

# Pipeline Construction and Operation



The West-East Gas Pipeline Project plays an important role in China's energy strategy development and the improvement of people's livelihoods. We carry out project planning, design, construction and operation in a manner which is responsible to our society and future generations. Giving priority to people, the environment, safety and quality, we constantly improve our management level, make great efforts to build a quality project, and provide downstream users with safe and stable supplies of clean energy.



## 1. Safe and Environmentally Friendly Engineering

We adopted a construction and management separation mode in project construction, with responsibilities shared between the employers, general contractors and supervisors. We implemented whole-process quality control, an all-staff safe production responsibility system and life-long project quality responsibility system, and accepted quality supervision from the government. This has effectively ensured our project quality and ecological protection.

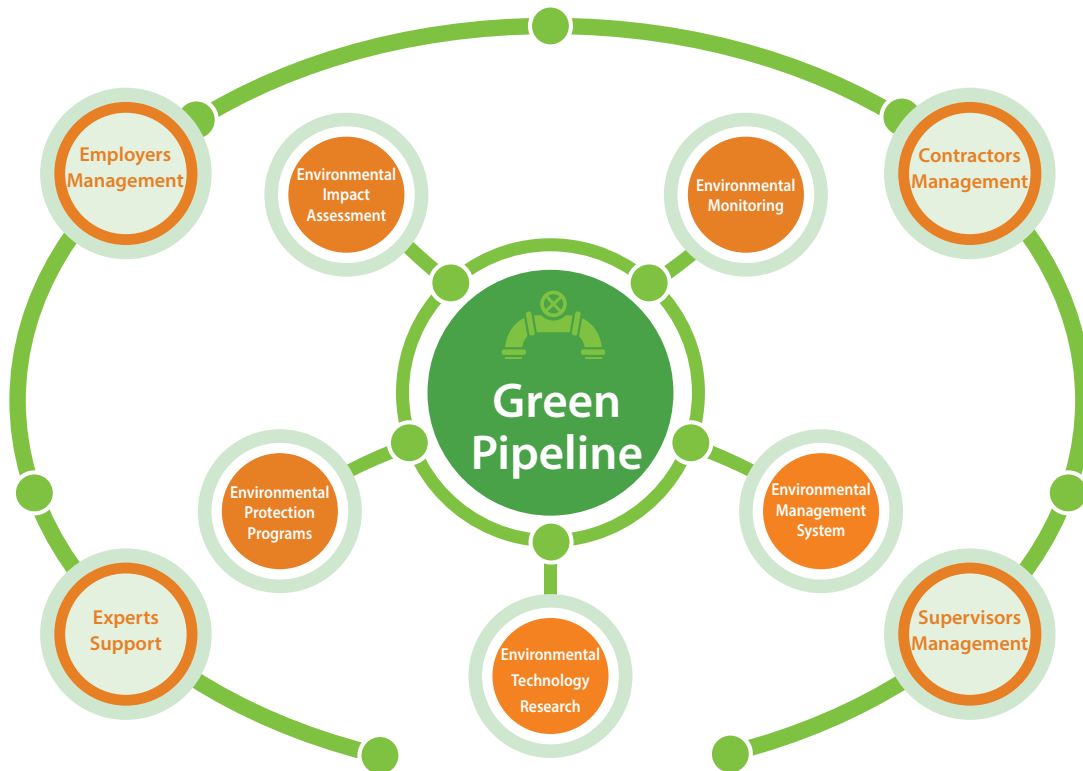
### Ecological Protection and Restoration

Great emphasis was put on soil conservation and vegetation restoration during construction as we avoided environmentally sensitive areas to minimize the impact of our construction on the ecological environment. In order to control water loss and soil erosion, we planted vegetation and grass as protective screens in the windy desert areas, removed and restored turf before and after construction in the grasslands, took engineering and biological measures for integrated control on the loess plateau and in mountainous and hilly areas; and took measures such as topsoil stripping and layered backfill to protect the

environment in the oasis region. To ensure ecological restoration, we adopted the management model of “restoration for one year and maintenance for three years”, ensuring a high survival rate of plants. Thanks to these efforts, during construction of the First and Second West-East Gas Pipelines, there was no ecological damage, major public complaint or environmental pollution incident. Therefore, the First West-East Gas Pipeline and the Second West-East Gas Pipeline (Western Section) were named the “National Environmental Friendly Project” and “Soil and Water Conservation Demonstration Project” successively.



↑ The ecological restoration after operation



## Avoidance Measures during Construction of West-East Gas Pipeline Project

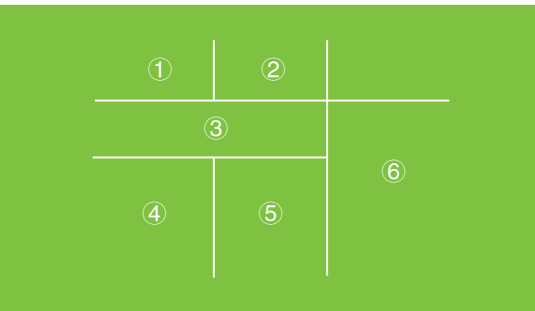
Environmentally sensitive areas / cultural relics	Avoidance measures
Gansu Anxi National Nature Reserve in Hyper-Arid Desert	The pipeline bypassed the experimental area 20km from the reserve, instead of going through the buffer zone of the reserve as originally planned. Sand control measures were undertaken such as gravel laying and vegetation restoration.
Shapotou National Nature Reserve, Zhongwei, Ningxia	Straw checkerboard barriers were established in the operating belts to control sand, grass seeds were sown on an area of 483,000 square meters and 322,000 trees were planted.
Xinjiang Lop Nur Wild Camel National Nature Reserve	The pipeline was moved 200km northward.
Ancient Great Wall	Pipe jacking was conducted for all pipelines for deep burial underground, resulting in investment at each location of nearly RMB 200,000.
Shaanxi Zhongshan Grottoes Cultural Relics	Cutting into the mountain, slope cutting, and trench excavation for 3km-long pipelines were carried out in the most rudimentary form in three weeks, which otherwise would be completed within a week.



↑ Green grassland construction



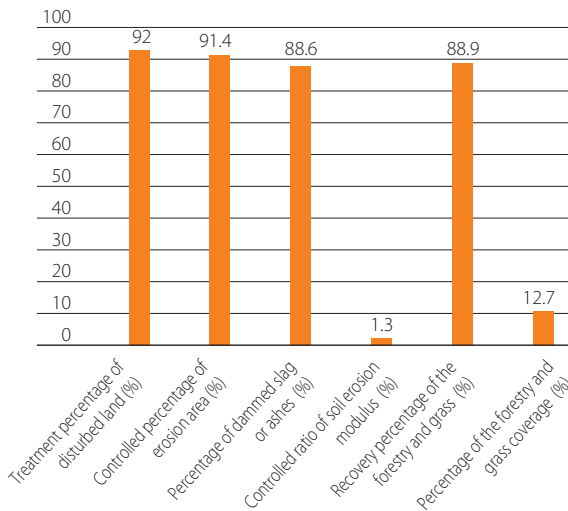
- ① The control of Guozigou Tunnel
- ② Shield Tunnel crossing Yangtze River
- ③ Set straw checkerboard barriers to control sand
- ④ Pasture assignment
- ⑤ Crossing Taihang mountain
- ⑥ Across farmland



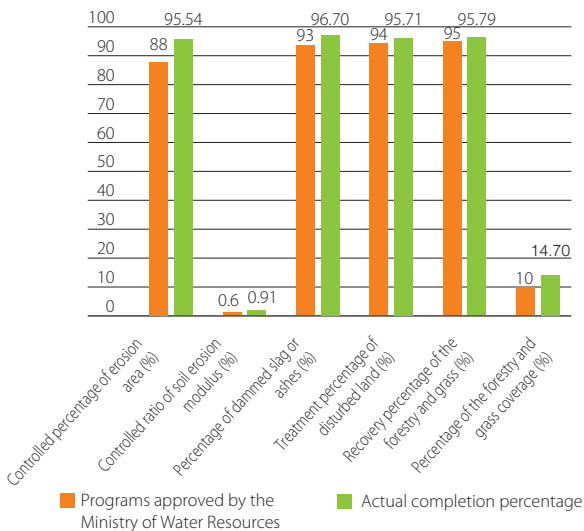
### Social evaluation

**Comments upon acceptance for national environmental protection projects:** The First West-East Gas Pipeline was built strictly in accordance with national environmental protection regulations, under an excellent environmental management organization and system with sound rules and regulations. Pollutant discharge has met the specified standards and the land has been well restored. No ecological damage or environmental pollution incident occurred during construction. The project has reached the advanced level internationally among its counterparts.

Monitoring results from the Ministry of Water Resources show that the 6 indicators of soil and water conservation of the First West-East Gas Pipelines project construction are all higher than the national standard



Monitoring results from the Ministry of Water Resources show that the 6 indicators of soil and water conservation of the Second West-East Gas Pipelines (west) project construction are all higher than the national standard



Social evaluation

Comments upon acceptance for national soil conservation facilities: The soil conservation facilities of the First West-East Gas Pipeline meet required quality standards with reasonable designing and appropriate selection of plant species. The project has brought valuable experience in the prevention and control of soil erosion for large development projects in China.



Case Study

Laying pipelines underground without disturbing the pasture land

During pipeline crossing in the Sayram Lake Scenic Area in Xinjiang, we invited experts from the Ministry of Environmental Protection, the Ministry of Water Resources and China Agricultural University to form an expert team. After several onsite inspections, the team developed a design program for ecological restoration, in order to minimize the impact on the environment.

During construction, we limited the construction area and removed turf for restoration to protect the ecological environment in Sayram Lake. Welding was conducted below the trench, and the originally 28-meter-wide operating belt was narrowed down to 20 meters, with space just enough for a construction vehicle to pass through. We used the existing three herding roads for construction machinery without opening up new roads. The turf was stripped in areas of thick soil to be covered by thickened sunscreen nets and sprayed with clean water, and it was restored after construction. In areas where the turf cannot be stripped due to thin soil, grass seeds were sown after backfilling.



### Protection of Cultural Relics

The western section of the West-East Gas Pipeline runs alongside the ancient Silk Road and the Yellow River Cultural Belt. Its midstream and downstream are located at areas where the Central Plain Culture and the Wuyue Culture were developed and promoted. Therefore, protection of cultural relics along the pipelines is a top priority in project construction.

CNPC established a leading group for cultural heritage protection in oil and gas pipeline projects, jointly with the State Administration of Cultural Heritage. They established the principle of putting heritage conservation before pipeline construction, issued administrative measures on heritage conservation for the West-East Gas Pipeline Project, and followed the policy of avoiding cultural relics and stopping construction at accidentally discovered cultural relics. With the assistance of the local cultural relics departments, we conducted field surveys along the pipelines, and drew special maps for the construction unit for reference. For accidentally discovered cultural relics, we excavated them to avoid any loss.

## 2. Securing Gas Supply

The First and Second West-East Gas Pipelines deliver natural gas to over 300 sub-transmission users, 3,000 large and medium enterprises and 60 million residents in over 100 cities along the pipelines. In 2013, the gas delivery accounted for 23.4% of China's total gas consumption.

### Gas Source Guarantee

We have built four gas provinces in Xinjiang, Changqing, Sichuan and Qinghai, with annual production in 2013 accounting for 75% of the national total. Gas produced in these areas was delivered to Eastern China through the West-East Gas Pipelines and their cross-link lines. In addition, CNPC also imported pipeline gas and LNG by land and by sea as an important supplement to domestic gas sources, in order to meet domestic gas demand.



↑ LNG storage tank



↑ The natural gas plant in the hinterland of the Taklimakan Desert



### External Evaluation

Archaeologist **Chen Wei**: CNPC's heritage conservation practices in pipeline construction serve as a role model for other projects. Such practices should be promoted, especially in a period when the country is experiencing nationwide large-scale construction.

### Peak Shaving

Gas consumption in China exhibits great seasonal variation, and gas storage facilities are in short supply. In order to guarantee stable gas supply for downstream users by seasonal peak shaving, we used the supervisory control and data acquisition (SCADA) system for 24-hour centralized control over the operations and scheduling management of pipelines. This has improved inter-regional and inter-network scheduling efficiency, as any valve on the pipelines could be opened or closed by pressing a button. In addition, we kept improving construction of gas storages and other infrastructure to enhance our peak shaving capacity. By the end of 2013, we had built dozen gas storage units in North China, Dagang, Hutubi, Xiangguosi and other areas in China. It is expected that the storing of these gas storages units-will reach 17 billion cubic meters by the end of China's 12th Five-year Plan.



↑ Integrated controlled center

### 3. Ensuring Operational Safety

As the West-East Gas Pipelines cover a long distance and a wide area, it is extremely difficult to control risks caused by geological disasters, pipeline corrosion and third-party damage. We developed a pipeline integrity management system, and carried out routine onsite inspection and joint prevention, in order to guarantee security in the use of gas for production and living.



↑ Routine onsite inspection



↑ Night inspection in Shanghai Baihe station



## Routine Onsite Inspection

We established pipeline onsite inspection measures, and improved our management through modern technology. Using the state-of-the-art global positioning system (GPS), geographic information system (GIS) and computer network communications and data processing technology, we acquired accurate information of the longitude, latitude and time through GPS to record the routes and time of onsite inspection. This has helped us achieve graphical patrol information and realize unified management of onsite inspection in different regions and provinces.



### Case Study

## Routine onsite inspection of gas pipelines

In order to ensure stable gas supply to millions of households, we carry out routine inspection at 77 stations, 250 valve chambers, and numerous sets of equipment along the over 20,000 kilometers of pipelines, for 24 hours a day, 365 days a year.

### Horgos Station:

**“There can be no negligence, for this is the first stop in the country”**

Located in Yili Kazakh Autonomous Prefecture, Xinjiang, Horgos Station is the first stop of the Second West-East Gas Pipeline in China. The transmission volume and quality of natural gas from abroad are measured here, with 16 types of real-time data including the temperature and pressure being recorded every four hours. Meanwhile, impurities are removed from natural gas through filtration and separation, pressurization, cooling and other processes, before being delivered to downstream pipelines.

The Horgos station is responsible for 76 kilometers of pipelines. In winter, the road condition would worsen as the mountainous region is covered with heavy snow, with the possible occurrence of an avalanche. It usually takes just more than 10 minutes to reach a mile post, and in winter it would take nearly an hour. To finish the whole inspection, it would take two or three days. “There can be no negligence, for this is the first stop in the country. We have more than 200 million users waiting for the gas delivered from this station downstream”, said a pipeline inspector.



### Dachandao Station:

**“Uninterrupted operation and gas supply must be guaranteed”**

Located in Qianhaiwan, Shenzhen, the Dachandao Station is the southernmost station of the project. It connects the Qiuyuling-Dachan Island Section of Guangdong-Shenzhen Branch and Hong Kong Branch of the Second West-East Gas Pipeline, playing an important role in guaranteeing stable gas supply in Hong Kong.

Routine inspection is carried out around the clock throughout the year, on the pressure, temperature, oil level, and water level as well as the equipment signs and labels in the process area and compressor plants. By doing so, we could identify and address hazards in a timely manner, with minor problems being fixed within 24 hours and major problems handled within a prescribed period of time.



## Joint Prevention

As the West-East Gas Pipelines enter into more densely populated cities in China, risks due to surface load increased. Any explosion will cause immeasurable losses to the lives and property of the surrounding residents. Therefore, we have established a mechanism for “joint prevention, treatment and control” together with governments at all levels along the pipelines, increased public awareness of such hazards, and jointly prevented and controlled pipeline risks.



### Tips

## Protection of gas pipelines – our shared responsibility

### (1) Why should the gas pipelines and relevant facilities be protected?

Natural gas is flammable and explosive. In a highly compressed state, it will leak and diffuse in a short time once the pipeline bursts or is broken, and is likely to cause severe explosions and large-scale fires. Therefore, pipeline safety is also public safety, bearing on the safety of everyone's life and property. In 2010, China promulgated the *Oil and Natural Gas Pipeline Protection Law of the People's Republic of China*, putting oil and gas pipeline safety under the protection of the law. Therefore, everyone shares the responsibility. Any unit or individual acting against pipeline safety will be punished. If the offence is serious and constitutes a crime, they will be given criminal sanctions.

### (2) How can I identify natural gas pipeline facilities?

Pipeline markers are set for identification and warning purposes, especially for people to identify pipeline types and properties, and to determine their location. Pipeline markers include: mile posts, test piles, marking piles, communications marks, warning signs and logo belts.

### (3) What behavior may endanger natural gas pipelines?

**Surface load and illegal construction:** Deep-rooted plants, earth borrowing and quarrying, stacking of heavy objects, excavation, and construction of buildings and structures within 5m from the pipeline centerlines; dropping or dragging anchors, dredging, quarrying, and underwater blasting in areas within 500m from pipeline centerlines at river crossings; quarrying, mining, and blasting in areas within 1,000m from the center lines of pipeline tunnels.

**Gas theft:** Damaging pipelines or stealing the natural gas transmitted, leaked or discharged by the pipelines by moving, cutting, punching, smashing, and dismantling the pipelines.

### (4) What can I do to protect natural gas pipelines?

First, never do any of the aforementioned actions; second, promptly report such actions by dialing our toll-free hotline 8008200375.