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# **Applications and Trends in Oil and Gas Technologies to Maximize Resource Production**

**China Petrochemical Corporation**  
**June, 2005**



- **Renewable never ever and irreplaceable in many areas, petroleum & gas are related to world economy and energy security.**
- **Short of hydrocarbon resources, China sees slow oil and gas production growth but surging crude consumption**
- **Energy-saving and efficiency improvement (esp. petroleum resource) are particularly important to China.**

# I. Status of Oil & Gas Energy-Saving Technologies in China

- Energy-saving regulation system is improved under Chinese government close attention;
- Impressive fruits achieved in oil & gas conservation through sci-tech progress;
- Petroleum efficiency in China is to be enhanced further due to huge potential in oil conservation.

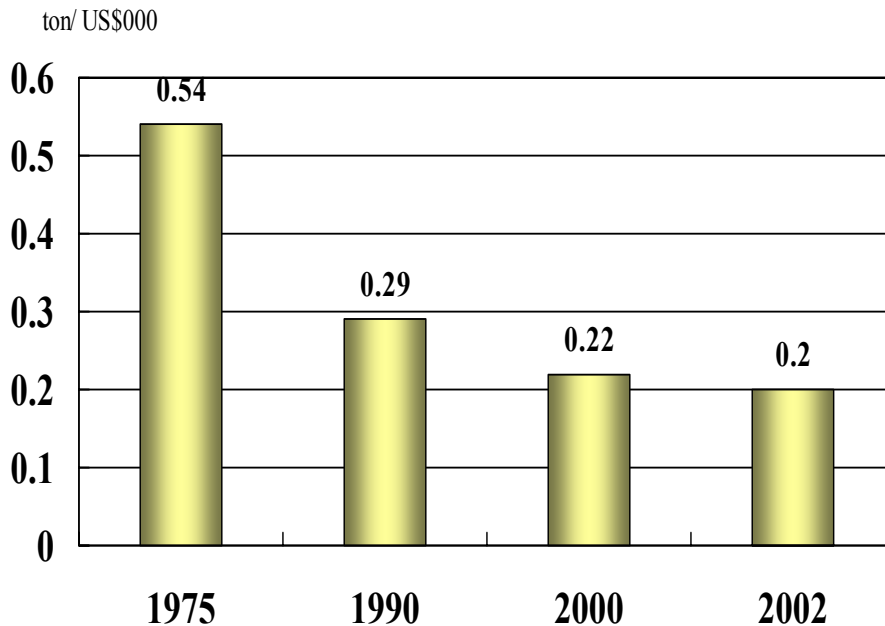


# 1. Energy-saving regulation system improved under Chinese government close attention

- Law of the People's Republic of China on Conserving Energy issued in November, 1997;
- Energy Conservation Management Measures on Key Energy Consumers and corresponding regulations debuted in succession;
- Draft 2004~2020 Programming Compendium of the Long-run Development of Energy Sources was passed at the regular meeting of State Council in June, 2004;
- First Medium- and Long-Term Special Planning for Energy Conservation issued in November, 2004.

## 2. Impressive fruits achieved in oil & gas conservation through sci-tech progress

Oil Consumption Intensity in China Y75-Y02



Since China's open-up and reforming——

Regulation improved;

Energy efficiency awareness heightened;

Technologies, processes and equipment developed, piloted, introduced and rolled out;

Effective results in energy-saving;

Oil consumption intensity (consumption/unit GDP) down 63% in less than 30 years.

## Transportation Sector

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- Car ownership rose to 24.21 mm from 16.09 mm at a growth rate of 14.5% in Y00-Y03;
- Auto fuel consumption rose to 54.09 mm from 39.78 mm tons at a rate of 10.8% thanks to restructuring, technology upgrading, road renovation & fuel improvement;
- Annual average auto fuel consumption on downward trend, single-vehicle consumption down to 2.23 ton in 2003 from 2.47 ton in 2000 at rate of 3.3%;
- **Y03 saved 5.81 mm tons according to 24.21 mm car ownership.**

## Oil & Petrochemical Sector:

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- **Exploration & Production Segment:**  
energy-saving delivered initial results through intensified technology revamping, new-technology application;

**Oil self-consumption rate in Chinese oil fields down by 100 bps, equivalent to 1.7 mm tons of oil saved according to the 170 mm tons of crude output in Y03 during Y98-Y03.**

## **Oil & Petrochemical Sector:**

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### **Technology Initiatives—Increase the Efficiency of:**

- **Mechanical Pumping**
- **Water Flooding**
- **Oil & Gas Gathering & Transportation (in case of Transportation Loss)**
- **Power Distribution and Supply**
- **Oil & Gas Production Heating Equipment**
- **Oilfield Drilling System**
- **Associated Gas Recovery System**

## Oil & Petrochemical Sector:

- Refining Segment—Overall energy consumption down by 13% from 90.98 kg in Y98 to 79.19 kg standard oil per ton of crude in Y03; Crude loss rate down by 38 bps from 1.39% in Y98 to 1.01% in Y03.

According the 240 mm tons of crude processed in Y03, energy consumption plus crude loss reduction, equivalent of saving 20 mm tons of standard oil.

# Oil & Petrochemical Sector:

## Technology Initiatives:

- Optimize resource allocation, logistics & supply chain management
- Consumption-effective management & energy recover technologies
- Increase utilization rate
- Thermal-efficiency improvement
- Encourage energy-efficient technologies (IGCC, cross-facility thermal integration, low-temperature thermal utilization)
- Build CFB boiler to realize IGCC and Petroleum Coke feedstock alternative
- Weed out obsolete and energy-guzzling processes and equipment

## **Oil & Petrochemical Sector:**

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- **Petrochemical Segment** —Energy consumption for ethylene production down by 12% from 809.05 kg standard oil/ton in Y98 to 711 kg in Y03.

**1,000,000 tons of standard oil were saved in Y03 while producing 6,110,000 tons of ethylene.**

**Material consumption per ton of ethylene produced down from 3.3 ton to 3.2 ton.**

# Oil & Petrochemical Sector:

## Technology Initiatives:

- **Encourage mega-scale facilities—**
  - giant ethylene crackers
  - grass-root cracking heater of 100 KTA capacity
  - higher thermal efficiency & lower energy consumption
- **Roll out energy-efficient equipment & technologies—**
  - on-line coking technology & extending cracker running cycle
  - high-efficiency internals for ethylene recovery
  - dual-tower depropanizer
  - combination refrigeration
  - CD-Hydro & optimum heat exchange, TLE, etc.

## Oil & Petrochemical Sector:

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- Significant technology improvement in 3 major synthetic material facilities delivered obvious energy efficiency
  - e.g. LDPE unit energy consumption down by 6.4% from 312.8 kg standard oil in Y98 to 293.6 kg in Y03

## Oil & Petrochemical Sector:

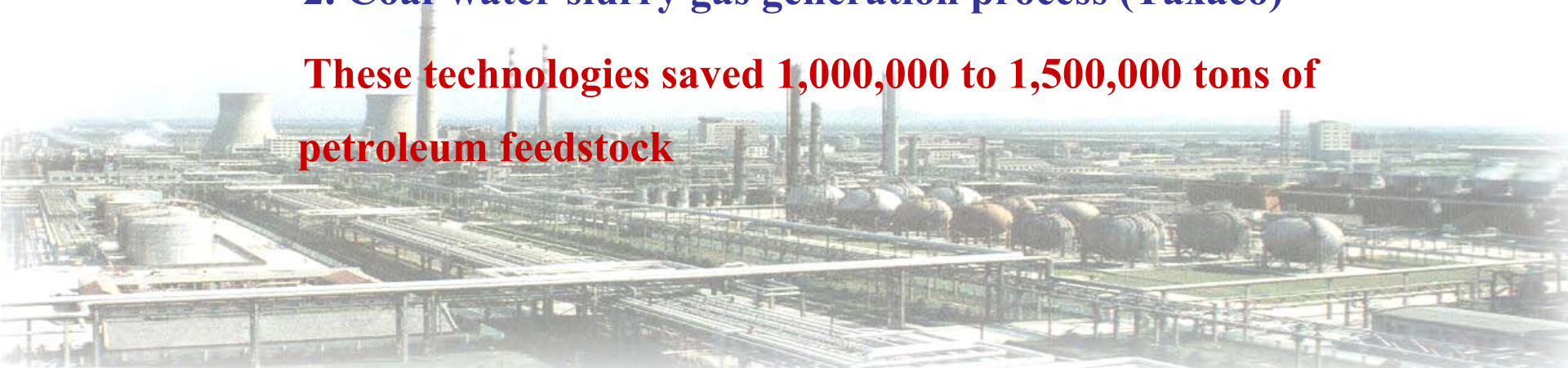
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- **Energy-Efficient Technologies for 3 Major Synthetic Material Facilities:**
  - **Advance Process Control System**
  - **Innovate polymerization technology, LLDPE condensation technology, gas-phase polymerization for grass-root PP facility**
  - **Eliminate outdated processes**

## Oil & Petrochemical Sector:

- Enhance international cooperation, replace hydrocarbon with coal feedstock through technology licensing
  - Replace naphtha as fertilizer and fuel feedstock through technology licensing
    1. Fine coal gasification (Shell)
    2. Coal-water slurry gas generation process (Taxaco)

**These technologies saved 1,000,000 to 1,500,000 tons of petroleum feedstock**



### **3. Huge Oil Conservation Potential in China to Further Petroleum Efficiency Improvement**

- **Consumption intensity in China still too high compared with developed countries**

**Oil consumption intensity in West Europe, North America and Asian developed countries averages 0.05-0.1 ton/thousand US\$, while that in China is 0.2 ton / thousand US\$, as twice of U.S. and 4 times of Japan.**

### **3. Huge Oil Conservation Potential in China to Further Petroleum Efficiency Improvement**

- **Key contributors to high consumption intensity:**
  - **High oil consumption in transportation sector (mostly motor vehicles)**
  - **High self-consumption mix among oil and petrochemical companies**
  - **Irrational oil utilization in electric, metallurgical, construction & agriculture sectors—leading to excessive consumption in heavy fuel oil**

## II. Trends in Energy-Efficient Technologies in China

- Chinese government set forth the principle of creating a conservation-minded society; give priority to and follow a path of energy-conservation where sci-tech progress and consumption effectiveness take a toll.
- Conservation holds paramount importance in the sectors of transportation, oil and petrochemical, electricity, metallurgical, construction and agricultural sectors.

# 1. Put Conservation in Transportation Sector in the 1<sup>st</sup> Place

- Transportation fuel consumption is the driving force for China's oil consumption growth
  - By 2020, mobility fuel consumption mix will rise from 40% to above 50%.
- It is China's principal task to lower fuel consumption through technology innovation and reduce petroleum dependence.

# 1. Put Conservation in Transportation Sector in the 1<sup>st</sup> Place

- Technology initiatives for lower fuel consumption efficiency improvement:
  - New engine fabrication technology
  - Drive system technique
  - Weight reduction technology
  - High-performance lubricant
  - Diesel engine
  - Hybrid Synergy Drive
- **Objective: to reduce auto fuel consumption/100 km by 20% in 2020**

## 2. Oil Conservation & Substitute in Industrial Sector through Technology Innovation

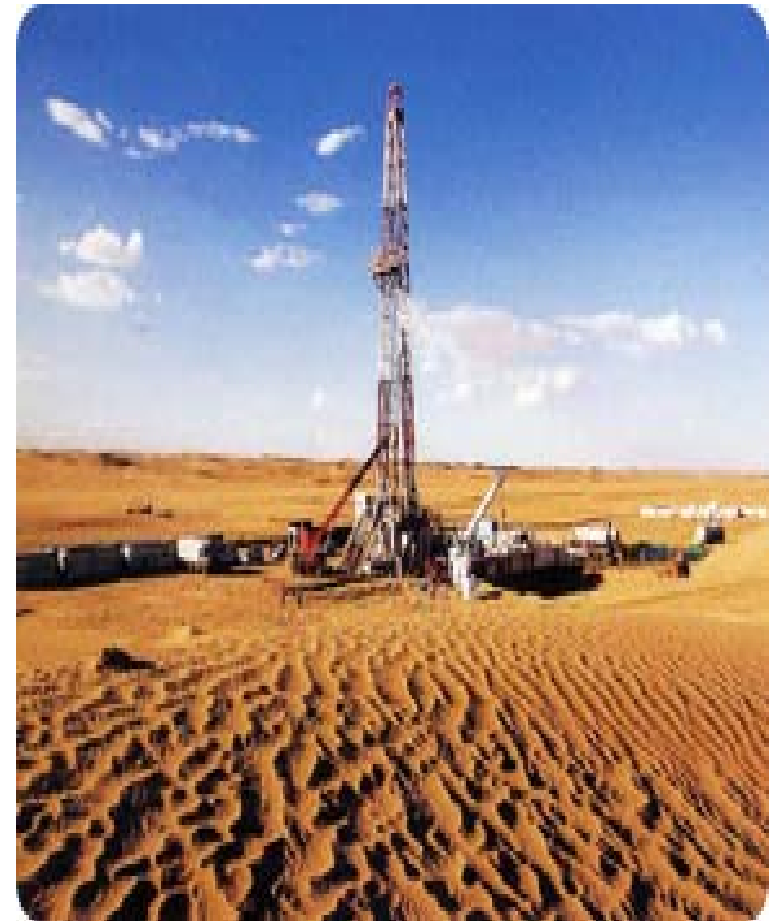
(1) Intensify technology research and application to reduce consumption in oil and petrochemical sectors

- Oil and gas exploration and production
- Refining & petrochemicals



# Exploration & Production

- **5 prevailing technologies**
  - Optimum allocation in oil lifting system
  - Thermal-flooding for heavy reservoir
  - Water-injection system optimization
  - closed layout of gathering system
  - Natural gas recovery



# Exploration & Production

- **Other energy-efficient technologies**
  - Power-saving through oilfield power grid
  - Waste heat recovery from sewage
- **Develop renewable alternatives for petroleum, lower self-consumption**
  - Geothermic technology
  - Wind & solar power-generators
  - Solar energy heating supply /refrigeration
  - Gathering & transporting technology with solar energy



# Refining & Petrochemicals:

- Utilize crude resource to mainly produce auto fuels and chemical feedstock
- Select deep-processing approach, develop high liquid-yield process, maximize light stream yield
- Develop petroleum coke, coal and natural gas to replace the feedstock of fertilizer, fuel oil and H<sub>2</sub> generation



# Refining & Petrochemicals:

- Tap Potential & Reduce Consumption with Advance Technology
  - Overall & system optimization technology
  - Theoretical study guiding R & D programs
  - Energy recover technology improvement
  - IGCC, combined cold heat and power generation, hydraulic turbine, gas turbine
  - Recover gas from storage & transportation system and reduce process loss
  - APC system roll-out
  - Reduce water emission & recover condensed water
  - Weed out obsolete process & equipment

## **(2) Oil Conservation & Substitute in Electricity, Construction and Metallurgical Sectors through Technology Innovation**

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### **■ Electricity Sector:**

- Coal gasification technology**
- Natural gas substitute for oil feedstock**
- Plasma ignition, small oil-gun ignition, pulverized coal combustion, boiler combustion stability at low utilization**

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- **Construction Sector**

- Rich O<sub>2</sub> combustion, stove temperature-holding

- **Metallurgical Sector**

- Eliminate open-hearth steelmaking process
- Replace boiler /heater fuels with recovered blast furnace gas, coking furnace gas and converter gas.
- For producers along “West-East Gas Pipeline”—encourage natural gas alternative as feedstock  
For other producers— encourage coal gasification

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## **(3) Improve the Efficiency of Farming Machine & Reduce Agricultural Use of Oil**

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- **Active technology application, increase efficiency of low-speed diesel engine to save diesel consumption.**



**In the last 20 years of 20th century, China's GDP was quadrupled, which was underpinned by doubling energy consumption. To build a well-off society in all-round aspects, China will give respective play to both development and conservation, put conservation in the 1st place, and make energy-efficiency improvement as the focal task, step up technology progress and improve end-use efficiency.**

**By 2020, China will promote sustainable development and quadruple its 2000's GDP with its energy consumption only doubled or even at lower rate.**



Thank you!

