

New Energies-The Road to the Future



- Since for ever, the humankind have always tried to embrace some sort of energy source in order to practice its activity and live a more comfortable life. Fossil fuels like natural gas, coal or petroleum have been great alternatives for centuries now. However, a divorce seems inevitable! As a matter of fact, the global warming trend is an evidence, the depleting of natural resources have to come to a stop, and countries have to achieve energy independence. Humankind is to find a new support, a new alternative in order to preserve its own existence and Life on Earth in general. It is in such a context that we starting flirting with what is called “Renewable Energies”.

What does renewable mean??

The idea behind the term "Renewable" is an "inexhaustible and environmentally friendly energy source". They can be listed as the following:

- Wind
- Direct sunlight
- Biofuels
- Biomass
- Geothermal
- Hydropower
- Passive solar

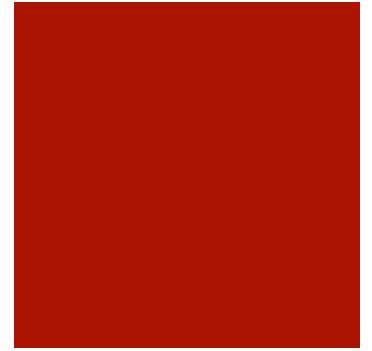


How the flame (renewable energies) got revived in the USA...



- On April 22, 1970: Denis Hayes, a graduate student from Harvard's Kennedy School of government, created "Earth day".
- The goal: raise an environmental consciousness in America.
- The main target: fight against environmental issues (dirty air, polluted rivers and seas, oil spills etc...)

This relationship (gasoline/
human) is not going to work!



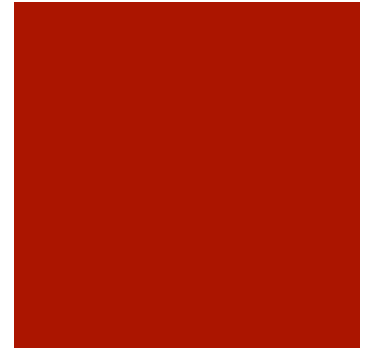
- Following the oil embargo of 1973, the skyrocketing price of gasoline and the long lines at the gasoline station brought energy as the number one issue.
- Senator Jacob Javits anecdote: “Son you will learn”.

“You are my sunshine”



- President Carter first ever conference on the top of the white house to honor a solar hot water system (June 20, 1979)
- “No one can embargo the sun” President Carter
- Target: 20% of U.S energy from solar by the end of year 2000

Game plan



- Creation of the Department of Energy.
- Creation of a national research laboratory devoted to solar energy, The Solar Energy Research Institute, in Golden Colorado.

Game Plan



- Creation of the Section 210 of the Public Utility Regulatory Policies Act of 1978, otherwise known as PURPA.
- PURPA required utilities to buy power from independent companies that could produce power for less than what it would have cost for the utility to generate that same power, hence generating "avoided cost."

Good Bye Sunshine

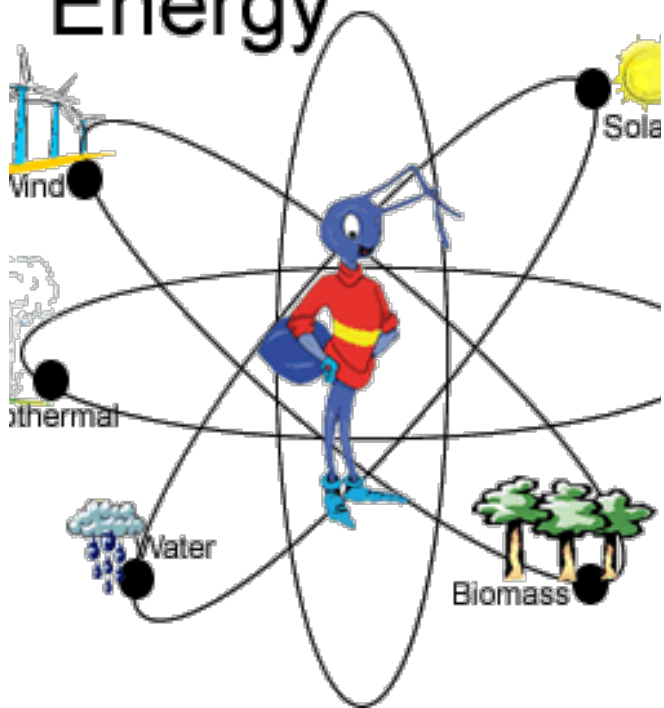


* The Iranian Revolution led to chaos in the oil market. President Carter lose the election against Regan.

* Regan vision can be summarize as the following: “
Production, production,
production

“ you are my hero...”

Renewable Energy



- In the early 1970's Kotaro Ikeguchi lead Japan towards renewable energy.
- The New Energy and Industrial Technology Development Organization (NEDO) is created.

“Together we stand”

- Germany reunification, coincides with the emergence of a renewable era in the country
- In 2000, the Renewable Energy Law is voted, according feed-in-rated for renewable energy technologies.
- Germany today:
- http://www.youtube.com/watch?v=Ec_D0_YwH8A



Why China is looking toward to renewables

- President Hu Jintao recognize the need of the country, to find cleaner source of energy to fight against the air pollution issue, and to satisfy the growing demand.
- Since 1973, China had already passed a law, which called for the use of solar and wind energy.
- In 1988, their first wind project was hooked up into the grid.
- The key factor for the emergence of renewables in china was the Renewable Energy Law of 2005.
- In 2007, The Medium and Long term Development Plan for Renewable Energy was created. The target: 15% of total energy by 2020.



“Back together...”

- The Clean Air Amendment of 1990 is passed which brought a major boost to the taking care of environmental concerns.
- George Bush restored the taxes incentive for renewable energy.
- One of the most important factor for the reboot of renewables was the new portfolio standards (RPS) of the states.
- By 2011, 29 states and Washington DC had renewable portfolios: New York, 29% of wind energy by 2015 Oregon, Minnesota and Illinois aiming at 25% of wind energy by 2025.

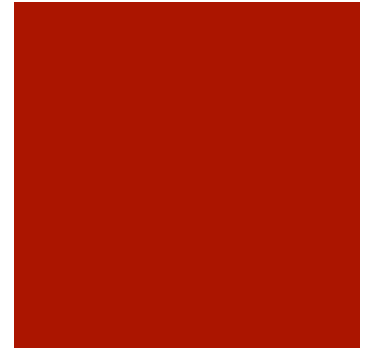


Ups...and Downs



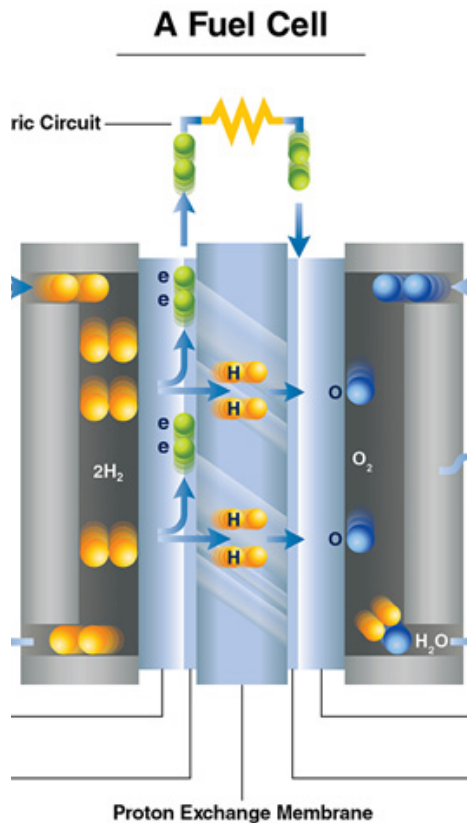
- The accelerating growth of the renewable industry in the USA will be greatly affected by the Great Recession of 2008.
- Barack Obama sees the future in green, he stated: “The nation that leads the world in creating new energy sources will be the nation that leads the 21st century global economy.”

Obama speech on renewables



- [http://www.youtube.com/watch?
NR=1&feature=endscreen&v=X-hRfOlqyll](http://www.youtube.com/watch?NR=1&feature=endscreen&v=X-hRfOlqyll)

“Everything is better at three...”



In Japan, the energy portfolio is called the “Three Denchi Brothers”.

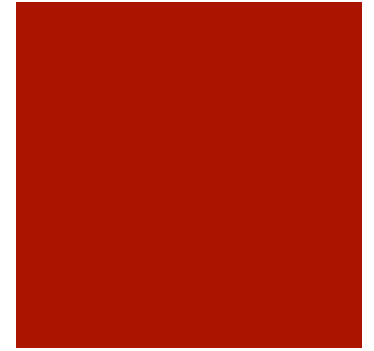
Target: develop solar cells, fuel cells and batteries to improve their competitiveness and to fight the climate change.

The European Union and its commitments



- * 20% of energy supply from renewables by 2020
- “I want us to be the greenest government ever”
said ex-Prime minister of England David Cameron
- Germany target by 2020: 35% of energy supply
from renewables.

Science the “wing-man” of the human-renewable relationship?



The Importance of Science Experiment.

- Sand Hill is the place where innovation and technology capable of changing the world are developed. It's the Headquarter of many VCs (venture capitalists).
- The great ambition with energy was to find and develop the “Google of energy”.

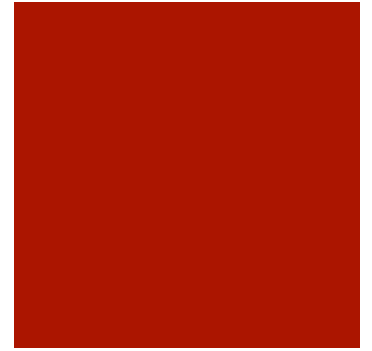
Science the “wing-man” of the human-renewable relationship



But where does the Technology itself come from?

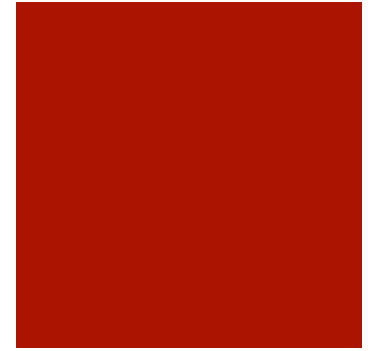
- Technology most likely comes from basic science and research development.
- Basic R&D consisted of “doing something just because you wanted to do it better” said chemistry teacher of Yale John Tully.
- “It was all about excitement. It was really contagious” Yale John Tully

Age is just a number...



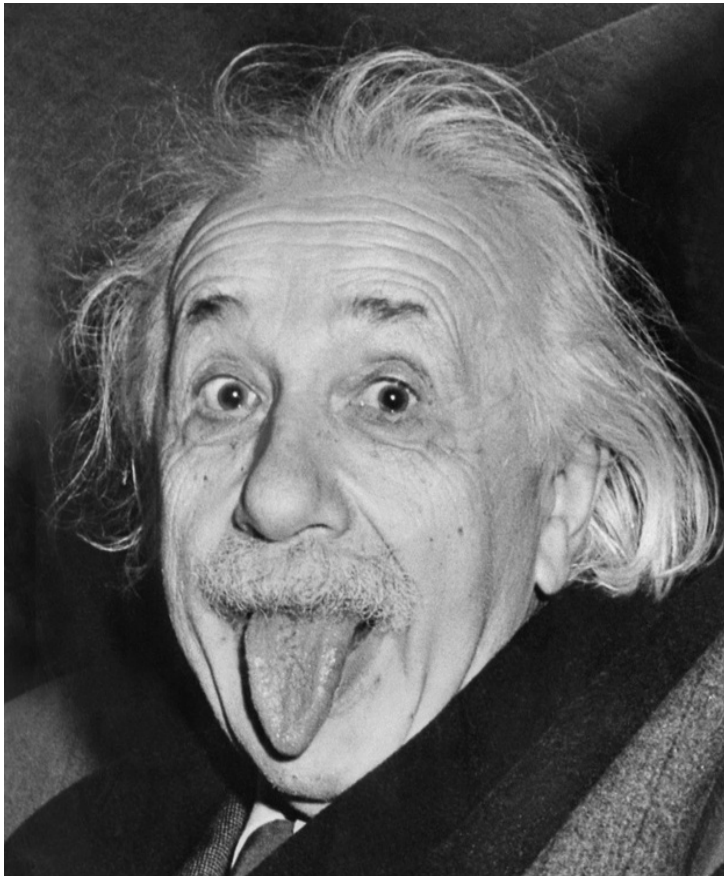
- <http://www.youtube.com/watch?v=n3Xyvclsrjo>

Science the “wing-man” of the human-renewable relationship



A man
explained the
concept of
PV solar
about a
century
ago???

Science the “wing-man” of the human-renewable relationship



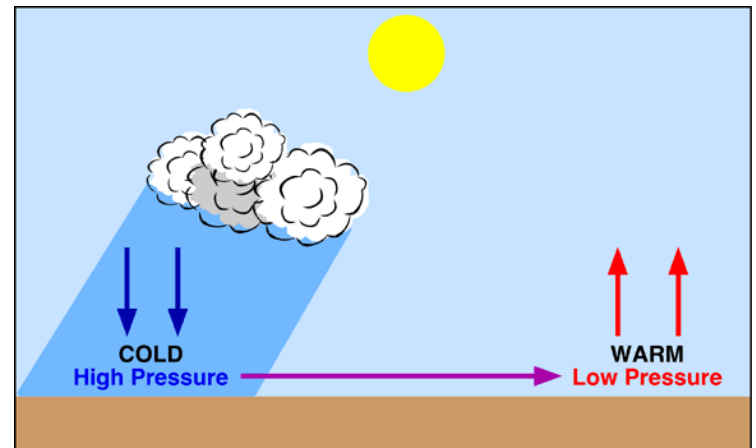
“He explained it all”



Mystery of Wind

How is wind created?

- When air moves from areas of high pressure to low pressure
- This is created by
 - The Earth's rotation
 - Irregularities on the Earth's surface
 - Solar Radiation



“Free Benefit of Wind”

- Earliest use of wind was to fill the sails of a ship and propel the vessel across the water
- Then in the eotechnic phase, the windmill arose as a source of power
- The windmill dates back at least a thousand years
- Provided mechanical energy for two main purposes
 - Grinding grain
 - Pumping water
- Significantly reduced man power



The beginnings



- Primitive windmills were working in Persia as early as the 10th century
- Quickly spread to Islamic world, China and eventually Europe

Windmills and Wealth

- It was said that in 12th century England the wealthy and powerful owned and protected sources of water energy
- Rural people took action and decided to take advantage of another source, wind
- “The free benefit of the wind ought not to be denied to any man.”



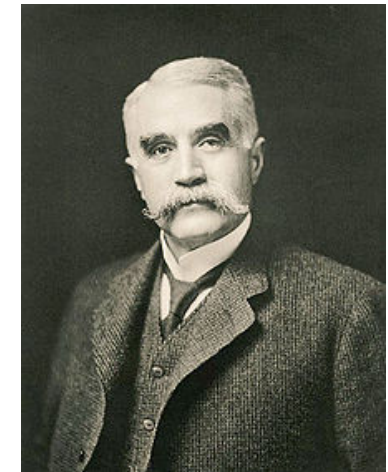
Commonality and Advancement



- Windmills became a common part of the landscape in many regions, especially Holland
- They then began to be used for industrial purposes such as:
 - Crushing olives
 - Making gunpowder
 - Powering blast furnaces
- It is estimated that 25% of Europe's energy was produced by wind from 1300 until the 19th century
- “distant announcement of the industrial revolution”

Electrification of Wind

- After the opening of Edison's Pearl Street station, it was wondered how wind would compete
- Charles Brush, was the man to take the next step in wind innovation
- Built a 60 ft. windmill with a network of batteries and was able to light his entire mansion
- First time that wind power generated electricity



Windmill → Wind Turbine

- A windmill takes the kinetic energy of the wind and turns it into mechanical energy
- A wind turbine takes the next step by turning that mechanical energy into electricity



<http://fr.wallpaperswiki.org/windmill-bruges-belgique/>



http://en.wikipedia.org/wiki/File:Wind_turbine_walnut_iowa.jpg

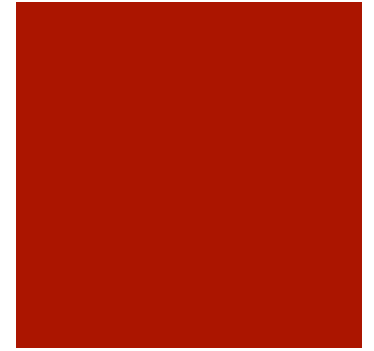
Growth of Rural Wind Use

- As centrally generated electricity became popular in urban areas, wind became popular on farms
- Jacobs brothers were the largest provider
- Windmills with storage were throughout



Death of Rural Wind Use

- The New Deal killed wind use.
- Roosevelt created the Rural Electrification Administration (REA)
- Allowed for electric cooperatives to spread out their grid
- Meant no use for impractical, expensive wind energy

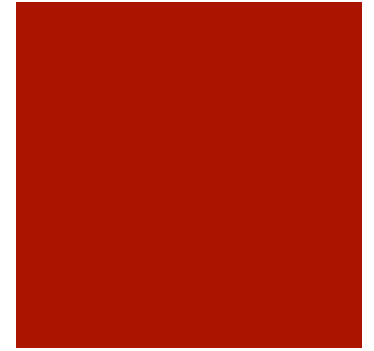


Palmer Putnam

- Spring of 1941
- Grandson of founder of G.P. Putnam and Sons assembled a team of experts
- Designed and built a 175 ft. wind turbine located on the top of Grandpa's Knob
- The power generated was fed into the Central Vermont Public Service grid
- Eventually failed and was not repaired



Challenges of Wind Energy



- Best winds are often in uninhabited areas
 - How do we efficiently transport this energy to a grid?
- Wind does not always blow
 - How do we store the energy?
- The strength of wind varies
- pure energy capacity of a megawatt of installed wind capacity provides less electricity than a megawatt of coal
- Is wind really free?

The Beginning of the Modern Industry

- Oil crisis in 1970s lead to the next push in renewable energy
- Federal government began to fund wind energy research and development
- Turned to large defense contractors such as Boeing, General Electric, and United Technologies
- Deep cuts of the Reagan era ended the program



California Wind Rush

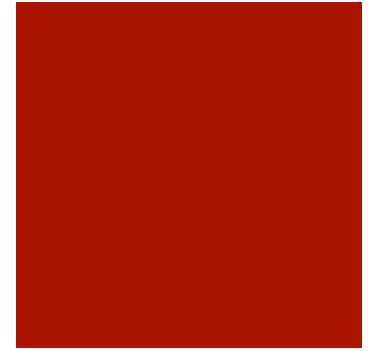
- State of California took the next big step by providing tax credits and breaks for companies providing renewable energy
- Initiated the “Wind Rush”
- From this frenzy of wind activity, came the wind farm.
- Began to realize just how vicious the winds could be
- Turned to a Danish company that created sturdy farm equipment
- They made turbines for the companies in California and the U.S. and Danish industries were forever linked.
- Changing government in California caused for benefits to run out and left a few in the wind industry standing





Return of Wind

- Energy Policy Act of 1992 reintroduced tax credits for wind power
- Credited not just building turbines, but rather producing energy
- States began to introduce renewable standards



Enron and wind

- Enron was the company who brought wind back to its peak
- Bought Zond and tried hand in renewables
- Eventually bought by GE who is the current operator
- GE continues to be one of the world leaders in wind energy production



<http://www.youtube.com/watch?v=igN4jpRx1ol>

Offshore Wind Farms

■ Pros:

- Wind can be much stronger and frequent
- Heavy turbines are easier to transport out to sea

■ Cons:

- Turbines must be stabilized somehow
- Corrosion is amplified in the ocean



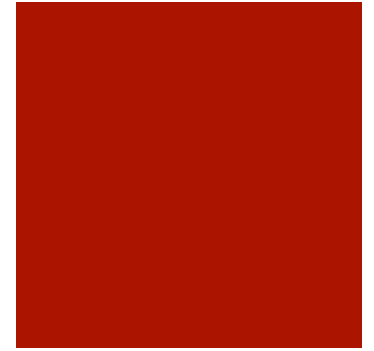
Wind Around the World

- In 2000 Europe's installed capacity was 5 times greater than the United States
- Germany and Spain accounted for 70%
- China recently began to utilize wind
- U.S. 2005-2009 installed capacity grew at 40% rate annually
- A turbine today provides 100 times more electricity than one in 1980



Wind Energy Today

- The wind industry is the largest and fastest growing renewable energy in the world
- In the United States alone, wind has increased tenfold in the past ten years.
- still only accounts for 3% of the energy produced in U.S.
- The Department of Energy has set a goal to get 20% of electricity from wind by the year 2030



Wind Use in New Zealand

- New Zealand has 17 wind farms
- Total of 622 megawatts
- They supply about 4% of New Zealand's annual electricity generation
- Developers are exploring sites throughout New Zealand for new wind farms.





Efficiency and Conservation

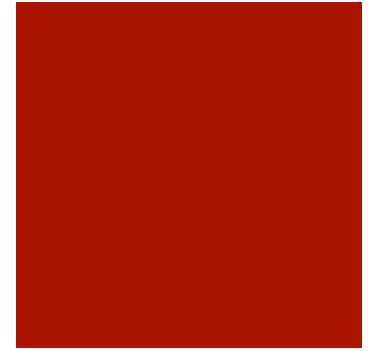
Defined.

- Efficiency - [ih-**fish**-uhn-see] noun - “the ratio of the work done or energy developed by a machine, engine, etc., to the energy supplied to it, usually expressed as a percentage.”
- Efficiency is “one energy resource [that] has the potential to have the biggest impact of all.”

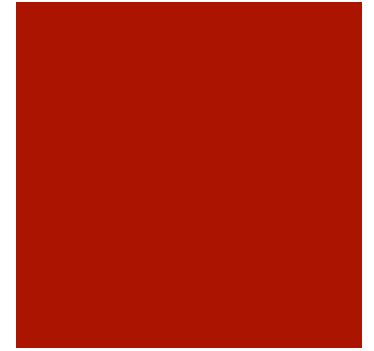


Changing Connotation

- The view on the subject has changed drastically over the years
- Efficiency or conservation used to be looked at as a denial of the readily available resources
- Nowadays it is looked at much differently
- It has become a necessity to stay a world player



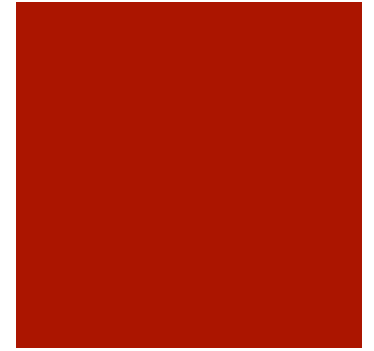
Efficiency and Government



- The term efficiency is popping up in governmental goals and policies around the globe
- The European Union has set a goal to improve their energy efficiency by 2020
- The Obama Administration has correlated investments into energy efficiency into a growing economy
- Russia also has plans to reduce energy intensity by 40% by 2020

Efficiency Gains

- The United States uses less than half as much energy for every unit GDP as it did in the 1970s
- Japan has doubled its efficiency over the past thirty years
- China has made conservation and efficiency a top priority



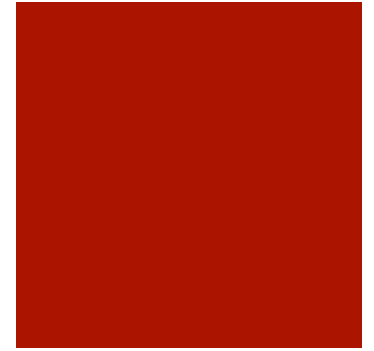
Efficiency in Industry

- Industry in the U.S. accounts for one third of the total energy consumption
- Computers allowed for more effective processes
- Still room for improvement
- Big of a sector means big room for change
- Price of investment must pay off



Dow Chemical

- one of the world's largest industrial consumers of energy
- Uses the equivalent of 1,000,000 barrels of oil a day
- reduced their energy use by 25% over a ten year period



How to become Efficient

- Consider every aspect that effects efficiency
- Design, behavior, and actual implementation of techniques
- By doing so we can close the conservation gap



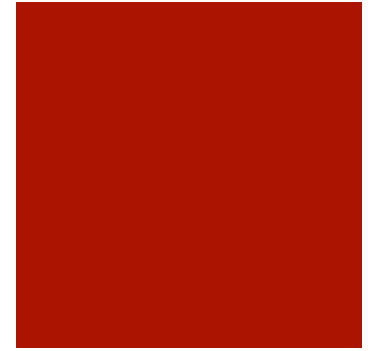
energy efficiency



Road to the Future

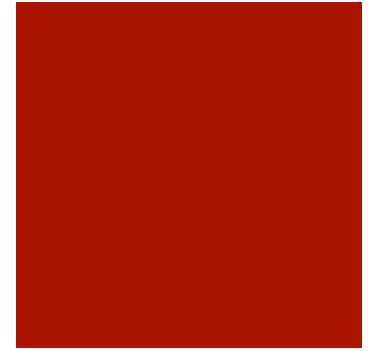
Finding our Valentine

- Carbohydrate Man
- Biofuels, ethanol
- Brazil's success with Ethanol
- “Who killed the Electric Car”
- A Great Revolution



Biofuel Vision

- Ethanol – ethyl alcohol, made from corn or sugar
- Its not so different from brewing beer or making rum
- Cellulosic ethanol – ethanol fermented and distilled for a mass scale from agricultural, urban waste, or designed crops (2nd Generation Biofuel)
- Biodiesel – for diesel, made from animal fat or vegetable oils. Recycled oils.



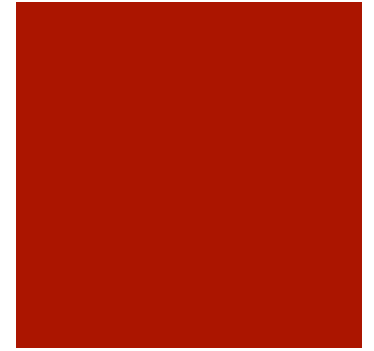
1st & 2nd Generation Biofuels

- 1st generation - from sugars, starches, vegetable oils or animal fats from proven technology
- 2nd generation – research and development, “conversion of plant lignin and cellulose into fuels by enzymes and the gasification of biomass material followed by a gas to liquid.”



Support for Biofuels in US

- US Navy & Air Force
- Air Force & green jet fuel
- Navy has goal to have half of its fuel to be biofuels by 2020
- US has mandated to triple its biofuels that are blended with transportation fuel from 1 million mbd in 2011 – 2.35 mbd by 2022
- Equivalent to 20 percent of all motor fuel, like adding another Venezuela or Nigeria to supply
- E85, 85% ethanol (only for flex-fuel vehicles)
- Only 3% of US cars have this capability



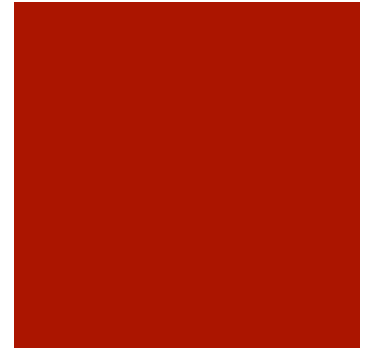
World Support



- EU mandates 10% renewable energy, including biofuels, by 2020
- India pushes for 20% biofuels for transportation by 2017
- World Champion, Brazil

First Flex-Fuel


- Henry Ford
- Made the Model T so that it could run on gasoline or ethanol
- Tie farm and city together



Ethanol's track record

- Up and Down
- Prohibition
- Great Depression
- 21st Amendment
- WWII and after
- Tractorcade & Soviet Union
- Oil prices collapsed



- 
- Clean Air Act Amendment of 1990
 - MTBE (methyl tertiary butyl ether)
 - Energy Policy Act of 2005 & George Bush
 - <http://www.youtube.com/watch?v=bO5R4vgkLX8>
 - “The Carbohydrate Economy has been a vision – and a dream – for over a century. But a reality now? How big? (651)”






Brazil

- Know as “alcohol”
- Started in 1930's
- By 1985, 95% of all new cars sold ran on “alcohol”
- Dropped off in early 90's due to shortage. Imported from US.
- 2000's - high oil prices, experience with ethanol, and flex-fuel autos – ethanol exploded
- Flex-fuel cars count for 94% of all new cars sold today.
- Mostly Sugarcane
- Gasoline the new “alternative” fuel



- 
- US produces 75% more ethanol than Brazil
 - Brazil's fuel market is 10% of the US gasoline market
 - To be equivalent with Brazil – 5 million barrels per day
 - More than any other OPEC country except Saudi Arabia
 - Promising future for Sugarcane and world market
 - US cannot meet expectations for biofuels with only biodiesel and ethanol for that 2022 mark as of now. Most needs to be 2nd generation biofuels, such as in laboratories---- cellulosic ethanol



FOOD OR FUEL?


Nearly a billion people will go hungry tonight, yet this year the U.S. will turn nearly 5 billion bushels of corn into ethanol. That's enough food to feed 412 million people for an entire year.

8 BUSHELS OF CORN = **21.6** GALLONS OF ETHANOL FUEL OR ENOUGH FOOD TO FEED A PERSON FOR A WHOLE YEAR

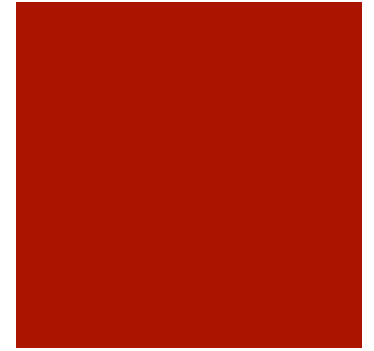


DOING THE MATH:
5 billion bushels / 8 bushels of corn (enough calories to feed a person for a year) = sufficient calories to support 625 million people, minus one-third to account for distiller's grain (DDG) = 412 million
8 bushels of corn (feeds a person for a year) x 2.7 gallons of ethanol per bushel = 21.6 gallons of ethanol per bushel


SOURCES:
450 pounds of corn supplies enough calories for one person for a year (http://www.foreignaffairs.com/articles/2009/03/food_rungs_and_barjatin_sarasin/how_biobuels_could_starve_the_poor/)
About 5 billion bushels of U.S. corn production is slated for ethanol production (<http://www.usda.gov/oc/commodity/wasde/forecast.pdf>)
One bushel of corn produces 2.7 gallons of ethanol (Purdue Extension, "How Fuel Ethanol is Made From Corn," http://www.extension.purdue.edu/extmedia/DVD_029.pdf)



Electric Car & Smog



- Believed to have started form the “Father of Smog” Haagen-Smit
- Lived in LA and made the connection with smog from the emissions from cars
- Smog attacks in LA created the agency CARB(California Air Resources Board)
- Governor Regan appointed “Father of Smog” as chairman
- CARB was created to basically come with ideas to diminish car emissions
- Created the catalytic converter, a more thorough burn of gasoline
- Introduced the zero-emission vehicle, opened the door for the Electric Car

- 
- CARB set out to have 10% of all cars be zero-emission cars by 2003
 - Car companies set out to deliver but failed
 - Who Killed the Electric Car?
 - Documentary that's asks what actually happened
 - <http://www.youtube.com/watch?v=k96tIRjxzw0>

Return of the EV

- Hybrids created a bridge for electric cars, and jump started a new outlook for electric cars
- Chevy Volt – plug in electric car
- Political campaign for 2008
- McCain – “the eyes of the world are now on the Volt”
- Obama – “campaigned to have a million plug-in hybrids and electric cars on the road by 2015”



Major Questions

- Battery needs to be have a major advancement. Need to be smaller, weigh less, charge quicker, and last longer
- Chevy Volt requires 4-10 hours to recharge
- Where would charging stations be located?
- Where's the electricity surplus coming from with everyone charging overnight?
- Coal, Uranium, renewables?



EPA
DOT

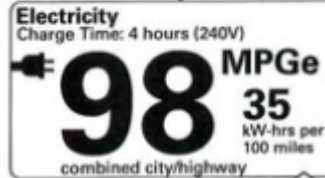
Fuel Economy and Environment



Plug-In Hybrid Vehicle
Electricity-Gasoline

Fuel Economy

Compact cars range from 14 to 62 MPGe.
The best vehicle rates 112 MPGe.



Driving Range



You save
\$6,850
in fuel costs
over 5 years
compared to the
average new vehicle.

G
F
S

Annual fuel **cost**
\$950

Fuel Economy & Greenhouse Gas Rating (tailpipe only)



Smog Rating (tailpipe only)



This vehicle emits 81 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel & electricity also create emissions; learn more at fuelconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 23 MPG and costs \$11,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.80 per gallon and \$0.12 per kW-hr. This is a dual fueled automobile. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuelconomy.gov

Calculate personalized estimates and compare vehicles

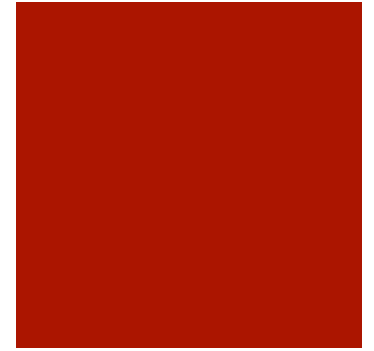


Smartphone
QR Code



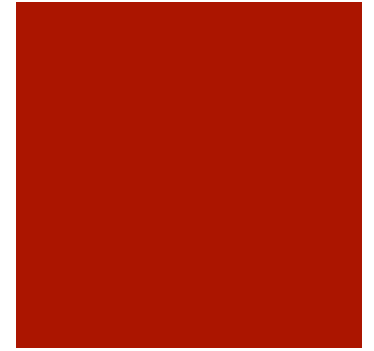
Hydrogen

- It extracts energy from chemicals in the form of electricity
- Combo of a fuel tank and a battery
- Fuel cells are expensive and will require a lot of investment
- Hydrogen- fueling stations
- Some started in California but quickly died



Natural Gas

- NGV
- Primarily local transportation, buses and taxicabs
- Has lower energy density, has less range or fewer miles per tank
- Would need a lot more natural gas fueling stations for longer travel distance



New Zealand

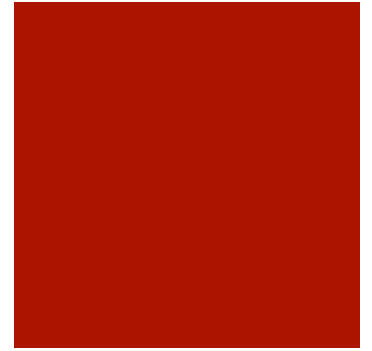
- Starting into Biofuels
- Biodiesel (blends up to 5%)- mostly from animal fat & cooking oils
- Ethanol (blends of 5 & 10 %) – produced from whey
- Not many EV, just starting a market



Race is on

- Who will win?

- We still don't know



A Great Revolution

- When will it happen?
- What's the “big red ribbon cutting”
- Environment will have impact on the energy market place
- Climate change & Carbon
- 80% of the world is supplied by carbon based fuels
- Oil sands, shale gas, tight oil, coal - environmental impacts?



Attitude for our Revolution



- <http://www.youtube.com/watch?v=6FMNFvKEy4c>
- “It will be critical for meeting the challenges and assuring the security and sustainability of the energy for a prosperous, growing world. That is at the heart of the quest, it is as much about the human spirit as it is about technology, and that is why this is a quest that will never end (711-717).”

Happy Valentines Day



Work Cited

- <http://www.transport.govt.nz/ourwork/climatechange/>
- "Efficiency." Dictionary.com. Dictionary.com, 2013. Web. 06 Feb. 2013.
- "New Zealand Wind Energy Association." NZ Wind Farms. N.p., n.d. Web. 10 Feb. 2013.
- Yergin, Daniel. The Quest: Energy, Security and the Remaking of the Modern World. New York: Penguin, 2011. Print.
- "What Causes Wind?" Weather Questions. Weatherstreet.com, 2012. Web. 6 Feb. 2013.

