

我们必须做得更好
ALWAYS DO BETTER



COSL

Technology creates value, innovation leads the future

— COSL's Technology-Driven Strategy

January 2025

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The background of the slide is a photograph of an offshore oil rig in the middle of the ocean. The rig is yellow and red, with a tall derrick. A large black pipe extends from the rig towards the bottom right of the frame. The ocean is blue with whitecaps, and the sky is blue with some clouds. In the bottom right, there is a circular inset showing a close-up of a mechanical component, possibly a valve or a part of the pipe, with a yellow and silver color scheme.

1. Technology-driven strategy and paths

2. Technology-driven implementation results

3. Outlook for future development

1.1 Corporate Strategy Adjustment

- In 2021, COSL released its “Five Development Strategies” for the new era, prioritizing the “Technology-Driven” Strategy

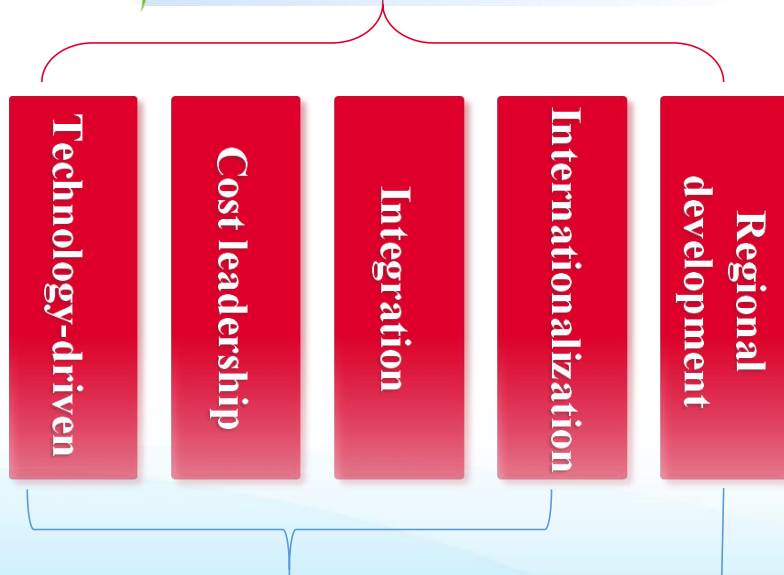
Company positioning:

A first-class energy service company that provides customers with whole life cycle services

Strategic goal:

To build a world-class energy service company with Chinese characteristics

COSL’s five major development strategies for the new era



New stage

New connotation



New stage

New requirements

Technology-driven strategies

- Connotation Path** : Focus on basic scientific research and exploration, applied scientific research and verification, and industrial application guidance from the perspectives of industry and development, and continue to enhance core competitiveness, making innovation the core engine for development.

Strengthen the technical system with customers’ asset management as the core

Optimize the scientific and technological R&D and experimental system with capacity improvement as the core



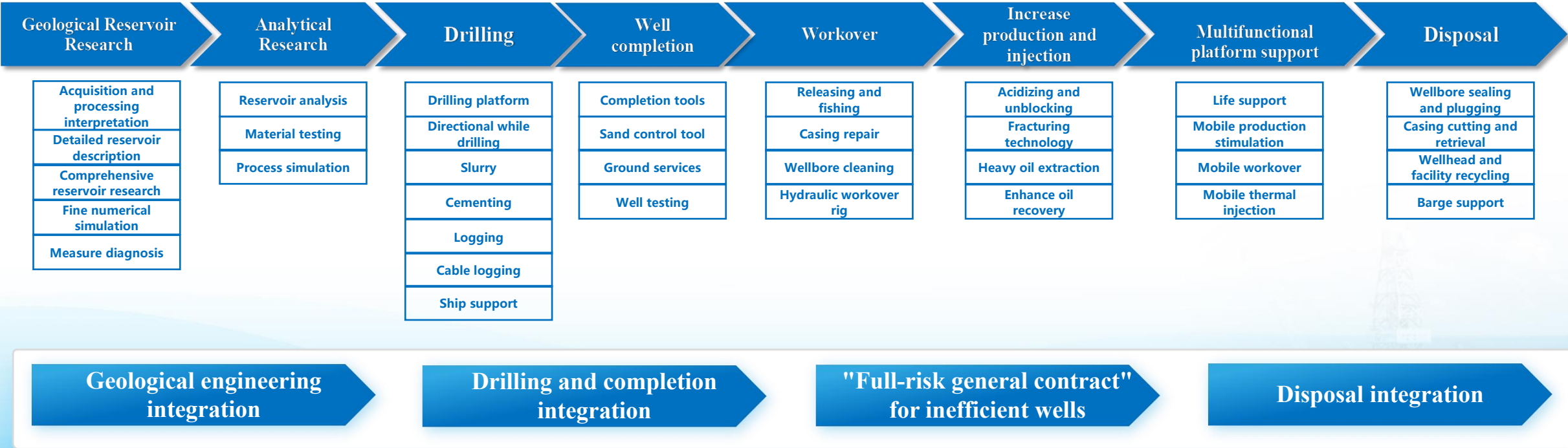
Consolidate the industrialization system of scientific research achievements with quality as the core

Deepen the scientific and technological talent system with value contribution as the core



1.2 Establish Customer Perspectives

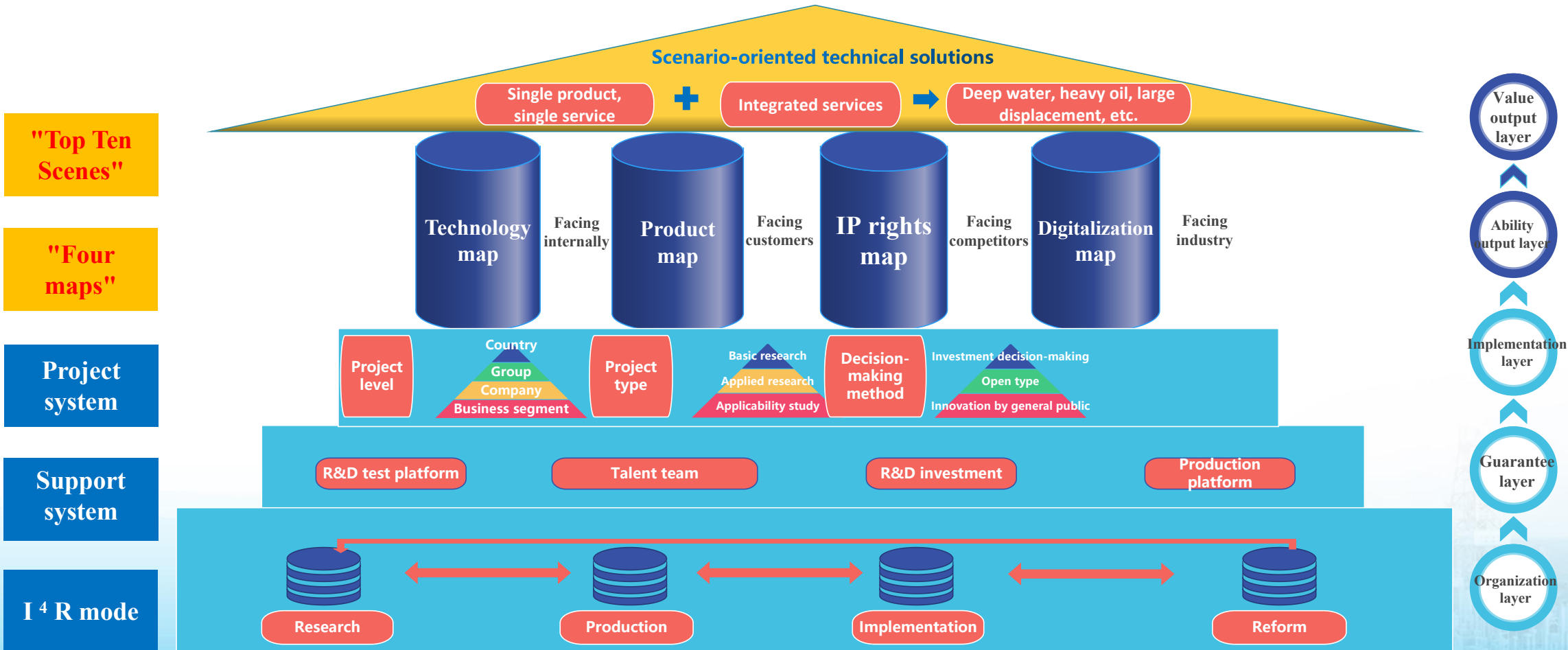
■ Focus on customer experience, uphold the concept of “high-quality oilfield services are the products delivered by the company to customers”, “recognize one's own positioning and understand the needs of customers”, cultivate characteristic technical products and integrated service capabilities, and advance towards the “Product+Service” dual driver.



1.3 Innovation System Architecture



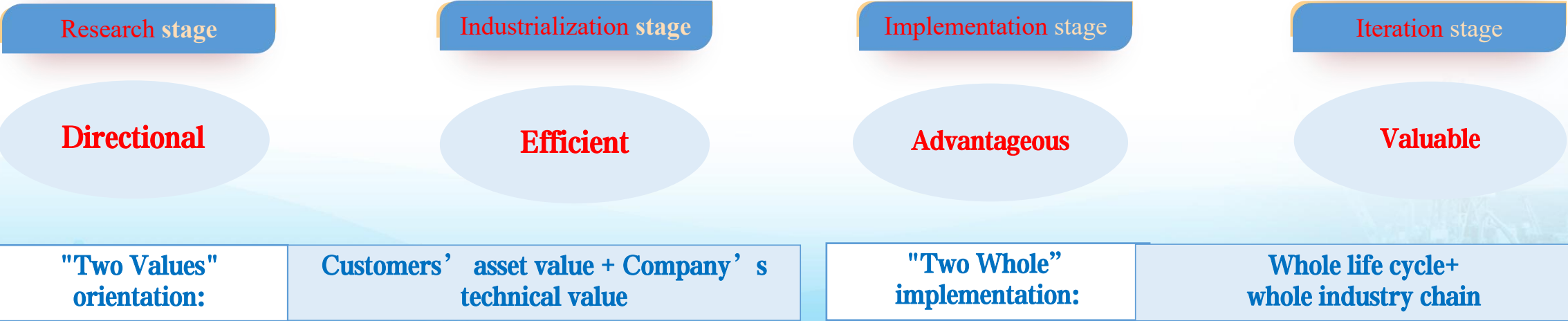
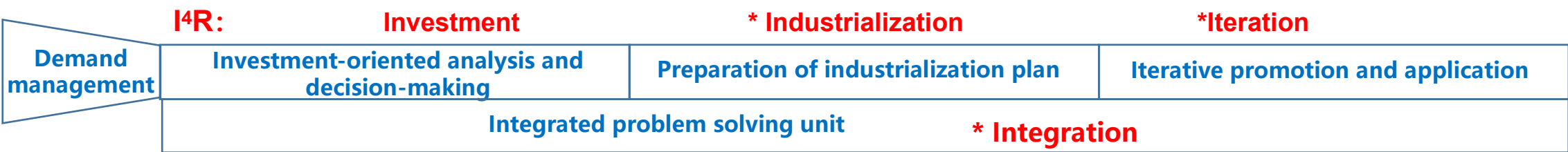
The “**two main and one characteristic**” technical system has been improved, has become visible, and basically realizes the three-dimensional output of “single product, overall solution, and integrated services”



1.4 Optimize Innovation Model

Focus on promoting "research" with "implementation" and realizing "implementation" through "research", forming the "with COSL characteristics to address research mode of **I⁴R** "

- ✓ **Research:** Conduct research guided by investment philosophy and value orientation;
- ✓ **Production:** Continue to build a "high-quality, high-efficiency, and low-cost" production system;
- ✓ **Implementation:** Strengthen technical support, training, promotion, and maintenance systems;
- ✓ **Reform:** Strengthen interactive feedback between demand and R&D, accelerate iteration, and enhance customer experience



1.5 R&D Platform Construction



Dare to create the finest technical products by the harshest environment, and focus on building a high-level scientific research platform that has "Chinese characteristics, international standards, industry leading, and leading concepts"

Hebei Yanjiao science and technology park



Applied research and testing

Asia-Pacific’s leading logging and directional well R&D and experimental platform

Tianjin R&D industrial park



Experiment and results transformation

R&D and production platform for seismic exploration and increasing oil recovery

Xinjiang drilling base



Real Drilling test

Leading multi-wellhead drilling test in Asia-Pacific at 7000m deep,

Binhai Huashan Road R&D and production base



Completion tool testing, high-end production

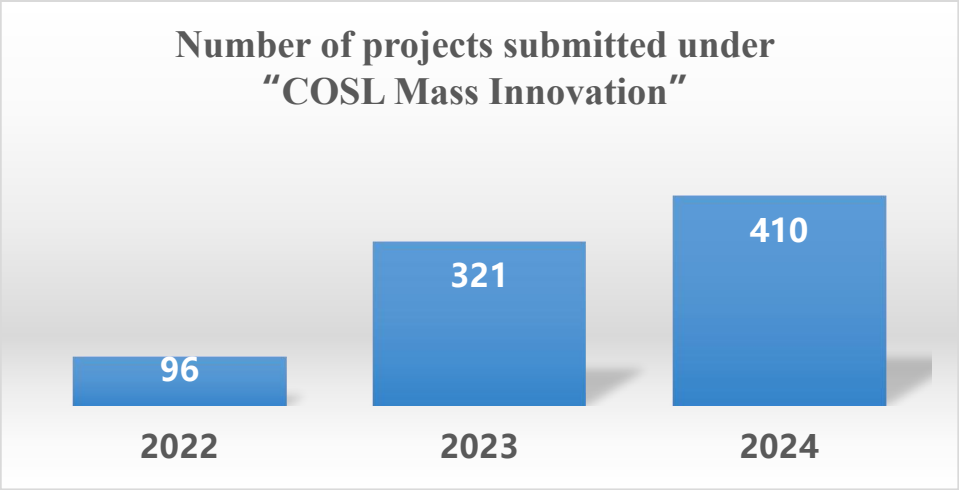
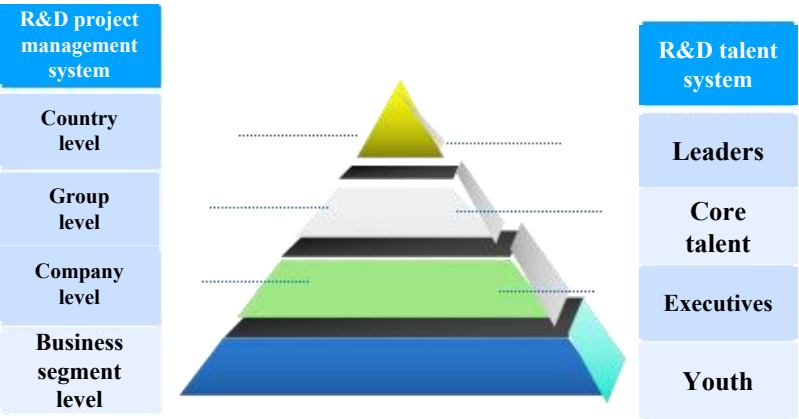
Largest indoor experimental and test well for completion tool and intelligent assembly in China

Laboratory	Responsible department
National Engineering Research Center of Offshore Oil and Gas Exploration- Geophysical Exploration Equipment R&D and Technology Sub-center	National Development and Reform Commission (NDRC)
National Engineering Research Center of Offshore Oil and Gas Exploration - Testing Equipment R&D and Technology Sub-center	NDRC
National Engineering Research Center of Offshore Oil and Gas Exploration- Drilling Equipment R&D and Technology Sub-center	NDRC
National Key Laboratory of Efficient Exploitation of Offshore Oil - Laboratory and Analysis Room	Ministry of Science and Technology
National Key Laboratory of Natural Gas Hydrate - CNOOC Services Division (in-situ testing and sampling)	Ministry of Science and Technology
Key Laboratory of Offshore Oil Environment and Reservoir Low-damage Drilling and Completion Fluid Enterprises in Tianjin	Tianjin
Key Laboratory of Exploitation of Difficult-to-extract Offshore Oil Reserves and Low-Carbon and Carbon Negative Enterprises in Tianjin	Tianjin
Key Laboratory of Well Logging and Directional Drilling	CNOOC
Key Laboratory of Offshore Drilling Fluid and Cementing	CNOOC
.....

1.6 Innovative Culture and Talent



■ Focus on the construction of an innovation culture and create a new landscape of “guaranteed strategic scientific research, responsiveness to customer needs, and vigorous grassroots innovation”



Youth Innovation Studio

- Built **22** youth innovation studios to create a grassroots innovation incubation and support platform
- **About 20** organizations including the Binhai New Area Communist Youth League Committee and the Tianjin High-tech Industry Alliance joined the first Youth Innovation and Achievement Exhibition to observe and learn



1.7 Discipline Construction and Positive R&D

Strive to promote scientific research cooperation through **discipline development** and support discipline development through scientific research projects, and conduct forward-looking basic research



Instrumental
Science &
Technology

Established a discipline committee
Distill scientific questions

Established "Basic Research Fund"
Established "Special Project for Discipline Development"

Approved as
pilot supporting unit of National Natural Science
Foundation of China

Mathematics &
Chemistry



Seepage mechanics
Rock mechanics



Colloid and
Interface
Chemistry



Established an innovation center with China University of Petroleum-Seepage Mechanics



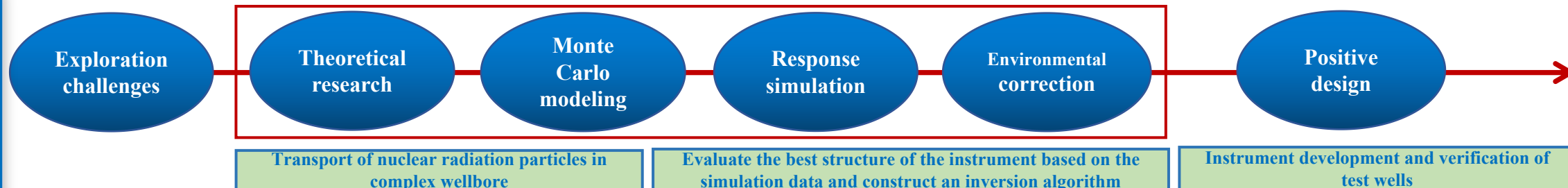
Established an innovation center for Mathematics and Chemistry

1.7 Discipline Construction and Positive R&D

COSL

Focus on theoretical research, analyze the origin of technologies, carry out **positive R&D**, and build a solid source of original technologies

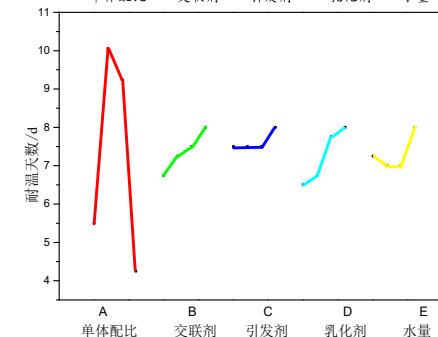
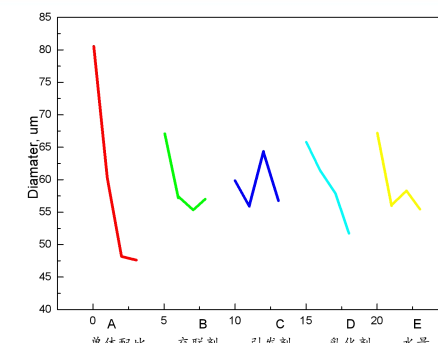
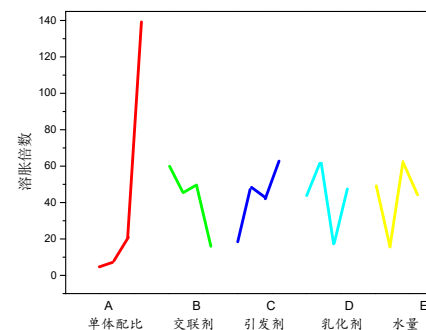
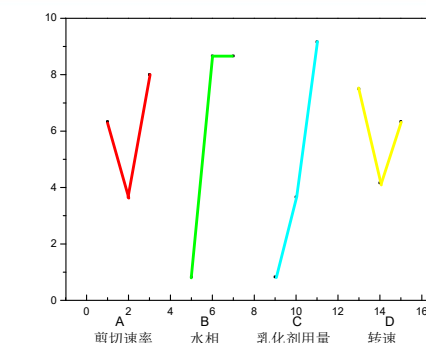
Equipment products



Chemical agents products



R&D platform based on a chemical molecular group database and simulation scenarios



Orthogonal experimental design of chemical reaction conditions

1.8 Industry Chain Construction

Focus on the integration of the industry chain and innovation chain to create an independent, reliable, highly efficient and low-cost manufacturing system

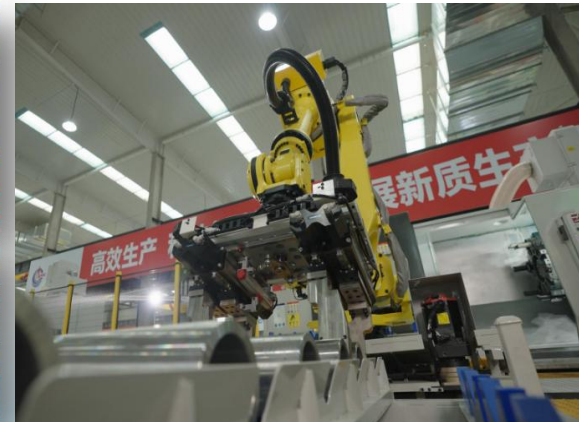


深水油气装备现代产业链

- Create a lean, synergistic, international, intelligent, and green industrial ecosystem, where the supporting, integration and driving role of industry players continues to be evident.
- Organize the Company's first industry chain and supply chain ecological partner conference
- Form a deep water oil and gas equipment industry alliance



CNOOC's first high-end machining mixed ownership enterprise- Well Technology



Intelligent manufacturing of well completion tools



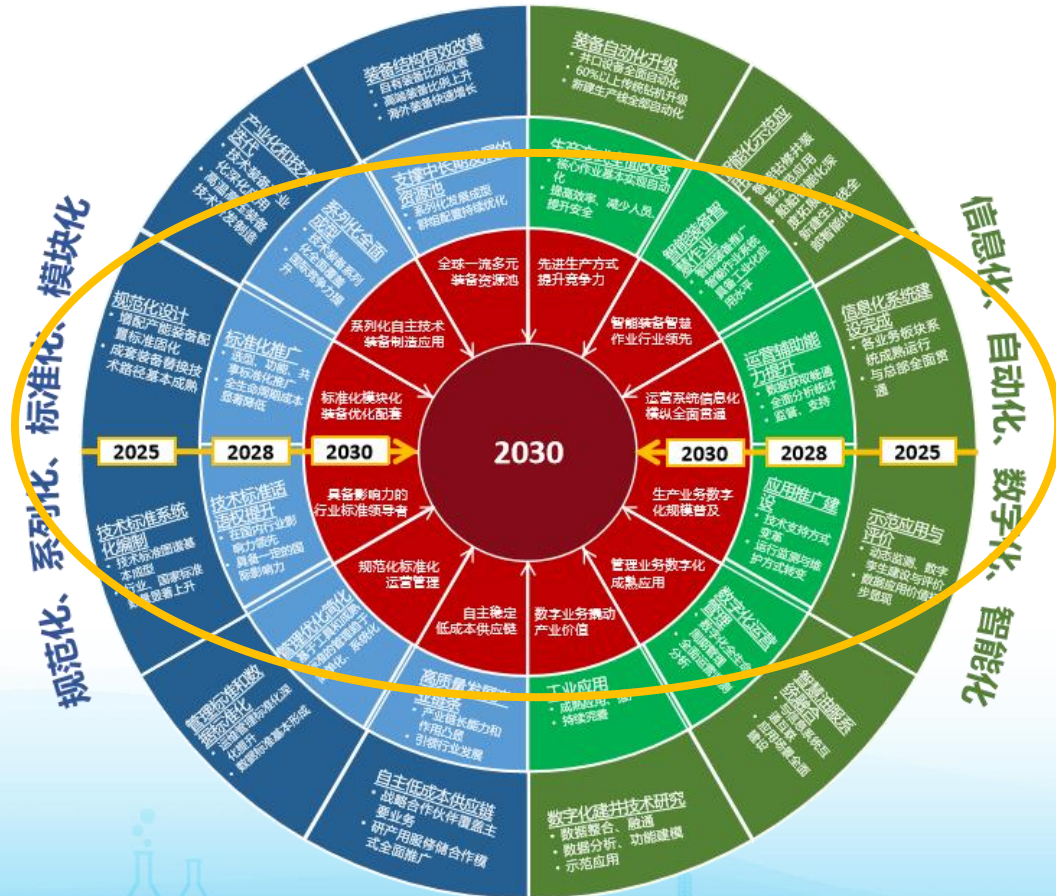
Chemical product manufacturing base

1.9 "Eight Hua" of Large-scale Equipment

Adhere to the philosophy of “**inadequate equipment, no stability; lacking technology, no prosperity**”, and focus on guiding the balanced development of technologies and equipment

➤ "Eight Hua"

- ✓ Adhere to the “**normalized, serialized, standardized, modular**” development direction, and insist on innovating and empowering in an “**information-based, automated, digitized, and intelligent**” manner.
- ✓ Set and realize visionary equipment management objectives of "reasonable structure, sophisticated technology, regional adaptation and platform sharing" and implement capacity building based on 12 key directions to enhance long-term competitive advantages.



Realize the
safety
advantage



Improve
cost
advantage



Long-term
competitive
advantage

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1. Technology-driven strategy and paths

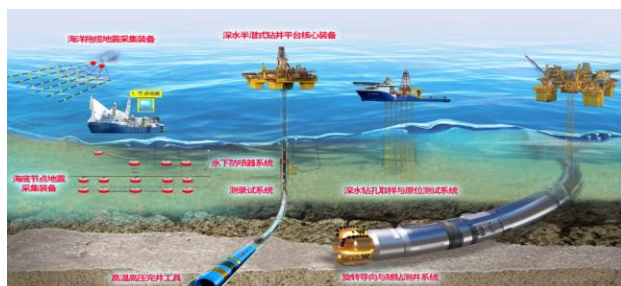
2. Technology-driven implementation results

3. Outlook for future development

2.1 Four Maps and 10 scenarios

Focus on the enhancement of **top-level design and basic-level foundation of technological development**, emphasize the **visible and tangible** perspectives of customers, and systematically develop demand-oriented technologies and product series

Technology map



- Theory
- Method
- Algorithm
- Craftsmanship
- Design

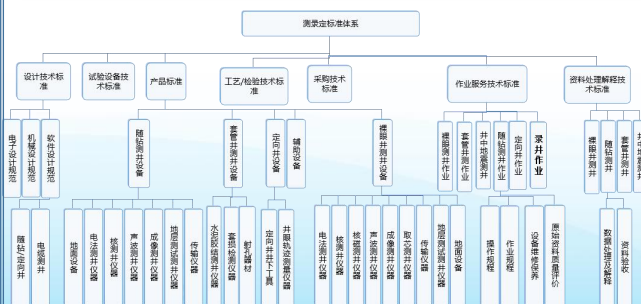
Product map

核心工具69种									
序号	名称	规格	单位	数量	备注	序号	名称	规格	单位
1	70	...	...	...
...
69	71	...	...	...

核心体系70种									
序号	名称	规格	单位	数量	备注	序号	名称	规格	单位
1	71	...	...	...
...
70	72	...	...	...

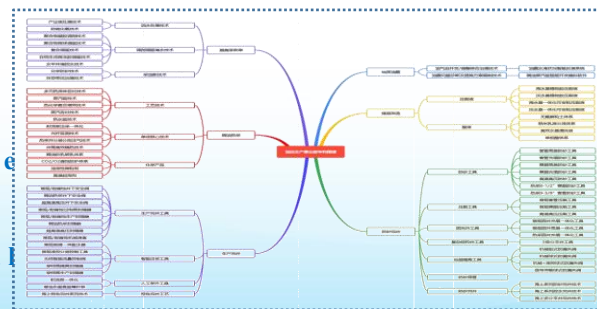
- Industry chain
- Manufacturing
- Quality control
- Test
- Iteration

Intellectual property map



- Patent
- Standard
- Software Copyright
- Technical secrets

Digital map



- Professional software
- Video, model, VR and other digital achievements

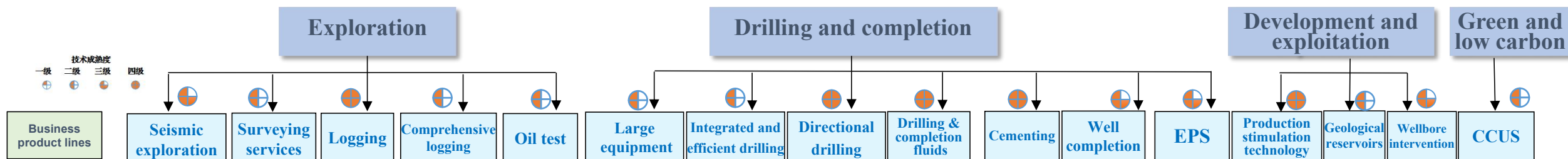
1. Infill adjustment well
2. Super extended reach well drilling and completion
3. Ultra-deep water and ultra-shallow layer drilling and completion
4. Limestone (Qianshan) drilling
5. Deepwater drilling and completion
6. High temperature and high-pressure drilling and completion
7. Heavy oil development and exploitation
8. Low permeability development and exploitation
9. Enhanced recovery with special well types
10. CCUS

Four maps

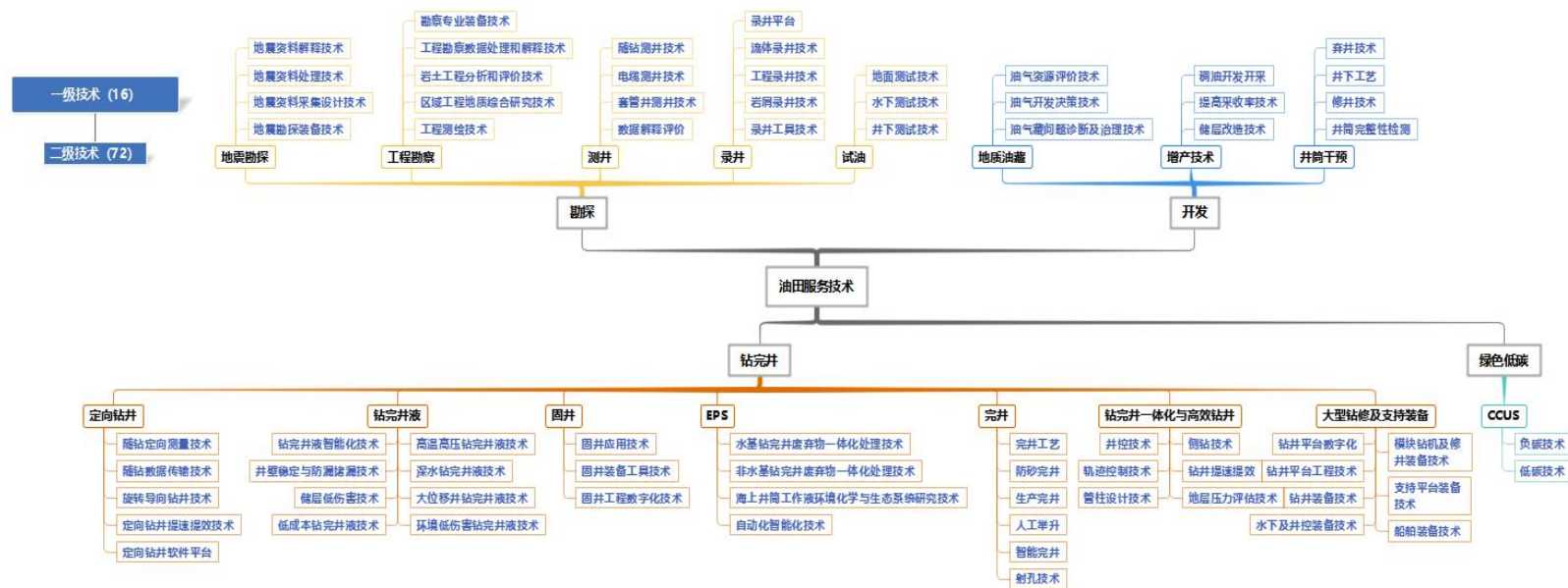
Top 10 scenarios

2.1 Four Maps and 10 Scenarios

Form a demand and future-oriented completed series of oilfield service **technology maps and product maps**



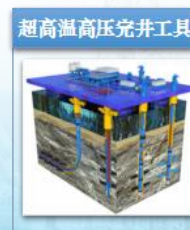
COSL Technology Maps



High-tech equipment and platforms for deepwater and deep layer exploration



Comprehensive drilling and completion technology for safe, efficient, low-cost and complex drilling

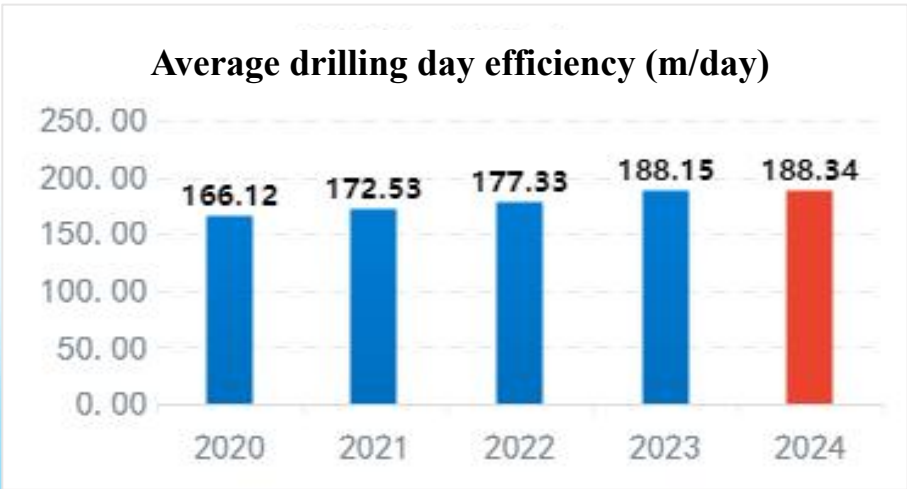
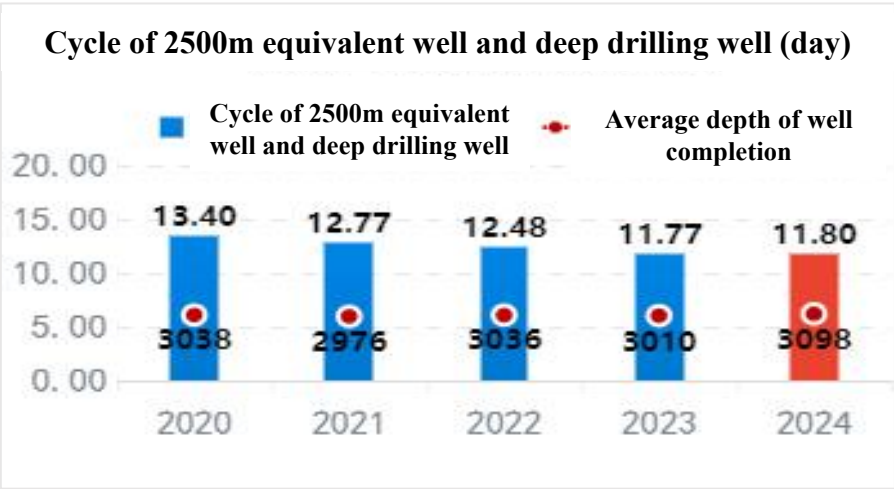
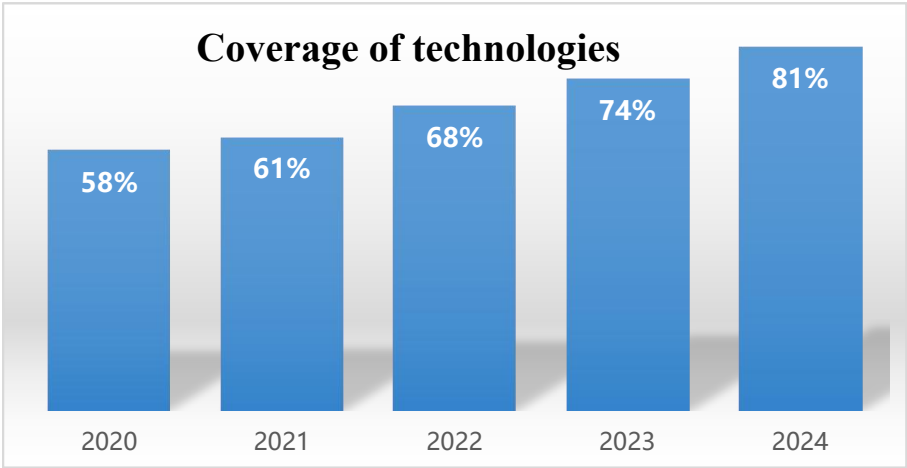
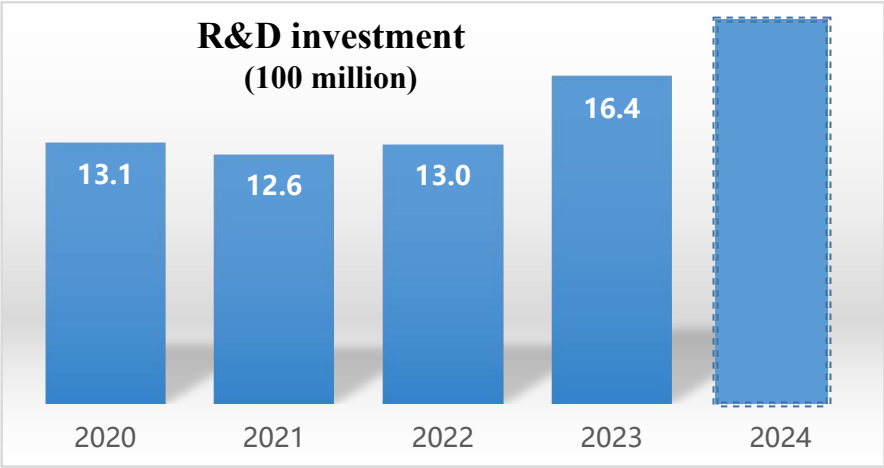


Meet the development and extraction needs

2.2 Technological Advancement

Continuous improvement of core technology product system and technical service capabilities

- ✓ The overall technology coverage has increased to **80%+**, the application of “**efficiency**” and “**effect**” indicators for core technologies has continued to improve, and customer experience continues to be optimized

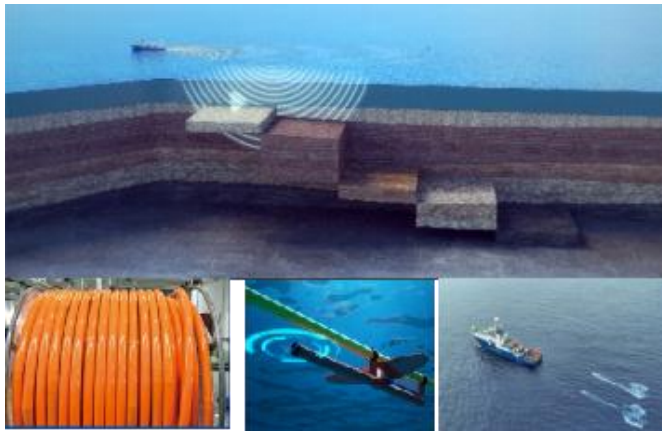


2.3 Major Technological Achievements



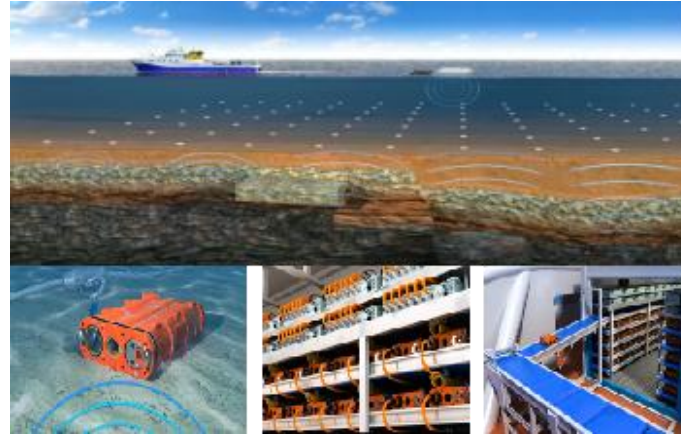
In the field of seismic exploration - Established self-developed equipment and distinctive acquisition processing technologies represented by "Hai Jing" and "Hai Mai" systems

- ✓ Bridging the technological gap in China, "Hai Jing" has achieved large-scale operations in offshore China and Indonesia and has also been exported for use in marine scientific research



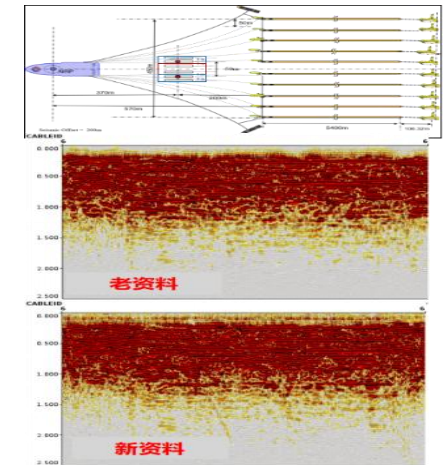
"Hai Jing" – Ocean towed streamer seismic acquisition equipment

- Applied to an area of more than 30,000 km²
- Successfully achieved export
- The successful Indonesian debut received positive acclaim



"Hai Mai" -Ocean Bottom Node seismic acquisition equipment

- Formed a basic node HQN500
- Efficiently completed the operations in the BZ block and continued to be applied, with a cumulative acquisition area of more than 300 km², leading to a great improvement in image quality.



Single-vessel three-source blended acquisition technology

- The first successful blended acquisition using a single towed vessel with three sources in China
- Developed supporting software for blended data separation
- 30% increase in work efficiency

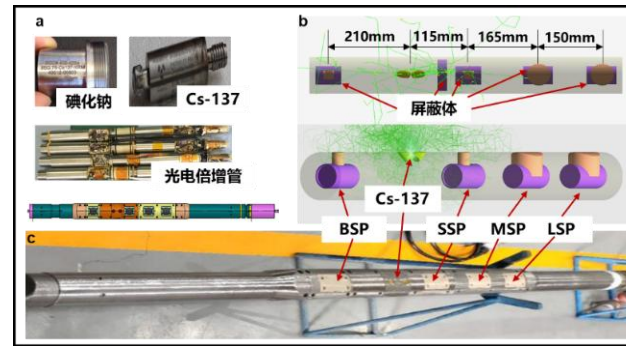
2.3 Major Technological Achievements

- In the field of logging - Developed "**Xuan Yue**", an ultra-high temperature and pressure cable logging system equipped with several international debut technologies
- ✓ 160 types of self-developed instruments across 52 categories, with applications covering China's offshore and onshore areas, as well as countries along the "Belt and Road", such as Indonesia



High-temperature and high-pressure rotating well-wall coring

- The only tool in the world that can drill large-diameter formation cores in small boreholes



Post-casing array density logging technology

- Significantly reduces risks associated with open-hole radioactive logging operations
- Disrupted the industry's conventional practice of selecting either wireline logging or measurement while drilling (MWD), and won an **OTC New Technology Award**



Integrated core sampling logging tool

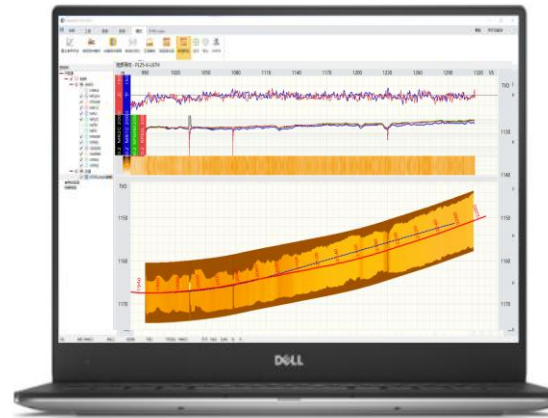
- Allows for the complete acquisition of gaseous, liquid, and solid oil and gas exploration samples in a single well drilling operation
- Solves challenging problems in exploration operations for complex oil and gas fields and reduces exploration and development costs by hundreds of millions of RMB every year

2.3 Major Technological Achievements

- In the field of directional drilling - Developed the first domestic rotary steerable drilling and logging-while-drilling equipment "**Xuan Ji**" with leading functions
- ✓ Reached the second "1,000 wells and one million meters drilled milestone" and successfully deployed commercially in more than 100 wells overseas, including Indonesia, Uganda , etc



High-angle rotary steerable tool



High-definition multi-layer edge detection while drilling technology



Formation pressure while drilling measurement tool

- A breakthrough in high-dynamic steering force closed-loop control technology
- Has the capability for vertical inclination and high-angle directional drilling
- Simultaneously inverts boundaries of more than 5 layers of geological formations
- Achieves detailed characterization of multiple sets of strata
- Reservoir penetration rate of over 90%
- A breakthrough in intelligent pressure measurement technology with short test time
- Can be used to adjust drilling parameters in real time, determine fluid interface, etc.

2.3 Major Technological Achievements

In the field of wellbore working fluid - Established a world-class drilling and completion fluid & cementing technology system

- ✓ Deepwater, high-temperature, high-pressure, **ultra-deep extended-reach wellbore working fluids** and other technologies have been applied on a large scale and can operate at temperatures as high as **220°C** and as low as **1.9°C**



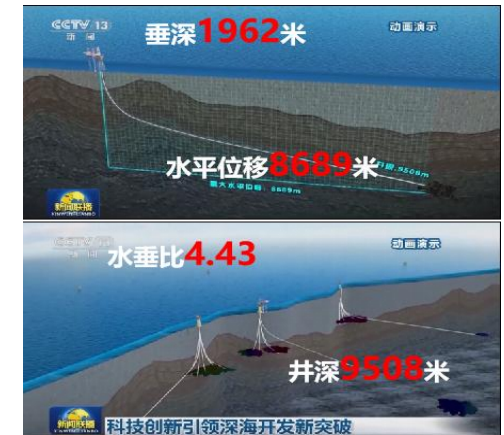
Key cementing technologies for CCUS

- Formed modified silicate long-lasting anticorrosive cement slurry systems
- Solved the problem of acid corrosion caused by high levels of CO₂ and ensured the integrity of the cement coating throughout its entire life cycle



Deepwater ultra-low temperature cement slurry technology

- Increased ultra-low temperature ($\leq 15^{\circ}\text{C}$) strength by nearly 3 times
- Reduced waiting time for cement slurry to set by 33%
- Significantly improved drilling efficiency



Offshore ultra-deep extended-reach well technology

- Developed domestically produced environmentally friendly synthetic base oil, reducing costs by 60%
- Set records for lowest density cement slurry for offshore cementing, the deepest casing depth and the length of cementing in a single operation

2.3 Major technological achievements

■ In the field of well completion technology - Established “**Hai Hong**”, an autonomous well completion system with distinctive features

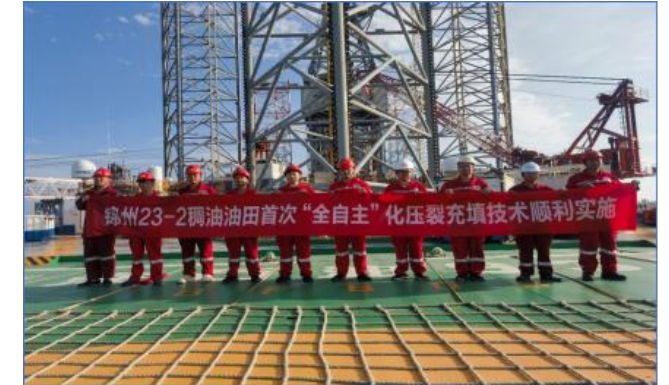
- ✓ Possesses leading domestic well completion technologies and equipment for ultra-high temperature, high-pressure and heavy thermal recovery of heavy oil, which has been successfully applied in major projects such as “**Shenhai-1**” and “**Shendi-1**”



Ultra-high temperature and high-pressure completion tool



Heavy oil thermal recovery completion tool



Frackpack sand control system

- Has a maximum temperature resistance of 204°C and a maximum pressure resistance of 25000psi
- Reduced costs by 20% and increased delivery time by 60%
- Maximum operating well depth of 9300 meters

- Withstood the test of extremely high-temperature steam at 350°C and the complex operating conditions of multiple cycles of steam injection with alternating hot and cold temperatures.
- Effectively supported the development of Jinzhou 23-2 oil field

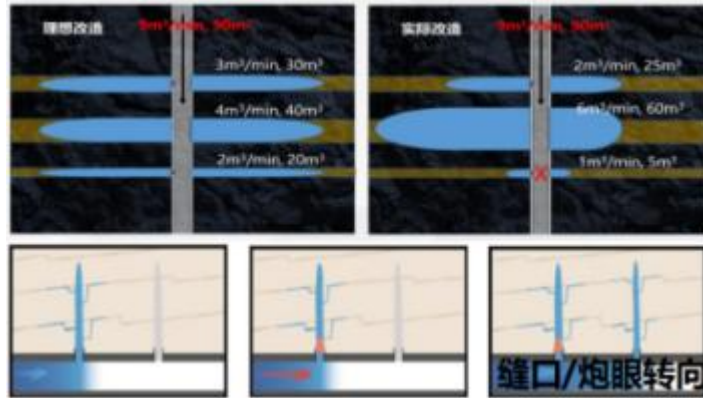
- Developed systems including the SMFP super one-pass multi-layer fracturing and packing system and realized the autonomy/localization of the core fracturing and packing algorithm model
- The key parameter matching degree of the sand control software is up to 95%

2.3 Major technological achievements



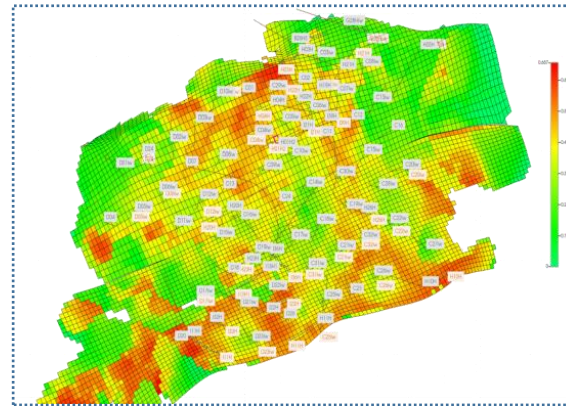
In the field of oilfield stimulation technology - Developed several distinctive technologies such as heavy oil thermal recovery, low permeability fracturing, oil stabilization and water control

- ✓ Guided by geological oil reservoir analysis, have implemented various measures to continuously improve the production of single wells and the ultimate recovery of oil fields



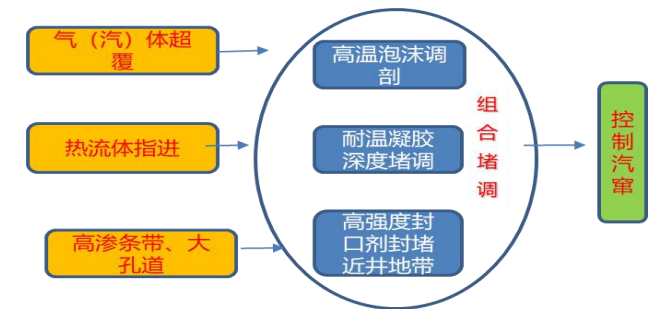
Acid fracturing technology for offshore hybrid sedimentary rocks

- Develops efficient and connected pathways for reservoirs with complex lithology
- Addresses key issues to form a green acid fracturing system for non-flowback fluid treatment



"Plug-adjustment-displacement" integrated water control for stable oil production

- New total water control technology for horizontal well blocks
- Intelligent compartmentalized water control technology
- Small-scale online integrated profile control process



Multi-thermal fluid thermal recovery technology for heavy oil

- Led to the development of a system of technology products such as geological oil reservoirs, experimental research, ancillary products, heat injection equipment, and support platforms
- Facilitated the efficient development of thermal heavy oil recovery in the Bohai Sea

2.4 Technical value

Scientific research input and output have generated significant economic benefits, effectively helping customers increase reserves and production, with product exports reaching record highs

X
u
a
n
Y
u
e

731 million [tons]



Helped increase newly proven reserves

RMB 500 million



External sales of instruments
Customer diversity

100+



[Flagship product] MUIL

X
u
a
n
J
i

253 million [tons]



Incremental oil and gas reserves in the past three years

RMB 300 million



External sales
Provide **Chinese** solutions

3.84 million [tons]



Incremental crude oil production in the past three years

H
a
i
J
i
n
g

54.46 million [tons]



Helped increase newly proven reserves in the past three years

RMB 30 million



External sales
3 external customers assisting in marine scientific research

361 million [tons]



Predicted reserves

H
a
i
H
o
n
g

97%



Well completion tool entry success rate

RMB 60 million



Customers outside the system
Cumulative sales revenue

8



[API International Product Quality Certification Certificates]

wellbore
working
fluids

6,633 [wells]



1,038 [wells] of overseas drilling & completion fluids and cementing operations in the past three years

RMB160 million



Export of oil field chemicals

9,131 m

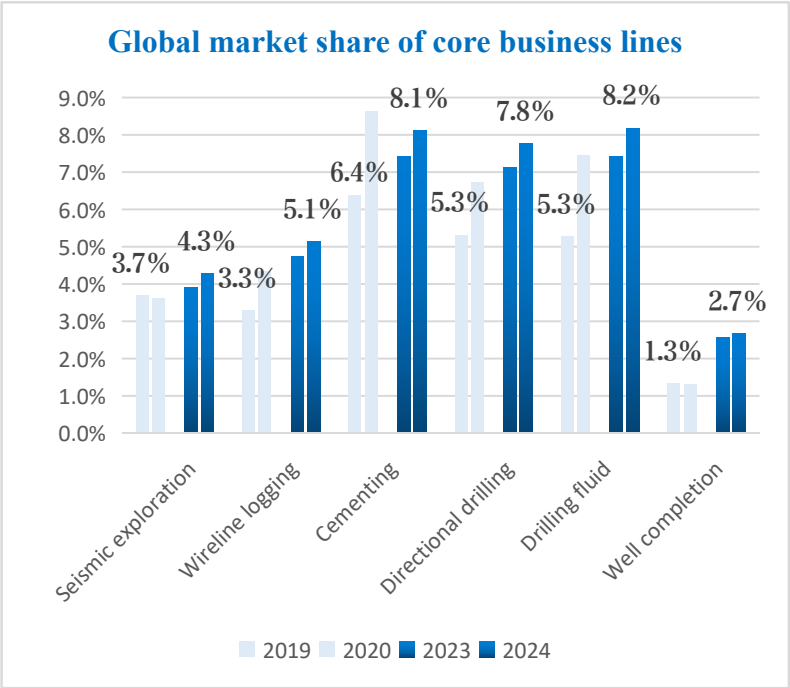


Maximum displacement of operating well
Maximum depth of well: 9508m

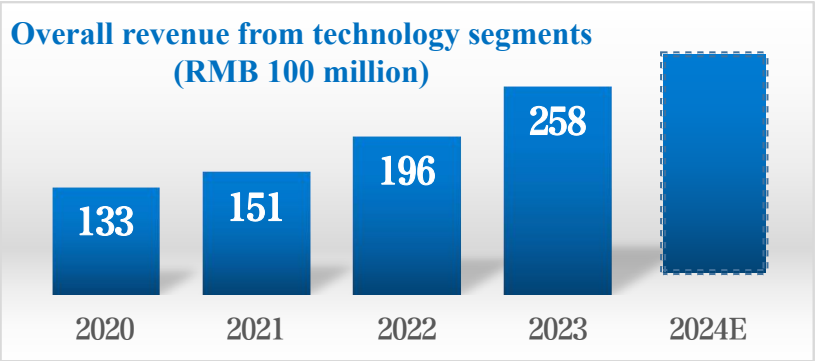
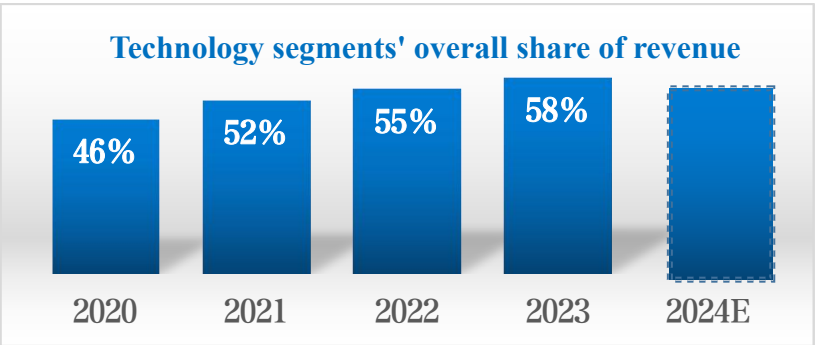
2.4 Technical value



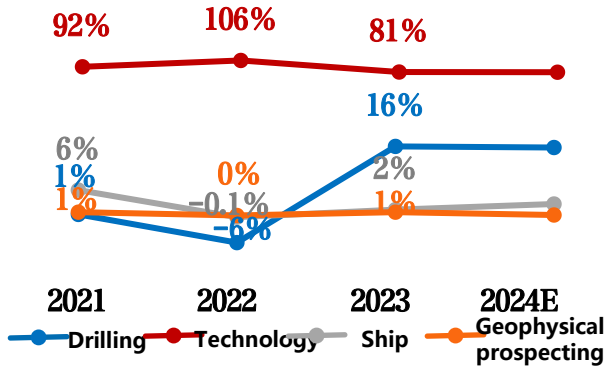
Significant benefits generated by the input and output of scientific research have contributed to the expansion of production and operation scale, as well as to the increase in the profits in the Company's technology segments



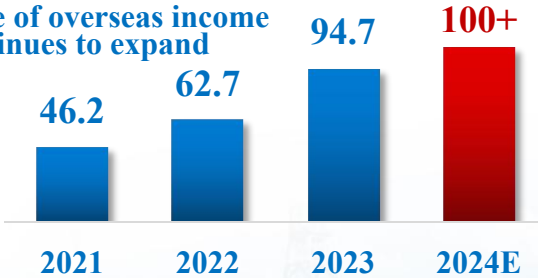
Data source: Spears & Associates



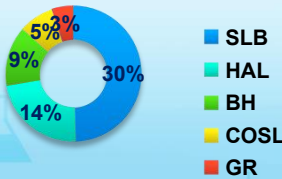
The technology sector is the main profit contributor



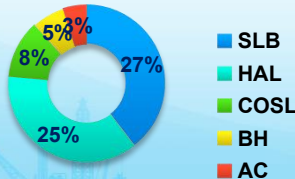
The scale of overseas income continues to expand



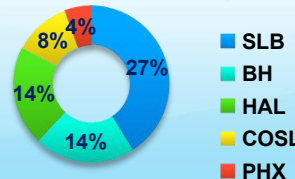
Wireline logging (ranks 4th globally)



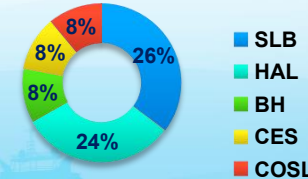
Cementing (ranks 3rd globally)



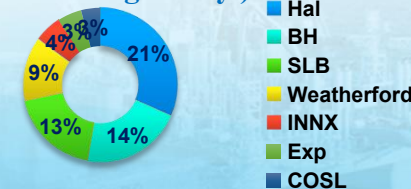
Directional wells (ranks 4th globally)



Drilling & completion fluids (ranks 5th globally)



Well completion (ranks 7th globally)



2.4 Social Benefits

COSL



The input and output of scientific research has generated great social benefits, resulting in an unprecedented boost to the industry recognition of COSL technology brands



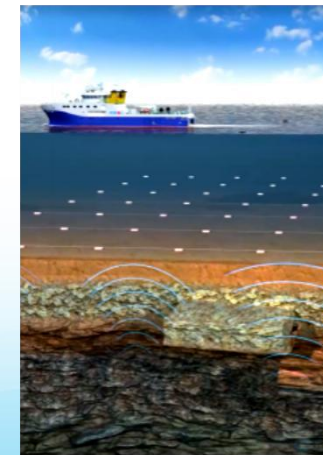
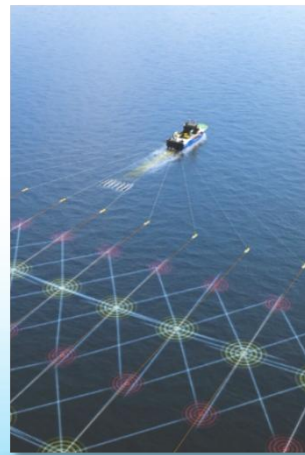
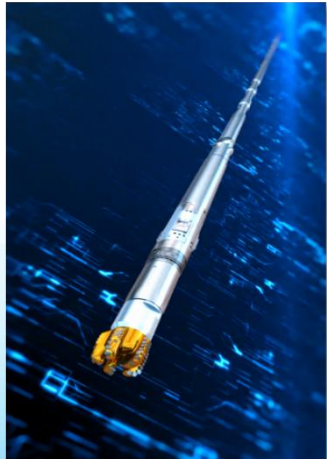
COSL TODAY -Released 3 integrated technologies globally



A first in China! Two of the Company's new technologies won OTC Awards



Took the lead in formulating and revising two international standards for the first time, and appointed [the Company's] first convener for an ISO working group (design of thermal fluid huff-and-puff processes)



Won the first (set) of major technical equipment in the national energy sector, the top ten national oil and gas exploration and development achievements, the China Industrial Award, and the promotion of scientific and technological innovation achievements of central enterprises

The background of the slide is a photograph of an offshore oil rig in the middle of the ocean. The rig is yellow and red, with a tall derrick. A large black pipe extends from the rig towards the bottom right of the frame. The ocean is blue with whitecaps, and the sky is blue with some clouds. In the bottom right, there is a circular inset showing a close-up of a mechanical component, possibly a valve or a wellhead, with a yellow cap and several bolts.

1. Technology-driven strategy and path

2. Technology-driven implementation results

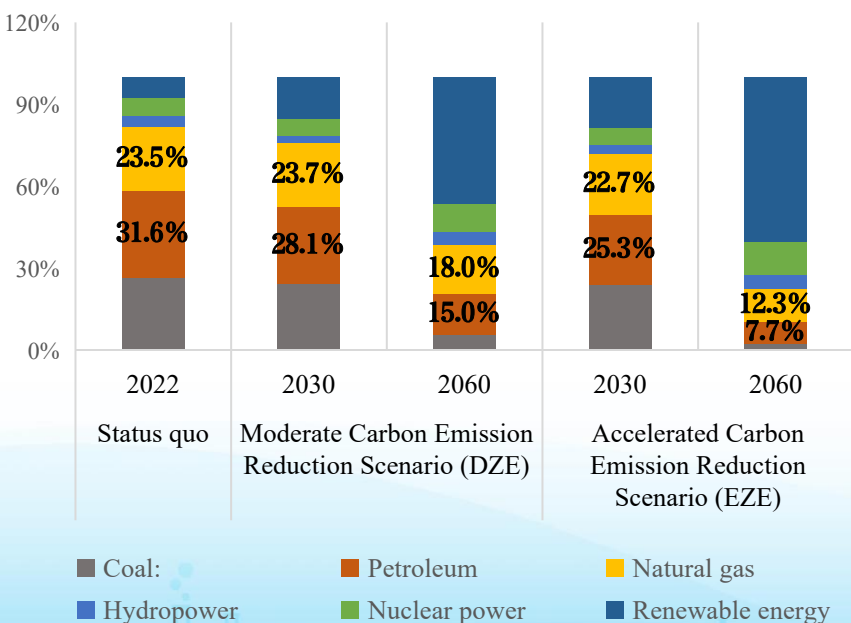
3. Outlook for future development

3.1 Industry development trend analysis

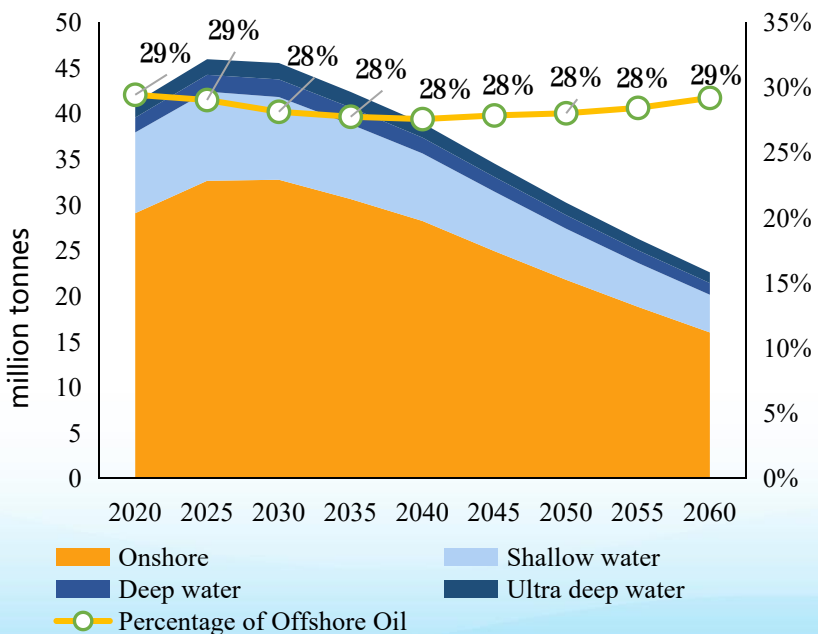
In the medium to long term, oil and gas will remain important primary energy sources, and offshore oil and gas will be an important strategic area for the future global oil and gas industry

- It is estimated that by 2030, global primary energy consumption will reach 16.6 billion tons of oil equivalent, and fossil energy consumption will account for 76%, of which **oil and gas will still account for more than half (51.8%)**
- Offshore oil and gas production accounts for about one-third of the world's total, of which crude oil will reach 1.2 to 1.3 billion tons in 2025 and natural gas will reach 1.6 trillion cubic meters in 2040

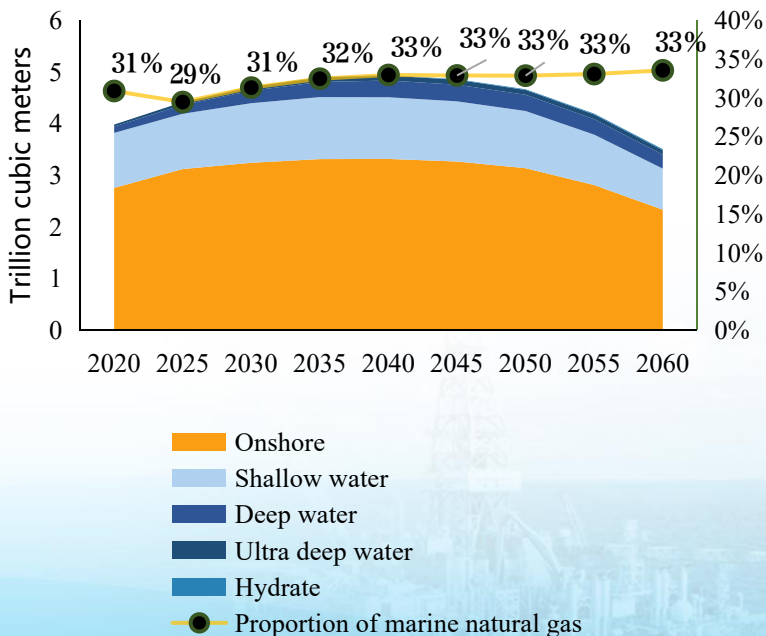
Forecast of Global Primary Energy Demand Structure



Global Offshore Oil Production Forecast



Forecast of Global Marine Gas Production and Structure

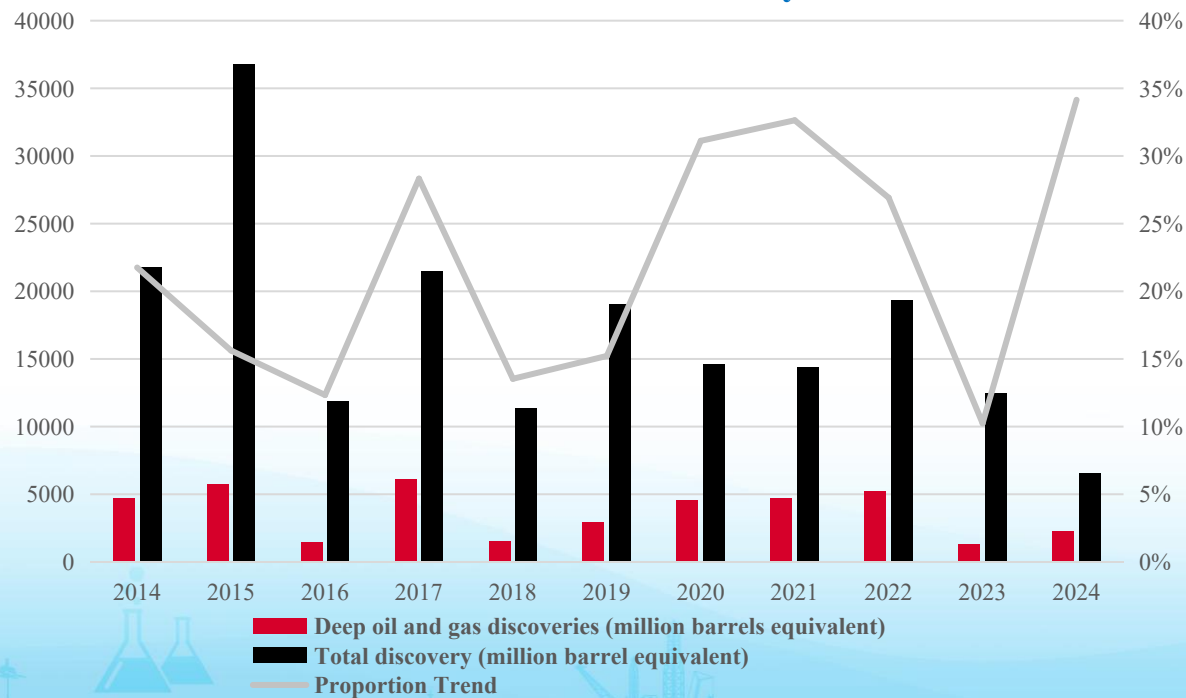


3.2 Technological Development Challenges

■ The trend of inferiority for oil and gas resources in the international market is obvious, and the technical challenges of oil and gas exploration and development are intensifying

- Exploration and development are moving into the areas of double depth and double height, low buried hill, low porosity and permeability, complex lithology, etc. The technologies for geophysical surveys, drilling, and completion engineering are quite challenging
- The development of “Low permeability, long development period, edge water, heavy oil ” fields is difficult, and old oil fields are facing the challenge of high recovery and high water content, and the difficulty of further developing the potential and stabilizing production is increasing

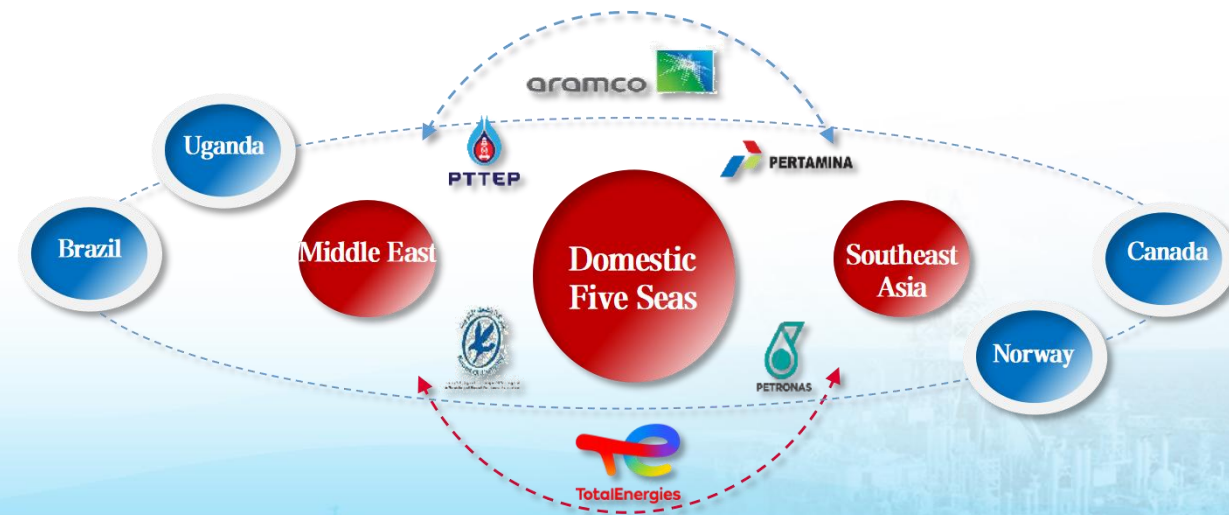
Comparison of global **deep-seated** oil and gas discoveries and total discoveries over the years



Data source: Rystad, S&P Global

The company's "1+2+N" market structure

With the domestic market as the main pillar and the Middle East and Southeast Asia as the two wings, the Company is driving the positive development of several overseas regions



3.3 Prospects of the Company's Technology Development

- Improve the “two main and one characteristic” technical system with the core objective of enhancing the full lifecycle value of customer assets
 - Optimize the main technology system around the core demand for increasing reserves and production, and encourage the technology sector to represent 60% of revenue

2025

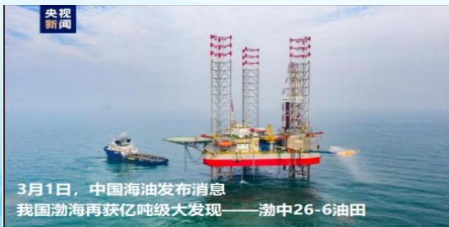
2030

1. Breakthrough high-end technologies such as pre drilling exploration and remote measurement, and promote the transformation and application of new technologies such as enhanced ocean bottom node
2. The proportion of revenue from the technology segments remains above 55%
3. The proportion of revenue from strategic emerging industries accounted for more than 20%

1. Systematization of core technology and equipment, large-scale application, leading the development of digitization and intelligence
2. The technology segments strive to achieve a 60% share of revenue
3. Strategic emerging industries strive to achieve a 30% share of revenue

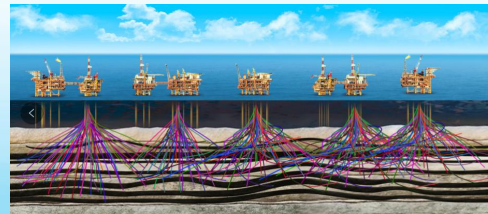
Exploration

- High-resolution acquisition of ultra-thin reservoirs and other technologies
- 3000m deep seabed node products
-



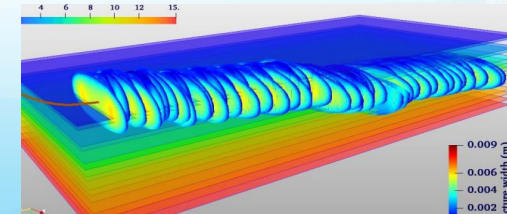
Drilling and completion

- Efficient trajectory control and anti-collision detection technologies
- Safe and efficient directional drilling products
-



Development and exploitation

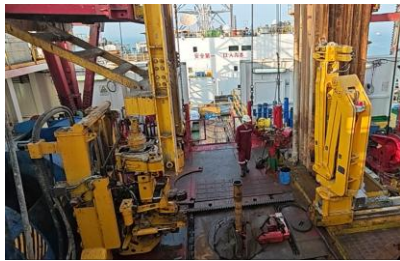
- Saturated fracturing of multi-layered reservoirs, deep coal seam fracturing
- Underground high-power electric heating technology
-



3.4 Technical outlook for large-scale equipment

- Adapt to the needs of deepwater exploration and development, as well as green transformation technology. Develop technical reserves related to intelligent drilling platforms and clean power fuels for ships
- During the 15th Five-Year Plan period, a new generation of intelligent, efficient, safe, reliable, and environmentally friendly floating drilling platforms will be built to enhance drilling capabilities at depths of 800-1500 meters

Configuration of "full set of pipe string automation equipment"



Wellhead automation

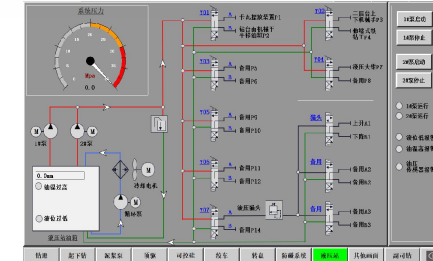


Double derrick

Tubular "one-key smart full-process automatic operation"

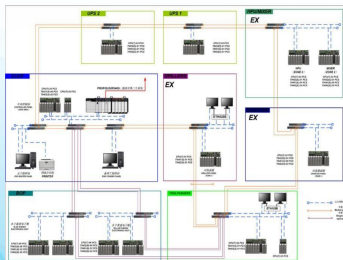


Intelligent homework monitoring

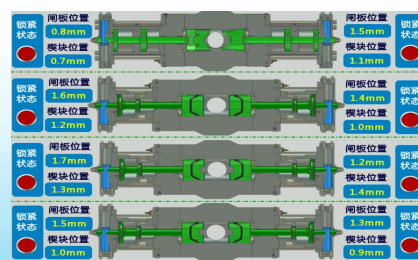


Intelligent linkage

Well control system "electro-hydraulic dual redundant control"



Electro-hydraulic composite control



Real time display of valve position

Real-time "monitoring of the operating status of each device"



Intelligent monitoring of equipment

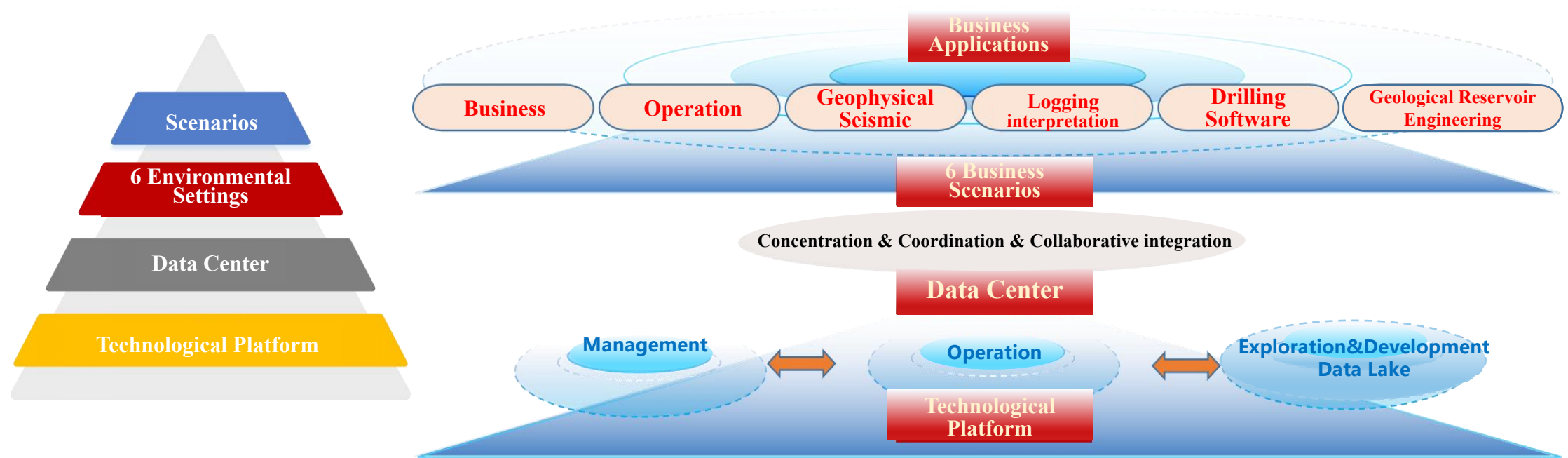


Intelligent hull monitoring

3.5 Outlook for software platform construction

- Facing the forefront of industry development, accelerating the transformation and upgrading of digitalization and intelligence through the carrier of "Smart COSL"
- Based the "1+1+6+N" software planning blueprint, it is promoting the accelerated transformation of oil field services from complete tangible products to ecological platform software and intangible products

"1+1+6+N" software platform and application planning blueprint



Looking ahead, COSL will continue to implement technology-driven strategies, enhance original and groundbreaking research on essential core technologies and offshore oil and gas equipment, and proactively cultivate strategic emerging and future industries, and achieve mutual benefit and win-win results with customers and shareholders through more outstanding products, better services, and better performance, and continuously move towards the goal of building a world-class energy service company with Chinese characteristics, contributing more wisdom and strength to the development of the industry!

The Chinese New Year is just around the corner. We wish everyone a happy new year and good health.



COSL



Thank you!

我们必须做得更好
ALWAYS DO BETTER