

**China
National
Nuclear
Corporation**

**Integrated
Solution
Provider**

**Your
Reliable
Partner**

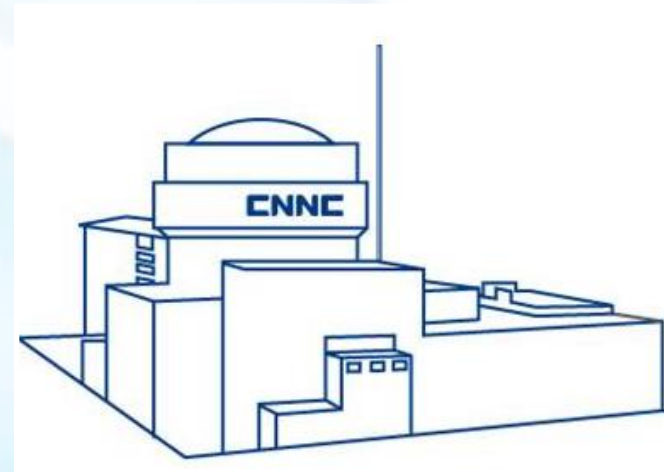
**Sao Paulo, Brazil
Oct, 2015**



CONTENTS

1. CNNC Introduction

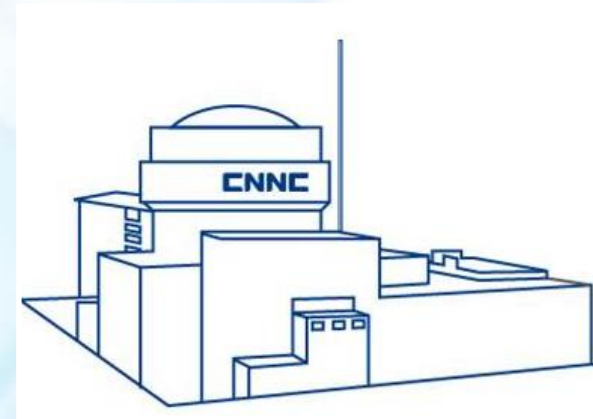
2. Integrated Solutions



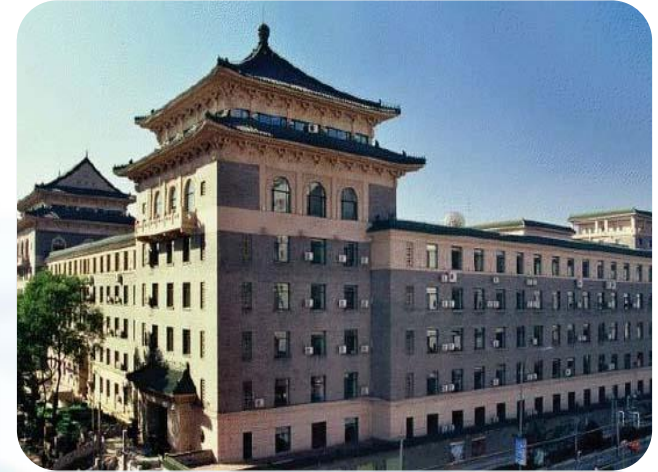
CONTENTS

1. CNNC Introduction

2. Integrated Solutions



- Founded in 1955;
- Over 100 subsidiary companies and institutes with more than 100,000 employees;
- Engaged in R&D, design, construction, operation, equipment supply, investment, etc. in nuclear electricity generation, nuclear fuel cycle and nuclear technology application;



CNNC Headquarter



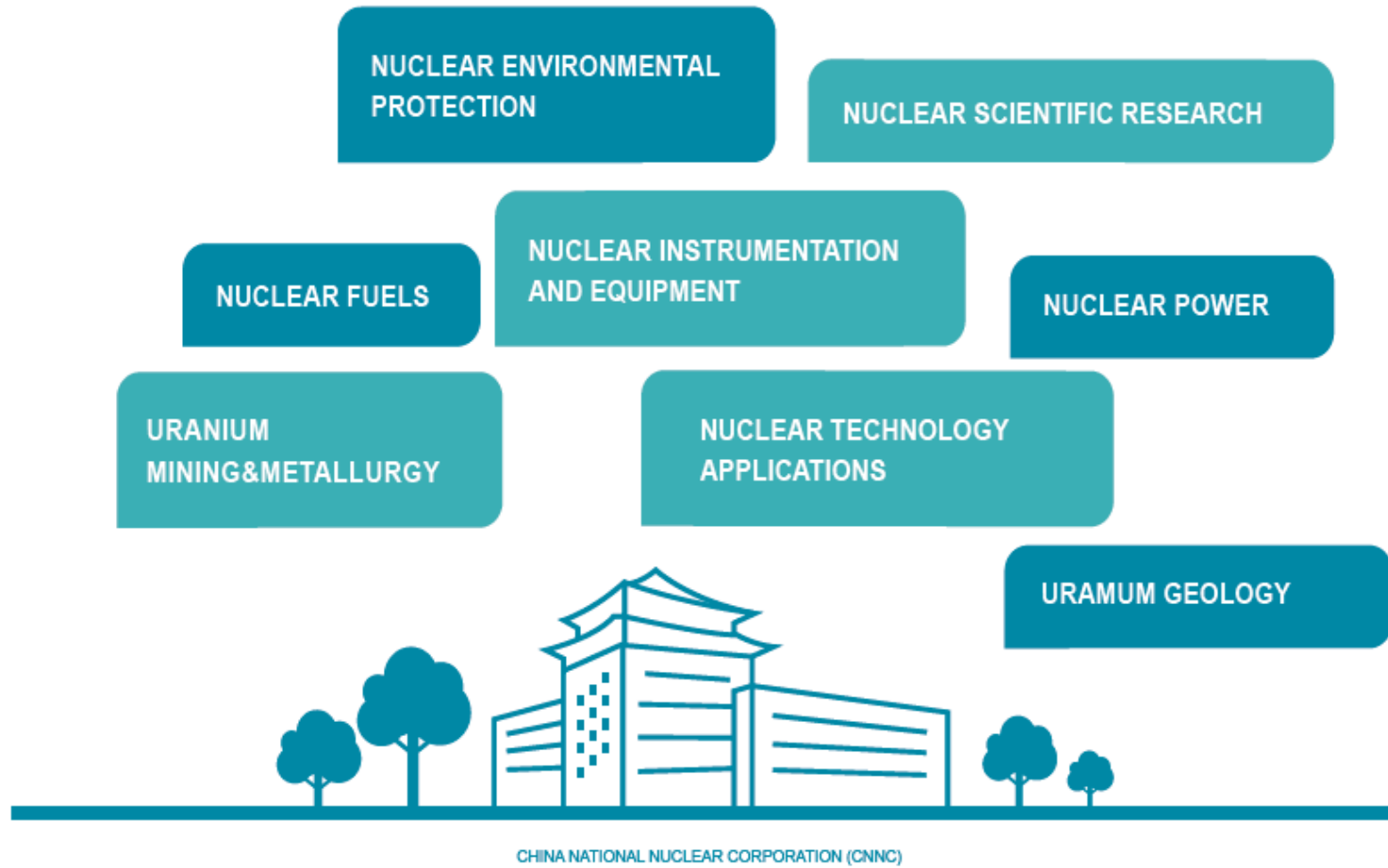
- The major body in the nuclear power technology R&D of China;
- The main nuclear power plant exporter in China;
- The general contractor of nuclear design and engineering of China;
- The only nuclear fuel supplier in China;
- The major investor of nuclear power plants in China;
- The nuclear power operation services provider of China.



CNNC Headquarter



➤ A Complete Nuclear Industry



➤ NPPs in Operation (13 units, 10.75GWe)



QinShan Phase I
1x 320MWe PWR



QinShan Phase II
4x 650MWe PWR



QinShan Phase III
2x728MWe PHWR



Tianwan NPPs
2x1060MWe PWR



Fuqing NPPs
2x1080MWe PWR



Fangjiashan NPPs
2x1080MWe PWR



➤ NPPs Under Construction (9 units, 9.31GWe)



Hainan Changjiang1&2
2×650 MWe



Zhejiang Sanmen1&2
2×1250 MWe



Fuqing 3&4&5
2×1080 MWe, 1×1150MWe



Tianwan3&4
2×1100 MWe



➤ CNNC Nuclear Power Design

1980s

Starting with self-reliance
and introduction of NPP



CP300
Qinshan phase I



M310
Daya Bay

1990s

Promoting self-reliance
and localization



CP600
Qinshan phase II



Long-term self-reliant
technology development plan

CP1000

- R&D started in 1997
- Standard design completed in Apr, 2010
- Construction drawings design, performance test and equipment procurement started in Oct, 2010

2010s

Advanced G-III technology



ACP1000

- Based on CP1000 design, overall technical scheme finalized in Aug, 2010
- Adopting the active & passive design
- Feedback of Fukushima accident

➤ CNNC Nuclear Power Design

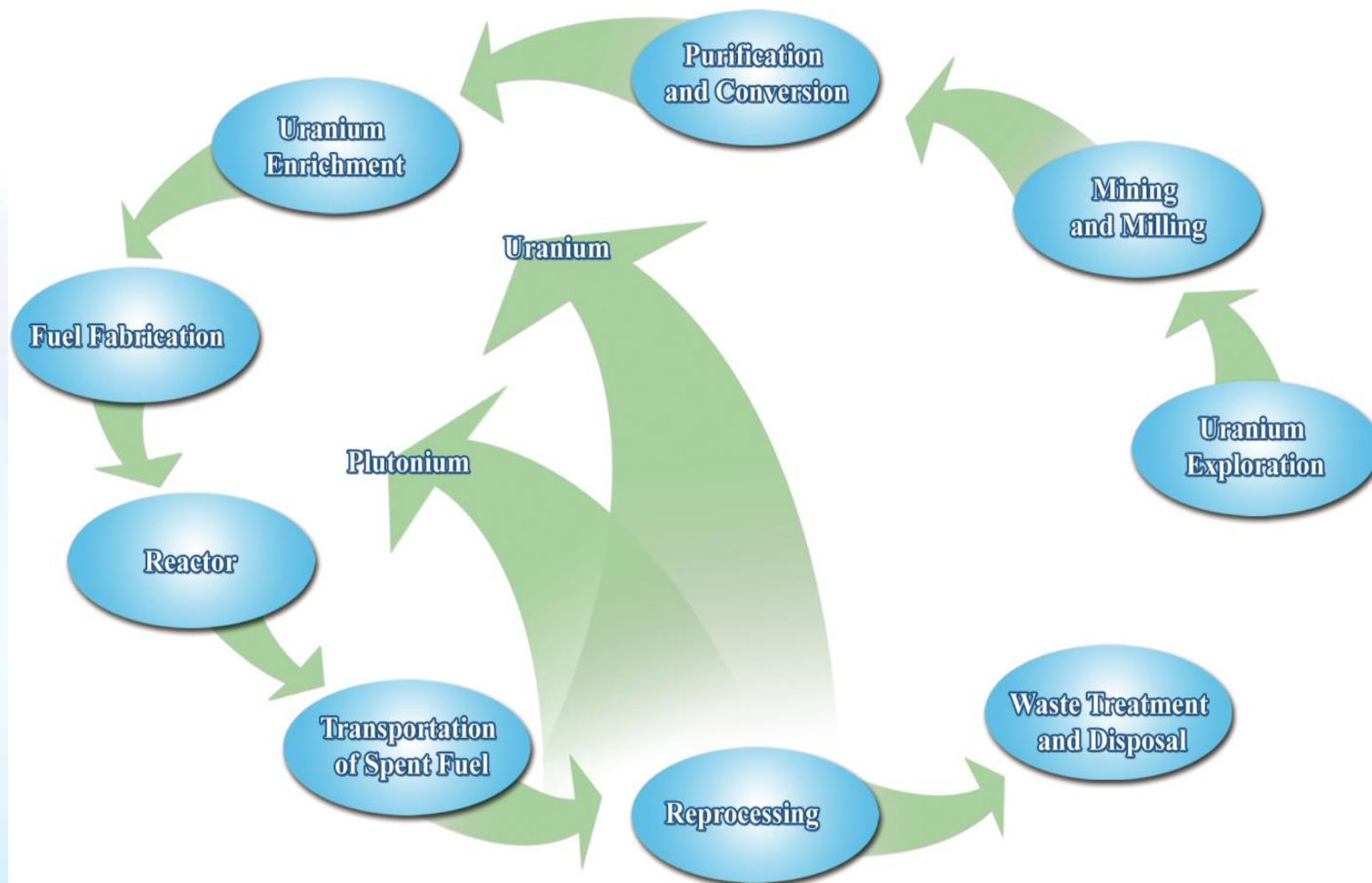


ACP series—(HPR1000, ACP600, ACP100), the G-III nuclear power technology

- A safe, reliable technology with economic competitiveness*
- Evolutionary design based on proven technology*
- Satisfying the requirement of latest nuclear safety codes and standards*
- Fulfilling the utility requirements for advanced light water reactor (URD, EUR)*
- Integrating the feedback of Fukushima accident*



➤ A Complete Nuclear Fuel Cycle System



➤ Nuclear Fuel Cycle Services

- Front End to Back End
- Uranium Conversion and Enrichment
- Nuclear Fuel Manufacturing
 - Complete nuclear fuel manufacturing system.
 - Most major types of fuel in the world.
- CF series fuel
- Life-cycle nuclear fuel supply of new NPPs



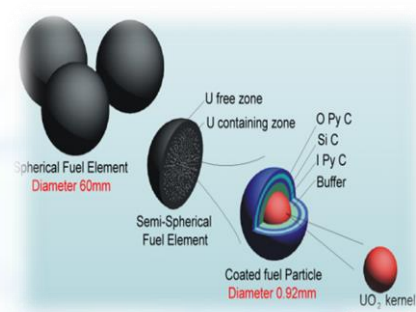
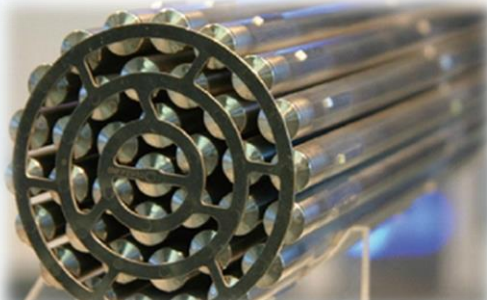
➤ Nuclear Mining and Metallurgy

Technologies of conventional milling, heap leaching and in situ leaching are widely adopted in uranium mining and metallurgy. As a result, the production capacity has been significantly enhanced and the production of uranium has increased year by year.



➤ Fuel Fabrication

The quality of nuclear fuel elements has reached the international advanced. Different types of nuclear fuels are supplied for all the NPPs in operation in China.



Type	Nuclear Power Plant
300MWe NPP	Qinshan Phase I
AFA3G	Qinshan Phase II, Guangdong Daya Bay NPP
VVER-1000	Tianwan NPP
PHWR	Qinshan Phase III
AP1000	Sanmen NPP and Haiyang NPP
HTGR	Shidaowan NPP
CF3	Fuqing NPP Unit 5&6

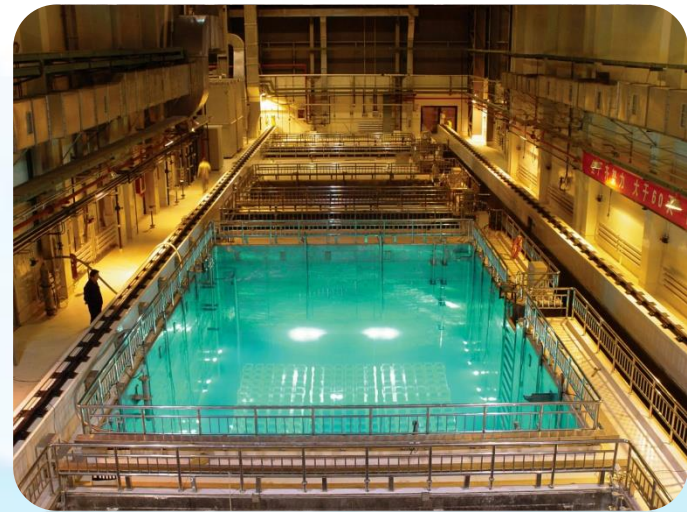


➤ Spent Fuel Reprocessing

The pilot spent fuel reprocessing plant has been built up and a large nuclear spent fuel reprocessing plant is under planning.



Pilot spent fuel reprocessing plant



Storage Pool of Spent Fuel Assembly



➤ Nuclear Technology Application

CNNC has sharpened its competitive edges in the fields of **isotope** and related products, **irradiation processing** and services and **ray application instrumentation**, and has fostered a group of key high-tech enterprises.



1. Electronic sterilizing irradiation facility

2. Radioisotope production line

3. Multitudinous production of COBALT-60

4. Intense proton cyclotron

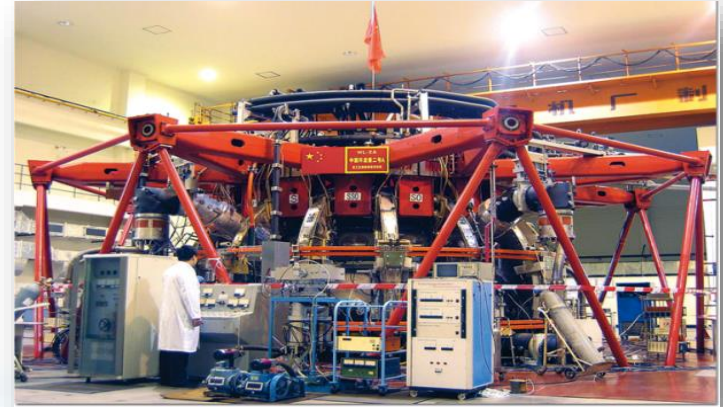


➤ Nuclear Technology Application

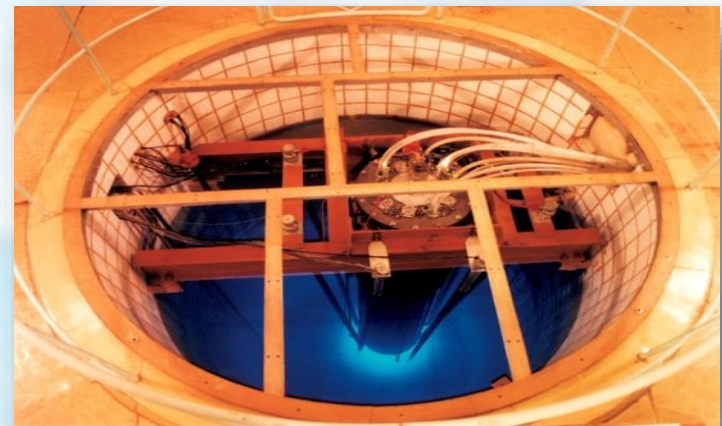
CNNC has developed a high level platform of basic scientific and technological research, and built up a R&D system in a comprehensive range of specialties.



High Flux Engineering Test Reactor



Nuclear Fusion Research Facility of Chinese HL-2A Project



Miniature Neutron Source Reactor



➤ Advanced Experimental Facilities



China Experimental Fast Reactor :

- 65MWt/20MWe
- May 2000-Jul. 2010



China Advanced Research Reactor:

- 60MWt
- Apr. 2002-Mar. 2012



➤ Advanced Experimental Facilities



**Comprehensive Experimental
Facility for Nuclear Power
Equipment**



**Medium and Large-scale
thermo-hydraulic test facility**



➤ Strong R&D Capability

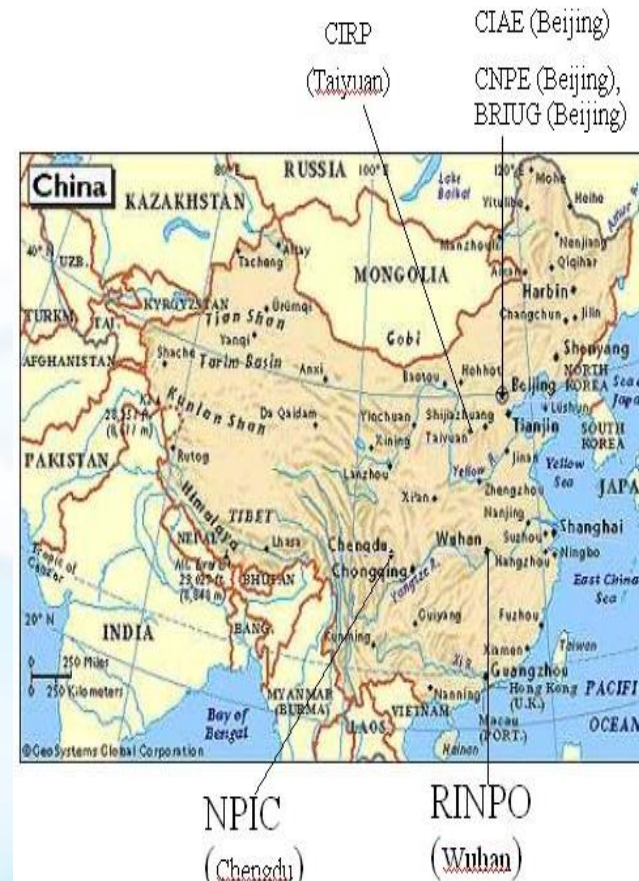
25 Research Institutes:

- ❶ China Institute of Atomic Energy
- ❶ Nuclear Power Institute of China
- ❶ China Institute for Radiation Protection
- ❶ Research Institute of Nuclear Power Operation
- ❶ China Nuclear Power Engineering Corp.
- ❶ Beijing Research Institute of Uranium Geology

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R&D staff:

- ❶ 17 Academicians
- ❶ 29 senior experts for central government
- ❶ 110 Ph. D supervisors
- ❶ **33,000 scientific & technical professionals**



➤ Nuclear Power Equipments Services and Supply



RPV(Reactor Pressure Vessel)



Turbine



DCS system



Generator



Steam Generator



➤ Human Resources Development

- Training services for Pakistan, Nigeria, Sudan, Saudi Arabia, League of Arab States, etc.
- International Educational Programme
- HRD proposal for nuclear new build



CNNC Graduate School



Simulator Training



➤ Human Resources Development



Training Center
Building



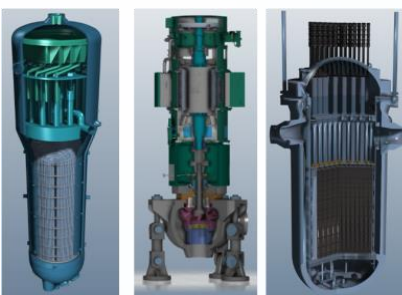
FSS
Development



Multifunctional
Simulators



NPP Equipment
modules



3D Teaching
Tools



Anti Human
Error Training
Systems



➤ Human Resources Development



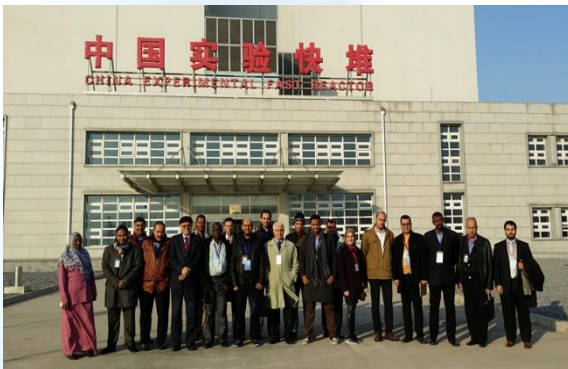
Contract for Nuclear Staff Training



The basic theory training



Workshop for league of Arab states



Visit China Experimental Fast reactor



Visit to Qian shan NPP



On the job training for uranium mining



➤ Renewable Energy

CNNC has paid great attention to develop renewable energy projects like wind power generation and solar power generation.



Wind Power Generation



Solar Power Generation



CNNC carries out extensive international cooperation in nuclear power, nuclear fuels and nuclear technology applications and has established trading relations with over 40 countries and regions.

Country	Reactor Type		Units	Build time
Algeria	Heavy Water Research Reactor		1	1992
Pakistan	Miniature Neutron Source Reactor (MNSR)		1	1989
	CP300	Chashma Unit 1 (C1)	4	2000
		Chashma Unit 2 (C2)		2011
		Chashma Unit 3 (C3)		2016
		Chashma Unit 4 (C4)		2017
	HPR1000	K2/K3	2	2014
Iran	Miniature Neutron Source Reactor (MNSR)		1	1994
	Heavy Water Zero Power Reactor		1	1997
Ghana	Miniature Neutron Source Reactor (MNSR)		1	1995
Syria	Miniature Neutron Source Reactor (MNSR)		1	1996
Nigeria	Miniature Neutron Source Reactor (MNSR)		1	2004
Jordan	Subcritical Facility		1	2012



**Birine Nuclear Research
Center in Algeria**



MNSR in Ghana



**Sub-critical Assembly
in Jordan**



CHASNUPP- 1&2



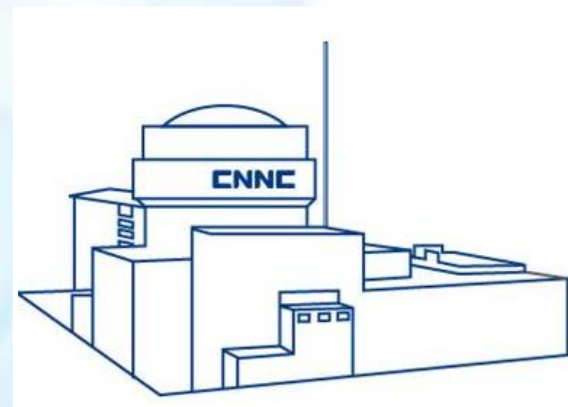
CHASNUPP- 3&4



CONTENTS

1. CNNC Introduction

2. Integrated Solutions



➤ Project Solution

- Self-Reliance Generation III nuclear technology Series (HPR1000, ACP600, ACP100)
- Various Contract Models (EPC, EPCM, BOT, BOO, etc.)
- Technical Services covering the entire fuel cycle (Feasibility Study, Technical Consulting, Life Extension, System Upgrading, NPP operation, HRD etc.)



➤ Financial Solution

■ Flexible Financing Options

- With the great support of Chinese Government and financial institutions, CNNC could provide wide range of competitive financial packages for the NPPs.

I Government support	II Financing Source	III Flexible Models	IV Financing Terms	V Others
<ul style="list-style-type: none">-Preferential policy-State guarantee-Foreign strategy	<ul style="list-style-type: none">·Large scale·Reliable·Multiple Channels (Eximbank, CDB, Commercial banks, etc.)	<ul style="list-style-type: none">·Export & Import Credit·Equity investment·Strategic investors attraction	<ul style="list-style-type: none">·Competitive interest rate·Medium and long term·Multiple Guarantee conditions	<ul style="list-style-type: none">·Risk sharing mechanism



➤ Financial Solution

CNNC has jointed effort with major Financial Institutions



CNNC Major Cooperation Partners

- **Brazil** is one of the founding member of Asian Infrastructure Investment Bank and BRICKS New Development Bank.
- All the financial institutions are paying close attention to China NPP oversea market.



➤ Pre-Project Phase Services

CNNC's integrated offer includes a full set of services and solution needed to establish a nuclear infrastructure for efficient and responsible governance and regulation of a sustainable national nuclear power program, including ***Project Management, Human Resources Development, Safety and Security , Emergency Response, Public Acceptance, Stakeholder Involvement, Human and Environment Protection, Grids Considerations and Site Selection.***

	Site Selection	<ul style="list-style-type: none">• Survey of potential sites• Selection of candidate sites• Site Characterization, etc.
	HRD	<ul style="list-style-type: none">• Necessary knowledge and skills identified• Develop and maintenance of HR base planned• HRD master plan for nuclear new build• Training, Technical exchanges and educational programme
Localization		<ul style="list-style-type: none">• Localization Guideline• Joint assessment of local industries• NPP technology development plan• Cooperation proposal on localization

Ability to Provide Integrated Solution

Industrial Solution

- Equipment Supply
- Nuclear fuel Supply
- Maximum Localization Ratio

Nuclear Management

- Infrastructure Establishment
- Site selection
- Project Management Support

Nuclear Technology Transfer

- Nuclear power
- Nuclear fuel

R&D

- Cooperation in Research and Design
- Research and Test Facilities

NPP Project

- Advanced NPP design
- NPP construction and life cycle management support
- Life extension & Consultation
- Operation & Maintenance support
- Various Contract Models (EPC, EPCM, BOT, BOO, PPP etc.)

Financial Solution

- Government support
- Flexible Financing Options

HRD

- HRD Services
- Joint educational program



**THANK YOU FOR
YOUR ATTENTION!**



● Proven

● Safe

● Economic