## Significant dates

**Lake Taupō**
- Discovered by Europeans: 1852
- Proposed for a power scheme (recognized by North Maori of Public Works Department): 1904
- Public Works Department survey parties investigate the area: 1907
- Aluminium ore of Canada excites miner's interest: 1947
- Ministry of Works supports an various possible schemes: 1954
- Building restrictions on Crown Land within 100 feet (30m) of average water level of Lake Taupō: 1955
- NZ Government appoints Consolidated Zine to consider hydro-electric potential of Lake Taupō and to issue Consolidated Zine Prop. Ltd. proceeded right to develop power from Taupō to Auckland, Whangārei and Hannana clients: 1960
- Petition of 25,000 signatures against mining of Lake Taupō: 1960
- Taupō Development Bill (1960) passed: 1960
- Exited Crown lands investigation for Consolidated Zine begins: 1961
- Power station site reached by river tunnel: 1963
- Work and investigation on suspended: Apr. 1962
- Government to build power station: Jun. 1963
- Special investigation by Ministry of Works to start construction: Feb. 1963
- Taupō - Whakatane Development Act enacted: Aug. 1963
- The Waikato electric at Deep Cove: 29 Aug. 1963
- Whakatane Dam completed: Sept. 1963
- First shaft into Taupō Tunnel: 4 Feb. 1964
- Whakatane Power Station completed: 1 Nov. 1965
- Taupō Tunnel hoist through: 24 Oct. 1965
- Work on Taupō Tunnel completed: 20 Aug. 1966
- Tunnel filled with water: 18 Sep. 1969
- First power transmitted: 14 Sep. 1969
- Second machine commissioned: 29 Sep. 1969
- Third machine commissioned: 30 Oct. 1969
- Fourth machine commissioned: 30 Oct. 1969
- Waikato Electric Deep Cove for Hong Kong: 27 Apr. 1970
- Second petition of 155,000 signatures presented: Dec. 1970
- First oilburner switched at Taupō Point: Apr. 1971
- Power Station complete: Sept. 1971

### Notes
- 1967 act amended to 155,000 lake water power from Taupō for national grid.
- Transmissions line opened.
- Taupō power controlled from Co. Gwy, (10/30, 400kV, 50MVA, 275ft. (84m) above mean level.
- Pilot shoreline clearing carried out.

---

**Laie Moana Repatriation**
- Repatriation to Palua's where Palauans was repatriated on March 8, 1992.
Significant Dates

1970
Feb.

1972
July.

1973
Oct.

1974
May.

1975
Nov.

1977
Dec.

1979
Dec.

1983
May.

1987
Sept.

1989
Sept.

1990
June.

1990
Feb.

1990
April.

1990
July.

1991
May.

1991
March.

1991
April.

1991
June.

1991
June.

1998
May.

1998
May.

Major Quantities

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total underground and excavated from all areas</td>
<td>1,391,680 m³</td>
</tr>
<tr>
<td>Total quantity of steel in all areas</td>
<td>2,000 tonnes</td>
</tr>
<tr>
<td>Total concrete poured in all areas</td>
<td>2,200 m³</td>
</tr>
<tr>
<td>Approximate tonnage handled through Winton Point</td>
<td>390,000 tonnes</td>
</tr>
<tr>
<td>Total quantity of explosives</td>
<td>8,000 tonnes</td>
</tr>
<tr>
<td>Total water used in all areas</td>
<td>0.35 m³</td>
</tr>
<tr>
<td>Total power consumed in all areas</td>
<td>3.4 MWh</td>
</tr>
</tbody>
</table>

Transmission Line

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length - Transmission line from switchyard</td>
<td>143.485 km</td>
</tr>
<tr>
<td>First span of transmission line from switchyard</td>
<td>17 km</td>
</tr>
<tr>
<td>Weight of cable on first towers</td>
<td>240 kg</td>
</tr>
<tr>
<td>Caesar number</td>
<td>0.018 A/m</td>
</tr>
<tr>
<td>Distance between each phase</td>
<td>3000 km</td>
</tr>
<tr>
<td>Voltage</td>
<td>520 kV</td>
</tr>
<tr>
<td>Number of towers to transmission</td>
<td>342</td>
</tr>
</tbody>
</table>
Rainfall
At 4 a.m. on 26 August 1963 the Nenana River reached 156 feet, taking out the control support for the bridge at Tcoh Kim. With the river level near zero, an estimated 550,000 cubic feet of water flowed into Lake Nenana. The contaminated floodwater reached halfway to Money Point.

<table>
<thead>
<tr>
<th>Location</th>
<th>Rainfall</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Cove</td>
<td>600.0 mm (23.6 inches)</td>
<td>22-25 April, 1967</td>
</tr>
<tr>
<td>West Arm</td>
<td>276.4 mm (10.9 inches)</td>
<td>25 April, 1967</td>
</tr>
</tbody>
</table>

*Note: 665.6 mm (26.2 inches) on 27 January 1964

Generators
Made by Siemens AG, Munich, Germany
Rated voltage: 11,000 volts
Weight of rotating generator parts: 264 tonnes
Diameter of stator frame: 5.6 m (18 ft 5.5 in)
Diameter of rotor: 5.55 m (18 ft 2.3 in)
Total thrust bearing load: 4.7 tonnes

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated current</th>
<th>Rated output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>4,200 amps</td>
<td>16,143 KVA</td>
</tr>
<tr>
<td>Upgraded</td>
<td>5,448 amps</td>
<td>10,655 KVA</td>
</tr>
</tbody>
</table>

Tunnel Boring Machine (TBM)

<table>
<thead>
<tr>
<th>Weight</th>
<th>Total length (including tailing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,500 tonnes</td>
<td>560 m (1800 ft)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average daily rate</th>
<th>Average daily rate (incl. tailing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>390 ft/120 m/day</td>
<td>490 ft/150 m/day</td>
</tr>
</tbody>
</table>

April 2000: 204 ft/62 m/day

<table>
<thead>
<tr>
<th>Total number of entries on face of TBM</th>
<th>Total entries replaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>408</td>
</tr>
</tbody>
</table>

Original power station project

<table>
<thead>
<tr>
<th>Total manhours on contract</th>
<th>Total manhours to complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,999,950</td>
<td>7,999,950</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total expected accidents</th>
<th>Total actual accidents on job</th>
</tr>
</thead>
<tbody>
<tr>
<td>5707</td>
<td>9</td>
</tr>
</tbody>
</table>

Second tailrace tunnel

<table>
<thead>
<tr>
<th>Total manhours on contract</th>
<th>Total manhours to complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000,000</td>
<td>1,000,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total expected accidents</th>
<th>Total actual accidents on job</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>
**Machine hall**

- **Height (total excavation):** 11.1 m/36.4 ft
- **Area:** 16,000 ft²
- **Average temperature at floor level:** 23°C/73°F
- **Number of units:** 7, 12.8 m/42 ft apart

**Floor levels (m):**
- Machine Floor: 2.3 m/7.6 ft
- Steam Floor: 3.66 m/12 ft
- Turbine Floor: 6.3 m/20 ft
- Feedstock Gallery: 6.7 m/22 ft
- Draft Tube Gallery: 8.33 m/27.5 ft
- Drainage Gallery: 11.87 m/38.9 ft

**Cranes**

- **Track:** by Savigliano, Italy
- **Main:** 180 tons capacity 15 m/55.2 ft
- **Span:** 18 m/180 ft

**Costs**

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Item</th>
<th>Cost (NZD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963-71</td>
<td>Complete installation of machinery</td>
<td>45,000,000</td>
</tr>
<tr>
<td></td>
<td>Installation and commissioning</td>
<td>1,500,000</td>
</tr>
<tr>
<td></td>
<td>Total (commissioning and installation)</td>
<td>56,500,000</td>
</tr>
<tr>
<td>1967-72</td>
<td>Purchasing of spare parts</td>
<td>2,000,000</td>
</tr>
<tr>
<td></td>
<td>Total (commissioning and installation)</td>
<td>58,500,000</td>
</tr>
<tr>
<td></td>
<td>Overall cost of original project</td>
<td>58,500,000</td>
</tr>
<tr>
<td>1997-2002</td>
<td>Second turbine project</td>
<td>112,000,000</td>
</tr>
<tr>
<td>November 1999 – August 2007</td>
<td>Lysepa of machinery</td>
<td>50,000,000</td>
</tr>
<tr>
<td>1999-2007</td>
<td>Replacement and mechanical equipment</td>
<td>10,345,000</td>
</tr>
</tbody>
</table>

Total cost of original project: 112,000,000 NZD

Comprehensive installation and commissioning: 58,500,000 NZD

Second turbine project: 112,000,000 NZD
### 220 KV cables

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of cable (from generator to switchyard)</td>
<td>363 m/1192 ft</td>
</tr>
<tr>
<td>Height of cable (from switchyard to switchyard)</td>
<td>231 m/760 ft</td>
</tr>
<tr>
<td>Diameter of sheath</td>
<td>13.2 mm/0.52 in</td>
</tr>
</tbody>
</table>

**Original cable:**
- Simple core - all-Aluminum - grooves insulated
- Conductor cross-section: Copper 5.34 cm²/0.07 ft²

**Replacement cable:**
- XLPE (Cross-linked polyethylene) cable
- Conductor cross-section: Copper 5.34 cm²/0.07 ft²

### Intakes and penstocks

**Diameter - Concrete section**
- Diameter - Steel section
- (d) 20.5 m (67 ft) to bottom
- Volume of water at full load
- Speed of water - Concrete section
- Speed of water - Steel section
- Thickness of steel at
- (d) 20.5 m (67 ft) bottom of vertical section
- Diameter of central section
- Intake area (per unit)
- Clear space between intake
- Water velocity through intake
- Trunkline size
- Size of headgate opening
- Weight of headgate
- Size of stop log
- Weight of stop log

### Turbines

**Original:**
- Vertical Francis Unit by Keithland Engineering Co. Ltd., Scotland
- Rated output: 15.5 MW
- Operating speed: 150 rpm
- Diameter of runner (turbine): 3.8 m/12.5 ft
- Centre line of turbine: 4 ft / 1.2 m / 10 ft
- Weight of turbine: 10 tonnes

**Replacement:**
- Vertical Francis Unit by General Turbine Cables International Inc.
- Rated output: 15.5 MW
- Weight of turbine: 10 tonnes

### Wilmot Pass Road

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of road</td>
<td>331 m/1090 ft</td>
</tr>
<tr>
<td>Material construction</td>
<td>Concrete</td>
</tr>
<tr>
<td>Cost of building</td>
<td>$50 per square metre/$2 per cubic foot</td>
</tr>
</tbody>
</table>
Hydrology

**Water Quality**

Very soft with 30% saturation of dissolved oxygen at 44.5 m deep (146 ft).

**Surface Temperature, Surface Water**

Upper 5°C

Below 20°C (moderately warm)

Winter temperature, surface to bottom:

Lake Taupō and Lake Maranguka

- **Shoreline**
  - Normal operating levels
  - Catchment area
  - Lake Maranguka area

- **25°C**
  - 18°C
  - 12°C
  - 10°C
  - 8°C
  - 6°C

- **Depth**
  - 157 m
  - 55 m
  - 34 m
  - 10 m
  - 2 m

- **Temperature**
  - 15°C
  - 11°C
  - 9°C
  - 7°C
  - 5°C

**Catchment for Marongua River**

Total catchment for both lakes and Marongua River

The maximum recorded levels of both lakes, before control gates were backwatered, were reached in October 1993.

- Te Araroa
  - Maximum level: 105.24 m (345 ft)

- Manapouri
  - Maximum level: 105.24 m (345 ft)

**Lift Shaft**

- Diameter of flight level
- Central room
- (Note: the actual depth is 100 ft)
- Speed of lift

- **Elevation from top level:**
  - 4.5 m (14.6 ft)
  - 237 m (776 ft)
  - 6.4 km/h (4 mph)
### Transformers

<table>
<thead>
<tr>
<th>Made by</th>
<th>Transformers in the**</th>
<th>18.4 AUO 230 KV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Original</strong></td>
<td>Weight</td>
<td>28 tonnes</td>
</tr>
<tr>
<td></td>
<td>Overall weight</td>
<td>197 tonnes</td>
</tr>
<tr>
<td></td>
<td>Weight of all</td>
<td>56 tonnes</td>
</tr>
<tr>
<td></td>
<td>Continuous rating</td>
<td>1.4-4.05 VMA, 1-3.50 HVA</td>
</tr>
</tbody>
</table>

**Upgraded:**
- **Weight of core waiting:** 41 tonnes
- **Overall weight:** 191 tonnes
- **Weight of all:** 56 tonnes
- **Continuous rating:** 1.2-1.10 HVA

### Tailrace tunnels

**Amount of water to pump out if de-watering:**
- Original: 7,258,766 litres
- 1,000,000 gallons

**Plan area:**
- Original: 34,000 litres/Nil, 5,000 gallons/Nil

#### Original, (by drill and blast method)

<table>
<thead>
<tr>
<th>Diameter (North Portal Entry)</th>
<th>9.3 m/30 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (North Portal Entry)</td>
<td>10 m/33 ft</td>
</tr>
<tr>
<td>Outlet (North Portal Entry)</td>
<td>5.4 m/17 ft</td>
</tr>
<tr>
<td>deepest point (North Portal Entry)</td>
<td>4.44 m/14 ft</td>
</tr>
<tr>
<td>Net head of water</td>
<td>346 m/1138 ft</td>
</tr>
<tr>
<td>Rock removed during excavation</td>
<td>785,904 m³/7,044,000 yds³</td>
</tr>
<tr>
<td>Total concrete for lining</td>
<td>210,200 m³/275,655 yds³</td>
</tr>
<tr>
<td>Total concrete for grouting</td>
<td>3,546 m³/13,012 yds³</td>
</tr>
</tbody>
</table>

**Grout pressure, up to:** 7,200 psi
**Discharge velocity - 450 cm³**
**Maximum water inflow during excavation:** 680 m³/810 yds³
**Average inflow during excavation:** 31 m³/37 yds³
**Maximum temperature of water:** 4° C
**Annual temperature percentage:** 80%

#### Second: (6.6 km by TBM, 0.8 km by drill and blast)

<table>
<thead>
<tr>
<th>Diameter (North Portal)</th>
<th>9 m/30 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (Drilled)</td>
<td>9.9 km/6.1 miles</td>
</tr>
<tr>
<td>Outlet (North Portal)</td>
<td>6.8 m/22 ft</td>
</tr>
<tr>
<td>Deepest point (North Portal)</td>
<td>6.22 m/20 ft</td>
</tr>
<tr>
<td>Net head of water</td>
<td>240 m/788 ft</td>
</tr>
<tr>
<td>Rock removed during excavation</td>
<td>approx. 6,400,000 m³/7,770,000 yds³</td>
</tr>
<tr>
<td>Total concrete for lining tunnel</td>
<td>220,644 m³/285,714 yds³</td>
</tr>
<tr>
<td>Total concrete for drainage</td>
<td>3,600 m³/12,144 yds³</td>
</tr>
<tr>
<td>Rock blasters used during excavation</td>
<td>6.1, 3.8 ft</td>
</tr>
<tr>
<td>Maximum water inflow during excavation</td>
<td>6,210 litres/Nil, 16,290 gallons/Nil</td>
</tr>
<tr>
<td>Approximate time</td>
<td>200</td>
</tr>
<tr>
<td>Total main hours</td>
<td>3,200,000</td>
</tr>
</tbody>
</table>

No loss of life or serious personal injuries (two serious recorded cases broken bones in cutting). Rock spill has created a new spillway across the river. Spillway broadened and widened between 10-13 m wide, covered by 220,000 native plants grown, especially for this project.

### Access tunnel

<table>
<thead>
<tr>
<th>Diameter</th>
<th>6.7 m/22 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>2,000 m/6,562 ft</td>
</tr>
<tr>
<td>Gradient</td>
<td>2.30</td>
</tr>
</tbody>
</table>
WE'RE HERE TO HELP

Please feel free to contact our Customer Service Team:

Phone  0800 496 496
Fax    0800 497 498

Monday to Friday, excluding public holidays,
between 7.30am and 7.30pm

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