

Earth's Climate: Past, Present and Future; Concerns and Solutions

Week 8: Wednesday March 13th, 2019

Paul Belanger

Solutions – part B

Class canceled due to snowstorm: had to go plow!



Solutions

- 2 weeks ago – Solutions PART A – expanded in next slide
- Then Bob Raynolds on Anthropocene last week March 6th
- This week – Solution PART B – More on renewables (wind and solar) – private and commercial/non-profit options, why it's not enough and what can be done!

Solutions – Part A

Expanded description: Week 6, February 28th:

<https://denverclimatestudygroup.com/wp-content/uploads/2019/02/OLLI-East-week-6-slides-final.pdf> without simulation of grid

- Plant Hardiness change
- Link to Spring 2017 where 6 of the 8 weeks on solutions:
 - https://denverclimatestudygroup.com/?page_id=2224
- Economics: Growth vs. Steady State; EEEF and IPCC
- Youth involvement
- Technology changes in Energy: Renewables, Energy storage and Grid alternatives
- Other publications: Climate of Hope, Drawdown, CRES Youtube channel
- GEOENGINEERING: SRM (Solar Radiation Management) vs CDR (Carbon Dioxide Removal)
- And ended with a video on Fusion Developments at Lockheed
- ETC.....

This week – Part B

Item by item in following slides

More on what WE as society and what YOU as a person can do

- FIRST – NEED TO CHANGE OUR THINKING ON THE ECONOMY
- DECARBONIZING ENERGY GENERATION: WIND and SOLAR
 - PERSONAL
 - COMMERCIAL/NON-PROFIT
- DECARBONIZING TRANSPORTATION
- WHY IT'S NOT ENOUGH – WE NEED TO TAKE OUT (SEQUESTER):
 - SOIL RESTORATION
 - BIOCHAR
 - OTHER
- EXTRAS

More on what WE as society and what YOU as a person can do

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The Story of Stuff

The goal of **BETTER** vs. **MORE**
Educate yourself and be aware!
PLAY VIDEO



<https://storyofstuff.org/movies/the-story-of-solutions/>

<https://youtu.be/cpkRvc-sOKk>

More on what WE as society and what YOU as a person can do

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AN IMPORTANT MESSAGE IN GOING SOLAR AND ELECTRIC VEHICLES

Debunk: Too Long to Reach Breakeven

OPTIONS

- BUY OR FINANCE: HOME INSTALLATION ON YOUR ROOF
- LEASE INSTALLATIONS ON YOUR ROOF (discounts amount you pay for electricity -~ 75%?)
- COMMUNITY SOLAR:
 - Ideal if you have too much shade
 - Someone maintains it – not that there's much to maintain
 - If you move it's still yours as long as you're still a customer of that utility

Does it survive hail

- YES
- However if your surrounding roof is damaged mount and remount costs apply (~ \$3 to \$5,000; insurance should still cover?).
 - Option – fix just the periphery of the roof that's damaged
 - i.e. insurance companies want you to replace the whole roof even if underneath is undamaged!

Personal Action: Electricity

FOLLOWING SLIDES also on the web page:

- PDF – John Bringenberg Solar program abridged: [JohnBringenberg Jan 27 solar program abridged \(NXPowerLite Copy\)](#)
- preferred as Pptx: [JohnBringenberg Jan 27 solar program abridged \(NXPowerLite Copy\)](#)

Also posted OLLI page, OLLI East, week 8

https://denverclimatestudygroup.com/?page_id=24

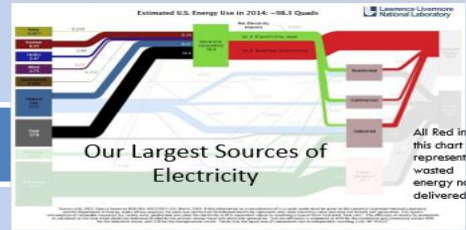
The following slides; special thanks to: John Bringenberg
john@bringenberg.com - 720-289-3289



Personal Action: Electricity

SAME LINK AS SLIDE 6

The Story of Solutions



Much Electricity is Lost Before it Reaches Your Home



Topics Today

- A hidden (seldom discussed) climate value of energy efficiency and Distributed Generation ... a.k.a rooftop solar.
- Why ROI [or “how long until break even?”] is not the right question when considering rooftop solar.
- What do the economics of rooftop solar look like?
- The Joy of opening your electric bill when you have rooftop solar.



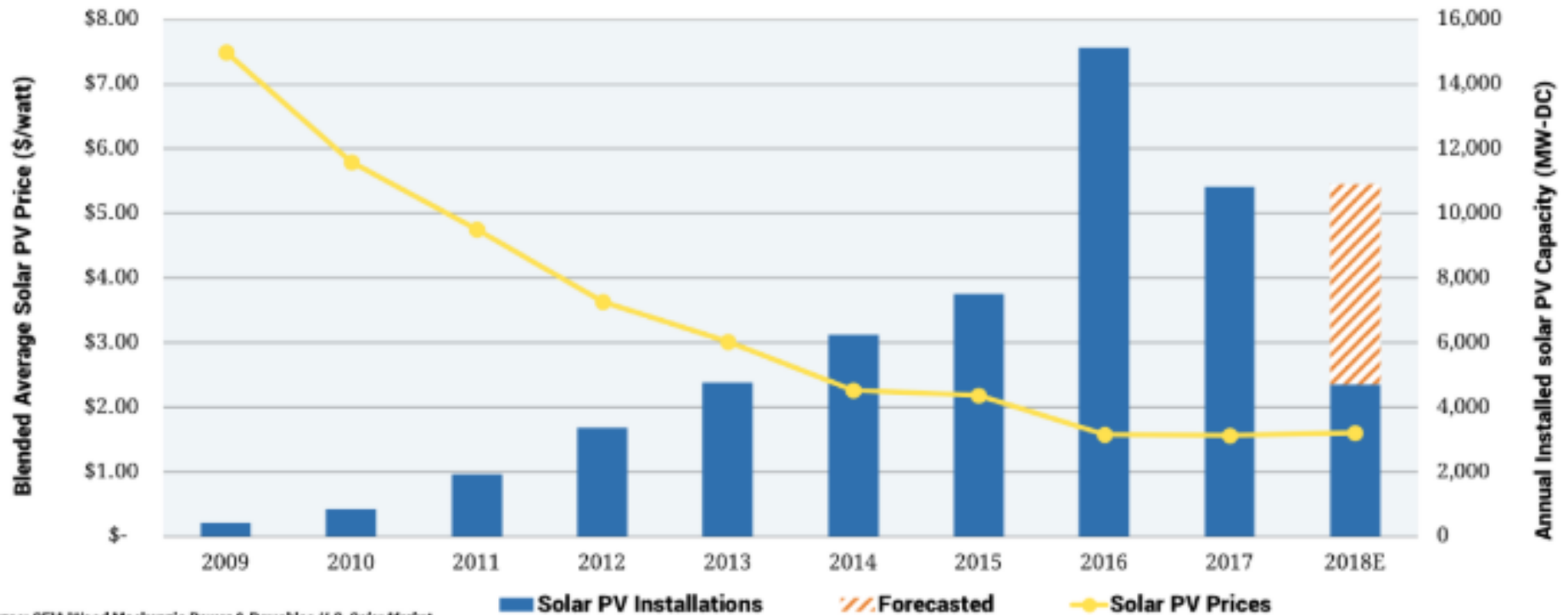
Solar Technology and Storage

- Most improvements are to racking, smart inverters and storage
- Steady modest improvement in cell performance



Solar Marketplace

Annual Solar PV Installations and Blended Average PV Prices



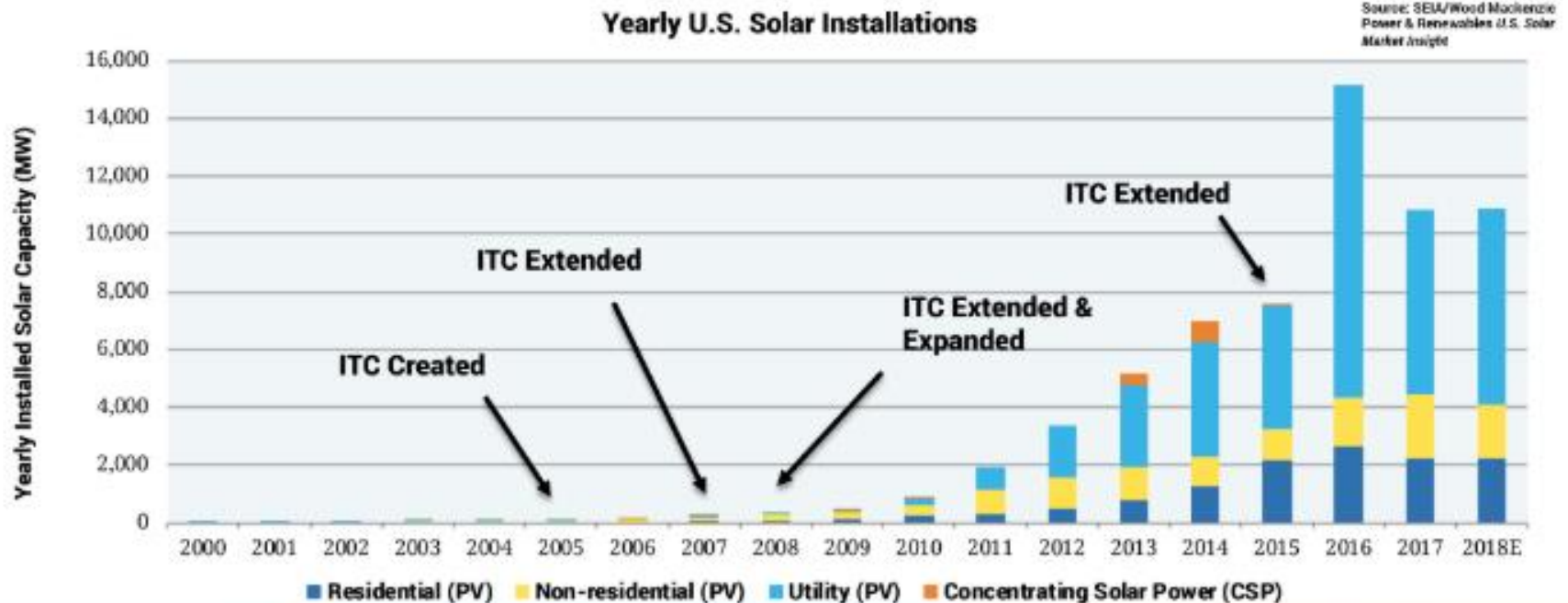
Source: SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight; Lawrence Berkeley National Laboratory, Tracking the Sun



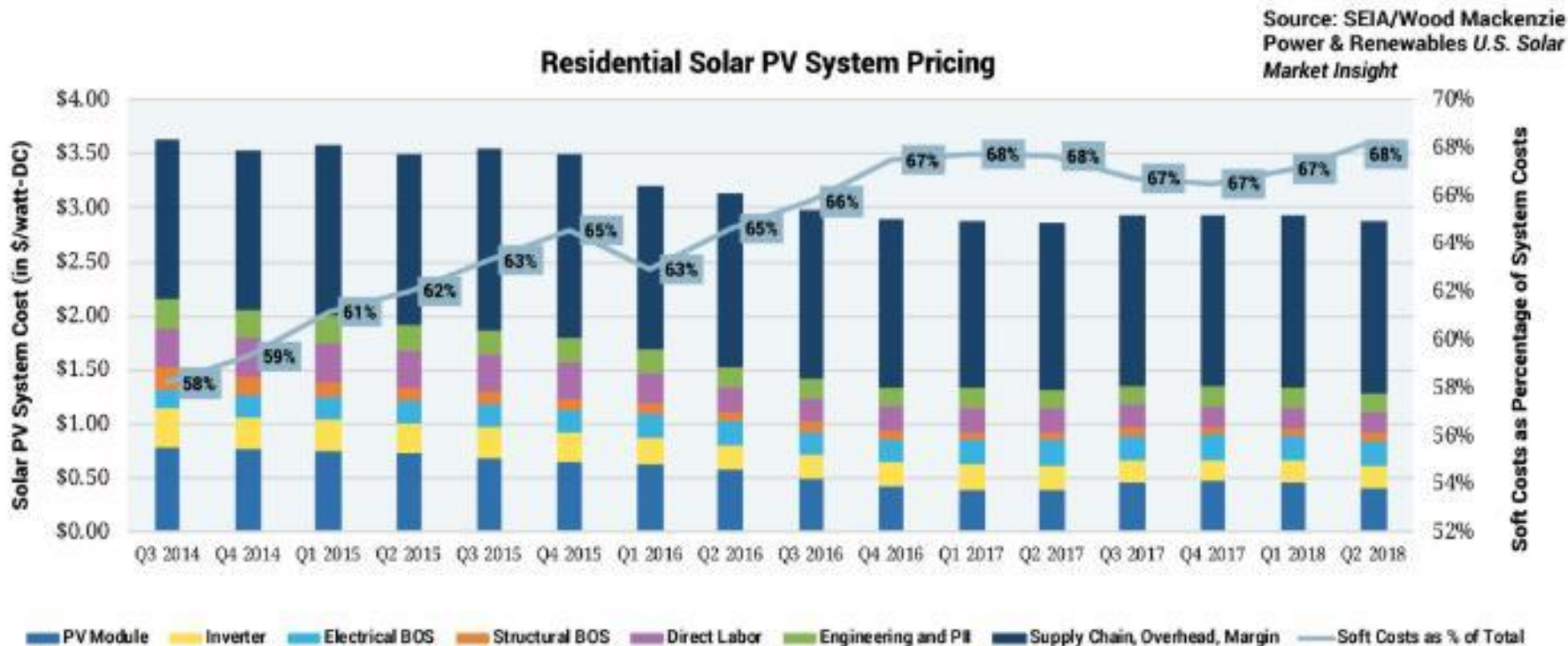
Solar Means Local Jobs

- ▶ Over 250,000 Americans work in solar -
- ▶ More than double the number in 2012
- ▶ More than 9,000 companies in every U.S. state.
- ▶ 2017 - generated \$17 billion investment in the US economy.

Tax Credits - Key Factor

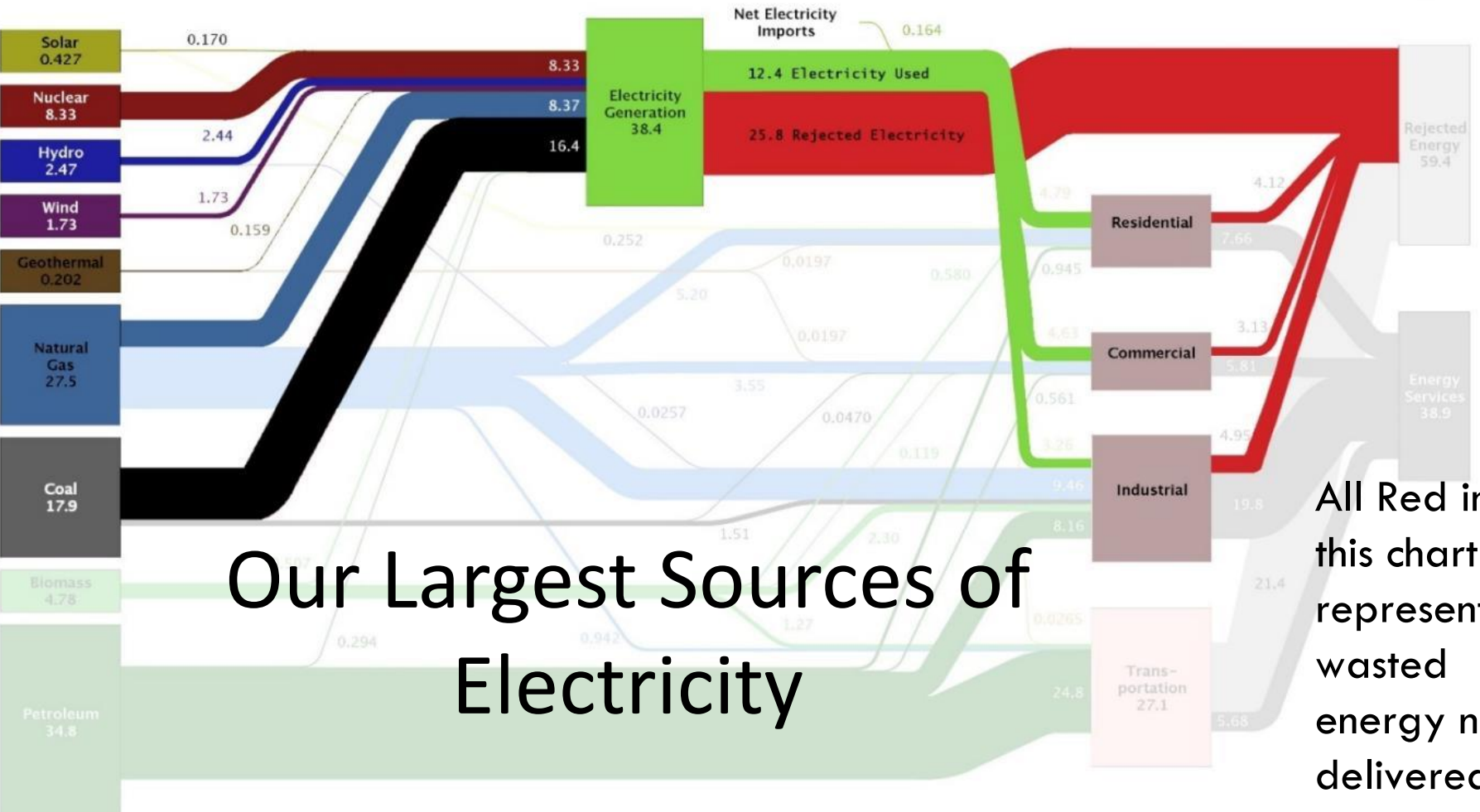


Pricing Impacts are Changing



Community Solar

- ▶ Started in CO
- ▶ CEC – Community Energy Collective
- ▶ SunShare
- ▶ Most have gravitated to commercial systems
- ▶ Bill Credit = about \$0.07 out of \$0.12
 - ▶ Most current deals = they keep bill credits and REC's
 - ▶ Charge no upfront costs
 - ▶ Customer retains 10% of the bill credits. (~\$0.007 discount)



Our Largest Sources of Electricity

All Red in this chart represents wasted energy not delivered

Source: LLNL 2015. Data is based on DOE/EIA-0035(2015-03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Much Electricity is Lost Before it Reaches Your Home

Estimated U.S. Energy Use in 2014: ~98.3 Quads

Lawrence Livermore
National Laboratory



Source: LLNL 2015. Data is based on DOE/EIA-0035(2015-03), March, 2014. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

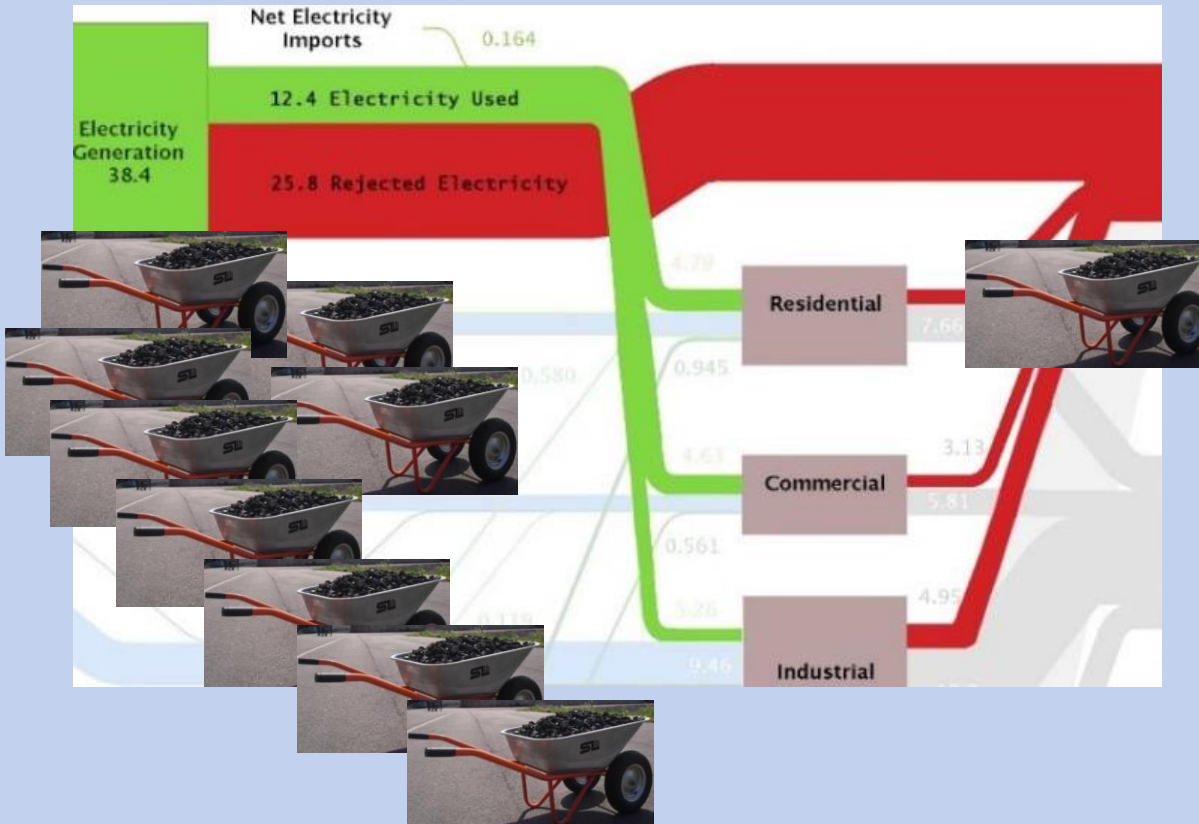
All Red in this chart represents wasted energy not delivered

Much Electricity is Lost Before it Reaches Your Home

The Real Costs of One Light Bulb



The Real Costs of One Light Bulb



All Red in this chart represents wasted energy not delivered

The Real Costs of One Light Bulb



Debunk: Too Long to Reach Breakeven

- One of the most common concerns about going Solar.
- Doesn't it take a long time to break even?



Debunk: Too Long to Reach Breakeven

True:

- *After approximately 8 – 12 years the monthly savings has paid for the 30+ year system and energy is essentially free thereafter.*
- *The \$12,000 - \$20,000 investment in rooftop solar will return ~4% - 7% annual ROI for each of 20+ years.*

Also True:

- *Your previous and next utility payment have negative financial gain ... Each month takes you further from any breakeven. **Perpetual cost. Never ROI.***

Can't solve this problem by continuing to pay your utility.



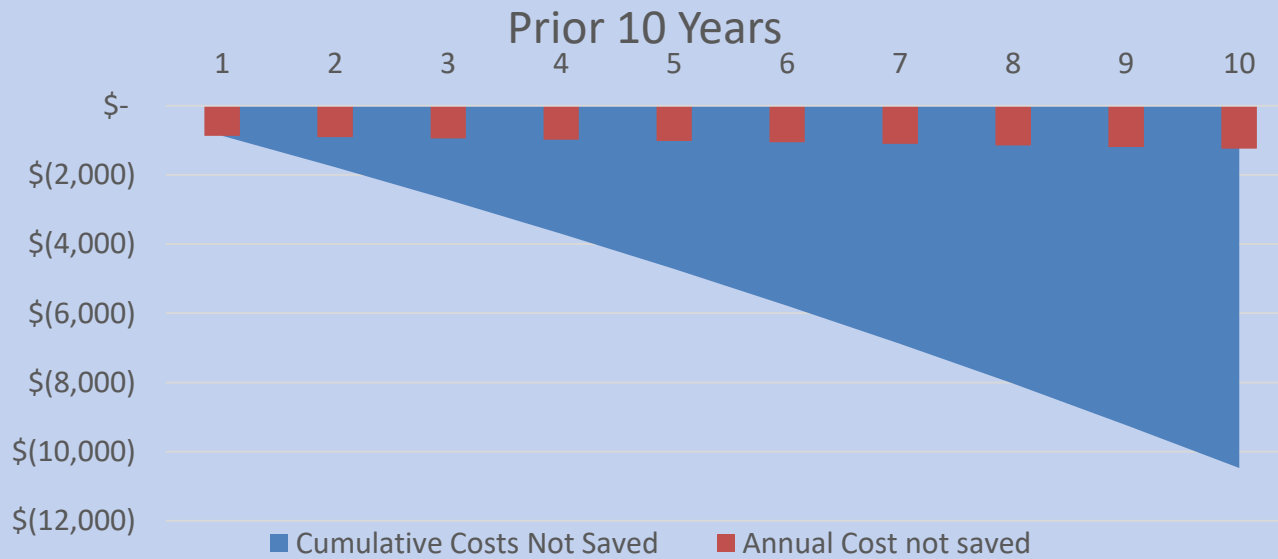
Debunk: Too Long to Reach Breakeven

System Example:

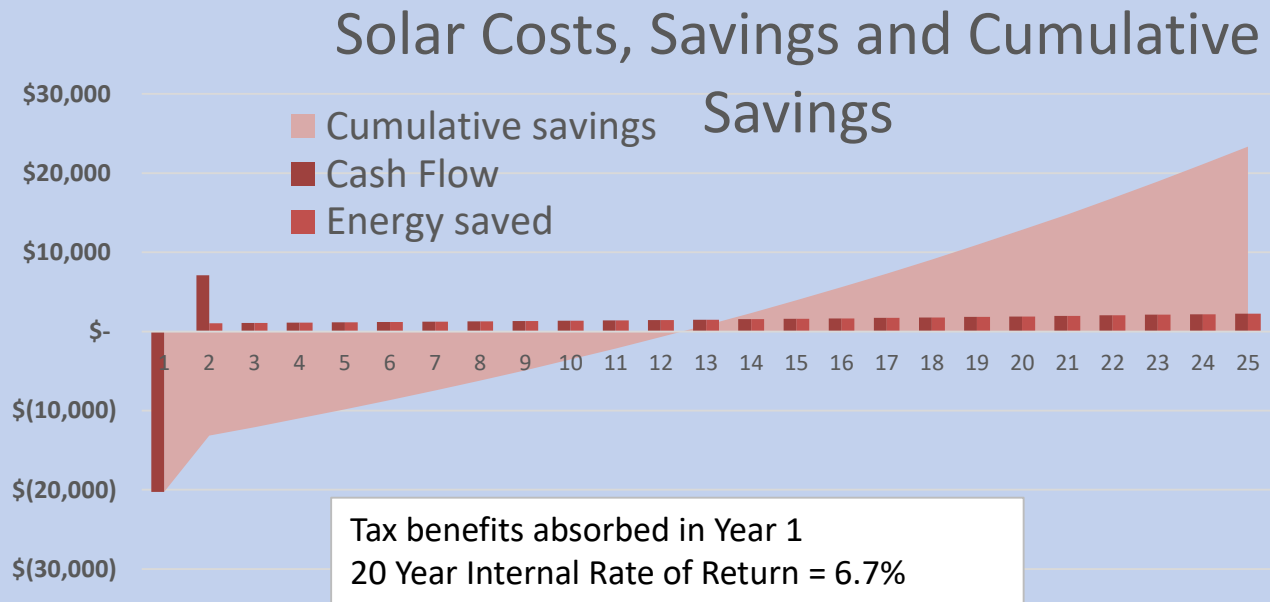
- *5.4kW system*
- *18 Solar Modules, 300kW each*
- *Cost at \$3.75 / W = ~ \$20,250*
- *First year Tax Credit = \$6,075 (can take over 19 years)*
- *\$0.125/kWh Energy increases at average 4% year*
- *Use internal cash liquidated from other sources*



Debunk: Too Long to Reach Breakeven



Debunk: Too Long to Reach Breakeven



Can't solve this problem by continuing to pay your utility.

Residential PACE is Possible in 2019

- Residential PACE is among the most popular form of renewable and EE financing ... yet only offered in 3 states.
 - California, Florida, Missouri
- Colorado is possible to be the 4th State in first half of 2019.
- 100% financing is attached to the property tax. *(not attached to the homeowner)*
 - Stays with the home upon sale
 - Credit score does not disqualify
 - State administrated program with oversight
 - Qualified lenders and contractors



The previous slides; special thanks to: John
Bringenberg john@bringenberg.com - 720-289-3289

TO REPEAT:
AN IMPORTANT MESSAGE IN GOING
SOLAR AND ELECTRIC VEHICLES

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 - OTHER

Solar Opportunities for Businesses and Non-Profits

Starts at 3 pm



Nick Perugini | Solar Consultant & Advisor
303-817-3104 | NickTheSolarGuy@gmail.com

October 8, 2017

FOR THE FULL SET OF SLIDES GO HERE:

– PDF – Nick Perugini – commercial and non-profit insights: [SolarOpportunitiesForBusinesses&Non-Profits10-8-2017](#)

– Pptx – Nick Perugini – commercial and non-profit insights: [SolarOpportunitiesForBusinesses&Non-Profits10-8-2017 Nick Perugini](#)

Special thanks to: Nick Perugini: nickthesolarguy@gmail.com ,
(303) 817-3104

FROM NICK PERUGINI

- The attached .ppt from 2017 is geared toward Businesses and nonprofits; links to full set below; slide 11 repeated below:
 - Slide 11 are some of the pros and cons of some finance methods.
 - Slide 17 and on, have good advice on choosing your installer
- The link mentioned to Xcel area Community Solar (SLIDE #10) providers by county is this:
- [https://www.xcelenergy.com/programs and rebates/residential programs and rebates/renewable energy options residential/solar/available solar options/community-based solar](https://www.xcelenergy.com/programs%20and%20rebates/residential%20programs%20and%20rebates/renewable%20energy%20options%20residential/solar/available%20solar%20options/community-based%20solar)

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Slide 11 are some of the pros and cons of some finance methods.

	Buying	Lease	Solar PPA
Upfront Capital?	Yes	Little to None	Little to None
Performance Risk?	Yes	Yes	No
System Knowledge Required?	Yes	Generally, Yes	No
Maintenance Required?	Yes	Yes	No
Purchase Required?	Yes	Yes, with option to re-lease	No
Recognize ALL Tax Benefits?	Yes	Depends on Lease	No
Recognize ALL Savings?	Yes	Yes	No
Insurance or Prop Tax Payments?	Yes	Yes	No
Purchase Required?	Yes	Yes, with option to re-lease	No

- **Strong partners will offer all options and assist in uncovering the best solutions for you**
- **Own and realize all benefits**
 - **Best for most profitable corporations**
 - **For on-site only**
 - **Appetite for tax credits and depreciation usually needed to pencil**
 - **All benefits pass to asset owner (you).**
 - **Comfort in owning, monitoring, and maintaining equipment (however minimal)**
 - **Finance options:**
 - **Cash, Loan, Property Assessed Clean Energy finance (“PACE”)**
- **Third Party Ownership**
 - **Can be on or off-site**
 - **Typically best for municipalities and non-profits**
 - **Also good for very risk averse corporations not wanting to utilize capital**
 - **Little to zero capital requirement**
 - **No tax credit or depreciation appetite necessary**
 - **No monitoring and maintenance requirement**
 - **Finance options:**
 - **Power Purchase Agreement (“PPA”) a.k.a. Solar Services Agreement (“SSA”)**
 - **Capital Lease (much like a loan)**
 - **Equipment Lease**
 - **Realize less benefits than ownership**

- **FOR THE FULL SET OF SLIDES GO HERE:**
- – PDF – Nick Perugini – commercial and non-profit insights: [SolarOpportunitiesForBusinesses&Non-Profits10-8-2017](#)
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IT'S HAPPENING FOLKS:

Renewables:

- Photovoltaics (PV)
- Concentrated solar power (CSP) -
https://en.wikipedia.org/wiki/Concentrated_solar_power
- Wind
- Geothermal – not discussed here but keep in mind and/or contact me: pebelanger@glassdesignresources.com
 - Ground source
 - Deep thermal

Hawaii becomes First State to Mandate 100% Renewable Energy.

See NREL slides for more details:

<http://denverclimatestudygroup.com/wp-content/uploads/2015/04/OSHER-10.14.15.pdf>

Renewable Energy News & Information

Interesting site though I'm not familiar

- <https://www.renewableenergyworld.com/index.html>
- <https://www.renewableenergyworld.com/articles/2016/08/renewable-energy-was-16-9-percent-of-u-s-electric-generation-in-the-first-half-of-2016.html>

It's happening: 17% and growing and economically

DistribuTECH 2019

Renewable Energy Was 16.9 Percent of US Electric Generation in the First Half of 2016

August 25, 2016

By Daniel Fleischmann



Best thing since Energiewende



LATIMES.COM

Germany to close all 84 of its coal-fired power plants, will rely primarily on renewable energy

i

Xcel Energy work to meet 100 percent clean energy goal

03/08/2019



ed by



< NEWS FEED

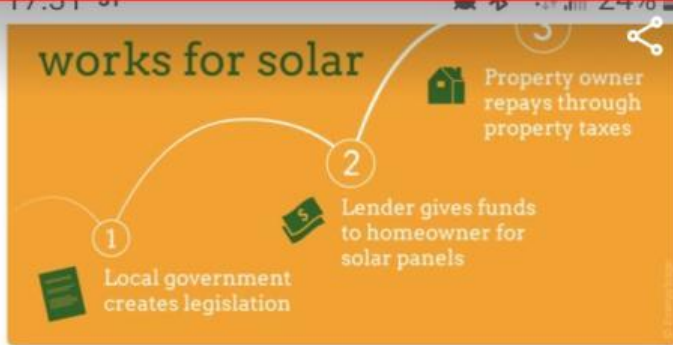


What is PACE financing for home solar power?

7 REPLIES

Reading Time: 3 minutes

If you want to install a solar energy system on your property, one of the first questions you've probably asked is, "How will I pay for it?" There are many financing options available today for homeowners who want to enjoy the benefits of



What is PACE financing for home solar power?

7 REPLIES

Reading Time: 3 minutes

If you want to install a solar energy system on your property, one of the first questions you've probably asked is, "How will I pay for it?" There are many financing options available today for homeowners who want to enjoy the benefits of solar. In many areas, an increasingly popular option for home energy improvements like solar is property assessed clean energy (PACE) financing.

How does Property Assessed Clean Energy (PACE) financing work?

Property owners who aren't able to or interested in buying solar panels in cash can finance their solar energy system with a solar loan or a solar lease or power purchase

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DECARBONIZING TRANSPORTATION

LINKS - posted at bottom of OLLI page:

2018 NOTES AND INFORMATION: By Don Sorenson:

- [EV Poster Page 1](#)
- [EV Poster Page 2](#)
- [Solar Vs Coal](#)

From David McNeil DEVC,INFO

- [The State of United States](#)

From COSEIA CONFERENCE – PANELISTS

- [SPMW cbr 031218](#)

OTHER:

- [PlugInAmericaFlier](#)
- [gas-vs-solar-ev-charging-2017](#)

DECARBONIZING TRANSPORTATION

LINKS - posted at bottom of OLLI page: continued

- **Prior notes/posts:**
- **SLIDES FROM CURRENT EVENTS 2/13/2018: [China takes pole position on EVs and renewables](#)**
- **MORE ON EVS and SUSTAINABILITY:**
 - [SustainabilityPresentation – Jim Smith](#)
 - Best Energy Retrofit – by John Avenson: avenson.net/
 - Denver Electric Vehicle Council: devc.info
 - COLORADO EV PLAN (THIS LINK WORKS!): [Colorado EV PLAN January 2018.pdf](#)
 - OTHER EV links (thanks Don Sorenson):
 - [Refuel Colorado](#) for Colorado State EV info
 - [National Drive Electric Week](#)
 - [Plugin America](#)
 - [Forth \(EV promotion link in Portland\)](#)
 - [Electrification Coalition](#)

DECARBONIZING TRANSPORTATION

LINKS - posted at bottom of OLLI page: continued:

The following links are from a GREAT DECISIONS slide presentation I embellished on on 1/31/2018 discussing China. Slides include references and links below:

- [China takes pole position on EVs and renewables](#)
- [Time Mag china takes the pole position](#)
- [China Catching Up to United States in Research and Development – Eos](#)
- [Amory Lovins slides Oct 6 2017](#) – Large file
- [The Gasoline-Powered Automobile Is Obsolete – New Version](#)

We can Invest in Solar Panels or Community Solar

- **AN INVESTMENT - Here's why:**
 - A personal story
 - **SPENT:**
 - \$30,000 (excluding 30% fed credit) for 30 panels (rounding out cost)
 - **RETURN:**
 - Saved **\$1000** in electricity for 1 year
 - With my Leaf – powered by solar panels I drove 14,000 miles replacing a car 25mpg say \$2.50 / gallon = i.e. I did NOT spend **\$1,400 on gasoline**
 - RETURN \$2,400 in ONE year on \$30,000 investment! = **8%**
 - NOW INCLUDING THE 30% FED TAX CREDIT = **11.4%**

Buy and Electric Vehicle (EV)

- 100 mpg equivalent
- Batteries > 100,000 miles
- Motor 1,000,000 miles
- No oil change EVER
- No maintenance
- Why Gasoline Powered Cars Are Obsolete - Jim Smith

<https://www.youtube.com/watch?v=d7tRlsoZgdI>

EVs no Emissions



**Steve Stevens with Tesla X
90 kWh = 300 mile range**



**Paul Belanger & Phil Nelson with
their Nissan Leafs
30 kWh = 107 mile range**

**Ron Larson with Tesla S
75 kWh = 250 mile range**



Imagining a World After Fossil Fuels



BREATHE EASY: COAL is not coming back Renewables win!

- **RENEWABLES are cheaper!**
 - Wind especially
 - PV next – but will become even cheaper
 - Battery backup
 - Concentrated Solar Power for Thermal backup



AN IMPORTANT MESSAGE IN GOING SOLAR AND ELECTRIC VEHICLES

- IF HAVE A 2ND CAR PLEASE make it an EV – it makes economic sense as well as the right thing to do!

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Why it's not enough – links to slides from March 26th, 2018

MONDAY March 26TH: CO2 Removal and Nature Conservancy presentation by Betsy Neely + What is and the Need for Biochar by Paul Belanger

Part A: Why PRICING IS NOT ENOUGH & WHY WE NEED SEQUESTRATION! – Paul Belanger

- Pptx: TROUBLE LOADING contact me pebelanger@glassdesignresources.com if copy desired
- Pdf: [2018.03.26 Belanger-why pricing is no enough EEEF](#)

Part C: Biochar and Related Soil Restoration Solutions: Paul Belanger & Ron Larson

- Pptx: [2018.03.26 Belanger-Larson Biochar EEEF](#)
- Pdf: [2018.03.26 Belanger-Larson Biochar EEEF](#)

For more on Biochar see updated Biochar

Page: https://denverclimatestudygroup.com/?page_id=28

•Leading web page: International Biochar Initiative: <http://www.biochar-international.org/>

Biochar

- Definition:

<https://en.wikipedia.org/wiki/Biochar>

- Biochar tab:

http://denverclimatestudygroup.com/?page_id=28





Carbon Dioxide Removal (CDR)



- <https://en.wikipedia.org/wiki/Biochar>:

“**Biochar** is [charcoal](#) used as a [soil amendment](#). Like most charcoal, biochar is made from [biomass](#) via [pyrolysis](#). Biochar is under investigation as an approach to [carbon sequestration](#) to produce [negative carbon dioxide emissions](#).^[1] Biochar thus has the potential to help mitigate [climate change](#) via carbon sequestration.^{[2][3]} Independently, biochar can increase [soil fertility](#) of [acidic soils](#) (low pH soils), increase agricultural productivity, and provide protection against some foliar and soil-borne diseases.^[4] Furthermore, biochar reduces pressure on [forests](#).^[5] Biochar is a stable solid, rich in [carbon](#), and can endure in soil for thousands of years.^[1]”

Cool Planet - @ 9:00 minutes

- https://youtu.be/JPJsYZLU_sM?t=535

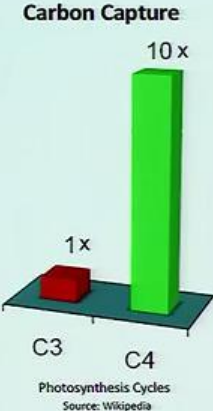


Following slides from Cool Planet Video


Rapid Growth C4 Plants Can Capture 10X CO₂

C3 : Trees
: Shrubs
: Flowers


C4 : Corn
: Switchgrass
: Sugarcane



Soybeans



Sorghum



Miscanthus




Diagram of C3 Photosynthesis: Shows a Mesophyll Cell with stomata. Carbon Dioxide (CO₂) enters, and Oxygen (O₂) and Water (H₂O) exit. The Calvin-Benson Cycle is shown inside the cell, involving RUBISCO.

Diagram of C4 Photosynthesis: Shows a Mesophyll Cell and a Bundle-Sheath Cell. Carbon Dioxide (CO₂) enters the Mesophyll Cell, where a CO₂ Pump and a Pump Concentrates CO₂ are shown. The Calvin-Benson Cycle is shown in both cells, involving RUBISCO.

C4 plants have a more efficient system of processing CO₂ than C3 plants

Source: Taub, D. Effects of Rising Atmospheric Concentrations of Carbon Dioxide on Plants. Nature (2010)
Source: Wikipedia, C4 carbon fixation, WEB, http://en.wikipedia.org/wiki/C4_plants (2011)

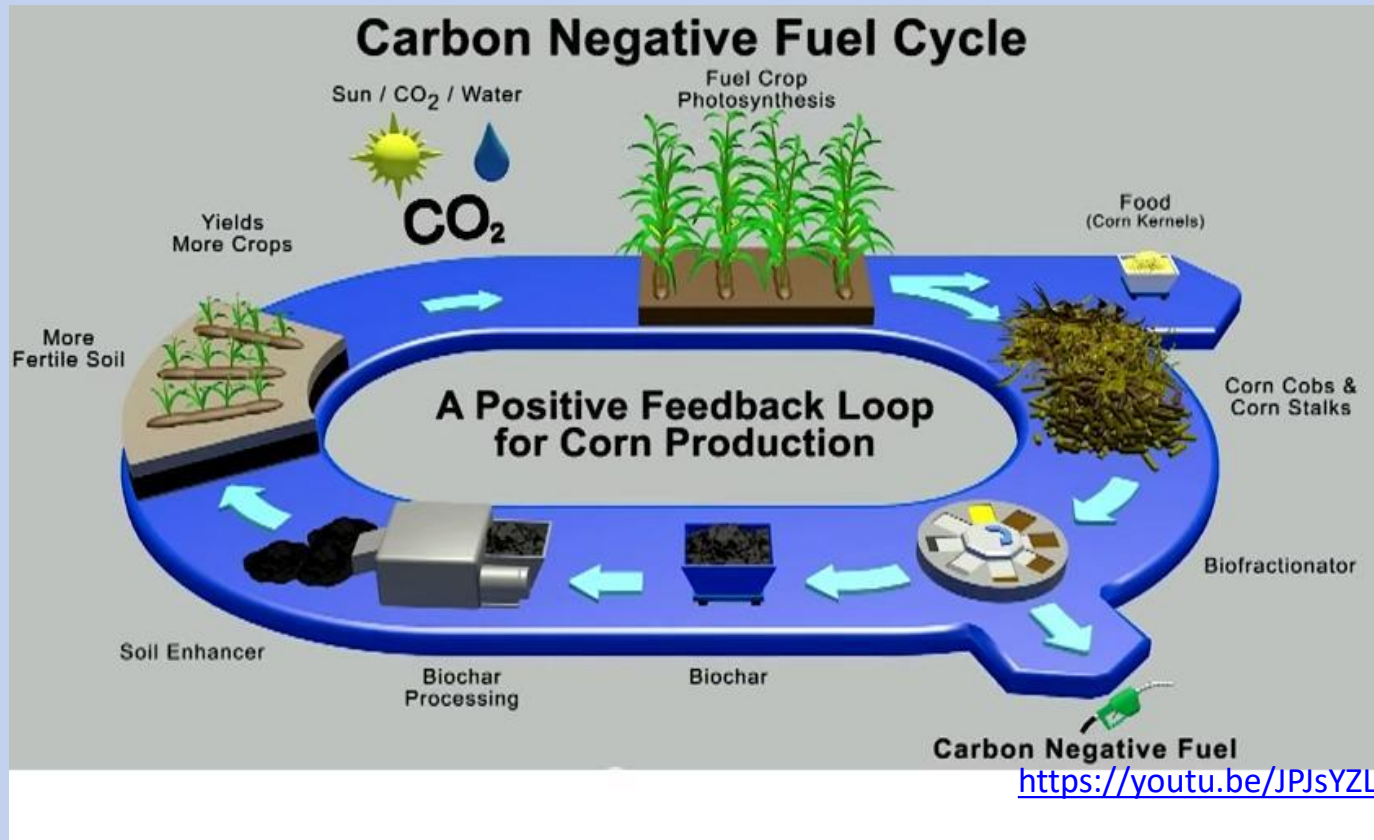
5

https://youtu.be/JPJsYZLU_sM?t=535

Types of Photosynthesis

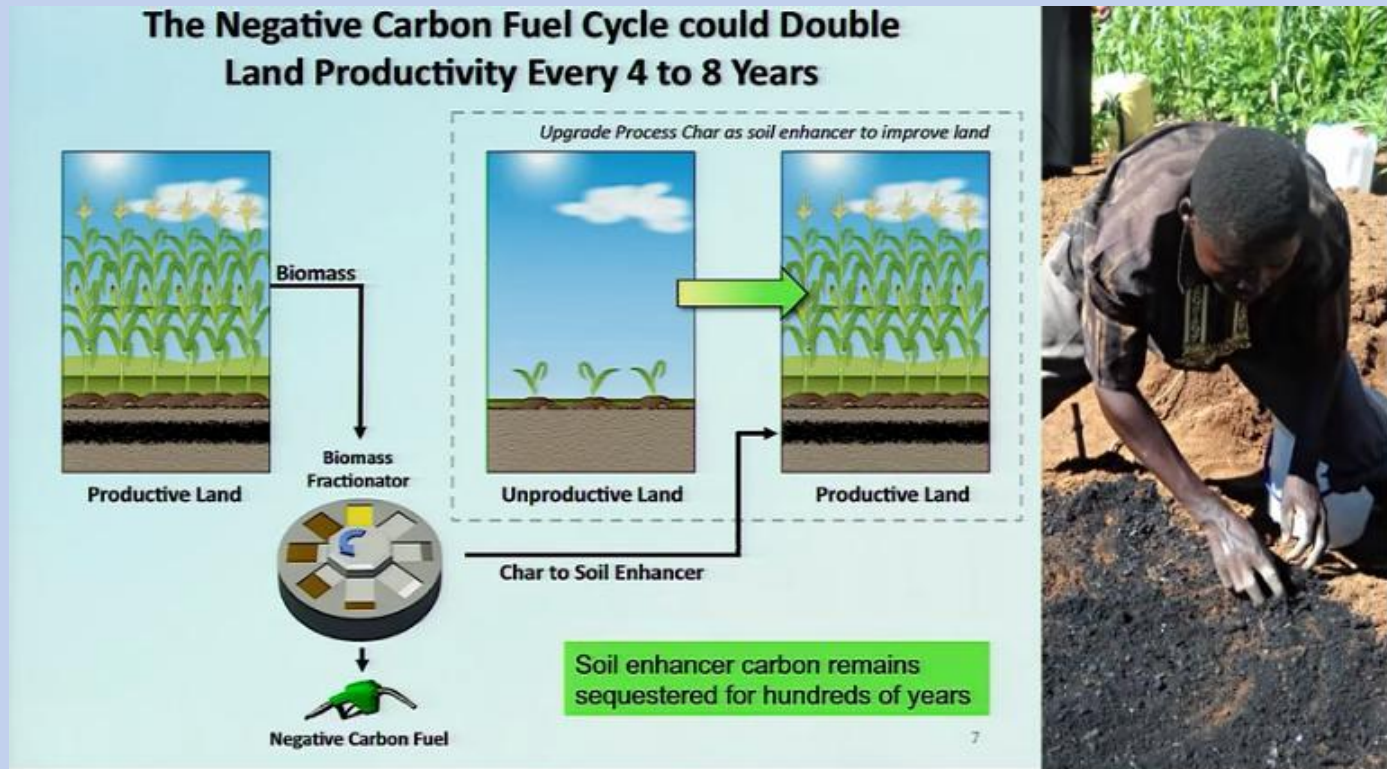
- **About C3, C4 and Cam Photosynthesis and Plants:**
- **Photosynthetic efficiency:** http://en.wikipedia.org/wiki/Photosynthetic_efficiency
- **C3 carbon fixation:** http://en.wikipedia.org/wiki/C3_carbon_fixation
- **C4 carbon fixation:** http://en.m.wikipedia.org/wiki/C4_carbon_fixation
- **Summary table comparison:** <http://www.cropsreview.com/types-of-photosynthesis.html>
- **C3 C4 CAM Photosynthesis video:** https://www.youtube.com/watch?v=Yg_pdXzWXVA

Carbon negative fuel cycle: Biochar and Biofuels



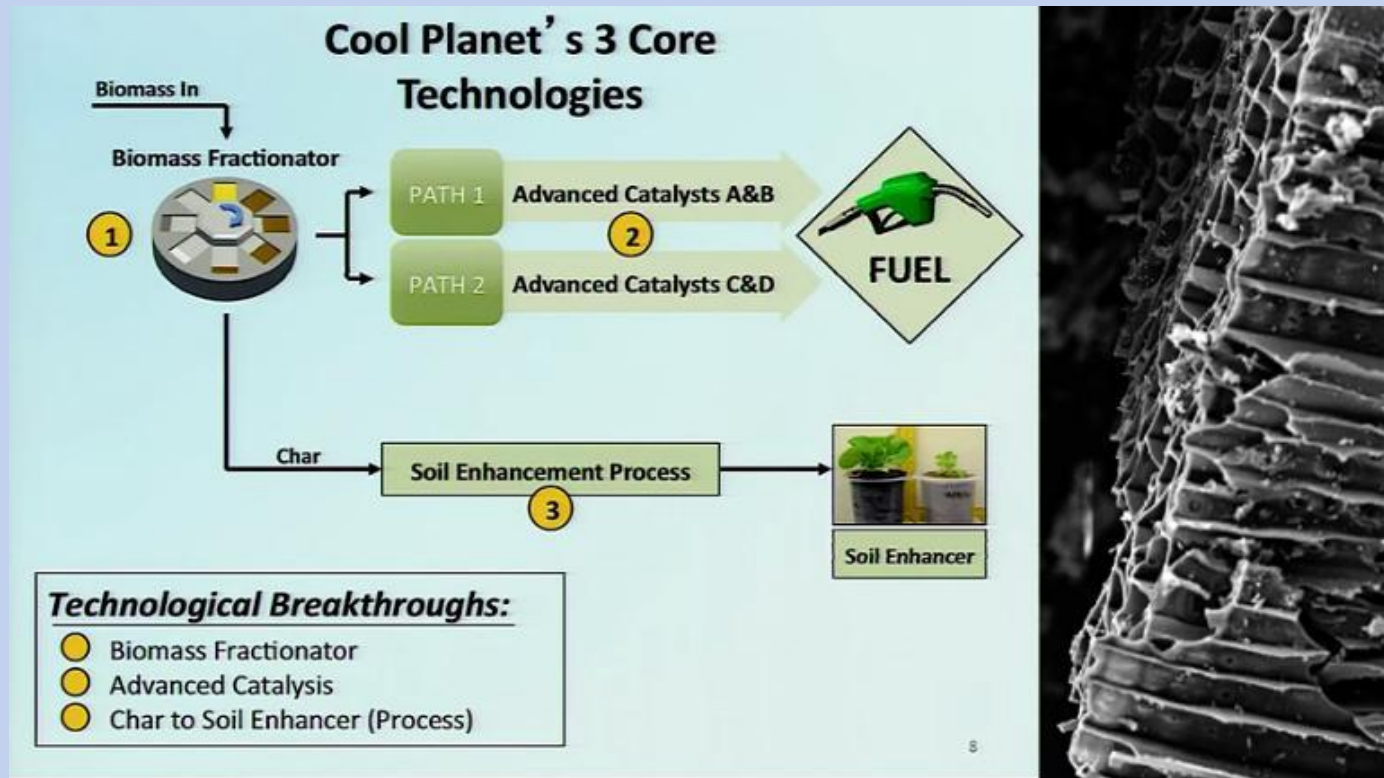
https://youtu.be/JPJSYZLU_sM?t=535

Soil Enhancement



https://youtu.be/JPJsYZLU_sM?t=535



Core Technologies:



Sponsorships



Current Plans to Deploy the Negative Carbon Fuel Cycle



Commercial Plants - 50 million gallons a year
(2,000 plants worldwide – developed world)

Global Village Plants - 1 million gallons a year
(100,000 plants worldwide – emerging world)

As suggested by:

google.org

Up to 8X gain in village income by increasing energy & food production while bringing the village into the information society

9

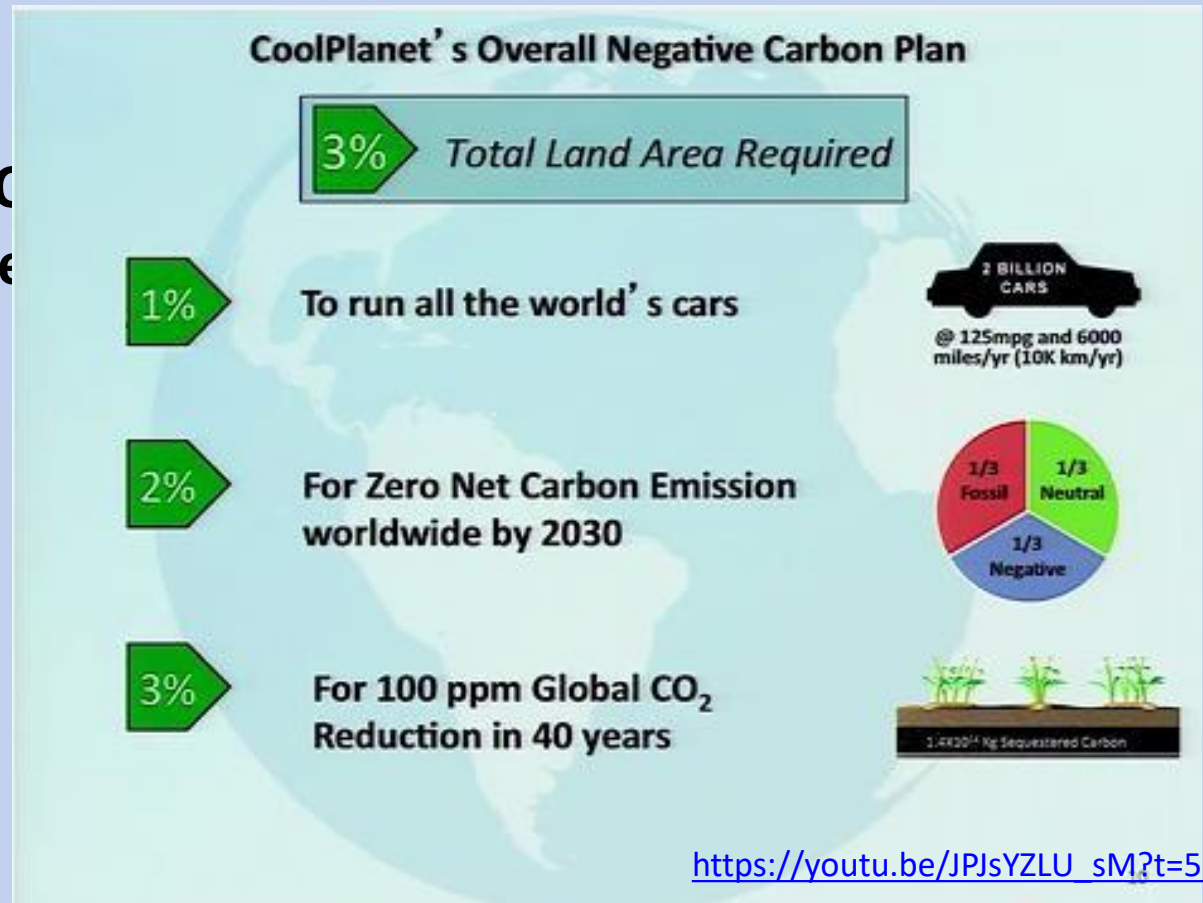
Logos: Google ventures, GE, bp, Constellation, ConocoPhillips, NRG, North Bridge venture partners, Shea Ventures



https://youtu.be/JPJsYZLU_sM?t=535

CARBON NEGATIVE BENEFITS:

- Sequester CO₂
- create Biofuel



BIOCHAR

- Ron Larson Presentation MAY 15TH to OLLI West class:

- BIOCHAR: POLICY AND COMPETITION:

- <http://denverclimatestudygroup.com/wp-content/uploads/2014/07/Larson-biochar-PART-B-BIOCHAR2017.pdf>



Move to Archive x

Agriculture.com



Successful **Farming**



Crops News

GENERAL MILLS AIMS TO DRIVE REGENERATIVE AGRICULTURE ON 1 MILLION ACRES BY 2030

**GM'S SUSTAINABILITY
OFFICER SAYS TRAINING,
PROGRAMS WILL BOOST SOIL
HEALTH AND ECONOMIC
RESILIENCE.**

Bio-energy with carbon capture and storage (BECCS)

Bio-energy with carbon capture and storage

- https://en.wikipedia.org/wiki/Bio-energy_with_carbon_capture_and_storage

OTHER - EXTRAS

- **Efficiency – the single quickest way to reduce:**
 - **What NREL is doing: Efficiency, Solar, wind, other**
- **Other strategies:**
 - **CCL – carbon fee/dividend**
 - **Cap and trade?**
- **Gloom and Doom? NO! IT'S A CHALLENGE, and humanity has always been challenged and we are an adaptable species that has met the challenge over and over again!**

National Renewable Energy Lab: NREL

- <http://www.nrel.gov/>

Go to this 74 slide presentation:
**TRANSITION TO RENEWABLE
ENERGY:** [OSHER 10.14.15](#)

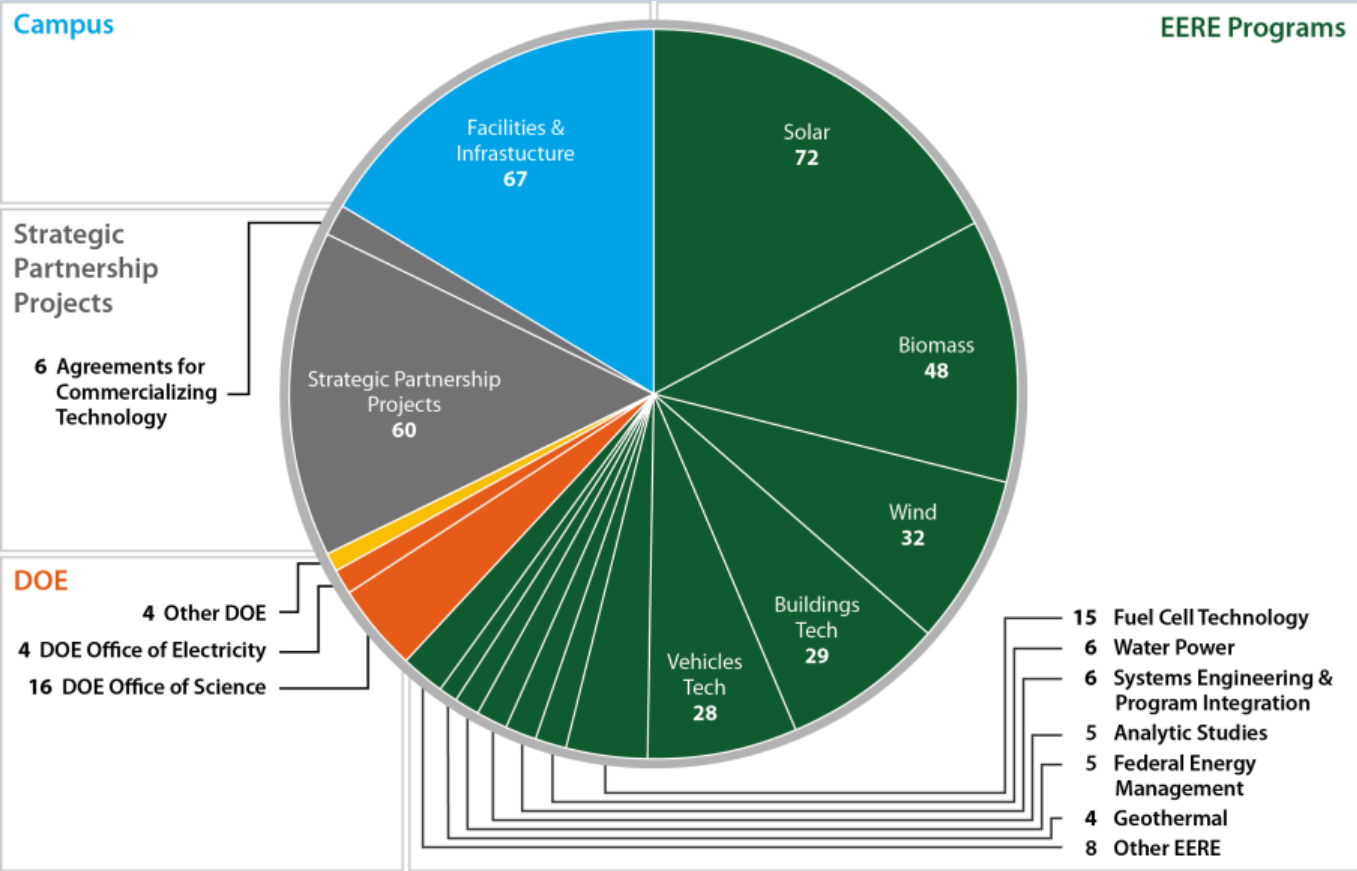


Leading the Way to a Clean Energy Future

The Transition to Renewable Energy
OSHER
David Warner, NREL Public Affairs Office
October 14, 2015

See What DOE's National Renewable Energy Lab (NREL) is Doing!

- Go to this 74 slide presentation: **TRANSITION TO RENEWABLE ENERGY** - [OSHER 10.14.15](http://OSHER.10.14.15)



SOLUTIONS

Carbon fee/dividend:

- citizensclimatelobby.org/ccl-applauds-republican-resolution-calling-for-action-on-climate-change/
- <http://citizensclimatelobby.org/>
- Facebook:
 - CCI – national:
<https://www.facebook.com/CitizensClimateLobby/?ref=ts>
 - CCL-Colorado:
<https://www.facebook.com/CitizensClimateLobbyDenverChapter/>

IN SUMMARY

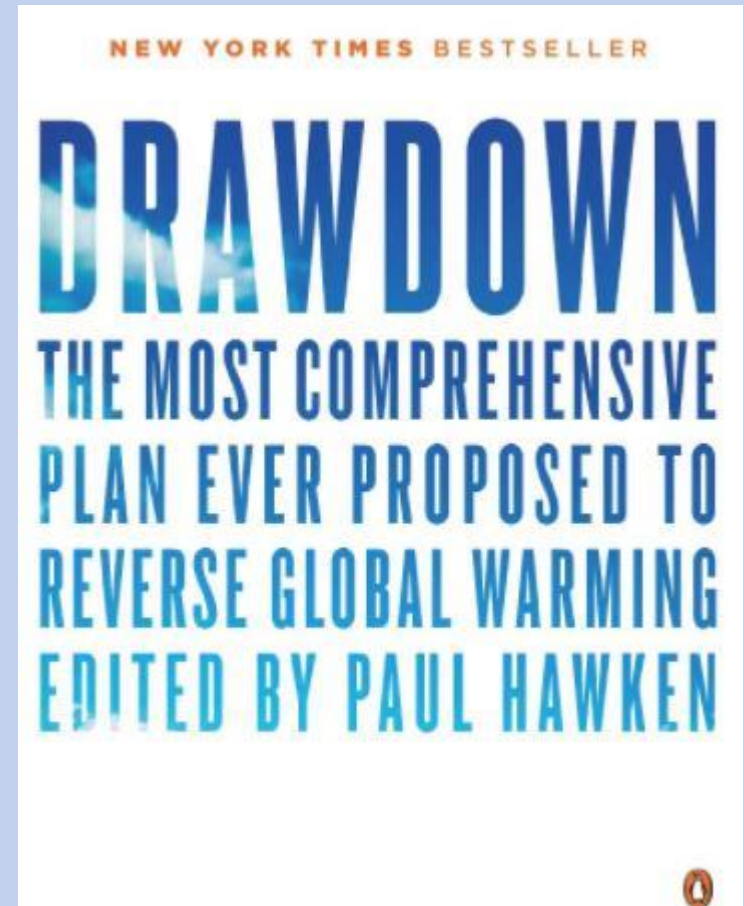
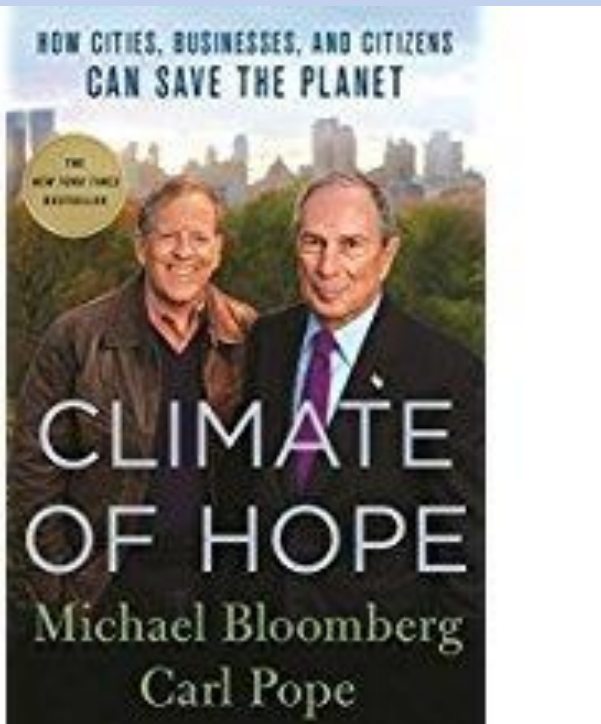
1. The world has been getting better
2. **Changes** are happening; **WE NEED TO CHANGE:**
 - 25+ Ways to Reduce Your Carbon Footprint:
<http://cotap.org/reduce-carbon-footprint/>
3. We need to support science and new technologies

DON'T FORGET WEEK 6 SLIDES AND LINKS:

Week 6 (2/28): Solutions; part A

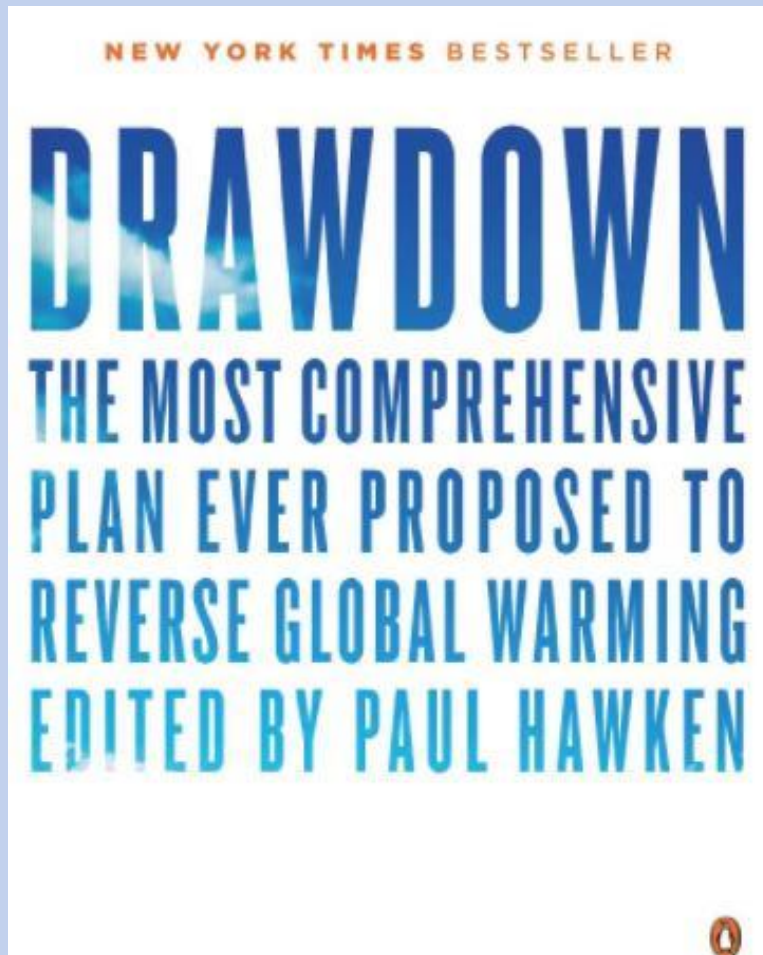
- **PDF SLIDES: [OLLI East week 6 slides final](#)**

- **READ:**
Climate of Hope – Solutions
Drawdown – and associated web
pages



Drawdown

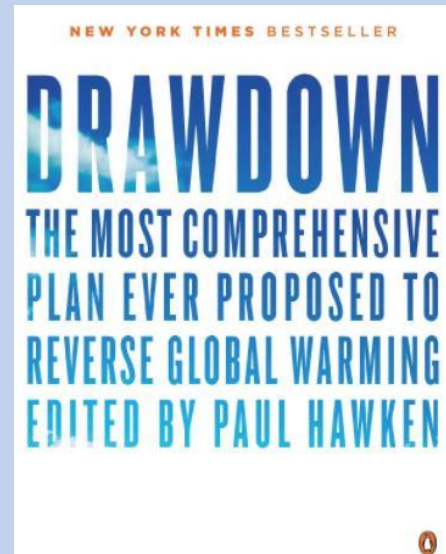
<http://www.drawdown.org/solutions-summary-by-rank>



- Drawdown video: 60 minutes with Paul Hawken: <https://youtu.be/4XrFnK1RrLE>

Colorado Renewable Energy Society – YouTube of selected talks:

- Drawdown CRES YouTube video: Drawdown: Ways out of the Climate Crisis. Paul Hawken, Chip Comins: <https://youtu.be/4XrFnK1RrLE>
- Other Drawdown links:
 - <http://www.drawdown.org/>
 - <http://www.drawdown.org/solutions>
 - <https://www.facebook.com/projectdrawdown>
- <http://www.drawdown.org/solutions-summary-by-rank>



**The Debate Should Not Be About Whether
Climate Change Is Happening...**

...Rather, What Are We Going to Do About It?

HHMI

SMALL WORKS
BY SARAH LAZAROVIC
(COMPLETEly)
HOW TO NOT BE DEPRESSED*
ABOUT CLIMATE CHANGE



Climate gradualism—"we all want to act on climate, but we also have to be slow, incremental, and realistic"—is the new climate denialism. —Alex Steffen

Steffen is 100% right that this kind of rhetoric is a tool of the status quo and an excuse for politicians and executives to do nothing. At the same time, the idea that it's game time for humanity (even though it is) can be a psychological nonstarter when it comes to getting things done. It's only in the movies that Tom Cruise comes back from insurmountable odds to save the planet, winking all the while. Even as we face our planetary mission impossible with the clock ticking, the way to prevail begins with a first step and then putting one foot in front of the other.

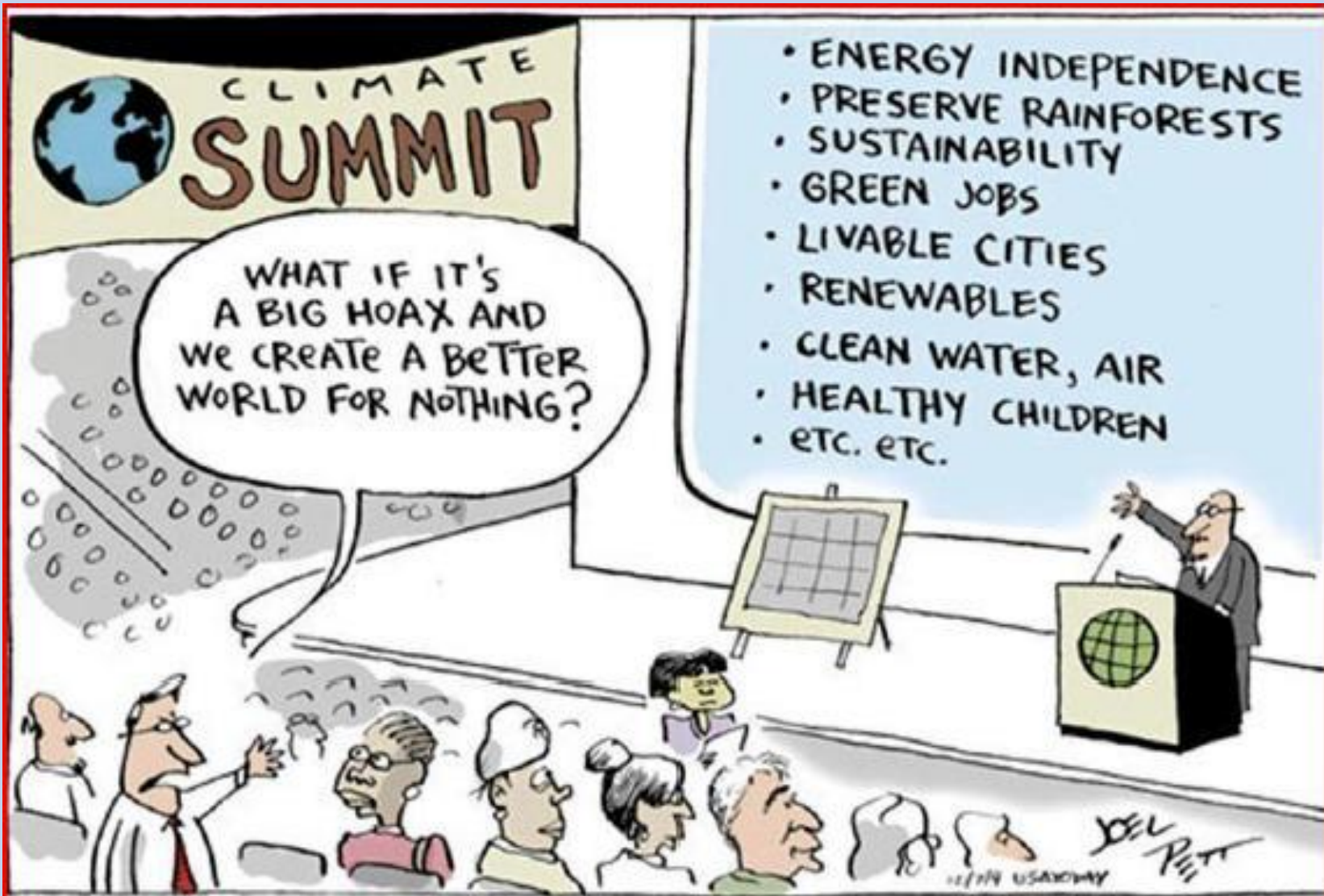
*Solastalgia is the term for this depression. There are support groups + medical help for those in need.



Doing something every day can be profoundly helpful in giving people hope, and it's a path to change.

CLICK HERE:

https://www.yesmagazine.org/planet/how-to-not-be-completely-depressed-about-climate-change-20190107?fbclid=IwAR177qhNTknD9K0_kflZmj9G9pKmzdPGSti2fEcQ3DITEAKxrA_R0Wm8ac0



It's the right thing to do.