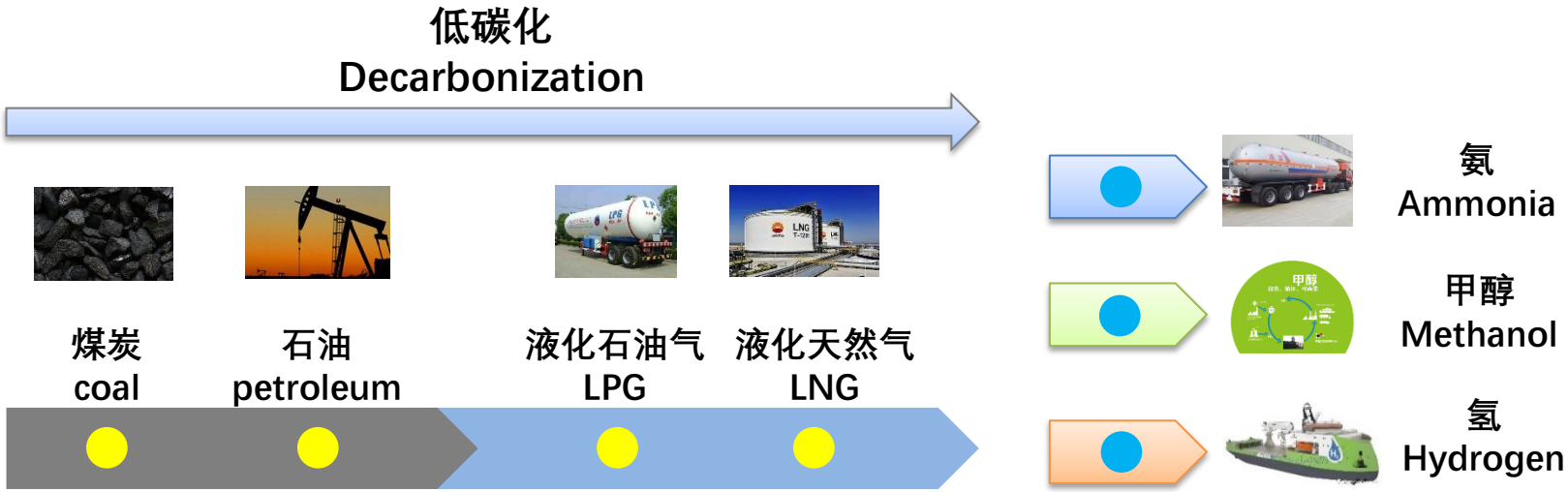
船用燃料发展趋势

中船动力（集团）有限公司

China Ship Power (Group) Co. LTD Co.,Ltd.

船用燃料发展趋势
Development of marine fuels



- 船用燃料呈低碳化且多样化的发展趋势

  Marine fuels are low carbonization and diversified

船用燃料发展趋势
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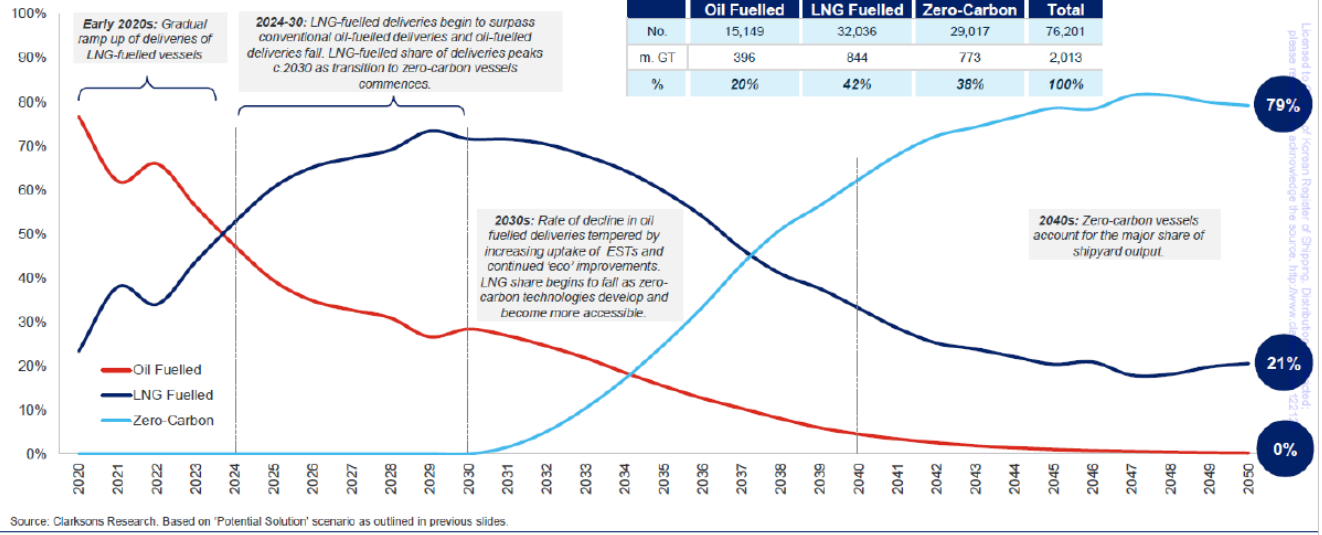
◘ 克拉克松（Clarksons）新造船舶燃料结构预测

Potential Decarbonisation Scenario: Implications For Ordering

What is the potential impact of meeting the carbon targets on contracting?

Shipyard Output Share, % GT

	Shipyard Output Shares (Deliveries 2020-2050)			
	Oil Fuelled	LNG Fuelled	Zero-Carbon	Total
No.	15,149	32,036	29,017	76,201
m. GT	396	844	773	2,013
%	20%	42%	38%	100%



Source: Clarksons Research. Based on 'Potential Solution' scenario as outlined in previous slides.

Clarksons Research | The Shipping Sector To 2030 | March 2020 | 31

* Source: Clarksons Research

零碳燃料预计2050年占比将达到79%。

By 2025, zero carbon contribute 78 percent of marine energy.

LNG预计在2030年占比达到顶峰，约70%，2050年降低至21%。

LNG contribute 70 per cents by 2030 and fall to 21% by 2050.

常规燃油占比将逐年降低，预计2030下降至30%，2050年被全部替代。

The proportion of conventional fuel will decrease, which is expected to be completely replaced by 2050.

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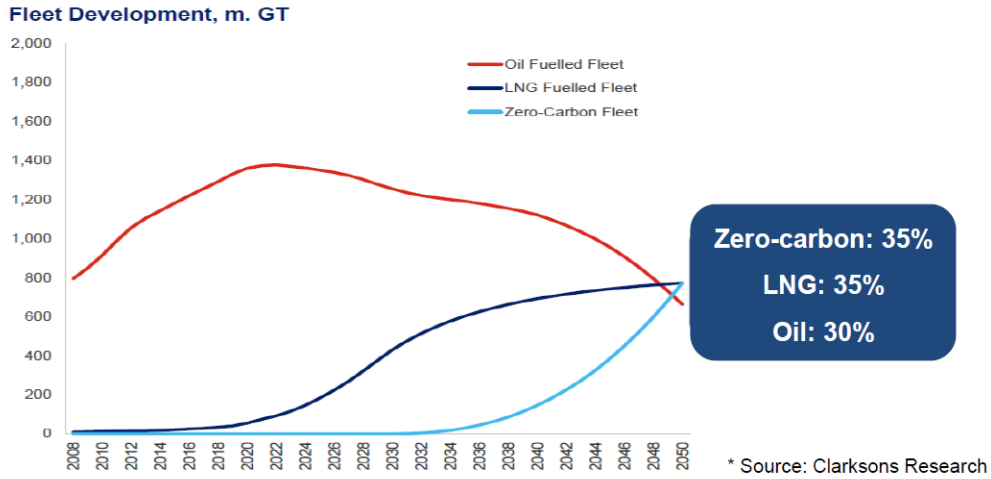
◘ 克拉克松（Clarksons）所有运营船舶燃料结构预测

Potential Decarbonization Scenario: Operational vessels



* Source: Clarksons Research

Scenario	Average Vessel Speed, Knots				Fleet Shares in 2050			CO2 Intensity		Total CO2 Output
	2008	2019	2030	2050	Oil Fuelled	LNG Fuelled	Zero-Carbon	2030	2050	2050
Potential solution	13.0	10.8	10.4	9.8	30%	35%	35%	57%	79%	53%

HFO/MDO/MGO常规燃油占比将逐年降低，2030年占比约74%，2050年降至30%；

The proportion of conventional fuel will decrease year by year, from 74% in 2030 to 30% in 2050.

LNG燃料使用占比升速逐渐降低，2030年占比约25%，2050年约占35%；

The increasing rate of LNG fuel decreases, accounting for about 25% in 2030 and 35% in 2050.

零碳燃料2030年开始应用，并逐年加速增长，预计2050年占比约35%。

Zero carbon fuel will be applied in 2030 and increase rapidly, accounting for about 35% in 2050.

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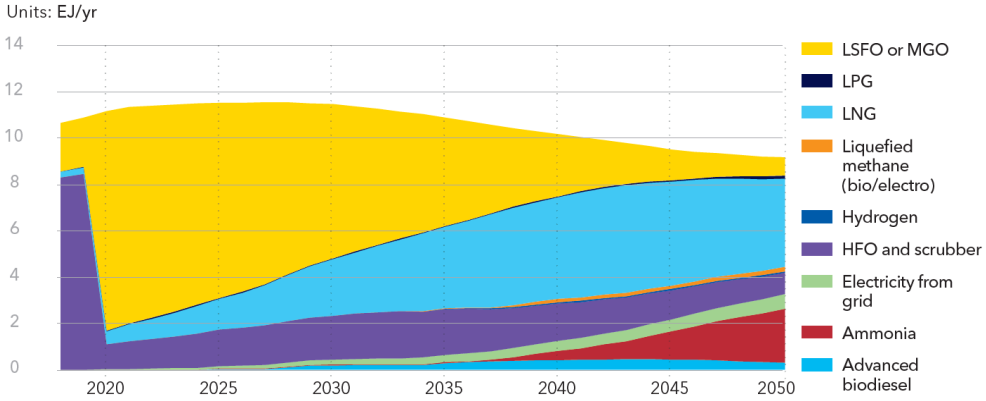
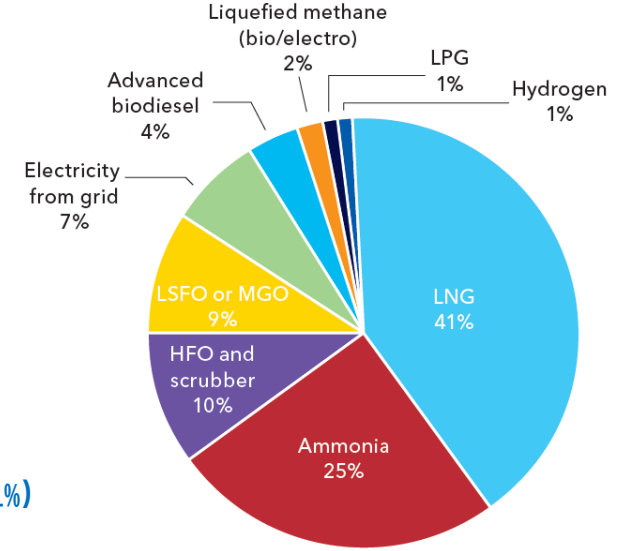
□ DNV-GL：基于IMO目标路径营运船舶能源利用与燃料结构预测

Energy use and projected fuel mix 2018–2050 for the simulated IMO ambitions pathway with main focus on design requirements





- 2050年，零碳燃料中氨燃料占比最高，约25%；（2050，NH3, 25%）
- 氢燃料由于高投资成本及技术限制，到2050年仅占1%；（2050，H2，1%）
- LNG在2050年占比约为41%，但不是碳中性LNG；（2050，LNG，41%）
- 化石燃料在2050年的占比约为20%。（2050，fossil fuel，20%）

DNV-GL，MARITIME FORECAST TO 2050Energy Transition Outlook 2019

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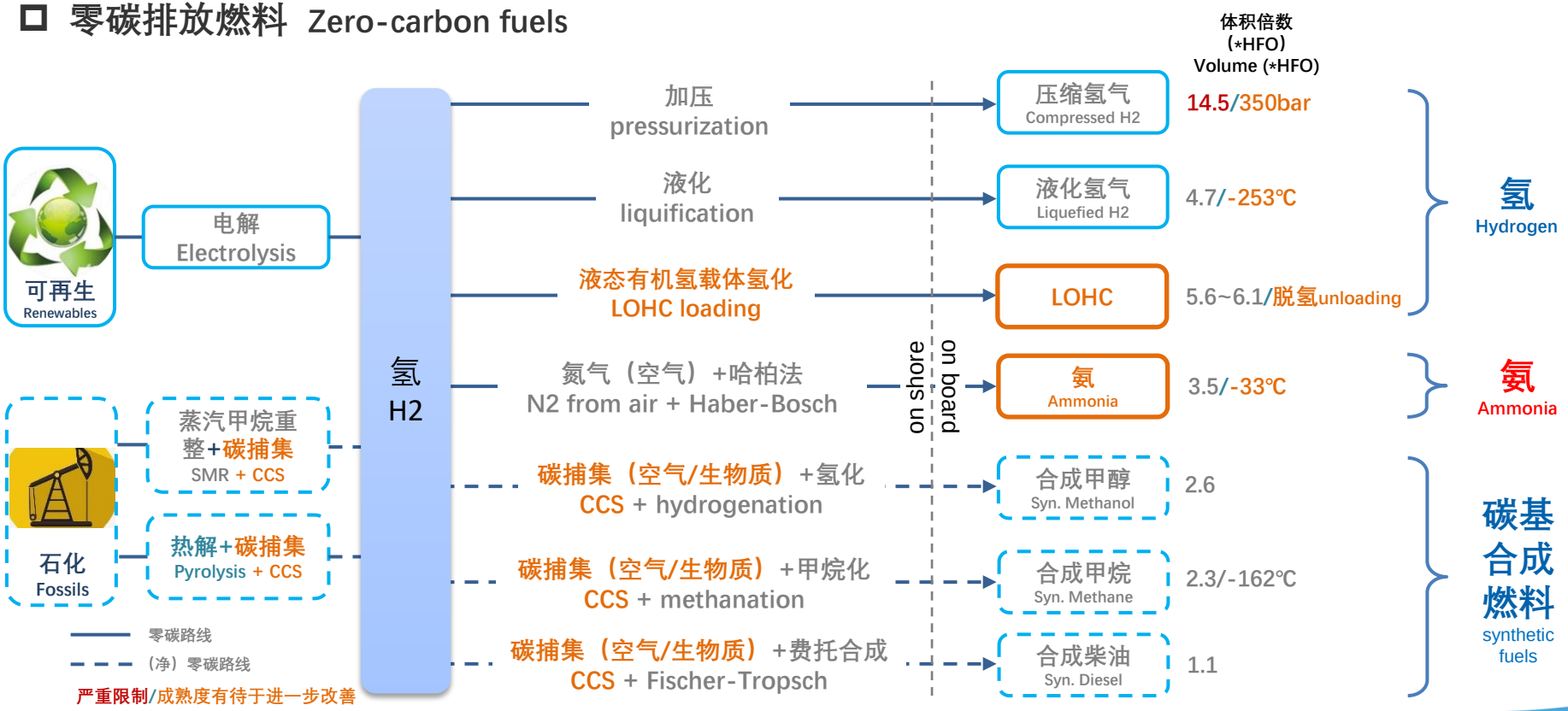
◘ 零碳排放燃料 Zero-carbon fuels



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□ 典型零碳燃料综合对比

Comprehensive comparison of zero-carbon fuels

燃料类型 Fuel type	低热值 LHV	能量密度 Energy density	储存空间 Tank size	供给压力 Supply pressure	排放降低程度（相对HFO Tier II）% Emission reduction Compared to HFO Tier II		
	MJ/kg	MJ/L	*HFO	bar	SO_x	NO_x	PM
氢（-253℃） Hydrogen(-253℃)	120.0	8.5	4.7	-	100	-	100
氨（-33℃） Ammonia(-33℃)	18.6	12.7	3.5	80	~100	-	90~100
甲醇（65℃） Methanol(65℃)	19.9	14.9	2.6	10	90~97	30~50	90
LNG（-162℃）	50.0	21.2	2.3	300/15	90~99	20~30/80	90

	甲醇 Methanol	氢 Hydrogen	氨 Ammonia
可供性 Availability	良好 good	中 average	良好 good
经济性 Economy	中 average	差 poor	中 average
技术性 Technicality	中 average	差 poor	中 average
环保性 Environment Friendly	中 average	良好 good	良好 good

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- 国内“双碳”目标与IMO温室气体减排初步战略加快了船用燃料向低碳化发展；

“Carbon peak and carbon neutral” target and IMO preliminary greenhouse gas reduction trategy accelerate the development of Marine fuel to low carbon.

- LNG在中短期内仍然是降低船舶碳排放的主流手段；

LNG is still the mainstream means to reduce ship carbon emissions in the short and medium term.

- 氨与甲醇相较于氢燃料成本较低，能量密度较高；

Ammonia and methanol have lower cost and higher energy density than hydrogen fuel.

- 从综合角度考虑，氨燃料更适用于大型远洋船舶。

From a comprehensive point of view, ammonia fuel is more suitable for large ocean-going ships.