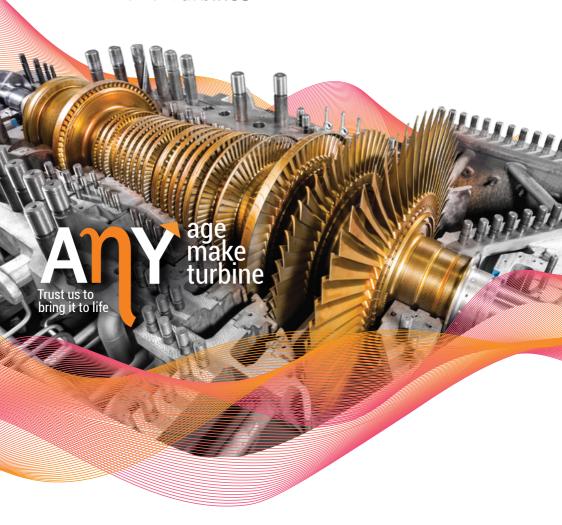
Efficiency/Power Enhancement & Life Extension Program for Multibrand Turbines







Efficiency Enhancement Solutions



- Upto 15% efficiency improvement of existing Turbines
- ROI under **2 years**
- Life extension upto 100,000 hours
- Increase in span between 2 Overhauls
- No modification in civil and Turbine housing
- Reduced carbon emission

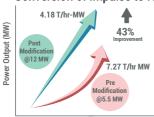
Efficiency improvement / Life extension projects are becoming more popular with cost savings being a major factor. An improvement program is cost effective compared to a new turbine with a cost difference of over 25%.

Factors considered by customers:

- Change in the process/enhancement / Power/grid
- Age of turbine
- Consuming more steam/MW

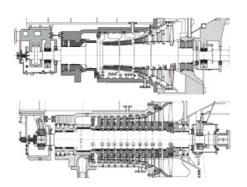
Turbine Efficiency Enhancement Case Studies





Inlet Steam Flow (t/h)

	Inlet			Bleed - 1			Bleed - 2			Exhaust			Power(MW)
	Р	T	F	Р	T	F	Р	T	F	P	T	F	
OEM	65	450	40.00	-	-	-	-	-	-	0.08	-	-	5500
Triveni	65	450	50.25	6	-	4.11	1.29	-	4.28	0.081	-	41.86	12000





OEM DESIGN (IMPUSLE - 12 STAGES)



TRIVENI DESIGN (REACTION - 26 STAGES)



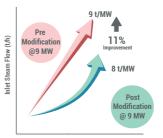


Make: European, 9MW Sector: Chemical



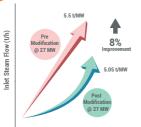
11% Improvement
Modification 10.69 t/MW
Modification @33MW Inlet Steam Flow (t/h)
India But 1

	Inlet		Ext.	1	Ext	t. 2	Exhaust		
P	T	T F P F		F	Р	F	P	F	
106.00	505	352.75	41	158.1	12.75	164.68	0.08	29.97	
103.95	505	354.7	41	140	12.5	154	0117	60.7	



	Power Output (MW)												
	Inlet		Exhaust										
Р	T	Р	F										
43.2	440	440 81 4		81									
43	440	72.5	4	72.5									

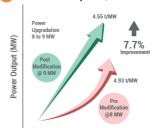
Make: European, 27MW Sector: Chemical



Power Output (MW)

	Inlet		Ext	traction	Exhaust		
Р	T F		Р	F	Р	F	
70	485	121	16	35	0.113	86	
70	485	111	16	35	0113	76	

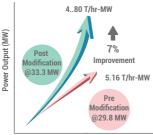
Make: European, 9MW Sector: Steel



Inlet Steam Flow (t/h)

	Inlet		Ex	traction	Exhaust		
Р	Т	F	Р	F	Р	F	
42	410	37	5.1	4	0.098	33	
42	410	41	5.1	4	0.098	37	

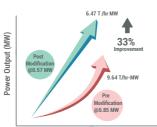
6 Make: China Sector: Textile



Inlet Steam Flow (t/h)

	Inlet Etraction		HP Bleed		LP Bleed		Exhaust			Power(MW)						
	Р	T	F	Р	T	F	Р	T	F	Р	T	F	Р	T	F	
OEM	86.3	515	154	6.87	222.3	67.01	30.8	389.7	14.67	1.39	109	7.7	0.17	56	-	29.82
Triveni	86.3	515	160	6.87	219.5	55	25.61	366.9	15	1.77	119	9.6	0.0883	43.4	77.86	33.3

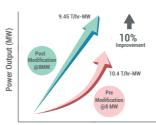
Make: India Sector: Agrochemical



Inlet Steam Flow (t/h)

		Inlet		Etraction				
	Р	T F		Р	T	F		
OEM	40	360	5.5	0.2	-	5.5		
Triveni	40	360	5.5	0.2	-	5.5		

Make: USA Sector: Textile

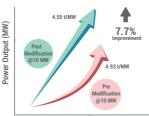


Inlet Steam Flow (t/h)

		Inlet		Е	xhaust	Power(MW)	
	Р	T	F	Р	T	F	
OEM	20.626	350	83.26	1.99	-	83.26	8
Triveni	20.626	350	75.6	1.99	-	75.6	8

Make: India Deration of 24 MW to 10MW

Sector: Steel



Inlet Steam Flow (t/h)

	Inlet			Bleed - 1		Bleed - 2			Е	xhaust	Power(MW)		
	Р	T	F	Р	T	F	Р	T	F	Р	T	F	
OEM	64	485	50	3.2	-	3	1.2	-	1.5	0.18	-	44.5	10000
Triveni	64	485	40.14	-	-	-	3.84	-	4.34	0.18	-	35.8	10000

Make: Japan

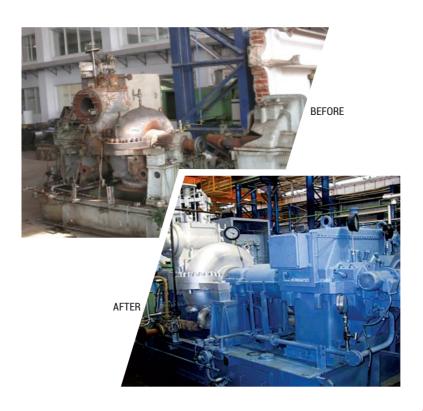
Sector: Sugar

9.91 T/HR-MW Power Output (MW) 2% Improvement Post Modification @10MW 10.11 T/HR-MW Pre Modification @10 MW

* During operation customer could not go beyond 6.6 MW

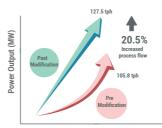
Inlet Steam Flow (t/h)

		Inlet		Е	xhaust	Power(KW)	
	Р	T	F	Р	T	F	
OEM	21	350	101.1	1.5	-	101.1	10000
Triveni	22	350	99.1	1.5	-	99.1	10000



Condensing to back pressure Case Studies

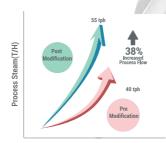
Make: India



Inlet Steam Flow (t/h)

	Inlet			Inlet Bleed Extraction				Exhaust				
	Р	T	F	Р	T	F	Р	T	F	Р	T	F
OEM	63	480	157.5	8.5	-	21	2.75	-	105.8	0.1	-	30.7
Triveni	63	480	157.5	8.5	-	30	2.5	-	127.5	-	-	-

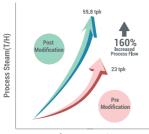
2 Make: European



Inlet Steam (T/H)

Inlet			Bleed			Extraction			Exhaust		
Р	Т	F	Р	Т	F	Р	Т	F	Р	Т	F
44	420	55	9	-	5	2.5	-	40	0.2	-	10
44	420	55	-	-	-	2.5	126	55	-	-	-

Make: Japanese



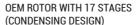
Inlet Steam (T/H)

	Inlet			Bleed		Extraction			
Р	T	F	Р	T	F	Р	T	F	
87	515	48	3	130	23	0.1	42	25	
87	515	59.8	3	151	59.8	-	-	-	

Make: Russian

Post Modification Process Flow S0 tph

Inlet Steam (T/H)





TRIVENI ROTOR WITH 9 STAGES (BACK PRESSURE DESIGN)



Inlet			Bleed			Extraction			Exhaust		
Р	Т	F	Р	Т	F	Р	T	F	Р	Т	F
35	435	112	13	-	50	1.2	-	40	0.1	-	22
35	445	112	13	-	85	5		12	-		-



AS RECEIVED CONDITION

FINAL CONDITION

Geothermal

Geothermal turbines often encounter blade erosion and cavity formation due to impurities in the steam, causing reduced efficiency, shorter turbine lifespan, and unexpected breakdowns.

Case Study: Revitalize 16MW turbine Geothermal sector Client Overview

Our client, a key player in geothermal energy, faced ongoing erosion and corrosion issues with their American-made 16 MW geothermal turbine, severely affecting rotor material lifespan and performance.

Client Challenges

The client faced a triad of formidable issues:

- (i) Frequent Erosion in Blade Tenons
- (ii) Cavity Formation in High-Pressure Gland Areas
- (iii) Rotor Material Enhancement

Solutions:

- 1. Integral Shroud Design
- 2. Enhanced Rotor Material
- 3. Precision Shot Peening

Benefits

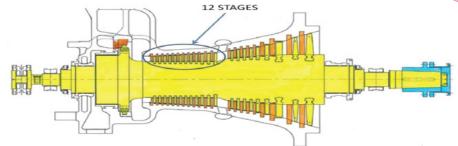
Prolonged Turbine Lifespan Augmented Reliability Heightened Plant Efficiency Enhanced Availability:



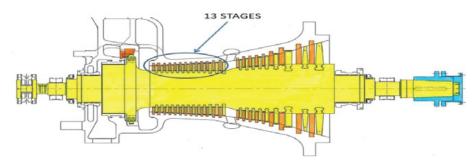


New design rotor

Efficiency Enhancement In Pictures



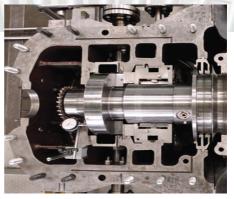
OEM Design: Original Steam Flow path



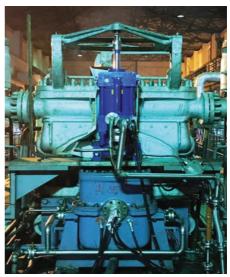
New Design: Original Steam Flow path





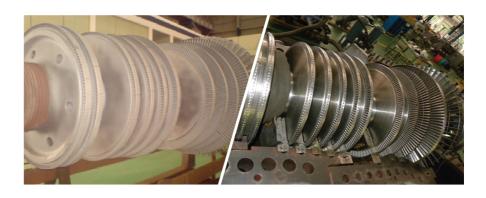




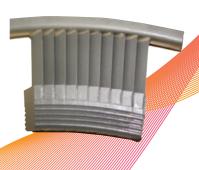


















EFFICIENCY ENHANCEMENT / LIFE EXTENSION

- Retain Existing Housing / Casing
- No civil modification
- Upgraded steam flow path
- New rotor with high efficient blades

On requests from customers we initially started supporting them on other makes of turbines. Today we have positioned ourselves on top of the pyramid to focus on efficiency improvement / life extension programs. The advantage are multi fold including never having to discard a turbine and change parameters to achieve the new requirements.

Our portfolio includes:

- Overhauling
- Long Term Service Agreement
- Health Survey & Condition Assessment
- Reverse/Re-Engineering
- High Speed Balancing
- Efficiency Enhancement
- Automation
- Triveni Touch: Remote Monitoring
- Renovation & Modernization



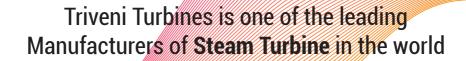












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INDIA

SALES, SERVICE AND MANUFACTURING FACILITY

Triveni Turbine Limited

12-A, Peenya Industrial Area, Bengaluru-560 058, Karnataka, India. Phone: +91 80 22164000 Fax : +91 80 22164100

SALES, SERVICE AND MANUFACTURING FACILITY

Triveni Turbine Limited

Plot No.491, Sompura 2nd Stage, KIADB Sompura Industrial Area Nelamangala Taluk, Bengaluru Rural - 562 123

THAILAND

MARKETING AND SERVICE OFFICE

Triveni Turbines DMCC

571 RSU Tower, Unit 903, 9th Floor, Sukhumvit 31 Road, Klong Ton Nua, Wattana, Bangkok 10110, Thailand Phone: +66 2 117 9575,

Fax : +66 2 662 3416

UNITED KINGDOM

REGISTERED OFFICE

Triveni Turbines Europe Pvt. Ltd.

C/O Vistra UK (3rd Floor) 11-12 St James's Square, London, SW1Y4LB, United Kingdom Phone: +44 2038727310 Fax : +44 2038727311

UAE

SALES AND SERVICE OFFICE

Triveni Turbines DMCC

4502-14 & 4502-15, 45th Floor, Al Mazaya Business Avenue - Tower BB2, Jumeirah Lake Towers, Dubai, United Arab Emirates, P.O. Box 393509 Phone: +971-4 5670752 Fax : +971-4432 8232

SOUTH AFRICA

MARKETING AND SERVICE OFFICE

Triveni Turbines Africa (Pty) Ltd. TSE Engineering

AMR Building,

3 Concorde East Road, Bedfordview, 2007, South Africa Phone: +27 10 007 5245 / 5246

SOUTH AFRICA

REPAIR CENTER

252 Vonkprop Street, Samcorpark, Pretoria, 0184 South Africa Phone: +27 12 804 2638

Email: customercare@triveniturbines.com

www.triveniturbines.com/