The main arguments in favour of wind power are reduction in balance of trade deficits in countries that import energy and, longer term, mitigating for energy scarcity and the reduction in supplies of affordable fossil fuels.
The main arguments against are higher primary cost plus ancillary costs of mitigating irregular intermittency that are paid by the consumer, landscape and amenity degradation and possibly grid destabilisation.
The same benefits can be delivered by nuclear power that also solves the main problems except the higher primary cost of supply. But nuclear power of course introduces its own list of liabilities.
There are a host of other factors, half truths and bogus arguments that are discussed below. Furthermore, the geo-political-physical circumstances vary greatly from one country to the next and there is not a single correct answer. The arguments for and against are in fact finely balanced but both disappear in any country that opts for nuclear power.
The energy and climate debates seem to have no end. This is symptomatic of complex, multi-facetetd issues that in fact have no unique solutions. Individuals, or vested interests, can cherry pick the arguments they like whilst ignoring those they don't, often trying to discredit their opponents en route. In this post I attempt to cover the main arguments in favour of and against wind power. This is inevitably written from a UK perspective that may not be representative for all and whilst I am endeavouring to be objective there will no doubt be individuals who disagree strongly with the balance I try to strike. Over the years I have flipped from being pro to anti wind on a number of occasions and readers of Energy Matters will be aware that in recent months I have had both feet firmly in the anti camp. That remains the case mainly because I see nuclear power as the 21st century solution to our energy enigma. I do not view the energy debate through the clouded lens of CO2 abatement but through a lens of providing citizens with affordable, reliable and secure supplies of electricity.
Wind power is used to make electricity directly. This is one of its greatest strengths but also it greatest weakness. It is a strength because it is highly efficient to make and to use electricity directly. Using coal, over 60% of the energy in the coal is lost as waste heat. Making electricity directly circumvents this thermal loss. In fact the main energy losses with wind power comes from the energy used to make the turbines in the first place. Multiple studies have concluded that wind has an energy return on energy invested of around 20. And so the energy efficiency is around 20-1/20 = 95%. The weakness stems from the fact that industrial society has evolved to its current point around the energy stored in fossil fuels. Stores are important because this allows us to use energy on demand. Electricity is

always there to boil a kettle, mow a lawn or run a computer. Just three of the things I have done today which is sunny and completely calm in Aberdeen. At present wind electricity needs to be used the instant it is made and there is no match between wind electric availability and our society's very specific pattern of electricity deman. It is the uncontrollability of this energy flow that is wind's Achiles heal.

Balance of trade: The main argument in favour of wind power is that indigenous primary energy production, as opposed to energy imports, is favourable for any country's balance of trade. See for example the combined impact of wind and hydro on the economy of Portugal.

Energy security: Another argument often made in favour of wind power is that indigenous primary energy production provides energy security. This is only partially true. Security of supply needs to be broken down into three components

1) dispatchability,
2) geopolitcal risk – supply disruption and
3) scarcity leading to high fossil fuel prices and physical shortages.

Intermittent wind fails on the dispatchable front. How serious this is depends very much upon the geo-physical setting of the nation involved. Furthermore, for so long as a country is dependent upon FF imports at all to provide balancing service and cover for extended lulls then wind does not provide security against FF supply disruption either. It is on the final point of reducing dependency on dwindling supplies of FF that wind may score. In 2012, Europe produced 99 MTOE of wind electricity compared with gas demand of about 450 MTOE. Gas supplies to Europe were tight that year and wind therefore alleviated gas scarcity and arguably contributed to keeping the lights on and spot gas and electricity prices down. This benefit from wind may increase going forward.

CO2 abatement: The argument most frequently made in favour of wind is that it reduces CO2 emissions. This argument only carries weight in the event that atmospheric CO2 does in fact lead to harmful global warming and despite the thousands of pages published by the IPCC, there are in fact considerable grounds to be optimistic that the worst warnings of the IPCC are unfounded, no global warming for 16 years being the most obvious line of evidence. It may of course be argued that the 99 MTOE of wind produced in Europe in 2012 represents unburned FF. This argument only holds up for so long as it can be proven that no one else burned or will ever burn the FF displaced by wind in Europe. The unilateral action taken by Europe to reduce global CO2 emissions by deploying renewable energy like wind has singularly failed so far and looks likely to continue to do so for the foreseeable future. Furthermore, it is a mistake to assume that 99 MTOE of wind has displaced that much FF since the gas power stations being used to balance the grid in many countries are now

running at sub-optimal efficiencies. I remain unpersuaded by the argument that it is worthwhile tolerating the negative aspects of wind power detailed below in pursuit of a goal that seems unachievable and that may end up having no point.

Distributed power: Community or localised ownership of power generation is one final argument often made to support wind power. A village can erect and own a wind turbine more easily than it can a nuclear power station. Community ownership varies greatly from country to country. For example, high community ownership in Denmark and low community ownership in the UK. In the UK, wind ownership is in fact highly discriminatory. Wealthy farmers can put up a turbine and have it subsidised by poor city dwellers who are largely excluded from this opportunity. Everyone has the opportunity to buy shares in listed utilities, and so I'm not sure I buy into community ownership as a significant argument in favour of an industry that seems destined to move offshore and to be owned by major utilities.

Intermittency: The main argument against wind power is irregular intermittency. The practicality and cost of dealing with this varies from country to country. Small countries with extensive hydro like Portugal and New Zealand can assimilate wind onto a grid with much greater ease and with low to zero costs than can large countries with little hydro like the UK, Germany and The Netherlands. The measures to counteract intermittency include balancing against conventional FF, normally gas; greater grid connectivity and more storage, preferably all three. It can be done but this means escalating the size of infrastructure and costs.

Consumer paid subsidies: The higher cost of wind power, compared with current alternatives, is also viewed by many as unfair and discriminatory, poor city dwellers being asked to line the pockets of wealthy farmers and wind development companies. This comes down to the policies deployed in Europe that guarantees wind power access to the grid at a higher price that has to be borne by the consumer. While this is a very real complaint today, it is also necessary to look to a future where ongoing scarcity of gas leads to even higher prices in which case wind may begin to look like a good deal, if only it weren't for the ancillary costs associated with intermittency.

Blot on the landscape: Landscape and environmental degradation is another very real concern for some but not all people. It is easy for evangelistic Green city dwellers to dismiss the environmental impact if they never venture into the country. But for many who live in the European countryside and who enjoy walking in the mountains, wind turbines can be a blot on the landscape and can blight individual lives. Turbines killing large numbers of birds is often cited as another evil of wind power.

Killing the grid: Wind power is killing the grid host in large industrialised economies where legislation is specifically designed to push FF generators out of the market but at the same time wind is dependent upon these same generators to balance the grid. A continuation of the current trend will see the FF generators go out of business leaving the government to assume ownership and consumers to pick up the bill.
Destabilising the grid: Variable wind power may also potentially destabilise a grid. A recent widespread blackout in Northern Scotland is suspected to have been caused by a sudden fluctuation in regional wind strength.
Greater connectivity solves intermittency: Proponents of wind like to argue that increasing the connectivity of the European and American grids will smooth out the intermittency problem – the wind will always be blowing somewhere. This is one of these half truths. Greater connectivity will reduce the intermittency effect a little all of the time and a lot on occasions. But it is not a reliable engineering solution. A large investment in grid infrastructure is required to provide a partial solution for some of the time. Real time data from across Europe exists that demonstrates this fact and this argument should be banished from the wind debate.
Demand management: The argument is often made that society will have to adapt to working when energy is available, i.e. schools, hospitals and factories may only work when it is windy. This would be a direct route to economic collapse with our current system, and so it is often argued that we need a new system. This is Green pipe dreaming. We may well end up with a new system but it would resemble more Medieval times than the 21st century. But demand management is another one of these half truths. Taking steps to reduce peak demand is a very sound strategy since it would reduce dependency upon peaking power plants. But this is a completely separate argument to managing wind intermittency.
Combining different renewables sources: Combining wind with solar, wave and tide is often put forward as a way to mitigate for intermittency. This is another half truth and partial solution that is very expensive. Europe currently has 100 GW of installed wind capacity and effectively zero wave and tide. Surely if this were to be a solution we should wait for these technologies to arrive lest they never get off the drawing board? To be useful at smoothing the supply different sources need to be negatively correlated. Tides are predictable, regular, and continually shifting, while wave is likely to be correlated with wind. Solar is also regular and predictable and may on occasions be negatively correlated with wind while on other occasions, not. Wind and hydro of course work a treat where hydro can be switched on and off creating a perfect negative correlation with wind. Control is all important.
The price of fossil fuels is set to rise further: Increasing demand and degrading resource

quality may well lead to further market led increases in the price of FF and this is a valid argument detailed above in favour of wind power. But excessive environmental legislation on the production and use of FF seems designed to artificially raise their price and in so doing make wind and other renewable sources more cost competitive. Extensive and excessive government meddling in European energy markets does in fact make any rational price comparison or forecast impossible.

Wind is making electricity cheaper: How can one of the more expensive sources of electricity make electricity cheaper? It is the case that when the wind blows in Europe spot electricity prices are depressed. But the wind producers are guaranteed that the glut of power they are temporarily producing is given access to the grid at a guaranteed high price. The consequence of low spot prices means the traditional base load and load following producers make a loss. This is the destruction of the market based system that has served the OECD well for many decades.

Storage is the solution: This is entirely correct. It is just that affordable grid scale storage technologies do not currently exist and so this remains a false promise for the time being. The minute grid-scale, affordable storage becomes available the usefulness of all intermittent renewable technologies is transformed. At present the storage solution does not exist and it may never do so. And so again we are embarking upon a journey without the resources to complete it.

Wind advocates have a habit of proposing as many of the half truths and partial solutions as possible in the hope that they may add up to whole system. This is of course nonsense. We are set on a course of building thousands of turbines, inter connectors and storage facilities whilst still on many occasions being 100% dependent upon the legacy FF producers that are slowly going out of business, which is after all the motive behind the CO2 abatement strategy.

There are examples such as Denmark, Portugal and New Zealand who all have access to significant hydro capacity, where wind may make some sense – reducing FF import bills and creating independence from future scarcity of FF supply. But elsewhere, wind is simply adding complexity and costs to electricity grids, creating more expensive less reliable electricity for consumers whilst degrading the landscape with turbines, power lines and pumped storage dams. We do have a choice – nuclear power.

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