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On Sustainable Energy in Florida

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Abstract

The renewable energy sources available in the state of Florida and their impact on the state's energy consumption are presented. The current incentives for using renewable energy in the state, and policy changes that may be needed to further the usage of renewable energy are discussed.

Keywords: Sustainable Energy, Florida

1. Introduction

The need for clean energy sources is important for numerous well known reasons. It is not possible to adopt a single method for multiple regions, due to different sources being more or less readily available than others. As a result, this paper will focus on one region, the state of Florida in the USA. After the energy consumption in Florida is presented, different energy sources for satisfying the state's future energy consumption are discussed.

1.1 Florida Energy Consumption

According to the Department of Energy (DOE), the total energy consumption in Florida was 4,447.4 trillion BTU in 2008 [1]. This is equivalent to 1.30×10^{12} kilowatt hours (kWh). It is important to realize that this is primary energy, not end-use energy. According to [2] it is reasonable to assume primary energy is about 3 times that of end-use for rough approximations. The United Nations Development Programme's World Energy Assessment puts the number at 37% globally [3]. This paper will assume 33%. For example, suppose a household consumes 500 kWh in a month. Due to losses at both the power plant and losses in the power lines, the utility might have to put in 1500 kWh worth of, say, natural gas into the power plant to supply that 500 kWh of electricity. The 1500 kWh is the primary energy, and the 500 kWh is the end-use energy.

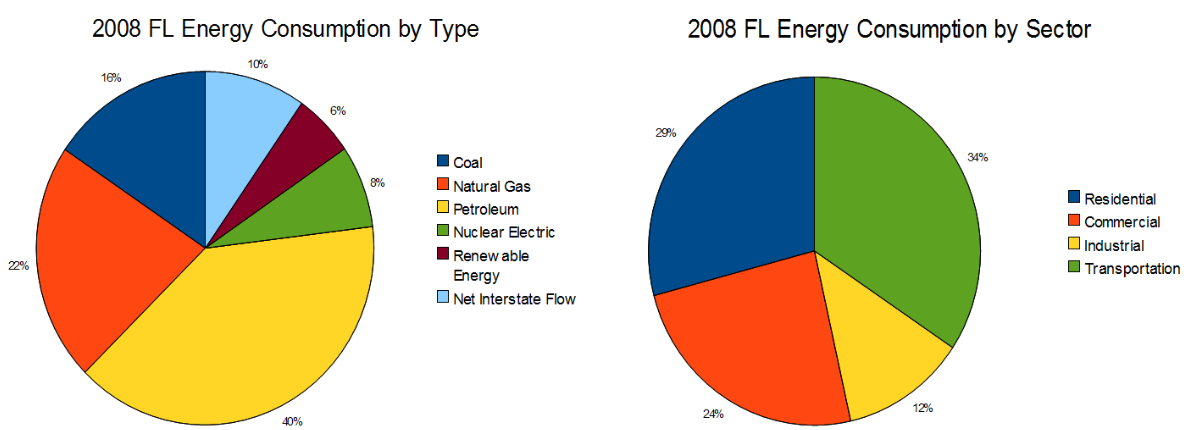

Figure 1: Florida Consumption by source and by sector (using DOE data).

It will also be assumed that vehicles have a 33% efficiency (which is rather generous), in order to group all sectors together.

In figure 1 charts representing the energy consumed by source and by sector are shown. For more information, one is referred to the DOE. Notice the small percentage of our energy, 6%, that comes from renewable energy sources. Over three quarters of our energy is from fossil fuels.

2. Solar Energy

Solar energy is perhaps the most promising energy source in Florida. Three different methods for utilizing solar energy will be considered in this section.

2.1 Photovoltaics (PV)

According to provided data from the National Renewable Energy Laboratory (NREL), a solar panel positioned at latitude would get between 5-6 kWh/m² per day on average [4] in Florida. Let's assume that a typical installed PV system is around 3kW which is fairly conservative. It wouldn't make much sense to get too small a system, considering the price of the BOS (balance of system) components (such as wiring, breakers, etc), power conditioning equipment (converters and inverters), installation costs, potential permitting costs, and other less obvious costs. Let us also round down and assume we get 5 kWh/m² per day (i.e. 5 peak sun hours) on average. This would mean a given house would yield 15 kWh per day, or 5,475 kWh per year (without losses). Florida had just shy of 9 million homes in 2009 [5]. If all these homes had the said solar panel systems, we might expect about 4.9275×10^{10} kWh of energy to be produced. That would be about 3.7% of the energy required to power all of Florida.

Of course, the above figures are slightly simplified. For one, we would have to look at the efficiency of the system. The 3kW system above is the PV output. We must account for losses due to wiring and power conditioning. A reasonable efficiency to assume in going from PV to grid would be around 80%, based on things such as inverter and wiring efficiencies. See PVWatts for a calculator that takes these inefficiencies into consideration [6]. Assuming that houses with PV systems use most of their own energy, let us ignore any power losses that would occur due to transmitting over the grid. That would mean that the end-use power would be expected to be 80% of the PV power input (primary energy). This is far better than the 33% assumed for the typical case. That would mean we would really get about 2.5 times as much energy for a given input of PV than for that of most other sources. So, the above 3.7% would really be about 9%. In other words, if all houses had a 3kW PV system (with panels positioned at latitude) on their homes, 9% of all the energy used in Florida would be taken care of. Of course, not all homes are well situated for solar panels (or would allow for them to be positioned at latitude), but if we also include the commercial buildings that could be used, this number is still a reasonable guess. Assuming 250 watt panels, Florida would need about 108 million solar panels (and 9 million inverters, a lot of wiring, etc.).

Solar panels are not limited to rooftops. Ground mounted solar panels are also pretty common. In fact, with ground mounted systems you can use tracking, which can amount to an extra hour or so of peak sun hours [4], though it is more costly, and may require more spacing between panels (since they could shade their neighboring panels). A few solar power plants have been developed by FPL, two of which use photovoltaics [7]. The first was completed in October 2009 in DeSoto County [8] . It is a 25 megawatt system consisting of 90,500 solar panels, and estimated to produce about 42,000 megawatt-hours of energy per year. Another one, completed in 2010, is located at the Kennedy Space Center, and is a 10 megawatt system [9].

One of the disadvantages of biofuels compared to solar panels is the need of land. Is it better to use land for PV, or for biofuels?

Let us quickly consider one more calculation that may be useful in comparing the use of solar panels to that of biofuels discussed later. How many square miles of solar panels would it take to produce the primary energy used in Florida in 2008? Let us assume panels of 5% efficiency in converting sunlight into electricity to account for row spacing, as well as BOS efficiencies (14% is probably a good module efficiency). Assuming 5 psh in a given day, a square meter would yield 0.250 kWh in a day, or 91.25 kWh in a year. So, a square mile of panels would yield 2.36×10^8 kWh a year. This means we would need around 5,500 square miles of solar panels to generate all of Florida's primary energy in 2007. This would be about 10% of Florida's almost 54,000 square miles [5] (or a little over 4% if you consider the change in the ratio of primary to end-user energy, as we did before). How many square miles of roof space do we have in Florida?

2.2 Solar Hot Water

Solar hot water heaters are another great option for capturing the sun's energy. In fact, it is more cost effective to get a solar hot water heater to heat water than to use solar panels. They are also more efficient in turning solar energy into heat than solar panels, since they absorb most of the light that fall on them. According to Energy Star, for the average family of 2.6 people, $250 can be saved annually (2500 kWh a year) when using a solar hot water heater in conjunction with an electric heater [10]. This system typically pays for itself within 10 years, which is much better than a PV system, which usually takes about twice as long. See [11] for other useful solar hot water information, including a calculator.

In Israel water heaters are required on new buildings. Hawaii is the only state in the US that mandates solar hot water heaters; a law that went into effect in 2010.

2.3 Other

There are other ways of harnessing the sun's energy. Concentrated solar is used in solar thermal plants. The 3rd FPL project mentioned earlier is a 75 megawatt system in Martin Country. The estimated annual generation for the plant is 155,000 megawatt hours. It is being used in conjunction with a power plant that uses natural gas. It was completed in 2010 [12]. It consists of about 190,000 mirrors on about 500 acres of land. (To compare to our PV above, that would be 1.98×10^8 kWh a year per square mile, though in this case it might be what goes into the grid, and so isn't primary energy). Florida is generally considered ill-suited for solar thermal plants. This is due to the cloud coverage which diffuses the sunlight; concentrated solar works much better with direct sunlight. See [4] to find out the typical psh for given configurations (tracking/flat or concentrated/at latitude/etc.).

3. Biofuels

Biofuels are the fuels obtained from plant matter (biomass). The options here are quite large, but a few of the more prominent ones will be discussed. One of the things missing when considering solar energy earlier was how it could be implemented in the transportation sector. Of course, electric cars are becoming more popular, and hence the grid may be all we need one day. However, at present, and for years to come, vehicles will be primarily powered by internal combustion engines. Hence, biofuels can help in making this more sustainable. First, burning biomass will be considered, followed by ethanol, biodiesel, and algae fuels.

3.1 Burning Biomass

Perhaps one of the most straightforward methods of obtaining energy from biomass is by burning it. According to a 2005 NREL report, Florida has about 5 million dry tons of forest and agricultural residue each year [13]. Assuming an energy content of biomass to be 8,600 Btu/lb (dry) [14] would mean about 2.5×10^{10} kWh a year, accounting for about 2% of our total electricity use.

Florida Crystals currently has a power plant that burns about 900,000 tons of wood waste to operate a 140MW power plant [15][16]. Assuming that it runs at 140MW all year long, this would imply a total of 1.23×10^9 kWh/yr. (This implies 2,325 Btu/lb. The smaller Btu/lb is probably due to the inefficiencies of the plant, which was likely not taken into consideration using the first number. Another paper claims a 100MW plant would need 630,000 dry tons a year, which is only slightly different [17]). A 100 MW power plant is currently under development in Gainesville. It is scheduled to open in 2013 [18].

There are some negative aspects to burning biomass. Studies show that burning biomass produces more CO2 than a coal power plant. Biomass does give off CO2 and methane as it decomposes, so even without being burned it contributes to the greenhouse effect. However, the immediate release of these gases when burned, compared to decomposing wood could be worse [19]. At this point burning biomass should be done with caution.

3.2 Ethanol

Ethanol is perhaps the most well known biofuel. It is also perhaps not regarded quite as well as it should be, due to its association with the many cons of producing ethanol via corn. However, ethanol can also be made from plant cellulose, as well as from algae. These methods will be considered in this paper, as they appear the only viable large scale option.

It is possible to make ethanol from crops that aren't as sugar rich as others. Instead, cellulose, or fibrous and woody material is used. The idea mimics that which is done by cows, using microbes to break down the cellulose into sugars (for digestion). Much of the work in this field is being done by Lonnie Ingram, a professor of microbiology at the University of Florida [20].

The following is an excerpt from a University of Florida research article on Lonnie Ingram:

> *“'Florida produces more biomass per year than any other state in the country,' says [Lonnie] Ingram, who also serves as director of UF’s Florida Center for Renewable Chemicals and Fuels. 'We have a climate that allows things to grow year-round. Estimates are that we could make as much as 10 billion gallons of ethanol a year from biomass resources, and much of that would be from material that is currently going to landfills, like yard waste.'”* [21]

Based on the biomass available in Florida as reported above and elsewhere, as well as the claimed output of a number of startup ethanol plants (such as Verenium and Citrus Energy), the 10 billion gallon figure is reasonable, though would likely be very hard to obtain using just waste biomass due to cost of transportation of the waste to a plant for ethanol conversion as well as harvesting. Also, one must keep in mind that some biomass is currently being burned and is not available.

Assuming 76,000 Btu/gallon for ethanol (LHV) [22], 10 billion gallons would yield 2.23×10^{11} kWh/yr, which is about 17% of Florida's annual energy needs. Granted, a billion gallons might be a more reasonable target for the not too distant future, which would still be quite impressive, assuming most of it came from waste.

3.3 Biodiesel and Algae

Biodiesel is another biofuel that may play an important role in Florida's move to renewable energy. It too can be made from “waste” product. In particular, waste vegetable oil and animal fats can be used. However, according to the NREL, even if all the waste cooking oil could be used to make biodiesel it would only account for replacing 3-5% of the currently used diesel in the country [23]. As such, for large scale biodiesel production we will need to consider biomass grown specifically for biodiesel. The most promising means of producing biodiesel is by using algae. This idea was studied for decades by the NREL, starting when petroleum prices got high in the 70s, but was retired in the mid-90s. It appears this was due to the large cost associated with producing biodiesel with this method. (See [24] for the full close out NREL report). Lately there has been a renewed interest in growing algae for fuel. Even NREL restarted their research in algae in 2009 [25].

There have been many claims concerning the biodiesel yield from algae, with some companies claiming 100,000 gallons of algae oil per acre per year [26]. I will assume the most conservative number I've seen, of about 2,000 gallons of biodiesel per acre per year [27].

Assuming 118,296 Btu/gallon, would mean one square mile would yield about 4.44×10^{7} kWh/yr. That means Florida would have to set aside 29,300 square miles. Compare this to solar panels above. Of course, this is using a conservative estimate. Also, we may not have the added benefit in decreasing the primary energy needed, if we would still be using heat engines for producing energy.

One company, Algaenol, uses algae to make ethanol. They claim they can get 6,000 gallons or more per acre per year (and less than a dollar per gallon in costs) [28]. This is more than what we used for biodiesel, but the energy content in ethanol is also a bit less, and so still pretty comparable to the biodiesel above, especially since diesel vehicles are more efficient than gasoline. The plants could ideally use CO2 from power plants, or something similar to use in growing the algae. This is a similar idea that was used in growing algae for biodiesel.

Algae should definitely still be considered. Not only does it produce energy for use with current vehicles, which solar does not, but it can also be used to capture CO2. It still remains to see how well a large scale algae farm would operate, and at what prices, but they seem to offer enough advantages to allow for some plants to be built.

4. Fuel Cells

Though not a renewable energy source, fuel cells might prove to be helpful in our energy problem. I won't discuss too much here, but rather refer the reader to a great article by the Rocky Mountain Institute called "20 Hydrogen Myths" [29]. I will mention a few things however. Many people see fuel cells as not too useful considering the best way of producing hydrogen has been by reforming fossil fuels such as natural gas. Even if we were to use natural gas for hydrogen we'd be doing better to use fuel cells than internal combustion engines. This is due to the fact that fuel cells are up to 2-3 times more efficient. Though we lose some energy in the conversion to hydrogen, we more than make up for it with the efficiency of the fuel cell.

Fuel cells are probably most remembered for the push for hydrogen cars near the beginning of the 21^{st} century. With battery technology also changing, it is hard to say how well fuel cell vehicles will compare to electric vehicles. However, stationary fuel cells might prove to be even more important. In particular, the Solid Oxide Fuel Cell (SOFC) has been demonstrated to reach efficiencies of over 50% when the heat is also used [30]. One popular new SOFC, the Bloom Fuel Cell, was unveiled in 2010. It had Google and Ebay as early investors and was even aired on the TV show "60 Minutes". Though natural gas is often used in SOFCs, biofuels could also be used, and could therefore decrease the end-use to primary energy ratio.

The IT Times believes that by 2017 1.2 million stationary fuel cells will be in use [31].

5. Other Renewable Energy Sources in the state of Florida

There was some consideration by FPL to build a windfarm [32], but things look bleak now. In general, Florida is not too well equipped for wind energy [33]. Perhaps one day the technology will advance enough to make it worth it, but not likely in the near future.

Hydropower is not much of an option in Florida [34], but there does seem to be some potential energy available from the ocean. At Florida Atlantic University, work is being done in trying to harness energy from the gulfstream. It is believed that 1/3 of Florida's energy needs could be met that way [35]. Unfortunately, this technology is not too developed at the moment, and so it is hard to say how viable it may be.

6. Other Considerations

There are several factors that were not considered in the paper. A more exact analysis will be needed to better gauge the outcome of implementing any particular technology.

One thing that was not considered herein was how energy consumption changes in time. One could look up the data from the DOE, and get an idea of the trend of energy consumption over the years in order to calculate what the future may hold if one wanted. This paper did not address the issue for a few reasons. (1) Changing our energy resources would also change how much (primary) energy we need. Without seeing how much energy might be varied by switching from one energy source to another, future energy consumption can't be accurately predicted. (2) If energy efficiency continues to become an important spec of various household appliances and electronics, or if policies are written to curtail extreme energy usage, one might see a slight decline. (3) The state of Florida's population isn't currently increasing, due to the economy downfall. Therefore, it is reasonable to consider only recent energy consumption for illustration purposes as described in the above sections of this paper.

Monetary cost was not discussed that much in the above sections, though some ideas were given. Easily as important is the materials cost. For example, some fuel cells require platinum, including the one currently used in hydrogen vehicles. This could be a critical issue in adopting hydrogen vehicles on a large scale. Also, the process of converting biomass into a biofuel requires chemicals (such as methanol and sodium hydroxide for biodiesel). These chemicals need to be readily available and made without significant environmental costs.

Although the sources mentioned above are renewable, it does not imply they are completely clean. There is information available concerning the environmental impacts of various technologies due to production and operation of these technologies. Externalities should be considered before implementing any new technology [36].

7. Getting the Money

7.1 Donations

Between 2004 and 2008, $11.4 million was collected by FPL for their renewable energy program. Customers agreed to pay $9.75 more a month with the guarantee that the money would be put towards renewable energy. Unfortunately, this program did not play out as it should have [37]. No doubt more money would have been collected if the consumer could have been sure that the money would have been used appropriately. People should be given the opportunity to contribute to renewable energy projects with security on their investments. If the utilities are not too responsive to such an idea, it could still be done other ways. The number of ways of implementing this are numerous. For example, one could create a PV system lottery. In short, the potential for renewable energy that could be gained by tapping into the willingness of energy concerned citizens could be very useful. Perhaps some environmental groups could help in this respect.

7.2 Rebates and Tax Credits

At present there are a number of ways of reducing the cost of renewable energy systems and more energy efficient appliances. The best place to go to see these rebates and credits is DSIRE (Database of State Incentives for Renewables and Efficiency) [38]. Under the federal incentives are a 30% tax credit for efficiency, such as for AC, water heater, and insulation. This is capped at $1500 and expired at the end of 2010. They also offer a 30% tax credit on renewable energy, including: Solar Water Heater, Photovoltaics, Wind, Fuel Cells, Geothermal Heat Pumps, Other Solar, and a Fuel cell (at least .5kW). The cap on this credit was removed in 2009. It is currently set to end in 2016, and allows for the tax credits to carry over.

Until mid-2010 the rebate program in Florida was very popular, even causing a waiting list. It gave $4/watt, up to $20,000 on PV systems, and $500 for a solar hot water heater system. (As of May 2011, the cost of PV is roughly $3/watt [39], so this was very good indeed). Though this program expired, perhaps a slightly weaker rebate program could be used in the future. The state has other things to offer, as do some of the state utilities. FPL has a pilot program, soon to begin, that offers $2/watt, but it is not guaranteed [40]. This could cut a system cost nearly in half.

7.3 Regulations and Incentives

Net metering is still not implemented everywhere. In particular there is no constraint on what the utility has to pay the consumer. This isn't necessarily a deal breaker, since many systems produce less than they need, but it can be in some cases, and could be a deal breaker. This might require some laws to be passed, whether it is local, state, or federal.

Feed-in-Tariffs are another idea used to promote renewable energy. They pay the resident handsomely for their clean electricity, and this rate is guaranteed for some fixed amount of time. This is a means of making the renewable energy system pay for itself quicker. Gainesville is the only city in Florida where this idea is in use, though they have a cap that is smaller than their demand.

Another option to encourage residential renewable energy systems would be to add a tax (to cover externalities) to the electric rate for energy produced by nonrenewable sources. This tax could have a number of positive effects.

For one, the higher cost of buying electricity would make a home PV system or solar hot water system more cost effective. Also, the money collected could be used for renewable energy incentives, whether its rebates on systems, or energy efficient appliances. This tax might also cause people to be more conservative in their energy use.

There is also the downside of increasing prices of goods and services due to increased cost. This would have to be explored carefully before being implemented.

8. The Future

It seems evident that Florida has high potential in producing a good portion (and perhaps eventually all) of its energy using sustainable sources. Solar energy, whether photovoltaics or solar thermal, is already well established technology. Consequently, the biggest push should be to increase the number of solar systems in Florida. The energy from biofuels is less certain, but they may yet provide a significant portion of Florida's energy. The utilization of PV as well as ocean energy depends on the state and federal government policies and regulations in the near future. Assuming the push for sustainable energy is sufficiently strong, and some of the above mentioned technologies are adapted, a rise in sustainable energy projects will occur in the state of Florida in the near future.

References

[1]: EIA, http://www.eia.gov/emeu/states/hf.jsp?incfile=sep_sum/plain_html/sum_btu_1.html
[2]: Masters, Gilbert, 2004, "Renewable and Efficient Electric Power Systems"
[3]: UN,, "World Energy Assessment: Energy and the challenge of Sustainability", http://www.undp.org/energy/activities/wea/drafts-frame.html
[4]: NREL, http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/Table.html
[5]: Census, "Florida QuickFacts from the US Census Bureau", http://quickfacts.census.gov/qfd/states/12000.html
[6]: NREL, "PVWatts", http://www.nrel.gov/rredc/pvwatts/
[7]: FPL, "FPL | Solar Projects", http://www.fpl.com/environment/solar/projects.shtml
[8]: FPL, "FPL | Desoto Solar", http://www.fpl.com/environment/solar/desoto.shtml
[9]: FPL, "FPL | Space Coast Solar", http://www.fpl.com/environment/solar/spacecoast.shtml
[10]: Energy Star, "Solar Water Heaters : ENERGY STAR", http://www.energystar.gov/index.cfm?c=solar_wheat.pr_savings_benefits
[11]: FSEC, "For Homes", http://www.fsec.ucf.edu/en/consumer/solar_hot_water/homes/index.htm
[12]: FPL, "FPL | Martin County Solar", http://www.fpl.com/environment/solar/martin.shtml
[13]: NREL, "", http://www.nrel.gov/docs/fy06osti/39181.pdf
[14]: EIA, http://www.eia.doe.gov/oiaf/analysispaper/biomass/table3.html
[15]: FL Crystals, "Florida Crystals: Renewable Energy", http://www.floridacrystals.com/content/112/renewable-energy.aspx
[16]: Welch, Deborah,March 26, 2009, "Biomass: Can Renewable Power Grow on Trees?", http://www.scientificamerican.com/article.cfm?id=biomass-renewable-power-wood
[17]: Florida, http://www.psc.state.fl.us/utilities/electricgas/RenewableEnergy/2008-12-03/WS_Fl_Pulp_Paper.pdf
[18]: Brighter Energy, 2010, "Florida Commission backs 100MW biomass power project", http://www.brighterenergy.org/11113/news/bioenergy/florida-commission-backs-100mw-biomass-power-project/
[19]: Wan, Lily, May 1, 2011, "The Biomass Controversy", http://www.thefineprintuf.org/2011/05/01/the-biomass-controversy/
[20]: University of Florida, "University of Florida Spotlight: Lonnie Ingram", http://www.ufl.edu/spotlight/ingram.html
[21]: Kays, Joseph, 2007, "Waste not, want not", http://www.research.ufl.edu/publications/explore/v12n2/story1.html
[22]: EIA, 2007, "Biofuels in US Transportation Sector", http://www.eia.doe.gov/oiaf/analysispaper/biomass.html

[23]: NREL, http://www.nrel.gov/biomass/benefits_microalgal_oil_production.html
[24]: DOE, July 1998, "A Look Back at the US Department of Energy's Aquatic Species Program: Biodiesel to Algae", http://www1.eere.energy.gov/biomass/pdfs/biodiesel_from_algae.pdf
[25]: NREL, April 3, 2009, "Algae-to-Fuel Research Enjoys Resurgence at NREL", http://www.nrel.gov/features/20090403_algae.html
[26]: CNN-Vertigro, http://www.youtube.com/watch?v=1MeIgaRfyD4
[27]: Exxon Mobil, http://www.exxonmobil.com/corporate/files/news_pub_algae_factsheet.pdf
[28]: Algenol, Feb 2011, "Algenol Overview", http://www.algenolbiofuels.com/Algenol_webpres_2011_3.pdf
[29]: Rocky Mountain Institute, 2005, "20 Hydrogen Myths", http://www.rmi.org/rmi/Library%2FE03-05_TwentyHydrogenMyths
[30]: EG&G Technical Services, November 2004 ,"Fuel Cell Handbook"
[31]: Korea IT Times, 5/19/2011, "Stationary Fuel Cell Sales to Reach 1.2 Million Units Annually by 2017", http://www.koreaittimes.com/story/14753/stationary-fuel-cell-sales-reach-12-million-units-annually-2017
[32]: TreeHugger, 3/20/08, "What Were They Thinking? Florida Power & Light Backs Off Wind Farm in Park Proposal", http://www.treehugger.com/files/2008/03/florida-power-light-backs-off-wind-farm.php
[33]: NREL, "Florida Wind Map and Resource Potential", http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=fl
[34]: US Geological Survey, "Hydroelectric power water use", http://ga.water.usgs.gov/edu/wuhy.html
[35]: Worthington, David, May 23, 2011, "University moves toward powering Florida with the Gulf Stream", http://www.smartplanet.com/blog/intelligent-energy/university-moves-toward-powering-florida-with-the-gulf-stream/6577
[36]: Messenger, Roger; Ventre, Jerry, 2004 ,"Photovoltaic Systems Engineering", CRC
[37]: Stapleton, Christine,2008, "Sunshine Energy participant sues FPL", http://www.palmbeachpost.com/search/content/local_news/epaper/2008/09/04/0905_fpl_suit.html
[38]: DSIRE, http://www.dsireusa.org/
[39]: Solar Buzz, "Module Pricing", http://solarbuzz.com/facts-and-figures/retail-price-environment/module-prices
[40]: FPL, http://www.fpl.com/landing/solar_rebate/residential_pv.shtml