

Integral high speed turbine

Green, efficient, low
carbon and smart



CONTENTS

- Manufacturing facilities
- Introduction to integral high-speed turbine
- Introduction to integrated high-speed turbine technology
- Applications





Factory



Workshops



Processing Equipment



NILES ZE1200 Forming gear grinding machine



Gantry machining center



HBM-4 Horizontal boring and milling machining center



Integrated gearbox efficiency test bench

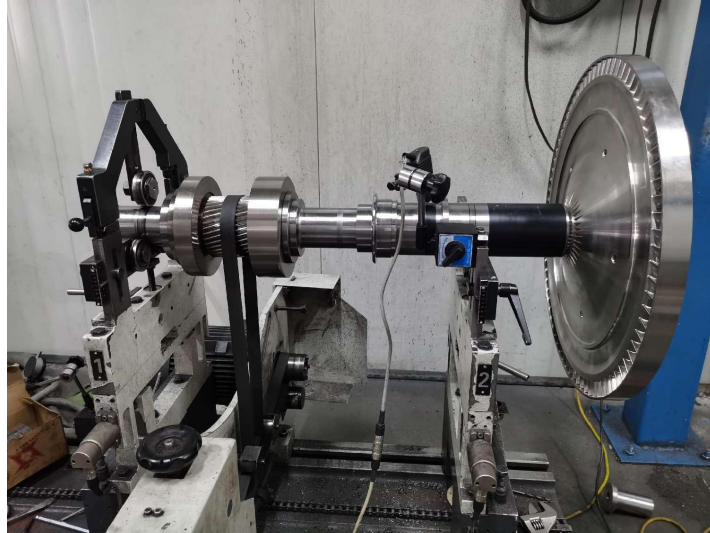


Three coordinate measuring room



NILES ZE800 Forming gear grinding machine

Processing Equipment



Dynamic balancing equipment accuracy G1



Testing platform



Assembly area



Testing platform



Integration area

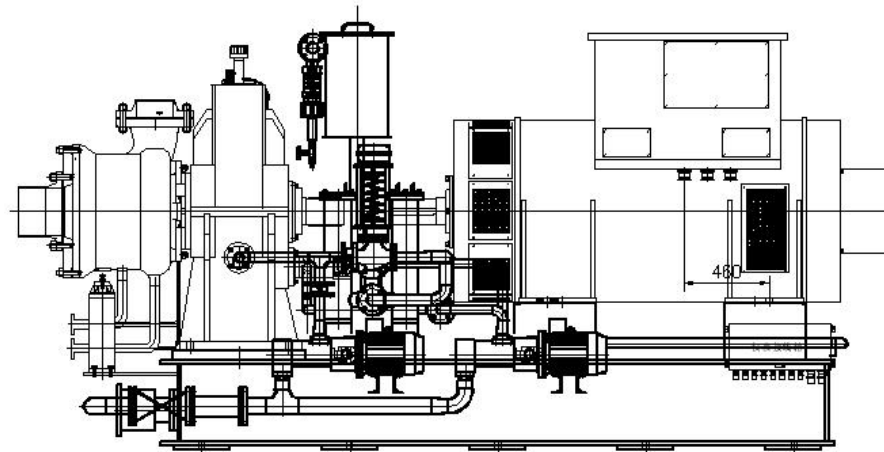
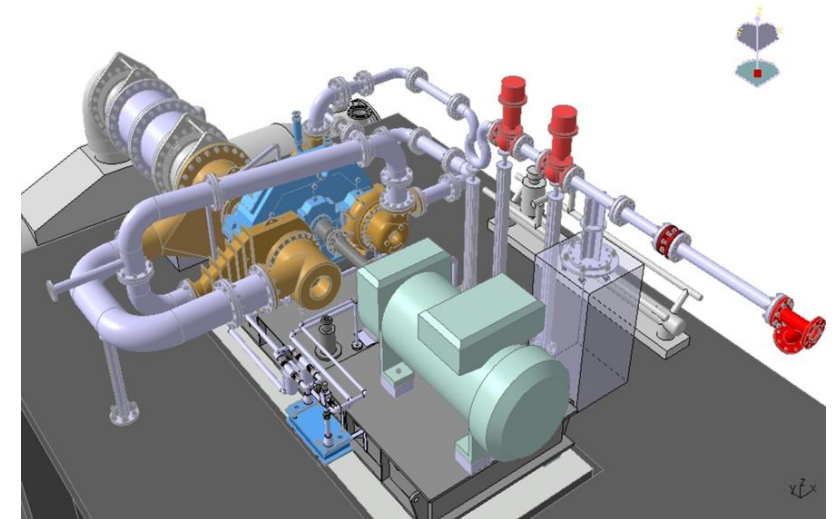
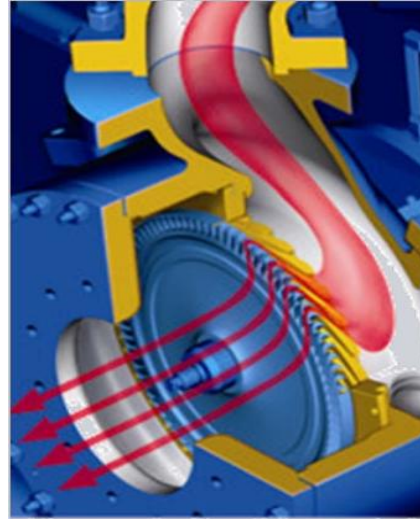
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Introduction to
integrated high-
speed turbine unit

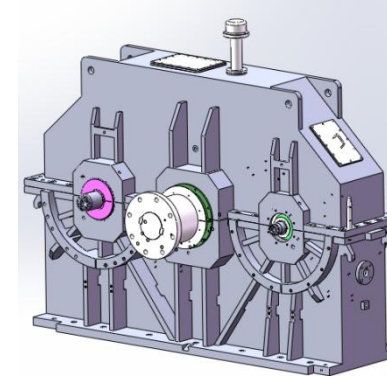
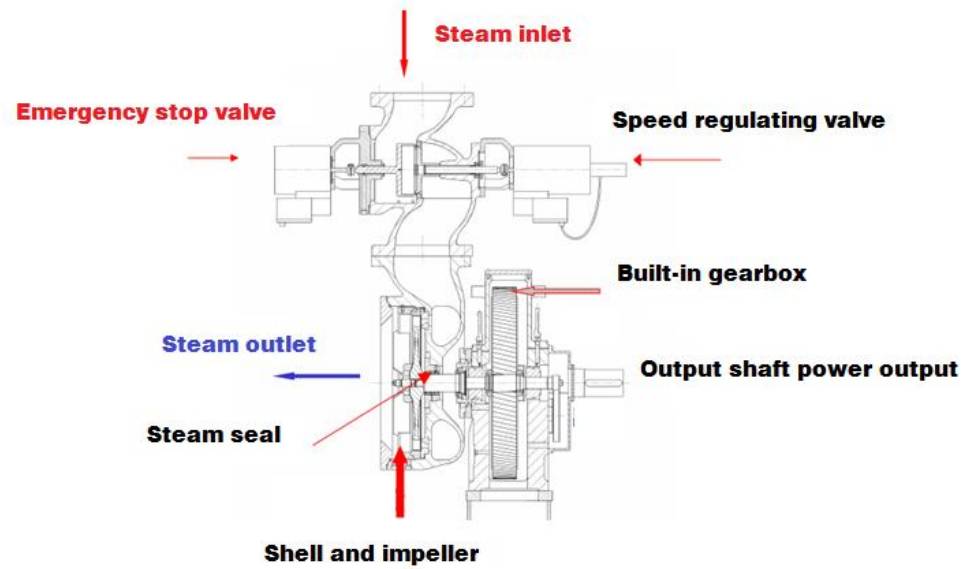
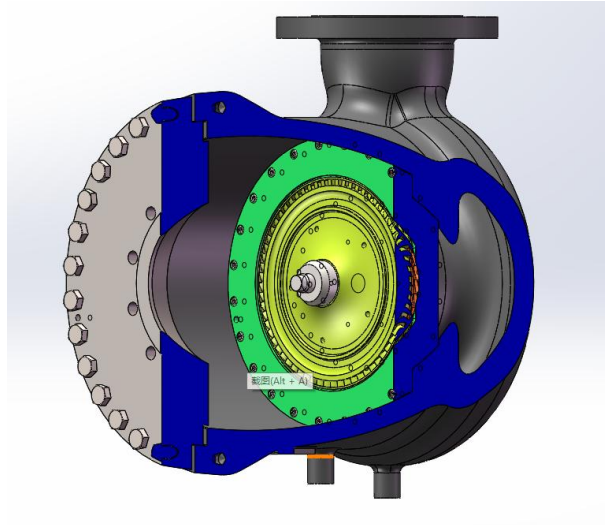
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High speed turbine principle

- High-speed turbine units use the changes in the speed of steam flowing in the turbine blade flow channels to convert energy.
- The steam expands in the flow part of the high-speed turbine unit to obtain kinetic energy, which drives the rotor and is converted into mechanical energy, which is then transferred to the generator through the gearbox to become electrical energy.



Schematic diagram of machine nose



High speed turbine

Integral gear transmission

Problems solved by integrated high-speed turbine

- ✓ Solve the problem of two middle and two low in the field of waste heat utilization.
 1. Medium and low pressure steam waste heat recovery and utilization
 2. Medium and low flow steam waste heat recovery and utilization
- ✓ Solve the problem of saturated water vapor and wet steam waste heat recovery
 1. Saturated water vapor has high humidity, and the final rotor of ordinary turbines is easily damaged.

Applicable heat source conditions

Steam pressure level: 0-20bar(A) Mpa (A)

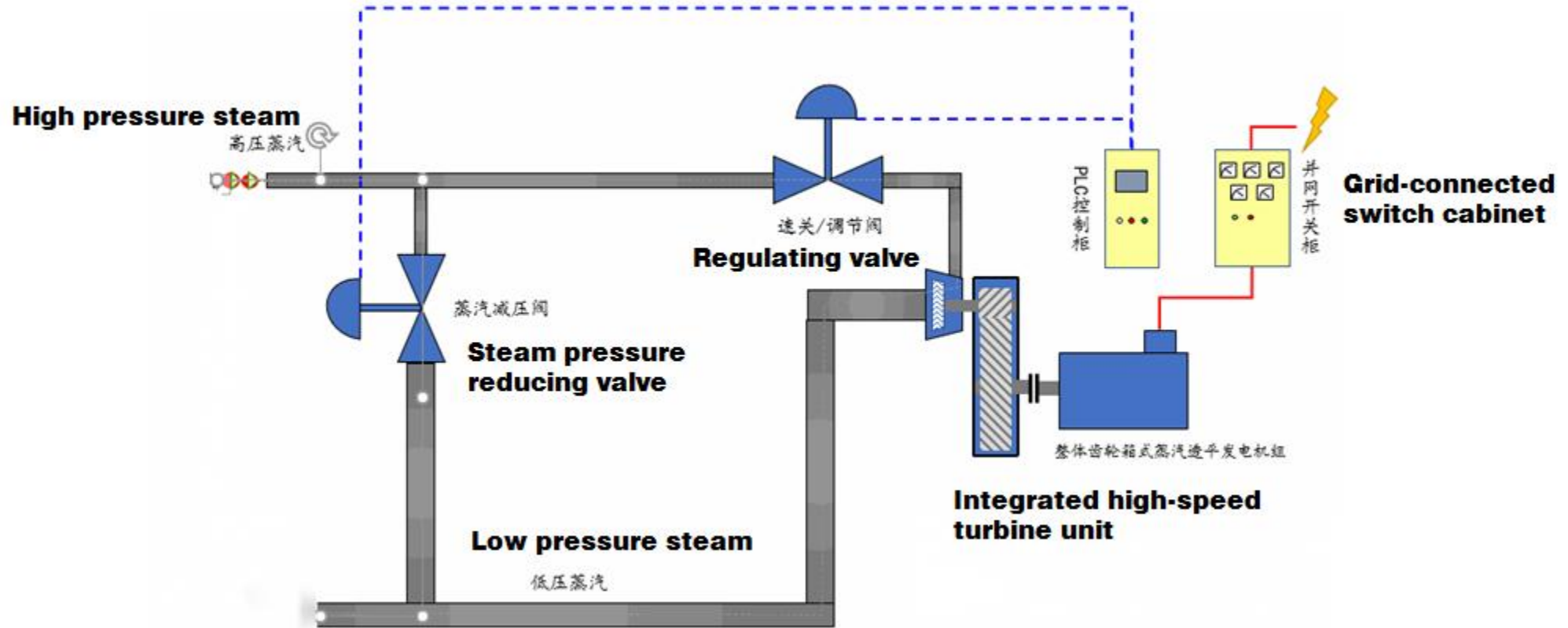
Heat source features:

- Low pressure and unstable
- The flow is small and unstable
- Mostly saturated steam

Integral high-speed turbine perfectly solves these difficulties!

Application 1

Replace pressure reducing valve, energy recovery and power generation
Recover residual pressure, eliminate peaks and flatten valleys, energy conversion and regeneration

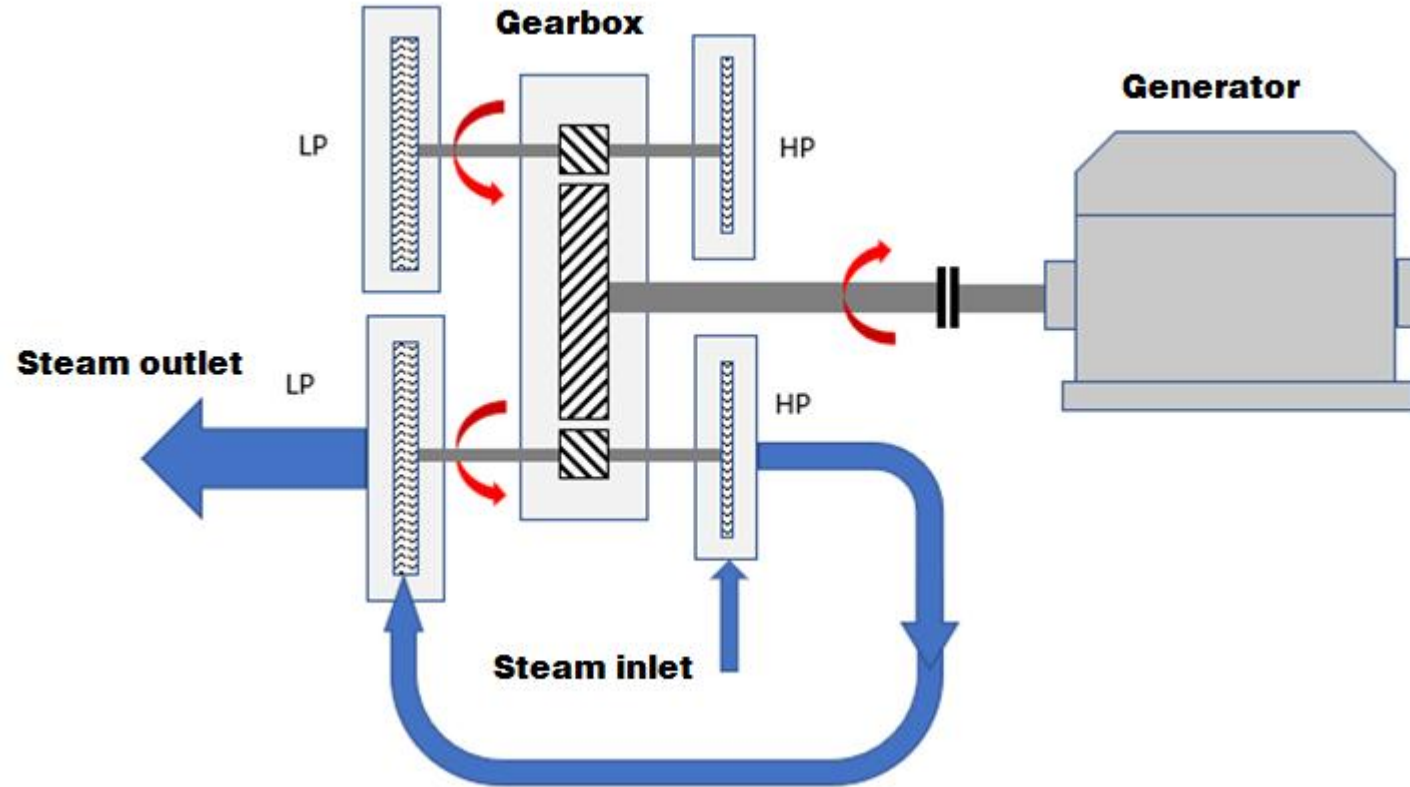


Back pressure unit

Application 2

Recovery of saturated steam and condensate water recovery

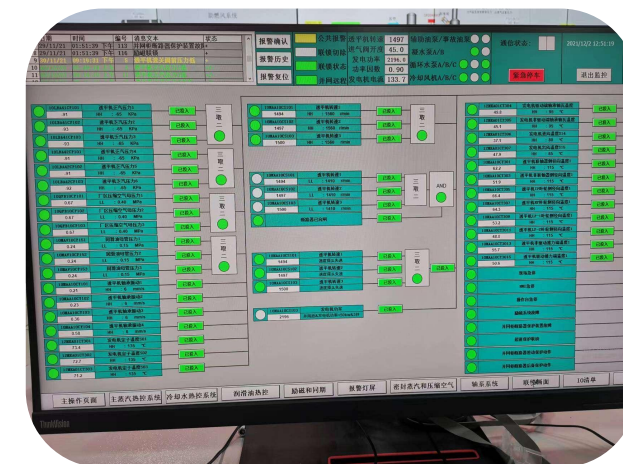
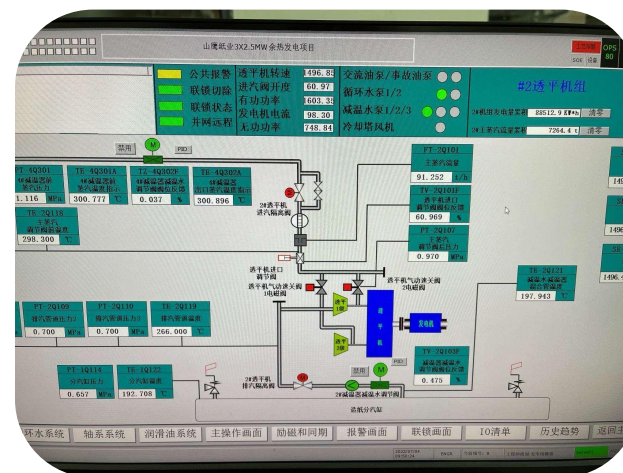
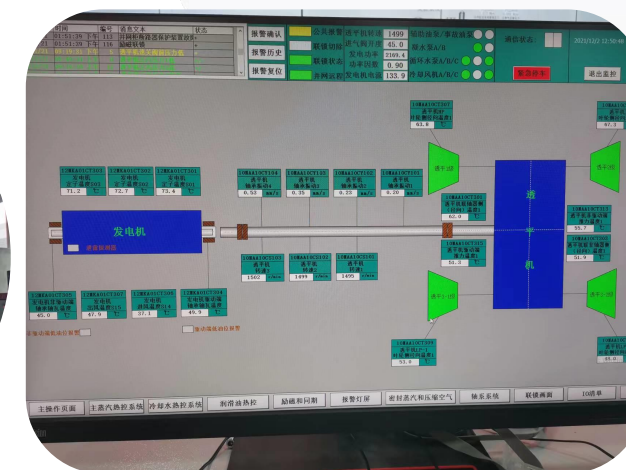
Recover waste heat, reduce emissions, and improve energy utilization



Pure condensation unit

Advantages of integral high-speed turbine unit

- Has wide adaptability to heat source and is suitable for both superheated steam and saturated steam.
- Customized design according to user's heat source parameters, with high operating efficiency.
- The speed of each level can be freely configured, and the free enthalpy drop of each level can adapt to the steam flow fluctuation range of 20%-110%. It operates under variable working conditions and has strong adaptability.
- The impeller speed is high (8000 rpm-22000 rpm) and the energy conversion efficiency is high.
- Skid-mounted design, easy installation, small footprint, saving space in the factory.
- It has a high automation for easy start and stop. The power supply can be started within 10 minutes in the cold state and 1 minute in the hot state. There is no need for long warm-up like conventional steam turbines.
- The unit operates smoothly, with small vibration and low noise.
- The unit maintenance technology and equipment requirements are low, no professional team and site equipment are required to maintain, and there will be no major repairs within 10 years of normal operation.



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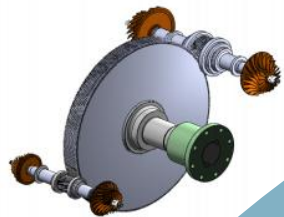
Introduction to
integrated high-speed
turbine unit technology

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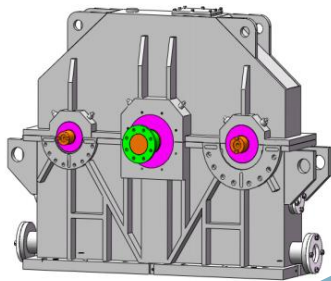
**Original technology,
independent and controllable**

Technological evolution process

High-precision
gear transmission
technology



Integral gear
transmission technology



High-speed powertrain technology

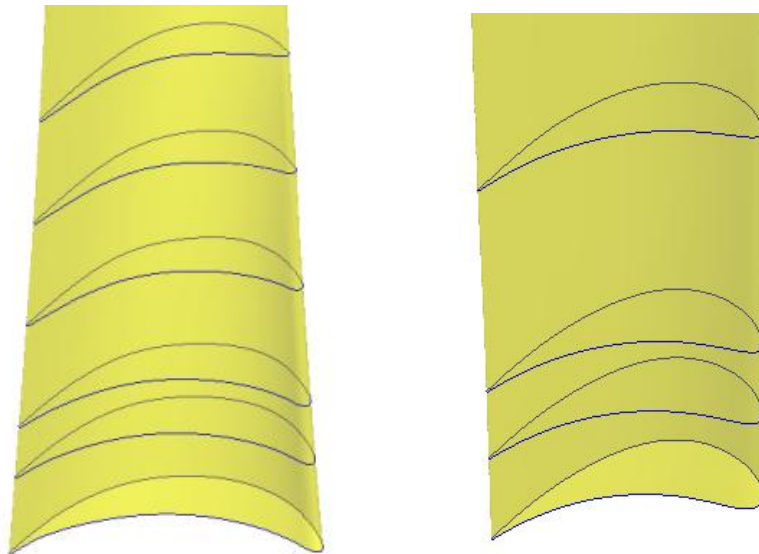
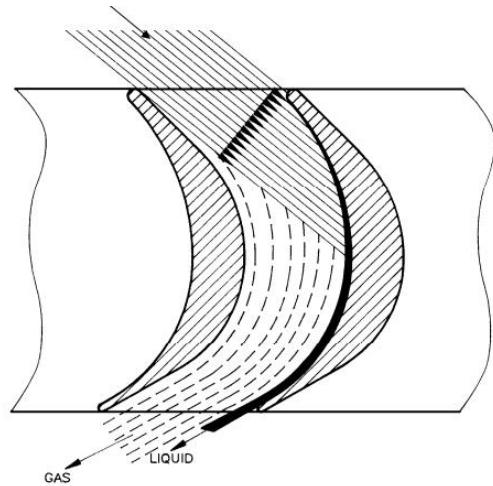
High-speed turbine power
generation technology



Machine integration technology

Independent research and development- impulsive blade design

Air flow from the nozzle (moisture, small droplets)

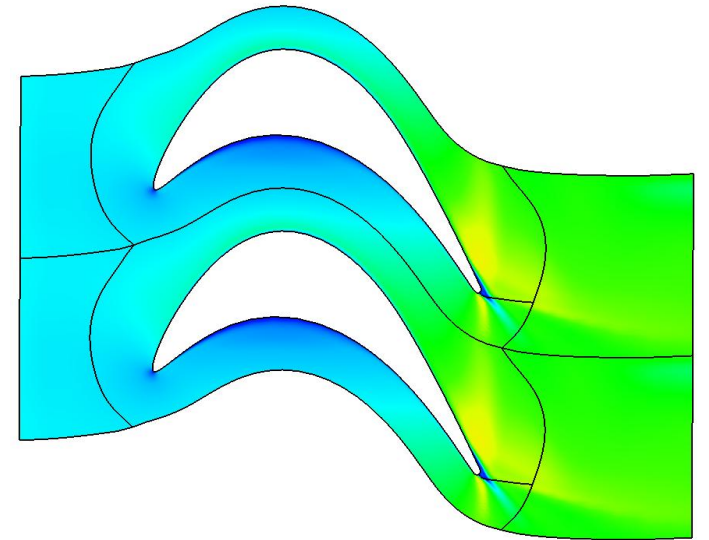
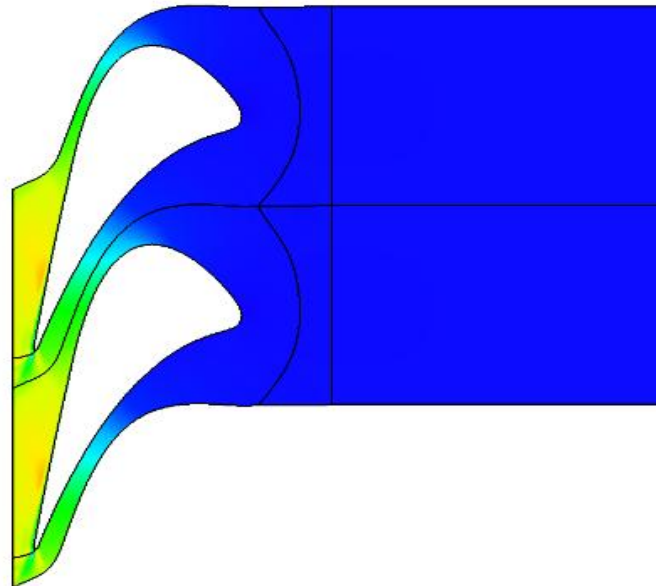


- ▶ The stage group adopts impulse type high-efficiency profile design, which has large enthalpy drop and strong working ability.
- ▶ The high-pressure airflow only expands and accelerates in the nozzle. It does not accelerate in the moving blade channel but only deflects. The droplets are not accelerated.
- ▶ The small droplets gather to form a film on the inner arc surface of the blade and gradually become thicker, and are torn and carried out by the airflow from the outlet side.

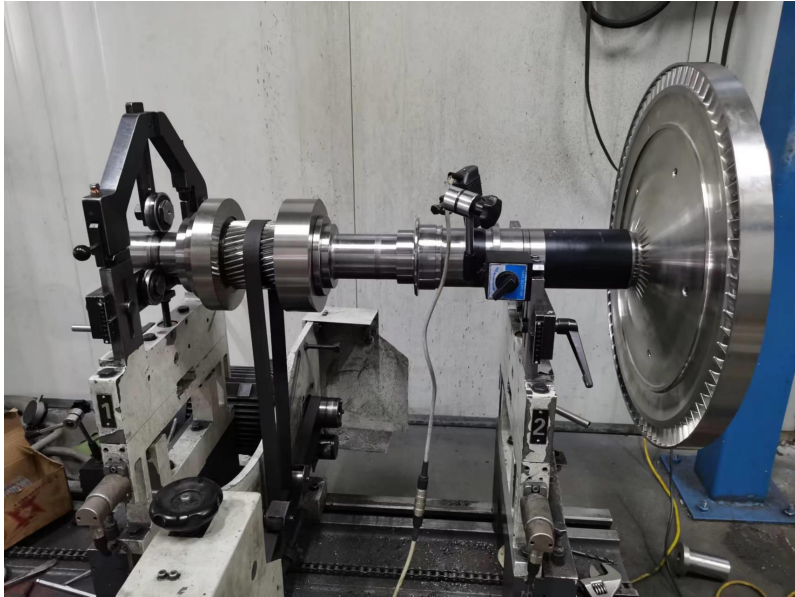
Independent research and development -
advanced and efficient flow technology

It has advanced and efficient controllable vortex technology, which makes the three-dimensional aerodynamic characteristics of the blade extremely excellent. It can control more fluid to flow into the high-efficiency area of the blade, thereby reducing the fluid in the high-loss secondary flow area at the end and improving the efficiency of the flow stage. .

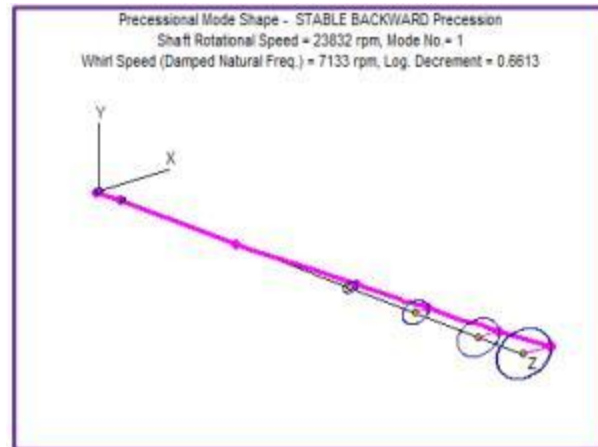
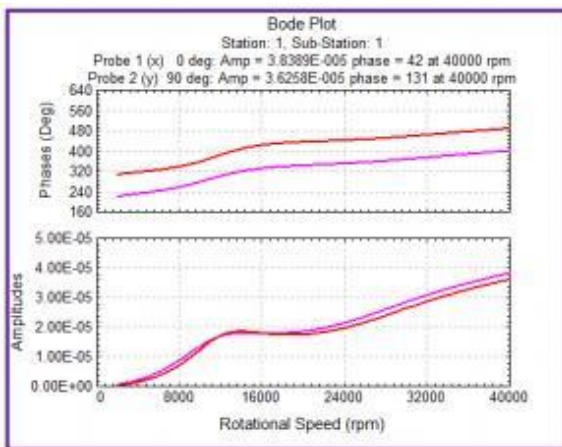
- Straight blade
- Twist blade
- curved blades
- Compound molding



Large cantilever flexible rotor design



Different from ordinary steam turbine series structure



- ▶ Free expansion at all levels, each expansion is not affected by other rotors
- ▶ Can achieve high speed, 8000-22000rpm
- ▶ The efficiency is high. Under the two medium and two low parameters, the single-stage efficiency is about 5% higher than that of a normal steam turbine.
- ▶ Low vibration, low noise, high reliability

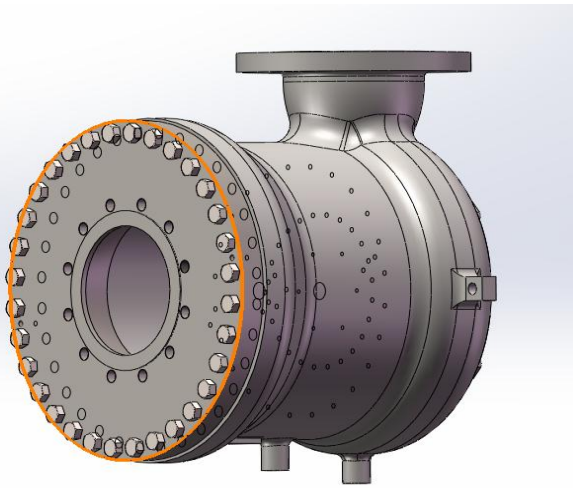
High-precision connection method-end tooth



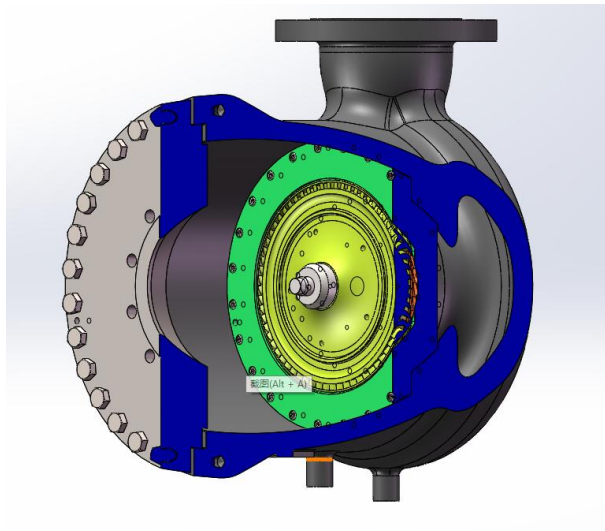
The transmission power is large, the centering accuracy is good, and it is easy to disassemble and assemble.

The traditional connection structure has poor alignment and inconvenient disassembly and assembly.

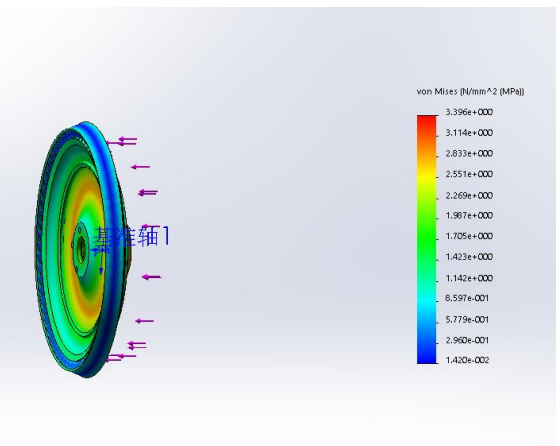
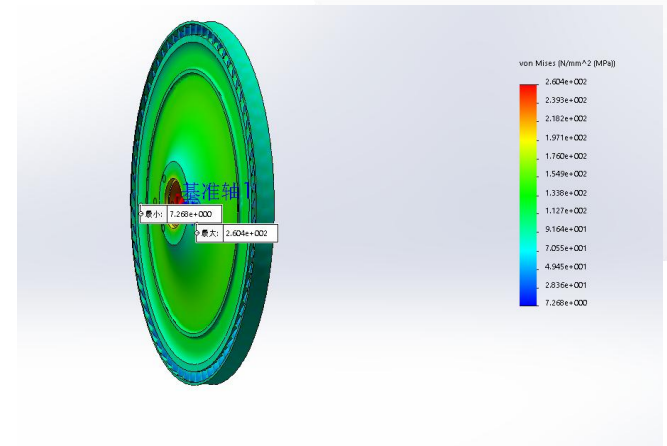
Excellent structural design and analysis



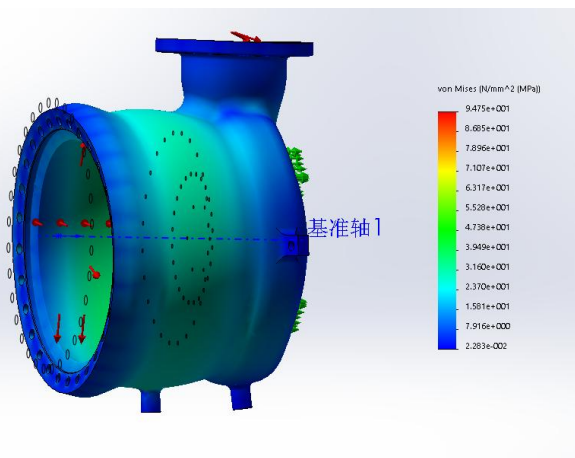
Machine nose model



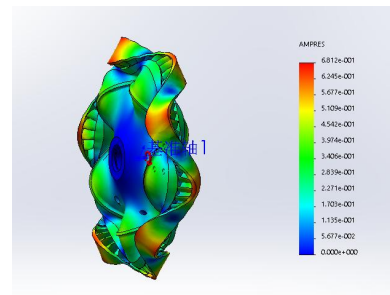
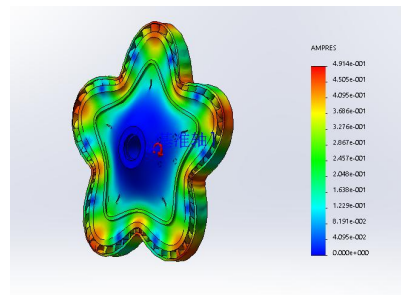
Machine nose model



Rotor frequency analysis



Finite element analysis of cylinder block



Rotor frequency analysis

Aviation materials, five-axis machining technology

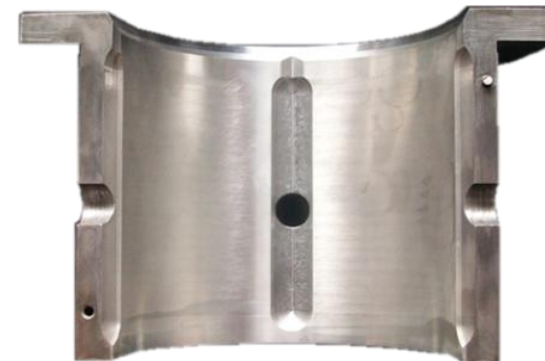
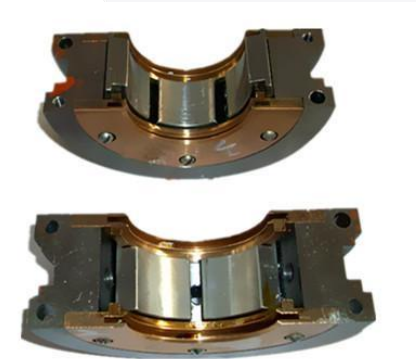
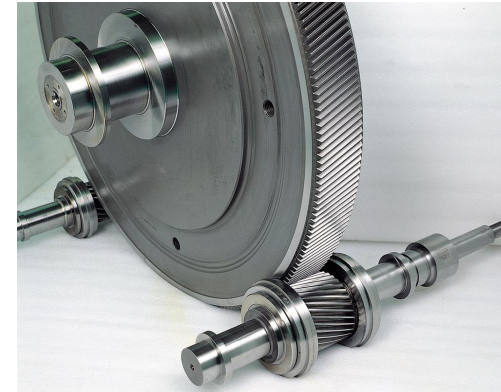


- ▶ Overall roulette design
- ▶ Made of erosion-resistant material
- ▶ The whole forging is processed in five axes and has high strength. It is suitable for working fluids containing moisture, and the impeller is durable and reliable.
- ▶ It can achieve high speed and high single-stage efficiency.



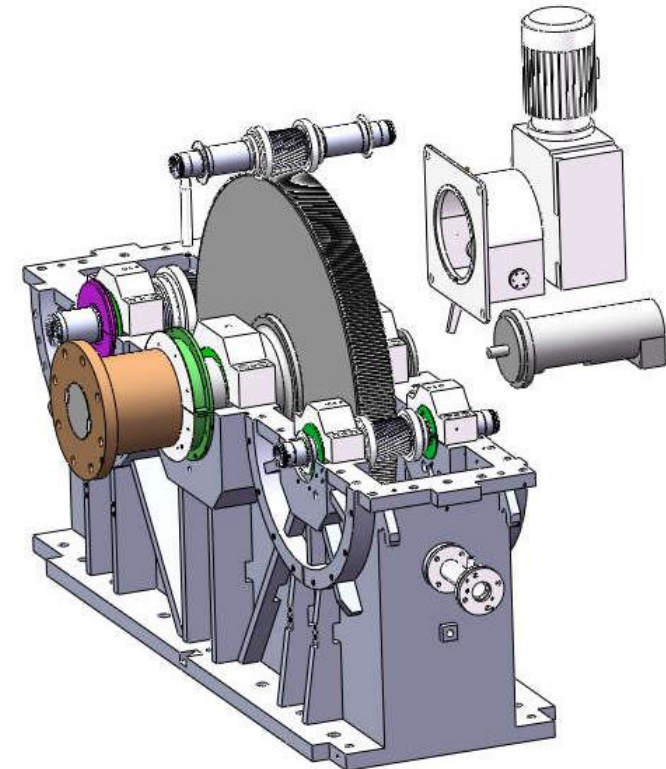
High reliability bearing rotor system

- ▶ High-precision gear transmission
- ▶ Gears of the highest quality grade
- ▶ Gear accuracy grade stable at ISO1328 level 3~4
- ▶ Equivalent to AGMA or DIN standard accuracy classes



20 years of high-speed transmission technology accumulation

- ✔ More than 20 years of product design experience, more than 8,000 engineering cases
- ✔ Commonly standardized structural components
- ✔ Comprehensive computer-aided design analysis
- ✔ Advanced processing and manufacturing equipment
- ✔ High-precision measurement and diagnostic technology
- ✔ Close cooperation with host manufacturers
- ✔ Highly developed computational analysis methods



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Typical project case study

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Project #1

A medical waste project in Guangzhou (EPC contracting)



Parameters

Steam inlet pressure:0.8MPa (a)

Steam temperature:185°C

Steam flow rate:10t/h

Steam outlet pressure:10KPa (a)

Net power output:1130KW

Installed capacity:1200KW

Yearly power generation:9,040MWh

Yearly saving: USD900,000

Yearly CO2 reduction:7,096ton

Project #2

A papermaking project in Guangzhou 3 units



Parameters

Steam inlet pressure:1.3MPa(a)

Steam inlet temperature:290°C

Steam flow rate:40t/h

Steam outlet pressure:0.55MPa(a)

Net power output:1800KW

Installed capacity:2000KW

Yearly power generation:14,000MWh

Yearly saving:USD1.6million

Yearly CO2 reduction:10,900ton

Steam inlet pressure:1.3MPa(a)

Steam inlet temperature: 290°C

Steam flow rate:115t/h

Steam outlet pressure:0.95MPa(a)

Net power output:1600KW

Installed capacity:2000KW

Yearly power generation:12,000MWh

Yearly saving:USD1.4million

Yearly CO2 reduction:9,420ton

Project #3

A project in Zhaoqing (EPC contracting)



Parameters

Steam inlet pressure: 2.0MPa (a)

Steam temperature: 350°C

Steam flow rate: 27t/h

Steam outlet pressure: 10KPa (a)

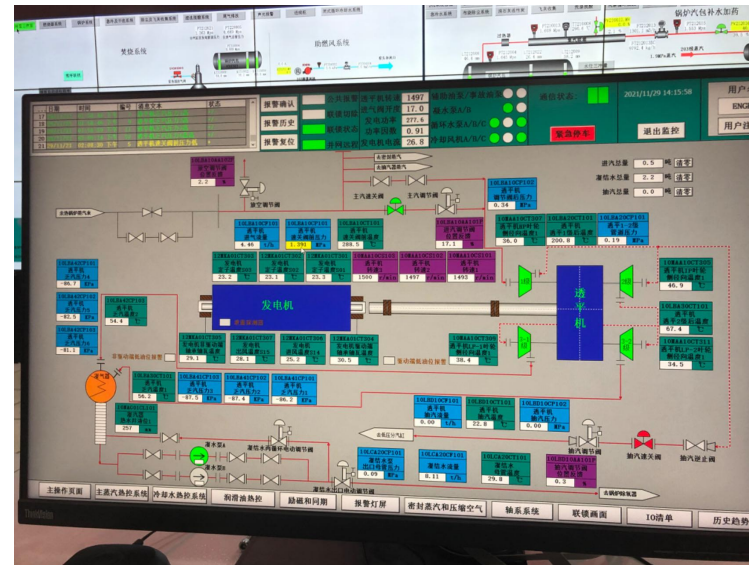
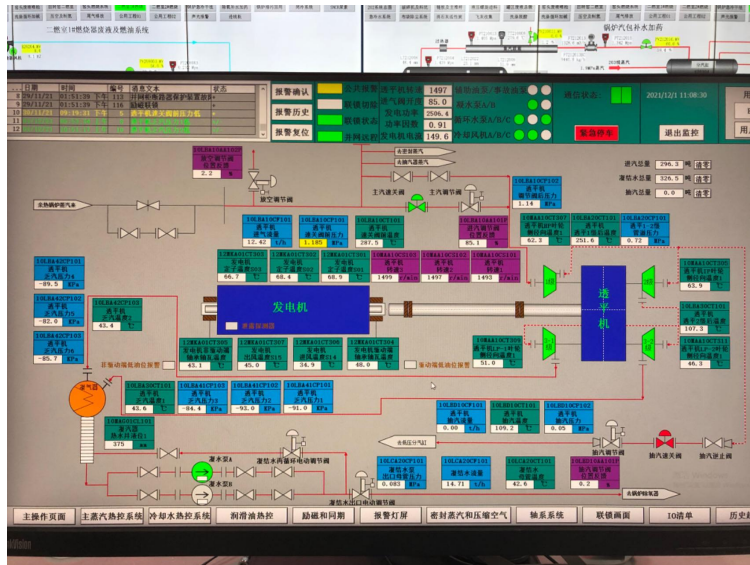
Net power output: 4,600KW

Installed capacity: 5,000KW

Yearly power generation: 36,800MWh

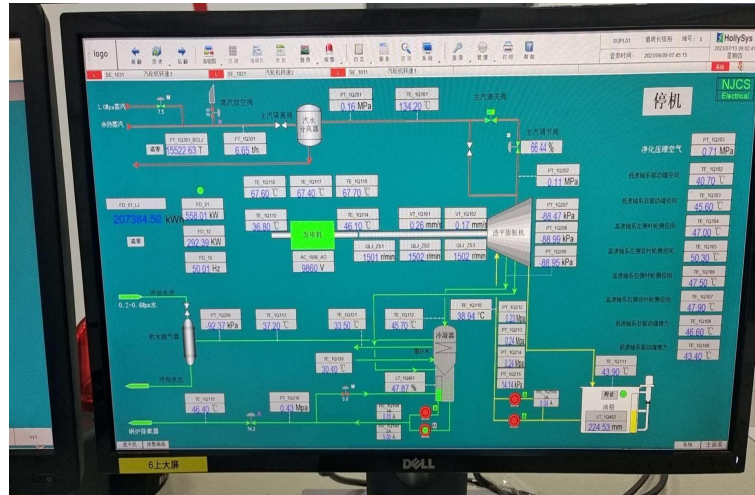
Yearly saving: USD 4.0 Million

Yearly CO2 reduction: 28,880ton



Project #3

A project in Henan (EPC contracting)



Parameters

Steam inlet pressure: 0.25 MPa (a)

Steam temperature: 127.4°C

Steam flow rate: 7.5 t/h

Steam outlet pressure: 10 KPa (a)

Net power output: 630 KW

Installed capacity: 750 KW

Yearly power generation: 5,040 MWh

Yearly saving: USD 600,000

Yearly CO2 reduction: 3,956 ton