



GEOHERMAL POWER PROFILE



World-class skills. World-class team.

Geothermal Steamfield and Power Plant Engineers

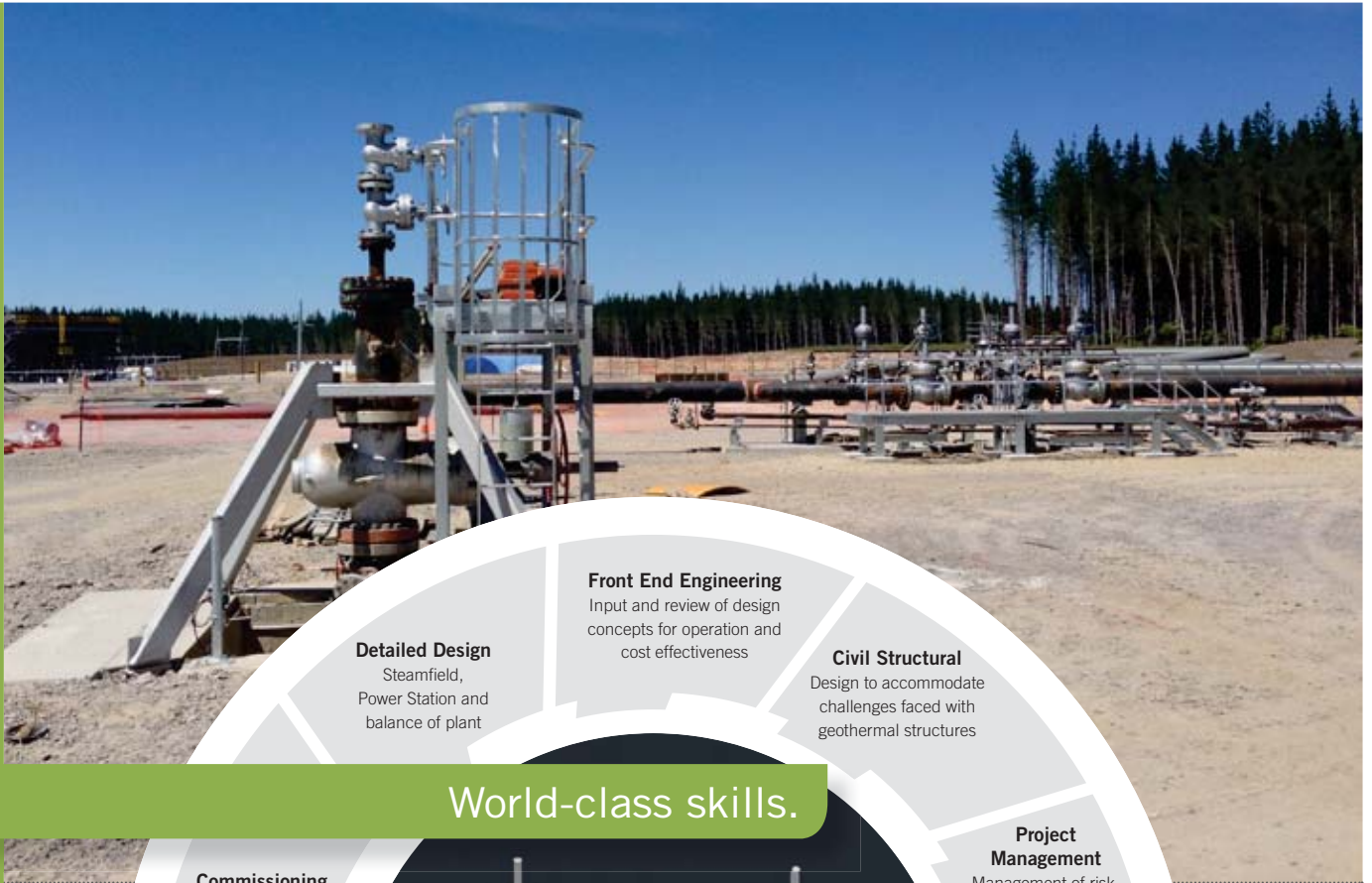
HYDRO

GEOHERMAL

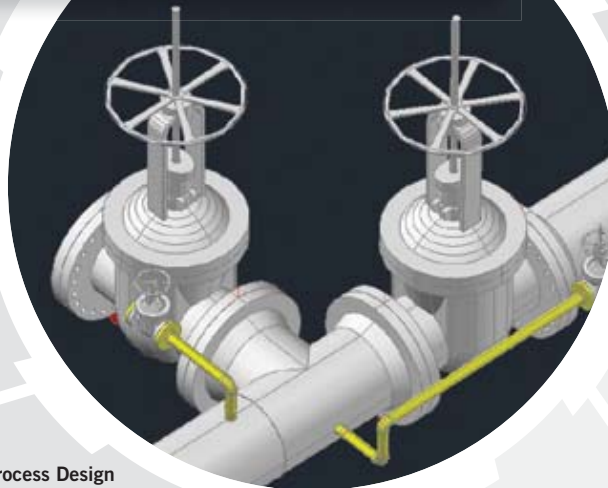
THERMAL

WATER

INDUSTRIAL



World-class skills.



Detailed Design
Steamfield,
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
geothermal structures

**Project
Management**
Management of risk,
design teams, project
programme,
procurement and
construction contracts.
Implementation of
project controls

Controls*
Specialist
geothermal
controls
experience

** We partner with Electrical
and Controls Consultants*

Key Software Capabilities:
Process Modelling – Fluid Flow
Head Loss – Pipeflow
Transient Modelling – Hytran
Pipe Stress Analysis – AutoPipe
Pipe FEA – Nozzle Pro
Pressure Vessel Design – PV Elite
Microstran – Structural Frame Analysis
Process Design – AutoCAD P&ID
Piping Design – AutoCAD Plant 3D
Parametric Modelling – Inventor
Structural Design – Revit

Commissioning
Power Station
and Steamfield
Commissioning

HAZOP
Design risk
assessments
of Geothermal
Power
Stations

Process Design
Steamfield and power plant
selection including power
plant optimisation

Value Engineering
Application of geothermal
knowledge to optimise
construction cost

Electrical*
Application of electrical
systems adapted for
the geothermal industry

**MTL's core
geothermal design
skills available.**

MTL Scope

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

MTL Projects

Recent projects include Steamfield detailed design for Karaha and Lumat Balai Geothermal Power Projects in Indonesia, Owners Engineer for Olkaria 1 Unit 6 Steamfield in Kenya and Steamfield detailed design for Ngatamariki Geothermal Power Project in New Zealand.

MTL Experience

We have experience in preparing geothermal feasibility studies, detailed geothermal power station and steamfield design, geothermal plant procurement, power station and steamfield construction management and commissioning and HAZOP Facilitation. We offer the complete package from project feasibility to handover.



Chris Mann
Project and Contract
Management, Commissioning
Management and HAZOP
Facilitator



Don Purdie
Process / Mechanical Design
Project & Contract Management
Commissioning Management
Asset Management



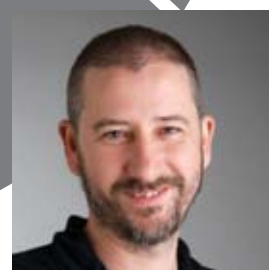
Matt Chubb
Civil and Structural
Design
Project & Contract
Management
Asset Management



Phillip Orr
Geothermal
Steamfield
Design



James Powell
Project Management,
Contract Management,
Procurement,
Scheduling



Stephen Kennedy
Design Management,
Detailed Engineering
Design



World-class team.

Design Process

MTL follows a formal design process for geothermal steamfield 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.

Collective Power

Collectively MTL's geothermal engineering personnel have a significant amount of specialist knowledge and experience to draw on. An overview of some of our key geothermal engineering personnel and partner consultants* can be provided upon request.

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.





World-class results.



42 George Street, Mt Eden, Auckland, New Zealand P: +64 9 638 3447 E: info@mtlnz.co.nz

W: www.mtlnz.co.nz PO Box 96030, Balmoral, Auckland 1342, New Zealand

HYDRO

GEOTHERMAL

THERMAL

WATER

INDUSTRIAL



CONTRACT MANAGEMENT SERVICES



Why invest in an experienced and suitably qualified Contract Administrator to manage your Construction Contract?

Because your project is likely to be at risk of significant avoidable delays and costs, without their expertise. MTL have Senior Professional Engineers who have considerable experience in administering Construction Contracts. We understand the commercial constraints that Clients and Contractors face.

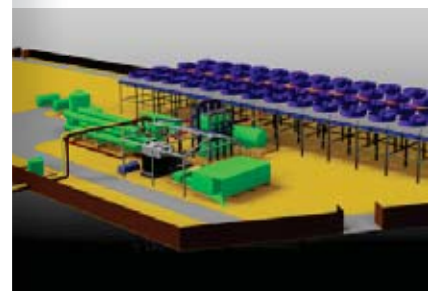
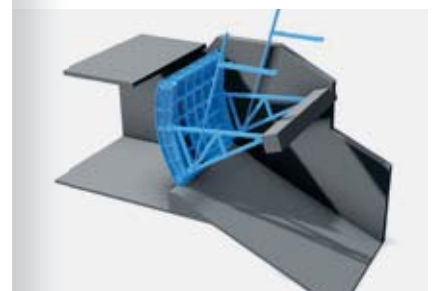
A project is a true success if everyone, including Clients, Stakeholders and Contractors accomplish their project objectives.

Recognition of each other's objectives and working together proactively to achieve these is beneficial for all parties. The Contract Administrator is best placed to promote collaborative working relationships between parties. This is assisted by providing clear and concise contract documentation to clearly communicate expectations to avoid surprises.

A Construction Contract in its strictest form is only relied upon when either party fails to deliver to agreed expectations. It is therefore essential that day to day business is managed to comply with general requirements of the contract to ensure it can be relied upon if needed. This includes the preparation of suitably worded contract instructions throughout the project to ensure time, cost and quality are closely managed.

Contract Management Services MTL offer:

- Tender document preparation
- Tender process management
- Advice on suitable forms of contract to be utilised
- Preparation of Construction Contract documentation
- Compilation of Contract Scope documents (Employers Requirements)
- Coordination of Technical on site Supervision
- Administration of a range of Construction Contracts
- Knowledge and advice concerning NZS3910, NZS3916, FIDIC, NEC3 forms of contract and CCA compliance requirements
- Fulfilment of "Engineer"& "Project Manager" contract representative roles



ASSET OPERATING DOCUMENTATION



Up to date, accurate and clear Plant Asset Documentation is essential to be able to efficiently and safely manage assets.

MTL are experienced at preparing Asset Operating Documentation for new and existing plant. MTL provide these services for Clients with critical facilities such as Hydro Power Stations, Geothermal Power Plants and Steamfields, Water Treatment Plants, General Industrial Applications and associated balance of plant.

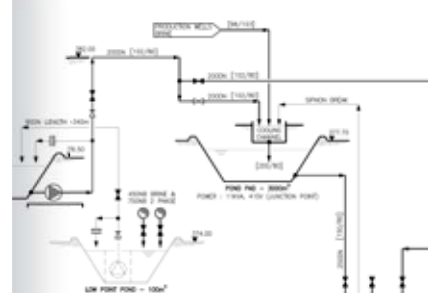
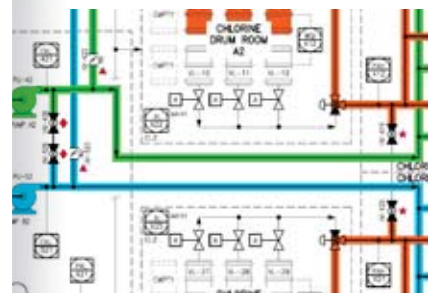
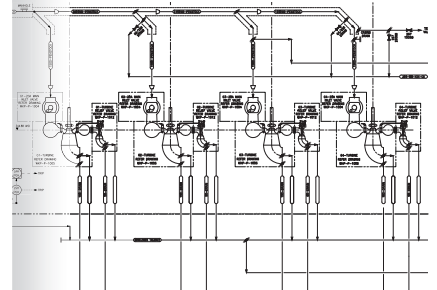
There are significant, and sometimes unrealised, benefits of producing up to date Asset Documentation.

They provide a foundation for a robust engineering process for upgrade works, improves understanding of Plant capabilities, results in clearer communication of asset operations/requirements amongst operators and third party contractors. Ultimately health, safety and environmental risks are reduced as a result.

MTL would typically spend time on site liaising with Plant Operators and review existing drawings/documentation to gain a clear understanding of how the specific plant is operated. MTL can tailor documentation to specific Client needs and with a focus on the end users specific knowledge/capabilities.

Asset Documentation Services MTL offer:

- As-built Process Flow Diagram (PFD) and Piping & Instrumentation Diagrams (P&ID's)
- AutoCAD Plant 3D capabilities featuring integrated P&ID - Plant Models – Engineering Lists
- Customised plant numbering systems (including KKS format)
- Operating and Maintenance Manuals (O&M)
- Standard Operating Procedures (SOP's)
- H&S Plant Isolation Procedures
- 2D or 3D as built documentation (Using 3D laser scanning if required)





OLKARIA 1 UNIT 6 OWNERS ENGINEER

Fichtner / KenGen, Rift Valley, Kenya

Project:

70 MW Geothermal Steamfield.

MTL Role:

KenGen are custodians of a significant geothermal resource in the Rift Valley, Kenya. The Olkaria I Unit 6 project will add 70MW to KenGen's significant geothermal capability. The project aim is to optimise the use of existing, unutilised production wells, minimising project development risks.

MTL is performing the role as the steamfield Owners Engineer. Fichtner are providing Owners Engineer Services for the Geothermal Power Plant. The steamfield utilises 12 production wells gathered into three separation plants with a total of 14km of cross country piping.

Project Outcome:

MTL has worked closely with KenGen to produce a comprehensive preliminary design that suits KenGen's requirements. The project is currently in tender stage.

Project Partners:

Fichtner, McMahon Electrical.





KARAH A STEAMFIELD DESIGN (Fluid Collection and Reinjection System)

Hawkins / BCK Singapore Ltd

Project:

30MW Geothermal Power Plant.

MTL Role:

MTL was the steamfield (FCRS) detailed designer for the EPC contract to build the 30MW Karaha Power Plant. The development is located in the West Java Province, Indonesia, and is being constructed for operator Pertamina Geothermal Energy (PGE) using existing and new wells.

The steamfield consists of 22km of cross-country piping on steep mountainous terrain, along with four production wellpads (clusters), three of which included separation plants and pump stations. The steep terrain posed many challenges for both the process, mechanical and civil design.

Project Outcome:

MTL worked closely with the constructors to produce an optimised design for the difficult topography. The design was successfully delivered and construction phase is currently underway.

Project Partners:

Hawkins / BCK, McMahon Electrical, Beta.



www.mtlnz.co.nz World-class skills. World-class team.



STEAMFIELD DESIGN

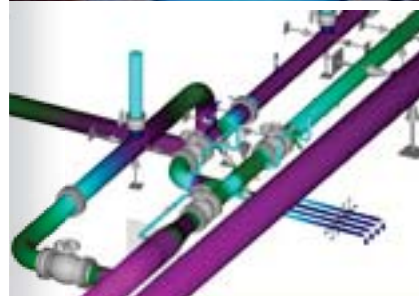
MTL specialise in steamfield designs for all types of geothermal steam collection and re-injection systems. Our team have designed and assisted in the delivery of fully commissioned geothermal steamfields throughout the Asia Pacific region. We are experienced in process design, pipe stressing, pipe support, separator and brine reinjection pump station design. We pride ourselves on delivering high quality cost effective practical designs to meet client expectations.

MTL delivered the Steamfield design for Mighty River Powers 82 MW Ngatamariki Geothermal Power Project which won the World GeoPower Market Award – “Best Power Project” 2013. Further information on this project and others can be viewed on our Projects page.

MTL provide valuable steamfield design knowledge and support from initial project inception through to commissioning and handover of the asset.

We regularly undertake the following key tasks:

- Preliminary Investigations (FEED)
- Conceptual Design
- Route selection, configuration and optimisation
- Piping Specifications
- Detailed Process Design
- Detailed Mechanical, Civil and Structural Design
- Design Build partnering
- Material Take-offs
- Equipment Specification and Selection
- Construction Supervision



**World GeoPower
Market Award**
“BEST PROJECT” 2013

NGATAMARIKI STEAMFIELD

Hawkins Infrastructure Ltd, Central North Island

Asset Owner: Mighty River Power

Steamfield to serve the 82 MW Ngatamariki Geothermal Power Station.

MTL Role:

MTL were part of a design build team for the Steamfield led by Hawkins Infrastructure. The detailed design of over 7.5km of Steamfield including 2 phase pipework, brine pipework, production and hot reinjection well pad piping, flash vessels and condensate injection pumping system. The design included DN750 and DN900 2 phase piping and support systems and cooling water channels.

The production well pads included for well minimum flow systems to allow continued well operation during Steamfield shutdowns. The minimum flow required separated fluid handling systems to be developed, that included brine cooling, brine reticulation, storage and reinjection pumping systems.

Project Outcome:

The project is fully operational. The design was completed under tight time constraints to ensure that project objectives were met. This required working closely with the constructor of the Steamfield, Hawkins Infrastructure to ensure timely delivery of the project.

Project Partners:

Mighty River Power
Hawkins Infrastructure, McMahon Electrical



www.mtlnz.co.nz World-class skills. World-class team.





POIHIPI POWER STATION

Mercury Geotherm Ltd, Central North Island, New Zealand

Project:

55 MW Geothermal Power Station.

MTL Role:

Design for the new 55 MW power station including; Preliminary design, from the receipt of Fuji turbine and generator drawings, through to initial layouts, plant arrangements, principal plant procurement; Detailed design of the complete plant, mechanical, electrical, and controls and instrumentation, suitable for construction; Construction supervision; Commissioning and Operator training.

Project Outcome:

Commissioned successfully in 1997 and has operated reliably since. The station incorporates an integrated steamfield and power station control system, thought to be the first of its kind when commissioned.

Project Partners:

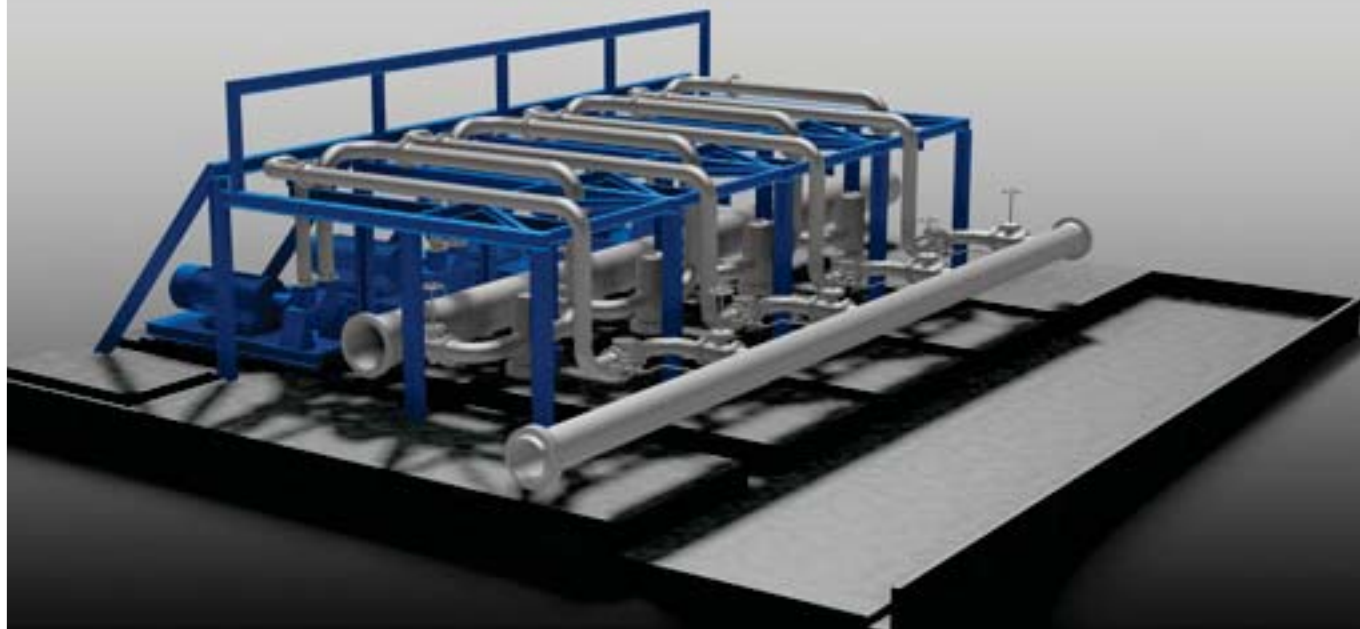
McMahon Electrical



"MTL's experienced Mechanical Engineers were a key part of the team that designed and built this 55 MW power station in 18 months - a very tight project program for a project of this size" **Chris Mann – MTL Project Manager**



www.mtlnz.co.nz World-class skills. World-class team.



TE MIHI REINJECTION PUMP STATION

Contact Energy, New Zealand

Project:

Te Mihi Steamfield Geothermal Reinjection Pump Station

MTL Role:

MTL undertook the detailed design of Contact Energy's Karapiti Pump Station, a critical facility which provides for the brine reinjection for three Contact Power Stations; TeMihi 164 MW, Wairakei 132 MW and Poihipi 55 MW. The pump station re-injects geothermal separated water(brine) discharged from the production wells.

The design accommodates a range of different operating scenarios that provides Contact Energy with flexibility in operating their Power Stations and allows for safe removal of a complete pump assembly for cleaning offsite while maintaining operation of the pump station. An OPEX analysis was completed as part of the final pump selection process to identify the optimum configuration.

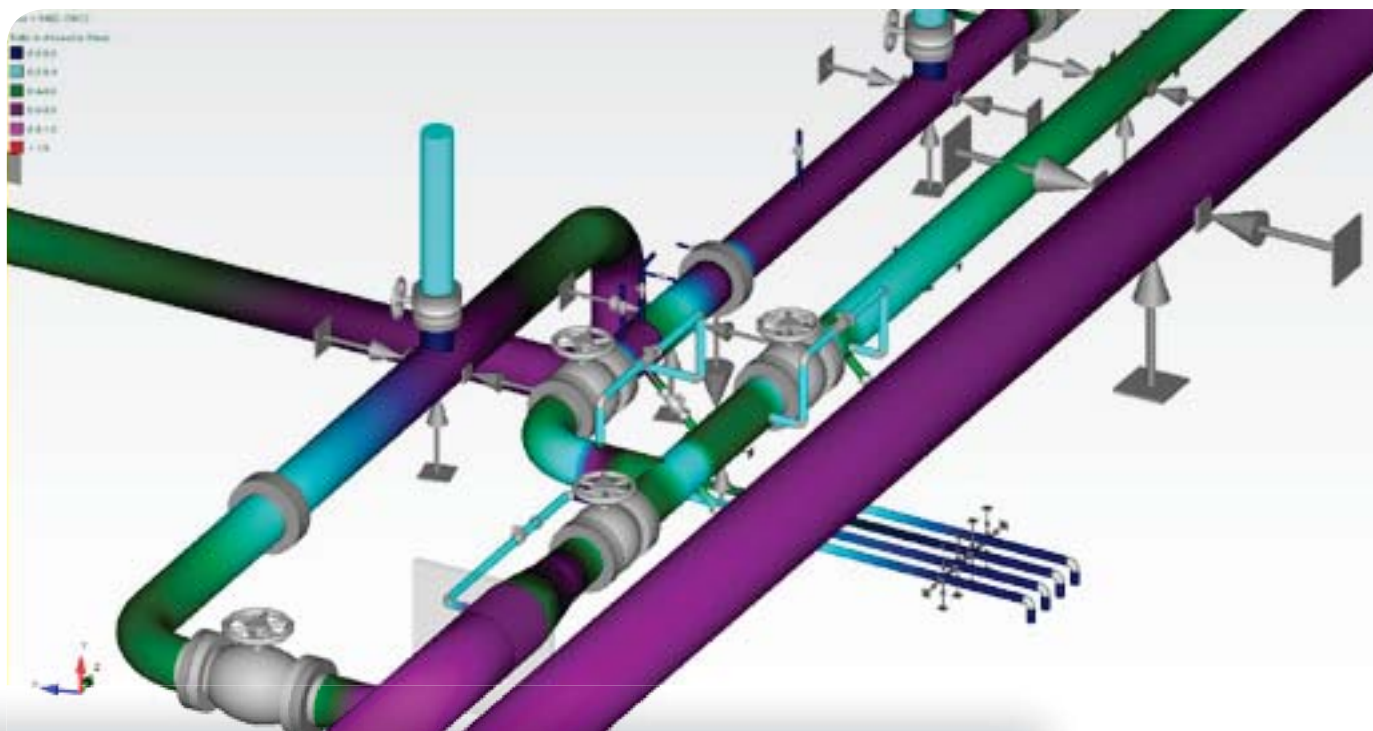
Project Outcome:

The Karapiti Pump Station has been in operation since 2011, providing reliable service re-injecting over 3000 tonnes/day of brine.

Project Partners:

MB Century, McMahon Engineering Consultants, and Sigma Consulting





WELLHEAD PIPING

Central North Island, New Zealand

Project:

Connection of a wellhead into the existing wellhead manifold.

MTL Role:

MTL carried out the detailed design of the wellhead piping including the civil and structural design of the pipe supports and foundations.

The design connected the well via a DN300 line to the existing cross over piping between production systems. Our scope included design of the secondary systems such as drains, bypasses and pressure relief.

Project Outcome:

The project was completed in June 2013.

Project Partners:





LIHIR GEOTHERMAL POWER STATION

Lihir Gold Ltd, Papua New Guinea

Project:

50 MW Geothermal Power Station.

MTL Role:

MTL was engaged to provide detailed design for the Balance of Plant (BOP) for the first stage 30 MW, and second stage 20 MW power plant projects. MTL provided site construction supervision and commissioning for the BOP on both stages, and commissioned the 10 MW steam turbines. The project was challenging because of the remote location.

Project Outcome:

The selection of turbine was interesting as 5 by 10 MW surplus second world war frigate LP turbines were used, including reversing blades. These turbines are very robust and well suited to a geothermal application. The power station has been operating successfully for a number of years supplying the gold mine.

Project Partners:

SMEC, Lihir Gold Ltd



www.mtlnz.co.nz World-class skills. World-class team.



ROTOKAWA OEC21

Mighty River Power, Central North Island

Project:

5 MW Geothermal Binary Power Station.

MTL Role:

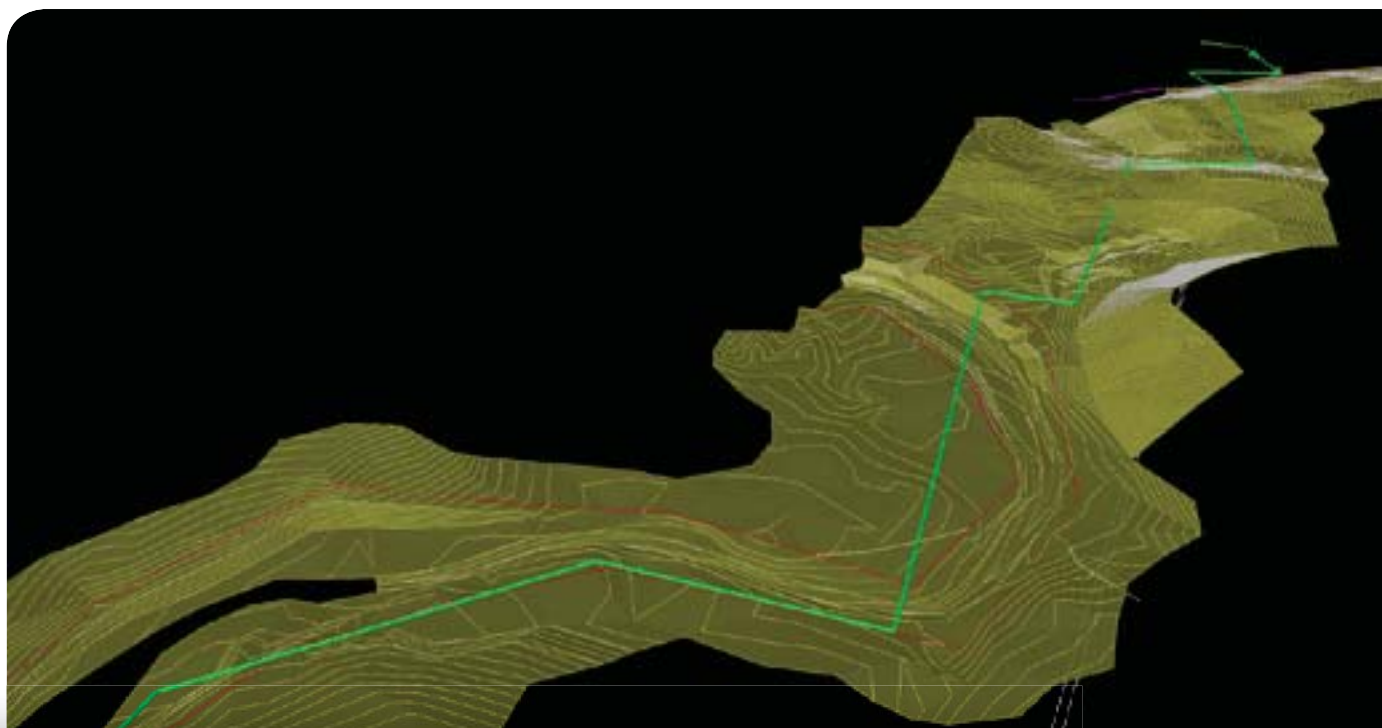
MTL provided engineering services for this plant from initial procurement advice through to plant commissioning. Our Engineers were on site during the complete construction period, managing the mechanical contractor, and overseeing the quality of the workmanship.

This project involved the construction of an Ormat 5 MW OEC plant to utilise excess brine from the plant's steamfield. The brine was available from the separator at the plant inlet, and the energy extracted from the hot fluid before being passed to the reinjection system.

Project Outcome:

The power plant has continued to operate successfully for over 10 years.





PRODUCTION PIPING

Central North Island, New Zealand

Project:

Connection of production well to Power Station production facilities.

MTL Role:

MTL were engaged as the designer to connect the new production well into existing production piping system. The detailed design included the design of the high pressure wellhead piping, two-phase cross country piping, tie-in piping and civil/structural design of all pipe supports and foundations.

The wellhead piping had the challenges of an unusually high design pressure and temperature of 112barg and 320°C. The two phase pipeline is DN500 and runs 1.1km from the production well pad to the existing two phase production line.

Project Outcome:

The project was constructed in 2013, and started producing in 2014. MTL worked closely with the client to deliver a pipeline that suited their requirements while offering sound and efficient engineering solutions.

Project Partners:

Transfield Worley

