Packaged Technology of Industrialized Delayed Coker

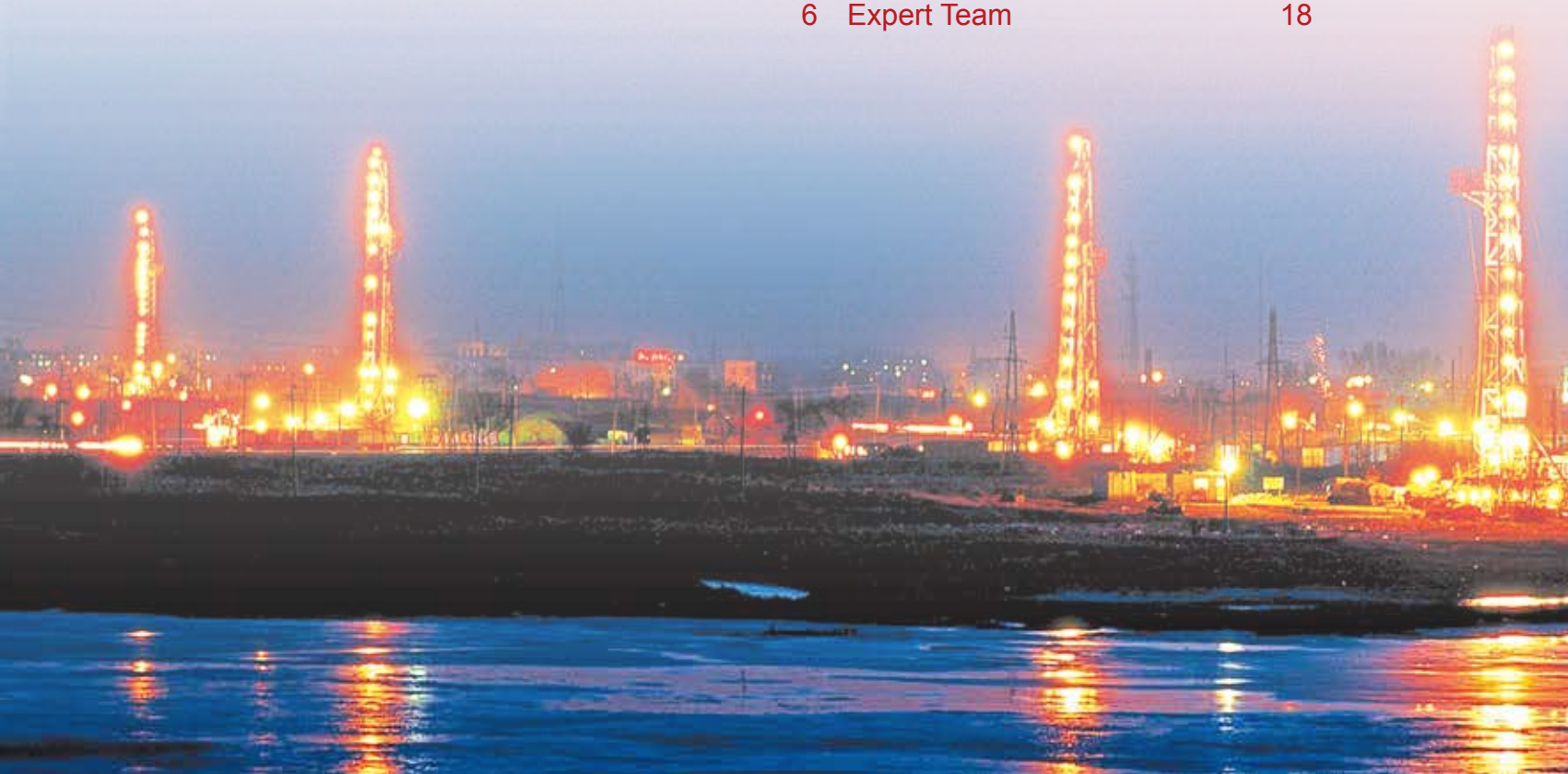
Science & Technology Management Department, CNPC

2015

CHINA NATIONAL PETROLEUM CORPORATION

The Packaged Technology of Industrialized Delayed Coker Provides You With Affordable And Eco-friendly Solutions to Inferior Heavy Oil Processing!

Contents



China National Petroleum Corporation (CNPC) is a state-authorized investment agency and a state holding company. On July 1998, with the implementation of the Institutional reform of the State Council, CNPC was reorgnized to become an integrated oil company of cross-regions, cross-industries and cross-countries, it adopts modern enterprise system to realize the integrations of upstream and downstream operations, internal and external trade, production and marketing. CNPC's business covers six main sectors: oil and gas operations, petroleum engineering service, petroleum engineering construction, petroleum equipment manufacturing, financial services and new energy development. In 2014 CNPC produced 113.67 million tons of crude oil and 95.46 billion cubic meters of natural gas, while crude processing volume reached 150.2 million tons. The total revenue of RMB 2,730 billion with a profit of RMB173.4 billion had been achieved the same year.

CNPC was ranked 3th among the world's largest 50 oil companies and 4th in Fortune Global 500 in 2014.

CNPC strictly follows by the combined strategies of increasing resource capacity, expanding market shares and consolidating the international role, and persists in regarding technical innovation as a key framework to advance technological progress. To develop its core businesses, focuses will be placed on the solutions of key bottleneck technologies and key proprietary technologies. Thanks to continuously improving of the technical innovation system, optimizing the configuration of technological resources and strengthening the construction of strong talent teams, CNPC's technological creativity has been considerably upgraded. Consequently, a large number of technologies have been developed independently, with its own intellectual property.

The packaged technology of industrialized delayed coker is one of representatives for major innovations of CNPC.

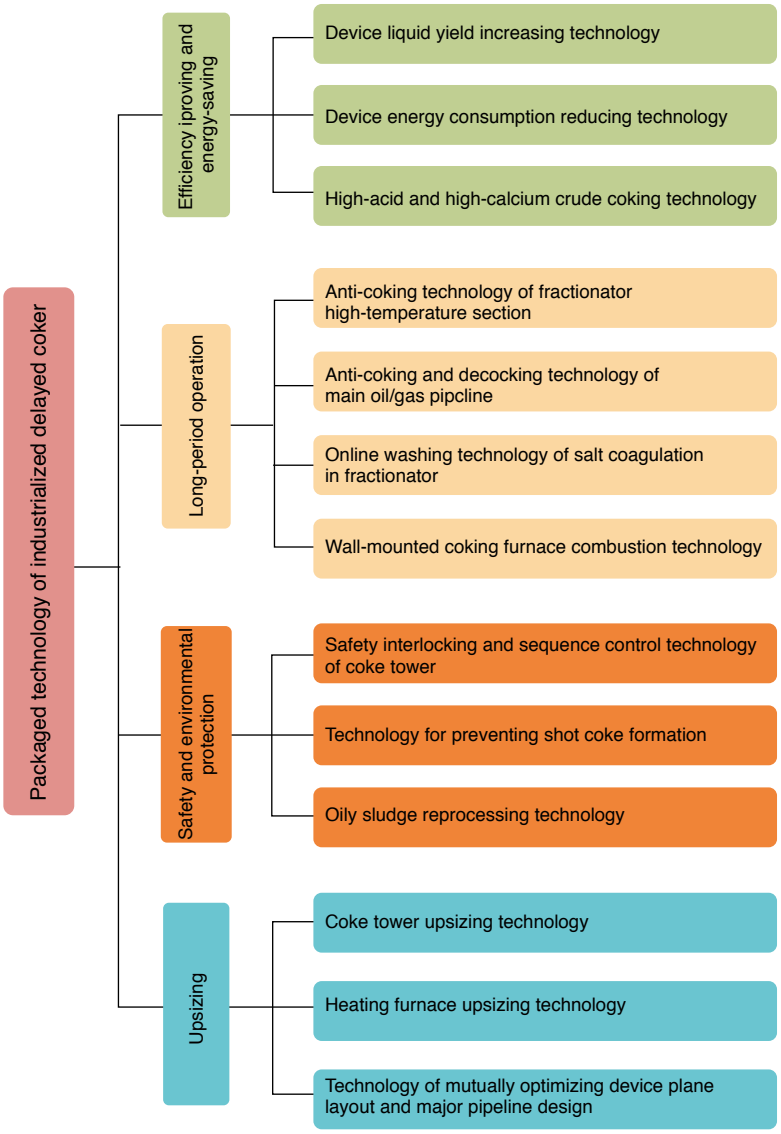
OFFERING ENERGY SOURCES, CREATING HARMONY

1 INTRODUCTION

The delayed coking technology, as an important mature processing technology of residue and other inferior heavy oil, has the advantages of strong adaptability to raw materials, low investment and processing cost, increased production of high quality diesel fraction and improved diesel/gasoline ratio, and has become the preferred processing technology for refineries especially in the processing of inferior heavy oil with high metal content and high carbon residue content.

The delayed coking reaction, which applies free radical chain reaction mechanism, mainly includes the cracking and condensation reactions, which occur in the coke tower with the reaction heat from the heating furnace. The delayed coker is mainly composed of such systems as the reaction, fractionating, absorption-stabilization and cold cutting coke water,etc. The following main process: the mixed raw oil and recycle oil enters the heating furnace after heat exchange, and is heated in the furnace tube rapidly to approximately 500℃ before reacting in the coke tower, where the buildup of generated petroleum coke takes place, and the hydraulic decoking system is applied; the intermediate products such as wax oil, diesel oil, gasoline and LPG are extracted from the oil and gas through the fractionating system and the absorption-stabilization system, also produced the dry gas as a byproduct.

The packaged technology of industrialized delayed coker with independent intellectual property rights is established by means of integrated development and independent research and development. More than 10 patens have been obtained in respects of efficiency improving and energy-saving, long-period operation, safety and environmental protection and upsizing, and 13 unique technologies have been developed and successfully applied in more than 10 oil refining companies from Sudan at abroad, and Dushanzi, Fushun and Liaohe at home, to realize the safety, stable and long-period operation of the coker. Compared with the conventional coking technology, the coker has a liquid yield increased by 2%, energy consumption reduced by 1 ~ 2 kg standard oil/t raw material, continuous operation period of 3 ~ 5 years and furnace thermal efficiency above 92%.


Packaged technology of industrialized delayed coker
Efficiency iproving and energy-saving
Device liquid yield increasing technology
Device energy consumption reducing technology
High-acid and high-calcium crude coking technology
Long-period operation
Anti-coking technology of fractionator high-temperature section
Anti-coking and decocking technology of main oil/gas pipcline
Online washing technology of salt coagulation in fractionator
Wall-mounted coking furnace combustion technology
Safety and environmental protection
Safety interlocking and sequence control technology of coke tower
Technology for preventing shot coke formation
Oily sludge reprocessing technology
Upsizing
Coke tower upsizing technology
Heating furnace upsizing technology
Technology of mutually optimizing device plane layout and major pipeline design

2 CHARACTERISTIC TECHNOLOGIES

2.1 Efficiency improving and energy-saving

2.1.1 Device liquid yield increasing technology

Under the premise of ensuring long-period operation of the device, such measures are taken as lowering the recycle ratio for hydrogen recycle, increasing the outlet temperature of heating furnace and reducing the operating pressure of coke tower in line with different properties of raw material and target products in an attempt to increase the device liquid yield and maximize its economic benefits. This technology can be widely used in the used cokers of all sizes.

2.1.2 Device energy consumption reducing technology

The heat removal by the fractionator was optimized by using pinch technology to increase the percentage of the high-temperature heat source, and meanwhile, the device energy consumption is reduced by improving furnace thermal efficiency, zero-emission of oily sludge within device, heat integration of fractionating system and absorption-stabilization system and recovery of low-temperature heat. This technology can be widely used in the delayed cokers of all sizes, reducing the energy consumption by 1 ~ 2 kg standard oil/t raw material.

2.1.3 High-acid and high-calcium crude coking technology

Considering the specialty of “four high values (high acid value, high calcium content, high density and high metal content) and two low values (low sulfur content and low light component content)” of crude oil from Sudan, the combined technology of atmospheric distillation-coking has been successfully developed. This technology, which functions in both atmospheric distillation and delayed coking, is especially suitable for processing the high-acid high-calcium inferior thickened oil, significantly simplifying the overall processing in refineries; the pretreatment of naphthenic acid damage plays a role in remarkably alleviating the workload of subsequent processing device in anticorrosion and saving investment cost. This technology can be used in the delayed cokers with inferior thickened oil as raw material.

2.2 Long period operation

2.2.1 Anti-coking technology of fractionator high-temperature section

For the desuperheating section of fractionator, the distributor and the tray are combined for use, and there is a coke powder deposition preventer at the bottom; besides, the appropriate washing oil is used to fully wash the coke powder, reducing the coke powder content in sideline product; and the recycle ratio can be adjusted flexibly as needed by production, so that coking much less likely occurs

at the bottom of fractionator which has an operation period of more than 3 years. This technology is applicable for all kinds of delayed cokers and has distinct advantages compared with those with low recycle ratio and ultralow recycle ratio.

2.2.2 Anti-coking and decocking technology of main oil/gas pipeline

The suitable fraction is used as quench oil and the injection point and way of quench oil is optimized, effectively mitigating the coking in main oil/gas pipeline. In addition, the online removable facility is used to replace the main oil /gas pipeline bend at the top of coke tower, so as to see clearly the coke layer within the main oil/gas pipeline, prolong the operation period of main oil/gas pipeline, and extend the cleaning period from 3 months to 6 months or more. This technology can be widely used in the delayed cokers of all sizes.

2.2.3 Online washing technology of salt coagulation in fractionator

The fractionator overhead circulating reflux and gasoline cold reflux system is used, and two process are involved, i.e. washing and rinsing; the upper parts of fractionator where salt coagulation is apt to occur are cleaned without shutting down, affecting the product quality, or splashing dirty oil; this operation is simple, safe and environmental friendly, ensuring a long operation period over 3 years of the coking fractionator. This technology can be extensively applied in the delayed cokers of all sizes.

2.2.4 Wall-mounted coking furnace combustion technology

The wall-mounted coking furnace combustion technology is developed. According to the coke forming properties of different coking feedstocks, different arrangement types of wall-mounted burners and furnaces are used, allowing more uniform distribution of smoke flow field and temperature field in the coking furnace radiation chamber, reducing the peak intensity of radiation furnace tube surface and preventing against the local coking at high temperature. At the same time, efficient, safe and smooth operation of coking furnace for a long period time is secured. This technology can be widely used in the delayed cokers with different raw materials.

2.3 Safety and Environment Protection

2.3.1 Safety interlocking and sequence control technology of coke tower

By using this technology, the sequential and safe switching of valves within the coke tower area is secured, and the operation procedure of coke tower is optimized and standardized, where the operators are only allowed to perform effective operation on active valves so as to avoid misoperation and ensure safe operation of the coke tower. Besides, the improved automation level allows for reducing the labor intensity. This technology can be widely applied in coke tower area of the delayed cokers of all sizes.

2.3.2 Technology for preventing shot coke formation

The shot coke is produced mainly depending on the property of raw materials. Where the asphalt content in the raw material is close to or equal to half the carbon residue content, the shot coke will likely be generated. But the production of shot coke can be increased or decreased to some extent by changing

operating conditions. This technology plays a part in both inhibiting and treating the formation of shot coke. In combination with the property of raw materials and the specific project conditions, on the one hand this technology functions in inhibiting shot coke against forming by means of improving the property of raw materials and optimizing the operating conditions; on the other, it can, through optimized design and operation, ensure the safe and smooth device running for a long period under the condition of shot coke formation. This technology is applicable for the delayed cokers that process the inferior raw materials with high asphaltene content.

2.3.3 Oily sludge reprocessing technology

The coke afterheat is used to enable the high-temperature thermal cracking of organic components of oily sludge, which allows its transforming into coking products. Meanwhile, the oily sludge can be used as quenching medium to cool the hot coke before decoking, not only eliminating the pollution from oily sludge, but also obtaining useful coking products. This technology can be applied in the delayed cokers of all sizes.

2.4 Upsizing

2.4.1 Coke tower upsizing technology

ANSYS software is used to conduct the optimized fatigue analysis for the skirt structure of coke tower. The integral forge-welding structure is adopted to greatly prolong the service life of coke tower; the tapered transition section of the upsized coke tower is so segmented as to be transported as a whole. The anchor bolt is equipped with disc spring to avoid its looseness due to coke tower shaking. The hot box is provided with a thermocouple for real-time monitoring of temperature change rate.

2.4.2 Heating furnace upsizing technology

The newly developed bottom-burning trapezoid furnace structure is adopted, and different combinations of radiation chamber-convection chamber can be utilized flexibly based on the processing capacity of the delayed coker, improving the adaptability of the delayed coker to feedstock and allowing a wider range of processing capacity of the device to meet the development needs of device upsizing. This technology can be extensively used in the delayed cokers of all sizes with various inferior raw materials.

2.4.3 Technology of mutually optimizing device plane layout and major pipeline design

The plane layout is performed and adjusted according to the arrangement procedure of equipment in core area, taking into consideration the piping layout and critical piping stress calculation, so as to realize the interactive optimization, reduce the floor space of device, reduce pipe usage and pipe rack investment and thus achieve economic reasonability. This technology can be widely applicable to the delayed cokers of all kinds, and the larger the device is, the more obvious the advantage will become.

3 TYPICAL CASES

CNPC's packaged technology of industrialized delayed coker has been successfully applied in many companies at home and abroad.

3.1 High-acid and high-calcium crude coking technology

Sudan Khartoum 200×10^4t/a delayed coker adopts the technology. The device is constructed in two phases: the first phase project was completed and put into production in September 2004; the second phase project started operation in May 2006. The device is equipped with one furnace and two coke towers as well as separate product fractionators in each phase, sharing one contact cooling system, electro-desalting system, absorption-stabilization system, dry gas desulfurization/liquefied gas desulfurization system and coke water system. With dual functions of atmospheric distillation and delayed coking, the device is particularly suitable for processing high-acid high-calcium inferior thickened oil, significantly shortened the overall processing period in refineries.

The device, since being put into production, has operated normally and produced qualified products with main technical and economic indexes reaching or exceeding the design value, realizing the safe and smooth running for a long period time.

200×10^4t/a high-acid and high-calcium crude delayed coker in Sudan Khartoum refinery

3.2 Upsizing technology and online salt washing technology

CNPC Fushun Petrochemical Company designed the 240×10^4t/a delayed coker with the maximum processing capacity up to 320×10^4t/a. This device, comprising the coking system and the absorption-stabilization system, is mainly used for processing the vacuum residue from Daqing. The processes such as two furnaces and four towers, fractionator top recycle for heat removal and four towers (absorption-stabilization-reabsorption-stabiliation) are adopted; the largest delayed coker with coke tower diameter of 9800mm has been built within CNPC system by extensive use of the upsizing technology and other advanced and mature technologies at home and abroad. Since its commissioning in Sept. 2010, the device has been running stably and has produced products meeting the design requirements with energy consumption lower than the devices alike at home and abroad.

Coke tower, 240×10^4t/a delayed coker in CNPC Fushun Petrochemical Company

3.3 Wall-mounted furnace combustion technology and high-temperature section anti-coking technology

The 100×10^{4}t/a delayed coker developed by CNPC Liaohe Petrochemical Company is the first device used for domestic processing of 100% ultra heavy oil residue from Venezuela. Considering device condition, the original two-sided radiation furnace and heating furnace has been modified by use of the wall-mounted furnace combustion technology; and the fractionator has been modified using the high-temperature section anti-coking technology; and the semi-automatic bottom cover machine of coke tower has been replaced by automatic bottom cover machine. Since its commissioning in October 2011, it has undergone the industrial test for the processing of 100% oil residue from Venezuela, and has accomplished smooth online switch to the processing of thickened oil from Liaohe.

CNPC Liaohe Petrochemical Company's 100×10^{4}t/a delayed coker for Venezuela ultra heavy oil residue

CNPC Liaohe Petrochemical Company's 100×10^{4}t/a delayed coker with heating furnace modified by "wall-mowited furnace combustion technology"

Distribution map of delayed coker development achievements

List of main achievements

SN	Construction location	Capacity (unit: 10000 t/a)	Design content	Design time	Remarks
1	Huantai, Shandong	20	Basic design, detailed design	2000.09	
2	Khartoum, Sudan	100	Basic design, detailed design	2003.04	(phase 1) Third Prize, National Ministry of Construction
3	Sichuan Shengma Chemical Co., Ltd.	20	Basic design, detailed design	2004.11	
4	CNPC Dagang Petrochemical Company	100	Basic design, detailed design	2004.10	
5	Shandong Kenli Petrochemical Group	40	Basic design, detailed design	2004.12	
6	Khartoum, Sudan	120	Basic design, detailed design	2005.08	(phase 2) First prize of excellent design, group company
7	Jinao (Hubei) Science & Technology Chemical Industry Co., Ltd.	40	Basic design, detailed design	2006.06	
8	Shandong Befar Group Co., Ltd.	100	Basic design, detailed design	2008.10	
9	CNPC Dushanzi Petrochemical Company	120	Basic design, detailed design	2009.10	Second prize of design, engineering company

to be continue

SN	Construction location	Capacity (unit: 10000 t/a)	Design content	Design time	Remarks
10	CNPC Fushun Petrochemical Company	240	EPC	2010.09	First prize of design, engineering company
11	CNPC Liaohe Petrochemical Company	100	adapted to processing Venezuela oil residue	2011.10	
12	Costa Rica	70	FEED	2012.11	
13	Jieyang, Guangdong	300	EPC	Under design	
14	Shandong Tianhong New Energy & Chemicals Co., Ltd.	160	Basic design, detailed design	Under design	
15	Shandong Yuhuang Chemical (Group) Co., Ltd.	160	Basic design, detailed design	Under design	

4 SCIENTIFIC RESEARCH EQUIPMENT

CNPC is armed with the advanced application system of computer network platform and real-time and efficient network communication system, which are widely used in design and management. Moreover, it provides over 100 kinds of engineering design software such as PIMS, PRO Ⅱ, AspenPlus and PDMS to meet the demands of different owners at home and abroad.

Designation	Category of Software
PIMS	An optimal management system of factory plan, also a powerful user-friendly software package of economic planning for process industry. It adopts the Linear Programming (LP) technology to optimize the operation plan of process industry enterprises. It can be used in: 1. Optimization of operational plan; 2. Logistics and supply chain management; 3. Technical evaluation; 4. Capacity estimation and production expansion study of each unit in factories
Pro/ Ⅱ , Aspen plus, Aspen Hysys	Large general process simulation software for production unit design, steady simulation and optimization
Aspen Energy Analyzer	Computing software of pinch technology based on process combination and integration. It uses the site operation data or the process simulation computation data as input to design the process flow with the minimum energy consumption and lowest operation cost in chemical plants and refineries. Typical applications are as follows: 1. Process integration plan design for energy conservation reconstruction of old plants; 2. “Debottleneck” analysis for production capacity expansion of old plants; 3. Design analysis for energy recovery system (e.g. heat exchanger network); 4. Rational layout and optimized operation of utility system (including models such as the heating furnace, steam turbine, gas turbine and refrigerating system)
Smart Plan P&ID	Smart PID design system centering on database and driven by rules
Dynsim	Dynsim is a full-featured and mature dynamic process simulation system based on precise calculation; it provides accurate and reliable calculation results by using the mechanism based technology and precise thermodynamic data to solve the most difficult problems of dynamic simulation encountered in engineering analysis, control system checking and operator training system, etc.

to be continue

Designation	Category of Software
PDS, PDMS	As a three-dimensional plant layout and design management system, the software has the following main features: 1. The full-scale 3D entity modeling; 2. Applying the network to perform real-time collaborative design of multiple disciplines and simulate real spot environment, thus allowing multiple professional groups to carry out collaborative design to establish a detailed 3D digital factory model and every designer at any time during design process to check what the other designers are doing; 3. In the process of interactive design, PDMS can automatically perform real-time 3D collision check among components and various professional design products, ensuring the accuracy of design results on the whole; 4. The separate database structure allows all the components and equipment information to be stored in the parameterized component library and equipment library, instead of the third party's database; 5. The open development environment facilitates the output of drawings meeting traditional industry standard
CAESAR Ⅱ	CAESAR Ⅱ is professional software for pressure piping stress analysis. It can be used for both static analysis and dynamic analysis. It can provide users with complete international general specifications concerning pipeline design conveniently
HTRI, HTFS	A kind of software used for calculation of heat transfer of heat exchanger and burning furnace and other relevant calculations
Flare-Net	Used for steady-state design, calculation and debottleneck of flare system
PFR FRNC-5PC	Heating furnace simulation and structure design
ANSYS	Equipment stress analysis
STADD/CHINA2006	Steel structure computation
P3E/C	Project program management
Project Wise	Document management
POWERON	General contracting management

5 QUALIFICATION STANDARDS

5.1 Qualification

CNPC possesses Class A qualifications in engineering audit, engineering investigation (geotechnical engineering, engineering surveying) and engineering cost consultation. Besides, CNPC holds the qualifications in pipeline design and the design of pressure vessels of 15 types in categories Ⅰ, Ⅱ and Ⅲ.

5.2 Standard

All kinds of domestic and foreign standard specifications are known well and the design standards proposed by owners are followed strictly.

Standards established by CNPC as chief compiler or complier member:

Standard number	Standard name/planned project name	chief complier/ complier member
GB/T9112—2010	Type and parameters of steel pipe flange	complier member
GB/T9125—2010	Fasteners for pipe flange connection	complier member
GB/T9124—2010	Technical specification of steel pipe flange	complier member
GB/T 13402—2010	Large-diameter steel pipe flange	complier member
HG/T20653—1011	Technical specification for chemical water treatment design in chemical enterprises	complier member
Q/SY1303—2010	General principles for anti-seepage treatment design in petrochemical enterprises	chief complier
CNPC DOC. (2005) No.519	Installation project expense standard in petroleum construction	complier member
Q/SY 1373—2011	Rules for compiling chapters concerning energy conservation in preliminary design of refining and petrochemical projects of fixed assets investment	chief complier
Q/SY 1579—2013	Rules for compiling chapters concerning water conservation in preliminary design of refining and petrochemical projects of fixed assets investment	chief complier
Q/SY 1064—2010	General rules for compiling sections(chapters) concerning energy and water conservation-feasibility study and preliminary design of fixed assets investment projects	complier member
Q/SY 1577—2013	Rules for making assessment report concerning energy conservation of refining projects of fixed assets investment	chief complier
GB/T 17185—1997	Steel flange fittings	complier member
GB/T19326—2003	Socket welded, thread and butt welded steel side tube base	complier member
GB/T17186.1	Calculation method of pipe flange connection strength Method A	
JB/T1762—2012	Stop valve and check valve for LNG	complier member
Q/SY2012—106	Technical requirements for prevention and control of water pollution under accident condition	complier member

5.3 Patent technologies

No.	Patent name	Patent type	Application No. or patent No.
1	A kind of welding assembly of large container bottom head and skirt	Invention	ZL 200310121385.9
2	Heating furnace equipped with deflector	Utility model	ZL 201120272933.8
3	Double-ladder two-sided radiation tube type heating furnace	Utility model	ZL 201120274457.3
4	Symmetric double-ladder tubular radiation furnace	Utility model	ZL 201120503562.X
5	Energy-saving type of wall-mounted wide flat flame gas burner with low NO_x emissions	Utility model	ZL 201120475572.7
6	Nonstop timely coke burning system for heating furnace of delayed coker	Utility model	ZL 201120525072.X
7	Desuperheating washing device for preventing the bottom of delayed coker fractionator from coking	Utility model	ZL 201120503695.7
8	Electric tap for delayed coker	Utility model	ZL 201220024653.X
9	Automatic decoking device	Utility model	ZL 201220022985.4
10	Decoking control valve	Utility model	ZL 201220023012.2
11	Bottom-burning trapezoid furnace	Utility model	ZL 201220177430.7
12	Intermediate firewall for oil-refining heating furnace	Utility model	ZL 201220178052.4
13	Heating furnace tube hanger	Utility model	ZL 201320101169.7
14	A method for preventing oil sump tank in high-temperature section of delayed coker fractionator from coking	Invention	201210250679.0
15	A switching method for delayed coker to process various feedstocks without suspending production	Invention	201210250292.5
16	An improved process to effectively prevent air cooler and water cooler of delayed coker blowdown system from wax hanging	Invention	201210313936.0
17	A king of delayed coker steaming out and unloading cooling system and its application	Invention	201310520929.2

6 EXPERT TEAM

Xie Chongliang

Senior technical expert and professional-level engineer. He has organized and participated in more than 30 refining engineering design projects, and assumed the positions of technology and equipment principal in Sudan coking project and technical director in Fushun large-scale coking project. He has been honored with 1 national excellent engineering design award and 8 excellent engineering design and science and technology progress awards at provincial level, and has published over 10 papers.

Tel: 0532-80950007

Email: xiechongliang@cnpccei.cn

Fan Hailing

Senior technical expert and senior engineer. As an expert in the engineering design and the development and application of relevant technologies of coking device, she has successfully taken part in the engineering design of 10 oil refining units. She has obtained 1 excellent design award above provincial level, issued 3 papers and owned 2 patents.

Tel: 0532-80950692

Email: fanhailing@cnpccei.cn

Bi Zhiguo

Senior technical expert and senior engineer. As an expert in the engineering design and the development and application of relevant technologies of coking device, he has successively taken part in the engineering design of 10 oil refining units and the development of 2 scientific research projects within group company. Moreover, he has won 1 excellent design prize above provincial level and published 4 papers.

Tel: 0532-80950713

Email: bizhiguo@cnpccei.cn

Han Yumei Senior technical expert. He holds the classes A and SAD pressure vessel auditor certificate and pressure vessel viewer certificate issued by China Standardization Committee on Boilers and Pressure Vessels. He is adept at the equipment design such as delayed coker and the development and application of relevant technologies. Besides, he has accomplished the design of many delayed cokers. He has been granted 7 excellent engineering design and science and technology progress prizes above provincial level with 2 patents respectively, and his 6 professional papers have been published.

Tel: 0532-80950264

Email: hanyumei@cnpccei.cn

Dong Gang Senior technical expert and senior engineer. He is specialized in the engineering design and the development and application of relevant technologies of delayed coker. He has successfully got involved in the engineering design of 20 oil refining units. He has obtained 5 excellent design awards above provincial level, issued 7 papers and owned 7 patents.

Tel: 0532-80950349

Email: donggang@cnpccei.cn

Lin Hongjun Senior technical expert and senior engineer. He is expert in the design of automatic control engineering of delayed coker and the research and design of factory automation and informatization. He has successively got involved in the engineering design of over 30 oil refining units in more than 20 projects, and as a professional head has presided over the overall professional design in respect of automatic engineering control of more than 10 oil refining units. He has got 5 awards involving excellent engineering design, engineering consultation and technology progress at provincial level.

Tel: 0532-80950523

Email: linhongjun@cnpccei.cn

Zhu Wuchuan Senior technical expert and senior engineer. Being skilled in the equipment plane layout and piping design of delayed coker, he has successifull participated in the engineering design of many coking devices in Sudan, Dushanzi, Dagang, Jieyang and the delayed coker for industrial test of Venezuela ultra heavy oil residue in Liaohe. He has won 2 excellent design awards above provincial level.

Tel: 0532-80950878

Email: zhuwuchuan@cnpccei.cn

CNPC
中国石油

技术依托单位联系人：

毕治国　先生

电　话：0532-80950713

Email: bizhiguo@cpeccei.cn

中国石油科技管理部联系人：

刁　顺／窦红波　先生

电　话：86-10-59986059/59982528

Email: sdiao@cnpc.com.cn/ douhb@cnpc.com.cn

Contact of the Technical Support Unit :

Mr. Bi Zhiguo

Tel: 0532-80950713

Email: bizhiguo@cpeccei.cn

Contact of Science&Technology Management Department,CNPC :

Mr. Diao Shun/Dou Hongbo

Tel: 86-10-59986059/59982528

Email: sdiao@cnpc.com.cn/ douhb@cnpc.com.cn