

# LNG FOR TRANSPORTATION IN CHINA

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# ***COUNTRIES IN ASIA WITH LNGVs***

## **ESTABLISHED**

- **China**
- **Australia**
- **India**
- **Korea**

## **PROPOSED**

- **Thailand**
- **Taiwan**
- **Japan**
  
- **Indonesia**
- **Kazakhstan**
- **Vietnam**
- **Philippines**

# ***CHINA LEADING THE LNGV REVOLUTION***

## **2013**

- ❑ ~ 100,000+ LNGVs (~ 60% Trucks; ~ 40% Buses)
- ❑ ~ 1,100 LNG/LCNG Stations

## **2015**

- ❑ ~ 247,000 LNGVs
- ❑ ~ 2,500 stations

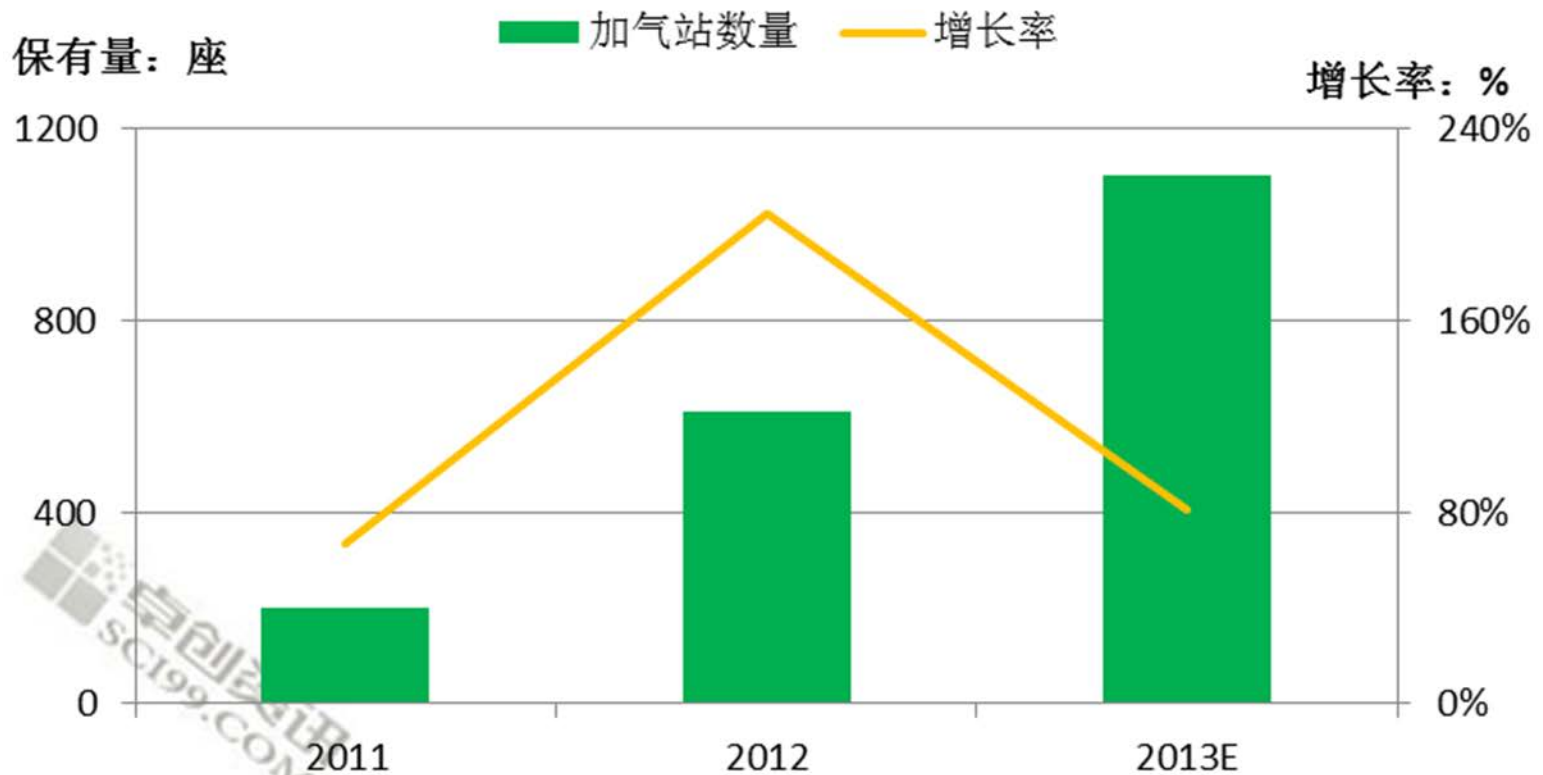
## **2025**

- ❑ ~ 700,000 LNGVs (= ~ 6% of 11.5 million fleet)
- ❑ ~ 7,500 stations

# LNG FILLING STATIONS IN CHINA

In 2013 462 filling stations were built, taking the total to 1,103 – an increase of 72% in 1 year

中国LNG加气站保有量及增长率



# REFUELLING STATIONS



# ***HOW CAN CHINA'S LNGV MARKET GROW SO RAPIDLY?***

- ❑ MAJOR CONCERN OVER SEVERE AIR POLLUTION**
- ❑ ENHANCED AVAILABILITY OF LNG**
- ❑ LOCALLY MADE VEHICLES, ENGINES & LNG SUPPLY EQUIPMENT**
- ❑ COMPETITIVE PRICING OF LNG**
- ❑ GOVERNMENT DRIVEN PROGRAMMES**

# CHINA EMISSION STANDARDS FOR HEAVY DUTY ENGINES

China	Test Cycle	CO	HC	NMHC	CH <sub>4</sub>	NOx	PM	SOx	Smoke
		g/kWh						ppm	1/m
III	<a href="#">ESC + ELR</a>	2.1	0.66	-		5.0	0.10 0.13 <sup>†</sup>	350	0.8
	<a href="#">ETC</a>	5.45	-	0.78		5.0	0.16 0.21 <sup>†</sup>		-
IV	<a href="#">ESC + ELR</a>	1.5	0.46	-		3.5	0.02	50	0.5
	<a href="#">ETC</a>	4.0	-	0.55		3.5	0.03		-
V	<a href="#">ESC + ELR</a>	1.5	0.46	-		2.0	0.02	10	0.5
	<a href="#">ETC</a>	4.0	-	0.55		2.0	0.03		-
VI <sup>c</sup>	<a href="#">WHSC</a>	1.5	-	0.13	-	0.40	0.01 <sup>b</sup>		
	<a href="#">WHTC</a>	4.0	-	0.16	0.5	0.46	0.01 <sup>b</sup>		

# EMISSION STANDARDS

- ❑ **Vehicle emission legislation has been a major driver for the adoption of LNG for transportation.**
- ❑ **In 2008, the maximum fuel sulphur limit in several cities was set at 50 ppm and in 2012, the maximum sulphur limit in Beijing was set at 10 ppm**
- ❑ **Nationwide the maximum allowable sulphur content will be reduced to 50 ppm by the end of this year to meet the China IV standard.**
- ❑ **The China V standard is planned to take effect in 2017 and will see the nationwide sulphur limit further reduced to 10 ppm.**
- ❑ **As a result of these regulatory measures, gas use is expected to increase dramatically.**
- ❑ **Given the emphasis on sulphur reduction the most significant growth is expected to be in the heavy duty sector.**



# ***INCREASED LNG AVAILABILITY – DOMESTIC PRODUCTION***



Total small scale production country wide is over 100 plants producing 33,500,000 m<sup>3</sup>/day (12.25 billion m<sup>3</sup>/year).

At the start of 2014 there were 25 domestic LNG plants under construction with a total capacity of 18.4 million m<sup>3</sup>/day.

By June 2014, the domestic LNG plant capacity will be more than 50 million m<sup>3</sup>/day.

The majority of this production is used for transportation.



# SMALL-SCALE LNG PRODUCTION



Domestic small-scale LNG plants mainly concentrated in Shaanxi, Xinjiang, Inner Mongolia, Ningxia, Hebei, Sichuan and Shanxi.

Largest small-scale plant was built in 2013 in Shaanxi with a capacity of 7,000,000 m<sup>3</sup>/day (2.56 billion m<sup>3</sup>/year)

# ***INCREASED LNG AVAILABILITY – IMPORTED LNG***

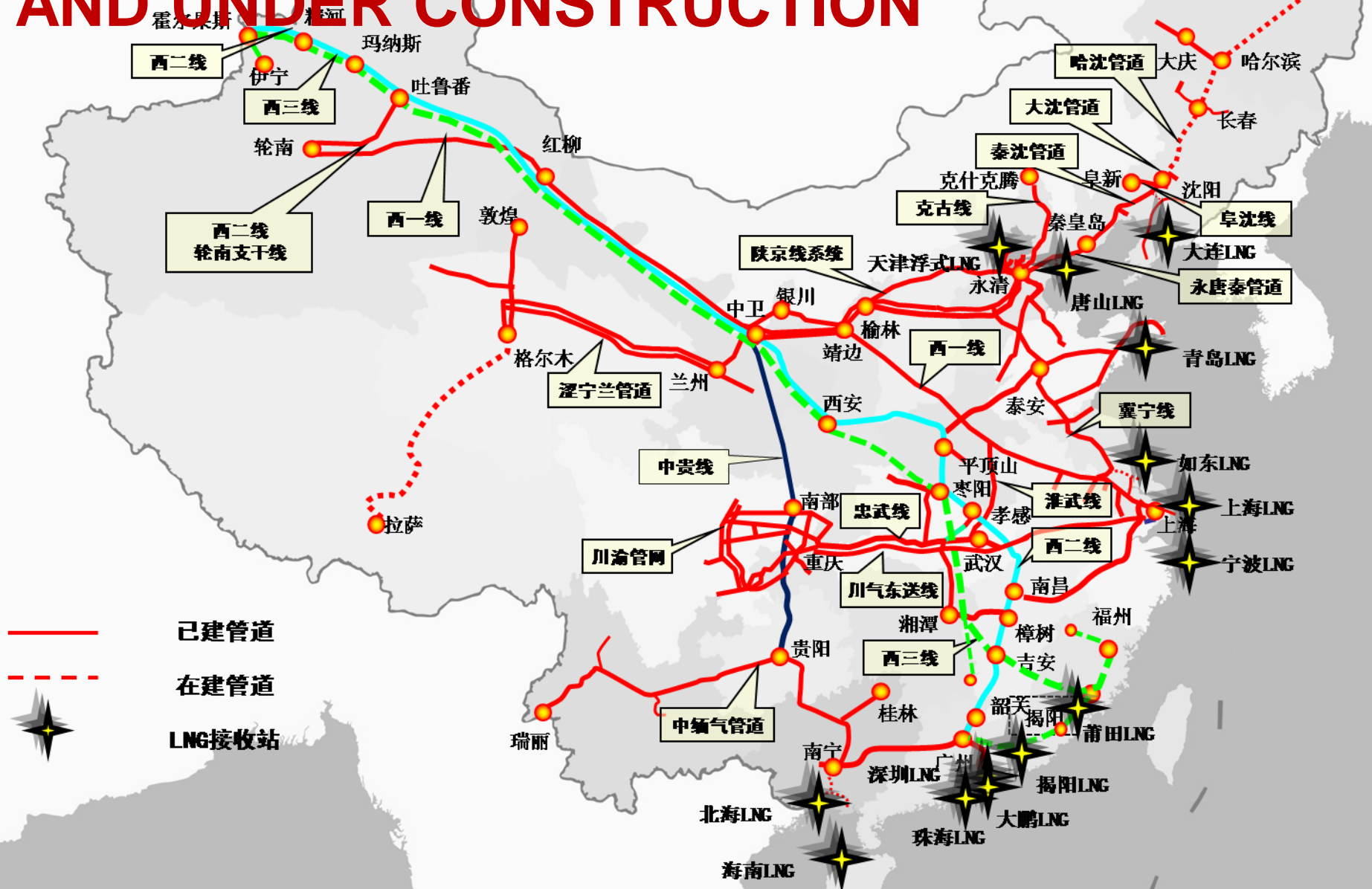


**Total available LNG (imports plus domestic production) grew by 27.0% in 2013 to 121 billion m3**





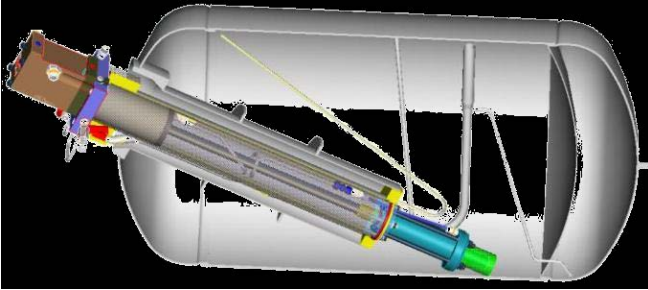
# LNG RECEIVING TERMINALS – OPERATING AND UNDER CONSTRUCTION



# NGV EQUIPMENT MANUFACTURE IN CHINA



ON-BOARD  
LNG TANKS



DISPENSERS



NOZZLE S & RECEPTACLES

# LNG TRANSPORT TANKS



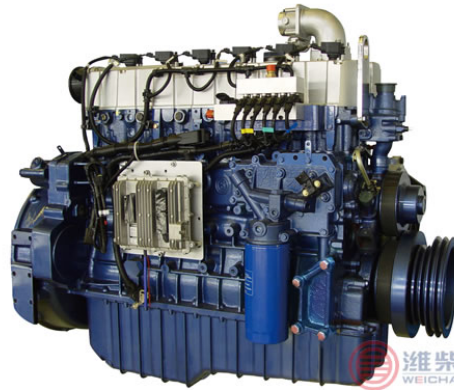


# LNG PLANTS, TANKS, LOADING ARMS



# LNG ENGINES AND VEHICLES

LNG vehicle production is maturing and 3 OEMs have already entered into large-scale production.



潍柴动力  
WEICHAI POWER  
Shanghai Tairan International Trading Co., Ltd.





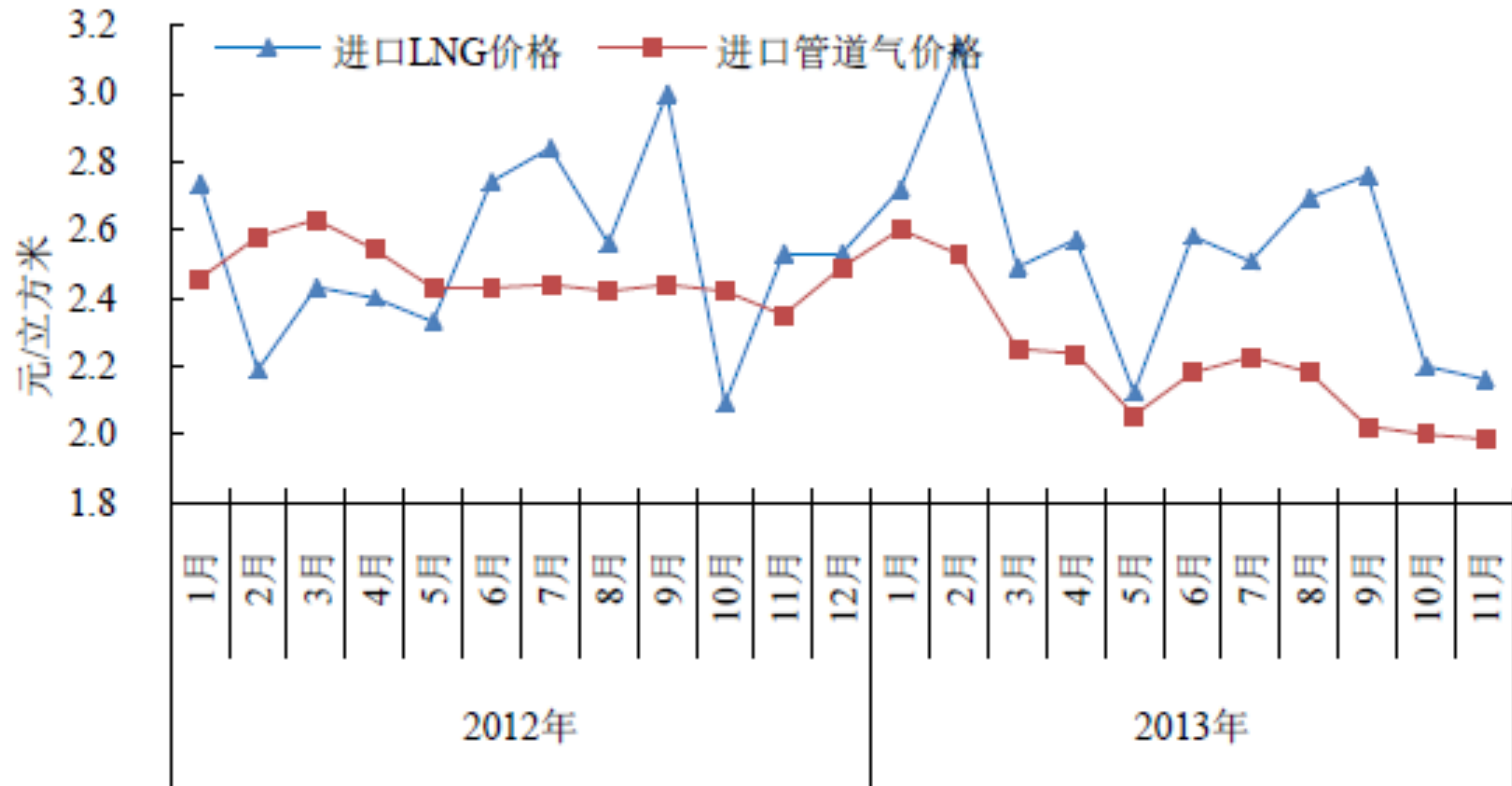
# PRICING

**During 2013 China's LNG import prices declined slightly.**

**The average overall landed LNG price was 0.39 US/m<sup>3</sup>, down 2.4% on 2012.**

<b>2013</b>		<b>USD/m<sup>3</sup></b>
<b>Average price overall</b>	<b>Landed</b>	<b>0.39</b>
<b>Average contract price</b>	<b>Landed</b>	<b>0.37</b>
<b>Lowest contract price (from Australia)</b>	<b>CIF</b>	<b>0.11</b>
<b>Average spot price</b>	<b>CIF</b>	<b>0.56</b>
<b>Highest spot price (from Qatar)</b>	<b>CIF</b>	<b>0.65</b>

# LNG IMPORT PRICING



# CASE STUDY CHINA

	UNIT	DIESEL	LNG
Investment premium for LNG vehicle	USD		12,800
Average driving distance	km/year	146,000	146,000
Fuel consumption	/ km	0.4 litre	0.5 m <sup>3</sup>
Average fuel price	USD	1.152/litre	0.736/m <sup>3</sup>
Fuel cost	USD/km	0.4608	2.3
Average annual fuel cost savings	USD		13,548.8
Additional annual maintenance costs	USD		288
Payback period	Months		11.3

Source: ENN

# LNG SHIPPING

LNG fuelled shipping is in its infancy but the use of LNG for vessels operating on inland waterways is rapidly developing.

2010 – LNG / diesel 3000 tons barge the "Su Su" (Su Suqian 1260) started operating in the northern section the Grand Canal hauling sand from Suqian City into Huai'an City.



2012 - 5,000 tons LNG / diesel conversion the "Red 166" trialled in Wuhu.

2012 - China CSC's LNG / diesel dual fuel bulk carrier "Long Hearing III" was successfully trialled.

2013 – CNOOC deployed two LNG / diesel tugboats with Wärtsilä 34DF Engines in Zuhai.

# Yangtze River Project

## Harbor Star 1

China's first floating LNG filling station

First vessel is a 3000T bulk carrier, **Bao Tong Jiang 1**, sailing between Wuhan and Shanghai.



Landing pontoon 100 meters long and 18 meters wide, equipped with two 250 m<sup>3</sup> LNG storage tanks, two low-temperature loading arms and other auxiliary facilities.

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