



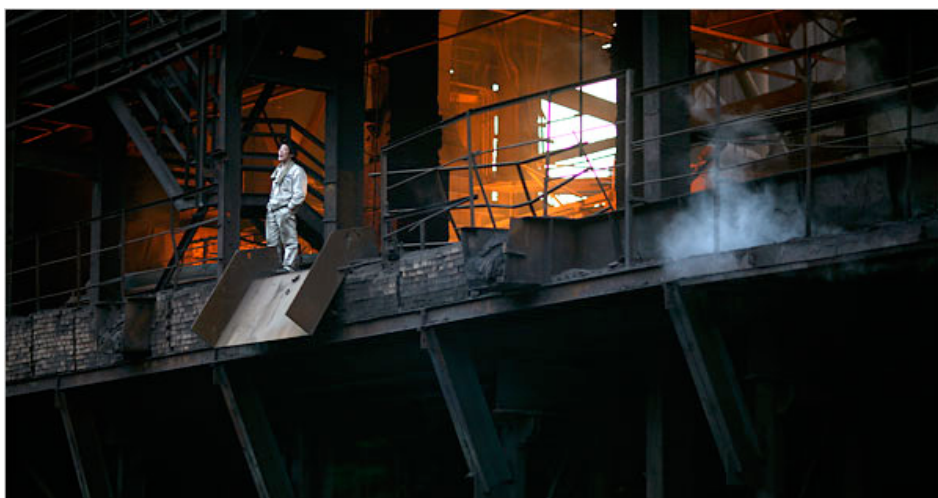
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Chang W. Lee/The New York Times

A worker took a break recently at a blast furnace of a steel plant in Handan, China. Residents live in a miasma of smoke.

By JOSEPH KAHN and MARK LANDLER Published: December 21, 2007

HANDAN, China — When residents of this northern Chinese city hang their clothes out to dry, the black fallout from nearby Handan Iron and Steel often sends them back to the wash.

Half a world away, neighbors of ThyssenKrupp's former steel mill in the Ruhr Valley of Germany once had a similar problem. The white shirts men wore to church on Sundays turned gray by the time they got home.



This is the ninth in a series of articles and multimedia examining the human toll, global impact and political

These two steel towns have an unusual kinship, spanning 5,000 miles and a decade of economic upheaval. They have shared the same hulking blast furnace, dismantled and shipped piece by piece from Germany's old industrial heartland to Hebei Province, China's new Ruhr Valley.

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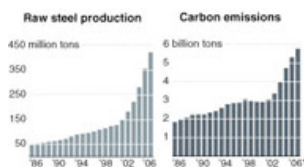
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Summaries of articles in this series are available in Chinese.

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**Multimedia**



\*Data for 2006 emissions is from the Netherlands Environmental Assessment Agency and German Federal Environment Agency

**Shifting Steel Making, and Pollution, to China**

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Chang W. Lee/The New York Times

THE LEVIATHAN NEXT DOOR Tian Lanxiu on a neighbor's roof next to the Hangang steel mill in Handan, China. "Hangang knocks 10 years off people's lives," she said.

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Marcus Gloger for The New York Times

THE PHOENIX HAS FLOWN Walter Schwalen saw the dismantling of Dortmund's Phoenix plant.

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The transfer, one of dozens since the late 1990s, contributed to a burst in China's steel production, which now exceeds that of Germany, Japan and the United States combined. It left Germany with lost jobs and a bad case of postindustrial angst.

But steel mills spewing particulates into the air and sucking electricity from China's coal-fired power plants account for a big chunk of the country's surging emissions of sulfur dioxide and carbon dioxide. Germany, in contrast, has cleaned its skies and is now leading the fight against [global warming](#).

In its rush to re-create the industrial revolution that made the West rich, China has absorbed most of the major industries that once made the West dirty. Spurred by strong state support, Chinese companies have become the dominant makers of steel, coke, aluminum, cement, chemicals, leather, paper and other goods that faced high costs, including tougher environmental rules, in other parts of the world. China has become the world's factory, but also its smokestack.

This mass shift of polluting industries has blighted China's economic rise. Double-digit growth rates have done less to improve people's lives when the damages to the air, land, water and human health are considered, some economists say. Outmoded production equipment will have to be replaced or retrofitted at high cost if the country intends to reduce pollution.

China's worsening environment has also upended the geopolitics of global warming. It produces and exports so many goods once made in the West that many wealthy countries can boast of declining carbon emissions, even while the world's overall emissions are rising quickly.

The Ruhr Valley city of Dortmund, where ThyssenKrupp once made steel, still suffers from high unemployment because of the loss of jobs to lower-cost countries like China. But Germans can buy Chinese-made iPods, washing machines and cargo ships at prices that, because of lax pollution controls, do not reflect the toll on the environment. And the outsourcing of polluting industries has given them cleaner air and water.

"It seems to me that China is making all the mistakes that we made in the 19th century," said Wilhelm Grote, an environmental regulator in Dortmund, who recalls washing his father's car as a child, only to see it immediately blanketed by soot. "They will find it is much more expensive to fix up later than to do it right from the start."

Having ignored the environmental consequences of its

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Chang W. Lee/The New York Times

FROM WASTE, MORE PROFIT A crane carried waste from a blast furnace at the Hangang plant in Handan. The waste can be used to make cement.

industrial binge for years, the Communist Party leadership now says it is determined to develop a cleaner economic model. Beijing has tried to enforce ambitious — though so far unmet — targets to improve energy efficiency and reduce emissions.

Officials say they are especially concerned about the environmental burden of producing more than \$1 trillion of goods each year for sale overseas. Of China's total carbon emissions, which by some estimates now exceed those of the United States, just over a third are incurred in the course of making products for foreign consumers,

according to the International Energy Agency, an energy policy and research group in Paris.

The country's central planning agency recently barred purchases of some used industrial equipment from abroad, requiring companies to install newer energy-efficient systems. It has canceled many incentives devised to promote exports, especially for companies that guzzle energy and pollute heavily. Officials have warned companies that breaking environmental laws will cost them their export licenses.

"Some enterprises are abusing the environment to lower export prices," Chen Guanglong, a Ministry of Commerce official, said in announcing a crackdown on polluters this fall. "They sell their products abroad, but the pollution is left at home."

There are few signs, however, that Chinese officials have real regrets about becoming the world's hub of heavy industry. Investment in new plants and equipment for steel, aluminum and cement has risen sharply even as central planners warn that the sector will get less state support. China's steel exports to the [European Union](#) are expected to double this year from the record set in 2006.

Three hundred miles south of Beijing, the city of Handan is both a beneficiary and a victim. Hangang, as the local steel mill is called, is a government favorite, having received permission to list its shares on the stock market and expand production. That is despite the fact that, like many of China's largest steel companies, it is in a crowded city.

Residents on the west side of Handan live in a miasma of dust and smoke that environmental authorities acknowledge contains numerous carcinogens. After public protests, the company agreed to pay an annual "pollution fee" to compensate some neighbors.

The Ruhr gets a different kind of subsidy. Germany and the European Union have committed nearly \$22 billion to transform the region into a center of education, technology and tourism. Bulldozers are remaking ThyssenKrupp's old steel mill into a terraced hillside community, with shops, restaurants and single-family homes surrounding a man-made lake.

### **A Faltering Leap Forward**

Hangang was created by an act of Mao. In 1958, the Chinese leader spurred his people to sacrifice everything, including their pots and pans, in China's first attempt to become a steel superpower. He called the campaign the Great Leap Forward.

Handan, an ancient but neglected city on the parched plains of southern Hebei Province, had two advantages: rich veins of coal and iron ore and easy access to a major north-south railway line.

"The ancient city of Handan must be rejuvenated as a capital of steel," Mao proclaimed.

So next to the Handan railway station, just west of the city's urban center, authorities erected a triumphal gate crowned with statues of heroic workers reaching for the sky. Inside, coking, sintering and smelting plants churned out crude iron and steel.

In economic terms, Hangang was not markedly more successful than the rest of the Great Leap Forward, which led to mass famine. It survived for decades on state subsidies, providing benefits for its 30,000 workers but making low-quality ferrous metals that earned poor returns.

In the 1990s, Hangang came under pressure to turn a profit. Its managers decided to start making sheet metal, for home appliances and cars, as well as their usual output of construction materials. That required a major upgrade.

Backed by state bank loans and a listing on the Shanghai stock market, Hangang embarked on an overhaul. But its ambitions far exceeded its budget. The company needed a cheap and radical solution to transform the mill.

The answer came from Europe, especially from the Ruhr Valley. The Ruhr had been the engine room of German industry since the mid-19th century. It was rich in coal and Prussian zeal.

The region's big steel groups, Thyssen, Krupp and Mannesmann, forged the weapons for Germany's armies and later the sheet metal for its automobiles.

But by the 1960s, Germany's industrial golden age had begun to wane. Miners had to dig deeper to extract coal, which became uneconomical. Taxes and labor costs rose, while reunification subjected West German companies to subsidized competition from the East. Steel mills also came under heavy government pressure to install the latest environmental and efficiency controls.

"In the 1980s, we still had a dream that it was just a temporary slump and we would grow strong again," said Michael Schwarze-Rodrian, director of the Ruhr Business Development Agency. "But pressures were too great. Our time had passed."

Thyssen and Krupp merged their steel operations in 1997 and consolidated production in Duisburg, on the Rhine.

The Dortmund steel mills, called Phoenix, which had been among Germany's largest since before World War II, were slated for closure, and probably the scrap heap.

That is, until Hangang got word that it could buy a relatively sophisticated German blast furnace for a small fraction of what a new one would cost.

"The reshuffle of the world steel industry gave Hangang this opportunity," Liu Hanzhang, chairman of Hangang, told local media after he bought the Phoenix furnace in 1998. "Some people think we are a low-tech steel mill. We will become first-class."

Germans did not have to dismantle their own industrial patrimony. Hangang sent workers to Dortmund. They labeled every part of the seven-story furnace, then disassembled it and packed it in thousands of wooden crates for the long voyage to the port of Tianjin.

"They worked day and night," said Erwin Schneider, a spokesman for ThyssenKrupp. "They could never have done it that fast if they were governed by German labor laws."

It was not the only such case. Hangang alone spent \$800 million importing new and used equipment, according to company literature. It purchased a used ladle furnace and billet caster from Société Métallurgique de Normandie in France. It bought another secondhand blast furnace and a sinter machine from Arbed in Luxembourg.

Other Chinese companies flocked to the European fire sale, stripping Dortmund of its assets.

ThyssenKrupp sold the remaining parts of the Phoenix plant to Shagang Group, a privately run steel mill on the Yangtze River, in 2000.

And in 2003, 400 Chinese workers traveled to the Ruhr Valley and dismantled the Kaiserstuhl coking plant in Dortmund, which had been built only a few years earlier to meet exacting European environmental standards.

It now belongs to Yankuang Group, a coking company in Shandong Province.

### **A Loud and Dirty Business**

Belching and thundering 24 hours a day, the coking, iron and steel works at Hangang cover four square miles and resemble a working museum of the industrial age. Its oldest coal-powered furnace, with its corroded, protruding shoots and shafts, might have belonged to [Andrew Carnegie](#). The newest, part of a big expansion, uses waste heat to generate power, a technology that saves energy.

The European castoffs fell somewhere in between. It took Hangang several years to integrate this equipment into its patchwork of production lines. The Phoenix plant was christened No. 7 blast furnace. The Normandy and Luxembourg machines became part of the No. 3 steel works.

Facing stiff competition in China's overcrowded steel industry, Hangang still does not consistently make a profit. But the shopping spree did send production surging. In the decade after 1996, its output rose 350 percent.

Shimmering yellow and raging red, Hangang's flare stacks burn off waste gases and inflame the night sky. A fleet of diesel locomotives hauling coal shakes the farmhouses and apartment buildings that hug the plant's outer walls. For Handan's 8.5 million residents, and especially the tens of thousands who live in the plant's immediate shadow, the complex is a noisome, noxious, money-spinning, job-creating leviathan.

Tian Lanxiu climbs to the roof of a neighbor's home in Mengwu Village to survey the expanse of Hangang beyond. In the gray horizon she points out the No. 7 blast furnace — “the one the West Germans come to fix.” Nearby is a cooling plant that hisses white steam, and a coking facility that oozes yellow exhaust.

Ms. Tian said she and other villagers learned to cope with Hangang's emissions. People do not eat outdoors, she said, to avoid having black briquettes flake their rice. If her children cannot fall asleep at night, she stuffs their ears with cotton.

Some people in Mengwu have died young, she said, often of heart disease or cancer. She has no evidence to connect their deaths to the steel mill, but says she has few doubts herself. “Hangang knocks 10 years off people's lives,” she said. “We all want to live longer. We're growing more aware.”

Hangang officials declined several requests to discuss production and environmental controls. But the company has said in domestic news media interviews that, along with the upgrading of its production facilities, it has installed pollution-control equipment

and improved the area's environment.

Government officials in Handan also declined to discuss the plant. But a 2006 study by the city and Tianjin University found abnormally high levels of chemicals of the benzene family attached to coal dust particulates around Handan.

Airborne concentrations of benzopyrene, a byproduct of coking that some studies have linked to lung cancer, were just below the level measured in two of the country's most polluted industrial areas, Lanzhou and Taiyuan, and 100 times the levels measured in London, the study said.

Hangang officials once considered moving their older, more heavily polluting production lines farther west of the city. Local environmental officials told state news media in 2005 that if the steel mill did move part of its operations, sulfur dioxide levels in Handan would drop 65 percent. Hangang ultimately elected not to move its older facilities, several people who work at the mill said, because the cost was prohibitive. Instead, Hangang and Shanghai-based Baoshan Iron and Steel teamed up to build another steel mill at the new site. Hangang's old plant remains in operation.

People who live near the plant have staged scattered protests about its pollution for years. The police have intervened and arrested some protesters. But the company has also sought to defuse unrest by giving jobs and other benefits to area residents.

Two years ago, Ms. Tian and a group of mostly older women sat on railroad tracks leading into Hangang and unfurled a banner that said, "Don't darken our skies." Their sit-in blocked a train. They demanded that Hangang arrange for them to move far from the plant, Ms. Tian said.

Hangang declined to do so. But it later agreed to pay them a subsidy in lieu of moving, which the villagers call a "pollution fee."

On a wall along the village street, officials have pasted strips of baby-blue rice paper listing the names of the heads of each household and its pollution payment. Ms. Tian said she recently collected her third annual installment, totaling \$140.

### **The Dream and Curse of Steel**

China surpassed the United States to become the world's largest steel producer 10 years ago. Since then, steel production in both the United States and Germany has barely budged, while China has left them in the dust. Its mills have increased their output fivefold over the decade, to about 38 percent of the world's total.

That is a realization of Mao's dream. But steel has also proved a curse. China has 77 large steel mills like Hangang, and hundreds of smaller rivals. They have so much excess capacity that production of some basic steel products has become unprofitable at home and abroad. Worse, steel pollutes more than any other industry in China, perhaps in the world.

Despite a government-mandated efficiency drive, steel will use 11 percent more power this year than last, fully one-tenth of the country's total energy supply, according to the China Iron and Steel Association.

Along with aluminum and cement, steel is the biggest reason China added 90 gigawatts of generation capacity this year, the third year in a row in which it will increase its power output by more than the total capacity of Britain. About 85 percent of those new power plants burn coal.

The International Energy Agency, which had predicted as recently as a few years ago that China's carbon emissions would not reach those of the United States until 2020, now thinks China took the lead this year.

Chen Kexin, an economist with China's Ministry of Commerce, said weak environmental laws and still inexpensive power, even more than low labor costs, had enabled Chinese steel makers to undercut prices elsewhere. "The shortfall of environmental protection is one of the main reasons why our exports are cheaper," Mr. Chen said. "This is hardly an 'edge' that we should be proud of."

In fact, Beijing has begun to discourage steel exports. It not only eliminated export tax rebates on many steel products in April, but also slapped an export surcharge on some. Officials expect export growth to slow.

But Mr. Chen said China now so dominated the international steel trade that any drop in its exports would raise prices abroad, keeping local steel competitive. "It could take years to restore a more normal trade balance," he said.

The transfer of pollution to China also complicates international efforts to cut greenhouse gas emissions and agree on a plan to succeed the Kyoto Protocol, an issue that will be under discussion for the next two years.

One apparent benefit of China's industrial rise is that developed countries have slowed or cut their carbon emissions, a political and environmental boon as pressure to combat climate change has increased. Even the United States, which has declined to set limits on carbon emissions, has recently shown slight declines. But the gains are illusory.

A study by researchers at [Carnegie Mellon University](#) found that if all the goods that the United States imported between 1997 and 2004 had been produced domestically, America's carbon emissions would have been 30 percent higher.

A separate study for the [European Parliament](#) examined the transfer of steel production to China from Germany. It found that China's less efficient steel mills, and its greater reliance on coal, meant that it emitted three times as much carbon dioxide per ton of steel as German steel producers.

From Beijing's perspective, its exports of steel and other "carbon-intensive" products provide one more reason — along with its still moderate per capita emissions and its low standard of living — for rejecting mandatory caps on carbon emissions. Rich countries, it says, should cut their own emissions sharply and transfer technology so that China will not pollute as much as those countries did when they had their industrial booms.

Some leading environmental economists agree. "The footprint of the rich countries is very large because they lay claim to resources in other countries," said R. Andreas Kraemer, director of the Ecologic Institute for International and European Environmental Policy in Berlin.

He and other experts say wealthy countries may have to reduce their consumption as well as their production of carbon in the future. That would oblige them to count what they import from China and elsewhere.

But that idea is notional, while heavy industry's shift to China is inexorable.

Germany is China's mirror image. Polluting factories have migrated abroad. Coal mining has withered. Since 1990, Germany has reduced its annual carbon emissions by 19 percent.

## The Greening of Germany

Its transformation dates to the 1970s, with the first attempts to limit lead in gasoline. But it gained momentum in 1980 with the founding of the [Green Party](#), the first environmental party to gain national prominence in Europe. In 1986, prodded partly by the Chernobyl nuclear disaster, West Germany established a ministry dedicated to protecting the environment. It had plenty to do. Germany's forests had been badly damaged by acid rain from factories in the Ruhr. The Rhine River, which flows past the western edge of the Ruhr Valley, was devoid of marine life.

German reunification in 1990 saddled the country with East Germany's low-grade brown coal plants, the dirtiest in Europe. Germany cleaned up the East, shutting down many low-efficiency factories, and achieved sharp reductions in carbon emissions.

Reunification also produced a new generation of green political leaders. Chancellor [Angela Merkel](#), an eastern German physicist, entered national politics in 1994, when [Helmut Kohl](#), then the chancellor, named her environment minister. Mrs. Merkel, who earned the nickname the "climate chancellor," has pushed multilateral agreements to reduce carbon emissions despite stern resistance from the United States to mandatory cuts.

On Dec. 5, her government passed legislation to reduce Germany's emissions by an additional 40 percent by 2020. "Germany wants to set an example," she said.

Dortmund and other Ruhr cities never fully recovered jobs lost to China's new titans of steel. The unemployment rate in the city still hovers around 15 percent, 50 percent higher than the national average.

Walter Schwalen, a 68-year-old former steelworker, points out the window of his second-floor walk-up to a yawning black pit where the Phoenix blast furnaces once roared.

He said he watched from his window as a team of Chinese workers dismantled and packed up his old workplace in 1998. "I thought, 'Our poor Germany,'" he said. "One company after another is closing. Germany is finished."

Yet, the Ruhr region is also a laboratory for how an industrial economy can make the transition to a post-industrial era. Once a byword for grit and grime, where drivers turned on their car headlights midmorning to see through the haze of coal smoke, it has been designated a European capital of culture for 2010.

In Essen, a depleted coal mine has been converted into a museum and performing-arts center. In Bochum, a 105-year-old gas-fired power plant is now used as a concert hall, its vaulted roof providing professional-quality acoustics.

The Ruhr is coming to grips with another legacy of its polluted past: the Emscher, a 52-mile long river that suffered the indignity of being turned into an industrial waste canal at the end of the 19th century. Germany now plans to spend \$7 billion to bring it back to life. Subterranean pipes will ferry wastewater to treatment plants, returning the river to a natural state. It will be flanked by parkland, the spine of a 248-mile Industrial Heritage Trail for tourists.

Dortmund, which in 1960 had 40,000 people working in steel mills, now has barely 3,000. But there are 12,000 new jobs in information technology and 2,300 in nanotechnology, which took root here in the last five years. The region, which once had no universities, now has six, as well as eight colleges, with a total enrollment of 160,000



students.

Even the Phoenix site is rising again. The city has left two old blast furnaces there as the corroded centerpiece of what they hope will be an outdoor performing-arts complex. The government is spending \$500 million to dig up soil and remove chemical residues from a half-century of steel making, clearing the way for a lake, a housing development and an office park for start-up companies.

"It took three generations to do this to the environment," said Mr. Schwarze-Rodrian of the Ruhr Business Development Agency. "I think it's reasonable that it will take a generation to fix."

*Joseph Kahn reported from Handan, China, and Dortmund, Germany, and Mark Landler from Dortmund. Jake Hooker and Ma Yi contributed reporting from Beijing and Handan, and Sarah Plass from Dortmund and Frankfurt.*

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