SMART ENVIRONMENT PROTECTION PROMOTES DEVELOPMENT OF SMART CITY

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The Environment Challenges the City Faced Today

Part 1

- Population
- Resources
- Air quality
- Energy
- Transportation

- Waste treatment
- Security issue
- Global warming
People live in cities

The percent of the population living in urban areas is projected to rise rapidly in the less developed regions—Asia, Africa, and Latin America.

The increase speed of population growth in 21st century is as the growth of bacteria not primate. (Edward O. Wilson)

Population Growth as Bacteria not Primate (year/billion)

- **World**
  - 1800: 1
  - 1900: 1.6
  - 2000: 6
  - 2050: 7.3-10.44

- **China**
  - 1950: 0.45
  - 1970: 0.7
  - 2000: 1.2
  - 2030: 1.6

1 million of world population have been increased every week, more than half of them lived in city till 2010.
The different scale of the urban environmental problems

<table>
<thead>
<tr>
<th>问题</th>
<th>地区/国家</th>
<th>城市</th>
<th>社区</th>
<th>家庭</th>
<th>低</th>
<th>自然灾害</th>
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<tr>
<td>水污染</td>
<td>Water pollution</td>
<td>年轮丢失</td>
<td>Loss of habitat, biodiversity and species diversity</td>
<td>交通拥堵</td>
<td>Traffic congestion</td>
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<td>土壤侵蚀</td>
<td>Soil erosion</td>
<td>河流泛滥</td>
<td>Flooded land</td>
<td>建筑物和历史建筑</td>
<td>Loss of buildings and historical buildings</td>
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<td>Soil</td>
<td>水污染</td>
<td>Water pollution</td>
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<td>Wastes and toxic substances</td>
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<td>交通拥堵</td>
<td>Traffic congestion</td>
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<td>Loss of agricultural land and productivity</td>
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<td>环境变化</td>
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Edward C. Wilson
Senior Biologist, Harvard University

We need another 4 earths like ours. If the consumption level of each person in the world enjoys the same with that of America under present scientific and technological level.
What is a smart city?

A city can be defined as ‘smart’ when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory governance.
A smart city should be identified by six dimensions

The smart cities of tomorrow

The smart city of tomorrow...

“Safe, Humane & Sustainable”
Smart City is an extension of the digital city. It is a comprehensive reflection of smart transportation, smart environment protection, smart water conservation, smart city management etc. The construction will be developed by hardware infrastructure, software facilities and public services. Internet of things technology, cloud computing technology, big data, 3S technology are the core technology of smart city construction!
Internet of things changes how we live

Any TIME Connection
- On the move
- Outdoors and indoors
  - Night
  - Daytime
- At the PC

Any PLACE Connection
- Between PCs
  - Human-to-Human (H2H), not using a PC
  - Human-to-Thing (H2T), using generic equipment
  - Thing-to-Thing (T2T)

Any THING Connection

Smart traffic and services & monitoring
Health & Elderly Care

Example on services

Hospital
- Video conference
- Transmission of data at home visit
- Supervision of analysis equipment

Care Center
- Video conference with visiting nurse
- Patient journal over TV
- Sensor measurements

Relatives
- Voice controlled picture phone using TV
- Safety alarm

Home Service
- Information on TV about planned visits
- Medicine reminder
- Alarm monitoring

Waste as a source of energy

Gavle City has brought down the level of deposit garbage to 3%

97% is reused or turned into energy!
The Benefits of Smart City

• **Sustainability**
  – Environment (carbon footprint)
  – Reduce waste

• **Economic development**
  – Attractive to people
  – Attractive to Investment
  – Attractive to Businesses
  – Increase per capita GDP
  – Drive economic diversity

Part 3

Smart Cities in China
Urban construction and how industry development are closely connected with competitiveness and development potential in the future of China which highly pay attention to the development of smart city, following cities are listed in the national planning program of "12.5" on smart city.

- Beijing
- Shanghai
- Tianjin
- Guangzhou
- Shenzhen
- Nanjing
- Wuhan
- Suzhou
- Ningbo

Beijing, to be a world-class city

**Digital Beijing**

"Digital Beijing" proposed in 1999 have been finished. "Smart Beijing" will be next stage of target.

**Outlines**

Beijing platform of action on Smart Beijing will be released soon, including intelligent transportation, remote medical treatment, EMR, e-commerce and other 50 programme.

**HS Internet**

Till the end of 2012, the internet bandwidth of family user in Beijing will be over 20 MB.

**World-class city**

Beijing will be the leading role in the information field at that time.

**Internet of Things**

WiFi will be covered Beijing rural and urban district in 2015, internet of things will be integratively set up.
Shanghai, to be the ICON

During “12.5”, the framework of “smart city” will be formed in Shanghai, which explicit four main points of focus:

- Energy level elevating on information infrastructure.
  Shanghai will put forth effort on “MONET” to expand network bandwidth and access capability for expanding whole city coverage, developing 3G, WIFI and others, motivating RD and application on cloud computing, internet of things and accelerating the progress on infrastructures integration.

- Widely application on information technology

- The innovation and industrialization of information technology

- The development environment on industrialization

Wuxi—Deeply build up internet of things

01 widely application on internet of things in Wuxi is a practice for intelligent city development, in the future 5-10 years, Wuxi will promote regional centralized international city, pave a path for new model city.

02 Specially pay attention to the trends and development of world intelligent city based on the evolutionary break on the technology of city development.

03 Fully utilized the opportunities on building new demonstration plot for Sensing china center, promoting the advantages on RD application of internet of things, entering the first bitch of perception city in the nation and world wide.
Part 4

Smart Environment Protection Promotes the Smart Cities

Smart Environment Protection Framework
“Smart Environment Protection” promotes the construction of “Smart City”

- Improve the perception ability of environment information
- Improve the efficiency and management level of environmental protection
- Provide a quantitative basis for macro decision
- Improve the public service level of environmental information

Smart City Air Haze Monitoring and Control System

Pollutant sources detection

Big data analysis

Justification modelling

Result assessment
Improve the perception ability of environment information

“Ground” — ground monitoring

“Space” — remote sensing monitoring

Satellite Remote Sensing

Satellite image collection

“Air”
unmanned air vehicle (UAV)

“Central Shandong May 1, 2012 AOD”

“Central Shandong May 1, 2012 PM10”

Establish remote sensing monitoring

Model inversion

GIS analysis

Thematic map making
In Jan. 2013 and Feb. 2014, the monthly averaged PM$_{2.5}$ are 173 ± 139 and 153 ± 124 μgm$^{-3}$ respectively, it decreased 11% in Feb. 2014 compare with that in Jan. 2013.
Exhaust gas online monitoring
Environmental emergency monitoring system

Radiation source monitoring
Drinking water dynamic supervision system

Improve the ground monitoring system

Environmental Data Center Analysis System
Spatial Data Sharing Service Platform

Environmental Monitoring Data Center System
2D and 3D Environmental GIS

Improve the efficiency and management level of environmental protection
Provide a quantitative basis for macro decision

- Air Quality Synthetic Decision Support
- Water Environment Synthetic Decision Support
- Ecological Environment Synthetic Decision Support
- Total Emission Reduction Synthetic Decision Support
- Environmental Monitoring Synthetic Decision Support

Environmental Synthetic Decision Support System

Air Quality Synthetic Decision Support

Provide a quantitative basis for regional joint prevention and control. Comprehensive understanding of the air quality status. Improve environmental early warning capability.

- Pollution Weather Condition Index Forecast System
- Air Backward Trajectory Simulation and Analysis System
- Multi-mode Air Quality Forecast System
Provide a quantitative basis for macro decision

Multi-model air quality forecasting system

---Realize the forecasting and warning of conditions of regional air pollution, achieving daily business running of regional air quality monitoring and forecasting at the same time.

Guangzhou Asian Games project

We predict the air factor like PM10 by NAQPMS-MODE, CMAQ-MODE and CAMx-MODE and we get predictive value (e.g., PM10) by integrating the three models.

Beijing Changping—Grid based Air Quality Monitoring System

- Data center
- Real time monitoring
- Sensors distribution
- Grid system
Water Environment integrated decision support

Use water model to provide comprehensive analysis for regional water quality monitoring, the eutrophication, water quality comprehensive toxicity warning, agricultural water source pollution, etc.

Jinjiang Quanzhou digital watershed (distributed hydrological model)
South-to-North water diversion middle route project
Water quality monitoring and warning key technology research and demonstration

Hongfeng Lake Basin, Guiyang - Water Program Classification and protection of drinking water sources
Water pollution of Danjiangkou Reservoir
Baiyangdian Lake-water program

Environmental Law Enforcement System

Design concept — “integration” design
Design concept — three level network
**Environmental Law Enforcement System**

**Functions:**
- Air quality and Green Commuting
- PM2.5, PM10
  - Interaction of Green Tips
  - Advice and Share of Commuting
  - City Rankings
- Historical trends

**Features:**
- Base on multi-model to forecast Air quality in the next 5 days,
- Push Weather warning information
- Refined air quality data based on the location,
- Air Quality Review (Interactive),
- Noise data.

**Improve the public service level of environmental information**

**WEIBAO-APP—A Public Mobil Product for Environmental Information Services**
Conclusions

◆ To truly move towards a new era of smart city, the construction of the smart environmental protection system must be strengthened;

◆ The smart environmental protection system is built based on comprehensively use of a new generation of intelligent data perception, transmission and application services technology, such as Internet of things, cloud computing, big data, environmental modelling and GIS;

◆ The smart environmental protection will build up the new service model with rapid, accurate, real production, transmission of the corresponding environmental protection data or solutions.

◆ Building smart environmental protection system is an important part of the smart city construction with a great significance.

Thank You

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