

Alternatives to renewable energy systems when reducing C02 emissions produced by conventional generating plant

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Introduction

The need for renewable energy to complement the existing electrical grid system in the UK is generally recognised as beneficial to our environment in terms of reduced CO₂ emissions emitted by conventional power generation facilities. Global warming as a threat is now seen by most people as a genuine issue that needs tackling in an appropriate manner by all industrialised countries that produce electrical power using fossil fuels as a fuel supply to heat water that produces steam to turn turbines that produce electrical power.

Targets for renewable energy production in the UK have been set by government, subsidies are in place to promote green technology (especially wind power), and laws have been passed to facilitate the swift implementation of wind energy and other renewable energy projects.

It should be noted however that there is only one imperative for building wind farms anywhere in the world. That imperative is to reduce CO₂ emissions currently generated by the existing electricity supply grid.

The desired CO₂ reductions however may not be easily achieved by the grid for the reasons outlined below.

As is so often the case with large scale engineering projects we tend to go for the single “big idea” (in this instance substituting conventional power generation for such technologies as wind power). The more intuitive approach might consider reductions in use at the point of power generation. In this instance we might consider hundreds if not thousands of measures that collectively would result in even greater savings than might be achieved using wind power. In this document I have outlined why wind may well not produce the emissions benefits we assume to be taking place at the grid. Then I have suggested some methods of reduction of use that would produce equivalent emissions benefits

1) **The issues affecting Wind Power generation when inputting to an existing large scale grid system.**

- 1) Wind is intermittent and generated when the wind blows at grid “off peak” or “on peak” periods.
- 2) In CO₂ terms the existing grid system comprises both relatively clean (nuclear), and dirty (coal) producers of electricity. It is convenient to imagine wind power will substitute power produced from the dirty power producing stations, but this is not always the case in practice. We might imagine the grid operators will “tune down” coal fired plants when the wind is blowing, but the grid operators have a “duty of care” to keep the lights on and will use whatever power supplies are available to do just that.
- 3) The full life cycle of wind power generation plants (wind farms) is rarely taken into account when estimating their beneficial impacts on CO₂ reductions. Consider the following; a 1000MW conventional power plant would need to be replaced by 500 2MW turbines (the output of Connah’s Quay combined cycle gas and oil power plant in North Wales is actually 1450MW). However the conventional (oil / gas fired) plant efficiency will be 75% compared to wind turbine efficiency of 25%. Therefore 3x as many turbines will actually be required to replicate the power output of the conventional plant, i.e. 1500. Each turbine will require an average of 600m³ of concrete giving a total of 900,000 tonnes of concrete, which is approximately triple that required for a conventional plant. The infrastructure for such a wind farm would be huge in terms of sub stations, interconnection facilities, roads etc. Such a wind farm when built would still be running “wild” and inputting the grid only when the wind was blowing. The conventional plant would “ramp up” and “ramp down” as demand dictates at peak periods.
- 4) When wind turbines of any scale were first mooted in the UK the developers were insistent that no additional back up stations would be needed to provide power when the wind was not blowing. This is actually the case and is an issue of serious concern when considering the effectiveness of wind turbine generated power’s effectiveness in reducing CO₂ emissions. The existing electricity supply grid (without wind power) is extremely

inefficient. Our western cultural expectations in terms of power supply in the UK, include the bringing on of two additional power stations to supply enough power for thousands of electrical kettles needed at the interval for the Football Association cup final. Similarly, spare power capacity is always available should an “on line” conventional power station fail, - this to enable the grid to be kept on line 24/7 in all areas of the country regardless of weather conditions or varying demand. The relatively small input in percentage terms of renewable power feeding in to this inefficient grid means its effects (in terms of reducing CO2 emissions) are unknown. No available figures exist that demonstrate how much CO2 is saved by using wind power. The measure used in the UK is a renewables power generation target set by the EU and similar targets used elsewhere in the world simply measure how much power is produced by renewable energy sources, not how much CO2 is saved. This means unequivocally that the CO2 savings are based on an assumption, i.e. if you input enough renewable energy to an existing grid you will reduce CO2 emissions by a significant amount. A figure of 430g of CO2 saving per kWh produced is used as a guide in the UK. The figure was halved 3 years ago from 860g when challenged by the UK advertising standards authority. The British government has recently used a 370g figure in recent wind farm benefits assumptions.

2) **Alternative measures that would reduce power use at the grid.**

- 1) In every gas station and convenience store we see a cabinet full of cooled drinks that seem essential to our everyday lives. If we are serious about saving the planet we can expect some reductions in the standard of living we are all accustomed to. Switching off tens of thousands of such chillers would marginally reduce our expectations in terms of well being but would save significant amounts of power. Politicians can expect extensive lobbying from cabinet makers but are we serious about climate change or not?
- 2) Each and every liquor store these days has similar equipment installed. Many have entire rooms chilled for convenience. We put the chilled wine and beer in our cars and wait for it to heat up on the way home.
- 3) A lot of us dutifully recycle waste paper each week. The production of junk mail is enormously costly in terms of power consumption. Legislation is possible that would insist only people who want junk mail receive it. Millions of tonnes of junk mail need not be produced in the first place. Millions of tonnes of waste paper need not then be recycled.
- 4) Compulsory energy surveys on factories would be enormously beneficial to the environment. Tuning down a compressed air system from 7 barg to 6.75 Barg can significantly reduce power consumption without affecting equipment performance. Compressed air systems run 24/7 and are very expensive in terms of power use. Similar thermal savings usually result from undertaking a factory energy survey.
- 5) Street lighting systems are not yet conventionally fitted with motion sensor equipment. This needs to be undertaken at the design stage, retro fitting is not usually a sensible option. Many areas where street lighting is installed run 24/7 lighting up huge areas where no lighting is required at 3am.
- 6) Domestic refrigerators can now be fitted with software that turns them off at peak power demand times. A chilled cabinet can suffer being turned off for two hours without significant problems. A simple override can be fitted if the refrigerator warms up for too long a period. The effect of not using hundreds of thousands of refrigerators at peak times would be marked.

Notes; -

As previously stated hundreds if not thousands of such measures could be considered. It will be a difficult road. Despite protestations to the contrary energy companies are not in favour of reducing power outputs. Reducing power outputs means reducing revenue. Politicians also would find it hard. Which politician would vote for warm beer?

We should not ignore the other two culprits in terms of CO₂ production – Transport and Construction. Reducing your engine size by half would be enormously beneficial to the environment if everyone did it. In the UK the average engine size is less than 1.6 litres not because we are environmentally aware but because our gas prices are so high.

In summary if we are serious about reducing CO₂ emissions we have to accept some changes to our lifestyle along with some reductions in our standard of living. If we think wind turbines are the answer, then we don't even understand the problem.