

The Third Session of Technical Committee of UNAPCAEM

**Engineering Technologies for
Sustainable Agriculture and
Rural Development in China**

Presented

by

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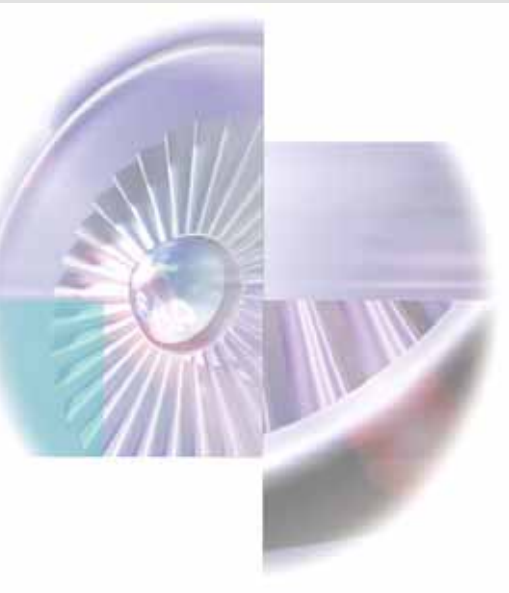
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Summary



1. Introduction

1-1. The UN Millennium Development Goals are closely Related to Agricultural & Rural Development:

- Eradicate extremely poverty (Goal 1)
- Ensure child primary education (Goal 2、 3)
- Reduce child & maternal mortality, improve health and combat disease (Goal 4-6)
- Ensure environmental sustainability (Goal 7)
- Development global partnership for development (Goal 8)

To Solve Agricultural, Rural & Farmers' Problems in DCs is a Crucial Challenge to Realize the Goals!

1-2. United Nations Framework Convention on Climate Change (May 22, 1992) and Tokyo Protocol (Dec.10, 1997) point out to face:

- ***Challenge of Global Climate Change, Control Greenhouse Gas Emission, Promoting CDM, Protection of Human livelihood Environment.***
- ***Rural Waste Treatment, Paddy Production, Cultivated Soil Management, Straw burning were listed in the Protocol.***

The solutions are required for improving farmers' income, technologies extension, education, etc.

Also as an important professional responsibility for Agricultural & Biological Engineers (ABE) ! ⁴

1-3. ABE as a Productive Profession

- *Civilization flourishes only when it can provide more food than the farmers' needs;*
- *The innovations of agricultural and biological engineers have increased productivity and slashed agricultural man-hours;*
- *The time and talents of millions shifted from agricultural tasks to other endeavors that have advanced society in enormous and innumerable ways;*
- *Challenges continue to emerge, as population grows and our understanding of the natural world deepens.*

Agricultural and Biological Engineers Lead the Way in Ensuring the Necessities of the Mankind.

1-4. Expanding Role of Agriculture

- **Food** not only for survival, but also for health
- **Fiber** not only for clothing, but also for fashion
- **Feed** not only for meat, but also for pets
- **Fuel** not only for energy, but also for climate & Environment.

6 functions identified in China's practice for Development of Modern Agriculture:

- ★ Food Guarantee;
- ★ Employment and income increase;
- ★ Sightseeing and Amenity;
- ★ Raw material supply;
- ★ Ecology Protection;
- ★ Culture Inheritance.

1-5. But ... Expanding Challenges

Soil: Exhaustion, erosion & salinization;

Water: Availability & quality;

Air: Pollution;

Labor: Availability - cost – quality;

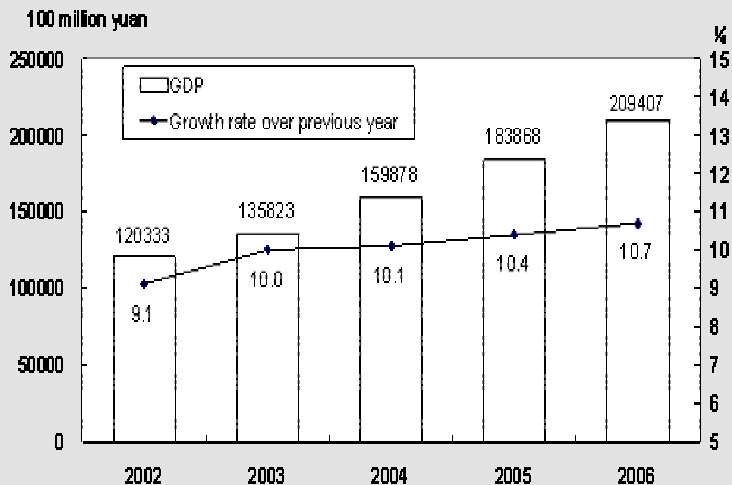
External Demands: Consumers -
Regulators – Retailers.

2. APPLICATION OF SCIENTIFIC OUTLOOK ON DEVELOPMENT

2-1. Steady Development of China's Socio-Economy

The annual average GDP increase in the past 29 years was 9.26 %.

GDP has been with double-digit growth rates since 2003



GDP per capita :

*2000 - 950 USD; 2002- 1132 USD;
2006 - 2012 USD*

China has become a moderate country in term of income per capita from 2006.

China's GDP per capita ranks No.129 in the world and it is still as a DC.

2-2. Thorough Application of Scientific Outlook on Development

- *Renovating development pattern, raising development quality & efficiency to pursue resources-conservation, clean and safety development for sustainability;*
- *Abandoning priority for growth and realizing better & faster development, pursuing social equity and building harmonious society;*
- *Stressing on taking rural development problems as the first important issue in the total socio-economic development;*
- *“Balancing urban & rural economic-social development, building modern agriculture, flourishing rural economy, increasing farmer’s income”.*

2-3. Develop Modern Agriculture and Building New Countryside

- *The top issue for developing modern agriculture is to improve agricultural productive forces*
- *The key approaches are to equip agriculture with modern material condition and to reconstruct agricultural S & T*
- *To Increase:*
 - ◆ *Field Water Conservancy, Mechanization and ICT Application Level;*
 - ◆ *Land Productivity, Resources Utilization Efficiency and Labor Productivity;*
 - ◆ *Agricultural Quality, Efficiency & Competitive Capability.*

***An Urgent Need to Promote
Agricultural Engineering
Technological Innovation
in the New Stage !***

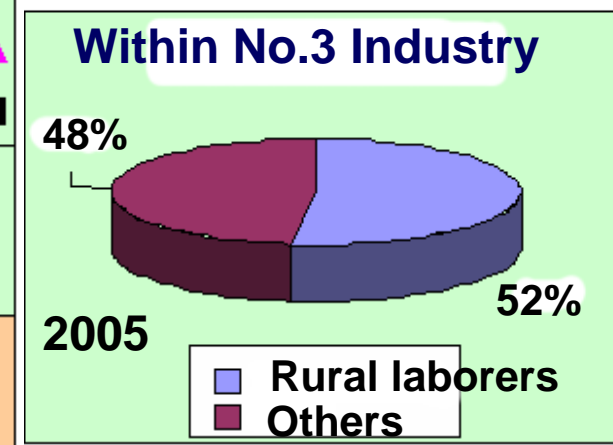
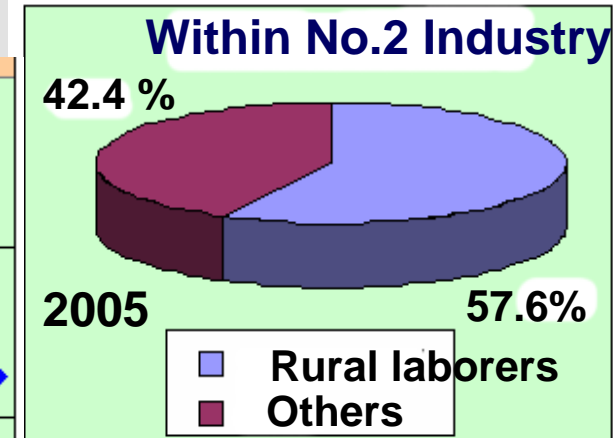
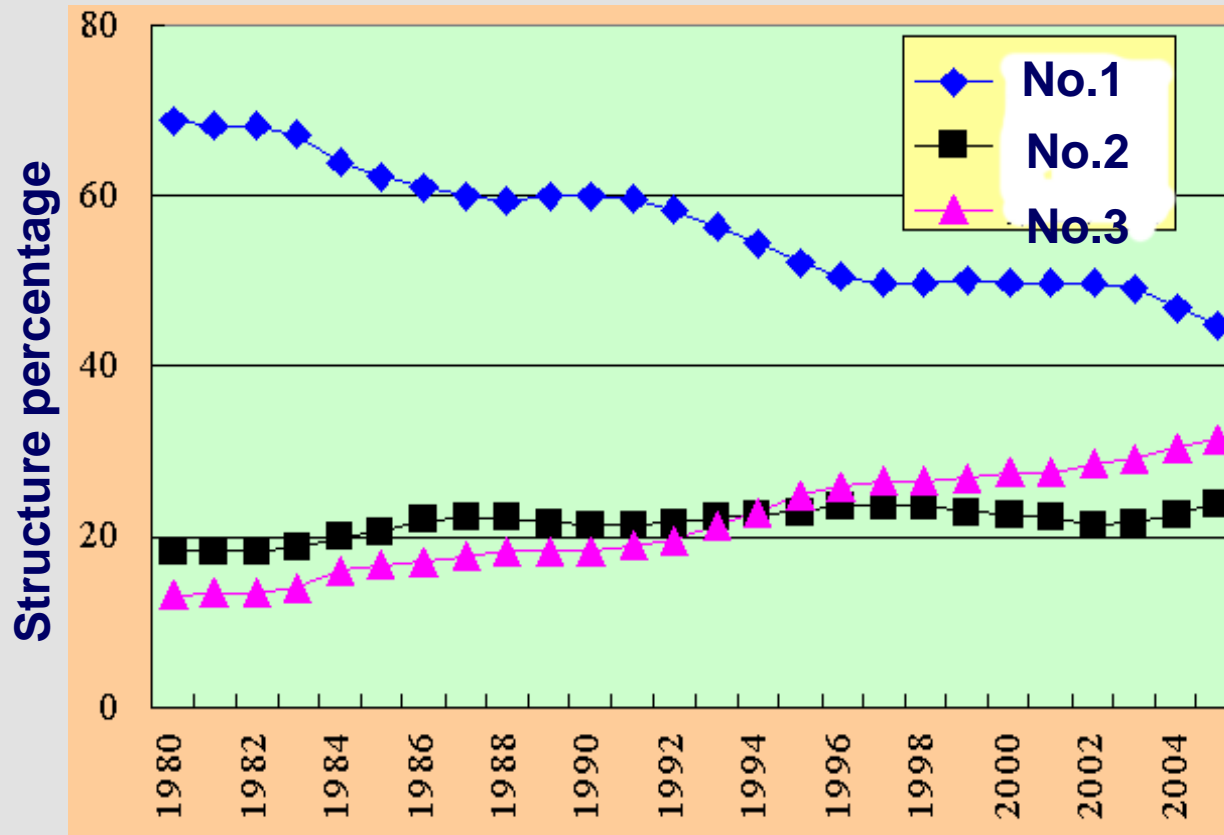
3. THE ROLE OF AGRI. ENG. IN SUSTAINABLE AGRICULTURE

3-1. Speeding up Agricultural Mechanization Development

- **Agricultural mechanization is still an essential component of agricultural engineering in China and in the most DCs.**
- **To speed up national industrialization & urbanization requires a large number of rural labor force to shift into other industries.**

■ The rural laborers become a principal force to promote national industrialization & modernization

Total employments by 3 types' industries



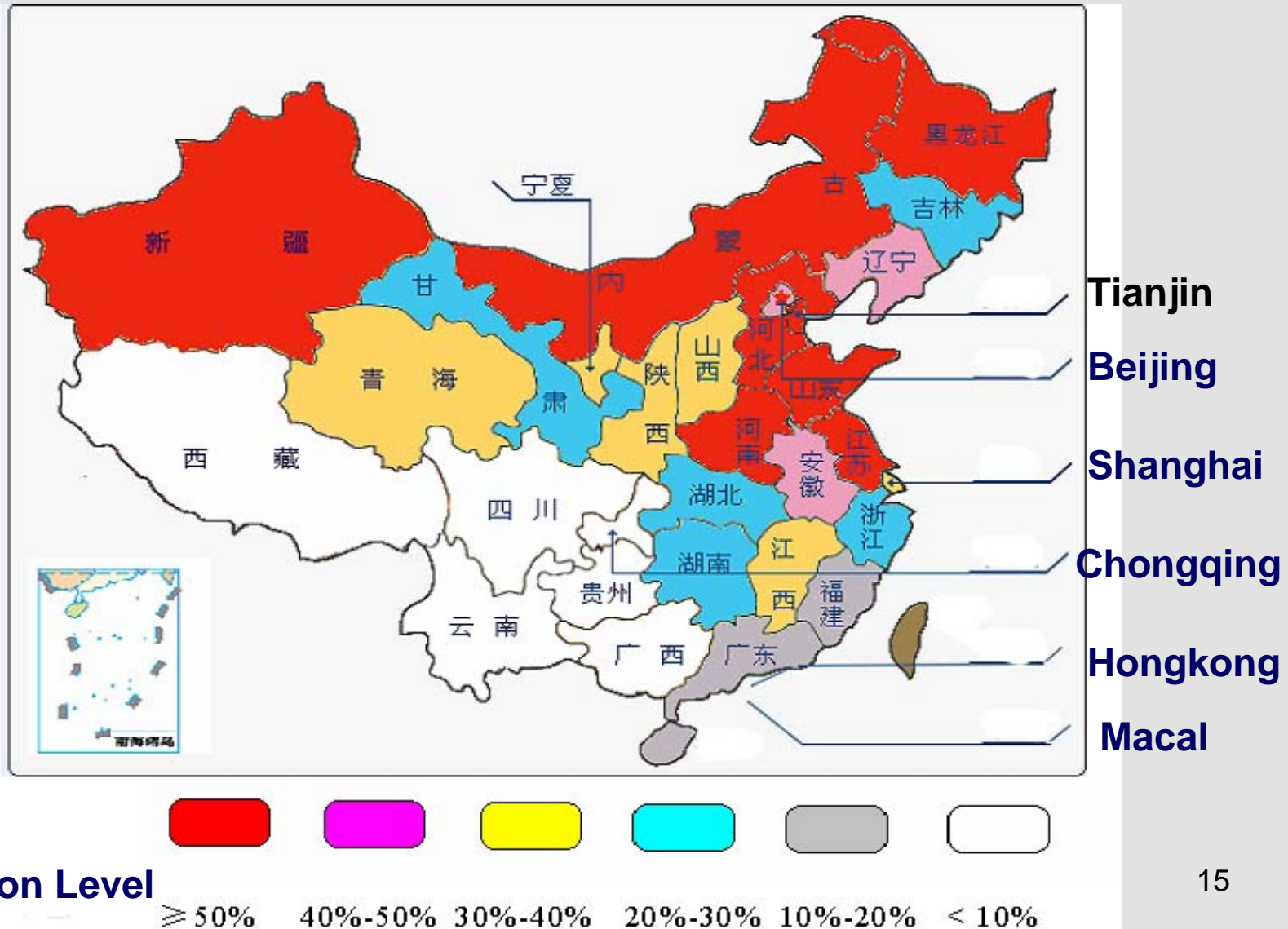
60-80 % rural youth with ages less than 35 are shifting into cities.

“Intelligent youth to originate new business, younger, stronger laborers to find suitable job in city, the old, weak & women remain in farming”

■ The Recent Status of Agricultural Mechanization in China

- ◆ The Agricultural Mechanization will enter into second development stage by the end of 2007, it featured with:
 - *Tillage, sowing & harvesting mechanization: > 40%*
 - *Farming labor forces reduce to less than 40 % of national total.*
- ◆ Fast advances of mechanization for key cereal crops, facility horticulture, intensive livestock & aquatic farming, post harvest processing
- ◆ Agricultural Mechanization social or contract service systems are fast developing. The capacity of governmental AM department for public services has been much enhanced

Recent Regional Development of Agricultural Mechanization in China

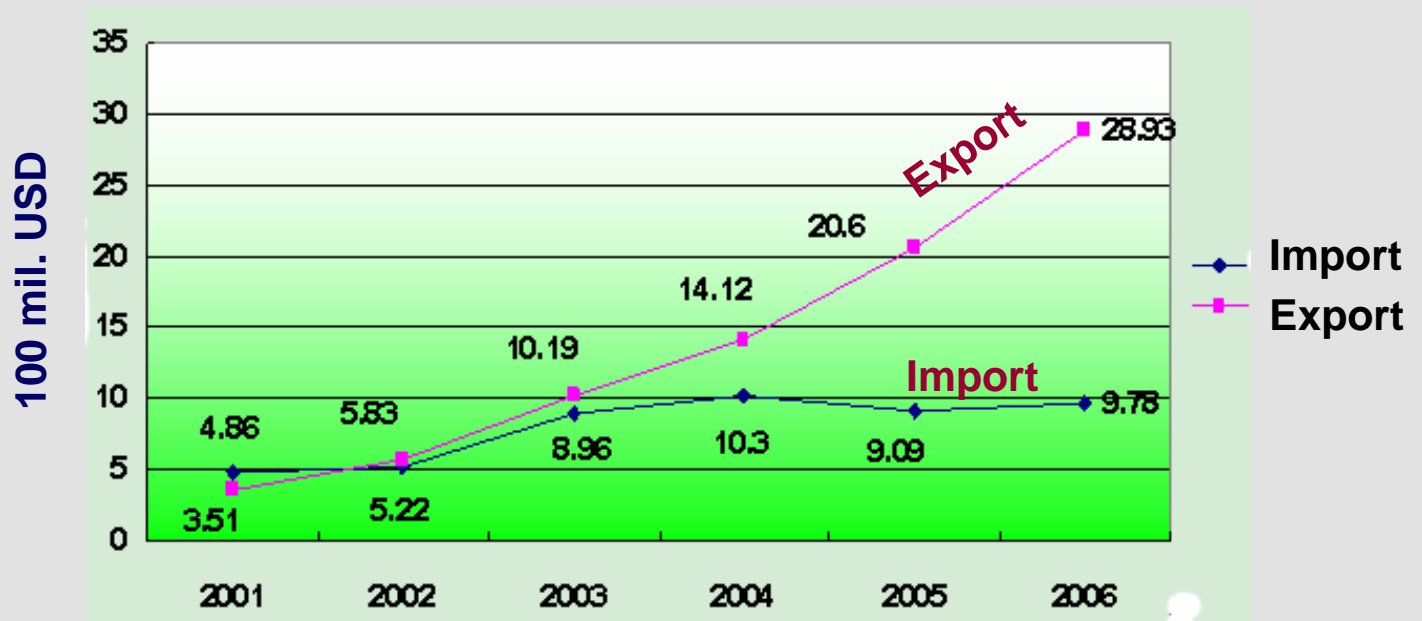


■ Fast Development of Agricultural Machinery Industry

- ◆ The Annual increase rate of agricultural equipment industries has been over 20% since 2002. It was 23.41 % increase in 2006
- ◆ The production index in 2006 :
 - Total production value: 17 bil. USD ;
 - Large-medium tractors: 0.2073 mil. sets
 - Small sized tractors: 1.915 mil. sets
 - Combine harvesters: 0.1375 mil.sets
- ◆ Over 8000 farm machinery industries with 1735 scale enterprises.

Importation & Exportation of Agricultural Machinery

- ◆ Import from **66 countries and regions** with total value of **978 million USD** in **2006** (engines and irrigation equipment not included)
- ◆ Export to **204 countries** with total value of **28.93 million USD** (engines and irrigation equipment not included)

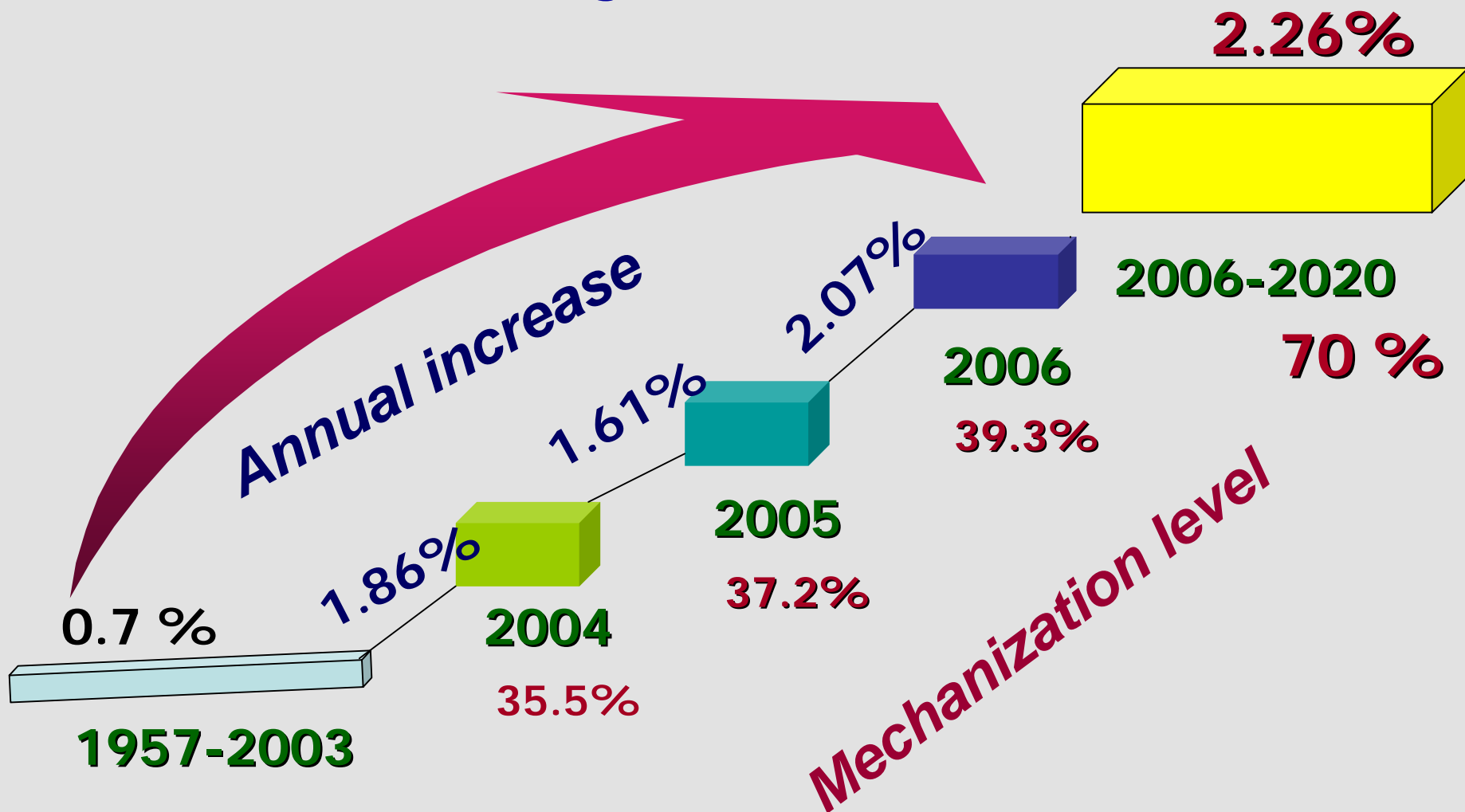


The trend of importation & Exportation value (engines and irrigation equipment not included)

■ Features of the New Development

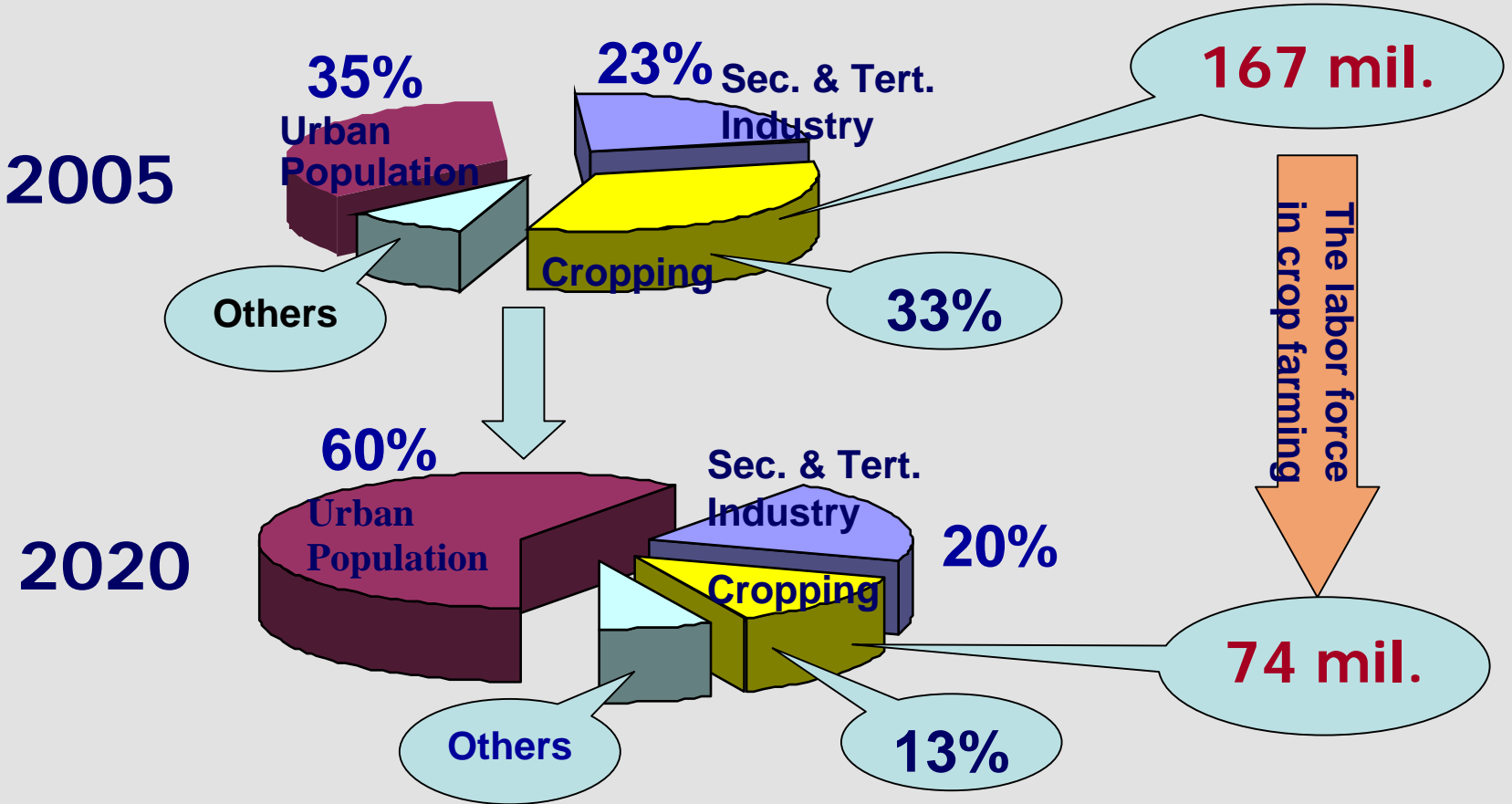
- ◆ *Farmers need machinery;*
- ◆ *AM Products should be introduced;*
- ◆ *Technology innovation is urgent need;*
- ◆ *Experiences should be communicated;*
- ◆ *National enterprises want to go abroad;*
- ◆ *Foreign ones yearning for coming to
China*

- Target of the general mechanization level in 2020: **70%** in tillage, planting, and harvesting



■ To enlarge average farming scale per laborer is needed

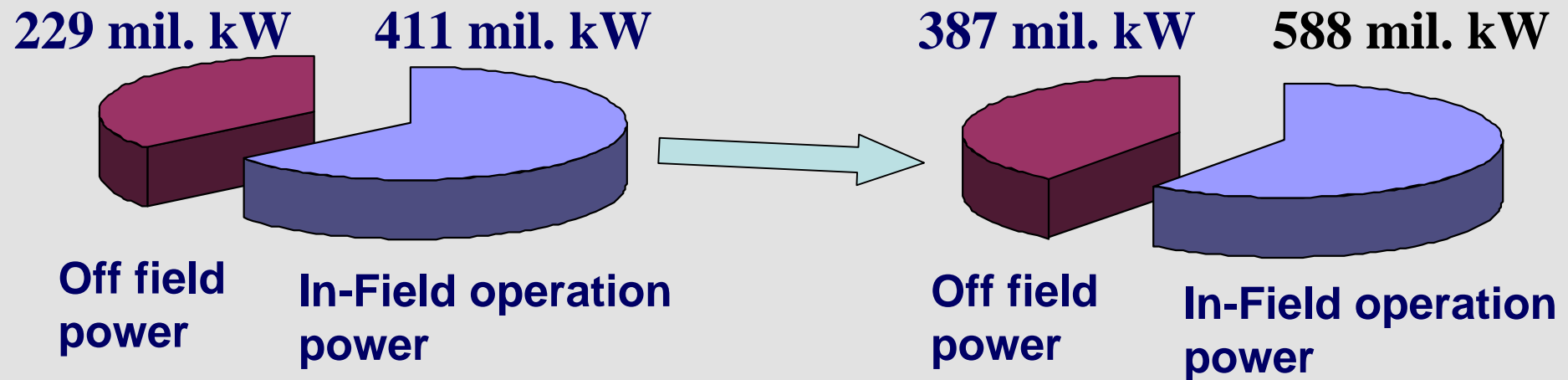
	Total cultivated areas	Laborers in crop farming	Average farming areas per laborer
2005	122 million ha	167 million	0.73 ha / laborer
2020	120 million ha	74 million	1.62 ha / laborer



- **Control the total farm power within 1 billion kW in 2020**

2005 (640 million kW)

2020(975 million kW)



Large-Scale farming practice in China



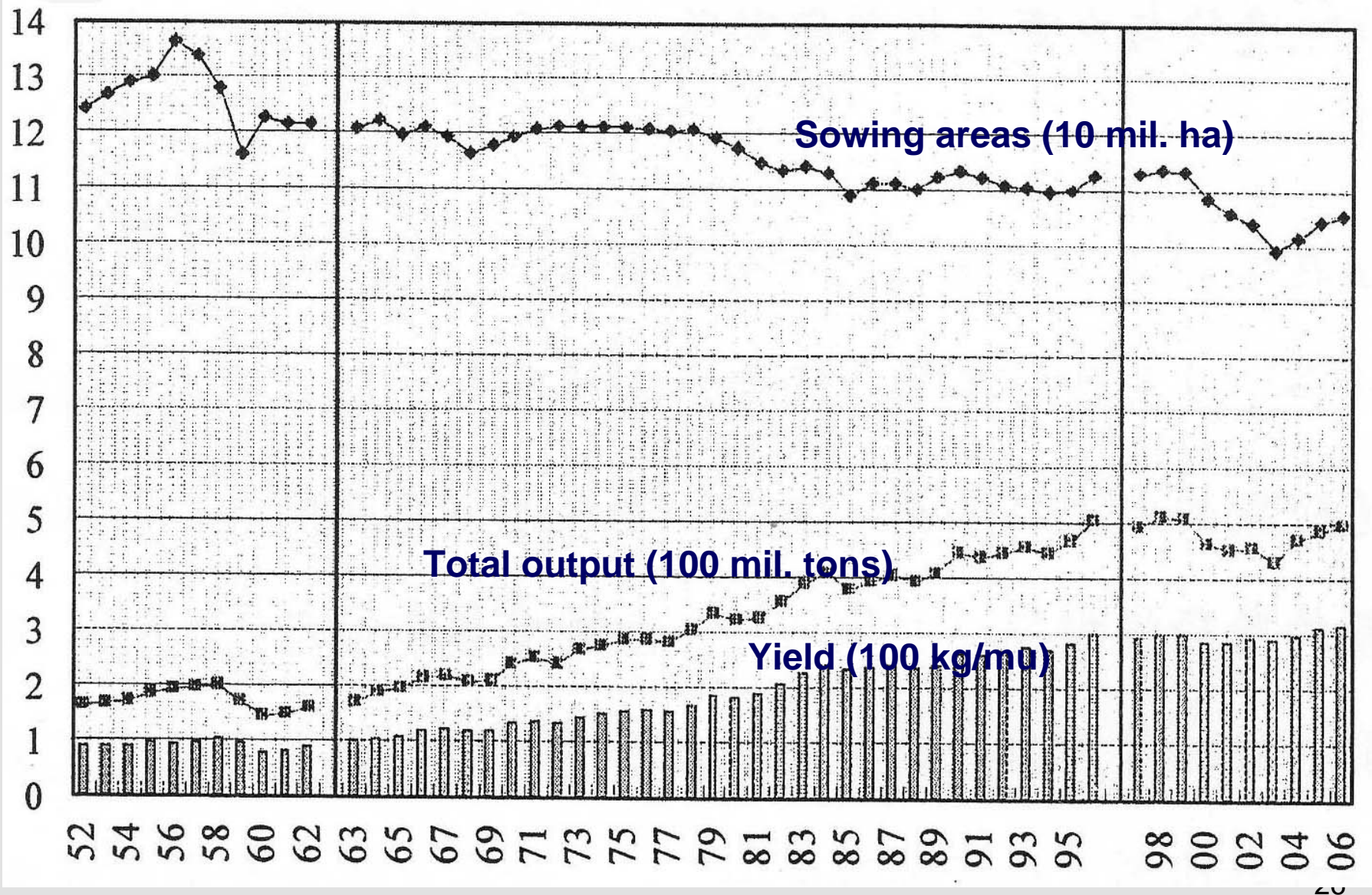


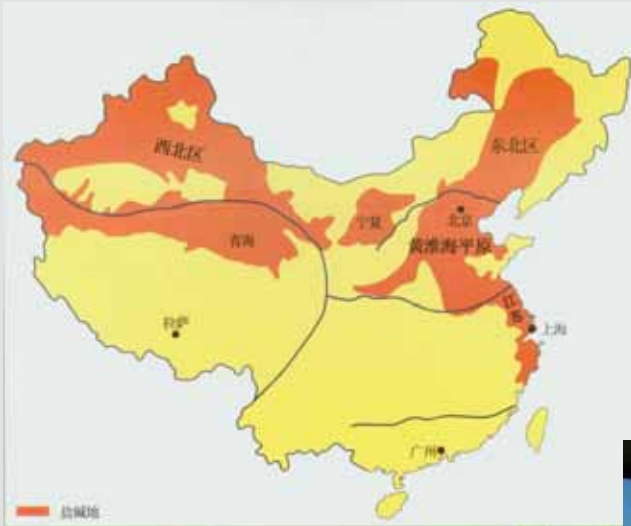


3-2. Land and water engineering technology innovation

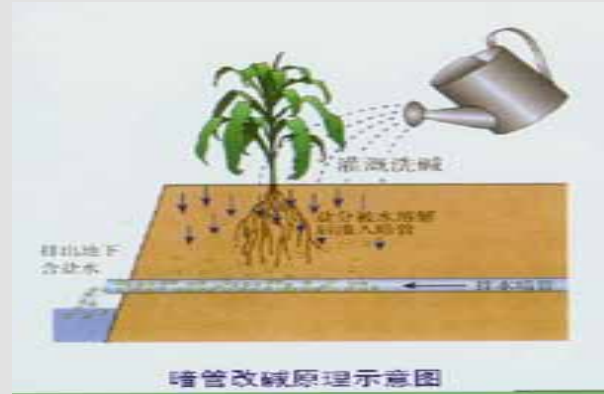
- **The farmland reduction was by 7.87 mil. ha (6.46 % of total) between 1998-2006**
- **A strictest farmland regulation has been effective that the available farmland should be strictly not be less than 120 mil. ha.**
- **Construction of fundamental farmland with improved quality, productivity and appropriate intensive farming requires a series of technological innovation.**
- **Innovation for improving water and rainfall utilization efficiency with biological, engineering & management water-saving technology.**
- **Soil & water environment protection and remedy technology innovation, etc.**

The trend of China's cereal total output — yield — sowing areas change between 1952 — 2006

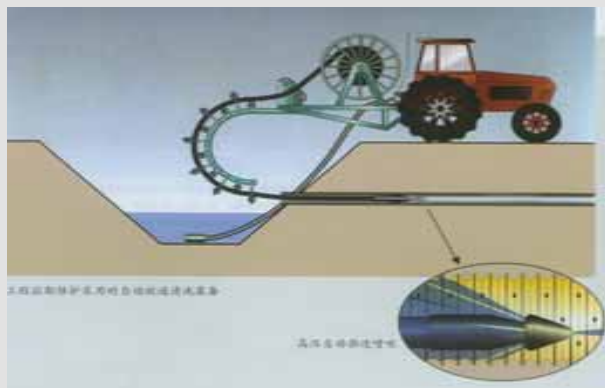




我国盐碱地分布图



暗管改碱原理示意图



暗管铺设示意图

3-3. Agro-biological environment facilities innovation for horticultural and livestock farming

- **Facility horticulture becomes one of the value-added agro-industry with fast adoption of high-tech. China uses about 3 % of its farmland to create 20 of total agricultural output value.**
- **Most of protected horticulture is based on traditional simple plastic facility. Great potentiality of this industry required multi-disciplinary coordinative efforts including agronomy, materials, structure, energy, and ICT experts' innovative contribution.**
- **The increasing concern with green products supply among the consumers requires a traceability system of full production chain based on RFID and ICT applications.**
- **To develop healthy livestock and aquatic farming system becomes essential in China. The structuring, environment, air and waste pollution control, disease protection and resources recycling utilization required for innovative contribution.**

Precision Horticulture:



3-4. Information and electrical technology for agriculture and rural development

- **162 mil. users (12.3 % of total population have got access to InterNet in China by 30 June, 2007.**
- **Over 100 million mobile phones were sold and more 430 billions mobile short messages were used for low-cost communication in 2006 in China.**
- **“Digital agriculture” is playing a leading role in technological innovation research on ICT for farming and rural development**
- **By the end of 2006, 99.97 % rural townships, 99.86% villages and 99.78 % peasant households have got State grid power supply. It provides great potentials for post harvest processing and electricity-saving technology innovation.**

■ Key Subjects to Promote Extensive ICT Applications

- ◆ Key technologies and tools development for high efficient information acquisition and processing;
- ◆ Embedded system and wireless sensors networking applied research, products development for farm use.
- ◆ Low-cost spatial location technology, data merging and system integration technology;
- ◆ Process monitoring and control technology & advanced equipment development
- ◆ Intelligent system development for modern agricultural machinery system, etc.

Different Soil intelligent sensors can be developed based on recent ICT advances to support information- & knowledge-based farming



We need “Simplicity Theory”, that is, to find the simplest method to solve real problems. To develop a low-cost with high-tech technologies is the future of innovation activities in promotion of ICT for agriculture !

3-5 Biomass resources utilization and Renewable Energy Engineering

- A **“State Renewable Energy Law”** was effective from 1st Jan., 2006.

- **Prospective Opportunities:**

- ◆ More 200 mil. tons out of 700 mil. tons of total crop stalk burnt out immediately after harvested in field;
- ◆ 200 mil. tons of forest castoffs are not used yet;
- ◆ More than 2.5 billion tons of animal dung & huge amount of organic residuals are left as polluting source;
- ◆ Others are biogas, wind power, solar energy, bio-ethanol and bio-diesel technology investigation.
- ◆ Energy saving and emission reduction has become a key state policy.

4. Summary - Vision for the Future

- 4-1. The advent of agricultural engineering profession has freed up millions of workers from farms to manufacturing & service industries in developed countries, and facilitate the industrial revolution process. It is accelerating agricultural modernization in less developed world and will bring to humankind with better living environment and the flourishing of the harmonious rural community;**

4-2. The first two decades of this century are of great importance in China's Socio-economic development. Promotion of Agricultural Engineering Technology Innovation will be more enhanced than before in realizing its national new development strategy. China is still in the development stage for speeding up industrialization. Agricultural Engineering" profession will continuously play important role for its agricultural modernization and new countryside construction.

- 4-3. To develop modern Agriculture requires multi-disciplinary integrated approaches. To widen fundamental knowledge and skills, close cooperation between agro-biologists and agronomists is the most important issue. Agricultural Engineers should be Agricultural & Biological System Engineers.**
- 4-4. Promotion of regional cooperation between Agricultural Engineering communities will be mutually beneficial to speeding up agricultural modernization and common efforts to face new challenge!**



Thanks!

