英语 | English

鸿鲲 新能源

Hongkun New Energy (Hainan) Co., Ltd.

# High Power and High Efficiency Magnetically Coupled Permanent Magnet Direct-Drive Water Injection System

**Annual Power Savings**
**4,000,000+** kWh

**Annual Carbon Reduction**
**3,000+** $tCO_2$

**Annual Power Cost Savings**
**800,000+** €

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# COMPANY PROFILE

Our core founding team originates from a national key defense research institute and has long been deeply engaged in the field of magnetic technologies. Building upon years of accumulated R&D expertise, we precisely align with industry needs to deliver innovative, high-performance technical solutions. Our R&D achievements have filled critical technology gaps in both the domestic market and the broader industry.

## Numerous innovation awards; a leading position in the industry

- 2025 10th 'Maker China' Innovation & Entrepreneurship Competition: 1st Prize (Provincial), 3rd Prize (National), Top 50 Enterprises (National).
- 2025 National Carbon Neutrality Awards: Gold Medal
- 2024 Science & Technology Innovation Competition: 1st Prize
- 2025 National High-Tech Enterprise Certified




# HONORS AND QUALIFICATIONS

Invention Patents

**x4**

Utility Model Patents

**x17**

Software Copyrights

**x5**

Industrial Design Patent

**x1**

ISO System Certification

**x3**








## Current Status of Water Injection Systems in Domestic Oilfields

### Reciprocating Plunger Pump

(Applicable Scenarios for <100 $m^3/h$)

**Adv.** Efficiency: 70% - 80% (Typical)

**Disadv.** Small flow capacity and significant transmission losses.

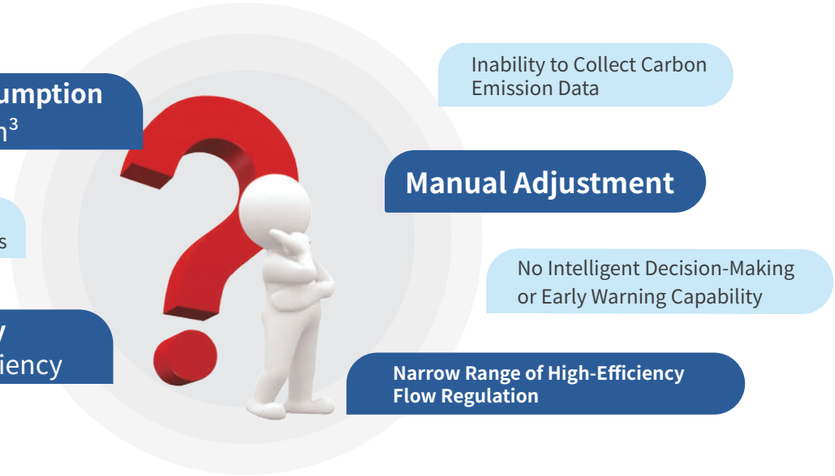
### Multistage Centrifugal Pump

(Applicable Scenarios for >100 $m^3/h$)

**Adv.** Large flow capacity

**Disadv.** Relatively low efficiency, with unit energy efficiency typically ranging from 50% to 70%.

## Pain Point Analysis




- The current operation of large centrifugal pump water injection systems in oilfields exhibits relatively high energy consumption, with an average specific energy consumption of 6.0 $kWh/m^3$. Some older or less efficient equipment exhibits even higher consumption, reaching up to 10 $kWh/m^3$.
- Based on the calculation of a single system' s water injection capacity of 250 $m^3/h$ and annual operation of 330 days, the annual water injection volume can reach 2 million $m^3$, resulting in an annual power consumption of up to 13 million kWh and a significant energy cost.



# SOLUTIONS

High-Power, High-Efficiency
Magnetically Coupled Permanent Magnet Direct-Drive Water Injection System

## Pioneering Across the Country

### High-Pressure, Large-Capacity Plunger Pump

- Plunger with self-priming lubrication and automatic centering
- Valve assembly with automatic rotation to optimize flow paths
- Crankshaft designed and machined for large thrust at multiple bends

## Pioneering Across the Country

### High-Efficiency PMSM Direct Drive

- Energy recovery from cyclic impact loads
- Integrated high-power permanent magnet drive and transmission coupling technology

## Pioneering in the Industry

### AI-Driven Permanent Magnet Servo Control

- Coupled control using multiple control algorithms
- AI-based global precision intelligent control technology

# ENERGY & EMISSION REDUCTION

## Single Unit

Multiple tests conducted by the CNPC Energy Saving Monitoring Center compared with conventional units / traditional units

## The energy-saving rate exceeds 30%

### Significant Energy Efficiency Improvement

The average system efficiency has increased from 57% to over 90%, achieving an improvement of more than 33%.

### Annual Electricity Savings

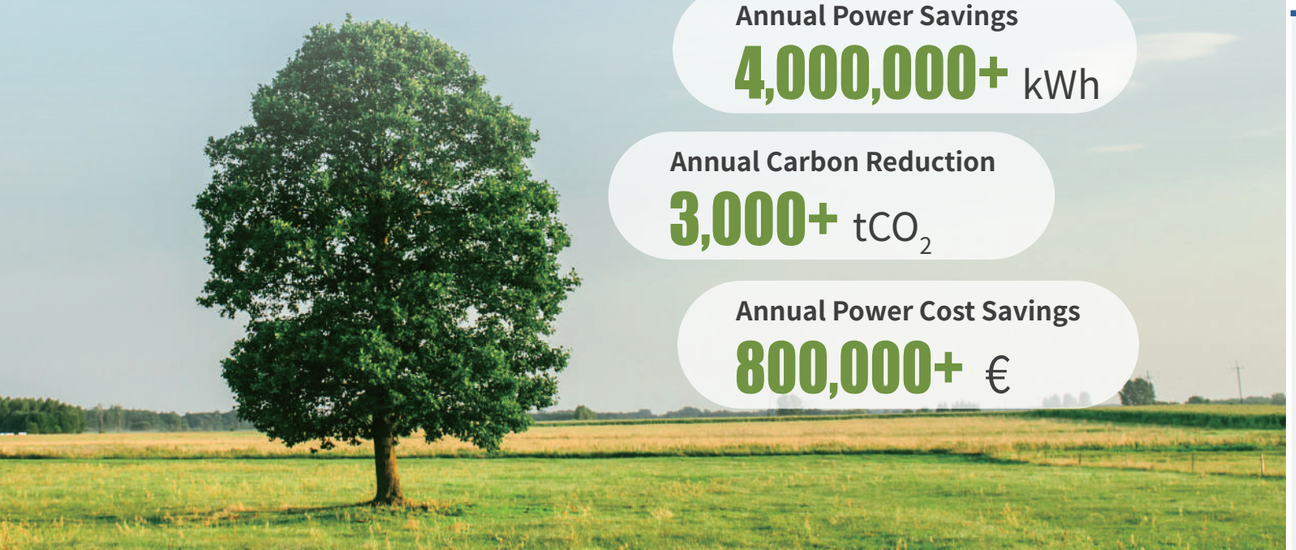
Approximately 4 million kWh of electricity saved annually, resulting in electricity cost savings of over 800.000 €.

### Contribution to Carbon Neutrality

A single unit reduces $CO_2$ emissions by 3,000+ tons annually.

### Payback Period

Only 1-3 Years



**Annual Power Savings**
**4,000,000+** kWh

**Annual Carbon Reduction**
**3,000+** $tCO_2$

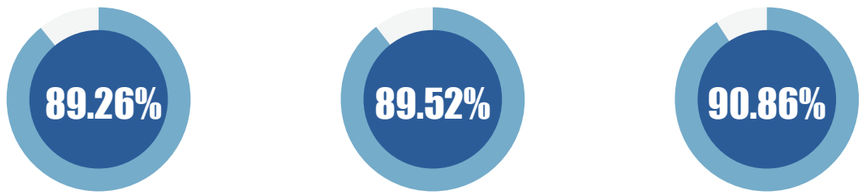
**Annual Power Cost Savings**
**800,000+** €



# APPLICATION CASES

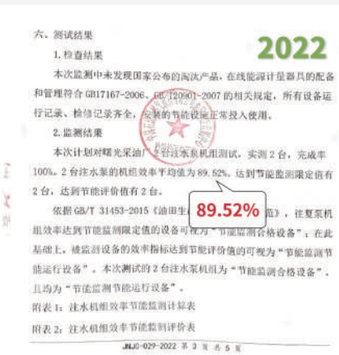
## CNPC Liaohe Oilfield

Two 1,400 kW water injection units were commissioned and underwent more than a dozen multi-party inspections over two years. In September 2023, they passed the acceptance tests at CNPC' s Liaohe Oilfield. The efficiency of the two units increased from below 57% before the retrofit to as high as 90% after the upgrade.

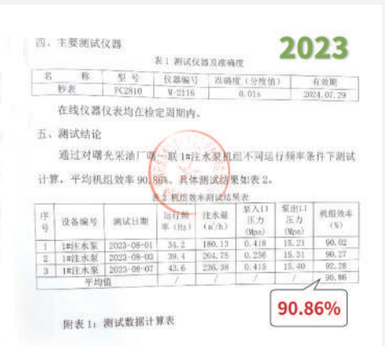



Efficiency Assessment in 2021

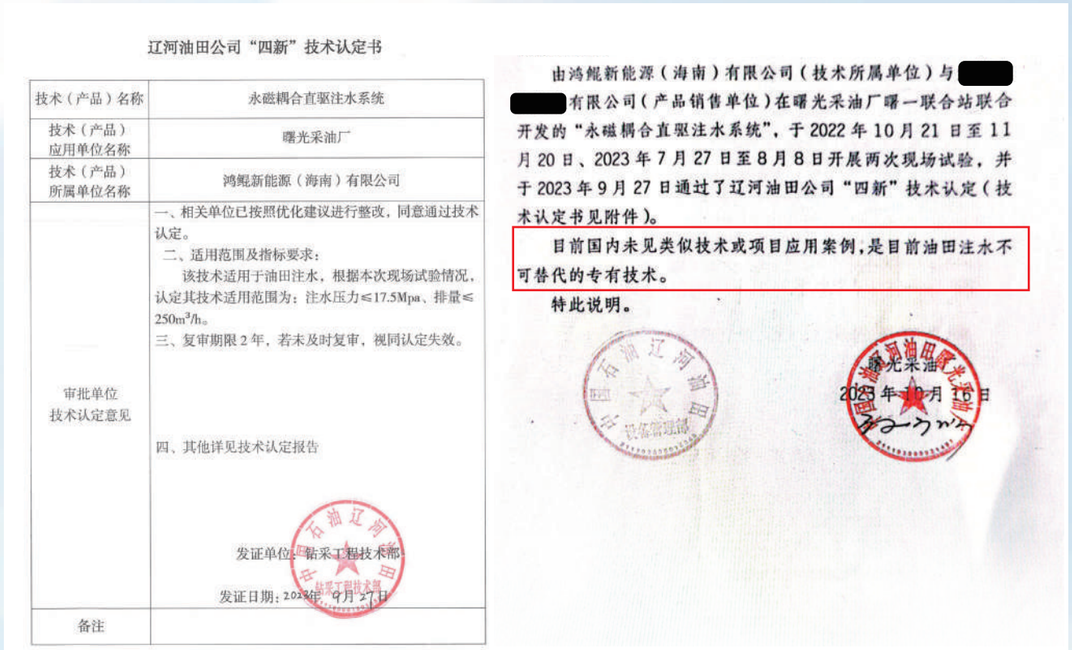

Average Efficiency Assessment in 2022




Average Efficiency Assessment in 2023



Endorsed by China National Petroleum Corporation (CNPC), the project outcomes are certified as "a domestically innovative and irreplaceable proprietary technology for oilfield water injection", which fills the long-existing gaps in industrial and domestic practices.



辽河油田公司“四新”技术认定书

| | |
|---|---|
| 技术（产品）名称 | 永磁耦合直驱注水系统 |
| 技术（产品）应用单位名称 | 曙光采油厂 |
| 技术（产品）所属单位名称 | 鸿鲲新能源（海南）有限公司 |
| 审批单位技术认定意见 | 一、相关单位已按照优化建议进行整改，同意通过技术认定。<br>二、适用范围及指标要求：<br>该技术适用于油田注水，根据本次现场试验情况，认定其技术适用范围为：注水压力≤17.5Mpa、排量≤250m³/h。<br>三、复审期限2年，若未及时复审，视同认定失效。<br>四、其他详见技术认定报告<br>发证单位：钻采工程技术部<br>发证日期：2023年9月27日 |
| 备注 | |

由鸿鲲新能源（海南）有限公司（技术所属单位）与[redacted]有限公司（产品销售单位）在曙光采油厂曙一联合站联合开发的“永磁耦合直驱注水系统”，于2022年10月21日至11月20日、2023年7月27日至8月8日开展两次现场试验，并于2023年9月27日通过了辽河油田公司“四新”技术认定（技术认定书见附件）。

目前国内未见类似技术或项目应用案例，是目前油田注水不可替代的专有技术。

特此说明。

曙光采油

2023年10月16日

## Technical Parameter Comparison

| Comparison | Technical Parameter Comparison | Permanent Magnet Coupled Direct-Drive Injection System |
|---|---|---|
| System Efficiency | 50%-70% | 89%-91% |
| High-Efficiency Flow Regulation | 10% | 70% |
| Flow and Pressure Regulation | Semi-Automatic | Fully Automatic – Adaptive Pressure Control |
| Multi-Pump Parallel Operation | Manual Pressure Adjustment – Low Accuracy | Automatic Pressure Adjustment – High Accuracy |
| System Rotational Speed | 3000RPM | 30-250RPM |
| Start-Up Method | Direct Full-Speed Start | Soft Start (Variable Speed) |
| Industrial IoT Integration | None / Partial | Full Capability |
| Unmanned Operation | None | Remote Start/Stop, Fault Self-Diagnosis, Enabling Unmanned Operation |



# ENERGY-SAVING COMPARISON

Two Permanent Magnet Coupled Direct-Drive Water Injection Systems

## CNPC Liaohe Oilfield*

| CNPC Liaohe Oilfield | 2021/11 | | 2022/11 | 2023/8 | Remarks |
|---|---|---|---|---|---|
| | Original | Post-Retrofit | Re-Test | Final Test | |
| Average Unit Efficiency | 55.82% | 89.20% | 89.52% | 90.86% | |
| Efficiency Improvement | - | **33.38%** | **33.70%** | **35.04%** | |
| Energy Savings Rate | - | **42.87%** | **44.72%** | **46.49%** | |
| Average Specific Energy Consumption (kWh/m³) | 8.27 | **4.725** | **4.572** | **4.531** | |
| Total Injected Water (10,000 m³) | 400 | 400 | 400 | 400 | 330 d / 8000 h |
| Annual Electricity Consumption (10,000 kWh) | 3380 | 1890 | 1828 | 1812 | |
| Annual Electricity Savings (10,000 kWh) | - | **1418** | **1479** | **1496** | |
| Annual Electricity Cost Savings (10,000 CNY) | - | **1234** | **1287** | **1301** | Power cost: ¥0.87 per kWh |
| Annual Carbon Emission Reduction ($tCO_2$) | - | **8224** | **8579** | **8674** | Carbon emission factor: 0.580 $tCO_2$/MWh |

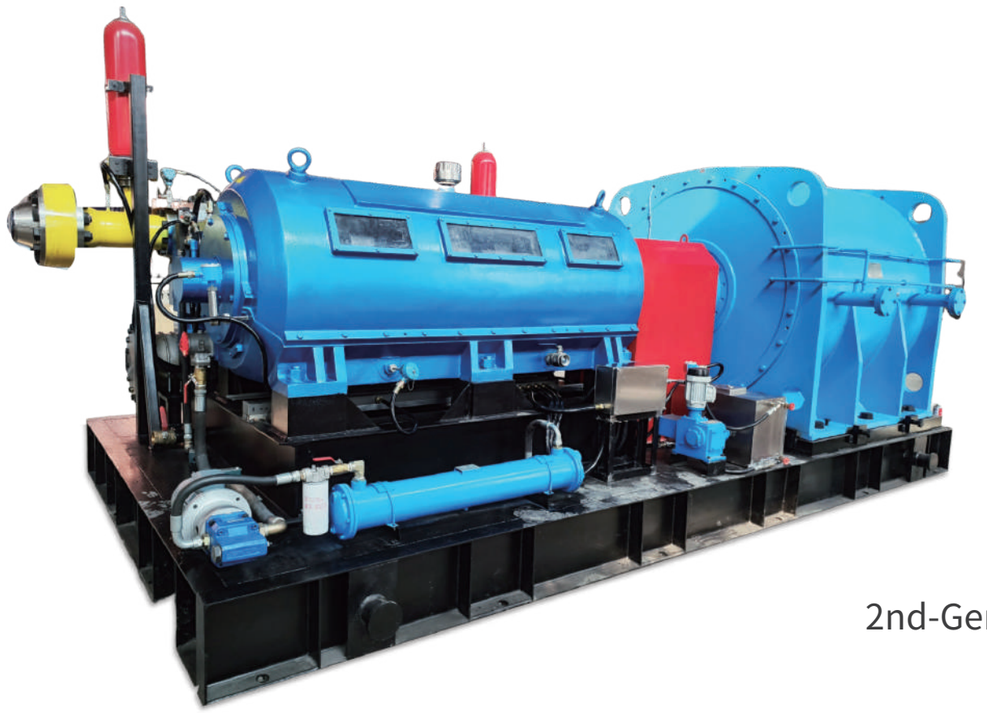
***Condition**: Flow Rate: 250 m³/h; Annual Operating Hours: 8000hrs; Pressure: 16 MPa, Power: 1400 kW

# MAIN PRODUCTS

## Permanent Magnet Coupling Direct-Drive Water Injection System

Project Background: In modern oilfield operations, water needs to be injected into wells under high pressure to fracture the oil-bearing formation and enhance oil recovery. This process consumes a significant amount of energy, with current water injection systems accounting for approximately 40% of total oilfield production energy consumption. Existing pressurized water injection systems mainly combine high-pressure, small-displacement plunger pumps and medium-to-high-pressure, large-displacement centrifugal pumps. The former is limited by low flow rate and average efficiency, while the latter, despite high flow, suffers from low efficiency. Due to these technical challenges, there is currently a global gap in high-efficiency, high-pressure, large-displacement plunger pump water injection systems.

This product has successfully overcome technical challenge: the high-pressure, large-displacement plunger pump. According to the 2018 national standard “Reciprocating Pumps”, the maximum power of plunger pumps commonly used for oilfield water injection is approximately 800 kW. Our company has completed the development of a 2,000 kW unit, with actual deployment of a 1,400 kW – 16 MPa – 250 $m^3$/h high-pressure, large-displacement, high-efficiency permanent magnet coupled direct-drive plunger pump water injection unit at CNPC’ s Liaohe Oilfield. Before the retrofit, the unit efficiency was below 60%, and after the upgrade, efficiency reached approximately 90%, filling the domestic and industry-wide application gap in the 800–2,000 kW range.



2nd-Gen



## Product Specification Sheet

| Product Model | YOZZ-150 | YOZZ-200 | YOZZ-250 | YOZZ-300 |
|---|---|---|---|---|
| Max Power(kW) | ~1100 | ~1400 | ~1700 | ~2000 |
| Flow Rate($m^3$/h) | ~150 | ~200 | ~250 | ~300 |
| Flow Regulation Range($m^3$/h) | 45-150 | 60-200 | 75-250 | 90-300 |
| Max Pressure(MPa) | ~30 | ~30 | ~25 | ~25 |
| Voltage(V) | 6k / 10k | 6k / 10k | 6k / 10k | 6k / 10k |
| Weight(t) | 28 | 32 | 35 | 38 |
| Dimensions(m) (L*W*H) | 5*2.8*2.6 | 6*3*2.8 | 6*3*2.8 | 6*3*2.8 |

Supports Customized Models

## Efficiency Improvement Comparison

| Category | Efficiency Improvement Comparison | Efficiency Improvement Comparison | Small-Displacement Plunger Pump Injection System | Permanent Magnet Coupled Direct-Drive Injection System |
|---|---|---|---|---|
| Component Efficiency | Drive-End Efficiency (%) | 95 | 85-93 | **97** |
| | Pump-End Efficiency (%) | 70-78 | 85-88 | **95** |
| | Control-End Efficiency (%) | 80-95 | 95 | **97** |
| Overall System Efficiency (%) | | 50-70 | 70-80 | **89-91** |
| Specific Energy Consumption (kWh/$m^3$) (16MPa、250$m^3$/h) | | 6.5 | 5.5 | **4.5** |
| Maximum Unit Flow ($m^3$) | | **500+** | 100 | 300+ |
| Synchronous Switching Technology (The system features one-to-multi control capability) | | × | × | ✓ * |
| High-Efficiency Flow Range (%) | | 10 | 30 | **70** |

*The synchronous switching technology breaks model limitations, supporting the hybrid parallel operation of N units with different specifications to easily construct a large-flow water supply system.

# INSTALLATION ADVANTAGES

## Skid-Mounted Equipment

### Fast Installation

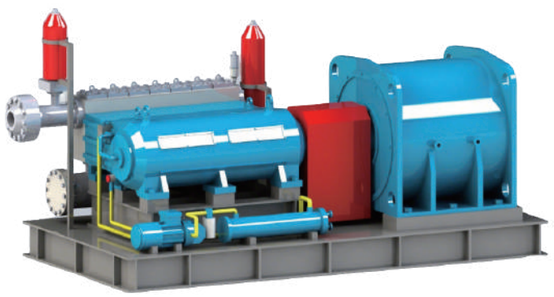
Factory prefabricated, ready for on-site assembly, achieving a 50% faster commissioning speed.

### Stable Quality

Precision-engineered in the factory, fully tested, and ensures more reliable operation.

### Cost Advantage

Reduced on-site investment, resulting in significantly lower overall costs.



## Annual Electricity Cost and Savings Calculation for a Single Permanent Magnet Coupled Direct-Drive Water Injection Unit (Multi-Country Comparison)

1.**Condition**: Flow Rate: 250 $m^3/h$; Annual Operating Hours: 8000hrs; Pressure: 16 MPa, Power: 1400 kW
Annual Water Injection Volume = 250 $m^3/h$ × 8,000 h = 2 million $m^3$/year
2.Electricity Price Standards by Country: China (0,076-0,115 €/kWh) , Europe (0,180-0,280 €/kWh) , USA (0,120-0,180 €/kWh)

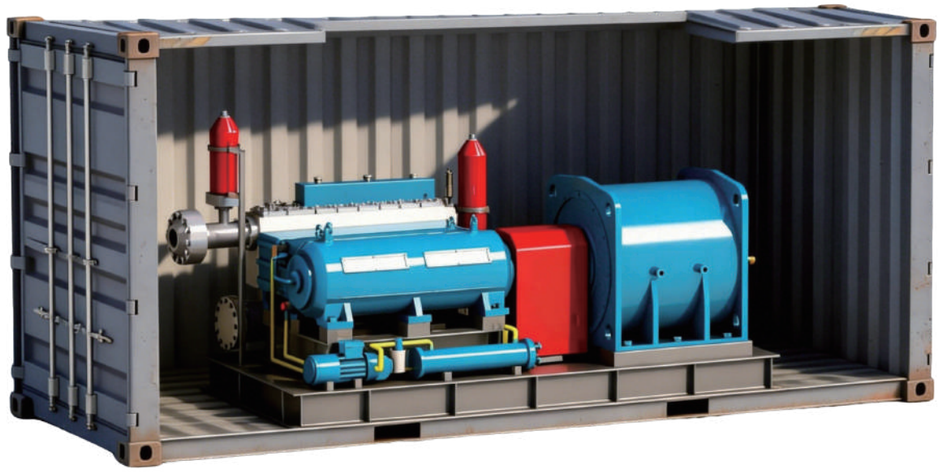
Currency Unit: Euro

| Water Injection Consumption (Current → Benchmark) | Decreased Consumption ($kWh/m^3$) | Annual Power Savings (MWh) | Annual Cost Savings (k€) | | |
|---|---|---|---|---|---|
| | | | China | Europe | USA |
| 6.0 → 4.5 | 1.5 | 3,000 | 228 - 345 | 540 - 840 | 360 - 540 |
| 6.5 → 4.5 | 2.0 | 4,000 | 304 - 460 | 720 - 1,120 | 480 - 720 |
| 7.0 → 4.5 | 2.5 | 5,000 | 380 - 575 | 900 - 1,400 | 600 - 900 |
| 7.5 → 4.5 | 3.0 | 6,000 | 456 - 690 | 1,080 - 1,680 | 720 - 1,080 |
| 8.0 → 4.5 | 3.5 | 7,000 | 532 - 805 | 1,260 - 1,960 | 840 - 1,260 |
| 8.5 → 4.5 | 4.0 | 8,000 | 608 - 920 | 1,440 - 2,240 | 960 - 1,440 |
| 9.0 → 4.5 | 4.5 | 9,000 | 684 - 1,035 | 1,620 - 2,520 | 1,080 - 1,620 |
| 9.5 → 4.5 | 5.0 | 10,000 | 760 - 1,150 | 1,800 - 2,800 | 1,200 - 1,800 |
| 10.0 → 4.5 | 5.5 | 11,000 | 836 - 1,265 | 1,980 - 3,080 | 1,320 - 1,980 |

**Remarks** 1.Annual Electricity Savings = Reduction in Specific Energy Consumption × 2 million $m^3$, directly reflecting the electricity saved as a result of reduced unit consumption.
2.Cost Savings: When the specific energy consumption decreases to 4.5 $kWh/m^3$, the annual electricity cost savings per unit are calculated within a specified range



# EASY TO TRANSPORT



## Annual Electricity Cost and Savings Calculation for a Single Permanent Magnet Coupled Direct-Drive Water Injection Unit (Multi-Country Comparison)

1.Carbon Emission Calculation Basis: Annual Electricity Savings × Thermal Power Carbon Emission Factor (0.785 $tCO_2$ per 10,000 kWh)
2.Carbon Tax Standards by Country: China (¥120/$tCO_2$), Europe (€80/$tCO_2$e), USA (€60/$tCO_2$e )
3.Equivalent Carbon Tax = Carbon Emissions Saved × Applicable Carbon Tax Rate by Country/Region

Currency Unit: Euro

| Water Injection Consumption (Current → Benchmark) | Decreased Consumption ($kWh/m^3$) | Annual Carbon Emission Reduction ($tCO_2e$) | Annual Carbon Tax Savings (€) | | |
|---|---|---|---|---|---|
| | | | China | Europe | USA |
| 6.0 → 4.5 | 1.5 | 1,749 | 2,676 | 14,867 | 10,494 |
| 6.5 → 4.5 | 2.0 | 2,332 | 3,568 | 19,822 | 13,992 |
| 7.0 → 4.5 | 2.5 | 2,915 | 4,460 | 24,778 | 17,490 |
| 7.5 → 4.5 | 3.0 | 3,498 | 5,352 | 29,733 | 20,988 |
| 8.0 → 4.5 | 3.5 | 4,081 | 6,244 | 34,689 | 24,486 |
| 8.5 → 4.5 | 4.0 | 4,664 | 7,136 | 39,644 | 27,984 |
| 9.0 → 4.5 | 4.5 | 5,247 | 8,028 | 44,599 | 31,482 |
| 9.5 → 4.5 | 5.0 | 5,830 | 8,920 | 49,555 | 34,980 |
| 10.0 → 4.5 | 5.5 | 6,413 | 9,812 | 54,511 | 38,478 |

**Remarks** 1.National carbon tax standards: published industry references; actual taxes subject to regional policies, reduction periods, etc.
2.Exchange rates: for calculation reference; actual conversions based on prevailing rates.
3.Equivalent carbon tax: quantifies emission reduction benefits, key for project reduction effectiveness evaluation.

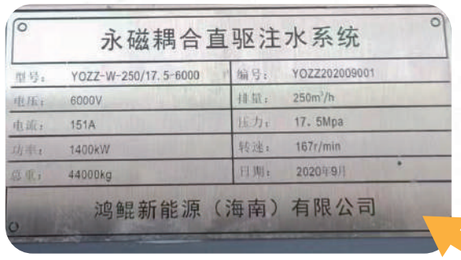
*The above estimates are based on publicly available data; actual results may vary depending on site conditions and implementation factors.

## 《用户真实反馈》

经济效益对比

根据现场运行情况，2024 年 1 月-12 月离心泵综合单耗为 5.84 度/方。改造后永磁耦合直驱注水系统的平均机组平均注水单耗为 4.49 度/方，单耗对比降低 1.35 度/方，2024 年全年离心泵注水 412 万方，如果生产调整可以使用柱塞泵注水，一年可节约电量 556 万度万，电价 0.87 元/度为基础数据计算，节约运行费用为 483.89 万元。

辽河油田曙光采油厂
2025 年 01 月 10 日




1st-Gen

## CNPC《Customer Testimonials》

### Economic Benefit Comparison

Based on on-site operational data from January to December 2024, the comprehensive specific energy consumption of the centrifugal pumps was 5.84 kWh/m³. After the transformation, the average water injection specific consumption of the permanent magnet coupled direct-drive water injection system was reduced to 4.49 kWh/m³, representing a decrease of 1.35 kWh/m³.

With a total water injection volume of 4.12 million m³ using centrifugal pumps in 2024, if production adjustments allow the use of plunger pumps, the annual electricity savings would reach 5.56 million kWh. Based on an electricity price of 0.87 CNY/kWh, the estimated annual savings in operational costs would be 4.8389 million CNY.

CNPC-Liaohe Oilfield Shuguang Oil Production Plant

2025.01.10

## MAINTENANCE

◎ Major maintenance cycle: 20,000 hours

◎ Minor maintenance cycle: 1.5-2.5x longer than national standard

CNPC

# CNPC Oilfield Energy Conservation Monitoring Center
# 2021 Test Report

五、测试结论

实施的永磁耦合直驱注水系统项目在曙光采油厂曙一联1#、4#注水泵与改造前曙一联2#、3#注水泵进行机组效率对比测试，通过现场的测试计算，在本次测试条件下，改造前曙一联2#注水泵机组效率为57.01%，3#注水泵机组效率为54.62%，改造后曙一联1#注水泵机组效率为89.26%，4#注水泵机组效率为89.13%，节能效果因设备运行状态而异。

表2 测试数据汇总表

| 序号 | 运行工况 | 设备编号 | 机组效率（%） | 注水单耗（kW·h/m³） |
|---|---|---|---|---|
| 1 | 改造前 | 2#注水泵 | 57.01 | 8.14 |
| 2 | | 3#注水泵 | 54.62 | 8.40 |
| 3 | 改造后 | 1#注水泵 | 89.26 | 4.74 |
| 4 | | 4#注水泵 | 89.13 | 4.71 |

A comparative test on unit efficiency was conducted between the water injection pumps No.1 and No.4 of Oil Production Plant, which were upgraded with the implemented permanent magnet coupling direct-drive water injection system, and the original pumps No.2 and No.3 of the same oil gathering station before renovation.

Based on on-site test and calculation, under the conditions of this test, the unit efficiency of the original pump No.2 was 57.01% and that of pump No.3 was 54.62%. After the renovation, the unit efficiency of pump No.1 reached **89.26%** and that of pump No.4 reached **89.13%**.

The energy-saving effect varies depending on the operating status of the equipment.

## Test Data Summary Table

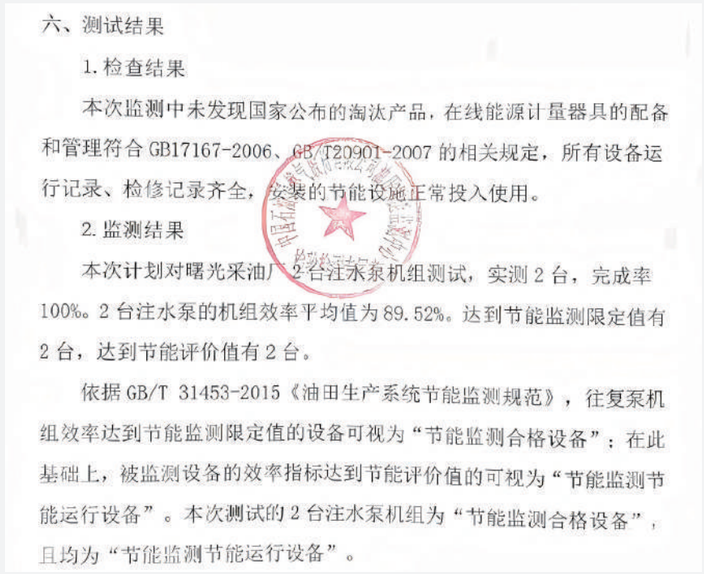
| 序号 No. | 运行工况 Operating Conditions | 设备编号 Equipment No. | 机组效率（%） Efficiency | 注水单耗（kW·h/m³） Specific Consumption |
|---|---|---|---|---|
| 1 | 改造前 Before Renovation | 2# | 57.01 | 8.14 |
| 2 | | 3# | 54.62 | 8.4 |
| 3 | 改造后 After Renovation | 1# | 89.26 | 4.74 |
| 4 | | 4# | 89.13 | 4.71 |

| 名称 Name | 单位 Unit | 数据来源 Data Source | 数据及计算结果 Data and Calculation Results | | | |
|---|---|---|---|---|---|---|
| 测试地点 Test Location | / | / | 曙光采油厂集输大队曙一联 CNPC-Liaohe | | | |
| 测试工况 Test Operating Conditions | / | / | 工况1 Operating Condition 1 | | 工况2 Operating Condition 2 | |
| 测试设备编号 Test Equipment No. | / | / | 2# | 3# | 1# | 4# |
| 注水泵类型 Pump Type | / | 铭牌 Nameplate | 多级离心泵 Multistage Centrifugal Pump | 多级离心泵 Multistage Centrifugal Pump | 柱塞泵 Plunger Pump | 柱塞泵 Plunger Pump |
| 注水泵型号 Model | / | 铭牌 Nameplate | DF320-165×11 | DF320-165×11 | GZB-7-250/17.5 | GZB-7-250/17.5 |
| 泵额定流量 Flow Rate | $m^3/h$ | 铭牌 Nameplate | 320 | 320 | 250 | 250 |
| 泵额定扬程 Head | m | 铭牌 Nameplate | 1810 | 1810 | 1750 | 1750 |
| 泵额定效率 Efficiency | % | 铭牌 Nameplate | 77 | 77 | 96 | 96 |
| 泵额定转数 Rotational Speed | r/min | 铭牌 Nameplate | 2985 | 2985 | 167 | 167 |
| 电机型号 Motor Model | / | 铭牌 Nameplate | YK2240-2/990 | YK2200-2/1060 | YCOHZQ-1400 -167-6000 | YCOHZQ-1400 -167-6000 |
| 电机额定功率 Motor Rated Power | kW | 铭牌 Nameplate | 2240 | 2200 | 1400 | 1400 |
| 电机额定电流 Motor Rated Current | A | 铭牌 Nameplate | 240 | 242 | 151 | 151 |
| 电机额定电压 Motor Rated Voltage | V | 铭牌 Nameplate | 6000 | 6000 | 6000 | 6000 |
| 电机额定转速 Motor Rated Speed | r/min | 铭牌 Nameplate | 2984 | 2984 | 167 | 167 |
| 测试日期 Test Date | / | / | 2019/1/9 | | 2021/11/23 | |
| 额定频率 Rated Frequency | Hz | 铭牌 Nameplate | 50 | 100 | 50 | 50 |
| 运行频率 Operating Frequency | Hz | 测试 Test | 47.1 | 93 | 33.6 | 工频 Power Frequency |

| 名称<br>Name | 单位<br>Unit | 数据来源<br>Data Source | 数据及计算结果<br>Data and Calculation Results | | | |
|---|---|---|---|---|---|---|
| 电机输入有功功率<br>Motor Input Active Power | kW | 测试<br>Test | 1354.5 | 1401.75 | 804.8 | 1176.56 |
| 电机输入无功功率<br>Motor Input Reactive Power | kvar | 测试<br>Test | 354.59 | 372.25 | 220.48 | 559.13 |
| 电机输入视在功率<br>Motor Input Apparent Power | kVA | 测试<br>Test | 1400.14 | 1450.34 | 834.45 | 1302.66 |
| 功率因数<br>Power Factor | / | 测试<br>Test | 0.9674 | 0.9665 | 0.9645 | 0.9032 |
| 流量<br>Flow Rate | $m^3/h$ | 测试<br>Test | 166.3 | 166.9 | 169.8 | 250 |
| 泵入口压力<br>Inlet Pressure | MPa | 测试<br>Test | 0.085 | 0.085 | 0.079 | 0.079 |
| 泵出口压力<br>Outlet Pressure | MPa | 测试<br>Test | 16.8 | 16.6 | 15.31 | 15.18 |
| 泵进口能量<br>Inlet Energy | kW | 计算<br>Calculation | 3.93 | 3.94 | 3.73 | 5.49 |
| 泵出口能量<br>Outlet Energy | kW | 计算<br>Calculation | 776.07 | 769.59 | 722.12 | 1054.17 |
| 泵的输出功率<br>Output Power | kW | 计算<br>Calculation | 772.14 | 765.65 | 718.4 | 1048.68 |
| 注水单耗<br>Specific Consumption | $kW·h/m^3$ | 计算<br>Calculation | 8.14 | 8.4 | 4.74 | 4.71 |
| 注水泵机组效率<br>Pump Unit Efficiency | % | 计算<br>Calculation | 57.01 | 54.62 | 89.26 | 89.13 |
| 总输注水量<br>Volume | $m^3/h$ | 计算<br>Calculation | 333.2 | | 419.8 | |
| 总输入功率<br>Total Input Power | kW | 计算<br>Calculation | 2756.25 | | 1981.36 | |
| 总注水单耗<br>Total Specific Consumption | $kW·h/m^3$ | 计算<br>Calculation | 8.27 | | 4.72 | |

**Note:** Operating Condition 1 refers to the operation mode of three-phase asynchronous motor + multi-stage centrifugal pump;
Operating Condition 2 refers to the operation mode of permanent magnet coupling direct-drive system + plunger pump.

## 2022 Energy Conservation Monitoring Report



六、测试结果

1. 检查结果

本次监测中未发现国家公布的淘汰产品，在线能源计量器具的配备和管理符合 GB17167-2006、GB/T20901-2007 的相关规定，所有设备运行记录、检修记录齐全，安装的节能设施正常投入使用。

2. 监测结果

本次计划对曙光采油厂 2 台注水泵机组测试，实测 2 台，完成率 100%。2 台注水泵的机组效率平均值为 89.52%。达到节能监测限定值有 2 台，达到节能评价值有 2 台。

依据 GB/T 31453-2015《油田生产系统节能监测规范》，往复泵机组效率达到节能监测限定值的设备可视为“节能监测合格设备”；在此基础上，被监测设备的效率指标达到节能评价值的可视为“节能监测节能运行设备”。本次测试的 2 台注水泵机组为“节能监测合格设备”，且均为“节能监测节能运行设备”。

Test Results

1. Inspection Results

No obsolete products (as announced by the state) were found during this monitoring. The allocation and management of on-line energy metering instruments comply with the relevant provisions of GB17167-2006 and GB/T20901-2007. All equipment operation records and maintenance records are complete, and the installed energy-saving facilities are in normal operation.

2. Monitoring Results

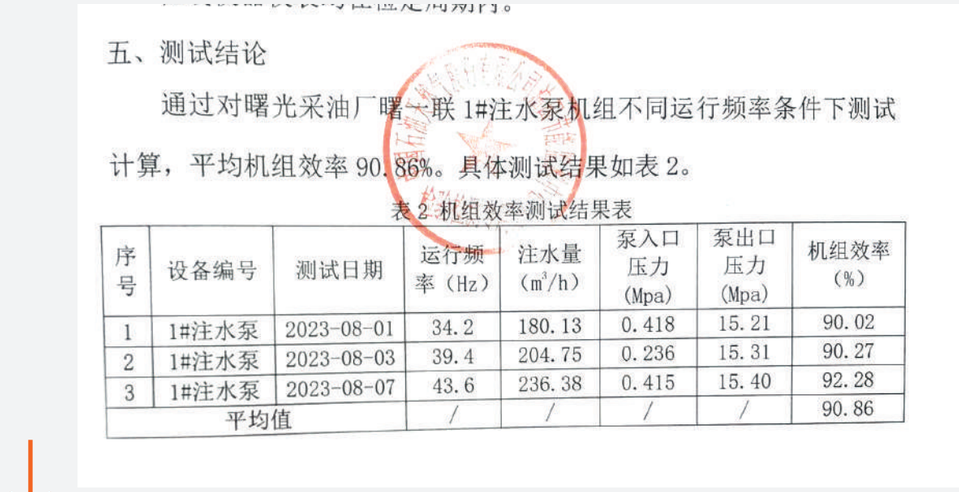
This plan aimed to test 2 water injection pump units at Shuguang Oil Production Plant; 2 units were actually tested, achieving a 100% completion rate. The average unit efficiency of the 2 water injection pumps is **89.52%**. Both units meet the energy-saving monitoring limit value, and both also meet the energy-saving evaluation value.

According to China National Standard GB/T 31453-2015 Energy-saving Monitoring Specification for Oilfield Production Systems: Reciprocating units whose efficiency meets the energy-saving monitoring limit value can be regarded as "energy-saving monitoring qualified equipment"; on this basis, monitored equipment whose efficiency index meets the energy-saving evaluation value can be regarded as "energy-saving monitoring energy-efficient operation equipment". The 2 water injection pump units tested this time are "energy-saving monitoring qualified equipment" and also qualify as "energy-saving monitoring energy-efficient operation equipment".

| 名称 Name | 单位 Unit | 数据来源 Data Source | 数据及计算结果 Data and Calculation Results | |
|---|---|---|---|---|
| 测试地点 Test Location | / | / | 曙光采油厂曙一联 CNPC-Liaohe | |
| 设备编号 Equipment No. | / | / | 1# | 4# |
| 测试日期 Test Date | / | / | 2022/11/11 | 2022/11/11 |
| 注水泵类型 Pump Type | / | 铭牌 Nameplate | 往复泵 Reciprocating Pump | 往复泵 Reciprocating Pump |
| 注水泵型号 Pump Model | / | 铭牌 Nameplate | GZB-7-250/17.5 | GZB-7-250/17.5 |
| 额定流量 Rated Flow Rate | $m^3/h$ | 铭牌 Nameplate | 250 | 250 |
| 额定排出压力 Rated Discharge Pressure | MPa | 铭牌 Nameplate | 17.5 | 17.5 |
| 柱塞直径 Plunger Diameter | mm | 铭牌 Nameplate | 150 | 150 |
| 电机名称 Motor Name | / | 铭牌 Nameplate | 永磁耦合直驱系统 Our product | 永磁耦合直驱系统 Our product |
| 电机型号 Motor Model | / | 铭牌 Nameplate | YCOHZQ-1400-167-6000 | YCOHZQ-1400-167-6000 |
| 电机额定功率 Motor Rated Power | kW | 铭牌 Nameplate | 1400 | 1400 |
| 电机额定电流 Motor Rated Current | A | 铭牌 Nameplate | 151 | 151 |
| 电机额定电压 Motor Rated Voltage | V | 铭牌 Nameplate | 6000 | 6000 |
| 电机额定转速 Motor Rated Speed | r/min | 铭牌 Nameplate | 167 | 167 |
| 运行频率 Operating Frequency | Hz | 测试 Test | 21.0 | 工频 Power Frequency |
| 电机有功功率 Motor Active Power | kW | 测试 Test | 546.00 | 1131.00 |
| 电机视在功率 Motor Apparent Power | kVA | 测试 Test | 578.44 | 1185.04 |
| 电机无功功率 Motor Reactive Power | kvar | 测试 Test | 178.49 | 353.78 |
| 功率因数 Power Factor | / | 测试 Test | 0.9505 | 0.9544 |
| 注水泵流量 Flow Rate | $m^3/h$ | 测试 Test | 121.13 | 244.00 |
| 注水泵入口压力 Inlet Pressure | MPa | 测试 Test | 0.43 | 0.31 |
| 注水泵出口压力 Outlet Pressure | MPa | 测试 Test | 15.10 | 15.10 |
| 注水泵输出功率 Output Power | kW | 计算 Calculation | 493.60 | 1002.43 |
| 注水泵机组效率 Unit Efficiency | % | 计算 Calculation | 90.40 | 88.63 |
| 注水单耗 Specific Consumption | $kW·h/m^3$ | 计算 Calculation | 4.508 | 4.635 |



## 2023 Energy Conservation Monitoring/Test Report



五、测试结论

通过对曙光采油厂曙一联 1#注水泵机组不同运行频率条件下测试计算，平均机组效率 90.86%。具体测试结果如表 2。

表 2 机组效率测试结果表

| 序号 | 设备编号 | 测试日期 | 运行频率（Hz） | 注水量（$m^3/h$） | 泵入口压力（Mpa） | 泵出口压力（Mpa） | 机组效率（%） |
|---|---|---|---|---|---|---|---|
| 1 | 1#注水泵 | 2023-08-01 | 34.2 | 180.13 | 0.418 | 15.21 | 90.02 |
| 2 | 1#注水泵 | 2023-08-03 | 39.4 | 204.75 | 0.236 | 15.31 | 90.27 |
| 3 | 1#注水泵 | 2023-08-07 | 43.6 | 236.38 | 0.415 | 15.40 | 92.28 |
| 平均值 | | | / | / | / | / | 90.86 |

Through on-site testing and calculation of the No.1 water injection pump unit of Shulian in Shuguang Oil Production Plant under different operating frequency conditions, the average unit efficiency reached **90.86%**. Specific test results are shown in Table 2.

### Table 2 Unit Efficiency Test Results

| 序号 No. | 设备编号 Equipment No. | 测试日期 Test Date | 运行频率（Hz） Operating Frequency | 注水量（$m^3/h$） Injection Rate | 泵入口压力（MPa） Inlet Pressure | 泵出口压力（MPa） Outlet Pressure | 机组效率（%） Efficiency |
|---|---|---|---|---|---|---|---|
| 1 | 1# | 2023/8/1 | 34.2 | 180.13 | 0.418 | 15.21 | 90.02 |
| 2 | 1# | 2023/8/3 | 39.4 | 204.75 | 0.236 | 15.31 | 90.27 |
| 3 | 1# | 2023/8/7 | 43.6 | 236.38 | 0.415 | 15.4 | 92.28 |
| 平均值 Average Value | | | / | / | / | / | 90.86 |

| 名称<br>Name | 单位<br>Unit | 数据来源<br>Data Source | 数据及计算结果<br>Data and Calculation Results | | |
|---|---|---|---|---|---|
| 测试地点<br>Test Location | / | / | 曙光采油厂曙一联<br>CNPC-Liaohe | | |
| 设备编号<br>Equipment No. | / | / | 1# | | |
| 注水泵类型<br>Pump Type | / | 铭牌<br>Nameplate | 往复泵<br>Reciprocating Pump | | |
| 注水泵型号<br>Pump Model | / | 铭牌<br>Nameplate | GZB-7-250/17.5 | | |
| 额定流量<br>Rated Flow Rate | $m^3/h$ | 铭牌<br>Nameplate | 250 | | |
| 额定排出压力<br>Rated Discharge Pressure | MPa | 铭牌<br>Nameplate | 17.5 | | |
| 柱塞直径<br>Plunger Diameter | mm | 铭牌<br>Nameplate | 150 | | |
| 电机名称<br>Motor Name | / | 铭牌<br>Nameplate | 永磁耦合直驱系统<br>Our product | | |
| 电机型号<br>Motor Model | / | 铭牌<br>Nameplate | YCOHZQ-1400-167-6000 | | |
| 电机额定功率<br>Motor Rated Power | kW | 铭牌<br>Nameplate | 1400 | | |
| 电机额定电流<br>Motor Rated Current | A | 铭牌<br>Nameplate | 151 | | |
| 电机额定电压<br>Motor Rated Voltage | V | 铭牌<br>Nameplate | 6000 | | |
| 电机额定转速<br>Motor Rated Speed | r/min | 铭牌<br>Nameplate | 167 | | |
| 测试日期<br>Test Date | / | / | 2023/8/1 | 2023/8/3 | 2023/8/7 |
| 运行频率<br>Operating Frequency | Hz | 测试<br>Test | 34.2 | 39.4 | 43.6 |
| 泵入口压力<br>Pump Inlet Pressure | MPa | 测试<br>Test | 0.418 | 0.236 | 0.415 |
| 泵出口压力<br>Pump Outlet Pressure | MPa | 测试<br>Test | 15.21 | 15.31 | 15.40 |
| 全天累计水量<br>Daily Cumulative Water Volume | $m^3$ | 测试<br>Test | 4323 | 4914 | 5673 |
| 全天累计电量<br>Daily Cumulative Power Consumption | kW·h | 测试<br>Test | 19731 | 22793 | 25590 |
| 泵流量<br>Pump Flow Rate | $m^3/h$ | 测试<br>Test | 180.13 | 204.75 | 236.38 |
| 泵输入功率<br>Pump Input Power | kW | 计算<br>Calculation | 822.13 | 949.71 | 1066.25 |
| 泵输出功率<br>Pump Output Power | kW | 计算<br>Calculation | 740.11 | 857.33 | 983.91 |
| 注水泵运行负荷率<br>Pump Operating Load Rate | % | 计算<br>Calculation | 72.05 | 81.90 | 94.55 |
| 机组效率<br>Unit Efficiency | % | 计算<br>Calculation | 90.02 | 90.27 | 92.28 |
| 平均机组效率<br>Average Unit Efficiency | % | 计算<br>Calculation | 90.86 | | |



# 永磁耦合直驱注水系统-单耗表

**Permanent Magnet Coupling Direct-Drive Water Injection System- Unit Consumption Table**

| Pressure<br>(MPa) | Flow Rate<br>($m^3/h$) | Specific Consumption<br>($kWh/m^3$) |
|---|---|---|
| 20 | 250 | **5.625** |
| 19 | 250 | **5.344** |
| 18 | 250 | **5.063** |
| 17 | 250 | **4.781** |
| 16 | 250 | **4.500** |
| 15 | 250 | **4.219** |
| 14 | 250 | **3.938** |
| 13 | 250 | **3.656** |
| 12 | 250 | **3.375** |
| 11 | 250 | **3.094** |
| 10 | 250 | **2.813** |
| 9 | 250 | **2.531** |
| 8 | 250 | **2.250** |

**公司网站**
Company Website

https://www.ecohongkun.com/

**能效计算**
Energy efficiency cal.

https://www.ecohongkun.com/tools

**可行性报告**
Feasibility Report

https://www.ecohongkun.com/request-analysis