

## THE CLEAN COAL COMBUSTION INNOVATORS

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*“Coal-burning small stoves and boilers are a big problem for China--too much dirty smoke in the countryside and even in Beijing. I invented something that produces low sulfur dioxide and low carbon dioxide--small technology, big impact.”*

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CEO, Beijing GW Process Technology Company  
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Professor Li Jinghai of the Chinese Academy of Sciences believed that the millions of small stoves and boilers being used in homes, small businesses, schools, and hospitals all over China was one of China’s biggest environmental problems. They produced a lot of high sulfur dioxide and high carbon dioxide black smoke. He invented an improved combustion process that produces low levels of both gases and wanted stoves and boilers all over China to be replaced. So, he filed for patent protection with the State Intellectual Property Office of China because “the technology is easily copied” and sought investors among his friends and in 2003 recruited Dr. Li Junfeng, another student of his mentor in Switzerland, to become CEO and primary investor in a company to manufacture and sell the stoves and boilers. But, while the marketplace need was great from an environmental perspective, their potential customers were too poor to buy their stoves and boilers. If they were to succeed, Li Junfeng would need to innovate their business model, too. In 2007 he started selling service contracts with their improved boilers to schools and hospitals. Professor Li Jinghai and Dr. Li Junfeng are “the Clean Coal Combustion Innovators.”

### ***Inventing a Clean-Burning Stove and Boiler***

There are three options for innovating toward “clean coal.” The first option is to clean the coal pre-combustion. The second option is to improve the efficiency of the combustion process. The third option is to clean the exhaust gases. Professor Li focused on the second option in his laboratory, the Institute of Process Engineering. He explains

that he designed a coal combustion process that injects air into a coke-based process that yields very low levels of sulfur dioxide and carbon dioxide. In his patent application to the State Intellectual Property Office of China, Number 01131238, Professor Li teaches how the process works in the combustion chamber. Patent application Number 97112562 states succinctly why Professor Li was so excited about his innovation: “Its advantages are simple apparatus, high effect..., and low cost.” He knew that he had made a major breakthrough in coal combustion that could revolutionize coal-based energy in China—and in other places around the world.

Professor Jinghai Li recalls that at the time there was not much interest in China in a “small environmental technology.” He looked outside China for funding and found it when he received a grant in 1998 from Gesellschaft Technische Zusammenarbeit, the Organization for Technical Cooperation, the German development agency known as GTZ, to demonstrate his technology concept. With the German money he and colleagues in the Institute of Process Engineering built 100 stoves to be tested in primary schools in villages outside Beijing. The stoves worked well and cleanly in practice, just as had his prototype in the laboratory.

He and his team focused R&D on boilers. The SIPO applications Number 200410019870 and 200410098603 teach how to design high-efficiency low-emission boilers. They patented a biomass-based clean-burning device, a hot water circulation heating system, and furnace devices. Professor Li was extending his basic technology logic to the variety of innovative uses in homes, buildings, and small factories that populate the villages and towns in the China’s vast countryside. Professor Li’s R&D efforts produced 29 SIPO patents in all.

“I believed that, if all stoves and boilers in China could be replaced, it would be a big contribution to challenges of global warming, pollution reduction, and energy efficiency. But, the big problem was the cost of buying the stove. My stove was for poor people in the countryside and in the cities, but they couldn’t afford to buy it. The government was focused on big energy projects, not little ones.”

### ***Innovating a Service Business Model***

Dr. Li Junfeng in the 1990s researched ways to save energy at the China Building Materials Academy. He won a scholarship in 1997 to study at the Federal Institute of Technology in Switzerland with Professor Lothar Reh. Thus, like Professor Li, he studied combustion technology engineering with Professor Reh. In 1999 he graduated with a doctorate from Southeast University in Nanjing. It was through their shared mentor that Professor Li and Dr. Li came to know of each other when the former was looking for the right guy to commercialize his clean coal stove and boiler technology.

Dr. Li says, “I was impressed with the quality of the innovation. There are amazing things in his technology. He provided the first good solution to the problem of sulfur dioxide and carbon dioxide emissions from coal stoves and boilers. What’s different is that the *inside* is a clean process, not the outside. I immediately saw the

potential environmental impact and commercial opportunity not only in China but in the world.” He adds, “In China we don’t have sulfur dioxide standards. But, the public and the government are getting more aware. Our products meet American and European standards for sulfur dioxide and carbon dioxide emissions. We decided in 2003 to start-up a company to take the technology into the marketplace, even though it was the time of the SARS epidemic so we would have to just stay in the laboratory for a while.”

Li Junfeng would be the primary investor and chief executive officer of the company. Professor Li and his three friends would invest to become minority share holders in the company. The Chinese Academy of Sciences would contribute no additional money to the company, but would provide a home for the company and would own a 39% share in the company. The company would own Professor Li’s patents. Beijing GW Process Technology Company, Ltd., was thereby established.

The “GW” refers to a word in ancient Chinese which refers to research, to new ideas, to embracing new ways of doing things. He designed a logo for the company that indicated with the color red and the characters “nine continents” of traditional Chinese world geography. Li Junfeng says, “We planned to go world-wide from the beginning.”

“We set up a small R&D staff to do product design and testing. We were able to improve on the combustion process of the prototype, making it more stable. We were able to make the stoves and boilers easier for users to operate.

He goes on, “We selected a manufacturer in Hubei who could provide the quality we wanted at the price we wanted. We improved the production process, getting better quality. We worked on market analysis and a marketing plan. At the beginning, in 2004, we set up networks of dealers to be our sales distributors around the countryside. We trained them how to install the stoves, which are relatively easy to do.”

“But, nobody bought them. Our customers are poor. That was our marketing problem. And, in 2004, Professor Li became Vice President of the Chinese Academy of Sciences, a big boss who would have no more time for stoves and boilers. So, I read business books. I knew that my problem was a business problem not a technology problem. I read about the history of IBM and how nobody could buy their computers because they were too expensive and too complicated. Our big strategy change was to become a service provider.”

“Our boiler is not like a TV: You don’t just turn it on and it works. It is complicated, so we would have to try to teach our customers how to use them. Therefore, it was wrong to *sell them the boiler*, even if they could afford it. It was best to think of ourselves not as manufacturers and sellers but to think of our customers as clients to whom we would *provide a service*. It is good for them: They are teachers and doctors; they shouldn’t be maintaining boilers. They pay us to do it for them. Since 2007 we have focused on schools and hospitals, not factories, where demand is from the local governments. Demand is more stable and it’s growing. Since the Olympics, if your pour smoke out, the public is against you. We call it ‘the Green Olympics.’”

As a result of the new business model, Dr. Li is reducing his network of distributors while building his organization around providing services. They have developed an online system that enables remote monitoring of the boilers and occasional, rather than frequent, physical inspection. The automation, he explains, allows him to provide better service to his clients and means that he is spending a lot of his time hiring and training service managers.

Dr. Li also explains that the service contract business model has improved the competitiveness of his company. “The patent is one way to protect our technology. But, it is not such a good way in China. Copiers of our technology have emerged. Our business model is better than intellectual property protection. We provide a service. But, we file for new patents to protect our innovations and we keep trying to make our boilers better. There are a lot of schools and hospitals in China. We have a lot to do.”