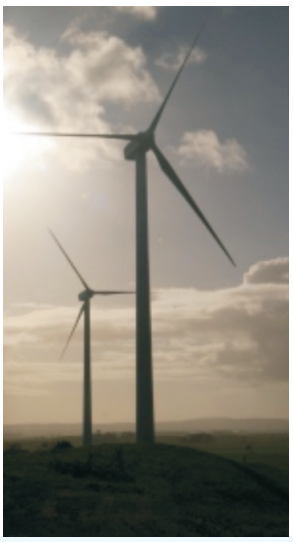
Woodlawn Wind Farm



Greenhouse Gas

13

13. Greenhouse Gas Emissions

13.1 Introduction

This chapter of the SEE addresses the importance of reducing the greenhouse gas emissions intensity of electricity generation and the role of the Woodlawn Wind Farm project in Australia's efforts to curtail emissions growth.

The initial Woodlawn Wind Farm EIS (URS, 2004) provided detailed information on the importance of greenhouse gas emissions reduction and the role of the Woodlawn Wind Farm project in Australia's efforts to curtail emissions. This chapter provides a brief overview of the greenhouse emission savings possible as a result of the proposed modifications.

13.2 Estimation of greenhouse gas emissions savings

The generation of electricity from wind farms utilising the renewable energy resource available at suitable sites can deliver a significant benefit through savings in greenhouse gas emissions. While the wind farm is generating it has the potential to displace other electricity generators that compete for supply to the NEM. Where the other generators produce electricity from fossil fuels and their production is fully or partly replaced by the wind farm's output then there are net savings in the greenhouse gas emissions produced from the NEM's operations. The generators supplying the NEM are predominantly large coal fired power stations and to a lesser extent large hydro and gas fired generators. There is also export and import of power between NSW and other states.

The NSW Pool Coefficient is a publicly available indicator of the average emissions intensity of electricity sourced from the electricity grid in NSW. It represents the emissions of greenhouse gases in tonnes of carbon dioxide equivalent per megawatt hour (t $CO_{2\text{-eq}}$/MWh) of electricity supplied from the 'pool' of major power stations serving the NSW electricity grid. The Pool Coefficient had a value of 0.967 t $CO_{2\text{-eq}}$/MWh in 2009 and is 0.973 t $CO_{2\text{-eq}}$/MWh for 2010. For the purposes of assessing the emission balance associated with Woodlawn Wind Farm, the pool coefficient value for 2010 has been used.

Based on displacement of the equivalent generation to that produced by the wind farm, and using the forecast NSW Pool Coefficient (2010) as an indicator of the emissions intensity for the displaced generation, the wind farm's output could over a year displace electricity production that would have otherwise produced about 146,000 tonnes of greenhouse gases for the year.

The actual level of emissions savings depends on a range of factors but most importantly the types and amounts of generation that are displaced relative to the wind farm contribution. Wind Energy generation will generally be taken up by the NEM and marginal price generators will be displaced. Given the dominance of large coal fired generators in NSW there is a reasonable potential that they could be displaced. In practice the emission savings may be less or more than the 146,000 tonnes predicted by the above method, but they are still likely to be significant. The emissions saving are also associated with a reduced consumption of fine fossil fuel resources.

The land on which the wind farm is to be constructed is cleared and used for farming. Minimal clearing of trees would be required to construct the turbine sites and in most cases site construction will avoid areas of remnant woodland. The bulk of effect on the grasslands would be temporary and localised and the net greenhouse gas effect would be negligible. Measures would be incorporated into the project to protect areas of ecologically significant vegetation.

13.3 Operational greenhouse gas emissions and savings

In the 2004 EIS, URS calculated that the estimated $CO_{2\text{-eq}}$ emissions that would be saved by the operation of Woodlawn Wind Farm based on the 2004 NSW Electricity Pool emission coefficient. Table 13.1 shows the $CO_{2\text{-eq}}$ savings calculated by URS compared to the $CO_{2\text{-eq}}$ emission savings that could be expected from the proposed modifications.

Table 13.1 – Estimated $CO_{2\text{-eq}}$ emissions from 2004 EIS and for the amended project

	2004 [1]	2009
No. of turbines and turbine capacity	25 X 2 MW [1]	20 x 2.1 MW
Total wind farm generation capacity	50 MW [1]	42 MW
Estimated annual output (MWh/yr)	140,000 [1]	150,000
Pool coefficient	0.906 t $CO_{2\text{-eq}}$/MWh	0.973 t $CO_{2\text{-eq}}$/MWh (2010)
Displaced greenhouse / year	126,840 t $CO_{2\text{-eq}}$ [1]	146,000 t $CO_{2\text{-eq}}$
Greenhouse over lifetime	3.17 million t $CO_{2\text{-eq}}$	3.65 million t $CO_{2\text{-eq}}$
Greenhouse per day	348 t $CO_{2\text{-eq}}$	399 t $CO_{2\text{-eq}}$

NOTE: [1] From URS, 2004

13.4 Life cycle analysis of emissions and savings

A life cycle analysis of the emissions arising from a development takes into account the emissions due to manufacture of component parts, construction activities, operations and maintenance and eventual decommissioning and disposal or materials recovery. Wind farm developments tend to have the following life cycle emission characteristics:

- Greenhouse gas emissions for wind generated electricity on a life-cycle basis are around 10 to 15 kg/MWh which is substantially below that of fossil fuelled electricity generation. URS (2004) used a worse case life cycle emissions factor of 20 kg/MWh (see Table 13.2)
- Only about one third of the wind farm's lifetime emissions occur during the operation of the wind farm.
- About two thirds of emissions occur due to the manufacture, delivery and construction of parts that are used to build a wind farm. These emissions are from steel production, chemical processes, machining and assembly and transportation.
- Where the wind farm displaces other fossil fuel generation systems there may be net savings in greenhouse gas emissions.

Greenhouse gas saving in context over Woodlawn Wind Farm project lifecycle is provided in Table 13.2.

Table 13.2 - Greenhouse gas emissions savings in context

		2004	2009
Annual generation output (MWh/yr)		140,000	150,000
Estimated greenhouse gas due to coal fired powers stations (t $CO_{2\text{-eq}}$)	A	126,840	146,000
Life cycle greenhouse gas emissions (t $CO_{2\text{-eq}}$) using worse case 20 kg/MWh life cycle emissions factor [1]	B	2,800	3,000
Overall greenhouse gas savings (t $CO_{2\text{-eq}}$) –	A – B	124,040	143,000
Average number of households [2]		~28,000	~30,000
Equivalent number of trees to be planted (t $CO_{2\text{-eq}}$ / 0.67) [1]		~185,000	~213,000
Proportion of the MRET target (9,500 GWh by 2010) [3]		1.47%	1.57%

NOTE: [1] URS, 2004

[2] Based on Australian Greenhouse Office (AGO, 2004) estimate that Sydney households use an average 5,000 kWh per year. USR (2004) used the AGO 1999 figure

[3] http://www.orer.gov.au/publications/mret-overview.html

13.5 Summary

The electricity produced by Woodlawn Wind Farm taking into account the proposed modifications, would be fed into the electricity supply grid to provide a proportion of the community's power needs.

The proposed modifications would result in a reduction in overall output of the wind farm from 50 MW to 42 MW however the electricity generation would increase to 150,000 MWh each year, with greenhouse gas emissions savings in the order of 146,000 tonnes of $CO_{2\text{-eq}}$ each year and up to 3.65 million tonnes over 25 years, This would be equivalent to providing the electricity needs for around 30,000 standard households.

In addition, there is significant literature that shows that:

- Wind farms are in the class of what is considered to be the most benign of generation technologies and with one of the lowest possible greenhouse gas impacts
- Wind farms have substantially lower greenhouse gas emissions than existing electricity generating plant
- Due to the nature of the wind turbine itself there is little opportunity to make other than very marginal gains in their greenhouse efficiency through changes in construction methods or transportation.

Overall the development of wind farm projects is considered by Woodlawn Wind Pty Ltd to be a viable commercial enterprise that can assist improvement of the greenhouse emission intensity of Australia's electricity generation operations and improve environmental performance and social responsibility in Australia's energy use.