# **P&W Marine /Fieldings Foundry**

### Sustainable Manufacturing in Action

- 30% reduction in energy use through solar and energy efficiency initiatives.
- Up to 150 tonnes per year reduction in solid waste to landfill.
- Innovative design and development of products with reduced material intensity and extended product life.
- Multi-award winning company for innovative design and for fostering advanced manufacturing skills of its workforce.

P&W Marine Engineers was established in 1978 and is Australia's largest manufacturer of underwater propulsion systems for both the pleasure and commercial sectors of the Marine Industry.

The company's non-ferrous foundry (Fieldings Foundry) produces custom made marine products cast from Aluminium, Bronze and Gunmetal. This includes propellers, marine anodes, water lubricated bearings, rudders, deck hatches, shafts, couplings and more.



Fieldings Foundry also produces custom made non-ferrous cast products for market sectors including Mining, Oil & Gas, and Construction and exports to several regions internationally. Products include wear plates, washers, balustrades, housings, automotive parts and mining tools, to name a few.

Innovation and business sustainability are a focus of the company which operates by the motto, 'Continual Development Ignites Us'. The multi-award winning company has designed and developed numerous innovative foundry products whilst continually looking for ways and means of improving manufacturing efficiencies.

# 'If you don't implement radical changes then you will be left behind'

Ross Cameron, Managing Director P&W Marine / Fieldings Foundry

# Design

P&W Marine spends significant time and resources developing innovative products and improving the design of existing ones. The examples below demonstrate how P&W are striving to produce reliable, durable and adaptable products that have longer working lives.

Design improvements result in improved customer satisfaction related to the extended life of the product and lower maintenance costs.





#### Light weighting

**Cast foil rudder** – the company has worked with Naval Architects to develop a rudder blade assembly which is cast in Aluminium Bronze (NiBrAl) traditionally produced from fabricated stainless steel. The rudder features a patented internal design which is hollow with water tight compartments. The reduced component weight adds to overall fuel efficiency and the aluminium bronze material maintains anti-corrosive properties.



#### Increased durability

**Deck hatch** – In 2014, sixteen deck hatches were installed on the Queensland Police Service 22m patrol boats. Years of research and development were invested into the product, working closely with ship yards in Australia to build more functional deck hatches. The hatches are designed to be installed flush, removing any trip hazard and have no surface dimples so water cannot pool and rust the product.



#### Reparability

Exhaust mixer – the P&W Marine designed product is a cast bronze marine vessel exhaust mixer. It works by mixing sea water with the motor exhaust gases which have the effect of cooling the exhaust and therefore minimising any metal corrosion. The exhaust mixer has a liner/sleeve which can be removed and repaired or polished, thereby extending the life of the exhaust fitting.



#### Manufacturing

P&W Marine's engineering workshop is equipped with Computer Numerical Controlled or CNC lathes and axis machining centres to turn raw castings into quality precision parts. The use of state of art equipment and software ensures efficient processing and resource consumption.

The foundry uses sand moulds and induction furnaces which produce molten metal in preparation for casting of new products. Propeller modifications, scans and repairs are completed using an MRI scanner, ensuring sophisticated propeller performance which extends the operating life.

#### Energy

With the support of the Australian Government Clean Technology Food and Foundries Investment Program, P&W implemented a wide range of initiatives to reduce its grid-power consumption and carbon emissions. These include:

- the installation of a 30 kW solar PV system which offsets grid electricity and reduces carbon emissions.
- switching metal halide lamps to energy efficient LED high bay lighting throughout the factory.
- the installation of an Energy Monitoring System that enables real time monitoring of electricity use. The system identifies excessive energy use during manufacturing and has optimised the operation of the office air conditioning system
- a comprehensive maintenance system based on machine hours or distances. The program includes regular checking of the compressed air system for operating pressure and leaks.

The solar PV installation and energy efficiency initiatives have reduced P&W's power consumption by about 30% (36 MWh). This saves the company around \$12,000/yr in electricity costs and with the initial outlay around \$48,000, it has an overall 4-year payback.





#### Recycling

Metal shavings, chips and offcuts (swarf) from the foundry process are separated into various grades which are all recycled. Packaging (cardboard and paper) is also separated and recycled.



The sand casting process produces significant amounts of spent foundry sand. Previously, up to 150 -500 tonnes per year of sand was sent to a Brisbane landfill. P&W Marine management invested significant time and resources into demonstrating that the sand could be beneficially reused. The material is now used as road base. The exercise is saving in the order of \$6000 per year in disposal fees.

#### **Partnerships**

P&W Marine has fostered partnerships with an extended list of organisations including:

- The University of Queensland, Centre for Advanced Materials Processing and Manufacturing
- The Australian International Marine Export Group

P&W Marine is the sole Australian distributor for Teignbridge Propellers. The design of the propellers makes a significant improvement to vessel fuel consumption as described by one Australian customer – 'We still have two of the original props from another supplier running so we can see there is a 5 L per hour fuel saving per engine fitted with the new Teignbridge propellers. The vessel is running 14 hours a day so that is a saving of approximately 50,960 litres per year.'

The Teignbridge company is working on a UK based project to develop a High Efficiency Propulsion System which is aiming to reduce fuel consumption of ships by 8% and an overall 30% improvement in fuel efficiency for marine vessels generally.



P&W Marine is also the authorised distributor for the Aqualube water lubricated bearings (produced by Michigan Marine Propulsion International). Oil lubricated bearings are potentially hazardous to the environment due to the potential for oil leaks and improper oil disposal. Traditional seals are also designed to leak in order to keep the seal lip lubricated, slowly polluting the ocean. As an environmentally friendly alternative, fresh and salt water are perfect lubricants, upholding suitable cooling properties and exhibiting low friction between the bearing and shaft.

# Staff Awareness and Engagement

P&W Marine fosters good relationships with its employees. They are a multi-award winning company receiving the MIGAS Training Organisation Employer of the Year 2012 and 2013 for their efforts in educating and guiding the next generation of tradespeople. They make a point of only employing people that are open to a challenge and who look for innovative ways and means to improve the business. Successes are celebrated with regular staff functions and individual staff awards for milestones and good performance.

#### **The Future**

Managing Director, Ross Cameron, is excited about the future prospects of his company and is researching and trialling the potential use of 3D printing technology to produce sand moulds and even metal components. This will be a game changer in the foundry industry with vastly reduced material input consumption and costs.



This case study has been prepared by The Ecoefficiency Group Pty Ltd for the Queensland Department of State Development in 2017.