

Stockyard Hill Wind Farm



Stockyard Hill Wind Farm Pty Ltd

Greenhouse Gas Abatement Report

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2. Introduction

2.1 Background

Stockyard Hill Wind Farm Pty Ltd (SHWF P/L) is proposing a 242 turbine wind farm to be located between the towns of Beaufort and Skipton, approximately 2 hours west of Melbourne.

The calculation of greenhouse gas abatement requires the use of a capacity factor. In January 2009 a capacity factor of 44.6% was calculated by Garrad Hassan after the collection and analysis of wind data collected since February 2008. This figure is based on REpower MM92 turbines.

The wind farm thus would generate approximately 1,890,000 MWh of electricity per year based on 2 MW turbines.

2.2 Nature of Greenhouse Gas Abatement and Equivalentents

The operation of the SHWF is expected to offer environmental benefits. Electricity generation by wind turbines reduces the need for production by fossil fuel sources. These sources, such as coal and gas, produce greenhouse gases. Thus, electricity generated by wind turbines reduces the amount of electricity, and hence greenhouse gases, produced by alternative generation sources.

Greenhouse gas emissions are represented by scaling all gases which have a negative greenhouse impact back to a single gas equivalent (using carbon dioxide as the base unit) depending on the severity of each gas's impact.

This report was prepared internally by SHWF P/L engineers using publically available information and formulae from Sustainability Victoria (2003). Where possible more up-to-date data has been sourced (e.g. average household power consumption data from ESAA in 2008) in order to provide rigour and authentic representation to the report.

2.3 Environmental Benefits Summary

The following summary shows the expected environmental benefits based on a capacity factor of 44.6%. All figures are based on a long term average.

- Yearly output: 1,890,969 MWh p.a.
- GHG abatement: 1,890,969 t CO₂e
- Equivalent houses powered: 270,138 p.a.
- Proportion of Melbourne's Homes: 21 %
- Proportion of Ballarat's Homes: 803 %
- Equivalent cars off the road: 436,713 p.a.
- Equivalent trees planted: 2,822,341 p.a.

3. Environmental Benefits

Calculations of environmental benefits are derived in the following manner shown below. Note that all figures are based on long term averages and may fluctuate from year to year.

3.1 Formulae

Expected electricity generation (MWh p.a.) = Capacity (MW) x 8760 (hrs p.a.) x Capacity Factor (%)

Avoided GHG emissions (t CO₂e p.a.) = Capacity (MW) x 8760 (hrs p.a.) x Capacity Factor (%) x
GHG abatement (t CO₂e /MWh)

Equivalent number of trees planted = $\frac{\text{Avoided GHG emissions (t CO}_2\text{e p.a.)}}{\text{Ave. GHG absorption per tree (t CO}_2\text{e /tree p.a.)}}$

Equivalent number of cars removed from roads = $\frac{\text{Avoided GHG emissions (t CO}_2\text{e p.a.)}}{\text{Ave. GHG emissions per car (t CO}_2\text{e /car p.a.)}}$

Equivalent number of houses supplied = $\frac{\text{Capacity (MW) x 8760 (hrs p.a.) x Capacity Factor (\%)}}{\text{Ave. electricity consumption (MWh p.a.)}}$

Proportion of houses powered = $\frac{\text{Ave. number of houses supplied (see above)}}{\text{Number of houses in Melbourne or Ballarat}} \times 100 (\%)$

3.2 Detail

Greenhouse Gas Emissions

GHG abatement: 1.00 t CO₂e/MWh

Reference: "Assessment of Greenhouse Gas Abatement from Wind Farms in Victoria", July 2006, Report commissioned by Sustainability Victoria, p(ii), McLennan Magasanik Associates Pty Ltd. Garrad Hassan, wind energy consultants, derived the above single figure from a table of figures based on conservative growth in wind farm capacity across the state.

Houses Powered

Average house usage: 7.00 MWh p.a.

Reference: Sustainability Victoria recommend a figure of 5.33 MWh p.a. in their document "Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria", 2003. Communications with the Energy Supply Association of Australia on 18/6/2008 suggested that a figure of 7.00 MWh p.a. was more representative. Note that this is significantly more conservative than the SV house usage figure.

Cars off the road:

Average car emissions: 4.33 t CO₂e p.a.

Reference: "Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria", Sustainability Victoria, 2003

Trees Planted:

Average tree absorption: 0.67 t CO₂e p.a.

Reference: "Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria", Sustainability Victoria, 2003

Proportion of Houses Powered

Number of houses in Melbourne: 1,283,301 dwellings

Number of houses in Ballarat: 33,648 dwellings.

Reference: Australian Bureau of Statistics 2006 Census Data

Capacity Factor

Determined by wind engineers Garrad Hassan in January 2009 after the collection of wind data since February 2008. This is based on REpower MM92 turbines.

3.3 Results of Calculations

Table 1: Environmental Benefit Figures shows the results of the discussed calculations.

Table 1: Environmental Benefit Figures

<i>Item</i>	<i>Figure</i>	<i>Units</i>
Yearly output	1,890,969	MWh p.a.
GHG Abatement	1,890,969	t CO ₂ e
Houses Powered	270,138	p.a.
Proportion of Melbourne's Homes	21	%
Proportion of Ballarat's Homes	803	%
Cars off the road	436,713	p.a.
Trees Planted	2,822,341	p.a.

4. References

Australian Bureau of Statistics, 2006 Census Data, retrieved from the internet from <http://www.censusdata.abs.gov.au> and accessing dwelling data through "QuickStats" for Ballarat and Melbourne. Information retrieved on 24/6/2008.

McLennan Magasanik Associates Pty Ltd, 2006. "Assessment of Greenhouse Gas Abatement from Wind Farms in Victoria". Report commissioned by Sustainability Victoria. Retrieved from the internet from <http://www.sustainability.vic.gov.au/www/html/2052-wind-energy-policy-and-planning-guidelines.asp> on 17/11/2008.

Sustainability Victoria, 2003. "Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria". Retrieved from the internet from <http://www.sustainability.vic.gov.au/www/html/2052-wind-energy-policy-and-planning-guidelines.asp> on 17/11/2008