



# TAMAR HYDROPOWER TURBINES

# HYDROELECTRIC POWER GENERATION

## PROVIDERS OF HYDROPOWER SOLUTIONS GLOBALLY

Pentair Southern Cross is a leading provider of hydroelectric generation solutions for the global renewable energy sector. We have more than 35 years experience in the design, supply, refurbishment and service of hydroturbines, generators, valves, controls and monitoring equipment. Our technical and engineering expertise in providing fully integrated hydroelectric solutions ranges from containerised micro-hydro units for rural electrification in developing countries to large scale utility grade hydroelectric turbine systems.





## HYDRO ELECTRIC POWER GENERATION

As global pressure mounts to act on climate change, renewable energy production continues to grow. Hydroturbines are the most reliable and proven source of renewable energy technology and Pentair Southern Cross has more than 35 years experience in providing integrated solutions to meet the requirements of our clients. Our facility is well equipped to undertake the full range of Hydroturbine design and manufacture services with dedicated in house project management, electrical, power, control and mechanical engineering capabilities as well as extensive fabrication and service facilities.

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# HYDROTURBINES

## REACTION TURBINES

### FRANCIS TURBINES

Francis turbines are most suited for low to medium head applications and have a variable flow range which generally extends from 40-110% of the nominal flow rate. The flow rate or power output is controlled by opening or closing the guide vanes. Pentair Southern Cross Tamar Francis machines are often employed as revenue generating alternatives for pressure reducing valves in existing water infrastructure.



### Features of Southern Cross Tamar Francis turbines

- Compact design with limited maintenance.
- High efficiency
- Can be manufactured in a range of materials to suit the customer's requirements
- Can be configured as either horizontal or vertical machines
- Can be readily integrated into existing water infrastructure
- Direct coupling to a generator is often possible to minimise the installation and maintenance requirements
- Manual or fully automated flow regulation
- Can be designed and built to operate on sewerage and other process effluent
- Output to 10MW per machine

### Pump as Turbine

Pentair Southern Cross' range of pump as turbine machines are ideal for low to medium head applications where the head and flow remain relatively constant. This range of machines have similar characteristics to the Francis Turbine, however without the movable guide vanes.

### Features of Pump as Turbines

- Low cost due to simplicity and mass manufacturing
- Minimal maintenance requirements and off the shelf spare parts





## KAPLAN

Kaplan turbines are recommended for low head applications. They generally have a flow range extending from 30 - 110% of the nominal flow rate. Double Regulated Kaplan turbines have both variable guide vanes and runner blades which ensure a high and flat efficiency curve across the entire flow range. These turbines can also be offered as single regulating and fixed flow (propeller) machines.

### Features of Southern Cross Tamar Kaplan turbines

- Compact design
- Designed and manufactured for minimal maintenance
- Can be manufactured in a range of materials to suit the customer's requirements
- Can be configured as either horizontal or vertical machines
- Can be inserted into pipelines to generate power from excess pressure
- Manual or fully automated flow regulation
- Can be retrofitted into existing weirs, dams etc. with minimal civil works
- Propeller (Fixed Flow) machines offer significant cost savings where head and flow are relatively constant
- Output to 10MW per machine



# HYDROTURBINES

## IMPULSE TURBINES

### TURGO

Turgo Impulse turbines are applicable for medium to high head applications and overlap the boundary of Pelton and Francis machines. These turbines are well suited to “run of river” schemes as they can tolerate some “dirty water” and perform well over a wide flow range. Whilst their peak efficiency is lower than Francis machines, they can often generate more energy due to their flat efficiency curve and high partial load efficiency, and as such can be preferable where considerable water supply fluctuations are experienced. The use of deflectors can mitigate issues of pressure surges in the upstream pipework, even on full load rejections.



### Features of Southern Cross Tamar Turgo turbines

- Compact design
- Available in single, twin or three jet configurations
- Robust design and manufacture
- Designed for minimal maintenance
- Fixed, manually variable or fully automated flow regulation
- Horizontal or vertical configuration
- Can be manufactured in a range of materials to suit the customer's requirements
- Output to 10MW per machine





## PELTON

Pelton turbines are designed for high head applications. These machines are impulse turbines using the kinetic energy of water impinging on the runner bucket to turn the generator shaft. Pelton turbines can handle wide flow variations down to 10% of nominal flow. Their flat efficiency curves yield excellent performance over this wide operating range.

### Features of Southern Cross Tamar Pelton turbines

- Compact design
- Designed and manufactured for minimal maintenance
- Flexibility of either horizontal or vertical installation
- Available in one to six nozzle configurations
- Can be manufactured in a range of materials to suit the customer's requirements
- Fixed, manually variable or fully automated flow regulation
- Runner options include fully CNC machined forgings or manually polished castings. Pin on buckets are used for smaller machines.
- Output to 10MW per machine

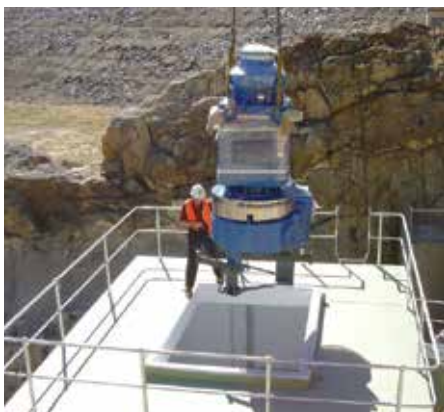
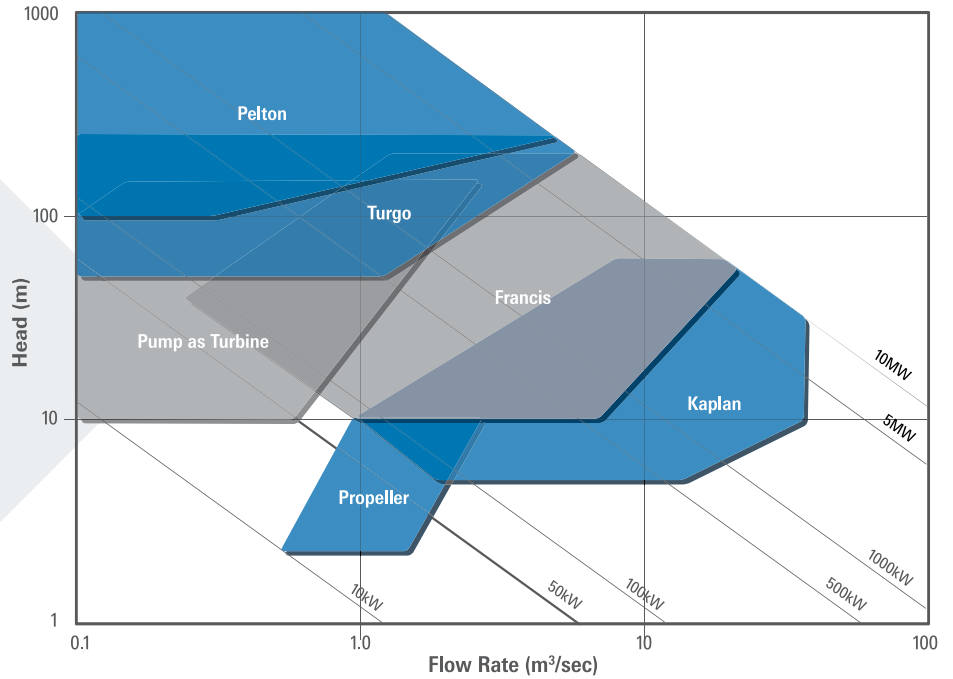


# HYDROTURBINES

## INTEGRATED SOLUTIONS

The turbine is pivotal to the success of any hydro project; furthermore, the turbine requires careful integration with the civil, hydraulic, electrical and mechanical portions of the project.

Pentair Southern Cross have many years of hydro experience and completed around two hundred successful hydro schemes. As such we are best placed to offer an optimally integrated hydro package. Whilst our turbine Selection Chart provides a quick guide to the operating range of the types of Southern Cross Tamar Turbines, it can be seen that there is significant overlap on the duty of these machines. As the ideal turbine selection for a given application and site is dependent on many parameters, we highly recommend that the customer consults with our experienced hydro engineers to discuss the optimal selection for the project.



### WATER TO WIRE SOLUTIONS

Pentair Southern Cross' specialty is "water to wire" turnkey packages. As the majority of all design work is in house, our engineered hydro power solutions are flexible and each design ensures that the best possible solution is achieved for our client. Every package is engineered to ensure the highest possible reliability and value for money. Our Pentair Southern Cross turnkey packages result in maximum efficiency, shorter delivery times, streamlined installation periods and optimised power house dimensions. As such, our solutions make hydroelectric power plants as economical as possible for our customers.

Whilst our focus is on complete solutions for electromechanical equipment supply, install, commission and service for hydroelectric power plants, we are happy to work with our customers to define the best scope required to meet their requirements.

Pentair Southern Cross specialise in both grid connected units and off-grid or stand-alone units. For stand-alone projects, complete electro-hydraulic and electronic governing systems are utilized to provide utility-quality power for remote sites. For grid connected installations a range of control systems are available, ranging from basic grid connect packages to complex PLC based control systems to meet our customers' requirements.





## RETRO-FITTED HYDRO TURBINE INSTALLATIONS

Pentair Southern Cross have extensive experience in developing and implementing retrofitted hydro power solutions designed to exploit the potential energy and improve the efficiency of existing utilities and water systems. Over the past 35 years, Pentair Southern Cross have installed many thousands of kW of hydro electric power in existing irrigation schemes, waste water systems, storage dams and into existing water utility infrastructure.

With the rising costs of power, more and more organisations are searching for ways to improve efficiency and reduce operating costs. Southern Cross Tamar Hydro Turbines present a viable option in a wide range of circumstances and can provide a cost effective solution to achieve the best efficiency and can significantly reduce the carbon footprint of systems by extracting the potential energy which is otherwise wasted. We can design and manufacture mini hydro systems to replace pressure reducing valves, which not only generate electricity, but also eliminate the noise pollution developed by dissipating valves.

Our experienced hydroelectric consulting engineers can conduct site audits and evaluations to determine the potential power available in existing systems and can provide advice in regards to the best possible method of exploiting these resources.



## CONTAINERISED HYDRO POWER SOLUTIONS

Pentair Southern Cross' turnkey containerised systems consist of complete hydro power plants fully installed within a shipping container at the factory. These high quality units are as close to "plug and play" as possible and have numerous advantages over traditional hydro installations. Fully integrated power plants are possible with options such as lighting, ventilation, overhead cranes etc.

### Features of Containerised turbines

- Simplified installation consisting of:
  - Positioning and restraint of the container
  - Connection of inlet penstock and draft tube
  - Termination of electrical connection
- Simplified shipping and customs clearance
- Substantially reduced site installation and commissioning costs
- Significantly reduced civil costs
- Construction of a powerhouse or slab is not required

# HYDROTURBINES

## SERVICE

### Full hydro power consultancy

Leveraging off experience gained over more than 35 years, Pentair Southern Cross offer a range of consultancy services in the hydropower field, including feasibility studies, site assessments and evaluation of existing hydropower assets to maximise efficiency and service life.

### Full in house design capability

Our in house design capability includes 3D design parametric modelling, AutoCAD electrical, Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD). We are able to assist in all areas of hydropower plant design including mechanical, electrical, control system and powerhouse design.

### Project Management

Pentair Southern Cross offers a complete project management service to ensure fully integrated on time and on budget project delivery. We understand the degree of integration and interaction required for hydropower projects and have extensive experience with large projects, complex logistics, large crane lifts, helicopter lifts, extreme site conditions and remote sites with difficult communication, access and transport.

### Turbines Inspection Services

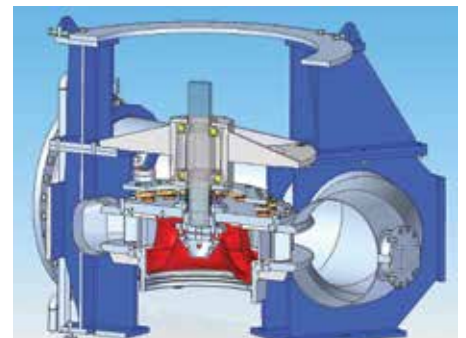
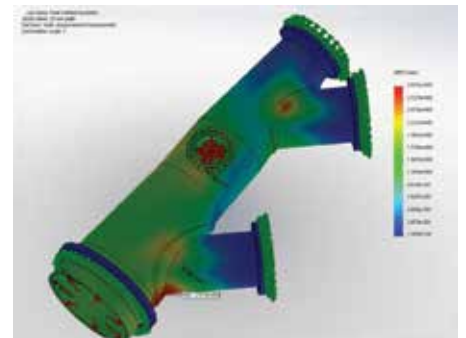
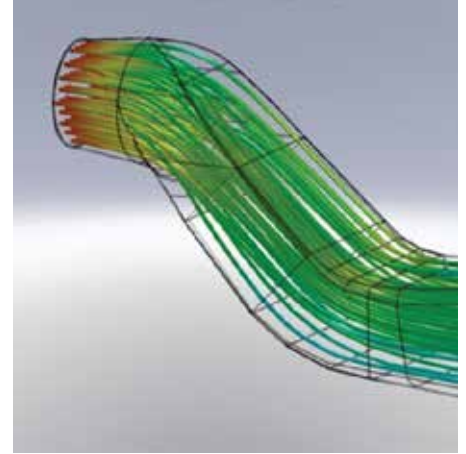
Pentair Southern Cross offers thorough inspection services for your hydro turbine system, and provides recommendations to improve efficiency and maintenance requirements. Our engineers are trained in conjunction with key industrial technical specifications and continuously updated on issues such as inspection best practices, safety and failure mechanisms prone to the industry we serve.

### Repairs, Upgrades, Refurbishments and Service to existing Hydro plant

Pentair Southern Cross has significant experience in repair, upgrades and refurbishments to existing Hydropower plant. Our experience and offering includes complete machine replacement, runner repairs, replacement runners, re-engineering of components to improve performance, valve refurbishments, generator refurbishments and modernised control systems.

### Design, Manufacture and Supply of components for the Hydropower Industry

In addition to offering complete turnkey Hydropower solutions, Pentair Southern Cross can design and manufacture or supply components of the Hydropower plant if this is more suitable for your project. Our design, manufacture and supply capability include turbines, runners, control systems, electrical systems, hydraulic systems, plant ancillary equipment, generators, valves, switchgear and transformers. We would be pleased to discuss your requirements with you.



## Installation and Commissioning

Pentair Southern Cross has extensive experience with installation and commissioning of Hydropower plant. Our installation offering includes fully fitted out containerised site workshops to save you time and money on site.

### Including:

- Two 20 foot containers for electrical inspection and onsite services
- Electrical consumables
- Electrical testing equipment
- Hydraulic crimping equipment
- Two 20 foot containers for mechanical inspections and onsite services
- Electrical and hand tools
- Welders
- Drilling machines
- Cutting equipment

Our commissioning engineers will ensure your hydro power equipment is brought into service safely and efficiently with optimised performance whilst interacting with the constraints of the site and existing infrastructure.



## Electrical Services

Pentair Southern Cross has a dedicated design office, workshop and personnel for the design, manufacture and testing of electrical and control switchboards to meet the requirements of hydro power installations. These switchboards are rigorously quality tested to ensure customer and regulatory requirements are met and exceeded.

The level of automation of our hydro control units ranges from simple grid connect units to fully integrated PLC based control systems, and for off-grid, basic shunt load governors through to highly complex governing units.

Our electrical personnel also have experience in design and implementation of electrical system projects that include:

- Automated systems
- Plant power reticulation
- Pumping Systems
- Industrial Equipment
- HV and LV connections and testing



## Systems Integration

Pentair Southern Cross works collaboratively with our customers to deliver solutions that help them turn ideas into successful integrated systems. These solutions enable companies to maximize the value derived from the equipment throughout their entire lifecycle. We offer the very best in monitoring and control system integration with our group of highly skilled professionals.

From initial design through system development, commissioning and support, we provide you with innovative control and automotive solutions to keep your system online. The experience we provide will result in cost effective solutions, reduced down time and total asset protection.





**SOUTHERN CROSS | TAMAR HYDROPOWER TURBINES**

**PENTAIR SOUTHERN CROSS**

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