



Impact of Fukushima Accident on China's Nuclear Energy Development

Chen Shaofeng

A prologue

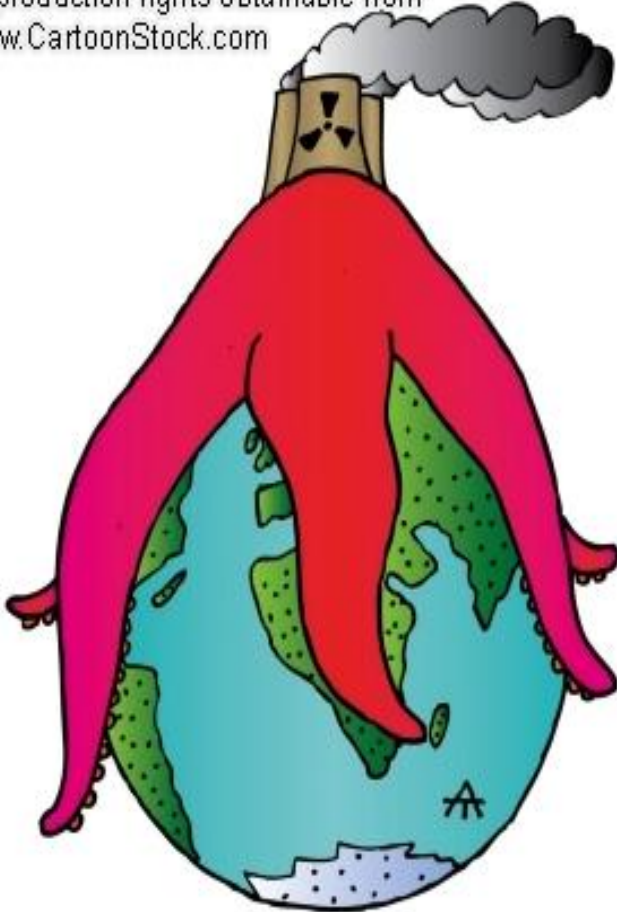
- **Germany: Nuclear power plants to close by 2022**
 - BBC, 30 May 2011
- **Swiss to phase out nuclear power by 2034**
 - Swissinfo, 25 May 2011



Outline

- I. Status quo
- II. China's nuclear energy ambition
- III. Impact of the Fukushima Daiichi crisis on china

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com



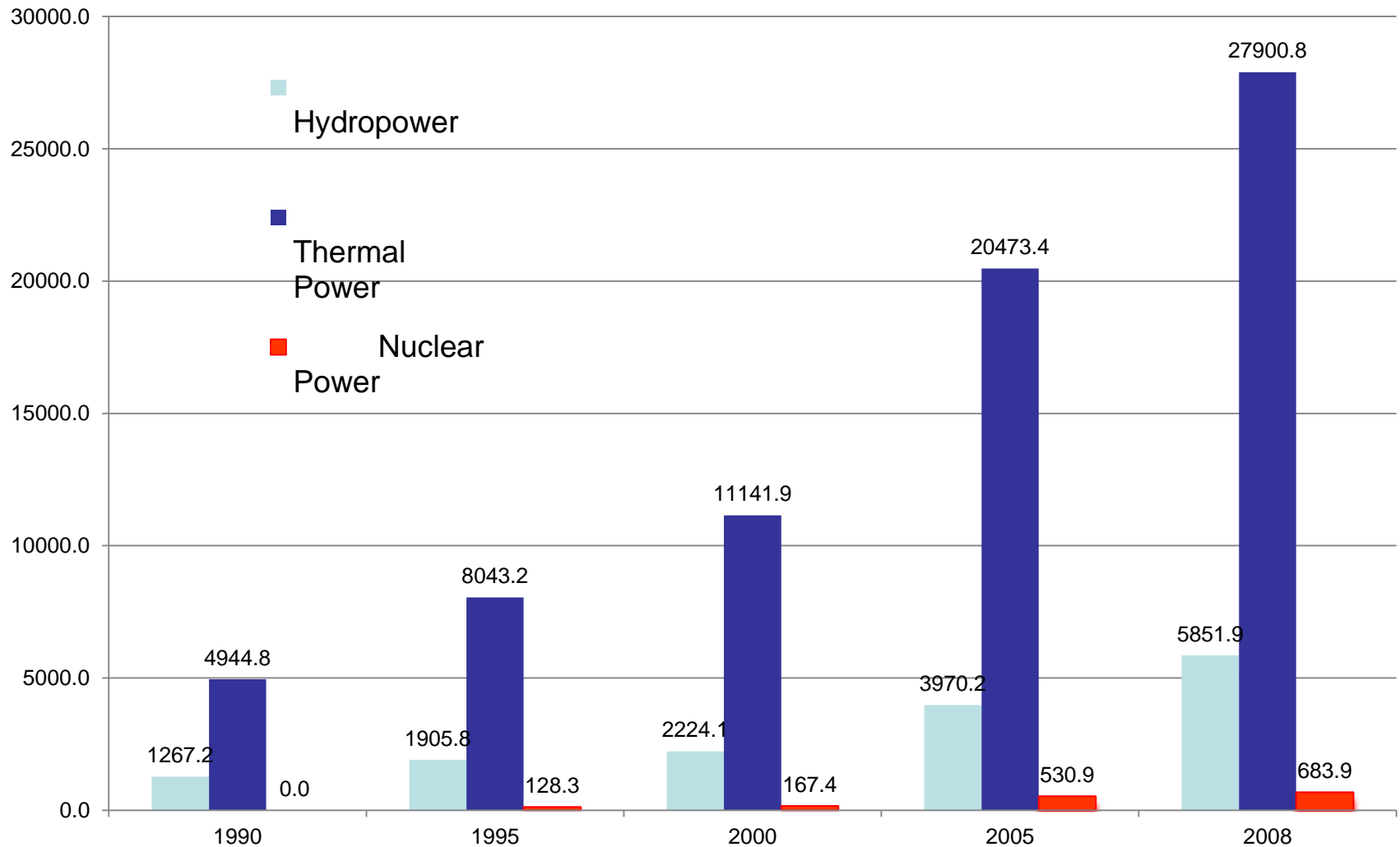
search ID: atan73

I. Status Quo

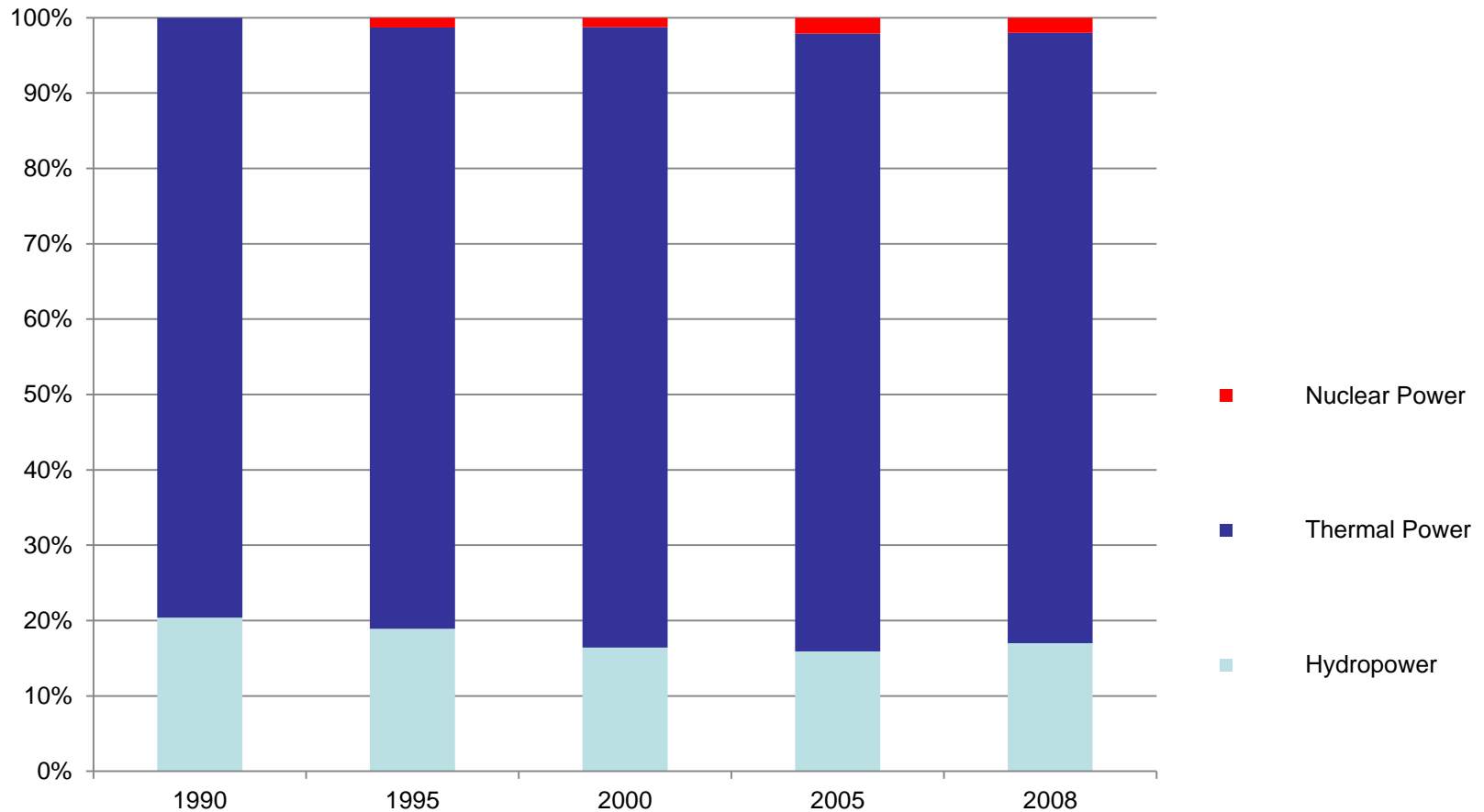
- commenced in 1970 and in the mid 2000s, into a rapid development phase
- Mainly borrowed technology with local development
- 13 nuclear power reactors in operation, 2010 – 74.7 Bwe, around 2% national electricity – saved 25 Mt coal and 73 Mt CO₂ per yr.

China's Electricity Available for Consumption

(100 million kwh)



Source: China's National Bureau of Statistics



nuclear power only accounts for 1.8% of China's total power output, far below the world average of 14%

II. China Ambition

As of 2010-11-30	No. of reactors in operation	electricity from nuclear/world total electricity generated
US	104	~20%
Japan	55	~50%
German	17	~23%
China	13	~2%
World	441	~14%

- 28 under construction, by 2015 installed generating capacity over 40 Gwe, fulfilling the original 2020 goal 5yrs in advance.
- Investment in nuclear energy in the next 5 yrs, over 70 billion CNY per yr
- nuclear power making up 5% of Chinese generating capacity by 2020, which would be over 70 GWe -- Sun Qin of the Chinese National Energy Administration
- The China Nuclear Energy Association projected 200 GWe of capacity by 2030, in a report issued in April 2010
- The country aiming to become self-sufficient in reactor design and construction, as well as other aspects of the fuel cycle.

Possible goal of nuclear power development plan

Year	NP capacity (GW)	Percentage of NP	Latest NDRC Plan
2020	70–90	~5%	5% (>70 reactors in operation)
2030	120-200	~8%	10%
2050	350-450	~15%	400 GWe

WNA Nuclear Century Outlook Data

Current Nuclear Programmes*	2008	2030 Low	2030 High	2060 Low	2060 High	2100 Low	2100 High
<i>Capacity in GWe</i>							
<u>Belgium</u>	6	6	8	8	10	8	22
<u>Brazil</u>	2	10	30	40	100	70	330
<u>Canada</u>	13	20	30	25	40	30	85
China	9	50	200	150	750	500	2800
<u>France</u>	63	65	75	80	110	80	130
<u>Germany</u>	20	20	50	40	80	80	175
<u>India</u>	4	20	70	60	500	200	2750
<u>Iran</u>	0	3	10	5	30	10	140
<u>Japan</u>	48	55	70	80	140	80	200
<u>Mexico</u>	1	2	20	3	75	20	225
<u>Russia</u>	22	45	80	75	180	100	200
<u>South Africa</u>	2	8	25	30	50	30	55
<u>South Korea (& North Korea)</u>	18	25	50	45	80	70	145
<u>Sweden</u>	9	10	15	10	18	10	18
<u>Switzerland</u>	3	4	6	5	10	5	11
<u>Ukraine</u>	13	20	30	20	40	20	45
<u>United Kingdom</u>	11	20	30	30	80	40	140
<u>United States</u>	99	120	180	150	400	250	1200
SUBTOTAL	367	559	1087	951	2939	1729	9137

III. Impact of the Fukushima crisis

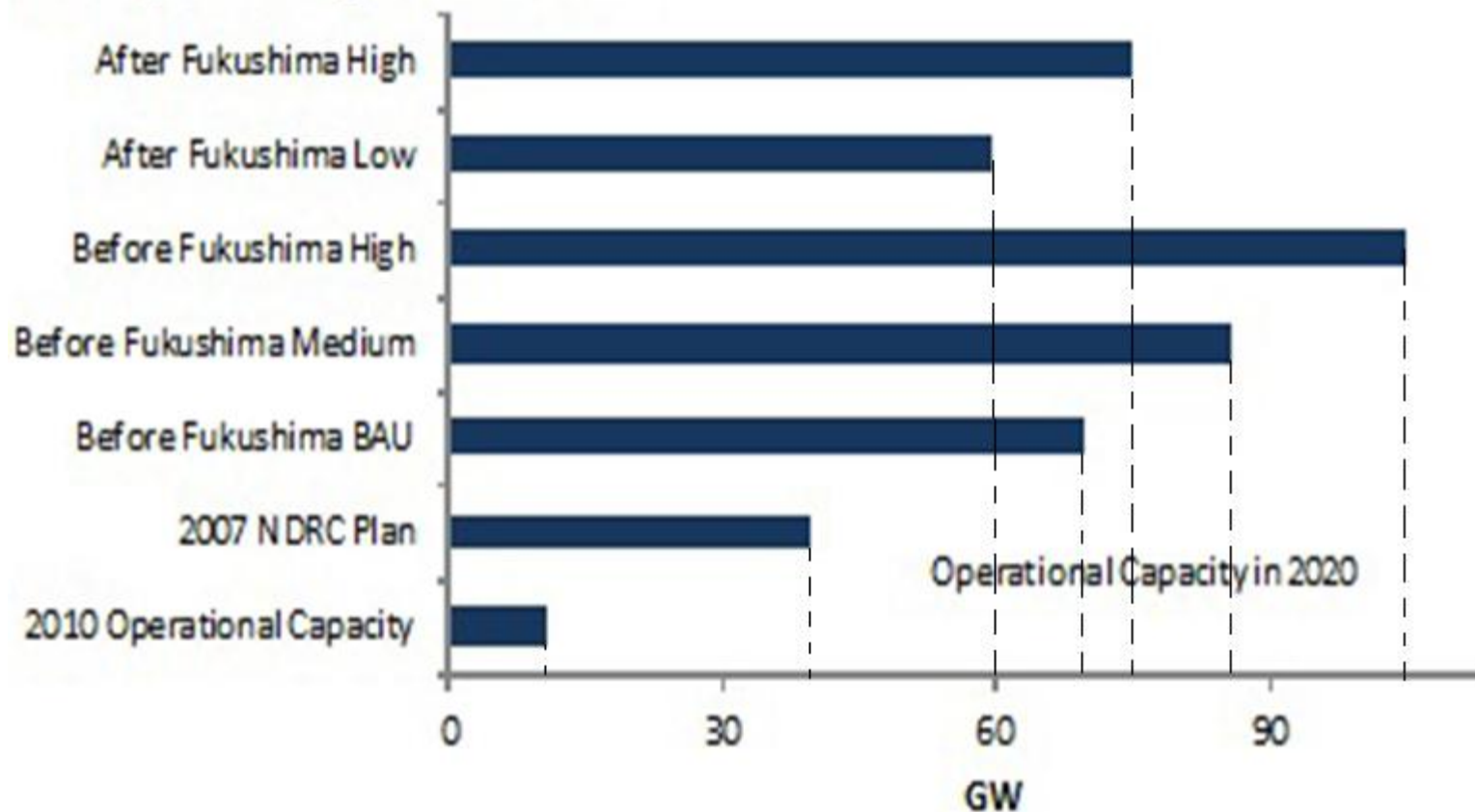
- 1. suspension and slow down
 - 2011-3-16: a temporary halt to assessment and approval of nuclear power projects that are in the planning stage
 - suspended work on four approved units due to start construction in 2011
 - The temporary halt applies only to projects yet to be approved
- 2012-10: release of "nuclear safety plan (2011-2020)" and "long-term nuclear power development plan (2011-2020)" : restart

- during the 12th -yr plan (2011-2015) period, not construct any nuclear projects in inland regions, only construct a few projects in coastal areas that have gone through adequate justification processes

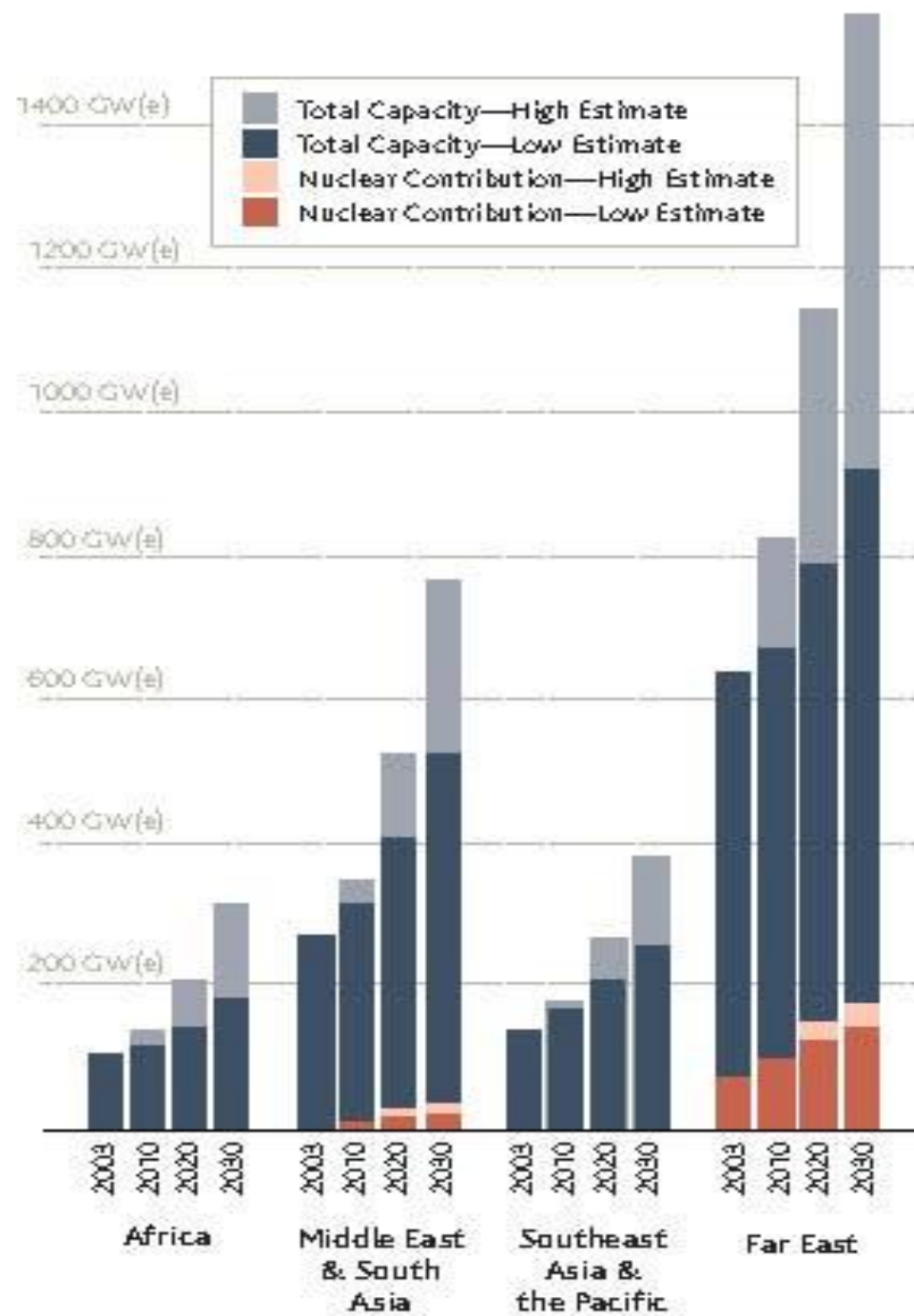
- 2. inspections and review
 - conduct a comprehensive review of all nuclear facilities and draw up nuclear safety regulations,
 - In May, a new China National Plan for Nuclear Safety with short-, medium- and long-term actions being formulated
 - some supplementary safety measures were announced
 - After three months the inspections of operating plants had been completed, and those on plants under construction were completed by October
 - require upgrades to existing reactors, including better back-up power facilities.

3. adjust its 15-year nuclear power–development plan

Figure 1 – The Impacts of Fukushima Daiichi Crisis on China’s Nuclear Development Target in 2020



- China's growing reliance on nuclear power is expected to continue.
- there would be 86 GWe installed capacity by 2020 -- Zhang Guobao, the former head of the country's National Energy Administration in March 2011



WNA Nuclear Generating Capacity Scenarios, GWe

	2005	2010	2015	2020	2025	2030
Reference	367	381	410	446	488	524
Lower	367	372	372	367	317	281
Upper	367	389	447	518	613	740

Source: WNA (2005)

These scenarios represent construction of 200 to 400 new reactors worldwide – some for replacement, most for new capacity.

- 4. improve the access threshold
 - New nuclear power project in accordance with the world's highest safety requirements.
 - New nuclear power plant must comply with the three generations of safety standards.
 - Core damage *frequency* (CDF) < 10^{-5} ; large release frequency (LRF) < 10^{-6}
 - CNP1000 & CPR1000 → AP1000
 - high temperature gas cooled reactor

- Site selection: geography and earthquake

- 5. public participation
- In 2012, NDRC for the 1st time, introduced stability assessment mechanism of social risks for large projects

Thank you!

Q & A

shaofeng@pku.edu.cn