



Expressing Solar

IEEE SCV-PV – Feb 11, 2015



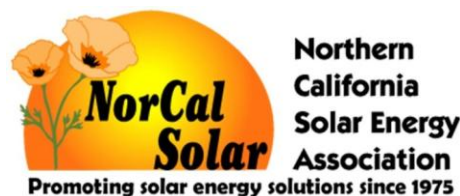
Doug McKenzie
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Who's Doug*?

LightsOnSolar.com



NorCalSolar.org



SunWork.org



**Also: career coach at AspirationalCoaching.com*

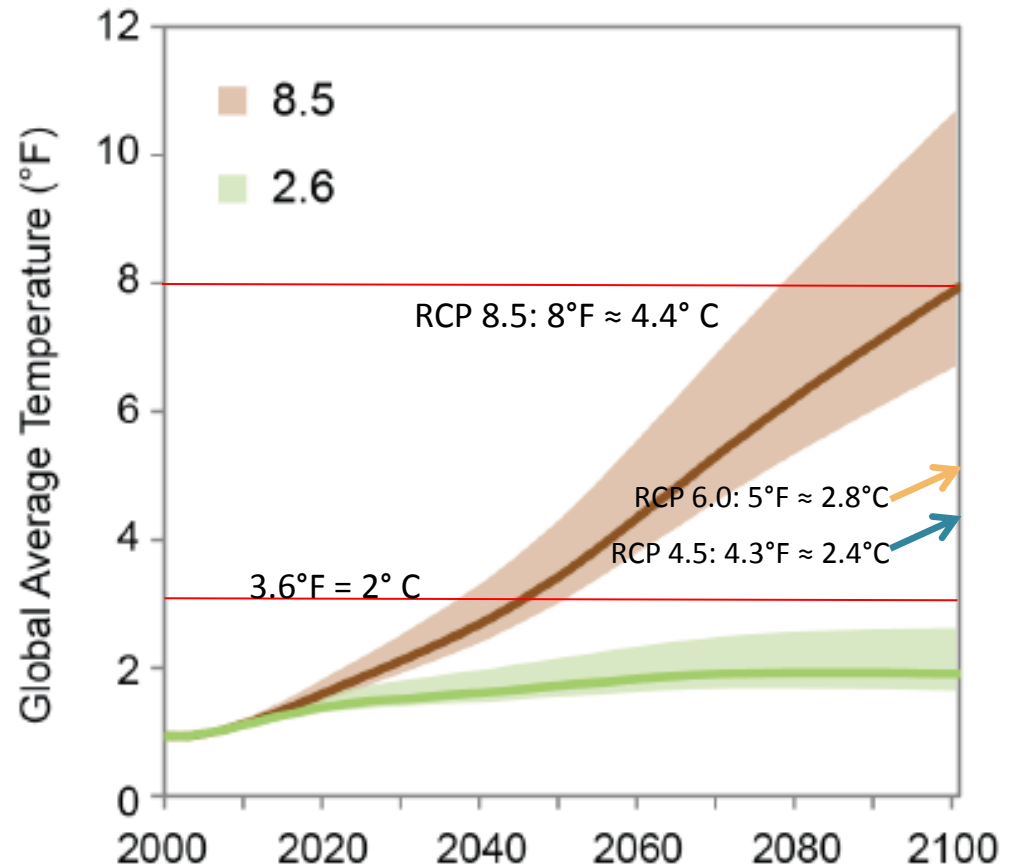
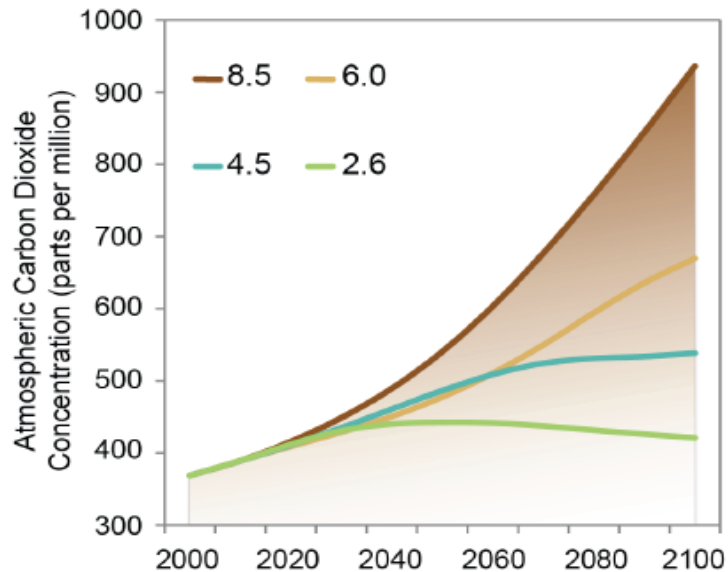
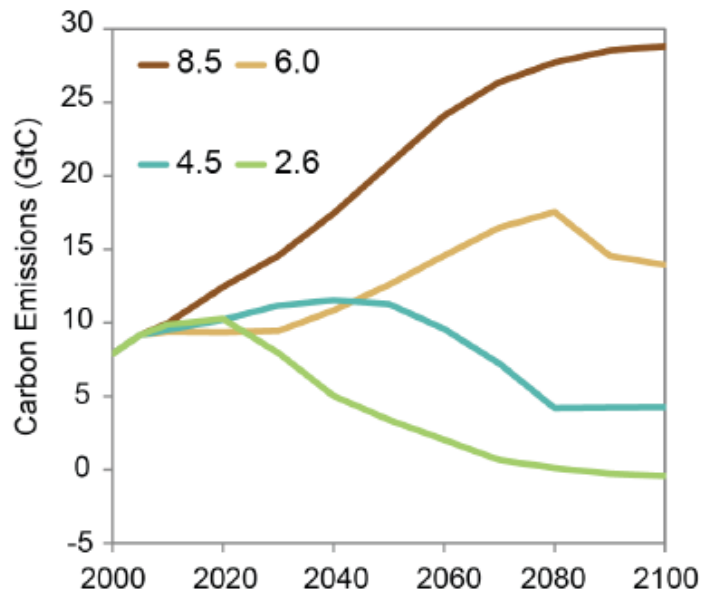
Tonight

- Climate Change
- Solar Growth
- Communicating Climate & Solar
- Call to Action



Climate Change

RCP* 2.6, 4.5, 6.0, 8.5



* RCP = IPCC AR5 (2014) Representative Concentration Pathways: eg: 8.5 watts/m² chg in radiative forcing. Graphs are from the US National Climate Assessment, May 2014, Full Report, pg 755

Climate Change

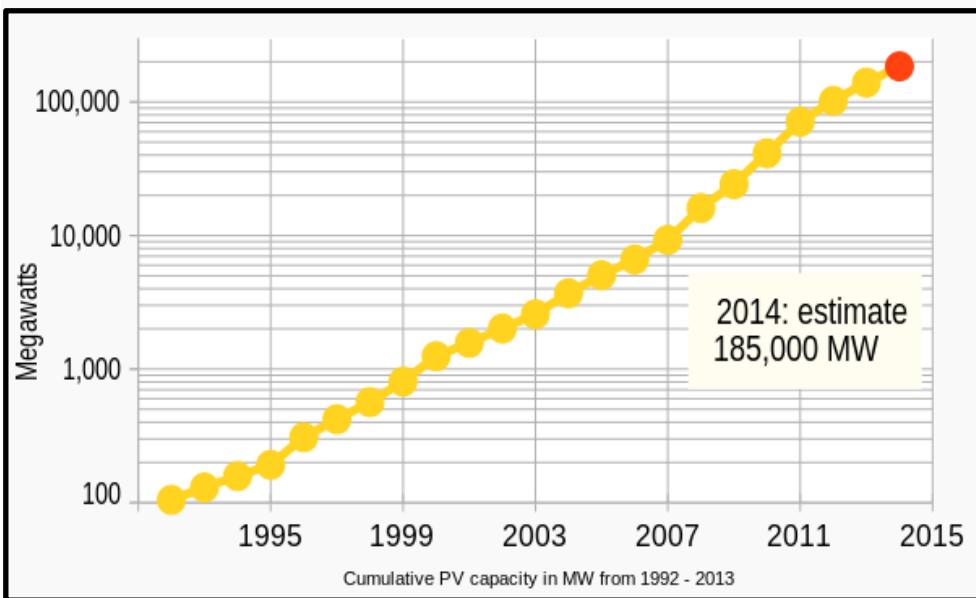
- Is happening now
- Will get worse, probably a lot worse.

IPCC AR5 Summary for Policymakers (2014):

Without additional mitigation efforts ... **warming by the end of the 21st century will lead to high to very high risk of severe, widespread, and irreversible impacts globally.** In most scenarios without additional mitigation efforts, warming is more likely than not to exceed 4°C above pre-industrial levels by 2100. The risks associated with temperatures at or above 4°C include **substantial species extinction, global and regional food insecurity, consequential constraints on common human activities, and limited potential for adaptation in some cases.**

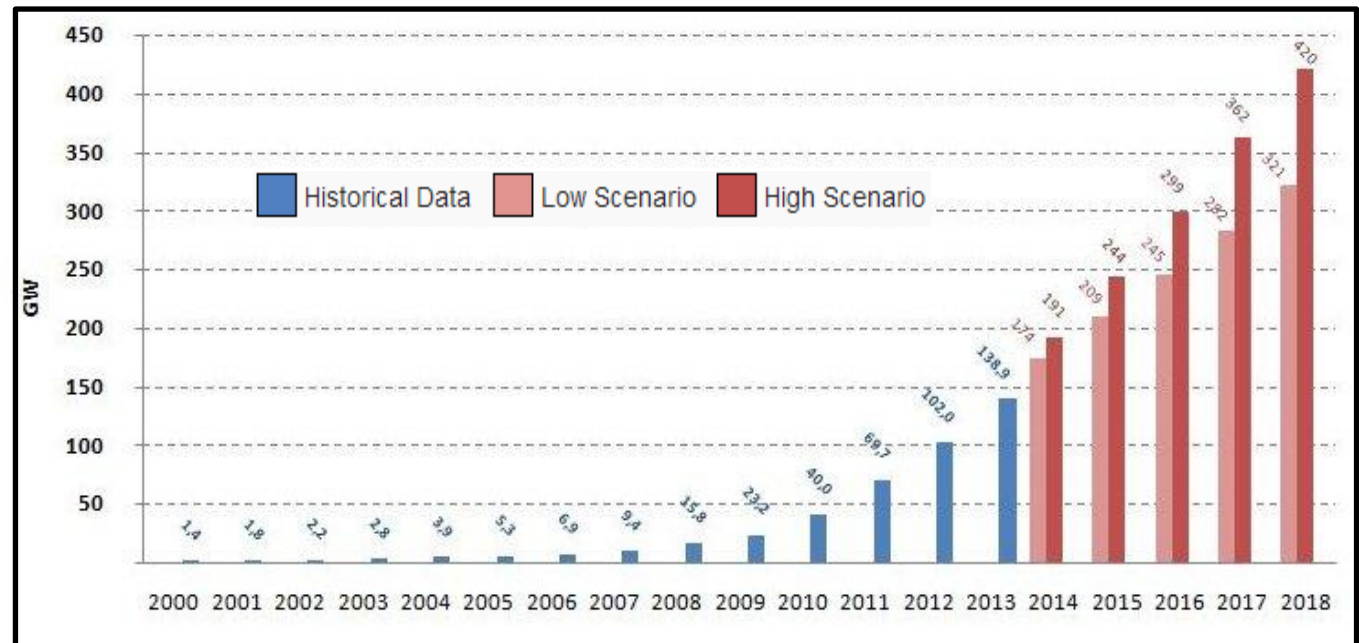
- May get outrageously worse
 - If **trillions** of tons of methane hydrates and permafrost melt





Solar Growth*

PV has been fitting an exponential curve for more than two decades



Solar Growth

- *TECHNICALLY* there is no obstacle to solar providing the world's energy needs
 - Global energy consumption per year ≈ 530 Quadrillion BTU*
(1 quadrillion BTU = 1 Quad ≈ 1 exajoule (EJ) $\approx 300,000$ GWh)
 - Solar energy reaching the earth per year $\approx 3.85 \times 10^6$ EJ**
 - 1 hour's sunlight $\approx (3.85 \times 10^6 \text{ EJ/yr}) / 365 / 24 \approx 440$ EJ

So ...

1 hour's sunlight ≈ 440 EJ ≈ 530 Quads

OR***

**1 hour of sunlight is worth a YEAR of the
WHOLE WORLD's energy use!!!**



* <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=44&pid=44&aid=2>

** https://en.wikipedia.org/wiki/Solar_energy

*** Depending on your more, or less, analytical point of view

Solar Growth Versus CO₂ Emissions

- No other source of clean energy comes remotely close to solar's potential (except *maybe* nuclear power).
How fast does solar need to grow, to mitigate climate change?

The exponential curve of GHG* emissions

v.

The exponential curve of solar growth



*GreenHouse Gases: H₂O CO₂ CH₄ N₂O O₃ CFCs

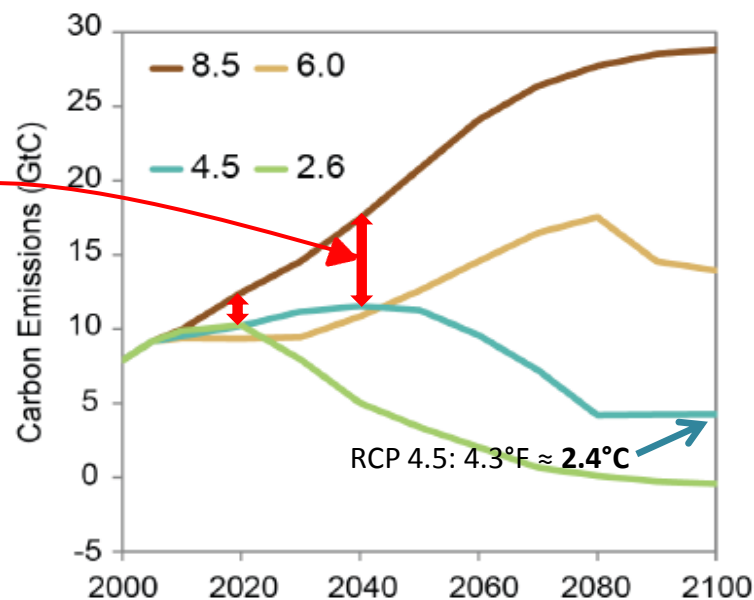
Solar v. CO₂ Math

Need to reduce yearly CO₂ emissions
by **~7.3 Gt** by 2020, & **~20 Gt*** by 2040

- Burning fossil fuels for electricity:
Avg: ~1700 lbs CO₂/MWh
(coal: 2249 lbs CO₂/MWh **)
(natural gas: 1135 lbs CO₂/MWh **)
1700 lbs/MWh = 850 tons CO₂ per GWh
- Need to reduce fossil fuel combustion by
2020: 8.6 million GWh per year (7.3 Gt/yr) / (850 tons/GWh)
2040: 23.5 million GWh per year (20 Gt/yr) / (850 tons/GWh)
- At ~1750 GWh/GW/year (US average) ...
- Need 5000 GW of solar installed by 2020 (8.6 million GWh / 1750 GWh) and

BOTTOM LINE:

Need ~13,500 GW of solar installed by 2040 (23.5 million GWh / 1750 GWh)



* 1 GtC ≈ 3.67 GtCO₂

** <http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html>

Solar v. CO₂ Math

- BOTTOM LINE: Need ~13,500 GW of solar installed by 2040
- Solar Compound Annual Growth Rate (CAGR) from 2000 to 2014:

43%*

Year	GW/yr	YoY	CAGR	GW total
2000				1.40
2001	0.37			1.77
2002	0.47	28.77%		2.24
2003	0.59	24.47%		2.82
2004	1.13	93.68%		3.95
2005	1.41	24.54%		5.36
2006	1.58	12.12%		6.95
2007	2.58	62.77%		9.52
2008	6.71	160.50%		16.23
2009	7.38	9.96%		23.61
2010	17.07	131.36%		40.67
2011	30.39	78.09%		71.06
2012	31.10	2.32%		102.16
2013	39.00	25.42%	43.24%	141.16

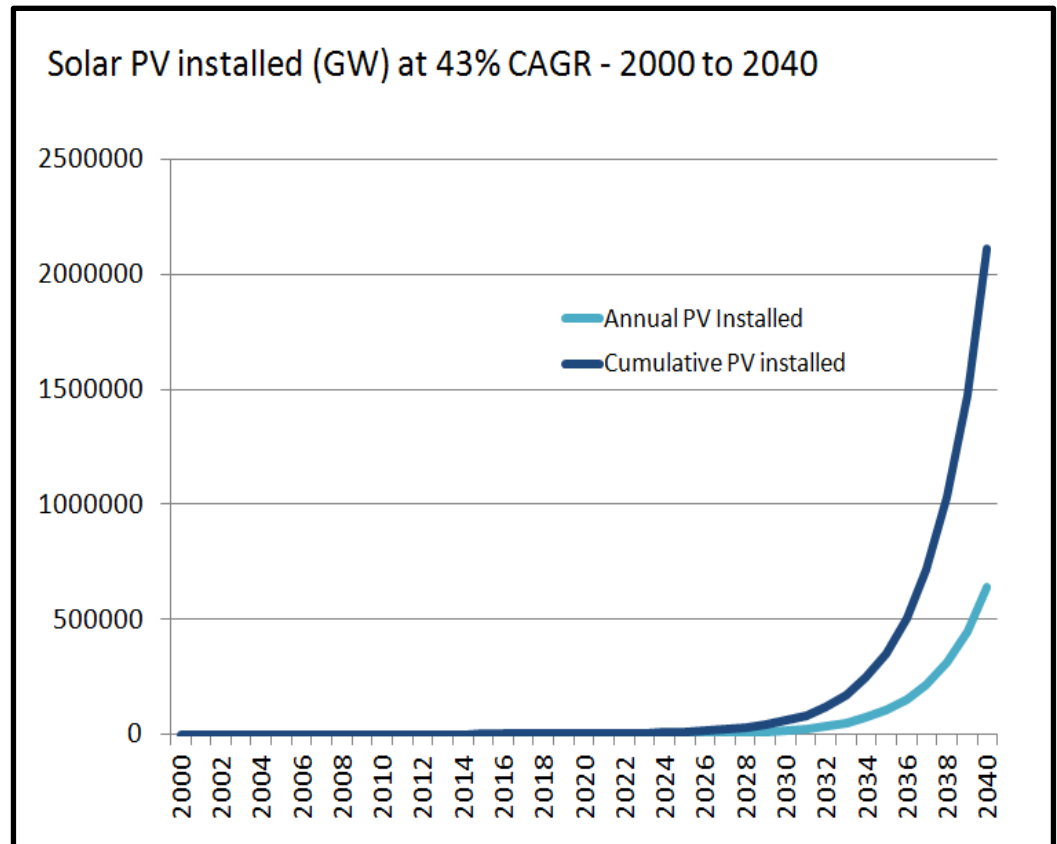
If solar continues to grow at 43%/year ...



Solar v. CO₂ Math

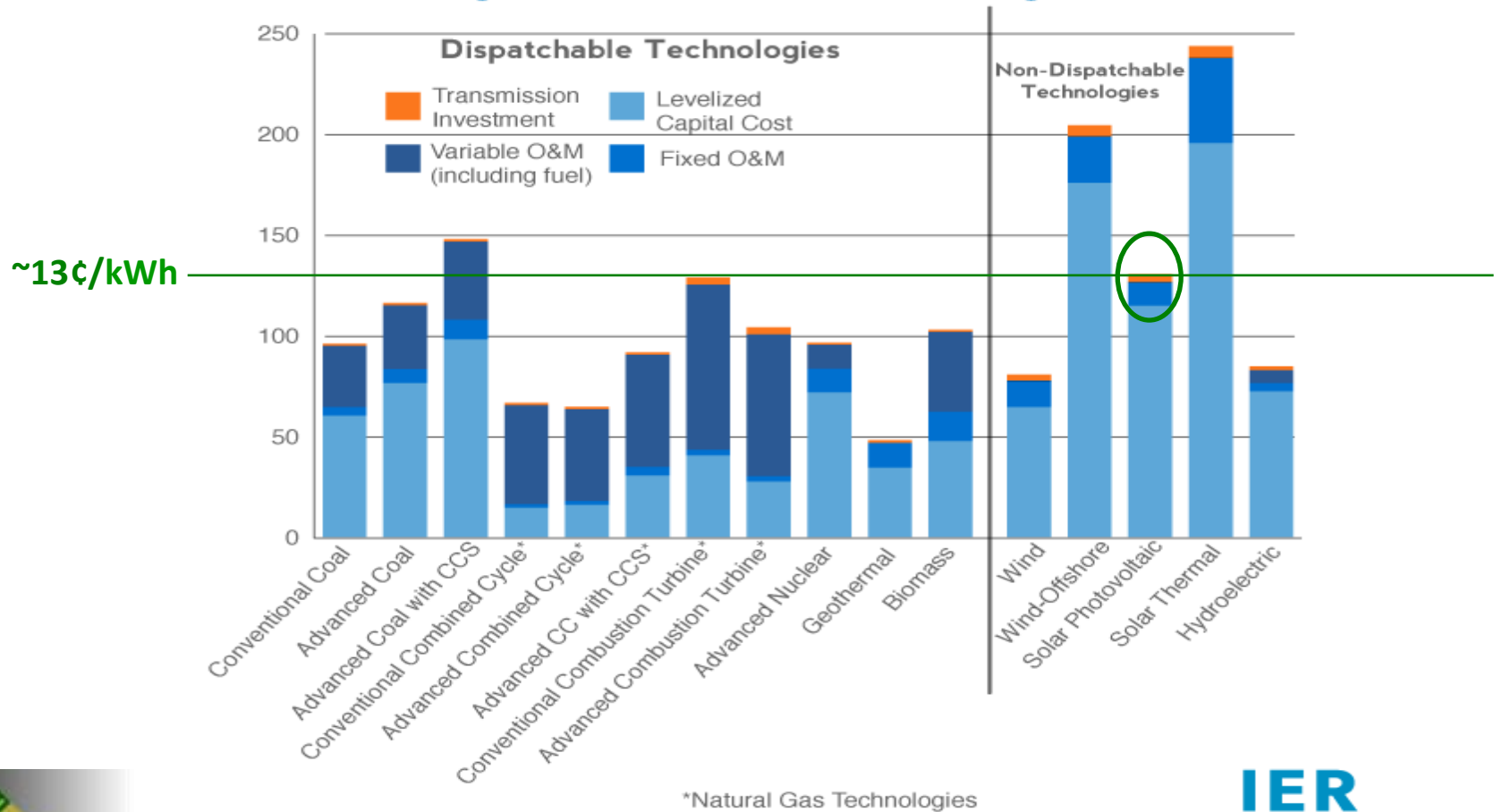
- BOTTOM LINE: Need ~13,500 GW of solar installed by 2040
- With 43%/year growth 2015 to 2040: 2,000,000 GW
 - Surpasses 13,500 GW in 2026
 - At 10 sq.mi. per GW, solar covering Arizona could power the world

Yes there are
huge obstacles...



Solar Growth - Obstacles

Estimated Levelized Cost of New Electric Generating Technologies in 2019 (2012 \$/megawatthour)*



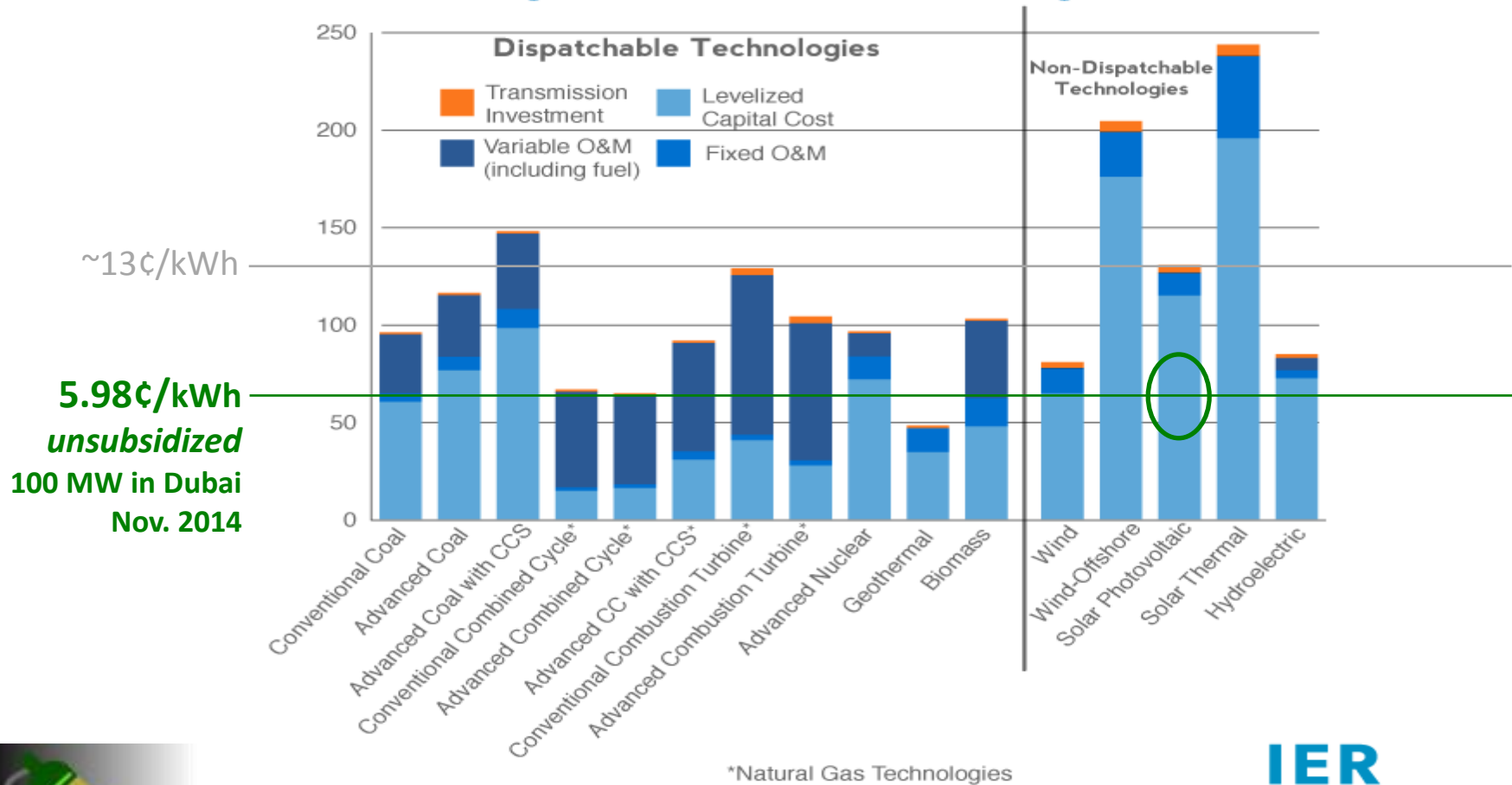
IER



* <http://instituteeforenergyresearch.org/topics/policy/electricity-generation-cost/>

Solar Growth - Opportunities

Estimated Levelized Cost of New Electric Generating Technologies in 2019 (2012 \$/megawatthour)

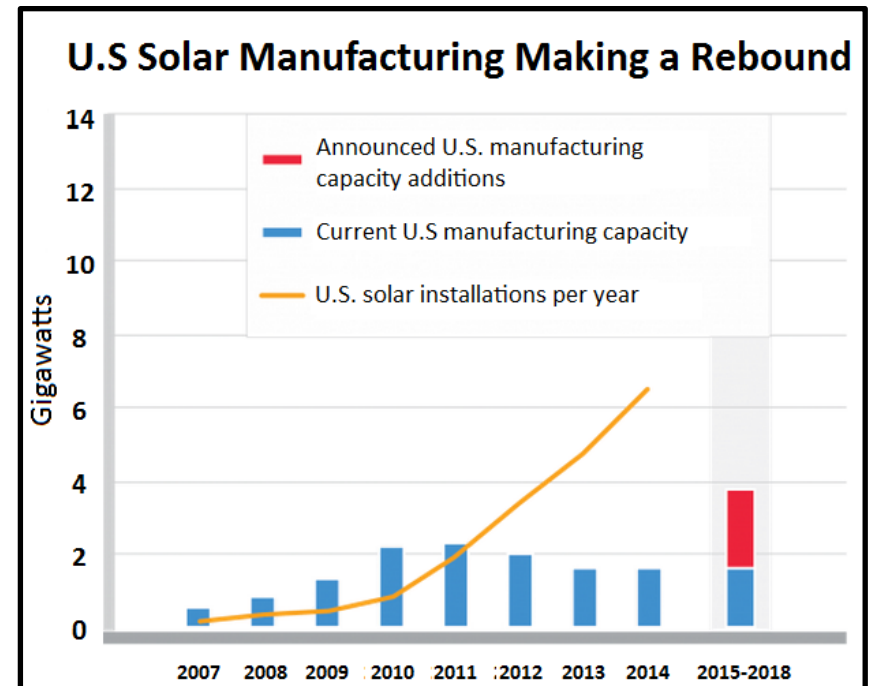


Solar Growth - Opportunities

- Manufacturing in the USA
- SolarCity has broken ground on its new 1GW Silevo fab in New York
- Siva Power estimates it can achieve a manufacturing cost of \$0.40/watt when it begins operating its 300MW line, and less than \$0.28/watt within two years

Solar Panel Manufacturers - 2014	
Europe (305)	Germany (85)
	Italy (74)
	Spain (24)
	Other (122)
Asia Pacific (804)	China (535)
	India (99)
	Japan (34)
	Korea (28)
	Taiwan (36)
	Other (72)
Americas (101)	Canada (19)
	USA (73)
	Other (9)
Africa (14)	
Middle East (8)	

<http://www.enfsolar.com/directory/panel/United%20States>



<http://breakingenergy.com/2015/02/06/u-s-solar-manufacturing-rising-on-the-horizon/>



***We have a huge high-probability terrible
awful problem and a potentially
unprecedented irreversible looming
catastrophe!***

And we have viable strategies for mitigating the
worst of it

So why are we (Congress, country, world) doing
essentially nothing about it?



Solar Growth - Obstacles

We're doing almost nothing because:

1. It's complicated and abstract
2. We're ill-informed and flooded with doubt



Solar Growth - Obstacles

It's complicated and abstract

- Total global warming since 1880: less than 1°C
BUT - Total daily change in Palo Alto: more than 10°C
- “2014 was the hottest year ever recorded”
BUT - On 2/8/2015 Boston had a base of 37” of snow, the deepest ever recorded since weather records began*
- CO₂ and Natural Gas are the primary problems
BUT - CO₂ and NG are invisible and odorless and non-toxic (in commonly occurring quantities) and CO₂ is vital for vegetation



*<http://www.usatoday.com/story/weather/2015/02/09/boston-new-england-snow-records/23109017/>

Solar Growth - Obstacles

We're ill-informed *because* we're flooded with doubt

DeSmogBlog.com database of individuals in the global warming denial industry*

Alexandre Aguiar, Arun Ahluwalia, Syun-Ichi Akasofu, Ralph B. Alexander, William JR Alexander, Claude Allgre, Helmut Alt, Gabriel Calzada Alvarez, Klaus F. Angerer, Bob Armstrong, Scott Armstrong, Jerome Arnett, August Auer, Dennis Avery, Ronald Bailey, Sallie Baliunas, Timothy F. Ball (Tim Ball), Robert C. Balling Jr., Jack Barrett, Joseph Bast, Joe Bastardi, Charles Battig, Calvin Beisner, Larry Bell, David Bellamy, Sonja Boehmer-Christiansen, Andrew Bolt, Christopher Booker, Donald J. Boudreaux, Alexandra Liddy Bourne, Robert L. Bradley Jr., Jan Breslow, Barry Brill, Robert Bryce, Reid Bryson, H. Sterling Burnett, Nigel Calder, Alan Carlin, Bob Carter, John Charles, Paul Chesser, John R. Christy, Petr Chylek, Ian Clark, Roger Cohen, John Coleman, Jeff Condon, Joseph Conklin, Russell Cook, Paul Copper, Roy Cordato, Vincent Courtillot, Richard S. Courtney, Walter Cunningham, Judith Curry, Joseph D'Aleo, Rupert Darwall, Edward David, Robert E. Davis, Donn Dears, Anne Debeil, James Delingpole, David Deming, Peter Dietze, Paul Driessen, Harold Doiron, David Douglass, John Droz, Reynald Du Berger, Geoffrey Duffy, John Dale Dunn, Freeman Dyson, Don Easterbrook, Gregg Easterbrook, Myron Ebell, Gunter Ederer, Nathalie Elgrably-Lvy, Gary England, Hugh W. Ellsaesser, Alex Epstein, Marcus D. Ernst, Willis Eschenbach, Robert H. Essenhigh, Christopher Essex, David Evans, Ray Evans, Friedrich-Karl Ewert, Peter Ferrara, Walter Fett, Richard Fink, Joe Fone, Viv Forbes, Bob Foster, Michael Fox, Stewart Franks, Chris de Freitas, Samuele Furfari, Dan Gainor, Evelyn Browning-Garriss, Lee C. Gerhard, Gerhard Gerlich, Ivar Giaever, Steven Goddard, Michael H. Goetz, Indur M. Goklany, Fred Goldberg, Stanley Goldenberg, Steve Goreham, Laurence Gould, Vincent Gray, William Gray, Kenneth Green, Kesten Green, Ken Haapala, William Happer, Keith D. Hage, Tom Harris, Howard Hayden, Steven F. Hayward, Roger Helmer, David Henderson, Victor Manuel Velasco Herrera, John Hinderaker, Gertrud Hhler, Art Horn, Chris Horner, Douglas V. Hoyt, Arthur Middleton Hughes, Craig Idso, Sherwood B. Idso, Keith Idso, James Inhofe, Niger Innis, Roy Innis, Kiminori Itoh, Albert F. Jacobs, Zbigniew Jaworowski, Claes Goran Johnson, Wibjorn Karlen, William Kay, Richard Keen, Don Keiller, Michael Kelly, Madhav Khandekar, William Kininmonth, Vaclav Klaus, Chip Knappenberger, Gerrit Cornelis van Kooten, George Kukla, Hans HJ Labohm, Donna Laframboise, Chris Landsea, Nigel Lawson, Douglas Leahey, David Legates, Jay H. Lehr, Ezra Levant, Dan Lewis, Michael Limburg, Richard Lindzen, Gerrit van der Lingen, John Loeffler, Craig Loehle, Bjorn Lomborg, Leon Louw, Horst-Joachim Ldecke, Sebastian Lning, Anthony Lupo, Augusto Mangini, Henri Masson, Alister McFarquhar, James McGrath, Steve McIntyre, Ross McKittrick, Owen McShane, Robert Mendelsohn, Patrick Michaels, Fred Michel, Steve Milloy, Nick Minchin, Asmunn Moene, A. Alan Moghissi, Christopher Monckton, Andrew Montford, Patrick Moore, Marc Morano, Nils-Axel Morner, Julian Morris, Wolfgang Mller, Robert P. Murphy, Tad Murty, Todd Myers, Maurice Newman, Rodney Nichols, Jacob Nordangrd, Bo Nordell, John Nothdurft, Joanne Nova, Oregon Petition, John O'Sullivan, Cliff Ollier, David H. Padden, Lewis Page, R. Timothy Patterson, Gernot Patzelt, James A. Peden, Benny Peiser, Al Pekarek, Tim Phillips, Ian Plimer, Harry N.A. Priem, Art Pope, Andreas Prokoph, Jim Puplava, Richard Rahn, Vijay Kumar Raina, Josef H. Reichholf, Paul Reiter, Matt Ridley, Malcolm Roberts, Art Robinson, Norman Rogers, Arthur Rorsch, Craig Rucker, Burt Rutan, Anthony J. Sadar, Nicola Scafetta, Rob Scagel, Harrison Schmitt, David Schnare, Joel Schwartz, Tom Segalstad, Jim Sensenbrenner, Frederick Seitz, Nir Shaviv, Gary D. Sharp, Robert C. Shoup (Bob Shoup), Paavo Siitam, Joanne Simpson, S. Fred Singer, L. Graham Smith, Willie Soon, Lawrence Solomon, James Spann, Roy Spencer, H. Leighton Steward, Mark Steyn, John H. Sununu, Brian Sussman, Henrik Svensmark, Gordon E. Swaters, Tom Tanton, Roger Tattersall, George Taylor, James Taylor, Thomasz Teluk, Hendrik Tennekes, Holger J. Thuss, Utz Tillmann, David Tuerck, Fritz Vahrenholt, Brian G. Valentine, Jan Veizer, James A. Wanliss, Anthony Watts, Gerd-Rainer Weber, Werner Weber, Edward Wegman, David Whitehouse, Boris Winterhalter, Bruno Wiskel, David Wojick, Joel Wood, Todd Wynn, Thomas Wismuller, Mikls Zgoni, Antonino Zichichi

* <http://www.desmogblog.com/global-warming-denier-database>



Solar Growth - Obstacles

- DeSmogBlog: **Anthony Watts**
- WattsUpWithThat.com
“The world’s most viewed site on global warming and climate change”
- Partially funded by the Heartland Institute

Anthony Watts



Anthony Watts

Credentials

Anthony Watts studied Electrical Engineering and Meteorology at Purdue University, but has been [unwilling to state whether he graduated](#). [1], [2]

He is a former television meteorologist.

Background

Anthony Watts is a climate skeptic best known as the founder and editor of the blog *Watts Up With That* ([WUWT](#)), which primarily publishes articles skeptical of climate change. He is also the director and president of IntelliWeather Inc., a weather graphics company alternatively known as Innovative Tech Works (ITWorks) and Weathershop. He is also the founder of [Surfacestations.org](#), a project with the stated purpose of documenting the siting quality of weather stations in the United States. According to [documents](#) released in 2012, Watts has received funding from the [Heartland Institute](#).

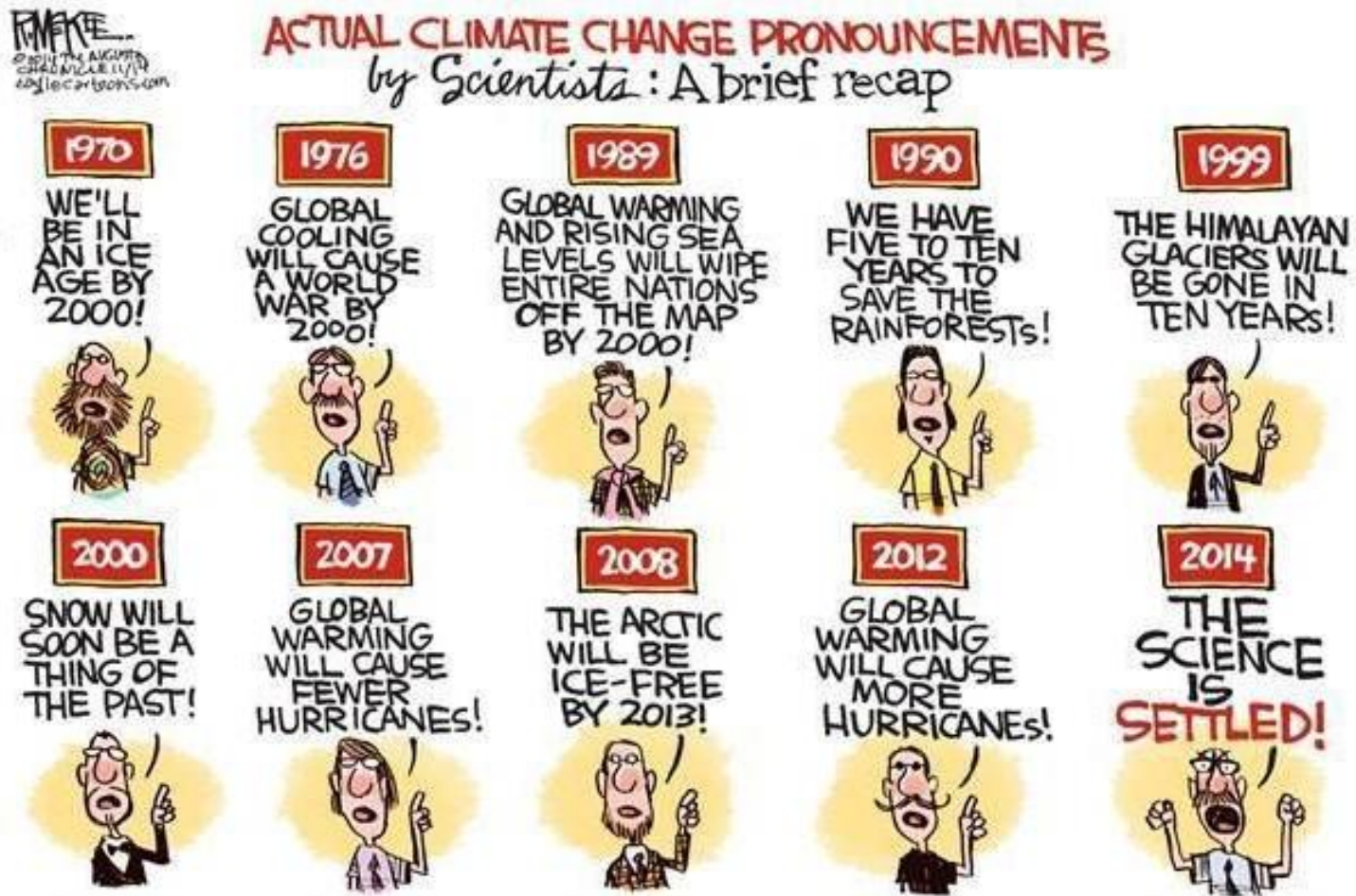
Watts previously worked as an on-air meteorologist for WLFI-TV in Lafayette, Indiana, and later joined KHSK-TV in 1987. In 2002, Watts left his position as a television weatherman to devote time to his private business, ITWorks. He returned to work part-time at KHSL in 2004, and has also been the chief meteorologist for KPAY-AM (an affiliate of Fox News) since 2002. [21], [22]

Watts admits “I’m not a degreed climate scientist” on his [WUWT profile](#), and his primary



Solar Growth - Obstacles

- Promoted on WattsUpWithThat.com



From climatechangepredictions.org, where the proprietor writes:



Solar Growth - Obstacles

- **Bjorn Lomborg** in the *Wall Street Journal**
- ***The Alarming Thing About Climate Alarmism:*** Exaggerated, worst-case claims result in bad policy and they ignore a wealth of encouraging data

It is an indisputable fact that carbon emissions are rising—and faster than most scientists predicted. But many climate-change alarmists seem to claim that all climate change is worse than expected. This ignores that much of the data are actually encouraging. The latest study from the United Nations Intergovernmental Panel on Climate Change found that in the previous 15 years temperatures had risen 0.09 degrees Fahrenheit. The average of all models expected 0.8 degrees. **So we're seeing about 90% less temperature rise than expected.**



* <http://www.wsj.com/articles/bjorn-lomborg-the-alarming-thing-about-climate-alarmism-1422832462>

Solar Growth - Obstacles

- Christopher Monckton's article in *Science Bulletin**
- ***Why models run hot: results from an irreducibly simple climate model***

From the abstract: An irreducibly simple climate-sensitivity model is designed to empower even non-specialists to research the question how much global warming we may cause... global warming this century will be < 1 K; and that **combustion of all recoverable fossil fuels will cause < 2.2 K global warming to equilibrium**



Solar Growth - Obstacles

- **Vaclav Smil's** article in *Scientific American**
- ***The Long Slow Rise of Solar and Wind: The great hope for a quick and sweeping transition to renewable energy is wishful thinking***

RENEWABLE ENERGY SOURCES COULD TAKE THE WORLD BY STORM

That is what well-known advocate Amory Lovins envisaged in 1976. He claimed that by the year 2000, 33 percent of America's energy would come from many small, decentralized renewable sources.



*Available free of charge on Smil's site at: <http://vaclavsmil.com/wp-content/uploads/scientificamerican0114-52.pdf>

Solar Growth - Obstacles

- Last October, natural gas advocate T. Boone Pickens ridiculed climate change as absurd
- Senate Environment and Public Works Committee Chairman James Inhofe's 2012 book was titled *The Greatest Hoax: How the Global Warming Conspiracy Threatens Your Future*
- NPR fired all three of its full time environmental reporters in 2014
- *The Moral Case for Fossil Fuels* author Alex Epstein argues:
 - CO2 has been 10 times higher in history and life thrived
 - Fossil fuels are the only energy technology that could possibly scale in the near future ... to provide energy for 7 billion people
- *And on and on and on and on and on and on*

No wonder that 37% of Americans believe global warming is a hoax*

* <http://www.mnn.com/earth-matters/climate-weather/stories/poll-37-of-americans-believe-that-global-warming-is-a-hoax>

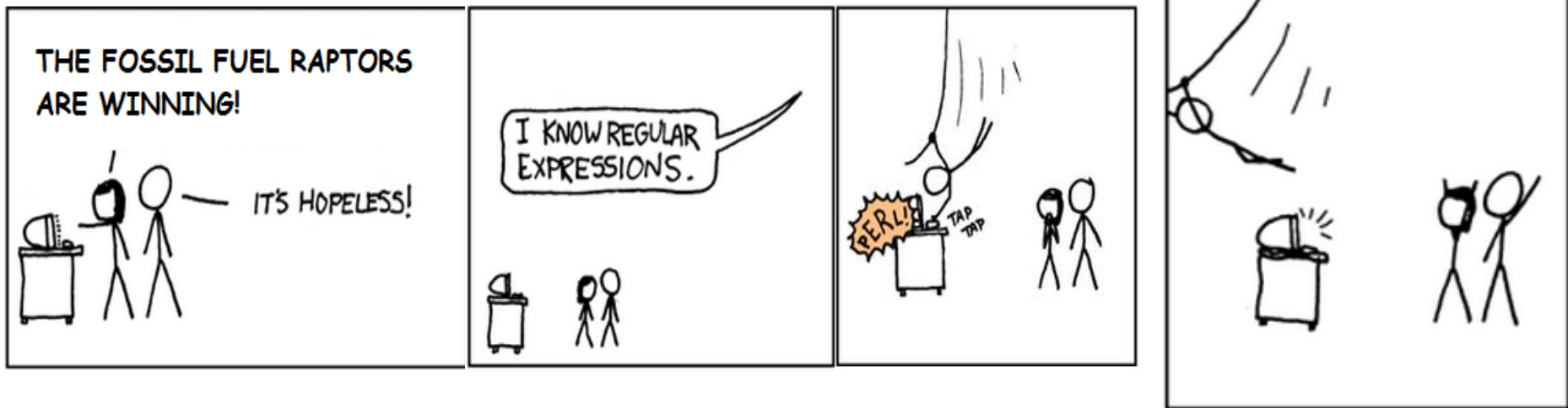


Solar Growth – What Now?

- Doubters and deniers are repeatedly debunked
- But we are doing almost nothing - GHG emissions are winning the race

What Now? Techies to the rescue!

(Apologies to Randall Munroe / XKCD*)



Communicating Climate & Solar - Preliminaries

Most people know almost nothing about:

- Exponential curves
- Where electricity comes from
- What an inverter does
- What the smart grid is
- What scientists know and don't know about climate change
- IPCC reports as primarily literature reviews of peer-reviewed papers
- What Peer review is; what a literature review is
- What's in the US National Climate Assessment
- That without major technological breakthroughs:
 - Most of the world's proven fossil fuel reserves **can't** be burned
 - Solar **can** scale to supply the energy that fossil fuels shouldn't
- Solar products, technology, contractors, cost, financing, durability, reliability, scalability, efficiency, Renewable Portfolio Standards, subsidies, incentives, ...
- What Levelized Cost of Energy means



Communicating Climate & Solar - Preliminaries

Wikipedia's List of cognitive biases* (selection)

- **Backfire effect** - When people react to disconfirming evidence by strengthening their beliefs
- **Confirmation bias** - The tendency to search for, interpret, focus on and remember information in a way that confirms one's preconceptions
- **Curse of Knowledge** - When better-informed people find it extremely difficult to think about problems from the perspective of lesser-informed people
- **Dunning-Kruger effect** - Where incompetent people fail to realize they are incompetent because they lack the skill to distinguish between competence and incompetence
- **Framing effect** - Drawing different conclusions from the same information, depending on how or by whom that information is presented
- **Illusion of truth effect** - That people are more likely to identify as true statements those they have previously heard

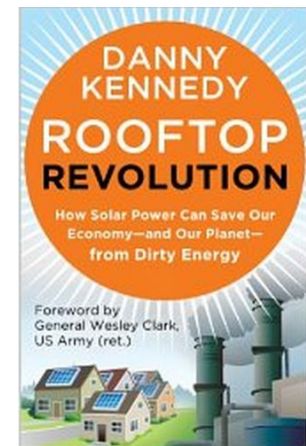
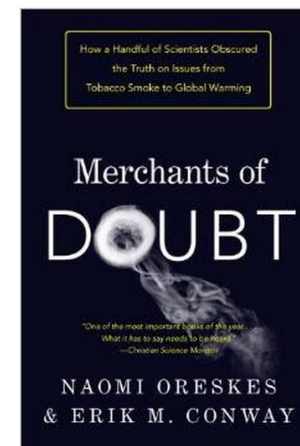
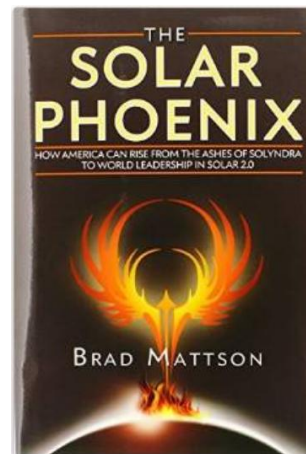
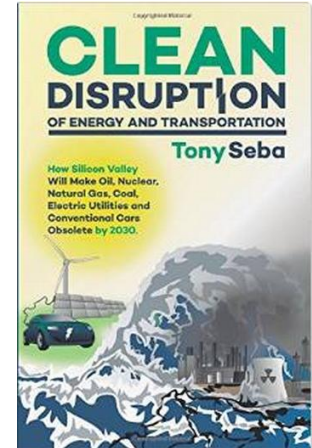
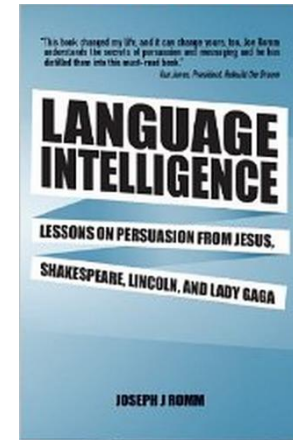
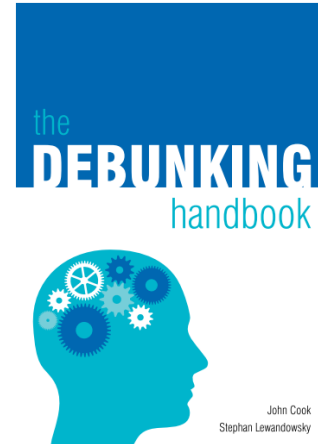


* https://en.wikipedia.org/wiki/List_of_cognitive_biases

Communicating Climate & Solar - Preliminaries

Must reads!

- *The Debunking Handbook*
Cook & Lewandowsky
- *Language Intelligence*
Joe Romm
- *Clean Disruption*
Tony Seba
- *The Solar Phoenix*
Brad Mattson
- *Merchants of Doubt*
Oreskes & Conway
- *Rooftop Revolution*
Danny Kennedy



Communicating Climate & Solar - Actions

Possibly the *only* way to prevent that

***potentially unprecedented irreversible looming
catastrophe***

from happening is for you to stop it

“Life begins at the end of your comfort zone”

Neale Donald Walsch



Communicating Climate & Solar - Actions

- Push the discussion with: family, friends, neighbors, kids' friends and families, colleagues, schools, churches, employers, meetups, city councils, membership organizations, strangers, ...
 - What do they think about climate and solar?
 - Are they confused about what and who to believe?
 - Do they understand the stakes and the urgency?
 - What are they doing about it?

How do they respond? ...



Communicating Climate & Solar - Actions

- When they push back with anger, argument, defensiveness, partisan bias, cognitive bias, ...
 - Climate isn't warming, it isn't humans, it isn't significant, it's good for the planet, there's no consensus, the science isn't settled, Arctic ice is growing, Antarctic ice is growing, God wouldn't let us destroy his earth, warming has paused, it's just natural cycles, fracking is God's gift to America, Al Gore's carbon footprint, ...
 - Solar is uneconomical, it won't scale, it's unreliable, it's intermittent, it's inefficient, it's dirty (manufacturing), it's all crony corruption, it's ugly, it's for tree-huggers, the price of oil has been cut in half, ...
 - Barack Hussein Obama, BO, The Democrat Party, ...
 - People like you [eggheads], ...

“The selling begins when the customer says no”

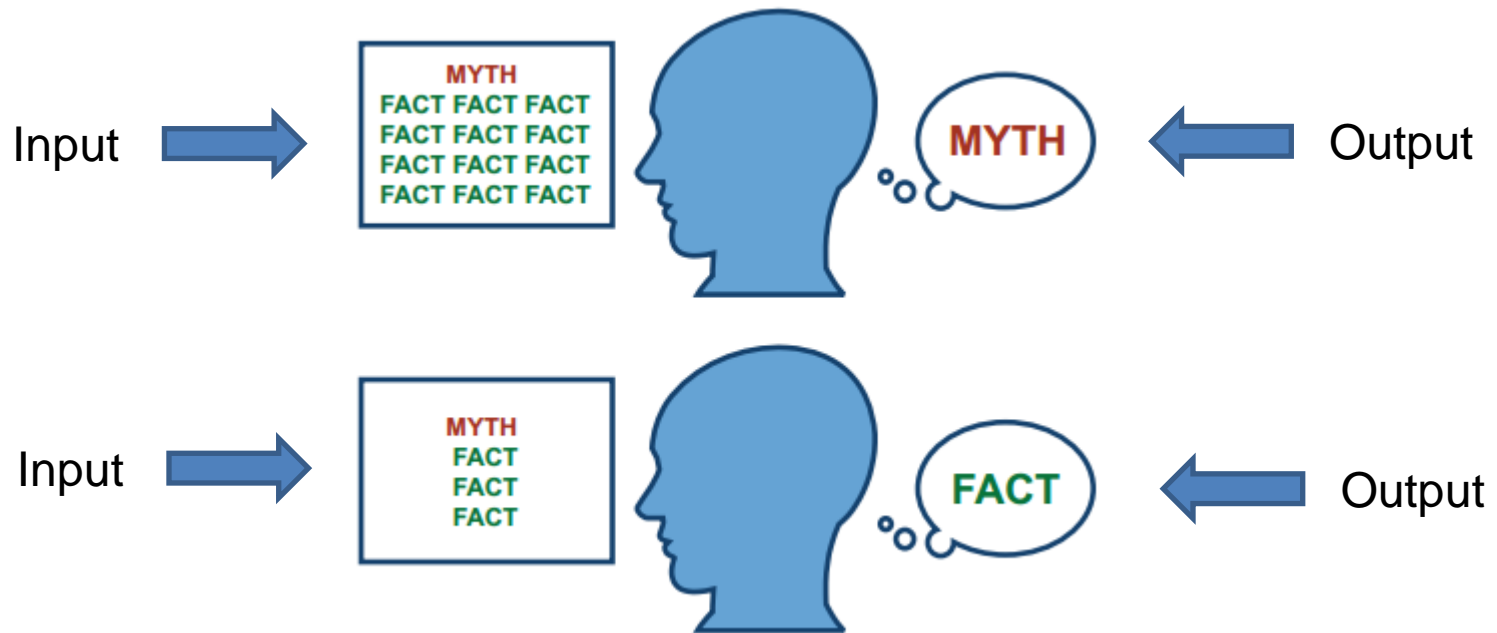


Communicating Climate & Solar - Actions

When they push back with a myth

(“there’s been no warming for 15 years”)

If you argue with facts, beware “The Overkill Backfire Effect”*



Communicating Climate & Solar - Actions

When they push back: blah blah Solyndra blah blah or
blah blah picking winners and losers blah blah

- Agree Solyndra lost \$535 million
- When Pres. Bush started the program that gave Solyndra money, it wasn't expected to make money
- So far (Nov 2014) there have been \$780 million in defaults (including Solyndra) but \$810 million in interest payments, so overall now \$30 million in the black



Communicating Climate & Solar - Actions

When they push back: It's a big-government conspiracy

- Denial correlates strongly with free-market ideology
- Test the rigidity of their belief:
 - Do they know about the Green Tea Party, where Tea Party members are pro-solar *because* they want free markets and less big government?
 - Ask: If you had a child with cancer and a compromised immune system, would you still want the measles vaccine to be a matter of personal choice for her schoolmates?



Test whether a counter-example can crack their certainty.
If they answer rigidly it may be time to move on



Communicating Climate & Solar - Actions

When they push back: I don't believe in global warming:

- There's probably an objection under this one. Dig down:
- It's not a matter of belief. Let's look at the data and to experts who have studied it to see what they have concluded. Discuss who the experts are. Politely ask if they've ever talked to an earth scientist; ask if you could find a local one and make an introduction
- Or try Cargill Executive Chairman Greg Page's soft step when he talks to farmers who think warming is a liberal euphemism for more regulation. He asks, would they want the university to suspend research on seeds that will do well in warmer times?*



Communicating Climate & Solar - Actions

When they push back: Scientists are just looking for big government dollars:

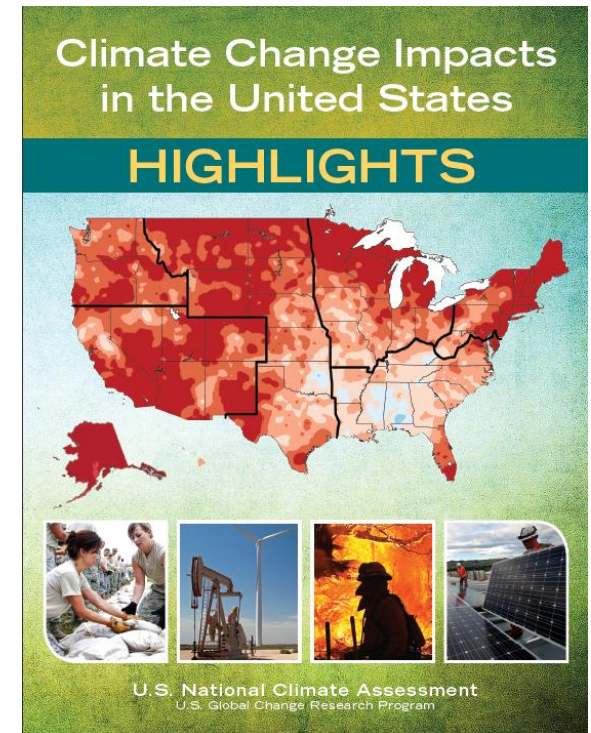
- Scientists and science itself are collateral damage in the fight against climate change action. If there were no consensus on warming, they would not need to be attacked
- Ask if 1000s of climate scientists and all major scientific organizations and science academies in the world are keeping an air-tight conspiracy going just to get short-term grants that are tiny in comparison to the salaries they could get working in the petroleum industry
- Try the child-with-cancer measles thought experiment. Measles is helping science make a comeback in the public eye.



Communicating Climate & Solar - Actions

When they push back: Frankly I don't give a damn about polar bears or Antarctica

- Try climate scientist Katharine Hayhoe's approach
- Avoid abstract and foreign climate consequences
- Focus on what's important to everyone: kids, livelihoods, risk of fire or drought or extreme weather
- Bring the consequences home. Give them the National Climate Assessment* and show them what it says about their region.



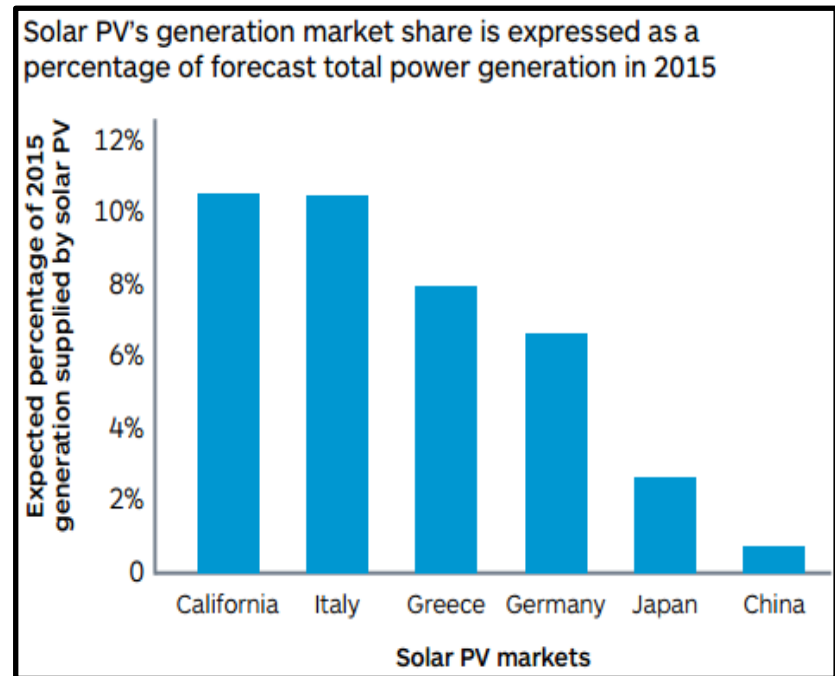
* <http://nca2014.globalchange.gov/downloads>



Communicating Climate & Solar - Actions

When they do get it, and turn hopeless

- Tell them about California
- Since Mitt Romney compared CA to a struggling European nation in 2012, CA has expanded “by almost every measure,”* racing ahead of Italy, Russia and Brazil to become the 7th largest economy in the world
- CA leads the US in solar
- CA leads in residential, commercial, governmental, non-profit and utility-scale solar
- CA understands how to set aggressive achievable solar and climate goals and then achieve them cost-effectively
- We are a model for the world



https://www.ihc.com/pdf/Top-Solar-Power-Industry-Trends-for-2015_213963110915583632.pdf

* <http://www.bloomberg.com/news/articles/2015-01-16/brown-s-california-overtakes-brazil-with-companies-leading-world>



Communicating Climate & Solar - Actions

- Join: NorCal Solar, Citizens Climate Lobby
- **Volunteer:** NorCal Solar, SunWork, many other great solar and climate and energy-efficiency and sustainability non-profits
- Read
 - Climate Progress (thinkprogress.org/climate/issue)
 - GreentechMedia.com (former IEEE SCV-PV Chair Eric Wesoff!)
 - CleanTechnica.com (Zach Shahan)
 - SolarWakeup.com (Yann Brandt)
 - <http://www.renewableenergyworld.com>
 - Scientific American
- Write: Letters, blogs, stories, books, speeches, ...
- Start a solar business: Check out SFunCube* in Oakland
- Invest in Solar companies, divest out of dinosaur companies



* <http://www.sfuncube.com/>

Final Thoughts

- Example is eternal, and the rings of its extending influence infinite.

Lawrence of Arabia, 1930

- When something becomes a crisis that enough of us care about then the lobbyists matter a lot less because we care a lot more.

Steven Brill, *60 minutes*, Jan. 2015, regarding US healthcare

- Lincoln didn't free the slaves. Slave rebellions freed the slaves.

Danny Kennedy, *NextGen Leadership Forum*, Dec. 2014

- Radically different futures stem from the climate actions we take today.

Pablo Gomez, *NextGen Leadership Forum*, Dec. 2014

- Americans were believing in global warming because of sound bites, and now they're disbelieving because of sound bites.

Steven Chu, Mercury News interview 2010

- Agnatology – the study of culturally induced ignorance or doubt, particularly the publication of inaccurate or misleading scientific data
- We find comfort among those who agree with us – growth among those who don't.

Frank A. Clark

- The Future is not a gift. It is an achievement.

Robert F. Kennedy



Backup



Beliefs about Climate Change*

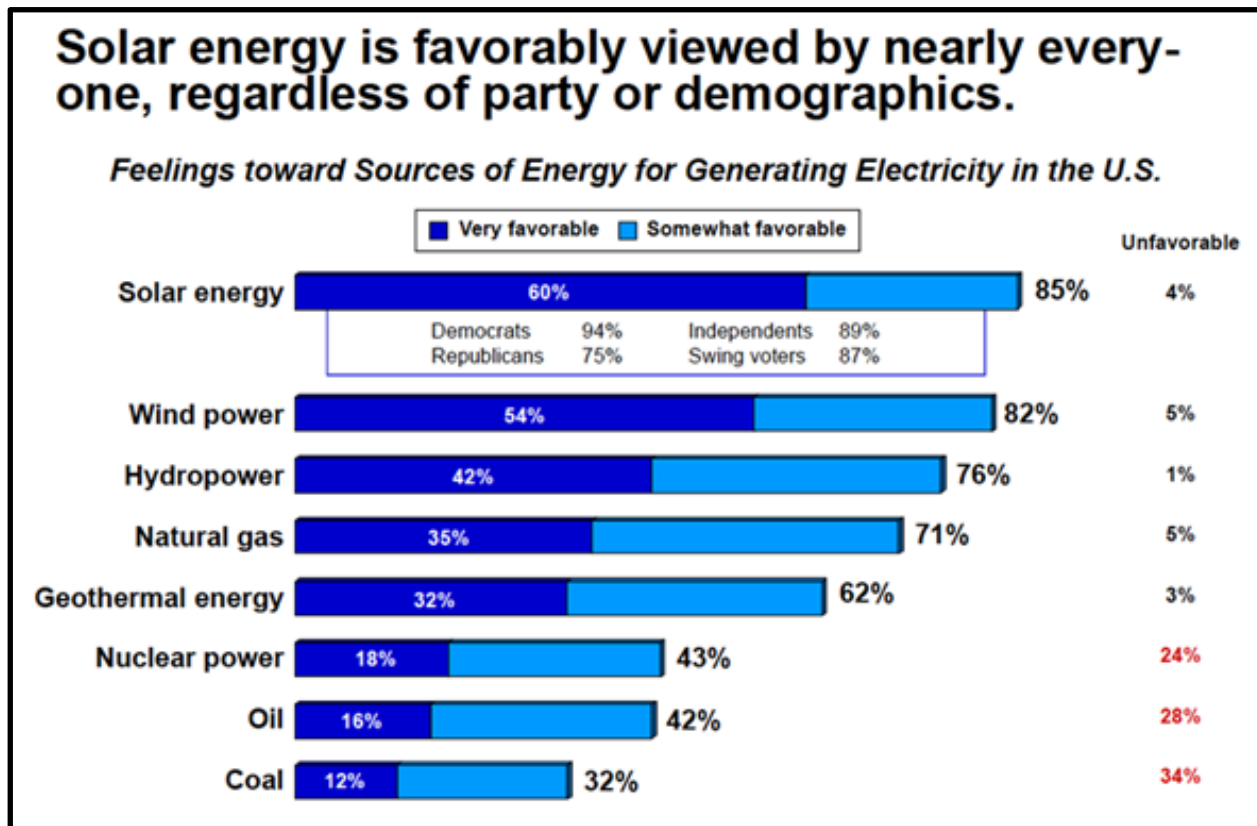
- “Polls show most Americans believe in climate change, but give it low priority”
 - Solid evidence that earth has been warming: 61% (91% of “Solid Liberals,” 21% of “Steadfast Conservatives”)
 - Warming is primarily due to human activity: 40% (of total)
 - Global climate change is a major threat to US: 48% (below ISIS, Iran’s or North Korea’s nuclear programs)
 - Global warming ranks near the bottom of American’s 2014 priorities for Obama and Congress



* <http://www.pewresearch.org/fact-tank/2014/09/23/most-americans-believe-in-climate-change-but-give-it-low-priority/>

Beliefs about Solar*

- How important is it for the US to develop and use solar power?
 - Very important: 58%; Somewhat important: 34%; Not important: 8%



* <http://www.seia.org/research-resources/america-votes-solar-national-solar-survey-2012>

Beliefs about Solar*

- Should Congress and President Obama approve construction of the Keystone XL pipeline? (Nov. 2014)
 - Yes: 60%; No: 25%; Unsure: 14%; Refused: 1%
- Do you believe Congress should vote to stop [proposed] new regulations [that would reduce emissions from power plants], or not?“ (Jul. 2013)
 - Vote to stop regulations: 46%
 - Don't vote to stop regulations: 42%
 - Unsure/Refused: 12%



Beliefs about Solar*

- Do you think the US should put more, less, or the same emphasis as it does now on producing domestic energy from each of the following? (Mar. 2013)

	More emphasis	Less emphasis	Same emphasis	Unsure
Solar power	76%	10%	12%	2%
Wind	71%	12%	16%	1%
Natural gas	65%	10%	24%	2%
Oil	46%	32%	21%	1%
Nuclear power	37%	32%	28%	3%
Coal	31%	41%	25%	3%



* <http://www.pollingreport.com/energy.htm>