A valve supplier's experience in the Chinese nuclear market

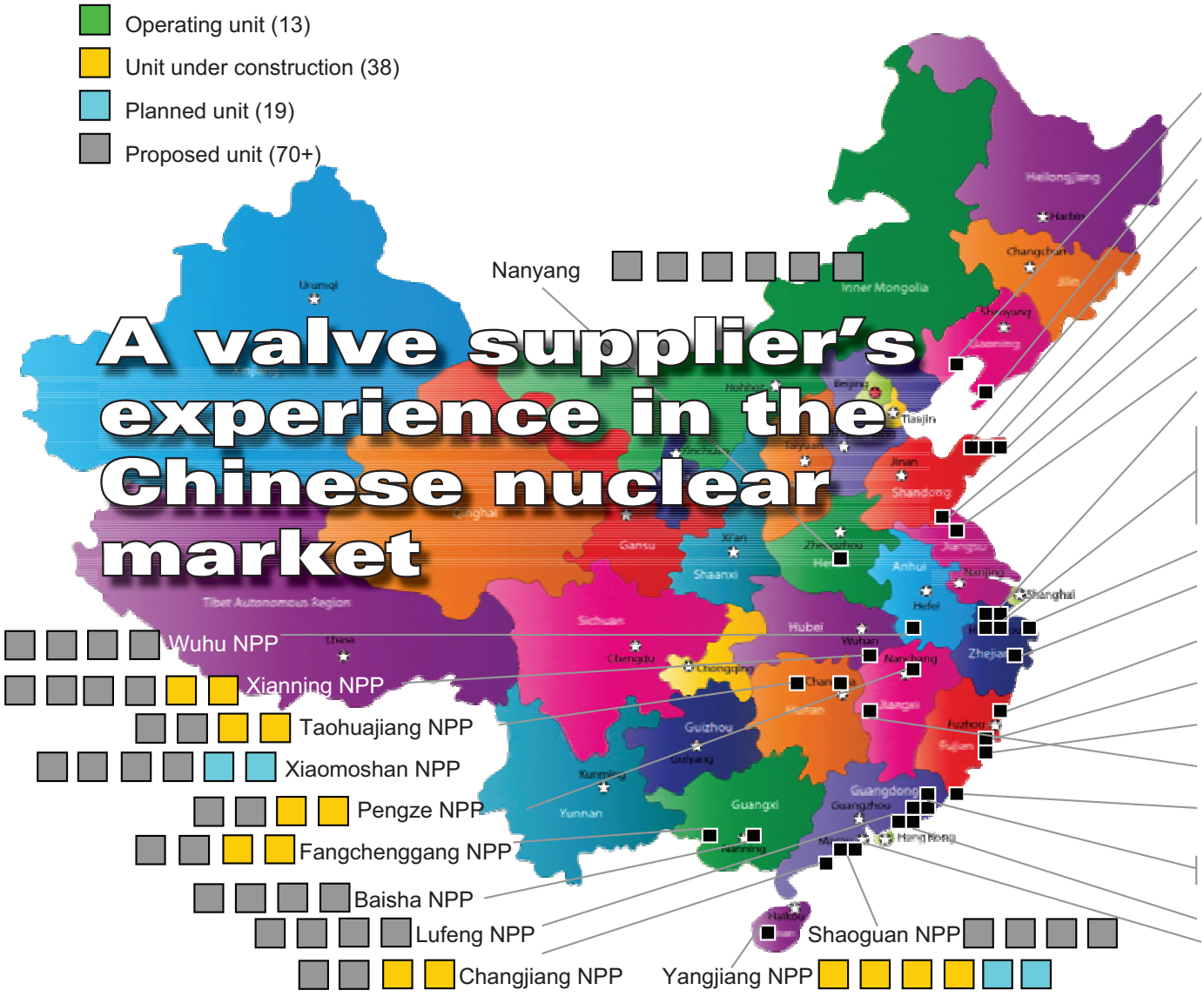

Figure 1. Chinese nuclear power map

As nearly everyone knows, one of the biggest nuclear growth markets in the world is in China. The central government has pledged to reduce their dependence on fossil fuels, and expanding nuclear power is one of the tools they are using to do that. Recent events in Japan have slowed down their plans a bit, but they recently indicated that they still want to have 70GW's of nuclear power on line by 2020. They currently have 10.8GW's of capacity, so adding an additional 60 GW's in nine years explains why there is so much attention being paid to this key market.

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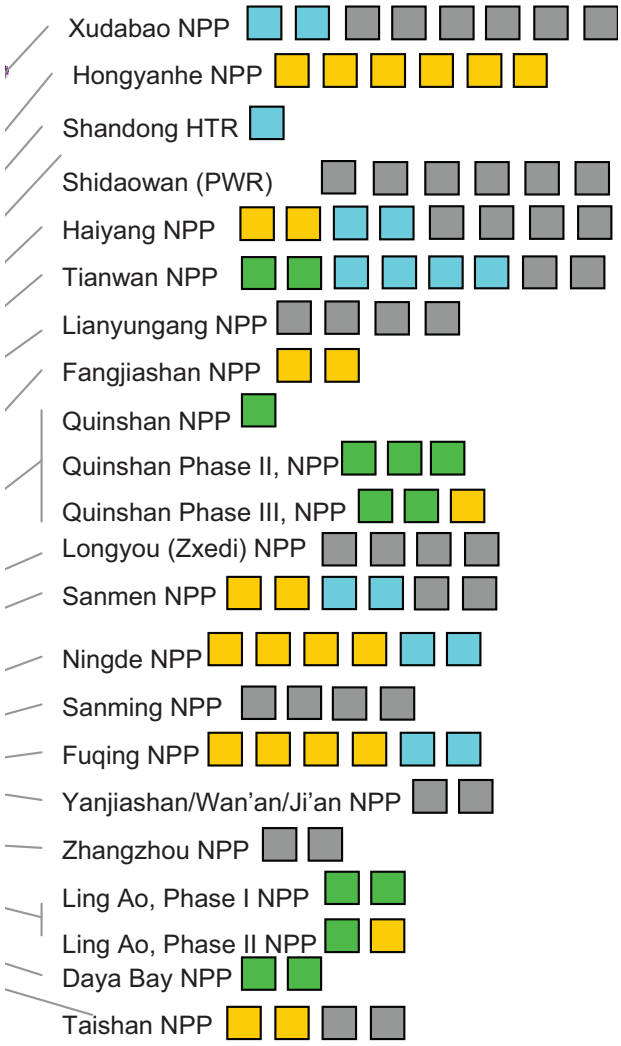
This article will provide some background on how the team at the State Nuclear Power Engineering Corporation (SNPEC), and one of the key global nuclear valve suppliers (the Fisher Division of Emerson Process Management) are working together to insure that the plants are built with a solid engineering foundation to insure that they will be safe and reliable over their 60 year design life.

Chinese nuclear industry background

Commercial nuclear power in China can trace its history back to the Daya Bay project in the early 1990's. This was a PWR design based upon French technology and located on the Southern coast. As it currently stands, the country has 13 reactors operating at 4 different sites, and using several different types of reactor platforms. The most common is that based upon French



PWR technology, like the CPR900 at Daya Bay, but the current plans include a broad range of design platforms, including the CPR, the CNP (indigenous design), the CANDU, the EPR by Areva, the VVER (Russia), and the AP1000. There are 38 more reactors in various stages of completion around the country. Figure 1 illustrates the breadth of the current plan, showing all the various sites, color coded to indicate plants in operation, under construction, or planned.

Key players in the Chinese nuclear industry

There are 3 principle entities engaged in the building program. They are the Chinese Guangdong Nuclear Power Group (CGNPC), the State Nuclear Power Technology Corporation (SNPTC), and China National Nuclear Corporation (CNNC).

CNNC has the broadest base of experience with various reactor platforms, and developed an indigenous pressurized water reactor (PWR) called the CNP platform in various size ranges from 300 to 1000 MW's. They have also been involved in building CANDU reactors at Qinshan, they are working with EDF on EPR's at the Taishan site, and will be involved with the Westinghouse AP designs at the inland sites.

CGNPC has been principally focused on the CPR designs, and has a lot of experience in building and running plants at sites like Daya Bay, Ling Ao, Qinshan, Hong Yanhe, Ningde, and Yang Jiang. They have the largest number of reactors to date either in operation, or under construction.

SNPTC has been given the task of managing the Westinghouse AP1000 designs in China at the Sanmen and HaiYang sites. Their engineering arm, SNPEC, is the subject of this article, and is working very closely with SNERDI, a design institute (DI) to expand the AP1000 design into larger sizes for the inland reactor sites. The balance of this article will focus on the AP1000 projects at Sanmen and Haiyang, which includes a total of 4 reactors.

The AP1000 in China

After extensive negotiations that started about 6 years ago, Westinghouse and the Chinese government signed an agreement that kicked off the construction of 4 new AP1000 reactors at the two sites already mentioned. There were the first projects in the world for the AP1000, and included technology transfer for many elements of the AP1000 design.

The AP1000 is a true 3rd generation design, and the AP stands for advanced passive design. What that really means is that the plant does not rely on pumps, or external power to run the pumps, to safely shut down. This a major leap forward in reactor design that has many advantages in today's market, especially given the recent events in Japan (see box).

There are two sites in China for the current AP1000 contracts, Sanmen and Haiyang. There are currently two reactors being built at each site, but Sanmen could be expanded to as many as 6 reactors, and Haiyang could see as many as 8.

The Fukushima incident

The Fukishima plant was actually shutting down just as it was designed to do after the earthquake. Unfortunately, most 2nd generation designs rely on back up power from diesel generator sets to insure the cooling process can continue even if off-site power is lost. They lost off-site power, and the diesel generators kicked in as expected, but were inundated by water and knocked off line when the subsequent Tsunami hit. The point is lost on the casual observer, but a third generation passive design would not have had the same problems that were experienced at this site, and most experts agree that this type of plant would have shut down with no major issues.

The AP1000 projects

The Fisher division of Emerson Process Management first became involved with SNPEC on the AP1000 projects in 2008. Fortunately, by that time, our US-based team had several years of experience with the AP1000 design in dealing with orders issued by the Westinghouse organization in Pittsburgh, so we were very familiar with the valve specifications for the AP1000. We had already worked on the PV63, PV14 and PV20. While that did provide some upside to our work in China with SNPEC, there were still many challenges that needed to be overcome in supporting SNPEC in getting the valves they needed for these reactors. A partial list included:

- Establishing commercial terms and conditions between the two companies, since we had never worked together before;
- Dealing with a customer located half way around the world in a country that has significant cultural differences with the United States;
- Language differences;
- Coming to an agreement on how to interpret the valve specifications so that both parties knew what was needed to meet the requirements;
- Working as a go-between for Westinghouse headquarters and SNPEC insuring that we took a consistent approach between the orders placed on us by both parties;
- Establishing a relationship based on openness and trust that would enable us to work as a team in dealing with inevitable technical and commercial issues that would come up. This was absolutely key.

For Emerson's part we had the advantage of being a global company with a significant presence in China. Our local sales office, Star Controls, based in Shanghai like SNPEC, proved to be invaluable in helping us with things like meeting logistics, negotiations of commercial terms, and dealing with cultural and language issues. Figure 2 shows two of our nuclear team members at Star Controls. In addition to our team in Shanghai, we had established a nuclear applications team in our Beijing headquarters who worked very closely with the US-based team to insure that we fully understood SNPEC's requirements for the packages we were bidding. They helped us jointly review the application conditions with SNPEC, so that the right valve was selected for each service. Figure 3 shows our nuclear team in Beijing.

Once SNPEC has evaluated the Suppliers bids and selected the successful Supplier, negotiations to conclude a contract involve SNPEC's technical, quality and commercial personnel. Figure 4 shows members of the SNPEC team involved with the Fisher contracts.

Figure 2. A local sales office such as Star Controls proved to be invaluable in dealing with meeting logistics, negotiations of commercial terms, cultural and language issues, etc.

Figure 3. Emerson's nuclear applications team in its Beijing headquarters worked closely with the US-based team to ensure full understanding of SNPEC's requirements.

Figure 4. Members of the SNPEC team involved with the Fisher contracts.

An environment of trust

As mentioned earlier, it was absolutely critical that we began what is now a 3 year relationship by establishing an environment of trust. It is a tribute to both sides that from the onset, we avoided the normal temptation to fall into a traditional adversarial relationship that characterizes many dealings between vendor and customer. The Fisher team made every effort to be transparent

in our dealings, and to share insights on the Westinghouse spec with SNPEC that we had learned on prior orders. It might have been to our advantage a bit to hold back on these and only play that card once we were in final negotiations. We decided that the better approach was to try and help wherever we could, and let our bids stand on their own two feet when compared to the competition. Many hours were spent at a white board going over the specifications in great detail with questions and comments coming in from both sides. Much of our first 6 months of working together was spent like this, with the Fisher team gaining a better understanding of what SNPEC really needed in their valve package, and the SNPEC team picking up on how design decisions can impact cost and performance for the critical valves that they needed on this project.

By the time we got around to a formal technical evaluation, these intense sessions gave a good foundation upon which to base our formal discussions and both parties were able to get to formal agreement on technical proposals that were deemed to be appropriate relatively quickly. This enabled us to enter into a contract for valve commodity PV63 in August of 2009.

Three additional valve commodity packages followed soon thereafter, and we are now working on almost a daily basis with the project management group at SNPEC to keep the projects moving to support a very aggressive schedule. Our local team in Beijing is the first contact for SNPEC and is only a short flight away if they need to meet face to face. They take care of engaging our North American team as necessary, and keep SNPEC up to date on our progress. In addition to local contacts, we normally make a trip to Shanghai every 4-6 months to report in person on the projects and make sure that SNPEC is fully informed of our status. Again, in keeping with the philosophy outlined above, we deliver bad news along with the good, and we've seen some delays at the front end. But SNPEC, to their credit has been good about not over-reacting to the delays and staying constructive in helping us work through them.

Conclusion

There's still a lot more work to be done. This has been a very interesting project with a lot of challenges, but we are working through them. The success of the Chinese program will have a major impact on the global nuclear industry, so we all need to do what we can to insure that it remains on track. So far, we would say that the partnership between a key US-based valve supplier, and one of the major players in the Chinese Nuclear industry is off to a very good start.