



# From survive to thrive gas power industry and policy in China

NexTurbine® (for ETN IGTC-18, Brussels, Oct.2018) | Ronnie C. TIAN & Leigh YANG

# *Paradox of China's gas power*

## Golden Age

**87.93GW** the 2<sup>nd</sup>  
largest market by installed  
gas turbine capacity globally

**800billion m<sup>3</sup>**  
gas consumption by 2050

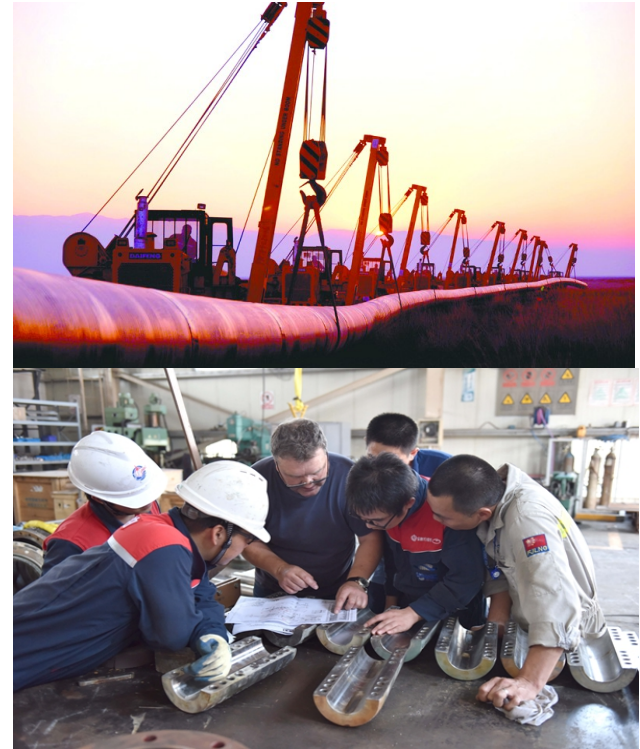
\*National Energy Administration(NEA)  
The Chinese academy of science(CAS):  
energy prospects 2018-2050.

## Struggle

**4.3%** of the total  
installed power-gen  
capacity are gas-fired units

**70%+** of capacity are  
peak shaving. Units in  
Zhejiang, Guangdong are  
operated with deficit or  
just break-even.

\*National Energy Administration  
(NEA), State Electricity Regulatory  
Commission .



# *A frame work to understand the paradox*

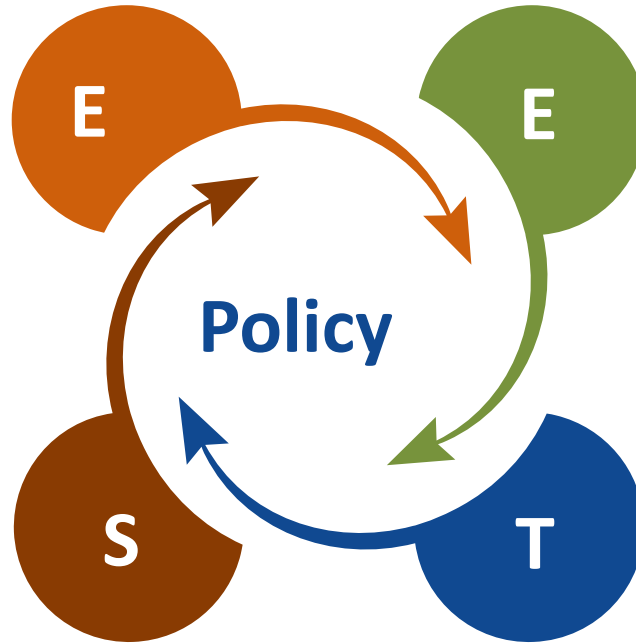
*This presentation is to provide a frame work to understand the paradox and dynamics of gas power in china, with a focus on policy.*

1. Industry
2. Policy
3. Status quo
4. Future

# A Driving Force Model

*Four driving forces that shape the energy (gas power) industry, and ultimately the policies.*

- **Economy**
- **Environment**
- **Security**
- **Technology**





# Economy Roars

## 224 times

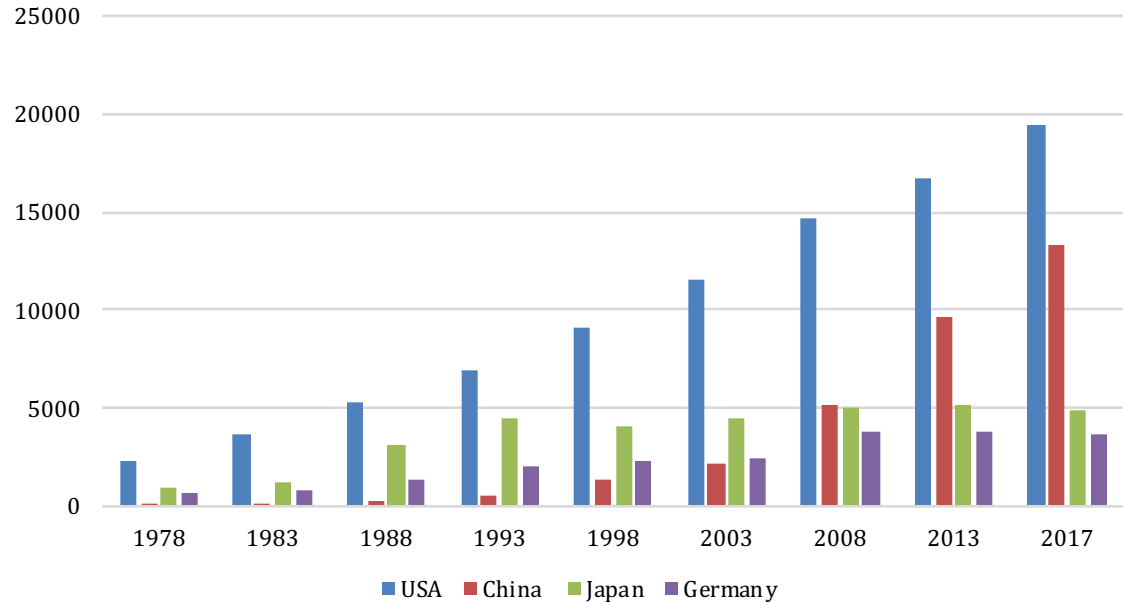
China's annual GDP has grown 224 times since 1978. It has been the 2<sup>nd</sup> largest economy since 2010.

## 60%

the top 5 provinces account nearly 60% of total GDP of China (Guangdong, Jiangsu, Shandong, Zhejiang, Henan)

\*National Bureau of Statistics of China(NBS),World Bank

### GDP Comparison by Countries (\$ billion)



# Environment Suffers

## 993

On 14<sup>th</sup> Jan 2013, the PM2.5 index reached 993, a day that Economist magazine called the darkest; as per EPA standard over 100 is unhealthy and 400 is dangerous.

## 60%

of 74 major cities failed to meet the new national <environment air quality standard>(GB 3095-2012) in 2013

\* Ministry of Natural Resources, map by <http://aqicn.org>

Europe and Asia Air Quality Index 29<sup>th</sup> Sept.2018



# Energy Security imbalanced and fluctuated

## Resource

Rich in coal, poor in oil & gas; Coal in the north, hydro in the west

## Shortage

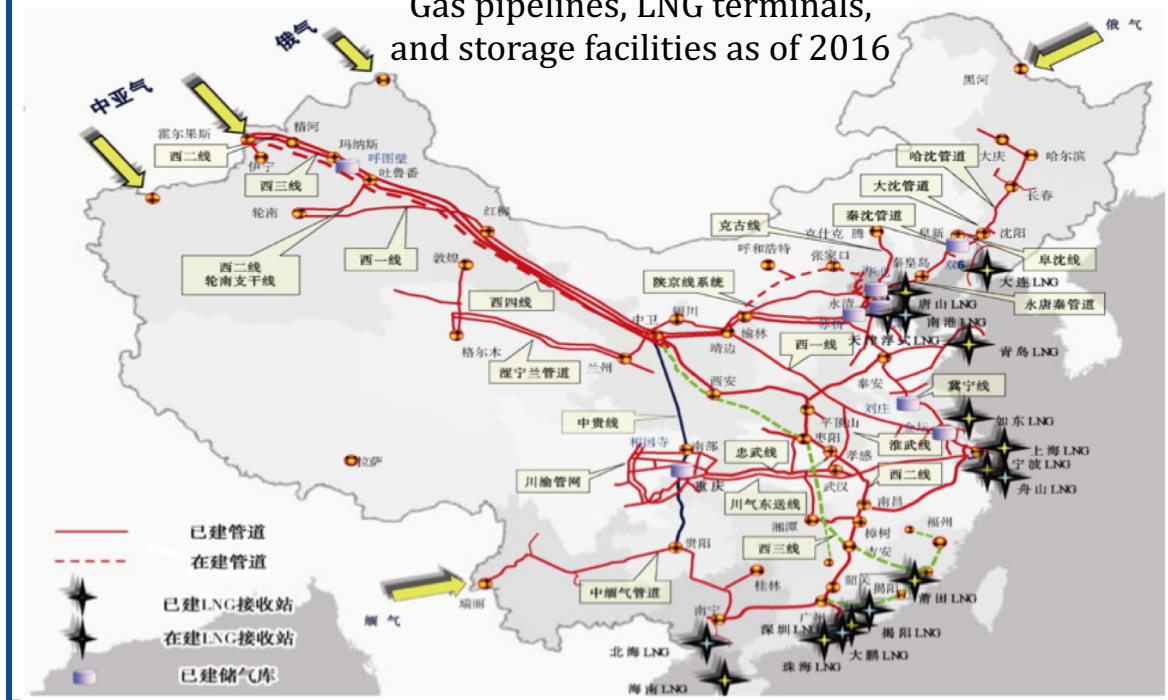
Gas: 2009, 2017;  
Electricity: 2000, 2011

## Gas Infrastructure

As of 2017, backbone gas pipeline 74,000km; gas storage capacity 11.7 billion m<sup>3</sup>

\*NexTurbine database, National Bureau of Statistics of China, NEA

Gas pipelines, LNG terminals, and storage facilities as of 2016



# Technology localization

**Coal** 600MW, 1000MW  
(ultra)supercritical units(boiler,  
steam turbine and generator)

**Hydro** 100% localized  
manufacture for 1000MW units

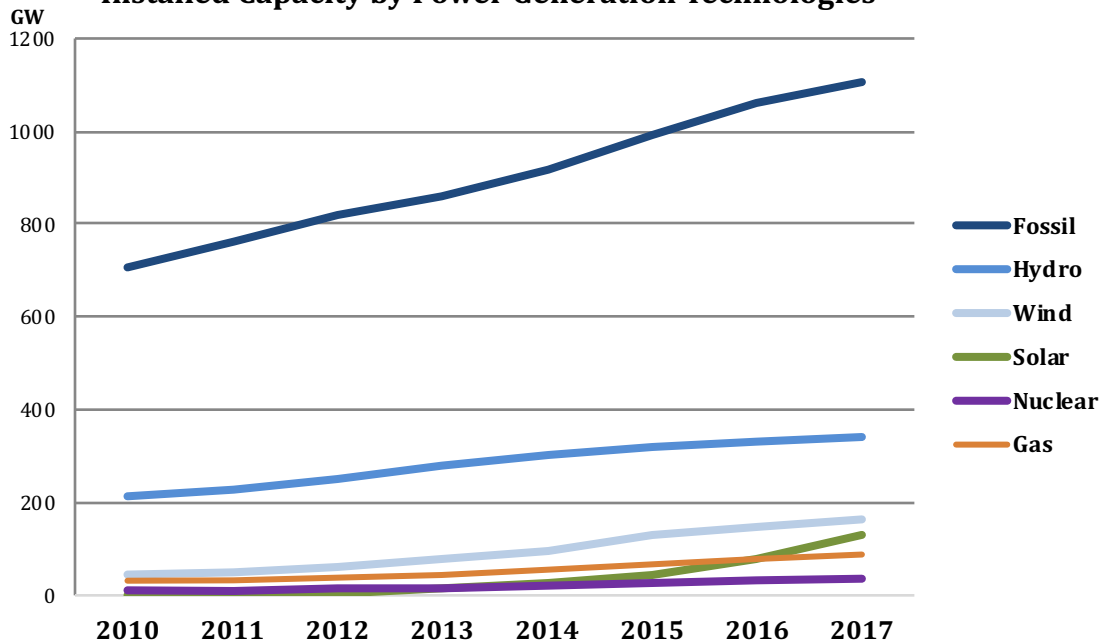
**Wind** units from 1.5MW-  
6MW, both land-based and off-  
shore

**Solar** 68GW of solar cells  
manufacture capacity per year,  
76GW PV modules manufacture per  
year (\*2017)

**Gas Turbine**

units  $\leq$ 50MW, 110MW  
Shanghai Electric: F, H class

Installed Capacity by Power Generation Technologies

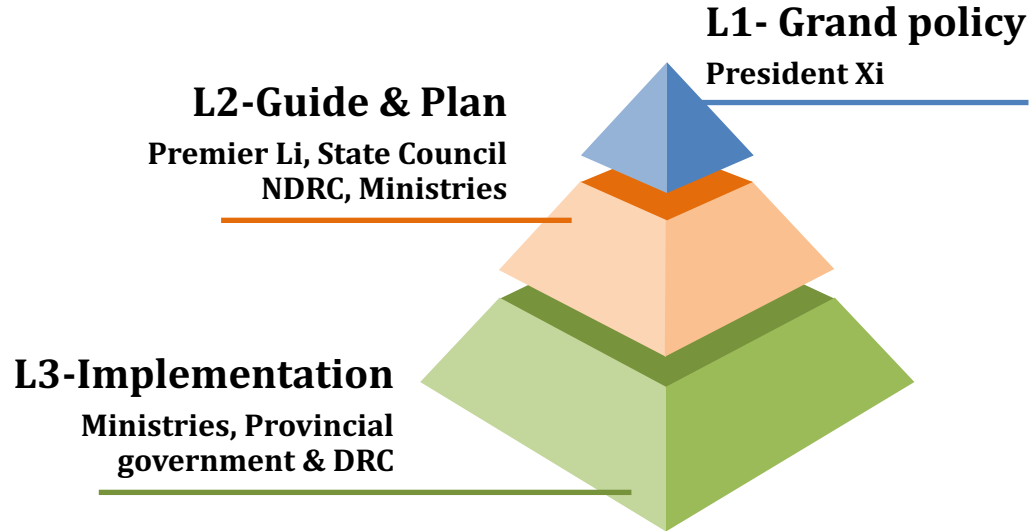




# Policy and its Level

*Policy making is the result of interaction among four driving forces; they also reflect leadership's intention.*

*We categorize China's energy (incl. gas power) policy into 3 levels.*



# Policies, Levels and Driving forces
















	Economy	Environment	Security	Technology
Level 1	<i>"China's New Normal"</i>	<i>"Beautiful China"</i>	<i>"Energy Revolution"-supply; cooperation</i>	<i>"Energy Revolution"-technology</i>
Level 2	<ul style="list-style-type: none"> <li>- The 13th five-year-plan(FYP) for economic and social Development</li> <li>- Guidelines on promoting the development of the Yangtze River Economic Belt 2014</li> <li>- The Outline of Collaborative Development of Beijing, Tianjin and Hebei Province</li> <li>- <i>Several Opinions on Further Deepening the Reform of the Electric Power System</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Action Plan on Air Pollution Control 2013</li> <li>- Integrated reform plan for promoting ecological progress 2015</li> <li>- <i>Three-year action plan to win the battle for a blue sky 2018</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Energy Development Strategy Action Plan (2014-20)</li> <li>- Energy Production and Consumption Revolution Strategy (2016-30)</li> <li>- <i>13<sup>th</sup> FYP for power/ natural gas</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Outline of the National Strategy of Innovation-Driven Development 2016</li> <li>- <i>Energy Innovation Action Plan (2016-2030)</i></li> <li>- <i>13<sup>th</sup> FYP for energy technology innovation</i></li> <li>- ...</li> </ul>

# Policies, Levels and Driving forces




	Economy	Environment	Security	Technology
Level 3	<ul style="list-style-type: none"> <li>- <i>Gungdong: Notice on reducing the provincial on-grid gas power electricity price 2017.</i></li> <li>- <i>Shanghai: Notice on refining the gas power electricity price mechanism 2018.</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Zhengzhou: Policy on funding and subsidies for clean heating pilot city.</li> <li>- <i>Qingdao: Policies to accelerate the development of clean energy &amp; heating.</i></li> <li>- <i>Shift-from-coal-to-gas program</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Renewable energy power quotas and assessment measures 2018.</li> <li>- <i>Opinions of accelerating the construction of gas storage facilities and improving the market mechanism 2018.</i></li> <li>- <i>Notice on the adjustment of preferential tax policy on natural gas import 2017.</i></li> <li>- ...</li> </ul>	<ul style="list-style-type: none"> <li>- Road map of key innovation action of energy revolution 2016.</li> <li>- <i>Notice of the first batch of gas turbine innovation development demonstration projects 2018.</i></li> <li>- ....</li> </ul>

Provincial governments follow up guidelines/options/suggestions/plans from level 1 and level 2. They have the resource and power to use most policy tools (quota, funding, subsidy, tax, price and etc.), especially for rich provinces.

# Gas Power in China-Policy signals

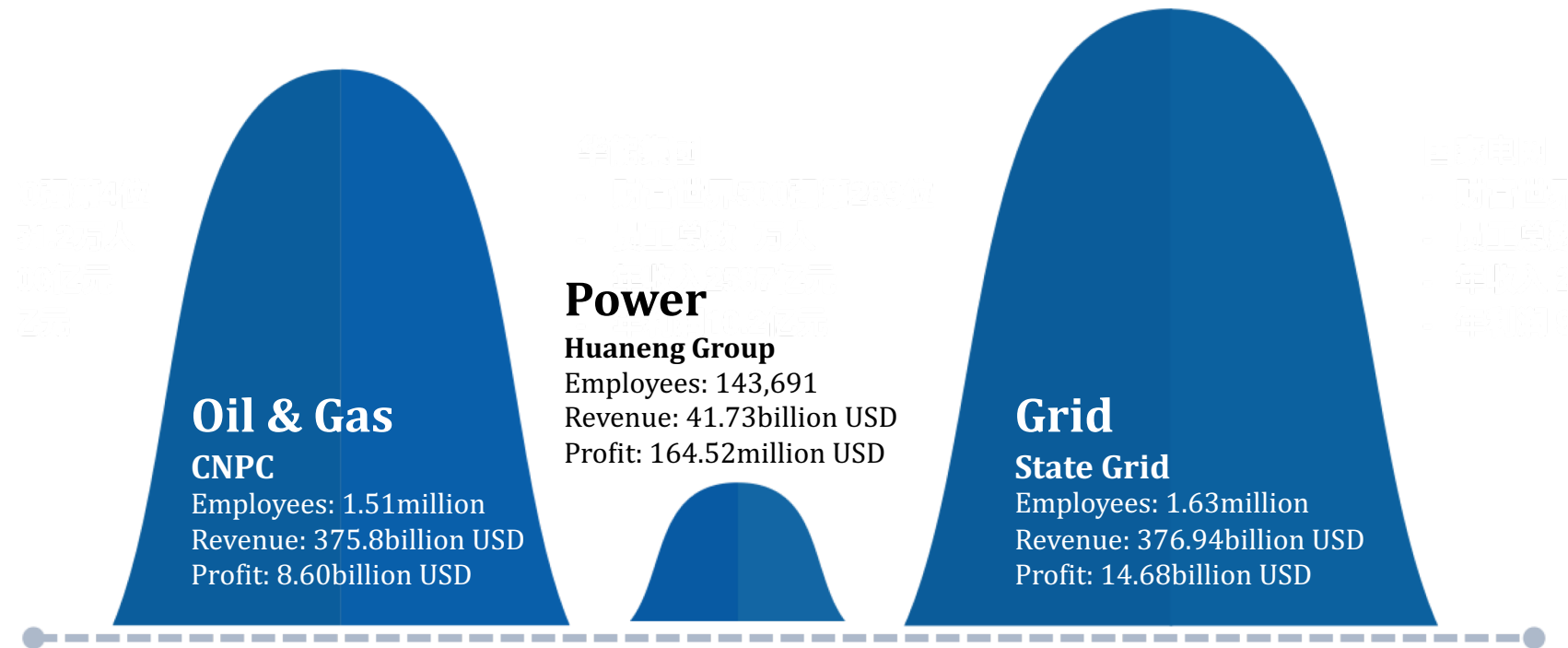
	Economy	Environment	Security	Technology
Level 1				
Level 2		 		
Level 3		 	 	

Level 3 are relatively short-term and therefore changing from time to time; level 2 contains both short-term and mid-term policies, they are also evolving; while level 1 is generally long-term.

 positive policy signal;  negative policy signal;  no clear policy preference/not mentioned



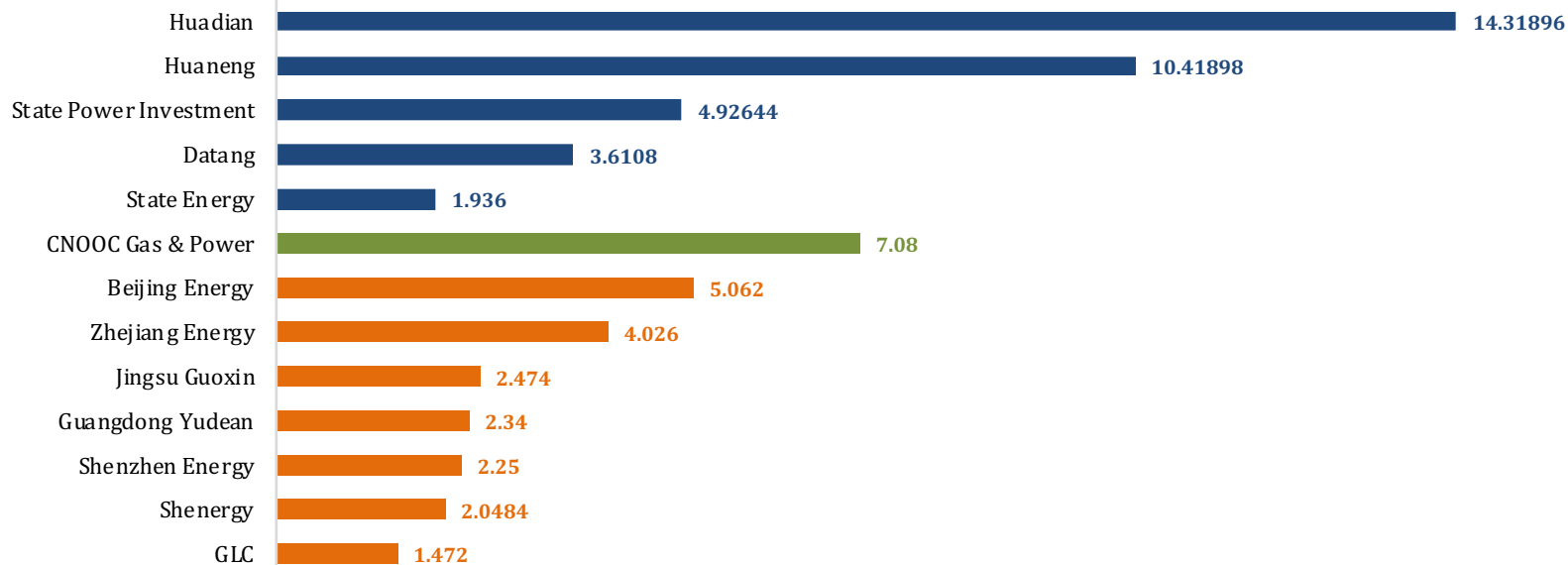
# Gas Power in China-powerful stakeholders



\* Data as released from annual report 2017.

# Gas Power in China-Major Operators

Installed Capacity by Major Players as of 2017 (GW)



# Gas Power in China-Regional Development

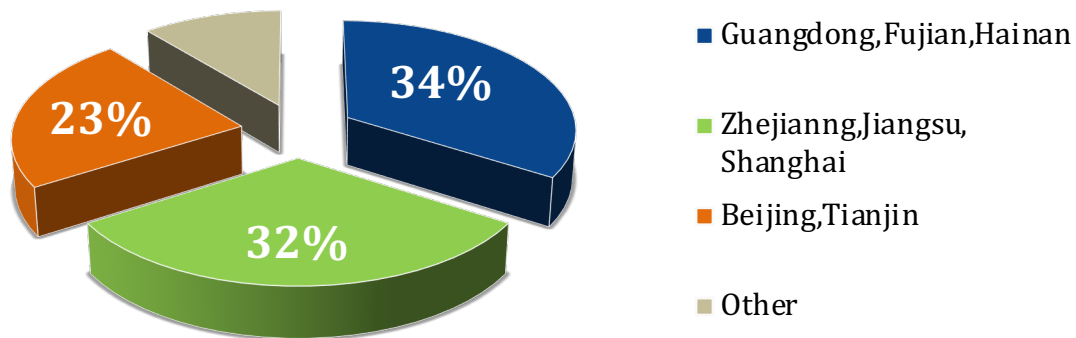
Nearly **90%** of gas power capacity are installed in Yangtze Delta, Pearl Delta and Jing-Jin-Ji (Beijing, Tianjin, Hebei Province)

**The 13<sup>th</sup> FYP for Power** by 2020, new-built capacity 50GW, total installed capacity 110GW.

**Guannngdong 13<sup>th</sup> FYP:** by2020, total gas power capacity 23GW.

**liangsu 13<sup>th</sup> FYP:** by2020, total gas power capacity 20GW.

## Installed Gas Power capacity by region 2017



# Gas Power in China-Regional Development

## Guangdong

### -GDP

\$13040billions

### -Population

109.99millions

### -Population Density

3193 people per km<sup>2</sup>

### -Major cities

Guangzhou,  
Shenzhen, Zhuhai,  
Shantou, Fuoshan...

- **No.1** province by power consumption
- **No.2** province by installed gas power capacity
- **First H class plant** in mainland China, Huadian Zengcheng Plant (2\*SGT5-8000H) is expected to operate by the end of 2019

\* From National Statistic Bureau and Siemens as of 2018



### **CNOOC Zhongshan Jiaming Power Plant**

Phase I: Coal Units 125MW\*2

Phase II: GE PG9531FA 390MW\*2

Phase III: MHPS M701F4 460MW\*3

Currently the largest gas power plant of Guangdong. It consumes gas 2 billion m<sup>3</sup> per year, generates electricity 12billion kW·h



# Gas Power in China-Regional Development

## Jiangsu

### -GDP

\$1248.2billions

### -Population

79.99millions

### -Population Density

2057 people per km<sup>2</sup>

### -Major cities

Nanjing, Wuxi, Suzhou,  
Changzhou...

- **No.1** province by gas consumption
- **No.1** province by installed gas power capacity
- **No.2** province by power consumption
- **13.4GW** total installed gas power capacity; 10GW belongs to Huadian Jiangsu Company

\* From government interviews and news as of 2018



### Jiangsu Huadian Qi Shu Yan Gas Power Plant

Phase I: GE 9F 390MW\*2

Phase II: MHPS M701DA 220MW\*2

Phase III: MHPS M701F4 475MW\*2

Located in Jiangsu Changzhou city, the plant is the hardcore peaking resource for Huadong regional grid network.

# Gas Power in China-Regional Development

## Zhejiang

### -GDP

\$762.1billions

### -Population

55.9millions

### -Population Density

2059 people per km<sup>2</sup>

### -Major cities

Hangzhou, Ningbo,  
Shaoxing, Wenzhou,  
Jiaxing...

- **No.3** province by installed gas power capacity
- **No.3** province by power consumption
- **12.28GW** total installed gas power capacity
- **1356 hours**, gas power plants runs very low annual operation hours with average at 1356 (2015)

\* From Zhejiang 13<sup>th</sup> FYP for power development issued in 2016



### Hangzhou Huandian Banshan Gas Power Plant

Phase I: GE PG9351FA 390MW\*3

Phase II: GE PG9351FA 415MW\*3

First gas power plant exceeded 2000MW capacity, strategic plant of Zhejiang provincial grid and hardcore resource of Hangzhou power supply.

# Gas Power in China-Regional Development

## Beijing

### -GDP

\$762.1billions

### -Population

13.63millions

### -Population Density

1145 people per km<sup>2</sup>

- **1<sup>st</sup> city** in China shut down all coal fired power plants
- **30%** of its power consumption are supplied by four thermal and power centers, with all new-built gas-fired units within 3 years
- **11GW** total installed gas power capacity

\* From government news as of 2017



### **Huaneng Beijing Gao Bei Dian Thermal Power Plant**

Phase I: Coal power

Phase II: MHPS M701F4 460MW\*2

Phase III: MHPS: M701F5 560MW\*2

Located in the east suburb of Beijing, the plant supplies 10% of electricity, 70% of steam, 30% of central heating for Beijing city. It is the corner stone of Beijing's heating source.

# The Future: some noteworthy points

Economy	Environment	Security	Technology
<p><b>Regions to watch</b></p> <ul style="list-style-type: none"> <li>• Yangtze Economic Belt: Jiangsu, Anhui, Jiangxi, Hubei, Hunan, Sichuan, Chongqing, Guizhou</li> <li>• Bohai Rim Economic Circle: Shandong, Hebei</li> </ul> <p><b>Key player' move</b></p> <ul style="list-style-type: none"> <li>• Power companies: go up stream and down stream</li> <li>• Oil &amp; gas: sell more gas (pipeline, LNG, unconventional)</li> </ul>	<p><b>Clean Air Phase II</b> Three-year action plan to win the battle for a blue sky</p> <ul style="list-style-type: none"> <li>• Rising regional emission standard</li> <li>• Upgrade for old gas turbine units</li> </ul> <p><b>Shift from Coal to Gas</b></p> <ul style="list-style-type: none"> <li>• Distributed gas power in the 2<sup>nd</sup>/3<sup>rd</sup>/4<sup>th</sup> tier cities</li> </ul>	<p><b>Speed-up Infrastructure</b></p> <ul style="list-style-type: none"> <li>• Gas storage facilities</li> <li>• LNG terminals</li> </ul> <p><b>Fluctuated world</b></p> <ul style="list-style-type: none"> <li>• Trade confrontation</li> <li>• LNG global market</li> <li>• Diversified trading players from China</li> </ul> <p><b>Grid &amp; security</b></p> <ul style="list-style-type: none"> <li>• Gas turbine as black-start-up resources</li> </ul>	<p><b>Localization</b></p> <ul style="list-style-type: none"> <li>• Service center/facility</li> <li>• SOE partners</li> </ul> <p><b>Own Development</b></p> <ul style="list-style-type: none"> <li>• Demo projects for heavy duty GT: Dongfang-50MW, Shanghai Electric-F, H</li> <li>• R&amp;D facility: CAS, China United Heavy Duty Gas Turbine Co.</li> </ul> <p><b>Renewables</b></p> <ul style="list-style-type: none"> <li>• Peak shaving: gas turbine V.S. coal units, grid tech &amp; capability</li> </ul>



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