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Why energy conservation trumps windmills

Eleanor Tillinghast, *Hill Country Observer*, February - March 2005

Proposals for wind power plants are springing up in western Massachusetts, southern Vermont and upstate New York. [1] In a few years, we could see some of our most prominent ridgelines and hilltop farms industrialized with wind turbines.

If we cover our mountains and farms with wind turbines, what will we accomplish?

Let's look at examples of other places that have been converting their countrysides into industrial zones.

Denmark. Denmark is somewhat smaller than the combined land area of Massachusetts and Vermont. [2] In the late 1970s, it began a massive subsidy program to encourage wind power development.[3]

By the end of 2003, Denmark had about 4,300 onshore wind turbines (plus about 200 offshore). [4] Wind turbines accounted for more than 24 percent of its installed electrical generating capacity, yet they produced less than 13 percent of the country's total annual electricity output. [5]

Since Denmark's wind power is often generated when it can't be used, most is dumped to neighboring countries,[6] sometimes below cost or even free.[7] This means all those turbines accounted for just over 3 percent of actual electricity consumption in Denmark. [8]

Denmark's main fuels for electricity production are coal, oil and natural gas,[9] and its levels of carbon dioxide, a key greenhouse gas, [10] have been rising over the past 15 years.[11] Of all the major European Union countries, it is expected to be the farthest from compliance with its Kyoto Protocol standards for greenhouse gases.[12]

In 2004, Denmark's average electricity cost for residential customers was the third highest in Europe. [13] That year, the national government cut subsidies to the wind industry, and just five turbines were built. [14]

Germany. Germany is about twice the size of New England.[15] Since 2000, its installed wind

power capacity, supported by heavy subsidies,[16] has more than doubled.[17] As of the end of 2003, it had 15,387 wind turbines [18] that were able to cover just under 4 percent of the country's demand for electricity.[19]

As Germany has discovered, because of the unreliability of wind power, so-called "shadow power stations" must be maintained at a total level of more than 80 percent of the installed wind power capacity. [20] Germany remains highly dependent upon energy imports, especially oil and natural gas. This dependency is expected to increase in the future.[21]

Despite all of those wind turbines, the European Environment Agency has warned that Germany may exceed its greenhouse gases limit set under the Kyoto Protocol. [22]

As reported by Bloomberg News, Germany also has volatile electricity prices because of its high number of turbines. [23] The German government just commissioned a report which suggests that if Germany goes forward with its plan to double the number of wind turbines, annual energy costs for consumers will more than triple.[24]

The report also undermines arguments that wind power is a good way to reduce air pollution, because it details how the same clean-air benefit could be achieved at lower cost by installing modern filters at existing fossil-fuel power plants.[25]

United Kingdom. The U.K. has 1,186 turbines at 94 locations,[26] spread over some of its most spectacular landscapes. Collectively, these turbines produce about as much electricity as one moderately sized natural gas plant.[27] Scotland, at less than half the size of New England, [28] has 332 turbines,[29] and 6,472 more have been proposed or are in the pipeline. [30]

California. California generates nearly one and a half times as much electricity as the New England states combined.[31] It has more than 13,000 wind turbines, [32] which, in 2003, produced less than 1.3 percent of the state's electricity usage.[33]

California continues to have high levels of air pollution, in large part because of car and truck emissions. [34] Scientists project that, in five years, a third of the smog-forming ozone over California will come from Asia. [35]

Vermont. The Searsburg wind power plant in Vermont is the only industrial-scale facility in New England.[36] Its 11 turbines are about 10 miles north [37] of the Hoosac wind project proposed by Enxco in the Massachusetts towns of Florida and Monroe. Built in 1997, [38] its highest output was in 1999, and production has been dropping ever since.[39] By the end of 2003, it was operating at about one-fifth of capacity [40] and generating 30 percent less electricity than promised. [41]

Whether you look abroad, nationally or regionally, the lesson should be clear: Blanketing our countryside with wind turbines will not solve any problem. We should focus, instead, on the underlying issue: the need to curtail escalating energy consumption.

The New England electricity grid operator forecasts that energy demand in the region will increase nearly 10 percent over the next eight years.[42]

New York's population will grow less than 4 percent during that period, [43] but its electricity use is expected to increase more than 10 percent. [44] Under the state's recently adopted renewable-portfolio standard (a legal requirement that utilities in New York buy a certain percentage of their power from "renewable" generating sources), the impacts will be huge: An estimated 1,850 1.5-megawatt turbines will have to be built in rural New York by the end of 2013. [45]

That averages to about 230 new 34-story wind turbines a year on New York's mountains and farms. But roughly half of the projected increase in the state's electricity demand will still have to be met by conventional sources like nuclear, oil and natural gas. [46]

What is the cheapest, cleanest, fastest alternative? Energy conservation and efficiency. [47]

Since its 2001 energy crisis, California has paid people and businesses to reduce energy use, and consumption has fallen 10 percent.[48]

According to a new study, New England could save billions of dollars in energy costs, avoid the need to build 28 300-megawatt power plants and reduce the emissions of millions of tons of greenhouse gases if it pursued more energy efficiency measures.[49]

For a state with the population size of Massachusetts, simply improving the efficiency of appliances and equipment could save enough electricity to supply 200,000 homes for a year and reduce carbon emissions by the equivalent of removing 50,000 cars from the road. [50]

Investments in energy-efficient equipment are less risky, cause fewer environmental problems, and create far more jobs than power plant construction. [51] In fact, experts suggest the savings from energy conservation and efficiency should be seen as a new source of energy, one that costs less than any alternative supply. [52]

Northeastern states have programs that encourage energy conservation and efficiency. But as one politician has noted, we've only scratched the surface. [53] Before we start destroying our last wilderness areas with wind turbines, let's do the following:

- Redirect public funds from building wind power plants to financing more energy efficiency measures.
- Establish stringent, mandatory efficiency standards.

- Offer rebates and other incentives to individuals, communities, and companies that measurably reduce electricity use.
- Count reductions in electricity usage toward our renewable-portfolio-standard targets.

If you really want to cut energy consumption, reduce pollution, improve public health and protect our environment, it's time to contact your elected officials, educate them about the lessons of Denmark, Germany and elsewhere, and tell them you want tougher energy efficiency measures instead of wind power plants.

Otherwise, in the next few years, you'll be looking at wind turbines in some of your favorite places, with the knowledge that they're doing little more than funneling your tax dollars to a few lucky corporations and landowners, and away from better solutions.

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[1] In western Massachusetts, wind power plant plans are underway in the towns of Florida, Hancock, Lenox, Monroe, Orange, and Savoy. A proposal has also been floated in North Adams. Williams College wants to build wind turbines on land it owns just over the border in Berlin, New York, but Berlin's zoning board of appeals has said it wants a full plan to be submitted before considering the proposal. In southern Vermont, the towns of Londonderry, Manchester, and Readsboro are facing proposals. In upstate New York, numerous counties are wrestling with proposals: Chautauqua, Erie, Lewis, Otsego, Steuben, and Yates.
[Ben Rubin, "Lease for wind farm project in Savoy signed," *North Adams Transcript*, 2/17/05, http://www.thetranscript.com;
Christopher Marcisz, "Wind farm signs deal to sell its electricity," *North Adams Transcript*, 12/8/04;
Bill Sample, "Lenox plans wind tower," *The Advocate*, 7/14/04, http://www.iberkshires.com/advocate/story14915.html;
Glenn Drohan, "Windmills blow into the forefront," *The Advocate*, 2/11/04, http://www.iberkshires.com/advocate/story13496.html;
Jon Wiener, "Williams group studying N.Y. site for wind turbines," *Berkshire Eagle*, 10/2/02, http://www.berkshireeagle.com;
Matt Crawford, "Turbines fuel debate across Vt.," *Burlington Free Press*, 10/6/03;
Associated Press, "Green Mountain Power wants more windmills in Searsburg," *Rutland Herald*, 12/11/03;
Robin Palmer, "Wrestling with the wind," *Barre Montpelier Times Argus*, 12/12/03;
Press Release, "Governor Announces $17 Million for Five State Wind Farms," 8/20/02, http://www.state.ny.us/governor/press/year02/aug20_2_02.htm]

[2] Denmark has 16,368 square miles of land; MA has 7,840 and VT has 9,250 square miles, for a total of 17,090 square miles of land. [McGeveran, William A. Jr., Editorial Director. *The World Almanac and Book of Facts: 2005*, New York: World Almanac Books, 2005, pp. 770, 424, 437.]

[3] Jørgen Drud Hansen, Camilla Jensen, and Erik Strøjer Madsen, *Green Subsidies and Learning-By-Doing in the Windmill Industry*, April 2001, p. 12, http://www.econ.ku.dk/cie/Discussion%20Papers/2001/pdf/2001-06.pdf

[4] *2003 Annual Report of the Danish Wind Industry Association*, March 2004, p. 8, http://www.windpower.org/media(404,1033)/annual_report_2003.pdf

[5] Denmark has two electricity systems that are not connected. The two systems are managed by two companies: Eltra in the West, and Elkraft System in the East. Eltra and Elkraft Transmission are the transmission system operators in West and East Denmark, respectively. Nordel is the intermediary between the transmission system operators of the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden.) The annual reports of all four companies are available on their websites, and Elkraft's website has information not contained in its annual report. In January 2005, Denmark took over ownership of Eltra and Elkraft. [http://www.eltra.dk/composite-11286.htm]

Nordel's annual reports contain statistics on all of Denmark. The most recent statistics are from 2003:
3,115 MW installed wind capacity, 12,830 MW total installed capacity (= 24.3% of total capacity);
5,560 GWh wind production; 43,754 GWh total production (= 12.7% of total production.)
[*Annual Report 2003*, Nordel, pp. 29, 36, http://www.eltra.dk/media(15971,1033)/Nordel%27s_Annual_Report_2003.pdf]

These numbers are reflected closely in the reports of Eltra and Elkraft:

West Denmark, 2003:
2,374 MW installed wind capacity, 7,457 MW total capacity;
4,363.4 GWh wind production, 27,364.1 GWh total production;
21,043 GWh total consumption
[*Annual Report 2003*, Eltra, p. 24, http://www.eltra.dk/media(15796,1033)/Annual_Report_2003.pdf]

East Denmark, 2003:
743 MW installed wind capacity, 5,334 MW total capacity;
1,197 GWh wind production, 16,393 GWh total production
14,717 GWh total consumption
[Installed wind capacity and total capacity, *Annual Report 2003*, Elkraft System, p. 12, http://eng.elkrafsystem.dk/elkraft/UK/Publications.nsf/ 0/FAB3139114BBBAFFC1256EA0002A034C/ $File/ELK+System+03.pdf!OpenElement;
Total wind production, http://eng.elkraft-system.dk/C1256CE2003CE4EF/ Electricity%

20Statistitics/4EB15C533A2CF6CBC1256CEC003C5652?OpenDocument;
Total electricity production,
http://eng.elkraft-system.dk/C1256CE2003CE4EF/ Electricity%
20Statistitics/01A5FEABB661E90CC1256CEC0030F09D?OpenDocument;
Total electricity consumption,
http://eng.elkraft-system.dk/ C1256CE2003CE4EF/Electricity%
20Statistitics/511AA657ED6CCB1DC1256CE9002FD13D?OpenDocument]

[6] David White, *Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution From Wind-Power*, Renewable Energy Foundation, December 2004, p. 3, http://www.ref.org.uk/images/pdfs/Whiteco2.pdf; Hugh Sharman, "Wind Power in Western Denmark's Energy System," forthcoming in *Civil Engineering: Proceedings of the Institution of Civil Engineers* (UK).

[7] According to the 2003 annual report of Eltra, the transmission system operator in Western Denmark, "…large wind power production in periods with low electricity consumption created several large energy transports, which the neighbouring countries settled at prices around DKK 0 per kWh." Hugh Sharman notes that this situation also happened in 2002. [*2003 Annual Report*, Eltra, p. 22, http://www.eltra.dk/composite-15581.htm;
Hugh Sharman, Incoteco (Denmark) ApS, *The Practicalities of Developing Renewable Energy in the UK – In the Light of Danish Experience*, p. 11, http://www.scottish.parliament.uk/business/committees/enterprise/inquiries/ rei/ec04-reis-sharman,hugh.pdf]

[8] According to Nordel's 2003 annual report, 5,560 GWh of wind electricity were produced in 2003. According to expert Hugh Sharman, 80% of that was exported, to neighbors leaving 1,112 GWh wind electricity to be consumed in Denmark. 21,043 GWh electricity consumed in West Denmark + 14,717 GWh electricity consumed in East Denmark = 35,760 GWh total electricity consumed in Denmark during 2003. 1,112 GWh ÷ 35,760 GWh = 3.1% of all electricity consumed in Denmark during 2003 came from wind turbines. [David White, *Reduction in Carbon Dioxide Emissions: Estimating the Potential Contribution From Wind-Power*, Renewable Energy Foundation, December 2004, p. 3, http://www.ref.org.uk/images/pdfs/Whiteco2.pdf; Hugh Sharman, "Wind Power in Western Denmark's Energy System," forthcoming in *Civil Engineering: Proceedings of the Institution of Civil Engineers* (UK).]

[9] *Environmental Report 2004 for Western Denmark*, Eltra, August 2004, p. 15, http://www.eltra.dk/media(15997,1033)/Milj%F8plan_2004-GB.pdf;
Annual Report 2003, Elkraft System, p. 23,
http://eng.elkraft-system.dk/elkraft/UK/Publications.nsf/0/FAB3139114BBBAFFC1256EA0002A034C/$File/ELK+System+03.pdf!OpenElement;
H. Nifenecker, *Comparison of the energy structure between Denmark, France and Sweden*, 11/23/03, p. 1,
http://www.ecolo.org/documents/documents_in_english/

[10] The definition of greenhouse gases from the Energy Information Administration of the U. S. Department of Energy is as follows: Those gases, such as water vapor, carbon dioxide, nitrous oxide, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride, that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface. [http://www.eia.doe.gov/glossary/glossary_g.htm]

[11] *Analysis of greenhouse gas emission trends and projections in Europe 2004*, European Environment Agency, EEA Technical report No 7/2004, Final draft version, 11/30/04, pp. 113, http://reports.eea.eu.int/technical_report_2004_7/en/Analysis_of_GHG_trends_and_projections_ in_Europe_draft.pdf;
Ron Quartermaine, "Renewable energy – an engineer's view," *Views of Scotland*, January 2005, p. 2, http://www.viewsofscotland.org/Library/VosConf%20-%20Jan05%20-%20RQ.pdf;
Richard Gray and Jeremy Watson, "Wind farms chaos leads to demands for rethink," *The Scotsman*, 1/30/05, http://news.scotsman.com/scotland.cfm?id=114462005

[12] Figure 10 of the report referenced below shows that, of the EU-15 countries, Denmark will have the greatest shortfall between greenhouse gas projections based on existing and additional domestic policies and measures and 2010 targets and changes by use of Kyoto mechanisms. (2010 is the shorthand used by EU reports to denote the compliance period of 2008 and 2012.) See page 21 for the note that Denmark has provided quantitative information on its intent to use the Kyoto Mechanisms in sufficient detail. Figure 10 and Table A3 18 show Denmark's shortfall based on existing domestic measures projections. See also the country report for Denmark in Annex 5. [*Analysis of greenhouse gas emission trends and projections in Europe 2004*, European Environment Agency, EEA Technical report No 7/2004, Final draft version, 11/30/04, Figure 9, Figure 10, Table A3 18, pp. 20, 21, 22, 113, 157, http://reports.eea.eu.int/eea_report_2004_5/en/GHG_emissions_and_trends_2004.pdf;
Analysis of greenhouse gas emission trends and projections in Europe 2004, European Environment Agency, EEA Technical report No 7/2004, Final draft version, Annex 5, 11/30/04, p.15, http://org.eea.eu.int/documents/newsreleases/ghg_emissions-trends2004-en]

[13] The print version of this article cites 2003 as the year that Denmark had the third highest average residential electricity costs. The date should be 2004. The document used for this footnote is dated 2003, but its chart for electricity prices in Europe refers to electricity rates for residential customers in Europe during 2004 (the average price excluding VAT.) It appears the document was written at the beginning of 2004.
[*EDF at a glance 2003*, Le Group EDF, p. 8, www.edf.com]

[14] "Windmill sales good, but not in Denmark," *Copenhagen Post*, http://www.cphpost.dk/get/85239.html

[15] Germany's total area is 137,847 square miles, and its land area is 134,836 square miles.

New England's equivalents are: total area, 70,447 square miles (CT 5,543; ME 35,385; MA 10,555; NH 9,350; RI 1,545; and VT 9,614), and land area, 62,810 square miles (CT 4,845; ME 30,862; MA, 7,840; NH 8,968; RI 1,045; and VT 9,250). If using total area, then Germany is slightly less than twice the size of New England. If using land area alone, then Germany is slightly more than twice the size of New England. [McGeveran, William A. Jr., Editorial Director. *The World Almanac and Book of Facts: 2005*, New York: World Almanac Books, 2005, pp. 778, 417, 423, 424, 428, 434, 437.]

[16] " Germany to cap green power subsidies paid by firms," *Reuters News Service*, 3/10/03, http://www.planetark.com/dailynewsstory.cfm/newsid/20080/story.htm;
Charles Hawley, "As windmills spread, some Germans balk at 'asparagus fields,'" *Christian Science Monitor*, 5/4/04, http://www.csmonitor.com/2004/0505/p01s04-woeu.html

[17] *Wind Energy Report*, E.ON Netz, p. 4, http://www.eon-netz.com/frameset_reloader_homepage.phtml?top=Ressources/frame_head_eng.jsp&bottom=frameset_english/energy_eng/ene_windenergy_eng/ene_windenergy_eng.jsp

[18] "Wind Energy Use in Germany - Status 31.12.2003," German Wind Energy Institute, http://www.dewi.de/

[19] *E.ON Netz Wind Energy Report*, p. 4, http://www.eon-netz.com/frameset_reloader_homepage.phtml?top=Ressources/frame_head_eng.jsp&bottom=frameset_english/energy_eng/ene_windenergy_eng/ene_windenergy_eng.jsp

[20] *E.ON Netz Wind Energy Report* pp. 3, 7, http://www.eon-netz.com/frameset_reloader_homepage.phtml? top=Ressources/frame_head_eng.jsp&bottom=frameset_english/energy_eng/ene_windenergy_eng/ene_windenergy_eng.jsp;
Current Experience with Renewable Support Schemes in Europe, Council of European Energy Regulators, p. 57 of 127.

[21] "Not enough juice to keep German industry growing," *Frankfurter Allgemeine Zeitung*, 9/1/04, http://www.faz.net

[22] Press Release, "Kyoto target within EU's grasp if all planned measures and projects are implemented, projections show," European Environment Agency, 12/21/04, http://org.eea.eu.int/documents/newsreleases/ghg_emissions-trends2004-en; http://www.planetsave.com/ViewStory.asp?ID=5545;
Mark Landler, "Mixed Feelings as Treaty on Greenhouse Gases Takes Effect," *New York Times*, 2/16/05, http://www.nytimes.com

[23] "German Stocks Drop, Led by Infineon, Bayer; Aareal Bank Plunges," *Bloomberg News*, 8/31/04, http://quote.bloomberg.com/apps/news?pid=10000100&sid=a7t6oHrQB6F4&refer=germany; "German Power Prices May Advance as Industrial Demand Increases," *Bloomberg News*, 9/24/04, http://quote.bloomberg.com/apps/news?pid=10000100&sid=ara1QPfZD2mM&refer=germany

[24] Tony Paterson, "Germany shelves report on high cost of wind farm-produced energy," *Sunday Telegraph*, 1/30/05, http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2005/01/30/nwind130.xml&sSheet=/news/2005/01/30/ixhome.html

[25] The information for this point comes from a British translation of a January 2005 article in *Der Spiegel*, as well as two articles about the *Der Spiegel* article from British newspapers. The translation is given here:

Frank Dohmen and Michael Sauga, "Wind Calculations," *Der Spiegel*, January 2005.

The results of a study commissioned by the federal government into the expansion of wind force have caused quite a stir: The "green" electricity propagated by the Red-Green coalition will indeed be considerably more expensive for the consumers than previously thought. Everything had, in fact, already been regulated. Over months, representatives of the federal government, the large energy producing groups and the wind-power sector had carried out energetic discussions in order to end the smoldering dispute as to whether a further expansion of wind power made sense or not.

A scientific study was to be set up. A work under the direction of the federal government's own Agency for Energy (DENA), which would be able to answer major questions free from the influence of any ideology: Is the amount of additional wind power planned by the federal government feasible at all? What costs would arise? Which technologies must be used in order to feed in the green electricity? What would be the effects of the wind power on the supply of power in Germany?

Well known scientific institutes such as the Deutsche Windenergie-Institut (DEWI: German Wind Power Institute) or the Energiewirtschaftliche Institut zu Köln (EWI: Institute of Energy Economics at the University of Cologne) were involved, and high caliber external consultants were entrusted with the checking of the results. When the representatives of the power industry and the wind power sector met last Monday, it should merely have been a matter of formalities: the approval of a summary that would then be presented to the general public.

The meeting led to a confrontation, however. Instead of approving the largely complete investigation, participants of the meeting have reported that the representatives of the wind power sector demanded an editorial revision. Without this, they let it be known to the group, they would not agree to the publishing of the study.

Probably with good reason: Because what the scientists had brought together on 490 pages regarding wind power and its expansion is hardly flattering for the ecological prestige project of the Red-Green coalition. The discussion regarding the study, which has been made available to DER SPIEGEL, could bring additional turbulence to the wind power sector, which has already suffered some setbacks.

It was also hardly helpful when the Green Federal Minister for the Environment, Jürgen Trittin, joined with the representatives of the wind power sector in warning against "misinterpretations" of the results, even before their publication. The figures and the statements raise delicate questions, even if meticulous attention has been paid to ensuring that every side can still publicly represent its position while referring to the expertise.

According to the study, a further financial and technical strong-arm effort would be required in order to be able to even input the quantity of green electricity planned by the federal government into the German electricity network by the year 2015.

845 kilometers of powerful high-voltage routes will have to be built in the next few years, at a cost of 1.1 thousand million Euro, in order to be able to integrate the wind parks that will be shooting out of the ground throughout the federal republic.

- Despite substantial investments into improved techniques, the risks for the supply of power cannot be completely excluded.
- The quantity of climate-damaging CO2 gas that would be saved by wind power could be achieved more cheaply with other measures.
- The costs that the consumers would have to pay for green electricity are considerably higher than previously assumed. According to the study, the "net additional costs" for the increase of the amount of wind power electricity planned by the federal government from 2003 to 2015 alone amount to between 12 to 17 thousand million Euro. The investment for the network and the support of existing inventory is not even included in this.

The statements made in the study are a blow to the wind power sector in a situation that was already critical. Throughout the country, the resistance of the affected population against the increasing "Verspargelung" of the landscape (turning the German countryside into asparagus fields) is growing. And even those who wanted to profit from wind power are becoming increasingly disappointed. Capital investors have had to accept that the profit forecasts of wind park operators and installation builders have sometimes turned out to be questionable.

Some companies who, only a short time ago, were celebrated as the "great white hope", have had to accept sharp setbacks in the meantime.

In addition, an increasing number of scientists, politicians and company managers are warning about a possible false path in the energy policy.

"We are risking a blackout in the supply of power if we continue with the promotion of renewable energy in this way," said the President of the Federal Association for Industry, Jürgen Thumann, last week. This kind of criticism could be further nurtured by the DENA

investigation.

Because, according to the data collected by the scientists, the amount of wind power in Germany will be dramatically increased in the coming years through the statutory promotional measures of the Red-Green coalition. From around 23 terawatt-hours (in 2003), the amount of wind power electricity will rapidly increase to more than 77 terawatt-hours by the year 2015. This would represent more than 16 percent of the electricity consumption in Germany.

In addition to further “asparagus poles” in the country, the so-called Offshore Installations in the North Sea and the Baltic will contribute to the planned increase. But the connection of the wind parks apparently involves hidden risks.

In the year 2003, according to the study, the incalculable wind electricity has already led to substantial safety risks. In the winter months in particular, with their strong winds, "large-area voltage and network failures could have occurred," which would have led to considerable "risks for the reliability of the supply to the German and European grid interconnection."

The wind power sector and Federal Minister for the Environment Trittin believe that they can avoid such serious dangers in the future. For example, the regulations for inputting into the network have already been changed. Furthermore, additional technical measures in the electricity network and to the individual installations should ensure reliability. Whether this will succeed in good time and to a sufficient extent remains to be seen, however. From 2015 at least, according to the DENA paper, critical situations could arise once again, following a temporary stabilization in some network areas. The statements are also less flattering for the argument that is always mentioned as the main reason for the promotion of wind power: The reduction of the greenhouse gas CO2.

The emission of the climate killers will in fact be considerably reduced by the avoidance of the use of fossil fuels such as coal, gas or oil. According to the study, however, this effect could also be achieved through other technical measures - but considerably cheaper. For example, if older power stations were modernized and their efficiency was thereby increased.

Wolfgang Clement, the Federal Minister for the Economy, warned quite openly against further experiments in the energy policy last week. For months now, Clement has been involved in an argument with his government colleague Trittin regarding the further expansion of wind power. Based on the results of the study, Clement has now also publicly expressed doubts. The costs for the green electricity, according to the minister, would increase from today’s 1.4 thousand million Euro to 5.4 thousand million Euro in the year 2015.

One has to ask, says Clement, whether Germany can afford that.

Trittin’s rejoinder was not long in coming. Clement must have been working with the wrong figures, blustered the Minister for the Environment. The expertise from DENA actually showed that a further expansion of wind power was feasible at acceptable costs. The households would be burdened with a maximum of one Euro per year.

The mollifications of the Minister for the Environment are just as misleading as the figures of his opponents. In fact, according to the study, the payments to be made to the operators of wind parks according to the Energy Input Law (EEG) will increase from an annual amount of around 2.1 thousand million Euro (2003) to around 5.4 thousand million Euro in the year 2015. This sum also includes the market price for the corresponding amount of electricity, however.

This will have to be subtracted from the development total in order to determine the added costs of wind electricity compared to conventional electricity. Other costs will also have to be added or subtracted, for example, the added outlay for standard and reserve energy in times of low wind, which the large power companies can reallocate to the running electricity costs. And this is exactly what the authors of this study have done, in a complex model taking a number of scenarios into account regarding the development of raw material prices (gas, coal or oil) in the future.

The result: For the wind electricity that will be produced in installations that will be additionally built from 2003 alone, the consumers will have to pay between 1.4 und 2.1 thousand million Euro more than for conventional electricity from 2015.

For a normal household with an annual consumption of around 4,000 kilowatt-hours, this would amount to additional costs of between 15.40 and 19 Euro for the additional wind electricity expansion according to the study. These amounts only indicate the "lower edge", however, as the "indirect costs" that result from the promotion of other regenerative energy and the windmills that already exist in 2003, "have not been taken into consideration." If these are also included, an annual "increase in the costs of obtaining electricity" for a normal household of between around 36 and almost 44 Euro results for all regenerative energy from 2015.

Calculations of this kind are very different from the sometimes very different figures that have been mentioned up to now by the green electricity lobby and the Green party. They assume that the price for conventional electricity will increase rapidly and that green electricity could perhaps become competitive at some time.

It is exactly here that the problem lies. Instead of openly stating the difficulties and risks that are hidden in the energy path that is being followed, and the costs that the citizens could really be asked to pay, the reaction is wheeling and dealing, fiddling and smooth talking.

There are certainly citizens who would be prepared to promote wind energy, despite the higher costs, in order to reduce the current dependency on gas, coal and oil. In general, there is no objection to the technology itself. At locations with really strong winds, they can make a contribution - even if considerably smaller - to the supply of power.

Massive over-promotion and an unbridled expansion, however, include risks and could cause costs in thousands of millions, which are documented in the DENA study for the first time.

Whether such realizations will be quickly reflected in politics is, however, questionable. Economy Minister Clement will, however, make use of the data from the study in order to

make the planned expansion of renewable energy somewhat more modest than previously planned. It seems unlikely, however, that he will start this attempt within the current legislative period.

Because, above the adversaries Clement and Trittin, there is somebody who wants to avoid a new fundamental conflict between economy and ecology under all circumstances in the upcoming continuous election campaign of the next few months: Federal Chancellor Gerhard Schröder. He wants as much calm as possible in this matter, no wind at all.

Here are the two articles on the *Der Spiegel* article. ["Day of Dread as First Giant Turbine Goes Up," *Western Morning News*, 2/3/05, http://www.westernmorningnews.co.uk;
Tony Paterson, "Germany shelves report on high cost of wind farm-produced energy," *Sunday Telegraph*, 1/30/05, http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2005/01/30/nwind130.xml&sSheet=/ news/2005/01/30/ixhome.html]

[26] http://www.bwea.org/map/index.html

[27] As of February 20, 2005, the U.K.'s 1,186 turbines represented 888.8 MW of installed capacity. Using the U.K.'s average capacity factor of 24.1% in 2003 (the most recent figure I could find), that would mean 1,876,399 MWh of output, equivalent to that of a medium-sized combined-cycle natural gas plant. [British Wind Energy Association, http://www.bwea.org/map/index.html;
Policy and Research Group, Renewable Energy: The Need for Balance and Quality, Renewable Energy Foundation, January 2005, p. 34, http://www.ref.org.uk/images/pdfs/REF.manifesto08.02.04.pdf;
Dr. V.C. Mason, *West Danish wind power - lessons for the UK*, Country Guardian, November 2004, p. 2 of 9, http://www.countryguardian.net/vmason.htm]

[28] According to the *2005 World Almanac*, Scotland is 30,418 square miles. It's not clear if that means total area or land area, but the context implies the latter. New England's total area is 70,447 square miles (CT 5,543; ME 35,385; MA 10,555; NH 9,350; RI 1,545; and VT 9,614), and its land area is 62,810 square miles (CT 4,845; ME 30,862; MA 7,840; NH 8,968; RI 1,045; and VT 9,250.) Either way, Scotland is less than half the size of New England. [McGeveran, William A. Jr., Editorial Director. *The World Almanac and Book of Facts: 2005*, New York: World Almanac Books, 2005, pp. 417, 423, 424, 428, 434, 437, 842.]

[29] Richard Gray and Jeremy Watson, "Wind farms chaos leads to demands for rethink," *The Scotsman*, 1/30/05, http://news.scotsman.com/scotland.cfm?id=114462005

[30] Edward Black, "Scotland split over wind turbine plans," *The Scotsman*, 2/2/05, http://business.scotsman.com/index.cfm?id=122642005

[31] http://www.eia.doe.gov/emeu/states/_states.html

[32] http://www.energy.ca.gov/wind/overview.html

[33] http://www.energy.ca.gov/electricity/gross_system_power.html; http://www.energy.ca.gov/electricity/electricity_generation.html

[34] U.S. Environmental Protection Agency, *Non-Attainment Area Map*, Green Book, http://www.epa.gov/oar/oaqps/greenbk/mapnpoll.html;
http://www.epa.gov/air/data/repsst.html?st~CA~California;
Clean Air Task Force, *Diesel & Health in America: Diesel Soot Health Impact*, http://www.catf.us/projects/diesel/dieselhealth/state.php?site=0&s=06

[35] Andrew C. Revkin, "A Far-Reaching Fire Makes a Point About Pollution," *New York Times*, 7/27/04, http://forests.org/articles/reader.asp?linkid=33877;
William Grimes, "Car Clones and Other Tales of the Mighty Economic Engine Known as China," *New York Times*, 2/15/05, http://www.nytimes.com/ 2005/02/15/books/15grim.html

[36] http://www.awea.org/projects/index.html

[37] See United States Geological Survey topographic maps for North Adams and Stamford.

[38] http://www.northeastwind.com/ whatwevedone/searsburg.html; *Green Mountain Power Wind Power Project Development: U.S. Department of Energy – EPRI Wind Turbine Verification Program*, EPRI, Palo Alto, CA; U.S. Department of Energy, Washington, DC; Green Mountain Power Corporation, South Burlington, VT: 1997. TR-109061, p. 7-7, http://www.epriweb.com/public/ TR-109061.pdf;
Michael Valenti, "Proving wind power in New England," *Mechanical Engineering-CIME*, August 1998.

[39] Searsburg's annual output:

Year	MWh	Capacity Factors
1998	12,886	(24.31%)
1999	13,605	(25.67%)
2000	12,246	(23.11%)
2001	12,135	(22.90%)
2002	11,458	(21.62%)
2003	10,828	(20.43%)

[Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 1998, filed with the SEC, 3/25/99, p. 10 of 295, http://www.sec.gov/Archives/edgar/data/43704/0000043704-99-000006.txt;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 1999, filed with the SEC, 3/28/00, p. 6 of 106, http://www.sec.gov/Archives/edgar/data/43704/0000043704-00-000004-index.html;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2000, filed with the SEC, 3/28/01, pp. 6, 12 of 103; http://www.sec.gov/Archives/edgar/data/43704/000004370401000017/0000043704-01-000017-0001.txt;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2001, filed with the SEC, 3/25/02, pp. 6, 11 of 168, http://www.sec.gov/Archives/edgar/data/43704/000004370402000005/secform10k2001.txt;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2002, filed with the SEC, 3/24/03, pp. 6, 12 of 129, http://www.sec.gov/Archives/edgar/data/43704/000004370403000002/gmpcorp200210k.txt;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2003, filed with the SEC, 3/12/04, p. 6 of 232, http://www.sec.gov/Archives/edgar/data/43704/000004370404000026/doc1.txt

[40] In 2003, Searsburg's capacity factor was 20.43%. [Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2003, filed with the SEC, 3/12/04, p. 6 of 232, http://www.sec.gov/Archives/edgar/data/43704/000004370404000026/doc1.txt]

[41] The website of Green Mountain Power Corporation, the owner of Searsburg, claims that the wind power plant produces enough electricity to supply over 2,000 average Vermont homes. The website of the project manager, John Zimmerman (head of Enxco's East Coast operations), claims the same. The actual number is 30% lower, the equivalent of less than 1,392 homes. It's worth noting that commercial and industrial users account for a substantial amount of electricity demand, but wind power companies typically refer to homes in order to illustrate equivalent usage.

Searsburg Year	MWh	Residential Use kWh	Homes Served
2000	12,246	7,717	1,587
2001	12,135	7,497	1,619
2002	11,458	7,491	1,530
2003	10,828	7,779	1,392

[http://www.gmpvt.com/whoweare/searsburg.shtml; _ http://www.northeastwind.com/whatwevedone/searsburg.html; _

http://www.gmpvt.com/whoweare/searsburg.shtml;
Green Mountain Power Corporation, Form 10-K, for the fiscal year ended December 31, 2003, filed with the SEC, 3/12/04, pp. 6, 7 of 232, http://www.sec.gov/Archives/edgar/data/43704/000004370404000026/doc1.txt]

[42] NEPOOL forecasts that net annual energy use in New England will be 132,740 GWh in 2005, and 145,715 GWh in 2013. That is an increase of 9.77% ((145,715 – 132,740 = 12,975) ÷ 132,740 = .09774). [*NEPOOL 2004 – 2013 Forecast Report of Capacity, Energy Loads and Transmission*, April 2004, p. 7, http://www.iso-ne.com/Historical_Data/CELT_Report/2004_CELT_Report/2004_CELT_Report.pdf;
Press Release, "Potential remains for huge energy efficiency savings," Northeast Energy Efficiency Partnerships, Inc., 11/17/04, p. 2, http://www.neep.org/files/ NEEP_Study_PR.pdf]

[43] http://www.census.gov/population/projections/state/stpjpop.txt; http://www.census.gov/population/www/pop-profile/stproj.html

[44] The state of New York forecasts an increase in electrical demand from 2005 to 2013 of 17,586,999 MWh (182,866,999 MWh - 165,280,000 MWh = 17,586,999 MWh increase); 17,586,999 ÷ 165,280,000 = 10.64% increase.

[State of New York Public Service Commission, *Order Regarding Retail Renewable Portfolio Standard*, Case 03-E-0188 – Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, 9/24/04, Table 1, http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/Web/85D8CCC6A42DB86F85256F1900533518/$File/301.03e0188.RPS.pdf?OpenElement]

[45] The state of New York commissioned a two-part study from GE Power Systems Energy Consulting on the effects of integrating wind power into its electrical grid. Phase 1 of the study was produced in February 2004. Phase 2 is in the draft stage, and will be released in March 2005.

The Phase 1 report looks at the potential of wind generation to meet part of the state's 25% Renewable Portfolio Standard goal. It considers a total wind generation potential of 10,026 MW, of which 600 MW would be offshore, and 9,426 MW would be onshore. The draft Phase 2 report considers two alternate scenarios with 3,300 MW of wind generation (see p. 1.2.)

According to the Phase 1 report, New York expects onshore wind power plants to generate 6,593,652 MWh annually (43.69% of all renewables) by 2013. In that report, GE established estimated capacity factors for designated regions, ranging from 25% to 30% and above (see pp. 5.3 and 5.4.) In its Phase 2 draft report, GE asserts that the overall capacity factors of those regions are on the order of 30% (see p. 2.14.) According to energy expert Tom Hewson,

the 2003 capacity factor for the Fenner NY wind power plant was 19.2%. Therefore, I struck a compromise, and used 27% as the capacity factor, which is the national average, and the average for all wind power plants installed nationally since 2000.

The equation for determining the number of turbines is as follows: 6,593,652 MWh = (MW x 8760 hours in a year) x .27 capacity factor. MW, the unknown factor, is 2,787.77. Dividing that by 1.5 MW turbines = 1,858.5 turbines by the end of 2013. This figure is probably low.

GE's draft Phase 2 study focuses on a scenario of 3,300 MW of wind power in 2008, 2,700 MW of which would be onshore (see Table 2.1.) That would correspond to 1,800 1.5 MW turbines in rural parts of the state. Of course, the total number would escalate through 2013, and thus above the 1,850 number through 2013 that I use in this article.

[State of New York Public Service Commission, *Order Regarding Retail Renewable Portfolio Standard*, Case 03-E-0188 – Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, 9/24/04, pp. 27, Tables 1, 7, http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/Web/85D8CCC6A42DB86F85256F1900533518/$File/301.03e0188.RPS.pdf?OpenElement;
Richard Piwko, Project Manager, GE Power Systems Energy Consulting, *The Effects of Integrating Wind Power on Transmission System Planning, Reliability, and Operations, Report on Phase 1: Preliminary Overall Reliability Assessment*, prepared for New York State Energy Research and Development Authority, 2/2/04, p. 3.5, http://www.dps.state.ny.us/Phase1FinalPreliminaryReliabilityAssessmentReport_020204.pdf;
Richard Piwko, Project Manager, GE Power Systems Energy Consulting, *The Effects of Integrating Wind Power on Transmission System Planning, Reliability, and Operations, Report on Phase 2: System Performance Evaluation*, prepared for New York State Energy Research and Development Authority, DRAFT, 2/3/05, http://www.nyserda.org/rps/draftwindreport.pdf]

[46] Based on Tables 1 and 7 in New York's Order Regarding Retail Renewable Portfolio Standard, 3.6% of the state's electricity is expected to be generated from onshore wind by the end of 2013 (6,593,652 MWh ÷ 182,866,999 MWh = 3.6%.) As shown in Footnote 44, a 10.64% increase in electricity demand is expected from 2005 through 2013. So, electricity from onshore wind power plants won't keep pace with the increase in demand. The percentage of all renewables compared to all electricity consumed is pegged at 19.29% in 2005 (see p. 27 of the Order) due to rise to 25% (24% mandatory and 1% voluntary) in 2013. The difference is 5.71%. That is a little more than half (53.67%) of the projected increase in electricity demand. The remainder will have to be met with conventional fuels. [State of New York Public Service Commission, *Order Regarding Retail Renewable Portfolio Standard*, Case 03-E-0188 – Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, 9/24/04, Table 1, http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/Web/85D8CCC6A42DB86F85256F1900533518/$File/301.03e0188.RPS.pdf?OpenElement]

[47] Press Release, "Potential remains for huge energy efficiency savings," Northeast Energy Efficiency Partnerships, Inc., 11/17/04, p. 2, http://www.neep.org/files/NEEP_Study_PR.pdf

[48] Timothy Egan, "Suddenly, It's Hip to Conserve Energy," *New York Times*, 6/20/04, http://www.nytimes.com

[49] A study commissioned recently by Northeast Energy Efficiency Partnerships, Inc. concluded that achieving total economically feasible energy efficiency in New England would result in energy savings of 17,103 GWh and consumption savings of 4,317 MW by the year 2008. This is the equivalent of the annual electrical needs of 2.4 million households, and 14 combined-cycle natural gas power plants. By the year 2013, an estimated 34,375 GWh of energy savings and 8,383 MW in consumption reduction could be achieved, equaling the electricity needs of all Connecticut and New Hampshire households combined, and equivalent to 28 combined-cycle gas units of 300 MW each. [Optimal Energy, Inc., *Economically Achievable Energy Efficiency Potential in New England*, Prepared for Northeast Energy Efficiency Partnerships, Inc., 11/17/04, pp. 4, 5, http://www.neep.org/files/Full_Report.pdf; Press Release, "Potential remains for huge energy efficiency savings," Northeast Energy Efficiency Partnerships, Inc., 11/17/04, p. 1, http://www.neep.org/files/NEEP_Study_PR.pdf

[50] William Prindle, et al., *Energy Efficiency's Next Generation: Innovation at the State Level,* Report Number E031, American Council for an Energy-Efficient Economy, November 2003, p. 1, http://aceee.org/pubs/e031full.pdf;
McGeveran, William A. Jr., Editorial Director. *The World Almanac and Book of Facts: 2005*, New York: World Almanac Books, 2005, p. 424.

[51] *Power To Spare: A Plan for Increasing New England's Competitiveness Through Energy Efficiency*, New England Energy Policy Council, July 1987, Executive Summary, p. 3.

[52] According to a recent study commissioned by the Northeast Energy Efficiency Partnerships, Inc., saving electricity costs 67% less than supplying it. In other words, investing in energy efficiency programs at current levels is 67% cheaper than the average cost to supply electricity over the study's timeframe. [Optimal Energy, Inc., *Economically Achievable Energy Efficiency Potential in New England*, Prepared for Northeast Energy Efficiency Partnerships, Inc., 11/17/04, pp. 6, 9, http://www.neep.org/files/Full_Report.pdf*;*
Power To Spare: A Plan for Increasing New England's Competitiveness Through Energy Efficiency, New England Energy Policy Council, July 1987, Executive Summary, p. 1.]

[53] Continuing New England's current energy efficiency policies over the next 10 years would target less than 20% of economically achievable energy efficiency potential, according to the NEEP study. [Optimal Energy, Inc., *Economically Achievable Energy Efficiency Potential in New England*, Prepared for Northeast Energy Efficiency Partnerships, Inc., 11/17/04, p. 12, http://www.neep.org/files/Full_Report.pdf;
Peter J. Larkin and Janet Domenitz, "Energy efficiency," *Berkshire Eagle*, 7/29/04, http://

www.BerkshireEagle.com]