CHAPTER 5

Climate Change Impacts on Florida's Energy Supply and Demand

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Florida's unique location in the contiguous United States ensures that the effects of climate change will be significant and persistent across the state. Florida's current economy and its population have developed energy use patterns based on fully developed fossil fuel industries. These industries and Florida's consumption patterns are presented and analyzed. Location of Florida's electricity generating facilities are shown and a significant proportion of these facilities are literally at the water's edge. Future actions to protect the state's energy supply may need to include costly moving of significant fossil fueled facilities and/or outright replacement by newer, cheaper renewable energy power plants. The current status of energy consumption in Florida is presented in this chapter, along with disruptive technologies in energy efficiency, renewable energy, and the electrical grid. World photovoltaic (PV) and wind power adoption rates are used to explore the possible time frames for renewable energy transformation.

Key Messages

- Currently, Florida has very few sources of energy within its borders. There are no appreciable coal mines, natural gas fields, or oil fields.
- Florida has very little diversity in its sources of energy. More than two-thirds of Florida's electricity is produced from natural gas, and almost all of the oil used in Florida is used for transportation.
- Significant portions of Florida's energy infrastructure are located at the water's edge and may be exposed to the effects of sea level rise much sooner than we expect.
- Florida's dependence on electricity to run its economy is inefficient and not competitive in comparison with leading U.S. states and other fully developed countries.
- A significant push to incorporate energy efficiency and renewable energy into Florida's energy mix can rapidly make the state more competitive and bring down the cost of energy for all of Florida residents.

Keywords

Power generation; Energy efficiency; Conservation behaviors; Renewable resources; Building performance; Consumer financing; Solar photovoltaics; Fuel economy

Introduction

Since the burning of fossil fuels is the single largest contributor to the greenhouse gas emissions (EPA 2016) that are forcing anthropogenic climate change, the issue of Florida's energy supply and demand is vital to the state's future. In addition to the stresses associated with rising temperatures, Floridians of the near future will also have to deal with sea level rise. Florida has the second longest coastline of all states in the US, and its relatively low coastal elevation means that these climate effects will be felt in Florida first. A study by The World Bank (2013) ranks cities in relation to potential for damage associated with increased flooding brought on by climate change. Of the top ten cities worldwide, five are in the US and two (Miami and Tampa) are in Florida; Miami is ranked second overall in the world. Florida also happens to be the third largest state in the US in terms of population, with just over 20 million residents as of 2016. Taking all of these facts together, one could argue that Florida is the state with the most dramatic and direct link between its location, its people, and the impending effects of climate change.

While climate change and our future scenarios have become familiar topics to many over the years, the energy systems that power modern society are often less familiar. There are many databases around the world that tabulate national energy use in primary terms to correlate the amount of energy pulled from the earth in the form of coal, oil, and natural gas. The United States uses a term called quads, which is short for quadrillion British Thermal Units (BTUs), while the Australians tabulate their energy use in peta-joules. While informative to energy analysts, these terms are probably unfamiliar to the general public and may fail to report energy consumption patterns in ways that can positively influence climate-friendly behavior changes. For the purposes of this chapter, oil is described in terms of barrels, each of which contains 42 US gallons. Natural gas is sold in USD per million BTUs, which is approximately 1,000 cubic feet, and production quantities are in cubic feet. Coal is sold in the United States by the short ton, which is 2,000 pounds; its energy quantity varies by the mine and general geographic location, with eastern coal having a higher energy content than western coal. Consumption patterns include transportation use and electricity consumption; we find that these two areas alone make up the majority of fossil fuel use in Florida. Thus, by focusing on consumption patterns, actionable decisions by Floridians are easier to for the general public to understand and to make.

Additionally, once Florida's consumption patterns are described, the source of these fuels can be analyzed. Broadly stated, many of the fuels we need in Florida are brought in by water, and many of the power plants that produce the electricity Floridians consume are located at the water's edge for cooling purposes. This is of critical concern when faced with even the most benign sea level rise predictions. The predictions described in Chapter 19 related to the most current thinking on this topic require us to start planning for the relocation of these energy-producing assets or their outright replacement with new, renewable technology located away from the changing coastline.

In fact, new and potentially disruptive technologies are already entering the state's energy market. Long-planned power plants will not be needed due to new energy efficient technologies that are actually leading to a decrease in total electricity demand within the state. Along with these new technologies will be the latest in renewable energy sources, especially solar photovoltaic (PV) electricity, which is rapidly becoming the cheapest new power source and is particularly well-suited to the "Sunshine State." This combination of new energy-efficient technologies and solar PV electricity will remake the energy landscape as we know it, not just here in Florida but around the world.

Implementation of these new approaches to energy supply and demand will require careful planning if we are to seamlessly transition from a modern economy fueled by fossil fuels to one operated by more renewable forms of energy. While this might seem a daunting task, it is worth noting that as of 2015, approximately 55 countries worldwide produced more than 50% of their electricity from renewable sources (EIA 2016).

Fossil Fuel Consumption and Status

The largest single source of greenhouse gases comes from the burning of fossil fuels to operate our modern societies. From the gasoline in our automobiles, the natural gas furnaces in our homes, and the coal-fired electric power plants that light our homes and power our offices, the use of fossil fuels permeates every aspect of our lives. This tends to make any discussion too big of a hill for most people to climb. It is hard, in the staggering amounts of energy consumed by today's society, to see where a single person could make a difference. To do so, we need to break down the larger problem into smaller concepts with more direct explanations and solutions. What we discover by investigating energy use patterns in Florida can help us make better decisions for the future.

Florida's agricultural- and tourism-based economy helps to simplify our analysis. The following sections will show that nearly all of the oil used in the state is consumed in transportation systems. In a similar manner, nearly all coal and natural gas burned in Florida is combusted in the state's electric power plants. These very good approximations will help us design effective mitigation strategies specifically for Florida.

Florida Oil Consumption

During 2015, Florida consumed approximately 832,000 bbl/day of oil products (EIA, 2016). A barrel (bbl) of oil is equal to 42 US gallons. The direct relation between personal consumption of gallons of fuel and the marketplace in barrels makes it easier for the reader to comprehend these relationships. Unlike some of the more industrial states, Florida uses nearly all of its oil in the transportation sector: 489,000 bbl/day of gasoline consumption, 134,000 bbl/day of diesel fuel consumption, and 89,000 bbl/day of jet fuel use (EIA 2016). The remaining oil use consists of small amounts of propane, mainly for space heating and fuel oil for heating, and oil-fired power plant operations. Individually, these are only a couple of percent each, so for general purposes we will focus on transportation when we are discussing oil use in Florida.

Florida Natural Gas Consumption

Nationally, natural gas has three main uses: natural gas-fired electric power plants, space and water heating in the built environment, and industrial process heating. Natural gas consumption for electricity production is about 40% of the total use nationally, with the other two categories splitting the remainder. However, Florida's warm climate and lack of heavy industry make it much easier to track total natural gas use in the state. More than 90% of the natural gas use in Florida is consumed in power plants to produce electricity. Natural gas consumption in Florida during 2014 totaled just over 1.22 trillion cubic feet (EIA 2016), and the use of natural gas for electricity production is steadily rising in Florida. Natural gas was used to produce 62% of total electricity in 2014, 66% of total electricity in 2015, and 68% in the first four months of 2016 (EIA 2016).

Florida Coal Consumption

Coal is also consumed in Florida to produce electricity. During 2014, approximately 26 million short tons were burned in Florida power plants to produce approximately 52 million MWh (EIA 2016). Nationally, approximately 90% of US coal production was used to produce electricity while the remainder was either exported or used for industrial purposes, mainly steelmaking. However, Florida is different in that there is an absence of heavy industry that would use coal.

The use of coal to produce electricity in Florida has been steadily decreasing. In 2000, coal was used to produce nearly 73 million MWh, representing 38% of Florida's total electricity consumption. In 2015, this had dropped to 43 million MWh, representing only 18% of Florida's electricity use.

Florida Nuclear Power Production

As of the end of 2015, there were four nuclear reactors operating located at three different power plants in Florida. Two reactors operate at the St. Lucie Nuclear Power Plant in Jensen Beach and two additional reactors operate south of Miami at the Turkey Point Nuclear Generating Station. An additional reactor has been permanently shut down at Crystal River. Florida Power & Light has permission to start building two new reactors at Turkey Point, but construction has not yet begun. Plans called for two more reactors to be built in Levy County, but construction has been halted. The four existing, operating reactors combine to produce 28 million MWh or 12% of Florida's annual electricity needs (EIA 2016).

Florida Energy Systems Locations

Florida's long coastline provides ample opportunity to locate electric power plants close to cooling water sources. Our state's many port facilities also provide strategic locations to receive, stage, and deliver fuel sources such as coal and oil close to population centers. However, locating power plants near the shoreline greatly increase their risks as the sea level rises. It might seem that the risks posed to these facilities are far in the future, but a few very real examples involving actual power plant sites show that this is not true.

The independent organization, Climate Central, has developed an interactive online tool that allows a user to explore the effect of rising sea levels on the detailed shoreline. This tool, Surging Seas Risk Zone Map (Surging Seas 2016), combines sea level rise predictions based on the "business as usual" world greenhouse gas emissions scenario with the specific coastal elevation map of Florida. Using this tool in conjunction with an online mapping program enables anyone to correlate specific locations with risk. Florida's three nuclear power plants provide compelling examples of the relatively immediate risk posed by sea level rise.

Anyone with access to a computer and the internet can see for themselves that some of Florida's power plant locations represent a serious problem with regards to sea level rise. For example, using Google Maps, a satellite view of the Turkey Point power plant site can easily be seen (Google Maps 2016). The power plant is the very visible structure right on the coast, approximately five miles southeast of the Homestead Air Reserve Base. The long canal structure to the south of the plant is a series of cooling water canals designed to limit thermal pollution to Biscayne Bay. This power plant site includes the two, 693 MW nuclear reactors, two 400 MW oil/natural gas-fired units, and one 1,150 MW combined cycle natural gas-fired unit. Turkey Point is one of the largest power plant sites in the US. This same section of coastline can be found and highlighted using Climate Central's Surging Seas risk mapping program. One of the most notable features of this program is that the sea level rise can be set in one foot increments from zero to ten feet.

Recent projections (Rahmstorf, Perrette, and Vermeer 2012) predict that the seas will rise a little more than three feet by 2100. Other researchers incorporating new data concerning the stability of the West Antarctic Ice Sheet warn that the sea level rise might be twice that by 2100 (DeConto and Pollard 2016). The Surging Seas risk mapping tool allows users to see what roughly one meter and two meters of sea level rise will look like. So, considering the location of the Turkey Point power plant site and using the Surging Seas Risk Zone Map tool (Surging Seas 2016), one can see that approximately one meter of sea level rise will result in fully flooded wetlands that extend all the way from the power plant to the runway for Homestead Air Force Base located nearly five miles to the northwest. In this scenario, the Turkey Point power plant site will be surrounded by water and essentially miles from dry land. And while the built up base of the power plant will still be well above the water level, the property itself will be well off shore. Side-by-side images of the current coastline and a future coastline with a three foot increase in sea level is shown in Fig. 5.1. And an extra one meter rise associated with the West Antarctic Ice Sheet melting added would be nothing short of catastrophic for southeast Florida (Surging Seas 2016).

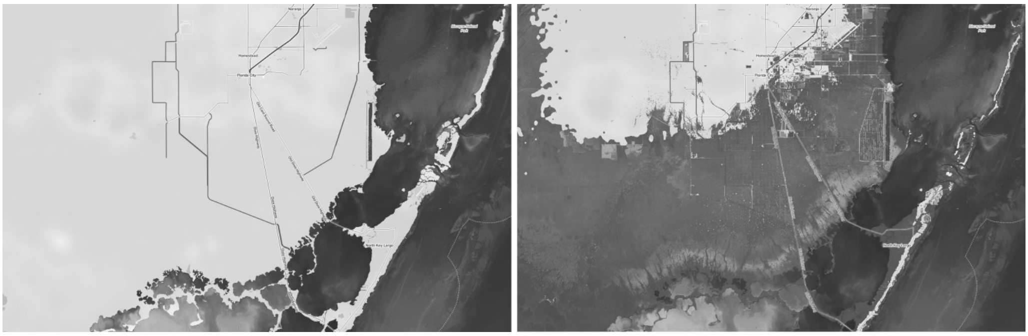

Figure 5.1. Existing Florida coastline compared to a future coastline scenario with a three foot rise in sea level (Harrison, adapted from Surging Seas 2016).

These sea level rise predictions are based on greenhouse gas emissions governed by a business-as-usual approach in relation to our state's collective carbon footprint. The ice sheet predictions are based on a rapidly evolving understanding of a very complex interrelationship between many climate variables, the complexity of which might lead some to delay in decision-making until a greater understanding is obtained. However, the Turkey Point site has a replacement value in excess of $20 billion and is fixed in place at the water's edge. Even a one foot rise puts this site in peril, and not too far into the future.

The Surging Seas Risk Zone Map tool can be used in a similar manner to look at the St. Lucie Nuclear Power Plant, which is located on Hutchinson Island, a barrier island with direct exposure to the Atlantic Ocean. Like Turkey Point, the power plant property in St. Lucie has been extensively elevated. However, even choosing a minimum one foot rise sea level on the Surging Seas mapping tool demonstrates how rising waters will isolate the island's main access road, A1A, in both directions, with water on both sides of the road bed (Surging Seas 2016). At this point, it should be noted that it can take ten years or more to safely decommission a nuclear power plant, and losing road access to a plant severely limits the ability to decommission the nuclear aspects of the plant in a timely manner. Choosing three feet of sea level rise on the mapping tool will show that access to the mainland through causeways north and south is compromised, and looking at a six foot sea level rise scenario results in a completely isolated nuclear power plant site located on the remains of a barrier island surrounded by the ocean.

Crystal River is a third nuclear power plant site in Florida, but at the time of publication the reactor has been permanently shut down, although it has not been fully decommissioned. The Crystal River site is also home to approximately 2200 MW of coal-fired electricity production, with a planned addition of 1,640 MW of combined cycle gas turbine-based power production. With development halted for the Levy County nuclear power complex and a natural gas power plant addition, some portion of the coal-fired complex will remain in the near future. Just a one-foot rise in sea level would dramatically change the shoreline around the Crystal River power plant property. This one-foot rise would bring the shoreline to the landward side of the power plant property, and the property itself is a peninsula jutting out into the Gulf of Mexico. A three-foot rise would bring the shoreline to the east of the power plant property, almost completely isolating the plant site (Surging Seas 2016). And a six-foot sea level rise, a possibility introduced by the recent publications, would have the site completely surrounded by the Gulf of Mexico.

A final example would be an oil import facility located in Tampa Bay. The vast majority of liquid fuels used for transportation purposes is delivered to Florida through its port facilities. The Port of Tampa oil terminal is located on the lower western shore of the peninsula that roughly bisects Tampa Bay. This peninsula is also the location of the Central Command MacDill Air Force Base, which contains runways that are easily recognized. Locating the Port of Tampa fuel terminal using the Surging Seas Risk Map tool (Surging Seas 2016) shows that with just one foot of sea level rise the southern portion of the facility's tank farm will be below sea level. Many additional tanks and some of the docks go below sea level with three feet of sea level rise (Surging Seas), and with a sea level rise of six feet the entire tank farm will be flooded, as will the docks. Under this scenario, what remains of the terminal will be entirely separated from the mainland.

These are a few examples in just our state. And unfortunately, none of these sites could be protected individually by a system of pumps and levees from the encroaching seas. And the truth is that we will not have the luxury of facing these problems individually; they will occur all along Florida's shoreline at roughly the same time. Sometime in the very near future, one such site will be slated for an upgrade, significant maintenance, or a service life extension. Somebody in the long line of permitting offices will ask the simple question: "Should we invest this much money for a facility that will soon be under water?" At this point, the choices will be:

- Do nothing and watch as an expensive energy facility is stranded by the rising seas.
- Upgrade the facility with levees and pumps to protect it for the near future.
- Move the legacy fossil fuel or nuclear fueled facility to a new location at considerable expense.
- Decommission the facility and transfer energy needs to new renewable energy facilities located inland.

Current conservative predictions show that the scenarios presented here could start happening as early as 2060, and this does not take into account new research describing the instability of the West Antarctica ice sheet referenced earlier. Newer predictions include estimates of six feet of sea level rise by 2100. As of this publication, the owner of the Turkey Point facility has decided to delay the construction start of the two new reactors for at least four years. With four more years of climate science and analysis behind us, it is doubtful that these new reactors will ever be built.

Any analysis of the choices that we, as a society, will be faced with brings us to the conclusion that our only viable long-term option is to transform our energy systems from fossil-fueled to a system powered by renewable energy.

Energy Efficiency and Disruptive Technologies

Nationally, about 74% of all electricity consumed in the US is used in the built environment, with the remainder consumed by industrial processes (EIA 2016). At present, only small amounts of electricity are used in domestic transportation systems. In 2014, 93% of all electricity consumed in Florida was used in residential (52%) and non-residential (41%) buildings (EIA 2016). These residential structures include single-family homes, townhomes, apartments, and condominiums; non-residential structures include retail businesses, office complexes, municipal buildings, schools, and universities.

It is important to quantify electrical consumption by totals, end use, and by sector. Knowledge of these quantities allows us to begin to benchmark our consumption and construct state and international level comparisons. It also helps to think of all energy consumption as a parasitic economic cost. By using less energy to run our society, we become more efficient and more of our output can be used to provide for our direct needs. With this in mind, let's look at the comparative data from a few key states and countries (Table 5.1).

Table 5.1. Energy consumption benchmarks for selected states and countries.

Country/State	Population, millions	GDP, Trillions ($ ppp)	Electricity consumption, Billion MWh/yr	MWh/yr, ca	$GDP/MWh
California	39.1	2.45	0.261	6.68	9,387
United Kingdom	64	2.68	0.335	5.23	8,000
Germany	81	3.84	0.585	7.23	6,560
Japan	126	4.83	0.960	7.62	5,031
USA	321	17.95	4.05	12.62	4,432
Florida	20.3	0.89	0.237	11.69	3,768

At first glance, the ordering of the countries and states seems random; unfortunately for Florida, it is not. Each one of these governmental entities has a population that is organized and works to produce the easily identified benchmark of gross domestic product (GDP). To make the comparison effective, the purchase power parity (ppp) category for GDP is also used. This equalizes the effects of currency value differences. Annual electricity consumption is tabulated for each entry. With this last entry, the benchmarks in the last two columns can be produced. The first is a per capita electricity consumption figure that simply divides all of the year's electricity consumption into the total population. This column generally increases down the list, with the US and Florida being at the bottom. The last column relates the creation of wealth (GDP) to the consumption of electricity (MWh). Again, the US and Florida are at the bottom of the list. If Germany, Japan, and the United Kingdom are assumed to be fully developed nations that the US competes with on a daily basis, our inefficient use of electricity puts us at a significant disadvantage. The inclusion of California shows that even within the United States, it is possible to be a world leader in the efficient use of electricity.

What if both Florida and the USA used electricity as efficiently as California to produce wealth? If Florida was as efficient as California, Florida would use 95 million MWh/yr instead of 237 million MWh/yr and the USA would only use 1.9 billion MWh/yr instead of 4.05 billion MWh/yr. Simply put, if the USA were as efficient as California, about 85% of our electricity would currently be produced from non-fossil fuel sources!

Energy Efficiency in the Built Environment

Stating that the United States and Florida should be more efficient is one thing, making it so is quite another. Many organizations promote ideas that show homeowners, renters, and commercial businesses how to become more energy efficient in economically viable ways. One of the more useful sites specifically built for Florida is *My Florida Energy Home* (2016). The online site introduction breaks down the energy use in a typical Florida home as follows:

- Air conditioning and heating is 36%
- Domestic hot water is 14%
- Appliances, electronics, and lighting consumes 50%

Nationally, lighting is about 15% of home energy consumption, which would make appliances and electronics approximately 35%. The actual energy consumed in each of these areas is related to the characteristics of each end use device and, just as importantly, how each device is operated. A simple example would be a light bulb. Operating a 60-watt incandescent light bulb four hours each day instead of eight hours each day will reduce overall energy consumption by 50%. This is easily accomplished by always turning a light off when not in use. Examples of this are seen everywhere in our lives—from our homes, to our schools, and in our businesses. Take this example one step further and replace the 60-watt bulb with an 8-watt LED light bulb that operates four hours each day. This would reduce the total energy used by 93%.

A near-term goal for both business competitiveness and climate change mitigation would be to make every effort to increase the energy efficiency of all economic sectors in our state and the nation. Fortunately for Floridians, there are ample opportunities to make quick progress towards this goal. The following are just a few ideas that cost literally nothing to implement, and yet will significant reduce a consumer's bottom line:

- Phantom loads: Many devices used in homes have instant-on, or standby features that consume power as long as they are plugged into an electrical receptacle. Entertainment centers house televisions, cable boxes, DVRs, receivers, powered sub-woofers, game boxes, etc. All of these devices consume power when not in use. When totaled over an entire year, many devices consume more energy when they are off than when they are actually being used. An easy fix for this problem is to plug all of these devices into a surge-protected power strip. When at work or asleep, the power strip can simply be switched off.

- Lights: A good amount can be saved on an electric bill just by turning things off when they are not being used. When you leave a room, turn out the lights.
- Ceiling fans: Another device that wastes energy by being on when it isn't needed is ceiling fans. The truth is that fans cool people, not rooms. When a room is not in use, turn the fan off. It's just that simple.
- Thermostats: Thermostats are directly linked to the size of a utility bill. The balance between comfort and expense is different for everybody, but the recommended set points for summer and winter are 78 °F and 68 °F, respectively. For every degree away from these recommended settings (i.e., cooler set points in summer, warmer set points in winter), air conditioning and heating costs are increased by about 4%. If current use settings are different than those recommended, consumers can adjust set points slowly, one degree at a time over a period of months and even seasons. The human body will adjust very well to warmer and colder temperatures, just not very quickly.

Combined, these simple, no-cost actions can typically reduce anelectric bill by as much as 20% with a capital cost of exactly zero. These examples are meant to show that the manner in which many of us operate our residences is far from efficient. Taking these steps can be done without any degradation of lifestyle while also returning some hard-earned money back to consumers to be used for other needs. Some people might construe a different temperature setting for heating and air conditioning as a lifestyle change. However, there are other benefits to doing so. Indoor temperatures below the prevailing summer dew point temperature of 77-79 °F can cause condensation on interior surfaces, which in turn produces an excellent environment for mold. Over air conditioning can produce a cold and clammy sensation and a situation that negatively affects indoor air quality.

At present, all of these suggestions for reducing energy consumption can be accomplished by everyone in their own residences. By doing these, the electricity consumption in the residential sector could be decreased by 20% overnight, which would amount to 24 million MWh/yr in Florida and approximately 300 million MWh/yr in the entire country. Technology trends support this transition. New standards for electronic devices have significantly dropped standby power consumption and instant-on power drain. Thus, as equipment gets replaced, more and more energy will be saved. New LED lights come with Wi-Fi connectivity that allows users to turn them off from anywhere. The same is true for new ceiling fans. One of the fastest selling home accessories relatively new to the market is the smart thermostat. Sales of smart thermostats already number in the millions, with growth rates in double digits. at this rate, the market will be saturated with smart thermosets within ten years.

It should also be noted that the primary new lighting technology, LED lights, will grow even more efficient in the near future. Currently, a quality, economically viable LED will produce between 100 and 120 lumens per watt. Laboratory results have already demonstrated a lamp efficiency of about 300 lumens per watt. The disruptive transition of LED lights over the next few years will cause the portion of our residential electrical bills related to lighting to drop from about 15% to about 1%.

The previous recommendations consist entirely of things that can be done without any capital expense, assuming that most houses currently have a power strip or two that can be used to manage phantom loads. There are also a number of things that households can do to reduce utility bills at very minimal expense. Some of these are:

- Replace one incandescent light with an LED version every month or two. A 60-watt incandescent can be replaced with an 8.5-watt LED. Electricity for lighting typically comprises 10–15% of a home's electrical consumption. The combination of upgrading to LEDs and always turning lights off when not in use can almost eliminate this category of consumption.
- Add faucet aerators and low-flow shower heads to all sinks and showers in a house or apartment, and remember that the length of shower is directly related to the energy consumed. In Florida the majority of water heaters use electricity. By reducing the use of hot water, electricity consumption is also reduced.
- Add pipe insulation to the accessible portions of the hot and cold water lines directly adjacent to the water heater. Also, add insulation to the larger of the two lines that go from the outside air conditioning unit into a house.
- Install a smart thermostat that will help keep the home at its most efficient temperature when residents are away at work, without the need to remember to do anything. Learning how to program an old style thermostat is no longer necessary.

Nearly every family in Florida and the US can afford to implement both sets of these no-cost, low-cost recommendations. The return on investment by saving 20-40% on an electricity bill can be used to pay for more capital intensive upgrades to a home, such as adding attic insulation, upgrading appliances, installing double-pane windows, and new energy efficient heating and air conditioning systems.

Financing Energy Efficiency and Renewable Energy in the Built Environment

If society is to both mitigate and adapt to climate change, it must be affordable. Fortunately, consumers hold a massive amount of power through their purchasing choices. Additionally, new financing options empower Floridians to support the energy efficiency and renewable energy (EERE) sectors while meeting their daily needs. However, no financial product is a panacea for people. Every household and business will have unique EERE goals, dependent on individualized credit worthiness. Thus, the financing options described in this section should be evaluated with critical minds and a balanced approach. The *My Florida Energy Home* website (2016) includes more complete coverage of this topic, including the SMART approach to achieving consumer financial goals.

While subjected to the political winds and industry whims, a variety of local, state, and federal incentives, manufacturer rebates, and EERE programmatic resources are often available to Floridians. A great place to start an evaluation of consumer options is the North Carolina Clean Energy Technology Center's Database of State Incentives for Renewables and Efficiency (DSIRE; 2016).

The DSIRE online repository documents dozens of policy and incentive categories. However, some of these incentives may be out of date and others may not be reported on DSIRE. Thus, savvy consumers will also investigate the current options directly advertised through their local government agencies, their utility providers, and the manufacturers of any EERE products and services they may be considering. The most common EERE incentive programs target the following major building systems: (1) structural, including thermal and air barriers; (2) mechanical, including ductwork and space conditioning; (3) appliances; (4) lighting; (5) distributed renewable energy generation, including solar PV and solar water heating; and (6) electrical grid load management. Additional details and resources can be found at the My Florida Energy Home website (www.myfloridahomeenergy.com).

Florida Statue 163.08 establishes guidelines and requirements enabling counties, municipalities, and special districts to implement property assessed financing (PAF) programs, also called property assessed clean energy (PACE) programs. These PAF/PACE programs may be used to finance qualifying building energy efficiency retrofits, renewable energy generation installations, and wind resistance improvements. Typically, local governments enter into agreements with one or more private sector financial partners who originate and service the loans. The governmental role comes in during the repayment process and occurs through non-ad valorem property assessments for participating property owners.

While other existing financial products may be used to fund EERE, the perceived benefits of PAF/PACE programs come primarily in their stimulus to local economies and their property assessment and repayment structures, which stay with the properties, regardless of the owner. Some evidence suggests measurable economic benefits. However, it is unclear whether PAF/PACE merely replicates the equivalent local impacts that might exist in conventional consumer financing. In theory, PAF/PACE may enable leveraged property owners with little to no equity available in their existing mortgage to receive the financing necessary to implement EERE and storm hardening property improvements. In reality, most PAF/PACE programs have underwriting standards similar to conventional consumer financing and they may offer less competitive rates due to programmatic overhead.

Unfortunately, property renters often lack direct access to PAF/PACE programs. Thus, in situations where property owning landlords have neither the means (e.g., lack credit worthiness), nor the motivation (e.g., lack awareness, lack interest), PAF/PACE programs may do little to address the "split incentive (principal agent) problem" commonly constraining EERE innovations within the rental marketplace.

While their benefits, constraints, and legal challenges are sometimes debated, the addition of PAF/PACE programs to the suite of climate change mitigation adaptation financing strategies is likely a positive trend, as they increase the diversity of options available to residential and non-residential property owners. A more detailed explanation and analysis of PAF/PACE programs is available at http://www.myfloridahomeenergy.com (My Florida Energy Home-Financing 2016)

Disruptive Technologies in the Built Environment

Disruptive technologies that are more energy efficient are starting to affect the entire US electricity market. Total electricity generation in 2004 was approximately 3.97 billion MWh. The 2016 data available as of this chapter's publication show the US on track to generate approximately 4.0 billion MWh (EIA 2016), in spite of an additional 27 million more people since 2004 and an increase in the GDP from $12.3 trillion to $18.3 trillion (projected for 2016).

An even more extreme example would be to compare Florida to California. Florida has approximately half the population of California and just over one third of the GDP, yet Florida consumes significantly more electricity. California made a concerted effort after the 1974 Oil Embargo to change the way Californians consume energy. The biggest change was to slowly evolve building codes over the years, eventually allowing California to develop some of the most energy efficient buildings in the United Sates, if not the entire world. The other significant change made in California was to de-couple the state's electric power producers' profits from generation. As a result, electric utilities were able to direct their customers to many new and existing technologies that could provide the same service with much lower energy consumption. As grid-wide electricity consumption fell, the utility was allowed to raise rates to cover the cost of transmission. At first glance, it might look as though the customer would lose because of the higher rates; however, the opposite is true. California residential customers pay higher electrical rates than their Florida counterparts but the average residential bill is lower (EIA 2016). Simply put, California saves more than the higher rates cost. It has taken California nearly 40 years to make the necessary changes and begin to reap the benefits. How does a state like Florida catch up, and catch up quickly?

The most disruptive technologies might be financial rather than physical. For example, many homeowners would like to upgrade their homes to consume less energy but are stymied by a lack of working capital. This lack of capital is one of the main reasons why the majority of homes in Florida and the nation have outdated home systems in the following key areas: air conditioning and heating systems, attic insulation, and ductwork; windows; lighting systems, and water heating

Conventionally designed and built, residential duct systems in Florida can wastefully leak between 20 to 40% (My Florida Energy Home 2016). Sealing duct systems can almost entirely eliminate this loss and increase the overall efficiency of a system. Another answer is to eliminate a duct system entirely by using what is called a mini-split design. Including new direct current motors and inverter designs allows mini-split design systems to be nearly twice as efficient as existing technology. Coupled with new smart thermostats, these new designs and controls offer significant savings as well as greater comfort.

While attic insulation might not seem to be an example of a disruptive technology, an energy efficient building envelope is certainly a critical component. Nationally, approximately 40% of homes have levels of attic insulation that do not meet current regional and national standards for design. Home insulation is quantified in terms of R-value, with a higher number reflecting better insulation levels that minimize the transfer of heat. The attic insulation level recommended by the Department of Energy for Florida is between R-30 and R-60 (EnergyStar 2016). A major Florida electric utility still recommends R-19 as the proper level for a home built in Florida. It is easy to see why better attic insulation could be seen as a disruptive technology by that utilty.

When it comes to the issue of windows, only 25% of the residential windows in Florida are double pane (EIA 2016). Single frame, aluminum frame windows still make up the majority of window systems in Florida homes. While nearly all of new construction incorporates double pane windows, many with even more advanced selective coatings, replacing existing windows with newer, more efficient designs is costly. However, as already mentioned, PACE programs can provide the necessary funds to speed this transition.

Lights are another area where updates are needed. Most homes built in Florida incorporate linear fluorescent lights in common areas (e.g., the garage, kitchen, laundry and bathrooms). Manufacturers of lighting products now produce linear LEDs that are drop-in replacements for typical 4 ft fluorescent fixtures. LED lamps use between 35 and 50% less electricity and the price is dropping dramatically. While existing fluorescent and incandescent technologies are as efficient as they can be, current LED technology is predicted to become almost three times as efficient as they are currently.

And finally, another area faced with a new, disruptive technology is electric water heating. Just as a heat pump for a home transfers heat from outside to inside when in heating mode, a heat pump water heater can do the same. Depending on the location and other home characteristics, a heat pump water heater can also remove heat from a garage or utility room and transfer it to a water heater tank. As a result, a home actually gets a small amount of additional air conditioning. While this "waste" cooling can be detrimental to households during the winter in heating-dominant climates, Floridians are fortunate to benefit from this heat pump water heater side effect for the vast majority of our year. The current generation of heat pump water heater units are typically between two to three times more efficient than typical electric water heaters.

Table 5.1 shows that more efficient states and countries can have robust economies and while still dramatically reducing their energy use. By making the state's electricity consumption as efficient as other top ranked states and countries, Florida can address significant decreases in the consumption of both natural gas and coal.

Before the subject of renewable energy transformation can be explored, a few benchmarks related to an energy-efficient economy can be established. The reasons for which are two-fold. An energy efficient economy is a more cost effective economy. Think of energy costs as parasitic, or bottom line costs. Retail establishments must turn the lights, computers and air conditioning systems must go on before any sales can take place. Lower utility bills can translate into greater profits. The same can be said for residences. As they become more efficient, residents have more money to spend on other items. The second reason is that an energy-efficient economy can be transformed easier and faster into a renewable energy economy.

As was mentioned earlier in this chapter, 52% of Florida's electricity is consumed in the residential sector and 41% in the commercial sector. Using the list of trends and upgrades already described, our built environment, encompassing both the residential and commercial sectors can be made twice as efficient as they are currently. This would result in Florida's electricity consumption dropping from 237 million MWhr/yr to approximately 127 million MWhr/yr.

Another way to arrive at a similar conclusion would be to establish energy efficiency goals similar to what California has done. On a per capita basis, California consumes just at 5,000 kWhr/year for each resident. Using the same rate, Florida would use just about 103 million MWhr/yr. This is significantly less than if the goal was to make the built environment twice as efficient.

Disruptive Technologies in Transportation

What about oil, the third fossil fuel? As stated earlier, almost all of the oil consumed in Florida is used for transportation. So where are the ideas for energy efficiency and disruptive technologies in relation to our transportation systems? Following are several major trends in transportation that will positively affect Florida's transportation energy consumption in both the near and long term:

- The US automobile fleet average miles per gallon is required to be 54.5 mpg by 2025, a rate that is more than twice as efficient as today.
- The move toward electric cars and plug-in hybrids is growing rapidly.
- Mass transit usage continues to climb, and more cities are adding mass transit systems around the country.
- Driverless cars and companies such as Uber and Lyft have demonstrated the potential benefits of these technologies and new business models penetrating the marketplace. Cars sit idle in parking spaces 95% of the time. Decreasing this to just 90% translates into a need for just half as many cars. The use of rideshare services will eliminate the need for parking spaces. Clients can choose to ride alone or decrease costs by traveling with more than one passenger. Traffic jams will become just a memory.

- New heavy duty 18 wheeler truck models have been developed that provide twice the miles per gallon as previous models.
- Railroads will compete for more road cargo with fewer rail cars being loaded with coal.

Taken in total, all of these trends will transform the use of oil in the US. Some of these changes will happen faster than others, but the end effect will be that the age of oil as we know it will start to end. The US consumed nearly 22.2 million barrels per day at its peak in late 2005, but despite adding approximately 25 million people since then, this level has not been topped. In part this is because by the end of 2016, the US automobile fleet will include more than 550,000 electric vehicles, including plug-in hybrids and total electric models (Inside EVs 2016). Lately, annual growth rates have been almost 30% and they are expected to increase as prices drop and capabilities increase. In less than ten years, the US market will have close to ten million electric cars on the road, remaining gasoline car models will have much better mileage figures, and driverless car services will allow many to forgo automobile ownership altogether.

How will these trends of electrification and efficiency affect our state? Florida drivers travel a total of just over 200 billion miles per year (EIA 2016). Converting half of these miles to electric cars that use 0.25 kWh/mile requires the production of 25 million MWh/yr, which represents about 11% of Florida's current electricity production. At the same, doubling the efficiency of the remaining automobiles reduces the remaining gasoline consumption by half. All in all, this yields a 75% reduction in oil use for automobiles in Florida.

Similarly, upgrades to truck fleets with new (existing) designs that can double the fuel efficiency and moving a portion of truck cargo back to the rails will also yield a 75% reduction in diesel fuel use. However, fuel use by the railroads will not increase because they will no longer be transporting coal, thereby saving about half of their current fuel consumption. And finally, many city truck systems including delivery trucks, buses and garbage trucks will convert to electric powered vehicles.

Renewable Energy Systems

Many areas in the United States have ready access to multiple sources of renewable energy. California is the site of the largest geothermal power plant on earth. The West Texas plains have the largest collection of wind turbines in the US. The hydroelectric power plants on the Columbia and Colorado rivers are among the largest in the world. And, California is home to several of the largest photovoltaic power plants on the globe.

The state's lack of steady, powerful wind patterns leaves wind power currently off the table in Florida, and a lack of elevation means that our state is a poor site for hydroelectric power plants. Florida's geothermal potential is also quite limited. Since there are some sources of waste biomass available within the state associated with forestry operations, these could be important in several areas of the state but will not be a major player based on cost alone. But there is one viable renewable energy source that is more than well-suited to Florida—solar energy. It would appear that photovoltaic (PV) power (commonly referred to as solar power) could be the main source of renewable energy for Florida's future. It involves the direct conversion of sunlight into electricity and offers many advantages:

- The direct conversion from sunlight to electricity requires no thermodynamic cycle as is required in all combustion and nuclear power plants. Therefore, no water source is needed for cooling.
- PV panels have no moving parts and are much simpler to maintain. They typically enjoy tremendous longevity; in fact, some of the original retail market panels made by ARCO Solar more than 40 years ago are still producing power.
- The price curve for solar panels has generally followed the semiconductor industry pattern that results in steady price drops as production grows. Prices were $76.67/watt in 1977 and are currently in the $0.35 to $0.37/watt range (Energy Trend PV 2016), and prices are still dropping.
- Solar panels are made from readily available materials with no foreseeable bottlenecks.
- Electric power produced by the very latest systems can do so at rates that are cheaper than all other sources, renewable or fossil-fueled (Lazard 2015).

The only disadvantage that PV power systems present is that they can only operate when the sun is out. They are not unpredictable or intermittent, at least not when aggregated over a region. Regional weather forecasts can provide utilities with meaningful predictions hours or even days in advance. That said, PV systems do have the lowest capacity factor of any grid-level system currently in use today. The capacity factor is defined as that portion of a year that a given power plant operates at its full rated capacity. For example, a 100 MW biomass power plant with a capacity factor of 0.7 would be able to operate at rated capacity for 6,132 hours per year and produce 613,200 MWhr during a year. In the same manner, a 100MW PV power plant located in Florida would be expected to operate with a capacity factor of 0.21, or 1,840 hours per year at rated capacity and produce about 184,000 MWhr/yr.

This capacity factor analysis does not mean that a given power plant only operates at 100% capacity for the defined number of hours each year. Especially with regards to PV plants, the production of power begins as soon as the early morning sun hits the solar panels and continues through late afternoon or early evening. Power produced both early and late is a fraction of full output, but the long-term averages result in a capacity factor for each region of the globe. This basic analysis can be used to estimate how much PV capacity needs to be added to transform Florida's energy systems.

Renewable Energy Systems Costs

One of the biggest hurdles to adopting renewable energy systems is the issue of cost. A popular way to look at costs is to quote the price on a per watt basis for a panel. However, it is more important to quote complete system prices on a per watt basis. There are three distinct markets for PV systems in the U.S.: utility, commercial, and residential.

Table 5.2. PV System Costs by Market (Solar Energy Industries Association 2016).

System scale	System Cost, $/Watt, Q1 2016
Utility, fixed axis	1.24
Utility, one axis tracking	1.41
Commercial	1.90
Residential	3.21

These capital costs can be used to estimate the complete system costs on an average, national basis. But what about the wholesale cost of delivered power in comparison to current fossil-fueled power plants? A series of annual reports have been produced by the Lazard Company, an international business firm, analyzing the unsubsidized costs of virtually all power-producing systems currently on the market. The reports compare each system based on the levelized cost of electricity (LCOE) in terms of US dollars per megawatt-hour produced ($/MWhr). For example, a cost of $43/MWhr would be equivalent to $0.043/kWhr, remembering that this represents the wholesale cost of power and not what individual consumers pay on their utility bill. The major points in the report (Lazard 2015) are as follows:

1. Energy efficiency upgrades are the best investment across the entire spectrum of electricity sources, but in some cases are beat out by the very cheapest PV and wind systems.
2. Utility-scale crystalline and thin-film PV systems using 2017 pricing models produce electric power cheaper than all fossil-fueled and nuclear electric systems.
3. Onshore wind power systems are cheaper than all fossil-fueled and nuclear powered electric systems.
4. Biomass and geothermal electric power systems are competitive, but they deliver power more expensively than the cheapest coal-fired and natural gas combined cycle systems.

The Lazard report presents a snapshot in time that puts a very positive spin on the future of renewable energy. However, it can't be emphasized enough that the cost structure for PV and wind power is still falling. The same cannot be said for coal, natural gas, and nuclear power systems. The cheapest of these, combined cycle natural gas systems, is very dependent on continued low prices for natural gas. The combination of US natural gas producers beginning to export liquefied natural gas and all-time lows for active natural gas drilling rigs make any prediction of continued low natural gas prices risky.

Renewable Energy Storage Systems

Exciting press releases from companies such as Tesla and Sonnen means that people often think of energy storage only in terms of batteries, and typically the next step in this thought process is to think of price, as in dollars per kWh stored. However, there is a bigger picture to be explored first. What consumers really want is increased capability to use energy that is created by various natural, renewable systems, but often the renewable energy is not collected when it is needed for use. Two examples would be 1) wind energy that is produced in the middle of the night in the Great Plains region of the US and 2) solar energy collected in the middle of the day.

The second largest use of electricity in US residences is for the production of hot water. Modern electric water heaters store 40 gallons or more of heated water and are surrounded by an excellent foamed-in-place insulation product that will keep water in a tank hot for hours. More than 90% of the water heaters in Florida are electric, as opposed to natural gas or propane. So based on an estimate of 2.4 people per Florida household and 90% electric water heaters, Florida has approximately 7.6 million water heaters. Programming each of these to be heated 10 °F each day by solar energy is equivalent to deploying 1,860 MW of storage capability that can be operated for four hours, which is equal to a total storage capacity of about 7,440 MWhr. This is significant in that it represents more deployed storage in Florida alone than what is expected for the entire US battery storage market by 2020. The only additional technology required for this type of move toward solar power is a Wi-Fi-connected or programmable water heater, and these are available in the marketplace right now. With Florida's naturally occurring "hard water," the lifetime of most electric water heaters is about ten years. So with suitable incentives, Florida could convert its entire residential water heating system within a decade.

There are several other trends that will also contribute to a vastly different grid load profile in the future. Just a few are listed here:

- Replacement of incandescent lights with LEDs will dramatically flatten the evening grid load peak.
- Emphasis on adequate attic insulation will also contribute to a lower evening peak load.
- Programmable dishwashers that will turn on in the middle of the day when solar energy is available.
- Charging electric cars during the day when renewable solar energy is available.

Renewable Energy Transformation

Unfortunately, Florida is not even ranked in the top ten states when looking at states' renewable electricity production. In fact, Florida is ranked 48^{th} (EIA 2016), with only 2.2% of its electricity produced from renewable energy sources. Six states produce more than 50% of their electricity from renewable energy sources, and ten additional states produce from approximately 20% to 40% of their electricity from renewable energy sources. These examples within our own country show that this transformation can be accomplished. While there are a number of promising renewable energy technologies, the focus in Florida is mainly on solar or PV electric power. As mentioned already, Florida winds speeds, although high at times, do not have long term averages great enough to support wind power with current technology. When the offshore wind power market expands in the US and wind energy companies have access to turbines designed for lower wind mean conditions, this will change and wind power will become a viable alternative in Florida. Florida is also not a hot spot for geothermal electricity production. So what will it take to transform Florida's current energy systems into a more renewable future?

Let's first take a look at the status of PV power in the US and the world as a whole. Fig. 5.2 shows the history of the cumulative capacity of solar power in the US from 200-2016 and Fig. 5.3 shows a similar history for the entire world. The first thing that stands out is that the growth rates have been tremendous. Growth curves such as these are similar to or even greater than the market penetration rates seen in the case of automobiles, radios, color television, and smart phones. As prices continue to drop and more markets are opened, there appears to be no national or international barriers for continued expansion of this promising energy source.

Florida's lack of progress in the renewable energy arena stems from a number of factors. First, Florida is one of a few states that presently does not have a legislative or voluntary renewable portfolio standards. These state-level standards require utilities to implement renewable energy.

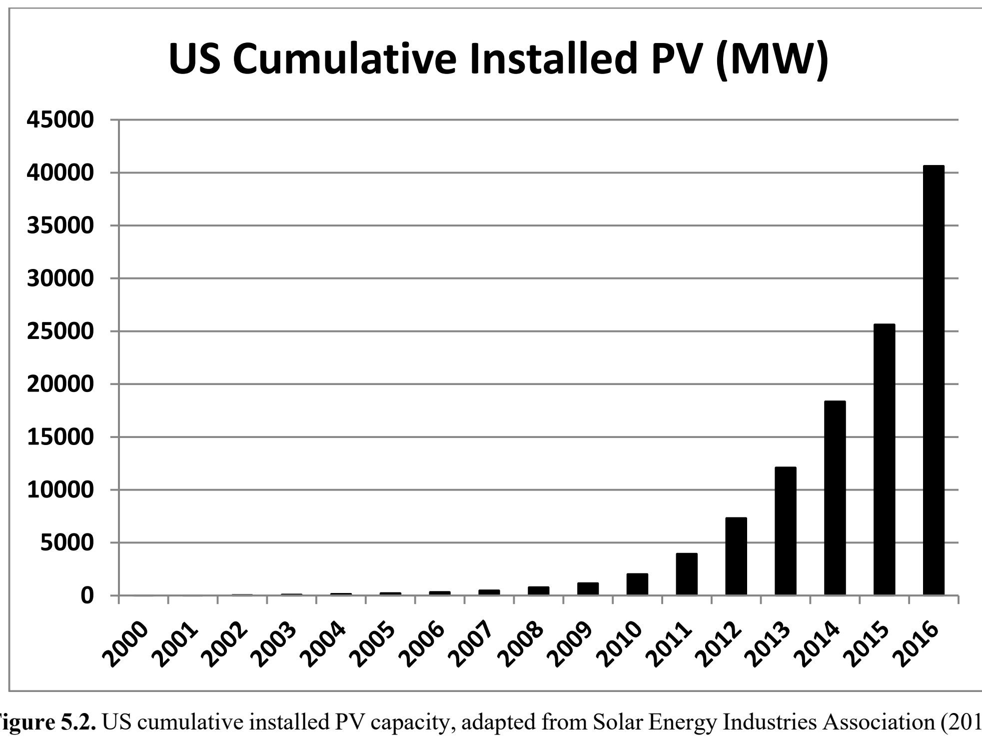

Figure 5.2. US cumulative installed PV capacity, adapted from Solar Energy Industries Association (2016).

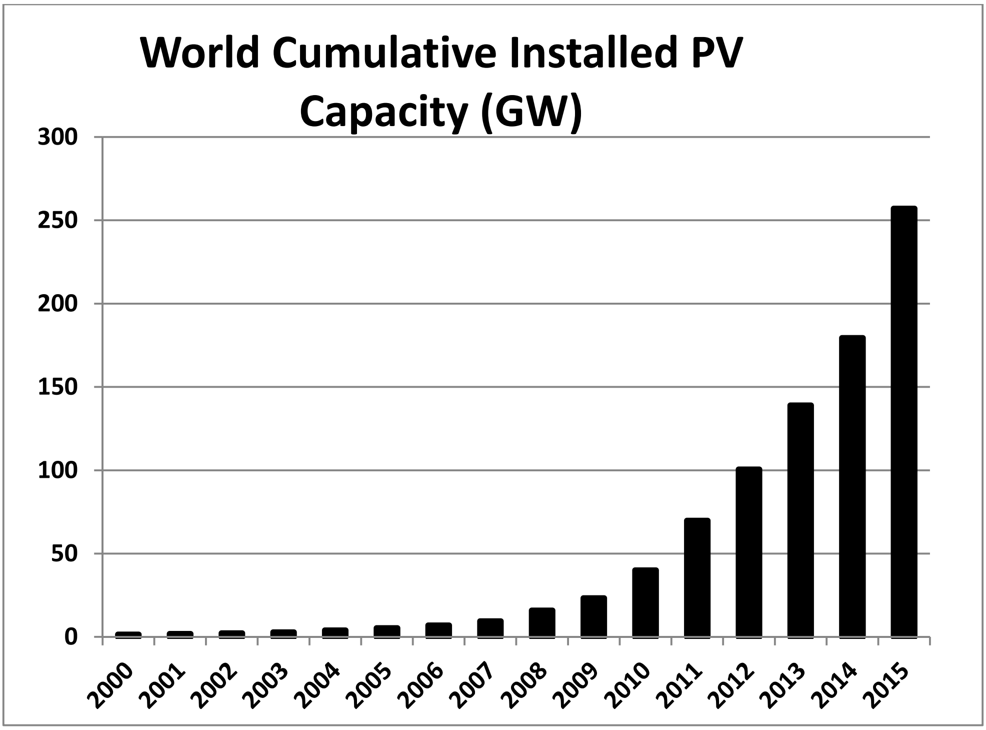

Figure 5.3. World cumulative installed PV capacity, adapted from Solar Energy Industries Association (2016).

For most renewable portfolio standards, the amounts and types are quite flexible, as are the time frames for attainment. For example, California's renewable portfolio standards requires the state to produce 50% of its electricity from renewable sources by the year 2030. Texas requires 10,000 MW of renewable electricity capacity be installed by 2025. Adoption of renewable portfolio standards is quite effective in that they produce a demand for a market, yet remain fairly flexible so that different regions can follow the paths that are most suitable for that geographic area. So, back to the question of what it will take to transform Florida.

A summary of the current status and the trends described in this chapter will provide an answer.

- Florida currently consumes 237 million MWh/yr of electricity, 52% in the residential sector and 41% in the commercial sector
- Doubling the efficiency of our built environment allows the state to better compete in the national and international market places. This also brings down the need for electricity in Florida to 122 million MWhr/yr.
- Florida currently produces nearly 30 million MWhr/yr from four nuclear reactors located at the Turkey Point Nuclear Generating Station and the St. Lucie Nuclear Power Plant. It can be assumed that, for near future of ten years, this will not change.
- The combination of biomass power plants, landfill gas power plants, and a small amount of remaining natural gas power plants can produce 20 million MWhr/yr.

Totally eliminating the use of coal to produce electricity in Florida and reducing the use of natural gas by about 90% would result in the need to produce 72 million MWhr/yr from renewable energy sources. With an overall capacity factor in Florida of 0.21, the state would have to add 39,000 MW of PV systems in order to reach this goal. Furthermore, producing the additional amount of electricity needed to charge electric vehicles for half of the existing fleet will require an additional 13,600 MW for a total capacity needed of 52,600 MW. While this may seem daunting, spread over a ten-year time span, just over 5,000 MW would have to be installed each year. This number is only slightly more than what California will have installed in 2016 in a market that is still growing at double digit rates each year.

Conclusion

This chapter has presented three broad areas of thought concerning Florida's energy systems and their relation to climate change. Every attempt has been made to use the most up-to-date information in order to provide an accurate picture of the positive and negative aspects of the transformation that we face as a state, a nation, and world.

- The current status of fossil-fueled power and transportation systems and consumption patterns was described. Comparisons were made between Florida, other states and nations to illustrate the relative inefficiency of Florida's energy landscape.
- Florida's current energy systems, such as power plants and coastal fuel terminals, were discussed in relation to sea level rise. While estimates of three feet of sea level rise by the year 2100 are well established in the scientific literature, the most recent research concerning the West Antarctic Ice Shelf suggests that planning for twice that, or six feet of sea level rise, might be necessary. Decommissioning a nuclear power plant can take ten or more years, which means that decisions about what to do with the reactors at Turkey Point, Crystal River, and St. Lucie must be put at the top of our state's to-do list. This issue of time needed to transition is not just related to nuclear power plants. Most of the oil products used in Florida are delivered via ship and barge, and coastal oil terminals will have to be moved if we continue to insist on an oil-powered transportation system.
- In comparison to other nations and states, Florida is considerably underachieving and lagging in both energy efficiency and renewable energy implementation. Proceeding down a more efficient path would make the transformation from a fossil-fueled economy to a renewable-powered one much faster and less expensive. The battery storage market does not have to be fully developed before the state can incorporate large amounts of renewable electricity with lower capacity factors into the grid. Solar power and wind energy are now the cost leaders for electric power, and their annual market growth rates reflect that.

How then does Florida rise from its 48th position for production of renewable energy electricity to a top five national ranking more representative of its position as the third most populous state? At the policy level, there are several successful strategies being used in other states that could be transferable to Florida. The renewable portfolio standards policy adopted by many other US states has led to innovations and cost reductions in the renewable energy marketplace. Recent open electric power auctions in the US and worldwide have resulted in the provision of solar PV and wind at the least expense, even considering no subsidies. Florida needs to adopt a significant renewable portfolio standard immediately, one that would challenge the state to produce at least 20% more of its electricity from renewable sources by 2025.

Florida could also create standards and policies to ensure that the state's built environment keeps up with a changing world. California created a Long-Term Energy Efficiency Strategic Plan (http://www.cpuc.ca.gov/General.aspx?id=4125) in September 2008 that established zero-net energy use goals for residential buildings by 2020 and for commercial buildings by 20430. These goals were motivated by the global Architecture 2030 Challenge (http://architecture2030.org/2030_challenges/2030-challenge/), which could provide an internationally-inspired platform for Florida's energy transition and climate change mitigation strategies, as well. The dual objectives of creating a more efficient built environment and large-scale deployment of solar PV energy capabilities would allow Florida to stop using coal and nearly end the use of natural gas to meet its energy needs.

Even more significantly, Florida could open up access to the electrical grid to additional providers, much like what Texas has done. Purchase power agreements can be signed between renewable energy providers and businesses or municipalities, and these arrangements often result in lower utility bills or lower rates of increases.

Moving away from oil for Florida's transportation needs would be fairly straightforward: Whether it is personal automobiles or the trucking industry, Florida could double the efficiency of existing systems by moving half of passenger vehicle miles to electric vehicles and half of the state's truck freight back to railroads. At the same time, fuel efficiencies for both modes will double. By simple ratios, this represents a 75% reduction in oil use in the state of Florida.

Rising seas will force Florida to confront our legacy fossil fuel energy systems much sooner than anticipated. Energy efficiency and renewable energy trends will rapidly shrink the need for coal and natural gas and begin a massive transformation of transportation systems. Florida's unique geographic location and history as an ever-shifting peninsula separating the hurricane-prone Atlantic Ocean and Gulf of Mexico make it a flashpoint in terms of facing the challenges of an already changing climate. So, shouldn't Florida also serve as a beacon for the 21st century cultural changes necessary to foster more resilient and adaptive communities from coast to coast? Promoting the policies and practices critical to energy transition and carbon-neutral urban renewal represent a promising first step. There is no more time left to delay. The future will not be forced, but rather chosen. May Floridians choose wisely.

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