

# HYDRO POWER

World-class skills. World-class team.

HYDRO POWER PLANT DESIGNERS

HYDRO | GEOTHERMAL | THERMAL | WATER | INDUSTRIAL

Detailed Design Head works, power station and balance of plant Front End Engineering Input and review of design concepts for operation and cost effectiveness

Civil Structural Design to accommodate challenges faced with hydro structures

Commissioning Hydro power station and headworks commissioning

Design risk assessments of hydro power stations and schemes

HAZOP

# WORLD-CLASS SKILLS.

Process Design Power station and head works plant selection, including power plant optimisation

Value Engineering Application of hydro power knowledge to optimise construction cost **Electrical\*** Application of electrical systems adapted for the hydro power industry Project/Design Management Implementation of proven design processes to manage design progress

Controls\* -Specialist hydro power controls experience

\* We partner with Electrical and Controls Consultants

Key Software Capabilities: Pipe Stress Analysis – AutoPipe Pipe FEA – Nozzle Pro Transient Modelling – Hytran Head Loss – Pipeflow Process Engineering – AutoCAD P&ID Piping Design – AutoCAD Plant 3D Machine & Equipment Design – Inventor Microstran – Structural Frame Analysis Structural Design – AutoCAD Structural Detailing / Revit Structure

#### **ABOUT MTL**

Hydro Power design

MTL's core

skills available.

MTL, established in 1994 is a medium sized owner operated engineering design consultancy located in Auckland, New Zealand employing Mechanical Engineers, Designers, Civil and Structural Engineers and Project Managers.

#### HYDRO PROJECTS

Our experience extends to working on projects within the hydro power, water treatment, thermal power and geothermal power industries. Key hydro projects include the balance of plant design for West Kiewa 62MW Hydro Power Station upgrade, design and refurbishment support for Mercury stations on the Waikato river, hydro power scheme gate designs and the design of six hydro power facilities in Samoa.

#### MTL EXPERIENCE

We have experience in preparing hydro power feasibility studies, detailed hydro power station and head works design, hydro power plant procurement, power station and head works construction management and commissioning. We offer the complete package from project feasibility to handover. James Powell Project Management, Contract Management, Procurement, Scheduling **Chris Mann** Project and Contract Management, Commissioning Management and HAZOP Facilitator

> Chris Brown Mechanical Design, Construction Supervision, and Commissioning



Matt Chubb

Civil and structural

#### **DESIGN PROCESS**

MTL follows a formal design process for hydro plant design, utilising industry standard P&ID's and Engineering Lists to define the equipment and interfaces. This practice is also used on existing plants, where accurate P&ID's are used to manage plant upgrades, and automation projects.

#### WORLD-CLASS TEAM.

**SKILLS & KNOWLEDGE** 

Collectively, MTL's hydro power

engineering personnel have a

significant amount of specialist

and partner consultants can be

provided on request.

knowledge and experience to draw

on. An overview of some of our key

hydro power engineering personnel

David McLachlan Hydro Power Specialist, Mechanical Design, Construction Engineer, Design Management

Stephen Kennedy Design Management, Detailed Engineering Design



MTL ROLE

We believe we have a unique offering due to our range of skills and our organisation's size. We are able to work closely with clients and partner consultants to repeatedly provide quality results.



# **SELECTED MTL HYDRO PROJECTS**





# TUAI POWER STATION RELIEF VALVE REFURBISHMENTS

Genesis Energy Limited, Waikaremoana, NZ.

### **PROJECT**:

52MW Tuai Hydro Power Station Relief Valve Refurbishments.

# MTL ROLE:

The Tuai power station was commissioned in 1929. The Turbine Relief Valves (TRVs) of each hydro turbine (G1 & G2) required refurbishment to improve their reliability. MTL prepared the scope of work for the Fitness For Service (FFS) & Refurbishment works of the TRVs. Specialist advice was provided on particular refurbishment, inspection and adjustment issues that arose in the course of the site work and commissioning.

### **PROJECT OUTCOME:**

Testing of the TRVs, for their return to service, showed that their performance had been restored to similar performance to that on their original commissioning.

### **PROJECT PARTNERS:**

MB Century Ltd, Bosch Rexroth NZ Ltd, Cheal Consultants, IMG, SGS New Zealand Ltd, Metal Repair Systems Ltd.













# SAMOA HYDRO POWER STATION REFURBISHMENTS

**Electric Power Corporation, Samoa** 

### **PROJECT**:

Samoa Hydro Refurbishments.

# MTL ROLE:

The existing hydro power stations had suffered significant damage following cyclone Evan in 2012. MTL redesigned penstocks, canals, intake structures and associated power station structures for the Samoa hydro power scheme refurbishments at the 1MW Samasoni (3.6km penstock), 1MW Alaoa and 1.7MW Fale ole Fee Hydro Stations.

### **PROJECT OUTCOME:**

Access to parts of the schemes was very constrained. The design had to account for the restricted accessibility for construction and for limited construction methods with available plant in Samoa. The projects were successfully delivered in 2018.

### **PROJECT PARTNERS:**

MAP Projects Ltd; Vortex Group Ltd.















# SAMOA HYDRO POWER STATIONS

**Electric Power Corporation, Samoa** 

## **PROJECT**:

Samoa Hydro Developments.

### MTL ROLE:

MTL designed the penstocks, intake reservoir chamber and power house structures, and associated structures for the Samoa hydro power schemes at the 0.6MW Fausaga-Tafitoala (3.5km penstock) and 0.2MW Faleata Hydro Power Stations.

### **PROJECT OUTCOME:**

Unique design solutions were found by working closely with the Constructor to overcome constraints due to the terrain and property boundaries. The projects were successfully delivered in 2018, with all power stations entering service supplying greater generation output than required.

### **PROJECT PARTNERS:**

MAP Projects Ltd; Vortex Group Ltd.













# WEST KIEWA VALVE AND PLANT UPGRADE AGL, Victoria, Australia

## **PROJECT**:

62MW Turbine, Main Inlet Valves and Balance of Plant Upgrade.

### MTL ROLE:

AGL engaged MTL to provide engineering and contract support for the upgrade of the West Kiewa turbines, replacement MIV's and balance of plant upgrades. The turbine upgrade includes replacing the runner, head cover, bearing and seal, guide vanes, servo motors, links and levers, and governor.

MTL's role included developing the project scope and delivery strategy, technical specification and tender document preparation, technical review of contractor's designs, design reviews, and equipment inspection.

#### **PROJECT OUTCOME:**

West Kiewa provides some unique challenges for upgrade projects. With restricted underground access, the logistics and planning of the work becomes a key element of the project management.

## **PROJECT PARTNERS:**

McMahon Electrical, Alstom.















# **COSSEYS HYDRO POWER**

Watercare Services Ltd, Auckland, New Zealand

## **PROJECT**:

Development of a new 150kW hydro machine installed in the water supply system for Auckland, New Zealand's largest city.

# MTL ROLE:

MTL was responsible for the project management, detailed mechanical, civil and structural design, construction management, and commissioning of this 150kW mini hydro. MTL's role also included the selection of a Erhard needle pressure reducing valve in parallel with the mini hydro.

# **PROJECT OUTCOME:**

The control system seamlessly coordinates the operation of the mini hydro and the bypass valve to provide the correct water supply flow rate in the most energy efficient manner.

### **PROJECT PARTNERS:**

McMahon Engineering Consultants (MECL), Hydroworks.













# **UPPER NIHOTUPU DAM**

Watercare Services Limited, Auckland

# **PROJECT**:

Upper Nihotupu Dam and Hydro Upgrade.

# MTL ROLE:

Working closely with Watercare Services Ltd, MTL led a design team for a major upgrade at Upper Nihotupu Dam in the Waitakere Ranges Regional Park. The upgrade ensures the dam complies with stringent Resource Management Act & Building Act requirements. Two 1kW 24V Eco-Innovation micro-hydro generators are installed to power controls & instrumentation, including 230V actuated 600NB intake valves via a 5kW inverter. Control & consent compliance monitoring is via radio to Watercare's Newmarket control room.

### **PROJECT OUTCOME:**

Upgrade of Watercare Services Ltd, Upper Nihotupu Dam ensures a sustainable water resource for the next 100 years in the Waitakere Regional Park. Meeting the consent discharge consent deadlines 12 months from kick-off was a major achievement.

### **PROJECT PARTNERS:**

McMahon Electrical, SKM, NZ Controls, Controlweb, Brian Perry Civil, Canadian Pacific Ltd, Clarksons, Service Engineers.

"It was rewarding to work with a focused and innovative design and construction team, where solving the issues was always a team approach. Don Purdie - MTL Project Manager







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# EILDON POWER STATION – TRV UPGRADE AGL Hydro, Victoria, Australia

## **PROJECT**:

Turbine Relief Valves (TRVs), monitoring and protection system upgrade for the 2x60MW hydro generators.

### MTL ROLE:

Operation of the TRVs at Eildon is critical for the safety of the generators. MTL reviewed the TRV issues, potential failure modes and solutions. MTL then designed and commissioned the TRV monitoring and protection system. The design included: development of P&ID and a functional description (FD), followed by equipment specification and design to meet the FD requirements.

#### **PROJECT OUTCOME:**

The monitoring system was successfully delivered which enables fault detection and diagnosis and allowing the station to build up a plant history of the TRV performance. The system also provides protection to reduce plant damage in the event of a TRV failure.

#### **PROJECT PARTNERS:**

McMahon Engineering Consultants (MECL), Mechanical Engineering Corporation, EDC Electrical.

"This design was developed from the perspective of how the system should operate, and what protection is appropriate. It's success was based on client consultation and partnership allied with a thorough technical understanding of the TRV and related systems." **David McLachlan - MTL Project Manager** 







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# **EILDON POWER STATION UPGRADE**

Southern Hydro/AGL Hydro, Victoria, Australia

# **PROJECT**:

Control and protection systems upgrade of 120MW Eildon Power Station.

# MTL ROLE:

MTL carried out the mechanical design and contractor site management/ commissioning for the control and protection systems upgrade. The detailed design included: development of P&IDs and a functional description (FD) for the machines and for the station, followed by equipment specification and design to meet the requirements of the FD.

# **PROJECT OUTCOME:**

The project was delivered successfully with the station recommissioned in August/September 2006. The commissioned systems operated with remarkable reliability, with over 99% availability achieved in the first month of operation.

# **PROJECT PARTNERS:**

McMahon Engineering Consultants (MECL), AgFab Engineering, EDC Electrical.

"Every effort was made by MTL and MECL in the procurement, design and implementation stages to ensure that all the clients' requirements, expectations and desired outcomes were catered for. "Ian Foy - Southern Hydro/AGL Project Manager









# **DEEP STREAM 5MW POWER PROJECT**

TrustPower Limited, Otago, South Island

## **PROJECT**:

Design of Gates for the Deep Stream Power Project.

### MTL ROLE:

MTL provided mechanical design for the project head works. This included the design of the scheme off-take gate, a scheme regulating (radial) gate as well as mechanical equipment for various intakes and pipelines.

MTL also provided implementation support with tendering review, manufacturing inspections and commissioning supervision for the off-take and radial control gates.

### **PROJECT OUTCOME:**

The design services were delivered on time and within budget. The gates have been operating successfully since commissioning in early 2008.

# **PROJECT PARTNERS:**

Riley Consultants, MA Corkery & Associates, E-Type Engineering, Jesco Hydraulics, Civil Construction Ltd, Earthworks Marlborough.











# MANAPOURI HYDRO TURBINE AND GENERATOR REFURBISHMENT

Manapouri Power Station, Fiordland, New Zealand Meridian Energy Ltd

### **PROJECT**:

Mechanical refurbishment of Manapouri hydro turbine and generators. Manapouri has 7 by 122MW vertical Francis machines in an underground machine hall.

### **MTL ROLE:**

MTL developed detailed refurbishment scope of works, and technical specifications for each of Manapouri's 7 units. The specs were developed to identify and resolve individual machine defects and condition, as well as provide a common refurbishment specification, and performance requirements. Development of the scope of work required 2-3 weeks on site inspecting the machine, interviewing the stations operations and maintenance team, and reviewing maintenance records. This project presented a number of technical challenges, with the machine hall carved out of solid rock 100m underground.

MTL's role included index efficiency testing of machines pre upgrade for baseline performance measurement. MTL has specific expertise in hydro machine efficiency testing, and the efficiency testing was performed in accordance with IEC 41:1991 and PTC 18.

# **PROJECT OUTCOME:**

Manapouri was undergoing an upgrade at the time of the refurbishment, with a second tailrace tunnel being built (a 10km long tailrace tunnel in parallel with the existing 40 year old tunnel). The reduction in tailrace level allowed the machine outputs to rise from 83MW per machine up to 122MW per machine. The client utilised MTL's technical specifications as generic specifications for use throughout their hydro fleet.







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# **EFFICIENCY TESTING**

Mercury NZ, Genesis Energy, Meridian Energy, PT Inco

# **PROJECT**:

Efficiency Testing of Power Station Hydro Turbines.

### MTL ROLE:

MTL developed test procedures specifying the testing process/test instruments and supervised the testing including: instrumentation setup and calibration; conduct of testing; post-test calibration and instrument checks. MTL processed and presented the test results to the client.

### **PROJECT OUTCOME:**

Efficiency testing enables optimisation of plant operation providing data for calculating efficiency using existing SCADA measurements. With Mercury NZ, MTL pioneered the sliding gate test method as an alternative to the static test method. It provides a more cost effective option for measuring operational efficiency data.

IEC/ASME code compliant testing provides efficiency data for turbine upgrade benchmarking.

# **PROJECT PARTNERS**:

ConTech Services Limited













# WORLD-CLASS RESULTS.



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