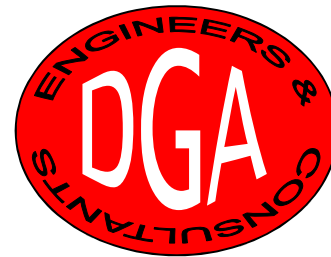
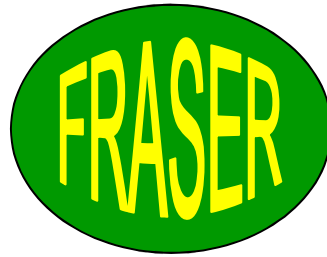


# **Fraser Energy SDN BHD**

**EPC contractors and Boiler  
Manufacturers**

Presented by

David Gardner



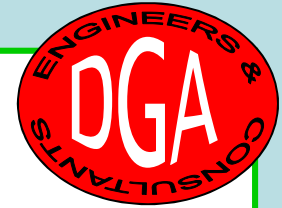
## **INTRODUCTION**

**This presentation describes the early history of DGA  
and the integration into the Fraser Group as  
Fraser Energy**



## INTRODUCTION TO FRASER GROUP

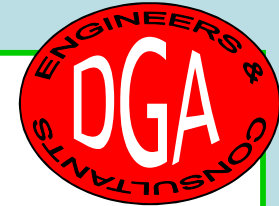
|                      |   |
|----------------------|---|
| Lead Company         | Bukit Fraser Thermal Technology SDN BHD                       |
| Subsidiaries         | Fraser Uniquip Pty Ltd<br>Fraser Energy SDN BHD<br>DGA Co Ltd |
| Staff Numbers        | 45  |
| Annual Turnover      | \$50 - \$60 million   |
| Head Office          | KL Malaysia, Fraser Energy office Bangkok                     |
| History              | 10 years  |
| Located in countries | Malaysia, Thailand, Australia                                 |
| Represented in       | Indonesia, Vietnam, Dubai, etc                                |



## **DGA Co Ltd**

- Independent Energy Consultant based in Bangkok Thailand and operating in SE Asia and Australia
- Specialist in biomass power and energy production
- Combustion Engineering a speciality including Fluidised Bed Combustion, Grate firing and Suspension firing
- 30+ years in EPC contracting in the waste and biomass power business
- Full range of boiler and ancillary products including “in house” developed equipment
- Primary Market has been outside Thailand, now focused in Thailand, Malaysia, Australia and the Asia Pacific area





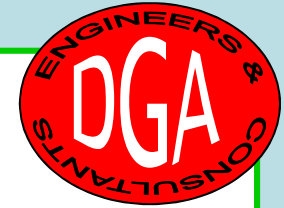
## CURRENT PROJECTS

### **DGA are currently working on :-**

- Completing the Eco Plant Range of modular small (1-10 MWe) power plants capable of firing biomass through to municipal waste.
- Having completed the series of 23 Vibrating Grates for Mackenzie ending with the sale of a license to Mackenzie to build the DGA grate for their boilers. DGA have redesigned the grate to suit the ERK range of steam boilers, in sizes up to 200 tn/h steam.
- The Vee grate now has references burning a wide range of biomass fuels, including fuel mixes eg wood chip, with and without bark over range of species; rice husk; parawood (rubber wood) both slab and root stock, Palm waste including fibre, shell and EFB either mixed or independently; eucalyptus and radiata pine wood and bark. The plants range between 45 - 80 tn/h of steam.

### **DGA have live prospects (this year) for :-**

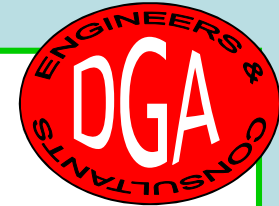
- BFB fired boiler for Benedicts, Sydney to fire C&D waste
- Many enquiries for Eco Plants to fire waste and/or biomass in Australia
- A number of Eco plants for rice husk in SE Asia and Australia
- A number of Biomass power projects with SBANG in Thailand, size 10 MWe
- Vee Grates to South America for firing Biomass
- A number of other assorted projects
- A biomass fired thermal oil heater for Expel Oil UK.



# PRODUCTS

## DGA Design & Manufacture :-

- Vee Grate stokers for palm waste and other solid fuels. These units are suitable for firing both the package and site erected solid fuel boilers. Currently developing the market to ERK licensees worldwide.
- BFB fluidised bed boilers to fire various solid fuels. The BFB is originally based on technology developed by the CRE (the Coal Research Establishment) of British Coal in the 1990s kept current by working with EPI of the US, Ebara Corporation of Japan, Energy Equipment of Australia and finally with Double A Paper on the Kvaerner plants.
- Collaboration with ERK to develop the BFB for large biomass and waste (RDF) firing. New water cooled air manifolds combined with DGA combustion experience allow use on larger capacity boilers for difficult fuel.
- ERK Licensed Watertube Boilers sized up to 200 tn/h size. Can be fired by DGA grates, BFB or Gasifiers for wastes and biomass fuels.
- A range of boiler ancillary products including Modular Bag Filters and Dry Scrubbers for pollution control behind boilers and gasifiers
- A range of exhaust gas boilers designed specifically for the exhaust gas engines particularly the GE Jenbacher engine and HRSG (ERK license) for Gas Turbines



## ERK Eckrohrkessel GmbH License

DGA became an ERK licensee in 2002. Since then DGA have participated in the design and development of many boilers of different styles, all taken from ERK's library of boiler designs. Some of these projects are illustrated on the following slides

- 20 tn/h boiler for Energy Equipment Australia, BFB unit firing wood
- 65 & 100 tn/h power boilers for Stuck Biomass and Thai Alcohol on BIB traveling grate
- 30 & 35 MW HMW water heaters for Gosfern (now Aalborg) for SBM
- 15 MW gas fired watertube boiler for HPP Australia, fired by Saacke burner
- Refurbishment and modification of TPS 200 tn/h rice husk/bark fired BFB boilers for AA
- Design of 100 tn/h marine superheat boilers for FPSO Polvo. Ship in commission with Prosafe. This is still the largest deck boiler with superheat in commission.
- 20 tn/h boiler designed specifically for the Torbed reactor. First Unit just in commission in Cambodia. Boiler Range projected from 2 – 10 MWe
- Design of HRSG behind a Gas Turbine for Mackenzie. Ultimate client Petronas, Malaysia. Currently operating successfully.
- Design of a heat recovery package behind Gasifier for Ecocycle.
- Potential sales of Eco Plants world wide for waste plants for firing biomass and waste fuels in a standardised configuration.



## **EARLY PRODUCTS**

This section describes the early projects of DGA.  
At this stage DGA worked mainly as a consultancy advising Double A paper on their arbitration with Kvaerner, and particularly BIB on their ERK license technology.  
Also involved in a number of other projects for Double A as an expert in Fluid Bed Firing Technology and steam boilers.

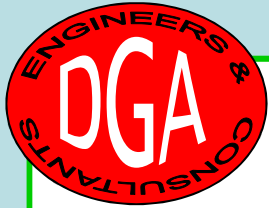
# Energy Equipment BFB Boiler

Supplied to Queensland Australia



The boiler was built by Bangkok Industrial Boilers, their first ERK boiler. The design was by DGA.  
The plant was installed in Queensland Australia in 2002





## 65 tn/h Power Boiler for Stuck Biomass supplied to Buriram, Thailand, 2003



The plant was designed and built by BIB. DGA was responsible for furnace and grate design

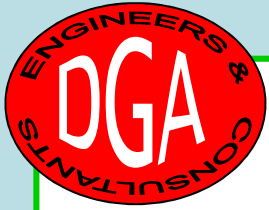




## 30MW HMB Boiler for FPSO vessel supplied to Gosfern for Vessel in Singapore, 2004



HMB watertube heater fired by Natural Gas on an FPSO vessel. DGA designed and supervised the manufacture of this and 4 more units for the offshore market



## 15 MW Gas Fired Process Steam Boiler supplied to Sun for Highland Pine Products, Australia



This boiler was DGA's first package gas fired boiler to ERK basic design.

The boiler is a 23 tn/h boiler to meet limited attendance operation. It is firing successfully in Australia.



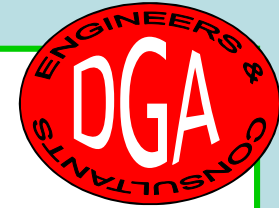


# 100 tn/h Power Boiler for Thai Alcohol.

supplied to Thai Alcohol, now operating. 2006



This plant was built by BIB with support from DGA.



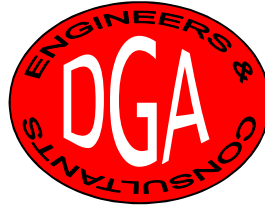
DGA were the consultants and detail designers for a major redesign of the Thai Power Supply (Part of AA, Double A Paper) PP4 power boiler.

Boiler is a 200 tn/h 80 barg 480 C BFB boiler firing rice husk and wet eucalyptus bark and at times supplementary coal fuel

Scope included approximately 550 tn of boiler pressure parts, including economisers, air heaters and a revised and redesigned combustion system.

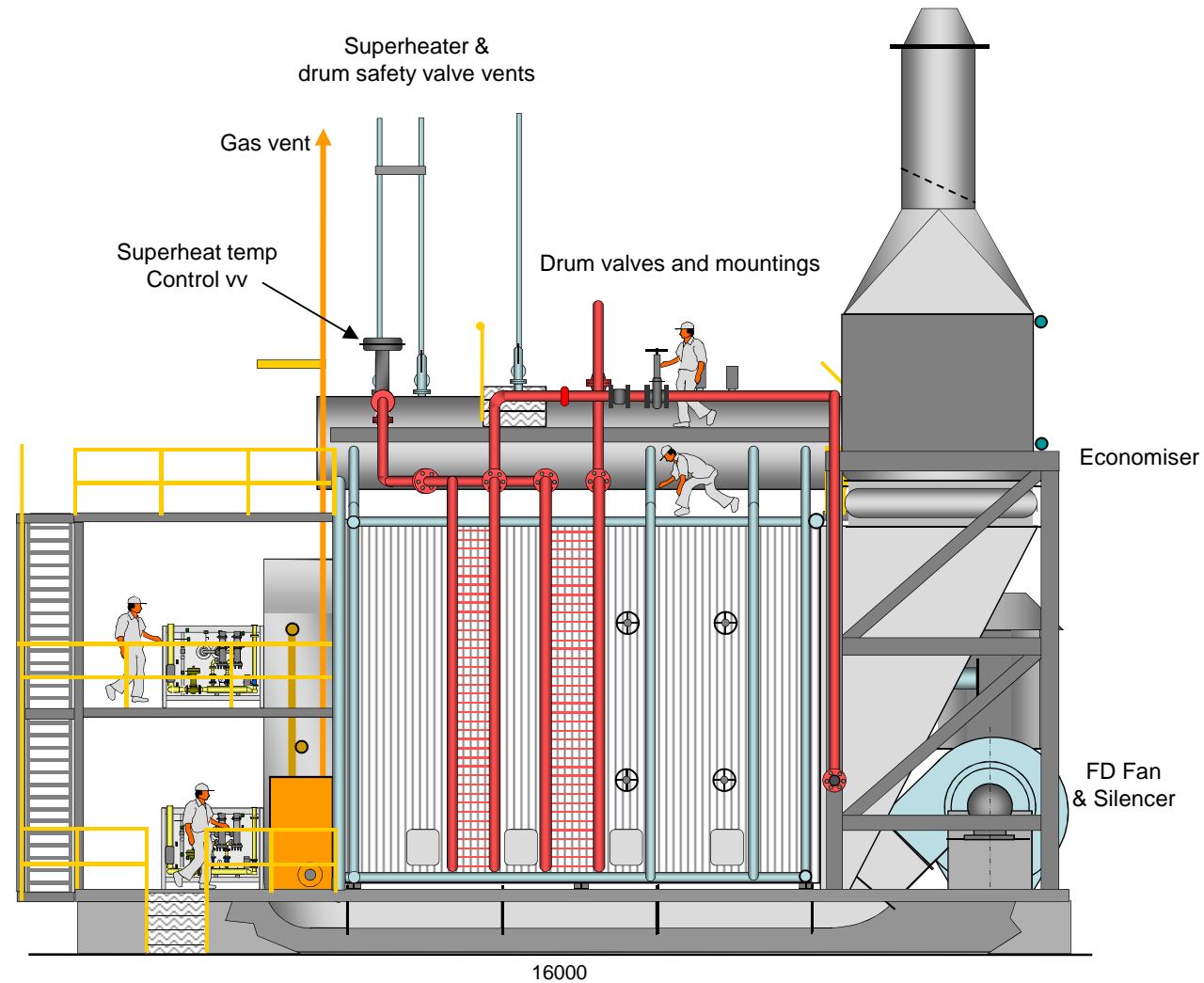
Work was completed successfully in May 2005 and the plant is now able to generate 38 MWe.

The redesign of the combustion system by DGA made this boiler one of the most successful boilers in Double A Paper. This redesign combined with the ERK boiler system forms the basis of Fraser's BFB boiler



## **DEVELOPMENT OF FPSO DECK BOILERS**

This section describes the early development of the Deck Boiler with Gosfern. Gosfern became a licensee of ERK on DGA's recommendation. This allowed ERK to become involved in the design. The initial concepts were provided by DGA and following 3 years of marketing, a project was won. The Polvo FPSO has 3 x 100 tn/h steam boilers which run Steam Turbines.



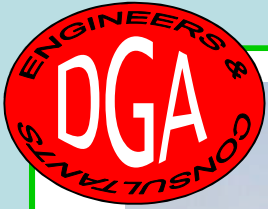
This sketch shows the design by DGA of an oil & gas fired 100 tn/h power boiler, skid mounted for use offshore in the oil and gas industry (for Gosfern Pty Ltd).  
The plant was sold and the reality follows on the next slides.....



## 3 x 100 tn/h 40 bar 400 C ERK Steam Boilers Designed for Gosfern Australia, 2006

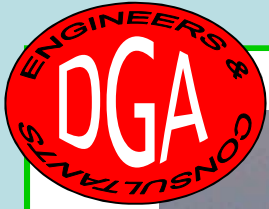


**FPSO Polvo**



**3 x 100 tn/h 40 barg 400 C oil and gas fired boilers of to Singapore for installation on the Polvo FPSO.  
The vessel is now located off the coast of Brazil. The boilers were designed by DGA under ERK License**





Safely installed on the FPSO Polvo at the Dockyard in Singapore



## **EGB and HRSG Development**

DGA were approached by Navigat for a compact steam boiler to operate behind the GE Jenbacher engine burning gas.

The result was the development of the EGB or 'baby boiler'.

8 boilers were sold until Navigat realised that absorption chillers were more popular.

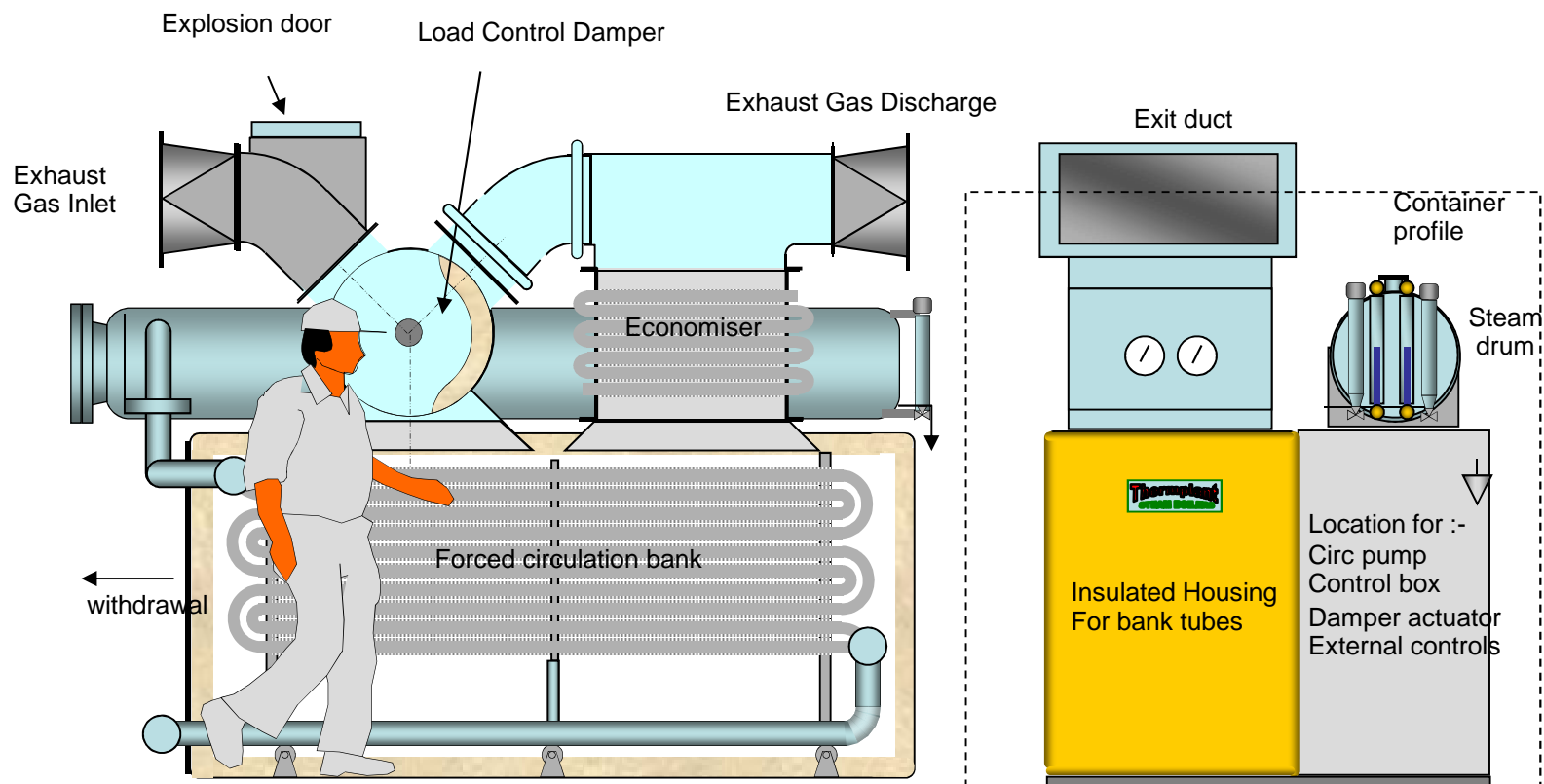
The design has been adapted to operate with multiple engine installations

Lately GE increased the product range of Navigat to include their gas turbines so DGA is taking an interest in the Cogen Package behind the turbine.

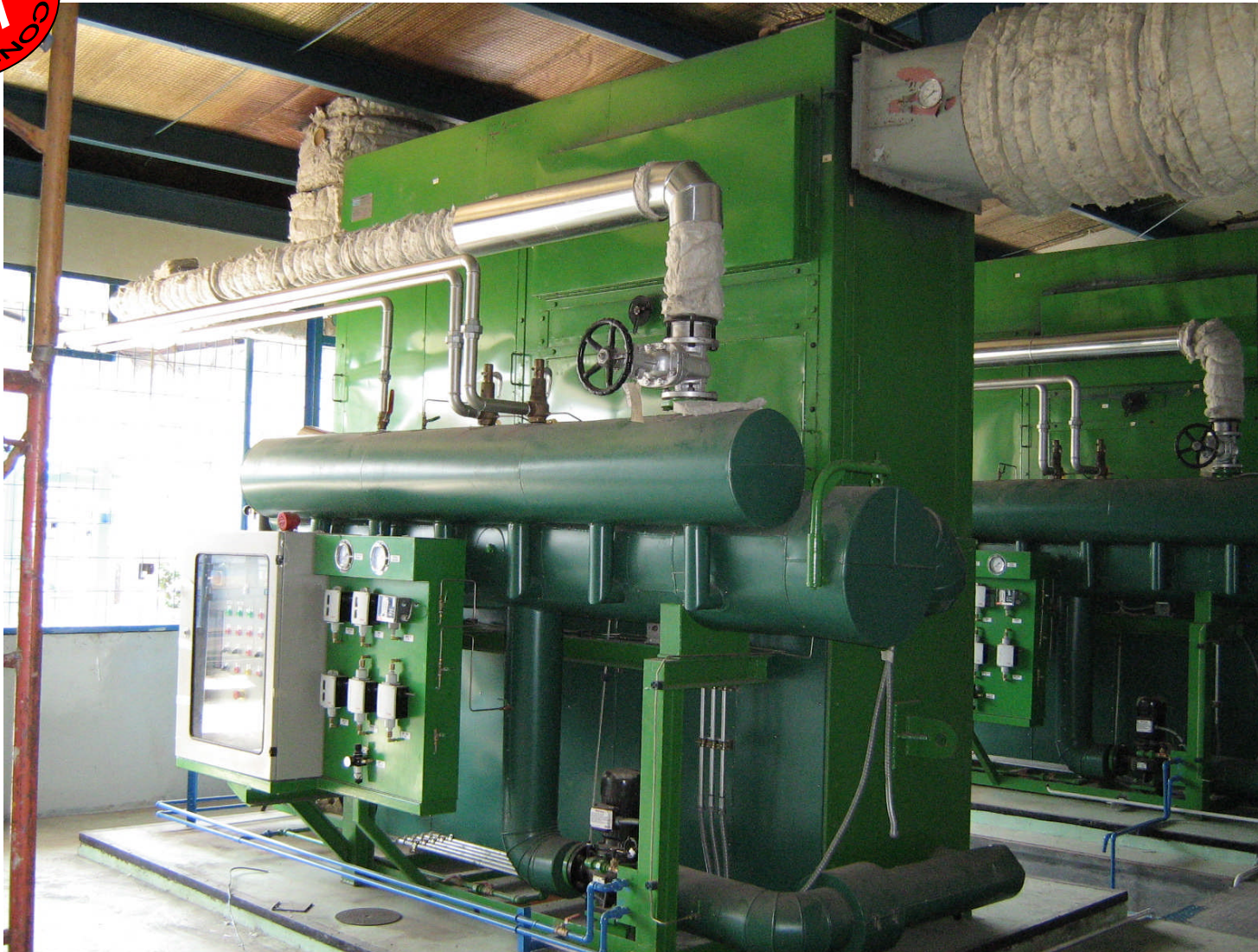
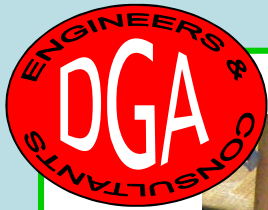
An example was designed under ERK license for Mackenzie, final client Petronas.



### DGA EGB (exhaust gas boiler)

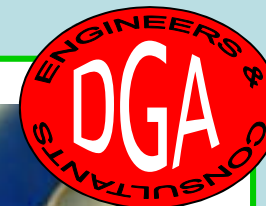


In 2002 Navigat, the Indonesian Agent for GE Jenbacher enquired for a compact steam boiler To suit the Jenbacher engine. This sketch design was submitted by DGA.  
This turned into.....



**These boilers were ordered by Navigat in 2006 and supplied to Argo Pantes. After initial problems with poor water, all 5 boilers have operated consistently since. This was DGAs 3<sup>RD</sup> order for EGB.**





**HRSG BEHIND 2 GAS TURBINES AT PETRONAS, MANUFACTURED BY MACKENZIE  
DESIGN BY DGA TO ERK LICENSE**



## **VIBRATING COMBUSTION GRATE**

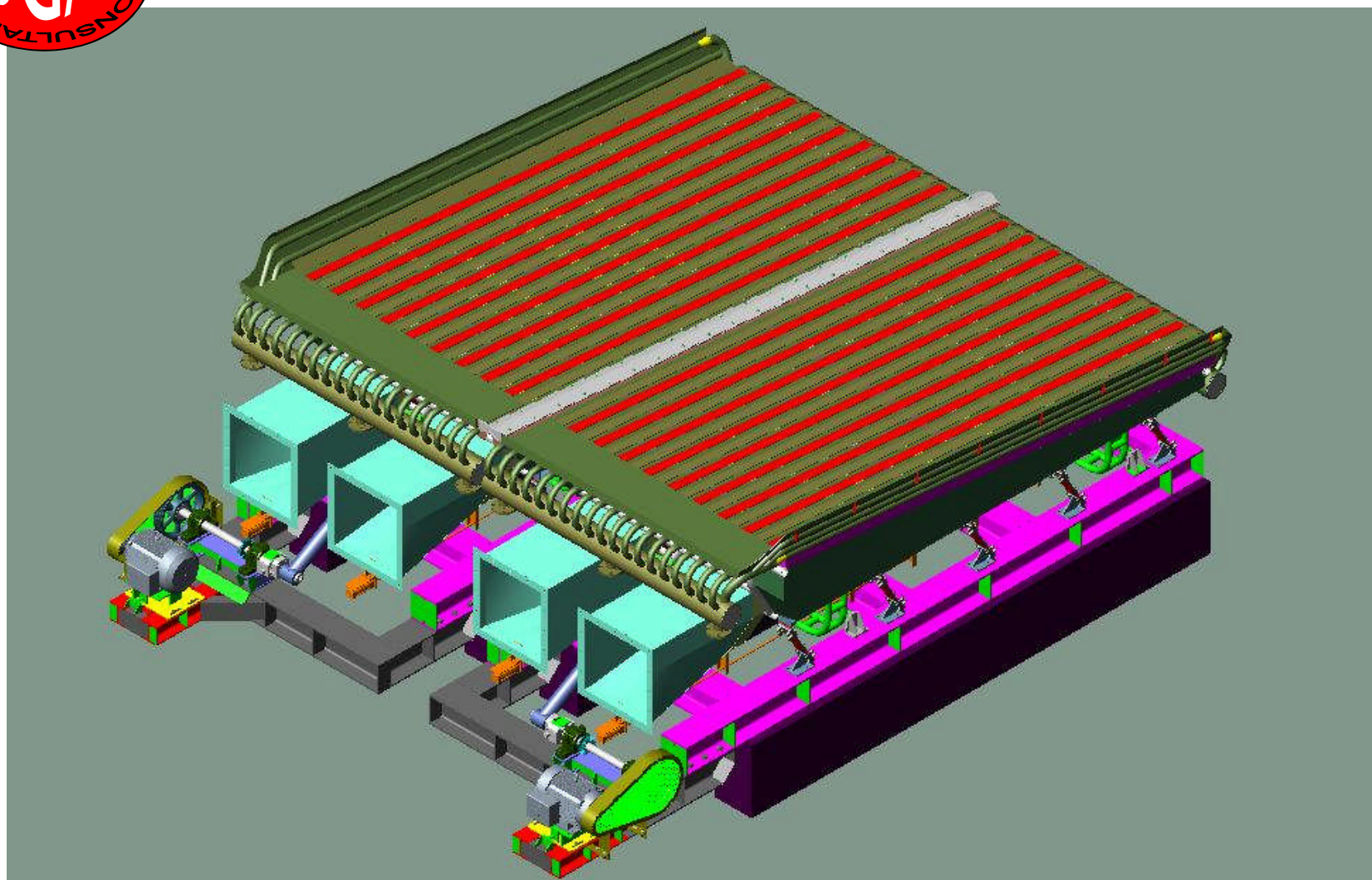
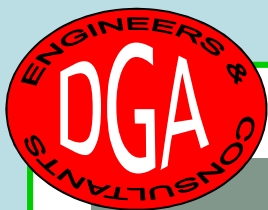
DGA were approached by Mackenzie to develop a combustion grate for their palm oil boilers. As Vickers they had some success with the Detroit Stoker Grate which was priced out of the market. DGA has since supplied 20+ grates for boilers sized between 20 and 70 tn/h steam.

The grate has proven successful at handling Palm EFB which is a notoriously difficult fuel.

The most notable is the MNI boiler which has produced an Availability of 90% over a 4 year period on an EFB mix.

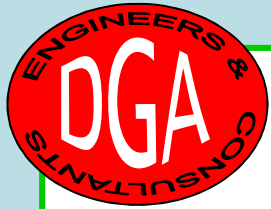
When DGA joined the Fraser Group, Mackenzie acquired the right to manufacture and market the Vibrating Grate for their own boilers .

DGA continue to market the Vee Grate to other boilermakers notably other ERK boiler licensees

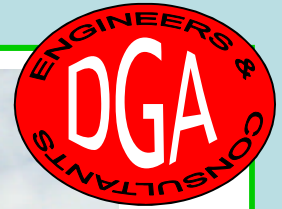


An original 3D drawing of the vibrating grate. After the initial grates were built, an improvements programme led to detail redesign of the concept. Now the grates run successfully on Palm Empty Fruit Bunch

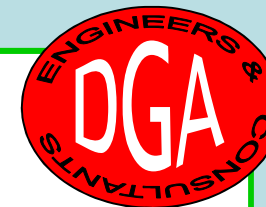




**W/C VIBRATING GRATE STOKER FOR PALM WASTE BEING INSTALLED  
IN A MACKENZIE BOILER AT MNI MALAYSIA. NOW OPERATING ON EFB (~48 MONTHS)**



**MNI MALAYSIAN NEWSPAPER INDUSTRIES  
IS POWERED BY A MACKENZIE BIOMASS BOILER WITH DGA VIBRATING GRATE ON PALM EFB**



## RUBBER WOOD, EFB AND WASTE IN THAILAND

Following a visit to MNI by SBANG in 2011, DGA received an increasing number of enquires from SBANG, considered by many, to be the premier EPC contractor for small to medium sized power projects in Thailand. A relationship was formed leading to the formation of a JV between Sbang and DGA under the SBANG Corporation. The JV will combine Sbang expertise in construction with DGA's combustion and boiler experience

3 projects are close to completion

- **APK Hat Yai** is successfully producing 60 tn/h steam from Rubber Wood root stick an slab
- **NEPS project** is successfully producing power from prepared EFB fired as a single fuel
- **Clover Project** is partly complete and will produce power from a variety of biomass fuels

New orders are in or expected from

- **4 Biomass power projects** sized c 10 MWe
- **3 Waste to Energy projects** designed under the Eco Plant programme This programme has established a standardised range of steam power plants to fire Biomass and treated waste in compliance with EU WID regulations. Eco Plants are available for standard power plants to produce 1 to 10 MWe net to grid.

All projects use the DGA Vee Grate and the ERK licensed boiler



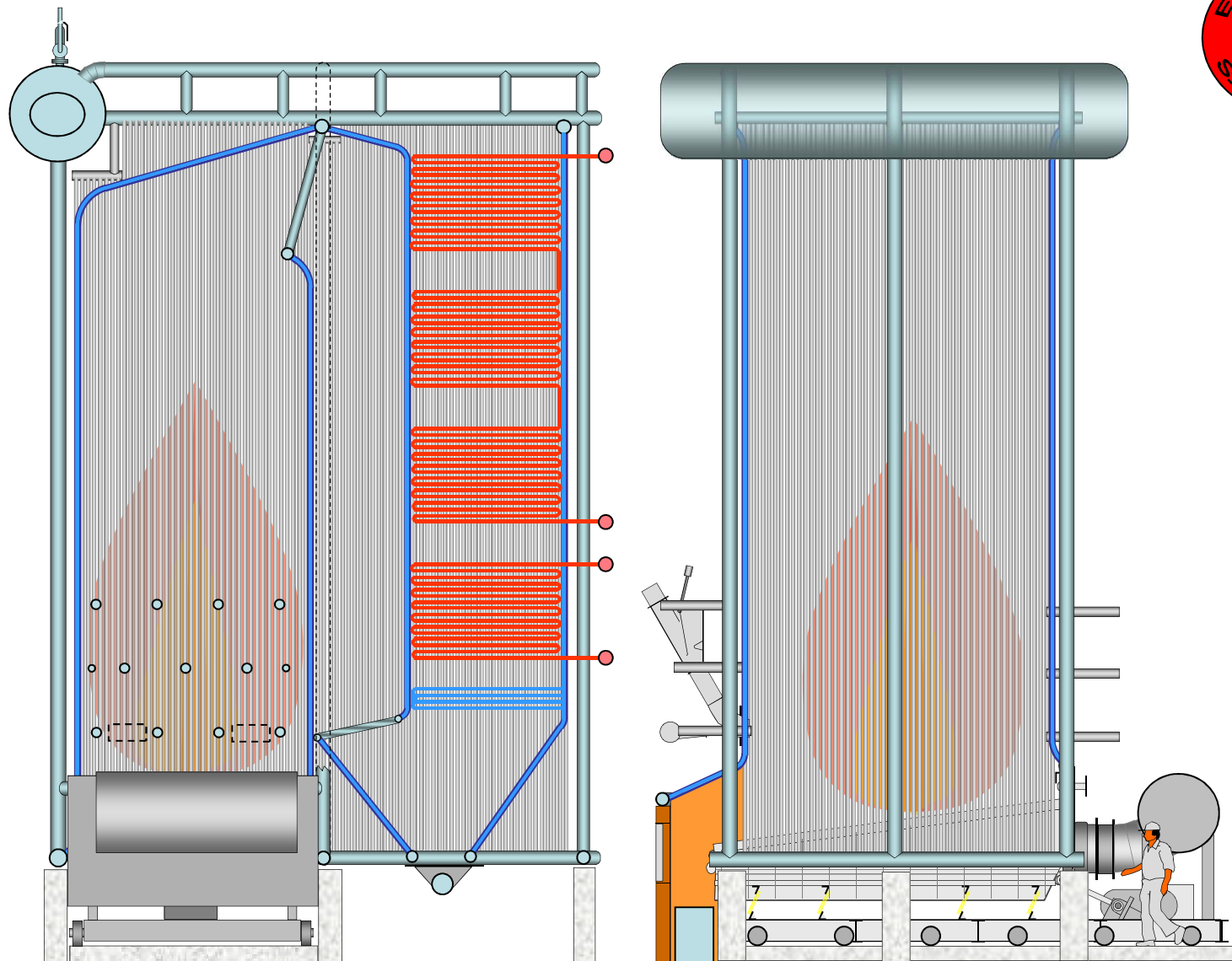


Project APK Hat Yai, Thailand with SBANG  
60 tn/h steam burning Parawood slab and roots



Project Natural Palm, Surat Thani, Thailand with SBANG  
50 tn/h steam burning Palm EFB





**Current 40 tn/h Sbang DG Boiler with Removable Vee grate.**



## **RICE HUSK FIRED BOILER**

DGA have been working on a Rice Husk boiler for approximately 7 years and have been directly involved in the ABC project for 5 years. The original combustion designer removed themselves from the project, so DGA changed the design to their standard BFB 'gasifier' This is directly competitive with the original design.

This Development allows Fraser Energy to market a range of Rice husk fired boilers to provide steam to power plants sized between 2 MWe and 10 MWe Gross power based on a single power boiler. This is an exciting development for Fraser who are developing the market in SE Asia for efficient RH fired power plants.

The by product of the plants will be amorphous silica ash which may provide more income to the power plants operator.

# FRASER

## Cyclone Boiler

This view shows how the cyclone firing technology has been integrated into a modern BFB watertube Boiler.

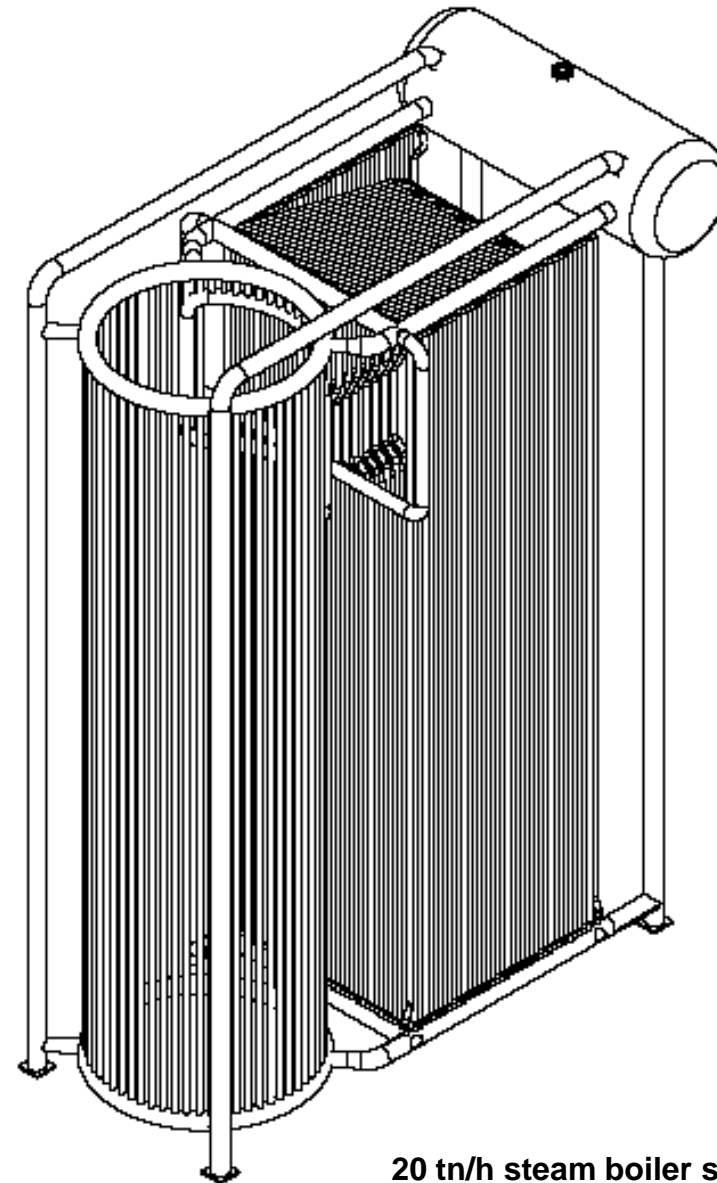
The design of the boiler is by DGA based on a license from ERK Eckrohrkessel of Germany. Close coupling of the furnace and boiler allows standard boiler materials to be used for the Furnace. The design uses strict temperature controls and FGR to control the combustion conditions required for an effective husk fired plant.

The development of the BFB Cyclone boiler has been Fully supported by ERK Eckrohrkessel.

The Boiler is designed in accordance with ASME 1 but not stamped

The gas velocities through the boiler are generally low to preserve the boiler from wear, as rice husk is extremely abrasive

This product is considered important for the future of Fraser Energy.



20 tn/h steam boiler shown

**FRASER**

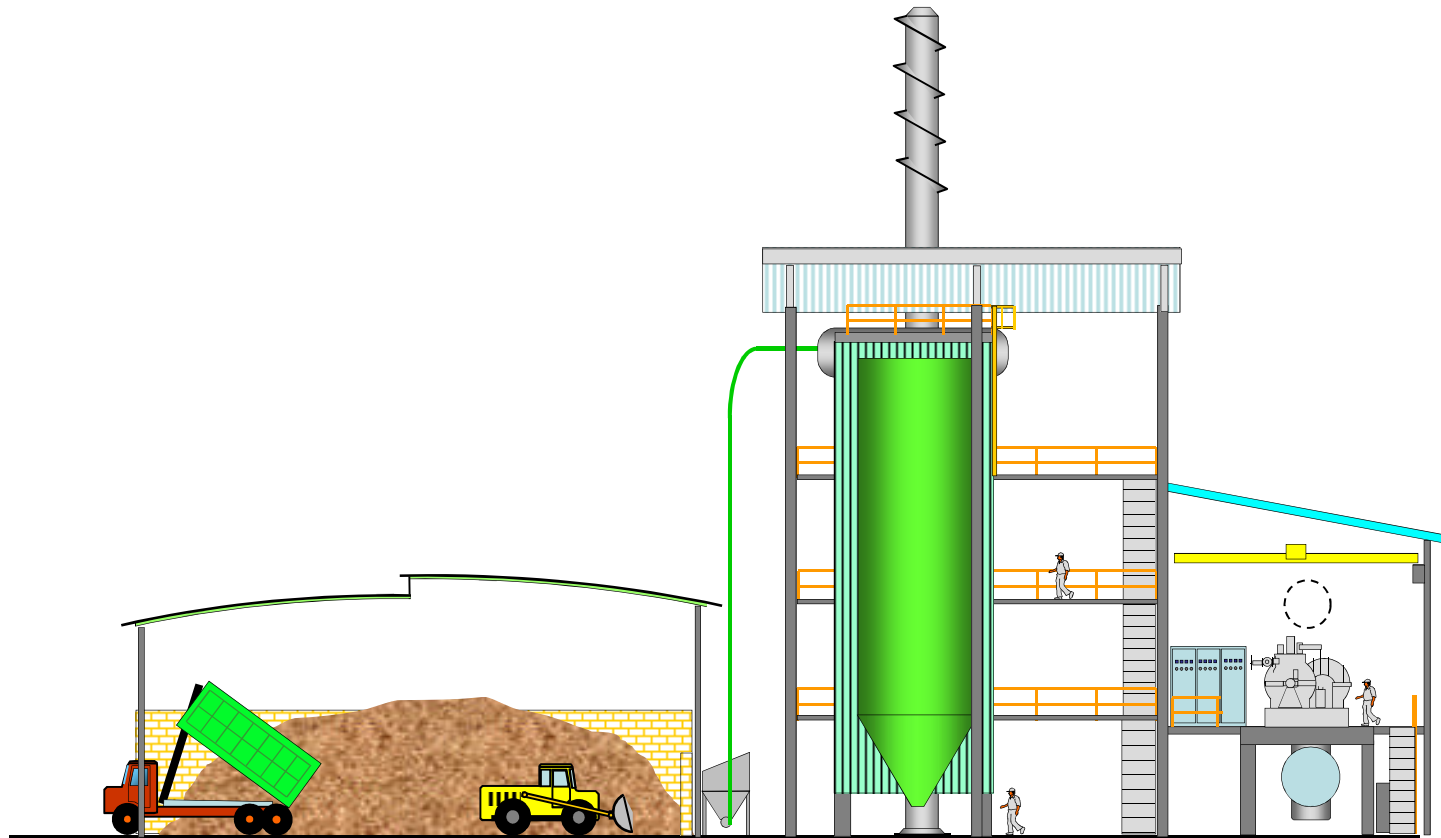
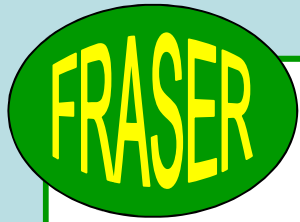


**Dated 5<sup>th</sup> August 09 this picture shows a DGA boiler being assembled adjacent the turbine house. All major equipment was on site and completed in February 2012**

FRASER

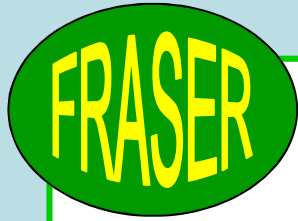


DGA PLANT at ABC IN CAMBODIA – Picture taken ~August 2011



ELEVATION SHOWING A PROPOSED SINGLE LINE 10 MWe POWER PLANT INSTALLATION





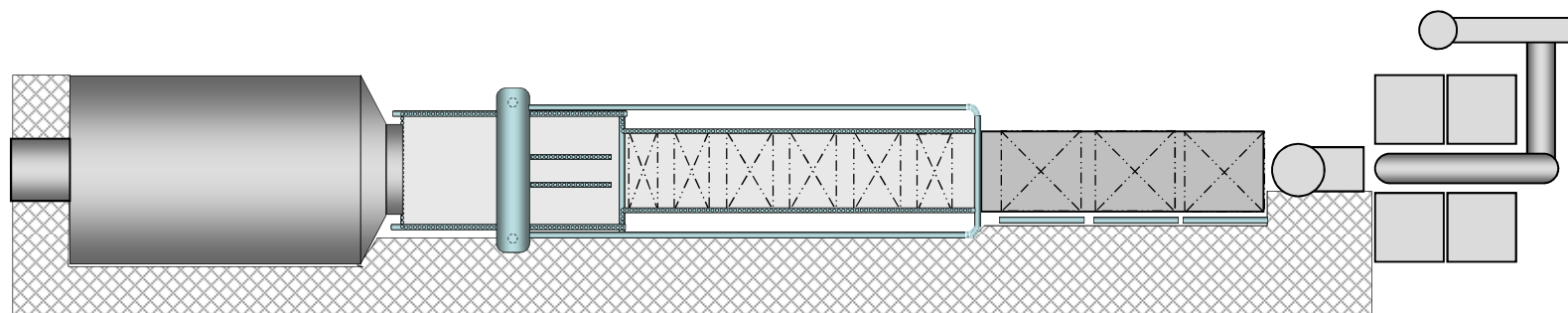
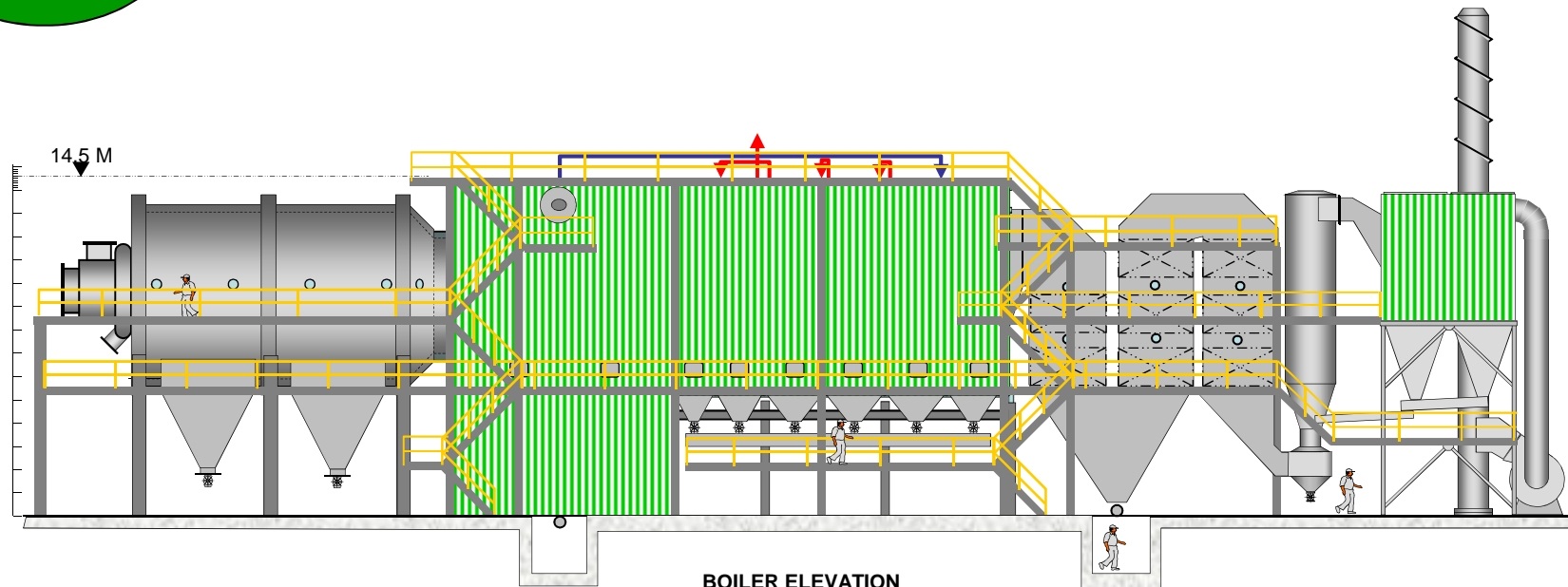
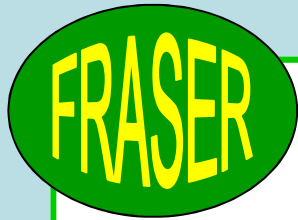
## **WASTE & BIOMASS GASIFIERS**

DGA understands gasification technology as it is used in BFB firing systems and have developed gasifier designs for use with Dry Biomass fuels on steam cycle plants.

However Fraser believe that gasification of waste is a not a mature technology, particularly if used with 'syngas' fired engines due to the high contaminants loading. Removing contaminants from hot syngas to the required level is very expensive.

If syngas is fired in a steam boiler to use the thermal energy released, then Fraser can offer suitable steam boilers to receive and combust the syngas and use dry scrubbing systems and filters in compliance with EU WID regulations. See diagram following for a low profile boiler to suit UK planning regs.

Fraser recommend a direct combustion system for wastes as this is better controlled and less dangerous than gasification systems. Direct combustion uses an identical mechanism to gasification but merely completes the process safely in one reaction in a single furnace.



**12 MWe COMBUSTOR AND BOILER FOR SYNGAS FROM GASIFIER FIRING RDF  
(With fully WID compliance)**



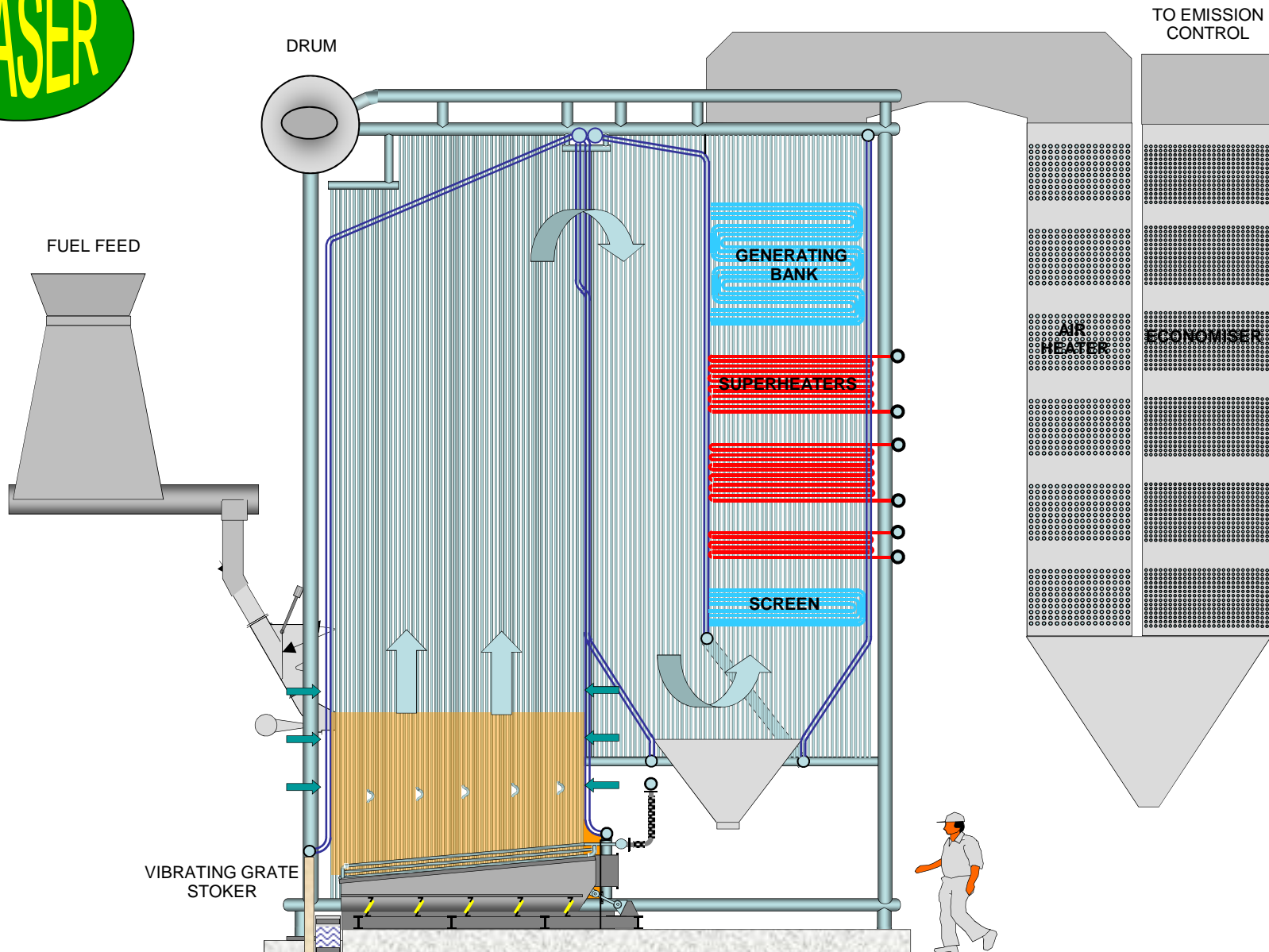
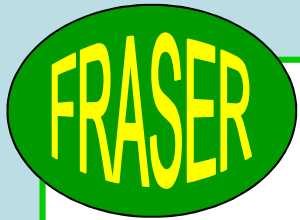
## **WASTE FIRED PLANTS**

ERK Eckrohrkessel are perhaps the most used boiler design for waste and garbage fired boilers anywhere.

Waste contains many materials which can foul a boiler so ERK have produced a 3 pass design which reduces the tendency to foul.

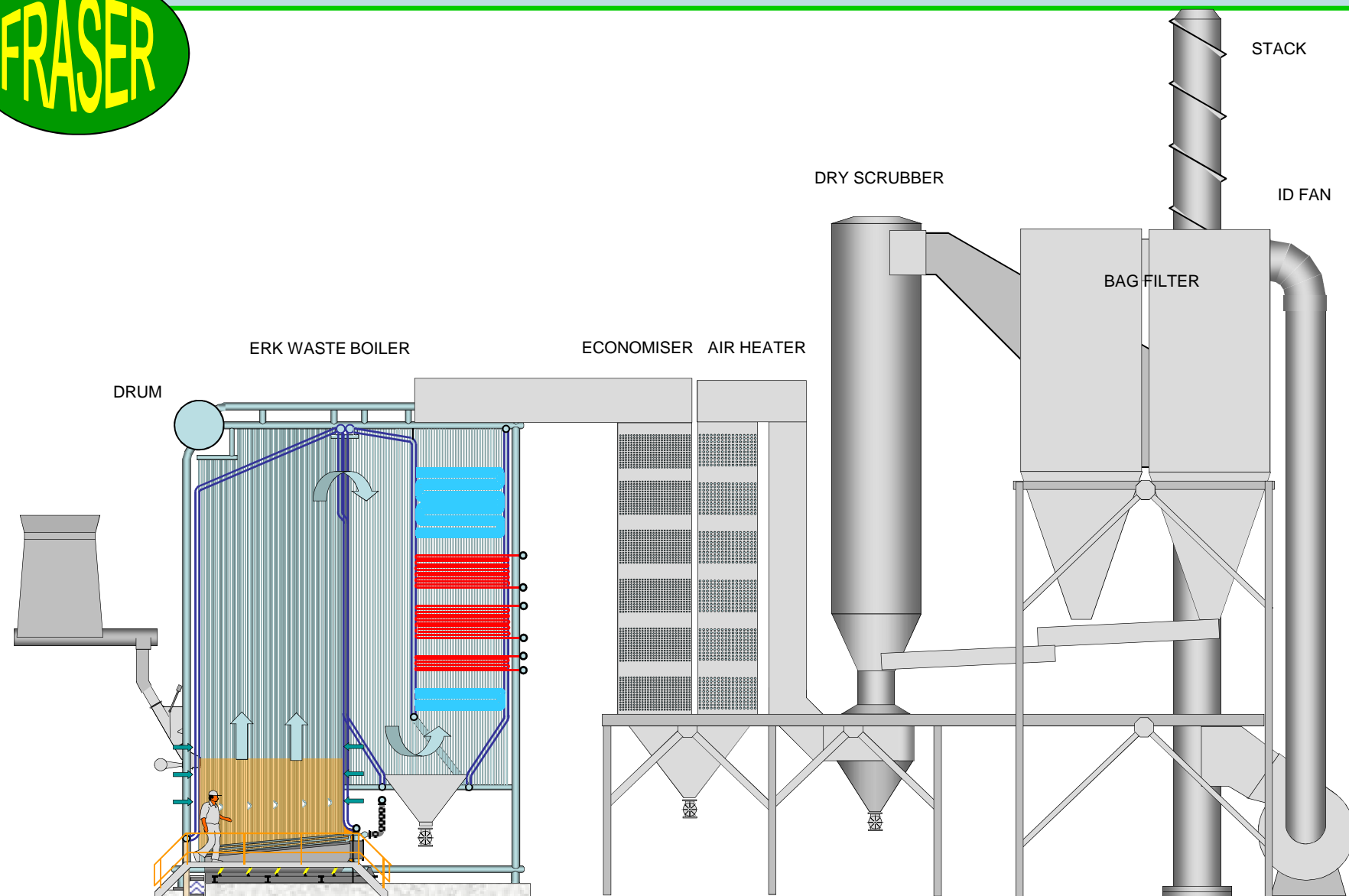
Fraser offer this boiler together with the DGA Vee Grate (vibrating Grate) to the waste industry in Singapore, Australia and Europe. The boiler has proven a good capability to reduce fouling on high alkaline fuels primarily biomass, indicating that with some adaptation It will be capable of handling prepared waste.

DGA's experience in the Waste Business suggests that this is an area with great potential.



**WASTE FIRED BOILER FOR ECO WASTE PLANT PART OF A NUMBER OF CURRENT PROPOSALS FOR <10 MWe POWER PLANTS**





**WASTE FIRED BOILER FOR SHOWING TYPICAL GAS CLEANING EQUIPMENT  
PART OF 10 MWe POWER PLANT**



## **NEW FPSO DECK BOILERS**

DGA have been working on Deck Boiler's for approximately 10 years initially with Gosfern, and latterly with Fraser.

The programme of work produced a number of HMW heaters, which are watertube style water heaters with a light weight and small footprint.

DGA then proposed a design for a larger scale boiler which was presented to Prosafe and ended in an order for Gosfern for 3 x 100 tn/h superheat boilers.

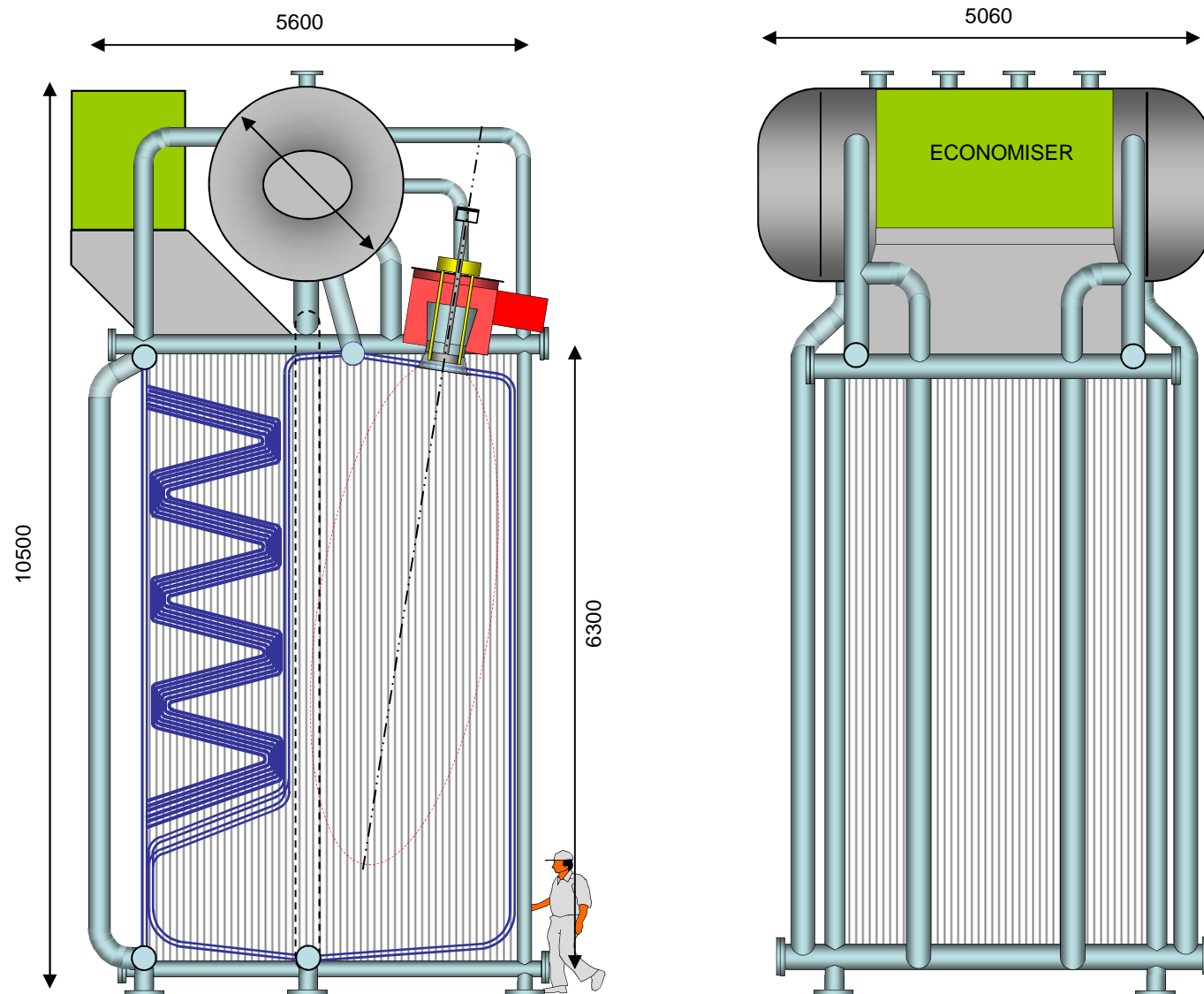
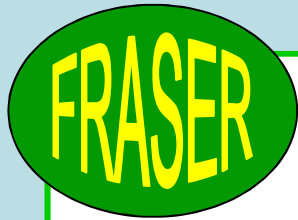
These were constructed and delivered to Singapore and are currently offshore Brazil on FPSO Polvo and working well.

Gosfern were purchased by Aalborg presumably to remove the threat to Aalborg's own boiler.

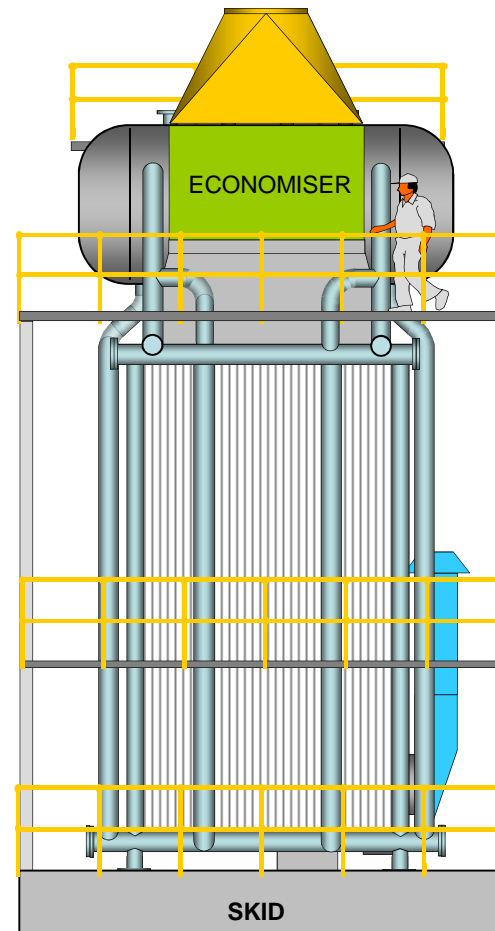
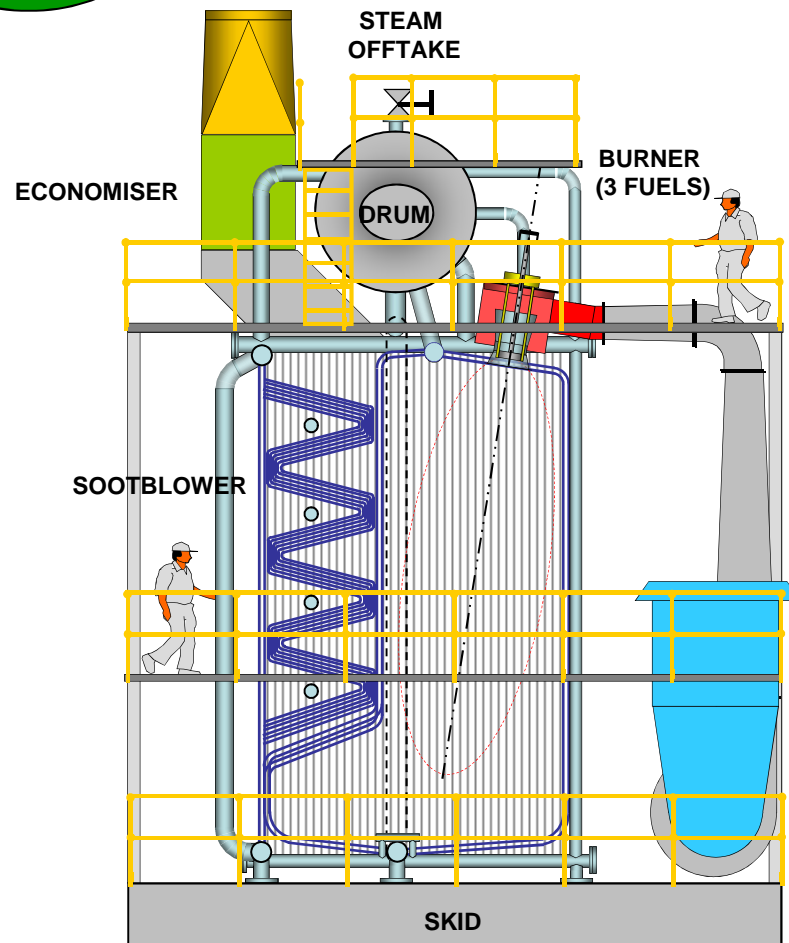
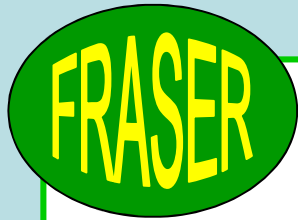
The ERK boiler is now available through DGA/Fraser Energy.

2 different styles are available, the vertical fired unit which is Illustrated, and the horizontal fired unit as installed on Polvo.

The horizontal boiler can be designed for up to 250 tn/h steam.

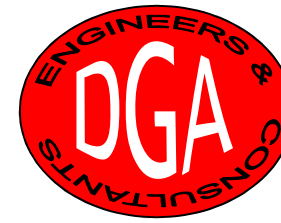


**50 TN/H SAT DGA/ERK STEAM BOILER FOR FRASER 17 BARG SATURATED  
OFFERED TO FPSO BUKIT TUAS**



**50 TN/H SAT DGA/ERK STEAM BOILER FOR FRASER 17 BARG SATURATED  
OFFERED TO FPSO BUKIT TUAS**





This presentation shows the growing relationship between Fraser and DGA and this has resulted in the formation of Fraser Energy.

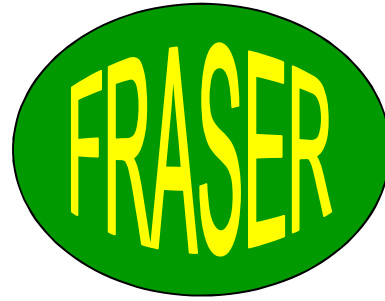
In 2011 Graham McClelland was an active director of Profab and he recognised that Profab needed to develop in a new direction and he approached DGA who had been active in Waste and Biomass firing systems and he initiated the purchase of DGA by the Profab Group.

During that year Profab defaulted on their contract with Graham, who promptly resigned from the Group and took his companies with him.

By mutual consent he also took over Profab's obligation to acquire DGA and Fraser Energy was formed as an Amalgam of Fraser and DGA.

Both Fraser Energy SDN BHD and DGA Co Ltd remain as separate companies within the Fraser Group. DGA remains the manufacturer of the firing equipment and generally providing the service and know how to Fraser Energy and also continues to make this available to other ERK license holders. Fraser Energy now focuses on EPC construction of power plants based on the ERK boiler range, DGA's range of firing and gas cleaning equipment and know how developed over 30 years in the same business by the two directors Graham McClelland and David Gardner

Since this agreement Fraser has moved from strength to strength and is making significant head way in the power market in the Asia Pacific area



Thank You !