



www.EnergyJustice.net

...helping communities protect themselves from polluting energy and waste technologies

Clean Energy Solutions

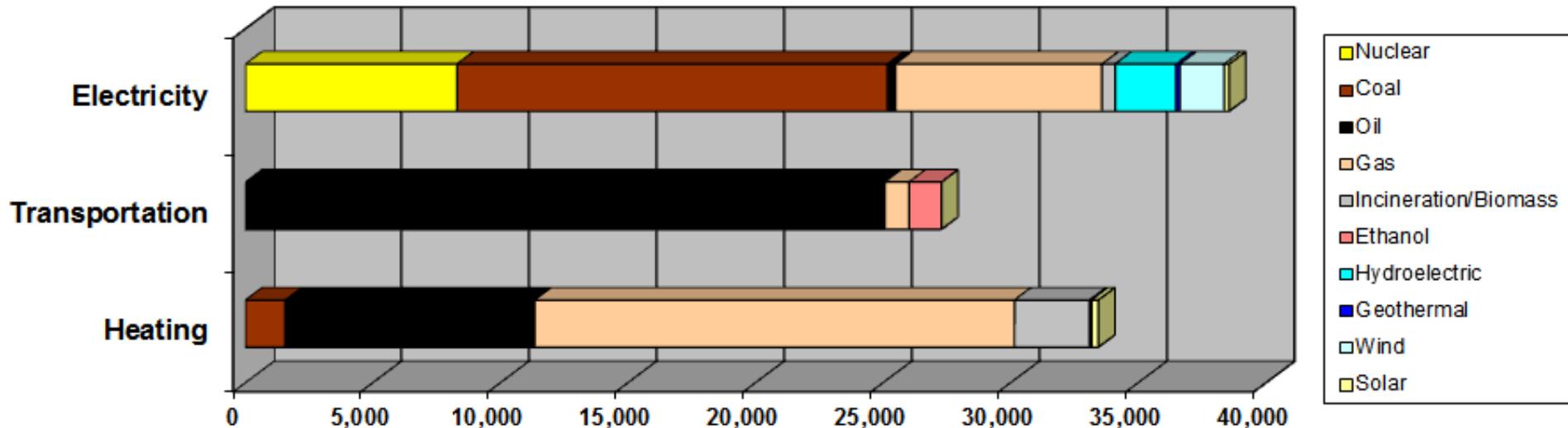
- Conservation
- Efficiency
- Solar
- Wind
- Ocean
- Energy storage
- No combustion necessary
 - Replace transportation fuels with clean electricity



www.energyjustice.net/solutions

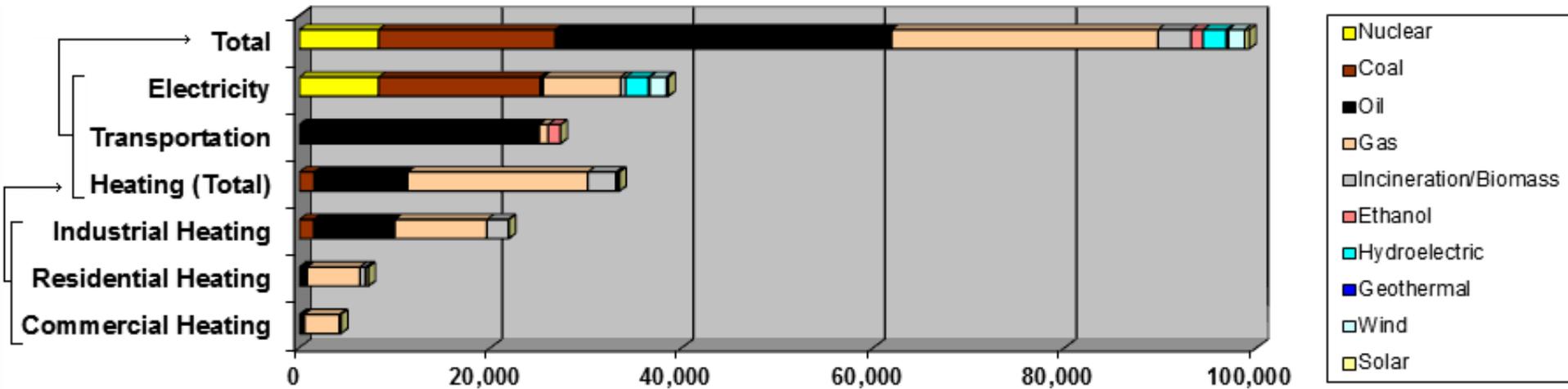
2014 U.S. Total Energy Use

(electricity, transportation & heating)



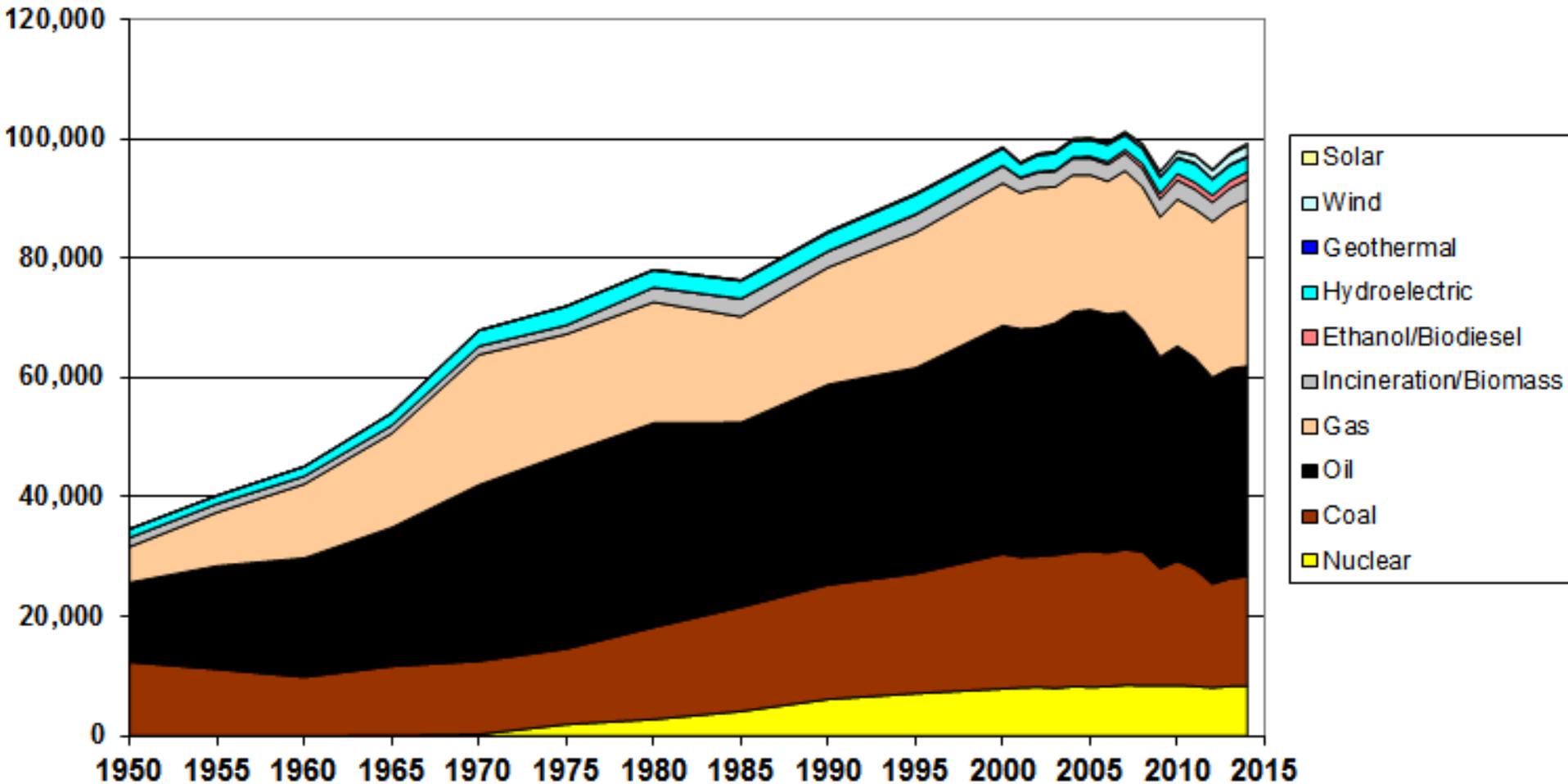
2014 U.S. Total Energy Use

(electricity, transportation & heating)

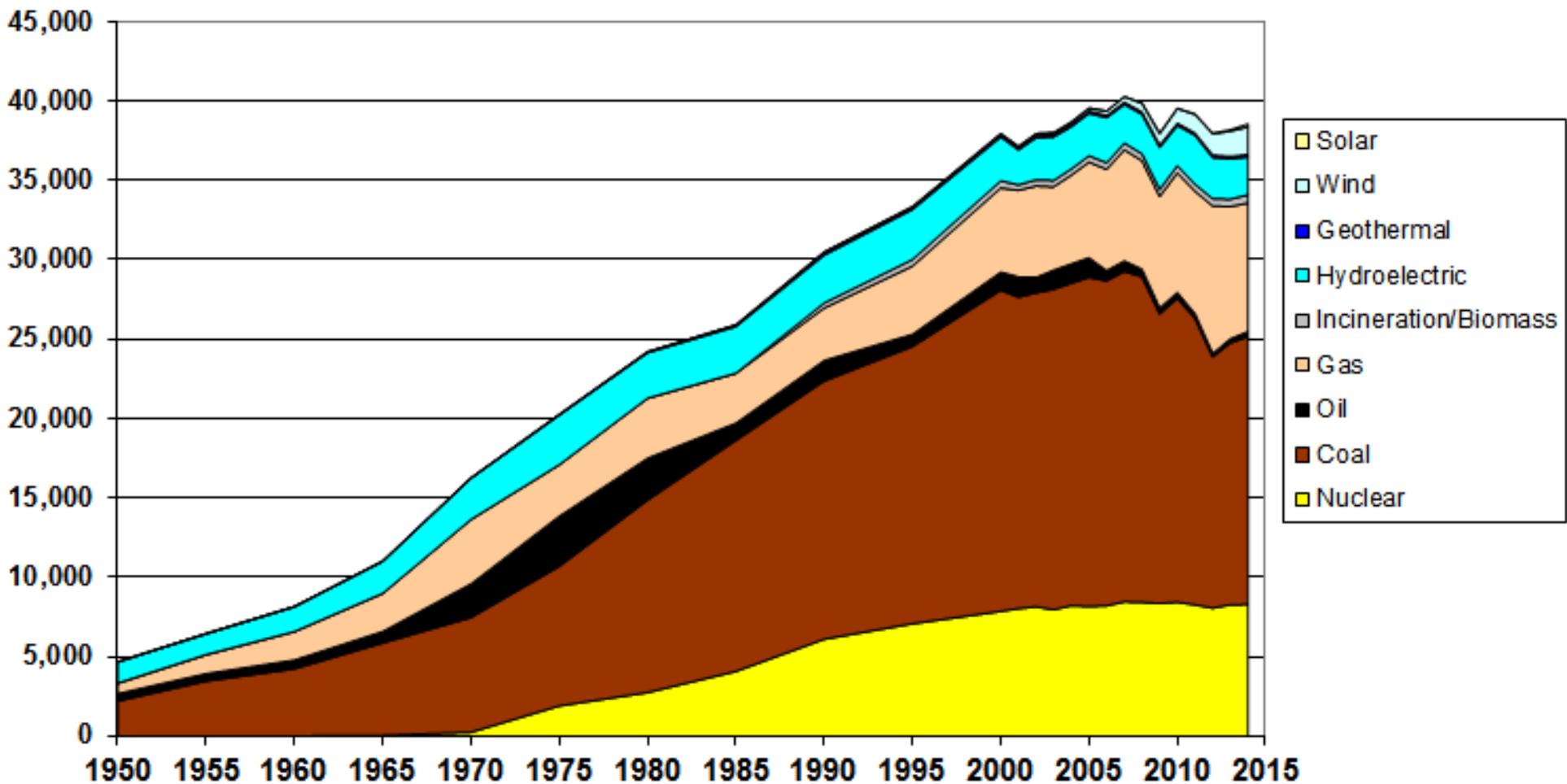


U.S. Total Energy Use

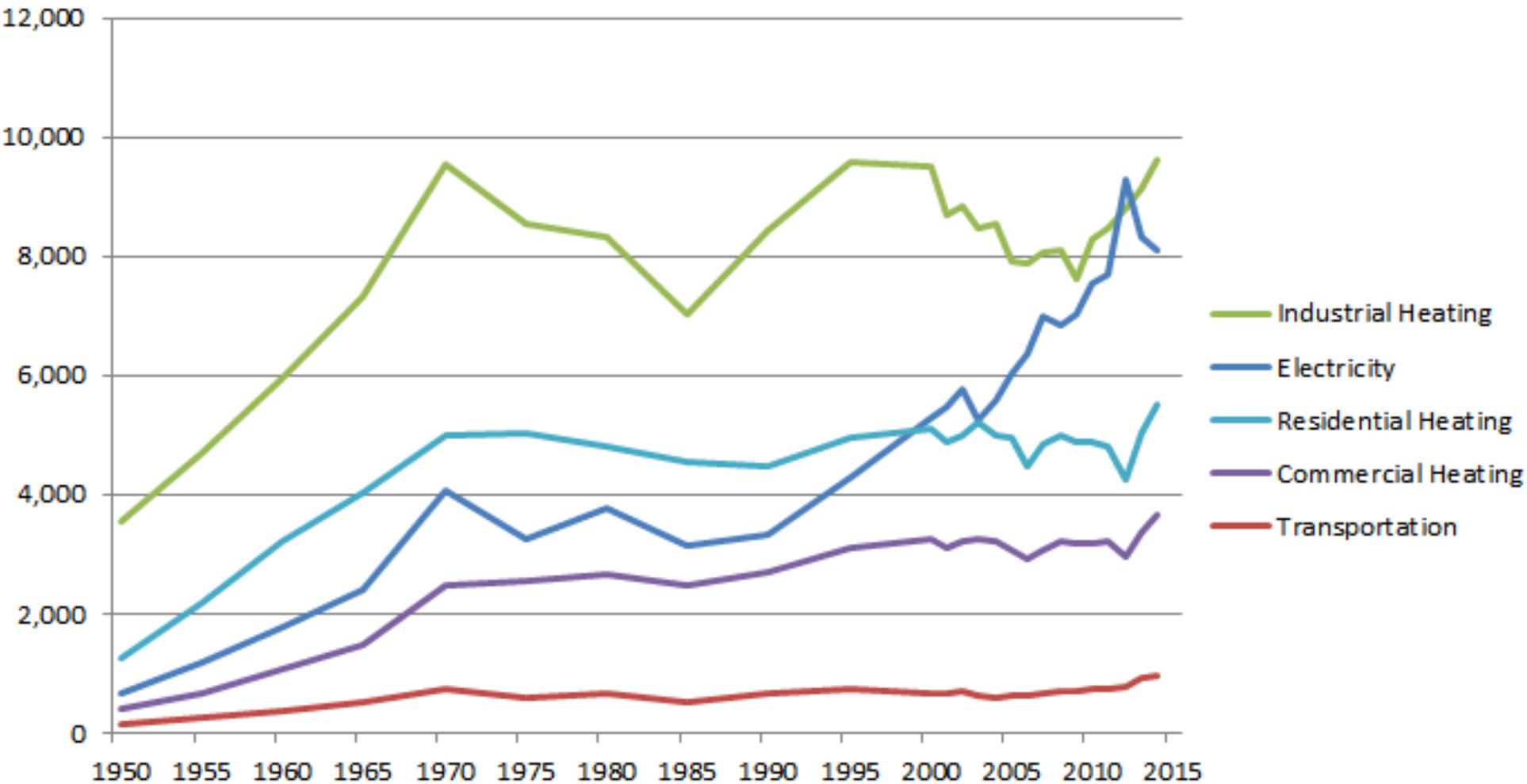
(electricity, transportation & heating)



U.S. Electricity Use



U.S. Gas Use by Sector



Wind, solar and energy storage

Journal of Power Sources 225 (2013) 60–74

Contents lists available at SciVerse ScienceDirect

Journal of Power Sources

journal homepage: www.elsevier.com/locate/jpowsour



Cost-minimized combinations of wind power, solar power and electrochemical storage, powering the grid up to 99.9% of the time

Cory Budischak^{a,b,*}, DeAnna Sewell^c, Heather Thomson^c, Leon Mach^d, Dana E. Veron^c, Willett Kempton^{a,c,e}

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^b Department of Energy Management, Delaware Technical Community College, Newark, DE 19713, USA

^c Center for Carbon-Free Power Integration, School of Marine Science and Policy, College of Earth Ocean and Environment, University of Delaware, Newark, DE 19716, USA

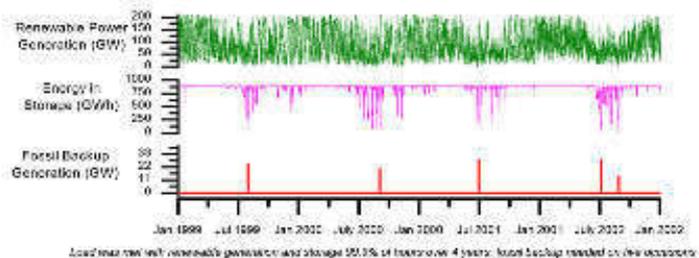
^d Energy and Environmental Policy Program, College of Engineering, University of Delaware, Newark, DE 19716, USA

^e Center for Electric Technology, DTU Elektro, Danmarks Tekniske Universitet, Kgs. Lyngby, Denmark

HIGHLIGHTS

- ▶ We modeled wind, solar, and storage to meet demand for 1/5 of the USA electric grid.
- ▶ 28 billion combinations of wind, solar and storage were run, seeking least-cost.
- ▶ Least-cost combinations have excess generation (3× load), thus require less storage.
- ▶ 99.9% of hours of load can be met by renewables with only 9–72 h of storage.
- ▶ At 2030 technology costs, 90% of load hours are met at electric costs below today's.

GRAPHICAL ABSTRACT



Load hour met only by renewable generation and storage 99.9% of hours over 4 years; fossil backup needed on the occasions

This December 2012 study from the University of Delaware found that **wind, solar and energy storage could economically fully power a utility scale electric grid (PJM) with 99.9% reliability by 2030 – cheaply and without government subsidies, if the proper mix is implemented.**

While You Were Getting Worked Up Over Oil Prices, This Just Happened to Solar



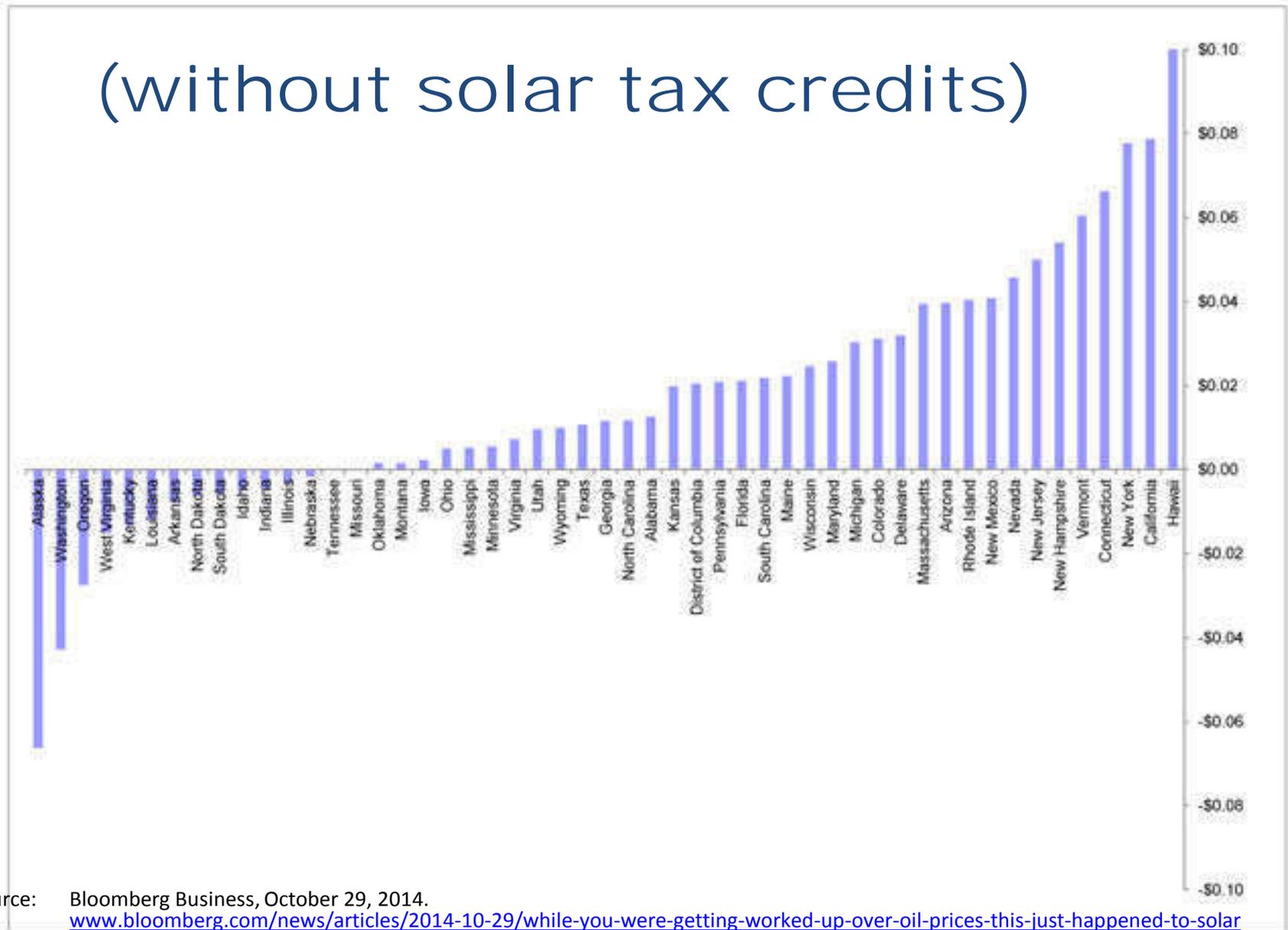
Photographer: Chris Sattlberger/Getty Images

“After years of struggling against cheap natural gas prices and variable subsidies, **solar electricity is on track to be as cheap or cheaper than average electricity-bill prices in 47 U.S. states – in 2016**, according to a Deutsche Bank report published this week.”

(if tax credits are renewed in 2016)

Grid Parity to Reach 36 States in 2016

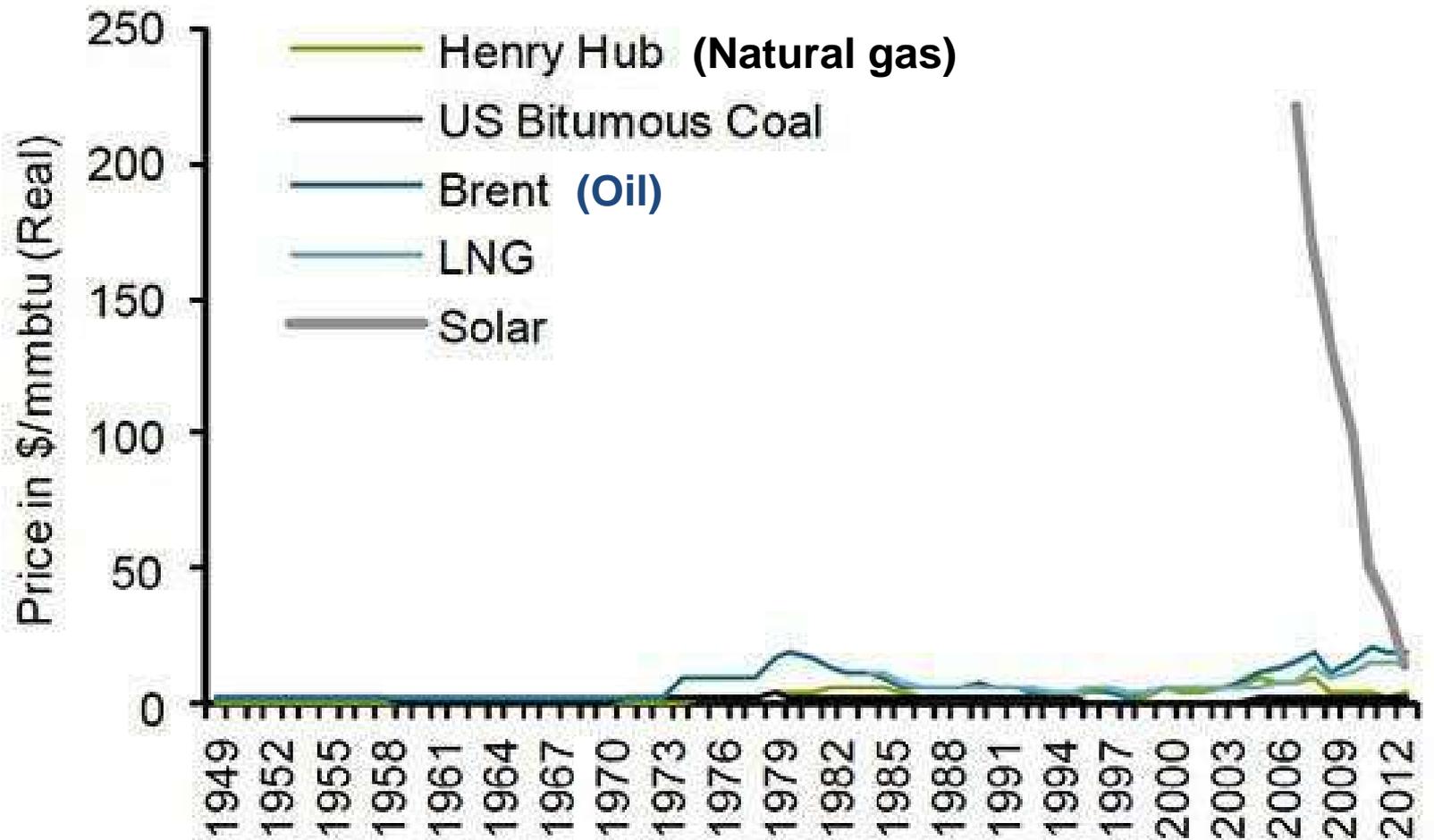
(without solar tax credits)



Source: Bloomberg Business, October 29, 2014.

www.bloomberg.com/news/articles/2014-10-29/while-you-were-getting-worked-up-over-oil-prices-this-just-happened-to-solar

Welcome to the Terrordome...



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Renewable energy starting to win on price



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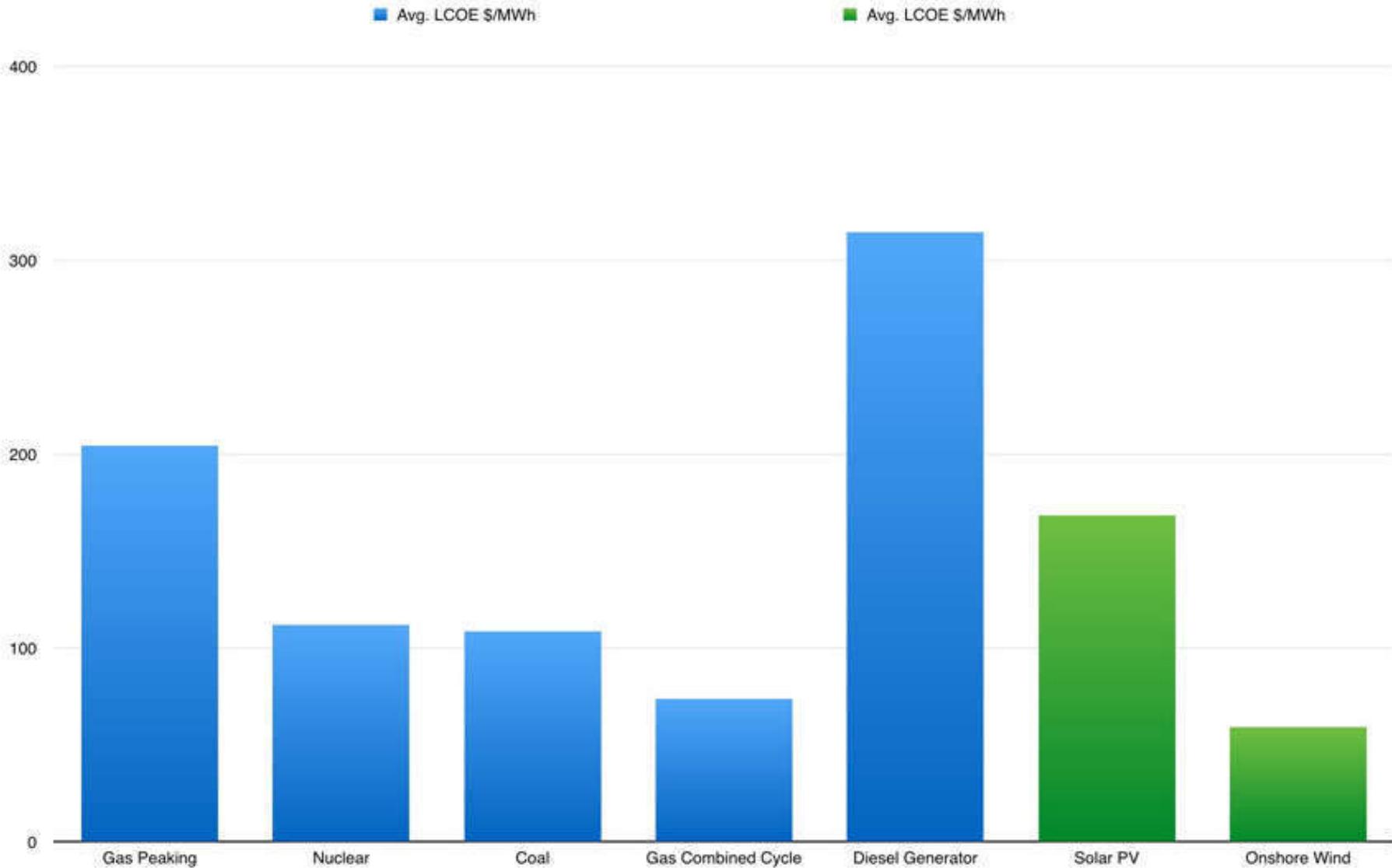


MICHAL CZERWONKA/NEW YORK TIMES

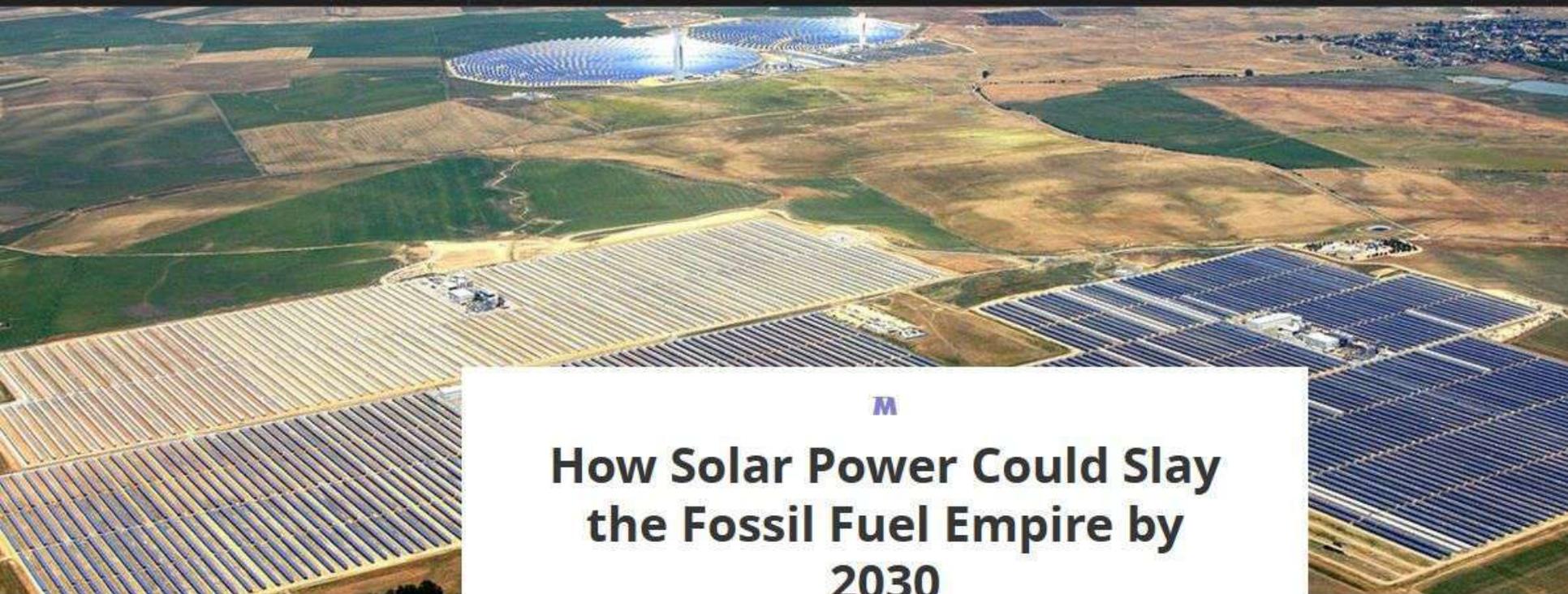
One study found the cost of utility-scale solar energy and wind power to be lower than that of natural gas.

By Diane Cardwell | New York Times November 24, 2014

Average Levelized Cost of Energy: Conventionals vs. Renewables



Sources: www.energypolicyforum.com/wp-content/uploads/2014/12/image5.jpg
www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf



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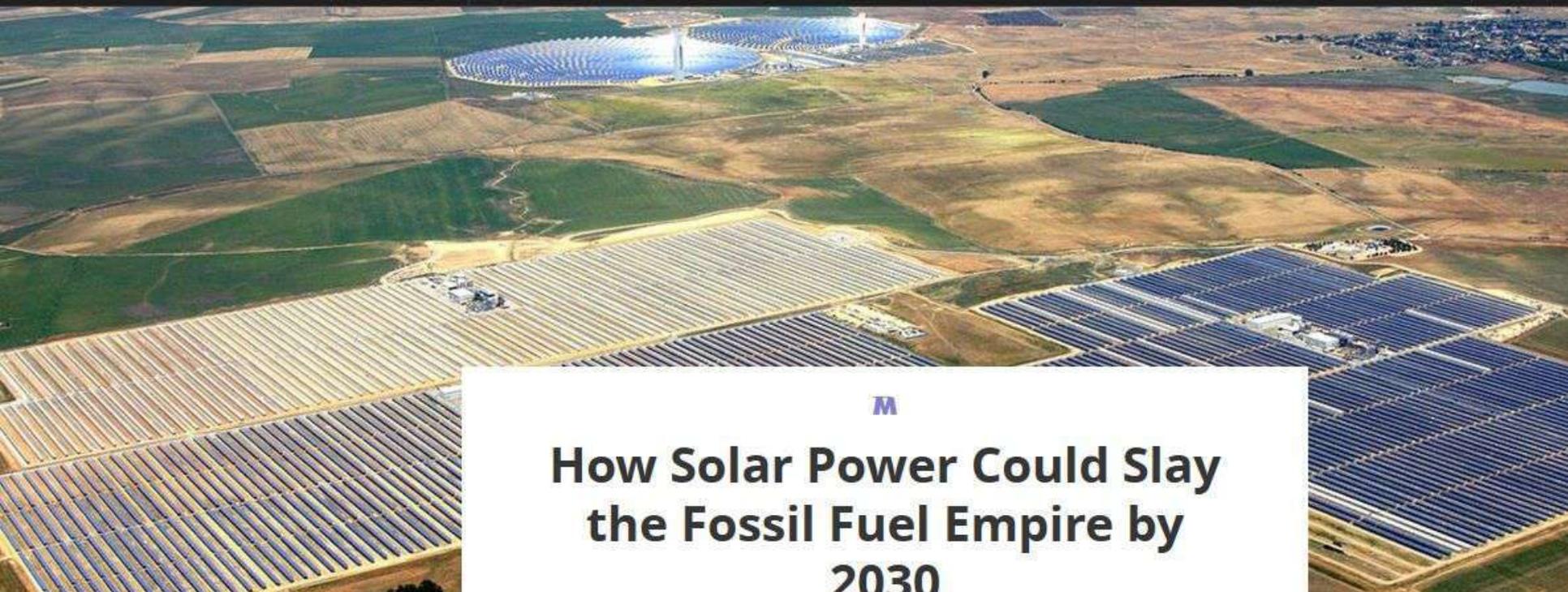
How Solar Power Could Slay the Fossil Fuel Empire by 2030

WRITTEN BY NAFEEZ AHMED

December 10, 2014 // 11:25 AM EST

In just 15 years, the world as we know it will have transformed forever. The age of oil, gas, coal and nuclear will be over.

Within just 15 years... solar and wind power will provide 100 percent of energy in competitive markets, with no need for government subsidies.



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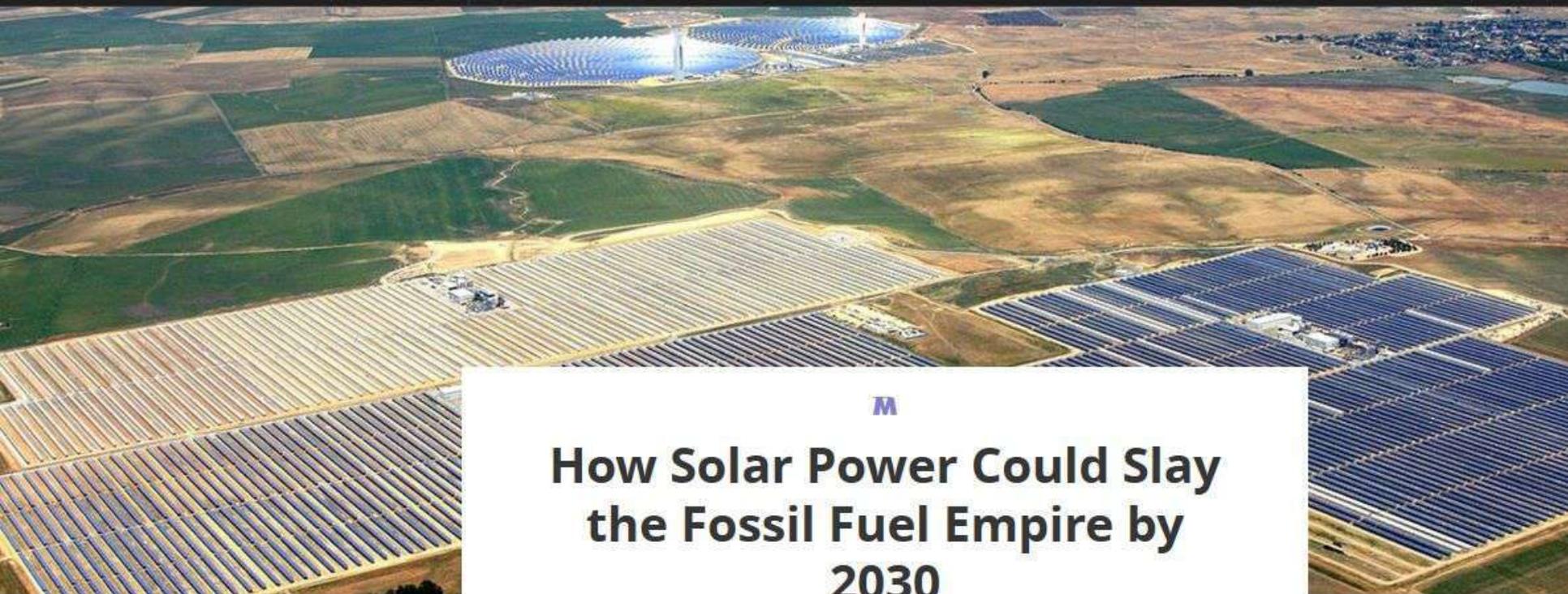
How Solar Power Could Slay the Fossil Fuel Empire by 2030

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December 10, 2014 // 11:25 AM EST

Over the last year [Silicon Valley entrepreneur Tony] Seba has even been invited to share his vision with oil and gas executives in the US and Europe. “Essentially, I’m telling them you’re out of business in less than 15 years.”

Solar panel costs are now 154 times cheaper than they were in 1970, dropping from \$100 per watt to 65 cents per watt.



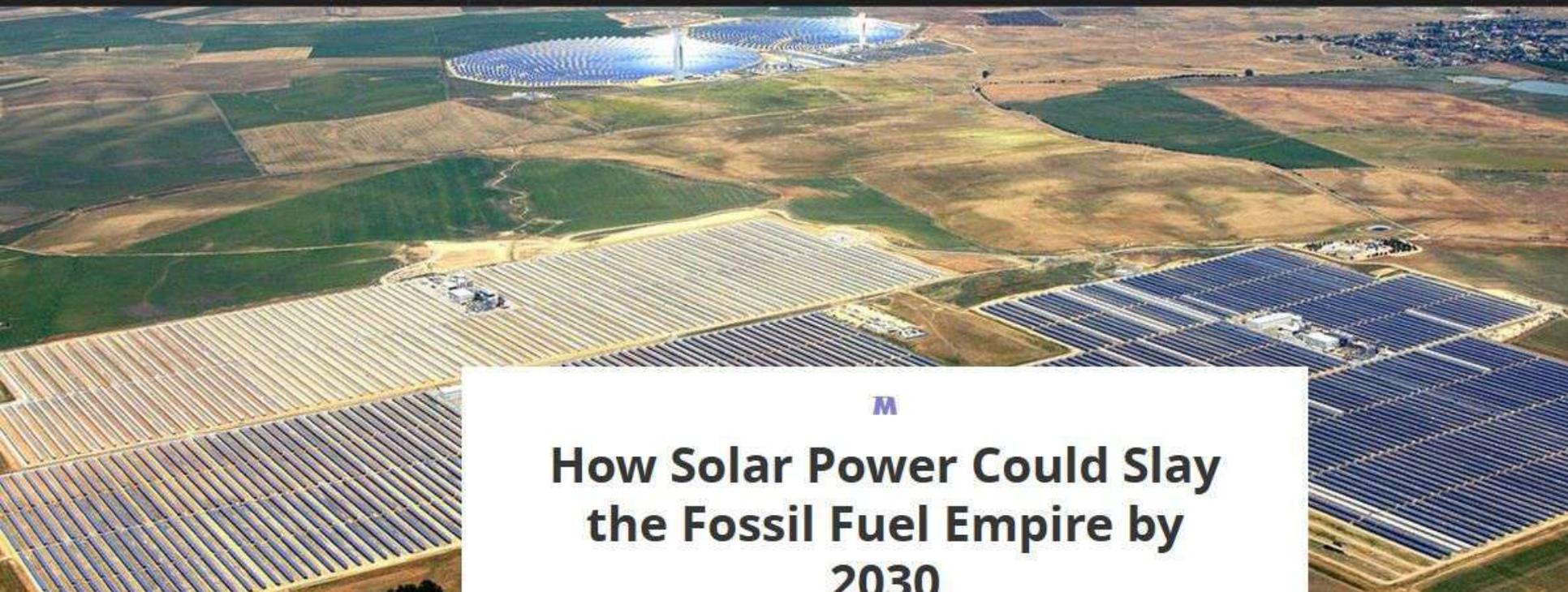
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How Solar Power Could Slay the Fossil Fuel Empire by 2030

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Paul Gilding, who has spent the last 20 years advising global corporations like Ford, DuPont, BHP Billiton, among many others on sustainable business strategy, agrees that **the trends Seba highlights imply “a disruptive transformational system change” that outpaces the “assumptions built on the old world view of centralised generation.”**



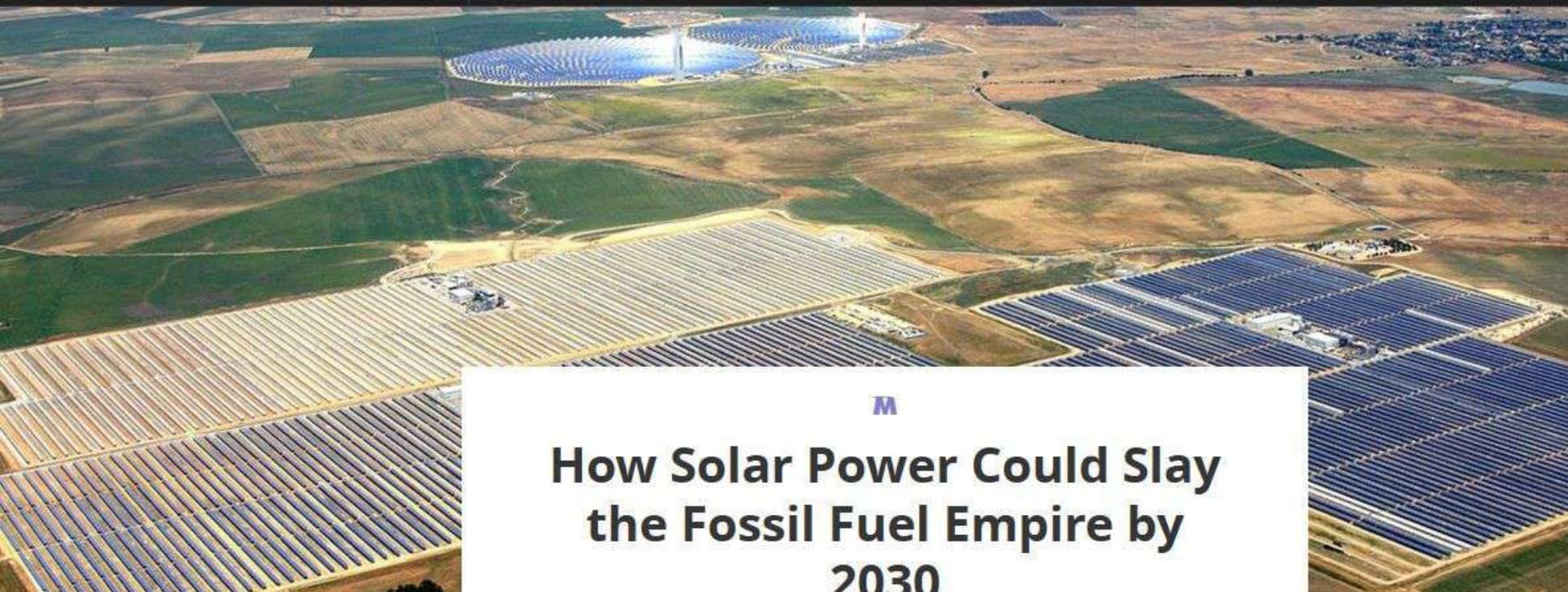
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How Solar Power Could Slay the Fossil Fuel Empire by 2030

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December 10, 2014 // 11:25 AM EST

While solar has already reached ‘grid parity’, becoming as cheap or cheaper than utility rates in many markets, **within five years** Seba anticipates the arrival of what he calls ‘God Parity’: when **onsite rooftop solar generation is cheaper than transmission costs**. Then, even if fossil fuel plants generated at zero costs (an impossibility), they could never compete with onsite solar. **So after 2020, the conventional energy industry will start going bankrupt.**



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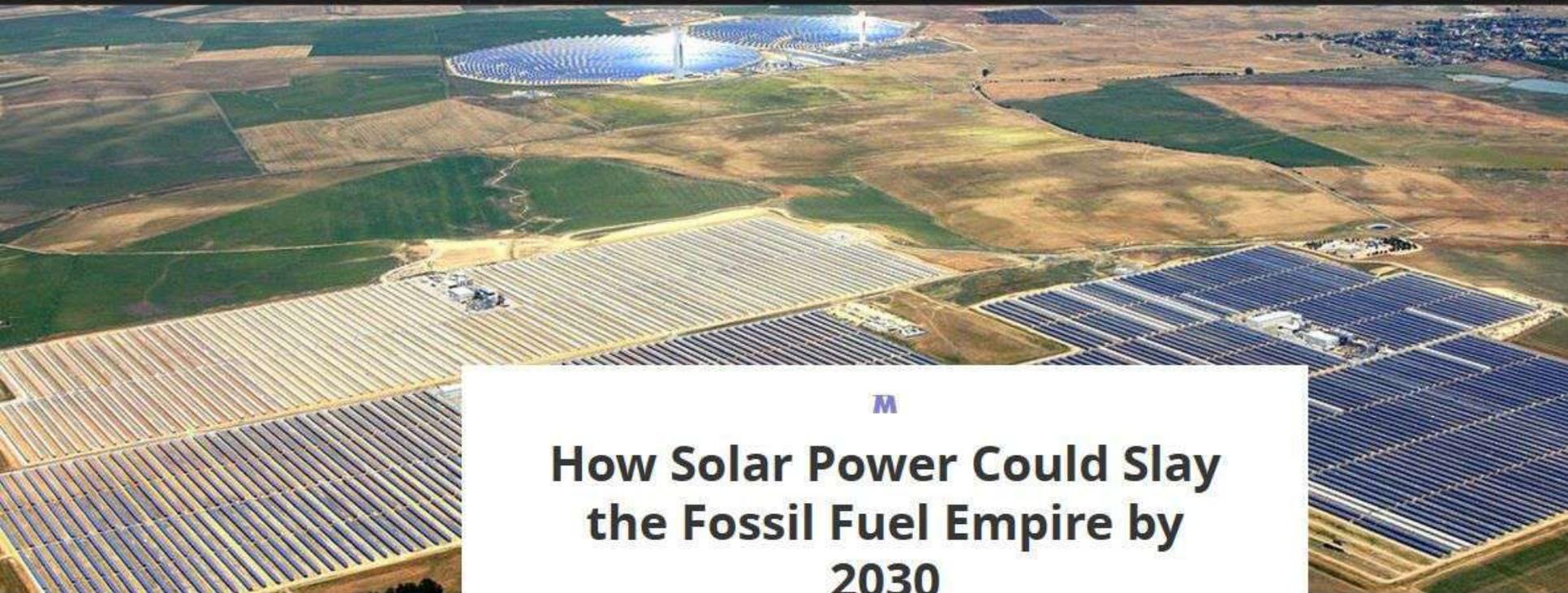
How Solar Power Could Slay the Fossil Fuel Empire by 2030

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December 10, 2014 // 11:25 AM EST

“We are on the cusp of the largest disruption of industry and society since the first industrial revolution. Large, centralized, top-down, supplier-centric energy is on its way out. It is being replaced by modular, distributed, bottom-up, open, knowledge-based, consumer-centric energy,” said Seba.

“The transition has already started and the disruption will be swift. Conventional energy sources are already obsolete or soon to be obsolete.”



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How Solar Power Could Slay the Fossil Fuel Empire by 2030

WRITTEN BY NAFEEZ AHMED

December 10, 2014 // 11:25 AM EST

But for Gilding, like Trainer, **the clean disruption will also disrupt economic growth as we know it:**

“In the end we’ll have to wake up to the impossibility of endless economic growth. Even with very cheap, zero carbon energy, we can’t have endless growth nor human progress defined by shopping.”

Transportation Solutions

- **Conservation** tactics

- Mass Transit
- Buy / Work Local
- Carpooling / Car Sharing
- Telecommuting

- Reduce Sprawl
- Trails-to-Rails
- Bicycling
- Walking



- **Efficiency** tactics

- Fuel Efficiency Standards
- Hybrids

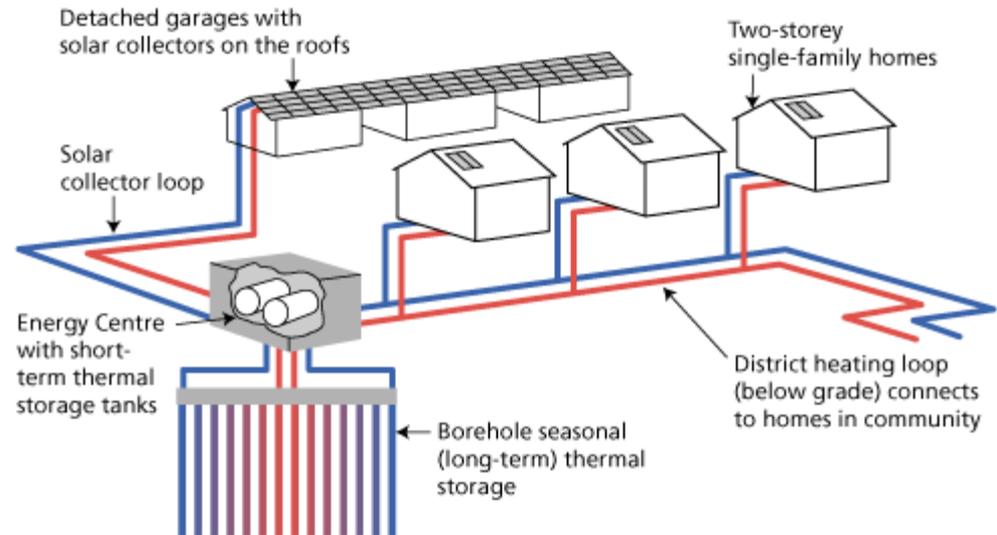
- **Wind/solar-powered electric vehicles**

- Plug-in hybrids
- Full electric vehicles

Heating Solutions

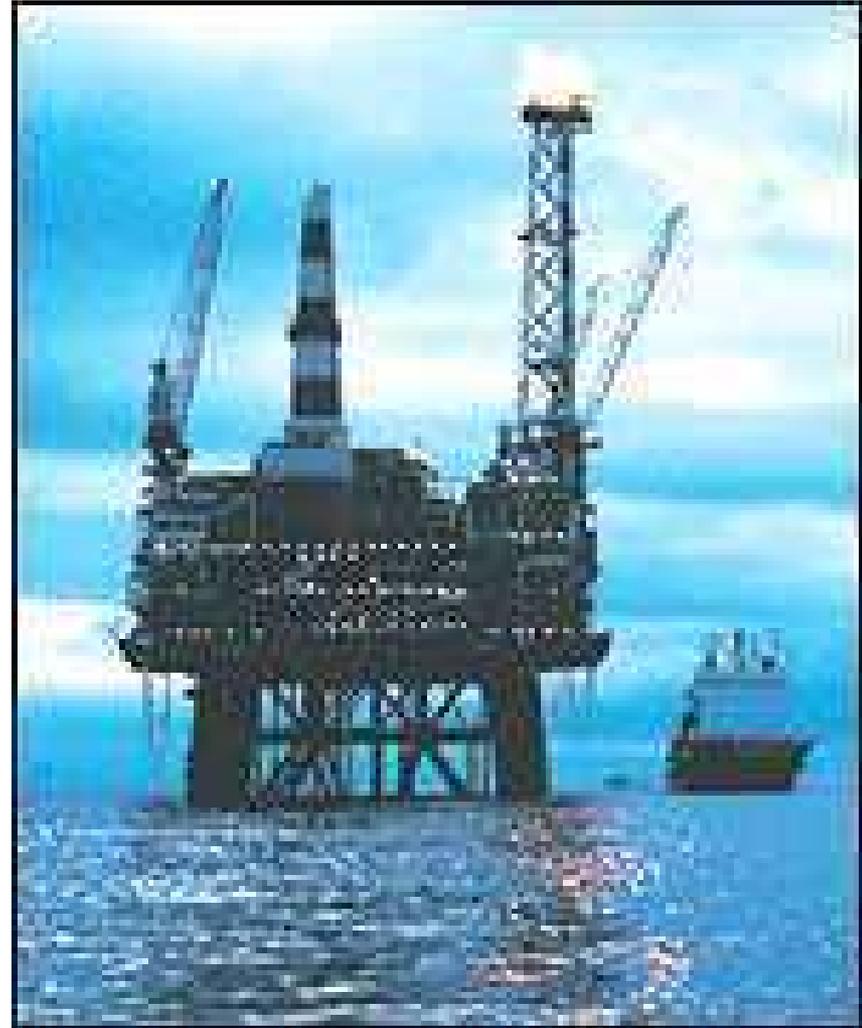
- Conservation
- Efficiency
- Solar (passive; hot water)
- Concentrated solar (for industrial heating)
- Heat pumps
 - Air-source
 - Ground-source (geothermal)
- Electric resistance heating

Okotoks, Alberta – 90% of winter heating needs met with solar from previous summer (stored underground) →



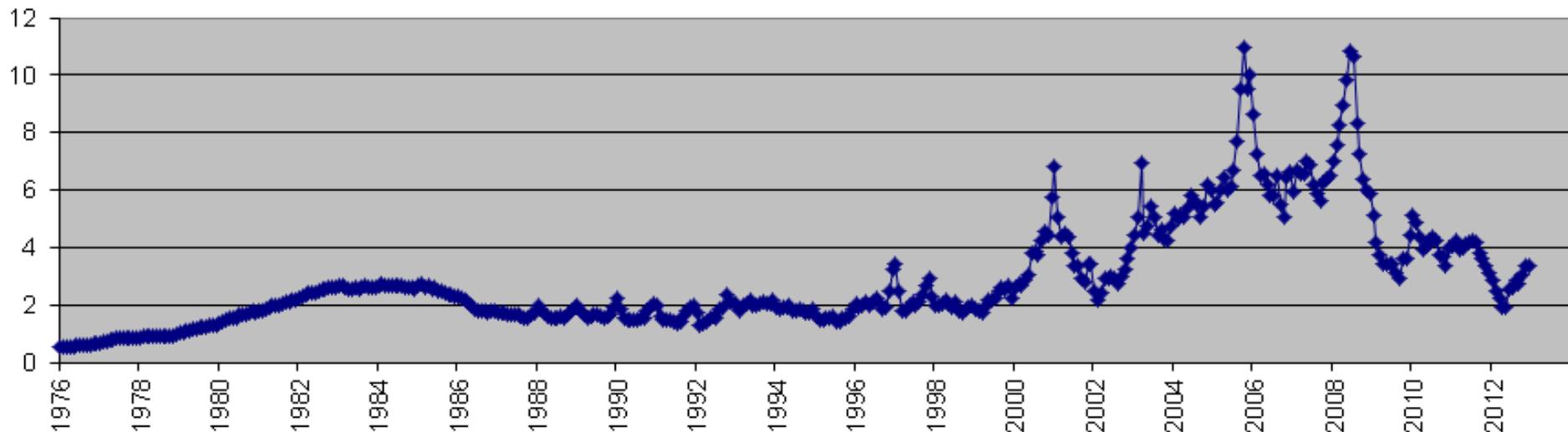
Natural Gas

- 97% of natural gas comes to U.S. via pipeline from U.S. and Canada
- U.S. and Canada gas production is peaking
- Global peak: 2020
- Became very expensive
- 400 new gas-fired power plants; over 1000 were proposed
- 48% of heating
16% of electricity
2% of transportation



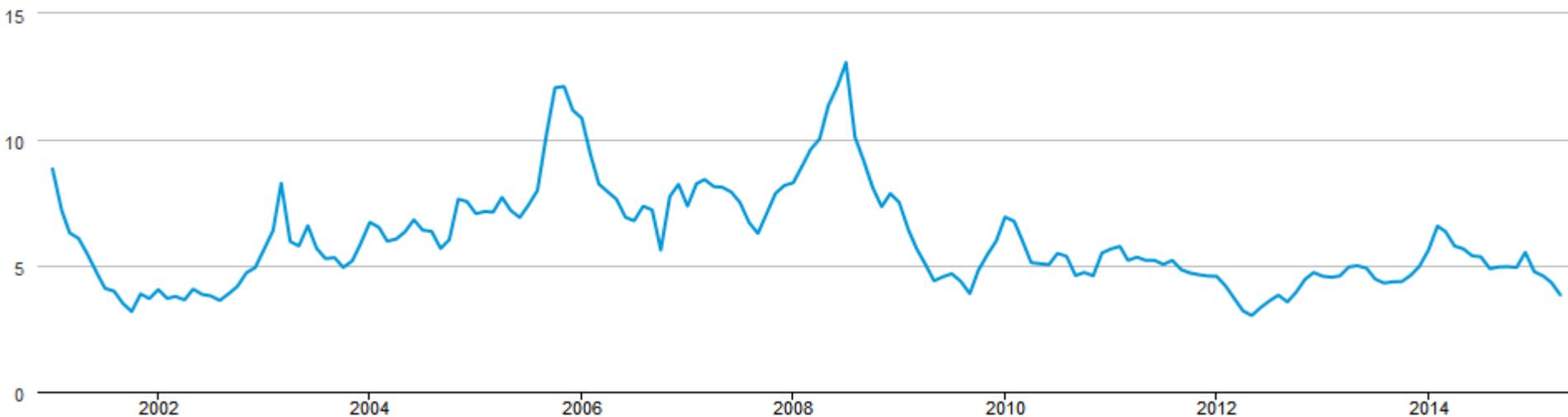
Natural Gas Prices

U.S. Natural Gas Wellhead Price
(Dollars per Thousand Cubic Feet)



United States Natural Gas Industrial Price

Dollars per Thousand Cubic Feet





The Marcellus is close to Peak Production and why this is so Important

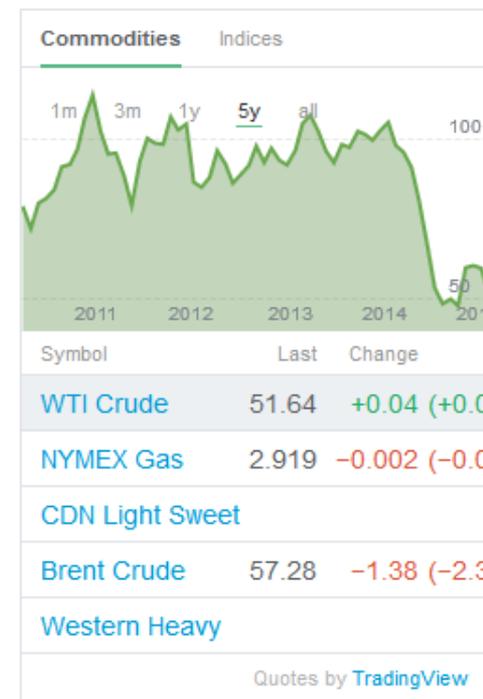
by KEITH SCHAEFER on APRIL 4, 2015

By Bill Powers One of the little spoken truths of the shale gas industry over the past three years has been that most of America’s gas fields are now experiencing production declines with one large exception: the Marcellus Shale in Pennsylvania. And that narrow reliance on one play gets even more concentrated—the North American natural gas market has morphed from relying on the entire Marcellus to provide all of the continent’s production growth a year ago—to now hoping that growth in select Pennsylvania counties will sustain current trends.

Unfortunately, in addition to production declines in West Virginia, Pennsylvania Marcellus production is now in decline in two of its three most prolific counties.

“A flattening of Marcellus production will send shockwaves throughout the North American natural gas market. ... US production could experience a net decline... over the next 12 to 18 months should growth in the Marcellus not pick up and natural declines continue.”

Sources: <https://oilandgas-investments.com/2015/natural-gas/the-marcellus-is-close-to-peak-production-and-why-this-is-so-important/>



Natural Gas = Fewest Jobs

Job-years per GWh

Solar PV Residential (<1 MW)	1.31
Biomass / Landfill gas	1.31
Solar PV Large Commercial	0.97
Small hydro	0.77
Geothermal	0.72
Solar PV Utility Scale	0.69
Nuclear	0.42
Solar Thermal - Concentrated	0.41
Coal	0.11
Wind	0.1
Natural gas	0.04

Natural Gas = Fewest Jobs

	Jobs per \$1,000,000 invested	Jobs per \$1 million output
Mass transit	22.3	11
Biomass	17.4	7.4
Building retrofits	16.7	7
Solar	13.7	5.4
Wind	13.3	4.6
Smart Grid	12.5	4.3
Coal	6.9	1.9
Oil	5.2	0.8
Natural gas	5.2	0.8

Source: Center for American Progress, "The Economic Benefits of Investing in Clean Energy - How the economic stimulus program and new legislation can boost U.S. economic growth and employment," June 2009., p.29.

www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF

Power Plants Reduce Property Values

Compared to neighborhoods with similar housing and demographic characteristics, **neighborhoods within two miles of plants experienced 3-7 percent decreases in housing values** and rents with some evidence of **larger decreases within one mile and for large capacity plants.**

In addition, there is evidence of taste-based sorting with neighborhoods near plants associated with modest but statistically significant decreases in mean household income, educational attainment, and the proportion of homes that is owner occupied.



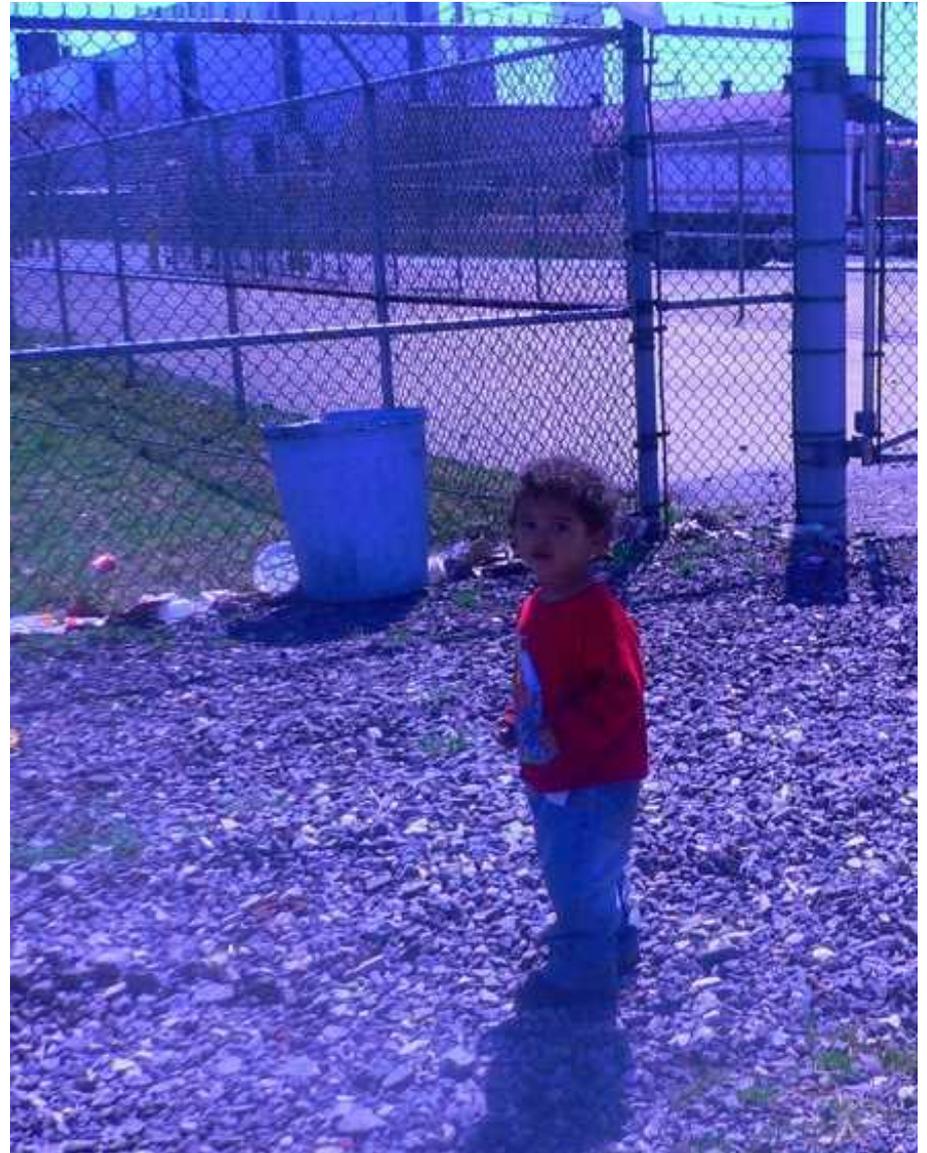
Source: Lucas W. Davis, "The Effect of Power Plants on Local Housing Values and Rents," *The Review of Economics and Statistics*, Vol. 93, No. 4 (November 2011) (pp. 1391-1402). www.mitpressjournals.org/doi/abs/10.1162/REST_a_00119. Official copies are behind pay walls at MIT press and here: <https://ideas.repec.org/a/tpr/restat/v93y2011i4p1391-1402.html> Free pre-publication versions are available from 2010 and 2009 here: <http://faculty.haas.berkeley.edu/ldavis/pp.pdf> and here: <http://web.mit.edu/ceepr/www/publications/workingpapers/2008-009.pdf>

Environmental Justice & Environmental Racism



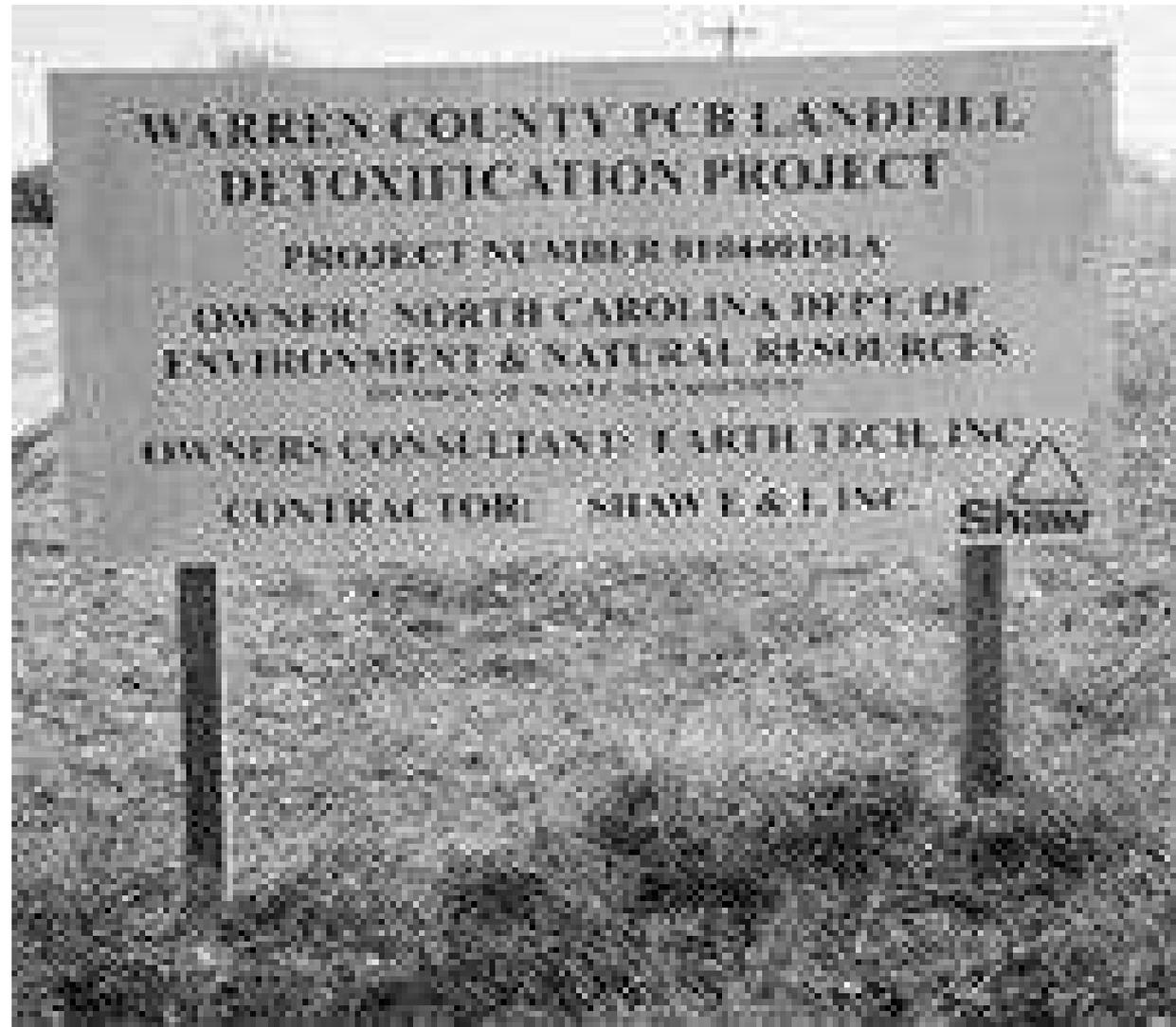
What is Environmental Racism?

- Communities of color are more heavily targeted for hazardous industries than poor communities are.
- Doesn't need to be intentional to have a discriminatory effect



“Environmental Racism” Term Coined in 1982 PCB Landfill Battle in North Carolina

Minority communities targeted by both private and government entities.



1982: Warren County, North Carolina



- Siting of a PCB landfill in a mostly Black community
- Protests & over 500 arrests
- Term “environmental racism” is coined

1983: U.S. General Accounting Office: *Siting of Hazardous Waste Landfills and Their Correlation with Racial and Economic Status of Surrounding Communities*: **Report finds that in the 8 states studied, 3 out of 4 commercial hazardous waste facilities were located in mostly Black neighborhoods, even though the region was only 20% Black overall.** Source: archive.gao.gov/d48t13/121648.pdf

1984: Cerrell Associates Report

(Trash incinerators in CA)

LEAST LIKELY TO RESIST

Southern, Midwestern communities
Rural communities
Open to promises of economic benefits
Conservative, Republican, Free-Market
Above Middle Age
High school or less education
Low income
Catholics
Not involved in social issues
Old-time residents (20 years+)
"Nature exploitive occupations"
(farming, ranching, mining)

MOST LIKELY TO RESIST

Northeastern, western, California
Urban communities
Don't care or benefits are minor
Liberal, Democrat, "Welfare State"
Young and middle-aged
College-educated
Middle and upper income
Other
Activist
Residents for 5-26 years
Professional ("YUPPIES" & "housewives")

1991: Epley Associates 'window survey' (nuclear waste dump in NC)

Coleridge	"houses fairly wealthy"	out
Snow Camp	"fairly affluent"	out
Cherry Grove	"residences of site minority-owned"	in
Farmington 1	"fairly affluent"	out
Gold Hill 1	"dynamite company--explosives/ munitions"	out
Gold Hill 3	"very depressed area"	in
Watson	"poultry operations--impressive--Holly Farms" "some new homes—affluent"	out
Ghio	"trailers everywhere" "forecloses then resells" "distressed county"	in
Marston	"distressed area" "buffer would have to be in game land" (which violates state criteria)	out
Hoffman	"distressed area" "major wetlands"	in
Millstone Lake	"Sheriff Goodman -- concerned about job loss"	in
Slocumb	"affluent"	out
Berea	"distressed county"	in

1997: Louisiana Energy Services (uranium enrichment in LA)

Average black population within 1 mile of sites considered in site selection:

78 sites in 16 parishes:	28.35%
37 sites in 9 parishes:	36.78%
6 sites in Claiborne Parish:	64.74%
Selected site:	97.1% (highest of all sites originally examined)

Contractor “performed... evaluation of the population of the LeSage and Emerson sites by driving through the area and performing a visual or ‘eyeball’ assessment.”

Atomic Safety and Licensing Board: “Racial discrimination in the facility site selection process cannot be uncovered with only a cursory review of the description of that process appearing in an applicant's environmental report. If it were so easily detected, racial discrimination would not be such a persistent and enduring problem in American society. ...the Staff must lift some rocks and look under them.”

www.ejnet.org/ej/les.html

1991:

First National People of Color Environmental Leadership Summit

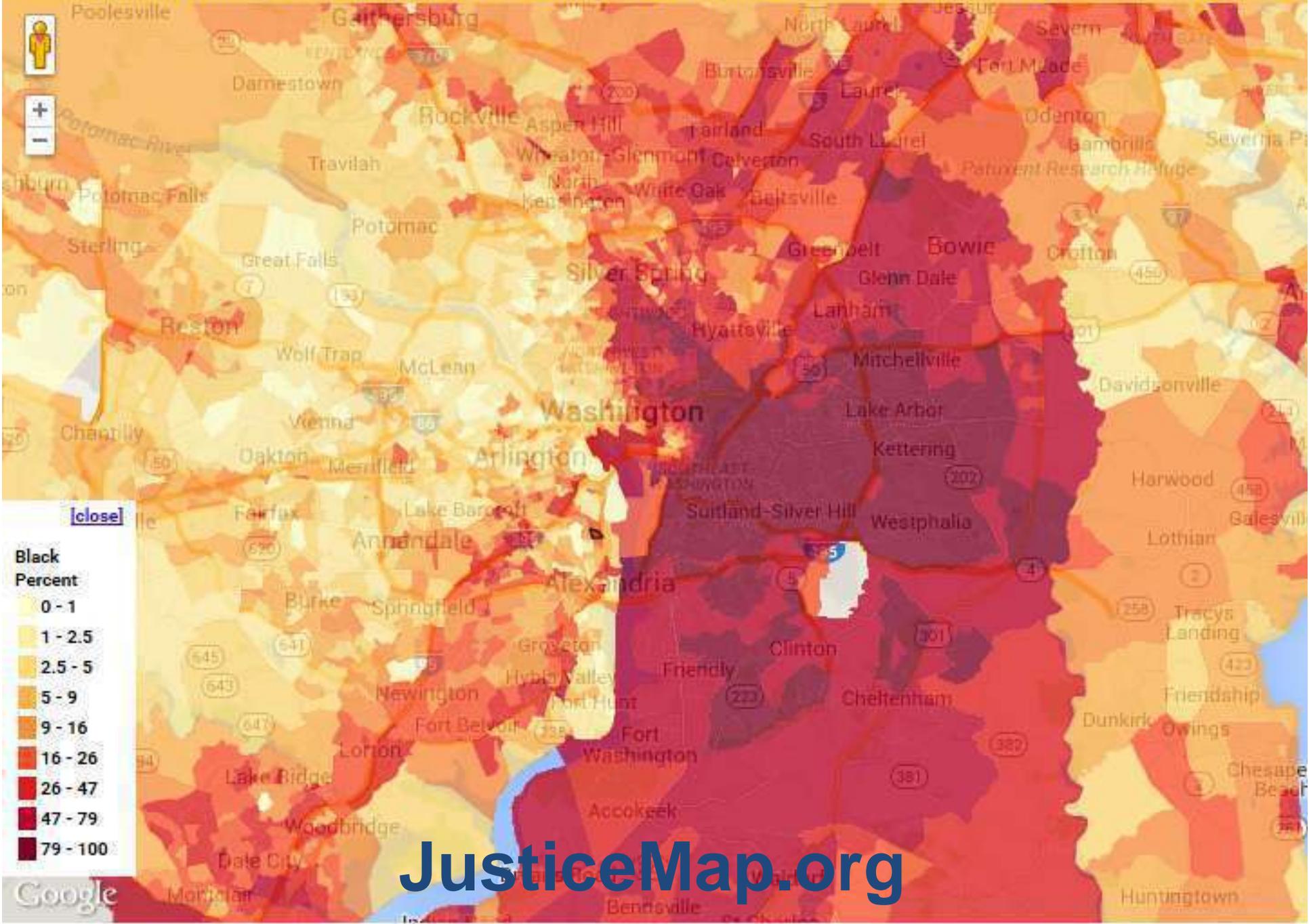


Redefined 'the environment' as "where people
live, work, and play"

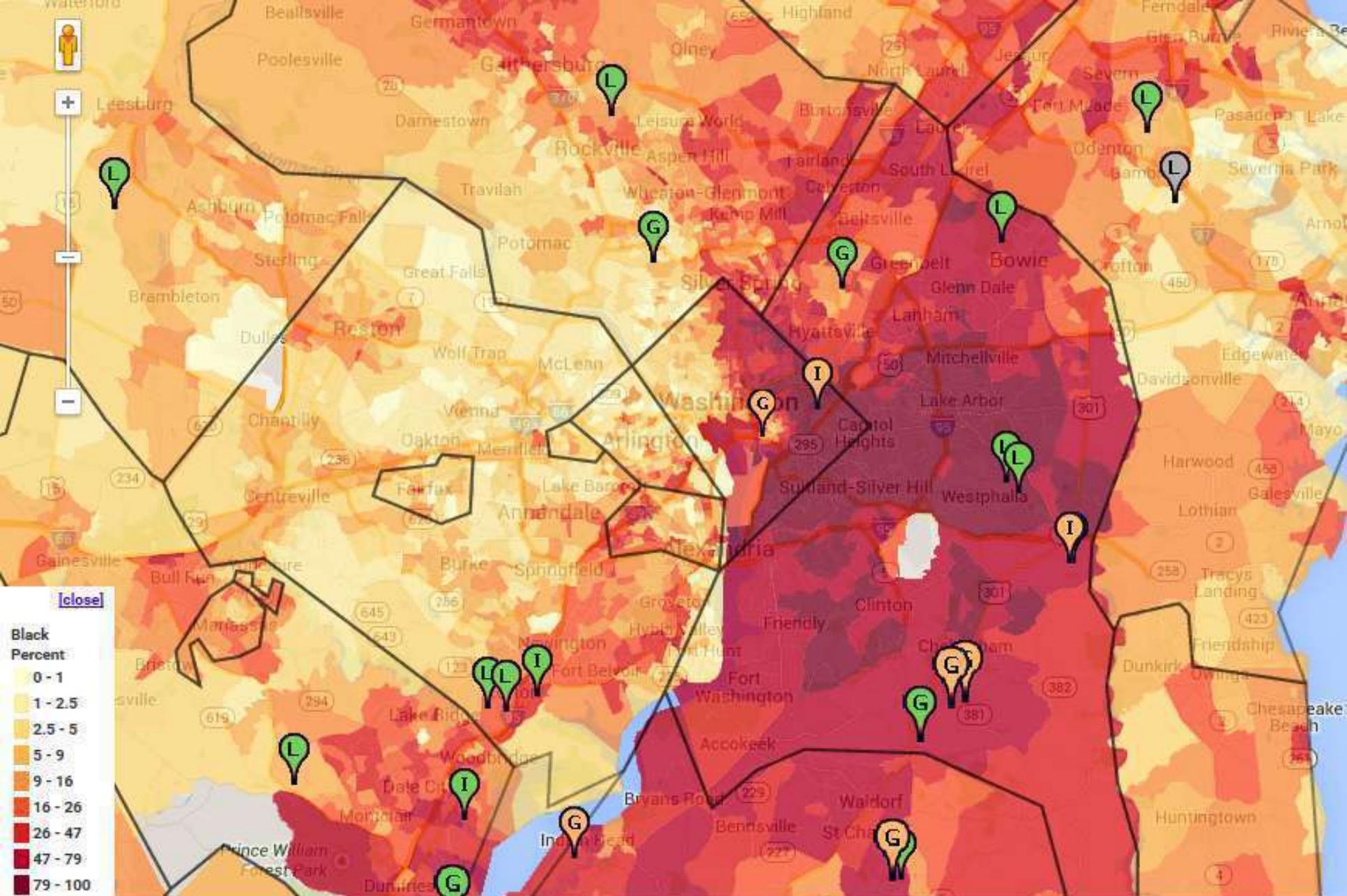
Proposed Gas-Fired Power Plants



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JusticeMap.org



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Poor Communities Bear Greatest Burden from Fracking

Poor in Pennsylvania? You're more likely to be fracked

By Brian Bienkowski and Environmental Health News | May 6, 2015

Fracking wells in Pennsylvania's Marcellus Shale region are disproportionately located in poor rural communities, which bear the brunt of associated pollution, according to a new study.

The study bolsters concerns that poor people are more likely to deal with hydraulic fracturing in their community and



Poor in Pennsylvania? You're fracked.

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Public Herald/flickr

Hydraulic fracturing wells and the pollution from them are more likely to impact poor communities in Pennsylvania

May 6, 2015

By Brian Bienkowski
Environmental Health News

Source: www.environmentalhealthnews.org/ehs/news/2015/may/pennsylvania-fracking-environmental-justice-poor-economics

Energy Justice Shale Initiative

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www.EnergyJusticeSummer.org

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 - www.EnergyJustice.net/zerowaste
 - www.ilsr.org/initiatives/waste-to-wealth
 - www.grrn.org/zerowaste
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www.EnergyJustice.net

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