Wind power feasibility study

Business, Industries

The following report investigates the feasibility and profitability of a wind farm, proposed to supply the island town of Lowton with electricity.

Using cost-benefit analysis techniques including spreadsheets formulated using Microsoft Excel the validity of the potential construction (15 turbines) was established.

The Results (including equations formulated) are available in table format in the 'Presentation Of Results' section (p 7).

Other factors, including the difficulties involved in the environmental decision-making process are discussed, for example the difficulties surrounding applying a monetary value to natural resources, pollutionlevels and visual intrusion.

The strengths and weaknesses of the decision making process are highlighted.

Environmental concerns and the importance of developing alternative energy sources are discussed.

The report concludes that the construction of the proposed wind farm should go ahead, and that it could be a profitable enterprise.

Introduction

This report is to investigate and appraise the environmental impact of a potential wind farm for the small island town of Lowton, while assessing the profitability and feasibility of this.

The island is inhabited by 1000 residents and currently has power supplied by a conventional power plant on the mainland, which owns a 650 watt electrical power station.

The wind farm in question would be small (about 15 turbines) which would be expected to service the town for 20 years each.

The immediate cost of constructing and installing the turbines would be ï¿½1 million per mega watt (MW) and the potential output should be reached by the end of the second year.

The cost of the fuel replaced by the wind power creates a saving of ï¿½25 per MW hour. Due to the fact wind is an uncontrollable phenomenon it is not available 100% of the time. The potential availability is estimated at 50%

A spreadsheet shall be devised using Microsoft excel in order to determine the financial benefits/losses.

The possible environmental impacts shall also be discussed and weighed up, using moral and financial arguments.

Aims & Objectives

The aims and objectives of this report are to assess the profitability and feasibility of the construction of the proposed wind farm.

Economic modelling skills shall be used to create and explain a discounted cash flow model.

A brief environmental impact assessment shall be created along with a discussion of environmental valuation techniques.

Background To Study

The town of Lowton lies on a small island in two miles into the English Channel. It is not densely populated; having only 1000 residents- therefore does not have a high demand for power.

The current situation sees the electricity being supplied by a local power company on the mainland via undersea cables. The company in question have a 650 MW conventional power station.

The cost of constructing and implementing the 5MW wind farm would be ï¿½1 million per MW at the start (year 1) and would be subject to later discounts due to the low maintenance costs of the turbines.

The cost of the wind power would save ï¿½25 on coal per hour.

Methodology

The primary supplied data was entered into a Microsoft excel spreadsheet (capital cost, capacity in MW, wind efficiency levels, capital repayments, discount rate, MW per hour of turbines, compared with the cost per MW hour of turbines and conventional generators.

The NPV function, found in 'f'- financial section- was used and the appropriate formulas were input. (Supplied on spreadsheets)

In addition to the above information sheets issued by the Department of Trade & Industry were studies for further information.

The spreadsheet was then altered to demonstrate the way in which a variation in wind efficiency may affect the NPV, should the turbines be less effective than anticipated.

Presentation Of Results

Discussion & Analysis Of Results

The results show the potential wind farm to be a profitable project. The discount rate is used in long term projects to reflect the fact things are worth more in the present than in the future so it is the opposite of compounding.

30% was decided to be the efficiency rate in the sensitivity analysis, as it is possible that a wind farm that operates on full speed 50% of the time to have an annual output of 30% efficiency.

People are impatient and would rather be instantly rewarded for something than wait to be rewarded in the future, even when this means sacrificing potentially larger gains for smaller immediate ones. This is basically human nature as the future is uncertain. A person may die for example, or shares/projects may collapse before the maximum potential is obtained.

The cost of long-term investment also means a persons financial resources are tied up so unavailable for other purposes.

Discounting can also be accused of belittling future benefits and the way it asks people to make personal decisions based on their own values about public goods closes off public debate.

Cost benefit analysis (CBA) should also be used for determining the worth of a project. It should not merely be a financial decision when hard to value resources/phenomenon's (e. g. habitat) are involved. This raises moral and ethical questions.

It is incredibly hard to attempt to put a value on human life. One way in which economists do this is by paying wages at levels which reflect the risk of the job involved e. g. soldiers earn more than teachers due to the extremely high risks associated with being sent into battle.

Rather than place a value on the individual it is considered more sensitive to see it in terms of altering the morbidity rate e. g. discovering how much a household will pay to cut pollution levels, which would save lives each year. Studies have shown that by cutting pollution levels by 26. 570 GWH may reduce deaths by as many as 80.

Many other factors are almost impossible to put a price on, e. g. visual intrusion, noise levels.

CBA does offer the opportunity to bring the costs and benefits of potential developments into the decision-making framework (as the name would suggest) and provide a 'precident'- a way to approach environmental problems from a solid standpoint. It also allows sensitivity analysis to be

conducted to establish variations in assumptions. It is a transparent process that allows outsiders the chance to see how a decision has been made.

The downsides of CBA, however, include the fact that it has to assign a cash value to a natural/environmental phenomenon.

There is a possibility the process may be miss-used to promote a political decision as opposed to promoting a neutral investigative /objective standpoint, as the results of the 'Pevensey Levels' exercise in Sussex illustrated.

Cost & Value Of Wind Energy

The cost of wind energy is dependant on the initial cost and productivity of the turbines. In this case it is ï¿½25 per MW hour. Installation costs may be covered relatively quickly in a successful case due to the low maintenance costs and 20-year lifep of each turbine.

The annual output of the turbines, however, is dependant on the position and mean wind speed of their erection site, which directly affects the cost of electricity per unit.

Despite the fact the proposed site is expected to reach its full potential 50% of the time (meaning the annual output may be the equivalent of working on full power 25-30% of the time) the supply tends to peak with demand, e. g. in the dark windy winter months when there is more demand for heating and lighting.

Although typical wind farms produce 2-3 times less power than conventional plants they are environmentally friendly, sustainable and low maintenance in comparison.

The government is currently trying to encourage the switch from conventional power plants to alternatives. It established the NFFO (Non-Fossil Fuel Order) in 1991-1998 that is now being succeeded by NFFO2- the aim of which is to subsidise and popularise the use of sustainable resources until they are in a position to compete with conventional and more traditional ones. The success of this scheme depends largely on the ever-volatile energy market.

THE PRICE OF PROGRESSION?

Due to the fact many benefits of sustainable power sources are long term it can be hard to interest investors. It is also hard to put a monetary value on factors such as pollution reduction, human life or the loss of wilderness land/habitat.

PUBLIC SAFETY:

Any man made product has a risk of malfunction but the risk from a wind turbine is considerably less than that of a plane or car engine etc. Coupled with the fact they are usually situated far from housing/roads the chance of receiving physical injury from a turbine is minimal.

Despite the fact it is possible for a rotary blade to become detached in high winds nobody has ever been injured by one, and it is unlikely a person would be nearby in such bad weather conditions.

Environmental Impacts

RISK TO WILDLIFE:

There is little risk to wildlife posed by wind farms. They produce little noise, and studies do not show them to disturb wild animals. Farmers can even graze livestock up to the base of the turbines

Birds may be slightly at risk of flying into the turbines, but they are no more likely to do this than they are likely to fly into conventional power pylons or be hit by aircraft/road vehicles.

Local wildlife is indeed likely to benefit from the construction of a wind farm, through the cuts in pollution levels and subsequent rise in air quality.

LOSS OF WILDERNESS LAND:

A method known as the 'Clawson Method' is used to assess the monetary value of a wilderness area. It is also called the 'Travel-Cost Analysis'.

Visitors to a site in question will be interviewed to establish how far they have travelled to reach the area, from five graded zones surrounding the site. Figures are then derived from each 1000 visitors and the travel cost is considered to be the cost of their visit.

This method however fails to look at the land as a future resource or take account of habitat/rare species living there.

All the above factors need to be addressed along with our need to cut toxic emissions and pollutants from industry, plus preserve fossil fuels. Despite the fact that developing alternative energy sources in the short term is unlikely to be immensely profitable it is another step towards a sustainable national grid.

Consumer Objections:

A BLOT ON THE LANDSCAPE?

Some people consider wind farms to be intrusive, and complain about the sights/sounds emitted. This depends greatly on the location in question-most 'farms' are built far from urbanised land or other developments, sights of national beauty or very popular recreational ground.

There is little that can be done at present to alter the appearance of the turbines.

Very little noise is produced, so little even livestock appear unconcerned. Manufacturers are nevertheless working to make them even quieter.

PUBLIC BIAS?

It is possible that public ignorance and bias is at the root of many complains. A lack of awareness may encourage low tolerance levels, especially amongst those who are unfamiliar with moderntechnologyand pollution problems.

NIMBY Syndrome (Not In MY Back Yard) may also contribute to peoples dissatisfaction, especially those who live downwind.

Conclusion:

The spreadsheet analysis of the potential wind farm indicates it would be a profitable enterprise, due to the high Net Present Value produced. This is however only deducted from a model that is only as good as the person who designed it and the assumptions it is based on. It is therefore subject to any number of unforeseen crises, and should merely be viewed as a hypothesis.

The Cost-Benefit Analysis also indicates that switching to environmentally friendly sources of power would be advantageous to both present and future generations.

Discounting affects future generations as the higher the discount rate, the quicker the non-sustainable resources are likely to be exhausted. The approach may backfire if the benefits are not obtainable for a prolonged period as investment will be virtually impossible to find. It is therefore hard to protect slow-replenishing resources like tropical hardwoods.

Discounting can even help to accrue worse future damage-however devastating the effects-if the future damage will not be felt for several generations.

There is no real alternative to CBA despite of its faults, so it should be refined rather than disregarded as a source of decision-making. Environmental decision-making is a sensitive issue. The only possible other

way is to use a citizens jury. Where this has been tried however the members failed to fully understand what was expected of them , or how to place prices on abstract phenomenon.

Most educated individuals recognise the benefits to society gained from switching to 'green' (sustainable) energy sources. The development of these sources are still in the early stages and are not going to affect the conventional production of power in the short term, it is still important to develop and popularise such alternatives today. This is the only way in which they will win social and scientific approval and eventually overcome fossil fuel consuming plants as a source of power.