A Look at Impacts of Wind and Solar Electric Generation on Electricity Price

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Electricity generation using wind and solar energy has come a long way over the last five decades. Governmental subsidies have come a long way also, from mainly fostering fossil fuels to assisting solar and wind deployment big-time. In this second decade of the 21st century, some concerns have been raised about how much solar and wind electric generation is sensible to install and how much is worth paying to do so. In addition, though not discussed much, there is an important question of how to handle technology transitions effectively.

Beginning with the Rio Summit[1] in 1992, governmental entities began making wild promises about saving the earth. Renewable energy achieved new status as the energy source of choice to help in saving the planet. Today, governmental commitments to eliminating use of carbon-based fuels and achieving 100% renewable energy for large geographic entities have become almost boring in their predictability. After all, we must save the planet. There is no time for "sensible" technology shifts. Over decades, the promises have mostly proven to be hot air, but politics often lives on empty promises.

By the time of the Paris "climate-saving" conference in 2015, saving the planet had come to mean so many things it was difficult to actually make sense of it, unless one believed mountains of politically correct platitudes alone have the power to save. Even the planet-saving scientist James Hansen called the Paris talks a "fraud."

Unfortunately, "saving the planet" in extreme ways with desperately short timetables also often means extreme consequences. Europeans have talked about complete "decarbonisation" of Europe (probably requiring elimination of most industry), but over time the implications of such planet-saving efforts appear to have cooled the rhetoric. Hawaiians have committed to having a 100% "clean" energy economy by 2045, and whatever that means will likely evolve over the next decades. California has now promised to be on the 100% renewable bandwagon by 2045. How empty will these promises be? The horizon is too far in the future to care much.

Rush to Change

Fortunately, the push to renewable electricity generation has led to important increases in the renewables share of electricity generated and also important improvements in the technologies and grid integration. But some have raised concerns that the rush to renewables may have gone too far (or maybe too fast), at least in some locations. Surcharges and taxes on energy to support renewables implementation have caused major price spikes for electricity in some locations and uncomfortable price increases in others. In the United States, major increases in use of renewables electricity generation in some locations have not caused much impact on prices locally, although decreasing use of coal does appear to have some discernable price increase impacts.

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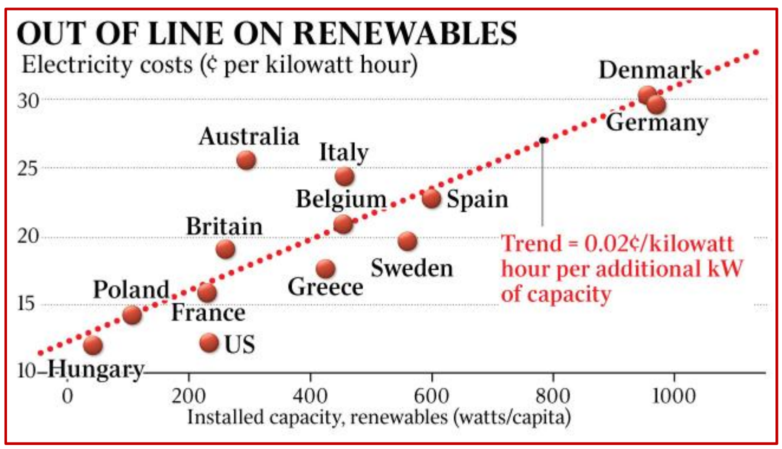
[1] United Nations Conference on Environment and Development, also known as the Rio de Janeiro Earth Summit, Rio Summit, Rio Conference, and Earth Summit — the first UN conference highly focused on saving the planet from global warming, held in Rio de Janeiro, June 3–14, 1992. The planet was to be "saved" before the year 2000, but nothing much changed.

In Germany, where 16% of electricity in 2016 was generated by wind and solar power, and price increases have not been popular, it is reported that about 800 citizen-led initiatives have been started to fight the government's energy plan and objectives. In June 2018, the German energy minister appeared to be retreating from European objectives to a degree in remarks made at a meeting of European energy ministers. Wind energy subsidies in Germany are reported to start expiring soon, and thousands of older wind turbines may be shutting down.

In South Australia, disruption events appear to have been introduced into the electricity supply through major increases in use of wind and solar electricity generation, and Australian electricity prices have increased dramatically over the last decade. Wind power provides about 35% of total electricity generation in South Australia, over double that of Germany. Australians appear to have sharp divides between those who support planet-saving efforts (and also seem unfazed by major increases in electricity prices) and those who feel such efforts can be misguided at best and economic suicide at worst. (Some political suicide also may be coming.)

An article in the *MIT Technology Review* provides an estimate that California's push to 100% renewables may require an investment of $2.5 Trillion to provide required energy storage (and reliability of storage technologies is uncertain).[2] One has to wonder whether citizens there might start to oppose this much additional investment in energy infrastructure? Especially as they have to start paying for it (possibly more than once if reliable technology lifetimes of storage are too short).

Current skeptical studies of the impacts of wind and solar electric generation on electricity prices have typically looked at the relationship between installed capacity per capita (kW/capita) and prices.[3] One example of this presentation is shown in the figure to the right, based on data from about 2014 (see footnote 3 for where it can be viewed in an Australian context). Deciphering or interpreting how a trend line on energy use (kWh) is related to power (W) is not straightforward.



Concerns about rising prices due to wind and solar electricity generation are beginning to lead to some resistance to further increases in solar and wind capacity in some locations. Concerns about potential inadequacy or high costs of power storage technologies are also cautionary. Analysis of price trends is limited, and the governmental push toward 100% renewables by some entities may be too costly in the end. Concurrent pushback and the push to 100 is a conflict. Pushing to save the planet is also in conflict with a lot of scientific data showing the planet does not need to be "saved" in a short period of time (or may not need saving at all). The consideration of whether there are optimum levels of wind and solar generation, and what the factors affecting any optima are, seems lost in the conflict(s).

Toward Increased Understanding

This paper looks at energy price vs total percent of electric generation for wind plus solar technologies in the year 2016 for several European countries and the 50 United States plus the District of Columbia. Trends based on these factors will be direct and not obscured by mismatches in units, although there are still issues related to grid interconnection levels, exports and imports of electricity, and what an "average" electricity price is. Changing the units to percent of electricity generated is one way of making the situation more understandable (kWh/capita might

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[2] "The $2.5 trillion reason we can't rely on batteries to clean up the grid," *MIT Technology Review*, July 27, 2018. https://www.technologyreview.com/s/611683/the-25-trillion-reason-we-cant-rely-on-batteries-to-clean-up-the-grid/

[3] See for example, Jo Nova's blog, which has links to other examples. http://tinyurl.com/y76yy7po

be another way, but is more obscure in some cases). Increased understanding of impacts of wind and solar generation on electricity prices is needed to begin to analyze potential optimization of electricity generation technology mixes, and maybe also to consider reasonable timelines and strategies for shifting technologies.

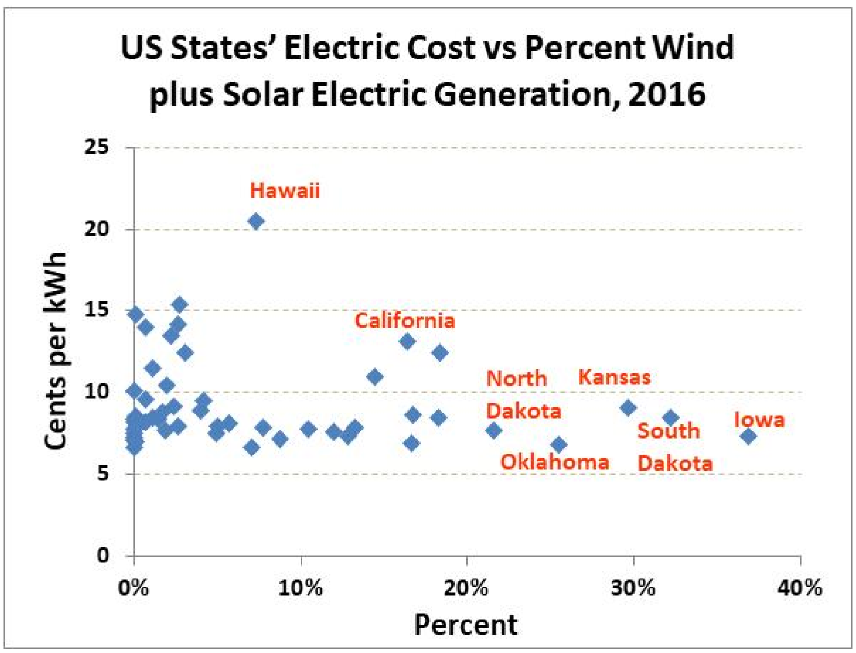
The push to increase renewables electricity generation has similarities in both the United States and Europe, but since the United States is such a large country, and since interstate electricity transmission is substantial, the US situation at the individual state level may have limits of comparability to individual European countries. European inter-country electricity transmission appears more limited than US interstate transmission. The extent of these differences may be useful for consideration of how best to shift technologies and limit price impacts, but they are not analyzed here.

This "look" at the current situations uses existing data to make the comparisons, and there are differences in types of prices used in Europe vs prices in the United States. The US EIA estimates an average price directly. Eurostat does not estimate average prices and instead has data on price components, so calculating an average "price" is complicated. So the results here are limited to a degree by the data available, but they provide one look at current discernible effects on price. Further study is needed.

US Trends

Electricity generation data for the US trends come from the Energy Information Administration (EIA) Electricity Data System[4] for 2016. Price data come from the EIA State Energy Data System (SEDS).[5] EIA has state-by-state (including the District of Columbia) estimates of electricity production by fuel type, and also has an overall average electricity price for all sectors combined (industry, transport, residential, and commercial). The total electricity generated by "fuel" types of interest for each state was divided by total electric generation for the state to calculate state-by-state shares of electricity generation mix for each. Exports are included in total generation, and imports are not. The major fuel types of coal, natural gas, and nuclear were analyzed, along with the combined generation for wind and solar technologies. Hydroelectric is an important type but was not considered here (hydro provided 6.6% of US total generation in 2016).

These average state prices were analyzed against wind+solar generation share, for these 51 data points using OLS regression. The results of the cross-sectional regression indicate no detectable relationship between state-level electricity prices and wind+solar shares re generation as specified here (F = 0.77, model Pr = 0.386, and adj R^2 = –0.005). The wind+solar generation shares and average prices for the 51 states+DC are shown in the figure to the right.



Regressions for the major fuel types of gas and nuclear indicated no discernible cross-sectional trends, with model significance as poor or worse than for wind+solar. For coal, a discernible negative trend was found (F=12.03, model Pr = 0.0011, adj R^2 = 0.18). In 2016, using no coal for generation has an expected average state price determined by the regression to be 10.7 cents per kWh,

[4] https://www.eia.gov/electricity/data/state/annual_generation_state.xls
[5] https://www.eia.gov/state/seds/

decreasing 0.046 cents / kWh for each one percent increase in coal generation share. The significance of the intercept was greater than 99.99%, while the coal-share percent coefficient was significant at the 99.9% level.

The coal-share for the country is about 30%. The highest state coal-share was in West Virginia, at 94.2%. A quarter of the states have a coal-share of 75% or more. The electricity price in North Dakota, Iowa, and Kansas is low because of significant coal-based generation (70%, 46%, and 49% respectively). The price in Oklahoma remains low due to cheap natural gas and a combined gas+coal generation share of 71%. South Dakota has both coal and extensive hydro generation that keep price lower. These older (sunk-cost) coal plants are an important factor in keeping electricity price reasonable, and rushing to exterminate them could be foolish price-wise.

Several states have wind+solar electricity generation share in the same range as South Australia or Denmark, but electricity price jumps have not been observed. The push to renewables in Europe and Australia has been reported to be also a push toward elimination of coal-based generation. Comments from Europe have indicated some congratulatory celebration for reducing the extent of coal-fired electricity plants, although the pushback in Germany has recognized the major issues related to backup generation needed to maintain grid reliability. Comments from Australia have indicated that the push to eliminate coal plants may have gone too far, and that there really is a need for underlying dispatchable plants (e.g., fossil-fuel thermal plants) to handle overall system reliability and stability in the face of the variability of wind and solar generation. The US situation is one of high levels of grid interconnection between and among states, and extensive interstate transmission. The US wind+solar generation fraction for the entire country in 2016 is 6.5%, and average price is 8.87¢/kWh.

The US push to wind and solar generation also had a more recent contemporary effort to eliminate coal-based generation via the Clean Power Plan (author interpretation), but that "plan" was legally flawed and probably never would have survived the legal challenges, and has now been relegated in all likelihood to the dustbin of history via executive fiat. In addition, this attempt to coerce shifts in generation technologies (or fuels) via legally suspect means has led to restriction currently of the ability of the government to regulate carbon dioxide as a "pollutant."

The effort to increase wind and solar generation, while also not using extreme efforts to reduce coal generation, allowed US market forces to influence the timing and nature of the shift. Understand that the "market" was strongly influenced by federal subsidies for wind and solar, and the subsidy situation is in flux at this time, but for the last decade the combination of wind and natural gas combined-cycle generation plants crushed new coal plants, while also not leading to major electricity price spikes. Reliability has not seemed problematic.

European Trends

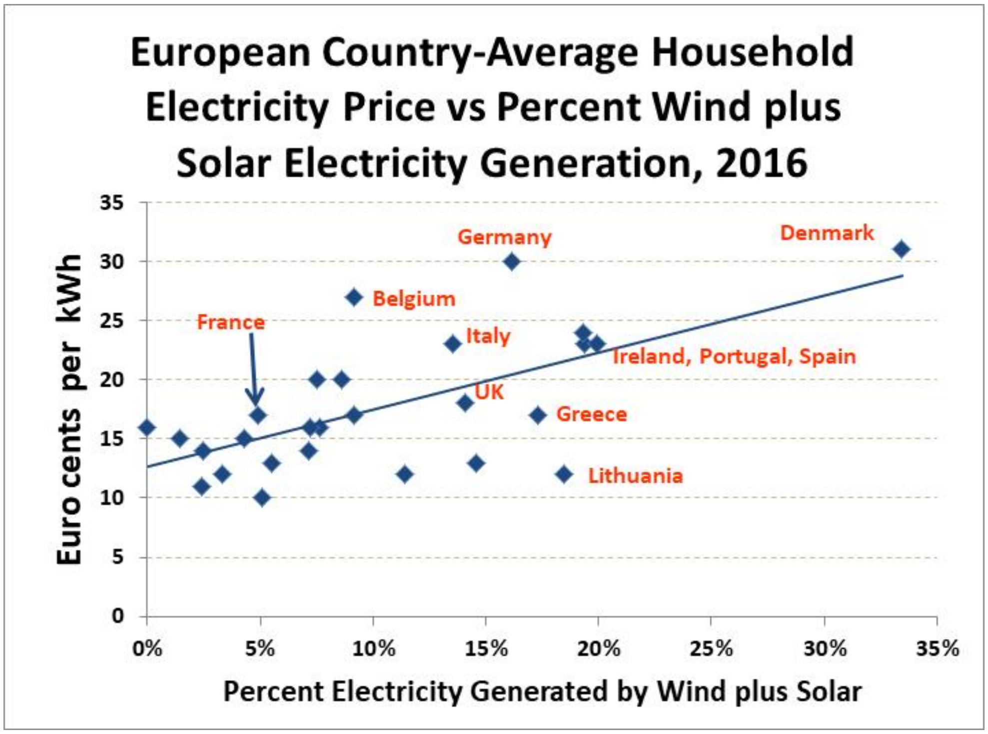
European energy data used are from Eurostat[6] for 2016 (May 2018 version). The price data from Eurostat are difficult to unravel without detailed knowledge of how the tariffs, taxes, and subsidies work, so the energy price data used are from the Strom-Report Blog for an "average" household in 2016.[7] Households apparently are the main subsidizers for wind and solar electricity generation, and industry prices are notably less than household prices. For manufacturing industries, tax and levy rate reductions can lower the policy-induced component of the electricity price substantially. Simplistically, industry is provided means to lower electricity price, while households pay more to support renewables initiatives. German resistance to the government energy program appears to be coming mainly from coalitions of households, although many of those households have highly competent technical expertise.

The share of generation is the same as for the US values. The wind+solar share of generation is a percent of generated electricity within country, including exports, and not imports The countries most impacted in this set of data by the import issue are Lithuania and Luxembourg, where most of the electricity used is imported. Thus, the share of electricity generated by wind and solar is misleading and would be much smaller if calculated as percent

[6] http://ec.europa.eu/eurostat/web/energy/data/energy-balances
[7] https://1-stromvergleich.com/electricity-prices-europe/

of total consumption. Price is also misleading for these two countries, since price is impacted by the price of the imports.

The calculated generation share is for the sum of wind, solar, and wave-tidal-ocean generation, but France was the only country with any wave-tidal-ocean energy, and that only a very small amount, so the results are titled as only wind plus solar generation. Energy and price data are available for 27 countries, and the data are shown in the figure below.



The export-import values do have some impact on the data presented here, but not enough that the trend of price vs percent wind and solar electricity generation is changed much. An OLS regression of these price data on percent wind+solar indicates a fairly strong cross-sectional trend (F=17.54, model Pr = 0.0003, adj $R^2 = 0.39$). The results indicate that a country with no wind plus solar electricity generation would, on average, be expected to have an "average" household electricity price of 12.7 Euro cents / kWh, and the expected average increases 0.48 Euro cents / kWh for each 1% increase in wind plus solar share of electricity generation (as shown in the figure). The significance of the intercept is greater than the 99.99% level, and the coefficient on price increase with generation share is at the 99.97% level. (The US data point for the whole country would be at 6.5% and about 8 Euro cents.)

Potential discernible trends for other fuels, such as coal or nuclear generation, were not examined.

Discussion

This 2016 look at potential impact trends of wind plus solar electricity generation on electricity prices has indicated no discernible trend on overall state-level electricity price in the United States at this time but a fairly strong trend toward increased electricity price for households in Europe.

Federal subsidies for wind and solar generation in the United States have been substantial over decades, and the costs of federal subsidies are spread across the country and mostly do NOT show up in electricity price.[8] European countries are beginning to shift electricity pricing and procurement approaches relative to wind and solar resources, including use of auctions to obtain the best deals for wind and solar. Current political trends suggest the impacts of large price increases resulting from current subsidy approaches are causing difficulties (voter resistance) for incumbent politicians, and the shifting approaches to acquiring wind+solar resources may be influenced by the political trends. European wind+solar electricity generation subsidies in 2016 do appear to show up primarily in (household) electricity price, so the nature of subsidies and how account funding of subsidies is handled impacts

[8] See for example, *Estimating the State-Level Impact of Federal Wind Energy Subsidies*, Univ of Texas Institute for Energy Research, 2013. http://instituteforenergyresearch.org/wp-content/uploads/2013/12/State-Level-Impact-of-Federal-Wind-Subsidies.pdf

the results seen here. Subsidies for older wind turbines in Germany start to phase out in 2020, and whether the wind+solar generation share will be maintained after 2020 is not known.

Arguments can be made about the merits of specific subsidies, but energy subsidies have been around for decades, and their changing nature must be understood to a degree in order to examine effects on energy infrastructure development. The US subsidies are changing at this time, so the next decade of electricity generation development may see differences from the last decade.

Australians are facing major internal conflict over renewables electricity generation and use of coal for same, with decisions partially being driven by recent electric grid reliability events that are not trivial. Coal continues to be a major export, leading to some dissonance in messaging about clean energy objectives. Although data for Australia are not covered here, the changes there over the next decade should also be interesting to follow.

The grid reliability issues in Australia and the beginning of grid stability issues in Europe (not covered here) are additional cautionary notes on how much wind and solar electricity generation is appropriate. The potential cost of electricity storage to allow California to become 100% renewable is also cautionary. If the conflicts affecting decisions about electricity generation technologies can reduce from current levels, inquiry into optimum shares of different electricity generation sources might be allowed to begin.

Conclusion

This inquiry into possible discernible trends for electricity price due to increasing levels of wind and solar electricity generation has shown different results for Europe as compared to the United States. The numerical analytical part of the inquiry looked at fraction of electricity generated as the independent parameter and electricity price as the dependent parameter. Prices used for the United States are state-level overall average price for all end-use sectors combined in the year 2016, reported by EIA. Prices used for Europe are “average household” prices for individual countries as reported in the Strom-Report blog for 2016, based on country-specific tariffs. US electricity generation by wind plus solar technologies for each state in 2016 was divided by total electricity generation in each state to calculate a 2016 wind+solar fraction of electricity generated. Similarly for European countries, the sum of wind plus solar electricity generation for 2016 was divided by total electricity generated in each country to calculate the 2016 wind+solar electricity generation fraction. For both US and European results, electricity imports were not included as generation, and instead were included for the state/country of export.

In Europe the cost for implementing wind and solar electricity generation up until 2016 appears to be paid significantly via household energy bills. In the United States, subsidies appear mostly not to show up in electricity billing. Cross-sectional regressions of state-level data for the United States of average state-level price on wind+solar fraction of electricity generation showed no discernible trend in 2016. Coal was the only fuel examined showing some discernible trend, where increasing share of electricity generated by coal shows an influence of decreasing average state-level electricity price.

Household electricity price in 2016 for the “average household” in Europe (based on data for 27 countries) was found to have a fairly strong discernible trend, based on a cross-sectional regression, with price increasing with fraction of electricity generated by wind and solar technologies (wind-wave-ocean technologies are also worth including in this mix, but current use is exceedingly small). Other fuels were not examined for Europe.

US state-level electricity prices in states with high levels of wind fraction of electricity generated typically retain large shares of coal-based generation, while elsewhere in the world, elimination of coal-based generation combined with increased wind+solar generation has been more of a priority. Retention of older fossil-fuel thermal electricity generating plants as part of a more price-stable transition to increased use of wind and solar resources is not a strategic concept found to receive much, if any, attention.

The results obtained for this paper indicate two contrasting pictures of the impacts of wind and solar electricity generation on electricity prices, with different effects on electricity price for Europe and the United States. Two factors that appear to have played an important role are the nature of subsidies used and grid interconnection / interstate transmission levels. Some level of retention of coal plants may also have played a role.

Improved means of keeping subsidies for different generation "fuels" on more equal standing may be needed. This paper does not examine subsidies to any degree, but an examination of how to make subsidies more comparable among "fuel" types and whether they should impact energy prices directly or not may be worth consideration. More study of price impacts from subsidies and methods of implementing subsidies may be needed, or possibly the lessons have been learned and the lessons should be documented. Changes in the nature of subsidies and of procuring wind and solar electricity resources are in play currently for both the United States and Europe. Continued evaluation of the technology (fuel) shifts is expected to be useful.

This paper did not discuss environmental impacts of wind and solar electricity generation technologies, but such impacts are reported to be nontrivial. The anomaly of rushing to save the planet on a macro scale while causing some local environmental destruction is rich in irony but too complicated to even begin to describe.

More research on the most useful mixes of electricity generation technologies, given the major increases in wind and solar generation over the last two decades — primarily driven by new subsidies, is needed to begin to address apparent undesirable impacts observed to date and expected to accrue over the next several years. The cost and benefit situation for different technologies is obscured at present and some of the smoke needs to be cleared away. Runaway prices and electric grid reliability issues should not be acceptable, although climate zealotry may brush away such concerns. Better understanding of potential optimization of generation technology mixes is desirable; wholesale changes that disrupt society are not.

Saving the planet may be a lofty goal, and certainly one that has been trumpeted for many decades now (although for different impending catastrophic doomsday stories), but the times are changing and the current doomsday story is old, tired, and likely soon to be mostly irrelevant. Rational examination of reliable and reasonably comparable data on electricity generation technology mixes is needed now to improve development of a 21st century electricity supply.

The current situation in the United States is not likely to lead to major issues, although extreme changes such as mandating 100% "renewable" energy may. Current conflicts in Australia are fueling political indigestion, and the situation there should be followed to see what develops, although the declining grid reliability in South Australia does not appear worth replicating elsewhere. The situation in Europe is in a fairly high state of change, and additional lessons to be learned from the European experience over the next several years may be important.

Overall, important changes have occurred for electricity generation over several decades, and much has been learned and accomplished relative to increasing use of renewables electricity generation. The push to renewables based on environmental fervor is now facing pushback due to some undesirable impacts. This paper provides a cursory look at changes and trends. Additional study is needed to find the best path forward.

Data Annex

Data used for the US and European regressions, as well as some additional US data are tabulated below.

US Data

The US data show the generation fractions for the "fuel" types that were examined, as well as for oil-based generation. Oil is shown to indicate the erratic picture for other fuels, which also include hydro, biomass, and some others. Vermont imports over half its electricity, and most of the untabulated balance is hydro. DC also imports most of its electricity, and most of the untabulated balance is "other biomass."

US Data for 2016 Cross-Sectional Regressions plus Petroleum (Oil)							
State	Price, cents per kWh	Wind+solar GWh	Wind+solar %	Coal %	Gas %	Nuclear %	Oil %
AK	15.42	169	2.67%	9.4%	48.0%	0.0%	13.1%
AL	8.23	31	0.02%	24.1%	40.6%	28.0%	0.0%
AR	6.99	26	0.04%	39.4%	30.1%	22.2%	0.1%
AZ	8.87	4,307	3.96%	28.0%	31.4%	29.8%	0.0%
CA	13.11	32,316	16.41%	0.2%	49.3%	9.6%	0.1%
CO	8.46	9,959	18.30%	55.0%	23.3%	0.0%	0.0%
CT	14.81	37	0.10%	0.5%	49.2%	45.4%	0.3%
DC	10.08	-	0.00%	0.0%	29.7%	0.0%	1.3%
DE	9.60	56	0.65%	5.5%	89.2%	0.0%	0.7%
FL	8.51	224	0.09%	16.5%	66.5%	12.3%	1.2%
GA	8.24	881	0.66%	28.4%	39.6%	25.9%	0.2%
HI	20.52	728	7.31%	15.1%	0.0%	0.0%	66.7%
IA	7.35	20,072	36.90%	46.3%	5.4%	8.6%	0.5%
ID	6.95	2,608	16.65%	0.2%	21.2%	0.0%	0.0%
IL	8.12	10,712	5.72%	31.7%	9.3%	52.6%	0.0%
IN	7.95	5,125	5.04%	71.3%	19.7%	0.0%	0.6%
KS	9.09	14,113	29.65%	48.5%	4.3%	17.3%	0.1%
KY	7.26	12	0.01%	83.2%	10.3%	0.0%	1.5%
LA	6.65	-	0.00%	11.2%	62.0%	16.0%	4.5%
MA	14.16	825	2.58%	5.9%	66.2%	16.9%	1.3%
MD	10.49	736	1.98%	37.2%	14.6%	39.7%	0.4%
ME	10.99	1,667	14.48%	0.6%	30.4%	0.0%	1.0%
MI	9.51	4,705	4.20%	36.1%	26.1%	28.1%	0.7%
MN	8.62	9,944	16.72%	39.0%	15.0%	23.3%	0.1%
MO	8.37	1,155	1.47%	76.7%	7.7%	12.0%	0.1%
MS	7.50	-	0.00%	8.5%	79.7%	9.4%	0.0%
MT	7.82	2,140	7.70%	51.4%	1.7%	0.0%	1.7%
NC	7.90	3,427	2.62%	28.6%	30.0%	32.7%	0.2%
ND	7.69	8,172	21.59%	70.2%	2.8%	0.0%	0.1%
NE	7.77	3,802	10.41%	60.0%	1.5%	25.6%	0.0%
NH	13.45	432	2.24%	2.2%	24.6%	55.8%	0.2%
NJ	11.52	856	1.10%	1.7%	56.4%	38.5%	0.2%
NM	7.88	4,357	13.24%	55.8%	30.3%	0.0%	0.2%
NV	7.20	3,468	8.72%	5.4%	72.7%	0.0%	0.0%
NY	12.43	4,080	3.04%	1.3%	42.3%	30.9%	0.5%
OH	8.48	1,311	1.10%	57.8%	24.3%	14.1%	1.0%
OK	6.78	20,075	25.52%	24.4%	46.4%	0.0%	0.0%
OR	7.58	7,198	11.96%	3.2%	25.4%	0.0%	0.0%
PA	8.78	3,551	1.65%	25.4%	31.6%	38.6%	0.2%
RI	13.98	41	0.63%	0.0%	95.8%	0.0%	0.4%
SC	8.41	5	0.01%	21.7%	16.9%	57.6%	0.1%
SD	8.45	3,715	32.23%	18.1%	8.0%	0.0%	0.0%
TN	7.95	116	0.15%	39.3%	14.3%	37.3%	0.2%
TX	7.33	58,262	12.83%	26.7%	49.8%	9.3%	0.0%
UT	7.52	1,876	4.92%	68.0%	22.8%	0.0%	0.1%
VA	7.81	21	0.02%	17.8%	44.2%	32.1%	0.6%
VT	12.42	350	18.32%	0.0%	0.1%	0.0%	0.2%
WA	6.65	8,043	7.05%	4.0%	9.6%	8.4%	0.0%
WI	9.17	1,518	2.34%	51.4%	23.8%	15.6%	0.2%
WV	7.71	1,432	1.89%	94.2%	1.6%	0.0%	0.2%
WY	7.07	4,389	9.41%	85.8%	1.7%	0.0%	0.1%
US	8.87	263,047	6.45%	30.4%	33.8%	19.8%	

European Data

The annual amount of electricity consumed by the "average household" has an influence on price.

European Data for 2016 Cross-Sectional Regressions		
Country	**Wind+solar Percent**	**Average Household Price, Euro cents per kWh**
Austria	7.5%	20
Belgium	9.2%	27
Bulgaria	5.1%	10
Croatia	5.5%	13
Cyprus	7.6%	16
Czech Republic	2.5%	14
Denmark	33.4%	31
Estonia	3.3%	12
Finland	4.3%	15
France	4.9%	17
Germany	16.2%	30
Great Britain (UK)	14.1%	18
Greece	17.3%	17
Hungary	2.4%	11
Ireland	19.4%	23
Italy	13.5%	23
Lithuania	18.5%	12
Luxembourg	9.1%	17
Malta	14.6%	13
Netherlands	7.2%	16
Norway	0.0%	16
Poland	7.1%	14
Portugal	19.3%	24
Romania	11.4%	12
Slovakia	1.4%	15
Spain	20.0%	23
Sweden	8.6%	20