



Green Secure
POWER SYSTEMS
— Engineering Energy —

WASTE HEAT RECOVERY GENERATION



Green Secure
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— Engineering Energy —

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The Background Of Waste Heat

In some industries, such as petrochemical, steel, paper making, pharmaceutical, rice mills, processing industries, etc., there is a lot of hot water, steam or gas generated in production process. Usually, all these heat resources will be discharged or cooled. It is not only polluting the atmosphere but also waste the latent heat.

Fossil fuel reserves depleted rapidly. There are many concerns about nuclear safety. How to use renewable energy, such as geothermal, biomass, solar energy source effectively?

High-pressure transmit and low-pressure use is the key features of steam. It mostly equips PRV (Pressure Reducing Valve) in use site if there is heat demand in following process. However, the energy loss of the pressure is also the economic loss.

Today, these waste heat sources are all useful for screw expander generator. The screw expander provides a renewable power solution by converting low, medium and high temperature heat into electrical energy. It can achieve energy saving and environment protection. Undoubtedly, it is an efficient, clean and reliable way to achieve energy saving and environment protection.



About Green Secure

Green Secure Power Systems Private Limited, promoted by JsR Holding, lead by Shri JSR Pasad has a diversified portfolio with a presence in power, cement, sugar and large scale infrastructure projects in the Sub-Continent and Africa.

GreenSecure Power is in the business of providing solutions for Industrial waste to energy by using new generation methods & Power Generation for process plants and IPP's.

Green Secure Power Systems Private Limited, formed in 2014, has entered into long term business association partnership with Zhejiang Turbine Import & Export Company Limited (ZTC), a subsidiary of Hangzhou Steam Turbine Co., Ltd, who are pioneers in manufacturing industrial and power turbines for more than 60 years.

Green Secure Power Systems in co-operation with ZTC (Zhejiang Turbine Import & Export Company Limited) has successfully commissioned a 2400KW waste heat recovery power plant at Keerthi Industries Limited, a 1600 TPD cement plant at Telengana, India with screw expander technology, which is first of its kind in the country.

There are other various projects for Sugar, Cement and IPP's that are executed in India and outside India.

Our Vision

With the lack of energy and industrial pollution increasingly serious today, energy conservation and emission reduction is one of the focus of the national energy development direction.

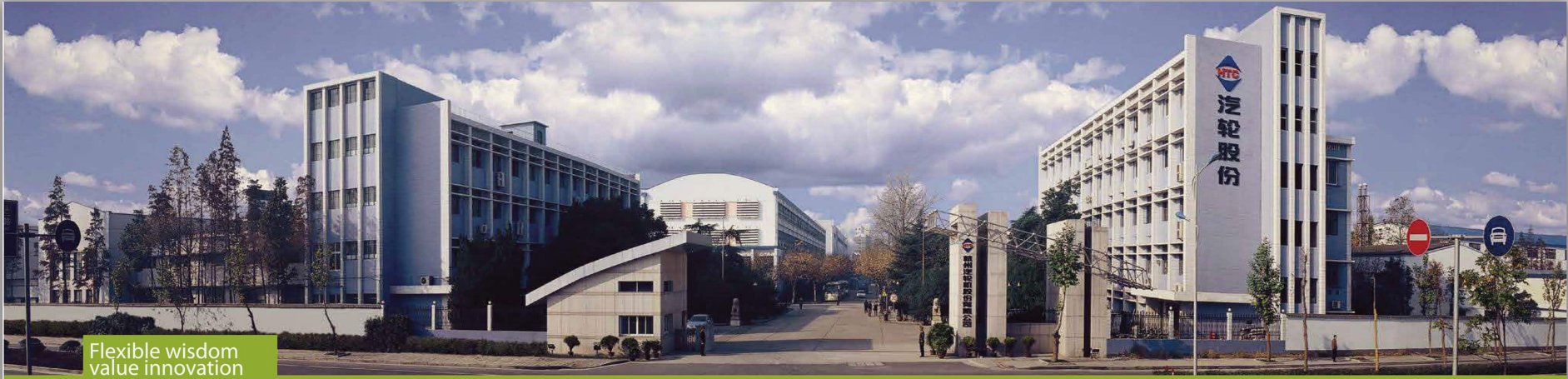
We believe in development without compromising on Natural Integrity. Green Secure Power Systems based on Screw Expander technology solves the problem of low grade waste heat, steam pressure drop and distribute waste recovery generation to improve our environment, meanwhile, increasing the economic benefit

At Green Secure, the process of manufacturing and transportation is tracked precisely to make sure the equipment is delivered to the site in time. We have a robust team that safeguards the process to keep it faultless. Continued relationship with the customers is maintained to extend our support at all the levels of project and after services including yearly maintenance, supply of spare parts and troubleshooting.



Sri J S R Prasad
Chairman
Green Secure Power Systems Pvt. Ltd.

Zhejiang Turbine Import & Export Co., Ltd



ZTC is one of the members of HTP - Hangzhou Turbine Grope. And is a wholly owned subsidiary of HTC - Hangzhou Steam Turbine Co., Ltd. we are the national foreign trade and economic cooperation. The company has a solid economic foundation, a comprehensive technical and staffing.

Zhejiang Turbine Import & Export Co., Ltd rely on First Class Design Institute and Hangzhou Steam Turbine Co., Ltd have strong ability in engineering, procurement, construction work which contains thermal power plant, renewable power plant (biomas power plant, garbage power plant), distribute waste recovery generation power plant.

Hangzhou Steam Turbine Co., Ltd. (HTC) is the biggest corporation in producing industrial steam turbines in china. Set up in 1958 as Hangzhou Steam Turbine Factory, then on April 23, 1998, it was restructured and sponsored sole by Hangzhou Steam Turbine Power Group Co., Ltd, and it is a share company Limited founded by collecting foreign shares (B-share) listed domestically.

Htc is the key research and production base for industrial steam turbine in China, also the only one in the country, according to customers special needs, to design and manufacture the industrial steam turbine with non-standard means requested. The corporation introduced the designing and manufacturing technology of industrial steam turbines from Siemens, Germany





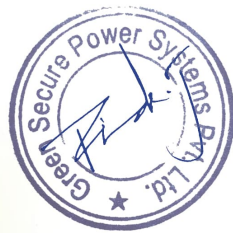
MEMORANDUM OF AGREEMENT

ZHEJIANG TURBINE IMPORT & EXPORT CO. LTD (ZTC)
&
GREEN SECURE POWER SYSTEMS PVT. LTD

Zhejiang Turbine Import & Export Co. Ltd & Green Secure Power Systems Pvt. Ltd has entered into a long term Business Association Agreement for supply of Screw Expander & Auxillary Heat Exchanger (Boilers) for Industrial and Process Application for various segments like steel mills, paper, mills, petro chemical, food processing, cement plants, bio gas boilers, geo thermal, oil refinery, solar thermal, etc. in India and outside India



Zhejiang Turbine
Import & Export Co. Ltd



Green Secure
Power Systems Pvt. Ltd

Waste Heat Recovery At Keerthi Industries Limited

Green Secure Power Systems in collaboration with ZTC executed a 2.4 MW Waste Heat Recovery Power plant (on EPC basis) at Keerthi Industries Limited. The plant was commissioned and started generating power from december 15, 2016.

AQC Boiler

S No	Description	Unit	Value
1	Flue Gas Volume	Nm3/Hr	105640
2	Flue Gas Temperature	Deg.C	350
3	Steam Pressure	Kg/cm2	11
4	Steam Temperature	Deg.C	330
5	Steam Flow (Mass)	TPH	9.0

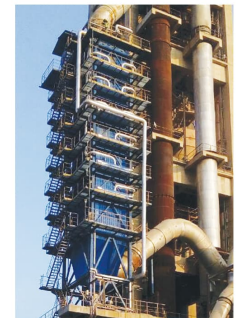
SP Boiler

S No	Description	Unit	Value
1	Flue Gas Volume	Nm3/Hr	115493
2	Flue Gas Temperature	Deg.C	320
3	Steam Pressure	Kg/cm2	11
4	Steam Temperature	Deg.C	300
5	Steam Flow (Mass)	TPH	8.6

AQC Boiler



Pre Heater Boiler



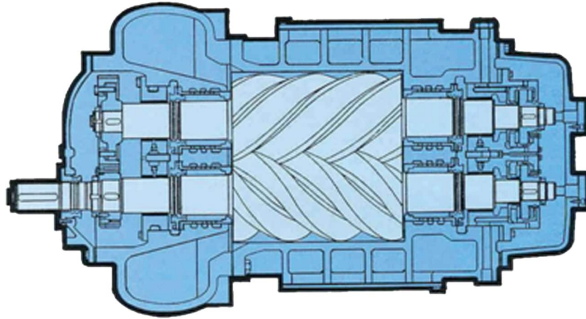
Screw Expander



Screw Expander Structure and Working Principle

A screw expander is a positive displacement type equipment. It comprises of a meshing pair of helical lobed rotors contained in a casing which together form a working chamber, the volume of which depends only on the angle of rotation only on the angle of rotation.

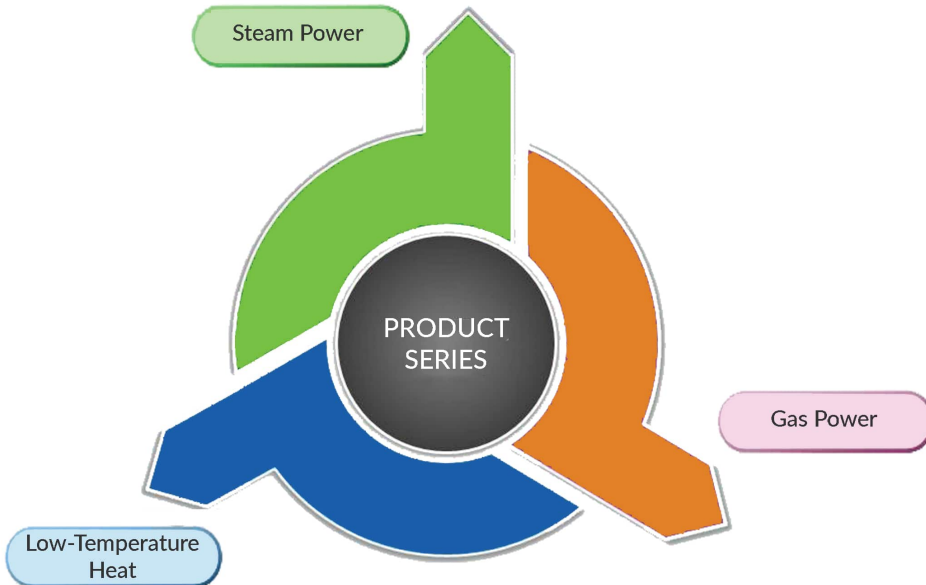
Other than a pair of screw rotor and the cylinder the structure consists of bearings, synchronous gears, seal assembly, etc.



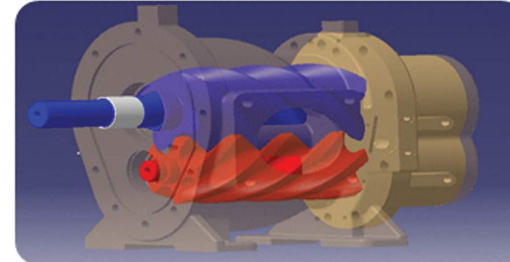
The expander works by gas inflation and inner energy consumption. It has the inverse principle of the screw compressor, which has the similar basic structure and reversed working process. But its manufacturing process and control system is much more complex than the screw compressor.

Our Solutions

Based on the application of screw expander, the same are classified into three types. Steam, Gas and Low-Temperature Heat based screw expanders



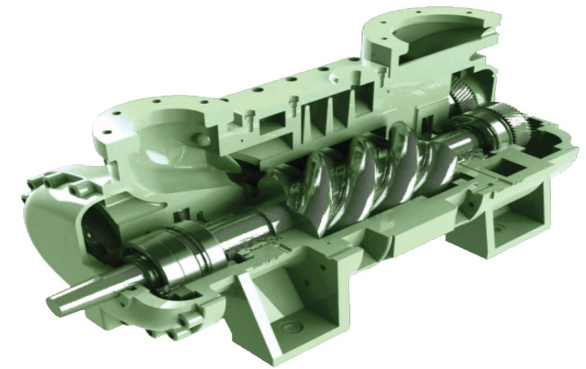
Steam Screw Expander



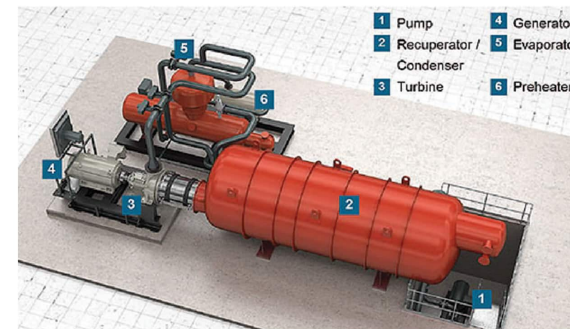
For less heat-source quality, this type can convert a variety of low-grade heat sources into power, and keep higher conversion efficiency in variable conditions. It creates advanced energy-electricity of equipment directly driving power from the low-grade waste heat generated in the production process.

Gas Screw Expander

This model can replace the decompression device to recover the internal energy caused by restriction tools, which can effectively, Handle the cooling caused by frost and ice. The unit has low failure rate, and its maintenance cycle is long.



Low-Temperature Heat Screw Expander



This model uses the advanced Organic Rankine Cycle (ORC). Low-boiling is the circulating medium which converts to steam through low-temperature thermal heating to drive the equipment and generate the power. It achieves the conversion from the low-temperature heat to the power.

Operating Principle

The expander works by gas inflation and inner energy consumption. It has the inverse principle of the screw compressor, which has the similar basic structure and reversed working process.



Suction Process

The inlet high-pressure medium promotes rotor rotation, then the tooth spacing volume increases until it is completely separated from the inlet, the suction process finishes.



Expansion Process

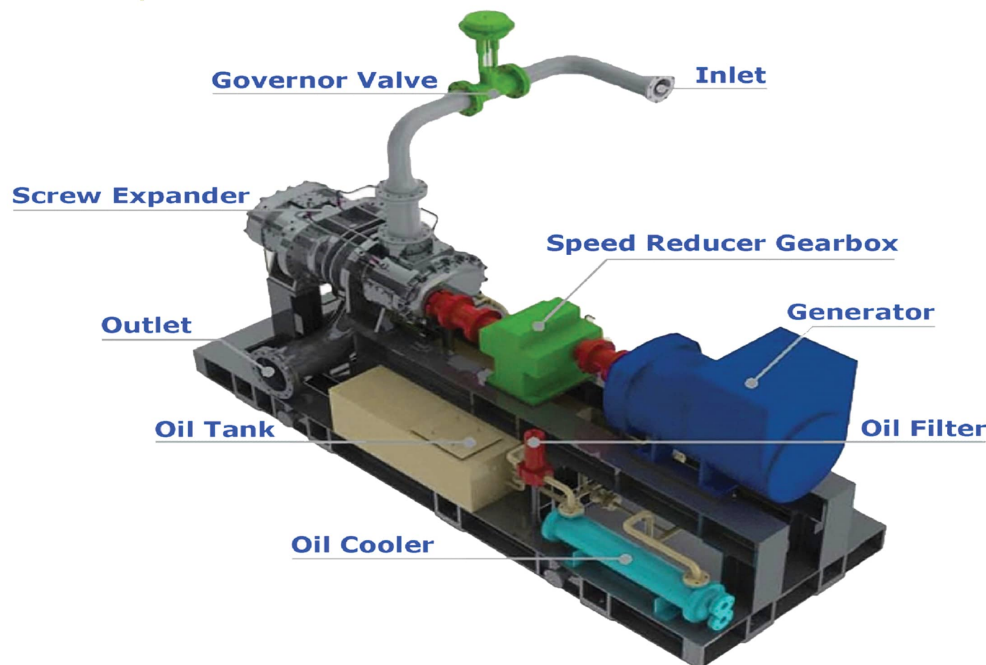
As the tooth spacing volume increases, the high pressure medium expands and its temperature reduces, meanwhile, output power to the rotor shaft.



Exhaust Process

When the tooth-spacing volume is connected with the outlet, the exhaust begins, the work cycle finishes when the tooth-spacing volume reduced to zero.

Screw Expander 3D Model



Power Output for various Heat Sources

Tentative power output from various Heat Sources is listed below. The same is indicative & will vary based on the application.

Saturated Steam / Wet Steam: A wet steam cycle is the thermodynamic cycle of a heat engine that converts heat into mechanical work. The heat is supplied externally to a closed loop which uses steam as the working fluid.

Pressure Range	Estimated Power Output
<3 bar	30-50 KW / TPH
3-6 bar	50-90 KW / TPH
6-10 bar	90-120 KW / TPH

NOTE: Back pressure (for process), condensing type screw expanders are offered.

Flue Gas: Flue gas heat recovery systems and screw expander will recycle waste heat to generate power for large-scale industrial enterprises.

Temperature Range	Estimated Power Output
~ 200°C	20-40 KW / 10,000 Cu m
~ 300°C	80-100 KW / 10,000 Cu m
~ 400°C	120-150 KW / 10,000 Cu m

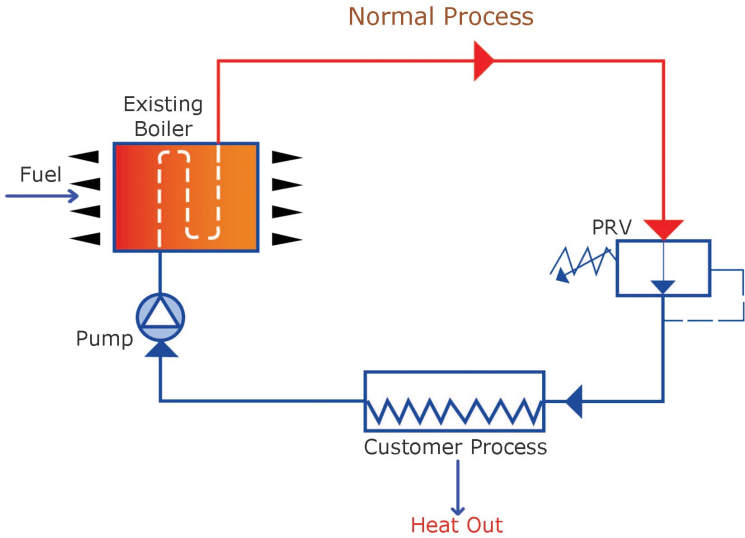
Low-Temperature Heat: Most of the heat recovery systems are designed at medium temperature (200–350 °C) and high temperature (350–500 °C) levels. Abundant amount of heat is rejecting in the temperature range of 100–150 °C. Low-Temperature Heat based screw expander is the prominent technology to tap the heat at this level.

Temperature Range	Estimated Power Output
80°C	0.3-0.4 kW / TPH Water
90°C	0.7-0.9 kW / TPH Water
100°C	1.2-1.5 kW / TPH Water
120°C	2.5-3.5 kW / TPH Water

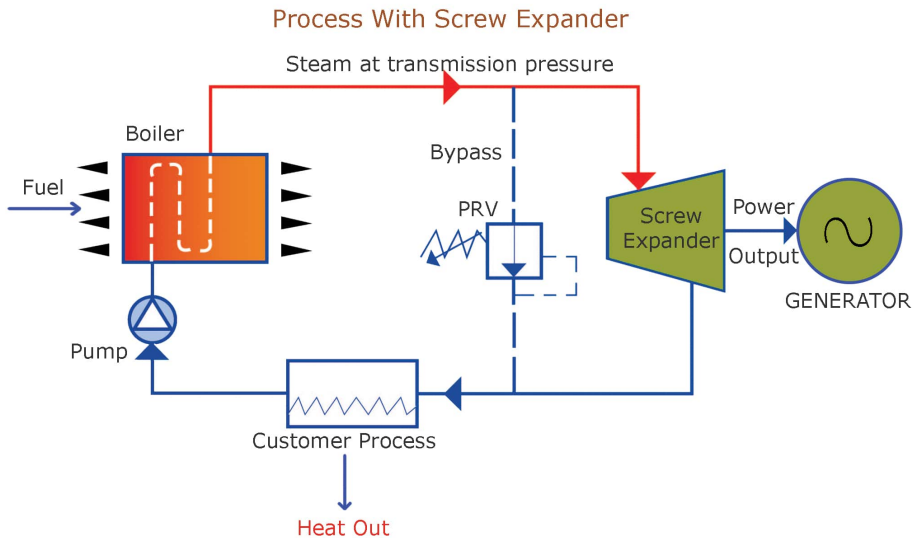


Steam PRV

The steam screw expander is open-loop type. During the periods when steam enters to exhaust, the quantity of the steam will be maintained and the same quantity can be used for the next step in the process line.

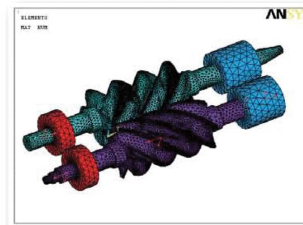
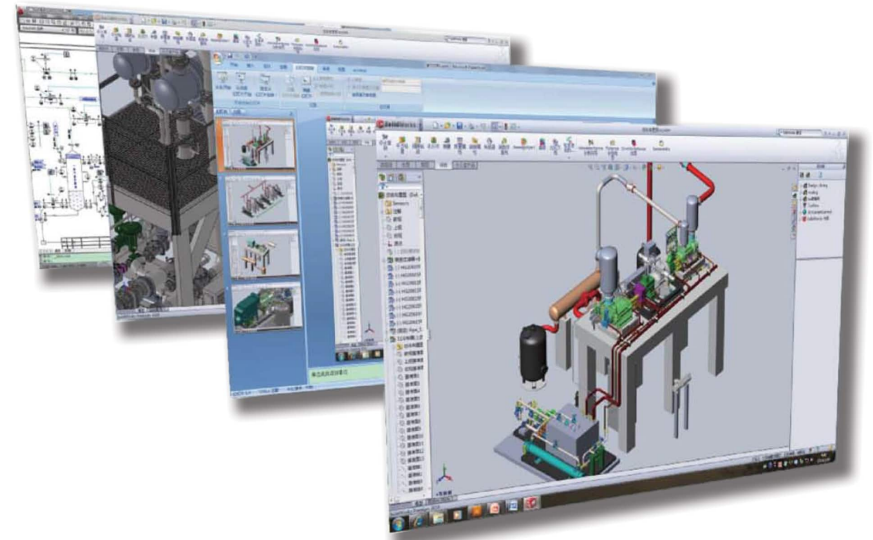


Energy which is lost of PRV in the past can be converted to power by screw expander now.

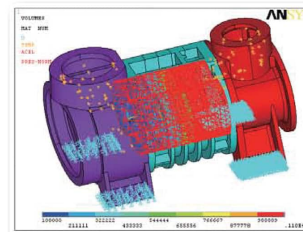
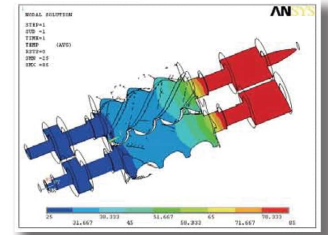


R&D Capacity

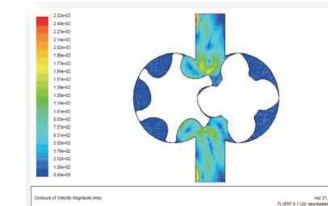
Green Secure Power Systems in house process can provide the most suitable and economic system solution for customers. Provide 3D models for customers, using the newest 3D design software



Powerful thermodynamics and dynamics calculation models to improve the device reliability.



Independence control system and on-line observation system are provided to meet grid power requirements



Application Area

There are wide range of applications which include the following:



After Sales Services

We provide customers high quality products and satisfactory After Sales Services support.

- 1 With grade level of engineering design quality, after service provides customers a entirety solution.
- 2 Takes Resposiility for the whole process which includes installation ad safety.
- 3 Kindly provides technical support for the whole project.
- 4 The perfect after service system has a service network all over the country.
- 5 After service has a fully reserve for wearing parts and spare parts throught out the year.
- 6 Reply within 24 hours and arrive at the site within 48 hours.
- 7 After service provides a field tracking and return-visiting system every six months.
- 8 Technical support on phone all the time.



Lagos Industria Quimica Ltda. --Brazil Market
1set x 400 KW, Biomass Boiler Decompression

Heat Source : Residual Steam 1.06MPa, saturated temperature, steam flow 32t/h
 Inlet Parameters : 1.01Mpa, 184°C, 20-22t/h
 Exhaust Parameters : 0.543Mpa, 161.5°C, 20-22t/h
 Rated power : 420kW
 Annual Energy Output : 3.36 million KWH
 Coal Annual Saving : 1176 ton
 Commissioning Date : April 17th 2012

Waste Steam Recovery Generation Project of Maoming Subsidiary of Sinopec
1set x 400 KW, Annual Energy Saving : 2.88 million KWH

Heat Source : Low Pressre Steam 0.60MPa, Temp. 162°C, Steam Flow 9t/h
 Inlet Parameters : 0.41Mpa, Temp. 145°C, Steam Flow 9t/h
 Exhaust Parameters : 0.1Mpa, Temp. 100°C, Ateam Flow 9t/h
 Rated power : 360kW
 Annual Energy Output : 2.88 million KWH
 Coal Annual Saving : 1008ton
 Commissioning Date : June 17th 2009



Original condition



Current condition



Solar Power Generation Application
Solar Energy Recovery Power Generation in Dacheng, Lazhou (200KW)

Heat Source : Steam Generated by Solar Device
 Layout : 0.8Mpa, 200W-300W/m³
 Actual Operation Parameters : 0.2-0.3Mpa, 100W-150W/m³
 Rated power : 200kW
 Annual Energy Output : 1.6 million KWH
 Coal Annual Saving : 560 ton
 Commissioning Date : April 17th 2012



**Throttle steam recovery power generation project
of Shanghai Baosteel Group**
(Temp and Pressure reduction in 2012, Annual energy output: 2.4 Million KWH)

Heat Source	: Differential pressure heat Resource
Inlet Parameters	: 1.3Mpa, Temp. 200°C, Steam Flow 18.5t/h
Exhaust Parameters	: 0.6Mpa, Temp. 159°C, Steam Flow 18.5t/h
Rated power	: 300kW
Annual Energy Output	: 2.4 million KWH
Coal Annual Saving	: 840ton
Commissioning Date	: May 23rd 2012

Residual hot steam recovery generation project of Xingtai Stel Works
5sets x 3300KW, Annual energy saving 21 million KWH

Heat Source 1	: 0.6Mpa, Steam Flow 3.5t/h, exhaust 0.11Mpa
Heat Source 2	: 1.8Mpa, Steam Flow 39t/h, exhaust 0.8Mpa
Heat Source 3	: 0.8Mpa, Flow 39t/h, exhaust 0.12Mpa
Rated power	: 3300kW
Generated Output	: 2625kW
Annual Energy Output	: 21 million KWH
Coal Annual Saving	: 7350ton
Commissioning Date	: 23rd May 2012



**Screw Expander power generation set of medium-high temperature
geothermal field yangpachen, Tibet**
Yangpachen geothermal field, Damxung County, Lhasa City, Tibet

Heat Source	: ZK4001 wellhead pressure around 0.8MPa Temp 170°C, flow around 200t/h
Inlet Parameters	: 0.8Mpa, Temp. 170°C, Steam Flow 28t/h
Exhaust Parameters	: 0.25Mpa, Temp. 127°C, Steam Flow 28t/h
Rated power	: 1000kW
Annual Energy Output	: 8 million KWH
Coal Annual Saving	: 2800ton
Commissioning Date	: August 11th 2009