



FLORIDA SOLAR ENERGY CENTER

Creating Energy Independence Since 1975

**Electricity Forecasts
OPPAGA Review of FSEC
External Review of FSEC**

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September 2008

A Research Institute of the University of Central Florida





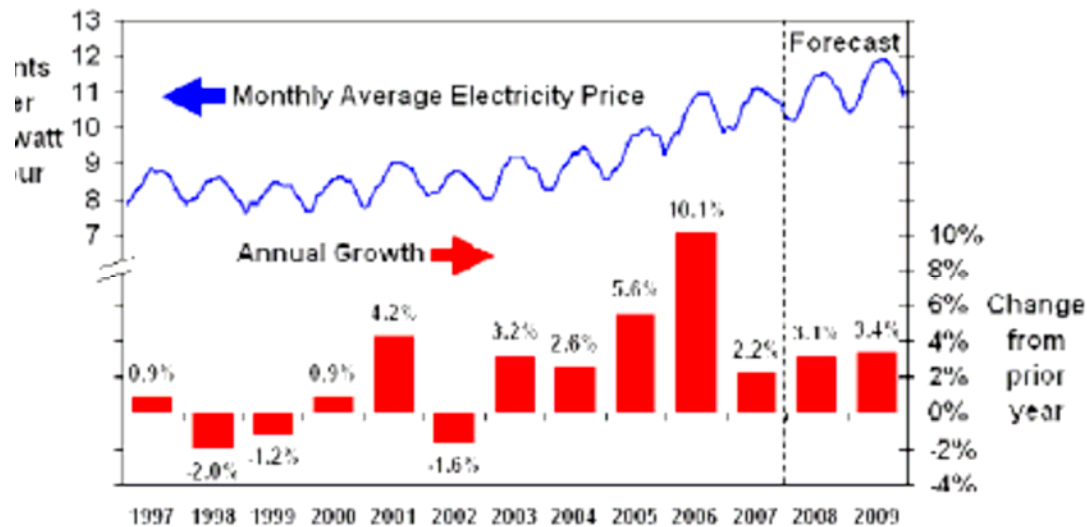
Electric Energy Forecasts

Slides taken from
Solar Energy Industry Forecast:
Perspectives on U.S. Solar Market Trajectory
June 24, 2008
United States Department of Energy
Solar Energy Technologies Program
www.eere.energy.gov/solar/solar_america/
solar@ee.doe.gov

Today's U.S. Electricity Cost Landscape



U.S. Residential Electricity Price



- Conservative forecasts from the Energy Information Agency (EIA) show residential electricity prices reaching 12 c/kWh by 2009

Term Energy Outlook, May 2008



- EIA shows historic national average retail electricity prices outpacing inflation by ~1.2%

EIA National Retail Electricity (cents / kWh)	
2007	10.64
2006	10.40
2005	9.45
2004	8.95
2003	8.72
2002	8.44

+ 4.7% per ann

EIA forecasts are good baselines, but are generally conservative as they are based on historical data without recent movement in supply/demand balances

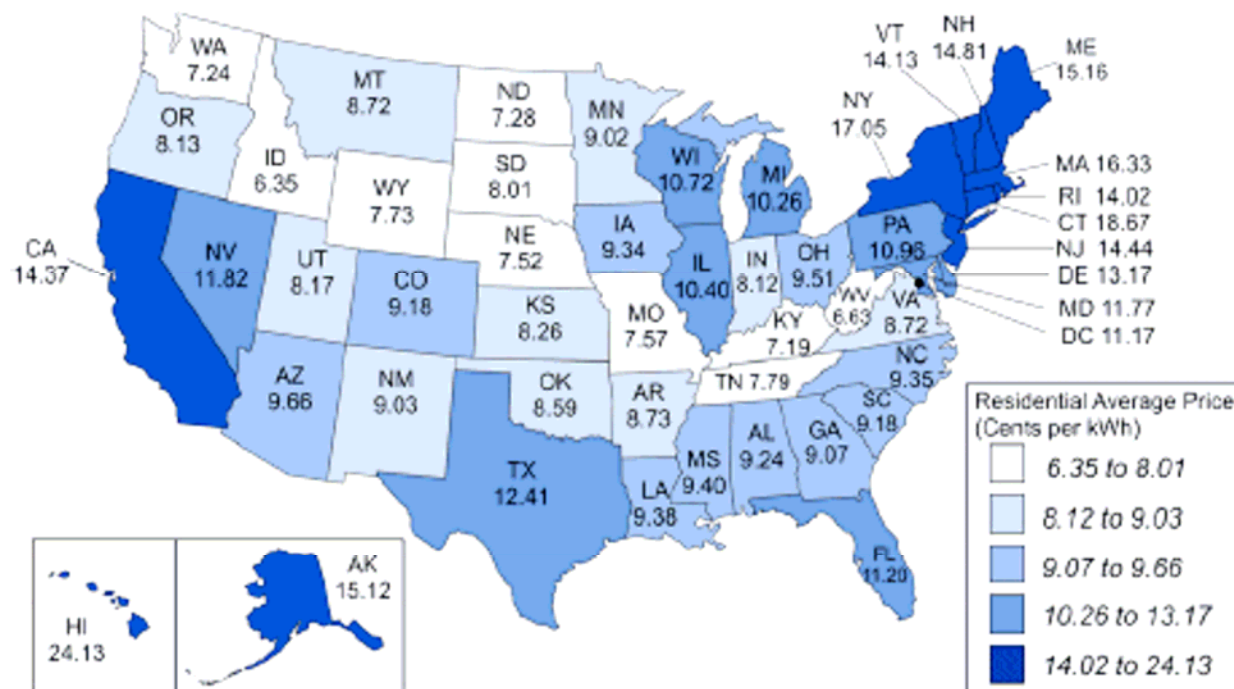
U.S. National Electricity Price Forecast



- Applying the same conservative 4.7% inflationary rate, average US electricity prices will reach 16 c/kWh by 2015
- Rates in some states will be higher, with CT electricity prices forecast to reach 27 c/kWh in 2015 by the same logic

Year*	c/kWh
2008E	11.55
2009E	12.09
2010E	12.66
2011E	13.26
2012E	13.88
2013E	14.53
2014E	15.21
2015E	15.93

The U.S. average residential retail price of electricity was 10.64 cents per kilowatthour in 2007.



*Estimates

Source: Energy Information Administration, Form EIA-826, "Monthly Electric Sales and Revenue with State Distributions Report."

Solar is already cost competitive in some states today and will be in many more in coming years as energy prices increase nationwide

Installed system cost ranges have implications for levelized cost of energy



Levelized Energy Cost with Current Federal Incentives



- Commercial / utility scale PV systems are currently economically competitive with grid electricity prices in many areas

Levelized Energy Cost with NO Incentives



- Both residential and commercial systems will be less expensive than grid electricity by 2010, assuming that the 4.7% annual growth rate continues

Solar market penetration is created by the levelized cost of energy (LCOE) over the

Traditional generation sources face hurdles even as demand grows



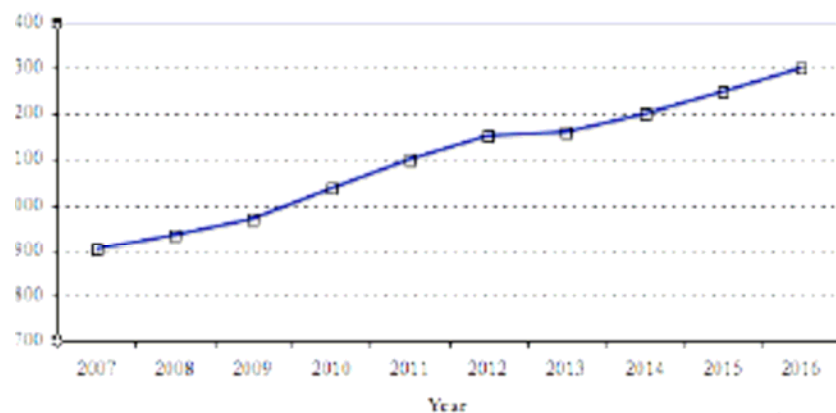
CAPP Front Month Contract Pricing (\$/ton)



Source: Bloomberg

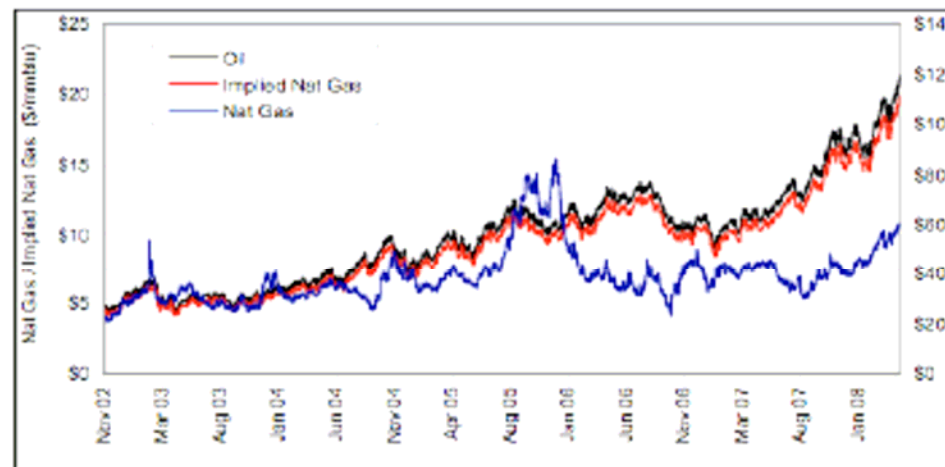
- Natural gas prices have more than doubled during the same time period

U.S. Electricity Demand Forecast



Source: EIA AEO 2008

- Coal prices have nearly tripled over the past five years
- Coal power plants face increasing project uncertainty due to carbon and siting concerns



Source: Bloomberg

Source: Simmons & Co

- Nuclear industry groups estimate the next generation nuclear plants will not be online until 2015
- Electricity demand is forecast to increase by **386 TW** through 2015, requiring substantial capacity additions

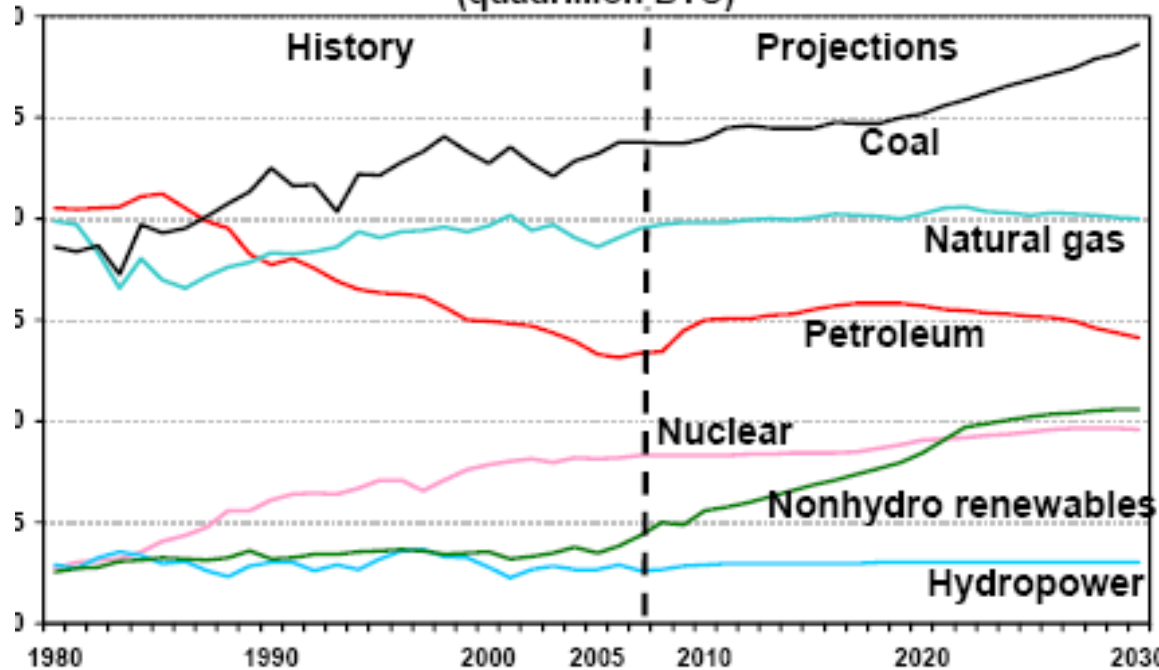
Coal and natural gas prices are increasing at much faster rates than 4.7% per year, while nuclear faces regulatory, financing and siting issues.

Most forecasts do not take into account these hurdles



Energy Generation by Fuel, 1980-2030

(quadrillion BTU)

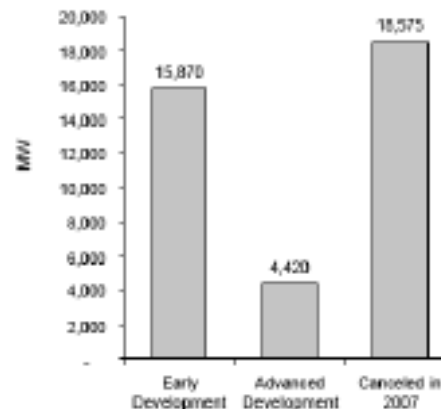


Source: EIA, Annual Energy Outlook 2008

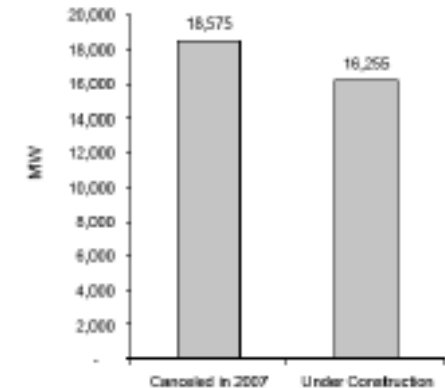
- EIA recognizes that no nuclear will enter the generation mix in the next five years
- However, EIA forecasts include substantial coal and natural gas generation capacity additions.

- Coal additions are difficult in today's regulatory and consumer market.
- Coal plants are being cancelled and CCS technology is being delayed
- Additional coal generation faces financing uncertainty due to the political risk of mandatory carbon values.

Coal Plants Canceled vs. Those in Development



Coal Plants Canceled vs. Those in Construction



The political climate is pushing in the same direction as electricity market economics



Energy security and climate change are two of the great challenges of our time.”

President Bush,
Major Economies Meeting, September 2007



“...proposals that will allow America to lead the world in combating global **climate change** ... to help develop and deploy the next generation of **energy** that will allow us to build the next generation’s economy.”

- Senator Barack Obama,
Portsmouth, NH, October 2007

The fundamental incentives of the market are still on the side of **carbon based energy**. This has to change...”

Senator John McCain,
Ft. Belton, VA, May 2008



“...move us from a **carbon based** economy to an efficient, green economy by unleashing a wave of private-sector innovation in **clean energy**...”

- Senator Hillary Rodham Clinton.



What Is This All About?

“It’s the economy stupid!”

James Carville, 1992

And, the corollary is “... *the cheapest, easiest and fastest kilowatt we can generate is the one we save through efficiencies.*”

Jeb Bush, 2000

In other words:

It’s the efficiency stupid!



Electricity Use

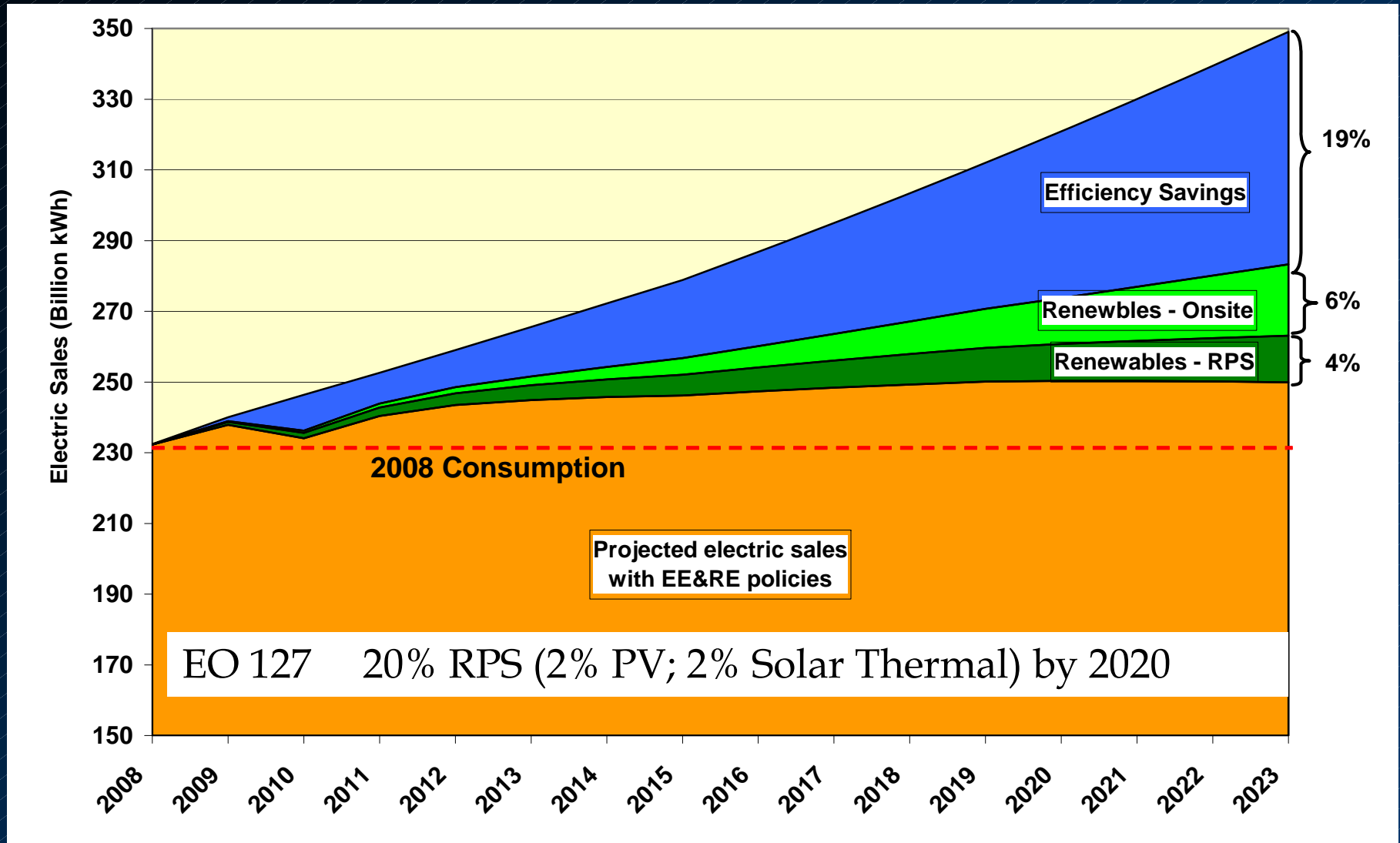
Efficiency, Efficiency, Efficiency....., Then Solar Thermal & PV

- ❖ **Efficiency First** – The least expensive kWh is the one that we do not use (or produce)
- ❖ New homes (190,000 per year) can cost effectively achieve almost 40% greater efficiency than 2007 code requirements¹
- ❖ Existing homes (7.3 million) can be cost effectively improved by more than 30%¹
- ❖ Achieving this cost-effective efficiency would result in 53 billion kWh savings at a levelized cost of about \$0.05 per kWh.¹

¹ ACEEE, June 2007. *Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demands*

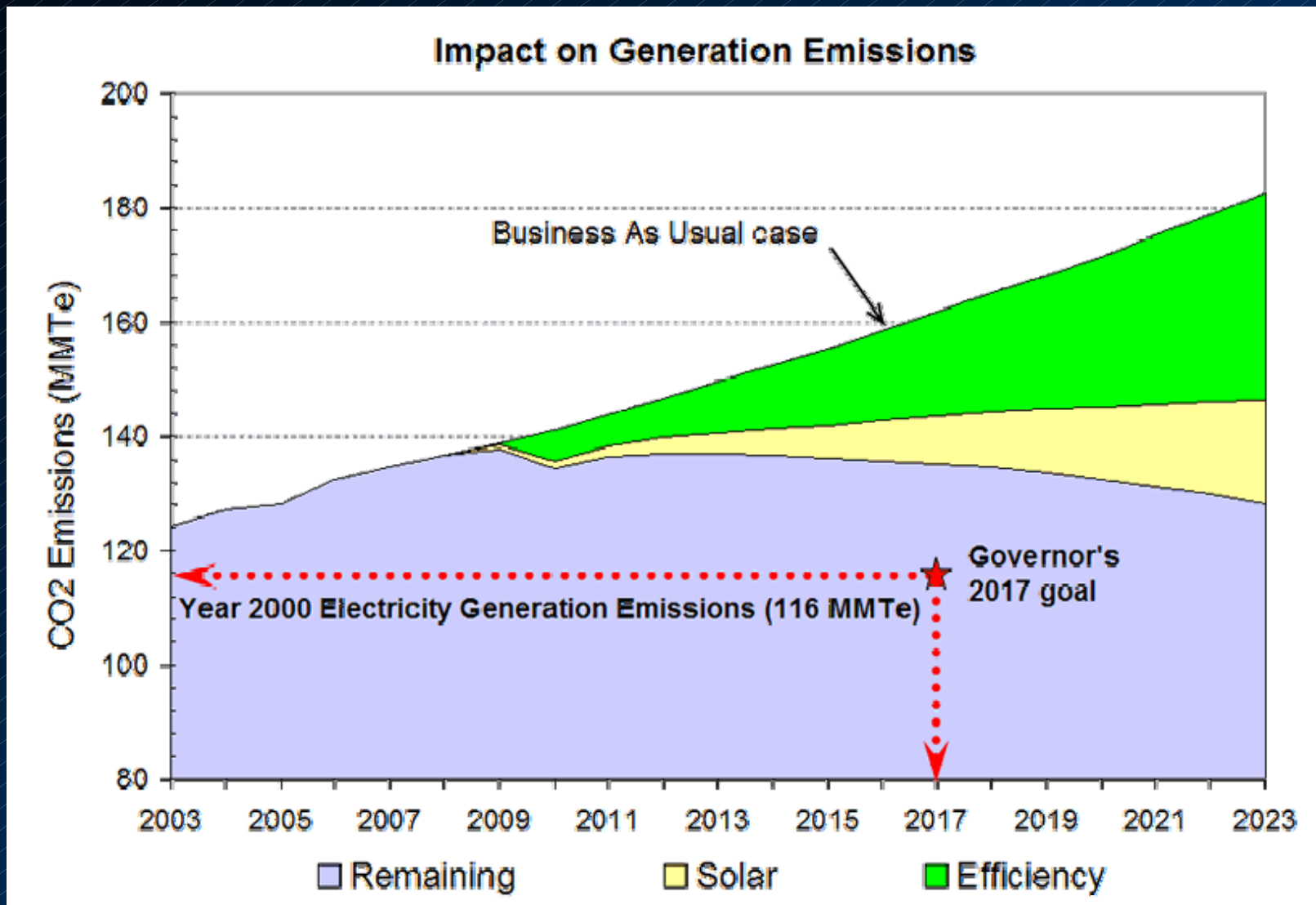


ACEEE: Energy Savings





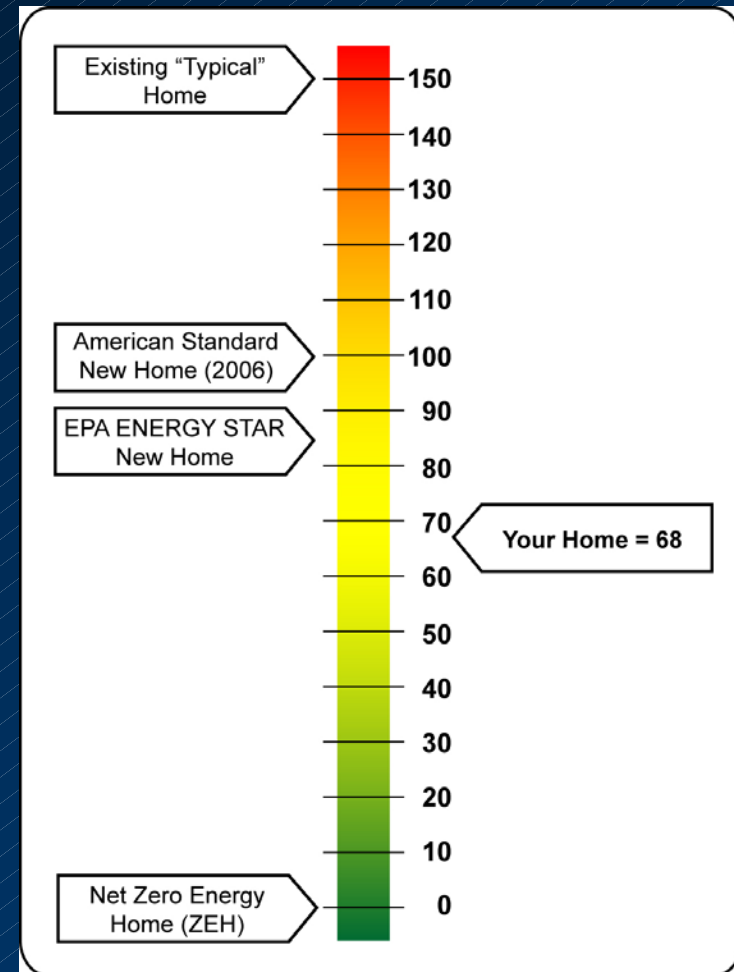
ACEER: Carbon Savings





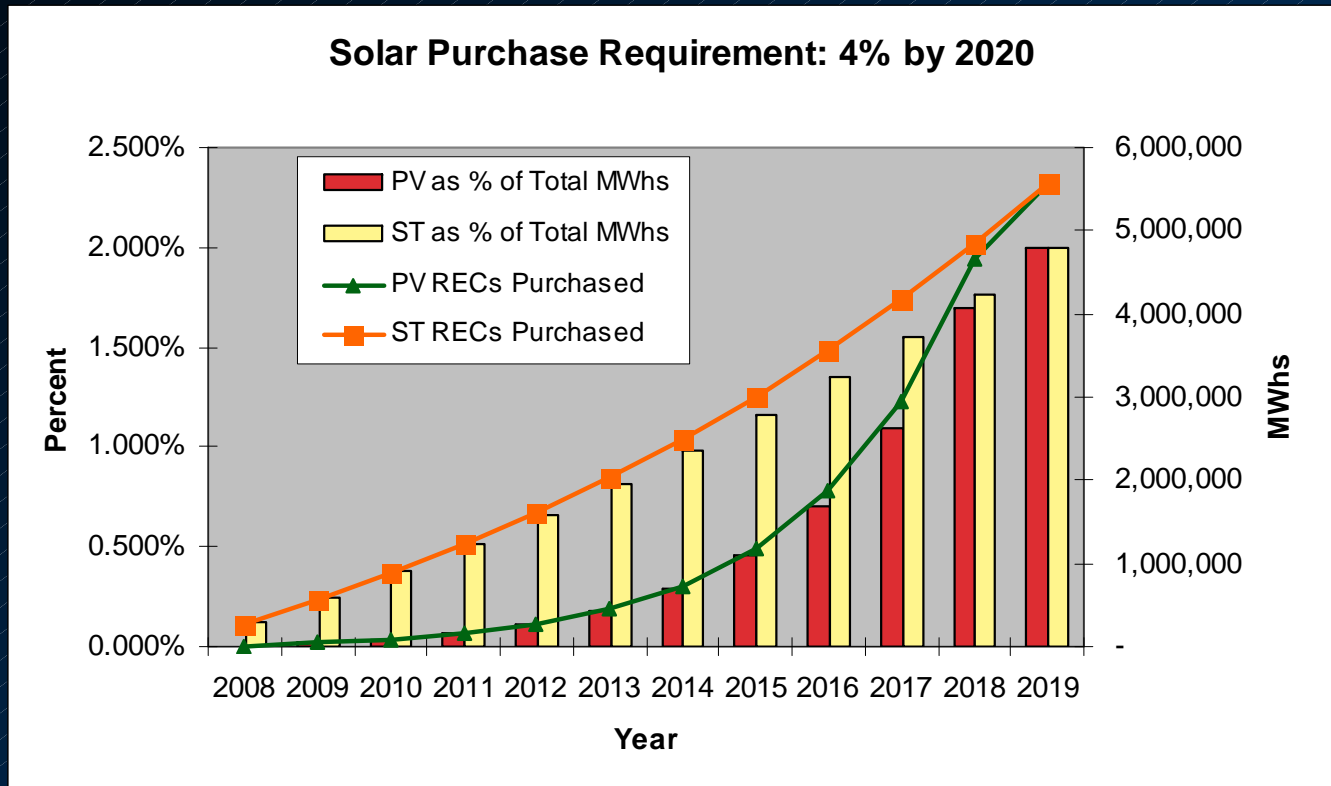
Home Energy Measurement & Verification

- ❖ A national energy use index that measures whole-home energy efficiency on a relative scale
 - 100 = The energy use of the “American Standard Home”
 - 0 = No net purchased energy use – the “Zero Energy Home”
- ❖ ENERGY STAR homes have a HERS Index of 85 or lower
- ❖ Widely used in the “Beyond Code” marketplace





20% RPS by 2020 (4% Solar)



As System costs decline (greater demand, maturing industry), solar requirements increase in later years. Solar Thermal today with no incentives \$0.09 kWh; PV with no incentives \$0.28 kWh today; \$0.15 kWh 2011; \$0.09 kWh 2020. Out of the wall \$0.08 kWh 2000; \$0.12 kWh today; \$?? kWh 2011.



RPS, PBF → Industries & Jobs

Solar PV

- ❖ Average 13 direct job-years/MW
 - (VS study of 5 models)
- ❖ Industry estimates that:
 - Residential: 10 job-yrs/MW
 - Small Commercial: 9 job-yrs/MW
 - Large Commercial: 7 job-yrs/MW

Benefit of 2% Goal:

- ❖ **31,600 job-years (low)**
- ❖ **50,000 job-years (high)**

**Orange County Convention Center
1 MW Solar PV**

Solar Thermal

- ❖ One job-year created for every 50 systems installed

Benefit of 2% Goal:

- ❖ **32,800 job-years**





How Much Can We Spend?

- ❖ 8.5 million homes
- ❖ Low hanging fruit:
 - \$1500 per home
 - Saves 1,250 kWh/yr
 - Saves 25 therms/yr
- ❖ Extensive Retrofit:
 - \$10,000 per home
 - Saves 5,000 kWh/yr
 - Saves 100 therms/yr





It's All About the Financing

- ❖ Low hanging fruit
 - \$13 billion
 - 7.2 year payback
- ❖ Big intervention
 - \$88 billion
 - 12 year payback





Other Benefits

- ❖ Thousands of new jobs
- ❖ Billions of dollars in annual savings to the public
- ❖ Large multiplier impact to Florida economy
- ❖ Improved Homes! Lower operating cost, better durability, safety and IAQ!
- ❖ Genuine national leadership





Energy and Economic Development

We must:

- ❖ Improve energy efficiency in existing homes (8.5 million) by more than 30% (about two-thirds of all buildings that will be in use in 2050 are already built.)
- ❖ New Homes 45% more efficient by 2018. All with PV and Solar Thermal
- ❖ Government provides \$0.75 per kWh/yr saved
- ❖ 2% PV and 2% Solar Thermal RPS 2020; Public Benefit Fund provides 50% cost
- ❖ Fund FSEC to measure and verify energy efficiency, and solar energy production!



Action Plan – Step One

- ❖ Make aggressive renewable energy and energy efficiency market development Florida's 1st energy priority.

STATE IS WORKING ON IT



Action Plan – Step Two

- ❖ Make advanced photovoltaic research and development a Florida priority.
- ❖ The R&D challenges facing PV technologies are to
 - Dramatically increase cell efficiency
 - Reduce the cost/watt
 - Increase manufacturing capacity.

MAJOR TASK OF UCF'S FESC



Action Plan – Step Three

- ❖ Significantly enhance Florida's renewable energy and energy efficiency research, education, job training, certification and demonstration capacity **MAJOR TASK OF UCF'S FESC**
- ❖ This enhanced capacity would require additional space of approximately 50,000 ft² at an estimated cost of about \$20 million. **NEED YOUR HELP**



FSEC Review (OPPAGA)

Requested by Florida Legislative Office of Program Policy Analysis and Government Accountability on July 31, 2008.

Provided summary letter (Aug 14, 2008) to the 13 requests

Provided 52 Attachments



FSEC External Review Team

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External Review Questions

1. How well does FSEC meet its mission and the execution of its strategic plan?
2. How well does FSEC's goals and programs align with and advance the overall goals of UCF and the state of Florida?
3. How effectively does FSEC meet the needs of its industries?
4. What obstacles hinder the growth and advancement of the center?
5. How well does FSEC meet the needs of its faculty and students?
6. How does FSEC effectively collaborate with other departments and colleges at UCF and at other Universities to take advantage of multi-disciplinary and multi-university opportunities?
7. Because FSEC serves a role in the state and metropolitan region, please evaluate the effectiveness of this role and make suggestions for improvement if appropriate.
8. Evaluate and comment on the financial productivity, return on Investment, and viability of the center.
9. Evaluate the research and comment on missed opportunities or suggestions for improvement, if appropriate.