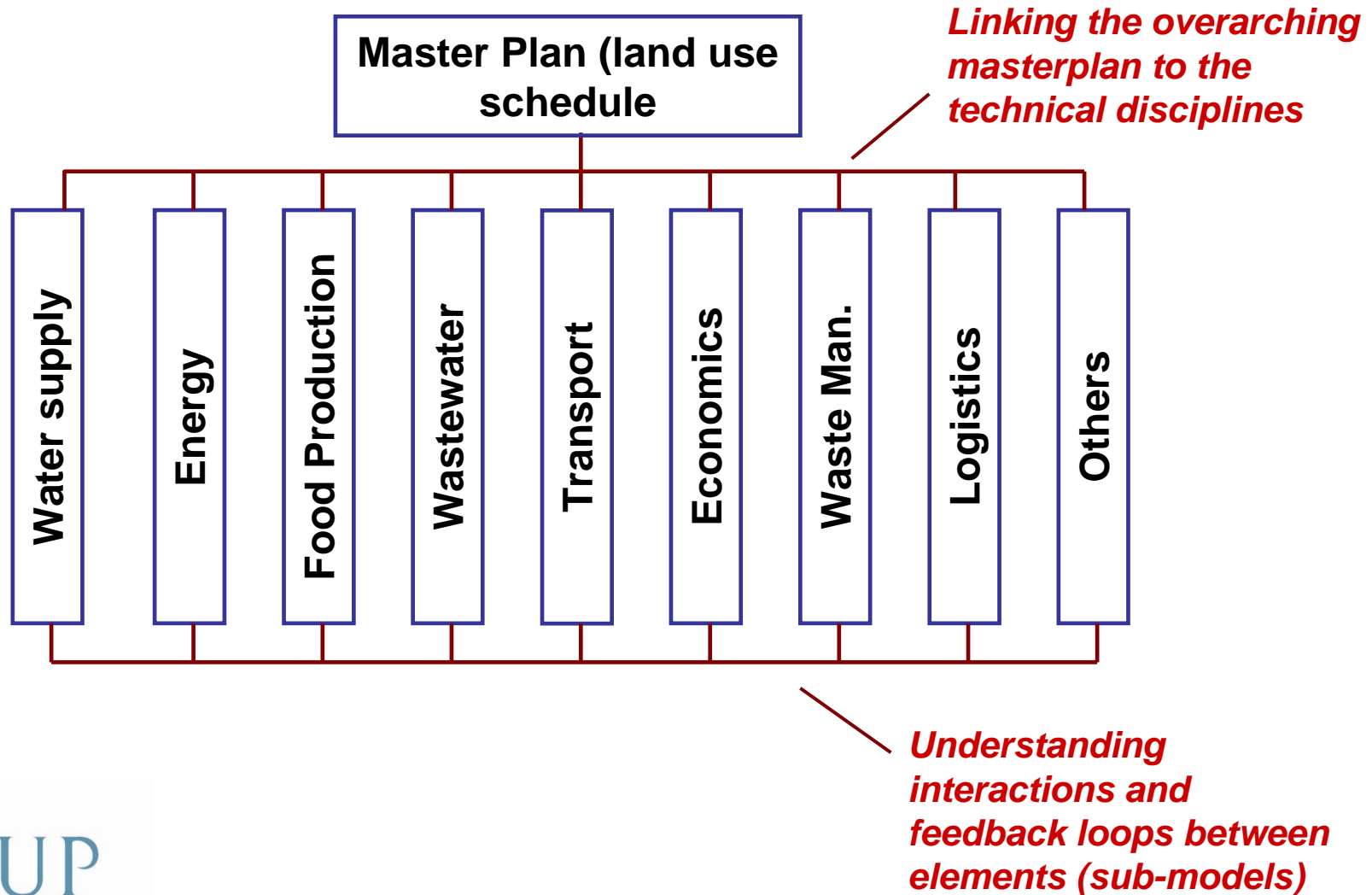
Conventional Approach City Footprint 5.8 gh/person



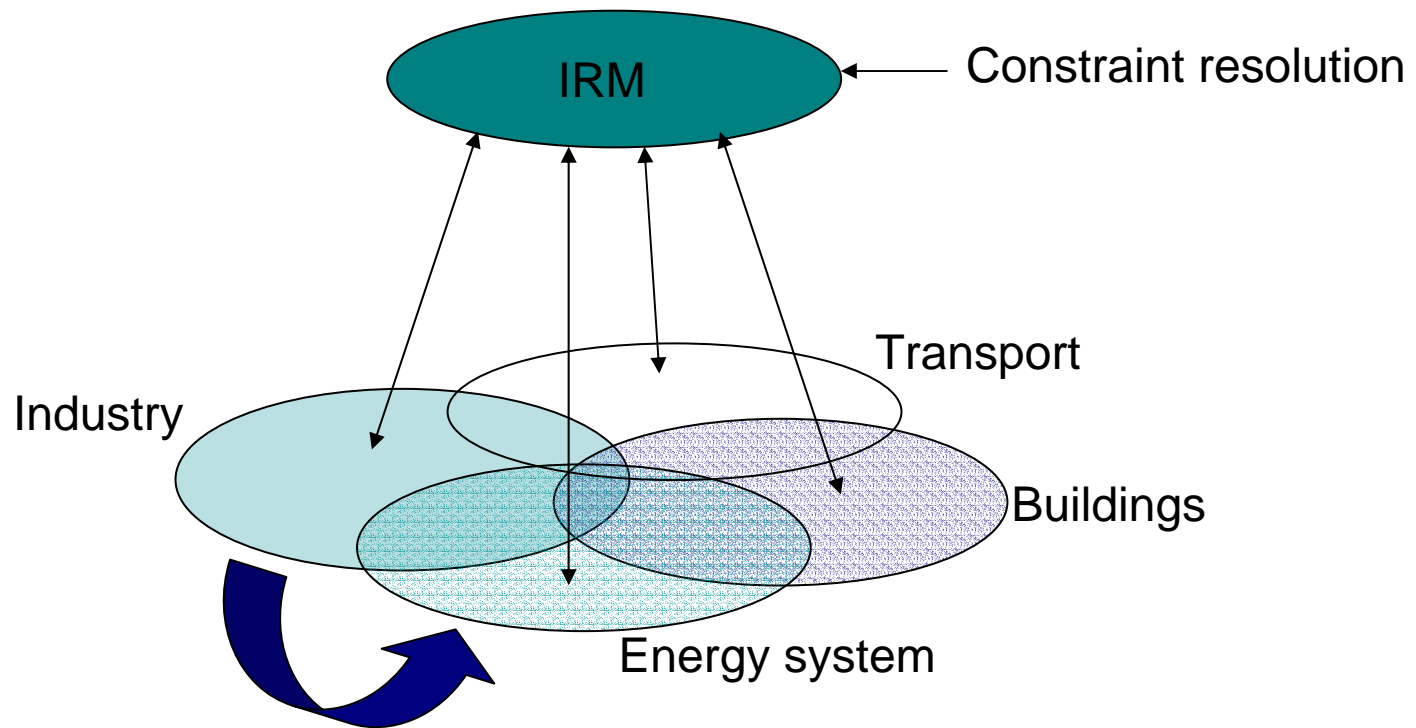
Integrated Resource Modelling



Integrated Resource Management (IRM) model – linking and integrating the different technical strands



Constraint Based Modelling for Sustainable Development



Ecological footprint – 2.6gh/capita down to 1.8gh/capita?



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Adopting Sustainable Systems

- Global standards
- Public Procurement
- Technology and innovation
- Tools and capabilities
- Achieving systemic change through partnership in intervention.



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