

# The Economics of Wind Power

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*Abstract — The objective of this presentation is to present the results of a study conducted to assess the costs, benefits and the risks associate with wind power generation and estimate the cost of electricity (\$/kWh) produced by a wind farm before the installation process being started. For estimation of wind power generated electricity cost, the characteristics of the site where the wind farm is installed and the power curve of wind turbine provided by manufacturer are used. And also for the purpose of economic analysis, the life cycle cost and time value of money are considered.*

## Introduction

Wind power has both environmental and economic benefits. One of the most important economic benefits of wind power is that it reduces the exposure of nation's economies to fuel price variation. This benefit is so sizable that it could easily justify a larger scale and contribution of wind energy, even if wind power-generated production costs were more expensive compared with other conventional power generation technologies.

One of the reasons that production costs of electricity from conventional power plants is relatively low, is mainly because the markets do not properly value the external effects of power generation. Obviously, it is cheaper for power companies to dump their wastes, ashes, for example, and other greenhouse gases i.e. nitrous oxides, sulphur oxides and methane for free. The problem is that it creates cost for others both society and environment.

According literature, approximately 75% of the total cost of energy for a wind turbine is related to capital costs such as the cost of the turbine and installation cost. The other 25% is for foundation, electrical equipment grid-connection Land rent electric installation, consultancy, financial costs, road construction, control systems, and etc. Obviously, because fuel is free, fluctuating fuel costs have no impact on wind-power generation costs.

Wind turbine, like nuclear energy and hydropower, is capital-intensive compared to conventional fossil fuel fired technologies such as a natural gas power plant, where as much as 40-70% of costs are related to fuel and O&M. The results of the study conducted by author of this article show that the power-generated production costs range from approximately 0.07-0.10 \$/kWh at sites with low average wind speeds, to approximately 0.05 – 0.07 \$/kWh at windy sites, with an average of approximately 0.07 \$/kWh at a wind site with average wind speeds.

It is worth to mention here that this study focuses on the annualised life cycle cost and cost in \$/kWh produced. This way of cost estimation allows us to make comparison between wind power-generated production cost and the electricity production cost of the other power generating technologies.

## The presenter

Ahmad Zahedi (PhD), IEEE, SM'96 is an Associate Professor in Power Engineering and Head of Electrical and Computer Engineering at the School of Engineering and Physical Sciences of James Cook University, Queensland, Australia. He has educated in Iran and Germany and is author or co-author of more than 160 publications including 4 books, and has trained 16 postgraduate candidates at Master and PhD levels, and completed 15 research and industry-funded projects. He has 20 years tertiary teaching and research and 6 years industry experience.