

NEW JERSEY LEADERSHIP: THE RENEWABLE ENERGY TRANSITION ACT

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COULD THIS BE AN AGE OF SOLVING COMPLEX GLOBAL PROBLEMS?

Incidence of extreme poverty worldwide:

Down from 40% to 14% since 1981

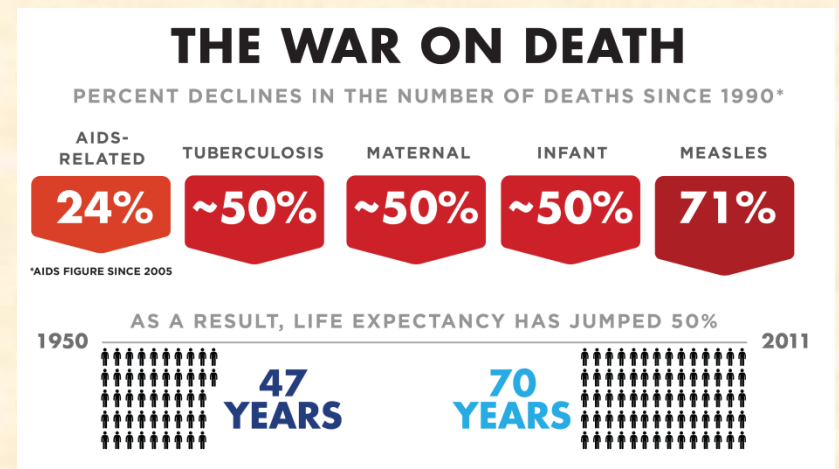
(source: Think Progress*)

Children dying of hunger each day:

Down by 70% since mid-70's

(source: The Hunger Project)

(decline in other causes of death shown below: ThinkProgress*)

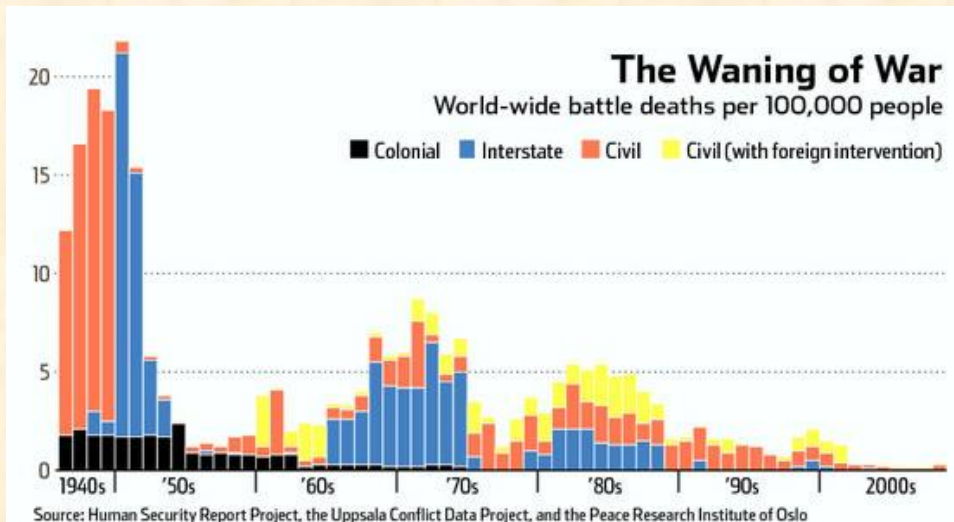


* "5 Reasons Why 2013 Was The Best Year In Human History", Zack Beauchamp 12/11/13

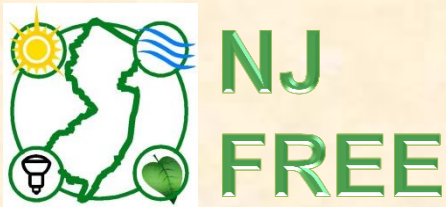
COULD THIS BE AN AGE OF SOLVING COMPLEX GLOBAL PROBLEMS? (cont.)

Incidence of war worldwide:
Becoming rarer and less deadly
(source: Think Progress*)

Incidence of murder worldwide:
Declined 48% from 2001 to 2008
(source: Think Progress*)



* "5 Reasons Why 2013 Was The Best Year In Human History", Zack Beauchamp 12/11/13



NJ FREE

NEW JERSEY FOR RENEWABLE ENERGY and EFFICIENCY

Industry

Kyocera Corporation
Mid-Atlantic Solar Energy Industries
Association (MSEIA)
Mid-Atlantic Renewable Energy Coalition
(MAREC)
Mitsubishi Electric U.S.A.
New Jersey Grid Supply Association

Environmental

Clean Water Action – New Jersey
Climate Mama
Delaware Riverkeeper Network
Environment New Jersey
Food and Water Watch
Grandmothers, Mothers, and More
for Energy Safety (GRAMMES)
Mr. Sustainable
Mom's Clean Air Force
New Jersey Environmental Lobby
New Jersey Highlands Coalition
Sierra Club – New Jersey

Professional

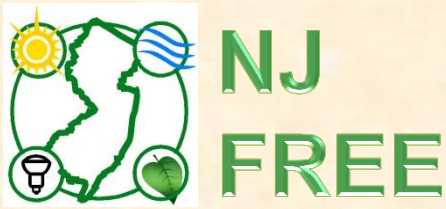
American Council on Renewable Energy (ACORE)
Greener by Design
Potter & Dixon
U.S. Green Building Council – New Jersey

Civic

League of Women Voters
New Jersey PACE
New Jersey Green Party

Faith-Based

Unitarian Universalist Legislative Ministry, NJ
Greenfaith
Waterspirit

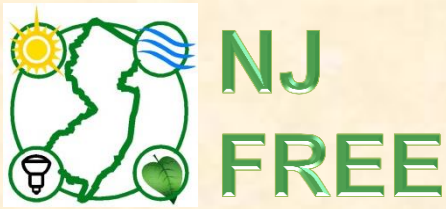


The Proposed “Renewable Energy Transition Act”

1. Require **80% Renewable Electricity by 2050.**
2. Require 5-year milestones to be met between now and 2050.
3. Require 30% reduction in electric use by 2050 compared to 2012 usage, also with 5-year milestones.

Additional measures hoped for (from original draft bill):

4. Restructure the incentive system for solar to accomplish societal goals while reducing the cost of solar to ratepayers.
5. Enable wind power development and other renewables.
6. Require development of demand-side management assets.
7. Address infrastructure changes needed, especially regarding control and management of the grid.
8. Address continuing role for utility companies.



80% Renewable Electricity by 2050: Not as hard as it sounds...

What would it take?

Added solar power = approx. 425 MW per year = 15 GW cumulative
Added wind power (primarily offshore) = approx. 4.5 GW

The solar and wind power additions seem readily achievable*

*463 MW of solar power was installed in NJ in EY 2012;

Federal BOEM leases for offshore wind off NJ coast total around 6 GW out of a total technical resource of 99 GW

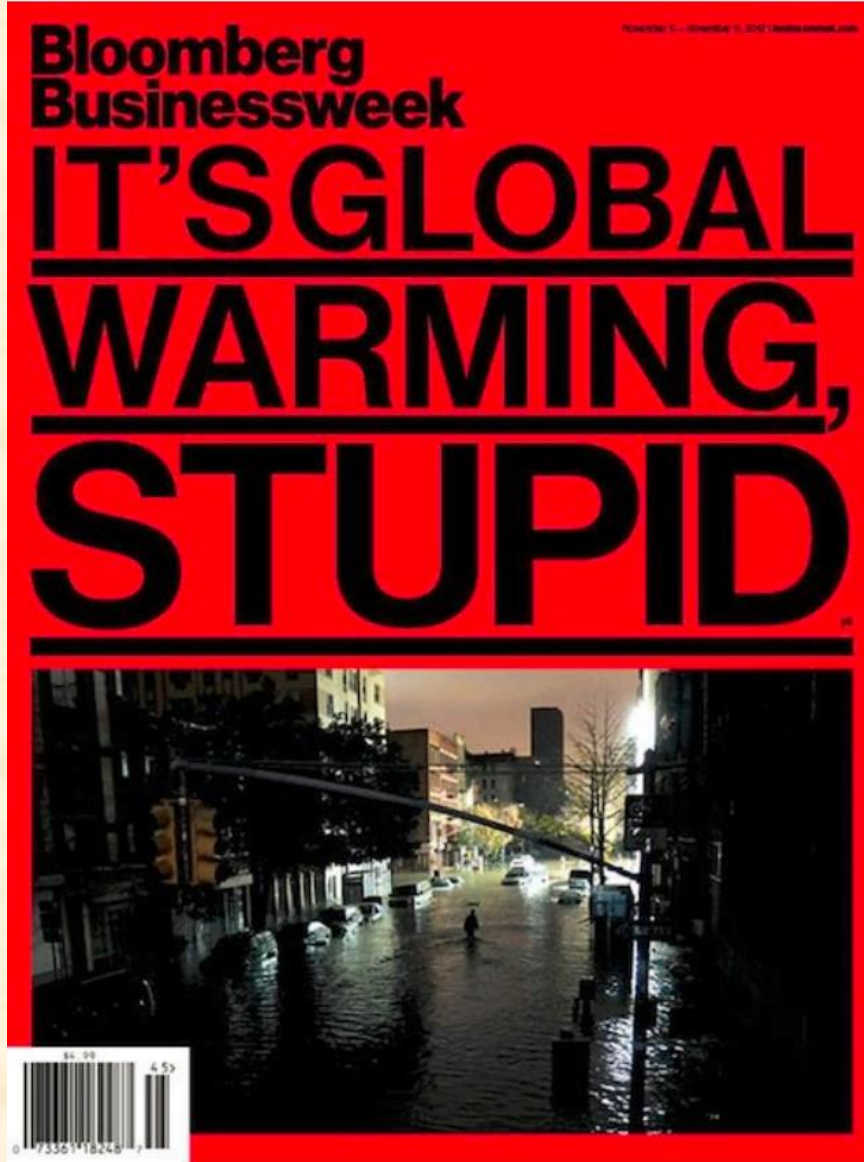
Why New Jersey? Why Now?

1. Existing NJ law requires 80% reduction in greenhouse gas emissions by 2050. Electric power production is the largest source. Thus, compliance with existing law requires transition of electric power to renewables.
2. The cost of solar power has plummeted. Studies of the value delivered by solar in the northeast show that value already exceeds cost – so incentives are not a subsidy, they are payment for value delivered.
3. Superstorm Sandy drives the perception of the importance of distributed sources of emergency power. Technology advancements in storage intersect with revenue potential from grid support services.
4. Superstorm Sandy also drives the perception of the near-term cost of global warming, while new studies quantify it.
5. New Jersey has a good solar industry infrastructure already in place, and unique market structures that will drive PV+storage.
6. It's not just a concept – other leading countries are already doing it.

Implications for the Future of PV from Superstorm Sandy:

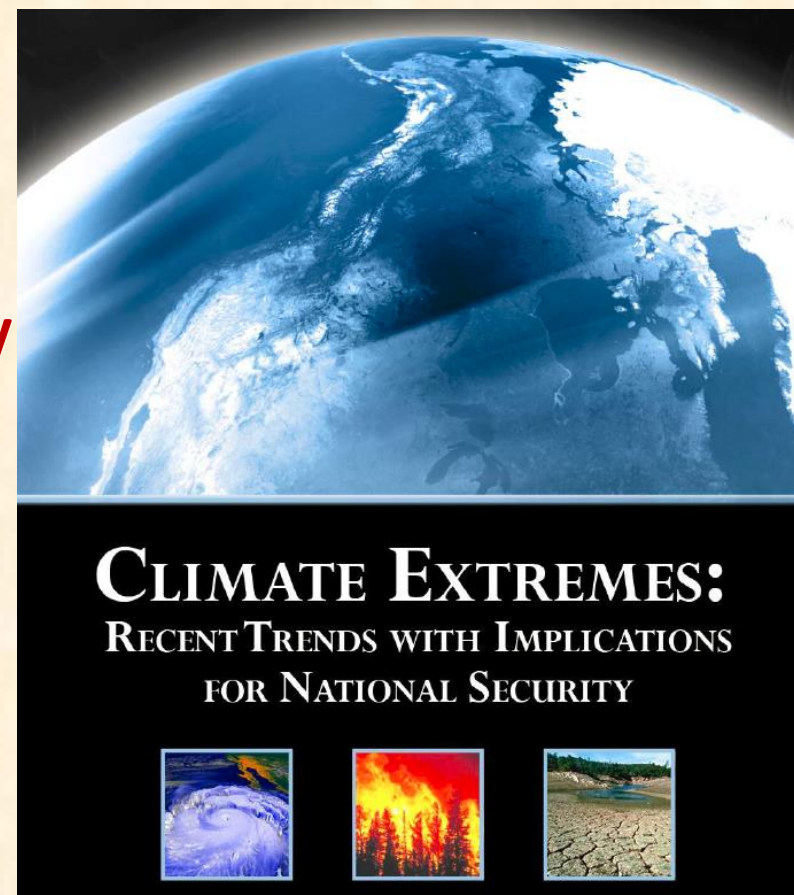
- The fragility of the electric grid was highlighted.
- The cost of global warming is being felt now, not in the future.
- The many advantages of distributed generation can be re-examined.





“Eric Pooley, senior vice president of the Environmental Defense Fund (and former deputy editor of *Bloomberg Businessweek*), offers a baseball analogy: “We can’t say that steroids caused any one home run by Barry Bonds, but steroids sure helped him hit more and hit them farther. Now we have [weather on steroids](#).”

Roughly at the same time that Sandy struck the Northeast, Harvard University released a report assessing the costs of global warming on a 10-year time scale.



“The authors sought to consider what one could expect in the period of the next decade...

The authors conclude that the early ramifications of climate extremes resulting from climate change are already upon us and will likely continue to be felt over the next decade – affecting human security and impacting U.S. national security interests.”

A Choice is Upon Us Regarding Our Energy Future

- With the EPA's new CSAP and NESHAP rules, coal power is in trouble. PJM, the nation's largest grid operator, estimates that 20 GW of coal plants are at high risk of retirement in its territory (New Jersey's statewide maximum load is 20 GW).
- New nuclear power is more expensive than solar on a KWH basis, more costly and more risky as an investment, and far more dangerous. e.g., Oyster Creek retires in 2019.
- Additional gas to fill this gap must come from unconventional drilling (fracking). New research suggests that unconventional gas has a bigger climate change impact than coal (Howarth et al., etc.).



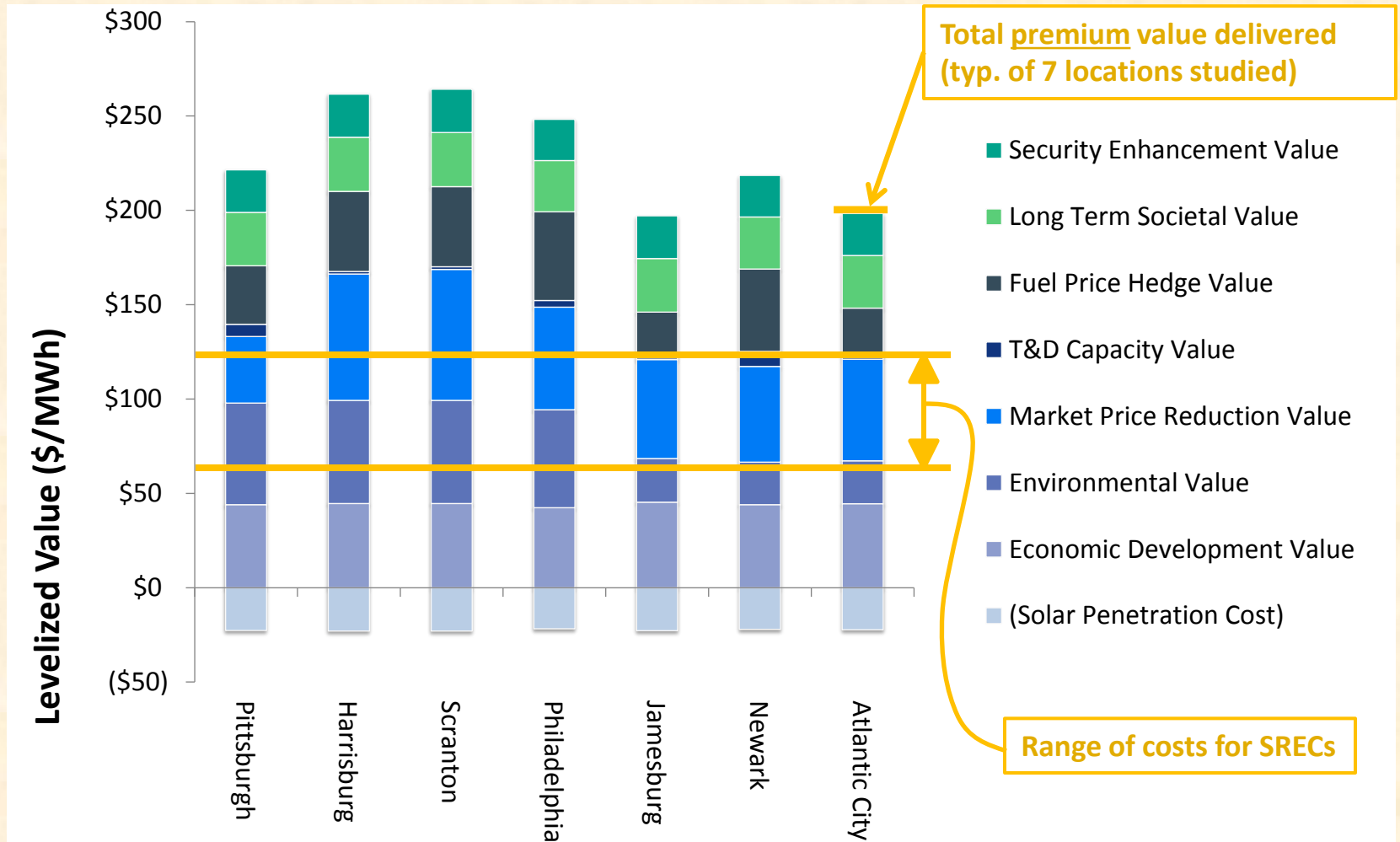
Economic Research on the Value of Solar in New Jersey:

The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania

**Dr. Thomas Hoff, Dr. Richard Perez, Dr. Benjamin Norris
Clean Power Research**

Commissioned by MSEIA

Figure ES- 2. Levelized attribute value (\$/MWh), by location (South-30).



New Jersey pays a premium for solar energy through attribute credits called “SRECs”. The Clean Power Research study commissioned by MSEIA shows that the **value of those attributes (the tops of the value bars - \$0.17 to \$0.22/KWH) **exceed the costs** (the range represented by the yellow lines - \$0.06 to \$0.12/KWH). Therefore, the incentives paid for those solar attributes are no longer a subsidy - they are a value transfer mechanism; a payment for value delivered.**

RENEWABLES' MAIN RIVAL: NATURAL GAS

“Natural has half the carbon footprint of coal.”

TRUE.

AND FALSE!

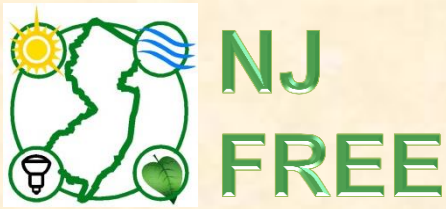
The statement above saturates the media and fossil fuel industry ads. It is deceptive. Natural gas has half the CO₂ footprint of coal, it's true. But CO₂ is only part of natural gas's Global Warming footprint – perhaps less than half of its total footprint.

Fugitive methane emission from extraction (e.g., fracking), processing, transmission, and distribution is a concentrated source of global warming.

Methane GWP = 34 to 105 (*AR5 100-year value vs. latest 25-year value*)

Methane leakage = 2% to 9% (industry studies vs. US Gov't studies)

Result: Natural gas has 79% to 415% of the global warming footprint of coal



September, 2011 - Peter Loscher, CEO of Siemens (announcing their exit from nuclear business): “Germany’s shift towards renewable energies is the project of the century”.

April, 2013 - Michael Liebreich, chief executive of Bloomberg New Energy Finance: “we are beyond the tipping point for a cleaner energy future”.

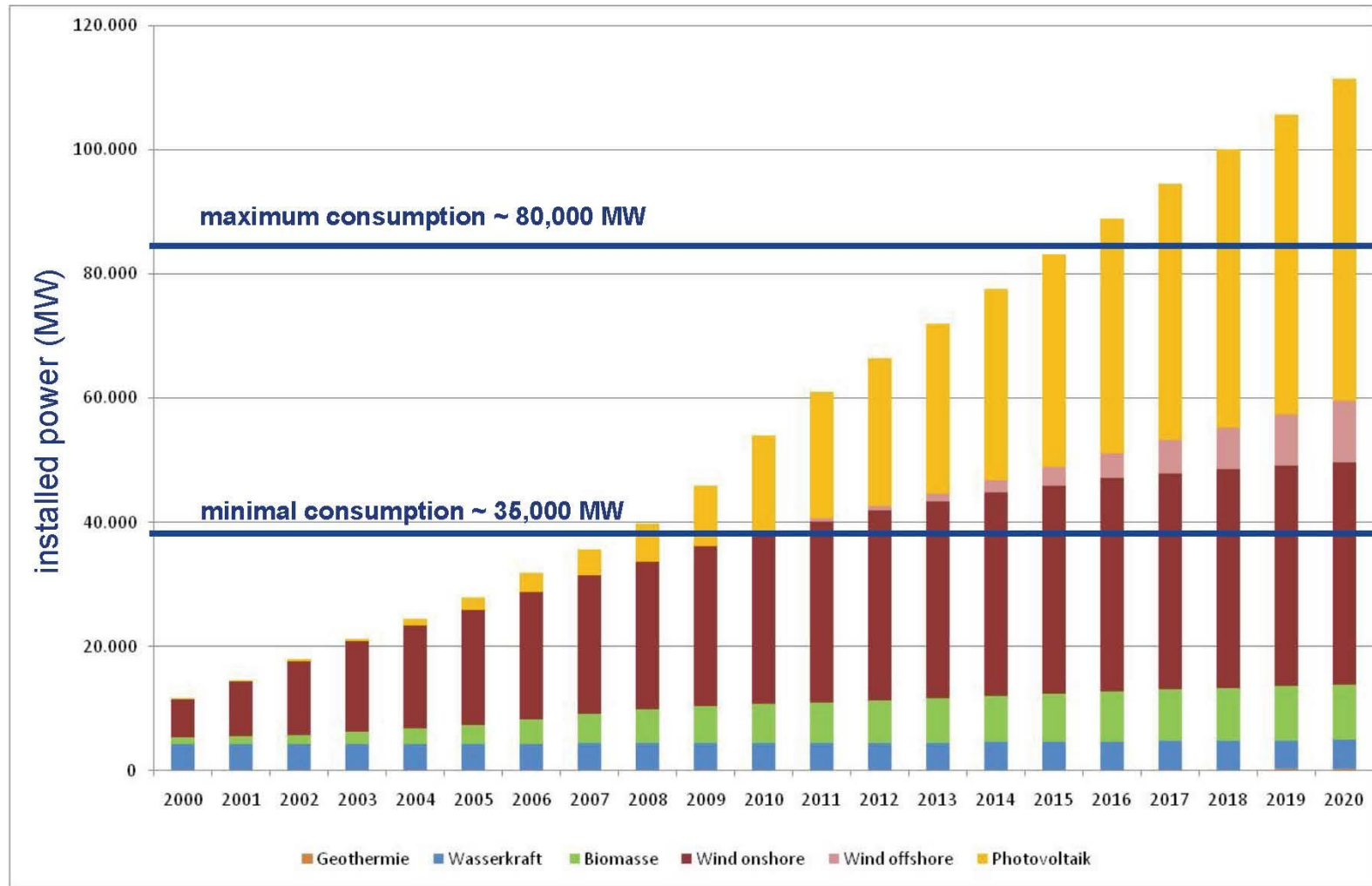
August, 2013 - Jon Wellinghof, Chairman of FERC: “Solar is growing so fast it is going to take over everything”

High-Penetration Renewable Energy in Europe – It's Already Happening.

- The Nordic countries – Denmark, Sweden, Norway, Finland, and Iceland – as a group exceeded 63% renewable power in 2012.
- Germany's "Renewable Energy Transformation" requires 85% renewable electricity by 2050. It is ahead of schedule, surpassing 26% in the first half of 2012. The RE Transformation has produced over 370,000 jobs; the German economic research institutes say it has been a net benefit to the economy, and the country's economy is by far the strongest in Europe (world's 4th largest economy overall, and the 2nd largest exporter).
- Most European Union countries have ambitious, binding RE targets.

GERMANY: Development of renewables 2020

Data base - BMU scenario 2010

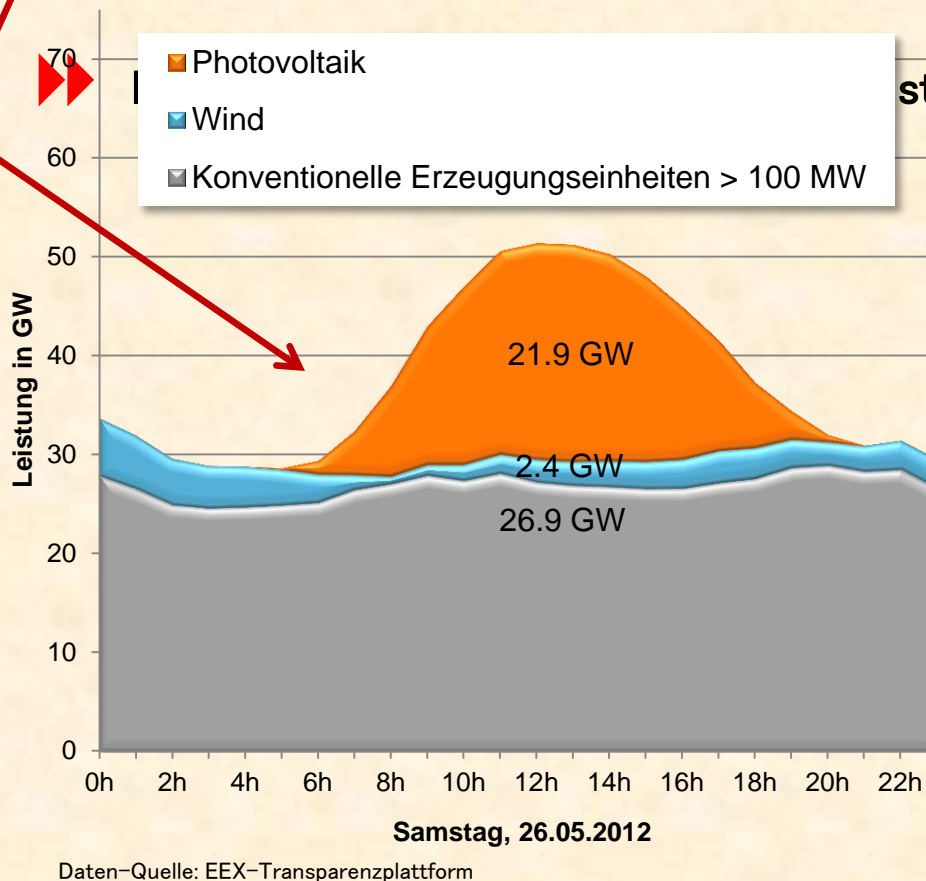


Sample day in Germany – country total load on April 5, 2012

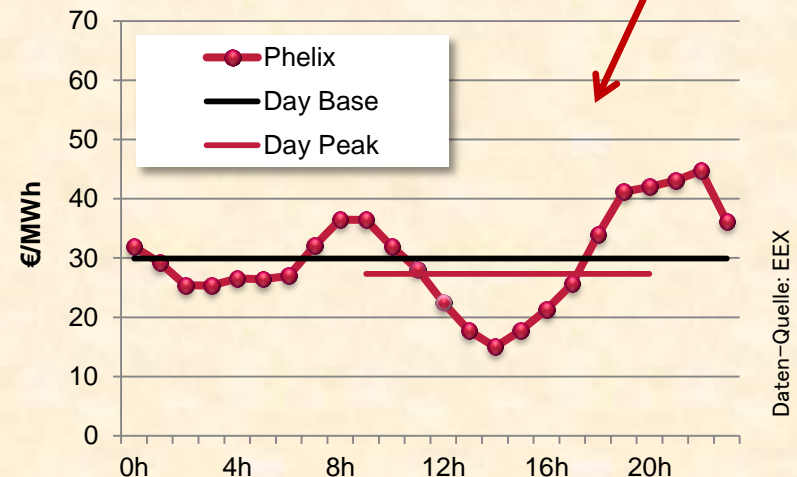
Shows that PV handles the peak load during the day; wind is greater at night; and conventional power is relatively steady.

Shows how PV drives down the cost of power during peak periods to below the cost of nighttime power.

Die Photovoltaik wird wesentliche Säule im Energiemix



- > Mittagsspitze in Deutschland am sonnigen Samstag zu 43% aus PV
- > PV-Leistung ist gut prognostizierbar
- > Zuverlässige, regional aufgelöste Folgetags-Prognosen für die Kraftwerkseinsatzplanung



How does Germany handle massive amounts of intermittent renewables without power problems or large amounts of storage?

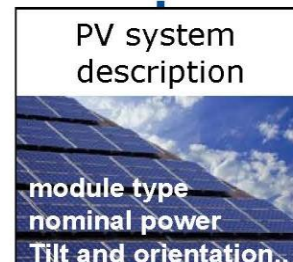
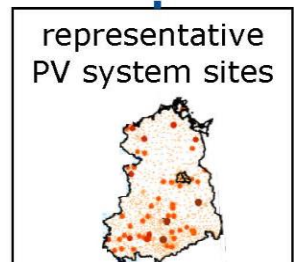
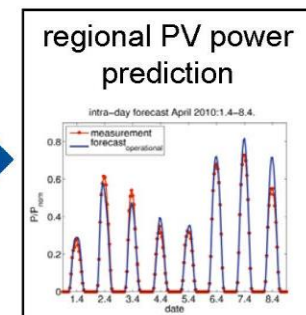
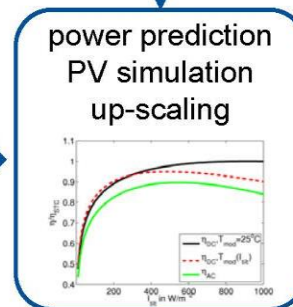
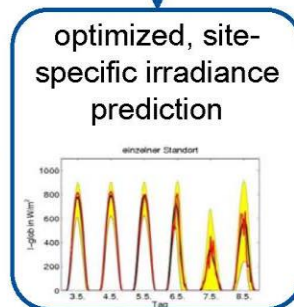
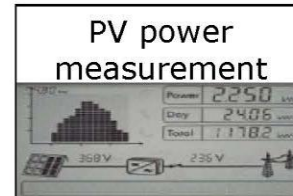
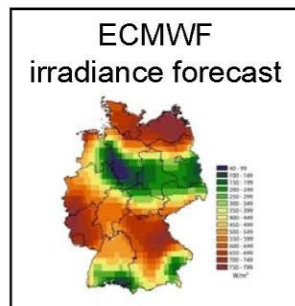
OVERVIEW ON POWER PRECTION SCHEME

Solar sensors around the country provide hour-ahead prediction

Data on installed solar systems is combined with resource data and models to calculate expected performance

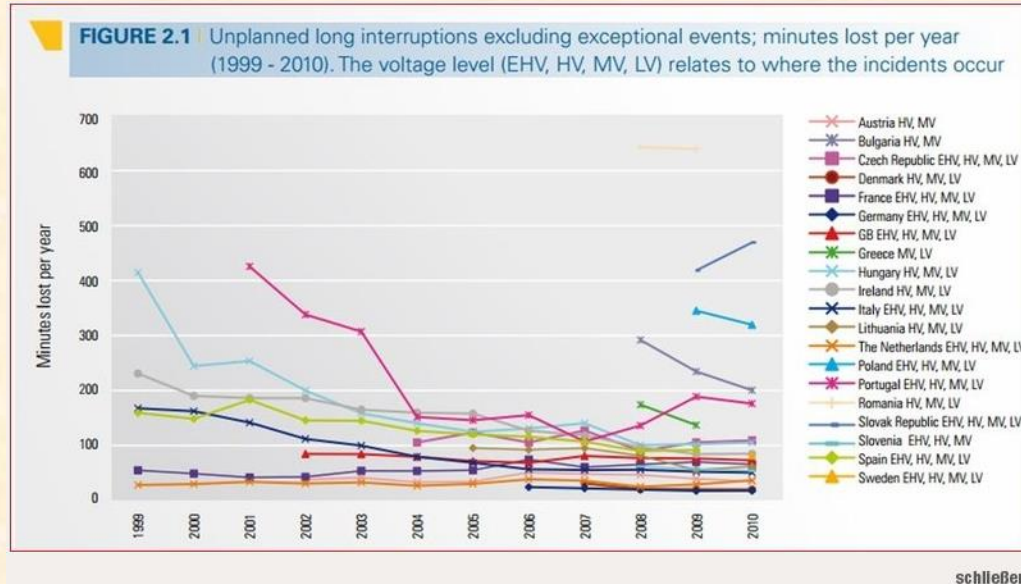
Solar resource is forecast a day ahead based on satellite data

Regional and local PV power predictions are constructed. Fossil-fueled power is adjusted accordingly



ECMWF:
European Center
for Medium-Range
Weather Forecasts

System Reliability with Intermittent Renewables



- In 2011, Germany achieved a new record low SAIDI*
Germany 2011 SAIDI = 15
 - For the same year, SAIDI for other European countries was much higher
Other European countries 2011 SAIDI = >30
 - For the same year, the U.S. SAIDI was even higher
U.S. 2011 SAIDI = 244
- * SAIDI is “System Average Interruption Duration Index”, a measure of the total duration of service interruptions. Lower numbers are better.

Bloomberg.com: “German Power Tumbles to Record Low as Solar Damps Demand”

German Power Tumbles to Record Low as Solar Damps Demand - Blo... <http://www.bloomberg.com/news/2013-01-16/european-power-for-februa...>

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German Power Tumbles to Record Low as Solar Damps Demand

By Julia Mengewein - Jan 16, 2013 12:44 PM ET

0 COMMENTS

Q QUEUE

Power for 2014 delivery in [Germany](#) and France dropped to records as rising solar output is expected to cut demand for other electricity sources.

German power, a European benchmark, fell as much as 1.5 percent, according to broker data compiled by Bloomberg. The equivalent French contract declined 0.3 percent.

Electricity for Germany next year lost 65 cents to 43.30 euros (\$57.93) a megawatt-hour, it's biggest decline since March 6, according to broker data compiled by Bloomberg. The French equivalent lost 15 cents to 46.20 euros.

As much as 18 percent of electricity demand may be replaced by solar panels not connected to Germany's grid, reducing demand for other sources by 6 to 10 percent by 2020. Per Lekander, a Paris-based analyst at [UBS AG](#) ([UBSN](#)), said in a research note.

"The unsubsidized solar growth should drive wholesale power prices further down," he said.

European power demand was unchanged in 2012 and will decline 0.7 percent this year on a "still weak economic outlook," Paolo Coghe, a Paris-based analyst at [Societe Generale SA](#) ([GLE](#)), said in an e-mailed note. While the bank's model represents 63 percent of European Union demand, it doesn't include Germany.

In France, [Electricite de France SA](#) has an unplanned shutdown at its 1,495-megawatt Civaux-1 nuclear reactor, the company said on its website. In Germany, [RWE AG](#) will resume output at its 634-megawatt Weisweiler-G lignite plant later tonight after halting the unit Jan. 14 on a boiler fault, according to the company's website.

Generation availability in Germany is expected to rise. The nation's power output is forecast to climb to 64,200 megawatts on Jan. 21 from 63,600 megawatts today, European Energy Exchange AG said on its [transparency website](#). In France, nuclear production will stay unchanged at 58,900 megawatts until Jan. 21, according to data from grid operator RTE.

To contact the reporter on this story: Julia Mengewein in Frankfurt at jmengewein@bloomberg.net

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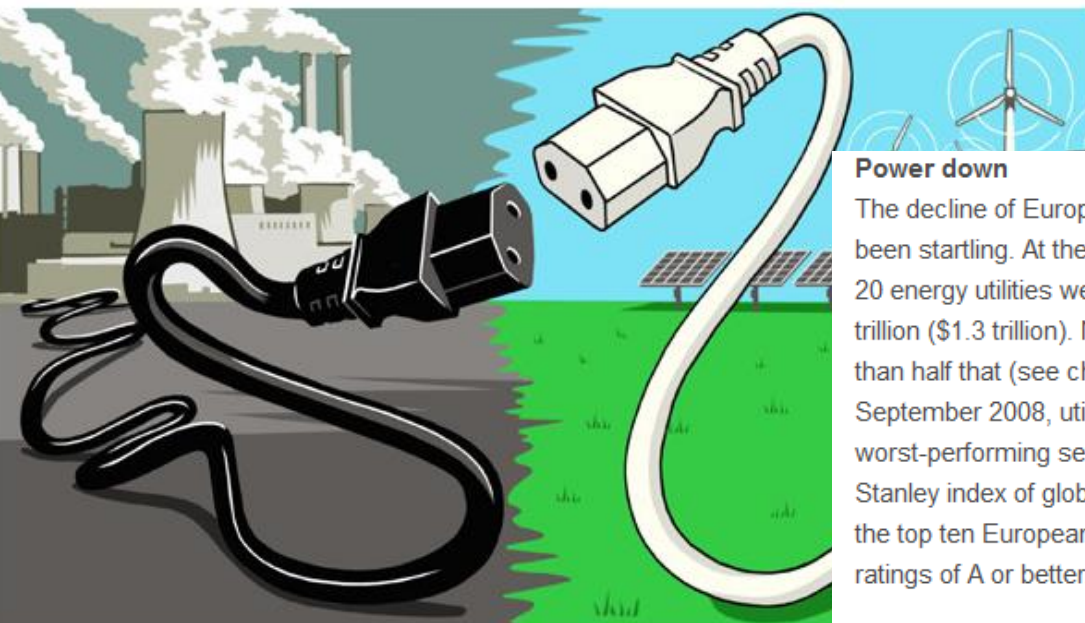
Microsoft's Office 2013 Is Software for the Cloud

European utilities

How to lose half a trillion euros

Europe's electricity providers face an existential threat

Oct 12th 2013 | From the print edition



Power down

The decline of Europe's utilities has certainly been startling. At their peak in 2008, the top 20 energy utilities were worth roughly €1 trillion (\$1.3 trillion). Now they are worth less than half that (see chart 1). Since September 2008, utilities have been the worst-performing sector in the Morgan Stanley index of global share prices. In 2008 the top ten European utilities all had credit ratings of A or better. Now only five do.

The rot has gone furthest in Germany, where electricity from renewable sources has grown fastest. The country's biggest utility, E.ON, has seen its share price fall by three-quarters from the peak and its income from conventional power generation (fossil fuels and nuclear) fall by more than a third since 2010. At the second-largest utility, RWE, recurrent net income has also fallen by a third since 2010. As the company's chief financial officer laments, "Conventional power generation, quite frankly, as a business unit, is fighting for its economic survival."

Dim and dimmer

MSCI European utilities share price, \$ terms
Jan 2005=100

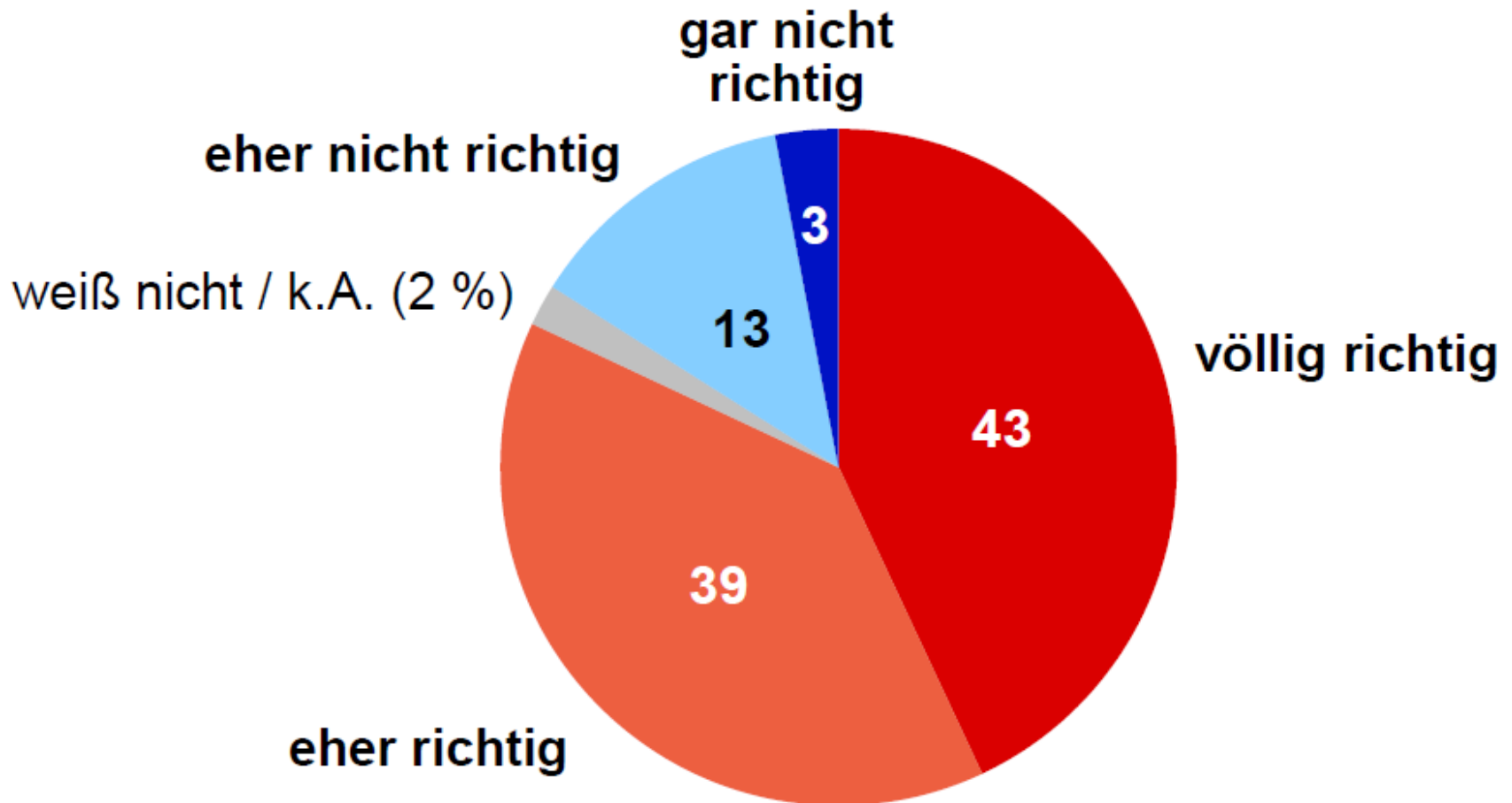


Source: Thomson Reuters

AUGUST 2013 NATIONAL SURVEY

German people's attitudes toward the Energiewende ("Energy Turnaround"):
82% say that the policy is either "completely right" (43%) or "mostly right" (39%)

Die Ziele der Energiewende finden:



Electric Energy Storage:

Rapid progress in new technologies, commercial products, and new business models lead to a new value proposition for PV.



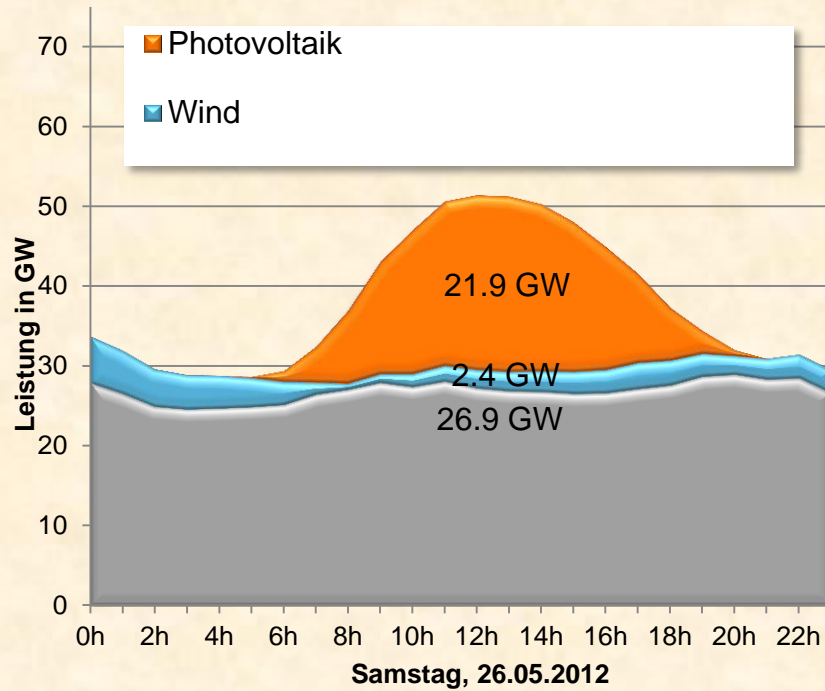
In this hybrid PV/battery storage project in Denville/Hackettstown, NJ, state-of-the-art lithium ion batteries work with a commercial PV system, simultaneously generating PV power, providing frequency regulation for PJM, and providing emergency power capability. The revenue from the frequency regulation services not only paid for the additional cost of the batteries, but paid for the inverter, too, actually reducing the cost of the solar energy.

Synergy Between Solar and Batteries:

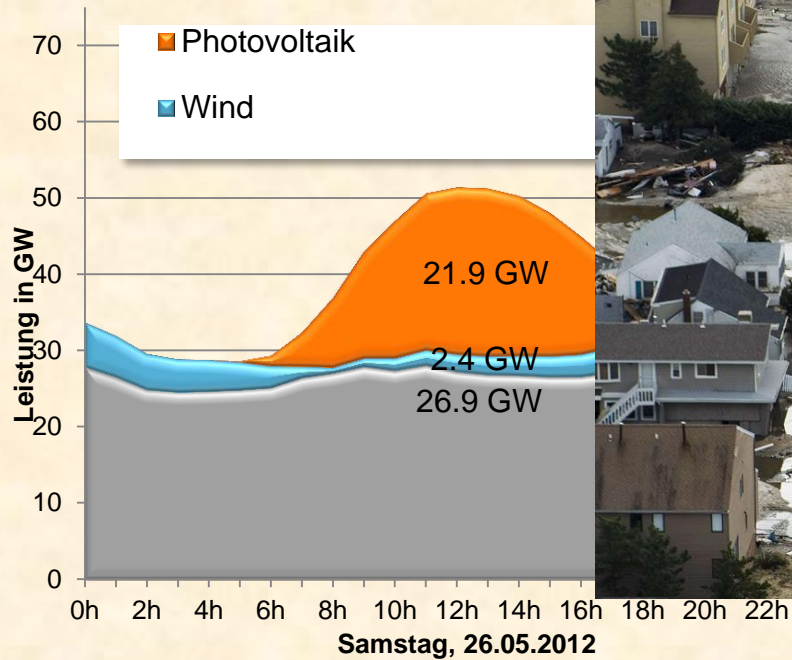
If storage can be paid for by grid stabilization services,
demand charge reduction, etc.,

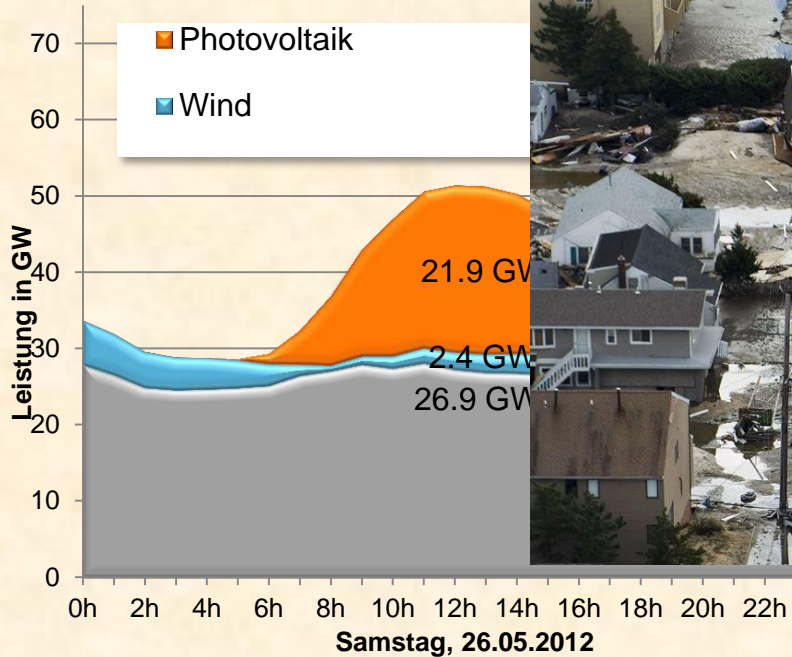
then we can have emergency power at
supermarkets,
restaurants,
food distribution centers,
gas stations,
police stations,
hotels,
YMCAs, etc.
in every town...
for little or no added cost.

**It's real (already being done by many
of the World's strongest economies)**



It's more urgent than ever (post-Sandy reality, urgency of climate change more apparent, retiring coal plants and nukes in PJM, Fukushima)





New technologies (e.g., storage), new income streams (e.g., frequency reg.), and new business models allow PV to deliver greater value than just KWHs

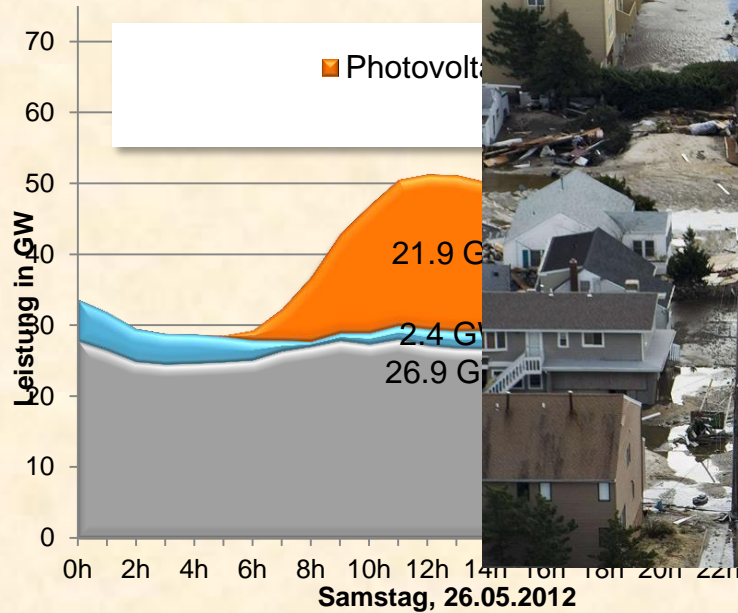
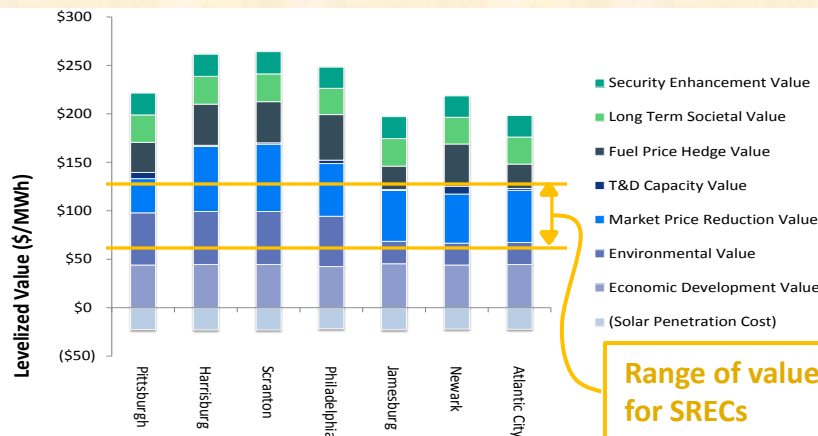


Figure ES- 2. Levelized attribute value (\$/MWh), by location (South-30).



It's more justifiable than ever (added value already exceeds added cost, today)

**We Can Create
a sustainable future**