Use of Quality Tools to Prevent Damage Due to Climate Change

David M. Saunders

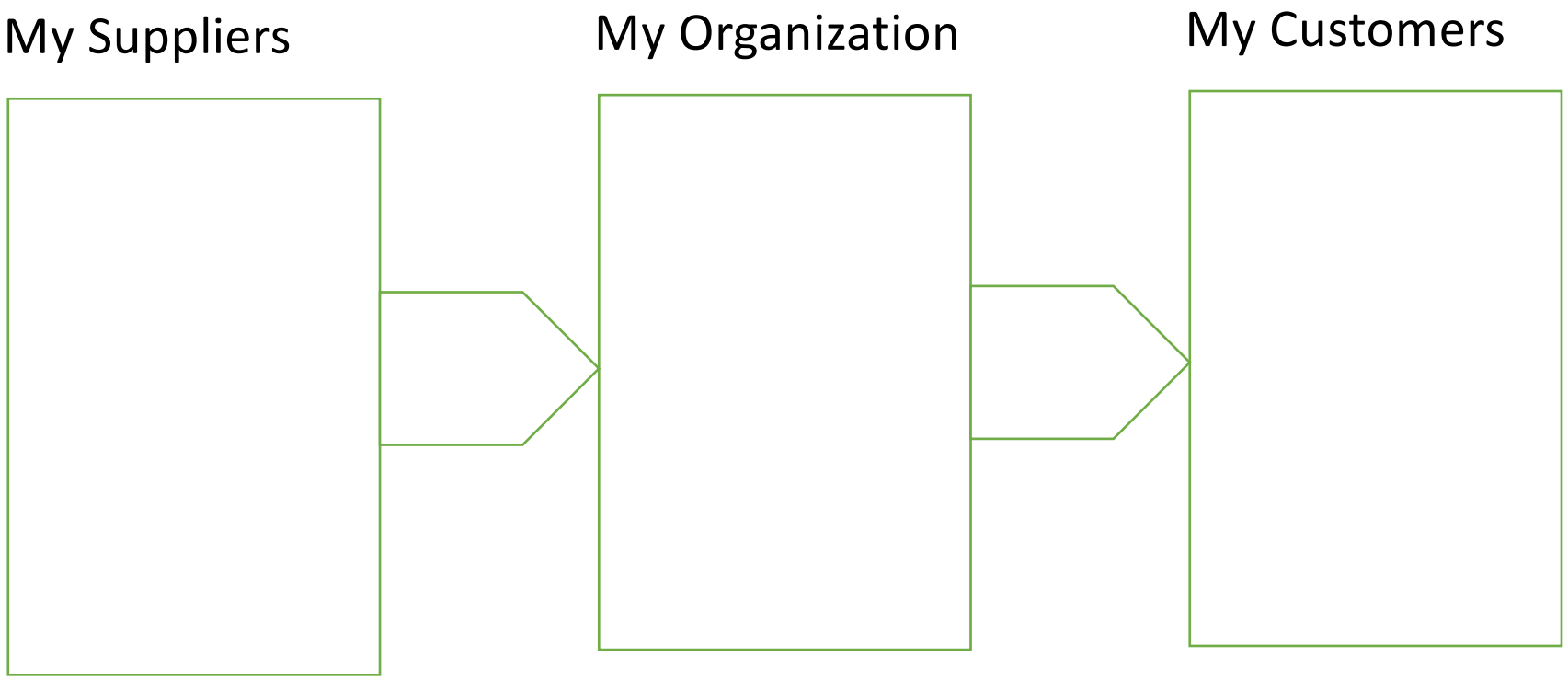
davidsaunders107@gmail.com

ASQ Baltimore Section

September 8, 2020

Brainstorm Risks Due to Climate Change

(floods, sea-level rise, intense storms, heat, infrastructure failure…)



Talk with a Climate Change Professional (CC-P)

- Director of Sustainability for large mid-western university
- Improving Vehicle Optimization
- Improving Tree Maintenance

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Live Online CC-P® Prep Programs:
Fall 2020 Training Announced ... Sign up Today!

Our live online training programs are led by instructors with recognized expertise and substantial experience in their respective subject areas. The curriculum is designed to prepare you to pass the CC-P® exams:

1. Climate Science & Vulnerability Assessment
2. GHG, Energy & Water Management
3. Governance, Law & Policy
4. Materiality, Risk Management & Economics

Download the Program Schedule

Enroll Today & Become a CC-P®!

Daytime Program
(Cohort V)

Classes Begin:
September 14, 2020

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Evening Program
(Cohort VI)

Classes Begin:
October 6, 2020

Last Class:
November 19, 2020

Tuition

ACCO Members:
$470

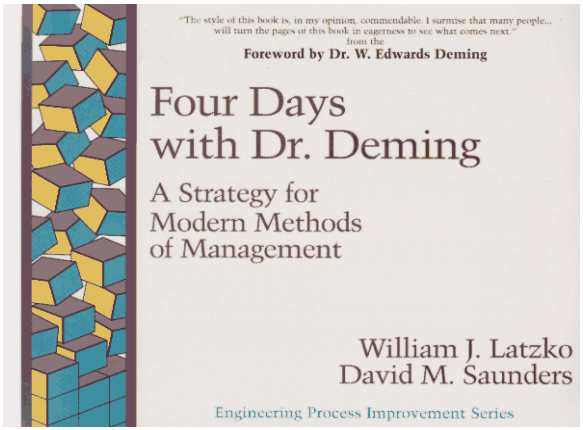
Non-member registrants must join ACCO:
$1 per month for 6 months

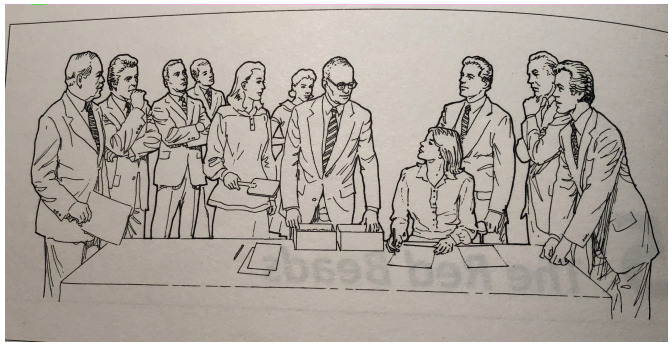
Scholarships now available!

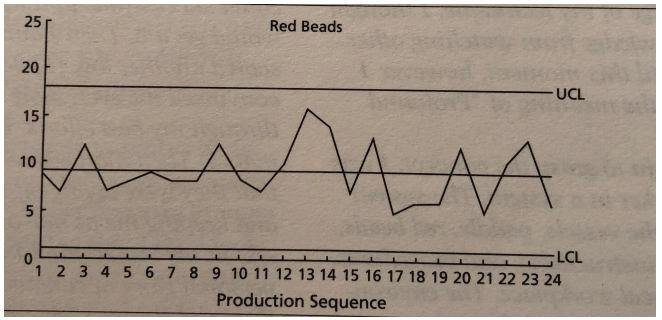
Agenda

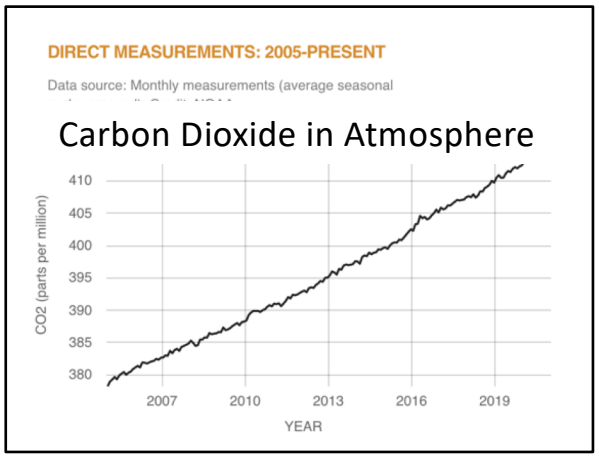
- ❑ Dr. W. Edwards Deming
- ❑ Vulnerability Assessments
- ❑ CO_2 Mitigation
- ❑ GHG (Greenhouse Gas) Reporting
- ❑ Solar Panels
- ❑ Taking Action
- ❑ Good News

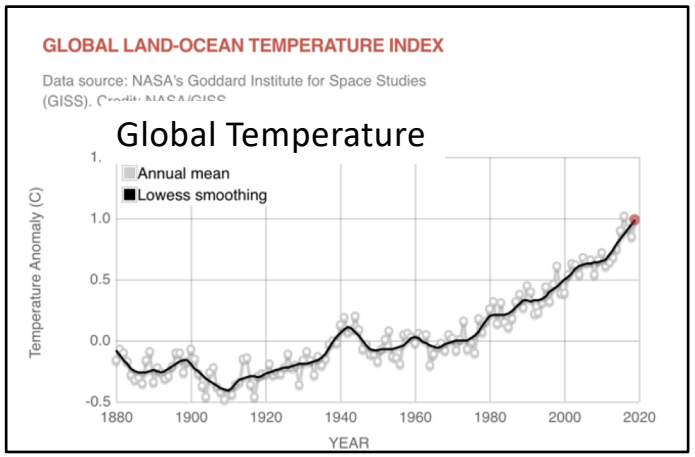
Dr. W. Edwards Deming

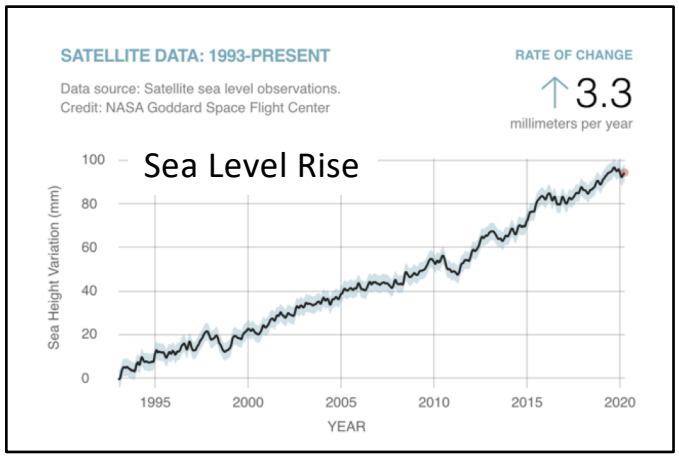


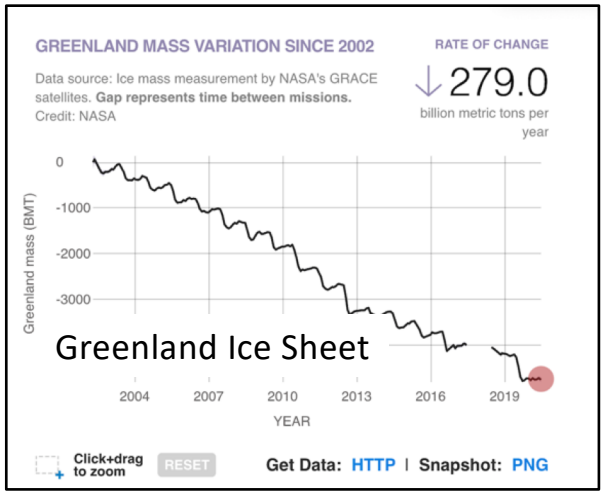


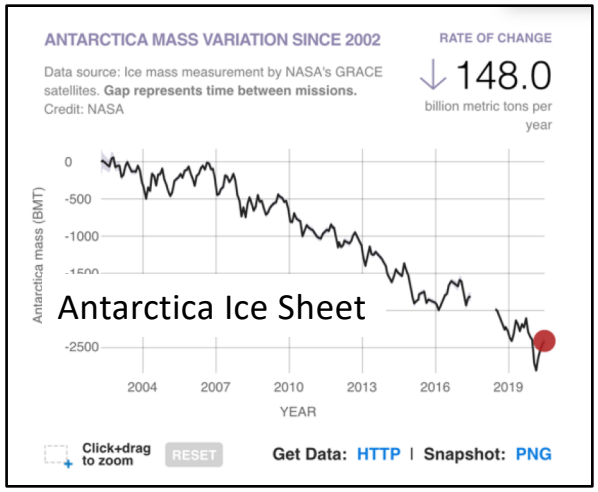


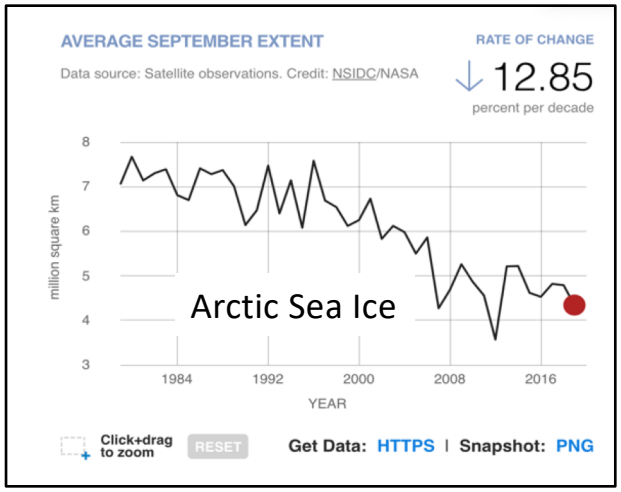












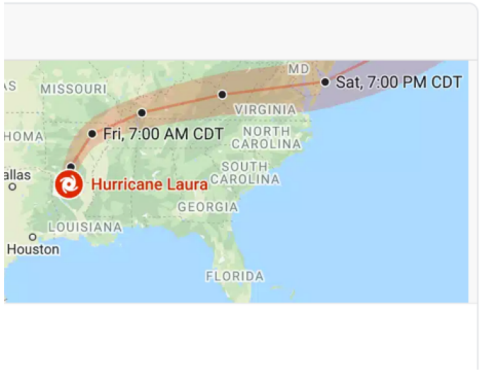
Source: https://climate.nasa.gov/vital-signs/ice-sheets/

Have any of you been asked:

1. To conduct **vulnerability assessment**.

2. To develop a **CO_2 mitigation plan**.

3. To **report progress** on environmental issues.



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Live Online CC-P® Prep Program #3
GHG-101: Basics of GHG Accounting, Reporting & Disclosing GHG Emissions (July 27, 2020)

Slide 58 of 68

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Author has permission to use ACCO charts.

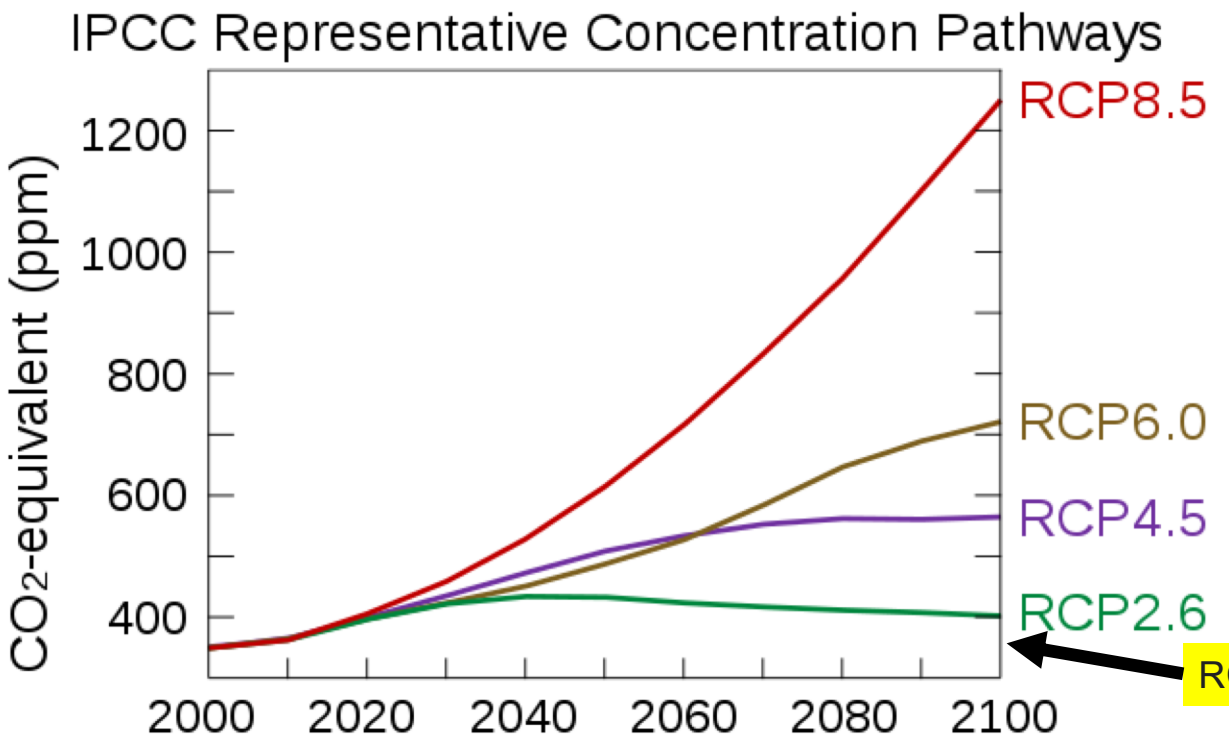
1. How to conduct a **vulnerability assessment**

U.S. Climate Resilience Toolkit

National Oceanic and Atmospheric Administration (NOAA)

Source: https://toolkit.climate.gov/

The Intergovernmental Panel on Climate Change (IPCC)



RCP1.9 is 1.5 °C, the Paris Agreement.[4]

Source: https://en.wikipedia.org/wiki/Representative_Concentration_Pathway

The Past, the Present, and the Future

16 Sea-Level Rise Modeling Handbook: Resource Guide for Coastal Land Managers, Engineers, and Scientists

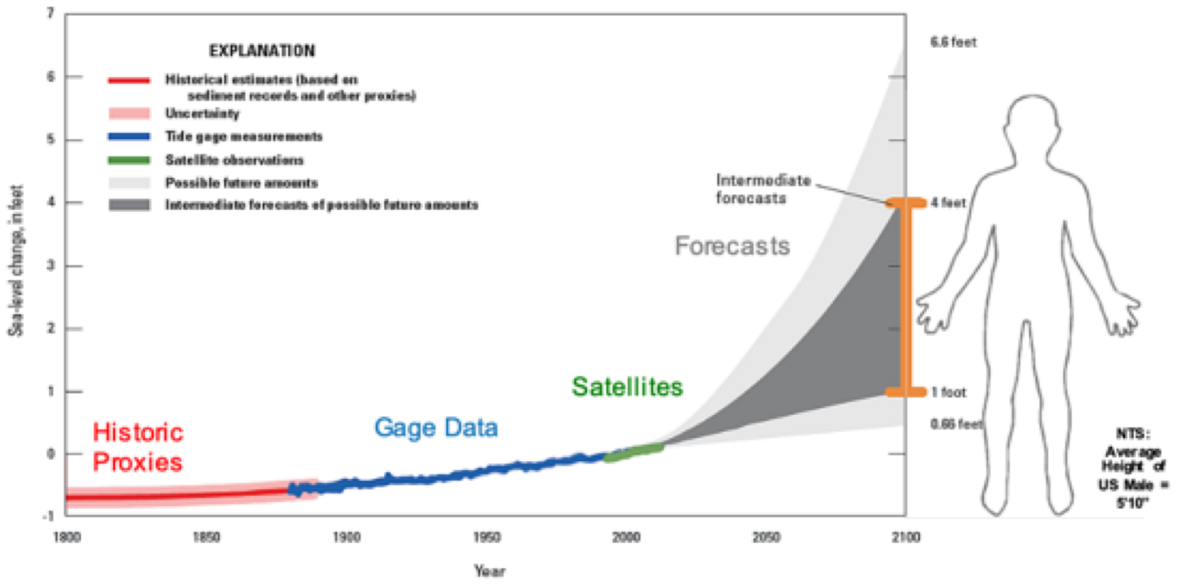
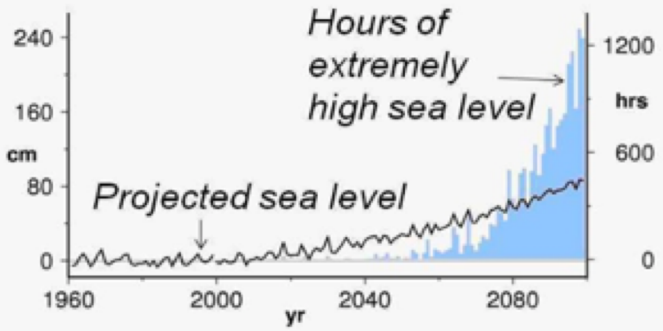


Figure 9. Historical, observed, and possible future amounts of global sea-level rise from 1800 to 2100 (from Melillo and others, 2014). Historical estimates (based on sediment records and other proxies) are shown in red (pink band shows uncertainty range), tide gage measurements in blue, and satellite observations in green.

Sea Level Rise Alone is Only Half the Answer

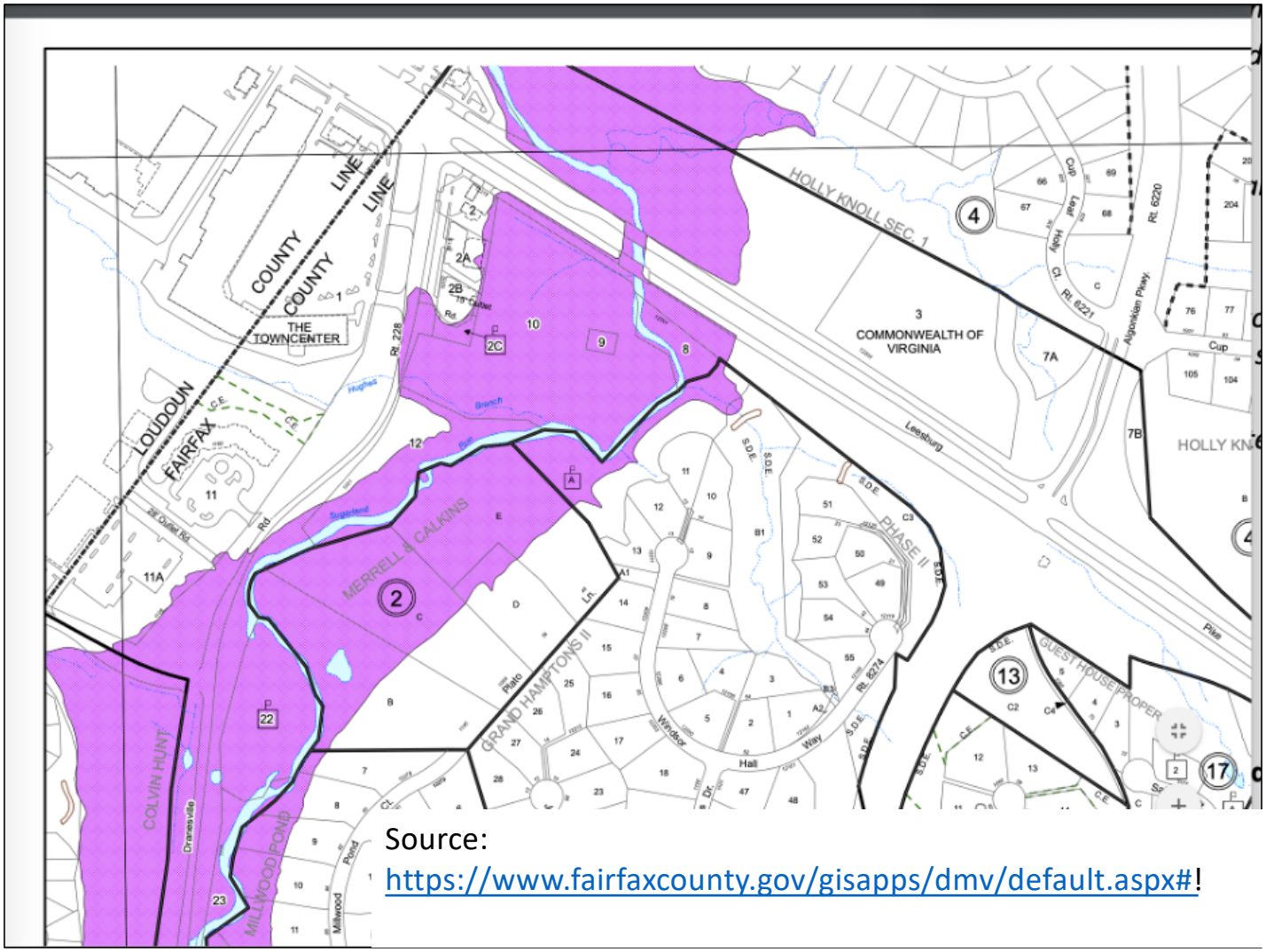
Sea-level rise will magnify the adverse impact of storm surges and high waves on the coast



Extreme high sea level events (>1.4 m above historical mean sea level) in San Francisco Bay is projected to increase substantially with sea-level rise based on model results

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

(NRC, 2012)



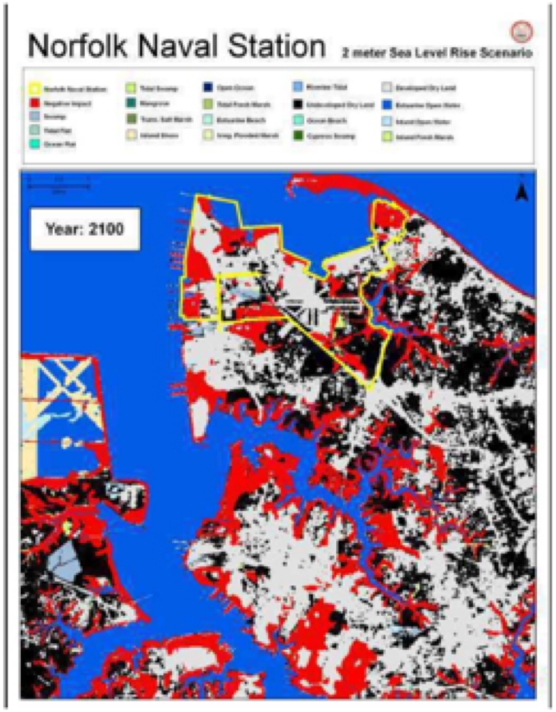
Source: https://www.fairfaxcounty.gov/gisapps/dmv/default.aspx#!

SLR-focused models at your fingertips

ECOLOGY

- **Ecological Response Models (habitat switching)**
  - SLAMM: Sea Level Rise Affecting Marsh Model

SLAMM



Burks-Copes et. al. (2014)

What are the Impacts of Climate Hazards on Systems upon Which you are Dependant?

ELECTRICITY DEMAND

WILD FIRE

INTENSIFICATION OF HEAT WAVES

Fro
Cal

On
am
hor
ten
wir
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ave
inc
sev

WINE INDUSTRY

LOSS OF WINTER RECREATION

RISING TEMPERATURES IN AGRICULTURE

From: Our Cha
California (pdf)

The agriculture
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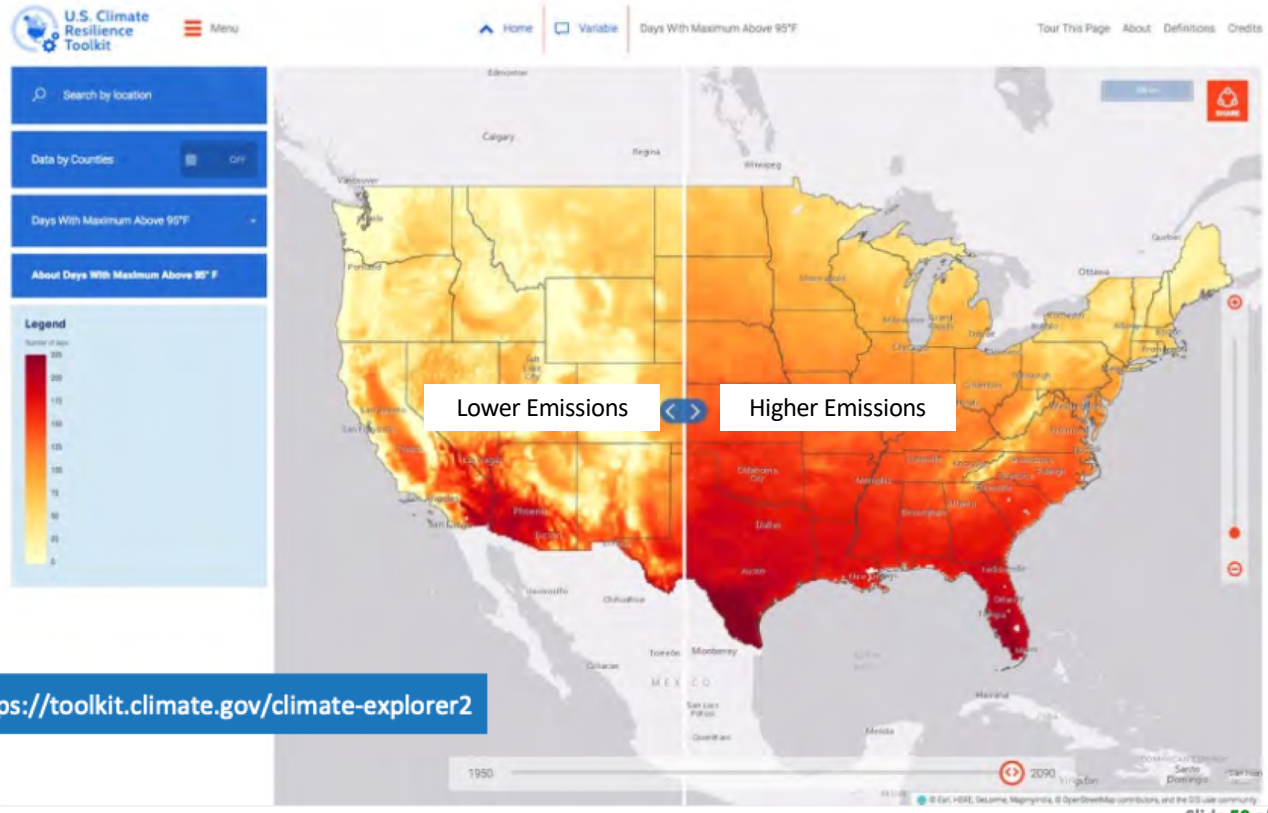
temperatures r
on the water su
diseases and o

Many fruit and
changes. As the

Mapping & Graphing Tool: Climate Explorer



https://toolkit.climate.gov/climate-explorer2

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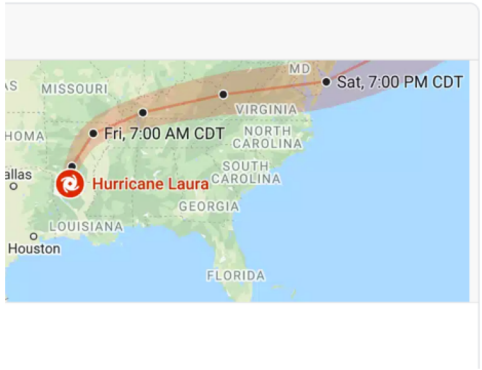

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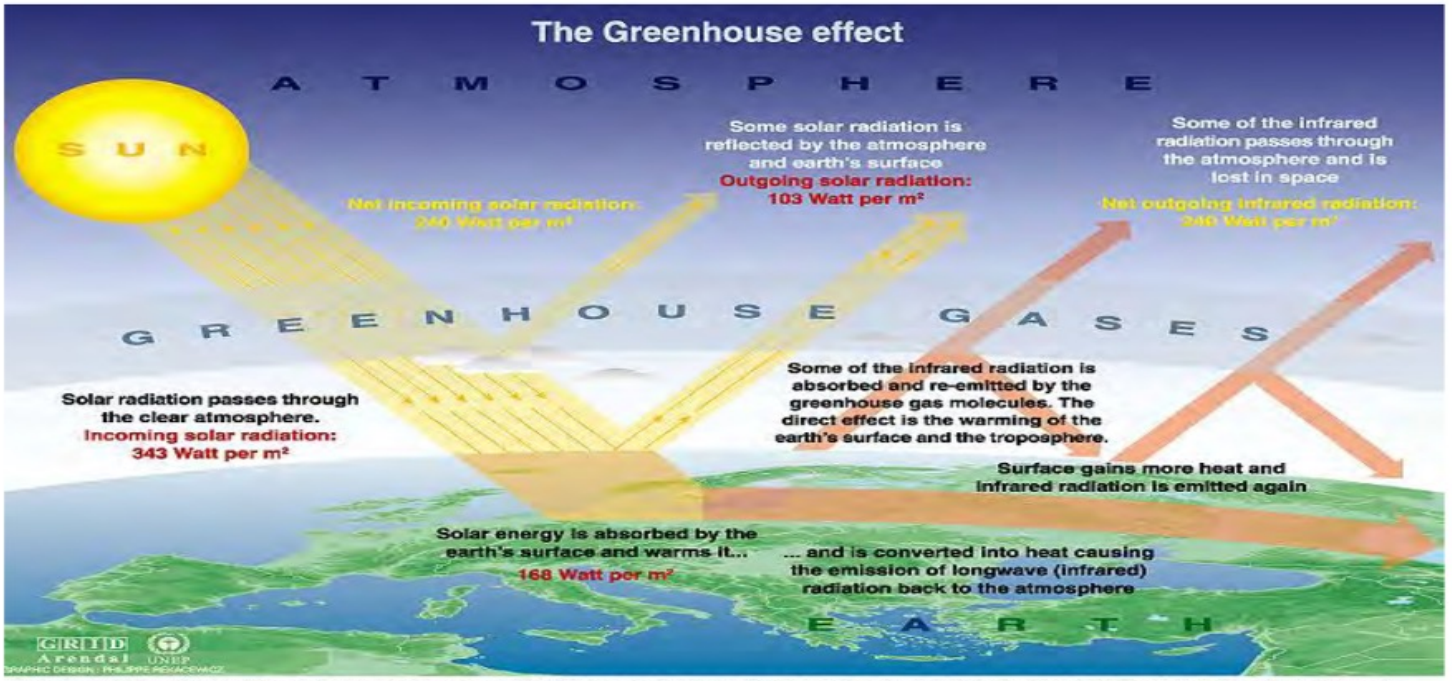
Anthropogenic Global Warming



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

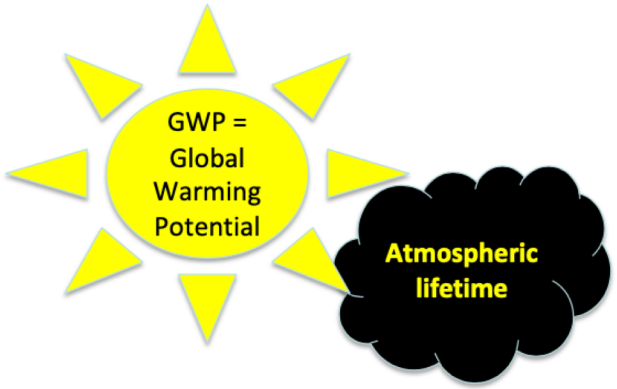
Greenhouse Gases (GHGs)

Kyoto Gases:

- Carbon dioxide (CO_2) GWP 1
- Methane (CH_4) GWP 21
- Nitrous oxide (N_2O) GWP 310
- Hydrofluorocarbons (HFCs)
  (HFC 134a) GWP 1,300 → 1,430
- Perfluorocarbons (PFCs)
  (CF_4) GWP 6,500
- Sulphur hexafluoride (SF_6) GWP 23,900

+

- Nitrogen triflouride (NF_3)
  GWP 17,200
- Hydrofluorinated ethers (HFEs)
  GWP 11 → 14,900



Design Consideration: Common Protocols & Standards

- WRI/WBCSD - The GHG Protocol
  - Corporate Accounting and Reporting Standard
  - Corporate Value Chain (Scope 3) Standard
  - Project Protocol
  - GHG Protocol for Cities
- The Climate Registry "TCR"
  (General Reporting Protocol, Local Government Operations Protocol, Electric Power Sector, etc.)

WORLD RESOURCES INSTITUTE

wbcsd

World Business Council for Sustainable Development (WBCSD)

The Climate Registry

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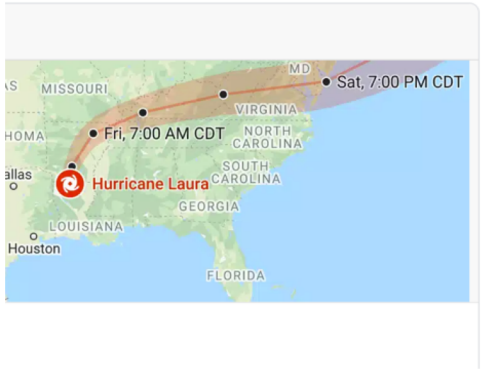

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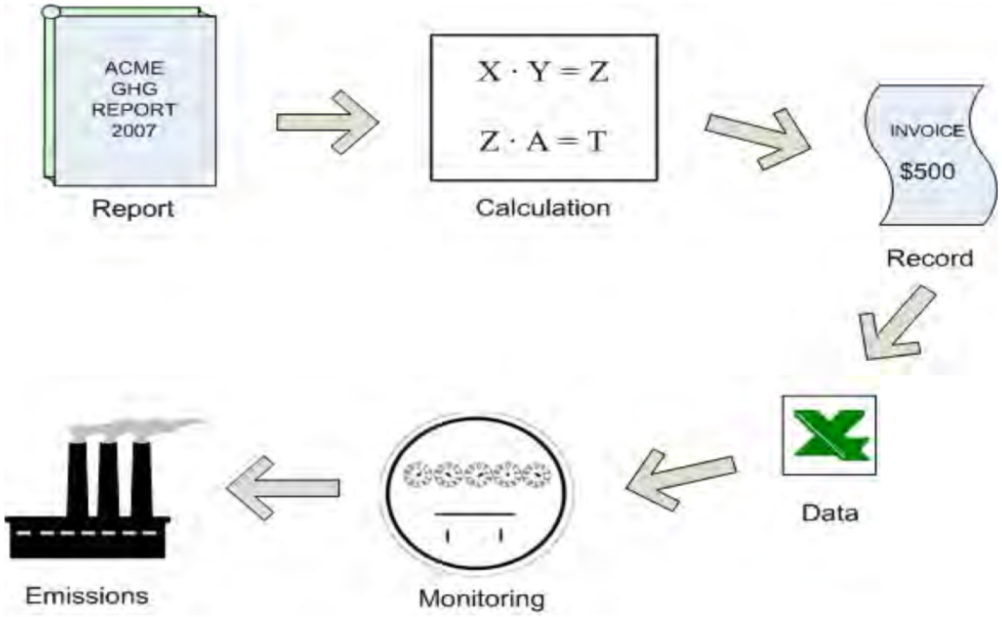
Design Consideration:
Common Protocols & Standards

- Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC)
- ICLEI Greenhouse Gas Protocols (4 total)
  - US Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (ICLEI version of the GPC)
  - Local Government Operations Protocol (LGOP)
  - Global Protocol for Community Scale Emissions
  - Recycling and Composting Emissions Protocol
- ISO 14064-1:2018 Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

I·C·L·E·I
Local Governments for Sustainability

ISO International Organization for Standardization

Following the Audit Trail



Voluntary Reporting & Disclosure

Securities and Exchange Commission (SEC) Guidance on Climate Change Disclosure for Publicly-traded Companies

SEC INTERPRETIVE GUIDANCE ON CLIMATE CHANGE DISCLOSURE	
Section of Guidance	**Examples of Potential Disclosure Items**
Impact of Legislation & Regulation **International Accords**	• Cost to purchase credits in a cap and trade system • Costs to improve facilities to comply with regulatory limits of a cap and trade system • Changes to profit/loss from changed demand for goods and services
Indirect Consequences of Regulation or Business Trends	• Decreased demands for goods with significant GHG emissions, or increased demand for those with lower emissions • Increased demand for energy from alternative energy sources • Decreased demand for services related to fossil fuels, such as drilling services or equipment maintenance
Physical Impacts	• Disruption of manufacturing or transport for registrants with operations on coastlines • Indirect impacts to major customers or suppliers from severe weather, such as hurricanes or floods • Increased claims and liabilities for insurance and reinsurance companies • Decreased agricultural production due to drought or other weather changes

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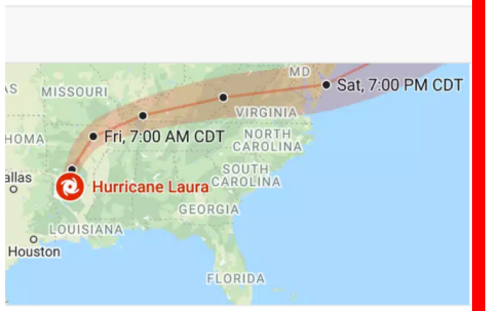

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Maryland Climate Leadership Academy

- https://www.mdclimateacademy.org/
- Sponsored by Department of Natural Resources for Maryland
- Tuition paid if you qualify and live in Maryland.

Maryland Climate Leadership Academy

Administered by:

MARYLAND

MARYLAND DEPARTMENT OF NATURAL RESOURCES

Powered by:

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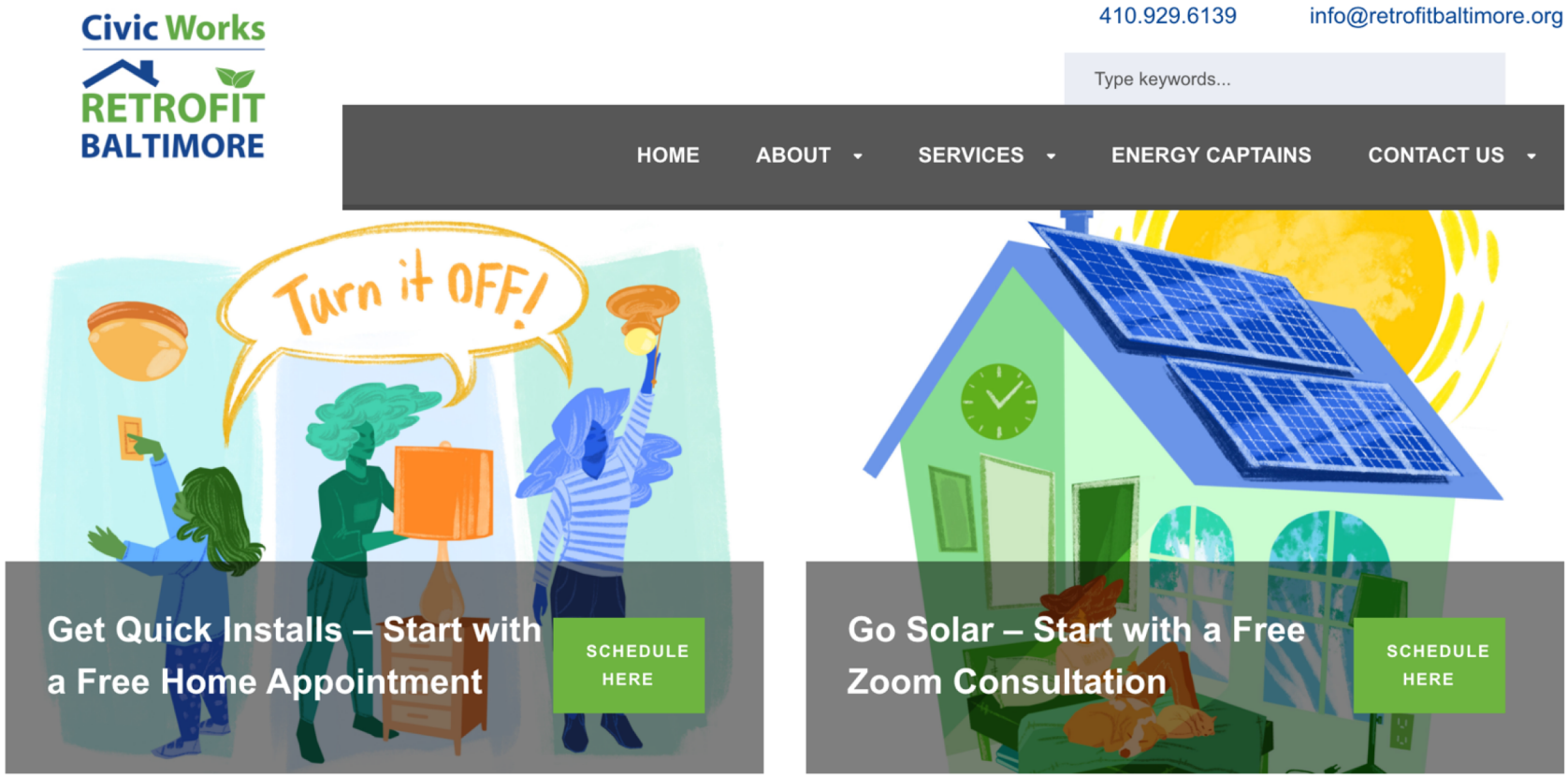

For more info: http://energyprograms.civicworks.com/

For more info: https://neighborhoodsun.solar/


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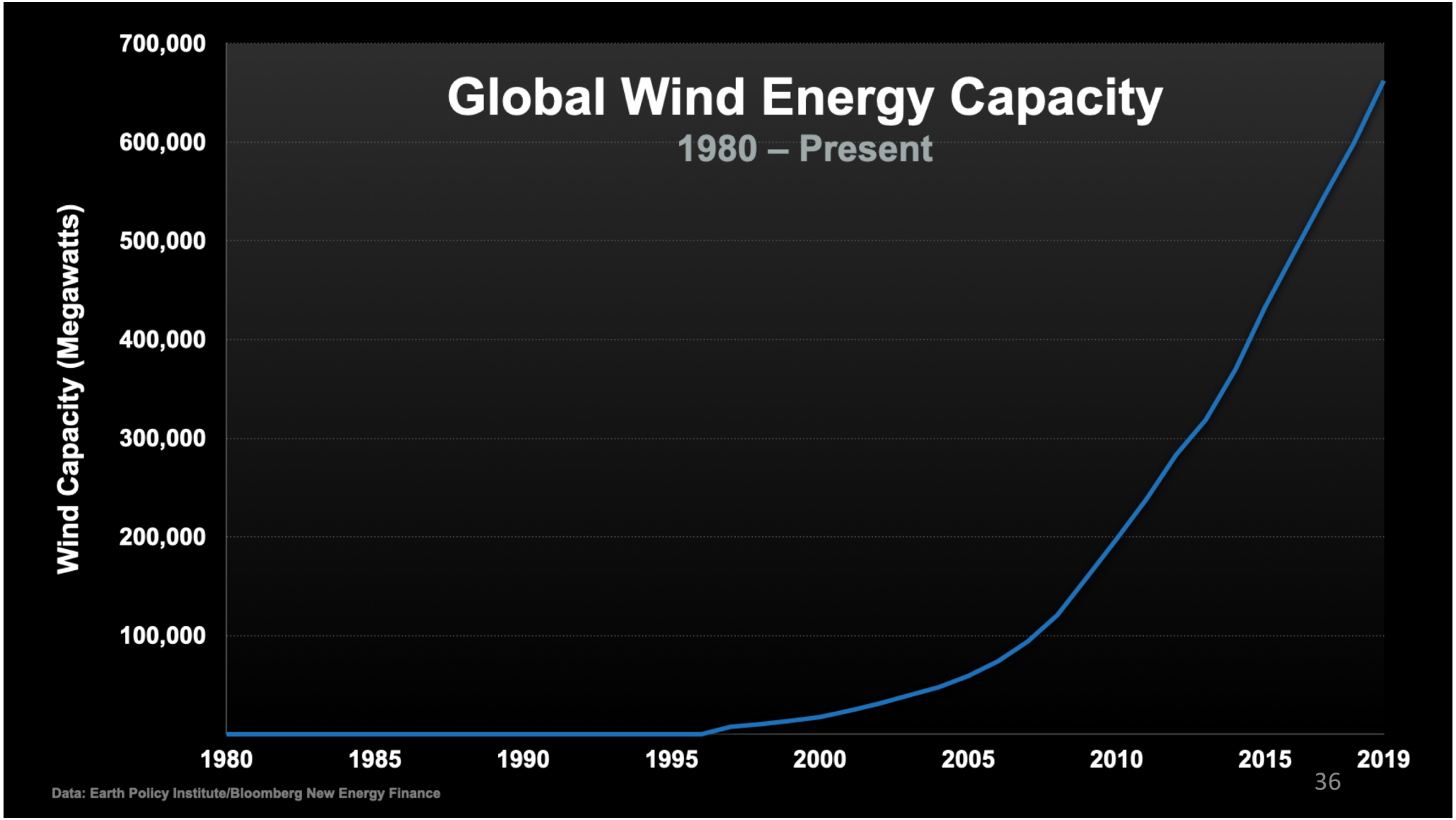
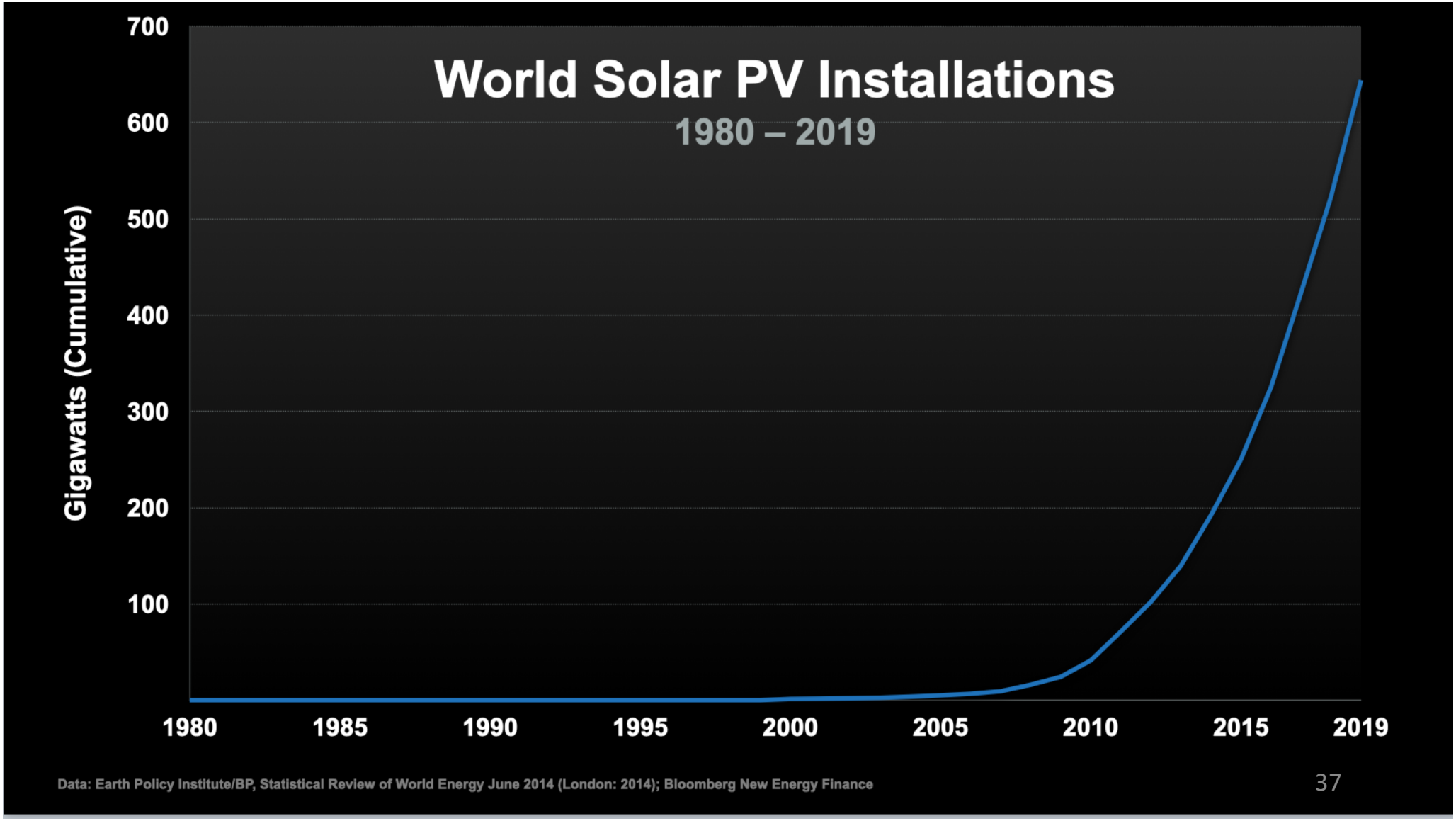
An Exelon Company
Outage | Pay Bill | Moving | Contact Us
Search...
My Account
Outages
Ways to Save
Smart Energy
Safety & Com
Smart Grid & Smart Meter +
Innovation & Technology +
My Green Power Connection –
Solar for Home & Business +
Developers & Contractors +
Other Renewables
FAQs
Contact Us
Home > Smart Energy > My Green Power Connection
My Green Power Connection
Green Power Connection is our process, and team of experts, available for customers interested in generating their own electricity and connecting with the energy grid.
Learn about the process for installing rooftop and commercial solar energy systems. Use our solar calculator to estimate your installation costs and energy savings. Get tips on how to find a contractor, and apply for interconnection.
Solar for Residential & Business
Find resources for helping customers apply for interconnection.
Developers & Contractors

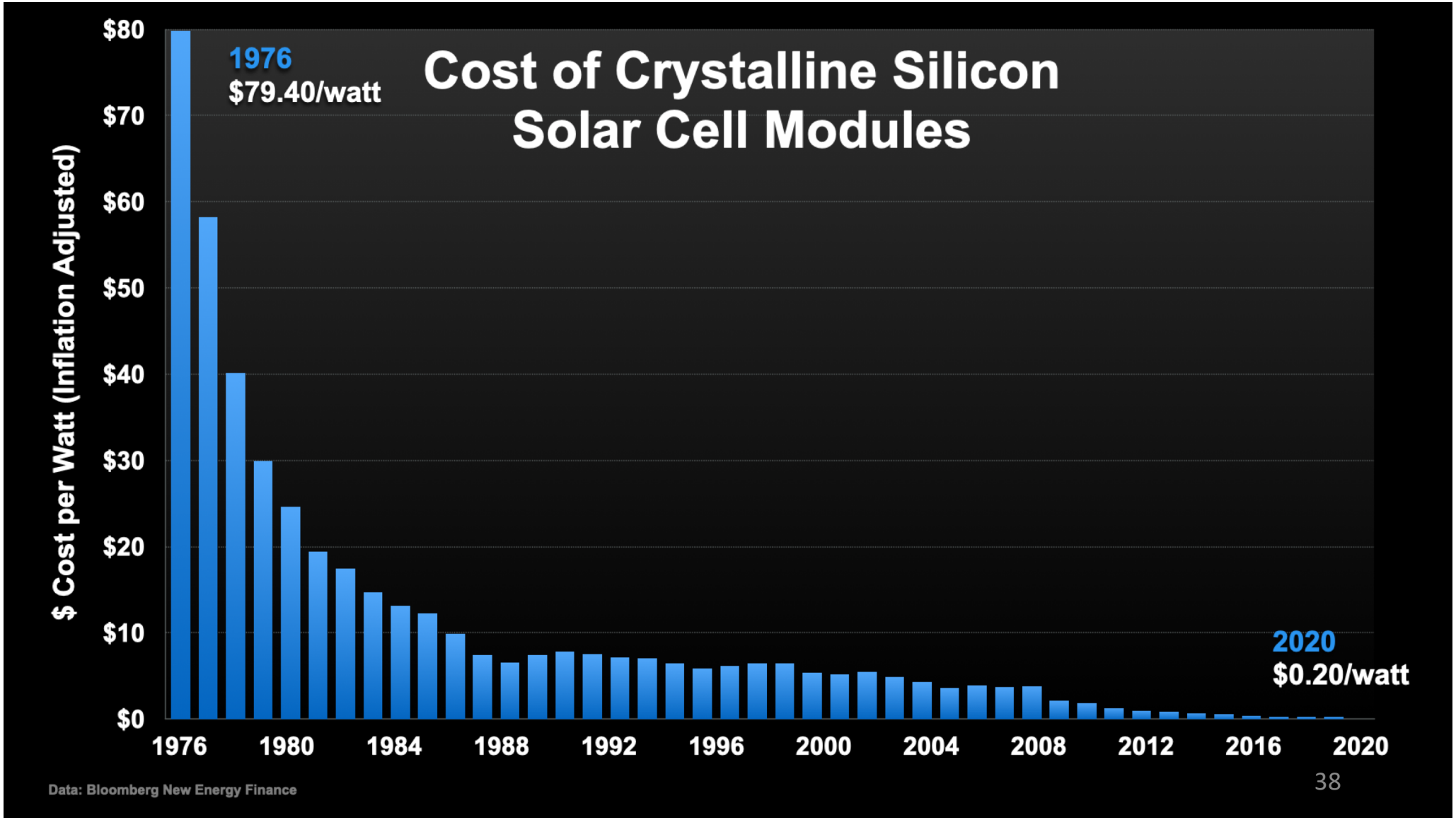
Chesapeake Climate Action Network (CCAN)

For more info: https://chesapeakeclimate.org/

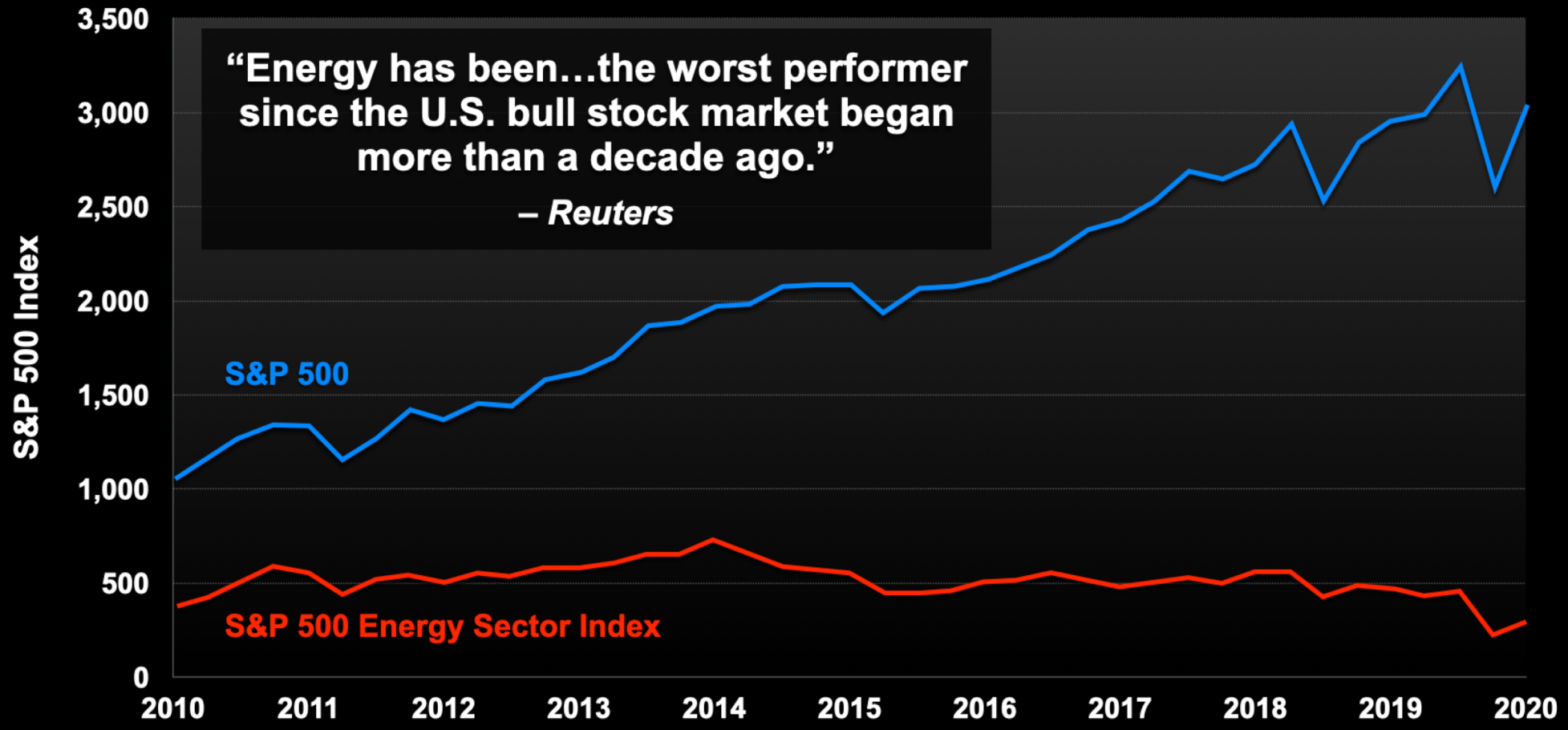

THE CLIMATE REALITY LEADERSHIP CORPS
GLOBAL TRAINING
44th in the Series
The Climate Reality Project®


Global Wind Energy Capacity
1980 – Present
Wind Capacity (Megawatts)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
1980
1985
1990
1995
2000
2005
2010
2015
2019
Data: Earth Policy Institute/Bloomberg New Energy Finance


World Solar PV Installations
1980 – 2019
Gigawatts (Cumulative)
700
600
500
400
300
200
100
1980
1985
1990
1995
2000
2005
2010
2015
2019
Data: Earth Policy Institute/BP, Statistical Review of World Energy June 2014 (London: 2014); Bloomberg New Energy Finance


Cost of Crystalline Silicon
Solar Cell Modules
1976
$79.40/watt
2020
$0.20/watt
$ Cost per Watt (Inflation Adjusted)
$80
$70
$60
$50
$40
$30
$20
$10
$0
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
Data: Bloomberg New Energy Finance

Conventional Energy Stocks Are the Worst Investments



Data: MarketWatch

How to drive fossil fuels out of the US economy, quickly

The US has everything it needs to decarbonize by 2035.

By David Roberts | @drvox | david@vox.com | Aug 6, 2020, 10:10am EDT

SHARE

The roof of the 96,000-square-foot "Circa" building on Platte Street in the Lower Highland neighborhood in Denver,

In the runup to World War II, President Franklin Delano Roosevelt enlisted the entire US economy in an effort to scale up production of war material. All of the country's resources were bent to the task. In 1939, the US had 1,700 aircraft; in 1945, it had 300,000 military aircraft and 18,500 B–24 bombers.

Source: https://www.vox.com/energy-and-environment/21349200/climate-change-fossil-fuels-rewiring-america-electrify

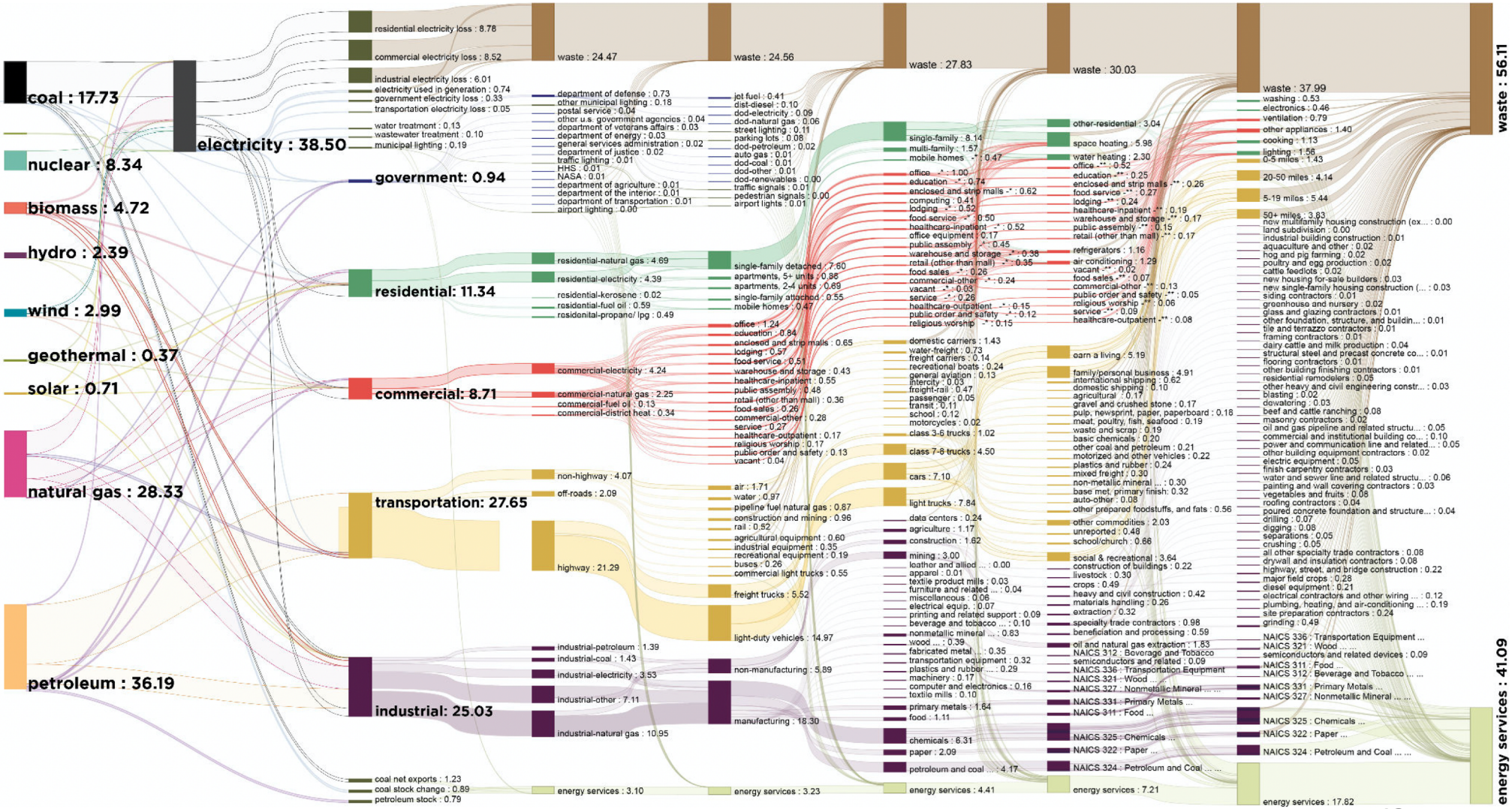
REWIRING AMERICA

A Field Manual for the Climate Fight

Saul Griffith

with more than a little help from

Laura Fraser
Sam Calisch
July 29, 2020


coal : 17.73
nuclear : 8.34
biomass : 4.72
hydro : 2.39
wind : 2.99
geothermal : 0.37
solar : 0.71
natural gas : 28.33
petroleum : 36.19
electricity : 38.50
government: 0.94
residential: 11.34
commercial: 8.71
transportation: 27.65
industrial: 25.03
residential electricity loss : 8.78
commercial electricity loss : 8.52
industrial electricity loss : 6.01
electricity used in generation : 0.74
government electricity loss : 0.33
transportation electricity loss : 0.05
water treatment : 0.13
wastewater treatment : 0.10
municipal lighting : 0.19
coal net exports : 1.23
coal stock change : 0.89
petroleum stock : 0.79
waste : 24.47
department of defense : 0.73
other municipal lighting : 0.18
postal service : 0.04
other u.s. government agencies : 0.04
department of veterans affairs : 0.03
department of energy : 0.03
general services administration : 0.02
department of justice : 0.02
traffic lighting : 0.01
HHS : 0.01
NASA : 0.01
department of agriculture : 0.01
department of the interior : 0.01
department of transportation : 0.01
airport lighting : 0.00
residential-natural gas : 4.69
residential-electricity : 4.39
residential-kerosene : 0.02
residential-fuel oil : 0.59
residenital-propane/ lpg : 0.49
commercial-electricity : 4.24
commercial-natural gas : 2.25
commercial-fuel oil : 0.13
commercial-district heat : 0.34
non-highway : 4.07
off-roads : 2.09
highway : 21.29
industrial-petroleum : 1.39
industrial-coal : 1.43
industrial-electricity : 3.53
industrial-other : 7.11
industrial-natural gas : 10.95
energy services : 3.10
waste : 24.56
jet fuel : 0.41
dist-diesel : 0.10
dod-electricity : 0.09
dod-natural gas : 0.06
street lighting : 0.11
parking lots : 0.08
dod-petroleum : 0.02
auto gas : 0.01
dod-coal : 0.01
dod-other : 0.01
dod-renewables : 0.00
traffic signals : 0.01
pedestrian signals : 0.00
airport lights : 0.01
single-family detached : 7.60
apartments, 5+ units : 0.86
apartments, 2-4 units : 0.69
single-family attached : 0.55
mobile homes : 0.47
office : 1.24
education : 0.84
enclosed and strip malls : 0.65
lodging : 0.57
food service : 0.51
warehouse and storage : 0.43
healthcare-inpatient : 0.55
public assembly : 0.48
retail (other than mall) : 0.36
food sales : 0.26
commercial-other : 0.28
service : 0.27
healthcare-outpatient : 0.17
religious worship : 0.17
public order and safety : 0.13
vacant : 0.04
air : 1.71
water : 0.97
pipeline fuel natural gas : 0.87
construction and mining : 0.96
rail : 0.52
agricultural equipment : 0.60
industrial equipment : 0.35
recreational equipment : 0.19
buses : 0.26
commercial light trucks : 0.55
freight trucks : 5.52
light-duty vehicles : 14.97
non-manufacturing : 5.89
manufacturing : 18.30
energy services : 3.23
waste : 27.83
single-family : 8.14
multi-family : 1.57
mobile homes -* : 0.47
office -* : 1.00
education -* : 0.74
enclosed and strip malls -* : 0.62
computing : 0.41
food sales -* : 0.52
food service -* : 0.50
healthcare-inpatient -* : 0.52
office equipment : 0.17
public assembly -* : 0.45
warehouse and storage -* : 0.38
retail (other than mall) -* : 0.35
lodging -* : 0.26
commercial-other -* : 0.24
vacant -* : 0.03
service -* : 0.26
healthcare-outpatient -* : 0.15
public order and safety -* : 0.12
religious worship -* : 0.15
domestic carriers : 1.43
water-freight : 0.73
freight carriers : 0.14
recreational boats : 0.24
general aviation : 0.13
intercity : 0.03
freight-rail : 0.47
passenger : 0.05
transit : 0.11
school : 0.12
motorcycles : 0.02
class 3-6 trucks : 1.02
class 7-8 trucks : 4.50
cars : 7.10
light trucks : 7.84
data centers : 0.24
agriculture : 1.17
construction : 1.62
mining : 3.00
leather and allied ... : 0.00
apparel : 0.01
textile product mills : 0.03
furniture and related ... : 0.04
miscellaneous : 0.06
electrical equip. : 0.07
printing and related support : 0.09
beverage and tobacco ... : 0.10
nonmetallic mineral ... : 0.83
wood ... : 0.39
fabricated metal ... : 0.35
transportation equipment : 0.32
plastics and rubber ... : 0.29
machinery : 0.17
computer and electronics : 0.16
textile mills : 0.10
primary metals : 1.64
food : 1.11
chemicals : 6.31
paper : 2.09
petroleum and coal ... : 4.17
energy services : 4.41
waste : 30.03
other-residential : 3.04
space heating : 5.98
water heating : 2.30
office -** : 0.52
education -** : 0.25
enclosed and strip malls -** : 0.26
food service -** : 0.27
lodging -** : 0.24
healthcare-inpatient -** : 0.19
warehouse and storage -** : 0.17
public assembly -** : 0.15
retail (other than mall) -** : 0.17
refrigerators : 1.16
air conditioning : 1.29
vacant -** : 0.02
food sales -** : 0.07
commercial-other -** : 0.13
public order and safety -** : 0.05
religious worship -** : 0.06
service -** : 0.09
healthcare-outpatient -** : 0.08
earn a living : 5.19
family/personal business : 4.91
international shipping : 0.62
domestic shipping : 0.10
agricultural : 0.17
gravel and crushed stone : 0.17
pulp, newsprint, paper, paperboard : 0.18
meat, poultry, fish, seafood : 0.19
waste and scrap : 0.19
basic chemicals : 0.20
other coal and petroleum : 0.21
motorized and other vehicles : 0.22
plastics and rubber : 0.24
mixed freight : 0.30
non-metallic mineral ... : 0.30
base met, primary finish: 0.32
auto-other : 0.08
other prepared foodstuffs, and fats : 0.56
other commodities : 2.03
unreported : 0.48
school/church : 0.66
social & recreational : 3.64
construction of buildings : 0.22
livestock : 0.30
crops : 0.49
heavy and civil construction : 0.42
materials handling : 0.26
extraction : 0.32
specialty trade contractors : 0.98
beneficiation and processing : 0.59
oil and natural gas extraction : 1.83
NAICS 312 : Beverage and Tobacco
semiconductors and related : 0.09
NAICS 336 : Transportation Equipment
NAICS 321 : Wood ...
NAICS 327 : Nonmetallic Mineral ...
NAICS 331 : Primary Metals ...
NAICS 311 : Food ...
NAICS 325 : Chemicals ...
NAICS 322 : Paper ...
NAICS 324 : Petroleum and Coal ...
energy services : 7.21
waste : 37.99
washing : 0.53
electronics : 0.46
ventilation : 0.79
other appliances : 1.40
cooking : 1.13
lighting : 1.56
0-5 miles : 1.43
20-50 miles : 4.14
5-19 miles : 5.44
50+ miles : 3.83
new multifamily housing construction (ex... : 0.00
land subdivision : 0.00
industrial building construction : 0.01
aquaculture and other : 0.02
hog and pig farming : 0.02
poultry and egg production : 0.02
cattle feedlots : 0.02
new housing for-sale builders : 0.03
new single-family housing construction (... : 0.03
siding contractors : 0.01
greenhouse and nursery : 0.02
glass and glazing contractors : 0.01
other foundation, structure, and buildin... : 0.01
tile and terrazzo contractors : 0.01
framing contractors : 0.01
dairy cattle and milk production : 0.04
structural steel and precast concrete co... : 0.01
flooring contractors : 0.01
other building finishing contractors : 0.01
residential remodelers : 0.05
other heavy and civil engineering constr... : 0.03
blasting : 0.02
dewatering : 0.03
beef and cattle ranching : 0.08
masonry contractors : 0.02
oil and gas pipeline and related structu... : 0.05
commercial and institutional building co... : 0.10
power and communication line and related... : 0.05
other building equipment contractors : 0.02
electric equipment : 0.05
finish carpentry contractors : 0.03
water and sewer line and related structu... : 0.06
painting and wall covering contractors : 0.03
vegetables and fruits : 0.06
roofing contractors : 0.04
poured concrete foundation and structure... : 0.04
drilling : 0.07
digging : 0.08
separations : 0.05
crushing : 0.05
all other specialty trade contractors : 0.08
drywall and insulation contractors : 0.08
highway, street, and bridge construction : 0.22
major field crops : 0.28
diesel equipment : 0.21
electrical contractors and other wiring ... : 0.12
plumbing, heating, and air-conditioning ... : 0.19
site preparation contractors : 0.24
grinding : 0.49
NAICS 336 : Transportation Equipment ...
NAICS 321 : Wood ...
semiconductors and related devices : 0.09
NAICS 311 : Food ...
NAICS 312 : Beverage and Tobacco ...
NAICS 331 : Primary Metals ...
NAICS 327 : Nonmetallic Mineral ...
NAICS 325 : Chemicals ...
NAICS 322 : Paper ...
NAICS 324 : Petroleum and Coal ...
energy services : 17.82
waste : 56.11
energy services : 41.09

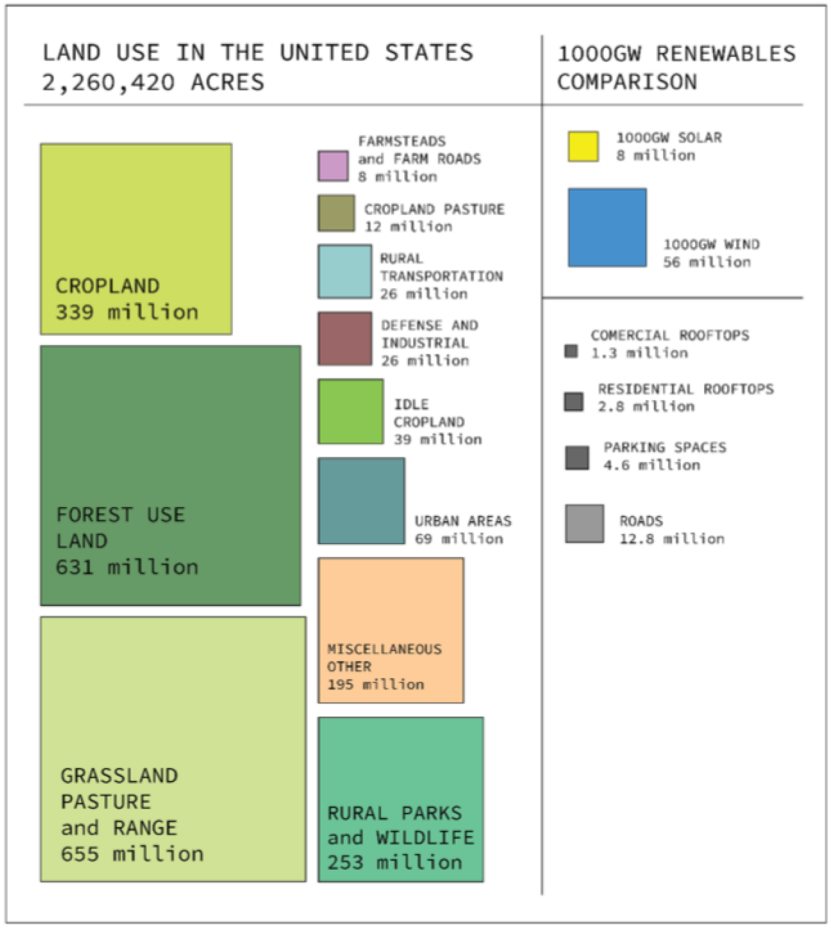
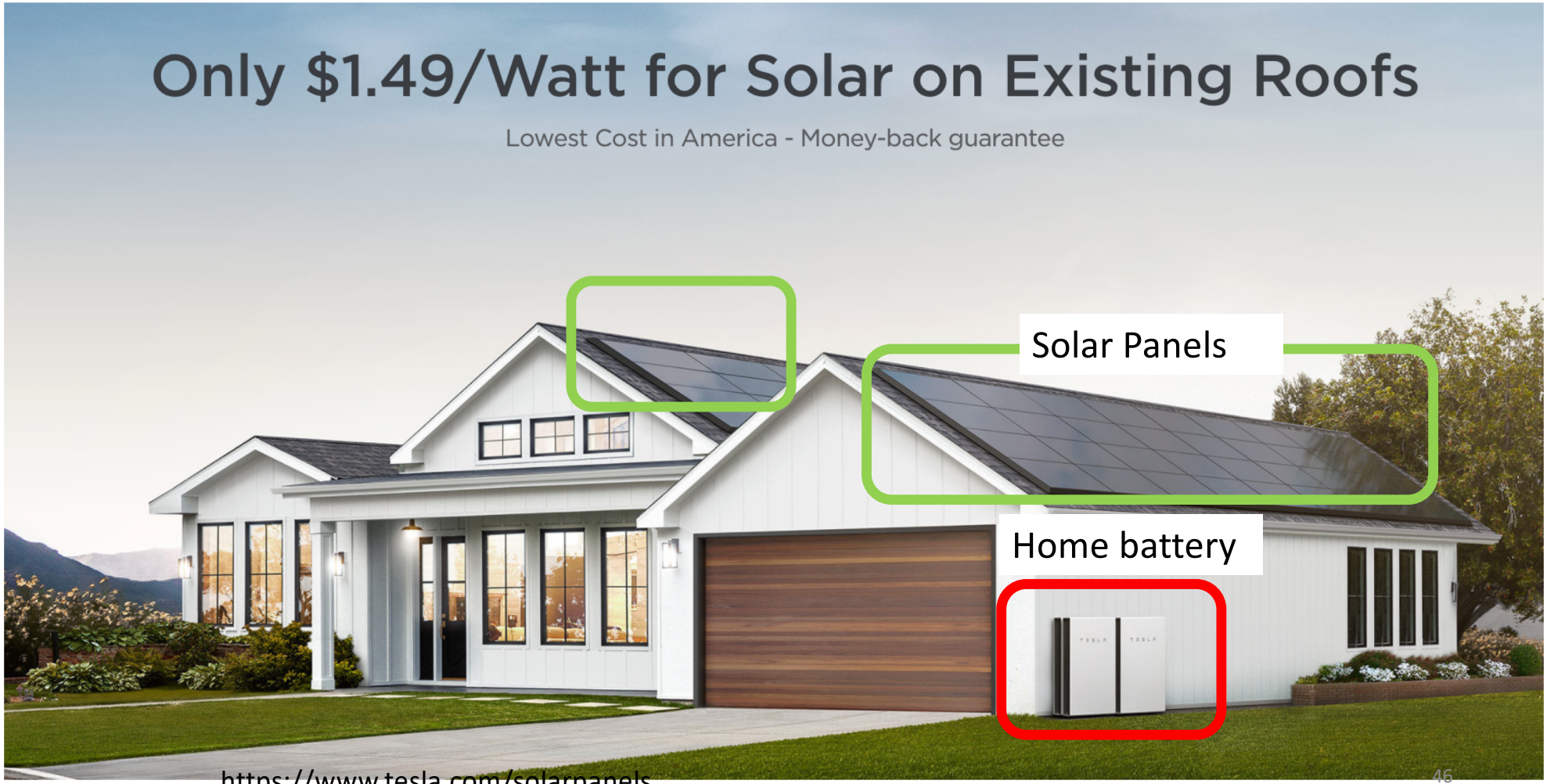


Figure 6.2: *Illustrative areas of the U.S. land use, including reference areas for renewables. Thanks to Kirk Von–Rohr*


250mi
140mph
5.3s

Source: https://civicworks.com/introducing-solar-installation-initiative-baltimore-city/



https://www.tesla.com/solarpanels

Agenda

- ✓ Dr. W. Edwards Deming
- ✓ Vulnerability Assessments
- ✓ CO_2 Mitigation
- ✓ GHG Reporting
- ✓ Solar Panels
- ✓ Taking Action
- ✓ Good News