Nuclear Power Status and Prospects in China

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Contents

I. Nuclear Power Status

II. Nuclear Power Prospects

III. Reinforced Nuclear Safety Regulation

I. China's Nuclear Power Status

Since initiating nuclear power program from 1980s in China, it has experienced the following three stages generally:

Stage 1: The first decade (1985-1994), start-up

- Qinshan, Daya Bay NPPs were constructed, with a total installed capacity of 2.10 GW;
- Breakthrough of "zero nuclear power";

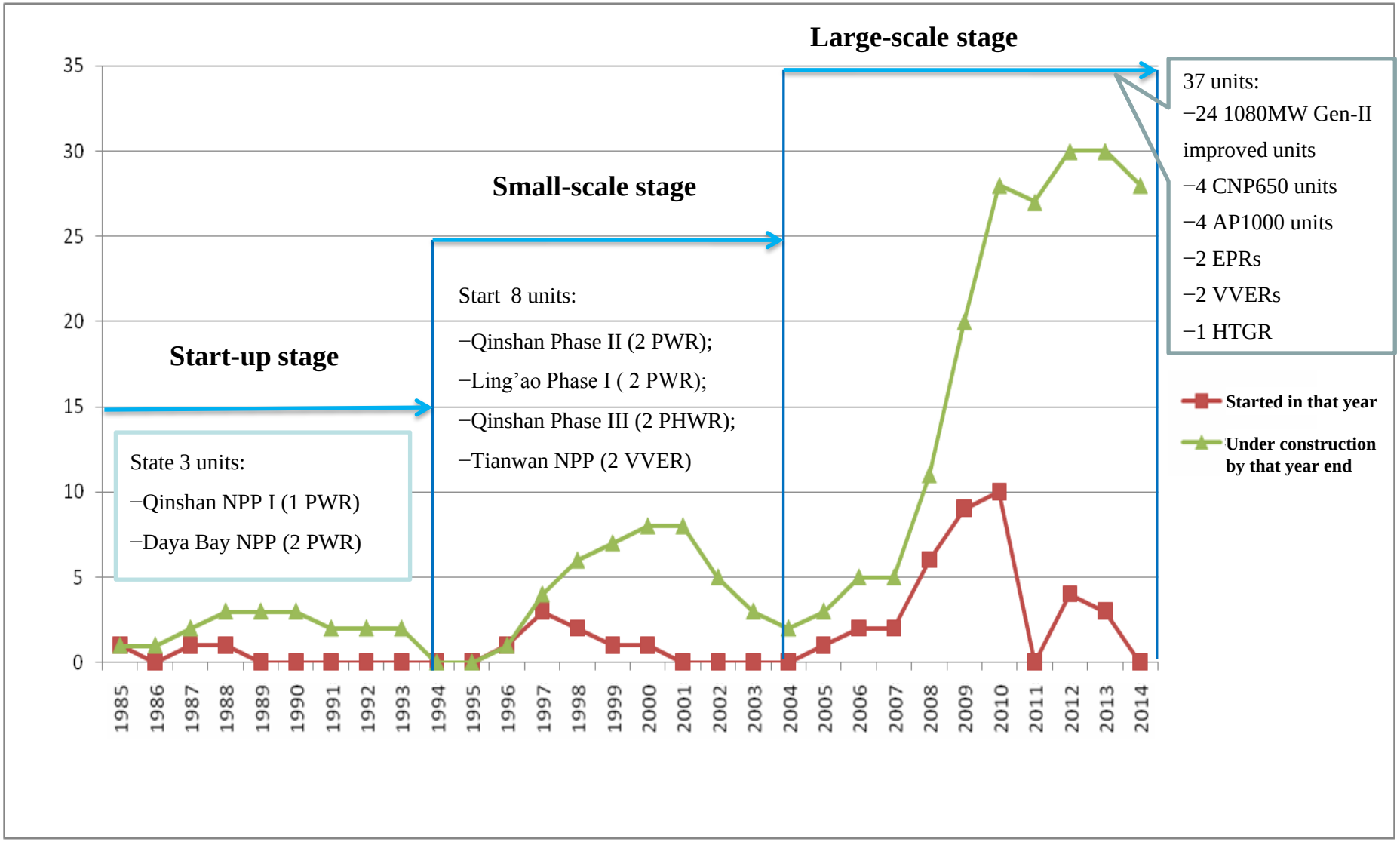
Stage 2: The second decade (1995-2004), small-scale construction guided by the national policy of "reasonably developing nuclear power".

- 8 units built in succession, with the installed capacity of 9.10 GW;
- Tapping a foundation for the follow-up development;

Stage 3: The third decade (2005-2014), driven by national policies on restructuring energy mix and improving environment, China's nuclear power entered rapid growth stage.

- 22 units in operation, 20.1 GW
- 26 units under construction, 28.45 GW

Nuclear Power Units List over the Years



- The Fukushima nuclear accident made significant impacts on Chinese nuclear power development, swayed the public convince on nuclear safety;
- Considering then situation, the State Council concluded the following decisions after special meeting:

1. Organize an immediate comprehensive safety inspection on all nuclear facilities in China;
2. Strengthen the safety management of nuclear facilities;
3. Not launch new nuclear power projects before issuing the *State Nuclear Safety Program*, and
4. Suspend the inland NPP approval during the 12th Five-Year plan.

- The nuclear safety inspection task, consisted of National Nuclear Safety Administration (NNSA), National Energy Administration (NEA) and China Earthquake Administration (CEA), issued the safety inspection report after one year's working, which stated that:

  "In China, all NPPs in-service are safe, all NPPs under construction satisfy the existing regulations, with the engineering quality under well control.";

- As required by this report, all NPPs shall reevaluate their capability for resisting extreme natural disaster, and make the necessary correction measures within limited period based on the reevaluation results.

- Oct. 24, 2012, the State Council approved the State Nuclear *Safety Program* and the *Mid- and Long-Term Development Plan for Nuclear Power*, it means the nuclear power construction back to normal track;

- Based on studying Fukushima lessons, NNSA issued *the General Technology Requirements on Improvement Measures for NPPs post-Fukushima Nuclear Accident* in June 2012, to further increase the NPPs' operation performance in China.

Qinshan Nuclear Power Plant

Daya Bay Nuclear Power Plant

Tianwan NPP

Yangjiang NPP

Lingao NPP

Qinshan III

Sanmen NPP

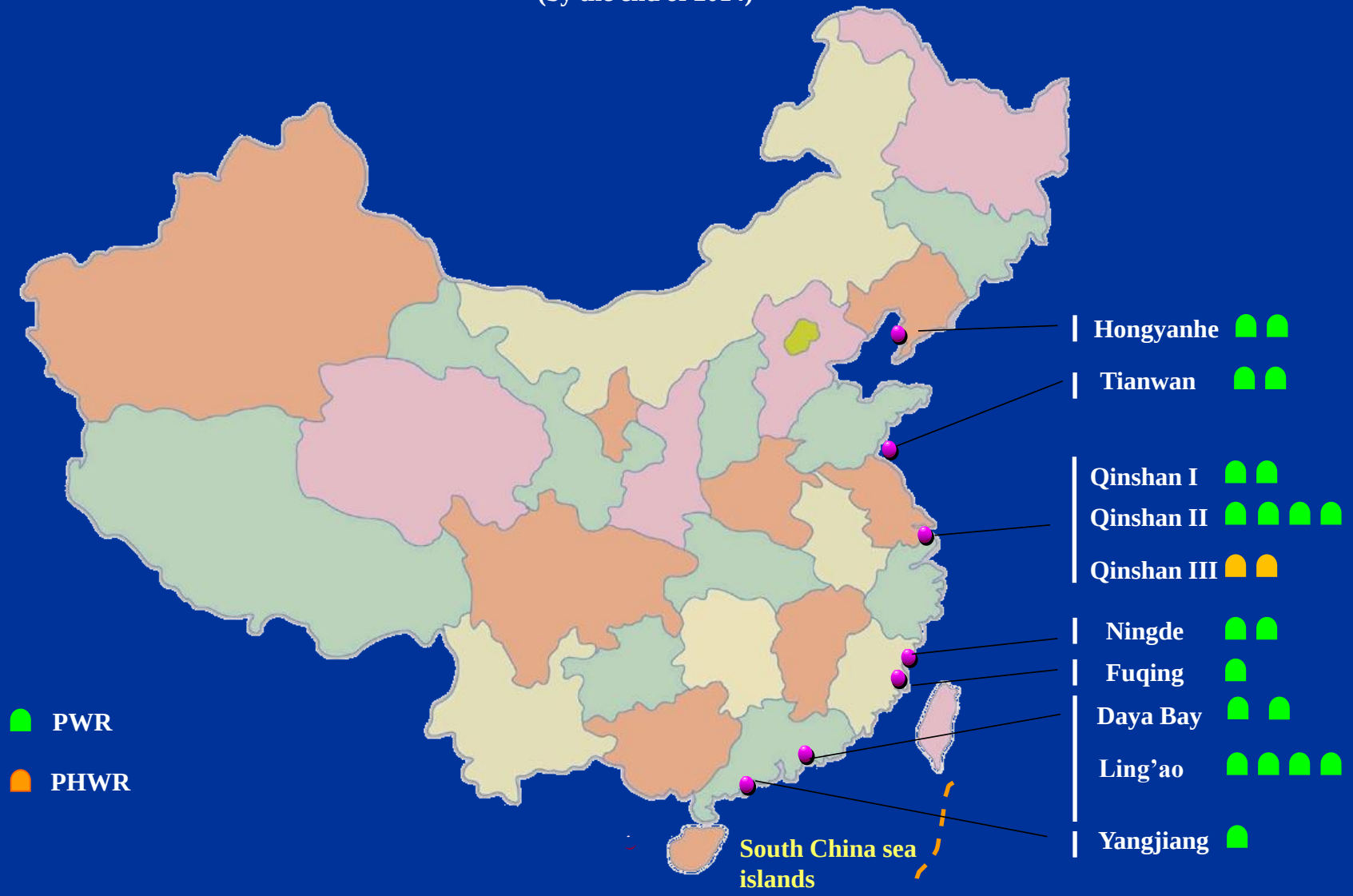
- By the end of 2014, 22 operating units with 20.1 GW, 26 units under construction with 28.45 GW, total 48 units with a gross installed capacity of 48.55 GW ;
- Shape a complete industry chain to match the scale development, from uranium resource exploration, fuel supply, technology R&D, NPP’s design and construction, equipment manufacturing, etc.

The operating units run safely with good performance.

- Based on WANO's indicators, the operating units as a whole are over the middle level. In particular, some ones can reach the advanced level in the world;
- In recent 20 years, no accident rated at 2 level or above of the IAEA's INES happen, the NPPs' surrounding radiation level maintain at the natural background;
- Good economic benefit, as its' grid price lower than the benchmark price of the local coal-fired desulfurization units.

The Operating NPPs in Chinese Mainland

(by the end of 2014)

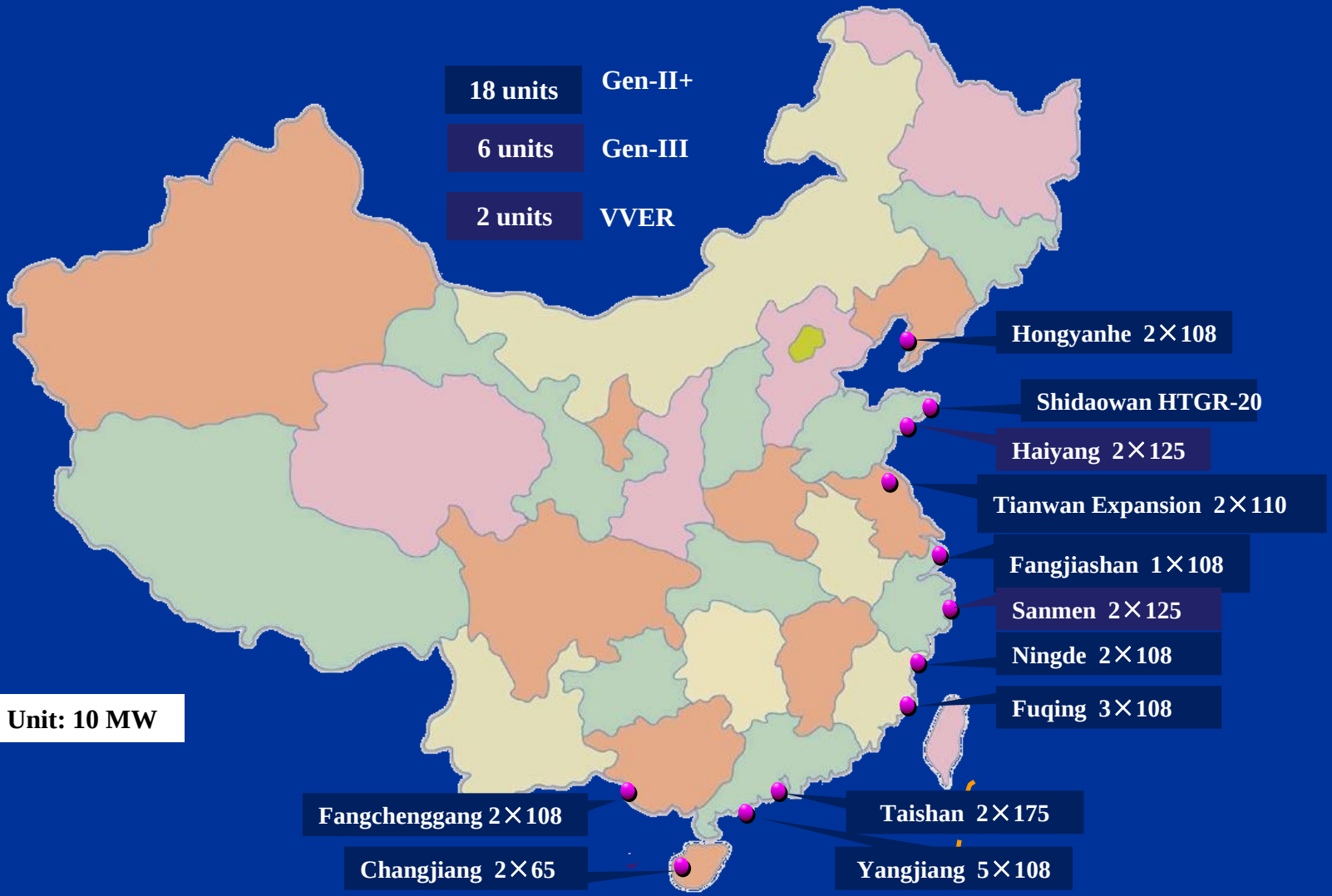


By the end of 2014, total 28 units under construction.

- 17 1080MW Gen-II improved units
- 2 CNP 650 units
- 4 AP1000 units
- 2 EPR units
- 2 VVER units
- 1 HTGR units

The NPPs under Construction in Chinese Mainland

(by the end of 2014)



Rapid enhancement of localization of equipment manufacturing

- The 11th Five-Year （2005-2010）has become an unprecedented golden period for nuclear power equipment manufacturing industry;
- Three major power equipment groups and two major heavy-machinery groups have invested over 30 billion yuan to expand the bases and capacities;
- According to the statistics of National Energy Administration by the end of 2011, the production capability of main nuclear equipment per year in China: 10 units (sets) of pressure vessels, reactor internals and control rod drive mechanisms, 27 steam generators, 30 primary pumps, and 15 sets of turbine generators, which can meet the demand of 8-10 new units per year.

The nuclear fuel supply is ensured greatly.

- Domestically, important progress has been made in the exploration of natural uranium. Internationally, China’s cooperation with some countries on uranium resource is being steadily pushed forward;
- The uranium resource and nuclear fuel will surely meet the demand of nuclear power development in China.

Paying high attention to technical innovation and talents training

- The CAP1400 has passed initial design review, and made significant achievements in engineering verification test and key equipment development. The CAP1400 project is predicted to start in Shandong Shidaowan in this year;

- HTR NPP project in Shidaowan is under smooth construction;

Paying high attention to technical innovation and talents training

- Meanwhile, the Hualong unit with independent intellectual property has made great progress, its PSAR is being examined. NEA has decided to build 2 units in Fuqing and Fangchenggang sites respectively, the first Hualong unit in the two sites will be started in this year.
- The educational training of nuclear professional talents has made steady progress: stronger professional capability and higher teaching quality in universities, and further standardization of on-the-job training. The cooperation between universities and enterprises as well as the combination involving production, teaching and research is an important way of talent training.

Promoting the management innovation and construction capability

- A general contracting model integrating four functions, namely design, procurement, construction management, and commissioning, is being gradually unfolded in nuclear power projects;
- Construction & installation enterprises have responded actively to the requirements of nuclear power multi-reactors construction and multi-projects management, trained a world-leading experienced team.

II. China's Nuclear Power Prospects

Planning targets of 2020

- The goal in the *Mid-Term and Long-Term Development Plan for Nuclear Power (2010-2020)*, by 2020, the installed capacity of nuclear power shall reach 58GW, further 30GW under construction. We need to contribute arduous efforts into reaching this goal, and encounter several challenges;
- During the 12th Five Years (2011-2015), priority will be given to coastal construction. At the same time, various preparations, especially communication with the public and social risk evaluation, shall be made for inland plant construction;

Planning targets of 2020

- New units shall meet the safety standard of Gen-III. The Gen-III technology will become a mainstream in China.
- As stated by NNSA, since the 13rd Five-Year Plan, the newly built NPP shall reach the following safety targets:

- To substantially eliminate the possibility of massive radioactive release by design measures;
- Only limited actions are necessary for nuclear emergency.

Prediction of long-term development

- Responding positively to Chinese government's initiative on revolution of energy production and consumption, nuclear energy application will surely play a crucial role in this movement to implement the low-carbon growth roadmap;
- As predicted by Chinese research agency concerned, by 2030, Chinese electricity consumption per capita will be 5500 kWh. The installed capacity of nuclear power will be 160GW, the nuclear power generation will account for about 10% of total electricity generation, can replace 370 million t. coal (then coal power will still be 64.6%);

Prediction of long-term development

- By 2050, electricity consumption per capita will be 8500 kWh. The installed capacity of nuclear power will be 240GW. Nuclear power generation will account for about 15%, and can replace about 600 million t. coal (then coal power will still be 50.5%);
- To reach low-carbon energy in China, developing nuclear power is inevitable to optimize energy mix and reduce coal consumption;
- While greatly conducting PWR, China is actively developing CEFR, commercial HTR, SCWR and small reactors technologies.

Creating the conditions favorable to further development

The further progress of nuclear power still depends on some conditions:

- The domestic issues affecting development mainly are the technical route selection, plant site layout and conditions, uranium resource insurance, and nuclear power economics compared with other power resources;
- The international factors affecting development mainly are global tendency and the public acceptance;

Creating the conditions favorable to further development

- We should enforced the safety supervision, publish the safety information by a open and transparent way; at the same time, we should strength the public communication, scientifically popularize nuclear power knowledge, advocate scientific and rational nuclear safety idea. We should make the local public share the benefits resulting from nuclear power growth, create a favorable social environment for nuclear power development.

III. Reinforced Nuclear Safety Regulation in China

- Chinese government pays close attention to nuclear safety, which has been brought into national security framework as a key element. Recently, especially after Fukushima accident, Chinese body has taken a series of measures to enforce nuclear safety supervision ability, to adapt to rapid progress in China. The main steps include:

- Enlarging the structure and staffing formation as well as funding of nuclear safety regulators, including 6 regional nuclear safety supervision points;
- Enlarging the staffing and funding of technology supporting units for nuclear safety;

- Promoting nuclear safety legislation, revising and improving nuclear safety laws, standards and guidelines, strengthening nuclear safety criteria;
- Increasing the capital investment in nuclear safety R&D, speeding up to construct the nuclear safety research institutes, extending the cooperation between institutes and nuclear power enterprises, emphasizing the competence training on supervisors;
- Furthering international cooperation in the field of nuclear safety;
- Publishing the statement on nuclear safety culture policy at the end of 2014, progressively establishing the public engagement mechanism, enhancing the public communication and propaganda.

- In 2014, the five major nuclear power groups including CNNC and CGN co-signed the *Cooperation Framework Agreement on Mutual Aid for Nuclear Accident Emergency Among Groups*, currently is building the green channel for this purpose. The five groups will establish and improve the emergency response mechanism and aid mechanism between adjoining NPPs belonging to different groups, so as to consistently deal with the serious nuclear accident at full stretch when necessary and deepen the cooperation.

Thank you !