

CGN Comprehensive Cooperation Proposal on Nuclear Power Plant Construction in Poland(HPR1000)

Kuang Yanjun
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CGN Overviews

CGN

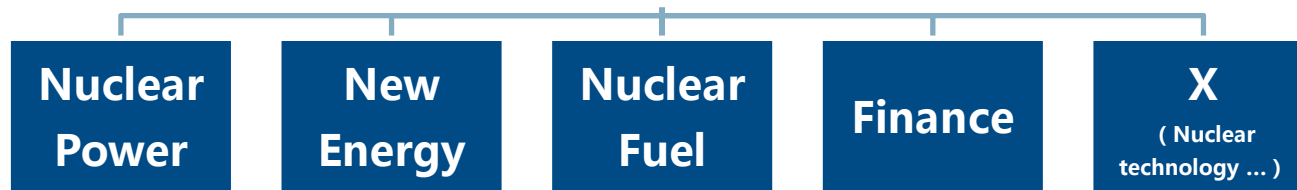
Who are we?

- A leading clean energy provider and server in the world.
- The largest nuclear power enterprise in China, and the third one in the world, with totally installed capacity of 45GWe.
- The largest Nuclear Power constructor in the world, independently developed HPR1000 – Chinese advanced Gen-III nuclear power technology.
- Total asset 100bn \$, 40,000 Employees.

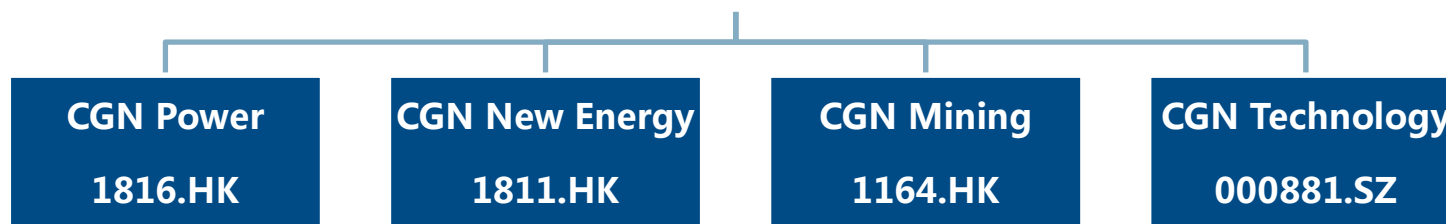
Business



"4+X" sectors



3 HK stock listed subsidiaries, 1 A stock subsidiary



Achievement in Nuclear Power Plant




 Daya bay
 2×984MW


 Ling'ao NPP phase 1
 2×990MW


 Ling'ao NPP phase 2
 2×1087MW




 Taishan NPP
 2×1750MW




 Hongyanhe NPP phase 1
 4×1119MW


 Hongyanhe NPP phase 2
 2×1119MW

NPP In Operation 

NPP Under Construction 




 FCG NPP phase 1
 2×1086MW


 FCG NPP phase 2
 2×1180MW




 Yangjiang NPP
 6×1086MW




 Ningde NPP phase 1
 4×1089MW

7 units under construction, **21** units in operation

Localization

- More than 30 years experience of NPP localization
- Localization ratio growing from 1% to 100%



02

HPR1000 Technology

□ Feature

□ Safe

- Enhanced emergency power & cooling ability based on feedback of Fukushima Accident;
- Combination of **active** and **passive** safety systems;
- Complete severe accidents prevention and mitigation measures;

□ Economic

- Build-up cost is competitive in the similar type of NPPs;
- Taking advantage of China's **batch** construction of NPP;

□ Proven and Approved

- Proven design technology, suitable for existing industry system;
- Demo plant, FCG units 3 &4, to be put into Commercial Operation in 2020;
- GDA & EUR assessment

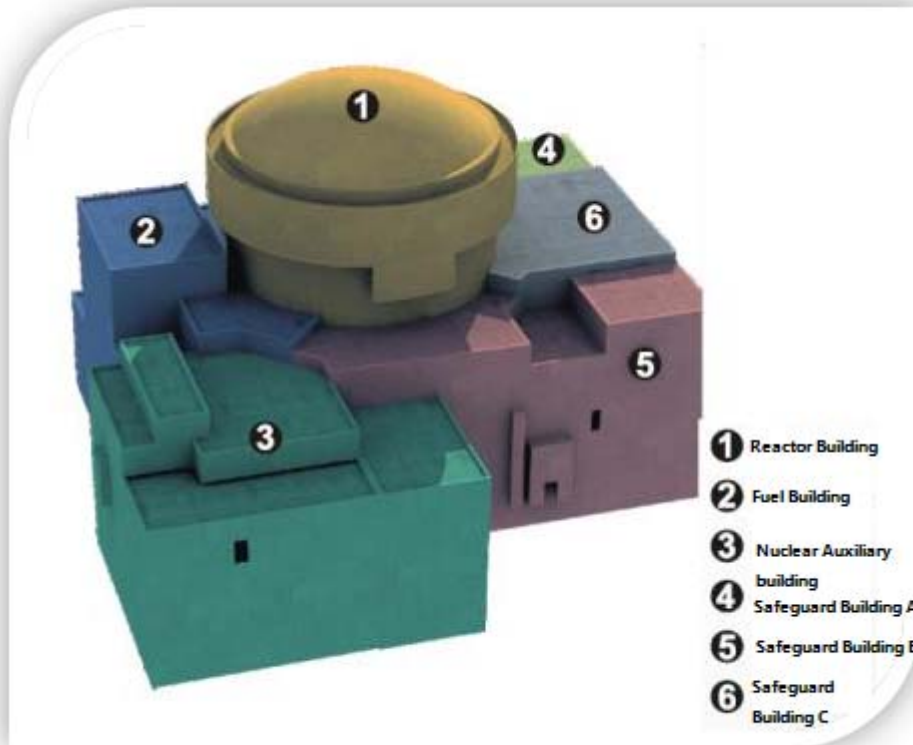


□ Key Parameters

Items	HPR1000	URD	EUR
CDF(Core Damage Frequency), /(reactor·year)	6.9×10^{-7}	$< 1 \times 10^{-5}$	$< 1 \times 10^{-5}$
LRF(Large Radioactive Release Frequency), /(reactor·year)	7.3×10^{-8}	$< 1 \times 10^{-6}$	$< 1 \times 10^{-6}$
Fuel Thermal Margin	>15%	>15%	>15%
Design availability Factor	92%	≥87%	≥90%
Safe shutdown earthquake	0.3g	0.3g	0.25g
Operator grace time	≥30 min	≥30 min	≥30 min
Solid waste, m ³ /(year·unit)	<50	<50	<50
Design lifetime, year	60	60	60

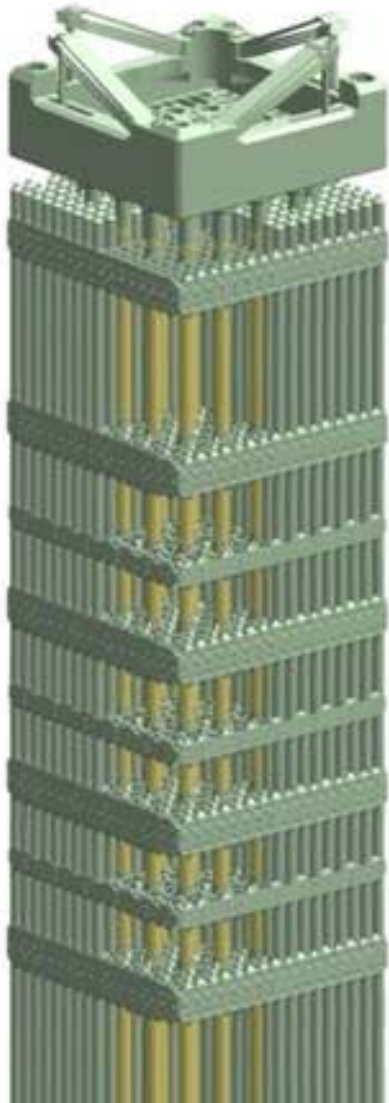
□ Technical Description

Three trains



- Three independent trains of safety systems, physically separated;
- **3X100%** redundant;
- CDF decreased compared with the traditional 2 trains system;
- Better resistance to internal and external hazards.

□ Technical Description



177 Fuel Assemblies

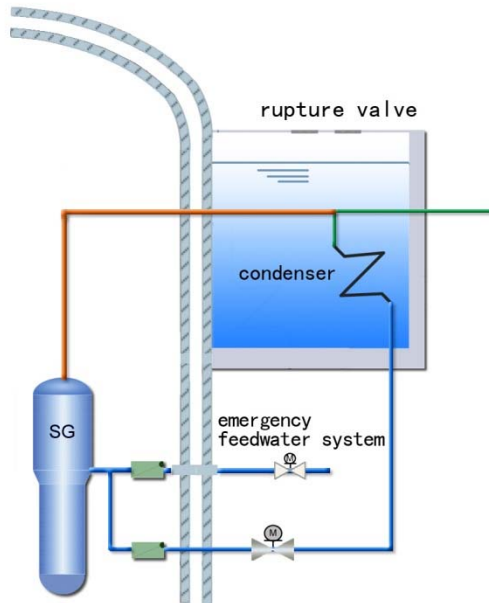
- 177 Fuel Assemblies (12 ft) ;
- Fuel thermal margin >15%;
- Lower linear power density;
- Higher core thermal power;

□ Technical Description

Passive

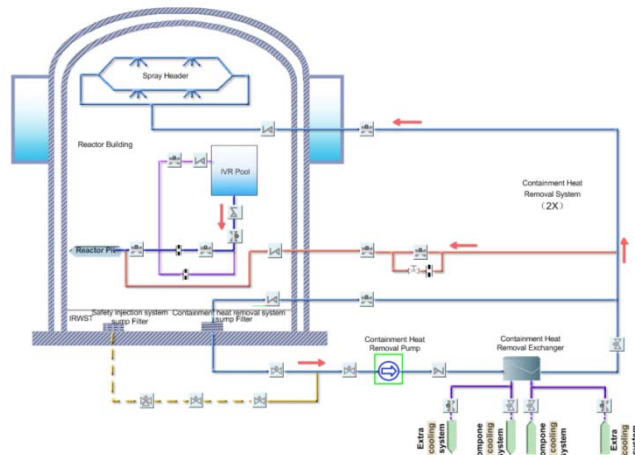
Secondary Passive Residual Heat Removal System

Ensuring long-term cooling of plant by natural circulation in case all active system disabled.



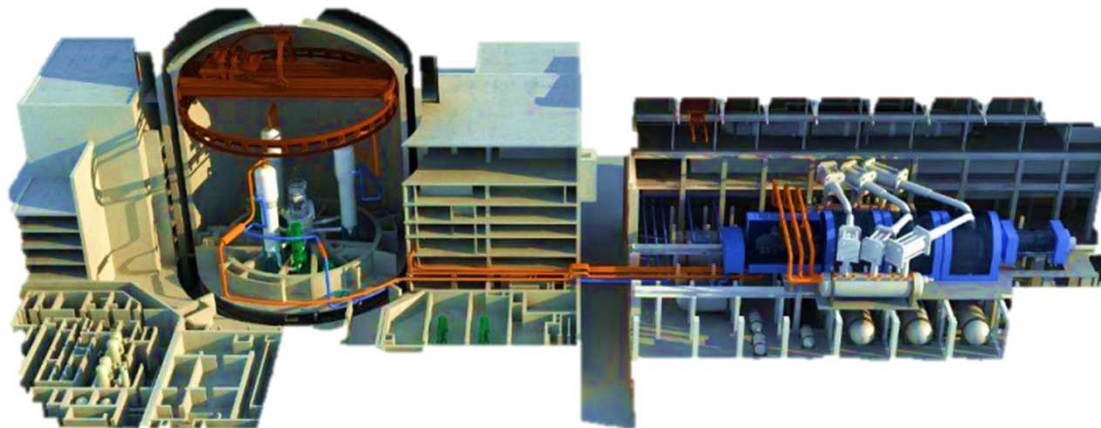
Passive Reactor Cavity Injection System (IVR)

Ensuring cooling of In-Vessel Retention during severe accidents.



□ HPR1000 in the world

- Batch construction in China domestic
- 2 units under construction in Pakistan
- To be constructed in British.



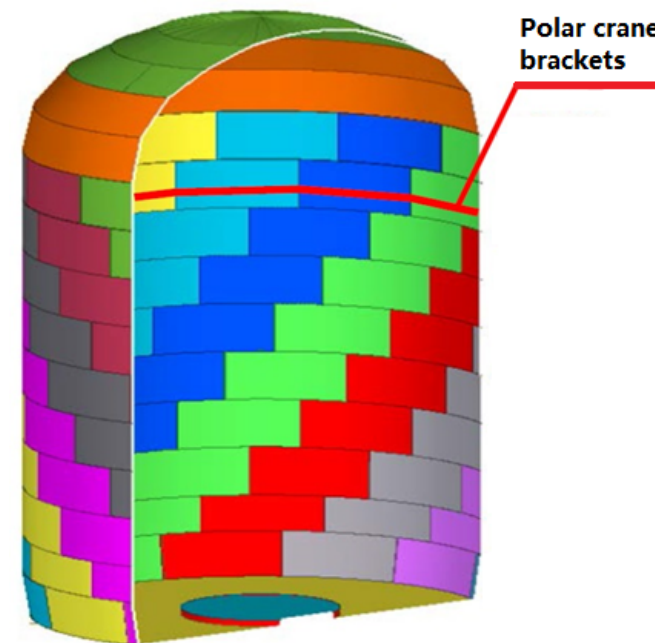
03

Welding Technology in HPR1000

□ Welding Technology

For the quality, cost and schedule consideration, HPR1000 has taken many technologies for plant construction, such as:

- Modular structures.
- Automatic welding of significant piping and stainless steel lining.
- Prefabrication for equipment and piping system.



□ Welding Technology

For each welding technology, the main work include:

- Quality control management of welding.
- WPS and WPQ management.
- Welder training and certificate.
- Sub-contractor management.
- NDT technology.

CGN has rich experience of NI&CI installation on site.



CGN has plenty of suppliers in China for fabrication and installation.



□ Harmonized Standards

Code and Standards for HPR1000

- The fabrication and installation of the most component is carried out according to **RCCM Code**.
- The pre-service inspection(PSI) and in-service inspection(ISI) is executed according to **RSEM Code**.
- The most supporting standards of RCCM and RSEM code are **EN or ISO** standards, few of them are NF standards or ASME /ASTM /AWS standards.

Advantages

- The related organizations (Owner, regulator, supplier, etc.) could prepare themselves in a very short time and join the work of HPR1000 construction due to the favorable code and standards.
- The potential enterprises in Poland or EU for manufacturing equipment and products as well as rendering services could join the chain of the qualified suppliers.

□ Harmonized Standards

Items	Typical Standard for nuclear components fabrication and installation
Testing	ISO9016(impact test), ISO4136(tensile test),ISO5173(bend test), ISO9015(hardness test), ISO17639(macroscopic and microscopic test)
Welding consumables	Carbon steel: EN ISO 2560, AWS A5.1, A5.18, A5.17, A5.20; Low alloy steel: AWS A5.5, AWS A5.23; Stainless steel: EN12072/AWS A5.9; EN1600 /AWS A5.4; EN12072/AWS A5.9 Nickel based alloy: AWS A5.14/5.11
Welding procedure specifications	EN ISO 15609
Welding procedure qualification	EN ISO 15614
Welder qualification	EN ISO9606 (manual, semi-mechanical/automatic) ISO14732 (fully mechanical & automatic)
Non destructive testing(NDT)	ISO 3452(PT), ISO17637(VT), ISO 17638(MT); ISO17636(RT), ISO17640(UT)
NDT qualification	EN473/EN ISO 9712



□ Welding of CI & BOP

Items	Typical Standard for piping system and components installation
Typical material types	Carbon steel and casting with $C\% \leq 0.35\%$ (GB/T 700, GB/T 711, NB/T 47008); Carbon-Manganese steel (GB/T 713, GB/T 1591, GB/T 1502); Manganese-Vanadium steel (GB/T 1591); Chrome-Molybdenum steel (GB/T 713, GB/T 5310)
Welding procedure specifications	DL/T 752-2010 The code of the welding on dissimilar steel for power plant DL/T 869-2012 The code of welding for power plant
Welding procedure qualification	DL/T 868-2014 Qualification standard for welding procedures
Welder qualification	TSG Z6002-2010 Examination rules for welding operators of special equipment DL/T 679-2012 Code for welder technical qualification
Non destructive testing (NDT)	NB/T 47013-2015 Nondestructive testing of pressure equipment

These Chinese national and industry standards are also applicable for thermal power station, which can be replaced by local harmonized standards.



□ Special Requirements

ESPN / PED /CE Marking

- The design, manufacture, conformity assessment and the installation operation of Nuclear Pressure Equipment shall be performed according to ESPN Orders.
- The design, manufacture, conformity assessment of Pressure Equipment shall be performed according to PED .
- CE Marking of the HPR1000 equipment or product.

Agreed Notified Body(ANB)

- For approval and monitoring of the manufacturer's quality assurance system or for direct product inspection.
- In charge of the conformity assessment of the nuclear Pressure Equipment.
- ANB agreed by the regulator.
- Certification approved by ANB of sub-contractor.

04

Proposal and Suggestion

□ CGN's Proposal in Polish Nuclear project

- Provide the proven, approved and practically realistic technology HPR1000 with its latest modifications.
- Enhanced quality, cost and schedule control to achieve a competitive power price, with the benefit from batch construction of HPR1000 in the world.
- Comprehensive cooperation with local industrial chain, including engineering, manufacture, construction and technical service, to maximize localization ratio up to 40%.
- Take advantage of Chinese investing and financing.
- Make the best of CGN's experience in NPP construction and operation, as well as Chinese regulatory and surveillance system.

□ Localizations

Options of Participants

- Suppliers: Provide equipment, products or service for HPR1000 by themselves.
- Sub-suppliers: Provide equipment, products or service for HPR1000 under the cooperation with CGN or Chinese supplier.
- Rendering companies: Provide technical personals or engineers.
- Certification service: Provide PED certification for Chinese suppliers.



Some Suppliers in EU or Poland for NPP Construction in China

- Supplier of welding consumables and base metal: ESAB, Sandvick, Bohler, Air Liquid, METRODE; **Outokumpu**, Creusot Forge, Valinox Nucléaire, CEFIVAL.....

□ Suggestion

- It is suggested for supply chain that some necessary work, such as licensing, certificating, and employee training, should be commenced as early as possible.
- CGN is willing to share our experience in construction and operation of nuclear power plants with Polish counterparts.



THANK YOU



You can contact this email if any question
kuangyanjun@cgnpc.com.cn