



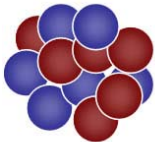


Isotopes of Carbon

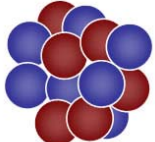





Unstable - decays in less than 50,000 years



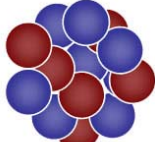
Light
carbon-12

6 protons
6 neutrons




Heavy
carbon-13

6 protons
7 neutrons







Radioactive
carbon-14

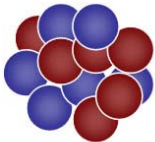
6 protons
8 neutrons



Isotopes of Carbon

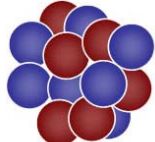





Unstable - decays in less than 50,000 years



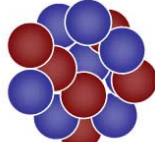
Light
carbon-12

6 protons
6 neutrons




Heavy
carbon-13
1.1%

6 protons
7 neutrons







Radioactive
carbon-14

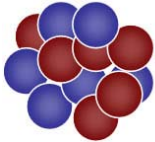
6 protons
8 neutrons



Isotopes of Carbon

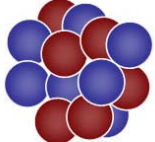





Unstable - decays in less than 50,000 years



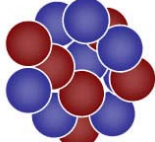
Light
carbon-12

6 protons
6 neutrons




Heavy
carbon-13
1.1%

6 protons
7 neutrons







Radioactive
carbon-14
<0.1%

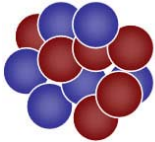
6 protons
8 neutrons



Isotopes of Carbon

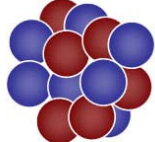





Unstable - decays in less than 50,000 years



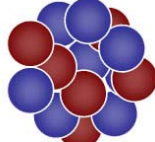
Light
carbon-12
98.9%

6 protons
6 neutrons




Heavy
carbon-13
1.1%

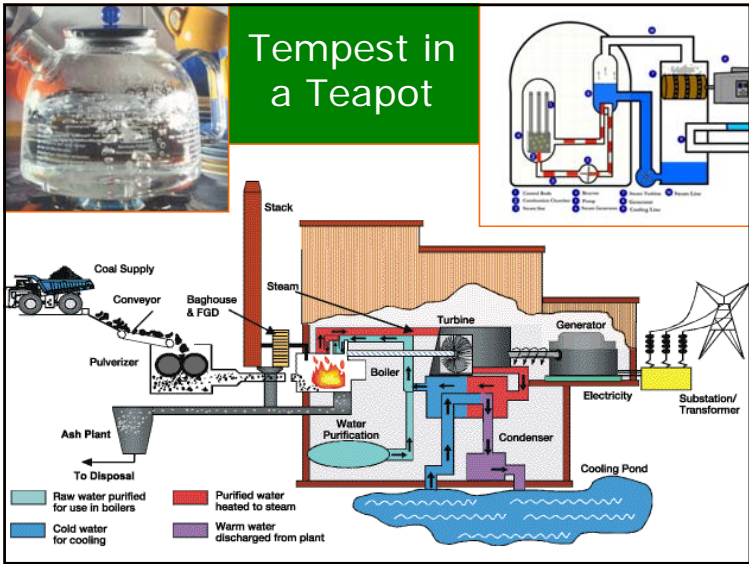
6 protons
7 neutrons



Radioactive
carbon-14
<0.1%

6 protons
8 neutrons

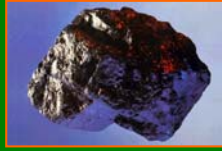




500 MW Coal Plant

- Produces 3.5 billion kilowatt-hours per year, enough to power a city of 140,000
- Burns 1,430,000 tons of coal
- Uses 2.2 billion gallons of water and 146,000 tons of limestone

500 MW Coal Plant

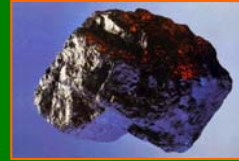


Released each year:

- 10,000 tons of sulfur dioxide - the main cause of acid rain
- 10,200 tons of NOx - a major cause of smog, acid rain.
- 3.7 million tons of carbon dioxide - major greenhouse gas
- 500 tons of small particles - health hazard
- 220 tons of hydrocarbons - incomplete combustion
- 720 tons of carbon monoxide - poisonous gas, GHG
- 125,000 tons of ash and 193,000 tons of sludge from the smokestack scrubber - powdered limestone and water used to remove pollution from the plant's exhaust.
- 225 pounds of arsenic, 114 pounds of lead, 4 pounds of cadmium, and many other toxic heavy metals
- Trace amounts of uranium - radioactive emissions are greater than those from nuclear power production.

x 1,436 Turbines in 504 Coal Fired Power Plants in US...

Coal Use in the U.S.



A fist sized lump of coal produces enough electricity when burned to run a 100 watt light bulb for 10 hours, a 25 watt compact fluorescent for 40 hours

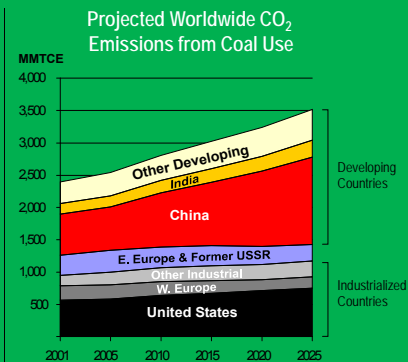
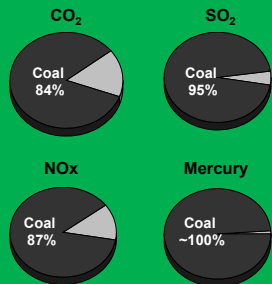


The average household uses 900 KWH per month. @1.25 lbs of coal per KWH, that works out to 10,950 lbs per year for electricity alone !

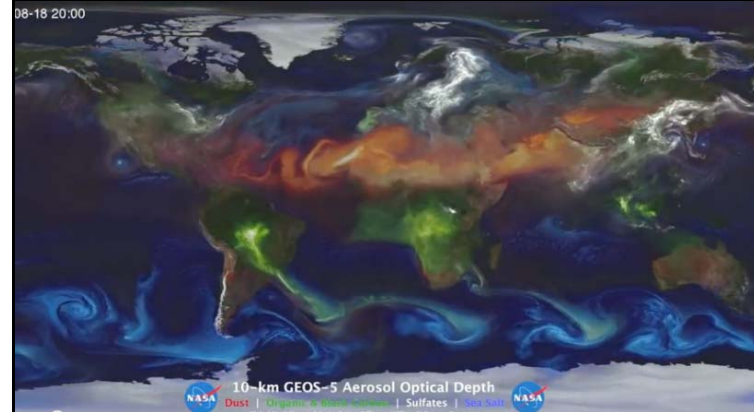
Considering all coal used in the U.S. each year, 8,000 lbs is burned for every man, woman and child...

Emissions from Coal Use

Percent of U.S. Electric Industry Emissions from Coal



Airborne Particles in Earth's Atmosphere



"We don't have a have an energy crisis, we have a combustion problem..."

Tall Stacks at TVA's Kingston, TN Coal Plant



Northeast Pollution Transport



Air Pollution & Health

- Hospital Admissions
- ER Visits
- Pulmonary Deaths
- Cardiovascular Deaths



Source: US DoD



Air Pollution & Health

- Lung Function
- Lung Growth
- Inflammatory Markers
- Blood Viscosity & Irregularities in Heartbeats

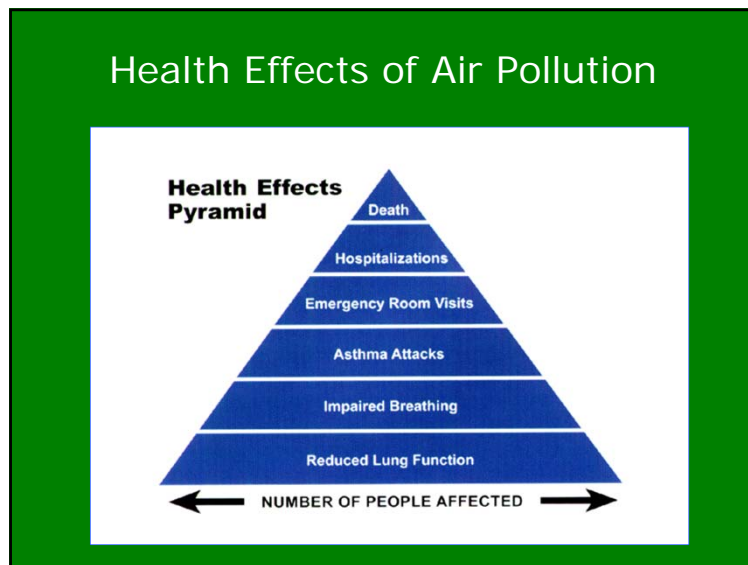
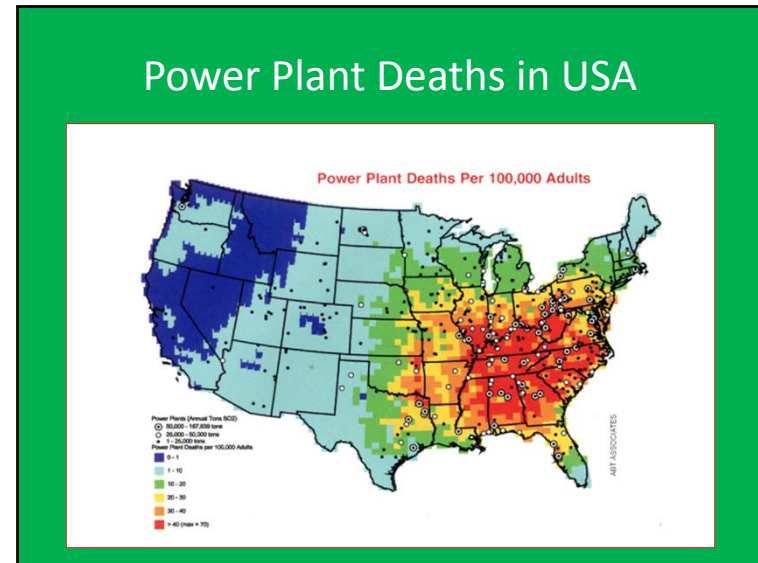


National Power Plant Impacts


Health Effect	Incidence (cases per year)
Mortality	23,600
Hospital Admissions	21,850
Emergency Room Visits for Asthma	26,000
Heart Attacks	38,200
Chronic Bronchitis	16,200
Asthma Attacks	554,000
Lost Work Days	3,186,000

Global Deaths Due to Particle Pollution = 3 million/year



Professor Paul R. Epstein, MD, MPH



Ann. N.Y. Acad. Sci. ISSN 0077-8025

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES
 Issue: Ecological Economics Reviews

Full cost accounting for the life cycle of coal

Paul R. Epstein,¹ Jonathan J. Buonocore,² Kevin Eckerle,³ Michael Hendryx,⁴ Benjamin M. Stout III,⁵ Richard Heinberg,⁶ Richard W. Clapp,⁷ Beverly May,⁸ Nancy L. Reinhart,⁹ Melissa M. Ahern,⁹ Samir K. Doshi,¹⁰ and Leslie Glustrom¹¹

¹Center for Health and the Global Environment, Harvard Medical School, Boston, Massachusetts; ²Environmental Science and Risk Management Program, Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts; ³Accenture, Sustainability Services, Philadelphia, Pennsylvania; ⁴Department of Community Medicine, West Virginia University, Morgantown, West Virginia; ⁵Wheeling Jesuit University, Wheeling, West Virginia; ⁶Frost Carbon Institute, Santa Rosa, California; ⁷Boston University School of Public Health, Boston, Massachusetts; ⁸Yantricians for the Commonwealth, London, Kentucky; ⁹Department of Pharmacotherapy, Washington State University, Spokane, Washington; ¹⁰Gund Institute for Ecological Economics, University of Vermont, Burlington, Vermont; ¹¹Clean Energy Action, Boulder, Colorado

Address for correspondence: Paul R. Epstein, M.D., M.P.H., Center for Health and the Global Environment, Harvard Medical School, Landis

Each stage in the life cycle of coal carries a cost. The waste stream generated at each stage is thus often considered "externalities." We estimate that the life cycle effects of coal and the waste stream generated are costing the U.S. public a third to over one-half of a trillion dollars annually. Many of these so-called externalities are, moreover, cumulative. Accounting for the damages conservatively doubles to triples the price of electricity from coal per kWh generated, making wind, solar, and other forms of nonfossil fuel power generation, along with investments in efficiency and electricity conservation methods, economically competitive. We focus on Appalachia, though coal is mined in other regions of the United States and is burned throughout the world.

\$500 Billion in Externalities in the US

**HARVARD MEDICAL SCHOOL
 CENTER FOR HEALTH AND THE GLOBAL ENVIRONMENT**



Mine Safety

Business as Usual?

1907 = 3,242 Deaths
 2000 - 2004 = 67 Deaths
 2006 = 47 Deaths

Coal mine deaths spike upward

Coal mining deaths soared to a 13-year high in 2010, according to the most recent of quarterly mining statistics and showing a sharp decline as coal production returns to normal.

Fifty-seven miners died last year, more than double the 22 deaths in 2008 and matching the number in 1999. The record span is the biggest percentage increase at 137% since 2006, according to figures compiled by the U.S. Bureau of Labor Statistics.

“It’s all of a sudden spike up to 57. It’s double the number of deaths,” says Bob Francis, deputy assistant secretary for the Mine Safety and Health Administration.

“Given the number of deaths in 2010, 2013, and 2014, it’s not surprising that the industry is looking for a more aggressive safety program,” says Tom Mendenhall, spokesman for the National Mining Association, a mining industry group.

Coal mine deaths rose in 2010 largely because there were less “incidents”—defined by MSHA as accidents that cut the mines off from air—for the first time since at least 1993, according to MSHA records. And the number of deaths rose sharply in that year because 12 miners were killed in that fatal explosion. The death toll rose to 23 in 2011.

Top 2008 deaths list in the top-right corner. (2012 deaths, when an average of 2,276 miners were killed per day.)

Obama announces power plant regulations, GOP lawmakers vow fight

Obama leaves coal with nowhere to go

Two dozen states sue Obama over coal plant emissions rule

Supreme Court Deals Blow to Obama's Efforts to Regulate Coal Emissions



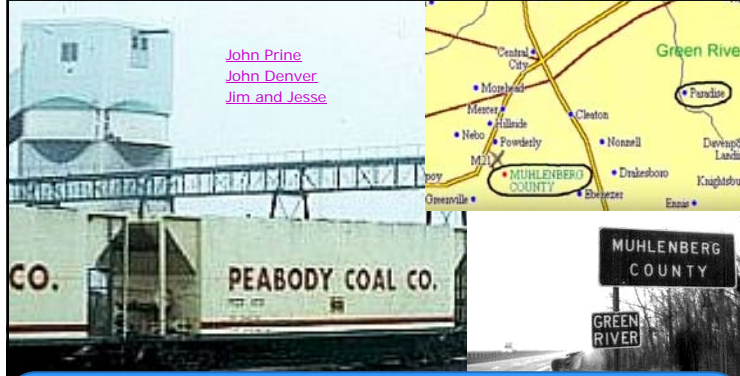
\$1200 per Share to \$2 per Share...



BIDNESS ETC

Peabody ENERGY

The Investor Class is Moving Away from Coal and other Fossil Fuels and to Renewables – “The smart money is investing in green tech”



John Prine
John Denver
Jim and Jesse

And daddy won't you take me back to Muhlenberg County
Down by the Green River where Paradise lay
Well, I'm sorry my son, but you're too late in asking
Mister Peabody's coal train has hauled it away

“Paradise” by John Prine



Harvard University Center for the Environment Speaker Series sponsored by Bank of America

THE FUTURE OF ENERGY



Steven Leer
Chairman and CEO
Arch Coal, Inc.
www.archcoal.com



Arch Coal, Inc.



The Vital Role of Clean Coal in Securing Our Energy Future

Steve Leer, Chairman and CEO
Arch Coal, Inc.
February 3, 2009



Bankruptcy

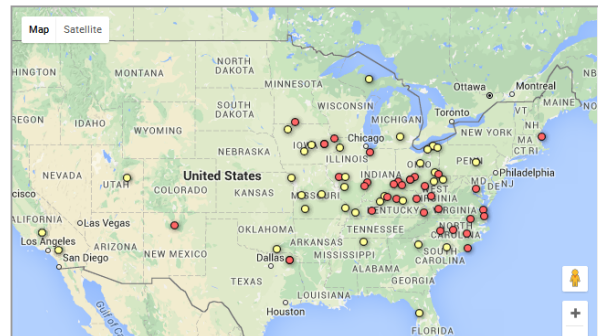
archCoal

Coal Plants Affected by EPA Regulations



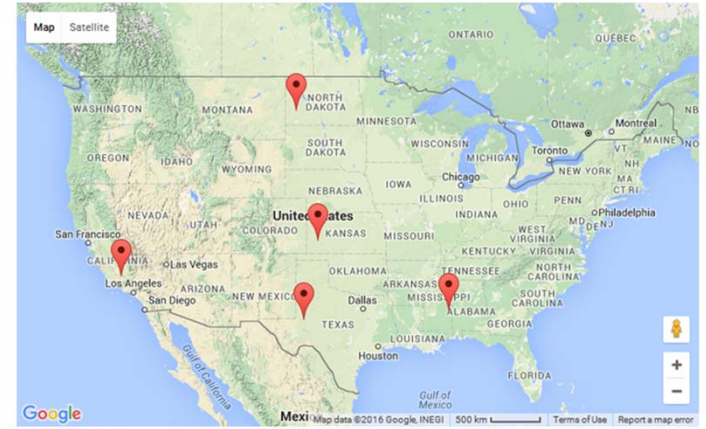
The Associated Press reports more than 32 mostly coal-fired power plants will close and another 36 plants could also be forced to shut down as a result of new EPA rules regulating air pollution.

Click the icons in the map to view details for each plant affected by the EPA rules. Red icons indicate at least one unit will retire; yellow icons denote at least one unit at a power plant is at risk of retirement.



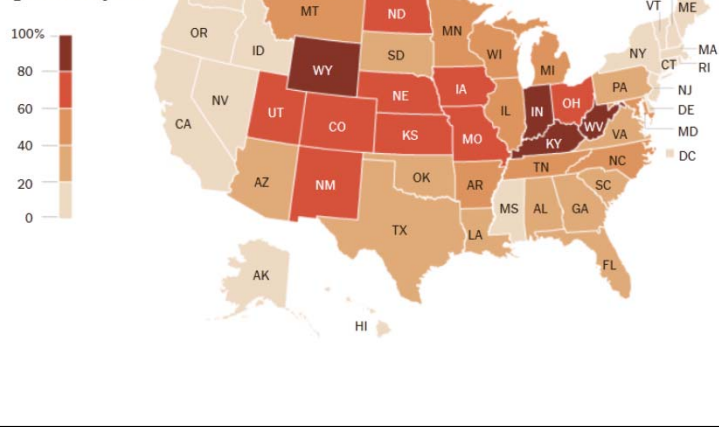
Map of Proposed U.S. Coal Plants December 2015 (electric power plants only)

The map below shows proposals for coal-fired power plants as of December 2015.



Any New Coal Plants Will Be with US for 40 Years...

Share of electricity generated by coal



The Boston Globe

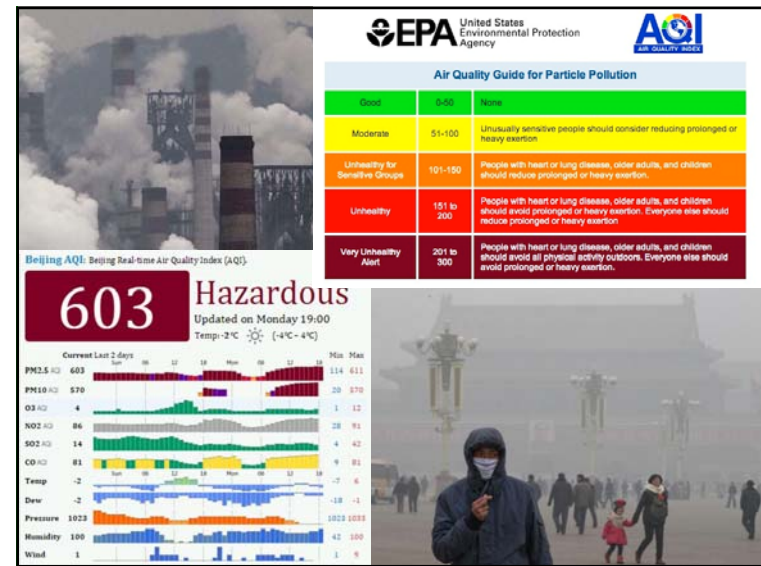
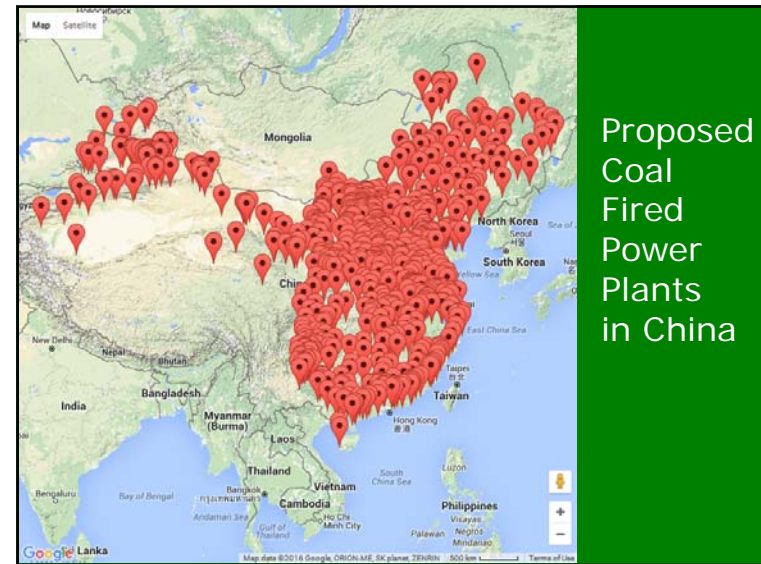
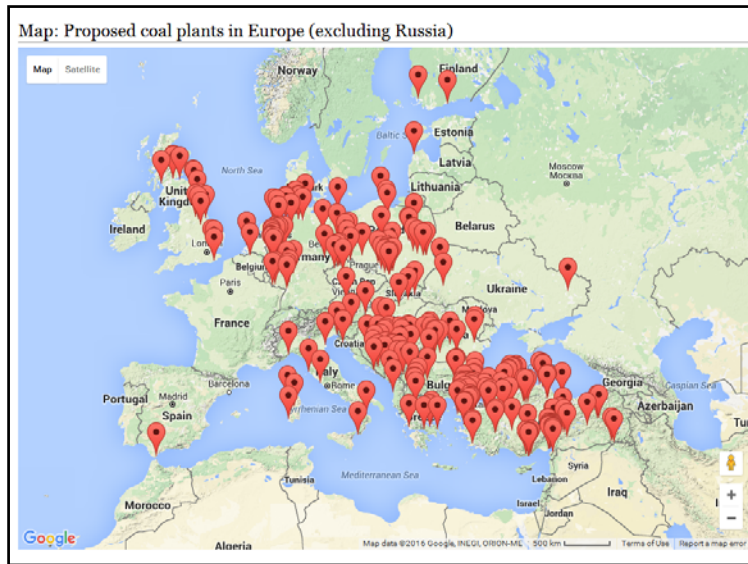
Massachusetts says goodbye to coal power generation



By Martin Finucane GLOBE STAFF JUNE 01, 2017

Once it was a giant with fire in its bowels, looming on the horizon. Now the flames in the Brayton Point power plant in Somerset have flickered out. The plant, which had generated power by burning coal for decades but had drawn criticism as a major polluter, has shut down.

The last coal-burning plant in Massachusetts, it generated nearly 1,500 megawatts, enough to power nearly 1.5 million homes. It was slated to shut down by midnight Wednesday, and it has stopped generating power, a spokesman for the company that owns the plant said Thursday morning.



Business as Usual...

- U.S. needs to build 100's of new power plants by 2030 to replace old plants and meet increasing energy demand.
- World use of primary energy will reach 2.5 times the 2000 level by 2050 and 4 times the 2000 level by 2100.
- World electricity generation will reach 3 times the 2000 level by 2050 and 5 times the 2000 level by 2100.

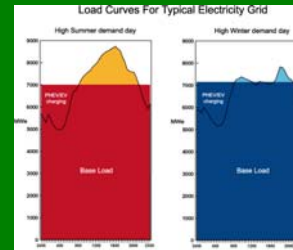
Pros and Cons of Coal Power

Pros

- Abundant
- Secure
- Transportable
- Existing Infrastructure
- Base Load

Cons

- Air Pollution
- Water Pollution
- Thermal Pollution
- Acid Rain
- Health Impacts
- Climate Impacts
- Visibility Impacts
- Subsidies
- Fossil Record

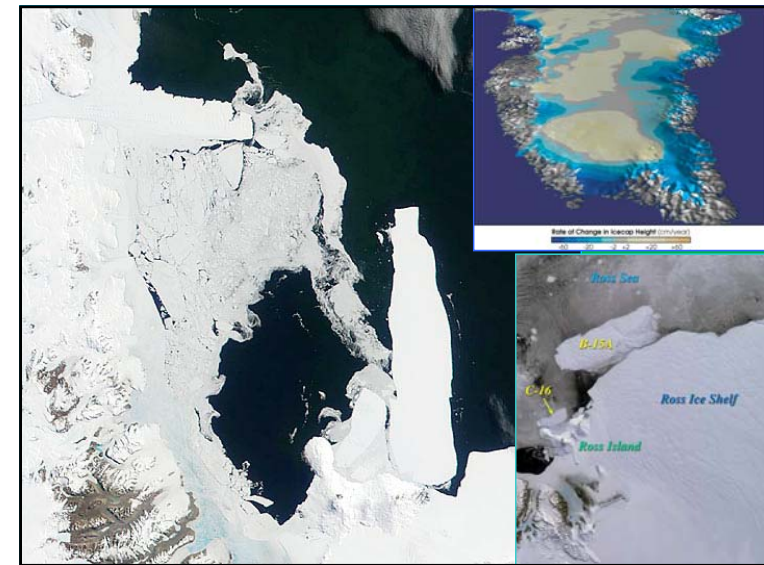
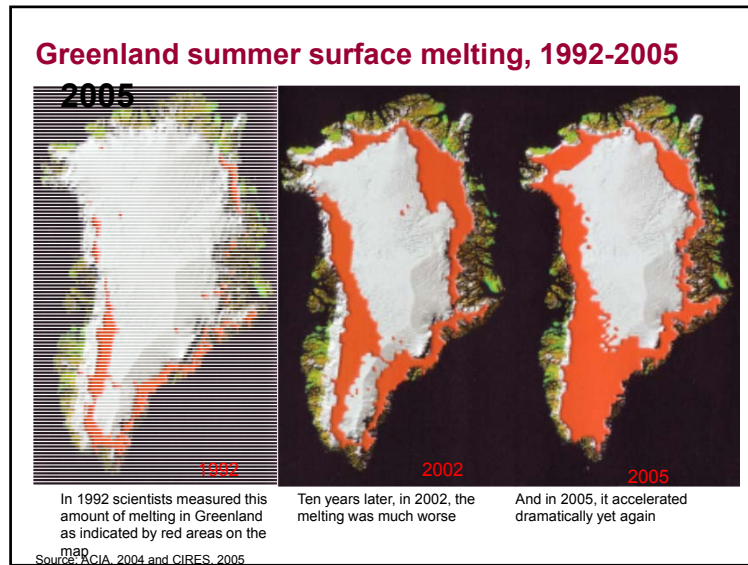
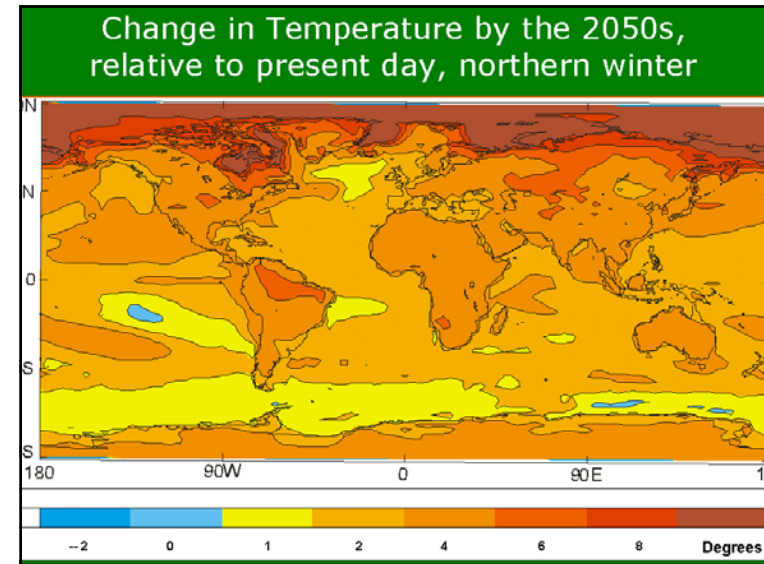
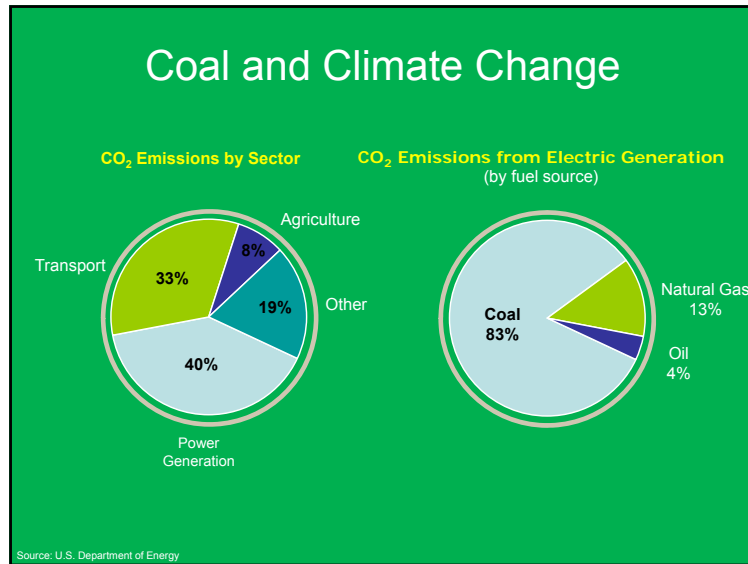


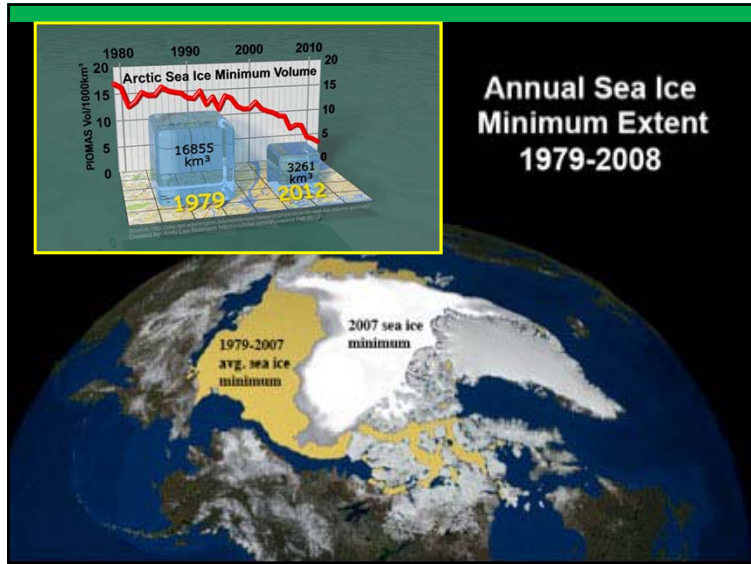
COALergy Ad



I ♥ CO₂ IT IS NOT POLLUTANT, IT IS PLANT FOOD

DEATH BEFORE INCONVENIENCE !





the guardian

politics world opinion sports soccer tech arts lifestyle fashion business travel environment

Climate change

Trump to scrap Nasa climate research in crackdown on 'politicized science'

Nasa's Earth science division is set to be stripped of funding as the president-elect seeks to shift focus away from home in favor of deep space exploration

This article is 3 months old

< 151,786
Oliver Milman in New York
@olliemilman

Wednesday 23 November 2016
00:00 EST

A Nasa Earth photo shows the Bruckner and Heim glaciers where they flow into the Johan Petersen fjord in southeastern Greenland. Photograph: Jeremy Harbeck/AFP/Getty Images

BUSINESS INSIDER SCIENCE

California governor: 'If Trump turns off the satellites, California will launch its own damn satellite'

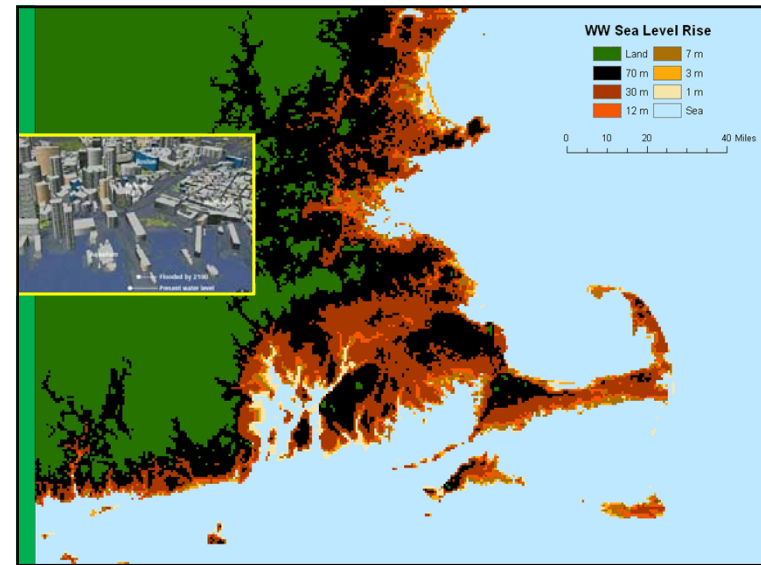
Rafi Letzter
Dec 14, 2016, 4:53 PM 543,983

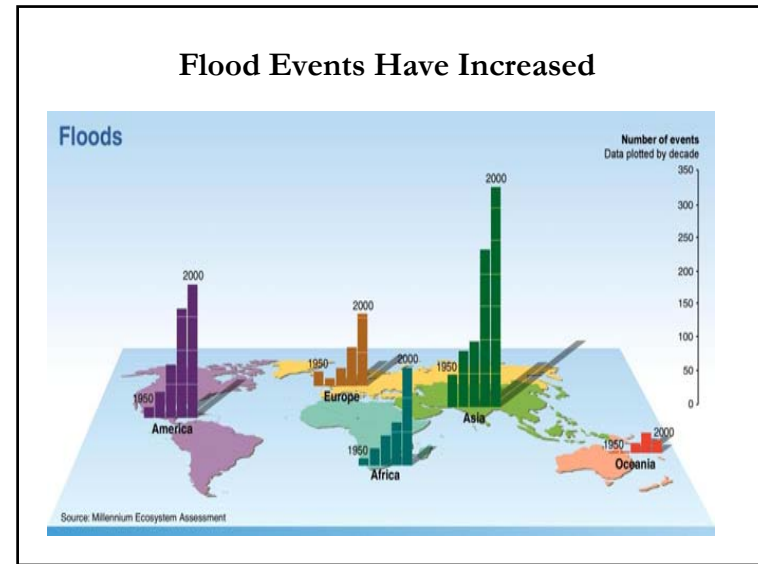
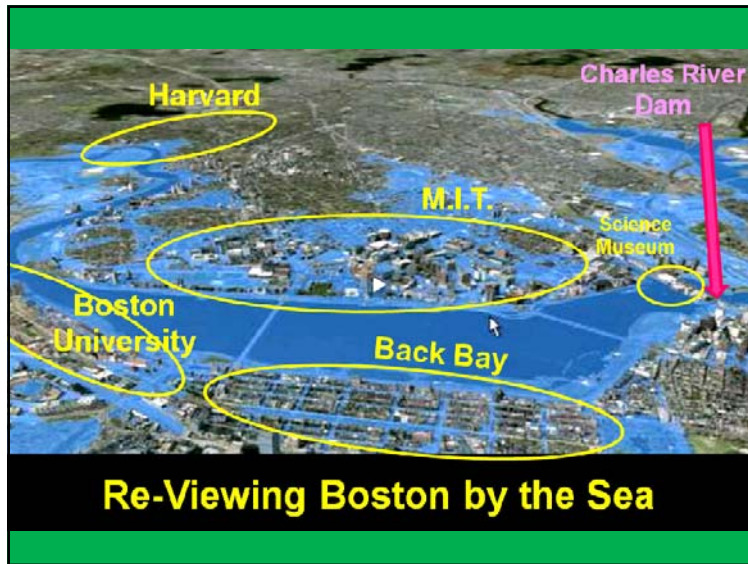
California Gov. Jerry Brown gave a fiery speech on climate-change policy on Wednesday, during which he said, "If Trump turns off the satellites, California will launch its own damn satellite," according to *The Los Angeles Times*.

Brown was speaking at the 2016 meeting of the American Geophysical Union, a prominent body of scientists who study Earth and space.

In November, a top adviser to President-elect Donald Trump suggested the incoming administration would eliminate NASA's earth-science programs.

California Gov. Jerry Brown. Max Whittaker/Reuters





Charting Himalayan Ice
 Chorabari glacier, like many Himalayan glaciers, has been shrinking.

Himalayan glaciers 'melting fast'
 Himalayan glaciers are among the fastest retreating glaciers in the world due to the effects of global warming.

This may result in water shortages for hundreds of millions of people who rely on glacier-dependent rivers in China, India and Nepal, warns the World Wide Fund for Nature (WWF), the global conservation organization.

A new WWF report "An Overview of Glaciers, Glacier Retreat and Subsequent Impacts in Nepal, India and China" reveals that Himalayan glaciers are retreating at a rate of 10-15 metres per year.

"The rapid melting of Himalayan glaciers will first increase the volume of water in rivers causing widespread flooding," said Jennifer Morgan, director of the WWF's Global Climate Change Programme.

"but in a few decades this situation will change and the water level in rivers will decline, meaning massive economic and environmental problems for people in western China, Nepal and northern India."

Declining figures

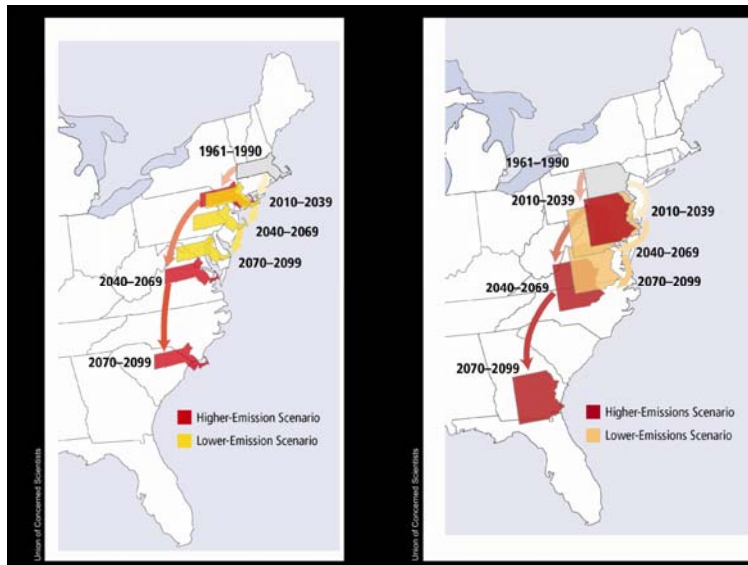
The Qinghai-Tibet Plateau is the most concentrated glacial centre in the middle and low latitudes of the world, covering an area of 104,850 square kilometres, including 23,000 square kilometres in India, 16,939 square kilometres in Pakistan, 5,362 square kilometres in Nepal, and 49,873 square kilometres in China.

CHINESE GOVERNMENT

Himalayan Glaciers Feed 7 Major River Systems in Asia

MEETING HIMALAYAN GLACIERS

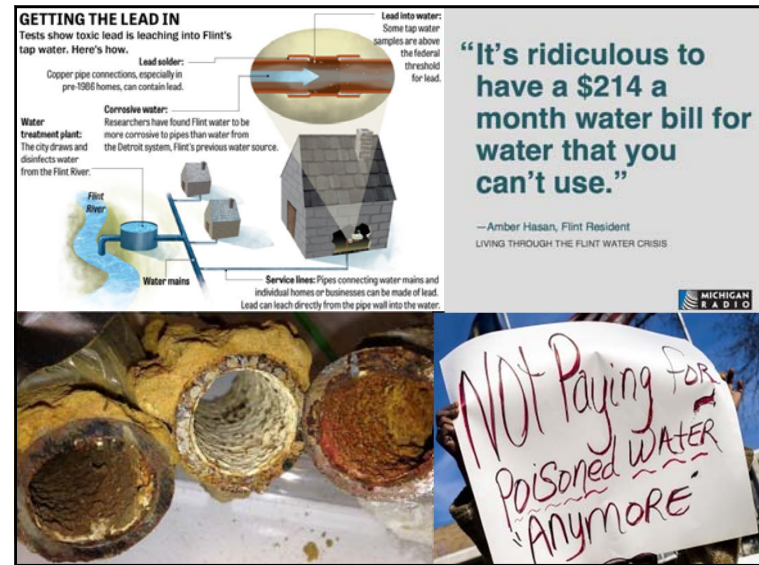
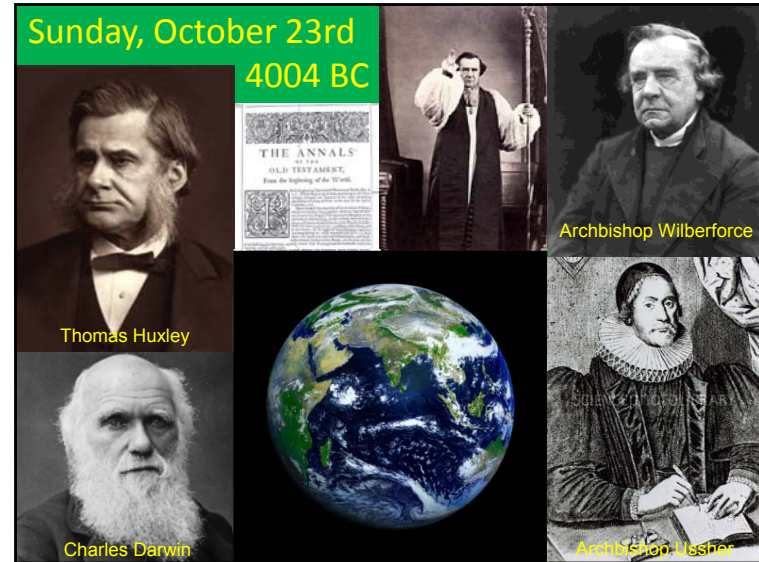
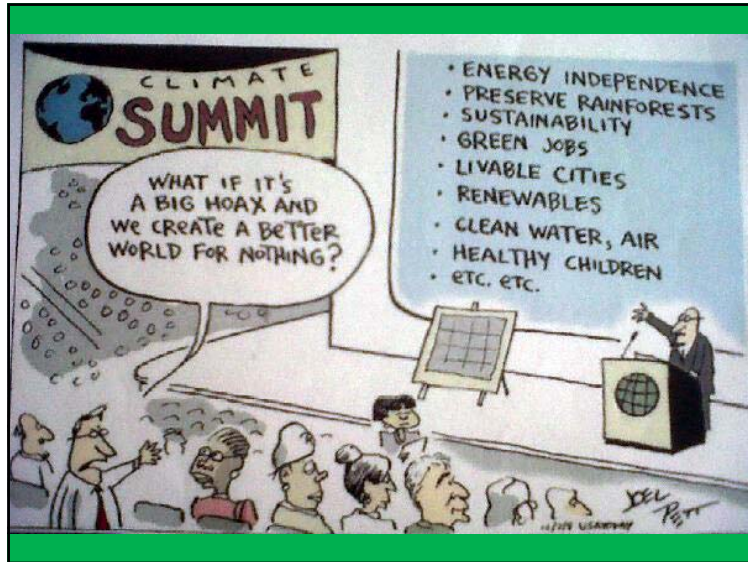
SOOT PARTICLES IN BROWN CLOUDS



Climate Skeptics Ignore the Threat

heritage.org

YOU'RE FEELING WARMER



What is the most polluted river in the world?
The Cuyahoga River

In 1957, the Cuyahoga River in Ohio became famous for being "the river that caught fire." Chocolate-brown, oily, bubbling with subsurface gases, it oozes rather than flows

Cuyahoga River Rebirthday

Cuyahoga River Urban Habitat Restoration

1872 Mining Law

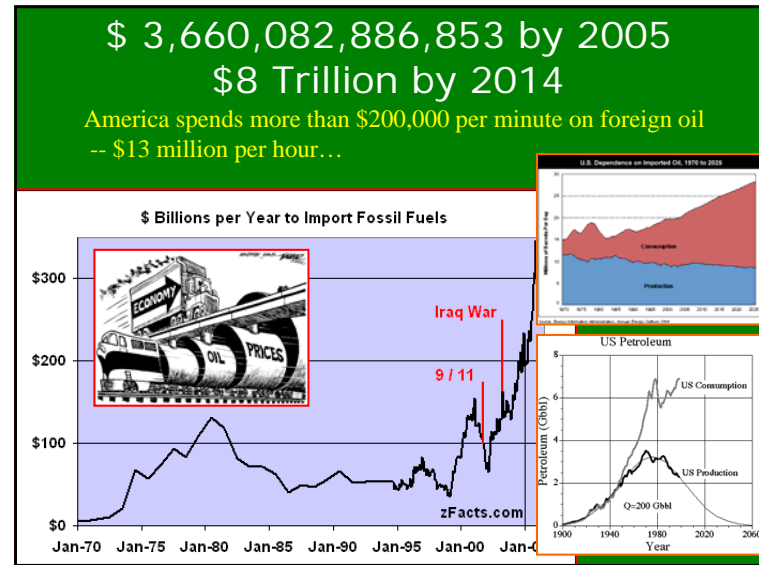
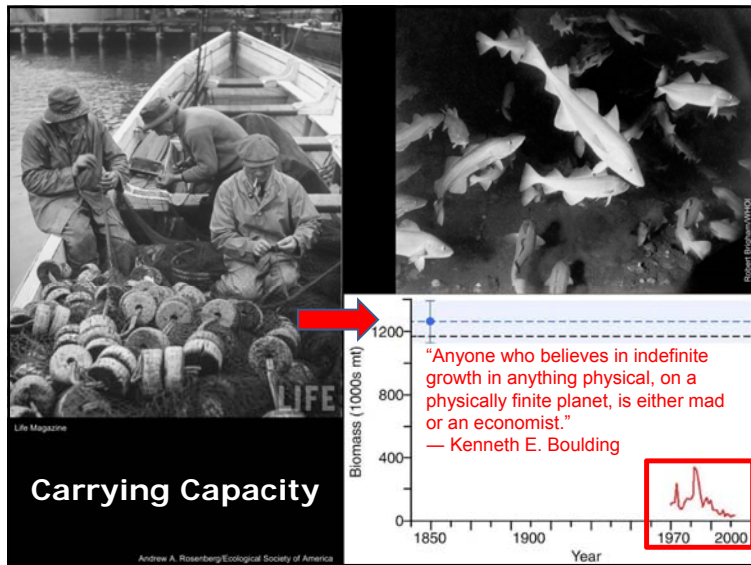
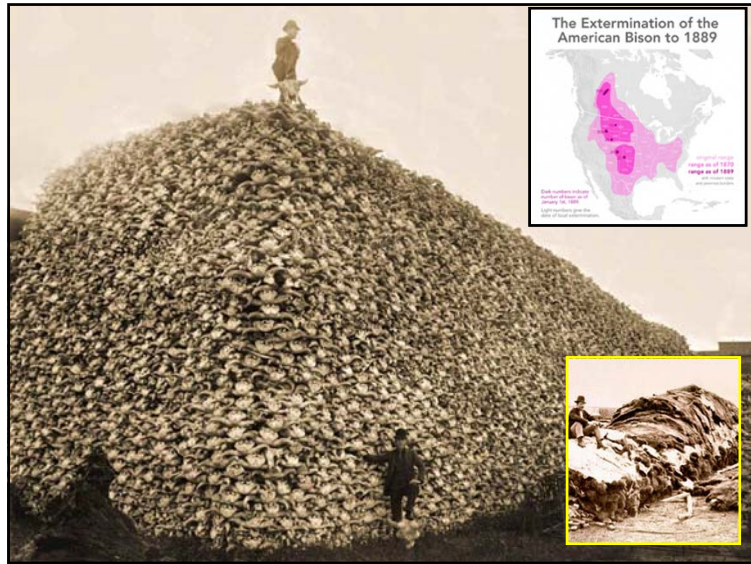
- Enacted by the Grant Administration
- Lease Federal Land for Any Use
- 4 cents per acre/year
- Mining, grazing etc.
- No Requirements for Reclamation
- Temporary Incentive to Settle the West
- Never Repealed
- Massive Environmental Damage
- Contaminated Land and Water
- Trillions for Taxpayers to Clean Up
- Pollution Based Profits

I WANT YOU TO REFORM THE 1872 MINING LAW

Buffalo Bill

Young Buffalo Bill
H. G. Cody
Buffalo Bill

CANADIAN PACIFIC 2306



Transfer of Wealth

300 New Skyscrapers to be built in Qatar by 2018

Dubai Skyline

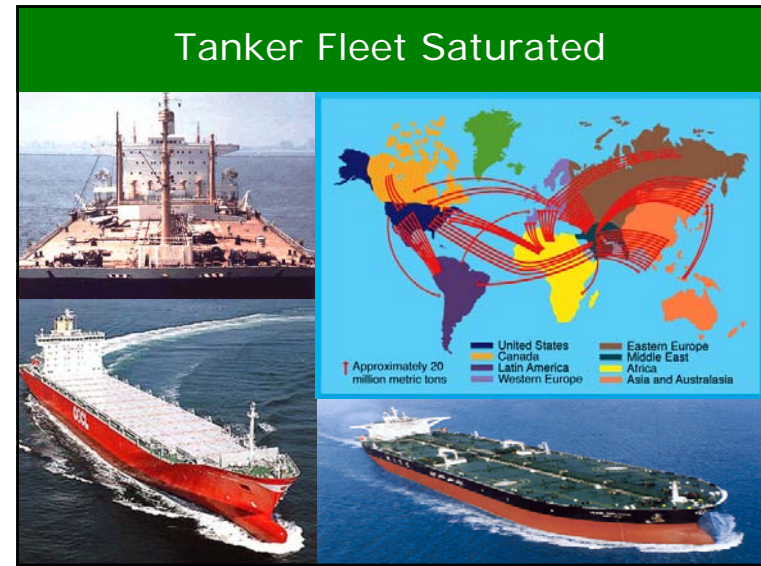


This slide features a green header with the text "Transfer of Wealth". Below it, a red arrow points to a yellow-bordered image of a city skyline at night, with the text "300 New Skyscrapers to be built in Qatar by 2018" next to it. Below this is a larger image of the Dubai skyline at night, with the text "Dubai Skyline" in yellow. To the right of the Dubai skyline is a smaller, yellow-bordered image showing a rendering of a dense cluster of skyscrapers.

Tanker Fleet Saturated

Approximately 20 million metric tons

- United States
- Canada
- Latin America
- Western Europe
- Eastern Europe
- Middle East
- Africa
- Asia and Australasia



This slide has a green header with the text "Tanker Fleet Saturated". It features a world map with red lines indicating shipping routes and a legend with colored boxes for various regions. Below the map are two images of oil tankers: a large red tanker and a smaller white tanker.

Legal Ruling vs. Regulatory Enforcement

Oil Spill in 1989
No Damages Paid
Case on Appeal...



This slide is divided into several sections. On the left is a map of Alaska showing the Kenai Peninsula and the Gulf of Alaska. In the center is the Exxon logo. Below the logo is the text "Legal Ruling vs. Regulatory Enforcement". At the bottom left is an image of workers in orange gear cleaning up an oil spill. At the bottom right is an image of ice cubes.

Deep Water Horizon

Worth the Risk?



This slide has a green header with the text "Deep Water Horizon" and "Worth the Risk?". It features a collage of images: an oil rig, a large fire, a bird covered in oil, and a BP logo. The text "60" and "AP" are also visible in the collage.

Tar Sands

Return on Energy Investment

- **Conventional Oil** - 2 Trillion Barrels
 - 1 barrel yields 30
- **Shale Oil** - 3 Trillion Barrels of Oil Equivalent (BOE)
 - 1 barrel yields up to 10*
- **Tar Sands** – 2 Trillion Barrels of Oil Equivalent (BOE)
 - 1 barrel yields up to 7*

**Shale and Tar Sands also require 5 barrels of water for every barrel of oil recovered*

**Depending on the quantity of oil per ton of sand/rock CO₂ released per barrel can be up to 5 times greater than conventional oil*

Getting the Oil Out

EVOLUTION OF RAIL INDUSTRY TANK CAR STANDARDS FOR CRUDE OIL

The railroad industry is proposing to increase the federal tank car design and construction standards for new tank cars used to transport crude oil. This proposal comes after a previous upgrade proposal which the industry voluntarily adopted and has been observing since October 2011. This graphic shows the additional tank car components included in the latest rail industry proposal.

HIGH CAPACITY PRESSURE RELIEF VALVE Current Standard: No requirement Latest Rail Industry Proposal: Requires a high capacity pressure relief device to protect against a rise in internal pressure resulting from fire. Provides for faster release of product.	TOP FITTINGS PROTECTION Current Standard: Requires top fittings protection to protect the integrity of valves and fittings used to load product in the event of an accident. Latest Rail Industry Proposal: Contains the same requirement.	STEEL TANK Current Standard: Requires a minimum 1/2 inch thick steel tank for unjacketed cars and a minimum 3/4 inch thick steel tank for jacketed cars. Latest Rail Industry Proposal: Requires a minimum 1/2 inch thick steel tank.
HEAD SHIELDS Current Standard: Requires minimum 1/2 inch thick half height head shields at both ends of the tank car to improve puncture resistance. Latest Rail Industry Proposal: Requires 1/2 inch thick full-height head shields at both ends of the tank car.	BOTTOM OUTLET HANDLES Current Standard: No requirement Latest Rail Industry Proposal: Requires bottom outlet handle reconfiguration to prevent the handle from inadvertently opening the bottom outlets in the event of an accident.	JACKET AND THERMAL PROTECTION Current Standard: Requires a minimum 1/2 inch thick steel tank OR a 1/2 inch thick steel jacket. Latest Rail Industry Proposal: Requires the addition of both a 1/2 inch thick steel jacket around the tank car and thermal protection.

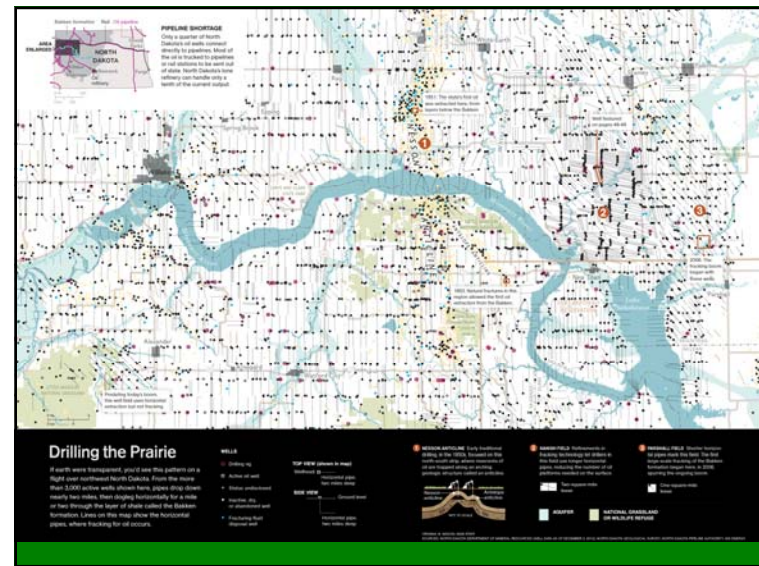
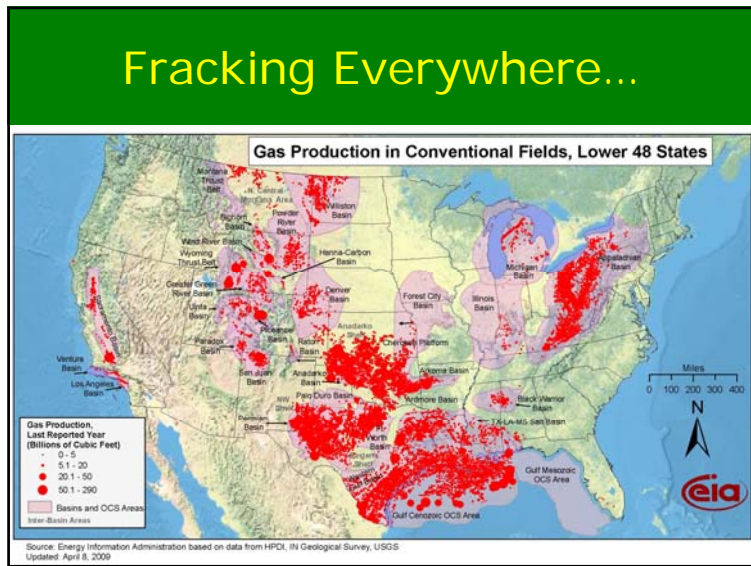
Natural Gas Hydraulic Fracturing

Exempt from Clean Water Act Regulations...

Cheap Gas
Is it Safe?

Shale Gas Basins In The United States

Total Resources
Potential of 500 - 1000 tcf



Leaking gas well
 Engineers speculate that the leak is coming from a hole in a 7-inch-diameter pipe about 500 feet below the surface. Attorneys representing Foster Ranch residents say a safety valve was removed in 1979.

DEVELOPING STORY
RESIDENTS FORCED OUT BY S. CALIFORNIA GAS LEAK
 Erin Brockovich | Consumer Advocate & Environmental Activist

Environmental Defense Fund
 Los Angeles

Approximate location of safety valves. Not scaled to valve specifications or shape.
 Source: Southern California Gas Co. @enrgraphics

JAPAN'S NUCLEAR DISASTER
POWER STATIONS AT RISK

55 NUCLEAR FACILITIES IN JAPAN SUPPLY OVER 30% OF THEIR ELECTRICITY

FUKUSHIMA DAIICHI

- Partial meltdowns have been confirmed in 3 of 6 reactors
- Radioactive gases continue to be released into the atmosphere
- Fears that reactor 2's containment vessel has been breached
- 210,000 people evacuated from the site's 20km radius
- No employees remain, making monitoring and maintenance difficult

FUKUSHIMA DAINI

- All reactors now stable following dangerous core temperatures

TOKAI

- All reactors now stable after a cooling pump failed

ONAGAWA

- All reactors now stable following reports of high radiation levels

Fukushima Daiichi

- REACTOR 4 This reactor caught fire last night
- REACTOR 3 This building already vulnerable and is still overheating
- REACTOR 3 Explosion hasn't last night. Fuel rods exposed after a rapid fall in water level. Sea water had been pumped in to cool the rods.
- REACTOR 1 exploded on Saturday after a partial meltdown of the fuel rods. It still poses a meltdown risk.

Lobbying Return On Investment...

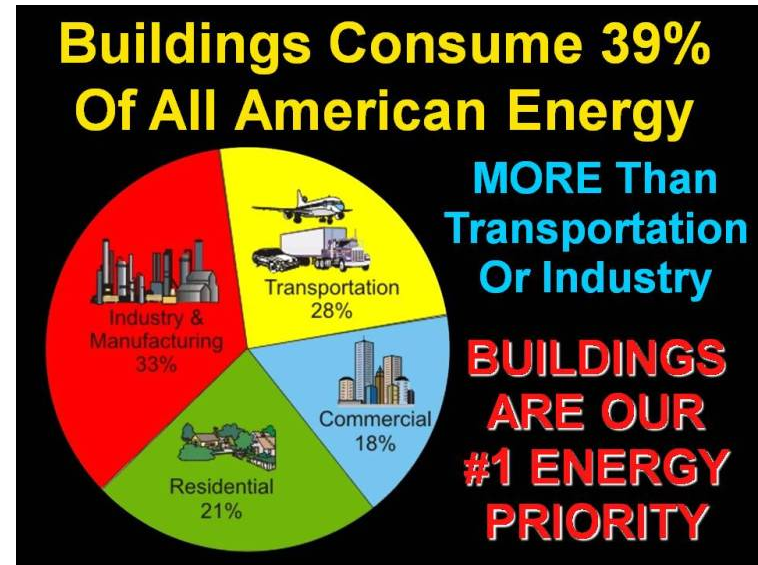
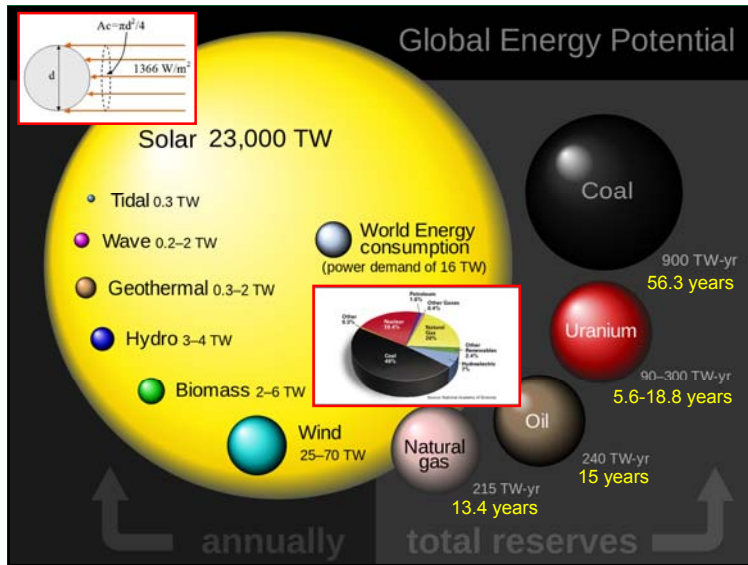
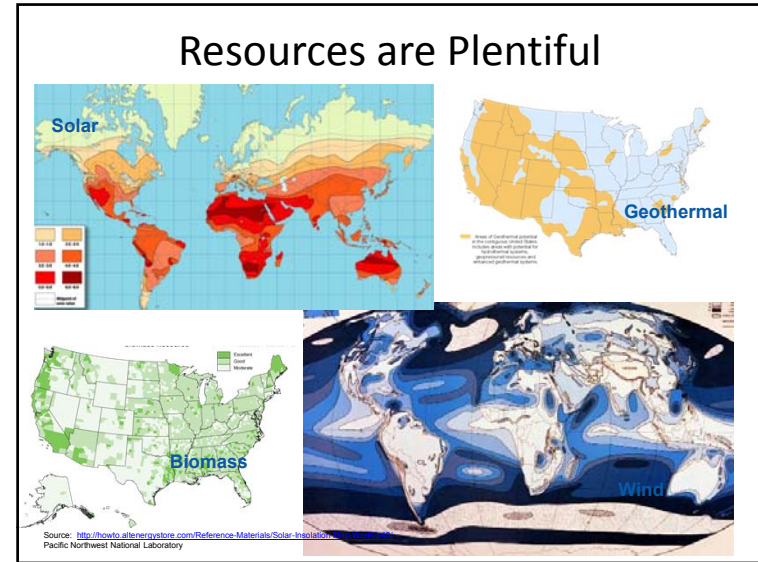
THE AMAZING ROI OF CORPORATE LOBBYING
 (Return on investment) Compare the expected returns for every dollar spent: lobbying blows any ordinary investment strategy out of the water, even a blue chip stock. If it's no wonder \$4.5 billion were spent lobbying in 2010.

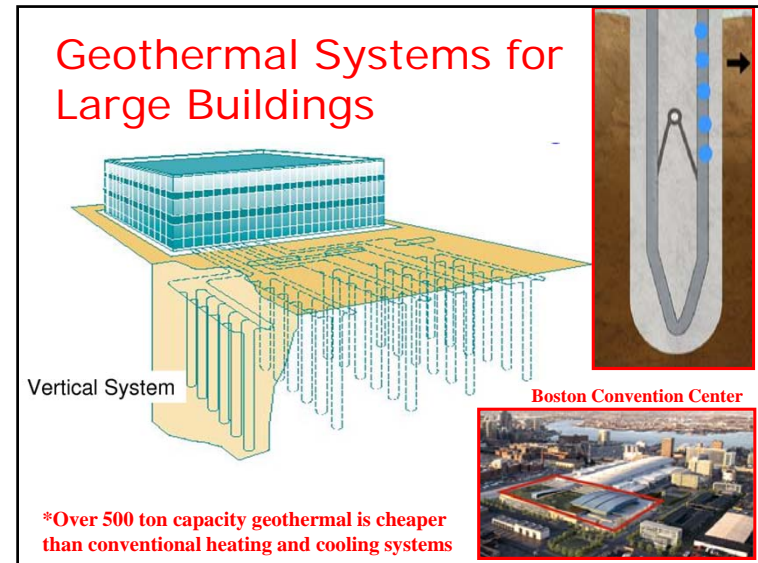
Category	ROI	Investment	Return
An Ordinary American Invests in one BLUE CHIP STOCK	11%	\$1	\$1.11
Big Fossil Lobbies for OIL SUBSIDIES	5,900%	\$1	\$59
Multinationals Lobby for a corporate TAX BREAK	22,000%	\$1	\$220
Big Pharma Lobbies to keep DRUG PRICES HIGH	77,500%	\$1	\$775

$E=mc^2$
 The Universe is made of energy.

We do not face an energy crisis
 We face a crisis of imagination

Size of Earth smaller than this diameter





BELVIDERE/ DALTON PROJECT
950,000 square feet
Under Construction

212 STUART STREET
146,000 square feet
Under Review

Green Buildings ?
1,500,000 square feet
115 WINTHROP SQUARE
Project Notification Form
November 8, 2016
Submitted To
Boston Planning & Development Agency
One City Hall Square
Boston, MA 02108
HPWinthropSquare.com

Proposed

Millions of Square Feet of Residential Housing in the Pipeline for the City of Boston, MA - 50+ Large Projects by 2020

A collage of images related to residential development in Boston. It includes architectural renderings of modern high-rise buildings, a project notification form for 115 Winthrop Square, and a red box containing text about the pipeline of residential housing projects.

Average US House Size

1950
~1,100 sq ft

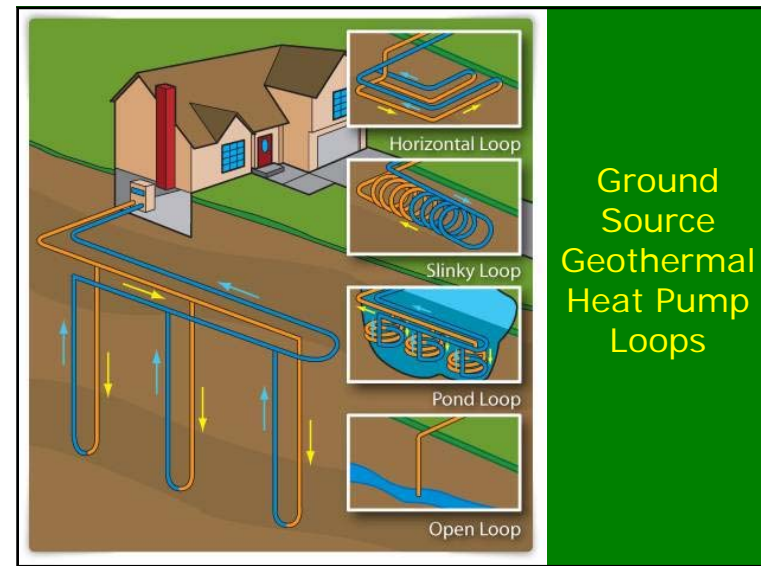
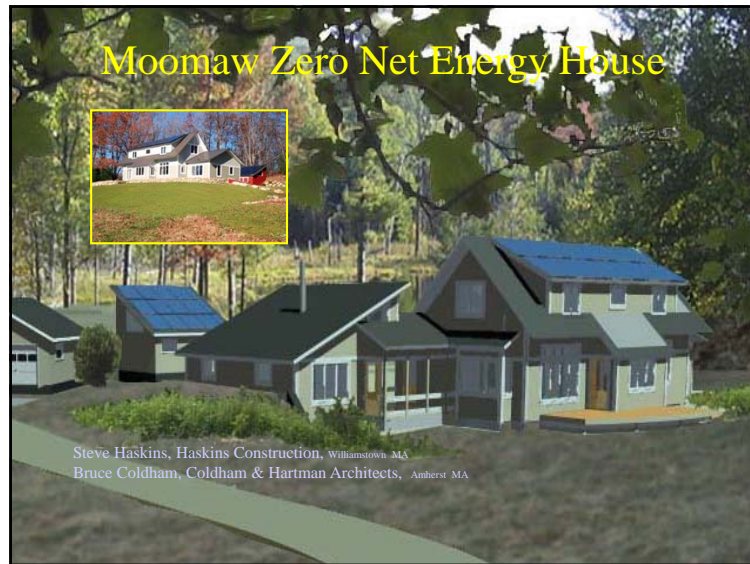
2015
~2,200 sq ft

Two photographs of houses. The top photo shows a small, single-story house with a gabled roof and a front porch. The bottom photo shows a larger, two-story house with a flat roof and a front porch, surrounded by landscaping.


Zero-Net Energy Home Conversions

- Design zero-net energy modular home additions with super insulation, hi performance windows and doors, solar roof, geothermal heating and cooling, excellent IAQ etc.
- Establish protocols to upgrade existing 1st floor single family homes (ranch, cape, etc.) – add 1 foot insulated curtain wall with new windows and siding, updated kitchen and baths, new geothermal HVAC, electrical and plumbing.





Ground Loop Geothermal Heat Pump



The video shows a man in a dark jacket and blue jeans standing next to a large, tan-colored geothermal heat pump unit. The unit is connected to a network of white pipes and electrical conduits. The setting appears to be a utility room or a basement. The video player interface at the bottom shows the title 'Geothermal Pump - Harvard University / C' and a duration of 1:46 / 5:42.

FRANK LESLIE'S POPULAR MONTHLY

Steam Car



The Stanley Stanhope Model No. 1
"LOCOMOBILE"
is Ready for Delivery. Price \$600.

It makes the ownership of a "rig" possible to thousands of people who cannot keep a horse because of the difficulty and cost of maintenance and the expense of a coachman. It requires no sanitary arrangements, no daily, hourly care (none at all when idle), and the few moments' attention required when in use can be given entirely at your convenience and without so much as removing your cuffs.

THE STANLEY LOCOMOBILE is driven by steam—the one power universally known and understood. The boiler automatically controls its supply of water and fuel, thus requiring no more care than a gas engine. It is constructed to bear twenty times the greatest strain that can be brought to bear on it. The engine consists of two cylinders acting directly on the driving wheels without intervening mechanism of any kind, and is flexible as a piston. It automatically stops if it can be readily repaired by any mechanic. Its speed and radius of travel is double that of any apparatus elsewhere in home traction. The cheapest liquid fuel is used. It can be obtained at any ordinary drug store. The rate of speed varies as to the character and is limited only by the character of the road up to forty miles per hour. It will climb a 30 per cent grade. Please per use, it will climb a 30 per cent grade. It weighs less than 400 pounds, and is reliable and indestructible in use. A more detailed description will be furnished if desired. Order from

THE "Locomobile" COMPANY OF AMERICA.

3001 Lombard Street, Brooklyn, N. Y. Agents: J. H. S. Co., 100 Broadway, New York, N. Y. Agents: J. H. S. Co., 100 Broadway, New York, N. Y. Agents: J. H. S. Co., 100 Broadway, New York, N. Y. Agents: J. H. S. Co., 100 Broadway, New York, N. Y.



DISPENSE WITH A HORSE
and save the expense, care and anxiety of keeping it. To run a motor carriage costs about 16 cent a mile.

THE WINTON MOTOR CARRIAGE
is the best vehicle of its kind that is made. It is handsomely, strongly and lighty constructed and easily managed. Speed from 4 to 20 miles an hour. The hydrocarbon motor is simple and powerful. No odor, no vibration. Suspension Wire Wheels. Pneumatic Tires. Ball Bearings. 2 1/2" Solid for Cylinders.

Hydrocarbon Car

Price \$1,000. No Axles.

Handsome Finish, Luxurious Equipment

Columbia Motor Carriage

Can be understood by anyone in 10 minutes.

Electric Car

Thoroughly Tested. Our Carriages are not experiments. We have in the past three years built and tested. We have had electric vehicles in steady use for over two years, and have succeeded in perfecting a carriage that is EFFICIENT, DURABLE and PRACTICAL. If you are in New York during May don't fail to see our exhibit at the Electrical Exposition, Madison Square Garden.

Send for Pictorial Matter. POPE MFG. CO., MOTOR CARRIAGE DEPT., HARTFORD, CONN.



Nikola Tesla

100% Electric 250 Mile Range



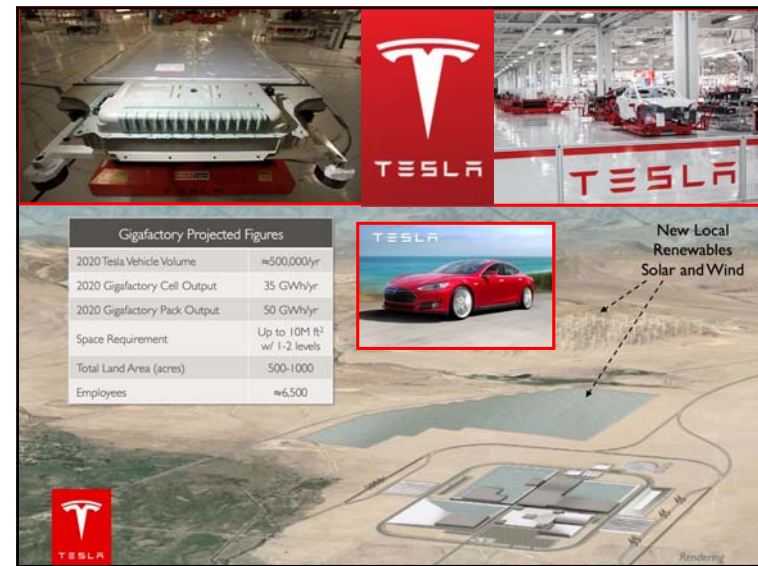
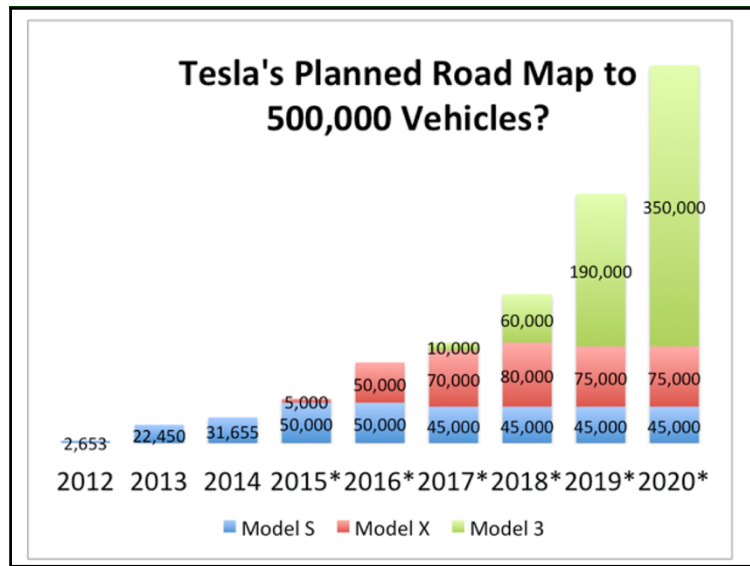
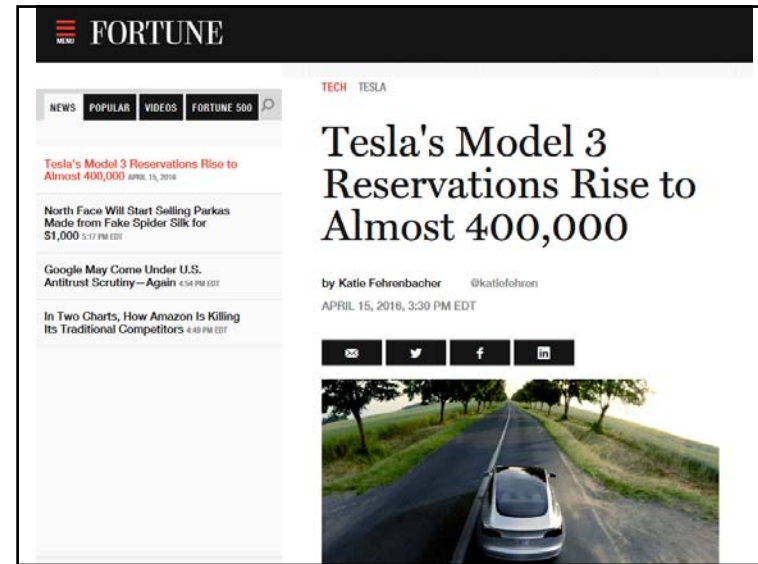
TESLA
100% ELEKTRISCH

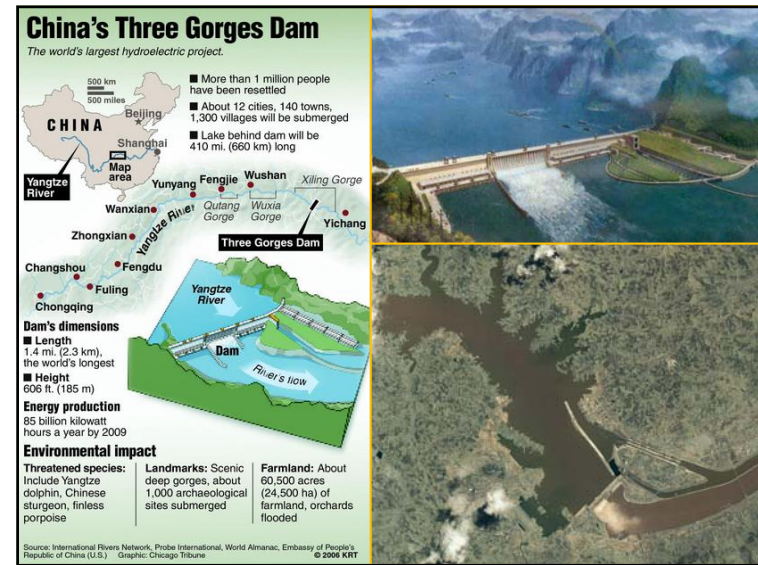
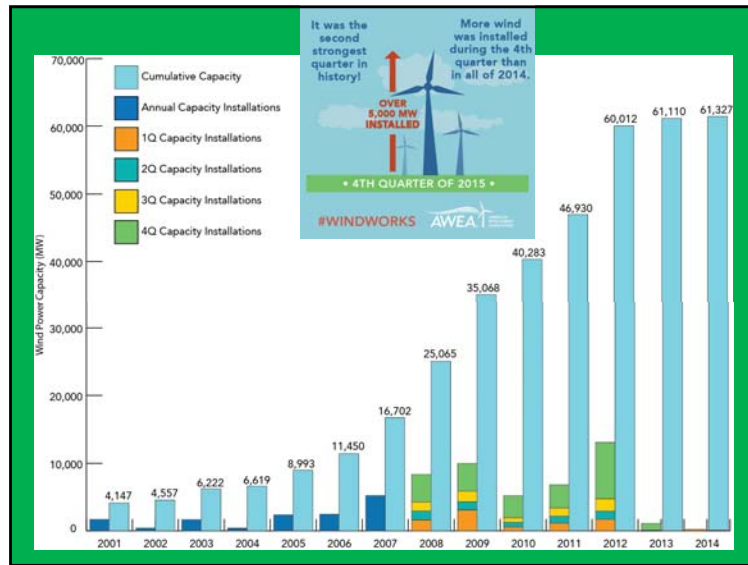
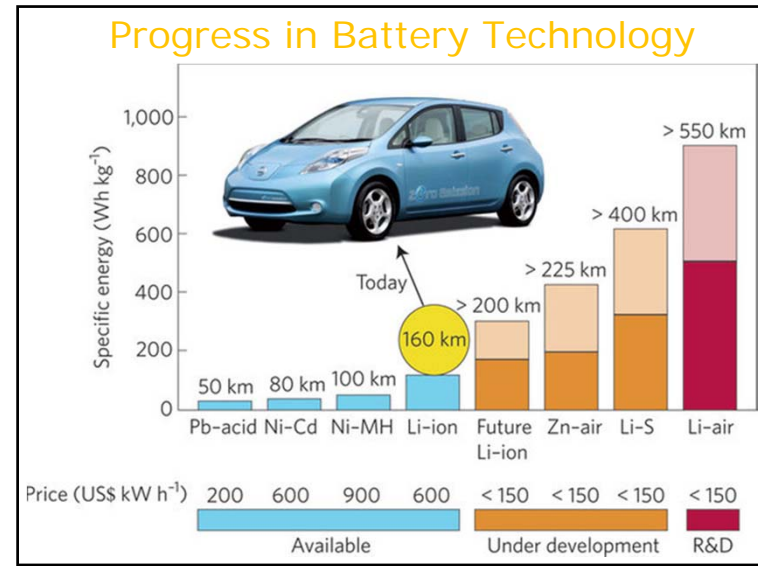
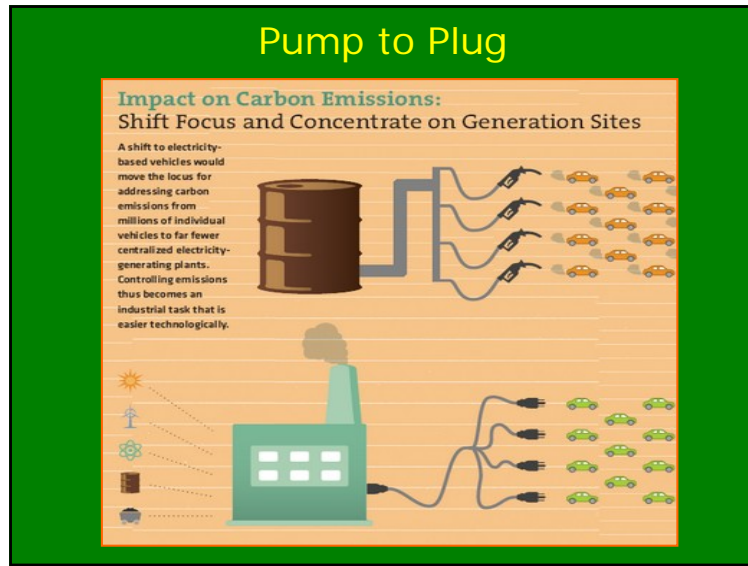
\$35,000

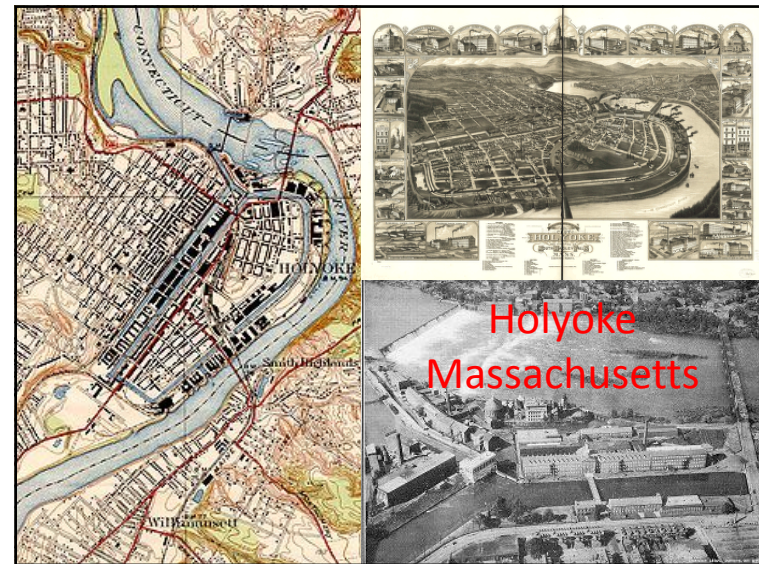
TESLA

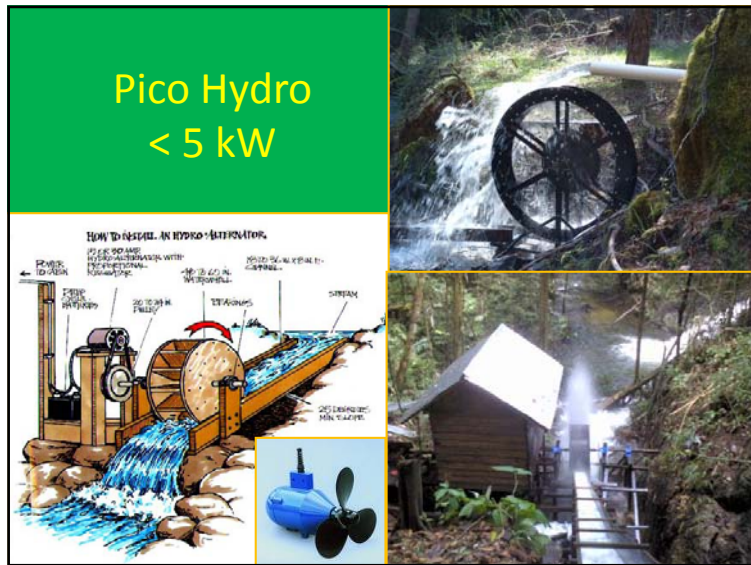
MODEL 3

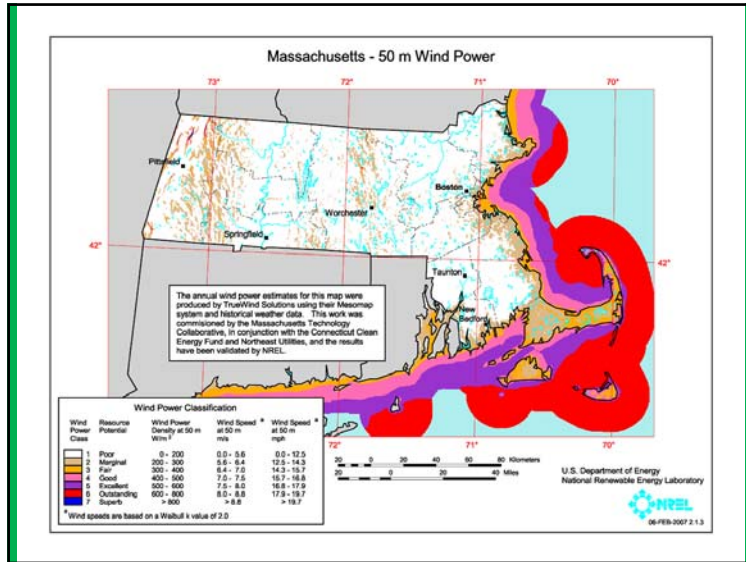










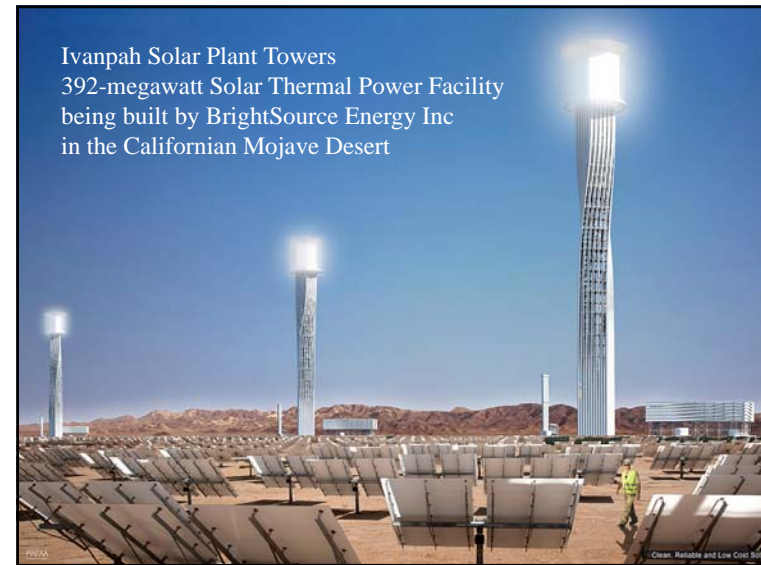
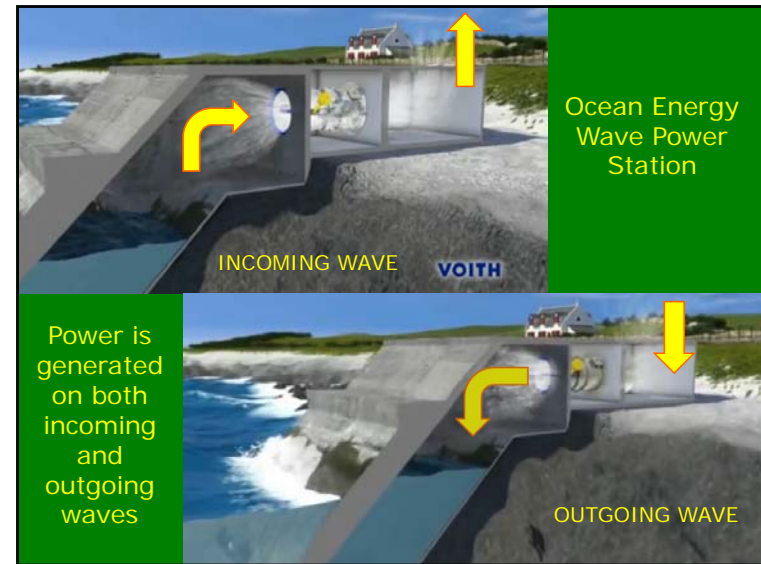
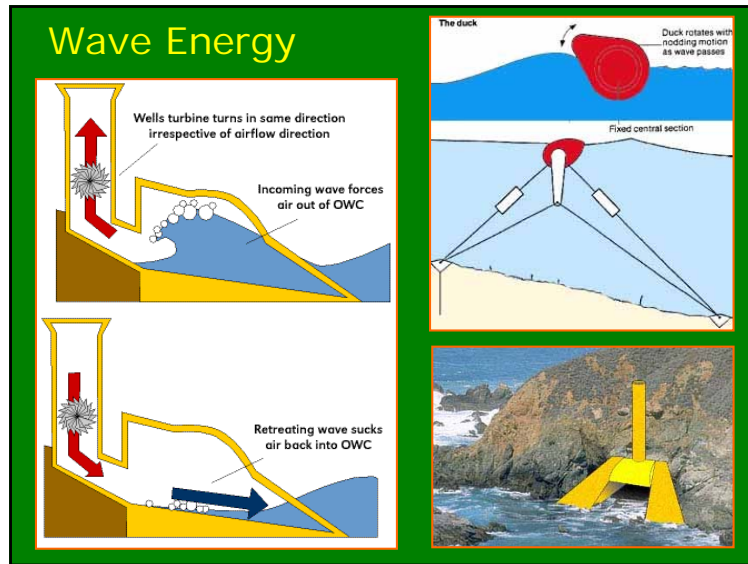


1 Power Generation
Vineyard Wind's turbine area is south of Martha's Vineyard, 14 miles from the nearest shore. The location was determined through a multi-year, inter-governmental and stakeholder process, which carefully considered scientific data and public input. The offshore wind project will consist of an array of wind turbines, spaced at least eight-tenths of a mile apart, that are each capable of generating over 8MW of power. Power from the turbines is collected by one of two offshore substations.

2 Energy Transmission
Submarine cables will be installed along a carefully designed route from the turbine site to a landing point on shore. Buried up to six feet below the sea floor, the route was designed after field studies to avoid as many sensitive areas as possible.

3 Connection to the New England Grid
From the onshore cable landing site, the route will extend to the grid connection point inland. The route will run underground its entire length, primarily along public roads, but will include segments within other previously disturbed corridors such as an existing utility right-of-way. After the initial installation, all maintenance work will be accessed via installed manholes.

4 Clean, Safe, Sustainable Operations
Once installed, little of the project will be visible but for the far distant turbines and some manhole covers in the street. The turbines will be serviced by technicians traveling to the project site on small vessels operated out of Vineyard Haven. A decommissioning fund ensures safe removal of equipment in the future.



EnviroMission clean green renewable energy

Home About Us Technology Investors Global Market Media Contact

EnviroMission - Developer of Solar Tower Technology [▶ more](#)

Solar powered electricity...

Technology Market Information Latest News

Is EnviroMission Closing In on \$110M in Funding for Its Massive Solar Tower?

Can a huge solar updraft tower be permitted, financed and built? EnviroMission the one to do it?

By Eric Weiskel September 03, 2015

EnviroMission Reports Progress On The First Solar Chimney In India

50 Million Rooftop Solar Hot Water Heaters in China

and Rising...

Figure 7. Share of Existing Solar Hot Water/Heating Capacity, Selected Countries, 2004

Country/Region	Share (%)
China	58.4%
European Union	12.7%
Turkey	9.0%
Japan	7.0%
Israel	4.4%
Brazil	2.1%
United States	1.8%
Australia	1.4%
India	0.9%
South Africa	0.5%
Other	1.7%

Solar Thermal

Water Hot Water Out

Ground Water

glass tube with high vacuum

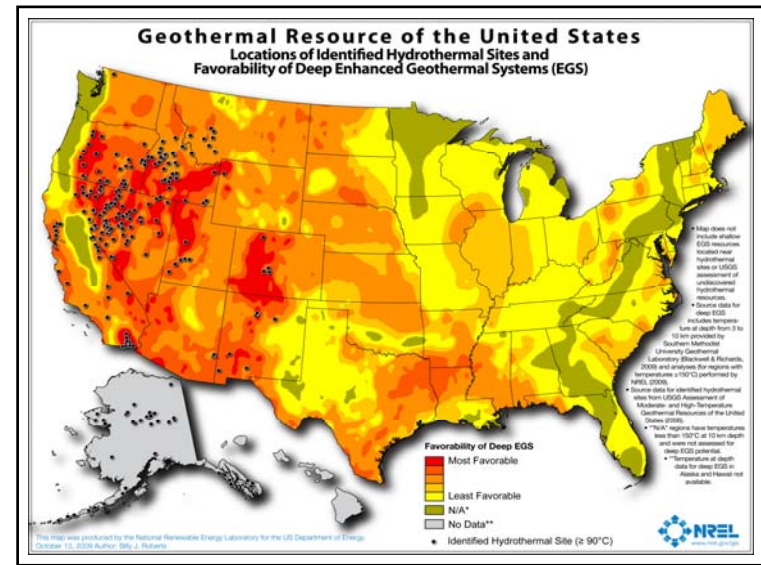
selectively coated absorber sheet

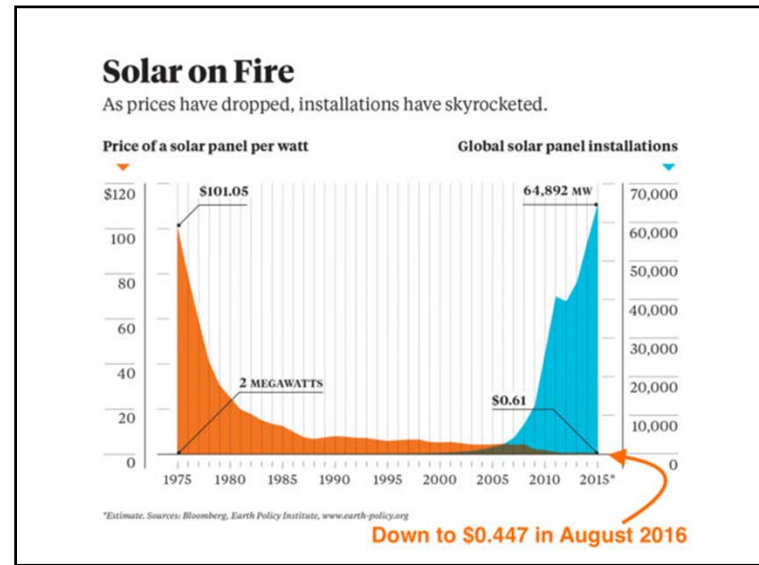
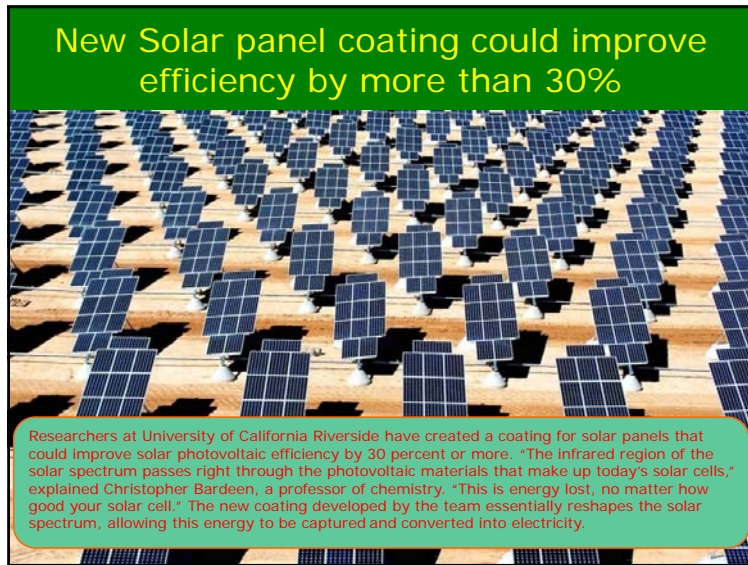
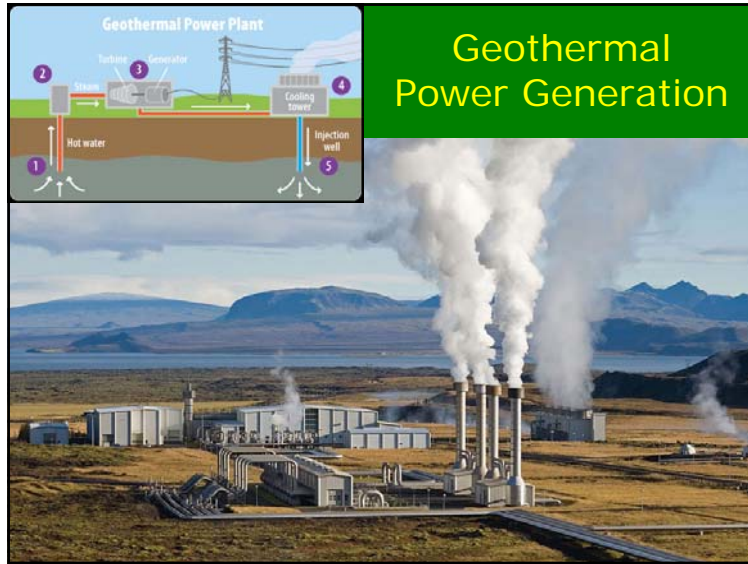
heat pipe

heat pipe fluid

condenser, heat exchanger

solar cycle heat carrier





UNSW Newsroom

SUBSCRIBE FIND AN EXPERT CONTACT US PUBLICATIONS FOR STAFF

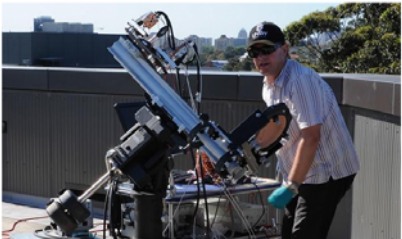
ALL NEWS SCIENCE & TECH HEALTH BUSINESS & LAW SOCIAL AFFAIRS ART, ARCHITECTURE & DESIGN STUDENTS GENERAL OPINION

UNSW researchers set world record in solar energy efficiency

08 DEC 2014

40% Efficiency

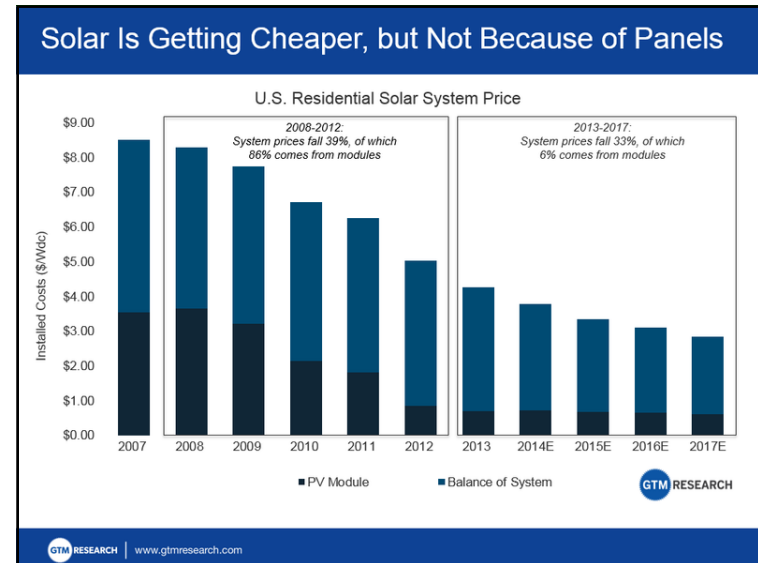
Solar engineers from UNSW's Australian Centre for Advanced Photovoltaics have set a new world-record in solar energy efficiency, achieving an electricity conversion rate of over 40%.




SIMILAR ARTICLES

- PM's global 'shout-out' for UNSW's world-leading solar research
- UNSW solar shines in new ARENA R&D funding
- Researcher seeks big gains from small power systems
- Cutting our carbon footprint
- UNSW solar technology central to renewable energy future - Bill Shorten

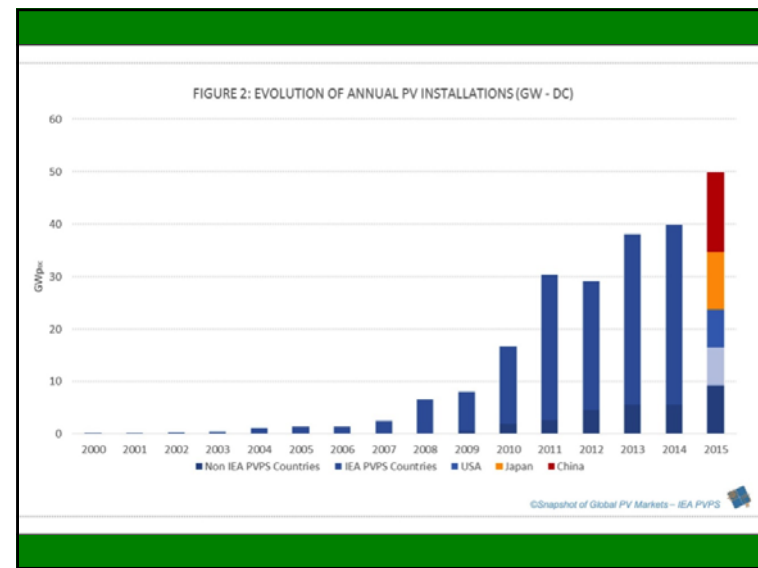
ARTICLE TAGS



Solar Land Area Requirements



How much land area needed to replace electricity from coal with photovoltaics? What about imported oil?



99 Percent Of New Power Generation Added In January Came From Renewable Energy



CREDIT: SHUTTERSTOCK

More than 99 percent of new electric capacity added in the U.S. in January came from renewable energy sources, according to data released by the Federal Energy Regulatory Commission (FERC) on Thursday.


Of the 325 megawatts of new capacity installed, solar led the way with 287 megawatts added in January. That was followed by geothermal power with three new units totaling 30 megawatts, one new unit of wind energy with an installed capacity of 4 megawatts, and three new units of biomass totaling 3 megawatts. In addition, there was 1 megawatt added that FERC defined as "other."

Despite significant gains, renewables are still a relatively small piece of the overall capacity picture in America. Renewable sources, including hydro, account for just over 16 percent of total installed operating generating capacity, according to FERC — a picture dominated by fossil fuels.

When there's a huge solar energy spill, it's just called a "nice day"

www.voltsolar.org

Source	Q1 2016 Capacity Added (MWac)	Q1 2015 Capacity Added (MWac)	Total Capacity (GWac)	% of Q1 2016	% of Q1 2015	% of Total
Utility-Scale Solar	522	404	16.12	23.6%	14.9%	1.4%
Other Solar (est.)	800	933	23.37	40.7%	34.3%	2.0%
Wind	707	861	74.55	32.0%	31.7%	6.3%
Water	29	2	100.12	1.3%	0.1%	8.4%
Geothermal		45	3.90	0.0%	1.7%	0.3%
Waste Heat			1.16	0.0%	0.0%	0.1%
Biomass	33	16	16.71	1.5%	0.6%	1.4%
Nuclear			107.03	0.0%	0.0%	9.0%
Coal			301.64	0.0%	0.0%	25.3%
Natural Gas	16	458	500.13	0.8%	16.8%	42.0%
Oil			44.68	0.0%	0.0%	3.8%
Other			0.77	0.0%	0.0%	0.1%
Total	2,209	2,719	1,190.18	100.00%	100.00%	100.00%
Renewables	2191	2261	235.93	99.2%	83.2%	19.8%
Solar + Wind	2129	2198	114.04	96.4%	80.8%	9.6%



"I THINK IT IS POSSIBLE FOR ORDINARY PEOPLE TO CHOOSE TO BE EXTRAORDINARY."

- Elon Musk

The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man.

George Bernard Shaw

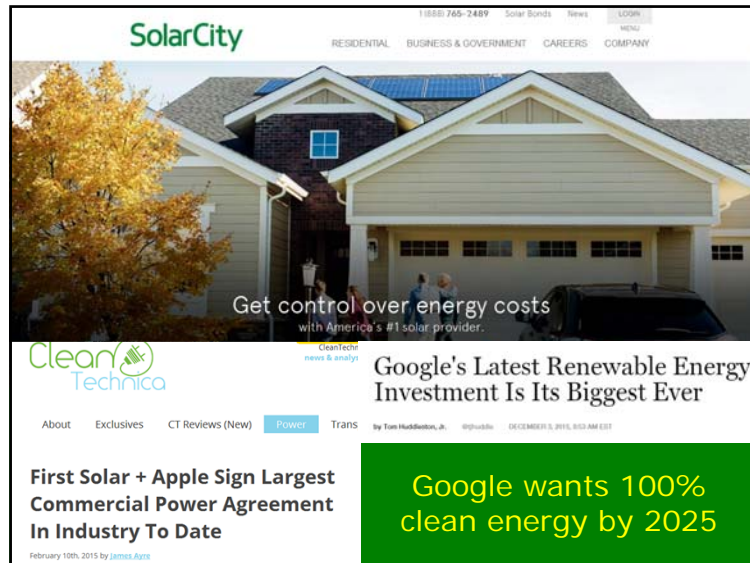
Why You Might Buy Electricity From Elon Musk Some Day

In California, homeowners are pulling the plug on their utilities by storing solar electricity in Tesla batteries.

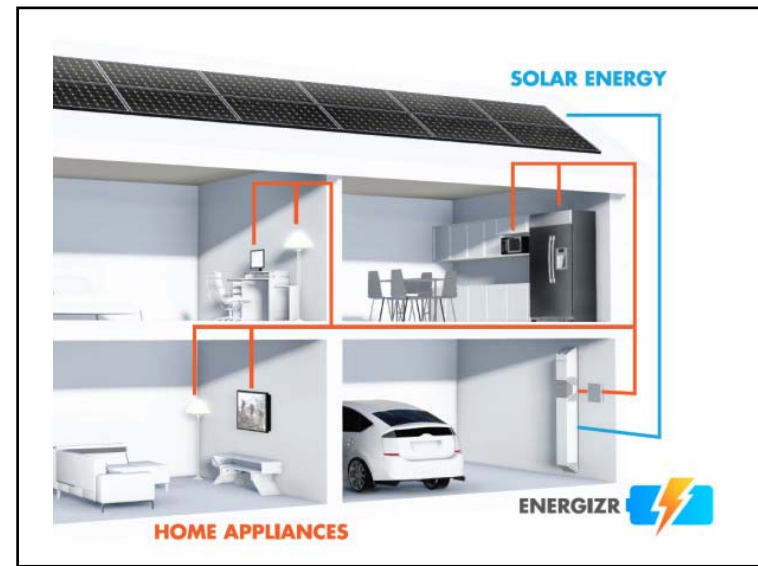
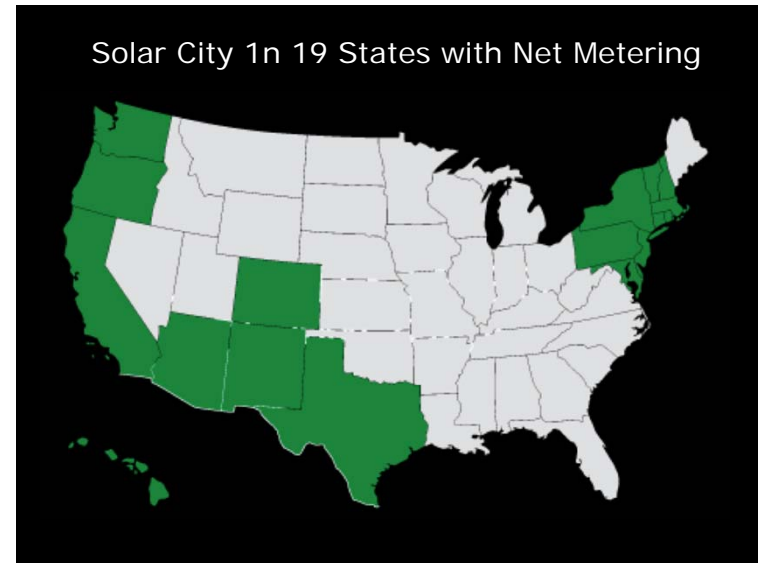
TODD WOODY | NOV 25, 2013 | TECHNOLOGY

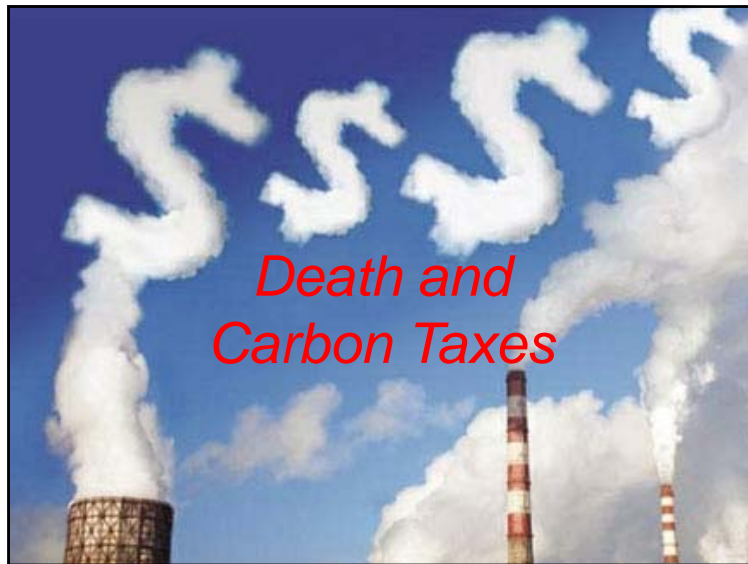






The image shows a screenshot of the SolarCity website at the top, featuring a house with solar panels and the text "Get control over energy costs with America's #1 solar provider." Below this is a CleanTechnica article titled "Google's Latest Renewable Energy Investment Is Its Biggest Ever" by Tom Haddock, Jr., dated December 5, 2015. A green banner at the bottom of the article reads "Google wants 100% clean energy by 2025". To the left of the banner is another article headline: "First Solar + Apple Sign Largest Commercial Power Agreement In Industry To Date" dated February 10th, 2015.





British Columbia Enacted the Most Significant Carbon Tax in the Western Hemisphere. What Happened Next Is It Worked.

Just before the economic collapse in 2008, the Canadian province passed a tax on carbon. Five years later, it's a case study in smart climate policy.

—By **Chris Mooney** | Wed Mar. 26, 2013 3:00 AM PDT

413 Tweet 92 Like

Carbon Tax

Overview of the revenue-neutral carbon tax

B.C. continues to be a leader in climate action by having a carbon tax.

The revenue-neutral carbon tax was implemented on July 1, 2008, and the final scheduled increase took effect on July 1, 2012.

The initial tax rate was relatively low and has increased gradually to allow families and businesses time to reduce their emissions. The tax is also intentionally broadly based and paid by all those who consume fossil fuels in the province.

The tax puts a price on carbon to

- encourage individuals, businesses, industry and others to use less fossil fuel and reduce their greenhouse gas emissions;
- send a consistent price signal;
- ensure those who produce emissions pay for them; and
- make clean energy alternatives more attractive.

The carbon tax is revenue neutral, meaning every dollar generated by the tax is returned to British Columbians through reductions in other taxes.

The Minister of Finance is required by law to annually prepare a three-year plan for recycling carbon tax revenues through tax reductions. This plan is presented to the Legislative Assembly at the same time as the provincial Budget. The Revenue Neutral Carbon Tax Plan and Report presented in [Balanced Budget 2014](#) shows the tax reductions that return carbon tax revenues to individuals and businesses.

Based on the revised forecast of revenue and tax reduction estimates, revenue neutrality has been met for 2013/14. In fact, the reduction in provincial revenue exceeds the \$1.212 billion in carbon tax revenue by \$20 million.

A gas pump in Vancouver, British Columbia displays the carbon tax. *Steven Godfrey/Flickr*

SUPPOSE THAT YOU LIVE IN VANCOUVER and you drive a car to work. Naturally, you have to get gas regularly. When you stop at the pump, you may see a notice like the one above, explaining that part of the price you're paying is, in effect, due to the cost of carbon. That's because in 2008, the government of British Columbia decided to impose a tax on greenhouse gas emissions from fossil fuels, enacting what has been called "the most significant carbon tax in the Western Hemisphere by far."

Compact Fusion

Breakthrough in Nuclear Fusion? - Prof. Dennis Whyte

MIT Club of Northern California

Energy & Environment

Breakthrough in Nuclear Fusion?

Dennis Whyte
MIT Department Head
Nuclear Science & Engineering

February 24th, 2016
Palo Alto, California

The ARC fusion pilot conceptual design

B. Sorboon, et al Fusion Eng Design (2015)

Integrated new REBCO superconductor tape + coil structure

500 million watts fusion power
~200 million watts electricity

R=3.2 meters

Hybrid Fusion

The most common hybrid design consists of a fusion reactor core surrounded by a blanket of fissile material such as uranium or thorium

Central solenoid
Vacuum vessel
Blanket and shield
Reactor core
Plasma
Plasma first wall
Toroidal field magnets

3.9 m
5.0 m
0.62 m
3.2 m

The generation of neutrons by the fusion of hydrogen isotopes in the core drives fission reactions in the blanket. These neutrons can be used to generate electricity, produce nuclear fuel for LWRs or transmute waste. Reproduced with permission from ref. 7; © 2008 ANS.



Featured Research from universities, journals, and other organizations

Fusion reactor concept could be cheaper than coal

Date: October 8, 2014
Source: University of Washington

Summary: Engineers have designed a concept for a fusion reactor that, when scaled up to the size of a large electrical power plant, would rival costs for a new coal-fired plant with similar electrical output.

Share This

- Email to a friend
- Facebook
- Twitter
- LinkedIn
- Google+
- Print this page

ScienceDaily
Your source for the latest research news

Related Topics

- Matter & Energy**
 - Nuclear Energy
 - Physics
 - Energy Technology
- Earth & Climate**
 - Energy and the Environment
 - Renewable Energy
 - Environmental Science

"A fusion power plant producing 1 gigawatt (1 billion watts) of power would cost \$2.7 billion, while a coal plant of the same output would cost \$2.8 billion"

The UW's current fusion experiment, HIT-S13. It is about one-tenth the size of the power-producing dynamak concept.

Credit: Image courtesy of University of Washington [Click to enlarge image]

Compact Fusion Lockheed Martin Skunkworks

Global Electricity Demand (100 T-kWh) by 2080

Global Electricity Demand (44 T-kWh) by 2045

by 2023 ?

Timeline:

- 1968: Tokamaks (\$500M/y)
- Today: ITER and DEMO
- 2023: Compact Fusion (x10 capacity every 5 years)
- 2040: 1 GW plants (x10 capacity every 10 years)
- 2045: 100 MW plants
- 2080: 1 GW plants

© 2013 Lockheed Martin Corporation. All Rights Reserved.

Space Mirror

"Novey Svet" (New Light) Experiment — Znamya 2.5

Cosmonauts control experiment from Mir; observe light spot

Thin film reflector

Progress spacecraft

Reflected light

Solar light

Night Light Spot Day Sun

Illustration exaggerated for clarity.

MIKE FISHER/G.M. Productions

Solar Tower Electricity from Hot Air...

Solar Tower 1000 Metres

Model View

Modern Marvels

EnviroMission

EnviroMission

\$750 Million to Build Payback in 11 Years

glass roof

chimney

wind turbine

VIDEO

VIDEO

