

## Wind Farms Even More Expensive and Pointless Than You Thought.

The cost of wind energy is significantly more expensive than its advocates pretend, a new US study has found.

If you believe this chart produced by the US Energy Information Administration (EIA), then onshore wind is one of the cheapest forms of power – more competitive than nuclear, coal or hydro, and a lot more than solar.





But when you take into account the true costs of wind, it's around 48 per cent more expensive than the industry's official estimates – according to new research conducted by Utah State University.

"In this study, we refer to the 'true cost' of wind as the price tag consumers and society as a whole pay both to purchase wind-generated electricity and to subsidize the wind energy industry through taxes and government debt," said Ryan Yonk Ph.D., one of the report's authors and a founder of Strata Policy. "After examining all of these cost factors and carefully reviewing existing cost estimates, we were able to better understand how much higher the cost is for Americans."

#### The peer-reviewed report accounted for the following factors:

The federal Production Tax Credit (PTC), a crucial subsidy for wind producers, has distorted the energy market by artificially lowering the cost of expensive technologies and directing taxpayer money to the wind industry.

States have enacted Renewable Portfolio Standards (RPS) that require utilities to purchase electricity produced from renewable sources, which drives up the cost of electricity for consumers.

Because wind resources are often located far from existing transmission lines, expanding the grid is expensive, and the costs are passed on to taxpayers and consumers.

Conventional generators must be kept on call as backup to meet demand when wind is unable to do so, driving up the cost of electricity for consumers. "Innovation is a wonderful thing and renewable energy is no exception. Wind power has experienced tremendous growth since the 1990's, but it has largely been a response to generous federal subsidies," Yonk stated.

Among the factors wind advocates fail to acknowledge, the report shows, is the "opportunity cost" of the massive subsidies which taxpayers are forced to provide in order to persuade producers to indulge in this otherwise grotesquely inefficient and largely pointless form of power generation.

In the US this amounts to an annual \$5 billion per year in Production Tax Credits (PTC). Here is money that could have been spent on education, healthcare, defence



or, indeed, which could have been left in the pockets of taxpayers to spend as they prefer.

Instead it has been squandered on bribing rent-seeking crony-capitalists to carpet the landscape with bat-chomping, bird-slicing eco-crucifixes to produce energy so intermittent that it is often unavailable when needed most (on very hot or very cold days when demand for air-conditioning or heating is high) and only too available on other occasions when a glut means that wind producers actually have to pay utilities to accept their unwanted energy. This phenomenon, known as "negative pricing", is worthwhile to wind producers because they only get their subsidy credits when they are producing power (whether it is needed or not). But clearly not worthwhile to the people who end up footing the bill: ie taxpayers.

Hence the observation of serial wind energy "investor" Warren Buffett, who says: "We get a tax credit if we build a lot of wind farms. That's the only reason to build them. They don't make sense without the tax credit."

But even this report may underestimate the real costs of wind energy. It doesn't account for the damage caused to the health of people unfortunate enough to live near wind turbines, as acknowledged officially for the first time in this report produced for the Australian government.

Nor does it account for the environmental blight caused to the landscape – far greater, as Christopher Booker has reported, than that created by the greenies' bete noire fracking.

When Professor David MacKay stepped down as chief scientific adviser to the Department of Energy and Climate Change (Decc) last year, he produced a report comparing the environmental impact of a fracking site to that of wind farms. Over 25 years, he calculated, a single "shale gas pad" covering five acres, with a drilling rig 85ft high (only needed for less than a year), would produce as much energy as 87 giant wind turbines, covering 5.6 square miles and visible up to 20 miles away. Yet, to the greenies, the first of these, capable of producing energy whenever needed, without a penny of subsidy, is anathema; while the second, producing electricity very unreliably in return for millions of pounds in subsidies, fills them with rapture.

Nor yet does it factor in the epic destruction of avian fauna caused by these



supposedly eco-friendly devices. According to Oxford University ecologist Clive Hambler:

Every year in Spain alone — according to research by the conservation group SEO/Birdlife — between 6 and 18 million birds and bats are killed by wind farms. They kill roughly twice as many bats as birds. This breaks down as approximately 110–330 birds per turbine per year and 200–670 bats per year. And these figures may be conservative if you compare them to statistics published in December 2002 by the California Energy Commission: 'In a summary of avian impacts at wind turbines by Benner et al (1993) bird deaths per turbine per year were as high as 309 in Germany and 895 in Sweden.'

Because wind farms tend to be built on uplands, where there are good thermals, they kill a disproportionate number of raptors. In Australia, the Tasmanian wedge-tailed eagle is threatened with global extinction by wind farms. In north America, wind farms are killing tens of thousands of raptors including golden eagles and America's national bird, the bald eagle. In Spain, the Egyptian vulture is threatened, as too is the Griffon vulture – 400 of which were killed in one year at Navarra alone. Norwegian wind farms kill over ten white-tailed eagles per year and the population of Smøla has been severely impacted by turbines built against the opposition of ornithologists.

Nor are many other avian species safe. In North America, for example, proposed wind farms on the Great Lakes would kill large numbers of migratory songbirds. In the Atlantic, seabirds such as the Manx Shearwater are threatened. Offshore wind farms are just as bad as onshore ones, posing a growing threat to seabirds and migratory birds, and reducing habitat availability for marine birds (such as common scoter and eider ducks).

In Britain, Chancellor of the Exchequer George Osborne has belatedly acknowledged the problem – which his Prime Minister's "greenest government ever" helped create – by promising to rein in green energy subsidies. The cost of subsidising new wind farms is spiralling out of control, government sources have privately warned.

Officials admitted that so-called "green" energy schemes will require a staggering  $\pm 9$  billion a year in subsidies – paid for by customers – by 2020. This is  $\pm 1.5$  billion more than the maximum limit the coalition had originally planned.



The mounting costs will mean every household in the country is forced to pay an estimated £170 a year by the end of the decade to support the renewable electricity schemes that were promoted by the coalition.

But given the damage that has already done to the British landscape by wind turbines it may well be a case of shutting the stable door after the horse has bolted. Especially when you consider that this man has already made £100 million out of the scam and that there are no mechanisms to get any of that wasted money back.

# WHAT'S THE TRUE COST OF WIND POWER?



As consumers, we pay for electricity twice: once through our monthly electricity bill and a second time through taxes that finance massive subsidies for inefficient wind and other energy producers.

Most cost estimates for wind power disregard the heavy burden of these subsidies on US taxpayers. But if Americans realized the full cost of generating energy from wind power, they would be less willing to foot the bill – because it's more than most people think.

Over the past 35 years, wind energy – which supplied just 4.4% of US electricity in 2014 – has received US\$30 billion in federal subsidies and grants. These subsidies shield people from the uncomfortable truth of just how much wind power actually costs and transfer money from average taxpayers to wealthy wind farm owners, many of which are units of foreign companies.

Financial advisory firm Lazard puts the cost of generating a megawatt-hour of electricity from wind at a range of \$37 to \$81. In reality, the true price tag is significantly higher.



This represents a waste of resources that could be better spent by taxpayers themselves. Even the supposed environmental gains of relying more on wind power are dubious because of its unreliability – it doesn't always blow – meaning a stable backup power source must always be online to take over during periods of calm.

But at the same time, the subsidies make the US energy infrastructure more tenuous because the artificially cheap electricity prices push more reliable producers – including those needed as backup –

out of the market. As we rely more on wind for our power and its inherent unreliability, the risk of blackouts grows. If that happens, the costs will really soar.



Many government agencies are in the wind business these days. GAO



### WHERE THE SUBSIDIES GO

Many people may be familiar with Warren Buffet's claim that federal policies are the only reason to build wind farms in the US, but few realize how many of the companies that benefit most are foreign. The Investigative Reporting Workshop at American University found that, as of 2010, 84% of total clean- energy grants awarded by the federal government went to foreign-owned wind companies.

More generally, the beneficiaries of federal renewable energy policies tend to be large companies, not individual taxpayers or small businesses. The top five recipients of federal grants and tax credits since 2000 are: Iberdrola, NextEra Energy, NRG Energy, Southern Company and Summit Power, all of which have received more than \$1 billion in federal benefits.

Iberdrola Renewables alone, a unit of a Spanish utility, has collected \$2.2 billion in federal grants and allocated tax credits over the past 15 years. That's equivalent to about 6.7% of the parent company's 2014 revenue of \$33 billion (in current US dollars).

President Obama's proposed 2016 budget would permanently extend the biggest federal subsidy for wind power, the Production Tax Credit (PTC), ensuring that large foreign companies continue to reap most of the taxpayer-funded benefits for wind. The PTC is a federal subsidy that pays wind farm owners \$23 per megawatt-hour through the first ten years of a turbine's operation. The credit expired at the end of 2013, but Congress extended it so that all projects under construction by the end of 2014 are eligible. In all, Congress has enacted 82 policies, overseen by nine different agencies, to support wind power.

I explained in December why Congress shouldn't revive the PTC, which expired at the end of 2014. In this article, I'm adding up the true cost of wind power in the US, including the impact of the PTC and other subsidies and mandates. It's part of a study I'm doing of other energy sources including solar, natural gas, and coal to determine how much each one actually cost us when all factors are considered.





Source: Compiled by UCS based on data from DOE 2014 and AWEA 2015

As Warren Buffett has said, there wouldn't be a wind industry without the PTC. UCS, DOE, AWEA

# TALLYING THE TRUE COSTS OF WIND

Depending on which factors are included, estimates for the cost of wind power vary wildly. Lazard claims the cost of wind power ranges from \$37 to \$81 per megawatt-hour, while Michael Giberson at the Center for Energy Commerce at Texas Tech University suggests it's closer to \$149. Our analysis in an upcoming report explores this wide gap in cost estimates, finding that most studies underestimate the genuine cost of wind because they overlook key factors.

All estimates for wind power include the cost of purchasing capital and paying for operations and maintenance (O&M) of wind turbines. For the studies we examined, capital costs ranged from \$48 to \$88 per megawatt-hour, while O&M costs ranged from \$9.8 to \$21 per megawatt-hour.

Many estimates, however, don't include costs related to the inherent unreliability of wind power and government subsidies and mandates. Since we can't ensure the wind always blows, or how strongly, coal and natural gas plants must be kept on as backup to compensate when it's calm. This is known as baseload cycling, and its cost ranges from \$2 to \$23 per megawatt-hour.



This also reduces the environmental friendliness of wind power. Because a coal-fired or natural gas power plant must be kept online in case there's no wind, two plants are running to do the job of one. These plants create carbon emissions, reducing the environmental benefits of wind. The amount by which emissions reductions are offset by baseload cycling ranges from 20% to 50%, according to a modeling study by two professors at Carnegie Mellon University.

While the backup plants are necessary to ensure the grid's reliability, their ability to operate is threatened by wind subsidies. The federal dollars encourage wind farm owners to produce power even when prices are low, flooding the market with cheap electricity. That pushes prices down even further and makes it harder for more reliable producers, such as nuclear plants, that don't get hefty subsidies to stay in business.

For example, the Kewaunee Nuclear Plant in Wisconsin and the Yankee Nuclear Plant in Vermont both switched off their reactors in 2013. Dominion Energy, which owned both plants, blamed the artificially low prices caused by the PTC as one of the reasons for the shutdown.

As more reliable sources drop off and wind power takes their place, consumers are left with an electrical infrastructure that is less reliable and less capable of meeting demand.

### • LOST IN TRANSMISSION

Another factor often overlooked is the extra cost of transmission. Many of America's wind-rich areas are remote and the turbines are often planted in open fields, far from major cities. That means new transmission lines must be built to carry electricity to consumers. The cost of building new transmission lines ranges from \$15 to \$27 per megawatt-hour.

In 2013, Texas completed its Competitive Renewable Energy Zone project, adding over 3,600 miles of transmission lines to remote wind farms, costing state taxpayers \$7 billion.

Although transmission infrastructure may be considered a fixed cost that will reduce future transmission costs for wind power, these costs will likely remain important. Today's wind farms are built in areas with prime wind resources. If we



continue to subsidize wind power, producers will eventually expand to sub- prime locations that may be even further from population centers. This would feed demand for additional transmission projects to transport electricity from remote wind farms to cities.

# • THE FINAL BILL COMES TO...

Finally, federal subsidies and state mandates also add significantly to the cost, even as many estimates claim these incentives actually reduce the cost of wind energy. In fact, they add to it as American taxpayers are forced to foot the bill. According to Giberson, federal and state policies add an average of \$23 per megawatt-hour to the cost of wind power.

That includes the impact of state mandates, which end up increasing the cost of electricity on consumer power bills. California is one of the most aggressive in pushing so-called Renewable Portfolio Standards (RPS), requiring the state to consume 33% of its electricity from renewables by 2020. Overall electricity prices in states with RPS are 38% higher than those without, according to the Institute for Energy Research, a non-profit research group that promotes free markets.

The best estimate available for the total cost of wind power is \$149 per megawatt-hour, taken from Giberson's 2013 report.

It is difficult to quantify some factors of the cost of wind power, such as the cost of state policies. Giberson's estimate, however, includes the most relevant factors in attempting to measure the true cost of producing electricity from wind power. In future reports, Strata will explore the true cost of producing electricity from solar, coal, and natural gas. Until those reports are completed, it is difficult to accurately compare the true cost of wind to other technologies, as true cost studies have not yet been completed.

### BLOWING IN THE WIND

The high costs of federal subsidies and state mandates for wind power have not paid off for the American public. According to the Mercatus Center at George Mason University, wind energy receives a higher percentage of federal subsidies than any other type of energy while generating a very small percentage of the nation's electricity.



In 2010 the wind energy sector received 42% of total federal subsidies while producing only 2% of the nation's total electricity. By comparison, coal receives 10% of all subsidies and generates 45% and nuclear is about even at about 20%.



Wind gobbles up the largest share of subsidies yet produces little power. EIA

But policymakers at the federal and state level, unfortunately, have decided that the American people will have renewable energy, no matter how high the costs. As a result, taxpayers will be stuck paying the cost of subsidies to wealthy wind producers.

Meanwhile, electricity consumers will be forced to purchase the more expensive power that results from state-level mandates for renewable energy production. Although such policies may be well intended, the real results will be limited freedom, reduced prosperity and an increasingly unreliable power supply.



### • How much land is required to set up a 1MW wind turbine?

There are two ways to answer this question:

The footprint of the turbine including the swept area.

The set-back required in the relevant jurisdiction and the separation distance required relevant to the number of turbines in this location.

Here is a link to one particular brand of turbine: Horizontal Axis Wind Turbine -1MW (not the most modern, but this post had all the data I needed). The Rotor Diameter of this one is 54.4 m (178 ft) so you are looking at a square footprint of about 3600 m<sup>2</sup> minimum for the swept area (60m x 60m).

The lowest set-back to residential properties that I have found is 350m, but some jurisdictions require up to 2Km.

From Draft PPS 18: Renewable Energy

Wind turbines need to be positioned so that the distances between them are between 3-10 rotor diameters (about 180-600 metres for a wind farm using 60m diameter, 1.3MW wind turbines) depending on the individual circumstances of the site. This spacing represents a compromise between compactness, which minimises capital cost, and the need for adequate separations to lessen energy loss through wind shadowing from upstream machines.