Revised January 2011

Long version of critique wider in scope than the short version. May overlap slightly.

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To the Kingscourt's residents against wind farming whose encouragement has motivated me to compile this document.

2nd revised compilation

Discussion Document on the generation of electricity by wind turbines in Ireland.

Technical overview

A Compilation of findings from a review of the progress of the Industry to date and Governmental approach to renewable energy.

A potential help to farmers and land owners considering becoming involved in generation by wind power.

A look at the total cost of the production of this form of energy in terms of output per turbine and impact of the National Grid from wind penetration.

A look at the possible increase / decrease in conventional power needed to run a system which includes wind generated electricity.

Some help for residents faced with planning applications for wind farms on neighbouring lands.

Environmental impact.

The content is intended to create awareness, provoke debate and elicit a response from proponents of wind generated energy which can then be subjected to rational analysis.

Part 1: **1) Wind as a source of sustainable energy.**

This paragraph explains my interest in the whole area of the wind energy business.

What approach should the farmer/landowner adopt to erecting a micro turbine or to entering into an agreement with a wind energy company to place full size turbines on his lands? When I was confronted with this situation, I did what seemed sensible to me, I analysed the situation, applied my own bit of limited expertise, tried to get information from reliable sources and came up with an approach best fitted to my needs. This article sets out what I discovered, which may guide other farmers.

There appears to be little by way of reliable information and if the potential of wind energy is overestimated it could lead to 1) waste, 2) a wind-energy-economic-bubble in Ireland with a subsequent collapse, 3) adverse visual and environmental damage in this country including tourism , 4) annoyance to neighbours 5) the destruction of farm land, 6) loss of revenue by pension funds/investors, 8) Destruction of wildlife 9) time wasting on wind energy at the expense of proper energy conservation and real sustainable generation of energy and 10) lastly the avoidance of a huge carbon footprint in manufacturing these machines, the concrete to hold them on each farm and the carbon cost of decommissioning them.

A Euro is as good in my pocket as it is in someone else's. I had to make my mind up when I was approached to allow a wind energy company to include a high part of my east Cavan farm in their plans for a wind farm. That forced me to consider the whole matter and I made a decision not to get involved. Many eminent observers (David Belamy, James Lovelock, Christopher Booker, Howard Heyden and John Etherington included) have come to the same conclusion. Modern societies demand energy. The question is "can wind play a role and compete with other forms".

I am prepared to change any view, if I can reasonably be shown to be wrong. But vague opinions will not change my mind; I want to hear from experienced engineers, especially those who work in electricity generation and on distribution. I am calling on Government to hold an independent examination allowing critics to be heard.

2) The Climate change debate: *This paragraph looks at the history of the global warming debate. Government policy is to reduce carbon emissions but no one can be sure if this will remain policy. Wind farming is a very long term commitment, comparable with forestry. The question arises as to whether it will remain profitable in the long term.* In the early 1960's, I went to the Spring Show in Dublin and saw a man with a sandwich board proclaiming the "the end was nigh". He maintained the world was going to end soon. Then there was the Cuban missile crisis. RTE Presenter Charles Mitchell read the 9 o'clock news in the early '60. He said that President Kennedy had commanded the Russians to halt deployment of nuclear missiles in Cuba and that the world was on the brink of nuclear war. There was no nuclear war. Then there were the 1973 oil crises. There was plenty of oil, except those holding it held up supplies for a higher price. A BBC documentary told us that the world oil supplies would run out in 15 years viz: 1988. Then they told us that at the

turn of the century, computers would collapse because only the last 2 digits were included for the year of the date. The century turned and – nothing happened either. When that vanished, along came the climate change debate. So what is the prognosis? James Hansen was born in 1941 in the small town of Denison, Iowa in the US. There were 7 children with only 2 bedrooms. His father was a tenant farmer. Hunger and deprivation were the hallmarks of his youth. However, he won a scholarship to the local university studying physics and astronomy. He then worked for NASA and developed the theory of Global warming. He reasoned that if mankind burned all the fossil fuels on earth, it would result in a return to a world with no ice, experts claim that if that happened, sea levels would rise by 7 meters. Alarming you may say! But is the theory true? Hansen compiled data on historic world temperatures over the past 100 years which tended to show that the decade "1990" was the warmest yet. He was forced to revise his data, when it was pointed out that his figures of the early part of the 20th century were .5 of a degree "C" too low. The hottest decade in the 20th century was actually the 1930's. 1963 was very cold and I can say that there were some very cold days in the early 1970's. In 1979, winter temperatures reached -9 degrees C. New year 2010 recorded extremely cold nights for Ireland as low as -12C and December 2010 was so cold the temperature at one weather station stayed below -9 C throughout one day. It is of course the average temperature that counts in this debate, because these melt ice. There are engineers who say carbon dioxide molecules are dispersed so far apart in the upper atmosphere that man's contribution could not possibly result in climate change. If you dig out a whitethorn tree, you will see the dark brown carbon clay in its roots. This is fixed carbon, taken by the plant from the air and deposited in the earth. However, such a process takes time. Hansen reckons that we are burning fossil fuels at a rate 10,000 times faster than nature can fix it back in the ground. The surplus goes to the atmosphere where it causes the sun's rays to get trapped raising the temperature.

Some do not agree. James Lovelock is 90; he is a scientist who invented a method of detecting life on Mars. He accepts the global warming theory, but says wind farms cannot provide sustainable energy. Scientist David McKay recently produced a report for the British Government on all forms of energy for Britain's future. He accepts there is considerable reserves of oil and other fossil fuels, but believes the demand for energy and competition for oil could lead to a shortfall between supply and demand. Irish demand for energy peaked at 4,952 MW (million watts) in the cold snap of January 2010. Leaked e-mails to an English scientific station at the University of East Anglia found that temperature readings taken from Russia were specially selected to show warming. Professor Phil Jones said he contemplated suicide when hackers discovered he had stifled requests for Freedom of Information Act disclosures. He said that he was inundated with requests and could not get on with his work. But he is accused of selecting who got the information, withholding it from climate sceptics whom he felt would abuse it. He is attempting to do an audit

on the whole issue. The United Nations climate change panel has been forced to accept that data presented to the Copenhagen conference was based on data that was not scientifically sound. A claim that the Himalayan icecaps would be melted within a human lifetime has been proved to be completely unfounded.

A startling report by the united nations watchdog that global warming might wipe out 40% or the Amazon rainforest was based on an unsubstantiated claim by green campaigners who had no scientific expertise (Sunday Times News 31/1/2010.)

Al Gore's film "the inconvenient truth" has been criticised because the graph shows CO2 levels follow warming rather than causing it, but this does not appear to have been proved.

It is now looking likely that the global warming theory may still be correct, but that the time scale of climate change may be four to ten times what was originally been presented. In other words instead of our grand children witnessing climate change, it will be our great, great, great, great grand children hundreds of years from now. There is absolutely no evidence that the sea level at Greenore (nearest to me) has risen, and water reaches its own level irrespective of location, but the experts say they have risen 5 inches in the last 100 years. Ice caps do appear to be getting smaller. The question is, is it a natural cycle or man made? There have been hot and cold periods in the last 1,000 years. Governments worldwide believe emissions are best cut, but will this policy endure? Most western governments are set on policies to cut emissions, which means they will try to switch to renewable energy. The main question is "can wind form a part of Ireland's energy sources?"

The United Nations climate science panel wrongly linked global warming to an increase in the number and severity of natural disasters such as hurricanes and floods. It based the claims on an unpublished report that had **not** been subjected to routine scientific scrutiny — and ignored warnings from scientific advisers that the evidence supporting the link was too weak. The report's own authors later withdrew the claim because they felt the evidence was not strong enough. The claim by the Intergovernmental Panel on Climate Change (IPCC), that global warming is already affecting the severity and frequency of global disasters, has since become embedded in political and public debate. It was central to discussions at last month's Copenhagen climate summit, including a demand by developing countries for compensation of $100 billion (£62 billion) from the rich nations blamed for creating the most emissions.

Ed Miliband, the energy and climate change minister in the UK, has suggested British and overseas floods — such as those in Bangladesh in 2007 — could be linked to global warming. Barack Obama, the US president, said last autumn: "More powerful storms and floods threaten every continent." However recent Irish floods only affected homes located on river flood plains where planning permission should never been granted.

Seems as some people at the UN climate panel are hot under the collar, (not from global warming).

any claim at all, as it contains no primary research data."

WWF said it prided itself on the accuracy of its reports and was investigating the latest concerns. "We have a team of people looking at this internationally," said Keith Allott, its climate change campaigner.

The Amazon is constantly undergoing huge changes because of natural variability in the weather. Spotting the additional impact of global warming against such a changing background is difficult — especially when the world has so far warmed by only about 0.7C since the 18th century.

Researchers who want to work out the potential impact of climate change on the Amazon have to use data from natural events such as droughts, backed up by experiments and computer modelling.

Study was 'misused'

LORD STERN'S report on climate change, which underpins UK government policy, has been slated by a disaster analyst who says the research he contributed was misused, *writes Jonathan Leake.*

Robert Muir-Wood, head of research at Risk Management Solutions, a US-based consultancy, said his work was misquoted to suggest a firm link between global warming and the frequency and severity of floods and hurricanes.

The Stern report, citing Muir-Wood, said: "New analysis based on insurance industry data has shown that weather-related catastrophe losses have increased by 2% each year since the 1970s over and above changes in wealth, inflation and population growth/movement. If this intensified with rising global temperatures, losses from extreme weather could reach 0.5%-1% of world GDP by the middle of the century."

Muir-Wood accused Stern of "going far beyond what was an acceptable extrapolation of the evidence". He said the study did show an association between global warming and impact and frequency of disasters, but this was caused by exceptionally strong hurricanes in the final two years.

A spokesman for Stern said: "Muir-Wood may have been deceived by his own observations."

Fig 1 - Article on climate change debate in the Sunday Times.

The latest criticism of the IPCC comes a week after it had retracted claims in its benchmark 2007 report that the Himalayan glaciers would be largely melted by 2035. It turned out that the bogus claim had been lifted from a glossy magazine.

The new controversy also goes back to the IPCC's 2007 report in which a separate section warned that the world had "suffered rapidly rising costs due to extreme weather-related events since the 1970s". It suggested a part of this increase was due to global warming and cited the unpublished report, saying: "there still remains an underlying rising trend." When the paper was eventually published, in 2008, it had a new caveat. It said: "We find insufficient evidence to claim a statistical relationship between global temperature increase and catastrophe losses."

Despite this change, the IPCC did not issue a clarification ahead of the Copenhagen climate summit in January 2010. It has also emerged that at least two scientific reviewers who checked drafts of the IPCC report urged greater caution in proposing a link between climate change and disaster impacts, but were ignored. Keep in mind that increasing population is forcing people to live in high risk areas. Also bear in mind that January and February 2010 has been extremely cold. (It is all still to play for).

Going back to common sense and my position: Only a full and thorough root and branch investigation will satisfy an intelligent observer, not argy-bargee. We want accurate facts and to be let check it out. We also need to come at the subject from various observed angles and compare results on the ground with all findings to date. This matter is too serious for messing about. What can be said for sure is that the sceptics have behaved more honourably than the proponents who are on the back foot. Two people arguing about a football match can never really be proved right or wrong, but if there is a rattle coming from the tractor engine and the driver dismissed it as a loose bonnet, he will be proved wrong if it turns to be a lack of lubricating oil. There are many with a vested interest in the Global warming theory and many with an interest in denying it. The best thing to do is to continue the search for real data results and combine them with our own observations of the environment and constantly adjust our position as more facts come to light. Experts feeling suicidal may be sad, but it's irrelevant. Strict objectivity based on science will win out in the end.

Suspicions are now falling on temperature monitoring stations located originally on green field sites which were later urbanised. One at Heathrow Airport may have been affected by jet exhausts and a waste incinerator was built beside another. A report in the Irish Daily Mail newspaper about 12th February, 2010 states that the experts have now admitted there was **no** increase in temperatures since 1995.

In Ireland, there was a noticeable absence of snow cover in winter between 1990 and 2008, but 2009, 2010 and 2011 reversed that trend. So there is no observable change in climate in Ireland yet except that some nature watchers claim that some species are moving northward. This could be the result of existing species being wiped out by changing farming methods.

3) Wind turbines when very few had them.*This paragraph is about the fact that my late father and I have experience of small wind turbines (called wind chargers). They did not provide useful power which is confirmed by recent studies.*

My late father PJ Martin, had a grasp of electrical engineering when no one had, he had an 9 foot diameter wind turbine (wind-charger "dynamo"or aero generator) at our house before the arrival of the ESB in 1952, when he dismantled it. As a young lad, I built a hut in the haggard out of wood and rushes for the fun of it. I re-installed the wind-charger on an ash tree as a source of light (still have

it) , only to discover that when there was no wind, there was no power. When there were high winds it blew the bulbs, a car battery and regulator (relay) "evened-out" the power at times of high gusts with the troughs in between and lit the bulb for about an hour after the wind died down, but the battery soon burned out due to the unevenness of the charging. It still failed most of the time. I asked my father how he managed to get it to provide light and he said he ran it in conjunction with a water wheel in the nearby river Glyde. Critics claimed you could only read the paper when there was a "gale or a flood". Some said that the system worked well, but I now believe they are commenting on a later period when he incorporated a petrol engine into the system to get a reliable supply. Notwithstanding this, he took the mains power immediately it was offered in 1952 and dispensed with renewable energy.

Nowadays, farmers owning high ground are been offered good money by wind energy companies to allow wind turbines be installed. Up to 7,000 euro per year (and more) per turbine has already being paid. Government is offering cash incentives resulting in payment up to 3 times that received by thermal production, yet when the potential of these machines is looked at, the figures don't appear to add up to a sustainable income generating source despite hansom tax incentives. What are the likely implications for farmers and the environment as a result of installing wind turbines and what actual return by way of useful electricity produced can be expected? Wind companies are presently seeking investors to fund their enterprises. Many private companies have declined, but some funds such as pensions and asset management concerns may consider becoming involved, presumably with the aid of tax incentives. One London specialising in alternative energy have decided not to get involved. Ulster Bank and Bank of Ireland say they are giving loans believing wind is the investment opportunity. Have they really considered their brief?

4) Energy: There are many definitions, "the ability to move objects" "ability to get work done" "to exert a pressure" There are many sources, animal, human, fossil fuel (heat energy), nuclear, wind, falling water, energy is even required to grow plants. Einstein told us the energy and matter are one and the same with his famous theory "E=MC squared ". In certain conditions energy will turn to matter and back again. He proved this by prompting the US President to make a nuclear bomb which was dropped on Japan. Energy is a force of nature and matter is its most obvious manifestation, but for the ordinary person, this theory only applies to nuclear power stations. In these, atoms with a high atomic number "i.e. Uranium" have their atoms split to release vast amount of energy. The "C" part of Einstein's equation stands for the speed of light = 186,000 meters per second. Whow!!!

Common sources of energy.

Explains why energy cannot be created, it can just be converted form one form to another usually losing some of its useful energy as a bye product in the process.

Energy cannot be created or made; it can only be converted from one source to another. A physical law called the "conservation of energy" means that no conversion process is ever 100% efficient. Unusually the process converts one source "oil" to 2 or more other sources " mechanical (kinetic) taken off from the engine crank shaft (useful), direct heat taken off as coolant (wasted) , and indirect friction heat dissipated through the bearings and lubrication system (wasted). A horse eats oats, pulls the plough through the soil and dissipates heat.

Nuclear: The Sun is a Nuclear reactor and the process can be replicated in a reactor to generate heat. This heat can be used to boil water, the steam of which drives a turbine. The output shaft can drive any appliance (usually a generator of electricity). Many sub-marines are powered by reactors. The radiation produced is harmful and lasts a very long time.

Despite recent reports that the nuclear industry has overcome all the difficulties with dealing with the spent fuel, this does not appear to be the case at the Sellafield plant in Cumbria. Casks containing spent rods are kept underwater for 3 years to cool. Then they are removed and placed in a nitric acid bath to form liquor which is evaporated to leave a toxic black powder. This is mixed with molten glass and stored in stainless steel canisters under 2 meters of lead and concrete. These can get as hot as 2,000C and give off 200 times the lethal dose of radioactivity for hundreds of thousands of years.

In the 1970's they came up with a bright ideal. Instead of using the plant just to store nuclear waste, they would convert the spent rods into re-usable fuel. (a great idea). The MOX plant was opened beside the main one in 2001 at a cost of £880m. It was intended to produce 120 tons of new black oxide fuel per year. But unforeseen difficulties kept cropping up and in 2009 it only produced 6.3 tons. Mox typifies the attitude to energy worldwide. Despite the fact that Britain has some of the best universities, scientists and engineers this project went ahead as a kind of experiment. It cost a fortune but was only partly successful. The government is now considering its closure. Why were these difficulties not foreseen at the planning stage? Nuclear power plants have come a long way and many countries such as France are heavily reliant on them. The most up-to-date type is the pressurised water reactor PWR, which is very safe and efficient. Even though the Chernobyl plant which blew apart was an old design, it was the ignorance of supervisor who overruled a junior's request to shut it down before it overheated, that led to the disaster there. This could not happen in a properly run plant.

Fossil fuels: These were laid down millions of years ago when the world was a hot a steamy place. Plants and other organisms (which grew by the heat of the sun) died and became submerged underground. Pressure and time produced what is among the most convenient and intensive fuels known. Oil, coal, gas and turf all contain (among other things) carbon which when burnt with oxygen produces intense heat with various chemicals as a bye product. Carbon dioxide is one. This gas is being blamed for the greenhouse effect causing global warming. By storing carbon, these fuels cleaned up the atmosphere millions of years ago, making it more suitable for modern livings things. Burning them returns the earth to the condition it was in before that clean up (according to the theory). We were lucky that there was such an abundance of fossil fuel in the last century, had there not been, nuclear power would undoubtedly have been used more and now the waste would be several times greater. Power plant using fossil fuels are referred to as Thermal plant.

Non-fossil fuels. These are fuels that grow in a short time e.g. a 100 year old tree, wheat, oats or barley. Carbon is taken in from the air. The energy contained can be converted by direct burning and also by fermentation to alcohol which works like petrol. These differ from fossil fuels in that they can be renewed by re-planting in a relatively short time span. They are referred to as carbon neutral fuels. They are true renewables because their renewal can be guaranteed here and now. In many cases, energy must be put in to get it out, e.g. planting by tractor etc. It is claimed that non-fossil fuel

can be used for this planting; the question is: will the amount of fuel produced be greater to that put in? Can non-fossil fuel be produced without fossil fuel? They take up food producing land.

Renewables: This name is a bit out of place. It is used to describe forms of energy which can go on indefinitely and can be harnessed by man. They are actually provided by nature as she deems fit. Man has absolutely no control over them, when or in what quantity they occur. Man can only harness them. No energy need be inputted by man once the equipment is installed and maintained, there is no direct by-product, but there may be a huge impact on the environment and huge maintenance costs. Man can only harness a tiny proportion of wind energy because it is not very dense and a huge area of land is required to produce any significant amount of energy.

Types of renewables:

Looks at some common types of renewable energy of which there are many and looks at their usefulness.

Tidal: This is the only form of (non nuclear) energy which can be harnessed that does not originate in the sun. It results from the fact that the earth and moon revolve around a common centre of gravity pulling on the water causing it to bulge. This occurs about every 10 hours in Ireland; if the sun went cold tomorrow, this form of energy would technically still exist. Certain enclosed estuaries are suitable for harnessing this, including Strangford Lough in Co. Down. It is untried technology. There is an environmental cost to harnessing it and good sites are scarce. It is said that sea areas off the Irish and Scottish coasts are loaded with this form of energy. The density of water makes water based energy attractive. Installation and maintenance costs will obviously be huge. My hunch is that it will work but the volume will be hopelessly inadequate.

Solar: Directly concentrates the heat from the sun to heat other media like water. It can also be used to react in cells to produce electricity. Works best in hot climates, the power produced is generally weak. Very large areas of panels are needed to produce small amounts of useful energy. Good for heating domestic water. Massive arrays of panels would obviously cool the environment in which they are placed, the impact is not known. Great for hot water in Ireland but questionable for mains power..

Wave: Results from the fact that moving water is dense and exerts a good pressure on any energy extractor. Research is ongoing. It originates with solar energy converting to wind and then to wave. It is a downstream version of wind energy. It must be understood that waves are a phenomenon that are not confined to water, sound, radio waves, light and even a length of tight string can release energy through waves. Take a small calm lake on a still evening. Throw in a big stone and see the wave circle out from source. However, if you are down beneath the surface, you notice that there is no disturbance other than the immediate area of the stone's landing. The water (called a medium) does not move away from the impact location; the waves that reach the shore received their energy from the stone's impact, but the water they are carried on has been the same that was there before the stone landed. Waves move, but their medium does not. A great example is to watch a man nailing on a slates on a roof over 200 meters away on a calm evening. The delayed sound waves

reach your ears, but the air they are carried on never moves. As a result it appears that tidal energy is much more intense than wave energy. The two must never be confused.

Hydro. Harnesses falling water to produce excellent power. The sun vaporises the water which rises (against gravity), moves over land and falls (by gravity) as rain to fill rivers. Greater water volume in winter makes it suitable for generating electricity when demand is high. Good sites are scarce. Interrupts fish breeding and causes farm flooding, but is otherwise an excellent source of power due to the density of water. When the country was electrified in 1926, its hydro potential was targeted immediately; Ardnacrusha near Limerick is one well known power plant. Without doubt, the most useful renewal energy source known, possibly surpassing fossil fuel. The backup reservoirs can be used to store energy in the short term. Goods sites are rare.

Wind: Originates in solar energy, the subject of this article.

Governments and bankers seem to be infatuated by it. Even Bakak Obama included it in his inauguration speech. It must be remembered that there are thousands of sources of renewal energy. Even falling leaves impart energy on impact. It must be remembered too, that just because these sources exist, does not mean that they can provide us with useful energy. Things to look for are the density of the moving material and the ability to harness some of its volume. You can harness wind in the back garden of any house in the world, but hydro sites are comparatively rare and none existent in most hot countries. Just because the world wants huge amounts of renewal energy, does not mean that mother nature is egger and waiting to oblige. There is just the possibility that renewables fall hopelessly short of providing even a fraction of our needs. Indeed, there appears to be the possibility that if we harness a large portion of the planet's natural energy bearing mediums, it could result in their slowing down over time. This is just a hypnotises. Only time will tell.

5) Wind Turbines

These are broadly of two designs: Horizontal shaft are the ones seen in various locations in Ireland. A column holds up the nacelle which in a large machine can be as large as a single decker

bus. All the key parts are contained in the nacelle.

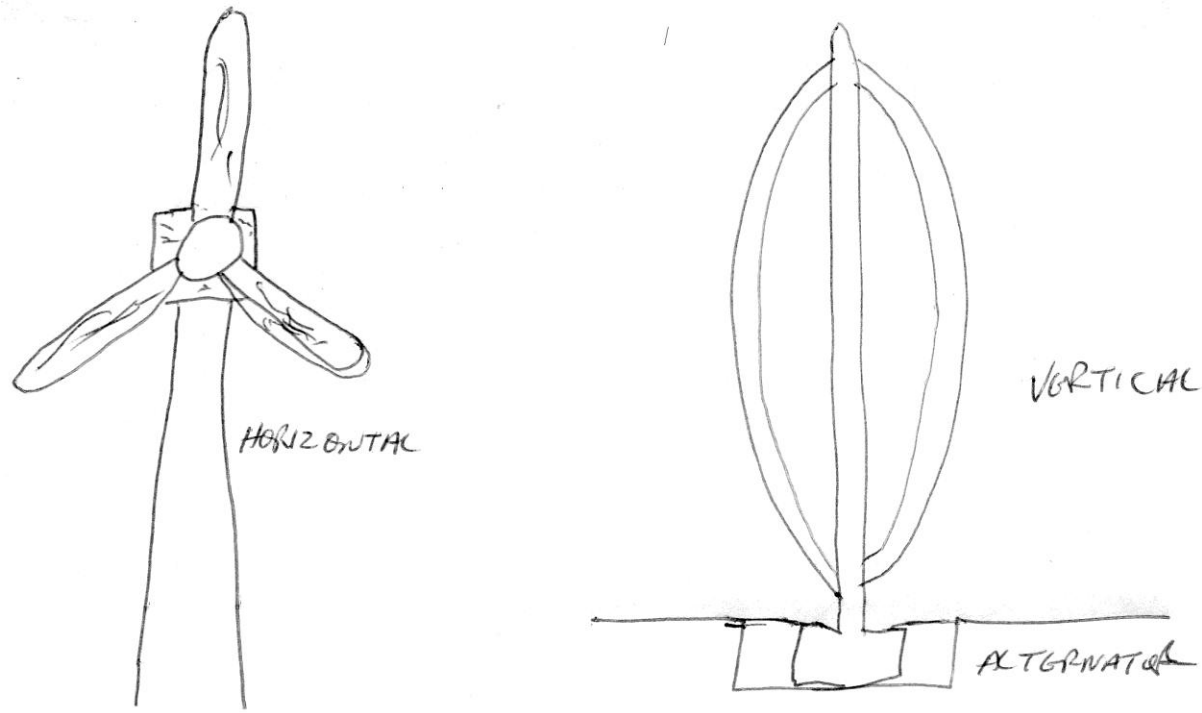


Fig 2 . There is a vertical design with vanes revolving round a vertical shaft with the alternator below ground level. They used to be called windcharger here and aerogenerators in America.

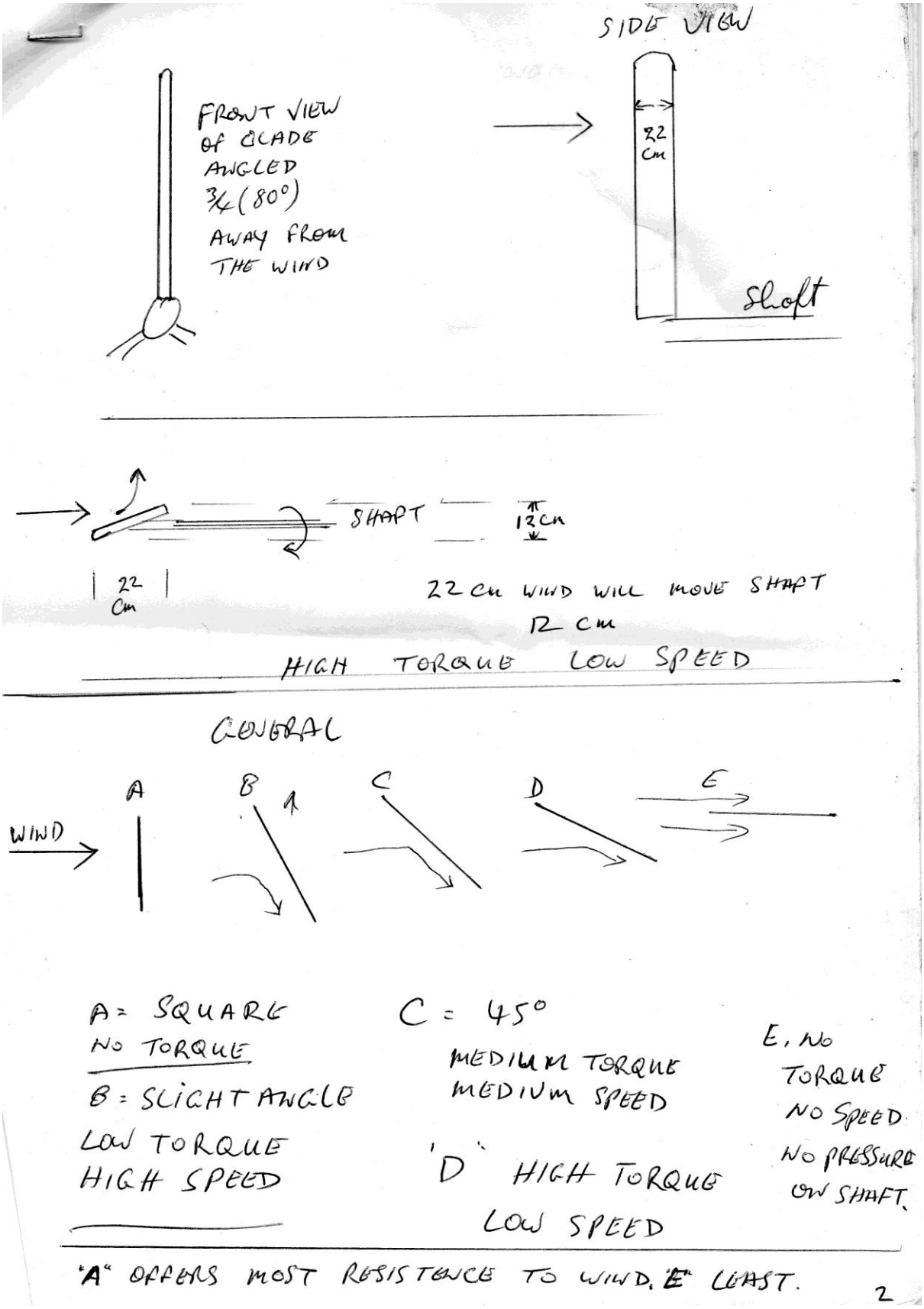


Fig 3 Blade Pitch controls.

Part 2: 6) How to determine the actual and useful power output of a wind turbine.

Looks at methods of indirectly ascertaining the power output of one turbine and comparing these to as many known figures as possible to find. The next paragraph also looks at a commonly used output –number of homes supplied-

The wind (air) is of low density moving over a vast area, it cannot be confined to the area of harness. A turbine intercepts a sample.

Every article published gives widely differing figures for the output and the number of homes turbines will supply. Farmers by necessity are good at judging any scheme or article offered, whether it is a second hand tractor or a cow; they can usually assess the sales talk to arrive at a common sense appraisal. Farmers manage to survive by having a keen instinctive awareness of value.

If we take the type of wind turbine in operation now in Ireland, what is the real output? How many homes will it supply and if installed on a farm as part of a wind farm spread out over several holdings, can it provide the company with the pay back they expect, so as to be able to pay the farmer in the long term? The answer is it can, you will get money "at least in the short term", but only because the public is heavily taxed and consumers levied in order to subsidise the wind industry. For wind energy cannot exist without thermal and nuclear energy.

The best way to appraise such turbines would be to carry out direct tests, by connecting a number of welders to one single phase from one machine in moderate winds to see how many it will power. It is unlikely if the proprietors would allow this, if not, we can wonder why. There is no reason why they should not. So an indirect examination would be the next best thing and compare it with reliable figures. After all, I can hardly build a 130 meter high machine to prove a point! Tests of domestic consumption of mains electricity in dwelling houses can be carried out by reading the meter. But remember, domestic consumption is only one of the many uses of power; there are factories, town lighting and many other users.

It will be noted that there are a few small scale wind generators in operation at dwelling houses in Ireland. All are virtual failures; the amount of energy is paltry. Why is that? Because they do not work! That's the inescapable conclusion. But, in order to progress we need to see how they work.

7) Operating principle.

Looks at the way a turbine works and while bigger turbines gather more energy from the wind, their speed must be kept down in proportion to their circumference which is 3.14 times their diameter. The larger the machine, the more ground must be allotted to it resulting in roughly the same output per hectare irrespective of size.

The unequal heat from the sun causes warm air to expand more than cooler air resulting in unequal pressure. High pressure air rushes to areas of low pressure causing wind. This was used by old time sailors to move sailing ships. Turbines catch some of the air, slowing it down and converting it into rotational mechanical energy. The turbine has blades angled to the wind causing the air to deflect

in one direction and the blade to move in the other. Atmospheric pressure acting on the back of the blade increases the torque. Some of the energy is wasted due to the resistance of the blade edge cutting through the air. All of the air cannot be absorbed by the blades; if it were, air would back up and by pass the turbine. The mechanical efficiency of a turbine is set out in the Bertz curve. In order to extract power from the air, it must be slowed down. The sweep increases as the blade diameter increases. The area swept is pie r squared. I have seen 2 meter diameter blades revolve at near 1,500 rpm (estimated). The length swept by the tip of the blade is called the tip speed. This limits the speed of larger turbines for 3 reasons, 1) the total tip speed can be huge as it cuts through the air and 2) vibration can damage the machine at high speeds and 3) the giro effect means that revolving the spinning turbine to face changing winds stresses the turbine which tends to stay in its own plane. (that's why a spinning top stays upright). The highest speed of the turbine is the tip. (Tip speed is arrived at by - revs per min X diameter in meters X 22/7 = meters per min).

Any observer can see that the larger the diameter the slower they revolve. At 20 rpm, a 50 meter turbine tip will travel 3.142 kilometres or 1.964 in a minute. In big machines, speed is controlled by varying the angle of the blade (using grid power) by computers which measure the wind speed. The speed slows as the blade twists/pitches towards the direction of the wind, but torque is increased. Torque is transmitted to the alternator by a step up gearbox. This gearbox may be fed with oil which is kept at a constant temperature by grid power. Voltage is induced in the generator coils by a rotating magnetic field powered (in small micro machines) by a permanent magnet. In most big commercial turbines, a copper winding in the rotor is fed with a direct current to magnetise the rotor poles. (I am investigating if this current also comes from the grid). As the input voltage is varied, the output current is varied. A low current in, will produce low output and a low torque to the blades so that they do not stall in low wind speeds. When the wind speed increases, there is a tendency for the blades to speed up due to the increased air speed striking the blades; to counter this, the voltage to the rotor is increased, increasing the output from the field coils and the corresponding torque on the turbine. By the co-ordinated control of the blade pitch and voltage input to the rotor, the turbine is kept at as constant a speed as possible. <u>However it must be remembered that just because they are revolving in low wind speeds, one cannot assume useful power is being generated.</u> Some of the large alternators use permanent magnets usually made from rare earth, mostly mined in china. All these have braking systems to keep speed constant and prevent a runaway should the gearbox break. Runaways have happened and can be seen on the internet.

A 3 phase generator and 3 phase motor are similar and many will both generate current when spun and revolve when electrical power from an outside source is supplied. A generator will act as a motor and visa versa, it depends on the speed the shaft is driven at. Once stopped, considerable wind may required to start them again and some are designed to keep going in near calm conditions to enable them to avail of any stronger gusts that come alone. In some cases, the grid (powered by fossil fuel) may be driving the turbine. The turbine assembly (top part) can weigh over 40 tones.

The output of the turbine increases as wind speed increases from about 12.5 mph to 33 mph. At higher speeds the huge torque caused by increasing output would overheat the coils, and could damage the gears. If a turbine were designed for "say" 40 mph winds, it would not produce useful power at the lower speeds. They are designed to give maximum output at wind speed of 28 - 36 mph in general. At this wind speed the rated output in kilo -1,000- watts (kW) or Mega –million-

watts (mw) is said to be achieved. At higher speeds the blade angle is increased (turned away) to keep speed down, but only a little more current can be produced. The reason is that this would overload the windings and possibly the power lines outward. The excess torque is dumped, this can be through a friction brake or a fluid based torque absorber. At wind speed over 35 mph the turbine may be turned away from the wind or shut down to avoid damage. Large wind farms may have a percentage of turbines set to avail of more extreme wind speeds. This does not mean that turbines cannot be designed to use gale force winds, they can, but the investment costs to produce them are not justified, because of the limited periods when such conditions exist. In reality the optimum wind speed is between 29 and 35 miles per hour, 18 to 28 mph will give good output, 12 to 18 will give some and below 12 the losses and the power needed from the grid mean no profit is being made. (this last bit may be disputed by the industry). The actual wind speed to power ratio is that as speed is doubled and output increases by the cube. i.e. 7mps = 2 kW, therefore 14mps = 2x2x2 = 8kW.

Observations if Cavan wind farms reveal that they are shut when there is a gale forecast, about 34 mph and above. Thus limiting their range from 12.5 – 34 mph, loosing in speeds above 34hpm. Sometimes you may see one of more turbines stopped while the rest thresh on in good wind. This is most likely “curtailment”. The grid cannot handle all the power and is referred to in EirGrid’s 2010 adequacy report.

On size, the output of a turbine increases with the area swept. i.e. for a 16 meter diameter blade the figures are 8 squared x pie = 210 kw. For a 32 meter diameter blade its 16 x 16 pie = 804 kw. Roughly the cube also. This has its source from the fact that the world is 3-dimentional. In his report David McKay says that it is the area or land swept and not the size of the turbines that matters. Less big turbines can be placed on a given plot due to the vortex created in the wake.

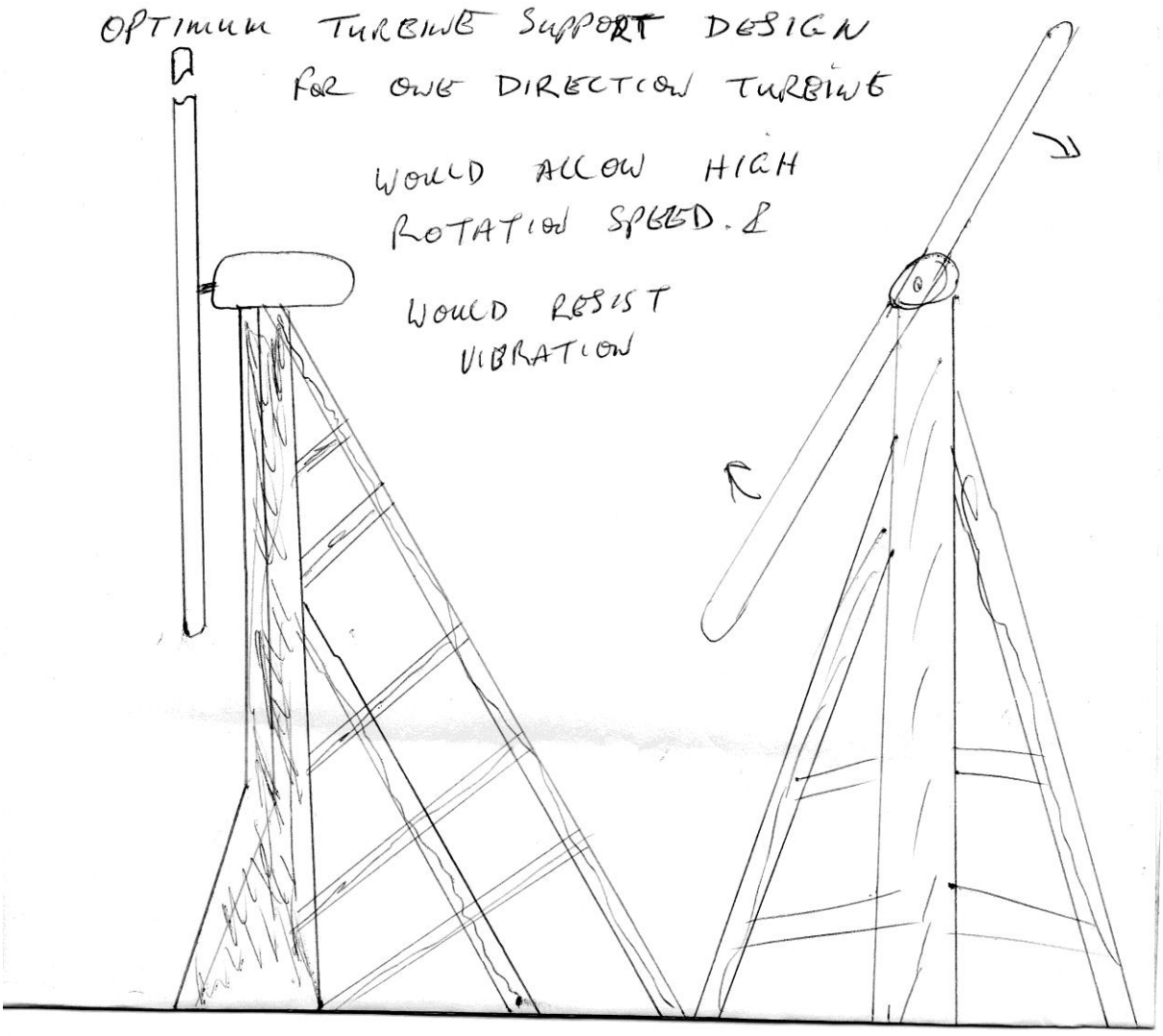
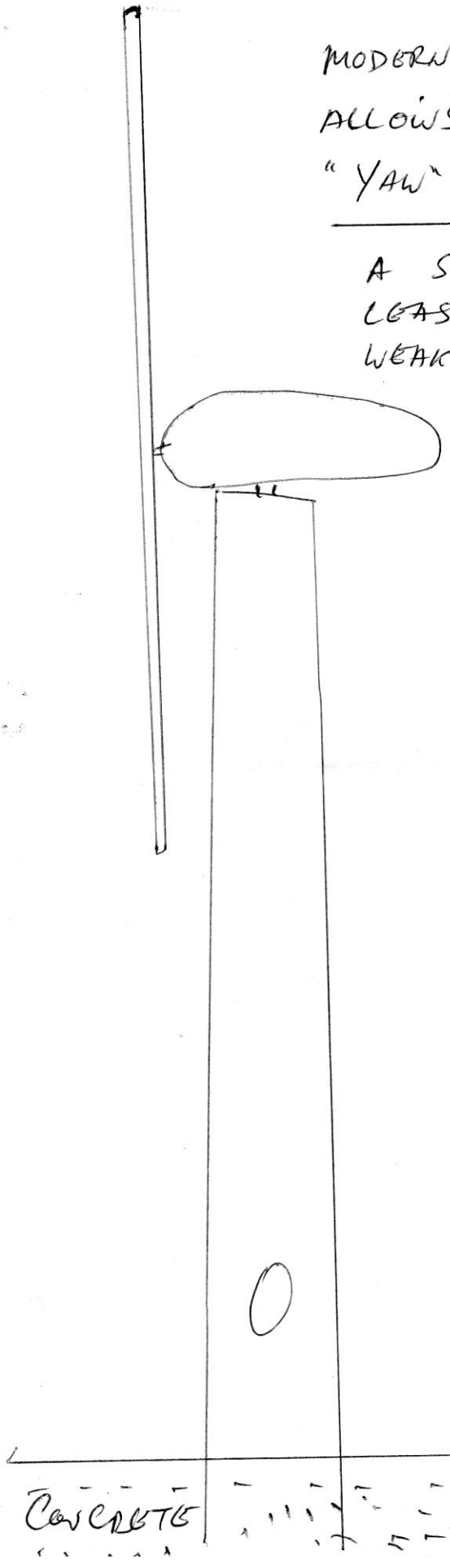


Fig 4) Best design for strength, but will not allow the turbine to yaw, “turn to face the wind”.



MODERN SUPPORT DESIGN ALLOWS TURBINE TO SWING "YAW" TO FACE WIND.

A SINGLE SUPPORT IS THE LEAST EFFECTIVE AND WEAKEST FORM.

THIS NECESSITATES KEEPING TURBINE SPEED LOW.

A SINGLE SUPPORT HAS NO "DAMPING" FOR VIBRATION.

MASSIVE STEEL TUBING IN NEEDED WHICH IN TURN NEEDS HUGE UNDERGROUND SUPPORT

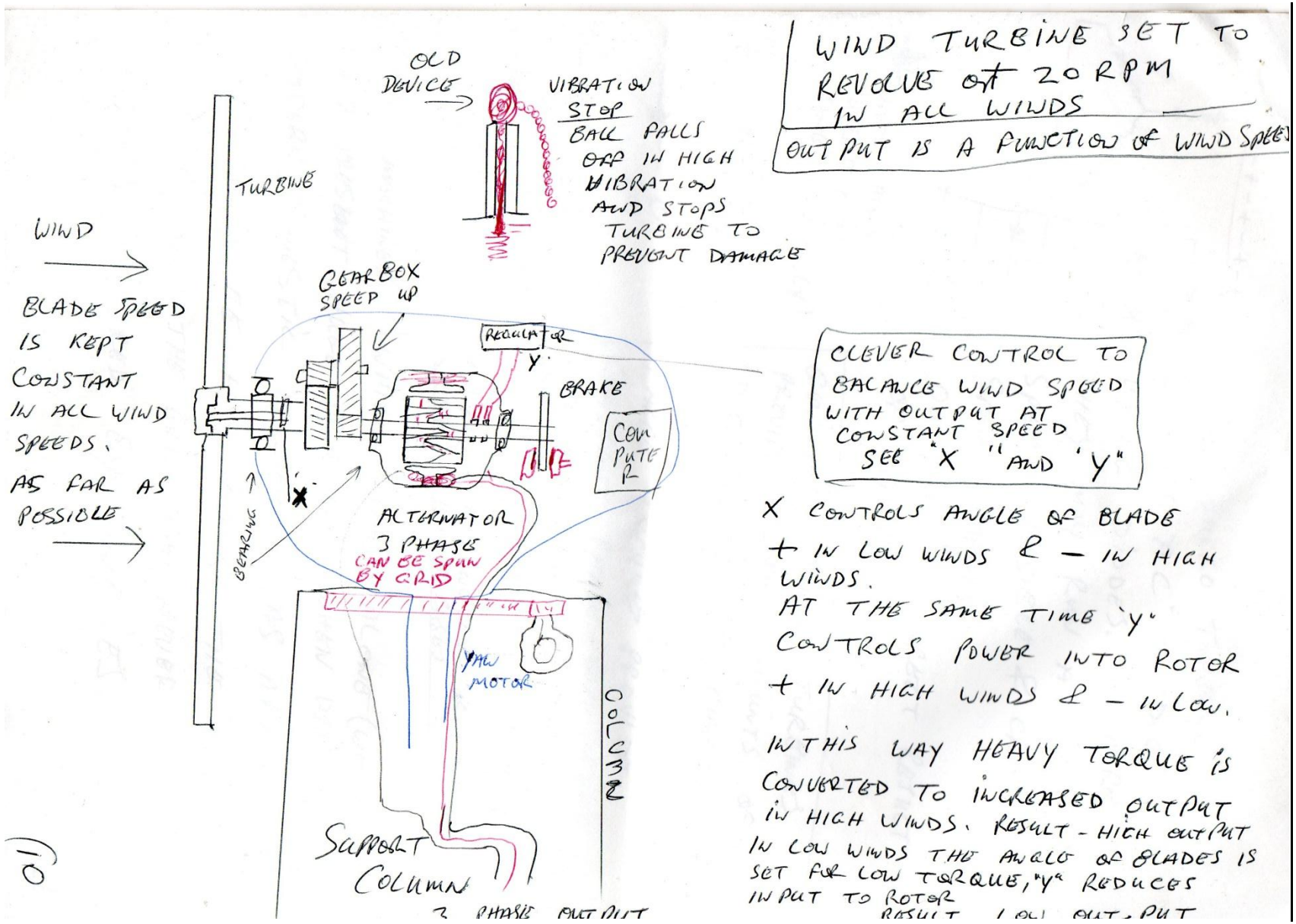


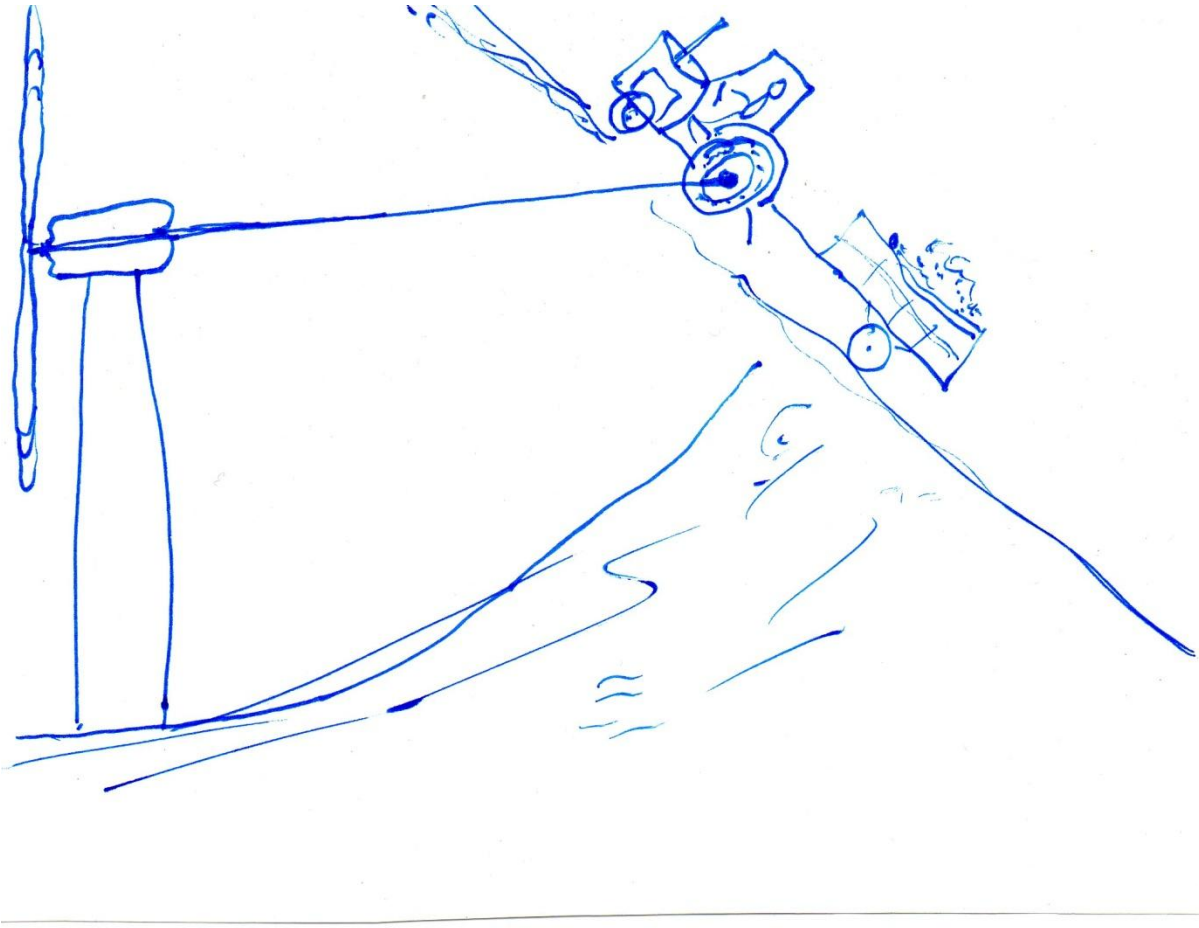
Fig 6 Workings of turbine

8) Calculating real output.

Puts a common sense measurement on a typical turbine output.

Take a standard turbine with blades about 50 metres in diameter. Picture the shaft running back from the blade hub out through the back of the horizontal cross head (called a nacelle) connected to the axle (with wheel) of a medium sized tractor attached (fig 2). Would it be powerful enough move the tractor? A common sense view would suggest it might pull a trailer loaded with 3 or 4 tons.

It would only do this if there was a good wind driving the turbine. Therefore it might be reasonable to say that the torque on the turbine shaft is roughly equal to the torque on a medium sized tractor half shaft pulling a 4 ton load. The speed of the turbine is about 14 - 20 revs per minute (RPM) which must be stepped up at least 75 times to 1500-2,500 RPM so as to drive any alternator (more in some cases). A step up gearbox looses power through bearings and cog wheel friction (probably about 40%). So the power at the alternator might be somewhat similar to that supplied by the engine of a small tractor such as Ford 4000 or Massey 35 with the engine connected directly to the generator, no gears.



All the workings of a wind turbine are contained in the horizontal nacelle on top of the tower which revolves (yaws) to face the wind. A look at various diesel generator sets show that those driven by 2

to 4 litre engines provide between 300 to 500 kilo (1000) watts of electricity at about 2500 RPM. The size of the 3 phase alternator on these sets is about half a meter outside diameter, very similar to the alternator size fitted to turbines shown in an internet photograph of one being assembled on site.

Taking all into account, assuming the wind is blowing at a steady 33 mph (the optimum wind speed), it is reasonable to assume that the output from one 50 meter turbine is in the region of 500 KW which equates to about 600 KVA. (KVA is an adjustment between kilo watts and actual output to take account of a time lag between voltage and amps produced in an alternator "power factor", many diesel alternators are thus rated). The alternator is 3 phase, so each phase would be 1/3 of this or 166 KW (one phase). It would light 1660 x 100 km bulbs or power 166 x 1000 watt appliances, such as an electric cooking ring or vacuum cleaner or large TV. The coil windings is probably about 12 sq mm copper wire and it is doubtful if it would cope with a greater load without overheating. One third of all the output pressure of a generator must flow through one of its single coils and the single wire of this coil must carry all the load of a single phase. (Some wiring arrangements result in more than one (usually 2 in series) coils carrying the load, but the total load is still carried by one wire). The coils can carry a minor overload for a short while, but not continuously. *(All current being produced by an alternator coil must flow through that coil (20 x 100 watt bulbs being lit = 2 kilo watts out = 2 kilo watts) flowing through the coil.*

A diesel generator as described provides in the region of 140 KW per phase or 420 KW in total. (3 x 1), (refer to the various suppliers of generators). A recent article in time magazine stated that Denmark has 5,200 turbines producing 3,100 megawatts, which equates to 396 kW per turbine. The internet web site "How Stuff Works" gives its industry figures at 500 kW. My estimate is 330 kW. If we take an average of all three estimates we arrive at (450+396+500+396/4 = **411 kW**. Hopefully, this will rebut many of the "wide-off-the-mark output figures" seen in the media. Wind turbine enthusiasts who claim wind farms can power thousands of houses, they have it ***very*** wrong. In optimum wind conditions the turbine described will power **411** appliances of 1000 watt rating. The rated output of turbines is established on a bench with an engine driving it. The speed is correct, but the "pre-stall" power is greater than available through wind.

To calculate the amount of power a turbine can actually generate from the wind, you need to know the wind speed at the turbine site and the turbine power output at optimum wind.. Most large turbines produce their maximum power at wind speeds around 15 meters per second (33 mph). Considering steady wind speeds, it's the diameter of the rotor that determines how much energy a turbine can generate. Keep in mind that as a rotor diameter increases the height of the tower increases as well, which means more access to slightly faster winds.

This table from the Danish wind energy association gives the rated output from turbines of varying diameters Note this gives the ***in optimal wind conditions***. *It is the nominal output at the base of the machine, not the power available to the end user. I dispute them, as my figures show these are double the actual output figures.* ***Do you believe that a 10 meter diameter turbine would outperform eight portable petrol generators of 3.5 kva?*** *An enclosed generating set on hire at my hire centre is rated 26 kva (about 22 kW). Are we to believe a 10 meter turbine will equal that? The table is useful in that it shows the relationship between size and output.*

If it is accepted that the rated output is away above that actually obtained in real conditions, the table can still be used to get the actual output by taking a particular diameter and multiplying by the real figure and dividing by the stated rated figure. i.e. there is no 50 meter example in the table, but there is a 48 @ 750kw and a 54 @ 1000 giving a mean of 830 for a 50 meter diameter. My figure is 411 so 411/833 = 50%. Therefore by

multiplying any output in the table by 50% we get the real output. A 10 meter dia blade gives 12.5kw. It would run 125 hundred watt bulbs or 12 cooker rings.

The figures in brackets are my adjustments for best wind speed. Remember this in optimum wind speed.

Fig 7

Rotor Size and Official Maximum Power Output		
Rotor Diameter (meters)	**Power Output (kW)**	**My estimate**
10	25	(12.5)
17	100	(50)
27	225	(112.5)
33	300	(150)
40	500	(250)
44	600	(300)
48	750	(375)
54	1000	(500)
64	1500	(750)
72	2000	(1,000)
80	2500	(1,250)
Sources: Danish Wind Industry Association, American Wind Energy Association		

Even if you accept the manufacturers figures, they should be adjusted as follows:

Rated output x .75 (copper losses and inefficiencies as already stated) x .24 (average wind) = load factor. (defined later)

So even with these figures, a 54 meter diameter turbine reads 1,000 X .75(wire loss) X .24(load factor) = 180 Kw. (Average output over the year, x 24 hours x 365 = 1,576,800 units. If the farmer gets 2 p per unit that is = 31,500 Euros. But my figures are 411 kW so 31,500 x 411 / 1000 = 13,000 Euros per year. Not too bad, if true. This is why we need accurate historic facts, not projection done on paper or computer. The unmentioned quantity here is government subsidies. Note: all money received cannot go to the farmer, the company takes the Lyons share.

Note these figures take no account of the cost of providing back-up power for wind farms.

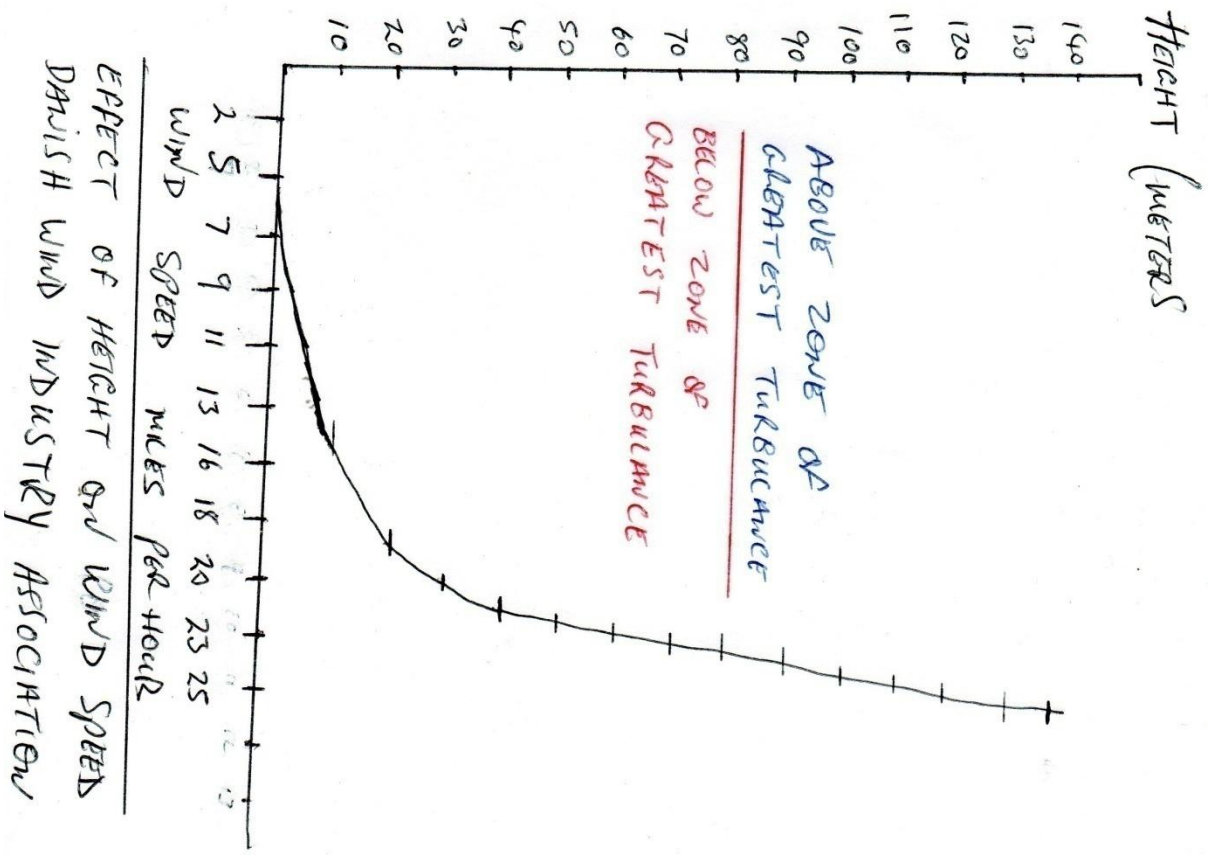


Fig 8 effect on height.

Effect of height on wind speed in miles per hour with height in meters. Danish wind energy Assoc.

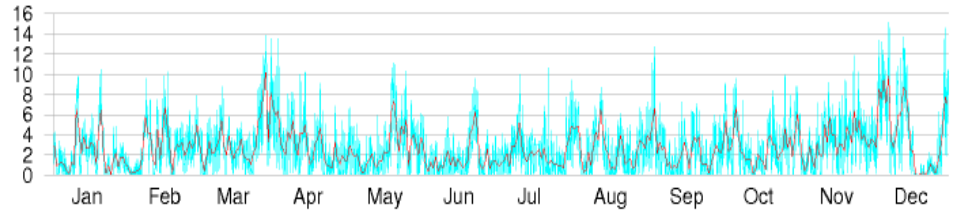
Part 3.

9) Real wind speeds .

Looks at wind speeds. The theory that there is always wind blowing somewhere is untrue. You can carry out your own survey by recording wind speed each day.

Note: Average wind speeds can be misleading, see chapter on Load Factor.

Fig 9 Excerpt from David McKay's report to the British Government. Wind speed in Cambridge, England.



"This figure of 6 m/s is probably an over-estimate for many locations in Britain. For example, figure 4.1 shows daily average wind speeds in Cambridge during 2006. The daily average speed reached 6 m/s (13.5mph) on only about 30 days of the year. But some spots do have wind speeds above 6 m/s – for example, the summit of Cairngorm in Scotland

To convert meters per second (mps) to Kilometres per hour kph x 3.6 mps to miles per hour x 2.25.

My trials showed that there are decent winds on one day out of four. On one out of six days, speeds will be above 20mph and the rest will be above 8 mph. British figures say that the optimum speed of 33mph occurs one third of the time for coastal wind farms set up many miles out to sea, but much less on land. (I wrote that in 2008, it appears that wind speeds have drastically reduced since then)

Historic Percentage frequency of occurrence of wind speeds in my part of Ireland. (South Ulster)

I tested the voltage of a 12 volt turbine and comparing it to wind speed using feather dropped between to markers.

Between 13.5 (6 meters per sec) and 20 miles per hour occurred 21.9% 79 days: over 20 mph occurred 6.7% = 28.6% 104 days. My average of 24.1 will be for all the country because speeds decrease farther south.

Having observed wind in my area between January 1st and April 4th 2009, I would estimate that there was a decent wind on one day out of five, or 20% of the time. There were light winds for about 8% and calm conditions for the remaining 72%. (Winter of 2009/2010 had little wind at all)

20 x 100%= 20%	Historic figures include the absolute minimum
8 x 50%= 4%	at which a turbine starts to generate 6mps
72 x 0%= 0%	whereas mine of the left start a little higher.
24%	

(The top of the Lough-an-lea mountain in east Cavan is the highest point in the area, the wind is about 5mph faster than lower down and at the Gartnaneane wind farm nearby its about 3.5 mph higher. High ground does not multiply speed, it increases it by a certain constant amount added on.

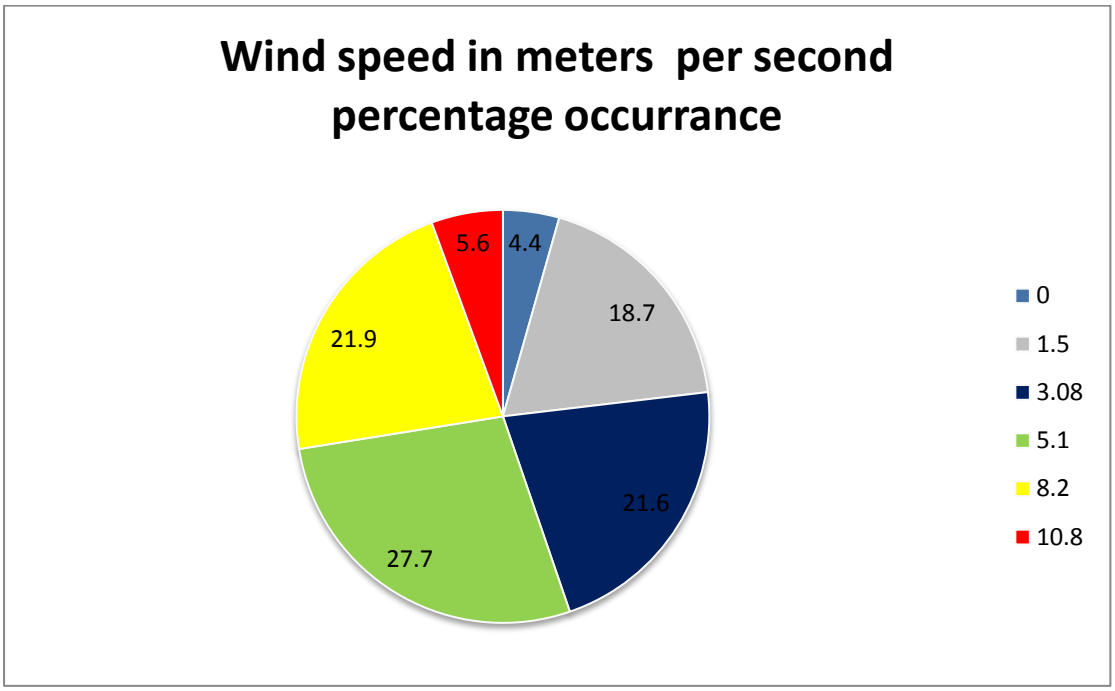
Met Eireann compiled 30 wind data for Clones at 10 meters above the Ground. It gives speed ranges which do not fit exactly with turbine cut in speed. When adjusted they show as follows:

0 - 12.5 mph	= 71.4%	259 days per year:	No power at all.
12.5 – 18 mph	= 21.9%	79 days:	Marginal power.
18 - 31 mph	= 6.6%	26 days	Near full power.
31 +	= .1	1 day.	Full power.
Total	100%	365 days.	

This shows that cut in speed to maximum speed occurs= 28.6% of the time, but this must be revised downward because power will be marginal between 12.5 mph and 31 mph. It's hard to judge, but say output is a generous 70% of nameplate rate output. Then 21.9% + 6.6% = 28.5 x . 7 = 19.95% + .1 to get 20%

This gives a figure of 20% when the full output is given. This is called the LOAD FACTOR. The figures given by some are 40%, 35% and 30.5% for Ireland. Eirgrid gave it in 2004 at 35% but have revised this downward to 30.5% in 2009. The digest of UK energy statistics gives it for Britain @ 27.5% on shore and 25.6 for offshore and average of 26.6% for 2008.

This chart gives a rough idea of real wind speeds in South Ulster, a turbine begin to generate at the yellow segment and give full output on the orange. Fig 10.



Blue = 0, grey = 3.4mph , black = 7mph, green = 11.5mph, yellow = 18.4mph, red = 24.15

This chart shows the average output of a 50 meter turbine over any long period. The Blue segment shows the percentage when output is Nil.

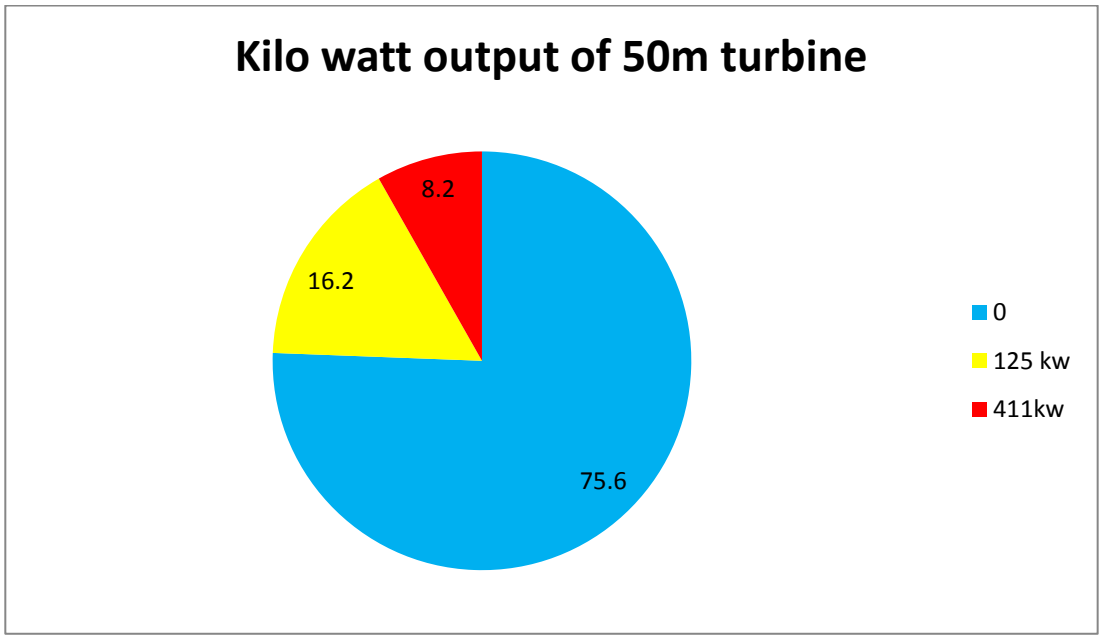


Fig 11

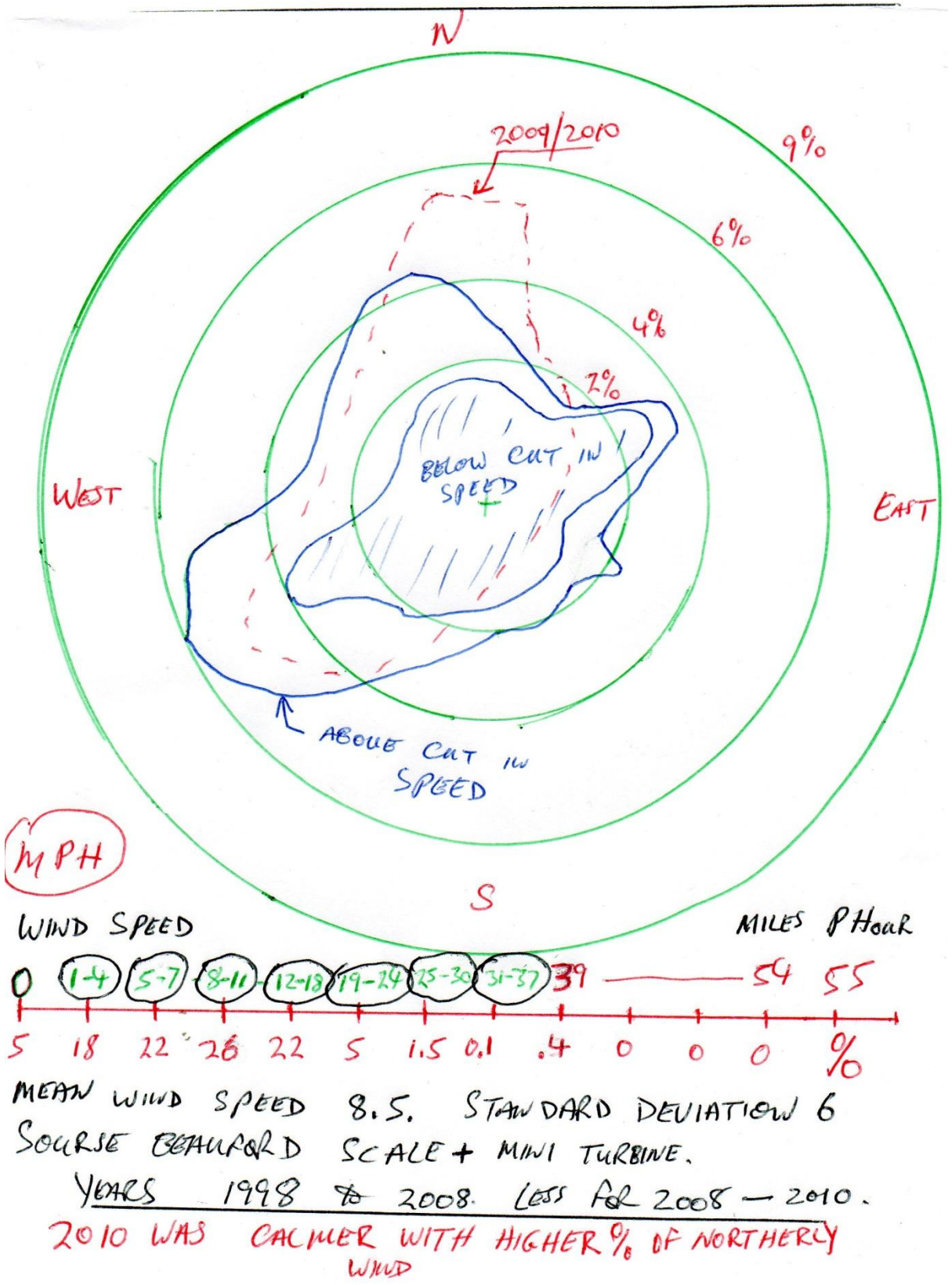
"There is a theory that in Ireland, there is always wind blowing somewhere so that the average wind blowing country-Europe wide is the roughly the same. This has its origins in the fact that on a windy day, gusting is not co-ordinated. A gust in Kerry may happen at 4.30pm while it may arrive in Donegal at 5.15pm. This smoothes the variation on the national grid. Average wind speeds are half in the south east compared with the north. "This cannot be taken to mean that there is always wind blowing somewhere, there is not. The McKay report (commissioned by the British government) agrees. I made checks at various times by phone and found that wind conditions are remarkably the same in all parts of Ireland. If it's calm in Cavan its calm in Cork and London. You can check this yourself when travelling"

Calm conditions usually occur during an anticyclone, a very large weather system which can extend right across Northern Europe. In Ireland best wind is on the west coast from Kerry right up to Antrim with average speed of 7 - 8 mps, next is the midlands 6 – 7, the lowest is the Kilkenny area 5 – 6 mps. North west Scotland has twice wind speed of south west England. It will be noted that winter frost and summer hot periods coincide with anticyclonic weather systems as out weather people continually tell us. In other conditions, wind speed can change rapidly from calm to gust, often in a matter of hours.

This subject is discussed in greater detail later. However it is important to get this right because it has a bearing on the real net contribution made by wind power. The Beauford scale is described on Wikipedia, why not keep a record your self

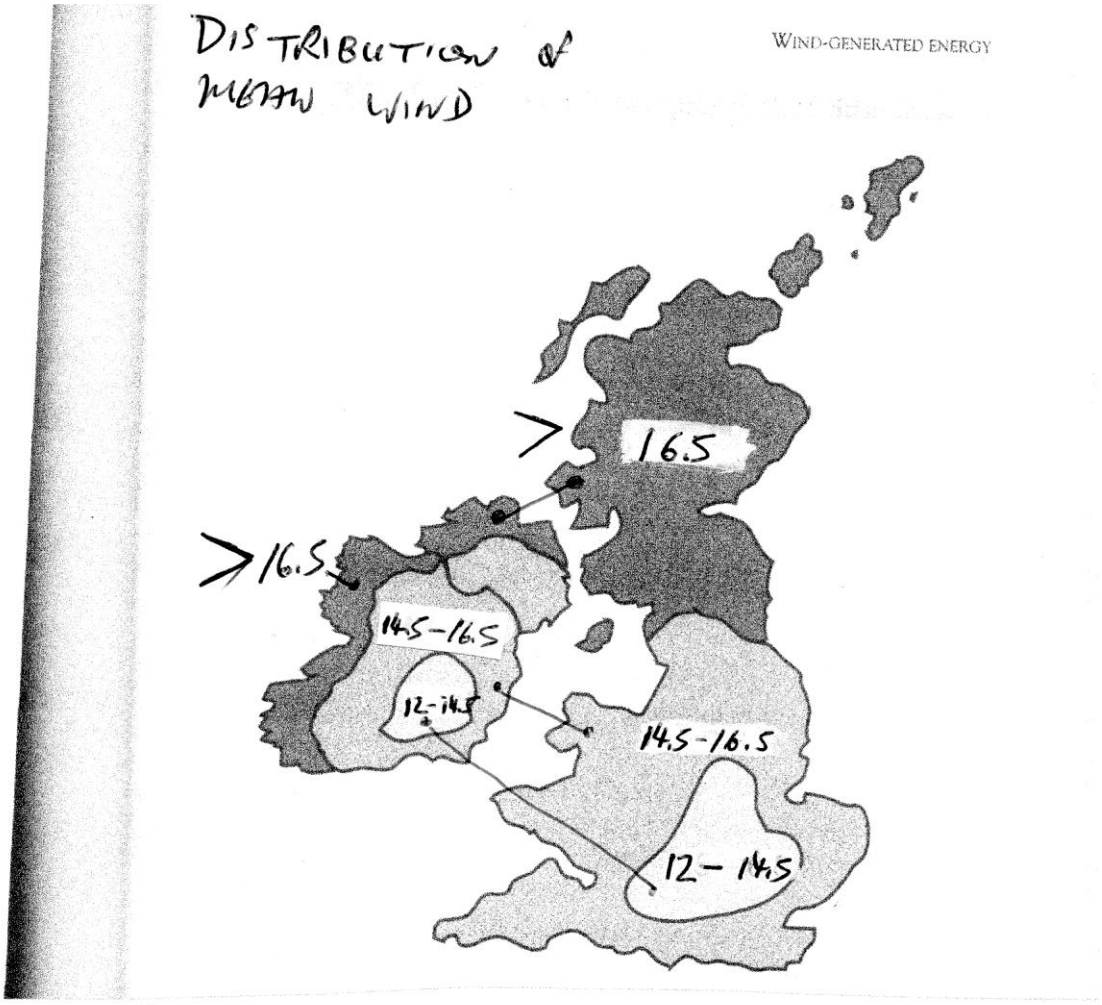
Historic wind speeds & Directions– tested by the author. 1998 – 2008 at 25 meters height.

Fig 12Official Met Eireann data from their various weather stations at 12 meters available directly from them. Late 2009 to September 2010 recorded exceptional periods of calmness and Northerly wind.



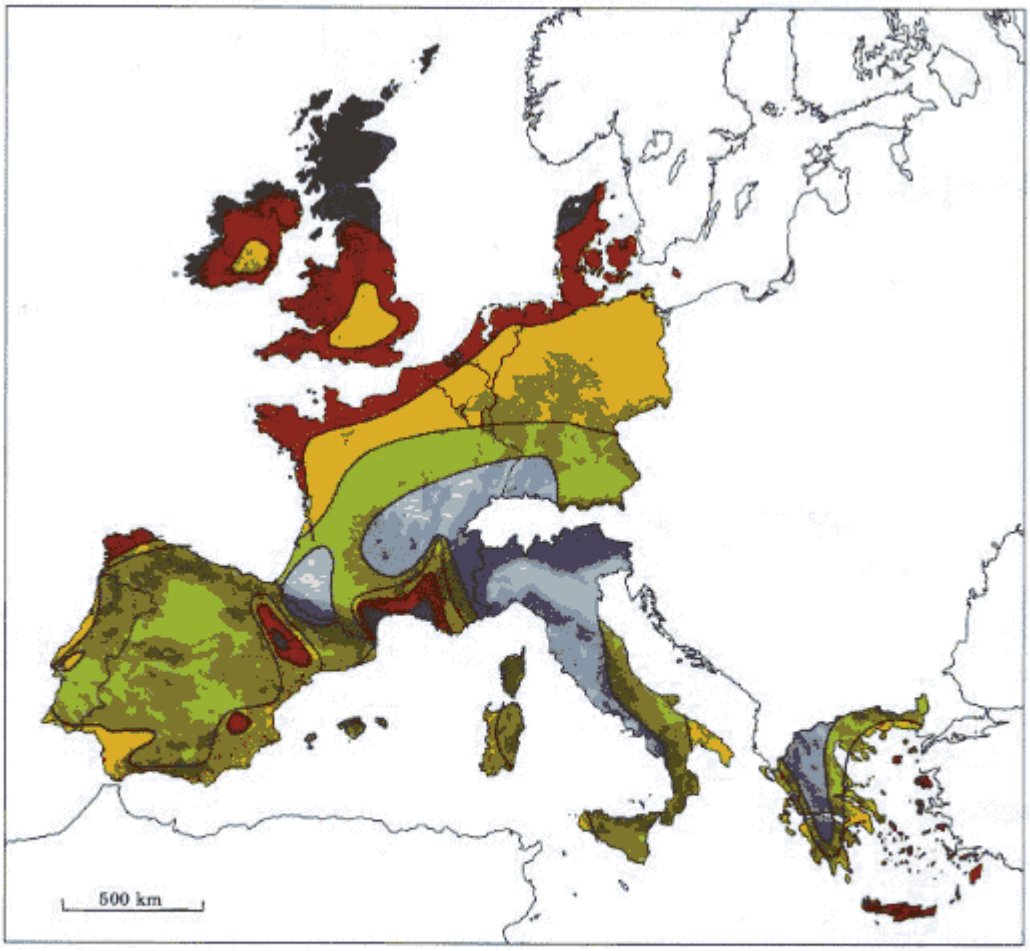
The most accurate average historic wind speed at Kingscourt is 8.2 miles per hour sec. or 3.5 meters per sec. It is the peaks that generate power and they come with troughs included.

Fig 13.



Common would say that all of Scotland and all of England north of Hull can match the wind speeds on the western seaboard of Ireland. A turbine begins to generate about 12.5 mph, but the power is marginal below about 17 MPH.

Speeds are in Miles per hour



Wind resources[1] at 50 metres above ground level for five different topographic conditions

	Sheltered terrain[2]		Open plain[3]		At a sea coast[4]		Open sea[5]		Hills and ridges[6]	
	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}	ms^{-1}	Wm^{-2}
	> 6.0	> 250	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 11.5	> 1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0- 8.5	400- 700
	< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 5.5	< 200	< 7.0	< 400

Dig 14. European wind speed atlas showing the claim that Ireland has the best wind speeds in Europe is a myth. Source www.windatlas.dk/europe, Google European wind speeds.

10) Number of houses powered by wind

Press announcements on proposed wind farms often give the number of houses to be powered as a guide to the output of the wind farm. How accurate are these figures? Basing them on the percentage of time the wind blows is incorrect, but readers should still watch out for misleading claims.

If Irish turbines will produce full power 24% of the time. Now let's apply this to our figures per home for one turbine.

1. Average supplied in optimum wind per page 12 =884
2. Actual average at 24% (over an average period) =258 x (884x24%)
3. Maximum supplied during peak draw @ optimum wind =103 (411kw/4kw)
4. Maximum supplied during peak draw @ average wind =31 (103x .24)

Divide the above number by 3 to get the number per phase.

In the real world, one turbine will power 258 homes over a yearly period on average and 31 homes at times of peak demand. It will power none during calm or stormy conditions. It can be seen that various figures can be used depending on choice, but as the producer will hope to be paid per unit produced. The ESB currently charges domestic customers E.1324 per unit with a standing charge of 120 Euros per year. It is unlikely that this charge could cover all maintenance and administration. So we will say .05 would be required for all expenses, leaving .0824 for actual power supplied as a rough estimate. (I am since informed that they pay 9 cents to one micro supplier)

One home drawing 15.3 kW hours per day = 5584 KW hours per year.

258 are powered by 1 machine = 5584 x 258 = 1440672 say @ .0824 cent = 118, 711 Euros.

Now look at the number of homes given in the media

My average number 258

Sunday Times 28/ 03/09

Power is stored in a cave in Huntdorf, Germany. Excess electricity from a fossil fuel power station is used to compress air giving an output of 290 MW which powers 290,000 homes. Power generated during the night (best wind) is used the very next morning, before air can leak out.

290000000/290000= 1000 watts per home. *(being consumed at any one moment) 24 units per day.*

Sunday Times 28/ 03/09

Power is stored in a cave in Huntdorf, Germany. Excess electricity from a fossil fuel power station is used to compress air giving an output of 290 MW which powers 290,000 homes. Power generated during the night (best wind) is used the very next morning, before air can leak out.

Hugh Piggott, a noted authority in small wind turbines for the home states the average person in Europe uses 100 watts of electricity in average. 2. 4 per day = 8760 KW units annually. (Includes power consumed outside the home.

My figures show my house consumes 637 kW (159 per person) on average annually, which is similar to the German or Piggott's figures. This all adds up to the fact that figures (from the industry) for the output of machines and numbers of homes they will supply are wide off the mark, fanciful if not downright deceiving. **Are we getting the truth!** My figures although crude, do co-relate with other industry sources. But they are way below the figures given in David McKay's report, which takes total UK consumption and divides it by the total number of people. Moreover, my calculations

above don't take account of the fact that the best wind generating conditions are at night, when demand is lowest. Averaging, means that one period can be taken with another, which would be the case if each consumer tailored his consumption to production. This would often mean sleeping during the day and staying up all night to avail of wind power to do the washing, cooking etc. In reality, this would only happen in emergency situations. A modern economy like Ireland needs power to suit the consumer, not the other way about.

I cannot possibly produce figures to quantify the mismatching of wind to demand, but could we agree on reducing the above figures to 66% or **2/3**. Therefore 258 homes becomes (258 x.66%) or 170. The Euros will change from 118,711 to (x.66) 78,349. Out of that has to come payment on interest, on capital investment and profit for the company, shareholders and farmers.

Take capital investment at 1.2m per machine over 25 years (principle (1200, 000/25) = 48,000 plus interest @9% = 108, 000 giving a total outlay to lending institution of 156, 000.

That's right Income is 78,349 and outgoings are 156,000 (+maintenance costs). So how are they going to pay the farmer? Government's money transfers in colossal amounts.

Wind companies may dispute these figures, but they should select a machine at random and say 1) at what minimum wind speed is the output less grid input a plus. 2) Give net output figures at 5 mph intervals between 0 and 50 mph. Give details of payments received from the ESB.

From the 14th December 2009 to the 27th February 2010, there were extremely cold conditions in Ireland, there was only 2 days that you would feel the wind when out and about. For measuring small wind speeds, turn away and walk briskly. When the wind is not felt on the back of the neck, your speed equals the wind. The beau ford scale method can be found on the internet.

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12) Matching wind power to the grid.

Looks at the problem of connecting turbines to the ESB grid, it can be done, but power is lost and conventional generating capacity must still be maintained at 100% capacity and maybe more.

Conventional grid systems here use mainly thermal power plant that convert fossil fuel to electricity to be used immediately in alternating form @ 50 hertz. Electricity has voltage (pressure), amperage (volume) which combine in varying amounts to give useful power watt. A watt is the power at any instant and is counted by watt/hours wh. 1 watt supplied for one hour = 1 wh, kw = kilo watt, mw = mega watt.

Base plant: The main string to their bow is base plant. Usually powered by heavy fuel oil or coal the fuel is conditioned and heated to burn intensely and completely. The heat boils water in special boilers that can withstand over 3,000 lbs of pressure per sq inch. The steam then drives a turbine which connects to a polyphase alternator . A separate dc generator is coupled to the end of the shaft to provide direct current for the alternator rotor. This is seriously heavy plant and is very efficient and has a low carbon emission. It is the train when compared to transport, cheap powerful but not very flexible. It can take 8 hours to start up and 4 to shut down and cannot normally be started while in shut down mode. It is most efficient when run continuously except for the annual service. Its credit capacity is about 95%.

It is referred to by Eirgrid as **low merit** plant. That means its best at supplying base load and not for responding to variations in other plant. It's not dispatchable meaning it can't be easily shut down to save fuel.

Nuclear plant is the same except that the heat is provided by a nuclear reactor. Start up times are one of more days.

Mid Merit plant: A lighter version of base load normally fired by Gas (rarely nuclear but small nuclear plants are coming on stream). Can be started in less time about 3 -4 hours and shut down in less time. Better at responding to failures of other plant in the short term and for meeting foreseeable daily peaks in demand on top of base plant. Because is normally spends more time shut down its credit capacity is lower. It does not make as good a job of converting its fuel to power and therefore emits more greenhouses than base load plant. It is the bus of the transport system and is slightly dispatchable.

High merit plant: The best example is a diesel engine. Immediate starting and stopping it can respond to a failure or sudden increase in demand within a few minutes. The oil is fed into the combustion chamber at room temperature. Heat is dissipated through the cylinder walls and wasted through the heating system. The pistons reciprocate wasting energy in the process and high pressure gasses are exhausted to the atmosphere. They are inefficient and heavy polluters like lorry engines. Credit Capacity is low: They are the motor car of the transport system flexible, handy but hard on the pocket and environment. They are dispatchable.

When starting all these plants must be pulled into phase (ramping up). You cannot just throw the switch. The heavier the plant the more time it takes to do this. Ramping up time must be added to starting time. Light plant can be pulled into phase quickly as it's dominated by the remaining system.

If hydro has a continuous supply of water it can be used for base load. It starts immediately and ramps up quickly. It's an excellent power source and very versatile though scarce in Ireland.

It is an unfortunate fact the if you want to provide back up for an intermittent power source you have 2 choices. 1) Use high merit plant switching it on and off as required with the consequent high level of carbon emissions and high fuel cost. 2) use mid merit or base plant leaving it running continuously even when it's not required thereby wasting its fuel. It can idle but this still requires fuel.

The only other variables are wind power and demand. They don't co-relate. You can now see the problems in using wind power for grid electricity.

Most figures for wind power's reliability are given as averages. Now If you paid me 1,500 Euros on condition that I supply you with a 4 course meal 50% of days in 2011 and you had no other food at all for that year, could you manage. Well yes if I fed you every other day, but no if I fed you nothing for the first 6 months. You might be dead for the next 6 months.

There was no sufficient wind to generate power from 15/12/2009 to the 28/1/2010 and from 1/2/1020 to 24/2/2010. The billions already spent on wind turbines gave no contribution despite the fact that ESB bills sent a portion to wind companies.

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The national grid is powered by several generating stations using fossil fuel (thermal) and the power of falling water. Some nuclear power and thermal may be imported to Ireland. A generating station may have rows of generators, with rotor diameters of 6 to 15 feet producing currents at moderate voltage (current pressure) but with huge amperage (current volume). Direct current into the rotor can be supplied by a separate generator at the end of the main generator shaft (as opposed to most turbines which are fed by the grid). There are 3 or more phases (individual windings, arranged in sequence) in each. The way the field coils are spaced and the way the rotor poles are arranged, combined with the rotation speed, results in current which alternates from negative to positive at 50 hertz (times per second). 3 phase power is the most efficient for industry because "for self starting motors" it produces a continuous rotating field, but for domestic houses one single phase is adequate. There are periods (sinusoidal wave troughs) in alternating current, when no current is flowing. In practice, a 3 phase line is fed out to several houses and tapped for each house in a way that balances the torque to the generator. Wind power fed into the grid must be matched and this is hard to do. Inverters, trysisters and other electronic devices are used to do this, which use (waste) some of the turbines power. Operators at conventional power stations can control every aspect of their system – rotational power supplied to the generator - output of generator in relation to demand, etc. The wind is erratic and a huge amount of the turbine output is lost through sudden changes in wind gusts, gearing, brakes and curtailment. There is some compensation, because gusts will hit turbines at different sites at different time, thereby partly evening out the gust effect. Hugh Piggott, who lectures on small turbines, compared wind power to "riding a Gazelle" and to fuel power being "riding a horse". (wind Power workshop available from Camden Books). A 100% wind supply could never be used, power would rise and fall with wind speed, as would hertz frequency, it would damage most appliances. Factory motor speed would vary, so operators would have to vary their operations accordingly. Irish wind speed varies greatly throughout the day as weather systems sweep across the country.

As a crude example, say we have a farm cart designed to be pulled by 4 horses. One horse gets ill and we replace it with a donkey. The effect it to reduce the total pulling power by (one horse – one donkey). We therefore have to reduce the load. Otherwise the system won't work. Suppose the donkey turns out to be stubborn and continually tries to wonder off to eat grass. He cannot, because he is hitched to the other 3 animals that are too strong for the donkey to pull off course. Even if the donkey decides to become a passenger and just walk along, the other 3 horses will still pull ¾ of normal. However, if we replace the donkey with a large elephant, and that elephant decides not to co-operate, the 3 horses cannot stop him, he is too powerful and becomes the dominant force. An erratic power source can only form a small proportion of the total supply. Imagine an economy being dependent of the mood of an elephant, well there are those who would have our economy can dependent on the wind!

Readers may hear the phrase "inertia in the system". This means the phases of sinusoidal alternating current have a tendency to pull into phase naturally. This offers the least resistance. Where the majority of the system is in phase, it will provide the inertia to pull the minority into phase.

"Voltage is a function of the potential of the output to supply and the potential of the appliance to absorb. Place a voltmeter across the terminals of a tractor battery (engine stopped). It should read about 13.5 volts. Pull out the stopper

and run the starter so that engine turns without starting. Note the drop in voltage to about 11 volts. The voltage reading is a balance within the entire circuit. " (be careful it can give nasty burns).

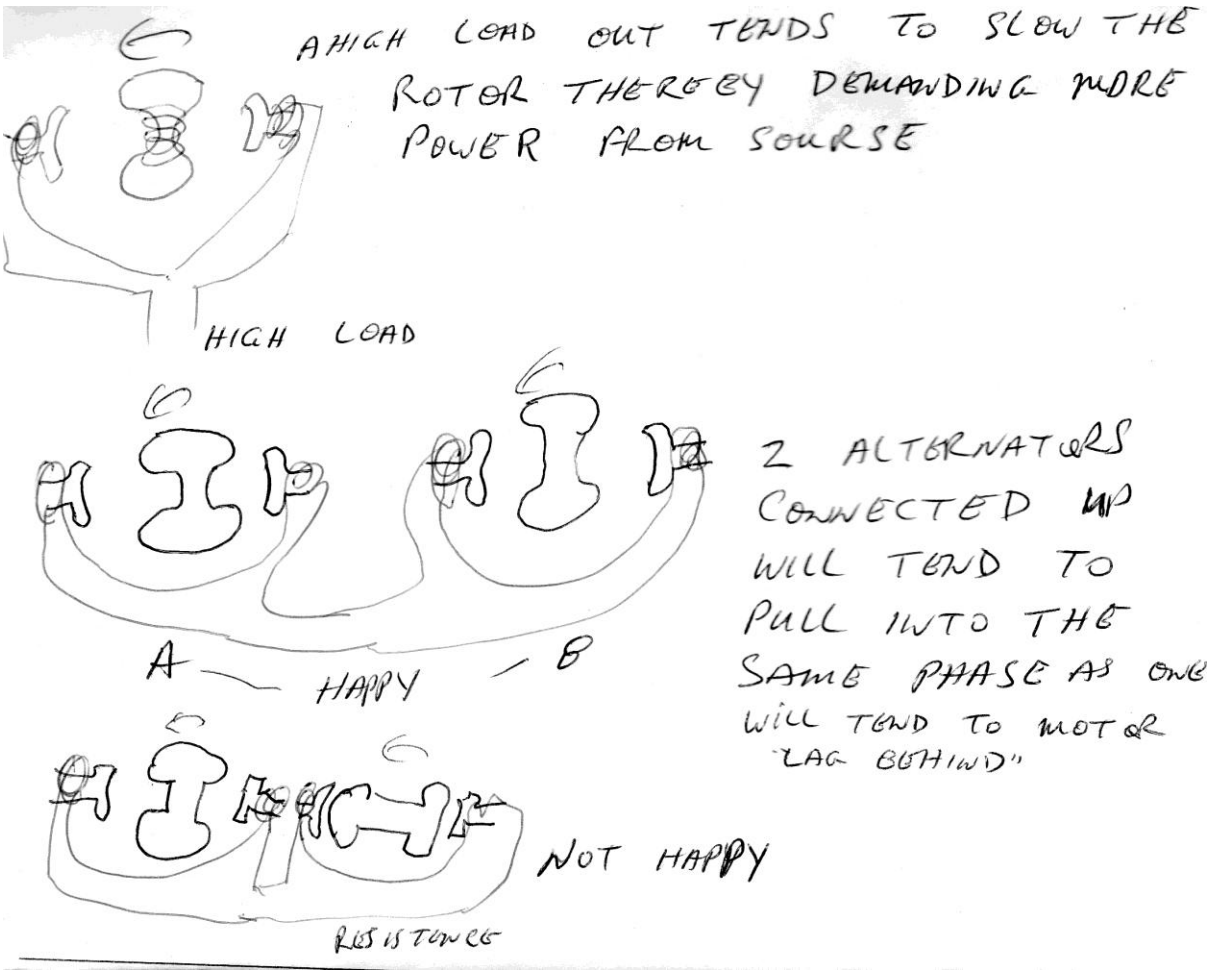


Fig 15

The term "watt" is the total power available for an instant, it's the strength of the output, like a boy lifting a weight to prove he can do so, watt/hours is the application of the strength for one hour. Like the boy carrying the weight for one hour, thereby working. An ESB "unit" is a kilo/watt/hour = kWh. (a small "k" is used). mW is 1 million watts or 1,000 kW, if applied for 1 hour its = 1mWh.

Traditionally a <u>generator</u> (dynamo) gives out direct current and an <u>alternator</u> gives out alternating current in vehicles. However, even power from vehicle alternators is converted into dc. Our grid uses mainly alternating current and in practice the machines may be called either generators or alternators interchangeably. Here, I use alternator for a/c & generator for d/c for clarity. Dynamos are obsolete nowadays.

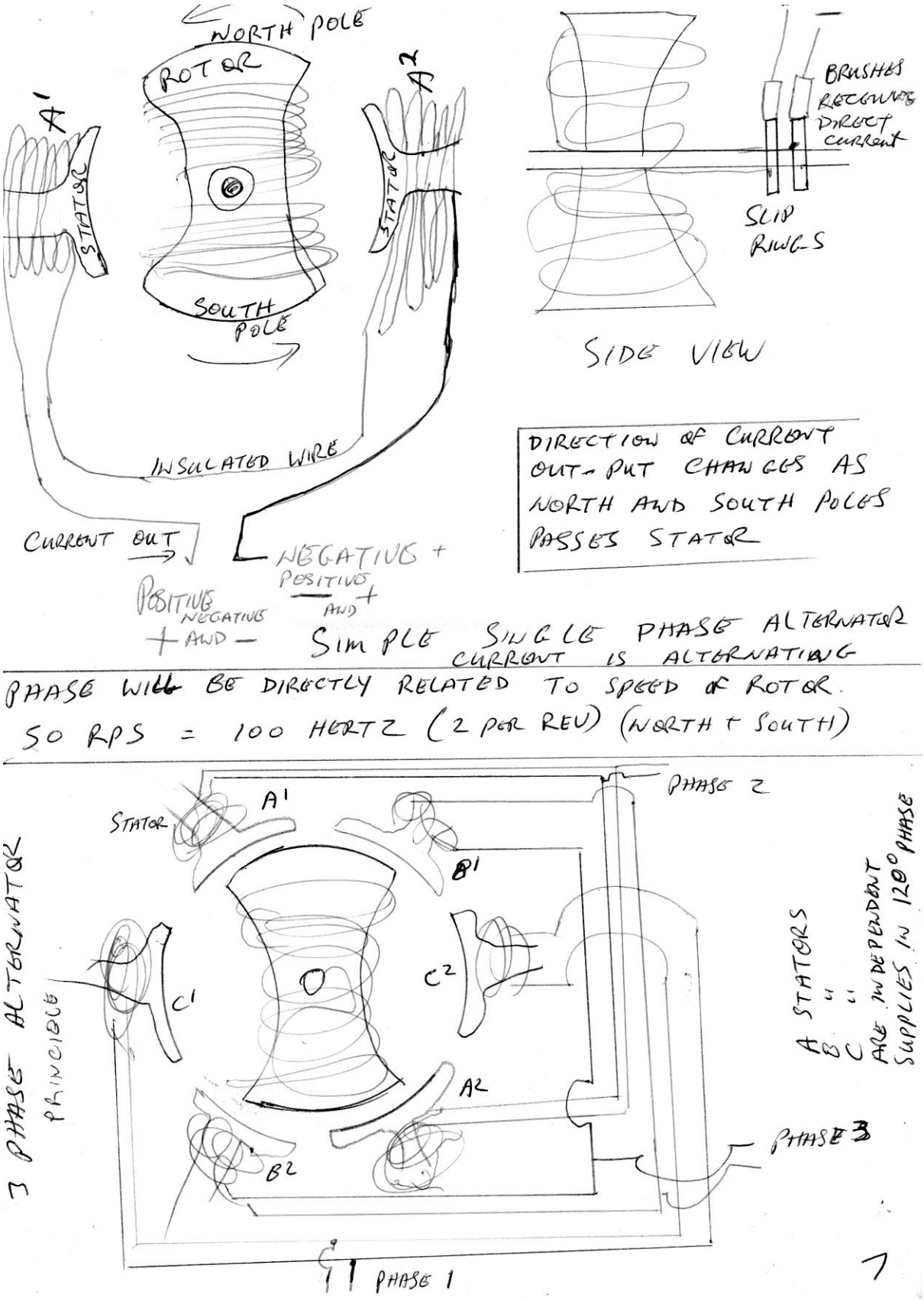


Fig 16: Nikola Telsa's polyphase principle of generation in 3 phase a.c output.

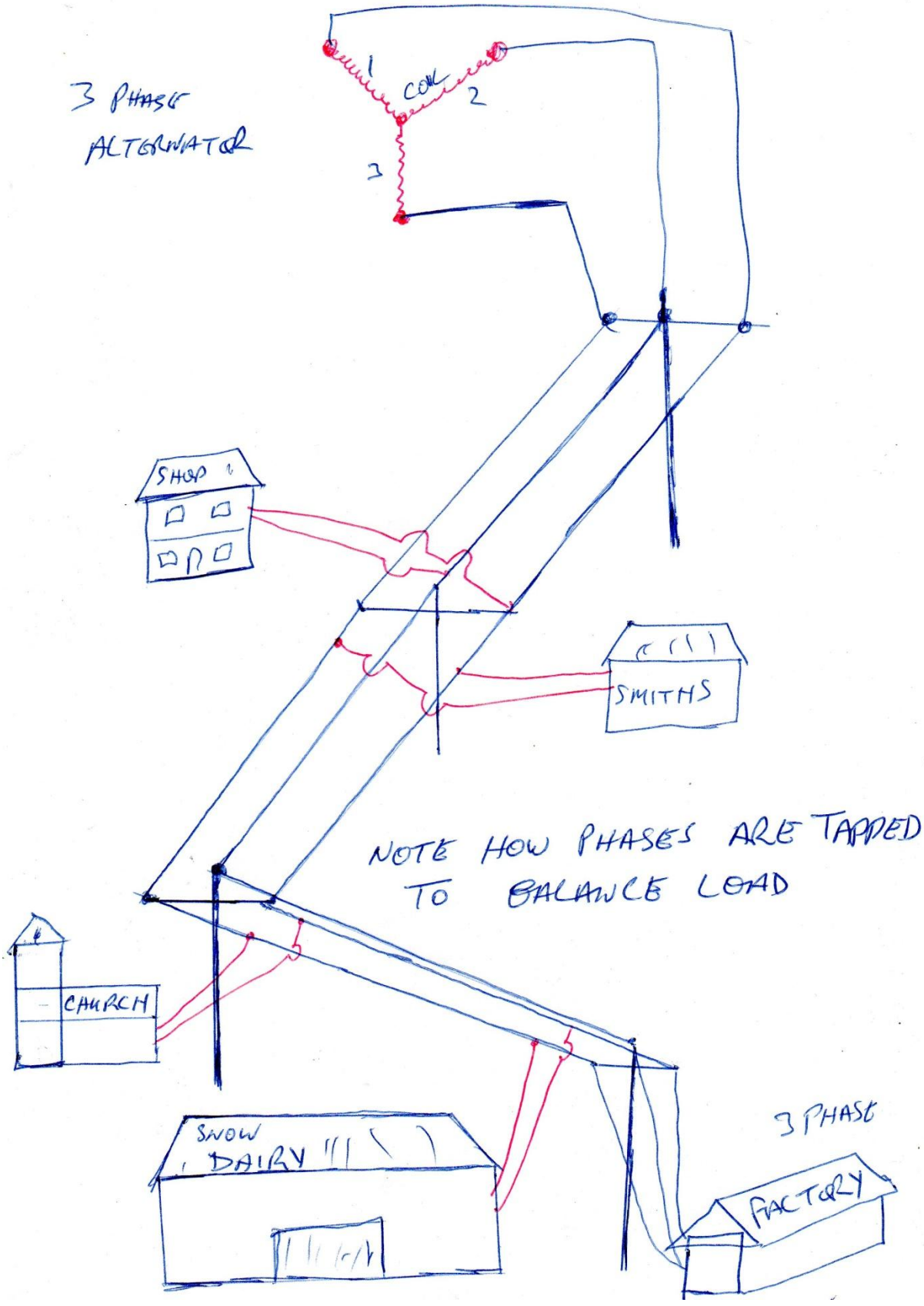


Fig 17, 3 phase power distribution.

Part 3

12) The Terms used to describe the workings of electricity generation.

Understanding these terms is key to deciphering all the jargon in relation wind power. It enables the reader to ask the right questions from commentators and to spot misinformation in the media. This is the most important chapter.

Load factor: No power plant will run at rated output continually. Faults, servicing etc mean there are times when output will be less than 100%. Load factor (capacity factor in the USA) is the actual output in a certain period (usually one year) expressed as a percentage of the nameplate output rating of that plant if it ran continuously during that period. With hydro it will be caused by water volume but with wind, it will be caused by stoppages and more importantly by the intermittent nature of wind speed. To clarify, if a turbine (in optimum wind) had a rated output or 1,000 kilo watts and an actual output of 1,000 kw and the wind blew half the year @ optimum speed and the other half @ zero, then the load factor would be 50%. On a completely calm day the load factor is 0%. A fault lies in the fact that few turbines actually deliver their nameplate value in ideal wind conditions. If they did, the load factor would be greater than it is reported, but the contribution would not change.

Base load plants either coal or nuclear tend to have load factors close to 95%. The concept is important when measuring pay back on capital spending on plant, if it's not used much it will be slow to pay back. If you use a lawn mower every week, you will most likely buy one, if you use an angle grinder once a year, you will most likely hire one.

Eirgrid's report of 2004 gave the load factor @ 35%. I wrote to them about it. Their 2009 report shows it reduced to 30.5%. It seems wind speeds are dropping. My figure is that the Load Factor based on wind speed only (not breakdown) is 24.1%, but based on Met Eireann's 30 year historic records it is 20%. A confidant within the industry tells me it 20%.

DUKES gives it for the UK at an average of 26% over 5 years up to 2008. (% total electricity supply based on 3401,671 GWh (DUKES 2008 table 5.5)(DUKES = Digest of UK energy supply)

The American wind energy association (AWEA) on their web site, plan for a factor of 30% in future, (amount of time there will be best wind). The historical figures are Britain 24.1%, Germany 14.7%, USA 12.7%, California 20%, Vermont 21% and declining each year. On-shore blades build up coatings of dead bugs and off- shore ones build up salt. However the biggest problem is the intermittency of the wind speed. My figure for the Irish load factor is 24.1%. I explain this figure later, but it means that a wind-farm only yields 24.1% of its optimum output.

Load factor actually is only a part of the equation in determining the contribution of wind. Whereas with conventional plant, breakdowns will not be at the same time, calm and storm conditions are. With conventional plant, breakdowns may be preceded by warnings just like a noise may warn you that your car may have a part needing replacement. But you can continue to get home. So there may be a warning that a base load plant's bearing is

getting worn giving time to start another cold plant. Hydro reservoirs can be measured and when emptying, other plant can be warmed up to replace it. Not so with wind.

Note that Load Factor is a simple % of the time wind give maximum output, not a mix of maximum and marginal. A turbine may turn 60% of the time and still have a load factor of only 25% because some of its production will be below optimum, but all power is included. i.e. Sunday 0, Monday 100%, Tuesday 50%, Wednesday 10%, Thursday 0, Friday 5% and Saturday 30% = 195/7 = load factor of 27%. The variety of terms use to describe Load Factor can make it difficult to pin down figures, but if the word "FACTOR" appears it is more than likely "Load factor"

Technically a privately owned diesel generator has a load factor. It is the % time it is used.

Average wind speeds can be misleading. Say on 1st March wind speed is 30 mph and on the 2nd its also 30 mph giving an average of 30 + 30/2 = 30 mph and a load factor of 100%.

Now say on the 1st April wind speed is 60 mph and on the 2nd its totally calm the average wind is 60+0/2 = 30 mph but the load factor is Nil as the turbines cannot turn either day.

"Reserve Capacity" There is a portion of demand which cannot be accurately planned. Power lines out from one power station may suddenly break down or a sudden cold night may cause people to turn on electric heaters. To cope with this, the ESB rely on "**reserve capacity**" of up to 20%. This plant is kept running along side base load plant but, the load is not applied unless and until an unexpected demand occurs. This reserve plant is then connected up (ramped-up) to cater for the extra load. If used 10% of the time, its load factor will be 10%, so it will be slow to repay its cost, compared with base capacity which could have a load factor of 95% and therefore pay back quickly. It is a type of prudent insurance against unexpected demand and gives us a very reliable supply admittedly at extra cost. If this reserve capacity plant is be kept running it will have a high merrit rating. Other plant will be left off and cold, but will be capable being started and ramped up in a short time to meet unexpected demand. It will use more fuel than low merit plant and is referred to as "mid merit plant". A plain diesel generator is high merit and a high emitter of co2.

Guess what the wind companies argue: *They say that as this capacity is already there, why not use it to take up the slack from wind, when the weather turns suddenly calm. In other words they want to steal our insurance policy. They pay nothing for the service provided, but get paid for their intermittent energy in full. So what is the result?*

Loughton M (2002) Platts Power in Europe. They made this observation:

> *"Regardless of the amount of wind power capacity installed, wind generation has no reserve capacity credit. It follows that the entire peak load plus reserve margin has to be covered by conventional plant as at present."*

"E.ON UK said: If the ludicrous suggestion for a total of 50GW from wind is implemented, we shall run head on into the paradox of needing nearly as much conventional capacity as of wind."

If the ESB are forced to give over their capacity reserve to the competing wind companies, they in turn have to commission more conventional plant to cover what their original reserve capacity was meant for. This plant may be high credit (more wasteful on fuel). This results in more fossil fuel being burned! Maybe you don't believe me: Well: Lumcoome energy claims to be a wind energy concern in Co Offaly. Guess what they are about to do first ? = Build a dirty gas fired power plant of 350 mW rating. The regulator will only allow them produce 100 mW and they are not happy. Of course if they are allowed to generate to full capacity, we the consumers will have to pay them for gas fired power we do not use, so that they can eventually bring their wind power along. (if you told that to an ass he would kick you! He - ha!) But the increased cost will mean cash starved consumers will have to turn off the heater in the cold or they will find themselves cut off altogether despite the fact that power is being dumped. And it gets better.

Term: Reserve Capacity or Capacity reserve. Look for the word reserve.

Installed capacity of wind is the maker's rated output of the entire countries wind farms in optimum wind conditions, with all in operation. (the manufacturers output rating is usually given, but I have already pointed out that turbines never actually achieve this output.

Penetration: Means the percentage of a particular form of plant in the system. When renewable power and wind power are being discussed it can be taken to apply to that form. i.e Wind penetration = 15%, then the official nameplate output of all wind turbines installed amounts to 15% of total capacity. (Load factor is not taken into account). Coal = 40%, gas = 30%, peat = 15%, hydro = 10% and wind = 5% total 100%, then wind = 5%. (figures for example only)

This is what Eirgrid have to say: (see their report page 37.) In the last number of years there has been a rapid increase in installed wind generation. Installed capacity has grown from 145 MW at the end of 2002 to 1167 MW at the time of writing. There is also a further 1348 MW of wind generation committed to connection.

Capacity Credit (firm capacity and secure credit in the USA) is a term is used to describe how efficient one type of generating plant is at replacing another. It is defined as **"the amount of one form of plant that can be shut and replaced by another without making the system less reliable" it is expressed as a percentage of the plant doing the replacing.** If the ESB install new gas generator of 100 mw and it is very reliable it could replace 100% of other plant in the first year, but as it gets older it might only replace 70% of other plant, in that case it's capacity credit would be 70%. I would sub divide it into temporary and permanently shut of down plant, but this is not done in the industry. As we have no nuclear power and just a little hydro, this country's electricity has been powered by various types of fossil fuel (thermal). I'll refer to our power supplier by its traditional name "the ESB". The first thing they need is a base

supply which underpins the basic everyday demand. They know that at 4am Tuesday morning, 1,500 mW is normally demanded and at 3pm on Friday evening , 4,000 mW is demanded. They ensure that their base supply is matched to this. Base generation requirements are predictable and is usually supplied by heavy plant with slow start and ramp-up times and slow cool down times, which are kept running over long periods. When kept running constantly, this plant is very fuel efficient and a low co2 emitter. Because this type of plant is slow and expensive to start up and stop, it is referred to as "low credit plant". (it is not good at replacing erratic wind which may stop blowing suddenly). Start up time is the time it takes to go from cold to ready to generate, ramp-up is the adjustment time to match the plant to the existing grid balance. Low credit plant cannot be started and stopped without the huge expense incurred in fuelling start up. (think of it as a steam locomotive).

Capacity credit for wind, is "the amount of conventional power plant that can be shut down to be replaced by wind power without making the system less reliable." If all wind farms delivered 100% continually, their capacity credit would be 100%. Note that it is not a percentage of the total capacity available to the consumer from all sources (which would be more objective in my view), it uses the rated (theoretical) installed wind capacity in optimum wind as the base of 100% and tells us what percentage of that capacity in conventional plant that was shut down. *Therefore if a system's total wind capacity were 2,000 mw and conventional capacity were 8,000 mw and the wind enabled 1,000 mw of conventional plant to be shut down, credit capacity would be 50%. However the contribution of wind would be 50% x 25% = 12.5%.* It has never been measured to date because, you would have to measure an ideal constant demand over a period with no wind farms and compare this with a similar period after wind is added. There are so many variables that it is very difficult to measure short term, however it can be estimated over a long period, and it has been.

The main factor in wind capacity credit is the intermittent nature of the wind. The way I tend to look at it is to see how much conventional power stations have been shut down permanently after wind penetration. **(The answer appears to be none!).** Others will argue that if you shut down thermal plant temporary, that counts as a saving on co2. Attempts have been made to measure capacity credit. German power companies put the figure at 6%, but likely to reduce to 4% if wind capacity is increased. (2005 press release from Martin Fuchs concerning wind energy there). (note this is % of total installed wind capacity, not total generation capacity from all sources.).

Malcolm Wicks in response to a parliamentary question in Britain asking about how easily new generating plant could be started and stopped, did not include wind energy at all in his answer, which tends to confirm what I would suspect: wind energy has little or no capacity credit itself. Wind energy proponents say these considerations are myths. All I ask of you is that you think about it in an open fair manner and decide for yourself.

(Note capacity credit is sometimes referred to as firm capacity (us) or secured capacity.)

Credit capacity when applied to wind generation, is the amount of conventional generating plant which can be shut down and replaced by wind generation without endangering supply. 2 issues affect it. 1) Installed wind X wind load factor. Say conventional capacity is 5,000 mW and wind is 500mW. A 24% Load Factor allows 20% conventional capacity to be shut down. 500 x 20% = 100 mw. As wind is 10% of the system, 20% x 10% = 2% of total installed capacity. Wind forecasting is a help, but wind can still drop off suddenly and equally importantly, if a good strong wind turns into a gale, the turbines must be suddenly shut down. The common tread running through Eirgrid's and foreign reports is "At low levels of penetration, contribution for wind tends towards the Load Factor, but as the penetration increases the contribution moves towards the credit capacity". Most reports (including EirGrids 2010 report) go on to say that as penetration increases saving in other plant generation falls.

"The next bit is very important" go and get a cup of coffee to settle the nerves! But swallow before reading the next piece! (health and safety act)

On the 4th June 2008 the Guardian carried a report from E.ON UK, the English subsidiary of E.ON nertz in Germany. They say that if the targets for renewable power relies on wind, conventional capacity in the UK will have to rise from 76 mW to 120 mW. (presumably with a corresponding increase in emissions!)

The Uk's Energy Research Centre admitted that some conventional plant will not be shut down during high wind, instead it will be left running thereby reducing efficiency.

I said 2 things effect credit capacity, but nothing about wind is that simple. It is an open question as to how much wind energy a system can accommodate at any given time. I know the definition includes "without making the system less reliable". High wind penetration does not appear to be in place any where yet, but as penetration increases problems may arise. I simply do not know the answer, only to say that a certain amount of inertia must be maintained to preserve frequency. Eirgrid's 2010 report accepts that some wind must be curtailed but that this will cease to be a problem with higher levels of penetration, but I would have thought high penetration would have made matters worse, because there will be increasing levels of erratic power. One question I am grappling with is can thermal plant be brought into service to control wind if the combined output exceeds supply? I think this is relevant because the plans to increase thermal capacity and import power contain an unknown risk, viz: what happens is demand does not increase. What happens the extra capacity or do they intend to generate it anyway and dump it to a heat sink? If they are found out to be dumping power to a heat sink, I believe it would lead to a public outcry. Denmark exports it as a loss at the expense of the Danish consumer. (see paragraph on Denmark)

Here is what Eirgrid have to say at page 24 of the 2004 report.

"However, it is an unfortunate fact that the contribution to adequacy of additional amounts of wind decreases progressively and tends towards zero. Consequently, the incremental capacity credit of increasing Wind Penetration Generation (wpg) tends to **zero.**
With increasing amounts of Wind capacity the total plant rises significantly but the amount of non-wind plant only falls off by a relatively small amount. In fact the amount of non-wind plant reaches a saturation level. The result is a rising level of 'excess plant'. Stated another way the capacity credit for WPG rises more slowly with increasing amounts of WPG and tends to saturate. This effect is illustrated in Figures 17 and 18.

Excess Capacity Required

Note that word "ZERO" that's what we will have left in our pockets when they are done.

Before leaving my favourite subject "Capacity Credit". Remember read the follow short paragraph.

13) Security or supply

On the 1st March 2005m the Spanish Grid operator Red Electrica Espanolia, cut off supply to 300 heavy electrical users. A drop in wind reduced the output form Spain's supposedly 11,000 wind mills to 700mw. It was a very cold day and the operators had allowed the reserve capacity to go out of commission. Since 2002 Spain has been investing heavily in Gas Plants.

Uncorroborated news I heard says that on a day in February 2008, output from Texas's windmills fell from 1,700 mw to 300 MW out of a wind installed capacity of 4,000 and a running demand of 35,000mw. Cold weather resulted in an increase in demand and they cut power to "interruptible" customers. I wonder are our government now compiling a list of "interruptible customers"? I wonder will the names on it be those of the well off and members Dail Eireann, or will it be bankers, maybe it will be the poor and less well off?

I didn't have time to check this interruption out by the time of going to press, perhaps readers could check it out. If I am wrong, I apologise.

On the 4th November 2006, 15 million consumers connected to the Union for Coordination of Transmission of energy (UCTE), a major grid spanning for Portugal to the Balkans were blacked out. The first thing to trip out was wind power @ 40% followed by 30% of thermal. Remember the piece I wrote about frequency and inertia in the system. Well when they tried to stabilise the situation by bringing conventional plant into line, they could not disconnect the wind which was outside operator's control. The wind that had tripped out soon tripped in again causing headaches and a huge geographical imbalance. A report from the Transmission systems operators, concluded:

> "The negative role of wind of wind generation performance on the 4th November was obvious, Due to uncontrolled behaviour of wind generation, it was not possible to maintain a sufficient power exchange balance in some German control areas." (Transmission systems operators report) 2006.

In plain man's language, this means that they tried to bring the power and frequency back up to resume supply and to do this they wanted to cut out the wind power temporarily until the thermal plant was back to normal, however the wind automatically tripped in as it was programmed to maintain output and profit, making it impossible to restore power that day. Remember they had vast grid interconnection. Do not allow the pro wind lobby to claim the answer to Irelands black out treat is greater interconnection. In this case they had great interconnection. Even with interconnection with the UK, that same UK is facing the same treat as us, so a break down there would cause black outs here. In this case the media used the term **"Brownout**" don't know what that means, I think it's a term to describe being in the dark as a result of a green energy failure as opposed to that awful dirty thermal failure that causes a **blackouts**! It's a sort of politically correct term for a **"renewable blackout."** Ha Ha.

Contribution from wind.

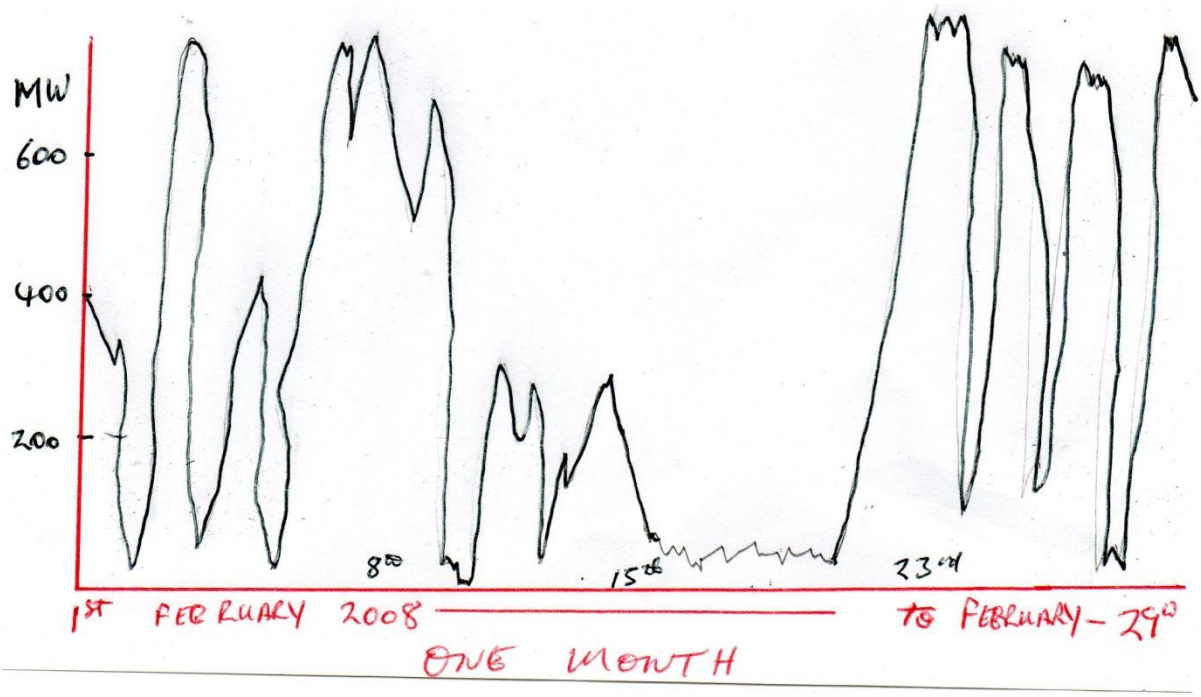


Fig: 17: Daily output from Eirgrid's wind power for February, 2008. Note the massive swings on the same day in some cases of up to 70%. Imagine trying to maintain supply without back up plant. Source: A Tubb and Campaign to Limit Onshore Development. (CLOWD).

I cannot provide a graph from mid December 2009 to the end of February 2010 because there was virtually no wind to record.

Believe it or not, there is no term to describe what the actual contribution for wind is! I now beg to inscribe a definition. First let's see why we are building wind farms. The reduce our dependence on imported fossil fuel and to save on the emission of harmful gasses including CO2. Therefore describing it as the amount of electricity generated does not cover this aim, nor does citing the total installed capacity, nor the load factor, not the capacity credit. The amount other plant shut down seems to fit, but is the shutting down of hyro power reducing emissions? I think not. As nuclear is considered harmful I think it is fitting to define winds contribution in terms of the amount of thermal plant shut down. My definition is as follows: "*The contribution of wind in a system is the amount of thermal fuel that would be burned without wind penetration less the amount of thermal fuel used with wind penetration, expressed as a percentage of the amount of fuel burned with no wind in the system for a given amount of units consumed.*

Example: 7,000 units of electricity sold in 2012.

With no wind, 2,000,000 units of thermal fuel would be burned.

With wind, 1,800,000 units of thermal fuel is burned.

Saving 200,000 units or 1%, therefore the contribution is 1%

I hope readers will agree this gives an objective reading, but there is a simpler method of arriving at it, maybe not so scientific, but near enough. Just take the credit capacity and multiply by the % of wind. Capacity credit 10% and penetration 8% 10% x 8% = .8%.

All other measurements are misinformation or spin.

14)Ballyhill.

A fictional village community in Ireland. There is a pub, a post office, a convenience store and filling station, 3 farmers (one dairy), 10 homes, a small firm making tables and chairs from wood, a small engineering shop doing welding, a small day care centre, 2 churches, a school and street lighting. They decide to build a power plant to provide all their power and dispense with the ESB altogether. A survey reveals that their requirements vary all the time, the lowest demand being at night 3.5 kW and the highest in the mid-afternoon. They vary at times of the year and weekends etc. However careful analysis clearly shows that over the last 10 years the maximum demand was 1,000 kW, = 1 MG, happening in mid winter, Friday before Christmas at 3pm.

If they buy one 1,000 kW generator they will be burning excess fuel at times of low demand and won't be able to shut it down for maintenance. A number of generators will allow them to diversify, carry out maintenance and adjust supply to demand more accurately.

They decide to buy 4 generating units as follows:

a) 40kW diesel unit (immediate start up time) (65% fuel efficient)
b) 190kW diesel unit (needs 10 minutes start up + ramp up to operating temperature)(70% fuel efficient).
c) 220kw (for economy and emission reduction reasons this uses a mix of (20% tractor vaporising oil, 50% diesel and 30% heavy oil (cheap left over's from refining). Start and ramp up (getting ready to generate) time is 30mins. (75% fuel efficient)
d) 550 kW generating set designed for continuous use and which must be started and ramped up for 3 hours before power can be produced. The fuel is half the price of diesel and gives off fewer emissions. During mid winter, early December, January and February this plant will be left running continuously, but during bank holiday weekends when industry is closed, a combination of the other 3 will keep things going without it. (Note in the real world very large plant is kept turning over when out of use to prevent warping of the very large shafts and bearings . It's 80% fuel efficient.

Old TVO tractors had to be started on petrol to get the vaporizer up to operating temperature, this usually took 10 minutes. Steam train locomotives take a long time to get up steam and grid generators take time to start and ramp up. They are most efficient when kept running. It's a bit like having a meal, the most wholesome meal takes more time to prepare.

Getting back to our village, the plant is chosen by me to emulate (in a small way) the grid supply. Now let's look at the choices this arrangement will give, with all alternators situated in one building off Main Street. Various combinations are used to give a wide choice of output.

(Airgrid uses the term perfect credit generator, this is an ideal (unrealistic) term for a generator that is totally reliable, never needs maintenance, uses a precise quantity or fuel. It provides a marker (or base line) to compare other realistic units to for the purpose of compiling data and making forecasts).

Ballymagash's generation power output levels by selective introduction of plant.

Output	Plant in use	Start up time	close off time	Fuel used to start and stop
40	(a)	nil	nil	Nil
190	(b)	10mins	Nil	quarter litre
220	(c)	30mins	20 mins	3 litres
230	(a +b)	10 mins	Nil	quarter litre
260	(a + c)	30 mins	20mins	3 litres
410	(b + c)	30mins	20mins	3 litres
450	(a+b+c)	30 mins	20 mins	3 + quarter litres
550	(d)	3 hours	90 mins	15 litres
740	(b+d)	Do	Do	15 + quarter litres
770	(c + d)	Do	Do	18 litres
780	(a + b + d)	Do	Do	15 + quarter litres
810	(a+c+d)	Do	Do	18Litres
960	(b + c + d)	Do	Do	18 + quarters litres
1,000	(a+b+d+d)	Do	Do	18 + quarters litres

Start and stop fuel produces no power. Generating plant on the national grid a requires start up and close down time and also bringing them into line with the rest of the grid called "ramping up" in the industry. This can take 8 hours for fossil fuel and 24 hours for nuclear. (hydro is near immediate)

Now! The Ballymagash Power people are ordered by government to incorporate a wind turbine into system. Now let's look at what happens for various proportions of penetration by wind.

The erratic nature of the wind means that penetration must remain below a defined proportion of the total capacity of the system. In this case, I give a figure for that of 22%. It's the best I can come up with, it appears to be less for national grids in general, but I am open to correction on this.

While the conventional capacity is static at 1,000 KW, the demand is variable over time, so the chart gives the demand from the system. Producers cannot force consumers to take power they do not want! But they can force us to accept black-outs.

The amount of wind energy admitted into a system, is called "penetration" and is expressed as percentages the total power being supplied to consumers.

Percentage wind penetration	Demand % conventional at Full Capacity	Demand % Conventional at 3 quarter Capacity	Demand % Conventional at half Capacity	Demand % Conventional one quarter Capacity	Demand % Conventional one eight Capacity
5%	5%	6.6	10%	20%	40%
7.50%	7.50%	10%	15%	30%	60%
10%	10%	13.30%	20%	40%	80%
11%	11%	14.60%	22%	44%	88%
15%	15%	20%	30%	60%	120%
20%	20%	26.60%	40%	80%	160%
22%	22%	29%	44%	88%	176%
30%	30%	40%	60%	120%	240%
40%	40%	53%	80%	160%	312.50%

Fig 19, Wind penetration as a percentage of total wind/conventional generating system.

Yellow area is within what wind can be accommodated being under 22% of total.

Orange area is above what can be accommodated and will require extra conventional capacity to accommodate it. It changes with demand.

To explain: Say is a good windy day and wind penetration is 20%. This can be accommodated if demand requires conventional output in the order of full or 3 quarter capacity. If lower demand causes conventional output to fall below this (say half) the penetration level will rise to 30% which cannot be accommodated in a 22% system. If such a penetration is forced on the system, conventional generation must be increased until penetration stands at 22%. To figure how much see next paragraph.

To establish how much conventional capacity must be increased we take the proposed percentage of wind penetration. Say it's the previous example of 30% up from 22%.

New penetration less previous accommodated penetration multiplied by 100 divided by original penetration. So (30 – 22) = 8 x 100/22 = 36.36% increase.

Now to put this in plain man's language. This system cannot accommodate wind penetration above 22%. By dividing 100 by 22 we find that for every 1 percent of wind we need 4,54 of conventional generation. So just find the extra wind penetration and multiply by 4.45. This can be applied to any figure. **The problem is the extra power is not wanted.**

The present Green party is aiming for a wind penetration of up to 40% by 2020. So we need to know what penetration the present grid can accommodate. Capacity was 5,000 mw up

to recently. So say penetration is 20% and its working ok. So (40-20)x 100/20 = 100% of increased conventional capacity – 5,000 + 5,000 = 10,000 MW or double output. Note this formula, it can easily be applied to any figure. On the first Thursday in January 2010, the demand on the Irish grid reached an all time high it reached 4,952 MW. The grid people performed well to meet demand. It was frosty and calm so there was little contribution from wind. It shows that existing thermal and hydro plant is just about right at present and no investment need be made on increasing capacity. (they may need replacing, but that is a different matter). I do not have the figure for present wind penetration, but let's assume its 8% @ optimum wind. What happens if the grid is forced to take a penetration of 40%. Grid capacity would need to be increased to 10,000mw and wind to 2,000 mw. This extra power is not wanted.

As there are no more sites for Hydro, the increase must be from thermal or nuclear (but say thermal for now). Should the wind be blowing at 33 mph some day and the minister's orders are to be complied with, the whole conventional plant must be put running: 10,000 MW so that the wind can be accommodated @ 40%. (20% is the most that conventional plant will accommodate) 10,000 + 2,000 = 12,000 MW. But the max we need is 4,952MW. So 7,048 must be disposed of. It can be sent to a heat sink which wastes it at high cost in which case the fossil fuel to produce it is also wasted and the extra carbon dioxide is sent into the air needlessly. Now bear in mind that this assumes that the optimum wind coincides with maximum demand. If demand is only half, then 75% of the thermal power and half of the wind power must be dumped. Now I am so glad to have gotten through all that and I must thank you the reader for your patience. Don't get bogged down in the figures, they are here for proof.

After I wrote the above, I took a look at Eirgrid's 2010 adequacy report. There is a remarkable closeness in their projections.

Eirgrid's projected increase in dispatchable (conventional) generation plant 2009 - 2015. Figure 1.2 page 8

Year	Year
2009	2015
Capacity	Capacity.
6,000	9,800

On figure 3-5 on page 26, they forecast peak demand from 2009 to 2016 to never exceed 6,000 mw.

Eirgrid's report is difficult to make sense of. It is produced in Industry Speak. For one thing is deals with a market moving from one restricted to the Republic Of Ireland to an All Ireland one. So the goal posts are changing.

Figure 4.4 on page 39 gives the historical wind generation of wind generation expressed as a percentage of total generation in the year in question. The best year's harvest was 2008 when the percentage was 8.8. What they do not say is what that 8.8 is, but reading it carefully it appear to mean that off all the power generated , wind generated 8.8%. I would ask, 8.8% of what. It does not appear to allow for the fact that conventional capacity had to be kept up and running in case the wind died down and there

was a storm, nor did it take account of the fact that extra plant may have to have been kept running to balance the wind and provide inertia.
If total conventional capacity was say as near (as I can find to the real thing) 5,800 mw + 700 mw wind = 6,500 mw. The 8.8 %= 572 mw for wind seems great. What was the credit capacity for that wind? How much conventional plant was shut down. The report says at page 42 that for forecasting the transmission peak it is assumed the contribution from wind is zero.

A factor in all of this is hydro. Water backed up in dams turns turbines to produce the cleanest, fastest, cheapest power known. It can be turned on and off immediately with no start and little ramp-up delays. In theory it makes wind power more feasible because sudden drops in wind can be met by turning on the hydro while the fuel plant warms up. If only it were that simple: Hydro is a major cost saver in a "no wind system". It can be used constantly with a small reserve to fill in for ramping-up of fuel plant in cases of unexpected demand. With increased wind penetration, hydro is diverted to trying to smooth out the winds erratic performance, thus depriving the conventional grid of its wonderful "stop/go" facility. It's loss means more plant must be kept steamed up resulting in greater costs, emissions and waste.

The same occurs in our fictional village of Ballhill with a 22% accommodation of wind. For every 1 % of extra wind, 4.54 % capacity will have to be added to their plant. But their plant is just ideal for purpose, it is finely adjusted and uses the minimum fossil fuel possible. It's a 1,000KW plant, so to increase wind penetration to say 35% will require an increase of 39% to 139 KW. Think of the cost of that, and the fact the existing 1,000kw is only needed for a few weeks per year and it is plain to see that they are either going to have to sell the excess off or dump it to a heat sink. The co2 emissions will also increase. Airgrid accept that at a certain point the financial advantage of wind penetration falls to zero. From where I am, it appears that wind can save a little fuel, but as the amount increases, it goes to zero and then it uses more fuel than with no wind. Those who dispute this, should read the section on Denmark, it's happening there and Ireland is heading in the same direction. Who is going to pay for the extra grid capacity and the extra fuel to run it?

On a U-tube video clip Eddie O'Connor of Airtricity says that the answer is to join up all of Europe's conventional grid, presumably at the expense of someone other than Airtricity to which I say "the European grid is no more immune to the vagaries of wind than the Irish one.

United Kingdom Energy research Centre 2006 (costs and impacts of intermittency) Had this to say: Try singing it, it make a lovely song. "Wind power means that the output form fossil fuel plant needs to be adjusted more frequently to cope with fluctuations in output. Some power stations will be operated below their maximum output to facilitate this. Extra system balances will be needed. Efficiency may be reduced as a result"

Pity I am not a poet, if I were I would write it like this.*:* *"The wind blows high and low each day,*

Playing havoc with the sockets,

They burn extra diesel oil,

To empty out our pockets."

Sorry for being flippant, but its is getting to be a laugh at this stage.

On the BBC programme If .... the lights go out in 2003, Dr. Helm Energy Economist and Fellow in Economics at New Oxford College said about wind power:

- What we know is the wind blows about 35%, perhaps 50% of the time. *(in Ireland it does not, my quote)* So the paradox with building windmills is that you have to build a lot of ordinary power stations to back them up and those are going to be gas fired. That's what is required. When asked who is making sure there is enough gas out there to back the windmills, the good lady replied "nobody".

That is what the lady said given a load factor of 35% - 40%, here Eirgrid agree to it being 30.5% and I claim it's a little better than 20%. This explain our government's plans to build more and more gas plants. It's like buying a dog and then having to bark yourself!

Part 4

15) Pylon Protests: A man I know said he would rather have turbines beside him than pylons. The pylons he speaks about is the Tyrone/Meath interconnector running near my place. It's in the planning stage as I write. Of course joining up Ireland North and South makes sense, but it is not essential. We did ok up to now. Where it helps is that we a small nation can but in reserve capacity from the North and England when demand rises unexpectedly. In this way we avoid the cost of leaving reserve plant running here. But it works both ways, and the UK may use our reserve capacity also. It boils down to the same thing. The interconnector it favoured by our government for the following reasons:

1) It leaves us less vulnerable to strike action by unions in the power plants.
2) It leaves Northern Ireland and Britain marginally less vulnerable to strikes there.
3) In a time of fuel scarcity, power could be exported/imported (this is likely only to last for a short term as emergency supplies will be needed at home).
4) The extra capacity could be called on in the event of a sudden rise in demand or drop in production here.
5) It allows us to import nuclear power without the hassle of producing it ourselves. (An Irish solution to an Irish problem).
6) It allows for greater competition as more players enter the market from the UK and Europe.
7) It is in keeping with the governments green policy dictated by the wind industry. Viz: continually expand the grid so that the fact that wind provides little of no energy can be hidden from the media and public.

Ask any wind proponent what he thinks about greater integration or the European electricity grid and he will be strongly in favour. The fact is that we could live well without it and the headlong drive for wind is a factor (though not completely) in its objectives.

16) Carbon Emissions.

Can wind power cut carbon emissions?

The question coming to mind now is "could it be that increasing wind power actually increases carbon emissions instead of cutting them"? It would be astounding if this were the case. Eirgrid's web page on the impact of wind on the grid suggests that as wind penetration is increased, saving on emissions decrease. The principle of diminishing returns applies. Emissions are cut only if the penetration by wind allows the grid to cut back on burning fuel. Even the industries own commentaries are vague on this. It does not appear to be the case in Denmark to date. If the grid cannot shut down more plant and let wind take over, then what's the point of having wind at all? Add the start and stoppages and the ramping up and down and it makes one think. The industry appears to say that new wind forecasting techniques will allow time for the orderly variations in fossil output, which appears to be an admission that emissions are not cut at present. Can the grid state, that given present penetration, what is the emissions saving in 2009?. If wind causes more fuel to be burned, then there cannot be a saving and the whole green side of wind is questionable.

An 85 meter turbine has 750 cubic meters of concrete in the base. Wikipedia state that the co2 emissions for cement it .9 by weight produced. @25 cements sand mix that equates to 187 tons of co2 to the atmosphere per turbine. The figure for steel is not to hand.

12) Transmission over long distances.

Explains why conducting wires act like a bar electric heater. Power is lost through resistance/heat. This can be reduced by rising voltage, but not eliminated. Intense power needs to be imputed to drive up voltages.

Thomas Edison set up power stations in the US, using direct current dynamos (*generators which switch alternating "ac" current to direct current "dc" by means of brushes on a commutater*) which could be stored in batteries. The voltage supplied was as it left the generator which was comparatively low. A generating station was needed every 2 miles, because even with heavy cables, the voltage dropped due to resistance at low voltages. The cable operates like a single bar electric heater, only not as dramatic. As the load increases the current in the wire heats it and the energy is lost through heat. Nicola Tesla, who worked with Edison, claimed that the answer was to use an alternator, providing alternating current on the polyphase principle. A transformer is an induction device using an input "primary" coil and an output "secondary" coil. ***It only works when the input current is varied, fluxed or interrupted***. This means that power transformers ***only work***

with alternating current which cannot be stored in chemical batteries. A current has voltage "V" (pressure) and amperage "A" (volume) which multiplied together give watts "W". A transformer uses the same induction process as a generator uses to change the voltage. The power in is the same as the power out, but the voltage can be changed. If the pressure is increased the volume is decreased and vice versa.

(Input = 2volts x 15 amperage is 30 watts = output 6 volts x 5 amps = 30 watts).

There is however a very useful application to this principle. If high voltage at low volume is transmitted through cables, the resistance is proportionally decreased. Therefore, an "ac" current at say 100 volts @ 5 amps (500 watts) will light say 10 bulbs at on site, but will power only 1 at 2,000 feet. If the output is fed into a step up transformer on site, rising voltage to 500 @ 1 amp (500 watts) and stepped down again at the bulbs to 60 volts @ 5 amps (300 volts (note loss in high voltage wires)), it will power many more, say 6 bulbs, depending on the wire.

This is the reason why ***ac*** current is widely used. It enables a generator in Cork to supply useful power to consumers in Letterkenny. There are limitations. Transformers waste much power through copper losses in the coils resulting in heat losses. "Eddy currents" act to oppose the transformer process and are countered by using laminated iron cores. They are not completely efficient in any case. It takes a lot of energy to drive 500 volts up to 500,000 volts and there are problems with arcing (jumping from + cable to – cable) (like the spark plug of a car). Even at high voltages, there are losses and the greater the load the greater the losses. Losses include the heat generated in the transformer's copper coils through resistance, Eddy currents operating counter to the normal current flow and the fact that no electrical devise is completely efficient, plus resistance in the wire cables. The laws of physics tell us that energy cannot be created, it can only be converted from one form say wind (disordered) to say electrical (ordered). The conversion process always sends energy into other sources such as wind to (electricity + heat + friction). Another example is a car engine (petrol to mechanical motion + friction in bearings + heat)

There are huge oil and gas reserves in eastern Russia which are pumped to the west. But why do they not generate electricity there and transmit it to Western Europe (several thousand miles distant)? The reason is that in the case of oil and gas, all of it gets through, but the electricity losses through heat resistance would result in only a small fraction of the power generated reaching the consumer. It cannot be done over very long distances, despite claims to the contrary. If it could, the Russians would do it. Even with the biggest fossil fuel generators possible, it is not feasible. What chance of doing it with feeble wind power. The idea that you can produce wind power in Italy and use it in Scotland is questionable. 1,000 x (100 meter diameter turbines) would only produce limited power over that distance because the input to the huge transformers needed would be too weak. Once the voltage is raised to a high level, the power can be transmitted reasonable distances out to 400 to 700 kilometres through heavy cables. Either dc or ac current can be used. In fact dc is best because there are no peaks or troughs (when current is zero). The proposed interconnector from Wales to Ireland will use high voltage dc to be converted back to ac for use here. It can be used to import and export power between both countries and imported power may include nuclear.

There is debate among technical electrical engineers about the feasibility of generating solar power in North Africa and transmitting it to Europe. Many (me included) claim that no more than a small amount would get through, due to resistance.

Something which can be done is to feed wind power from Italy into the Italian grid where it is used by Italians and feed fossil fuel power from Italy to France. France in turn feeds their power to London where it is used and London supplies Scotland. Sounds ridiculous! It is. Scotland ends up with fossil fuel power dressed up as wind power. The Danes have a huge wind turbine resource, they discovered that surpluses occur at night, so they export it at a knock down price, because nobody wants it.

(It just occurred to me, could the heat from power lines be a contributor to global warming? well after September 11, air temperatures in the USA dropped by 3 degrees due to the absence of jet emissions, but this was said to be water vapour)

17) Grid Power used by turbines.

This information must be estimated because wind companies do not allow it into the public domain. There is definitely grid power generated by fossil fuel supplied to all large turbines. Up to half of the total power produced by wind may be drawn from the grid to maintain the turbines. They take in dirty power and pump out clean power – power laundering -.

Large wind turbines require a large amount of energy to operate. Other electricity plants generally use their own electricity, and the difference between the amount they generate and the amount delivered to the grid is readily determined. Wind plants, however, use electricity from the grid, which does not appear to be accounted for in their output figures. I wonder is it even metered and charged for. The manufacturers of large turbines -- for example, Vestas, GE, and NEG Micon -- do not appear to include electricity consumption in the specifications they provide.

Among the wind turbine functions that use electricity are the following:

- yaw mechanism (to keep the blade assembly facing to the wind; also to untwist the electrical cables in the tower when necessary) -- the nacelle (turbine housing) and blades together can weigh 92 tons on a GE 1.5-MW turbine
- blade-pitch control.
- lights, controllers, communication, sensors, metering, data collection, etc.
- heating the blades -- this may require 10%-20% of the turbine's nominal (rated) power, very necessary in frost to prevent ice flying off the blades causing damage.
- heating and dehumidifying the nacelle -- according to Danish manufacturer Vestas, "power consumption for heating and dehumidification of the nacelle must be expected during periods with increased humidity, low temperatures and low wind speeds"
- oil heater (oil must be kept warm), pump, cooler, and filtering system in gearbox

- hydraulic brake (to lock the blades in very high wind)

- thyristors (to graduate the connection and disconnection between generator and grid) -- 1%-2% of the energy passing through is lost

- magnetizing the stator -- the synchronous generators used in most large grid-connected turbines require a "large" amount of dc electricity from the grid to actively power the magnetic coils around the asynchronous rotor on the generator shaft; at the rated wind speeds, it helps keep the rotor speed constant, and as the wind starts blowing it helps start the rotor turning, in the best wind speeds, the stator may use power equal to 10% of the turbine's rated capacity, in slower winds possibly much more – this is dirty power. (Note a car alternator provides its own current to the rotor (except start up), I cannot find out if a turbine does this.

- using the generator as a motor (to help the blades start to turn when the wind speed is low or, as many suspect, to maintain the illusion that the facility is producing electricity when it is not particularly during important site tours) -- it seems possible that the grid-magnetized stator must work to help keep the 40-ton blade assembly spinning. Spinning is necessary to prevent warping of the enormous blades due to unequal heat over their height. I have personally witnessed blades being turned in complete calmness.

It may be that each turbine consumes more than 50% or more of its rated capacity in its own operation over a year. If so, the plant as a whole -- which may produce only 24% of its rated capacity annually -- would be using (for free?) twice as much electricity as it produces and sells. An unlikely situation perhaps, but the industry doesn't publicize any data that proves otherwise; incoming power is apparently not normally recorded. The grid may charge for it, but the emissions are still released. I cannot discover if the grid charge for power fed to turbines.

Is there some vast conspiracy spanning the worldwide industry from manufacturers and developers to utilities and operators? There doesn't have to be, if engineers all share an assumption that wind turbines don't use a significant amount of power compared to their output and thus it is not worth noting, much less metering. Such an assumption could be based on the experience decades ago with small DC-generating turbines, which were yawed by a rudder, and do not require heating etc. However mistaken such an assumption might now be, it stands as long as no one questions it. No conspiracy is necessary -- self-serving laziness is enough. There is definitely no Irish journalist capable of getting his /her head around it.

Whatever the actual amount of consumption, it could seriously diminish any claim of providing a significant amount of clean energy. Instead, it looks like industrial wind power could turn out to be a laundering scheme: "Dirty" energy goes in, "clean" energy comes out. That would explain why developers demand legislation to create a market for "green credits" -- tokens of "clean" energy like the indulgences sold by the medieval church. *i.e carbon trading.*

One need only ask utilities to show how much less "dirty" electricity they produce because of wind-generated power to see that something is amiss in the wind industry's claims. If wind worked and is not mere window dressing, the industry would trot out some real numbers. But they don't. I suspect that they can't.
Proponents claim that these turbines begin producing energy at 5 m/c 12 mph, the ones I observed do not stop even at wind speeds of 2 to 4 mph. They never stopped between 16th December 2009 and 18th February 2010 right through all the calm frost. There kept going making noise too.

An observer in Toronto, Ontario, points out that the blades of the turbines installed at the Pickering nuclear plant

and Exhibition Place turn 90% of the time, even when there is barely a breeze and when the blades are not properly pitched -- in a region acknowledged having low wind resource. (I have made a similar observation at Mountain lodge and Gartnaneane wind farms.) The ones at Gartnaneane were rotation on the evening of the 4th February 2010 when there was dense fog all around. One was making noise like an engine. Wind speeds in the hollows were 0 but were about 3mph (beauford scale) at turbine height on what is a good site wind wise.

In large rotating gear trains such as these, if allowed to stand motionless for any period of time, the unit will experience "bowing" of shafts and rotors under the tremendous weight. Therefore, frequent rotating of the unit appears necessary to prevent this. As an example, even in port Navy ships keep their propeller shafts and turbine power trains slowly rotating. It is referred to as "jacking the shaft" to prevent any tendency to bow. Any bowing would throw the whole train out of balance with potentially very serious damage when bringing the power train back on line.
"In addition to just protecting the gear box and generator shafts and bearings, the blades on a large wind turbine would offer a special challenge with respect to preventing warping and bowing when not in use. For example, on a sunny, windless day, idle wind turbine blades would experience uneven heating from the sun, something that would certainly cause bowing and warping. The only way to prevent this would be to keep the blades moving to even out the suns exposure to all parts of the blade.
"So, the point that major amounts of incoming electrical power are used to turn the power train and blades when the wind is not blowing is very accurate, and it is not something the operators of large wind turbines can avoid. Using the farmer's common sense rule, this has to be correct.
In addition, there is the likely need for a hefty, forced-feed lubricating system for the shaft and turbine blade assembly bearings (like a car engine). This would be a major fixed load even on a still frosty day. I can't imagine passive lubrication (as for the wheel bearings on your car) for an application like this. Maybe so, but I would be very surprised. Assuming they have to have a forced-feed lubrication system, given the weight on those bearings (40 tons on the bearing for the rotor and blades alone) a very robust lubricating oil system would be required using a pump. It would also have to include air cooling for the oil and an energy using lube oil purification system too." Oil would require heating in sub – zero temperatures.
--Lawrence E. Miller, Gerrardstown, WV, an engineer with over 40 years of professional experience with large power train machinery associated with Navy ships corroborates most of this.

Airgrid or the Dept of Energy should clarify if dirty power fed to wind turbines is charged for, how it is metered and what is the rate at which charged. We could do with some figures of payments to wind companies per unit and if power supplied is deducted. I hope I do not have to go to the "Freedom of Information Act" for this as that will take a long time. I cannot understand why turbines do not power their own rotors like car alternators when generating.

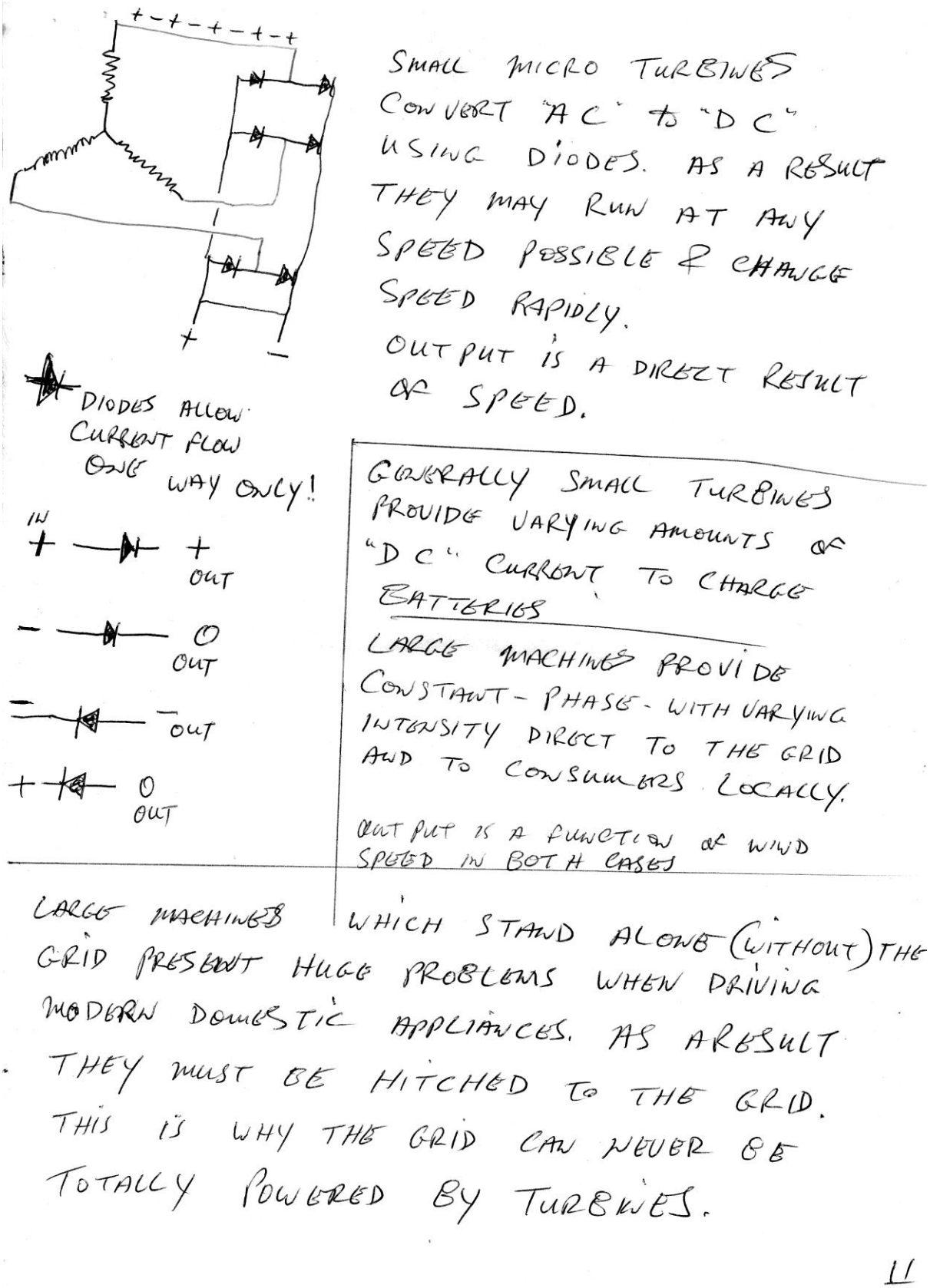
On the 17th February, 2010 smoke from Gypsum industries was rising at 45 degrees meaning it was almost calm. 2 turbines at Bailieboro/Gartnaneane had their blades turned away and were stopped. 5 had their blades set and were slowly revolving, 3 were going slowly but ground to a halt and one was going strong, 13 revs per min. It had to be being driven by the grid, but it too halted after 15 mins. All eventually stopped. I would have thought that it would be wise to stop them and lock them at all wind speeds under about 13 miles per hour. This would stop TV interference, flicker, noise etc. It is a great pity and a flaw in their design in my opinion. It's bad enough to have them annoying you when producing, but worse when they are not producing at all. Surely payment should be for total output less total inputs, otherwise we are subsidising dirty power.

There is now growing evidence that the noise and shadow flicker from wind turbines is the cause of serious health problems in people living nearby. Low frequency vibrations is said to travel through the ground manifesting itself in an annoying sensation to dwellers.

One of the greatest misfortunes is that if the adverse effects were only present when the turbines were generating, there would be background wind noise to help cover it and local people would only have to endure the nuisance when useful power was being produced. However the fact is that wind turbines must be kept turning by grid power if necessary even when wind speeds are not enough to produce power. This is for the reasons stated in the section “Grid Power used by turbines”. My observations reveal that turbines are shut down for only about 4% of the time in calm conditions. They are started and stopped to avoid damage. I am of the opinion that it is during this time that the most annoying noise and flicker happen. There is no background noise to mask the effects. One can imagine a wet windy March day at 2 pm. People are either working or inside. However now imagine a lovely calm April day at 2 pm. People will be outside tending to their plants or reading. This is the time the effects are the worst. Why have the wind industry not tried to allow for the shutting down of turbines when there is no energy being produced.

18) Storage of wind generated electric power.

Explains why storage of electric power is next to impossible.



Fog 20. The power supplied by these machines is alternating current, as is that supplied by the ESB.

It cannot be stored as electrical energy in any practical form yet invented. Batteries need a continuous supply of current flowing in one direction to charge. It can be converted to direct current for storage in a battery but a lead acid battery to serve Dublin city for an hour would be too large to fit into Croke Park and would be 150 feet high. The lead and acid would create a huge environmental cost as would the gas released on charging. Storage of compressed air in mines etc has a very limited application due to air escape through water fissures because the walls cannot be sealed, the energy obtained from escaping air decreases with its volume. There are people, who will argue that it can be stored, but it cannot as yet and any such storage is only possible in certain rare locations.

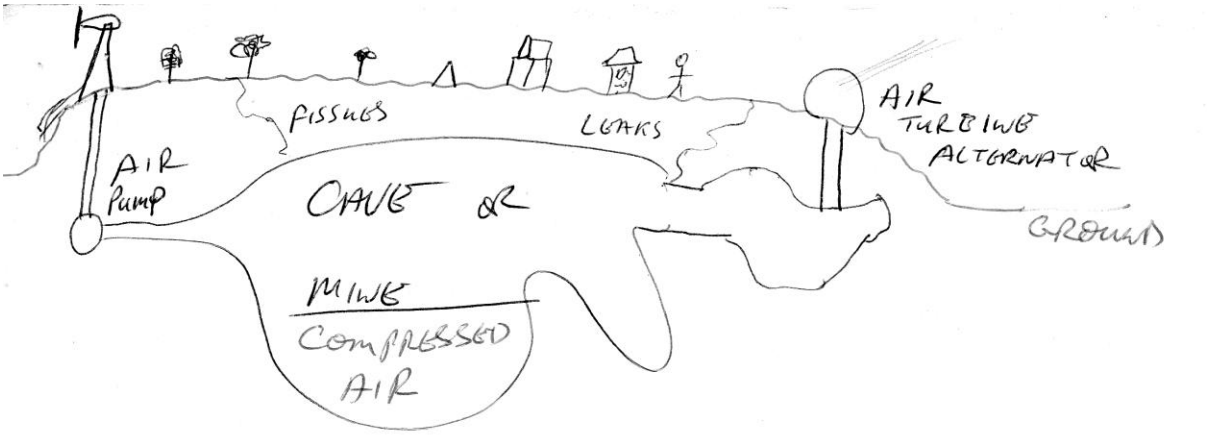
It is suggested that turbines could pump water from lowlands to reservoirs on high ground and the failing water then used to generate power. The advantage of this is the rate of flow could be strictly controlled by sluices and fed to the grid precisely. The disadvantage is that it would take huge lakes to store the water in upland valleys. The impact on the environment and the wipe out of homes and farms is obvious. Can anyone suggest a suitable site? This scheme has only minimal use in Ireland ""unfortunately"". Every molecule of water must be forced up the hill, whereas over 50% must be allowed to return down unhindered in order to extract the optimum power from the remaining water striking the blades. There are huge losses through energy conversion and inertia.

It is suggested that electric powered car batteries could store wind current produced at night so that the national fleet of these cars could act as a dispersed storage battery. This could have some application, but if it has, a small home turbine unit would be an obvious choice, rather than to buying it from a wind farm. This technology is a long way into the future. Storage of mains power comes down to one question. How do you cope with the huge volume of storage media required.

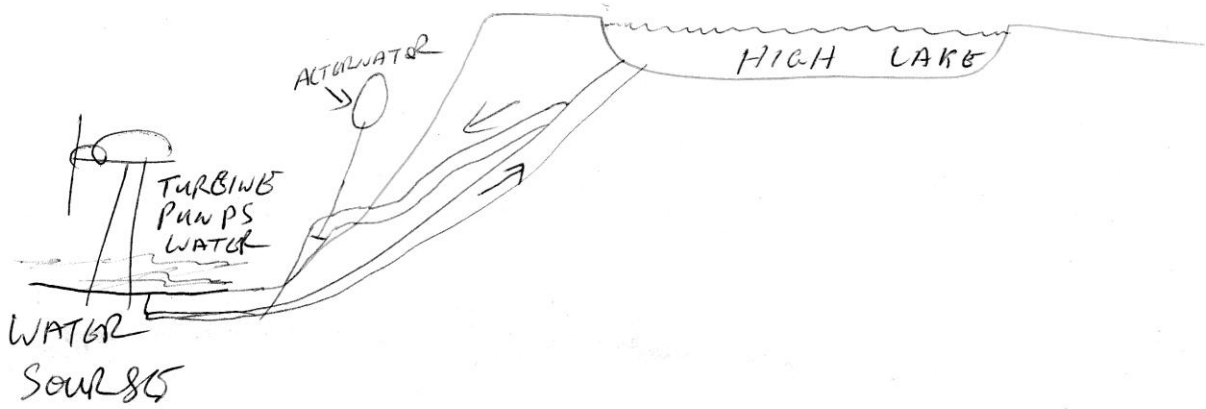
Modern single phase appliances need a regular constant supply of power alternating at near 50 hertz between 220-240 volts. Even the lighting of farm buildings can be damaged by cheap portable generators. They will be damaged by erratic current. Even with the grid, not all power fed in at the power station makes it to the consumer. In the absence of reliable independent information, we can estimate that 70% of the power coming out of the generator makes its way to homes, farms and factories. A 50 meter turbine would, by my reckoning, provide a total 338 KW of useable power at optimum wind speed to a user 1,000 meters away. This declines with distance.

According to a web site -prenwire- it quotes Sorne Developments and Renewable Energy Ireland and says that up to 700 MW of electricity storage will be required in Ireland. That's right! 700 million watts. = 700,000,000 watts. Now do the maths. Volts x amps = watts. Now say the voltage is 12. Therefore 700,000,000 divided by 12 = 5833333 amps. How many 80 amp (tractor) batteries would that amount to? 5,833,333 / 80 = **72,916** tractor batteries. Allow 18 inches per battery, it would amount **to 9 miles of batteries placed end to end.**

"Read this quote from the press release of this Canadian company: *"Caution regarding forward-looking statements: VRB Power's press releases may contain forward-looking statements. These statements are based on management's current expectations and beliefs which are subject to a number of known and unknown risks and uncertainties (including, but not limited to, the risk factors described in VRB Power's Annual Information Form filed with the British Columbia Securities Commission and available at www.sedar.com) that could cause actual results to differ materially from those expressed or implied in our forward-looking statements.* **The Company does not assume any obligation to update any forward-looking statements contained in this press release".** My advice is to apply this waffle to every single thing you read about wind energy. The whole thing is based on forward "**wishful**" thinking.



COMPRESSED AIR STORAGE "SHORT TERM ONLY" "LEAKS"



WHEN PUMPING WATER OR AIR, EVERY MOLECULE MUST BE FORCED AGAINST GRAVITY BY SLOWING PART OF THE WIND, Water HOWEVER ONLY A PORTION OF AIR/WATER WILL HIT THE TURBINE ON THE WAY DOWN. Some MUST BE ALLOWED UNHINDERED TO AVOID TOTALLY HALTING THE FLOW.

BOTH SYSTEMS WILL PROVIDE POWER AT A VERY CONTROLABLE RATE. IF POWER IN is (1000) Power out is (500) ESTIMATE. BUT ITS NOT ERRATIC SEALING CAVE [illegible]

Fig 21. (last line reads: But it's not erratic, however sealing the cave is a problem.)

Withdrawing stored energy. This can be divided into 2 forms. 1) Gives up its energy consistently irrespective of remaining quantity, 2) the immediate power available decreases with the decrease in quantity. Energy stored in oil, hydrogen fuel cell, coal etc releases its power at the same rate. For example, a car engine provides the same power whether the tank contains 40 litres or 1 litre. A fully charged battery gives greater intensity of power than one which is partly discharged or nearing total discharge and is not as useful. The outward journey would be brisk, while the return could be sluggish. See post script.

19) How it is paid for! **Details I have requested have not been supplied, even by government, so this is my best effort.**

Exactly how much power we are actually getting from wind is very hard to say. We can say that over the last ten years the ESB has upgraded its plant and increased its capacity. It might well have to do this anyway to replace old plant and to cope with any future demand. Their aim is to increase from the 5,000 mW to at least 6,500 mW and above. The recession has meant that demand is now going down. The Airgrid web sites speak about the need to increase capacity to allow extra penetration of wind. Common sense would say that the opposite should be the case, There is now a good deal of wind farms and that should mean that less (not more conventional plant should be required). The whole theme of this document is to point out that as wind penetration increases so conventional generation increases and more fossil fuel is burned. How that can save the planet is beyond me.

There is an energy regular to control production and supply and to control the billing and payments system and charges to the consumer. I have found it next to impossible to secure accurate information but here is what I believe happens.

1) Substantial capital grants are made available for the construction of wind farms.
2) Rapid depreciation rules amount to a tax break on wind farming profits. Other direct tax reliefs may be available.
3) A government subsidy of 57 euros per mW is paid from taxpayers and from ESB bills.
4) A carbon penalty is imposed on electricity generated from fossil fuel including imported thermal energy but not nuclear.
5) Every mW of renewable energy sold attracts a certificate called a Renewable Obligation Certificate ROC. This certificate can be traded on the markets at the going rate. Producers of thermal energy facing a fine per mW can but these certificates to off-set against thermal fine.

All this adds up to wind energy being paid for in the region of 3 times that of its thermal counterpart. Nuclear power attracts no certificate even though there are no emissions.

Who pays: The Irish taxpayer contributes part of the subsidy through the exchequer. Even if you have your own diesel generator, you pay through VAT and income tax. Consumers pay an added per unit fee towards renewable energy all of which is wind based. This means that an old person using a 2 bar electric heater to keep warm during the cold spell of 2009/2010 is paying a percentage towards wind even though there was no wind energy produced during this calm period.

The certificates are the best of all: If there is a year with good wind blowing and therefore a high number of certificates issues, these will trade a relatively low price. If the next year is very calm by comparison, less certificates will be issued but they will be in higher demand so holders will be paid better. i.e.

Year 2009 : 10,000 mW produced yielding 10,000 certs sold @ E50 = 500,000

2010: 8,000 mW produced yielding 8,000 certs sold @ E62.5 = 500,000

The effect of this is that so long as some wind blows the wind farm will yield the same income even though it creates varying amounts of energy. Remember that it is we the consumers and taxpayers who must foot the bill by paying for a product that does not exist. Ridiculous: It's a swindle cleverly presented and fooling politicians and the media. They are not fooling me and my goal is that they will not fool the public.

20) Marketing environment.

Exhorts the reader not to be fooled by reports of money being made on wind energy. Suggests that it is sales of equipment that make money, not selling electricity.

A recent report in the Sunday Times giving a roundup of the new eco-pack (people who made money out of green energy) outlined those who have made a lot of money from wind technology. None made money from supplying electric power for consumers. All became rich by selling their machines and their companies to others. Many trust funds, pension funds, and managed funds are led to believe that wind power will provide a return on investment, by producing power to consumers. They may be in for a nasty shock when they discover that no return will be forthcoming on calm days and worse still, in the case of the larger wind farms, they will have to build one of more conventional fossil fuel "gas" power stations to replace wind on calm days.

Even producers of micro wind turbines are making wild claims for the output of their machines. However, all are careful to include the promise, **"subject to suitable siting and wind conditions."** When machines are found **not** to produce adequate power, "a get out clause will come into play: "The site is not good enough and the wind did not blow hard enough. " I have consulted several

owners of micro turbines. The general reply is "It wouldn't even boil the kettle in a gale"! I rang one advertiser in the farmer's journal. He told me his brother in law persuaded him to buy and brag about it. He admitted it was of little use. A report by David McKay, commissioned by the British Government found that "**micro turbines consume more power than they produce**." This same government is now in the process off giving grant aid for such turbines to sell to the grid, thereby grant aiding increased CO 2 emissions.

David McKay found that wind speeds can increase by 25% with increased height (the highest Scottish Mountain tops) , but that larger machines provide the same amount of energy for the same amount of ground because they must be spaced out more. Normally wind energy companies considering a project will erect an anemometer to measure the wind speed on the site. It is vital that this measure is taken at proposed hub height and left for 2 years. From the 15th December 2009 to late February 2010 there were only few days with a bit of wind and some very cold temperatures, turbines would have to be kept heated while giving little power. Huge losses must have been incurred. There is a slight increase in turbine output with height, but this is offset partly by unequal wind speed from top to bottom. The ideal one would have 100 meter column and a 40 meter dia blade. McKay says the wind speed increase with extra height relatively small. Note "high ground adds a set of extra numbers of mph to existing speed. It does not cause a multiplying effect. Say when speed is 1 mph at low level and its 3 mph at hilltop, when its 8mph at low level it will be 8+2 = 10 at hilltop. 20mph lowdown will be 22 mph at hilltop.

21) Business tools and models.

Barriers to entry. This is where there is a barrier to enter a market. Pubs need to buy an existing licence, pharmacies must employ a qualified chemist at all times, farmers need land, Mobile phone operators need a licence restricting numbers of players. Steeple jacks need a good head for heights. Anyone can open a vegetable, sweat or clothes shop so profits are small and towns are full of boutiques doing little. Door to door salesmen have a hard time. A new ideal starts with a supernormal profit which declines as others enter the market. Then it declines to a normal profit over time due to supply and demand factors.

Wind energy production. These can be put up on land or sea. All that is needed is a piece of land and planning permission for an on-shore project. These are barriers to entry, but very small ones. No qualification is needed to operate or own. So they are nearly in the same bracket to vegetable shops. A huge number of players - large, small, companies and private individuals-can enter the market. They can sell to the grid and can generate their own power. If the cost of power becomes prohibitive, consumers can generate their own with a diesel engine leaving huge over capacity just like mushrooms and house building. 5 years ago the public service was the place to be for pay and pensions, but their numbers increased out of line with the economy, now they are being cut and remuneration reduced. So if a huge amount of players enter the market over the next 10 years, who is going to pay for the power while maintaining convention capacity and possibly importing cheap nuclear power from the UK? They may pay, but not over the odds. Will the taxpayer fork up? Will we be able to export it? If so to whom? To Britain, who will have cheap power and plenty of wind of their own. We cannot supply wind power on calm days. The highest demand in

Ireland occurred in January 2010 when there was no wind. (4,952mw) Will a special tax be placed on wind farm income? Current receipts are subject to VAT and income tax only. Can government impose limits of new entrants while pushing for a green agenda? The market will dictate the price and the product life cycle may be the same as anything else.

Economists tell us that products have a life cycle. 1st) Introduction, 2) Growth, 3) Maturity, 4) Decline. The period can be short in the case of the old video tapes to long in the case overcoats.

Swat analysis. This is a business tool use to examine a business based of Strengths, weaknesses (internal) Opportunities and treats (external).

Strengths: Free fuel, green product much in demand, Good partner companies, finance available. No input by farmer for rented model.

Weaknesses: Unreliable variable erratic fuel source. Ireland has poor wind speeds, Very high start up costs and high maintenance costs. Land devalued and control given away. Huge environmental and annoyance from noise and flicker. Bird kills.

Opportunities: Enter and expand, Income can be used to fund other ventures. Possible government grants to add to profits.

Threats: No barriers to others entering the market and depressing prices. Danger of being sued by neighbours who suffer loss of sleep or devalued property. Danger of technology becoming obsolete. Nuclear power coming on stream and cutting prices. Voters rejecting levies on fuel and conventional power so bringing pressure on government to cut subvention to producers. Danger of an increased number of calm days, forcing low sales. Danger of partner company going burst. Idle machines. Increased power costs resulting in more home diesel generation. –Note keeping prices high will necessitate stopping new entrants at some stage - There could be legal challenges to this. Danger that the Global warming theory will be proved wrong or the timescale will be found to be much longer that first though. Wars leading to breaking agreements. Decommissioning costs.

19) The psychology of economic bubbles.

Suggests that a wind energy economic bubble is in the making.

These bubbles occur when investors follow a source of income which is non-sustainable. The 1929 crash involved the stock market, the dot.com bubble involved computer technology, the sub-prime mortgage/housing bubble we are now suffering needs no explanation. Yet anyone who warned of

these was laughed at by developers/governments. I maintain that the current "clean energy based on wind" craze is another such bubble. (But I do believe in energy conservation and any green source that works and is sustainable long term? YES). Unfortunately wind does not work!

The late Gerry Ryan on his morning radio program on 24th November, 2009 in relation to the Minister of the environment's sending officials to Britain to seek assurance that proposed new nuclear power stations will not affect Irish people's health ***" Why don't they stop this tripe - tricking around with wind and wave and the devil-knows-what, will never provide power for a modern economy like Ireland, this government is about to import this same nuclear power from Britain and the sooner they realise this the better".***

Mink farming: *Went for a while and is now a minor industry leaving destruction by wild mink.*

Deer farming: Big investments led to nothing.

Mushroom farming. Surviving after a huge start, but profits tapered off, product life cycle is obvious here.

Ostrich farming: Bordering on a novelty "hobby" pursuit. (you eat it if you like).

Celtic Tiger building boom. No need to elaborate, but big companies specialising in large commercial construction are holding on well. Consistency being the key. Bertie Ahern said no-one warned him of the impending collapse. Will current politicians take note?

Money: The biggest barrier to entry to wind farming is the cost. (Said a local farmer to the author).

This section shows that there is no shortage of investment for sound profitable ventures.

Babcock & Brown and Enron were two large investment companies that invested heavily in wind farming, both went bust.

Bond Market: No matter how the economises of the worlds are getting on, there is still the same amount of money out there to roughly equal the value of the economic unit that issue it. Borrowing and lending are an integral part of the world financial system. A farmer wanting to borrow for a new tractor goes cap in hand to the bank, but if a strong profitable company want to borrow, they go about it the in the opposite direction. Governments do the same. It's called "to issue a bond". A bond is a piece of hard glossy embossed paper about the size of an A 4 sheet. It has ten (usually) serrated slips down the side called "coupons". Say the Irish government or Guinness's want to raise finance to run the economy or to extend the brewing plant, they go to an agent bank and say they want to issue a bond. Financial houses who invest pension funds, shares etc, will consider the offer and decide whether to invest. Rating agencies like "Standard and Poors" and "Moodys" will rate the bond issuer according to certain well established criteria. Usually the more solid the issuer the lower the coupon (interest) rate. For good clients, there is usually a clamour of investors and many later disappointed.

What would you guess is the minimum amount of a bond issue currently. ???????????

500 million euro upwards.

So there is no shortage of money for anything. Now bear in mind, that it is currently accepted the wind farms in low lying areas of Ireland and Britain are not profitable. Up land areas will be better graduating to high mountains up to 25% better (David McKay's report). That shows that the margin is tight. Recent reports in the media show that investors are becoming more discerning and money to wind farms is drying up, resulting in a demand for more government hand outs. So the notion that the set up costs are beyond the ordinary farmer is nonsense. The markets will support any projects by lending to banks who in turn lend to developers, if they believe the returns are guaranteed and the profit will enable the bond coupon to be met each year with the principle met after ten years or more. If you discover a gold mine in the wee field, I bet you will find all the capital you need to develop it.

After the great depression in the 1930s banks were compelled to decide whether they wanted to provide a commercial banking service for businesses and the public or if they wanted to enter the high risk ventures such as hedge funds, derivatives markets, insurance underwriting etc. Lobbying by bankers to US President Bill Clinton led to this restriction being scrapped in the mid 1990s. It is now blamed in part for the present economic collapse together with the sub-prime mortgage debacle. Every one reading this will have experienced the Celtic Tiger rise and fall first hand.

A book has recently been published blaming a culture of "Thinking Positive" for many of America's woos. By thinking positive, you think your car will never break down, you will not get ill and if (as happen the author) you get cancer, you think positive thinking will affect a cure. She found it did not. What frame of mind do you borrow to the hilt? --- A positive frame of mind of course ---

"The curse of positive thinking: Barbara Ehrenreich" published by Granta £10.99.

I would add, in what frame of mind do you invest in an unproven technology?

23) The psychology of wishful thinking in relation to generating energy out of nothing or very little energy out of very big machines.

In an Irish village (location not included here to avoid embarrassment, but available to genuine enquirers on privacy terms), there, in the 1990.s a local man believed he could generate electricity from nothing. He spent over 64,000 Irish punts. He built a steel gantry about 40 meters high and 40 long. He made 1 meter diameter concrete spheres (balls) wrapped in steel casings. The idea was that the balls would roll on top rails to the end, where they would fall to earth. They would strike a spring loaded piston which would compress fluid to drive a hydraulic pump. The pump would drive a generator to produce electricity. The problem was how he would get the balls to go back up to the top of the structure to complete the cycle. He reasoned that a man carrying a bag of cement up to the top of a house would find it easier if he carried it up steps diagonally. He did not take into account that a diagonal is longer than the upright side by the sum of the square of the other 2 sides. (Pythagoras' theory). The device never worked. Many perpetual motions machines were refused a patent in the last century.

A representative of a wind farming firm spoke to me on that subject of size of turbines. He maintained that "the medium sized machines installed at Mountain Lodge and Gartnaneanne in Bailieboro near me are not economic any more" He proposes installing turbines with a height of 85 meters to the hub (column length) with a rotor of 82 meters go give a total height of **130 meters** overall. He stated that it will be necessary to install this size of machine in future. By definition he is saying this size is necessary to break even and make a profit. The upshot of this if true, is that all the existing turbines are obsolete. There will have to be taken down and replaced by bigger ones to avoid a loss. Machines are getting bigger and **WHY?**

To my way of thinking, there is a realisation within the industry that profits from existing medium sized machines are not living up to expectations. Machine producers cannot concede that wind farming is not profitable, so they suggest bigger and bigger turbines to persuade installers into thinking the bigger machines will return a better profit. The McKay report states that it is the area of upland swept and not the size of individual turbines that determine the total output of a land area. (not the individual size of machine).

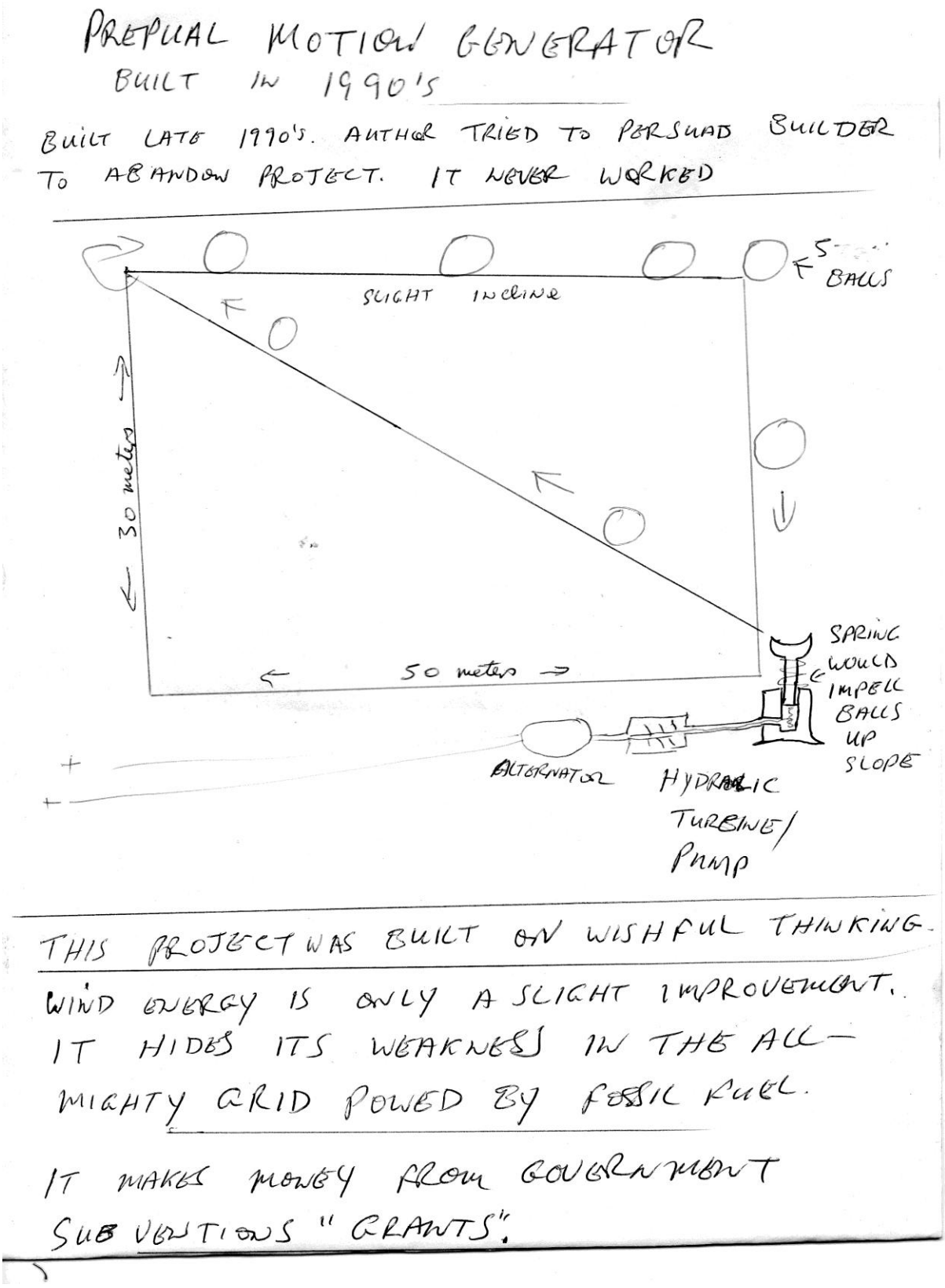


Fig 22. Perpetual motion machine. Worldwide patent offices are littered with applications for such worthless machines.

When he was building it, I sent a message through an acquaintance, saying that it would not work and defied the laws of physics. I urged him to build a small less expensive version first and build the bigger one only if the small one worked. The reply that I got back typifies the response now being

heard by proponents of wind power. **He said that a small version would not work, to be successful; *he needed to scale it up as much as possible***. "Sounds familiar" He was wrong and those who say larger wind turbines will be practical where smaller ones fail are either wrong or trying to deceive investors and government backers. There are limitations to scale comparison, but only in the case of very small proto types (try making a miniature car ignition high tension coil). If a hand held strimmer engine will not power a toy lorry, then a lorry engine will not power a real lorry. It is accepted that higher machines reach above the air turbulence close to the ground, but this is minor. Remember the larger turbines must revolve slower to keep tip speed down to acceptable levels.

I am now predicting that as it becomes obvious that existing wind turbines are not providing useful power, proprietors will argue that the answer is to increase turbine size. In this way governments and landowners are kept from realising that you cannot extract power from still air, no matter how big the turbine is. If a water wheel will not run in a still lake of 2 acre size, you will not get it to run by taking it to a larger lake or 1000 acre size. The water is not moving in either case. The difference is the huge financial and environmental cost of constructing the ever larger machines.

I now predict that as it becomes obvious that existing turbines are not delivering expected profits, the cry will go out for **larger** on-shore machines and to move off-shore machines farther out to sea. That way the profits of equipment makers will be maintained and more millionaires produced. I also predict that we will witness calls for increasing the capacity of the grids and the interconnecting of Europe's grids. ***"It's easier to hide in a bigger house!"***

24) The psychology of marketing the embryo for an unsustainable business.

Explains why people can get carried away about ideas that don't work.

A similar psychology was used by suppliers of dear to the farming community some time ago. They convinced some farmers to erect expensive fencing on their land to contain the dear. They told them that there would be a market for venison (which never materialized) and they sold these farmers expensive breeding stock to establish their herds, plus expensive husbandry equipment. When it was realised there was no market for all but a tiny proportion (because venison is a novelty food), some resorted to cutting the fence and letting them out into the wild. The point is, that unrealistic hopes were built up to sell the means to enter a fictional market, wind power is and always will be a semi-novelty source of power, just like venison.

The Irish wind energy company run by Eddie of O'Connor has an interesting future business model. It proposes to select and acquire sites, construct the machines, commission the wind farms and then sell the entire site on to others at a profit. "Note they do not propose to sell power to consumers", but to profit from sale of the wind-farms themselves. "Sound familiar" This is reminiscent of the dear suppliers. It is only when the various purchasers (pension funds, assurance funds and investment funds) have acquired the wind farms that they will come to realise they have to build a coal, oil, gas or nuclear powered power station to actually supply power. Buying the wind farm is

only the start of the investment. Coillte have now adopted the same business model. The London array, a proposed wind farm of 341 turbines in the Thames estuary (note it's close to the consumer, reducing transmission losses) was to be 40% funded by "The Royal Dutch Shell" company as part of their green credentials. They have now withdrawn from the project and it may not go ahead. They carried out a due diligence analysis and being an energy company, came to realise that ***one or more huge fossil fuel generating stations*** would be required to back up the wind farm during calm conditions. The nominal number of homes to be supplied was greatly reduced from that stated by the equipment supplier. I believe that there is a gradual cooling off of investor confidence among investors, with a technological background. The question is, will that be followed through among those from a finance background***? It is interesting that the existing London grid suppliers were not prepared to bear the cost of penetration by these wind machines.***

25) Why are wind farms being built?

Looks at why wind farms were never considered 20 years ago, but are now all the rage through government transfers from taxpayer to wind producers

Considering the green lobby, it's surprising how few have got off the ground. For those that have, the answer to that, is government incentives, (tax us to pay them) coupled with unrealistic hopes are driving the market. Global warming policy means that Governments have to be seen to work towards the reduction of fossil fuel generating. OK. There is 400 years oil supply in the ground at current demand of 85m barrels per day, but some is in the hands of unreliable countries and demand will rise. Even if we continue to rely of fossil fuel, it may well be damaging the world climate system, which could lead to real long term problems. For the farmer/investor it does not immediately matter if the climate change theory is true of not. If money is on offer for no outlay why not go for it. Surely we must try to find alternative ways that work and my contention is that producing wind power by means of ever increased sized turbines does not reduce carbon emissions at all. (When the carbon cost of making and installing them is taken into account). At best they can make a small contribution by staggering fossil fuel burning, but only at a small penetration rate and then only maybe. The farmer needs to know if the income he is set to receive will continue for a reasonable number of years. If it is realised that wind farming does not contribute to power supply, then the bottom may fall out of the whole project and there will be a rush to nuclear. We are still at a very early stage. No farmer should take a chance like that. We need more information! There is no guarantee that the greens will remain in power after the next election. Farmers with existing wind farm firms as partners are getting paid well enough, but remember that if even one wind company collapses or cuts the price to farmers, it will make new entrants more wary. So the last thing they can allow happen is to renege on paying existing farmers. Remember, how the builders tried to keep the house price bubble going and many really believed it would last forever.

But aren't existing participants getting good money? Wikipedia say that the 2 main investors in wind farms are Babcock & Brown and Goldman Sachs. Babcock & Brown have gone into liquidation. Wind companies know full well that the sums paid to landowners is comparatively small compared to the huge investment they (or their investors have made). One complaint from a participant would lead to a media frenzy and to the spotlight being turned on the industry. New entrant

farmers might get cold feet. Alas as the house price collapse shows, there will be no gradual reduction in price, if a reduction comes, it will hit the industry suddenly and the industry will do all it can to ensure the evil day is put back as long as possible. Let's watch Denmark carefully. I believe they are at excess wind capacity; let's see if any more turbines will be built in 2010/2011. Let's also see if conventional and nuclear generation will be increased. The problem is that whole industry is shrouded in a veil of mystery. Farmers can find out the price of beef, grain and milk, shoppers know the prices of goods and so on, but I cannot find a set of accounts dealing exclusively with wind cost and receipts. British wind companies have in January 2010 appealed to the government for help claiming that without it the industry will die. Perhaps the answer to the heading of this paragraph is given by the Irish Academy of Engineers: "Wind farming not driven by performance, but by Ideology." To which I would add "One that we will pay dearly for". As the drawbacks of wind farming become apparent voters may elect politicians who will be more sceptical and as the contracts will already have been signed, their only recourse will be to impose a wind farm tax. Landowners are already subject to tax and VAT on their earnings, but government can impose any tax they like. Government will still be obliged to support green energy long after the scam of wind is realised, that money has to come from somewhere, a levy on income from the then defunct wind farms is one obvious way.

Is the recourse of wind to be let go with the breeze? I believe the answer is no. One use that can be made is generating power to use for storage heating. Take a small old peoples care home in a rural area. A few smallish turbines could be erected nearby and connected directly to these homes. The alternating current could be fed into electric storage and convection heaters, independent of the grid. Excess heat could be let out the window and shortfalls could be supplied from conventional heating systems. Double wiring would be needed. Cold wintery windy nights would be perfect for wind heat. If large insulated water tanks were built on site, the heat could be stored for a few days. "Note however, that there is little wind in frosty weather". It may be that the reason this is not already up and running is that it would be of little practical use.

Airgrid's most recent report points out that profitability of wind depends on a high fuel price, a high co2 emission penalty or both. It is beginning to look like CO2 penalties are set to become the main driver for wind profits.

26) Micro wind power for home and farm.

Explains why there are currently no self contained energy communities and make a suggestion to experiment.

"Roof mounted generators consume more power than they create" - David McKay, British government's chief scientific advisor.

Very small wind turbines revolve relatively fast resulting in lower gear losses, some are connected directly to the alternator. The tip speed is low at the smaller diameter. The rotor is usually a permanent magnet and the output may be direct current (via diode converters) at 12 volts, capable of storage in a battery pack to power lights and other low wattage appliances like computers and TV sets. Dynamos also work well. They will **not** run cookers, boil kettles or run vacuum cleaners etc and may even be too erratic for computers etc. Erratic charging will shorten the life of a battery. The only issue is the installation cost. They are a lot of trouble and need double wiring to separate them

from the mains. I suspect Mr McKay was talking about supplying small turbine ac output to the grid. This is a ridicules proposition. It would be like putting a horse pulling a plough on one side and a duck on the other, yet the British government looks set to provide then with grant aid. Grid connected ones are carbon negative. If purchased cheaply or made up, they can be a source of education, particularly for someone considering joining forces with a turbine company. Some re-winding companies might re-wind a car alternator to run at small turbine speed. Turbine blades can be made from wood. See books by Hugh Piggott available from Camden Steam Services.

So what about a dairy farmer installing a large (say 25m dia) turbine to milk and run the house. What about a village installing a turbine. First, a mains supply will still be required for up to 80% of the time. As wind gusts, a mains supply may be needed in optimum wind conditions to stabilize the phases and absorb excesses. I cannot find any outlying island community relying of wind power alone; a backup diesel generator is usually available. (The Danish Island of Sams claims the exception, something which is very doubtful and may result from the fact that Denmark has extremely high electricity costs) they may al have generators. Remember isolated communities may accept an interrupted supply, whereas an industrial/farming community like Ireland could not. The farmer or community may have to make a huge investment in the turbine to provide power only 20% of the time and erratic power at that. If the government gives a grant, that cost is loaded on to the taxpayer/bill payer, who in turn must use more fossil energy to generate the income. Why don't government provide funding for a West Coast Island like Arran More off Galway to install a few turbines as a test project? There is wind, there is a community, there is a need for power, and the small area would be perfect for electric cars. Renewable energy companies may try to find excuses to stop such a project, because they know the inadequacy will be exposed. This discovery would endanger government investment to them country wide.

There is a 2.5 meter dia turbine on sale in a local outlet. It's is designed to generate power for connecting to an immersion heater for household hot water for washing etc. The full retail price is 3,640 Euros. Needless to say few if any are to be seen in the area, it's an example of the culture of ripping off anyone foolish enough to buy. The value of this machine is about E1,500.

Sunday Times 7th March 2010: The Green party initiative to encourage home owners to create their own electricity has attracted only 5% of expected take-up launched in February 2009. Eamon Ryan the energy minister has ordered a review as to why it generated so little interest. He is considering changing the regulations. The scheme has a target of 4,000 participants but only 222 have installed micro turbines. Surplus can be fed back to the grid @ 19 c per unit (42c in Germany) for the first 3 years (current unit price from ESB is 13c.) Set-up costs are between 17,000 and 30,000. Simon Covney FG TD said the state should increase the unit subsidy and give a grant to installation cost. David Staunton FG TD said there is a limit on how much power can be sold and how big the generator can be. *My opinion: Surely micro generation is open to abuse by proprietors feeding diesel power into it instead of wind. Also the TDs say its frustrating: "Did anyone consider that the reason its frustrating is that the wind does not blow most of the time." The people most likely to take up this scheme are farmers. I have a lovely bit of high ground which would be suitable for a small turbine. But I cannot see how it could pay me back over about 10 years. There was no wind between 15th December 09 and 18th March 2010." Farmers are out and about all the time and instinctively know the wind conditions. They know it's not reliable. Imagine getting the demand for re-payments from the bank on 4th January '10 and waiting for the wind to blow to get some money in. Thats real frustration. Unlike large wind turbines, it's easy to contact a fellow with one up already and find out what he is making. The feedback is that small turbines are no good and that why no-one*

is foolish enough to bother with them. If you must, my advice is go for the smallest cheapest machine and see what that pays and then decide whether to go for a bigger one. The idea of increasing the subsidy is ridiculous is like subsidising sheep's wool and taxing woollen clothes.

27) What about selling power back to the grid?

Deals with the practical difficulties with raising the voltage of a small turbine to put power into the grid.

So if you install a micro turbine of decent size, can't you use some of it and sell the rest back to the ESB. This is being proposed by means of a special meter (runs forwards and backwards). So total bill due to ESB = E1, 000 less power supplied E 200 = a reduced bill to E800. This is only sustainable if only a minor percentage of power is so supplied and as far as the ESB is concerned, wind-power - is wind power - no matter where is comes from. Such power is best used locally, remember the ESB must still maintain conventional generating capacity for every watt of wind energy supplied to it. If you can get paid, take it as long as it lasts, it may not last. It does have the advantage that the generating capacity is widely dispersed through the country and less susceptible to gusts and variations in wind speed. The rate quoted is 5.9 cent per unit.

Readers might wonder how a small roof mounted turbine can push power into the almighty grid.

Current flows similar to water in pipes. It will flow from high pressure (voltage) to low pressure at the point of connection. Pressurised water pumped through a long narrow pipe will loose a lot of flow pressure because of resistance to it in the pipe, but water will always flow from high to low pressure given time. Electricity will do the same, but if the small alternator can produce a voltage at the connection point greater that the grid, current will flow into the grid. To get a high voltage, the number of windings in the stator coils must be very high. Say 1,000 at 700 rpm. From this speed upwards, the output voltage will be high enough to cause a flow into the grid. If the wind decreases to say 700 rpm, the voltage will drop and unless there is a cut out, current will flow back from the grid to the turbine windings. The problem is that fitting so many turns on the coil means the diameter of the wire must be very small to fit into the stator casing. Such thin wire would carry hardly any useful current. Maybe it would light a 15 watt bulb in a 20 mph wind. With a 12 volt machine, less turns of thicker wire will suffice, which will fit nicely into the stator. You **can** pump power into the grid, but the volume will be miniscule for a small machine, increasing for the bigger ones.

The British government is currently examining ways to pay those generating power from micro and small turbines, most likely it will be a price per watt supplied. Remember that they commissioned David McKay to report on the feasibility of all form of renewals and he said that small turbines consume more power (dirty power) than they produce, so that government is going to subsidise the production of electricity from fossil and nuclear fuel. (please read this paragraph again). To my mind it's unbelievable and totally ideology driven. They are hoping to dress up dirty energy as clean energy and get away with.

Part 6

28) Worst case scenario. A hypothetical look back to the future.

Self explanatory.

The year is 2025, Ireland is littered with wind turbines, and there is one or more on every hill, except a few places of special beauty. Billions of Euros of taxpayers and investors money has been ploughed into construction of wind farms. Planners tried to call a halt, but new entrants complained that they were being cut out of the action to save the planet. Back in 2015, enough machines were running to theoretically power all our needs in optimum wind conditions. However it was found that the figures were wildly off the mark, governments and land owners had been misled. The huge "taxpayer" to "operator" (grants) transfer is failing to do what it was said to do. So a new scheme is set up to make Ireland self sufficient and even export power to the UK and France. There is a wind turbine in every bit of high ground. Tourism is adversely affected by the blight on the landscape. Britain waits to see how Ireland gets on. We are now self sufficient at optimum wind conditions. Households, factories etc find that wind power is damaging equipment due to its erratic nature and the ESB is forced to keep 75% of calm output running to stabilise supply. Moreover, fossil fuel power stations need 8 hours to start up and close down. Nuclear stations take much longer. As wind can suddenly subside, the ESB must keep a further 10% running to be ready to resume supply. If wind is further increased for export, the ESB will have to maintain greater capacity than for the domestic market, fossil fuel capacity and use will increase. The benefit of our hydro production will decrease.

Leaving aside exporting: A hypothetical situation to supply Ireland could be.

Total ESB fossil capacity with no wind power at all.	Say	12 million kW.
Total wind capacity	says	5,000 million kW
Required ESB capacity for calm days		12 million kW
Total ESB supply for optimum wind conditions to stabilize		20 million kW
Unused wind capacity		8 million kW

It can be seen that we can never economically have full wind capacity, only full capacity less fossil capacity needed to stabilize. That means fossil power is only reduced by a little and if power is exported, we will need to increase fossil capacity to match home and export needs, to stabilize that too. And who is going to buy our energy. Britain has just announced they are planning to build 6 new nuclear power stations. Why is this, when Britain has such windy coastlines? France is a huge producer of nuclear power. Selling wind power to these nuclear countries seems unlikely! In order to have 40% penetration, we must produce 80% fossil fuel power 40% + 80% = 120% (20% must be got rid of). They can still say "we produce 40% from wind and we export 20% yippee". They won't tell us that without wind we would burn only half the fossil fuel!.

29) Denmark:

This so called green energy exporter's figures are strange.

Denmark is a producer of wind turbines. It is held up as a showcase. It produces wind energy mainly in Jutland and (hey presto) is an exporter. A great example for Ireland!

In order to understand the electrical system in Denmark one has to consider the country from the point of view of 1) electricity bills to homes and businesses and 2) the sources of the power used in the country. The billing system is similar to Ireland where you choose your supplier from a few companies in the market, but the actual power all comes from the same source. On the generation side, Denmark is part of power transmission network linking it to Norway, Sweden and Germany .

Norway has some conventional thermal power plants, but the most of its power comes from Hydro Dams. The country is blessed with several large rivers running through valleys. The power is dispatchable, fast to start and ramp up and unless you are salmon "green". Hydro is used for base load, mid merit and high merit generation. They have no wind farms. A study resulted in a policy not to use wind.

Sweden has conventional thermal power, but relies on nuclear for most of its base load. Nuclear accounts for most of its power. It did not go the wind route.

Germany has some nuclear and quite a bit of wind power installed. The bulk of its power comes from burning brown coal, a fossil fuel found there.

Denmark did build at least 3 nuclear power plants, but the government decided not to produce power from them. They are used for research and development and produce waste. Denmark uses thermal plant fired by coal, gas and oil similar to Ireland. However there are 5,200 turbines in the country. The grid in Denmark is split in two, Jutland in the west had no link with the eastern part up to recently. All 4 countries are almost totally interlinked. They are at a stage now where the green party in Ireland would hope Ireland to be in the future.

The policy not to use nuclear may be linked to the image Denmark wants to portray – a country which has proved renewable power can be generated and which is in the business of selling turbines-. A look under the carpet reveals that all it not so rosy.

Very little of the wind power produced in Denmark is actually consumed by Danish consumers. Most is exported through the extended grid to the other 3 countries. As Germany is getting it hard to deal with its own wind power, they are left with Sweden and Norway to take the bulk. Most of the sales to Sweden are made below the cost of production. In a dry windy year, Norway's hydro power is insufficient and they buy power from Sweden, Germany and Denmark. It appears that in such a favourable year Denmark can get something close to a reasonable price. However if there is a wet year when Norway has enough hydro power, Denmark has a problem getting rid of its wind

power. In some instances they are forced to pay neighbours to take it. A fee of about 20 cent per unit (kwh) is mentioned. Hard information is not easy to get, but there is widespread acceptance that most of Denmark's wind power is exported at a loss.

What I cannot say is how this loss is computed. Are they paid for the gross power leaving the windfarms or is it on credit capacity? In everyday life, if one is assessing a profit or a loss, it is selling price less buying price. As with so many things about wind farming, percentages and other figures are touted out without telling us what they are comparing to. The Danes are among the highest emitters of CO2 in Europe per head of population, this fact is of course ignored in the media.

It is probable that Denmark's wind power is not exported "neat" and that a considerable amount of dirty thermal power is missed with it. They are importing fuel at full market price to export below cost. The neighbours are getting a bargain the natives are subsidizing foreign consumers.

The penetration level for wind in Jutland is 19% and this is frequently given of the figure for the country as a whole. However eastern Denmark has a much lesser penetration level. When East and west is measured the actually percentage for wind in the entire country is close to 14%, below Irelands current lever of 16%.

The real sting in the tail is the cost of Denmark's wind project. Electricity costs are amount the highest in the world, double that of France. According to a friend of mine who has been there, a unit of electricity in Denmark costs over 26 euro cents per unit at present. The price in Ireland in 2010 was 13.5 cent and is now 14.5 (give or take a few decimals.) This is the tariff Danish consumers are forced to pay in order to keep the wind farms running. I cannot find out how much extra they must pay in tax to cover wind farming, but it is likely they pay through their power bills and through taxes as well as tax reliefs to the industry.

There is little doubt that if Denmark were not interlinked by supergrids to its neighbours, they could not use all the wind power they produce and they could not get rid of the surplus. By being interlinked, they can make an effort to export some of it at least. It is harder to trace and quantify the benefits of its wind power. I claim that this is why we constantly hear wind companies and supporters call for a super grid between Ireland and the rest of Europe. "It's easier to hide in a bigger house".

Not one conventional power plant has been shut down. Conventional plants must be kept running at high capacity. When the wind is not blowing. Denmark imports a small amount of energy, but when wind is strong it exports it at a discount price. David J White wrote in the utilities journal, that all the turbines provided only 3.3% of the nation's electricity in 2003 and exported 84% of it at a loss. The Copenhagen newspaper Politiken reported (according to the Wall Street Journal in Europe) that wind only met 1.7% Denmark's total demand in 1999. Frede Vestergaard reported that Denmark exported 70.3% of its wind production in 2004 at a loss. Danish electricity costs to consumers are the highest in Europe. (Prices for everything are very high) (My

note--- **Are we facing a huge increase in power bills here? While we increase pollution!! And damage tourism and wildlife.**

P.S. On the 30th March, 2010 the weather forecast gave strong North East winds accompanied by snow in the evening. Seems like a good time to shut down some conventional plant and replace it with wind. Demand was high due to the cold. The turbines at Gartnaneanne, Bailieboro were strutting their stuff as I passed at 5.30pm. It could be seen they were aggressively pumping power into the grid in what was near optimum wind speeds. Terrific:

Well, I popped over at 8.pm and guess what! They were all stopped. They had to be shut down to prevent damage because of the possibility of very high winds. Now where would that leave the grid operators? If they had shut down their thermal plant a supply shortage would cause blackouts. The grid cannot chance blackouts, they will leave thermal plant running, so where's the saving? There is none. When all was added up on that day, there was no saving of thermal plant, just an input of wind contributing nothing! **That is the inescapable conclusion.**

Just imagine if you were operating the grid and a good windy evening, would you shut down thermal plant and rely on the wind? If you did what would happen if the wind turned into a gale **and all turbines shut down for safety? As they say in Cavan "you could be in a spot of bother".**

30) Approach to planning Why do we not have zoned area for wind farms?

English case law states that planners must consider the amount of power provided by wind farms as part of the planning process.

The biggest worry is noise. The torque on the alternator is a "saw tooth" pattern, it gives out a low pitched hum. This has been found by some to cause annoyance during sleep. Personally, I will not sleep in rear rooms of a hotel, because the heating burner keeps me awake all night. This low frequency hum can be noticed from ESB transformers (technically it's at a similar frequency). It appears, some people are more susceptible than others. New hub gear designs are said to reduce gear noise, it is possible but the degree of reduction is not known. Experience here and in Denmark which I have gathered myself or directly from witnesses is that noise from the gears increases as the machine gets older. Department guidelines say that the blades give out a swish cutting through the air, in fact as the blade approaches the column it compresses the air against it which gives off a "swhooch" as it escapes. The point is that the sound is rhythmic, and rhythmic sound is more annoying that the swish of the blades. The Davis family in Spalding in Lincolnshire where forced to leave their home and an auctioneer said he could not give a valuation due to the windfarm nearby. The local council reduced the council tax because of the devaluation of the house. Proof that officialdom recognise the nuisance.

In regard to the law of nuisance: There is no rule of law that a person moving to the nuisance has no right to sue for damages and remedies. They certainly can and a good solicitor will tell you that, but you need a "good" solicitor. If a nuisance exists for 20 years the right to sue is gone because of a law called prescription. So don't leave it too long.

The key to the attitude to planning is size of blade and distance from dwellings. I see figures of 10 times the diameter or the blades. It depends on the county side. Big bare windswept hills with few houses seem better, but it's rare to find such hill without a house or two within 300 meters. A 500 meter department guideline is for the traditional 55 meter column and should be adjusted upwards for larger machines. It is doubtful if Dept guidelines distances are enough to ensure avoidance of noise.

To my mind, it should not be left to residents to second guess the effects of turbine, there should be guidelines for companies and for residents backed by good data. Word is coming through from America that residents who welcomed turbines in their area are now suing by class action (group legal action) for loss of quality of life due to unforeseen annoyance and loss of sleep. The greatest danger of noise annoyance is when there is little or no wind. You have in effect an engine driven from the grid with no background wind to dampen it. (Note how you can hear dogs barking on a calm night). Expect turbines to turn 95% of the time.

One resident I spoke to near me said that "when is not blowing hard, there is little noise, when it is moderate there is a lot of noise, so I close all the windows. Residents are in position that they may err on the side of safety and object. The ideal thing would be to stay over in a house close to a wind farm to see what it's like. Personally, I think they do not improve a rural area and an eyesore. If in doubt, one solution would be submit to the planning authority that you ask them to apply whatever rules and standards exits to the application in regard to your property, but remember these are very loose. If there are no objections they are likely to grant permission and then it's too late.

As for applicants, keep them as small as possible, bigger machines do not necessary mean bigger profits.

Insist on Artist's impressions or photo montages giving views of the turbines in your landscape. Watch out for the distortion of these by pushing out the focus (like looking in the wrong end of binoculars) and widening the horizontal plane at the expense of the vertical plane to make the turbines look smaller than they actually are. The rules of trigonometry apply.

TV interference: If a wind farm is placed between the transmitter and a house with a television set future reception of that particular station by aerial is gone forever. Terrestrial signals not obstructed by the machines are not affected, but a house between the transmitter and turbines may cause reflective interference. A house in the middle of a wind farm will have no aerial reception. The effect extends up to 8 miles or more. Future reception is available only be satellite and these are in turn controlled by commercial companies.

The normal minimal remedy is for the company to install "Free Air", a satellite dish with 30 British Stations and 3 Sky, but with no RTE or TV 3. If the windfarm is so placed so that there is no RTE,

you will need a full Sky service which will have all RTE and TV 3 stations as part of the package. If this is installed free by the company you have everything free. It costs between 500 and 700 euro per year at present. If they do not install this, then you will have no RTE of TV3. Usually they wait until the turbines are up and give the service afterwards.

Some owners of the printed press also own satellite tv networks. There could be a potential for a conflict of interest when it comes to reporting on the viability of wind farms. This does seem improbable I admit. But there is a huge bias in favour of wind farming.

If planning permission is applied for after the wind farm is erected, the company can object to a new development. The new house owners will have to pay for the satellite service. This is an extra cost, usually paid for by working extra, which burns more fossil fuel. Remember the business model for most is to build the wind farm and then sell it on. It is unlikely that the company building it will run it, so you will be dealing with a new outfit and they will be well up to speed in dealing with you.

Wildlife: The spin here is to count all the birds killed in a year and compare it to statistics of birds killed by cars hunters etc. This includes species like Jackdaws, magpies, crows, swallows and starling which are plentiful and fly in daytime. What they don't tell us is that a high proportion of birds killed are endangered birds of prey such as owls, eagles and hawks. These birds evolved to see danger from below (not from overhead) the fly at night. The book "the Wind Farm Scam" sets out the huge loss of these birds all over the world. It is sad that our rarest and most endangered birds should be put under pressure for nothing.

Ireland is a common law country and decisions in some foreign countries are persuasive here. One Englishman held that the adequacy of wind farms is relevant to planning despite the fact that Irish Planning Authorities may claim that adequacy is outside the scope of the application. Renewable Energy Systems refusal for planning permission was conceded on noise grounds alone, but the secretary of state applied for a judicial review in 2008. It was held that the inspector must consider the likely electric city contrition in each case

31) China and the Kyoto agreement.

Evidence that there is an accepted limit of the proportion of wind energy a system can cope with.

As part of the terms of this agreement designed to reduce carbon emissions, a system of carbon trading is in place. The system appears to work like this. Say I run a glass factory in Cavan which uses a lot of fossil fuel. I must reduce emissions by a certain amount (say 15%). The ideal way is to install wind turbines to fill this gap with renewables. However, wind turbines cannot provide the energy needed, so I contribute towards the installing of turbines elsewhere and I can use the nominal output of these as carbon credits thereby avoiding a fine. Nobody wants to install turbines at home (because they don't believe they work) so I contribute to the installing of them abroad. They don't work there either, but there is a trick in the trade. The nominal output can be used (not a measured output). It appears to be assumed that the wind never stops blowing abroad.

Financial Times article, 2nd December, 2009. (Front page). The scheme is administered by the United Nations. China had offered incentives to its companies to build a number of wind farms there. They then decided to reduce the amount offered (Chinese domestic grants) so as to qualify for funds from foreign companies who contributed to installing these machines in China. The UN refused to sanction the Chinese project because it was initiated by a promise of Chinese funding.

I am now suggesting that there is a slowly dawning idea that wind power is not all it's cracked up to be. The recession is forcing a more in dept examination. Had the Chinese project gone ahead it would have created a ludicrous situation where western companies could save carbon fines by installing turbines in China (which is one of the biggest polluters in the world)(They do appear to be trying to mend their ways I admit).

The article went on to say that that the U.N. feared that the Chinese project would result in "**over capacity**." This serves to confirm that there is such a thing as over capacity with wind power.

32) Government energy policy.

Looks at the waste in the present system and asks if conservation is not better than wind.

According to November 09 issue of Newsweek, enough electric energy is wasted globally each year to power Canada, Germany and Japan. This can be seen everywhere and one would wonder if governments understand anything about energy. The turf burning power station at Lanesboro, Co Longford is one example. Turf heats water to produce steam at pressure which drives the turbines to drive the alternators. At exhaust, the steam is cooled and condensed back to water and re-boiled for use again. Water from the river Shannon is used to cool the steam in a heat exchanger. Hot water is released into the river and is too hot to hold ones hand in. The river downstream is a popular beat for course fishermen, fish like to live there as the water is warm. Surely there is a case to locate power stations near centres of population where this water could supply central heating. But there are no such plans. Climb up on any roof when there is a fire burning in a house. Put your hand over the chimney pot while there is a fire in the grate. It's too hot to keep the hand there for long. Vast amounts of heat are lost through chimneys; a simple heat exchanger would transfer this heat to bedrooms etc. There are many other examples, yet government appear to be very focused on wind power. The Bowmore distillery on the Isle of Islay in Scotland supplies heat from its coolers to the local swimming pool. Many homes could be heated in winter from Irish power stations.

Irish Academy of Engineers claim that the drive to increase wind farm penetration is driven by ideology. You can access their article by googling -"independent business Irish ideology is driving energy policy." They say that those supporting the current development of "ad-hoc" wind farm development do not take into account the total cost of linking it to the grid. They say Eamon Ryan is proposing to surpass Denmark in achieving a penetration for wind energy of 40% by 2020 for renewable energy. I discovered the engineer's remarks after I compiled this article and as far as I can see they are singing from the same hymn sheet as I am. *Irish independent business (10th February, 2010).*

For those who are not technically minded, just note the wind conditions in your area a year, (just a mental note each day). Ask yourself the question: would the wind you experience supply our economy with any of its needs and if so what proportion. Then consider the huge environmental and financial costs involved.

Ireland's energy minister Eamon Ryan said on a resent TV programme that the inclusion of wind power in the Irish grid would bring down costs and that this was already beginning to happen. The presenter obviously was no familiar with the guff of this Green politician. The real question that he should have been asked is "bring down the cost in relation to what?" If government policy keeps going the way it is, power prices will increase to twice the present level and at this price bringing it down is just a matter of reducing carbon levies. The only objective measure of price is to compare a system with no wind to a similar one with wind. Denmark charges its consumers twice that of France with no wind. Of course this is all part of a wider misinformation campaign and will work so long as it's not challenged. When it is challenged they move the goal posts again and again. You can be sure that they will run a mile from sitting down with a pencil to run through the figures.

The same minister constantly goes on about his target to bring renewables to 40% (wind being about 37%). But the next time you hear or read this you will notice that they do not say what the 40% is actually of. It would be like if you walked into a shop to price a suit and the assistant told you the price is 40%. Unless you know what the 40% of off, you do not know the price.

Norway conducted an examination on wind power and decided not to go down that route because it was too expensive, too harsh on the environment and produced to little power.

33) Why some fossil fuel suppliers favour wind.

One would think that companies supplying oil, gas and other fossil fuel would be against the building of wind turbines. I have discovered that the opposite is the case in many locations (particularly the United States, in Kansas). It seems that companies generating electricity from fossil fuel have realised that the more power is generated from wind, the more fossil fuel they will sell. That's right: **generating power by wind results in a greater demand for fossil fuel.** Apart from that already stated, consumers may think that it is OK to waste electricity as it is coming from a "**completely renewable source**", thereby increasing demand, which must be fulfilled from fossil of nuclear fuel.

Emerging fact. In order to be able to meet demand on a day to day basis, the grid companies constantly match production to demand. To do otherwise would result in blackouts, which would damage the economy. Wind cannot be matched to the grid, therefore for every kW of wind energy available to the grid during optimum winds conditions, an equal amount of capacity for non-wind sources must be maintained. This must be from a sure and certain source such as fossil fuel or hydro. Of course, if there is wave or tidal, great, but that won't affect wind's shortcomings.

Grid without wind: capacity 5,000,000 kW.

Wind capacity: 10,000 kW.

Conventional capacity required 5,000,000kw.

So not one less kW of conventional capacity can be dropped. (Not one).

The big lesson to be learned from this is that when you hear someone talking about renewable energy, watch out for the word **"claims"** ***"intends" "hopes to" "is planning for".*** What we want to hear is "***is self sufficient***" ***"uses only renewable energy for all its electricity"***. Over 25 years ago, the BBC programme "Tomorrows World" did a feature on a man in the US who claimed to have developed a hydrogen powered car. A picture was shown but he would not allow the car be examined by an engineer. 25 years down the road we hear of "men" who are **about to** develop a hydrogen car. (Eddie Hobbs' interview on RTE television, Nov 2009.) (You can make hydrogen by hydrolyses using a battery and a plastic basin). Hydrogen takes a lot of electricity to make and gives off little power when used. I reckon that hydrogen cells could be used as a means to store energy for transport, but other means of making the 2 gasses required are still needed. (electricity). So hydrogen is only a potential method of storing other sources of energy. You cannot fill up with water and drive off.

RTE news 15th Dec, 2009. New hydrogen cell car launched in the US. This clip showed the car being driven along the road. Great! Then the lady said it was running on batteries, but could run on hydrogen. **Now it either can run on hydrogen or it cannot**. What appeared to be happening was that the car was running on batteries, but it was **hoped** to run it on hydrogen later. **Sounds familiar!**

If there were thousands of large turbines in Ireland which did not produce useful power to the grid, it is possible that these would eventually be wired separately to produce hydrogen from water as a fuel. I have to admit that this appears feasible and if I were to bet it would be where I would put my money. Whether users will pay existing farmers for the power is an open question.

34) Deals with wind companies.

This looks at how to deal with wind companies and asks why a farmer cannot keep control of his wind resources.

A person who is trying to make a living in the area of wind energy production confided to me recently that onshore wind turbines in Ireland will produce useful power 20% of the time. (I think he factored in night-time wind production, but he would not elaborate).

If there is high ground near your land with a lake or which could be turned into an upland water store, be aware that your property could be more valuable than normal should they ever develop energy storage by pumping at night and drawing in the day.

There are “tricks in every trade” (old saying). One trick is “inflation” 1,000 Euros in 2009 may be worth far less in 2019 due to inflation which is beginning to rise. A flat rate from the company now may be worth less in a few years time. A better proposition is to do a deal (if you decide to go for one), giving you a percentage of the Kilo-watt output accepted and paid for by the grid. There should also be a clause allowing the contract to end after 25 to 40 years. After that period, they should be required to decommission or allow you to transfer to another company. This will provide completion. Link your payments to current price and per unit sold.

When a nearby farm sought planning permission to build a 7 turbine wind farm, ***I submitted that I should be entitled to connect to their line out to the grid at a future date***. So if I decide to install a turbine of my own, I can connect and get all the benefit. Why do we need a third company, we don’t share our milk, grain or beef output with third parties, why should we do it with wind companies. If a planning application for a wind farm is submitted near you, why not submit (20 euro to be included) that you be entitled to connect any future turbine to their output. This should be a condition set out by law, where is the Green Party? Signing up with a wind energy company will result in loss of control in your farm and you may see the share price of that company listed on stock exchanges around the world. That company may be sold on leaving you to deal with a new company. In fact many have already being sold. Why?

If wind turbines work and government are so determined to install them, why not wait and install turbines yourself? Let the government provide incentives to the landowner to build and connect, just like tree planting schemes. Why should you share you resource with a third party? If government is aiming to allow householders with small turbines to sell to the grid, why cannot a farmer install a large one (or more) and sell to the grid? If they can connect to a small one, why not large? If these machines provide a worthwhile payback, there should be no difficulty getting a loan from a finance house when the economy picks up. Wind farms either work or they don’t. As I see it, if I ever install turbines, they will be with the approval of neighbours in location and size, there will be only minor road building with installation done in dry conditions when off-road vehicles will be used to install and maintain. If these things work, there will be no shortage of firms who will co-operate with the farmer and find ways to avoid permanently changing the farm layout and ownership. Would you sell your cow to the first dealer to approach you in the fair? If a person can get a mortgage of E400,000 to buy a house to live in and pay it off from income, why should a farmer not be able to get a 1.2m euro loan to install one large turbine and repay it from “ the sure and certain profit from the sale of power”. Could the Department of agriculture not provide capital grants or capital loans to farmers which he would then repay over as many years as it takes? It’s a “no brainer”. Government provides a grant to the farmer who installs the machines, the farmer pays government a percentage of income in return until capital and interest is paid. He also pays income tax on profits received. That’s not happening and I suspect that the industry knows these machines do not work.

However, each situation will differ and the easy way of letting someone else take the problems and the risk might suit someone who is busy and does not have the time or commitment to go it alone. In such a case, I would like to know exactly what the contract entails. Only time will tell.

35) Transparency Let’s have an independent analysis done by people who are not part of the wind marketing group. Tell farmers what is being experienced elsewhere. There is currently no

independent information or guidance. The IFA could help here too. Let's hear from ESB experienced engineers who keep us in power day in day out. Let's hear from those who regulate the power from incoming wind to the grid each day. In particular we need to examine the Danish experience and the Norway findings. What's happening in Portugal? Can we be told, are wind farms being charged for power supplied from the grid or getting it free? What are the costs in money and omissions from wind penetration? Taking one 130 meter turbine over a 30 year lifetime, exactly what is the total saving in greenhouse gasses? Surely with all our schools and universities we can work that out.

If promising grant aid and incentives to the unit price produced, **PUT A 3 YEAR TIME LIMIT ON IT.** Otherwise the tax payer may be caught for eternal subventions to an obsolete technology. I will pay increased ESB bills to keep a nuisance next door. It can then be reviewed. Current grant aid is 5.7 cent per kWh. This will eventually come from ESB charges. It is promised for 15 years.

Most importantly, ensure the payments from the grid + government subsidy are for net green energy produced. That means total power out less total power in. Turbines photographs show that they are not made with their own power to the rotor, why is this? Could they be getting this power at market rate and selling it out again at market rate + subsidy?

36) Conclusion:

Urges readers to resist "HYPE"

One would have thought that by now there would be small turbines at every farm house where planning is not a problem. Even at today's energy prices, you would think a few people would invest. It's not happening! Why? It's because most people know deep down that they are a gimmick. As for full sized wind farms, several prominent experts have written them off as of no benefit. Most others have not stopped to study them. The experience abroad is that as the percentage of wind increases the saving fuel heat decreases to zero. I go a step further and point to the fact that the evidence is now mounting that beyond a certain level of wind power, more (not less) fossil fuel is burned. At the very best countries like Denmark and Germany are saving 1.5% on fuel. It's actually looks as if they are saving nothing. The complicated nature of our generating system makes it hard for the lay-person to know what is happening. But Ireland is now increasing it's capacity to burn more fuel. Something is wrong! I would not invest in wind and I would not allow them of my lands. It's now up the government and wind industry to prove me wrong, not with spin doctoring, and misinformation, but by facts.

There is a massive media blitz by the wind farm industry which is almost totally successful to date. I believe those who see through this scam have a duty to try and stop it. An enquiry does not have to involve judges and lawyers. No one is accused, the issue is does wind power work and examination

by a panel of experts costing about 30,000 euros. On fact a joint enquiry by Britian and Ireland would make more sense. The Australian senate have embarked on exactly this course. I say it does not and it is set to cost up dearly through ignorance. My efforts are to remove this ignorance.

Val Martin, ,

Val Martin BBS

Post Script: Tricks of the trade and fraud.

This occurred to me after I compiled the above. Every money making scheme ever to come on stream resulted in someone inventing a scam to fiddle it. You only need look at the ponzy scheme of Bernard Madoff, the Enron scandal to see that this is possible with wind generation.

Home Micro turbines: It appears these will work by running the meter backwards when production exceeds demand in the user's house. He will get a cheque in the post:

Scam: In low wind conditions, disconnect the turbine and connect a diesel generator for a few hours or days. The receiving power company have no way of knowing to source of the power. The fuel cost will equal the unit payment received. The profit is in the subsidy of 5.9 cent per unit. This is stealing, but if done discretely who's to know, particularly as micro turbines proliferate.

Wind farms with permanent magnet rotors: Some of these take a lot of force to start from stop due to the magnetic pull. (try turning a bicycle dynamo). A starter motor is used powered by the grid. Scam: When there is no wind, driving the starter motor permanently using power at the market rate to give out the same power paid for at the market rate + subsidy generated by the alternator. Of course connecting a diesel generator at times of low wind such as in January 2010, would bring some income as that would be covered by the payment from the grid and the subsidy would be profit.

Preventing diesel generated power entering the grid would need policing. The other scams can be prevented by ensuring the payments including subsidy are only made for net outputted power.

Example: Total power supplied to wind farm by grid. 1000 units charged for 14 cent = 140

Total power output in same period 1000 units paid for at 14 cent + 5.7cent sub = 19.7 x 1000 =197

No green energy is produced but profit is 57

The potential for fraud appear great.

Appendix:

Irish Academy of Engineers claim that the drive to increase wind farm perpetration is driven by ideology. You can access their article by googling -"independent business Irish ideology is driving energy policy." They say that those supporting the current development of "ad-hoc" wind farm development do not take into account the total cost of linking it to the grid. They say Eamon Ryan is proposing to surpass Denmark in achieving a penetration for wind energy of 40% by 2020 for renewal energy.

Sunday Ind business section 16/9/2009 Permission granted for a 500 MW interconnector. Between Ireland and Wales. It will carry 500 mw equivalents to supply 300,000 homes. This capacity (500 MW) is 10% of peak daily winter demand. (mine= therefore peak winter demand is 500 x 10 = 5000 mw = 5 billion watts.)

Sunday times 4/10/09: Professor David McKay the British government's chief scientific advisor of climate change prevention measures, has proposed quadrupling of British nuclear energy to prevent greenhouse gas emissions. He calculated that renewable energy sources (wind and tidal) can only provide a fraction of Britain energy needs.) He says that whatever energy source is used (the sums must add up). Britain emits 680 million tons of greenhouse gasses each year. Current nuclear output is 12 Gig watts (15% of Britain's needs). He sees that in order to cut emissions from transport, electric powered vehicles will have to be used and this will increase demand for generating capacity. He sees boiler pumps (Geothermal) to be forced on households. Generating solar power in the deserts of North Africa and transmission through high voltage lines is considered. He says there is a huge political and technical cost. The article goes on to give ways of reducing energy consumption saying roof mounted wind turbine consumes more power than they generate.

Article in the Sunday Times Sunday 1st November 2009. Board Gais Energy accuses Airtricity of selling their power to new customers as green/wind energy, when it fact it is nothing of the sort.

Crown estates have will shortly announce the names of companies to be granted licences to build giant off-shore wind farms off the British Coast***. "In theory "*** (note this word in a country with some of the most advanced engineering faculties in the world) the projects will provide one third of the UK's electricity. "Cost is estimated at 125 Billion pounds over 12 years. Off-shore wind is at optimum speed 33% of the time as opposed to 25% for on-shore winds. One would expect that this would reduce electricity costs; on the contrary, the energy regulator estimates that household costs will rise to 2,000 pounds annually from present £1,100. Andy Cox, energy partner at KPMG, said "The hostile operating environment that awaits these projects must be a real concern to investors. Even with the more benign on-shore sector, there have been numerous problems with gearboxes failing and blade issues."

Some of the farms proposed will be 150 miles off shore in deep water. In the event of breakdown it could take weeks for suitable weather conditions to allow repair by ship. More special ships will have to be built. The industry has now made desperate requests to Government for aid on top of an already subsidised package. Government responded by increasing the subsidy by a third and immediately costs were ratcheted up by exactly that amount. Lack of competition meant that the cost of off-shore equipment has doubled in the last 3 years despite the fact the material cost have halved. **Government subsidies have been passed directly on to equipment manufacturers** – said Mortimer Menzel, a banker at Augusta & Co. (Sunday Tomes 8/11/2009). They want to build these huge projects, but they cannot afford it. The article goes on to say that unless Centricity gets investment backing, they will go bankrupt.

There is no such thing as a free lunch! Apply common sense; should a high wave reach the revolving turbine, there will be damage!

Irish Daily mail, 6th December, 2009. Irish Finance Section. Board Gais energy have bought West Cork, **SWS Natural resources** for more than 500million. The ESB backed out of a similar deal because the price was too high. SWS have seven existing wind farms. ----- Now get this ----- "they are "**PROJECTED" (repeat) "PROJECTED"** to turn an operational profit in 2010 of 35 million. I would ask where their profit is for 2008 and 2009, ha? The article goes on to say that the minister for finance must approve the deal. Could it be that he will have to fund the project in whole or part, "not the purchase" but the "future projected profit"? The Sunday Times the following week carried an article – "Anglo Irish clients who invested 700 million in equity (shares) and 30 million in loan notes (loans) stand to make a 15% annualised return following the sale of the Company. The deal put a 500m enterprise value (like 2 fellas in a pub judging the value of a lorry load of cattle heading for the mart) and an equity value (projected value of shares) of 300 m Euros. Bord Gais (a state backed company funded by your taxes) intends to pump in 700 m euro to expand the project. Author's note: Imagine pumping 700 million Euros into a wind farm that only has wind blowing 24% of the time. Get it 700 million Euros.

Sunday Times 7th Dec, 2009.

Just outside the heavily polluted city of Baotou, Inner Mongolia lies a lake with no name. It oozes a viscous red liquid where toxic material is stored for further processing. Farming has been wiped out and the water is poisoned. This is the price Chinese peasants are paying for a low carbon future. Rare earths are a class of metallic element that are highly reactive but essential for the next generation of green technologies. The battery of the Toyota Prius contains more than 22lbs of lanthanum. Low energy light bulbs contain terbium. The permanent magnets in a 3 MW wind

turbine contain 2 tons of neodymium and other rare earths. Unprotected workers watch over vats of acid and other chemicals as they stir and bag liquid and power oxides for making into batteries and magnets. They breathe it and handle it without any protective clothing. In Jiangxi province 1,000 miles away, they pump acid into the earth. Locals protest that their lives are being ruined. A woman says "we farmed rice and grew fruit, but not anymore, she was afraid to give her name because her husband is still in prison for protesting. Even the weeds died", she weeps. Government efforts to improve things have been thwarted by mafia and local communist party members. China produces 95% of rare earth materials. The chief executive of the US Molycorp Minerals Mark Smith (*his grandfather may have come from Cavan*)"joke" said we are trading dependence on foreign oil for dependence of Chinese rare earths. If we cannot get our own supplies new green technologies will not be possible." Global demand is expected to reach 140,000 in 2010. China's then leader Deng Xiaoping said, "*the Middle East has oil but China has rare earths*." End. *In fairness China is trying to get into the high end manufacture of these products, but the west cannot compete with Chinese "almost complete absence" of health and safety controls. Those driving the new "environmentally friendly" hybrid cars, might temper their green credentials with a though for the thousands of Chinese people and their families whose lives have and continue to be destroyed by this self same technology. You won't see that on the news!*

There is a conference planned in late March in Dublin. The subject is renewable energy. It is sponsored by Siemens and other interested parties. There are at least 4 eminent speakers. I decided I would breeze in and maybe learn something, even ask a question or two. Guess the admission fee: ***- 480 Euros*** - Information is expensive, well I have given it here free!

This is what POWRY have to say in their report to Eirgrid on a future "low carbon all-island market"

In page 16 paragraph 2.5.2 Heading "PUMPED STORAGE". They are talking here about pumped storage by mains power to do the pumping . There is on at Turlough Hill, Co. Wicklow.

"Such plants are built because they can be turned on and off extremely fast to cater for peaks in television viewing etc. Few such schemes are constructed with large storage in mind. The volume of water and height are too much, One cubic meter of water falling 100 meters will only generate around .2kWh. The pumping efficiency is not 100% and pumped storage schemes are usually net consumers of electricity, but night time pumping may compensate". You will probably hear the "Spirit of Ireland" crowd on about their ambitions wind pumped storage plans in the west of Ireland. They do not propose to pay for it, they want you and me to pay and the old and poor people trying to warm themselves.!

Coping spin doctoring: Watch out for the spin doctors: One example is when they say: Wind is already supplying most of Ireland's renewable needs. It is not: Hydo provides power that does not need to be backed up. Leaving out hydro, there is no other renewable form of energy in our system, so if even 1 kw/h of wind energy made to a home, wind would be supplying all of our renewable needs. However the amount is miniscule. Spin!

Linking wind with hydro. This is an attempt for cover the fact that wind is useless by linking it to hydo which is very useful. It's like saying a player on a team is good because they won. Or a teacher

is great because she gets high exam results, when in fact she is so bad everyone gets grinds. Its spin by an unsustainable industry depending of a massive campaign of lobbying.

Renewables will provide us with cheaper electricity. Prices are already rising, we are going to have to pay for the wind and the thermal plant to back it up. How can duplication save us money? Spin.

We are going to have 40% renewable energy: 40% of what, they do not say. Spin!

The materials for building wind farms are remarkably the same as for building houses. CONCRETE and STEEL. We had the building boom, now we're are heading for an energy boom with the subsequent bust. I say it's a "SCAM!"

Minister Ryan is a member of the Green Party which has been in Government for more than three years. This government failed to heed the warning about the banks and property bubble which has crippled Ireland. On his web site he claims that on the 26th December 2010, a high portion of our power came from wind. Why is he selecting one day, what conventional plant was running parallel to the windmills to provide back up should the wind die down and turn into gale. Presumably when the truth is pointed out in a few years time after the harm is done, he will say nobody told him! Selective figures do not tell the truth.

Useful references.

David McKay: Report on Britain's energy requirements in the future. Web Site.

Airgrid : The impact of wind power on the grid. Web site _ Google Airgrid.

Books on home wind energy available from Camden Steam, "Google" Camden Books.

The Sunday Times

The Great Wind farm Scam by john Etherington published by Stacy International available from good book shops and on-line. Price under £10.

Further studies are required and information will be sought. That's all I can tell you for now;

Thanks for your time.

Val Martin