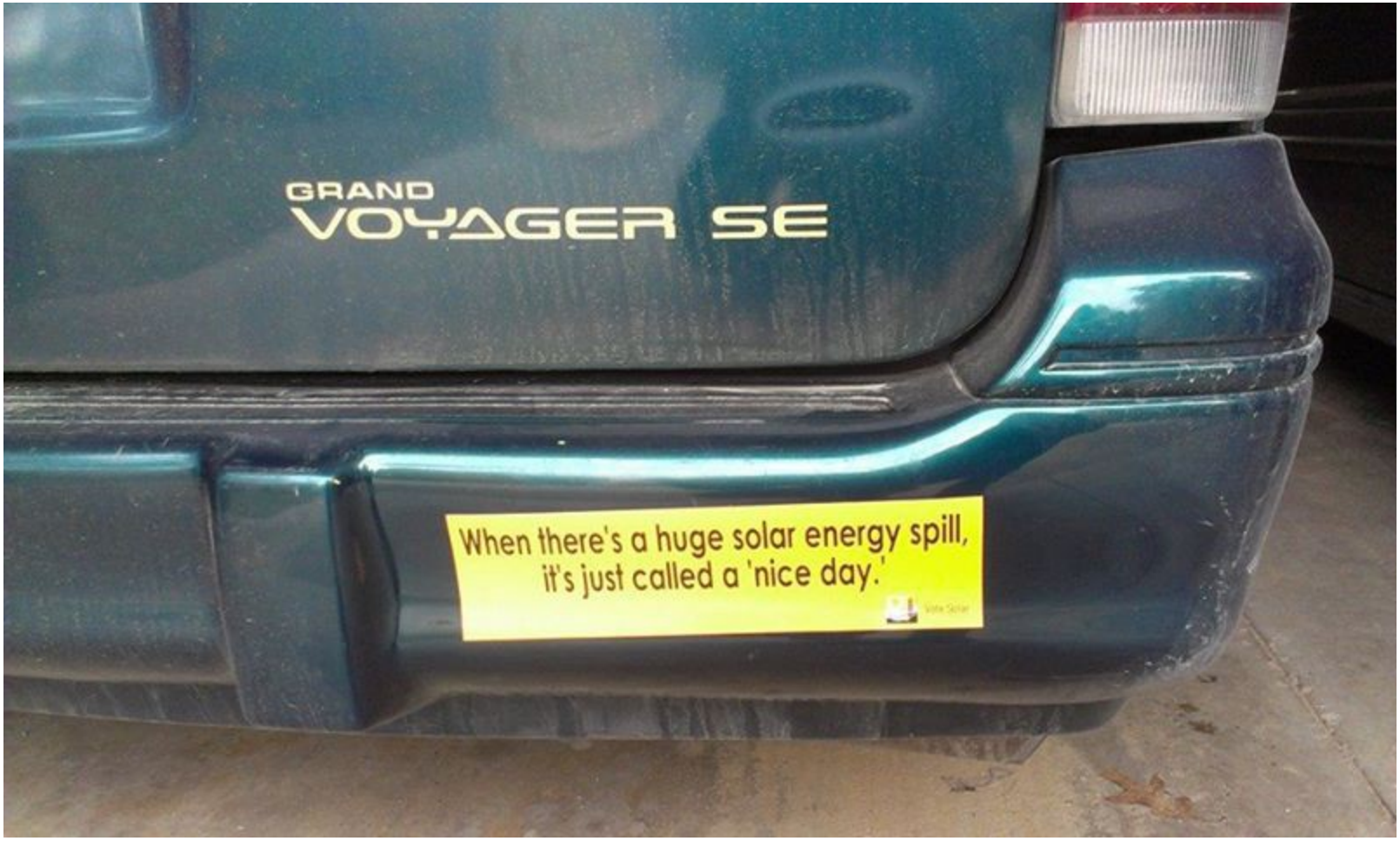
Electric Cars & Solar PV

Presented by Kraig Schultz

November 7, 2013

for ASM – Grand Rapids, MI

The Good Thing About Clean Energy



Calculations that Changed my Life

The Invisible Hand of Self Interest

I got into the environmental movement by accident.

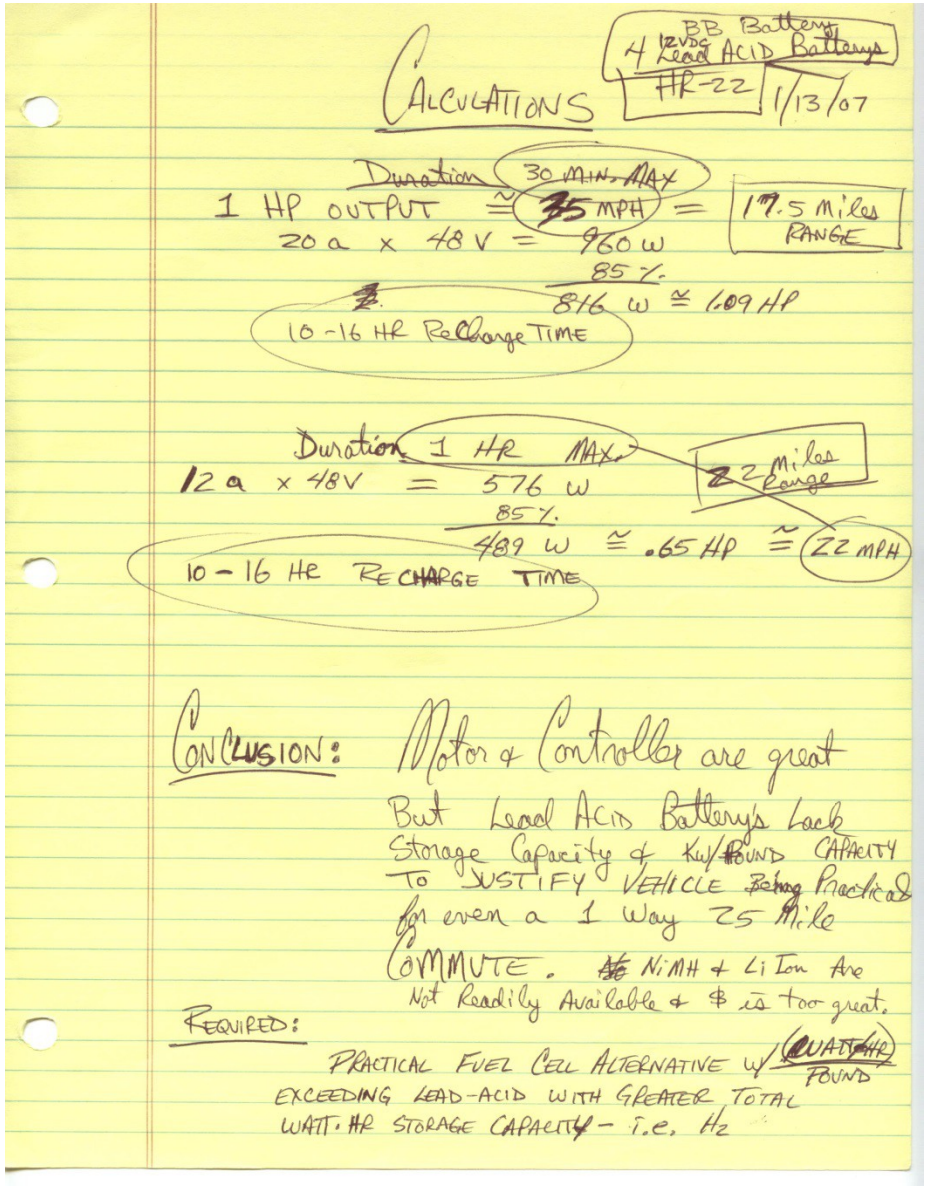
In 2007, I recognized an opportunity for business profit in energy storage. I got into Electric Vehicle Development to exploit the energy storage opportunity and to satisfy my passion for seeing efficient transportation vehicles developed.

Along the way, I have learned more about how our appetite for profit and cheap energy is destroying our planet.

We can continue on the path we are on, or choose a different one. One that is equally profitable in the short run, but less destructive and much more sustainable in the long run.

Tonight, I'll share some of what I've learned on my journey along with what I see as great opportunity to make a profit while making the world a better place.

Kraig Schultz



Life Long Dream

KRAIG SCHULTZ
MY DREAM SINCE 1980:

5000 MPG
COMMUTER VEHICLES

My First EV

- I went to Black River Recycling and bought this old motorcycle frame for $15 and built my first electric vehicle.

3,000 Miles Later

January 1, 2008

- I resigned from my job to go on a one year sabbatical to build the ultimate commuter vehicle.

2007-2012 Projects Focused on Innovation
Tilting Trikes, Multi-Position Riding, Aerodynamics

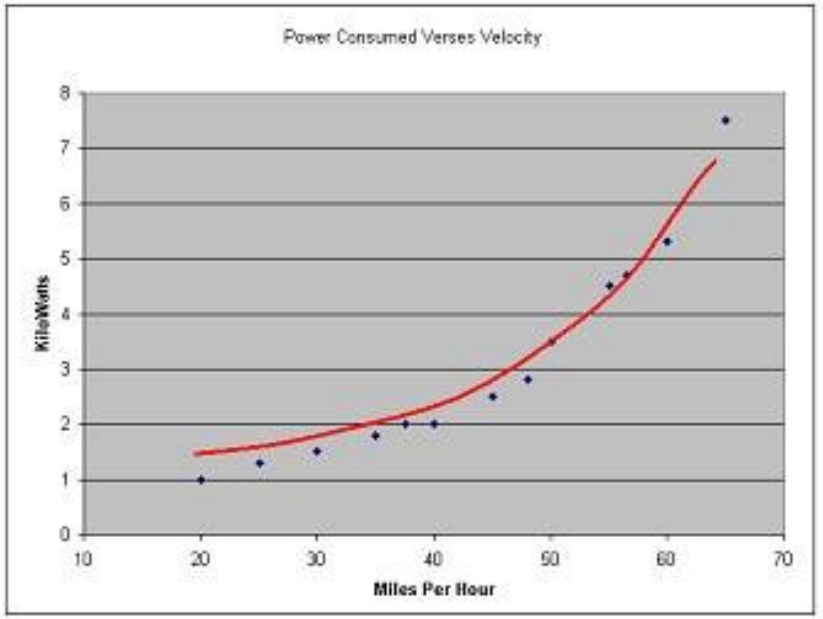
$250,000 Later

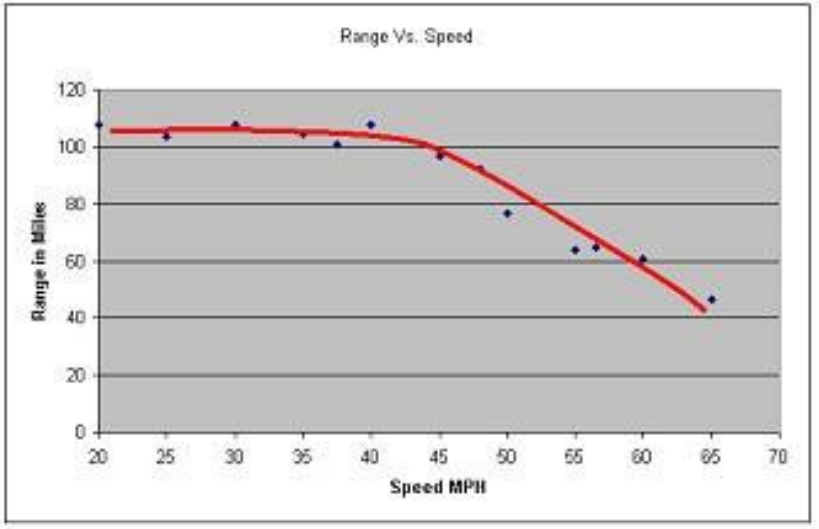
- 1 Year Sabbatical = 4.5 Years
- Battery Project = Electric Vehicle Project
- 1 EV = 12 + EV's
- Following Passion = Joy in Work
- Too Much Joy in Work = Lot's of Debt

Latest Vehicle = Delta-11

How Far?

- Over 100 Miles on One Charge





How Fast?

- 70 MPH

How Long to Recharge?

- 1 Hour

What Kind of Batteries?

- Lithium Iron Phosphate (LiFePHO4)
- Real Force Brand (Made in China)
- 96 Volt Nominal, 80 AH
- 7.6 kW – Hour Storage Capacity

Where's the Motor?

- 40 Hp Brushless Hub Motor (Enertrac) in Rear Wheel

How Much does it Weigh?

- 520 # Weight of Motorcycle w/out rider
- 200 # Weight of Batteries

Did you Build That?

- 3 Months to Design/Build
- No Welds in Frame –

- Water Jet Cut Aluminum Sheet Bolted
- To 1”x1” Aluminum Tube
- Aluminum Billet Connection Points

Where did you get Components?

- Kawasaki Ninja Front Forks
- Yamaha Seca 2 Rear Swing Arm
- Rifle Vetter Fiberglass Fairing
- RV-8 Aircraft Canopy Windshield

Fuel Efficiency

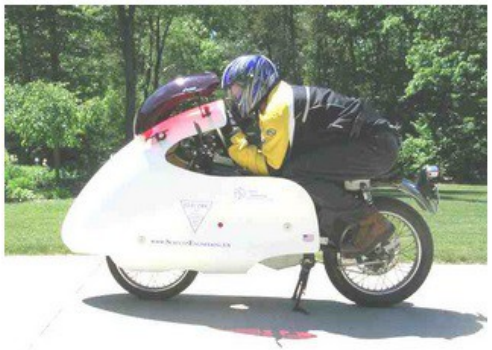
2nd Most Efficient Commuter in Country

- 100 Wh/Mile to recharge from the wall
- 338 MPGe
- My Electric Daily Commute = $.50
- My Gasoline Daily Commute = $5.50

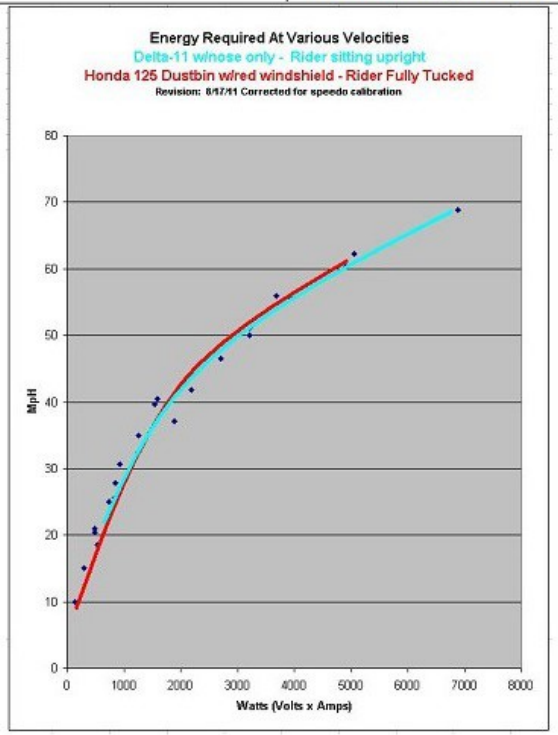
Comparing our 2011 with our 2009 Bike

Which bike looks more comfortable to you?

2011 Bike: Equally efficient, but way more comfortable, the Delta-11 is the BLUE line on the chart below.



2009 Bike: Efficiency comes at the price of comfort with the Racing tuck. RED line on the chart below.



Delta-Bike Innovation = 2 Position Seating

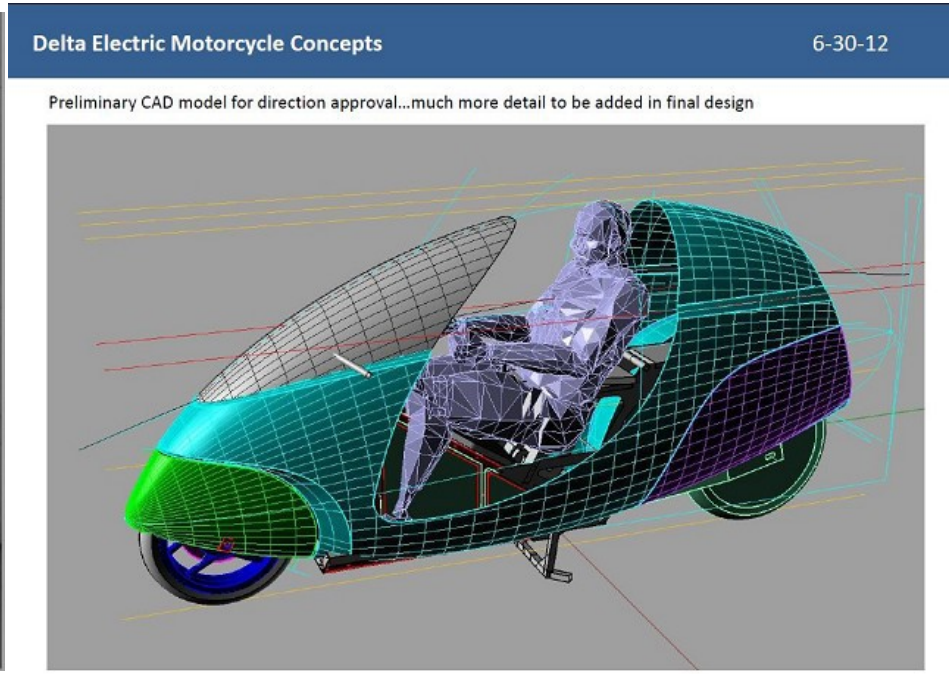
The upright seating position allows the rider to see and be seen in parking lots and busy traffic conditions.

The lower seating position puts the rider INSIDE the bike for better comfort and aerodynamics.

Future Plans

(Seeking Funding)

- Install Tail & Better Batteries in Delta-11
- Build Improved Version based on Zero MC



What Did I Learn Riding 13,000 Miles Electric?

- Range Anxiety is a Myth: (60 mile range is ample for 95% of my commuting.)
- Vehicles are parked more than they are driving.
- If vehicle were plugged in at each stop during running errands, the vehicle would be fully charged after each stop.
- Average commuting speed is 40mph.
- Fast & Easy Plug-in is key to painless EV's

Charge Point America

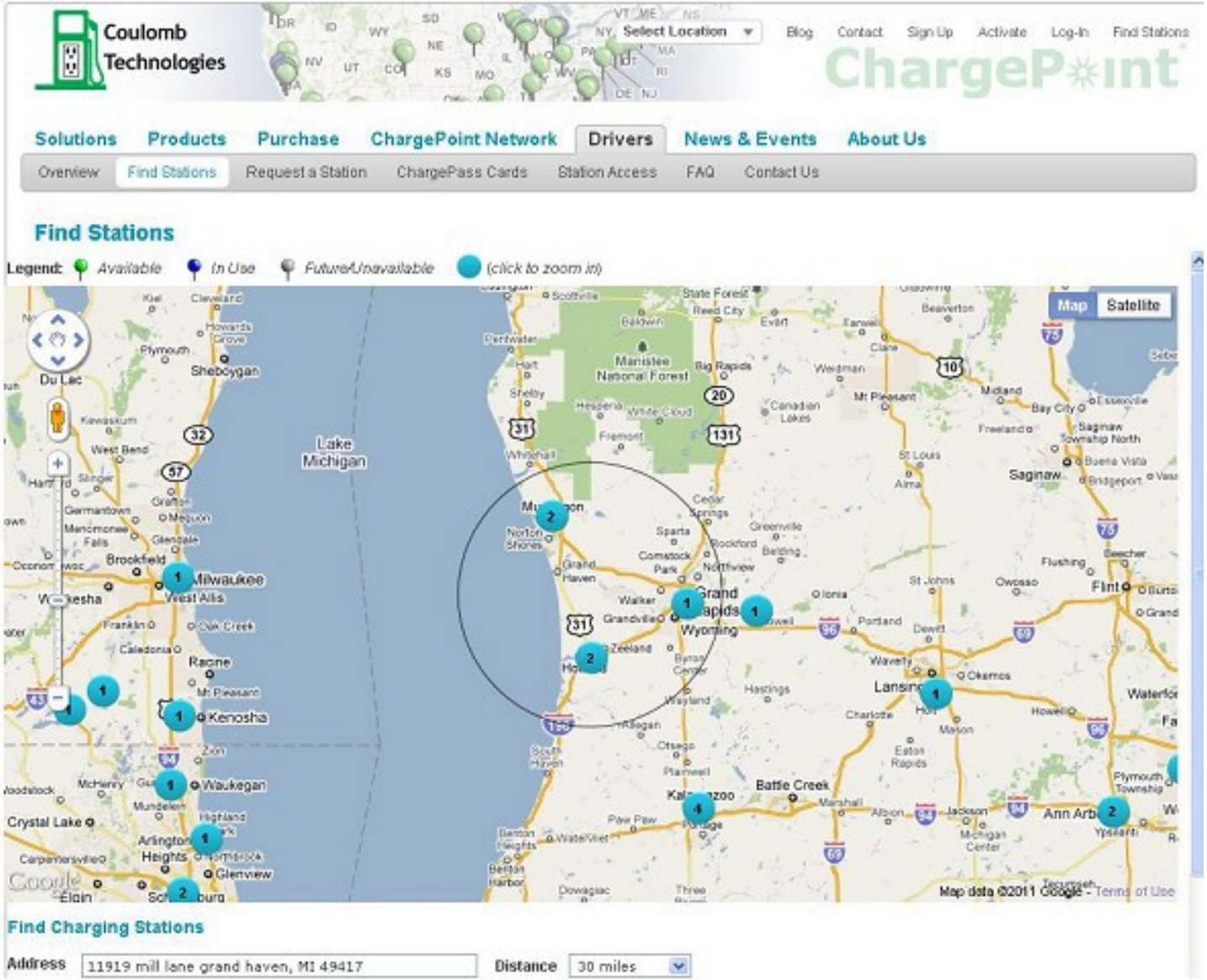
http://www.chargepoint.com/blog/

- Sponsored by US Dept. of Transportation
- $15 Million Matching Grant
- 4,600 Charging Stations Installed
- Taxpayer Average cost/Install = $3,300
- Data collected and shared by DOT for understanding vehicle charging patterns

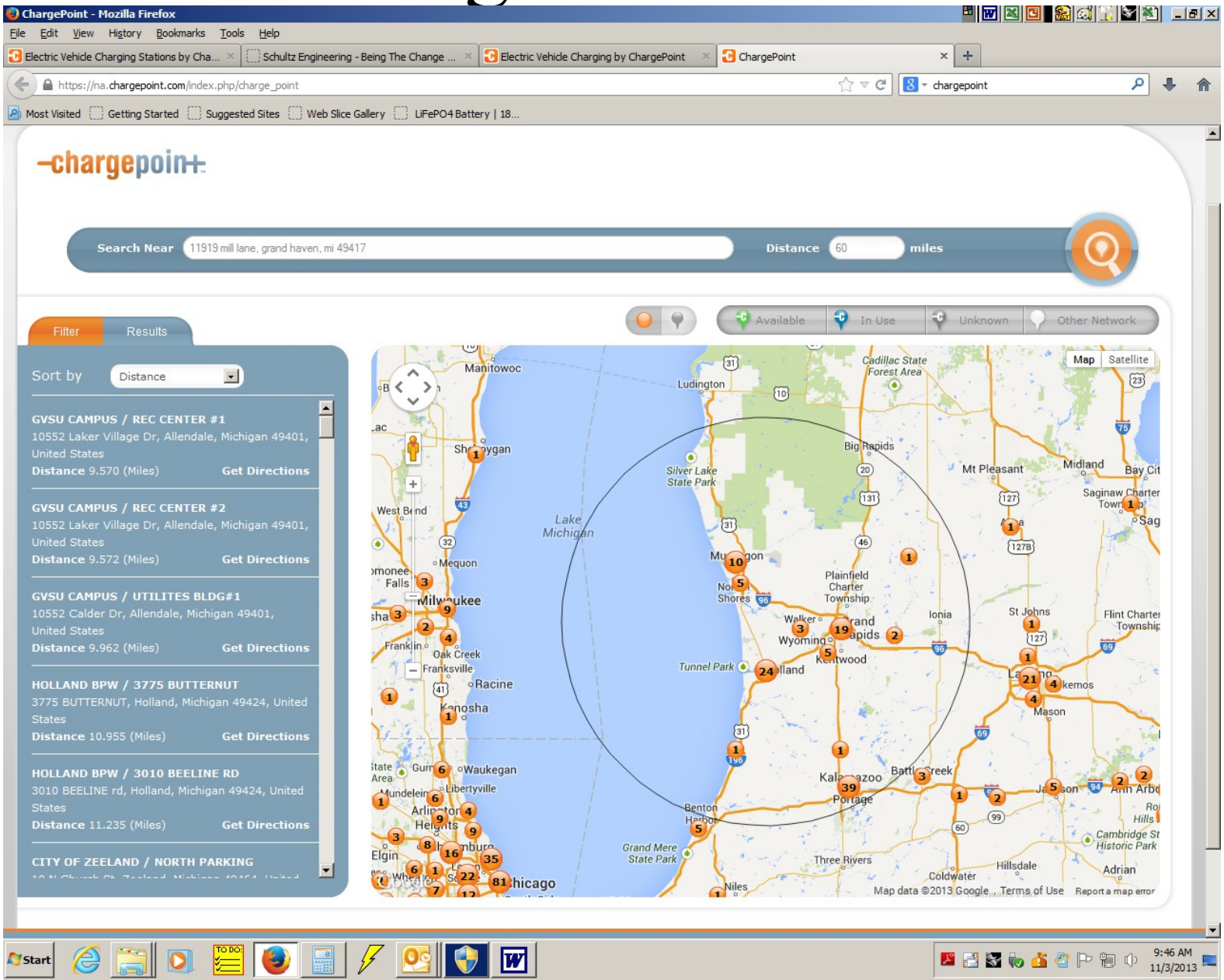
Charging with J1772

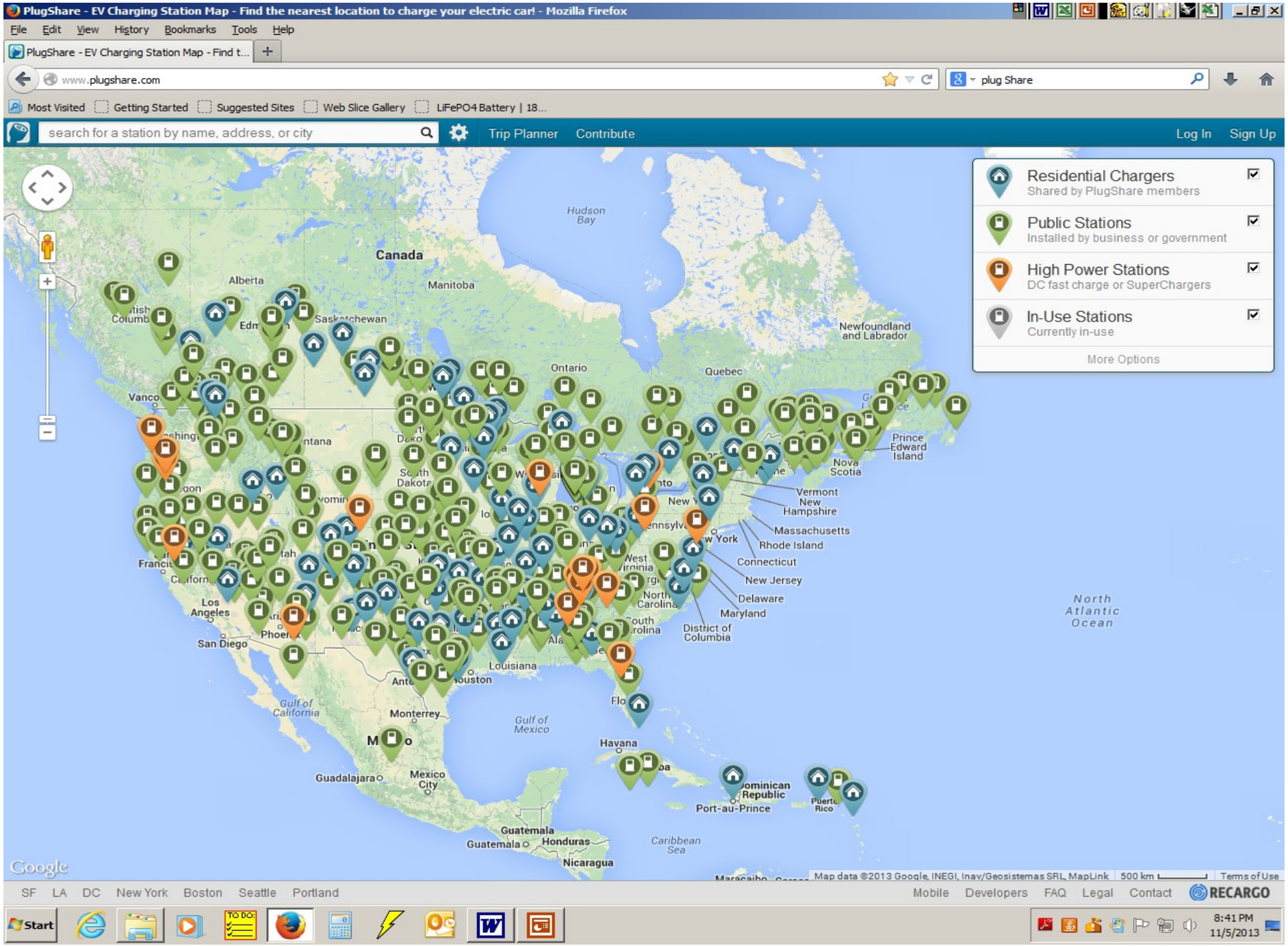
- Smart phone apps show where the charging stations are.
- Public Charging Network is expanding rapidly

March 2011 Chargepoints



60 Mile Range November 2013

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Saskatchewan
Ontario
Quebec
Newfoundland and Labrador
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Nova Scotia
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New Hampshire
Massachusetts
Rhode Island
Connecticut
New Jersey
Delaware
Maryland
District of Columbia
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Los Angeles
San Diego
Louisiana
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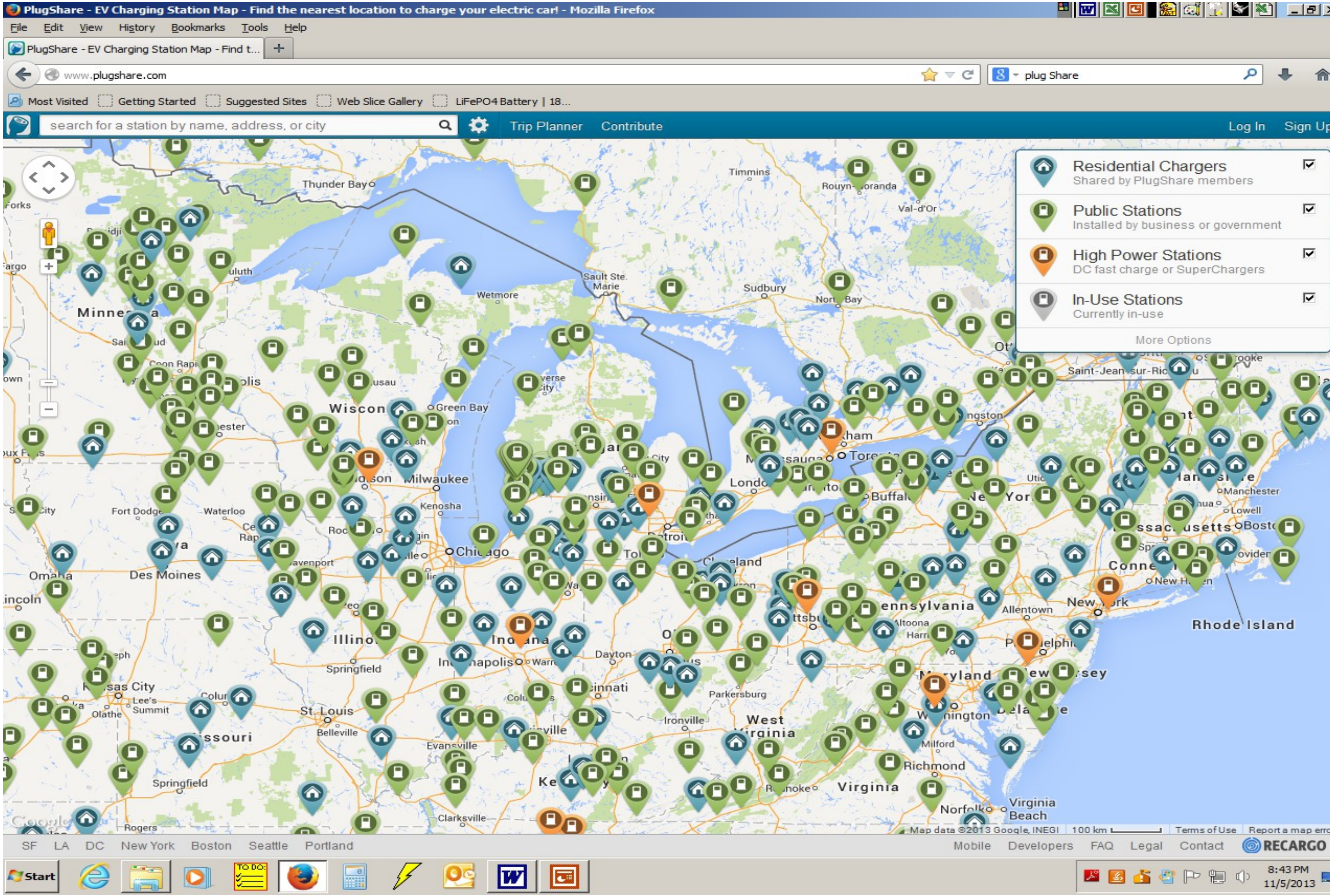
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Sign Up
Residential Chargers
Shared by PlugShare members
Public Stations
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High Power Stations
DC fast charge or SuperChargers
In-Use Stations
Currently in-use
More Options
Thunder Bay
Timmins
Val-d'Or
Sault Ste. Marie
Sudbury
Wetmore
Green Bay
Milwaukee
Kenosha
Waterloo
Fort Dodge
Des Moines
Davenport
Springfield
St. Louis
Belleville
Evansville
Clarksville
Dayton
Parkersburg
Ironville
Richmond
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Virginia Beach
Rhode Island
Allentown
Altoona
Manchester
Lowell
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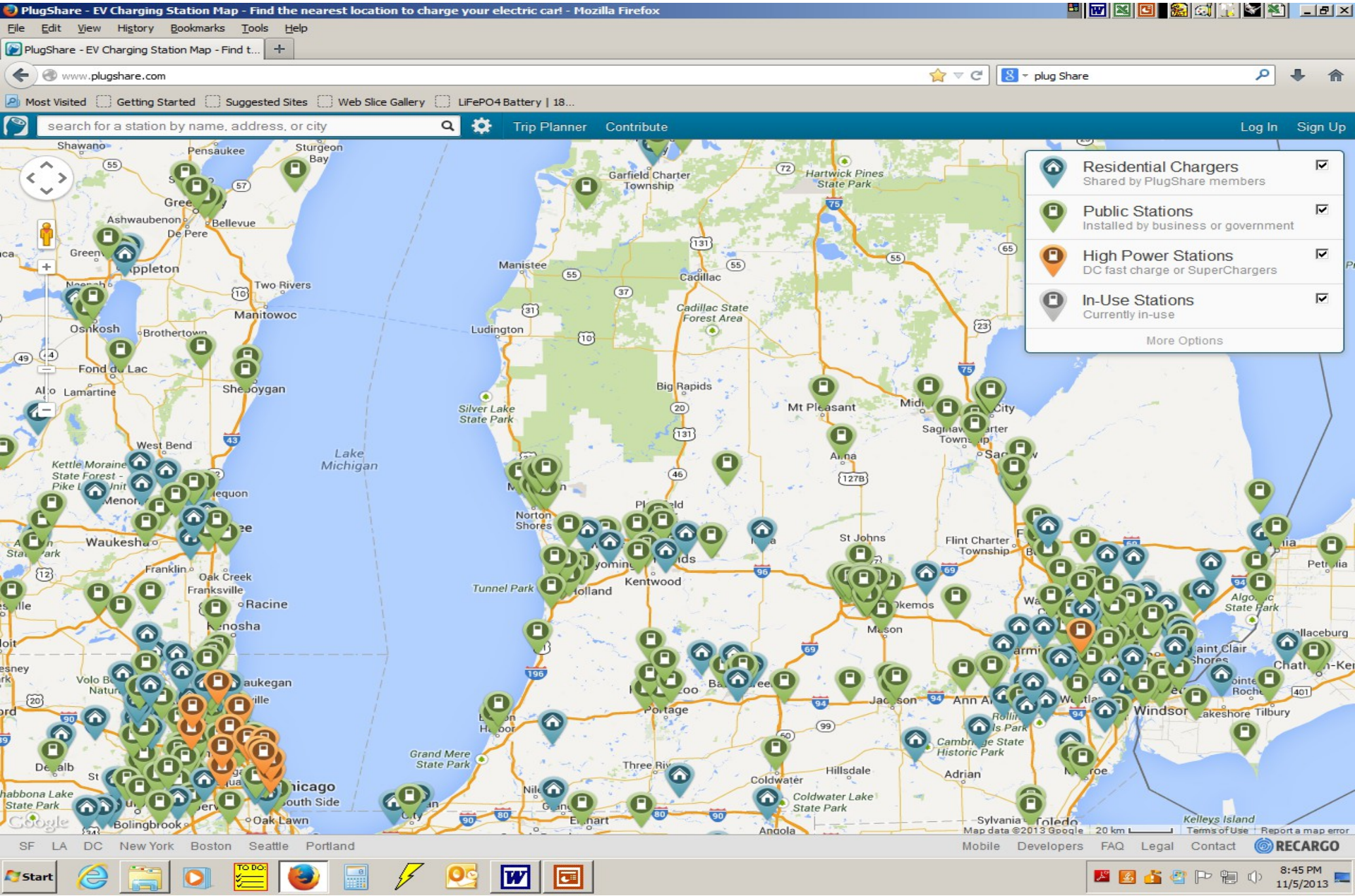
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DC fast charge or SuperChargers
In-Use Stations
Currently in-use
More Options
Lake Michigan
Map data ©2013 Google
20 km
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Report a map error
SF LA DC New York Boston Seattle Portland
Mobile Developers FAQ Legal Contact
RECARGO
Start
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Level 1 or Level 2?

http://aprs.org/payin-to-plugin.html

Level 1

110V, 15 Amp

$6,000 Level 2

220V, 30 Amp

Electric Vehicle Charging
(skip next 6 slides?)

- Vehicles are parked more than they are driven, so charge time is not as important as one might think.

Charging At Work

http://aprs.org/payin-to-plugin.html

Employee's pay for coffee mess
and yet get free electricity

SAME = LOAD

We dont want free electricity, we want to pay for it, and simply be allowed to plugin!

Level 1 Good Enough For Work

http://aprs.org/payin-to-plugin.html

Instead of Promoting the limits on L1

Vehicle	Hours to charge
Prius PHEV	4
Volt	11
Leaf	17
Tesla	36

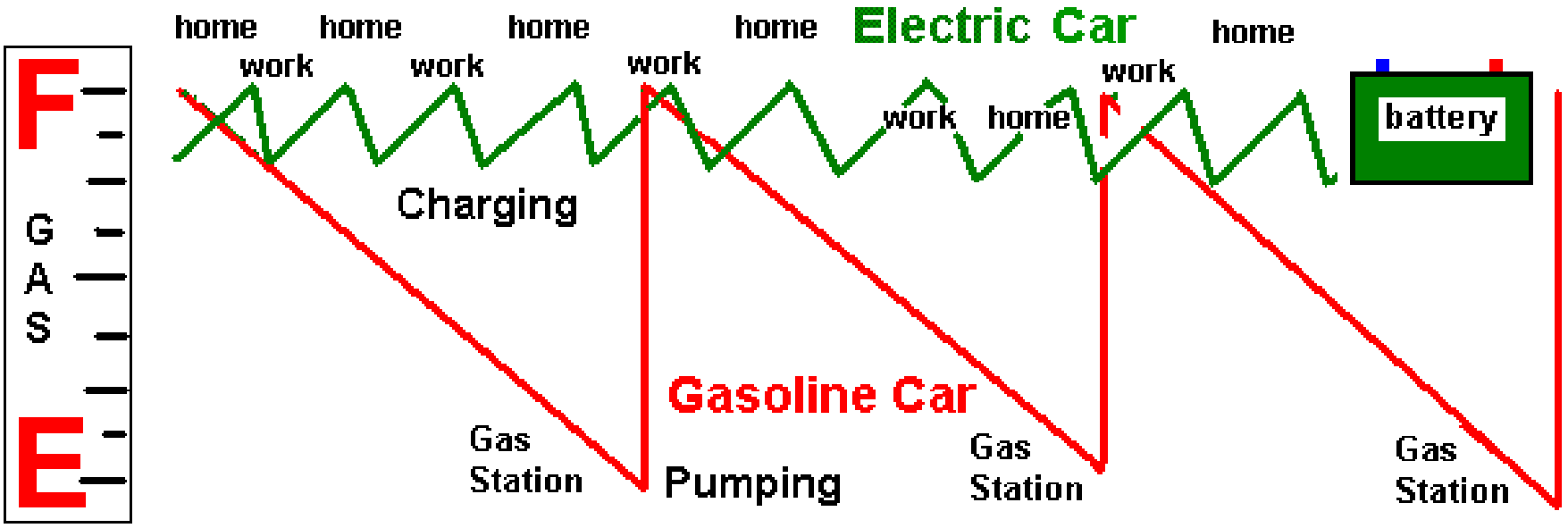
We should be showing the Benefits of L1:

Vehicle	Miles in 8 hrs
Prius PHEV	15 4 hrs
Volt	32
Leaf	32
Tesla	32

double this by charging at work too

EV's More like a Cell Phone

http://aprs.org/payin-to-plugin.html



Charging At Work

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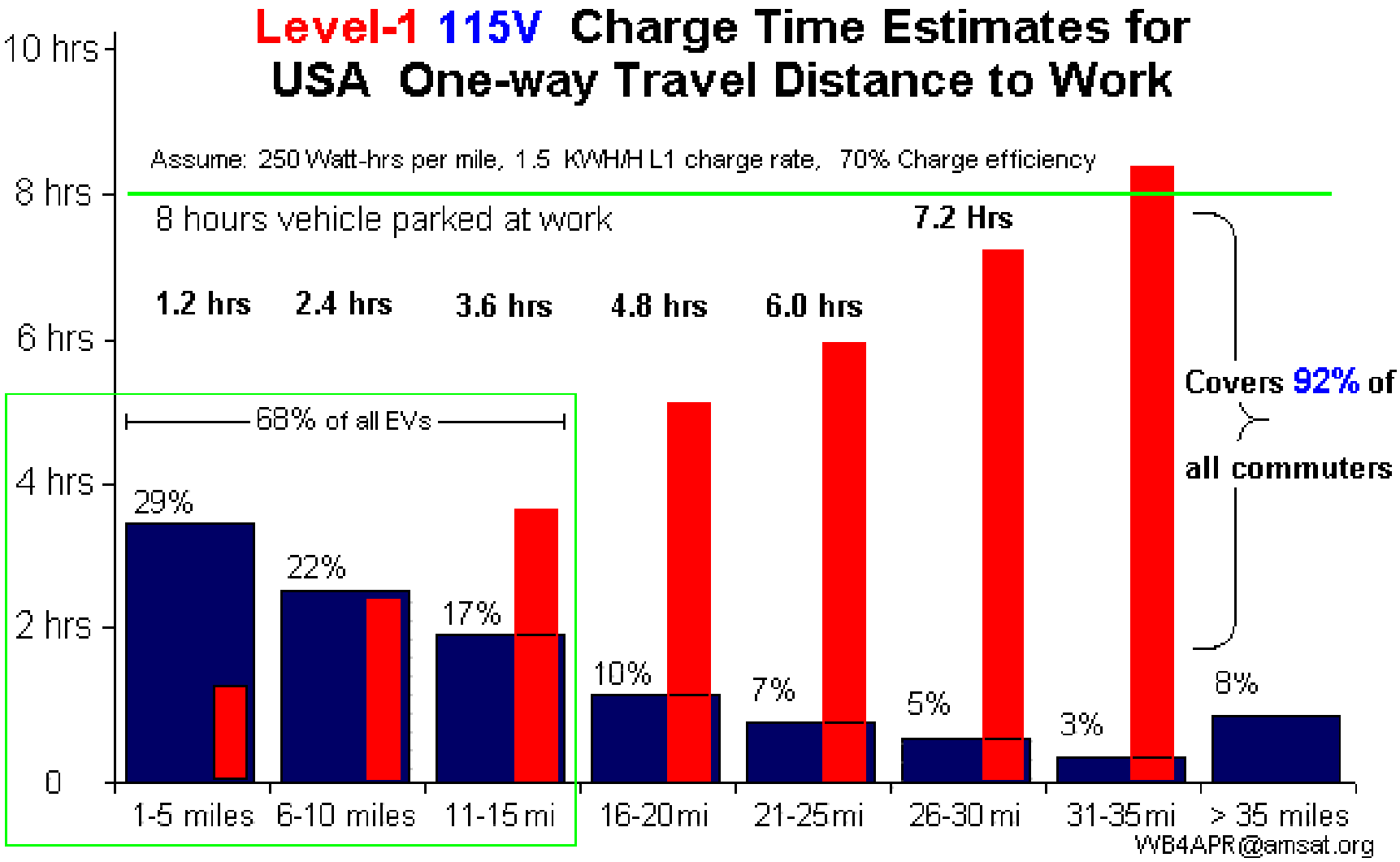

Charging At Work

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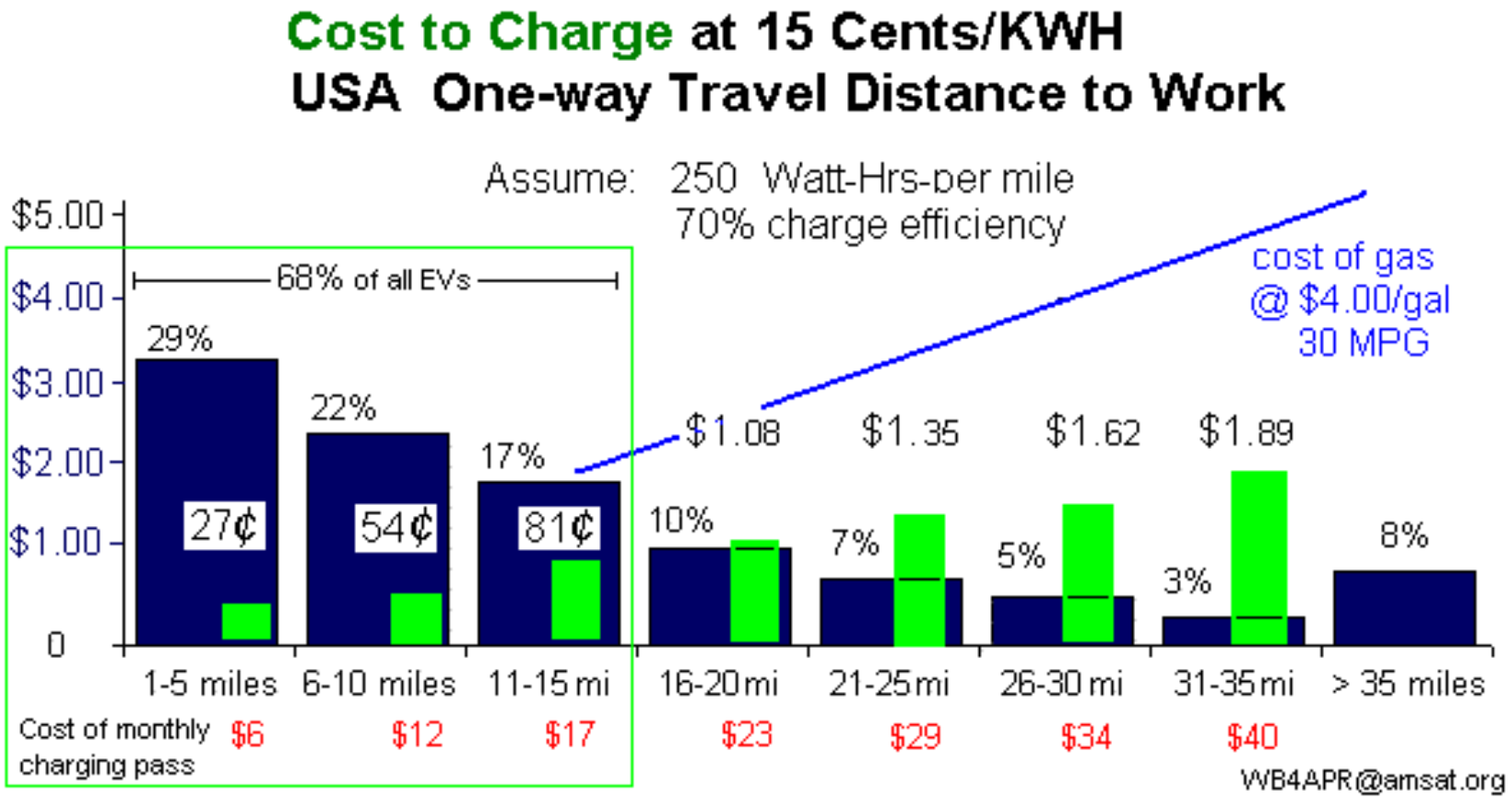
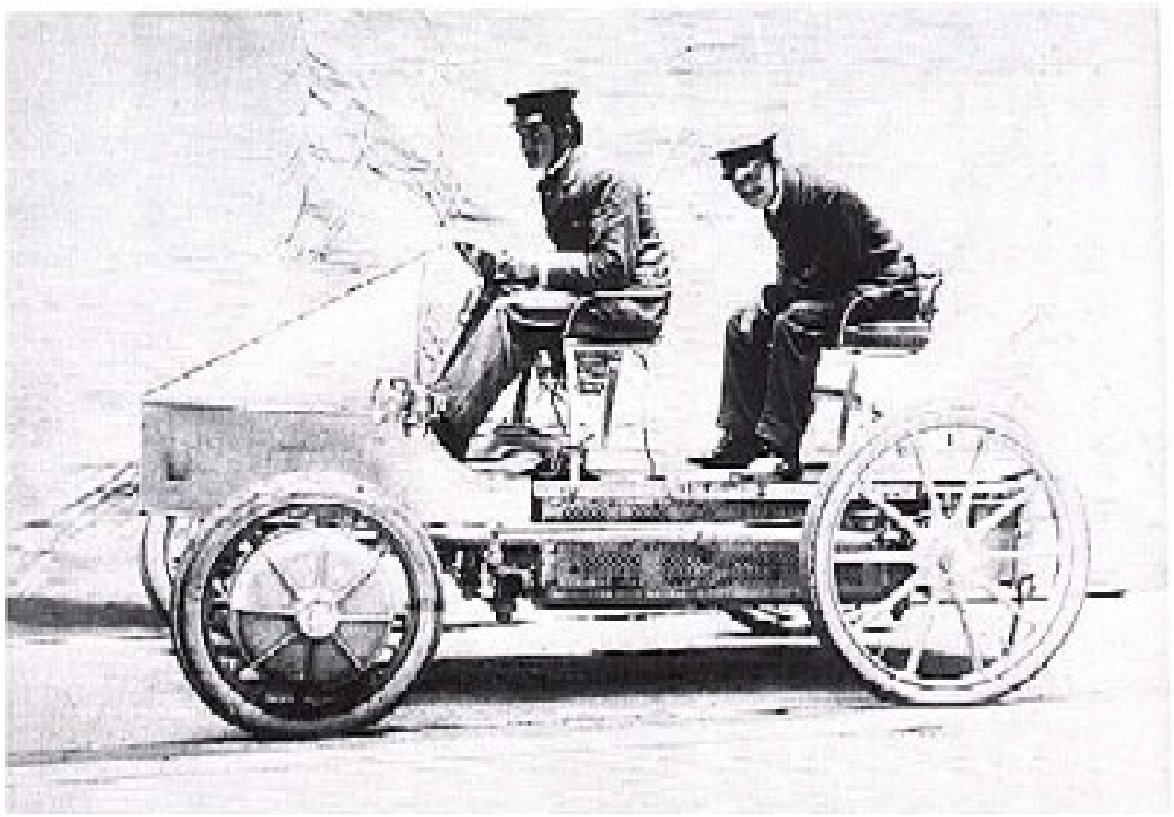


History of EV's

The Past: 1900

- Steam?
- Gasoline?
- Electric?



1900: Ferdinand Porsche's First Car – Electric Hub Motors!

In 1900, there were more electric automobiles on New York City streets than cars powered by gasoline. True, there were only 4,192 cars sold in the United States that year, but 1,575 of them were electric. The advantages were obvious — electrics were quiet, clean, and easy to use. Battery power looked like the ideal choice for personal urban transportation (For what it's worth, both electrics and gas-engined cars were both beaten in sales by steam-powered cars — 1,681 of them, to be precise — but who the hell really thinks steam still makes sense?).

Electric Vehicle Issues in Year 1900 and 2013

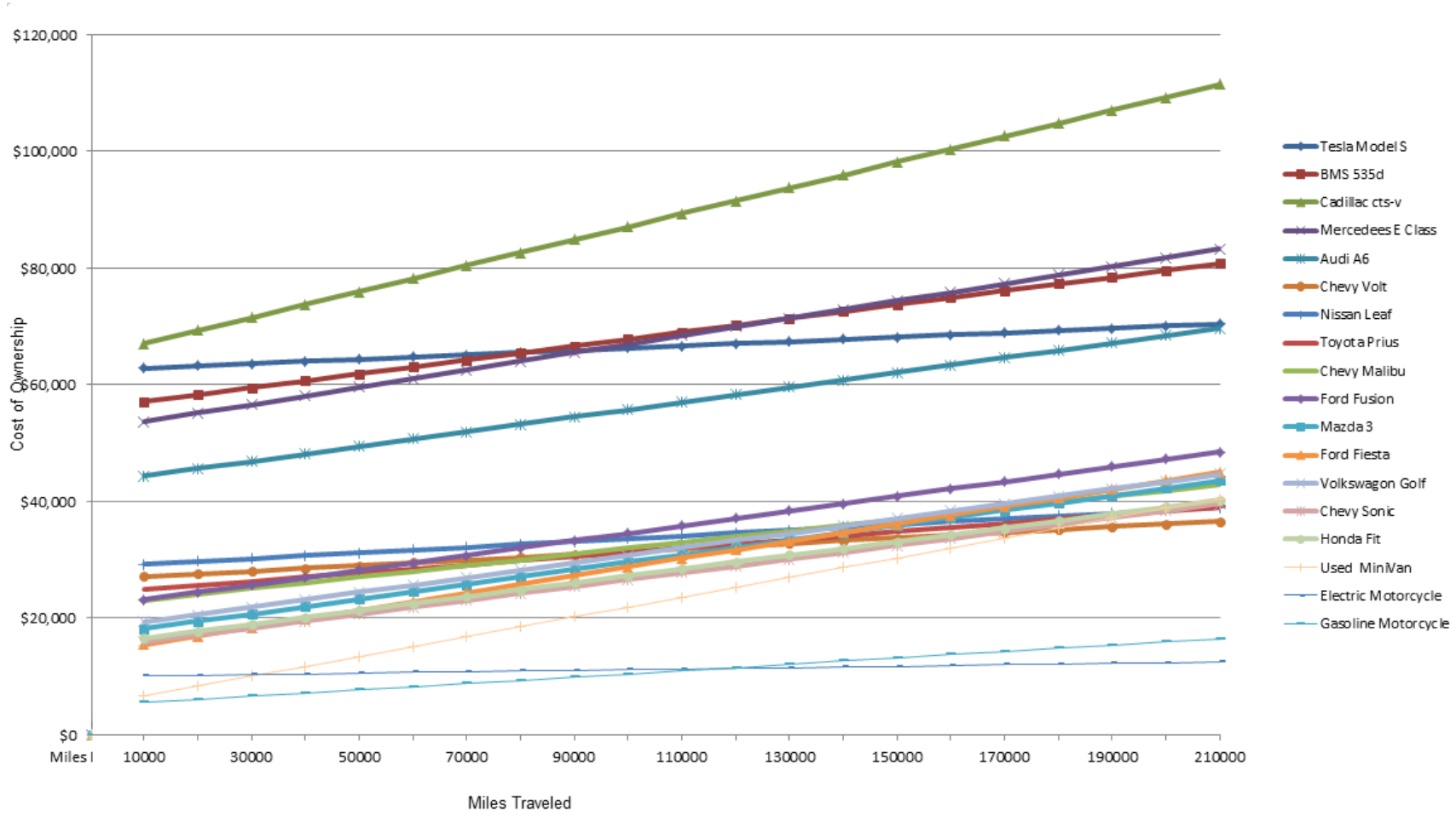
- Limited Recharging Locations (Remember, less than 10% of homes had electricity in 1900)
- Limited Range - Could not tour
- Relatively Long Recharge Time
- Low Battery Life if Not Charged Correctly

The Future: Limiting Factors

- Touring Range
  - Battery Capacity
- Cost Per Mile
  - Battery Cost

Electric Car ROI Chart

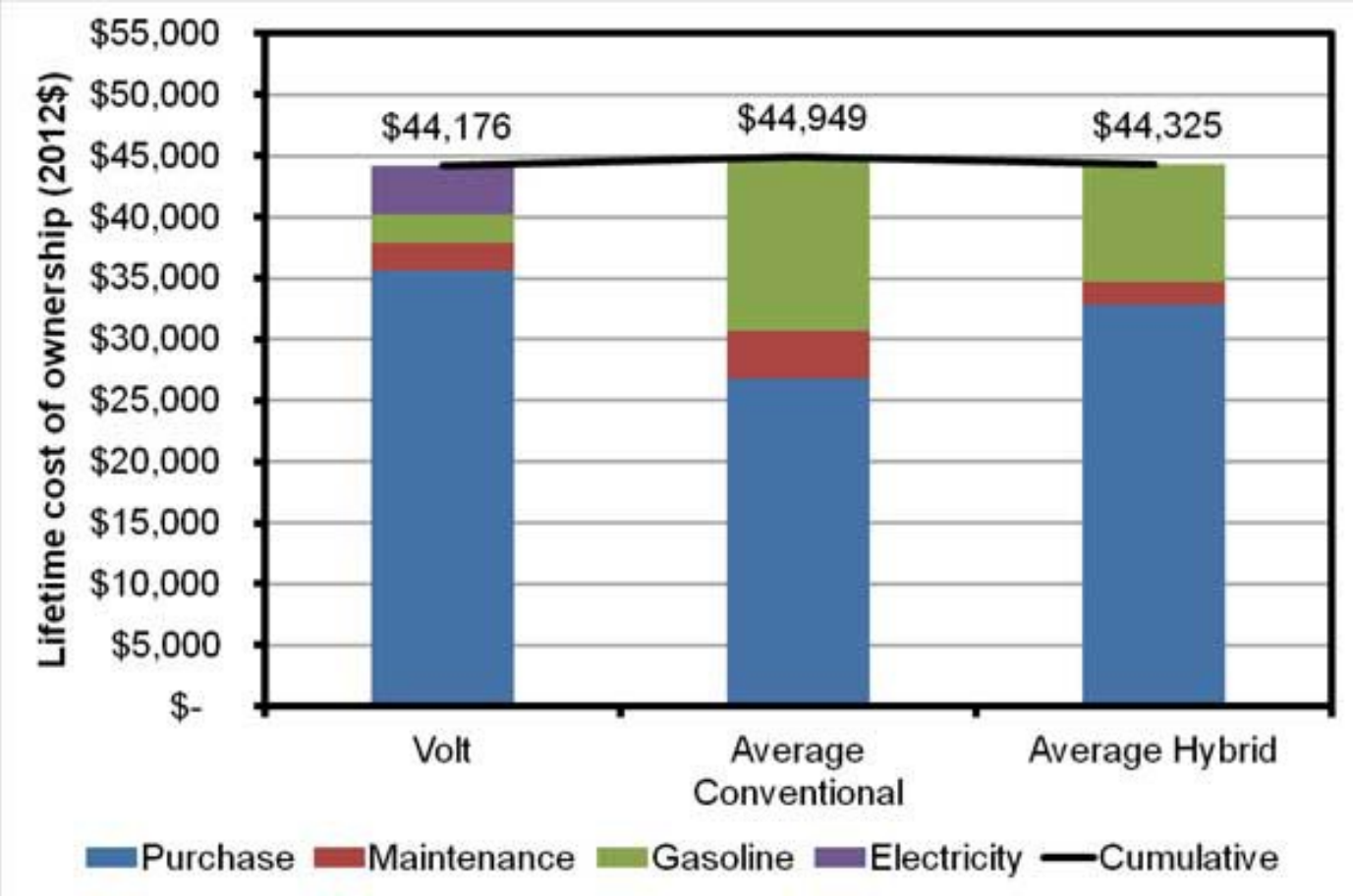
Link to Spreadsheet



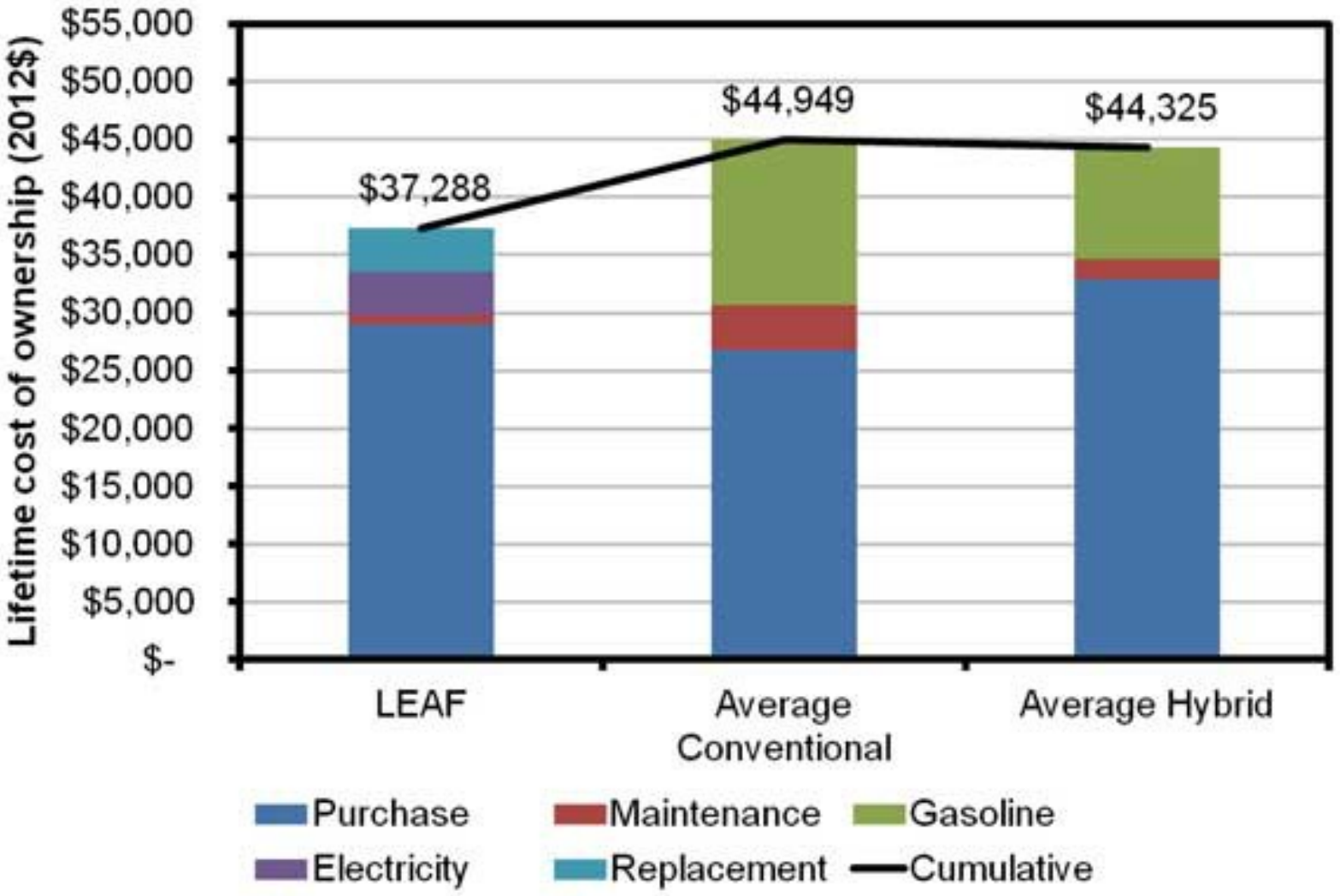
EV ROI?

- Look at the chart, people don’t buy cars for ROI!
- People are going to buy EV’s because they are BETTER than what they currently drive.

Electric Car ROI



Electric Car ROI



State of EV Industry

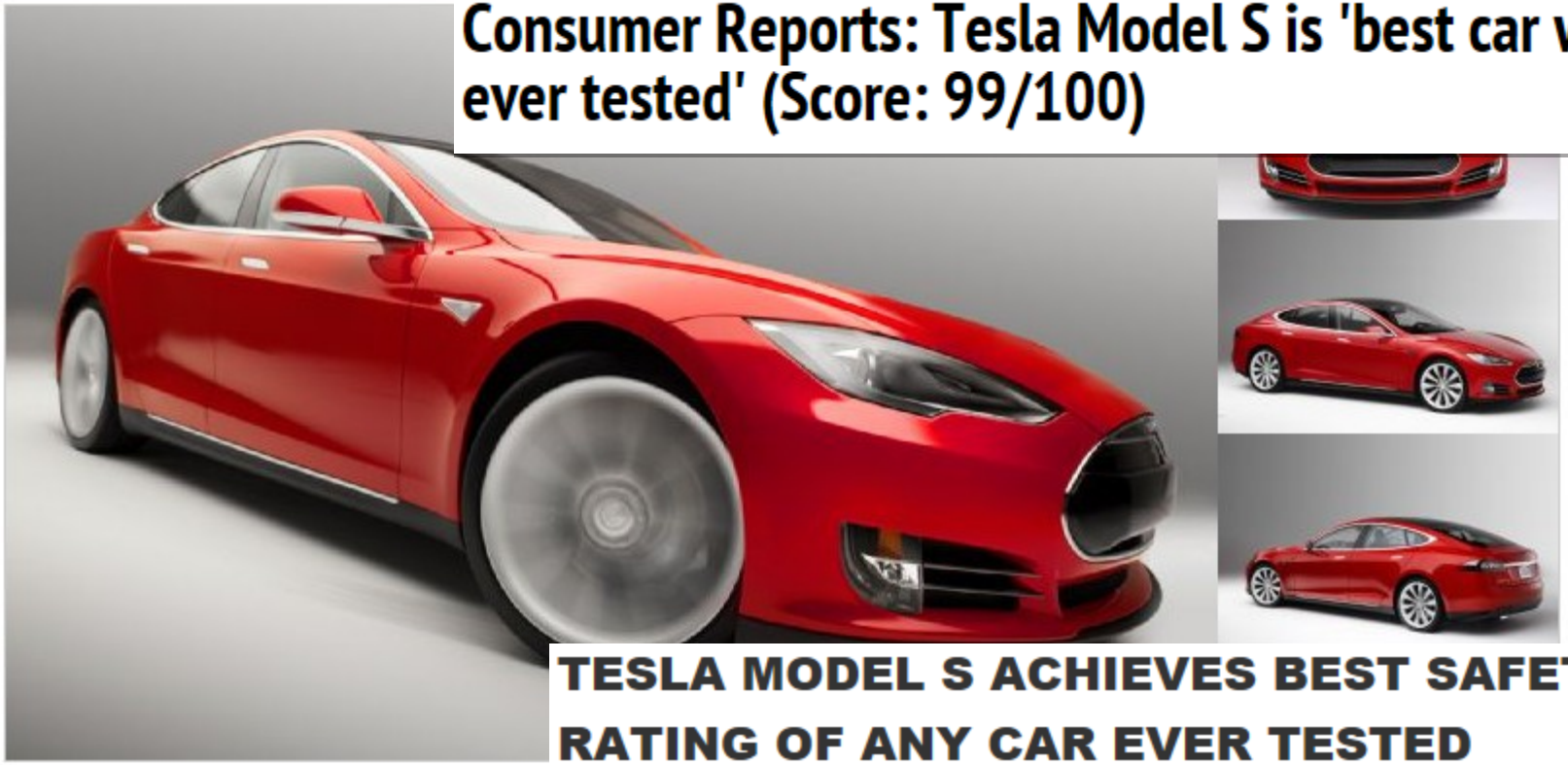
Tesla Model S $125K

2013 Motor Trend Car of the Year: Tesla Model S

Shocking Winner: Proof Positive that America Can Still Make (Great) Things

By Angus MacKenzie | Photos By Andrew Yeadon, Motor Trend Staff | From the January 2013 issue of Motor Trend | 644

Consumer Reports: Tesla Model S is 'best car we've ever tested' (Score: 99/100)



TESLA MODEL S ACHIEVES BEST SAFETY RATING OF ANY CAR EVER TESTED

SETS NEW NHTSA VEHICLE SAFETY SCORE RECORD

MONDAY, AUGUST 19, 2013

Tesla Model S Specs

- 85 kWh or 60 kWh Battery!
- 301 or 232 Mile Range
- $125,000 or $62,500

State of EV's Industry

$17K Motorcycle

2014 Zero Motorcycles: Up To 171 Mile Range, 0-60 MPH As Quick As 3.3 Seconds

November 5, 2013 at 11:10:00 PM by Basem Wasef | Comments

Electric vehicles are still finding their place in this brave new world, duking it out with internal combustion and alternative propulsion machines for consumer attention. As such, Scotts Valley, California-based Zero Motorcycles has played both the mileage game and the hot rod card, and their just-unveiled 2014 lineup encompasses an even wider swath of those extremes than ever before.

Consider, for instance, the new SR model (pictured), an "R" spinoff of the "S" model that boosts horsepower by 24 percent and torque 56 percent. The added grunt hustles this guy (the only Zero available in red, incidentally) to 60 mph in a supercar-like 3.3 seconds.

If range is your concern (as it likely is), Zero now offers a 2.8 kW accessory battery that occupies the

2014 Zero Model SR Specs.

- Range = 171 City, 106 Highway
- Torque = 106 ft-lb
- 67 hp
- 0-60 in 3.9 seconds
- Top Speed 102 mph
- Battery life: 385,000 miles
- Price: $17,000

Conclusion

You will buy an EV not to save money, but because it is a better performing vehicle.

ENERGY

No One Cares About The Planet…

Until it hits their pocket book.

Electric Residential Service

Rate: 1000

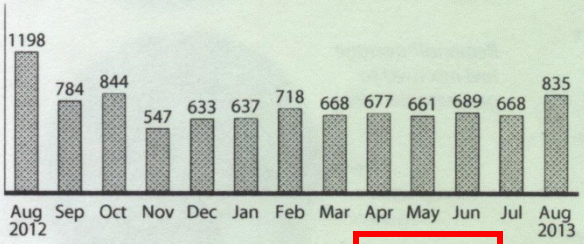
Kilowatt-hours used: 835 kWh

Meter reading: 951 - 1786 (estimate)

Meter Number: [redacted] POD: [redacted]

Electric Power Supply Charges		
Energy-First 600 kWh	600 @ 0.083791	$50.27
Energy-Over 600 kWh	235 @ 0.118791	$27.92
PSCR	835 @ 0.001570-	$1.31-
Renewable Energy		$0.52
Electric Delivery Charges		
Green Generation Block	1 @ 1.500000	$1.50
System Access		$7.00
Distribution	835 @ 0.043794	$36.57
Energy Efficiency	835 @ 0.002579	$2.15
Securitization	835 @ 0.001387	$1.16
Securitization Tax	835 @ 0.000682	$0.57
Total Electric		**$126.35**

Power supply charges include generation and transmission costs based on the amount of kWh used. Consumers Energy does not make a profit on the cost of fuel or purchased power.



August Electric use	835 kWh
Electric use per day	29 kWh
Electric cost per day	$4.36

Account Number: [redacted]

Service: [redacted]

GRAND HAVEN MI 49417-8700

Last Month's Account Balance	$102.63
Payment 07/26/13 - Thank You	$102.63-
Balance Forward	**$0.00**

Payments applied after Aug 01, 2013 are not included.

Total Electric	$126.35
Sales Tax	$5.05
Total Energy Charges	**$131.40**
Total Amount Due	**$131.40**
Billing Period	07/03/13 - 07/31/13
Bill Month	August
Days Billed	29
Invoice	205007451449

Your next scheduled meter read date is on or around 08/29/2013.

Your payment is due August [redacted], 2013. After the due date, the unpaid balance is subject to a 2% late payment charge.

News You Can Use

For the average Michigan residential customer, renewable energy is estimated to avoid $3.90 per month of new coal-fired generation costs. Customers are expected to save $3.71 each month over the life of the Energy Efficiency programs.

Go to www.michigan.gov/rendocs to view the Michigan Public Service Commission (MPSC) annual report on renewable energy and advanced cleaner energy.

$131.40 Total Bill

divided by

835 kWh = $.16 / kWh !

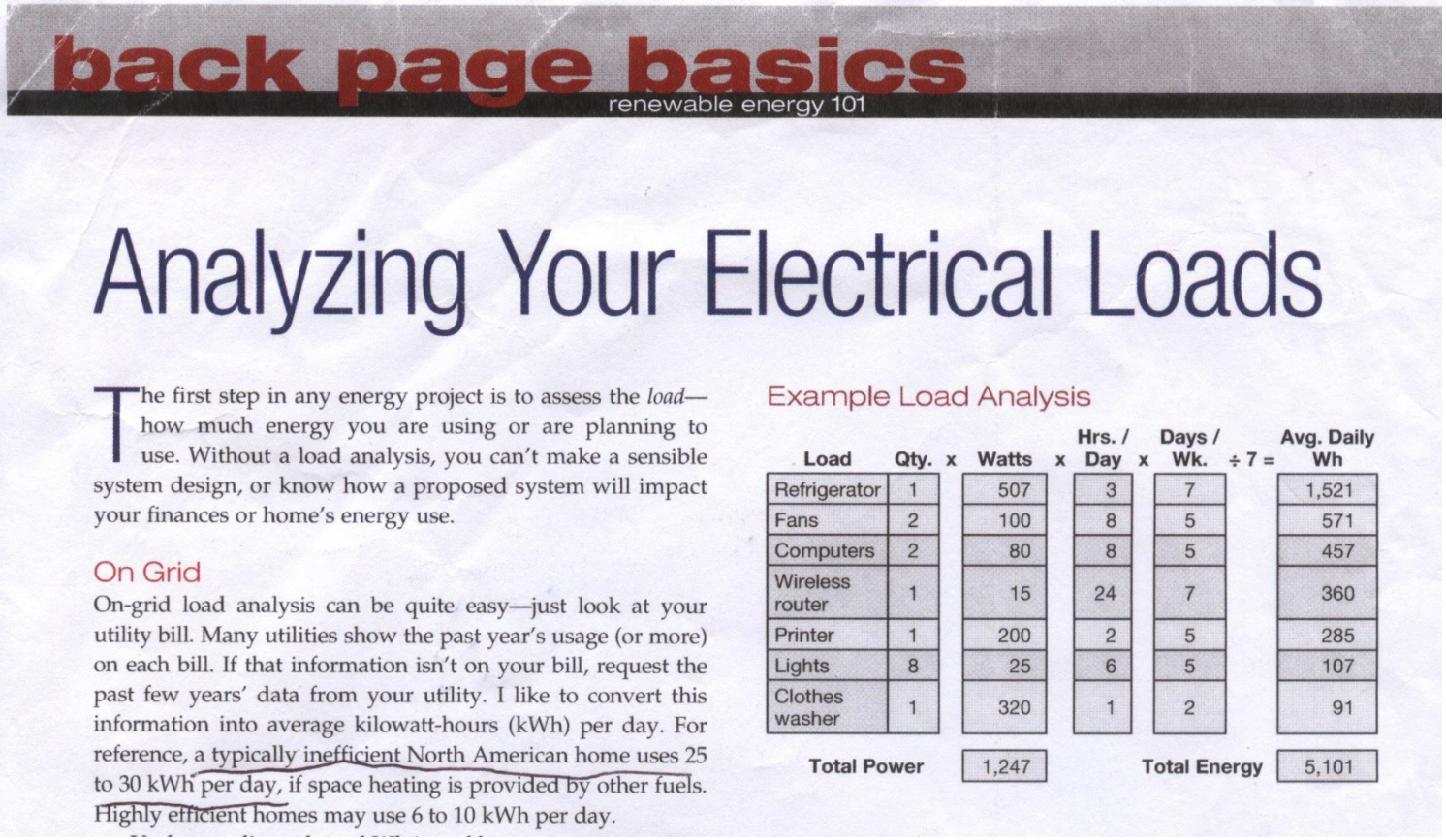
Consumers Energy

Count on Us

Visit: **www.ConsumersEnergy.com**

Form 3818 7-2013
(Form Page 1 of 2)

Average N. American



back page basics

renewable energy 101

Analyzing Your Electrical Loads

The first step in any energy project is to assess the *load*—how much energy you are using or are planning to use. Without a load analysis, you can't make a sensible system design, or know how a proposed system will impact your finances or home's energy use.

On Grid

On-grid load analysis can be quite easy—just look at your utility bill. Many utilities show the past year's usage (or more) on each bill. If that information isn't on your bill, request the past few years' data from your utility. I like to convert this information into average kilowatt-hours (kWh) per day. For reference, a typically inefficient North American home uses 25 to 30 kWh per day, if space heating is provided by other fuels. Highly efficient homes may use 6 to 10 kWh per day.

Example Load Analysis

Load	Qty.	x	Watts	x	Hrs. / Day	x	Days / Wk.	÷ 7 =	Avg. Daily Wh
Refrigerator	1		507		3		7		1,521
Fans	2		100		8		5		571
Computers	2		80		8		5		457
Wireless router	1		15		24		7		360
Printer	1		200		2		5		285
Lights	8		25		6		5		107
Clothes washer	1		320		1		2		91
Total Power			1,247				**Total Energy**		5,101

What is Your Bill?

- Everyones bill is different, some of us have bigger houses, workshops, electric vehicles, electric ranges, extra refrigerators, or even electric heat. What is your kWh/Month by raise of hands:
- How many are under 500 kWh per month?
- How many are between 500 and 1000?
- How many are between 1000 and 1500?
- How many are over 1500 kWh per month?

How to Size a Solar PV Array

- Rule of Thumb: With Michigan's yearly sunlight profile, a 1,000W array will put out about 1,000 kW/Year

Local Installer Example

Paw Paw Michigan

Paw Paw Michigan Example:

This is an example of a seasonally (winter, spring, summer and fall) adjustable ground mount solar panel racking system in Paw Paw, Michigan.

This 3KW system is composed of twelve 250 watt solar panels with a 4000 watt grid tie inverter.

The system would run for about $16,500 with a data logger.

So, if we assume similar output from a 3kW system that would be 4,200 kWh/Year.

If we go after the usage over 600 kWh/Month, because Consumers zaps me with a much higher rate for that power, I'll assume a savings of $.16/kWh for each kWh the array produces.

Assuming $.16/kWh (over 600 kWh/Month Rate)
$672/Year Savings = $.16/kWh x 4,200 kWh / Year

$16,500 Installation Cost / $672 Annual Savings = 24.6 Year Payback

Are there any tax rebates or other incentives that would change this ROI calculation for most people? Yes, 30% Tax Rebate is available.

Example

- What does this mean to you? Are you going to go out and buy solar panels for your home? How much would these solar panels cost? What size would you need to purchase? What is the ROI for you personally?
- Everyone is different, so for this exercise, I'll use myself as an example, fortunately, my electricity use is right at the Average Inefficient North American users level.

Skid Mounted Example

What size should I buy? Well that depends, but for the sake of this exercise let's make the following assumptions. I'm going to size my system to run my house and charge my electric car and I'm going to install the system myself.

My house uses: 8,400 kWh/Year
My Nissan Leaf uses: 1,248 kWh/Year (100Wh/Mile * 40 miles / trip x 312 days / Year)
Total Usage: 9,648 kWh/Year

I'm going to go after the usage over 600 kWh/Month, because Consumers zaps me with a much higher rate for that power.

600 kWh/Month * 12 months = 7200 kWh/Year
2,448 System Need = 9,648 kWh/Yr Total – 7,200 kWh/Year non-premium

A 12 panel system Sunpod System would provide 3,000 Watts and cost $8760 + shipping and permitting estimated $10,000 installed cost.

Continued on Next Page...

http://www.bluepacificsolar.com/solar-energy/grid-tied-solar/3000-watt-solar.html

Skid Mounted Example

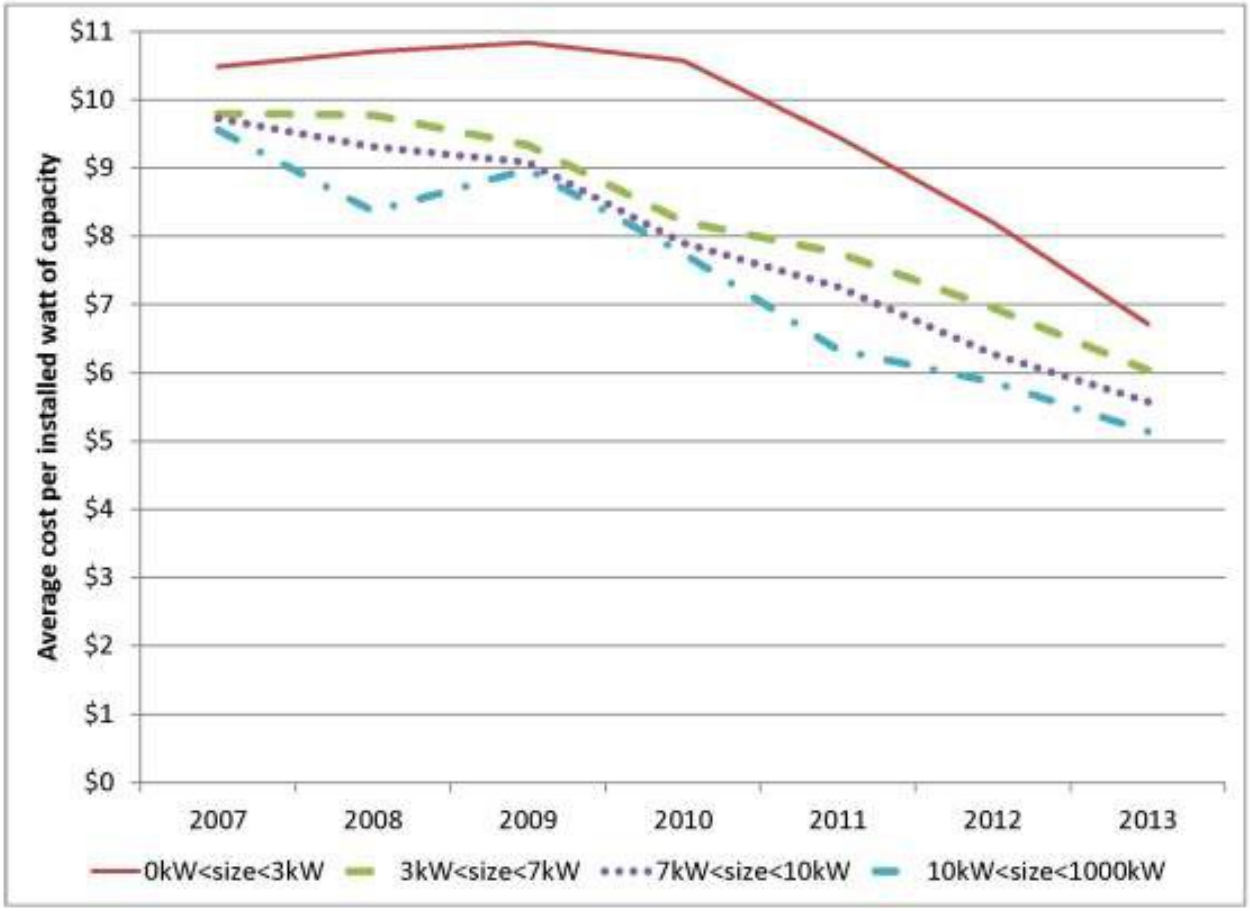
For Michigan we don't get as much sun as Arizona, so I'll assume based on numbers of other users in our areas that a 3 kW maximum output Array would produce 3,000 kWh/year.
Assuming $.16/kWh (over 600 kWh/Month Rate)
$480/Year Savings = $.16/kWh x 3,000 kWh / Year
$10,000 / $480 = 20.8 Year Payback!

Why is Payback so Poor?

- Cost per Watt Hour for Solar system installed by someone else is about 2x the cost if you were to do it yourself!

- Most people would be tempted to claim the available 30% federal tax credit

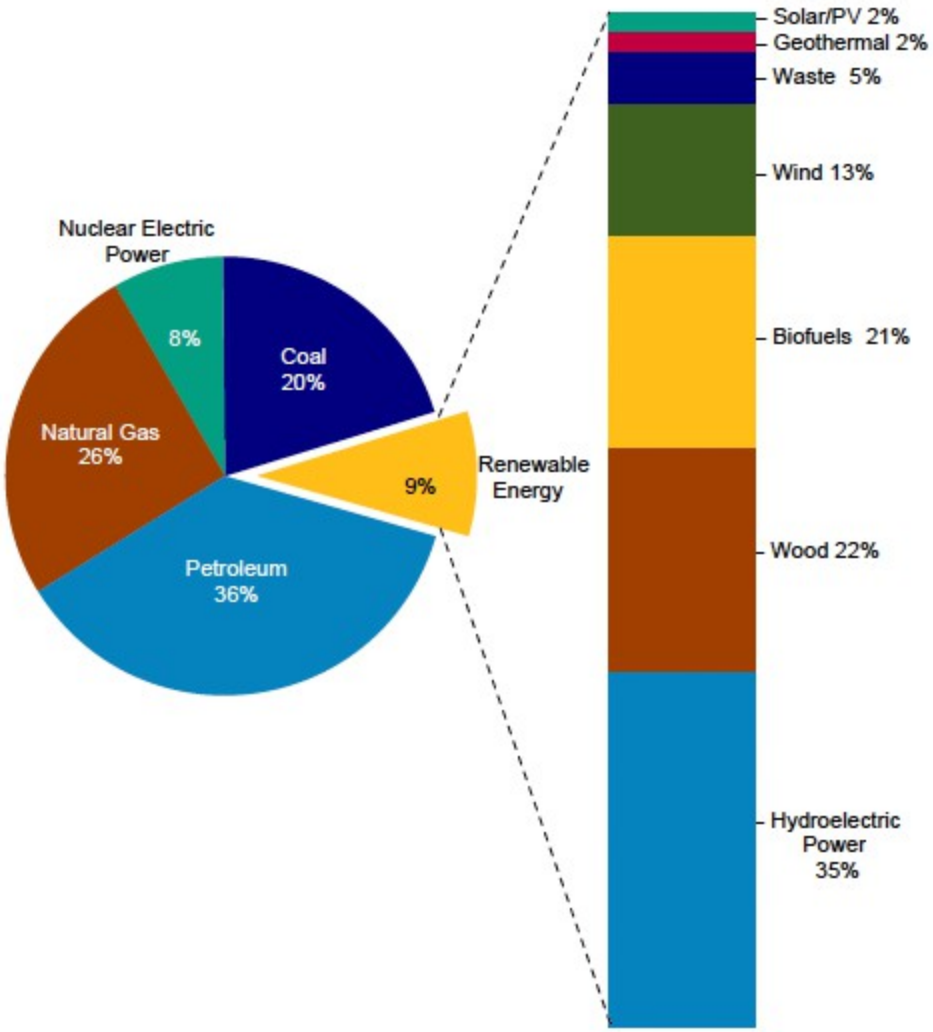
Cost of Solar Electricity Declining

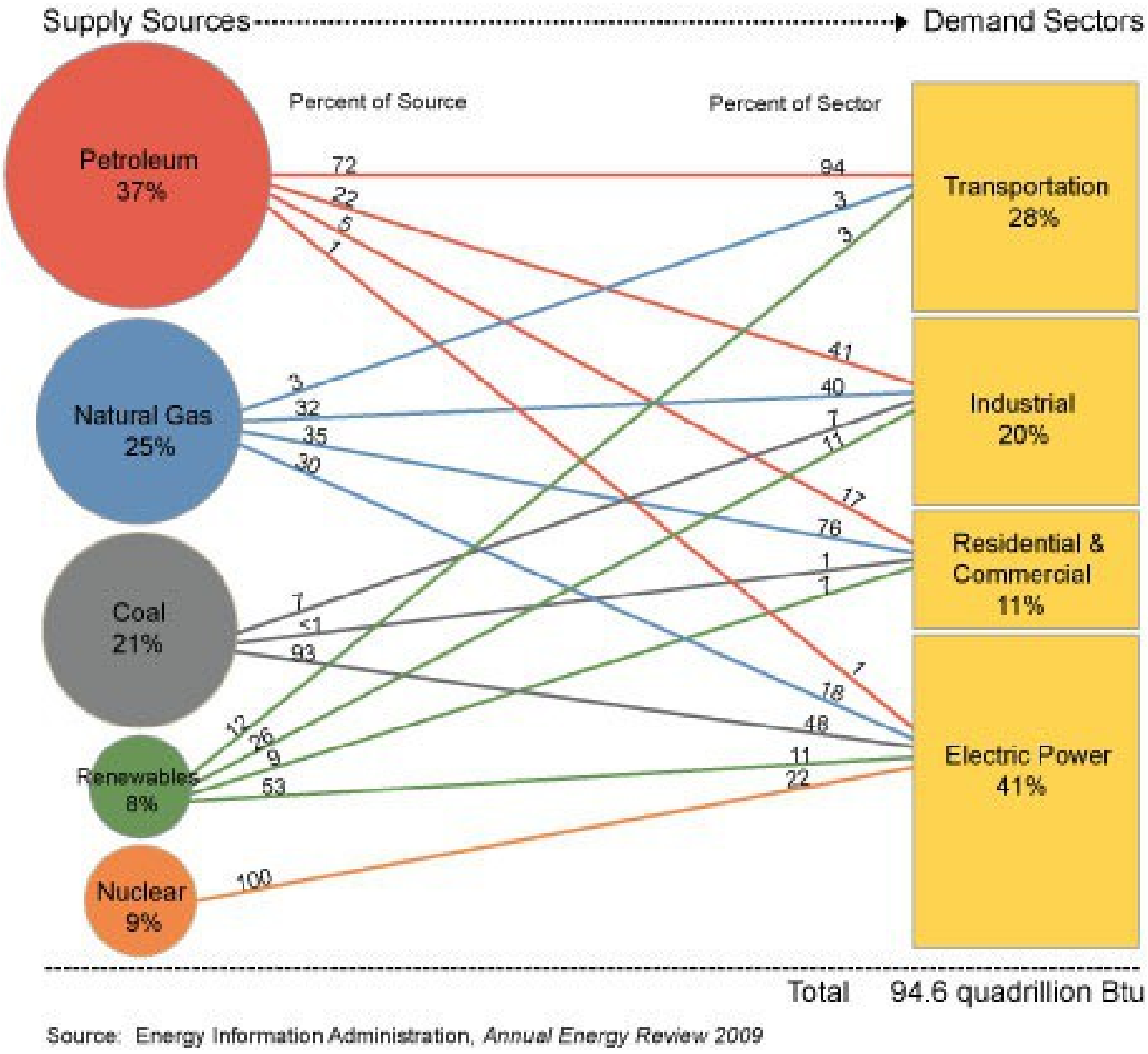


Problem with Clean Energy

It's not profitable for the established powers

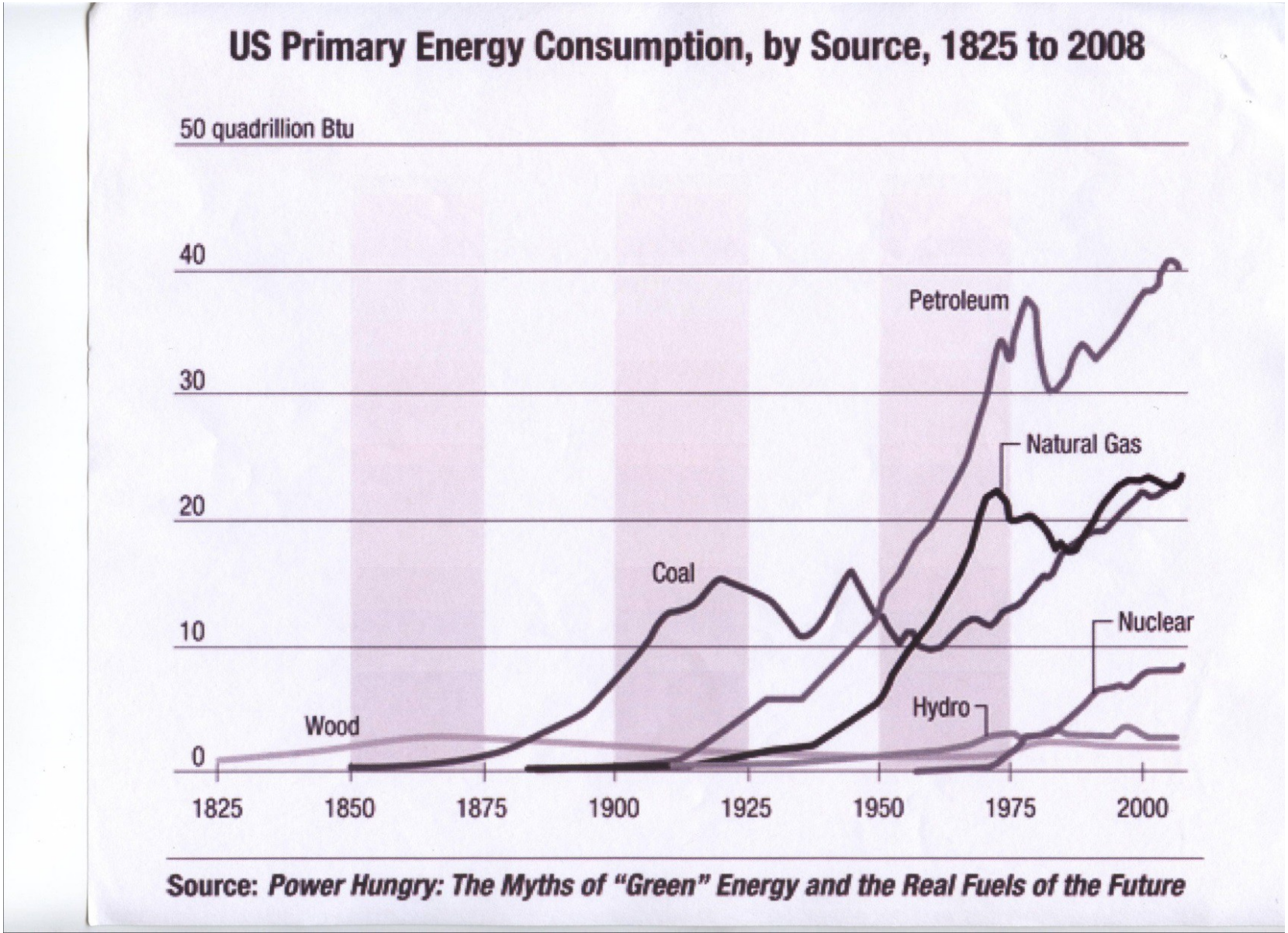
Energy Source
(All Sources)



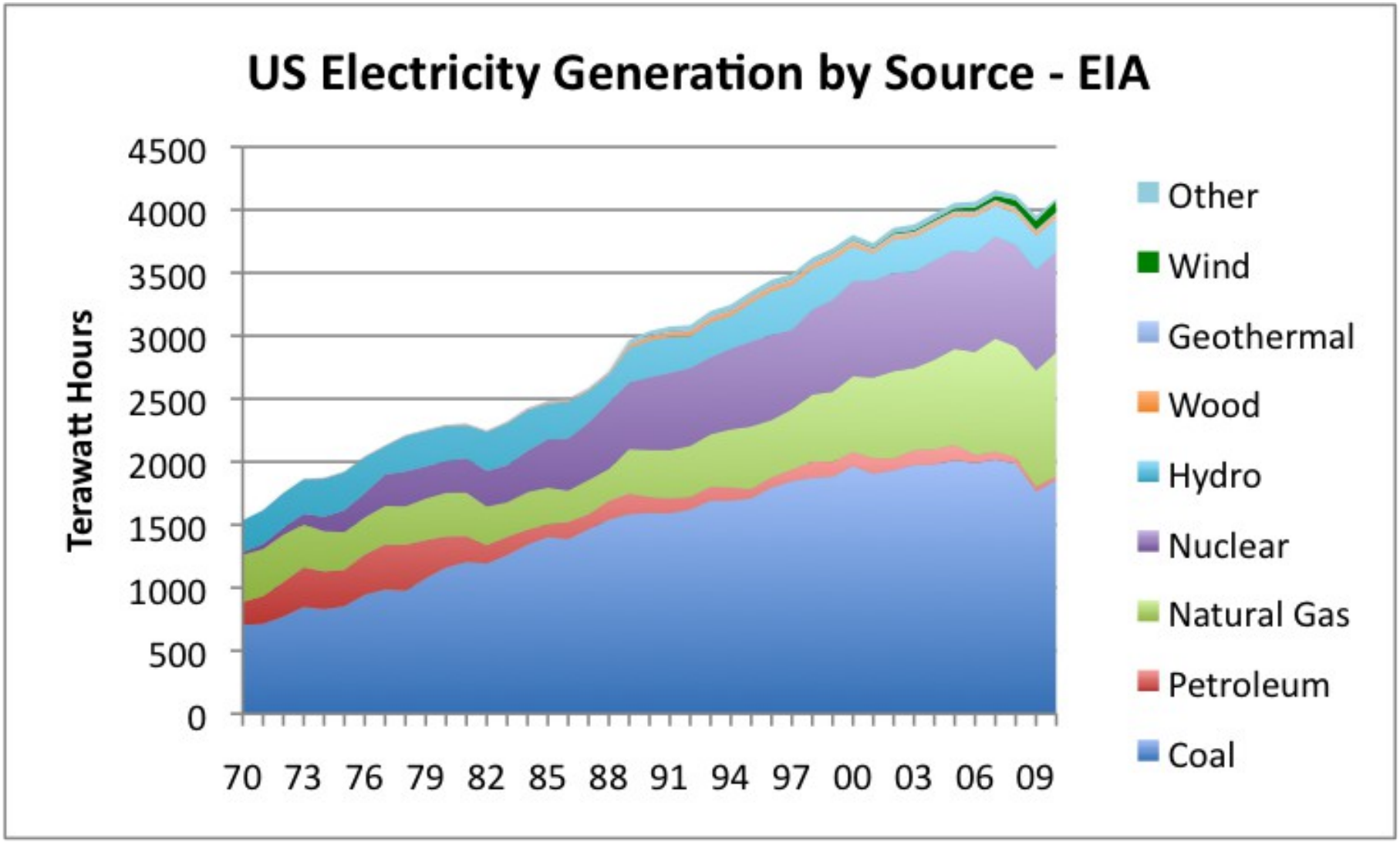


Source: Energy Information Administration, *Annual Energy Review 2009*

History of Energy 1825-2008

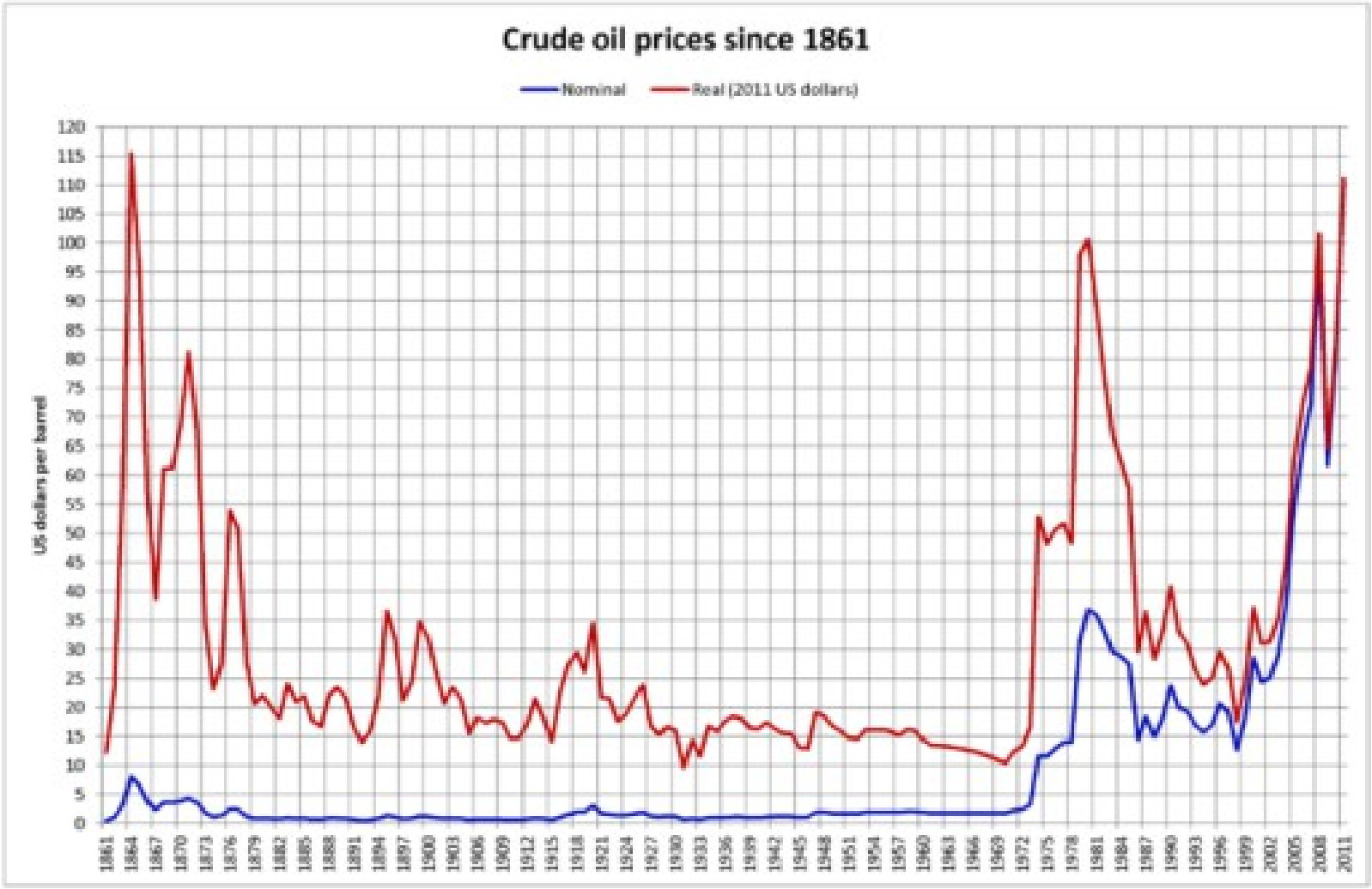


Electricity Use Over Time

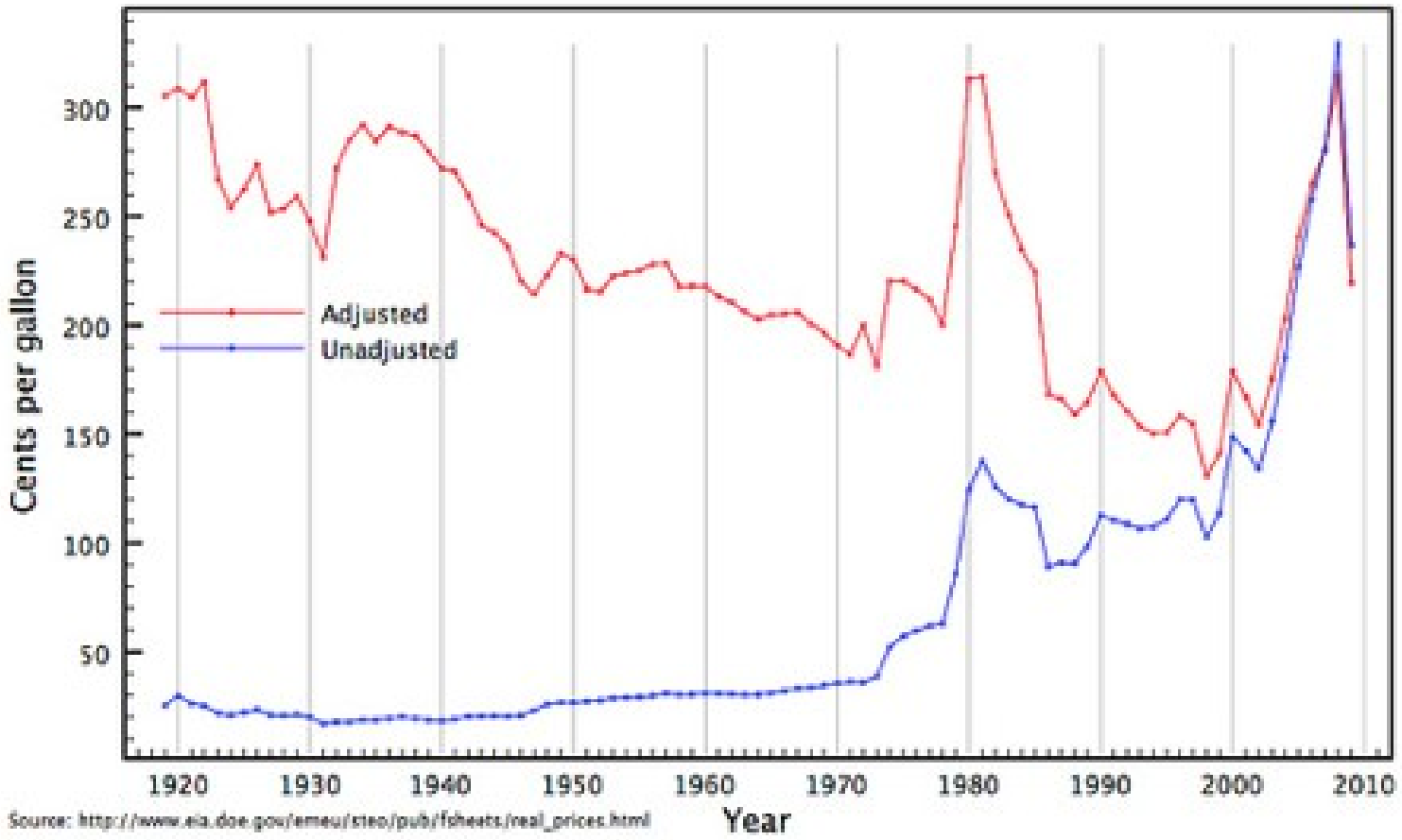


Price of Energy

Crude Oil

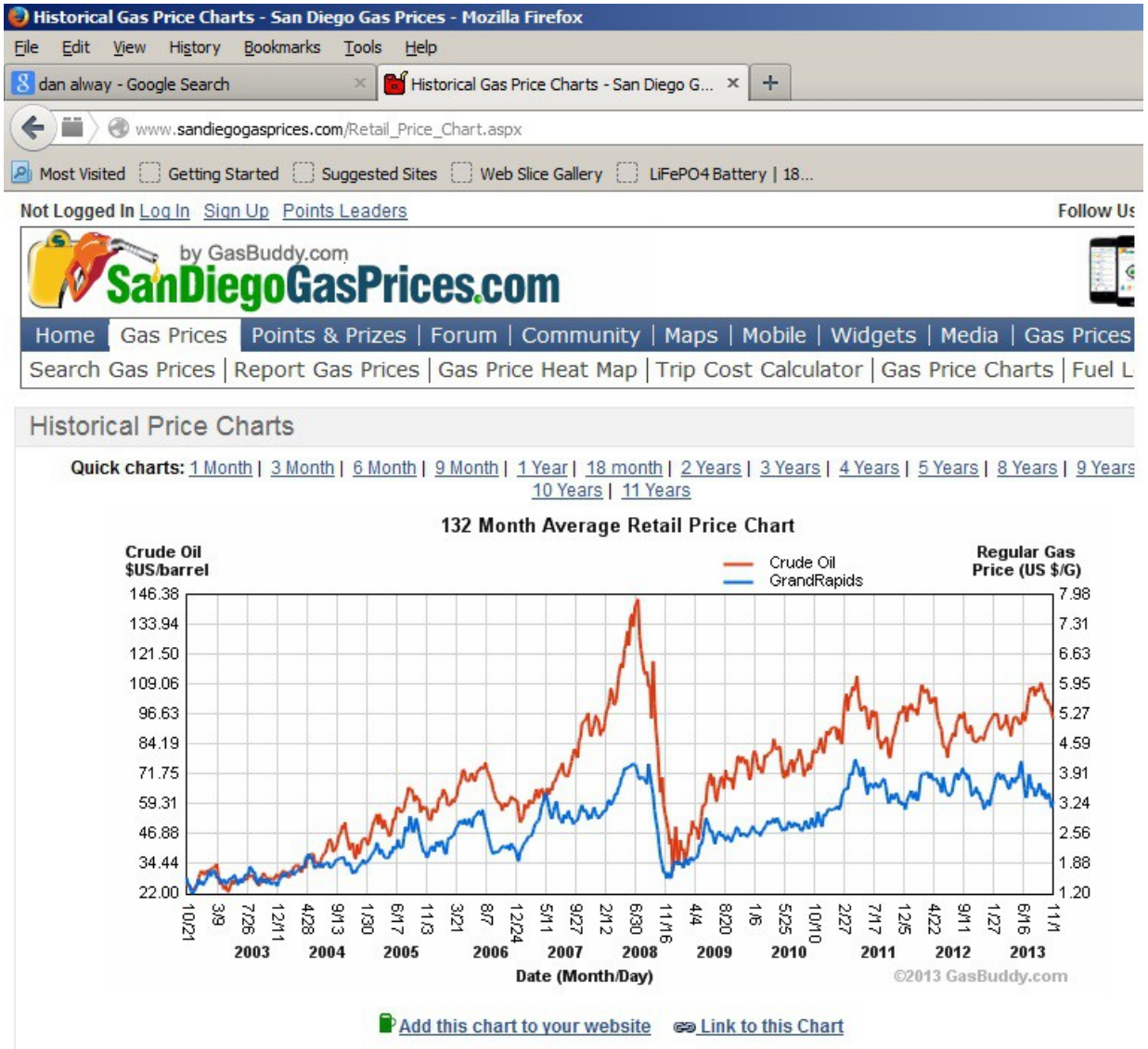


Price of Gasoline

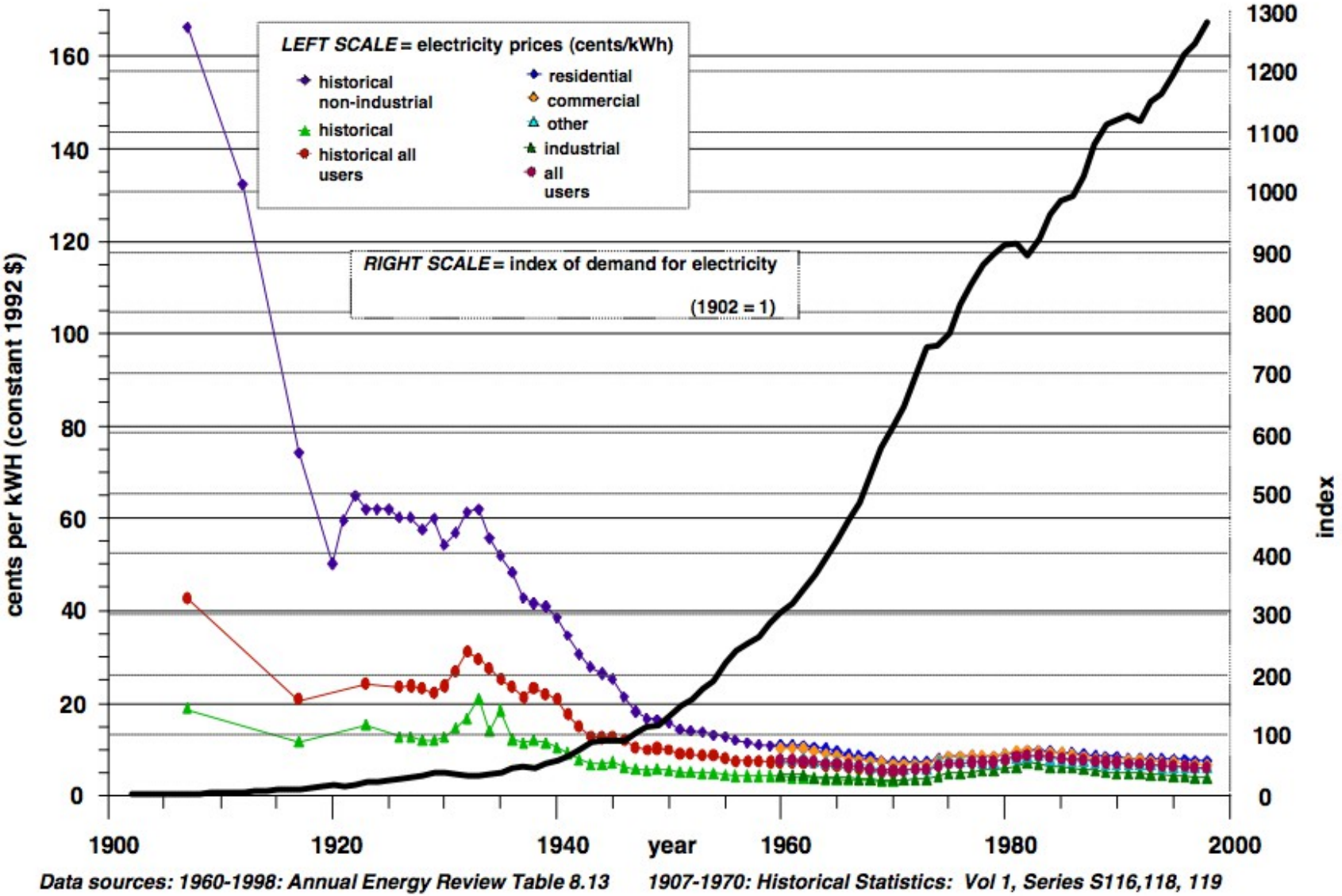


Price of Energy

Gasoline

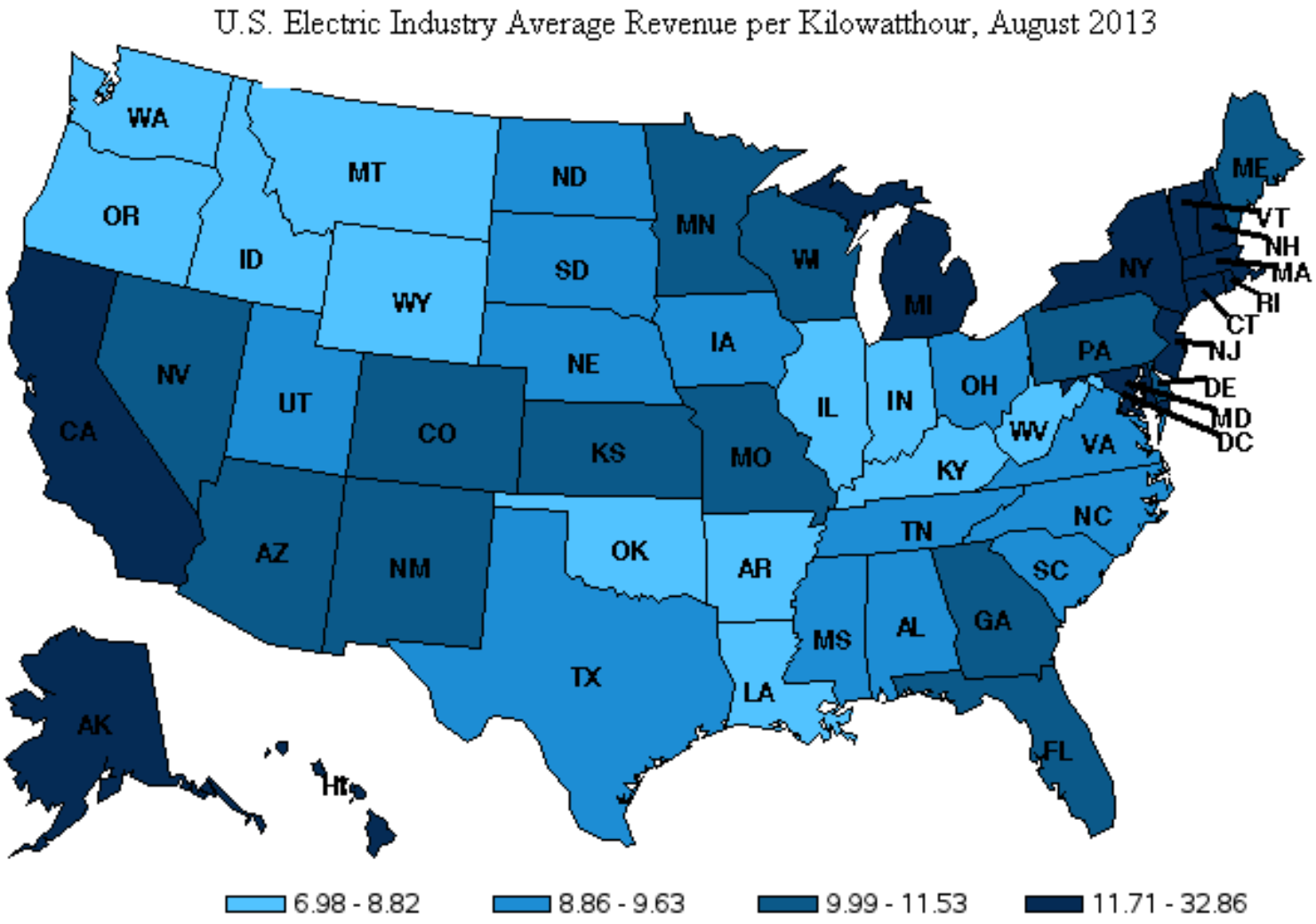


Historical Price of Electricity



How Much Does Electricity Cost?

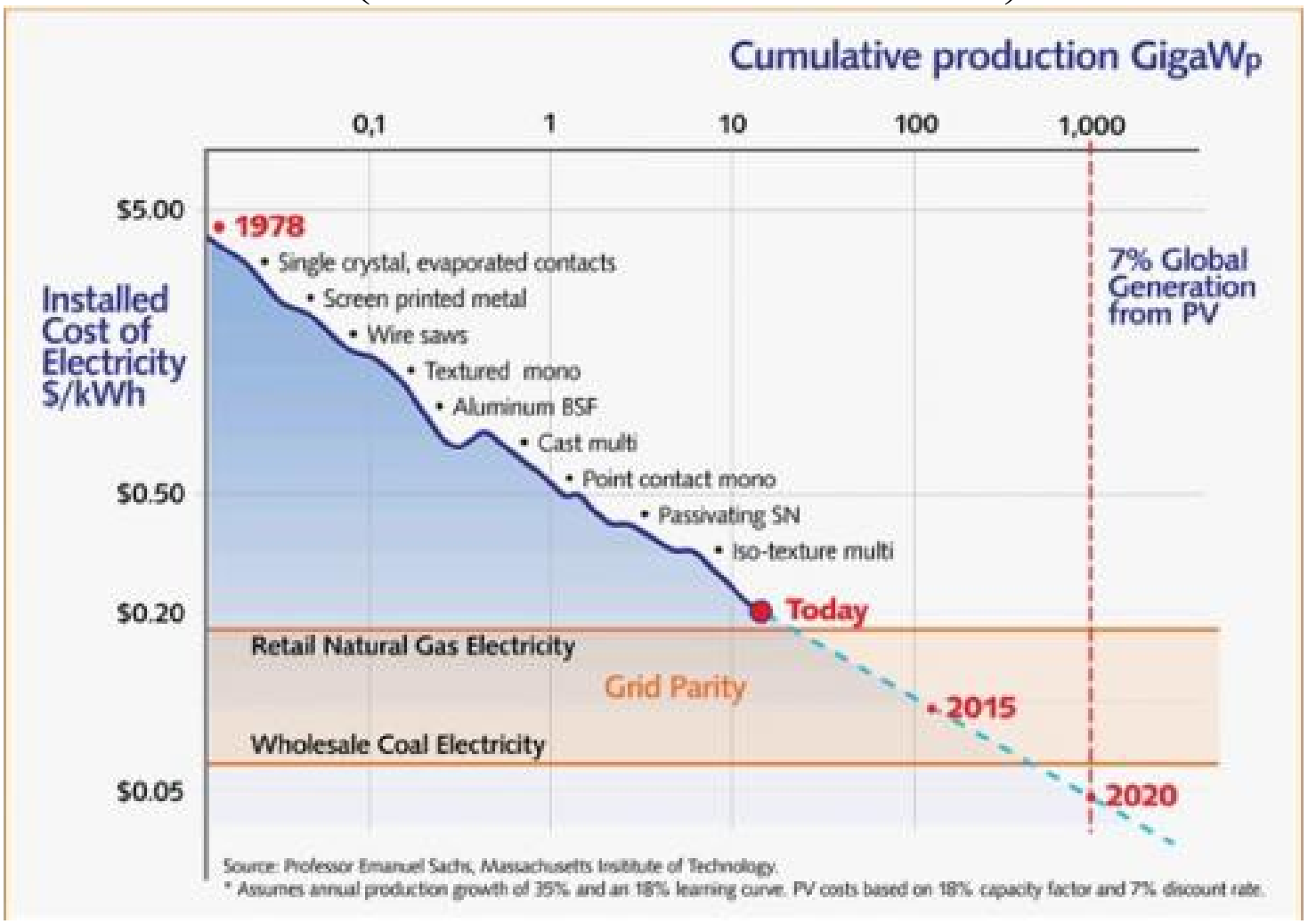
USA



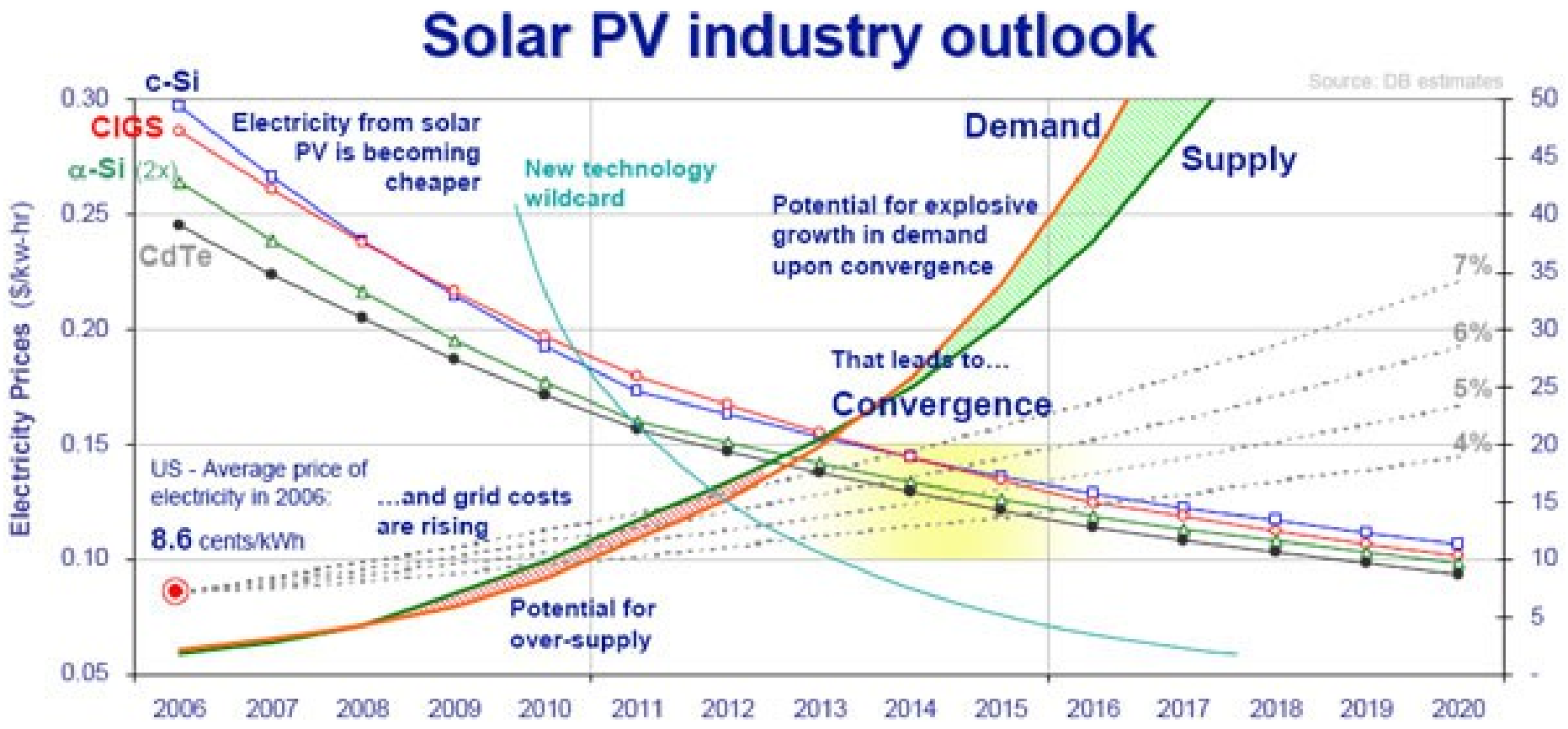
Source: Energy Information Administration

Solar Price in Free-Fall

(Chart from November 2011)



Solar Industry Outlook



Why has price of Gasoline Stabilized under $4/Gallon?

- ELECTRICITY price has stayed constant and CANNOT go up because Solar and Wind are now setting market limit

- Electric Cars can now “burn” sunlight.

Zero Net Electricity Use in Upstate NY

Residence of Paul Willing, Collie Goldstein, and Alon Willing

Solar Collectors

1) Solar water collector
2) House heating and clothes dryer
3) House heating
4) Older photovoltaic system: 2.8 KW
5) Newer photovoltaic system: 4 K

Energy Use

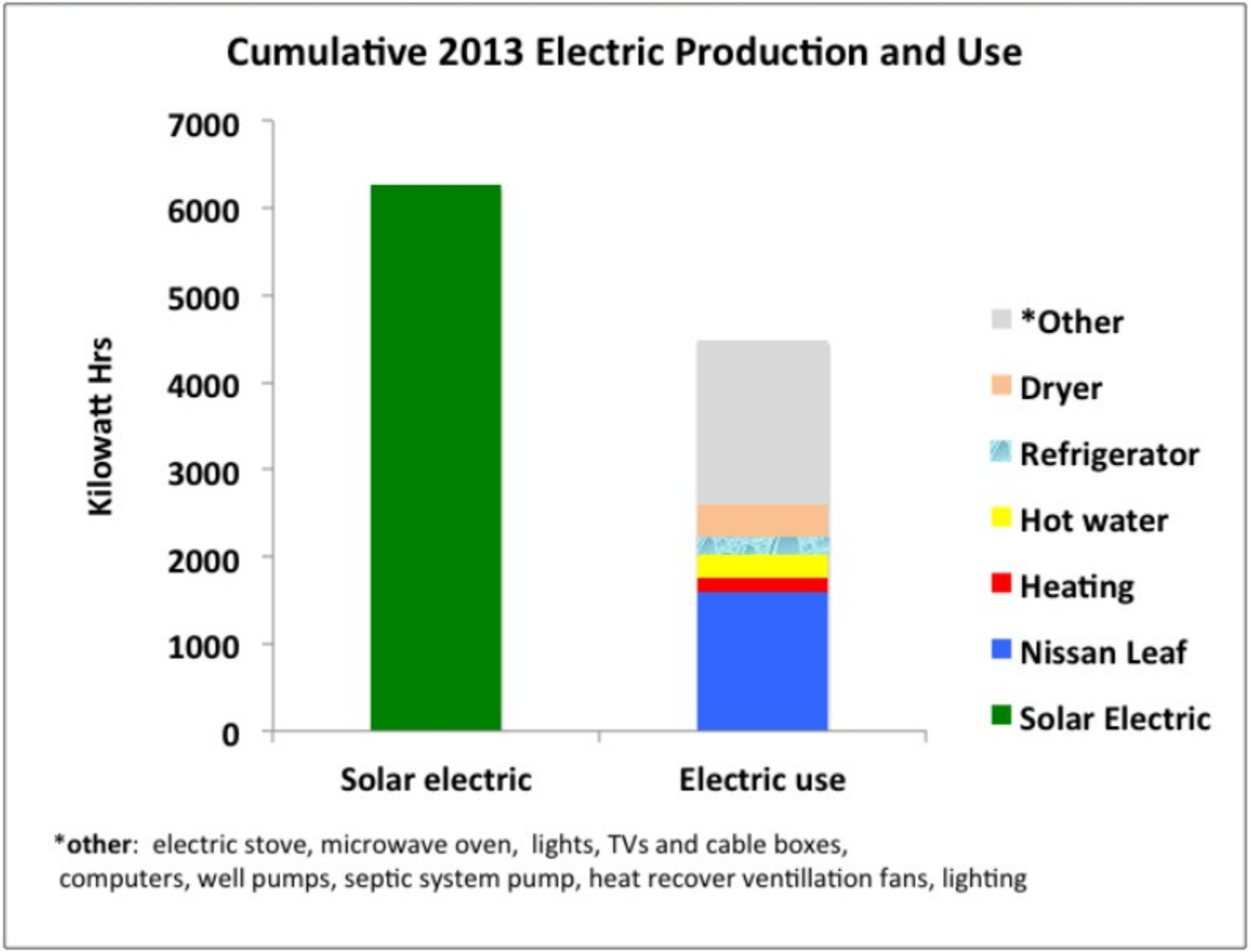
- **Heating**: about 50% from a geothermal heat pump; about 30% from direct solar; about 20% from a wood stove (0.8 cords/winter)
  - Ground source heat pump:

- **Cooling:** heat exchanger in well
- **Water heating**: solar; second heat pump
- **Lights**: fluorescent and LED fixtures
- **Cooking, refrigeration:** all electric appliances
- **Commuting** 900 miles/month:

2012 Nissan Leaf (electric; no gas)

Note that we use no fossil fuels for heating, cooking, or hot water.

June2012 July Oct Nov Dec 2013: Jan Feb Mar April May June july august sept Oct



Interesting Numbers

- Nissan Leaf has 21kW Hour Battery Pack and around a 75 mile range per charge
- Average American Household uses 29 kW Hours per day (10,600 kW hours per year).
- Average daily commute in US is around 40 miles.

Problems?

- Cell Phones “displaced” Land Lines
- Ipods “displaced” CD’s
- Internet “displaced” books, magazines, newspapers
- Just like Solar PV will “displace” Large utility Grids
- Intermittency of wind and solar

Or Opportunities?

- Buy an electric car for a fun drive, at no extra cost today, reduced price/mile coming in the future.
- In 3 years, plan to buy a Solar Array as a good ROI investment for retirement
- EV's have battery's big enough to power your house for days.
- If you want great business opportunities
  - Develop smart interconnects for houses
  - Develop smart interconnects for car charging that allow consumers to power the grid with their cars
  - Become a Solar System builder (factory based)

END OF SHOW

My Contact Info

- www.SchultzEngineering.US
- www.DeltaBike.US
- www.RenewableFuture.US

Electric Residential Service

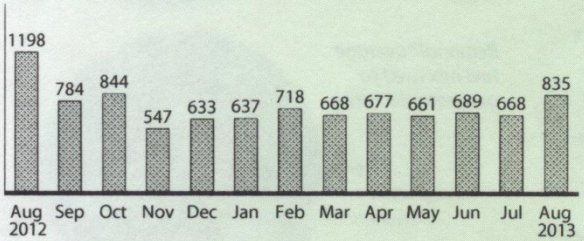
Rate: 1000

Kilowatt-hours used: 835 kWh
Meter reading: 951 - 1780 (estimate)

Meter Number: [redacted] POD: [redacted]

Electric Power Supply Charges		
Energy-First 600 kWh	600 @ 0.083791	$50.27
Energy-Over 600 kWh	235 @ 0.118791	$27.92
PSCR	835 @ 0.001570-	$1.31-
Renewable Energy		$0.52
Electric Delivery Charges		
Green Generation Block	1 @ 1.500000	$1.50
System Access		$7.00
Distribution	835 @ 0.043794	$36.57
Energy Efficiency	835 @ 0.002579	$2.15
Securitization	835 @ 0.001387	$1.16
Securitization Tax	835 @ 0.000682	$0.57
Total Electric		**$126.35**

Power supply charges include generation and transmission costs based on the amount of kWh used. Consumers Energy does not make a profit on the cost of fuel or purchased power.



August Electric use	835 kWh
Electric use per day	29 kWh
Electric cost per day	$4.36

Account Number: [redacted]

Service: [redacted]

GRAND HAVEN MI 49417-8700

Last Month's Account Balance	$102.63
Payment 07/26/13 - Thank You	$102.63-
Balance Forward	**$0.00**

Payments applied after Aug 01, 2013 are not included.

Total Electric	$126.35
Sales Tax	$5.05
Total Energy Charges	**$131.40**
Total Amount Due	**$131.40**

Billing Period	07/03/13 - 07/31/13
Bill Month	August
Days Billed	29
Invoice	205007451449

Your next scheduled meter read date is on or around 08/29/2013.

Your payment is due August 26, 2013. After the due date, the unpaid balance is subject to a 2% late payment charge.

News You Can Use

For the average Michigan residential customer, renewable energy is estimated to avoid $3.90 per month of new coal-fired generation costs. Customers are expected to save $3.71 each month over the life of the Energy Efficiency programs.

Go to www.michigan.gov/rendocs to view the Michigan Public Service Commission (MPSC) annual report on renewable energy and advanced cleaner energy.

Meter Reading = Estimate

Energy over 600 kWh is billed a higher rate.

Consumers Energy
Count on Us

Visit: **www.ConsumersEnergy.com**

Form 3818 7-2013
(Form Page 1 of 2)

Electric Residential Service

Rate: 1000

Kilowatt-hours used: 835 kWh

Meter reading: 951 - 1786 (estimate)

Meter Number: [redacted] POD: [redacted]

Electric Power Supply Charges		
Energy-First 600 kWh	600 @ 0.083791	$50.27
Energy-Over 600 kWh	235 @ 0.118791	$27.92
PSCR	835 @ 0.001570-	$1.31-
Renewable Energy		$0.52
Electric Delivery Charges		
Green Generation Block	1 @ 1.500000	$1.50
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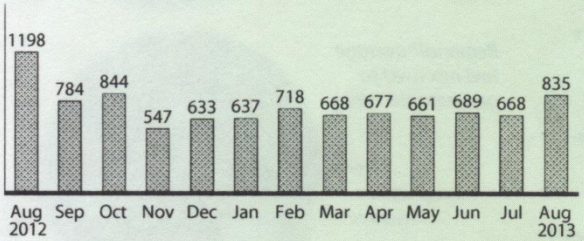

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System Access $7

Distribution $36.57

Consumers Energy

Count on Us

Visit: **www.ConsumersEnergy.com**

Call us: **(800) 477-5050**

Form 3818 7-2013
(Form Page 1 of 2)

Solar Electricity Production

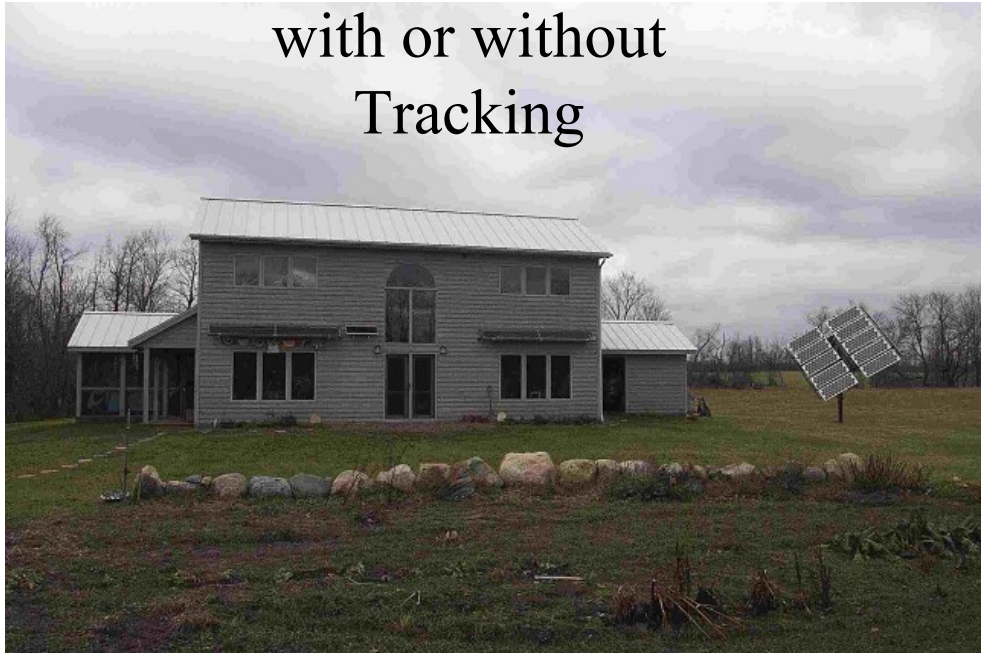
- Concentrated Solar Power (CSP)
- Solar Photovoltallic (PV)

Concentrated Solar Power (CSP)

In the 3rd century B.C. the Greeks made history not for using solar energy for domestic comfort, but —allegedly—as a weapon of mass destruction! The story (which to this day is a hot topic of dissention among scientists and historians) goes that a Roman naval force was sailing to sack the Greek citadel of Syracuse. With the help of the inventor Archimedes, the Greeks are reported to have used highly polished metal shields as mirrors to amplify and focus the rays of the sun—and set fire to the advancing ships!

Solar Photovoltaic (PV)

Ground Mounted with or without Tracking



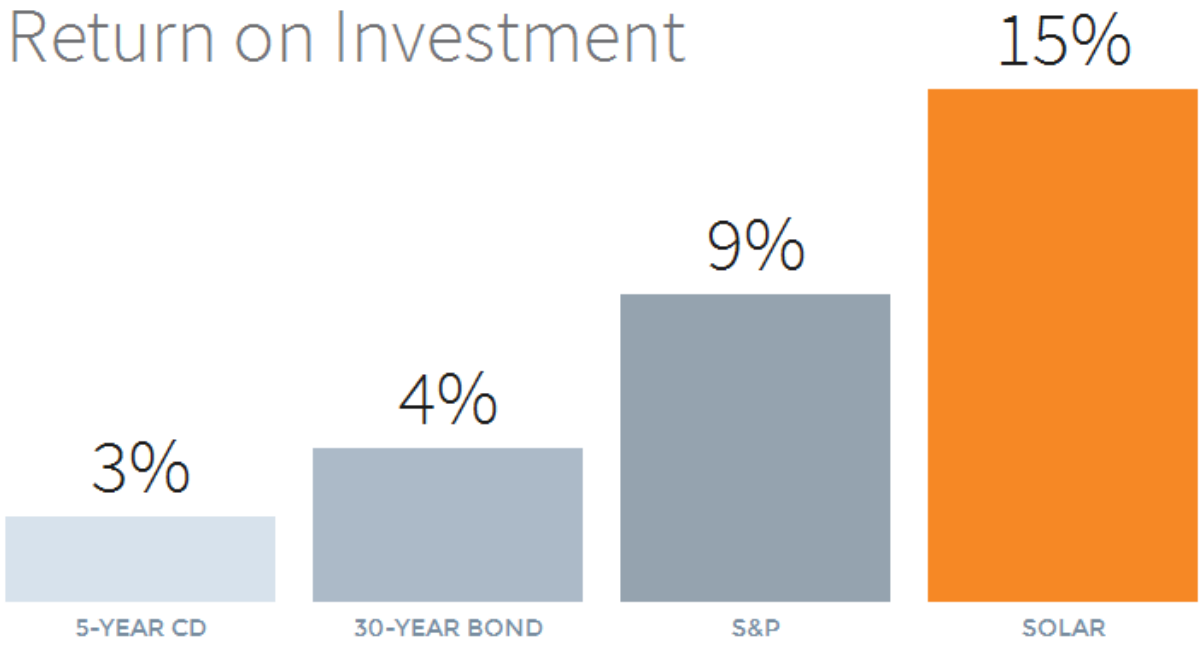
Roof Mounted

Solar is a great investment

YOUR BOTTOM LINE WILL THANK YOU

Installing solar is one of the most significant investments you will make. You'll see immediate reduction in your energy bill, shield yourself from increasing energy rates, and enhance your energy independence! In fact, a system from MAGE SOLAR can provide up to a 15 - 17 percent internal rate of return. That's better performance than you'd get from the stock market!

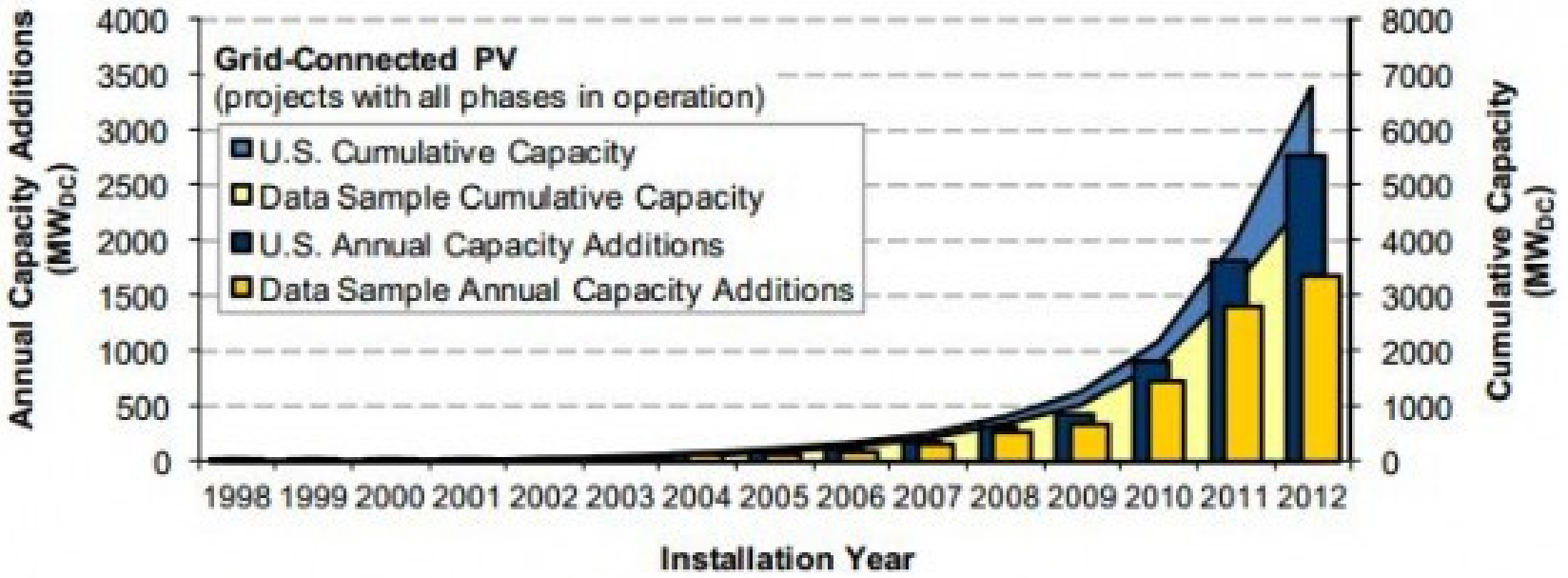
Return on Investment



Average calculation. Actual savings vary depending on system size and other variables.

Solar Capacity

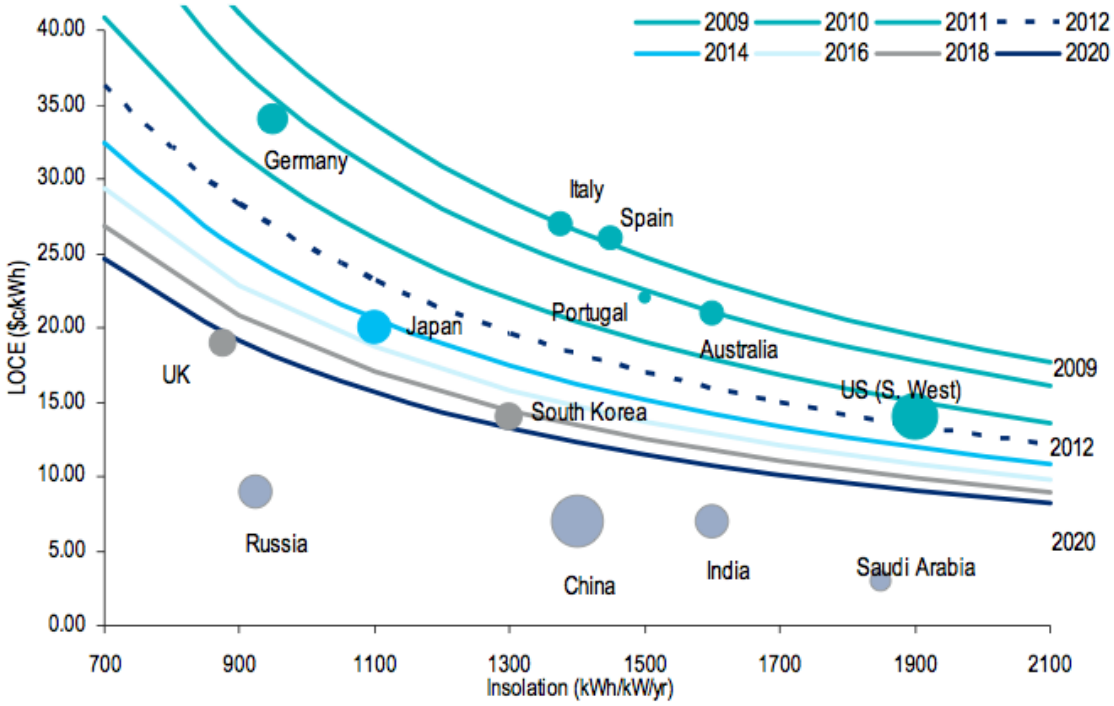
(Note: Palisades is 700MW)



Data source for U.S. total grid-connected PV capacity additions: Sherwood (2013). LBNL modified those values by deducting the capacity associated with the operational phases of several large utility-scale PV projects that were still under construction as of year-end 2012.

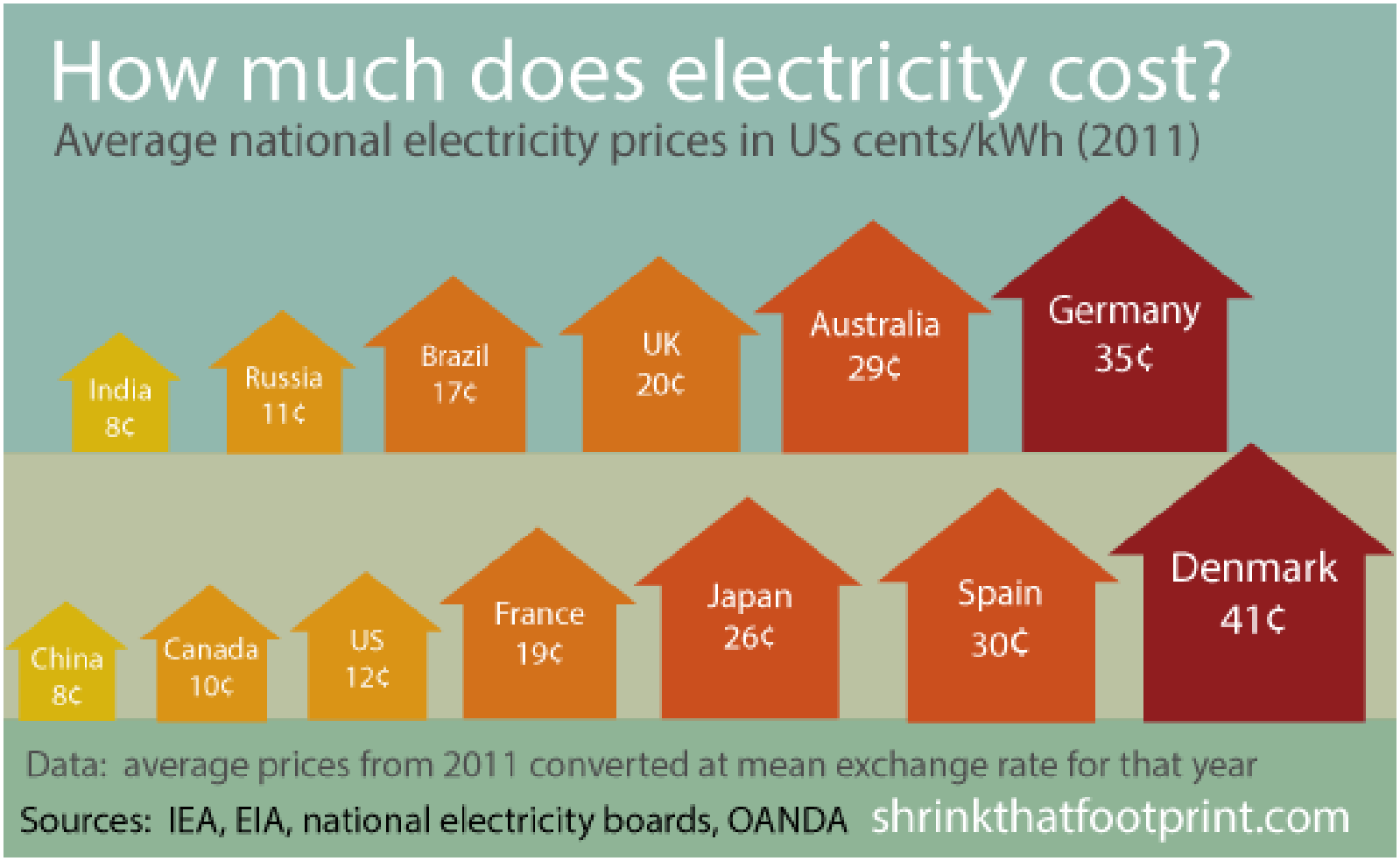
Actual Price Solar Electricity

Figure 4. Domestic 'socket' parity has already been reached in Germany, Italy, Spain, Portugal, Australia and the SW states in the US



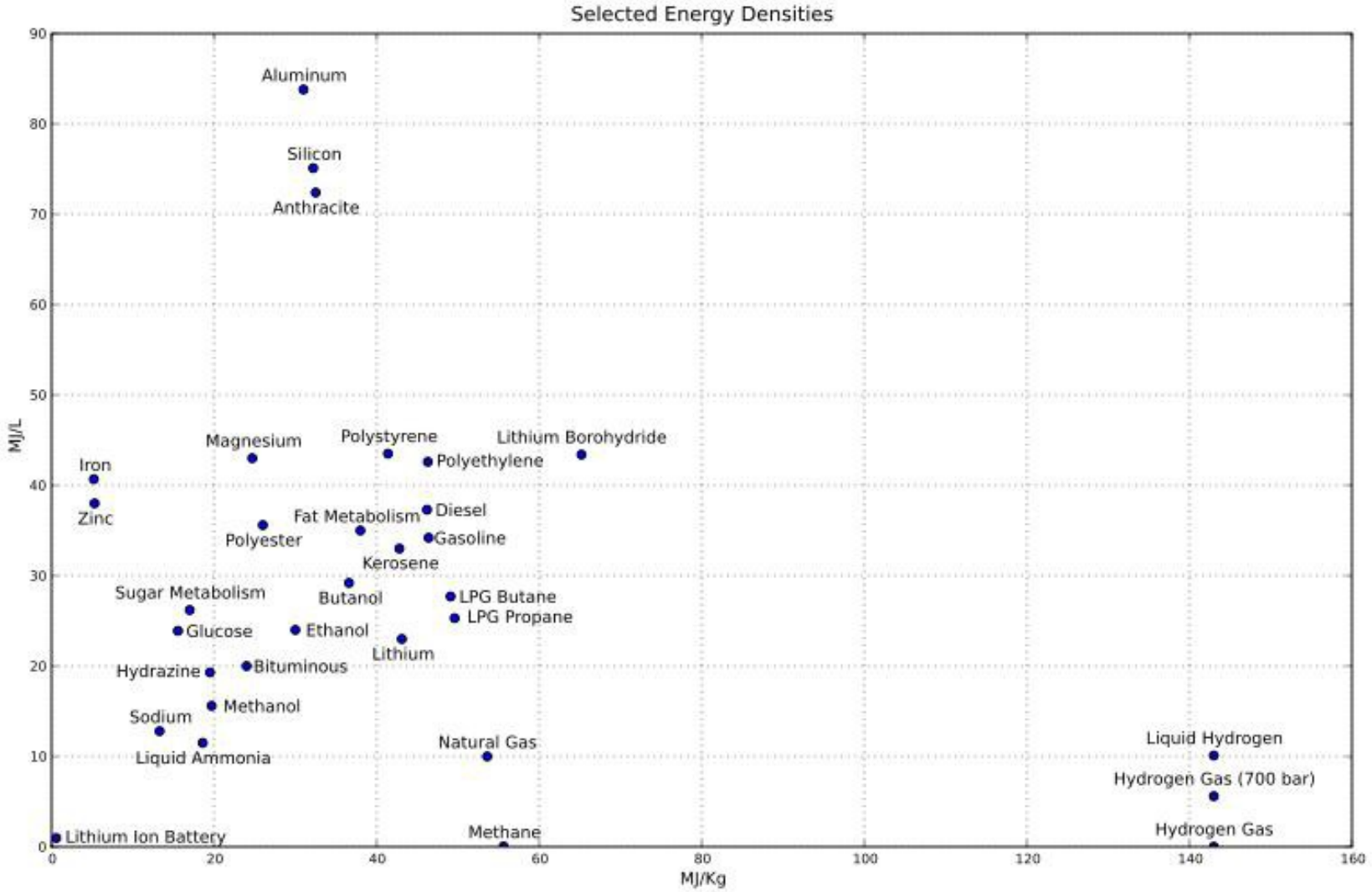
Source: Citi Research, Bloomberg New Energy Finance

How Much Does Electricity Cost? Globally



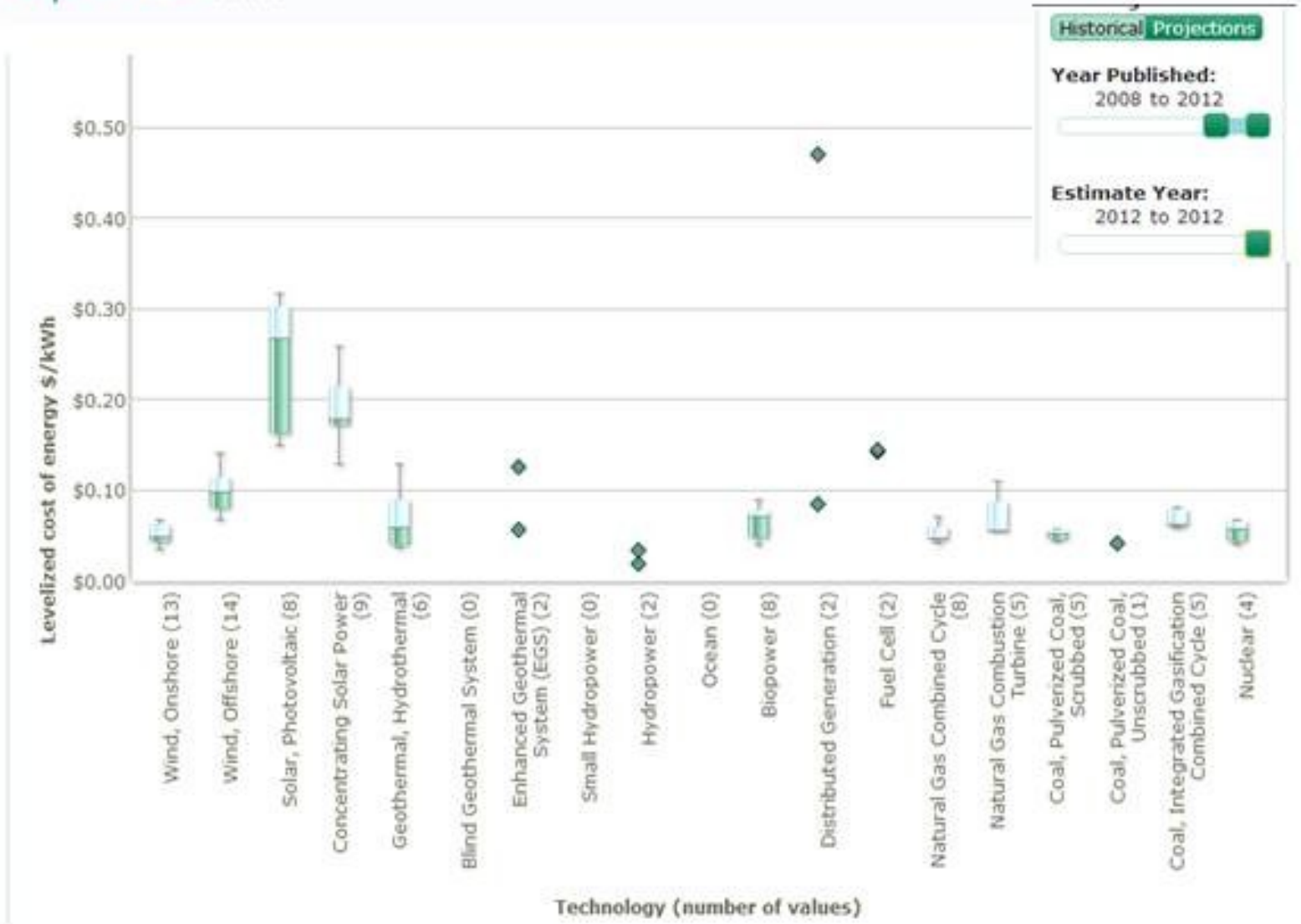
Energy Storage

Energy Storage Mediums



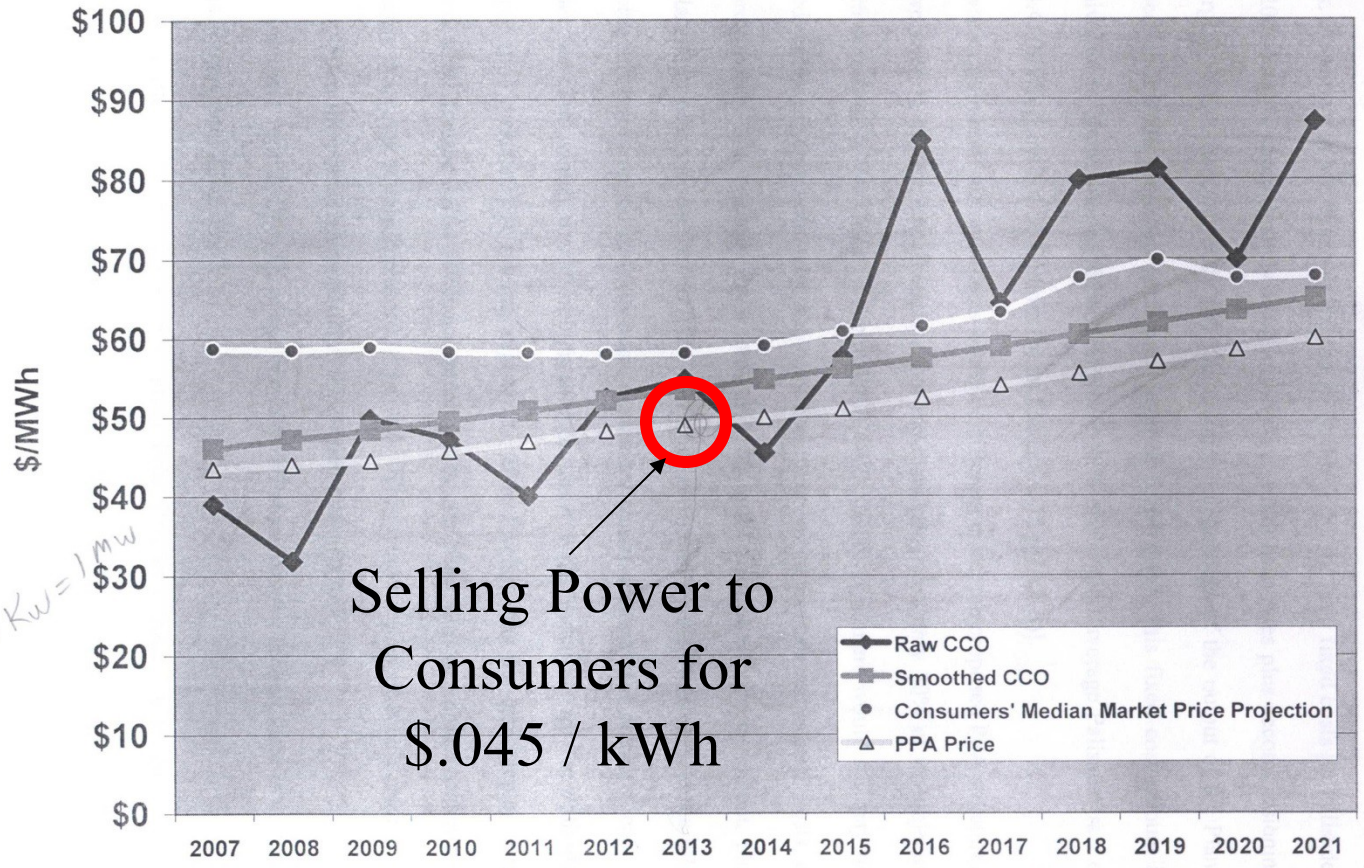
Battery Vs. Gasoline

- Typical Electric Motorcycles use 110 Wh/Mile = 306 MPGe
- Typical Electric Cars use 260 Wh/Mile = 129 MPGe
- 33,705 Watt hours = 1 gallon of gasoline


Historical Projections
Year Published:
2008 to 2012
Estimate Year:
2012 to 2012
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
Levelized cost of energy $/kWh
Wind, Onshore (13)
Wind, Offshore (14)
Solar, Photovoltaic (8)
Concentrating Solar Power (9)
Geothermal, Hydrothermal (6)
Blind Geothermal System (0)
Enhanced Geothermal System (EGS) (2)
Small Hydropower (0)
Hydropower (2)
Ocean (0)
Biopower (8)
Distributed Generation (2)
Fuel Cell (2)
Natural Gas Combined Cycle (8)
Natural Gas Combustion Turbine (5)
Coal, Pulverized Coal, Scrubbed (5)
Coal, Pulverized Coal, Unscrubbed (1)
Coal, Integrated Gasification Combined Cycle (5)
Nuclear (4)
Technology (number of values)

Case No. U-14992
Exhibit: A-2 (WEG-2)
Witness: WEGarrity
Date: August, 2006
Page: 1 of 1

PALISADES POWER PURCHASE AGREEMENT PRICING



1,000 Kw = 1 mw

$50/1,000 Kwh = $.05/Kwh

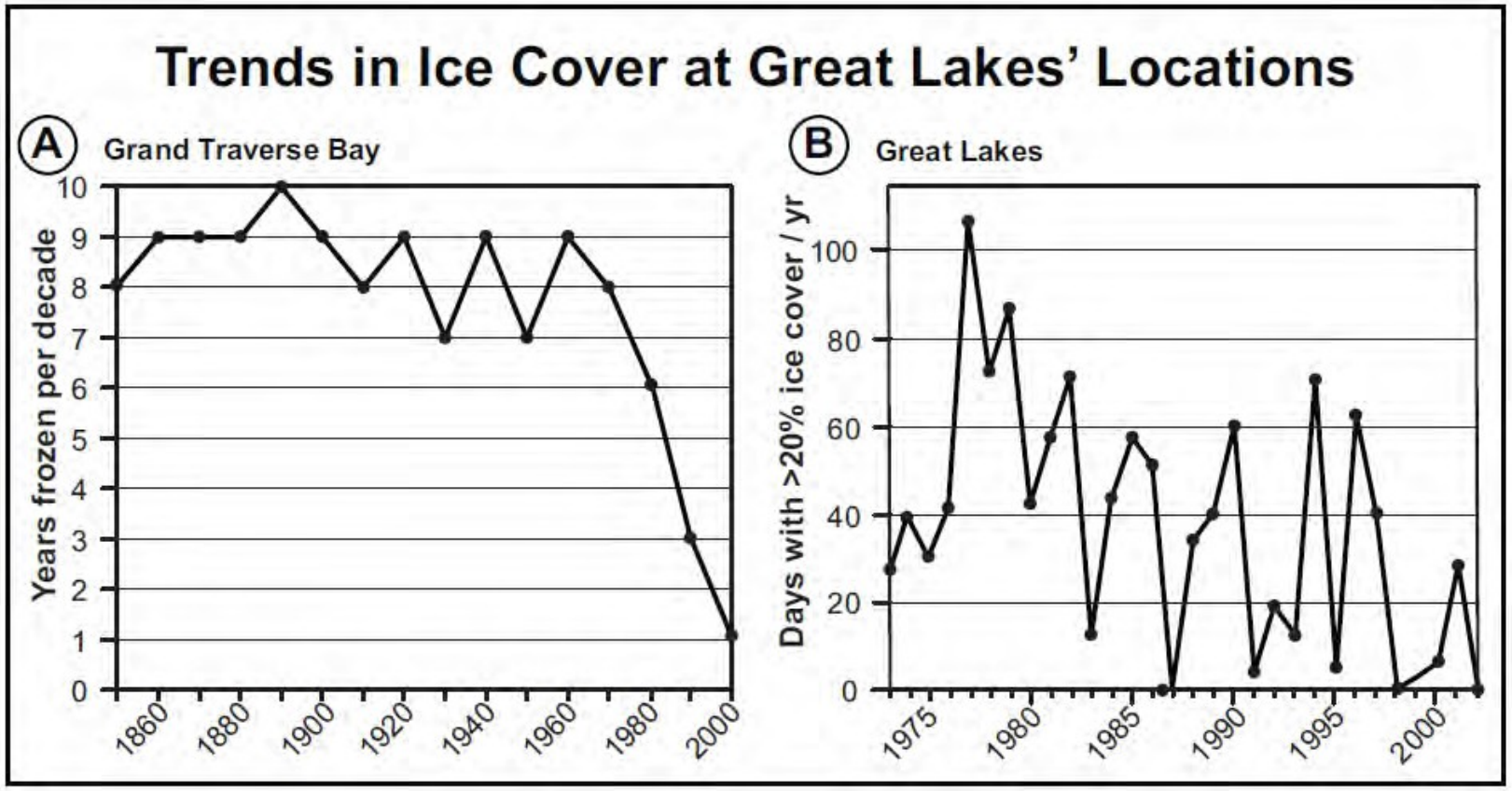
2007-2011 Produced on Average 6,000,000 Mwh/Yr
Aver. Net ≈ $21,000/DAY
= 6,000,000,000 Kwh
X $.05 = $300 Million/YR

Global Warming

- If CO2 is causing Global Warming and
- If Global Warming is Causing Severe weather patterns
- Then, Economic damage from weather can topple our fragile economic system

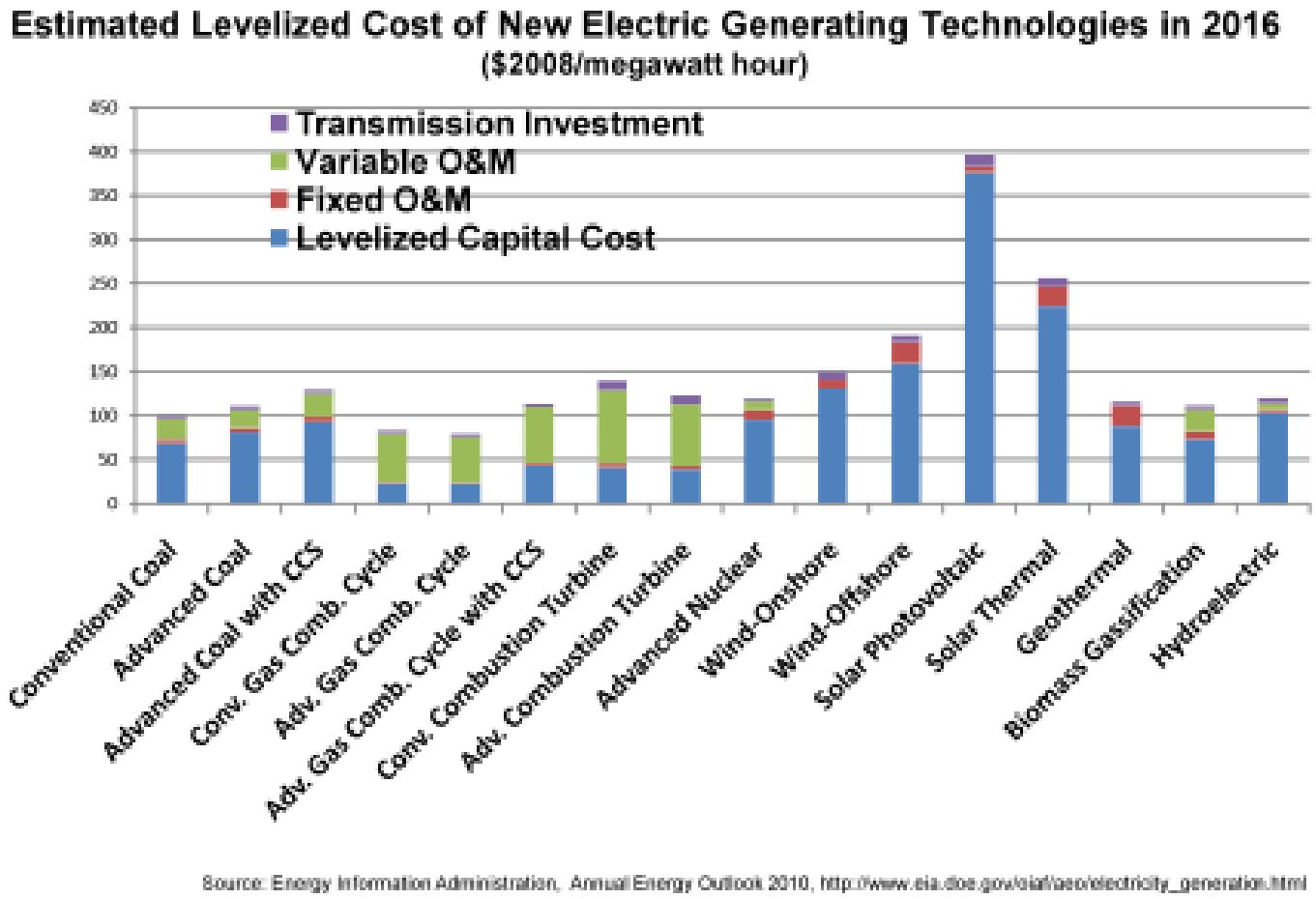
Is Global Warming Significant?

- Watch this Video from Bill McGibben of 350.org
- http://www.youtube.com/watch?v=58cAD9Uw8XA



Price of Energy

From Various Sources



Source: Energy Information Administration, Annual Energy Outlook 2010, http://www.eia.doe.gov/oiaf/aeo/electricity_generation.html

Available Sunlight = $