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New Drive for China's Coal Industry

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Answers for energy.

New Drive for China's Coal Industry

State-of-the-art Siemens gasifiers are helping China's biggest coal company to modernize its chemical business – resulting in highly profitable operations and a reduction of carbon emissions, and boosting economic development in Ningxia Hui Autonomous Region.

The olefins plant, at the heart of the Ningdong coal chemical center, represents an investment of US$2.8 billion – the largest-ever investment in Ningxia province.

From the perspective of Shanghai or Beijing, Ningxia is a remote place. Situated in the west of the country, it is nowhere near the main centers of economic development. Ningxia Hui Autonomous Region is home to the Hui nationality – Chinese-speaking Muslims. They form one of the largest among the more than 50 ethnic minorities in China.

A large part of the region is arid, desert-like country. It is here, about 40 kilometers outside of the provincial capital Yinchuan, that the tall chimneys of the Shenhua Ningmei Group tower over the dry land. What first appears to be a mirage turns out to be huge factory premises – the Ningdong coal chemical center, stretching over more than 25 square kilometers. The site, still under construction, is covered by a multitude of factory buildings and crisscrossed by pipelines glistening in the hot sun. More than US$4.7 billion are being invested in this large-scale coal chemical business. Its methanol, olefins, and DME plants as well as five other installations are now completed and successively going into operation.

Two World Records

One of the most important outfits among the Ningdong coal chemical center's various installations is no doubt its olefins plant. It alone represents investments of approximately US$2.8 billion. So far, this is the largest single investment ever made in Ningxia. Its production capacity adds up to 500,000 tonnes of polypropylene per year and up to 188,000 tonnes of mixed hydrocarbon, 41,000 tonnes of liquid fuel, and 13,800 tonnes of sulfur. This makes it the largest production facility in the world for coal-based polypropylene.

What attracts even more attention than these figures is the fact that the olefins plant uses five Siemens SFG-500 gasifiers based on Siemens technology. Each set of SFG-500 gasifiers can "digest" approximately 2,000 tonnes of coal every day, providing sufficient raw material for further chemical processing. Such large gasifiers have never before been employed for production in the chemical industry. The olefins plant underwent a

test run in September 2010 and got the official go-ahead in April 2011. Due to the efforts of Siemens engineers and Shenhua Ningmei technical staff, this installation, one of the core elements of the coal chemical center and a mainstay of the regional economy, is now approaching full capacity. Chen Shu, the Chairman of Ningxia's Energy Resources Association, has long participated in the cooperation between Siemens and Shenhua Ningmei. The 61-year-old has been working in the coal industry for nearly 40 years. Chen has held positions, among others, as vice-director general at Shenhua Ningmei Group and as party secretary in charge of that same company. Today, he works as advisor to the group. In 2005, he led a research ▸

"With a project of such enormous proportions, we had to be very careful. But in the end, we all agreed Siemens was the right choice."

Chen Shu, Vice-Chairman of the Board, Shenhua Ningmei Group


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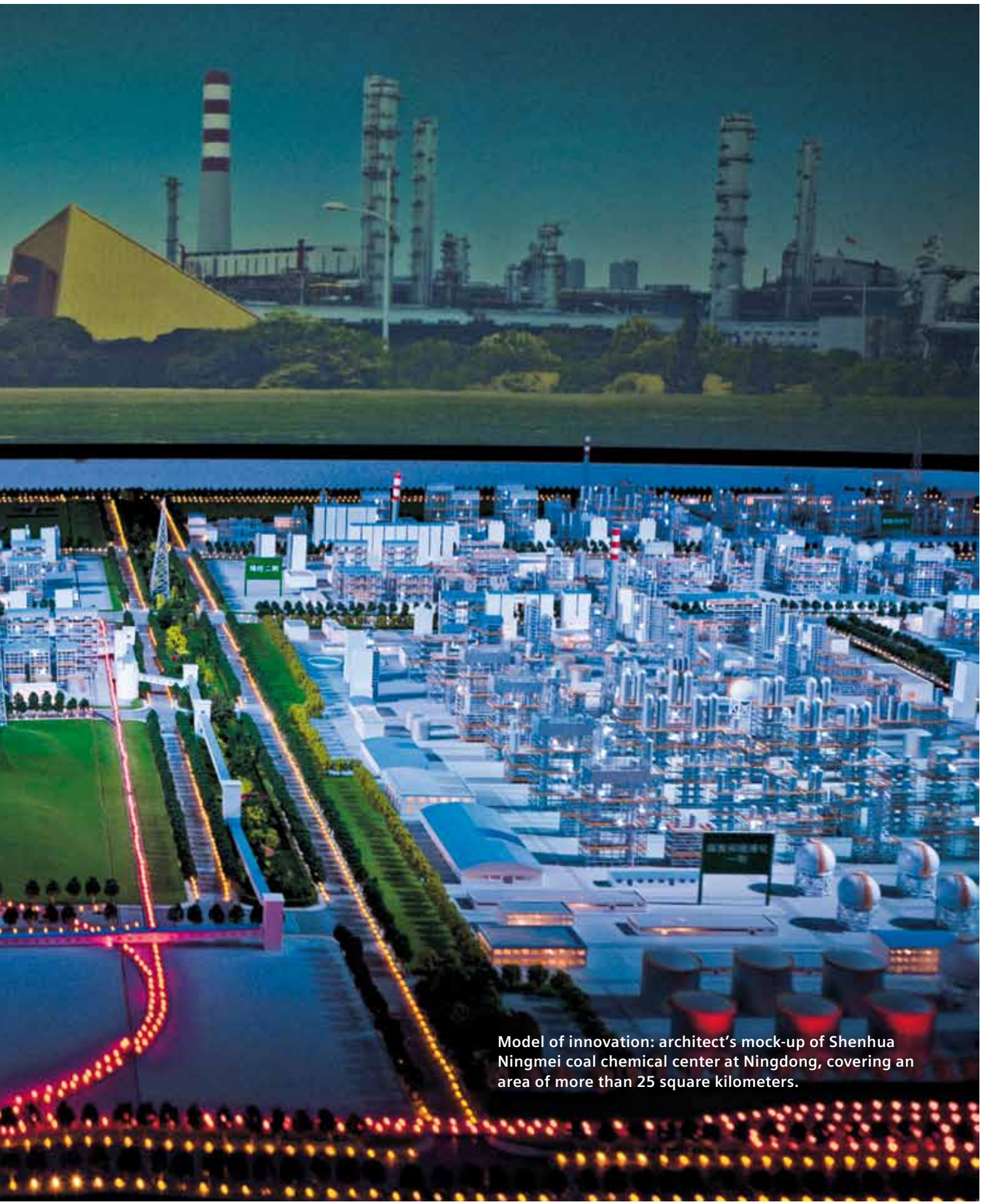

Model of innovation: architect's mock-up of Shenhua Ningmei coal chemical center at Ningdong, covering an area of more than 25 square kilometers.

Top row: The olefins plant draws a constant flow of visitors. Customers attend the open door factory event in Ningdong in October 2011 – attractions included the Siemens SFG-500 gasifiers.

Coal Gasification

China, the world's largest coal producer, also uses coal to produce chemicals such as ammonia and methanol. The first main conversion step, gasification, is a partial oxidation process. As oil and gas prices continue to rise, the use of low-cost replacement fuels in the chemical industry is attracting global interest.

team that traveled to Germany to take a good look at Siemens gasification technology. He was absolutely delighted with what he saw and suggested that Shenhua Ningmei opt for Siemens technology as the backbone of its olefins project.

"Upon our return to China, we held a meeting in Beijing that lasted for no less than three days," Chen recalls. "We called together the leading experts to discuss whether this particular gasification technology was really feasible. The leaders of our company were also present, as was as the political leadership of Ningxia Hui Autonomous Region," he adds. "Ningxia Hui's economic strength has limits, so everybody felt that with a project of such enormous proportions, we really needed to be very careful. One mistake in the early stages could have had disastrous ramifications in the future," Chen explains. "In the end, however, everybody agreed that Siemens was the right choice."

Bottom row: During a tour of the factory and the office buildings, *Living Energy* author Wang Lang (right) is briefed by Chen Shu, Vice-Chairman of the Board of Shenhua Ningmei Group, on the merits of gasification for the polypropylene industry.

There was a reason why Shenhua Ningmei thought the project through carefully. At the time, only two smaller versions of the later SFG-500 gasifier design were in operation, a testing facility and larger gasifier with a daily capacity of 800 tonnes. It was not entirely clear yet how efficient it would be. Even then, however, Siemens gasifiers had clear advantages over competing technologies. That is why Shenhua Ningmei decided to adopt this technology for the olefins project, which was still under construction at the time. "After our research trip to Germany", says Chen, "it took just one month until Siemens and Shenhua Ningmei signed their agreement."

Five Gasification Units and ¥1 Billion of Profits in One Year

Under the close cooperation between Siemens and Shenhua Ningmei, the cutting-edge technology has already brought about hugely positive results at the Ningdong coal chemical center. In order to get the technology up and running as quickly as possible, Siemens sent a team of technicians to be permanently on-site in the olefins plant, where they also deal with day-to-day operations.

In its early phase, the coal chemical center in Ningxia employed a range of different gasifiers built both by domestic and foreign companies. The comparison, recalls Chen Shu, clearly showed the superior performance of GSP and proved that the new technology was ▸

Decisions, decisions: After Chen Shu's research trip to Germany, Siemens and Shenhua Ningmei signed their agreement within a month.

"Siemens technology not only improves the profitability of Shenhua Ningmei; it raises the level of China's entire coal chemical industry."

Chen Shu

more efficient than the competition. In 2010, the olefins project was still in the testing phase, but it was already beginning to run a profit. After it was officially put online, the company achieved a net profit of approximately ¥1 billion (US$157 million) within one year.

Raising the Level of China's Coal Chemical Industry

In the meantime, the gasifiers installed in the olefins plant have become the main attractions at the Ningdong coal chemical center. There is a constant flow of visitors coming in order to take a look at the ground-breaking outfit – so many that the company has actually acquired five solar-powered vehicles to drive them around on-site. In October 2011, representatives of various companies from the USA, the UK, France, Germany, South Korea, Australia, New Zealand, Singapore, Indonesia, South Africa, and other countries followed the invitation from Siemens to visit the Ningdong coal chemical center and to see the SFG-500 gasifiers in operation. Huang Bin, Chief Engineer at the olefins plant, explained the advantages to them in detail.

One of them is that the gasifiers can utilize a wide range of different types of coal. Inferior coal, for instance, does not present a problem. At an ash content of 20 percent, the equipment runs normally. Gas production reaches a cold gas efficiency rate of more than 80 percent. Moreover, the technology facilitates very high carbon conversion rates of more than 99 percent, a clear advantage over other approaches to gasification. In addition, no harmful emissions are produced during gasification. The slag is also free of harmful substances and can thus be converted directly into building material or put to other uses.

Huang Bin's presentation was followed by a lively discussion, with the visitors enquiring about the optimal degree of moisture in the coal, the influence of ash content on the equip-

ment, and about the origin of the coal used in the process. Obviously, the Siemens gasification technology captured everybody's attention.
Chen Shu thinks that Siemens technology not only improves the profitability of Shenhua Ningmei; it also helps to raise the level of China's entire coal chemical industry. Coal will continue to cover about 70 percent of Chinese energy production in the long run, even as the imports of oil keep rising. This energy mix means that the coal chemical industry has great potential for development in China.
With price constituting a key factor in competitiveness, Siemens' gasifiers are exactly the right technology, as it leads to a significant reduction of production costs. Moreover, as Chen Shu reveals, the Ningdong coal chemical center is already moving on to the second phase: The projected capacities are at 2 million tonnes for olefins production and 4 million tonnes for coal liquefaction. All in all, these projects will require more than 40 sets of gasifiers. Since the Siemens gasifiers have already demonstrated their unique qualities, Shenhua Ningmei Group naturally considers them its first choice.

Using CO_2 to Extinguish Fires in the Mines

But what influence will Siemens gasification have on the local environment? Chen Shu thinks that it has three main effects. Because it raises efficiency, it reduces the consumption of coal and oxygen during the production process. This means lower carbon emissions. Secondly, with Siemens technology, the entire sulfur contained in coal can be captured, thus reducing air pollution. For countries like China, where coal is the main source of energy, this is an extremely important point. Finally, Shenhua Ningmei plans to use CO_2 generated during production with Siemens gasifiers to deal with mine fires. In the past, it took quite a long time to put these fires out. With CO_2, this process will be much faster. Utilizing CO_2 is still in the planning phase. "Once this works", says Chen Shu, "it will be an additional measure to reduce the tremendous carbon dioxide emissions resulting from these fires." ■

Shenhua Ningmei

Ningxia Hui Autonomous Region in northwestern China has a population of over 6 million and an area of 66,000 square kilometers.

The Manager

Chen Shu (61), Vice-Chairman of the Board of Shenhua Ningmei Group, has nearly 30 years of experience in the coal mining industry of Ningxia Hui Autonomous Region. He also serves as Chairman of the region's Energy Resources Association, a professional trade body.

The Company

With proven coal reserves of up to 24.1 billion tonnes, Shenhua Ningmei Group is the largest coal company in China, where coal accounts for about 70 percent of power generation. Its aim is to use local coal to build Asia's largest coal chemical production base.

2009: group's total assets over
¥60 billion (US$9.4 billion)

2010: annual coal production surpasses
60 million tonnes

2011: more than
50,000 employees

Wang Lang *is a former author, editor, and editorial director at* Business Daily, *the largest publication of its kind in China. Since his retirement from the paper in 2011, he has been working as a freelance writer.*

Graphic: independent

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