3.1 Justification for the Project

3.1.1 Energy Supply

The National Electricity Market

In December 1998, a single competitive national electricity market (NEM) for the supply of electricity was introduced. The NEM introduced competition in the wholesale supply and purchase of electricity combined with an open access regime for the use of electricity networks across the Australian Capital Territory, New South Wales, Queensland, South Australia, Victoria and Tasmania.

The NEM is a wholesale market for the supply and purchase of electricity, the arrangements for which are defined in the National Electricity Code. The National Electricity Market Management Company (NEMMCO) managed the operation of the wholesale electricity market and security of the power system. Since 1 July 2009 NEMMCO's roles and responsibilities have transitioned to the Australian Energy Market Operator (AEMO).

Generators bid their electricity into the NEM, which is split into regions based largely on state boundaries. The last bid accepted sets the spot price for electricity with prices set on a half-hour basis. Retailers purchase the electricity direct from the NEM. The AEMO facilitates these purchases. The electricity is then on-sold to the consumer and transported by transmission lines (high voltage) and distribution networks (lower voltage).

The cost of power in the market varies each half hour based on the prices that are bid in by generators that wish to sell power. As demand varies, different power plants run and the price of power varies. NSW, Snowy Mountains, Victoria, South Australia, Queensland and Tasmania are interconnected and electricity flows between the regions based on the half hour price that prevails between adjacent regions.

NSW Government Energy Policy

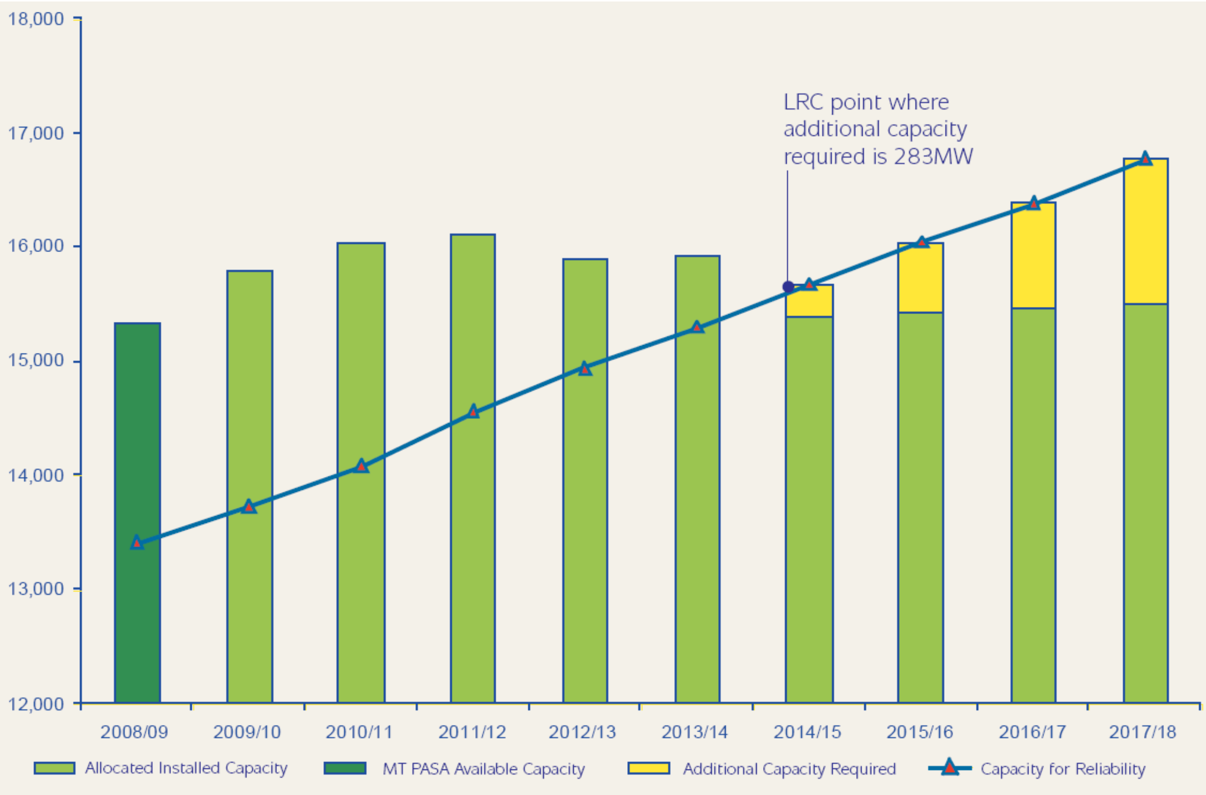
As the security of energy supply is a critical issue for the future of NSW, the NSW Government released their *Energy Directions Green Paper* in December 2004 (NSW Government 2004). This Green Paper stated that while there is currently sufficient electricity generation capacity to meet demand, the level of maximum demand is increasing by around 4 % per year. The Green Paper stated that in NSW the summer peak demand has grown by around 3.8 % per year for the previous five years. The Green Paper noted that if this trend continues additional generation capacity or demand management will be needed by the end of the decade.

Over the coming decade, it is predicted that rising electricity demand from NSW will exceed existing generation capacity unless a new source of electricity generation is constructed and fully operational by 2009. The Green Paper also identifies that new base load generation capacity may be required from around 2012/13.

NEMMCO Statements of Opportunities

Each year NEMMCO (now AEMO) releases a Statement of Opportunities (SOO) which, in part, analyses the supply and demand scenarios for each region of the NEM. The 2008 SOO (NEMMCO 2008) confirmed the trend forecast in previous SOO's that NSW is likely to experience a deficit in summer peak electricity supply unless additional generation capacity is provided. In particular, the 2008 SOO identified:

- NSW is a net importer of up to 1946 MW of electrical capacity;
- NSW has a projected 10-year summer peak load growth of 2.3%; and
- NSW has a projected capacity shortfall of some 283 MW in 2014/15 (**Figure 3-1**).



LRC Point – Low Reserve Condition Point: represents the first year that the projected Allocated Installed Capacity falls below the Capacity for Reliablilty. Source: NEMMCO SOO (2008)

Figure 3-1 2008 Projected NSW Summer Outlook to 2017/2018

NEMMCO also predicts that the generation shortfall for the NEM could be around 650 MW by 2013/14. This deficit could be exacerbated by the possible early retirement of coal fired power plants, particularly in Victoria, due to the introduction of the Carbon Pollution Reduction Scheme.

Owen Inquiry

The NSW Government established an inquiry into Electricity Supply in NSW in May 2007 to advise the Government on the actions it needs to take for a timely investment in new base load generation. The inquiry was undertaken by Anthony Owen, Professor of Energy Economics at Curtin University of Technology (generally referred to as the Owen Inquiry), with the terms of reference to:

- review the need and timing for new base load generation that maintains both security of supply and competitively priced electricity;
- examine the base load options available to efficiently meet any emerging generation needs;
- review the timing and feasibility of technologies and / or measures available both nationally and internationally that reduce greenhouse gas emissions; and
- determine the conditions needed to ensure investment in any emerging generation, consistent with maintaining the NSW AAA Credit Rating.

The Owen Inquiry (Owen 2007) found that energy consumption in NSW is forecast to increase to 91,000 GWh a year by 2013-14, an increase of 10,500 GWh from 2006-07. The Owen Inquiry also stated that NSW's innovative energy efficiency measures are currently playing, and will continue to play, a significant role in reducing energy consumption and that renewable energy and other small-scale generation are forecast to provide over 1,500 GWh of the 10,500 GWh needed.

The Owen Inquiry Report found the remaining 9,000 GWh base load electricity required annually by 2013-14 is likely to be met by gas- or coal-fired generation. New renewable energy generation sources, mainly wind and biomass, are expected to supply 1,375 GWh in 2013/14 and about 1,600 GWh by 2016/17. Other technologies such as solar or geothermal are expected to contribute significantly in the longer term.

3.1.2 Climate Policy

International Policy

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1997 and entered into force in 2005. The Protocol aims to reduce the collective greenhouse gas emissions of developed countries by at least 5% below 1990 levels during 2008 – 2012, known as the first commitment period. To achieve this, the Protocol has set binding emission targets for developed countries.

In December 2007 Australia ratified the Kyoto Protocol, committing to meeting a Kyoto target of 108% of 1990 greenhouse emissions by 2008 - 2012. Australia's emissions are expected to reach an average of 107% of 1990 levels during the first commitment period. However, this achievement is mainly due to lower than projected transport emissions and the effect of slow growth in electricity generation since late 2007 (DCC 2009).

The Kyoto Protocol allows for countries to create and acquire Kyoto units called Assigned Amount Units (AAUs) from other countries via three flexibility mechanisms (International Emissions Trading, the Clean Development Mechanism and Joint Implementation). These mechanisms are based on the principle that the benefit to the climate of reducing greenhouse emissions is the same regardless of where they are produced.

The UNFCCC will meet in Copenhagen in December 2009 and attempt to develop a post Kyoto international framework on climate change, which should provide a long term approach for global cooperation on climate change.

In order to meet its Kyoto Protocol target and post Kyoto targets which are yet to be defined, the Government will need to encourage projects that result in the creation of Assigned Amount Units, such as renewable energy production including biomass power stations. These are considered to be greenhouse neutral as the carbon emitted by the biomass combustion process represents part of the ongoing bio-geochemical carbon cycle.

National Approach to Management of Greenhouse Gas Emissions

Underlying the National Government's Climate Change Policy are three pillars; to reduce Australia's greenhouse gas emissions, to adapt to climate change that cannot be avoided and to help shape a collective international response.

The Government has committed to reducing Australia's carbon pollution to 25 % below the 2000 levels by 2020, providing that there is international agreement to stabilise levels of greenhouse gases in the atmosphere at 450 ppm CO_2-e or lower. If no international agreement is achieved, Australia will reduce its emissions by between 5 % and 15 % below 2000 levels by 2020.

Emissions Projections released in August 2009 showed that in the absence of the Carbon Pollution Reduction Scheme (CPRS), Australia's emissions are projected to rise to 120% of 2000 levels (DCC 2009). The amount of abatement that the CPRS and other new policies need to generate to achieve our national emissions targets represents Australia's "abatement challenge". Under the -5% target option this is equal to 138 Mt CO_2-e, while under the -25% target option the abatement challenge is 249 Mt CO_2-e.

- **Carbon Pollution Reduction Scheme**

The main driver of the Government's plans to reduce greenhouse gas emissions is the CPRS, which will use a cap and trade mechanism to ensure reduction of greenhouse gas emissions. The CPRS caps will be calculated as the difference between the indicative national trajectory and the emissions projections for uncovered sectors. Emitters of greenhouse gases will need to acquire and surrender a permit for every tonne CO_2-e that they emit. As well as driving actual emissions reductions, the introduction of a carbon price provides a financial incentive for investment in low emissions technology, such as biomass power stations.

In May 2009 the Government announced that obligations under the CPRS would be phased in from July 2011. According to the White Paper the CPRS will cover around 75% of Australia's emissions. Emissions from the stationary energy, transport, fugitive, industrial processes, waste and forestry sectors will be included under the CPRS (Commonwealth of Australia 2008).

The CPRS White Paper states that CPRS obligations would not apply to emissions from combustion of biomass for energy as they would be receive a zero rating. Emissions from deforestation will also not be included in the CPRS, despite being included under Kyoto Protocol rules.

- **Renewable Energy Target (RET)**

The Office of the Renewable Energy Regulator (ORER) is the statutory authority established to administer the Government's *Renewable Energy (Electricity) Act 2000* and the *Renewable Energy (Electricity) Regulations 2001*. The policy that underpins the Act and Regulations is commonly referred to as the Mandatory Renewable Energy Target (MRET) scheme. The objectives of the MRET are to encourage the additional generation of electricity from renewable resources, reduce emissions of greenhouse emissions and ensure that renewable energy sources are ecologically sustainable.

The MRET is a market-based measure that encourages renewable energy deployment by creating an obligation for electricity retailers and large users to purchase Renewable Energy Certificates (RECs) that are created by renewable energy generators. Under the scheme a legal liability is placed on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9,500 GWh of renewable energy per year by 2010. All retailers and large buyers are required to maintain the 9,500 GWh of new renewables between 2010 and 2020 to provide investment certainty up to 2010.

Demand is created by legally obliging parties who buy wholesale electricity to source an increasing percentage of their electricity purchases from renewables-base generation, or pay a penalty of $65 per MWh of shortfall. A supply incentive is created by enabling an extra revenue stream to be earned for generating this additional renewable-based electricity. This revenue stream, which is additional to the price a generator would receive for the electricity, is achieved by creating a tradeable REC.

The measure provides that one REC may be created for each MWh of electricity generated by accredited power stations using eligible renewable energy sources. As at December 2008, a total of 37,111,281 RECs has been created in the REC registry for the generation years. RECs created by wood waste generators account for 2.4% of this total (892,384 RECs) (ORER 2008).

The MRET scheme was the first of its kind globally and has been a key factor in the growth of renewable electricity generation within Australia. Success of the scheme is evidenced by:

- increased investment in the renewable energy industry since 2001. The ORER estimates that by mid 2009 total investment was over $5.6 billion and the generating capability of the system was in the order of 9,500 GWh of eligible renewable energy per typical year. This is equivalent to the residential electricity needs of over 1.5 million households;
- Australian households opting to purchase electricity from renewable sources created additional demand for 2,400,000 MWh of renewable electricity in 2008. Voluntary participation in the scheme by creating additional REC demand has been in place since 2006;
- almost 100% compliance by liable parties for the last 7 years demonstrating industry cooperation with the scheme;
- 280 renewable energy power stations were accredited through ORER by mid 2009; and
- an exponential increase in the number of participants in the scheme, with more than 90,000 additional participants registering with the scheme in 2008, a growth of 20% from 2007. The total number of participants in the scheme was 300,000 in 2008.

In 2008 the Federal Government committed to introducing an expanded Renewable Energy Target (RET) scheme to subsume the MRET scheme and ensure that 20% of Australia's electricity supply is provided by renewable energy by 2020. Key attributes of the RET include:

- ensuring that at least 20% of Australia's electricity supply (approximately 60,000 GWh) is generated from renewable sources by 2020, by maintaining 15,000 GWh of existing renewable energy capacity as well as providing 45,000 GWh of additional generation;
- maintaining the same eligibility criteria as in the current MRET scheme and retaining the eligibility of all renewable energy projects that have been approved under existing state-based schemes; and
- phasing out the RET between 2020 and 2030 as the proposed CPRS matures and carbon prices become sufficient to ensure the RET is no longer required.

The RET is designed to encourage the deployment of both large and small-scale renewable energy technologies, from large power stations to household renewable energy systems. Eligible renewable energy sources under the RET include hydroelectric, wind, solar, biomass, geothermal, wave and tidal energy.

Renewable energy sources eligible under the MRET and RET are defined under the *Renewable Energy Act 2000*. Wood chip waste generated by SEFE would be eligible to create RECs under the category of wood waste.

NSW Approach to Management of Greenhouse Gas Emissions

- **Greenhouse Plan**

The NSW Greenhouse Plan provides the strategic approach to combating climate change in NSW (NSW Greenhouse Office 2005). The Plan sets emission reduction targets of a 60% cut in greenhouse emissions by 2050 and a return to year 2000 greenhouse emission levels in NSW by 2025. These targets would mean net NSW CO_2-e emissions of 155.5 Mt in 2025 and 62.2 Mt in 2050.

The plan recognised energy as the largest, and one of the fastest growing, greenhouse gas emission generators in NSW and considers reducing emissions from electricity generation as a priority. The NSW state government is currently developing a Climate Action Plan which will revise the NSW Greenhouse Plan and give greater attention to adapting to the impacts of climate change.

- **NSW Greenhouse Gas Reduction Program**

This program aims to reduce greenhouse gas emissions associated with the production and use of electricity. By using project-based activities to offset the production of greenhouse gas emissions, the program establishes annual statewide greenhouse gas reduction targets and then requires individual electricity retailers to meet mandatory benchmarks based on the size of their share of the electricity market.

The SEFE Power Plant may be eligible to participate as an Abatement Certificate Provider under the Generation Rule which allows electricity generators to create abatement certificates (NSW Greenhouse Abatement Certificate, or NGACs) for electricity generated at an emissions intensity lower than that of the designated NSW pool coefficient. If this was the case, it would be classed as a Category D generating system and would be able to generate NGACs for each MWh generated.

Abatement certificates would then be supplied to retailers on the market who are then required to surrender NGACs on the basis of their share of the NSW electricity market.

The proponent notes that the Greenhouse Gas Reduction Program could be subsumed by the CPRS by the time the facility is operational.

3.1.3 SEFE's Response

The preceding discussion outlines the need for additional base load generation to satisfy a projected energy shortfall by 2014/15. Failure to address the predicted shortfall is likely to have significant social and economic impacts for NSW, due to the increased unreliability of supply during critical periods, resulting in more frequent black outs and increased costs to electricity retailers and consumers.

SEFE seeks to protect its interests through the generation of its own electrical supply and through the sale of excess electricity to the network, to capitalise on the opportunities presented through incentives established to encourage transition to renewable electricity generation.

Development of SEFE's biomass Power Plant would contribute to the identified need for additional base load generation capacity and would have the least possible environmental and social impacts.

Nationally, the projected impact of climate change and the likely introduction of the CPRS will make the need for "cleaner" energy most pressing.

3.2 Project Benefits

The Project would benefit SEFE, and the local and regional community on a number of levels including:

- improved security of electricity supply through the on-site generation of the 6 GWh per annum necessary to power SEFE's existing operations. SEFE currently experiences outages and onsite generation will remove this risk;
- the generation of electricity from renewable biomass material that is currently largely burnt for no energy recovery or commercial return. In the course of its timber milling operations of hardwood and softwood logs, SEFE generates around 35,100 tpa of potential biomass fuel, a proportion of which is currently sold as landscaping materials with the balance being disposed of in a burner for no energy recovery. In addition SEFE has established that a further 22,600 tpa of wood waste would be available for power generation from local timber processing operations;
- the supply of around 22 GWh of base load power annually to the electricity grid;
- improved reliability of part of the local electricity supply through local generation and provision of long term economic benefits in the Eden area due to the increased reliability of supply during peak demand periods;
- improved environmental outcomes due to lower greenhouse gas emissions per unit of output compared to conventional coal-fired power generation technologies. The generation of 28 GWh per year by the proposed plant (31 GWh minus the parasitic load from the Power Plant) would avoid the emission of approximately 23,800 t of CO_2 from fossil-fuel based power generation;

- optimising the use of electricity generated locally. Eden is situated at the end of a spur line from Bega, and the generation of electricity locally would remove associated transmission losses;
- the establishment of a base load electricity supply that would be market competitive and be consistent with current trends and future energy demands. The financial justification has been based on currently available market information relating to electricity purchase price and current market price for the alternative use of the wood waste fuel;
- short term economic benefits to the Eden community through the purchase of local goods and services by the construction workforce; and
- long term local employment for six suitably trained operators, with anticipated flow - on employment opportunities in the engineering maintenance sector.

3.3 Alternatives Considered

3.3.1 Alternatives to Electricity Generation

SEFE has considered converting the on-site wood waste available to fuel pellets for sale domestically or overseas. No significant domestic market for fuel pellets currently exists and whereas there is a substantial and growing market in Europe for pellets, there is insufficient waste wood on-site to justify the expenditure that construction of a pellet plant would require.

3.3.2 Site Options

In practical terms the proposed site has a number of characteristics that make it ideally suited to the establishment of a biomass Power Plant. These include:

- the site is owned by SEFE;
- the site is appropriately zoned to allow the establishment of the Power Plant;
- there is sufficient room on the site to accommodate the Power Plant without the need to develop an alternative site. Minimal vegetation clearing will be required and the site has no heritage values;
- ancillary infrastructure needed to support the project is already supplied (fresh water supply, seawater for cooling, materials handling components, electrical substation and existing transmission network);
- the site is remote from a major population centre (Eden is around 4 km away);
- there are no sensitive receivers that would be impacted by emissions (air, noise) from the Power Plant;
- over 60% of the proposed biomass fuel is available at SEFE's site removing the need to double handle the fuel to another site; and
- around 29% of the electrical output from the power plant will be used locally at SEFE's operations.

Transportation and processing costs are key factors in the determination of price, so biomass power plants must be sited near an ongoing, reliable biomass source. The co-location of the proposed plant with the existing timber mill offers efficiencies in fuel transportation by using wood waste from the mill that is currently incinerated or sold offsite as mulch.

For the above reasons, alternative sites for the location of the Power Plant were not considered.

3.3.3 Combustion Processes

SEFE has taken a conservative approach to technology selection. Grate-fired biomass combustion is mature technology, but other technologies are emerging, such as gasification and pyrolysis. Fluidised bed combustion has been considered and while this technology is suitable, the additional cost impact would weaken the viability of the project.

Although SEFE has selected technology which will maximise overall thermal efficiency, there will still be significant waste heat rejected to the sea from the steam condenser and the atmosphere from the flue gas stack.

The thermal efficiency can be improved if use can be made of this waste heat. Considerable time and effort has been applied to this topic and several possibilities have been identified. For example, waste heat can be used to:

- cool water with absorption chillers;
- dry timber; and
- power an organic Rankine cycle plant to produce electricity from the biomass boiler waste heat.

SEFE intends to incorporate into the Power Plant design the capability of extracting process heat for any future application which may develop into a viable proposition.

3.3.4 Cooling Options

The steam exiting the last stage of the condensing turbines is typically under a near vacuum but still in a steam phase. The cooling system rejects heat from the cycle, condensing the steam discharging from the turbines so that it can be returned to the boiler. Around 15 MW of heat needs to be rejected from the system.

Four options were considered for cooling:

- cooling towers – this would incorporate a water cooled condenser with evaporative cooling towers providing the heat loss to the atmosphere. Three towers would be required. This option has a high daily fresh water usage of around 1 ML;
- seawater cooling – this option incorporates a similar water cooled condenser with seawater being used to dissipate the heat without the need for cooling towers. Intake and discharge points would be established on the existing jetty. This option is slightly more expensive than the cooling tower option but requires no reliable long-term fresh water supply;

- seawater cooling with secondary heat-exchanger – this is similar to the previous option with a secondary heat exchanger incorporated on the seawater side minimising corrosion in the condenser. This option would be significantly more expensive that the seawater cooling option; and
- air cooled condenser – this option uses air as a cooling medium without the need for cooling towers or the use of seawater. The parasitic load or running cost for this option is high (six fans at around 45 kW each) and the capital outlay is also high (around $1.1 million).

The analysis supports the selection of the seawater cooling option because:

- it has a low capital cost;
- it has the lowest operating cost;
- it imposes the lowest parasitic electrical load on the generator.

Preliminary investigations identified that sensitive marine communities needed to be avoided, adequate mixing of the discharge needed to be achieved and chemical usage minimised or eliminated. These issues have all been addressed in the design of the seawater system and, as a result, seawater cooling has minimal environmental impact.

3.3.5 Seawater cooling volumes

Consideration has been given to two cooling system design options denoted as Case 1 and Case 2, with cooling water discharge characteristics for each case summarised in **Table 3-1**. The Case 1 summer and winter scenarios involve a larger ambient to discharge temperature differential and a lower flow rate when compared with Case 2.

Table 3-1 Cooling Water Quality Characteristics

Scenario	Units	Case 1		Case 2	
		1A	1B	2A	2B
		Summer	Winter	Summer	Winter
Seawater temperature in	°C	23	13	23	13
Temperature rise	°C	10	21.1	8	19.1
Seawater temperature out	°C	33	34.1	31	32.1
Flow rate	litres/s	333	158	416	174

Chapter 6 provides the results of an assessment which compares the potential impacts associated with the two discharge scenarios. Results suggest that the temperature differential between the discharge plume and the ambient environment will fall below the trigger value of 2.4ºC within 1 m (summer scenarios) and 3.5 m (winter scenarios) of the diffuser.

In addition, reducing the seawater flow rate as seawater temperatures drop below the ambient design temperature of 23^{o}C, will reduce the instantaneous parasitic load by up to 70 kW.

Based on communications with SEFE, it was concluded that the differences in the environmental outcomes between Case 1 and Case 2 did not warrant the large operational cost differential between these two design options. Case 1 will require lower flow rates than Case 2 and result in a significant reduction in pump running costs. Case 1 was therefore selected as the preferred option.

3.3.6 Diffuser Design

The initial design for the diffuser had outlet ports parallel to the sea floor. Following modelling of the discharge plume (**Chapter 6**) the ports were angled upwards at 30^{o} to ensure that the plume did not come into contact with the sea floor (**Figure 3-2**).

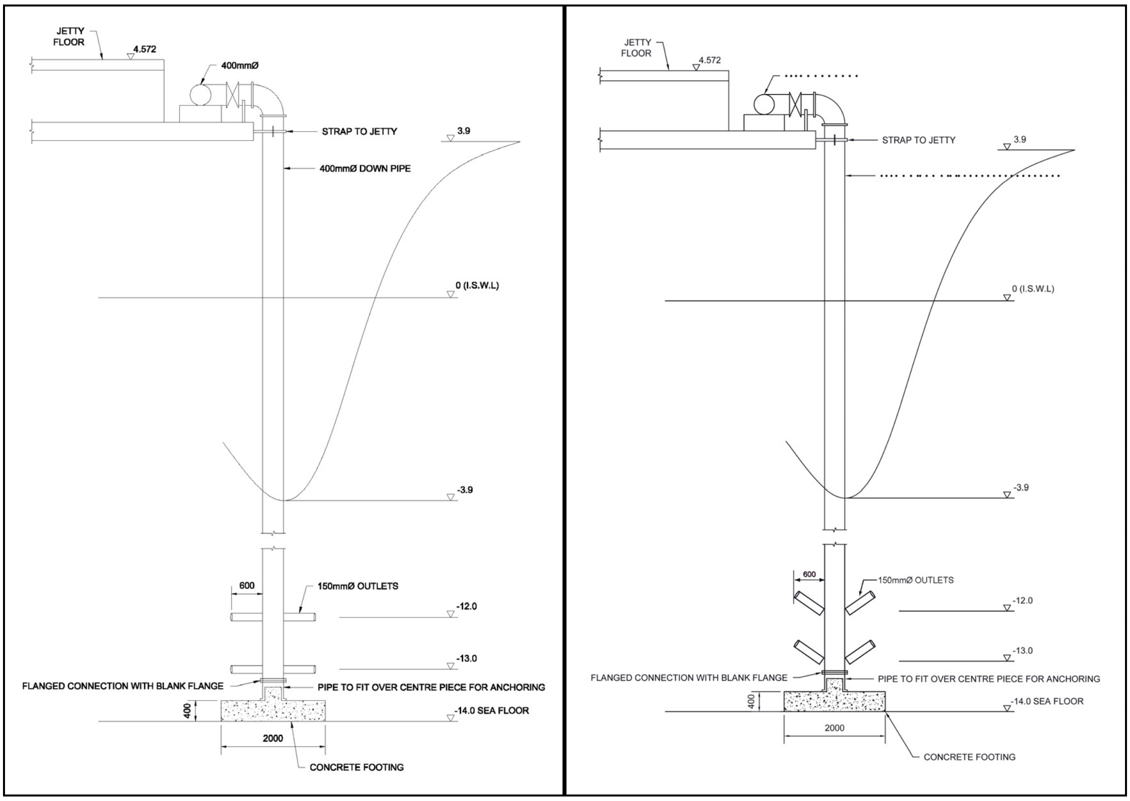


Figure 3-2 Outlet options – horizontal (left), at 30^{o} (right)

3.3.7 Do Nothing Scenario

If the project is not progressed the status quo will be maintained. Wood waste will continue to be sold as mulch or burnt on-site for no commercial return, the opportunity to produce 31 GWh of renewable energy with a low greenhouse gas intensity will be lost, SEFE will continue to purchase electricity from the grid with annual carbon emissions of 5,300 t CO_2-e, and SEFE will miss out on the opportunity to secure a reliable source of electricity from on-site generation.