Deutsche Bank
Markets Research

F.I.T.T.

Industry
China Nuclear

Date
7 January 2015

Asia
China

Utilities
Utilities

Michael Tong, CFA
Research Analyst
(+852) 2203 6167
michael.tong@db.com

Yingying Dong, CFA
Research Associate
(+852) 2203 6207
yingying.dong@db.com

F.I.T.T. for investors

Nuclear Power Generation in China – risk reality check

An in-depth risk analysis of China's nuclear power generation business

China has the largest amount of nuclear capacity under construction in the world. While there is consensus on its strong growth and stable returns, it is important for investors to know potential downside risks to this positive story. We look into four areas that may cause negative surprises, namely: project construction, plant utilization, tariff and future liability for decommissioning. We initiate coverage on CGN Power with a Sell. While we project a 17% EPS CAGR in 2014-17E, its valuation is still demanding at 20x FY15E PE and 2.5x P/B for a 13% ROE.

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Focus 1: what are risks to construction costs and delay for nuclear power?

Returns are highly sensitive to construction costs overrun and delays, which are more frequent in nuclear than in other power sources. This is in particular a concern for GIII units (AP1000 and EPR). Based on completion milestone analysis, we expect CGN's Taishan Unit 2 to start operation one year later than guided while costs might be revised up further, threatening project returns.

Focus 2: what are risks to utilization rate for nuclear power?

Nuclear power is given priority as a base load but can still face volatility of utilization caused by: 1) longer-than-expected ramp-up/teething periods, and 2) severe power oversupply. Our provincial demand-supply analysis suggests that Liaoning and Guangxi are most vulnerable. Guangdong and Fujian look reasonably healthy but could still face uncertainty if demand weakens or power imports to Guangdong rise too quickly and power exports from Fujian fall below expectation, in which cases there will be extreme pressure on thermal plants and nuclear plants will have to shoulder some of the burden.

Focus 3: what are risks to tariffs for nuclear power?

The nuclear benchmark tariff is competitive in most provinces, but first batch GIII units are likely to be priced at a premium to local coal-fired units, which will reduce its competitiveness or compromise returns if the tariff is set lower. Also, some tariff discount was introduced in Fujian in order to support peak-shaving plants. Long-term, the liberalization of the power market would involve nuclear. In 2002, the low wholesale price was mostly to blame for the financial collapse of British Energy, the only listed nuclear pure play at that time.

Focus 4: what are risks to backend liabilities for nuclear power?

There are no specific regulations regarding decommissioning costs in China but average estimates of Rmb1,400/KW are at low end of Rmb1,300-3,800/KW globally. Further, this liability may be underestimated due to the use of 6.55% discount rate (the highest around the globe) to derive the present value of the liabilities. Although the earliest decommissioning in China will not come before 2034, there is a chance that a tighter set of regulations could be announced.

Initiating CGN Power with Sell; Buy Huadian Fuxin

CGN Power has risen 26% from its IPO that was priced at the top end of its offering range. Given a demanding valuation at 20x 15E P/E and uncertainties arising from the abovementioned concerns, we initiate with Sell, with 17% downside potential to our DCF-based target price of HK$2.9. Meanwhile, we reiterate our Buy on Huadian Fuxin – an IPP with a balanced fuel mix including 29% earnings from nuclear in 2017E. The stock trades at a more attractive 8x FY15E P/E for an earnings CAGR of over 30% in 2014-17E, higher than CGN.

Key Changes

Company	Target Price	Rating
1816.HK	– to 2.90(HKD)	NR to Sell

Source: Deutsche Bank

Top picks

CGN Power (1816.HK),HKD3.40	Sell
Huadian Fuxin (0816.HK),HKD3.85	Buy

Source: Deutsche Bank

Companies Featured

CGN Power (1816.HK),HKD3.40			Sell
	2013A	2014E	2015E
P/E (x)	–	23.14	20.04
EV/EBITDA (x)	–	17.2	23.4
Price/book (x)	0.0	2.7	2.5

Huadian Fuxin (0816.HK),HKD3.85			Buy
	2013A	2014E	2015E
P/E (x)	9.13	13.18	8.69
EV/EBITDA (x)	7.6	8.9	8.0
Price/book (x)	1.7	1.8	1.5

Source: Deutsche Bank

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Executive summary

China has the largest amount of nuclear capacity under construction in the world. While there is consensus on its strong growth and stable returns, it is important for investors to know potential downside risks to this positive story. We look into the four areas that may cause negative surprises, namely: project construction, plant utilization, tariff and future liability for decommissioning.

Focus 1: what are risks to construction costs and delay for nuclear power?

Nuclear project returns are highly sensitive to the construction schedule and costs, while construction delays and consequent capex overruns have been more frequent than in the thermal, hydro and renewable power development.

Construction delay has been a universal problem for nuclear, especially for GIII units – accompanied by cost overrun

Nuclear projects have incurred significant construction delays globally. In China, such risk is potentially overlooked as most of existing units in operation are using matured GII technology. With more projects to adopt GIII technology (AP1000, EPR, Hualong One, CAP1400), the chance of delay is on the rise:

- The two AP1000 projects, also the first of this type globally – Sanmen Nuclear and Haiyang Nuclear – have both been delayed by over two years, due to lack of prior experience and problems with the main equipment supply.
- The first EPR project in China and the world – Taishan Nuclear – has been behind schedule for two years with costs escalating 46% to an estimated Rmb20,900/kW. The EPR units in France and Finland have also incurred significant delays, with over 150% cost inflation to an estimated Rmb37,200/kW.

Based on completion milestone analysis, we expect CGN's Taishan Unit 1 and 2 to start operation in July 2016 and July 2017, respectively, compared with the 1H16 and 2H16 guided by CGN. The project cost might be revised up further.

- To date, the Cold Testing of Unit 1 has not started; normally 16 months are needed before commercial operation following Cold Testing.
- As for Unit 2, while CGN currently guides for a start-up in 2H16, its equipment and fuel supplier Areva's estimate is one year behind Unit 1, which looks more reasonable, based on the timeline of its Reactor Pressure Vessel installation, which started 30 months after Unit 1.
- Taishan Unit 1 and 2 have completed 70% and 58% of construction progress, while the incurred capex up to 1H14 has reached 93% and 78% of the total capex budget. Even though the figure might not be proportionate to the time of construction, we suspect there is still a risk that Taishan may report another round of cost increases.

Focus 2: what are risks to utilization rate for nuclear power?

Given the high fixed-cost feature, the profitability of nuclear power is greatly leveraged to its utilization rate. Nuclear power is given priority as a base load but can still face volatility of utilization caused by: 1) longer-than-expected ramp-up/teething periods for newly-commissioned units, especially if reactor technology is new; 2) longer-than-expected fuel reload or equipment maintenance/breakdown throughout the year of operation; and 3) severe power oversupply in regions where nuclear power is operating.

Utilization risk from operating perspective – several cases historically

We run through a detailed analysis of China's historical nuclear utilization record. Results show that several individual units have incurred low utilization in some years for various reasons other than the normal refueling cycle:

- Daya Bay Unit 1: 4,088hrs in 1995
- Qinshan Unit 1: 2,519hrs in 1999
- Qinshan 2 Unit1: 4,890hrs in 2006 and 5,681hrs in 2007
- Tianwan 1 Unit 2: 6,553hrs in 2009
- Ningde Unit 1: only 197hrs in 2Q14

Elsewhere, there are lessons that need to be considered with regard to the nuclear utilization risk:

- South Korea: falsified nuclear component, leading to an operational halt for several nuclear projects in 2012-13

Utilization risk from demand perspective – Liaoning and Guangxi are most vulnerable

Nuclear power is not without market risk if there is a severe oversupply in the local power market. While nuclear power output is less than 3% for China at the national level, the output is expected to account for 11-25% for several provinces. In addition, power oversupply is now an issue with national coal-fired utilization hours at their lowest since 2001.

We carried out a provincial demand-supply analysis for Liaoning, Fujian, Guangdong and Guangxi, where there are substantial new nuclear projects due to come online. **Liaoning and Guangxi are most vulnerable, given current severe power oversupply with a likely nuclear utilization rate lower than 7,000hrs.** Guangdong and Fujian look reasonably healthy but could still face uncertainty if local power demand weakens or hydro power imports to Guangdong rise too quickly and power export from Fujian to Zhejiang fall below expectation, in which cases there will be extreme pressure on thermal plants and nuclear plants will have to shoulder some of the burden.

Focus 3: what are risks to tariffs for nuclear power?

The nuclear benchmark tariff of Rmb430/kWh for GII+ units is competitive in most provinces in China. However, the first batch of GIII units, at a likely 8-16% tariff premium to local coal-fired units, may **either see reduced competitiveness or compromise the return if the tariff is set at a lower premium**:

Current benchmark tariff may not be sufficient to cover the high cost of GIII units

- Currently, for provinces with GII+ nuclear units, only Liaoning's nuclear benchmark tariff is higher-than that for coal-fired; while in the remaining provinces, it is at a 0.2-14.3% discount.

- We believe the GIII units under construction are likely to receive a tariff premium, given their much higher unit investment (Rmb16,320-20,900/kW vs. c.Rmb12,500/kW for GII+ units).
- CNNC stated that it would propose an Rmb510/MWh (tax-inclusive) tariff for Sanmen Nuclear if the final investment were to overrun by 20% (c.Rmb19,600/kW). On a similar calculation, the potential tariff needed by Taishan Nuclear would be up to Rmb540/kWh.

Downside risks to nuclear tariff – both near-term and long-term

There is still some downside risk to benchmark nuclear tariffs, due to: **1) a potential tariff discount or some kind of profit-sharing in regions with power oversupply; and 2) a further coal-fired tariff cut if coal prices continue to fall:**

- In May 2014, State Grid Fujian signed a Peak-shaving Compensation Agreement with Ningde Nuclear, which will have a profit-sharing scheme for excess power generation over the planned 7,008hrs.

Nuclear power is unlikely to be included in direct power supply in the near term. **But in the long term, the full liberalization of the power market would potentially require the participation of nuclear:**

- In the US and Europe, nuclear power plants are participating in the wholesale power market in a similar way as thermal and hydro power plants.

While the above tariff risks are somewhat more remote, the impact will be very material – **in 2002, the wholesale price free-fall in Britain was mostly to blame for the financial collapse of British Energy**, the only listed, pure play, nuclear generator in the world at that time.

Unlike the feed-in-tariff for wind and solar, there is no regulation that stipulates the benchmark nuclear tariff will apply for the whole lifecycle of 40 years.

Focus 4: what are risks to backend liabilities for nuclear power?

Decommissioning provision looks underestimated in the sense of both back-end liability and discount rate

Without specific regulations, China's nuclear players estimate terminal decommissioning costs based on 10% of investments, which falls at the low end of the global average on an absolute dollar basis:

- The current decommissioning cost of Rmb1,400/KW, based on 10% estimates of construction cost in China, are at the low end of Rmb1,300-3,800/KW globally across different reactor types.

On the other hand, **the 6.55% discount rate applied to derive the present value of liabilities appears to be the highest around the globe**, which may underestimate this long-term back-end liability:

- The rate is 5% in France and 3-5% in the US, based on owners' discretion; while the rate in Spain is even lower, at 1.5%.
- For typical GII+ PWR units, assuming an Rmb12,500/kWh investment cost and terminal decommissioning liabilities of 10% of investment, the present value in the first year would be Rmb101/kWh under a 6.5% discount rate, while it would be Rmb316m/kWh under a 3.5% discount rate, a big difference due to the long time-span.

Although the earliest decommissioning in China will not come before 2034, there is a chance that a tighter set of regulations may be announced, in view of the incoming installation peak.

Stock implication

Initiating CGN Power with Sell; reiterating Buy for Huadian Fuxin

CGN Power has risen 26% from its IPO, which was priced at the top end of its offering range. Given a demanding valuation at 20x 15E P/E and uncertainties arising from the abovementioned concerns, we initiate with Sell, with 17% downside potential to our DCF-based target price of HK$2.9. Meanwhile, we reiterate our Buy on Huadian Fuxin – an IPP with a balanced fuel mix including 29% earnings from nuclear in 2017E. The stock trades at a more attractive 8x FY15E P/E for an earnings CAGR of over 30% in 2014-17E, higher than CGN.

Focus 1: what are risks to construction costs and delay for nuclear power?

Summary

- Nuclear project return is highly sensitive to the construction schedule and costs, while construction delay and consequent capex overrun are more frequent in nuclear than for thermal, hydro and renewables.
- A 12-month delay in project operation would bring down the equity IRR of the project by 0.7ppt from 14.0% in the base case. A standalone 10% capex overspend would bring down the equity IRR of a project by 2.5ppt from the 14.0% in the base case.
- Nuclear projects have incurred significant construction delays globally. In China, such risk is potentially overlooked as most of existing units in operation are using matured GII technology. With more projects about to adopt GIII technology (AP1000, EPR, Hualong One, CAP1400), the chance of delay is on the rise.
- Based on the project completion milestone analysis, we expect CGN's Taishan Unit 1 and 2 to start operation in July 2016 and July 2017, respectively, compared with the guided 1H16 and 2H16 by CGN.
- Taishan Unit 1 and 2 have completed 70% and 58% of the construction progress while the incurred capex up to 1H14 has reached 93% and 78% of total capex budget. The figure might not be proportional to time of construction but there is still a risk of another round of cost increase. Hence, project returns could be lower than expected unless a very generous tariff is approved.

Key to project return and cost of generation

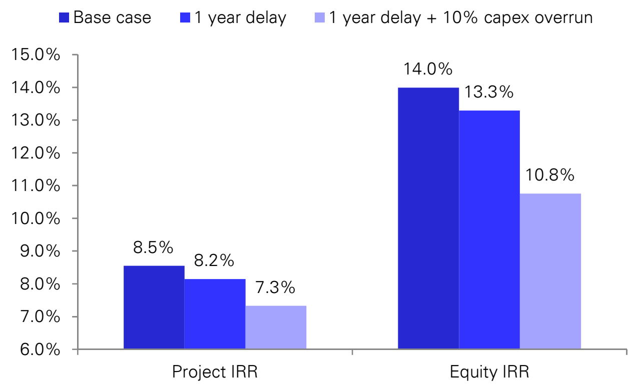
Nuclear is capex-intensive with unit investment in China ranging Rmb12,000-21,000/kW on different technologies, the highest among all types of power. Over the past few years, nuclear unit capex has trended up, due to increasing safety facility investment, labor costs and longer-than-expected construction time. As a contrast, wind/solar unit capex has declined, thanks to technology advances, although they are still more expensive than nuclear.

Construction cost control is key to nuclear project return – a 10% overspend will lower equity IRR by 2.5ppt

Nuclear's high depreciation and interest expenses in the mix of operating costs makes construction cost control critical to the total generation costs and project return that can be achieved. Delay in project commissioning will not only push up construction costs but also postpone operating cash flow generation. Based on our simple case illustration (Figure 48), we arrive at the following sensitivity analysis:

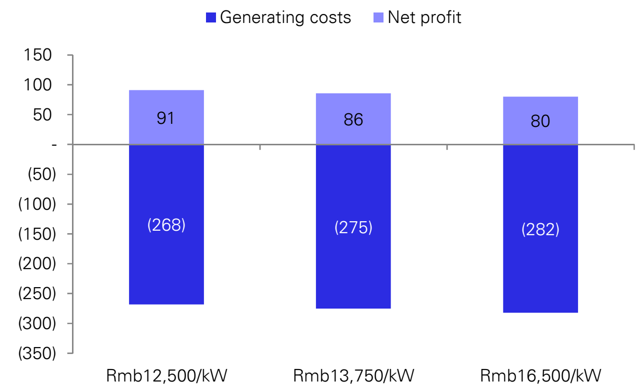
- **Project delay:** A 12-month delay in project operation would bring down the equity IRR of the project by 0.7ppt from the 14.0% in the base case, where we assume a 54-month construction period.
- **Capex overrun:** Even worse, project delays are often intertwined with overshooting costs. A standalone 10% capex overspend would increase the unit operating costs (including depreciation, interest expense and other cash costs) by Rmb7/MWh (2.6%); and bring down the equity IRR of a project by 2.5ppt from the 14.0% in the base case, based on a capex assumption of Rmb12,500/KW.

Figure 1: Project return under construction delay and capex overrun scenario



Source: Deutsche Bank estimates

Figure 2: Average generating costs and net profit under different capex scenarios (Rmb/MWh)



Source: Deutsche Bank estimates

Building nuclear power projects has never been easy

Start-up delay has been a universal problem for nuclear projects, and more frequently experienced than for thermal/hydro/renewables

According to the latest statistics provided by World Nuclear Industry Status Report 2014[1], as of July 2014, 67 reactors (64GW total capacity) are under construction with an average building period of 7 years. Among them: 1) eight reactors have been under construction for over 20 years; one for 12 years; 2) at least 49 have been delayed, and mostly for several months to several years; 3) while for the remaining 18 reactors, either construction began shortly before or hasn't reached start-up dates yet.

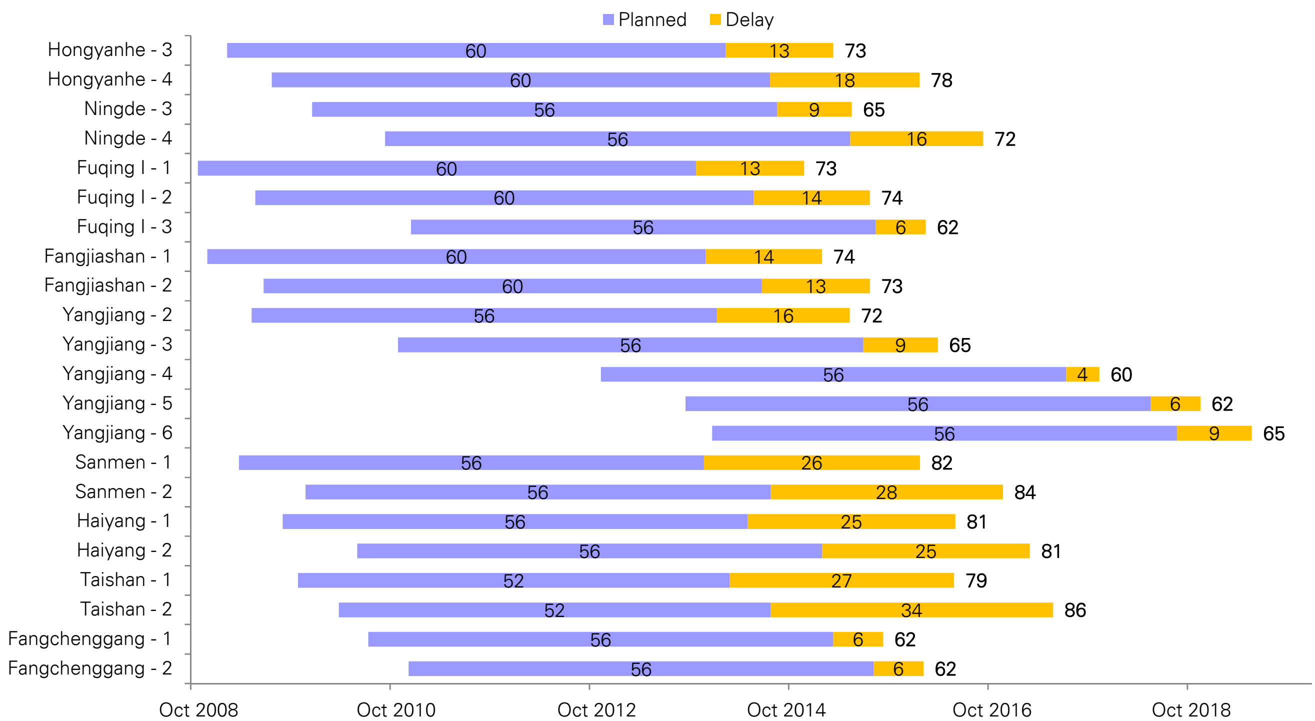
In China, we estimate that 22 out of the 27 units under construction will be delayed by several months or over two years, based on the latest progress. While the overall construction time looks controllable for GII+ units at 60-75 months (only months of delay), the situation for GIII units seems to be much worse. The start-up of first-batch GIII units in China, either using AP1000 or EPR technology, has been postponed by over two years, due to various issues. So far, there are no GIII units that have been commissioned yet globally.

As far as we understand it, China has rarely incurred severe delays in thermal power projects once construction has kicked off, with a completion period of about two years. For hydro, the delay has been seen only in a few large hydro projects, which have often been linked to social issues, such as original

[1] Statistics provided by The World Nuclear Industry Status Report 2014

resident migration arrangements. After they commence construction, wind and solar projects are normally on schedule, although connection to the grid is sometimes delayed by a few months.

Figure 3: Construction delays in China by units (months)



Source: Company data, Deutsche Bank estimates

More of a concern for Generation III units

AP1000 units in China: delayed by over two years

AP1000 units are experiencing over a two-year delay and a 63% cost hike

In April 2009, the construction of Sanmen Nuclear Unit 1, the world's first AP1000 (Westinghouse) unit, was started. While AP100 is designed for a construction cycle of 50 months from first concrete to fuel loading and then another six months to commercial operation, the reality of progress has been much more painful.

- In July 2014, SNTPC announced that the start-up of Sanmen Nuclear Unit 1 had been pushed back further to at least end-2015, from the originally-set end-2013 and later-revised end-2014. As per disclosure from CNNC, the estimated investment cost of Sanmen Nuclear would be Rmb40.8bn (Rmb16,320/kW), which is a 63% mark-up from original estimates of Rmb25bn. Moreover, our industry checks suggest this could be still significantly underestimated for the first two units, given the operation is likely to be further delayed into 2016.
- Similarly, for another AP1000 pilot project – Haiyang Nuclear, the operation has also been delayed into 2016. Delays for both projects are said to be related to problems with their main cooling pumps and squib valves, which were yet to be fully resolved as of late 2014, based on our talks with industry experts.

AP1000 units in the US: delayed by two years or longer

Currently, there are two nuclear projects using AP1000 design being built in Georgia (Vogtle Nuclear units 3/4) and South Carolina (V.C. Summer units 2/3) of the US.

- V.C. Summer unit 2 is now expected by project owners to finish completion in late 2018 or 1H19 from the previously-expected 1H17. The delay was attributed to the fabrication and delivery of structural modules. The project capex is now expected to be US$1.2bn more than the US$9bn proposed in early 2012, suggesting a unit capex of US$4,500/KW.
- Vogtle Nuclear 3/3 is budgeted as a US$14bn (US$5,800/KW) project with unit 3 targeted to go online in late 2017. However, as per media reports (Reuter's 3/4/2013), there is an ongoing dispute and litigation between the owners of the project and the team providing EPC services contractors.

EPR units: universal delay in China, France and Finland

EPR units also delayed by two years, with 46% cost increase

China's other two GIII units, Taishan Nuclear Unit 1-2, featuring the French EPR technology by Areva, have also incurred delays. Taishan Nuclear Unit 1-2, first scheduled to commence operation at end-2013 and October 2014, are now postponed to 1H16 and 2H16, respectively, according to the latest guidance provided by the developer, CGN. The cost is estimated to be Rmb73.2bn (Rmb20,900/kW), up 46% from the original estimate of Rmb50bn.

Moreover, reading through progress reports of other EPR units under construction, it is still too early to say if further delays and cost overruns are unlikely. Currently, there are another two EPR units under construction outside China, namely Flamanville Unit 3 in France and Olkiluoto Unit 3 in Finland.

- EPR in France: 5-year delay

Flamanville Unit 3, developed by EDF, started construction in December 2007 with an originally-designed construction period of 54 months (start-up in 2012). In Dec 2012, EDF announced a completion delay into 2016 while the cost moved up to EUR8.5bn (Rmb64bn, or Rmb37,200/kW). In November 2014, EDF announced a further postponement into 2017 due to delays in component delivery by Areva.

- EPR in Finland: 10-year delay

In August 2005, Finland started the construction of the world's first EPR unit which was estimated to start-up in 2009 originally. Now, it is expected to go live by late 2018, delayed by nearly a decade with a prolonged construction period of over 13 years, if not pushed back further. The cost overrun is also substantial. In December 2012, Areva estimated that the full cost would amount to EUR8.5bn (Rmb64bn, or Rmb37,200/kW), almost three times its original-planned EUR3bn.

Figure 4: Estimated construction months for China's GIII units

Units	MW	Tech	Developer	FCD	Start-up (DBe)	Construction time (months) Designed	Estimated	Delay
Sanmen – 1	1,250	AP1000	CNNC	Apr 2009	Mar 2016	56	82	**26**
Sanmen – 2	1,250	AP1000	CNNC	Dec 2009	Jan 2017	56	84	**28**
Haiyang – 1	1,250	AP1000	CPIG	Sep 2009	Jul 2016	56	81	**25**
Haiyang – 2	1,250	AP1000	CPIG	Jun 2010	Mar 2017	56	81	**25**
Taishan – 1	1,750	EPR	CGN	Nov 2009	Jul 2016	52	79	**27**
Taishan – 2	1,750	EPR	CGN	Apr 2010	Jul 2016	52	86	**34**

Source: Deutsche Bank estimates

A closer look at Taishan's construction progress

Given Taishan is the only GIII project under construction for CGN and its inclusion from 2015 is disclosed in the IPO prospectus, its construction schedule and costs are critical to CGN, in order to meet the Street's expectation. Thus, we conduct a more detailed analysis on the milestone of progress achieved and compare it to other nuclear projects under construction. Our conclusion is that we expect Taishan Unit 1 and 2 to start operation in July 2016 and July 2017, respectively, compared with 1H16 and 2H16 as per management guidance.

Leading the progress of its French/Finland peers

According to the September press release from Areva, 95% of components, as well as the operational I&C system for the Taishan 1 plant in China, have been delivered, and the first commissioning activities have started. This appears more advanced than two other EPR reactors built in France and Finland. The Flamanville Unit 3 in France completed Reactor Pressure Vessel (RPV) installation in Jan 2014 (Figure 5) and received four steam generators in September, while Taishan Unit 1 completed such a step a year ago.

In Finland, the progress lags far behind, as it was hindered by: 1) the dispute on compensation for capex overspend, which led to a construction halt; and 2) a problem with its contract workers.

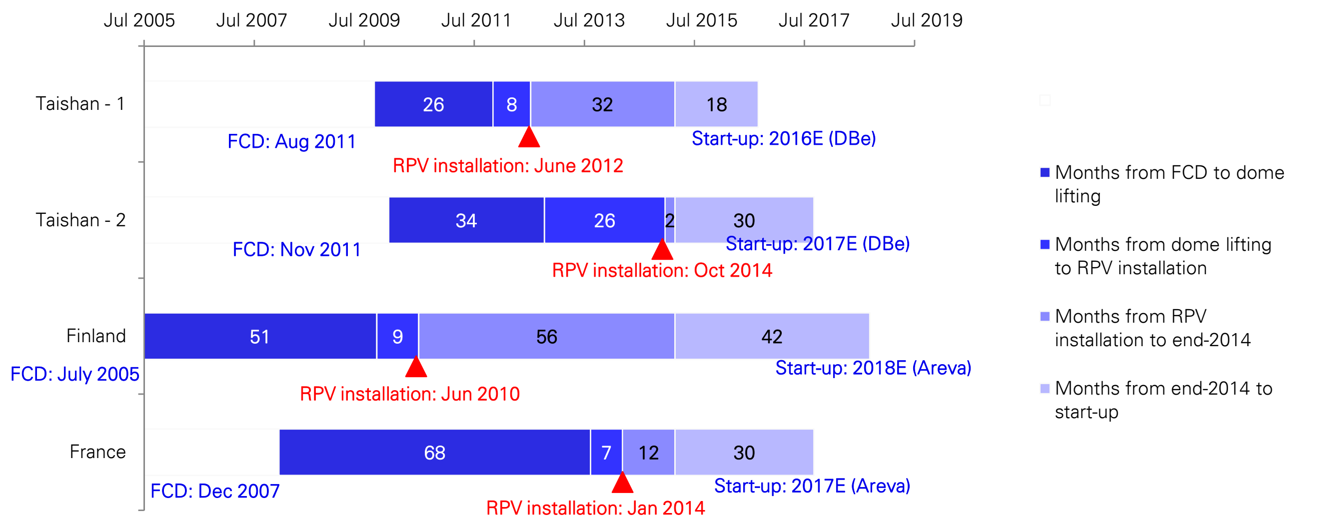
But project milestone achieved suggests likely delay versus guidance

Taishan Unit 2 is likely to see a one-year delay in operation vs. company guidance

We also noticed that Taishan completed installation of the hoisting main pump motor on 29 September. To date, in mid-December 2014, the Cold Testing of Taishan has not started, while another 16 months are needed before commercial operation following Cold Testing, by simply assuming a similar cycle as GII+ units (Ningde 1 – 17 months, Hongyanhe 2 – 15 months). As such, we assume a start-up of Unit 1 in July 2016, leaving two to three months' buffer in between now and Cold Testing.

As for Unit 2, it completed RPV installation in October 2014, about 30 months behind Unit 1. Nevertheless, we expect some speed-up in the construction in Unit 2, benefiting from the experience of Unit 1. While CGN is currently guiding a start-up in 2H16, Areva's estimate is one year behind Unit 1, which looks more reasonable, based on current progress. Correspondingly, we assume a start-up in July 2017.

Figure 5: Construction progress for EPR units



Source: Areva, Deutsche Bank estimates

Taishan investment costs might be revised up further

The investment of Taishan could be revised up considering higher cost estimates of its peers and the proportion spent till date

As capex overspend is mostly a consequence of construction delay, we are not too worried for the GII+ units, given the delay is normally within one year. The question remains on Taishan Nuclear, which is likely to be the first GIII EPR project in the world. While the total investment estimated for the French and Finland projects might not be indicative, given the much longer construction period, the cost estimated for the to-be-started Hinkley Point C in the UK (HPC, 2x1,630MW, EPR) reached GBP24.5bn (Rmb72,800/kW), which almost doubled the unit investment for Taishan. Hinkley Point C has not started construction yet but the UK government has agreed to pay EDF GBP0.0925/kWh (Rmb0.9/kWh) for the electricity output from Hinkley Point C.

Based on our estimated schedule, Taishan Unit 1 and 2 have completed 70% and 58% of the construction progress (by simply dividing the months in construction by total months needed), while the incurred capex up to 1H14 reached 93% and 78% of total capex budget. The figure might not be proportional to time of construction as the capex should be frontloaded – the last few months are mostly testing with major equipment purchases completed – but we believe there is still a risk that Taishan may report another round of cost increase (after revising costs up by 46% from Rmb50bn in total previously).

Focus 2: what are the risks to the utilization rate for nuclear power?

Summary

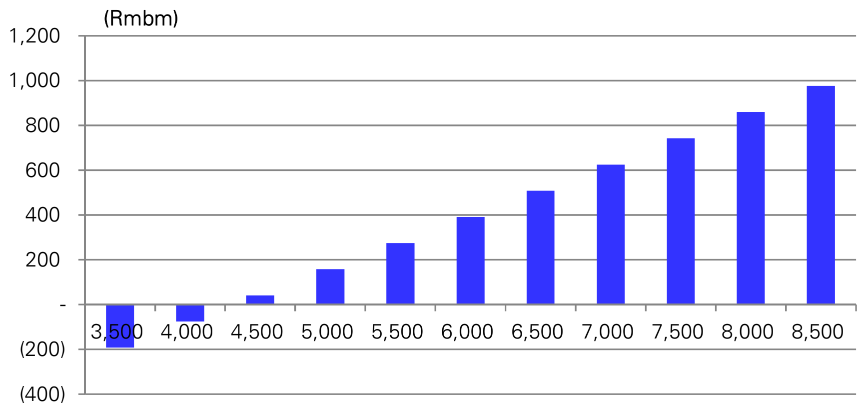
- Given the high fixed-cost feature, the profitability of nuclear power is very sensitive to utilization hours. Despite being a base-load power source, nuclear power can still face volatility in the utilization rate, caused by 1) a longer-than-expected ramp-up/teething period for newly commissioned units, 2) a longer-than-expected fuel reload or an unplanned outage on equipment maintenance/breakdown, and 3) severe power oversupply in operating regions.
- We run through a detailed analysis of China's historical nuclear utilization. Results show that several individual units have incurred low utilization during some years, for various reasons. Elsewhere, there are lessons that need to be learned with regard to nuclear utilization risk.
- Nuclear power is not without market risk if there is severe oversupply in the local power market. While nuclear power output is less than 3% for China on a national level, the output is expected to rise to 11-25% for several provinces in 2017. In addition, power oversupply is now at its most severe since 2001 with coal-fired utilization hours at their lowest level.
- We have carried out a provincial demand-supply analysis for Liaoning, Fujian, Guangdong and Guangxi, where there are substantial new nuclear projects to come online, and the analysis suggests that Liaoning and Guangxi are the most vulnerable, with likely nuclear utilization lower than 7,000hrs.
- Guangdong and Fujian look reasonably healthy but could still face uncertainty if local power demand weakens or hydro power imports to Guangdong rise too quickly and power exports from Fujian to Zhejiang fall below expectations, in which case pressure on thermal plants could become too extreme and nuclear plants could have to shoulder some of the burden.

Nuclear profitability is highly sensitive to utilization

1% capacity factor change would result in 3.1% profit downside for a nuclear unit

Given the high proportion of fixed costs, the profitability of nuclear power is highly leveraged to its utilization hours (or capacity factors). Based on our estimates, an 88-hour utilization change (or a 1% capacity factor change) would affect annual earnings (taking the first full year of operation as an example) by 3.1%. Based on our assumptions of the GII+ nuclear project in China, the utilization at the project breakeven level is c.4,500hrs, which is much higher than that of coal-fired power (c.3,500hrs). In addition, nuclear unit concentration is higher than that of thermal – e.g. CGN owns 10 generation units, while Huaneng owns close to 100 generation units, which makes nuclear IPP more exposed to utilization downside for generation units.

Figure 6: Year 1 earnings for a 1GW unit under different utilization hours



Source: Deutsche Bank estimates

Despite playing base-load role, with more stable utilization than thermal and renewables, nuclear power can still face volatility in the utilization rate, caused by 1) a longer-than-expected ramp-up/teething period for newly commissioned units, 2) longer-than-expected fuel reload or equipment maintenance/breakdown, and 3) severe power oversupply. For nuclear power in China, we are more concerned about the adverse impact brought about by power oversupply, which is now happening and will persist for the next few years. Nevertheless, the quick ramp-up in new units also poses challenges from the first two aspects.

High nuclear utilization in China historically…

Combined with its base-load nature and priority in dispatch, China's average nuclear utilization hours reached 7,700-7,900hrs (Figure 8) over 2009-2013.

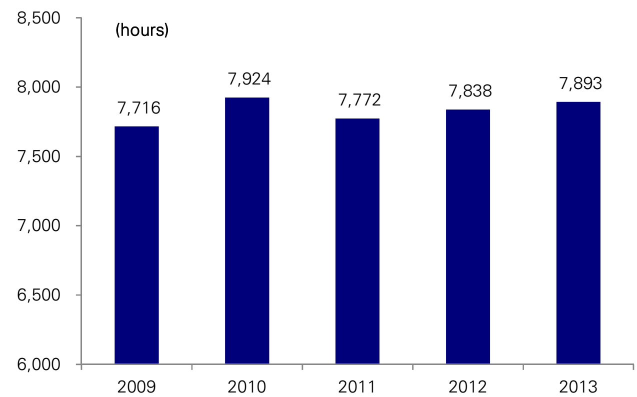
- **High capacity factor:** Generally, the operation of a nuclear unit is halted only during the period of fuel reloading, leading to it having the highest capacity factor, at 80-90%, among various types of power generation, much better than the 30-50% of other clean energies.
- **Priority in dispatch:** According to the Dispatch of Energy Saving Power Generation (pilot) released by the State Council in August 2007, nuclear power enjoys priority in dispatch compared with coal-fired power plants (Figure 7), but is behind renewables. However, nuclear is favored by the power grid, as wind and hydro are more seasonal and volatile, depending on weather conditions.

Figure 7: Nuclear enjoys priority in power dispatching

Priority order	Source of power
1	Non-adjustable renewable energy (wind, solar, ocean and hydro, etc.)
2	Adjustable renewable energy (hydro, biomass, geothermal, environmentally friendly garbage incineration)
3	**Nuclear power generating units**
4	Coal-fired cogeneration units with heat load, power generating units utilizing integrated resources, including residual heat, gas and pressure, coal gangue, coal methane, etc.
5	Gas-fired power generating units
6	Other coal-fired power generating units, including cogeneration units without heat load

Source: CEC, Deutsche Bank

Figure 8: Nuclear utilization hours in China (2009-13)



Source: CEC, Deutsche Bank

Introduction to nuclear refueling

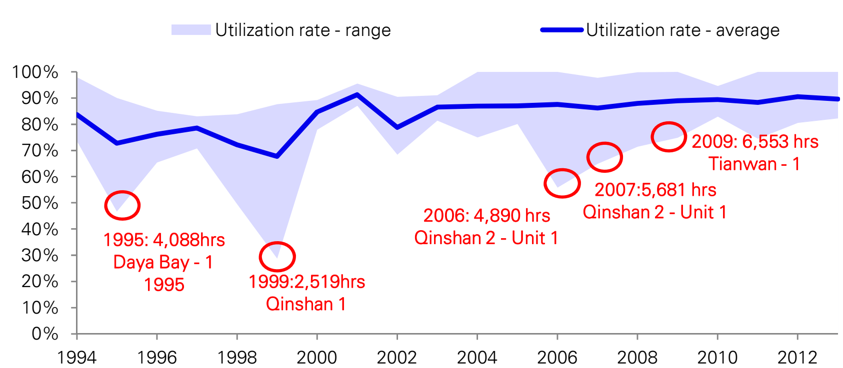
Refueling is a routine outage that occurs every 12-18 months, depending on the specific plant. About one-third of the spent fuel rods are replaced with new fuel, and some other maintenance is also carried out in the meantime. The process normally lasts for 30 days, except in the second and tenth years of operation, when the process is extended to 60-90 days. Most GII units have a refueling cycle of 12 months, while GIII units are designed for an 18-month refueling cycle.

…but with a deviation in individual units

There have been several occasions of low utilization (<7,000hrs) in China historically, without an impact from load-following

However, after carrying out a more detailed examination of utilization data by unit, we conclude that there have been occasions since 1994 when individual units have incurred operational and technical issues and reported low utilization during China's nuclear operation (Figure 9).

Figure 9: Historical utilization rate of China's operating nuclear units



Source: IAEA, Deutsche Bank

- **Lack of operating experience:** this has been mostly in the early years of China's nuclear operating history. For example, in 1995 and 1999, the utilization hours of Daya Bay Unit 1 and Qinshan Unit 1 dropped 4,088hrs and 2,519hrs, respectively.

- **Teething issue for new units**: while normally a new unit will have lower utilization in the second year of operation for the purpose of first refuel and comprehensive examinations, sometimes the ramp-up period can be extended to more than two years, as experienced by Qinshan 2 -1 and Tianwan - 1&2 (Figure 10).
- **Unplanned outage on equipment breakdown:** Ningde Unit 1 reported only 197hrs of utilization in 2Q14, due to issues with its steam generator, resulting in a financial loss for the plant during the quarter.

Figure 10: Utilization overview of China's operating units after 2002

Unit	Operator	Tech	Operation	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Qinshan 1	CNNC	CNP-300	01-Apr-1994	5989*	7798	8784	7693	8086	7218	8434	7704	7398	7762	8784	7199
Daya Bay - 1	CGN	M310	01-Feb-1994	7924	7958	7789	8760	7133	8074	8774	8055	7876	8760	7452	7682
Daya Bay - 2	CGN	M310	06-May-1994	7224	7503	6580*	7075	8760	7858	7667	8760	7858	7667	8760	8197
Qinshan 2 - 1	CNNC	CNP-600	15-Apr-2002	4631	7123*	7117	7982	4890	5681	7554	7256	8095	6521*	7543	7561
Qinshan 2 - 2	CNNC	CNP-600	03-May-2004			6381	7331*	7822	7792	7545	7821	7645	8014	7072	7826
Qinshan 2 - 3	CNNC	CNP-600	05-Oct-2010									2685	7226	7977	8243
Qinshan 2 - 4	CNNC	CNP-600	30-Dec-2011										614	8438	7428
Ling'ao - 1	CGN	M310	28-May-2002	5184	7215	7884	7424	7964	7345	8163	7997	8288	8072	8286	7340
Ling'ao - 2	CGN	M310	08-Jan-2003		74`94	7109*	8075	8164	7796	7577	8052	8112	8284	8113	7804
Lingdong - 1	CGN	CPR1000	15-Sep-2010									2642	6866*	7877	8017
Lingdong - 2	CGN	CPR1000	07-Aug-2011										5268	7156*	7880
Qinshan 3 - 1	CNNC	CANDU 6	31-Dec-2002		7977	6745*	7249	8484	7597	8051	8076	7884	8131	8462	7949
Qinshan 3 - 2	CNNC	CANDU 6	24-Jul-2003			8236	7014*	7721	8559	7697	8359	8099	7951	7980	8760
Tianwan - 1	CNNC	VVER-1000	17-May-2007						5688	6270*	6553	7643	7606	7635	7959
Tianwan - 2	CNNC	VVER-1000	16-Aug-2007						4471	7193*	7054	7260	7658	7722	7837
Hongyanhe - 1	CGN	CPR1000	06-Jun-2013												7632
Ningde - 1	CGN	CPR1000	15-Apr-2013												7369

*Source: IAEA, Deutsche Bank; Note:1) * for 2nd or 10th year of refueling; 2) grey-colored for the data of first year in operation due to partial year operation*

Lessons learned from Korea

South Korea is the world's fifth-biggest country by installed nuclear capacity. As of end-2013, South Korea has 23 units in operation, with a total capacity of 20.7GW. However, over the past few years, the South Korea nuclear industry has been crippled by a series of setbacks that caused several operating units to be shut down, despite running at consistently high utilization hours. While the investment community is fully aware of Japan's Fukushima accident, the concern on equipment quality, which has led to nuclear plant utilization risk, is less well-known, even though it could be a standalone case.

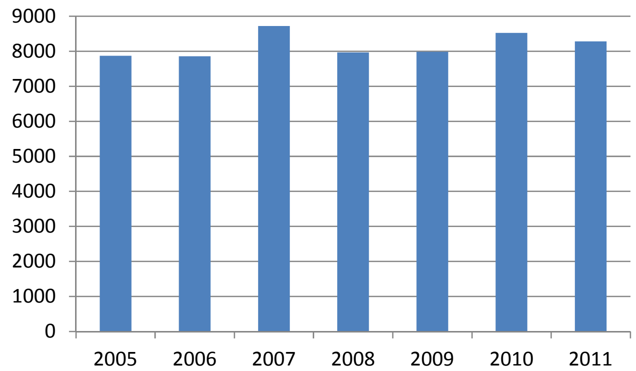
Case study – Hanbit Nuclear Plant

Several Korean nuclear units have been taken offline since 2012, due to the application of falsified components

In 2012, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), a subsidiary of KEPCO, reported that at least five of its nuclear reactors had been supplied with falsely certified, non-safety-critical parts. According to KHNP, eight unnamed suppliers, seven domestic and one US, forged about 60 quality control certificates covering 7,682 components that were delivered in 2003-12. The majority had been installed at Hanbit Unit 5-6, while the rest were applied at Hanbit Unit 3-4 and Hanul Unit 3. Hanbit units were taken offline, while the parts were replaced. Before the problem was spotted in 2012, both Habin Unit

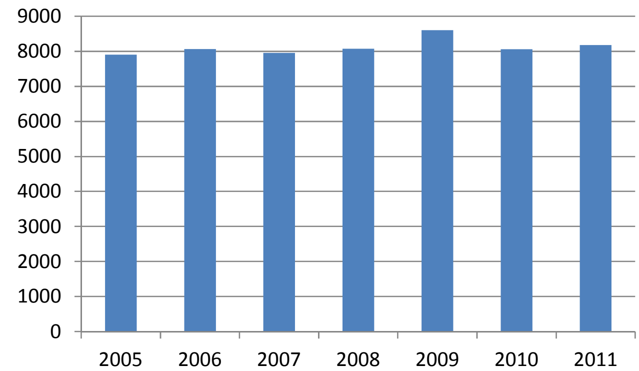
5 and 6 had been running at high utilization hours since 2005 (Figure 11 and Figure 12). However, this does not suggest that everything can be assured.

Figure 11: Annual utilization hours – Hanbit 5



Source: Deutsche Bank, WNA

Figure 12: Annual utilization hours – Hanbit 6



Source: Deutsche Bank, WNA

Case study – Shin Kori Nuclear Plant and Shin Wolsong Nuclear Plant

In May 2013, it was found that control cables, with fake certificates, had been used for Shin Kori Unit 1-2 and Shin Wolsong Unit1-2. The Korean Nuclear Safety Security Commission (NSSC) immediately decided to shut down the Shin Kori Unit 2 and Shin Wolsung Unit 1 nuclear power plants; Shin Kori Unit 1 was to remain shut down (it was offline for scheduled maintenance at the time) and Shin Wolsung Unit 2, newly constructed and pending approval to start commercial operation, was not allowed to start up. All of them were to remain closed until the completion of the cabling replacement – taking about four months. Shin Kori Unit 1-2 and Shin Wolsong 1 were cleared to restart in January 2014. However, the resumption of Shin Kori 3-4 was delayed into 2015, owing to the need to replace the control cabling, which had failed tests.

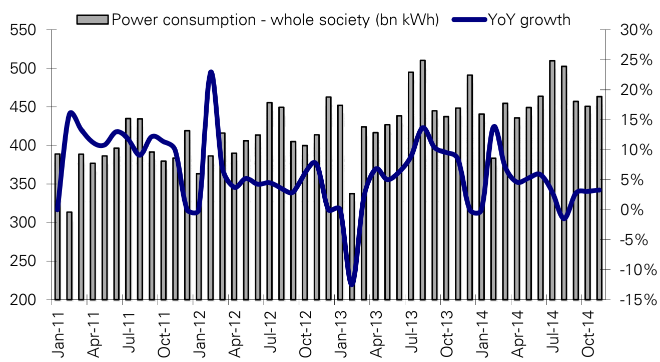
Utilization threat from power oversupply

Nuclear power is not without market risk if there is severe oversupply in the local power market. While nuclear power output is less than 3% for China on a national level, the output is expected to be 15-25% for provinces like Fujian, Liaoning and Guangdong in the next few years. In addition, power oversupply is now increasingly becoming an issue for the country, with national coal-fired utilization hours at their lowest level since 2001. Under such circumstances, nuclear power units may have to compromise on the utilization front.

Weak power demand has triggered historically low thermal utilization

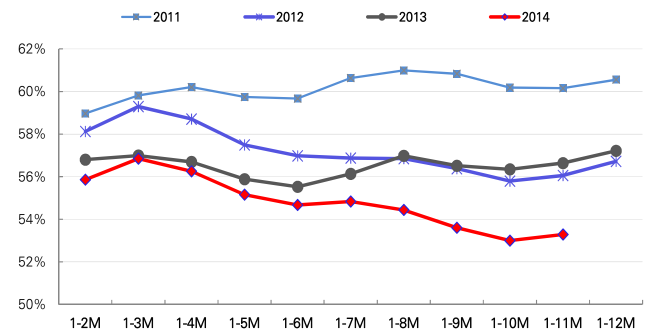
In 11M14, China's power consumption growth slowed to 3.7% yoy (vs. 7.5% in 2013 and 5.9% in 1H14) (Figure 13). Correspondingly, the accumulated thermal utilization hours in 1-11M14 in China averaged 4,272 hours, down by 6% or 262 hours yoy, affected by both the slowdown in power demand growth and the surge in non-fossil power generation. The gradual ramp-up in nuclear capacity could add to further pressure in thermal utilization. Given the already low level of thermal utilization, nuclear units may also have to operate at lower utilization in order to keep thermal units above the lifeline.

Figure 13: Monthly power consumption growth



Source: Deutsche Bank, WIND

Figure 14: Thermal utilization (monthly accumulated)



Source: Deutsche Bank, WIND

Nuclear peak-shaving? Possibilities cannot be ruled out.

Given the current power oversupply, especially in certain provinces with substantial nuclear capacity coming online in the future, there is anecdotal evidence that China's nuclear power might be required to participate in peak-shaving in the future. This could lower their annual utilization to c.7,000 hours, despite the historically high utilization hours of above 7,700 hours, and priority in dispatch:

Peak-shaving is technically viable for nuclear and increasingly possible, due to regional power oversupply

- As a reference, nuclear reactors in France are operated under a load-following mode and are even closed at weekends sometimes, leading to a much lower capacity factor of c.77.3% (6,700hrs).
- Technically, new nuclear units, especially GIII units, are equipped with enhanced peak-shaving functions, reducing safety concerns when operating at a lower load level; older units could also be upgraded to improve the capability of peak-shaving (e.g. to more than 20% of capacity factor).
- Even running at high utilization, power oversupply is likely to adversely affect nuclear plant profitability through some sort of arrangement, as illustrated in Focus 3.

Nuclear utilization outlook: Liaoning and Guangxi are most vulnerable

In 2014-17, we expect a total of 29.5GW new nuclear projects to be added in China. Within this, 71% will be added in four provinces – Guangdong (27%), Fujian (26%), Liaoning (11%) and Guangxi (7%). As a result, nuclear power output will likely represent 11-25% of total provincial output. Hence, the power demand and supply forecast is important in estimating the nuclear power utilization risk, even if it is essentially regarded as base-load plant.

Nuclear utilization: Liaoning and Guangxi might drop below 7,000hrs, given severe power oversupply

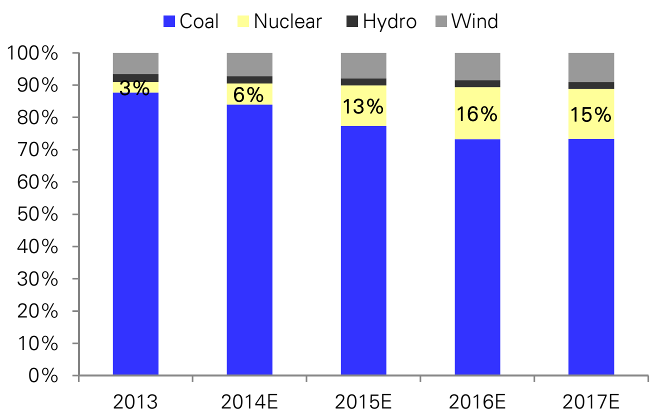
Among the provinces that have nuclear exposure, we believe Liaoning and Guangxi are subject to higher utilization rate risks, due to 1) for Liaoning, sluggish power demand, sequential commissioning of Hongyanhe Nuclear, a large amount of cogeneration units and the squeeze from wind power, and 2) for Guangxi, excessive capacity growth (especially in thermal), while hydro volatility is likely to post further downside to nuclear dispatch. We show a detailed provincial power demand/supply analysis in the Appendix.

Liaoning: nuclear has to compromise on high mix of cogeneration and wind

Liaoning has been facing a power oversupply for a couple of years. In 2013, utilization for coal-fired units was only 4,353hours, one of the lowest levels in China. With the sequential commissioning of nuclear units and a quick wind capacity addition, Liaoning will likely suffer more severe power oversupply in the next few years.

- In 9M14, Hongyanhe Unit 1 recorded only 4,194hrs of utilization, indicating full-year utilization of below 6,400hrs.
- Even assuming 6,500hrs of nuclear utilization and treating coal as a plug-in, coal utilization will still face a significant drop to 4,000-4,200hrs in 2015-17E.
- Given that most coal units supply heat for local residents, the dispatch of coal-fired units must be prioritized during the winter.

Figure 15: Liaoning – power generation mix



Source: CEIC, Deutsche Bank estimates

Figure 16: Liaoning – thermal utilization sensitivity

	2015E	2016E	2017E	2015E	2016E	2017E
Power demand gr.	Thermal utilization			Yoy change		
1.0%	4,030	3,738	3,713	-9.5%	-7.3%	-0.7%
2.0%	4,096	3,869	3,910	-8.0%	-5.6%	1.1%
3.0%	4,162	4,000	4,110	-6.5%	-3.9%	2.7%
4.0%	4,227	4,133	4,314	-5.0%	-2.2%	4.4%
5.0%	4,293	4,268	4,523	-3.6%	-0.6%	6.0%
Nuclear utilization	Thermal utilization			Yoy change		
6,000	4,213	4,068	4,177	-5.3%	-3.5%	2.7%
6,250	4,188	4,034	4,143	-5.9%	-3.7%	2.7%
6,500	4,162	4,000	4,110	-6.5%	-3.9%	2.7%
6,750	4,136	3,967	4,077	-7.1%	-4.1%	2.8%
7,000	4,110	3,933	4,043	-7.7%	-4.3%	2.8%

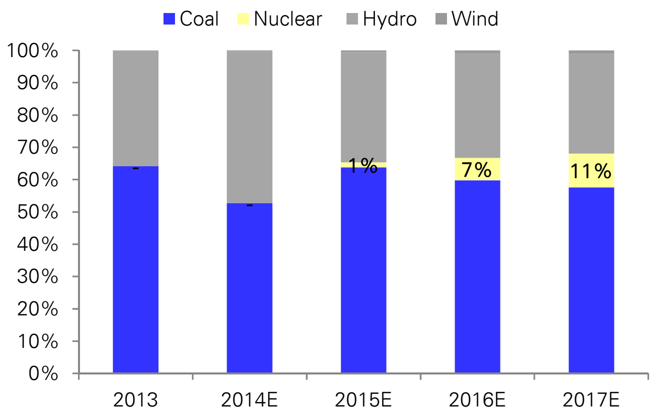
Source: Deutsche Bank estimates

Guangxi: increasing oversupply risk under quick ramp-up of thermal capacity

In 2015/16/17, we estimate that the total installed capacity in Guangxi will increase by 10.2%/12.1%/4.5%, contributed mainly by thermal and nuclear. Compared with power demand growth of 6.0% p.a., the excessive capacity growth will result in a significant oversupply situation in 2016-17E, while the high hydro generation mix (47% in 11M14) will increase the volatility in thermal utilization.

We assume a normalized 2,800hrs of utilization during 2015-17. Nevertheless, power oversupply still looks severe in 2016-17E, with substantial thermal new capacity to come online. We forecast that thermal utilization is likely to fall to only 3,602hrs in 2017, suggesting that it may be a challenge for nuclear to stay above 7,000hrs. In addition to pressure from a thermal utilization collapse, in a year of better-than-expected water flow, it is likely that nuclear utilization will be further squeezed, given the priority dispatch of hydro over nuclear.

Figure 17: Guangxi – power generation mix



Source: CEIC, Deutsche Bank estimates

Figure 18: Guangxi – thermal utilization sensitivity

	2015E	2016E	2017E	2015E	2016E	2017E
Power demand gr.	Thermal utilization			Yoy change		
4.0%	4,825	3,820	3,228	15.9%	-20.8%	-15.5%
5.0%	4,903	3,956	3,413	17.7%	-19.3%	-13.7%
6.0%	4,981	4,094	3,602	19.6%	-17.8%	-12.0%
7.0%	5,060	4,232	3,794	21.5%	-16.3%	-10.4%
8.0%	5,138	4,372	3,990	23.4%	-14.9%	-8.7%
Nuclear utilization	Thermal utilization			Yoy change		
6,500	4,990	4,127	3,649	19.8%	-17.3%	-11.6%
6,750	4,985	4,110	3,625	19.7%	-17.6%	-11.8%
7,000	4,981	4,094	3,602	19.6%	-17.8%	-12.0%
7,250	4,977	4,077	3,578	19.5%	-18.1%	-12.2%
7,500	4,973	4,060	3,555	19.4%	-18.4%	-12.4%

Source: Deutsche Bank estimates

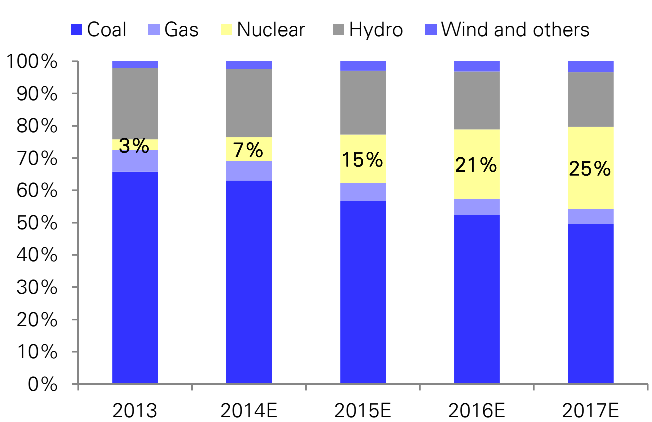
Fujian: better than Liaoning, due to strong demand growth and export potential

By assuming 7,500hrs of nuclear utilization, we calculate that Fujian's coal utilization will remain above 5,000hrs in 2015-16, but we believe we will see a likely 4% decline to 4,958hrs in 2017. Indeed, nuclear will represent 25% of provincial generation output in 2017E, the highest level among all the provinces in China. However, the outlook is better than for Liaoning, thanks to:

- a relatively healthy power market, with strong demand growth (9.3% in 11M14) and high coal utilization hours (5,296 in 2014E, 450hrs above the national average), and
- the Ultra-High-Voltage transmission line being built for exporting power to the neighboring Zhejiang province, which will export 12% of Fujian's output in 2017, based on our estimates.

However, a 1% drop in annual power demand growth in Fujian, over the assumed 6% pa in 2015-17E, will further bring down the 2017E coal utilization to 4,710hrs. Meanwhile, given Fujian's higher reliance on hydro (20%), there is likely downside risk in a year when rainfall is extremely favorable to hydro.

Figure 19: Fujian – power generation mix



Source: CEIC, Deutsche Bank estimates

Figure 20: Fujian – thermal utilization sensitivity

	2015E	2016E	2017E	2015E	2016E	2017E
Power demand gr.	Thermal utilization			Yoy change		
4.0%	5,020	4,823	4,466	-6.0%	-3.9%	-7.4%
5.0%	5,101	4,987	4,710	-4.5%	-2.2%	-5.6%
6.0%	5,182	5,152	4,958	-3.0%	-0.6%	-3.8%
7.0%	5,263	5,319	5,212	-1.4%	1.1%	-2.0%
8.0%	5,344	5,488	5,470	0.1%	2.7%	-0.3%
Nuclear utilization	Thermal utilization			Yoy change		
7,000	5,274	5,293	5,129	-1.2%	0.4%	-3.1%
7,250	5,228	5,223	5,044	-2.1%	-0.1%	-3.4%
7,500	5,182	5,152	4,958	-3.0%	-0.6%	-3.8%
7,750	5,136	5,082	4,873	-3.8%	-1.1%	-4.1%
8,000	5,090	5,011	4,788	-4.7%	-1.5%	-4.5%

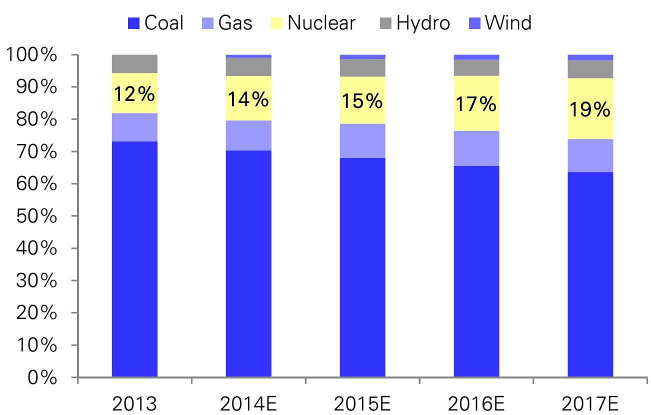
Source: Deutsche Bank estimates

Guangdong: less of a concern but potential threat from cheaper hydro imports

By assuming 7,500hrs of nuclear utilization, we believe Guangdong's coal utilization will remain above 5,000hrs in 2017, which suggests that the local market can absorb the doubling nuclear capacity. However, the results are sensitive to the power demand growth assumption – by assuming 5.0% demand growth p.a., instead of 7% in our base case, thermal utilization will drop to 4,455hrs by 2017E.

In addition, another swing factor is cheaper hydro imports from southwest China (25-28% of Guangdong's power consumption in 2015-17E), such as Yunnan and Guangxi, given their lower costs than nuclear. From both the dispatch priority policy and cost competitiveness perspective, hydro is superior to nuclear.

Figure 21: Guangdong – power generation mix



Source: CEIC, Deutsche Bank estimates

Figure 22: Guangdong – thermal utilization sensitivity

	2015E	2016E	2017E	2015E	2016E	2017E
Power demand gr.		Thermal utilization			Yoy change	
5.0%	4,793	4,602	4,455	-6.2%	-4.0%	-3.2%
6.0%	4,888	4,792	4,741	-4.3%	-2.0%	-1.1%
7.0%	4,984	4,985	5,033	-2.5%	0.0%	1.0%
8.0%	5,079	5,179	5,330	-0.6%	2.0%	2.9%
9.0%	5,175	5,375	5,633	1.3%	3.9%	4.8%
Nuclear utilization		Thermal utilization			Yoy change	
7,000	5,055	5,071	5,133	-1.1%	0.3%	1.2%
7,250	5,020	5,028	5,083	-1.8%	0.2%	1.1%
7,500	4,984	4,985	5,033	-2.5%	0.0%	1.0%
7,750	4,948	4,942	4,983	-3.2%	-0.1%	0.8%
8,000	4,913	4,899	4,933	-3.9%	-0.3%	0.7%

Source: Deutsche Bank estimates

Focus 3: what are the risks to the tariff for nuclear power?

Summary

- The nuclear benchmark tariff of Rmb430/kWh for GII+ units is competitive in most provinces in China, but the first batch of GIII units are likely to be priced at an 8-16% tariff premium to local coal-fired units, which will either see reduced competitiveness or expose the return to risk if the tariff is set at a lower premium.
- There is still some downside risk to nuclear tariffs, due to 1) a potential tariff discount or some kind of profit-sharing in regions with power oversupply – in May 2014, State Grid Fujian signed a peak-shaving Compensation Agreement with Ningde Nuclear, which will have a profit-sharing scheme for excess power generation over the planned 7,008hrs, and 2) another coal-fired tariff cut if the coal price falls further.
- Nuclear power is unlikely to be included in direct power supply in the near term. However, in the longer term, the full liberalization of the power market would potentially require the participation of nuclear. In the US and Europe, nuclear power plants are participating in the wholesale power market in a similar way to thermal and hydro power plants.
- While the above tariff risks are somewhat more remote, the impact could be very material – we note that, in 2002, the wholesale price free-fall in Britain was mostly to blame for the financial collapse of British Energy, the only listed pure play nuclear generator in the world at that time.
- Unlike the feed-in-tariff for wind and solar, there is no regulation that stipulates that the benchmark nuclear wind tariff will apply for the whole lifecycle of 40 years.

Nuclear tariff-setting mechanism

In July 2013, the NDRC announced the new tariff mechanism for China's nuclear power plants. The key elements include the following:

- A nationwide benchmark nuclear tariff is set at Rmb430/MWh (tax-inclusive) (vs. the previous "*one plant, one price*" mechanism based on the construction costs of nuclear power plants).
- If the benchmark tariff is higher than the tariff of local coal-fired power plants, the new nuclear power units will adopt the coal-fired tariff.

Nuclear benchmark tariff is set at Rmb430/MWh for GII+ units coming online after 2013

- The above policy is applicable for Generation II+ units operational after 1 January 2013, while prior units will still apply the old mechanism. Proper consideration could be given to the tariff setting for Generation III demonstration projects (first batch of units).
- The benchmark tariff will remain relatively stable. However, adjustments based on the changes in technology, costs, power demand and supply will also be carried out at appropriate times.

We summarize the tariff for China's operating nuclear units in Figure 23.

Figure 23: Tariff overview of China's operating nuclear units (Rmb/MWh, incl. VAT)

Nuclear units	Operator	Operation	Location	Tariff	Deutsch Bank Comments
Daya Bay Unit 1-2	CGN	1994	Guangdong	420.0	Into operation before Jan 2013, apply "one plant, one price" tariff
Ling'ao Unit 1-2	CGN	2002-03	Guangdong	429.0	Into operation before Jan 2013, apply "one plant, one price" tariff
Lingdong Unit 1-2	CGN	2010-11	Guangdong	430.0	Benchmark tariff applied
Yangjiang Unit 1	CGN	2014	Guangdong	430.0	Benchmark tariff applied
Ningde Unit 1-2	CGN	2013-14	Fujian	430.0	Benchmark tariff applied for unit 1, should be applicable to unit 2-4 as well
Hongyanhe Unit 1	CGN	2013-14	Liaoning	414.2	Apply local on-grid tariff for coal-fired units as it is lower than nuclear benchmark tariff
Qinshan I	CNNC	1994	Zhejiang	420.0	Into operation before Jan 2013, apply "one plant, one price" tariff
Qinshan II Unit 1-2	CNNC	2002-11	Zhejiang	420.0	Into operation before Jan 2013, apply "one plant, one price" tariff; Rmb393/MWh during 1 Jan 2011 – 24 Sept 2013; adjusted to Rmb420/MWh from 25 Sept 2013
Qinshan II Unit 3-4	CNNC	2010-11	Zhejiang	430.0	Into operation before Jan 2013, apply "one plant, one price" tariff
Qinshan III Unit 1-2	CNNC	2002-03	Zhejiang	464.0	Into operation before Jan 2013, apply "one plant, one price" tariff
Tianwan Unit 1-2	CNNC	2007	Jiangsu	455.0	Into operation before Jan 2013, apply "one plant, one price" tariff; Rmb445/MWh during 1 Jan 2011 – 30 Jun 2013; adjusted to Rmb455/MWh from 1 Jul 2013

Source: CGN CNNC, Deutsche Bank

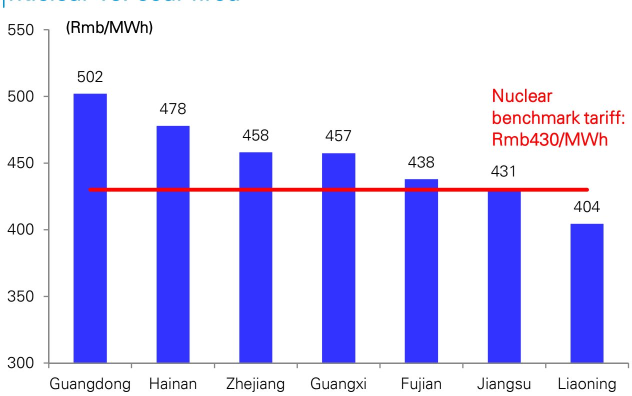
Competitiveness vs. coal-fired

Currently, for provinces where China's GII+ nuclear units are located, namely Guangdong, Jiangsu, Liaoning, Fujian, Zhejiang, Hainan and Guangxi, only Liaoning's nuclear benchmark tariff is higher than that of coal-fired power, while, in the remaining provinces, it is at a 0.2-14.3% discount.

Competitiveness vs. other renewables

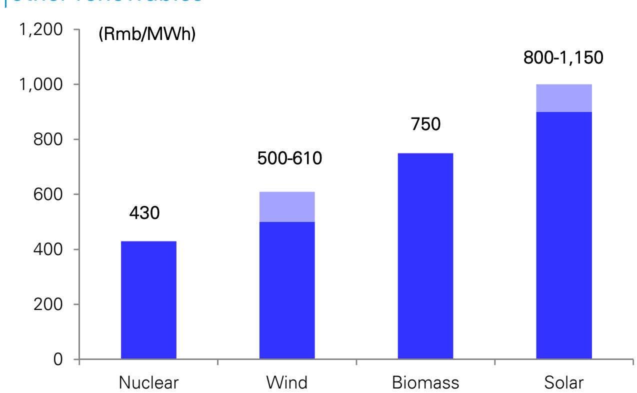
Compared with other renewables, the discount is even higher, at 14-30% vs. wind, 43% vs. Biomass and 52-57% vs. solar.

Figure 24: Tariff comparison by province: benchmark nuclear vs. coal-fired



Source: NDRC, Deutsche Bank

Figure 25: Tariff comparison: nuclear benchmark vs. other renewables



Source: NDRC, Deutsche Bank

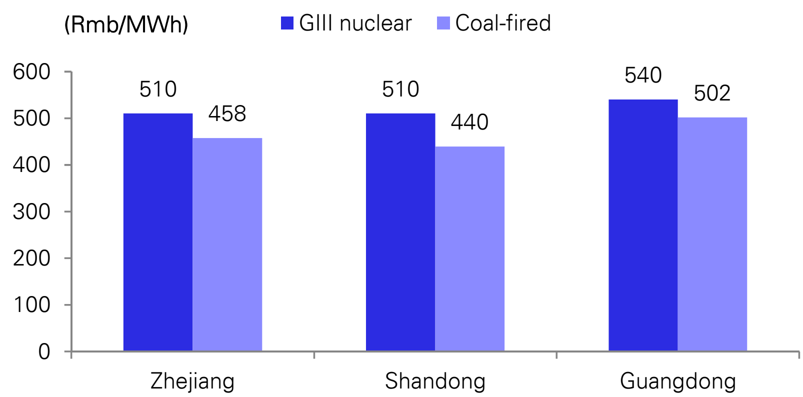
Likely reduced competitiveness of GIII nuclear tariff

An Rmb510-540/MWh tariff might be required for GIII nuclear units – no longer competitive vs. thermal

Given the line that "A proper increase could be given to demonstration projects" in the tariff announcement, we believe the GIII units under construction are likely to receive a tariff premium, given their much higher unit investment (Rmb16,320-20,900/kW, vs. c.Rmb12,500/kW for GII+ units). CNNC stated that it would propose an Rmb510/MWh (tax-inclusive) tariff for Sanmen Nuclear if the final investment were to overrun by 20% (c.Rmb19,600/kW). On a similar calculation, the potential tariff needed by Taishan Nuclear would be rounded up to Rmb540/kWh.

This would suggest an 8-16% tariff premium for the first batch of GIII nuclear units vs. local coal-fired units, which might reduce the willingness of the local power grid to purchase nuclear generation.

Figure 26: Tariff comparison: hypothetical GIII nuclear vs. local coal-fired



Source: NDRC, Deutsche Bank estimates

Downside risks to future nuclear tariffs

In the near term, downside risks to the nuclear tariff will come mainly from the following.

- **Potential tariff discount or profit-sharing scheme**: In a supply-surplus situation, a tariff discount or some kind of profit-sharing schedule could be introduced for excess power generation over a certain limit – likely 7,008hrs, which China used to set the current nuclear benchmark. For example, in May 2014, State Grid Fujian Electric Power signed a Peak-shaving Compensation Agreement with Ningde Nuclear, which will have a profit-sharing scheme for the excess power generation over the planned 7,008hrs (80% plant load factor) in order to support pump storage plants' development for the sake of peak shaving.
- **Coal-fired tariff cut:** the nuclear tariff could be adjusted downwards if China cuts the coal-fired tariff – a risk for provinces where coal-fired tariffs are close to, or already lower than, the benchmark nuclear tariff (Liaoning, Jiangsu and Fujian). Although we do not assume a coal-fired tariff cut in the next review period around September 2015, there is a small chance of 1) coal prices dropping below Rmb480/ton, or 2) coal-fired utilization seeing a good recovery. For details of the coal-fired tariff, please refer to our note "*Multiple catalysts in 2015; maintaining Buy ratings",* published on 12 November 2014.

How could power reform affect the nuclear tariff?

According to media reports (Shanghai Securities News), the Draft of Opinions on Further Deepening Power System Reform, which was led by the National Development and Reform Commission, was completed in November and issued to relevant parties after extensive opinion consultation and modifications. One of the key elements highlighted in the draft is the rolling out of Direct Power Supply (DPS).

Currently, the DPS volume remains low, at 5%/10% of total electricity sales of IPPs in 2015/16, based on the plan announced by various provinces, and is limited mostly to large thermal and hydro plants. Nuclear power, with less than 3% of total electricity output, is unlikely to be included in direct power supply in the near term.

No regulation to keep China's nuclear power out of competition forever

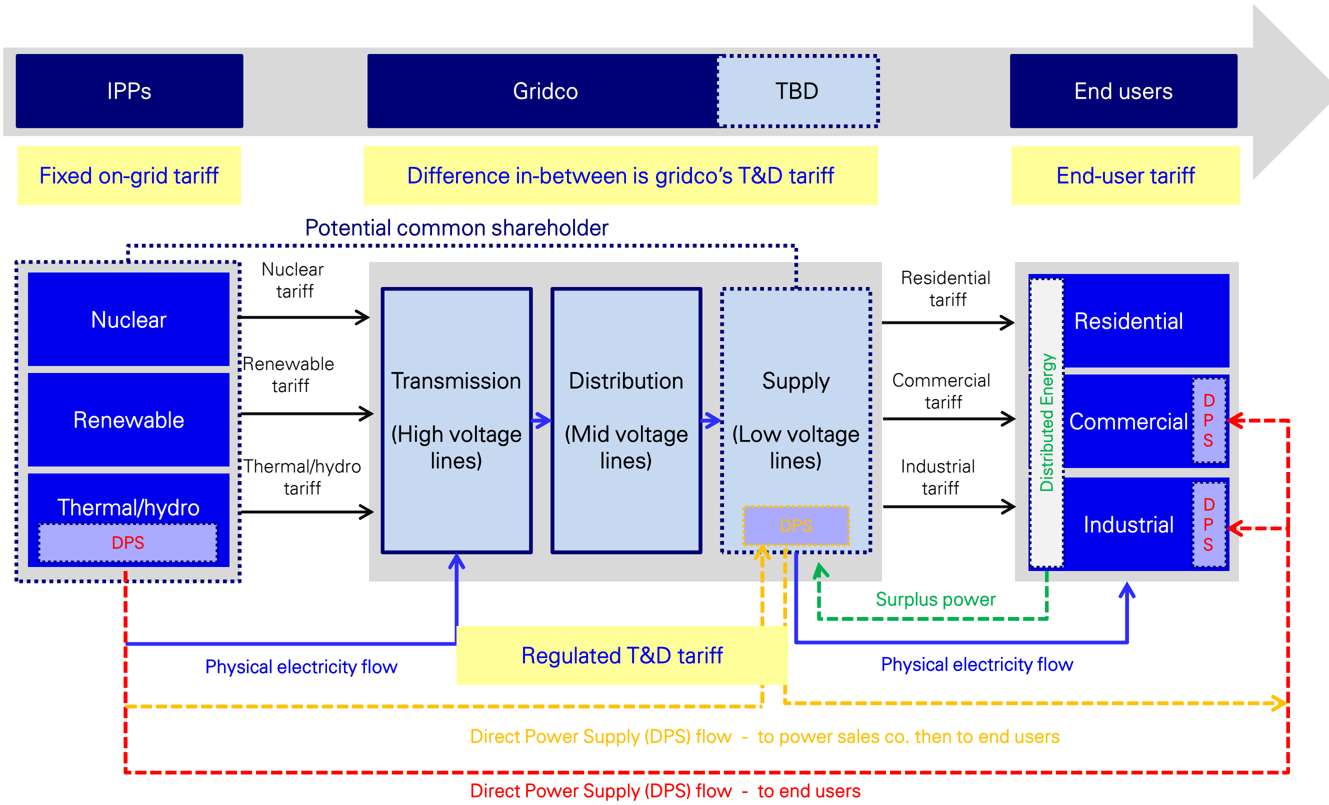
The full liberalization of the power market would require nuclear to participate in DPS in the longer term, with tariff risk to the downside

However, the further rolling out of the scheme and the rising mix of nuclear power on a provincial basis would potentially require the participation of nuclear power – when nuclear gencos' tariff is no longer fixed and could be subject to market dynamics. Currently, unlike the feed-in-tariff for wind and solar, there is no regulation that stipulates that the benchmark nuclear wind tariff of Rmb430/MWh will apply for the whole 40-year lifecycle of nuclear.

In the US and Europe, nuclear power plants are participating in the wholesale power market in a similar way to thermal and hydro power plants, which tend to benefit if the wholesale price moves up, while suffering vice versa, owing to a largely fixed-cost base.

Therefore, nuclear tariff risk cannot be excluded in the long term in China amid a power reform targeting a more market-oriented tariff mechanism.

Figure 27: New power sector structure under proposed reform



Source: Deutsche Bank

Case study: the collapse of British Energy

We note that CGN is not the first and only listed pure-play nuclear power producer in the world – British Energy was delisted following its takeover by EdF after falling into financial difficulties after five years of listing. It is not our intention to suggest any similarity between CGN and British Energy, apart from their position as the only two listed pure nuclear operators, but we want to remind investors of the risk of being a pure-play nuclear operator in a liberalized power market.

A bit of history

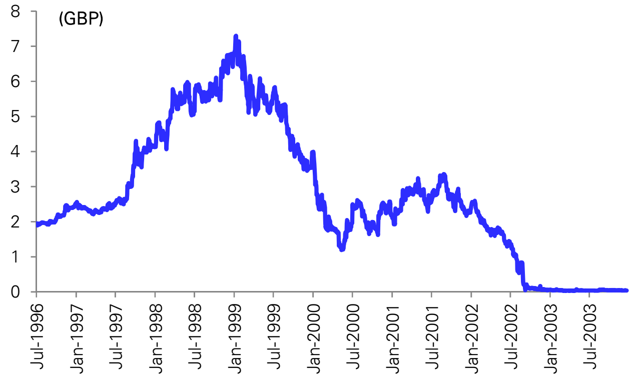
Tariff free-fall was mostly to blame for the financial collapse of British Energy, a nuclear-pure-play

In 1996, the British government privatized British Energy to take on the more modern nuclear plants, including seven Advanced Gas-cooled Reactor (AGR) stations and one Pressurized Water Reactors (PWR) station.

British Energy operated successfully with substantial surges in the share price. By 1998, it had become the country's biggest generator; by 1999, it was able to pay a dividend of GBP432m, c.10% of its market cap. However, in 2002, the company announced that it was no longer able to meet its liabilities and applied to the government for emergency credit. In October 2003, the government launched a restructuring – wherein shareholders received only 2.5% equity in the restructured company and lost most of their investment, with the remainder going to British Energy's creditors.

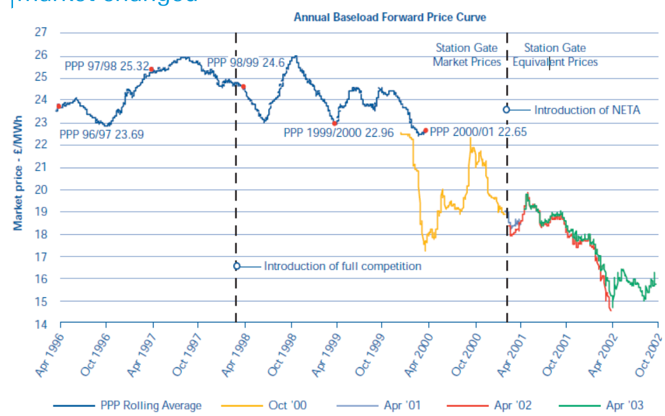
While the financial collapse of British Energy could be attributed to a complex set of causes, one of the key triggers was the decline of wholesale prices.

Figure 28: Share price of British Energy (delisted in 2004)



Source: Datastream, Deutsche Bank

Figure 29: Wholesale electricity prices fell sharply as the market changed



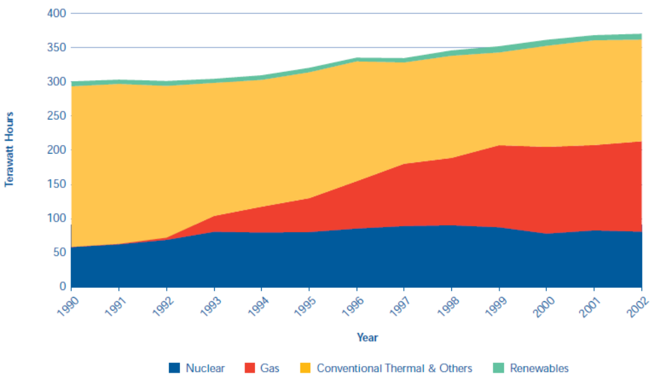
Source: British Energy, The National Audit Office ,Deutsche Bank

Drivers behind the decline of wholesale electricity prices

- **The "Dash for Gas":** from the early 1990s, the UK witnessed a rapid build-up in gas-fired power plants, as the gas cost, locked through long-term contracts, became lower than the coal price. In 1992, gas accounted for only 2% of the UK's total generation, while, in 1997, the ratio had risen to 24% (Figure 30). As a result, the UK power market was running at 25% surplus capacity in 2002.
- **The transition to NETA:** the new wholesale power market in the UK – NETA (New Electricity Trading Agreement) ended the distortion in the way electricity was sold in the old Pool market, which kept prices artificially high, due to large players' price manipulation.
- **The rolling out of supply competition:** in 1990, large end-users were allowed to choose their own supplier; in 1994, smaller users became eligible as well; by June 1999, domestic competition in the supply business had been rolled out across the country.

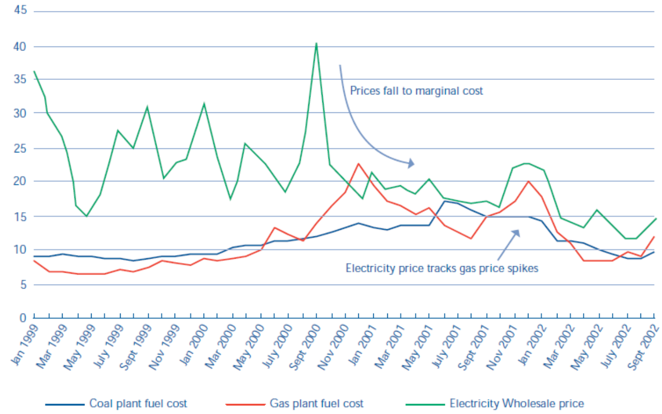
In response, supply companies asked for competitively priced wholesale prices from gencos, which drove down wholesale prices to the industry's marginal cost of generation, the gas fuel cost. By 2002, the wholesale price had dropped to GBP16-17/MWh, nearly 30% lower than in 1999 (c.GBP24/MWh).

Figure 30: Generation mix in UK



Source: The National Audit Office ,Deutsche Bank

Figure 31: Wholesale price fell to the marginal cost of gas



Source: The National Audit Office ,Deutsche Bank

Failure to vertically integrate exposed British Energy to pricing risk with high fixed cost base

By late 2002, most of the large British gencos had responded to the scheme change by vertically integrating to a matching supply business, while British Energy bought only a 6% market share in the supply market through the purchase of SWALEC, and sold it soon after, in 2000. As much as other gencos suffered from the power price collapse, the situation was much worse for British Energy as nuclear genco has much higher fixed costs and lower marginal costs.

Focus 4: what are the risks to backend liabilities for nuclear power?

Summary

- Lacking specific regulations, China's nuclear players estimate terminal decommissioning costs based on 10% of investments, which falls at the low end of the global average on an absolute dollar basis.
- On the other hand, the 6.55% discount rate applied to derive the present value of the liabilities appears to be the highest around the globe (U.S. 3-5%, France 5%).
- For a typical GII+ PWR unit, assuming Rmb12,500/kWh investment costs and terminal decommissioning liabilities of 10% of investment, the present value in the first year would be Rmb101/kWh under a 6.5% discount rate, while it would be Rmb316m/kWh under a 3.5% discount rate, a big difference due to the long time-span.
- Although the earliest decommissioning in China will not come before 2034, there is a chance that a tighter set of regulations will be announced in view of the incoming installation peak.
- Besides, an underestimated liability suggests an inflated equity value for nuclear gencos – for which investors should make a corresponding adjustment.

Decommissioning provisions – an introduction

Decommissioning refers to the process to dismantle a nuclear power plant at the end of its useful life, so that the site can be released for unrestricted use after the cleaning-up of radioactive materials.

Accounting treatment: the Chinese practice

Currently there's no domestic regulation regarding the decommission costs. However, both CGNPC and CNNC make decommissioning provisions (a long-term liability) based on 10% of the book value of the fixed assets upon the completion of the nuclear power station, and discounted to its present value.

- CGNPC estimated the decommissioning costs based on the statistics of Trojan Nuclear released by the US Nuclear Regulatory Commission (NRC), which is c.10% of the investment costs.
- For the discount rate, currently, CGNPC uses the PBOC benchmark lending rate for 5-years and above (6.55% before the November rate cut), subject to changes in benchmark lending rates and inflation.
- According to CGNPC, "the estimated future cash forecasts are inflation-adjusted, based on historical inflation rates".

- The same decommissioning costs are added to the carrying amount of related PPE and depreciated over their estimated useful lives.
- The unwinding of the discount on this provision is charged to the P&L, reported under finance costs.

Nuclear waste treatment: an introduction

Given the radioactive nature of nuclear waste, proper treatment and safe disposal is required. Nuclear waste treatment falls into the below two categories: 1) treatment of spent-fuel and 2) treatment of low- and medium-level radioactive waste.

Spent-fuel disposal

Spent-fuel refers to nuclear fuel that has undergone nuclear fission in a reactor and is no longer useful in remaining within the reactor. China adopted a closed fuel cycle strategy which includes 1) at-reactor storage; 2) away-from-reactor storage; and 3) reprocessing.

- After being removed from the reactor, spent-fuel is first temporarily stored in an on-site spent-fuel pool of the nuclear power plant for cooling or decaying its radioactivity, taking 8-10 years. Then it will be transferred a third-party spent-fuel reprocessing plant, after which the genco itself will no longer be liable.

Low-and medium-level radioactive waste

Low- and medium-level radioactive waste generally falls into gaseous, liquid and solid radioactive waste.

- **Gaseous waste**: generally low-radioactive, can be discharged directly after passing through a gas purification treatment system and having met the relevant requirements; gencos remain liable before the waste is discharged.
- **Liquid waste:** low-radioactive liquid waste is usually collected, inspected and then discharged; high-radioactive waste is processed at the power station before being discharged; gencos remain liable before the waste is discharged.
- **Solid waste:** will first transform into a durable and stable solid and stored on-site for several years, before being transported into a long-term storage area of a third-party, after which gencos are no longer liable.

Potential underestimation vs. global practice

Compared with global practice, China’s estimation of back-end decommissioning costs appears at the low end of the range of historical global costs; while a higher-than-others discount rate might add to the under-estimation of the present value of the actual liabilities.

Back-end decommissioning costs lower than in other countries:

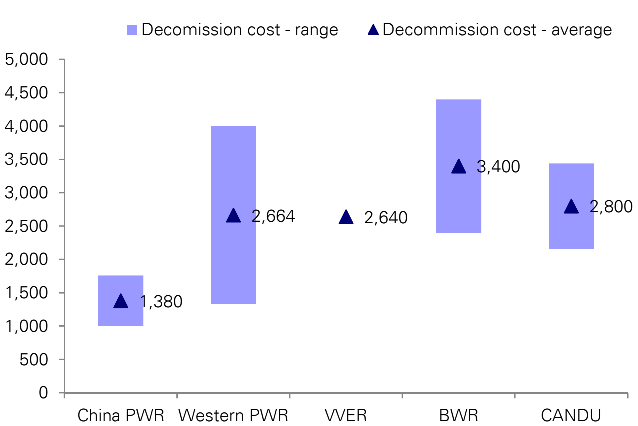
According to the statistics released in the IAEA Bulletin [2], reported decommissioning costs have a wide range but generally account for 9~15% of initial investment. In 2003, according to an OECD survey released in the USD (2001) decommissioning costs by reactor type were: USD160-500/kW for western PWRs; c.USD330/kW for VVERs; USD300-550/kW for BWRs; USD270-430/kW for CANDU; while the costs were much higher for gas-cooled reactors due to the greater amount of radioactive materials involved, at USD2600/kW for some UK Magnox reactors. We have summarized the range of decommissioning costs (converted to Rmb from 2013 USD) and simple average mid-point in Figure 32.

Compared with the wide range of decommissioning costs across different reactor types, those for PWR appear controllable and range within Rmb1,300-3,800/kW, if taking out the extremes (three out of 22 data sets). The two highest cost estimates, for Trino in Italy and Haddam Neck in the United States, were commissioned in the 60s. The lowest cost figure, for Ringhals 2 in Sweden, may be partly attributable to the lower waste management and disposal cost assumed in Sweden.

In China, decommissioning cost estimates are.Rmb1,000-1,760/kW, vs. Rmb1,300-3800/kW globally

Based on the average investment costs of Rmb10,000-17,600/kW for PWR units in China, the current 10% estimate falls into the low end of the global range. In the US, gencos need to pay USD0.1-0.2cents/kWh to fund the decommissioning. For a typical 1-GW unit, assuming 7,200hrs of utilization, this translates into a total cost of Rmb1,700-3,400/kW (undiscounted).

Figure 32: Decommission costs – China vs. global units by type



Source: OECD survey, Deutsche Bank

Figure 33: Decommissioning cost estimates for global PWRs

Country	Plant	Capacity	Total cost	(Rmb/kW)
Immediate dismantling				**2,889**
Belgium	Doel 1-2	412x2	2,240	2,719
Belgium	Tihange 1	1009	1,704	1,689
Germany	Germany PWR	1200	2,520	2,100
Italy	Trino	270	1,960	7,260
Slovenia	Krsko	707	2,656	3,757
South Africa	Koeberg	844x2	2,536	1,343
Spain	Spain ref.PWR	1000	1,328	1,328
Sweden	Ringhals 2	917	680	742
Switzerland	Beznau	380x2	2,072	2,727
Switzerland	Gosgen	1020	1,904	1,867
United states	Haddam Neck	587	3,616	6,161
United states	Main Yankee	900	3,032	3,369
United states	Trojan	1155	2,368	2,050
United states	Zion	1085x2	7,233	3,333
Deferred dismantling				**2,228**
Brazil	Angra 1	657	1,584	2,411
Brazil	Angra 2	1350	1,920	1,422
France	Average PWR	1070x58	111,798	1,801
Germany	Germany PWR	1200	2,648	2,207
Japan	Tsuruga 2	1160	3,760	3,242
Netherland	Borssele	481	1,344	2,795
Slovenia	Krsko	707	1,216	1,720

Source: OECD survey, Deutsche Bank; reported in USD (2001), translated into USD(2013) by a GDP deflator of 1.27, then converted to Rmb by a 6.3 exchange rate

[2] Statistics from the Mar 2007 issue of "IAEA Bulletin"; source data valued by 2001 USD, adjusted to 2013 USD by a 1.27 GDP deflator

Discount rate higher than in other countries

The higher the discount rate, the lower the present value of decommissioning liabilities reflected in the balance sheet. In France, the rate is chosen by the operator based on the regulatory constraints and EDF, Areva and CEA[3] currently adopt 5%; In the US, the rate is 3-5% based on owners' discretion; while the rate in Spain is lower at 1.5%.

The 6.55% discount rate is also the highest globally -- indicating a potential underestimation in nuclear liabilities

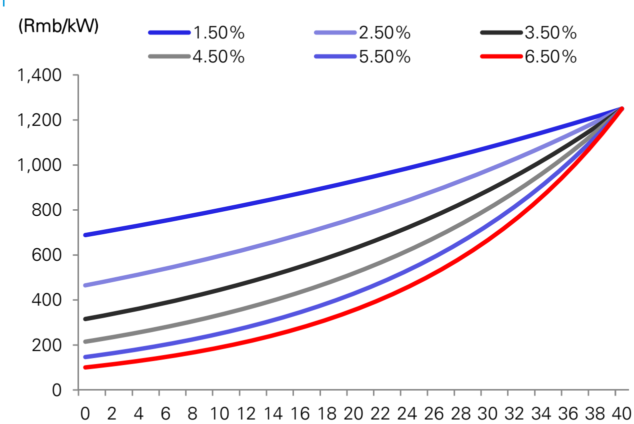
In comparison, China's discount rate of 6.55% appears the highest. For a typical GII+ PWR unit, assuming Rmb12,500/kW investment costs and terminal decommissioning liabilities of 10% of investment, the present value in the first year would be Rmb101/kW under a 6.5% discount rate, while it would be Rmb316/kW under a 3.5% discount rate (benchmarking the US practice), or 3x higher – the discount rate makes a big differences due to the long time-span.

Figure 34: Discount rate – China vs. global

Country	Adjusted for inflation	Discount rate
Belgium	Yes	Yes
France	Yes	5% (EDF, Areva, CEA*)
Germany	No	No
Italy	No	No
Japan	Yes	Yes
Netherlands	Yes (2%)	4%
Slovakia	Yes	No
Spain	Yes	1.50%
Sweden	No	Specified by authority
United States	Yes	3-5% (owner specified)
China	Yes	6.55%

Source: OECD Nuclear Energy Agency, Deutsche Bank

Figure 35: Higher discount rate leads to lower PV of liabilities



*Source: OECD Nuclear Energy Agency, Deutsche Bank; Note: based on terminal value of Rmb1,250/MWh (10% * Rmb12,500/kW for China PWR)*

Although the earliest decommissioning in China will not come before 2034, there is a chance that related regulations will be announced in view of the incoming installation peak, to either revise up the terminal decommission cost, or set a discount rate benchmark that is more in line with global practice. Even if this doesn't happen, the recent benchmark lending rate cut to 6.15% would suggest a corresponding adjustment. Besides, an underestimated liability suggests an inflated equity value for nuclear gencos – for which investors should make a corresponding adjustment.

Provision for spent-fuel treatment

Effective from 1 October 2010, MOFCOM/NDRC/MIIT in China requires that PWR nuclear reactors need to contribute Rmb0.026 cents per KWh to the Spent-Fuel Fund (the Fund) based on actual on-grid sales volume, applicable after five years of commercial operation. The Fund will be used for the treatment and disposal of spent-fuel, covering transportation, away-from-reactor storage and post-treatment of spent-fuel. As of end-2013, contributions to the Spent-Fuel Fund amounted to Rmb7.58bn, while the actual expense is Rmb378m (<5% of total).

[3] CEA is the French Alternative Energies and Atomic Energy Commission

Nuclear power basics

Introduction to Nuclear Reaction Technology

Nuclear power reactor technology usually refers to the type of nuclear reactor and respective design/structure/component in a nuclear island. The conversional island technology (such as turbine and generator) is similar to that of coal-fired plants.

Two designs are predominant among China's nuclear units under construction currently, namely CPR1000 (GII+) and AP1000 (GIII). However, plans for the former have been scaled back post-Fukushima, while the progress of AP1000 construction in the Sanmen and Haiyang sites is slower than expected. EPR, another GIII design under construction, might not see a further roll-out, given its more redundant safety systems and higher costs. As a result, three types of technology have emerged as the most promising trend for the incoming units to be approved: 1) ACPR1000, represented by Hongyanhe 5-6; 2) CAP1400, represented by Shidaowan, and 3) Hualong One, represented by Fuqing 5-6 and Fangchengang II.

CPR1000 (GII+) – widely applied in operating units

The CPR1000, developed by CGN, is an upgraded version of the three-loop French M310 technology with a design life of 60 years. Standard construction time is 52 months with unit cost of Rmb10,000-14,000/kW domestically.

CPR1000 was firstly deployed by Ling Ao Phase II, and was being widely applied thereafter in Hongyanhe 1-4, Ningde 1-4, Yangjiang 1-4 and Fangchenggang 1-2. CNNC-built units (Fuqing 1-4 and Fangjiashan 1-2) are often designated M310+.

AP1000 (GIII) – China's first move into GIII technology

AP1000, designed by Westinghouse, is a two-loop pressurized water reactor (PWR) and is the main basis of China's move to Generation III technology.

The timeline is initially estimated at 50 months from first concrete to fuel loading, and then six months to grid connection for the first four units, with this expected to fall significantly for the following units. The first four AP1000 reactors are being built at Sanmen for CNNC and Haiyang for China Power Investment Corp (CPI Group), which have experienced a two-year delay relative to originally schedule, mainly due to technical issues relating to main coolant pumps.

The China Nuclear Energy Association (CNEA) estimated in May 2013 that the construction cost for the two AP1000 units at Sanmen were Rmb40.1bn (US$6.54bn), or Rmb16,000/kW (US$2,615/kW), c.14% higher than the latest estimate for the CPR1000, but likely to increase further as the commissioning of unit one of the Sanmen project is further pushed to 2016. Nevertheless, unit construction costs may be lower for future AP1000 projects with series construction and more locally made equipment.

Besides Sanmen 1-2 and Haiyang 1-2, AP1000 will be deployed by Sanmen 3-4, Haiyang 3-4 and Lufeng 1-2.

EPR (GIII) – a large version of PWR

EPR, a large (typically 1750MWe gross) PWR developed by Areva, is a four-loop design that could operate flexibly to follow loads and with an expected availability of 92% over a 60-year service life. In November 2007, Areva signed a EUR8bn contract with CGNPC to 1) build two EPR units at Taishan; 2) supply fuel up to 2026 as well as other materials and services (nuclear reactors accounts for EUR3.5bn). In August 2008, EDF and CGNPC signed agreements to create a 30%:70% joint venture, TNPC, which will be responsible for both the construction and operation of Taishan Nuclear.

However, with start-up delays and cost overrun across its four units under construction, EDF acknowledged in 2013 that it was having difficulties in the building of EPR units. Also, as EPR has multiple redundant safety systems and is more complex and expensive than the Westinghouse design, it is likely that no further EPR units will be built in addition to Taishan.

ACPR1000 (GII+) – improved GII+ meeting post-Fukushima safety standard

ACPR1000 is a three-loop PWR unit developed based on the CPR1000 technology, featuring the main safety technical characteristics of the GIII technology that meets the latest post-Fukushima PRC safety regulatory requirement. ACPR1000 was launched by CGN in November 2011 and has full Chinese intellectual property rights.

ACPR stands for Advanced China Pressure Reactor

ACPR1000 will be applied on Hongyanhe Unit 5-6 and Yangjiang Unit 5-6.

Hualong One (GIII) – the rationalization of ACP1000 and ACPR1000+

Previously, there are two indigenous Generation III designs based on the French predecessor M310. One is ACP1000, developed by CNNC and another is ACPR1000+, developed by CGN. In 2012, following NEA’s call to rationalize China’s reactor programs, ACP1000 and ACPR1000 were thereafter merged into one standardized design, namely the Hualong One. The average cost is estimated at US$2,800-3,500/kW with c.90% of indigenous components. The Hualong One has a 18-24 month refuelling interval and a 60-year design life.

On 3 November, National Energy Administration (NEA) approved the first deployment of Hualong One on Fuqing Unit 5 & 6 (CNNC), which are planned to use ACP1000 previously). Fangchenggang Unit 3 & 4 (CGN) will also use the Hualong One technology.

CAP1400 (GIII) – China’s ambition of proprietary PWR technology

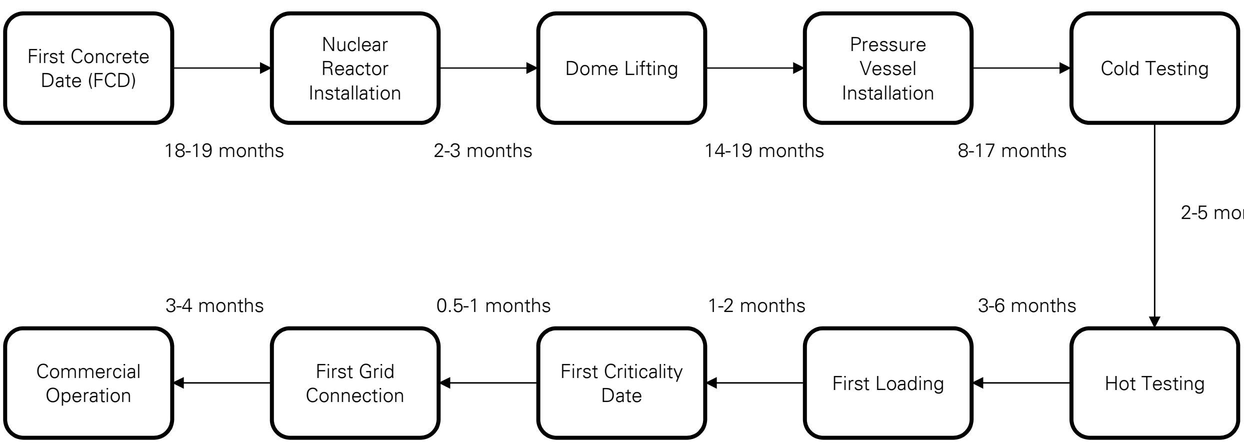
The CAP1400 Nuclear Power Plant is a Generation III passive plant developed by SNPTC from the digestion and absorption of AP1000 technology. It marks the move to form the Chinese brand of large-scaled advanced PWR with bigger generation capacity and China’s exclusive proprietary through innovation and development. In December 2009, SNPTC and China Huaneng Group set up a 55:45 joint venture, the State Nuclear Plant Demonstration Company, to build and operate an initial demonstration unit of CAP1400 at Shidaowan, Shandong Province. CAP1400 has a design life of 60 years and US$3,000/kW capital cost per SNPTC statistics in mid-2013. Over 80% of the components will be indigenous.

Introduction to construction cycle

Based on the progress record data of Ningde Unit 1-2 and Yangjiang Unit 1, we summarize the average months of work needed to arrive at each key milestone along the whole construction period.

- From First Concrete Date (FCD, which marks the official construction start) to Nuclear Reactor Installation to Dome Lifting: the process takes 20-22 months;
- From Dome Lifting to Pressure Vessel Installation: the process takes 14-19 months;
- From Pressure Vessel Installation to Cold Testing: the process takes 8-17 months;
- Cold testing and Hot Testing takes 7-10 months;
- From First loading to First Criticality Date, the process takes 1-2 months; about one month later, it will come to First Grid Connection
- Upon Grid Connection, the units take 3-4 months to start Commercial Operation.

Figure 36: Construction cycle of a typical GII+ units



Source: CNECC; Deutsche Bank;

Introduction to fuel supply

Unit fuel cost is less volatile than natural uranium prices

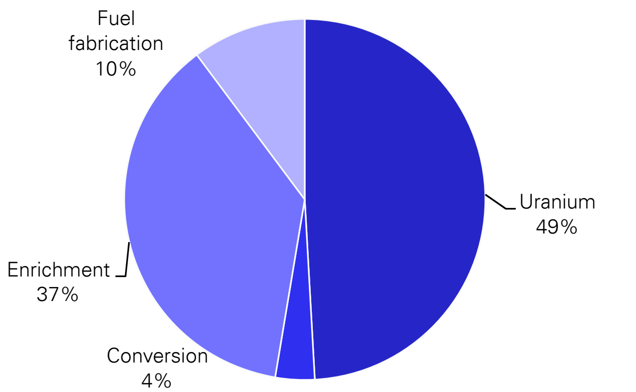
Uranium is the major raw material of nuclear power stations and is normally procured and processed (including the conversion/enrichment etc.) two to five years in advance. A typical one-GW nuclear unit generally consumes c.25 tons of nuclear fuel per annum, or 185 tons of uranium per annum.

Despite the price volatility of uranium over the past ten years, impact to profitability of a nuclear unit is limited mainly due to:

- First, within the fuel costs, Uranium costs 40-50% of the total nuclear fuel cost, while the processing (conversion, enrichment and fuel fabrication) consists of the remaining 50-60%, according to WNA statistics (Figure 37). In other words, only 40-50% is exposed to the volatility in prices of natural uranium.

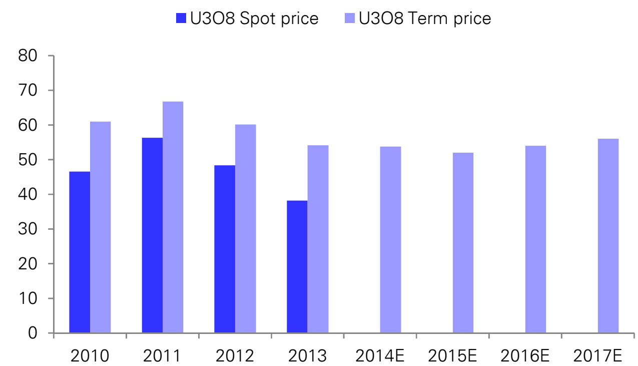
- Second, nuclear fuel is generally purchased through a long-term contract, with a more smooth/stable price setting.

Figure 37: Nuclear fuel cost breakdown



Source: WNA, Deutsche Bank

Figure 38: Long-term contract price of Uranium



Source: Deutsche Bank estimates

Contract price outlook muted by continued oversupply

According to our Commodity Strategist, Michael Hsueh, the long-term uranium contract price outlook will stay weak, at USD52-56/lb in 2015-17, compared with USD60-61/lb in 2010-12 (Figure 38).

Since 2010, the global uranium market has been characterized by oversupply triggered by (i) stagnant demand growth, (ii) a strong rise in Kazakh production over the 2006 to 2012 period, and (iii) exacerbated by shutdowns of generation capacity in Japan and Germany.

While 2014 holds the most promise in at least four years for a supportive fundamental picture, he is concerned about the possible extent of inventories accumulated since 2009, both in the US and as a result of shutdowns in Japan and Germany.

Beginning in 2015, a resumption of supply growth from Canada and secondary sources threatens to tip the market into oversupply once again until new construction in China and restarting capacity in Japan catch up in the latter part of the decade.

Introduction to nuclear decommission method

The International Atomic Energy Agency (IAEA) has defined three options for decommissioning[4]:

- **Immediate Dismantling** (or Early Site Release/'Decon' in the US): This option allows for the facility to be removed from regulatory control relatively soon after shutdown or termination of regulated activities. Final dismantling or decontamination activities can begin within a few

[4] The definition quotes from WNA

months or years, depending on the facility. Following removal from regulatory control, the site is then available for re-use.

- **Safe Enclosure** ('Safstor') or deferred dismantling: This option postpones the final removal of controls for a longer period, usually in the order of 40 to 60 years. The facility is placed into a safe storage configuration until the eventual dismantling and decontamination activities occur after residual radioactivity has decayed.
- **Entombment** (or 'Entomb'): This option entails placing the facility into a condition that will allow the remaining on-site radioactive material to remain on-site without ever removing it totally. This option usually involves reducing the size of the area where the radioactive material is located and then encasing the facility in a long-lived structure such as concrete, that will last for a period of time to ensure the remaining radioactivity is no longer of concern.

In China, the decommission costs are estimated on the basis of immediate dismantling, which generally includes three stages:

- Stage one – storage with surveillance: shutdown of the power station; post-operational clean out of the radioactive material (e.g. spent fuel).
- Stage two – restricted site release: all equipment and buildings which can be easily dismantled are removed or are decontaminated and made available for other uses.
- Stage three – unrestricted site release: the remaining parts of the plant and the site are released for unrestricted use and, in some cases, re-established to "green field" conditions.

While in China, the earliest decommissioning will not happen before 2034 (Daya Bay), the global experience has been considerable. Based on WNA statistics, c.85 commercial reactors and 45 experimental/prototype reactors have been retired from operation. Among them, at least 15 have been fully dismantled, over 50 are being dismantled, over 50 are in Safstor, three have been entombed, while for the others the decommissioning strategy is not yet specified.

Nuclear power producers in China

Nuclear developers: the three sisters

As of June 2014, only three companies are licensed to develop and take controlling stakes in nuclear power plants in China, namely CGNPC, CNNC and China Power Investment Corporation (CPI Group).

Only three nuclear developers licensed in China

- **CGNPC:** As of June 2014, CGNPC had 11 operating units with a total installed capacity of 11,624MW. CGNPC also had 13 units under construction, with a total installed capacity of 15,506MW.
- **CNNC:** As of June 2014, CNNC Group had nine operating units with a total installed capacity of 6,510MW, or a total installed capacity of 12,532MW, including capacity under construction.
- **CPI Group:** As of June 2014, CPI Group had a non-controlling interest in two operating units, with total attributable capacity of 1,007MW. It also has a non-controlling interest in four units under construction, with total capacity of 4,738MW.

Figure 39: Asset overview of major nuclear developers in China

Company Name	Units in Operation	Installed Capacity (MW)	Reactor Type
CGNPC*	11	11,624	PWR
CNNC	9	6,510	PWR/PHWR
CPI Group**	2	2,238	PWR

*Note: * includes the two operating units of Hongyanhe (with non-controlling interests); ** includes two operating units of Hongyanhe (with non-controlling interests); Source: Company data, Deutsche Bank*

Major IPPs with nuclear exposure

Meanwhile, several major IPPs hold minority stakes in China's nuclear power projects without an operational license. These include the following:

- **China Huaneng Group**, owns a 48% stake in Shidaowan Nuclear Project (high temperature gas-cooled, 210MW) in Shandong province.
- **Datang Power** (0991.HK, HK$4.28; Buy) owns a 44% stake in Ningde Nuclear Project (4x1,080MW) in Fujian province.
- **Huadian Fuxin** (0816.HK, HK$3.78 Buy) owns a 39% stake in Fuqing Nuclear Project (4x1,080MW) in Fujian province.
- **Zheneng Electric Power** (600023.SS, non-rated) owns a 28% stake in Qinshan Nuclear Project Phase I (310MW), a 20% stake in Qinshan Nuclear Project Phase II (4x650MW), a 10% stake in Qinshan Nuclear Project Phase III (2x700MW), a 20% stake in Sanmen Nuclear (2x1,250MW) and a 10% stake in Xudapu Nuclear (2x1,080MW).
- **Shenergy** (600642.SS, non-rated) owns a 12% stake in Qinshan Nuclear Project Phase II (4x650MW) and a 10% stake in Qinshan Nuclear Project Phase III (2x700MW).

China nuclear: entering into an installation peak

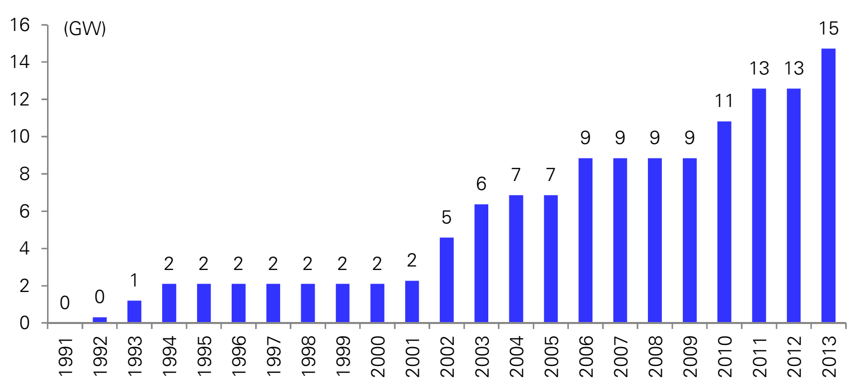
Nuclear: still underrepresented in China's power mix

China nuclear development – a brief history

China's nuclear power effort started in 1970, when the government issued its first nuclear power development plan, while from the 2000s, the industry kicked off its rapid expansion period. Below we summarize the major milestones in China's nuclear development:

- In the early 1980s, China decided to focus on the development of PWR units via import first and to achieve localization gradually later on.
- In 1985 and 1987, China commenced construction of its first two nuclear projects, namely Qinshan Nuclear and Daya Bay Nuclear. On 15 December 1991, China's first nuclear power reactor, a 288 MW PWR unit at the Qinshan Nuclear, was connected to the grid.
- From the early 2000s, installed capacity experienced a quick expansion, at an 18% CAGR over 2001-13.

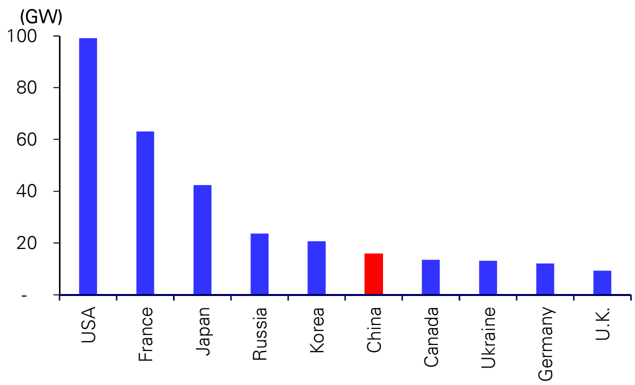
Figure 40: China – installed nuclear capacity (1991-2013)



Source: CEIC, Deutsche Bank

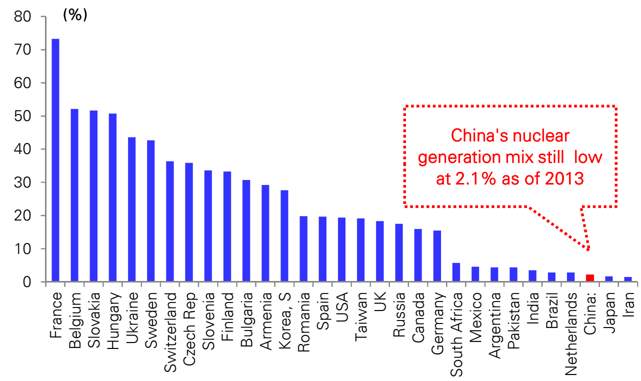
As of end-2014, China has 22 nuclear units in operation, with a total capacity of 19GW, ranking sixth globally. Nevertheless, in terms of power generation mix, nuclear is still underrepresented. In 2013, nuclear accounted for merely 2.1% of China's total power generation, a much lower mix compared with European countries (30-73%), the US (19.7%) and the UK (18.3%) (Figure 42).

Figure 41: Nuclear installed capacity in major countries (2013)



Source: IAEA , Deutsche Bank

Figure 42: Nuclear % of total power generation by country (2013)



Source: WNA, IAEA, Deutsche Bank; Japan's mix lowered to c.2% post Fukushima accident from previous 25-30% during 2003-2011

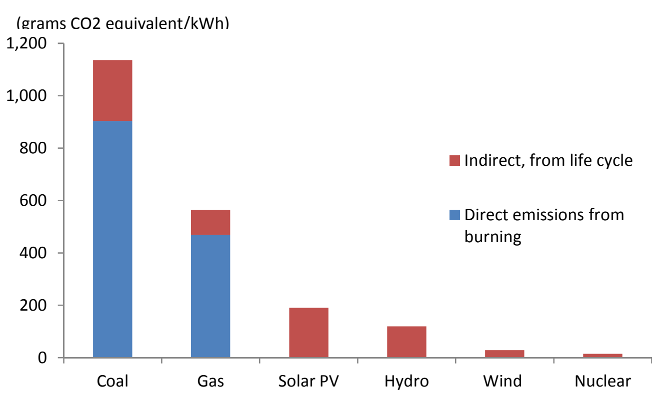
Nuclear – key to reaching China's emission control target

Effective way to bring down carbon emission

Nuclear will play a key role in reducing China's carbon emission, or slowing down the medium-term emission hike. In November 2014, China specified, for the first time, that it would strive for carbon emissions to peak by 2030. Compared with the fossil-fuel power source, nuclear could reduce the life-cycle carbon emission by as much as 97% (Figure 43), according to the assessment carried out by World Nuclear Association (WNA) and the International Atomic Energy Agency (IAEA).

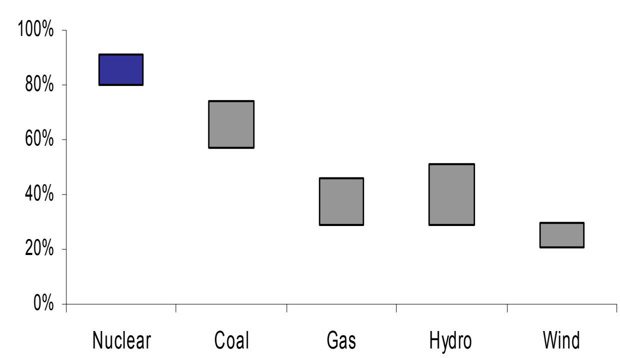
Although the lifecycle carbon emission from renewable energy and nuclear are largely similar, nuclear stands out for its stably high capacity factor to act as a base-load power source while wind/hydro/solar are highly dependent on weather conditions despite their similar environmentally-friendly nature.

Figure 43: Emission comparison



Source: IAEA, Deutsche Bank

Figure 44: Capacity factor comparison



Source: Deutsche Bank

Nuclear target for 2020

The Energy Development Strategic Action Plan (2014-2020) issued by the State Council in November 2014 specified that China's total installed capacity of nuclear power units in operation/under construction should reach 58GW/30GW by 2020, which is in line with the goal set in the Long-term Nuclear Power Development Plan (2011-2020), released in late 2012.

To catch up with the 2020 nuclear capacity target, China needs to approve six units p.a. in 2015-20

As of end-2014, China has 31 GW of nuclear capacity under construction, in addition to the 19GW of capacity in operation. In order to meet the 2020 capacity target for both operation and construction, we believe China is likely to approve an average of six units per year in 2015-20 [(58GW+30GW-19GW-31GW)/6=6.5GW].

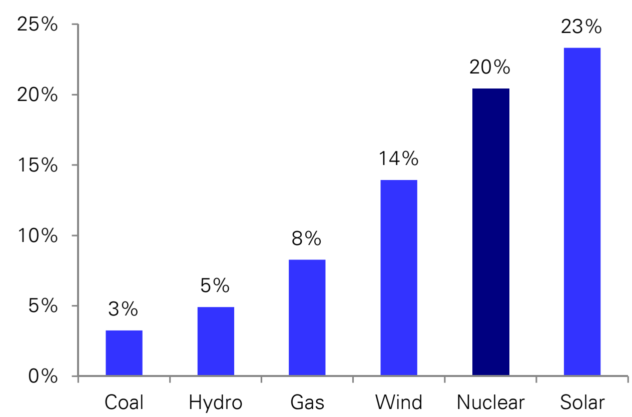
According to media reports, Fuqing Unit 5-6, Hongyanhe Unit 5-6 and Shidaowan Unit 5-6, using the technology of Hualong One, ACPR1000 and CAP1400, respectively, are the most likely to receive approval first. Specifically, Fuqing Unit 5-6 was approved by the National Energy Administration (NEA) on 4 November and will become the first nuclear project to start construction after it gets final approval from the State Council.

Entering into a fast-track growth

Nuclear capacity addition is likely to peak in 2015-17E under current construction progress

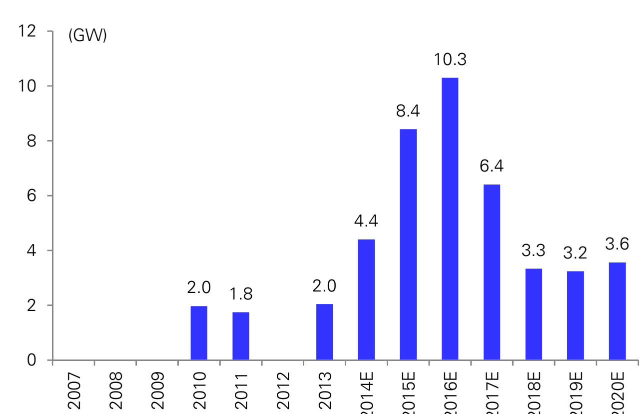
Compared with a 0-2GW p.a. capacity addition in 2007-13, we believe China's nuclear installation is entering into a fast track. Based on the targeted 58GW of targeted nuclear installation set by the government for 2020E, China's nuclear capacity will see a 20% capacity CAGR in 2014-20E, second only to the growth of solar (23%). While the 2019-20E actual capacity would be subject to the project approval in the next six to twelve months, the growth in 2015-17E is visible given the current construction schedule. We forecast a 9.5GW/10.9GW capacity addition in 2015/16, the highest in China's history, and representing c.50% of the 2014E total capacity.

Figure 45: Implied capacity CAGR in 2014-20E by fuel type based on government target



Source: CEIC, Deutsche Bank estimates

Figure 46: China's nuclear capacity addition (2007-20E)



Source: NDRC, Deutsche Bank estimates

Nuclear power economics through lifecycle

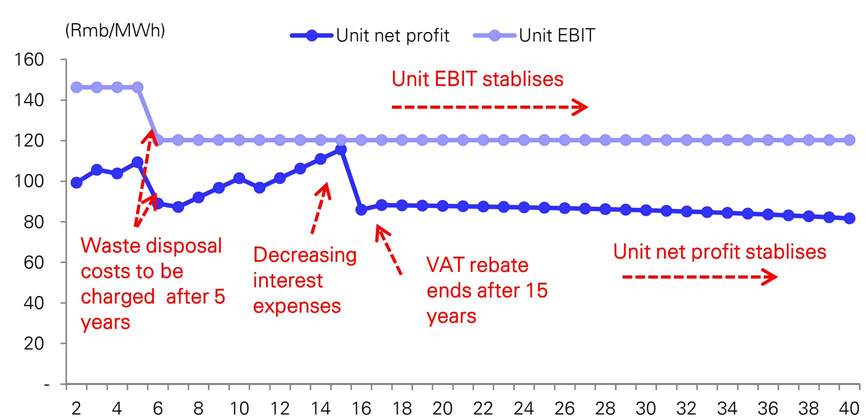
A single generation unit illustration

In this section, we illustrate the revenue, cost, provisions, tax and profit evolution of a typical GII+ nuclear unit in China over years of operation.

With limited fluctuations in either utilization hours or fuel costs, nuclear power-generating units should be capable of offering a sustainable high unit profit, at Rmb80-120/MWh, over its 40-year lifetime There will be minor variations during year 1-15, as show in Figure 47:.

- Profit to retreat slightly in year four, due to expiry of zero corporate income tax for the first three years of operation
- Profit to fall in year six as waste disposal cost needs to be charged after five years of operation
- Profit to rise gradually from year six to year 15, with decreasing interest expense given average loan tenure of 15 years
- Profit to drop again in year 16, as the preferential VAT rebate ends after 15 years of operations
- Profit to stabilize from year 16 onwards. We expect the unit net profit of a nuclear unit to stabilize at Rmb80-90/MWh (or a net margin of 22-24%).

Figure 47: Single unit illustration – unit profit evolution (Rmb/MWh)



Source: Deutsche Bank estimates

Figure 48: Single unit illustration – return over lifecycle

Key assumptions		Comment			Comment
Installed capacity (MW)	1,000		Depreciation years	40	Depreciated based on the "units of production method"
Months to construct	54	Generally 50-60 months of construction	Labour cost (Rmb/kW)	370	Based on the historical average of CGN
Implied operation start year	5		Waste disposal (Rmb/MWh)	26	Per China regulation, Rmb26/MWh after five years
Investment (Rmbm)	12,500		Debt repayment years	15	Repayment in 10-20 years
% of debt	80%		Interest rate	6.50%	
Life span (years)	40		Business Tax % of revenue	1.6%	Based on the historical average of CGN
Utilization hours	7,200	Conservative vs. China avg. nuclear utilization of c.7,800 hours	Fuel cost % of revenue	16.5%	Based on the historical average of CGN
Plant usage	6.0%	Based on the historical average of CGN	SG&A % of revenue	6.5%	Based on the historical average of CGN
Benchmark tariff (Incl. VAT, Rmb/MWh)	430	Per China regulation	Other costs % of revenue	8.0%	Maintainence cost etc
VAT	17%	Per China regulation	Decommission provision	10%	As per government regulation
			Decommission discount rate	6.55%	

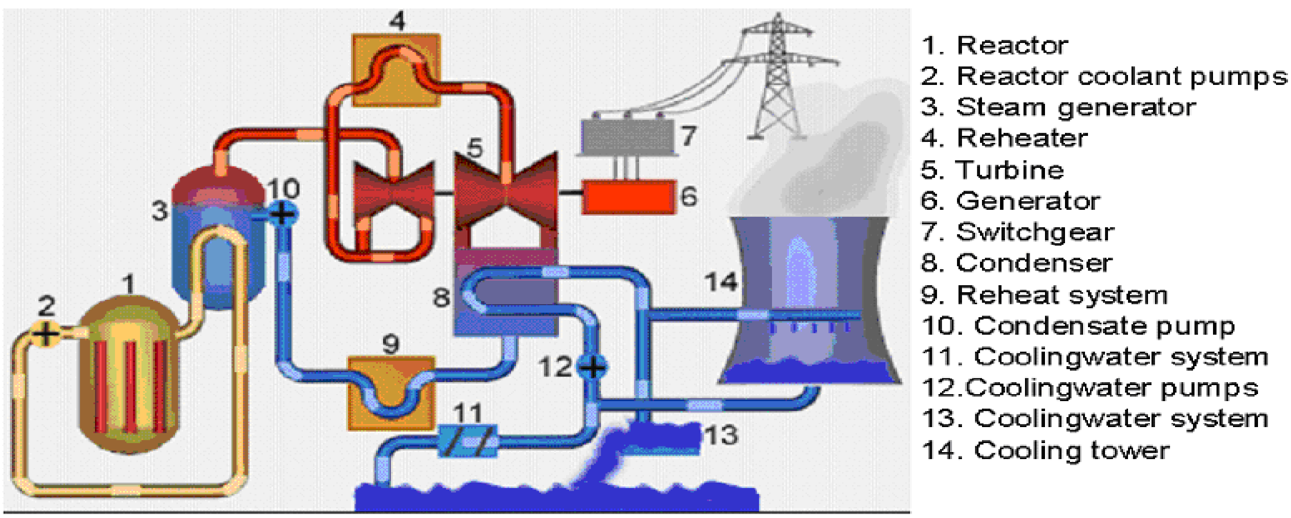
Year	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	....	30	31	.....	40
Operating metrics																									
Effective capacity (MW)	-	-	-	-	500	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000		1,000	1,000		1,000
Utilization hours	-	-	-	-	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200		7,200	7,200		7,200
Net power generation (bn kWh)	-	-	-	-	3.4	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8		6.8	6.8		6.8
Financials (Rmb m)																									
Revenue (net VAT)	**-**	**-**	**-**	**-**	**1,244**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**	**2,487**		**2,487**	**2,487**		**2,487**
Business Tax and Surcharges	-	-	-	-	(20)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)	(40)		(40)	(40)		(40)
Fuel costs	-	-	-	-	(205)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)	(410)		(410)	(410)		(410)
Depreciation	-	-	-	-	(158)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)	(316)		(316)	(316)		(316)
Labor cost	-	-	-	-	(185)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)	(370)		(370)	(370)		(370)
Waste disposal	-	-	-	-	-	-	-	-	-	(176)	(176)	(176)	(176)	(176)	(176)	(176)	(176)	(176)	(176)	(176)		(176)	(176)		(176)
SG&A	-	-	-	-	(81)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)	(162)		(162)	(162)		(162)
Others	-	-	-	-	(99)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)	(199)		(199)	(199)		(199)
EBIT	**-**	**-**	**-**	**-**	**495**	**990**	**990**	**990**	**990**	**814**	**814**	**814**	**814**	**814**	**814**	**814**	**814**	**814**	**814**	**814**		**814**	**814**		**814**
Finance costs	-	-	-	-	(313)	(635)	(592)	(549)	(507)	(464)	(421)	(378)	(336)	(293)	(251)	(208)	(166)	(123)	(81)	(38)		(41)	(43)		(77)
VAT rebate	-	-	-	-	159	317	317	317	317	296	296	296	296	296	233	233	233	233	233	-		-	-		-
VAT rebate rate	-	-	-	-	75.0%	75.0%	75.0%	75.0%	75.0%	70.0%	70.0%	70.0%	70.0%	70.0%	55.0%	55.0%	55.0%	55.0%	55.0%	-		-	-		-
Pre-tax profit	**-**	**-**	**-**	**-**	**340**	**672**	**715**	**758**	**801**	**646**	**689**	**732**	**774**	**817**	**796**	**839**	**881**	**924**	**966**	**776**		**773**	**771**		**737**
Income tax	-	-	-	-	-	-	-	(55)	(60)	(44)	(98)	(109)	(120)	(130)	(141)	(152)	(162)	(173)	(183)	(194)		(193)	(193)		(184)
Tax rate	-	-	-	-	-	-	-	12.5%	12.5%	12.5%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%		25.0%	25.0%		25.0%
Net profit	**-**	**-**	**-**	**-**	**340**	**672**	**715**	**703**	**740**	**602**	**591**	**623**	**655**	**687**	**655**	**687**	**719**	**751**	**783**	**582**		**580**	**578**		**553**
B/S - decommission provision				(99)	(105)	(112)	(120)	(127)	(136)	(145)	(154)	(164)	(175)	(186)	(199)	(212)	(225)	(240)	(256)	(273)		(663)	(706)		(1,250)
Decomission int exp.					(6)	(7)	(7)	(8)	(8)	(9)	(9)	(10)	(11)	(11)	(12)	(13)	(14)	(15)	(16)	(17)		(41)	(43)		(77)
Margin and costs analysis																									
EBIT margin	-	-	-	-	39.8%	39.8%	39.8%	39.8%	39.8%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%		32.7%	32.7%		32.7%
Net profit margin	-	-	-	-	27.4%	27.0%	28.7%	28.2%	29.8%	24.2%	23.7%	25.0%	26.3%	27.6%	26.3%	27.6%	28.9%	30.2%	31.5%	23.4%		23.3%	23.2%		22.2%
EBIT/kWh	-	-	-	-	146	146	146	146	146	120	120	120	120	120	120	120	120	120	120	120		120	120		120
Net profit/kWh	-	-	-	-	101	99	106	104	109	89	87	92	97	101	97	102	106	111	116	86		86	85		82
Project return																									
Total capex	2,778	2,778	2,778	2,778	1,389	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-
Equity injection	556	556	556	556	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-
Debt balance - bgn	-	2,222	4,444	6,667	8,889	10,000	9,333	8,667	8,000	7,333	6,667	6,000	5,333	4,667	4,000	3,333	2,667	2,000	1,333	667		-	-		-
New borrowing	2,222	2,222	2,222	2,222	1,111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-		-
Debt repayment	-	-	-	-	-	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)	(667)		-	-		-
Debt balance - end	2,222	4,444	6,667	8,889	10,000	9,333	8,667	8,000	7,333	6,667	6,000	5,333	4,667	4,000	3,333	2,667	2,000	1,333	667	-		-	-		-
Pre-tax cash flow for distribution	-	-	-	-	812	1,624	1,624	1,624	1,624	1,427	1,427	1,427	1,427	1,427	1,363	1,363	1,363	1,363	1,363	1,131		1,131	1,131		1,131
Cash tax payment	-	-	-	-	-	-	-	(55)	(60)	(44)	(98)	(109)	(120)	(130)	(141)	(152)	(162)	(173)	(183)	(194)		(193)	(193)		(184)
Free cash flow to firm (FCFF)	(2,778)	(2,778)	(2,778)	(2,778)	(577)	1,624	1,624	1,569	1,563	1,383	1,328	1,318	1,307	1,296	1,222	1,212	1,201	1,190	1,180	937		937	938		946
Free cash flow to equity (FCFE)	(556)	(556)	(556)	(556)	221	322	365	352	390	252	240	273	305	337	305	337	369	401	432	232		896	894		869
Project IRR	**8.6%**																								
Equity IRR	**13.9%**																								

Source: Deutsche Bank estimates

Key nuclear power plant equipment

A typical nuclear power plant has more than 300 different systems with thousands of types of equipment, which can be divided largely into three categories: Nuclear Island, Conventional Island and Balance of Plant (BOP). Nuclear Island equipment has several major sub-categories: steam generators, reactor cores, coolant pumps, main lines and valves. Conventional Island includes turbines, turbine generators and other accessories. In Figure 49, we illustrate the simple schematic chart of a PWR nuclear power plant.

Figure 49: Simple schematic chart of PWR NPP (courtesy of Areva)



Source: Deutsche Bank, Areva

Key nuclear island equipment

Steam Generator

A Steam Generator (SG) is used for transferring heat carried by a coolant from the reactor to the second circle of the water system, which gives power to the turbine generator. A nuclear reactor is accompanied by two to four sets of SG. Each SG costs around Rmb150-200m (product weight: 300-420 tons), which represents around 8% of the total nuclear power equipment costs. Major materials used are steel-related.

Reactor Pressure Vessel

The Reactor Pressure Vessel (RPV) is used to hold the radioactive material during the nuclear reaction. It contains the coolant and reactor core. Each nuclear reactor needs one RPV with a unit price of c. Rmb150-200m (weight: 330-460 tons), which represents around 3% of the total nuclear power equipment costs. Major materials used are steel-related, which account for roughly 70% of cost of goods, according to industry sources.

Reactor vessel internal and Control rod drive mechanism

Reactor vessel internal (RVI) is used to hold hundreds of fuel assemblies in which nuclear action fuel – uranium – is placed. Control rod drive mechanism (CRDM) is functioned to drive the control rods. Control rod is filled with substance materials such as hafnium or cadmium in order to capture neutrons. Each nuclear reactor needs one set of reactor internals and one set of rod drives. RVI's price is approximately Rmb180m per set (weight: 160-230 tons) and CRDM costs around Rmb120m per set, which collectively account for 5% of total equipment costs.

Reactor coolant pump

Reactor coolant pump (RCP), the heart of the nuclear reactor, is used to maintain the circling of the coolant between the reactor and the steam generator. Since nuclear internal water should not leak out, RCP has a critical requirement to work continually. A nuclear reactor has four sets of coolant pumps, including one for back-up. The price is around Rmb50~60m per set (weight: 70~120 tons), which collectively represents 4% of total equipment cost.

Figure 50: Equipment value breakdown for a 1,000MW GII+ nuclear unit

Items	% value total	No. of Unit	Rmb m per unit	Value (Rmbm)	% of equip. cost
>Equipment Total	52.00%			6,500	100%
>>Nuclear island	23.80%			2,980	46%
>>>Steam Generator	4.10%	3	170	510	8%
>>>Pressurizer	0.40%	1	50	50	1%
>>>Tanks (Boron Injection, safety injection)	0.40%			50	1%
>>>Reactor pressure vessel/Containment vessel	5.60%	1	700	700	11%
>>>Control rod drive mechanism	1.00%	1	120	120	2%
>>>Reactor vessel internals	1.40%	1	180	180	3%
>>>Reactor coolant pumps	1.90%	4	60	240	4%
>>>Main lines	0.60%	1	80	80	1%
>>>Nuclear Valve	2.80%	-	-	350	5%
>>>Fuel transportation system	0.80%			100	2%
>>> Others (Pipes/Heat exchanger, etc)	4.80%			600	9%
>>Conversional island	16.20%			2,020	31%
>>>Turbine	3.80%	1	480	480	7%
>>>Generator	2.90%	1	360	360	6%
>>>MSR	1.90%	2	120	240	4%
>>>Motors	1.20%			150	
>>>Others (Condenser/Heater/Pipes/Pumps/Valves, etc)	6.30%	-	-	790	12%
>>Auxiliary items	12.00%	-	-	1,500	23%

Source: Deutsche Bank, Dongfang Electric, Shanghai Electric, Harbin Electric, China First Heavy, various press reports

Appendix A: provincial power demand/supply forecast

New nuclear projects concentrated in Guangdong, Fujian and Liaoning

In 2014-17, we expect a total of 29.5GW new nuclear projects to be added in China. Among this, 64% will be added in three provinces – Guangdong (27%), Fujian (26%) and Liaoning (11%). As a result, nuclear power output will likely represent 15-25%-of total provincial output. Hence, the power demand and supply forecast is important to estimate the nuclear power utilization risk, even if it is essentially regarded as a base-load plant.

Guangdong province

- **Inter-provincial transmission**: In 11M14, Guangdong suffered a 7.5% drop in thermal utilization, squeezed mainly by the substantial increase of power imports from Yunnan upon the operation start of the Xiluodu-Guangdong EHV line. However, we expect power import volumes to remain relatively stable through 2017, as the next major transmission line, Northwest Yunnan – Guangdong UHV, is planned to commence operation at end-2017.
- **Capacity:** We expect 9.1%/7.8%/6.4% total capacity growth (year-end) in 2015/16/17. Among the total capacity addition of 22GW during the three years, 59%, or 12.9GW, will be contributed by thermal (including coal-fired and gas-fired, based on the NDRC project approval and current construction progress), 6.7GW will come from nuclear (Yangjiang and Taishan), while the remaining 2.4GW will come from wind.
- **Power demand**: Guangdong recorded good power demand growth of 8.7% yoy in 11M14, and we continue to expect 7% demand growth p.a. during 2015-17.
- **Conclusion**: By assuming 7,500hrs of nuclear utilization and treating coal as a plug-in, we believe Guangdong's coal utilization will remain above 5,000hrs. However, the result is sensitive to the power demand growth assumption – by assuming 5.0% demand growth p.a. instead, thermal utilization will drop to 4,455hrs by 2017E.

Not much pressure for nuclear peak-shaving in Guangdong if demand growth stays at 7% p.a.

Fujian province

- **Capacity:** We expect a 8.6%/7.6%/5.5% total capacity growth (year-end) in 2015/16/17, respectively. Among the total capacity addition of 10GW during the three years, 32% or 3.3GW will be contributed by thermal; 5.4GW will come from nuclear (Fuqing and Ningde) while the remaining 1.6GW will come from wind and hydro.

- In view of the substantial incoming nuclear new capacity, we see NDRC as cautious in approving new thermal projects. Currently, the only approved project under construction is Shenhua Luoyuan Bay (2x1,000MW), which we expect to start operation in 2015-16. Nevertheless, we also factored in the potential projects including Huadian Fuxin Shaowu Expansion (2x660MW) and Huaneng Luoyuan (2x600MW) and assumed operation start in 2017E for one unit for both projects.
- **Power demand**: Fujian also achieved robust 11M14 power demand growth at 9.3% yoy, and we expect this will slightly normalize to 7% p.a. during 2015-17E.
- **Inter-provincial transmission**: North Zhejiang-Fuzhou UHV, which transmits electricity from Fujian to Zhejiang, is scheduled to start operation in March 2015. By November 2014, three of the critical transmission sites have entered commissioning phase. Upon completion, the UHV line will increase Fujian's power transmission capacity by 6,800MW on top of the current 1,700MW and digest the rising power supply. Nevertheless, as Zhejiang's supply shortage has been eased by import from Xiluodu, we do not expect a high utilization for the Zhejiang-Fuzhou UHV line. By assuming a relatively low 3,500 hours of utilization, we expect Zhejiang will consume c.12% of Fujian's power supply from 2016E and partially relieve the over-supply concern in Fujian.
- **Conclusion**: by assuming 7,500hrs of nuclear utilization and treating coal as a plug-in, we calculated that Fujian's coal utilization will remain above 5,300hrs in 2015-16 but will see a likely 4.7% decline in 2017E. A 1% drop in the annual power demand growth (i.e. 6% in 2015-17E) will further bring down the 2017E coal utilization to 4,835hrs.

Coal utilization faces downward pressure from 2017E, but still tolerable

Liaoning

- **Capacity:** We expect 8.7%/3.3%/1.7% total capacity growth (year-end) in 2015/16/17, respectively. Among the total capacity addition of 6.0GW during the three years, 23% or 1.4GW will be contributed by thermal; 2.2GW will come from nuclear (Hongyanhe) while the remaining 2.4GW will come from wind.
- **Power demand**: In 11M14, power demand growth in Liaoning is relatively weak at 1.8% yoy. We expect the growth rate will slightly improve to 3.0% p.a. in 2015-17E along with the nationwide demand recovery.
- **Inter-provincial transmission**: Due to a lack of major planned transmission lines, we expect the power import/export volume to remain stable.
- **Conclusion**: With the sequential commissioning of nuclear units and a quick wind capacity addition, Liaoning will likely suffer from a severe power oversupply in the next few years. In 9M14, Hongyanhe Unit 1 recorded only 4,194hrs of utilization, indicating full-year utilization of below 6,400hr. Even assuming 6,500hrs of nuclear utilization and treating coal as a plug-in, coal utilization will still face a significant drop to 4,000-4,200hrs in 2015-17E.

Severe over-supply in Liaoning might lead to a nuclear utilization of as low as 6,500hrs

Guangxi

- **Capacity:** In 2015/16/17, we estimate that the total installed capacity in Guangxi will increase by 10.2%/12.1%/4.5% . Among the total capacity addition of 9.4GW during the three years, 71%, or 6.6GW, will come from coal-fired units, including 1) Luzhai co-generation (2x300MW, approved), 2) Shenhua Beihai (2x1000MW, approved), 3) Fangchenggang Thermal Phase II (2x660MW, approved), 4) Qinzhou Phase II (2x1000MW, approved), and 5) Guiguan Heshan Unit 2 (600MW, likely to be approved soon). Nuclear will contribute 2.2GW, or 23%, of new capacity, as we expect Fangchenggang Nuclear to start operation in October 2015 and October 2016.
- **Power demand**: In 11M14, power demand growth in Guangxi reached 5.7% yoy, and we expect the growth to remain at c.6.0% p.a. during 2015-17, slightly higher than the national average.
- **Inter-provincial transmission**: In June 2014, Guangxi signed a framework agreement with Yunnan Province and China Southern Grid to start power imports from Yunnan from end-2015, and gradually ramp up the annual import volume to 13bn kWh and import capacity to 3GW. Given the relatively sufficient power supply in 2016/17E, we assume a conservative 9.5bn kWh and 11.0bn kWh of net imports.
- **Conclusion**: The high hydro generation mix (47% in 11M14) of Guangxi increases the volatility in thermal utilization. Considering the exceptionally good water flow conditions in 2014 (hydro utilization was up by 31% yoy in 11M14), we assume a normalized 2,800hrs of utilization during 2015-17. Nevertheless, the power oversupply still looks severe in 2016-17E, with substantial thermal new capacity to come online. We forecast that thermal utilization is likely to fall to only 3,602hrs in 2017, suggesting that it could be a challenge for nuclear to maintain above 7,000hrs. In addition to pressure from a thermal utilization collapse, in a year of better-than-expected water flow, it is likely that nuclear utilization will be further squeezed, given the priority dispatch of hydro over nuclear.

Guangxi will encounter significant power supply with the quick ramp-up in thermal capacity; hydro is likely to squeeze nuclear utilization to below 7,000hrs

Figure 51: Power demand and supply analysis – Guangdong Province

End year capacity (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	45,534	47,201	51,839	52,539	55,739	58,739	61,739
Gas	10,856	10,856	10,856	12,537	15,456	16,256	16,256
Nuclear	6,108	6,108	6,108	7,188	8,268	11,098	13,928
Hydro	12,950	13,032	13,080	13,080	13,080	13,080	13,080
Wind			1,707	2,507	3,307	4,107	4,907
Total	76,310	77,958	83,531	87,851	95,850	103,280	109,910

New capacity addition (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	3,460	1,668	4,638	700	3,200	3,000	3,000
Gas	0	0	0	1,681	2,919	800	0
Nuclear	1,080	0	0	1,080	1,080	2,830	2,830
Hydro		82	48	0	0	0	0
Wind		0	1,707	800	800	800	800

Power demand (bn KWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Power consumption	439.9	461.9	483.0	516.8	553.0	591.7	633.1
% yoy change		*5.0%*	*4.6%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*
Power import	116.2	81.7	106.6	137.6	156.2	156.2	156.2
% yoy change		*-29.7%*	*30.5%*	*29.1%*	*13.5%*	*0.0%*	*0.0%*
% of total consumption		*17.7%*	*22.1%*	*26.6%*	*28.3%*	*26.4%*	*24.7%*

Power generation (bn kWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	268.1	253.5	274.1	266.7	269.8	285.3	303.2
Gas	32.6	32.6	32.6	35.1	42.0	47.6	48.8
Nuclear	42.5	47.4	46.4	52.0	58.0	74.0	90.2
Hydro	14.9	20.3	21.6	21.6	21.6	21.6	26.2
Wind				3.8	5.4	7.0	8.6
Total	323.7	380.2	376.4	379.2	396.8	435.5	476.9
Generation mix %							
Coal	*83%*	*67%*	*73%*	*70%*	*68%*	*66%*	*64%*
Gas	*10%*	*9%*	*9%*	*9%*	*11%*	*11%*	*10%*
Nuclear	*13%*	*12%*	*12%*	*14%*	*15%*	*17%*	*19%*
Hydro	*5%*	*5%*	*6%*	*6%*	*5%*	*5%*	*5%*
Wind	-	-	-	*1%*	*1%*	*2%*	*2%*

Utilisation hours	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	6,121	5,467	5,535	5,110	4,984	4,985	5,033
Gas	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Nuclear	7,789	7,767	7,604	7,500	7,500	7,500	7,500
Hydro	1,498	1,703	2,645	2,000	2,000	2,000	2,000
Wind				2,000	2,000	2,000	2,000

Source: CEIC, NDRC, Deutsche Bank estimates

Figure 52: Power demand and supply analysis – Fujian Province

End year capacity (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	21,240	22,400	22,660	22,660	23,410	24,660	25,920
Gas	3,860	3,860	3,860	3,860	3,860	3,860	3,860
Nuclear	0	0	1,089	3,258	5,427	7,596	8,676
Hydro	11,250	11,380	12,250	12,350	12,450	12,550	12,650
Wind	1,030	1,133	1,462	1,981	2,500	2,900	3,300
Total	37,170	38,850	41,330	44,209	47,747	51,666	54,506

New capacity addition (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	2,220	1,160	260	0	750	1,250	1,260
Gas	0	0	0	0	0	0	0
Nuclear	0	0	1,089	2,169	2,169	2,169	1,080
Hydro	150	130	870	100	100	100	100
Wind	300	103	329	519	519	400	400

Power demand (bn KWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Fujian power consumption	152.0	157.9	170.1	183.7	194.7	206.4	218.8
% yoy change	*15.6%*	*3.9%*	*7.7%*	*8.0%*	*6.0%*	*6.0%*	*6.0%*
Power exports to Zhejiang	5.7	4.0	8.3	10.0	14.2	25.5	29.8
Export capacity (MW)			1,700	1,700	8,500	8,500	8,500
Export capacity (time-weighted, MW)			1,700	1,700	5,667	8,500	8,500
Utilisation hours			4,898	5,882	2,500	3,000	3,500
Export % of Fujian's total output	4%	2%	5%	5%	7%	11%	12%
							12.0%

Power generation (bn kWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	115.7	97.8	115.1	121.0	117.4	120.6	122.3
Gas	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Nuclear	0.0	0.0	5.8	14.2	31.2	49.5	63.0
Hydro	28.5	47.6	38.8	40.6	40.9	41.3	41.6
Wind	2.3	2.8	3.6	4.6	6.0	7.3	8.4
Total	158.0	162.3	176.5	193.7	208.9	231.9	248.5
Generation mix %							
Coal	*73%*	*60%*	*65%*	*62%*	*56%*	*52%*	*49%*
Gas	*7%*	*7%*	*7%*	*6%*	*6%*	*5%*	*5%*
Nuclear	-	-	*3%*	*7%*	*15%*	*21%*	*25%*
Hydro	*18%*	*29%*	*22%*	*21%*	*20%*	*18%*	*17%*
Wind and others	*1%*	*2%*	*2%*	*2%*	*3%*	*3%*	*3%*

Utilisation hours	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	5,747	4,483	5,107	5,340	5,182	5,152	4,958
% yoy change		*-22%*	*14%*	*4.6%*	*-3.0%*	*-0.6%*	*-3.8%*
Gas	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Nuclear			7,500	7,500	7,500	7,500	7,500
Hydro	2,505	4,185	3,263	3,300	3,300	3,300	3,300
Wind		2,803	2,738	2,700	2,700	2,700	2,700

Source: CEIC, Fujian NDRC, Fujian NEA, Deutsche Bank estimates

Figure 53: Power demand and supply analysis – Liaoning Province

End year capacity (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Thermal	28,520	30,657	30,275	30,975	31,675	32,375	32,375
Nuclear			1,080	2,160	4,320	4,320	4,320
Hydro	1,470	2,874	2,725	2,725	2,725	2,725	2,725
Wind	3,813	4,710	5,634	6,434	7,234	8,034	8,834
Total	34,010	38,443	39,657	42,294	45,954	47,454	48,254

New capacity addition (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	800	2,137	(382)	700	700	700	0
Nuclear	0	0	1,080	1,080	2,160	0	0
Hydro	1,470	1,404	(149)	0	0	0	0
Wind		898	924	800	800	800	800
Total	1,730	4,433	1,215	2,637	3,660	1,500	800

Power demand (bn KWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Power consumption	186.2	190.0	200.8	205.9	212.0	218.4	225.0
% yoy change		*2%*	*6%*	*2.5%*	*3.0%*	*3.0%*	*3.0%*
Power import			43.6	43.6	43.6	43.6	43.6

Power generation (bn kWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	126.2	128.2	133.5	136.3	130.4	128.1	133.1
Nuclear			5.0	10.5	21.1	28.1	28.1
Hydro	3.2	3.8	3.8	3.8	3.8	3.8	3.8
Wind	6.7	7.9	10.0	11.7	13.3	14.9	16.5
Total	137.0	144.1	151.6	162.3	168.5	174.8	181.4
Generation mix %							
Coal			*88%*	*84%*	*77%*	*73%*	*73%*
Nuclear			*3%*	*6%*	*13%*	*16%*	*15%*
Hydro			*2%*	*2%*	*2%*	*2%*	*2%*
Wind			*7%*	*7%*	*8%*	*9%*	*9%*

Utilisation hours	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	4,797	4,558	4,353	4,451	4,162	4,000	4,110
% yoy change		*-5%*	*-5%*	*2.3%*	*-6.5%*	*-3.9%*	*2.7%*
Nuclear			7,813	6,500	6,500	6,500	6,500
Hydro	2,818	2,993	2,901	2,900	2,900	2,900	2,900
Wind		1,761	1,923	2,000	2,000	2,000	2,000

Source: CEIC, NDRC, Deutsche Bank estimates

Figure 54: Power demand and supply analysis – Guangxi Province

End year capacity (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Thermal	11,850	14,848	15,625	15,625	17,625	20,645	22,245
Nuclear				0	1,080	2,160	2,160
Hydro	15,000	15,126	15,825	16,225	16,225	16,225	16,225
Wind	61	100	125	325	525	725	925
Total	26,900	30,073	31,860	32,175	35,455	39,755	41,555

New capacity addition (MW)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	1,531	2,998	778	0	2,000	3,020	1,600
Nuclear	0	0	0	0	1,080	1,080	0
Hydro	15,000	126	699	400	0	0	0
Wind		39	25	200	200	200	200
Total	1,750	3,173	1,787	315	3,280	4,300	1,800

Power demand (bn KWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Power consumption	111.2	115.3	123.8	130.0	137.8	146.0	154.8
% yoy change		*3.7%*	*7.3%*	*5.0%*	*6.0%*	*6.0%*	*6.0%*
Power import	9.8	2.0	3.9	6.5	8.0	9.5	11.0

Power generation (bn kWh)	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	62.3	63.0	76.9	65.1	82.8	81.6	82.8
Nuclear				0.0	1.9	9.4	15.1
Hydro	39.0	48.2	42.8	58.0	44.3	44.3	44.3
Wind	0.0	0.0	0.2	0.3	0.7	1.1	1.5
Total	101.4	113.3	119.9	123.5	129.8	136.5	143.8
Generation mix %							
Coal			*64%*	*53%*	*64%*	*60%*	*58%*
Nuclear			-	-	*1%*	*7%*	*11%*
Hydro			*36%*	*47%*	*34%*	*32%*	*31%*
Wind			*0%*	*0%*	*1%*	*1%*	*1%*

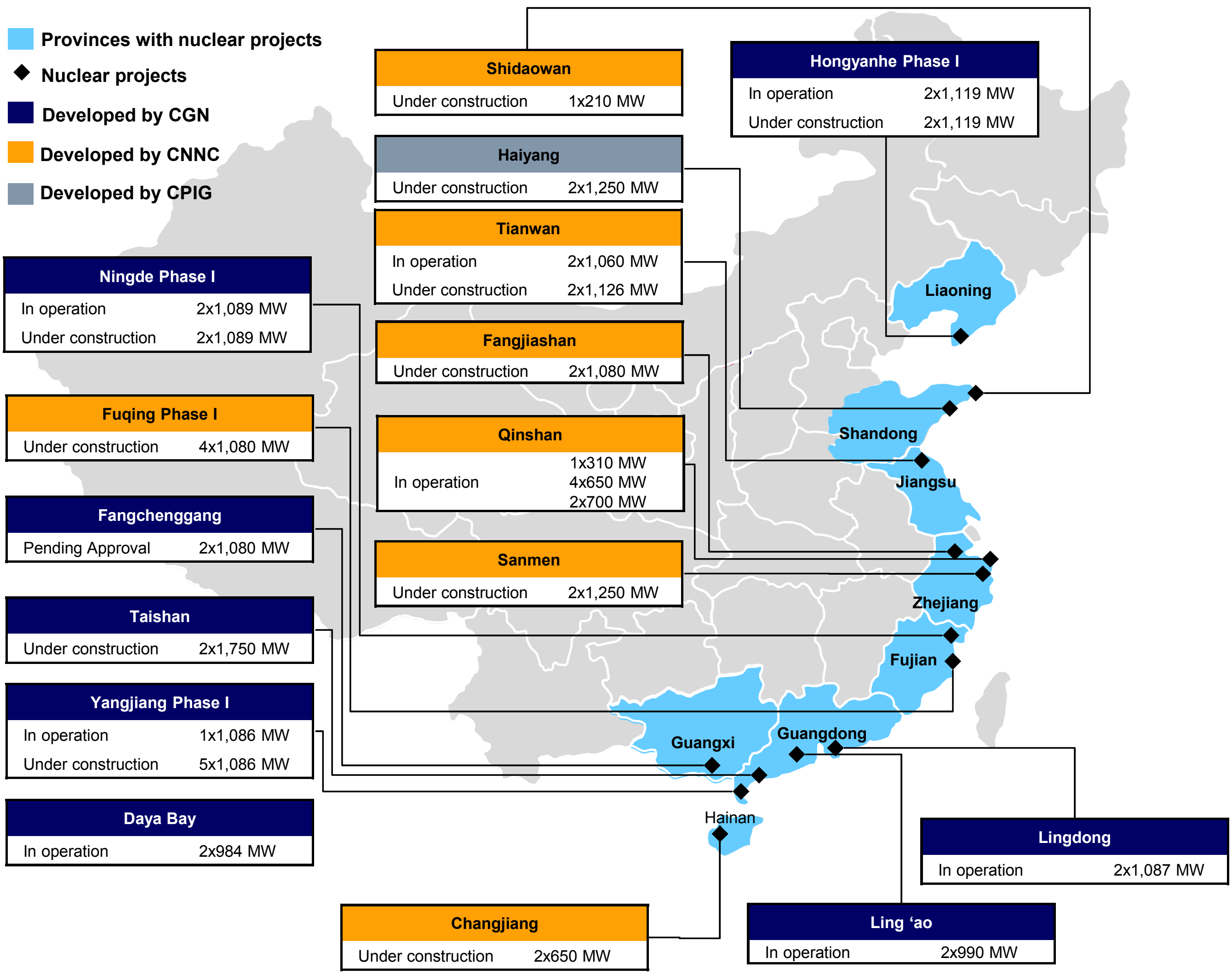
Utilisation hours	2011	2012	2013	2014E	2015E	2016E	2017E
Coal	5,915	4,808	4,729	4,164	4,981	4,094	3,602
% yoy change		*-19%*	*-2%*	*-11.9%*	*19.6%*	*-17.8%*	*-12.0%*
Nuclear				7,000	7,000	7,000	7,000
Hydro	2,783	3,389	2,836	3,715	2,800	2,800	2,800
Wind				2,000	2,000	2,000	2,000

Source: CEIC, NDRC, Deutsche Bank estimates

Appendix B: snapshot of China's nuclear units

China nuclear map

Figure 55: China's nuclear projects in operation and under construction (December 2014)



Source: NDRC, Deutsche Bank

CGNPC

Daya Bay Nuclear Power Station

Daya Bay Nuclear, located at CGN's Daya Bay base in Guangdong Province, has installed capacity of 1,968MW (2x984MW units, M310 technology). With the first unit being commissioned on 1 February 1994, it is the earliest power station to begin commercial operations in China. Daya Bay Nuclear is held by GNIC (75%), a subsidiary of CGN and HKNIC (25%), a subsidiary of CLP Holdings.

Ling'ao Nuclear Power Station

Ling'ao Nuclear Power Station, also located at Daya Bay base, has installed capacity of 1,980MW (2x 990MW ,M310 technology). Units 1 and 2 start operation in May 2002 and January 2003, respectively. Ling'ao Nuclear is held by CGN (70%) and GNIC (30%); CGN has an effective interest of 100%.

Lingdong Nuclear Power Station

Lingdong Nuclear, also located at the Daya Bay base, is the phase II project of Ling'ao Nuclear. It has installed capacity of 2,174MW (2x 1,087MW, CPR1000 technology) and marks China's first station of self-developed GW-level CPR1000 technology. Units 1 and 2 start operation in September 2010 and August 2011, respectively. Lingdong Nuclear is held by CGN investment (40%), GNIC (30%) and CGN (25%); CGN has an effective interest of 93.2%.

Yangjiang Nuclear Power Station

Yangjiang Nuclear is located in Yangjiang city, Guangdong province, and plans 6x 1,086MW units. Units 1-4 will apply CRP1000 technology, while Unit 5-6 will apply ACPR1000 technology. Unit 1 starts operation in March 2014, while the remaining five units are still under construction. Yangjiang Nuclear is held by CGN (46%), GNIC (30%), Guangdong Yuedean Group (17%) and CGN Fund Phase I (7%); CGN has an effective interest of 78.2%.

Ningde Nuclear Power Station

Located in Fuding City, Fujian Province, Ningde Nuclear plans to build 6x GW-level units. Phase I has 4x1,089MW units featuring CPR1000 technology. Units 1 and 2 started operation in April 2013 and May 2014, respectively, while Units 3-4 are still under construction. Ningde Nuclear is held by Ningde Investment (46%), Datang Power (44%) and Fujian Energy Group (10%); CGN has an effective interest of 33.3%.

Hongyanhe Nuclear Power Station

Hongyanhe Nuclear, located in Dalian, Liaoning Province, is the first nuclear power station built in Northeastern China. Hongyanhe Nuclear plans 6x 1000MWe-class units, of which Phase I will build 4x1,119MW units featuring CPR1000 technology. Units 1 and 2 start operation in June 2013 and May 2014, respectively, while Units 3-4 are currently under construction. Phase II (Unit 5-6) will use ACPR1000 technology and will be among the six units that are most likely to get the first batch of approval to start construction in 2015. Hongyanhe Nuclear is held by CGN (45%), CPI Group (45%) and Dalian Construction Investment Group (10%).

Taishan Nuclear Power Station

Taishan Nuclear, located in Taishan City of Guangdong Province, is planned with four PWR units. Phase I, featuring the EPR technology (GIII), will have 2x1750MW units, the largest single-unit capacity around the globe. Both units are currently under construction. Currently, Taishan Nuclear is held by CGN (10%), Taishan Investment (47.5%), EDF (30%) and CGNPC (12.5%); Taishan Investment is held by CGNPC (60%) and Guangdong Yuedean Group (40%).

Fangchenggang Nuclear Power Station

Fangchenggang Nuclear, located in Guangxi Province, is planned with 6x 1000MWe-class PWR units. Phase I has 2x1,080MW units featuring CPR1000 units, which are both under construction currently. Fangchenggang Nuclear is held by CGNPC (61%) and Guangxi Investment Group (39%).

Lufeng Nuclear Power Station

Lufeng Nuclear will be the fourth nuclear power base of CGNPC in Guangdong, after Daya Bay (including Daya Bay, Ling'ao and Lingdong), Yangjiang and Taishan. It is planned that six units will be built in total. In March 2003, Lufeng Nuclear received preliminary approval from NDRC for its Phase I project to build 2 AP1000 units, with a total investment of Rmb37.4bn.. As of end-2014, the project is still pending the final approval to start construction. CGNPC is the controlling shareholder of the project.

Xianning Nuclear Power Station

Xianning Nuclear, located in the Hubei province, is among China's first batch of inland nuclear projects. Xianning Nuclear Phase I will have two units featuring the AP1000 technology, and CGNPC will be the controlling shareholder. The project is still pending approval from NDRC to start construction.

CNNC

Qinshan Nuclear Power Station

Qinshan Nuclear, located at Haiyan County, Zhejiang Province, was the first domestically designed and built nuclear power plant in China. The power station was constructed in three phases in total, and the total capacity of Qinshan-I, Qinshan-II and Qinshan-III is 310MW, 4x650MW and 2x700MW, respectively. Qinshan-I started construction in March 1985 and commenced operation in April 1994. The four units of Qinshan-II commenced operation in April 2002, May 2004, October 2010 and December 2011, respectively, while the two units of Qinshan-III commenced operation in December 2002 and July 2003.

Qinshan-I is fully held by CNNC; Qinshan-II is held by CNNC (50%), Zhejiang Electric Power (20%), Shenergy (12%), Guoxin Investment (10%), CPI Group (6%), and Anhui Province Energy (2%); Qinshan-III is held by CNNC (51%), CPI Group (20%), Zhejiang Electric Power (10%), Shenergy (10%) and Guoxin Investment (9%). Qinshan-I applies CNP-300 technology, while Qinshan-II and Qinshan-III apply CNP-600 and CANDU 6 technology, respectively.

Fangjiashan Nuclear Power Station

Located in Haiyang County, Zhejiang province, Fangjiashan Nuclear is the expansion project of Qinshan Nuclear power station. Fangjiashan Nuclear has 2x1,080MW capacity, and the station applies CNP1000 technology. Fangjiashan-1 started construction in December 2008, while Fangjiashan-2 started construction in July 2009. Fangjiashan nuclear power station is held by CNNC (72%) and Zhejiang Energy (28%).

Tianwan Nuclear Power Station

Tianwan Nuclear, located at Lianyungang City, Jiangsu Province, planned to have six generating units. Tianwan-1 and Tianwan-2 have planned capacity of 2x1,060MW with VVER-1000 technology. Tianwan-3 and Tianwan-4 have planned capacity of 2x1,126MW with VVER-1000 (AES-91) technology, while Tianwan-5 and Tianwan-6 have planned capacity of 2x1,060MW with VVER-1200/CPR1000 technology. Tianwan-1 and Tianwan-2 commenced operation in May 2007 and August 2007, respectively; Tianwan-3 and Tianwan-4 are still under construction; Tianwan-5 and Tianwan-6 are still pending final approval.

Tianwan nuclear power station is held by CNNC (50%), CPI Group (30%) and Guoxin Investment (20%).

Fuqing Nuclear Power Station

Fuqing Nuclear, located at Fuqing City, Fujian Province, was designed to have six generating units with 6x1,080MW capacity. Fuqing-1 started construction in November 2008 and commenced operation in December 2014; Fuqing-2, Fuqing-3 and Fuqing-4 are still under construction while Fuqing-5 and Fuqing-6 are pending approval. Fuqing 1-4 apply CNP1000 technology while Fuqing-5 and Fuqing-6 will apply Hualong One technology. The station is held by CNNC (51%), Huadian Fuxin (39%) and Fujian Investment & Development Co., Ltd. (10%).

Sanmen Nuclear Power Station

Sanmen Nuclear, located in the southern part of Zhejiang Province, is the second nuclear power station built within Zhejiang Province after Qinshan Nuclear Power Station. The power station was designed to have four generating units with 4x1,250MW capacity. Samen-1 and Samen-2 started construction in April 2009 and December 2009, respectively. Sanmen-3 and Sanmen-4 are still pending final approval. All the four generating units will apply AP1000 technology. The power station is held by CNNC (51%), Zhejiang Energy (20%), CPI Group (14%), Huadian Group (10%) and CNECC (5%).

Changjiang Nuclear Power Station

Changjiang Nuclear, located at Changjiang County, Hainan Province, has two generating units with total capacity of 2x650MW under construction. Changjiang-1 and Changjiang-2 started construction in April 2010 and November 2010, respectively. The power station applies CNP600 technology. It will be the first nuclear plant in Hainan province upon completion. It is held by CNNC (51%) and Huaneng Group (49%).

Others

Haiyang Nuclear Power Station

Located in Haiyang City, Shandong Province, Haiyang Nuclear Power Station is planned with 6x1,250MW generating units. Haiyang-1 and Haiyang-2 started construction in September 2009 and June 2010, respectively, while Haiyang-3 and Haiyang-4 are pending approval. The station applies AP1000 technology. The power station is held by CPI Group (65%), Shandong International Trust (10%), Yantai Power Development (10%), Huaneng Group (5%), CNNC (5%), and Guodian (5%).

Figure 56: Construction and operation schedule of nuclear units in China

Project/Unit name	Province	(MW)	Reactor type	Developer	Constr. (FCD, DBe)	Operation (DBe)
27 units under construction						
Hongyanhe - 3	Liaoning	1,080	CPR1000	CGNPC	Mar 2009	May 2015
Hongyanhe - 4	Liaoning	1,080	CPR1000	CGNPC	Aug 2009	Mar 2016
Ningde - 3	Fujian	1,080	CPR1000	CGNPC	Jan 2010	Jul 2015
Ningde - 4	Fujian	1,080	CPR1000	CGNPC	Sep 2010	Oct 2016
Fuqing I - 2	Fujian	1,080	CNP1000	CNNC	Jun 2009	Sep 2015
Fuqing I - 3	Fujian	1,080	CNP1000	CNNC	Dec 2010	Mar 2016
Fuqing I - 4	Fujian	1,080	CNP1000	CNNC	Nov 2012	Apr 2017
Fangjiashan - 1	Zhejiang	1,080	CNP1000	CNNC	Dec 2008	Mar 2015
Fangjiashan - 2	Zhejiang	1,080	CNP1000	CNNC	Jul 2009	Aug 2015
Yangjiang - 2	Guangdong	1,080	CPR1000	CGNPC	Jun 2009	Jul 2015
Yangjiang - 3	Guangdong	1,080	CPR1000	CGNPC	Nov 2010	May 2016
Yangjiang - 4	Guangdong	1,080	CPR1000	CGNPC	Nov 2012	Dec 2017
Yangjiang - 5	Guangdong	1,080	ACPR1000	CGNPC	Sep 2013	Dec 2018
Yangjiang - 6	Guangdong	1,080	ACPR1000	CGNPC	Dec 2013	Jun 2019
Sanmen - 1	Zhejiang	1,250	AP1000	CNNC	Apr 2009	Mar 2016
Sanmen - 2	Zhejiang	1,250	AP1000	CNNC	Dec 2009	Jan 2017
Haiyang - 1	Shandong	1,250	AP1000	CPIG	Sep 2009	Jul 2016
Haiyang - 2	Shandong	1,250	AP1000	CPIG	Jun 2010	Mar 2017
Taishan - 1	Guangdong	1,750	EPR	CGNPC	Nov 2009	Jul 2016
Taishan - 2	Guangdong	1,750	EPR	CGNPC	Apr 2010	Jul 2017
Fangchenggang - 1	Guangxi	1,080	CPR1000	CGNPC	Jul 2010	Oct 2015
Fangchenggang - 2	Guangxi	1,080	CPR1000	CGNPC	Dec 2010	Feb 2016
Shidaowan	Shandong	210	HTGR	Huaneng	Dec 2012	Jul 2015
Changjiang - 1	Hainan	650	CNP600	CNNC/Huaneng	Apr 2010	Jul 2015
Changjiang - 2	Hainan	650	CNP600	CNNC/Huaneng	Nov 2010	Feb 2016
Tianwan - 3	Jiangsu	1,126	VVER-1000 (AES-91)	CNNC	Dec 2012	Feb 2018
Tianwan - 4	Jiangsu	1,126	VVER-1000 (AES-91)	CNNC	Sep 2013	Dec 2018
Six units likely to receive approvals first						
Fuqing – 5	Fujian	1,080	Hualong One	CNNC	Dec 2014	Jul 2019
Fuqing – 6	Fujian	1,080	Hualong One	CNNC	Oct 2015	May 2020
Hongyanhe – 5	Liaoning	1,080	ACPR1000	CGNPC	Apr 2015	Nov 2019
Hongyanhe – 6	Liaoning	1,080	ACPR1000	CGNPC	Dec 2015	Aug 2020
Shidaowan – 1	Shandong	1,400	CAP1400	SNPTC/Huaneng	Jul 2015	Jan 2020
Shidaowan – 2	Shandong	1,400	CAP1400	SNPTC/Huaneng	Jun 2016	Jan 2021
Another 16 units likely to receive approval over the next few years						
Tianwan – 5	Jiangsu	1,060	VVER-1200/CPR1000	CNNC	Jul 2015	Aug 2019
Tianwan – 6	Jiangsu	1,060	VVER-1200/CPR1000	CNNC	Apr 2016	Jun 2020
Xudapu – 1	Liaoning	1,080	CNP1000	CNNC	May 2015	Nov 2019
Xudapu – 2	Liaoning	1,080	CNP1000	CNNC	Feb 2016	Sep 2020
Lufeng – 1	Guangdong	1,250	AP1000	CGNPC	Jan 2016	Jul 2020
Lufeng – 2	Guangdong	1,250	AP1000	CGNPC	Oct 2016	May 2021
Sanmen – 3	Zhejiang	1,250	AP1000	CNNC	Jul 2015	Jan 2020
Sanmen – 4	Zhejiang	1,250	AP1000	CNNC	Apr 2016	Nov 2020
Haiyang – 3	Shandong	1,250	AP1000	CPIG	Jul 2015	Jan 2020
Haiyang – 4	Shandong	1,250	AP1000	CPIG	Apr 2016	Nov 2020
Zhangzhou – 1	Fujian	1,250	AP1000	CNNC	Jun 2016	Jan 2021
Zhangzhou – 2	Fujian	1,250	AP1000	CNNC	Feb 2017	Apr 2021
Zhangzhou – 3	Fujian	1,250	AP1000	CNNC	Nov 2017	Jan 2022
Zhangzhou – 4	Fujian	1,250	AP1000	CNNC	Aug 2018	Sep 2022
Fangchenggang - 3	Guangxi	1,080	Hualong One	CGNPCPC	Apr 2015	May 2019
Fangchenggang - 4	Guangxi	1,080	Hualong One	CGNPCPC	Jan 2016	Mar 2020

Source: Deutsche Bank estimates

Figure 57: China power demand and supply (2007-2020E)

End of year capacity (GW)	2007	2008	2009	2010	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Coal	527	575	627	680	730	778	815	850	880	910	940	970	1000	1030
chg.	64	48	52	53	50	48	36	35	30	30	30	30	30	30
Shut down	-14	-17	-26	-12	-5	-3	-4	-2	-2	-2	-2	-2	-2	-2
Oil	8	6	4	3	3	3	0	0	0	0	0	0	0	0
chg.	-2	-2	-2	-1	0	0	-3	0	0	0	0	0	0	0
Hydro	145	172	197	216	231	249	280	300	317	335	352	368	384	400
chg.	20	27	25	19	14	18	31	20	17	18	17	16	16	16
Nuclear	9	9	9	11	12.6	12.6	14.6	19.0	27.4	37.7	44.1	47.5	50.7	54.3
chg.	0	0	0	2	2	0	2	4	8	10	6	3	3	4
Gas	18	20	21	26	33	38	47	62	72	77	82	88	94	100
chg.	3	2	1	5	6	6	9	15	10	5	5	6	6	6
Wind	5	9	16	29	45	61	75	93	114	131	150	170	190	210
chg.	2	4	7	13	16	16	15	17	21	17	19	20	20	20
Solar				0	2	8	19	31	44	57	70	83	96	110
chg.				1	2	6	11	12	13	13	13	13	13	14
Biomass and others	1	1	2	0	0	6	8	11	14	17	20	23	26	29
chg.			1	-2	0	6	2	3	3	3	3	3	3	3
Total	712	792	876	966	1,063	1,147	1,260	1,366	1,469	1,565	1,658	1,750	1,841	1,934

Demand	2007	2008	2009	2010	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Power consumption(TWh)	3,221	3,438	3,643	4,192	4,693	4,959	5,322	5,525	5,801	6,091	6,395	6,715	7,051	7,403
Consumption % chg	14.4%	5.2%	6.0%	15.1%	11.9%	5.7%	7.3%	3.8%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%

Utilization (hrs)	2007	2008	2009	2010	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Thermal	5,316	4,911	4,839	5,031	5,294	4,965	5,012	4,700	4,753	4,665	4,636	4,656	4,701	4,759
Hydro	3,580	3,589	3,264	3,429	3,028	3,555	3,318	3,600	3,400	3,400	3,400	3,400	3,400	3,400
Wind			2,077	2,097	1,903	1,893	2,080	1,930	2,100	2,150	2,200	2,200	2,200	2,200
Nuclear			7,716	7,924	7,772	7,838	7,893	7,500	7,500	7,500	7,500	7,500	7,500	7,500
Gas							2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Solar					1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Biomass and others							5,844	5,500	5,500	5,500	5,500	5,500	5,500	5,500
Total	5,011	4,677	4,527	4,660	4,731	4,572	4,511	4,351	4,230	4,149	4,099	4,070	4,055	4,050

Power generation (bn kWh)	2007	2008	2009	2010	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Coal	2,723	2,790	3,012	3,415	3,898	3,911	4,215	3,985	4,112	4,176	4,289	4,447	4,631	4,831
Conventional hydro	485	637	616	686	663	864	789	957	953	994	1,029	1,062	1,092	1,123
Wind				50	73	100	140	152	204	252	296	338	382	426
Nuclear				77	87	98	111	126	162	244	307	344	368	394
Gas					NA	NA	107	137	168	187	199	213	228	243
Solar						10	14	28	42	58	74	89	105	121
Biomass and others						21	36	59	76	92	109	125	142	158
Total	3,282	3,496	3,715	4,228	4,722	4,977	5,245	5,444	5,717	6,002	6,303	6,618	6,949	7,296

Source: Deutsche Bank estimates , China Electricity Council

Rating
Sell

Asia
China

Utilities
Utilities

Company
CGN Power

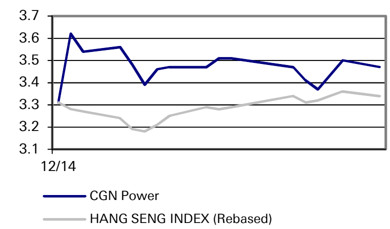
Reuters	Bloomberg
1816.HK	1816 HK

Price at 6 Jan 2015 (HKD)	3.40
Price target - 12mth (HKD)	2.90
52-week range (HKD)	3.62 - 3.31
HANG SENG INDEX	23,721

Michael Tong, CFA
Research Analyst
(+852) 2203 6167
michael.tong@db.com

Yingying Dong, CFA
Research Associate
(+852) 2203 6207
yingying.dong@db.com

Price/price relative



Performance (%)	1m	3m	12m
Absolute	–	–	–
HANG SENG INDEX	-1.2	1.7	4.6

Source: Deutsche Bank

A leading nuclear play but at demanding valuation; initiate with Sell

Demanding valuation with overlooked risks; initiating with Sell

CGN Power is a prime beneficiary of government policy to steer energy consumption away from coal. Its strong capacity growth outlook was a major factor behind its successful IPO last month. However, we have four key concerns which should be incorporated into the analysis of the company - risks related to the costly Taishan project; a potential drop in utilization rates; operational challenges; understated liabilities for decommissioning. After a 26% gain on listing, the shares are trading at 20x 2015E PE and 20% above our DCF-based target price of HK$2.90. We therefore initiate coverage with a Sell.

Taishan Nuclear – execution risks for the world's first GIII EPR project

CGN has a proven track record in construction and operations but there are risks from the proposed acquisition of Taishan Nuclear, which include: 1) further construction delay and capex overrun; 2) insufficient tariff to compensate for the higher costs; and 3) low utilization during initial operating period for a new technology plant. Another potentially acquired plant, FCG, is likely to face low utilization due to severe power oversupply in Guangxi.

Several other risks spotted; likely amplified impact on valuation multiples

We also see several other downside risks to future earnings, including: 1) lower utilization in regions with power oversupply; 2) tariff discount or profit-sharing scheme, 3) expiration of Daya Bay's preferential VAT treatment; and 4) potential upward revisions in decommission liabilities will be a negative surprise to the market, even though earnings impact will be minor.

DCF-based target price of HK$2.90; risks

We derive our target price via DCF through 2060E, with zero terminal value and a WACC of 6.9%. Upside risks including higher-than-expected plant utilization, higher-than-expected tariff for Taishan, ahead-of-schedule new project start-ups and a greater-than-expected interest rate cut.

Forecasts And Ratios

Year End Dec 31	2012A	2013A	2014E	2015E	2016E
Sales (CNYm)	17,575	17,365	19,448	21,642	28,043
EBITDA (CNYm)	9,553	9,182	10,382	11,259	14,628
Reported NPAT (CNYm)	4,144	4,195	5,352	6,181	7,640
Reported EPS FD(CNY)	0.165	0.153	0.118	0.136	0.168
DB EPS FD (CNY)	0.165	0.153	0.118	0.136	0.168
DB EPS growth (%)	-42.7	-7.2	-23.2	15.5	23.6
PER (x)	–	–	23.1	20.0	16.2
Price/BV (x)	0.0	0.0	2.7	2.5	2.2
EV/EBITDA (x)	–	–	17.2	23.4	18.6
DPS (net) (CNY)	0.000	0.000	0.062	0.045	0.055
Yield (net) (%)	–	–	2.3	1.6	2.0
ROE (%)	24.6	21.3	15.6	12.9	14.4

Source: Deutsche Bank estimates, company data

[1] DB EPS is fully diluted and excludes non-recurring items

[2] Multiples and yields calculations use average historical prices for past years and spot prices for current and future years, except P/B which uses the year end close

Model updated:30 December 2014

Running the numbers

Asia

China

Utilities

CGN Power

Reuters: 1816.HK | Bloomberg: 1816 HK

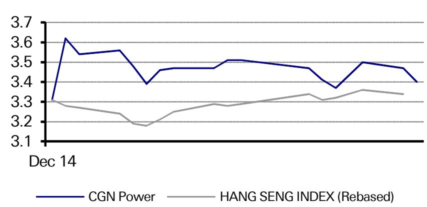
Sell

Price (6 Jan 15)	HKD 3.40
Target Price	HKD 2.90
52 Week range	HKD 3.31 - 3.62
Market Cap (m)	HKDm 154,526
	USDm 19,922

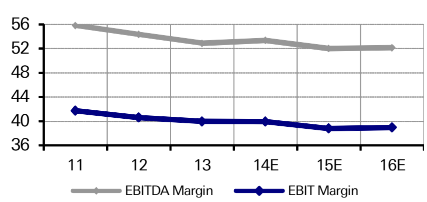
Company Profile

CGN Power Co., Ltd. (CGN Power) is the largest nuclear developer in China by both total installed capacity and attributable capacity, and among one of the only three licensed nuclear operator in China. As of June 2014, CGN Power operated and managed 11 nuclear generating units with a total installed capacity of 11.6GW.China General Nuclear Power Corporation (CGNPC), a central SOE under SASAC, is its parentco with 66.38% of stake.

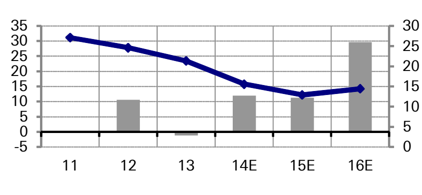
Price Performance



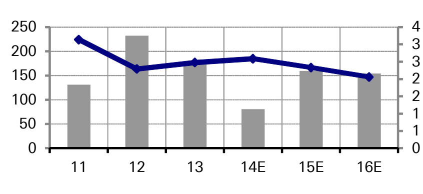
Margin Trends



Growth & Profitability



Solvency



Michael Tong, CFA
+852 2203 6167 michael.tong@db.com

Fiscal year end 31-Dec	2011	2012	2013	2014E	2015E	2016E
Financial Summary						
DB EPS (CNY)	0.29	0.17	0.15	0.12	0.14	0.17
Reported EPS (CNY)	0.29	0.17	0.15	0.12	0.14	0.17
DPS (CNY)	0.00	0.00	0.00	0.06	0.04	0.06
BVPS (CNY)	1.1	0.6	0.8	1.0	1.1	1.2
Weighted average shares (m)	16,403	25,088	27,369	45,449	45,449	45,449
Average market cap (CNYm)	na	na	na	123,862	123,862	123,862
Enterprise value (CNYm)	na	na	na	178,216	263,329	272,492
Valuation Metrics						
P/E (DB) (x)	na	na	na	23.1	20.0	16.2
P/E (Reported) (x)	na	na	na	23.1	20.0	16.2
P/BV (x)	0.00	0.00	0.00	2.71	2.47	2.22
FCF Yield (%)	na	na	na	nm	nm	3.4
Dividend Yield (%)	na	na	na	2.3	1.6	2.0
EV/Sales (x)	nm	nm	nm	9.2	12.2	9.7
EV/EBITDA (x)	nm	nm	nm	17.2	23.4	18.6
EV/EBIT (x)	nm	nm	nm	22.9	31.3	24.9
Income Statement (CNYm)						
Sales revenue	15,881	17,575	17,365	19,448	21,642	28,043
Gross profit	10,129	10,830	10,644	12,058	13,126	17,022
EBITDA	8,866	9,553	9,182	10,382	11,259	14,628
Depreciation	2,234	2,413	2,240	2,612	2,854	3,695
Amortisation	0	0	0	0	0	0
EBIT	6,631	7,141	6,942	7,770	8,404	10,933
Net interest income(expense)	-2,114	-3,118	-2,804	-3,006	-3,609	-5,318
Associates/affiliates	0	0	0	0	0	0
Exceptionals/extraordinaries	0	0	0	0	0	0
Other pre-tax income/(expense)	1,815	1,844	1,931	2,678	3,547	4,792
Profit before tax	6,332	5,867	6,070	7,442	8,342	10,407
Income tax expense	936	890	998	1,062	1,047	1,112
Minorities	669	833	877	1,027	1,114	1,655
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	4,727	4,144	4,195	5,352	6,181	7,640
DB adjustments (including dilution)	0	0	0	0	0	0
DB Net profit	4,727	4,144	4,195	5,352	6,181	7,640
Cash Flow (CNYm)						
Cash flow from operations	10,218	8,660	9,493	10,966	12,193	15,991
Net Capex	-12,128	-7,774	-9,923	-11,546	-17,409	-11,785
Free cash flow	-1,910	886	-430	-580	-5,215	4,205
Equity raised/(bought back)	7,510	2,823	1,832	21,558	0	0
Dividends paid	-2,769	-9,843	-1,655	-4,175	-1,766	-2,040
Net inc/(dec) in borrowings	15,595	24,165	15,340	-3,217	-1,901	-2,584
Other investing/financing cash flows	-14,334	-23,049	-14,012	3,411	5,335	-3,746
Net cash flow	4,092	-5,018	1,075	16,997	-3,547	-4,165
Change in working capital	*-39*	*2,540*	*1,168*	*874*	*790*	*1,234*
Balance Sheet (CNYm)						
Cash and other liquid assets	10,453	5,434	6,640	23,637	10,390	6,225
Tangible fixed assets	70,068	79,185	87,042	99,129	188,859	201,377
Goodwill/intangible assets	511	629	765	765	714	714
Associates/investments	74	84	98	98	98	98
Other assets	32,601	36,932	33,130	36,071	40,767	47,170
Total assets	113,708	122,263	127,675	159,700	240,828	255,585
Interest bearing debt	41,268	61,550	61,916	68,422	127,041	130,384
Other liabilities	48,897	36,564	34,067	35,824	40,077	44,235
Total liabilities	90,165	98,114	95,983	104,246	167,117	174,619
Shareholders' equity	17,452	16,304	23,052	45,787	50,202	55,802
Minorities	6,091	7,845	8,640	9,667	22,914	24,569
Total shareholders' equity	23,543	24,150	31,692	55,455	73,116	80,372
Net debt	*30,815*	*56,116*	*55,276*	*44,784*	*116,651*	*124,159*
Key Company Metrics						
Sales growth (%)	nm	10.7	-1.2	12.0	11.3	29.6
DB EPS growth (%)	na	-42.7	-7.2	-23.2	15.5	23.6
EBITDA Margin (%)	55.8	54.4	52.9	53.4	52.0	52.2
EBIT Margin (%)	41.8	40.6	40.0	40.0	38.8	39.0
Payout ratio (%)	0.0	0.0	0.0	52.9	33.0	33.0
ROE (%)	27.1	24.6	21.3	15.6	12.9	14.4
Capex/sales (%)	78.3	44.4	57.2	59.4	80.4	42.0
Capex/depreciation (x)	5.6	3.2	4.4	4.4	6.1	3.2
Net debt/equity (%)	130.9	232.4	174.4	80.8	159.5	154.5
Net interest cover (x)	3.1	2.3	2.5	2.6	2.3	2.1

Source: Company data, Deutsche Bank estimates

Investment thesis

Outlook

CGN Power is a prime beneficiary of government policy to steer energy consumption away from coal. Its strong capacity growth outlook was a major factor behind its successful IPO last month. CGN has a proven track record in construction and operations but there are significant risks to its earnings outlook from the proposed acquisition of Taishan Nuclear. These include: 1) further construction delay and capex overrun; 2) insufficient tariff to compensate for the higher costs; and 3) low capacity utilization during initial operating period for a new technology plant. Meanwhile, another potentially acquired plant, Fangchenggang Nuclear (FCG), is likely to face low utilization due to severe power oversupply in Guangxi province. We also see several downside risks to future earnings, including: 1) lower utilization in regional with power oversupply, especially for the Hongyanhe project in Liaoning; 2) tariff discount or profit-sharing scheme, which was adopted in the Ningde project in Fujian; 3) the expiration of Daya Bay's preferential VAT treatment; and 4) potential upward revisions in decommission liabilities will likely be a negative surprise to the market, even though earnings impact should be minor.

After a 26% gain on listing, the shares are trading at 20x 2015E PE or 40-70% premium to wind/thermal peers and 20% above our DCF-based target price of HK$2.90. We therefore initiate coverage with a Sell recommendation.

Valuation

Our target price of HK$2.90 is based on a discounted cash flow (DCF) projection through 2060E, where we assume zero terminal value, as all the units (except for Taishan) will be decommissioned by then. We have added the value of Taishan (operative until 2076E) by assuming similar cash flow generation as of 2060E. We assume a WACC of 6.9%, based on a 6.5% pre-tax cost of debt, a 3.9% risk-free rate, a 5.6% equity risk premium, 1.2 beta, and a 60% target debt-to-capital ratio.

Risks

Key upside risks include: 1) higher-than-expected capacity factor for all of its nuclear units on strong power demand and higher operation efficiency; 2) good earnings delivery from Taishan Nuclear as a result of timely start-up with stringent investment cost control and a higher-than-expected tariff; 3) parent company asset injection at favorable pricing; and 4) a greater-than-expected interest rate cut.

Valuation

DCF is our preferred approach given visible cash flow

We tend to value all types of IPPs using a discounted cash flow (DCF) method, given these companies' relatively visible and stable long-term cash flow generation profiles. Compared to thermal and wind IPPs, nuclear power producers' cash flow appears to have even less volatility given their more stable fuel cost (through long-term uranium supply contracts) and utilization hours (base load generation), especially in the context of China due to the lack of perfect implementation of fuel tariff linkage for thermal power and regulated tariffs for nuclear power. Nevertheless, our DCF approach in valuing CGN still incorporates a few specific factors that are unique to nuclear power.

Incorporating only existing pipelines

Preliminary-stage projects are mostly reserved at parentco level and thus not incorporated in our model

Although China will continue to ramp up its nuclear capacity in the next 20 years and CGN is highly likely to get a slice, we have factored in only projects under construction, as preliminary-stage projects that are currently retained at the parentco level might be injected into listcos later. However, the timing and pricing of injection remain unknown. This is in line with our practice of not incorporating parentco asset injection when valuing thermal IPPs, despite the great scope of asset injection and reiterated parentco commitment.

Although we have factored in 1-2GW new wind capacity per year for wind IPPs in 2015-20E, we believe it is less uncertain based on China's 2020 wind capacity target and rare delays in project construction. Currently, based on the existing capacity pipeline, CGN is set to grow until 2019, but growth beyond that depends on the project approval status and asset injection timeline, with any earnings contribution at least five years away.

Nevertheless, we believe the asset injection of Fangchenggang 1-2 represents a near-term upside, as these two units are scheduled to be operational by 2016. We provide a scenario analysis for potential value upside, but we would like to caution potential utilization rate challenge for Fangchenggang based on our Guangxi power market forecast included in our FITT report "*Nuclear Power Generation in China – risk reality check"*.

Discounted cash flow through whole life cycle with zero terminal value

We adopt a DCF through 2060E with zero terminal value, as most of the units will be decommissioned by then

Nuclear units have a designed lifespan of 40 years for Generation II/II+ projects and 60 years for Generation III projects. Unlike thermal and wind, any nuclear power site is forfeited forever when decommissioned. Thus, we tend to value the cash flow throughout the whole life cycle.

By 2060E, most of CGN's units will have been decommissioned given they are Generation II/II+ projects. For the Generation III Taishan Nuclear project, which will be operational until 2076E, we have added value by assuming similar cash flow generation for another 16 years, up to 2076E.

Nuclear decommission liabilities

Unlike coal-fired/wind IPPs, a nuclear power unit has to bear a cash outflow for project site decommissioning at the end of its operating cycle. (For an introduction on nuclear decommissioning, please refer to our FITT Report). In our DCF valuation, we have excluded the decommission cash flow from the operating cash flow at the year end, but have applied a separate discount rate for such long-term liability, which is similar to the valuation of corporate pension liability.

JV/Associates contribution

With the sequential commissioning of Ningde Nuclear (JV) and Hongyanhe Nuclear (Associate), JV and associates income will become an important earnings contributor for CGN (28.4% in 2017E). Thus, we have separately discounted their equity cash flow contribution to CGN through 2060E.

WACC

Our WACC assumption is 6.9%, based on a 6.5% pre-tax cost of debt, a 3.9% risk-free rate, a 5.6% equity risk premium, 1.2 beta, and a 60% target debt-to-capital ratio. Our WACC for CGN is lower than the 8.7-9.3% used for thermal IPPs and 8.6-9.8% used for wind IPPs, which is justified by its lower exposure to the volatility of fuel costs and wind conditions.

We illustrate the sensitivity to WACC assumption in Figure 58 and detailed cash flow projection in Figure 59. **Our target price of HK$2.9/share implies 17x/14x/12x/10x FY15E/FY16E/FY17E/FY18E PE.**

Figure 58: Sensitivity of target price to WACC assumptions

WACC assumed	6.5%	6.7%	6.9%	7.1%
Target price (HK$)	3.4	3.1	2.9	2.8

Source: Deutsche Bank estimates

Figure 59: Detailed DCF projection through 2060E

DCF Model (Rmb mn)		2015E	2016E	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	....	2060E
EBIT			**13,684**	**17,134**	**20,200**	**22,503**	**23,059**	**22,331**	**21,763**	**21,559**	**21,372**	**20,983**		**16,501**
Cash tax			(1,047)	(1,112)	(1,597)	(1,739)	(1,947)	(2,240)	(2,385)	(2,653)	(2,904)	(3,089)		(1,829)
EBIT after tax			12,638	16,022	18,603	20,763	21,112	20,091	19,378	18,906	18,468	17,894		14,672
add back Depreciation & Amortization			3,695	4,725	5,537	6,054	6,213	6,196	6,196	6,196	6,213	6,196		0
less: Projected Capex			(11,785)	(7,698)	(5,247)	(2,705)	(1,614)	(1,614)	(1,614)	(1,614)	(1,614)	(1,614)		(350)
Total			4,547	13,049	18,892	24,112	25,711	24,673	23,960	23,488	23,067	22,476		14,322
movement in WC			(1,234)	(1,449)	(1,407)	(1,340)	(1,392)	(1,524)	(2,042)	(2,558)	(2,762)	(2,956)		(638)
Cashflow proxy			**3,313**	**11,599**	**17,485**	**22,772**	**24,319**	**23,149**	**21,918**	**20,930**	**20,305**	**19,520**		**13,684**
Discount factor		1.00	1.07	1.14	1.22	1.31	1.40	1.50	1.60	1.71	1.83	1.96		20.55
Discounted Cashflow ex TV			3,098	10,141	14,294	17,406	17,381	15,470	13,696	12,229	11,093	9,971		666
Total DCF	**236,137**													
Terminal value (for Taishan)	6,313													
JV (Ningde Nuclear)	**33%**													
Pre tax cashflow available for distribution			3,930	4,935	4,898	4,851	4,832	4,764	4,937	5,042	5,170	5,248		0
Less cash tax paid			(69)	(147)	(207)	(332)	(403)	(472)	(574)	(618)	(665)	(704)		0
Less debt repayment			(2,124)	(2,832)	(2,832)	(2,832)	(2,832)	(2,832)	(2,832)	(2,832)	(2,832)	(2,832)		0
Equity injection			(36)	0	0	0	0	0	0	0	0	0		0
Total cashflow to equity			1,701	1,956	1,859	1,687	1,598	1,460	1,531	1,592	1,672	1,712		0
Equity cashflow to CGN			**566**	**651**	**619**	**562**	**532**	**486**	**510**	**530**	**557**	**570**		**0**
Discount factor		1.00	1.07	1.14	1.22	1.31	1.40	1.50	1.60	1.71	1.83	1.96		20.55
Discounted Cashflow ex TV			529	569	506	429	380	325	318	310	304	291		0
Total DCF (inc TV)	**10,988**													
Associate (Hongyanhe Nuclear)	**38%**													
Pre tax cashflow available for distribution			3,363	3,632	3,624	3,601	3,603	3,561	3,739	3,858	3,996	4,092		0
Less cash tax paid			(35)	(80)	(104)	(163)	(205)	(243)	(311)	(355)	(403)	(444)		0
Less debt repayment			(2,182)	(2,909)	(2,909)	(2,909)	(2,909)	(2,909)	(2,909)	(2,909)	(2,909)	(2,909)		0
Equity injection			(15)	0	0	0	0	0	0	0	0	0		0
Total cashflow to equity			1,132	644	611	529	489	410	520	594	683	739		0
Equity cashflow to CGN			**432**	**246**	**233**	**202**	**186**	**156**	**198**	**227**	**261**	**282**		**0**
Discount factor		1.00	1.07	1.14	1.22	1.31	1.40	1.50	1.60	1.71	1.83	1.96		20.55
Discounted Cashflow ex TV			404	215	191	154	133	104	124	132	142	144		0
Total DCF (inc TV)	**7,945**													
Less Net Debt (cash) at Year End	129,759													
Less Minority Interest (Market Value)	22,914													
Less nuclear liabilites	3,438													
Associate + JV (DCF)	18,933													
Investment	0													
Total Equity Value (Rmb m)	**105,272**													
Total per share (HKD)	2.9													
		rf	b	mrp	kd	implied ke	fter tax debt	Tax Rate	% equity	% debt				
WACC	**6.9%**	3.9%	1.20	5.6%	6.0%	10.62%	4.5%	25.0%	40%	60%				
TV Growth	0.0%													

Source: Deutsche Bank estimates

Scenario 1: upside from acquisition of Fangchenggang

Background of Fangchenggang Nuclear

Fangchenggang Nuclear, located in Guangxi province, plans to build six 1,000MW units. Phase I has two 1,080MW units featuring CPR1000 (GII+) technology, which started construction in July and December 2010, respectively, and which are scheduled to come on line in June 2015 and February 2016. Phase II will have two 1,080MW units with Hualong One technology (GIII), although the final approval to start construction is still pending. Fangchenggang Nuclear is financed by CGNPC (61%) and Guangxi Investment Group (39%).

Impact on NAV and earnings

The acquisition of Fangchenggang might increase the NAV to HK$3.0/share

Based on: 1) the investment of Rmb28.2bn for Phase I disclosed by CGNPC; 2) the benchmark tariff of Rmb430/MWh; and 3) a relatively low capacity factor of 80% (see our FITT report for Guangxi power market forecast), we calculated that the total equity enhancement will be Rmb4.2bn, or a 4.0% increase to our current target price to HK$3.0. Assuming the 61% equity interest acquisition is funded by internal cash, CGN's 2017E earnings will be increased by 8.9% if the deal is completed by end-2016. This subsequent c.30ppt hike in net gearing to over 200% in end-2016, would increase the chances of another equity placement.

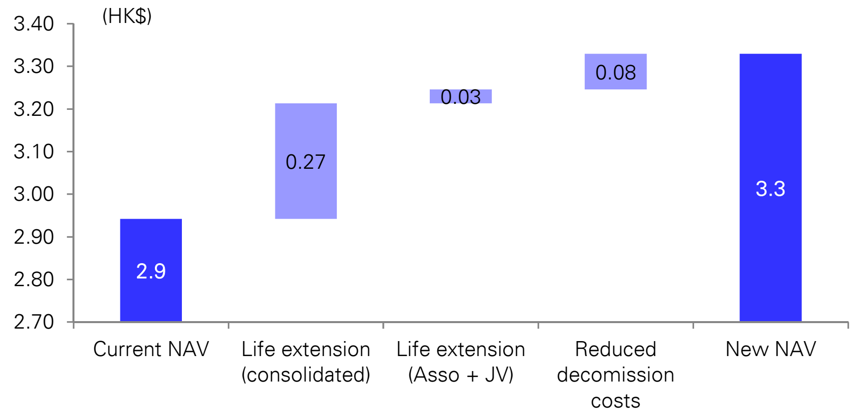
Scenario 2: upside from potential life cycle extension

Most of CGN's units are GII/II+ projects with a designed life cycle of 40 years. However, in practice, the actual operating life could be extended to 60 years as long as their equipment is in good condition and the external operating environment supports an extension. For example, as of end-2013, the US has approved the operation extension for 72 of its 100 operating units, of which 20 have entered 40 to 60 years of operation.

A 20-year life extension will increase the NAV to HK$3.3/share – a remote consideration subject to several downside factors

By simply assuming similar cash flow generation, we estimate that a 20-year life extension for all units (except Taishan) could add a 12% upside to our current target price to HK$3.30. However, this is just a "blue-sky" scenario that has yet to take into account several considerations: 1) the tariff for extended operations might be subject to downward revisions; 2) incremental capex and maintenance costs will be required for the extension; and 3) it is a remote upside scenario similar to the remote downside scenario from a potential underestimation of decommission liability, as discussed below. Nevertheless, even valuation under this scenario suggests 6% downside to the current share prices.

Figure 60: NAV/share under 20-year life extension



Source: Deutsche Bank estimates

Scenario 3: adjusting for likely underestimated liabilities

CGN currently uses the PBOC benchmark lending rate for five-year and above (6.55%), subject to changes in China's benchmark lending rate and inflation. Following the 40bps lending rate cut in November 2014, our China economist, Zhiwei Zhang, believes there will be another two rounds of 25bps cuts in 2Q15 and 3Q15, respectively.

The discount rate might be adjusted down to 5.65% along with China's interest rate cuts…

If CGN adheres to this policy, we believe the company will have to adjust the discount rate down to 5.65% by early 2016E (assuming adjustment from the beginning of next year). Nevertheless, this remains the highest globally.

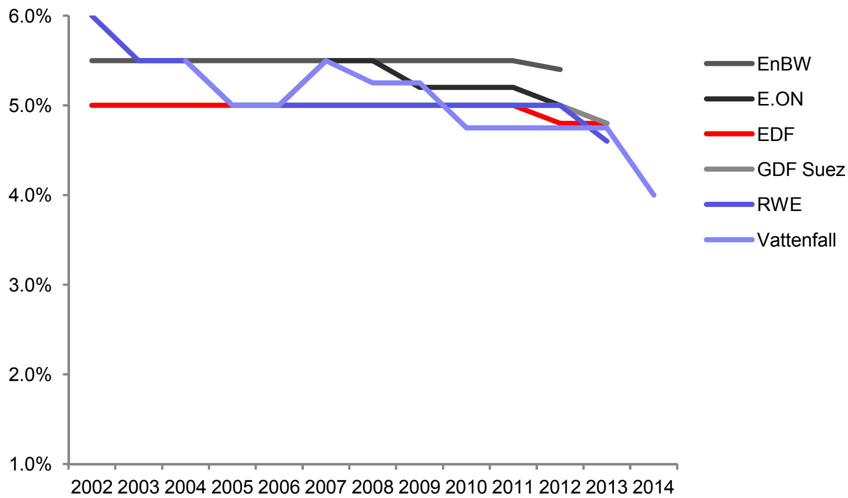
- In France, the rate is chosen by the operator based on regulatory constraints. EDF, Areva, and CEA (French Alternative Energies and Atomic Energy Commission) currently use 5%.
- In the US, the rate is 3-5% based on the owner's discretion.
- The rate in Spain is lower (1.5%).

Figure 61 shows the history of discount rates used by a number of nuclear operators for nuclear liabilities in France, Germany and Belgium. While there is a downward trend in the discount rates, all operators are using rates of 4% or more. Nevertheless, there are reasons to expect a more severe step down in the discount rates used in future years. Vattenfall, which operates nuclear stations in Germany, cut the discount rate it uses for its balance sheet provision at its 1H13 results from 4.7% to 4.0%. Vattenfall said that while it always monitored the rate to be used, it had decided that it needed to make a 'deep dive' on the issue, based on dialogue with its auditors and evidence from the market.

..but still higher vs. that of global peers

Vattenfall also uses a 4% discount rate for its Swedish nuclear liabilities, while E.ON uses a 3.0% discount rate in Sweden and 4.8% in Germany.

Figure 61: Discount rates used for nuclear liabilities in France, Belgium and Germany



Source: Company data, Deutsche Bank

In addition, although CGN's policy states the "discount rate is a pre-tax rate taking into account the risks specific to the effect of inflation based on the historical inflation rates", the 6.55% rate looks a bit high on a "real" rate basis.

CGN will have a total back-end decommission liability of Rmb24.2bn, based on its 10% estimation policy for the fixed assets of the existing project pipeline. In 2019, when all the projects are commissioned, the PV will be Rmb3.8bn, Rmb4.8bn, Rmb5.6bn, and Rmb7.9bn, respectively, based on a discount rate of 6.55% (currently used by CGN), 5.65% (adjusted by three rounds of rate cuts), 5% (benchmarking the French practice), and 3.77% (China's current 10-year government treasury yield).

Be aware of the risks from potential upward revision in nuclear liabilities – though impact to NAV is limited at this stage

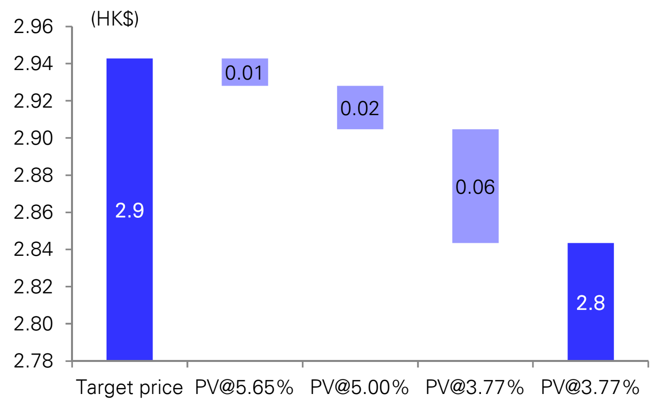
Given the low present value for such a long-term liability, the impact to NPV is limited even if it is underestimated. **At a discount rate of 3.77%, the NPV will be reduced by HK$0.09/share to HK$2.80/share.** However, as we discussed in our FITT report, the potential regulation change, either reducing the discount rate or raising the percentage of cost to more than 10%, could bring a more meaningful impact to stock price as such specific risks of nuclear power become more aware to the market.

Figure 62: PV of decommission liabilities at different discount rate

	Back-end	Year to	Present value			
(Rmbm)	liabilities	2019	6.55%	5.65%	5.00%	3.77%
Daya Bay - 1	1,731	15	668	759	832	993
Daya Bay - 2	1,731	15	668	759	832	993
Ling'ao - 1	1,666	23	387	471	543	711
Ling'ao - 2	1,666	24	363	446	517	686
Lingdong - 1	1,095	31	153	199	241	348
Lingdong - 2	1,095	32	144	189	230	335
Yangjiang - 1	1,281	35	139	187	232	351
Yangjiang - 2	1,281	36	131	177	221	338
Yangjiang - 3	1,306	37	125	171	215	332
Yangjiang - 4	1,306	38	117	162	205	320
Yangjiang - 5	1,354	39	114	159	202	320
Yangjiang - 6	1,354	40	107	150	192	308
Taishan - 1	3,659	37	350	479	602	930
Taishan - 2	3,659	38	328	453	573	897
Total	**24,185**		**3,795**	**4,760**	**5,637**	**7,863**
Discount to 2015			**2,944**	**3,821**	**4,638**	**6,781**

Source: Deutsche Bank estimates

Figure 63: Impact to NPV/share



Source: Deutsche Bank estimates

Valuation comparison vs. peers

As CGN is a unique nuclear power pure play, we compared its valuation with China IPPs (coal-fired and wind power), China environmental plays (waste-to-energy), and international power utilities with nuclear exposure. The results show that CGN's current valuation is less attractive than that of its peers, either by PE vs. EPS growth, EV/EBITDA vs. EBITDA growth or by PB vs. ROE. Other than its likely scarcity value as the only listed nuclear pure play in the world, we are less convinced of its current valuation from the growth and risk angles. As we discussed in our FITT report, there are four areas of potential concerns that the market may be overlooking when balancing the growth outlook with risk for nuclear power players like CGN. In turn, we believe the stock is overvalued.

PE vs. EPS growth

- In Figure 64, we compare the 2014E PE vs. the 2014-16E EPS CAGR (as the earnings forecast for most companies are available to 2016E). The companies to the right have better EPS growth, while those in the upper section have more-expensive valuations.

CGN is trading at higher PE while EPS growth is only about half of China wind developers

- CGN's PER is outstandingly high at 23.2x 2014E PE vs. 7.5-20.7x for its peers. However, its 2014-16E EPS growth CAGR of 19% is only about half of that of China wind developers (36-42%). On FY16E PE, CGN currently trades at 16.4x vs. Longyuan's 11.2x, HNR's 8.1x, and Huadian Fuxin's 5.8x. As we have extended our forecast to FY18E for CGN, the stock trades at 12.3x FY18E PE, still higher than wind developers, which are likely to have even lower PE on continued capacity growth and reduced curtailment on UHV completion.
- Compared to thermal IPPs at 7x FY16E PE, it could be argued that CGN deserves higher multiples due to its stronger long-term growth outlook and more-stable earnings profile. We agree with this based on organic growth. However, thermal IPPs do have substantially greater asset injection potential than CGN given the large scale of their assets that are still retained at the parentco level.

- Compared to leading waste energy players (e.g. China Everbright International-Hold HK$11.54), CGN's FY16 PE appears on par. Although some tend to put CEI and CGN in same group because of their scarcity value and market leading positions, we like to draw a subtle difference between them. We believe any earnings upside is more likely for CEI than for CGN, as CEI can surprise the market by winning more projects with a current market share of less than 10% in the very fragmented waste/water market. CGN is unlikely to do so, given concentration of the nuclear market and its 60% market share.

PB vs. ROE

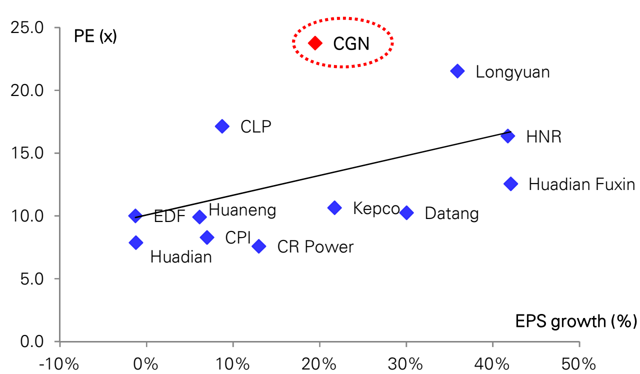
- In Figure 65, we compare 2015E PE to ROE (CGN's 2014E ROE is distorted by a lower equity base given that its IPO took place at year-end). Companies to the right have higher ROE ratios, while those in upper section have more-expensive valuations.
- CGN's PBV ratio is also the highest at 2.5x compared with the 0.5-1.7x of its power peers.
- China IPPs (CR Power, Huaneng, and Huadian) trade at 1.1-1.5x PB (c.50% discount), while their ROE is higher at 17.0-17.9%. Meanwhile, CGN's net gearing is similarly high at 160% vs. 82-225% for those three IPPs.

CGN is trading at about twice as high P/B vs. China IPPs despite a lower ROE

EV/EBITDA vs. EBITDA growth

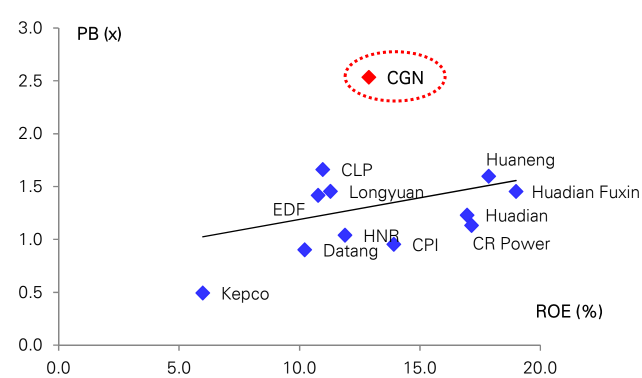
- CGN is also trading at the highest EV/EBITDA among the peer group at 13.2x (14E) relatively to its 19% CAGR in 2014-16E EBITDA.
- China thermal IPPs are trading at much lower multiples despite also decent growth. For example, Huaneng and CR Power, are trading at 3.3-3.9x 2014E EV/EBITDA with 10-15% EBITDA CAGR in 2014-16E.
- China wind developers enjoy 17-32% EBITDA growth while their 2014E EV/EBITDA is at 20-30% discount (8.8-10.2x).

Figure 64: 2014E PE vs. EPS CAGR (2014-16E)



Source: Deutsche Bank estimates; share price as of 30 Dec 2014

Figure 65: 2015E PB vs. 2015E ROE



Source: Deutsche Bank estimates; share price as of 30 Dec 2014

Figure 66: CGN – comps and share price performances

Share price as of 1/2/2015 Company	Ticker	Price	Rating	Price target	% to target	Mkt. Cap. US$m	Performance Absolute 3m	Performance Relative 3m	Valuations P/E 14E	P/E 15E	EV/EBITDA 14E	EV/EBITDA 15E	P/BV 14E	P/BV 15E	Returns & Gearing (%) RoE 14E	RoE 15E	ROA 14E	ROA 15E	Gearing 13A	Yield 14E
China Thermal IPPs with nuclear exposure																				
Datang	0991.HK	HKD4.25	Buy	HKD5.50	29%	7,292	8%	(9%)	10.3	6.9	9.2	7.8	1.0	0.9	9.7	10.2	1.4	1.8	287.9	3.9
Huadian Fuxin	0816.HK	HKD3.68	Buy	HKD6.10	66%	3,786	(15%)	(28%)	12.6	8.3	8.8	7.9	1.7	1.5	14.9	19.0	2.5	3.4	292.8	1.6
Shenergy	600642.CH	CNY6.46	NA	NA	NA	4,853	39%	0%	11.8	11.1	9.1	8.5	1.3	1.2	12.0	10.6	5.6	5.4	5.1	3.0
Zhejiang Energy	600023.CH	CNY7.17	NA	NA	NA	13,877	29%	(7%)	14.0	11.6	NA	NA	NA	NA	15.0	NA	NA	NA	68.6	NA
					Average		15%	(11%)	12.2	9.5	9.0	8.1	1.3	1.2	12.9	13.3	3.2	3.5	163.6	2.8
China Wind/Hydro IPPs																				
Longyuan	0916.HK	HKD8.21	Buy	HKD10.00	22%	8,505	9%	(7%)	21.5	13.5	10.2	8.8	1.6	1.5	7.7	11.3	2.2	3.1	144.4	1.2
HNR	0958.HK	HKD2.53	Buy	HKD3.50	38%	2,755	(1%)	(16%)	16.4	9.8	9.4	8.1	1.2	1.0	7.8	11.9	1.7	2.4	197.3	1.2
Yangtze Power	600900.CH	CNY10.67	NA	NA	NA	29,108	39%	(0%)	17.2	16.6	11.3	11.4	2.2	2.0	12.9	11.9	7.6	7.9	72.8	3.0
Guotou Power	600886.CH	CNY11.44	NA	NA	NA	13,445	78%	28%	15.9	13.9	9.5	8.4	3.8	3.1	24.1	23.6	3.2	3.3	326.0	1.7
					Average		31%	1%	17.8	13.5	10.1	9.2	2.2	1.9	13.1	14.7	3.7	4.2	185.1	1.8
Regional power utility with nuclear exposure																				
CLP	0002.HK	HKD67.25	Hold	HKD59.50	(12%)	21,903	8%	(9%)	17.1	15.5	8.2	7.6	1.7	1.7	12.8	11.0	5.4	4.8	58.1	3.9
Kepco	015760.KS	KRW42700	Buy	KRW60800	42%	24,920	(14%)	(11%)	10.7	7.8	6.1	5.7	0.5	0.5	4.7	6.0	1.5	2.0	113.5	2.6
					Average		(3%)	(10%)	13.9	11.6	7.1	6.7	1.1	1.1	8.7	8.5	3.5	3.4	85.8	3.2
International power utility with nuclear exposure																				
EdF	EDF.PA	USD15.51	Sell	USD18.00	16%	54,599	(16%)	(20%)	10.0	10.4	5.7	5.9	1.5	1.4	9.4	10.8	1.4	1.7	69.7	5.8
Exelon	EXC.N	USD37.57	Buy	USD43.00	14%	32,299	9%	4%	15.3	15.3	8.6	8.3	1.3	1.3	8.8	8.5	2.6	2.4	80.0	3.3
RWE	RWEG.DE	EUR25.68	Hold	EUR29.00	13%	19,188	(13%)	(18%)	12.5	14.7	3.2	3.3	2.5	2.5	13.6	12.9	1.5	1.3	252.3	3.9
EON	EONGn.DE	EUR13.95	Hold	EUR15.00	8%	32,934	(1%)	(7%)	16.6	17.6	3.6	3.9	0.8	0.8	5.1	5.0	1.2	1.2	87.9	3.6
Fortum	FUM1V.HE	EUR18.04	Hold	EUR16.50	(9%)	19,479	(4%)	(8%)	15.1	18.6	6.5	8.4	1.3	1.1	16.2	9.2	12.5	3.7	73.6	6.1
CEZ	CEZ.PR	CZK592	NA	NA	NA	13,749	(8%)	(7%)	11.0	13.1	6.5	7.0	1.2	1.2	10.8	8.9	4.3	3.6	66.1	5.9
					Average		(6%)	(9%)	13.4	15.0	5.7	6.2	1.5	1.4	10.6	9.2	3.9	2.3	104.9	4.8
CGN Power	1816.HK	HKD3.50	Sell	HKD2.90	(17%)	20,391	25%	6%	23.8	20.6	13.2	13.3	2.8	2.5	15.6	12.9	3.7	3.1	174.4	2.2

All estimates are DB estimates and all stock data is from Bloomberg Finance LP
Definitions: 1) Gearing is net debt / shareholders equity; 2) EV is after deducting estimated value of associates;

Share price as of 1/2/2015 Company	Price	Rating	Share price performance local currency 1wk	1m	3m	6m	12m	3yr	avg. daily trade US$, 1m*	Relative performance local currency & local country index** 1wk	1m	3m	6m	12m	3yr	avg. daily trade US$, 6m*	Share price statistics 52w H	52w L	current /current/ 52W H	52W L	10yr H	10yr L	avg. daily trade US$, 1yr*
China Thermal IPPs with nuclear exposure																							
Datang	HKD4.25	Buy	1%	2%	8%	41%	27%	96%	10.1	(1%)	(3%)	(9%)	21%	9%	62%	11.2	4.60	2.62	0.92	1.62	7.93	1.58	7.8
Huadian Fuxin	HKD3.68	Buy	9%	(3%)	(15%)	(7%)	9%	125%	15.4	7%	(8%)	(28%)	(20%)	(7%)	87%	8.1	4.94	3.08	0.74	1.19	4.94	1.31	8.4
Shenergy	CNY6.46	NA	3%	19%	39%	59%	57%	59%	86.6	(1%)	6%	0%	(1%)	(0%)	4%	37.0	6.91	3.89	0.93	1.66	11.93	2.50	23.1
Zhejiang Energy	CNY7.17	NA	2%	18%	29%	61%	45%	10%	70.6	(2%)	5%	(7%)	1%	(8%)	(28%)	42.0	7.77	4.46	0.92	1.61	7.77	4.46	31.5
	Average		4%	9%	15%	38%	35%	73%	45.7	1%	0%	(11%)	0%	(2%)	31%								
China Wind/Hydro IPPs																							
Longyuan	HKD8.21	Buy	3%	1%	9%	(3%)	(16%)	44%	10.1	2%	(4%)	(7%)	(17%)	(28%)	19%	13.4	10.21	7.12	0.80	1.15	10.72	4.40	16.0
HNR	HKD2.53	Buy	5%	(2%)	(1%)	(0%)	(31%)	30%	5.9	4%	(7%)	(16%)	(15%)	(41%)	8%	7.4	3.81	2.14	0.66	1.18	3.83	0.86	8.9
Yangtze Power	CNY10.67	NA	5%	19%	39%	82%	86%	101%	183.2	2%	6%	(0%)	14%	18%	31%	63.0	11.26	5.29	0.95	2.02	12.85	3.21	39.4
Guotou Power	CNY11.44	NA	15%	58%	78%	135%	223%	418%	273.7	11%	41%	28%	47%	104%	239%	87.3	12.55	3.62	0.91	3.16	12.55	1.42	56.3
	Average		7%	19%	31%	53%	65%	148%	118.2	4%	9%	1%	8%	13%	74%								
Regional power utility with nuclear exposure																							
CLP	HKD67.25	Hold	(1%)	(0%)	8%	7%	15%	13%	18.7	(3%)	(5%)	(9%)	(8%)	(2%)	(6%)	18.9	67.90	54.62	0.99	1.23	67.90	28.12	19.4
Kepco	KRW4270C	Buy	(3%)	(9%)	(14%)	12%	22%	55%	83.2	(2%)	(6%)	(11%)	18%	24%	51%	78.1	50200	33250	0.85	1.28	50200	19548	61.7
	Average		(2%)	(5%)	(3%)	10%	19%	34%	51.0	(3%)	(5%)	(10%)	5%	11%	22%								
International power utility with nuclear exposure																							
EdF	USD15.51	Sell	1%	(7%)	(16%)	(20%)	(4%)	(4%)	3.3	3%	(6%)	(20%)	(23%)	(15%)	(40%)	1.7	20.24	13.94	0.77	1.11	21.74	13.94	1.7
Exelon	USD37.57	Buy	(3%)	6%	9%	13%	47%	5%	223.7	(1%)	6%	4%	9%	30%	(35%)	221.5	38.93	25.58	0.97	1.47	68.33	25.48	242.3
RWE	EUR25.68	Hold	(2%)	(14%)	(13%)	(20%)	4%	8%	103.0	(0%)	####	(18%)	(18%)	0%	(32%)	94.5	32.98	23.95	0.78	1.07	67.06	17.91	108.5
EON	EUR13.95	Hold	(3%)	(9%)	(1%)	(8%)	11%	(2%)	183.2	(2%)	(6%)	(7%)	(6%)	7%	(39%)	153.6	15.47	12.23	0.90	1.14	34.37	10.38	164.8
Fortum	EUR18.04	Hold	(1%)	(9%)	(4%)	(7%)	17%	36%	34.8	(1%)	(7%)	(8%)	(9%)	10%	(5%)	38.0	20.32	14.62	0.89	1.23	22.97	5.35	43.5
CEZ	CZK592	NA	1%	(4%)	(8%)	4%	22%	(6%)	8.6	(1%)	0%	(7%)	4%	26%	(12%)	10.3	672	269	0.88	2.20	951	208	12.1
	Average		(1%)	(6%)	(6%)	(7%)	16%	6%	92.8	(0%)	(4%)	(9%)	(7%)	10%	(27%)								
CGN Power	HKD3.50	Sell	0%	25%	25%	25%	25%	25%	193.4	(1%)	19%	6%	7%	7%	4%	193.4	3.66	2.78	0.96	1.26	3.66	2.78	193.4

* in USD millions
**Relative performance is against the HSCEI

Source: Deutsche Bank estimates, Bloomberg Finance LP, Datastream; share price as of 2 Jan 2015

Key upside risks

Higher-than-expected capacity factor

Our assumptions of 74-88% capacity factor might be subject to upside risks from: 1) a shortened overhaul period from smoother-than-expected maintenance/refueling work conducted; 2) high plant availability with less unplanned outage from equipment breakdowns or operation mishandling; and 3) better-than-expected power dispatch even in regions with power oversupply.

Stronger than-expected contribution from Taishan

This mainly includes 1) timely or even ahead-of-schedule start-up of Taishan Nuclear; 2) lower-than-expected investment costs, though the possibility is low based on its current capex spending; 3) higher-than-expected on-grid tariff to lend support to the project as the first EPR project in the world; and 4) other preferential treatment from government such as additional tax incentives.

Parentco asset injection at favorable pricing

Based on the non-competition deed, CGN will have the right to acquire the parentco nuclear assets after they are “substantially completed or ready for commercial operation”. Currently CGNPC has another project under construction, Fangchenggang Nuclear (2x 1,080MW featuring CPR1000 technology). CGNPC has a 61% stake while Guangxi Investment Group holds the remaining 39%. The two units started construction in 2010 and are scheduled to commence operation by 2016.

We believe CGN will likely announce the acquisition of Fangchenggang Nuclear in 2016 or 2017 when the project begins operations. The deal could be value-enhancing at favorable pricing and presents potential upside to our current 2016-17E EPS forecast.

More-than-expected interest rate cut

Given the high debt-to-equity ratio for nuclear project funding, interest expense is a major cost element, accounting for as much as c.25% of total revenue in the early stages of operation. For CGN, every additional 25bps decrease in average finance cost on top of a 50bps cut assumed will result in a 1.9% and 2.5% earnings upside for FY15E and FY16E.

Taishan project – an outlier for CGN

Summary

It is fair to say that CGN has demonstrated good track record in construction and operations in GII/GII+ units, but the proposed acquisition of Taishan GIII Nuclear will add some uncertainty to CGN's earnings growth visibility, for the risks identified below:

- Further construction delays and capex overruns cannot be ruled out given the lack of prior experience for EPR GIII units worldwide and the construction delays and budget overrun for same type of reactors built in France and Finland. Our analysis on project milestones suggests a one year longer delay than management guidance for Unit 2.
- The tariff to be set may not be sufficient to guarantee similar return to GII+ projects under the benchmark tariff given the incurred high costs at Rmb20,900/kW vs. c.Rmb12,500/kW for GII+ units.
- As Taishan will have the world's first GIII EPR units, plant operation will be challenging when it comes to ramping up capacity for the first several years.

Taishan acquisition planned to close in 1Q15

CGN plans to acquire 41% stake in Taishan at Rmb9.7bn, or 1.1x PB

As stated in the prospectus, upon the completion of its Hong Kong listing, CGN is planning to acquire from its parentco a 12.5% equity interest in Taishan Nuclear and a 60% interest in Taishan Investment (one of Taishan Nuclear's current shareholders). The transaction will effectively increase CGN's stake in Taishan Nuclear by 41%, and Taishan Nuclear will become a 51% subsidiary from a 10% equity investment. The acquisition price of Rmb9.7bn will be funded by IPO proceeds.

- Based on the disclosed Rmb20.97bn NAV as of June 2014, the acquisition price would represent 1.1x PB, or c.1.0x if we factor in the further equity contribution for planned capex during the period.
- Taishan Nuclear, located in Guangdong Province, has two 1,750MW units that are currently under construction applying the GIII EPR technology.
- While the transaction is still pending due to relevant approvals from the MOFCOM, CGN expects completion in by end of March 2015. We have factored the consolidation into our model from 2015.

Construction progress of EPR units have encountered universal delay

Taishan Nuclear Units 1-2, firstly scheduled to commence operations in end-2013 and October 2014, are now postponed to 1H16 and 2H16, respectively, according to the latest guidance provided by CGN. The cost is estimated to be Rmb73.2bn (Rmb20,900/kW), up 46% from the original estimates of Rmb50bn.

Moreover, reading through progress of other EPR units under construction, it is still too early to say whether further delays and cost overruns are unlikely. Currently, there are another two EPR units under construction outside China (Flamanville Unit 3 in France and Olkiluoto Unit 3 in Finland).

- EPR in France: five-year delay

Estimated construction period of EPR units in Finland and French are as long as 13 years and 10 years

Flamanville Unit 3, developed by EDF, started construction in December 2007 with an originally designed construction period of 54 months (start-up in 2012). In December 2012, EDF announced completion would be delayed until 2016 and that the cost would increase to EUR8.5bn (Rmb64bn, or Rmb37,200/kW). In November 2014, EDF announced a further postponement into 2017 due to delays in component deliveries from Areva.

- EPR in Finland: 10-year delay

In August 2005, Finland began construction on the world's first EPR unit, which was originally expected to go on line in 2009. It is currently expected to go live by late 2018, as its prolonged construction period (more than 13 years) has delayed it by nearly a decade. It may even be pushed back further. The cost overrun is also substantial. In December 2012, Areva estimated the total cost would come to EUR8.5bn (Rmb64bn, or Rmb37,200/kW), almost three times its original planned EUR3bn.

A closer look at Taishan's construction progress

Because Taishan is the only GIII project under construction for CGN and because its inclusion from 2015 was disclosed in the IPO prospectus, construction schedule and costs are critical for CGN to meet expectations. Therefore, we conducted a more detailed analysis on the milestones of progress achieved and compared it to other nuclear projects under construction. We conclude that Taishan Unit 1 and 2 should start operations in July 2016 and July 2017, respectively, compared to management guidance of 1H16 and 2H16.

Outpacing its French/Finnish peers

According to the September press release from Areva, 95% of components as well as the operational I&C system for the Taishan 1 plant in China have been delivered, and the first commissioning activities have started. This seems to be further along than the two other EPR reactors being built in France and Finland. The Flamanville Unit 3 in France completed RPV installation in January 2014 (Figure 5) and received four steam generators by September, while Taishan Unit 1 completed such steps a year ago.

In Finland, progress is lagging a long way behind. It was hindered by the dispute on compensation for capex overspend, which led to a construction halt, and problems with its contract workers.

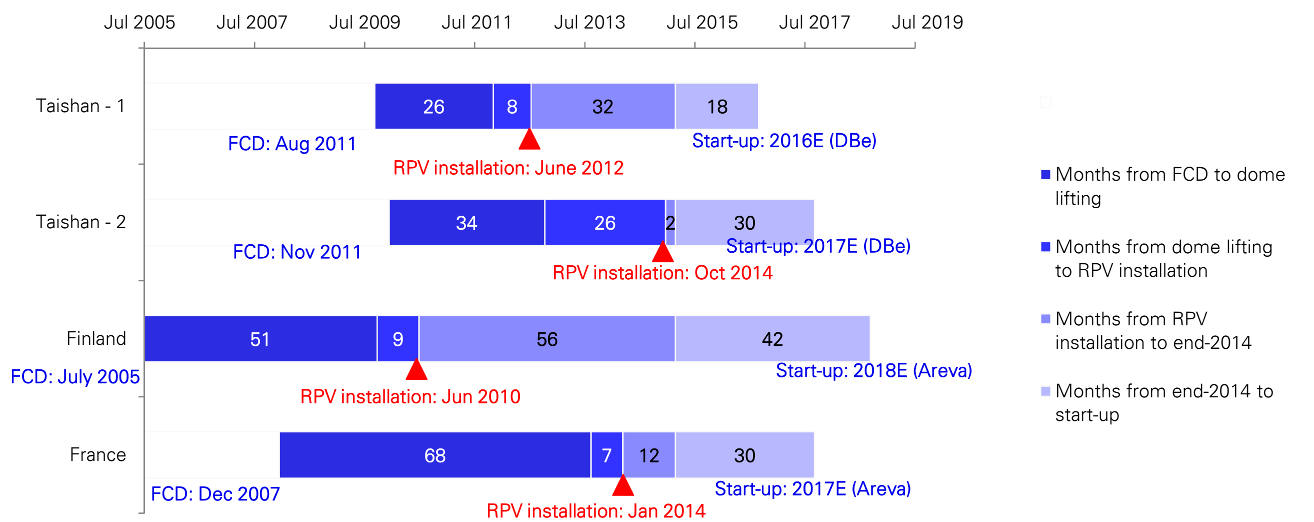
Project milestone achieved suggests likely delay versus guidance

We also noticed that Taishan completed the installation of its hoisting main pump motor on 29 September. As of mid-December 2014, cold testing of Taishan has not started and another 16 months will be needed after cold testing before commercial operation can begin, if we assume a similar cycle as GII+ units (Ningde 1: 17 months; Hongyanhe 2: 15 months). Therefore, we assume a start-up of Unit 1 in July 2016, leaving a two- to three-month buffer between now and cold testing.

Taishan Unit 2 is likely to start operation one-year behind company guidance

Unit 2 completed reactor pressure vessel (RPV) installation in October 2014, about 30 months behind Unit 1. Nevertheless, we expect the pace of construction in Unit 2 to pick up, as it benefits from the experiences of Unit 1. Although CGN management guidance calls for a 2H16 start-up, Areva's estimate is one year behind Unit 1, which looks more reasonable based on current progress. Therefore, we expect a start-up in July 2017.

Figure 67: Construction progress for EPR units



Source: Areva, Deutsche Bank estimates

Taishan investment costs might be revised up further

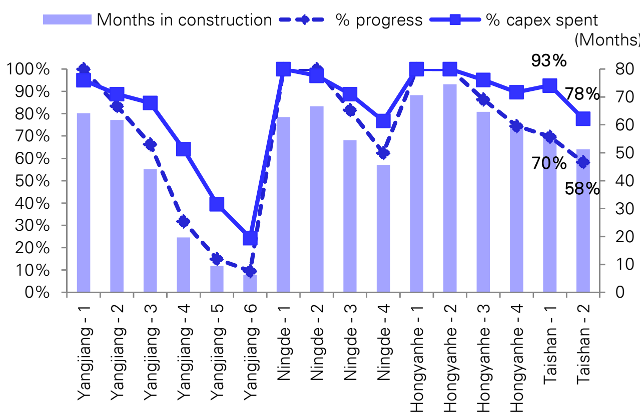
As capex overspend is usually a consequence of construction delays, we are not too worried for the GII+ units, given the delay is normally within one year. However, the question remains open on Taishan Nuclear, which is likely to be the first GIII EPR project in the world.

The investment of Taishan could be revised up considering higher cost estimates of its peers and the proportion spent up-to-date

Although the total investment estimated for the France and Finland projects might not be indicative given the much longer construction period, EU officials revealed in October that costs for Hinkley Point C in the UK (HPC, 2x1,630MW, EPR) would reach GBP24.5bn (Rmb72,800/kW), almost double the unit investment for Taishan. Hinkley Point C has not started construction yet but the UK government has agreed to pay EDF GBP0.0925/kWh (Rmb0.9/kWh) for the electricity output from Hinkley Point C.

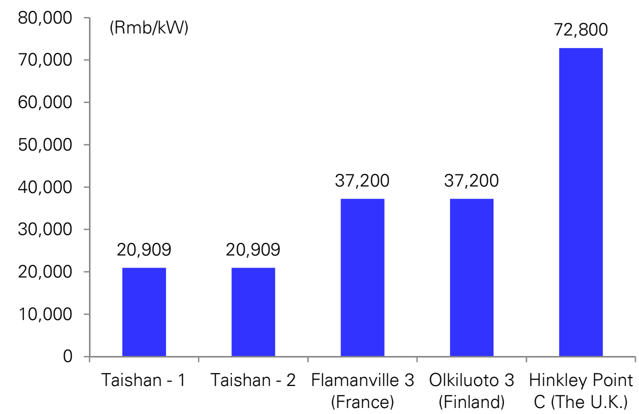
Based on our estimated schedule, Taishan Unit 1 and 2 have completed 70% and 58% of construction, respectively, based on months in construction divided by months needed, while the incurred capex up to 1H14 has reached 93% and 78% of total capex budget. The figure might not be proportional to time of construction as the capex should be frontloaded – the last few months are mostly testing with major equipment purchases completed – but we believe there is still a risk that Taishan may report another round of cost increases (after revising up by 46% from Rmb50bn in total previously).

Figure 68: Construction progress vs. % capex incurred



Source: Company data, Deutsche Bank

Figure 69: Estimated unit capex comparison



Source: Company data, Deutsche Bank estimates

Uncertainty in the tariff setting of Taishan Nuclear

Taishan might need a tariff of Rmb540/MWh to cover its high investment

There is currently no clear policy guidance regarding the tariff setting for GIII units. As Taishan's investment is 70-100% higher than CGN's GII+ units, we believe that even if a higher tariff is granted, the amount could still be insufficient to make it earn comparable return to GII units. For reference, CNNC stated that it would propose a Rmb510/MWh (tax-inclusive) tariff for Sanmen Nuclear if the final investment runs over by 20% to c.Rmb19,600/kW. On a similar calculation, the potential tariff needed by Taishan Nuclear would round up to Rmb540/kWh (without factoring any further capex overrun), which is 26% higher than the current GII+ benchmark tariff of Rmb430/MWh and 8% higher than the local coal-fired tariff of Rmb502/MWh in Guangdong.

Currently, we assume tariff of Rmb510/MWh in our model, which is slightly above local coal-fired tariff. An Rmb25/MWh change in Taishan's tariff will lead to 0.8%/3.2% earnings change in CGN's 2016/17E earnings.

Figure 70: Taishan – project IRR under different tariff and investment case

Tariff	Unit investment (Rmb/kWh)				
(Rmb/MWh)	19,855 (-5%)	20,900 (base)	21,945 (+5%)	23,042 (+10%)	24,194 (+15%)
430 (GII+)	5.3%	5.0%	4.8%	4.5%	4.3%
470	6.0%	5.7%	5.4%	5.2%	4.9%
510 (base)	6.6%	6.3%	6.0%	5.7%	5.5%
550	7.2%	6.9%	6.6%	6.3%	6.0%
590	7.8%	7.5%	7.1%	6.8%	6.5%

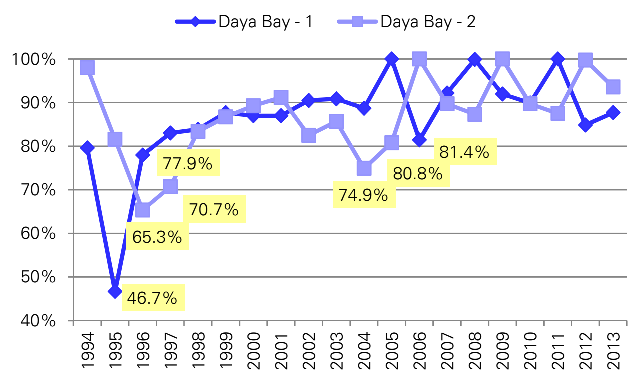
Source: Deutsche Bank estimates

Operation challenge for the first EPR project in the world

Plant operation could be challenging for Taishan during the first several years – as experienced in Daya Bay

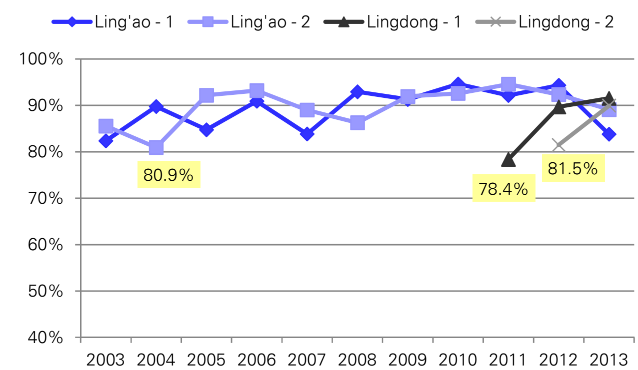
Despite a high designed capacity factor and dispatch priority, nuclear utilization is not immune to risks from 1) lack of operating experiences; 2) teething issues; and 3) equipment breakdowns. As Taishan is likely to be the worlds' first EPR units, plant operation will come as another big challenge once commissioned, and if any breakdown happens, the overhaul period could be prolonged. The same has been experienced during the early days of Daya Bay operation. As shown in Figure 71, Daya Bay reported a low capacity factor in 1995 (46.7%, Unit1) and 1996 (65.3%, Unit 1; 70.7%, Unit 2). Although we believe CGN has demonstrated a strong operation track record, it is prudent to apply caution given the challenge for the first EPR GIII project.

Figure 71: Historical utilization – Daya Bay



Source: IAEA, Deutsche Bank

Figure 72: Historical utilization – Ling'ao and Lingdong



Source: IAEA, Deutsche Bank

Profitability risk for other units

Summary

Besides the GIII Taishan project uncertainty discussed, we see several risks relating to the future profitability of GII/II+ projects, including:

- Lower utilization from regional power oversupply. For each 1% decrease in capacity factor (or 88-hour decrease in utilization hours), CGN's FY15E earnings will be reduced by 3.3%.
- Potential tariff discount or profit sharing for extra outputs above 80% capacity factor to support peak-shaving pump storage plants.
- Expiration of Daya Bay's preferential tax treatment and VAT rebate may pose a downside risk. In addition, nuclear plants have a higher sensitivity to labor cost hikes compared with other types of power generation.

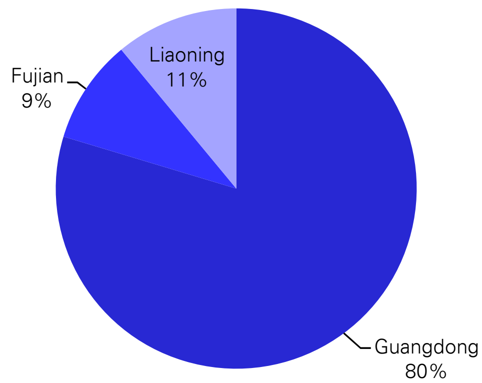
Market risk from regional power oversupply

Nuclear utilization is increasingly subject to market risks under potential regional oversupply

In addition to the capacity loss coming from the generating plant itself, nuclear utilization is increasingly subject to market risks, especially in regions with abundant supply. There are anecdotal reports that China's nuclear power might participate in peak shaving in the future when nuclear become a meaningful source of energy supply. i.e. >15% of local power market, which could lower their annual utilization to c.7,000 hours.

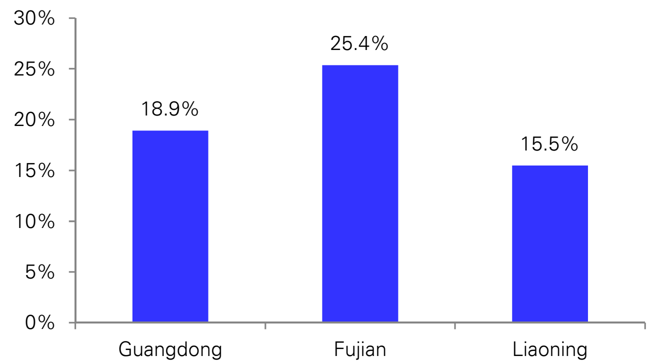
CGN's units are concentrated in Guangdong, Liaoning, and Fujian provinces, where nuclear power will account for 15-25% of total generation in 2017E. Among the three, Liaoning is already subject to lower utilization (<7,000 hours). Guangdong, the most important market to CGN, is likely to maintain utilization of 7,500 hours, but is still exposed to risk from unfavorable change in local power demand growth and volume of hydro power imports from southwest China under the West-to-East Power Transmission arrangement.

Figure 73: CGN – attributable capacity breakdown by province (including units under construction)



Source: Company data, Deutsche Bank

Figure 74: Nuclear percentage of total generation (2017E)



Source: Deutsche Bank estimates

Liaoning – nuclear has to compromise on high mix of cogeneration and wind

Liaoning has been facing power oversupply for a couple of years. In 2013, utilization for coal-fired units was only 4,353 hours, one of the lowest in China. With the sequential commissioning of nuclear units and a quick wind capacity addition, Liaoning will likely suffer from a more severe power oversupply in the next few years.

- In 9M14, Hongyanhe Unit 1 recorded only 4,194 hours of utilization, indicating a <6,400-hour full-year utilization.
- Even assuming a 6,500 hours of nuclear utilization and treating coal as a plug-in, coal utilization will still face a significant drop to 4,000-4,162 hours in 2015-17E.
- Given that most coal units supply heat for local residents, the dispatch of coal-fired cogeneration units must be prioritized during winter.

Guangdong: less of a concern but potential threat from cheaper hydro imports

Currently, more than 80% CGN's attributable nuclear outputs came from Guangdong province. Therefore, the power demand and supply forecasts in Guangdong are extremely important to CGN's utilization outlook.

By assuming 7,500 hours of nuclear utilization (vs. 7,600-7,800 hours historically), we believe Guangdong's coal utilization will remain above 4,900 hours until 2017, even with the commissioning of the 4.4GW Yangjiang Nuclear (units 1-4) and 3.5GW Taishan Nuclear, due to the large size of the power market and the expectations for stronger growth. However, the results are sensitive to the power demand growth assumption – by assuming a 5% demand growth p.a. instead of 7% in our base case, thermal utilization will drop to 4,455 hours in 2017E, in which case utilization rate of nuclear units will also be vulnerable.

In addition, another swing factor is cheaper hydro imports from southwest China such as Yunnan and Guangxi, given their lower generation costs (Rmb290/MWh) than nuclear (Rmb430MWh). From both dispatch priority policy and cost competitiveness perspectives, hydro is superior to nuclear.

Fujian: better than Liaoning due to strong demand growth and export potential

By assuming 7,500hrs of nuclear utilization, we calculate that Fujian's coal utilization will remain above 5,000hrs in 2015-16 but we will see a likely 4%

decline to 4,958hrs in 2017E. Indeed, nuclear will represent 25% of provincial generation output in 2017, the highest among all provinces in China. However, the outlook is better than for Liaoning thanks to:

- A relatively healthy power market with strong demand growth (9.3% in 11M11) and high coal utilization hours (5,296 in 2014E, 450hrs above national average), and
- The Ultra-High-Voltage transmission line being built for exporting power to neighboring Zhejiang province, which will export 12% Fujian output in 2017, based on our estimates.

However, a 1% drop in the annual power demand growth in Fujian, over the assumed 6% pa in 2015-17E will further bring down the 2017E coal-utilization to 4,710hrs. Meanwhile, given Fujian's higher reliance on hydro (20%), there is likely downside risk in the year when rainfall is extremely favorable to hydro.

Guangxi: increasing oversupply risk under quick ramp up of thermal capacity

In 2015/16/17, we estimate that the total installed capacity in Guangxi will increase by 10.2%/12.1% and 4.5%, respectively, mainly contributed by thermal and nuclear. As compared to a power demand growth of 6.0% p.a., the excessive capacity growth will result in a significant oversupply situation in 2016-17E while the high hydro generation mix (47% in 11M14) increases the volatility in thermal utilizations.

We assume a normalized 2,800hrs of utilization during 2015-17E. Nevertheless, the power oversupply still looks severe in 2016-17E with a substantial thermal new capacity to come online. We forecast thermal utilization likely to fall to only 3,602hrs in 2017E, suggesting it may be a challenge for nuclear to maintain above 7,000hrs. In addition to pressure from thermal utilization collapse, in a year of better-than-expected water flow, it is likely that nuclear utilization will be further squeezed given the priority dispatch of hydro over nuclear.

CGN may enter into Guangxi province through the acquisition of Fangchenggang Nuclear, which we discussed in our valuation scenario analysis.

In our FITT report, we conducted a more detailed analysis for the power market outlook in Liaoning, Fujian, Guangdong and Guangxi, based on our proprietary bottom-up, plant-by-plant pipeline for thermal, nuclear, and large hydro.

Potential tariff discount or profit sharing scheme

In contrast with wind tariff, where a 20-year time frame has been specified, the nuclear benchmark tariff is only stated to "remain relatively stable" and "adjustable based on the changes in technology, costs, power demand and supply". **In a supply-surplus situation, we believe a tariff discount or some kind of profit-sharing schedule could be introduced for the excess power generation over a certain level.**

For example, in May 2014, State Grid Fujian Electric Power signed a Peak-shaving Compensation Agreement with Ningde Nuclear, which will have a profit-sharing scheme for the excess power generation over the planned 7,008 hours in order to support local pump storage plant undertaking peak-shaving functions.

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Besides, the undergoing power reform could also be a game changer over the long term. Currently the Direct Power Supply volume remains low at 5%/10% of total electricity sales of IPPs in 2015/2016 based on the plan announced by various provinces and is mostly limited to large thermal and hydro plants. However, rolling out the scheme further would potentially require the participation of nuclear power – when nuclear gencos may have to trade tariff discount for volume given its relatively low marginal operating cost.

Limited impact from new nuclear approval in 2015-16

New nuclear project approval in 2015, although sentimentally positive to the whole industry, will have limited impact on CGN given:

- Hongyanhe 5-6, likely to be approved in 1H15 and included or injected in listco, seem to be less exciting due to Liaoning's power oversupply discussed earlier.
- Other new projects are reserved at the parentco level, contingent on the timing and pricing of injections, and will not contribute any earnings before 2020E – such as Lufeng and Xianning.
- Several other likely approved projects not invested by CGN, such as Shidaowan, Fuqing 5-6, Ningde 5-6, Tianwan 5-6, Xudapu 1-2, Sanmeng 3-4, Haiyang 3-4 and Zhangzhou 1-2.

Hongyanhe Units 5-6 likely under listco, but profitability is a concern

Except for Hongyanhe 5-6, other new projects to be approved are reserved at parentco level and injection is unlikely before 2020

Hongyanhe Phase II (Units 5-6), featuring a relative mature ACPR1000 technology, are among the most likely units to receive approval first. Assuming a construction start in April 2015, the two units could be commissioned in 2020 and 2021, respectively, based on the planned construction period of 65 months. While the final decision is still up to the government, it is likely that Units 5-6 will be approved as a Phase II project subordinated to Phase I and included in the CGN listco. However, we are concerned over profitability given the already severe power oversupply in Liaoning province. The market may not view it favorably if Hongyanhe Phase I generates low returns.

Other new projects reserved at parentco level

Other than Hongyanhe 5-6, the projects currently pending approval are still under parentco (Figure 75). Among them, Fangchenggang Units 3-4 might receive approval in mid-2015 and start operations before 2020. However, based on our Guangxi power market analysis, Fangchenggang could face similar utilization rate challenges like Hongyanhe in Liaoning. Meanwhile, the commissioning of Lufeng (AP1000) and Xianning (in-land) should be post-2020 due to significant delays in pilot AP1000 projects.

Based on the non-competition deed, CGN will have the right to acquire the parentco nuclear assets after they are "substantially completed or ready for commercial operation". As a result, to CGN, the benefit from nuclear resumption is contingent on pricing and timing of project injection, while actual earnings contribution is either with uncertainties or post-2020.

Figure 75: CGNPC – projects under construction/at preliminary stage

Unit	Location	Technology	Size (MW)	Stake	Attri.	Construction start	Operation start (DBe)	Comment
Fangchenggang Unit 1	Guangxi	CPR1000	1,080	61%	659	Jul 2010	Jun 2015	Under construction
Fangchenggang Unit 2	Guangxi	CPR1000	1,080	61%	659	Dec 2010	Feb 2016	Under construction
Fangchenggang Unit 3	Guangxi	Hualong One	1,080	61%	659	Apr 2015	May 2019	Preparatory stage (not approved)
Fangchenggang Unit 4	Guangxi	Hualong One	1,080	61%	659	Jan 2016	Mar 2020	Preparatory stage (not approved)
Lufeng Unit 1	Guangdong	AP1000	1,250	100%	1,250	Jan 2016	Post-2020	Preparatory stage (not approved)
Lufeng Unit 2	Guangdong	AP1000	1,250	100%	1,250	Oct 2016	Post-2020	Preparatory stage (not approved)
Xianning Unit 1	Hubei	AP1000	1,250	60%	750	Jul 2016	Post-2020	Preparatory stage (not approved)
Xianning Unit 2	Hubei	AP1000	1,250	60%	750	Apr 2017	Post-2020	Preparatory stage (not approved)

Source: Deutsche Bank, CGNPC

Other risks

Expiration of preferential tax treatment

Daya Bay Nuclear has been in operation for more than 15 years and still enjoys a full VAT refund for all of its power sales to Guangdong Grid, which accounts for 30% of its generation. This preferential treatment expires at end-2014, and there is a risk that CGN may not receive an extension. If this is the case, CGN's 2015/16E earnings will be reduced by 0.9%/0.8% (currently we assumed a 50% rebate from 2015E). In addition, Daya Bay and Ling'ao are considered high-tech enterprises and therefore enjoy a three-year preferential tax rate of 15%. This rate was renewed in 2014 but might fail to be renewed upon its next expiration in 2017.

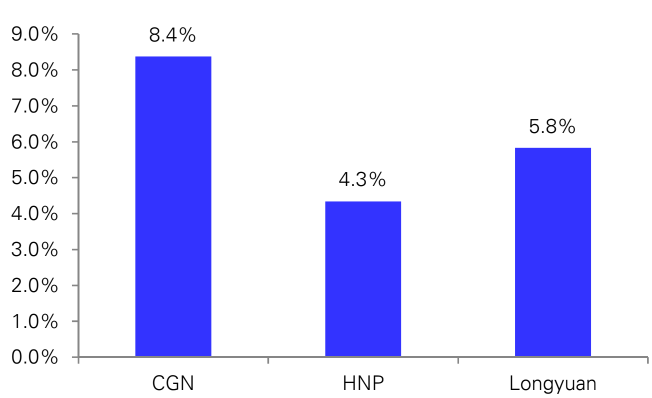
Daya Bay enjoys full VAT rebate for mainland power sales and 15% tax rate – both might expire

Labor cost hikes

Nuclear power has a lower portion of fuel costs within its operating costs. However, interestingly, it has the highest proportion of labor costs of revenue among all types of power generation. As shown in Figure 76, labor costs account for 8.4% of revenue for CGN vs. 4.3% for Huaneng and 5.8% for Longyuan. A 10% hike in labor costs will lead to a 3.4% earnings downside to CGN (2015E). With a considerable amount of nuclear capacity coming into operation in the next three years, a potential shortage of talent may push up labor costs.

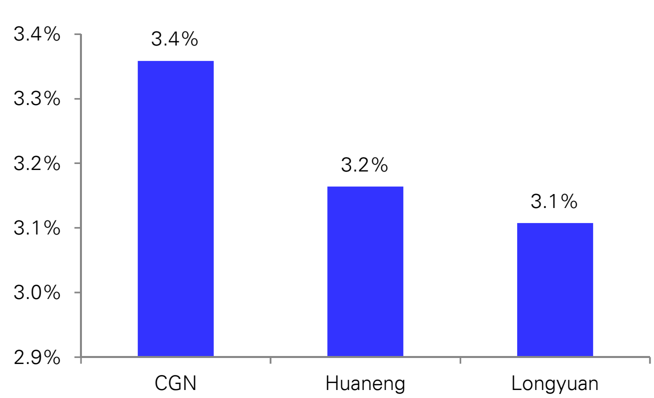
High sensitivity to labor cost increase –- a concern if skilled staff run short of the quickly ramping-up capacity

Figure 76: Labor cost as percentage of revenue (2013)



Source: Deutsche Bank, Company data

Figure 77: Earnings sensitivity to 10% labor cost change (2015E)



Source: Deutsche Bank estimates

Key operating assumptions

Commissioning schedule

Status check for the constructing GII+ units: on track

With the exception of Taishan, CGN's constructing units use a mature GII+ CPR1000/ACPR1000 technology, for which CGN has an established track record of construction time control. For Lingdong Units 1-2, Yangjiang Unit 1, and Ningde Units 1-2, construction took between 58 and 67 months, while Hongyanhe Units 1-2 took slightly longer (71-75 months) due to the winter break needed in the northeast region.

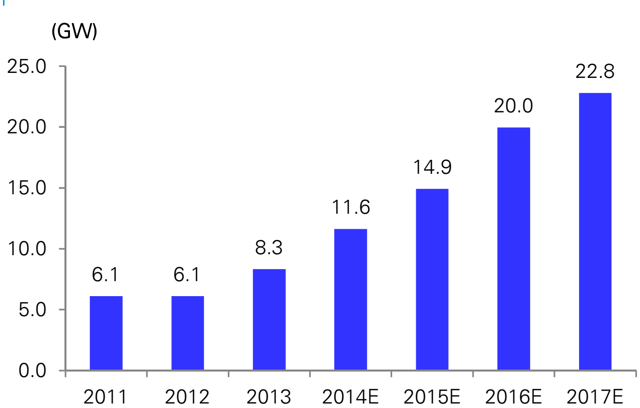
Except for Taishan, other CGN's projects look largely on track to be commissioned as scheduled

Attributable capacity growth: 20% CAGR in 2014-17E

Among the 13.3GW capacity under construction, we expect 11.2GW will be put into operation by end-2017, which will translate into a 20% CAGR in attributable capacity in 2014-17E. The capacity growth will mainly come from:

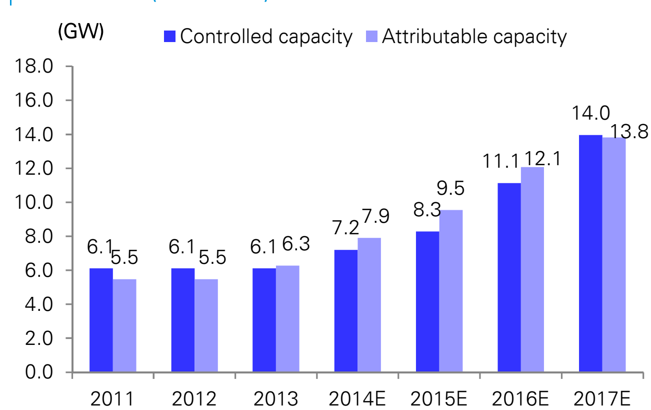
- **Yangjiang Nuclear** (subsidiary, 78.2% stake): While Unit 1 was successfully put into operation in March 2014, the remaining five units (5.4GW, 78.2% interest) are currently under construction. Based on our estimates, Units 2, 3, and 4 will be commissioned in July 2015, May 2016, December 2017, respectively, with a total of 3.2GW. Units 5-6, on the other hand, are likely to become operative in 2018-19.
- **Ningde Nuclear** (JV, 33.3% stake): Units 3 and 4 will be commissioned in July 2015 and October 2016, respectively, with a total of 2.2GW.
- **Hongyanhe Nuclear** (Associates, 38.2% stake): Units 3 and 4 will be commissioned in May 2015 and March 2016, respectively, with a total of 2.2GW.
- **Taishan Nuclear** (upon acquisition, subsidiary, 51% stake): Units 1 and 2 will be commissioned in July 2016 and July 2017, respectively, with a total of 3.5GW.

Figure 78: CGN – capacity growth, total (2011-17E)



Source: Company data, Deutsche Bank estimates

Figure 79: CGN – capacity growth, controlled and attributable (2011-17E)



Source: Company data, Deutsche Bank estimates

Figure 80: CGN – nuclear assets overview (in operation + under construction) post the acquisition of Taishan

Plant	Location	Technology	Size (MW)	Type	Stake	Attrib. (MW)	Status	Construction start	Operation (DBe)
Daya Bay Unit 1	Guangdong	M310	984	Consolidated	75.0%	738	In operation	Aug 1987	Feb 1994
Daya Bay Unit 2	Guangdong	M310	984	Consolidated	75.0%	738	In operation	Apr 1988	May 1994
Ling'ao Unit 1	Guangdong	M310	990	Consolidated	100.0%	990	In operation	May 1997	May 2002
Ling'ao Unit 2	Guangdong	M310	990	Consolidated	100.0%	990	In operation	Nov 1997	Jan 2003
Lingdong Unit 1	Guangdong	CPR1000	1,087	Consolidated	93.2%	1,013	In operation	Dec 2005	Sep 2010
Lingdong Unit 2	Guangdong	CPR1000	1,087	Consolidated	93.2%	1,013	In operation	Jun 2006	Aug 2011
Yangjiang Unit 1	Guangdong	CPR1000	1,086	Consolidated	78.2%	849	In operation	Dec 2008	Mar 2014
Yangjiang Unit 2	Guangdong	CPR1000	1,086	Consolidated	78.2%	849	In operation	Jun 2009	Jul 2015
Yangjiang Unit 3	Guangdong	CPR1000	1,086	Consolidated	78.2%	849	Under construction	Nov 2010	May 2016
Yangjiang Unit 4	Guangdong	CPR1000	1,086	Consolidated	78.2%	849	Under construction	Nov 2012	Dec 2017
Yangjiang Unit 5	Guangdong	ACPR1000	1,086	Consolidated	78.2%	849	Under construction	Sep 2013	Dec 2018
Yangjiang Unit 6	Guangdong	ACPR1000	1,086	Consolidated	78.2%	849	Under construction	Dec 2013	Jun 2019
Ningde Unit 1	Fujian	CPR1000	1,089	JV	33.3%	363	In operation	Feb 2008	Apr 2013
Ningde Unit 2	Fujian	CPR1000	1,089	JV	33.3%	363	In operation	Nov 2008	May 2014
Ningde Unit 3	Fujian	CPR1000	1,089	JV	33.3%	363	Under construction	Jan 2010	Jul 2015
Ningde Unit 4	Fujian	CPR1000	1,089	JV	33.3%	363	Under construction	Sep 2010	Oct 2016
Hongyanhe Unit 1	Liaoning	CPR1000	1,119	Associate	38.2%	427	In operation	Aug 2007	Jun 2013
Hongyanhe Unit 2	Liaoning	CPR1000	1,119	Associate	38.2%	427	In operation	Mar 2008	May 2014
Hongyanhe Unit 3	Liaoning	CPR1000	1,119	Associate	38.2%	427	Under construction	Mar 2009	May 2015
Hongyanhe Unit 4	Liaoning	CPR1000	1,119	Associate	38.2%	427	Under construction	Aug 2009	Mar 2016
Taishan Unit 1	Guangdong	EPR	1,750	Consolidated	51.0%	893	Under construction	Nov 2009	Jul 2016
Taishan Unit 2	Guangdong	EPR	1,750	Consolidated	51.0%	893	Under construction	Apr 2010	Jul 2017
Total			**24,970**			**15,520**			

Source: Company data, Deutsche Bank estimates

Tariff

About half of CGN's units will apply benchmark nuclear tariff, with exceptions to Daya Bay, Ling'ao, Hongyanhe and likely Taishan

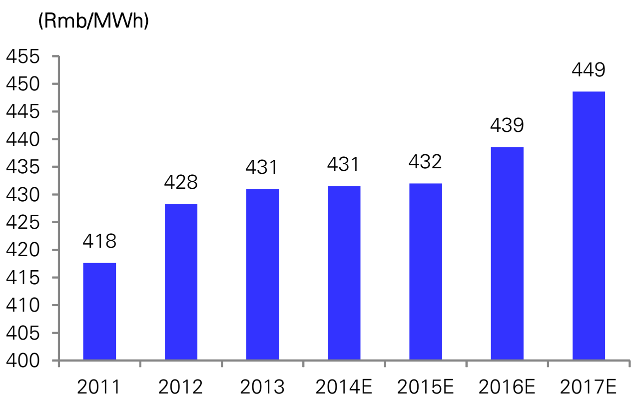
In July 2013, China set a benchmark tariff of Rmb430/MWh for GII+ nuclear units coming into operation after January 2013, which is guided to stay relatively stable to encourage the healthy development of the industry. Among the 22 units to which CGN has exposure, 14 units apply or will likely apply the benchmark tariff with the exceptions of Daya Bay Units 1-2, Ling'ao Units 1-2 and Hongyanhe Units 1-4. For Taishan GIII project, we have assumed a tariff of Rmb510/MWh as discussed before.

- **Daya Bay Nuclear**: its domestic sales to Guangdong Power Grid (c.30%) will apply an Rmb420/MWh tariff set under the "one plant, one price" tariff, as it started operation as early as 1994. For its power sales to Hong Kong, the tariff is negotiated based on a set of factors including the capacity factor, market condition, costs of generation, and exchange rates. Based on our calculation, the historical tariff ranges between Rmb430-441/kWh, which is slightly higher than the VAT-exempted tariff for domestic sales.
- **Ling'ao Nuclear**: commissioned during 2002-03, also applies the "one plant, one price" tariff set at Rmg429/MWh.
- **Hongyanhe Nuclear**: as Liaoning's coal-fired tariff is lower than the benchmark nuclear tariff, Hongyanhe Nuclear will apply the coal-fired

tariff at the time of commissioning. After the September 2014 coal-fired tariff cut, we expect a lower tariff to Rmb404/MWh for Units 3-4.

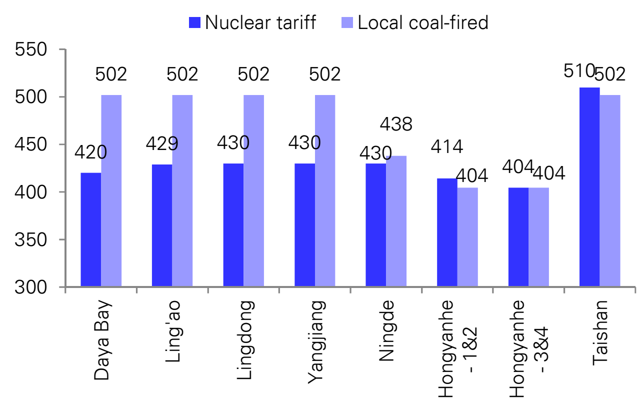
Overall, we expect the weighted average tariff of CGN (consolidated) will see a slight increase during 2015-17E contributed by the higher assumed tariff for Taishan Nuclear (Figure 81).

Figure 81: Weighted average on-grid tariff, including VAT (2011-17E)



Source: Deutsche Bank estimates, company data

Figure 82: Tariff by plant, including VAT (2011-17E)



Source: Company data, Deutsche Bank estimates

Utilization hours

We assumed a 83-85% capacity factor (or 7,300-7,500 hours of utilization) for most of CGN's operating units in 2015-17E by taking into consideration 1) the refueling cycle; 2) provincial power demand and supply; and 3) a safety buffer from unexpected equipment breakdown. For Hongyanhe Nuclear, our assumption is lower at 74.2% (or 6,500 hours) considering the more severe power oversupply issue in Liaoning Province. For Daya Bay, our assumption is higher at 88% (or 7,700 hours) considering it will supply 70-80% of power generation to Hong Kong.

Our capacity factor assumption ranges in 74-88%, with a company average (consolidated) of c.86% in 2015-17E

Refueling cycle

Refueling is a routine outage that occurs every 12 to 18 months depending on the specific plant. The process normally lasts for 30 days (c. 8% capacity loss on an annual basis), except in the second and tenth years of operation, when the process could be extended to 60-90 days (16-19% capacity loss). For example, the refueling outage sessions for Ningde Unit 1 and Hongyanhe Unit lasted for 91 days and 81 days, respectively, in their second year of operation.

- Daya Bay and Taishan Nuclear have a designed refueling cycle of 18 months. Note that the actual refueling interval could be different from the designed one based on operation arrangement.
- Ningde Nuclear, after the first reload 12 months after commissioning, could extend its refueling cycle to 18 months but the actual interval depends on the plant operation schedule.
- Other units all adopt a refueling cycle of 12 months.

Figure 83: Capacity factor (%) – plant breakdown (2011-17E)

Plant	2011	2012	2013	2014E	2015E	2016E	2017E
Daya Bay - 1	100.0	83.9	86.8	85.0	88.0	88.0	88.0
Daya Bay - 2	86.6	100.0	86.0	85.0	88.0	88.0	88.0
Ling'ao - 1	91.4	93.6	82.9	85.0	85.0	85.0	85.0
Ling'ao - 2	94.1	91.3	88.6	85.0	85.0	85.0	85.0
Lingdong - 1	72.1	88.5	90.1	85.0	85.0	85.0	85.0
Lingdong - 2	99.6	80.6	89.0	86.0	85.0	85.0	85.0
Yangjiang - 1				92.0	85.0	85.0	85.0
Yangjiang - 2				83.0	85.0	85.0	85.0
Yangjiang - 3					85.0	85.0	85.0
Yangjiang - 4					85.0	85.0	85.0
Yangjiang - 5					85.0	85.0	85.0
Yangjiang - 6					85.0	85.0	85.0
Ningde - 1			100.0	65.0	83.0	83.0	83.0
Ningde - 2				85.0	83.0	83.0	83.0
Ningde - 3					83.0	83.0	83.0
Ningde - 4					83.0	83.0	83.0
Hongyanhe - 1			99.9	74.2	74.2	74.2	74.2
Hongyanhe - 2				74.2	74.2	74.2	74.2
Hongyanhe - 3					74.2	74.2	74.2
Hongyanhe - 4					74.2	74.2	74.2
Taishan - 1					85.0	85.0	85.0
Taishan - 2					85.0	85.0	85.0
Consolidated	**89.4**	**89.5**	**87.3**	**86.0**	**85.8**	**85.6**	**85.5**

Source: Company data, Deutsche Bank

Figure 84: Net output (bn kWh) – plant breakdown (2011-17E)

Plant	2011	2012	2013	2014E	2015E	2016E	2017E
Daya Bay - 1	8.22	6.95	7.15	7.00	7.25	7.27	7.25
Daya Bay - 2	7.11	8.31	7.09	7.01	7.26	7.28	7.26
Ling'ao - 1	7.57	7.66	6.84	7.01	7.01	7.03	7.01
Ling'ao - 2	7.73	7.47	7.26	6.97	6.97	6.99	6.97
Lingdong - 1	6.33	7.72	7.94	7.49	7.49	7.51	7.49
Lingdong - 2	3.55	7.01	7.87	7.61	7.52	7.54	7.52
Yangjiang - 1				6.31	7.60	7.62	7.60
Yangjiang - 2				-	3.81	7.62	7.60
Yangjiang - 3				-	-	5.08	7.60
Yangjiang - 4				-	-	-	0.33
Yangjiang - 5				-	-	-	-
Yangjiang - 6				-	-	-	-
Ningde - 1			6.27	5.73	7.31	7.33	7.31
Ningde - 2				5.03	7.44	7.46	7.44
Ningde - 3				-	3.73	7.46	7.44
Ningde - 4				-	-	1.86	7.44
Hongyanhe - 1			4.98	6.49	6.49	6.51	6.49
Hongyanhe - 2				4.35	6.84	6.86	6.84
Hongyanhe - 3				-	4.57	6.86	6.84
Hongyanhe - 4				-	-	5.71	6.84
Taishan - 1				-	-	6.14	12.25
Taishan - 2				-	-	-	6.14
Consolidated	**40.52**	**45.11**	**44.16**	**49.40**	**54.91**	**70.08**	**85.02**

Source: Company data, Deutsche Bank

Fuel costs

Fuel costs account for 34% of CGN's COGS in 1H14 (Figure 85) and 13-16% of CGN's total revenue in 2011-1H14.

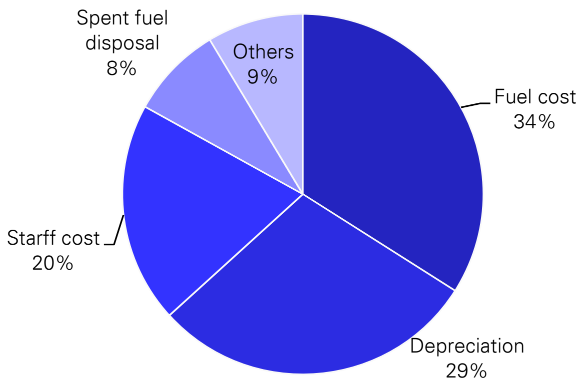
CGN procures most of its nuclear fuel via a 10-year contract from CGN Uranium, a subsidiary of CGNPC, with exceptions to only Daya Bay and Taishan.

Fuel cost will likely remain at c.15% of revenue considering the stable uranium price outlook and the long-term purchasing contract

- Daya Bay procures part of its enriched uranium from CNEIC (a subsidiary of CNNC, to expire in 2015) and nuclear fuel from overseas (contract period 2009-22).
- Taishan Nuclear will purchase the fuel assemblies for its first 15 deliveries of fuel directly from abroad under the agreement with Areva.
- However, CGN's management advised that despite using a different supplier, the cost is generally in line with the global long-term contract price, with limited differences.

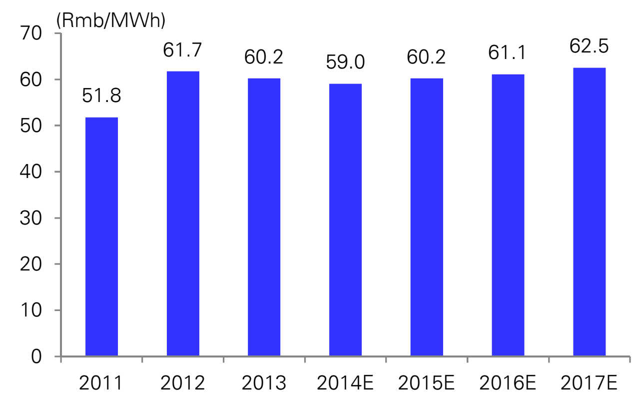
Given a relatively stable uranium contract price outlook, we assume fuel cost will continue to account for c.15% of CGN's total revenue in 2015-17E, with slight increase in unit fuel cost attributable to Taishan's overseas purchase.

Figure 85: CGN – cost breakdown (1H14)



Source: Company data, Deutsche Bank

Figure 86: Unit fuel cost trend



Source: Company data, Deutsche Bank estimates

Tax rate and VAT rebate

VAT rebate

Based on the VAT rebate policy, CGN's nuclear units are entitled to VAT refunds for the first 15 years of operation. The VAT refund rate is 75% for the first five years, 70% for the second five years, and 55% for the third five years.

Nuclear enjoys preferential treatment for VAT (first 15 years) and income tax (first 6 years)

Daya Bay Nuclear, though being in operation for over 15 years, enjoys a full VAT refund for all of its power sales to Guangdong Grid, which accounts for 30% of its generation. Although the preferential treatment will expire at the end of 2014, CGN is applying for an extension, though the actual refund rate is not clear yet. We assume a 50% refund from 2015E for its domestic sales, which will lower the effective refund rate of Daya Bay to 10% in 2015-17E from 30% earlier. The power sales to Hong Kong (c.80% of power generation) are exempt from VAT.

Preferential income tax rate

According to the State Administration of Taxation (SAT), nuclear power units will be exempted from 100% of corporate income tax in years 1-3 and from 50% in years 4-6 after operation commences. In addition, Daya Bay and Ling'ao are considered high-tech enterprises and enjoy a three-year preferential tax rate of 15%, which was renewed in 2014. However, we assume the preferential tax rate will expire from 2018 onwards, when the 25% statutory tax rate applies.

Figure 87: VAT rebate rate (2011-17E)

Plant	2011	2012	2013	2014E	2015E	2016E	2017E
Daya Bay - 1	30%	30%	30%	30%	10%	10%	10%
Daya Bay - 2	30%	30%	30%	30%	10%	10%	10%
Ling'ao - 1	70%	55%	55%	55%	55%	55%	0%
Ling'ao - 2	70%	70%	55%	55%	55%	55%	55%
Lingdong - 1	75%	75%	75%	75%	70%	70%	70%
Lingdong - 2	75%	75%	75%	75%	75%	70%	70%
Yangjiang - 1				75%	75%	75%	75%
Yangjiang - 2					75%	75%	75%
Yangjiang - 3						75%	75%
Yangjiang - 4							75%
Yangjiang - 5							
Yangjiang - 6							
Ningde - 1			75%	75%	75%	75%	75%
Ningde - 2				75%	75%	75%	75%
Ningde - 3					75%	75%	75%
Ningde - 4						75%	75%
Hongyanhe - 1			75%	75%	75%	75%	75%
Hongyanhe - 2				75%	75%	75%	75%
Hongyanhe - 3					75%	75%	75%
Hongyanhe - 4						75%	75%
Taishan - 1						75%	75%
Taishan - 2							75%

Source: Company data, Deutsche Bank

Figure 88: Income tax rate (2011-17E)

Plant	2011	2012	2013	2014E	2015E	2016E	2017E
Daya Bay - 1	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
Daya Bay - 2	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
Ling'ao - 1	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
Ling'ao - 2	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
Lingdong - 1	0.0%	0.0%	12.5%	12.5%	12.5%	25.0%	25.0%
Lingdong - 2	0.0%	0.0%	0.0%	12.5%	12.5%	12.5%	25.0%
Yangjiang - 1	-	-	-	0.0%	0.0%	0.0%	12.5%
Yangjiang - 2	-	-	-	-	0.0%	0.0%	0.0%
Yangjiang - 3	-	-	-	-	-	0.0%	0.0%
Yangjiang - 4	-	-	-	-	-	-	0.0%
Yangjiang - 5	-	-	-	-	-	-	-
Yangjiang - 6	-	-	-	-	-	-	-
Ningde - 1	-	-	0.0%	0.0%	0.0%	12.5%	12.5%
Ningde - 2	-	-	-	0.0%	0.0%	0.0%	12.5%
Ningde - 3	-	-	-	-	0.0%	0.0%	0.0%
Ningde - 4	-	-	-	-	-	0.0%	0.0%
Hongyanhe - 1	-	-	0.0%	0.0%	0.0%	12.5%	12.5%
Hongyanhe - 2	-	-	-	0.0%	0.0%	0.0%	12.5%
Hongyanhe - 3	-	-	-	-	0.0%	0.0%	0.0%
Hongyanhe - 4	-	-	-	-	-	0.0%	0.0%
Taishan - 1	-	-	-	-	-	0.0%	0.0%
Taishan - 2	-	-	-	-	-	-	0.0%

Source: Company data, Deutsche Bank

Nuclear provision

CGN's nuclear liabilities fall into three categories:

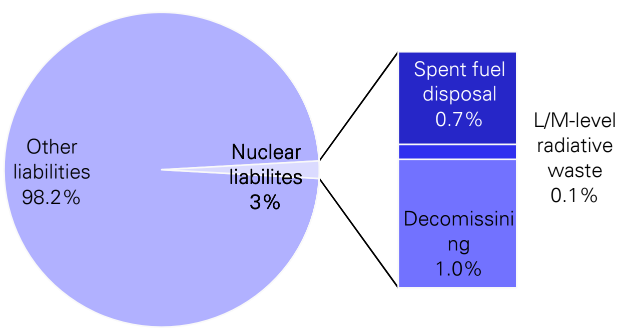
- Provision for **spent fuel disposal** (current liabilities): in accordance with the requirement of MoF/NDRC/MIIT, CGN contributes Rmb26/MWh to the Spent Fuel Fund based on actual on-grid sales volume for plants in commercial operation for five years or longer.
- Provision for **low- and medium-level radioactive waste** management (non-current liabilities): estimated by management (undiscounted). The amount is relatively small at Rmb11-14m p.a. during 2011-13.
- Provision for **decommissioning** (non-current liabilities): CGN makes decommissioning provisions based on 10% of the book value of the fixed assets upon the completion of the nuclear power station, and discounted to its present value. Currently, it uses the PBOC benchmark lending rate for five-year and above (6.55% before the November rate cut) as its discount rate, subject to changes in the benchmark lending rate and inflation.

Nuclear provision represents a relatively small portion of CGN's total liability as most units are newly operative

As most of CGN's units are still at an early stage of operation, its nuclear provision represents a relatively insignificant proportion to its total liabilities at 3% as of 1H14. By type, provision for decommissioning, low-to-medium radioactive waste and spent fuel accounts for 1.0%, 0.1% and 0.7% of its total liabilities, respectively.

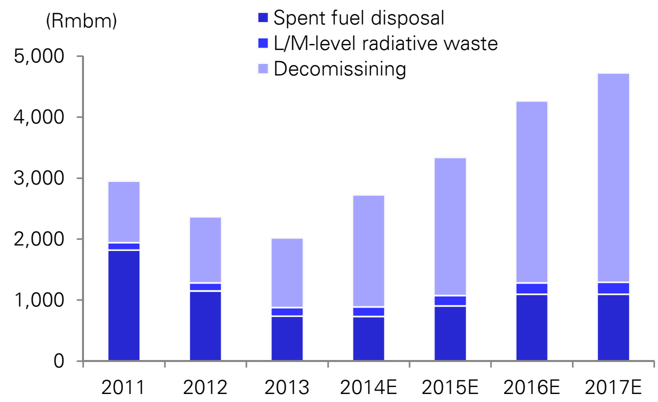
In 2015-17E, we expect its decommissioning provision to steadily grow at 23% CAGR as a result of: 1) addition from new units; and 2) incremental from a lower discount rate due to the cut in benchmark lending rate.

Figure 89: Nuclear liabilities overview (1H14)



Source: Company data, Deutsche Bank

Figure 90: Nuclear liabilities overview (2011-17E)



Source: Company data, Deutsche Bank estimates

Financial outlook

Revenue and earnings outlook

21% revenue CAGR during 2014-17E

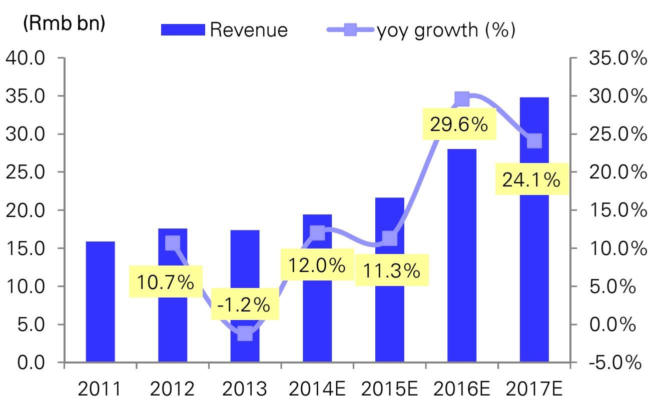
Compared to 2011-14E, when CGN's revenue growth is moderate at 7% CAGR, we expect CGN's revenue growth will pick up to 21% CAGR during 2014-17E. This will be driven by the 25% growth in installed capacity (controlled) with the sequential commissioning of its constructing units (Yangjiang Nuclear Units 2-4 and Taishan Nuclear Units 1-2).

Stable margin trend

Meanwhile, both EBITDA and EBIT margin should stay relatively stable at 52-53% and 39-40%, respectively, during 2015-17E given: 1) its high fixed costs nature; 2) our assumption of limited fluctuation in capacity factors; and 3) the fuel cost remaining largely fixed by the long-term purchasing contract.

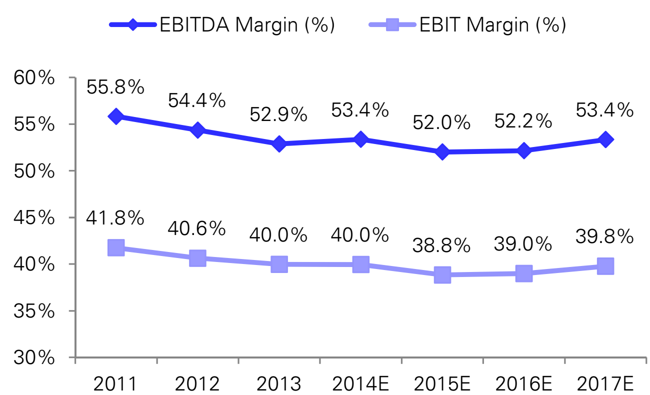
The slight increase in 2016-17E is attributable to the newly operative units, which are free from spent fuel disposal costs in their initial five years.

Figure 91: Revenue and yoy growth



Source: company data, Deutsche Bank estimates

Figure 92: Margin trend



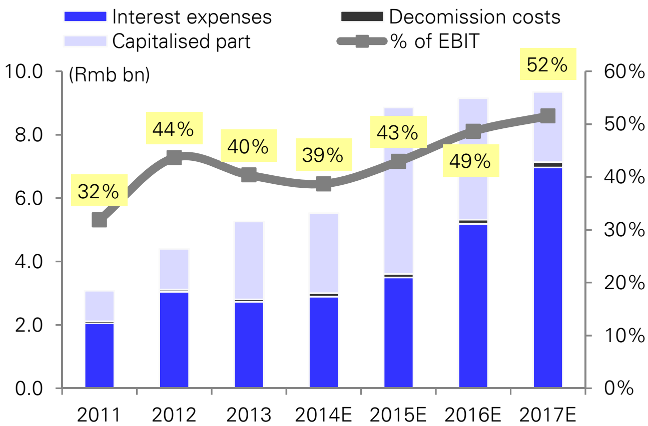
Source: company data, Deutsche Bank estimates

Interest expense to hike upon Taishan's operation

On the other hand, finance costs will see a major hike after the consolidation of Taishan, which has total borrowing of Rmb39.5bn as of 1H14 (55% of CGN's total borrowing). With gradually reduced capitalized interests upon the start-up of new units, we estimate finance costs will grow to c.Rmb7.0bn by 2017E (52% of EBIT), almost 2.5x of the amount in 2013 (40% of EBIT). Note that decommission costs are also reported under the interest expense line, though in the next few years the proportion will remain small (<3% of total finance costs).

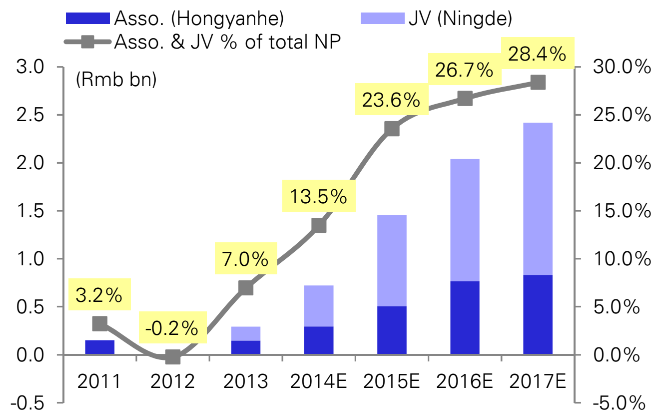
In addition to the 40bps cut in benchmark lending rate announced in November 2014, we have factored in the impact of another two rounds of 25bps cuts in 2Q15 and 3Q15 (assume effective loan re-pricing from the next year beginning), respectively, as forecasted by our economists.

Figure 93: Interest expense breakdown and % of EBIT



Source: company data, Deutsche Bank estimates

Figure 94: Associate and JV contribution



Source: company data, Deutsche Bank estimates

Increasing contribution from JV and associates

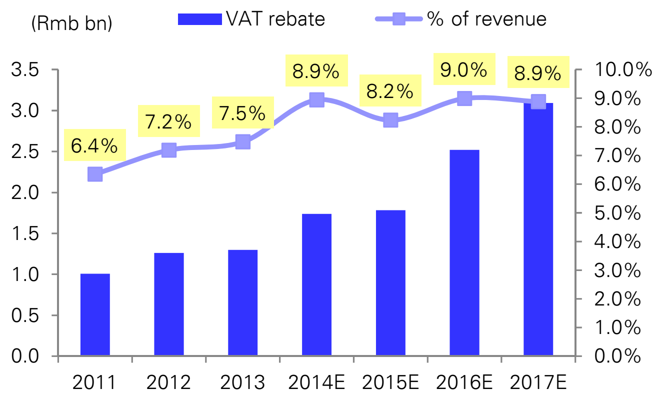
CGN's JV contribution will mainly come from Ningde Nuclear, while associates will come mainly from Hongyanhe Nuclear. As we expect Ningde 3-4 and Hongyanhe 3-4 to be commissioned by 2016, the total contribution from JV and associates will reach 28.4% by 2017E. Compared with Ningde (18.6%), the contribution from Hongyanhe will be less (9.8%) mainly due to its lower tariff and lower utilization hours.

Evolution of VAT rebate and effective tax rate

New projects enjoy both a higher percentage of VAT rebate and lower income tax rate. We expect a steady increase of VAT rebate to Rmb3.0bn in 2017E from Rmb1.3bn in 2013, representing c.9% of total revenue. In 2015E, the VAT rebate/revenue ratio will marginally decrease as the 100% rebate for Daya Bay's power sales to Guangdong will expire, and we assume a lower rebate rate of 50% from 2015E.

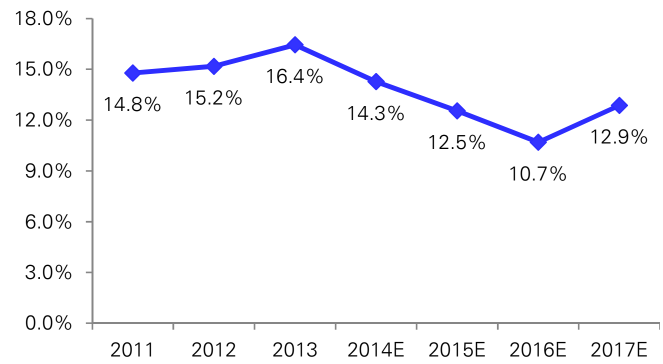
Similarly, the effective tax rate will keep falling during 2014-16E, before a slight rebound in 2017E due to 1) our assumption that Daya Bay's tax rate will return to 25% after the 15% preferential tax rate for high-tech enterprise expires in 2016E; and 2) the higher tax rate for Lingdong 2 and Yangjiang 1 as they enter the next stage of preferential tax treatment, which incurs a higher tax rate.

Figure 95: VAT rebate and % of revenue



Source: company data, Deutsche Bank estimates

Figure 96: Effective tax rate

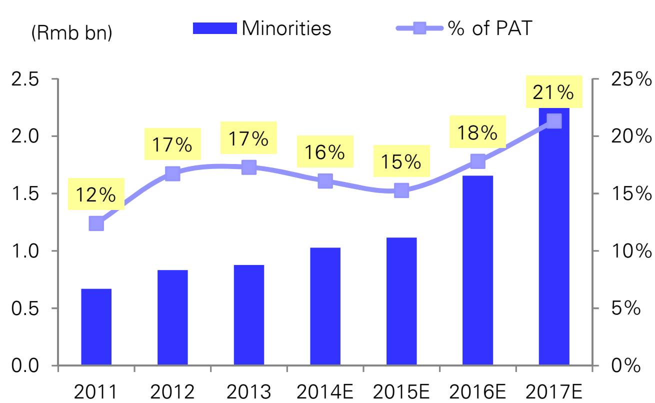


Source: company data, Deutsche Bank estimates

Minorities to increase upon Taishan's operation

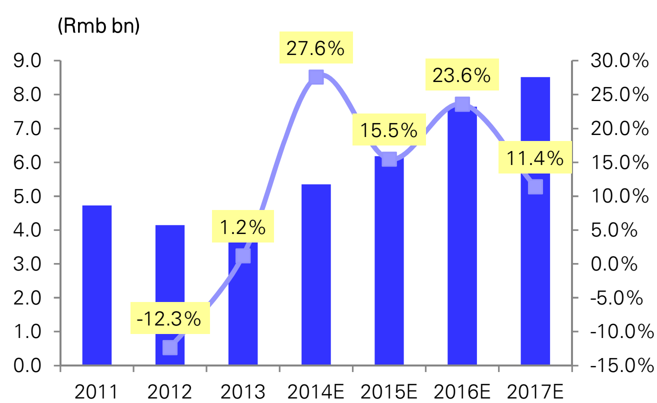
As CGN will hold a 51% stake of Taishan, the minority ratio will increase gradually in 2016-17E when Units 1-2 are commissioned, though this will be partly offset by the increasing contribution of Yangjiang (78.2% owned).

Figure 97: Minorities and % of PAT



Source: company data, Deutsche Bank estimates

Figure 98: Net profit and yoy growth

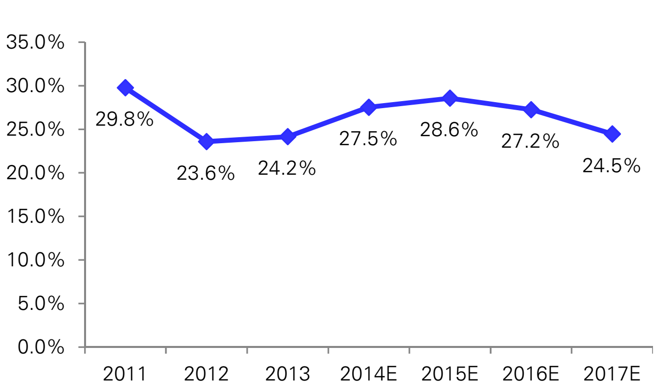


Source: company data, Deutsche Bank estimates

17% CAGR in net profit 2014-17E; margin contraction

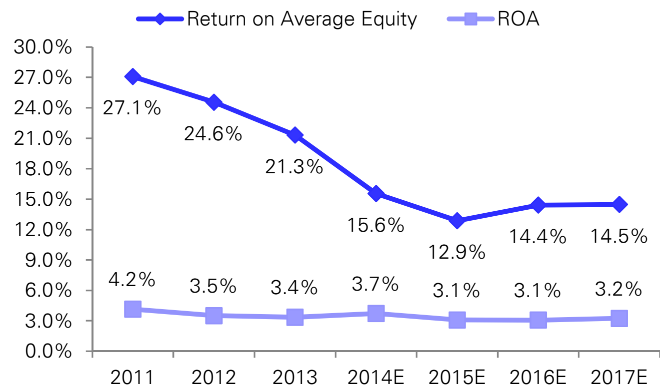
Overall, we expect CGN to deliver 17% earnings CAGR during 2014-17E, driven by the pipeline capacity. Nevertheless, net margins will slightly decrease due to the lower profitability of Taishan, as we assume the tariff is not sufficient to allow it to earn a comparable return to Dayabay and Lingao given significantly higher investment. ROE should normalize to the mid-teens upon completion of the IPO.

Figure 99: Net margin trend



Source: company data, Deutsche Bank estimates

Figure 100: ROE and ROA trend



Source: company data, Deutsche Bank estimates

Sensitivity analysis

We performed a sensitivity analysis for the major operating metrics and highlight a few factors to which CGN has higher sensitivity (Figure 101):

- **Capacity factor:** a 1% decrease in capacity factor (or 88-hour decrease in utilization) would reduce CGN's 2015E/2016E/2017E earnings by 3.3%/3.4%/3.4%, respectively.
- **Interest rate:** a 25bps higher effective interest rate should lead to a 1.9%/2.5%/2.8% decrease in 2015E/2016E/2017E earnings, respectively, on a full-year basis.
- **Start-up delay:** we expect three units to be commissioned in FY15 including Yangjiang Unit 3, Ningde Unit 3 (JV), and Hongyanhe Unit 3 (associate). A three-month delay for these units should result in a 3.7%/1.5%/0.7% decrease, respectively, in CGN's FY15E earnings.
- **Capex overspend:** CGN's 2016E/2017E earnings should decline by 0.8%/3.2% if Taishan Nuclear incurs 10% more investment.
- **Fuel cost:** a 5% increase in fuel cost should result in a 2.7%/2.8%/3.2% decrease in 2015E/2016E/2017E earnings, respectively.
- **Labor cost:** a 5% increase in labor cost should lead to 1.8% earnings decline for each year.

Figure 101: FY15E/16E earnings sensitivity

Earnings sensitivity	FY15E	FY16E	FY17E
Capacity factor (1% decrease)	-3.3%	-3.4%	-3.4%
Effective interest rate (25bps higher)	-1.9%	-2.5%	-2.8%
Capex overspend (10% for Taishan)	-	-2.6%	
Commissioning delay (3M for Yangjiang)	-3.7%	-	
Commissioning delay (3M for Ningde)	-1.5%	-	
Commissioning delay (3M for Hongyanhe)	-0.7%	-	
Rmb25/MWh change for Taishan Nuclear	-	-0.8%	-3.2%
VAT rebate expiration for Daya Bay Nuclear	-0.9%	-0.8%	-0.7%
5% increase in fuel cost	-2.7%	-2.8%	-3.2%
5% increase in labor cost	-1.8%	-1.8%	-1.8%

Source: Deutsche Bank estimates

Balance sheet and cash flow analysis

Capital expenditure to peak in 2015E

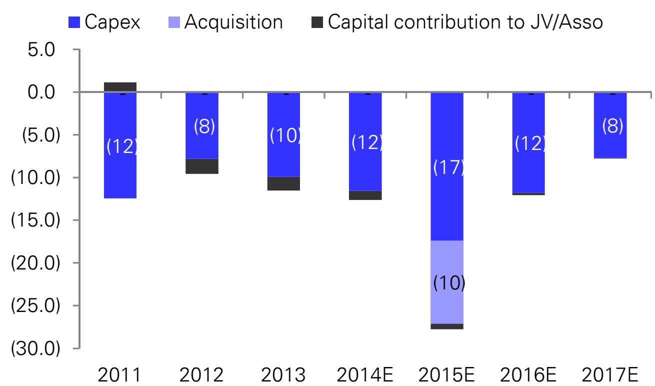
CGN has outlined a detailed capital expenditure plan for each of its constructing units (Figure 102). Based on the plan, capex will peak in 2015E with the highest number of units under construction at the time, in addition to the Rmb9.7bn reserved for Taishan's acquisition.

Figure 102: Capex breakdown by project

(Rmbm)	Total capex	Incurred up to 1H14	% capex spent	2H14E	2015E
Yangjiang - 1	12,814	12,173	95%	-	641
Yangjiang - 2	12,814	10,621	89%	755	797
Yangjiang - 3	13,064	9,933	85%	1,151	829
Yangjiang - 4	13,064	6,893	64%	1,490	1,735
Yangjiang - 5	13,539	4,072	40%	1,280	2,843
Yangjiang - 6	13,539	2,219	24%	1,079	2,285
Ningde - 1	13,275	13,275	100%	-	-
Ningde - 2	13,275	12,612	97%	266	398
Ningde - 3	13,275	11,080	89%	711	1,153
Ningde - 4	13,275	8,725	77%	1,469	1,447
Hongyanhe - 1	13,635	13,635	100%	-	-
Hongyanhe - 2	13,635	13,635	100%	-	-
Hongyanhe - 3	13,635	12,471	95%	500	300
Hongyanhe - 4	13,635	11,223	90%	1,000	800
Taishan - 1	36,590	31,804	93%	2,086	2,457
Taishan - 2	36,590	26,021	78%	2,434	5,647

Source: company data, Deutsche Bank

Figure 103: Overall capex trend



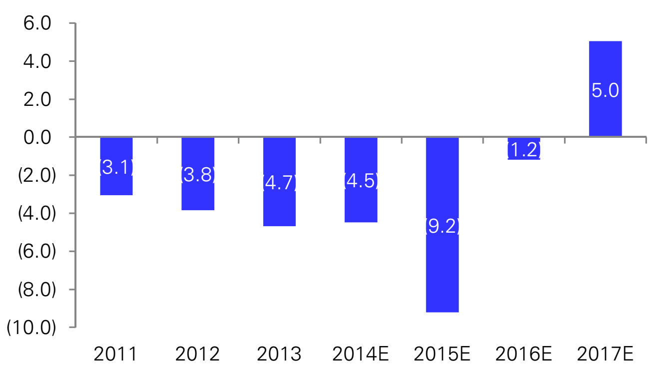
Source: company data, Deutsche Bank estimates

Free cash flow to turn positive from 2017E; net gearing

Due to the substantial capex requirement, FCF will remain negative in 2015-16E, before turning positive from 2017E under a higher operating/constructing capacity mix. We believe 2016-17E will be a good time for CGN to acquire Fangchenggang Nuclear from parentco because the project is planned to start operation by 2016 and because of the improving cash flow trend. We note that we have not deducted the acquisition capex from our FCF calculation.

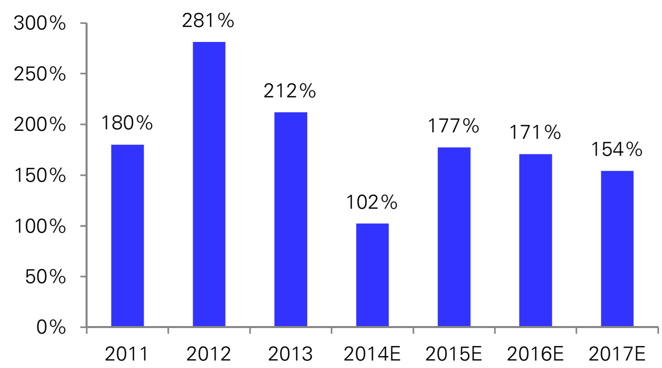
Meanwhile, despite the visible drop in net gearing ratio to 102% upon IPO, it will quickly rebound to 177% in 2015E due to the debt brought along by Taishan acquisition.

Figure 104: FCF trend



Source: company data, Deutsche Bank estimates

Figure 105: Net gearing trend



Source: company data, Deutsche Bank estimates

1H14 results recap

In 1H14, CGN's reported net profit slightly declined by 3% yoy despite a 19% increase in revenue mainly due to:

- 25% decline in other income, which we believe is more of a timing issue, as over 90% of VAT refund was recognized in 1H13
- Losses attributable from associates and JV due to low capacity factor of Ningde Unit 1 (19.6%) and Hongyanhe Unit 1 (54.0%) in 1H14 due to outage repair. However, we expect a turnaround in full-year 2014 as both the units will resume normal operation in 2H, in addition to the extra contribution from Ningde Unit 2 and Hongyanhe Unit 2, both of which started operation in May 2014.
- Non-recurring items including: 1) loss from fair value change in derivatives and 2) other gains and losses, mainly foreign exchange losses and disposal gain/losses. Recurring net profit would be up 5% yoy if we exclude the impact from these two lines.

Figure 106: 1H14 results overview

Financials	1H13	1H14	yoy %	Deutsche Bank comments
Total revenue	**8,171**	**9,754**	**19%**	Driven by 19% increase in net output
Tax surcharges	(103)	(121)	17%	
Cost of sales	**(3,991)**	**(4,496)**	**13%**	
Fuel cost	(1,236)	(1,350)	9%	Unit fuel cost (per kWh) declined by 8% yoy
Depreciation	(1,004)	(1,189)	18%	
Staff cost	(734)	(931)	27%	
Operating maintenance fee	(523)	(382)	-27%	
Spent fuel disposal	(358)	(395)	10%	Growth is lower than net generation growth as newly operative units (within five years) are exempted from the charge
Others	(138)	(249)	81%	Costs related to services/equipment sales and R&D
Gross profit	**4,076**	**5,137**	**26%**	
Other income	1,317	989	-25%	Mainly VAT refund; In 2013, >90% proportion is recognized in 1H
Fair value chg. of derivatives	(48)	(109)	127%	Currency/interest rate forward/swap contracts
Selling expense	(2)	(2)	-24%	
Other expenses	(83)	(38)	-54%	
Administrative expenses	(446)	(584)	31%	
Other gains and losses	161	(57)	-136%	Foreign exchange losses and one-off disposals
Share of results from associates	23	(39)	-272%	Low capacity factor for Hongyanhe-1 (54.0%) on fuel re-load
Share of results from JV	95	(155)	-263%	Low capacity factor for Ningde -1 (19.6%) due to fuel-reload and additional overhaul
Finance costs	(1,414)	(1,515)	7%	
PBT	**3,679**	**3,626**	**-1%**	
Tax	(532)	(537)	1%	
PAT	3,147	3,090	-2%	
Minority interest	(495)	(518)	1%	
Net profit	**2,653**	**2,572**	**-3%**	Recurring earnings is up by 5% yoy to Rmb2.7bn

Source: Company data, Deutsche Bank

Operating metrics and key financials

Figure 107: CGN – operating metrics (2011-20E)

Operating metrics	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Operating capacity, controlled (year-end, MW)	**6,122**	**6,122**	**6,122**	**7,208**	**8,294**	**11,130**	**13,966**	**15,052**	**16,138**	**16,138**
yoy growth (%)		0.0%	0.0%	17.7%	15.1%	34.2%	25.5%	7.8%	7.2%	0.0%
yoy growth (MW)		0	0	1,086	1,086	2,836	2,836	1,086	1,086	0
Operating capacity, attributable (year-end, MW)	**5,482**	**5,482**	**6,272**	**7,910**	**9,549**	**12,080**	**13,822**	**14,671**	**15,520**	**15,520**
yoy growth (%)		0.0%	14.4%	26.1%	20.7%	26.5%	14.4%	6.1%	5.8%	0.0%
yoy growth (MW)		0	789	1,639	1,639	2,531	1,742	849	849	0
Operating capacity, total (year-end, MW)	**6,122**	**6,122**	**8,330**	**11,624**	**14,918**	**19,962**	**22,798**	**23,884**	**24,970**	**24,970**
yoy growth (%)		0.0%	36.1%	39.5%	28.3%	33.8%	14.2%	4.8%	4.5%	0.0%
yoy growth (MW)		0	2,208	3,294	3,294	5,044	2,836	1,086	1,086	0
Constructing capacity, controlled (year-end, MW)	3,258	4,344	6,516	5,430	7,844	5,008	2,172	1,086	0	0
Constructing capacity, attributable (year-end, MW)	7,490	8,340	9,249	7,610	5,971	3,440	1,699	849	0	0
Constructing capacity, total (year-end, MW)	15,590	16,676	16,640	13,346	10,052	5,008	2,172	1,086	0	0
Operating units (controlled)	6	6	6	7	8	10	12	13	14	14
Operating units (total)	6	6	8	11	14	18	20	21	22	22
Market share, controlled	49%	49%	42%	38%	29%	28%	32%	32%	32%	30%
Market share, total	49%	49%	57%	61%	52%	51%	52%	50%	49%	46%
Net generation (m MWh)	**40,519**	**45,113**	**44,157**	**49,402**	**54,909**	**70,083**	**85,024**	**99,024**	**110,436**	**113,913**
yoy growth (%)		11.3%	-2.1%	11.9%	11.1%	27.6%	21.3%	16.5%	11.5%	3.1%
Average on-grid tariff (incl. VAT)	**418**	**428**	**431**	**431**	**432**	**439**	**449**	**451**	**448**	**448**
yoy growth (%)		2.6%	0.6%	0.1%	0.1%	1.5%	2.3%	0.5%	-0.5%	-0.1%
Average capacity factor	90.6	89.6	87.2	86.0	85.8	85.6	85.5	85.4	85.4	85.4
Average utilization hours	**7,773**	**7,750**	**7,586**	**7,533**	**7,513**	**7,519**	**7,489**	**7,483**	**7,479**	**7,499**

Source: Company data, Deutsche Bank estimates

Figure 108: CGN – key ratios (2011-20E)

Key Company Metrics	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Growth										
Sales growth (%)		10.7%	-1.2%	12.0%	11.3%	29.6%	24.1%	17.1%	10.9%	3.0%
Net earnings growth (%)		-12.3%	1.2%	27.6%	15.5%	23.6%	11.4%	18.7%	10.7%	3.8%
DB EPS growth (%)		-41.4%	-11.8%	25.8%	-27.9%	23.6%	11.4%	18.7%	10.7%	3.8%
EBITDA growth (%)		7.8%	-3.9%	13.1%	8.4%	29.9%	26.9%	18.3%	10.3%	2.4%
Margin										
EBITDA Margin (%)	55.8%	54.4%	52.9%	53.4%	52.0%	52.2%	53.4%	53.9%	53.6%	53.3%
EBIT Margin (%)	41.8%	40.6%	40.0%	40.0%	38.8%	39.0%	39.8%	40.3%	40.2%	40.0%
Net Margin (%)	29.8%	23.6%	24.2%	27.5%	28.6%	27.2%	24.5%	24.8%	24.8%	25.0%
Return										
Return on Average Equity	27.1%	24.6%	21.3%	15.6%	12.9%	14.4%	14.5%	15.4%	15.3%	14.4%
ROA	4.2%	3.5%	3.4%	3.7%	3.1%	3.1%	3.2%	3.7%	4.0%	4.1%
ROIC	7.5%	5.4%	4.4%	5.0%	3.1%	3.6%	3.9%	4.5%	5.0%	5.2%
Capitlization										
Payout ratio (%)	0.0%	0.0%	0.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%
Capex/sales (%)	78.3%	44.4%	57.2%	59.4%	80.4%	42.0%	22.1%	12.9%	6.0%	3.5%
Capex/depreciation (x)	4.7	2.9	4.0	4.4	6.1	3.2	1.6	0.9	0.4	0.3
EBITDA / Interest	4.2	3.1	3.3	3.5	3.1	2.8	2.6	2.8	2.9	3.1
Net Gearing %	180.0%	281.4%	212.0%	102.2%	177.5%	170.8%	154.3%	131.5%	107.3%	85.7%
Debt to Asset	79.3%	80.2%	75.2%	65.3%	69.6%	68.6%	67.1%	64.0%	60.9%	56.8%
Working capital										
Inventory days		300	324	321	315	297	307	318	326	336
Receivable days		36	36	32	33	30	31	32	33	34
Payable days		47	51	61	73	71	70	68	67	70

Source: Company data, Deutsche Bank estimates

Figure 109: CGN – income statement (2011-17E)

Income Statement (Rmb million)	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019	2020
Operating Revenue, Net	**15,881**	**17,575**	**17,365**	**19,448**	**21,642**	**28,043**	**34,798**	**40,736**	**45,183**	**46,552**
Power sales	14,972	16,514	16,268	18,219	20,274	26,271	32,599	38,162	42,328	43,610
Services	755	796	843	945	1,051	1,362	1,690	1,979	2,194	2,261
Others	154	265	254	284	316	410	509	595	660	680
Tax surcharges	(221)	(250)	(255)	(286)	(318)	(412)	(512)	(599)	(664)	(685)
Operating Expenses	**(9,259)**	**(10,292)**	**(10,343)**	**(11,611)**	**(13,162)**	**(17,012)**	**(20,836)**	**(24,169)**	**(26,854)**	**(27,791)**
Fuel cost	(2,099)	(2,785)	(2,658)	(2,915)	(3,305)	(4,282)	(5,314)	(6,220)	(6,899)	(7,109)
Depreciation	(2,234)	(2,413)	(2,240)	(2,612)	(2,854)	(3,695)	(4,725)	(5,537)	(6,054)	(6,213)
Staff cost	(1,260)	(1,311)	(1,455)	(1,735)	(1,992)	(2,619)	(3,191)	(3,720)	(4,152)	(4,271)
Operating maintenance fee	(1,050)	(1,118)	(1,204)	(1,258)	(1,444)	(1,898)	(2,313)	(2,697)	(3,010)	(3,097)
Spent fuel disposal	(797)	(790)	(732)	(728)	(935)	(1,134)	(1,131)	(1,131)	(1,329)	(1,530)
Others	(777)	(849)	(849)	(973)	(1,082)	(1,403)	(1,741)	(2,038)	(2,260)	(2,328)
SG & A	(1,042)	(1,027)	(1,207)	(1,390)	(1,549)	(1,982)	(2,422)	(2,826)	(3,150)	(3,242)
Profit from Operations	**6,631**	**7,141**	**6,942**	**7,770**	**8,404**	**10,933**	**13,841**	**16,427**	**18,172**	**18,600**
Operating margin	41.8%	40.6%	40.0%	40.0%	38.8%	39.0%	39.8%	40.3%	40.2%	40.0%
Fair value chg. of derivatives	(8)	42	157	0	0	0	0	0	0	0
Finance costs	(2,114)	(3,118)	(2,804)	(3,006)	(3,609)	(5,318)	(7,136)	(7,809)	(8,408)	(8,066)
Non-operating income, gain & losses	1,671	1,812	1,482	1,956	2,091	2,751	3,293	3,753	4,330	4,459
VAT rebate	1,009	1,263	1,299	1,739	1,783	2,521	3,090	3,561	4,116	4,182
Others	662	549	183	217	308	230	203	192	214	277
Share of results from associates	151	(5)	149	295	508	767	832	820	788	771
Share of results from JV	2	(4)	144	427	948	1,274	1,585	1,540	1,461	1,418
Profit Before Tax	**6,332**	**5,867**	**6,070**	**7,442**	**8,342**	**10,407**	**12,415**	**14,730**	**16,344**	**17,182**
Tax	(936)	(890)	(998)	(1,062)	(1,047)	(1,112)	(1,597)	(1,734)	(1,947)	(2,240)
Effective tax rate	14.8%	15.2%	16.4%	14.3%	12.5%	10.7%	12.9%	11.8%	11.9%	13.0%
Profit Before Minority Interest	**5,396**	**4,977**	**5,071**	**6,379**	**7,296**	**9,295**	**10,818**	**12,996**	**14,398**	**14,942**
Minority interest	(669)	(833)	(877)	(1,027)	(1,114)	(1,655)	(2,307)	(2,896)	(3,212)	(3,326)
Net Profit	**4,727**	**4,144**	**4,195**	**5,352**	**6,181**	**7,640**	**8,511**	**10,100**	**11,185**	**11,616**
Net profit margin	30%	23.6%	24.2%	27.5%	28.6%	27.2%	24.5%	24.8%	24.8%	25.0%
Recurring net profit	**4,392**	**3,902**	**4,213**	**5,352**	**6,181**	**7,640**	**8,511**	**10,100**	**11,185**	**11,616**
growth yoy %		-11.2%	8.0%	27.1%	15.5%	23.6%	11.4%	18.7%	10.7%	3.8%
EPS (Rmb)	0.29	0.17	0.15	0.19	0.14	0.17	0.19	0.22	0.25	0.26
growth yoy %	NM	-41.4%	-11.8%	25.8%	-27.9%	23.6%	11.4%	18.7%	10.7%	3.8%
DPS (Rmb)	-	-	-	0.06	0.04	0.06	0.06	0.07	0.08	0.08
growth yoy %	NM	NM	NM	NM	-28%	24%	11%	19%	11%	4%
Dividend payout ratio	0%	0.0%	0.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%	33.0%

Source: Company data, Deutsche Bank estimates

Figure 110: CGN – balance sheet (2011-20E)

Balance Sheet (Rmb million)	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Non-current assets	**87,421**	**95,167**	**105,914**	**119,797**	**212,377**	**227,201**	**235,165**	**238,648**	**237,980**	**235,570**
Property, plant and equipment	70,068	79,185	87,042	99,129	188,859	201,377	206,851	207,974	205,055	200,456
Intangible assets	511	629	765	765	714	714	714	714	714	714
Interests in associates	11,211	5,872	6,730	7,599	8,496	9,347	10,253	11,073	11,861	12,632
Interests in JV	2,769	3,325	4,364	5,290	6,514	7,969	9,554	11,094	12,556	13,974
Available-for-sale investment	110	2,090	2,475	2,475	0	0	0	0	0	0
Deferred tax assets	74	84	98	98	98	98	98	98	98	98
VAT recoverable	1,369	2,141	2,385	2,385	4,716	4,716	4,716	4,716	4,716	4,716
Prepaid lease payments	548	1,068	1,007	1,007	1,799	1,799	1,799	1,799	1,799	1,799
Deposits for PPE	451	449	682	682	780	780	780	780	780	780
Others	309	325	368	368	402	402	402	402	402	402
Current Assets	**26,287**	**27,096**	**21,761**	**39,903**	**28,451**	**28,384**	**34,540**	**35,621**	**43,109**	**44,829**
Inventories	7,531	7,514	8,384	9,197	10,430	13,510	16,764	19,625	21,767	22,426
Trade/bill receivables	1,659	1,837	1,629	1,825	2,031	2,631	3,265	3,822	4,240	4,368
Prepayment & other receivables	988	1,175	1,143	1,280	1,428	1,846	2,290	2,681	2,974	3,064
Amounts due from related parties	3,084	8,009	286	286	464	464	464	464	464	464
Cash and cash equivalents	10,453	5,434	6,640	23,637	10,390	6,225	8,049	5,321	9,956	10,798
Other deposits over 3 months	1,894	2,300	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760
Other current assets	677	827	918	918	948	948	948	948	948	948
Total assets	**113,708**	**122,263**	**127,675**	**159,700**	**240,828**	**255,585**	**269,706**	**274,270**	**281,088**	**280,399**
Shareholders' equity	**17,452**	**16,304**	**23,052**	**45,787**	**50,202**	**55,802**	**61,792**	**69,084**	**76,936**	**84,861**
Share capital	15,709	18,280	19,768	45,449	45,449	45,449	45,449	45,449	45,449	45,449
Reserves	1,743	(1,976)	3,284	339	4,754	10,354	16,344	23,635	31,488	39,412
Minorities interests	**6,091**	**7,845**	**8,640**	**9,667**	**22,914**	**24,569**	**26,876**	**29,772**	**32,984**	**36,310**
Non-current liabilities	**49,619**	**58,226**	**69,521**	**76,298**	**133,599**	**140,600**	**139,852**	**130,757**	**123,942**	**111,346**
Bank borrowings	30,044	37,861	48,722	54,741	109,590	115,845	114,630	109,172	101,975	89,126
Bond payables	8,500	8,500	8,500	8,500	8,500	8,500	8,500	4,500	4,500	4,500
Payables to ultimate holding co.	5,530	5,530	5,530	5,530	5,530	5,530	5,530	5,530	5,530	5,530
Loans from subsidiary/ultimate holding co.	3,168	3,441	3,500	3,500	4,704	4,704	4,704	4,704	4,704	4,704
Provision	1,135	1,217	1,286	2,044	2,497	3,243	3,710	4,073	4,455	4,708
Other liabilities	1,242	1,677	1,983	1,983	2,178	2,178	2,178	2,178	2,178	2,178
Current liabilities	**40,546**	**39,887**	**26,462**	**27,948**	**34,112**	**34,614**	**41,186**	**44,656**	**47,225**	**47,882**
Trade/Bills payables	8,398	11,183	10,350	11,353	13,463	16,677	20,695	24,226	26,870	27,685
Amounts due to related parties	18,831	3,687	1,825	1,825	1,907	1,907	1,907	1,907	1,907	1,907
Loans from ultimate holding and fellow companies	8,079	20,880	10,697	10,697	11,447	10,697	10,697	10,697	10,697	10,697
Taxes payables	273	175	356	356	356	356	356	356	356	356
Provisions	1,820	1,153	737	733	940	1,139	1,136	1,136	1,334	1,535
Bank borrowings due in one year	3,046	2,709	2,401	2,888	5,908	3,746	6,304	6,243	5,970	5,610
Derivative financial instruments	98	100	96	96	96	96	96	96	96	96
Total shareholder equity and liabilities	**113,708**	**122,263**	**127,675**	**159,700**	**240,828**	**255,585**	**269,706**	**274,270**	**281,088**	**280,399**

Source: Company data, Deutsche Bank estimates

Figure 111: CGN – cash flow statement (2011-20E)

Cash Flow (Rmb million)	2011	2012	2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E
PBT	**6,332**	**5,867**	**6,070**	**7,442**	**8,342**	**10,407**	**12,415**	**14,730**	**16,344**	**17,182**
Provisions for nuclear power operation	811	798	746	742	949	1,148	1,145	1,145	1,343	1,544
Depreciation & Amortization	2,633	2,704	2,490	2,612	2,854	3,695	4,725	5,537	6,054	6,213
Net interst expenses	1,946	2,946	2,642	2,828	3,340	5,128	6,972	7,657	8,233	7,829
Share of results of JV/associates	(153)	9	(292)	(722)	(1,456)	(2,041)	(2,417)	(2,360)	(2,249)	(2,190)
Loss (gain) on disposal of PPE/investments	64	(408)	39	0	0	0	0	0	0	0
Other adjustments	(272)	9	(452)	0	0	0	0	0	0	0
Net changes in working capital	39	(2,540)	(1,168)	(874)	(790)	(1,234)	(1,449)	(1,408)	(1,339)	(1,392)
Taxes paid	(1,182)	(726)	(580)	(1,062)	(1,047)	(1,112)	(1,597)	(1,734)	(1,947)	(2,240)
Total Operating Cashflow	**10,218**	**8,660**	**9,493**	**10,966**	**12,193**	**15,991**	**19,794**	**23,566**	**26,439**	**26,946**
Purchase of PP&E	(12,436)	(7,805)	(9,932)	(11,546)	(17,409)	(11,785)	(7,698)	(5,247)	(2,705)	(1,614)
Dividends received	27	0	22	0	0	0	0	0	0	0
Interest received	168	172	162	178	269	190	163	153	175	237
Proceeds from disposal of PPE	308	31	9	0	0	0	0	0	0	0
Capital Contribution to JV/associate	1,111	(1,754)	(1,604)	(1,074)	(665)	(265)	(74)	0	0	0
Others	(997)	(5,623)	6,862	0	1,112	0	0	0	0	0
Total Investment Cashflow	**(11,818)**	**(14,979)**	**(4,482)**	**(12,442)**	**(26,393)**	**(11,860)**	**(7,609)**	**(5,094)**	**(2,530)**	**(1,376)**
Capital injections	7,510	2,823	1,832	21,558	0	0	0	0	0	0
Proceeds from bank borrowings	20,485	10,739	13,548	9,723	13,358	6,678	8,331	3,875	1,756	850
Loans from related parties	27,835	27,424	18,336	0	0	0	0	0	0	0
Repayments of loans	(12,240)	(3,259)	(2,996)	(3,217)	(1,901)	(2,584)	(6,988)	(13,393)	(9,226)	(14,059)
Interest/dividend paid	(5,799)	(14,172)	(6,834)	(9,590)	(10,505)	(11,054)	(11,704)	(11,682)	(11,803)	(11,519)
Others	(32,099)	(22,254)	(27,823)	0	0	0	0	0	0	0
Total Financing Cashflow	**5,692**	**1,301**	**(3,937)**	**18,474**	**952**	**(8,295)**	**(10,361)**	**(21,200)**	**(19,273)**	**(24,728)**
FX changes	165	(0)	131	0	0	0	0	0	0	0
Beginning cash and cash equivalent	6,195	10,453	5,434	6,640	23,637	10,390	6,225	8,049	5,321	9,956
Net cash increase/(decrease) for the year	4,092	(5,018)	1,075	16,997	(13,248)	(4,165)	1,824	(2,728)	4,635	842
Ending cash and cash equivalent	10,453	5,434	6,640	23,637	10,390	6,225	8,049	5,321	9,956	10,798

Source: Company data, Deutsche Bank estimates

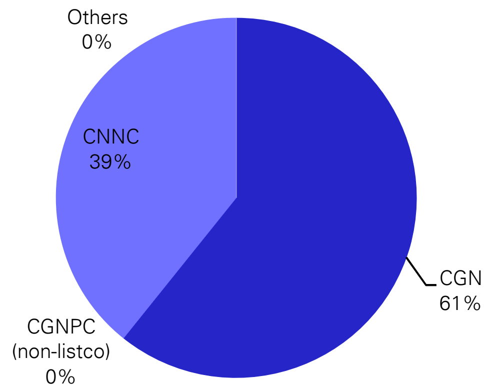
Company background

Company overview

A nuclear pure-play with dominant market share in China

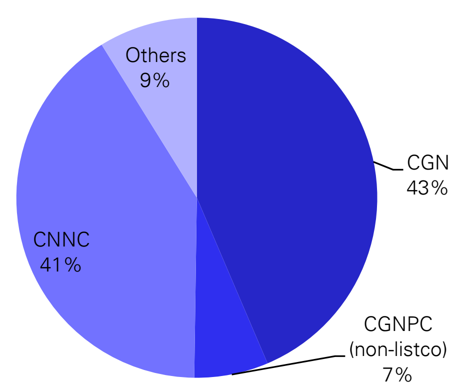
CGN operated and managed 11 nuclear generating units in Guangdong, Fujian and Liaoning provinces as of June 2014. It has a total (assuming 100% in Associates/JCE) and attributable capacity of 11.6GW and 8.1GW, respectively, which accounts for 61% and 45% of China's total operating nuclear capacity, making it the dominant nuclear play in China. In addition, CGN has a strong pipeline capacity of 13.3GW under construction (total), which accounts for 43% of China's total.

Figure 112: CGN's market share in China by total capacity in operation (end-2014)



Source: Company data, Deutsche Bank;

Figure 113: CGN's market share in China by total capacity under construction (end-2014)



Source: Company data, Deutsche Bank; CGNPC non-listco capacity is Fangchenggang Nuclear;

Company history

China General Nuclear Power Corporation (CGNPC), formerly known as China Guangdong Nuclear Power Corporation Limited, was founded in 1994 to lead the centralized construction and operation of nuclear power stations in Guangdong.

On 25 March 2014, CGN Power was established by CGNPC, Hengjian Investment (an SOE owned by Guangdong Provincial Government), and CNNC with an 85.1%, 10.0% and 4.9% interest split. Upon the Hong Kong listing, CGNPC will remain the controlling shareholder with a 66.8% stake.

Figure 114: Key company milestones

Year	Key events
1979	China and Hong Kong decided to establish a JV to build and operate Daya Bay Nuclear Power Station (Daya Bay Nuclear), which is located close to Hong Kong.
1982	Construction of Daya Bay Nuclear was approved by the State Council on 13 December 1982.
1985	Guangdong Nuclear Power Joint Venture Vo., Ltd. (GNPJVC) Was established jointly by GNIC (a wholly-owned subsidiary of CGN) and HKNIC with 75%:25% stake split on 26 January 1985.
1987	First concrete date (FCD) of Daya Bay Nuclear Power Station was 7 August 1987. Its two nuclear units started commercial operation on 1 February and 6 May 1994, respectively, and was the first large commercial nuclear power station in China.
1994	On 5 February 1994, State Council decided to establish China Guangdong Nuclear Power Corporation Limited (now known as China General Nuclear Power Corporation, CGNPC), which will be responsible for the centralized construction and operation of nuclear power stations in Guangdong. CGNPC was established on 29 September 1994.
1997	Ling'ao Nuclear Power Station (Ling'ao Nuclear) commenced construction in May 1997. Its two nuclear power generating units began commercial operation on 28 May 2002 and 8 January 2003, which were 48 days and 66 days ahead of schedule.
2003	Daya Bay Nuclear Power Operations and Management (DNMC) was established on 12 March 2003 by GNIC and CLP Nuclear Power Operations & Management with a 87.5%:12.5% interest split. DNMC is the first specialized nuclear power operating company in China and is in charge of operations and management for six GW-level nuclear power generating units including Daya Bay Nuclear, Ling'ao Nuclear, and Lingdong Nuclear.
2005	Lingdong Nuclear Power Station (Lingdong Nuclear) commenced construction in December 2005. Its two units began operation on 20 September 20 2010 and 7 August 2011, respectively.
2009	On 29 September 2009, GNIC and HKNIC entered the contract to extend the Joint Venture term of Daya Bay Nuclear Power Station for another 20 years to 5 May 2034.
2013	Construction of Yangjiang Nuclear Unit 6 commenced on 23 December 2013 and became the largest nuclear power site by total capacity in China.
2014	CGN Power Co. Ltd. was incorporated in PRC on 26 March 2014.

Source: Company data, Deutsche Bank

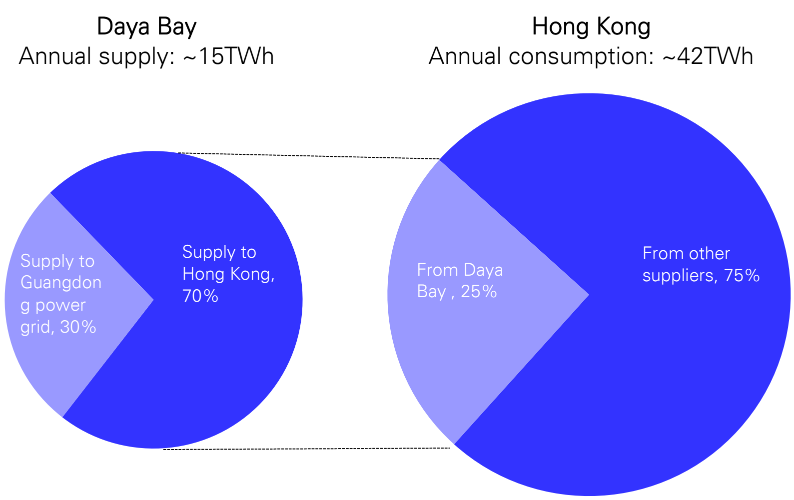
A key power supplier to Hong Kong

According to the agreement signed between GNIC and HKNIC on 19 January 1985, Daya Bay agrees to sell 70% electricity generated to Hong Kong while the remaining 30% will be sold to Guangdong power grid. As of 30 April 2014, Daya Bay has transmitted a total of 192.7bn kWh power to Hong Kong.

On 31 December 2013, GNPJVC, GNIC, and HKNIC reached another agreement that Daya Bay will send additional 10% power to Hong Kong in 4Q14. While the original supply term expired on 6 May, 2014, on 29 September 2009 GNIC and HKNIC extended the term to 6 May 2034.

Daya Bay will supply c.80% of power generation to Hong Kong during 2015-2034

Figure 115: Daya Bay sells 70% of its generation to Hong Kong



Source: Company data, Deutsche Bank

Demonstrated operating performance and safety record

CGN has achieved outstanding operating performances historically as compared to global peers, winning competitive scores from both WANO and EDF. According to World Association of Nuclear Operators (WANO), in 2013, for CGN's six nuclear units at the Daya Bay base, 36 out of the 54 of the WANO's performance indicators (67%) ranked in the top quartile (or at an "advanced" level) and 28 out of the 54 (52%) ranked in the top decile (or at an "excellent" level). In 2013, the average capacity factor (one of the major WANO indicators) of CGN's six nuclear units in the Daya Bay base was 87.2%, compared to WANO's reported global average of 83.4% for PWR nuclear power generating units in operation.

During 1999-1H14, CGN's nuclear units at Daya Bay Nuclear and Ling'ao Nuclear received a total of 31 first prizes in a number of categories at EDF safety challenge contests, competing with more than 60 similar generating units from countries including France, China, Germany and South Africa.

As of 30 June 2014, Daya Bay Unit 1 had recorded 4,203 consecutive days of safe operations without unplanned reactor shutdowns, the longest among nuclear power generating units in China.

Besides, CGN has not recorded any incidents at or above level 2 on the INES (i.e., incidents involving significant failure in safety provisions but with sufficient defense-in-depth to cope with additional failures) up to November 2014.

Introduction to CGNPC

As of June 2014, CGNPC had total assets of Rmb344.6bn, with substantial power assets in both nuclear and non-nuclear clean energy (9.7GW in wind/hydro/solar). CGNPC is also engaged in uranium-related business, finance-related services, the application of nuclear technology, general services (e.g., landscaping and transportation), and investment holding businesses. As of November 2014, CGNPC's interest in other listco includes:

- **CGN Meiya Power** (1811.HK, non-rated, 72.29% equity interest), which is primarily engaged in gas-fired, coal-fired, oil-fired, hydro, co-gen and fuel cell power generation projects, as well as a steam project in China and Korea. The company may acquire CGNPC's wind and solar projects in China in coming years.

- **CGN Mining** (1164.HK, non-rated, 50.11% equity interest), which is primarily engaged in selling, distributing, and manufacturing pharmaceutical and food products, property investment and trading of natural uranium.

- **Energy Metals** (EME.AX, non-rated, 66.45% equity interest), which is primarily engaged in Australian uranium exploration with a portfolio of mid- and high-advanced projects located in the Northern Territory and Western Australia.

SWOT analysis

Figure 116: CGN – SWOT analysis

Strengths	Weakness
• Dominant market share (61% by total capacity, end-2014E) • High entry barrier: one of only three licensed nuclear operators in China • Outstanding track record in the construction and operation of GII/II+ units • Strong parentco back-up	• Inexperienced in the construction/operation in GIII units, leading to potential start-up delay, capex overrun, and low capacity factor • Profitability highly dependent on policy changes (VAT refund, preferential tax rate, tariff setting) • Highly geared; substantial capex requirement, and negative FCF
Opportunities	**Threats**
• Parentco asset injection of Fangchenggang Units 1-2 • Project approval for Hongyanhe Units 5-6 • Long-term opportunity in acquiring CGNPC's nuclear project investment overseas • Parent asset injection of other nuclear projects such as Lufeng and Wuhu once approved or in operation	• Failing to start up GIII units due to construction difficulties • Shifting from base-load to peak shaving due to power oversupply • Plant breakdown or prolonged overhaul due to the likely shortfall in experienced staff and rapid increase in localization rate • Tariff cut/discount as a result of power sector reform (rolling out of DPS) or regional profit-sharing mechanism • Higher decommission provision requirement set by government vs. current company practice • Significant single business risk in case of any industry-wide events (nuclear incident, policy changes, etc.)

Source: Deutsche Bank

Use of proceeds and shareholding structure

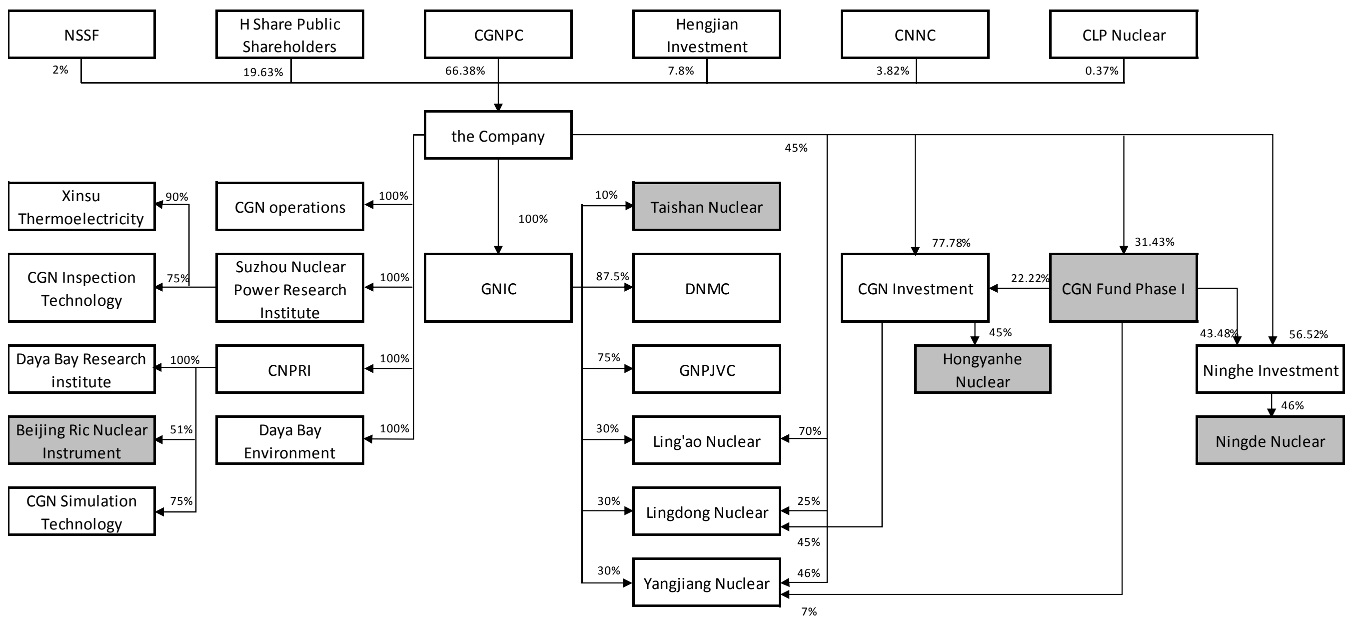
After the green-shoe implementation, CGR received total IPO proceeds of HK$27,389m (Rmb21,558m). Under the assumption of a HK$22,456m net proceeds, the company plans to use 54.6% of the proceeds to acquired additional 41% equity interest (10% currently) in Taishan Nuclear; 27.5% of the proceeds will be used for nuclear power station related capital expenditures, such as the construction of Yangjiang and Ningde Nuclear Power Station; 17.9% of the net proceeds will be used for research and development, repayment of corporation bonds, and oversea business expansion, among other activities. The additional amount will be used to supplement the capex requirement for nuclear projects under construction.

Figure 117: Use of IPO proceeds assuming net proceeds of HK$22.5bn

Proceeds (HK$m)	% of total	Use of Proceeds
12,252	54.6%	Acquire an additional 41% equity interest in Taishan Nuclear.
6,175	27.5%	Capital investments in the under-construction nuclear power stations, including under-construction nuclear power generating units at Yangjiang Nuclear Power Station and Ningde Nuclear Power Station.
1,123	5.0%	R&D activities to promote the development and commercial use of nuclear power technology.
1,684	7.5%	Repay a portion of the corporate bond.
1,221	5.4%	Expand business into overseas markets. No specific targets for overseas expansion have been identified yet.

Source: Deutsche Bank, Company data;

Figure 118: Shareholding structure upon IPO listing



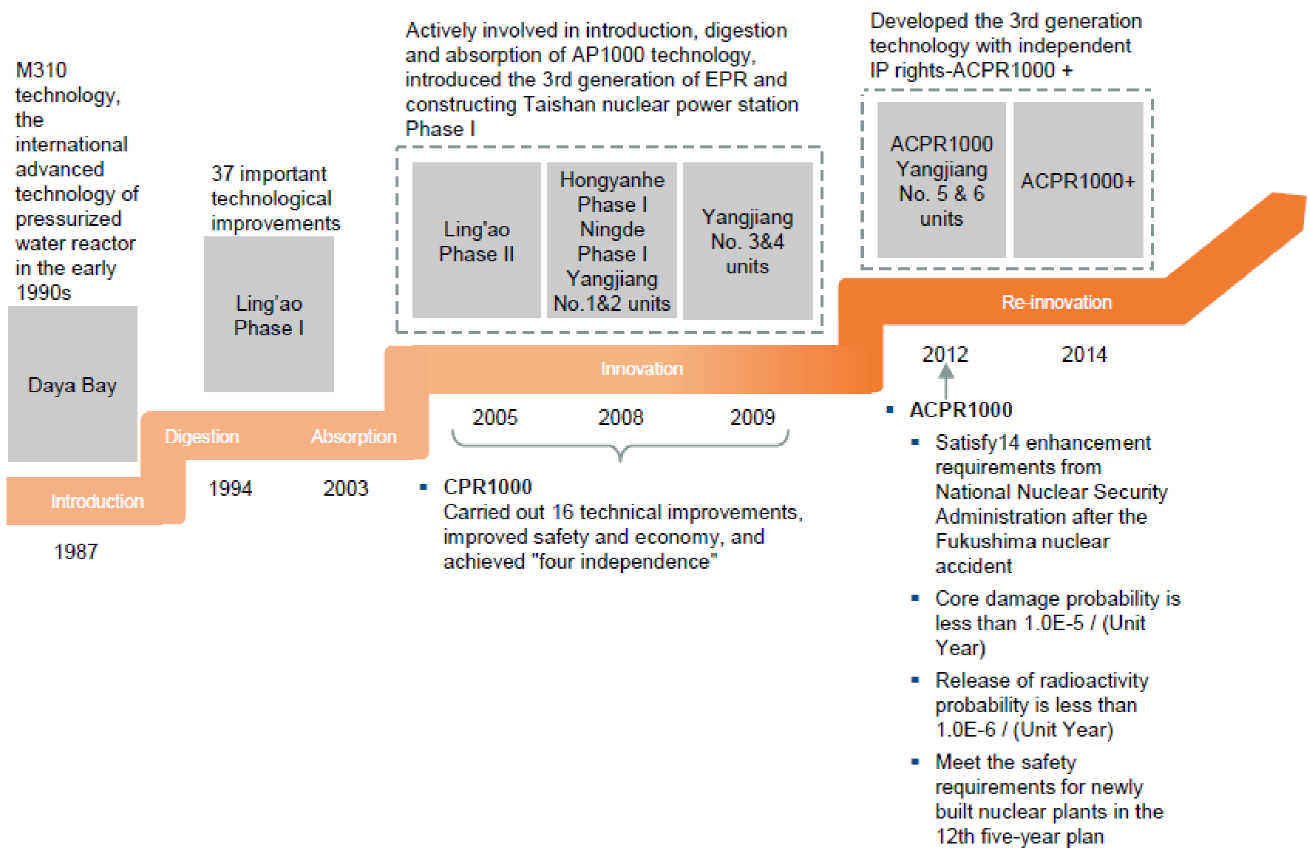
Source: Company Data, Deutsche Bank

Figure 119: Management profile

Name	Age	Position	Experience & Qualifications
Mr. Zhang Shanming	50	Chairman of the Board, Non-Executive Director, President of CGNPC	• Appointed Chairman and non-executive Director 24 March 2014 • More than 30 years of experience in nuclear power industry • Joined GNPJVC in August 1984 • Served as the chief economist, senior vice president and president at CGNPC since 2003 • Doctor of economics in finance from Wuhan University in June 2012 • Training experience on operations management and safety supervision in EDF in France and in GE from April 1989 to December 1990 • Professorship-level senior engineer by CGNPC in December 2001
Mr. Gao Ligang	49	Executive Director and President of CGNPC	• More than 26 years of experience in the nuclear power industry. • Joined GNPJVC in March 1988 • Chairman of the board of directors of Taishan Nuclear since December 2007 • Master of engineering in power system and automation from North China Institute of Electric Power in January 1988 • Professorship-level senior engineer by CGNPC in December 2001
Mr. Zhang Weiqing	59	Non-Executive Director, Vice Chairman of the Board of Directors at CGNPC	• More than 13 years of experience in the nuclear power industry • Joined CGNPC in May 2001 • Worked as deputy director of the general office, board secretary, assistant general manager, senior vice president of CGNPC from November 2001 to March 2014 • Bachelor of engineering in computer hardware from University of National Defense Technologies in March 1982 • Accredited as a senior engineer in December 1994
Mr. Yue Linkang	58	Chief Financial Officer	• Appointed as CFO 24 March 2014 • Joined GNPJVC in December 1991 • Served as deputy CFO, CFO and chief economist from January 2003 to May 2014 • Master of engineering in industrial management from Tsinghua University • Accredited as senior economist and senior account and the third Assessment Committee of Senior Accountant Qualification
Mr. Shi Bing	47	Non-Executive Director, Senior Vice President, Chief Financial Officer.	• Appointed as non-executive director 24 March 2014 • More than 18 years of experience in finance, accounting, auditing, and management of large nuclear power enterprises • Joined CGNPC in April 1996 • Served as deputy CFO, senior vice president, senior vice president and CFO since January 2008 to now • Master of economics in accounting from Central university of Finance and Economics • Accredited as a senior accountant in December 2003
Mr. Li Yourong	50	Chairman of the Supervisory Committee, Head of Disciplinary Inspection group of CGNPC	• Appointed as supervisor 24 March, 2014 • Joined CGNPC in March 2013 • Served as chairman of the trade union of CGNPC from August 2013 to June 2014 and served as the director representing ordinary employees from April 2014 to June 2014 • Doctor of economics in industrial economics from Renmin University of China

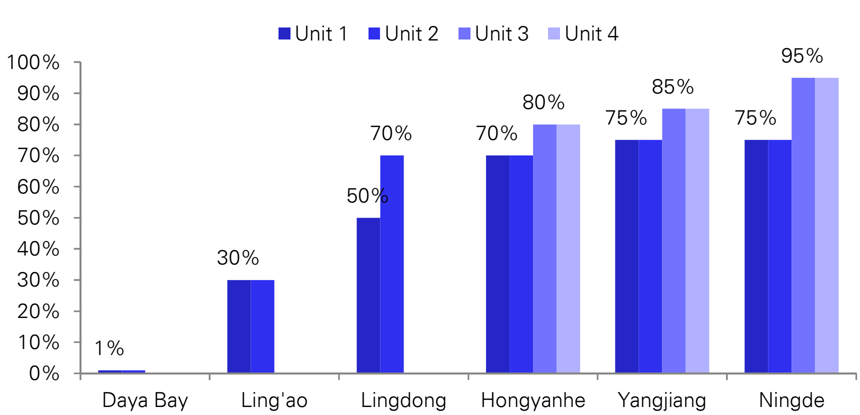
Source: Deutsche Bank, Company Data;

Figure 120: CGN – technology evolution



Source: Company data, Deutsche Bank

Figure 121: CGN – progressive localization rate for its nuclear units



Source: WNA, company data, Deutsche Bank

Appendix A: comparison with CNNC

Introduction to CNNC

China National Nuclear Corporation (CNNC Group), a central SOE, is founded in 1999 as the successor of the Ministry of Nuclear Industry. It is one of the only three licensed nuclear developers in China, along with CGNPC and CPI Group. CNNC covers a full range of nuclear business including R&D, engineering design, uranium exploration and mining, enrichment, fuel fabrication, reprocessing and waste disposal. As of end-2013, CNNC has total assets of Rmb330bn and shareholder equity of Rmb61.8bn. In 2013, its net profit amounts to Rmb3.2bn.

CNNC takes 39% of market share in China by installed nuclear capacity as of end-2014

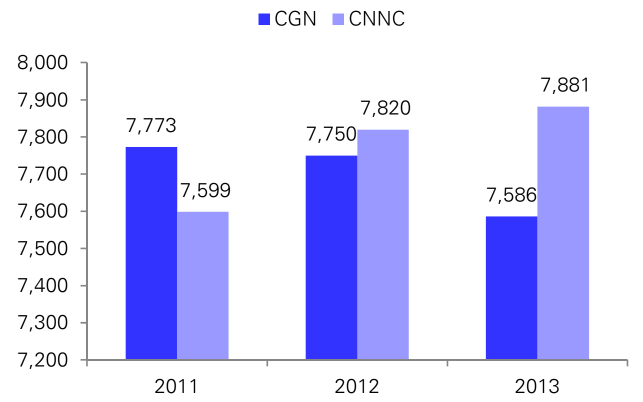
In December 2011, as part of the restructuring plan for listing, China National Nuclear Power Co., Ltd. (CNNC) was established jointly by CNNC Group (97%), China Three Gorges Corporation (1%), China Ocean Shipping Group Company (COSCO, 1%), and Aerospace Capital (1%). CNNC will be responsible for the development, investment, construction, operation, and management of nuclear projects owned by CNNC Group. It has 12 nuclear power project companies including Qinshan I, Qinshan II, Qinshan III, Jiangsu Nuclear, Sanmen Nuclear, Fuqing Nuclear, Hainan Nuclear, Liaoning Nuclear, Sanming Nuclear, Taohuajiang Nuclear, Henan Nuclear and Zhangzhou Nuclear. As of end-2014, CNNC has controlled nuclear capacity of 7.5GW, representing 39% of China's total operating capacity. It also has another 11.5GW under construction.

Comparison in key metrics

Below we compare the key operating/financial metrics of the two listco in 2011-13. Generally, CGN demonstrated better operating efficiency by achieving better net margin, higher ROE with a lower gearing.

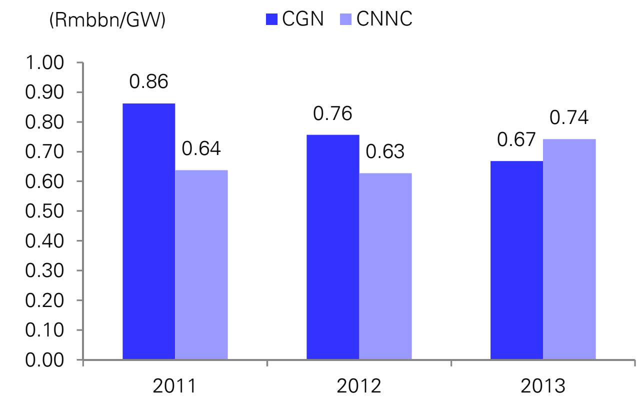
- **Similar utilization hours**: both companies achieved high utilization hours of above 7,500 hours during 2011-13, with slight fluctuations from refueling cycles.
- **CGN has higher profit margin**: as CNNC has a high minority proportion, we have compared the after-tax profit margin to avoid distortion. During 2011-2013, CGN's profit margin is higher at 20-23% vs. the 16-20% achieved by CNNC. By unit, profitability (net profit/year-end attributable capacity), CGN also achieved higher level at Rmb760-860m/GW, though the figure is slightly lower in 2013 due to partial contribution from Ningde Unit 1 and Yangjiang Unit 1.
- **CGN has higher ROA and ROE:** CGN also recorded better ROA at 4.1-4.7% in 2011-13 (CNNC: 2.9-3.0%). Note we have adjusted the calculation by using post-tax profit instead of net profit. Besides, ROE is much higher at 21-27% (CNNC: 13-15%).
- **CGN has lower net gearing** at 180-281% (CNNC: 316-382%).

Figure 122: Utilization hours



Source: Company data, Deutsche Bank

Figure 123: Net profit/MW (attributable capacity)



Source: Company data, Deutsche Bank

Figure 124: Financial comparison – CGN vs. CNNC (2011-13)

	CGN			CNNC			Comment
	2011	2012	2013	2011	2012	2013	
Operating Metrics							
Controlled capacity (year-end, MW)	6,122	6,122	6,122	6,506	6,506	6,506	
yoy growth (%)		0%	0%		0%	0%	
Attributable capacity (year-end, MW)	5,482	5,482	6,272	3,336	3,336	3,336	Similar controlled capacity, but CGN has higher attributable capacity with 2013 increase contributed by Ningde
yoy growth (%)		0%	14%		0%	0%	
Net generation (m MWh)	40,519	45,113	44,157	41,679	47,012	47,968	
yoy growth (%)		11%	-2%		13%	2%	
Average on-grid tariff (excl. VAT)	357	366	368	372	372	378	
yoy growth (%)		3%	1%		0%	2%	
Average utilization hours	7,773	7,750	7,586	7,599	7,820	7,881	
Financials							
Operating revenue	15,881	17,575	17,365	15,617	17,750	18,081	
Fuel cost	(2,099)	(2,785)	(2,658)	(2,914)	(3,284)	(3,534)	
Depreciation	(2,234)	(2,413)	(2,240)	(1,979)	(2,102)	(2,102)	
Waste disposal	(796)	(789)	(736)	(507)	(699)	(930)	
SG&A	(812)	(918)	(1,031)	(1,073)	(1,151)	(1,043)	
Finance costs	(2,114)	(3,118)	(2,804)	(1,154)	(2,551)	(1,993)	
VAT rebate	1,009	1,263	1,299	1,692	1,810	1,933	CGN's tax rebate is lower as Daya Bay only have rebate on its mainland sales (c.30%)
Share of results from associates/JV	2	(4)	144	-	-	-	
PBT	4,357	4,607	4,355	5,434	5,243	6,092	
Tax	(936)	(890)	(998)	(1,025)	(688)	(969)	
Effective tax rate	*14.8%*	*15.2%*	*16.4%*	*18.9%*	*13.1%*	*15.9%*	
Minorities	(669)	(833)	(877)	(2,283)	(2,462)	(2,646)	Similar effective tax rate at c.15% under preferential policy; CNNC has higher minority %
Minority %	*15.4%*	*18.1%*	*20.1%*	*42.0%*	*47.0%*	*43.4%*	
Net Profit	4,727	4,147	4,195	2,126	2,094	2,477	
Profitability							
Net Margin (%, adjusted)	23.2%	21.5%	20.0%	20.2%	15.7%	19.1%	We have adjusted the net margin and ROA calculation using profit after tax given the difference in minority %
Net profit / attributable capacity (Rmb m/MW)	0.86	0.76	0.67	0.64	0.63	0.74	
Return on Average Equity	27.1%	24.6%	21.3%	15.3%	13.0%	12.9%	
ROA (adjusted)	4.7%	4.2%	4.1%	3.0%	2.9%	2.9%	
Cashflow and leverage							
Operating cashflow (net int. exp.)	8,273	5,714	6,852	10,393	11,428	9,329	
Capex	(12,436)	(12,436)	(12,436)	(26,915)	(22,742)	(23,704)	CGN has better cashflow and lower gearning
Free cashflow	(4,164)	(6,722)	(5,585)	(17,676)	(13,865)	(16,368)	
Net Gearing %	180%	281%	212%	382%	323%	316%	

Source: Deutsche Bank, company data

Rating
Buy

Asia
China

Utilities
Utilities

Company
Huadian Fuxin

Reuters	Bloomberg
0816.HK	816 HK

Price at 6 Jan 2015 (HKD)	3.85
Price target - 12mth (HKD)	6.10
52-week range (HKD)	4.84 - 3.16
HANG SENG INDEX	23,721

Michael Tong, CFA
Research Analyst
(+852) 2203 6167
michael.tong@db.com

Yingying Dong, CFA
Research Associate
(+852) 2203 6207
yingying.dong@db.com

Price/price relative

Performance (%)	1m	3m	12m
Absolute	-1.5	-14.8	11.9
HANG SENG INDEX	-1.2	1.7	4.6

Source: Deutsche Bank

Diversification underappreciated; Buy as sector top pick

Visible and strong growth with attractive valuation; Buy as sector top pick

We like Fuxin for its balanced capacity portfolio, which effectively diversifies single business risk and grants the company more safety margin to achieve the 34% earnings CAGR in 2014-17E. The company will be a key beneficiary under an easing cycle and we see multiple near-term catalysts to provide extra earnings upside. At 8.5x 15E PE, the stock looks mispriced for its growth outlook. Reiterating Buy as our top pick within the utilities universe.

Diversified portfolio to support a highly visible 34% CAGR in 2014-17E

Fuxin has the most balanced capacity portfolio (coal/wind/hydro/nuclear) among major power gencos in China, which will help the company to effectively cushion the earnings volatility from single businesses. After factoring in a 5%/4% drop in coal utilization in 2015/16E, we believe the company will still be able to deliver 34% earnings CAGR in 2014E-2017E, driven mainly by the strong pipeline of nuclear and wind power.

Key beneficiary under an easing cycle; catalysts

Fuxin will also be a key beneficiary of the easing cycle given its still high leverage. Our economists expect two more cuts of 25bps in benchmark rates in 2Q15 and another 25bps in 3Q15, which would increase Fuxin's FY15E earnings by 5.4%. We also see several catalysts in 2015 including 1) nuclear: final approval for Fuqing Nuclear Unit 5-6 and commissioning of Unit 2; 2) thermal: approval for Shaowu Expansion and Kemen Phase III; and 3) wind speed turnaround.

Target price of HKD6.1; risks

Our target price is derived from an SOTP-based valuation by applying DCF to the main business and PE multiple to associates. Key risks: weak power demand in Fujian, low wind speed, higher-than-expected interest rate and share placement.

Forecasts And Ratios

Year End Dec 31	2012A	2013A	2014E	2015E	2016E
Sales (CNYm)	11,352	13,242	13,766	15,448	16,663
EBITDA (CNYm)	4,833	6,510	7,559	9,217	10,320
Reported NPAT (CNYm)	1,093	1,468	1,854	2,834	3,770
Reported EPS FD(CNY)	0.160	0.193	0.234	0.355	0.472
DB EPS FD (CNY)	0.160	0.193	0.234	0.355	0.472
DB EPS growth (%)	69.9	20.1	21.6	51.7	33.1
PER (x)	7.5	9.1	13.2	8.7	6.5
Price/BV (x)	0.8	1.7	1.8	1.5	1.3
EV/EBITDA (x)	8.1	7.6	8.9	8.0	7.5
DPS (net) (CNY)	0.029	0.038	0.047	0.071	0.094
Yield (net) (%)	2.4	2.2	1.5	2.3	3.1
ROE (%)	12.1	13.5	14.9	19.0	21.2

Source: Deutsche Bank estimates, company data

[1] DB EPS is fully diluted and excludes non-recurring items

[2] Multiples and yields calculations use average historical prices for past years and spot prices for current and future years, except P/B which uses the year end close

Model updated:12 November 2014

Running the numbers

Asia

China

Utilities

Huadian Fuxin

Reuters: 0816.HK | Bloomberg: 816 HK

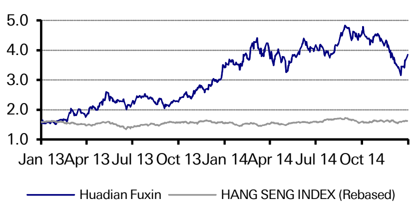
Buy

Price (6 Jan 15)	HKD 3.85
Target Price	HKD 6.10
52 Week range	HKD 3.16 - 4.84
Market Cap (m)	HKDm 30,721
	USDm 3,961

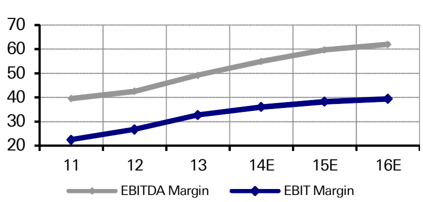
Company Profile

Huadian Fuxin is a leading diversified clean energy player in China with a balanced capacity portfolio of hydro, wind, coal-fired and other renewable energy. Besides, it also holds 39% interest in Fuqing nuclear. Its total consolidated capacity reached 9,510MW as of 1H13. China Huadian Corporation is its controlling shareholder with 65.7% interest as of 1H13.

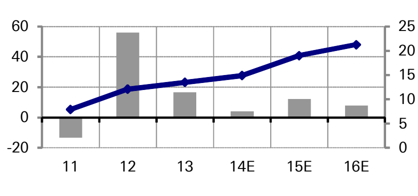
Price Performance



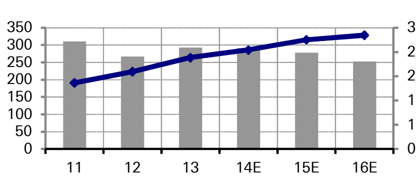
Margin Trends



Growth & Profitability



Solvency



Michael Tong, CFA
+852 2203 6167
michael.tong@db.com

Fiscal year end 31-Dec	2011	2012	2013	2014E	2015E	2016E
Financial Summary						
DB EPS (CNY)	0.09	0.16	0.19	0.23	0.36	0.47
Reported EPS (CNY)	0.09	0.16	0.19	0.23	0.36	0.47
DPS (CNY)	0.00	0.03	0.04	0.05	0.07	0.09
BVPS (CNY)	1.3	1.4	1.5	1.7	2.0	2.4
Weighted average shares (m)	6,000	6,820	7,623	7,920	7,980	7,980
Average market cap (CNYm)	na	8,235	13,402	24,625	24,625	24,625
Enterprise value (CNYm)	na	39,272	49,669	67,419	73,692	77,838
Valuation Metrics						
P/E (DB) (x)	na	7.5	9.1	13.2	8.7	6.5
P/E (Reported) (x)	na	7.5	9.1	13.2	8.7	6.5
P/BV (x)	0.00	0.85	1.65	1.80	1.52	1.27
FCF Yield (%)	na	nm	nm	nm	nm	nm
Dividend Yield (%)	na	2.4	2.2	1.5	2.3	3.1
EV/Sales (x)	nm	3.5	3.8	4.9	4.8	4.7
EV/EBITDA (x)	nm	8.1	7.6	8.9	8.0	7.5
EV/EBIT (x)	nm	12.9	11.5	13.6	12.5	11.8
Income Statement (CNYm)						
Sales revenue	7,278	11,352	13,242	13,766	15,448	16,663
Gross profit	4,169	6,972	8,740	9,833	11,749	13,112
EBITDA	2,879	4,833	6,510	7,559	9,217	10,320
Depreciation	1,244	1,798	2,175	2,594	3,302	3,744
Amortisation	0	0	0	0	0	0
EBIT	1,635	3,035	4,335	4,965	5,915	6,576
Net interest income(expense)	-1,201	-1,905	-2,305	-2,435	-2,630	-2,805
Associates/affiliates	3	43	94	117	514	1,044
Exceptionals/extraordinaries	0	0	0	0	0	0
Other pre-tax income/(expense)	310	443	61	105	70	70
Profit before tax	748	1,616	2,185	2,752	3,869	4,885
Income tax expense	95	261	484	622	719	812
Minorities	87	262	233	276	316	303
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	566	1,093	1,468	1,854	2,834	3,770
DB adjustments (including dilution)	0	0	0	0	0	0
DB Net profit	566	1,093	1,468	1,854	2,834	3,770
Cash Flow (CNYm)						
Cash flow from operations	1,469	4,677	6,622	6,824	8,142	9,316
Net Capex	-5,997	-7,062	-7,186	-11,827	-10,028	-9,386
Free cash flow	-4,528	-2,385	-565	-5,003	-1,886	-70
Equity raised/(bought back)	0	2,118	0	916	0	0
Dividends paid	-182	-338	-377	-291	-374	-567
Net inc/(dec) in borrowings	4,898	3,016	5,006	8,096	5,927	4,137
Other investing/financing cash flows	-1,355	-1,591	-4,871	-3,342	-3,472	-3,228
Net cash flow	-1,167	820	-807	376	195	273
Change in working capital	*-1,404*	*-275*	*551*	*-219*	*-426*	*-262*
Balance Sheet (CNYm)						
Cash and other liquid assets	1,528	2,576	1,769	2,145	2,340	2,612
Tangible fixed assets	38,895	46,639	52,265	61,905	69,107	75,172
Goodwill/intangible assets	700	970	1,096	1,096	1,096	1,096
Associates/investments	2,046	2,668	3,546	4,163	5,043	6,087
Other assets	7,079	8,487	9,001	9,146	9,706	10,114
Total assets	50,248	61,341	67,676	78,455	87,292	95,081
Interest bearing debt	30,412	36,539	41,918	50,014	55,941	60,079
Other liabilities	10,526	12,092	12,048	11,974	12,108	12,254
Total liabilities	40,939	48,632	53,966	61,988	68,049	72,332
Shareholders' equity	7,504	10,574	11,211	13,690	16,150	19,354
Minorities	1,805	2,135	2,500	2,776	3,093	3,395
Total shareholders' equity	9,310	12,709	13,711	16,466	19,243	22,749
Net debt	*28,885*	*33,964*	*40,149*	*47,870*	*53,602*	*57,466*
Key Company Metrics						
Sales growth (%)	-13.3	56.0	16.7	4.0	12.2	7.9
DB EPS growth (%)	8.6	69.9	20.1	21.6	51.7	33.1
EBITDA Margin (%)	39.6	42.6	49.2	54.9	59.7	61.9
EBIT Margin (%)	22.5	26.7	32.7	36.1	38.3	39.5
Payout ratio (%)	0.0	18.0	19.8	20.0	20.0	20.0
ROE (%)	7.9	12.1	13.5	14.9	19.0	21.2
Capex/sales (%)	82.4	62.2	54.3	85.9	64.9	56.3
Capex/depreciation (x)	4.8	3.9	3.3	4.6	3.0	2.5
Net debt/equity (%)	310.3	267.2	292.8	290.7	278.6	252.6
Net interest cover (x)	1.4	1.6	1.9	2.0	2.2	2.3

Source: Company data, Deutsche Bank estimates

Investment thesis

Outlook

Huadian Fuxin, a well-balanced power generation player, has the highest exposure to nuclear power among listed China power companies, via a 39% interest in Fuqing Nuclear. As Fuqing commences operation in 2014-17, it should contribute 29% of Fuxin's 2017E earnings. With an approximately even capacity split across wind, coal, hydro and others, Fuxin has the most balanced capacity portfolio among the major IPPs and clean energy players. This helps the company to effectively diversify from earnings volatility while capturing China's fast clean energy development with continued earnings CAGR of 34% in 2014E-2017E, driven mainly by the strong capacity pipeline of nuclear and wind power. We also see four share price catalysts in 2015: 1) the operation commencement of Fuqing Nuclear Unit 2 in 2015; 2) contrary to market consensus of no coal-fired capacity growth, we expect Fuxin to receive approval for two highly profitable ultra-supercritical coal-fired power plants, bringing Rmb600m earnings upon operation in 2017 (13% upside to 2017E earnings); 3) Fuqing phase II is likely to receive approval by 1Q15, adding another Rmb500m profit upon operation in 2018-19; and 4) accelerated wind power development. Despite the strong stock performance over the past year, Huadian Fuxin is still trading at 10x/7/6x of 2015/16/17E PE; Buy.

Valuation

Our target price is based on an SOTP-based valuation by applying DCF to the main business and PE multiple to associates. For its main business, we discount operating cash flow through 2025E and assume zero terminal growth. We apply a WACC of 8.6%, based on a 6.5% pre-tax cost of debt, a 3.9% risk-free rate, a 5.6% equity risk premium, a beta of 1.5 and a 50% target debt-to-capital ratio. We value associates by 12x 17E PE (when Fuqing Nuclear fully commences operation), discounted to 2015 by an 8.6% WACC.

Risks

Key downside risks include: 1) delayed commissioning and capex overrun for Fuqing Nuclear, 2) lower-than-expected wind speed/capacity addition for wind power, 3) greater-than-expected coal tariff cut relative to its coal price decline for thermal, 4) insufficient rainfall to lower hydro utilization hours, 5) weak power demand, and 6) share placement.

Appendix 1

Important Disclosures

Additional information available upon request

Disclosure checklist

Company	Ticker	Recent price*	Disclosure
CGN Power	1816.HK	3.40 (HKD) 6 Jan 15	NA
Huadian Fuxin	0816.HK	3.85 (HKD) 6 Jan 15	6
Datang Int'l Power	0991.HK	4.25 (HKD) 6 Jan 15	NA

*Prices are current as of the end of the previous trading session unless otherwise indicated and are sourced from local exchanges via Reuters, Bloomberg and other vendors . Data is sourced from Deutsche Bank and subject companies.

Important Disclosures Required by U.S. Regulators

Disclosures marked with an asterisk may also be required by at least one jurisdiction in addition to the United States. See Important Disclosures Required by Non-US Regulators and Explanatory Notes.

6. Deutsche Bank and/or its affiliate(s) owns one percent or more of any class of common equity securities of this company calculated under computational methods required by US law.

Important Disclosures Required by Non-U.S. Regulators

Please also refer to disclosures in the Important Disclosures Required by US Regulators and the Explanatory Notes.

6. Deutsche Bank and/or its affiliate(s) owns one percent or more of any class of common equity securities of this company calculated under computational methods required by US law.

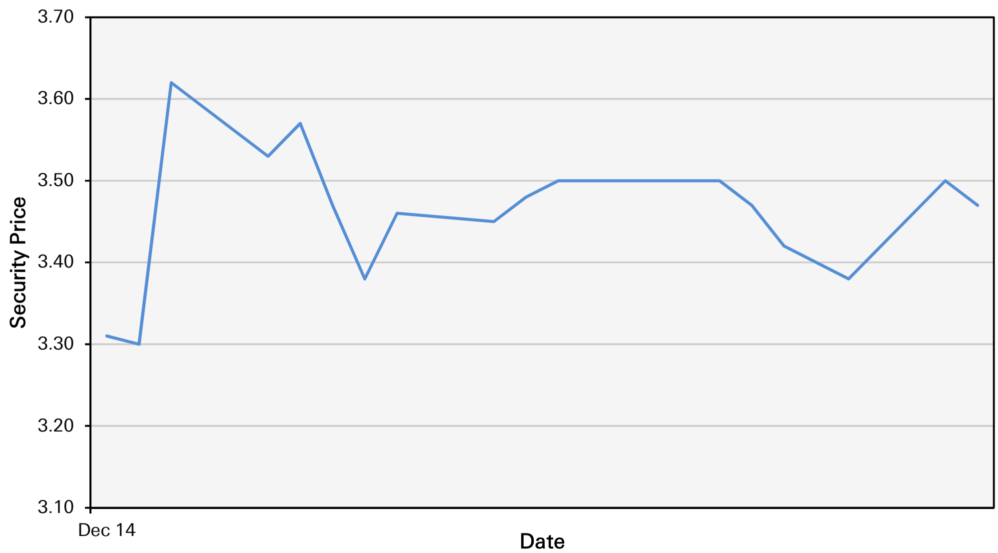
For disclosures pertaining to recommendations or estimates made on securities other than the primary subject of this research, please see the most recently published company report or visit our global disclosure look-up page on our website at http://gm.db.com/ger/disclosure/DisclosureDirectory.eqsr

Analyst Certification

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst about the subject issuers and the securities of those issuers. In addition, the undersigned lead analyst has not and will not receive any compensation for providing a specific recommendation or view in this report. Michael Tong

Historical recommendations and target price: CGN Power (1816.HK)

(as of 1/6/2015)



Previous Recommendations

Strong Buy
Buy
Market Perform
Underperform
Not Rated
Suspended Rating

Current Recommendations

Buy
Hold
Sell
Not Rated
Suspended Rating

*New Recommendation Structure as of September 9,2002

Historical recommendations and target price: Huadian Fuxin (0816.HK)

(as of 1/6/2015)

Previous Recommendations

Strong Buy
Buy
Market Perform
Underperform
Not Rated
Suspended Rating

Current Recommendations

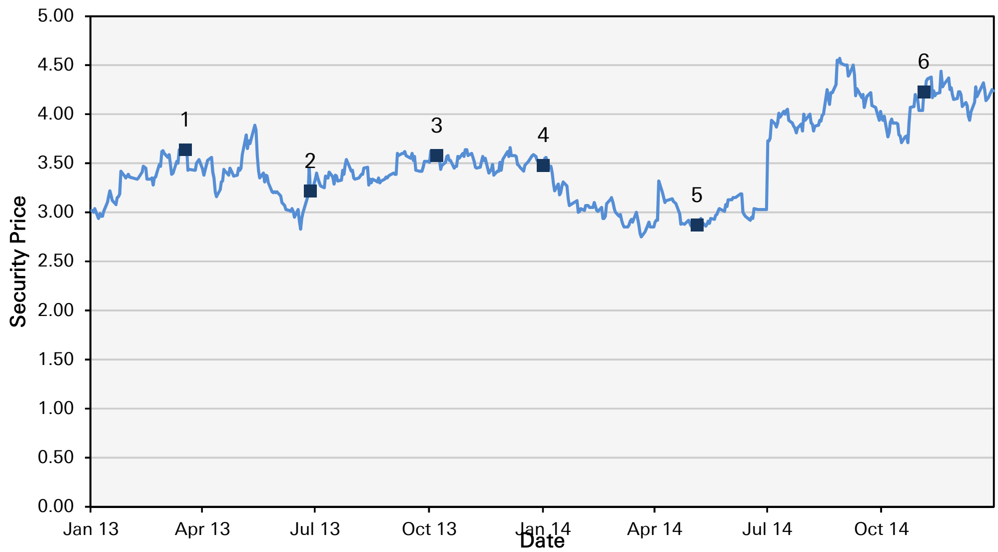
Buy
Hold
Sell
Not Rated
Suspended Rating

*New Recommendation Structure as of September 9,2002

1.	11/03/2014:	Upgrade to Buy, Target Price Change HKD5.50	3.	24/08/2014:	Buy, Target Price Change HKD6.00
2.	04/06/2014:	Buy, Target Price Change HKD5.60	4.	12/11/2014:	Buy, Target Price Change HKD6.10

Historical recommendations and target price: Datang Int'l Power (0991.HK)

(as of 1/6/2015)



Previous Recommendations

Strong Buy
Buy
Market Perform
Underperform
Not Rated
Suspended Rating

Current Recommendations

Buy
Hold
Sell
Not Rated
Suspended Rating

*New Recommendation Structure as of September 9,2002

1.	25/03/2013:	Buy, Target Price Change HKD4.10	4.	08/01/2014:	Buy, Target Price Change HKD4.80
2.	04/07/2013:	Buy, Target Price Change HKD4.20	5.	12/05/2014:	Buy, Target Price Change HKD4.10
3.	14/10/2013:	Buy, Target Price Change HKD4.40	6.	11/11/2014:	Buy, Target Price Change HKD5.50

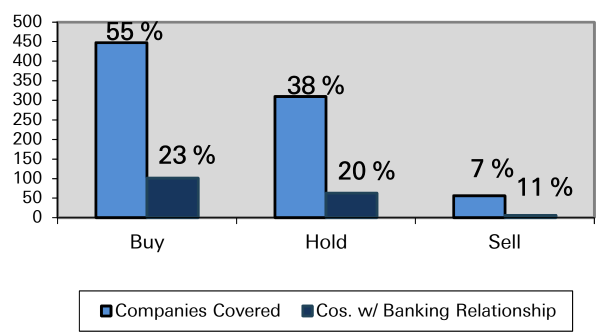
Equity rating key

Buy: Based on a current 12- month view of total share-holder return (TSR = percentage change in share price from current price to projected target price plus pro-jected dividend yield) , we recommend that investors buy the stock.
Sell: Based on a current 12-month view of total share-holder return, we recommend that investors sell the stock
Hold: We take a neutral view on the stock 12-months out and, based on this time horizon, do not recommend either a Buy or Sell.
Notes:

1. Newly issued research recommendations and target prices always supersede previously published research.
2. Ratings definitions prior to 27 January, 2007 were:

    Buy: Expected total return (including dividends) of 10% or more over a 12-month period
    Hold: Expected total return (including dividends) between -10% and 10% over a 12-month period
    Sell: Expected total return (including dividends) of -10% or worse over a 12-month period

Equity rating dispersion and banking relationships



Asia-Pacific Universe

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International locations

Deutsche Bank AG
Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

Deutsche Bank AG
Große Gallusstraße 10-14
60272 Frankfurt am Main
Germany
Tel: (49) 69 910 00

Deutsche Bank AG
Filiale Hongkong
International Commerce Centre,
1 Austin Road West,Kowloon,
Hong Kong
Tel: (852) 2203 8888

Deutsche Securities Inc.
2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6770

Deutsche Bank AG London
1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

Deutsche Bank Securities Inc.
60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500

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