Progress and Prospect of LNG Technology in China

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Agenda

• **Current situation of Chinese LNG industry**
  – Natural Gas Production, Importation and consumption
  – Chinese LNG facilities

• **LNG technology progress of CNOOC**
  – CNOOC LNG/FLNG Liquefaction technology
  – LNG/FLNG CWHE technology
  – LNG receiving terminal and LNG tank technology
  – Other LNG Equipment technology

• **Conclusion**
  – Prospect of LNG Technology Demand in China
1. Current situation of Chinese LNG industry

Natural Gas Production, Importation and consumption

- LNG imports growth trend will continue, but growth rate may get slow, since
  - Natural gas accounts for only 7.8%.
  - Consumption VS production growth rate.
  - Government's Environmental Policy.
  - LNG Seasonal peak-shaving role.

- Challenges faced by LNG domestic market
  - LNG fueling face competition from electric vehicles.
  - Import LNG lacks competitiveness.
1. Current situation of Chinese LNG industry

Chinese LNG facilities

- **Current LNG facilities**
  - 20 LNG receiving terminals in operation with total capacity of 71.25MTPA. 7 terminals in construction.
  - 190 small LNG plants (<1MTPA) in operation, with total capacity of 27MTPA.
  - 2528 LNG fueling stations, 310,000 LNG vehicles.
  - 280 LNG power ships and 18 inland LNG filling wharfs have been built. 4 LNG power coastal tugs in operation.
  - 1 Small LNG vessel (HYSY301 30,000m³) for LNG coastal transmission.

- **Challenges faced**
  - Participation in overseas large LNG production.
  - Technical regulations and technology.
2. LNG technology progress of CNOOC

CNOOC LNG/FLNG Liquefaction technology

- SMR/DMR process (<5MPTA), are optimized and dynamical simulated with proven proprietary CWHE and PFHE. For FLNG CFD simulation of ocean sloshing influence to High tower and CWHE are verified by sufficient experiments.
- Automatic and optimal operation are executed to a new level.
- 5 successful LNG Plants EPC practices.
2. LNG technology progress of CNOOC

LNG/FLNG CWHE Design Software and Manufacturing
CNOOC LNG/FLNG Liquefaction technology

- Undertook the manufacturing of 36 core process modules of Yamal project, weighed 180,000 tone.
- Mastered the key technology of modular manufacturing and precision positional installation of arctic LNG project. Modular Weight deviation < 1%.
2. LNG technology progress of CNOOC

LNG receiving terminal and LNG tank technology

- LNG receiving terminal and LNG full containment tank technology and EPC.
- 5 successful LNG receiving terminal EPC practices. 6 LNG full containment tanks EPC.
2. LNG technology progress of CNOOC

Other LNG Equipment technology

- Successful development and application
  - LNG Submerge pump
  - LNG/FLNG expanding turbine
  - IFV/ORV
Prospect of LNG Technology Demand in China

- Technology Enhancing the liabilities and competitiveness of LNG resource.
  - Large scale LNG/FLNG project technology

- Technology Improving LNG's Access to domestic residual market, emerging or potential LNG market.
  - FSRU, LNG bunkering
  - Combination of LNG and other renewable energy.

- Application of digital/Al technology in LNG industry.