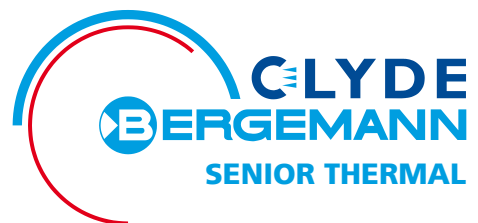




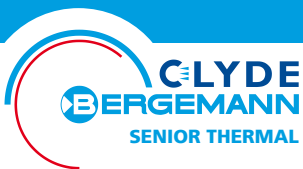
# WASTE HEAT RECOVERY

Clean energy and efficiency solutions  
for the global energy market





## Solutions for boiler efficiency and steam raising plant



Clyde Bergemann Senior Thermal Pty Ltd (CBST) provides to the boiler and steam raising industry, locally designed and manufactured fuel economisers and specialised heat exchange products for power generation and large industrial steam raising plants.

CBST opened its doors for business in 1962, with its primary product being boiler economisers. Through the years, our knowledge and experience in many other processes has allowed us to develop other waste heat recovery products. Today CBST is known as an innovator of waste heat recovery and clean energy solutions to power generators and industry across Australia and abroad.

Our product range includes:

- economisers
- waste heat recovery systems
- air preheaters
- recuperators
- longwall cable handling equipment
- heat treatment

In conjunction with the Clyde Bergemann Power Group we offer an enhanced product range which includes:

- on-load 'intelligent' boiler cleaning
- materials handling and air pollution control solutions
- damper and diverter systems

CBST is involved in the design and manufacture of many types of waste heat recovery equipment. Our expertise lies in waste gas-to-liquid heat exchangers and waste gas-to-gas heat exchangers which absorb heat from the exhaust of reciprocating engines, gas turbines, furnaces, incinerators, boilers and other combustion equipment. The energy is transferred to process fluids such as water, steam, oil or air. Our equipment is built to AS, BS and ASME standards for both fired and non-fired vessels.

CBST is a fully owned subsidiary of the Clyde Bergemann Power Group. Our clean energy solutions are based on extensive experience with the original design of the Senior Steel 'H'® extended surface economiser further developed for applications in heavily fouled gas streams such as those fired with coal, PF and biomass fuels. Continued development of Senior Double 'H'® finned tube in varied symmetries has provided cost effective waste heat recovery for clean natural gas-fired cogeneration and fired steam raising plant.

In addition, we offer complete solutions for effective on-line cleaning of Steel 'H'/Double 'H'® heating surfaces with Clyde Bergemann on-load cleaning technology.



## Energy recovery solutions for global power and industrial steam raising plants

### Waste heat recovery systems

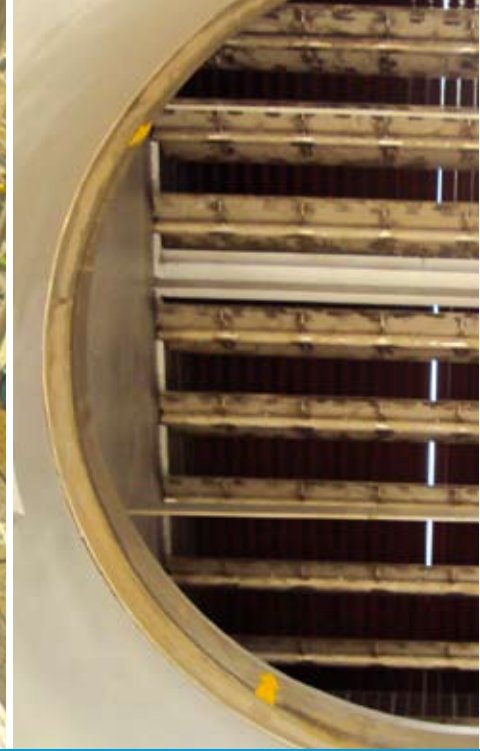
CBST offer a variety of heat recovery solutions for the modern plant. From hot water to steam to fluid heating our company caters for many industrial applications requiring waste heat in some form. Our waste heat units are designed with integral bypass reducing the footprint required for heat recovery and consist of proven robust steel 'H'® design heating surface. Typical markets include marine waste heat including FPSO/FLNG vessels and land based waste heat. Our capacities range from 0.5 MW of heat recovered up to 35 MW of heat recovered. Additional capabilities include provision for supplementary firing and extra heating surface.

### Advantages:

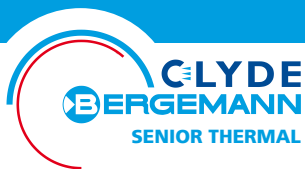
- Robust heating surface
- Units delivered in largest transportable pieces
- Increases thermal efficiency to the process
- Optimum supplementary firing to increase overall heat recovery potential
- Ideal for retrofit applications
- Custom made designs available
- Turnkey experience in delivery
- Low maintenance costs

Reference List (extract)

Country	Plant	Year
Brazil	Modec International – Tupi MV22 FPSO – Petrobras	2010
Brazil	Prosafé – Cidadesde São Mateus FPSO - Petrobras	2009
Australia	Apache Energy – Varanus Island	Various 1991-2009
Australia	BP Bulwer Island – ATCO Power	1999
Indonesia	Kakap Compression Project	1999
New Zealand	Bay Milk	1996



## Simplifying the installation's footprint



### Integral Bypass Solutions

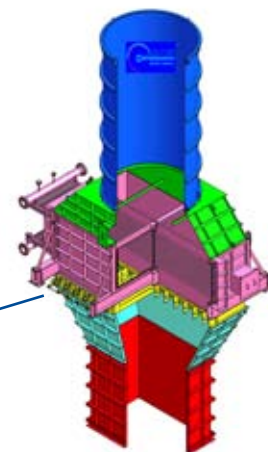
An integral bypass solution can be applied to the waste heat units in order to simplify the footprint of the installation. This saves additional ductwork and reduces installation timing down to fewer lifts.

The system consists of louvre type dampers that have been operating on CBST installations over the last two decades. The damper operation can be either pneumatic actuated or hydraulic operated depending on individual customer requirements.

The gas flow over the heat convection bank is modulated depending on the outlet fluid temperature. CBST integral bypass dampers fail safe in the 'bypass' mode in the event of turbine/compressor/engine failure.

### Advantages:

- Fit anywhere in ductwork
- Compact, minimal external clearance required
- Drive and linkage readily accessible
- Good flow modulation capabilities
- Fast opening / closing possible
- Zero leakage to atmosphere possible
- Fail safe in bypass mode
- Proven over two decades of operating experience



Integral bypass damper located on the inlet to the WHRU



## Purpose built machinery for high quality design

### Specialised manufacturing

Our manufacturing facility in Wetherill Park, Australia, is configured to ensure efficient processes throughout and contains purpose built machinery designed to produce the highest quality output.

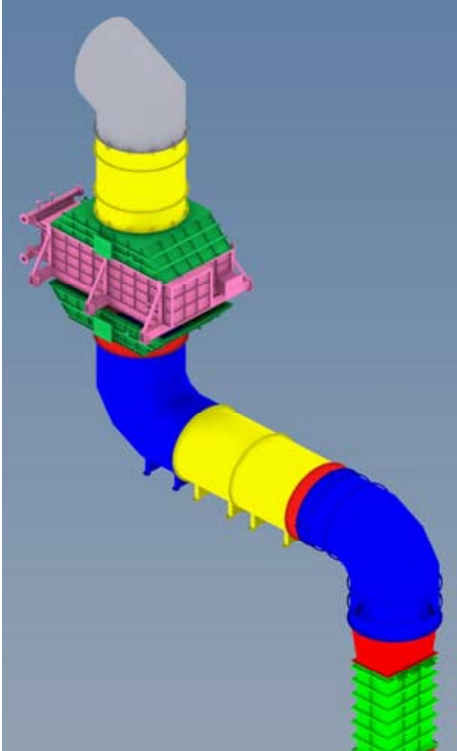
- Throughout the manufacturing process modern welding equipment is used to meet regulatory standards.
- Purpose built resistance welding finning machines
- CBST has over four decades of experience in manufacturing heat recovery solutions
- Specialist boiler tube bending machines form part of the process of ensuring our heat recovery solution confirms to code requirements
- Senior Steel 'H'® and Double 'H'® finned tubes assembled into individual elements giving greater flexibility to expand and contract in the operation and allowing for easy removal in the event of maintenance if required.
- Proven designs cater for all relevant code requirements

### Quality assurance

We are quality assured to ISO9001 and ASME 'S' Stamp. Regular audits from international assessment organisations ensure we are producing high quality output at every level of production.

Our products are also designed and manufactured to the following Pressure Vessel codes and rules:

- AS1228
- ASME Codes Section I and VIII Div.1 'S'
- ASME 'S' Stamp
- Lloyds Register of Shipping
- BS.1113 / BS.5500 / BS.2690
- EN Approvals pending
- API code compliance



## International installed base



### BRAZIL - Tupi MV22 FPSO

Customer	MODEC International
Water heaters	3 x 231 tph
LM2500	3-off
Heat recovered	17.7 MW
Hot Water	145°C



### BRAZIL - Cidades de São Mateus FPSO

Customer	Prosafe Production Services
Water heaters	3 x 210 tph
Solar titan 130	3-off
Heat recovered	13.56 MW
Hot Water	135°C



### AUSTRALIA - BP 'Bulwer Island' Refinery

Customer	ABB Alstom
Steam output	92,000 kg/h
Steam temp	370°C
Steam pressure	34 Bar a
Support fuel	Natural gas
AGT Cyclones	2-off





## Proven technology around the world

### NEW ZEALAND - Kapuni Energy Plant

Customer	Kapuni Energy	
Steam output	2 x 45,000 kg/h	
Steam temp	300°C	
Steam pressure	34 Bar a	
Support fuel	Natural gas	
Solar Mars 100	2-off	



### AUSTRALIA (North West Shelf) - Wandoo B Platform

Customer	Solar Turbines USA	
Water heaters	2 x 200 tph	1 x 195 tph
Heat recovered	7.1 MW	76.8 MW
Hot water	120°C	120°C
Solar Taurus 60	2-off	1-off



### AUSTRALIA - BHP Whyallia Steel works

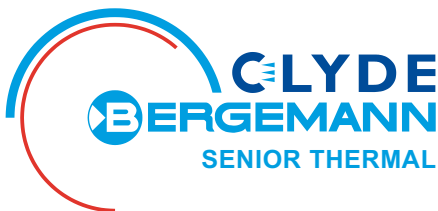
Customer	GEC Alstom	
Projects	2 x gas turbine exhausts into 1 x HRSG	
EGT Typhoon MR GT	2-off	
WHR	1 x 16,000 kg/h steam	
Superheat	454°C @ 4.2 mpa	



Clyde Bergemann is represented in over 40 countries worldwide



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- Clyde Bergemann Associates



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