Shale gas development and utilisation

In 2015, remarkable progress was made in the development of shale gas. The national shale gas demonstration zone – Sinopec Fuling shale gas field successfully completed the first phase of 5 billion cubic meters per year capacity construction. This is of great significance to our country’s energy structural adjustment, the prevention and control of air pollution, and energy-saving and environmentally friendly enterprise, contributing to the harmonious development between human and nature.

Green is the prerequisite for sustainable development

Sinopec Corp. strictly complies with state laws like Law on Environmental Protection, Law on Water Pollution Prevention and Law on the Prevention and Control of Environmental Pollution by Solid Wastes, as well as company policies and rules such as Sinopec’s Rules on the Prevention and Control of Waste Water Pollution and Sinopec Rules on Environmental Protection. We drive environmental protection through clean energy production, energy conservation and emission reduction, building a comprehensive integrated management system for emission and carbon reduction.

1. Supply clean energy

Case: About China’s first large shale gas field

Shale gas is clean energy

Shale gas is an unconventional natural gas in the form of adsorption or dissociation existing in the clay shale and its interlayers. It is a clean and efficient energy resource able to drastically improve the energy consumption structure. The completion of first phase development of Fuling shale gas can reduce 6 million tonnes of carbon dioxide emission per year, equivalent to planting almost 5 million trees, taking up to 4 million economy cars off the road for one year. Meanwhile, it can reduce the emission of 150,000 tonnes of sulfur dioxide and 50,000 tonnes of nitrogen oxides.

On December 28, 2012, the first shale gas well Jiaoye H1F drilled high yield shale gas, starting a new era of China’s shale gas development.

In November 2013, Sinopec Corp. started the development of the demonstration zone. By the end of that year, 21 test wells had been completed, building an annual shale gas capacity of 600 million cubic meters.

In 2015, Sinopec Fuling Shale Gas Field produced accumulatively 2.124 billion cubic meters of shale gas, with a daily production capacity reaching 15 million cubic meters. Sales totaled 2.036 billion cubic meters, supplying to Central China and Eastern China.

In 2015, Sinopec Fuling Shale Gas Field produced accumulatively 2.124 billion cubic meters of shale gas, with a daily production capacity reaching 15 million cubic meters. Sales totaled 2.036 billion cubic meters, supplying to Central China and Eastern China.

In 2015, Sinopec Corp. started the second phase of capacity construction with annual capacity of 5 billion cubic meters, and will build Chongqing Fuling into a large gas field with capacity 10 billion cubic meters by 2017.

The “growth story” of Chongqing Fuling shale gas field

On December 28, 2012, the first shale gas well Jiaoye H1F drilled high yield shale gas, starting a new era of China’s shale gas development.

In November 2013, Sinopec Corp. started the development of the demonstration zone. By the end of that year, 21 test wells had been completed, building an annual shale gas capacity of 600 million cubic meters.

In 2015, Sinopec Fuling Shale Gas Field produced accumulatively 2.124 billion cubic meters of shale gas, with a daily production capacity reaching 15 million cubic meters. Sales totaled 2.036 billion cubic meters, supplying to Central China and Eastern China.

Chongqing has become the main place for commercial shale gas development, and Fuling has become the largest shale gas field in the world outside North America.

The successful completion of the first phase of development indicates that our country has entered a new journey of energy revolution, meaning that our country’s natural gas supply structure will change from now on. This is of great significance to alleviating our country’s constraint in natural gas supply, reducing our external dependence, improving our guarantee capabilities, upgrading people’s livelihoods, facilitating energy conservation and emission reduction, and preventing and controlling air pollution.

— Weng Jieming, Executive Vice Mayor of Chongqing
Commercial application of bio-jet fuel

In 2015, bio-jet fuel independently developed by Sinopec Corp. was successfully deployed in its first commercial passenger flight, making China one of the few countries in the world that own self-developed production technology of bio-jet fuel which successfully achieved commercialisation.

Tips:
Bio-jet fuel is produced with renewable resources as raw materials, mainly made from coconut oil, palm oil, leprosy seed oil, flaxseed oil, algae oil and waste cooking oil. Compared with traditional petroleum-based jet fuel, carbon emission in the entire lifecycle can be reduced by more than 35%, turning waste cooking oil into a benefit.

Case: Bio-jet fuel independently developed by Sinopec Corp. was successfully deployed for the first time in commercial passenger flight

In March 2015, Flight HU7604 of Hainan Airlines filled with Sinopec No.1 bio-jet fuel took off at 8:20 from Shanghai Hongqiao Airport with 156 passengers and 8 crew members on board. After a flight of two and a half hours, it landed in Beijing Capital Airport steadily.

“Today’s flight went very well. There was no difference in the flying experience. I am happy that I had chance to fly this flight to witness the historic moment in China’s civil aviation history and the environmental protection cause.”

— Pu Ming, Captain

Our footprints in quality upgrading of oil products

Sinopec Corp. persistently upgrades the quality of refined oil products and actively supplies clean energy to the society. The sulfur content in gasoline was reduced from nearly 1,000 ppm in year 2000 to current 10 ppm. Eleven municipalities and provinces in Eastern China such as Beijing, Shanghai, Jiangsu, Guangdong and Zhejiang have adopted the gasoline standard of GB IV, equivalent to European IV.

National Standards

<table>
<thead>
<tr>
<th>Sinopec Oil Product Upgrading, Sulfur Content Keeps Dropping (ppm)</th>
<th>GB I (unleaded)</th>
<th>GB II</th>
<th>GB III</th>
<th>GB IV</th>
<th>GB V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur Content</td>
<td>≤800</td>
<td>≤500</td>
<td>≤150</td>
<td>≤50</td>
<td>≤10</td>
</tr>
</tbody>
</table>

• Quality upgrading of refined oil products
Sinopec Corp. persistently upgrades the quality of refined oil products and actively supplies clean energy to the society. The sulfur content in gasoline was reduced from nearly 1,000 ppm in year 2000 to current 10 ppm. Eleven municipalities and provinces in Eastern China such as Beijing, Shanghai, Jiangsu, Guangdong and Zhejiang have adopted the gasoline standard of GB IV, equivalent to European IV.
2. Green and low-carbon development

- Clean Water and Blue Sky Campaign
  In 2015, Sinopec Corp. continued to advance the Clean Water and Blue Sky Campaign, accelerated project approval and construction, and conducted follow-up audit of projects’ execution and supervision of key projects. As of the end of 2015, all the projects of the campaign had been approved, of which 512 projects had been completed and put into operation. The Company’s ability to meet emission standards was constantly improved. The total emission of four major pollutants, known as COD, sulfur dioxide, ammonia nitrogen, nitrogen oxide, had all achieved the emission reduction targets which were signed in the responsibility agreement at the beginning of the year.

Case: Sinopec Yangzi actively participates in the Clean Water and Blue Sky Campaign

Sinopec Yangzi Petrochemical Company invested RMB1.38 billion in the Clean Water and Blue Sky Campaign. It has implemented 12 environmental improvement projects, including water body protection and reuse, air treatment, leak detection and maintenance projects as well as monitoring and early warning. In 2015, the company’s wastewater reuse device with capacity of 850 tonnes/hour was successfully put into operation and produced qualified reusable water; its capacity amounted to 7 million tonnes/year.

- The Energy Conservation Plan
  In 2015, Sinopec Corp. fully carried forward the Energy Conservation Plan. We reinforced management team to implement the plan, included the assessment result into annual performance appraisal. We also promoted mature and applicable energy conservation technology by organising expert teams to offer technical services for our subsidiaries. We completed 484 projects during the year with an investment of about RMB1.5 billion, and saved energy equivalent to 960,000 tonnes of standard coal.

- Contract energy management
  In 2015, Sinopec Corp. revised Rules of Sinopec Contract Energy Management Projects, further optimised project management procedures. We carried out 47 contract energy management projects and saved energy equivalent to 45,000 tonnes of standard coal. Of which, Sinopec Maoming Branch, Sinopec Guangzhou Branch and Zhanjiang Dongping Petrochemical Company replaced 2,484 outdated motors by adopting the contract energy management approach.

- Water resources management
  Sinopec Corp. spares no efforts in using municipal reclaimed water and desalinated seawater as its industrial water. We place an emphasis on water resource protection, enhance measures to wastewater treatment and recycling in various business segments, and improve the utilisation rate of water resource.

2015 Industrial water consumption

<table>
<thead>
<tr>
<th></th>
<th>2015 compared with 2014</th>
<th>2010 compared with 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0%</td>
<td>6.1%</td>
</tr>
</tbody>
</table>

3. Green Development

- Exploration and Production segment
  - Taking measures including optimising development programmes, conducting reservoir reconstruction, optimising injection formation, using reclaimed water, and building advanced treatment facility for produced water in oil production to improve injection efficiency;
  - Enhancing the treatment capacity of drilling sewage and fracturing liquid to meet the water injection quality standard, and improving injection rate.

Case: Sinopec Tianjin introduced municipal reclaimed water and desalinated water as supplement of circulating water

Starting from 2010, Sinopec Tianjin Petroleum Company has used desalinated seawater as supplement of circulating water, and accumulative usage reached 10 million tonnes by 2015, yielding good results in water saving. In particular, the million-tonnage ethylene project of Sinopec Tianjin mainly uses desalinated seawater as its water source, making it the largest desalinated seawater user in Tianjin city. In 2015, the company for the first time successfully introduced the municipal reclaimed water as the water source for preparing chemical water, using more than 4 million tonnes of municipal reclaimed water.

- Energy conservation and emission reduction
  In 2015, Sinopec Corp. actively took measures to conserve energy and improve resource utilization rate.

- Refining and Chemical segments
  - Taking chance of the wastewater treatment plant upgrading, deeply exploring the reclaimed water potential, building water reuse facilities by phases, and constantly improving the operation load of the reuse water facilities to reduce fresh water.
  - Using unconventional water resources such as water from the municipal wastewater treatment plant, seawater and brackish water.

Case: Can oil sludge be reused?

In 2015, the first set of oil base rock cuttings treatment device independently developed by the Company was officially put into operation in Chongqing Fulling Shale Gas Field. Oil base rock cuttings can now be properly collected without dropping to the floor, and stored without permeation; furthermore, the treatment process is innocuous and can meet the strict discharge standard. The cuttings can be recycled for construction materials like cement and bricks. This fills the gap in large-volume innocuous treatment technology for oil base rock cuttings in the development of shale gas. Currently, the device’s treatment capacity is 15,000 cubic meters a year.
• Biodiversity protection
Sinopec Corp. attaches great importance to the protection of the surroundings of our plants and take various measures to ensure ecological safety as well as to create a healthy and harmonious ecological homeland.

Case: Protect animals and plants, maintain ecological balance
Sinopec Mansarovar Energy Colombia Ltd., places an emphasis on protecting animals, plants and the natural ecological environment. The company identifies highly sensitive ecological areas and protection areas, and fords oil and gas exploration and operation in these areas. They work closely with the local government, and task the company’s dedicated safety and environment professionals with special protection of wild animals. The company also held wild animal photography competition to call for the local people to protect wild animals and the ecological environment, especially the endangered species. In addition, the company conducts special training of animal protection in the local community to increase the awareness and ability of local people in protecting animals.

Case: Improve marine ecosystem
Sinopec Zhanjiang carried out Restocking for Enhancement of Fish Resources Activity to protect the marine ecological environment. They planned to release 50 million fish seedlings every year for the recovery of fisheries population and the protection of biodiversity, improving marine ecosystem and promoting the sustainable development of fishery industry.

3. Tackle climate change
• Caring for Climate China Summit
Promoting energy conservation and emission reduction and tackling climate change require the joint efforts and active participation of the entire society. As a leading enterprise of the UNCC, Sinopec Corp. continued to support activities organised by UNCC China Network in 2015. We actively participated and organised the Ecological Civilization & Beautiful Home Caring for Climate China Summit, leading Chinese enterprises to pay attention to climate change.

Support Ecological Civilization & Beautiful Home Caring for Climate China Summit, Contribute to ecological civilization construction

In 2015, in the 1st summit, Sinopec Corp. joined hands with 60 Chinese enterprises to sign the Initiative of China’s Business Community on Caring for Climate. We officially launched Sinopec Clean Water & Blue Sky Campaign and submitted relevant achievements to the UNCC Leadership Summit and Caring for Climate Summit.

In 2014, the 2nd summit themed on Embracing Children. A collection of case studies of Sinopec and other leading enterprises with the title of Build a Beautiful World – 2014 China Practice in Caring for Climate and Ecological Civilization was released and submitted to the UNCC Organization and the UN Climate Summit. Sinopec Corp. bought four children’s paintings on environmental protection in the philanthropic auction. We won the title of Pioneer Enterprise of Caring for Climate & Ecological Civilization, and announced our Implementation of the Energy Conservation Plan.

In 2013, the 1st summit themed the Power of Action. It released a collection of case studies of Sinopec Corp. and other leading enterprises titled Caring for Climate – Chinese Practice in Caring for Climate and Ecological Civilization, which all passed the verification by the third-party international verifiers. We officially launched Sinopec Clean Water & Blue Sky Campaign and submitted relevant achievements to the UNGC Organization and the UN Climate Summit. We signed the Initiative of China’s Business Community on Caring for Climate, and announced our Implementation of the Energy Conservation Plan.

• Carbon Asset Management
In 2015, Sinopec Corp. published policies including Sinopec Rules for Carbon Asset Management (Trial implementation) to enhance carbon asset management. We set up a greenhouse gas emission statistics, monitoring and management system, and further improved the function module construction of carbon asset management information system. Moreover, we conducted relevant studies, and determined the study method for the carbon footprint of petrochemical products.

Carbon accounting
Sinopec Corp. further carried out carbon accounting. According to ISO14064, we have conducted greenhouse gas accounting in the petrochemical units and service stations of our subsidiaries for five consecutive years, which all passed the verification by the third-party international verifiers.

Carbon capture
Our subsidiaries including Zhongyuan Oil Field actively conducted carbon dioxide capture, storage and utilisation test studies to increase recoverable reserves and oil recovery efficiency. As of the end of 2015, they had injected 2.7 million tonnes of carbon dioxide and increased oil production of 235,000 tonnes. Meanwhile, methane recovery and utilisation technology was applied among oil field enterprises, recovering about 200 million cubic meters of methane in 2015, and reducing greenhouse gas emission by 3 million tonnes of carbon dioxide equivalent.

Carbon trading
In 2015, Sinopec Corp. continued to participate in carbon trading. Pilot carbon trading enterprises all met carbon quota and trading targets, with a carbon trading volume of 1.80 million tonnes and a turnover of RMB54 million. As of the end of 2015, our trading volume had reached 3.90 million tonnes with a turnover of RMB140 million, accounting for roughly 8% of the total domestic trading volume and turnover.