



[www.EnergyJustice.net](http://www.EnergyJustice.net)

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

# Just Transition Principles

- Healthy & sustainable
- Community decision-making  
(needs assessments and alternatives assessments)
- Local
- Decentralized
- Public or worker (cooperative)-owned
- Union / living wage
- Retraining opportunities for workers
- Benefits must be prioritized and targeted toward impacted communities and those historically least-advantaged

# Zero Waste Jobs



Deconstruction Crew, Second Chance, Baltimore, MD. Photo Credit: C. Seldman

# What is Zero Waste?

**“Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.**

**Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.**

**Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.”**

# **If you're not for Zero Waste, how much waste are you for?**

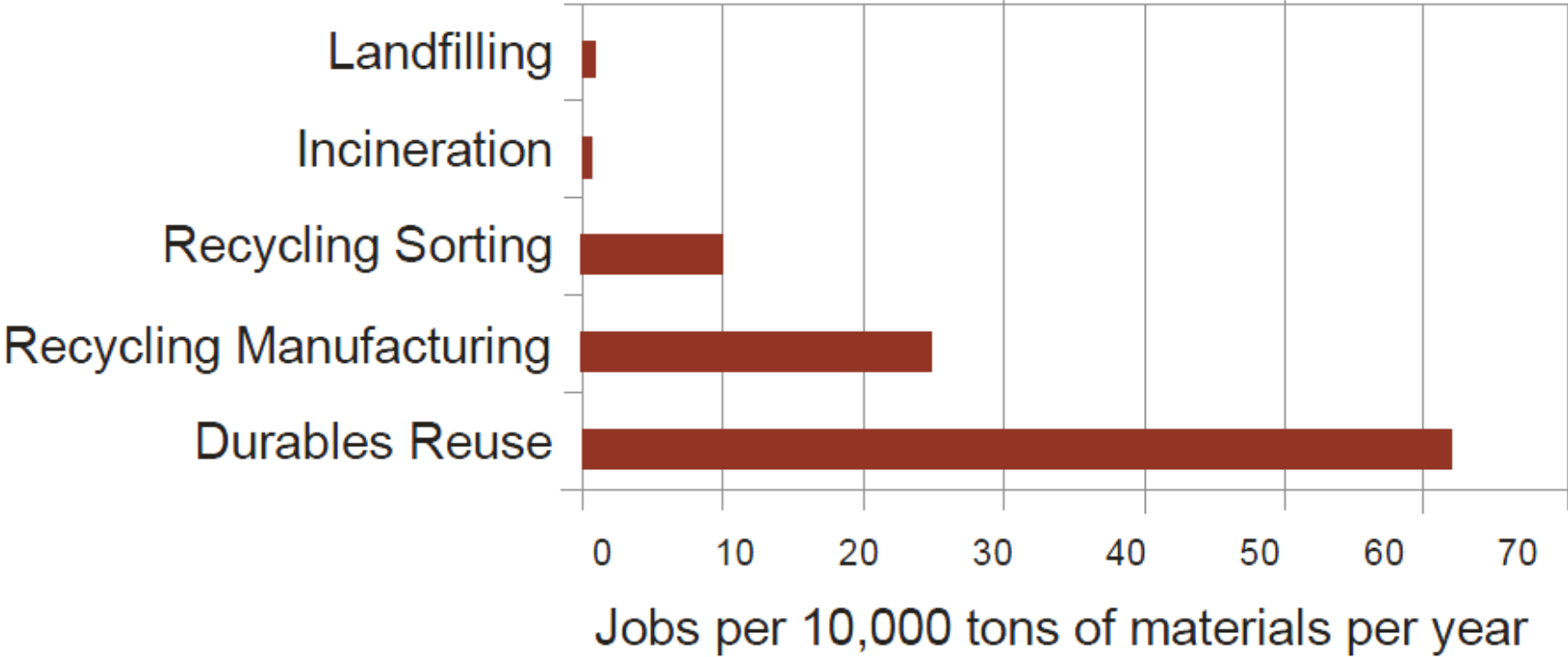
Zero waste is recognized as achieving 90% or greater diversion from landfills and incinerators.

The goal is to get as close to zero as possible, without getting caught up on the impossibility of actually hitting zero.

“Zero waste” is like “zero drug tolerance” or “zero accidents in the workplace” standards. Zero is the goal, and the right policies will get you as close as you can get.

# Worst Way to Create Jobs

## Job Creation: Reuse & Recycling vs Disposal



Source: Institute for Local Self Reliance

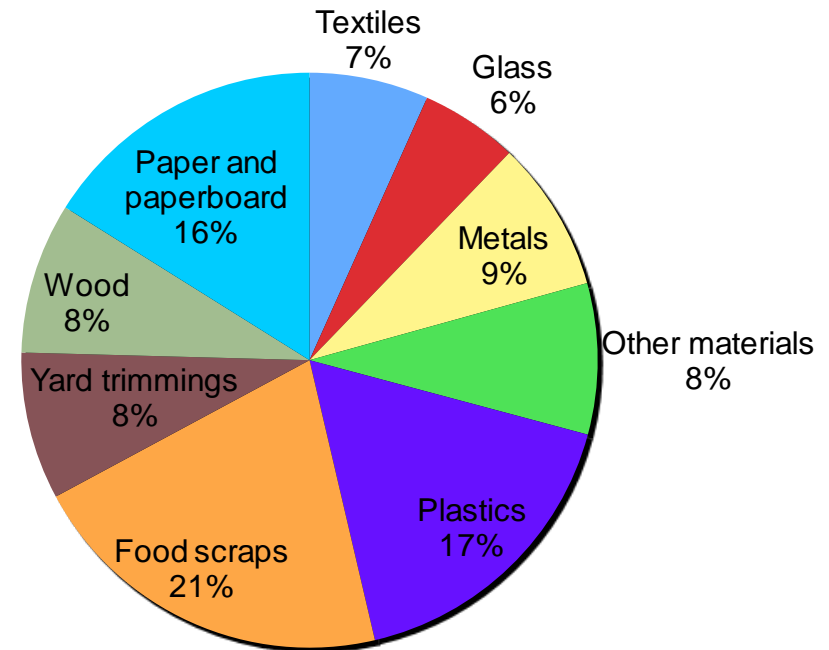


## Job Creation: Reuse & Recycling Versus Disposal in the United States

Type of Operation	Jobs Per 10,000 Tons per Year
<b>Product Reuse</b>	
Computer Reuse	296
Textile Reclamation	85
Misc. Durables Reuse	62
Wooden Pallet Repair	28
<b>Recycling-Based Manufacturers</b>	25
Paper Mills	18
Glass Product Manufacturers	26
Plastic Product Manufacturers	93
<b>Conventional MRFs<sup>101</sup></b>	10
<b>Composting</b>	4
<b>Incineration</b>	1
<b>Landfilling</b>	1

# Money Thrown Away

**\$11.4 billion worth of recyclable packaging wasted (sent to landfills and incinerators) in 2010**



Source: "Unfinished Business: The Case for Extended Producer Responsibility," 2012 Report, [www.asyouow.org/sustainability/eprreport.shtml](http://www.asyouow.org/sustainability/eprreport.shtml)





# AUSTIN RESOURCE RECOVERY MASTER PLAN DECEMBER 15, 2011



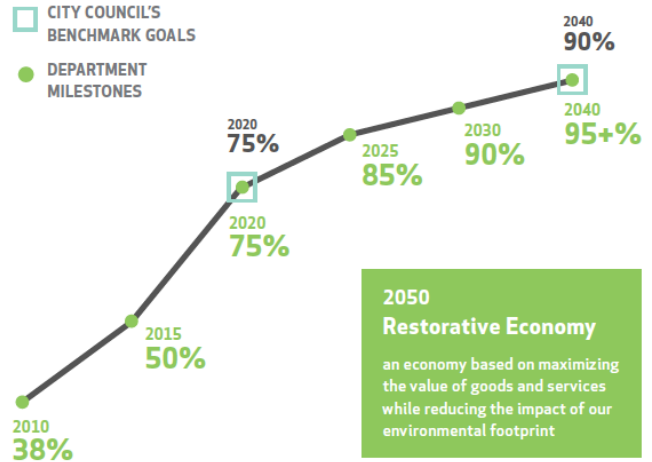
# ZERO WASTE BY 2040

The Austin City Council established three benchmark goals for achieving Zero Waste:

- 1** Reducing by 20 percent the per capita solid waste disposed to landfills by 2012
- 2** Diverting 75 percent of solid waste from landfills and incinerators by 2020
- 3** Diverting 90 percent of solid waste from landfills and incinerators by 2040

## DIVERSION GOALS

The Master Plan establishes more aggressive milestones to ensure the City Council's benchmark goals are achieved.



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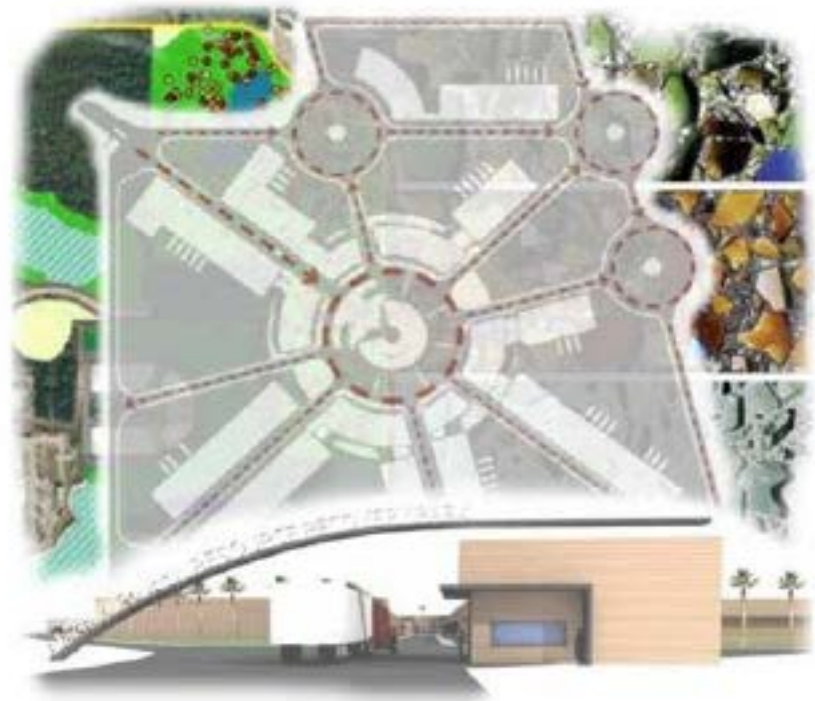
**Table 1 - Projected Department Hauled Material Collection**

Department Hauled Collection	In Tons				
	FY 2010 (Actual)	FY 2015	FY 2020	FY 2025	FY 2030
Total waste disposal	138,757	115,000	68,000	49,000	37,000
Total diversion: reuse, recycling, organics, HHW	82,611	115,000	205,000	277,250	332,000
Total waste generation	221,368	230,000	273,000	326,250	369,000
Diversion rate	38%	50%	75%	85%	90%



## Alachua County Resource Recovery Park

**40-acre site in  
Alachua County, FL**



Working in conjunction with the University of Florida College of Design, Construction and Planning over the Fall of 2010 through the Spring of 2011 conceptual plans for the economic development of the Leveda Brown Environmental Park expansion were modeled. These proposals will help shape the eventual request for proposals for the buildout of the Resource Recovery Park; an integral component of the Alachua County Sustainable Solid Waste Strategy. Submissions to the County covered three overarching components:



# Ohio State Reported Achieving Zero Waste Last Fall



On November 3, 2012, Ohio State University achieved zero waste at its Ohio Stadium – **diverting a record 98.2%** of its total generated waste. Total attendance was 105,311.

At its October 20<sup>th</sup> home game, **OSU diverted 94.4%**. That's everything from food scraps to compostable packaging to recyclables. Source: <http://sustainability.osu.edu>

# Zero Waste Hierarchy

- Rethink / Redesign
- Reduce
- Reuse
- Source Separate:
  - Recycle
  - Compost
  - Waste
    - Research
    - Mechanically remove additional recyclables
    - Anaerobically digest residuals
- Stabilized (digested) residuals to landfill

[www.energyjustice.net/zerowaste](http://www.energyjustice.net/zerowaste)

# Clean Energy Solutions

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



[www.energyjustice.net/solutions](http://www.energyjustice.net/solutions)

# Natural Gas = Fewest Jobs

## Job-years per GWh

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

# Natural Gas = Fewest Jobs

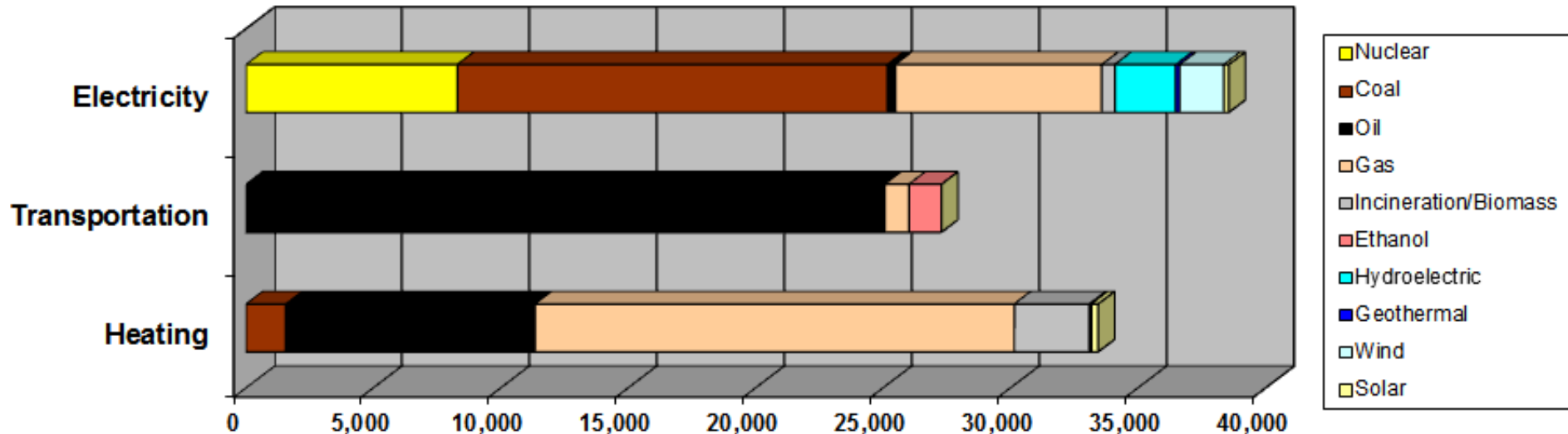
	<b>Jobs per \$1,000,000 invested</b>	<b>Jobs per \$1 million output</b>
<b>Mass transit</b>	<b>22.3</b>	<b>11</b>
<b>Biomass</b>	<b>17.4</b>	<b>7.4</b>
<b>Building retrofits</b>	<b>16.7</b>	<b>7</b>
<b>Solar</b>	<b>13.7</b>	<b>5.4</b>
<b>Wind</b>	<b>13.3</b>	<b>4.6</b>
<b>Smart Grid</b>	<b>12.5</b>	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

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](http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/economic_benefits/economic_benefits.PDF)



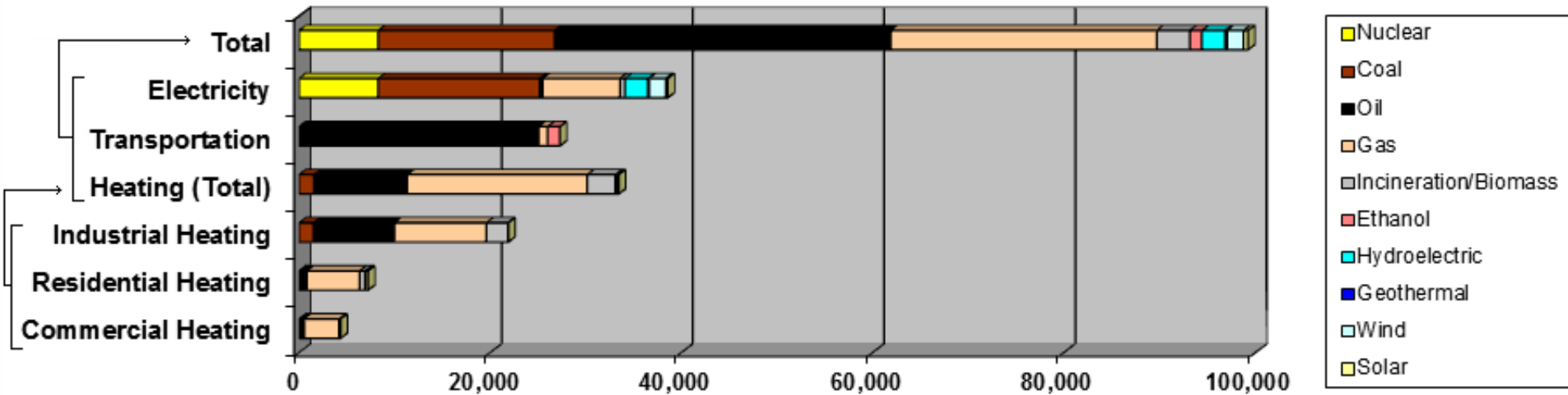
# 2014 U.S. Total Energy Use

(electricity, transportation & heating)



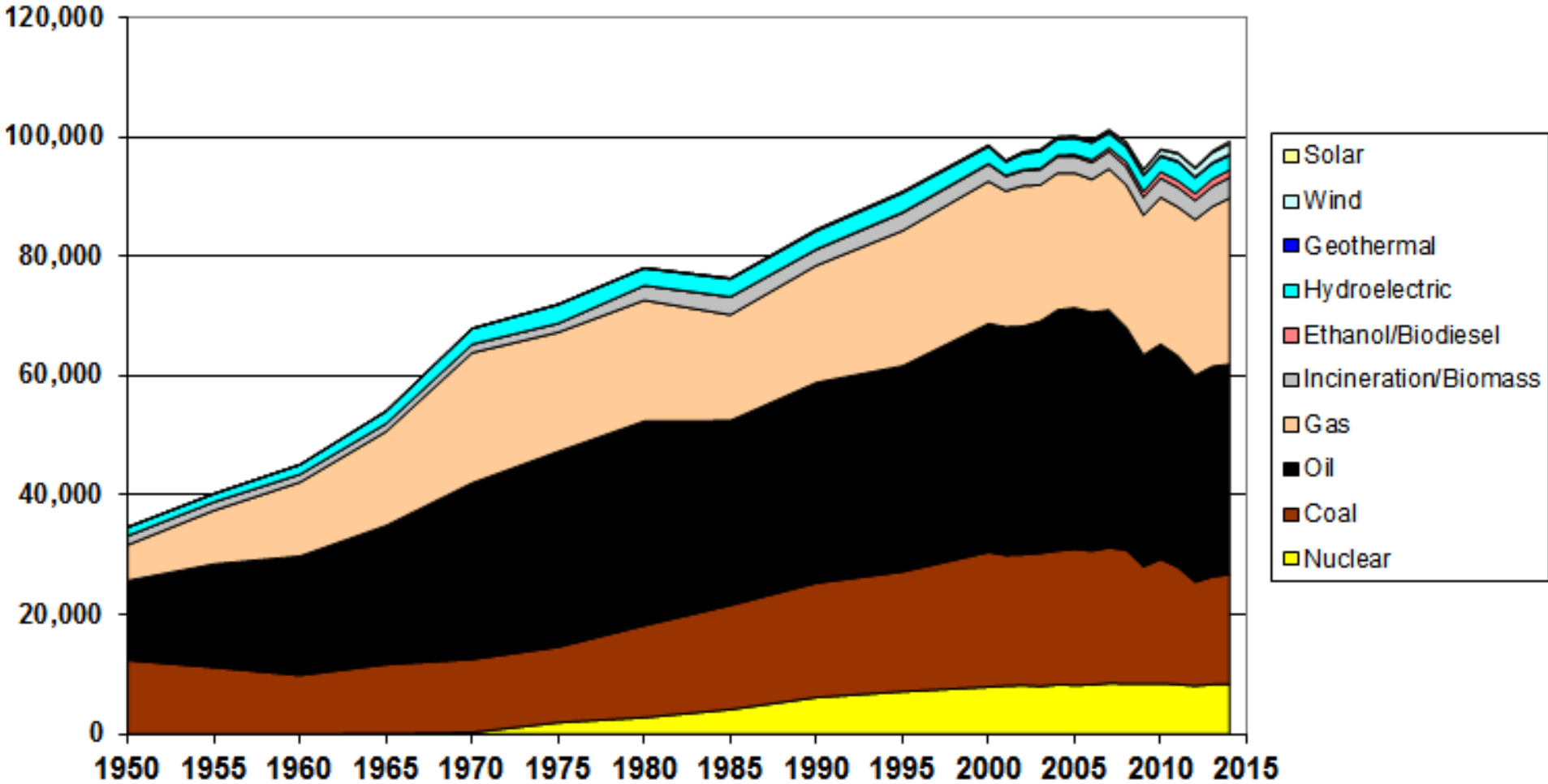
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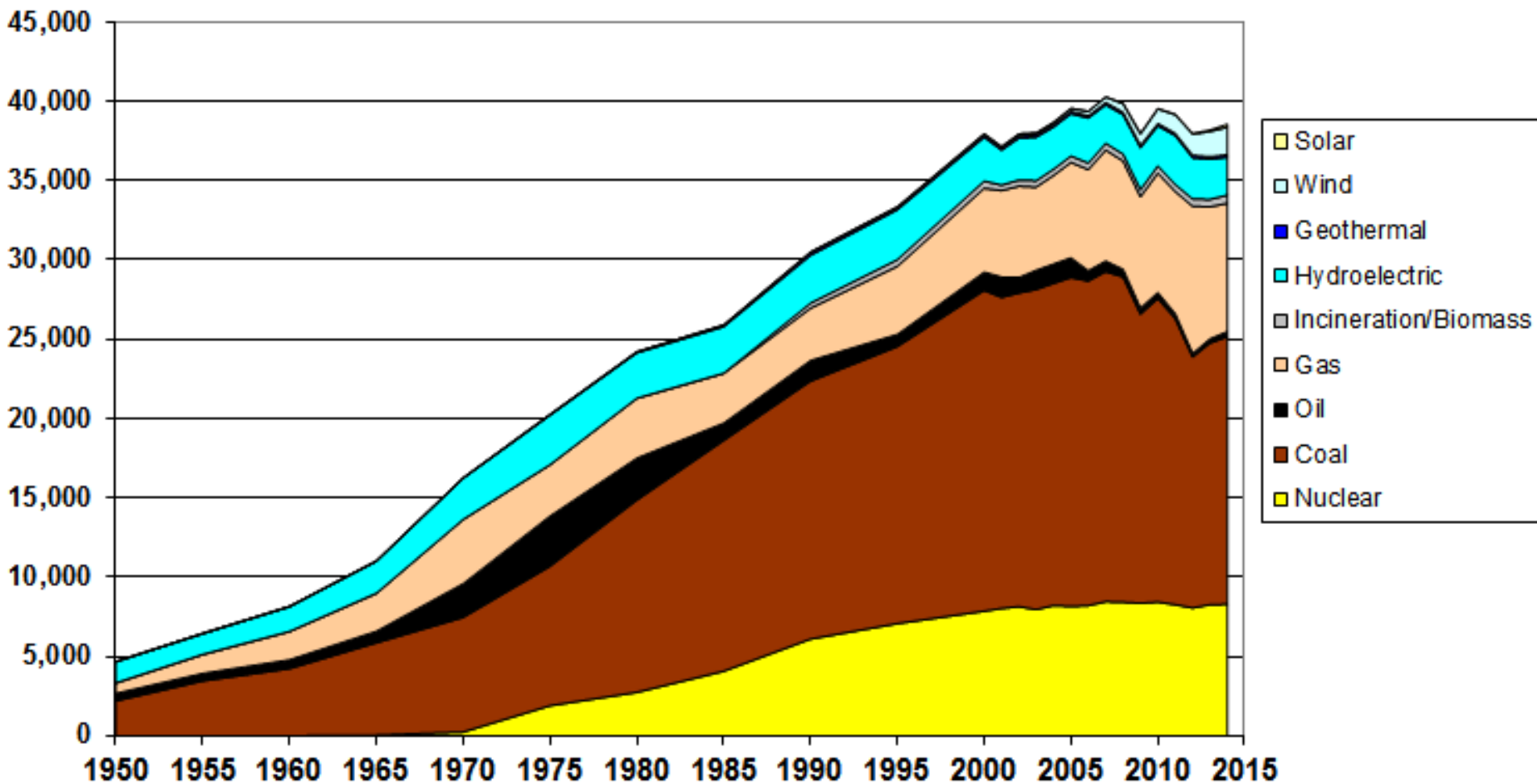


# U.S. Total Energy Use

(electricity, transportation & heating)



# U.S. Electricity Use



# 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](http://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<sup>a,b,\*</sup>, DeAnna Sewell<sup>c</sup>, Heather Thomson<sup>c</sup>, Leon Mach<sup>d</sup>, Dana E. Veron<sup>c</sup>, Willett Kempton<sup>a,c,e</sup>

<sup>a</sup> Department of Electrical and Computer Engineering, University of Delaware, Newark, DE 19716, USA

<sup>b</sup> Department of Energy Management, Delaware Technical Community College, Newark, DE 19713, USA

<sup>c</sup> 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

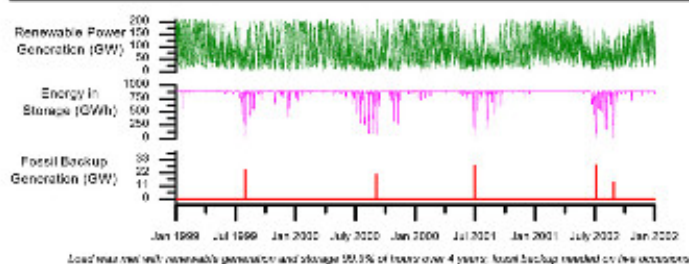
<sup>d</sup> Energy and Environmental Policy Program, College of Engineering, University of Delaware, Newark, DE 19716, USA

<sup>e</sup> Center for Electric Technology, DTU Elektro, Danmarks Tekniske Universitet, Ags. 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

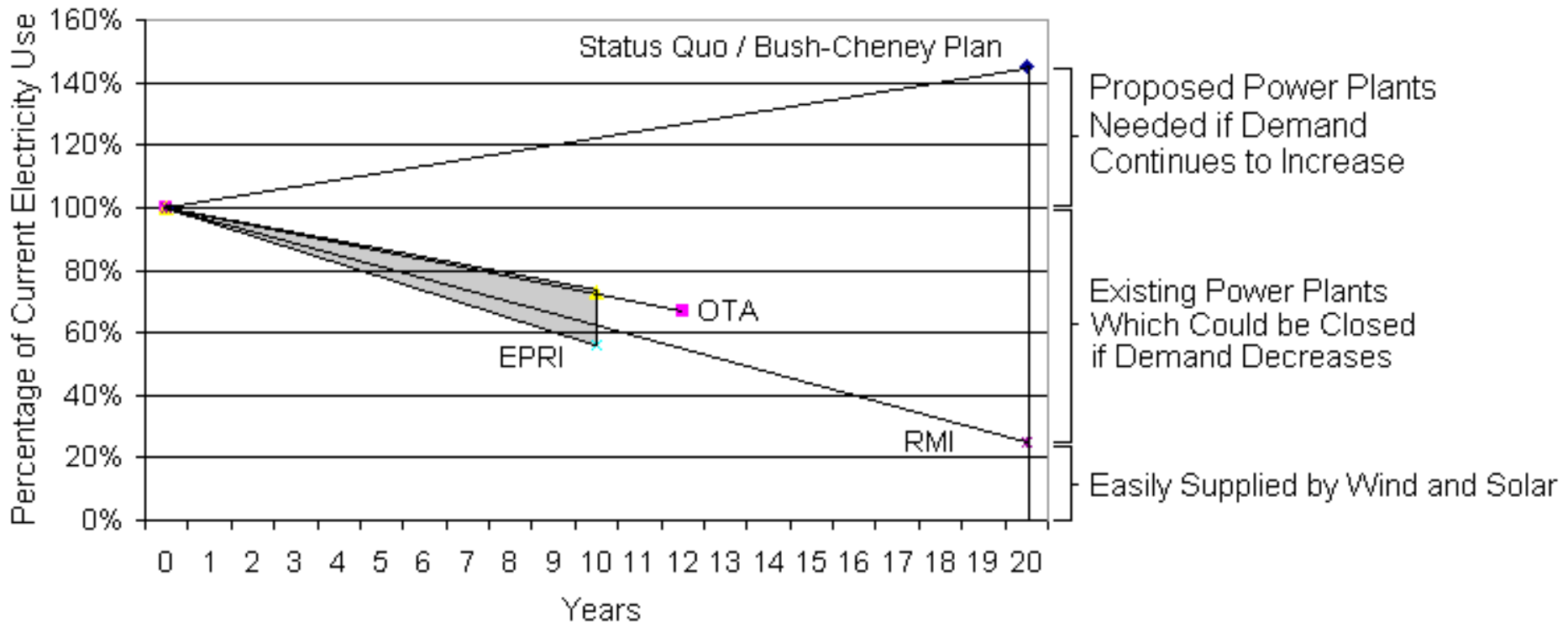


Load hour met with renewable generation and storage 99.9% of hours over 4 years; fossil backup needed on the occasions

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.**

# Conservation and Efficiency

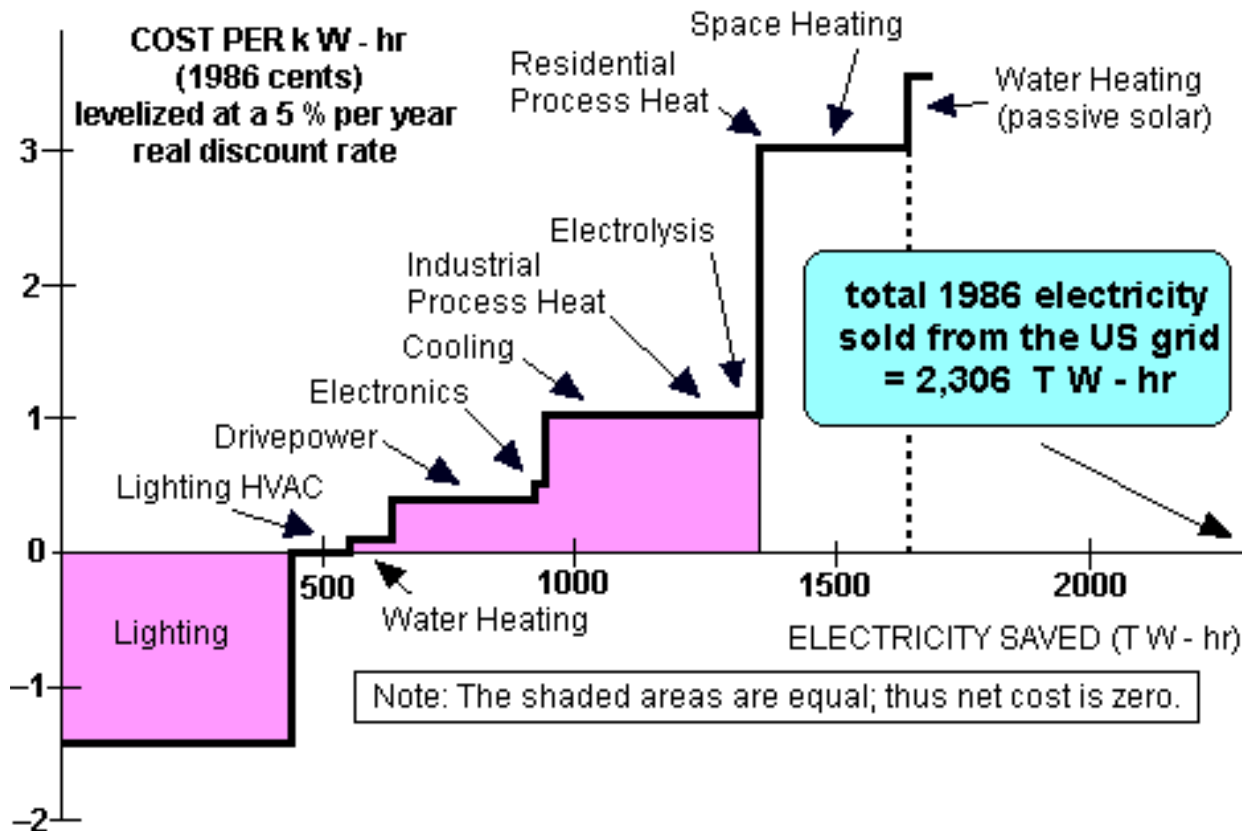
We can reduce electricity demand by as much as 75% within 20 years.



# Conservation and Efficiency

Figure 4

*A Preliminary Estimate of the Full Practical Potential for Retrofit Savings of US Electricity at an Average Cost of about 0.6 ¢ per kW-hr*

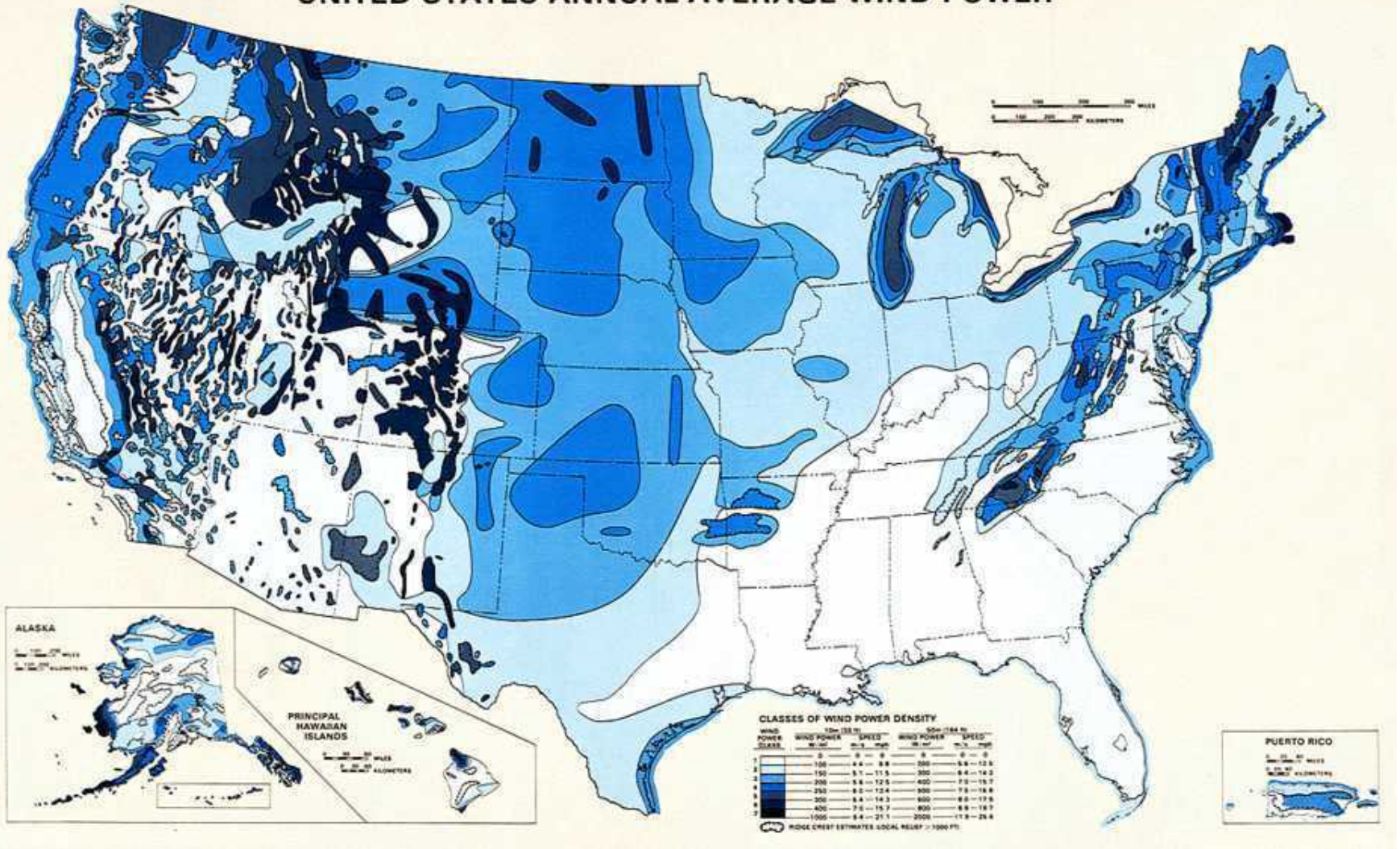


Reducing 75%  
within 20  
years at  
1/10<sup>th</sup> the  
cost of  
buying  
electricity



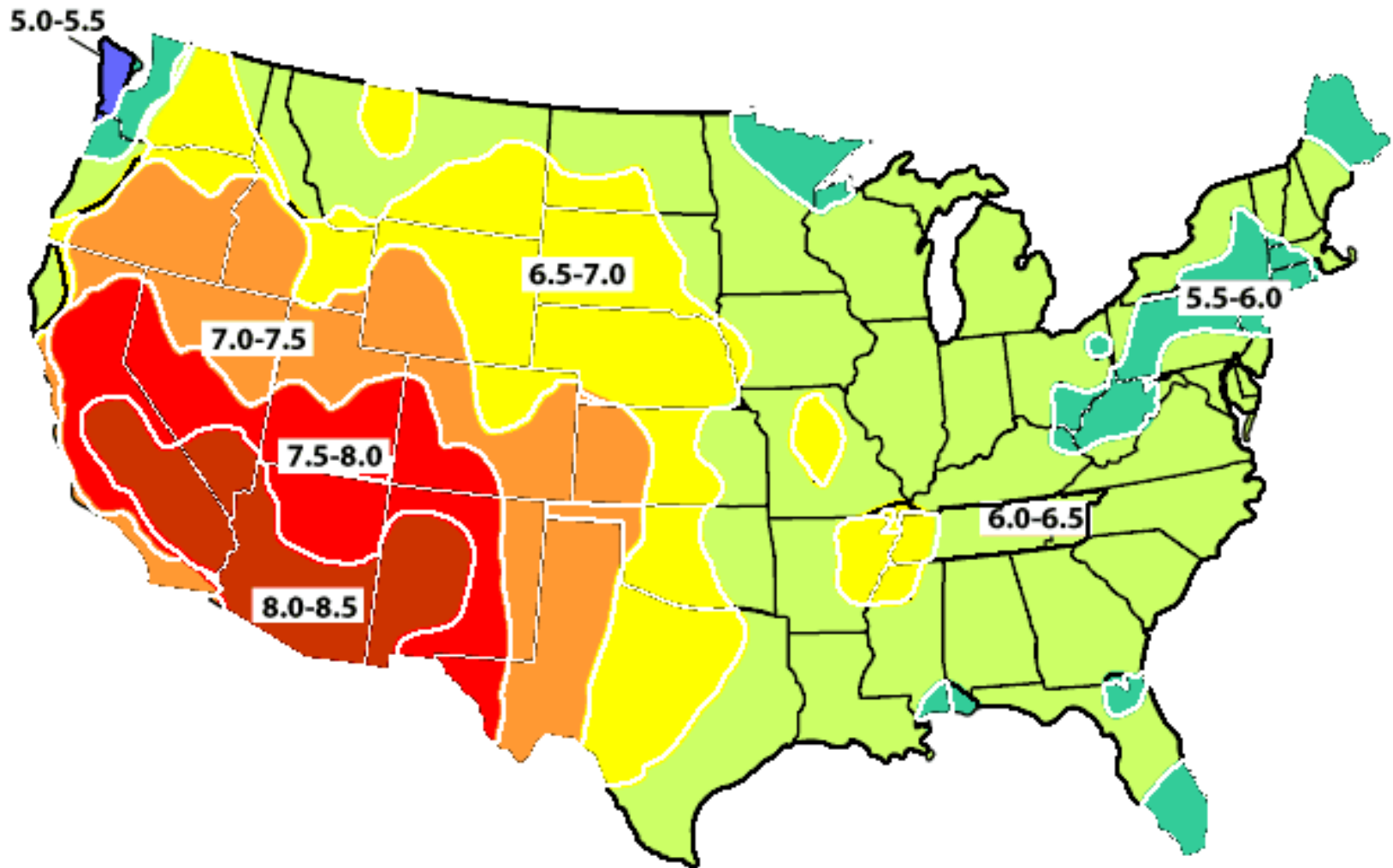
# Wind Power

UNITED STATES ANNUAL AVERAGE WIND POWER

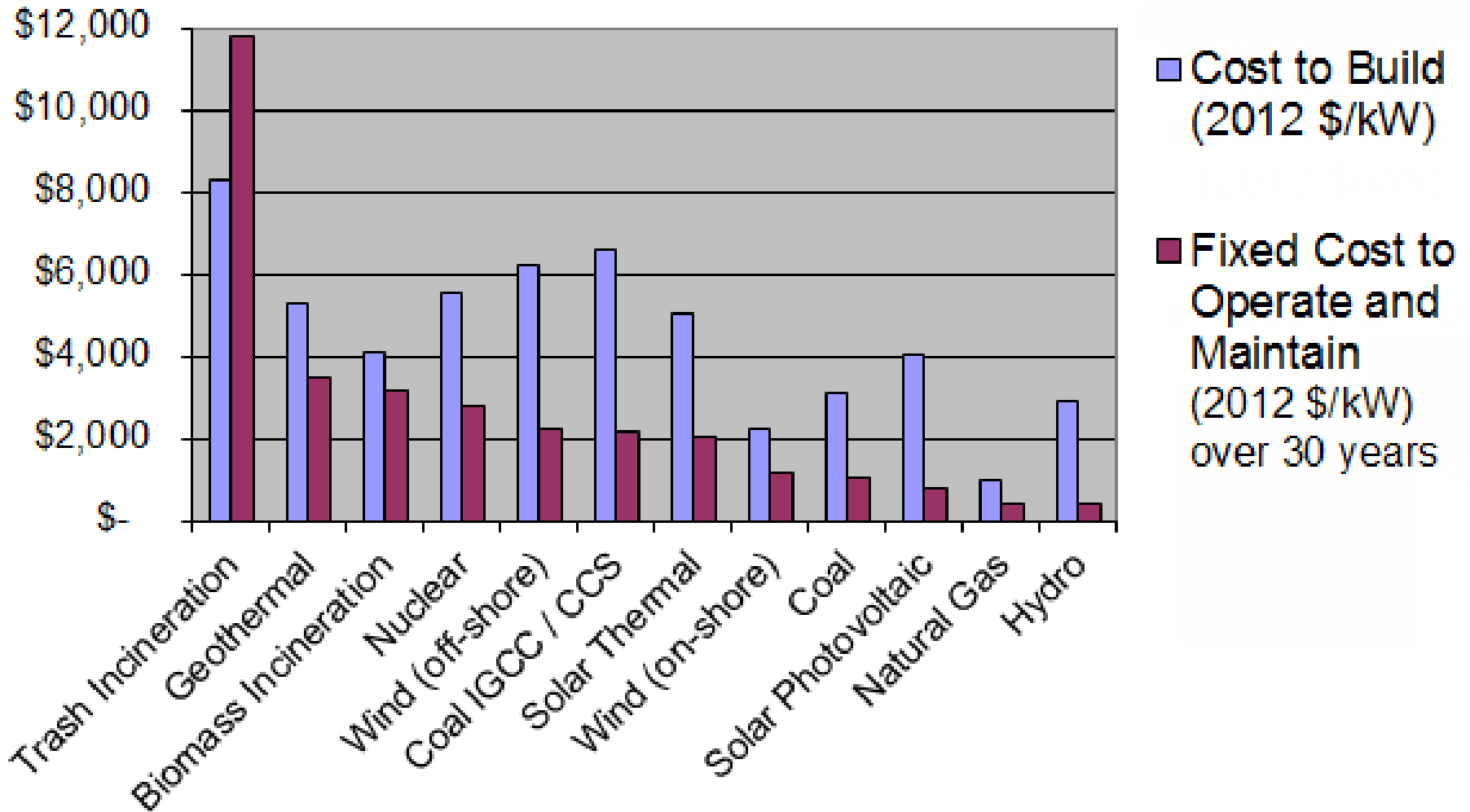




# Solar Power



# Most Expensive Way to Make Energy



Source: "Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants," Energy Information Administration, April 2013, p.6, Table 1. Full report here: [www.eia.gov/forecasts/capitalcost/pdf/updated\\_capcost.pdf](http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf)

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



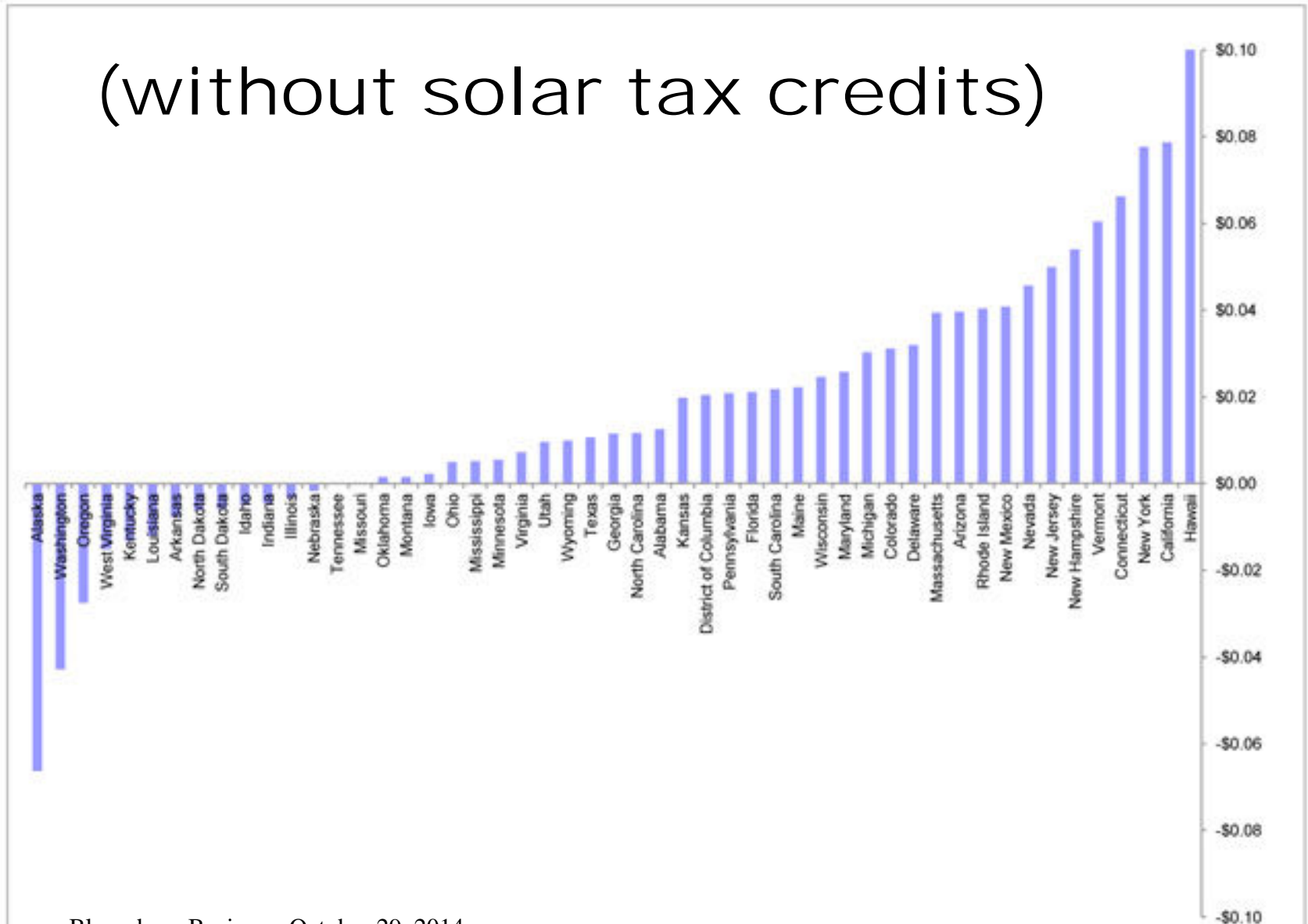
Photographer: Chris Sattlberger/Getty Images

“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

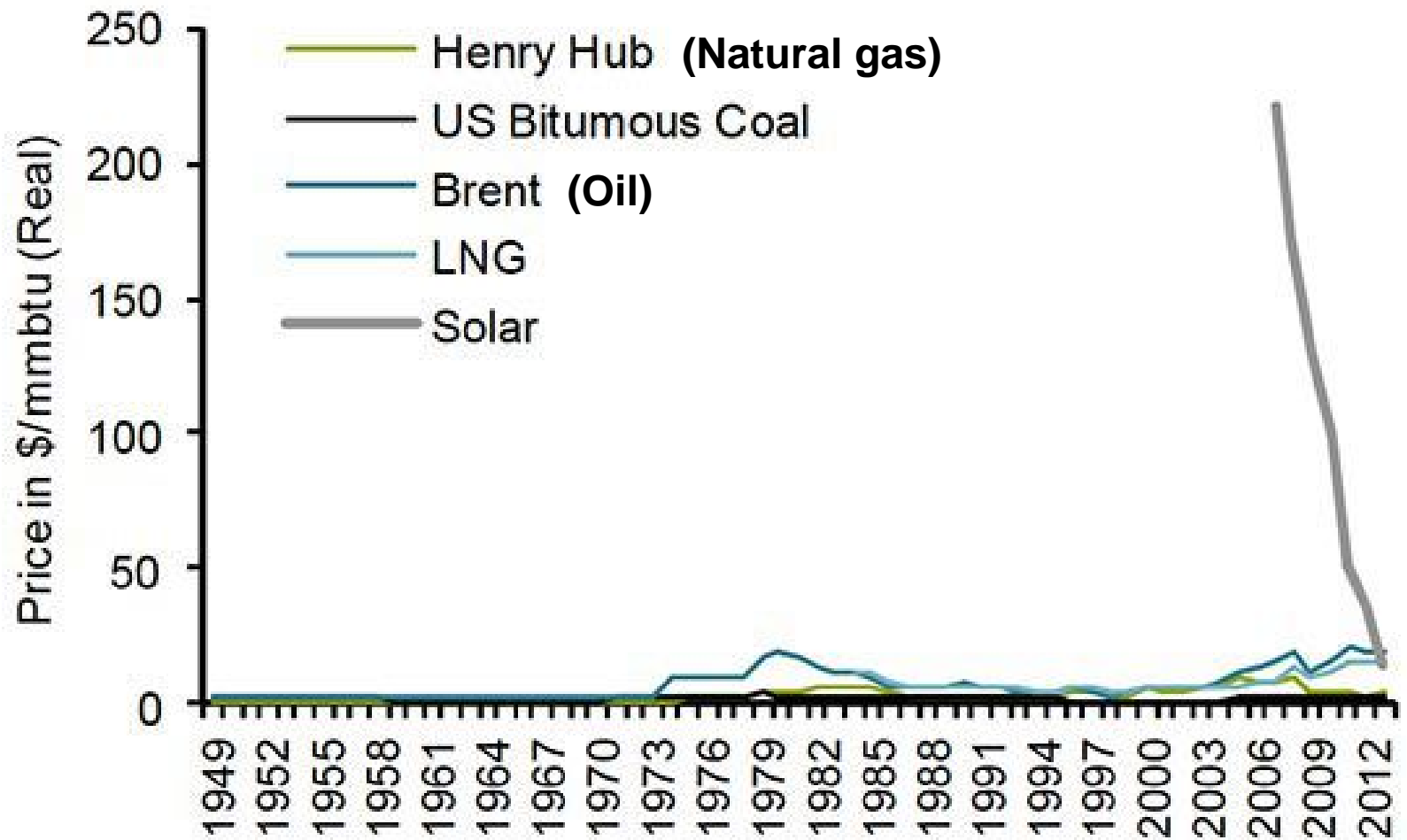
(without solar tax credits)



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](http://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...



## Renewable energy starting to win on price



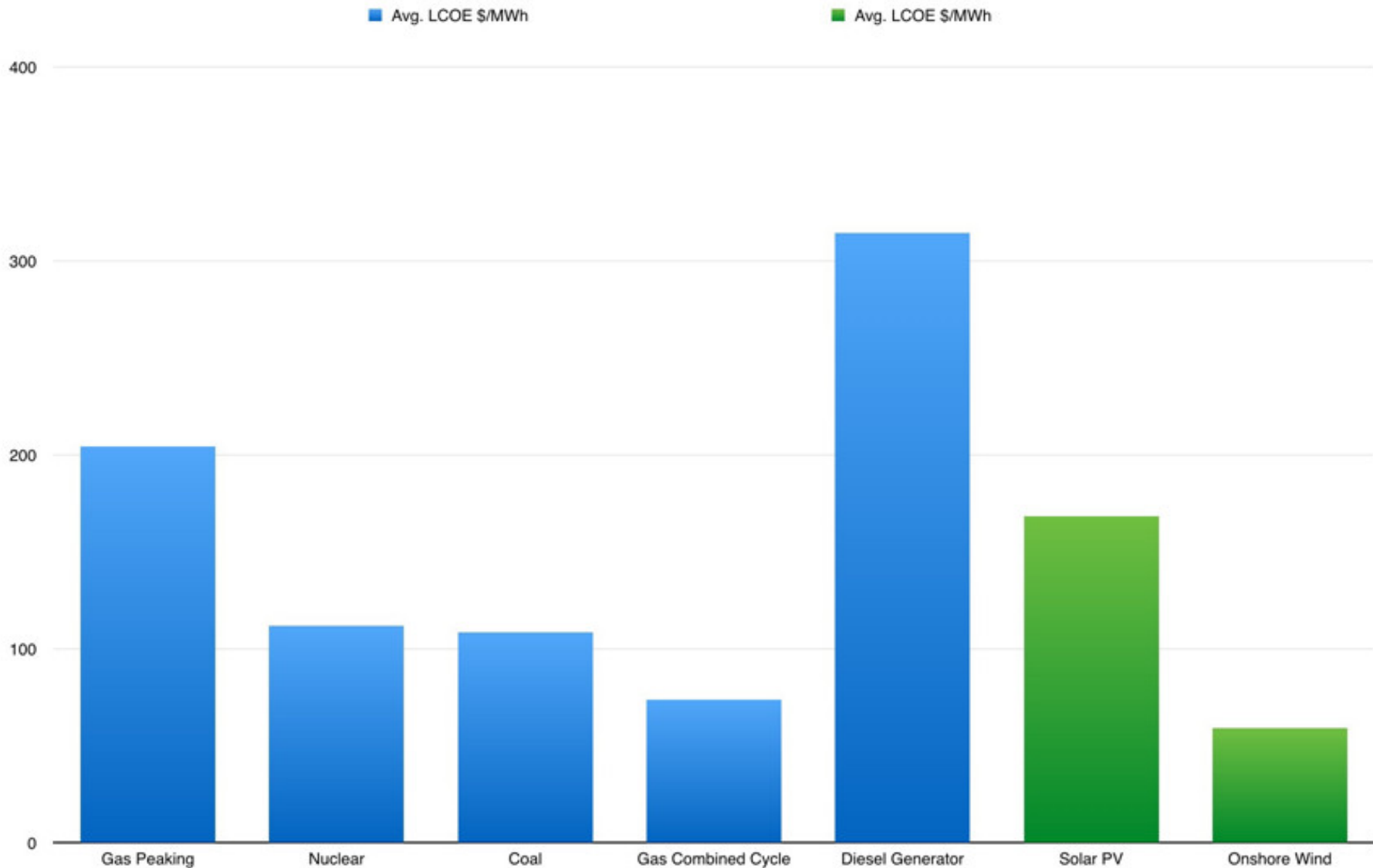
MICHAL CZERWONKA/NEW YORK TIMES

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

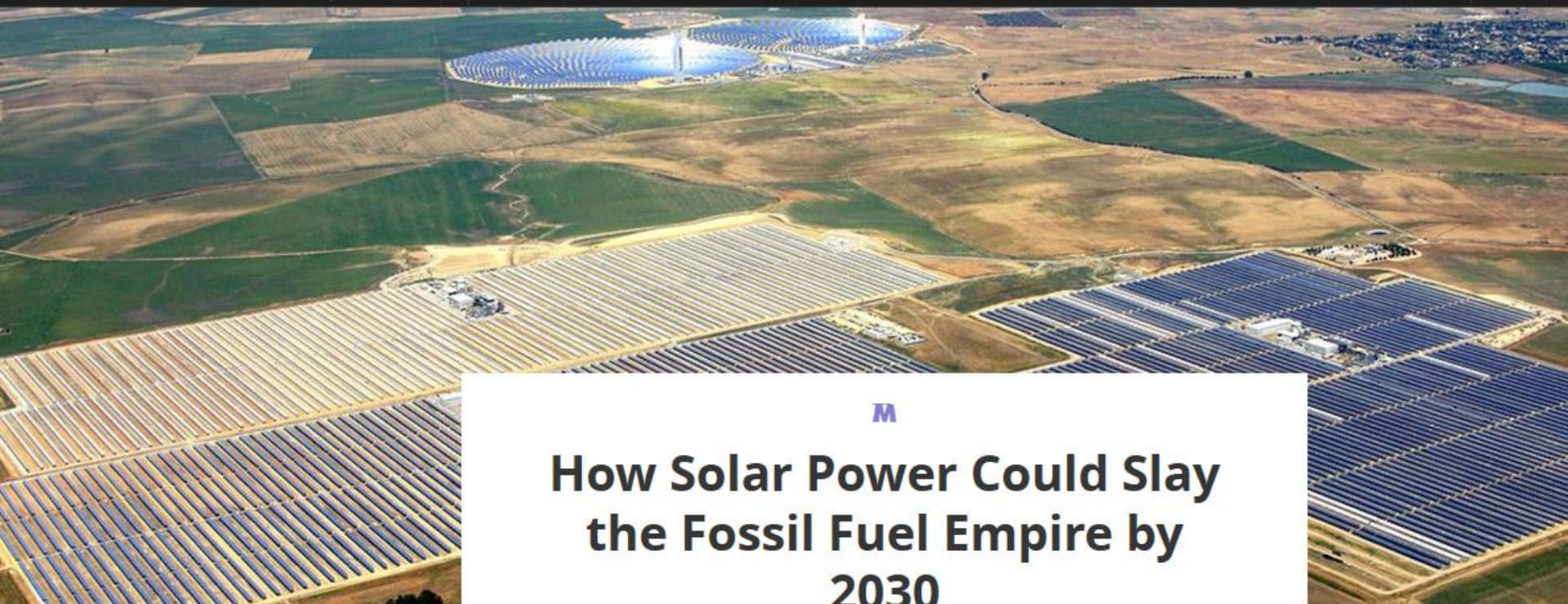
By Diane Cardwell | New York Times November 24, 2014



# Average Levelized Cost of Energy: Conventionals vs. Renewables



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

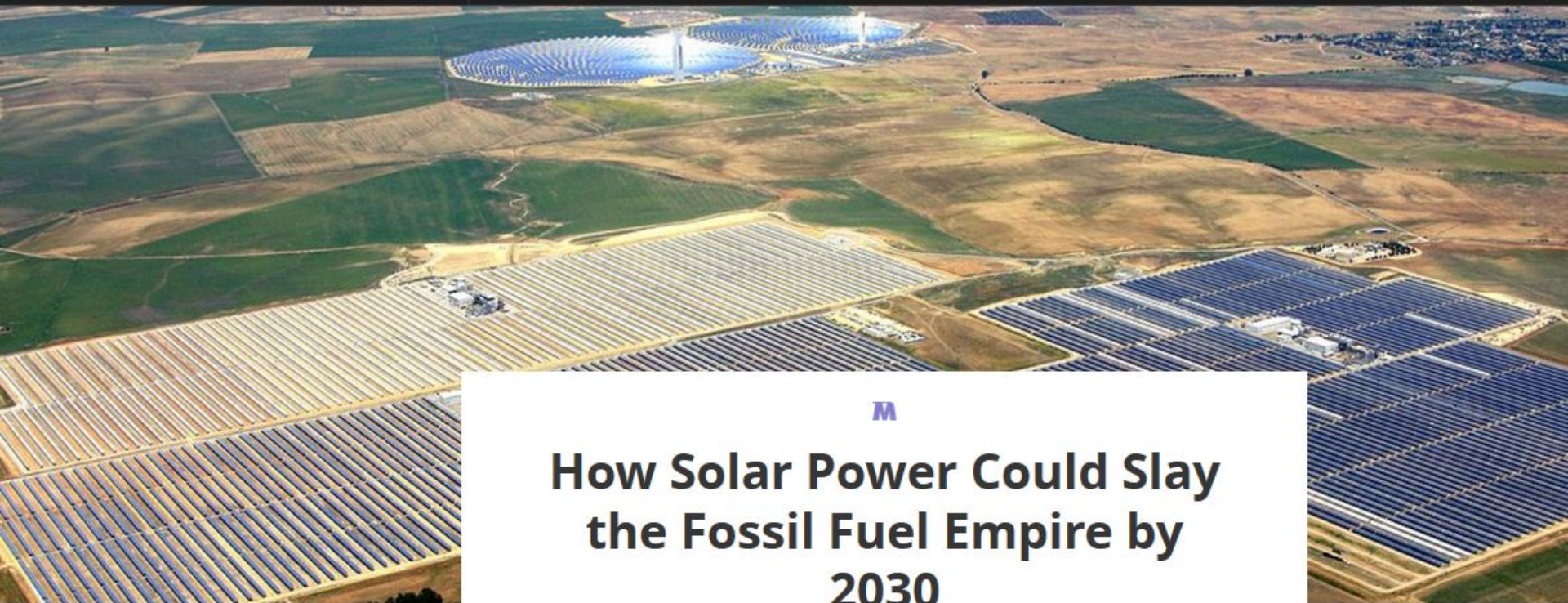
WRITTEN BY NAFEEZ AHMED

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

WRITTEN BY NAFEEZ AHMED

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

WRITTEN BY NAFEEZ AHMED

December 10, 2014 // 11:25 AM EST

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

WRITTEN BY NAFEEZ AHMED

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

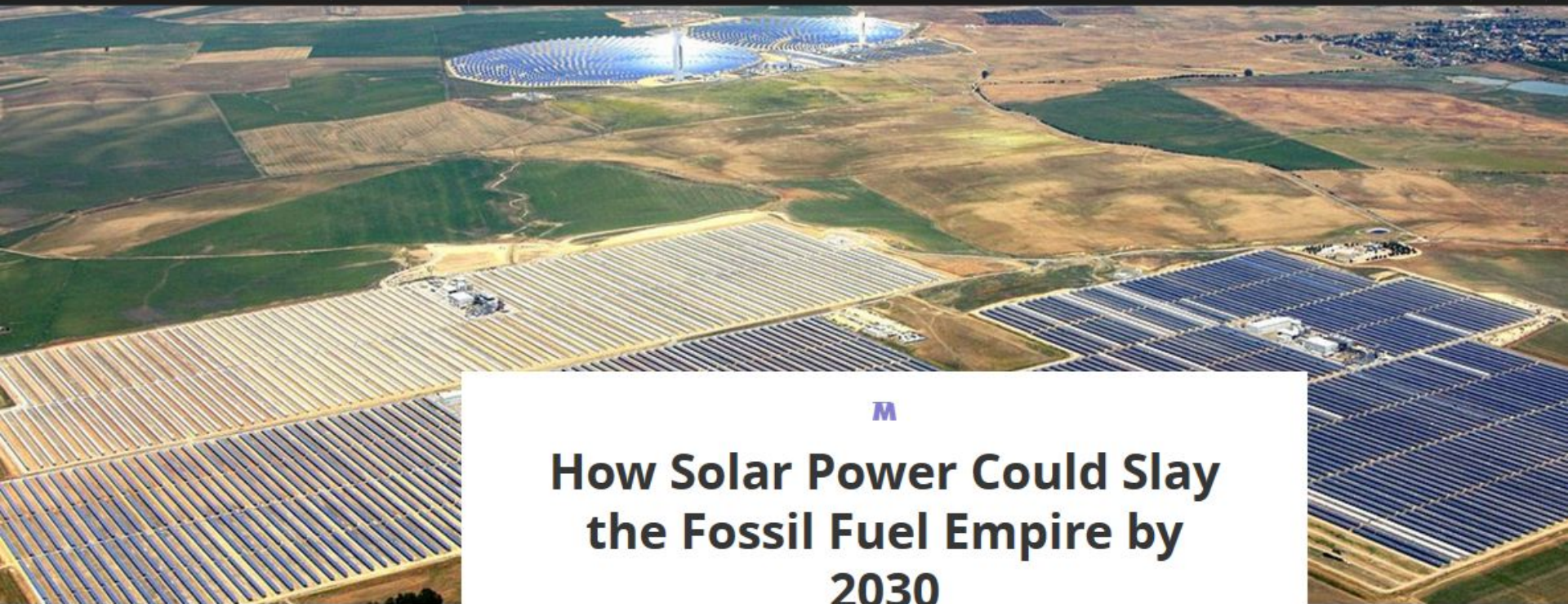
WRITTEN BY NAFEEZ AHMED

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

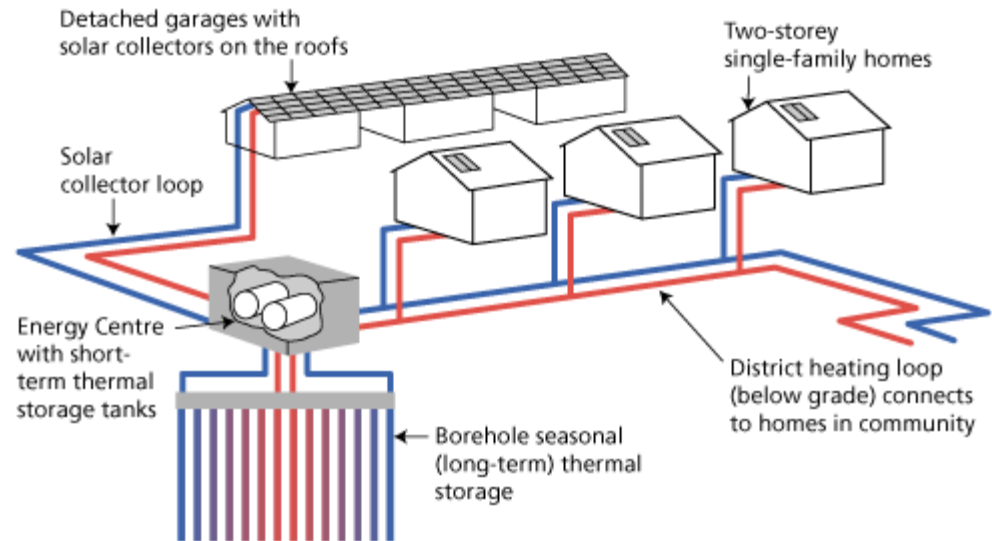
- **Wind/solar-powered electric vehicles**

- 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) →



# For more Info...

- Energy Solutions:
  - [www.EnergyJustice.net/solutions](http://www.EnergyJustice.net/solutions)
  - [www.EnergyJustice.net/platform](http://www.EnergyJustice.net/platform)
- Zero Waste:
  - [www.EnergyJustice.net/zerowaste](http://www.EnergyJustice.net/zerowaste)
  - [www.ilsr.org/initiatives/waste-to-wealth](http://www.ilsr.org/initiatives/waste-to-wealth)
  - [www.grn.org/zerowaste](http://www.grn.org/zerowaste)
  - [www.zwia.org](http://www.zwia.org)
  - [www.zerowasteusa.org](http://www.zerowasteusa.org)





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