广东能源集团
GUANGDONG ENERGY GROUP

广东粤电阳江沙扒海上风电项目

Guangdong Yudean Yangjiang Shapa Offshore Wind Power Project

新开发银行贷款项目经验分享

NDB Loan Project Experience Sharing

2026年9月23日 | 23 September 2026

RMB 2 billion

NDB贷款20亿 | NDB loan: RMB 2 billion

总投资67亿+ | Total Investment 6.7B+ RMB

装机容量300MW | Installed Capacity

47台风机 | 47 Turbines

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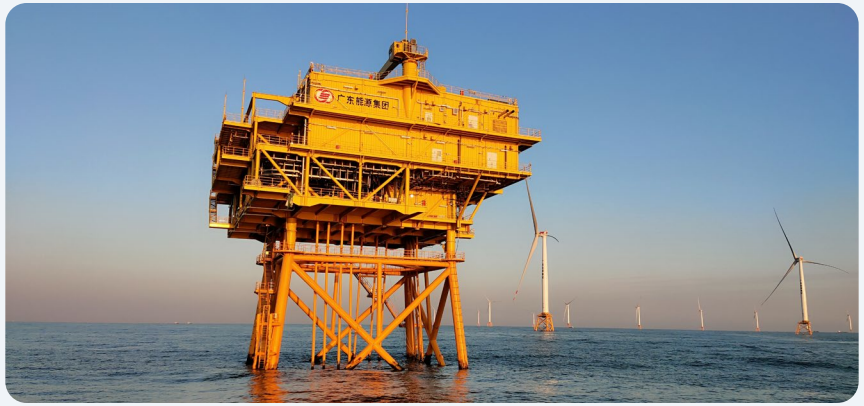

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项目执行机构
Project Implementation Agency (PIA)

广东省能源集团有限公司
Guangdong Energy Group Co., Ltd.

- 广东省实力最强、规模最大的省属能源企业
  The **largest** and strongest provincial energy enterprise in Guangdong Province
- 装机容量位列全国省属能源企业首位
  Ranking **No.1** in installed capacity among provincial energy enterprises nationwide
- 2025中国企业500强第299位
  Ranked #299 in China Top 500 (2025)
- 以发电为核心，天然气、煤炭、航运、港口、储能、节能、环保、金融、综合能源服务等上下游产业链协同发展
  Power generation business-focused, coordinated upstream & downstream industrial chain development

集团核心指标
Key Group Indicators

6500万+
可控装机容量(kW)
65 GW+ Controllable Capacity

550家+
下属单位(家)
550+ Subsidiaries & Affiliates

3273亿
资产总额(元)
RMB 327.3 Billion Total Assets

1.8万+
在职员工(人)
18,000+ Employees

注：以上数据截至2025年末。Note: Data as of end-2025.



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项目立项背景
Project Background

全球海上风电快速发展
Rapid Global Growth of Offshore Wind

- 2011–2017年全球年均增长约30%
  Global offshore wind grew by about 30% annually (2011–2017)
- 2017年全球累计装机达18.8GW
  Global cumulative capacity reached 18.8 GW in 2017

广东独特资源优势
Guangdong's Unique Advantages

- 海岸线4114公里，海域41.93万平方公里
  4,114 km coastline, 419,300 km² sea area
- 经济强省与"世界工厂"，用电需求旺盛
  Economic powerhouse & "World Factory" with strong demand

NDB主权贷款契机
NDB Sovereign Loan Opportunity

2018年，NDB董事会批准向中华人民共和国提供20亿元人民币主权贷款，用于本项目融资。

In 2018, the NDB Board of Directors approved a RMB 2 billion sovereign loan to the People's Republic of China to finance this project.

项目目标：在广东省阳江市建设300MW海上风电场，替代部分计划淘汰的燃煤电厂，加速区域清洁能源转型。

Project Objective：Develop a 300 MW offshore wind farm in Yangjiang, Guangdong, replacing coal-fired power plants and accelerating clean energy transition.



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项目概况
Project Overview



场址位置 | Location
广东省阳江市阳西县沙扒镇附近海域，涉海面积约48km²
Sea area near Shapa Town, Yangxi County, Yangjiang, covering approx. 48 km²

水深/离岸 | Water Depth & Distance
水深23~27米，中心离岸约20公里
Water depth 23–27 m, approx. 20 km offshore from the center

机组配置 | Turbine Configuration
1台5.5MW + 46台6.45MW，共47台
1 × 5.5 MW + 46 × 6.45 MW, 47 turbines in total

配套设施 | Supporting Facilities
220kV海上升压站1座 + 陆上控制中心1座
1 × 220 kV offshore substation + 1 onshore control center

300MW	47台	48km²	220kV	20km
装机容量 Capacity	风机数量 Number of Turbines	涉海面积 Sea Area	海上升压站 Offshore Substation	离岸距离 Offshore Distance

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项目实施过程
Project Implementation

2017.12
申请NDB贷款
Applied for NDB loan

2019.01
开工建设
Construction starts

2019.08
完成首台基础沉桩
Completion of first foundation pile driving

2020
签订转贷协议
Signed sub-loan agreement

2021.02
首台风机安装
First turbine installed

2021.09
全部风机吊装
All turbines installed

2021.12
全容量并网
Full commissioning achieved

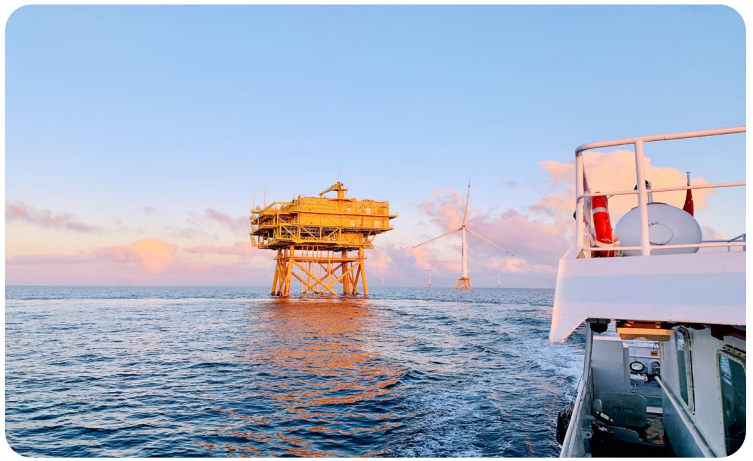
多方协同推进机制
Multi-party Coordination Mechanism

广东省财政厅
Guangdong Provincial Department of Finance
Overall Coordination

广东省能源集团
Guangdong Energy Group（PIA）

新开发银行
New Development Bank
Funding Support

监理施工方
Supervisor & Contractor
Quality Control



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项目实施过程
Project Implementation

01 地质条件复杂恶劣
Complex and Adverse Geological Conditions

风化岩面埋深变化大、覆盖层浅、基岩种类多强度变化大，是国内乃至全球地质**最复杂的海上风电项目之一。**

Highly variable weathered rock depth, thin overburden, diverse bedrock types with varying strength — one of the most geologically complex offshore wind projects globally.

02 施工窗口极度紧缺
Extremely Limited Construction Window

受东北季风和台风严重影响，年有效施工作业**窗口期仅约120天**，施工时间高度受限。

Severely affected by northeast monsoons and typhoons, the annual effective construction window is only about 120 days.

03 “抢装潮”资源紧张
Resource Crunch during "Installation Rush"

2020-2021年海上风电抢装潮，安装船舶资源紧缺，全国能满足项目施工的风机安装船**仅20余条，且大部分被锁定**，租赁价格"一天一价"，无序飙升，资源锁定成为最大瓶颈。

During the 2020–2021 offshore wind installation rush, installation vessels were in acute shortage; charter rates changed daily and soared erratically, making vessel resource lock-in the biggest bottleneck.

04 新冠疫情冲击工期
COVID-19 Impact on Schedule

2020年疫情影响生产制造、人员进场、资源锁定，推算延**误工期约3至6个月**，原本紧张的施工窗口再度压缩。

The pandemic disrupted manufacturing, worker mobility and resource availability, delaying the schedule by an estimated 3-6 months and further compressing the construction window.

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项目实施过程

Project Implementation

01 **基础技术创新：嵌岩率90%→40%**

Foundation Innovation: Rock-socketing Rate Reduced 90%→40%

02 **主机升级：5.5MW→6.45MW**

Turbine Upgrade: 5.5MW → 6.45MW

03 **资源锁定：30+船舶协同作业**

Resource Lock-in: 30+ Vessels Coordinated

04 **科学统筹：提前26天实现全容量并网**

Scientific Planning: Full Commissioning 26 Days Ahead of Schedule





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运营情况
Operations & Maintenance

自2022年投产至今

31.35亿千瓦时

累计发电量 | Cumulative power generation: 3.135 billion kWh

持续稳定运行，绿电供应大湾区
Stable Operation, Green Power for the Greater Bay Area

项目2021年底全容量并网，2022年进入正式运营期。截至目前，累计上网电量已达31.35亿千瓦时，全部为清洁可再生能源，累计约相当于再造6700多公顷森林。

Full-capacity grid connection: end-2021; commercial operation: 2022. Cumulative on-grid power 3.135 billion kWh (clean renewable), displacing coal power, equivalent to >6,700 ha new forest.

累计节能减排效益（2022年至今）
Cumulative Energy Saving & Emission Reduction (Since 2022)

94.51万	251.44万	347.34	496.20	99.24
节约标煤（累计）	CO_2减排（累计）	SO_2减排（累计）	NO_2减排（累计）	烟尘减排（累计）
Standard Coal Saved (10^4 t, cumulative)	CO_2 Reduction (10^4 t, cumulative)	SO_2 Reduction (t, cumulative)	NO_2 Reduction (t, cumulative)	Smoke & Dust Reduction (t, cumulative)

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运营情况
Operations & Maintenance

机组可利用率 99%+
Turbine Availability

远程集中监控
Remote Centralized Monitoring

安全生产事故：0
Zero Safety Incidents

运维管理体系
O&M Management System

- **2025年阳江区域集控中心全面接管**
  Yangjiang Regional Control Center fully takes over dispatch & monitoring
- **大数据平台远程监控47台机组**
  Big-data platform: real-time status, alarms, power forecast, AGC/AVC
- **台风季前防台专项工作**
  Pre-typhoon: pitch battery check, blade inspection, typhoon-mode test
- **常态化分析与隐患排查闭环**
  Monthly production & reliability analysis, closed-loop hazard rectification
- **投运至今安全生产零事故**
  Zero safety incidents since commissioning in 2021

技术研发创新
R&D Innovation

智能监控与数字化决策
Smart Monitoring & Digital Decision

设备状态监测与预警
Condition Monitoring & Warning

防腐技术体系
Anti-corrosion Technology System

无人化与智能运维
Unmanned & Smart O&M

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社会与经济效益
Social & Economic Benefits

总投资 67亿+
Total Project Investment: RMB 6.7 Billion+

纳税 2469万元
Cumulative Tax Payment: RMB 24.69 Million

产值 21.55亿元
Cumulative Output Value 2.155 Billion

区域带动效应（项目作为先驱）
Regional Development Impact (Project as Pioneer)

带动阳江海上风电全产业链发展
Driving Yangjiang Offshore Wind Full-Chain Development

- 已建及在建装机约1300万千瓦
  Installed capacity under construction & operation: approx. 13 GW
- 区域产业链总投资超400亿元
  Regional industrial chain investment: over RMB 40 billion
- 引进明阳、金风、东方电气等企业
  Mingyang, Goldwind, Dongfang Electric and other enterprises attracted
- 推动阳江建设"国际风电城"
  Promoting Yangjiang as an "International Wind Power City"

赋能粤西海洋经济发展
Empowering Marine Economy in Western Guangdong

- 带动地方税收和GDP增长
  Driving local tax revenue and GDP growth
- 为粤西海洋经济发展注入新动能
  New momentum for western Guangdong marine economy
- 优化广东电源结构，提升清洁能源占比
  Optimizing Guangdong power mix, raising clean energy share
- 保障大湾区绿色电力供应
  Securing green power for Greater Bay Area

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技术创新与项目亮点

Technology Innovation & Project Highlights

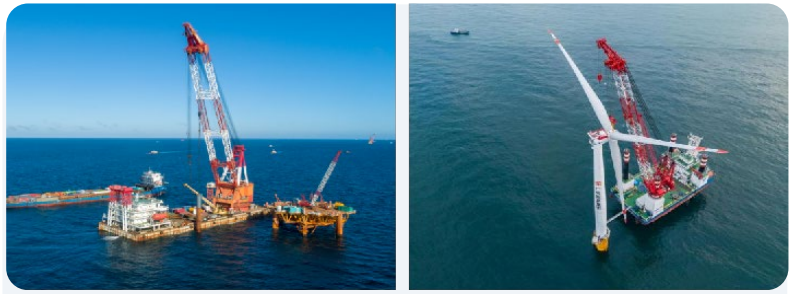


大兆瓦机组规模化应用

Large-scale MW-class Turbine Application

46台6.45MW半直驱机组，抗台风型叶片技术国际先进

46 × 6.45 MW semi-direct-drive turbines; typhoon-resistant blade technology at internationally advanced level



抗台风基础创新设计

Innovative Typhoon-resistant Foundation

国内首个植入嵌岩三桩导管架，嵌岩率从90%降至40%

China's first embedded rock-socketed three-pile jacket foundation; rock-socketing rate reduced from 90% to 40%



关键装备国产化与专利

Domestic Equipment Localization & Patents

核心装备全国产化，申请专利15项，参与国家行业标准

Core equipment fully localized; 15 patent applications; participation in national and industry standards

单月安装17台 • 创行业纪录 17 turbines installed in July 2021, setting an industry record

贷款的显著优势 Key Advantages of the NDB Loan

1.利率定价优势 Interest Rate Advantage

利率定价方式挂钩SHIBOR，为3M SHIBOR+41BP，显著低于同期国内贷款利率。

Interest rate pricing is linked to SHIBOR at 3M SHIBOR +41BP，notably below comparable domestic loan rates

2.资金直接发放及归还 Direct Disbursement & Repayment

搭建转贷结构，资金直接从新开发银行发放至项目公司，由项目公司直接向银行还款，便利项目用款及还款

The on-lending structure enables direct NDB fund disbursement to the project company and direct repayments by the company, streamlining fund drawdown and repayment.

3.贷款币种选择为人民币 RMB Denomination

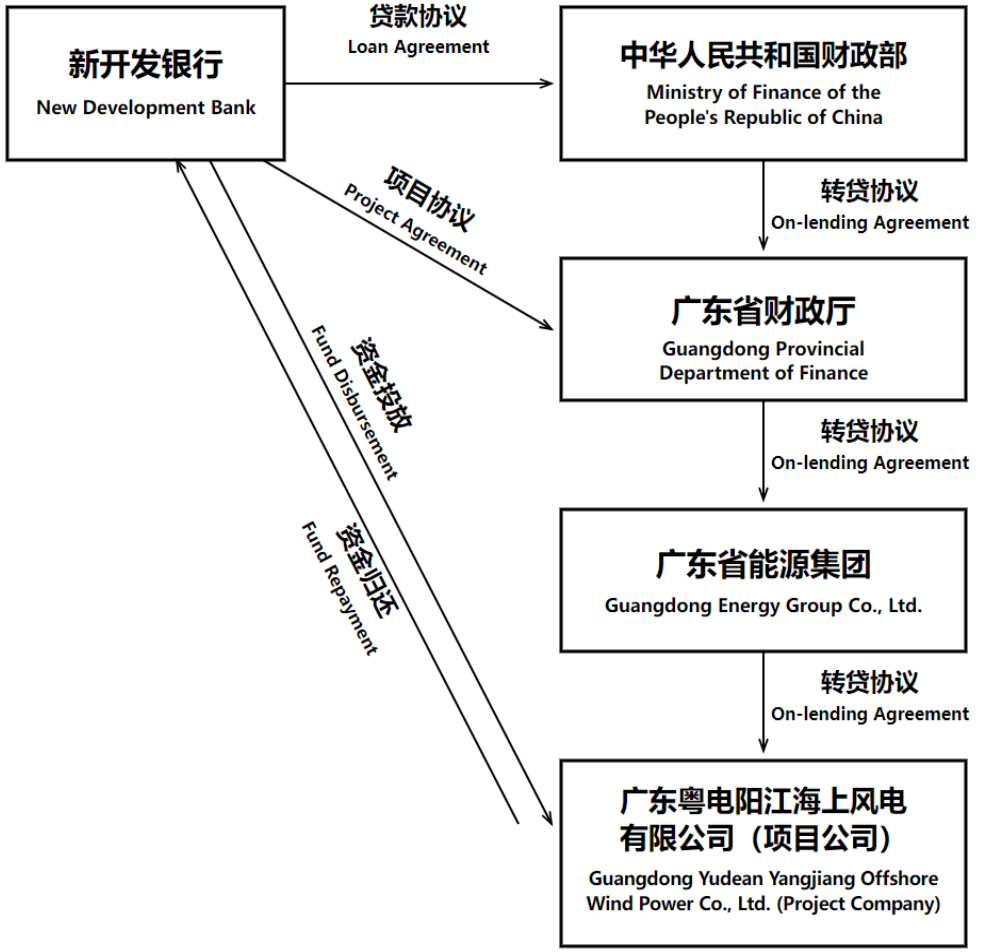
贷款币种选择为人民币，灵活满足项目建设的资金需求，避免汇兑损失风险

The loan is denominated in RMB to flexibly meet capital needs for project construction and effectively avoid exchange loss risks.

4.支付方式（归垫） Payment Method (Reimbursement)

资金可以进行归垫，具有明显的灵活性。

Fund reimbursement is available, offering high flexibility.



广东能源集团
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所获奖项
Awards & Recognition

标准化良好行为企业AAAAA认证（全国首个海上风电领域5A认证）
Standardization Good Practice Enterprise AAAAA Certification (China's first 5A certification in offshore wind)

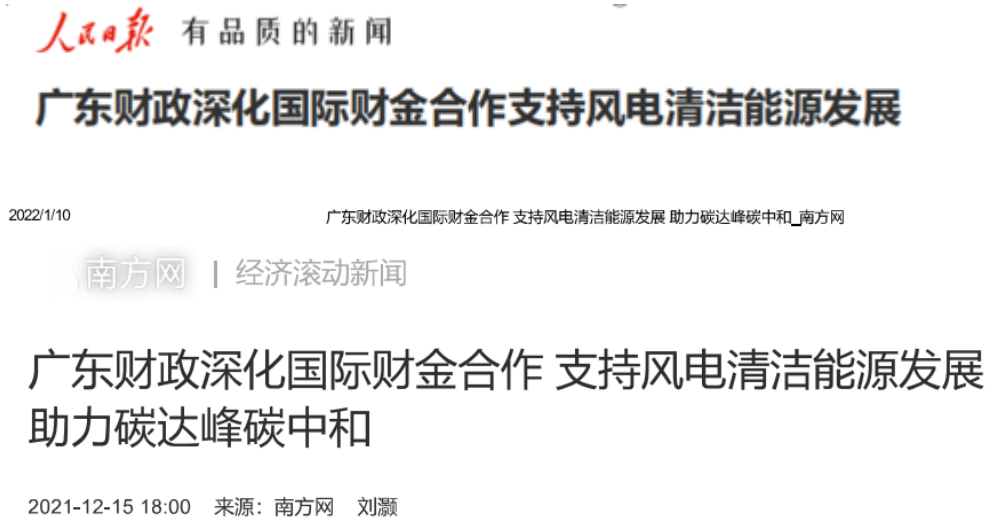
安全生产标准化一级企业

Work Safety Standardization Level 1 Enterprise

全国企业管理现代化创新成果二等奖

National Enterprise Management Innovation Award (2nd Prize)




人民日报 有品质的新闻

广东财政深化国际财金合作支持风电清洁能源发展

2022/1/10 广东财政深化国际财金合作 支持风电清洁能源发展 助力碳达峰碳中和_南方网

南方网 | 经济滚动新闻

广东财政深化国际财金合作 支持风电清洁能源发展 助力碳达峰碳中和

2021-12-15 18:00 来源：南方网 刘灏

广东能源集团
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所获奖项
Awards & Recognition

2021

NDB绩效评估国内第一

项目得分在国内放贷项目中排列第一；省财政厅绩效评价评分90.24分，等级为"高度成功"。

2021 NDB performance evaluation: ranked 1st among domestic lending projects; scored 90.24 by Provincial Finance Dept., rated "Highly Successful".

2023

NDB理事会年会代表项目

受邀参加第八届理事会年会，从全球98个主权贷款项目中遴选为3个代表性推介项目之一，打造"广东样本"。

2023 8th NDB Annual Meeting: selected as one of 3 representative projects out of 98 sovereign loans worldwide, creating a "Guangdong Model".

2025

独立评价

新开行独立评价局开展绩效评估，实地访谈高度认可；多个维度评级等级为"成功"乃至"高度成功"。

2025 NDB Independent Evaluation Department conducted field visits and rated the project "Successful" to "Highly Successful.





广东能源集团
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融资经验与启示

Financing Experience & Insights

申报阶段
Application Phase

- **提前对接NDB，明确贷款条件**
  Early engagement to clarify loan terms & KPIs
- **项目符合NDB战略与E&S标准**
  Align with NDB strategy & E&S standards
- **财政部门牵头，跨部门协调**
  Finance dept leads cross-departmental coordination

实施阶段
Implementation Phase

- **严格执行NDB采购与ESMP**
  Strict NDB procurement & ESMP compliance
- **建立定期报告与绩效监测**
  Regular reporting & performance monitoring
- **资金专款专用，规范提款报账**
  Earmarked funds, standardized disbursement

运营阶段
Operation Phase

- **持续跟踪绩效指标**
  Continuous KPI tracking to ensure targets are met
- **做好项目后评价，总结经验**
  Project post-evaluation & lessons learned
- **发挥示范效应，推广可复制经验**
  Demonstrate & replicate best practices

体会与启示
Key Insights

- **融资与融智相结合**：NDB在为项目提供低成本、长期限的优惠贷款，有效实现**“融资”**支持的同时，更注重引入国际先进的技术、理念与管理制度，提升**“融智”**成效
  Integrating financing with intellectual expertise
- 早期深度沟通与全程协同是项目成功的关键
  Early engagement and full-process collaboration are key to success
- 多边开发银行合作为新兴市场清洁能源提供示范
  MDB cooperation sets a benchmark for clean energy in emerging markets

广东能源集团
GUANGDONG ENERGY GROUP

上级主管部门支持

Government Support & Coordination

01 申请阶段
Application Phase

在财政部、省财政厅大力指导下高效落实全套申请文，项目成功列入2018—2019年新开发银行贷款备选项目规划。

With strong guidance from the MOF and the Guangdong Provincial Department of Finance, the full application package was efficiently completed, and the project was successfully included in the 2018–2019 NDB loan pipeline.

02 贷款推进过程
Loan Implementation

财政部、省财政厅积极协调指导核准文件资金来源调整、企业主体主权贷款反担保等工作，对贷款推进落地起到重要推动作用。

The MOF and the Guangdong Provincial Department of Finance actively coordinated and guided the adjustment of funding sources in the approval documents and the sovereign loan counter-guarantee by the project entity, among other matters, playing a key role in advancing and finalizing the loan.

03 机制创新
Mechanism Innovation

作为NDB在粤首个项目贷款，无先例可循。省财政厅发挥战略支点作用，指导优化资金拨付流程，提高还款效率、保障合规使用。

As the first NDB loan in Guangdong with no precedent, the MOF and the Guangdong Provincial Department of Finance provided strategic guidance on optimizing disbursement procedures, improving repayment efficiency and ensuring compliance.

财政部及广东省财政厅的悉心指导与大力支持，为本项目成功申报、落地实施提供了关键保障。

Thoughtful guidance and strong support from MOF and Guangdong Provincial Department of Finance, critical guarantee for successful project application and implementation

发展展望
Development Outlook

深远海风电规模化开发
Large-scale deep-sea wind development

海上风电+储能+制氢融合
Wind + Storage + Hydrogen integration

数字化运维持续升级
AI predictive maintenance & unmanned inspection

推动阳江风电产业集群发展
Promoting Yangjiang Wind Power Industry Cluster

风电+算力（电算融合）：绿电直供数据中心
Wind + Computing: green power to data centers

风电+渔业（风渔融合）：海上风电与海洋牧场协同
Wind + Fishery: synergy with marine aquaculture



谢谢

Thank You