

TORUSTM

STEAM TURBINE GENERATORS
100kW to 2000kW

Introduction



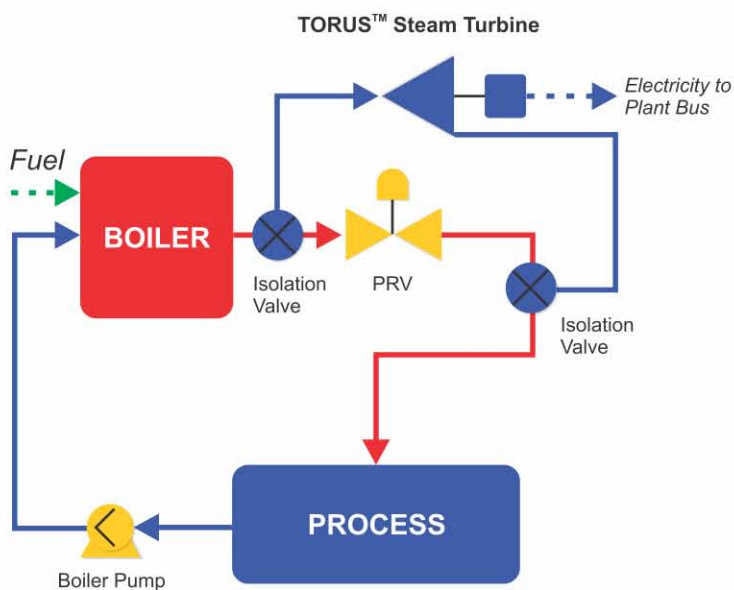
TORUS™ Turbine Generators are engineered with perfection keeping in mind RELIABILITY as the most important parameter. With the core equipment in small to medium power plants such as Turbines and Boilers evolving over a period of time and the technologies being fairly at par, it's the right configuration and application of the systems that matters the most. All systems proposed by BIOGREEN go through full cycle application engineering since we believe every requirement is unique.

The core of the system, Steam Turbine is Imported from SKINNER, USA completely factory tested on live steam. SKINNER's legacy with steam extends to more than 135 years and the technology has matured over a period of time to provide most reliable and rugged Steam Turbines in the world. SKINNER Steam Turbines are built to most stringent API 611 and NEMA Standards bringing in safety and design consistency into every turbine built.

Saturated Steam Turbines have definite advantages when used for Back Pressure applications. Cost of power generation is much lower. Also, Saturated Steam Turbines and boilers allow higher flexibility for processes with variations in the steam consumption. TORUS™ Steam Turbines are a proven solution for Saturated Steam Applications.



Applications



TORUS™ Steam Turbines are used for power generation by virtually any industry that is using steam in their process. TORUS™ is a simple fit and forget solution tailored to process industry needs and can operate on Superheated Steam as high as 480° C to simple Saturated Steam.

The versatility of TORUS™ makes it possible to configure it with a new high pressure boiler and also as a retrofit for an existing low pressure Saturated Steam Boiler.

The system is designed to easily sandwich between your process boiler and the process plant with minimum intervention to your Plant Operation and without any additional load on your manpower. TORUS™ is capable of running unmanned.

Amount of Power Generated depends on the Steam used in the process. Grid power is used to meet the difference in power demand and power generated. To make this happen seamlessly, TORUS™ Synchronizes with your plant grid. The difference in power generated and used is balanced continuously without any manual intervention.

Truly! Cogeneration, Simplified!!

Several industries have benefitted from TORUS™



Case Study

Vegetable Oil Refinery

| | |
|--------------------------|----------------------------|
| Power Demand | : 970 kW |
| Steam Demand | : 12 TPH @ 3.5 barg |
| Boiler Parameters | : 35 barg 350 °C |
| Grid Power Cost | : 5.75 Rs/kWh 0.1 \$/kWh |

Operating Hours/Annum : 7200 hrs

Power Generated by Turbine 700 kW

Power Drawn from the Grid : 270 kW

Cost of Power

| | |
|-----------------------|------------------------------------|
| Before Turbine | : Rs. 401.60 Lakhs \$ 669,300.00 |
| After Turbine | : Rs. 111.78 Lakhs \$ 186,300.00 |

Gross Savings / annum : Rs. 289.82 Lakhs
\$ 483,033.00

Less, Maintenance Cost / annum : Rs. 6.25 Lakhs
\$ 10,417.00

Less, Cost of Additional Fuel : Rs. 30.24 Lakhs
\$ 50,400.00

Net Savings / annum : Rs. 253.33 Lakhs
\$ 422,216.00

% of Power cost Saved / annum : 63%

The total investment gets paid back within less than a year.

Reduction in the cost of production continues year after year, for about 25 years. Also, the TORUS™ Turbine Generator maintains a near constant back pressure, improving process efficiency of the Vegetable Oil plants further.

TORUS™ Turbine Generators can also work on existing medium and low pressure Saturated Steam boilers.

Note: Values above are based on certain fuel and other costs which can be different for every case. The savings may thus get affected, either way. Please contact us for specific feasibility calculations for your specific case.

10 REASONS

Made in USA

Turbine manufactured in USA by SKINNER with 135 years of legacy with Steam

Saturated Steam

Can work on Saturated Steam and pressures as low as 10.5 bar

Live Steam Tested

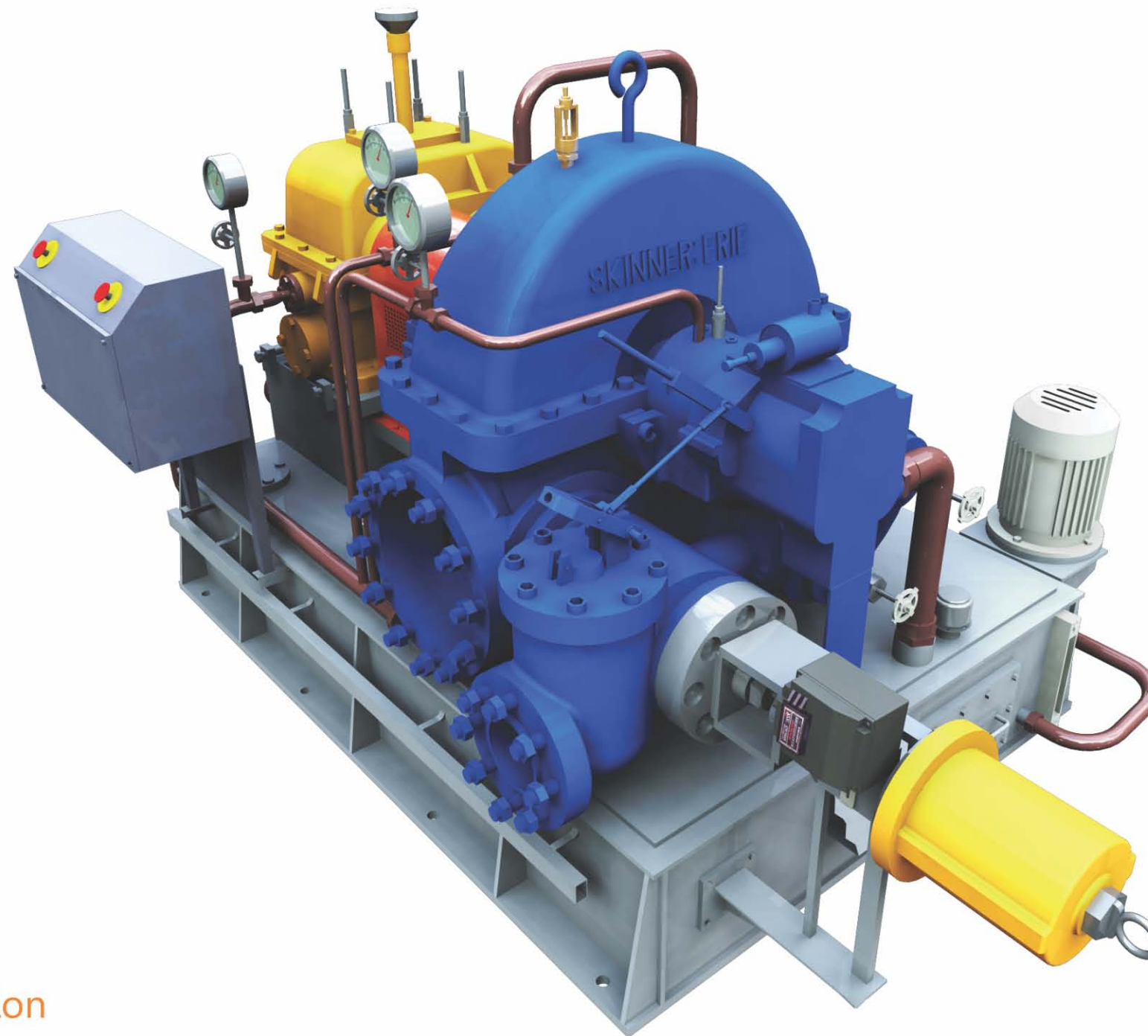
Every turbine is tested on Live Steam before shipment

Complying to International Standards API / NEMA

Code compliant, means capability to run 2 years uninterrupted and much more

TurboSmart™ Next Generation Turbine Control System

Its not just a Governor, it's a Turbine Controller with Auto Grid Sync and auto fallback into Stand Alone Mode.



SmoothLube* Optimized Lubrication System

Optimized lube system for long machine life and lower operating cost.

Multiple Level Safeties

Completely secured and safe operation

Low Operating Speed

Operating speed is less than first critical speed, lower maintenance and robust

24 X 7 Service Backup

360° Customer Centric Service Support with Spares and Technicians

Quick Startup & Shutdown

Turbine Startup within 20 minutes from Cold Start and virtually instant Warm Start and Stop.

Testimonials



Hugo Douglas-Dufresne
Technical Director
James Finlay, Kenya

We purchased 1000 kVA Back Pressure Steam Turbine Generator From Biogreen During 2008. Complete system Engineering was carried out by Biogreen along with supply of equipment and supervision of commissioning.

The system did encounter certain unforeseen issues during the commissioning; however Biogreen put its best efforts and finally sorted out the problems.

I appreciate the dedicated service of Biogreen. The system has been running satisfactorily since then.

We have installed Steam Turbine Generator Set of 1250kVA / 1000 kW Capacity Supplied by Biogreen Energy Systems (P) Ltd, Pune at our factory Sudarshan Chemical Industries Ltd, Roha. It has been running successfully since commissioning. We appreciate the technical abilities and swift delivery as committed by Biogreen. The Steam Turbine Generator set is running satisfactorily in synchronization with local electricity Grid. We are happy with the performance of the STG Unit.

S. M. Patil
Head Engineering Purchase and Stores
Sudarshan Chemical Industries Ltd, Roha, India

Biogreen is technically sound company which believes in customer specific solutions. For our unique first of its kind Vegetable Oil Refinery which runs at low pressure, we purchased a 350 kVA Steam Turbine Generator (STG) from Biogreen in 2005.

The Turbine has unique virtually unmanned TurboSmart™ Turbine Control System developed by Biogreen. For small power users like us, it has proven to be very beneficial as we do not need to hire expensive, trained and skilled turbine operators.

This STG works in load sharing with our local power source flawlessly and all the controls are automatic.

Impressed with performance of this machine, we have purchased another 600 kVA steam turbine from Biogreen during 2009. Both these STGs are working satisfactorily and we wish Biogreen a very bright future.











Bajrang Saboo
Managing Director
Shiv Edibles Ltd., Kota, India

We have been using a 750 kVA Steam Turbine Generators (STG) supplied by Biogreen Since 2006. Our STG has been operating 24X7 with no major noticeable shut downs for maintenance. There is very little spares requirement, in fact the main bearings and carbon seals are still the same supplied with original machines 5 years ago against a known life of 3 years. We are completely satisfied with the product and unique support of Biogreen. I appreciate the dedicated service of Biogreen. The system has been running satisfactorily since then.

Sameer Godbole
Vice President
Jaimurty Minerals & Chemicals, Ponta Sahib, India

References

Some of our reputed customers

| | | | | |
|---|---|---|--|---|
|  |  |  |  |  |
| James Finlays | Hindustan Zinc Ltd., | Aarti Industries | Alkyl Amines & Chem. | Vedanta |
|  |  |  |  |  |
| Thermax | Hindustan Unilever | Betul Oil | Privi Organics | Sudarshan Chemicals |

Product Range Overview

| POWER | TURBINE COMBINATIONS | | ELECTRICAL COMBINATIONS | | | OPERATING PARAMETERS | | |
|--------------------|----------------------|------------|-------------------------|------------------------|---------------------------------|--|---------------------------|-----------------|
| | Back Pressure | Condensing | Alternator - Standalone | Alternator - Grid Sync | Induction Generator - Grid Sync | Max. Inlet Pressure kg/cm ² (g) | Max. Inlet Temperature °C | Saturated Steam |
| 30 kw to 315 kW | ✓ | ✓ | ✗ | ✗ | ✓ | 63 | 480 | ✓ |
| 100 kW to 750 kW | ✓ | ✓ | ✓ | ✓ | ✗ | 63 | 480 | ✓ |
| 750 kW to 1250 kW | ✓ | ✓ | ✓ | ✓ | ✗ | 63 | 480 | ✓ |
| 1250 kW to 2100 kW | ✓ | ✓ | ✓ | ✓ | ✗ | 63 | 480 | ✓ |

Spares and Services

With a motto of Service What You Sell, TurboCare supports Biogreen as a standalone Services Arm providing world class 24 X 7 Services with experienced and committed Service Technicians and Spares in stock. Complete Installation, Commissioning and After sales services are provided seamlessly under one roof. TurboCare provides Operations & Maintenance services across India, South East Asia, Asia Pacific and African region.

Qualified and Experienced Technicians with refined and predefined Standard Operating Procedures (SOPs) carry out following Services on the TORUS Steam Turbines supplied by Biogreen.

- > Installation Supervision
- > Commissioning Services
- > Training and Hand Holding support to the New Operators
- > Preventive Maintenance Services
- > Onsite Emergency Maintenance Services
- > Complete Steam Turbine overhauls
- > Rerating of Turbine Generators
- > Periodic Training to Operators





Cogeneration, Simplified!



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