

DSRC Alt. Energy presentation.

SLIDE 1: Title slide, Alternative Energy Resources, Wind , Solar and ???.

Once again, due primarily to the increased cost of energy produced from FOSSIL FUELS and an enhanced awareness of the environmental impacts from use of fossil fuels, our attention has turned to various sources of alternative energy.

An emphasis on WIND and SOLAR POWER generation is at the forefront of efforts to reduce the use of fossil fuels. But these are not the only viable methods of alternative energy production available today. They are just the most publicly visible.

Many other processes for harnessing power from renewable sources are becoming technologically viable. Two of these are GEOTHERMAL and HYDRO-KINETIC. I will mention these processes later

We are also looking, with renewed interest, at NUCLEAR and CONVENTIONAL HYDRO as ways to reduce a dependence on fossil fuels.

It would be impossible to adequately cover this subject in a four year course at MIT let alone a ½ hour discussion here so I will briefly cover what I can but try to focus on what we can do at home in NJ. It is nice to see what our government and utilities are doing in the larger sense. But I am sure all of us would like to see some benefits from using renewable sources, like lower monthly utility bills.

Do not hesitate to interrupt and ask a question at any time during this presentation. I will attempt to answer your questions to the best of my knowledge and will provide everyone with links to web sites for future reference.

SLIDE 2; A brief history of harnessing wind power in modern times.

The idea of harnessing the wind for power generation has been around since the late 1800's. In 1887, Charles F. Brush (1849-1929) built what is widely considered the first automatic windmill for power generation on his estate in Cleveland, OH. This generator had a capacity of 12 kilowatts and 70-75 volts. This windmill was operated until 1909. Brush's windmill was considered economically unsound. The *Scientific American* stated "The reader must not suppose that electric lighting by means of power supplied this way is cheap because the wind costs nothing"

Denmark's Poul la Cour, (1846-1908) had a goal of using electricity produced from wind to break down water into hydrogen and oxygen and store these for use in room lighting and heating. This was not successful but he did produce a considerable amount of interest in wind energy. Today we are still wrestling with the means to store power to have it available when we need it.

Wind power was considered unreliable, uneconomical and most of all unprofitable for commercial power production purposes.

Attempts at developing wind power were limited to SMALL WIND and the realm of tinkerers for the first part of the 20th century. Most wind power generators were used to recharge battery banks to provide power for later consumption. The ZENITH corporation produced 500, 750, 1000 and 1200 watt generators and claimed to have sold 750,000 of these units by 1938. Marcellus Jacobs produced and sold a 2.5KW unit, one of which was installed at Adm. Richard E. Byrd's "Little

America” camp in Antarctica. This unit ran from 1933 to 1955. Many farmers were also known to attach automobile generators to windmills to charge batteries.

SLIDE 3: BIG WIND

The gas crisis of the early 1970’s brought an awareness of the need to develop alternative power generation systems which were not dependent on finite resources. With the memorable long gas lines and gas rationing in many areas, the political and business climate was in place to stimulate the research and development of large scale alternative energy projects.

The first wind farm, or cluster of wind turbines, was built near Greenfield, New Hampshire in 1979. This project experienced major technical difficulties and did not last long.

California experienced a “wind rush” through the 1980’s. These were developed at Altamont Pass, east of Livermore, Tehachapi which is to the south and east of Bakersfield and San Geronio Pass near Palm Springs. The average annual wind speed at San Geronio Pass is between 13 MPH and 25 MPH, Making this location ideal for large scale wind power generation.

Currently the United States is still years behind many European countries in the development of viable alternative energy projects. Much of this is due to the very limited fossil fuel resources available in many European countries. In the US, abundant coal and oil reserves have allowed us to drill and dig our way out of any energy crisis.

The development of large scale wind energy projects in the US has been and is dependent on the price of oil, tax breaks and incentives from the

government. The tax breaks will depend on the political climate and the general mood of the public. The government tends to be reactive to the needs of the day. Low energy cost lessens the feeling of urgency to develop alternative power generation systems.

A GE 1.5 megawatt turbine can generate enough power for over 500 average homes.

In 2007 the US installed more than 5,244 megawatts of new wind power generation.

SLIDE 4: SMALL WIND

Small wind turbines are ideal for small businesses, farms and even homeowners but energy storage and inadequate wind resources are often still a problem. Net metering laws in many states offset the energy storage issue but very few people will complete an adequate wind study prior to installing a small wind turbine.

Here in New Jersey, we do not have the wind resource available, unless you are located near the shore or in the Highlands regions, for one to get a decent return on investment from a small wind turbine.

SLIDE 5: OFFSHORE WIND FARMS

New Jersey has some of the best offshore wind resources in the country. At this time a large wind farm of 96 turbines producing 386 megawatts is proposed for 20 miles off the coast Ocean and Atlantic counties.

Many European and Scandinavian countries have been putting turbines offshore for years with very good results.

SLIDE 6, 7, & 8: WIND RESOURCE MAPS

Map 1 shows NJ wind resources measured at a height of 50 meters. This is one of the measurements generally taken for commercial wind installations. Developers usually seek a “class 3 industrial” wind.

Map 2 shows NJ Wind resources measured at 30 meters. Note the wind resource available in the Mercer County area. Winds averaging 4-5 MPH would not support large commercial wind farms but may be adequate for some “small wind” generators.

Map 3 shows National wind resources on the top image and North Dakota resources on the bottom. Note the “outstanding” category for offshore wind power generation at the NJ coast. Also note the difference in resources around the country, specifically the mid-west. You can see why I am always working in North Dakota and not here at home in NJ.

SLIDE 9: RESIDENTIAL SOLAR SYSTEMS

Solar systems are an ideal way for a homeowner to invest in “green energy”. The many tax credits and government and private incentives available make it economical for a homeowner to install a viable solar system.

As important as large scale development of alternative energy projects are in the long term for our country, most of us would like to see some benefit from this investment right now. (I think that seeing instant

results is in the DNA of our American psyche.) And that means seeing lower bills from the power companies now.

But solar is often “oversold” at the numerous seminars that one could attend every week in our area. One of the pitfalls a homeowner can experience is inadequate sunlight. ANY shade will diminish the amount of power produced by solar panels even a cloud passing overhead. And NJ homes tend to have a lot of trees around. Not open lots like many homes in the SW portions of the country.

And the initial outlays can be considerable. Most of us do not have \$35,000.00 or more cash on hand to invest in a solar system.

Remember, many of the incentives come in the form of tax credits which we will take over years not instant rebates that can be used to offset the initial cost of installation.

Net metering, where power produced is fed into the power grid when it is produced and taken out when needed is one way of storing power for later use. The net metering laws enacted by many jurisdictions make many alternative energy systems work for the homeowner. Solar power only produces power when the sun shines but we tend to have the lights on at night.

SLIDE 10: COMMERCIAL SOLAR SYSTEMS

For many years large scale commercial solar systems were thought to be practical only in the southwestern regions of our country. California, Nevada and Arizona have all developed considerable solar utility grade installations.

But commercial solar systems can be very diverse, from a small solar panel producing enough power for a sign to systems large enough to power a building. Many cities are proposing solar panels to be installed on building rooftops.

Mayor Fried, Of Robbinsville is now proposing a large scale solar farm for some property the township owns south of the town center being built

SLIDE 11 & 12: HYDRO-KINETIC SYSTEMS

Much research is being done to harness energy from tides, waves and ocean currents. Researchers claim that the energy in these resources could provide for the majority of the worlds needs if we could learn to economically exploit them.

One of the drawbacks is the need for a fast current, studies claim that 6 knots or more would be required, to produce power from underwater turbines. Ocean currents average less than 3 knots.

At this time, the most advanced system is the Pelamis wave power project located off the coast of Portugal. This project produces onle 2 megawatts of power.

SLIDE 13 & 14: GEOTHERMAL SYSTEMS

Geothermal energy is another way a New Jersey homeowner can invest in green energy. Closed loop geothermal systems used by homeowners do not really produce, but transfer energy from the ground to a home. They are a heat pump except they use the constant temperature of the ground rather than varying atmospheric temperatures to move BTU's.

One of the drawbacks is the excavation required to install a geothermal system. But geothermal, in conjunction with other alternative energy systems can provide a very cost efficient means of supplying energy for a home.

When most of us think of Geothermal energy we envision heat coming from the core of the earth. This heat originates from decaying radioactive materials at the core of the earth. Yes, we are sitting on a great big nuclear reactor. Scientists and researchers have viewed this largely untapped resource as a solution to our future energy needs for centuries. Geothermal power has been used to produce power in many areas of the world such as Iceland, Italy and Japan. But even with modern technologies this resource still does not show much wide scale economic promise. As of 2000 about 6800 megawatts of power is being produced worldwide from geothermal resources but that is going to change.

[LINKS TO RELATED WEBSITES](#)

SOLAR POWER ROCKS .com – This is a great site for researching incentives, grants, rebates and tax credits for installing renewable energy systems at your residence.

<http://www.solarpowerrocks.com/new-jersey/>

SOLAR 4 POWER .com – This site will give a wealth of information about anything solar. A very useful and interesting tool.

<http://www.solar4power.com/index.html>

DSIREUSA .org – Another useful site for researching incentives, rebates and tax credits. I have linked this to the NJ section of the site.

<http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=NJ&RE=1&EE=1>

PSEG Solar Loan program – This is a link to a program where PSE&G will provide loans for “behind the meter” solar installations

<http://www.pseg.com/customer/solar/index.jsp>

NEW JERSEY STATE ENERGY MASTER PLAN – This is self explanatory

<http://www.state.nj.us/emp/>

NEW JERSEYS CLEAN ENERGY PROGRAM – Information about NEW JERSEY’s REIP (renewable energy investment program)

<http://www.njcleanenergy.com/renewable-energy/home/home>

ALTERNATIVE ENERGY NEWS – Geothermal anyone? This site has some great information on geothermal energy systems. Geothermal is not just for Yellowstone anymore.

<http://www.alternative-energy-news.info/technology/heating/>

AMERICAN WIND ENERGY ASSOCIATION – Anything wind!! Interested in wind power/ This site will take you there or at least start you on your way

<http://www.awea.org/>

WIND POWERING AMERICA – A DOE site with some great information on wind resources, I linked this to the NJ wind resource maps.

[http://www.windpoweringamerica.gov/where is wind new jersey.asp](http://www.windpoweringamerica.gov/where_is_wind_new_jersey.asp)

<http://www.windpoweringamerica.gov/>

NEW JERSEY WIND – A link to a site profiling the only commercial wind farm in NJ at this time, Located outside of Atlantic City.

<http://www.njwind.com/project.html>

NEW YORK TIMES ARTICLE – Article in the New York Times announcing a offshore project for NJ. A good, informative read!!

<http://www.nytimes.com/2008/10/04/nyregion/04wind.html>

Interesting energy facts – Good info

<http://interestingenergyfacts.blogspot.com/2009/09/geothermal-energy-how-to-use.html>

Photo credits and Sources

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Slide 2; Photo by Amber Palecek, Wind farm. N. of Storm Lake, IA

Slide 3; Photo by Amber Palecek, Wind farm, Roscoe, TX

Slide 4; Photo courtesy of Quietrevolution LLC, Qr5 vertical axis wind turbine

Slide 5; Photo courtesy of AWEA

Slide 6, 7 & 8; Maps courtesy of U.S. Dept of Energy, National renewable energy laboratory

Slide 9; Photo courtesy of Greenpeace, Solar home in England

Slide 10; Photo courtesy of Solargenics and USDoE, Solar one project, Barstow CA

Slide 11; Photo's courtesy of Wired Magazine, WaveGen and New Energy News.

Slide 12

Slide 13; Courtesy of the Denver Post, Jonathan Moreno, Interesting energy facts, 9/13/2009

Slide 14; Misc images taken off the web, I should credit but I do not know where they originated

Sources; Wikipedia,

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The Scientific American, Many articles

US D.o.E., Website and various publications

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Wired Magazine, Article by Alexis Madrigal, 10/28/2008

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New Energy News, Article by James Rickman, 6/8/2009 A very informative article

<http://newenergynews.blogspot.com/2009/07/happening-in-hydrokinetic-energy.html>