Dominion Salt

Lake Grassmere Wind Farm Project

energy3

Overview

- Dominion Salt Limited, a producer of salt and related products became interested in self generation in 2005.
- Maximum demand of 650kW, and yearly demand of approximately 2.0 GWh p.a.
- Dominion Salt recognised that it's exposed geographic location in Marlborough lent itself to wind generation.
- Dominion Salt approached Energy3 Services early in 2009 to provide consulting and management services.
- Energy3 subsequently carried out detailed analysis on generation potential, prepared a resource consent application, and provided project management services
- Resource Consent was gained in late 2010
- Board approval for project construction given in late 2011
- Vestas V47 turbine located in August 2013
- Turbine installed and commissioned March 2014

Energy3 Profile

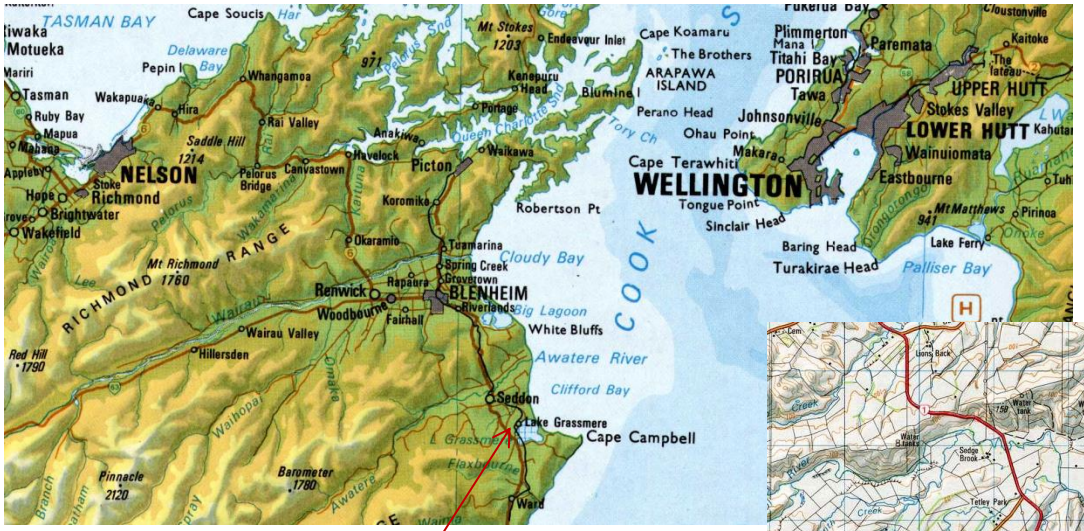
- Privately owned
- Based in Christchurch
- Provides wind measurement services and consultancy in both NZ and Australia
- Focused on smaller embedded sites and distributed generation
- Has developed and commissioned 4 wind projects, and taken another project thought consenting

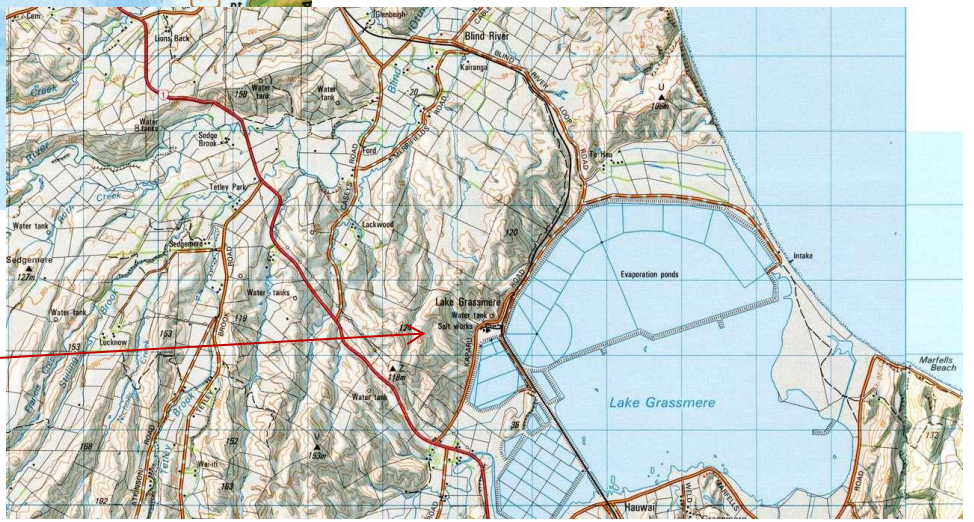
Dominion Salt Profile

- Established in 1949 by George Skellerup
- Currently owned by Cerebos Greggs and CK Life Sciences
- Production based Lake Grassmere, Marlborough, over 1,629 Hectares
- Head office and processing facility is based in Mount Maunganui
- Produces around 70,000 tonnes per annum, approximately 50% of NZ's Demand
- Key business focus is environmental sustainability

Location

- Located ~12km south of Seddon, Marlborough
- Surrounding terrain ~100m above sea level
- Good exposure to prevailing winds

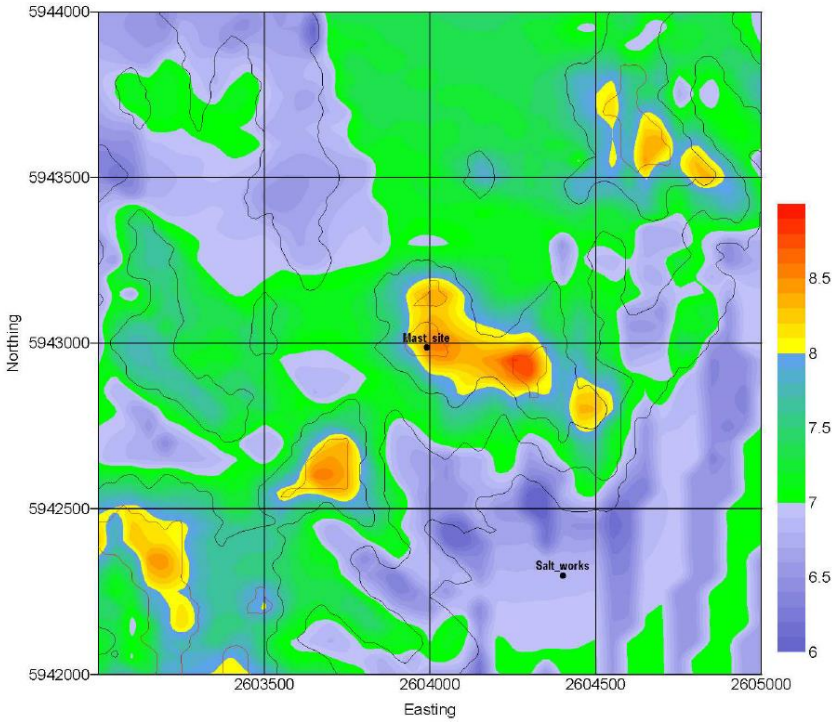


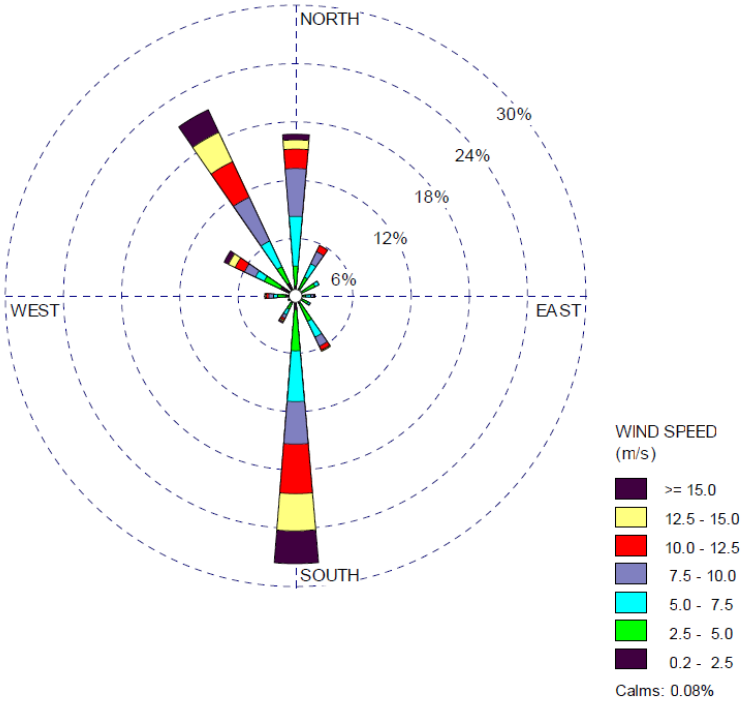


Turbine Location

Wind Resource

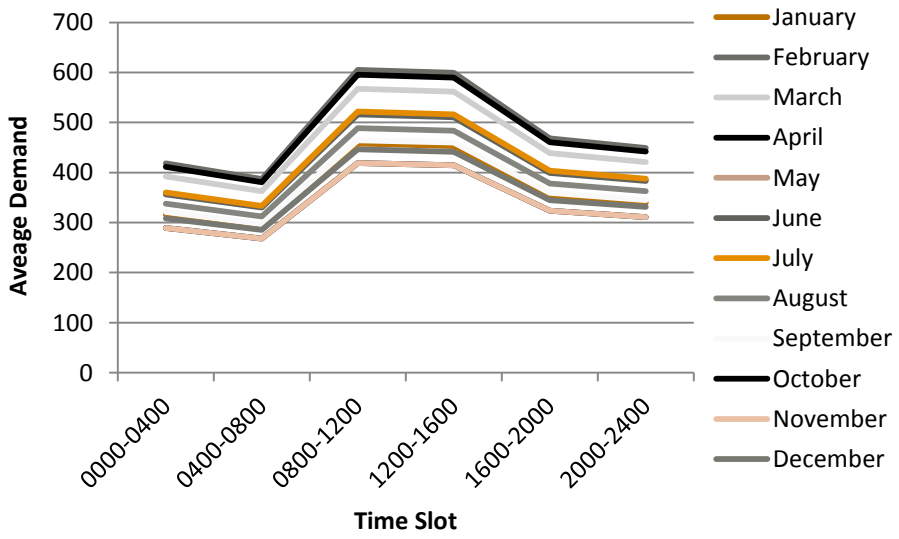
- Measured initially with a 10m mast, mean ~8.1m/s over 5 years
- Mesoscale modelling via WRF used to refine, 8.5 m/s @50m
- Not a stellar speed, but sufficient for economic self generation

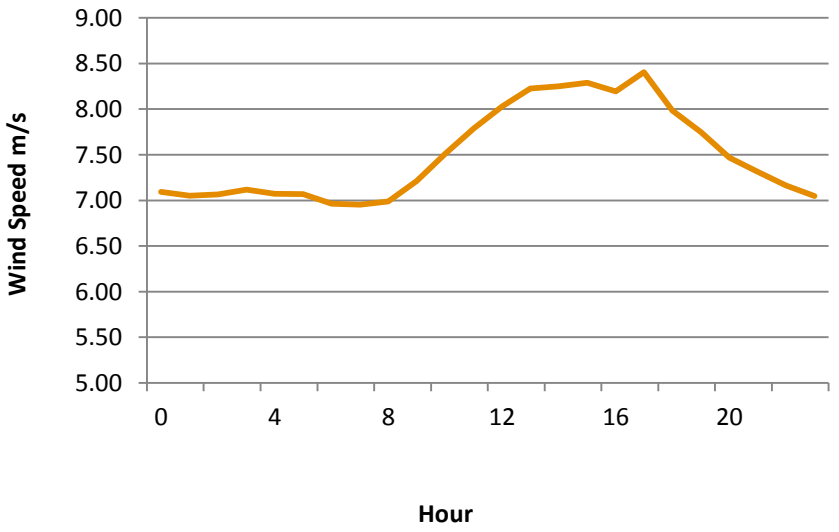




Demand Overview

- Maximum demand of 650kW
- Seasonal variations, peak for harvest (Jan-Mar)
- Defined diurnal profile
- Some loads constant
  - Flaky salt plant
- Reasonable ability to control load, i.e. pumps
- Load matches wind resource well





Consenting

- Consent prepared by Energy3
- External consultants utilised for:
  - Landscape
  - Flora and Fauna
  - Avian
  - Acoustics
- Only one objection
- Additional information supplied to address appellants concerns post hearing
- Consent granted after subsequent hearing and assessment of appellants concerns

Economic Feasibility

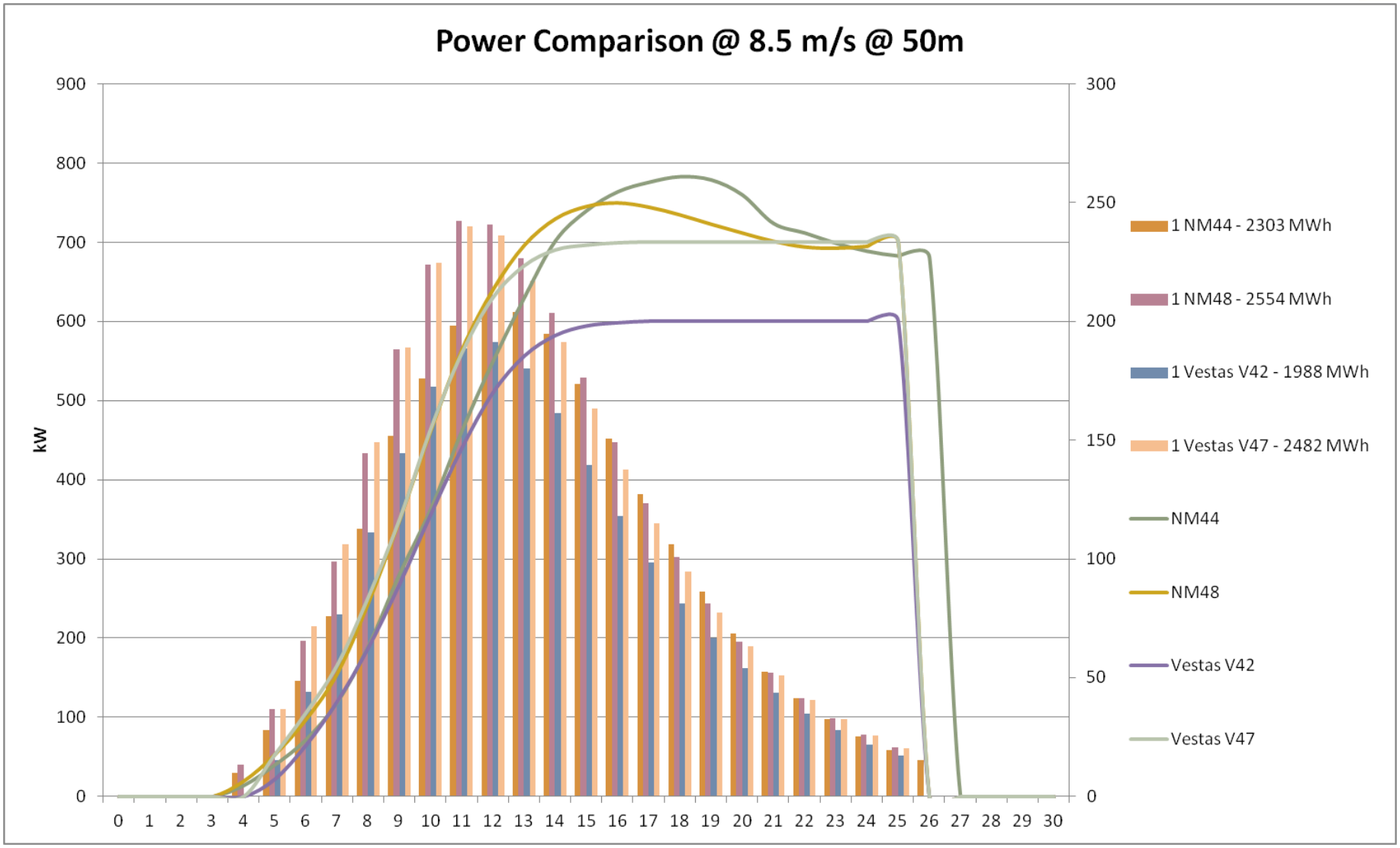
- Modest wind speed reduces turbine options
- Displacement of energy only yields marginal economics
- Variable line charges improve economics significantly
- Variable lines charges are approximately $30/MWh during daytime
- Seasonal and diurnal plant demand was modelled in conjunction with respective wind speed profiles
- Resultant power production was modelled against energy supply schedules to determine economic outcome
- Analysis suggests on average:
  - Imports will be reduced to ~ 0.5GWh, down from 2.0GWh
  - Exports ~ 0.9GWh
  - Direct consumption ~ 1.5GWh, of ~2.4GWh
- LRMC ~ $84/MWH
- Installed cost of ~1,500/kW
- Overall a good return on investment

Turbine Selection

- Range of turbines considered
- Consent allowed for 5 turbines with a 75m envelope, or 7 with a 45m envelope
- Key criteria were track record, serviceability, O&M presence
- A larger turbine was chosen to be preferable, suitable options were identified as either Vestas or NEG Micon
- Vestas V47 chosen
  - Good energy production for wind conditions
  - Support by Vestas NZ
  - Proven in NZ conditions

Unit	Micon NM44	Micon NM48	Vestas V47
Power Regulation	Stall	Stall	Pitch
Rotor Size (m) / kW	44 (750)	48 (750)	47 (660)
Generation @ 8.5 m/sec (GWhr)	2.3	2.54	2.48
Cost ex site (euro)	90,000	140,000	150,000
Hub Height	45-70	45-70	40-65

Potential Power Generation Comparison

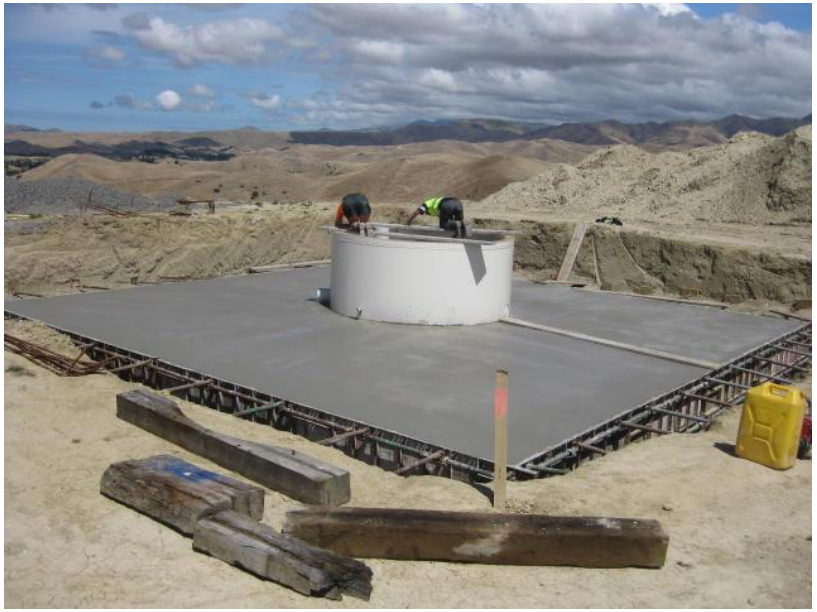


Turbine Procurement

- Energy3 has a number of contacts in EU
- V47 models are hard to find, highly sought after
- 6 months to find suitable turbine, tower limited to 45m
- Located unit in Switzerland , only 16% capacity factor
- Excellent condition, serviced by Vestas Germany
- Full documentation

Civil Works

- Foundation design re worked by Aurecon
- Embed manufactured in NZ
- Foundation construction carried out by local Blenheim firm
- Dominion Salt have their own 11kV network
- Connected behind the 11kV meter
- Approx 2km of new overhead line, 690V/11kV connection



Commissioning

- Lead by 2 technicians from Vestas, E3 provided 3 experienced staff members
- Cranes and lift supervisor provided by Smith Crane and Construction
- 2.5 days to assemble, additional 4 days to commission
- Trouble free installation and commissioning process
- Metering delayed final sign off
- Trouble free operation since

Lessons Learned

- Remove lower tower flange
- Specification of removal important
- Transport important to get right
- Expertise and specialised tools from Vestas invaluable