

HAWKINS GEOTHERMAL

PROFILE



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Leading edge work for Mighty River Power

Hawkins worked as a major part of a consortium led by Sumitomo Corporation and Fuji Electric Systems to deliver two major geothermal power stations for Mighty River Power, who are undertaking a major strategic geothermal power expansion programme to add 400MW of new generation by 2013.

The consortium delivered the 100MW Kawerau power station, which was completed in August 2008, and the 140MW Nga Awa Purua power station at Lake Rotokawa, completed in April 2010.

Core to the successful delivery of both projects has been the co-ordinated integration of process-related information within the scope of Hawkins' work.

Partnership drives early completion

Historically, power generation projects in New Zealand have not been completed on time and have often been technically deficient in a number of areas.

For Kawerau and Nga Awa Purua, Mighty River Power established a project culture through which all stakeholders were focused on early completion of a quality project in a safe manner, building a hard-working, dedicated team that successfully responded to the constant challenges of fast-track Engineering, Procurement and Construction (EPC) implementation.

The success of the two projects was underpinned by an alliance philosophy through which all issues and challenges were examined against a best-for-project outcome.



Nga Awa Purua geothermal power station, Rotokawa



Kawerau power station team



Nga Awa Purua geothermal power station, Rotokawa



Construction at the Kawerau power station

Team roles

Both projects - Kawerau and Nga Awa Purua - were undertaken by the same team:

Sumitomo Corporation

Engineering, Procurement and Construction (EPC) contractor.

Fuji Electric Systems

Technical leadership, plus supply and installation of generating and process equipment.

Hawkins

The onshore partner responsible for the design and construction of the civil, structural, architectural and building services elements of the projects.



Nga Awa Purua geothermal power station, Rotokawa

Kawerau success leads to Nga Awa Purua

The success of the Kawerau project led to work on the \$430 million, 140MW Nga Awa Purua geothermal power station at Rotokawa, New Zealand.

Located 10 km north of Taupo, the site is close to the Waikato River and adjacent to the existing Rotokawa geothermal power station, which is at the edge of the Taupo volcanic zone.

In partnership with Sumitomo Corporation and Fuji Electric Systems, Hawkins completed over \$40 million of the project for the Mighty River Power / Tauhara North Number 2 Trust JV.

Hawkins' role

Similar to Kawerau, the scope of work and services supplied within the context of this EPC contract comprised the planning, design, manufacture, procurement, transportation, construction, installation and commissioning of all facilities within the boundary of the power station.

Hawkins played an important role in the team as the main design and build contractor, responsible for the civil, structural, architectural and building services elements of the project.

Continuous improvement

As part of this new project, all participants took part in a continuous improvement process to increase implementation efficiency, particularly as the triple flash plant resulted in increased paperwork and complexity.

This led to numerous efficiencies and innovations, many of which were applied at Nga Awa Purua.

In order to improve constructability, but maintain accessibility, several design changes were implemented:

- The Kawerau electrical annex has two stories. For Nga Awa Purua, the building was changed to a flat single-story building to improve construction and operational access.
- At Kawerau, the project land site was flat, so brine pumps were located in a 4m-deep pit to retain suction head from the LP separator. The Nga Awa Purua site natural terrain is hilly

compared to that of Kawerau, so separators were located at higher elevation and this brine pump pit was deleted.

- At Kawerau, all the first and second stage steam jet ejectors were arranged vertically to minimise the footprint area. For Nga Awa Purua, they are rearranged horizontally.
- Increased use of modular precast systems.
- Use of post-tensioning in the cooling tower.
- Improved sequencing of the turbine/generator pedestal construction.

Upon completion

Hawkins was part of the team that completed and handed over the power station on 4th April 2010, 39 days ahead of programme.



Nga Awa Purua



Nga Awa Purua

Kawerau

At the time it was built in 2008, the Kawerau power station was the largest geothermal project in New Zealand for more than twenty years. Originally specified as a 90MW power station, when delivered it produced in excess of 100MW.

Hawkins was contracted in late November 2006 to carry out site investigation, design and consenting work, followed by establishment, piling, bulk earthworks and construction of the powerhouse facility by early October 2007 to enable installation of the generating equipment.

The overall project was completed three weeks early in August 2008.

Project data:

- 100-week contract
- 27 companies and 400 people on site at peak
- 200,000m³ earthworks
- 8000m³ concrete
- 1100 tonnes reinforcing steel
- 700 tonnes structural steel

Site establishment and bulk earthworks commenced in January 2007. The erection of steel structures for the turbine building started in July 2007, and the final pour for the turbine generator pedestal was completed in September.

Commissioning work began in mid-2008. Hawkins was involved right to the end with roading, ground finishes, fencing and landscaping.

Key challenges

Geotech design

To protect the power plant from liquefaction and settlement issues in the event of a major earthquake, the 6ha site was excavated to a depth of 3m and re-compacted. Significant piling was required for the powerhouse structure and turbine / generator pedestal. Each pile was different and difficult to place due to large boulders undiscovered in

original soil investigations, plus a high water table.

Steam separation area

Although this was technically a relatively simple engineering exercise, the volume of information was intense. A structural 3D model integrated the interface of the pipe supports with the foundations.

Civil infrastructure design

The project involved the civil infrastructure required for a small city, including:

- Bulk earthworks in sensitive, erodible volcanic soils subject to liquefaction
- A roading network for oversized equipment, including the 120-tonne turbine and generator lifts
- Detailed drainage system design in the steam separation field
- Diversion of a watercourse outside the site
- A sanitary sewer treatment system for 350 workers
- A system to collect, reticulate and treat the 100°C water
- A number of ponds to provide silt handling for on-site drainage and geothermal brine

Construction

The pedestal structure was supported on a 1.6m raft foundation 9m underground, with 40 piles extending 30m down. With such large depths of concrete, high internal temperatures can develop that can damage the mix, leading to cracks. Hawkins developed a special concrete mix and methodology to ensure this did not happen.

Commissioning

Pre-commissioning began in February 2008. The first commissioning milestone of power back-feed from the 110kV grid was achieved on March 14th, followed by another landmark - the admission of two-phase geothermal fluid into the power station - on April 19th.

Upon completion

Kawerau's completion boosted the country's geothermal capacity by 25% and helped strengthen electricity supply significantly for New Zealand.

The project delivered best practice in many areas of sustainable development and energy efficiency, from sustainable geothermal reservoir management, distributed generation, engineering design and construction, to environmental management and community participation.



Kawerau power station

Powering up: Hawkins' geothermal approach:

Hawkins is an established and successful participant in the New Zealand energy sector.

Formed to deliver energy and geothermal projects across New Zealand, we operate nationally and internationally, offering a multi-disciplinary approach to turnkey project delivery and adding value to clients on a diverse range of projects.

As a market leader in delivering innovative responses to technically demanding geothermal projects, we have built a depth of knowledge and experience in delivering cost-effective solutions to the complex challenges posed by our clients, developing a superlative track record in creating this essential national infrastructure.

Geothermal services

Hawkins has built close relationships with energy generators across New Zealand through a track record of delivering projects on time and under budget.

Hawkins offers a comprehensive range of services in the geothermal arena, already proven at Mokai, Te Huka (binary plants), Te Mihi Steamfield, Kawerau and Nga Awa Purua (flash plants), including:

- Site investigation
- Design
- Planning
- Consenting
- Manufacture
- Procurement
- Transportation
- Construction
- Installation
- Commissioning
- Management

About Hawkins

Established more than sixty years ago, Hawkins is one of New Zealand's largest privately owned construction companies. Acknowledged as a dynamic industry leader, Hawkins manages projects throughout New Zealand, with responsibility for some of our most iconic buildings and environments.

Hawkins continues to grow in experience, identifying opportunities to deliver a full range of complementary services, establishing companies and divisions that include Construction, Infrastructure, Environmental, Interiors and Open Spaces.

Hawkins Infrastructure

Hawkins Infrastructure is a key division of the Hawkins group formed in 2007 to target infrastructure projects throughout New Zealand and overseas.

Much more than a civil engineering business, Hawkins Infrastructure is an established and ambitious contractor within the New Zealand infrastructure market offering a multidisciplinary approach to asset planning, design, construction and maintenance.

Within a relatively short period of time, Hawkins Infrastructure has delivered a number of nationally significant assets within the energy, transport, water, marine and environmental sectors. We are proud of the year-on-year growth we have achieved, while generating repeat business through negotiated procurement methods.

Our intention is to widen and develop the range of services and skills we offer, in order to broaden our IP and expertise and to open up new markets domestically and internationally.

Hawkins Infrastructure's proven system of integrated project delivery enables us to manage the delivery of our clients' entire infrastructure asset projects seamlessly. We are increasingly involved in diverse and new delivery models, such as Engineer, Procure and Construct contracts, that allow us to flex our capabilities and add the most value to projects from the design phase through to handover. What sets us apart is our ability to direct all phases of the project from planning, design, delivery and operation to ensure risk mitigation with the highest quality, safety and environmental standards.

Hawkins is committed to growing its presence in the infrastructure sector. We are ambitious with our future goal to be the number one infrastructure contractor in New Zealand.



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