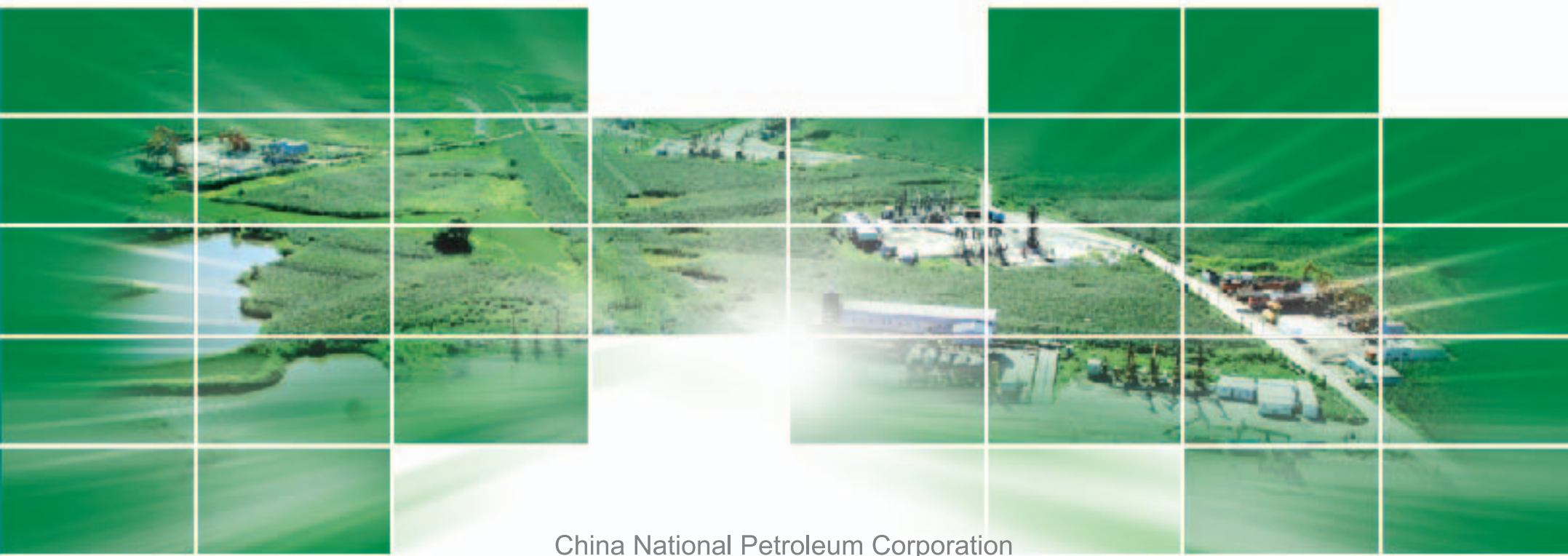




Environment

Protection of the World's Largest Reed Marsh



China National Petroleum Corporation



Liaohe Oilfield is located in the Shuangtai Estuary Wetland in the Liaohe Delta, geologically a part of the Liaohe Depression of the Bohai Bay Basin, which is the exploration area of CNPC's Liaohe Oilfield Company.

General Information

Being China's largest production base for heavy oil, high pour-point oil and super-heavy oil, Liaohe Oilfield produces 9 million tons of heavy oil every year. The oilfield is characterized by deep reservoirs, high reservoir pressures and high-viscosity crude oil—200,000 mPa·s at 50°C.



Drilling Techniques

- Cluster drilling is applied to dramatically reduce the land use of well sites and access roads.
- Horizontal drilling is applied to minimize the number of drilled holes while taking up only two-thirds of the land otherwise used.
- Window sidetrack drilling is applied to revitalize abandoned wells. In 2005, 249 wells were revitalized using this technique, with a reduction in land use of approximately 50 hectares.

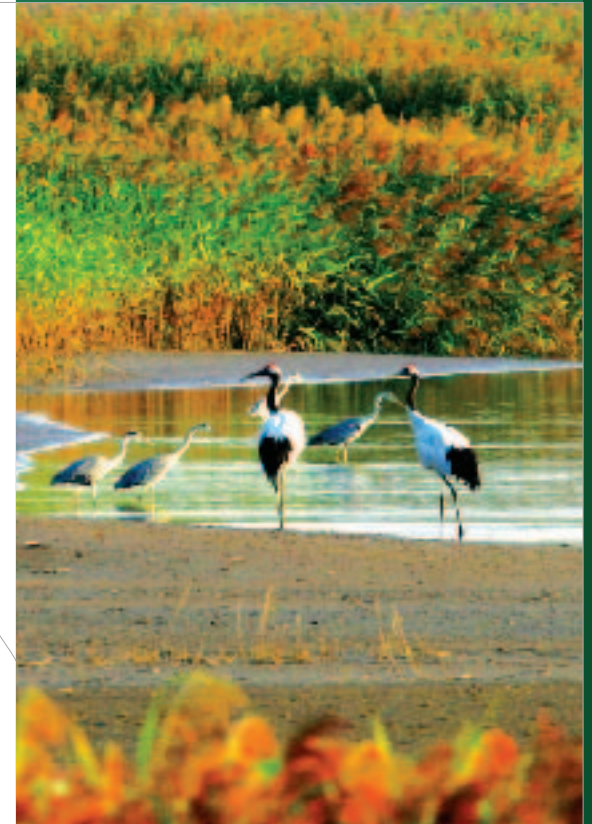


Green Workover Techniques

Green workover techniques allow for “clean workers, clean sites and clean machines” throughout the operation process while minimizing the environmental impact.



Shuangtai Estuary Wetland in Liaohe Delta, Panjin, Liaoning Province is the largest of its kind in the world and has the most complete variety of vegetation. The wetland accommodates 409 species of wild animals, including 257 types of birds. It is an excellent habitat for rare birds such as white swans, Saunder's gulls and red-crowned cranes, China's Class-A protected bird. The "Red Beach" here is regarded as one of the world's natural wonders.



What We Have Achieved

Thirty years ago, the reed marshes in the Liaohe Delta covered an area of less than 80,000 hectares and were known as the world's third-largest. However, the entire area is now over 100,000 hectares, making it the world's largest. The growth in the reed marshes has been accompanied by the exploitation of the world's most viscous Liaohe heavy oil and super-heavy oil, which currently accounts for 60% of Liaohe Oilfield's total crude oil production. The changes in the coverage of the reed marshes and the volume of oil production demonstrate the harmonious relationship existing between energy and the environment.

Environmental Measures to Protect the Wetland

It is a constant challenge to tap hydrocarbon resources while preserving the wetland. In view of this, CNPC has invested heavily to carry out environmental measures throughout the production cycle to avoid any unwanted impact or damage to the wetland ecology. Oil spills have been fully reclaimed and an environmental impact assessment system has been extensively implemented for many years. A tree planting program in the saline tidal flats of Bijialing production zone replaced the saline soil with non-saline soil, between two and three cubic meters for each tree, to ensure the survival ratio of trees thus planted. Nowadays, the lush trees in the Bijialing production zone have provided an ideal habitat and breeding area for 5,000 Saunder's gulls, the number of which was only 1,200 in the 1990s.

Regulatory Compliance

At Liaohe Oilfield, measures are taken to ensure compliance with relevant environmental protection laws and regulations. All wastewater must be treated to meet drainage standards before being discharged and all oil sludge, drilling waste and waste mud must be treated in order to nip environmental risks in the bud.

In August 2006, the flood contingency plan of Liaohe Oilfield played a vital role in withstanding the impact of four successive rainstorms in the Panjin region of Liaoning Province. No oil leakages were reported in the 1,000 oil wells located in the reed marshes spanning hundreds of miles.





Wastewater Treatment

Ten years of efforts have brought about the development of practical techniques for heavy oil wastewater treatment and reuse for steam boilers. These techniques allow for the recovery and reuse of treated wastewater as a water supply for steam injection boilers which, in turn, provides the steam supply required to extract heavy oil.

So far, there are four wastewater disposal centers in Liaohe Oilfield, which can treat 43,000 cubic meters of wastewater every day. Wastewater treatment has effectively eliminated pollution from heavy oil production while enabling the recycling of wastewater in order to minimize energy use.



