The Art and Science of Eco-Development

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China urbanization rate will reach 75% by 2030. Urban population will reach 1000 million by 2030. At least 400 million more people will move to the city in the next 25 years.
Current status
40 billion square meters of construction between now and 2030, spread over 5 million new buildings.
Non-building related construction - RMB 12 trillion (US$1.76 trillion)
Residential construction – RMB 4.255 trillion (US$0.63 trillion)
Non-residential construction – RMB 4 trillion (US$0.59 trillion)
Total building related construction - about 25% of its GDP
Suzhou Industrial Park (SIP)

SIP covers a total jurisdiction area of 288 sq km, among which 80 sq km area belongs to China-Singapore Cooperation Zone.
SIP “Scientific” Master Plan

... in pursuit of a comprehensive, harmonious, and sustainable development

G-to-G agreement signed on February 26, 1994
Planning Concepts and Practices
Think Globally, Act Locally

• Focus on "transformation, optimization, upgrading, and innovation".
• Four action plans:
  – industrial upgrading ( "3 + 5” Industrial Planning)
    • coordinated clustering development of advanced industries
  – technological leap growth (new “Silicon Valley”)
    • Policies, business and financial support to encourage innovation and integration capacities
  – service sector multiple growth
    • realized by replacing energy-consuming industries with highly efficient and advanced industries, optimizing the secondary sectors and promoting the tertiary industry
  – ecological optimization
    • guidelines for comprehensive, harmonious, and sustainable development
• Planning Legislation and Enforcement
  – strict land parcel bidding procedures
  – flexible control of functionally undefined land to improve development efficiency and land use intensity
  – “one-stop” coordinated public bidding, project examination and approval process for all construction projects
  – transparent administration environment

Art and Science of Eco Development

"3+5" Three plus Five Industrial Planning
To upgrade three industries:
- modern service industry
- electronics and IT industry
- mechanical manufacturing industry

To accelerate development of five emerging industries:
- bio-pharmaceutical
- eco-environment protection
- software and animation & game
- unified communication
- nano-photonics & new energy

"9 Utilities and Leveled Land"
- Street lamp
- Traffic monitoring cables
- Telecommunication cable
- Gas
- Water supply
- Sewage
- Rain water
- Power supply
- Industrial gas
- Steam

Fashion city
Some Major Economic Indicators of SIP

- Total Investment (x million US$)
- Gross Domestic Product (x million Yuan)
- Total Employees
- Total Government Revenue (x million Yuan)
- Deposits Balance of Financial Institutions at Yearend And Savings Deposits of Residents (x million Yuan)
- Net Income Per Capita of Farmers (Yuan)
Key Achievements
(over the past 15 years since 1994)

• Annual revenue increased from 30 million Yuan in the beginning, to nearly 10 billion Yuan.
• Gross regional product exceeded 100 billion Yuan, increasing nearly 100 times compared to the early days of exploration.
• Total of more than 100 billion Yuan in tax revenues.
• Utilized foreign funds of nearly US$ 16 billion.
• Registered capital of more than 130 billion Yuan, and created 500,000 job opportunities.
• Average salary of local working population reaches 37,700 Yuan, and the rural per capita net income is 15,000 Yuan, both registering about five times increase over the early period of its development.
• Level of per capita GDP in the SIP is close to that of Singapore (Spore-US$37,300.00) (China average – US$3680.00)
• First integrated free trade zone in the country, which makes SIP an experimental field for new policies on reform and opening-up in China.
• IT technology, integrated circuit, and offshore outsourcing output value accounted for 3%, 17%, and 8.8% of the national total respectively. (2008). Service outsourcing output value and offshore income increased by 35.9% and 108% respectively (from Jan – Aug 2009).
• Added value of service sector accounts for 30% of GDP for the first time (2008) and the proportion keeps increasing at a speed of 2% every year.
• 45% and a total of 33.67 million square meters of green area obtained the ISO14000 certification for environment, and became one of the first National Pilot Ecological Industrial Parks, with several records in terms of total coverage of environmental-protection infrastructure, of green towns and villages, and with the most local enterprises meeting ISO14001 standards.
• Reducing the amount of energy consumption to 0.36 ton of standard coal equivalent per ten thousand Yuan GDP, and the emission of CO₂ and SO₂ to 1/18 and 1/40 of national averages
• Initiated an ecological optimization campaign aimed to build a pilot ecological city district of green lifestyle and sustainable industrial and social growth (2009).
Tianjin Eco-City

It covers an area of 31.23 sq. km (12 sq. miles) with a target population of 350,000
Tianjin Eco-City

Mode of development to be replicable, practicable and scalable
Key Performance Indicators

- Conceptualized based on four Guiding Key Performance Indicators:
  - Healthy Ecological Environment
  - Social Harmony and Progress
  - Vibrant and Efficient Economy,
  - Integrated Regional Coordination

- 22 Quantitative KPI’s

Tianjin Eco City Project - formally commenced on November 18, 2007

A 50:50 joint venture between Singapore Tianjin Eco-City Investment Holdings Pte. Ltd. (STEC) and Tianjin Eco-City Investment and Development Co., Ltd (TECID), signed on July 1, 2008. Initial registered capital RMB 4 billion
Tianjin Eco-City Master Plan

1. Northeast District
   Residential and High Tech Eco Industries

2. Northern District
   Administration, Residential and Cultural Center

3. Eco Core
   Ecological Landscape, Entertainment and Eco Residence

4. Central District
   Downtown, Business Center and Residential

5. Southern District
   Residential and Film Production

DEVELOPING A CITY OF THE FUTURE

SINO-SINGAPORE TIANJIN ECO-CITY

Mr Goh Chye Boon
CEO
Sino-Singapore Tianjin Eco-city
Investment & Development Co. Ltd

Eco-Technology Targets

- 100% potable tap water
- 50% non-traditional resource
- <120L/d per capita
- Meet Grade IV standard

- Research/Engineer
- Service network coverage
- Domestic water use
- Surface water body

Intelligent city
Clean Water
Clean Environment
Green Transport

- Eco-technology
- Green Building
- Green Economy
- Easy accessibility

- Water supply
- Domestic water use
- Surface water body
- Meet Grade IV standard

- Zero loss of natural wetland
- Green space >12m² per capita
- Local plant index >0.7

- Ambient air quality to meet Grade II > 310 d/yr
- Noise pollution 100% meet respective functional area standard

- Domestic waste generation <0.8kg/d
- 100% non-hazardous treatment
- >60% overall recycling rate

- >30% green trips by 2013
- >90% green trips by 2020

- >20% public housing provision
- >20% renewable energy use
- 100% barrier-free accessibility
- Free recreational/sports facilities within walking distance of 500m

Concept of Eco-Cell

An illustration of the Eco-cell
Residential Plot 12a Development
Plot 12 a Sunlight and Daylight Availability Analysis for Tianjin Eco-City GBES Requirements
Plot 12a
CFD Modeling:
Concurrent Outdoor and Indoor Air Flow Analysis
### Velocity and Temperature

<table>
<thead>
<tr>
<th></th>
<th>Velocity (m/s)</th>
<th>Temperature (K)</th>
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<tbody>
<tr>
<td><strong>NW</strong></td>
<td><img src="image1.png" alt="Velocities" /></td>
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<td><img src="image12.png" alt="Temperatures" /></td>
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</table>

**Scenario 1:** All internal doors are opened.

**Scenario 2:** Only the Living Room doors are opened.

*Plot 12a CFD Modeling: Concurrent Outdoor and Indoor Air Flow Analysis*
### Energy Consumption Comparison
(Active vs. Mixed Mode Model)

#### 23-STORY BLOCK – LEVEL 12

**Energy Use Intensity (EUI) Breakdown by End-uses per Occupied Area**

<table>
<thead>
<tr>
<th>End-use</th>
<th>Apartment A (57.4 m²)</th>
<th>Apartment B (69.5 m²)</th>
<th>Apartment C01 (86.8 m²)</th>
<th>Apartment C02 (87.0 m²)</th>
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</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>30.3</td>
<td>28.8</td>
<td>46.5</td>
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<tr>
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<td>50.4</td>
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<tr>
<td>Lighting</td>
<td>12.4</td>
<td>12.8</td>
<td>13.2</td>
<td>13.2</td>
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<tr>
<td>Domestic Appliances</td>
<td>15.7</td>
<td>14.7</td>
<td>14.6</td>
<td>14.7</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>7.8</td>
<td>7.8</td>
<td>15.7</td>
<td>8.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>110.4</strong></td>
<td><strong>114.5</strong></td>
<td><strong>117.8</strong></td>
<td><strong>117.7</strong></td>
</tr>
<tr>
<td><strong>EUI of Level 12 BASECASE</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>115.6</strong></td>
</tr>
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#### MIX-MODE MODEL
When outside temperature is between 15 and 22 °C, wind speed < 5 m/s, window is open.

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<tr>
<td>Fan</td>
<td>4.3</td>
<td>2.3</td>
<td>3.2</td>
<td>2.9</td>
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<tr>
<td>Lighting</td>
<td>12.4</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>53.3</strong></td>
<td><strong>65.6</strong></td>
<td><strong>75.8</strong></td>
<td><strong>66.6</strong></td>
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<tr>
<td><strong>Energy Saving (%)</strong></td>
<td><strong>51.70</strong></td>
<td><strong>42.70</strong></td>
<td><strong>35.63</strong></td>
<td><strong>43.44</strong></td>
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Sichuan Earthquake Disaster Region
Green School Design Guide

May 12, 2008
Eco-City Development

“Perfecting” China’s Planning Regulations
Our future.... the next generation
Thank you

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