



**Shell Global Solutions**

# Shell Gasification Processes

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Global Manager Gasification & Hydrogen technologies

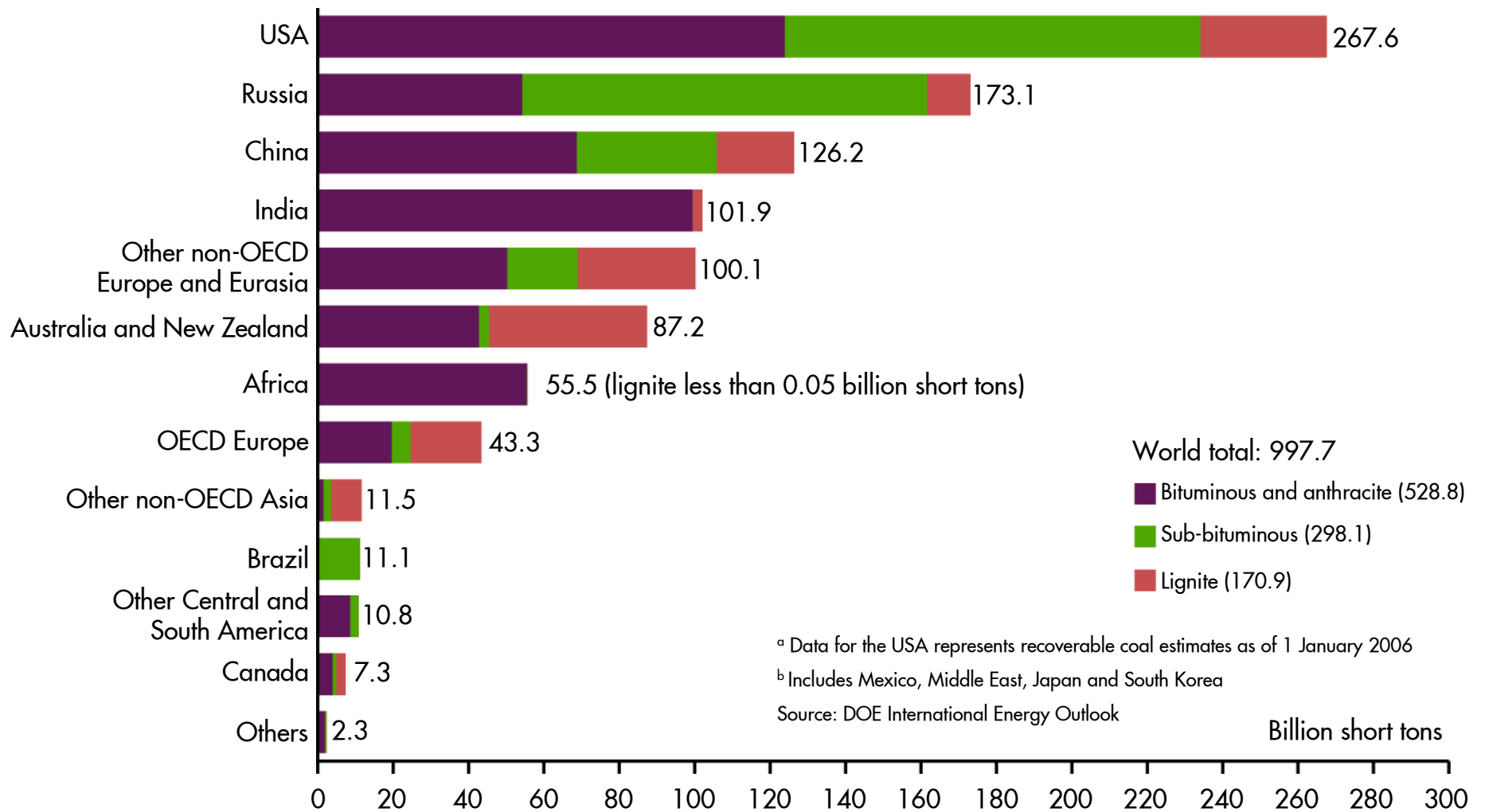
Gasification Technology Conference 2007

14–17 October 2007

Hyatt Regency, San Francisco



# World recoverable coal reserves



# Shell China coal gasification licences

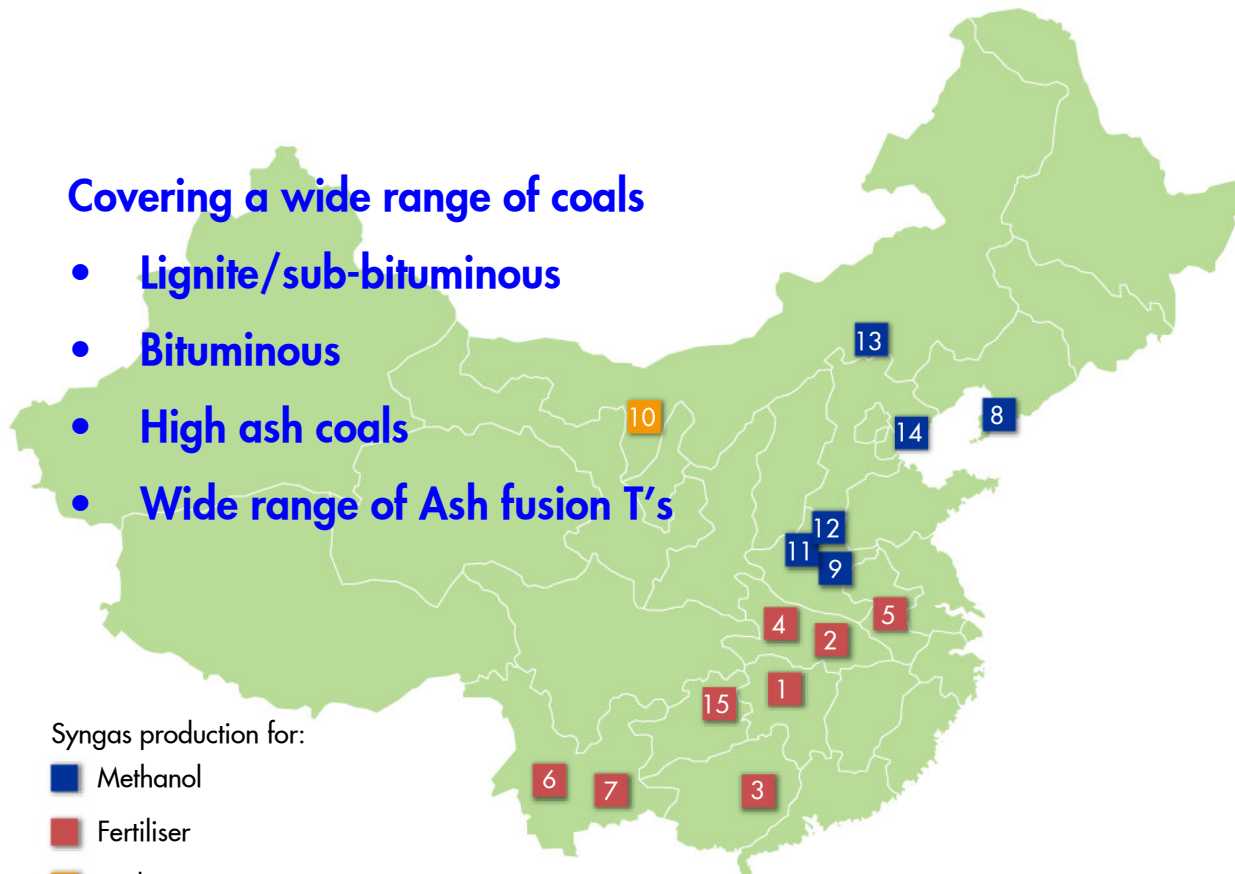
## Including its first equity investment

### Covering a wide range of coals

- Lignite/sub-bituminous
- Bituminous
- High ash coals
- Wide range of Ash fusion T's

Syngas production for:

- Methanol
- Fertiliser
- Hydrogen



- 1 – Yueyang Sinopec and Shell Coal Gasification Co. Ltd
- 2 – Hubei Shuanghuan Chemical Group Co. Ltd
- 3 – Liuzhou Chemical Industry Co. Ltd
- 4 – Sinopec Hubei Chemical Fertiliser Co.
- 5 – Sinopec Anqing Chemical Fertiliser Co.
- 6 – Yunnan Tianan Chemical Co. Ltd
- 7 – Yunnan Zhanhua Co. Ltd
- 15 – A chemical company in Guizhou
- 8 – Dahua Group Ltd
- 9 – Yongcheng Coal and Power Group
- 11 – Zhongyuan Dahua Group
- 12 – Henan Yima Kaixiang
- 13 – A power company in Inner Mongolia
- 14 – Tianjin Soda Plant of Bohai Chemical Group
- 10 – Shenhua Coal Liquefaction Corporation

# Status of plants in China



Yueyang Sinopec and Shell coal gasification



Sinopec Anqing



Sinopec Hubei



Yunnan Zhanhua



Liuzhou



Hubei Shuanghuan



Yunnan Tianan



Giuzhou



Yongcheng



Inner Mongolia



Zhongyuan Dahua



Kaixiang



Dahua



Shenhua

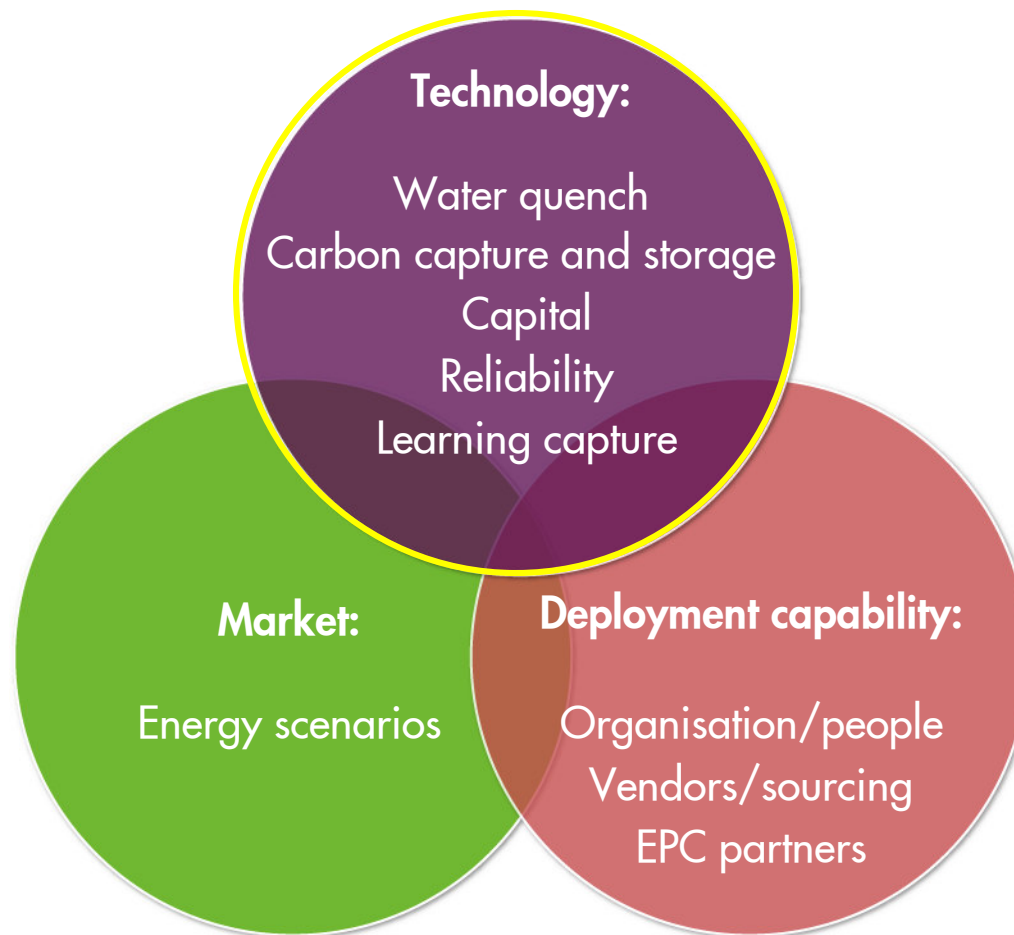
# Shell China's achievements and challenges

- First year availability is confirmed.
- Technical availability increasing – run times of 60 days plus.
- High-ash coals proved to be process-able at commercial scale.
- Shell's technical support capability in China has been built up in 2006/2007.
- Operational learning curve for SCGP.
- Numerous Chinese start-ups have added to Shell's experience and competencies regarding local procurement, construction and operations.
- Thorough commissioning is a must for reliable operation later.
- Obtaining consistent coal quality continues to be a challenge.

# Coal transportation in China



# Enablers for the future



# Research and development in the 1970s/80s

## Clean coal development



SCGP pilot plant  
Amsterdam 6tpd

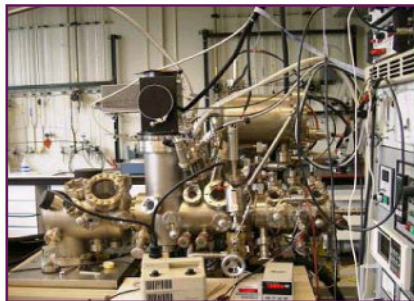


SCGP demonstration  
plant Harburg 150 tpd



SCGP demonstration  
plant Houston 400 tpd

## Residue gasification and Gas-to-liquids (GTL) development



GTL laboratory  
Amsterdam



GTL pilot plant  
Amsterdam

30<sup>+</sup> years of experience in R&D and Demonstration plants.

# The design journey – Shell Gasification projects & licensed projects 1990 to today



Buggenum – SCGP for power



Up to 30% biomass co feed in SCGP

Chinese licences, including CO<sub>2</sub> carrier gas designs



Dongting – SCGP for fertiliser



Pernis – Shell gasification process for hydrogen and power

Sannazzaro

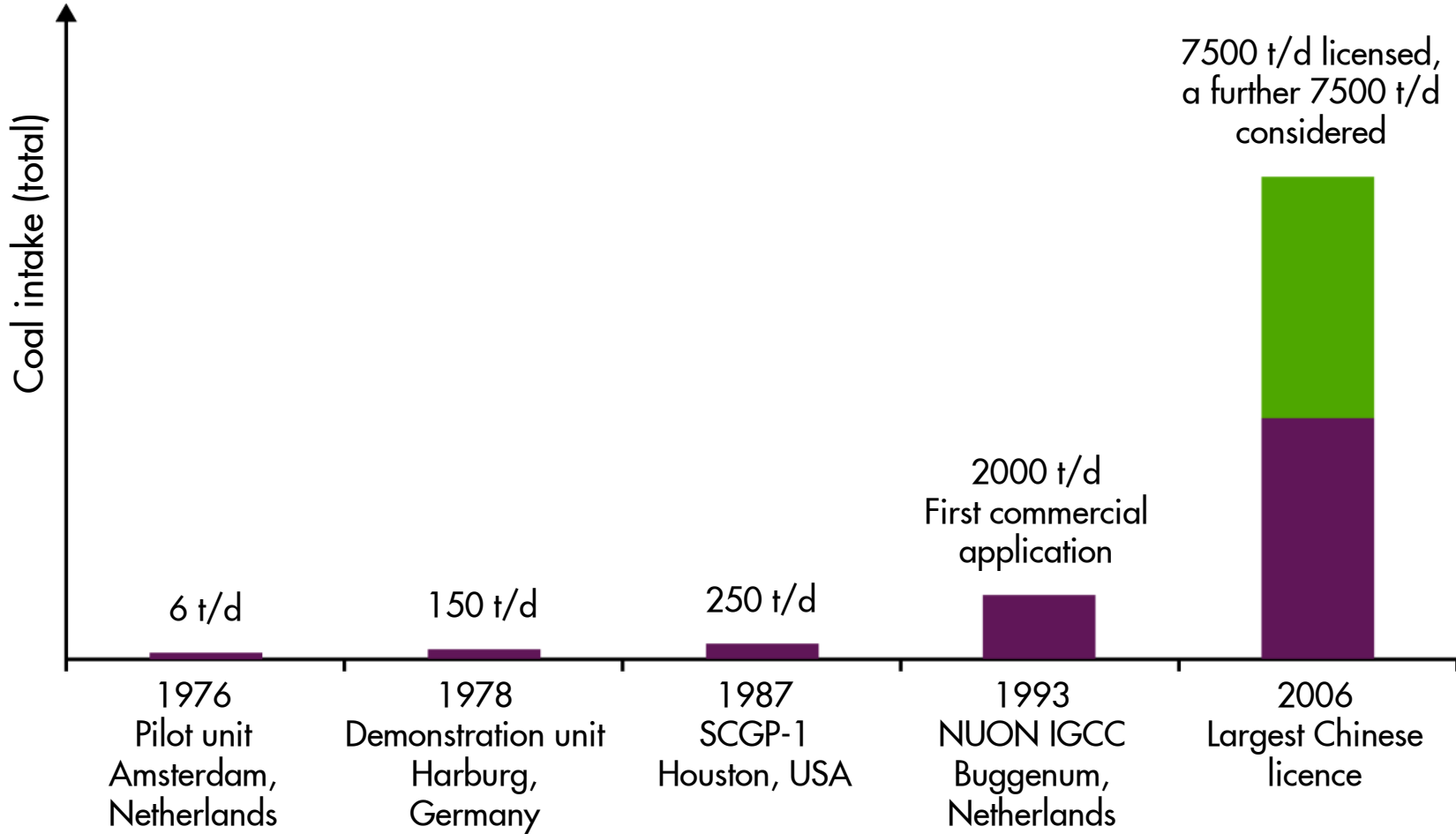
Opti Canada



Bintulu – GTL Shell middle distillate synthesis for specialties and transportation fuels

**20<sup>+</sup> years of Design and Operating experience at commercial scale, 86 gasifiers in total.**

# SCGP is a proven technology at ever increasing scales



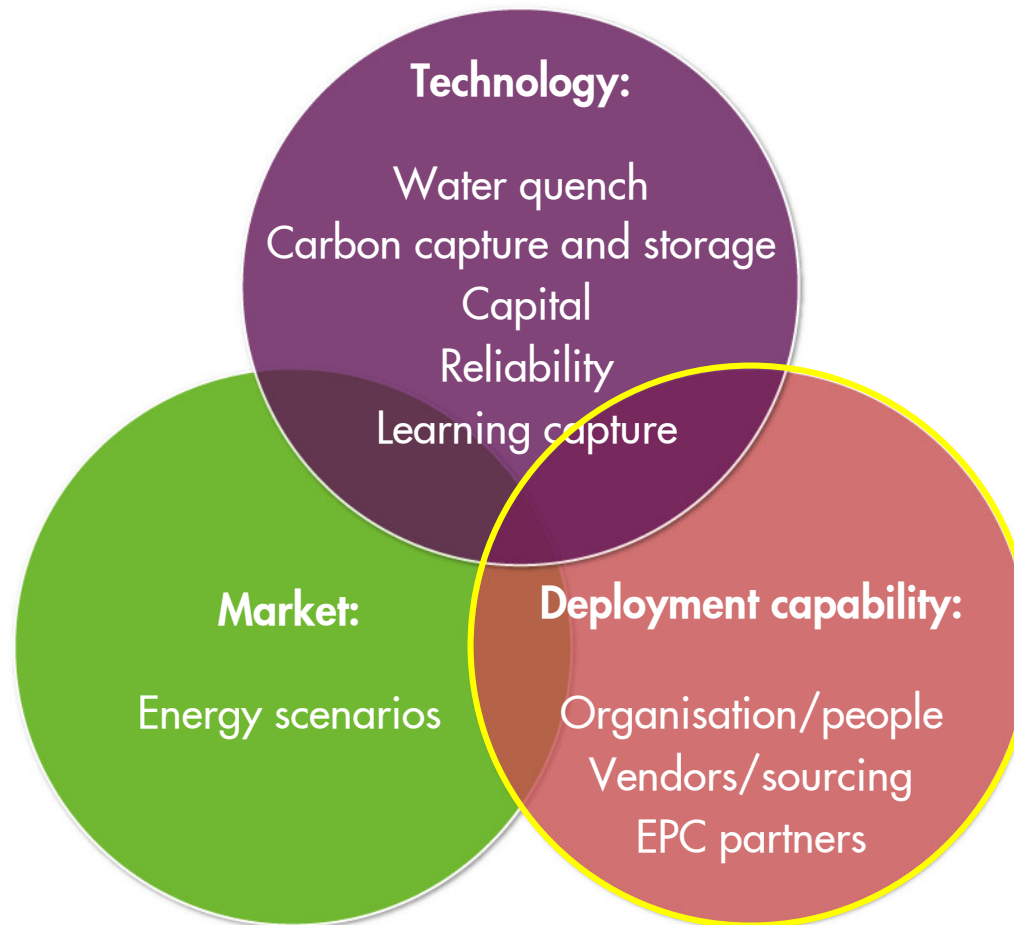
# SCGP water quench – a change for the better...

- Enable gasification of coals, which cannot be processed with a syngas cooler owing to fouling
  - High sodium/chlorine content
- Reduce capital expenditure
  - No syngas cooler
  - No candle filter
  - Simpler shift line-up
- Improve integration with a downstream shift for chemical applications
  - Water is added directly to the syngas, not via a saturator cycle in the shift section

## ...but stick to key advantages of SCGP

- Membrane wall, heat protection for the gasifier through water cooling and steam production
- Separate gas and slag outlets for processing high-ash coals
- Multiple burners enable large capacities and efficient slag removal with only a small amount of fines
- Proven scale-up rules for the gasifier

# Enablers for the future



# Shell Global Solutions

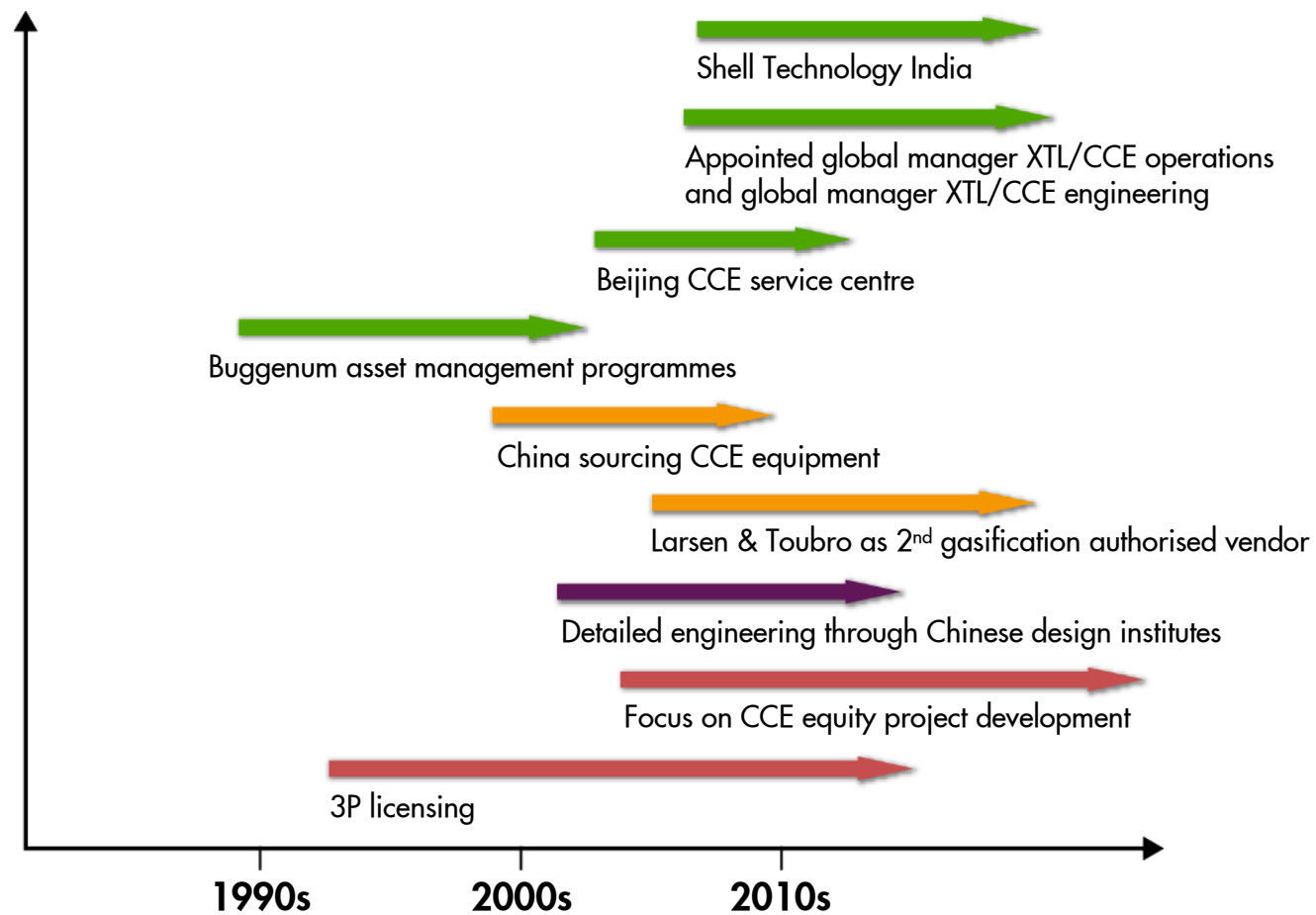
Combining the operating experience of over 5000 staff with proven implementation skills and advanced technologies

- Diverse cultures and nationalities
- Over 50 years of implementing business and engineering solutions
- Project management
- Continued investment in innovation

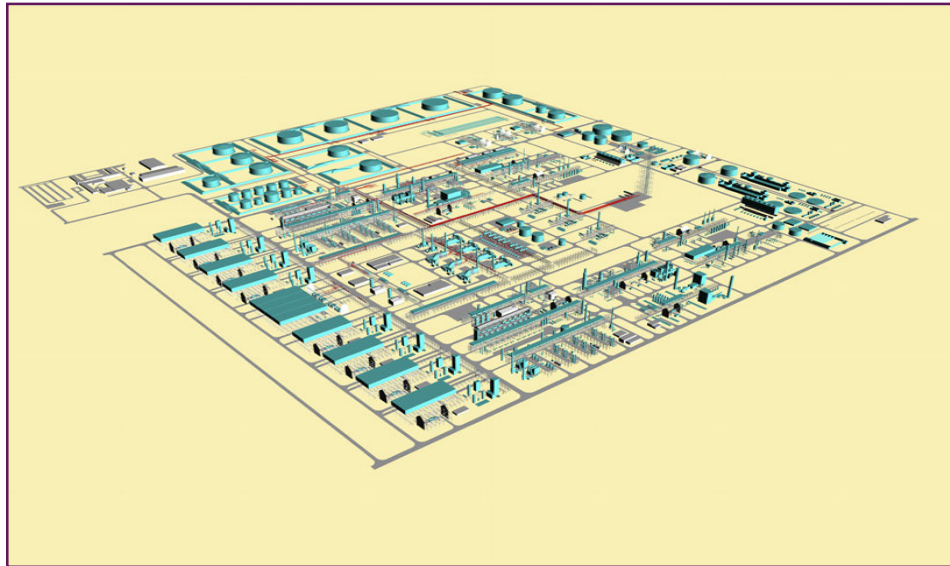


- XTL and Gasification skills and Technologies
- Shell Global Solutions

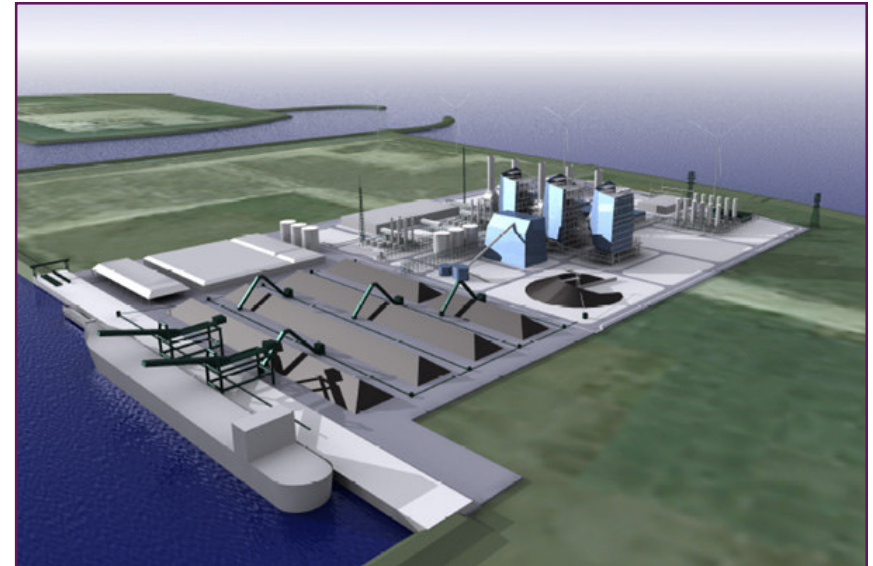
# Building XTL/CCE capabilities that prepare for the future



# Integrated, large-scale projects for the future



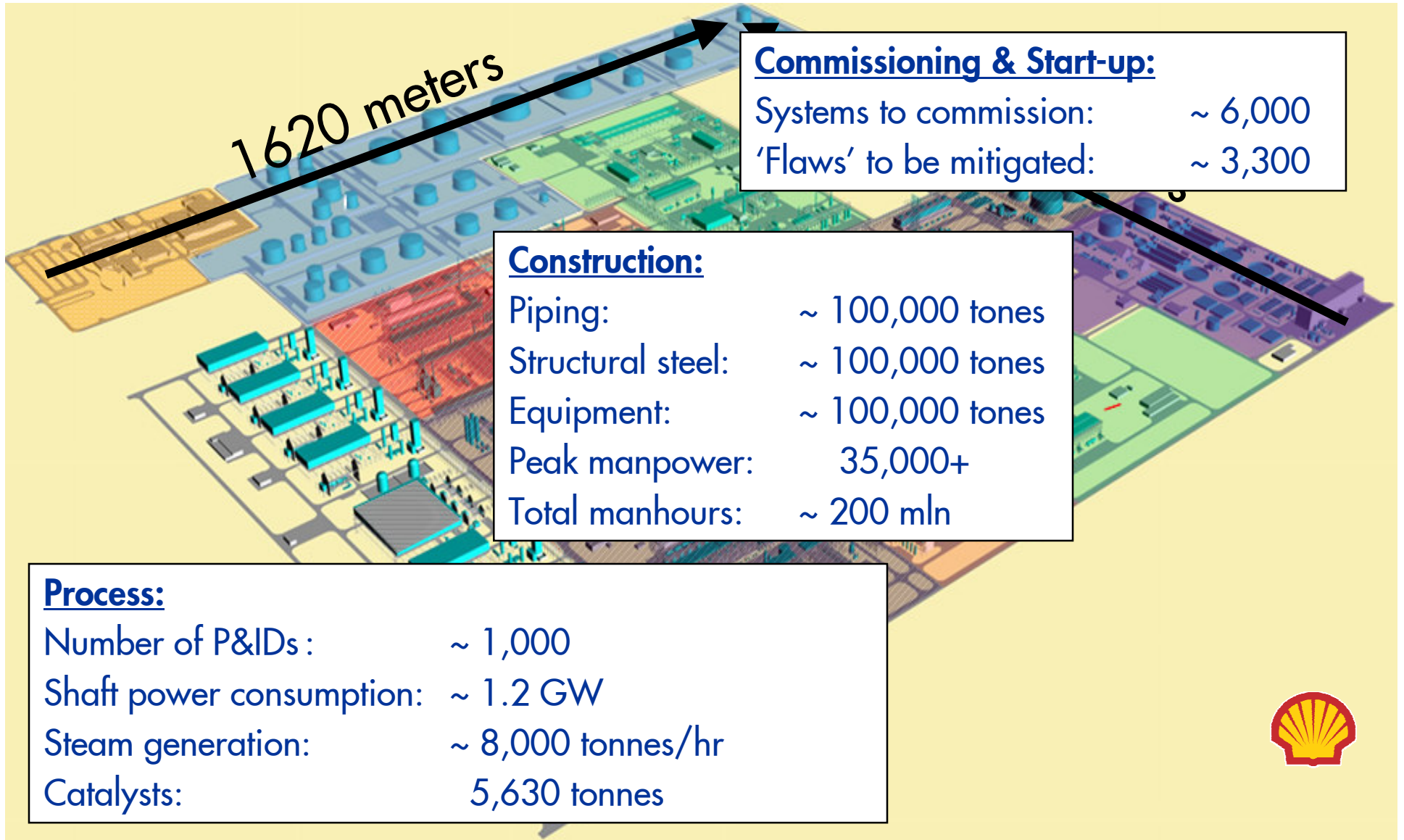
Pearl – GTL with Shell gasification process and Fischer-Tropsch technology



Nuon Magnum – large-scale SCGP for power production with deferred carbon dioxide sequestration

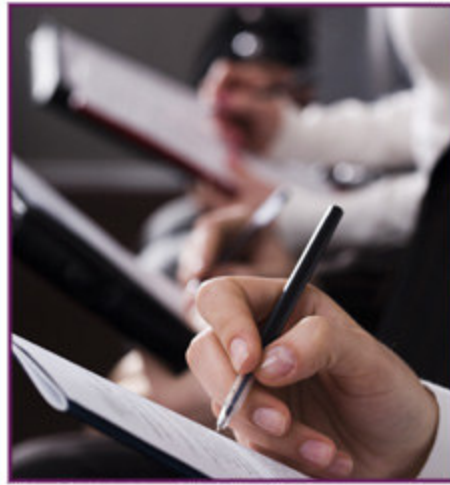
Courtesy Nuon

# Pearl GTL Onshore: Huge Dimensions



Pearl an example of Mega Project Management

# Thank you



Shell Global Solutions is a network of independent technology companies in the Shell Group. In this presentation, the expressions 'Shell' and 'Shell Global Solutions' are sometimes used for convenience where reference is made to these companies in general, or where no useful purpose is served by identifying a particular company.