Promote the Implementation of Sustainable Energy Utilization Campaign and Protect & Improve Air Quality in Chongqing Municipality

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Background and Basic Information
--Information on whole municipality

- At middle and west of China, upper Yangtze
- In south-eastern boarder of Sichuan Basin, disadvantageous to pollutants diffusion
- 40 districts or counties under the jurisdiction
- 82,000 km²
- Population of 30.9109 million by 2000
Background and Basic Information
--Information on city proper

- Constructed area of 190 km²
- 5 million people live
- Between Tongle and Zhong-liang Mountain, is valley-hill land
- Split by Yangtze and Jialing River
- Very disadvantageous to pollutants diffusion
Background and Basic Information

--Information on energy

- Relatively shortage of energy with an imbalance nature
- Conventional energy exploited amounts to 5 billion ton standard coal with an average of 166 ton standard coal per capita and it only takes 20.5% of the national average level
- No oil reserves are founded and also geothermal, solar and wind energy are scare
- Natural gas resources are relatively abundant
- Great potential in the exploitation and utilization of hydraulic and biological energy
Energy Reserves

- By 2000, natural gas reserves amount to 110 billion m$^3$.
- Coal reserves amount to 2.1 billion ton.
- Hydraulic resources reserves of 7600 MW can be developed.
- Gas partner for coal reserves amount to 18.4 billion m$^3$.
- Grain stalks can produce 2.8 billion m$^3$ methane gas every year.
Energy Production

• In 2000, primary energy production totals to 21.92 million ton standard coal
  – Coal production is 19.50 million ton, equivalent to 13.93 million ton standard coal
  – Natural gas production is 4.7 billion m$^3$, equivalent to 6.25 million ton standard coal
  – Hydraulic power production is 4.3 billion kW.h, equivalent to 1.74 million ton standard coal

• Additionally, 1.12 million m$^3$ methane gas is produced, equivalent to 80,000 ton standard coal
Energy Production
--Primary energy production structure in 2000

- Coal: 63.5%
- Natural gas: 28.5%
- Hydraulic power: 8.0%
Energy Consumption
-- Primary energy Consumption of whole municipality in 2000

• In 2000, primary energy of 20.76 million ton standard coal was consumed
  – Coal consumption was 17.50 million ton, equivalent to 12.50 million ton standard coal
  – Hydraulic power consumption was 7.5 billion kW.h, equivalent to 3.03 million ton standard coal
  – Natural gas consumption was 2.1 billion m³, equivalent 2.79 million ton standard coal
  – Oil consumption was 1.67 million ton, equivalent to 2.44 million ton standard coal
• Additionally, methane gas consumption was 1.12 million m³, equivalent to 80,000 ton standard coal
• Liquefied petrol gas consumption was 20,000 ton
Energy Consumption

--Primary energy Consumption structure of whole municipality in 2000

- Coal: 60.2%
- Oil: 11.8%
- Natural gas: 13.4%
- Hydraulic power: 14.6%
Energy Consumption

-- Primary energy Consumption of city proper in 2000

- In 2000, 9.14 million ton standard coal of primary energy was consumed in city proper
  - Coal consumption was 4.20 million ton, equivalent to 3.00 million ton standard coal
  - Natural gas consumption was 1.14 billion m$^3$, equivalent to 1.52 million ton standard coal
  - Imported power consumption was 10.0 billion kW.h, equivalent to 4.04 million ton standard coal
  - Oil consumption was 400,000 ton, equivalent to 580,000 ton standard coal
- Additionally, liquefied petrol gas consumption was 15,000 ton
Energy Consumption
-- Primary energy Consumption structure of city proper in 2000

- **Coal**: 32.8%
- **Imported Power**: 44.2%
- **Natural Gas**: 16.6%
- **Oil**: 6.4%
### Environmental Problems From Energy

--Atmospheric pollutants emission in 2000

**Pollutants emission from primary energy consumption**

Unit: 10,000 ton

<table>
<thead>
<tr>
<th>Region</th>
<th>SO$_2$</th>
<th>Smoke dust</th>
<th>NO$_x$</th>
<th>CO</th>
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<tbody>
<tr>
<td>Chongqing</td>
<td>83.94</td>
<td>21.35</td>
<td>18.03</td>
<td>2.42</td>
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<tr>
<td>City proper</td>
<td>20.15</td>
<td>5.12</td>
<td>4.54</td>
<td>0.36</td>
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</tbody>
</table>

Note: Coal has a average sulfur content of 3.5%, and ash of 25%
Environmental Problems From Energy
--Air pollution status in 2000

Monitoring Results of Air Quality and Precipitation
in City proper, Wan Zhou, Hu Ling, Qian Jiang and
Other Districts /Counties(Autonomy County and City)

<table>
<thead>
<tr>
<th>Index</th>
<th>City proper</th>
<th>Wan Zhou</th>
<th>Hu Ling</th>
<th>Qian Jiang</th>
<th>Other Districts/Counties</th>
<th>Class II standard</th>
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</thead>
<tbody>
<tr>
<td>SO₂ (mg/m³)</td>
<td>0.156</td>
<td>0.056</td>
<td>0.187</td>
<td>0.136</td>
<td>0.096</td>
<td>0.06</td>
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<tr>
<td>NO₂(mg/m³)</td>
<td>0.052</td>
<td>0.032</td>
<td>0.041</td>
<td>0.015</td>
<td>0.029</td>
<td>0.08</td>
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<tr>
<td>TSP (mg/m³)</td>
<td>0.248</td>
<td>0.295</td>
<td>0.228</td>
<td>0.281</td>
<td>0.232</td>
<td>0.20</td>
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<tr>
<td>Average annual pH value</td>
<td>4.66</td>
<td>4.81</td>
<td>5.62</td>
<td>6.38</td>
<td>5.04</td>
<td>5.6</td>
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<tr>
<td>Acid Rain Frequency(%)</td>
<td>44.5</td>
<td>27.7</td>
<td>23.1</td>
<td>2.60</td>
<td>43.9</td>
<td>--</td>
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</tbody>
</table>
Environmental Problems From Energy
--Greenhouse gas emission in 2000

- Greenhouse gas from fossil fuel combustion, CO$_2$, is calculated by C
- In 2000, energy consumption emits 12.1` million ton C
  - 3.3 million ton C is contributed by the city proper
- Left 2 Figures show that improvement of energy structure can reduce greenhouse gas emission
Problems with Energy Production and Consumption for whole municipality

- **Large Proportion of Coal Consumption**
  - In 2000, primary energy coal consumption ratio is 60.2%

- **Low Energy Utilization Rate**
  - In 2000, energy utilization efficiency is only 34%

- **Slowly-Developed Energy Infrastructures**
  - In urban area of some counties, natural gas has not been used yet
  - Power network with 220 kV has not entered the south-eastern region

- **Insufficient Cleaner Energy Utilization**
  - In 2000, natural gas consumption takes only 44.7% of total production
  - Developed hydraulic resources takes only 12% of hydraulic reserves
  - Produced methane gas takes only 4% of total biological energy reserves
Problems with Energy Production and Consumption for whole municipality

- **Irrational Arrangement and Structure of Energy Production**
  - Chongqing Power Station which has 3x200 MW fire-powered generation units is located in the city proper
  - Hua Neng Luo Huang Power Station which has 4x360 MW fire-powered generation units is only 25 km away from the city proper
  - Collection of small fire-powered generation units with a capacity under 50 MW reach a total of 1025 MW

- **No Actions on Rural Energy Purification**
Optimum Energy Structure and Promote Air Quality

- By 2005, primary energy consumption will amount to 26.26 million ton standard coal, so following measures must be taken:
  - **Reduce Coal Consumption Ratio Significantly**
    - By 2005, total coal consumption will amount to 19.00 million ton, equivalent to 13.75 million ton standard coal. Coal consumption ratio will decrease 8.5% comparison with 2000
  - **Development and Utilization of Cleaner Energy with Great Efforts**
    - **Increase Natural Gas Utilization Ratio**
      - By 2005, natural gas consumption will increase to 3.2 billion m³, equivalent to 4.25 million ton standard coal. Natural gas consumption ratio will increase 2.8% comparison with 2000
    - **Sufficient Development of Hydraulic Power**
      - By 2005, hydraulic power generation will amount to 12 billion kW.h, equivalent to 4.85 million ton standard coal. Hydraulic power consumption ratio will increase 3.8% comparison with 2000
    - **Rational Development of Fire-Powered Generation**
      - By 2005, number of a single unit with the capacity over 200 MW will take 74% of the total generator installation capacity, 10% more than 2000
    - **Development of Nuclear Power**
      - Preparation for construction of Chongqing Nuclear Power Plant
Optimum Energy Structure and Promote Air Quality

--Predicted energy consumption structure
Optimum Energy Structure and Promote Air Quality

- Optimum Rural Energy Structure and improve energy utilization rate
  - Change Concept of Energy Consumption
    - In stead of burning grain stalks, some cleaner energy or commercial cleaner energy will be gradually developed and used in the countryside
  - Speed up Construction of Rural Energy Infrastructure
  - Exploitation of Biological and Solar Energy
  - Gradual Popularization of Cleaner Coal
    - Burning of raw coal will be gradually prohibited in the countryside
  - Rational Plan and Full Utilization of Atmospheric Environmental Capacity