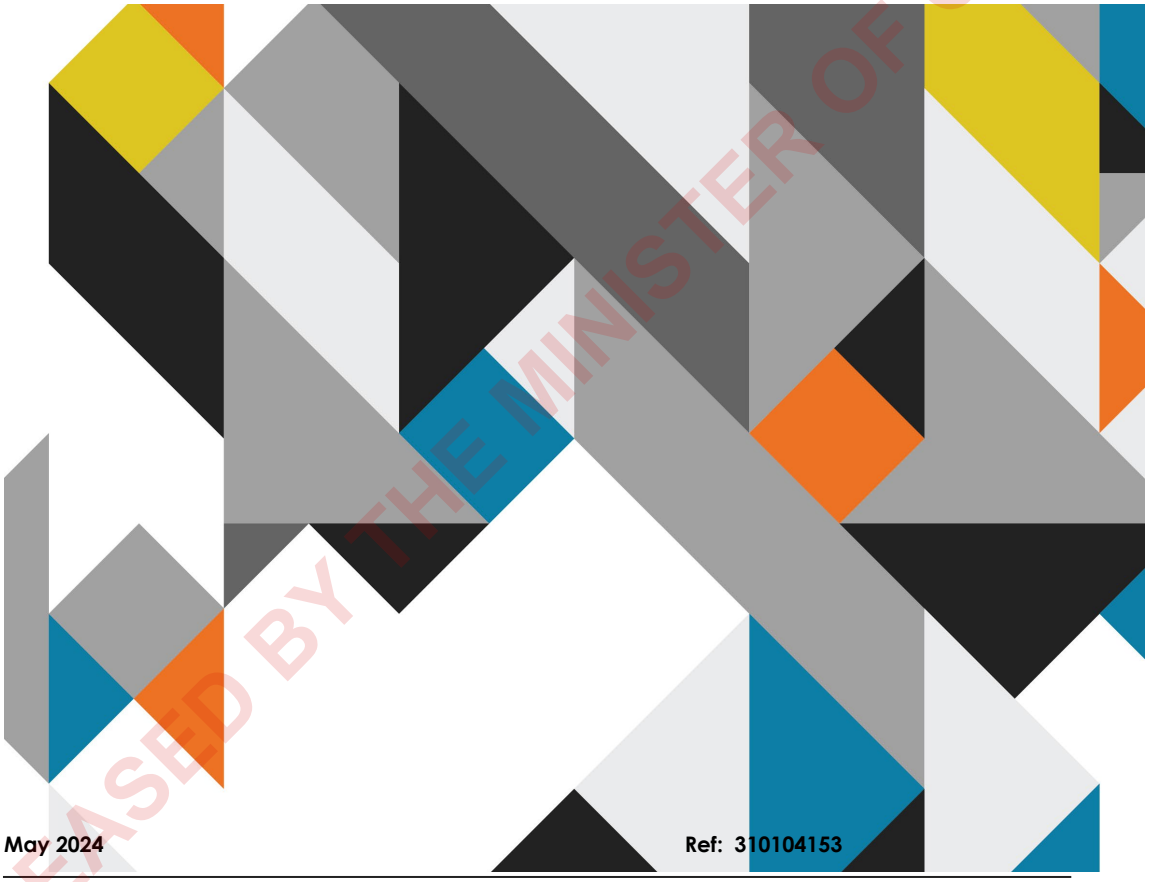
Milford Opportunity Project

Infrastructure Energy Demand



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Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
A	13/12/2023	Draft	Coert Marais	Phelia Klopper	Robin Spittle	Sarah Velluppillai
B	28/03/2024	Final	Phelia Klopper	Robin Spittle	Andrew Bird	Phelia Klopper
C	15/05/2024	Final Revised	Phelia Klopper	Andrew Bird		Phelia Klopper

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1. Introduction

As part of the Milford Opportunities Project, various nodes along the Milford corridor will be developed or expanded. The intention for these nodes is discussed in the reports “Milford Opportunities Project: Infrastructure Assessment Report” and “Milford Opportunities Project: Tourism Report”. Stantec undertook a review of these documents to identify the power requirements associated with the planned development.

A high-level calculation of the peak power requirements was completed by using typical power demand of electrical items where applicable. For infrastructure with too much uncertainty, a typical value for the energy demand per square metre was estimated based on similar buildings, past experience, and Table C3 in AS/NZS3000.

In many cases, the power demand for heating and cooling far outweighs the power demand of all other equipment in a building. The heating can be made more efficient in further design stages, potentially reducing the load. For the hotel at Milford Sound and lodge at Knobs Flat we have assumed that eco-concepts will be incorporated into the design of the buildings to make the buildings more energy efficient, therefore a 25% reduction in typical energy per square metre for these types of buildings was applied.

2. Infrastructure Energy Demand

TE ANAU HUB
ASSUMPTION
Excluded from scope - connected to network

NODE 1 TE RUA-O-TE-MOKO FIORDLAND NATIONAL PARK ENTRANCE
ASSUMPTION
Assume no power demand

NODE 2 EGLINTON REVEAL	
DEMAND	**ASSUMPTION**
Parking area	It is assumed no lighting is required for the parking area.
Vaulted toilets	It is assumed that the four vaulted toilets only require lighting at between 10 to 20 W per toilet and extraction fans. Assuming that hand paper towels will be used instead of electric hand dryers No electric/automatic taps have been allowed for. Estimate 280 W.
Sales kiosk	It is assumed a sales kiosk uses the following equipment to operate: Computer: 150 W + Cash register: 30 W + Display: 100 W x 2 screens + Lighting equipment: 20 W x 4 lights + Peripheral devices: 30 W x 2 devices + Air conditioning: 1.5 kW

	= 2 kW total electricity consumption. Estimate 2 kW.
TOTAL	**2.3 kW**

NODE 3 TE HUAKAUE KNOBS FLAT	
DEMAND	**ASSUMPTION**
Cabins	For the cabins' electrical the average power consumption has been calculated using Table C2 in AS/NZS3000 with assumptions of seven socket outlets and 14 light fitting withing cabin averaging on 18 W per luminaire. Thus, total ADMD (After Diversity Maximum Demand) per cabin for small power and lighting will accumulate to 1.7 kW. Due to the nature of the cabins we can apply and assume simultaneous factor of 0.25. This totals to 6.4 kW (or 0.425 kW per cabin). For space heating, VRF split units are assumed due to energy efficiency, and hot water is assumed to be supplied from centralised water heating. These loads are assumed to require about 3 kW per cabin or 45 kW in total. Estimate 51.4 kW.
Camp ground	Assuming 15 campervans with an average power consumption per campervan of 500 W. This will allow for some lights and basic power needs. Thus, the total campervan power consumption will be7.5 kW. Assuming and applying a simultaneous diversity factor of 0.5 the maximum demand will be 3.75 kW. Estimate 3.75 kW.
Amenities	The shared kitchen area has an area of about 50 m^2. Considering an average power consumption of 40 W/m^2 for lighting and appliances, the power required will approximate to 2 kW. Only basic, energy-efficient electrical operating items like small microwaves, toasters, fridges, and induction cook tops have been allowed for, assumed to not operate simultaneously. The hot water is assumed to be supplied by the centralised water heating, and a VRF split unit is assumed to be used for space heating. These loads require 4.2 kW. Estimate 6.2 kW.
Washing and drying facilities	Assume that no shared washing or drying facilities are provided.
Interpretation building:	The interpretation building has a total area of about 200 m^2. Using 90 W/m^2, the power required for the interpretation building would be approximately 18 kW. This includes heating and ventilation. Estimate 18 kW.
Wi-Fi:	Assuming four Wi-Fi access points (at the kitchen and interpretation building) with an average power consumption of 100 W, the total Wi-Fi load would be 400 W.
Expansion of wastewater and drinking water:	Energy requirements for wastewater and drinking water expansion depend on the specific infrastructure deployed. These may include pumps, filtration systems, and other equipment that requires electricity. It is assumed that the current power demand is 15 kW and will increase by 20% (to allow for enhancement of treatment and increase in demand).

	Estimate 18 kW.
Food cart:	Allowance for 3.5 kW for one food cart, this assumed that the cooking and heating will be achieved using gas.
Kiosk Creek Lodge:	The lodge is assumed to be similar to the proposed eco-concept hotel at Milford Sound with 70 W/m^2, but 30% of the capacity of the hotel. For more detail, see the hotel description under Milford Hub. Estimate 33 kW.
TOTAL	**134 kW**

MIRROR LAKES
ASSUMPTION
Assume no power demand

NODE 4 OTAPARA CASCADE CREEK/MISTAKE CREEK OVERNIGHT WALKING TRACK EXPERIENCE[1]	
DEMAND	**ASSUMPTION**
Camp ground	It is assumed that no power will be provided at the camp sites.
Shared kitchen	The two shared kitchen areas have areas of about 25 m^2 each. The power consumption for lighting and appliances is assumed to be 2 kW per kitchen. Only basic, energy-efficient electrical operating items like induction cook tops have been allowed for, assumed to not operate simultaneously. No allowance has been made for appliances such as microwaves, toasters, kettles, and fridges. Assuming no spatial and water heating for these kitchens. Estimate 4 kW.
Shower facilities	Assume no hot water for showers. Assume minimal lighting requirements for eight showers at 10 to 20 W per light. Estimate 160 W.
Toilets	It is assumed eight vaulted toilets will be required that only require lighting at between 10 to 20 W per toilet with 50 W/toilet extraction fans. Assume paper towels will be used instead of electric hand dryers. Estimate 560 W.
Meals/shelter from heavy rain:	The two large shelters/rain shelters are 30 m^2 each with solid roofs opening to both sides and metal floors. It is assumed these shelters will require 10W/m^2 of lighting. These shelters can have an electricity demand of about 300 W each.

[1] Note that these estimates would remain unchanged regardless of the location of the track and hut.

	Estimate 600 W.
Wi-Fi:	Assuming four Wi-Fi access points with an average power consumption of 100 W, the total Wi-Fi load would be 400 W.
Bus stops:	Assuming basic lighting is required, the power demand for the bus stop is assumed to be 100 W. Estimate 100 W.
Trail Lighting	Assume no trail lighting is required.
Mistake Creek Hike Shelter:[2]	The hiking hut is designed to accommodate up to 80 hikers and is designed to be completely self-contained. Allowance for only basic lighting at 20 W for two beds. Thus, accumulated to 800W for all 80 beds.
TOTAL	**6.62 kW**

NODE 5 THE DIVIDE / WHAKATIPU TRAILS HEAD	
DEMAND	**ASSUMPTION**
Wananga	Assuming an average lighting, small power and HVAC load of 90 W/m^2 for a 200 m^2 building. This includes an allowance for a small restaurant kitchen and small shop. Estimate 18 kW.
Wi-Fi	Assuming six Wi-Fi access points with an average power consumption of 100 W, the total Wi-Fi load would be 600 W.
Parking area	It is assumed no lighting is required for the parking area.
Public toilets	It is assumed eight vaulted toilets will be required that only require lighting at between 10 to 20 W per toilet with 50 W of extraction fans per toilet cubical. Estimate 560 W.
TOTAL	**19.2 kW**

NODE 6 GERTRUDE VALLEY	
DEMAND	**ASSUMPTION**
Trail Lighting	Assume no trail lighting is required.
Facility Power Requirements	It is assumed that there will be four vaulted toilets that are not flushable and only require lighting at between 10 to 20 W per toilet. It is assumed that the toilets will not have extraction fans, but rather whirlybirds that are wind driven and do not require power. The addition of extraction fans would add

[2] Note that these estimates would remain unchanged regardless of the location of the hut/shelter.

	200 W to the load. It is assumed a shelter, interpretative displays, and the parking area will not require any power. Estimate 80 W.
TOTAL	**0.08 kW**

NODE 7 CLEDDAU CIRQUE	
DEMAND	**ASSUMPTION**
Parking area	It is assumed no lighting is required for the parking area.
Shelter	It is assumed the shelter would not require any power, e.g. no lighting, heating, ventilation, or electrical outlets will be required.
TOTAL	**No power demand**

THE CHASM	
DEMAND	**ASSUMPTION**
Public toilets	It is assumed that there will be three vaulted toilets that are not flushable and only require lighting at between 10 to 20 W per toilet. It is assumed that the toilets will not have extraction fans, but rather whirlybirds that are wind driven and do not require power. The addition of extraction fans would add 150 W to the load. It is assumed a shelter, interpretative displays, and the parking area will not require any power. Estimate 60 W.
Coffee Cart	Allowance has been made for a coffee cart to use 3 kW. Note that this would not allow for all commercial type coffee machines to be operated.
TOTAL	3.06 kW

MILFORD HUB	
DEMAND	**ASSUMPTION**
Gondola	Based on the power demand of existing operational gondolas, it is assumed a Milford Gondola would consume between 170-250 kW.

	Estimate 250 kW.
Staff accommodation	The staff accommodation building of 5,200 m^2 will have basic power needs including lighting, heating, ventilation, basic shared kitchen, and basic shared laundry facilities. Assuming 70 W/m² for a low energy design. Estimate 365 kW.
Visitor centre	Assuming a load of 90 W/m² for the1,800 m^2 building totals to 162 kW. The external covered area is assumed to require minimal power. Estimate 162 kW.
Interprative marine centre	
Gallery	A gallery of 650 m^2 will likely require lighting fixtures, including track lights or spotlights, to illuminate the displays properly. Additionally, climate control systems such as air conditioning or heating may be necessary to maintain suitable environmental conditions for the displays. Assuming 80 W/m², it totals to approximately 52 kW.
Audio-visual / seminar room	The audio-visual / seminar room of 80 m^2 will likely include audio-visual equipment such as projectors, screens, speakers, and lighting fixtures. These devices will require a significant amount of power during operation. Assuming 75 W/m², it totals to approximately 6 kW.
Viewing room with interpretation / touch tanks	It is assumed the space of 200 m^2 will feature interactive displays and touch tanks that require electricity to function. It is assumed lighting fixtures and climate control systems are required in this area. Assuming 110 W/m², it totals to 22 kW.
Office	The office (20 m^2) is assumed to include computers, printers, lighting fixtures, and other office equipment that consume power during operation. Assuming 90 W/m², it totals to 2 kW.
Plant room / back of house / loading dock	The plant room (40 m^2) houses mechanical and electrical equipment necessary for the building's operations, such as HVAC systems, pumps, and generators. Pump rooms and HVAC systems is incorporated in the W/m² estimation. Assuming 90 W/m² it totals to 3.6 kW.
TOTAL	Estimate 86 kW.
Hotel	For the entire 1,540 m² facility a power consumption of 70 W/m² is assumed which include HVAC and mechanical systems. Thus 1,540 m² at 70 W/m² = 107.8 kW. The 70 W/m^2 assumes an energy efficient design with passive heating technology. Depending on the final design and innovations involved, this number could be further reduced. A commercial kitchen is included. No allowance has been made for industrial washing and drying. Laundry is assumed to be transported off site. Estimate 110 kW.

Ferry terminal building at Fresh Water Basin	Assuming 150 W/m² for the entire 600 m² ferry terminal totals to 90 kW. This excludes any vessel charging points and only accommodate heating, lighting, and small power. Any additional mechanical equipment like cranes etc. shall be additional to the load. Estimate 90 kW.
Wastewater facility	Assuming that sanitary waste from the facility will not be able to be run via gravity and will require macerating and pumping to the civil sewer network, or onsite septic tank (or similar). Allows for a duty / standby configuration, that considers the flows which have been assumed in the potable water section below. Sanitary Drainage – duty / standby 4 kW pumps and 4 kW macerators (16 kW total). Estimate 16 kW.
Potable water facilities	Assuming a combined maximum diversified probable simultaneous flow of 5 l/s to the facility that will be boosted by 500 kPa for distribution. This is the equivalent of 15 hose taps, 10 washing machines, 20 sinks, 50 showers, 60 toilets, 60 hand basins, and an allowance made for make up for hot water supply, minor irrigation, and commercial kitchen appliances. Potable Water – duty / standby 5.5 kW pumps (11 kW total) Estimate 11 kW.
Food carts at Deep Water Basin	The control requirements for a food cart depends on the apparatuses and hardware included. Regularly, a food cart may have fridges, coolers, stoves, flame broils, fryers, coffee machines, and other little machines. The control utilisation of these apparatuses can extend from 500 W to 3000 W each. It is assumed each food truck will use 3.5 kW. This assumes that the stove and water heating elements will be gas operational and not electrically. Only basic electrical operating items like small microwaves, toasters and small fridges has been allowed for. For three food carts the power demand is 10.5 kW. The 40 m² seating area may require lighting, fans or air conditioning units, and media gear. Lighting installations can expend around 30W per luminaire, whereas fans or air conditioning units can run from 500 W to a few kilowatts depending on their capacity. Varying media gear such as speakers, projectors, and screens may also require extra control. Assuming a 3.5 kW for sheltered seating areas and an additional 500 W for outdoor shelter lighting it will total to 4 kW. Estimate 15 kW.
Base of Operations Building at Cleddau Delta	It is assumed that the Base of Operations building will include an area/workshop to maintain buses including lighting and power outlets. The basic bus workshop will be assumed to be double volume with low-bay luminaires. Cranage is excluded. It is assumed that the basic workshop will be 189 m² (21 m x 9 m). Assuming 70 W/m² for light industrial area according to Table C3 in AS/NZS3000, this totals to 13.2 kW. A small area (assuming 40 m²) for bus drivers to rest including a basic kitchen area, toilet facilities, lighting, and Wi-Fi can require up to 2.8 kW. Estimate 15 kW.
TOTAL	**1,120 kW**

3. Monthly infrastructure energy demand

The peak power demand estimates as discussed in Section 2 were translated to monthly energy demand values using a number of criteria including:

- An assumed number of visitors (Table 3-1)
- Heating Degree Day[3] data (18C base) to approximate the variation of heating energy (Table 3-2)
- The length of night[4] to approximate the variation of lighting and general power energy (Table 3-3)
- An assumed business day length of 10 hours to approximate the energy requirements of visitor-based services (e.g. gondola, food carts etc.)

The above adjustment criteria were applied to each facility type as appropriate.

Table 3-1: Visitor profile

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of visitors as percentage of peak monthly average	99%	100%	91%	80%	41%	32%	32%	27%	37%	51%	76%	94%

Table 3-2: Heating Degree Day data (from NIWA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating degree days as % of maximum month	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	90%	80%

Table 3-3: Night length in hours

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Night length (hours)	12	14	14	16	18	18	18	16	15	13	13	12

[3] Heating Degree Day (HDD) is a measurement of the energy required to heat a building. Here the HDD is used with a 18C base (as published by NIWA) to make a rough approximation of how the building heating loads vary over a year. It has been assumed that the heating requirements included in the Maximum Demand values in Section 2 will be for the periods with highest HDD and periods with lower HDD had their heat load scaled accordingly. This is a very high-level approximation,

[4] The NIWA solar calculator was used to establish when the sun is visible (considering local topology). When the sun is not visible it is "night" and lighting would be required.

Table 3-4: Monthly Infrastructure Energy Demand (kWh)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Node 2	Infrastructure	1,095	1,093	1,277	1,279	1,104	1,020	1,054	1,026	1,047	1,160	1,138	1,183
Node 3	Infrastructure	69,275	68,925	80,354	80,426	69,853	64,640	66,794	65,095	66,284	73,251	71,842	74,679
Node 4	Infrastructure	2,777	2,508	2,777	2,687	2,777	2,687	2,777	2,777	2,687	2,777	2,687	2,777
Node 5	Infrastructure	7,068	6,384	7,068	6,840	7,068	6,840	7,068	7,068	6,840	7,068	6,840	7,068
Node 6	Infrastructure	60	54	60	58	60	58	60	60	58	60	58	60
Node 7	Infrastructure	603	544	603	583	603	583	603	603	583	603	583	603
Milford Hub	Infrastructure	436,197	431,301	499,454	517,306	489,238	469,120	484,757	482,268	485,929	534,991	488,892	475,011

4. Monthly transport energy demand

Monthly transport energy demand was based on the following:

- Boats:
  - Boats total battery capacity of 50,500 kWh for 100% demand.
  - Charge period: 13 hours, constantly applied across the period.
  - Allowance for contingency such as charging losses.
- Buses:
  - Bus battery sizes of 400 kWh.
  - Bus peak demand: 6000 passengers per day requiring 123 buses.
  - Bus high demand: 4000 passengers per day requiring 82 buses.
  - Bus moderate demand: 2000 passengers per day requiring 41 buses.
  - Bus low demand: 1200 passengers per day requiring 24 buses.
  - Charge period: 8 hours, constantly applied across the period.
  - Allowance for charging losses.

The demand profiles for boats and buses followed the same profile as per Table 3-1.

Table 4-1: Monthly Transport Energy Demand (kWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Boats	2,528,900	2,284,200	2,528,900	2,232,900	1,816,600	1,641,700	1,696,400	1,696,400	1,758,000	1,966,800	2,232,900	2,528,900
Buses	905,300	817,700	905,300	584,100	301,800	175,300	181,100	181,100	292,100	301,800	584,100	905,300

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