The Energy Collective

The world's best thinkers on energy & climate

Facts About The German EEG Program

Like it? 113

Posted January 16, 2012 7 comments

Keywords: Renewables, Subsidies, C02, feed in tariffs (FIT), germany, subsidies

7 8 0 1 15

Posted by:

Willem Post

Posts Profile

Comments Follow

As a result of Germany's decision to phase-out its nuclear plants by 2022 and meet its self-imposed CO2 emissions targets, Germany will need to build out its renewables capacity to increase its renewable energy production. Almost all of that increased energy will be covered, i.e., subsidized, under existing renewable energy laws.

Germany's Renewable Energy Act (EEG) of 2000 guarantees investors above-market fees for renewable energy for 20 years from the point of installation. An EEG surcharge, equal to the feed-in tariffs paid by utilities for renewable energy, minus the revenue from that energy fed into the grid, is added to the electric bills of almost ALL households and businesses.

In 2010, German investment in renewables was about 29.4 billion euros, of which about 25.8 billion euros in 7,400 MW of solar systems (3,485 euro/kW). **Note:** 1 bn = 1,000 million.

In 2010, about 79%, or about 80.7 TWh of renewable energy was covered by the EEG program at an average cost of 15.85 eurocent/kWh. The cost has been steadily rising from 10.87 eurocent/kWh in 2006, primarily due to the rapid solar build-out.

The EEG charges on household electric bills were 5.6, 7.6, 8.8,10.7, 8.2 and 13.5 billion euros from 2006 to 2011; they are expected to be 14.1 and 20.4 billion euro in 2012 an 2013, respectively.

The EEG charges on household electric bills were: 0.41, 0.58, 0.68, 0.88, 1.02, 1.12, 1.13, 2.047, 3.53, 3.592 eurocent/kWh, excl. VAT, from 2003 to 2012: it was 5.277 eurocent/kWh for 2013, and 6.240 eurocent/kWh for 2014, a 6.240/3.592 = 74% increase over 2012, much greater than expected, due to EEG law changes.

In 2011 the EEG apportionment to household electric bills was 3.53 eurocents/kWh, excl. VAT, 14% of the consumer price, or 4.20 eurocents/kWh, incl. VAT, 16% of the consumer price. Thus the national average consumer pricewas 4.20/0.16 = 26.3 eurocents/kWh.

http://de.wikipedia.org/wiki/Erneuerbare-Energien-Gesetz
http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/ee_in_deutschland_graf_tab.pdf
http://www.ag-energiebilanzen.de/viewpage.php?idpage=65

.

Notes:
- In 2011, Germany had the 2nd highest household electric rate in Europe, Denmark was No.1 at 30.5 eurocents/kWh.
- The 2011 EEG apportionment reflects the energy production of the renewable systems installed PRIOR to 2011.

Renewables Build-out: As the phase-out of the nuclear plants proceeds and to meet Germany's self-imposed 2020 CO2 emissions targets, the following will need to be installed during the next 9 years to augment the renewables energy production from 101.8 TWh in 2010, or 16.8% of production, to 344 TWh in 2020, or 57% of production.

- About 53,300 MW of NEW offshore and 696 MW of NEW onshore wind capacity (about 2 times existing, buildrate about 6,000 MW/yr)
- About 64,680 MW of NEW solar capacity (almost 4 times existing, buildrate about 7,000 MW/yr)
- About 1,400 MW of NEW biomass capacity (about 0.3 times existing, buildrate about 150 MW/yr)

This reference shows how the above renewables capacities were calculated.
http://theenergycollective.com/willem-post/67528/german-nuclear-phase-out-and-renewables-build-out

Renewables investments, subsidies, and EEG apportionments will increase, even though the feed-in tariffs for later solar installations are less/kWh than for earlier installations.

EEG Subsidy Projection: In this study the subsidy was calculated using the following assumptions and conditions;

- The annual production remains constant at 603 TWh in 2010 through 2020 due to increased energy efficiency.
- The renewables energy is 16.8% of production in 2010, or 101.8 TWh, and 57% , or 344 TWh in 2020.
- The build-out starts the beginning of 2012 and ends the end of 2020, i.e., 9 years, for calculation purposes.
- The EEG percentage remains at 79% of renewables production.
- The EEG subsidy remains constant at 15.85 eurocent/kWh from 2012 to 2020; a conservative value because it should be rising due to the more expensive offshore build-out being added to the renewables mix.
- The EEG apportionment increases at a constant 1.25 eurocent/kWh each year from 2013 to 2021; a conservative value. This increase is due to the increasing quantities of renewable energy covered by EEG subsidies.

Notes:
- Future feed-in tariffs will likely not be reduced, because it would reduce capital inflows and slow down the renewables build-outs, which is undesirable, if nuclear plants are to be decommissioned.
- Based on forecasts by the four German transmission system operators, the EEG surcharge is likely to increase from 3.592 eurocent/kWh in 2012 to 5.277 eurocent/kWh in 2013. It may become 6.5 - 7.5 eurocent/kWh in 2014.
http://www.germanenergyblog.de/?p=7846

Based on the above assumptions and conditions, the EEG subsidy are estimated to rise from 12.8 bn euros in 2010 to 43.1 bn euros in 2021, for a total of 321.67 bn euros for the 2012 - 2021 period.

The revenue from selling the EEG energy is estimated at 101.45 bn euros for the 2012 - 2021 period.

The net cost. i.e., the EEG surcharge apportioned to electric bills, is 321.67 - 101.45 = 220.23 bn euros, or $308.3 billion.

Note: The 2021 apportionment reflects the energy production of the renewable systems installed prior to 2021.

EEG Impact on Household Electric Bills: The EEG apportionments are estimated to increase monthly electricity bills of households from 26.3 eurocents/kWh, incl. VAT in 2011, to 39.7. incl. VAT in 2021, a total increase of (39.7 - 26.3)/26.3 = 51% by 2021 compared with 2011. This increase is largely due to the solar and offshore wind build-outs. This is a real increase based on 2011 euros. Bills will likely increase by more than 51%, because other components of the household bill will also increase.

The EEG apportionments will be borne by all households, including those without solar systems. They act as a steadily-increasing regressive tax that will affect lower income households more than higher income households, many of which receive feed-in tariff benefits from having solar systems; an inequitable condition.

http://thebreakthrough.org/blog//2011/06/analysis_germanys_plan_to_phas-print.html
http://mobile.bloomberg.com/news/2011-05-31/merkel-faces-achilles-heel-in-grids-to-unplug-german-nuclear.html
http://www.theecologist.org/News/news_analysis/829664/revealed_how_your_country_compares_on_r
http://en.wikipedia.org/wiki/Solar_power_in_Germany
http://www.diw.de/sixcms/media.php/73/diw_wr_2011-06.pdf
http://www.econstor.eu/bitstream/10419/19388/1/358.pdf
http://www.bmu.de/files/english/pdf/application/pdf/ee_in_zahlen_2010_en_bf.pdf
http://www.polderpv.nl/EEG_impact_BRD.htm
http://www.polderpv.nl/PV_weltmeister_2010_II.htm
http://www.welt.de/dieweltbewegen/article13506987/Energiewende-kostet-335-Milliarden-Euro.html

SUMMARY OF ESTIMATED CAPITAL AND OTHER COSTS

This is a summary of my estimate of the capital costs and other costs for phase-out the nuclear plants, restoring the sites, adding fossil plants to replace nuclear plants, building out renewables to replace nuclear energy, adding wind and solar energy balancing plants, reorganizing electric grids and increased energy efficiency over 9 years to satisfy Germany's self-imposed 2020 CO2 emissions targets. $1 billion (US) = $1 milliard (Europe)

Increased energy efficiency: $20 b/yr x 9 yr = 180 billion; ($20 b/$3,286 b in 2010) x 100% = 0.6% of GDP, or $250 pp/yr
Decommission 23 nuclear reactors and restore sites: 23 @ $1 billion/reactor = $23 billion
Plants to replace nuclear plants: 25,000 MW of CCGTs @ $1,250,000/MW = $31.3 billion

Wind turbines, offshore: (53,300 - 150, existing) MW @ $4,000,000/MW = $212.6 billion
Wind turbines, onshore: (27,900 - 27,204, existing) MW @ $2,000,000/MW = $1.4 billion
Solar systems: (82,000 - 17,320, existing) MW @ $4,500,000/MW = $291 billion
EEG feed-in tariff costs added to electric rates over 9 years $450.3 billion, less $142 billion revenue from sale of EEG energy (0.79% of total renewable energy): $308.3 billion
Balancing plants: 25,000 MW of OCGTs and CCGTs @ $1,250,000/MW = $31.3 billion
Reorganizing the German grid and neighbor grids: $100 billion
Biomass (incl. biogenic waste): 1,400 MW @ $3,000,000/MW = $4.2 billion

Note: The estimate does not include any future energy storage systems or sequestering systems (a dubious technology) for underground storage of CO2.

Other Estimates of Capital Costs: The EIA says an ADDITIONAL $36 trillion of investment will be required to overhaul the world's energy system by 2050, but this will be offset by $100 trillion in savings through reduced use of fossil fuels. The capital cost estimate appears too low, the cost savings, much more difficult to estimate, appear much too great.

Example showing EIA capital cost estimates are much too low: Siemens estimates the total price tag of meeting Germany's renewable, energy efficiency and CO2 emissions goals at about 1.7 trillion euros ($2.26 trillion) by 2030; the estimate includes decommissioning nuclear plants, energy storage and CO2 sequestering systems.
http://www.reuters.com/article/2012/01/17/us-siemens-energy-idUSTRE80G10920120117

Remember that does not get Germany to its energy and CO2 emission goals by 2050, which would be about another 1.7 trillion euros ($2.26 trillion), for a total of $4.5 trillion by 2050.

If the US were to follow Germany's course, the cost would be about ($14.5 trillion, US GDP)/($3.5 trillion, German GDP) x $2.26 trillion = $9.36 trillion, plus about another $9.36 trillion for 2050 emission goals, for a total of about $18.7 trillion by 2050.

The US cost likely would be even greater as it is more spread-out than Germany and more of its aging electrical systems would need to be upgraded and replaced.

It is 100% sure, the US will NOT follow on that course anytime soon, if ever, and almost all other nations will not either.

Additional estimates of capital and other costs are in these URLs.

http://theenergycollective.com/willem-post/67528/german-nuclear-decommissioning-and-renewables-build-out
http://www.welt.de/dieweltbewegen/article13506987/Energiewende-kostet-335-Milliarden-Euro.html

IMPACT OF NUCLEAR PHASE-OUT ON THE GERMAN ECONOMY

The existing power generation system is based on 60% fossil, 23% nuclear and 16.8% renewables. Exchanging the existing system with one based on 43% fossil and 57% renewables implies an owning+O&M cost of about 2 -3 times the current system because:

- the renewables energy production units are more capital intensive PER UNIT OF PRODUCTION than existing energy production units.
- the useful service lives of wind turbines is about 20 years and of solar panels about 25 years versus 40 to 60 years for existing energy production units.
- the reorganized grid serving the widely-distributed energy sources, fitted with demand and supply management, will have greater owning+O&M costs than the existing grid.
- almost ALL of the existing generators, plus about 25,000 of NEW CCGTs to replace the nuclear plants, will need to be staffed 24/7/365 and kept in proper operating condition to provide energy during periods of low renewables energy production.
- As renewables energy increases to about 57% of all energy production by 2020, the increased cost of energy will bear heavily on industry and commerce, thereby reducing their competitiveness in world markets, and job creation capacity in Germany.

The economic impact of the transition will increase the costs of German goods and services which will

- adversely affect its competitive position in world markets.
- lower the living standards of households, accelerating the current trend.
- affect, on a relative basis, Germany faring better than its neighbors, if these neighbors cannot be persuaded to follow Germany's lead; as a minimum, it appears likely England, France and the Netherlands will not.
- divert capital from economic development, such as energy efficiency, that provides much better returns on investments without subsidies.

Diverting scarce resources from unsubsidized, profitable ventures to subsidized build-outs of wind and solar energy that have high owning+O&M costs and rolling those costs into rate schedules and the prices of goods and services is a sure way to make Germany less competitive relative to the rest of Europe and East Asia, lower living standards and increase unemployment.

Mega-Utility?
2/17/2015 by Coley Girouard

Atomic Balm: Some Prominent Environmental Veterans are Talking up Nuclear Power as a Climate Change Solution
2/16/2015 by Peter Dykstra

WHAT'S NEW ON
SustainableCitiesCollective

» JOIN OUR WEBINAR: Can Strong Communities Be Designed by Architects?
» The Nature of Holy Cities
» The Waste Biz: Time To Shake Up The Recycling Business?
» Will an Ideas Competition Improve Informal Trading Conditions in Cape Town?
» Why India Needs Open Data for Better Urban Mobility
» Riverside City Councilmember MacArthur Channels Citrus Background into Enthusiasm for Local Food

Authored by: *Connect:*

Willem Post

Willem Post, BSME'63 New Jersey Institute of Technology, MSME'66 Rensselaer Polytechnic Institute, MBA'75, University of Connecticut. P.E. Connecticut. Consulting Engineer and Project Manager. Performed feasibility studies, wrote master plans, evaluated and performed designs for incineration systems, air pollution control systems, utility and industrial power plants, and integrated energy ...

See complete profile

Would you like to contribute to this site? Get started »

Other Posts by Willem Post

Comparison of Grid-Connected and Off-the-Grid Houses - November 26, 2014

Is Renewable Energy Less Effective Than Energy Efficiency at Reducing CO2 Emissions? - October 29, 2014

Russian Gas Exports and Western Encroachments on Russia - April 17, 2014

High Renewable Energy Costs Damage the German Economy - February 12, 2014

High Renewable Energy Costs Damage the Vermont Economy - January 28, 2014

Related Posts

The Next Generation of Battery Tech at ARPA-E
February 22, 2015 by JeffStJohn

Are Energy Managers Making Progress? Introducing a Tool to Help
February 22, 2015 by EDFEnergyEX

Advanced Energy: It's Kind of a Big (Business) Deal
February 21, 2015 by Lexie Briggs

Illinois Bill Pledges More Clean Energy Jobs, Boost to Economy, and Cleaner Air
February 21, 2015 by EDFEnergyEX

Energy Quote of the Day: On 'No Regret' Negative Emissions Technologies
February 21, 2015 by Ed Dodge

Login now to comment!» Already a member?

Register to comment!» Not a member?

January 21, 2012

Like it? 133

GeorgeYuri Mogiljansky says:

"..Low Cost but Totally Renewable Electricity Supply for a Huge Supply Area
– a European/Trans-European Example –.."

Finally, the documented proof of what I had been searching for and talking about -

http://www.iset.uni-kassel.de/abt/w3-w/projekte/LowCostEuropElSup_revised_for_AKE_2006.pdf

and, a solid attempt to deal with the abstract concepts (cost of capital), etc. -

http://www.eurotrib.com/story/2009/5/1/174635/6513

The cost of wind, the price of wind, the value of wind

Share this comment:

» **Login** or **register** now to comment!

communicate about cleaner energy solutions. **More »**

Geoffrey Styles is Managing Director of GSW Strategy Group, LLC and an award-winning blogger. **More »**

The Energy Collective
webcast archive

Who Will Build Tomorrow's Grid? Smart Grid & the Expertise Challenge [Webcast Recording]

Hydro and Ocean Power: Untapped Renewable Resources? [WEBCAST]

Germany's Clean Energy Push: What Can the World Learn? Webcast Recording

Webinar Replay: Gone With The Wind? Understanding Grid Resiliency

Webinar Replay: Can Shale Gas Global?

Webinar Replay: Energy Policy in the 113th Congress - A Look Ahead

Featured Contributors

YOU	Rod Adams
Scott Edward Anderson	Charles Barton
Barry Brook	Steven Cohen
Dick DeBlasio	Senator Pete Domenici
Simon Donner	Big Gav
Michael Giberson	Kirsty Gogan
James Greenberger	Lou Grinzo
Tyler Hamilton	Christine Hertzog
David Hone	Gary Hunt
Jesse Jenkins	Sonita Lontoh
Rebecca Lutzy	Jesse Parent
Jim Pierobon	Vicky Portwain
Willem Post	Tom Raftery
Joseph Romm	Robert Stavins
Robert Stowe	Geoffrey Styles
Alex Trembath	Gernot Wagner
Dan Yurman	

Events

No events listed

Add your own!

The Energy Collective »See them all
»Subscribe (iTunes)
»Subscribe (RSS)

Weekly Newsletter **Twitter**
LinkedIn
Facebook **Google+**
RSS

June 23, 2012

Like it? 112

Willem Post says:

George,
I read the subject article indicating wind energy at 5-7 e

On 2500-ft high ridge lines in Vermont, US, the capital co
$2,500/kW, the subsidized energy cost is about 10 c/kWh, u
about 15 c/kWh.

On the Great Plains in the US, say Kansas, the capital cos
$2,000/kW, the subsidized energy cost is about 8 c/kWh, un
about 12 c/kWh.

East Coast Offshore, the capital cost are as shown below:

Cape Wind: Cape Wind Associates, LLC, plans to build and o
facility on the Outer Continental Shelf offshore of Massac
wind facility would have a rated capacity of 468 MW consis
Siemens AG turbines each 3.6 MW, maximum blade height 440
arranged in a grid pattern in 25 square miles of Nantucket
federal waters off Cape Cod, Martha's Vineyard, and Nantuc
the lease is for 46 square miles which includes a buffer z

The Massachusetts Department of Public Utilities approved
purchase agreement, PPA, between the utility National Grid
Wind Associates, LLC. National Grid agreed to buy 50% of t
facility's power starting at $0.187/kWh in 2013 (base year
at 3.5%/yr which means the 2028 price to the utility will
$0.313/kWh. The project is currently trying to sell the ot
its power so financing can proceed; so far no takers.

A household using 618 kWh/month will see an average wind p
surcharge of about $1.50 on its monthly electric bill over
life of the contract; if the other 50% of power is sold on
basis, it may add another $1.50 to that monthly bill.
Power production is estimated at 468 MW x 8,760 hr/yr x CF
GWh/yr.
The capital cost is estimated at $2.0 billion, or $4,274/k
subsidies would be 30% as a grant.

Block Island Offshore Wind Project: The 28.4 MW Block Isla
Wind Project has a 20-yr PPA starting at $0.235/kWh in 200
year), escalating at 3.5%/yr which means the 2027 price to
will be $0.468/kWh. A State of Rhode Island suit is pendin
the contract; the aim is to negotiate to obtain a lower pr
Power production is estimated at 28.4 MW x 8,760 hr/yr x C
0.097 GWh/yr.
Capital cost is estimated at $121 million, or $4,274/kW. F
subsidies would be 30% as a grant.

Delaware Offshore Wind Project: The 200 MW Delaware Offsho
Project has a 25-year PPA starting at $0.0999/kWh in 2007
escalating at 2.5%/yr which means the 2032 price to the ut
$0.185/kWh.
Power production is estimated at 200 MW x 8,760 hr/yr x CF
GWh/yr.
Capital cost is estimated at $855 million, or $4,274/kW. F
subsidies would be 30% as a grant.

Wind Energy O&M Costs

O&M costs are related to a limited number of cost componen
including: insurance, regular maintenance, repair, spare p
administration.

The standard warranty of an onshore, utility-scale wind tu
about 2 years. After that period owners are vulnerable to
O&M costs for gearboxes, generators, drive trains and blad
example: A gearbox changeout may cost $500,000 and up, inc
costs of about 30 days of down time. Gearboxes and blades
fail within 2 -3 years. Extended warranties are available
significant fees.

The average O&M costs of onshore, utility-scale wind turbi
2.7 cents/kWh; the O&M costs are from actual cost data of
turbine facilities throughout the world. See below website

The 2.7 cents/kWh is about 3 to 5 times the values used in
of wind turbine vendors and project developers to attract
secure financing and obtain government approvals.

On ridge lines of New England O&M would be about 2 times t
Offshore it would be about 3-4 times the average.

O&M increases with wind turbine age: a lifetime average of
percent of the levelized generating costs, starting at abo
percent for unsubsidized newer units, gradually increasing
percent for unsubsidized older units.

http://www.renewableenergyworld.com/rea/partner/first-conf

http://www.croh.info/index.php?option=com_content&view=art
http://spectrum.ieee.org/energywise/green-tech/wind/troubl
http://www.slideshare.net/WindEnergyReports/summary-the-wi

Share this comment:

» **Login** or **register** now to comment!

January 18, 2012

Like it? 112

reinholt niehbur says:

We all KNOW (at least those paying attention & doing their homework) that renewables energy production are more capital intensive PER UNIT OF PRODUCTION than existing energy production . That isn't the point. The fact is that we are rapidly using up the energy dense non-renewable resources; and must look at the alternatives. By definition, the alternatives are more costly, or they would have been consumed in the first place.

I agree that the best solution is to focus on energy efficency, especially the dumb stuff (build smaller buildings to Passivhaus or better standards). The truth is, we are running out of capital to make the necessary investments.

Share this comment:

» **Login** or **register** now to comment!

January 16, 2012

Like it? 109

Rick Engebretson says:

Please forgive my intellectual laziness. But I've spent several days filtering all the options, then re-compiling, the Linux kernel to better suit my development needs. I use a German version, SuSE Linux, that has great assistive tools for those of us who have only been working with this stuff for 30 years.

All I wanted was the standard serial port to manage microcontrollers. Then it got into the new interrupts, very diverse chip and platform options, driver features, etc..... When I thought I had it, I had messed up my flash disk drive access. Now for some applications programming (I hope)!!

Germany supports smart people. America has turned against smart people, and supports angry people. It is amazing the scientific advancements around the world Americans don't have a clue about.

If you think you know all the options, compile the Linux kernel!

Share this comment:

» **Login** or **register** now to comment!

January 22, 2012

Like it? 115

Jeff Watts says:

"Germany supports smart people. America has turned against smart people, and supports angry people. It is amazing the scientific advancements around the world Americans don't have a clue about."

LOL, do you actually have evidence for this that supports somekind of deductive proof? I'm particulary interested in the 'amazing scientific advancements around the world' that I (an American) have no clue about. Or are you asking us to take your word for it? If so, No Thanks, I'll keep on thinking for myself.

Share this comment:

» **Login** or **register** now to comment!

January 16, 2012

Like it? 117

Paul O says:

Rick..no disrespect, but why do you frequently use allegories. It makes it hard for literal minded folks like me to follow your point. And I hasten to admit that you're far smarter than I am, just so you know.

In any case I get that America supports angry people (number one cause of political correctness IMO), the rest I am still working on, LOL!

Share this comment:

» **Login** or **register** now to comment!

January 17, 2012

Like it? 108

Rick Engebretson says:

Paul, I've really screwed up if I made another person think I'm smart. Instead I deeply admire smart people and read their work, listen to their music, admire their architecture.

As for the Linux "allegory," it is actually quite "literal." I got lost trying to thin out the hundreds of linux kernel options (networking, sound, drives, etc...) down to simple serial ports where there are more dozens of options based on chips and platforms. And more dozens of options in the serial port driver that is derived from the ancient teletype (or tty). And more hundreds of options in microcontroller systems.

Perhaps to better answer how this might pertain; the issue is productivity. Unless we produce more with less, we will be producing less. And arithmetically, that means the poor get poorer. The first pre-computer programmer IIRC was a woman (Lady Ada Lovelace) who automated textile mills. Everything on this site presumes a high level of automation. And I hope I have suggested a direction to look for growth in productivity. Willem has advocated efficiency, which of course is similar.

I don't know where this global inquiry is going. But there are a lot of changes in energy effectiveness coming from a lot of directions right now. Germany is very active in this field.

Share this comment:

» **Login** or **register** now to comment!

Please note: Your first comment as a registered user will be held for moderation up to 24 hours **FAQ**(usually less). For more information about comments on our site, please read our and .

terms of use

Climate Change
Energy Innovation
Energy Storage
Renewable Energy
Energy Efficiency
Energy Risk
Smart Grid
Cleantech
Social Media & Energy
Nuclear Energy
Fukushima