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The WVU Industrial Energy Efficiency China Project – Exporting IOF-WV!

By Carl Irwin

Bhaskaran Gopalakrishnan (Gopala), Professor of Industrial and Management Systems Engineering and Director of the WVU Industrial Assessment Center (IAC), Ken Means, Professor of Mechanical and Aerospace Engineering and Director of WVU Projects with Industry, Subodh Chaudhari, Gopala's PhD student, and I all left the Pittsburgh airport together on Fri morning Aug 3. Gopala had picked me up at my home around 3:00 that morning – I was madly trying to get all my stuff into a couple of suitcases and a backpack – and didn't even go to bed that night. From Pittsburgh, we got to Newark, NJ around 9:00 Fri morning and waited a few hours to get our Continental flight to Beijing

Qingyun Sun, WVU Research Professor of Resource Management was already in China and met us when we arrived at the Beijing airport Sat afternoon Aug 4 – he had a car and driver waiting who took us to the Oriental Bay Hotel on Ring Road 2 in the Dongcheng district of Beijing.

My initial impressions were ones that I had several other times in China – this is a very modern place – nice spacious airports, good highways, lots of traffic, lots of construction, very nice hotels, more high rise buildings than I've ever seen anywhere! Is this really a “developing country”? Or is it a developed country that has underdeveloped parts?? I had this conversation with quite a few Chinese people – mostly they said I needed to see places other than big cities to get a true picture. One American who had worked in China for six years said I should go to Lanzhou and drive out into the surrounding rural countryside.

That first night in Beijing, Mr. Ren, VP with Shenhua Group, and his daughter took us to a dinner that was followed by some musical performances. That was the first of several “round table” meals, where the host orders lots of different dishes that all go on the middle part of the table that rotates so you can nibble with your chop sticks (kwai zi) from all the different bowls and platters. You have a small saucer at your place – at first I would pile it up with food and then eat – till someone told me just to eat from the bowls and platters and let the excess drop on the saucer! We were dead tired after the flight and big meal - no one had any trouble going to sleep that night.

On Sunday, we had an afternoon flight to Taiyuan, the capital of Shanxi Province. The first thing I noticed in Taiyuan after getting off the airplane was a huge ultra modern new airport building under construction – I also noticed how hazy and overcast the air was – I could only see clearly for a few blocks. After getting into Taiyuan, it was like the whole city was under construction – roads, buildings – and the late afternoon traffic was unreal – cars, trucks, bulldozers, buses, scooters, pedestrians, bicycles, bicycles with trailers piled with cardboard, beer, fruits, veggies, recyclables, ...– lots of people on the go. (Hustle-bustle is the way I

described it to one Chinese woman – she asked me about that word – and wanted me to write it down for her.)

I was truly amazed with the flow of all these vehicles – seems like drivers routinely play “Chicken” with on-coming traffic – and have a sixth sense for weaving in and out and around other cars with about ½ inch clearance on each side. Lane lines – even centerlines – sometimes don’t mean much – and “pedestrian right-of-way” is a very dangerous assumption! The bicyclists seem strangely oblivious to all this and trust that they have equal rights to space. Somehow or other it all works – in three weeks, I only saw two minor “fender benders” and no bike-car accidents! I decided an axiom of driving or walking in large Chinese cities is: He Who Hesitates Waits!

That first night in Taiyuan, we had another round table dinner, hosted by Mr. Ling, director of the Shanxi Development and Reform Commission (SDRC). This was the dinner where we were introduced to the prominent ritual of toasting with the clear, strong Chinese liquor. It started with Mr. Ling welcoming us – and went on all during dinner. We all made some toasts to them – and I had fun trying out some of my Chinese words. After a while the Chinese were toasting each other – sometimes they would get up and walk over to personally toast with a colleague. Needless to say we were very warmly received and welcomed.

This toasting went on at most all of our “business” lunches and dinners. And every place had a very determined waitress whose job was to make sure your little glass never got empty. Someone explained to me a week or two later that important business decisions and agreements are frequently made on these occasions.

The road in front of our hotel in Taiyuan was under construction – and a new building was going up next to the hotel. They worked most of the night – digging foundation with pile drivers - putting up steel girders. One night there was a firecracker celebration because they had reached a certain point in the construction. If you think it was a little noisy around the hotel, you’re right! There was also a large park across the street, with a lake and lots of people strolling along in the evenings.

Our purpose in Taiyuan, and the basic reason for the trip, was to conduct an industrial energy assessment at a plant near Taiyuan. The plan was that we would visit three plants and then select one at which to do an in-depth assessment.

On Monday morning Aug 6, we visited the Shanxi New Oriental Aluminum Company, about an hour out of Taiyuan. They made a very professional presentation for us, including a high quality video with inspiring music, footage of visiting dignitaries, and superb accolades for the plant. Turns out this plant was new – it had just reached full production in January of 2007! My impression was, “What are we doing here? This place is newer than anything in West Virginia, if not in the U.S., It’s modern and efficient. We can’t help them with energy efficiency!” But we had a good discussion, a plant tour, and then a nice round table lunch – including

the little glasses and a determined refill waitress - right in the Chief Engineer's conference room!

That afternoon, we went to the Shanxi Hentong Energy Company – actually a Chromium Ferroalloy plant - on the opposite side of Taiyuan. I thought this plant was more like what we wanted. Definitely not new, intense heat, technically more primitive than the aluminum company - just seemed like a much greater opportunity to make substantial energy savings recommendations. They said energy was about 50% of their cost of production. The Hentong people were very glad to have us visit. The company president, Mr. Ma, joined us after we had a plant tour. His daughter Ma Le, a student at Tian Jin University, working for her Dad during the summer, went around with us, as did the chief engineer, Mr. Jia, and a few other employees. We learned that Hentong uses an old coal-burning boiler for winter heating – we assumed it has minimal emissions controls and could likely be replaced if sufficient waste heat could be recovered from high-temperature operations in the plant. Mr. Ma said he would implement any recommendations that were cost effective, which is something we very much wanted to hear. Mr. Ma informed us that they are installing a newly rebuilt furnace within the next few months, making a total of three reduction furnaces, which will almost double their production capacity, as well as the amount of available waste heat. We felt it would be very good timing for them to have the results of an assessment prior to installation of the new furnace.

We also found out from Mr. Ma that there are 40+ other ferroalloy plants just in Shanxi! This really made me think that we can go after an entire industry sector – not just a single plant. Mr. Ma said that even if we did not choose his plant for an assessment, he hoped we could share general energy efficiency information with him.

On Tuesday morning, we went to another ferroalloy plant – the Shanxi Jiaochen YiWang Ferroalloy Company. They make manganese ferroalloy ingots for the steel industry. This was an interesting company. Entering the gates, you see a big sign saying “Studying, Researching, Creating” (in English!) I thought they had some sort of school or research lab there, but Qingyun said it was just for the positive image. Nevertheless, this plant was very efficient, well run, much newer than Hentong. They said energy was about 30% of their cost of operation. Amazingly, these people said they have no waste products – everything is recycled. They even make construction bricks from the fly ash coming from their on-site 24-megawatt power plant. They said they had recently installed new equipment that enabled them to reduce energy consumption by 25%! One thing they were very interested in is equipment to separate out metallic particles in a high-temperature gas stream. (Gopala has located a couple of U.S. companies that can provide such equipment.) After all this discussion, the company president, Mr. Song, led us out to a local restaurant where we had a round table lunch with the little glasses that never go empty. (I discovered that if you sneak a little water in that glass, the refill waitress thinks you still have some spirits left!)

If the big cities like Beijing and Shanghai are modern and advanced, the little villages we drove thru on the way to visit these plants for sure show the undeveloped side of China, including, I was told, people living in shelters dug into the sides of hills outside Taiyuan. But I grew up in East Tennessee and have visited native American Indian reservations in the West, and have lived in West Virginia for 30+ years and so have seen deprived living conditions in the U.S. Developed does not mean perfect!

We choose to do the in-depth assessment at Hentong – but to also revisit New Oriental Aluminum to install data loggers on their air compressors and to estimate heat losses at other points in the aluminum smelting process. The main opportunity at Hentong was estimated to be with waste heat recovery from the furnace hot exhaust stream. This heat could then be used for power generation and for comfort heating during winter months. With the new rebuilt furnace slated to be installed, the team estimated the waste heat available for recovery would be doubled if the new exhaust ducting could be tied in with ducting for the two existing furnaces.

I left Taiyuan Thursday morning to visit Xi'an, capital of the neighboring province of Shaanxi. Xi'an is a large city, about six to eight million, but a much calmer place than Beijing or Taiyuan. My main host in Xi'an was WVU Professor Xingbo Liu's friend Mr. Wei, Director of the Shaanxi Intellectual Property Office – and a past participant in Bill Riley's China Business Program. Mr. Wei graciously had two of his office staff (Xu Rui, a pre-law student, and Mr. Sun, recently retired from the Chinese Air Force) accompany me to meetings and sights around Xi'an. On the first night, they took me to the Tang Dynasty Theater Restaurant for dinner and an entertaining performance of music and dance dating back to the Tang Dynasty (618AD to 907AD) era.

The Shaanxi IP Office is really more of an investment company to launch new companies based on IP from any source. They launched approximately 300 new companies last year. Their funding comes from many private and public sources – the IP office mostly manages and invests other peoples' money.

I visited two small companies the IP Office is supporting. One company was based on several patents for emulsifying agents for blending various types of liquid fuels – methanol, diesel, bio-based, and other additives to improve combustion. One application is to blend water or methanol with heavy oil to obtain an extended fuel that is economical and less polluting. I met Professor Li FaZhong and his students who are doing research on emulsifiers for blending and extending fuels.

The second company was a female owned company that has proprietary technology to improve gas/liquid phase separations by 20% – Ms. Li Caiqin, General Manager, said this applies to production of methanol from syngas. That should be of interest to Tennessee Eastman, I mentioned. (Tennessee Eastman produces all its chemical feedstocks from syngas).

I also visited the Xi'an High Technology Industrial Development Zone (XHTZ), a 96 sq. km. region that includes large and small technology companies – pharmaceuticals, software, electronics, materials, semiconductors, etc - some supported by the Shaanxi IP Office. Mr. George Zou, Project Manger for Foreign Investment, presented an overview of XHTZ. Mr. Dang Jingkun, Director of Industrialization for the Shaanxi IP Office, described six measures that are being implemented all across Shaanxi to reduce energy consumption. He said their GDP is growing at about 11.4% per year, but energy consumption is growing by 15.8% per year. The Shaanxi people would be very interested in having the WVU assessment team do a project in Shaanxi.

After these visits, Mr. Wei hosted a very wonderful round table lunch for the group at a restaurant that specializes in zhu zi (boiled dumplings) – there must have been 25 or more different kinds of zhu zi – we had lots of them! Others at the lunch were Ms. Liu YuHong, our translator, and Mr. Zhang Jianguo, head of International Exhibitions for the China Chamber of International Commerce. He is co-organizer of an international dialog to be held in Shaanxi on “Values for Development – Towards a Life-Sustaining Civilization.”

Before leaving Xi'an, Xu Rui and Mr. Sun took me to visit the incredible Bing Ma Yang (the Qin Dynasty Terra Cotta Army). Thousands of terra cotta clay life-size models of soldiers, horses, chariots, servants, weapons, etc. that date back to 200+ BC. They were intended to protect Emperor Qin in his second life - and were discovered in 1974 when local farmers were digging irrigation wells. The Chinese have done an amazing job of reconstructing and exhibiting these cultural relics.

We all rendezvoused back in Beijing on Saturday, Aug 11. David Yao, Director of International Operations and CEO of China Operations for Kanawha Scales and Systems (based in Poca, WV), took us to Tiananmen Square, the Forbidden City, and a few other sights around Beijing. He treated us to a really great dinner Sat night at a little Indian restaurant on a narrow street in a section of old town not far from the Oriental bay Hotel. We were ready for a change from Chinese round table food – and this was Gopala's first choice!

The Assessment Team returned to the U.S. on Sunday Aug 12 – Qingyun went to Shanghai early Monday morning - and suddenly I was all on my own! Some of my seemingly small accomplishments (but I felt proud of them!) were finding a laundry outside the hotel, getting a haircut, buying a new shirt, and ordering food in local restaurants outside the hotel. I do admit that Mary, a receptionist at the Oriental Bay Hotel, (native of France – went to school in Boston – has degrees in Chinese – and has worked in Beijing for a couple of years) was very helpful!

Our new friend, Alan Gagnet, consultant to EERE on China activities, arranged two important meetings for me. (Alan also accompanied us on the plant visits and assessments in Shanxi.) The first meeting was on Tues Aug 14 with Ms. Cindy Jiang,

Director of Environmental Projects for the Chinese Enterprise Confederation (CEC), an organization of more than 4,500 companies. The CEC would be interested in participating with us on future proposals and would also be very interested in helping arrange networking meetings for a delegation of West Virginia manufacturers and business people.

Ms. Jiang provided valuable background and perspective on industrial transitions in China over the past 40 to 50 years. For example, she told me about the national government's recent decision to redevelop three provinces and part of Inner Mongolia in Northeast China that 50 years ago, prior to development booms in the south east of China, had been the heart of China's heavy manufacturing industries. I subsequently read several articles in the China Daily on the NE redevelopment initiative.

An observation – heavy industry usually means energy-intensive industry, so we need to look into industrial energy efficiency partnerships involving China's NE redevelopment initiative.

On August 14, I also met with the U.S. DOE delegation led by John Mizroch, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy. Other members of the delegation included Jim Quinn with ITP, Michaela Martin with ORNL, and Mark Ginsberg and Amy Chiang with EERE. Maria Rivera and Marco Di Capua with the U.S. Embassy in Beijing hosted the meeting, which included discussions with 12 to 15 company representatives on opportunities in China for energy efficiency business development. One point in particular is that the group thought there would be plenty of work in China for ESCO type projects.

On Wednesday and Thursday, I visited the Science and Technology University Beijing, the University where Xingbo Liu and Jing Xu graduated. (Jing was an outstanding PhD student at WVU – she just finished her PhD in Mechanical Engineering in May.) Xingbo's friend and classmate, Dr. Dong, Professor of Metallurgical Engineering, sent his PhD student, Bi Zhong Nan (Bill), to meet me at the Oriental Bay hotel and bring me to the S&T campus. Bill and another student made very nice presentations on their research topics. Bill is developing high chromium-content steel alloys – and Mr. Jiao (John) is studying inter-granular corrosion of bimetallic composites.

The next day, I went to S&T again and met with Prof Bai, Professor of Mechanical Engineering. I gave presentations on the IOF-WV program and on the assessment project in Shanxi. Dr. Bai told me about the work he does with Prof Cang on industrial energy efficiency. They seem to do quite a bit with Bao Steel. After these discussions, we took pictures and then Dr. Dong, Bill, John, and Dr. Jiang took me to another interesting and tasty round table lunch in the restaurant on S&T campus – no little glasses with clear potent Chinese liquor this time! Professor Cang is a very senior person at S&T and works extensively with industrial energy efficiency projects. He was not in town when I was there, but has subsequently sent me an

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email saying he would very much like to cooperate with WVU on China/USA projects. I very much enjoyed the visit to S&T.

On Friday afternoon August 17, I met Rong Xu, Jing's older sister, and her husband Zhao Yuan at their apartment on the north east side of Beijing. I rode with them to Huai Rou, the Xu family hometown, about 50 km north east of Beijing. This happened to be the weekend that Beijing was doing an air quality and traffic reduction experiment in preparation for the upcoming 2008 Olympics. On Friday and Sunday, only cars with license number ending in an odd number were allowed on the roads – Sat and Mon only even numbers. Their car had an even number, so Zhao had to use a few creative maneuvers to avoid getting arrested. (If you got caught, you were supposed to return to where you started!)

It was great fun to see Xu Qing again (he had visited Jing in Morgantown Jan – March of 2007) and to meet Jing's mom, sister, brother in law, and especially 18 month-old baby Doudou – people I had heard quite a bit about from Jing. That afternoon, Xu Qing, Zhao and I took a bus to the edge of Huai Rou and then walked several miles through small villages and the countryside. This felt more like West Virginia - it was wonderful to get away from the hustle bustle – and to see some of rural China!

Friday night they took me to a “hot pot” restaurant in Huai Rou. This was the usual round table layout, but they brought out something new - platters of paper-thin sliced beef and lamb, which you pick up pieces of with your chop sticks, dunk in your hot pot for about a minute to cook, dip into one of various sauces, let it cool a few seconds and eat! Very yummy! This was a special dinner and included several toasts with XuQing's own special clear potent Chinese liquor!

The next morning, Xu Qing and Zhou met me at the hotel around 7:30 for a trip to the Mu Tian Yu section of the Great Wall – about a 30 min drive from Huai Rou. It was an awesome experience to see it, walk on it, run on it (I have that on tape!), and wonder about how they built it. This section of the Great Wall is rebuilt on the ruins of another Great Wall from an earlier Dynasty!

Monday morning Aug 20, I left Beijing on a 7:40 flight to Shanghai. It was a real kick to take the Mag-Lev Train from the Shanghai Pudon Airport into Shanghai. Humming along at 431 km per hour – about 268 mph – I thought about Ron Klein and all his efforts to get mag-lev projects going at WVU. We talk about it – they did it! Again – this is a developing country?!

Shanghai is the New York of China – and has the most nervous taxi drivers I've seen anywhere – jump lanes, tailgate, stop, honk, go! Seems like it can take forever to get somewhere in a taxi - and then it only costs 20 yuan – about \$2.67! I was told that Shanghai has fewer cars than Beijing because it costs almost as much to license a car in Shanghai as it does to buy the car!

I had another wonderful guide in Shanghai, compliments of Bill Riley's colleague, Michael Zhou, Director of International Programs for Shanghai Educational Center for Municipal Administrators. Huang Yao, a native of Shanghai doing a summer intern with Mr. Zhou's office, met me at my hotel late Monday afternoon. She took me around Shanghai including a stop at a market bazaar type shopping area located in a 400 year-old group of buildings that had once been the palatial home of a wealthy Shanghai businessman. That night we walked along the Bund, a two to three mile pedestrian way along the Huangpu River – that divides older Shanghai from the ultra modern Pudong area across the river that a decade or two ago was rice paddies. Now it's a metropolis of space age towers, the tallest buildings in the world, and a blaze of neon lights. I expected to see Superman or Spiderman swooping down from one of them!

My first meeting in Shanghai was with Debra Martin's colleague Eric Hsu, a Commercial Consular with the U.S. Consulate in Shanghai. His job is to develop business opportunities for U.S. companies and to promote U.S. exports into China. He says performance contracting is a new concept in China and he is keen to help develop it. He can provide assistance with visiting industry groups.

Next I met with Charles McElwee, another contact from Debra Martin, whose father is a well-known attorney in Charleston, WV. Charles is with the Squires Sanders law firm that works with companies locating or doing business in China. He specializes in environmental issues and gave me a good picture of some of China's environmental challenges. He said that in 2005, there were thousands of civil disturbances in China related to environmental issues. China's EPA is severely under staffed and under funded. On an international level, as much as 30% of California's particulates may come from China. These things are openly discussed in the Chinese press – and the government has added environmental criteria and energy efficiency benchmarks to performance expectations of provincial and local officials. Shanghai is gearing up for their Expo in 2010 and everyone says energy efficiency must improve by at least 20% by then.

I saw a good example of how Shanghai and other big cities are improving the local environment. Huang Yao and Ms. Wang Yong Rong, also from Michael's office, took me to the Luwan District of Shanghai where I met Mr. Wang Ri Hua, Senior Economist with the Luwan District Economy Planning Committee, and Mr. Zhen Xiang, General Manager and Chairman of the Board of a business development company. Mr. Wang described the changing Luwan District economy and then we headed out to visit a "business mall" that until recently had been an automobile brake and engine component factory.

These factory buildings have been converted into a modern office complex that rents to design, advertising, real estate, architectural, and other such businesses – including a cozy restaurant where Mr. Xu treated us to tea and ice cream sundaes! The brake factory has relocated to a suburban area some 40 km out of Shanghai. I was told the factory people are happy to have moved and are now making a mint

from rents they collect on their high-value Luwan District property! A promotional brochure for the office complex describes it as an open, urban chic, funky layout, with design and décor that retain the image and feel of a manufacturing center. I asked what is the Chinese word for funky? They had no idea and asked me what does funky mean anyway!

Huang Yao and Ms. Wang took me to the Shanghai Chemical Industry Park (SCIP) about 50 km south of Shanghai City. Mr. Zhang Chun, SCIP VP, and Ms. Jane Wu, SCIP Planning and Designing Section Chief, gave us an excellent overview of SCIP and its operations. Multinationals with operations at SCIP include Dow, BP, BASF, Bayer, Huntsman, Degussa, Mitsui, and several large Chinese chemical companies. A consortium of companies operates a 1 million ton per year ethylene cracker.

SCIP provides “integrated” production areas for companies, park-wide utilities that cost 30% less than conventional sources, on-site logistics, complete environmental protection services, and administrative support. SCIP covers approximately 60 sq. km and is located on the HangZhou Bay, providing ocean shipping and jetty port facilities for SCIP companies. Power and steam are generated with domestically sourced natural gas, however, two 300 MW coal-fired power plants are under construction to meet future demands for power and steam. There is even a stadium for company teams to play soccer! This is an incredible industrial facility and it’s not the only such chemical industry park in China, not even the only one in the Shanghai area! Sure makes you think - how in the world does the WV chemical industry compete with something like this!

On Wed Aug 22, Charles McElwee introduced me to Tom McCawley, Energy Solutions General Manager for Owens Corning (China) Investment Company. We had lunch at a German Restaurant in the Pudong area of Shanghai. Tom travels the country for Owens Corning and has had success with CHP projects on some of the older Soviet style coal-based plants. He talked about the huge challenges of dealing with rapid urbanization of China (15 to 20 million rural to urban migrants per year!) and the environmental challenges the country still has to address.

Tom recently sent me information on the “Joint US-China Cooperation on Clean Energy” (JUCCCE). This is a non-profit group that is mobilizing resources, expertise, and technologies to help increase energy efficiency in buildings, industry and transportation in China, and to promote clean energy through renewables and clean coal technologies. Their premise is that energy efficiency improvements are the cheapest form of energy supply. JUCCCE is a new organization chaired by Ms. Peggy Liu. Tom and Charles are active in the group and, I assume, could facilitate our participation in the area of industrial energy efficiency. JUCCCE recognizes that large centralized power generation plants lose around 2/3 of the input fuel value by the time the electrons reach your home or business. For one thing, they are promoting integrated energy/industrial parks – sounds like our Marshall County “energy-intensive industry cluster” concept!

Here are two amazing China statistics that you may already have heard about: 1) On the average, a new electrical power generation plant goes up in China each week (mostly pulverized coal plants); and 2) every year China builds approximately 2 billion sq meters (more than 21 billion sq ft) of new floor space for offices, housing, commercial, etc.

On Thursday morning Aug 23, I went for a swim in the 50-meter pool not far from my Shanghai hotel. On the walk back, I saw a Starbucks - had my first cup of coffee in three weeks and a large muffin – it struck me that I would be back in the U.S. tomorrow afternoon! I packed up, got a taxi to the Mag-Lev station, paid the 40 yuan (\$5.33) for a ticket and totally enjoyed another 431 km/hr ride to the airport.

I stayed Thursday night in a hotel not far from the Beijing Airport. My return flight to the U.S. was Friday afternoon at 3:45, so I had time for one more trip into Beijing. I visited the Lama Temple - that had been highly recommended by Zhao Yuan. This was an interesting contrast to the hustle bustle of the big city outside – quiet – Buddhist monks in orange robes – lots of people bowing, praying, and offering incense to the statues and images of various Buddhas. I stood outside one of the temple buildings for a while and listened to a monk chanting from their scriptures.

Some observations and opinions:

It was very interesting to see the WVU assessment team at work in the Hentong plant – drilling holes in very hot exhaust ducts, making measurements, taking notes on readings –and working side by side with the chief engineer and other Hentong employees. (You’ve got to see my video of Subodh climbing up a ladder inches away from the 500 deg F exhaust duct exiting the boiling caldron of chrome, coke, and carbon anode!) This project is for sure a REAL showcase example of joint US-China cooperation on industrial energy efficiency!

This country is on a roll and is not looking back – nothing we do is really going to slow them down or significantly speed them up. What we can do is engage with them to help reduce their demand for energy and to improve the environment. It’s to OUR benefit to help them reduce their demands on the world’s energy resources, to clean up the world’s environment, and in so doing, create opportunities for U.S. companies to sell energy efficiency and environmental technologies.

Mr. John Mizroch, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. DOE, is providing inspiring leadership for cooperative U.S. - China programs that will help improve China’s environment, reduce pressures on world energy supplies, and create new business opportunities for U.S. companies.

Three “front burner” topics that were frequently written about in the China Daily newspaper are 1) food and product safety, 2) energy efficiency, and 3) China’s environment. You get the impression that these problem areas really have the

government's attention and they will do whatever it takes to fix them – because they affect business growth and China's image to the rest of the world. Should be interesting to see what happens!

Some acknowledgements:

We gratefully and sincerely thank the Shanxi Reform and Development Commission for their hospitality and support during our stay in Taiyuan. Their communications with the three plants prior to our arrival assured a welcome reception for us and enabled the energy efficiency assessments to be highly successful. We look forward to helping make Hentong a showcase example of industrial energy efficiency in the ferroalloy industry. Our special thanks to Mr. Ling, SDRC Director, Mr. Li, Deputy Director, Mr. Li, Mr. Zhao, Mr. Wang, and Mr. Ren.

A very special thanks to WVU Research Professor Qingyun Sun for his coordination and facilitation of the assessment trip – and working very effectively on both continents to make the assessment and the follow-up big successes!

The help I had with China contacts from Bill Riley, Director, West Virginia University China Business Program, Debra Martin, International Business Development, West Virginia Development Office, Xingbo Liu, and Alan Gagnet were invaluable – and really kept me hopping! Many thanks!

The assessment team warmly thanks Ms. Angela Shock, NRCCE Program Coordinator with the IOF-WV program, for her diligence, attention to detail, and commitment to supporting our trip AND taking responsibility for shipping two large boxes of equipment to Taiyuan in time for the assessment and getting them back safely in time for Gopala's next IAC assessment. I especially appreciate her meeting me at the Pitt Airport – a flight that got in at 12:15 am Saturday morning instead of 10:15 pm Friday evening!

The assessment team would like to sincerely thank Richard Bajura, Director of the WVU National Research Center for Coal and Energy, for his support of the China Industrial Energy Efficiency Initiative

I greatly appreciate all the “ling gan” I have had for taking the assessment team and the IOF-WV concept to China – keep it coming – there's lots to do and we can have a great future!