Greenhouse benefits

A guide to calculating greenhouse benefits of wind energy facility proposals

The following information has been developed by Sustainability Victoria.

Assumptions

The amount of energy a wind energy facility can produce is dependent on the wind speed profile of the site. The term 'capacity factor' is used to describe the productivity of a wind energy facility over a given period of time as a percentage of the amount of energy the wind energy facility would have produced if it had run at full capacity for the same amount of time.

Capacity Factor = P/M

P = Actual amount of energy produced over time

M = Energy that would have been produced if the wind energy facility had operated at maximum output 100% of the time.

A wind energy facility in Victoria will typically have a capacity factor of 30%.

The Victorian Government has undertaken modelling of the electricity system to determine the level of greenhouse gas abatement from wind generation in Victoria. The modelling examines the different generators in Victoria as well as the interconnections with other states, using the same techniques that are used by the Australian Energy Market Operator to manage the electricity market.

This modelling shows that increased levels of wind generation delivers a proportionally greater amount of greenhouse abatement. With 100MW of wind capacity in Victoria, every megawatt hour of wind energy displaces the emission of approximately 0.94 tonnes of carbon dioxide equivalent from fossil fuel generation. If the level of wind generation is increased to 1000 MW, according to the modelling the offset of CO_2 is increased to 1.08 tonnes for each megawatt hour of wind generation[1]. This is because higher levels of wind generation offset increasing amounts of brown coal, a higher greenhouse intensity fuel.

Department of Planning and Community Development
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As Victoria moves to higher levels of wind generation (1000 MW), a higher abatement co-efficient will apply, which is expected to average 1 tonne of CO_2 equivalent per megawatt hour in the period 2009 – 2015.

Electricity generated per year

Generation capacity (MW) x 8760 hours p.a. x capacity factor = Expected output (MWh)

Example: a 10 MW wind energy facility with a capacity factor of 30%.

10 x 8760 x 0.30 = 26,280 MWh of electricity generated in a year.

Greenhouse gas emissions displaced

A formula for calculating the greenhouse benefit of the proposal is:

Expected output (MWh) x 1 = Greenhouse gas emissions displaced (tonnes of CO_2)

Using the above example the greenhouse gas emissions displaced can be calculated as follows:

26,280 x 1 = 26,280 tonnes of CO_2

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1   Assessment of Greenhouse Gas Abatement from Wind Farms in Victoria, McLennan Magasanik Associates Ltd., July 2006.