The Florida Senate

COMMITTEE MEETING EXPANDED AGENDA

COMMUNICATIONS, ENERGY, AND PUBLIC UTILITIES
Senator Benacquisto, Chair
Senator Smith, Vice Chair

MEETING DATE: Tuesday, January 11, 2011
TIME: 8:30 —10:30 a.m.
PLACE: 301 Senate Office Building

MEMBERS: Senator Benacquisto, Chair; Senator Smith, Vice Chair; Senators Altman, Bogdanoff, Diaz de la Portilla, Evers, Fasano, Flores, Joyner, Lynn, Margolis, Negron, and Sachs

TAB	BILL NO. and INTRODUCER	BILL DESCRIPTION and SENATE COMMITTEE ACTIONS	COMMITTEE ACTION
		Presentation by Dave Mooney, Center Director, Electricity, Resources, and Building Systems Integration, National Renewable Energy Laboratory, United States Department of Energy .	
		Presentation by R. Eli Schoen, Manager, Kennedy Space Center Energy .	
		Presentation by James Fenton, Director, Florida Solar Energy Center, University of Central Florida .	
		Presentation by Dave Cartes, Director, Institute for Energy Systems, Economics and Sustainability, Florida State University .	
		Presentation by Elias "Lee" Stefanakos, Director, Center for Clean Energy Research Center, University of South Florida .	

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Innovation for Our Energy Future

Renewable Energy Development in Florida

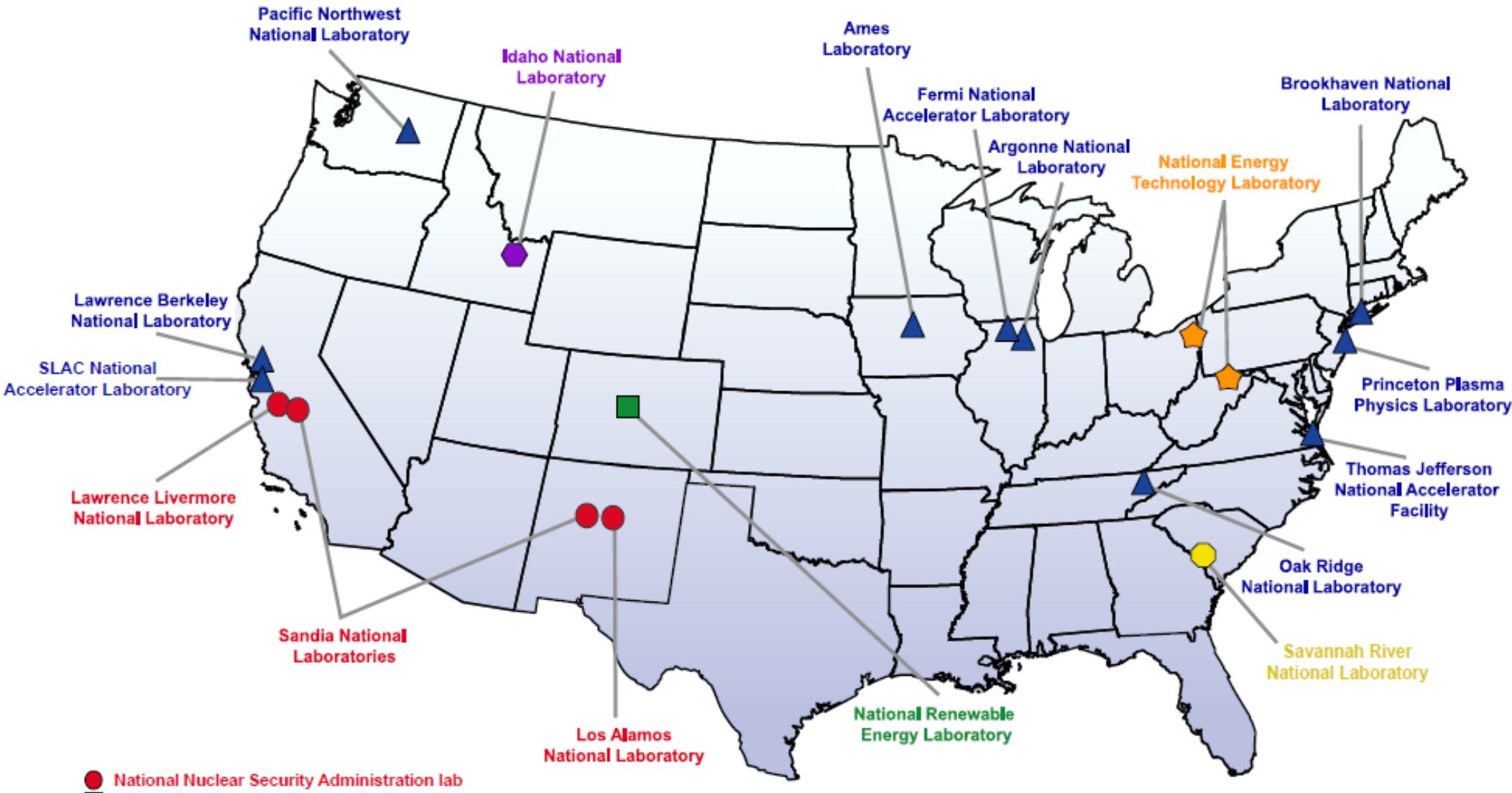
Desoto Next Generation Energy Center – 25 MW

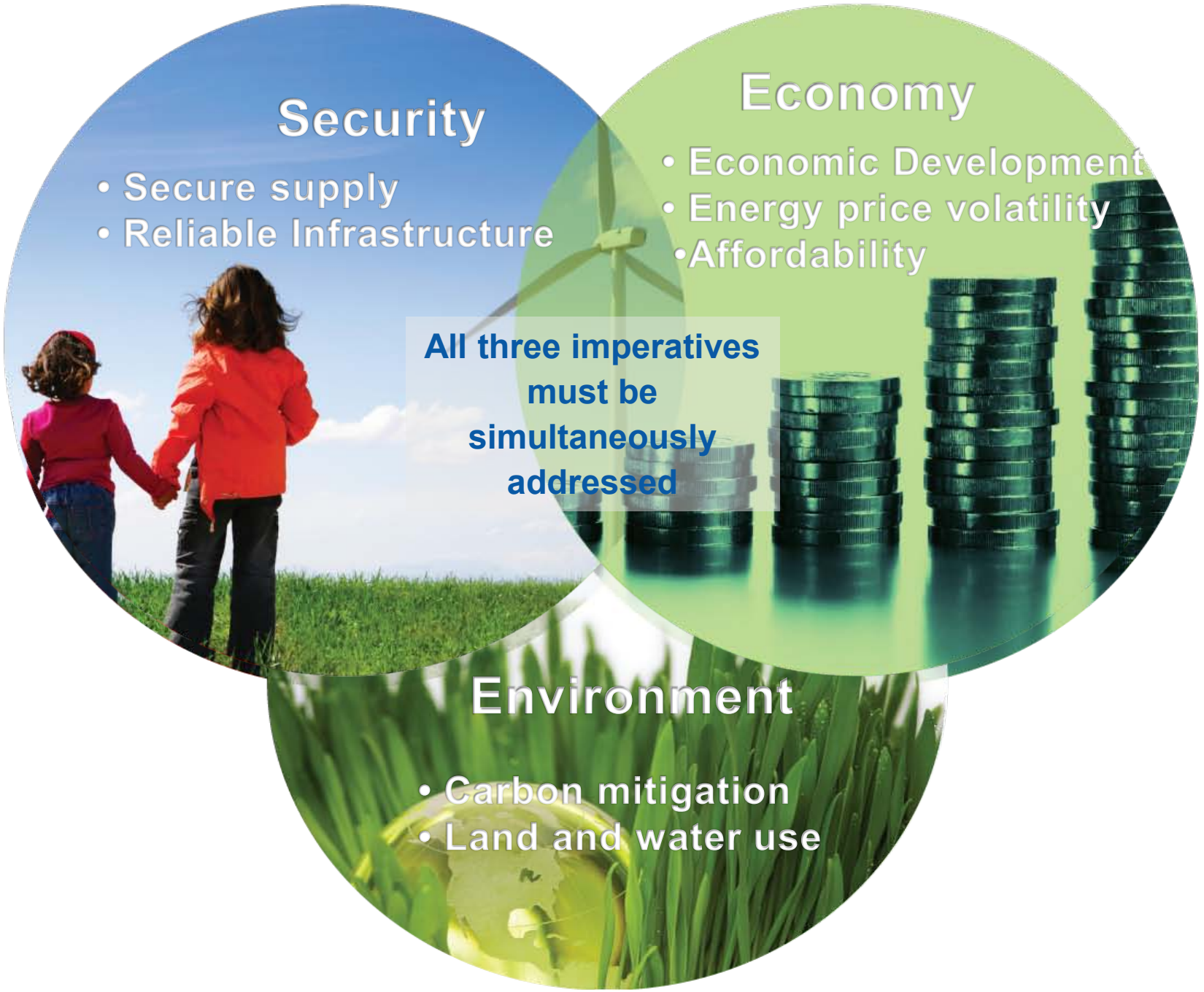
David Mooney, PhD

Director

Electricity, Resources, and Building Systems Integration Center

Department of Energy National Laboratories




Security
• Secure supply
• Reliable Infrastructure
Economy
• Economic Development
• Energy price volatility
•Affordability
All three imperatives must be simultaneously addressed
Environment
• Carbon mitigation
• Land and water use

Key Messages

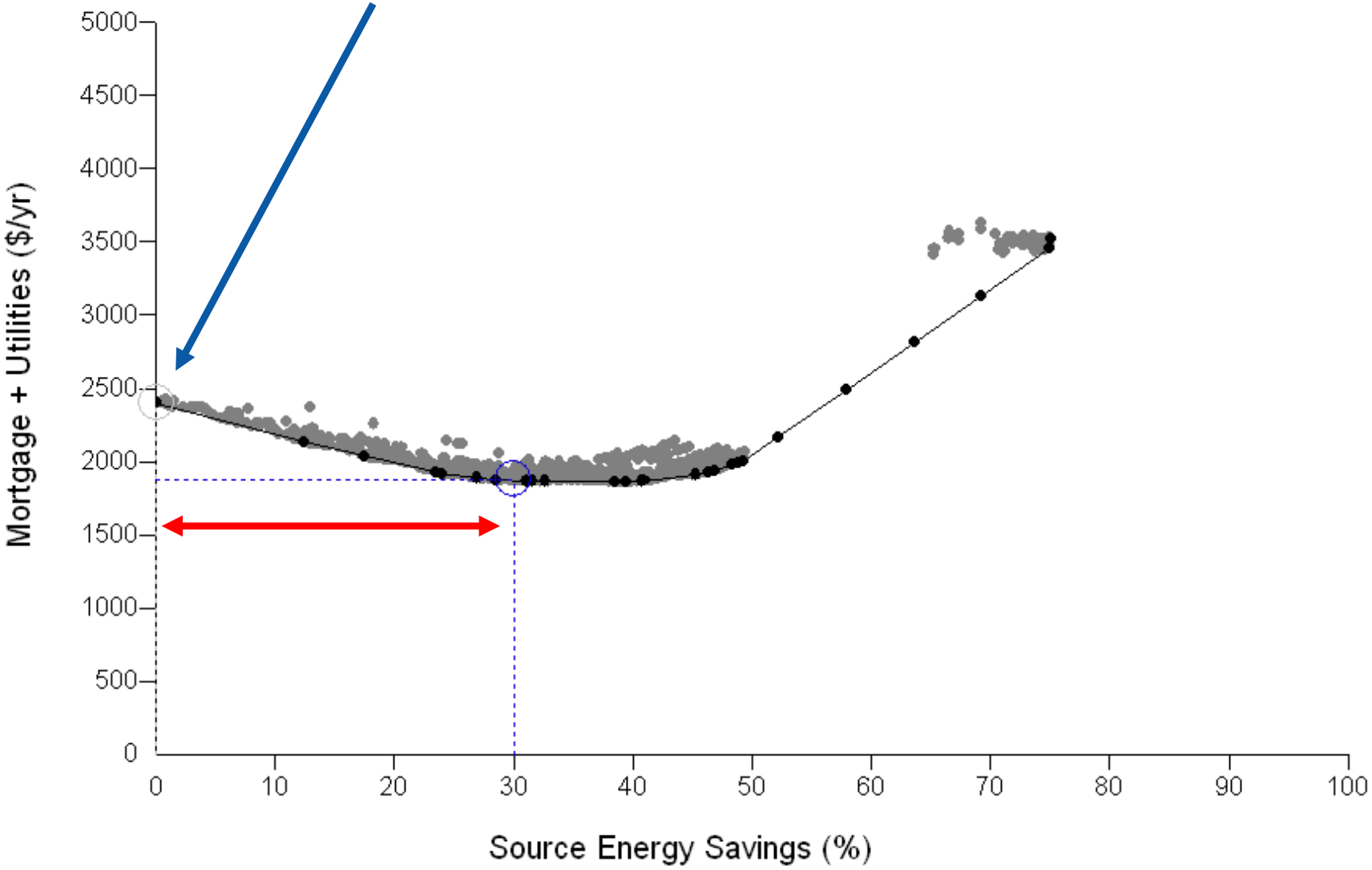
- Florida is rich in natural, renewable resources
- There are considerable economic, energy-security, and environmental benefits to efficiency and renewable technology deployment
- There are significant, but solvable challenges ahead in transforming our nation's energy infrastructure

Abundant Resources

- Efficiency
- Solar
- Wind
- Biomass
- Ocean

Efficiency Opportunities are Significant

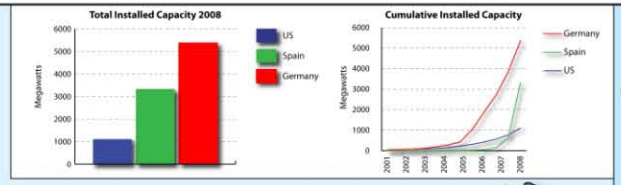
Current Energy Codes Do Not Achieve Minimum Cost



(2000 ft2, 2-story, 16% window to floor area ratio), unconditioned basement

Photovoltaic Solar Resource

The United States of America, Spain and Germany



Mainland USA

Spain

Germany

Hawaii (USA)

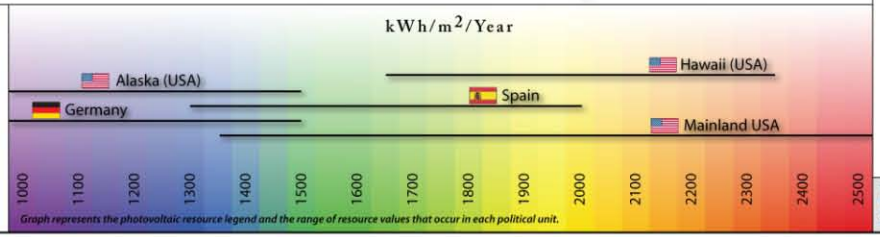
Alaska (USA)

- Annual average solar resource data are for a solar collector oriented toward the south at a tilt = local latitude.
- The data for Hawaii and the 48 contiguous states are derived from a model developed at SUNY/Albany using geostationary weather satellite data for the period 1998-2005.
- The data for Alaska are derived from a 40-km satellite and surface cloud cover database for the period 1985-1991 (NREL, 2003).
- The data for Germany and Spain were acquired from the Joint Research Centre of the European Commission and is the yearly sum of global irradiation on an optimally-inclined surface for the period 1981-1990.
- States and countries are shown to scale, except Alaska.

2008 Cumulative Capacity (MW) as Percent of World Total

2008 Cumulative Capacity (MW) as Percent of World Total

2008 Cumulative Capacity (MW) as Percent of World Total

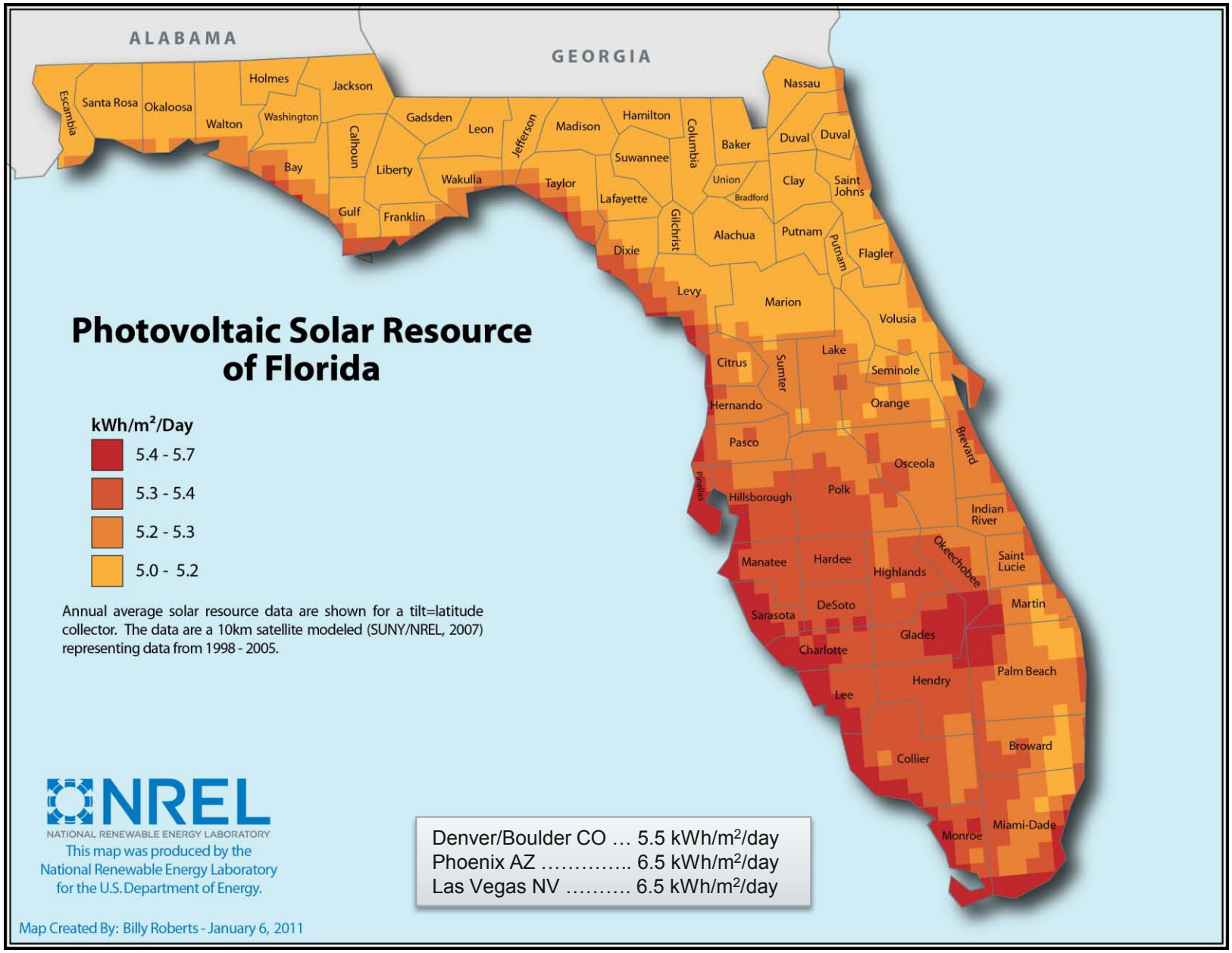


Graph represents the photovoltaic resource legend and the range of resource values that occur in each political unit.

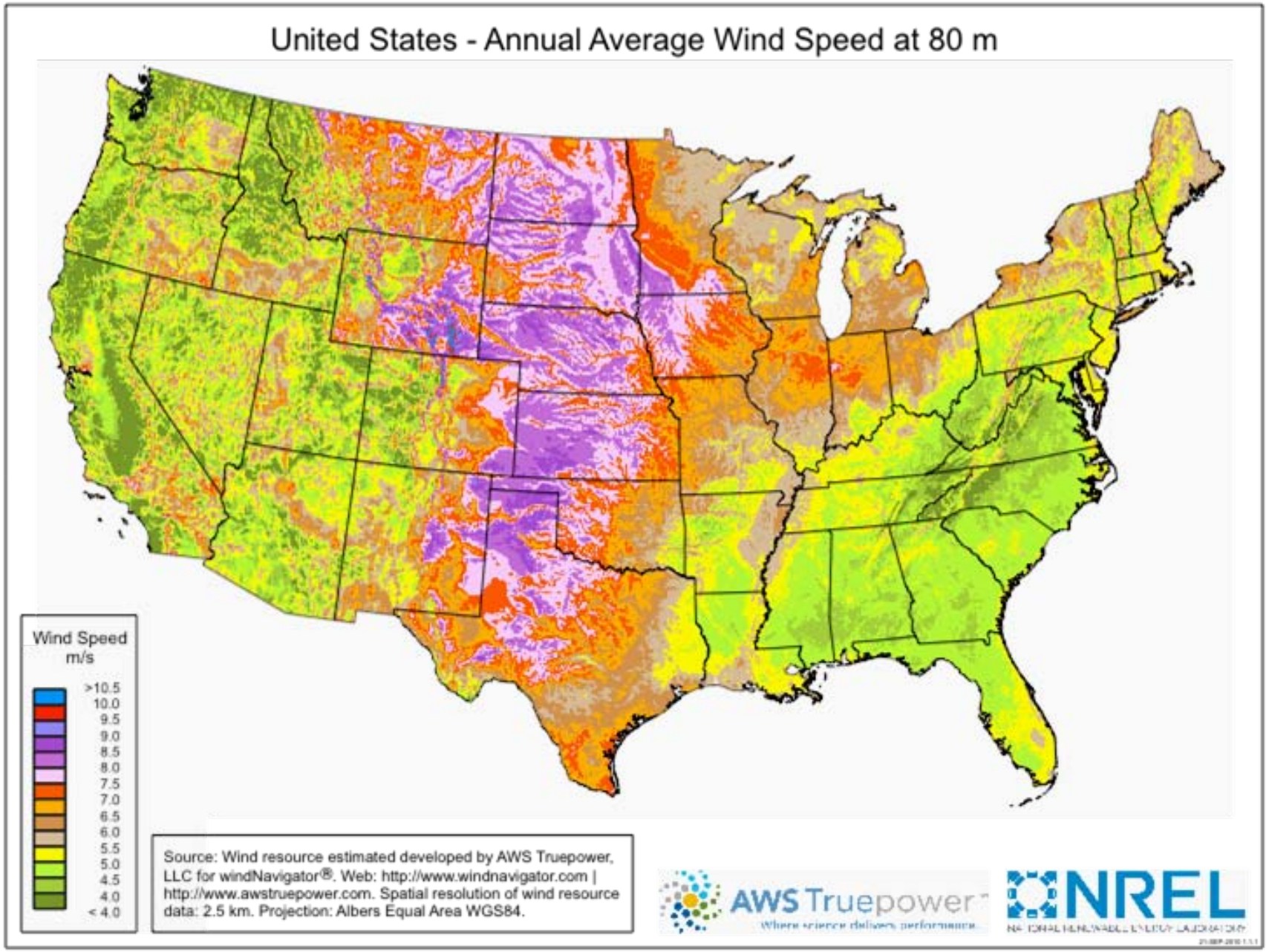
This map was produced by the National Renewable Energy Laboratory for the United States Department of Energy.
Author: Billy J. Roberts
Date: November 23, 2009

NREL www.nrel.gov/gis

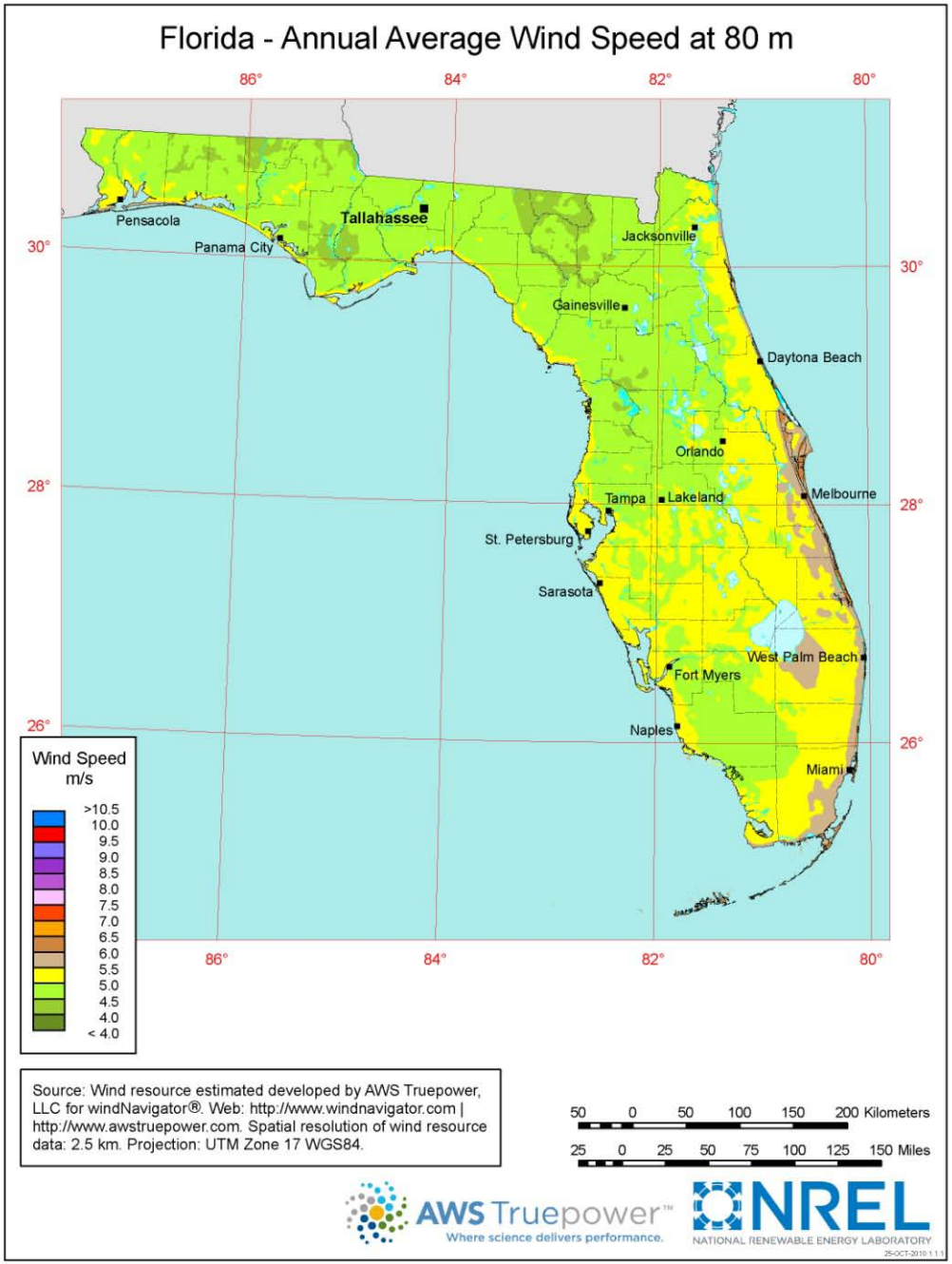
Annual PV and DHW Solar Resources



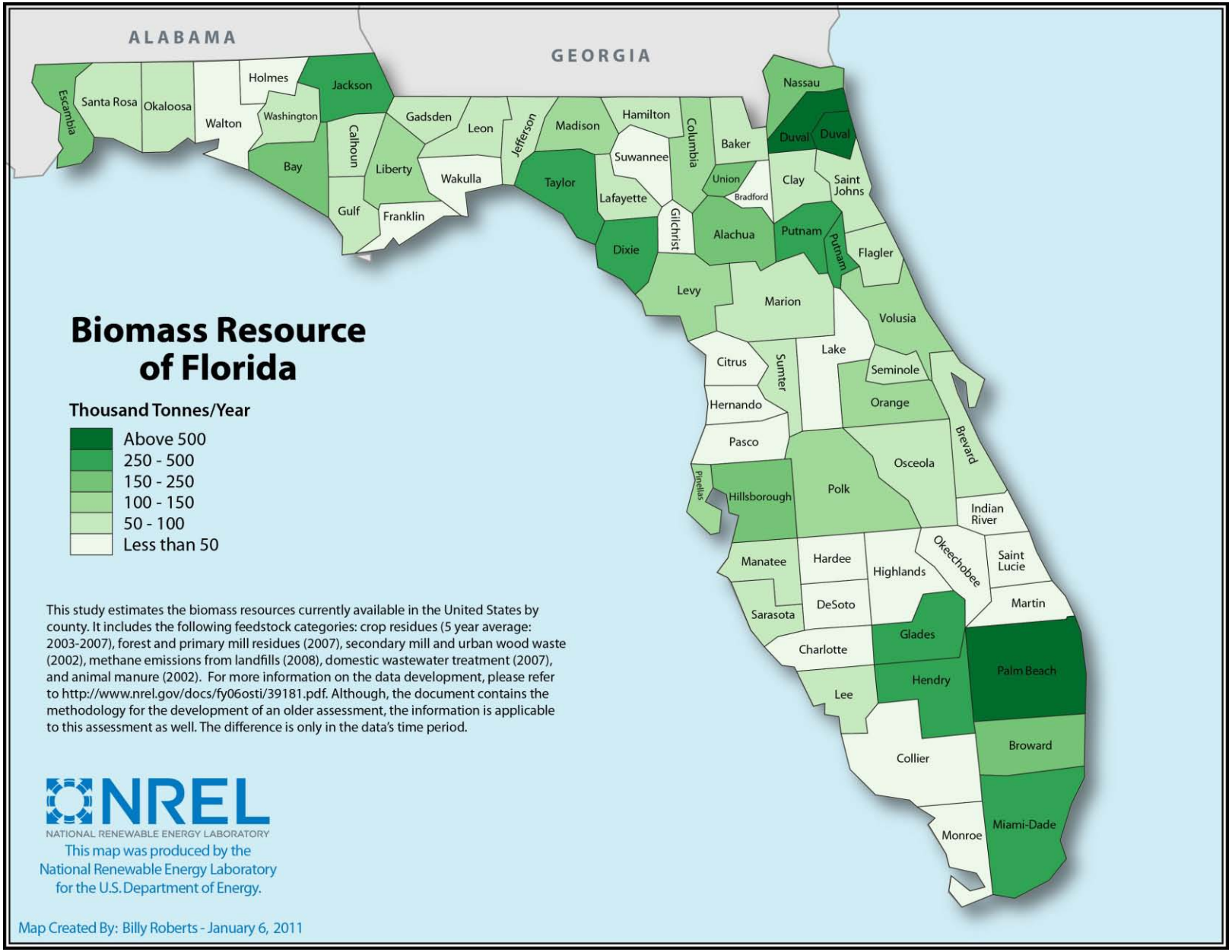
Average Annual Wind Speed



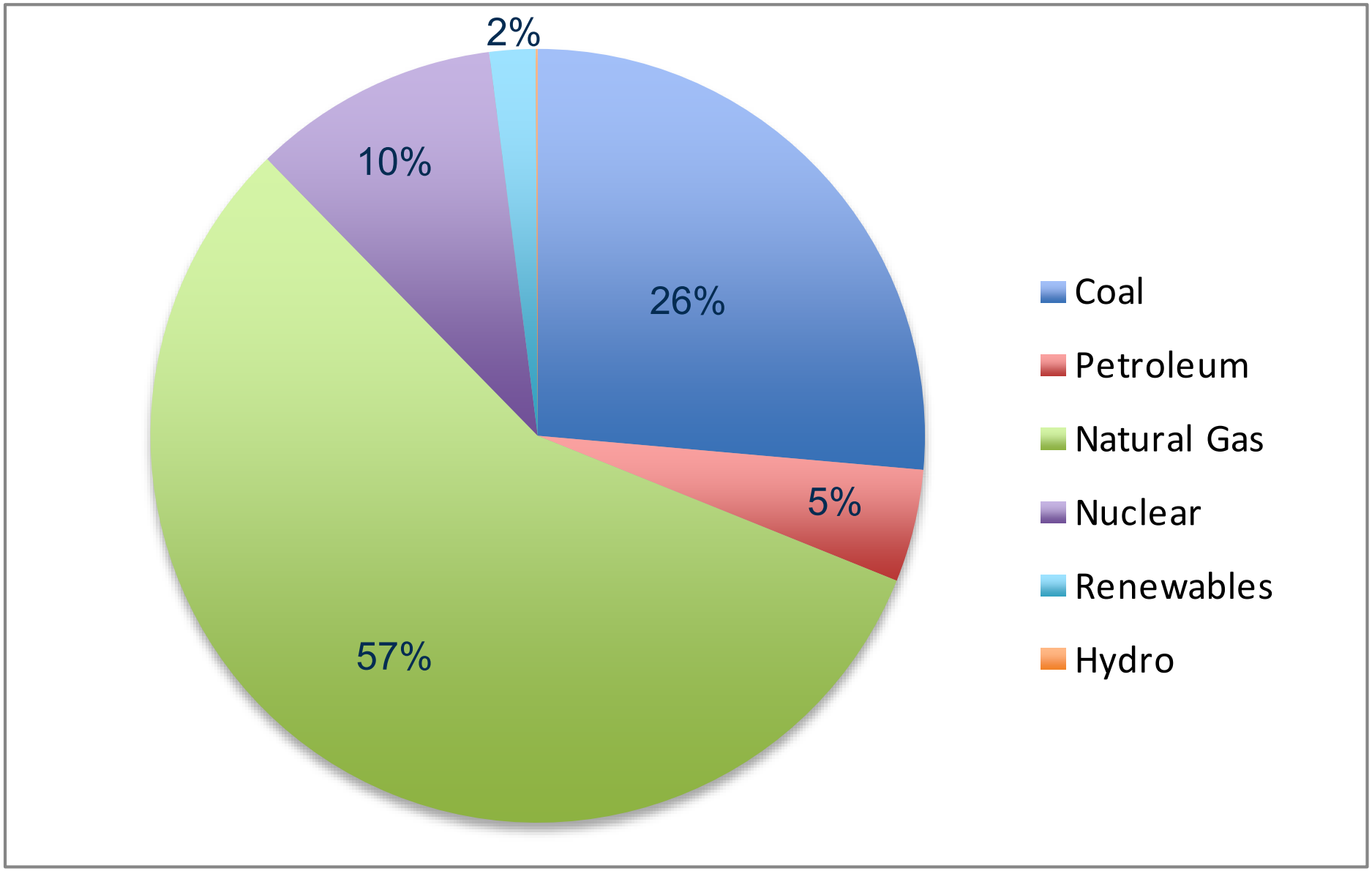
Average Annual Wind Speed



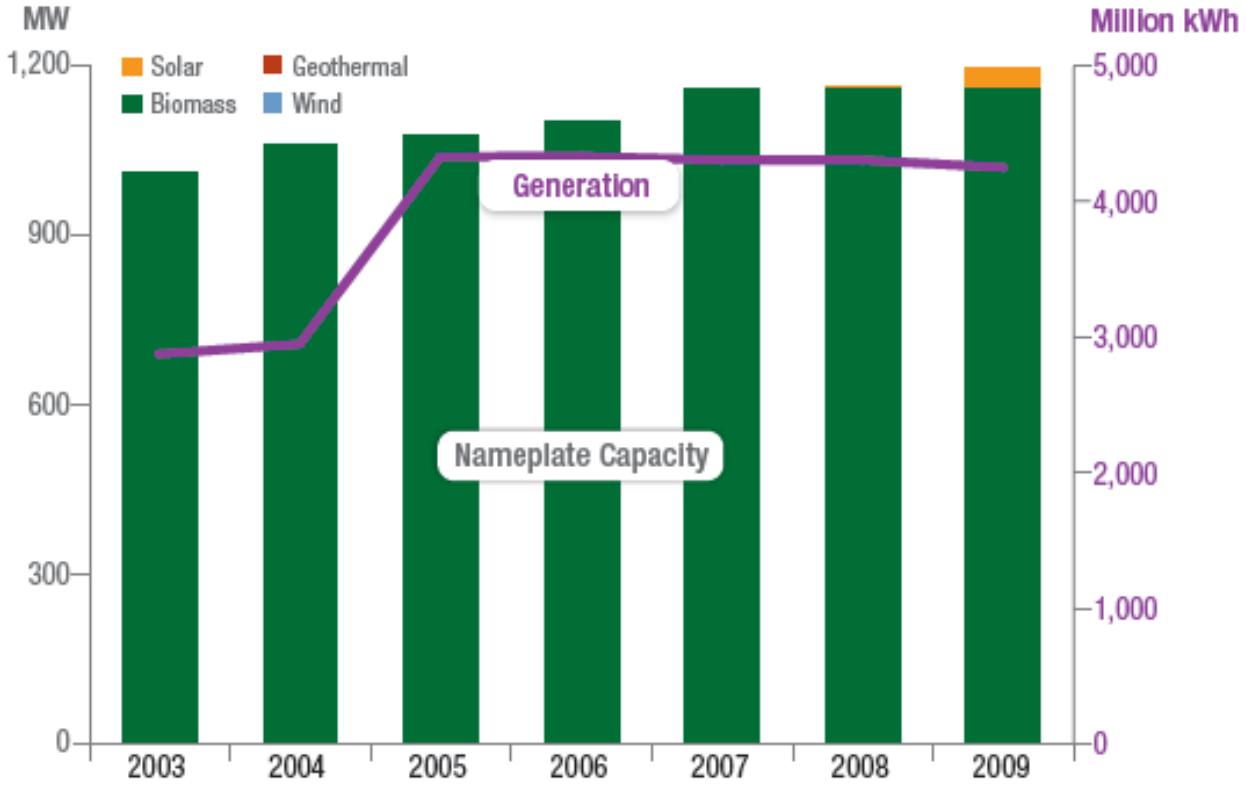
Total Biomass Resources



Existing Florida Generation Mix



But, there are Signs of Change

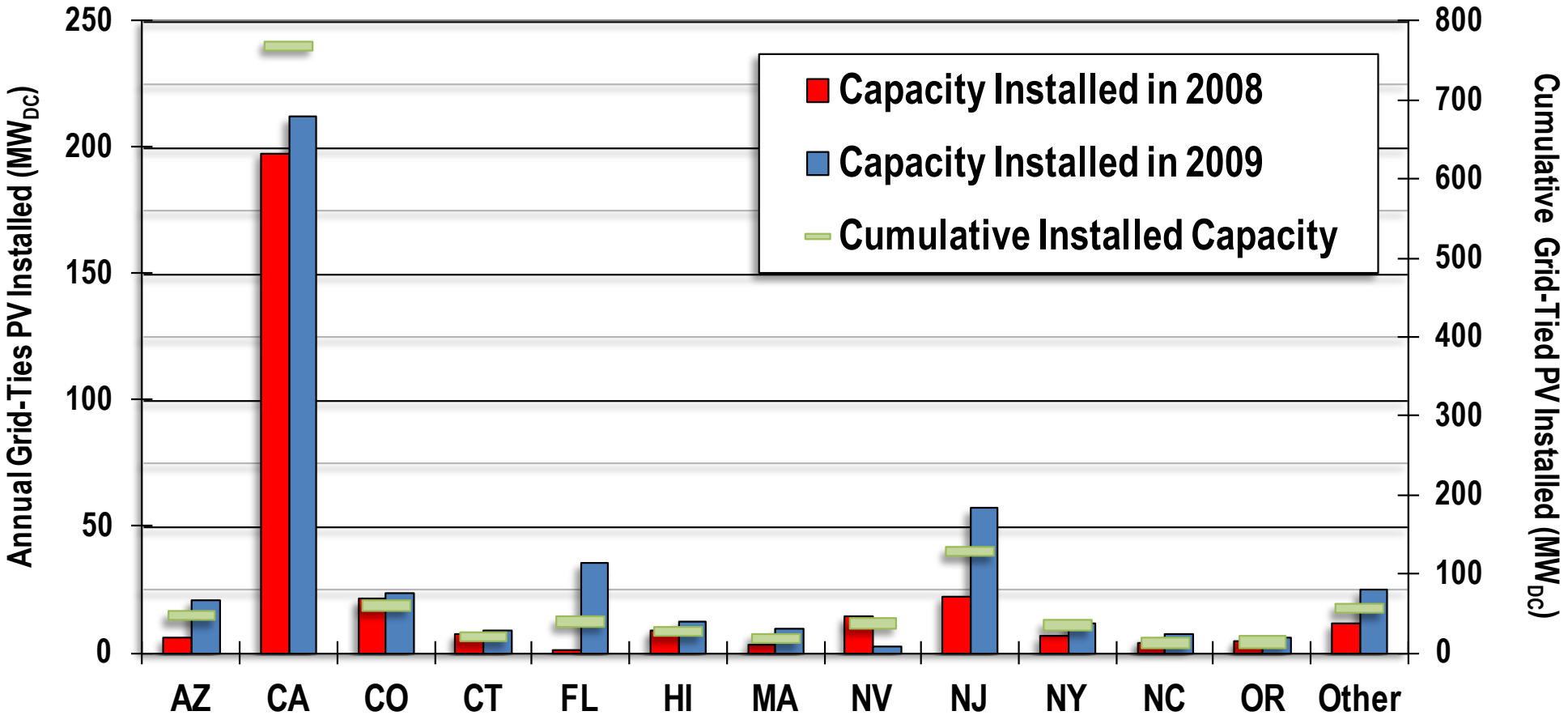


	Total Nameplate Capacity (MW)				Total Generation (Million kWh)
	Biomass	Geothermal	Wind	Solar	
2003	1,012	0	0	0	2,873
2004	1,059	0	0	0	2,946
2005	1,075	0	0	0	4,327
2006	1,100	0	0	0	4,331
2007	1,158	0	0	0	4,303
2008	1,158	0	0	3	4,303
2009	1,158	0	0	39	4,248

Sources: EIA, AWEA, SEIA, GEA, Larry Sherwood/IREC

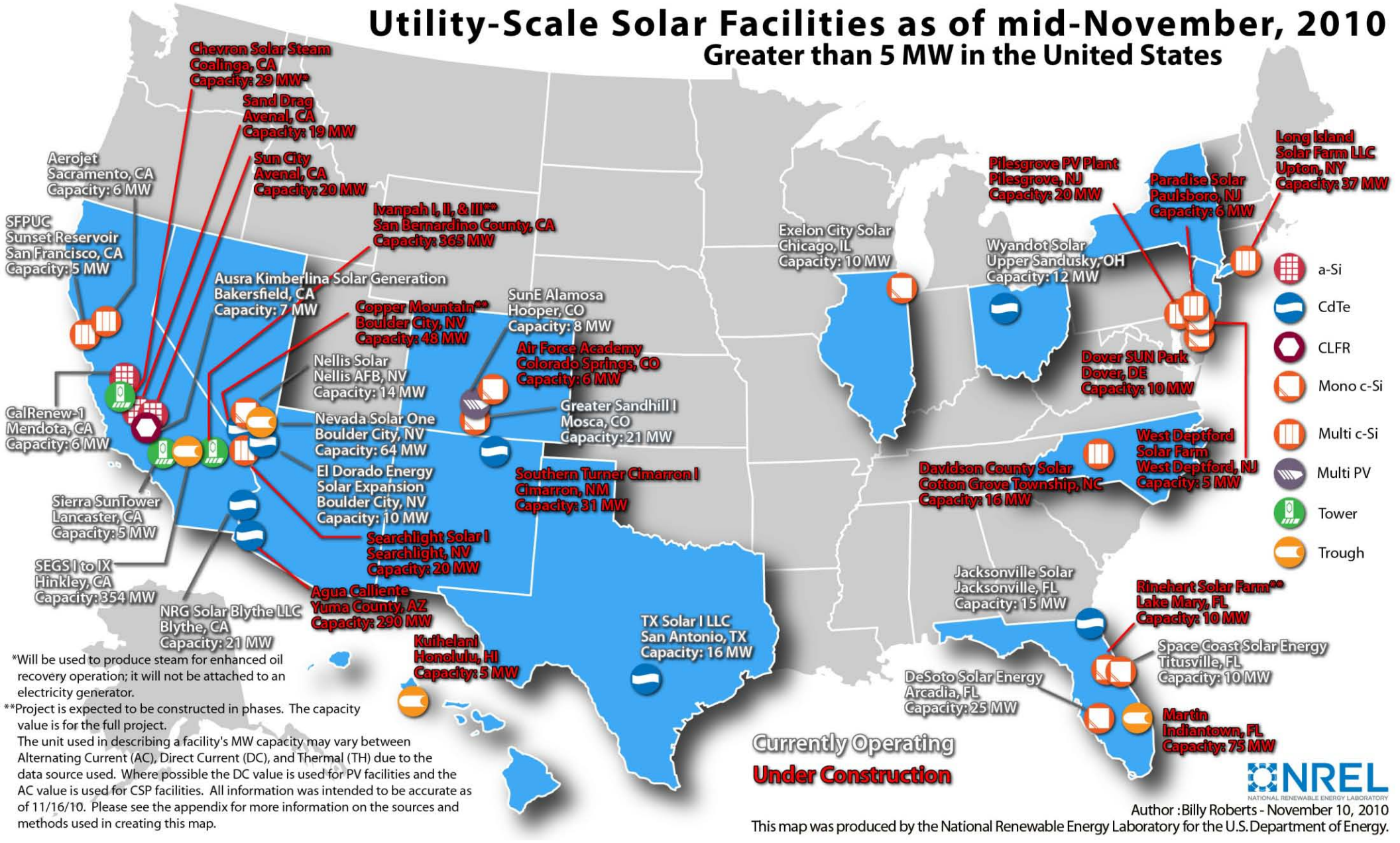
Florida Solar PV Market Trends

While several states have shown significant growth in installations between 2008 and 2009, Florida's nearly 39,000% annual increase is particularly notable

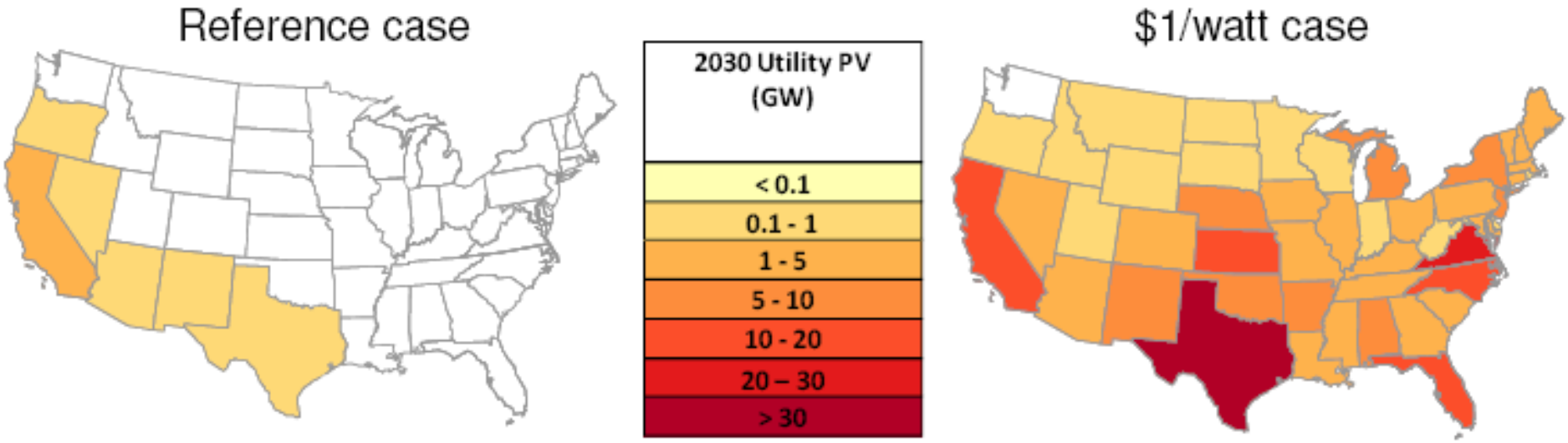


•**Source:** IREC (7/10)

U.S. Utility-Scale Solar Facilities



Potential Impact of PV at $1/W – A Scenario



NREL: At $1/watt, PV would be 14% of U.S. electricity by 2030, with minimal need for storage or additional transmission

*14% of total annual energy.
With capacity factor of PV between 15-20% means that capacity penetrations could be 70%+ during daytime

Economic Benefits

Top 5 Sectors for Clean-Tech Job Activity (U.S.)

Rank	Sectors
1	Solar Power
2	Biofuels & Biomaterials
3	Smart Grid & Energy Efficiency
4	Wind Power
5	Advanced Transportation/Vehicles

Source: Clean Edge, Inc., 2010

**Sector rankings are based on Clean Edge research of job placements, job postings, and public and private investments*

Sector	Global Employment
PV	300,000
Wind	500,000
Total RE	3,000,000+

Top 10 Clean-Tech Employers (Publicly Traded Pure Plays)

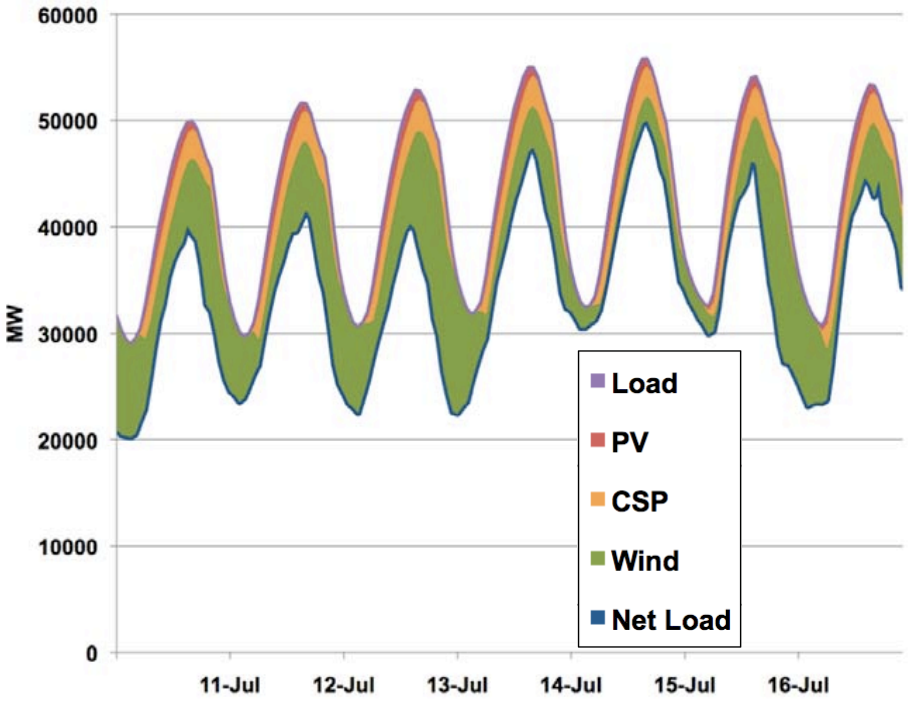
Rank	Company	Headquarters	Sector/Activity	Employees
1	Vestas Wind Systems	Randers, Denmark	Wind	20,730
2	LDK Solar	Xinyu, China	Solar	13,464
3	Suntech Power Holdings	Wuxi, China	Solar	12,548
4	Itron	Liberty Lake, WA	Smart Grid	9,000
5	China BAK Battery	Shenzhen, China	Energy Storage	8,200
6	Trina Solar	Changzhou, China	Solar	7,891
7	Baldor Electric Company	Fort Smith, AR	Electric Motors	7,250
8	Gamesa Corpora-cion Tecnologica	Vitoria, Spain	Wind	6,721
9	Neo-Neon Holdings	Hong Kong	LED Lighting	6,505
10	Yingli Green Energy	Baoding, China	Solar	5,813

Source: Clean Edge, Inc., 2010

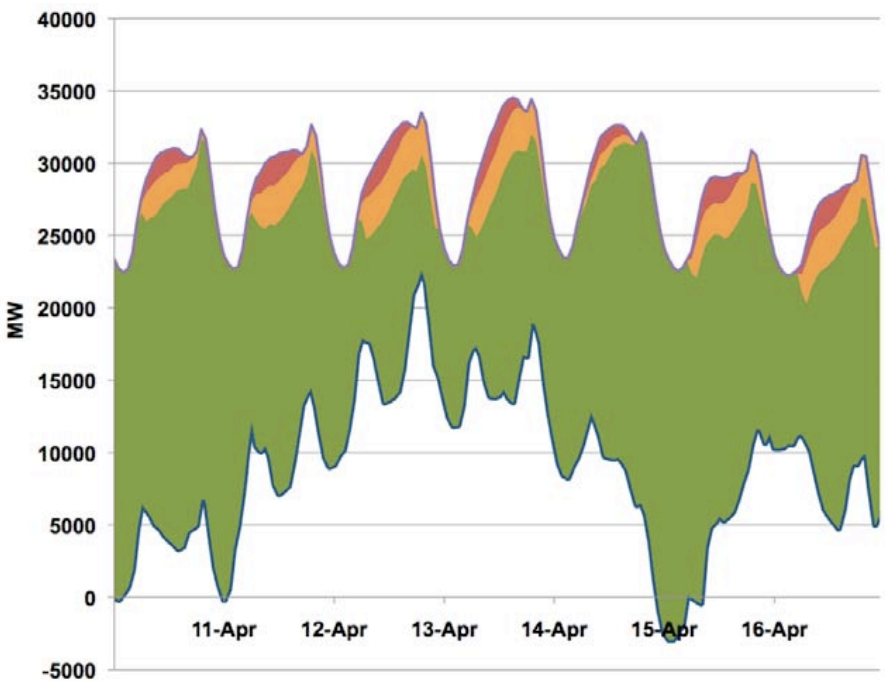
Based on companies' reported claims and publicly available Q2 2010 financial filings/most recent annual reports

Challenges - How does the Western Interconnection Operate with 35% Wind and Solar?

Mid-July



Mid-April

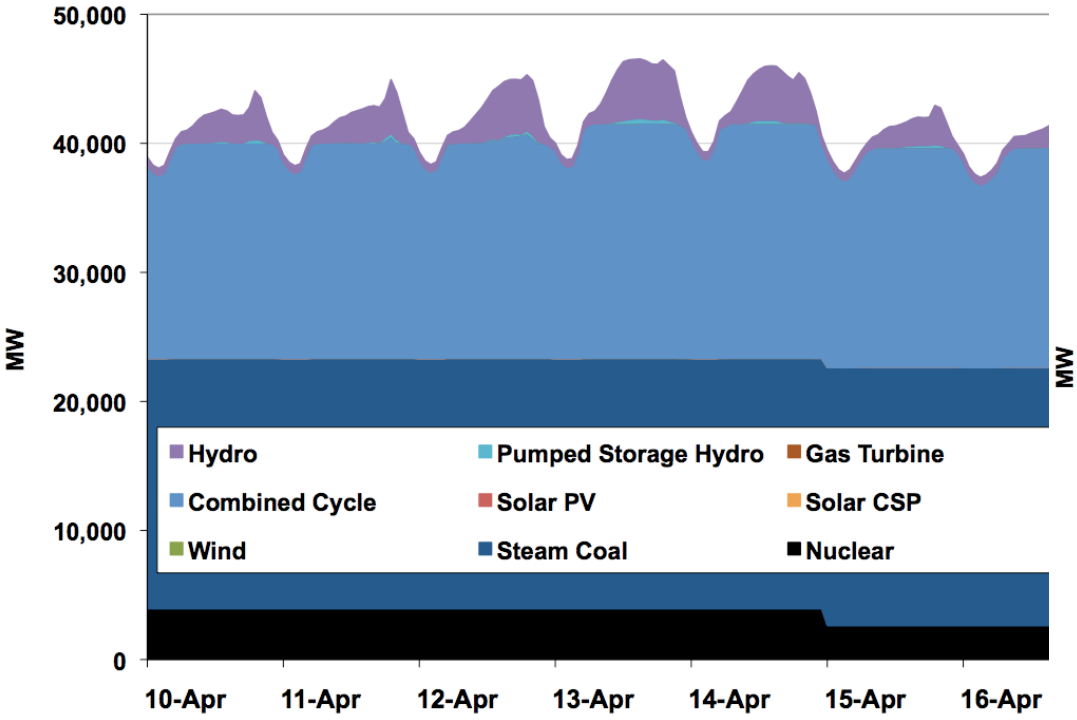


Mid-April shows the challenges of operating the grid with 35% wind and solar.

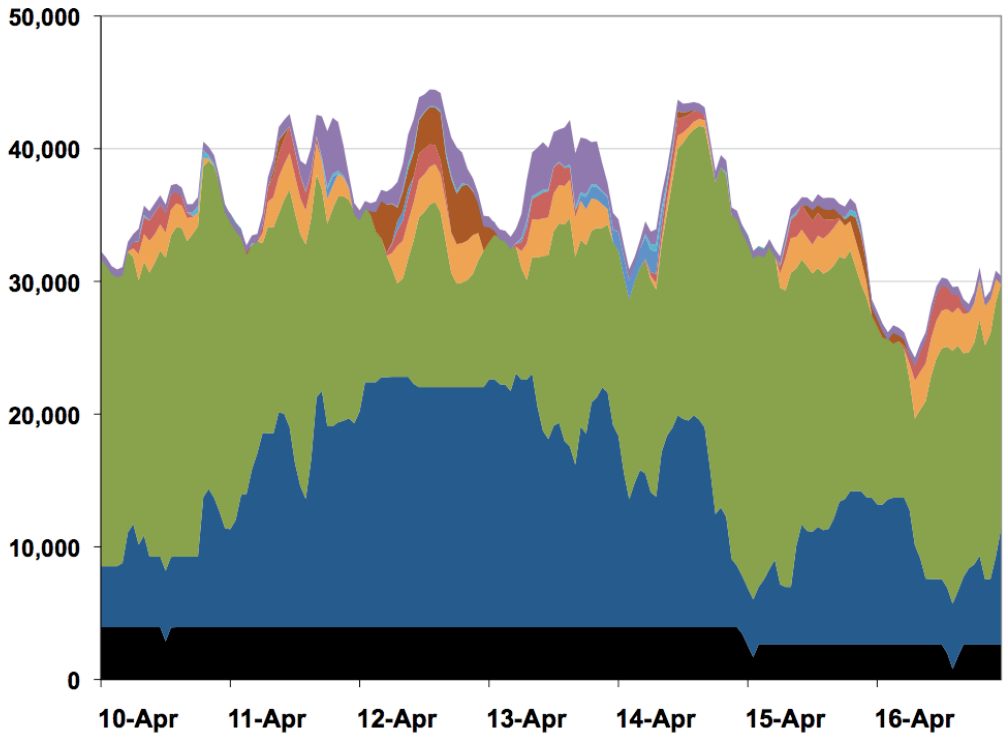
This was the worst week of the 3 years studied.

Western Interconnection Operations during mid-April

No Wind/Solar



35% Wind/Solar



Modeled Economic Generation Dispatch “Stacks”

Florida Senate Committee Meeting
Energy and Sustainability at NASA Kennedy Space Center

Presented to:

Chairwoman Benacquisto, Vice Chairman Smith, and members of the Committee on Communications, Energy, and Public Utilities

By:

Eli Schoen, KSC Energy Manager

January 11, 2011

Energy and Sustainability at KSC

- Agenda
  - KSC Background
    - Who we are…and what we do
  - KSC Projects
    - Commitment to sustainability and renewable energy
  - Address questions

Energy and Sustainability at KSC

- Kennedy Space Center Mission Statement

KSC safely manages, develops, integrates, and sustains space systems through partnerships that enable innovative, diverse access to space and inspires the Nation's future explorers.

Energy and Sustainability at KSC

- Facility Infrastructure and Land
  - National Wildlife Refuge
  - 34 miles long; 5-10 miles wide
  - Over 138,000 acres
  - Land management is a joint effort with US Fish & Wildlife Services and the National Park Service
  - Manage over 7 million SF
  - Infrastructure:
    - Office Space
    - Vehicle Processing
    - Horizontal Launch
    - Vertical Launch
    - Life Safety…and more!

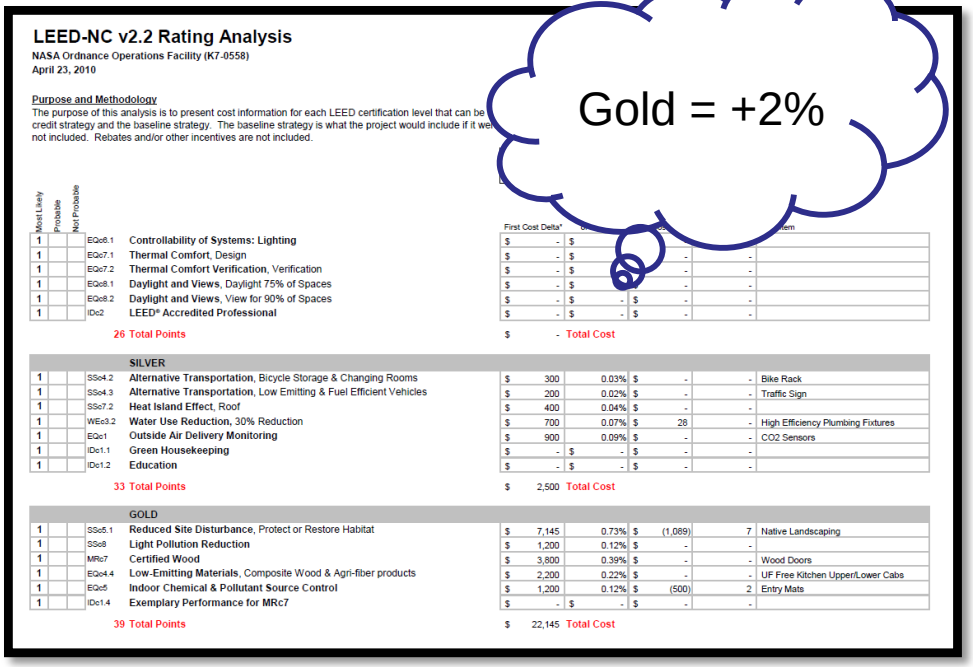
Energy and Sustainability at KSC

- Overview of Energy Accounts
  - Portfolio is 75% electricity and 25% natural gas
  - In FY-2010 KSC spent $22.8 million on energy
    - Electricity provided by Florida Power & Light Company (FP&L)
    - Natural gas provided by Atlanta Gas Light (AGL)
- Legislative Energy and Sustainability Goals
  - Per the Energy Independence & Security Act of 2007 (EISA)

Topic	Requirement
Energy Intensity	Reduce Btu/gsf 3% annually from FY 2003 baseline for FY 2006-2015 (30%)
Water Intensity	Reduce gal/gsf 2% annually from FY 2007 baseline for FY 2008-2020 (26%)
Renewable Energy	Increase percentage of total electricity from renewable sources 3% FY 2007-2009, 5% FY 2010-2012 and 7.5% FY 2013+
Facility Audits	Complete comprehensive evaluations (audits) for 25% of facilities each year

Energy and Sustainability at KSC

- Committed to US Green Building Council's Leadership in Energy and Environmental Design (LEED)
  - All facility projects will achieve at minimum a LEED Silver rating
  - Projects document cost of LEED to ensure good investment
  - Tools such as Building Information Modeling (BIM) are used to optimize performance and reduce error during construction



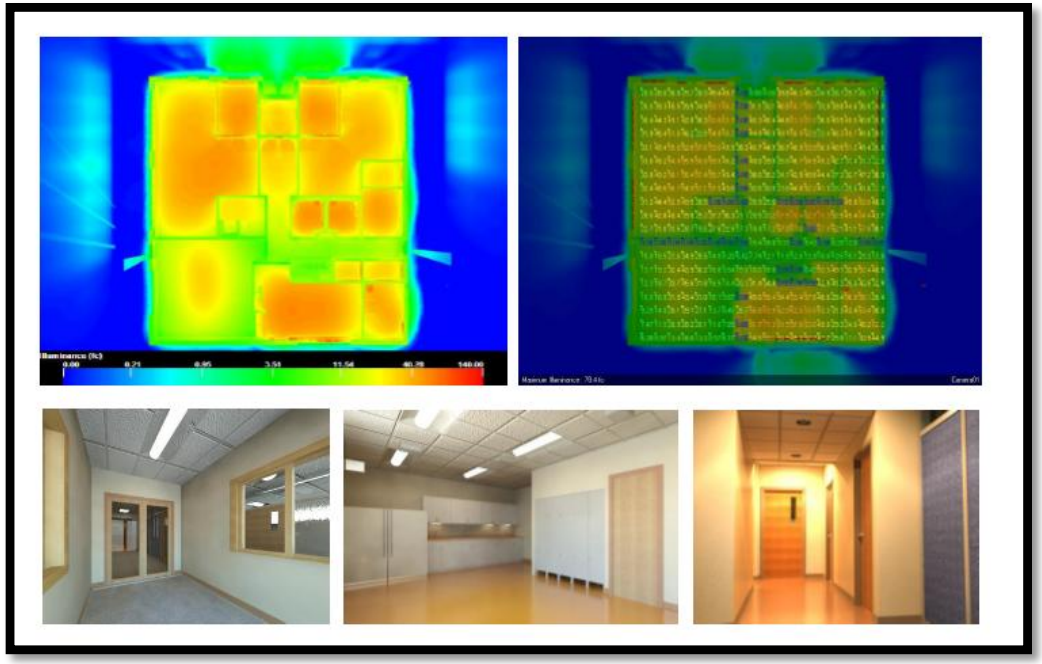
LEED-NC v2.2 Rating Analysis

NASA Ordnance Operations Facility (K7-0558)
April 23, 2010

Purpose and Methodology
The purpose of this analysis is to present cost information for each LEED certification level that can be credit strategy and the baseline strategy. The baseline strategy is what the project would include if it we not included. Rebates and/or other incentives are not included.

Gold = +2%

Most Likely	Probable	Not Probable			First Cost Delta*				Item
1			EQc6.1	**Controllability of Systems: Lighting**	$ -	$	-	-	
1			EQc7.1	**Thermal Comfort**, Design	$ -	$	-	-	
1			EQc7.2	**Thermal Comfort Verification**, Verification	$ -	$	-	-	
1			EQc8.1	**Daylight and Views**, Daylight 75% of Spaces	$ -	$	-	-	
1			EQc8.2	**Daylight and Views**, View for 90% of Spaces	$ -	$ -	$ -	-	
1			IDc2	**LEED® Accredited Professional**	$ -	$ -	$ -	-	
			26	Total Points	$ -	Total Cost			
				SILVER					
1			SSc4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	$ 300	0.03%	$ -	-	Bike Rack
1			SSc4.3	**Alternative Transportation**, Low Emitting & Fuel Efficient Vehicles	$ 200	0.02%	$ -	-	Traffic Sign
1			SSc7.2	**Heat Island Effect**, Roof	$ 400	0.04%	$ -	-	
1			WEc3.2	**Water Use Reduction**, 30% Reduction	$ 700	0.07%	$ 28	-	High Efficiency Plumbing Fixtures
1			EQc1	**Outside Air Delivery Monitoring**	$ 900	0.09%	$ -	-	CO2 Sensors
1			IDc1.1	**Green Housekeeping**	$ -	$ -	$ -	-	
1			IDc1.2	**Education**	$ -	$ -	$ -	-	
			33	Total Points	$ 2,500	Total Cost			
				GOLD					
1			SSc5.1	**Reduced Site Disturbance**, Protect or Restore Habitat	$ 7,145	0.73%	$ (1,089)	7	Native Landscaping
1			SSc8	**Light Pollution Reduction**	$ 1,200	0.12%	$ -	-	
1			MRc7	**Certified Wood**	$ 3,800	0.39%	$ -	-	Wood Doors
1			EQc4.4	**Low-Emitting Materials**, Composite Wood & Agri-fiber products	$ 2,200	0.22%	$ -	-	UF Free Kitchen Upper/Lower Cabs
1			EQc5	**Indoor Chemical & Pollutant Source Control**	$ 1,200	0.12%	$ (500)	2	Entry Mats
1			IDc1.4	**Exemplary Performance for MRc7**	$ -	$ -	$ -	-	
			39	Total Points	$ 22,145	Total Cost			



Energy and Sustainability at KSC

- NASA's first LEED Platinum net-zero facility
  - 11,000 SF facility is adjacent to the Vehicle Assembly Building
  - Project is one of very few LEED Platinum facilities in Florida
  - Creative reuse of Launch Control Center windows and reclaimed concrete waste from previous demolition sites
  - Innovative rainwater harvesting that supplies restroom fixtures
  - Integrated 80 kW solar photovoltaic roof system – "off the grid"

Energy and Sustainability at KSC

- Enhanced Use Lease (EUL) agreement with FP&L
  - In exchange for the use of KSC land, FP&L built and will maintain a 1-MW solar photovoltaic facility to benefit KSC
  - On KSC land, FP&L constructed a 10-MW solar photovoltaic facility to benefit their customers
  - Provides 18,000 MWh electricity avoiding 12,000 tons CO2e
  - Phase 2 is awaiting Florida Public Service Commission approval of FP&L request to extend 110 MW solar power agreement

Energy and Sustainability at KSC

- What are the existing renewable energy resources available in Florida?
  - Solar will always have good potential
    - Current market promotes large scale land based
    - Improved technology will promote building integrated
    - KSC has experienced reduced costs from $6.50-$5.00/watt
  - Wind has potential, but with current barriers
    - On-shore Florida winds are not consistent enough for traditional technology while off-shore infrastructure is currently too expensive
    - Large horizontal wind structures pose threat to flying species
    - KSC will investigate vertical wind structures
  - Geothermal has new potential with increased technology
    - Traditional geothermal has been limited due to local climate
    - Recent project will install a refrigerant based geothermal unit manufactured by Florida company (Earthlinked out of Lakeland)

Energy and Sustainability at KSC

- What are the benefits provided and challenges presented for the renewable energy resources in Florida?
  - Primary benefits include reduced greenhouse gas emissions as well as reduced reliance upon fossil fuels
  - Secondary benefits include opportunity for investment and research of opportunities with renewable energy technologies
    - KSC has experienced a 7.8% utility inflation over past 10 years providing opportunity for long term return on investment
  - Primary challenges include risks with return on investment and limited experience with maintenance
    - Long term investment relies upon utility inflation with risk of maintenance and natural disaster
  - Secondary challenges include energy security and reliability
    - Current installations do not qualify for emergency backup considering the inconsistencies of renewable energy
    - Reliability would require costly storage

Energy and Sustainability at KSC

- What are the cost drivers for renewable energy resources in Florida?
  - Small scale installations rely on incentives to provide return
  - Large scale installations rely on approved medium for investment
    - Florida Public Service Commission will need to approve
- What are the short and long term economic viability for each category of renewable energy?
  - Short term will rely on incentives to provide return
  - Long term opportunities are positive with specific interest in solar and geothermal (without incentives)
    - Solar photovoltaic projects are providing a 20-30 year payback
    - Solar thermal installations are providing a 10-15 year payback
    - Geothermal projects are expected to provide a 10-15 year payback

Energy and Sustainability at KSC

- What are some of the emerging technologies for Renewable energy (i.e., biogas, algae, synfuels, etc.) that we should explore in Florida?
  - Investigate…
    - Biomass opportunities for transportation fuels and electricity
    - Integrated solar technology (roof tile, building membrane, glazing)
    - Bird-friendly wind technology (offshore and vertical turbines)
    - Refrigerants in ground source heat exchange (Earthlinked)
- What are your recommendations to create an effective market for renewable energy in Florida?
  - Promote…
    - Rebates and financial assistance for renewable energy installations
    - Renewable portfolio standards that require public utilities to provide renewable energy and obtain cost recovery from customers

Energy and Sustainability at KSC

- In conclusion…KSC has a big interest in Energy and Sustainability. We challenge ourselves everyday to make a difference, and we look forward to opportunities in benefitting the natural environment.
- Questions??

Investing in Renewable Energy and Green Jobs

January 11, 2011

James Fenton & Philip Fairey
Florida Solar Energy Center
University of Central Florida

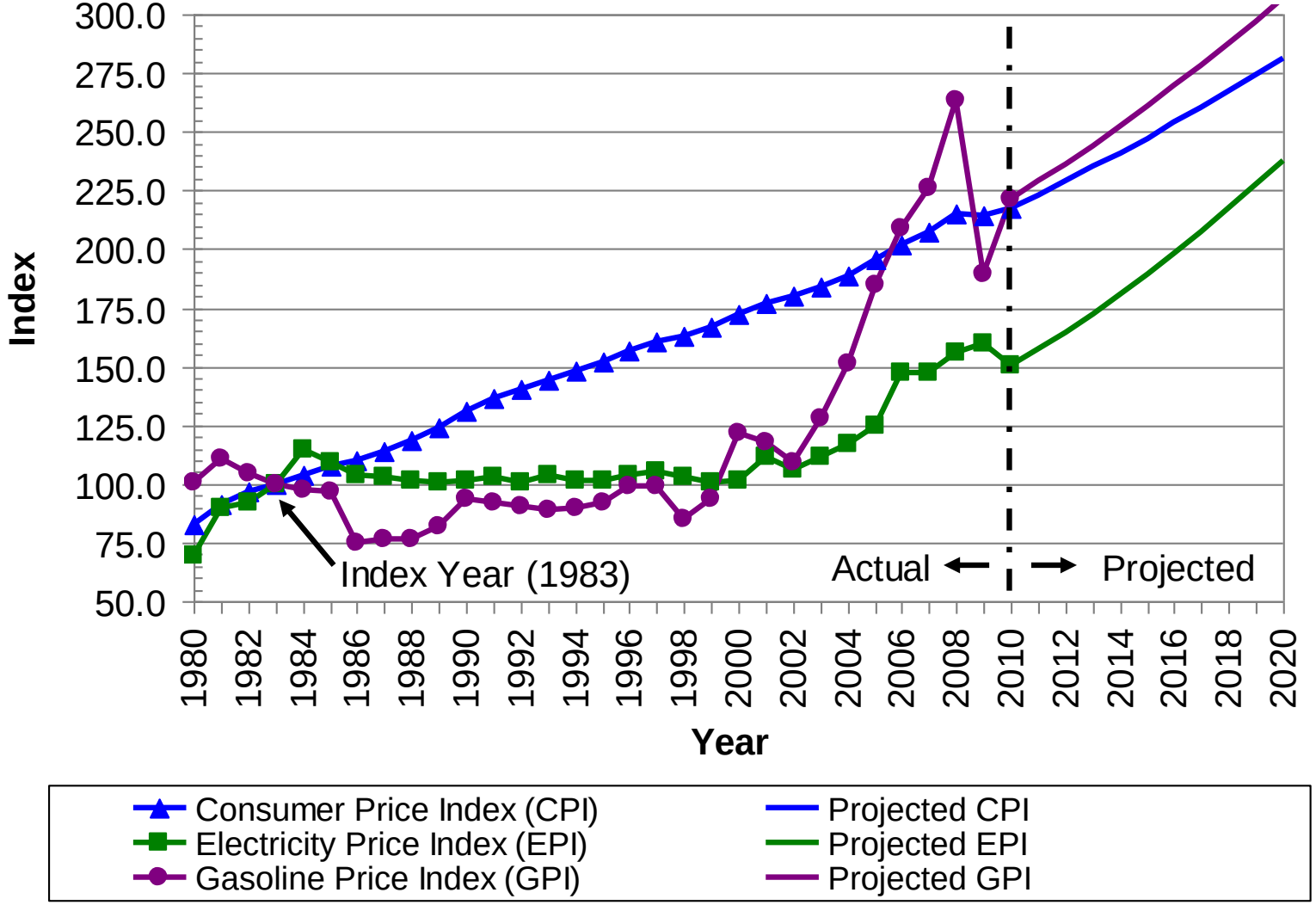
FSEC Policy Advisory Board

"It is imperative for Florida's economic sustainability that the State of Florida establishes and incentivizes a renewable energy goal that establishes a marketplace for renewable energy. Without a strong renewable energy market in Florida, the high–wage manufacturing, engineering, and research and development jobs for renewable energy products will go elsewhere. Clean energy technologies create jobs, attract new industry investment and diversify fuel types, reducing the state's dependence on imported fossil fuels. From a competitive perspective, 35 other states and the District of Columbia have renewable energy goals – Florida does not. If we do not quickly establish a strong renewable energy market place within Florida, the high paying jobs associated with this industry will likely be lost to Floridians forever."

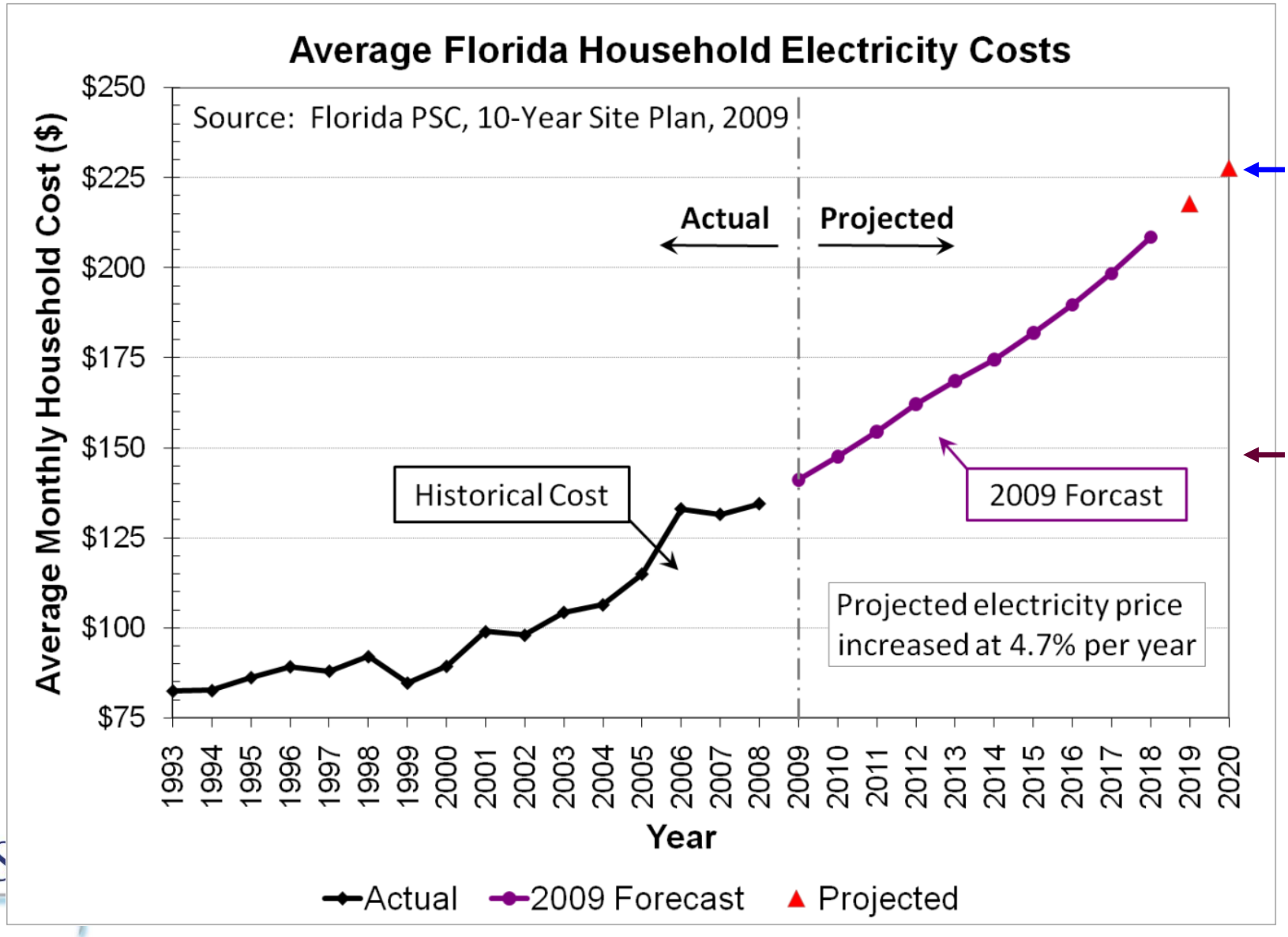
Gasoline & Electricity Prices

	80s and 90s	2010	2030
	$1/gal	$2.96/gal	??
	8¢/kWh	12¢/kWh	??

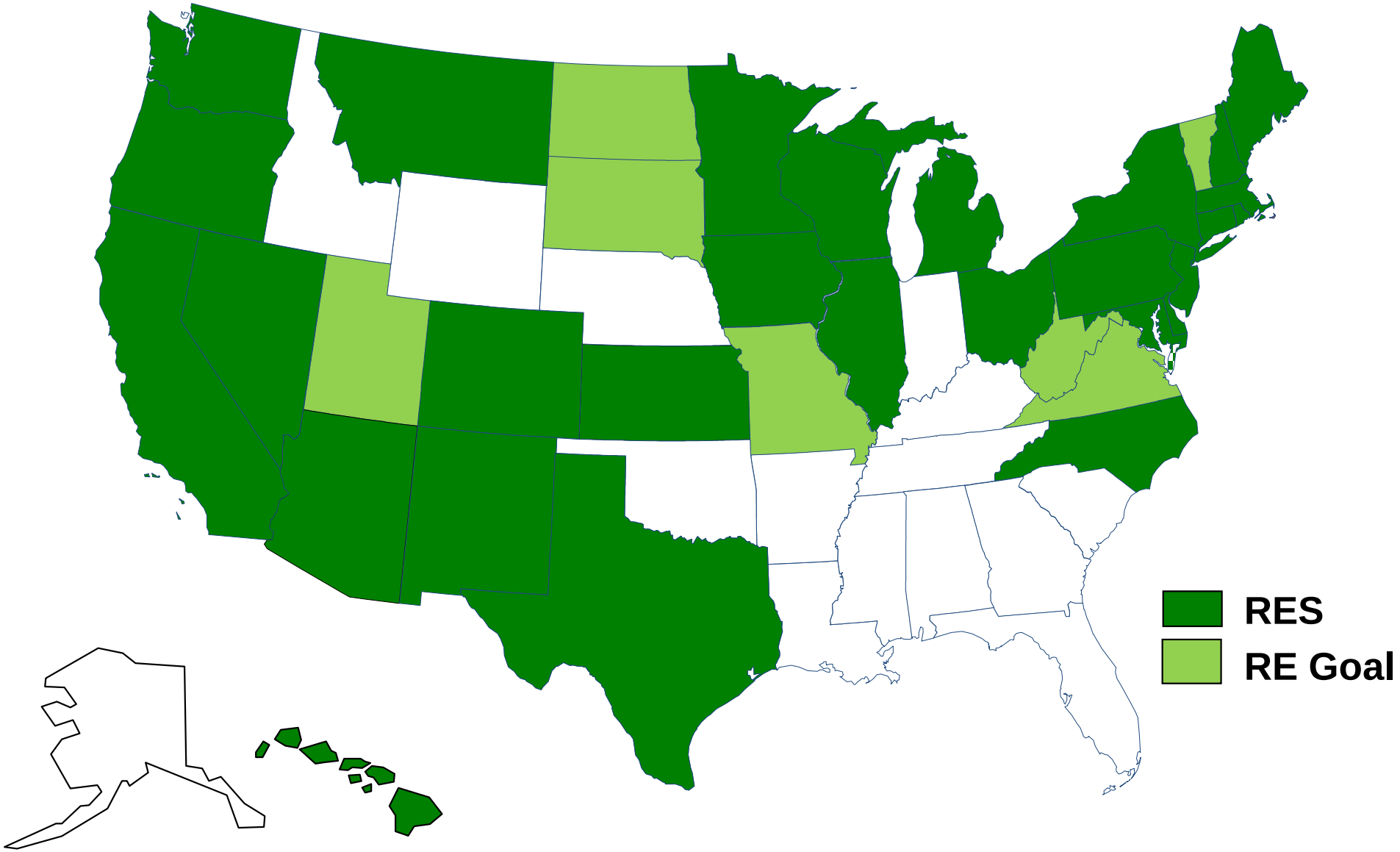
Gasoline & Electricity Prices



Projected Electricity Costs



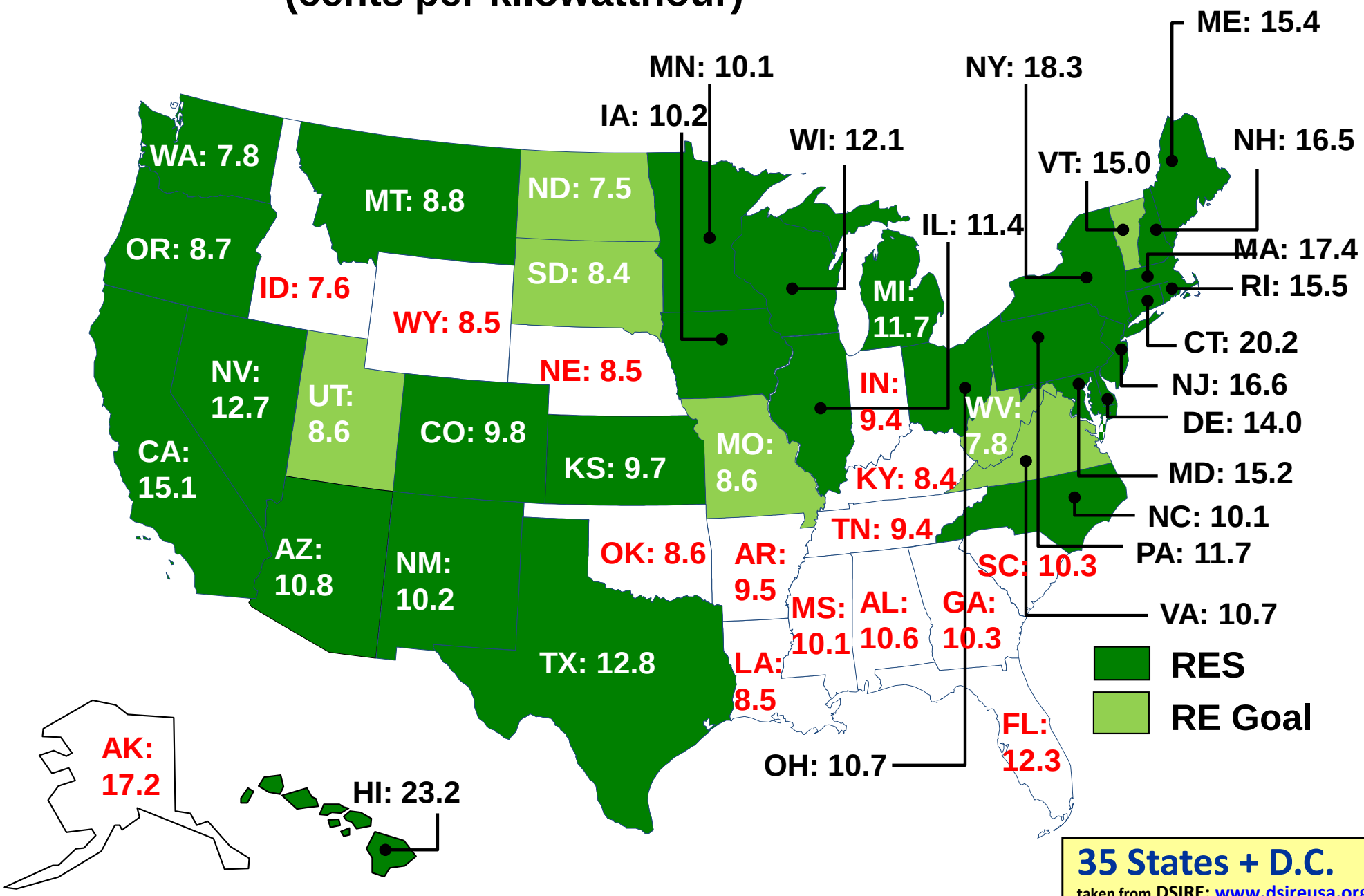
Renewable Energy States



Alternative Energy Cheaper?

Average Residential Retail Price of Electricity (cents per kilowatthour)

Year to date August 2009



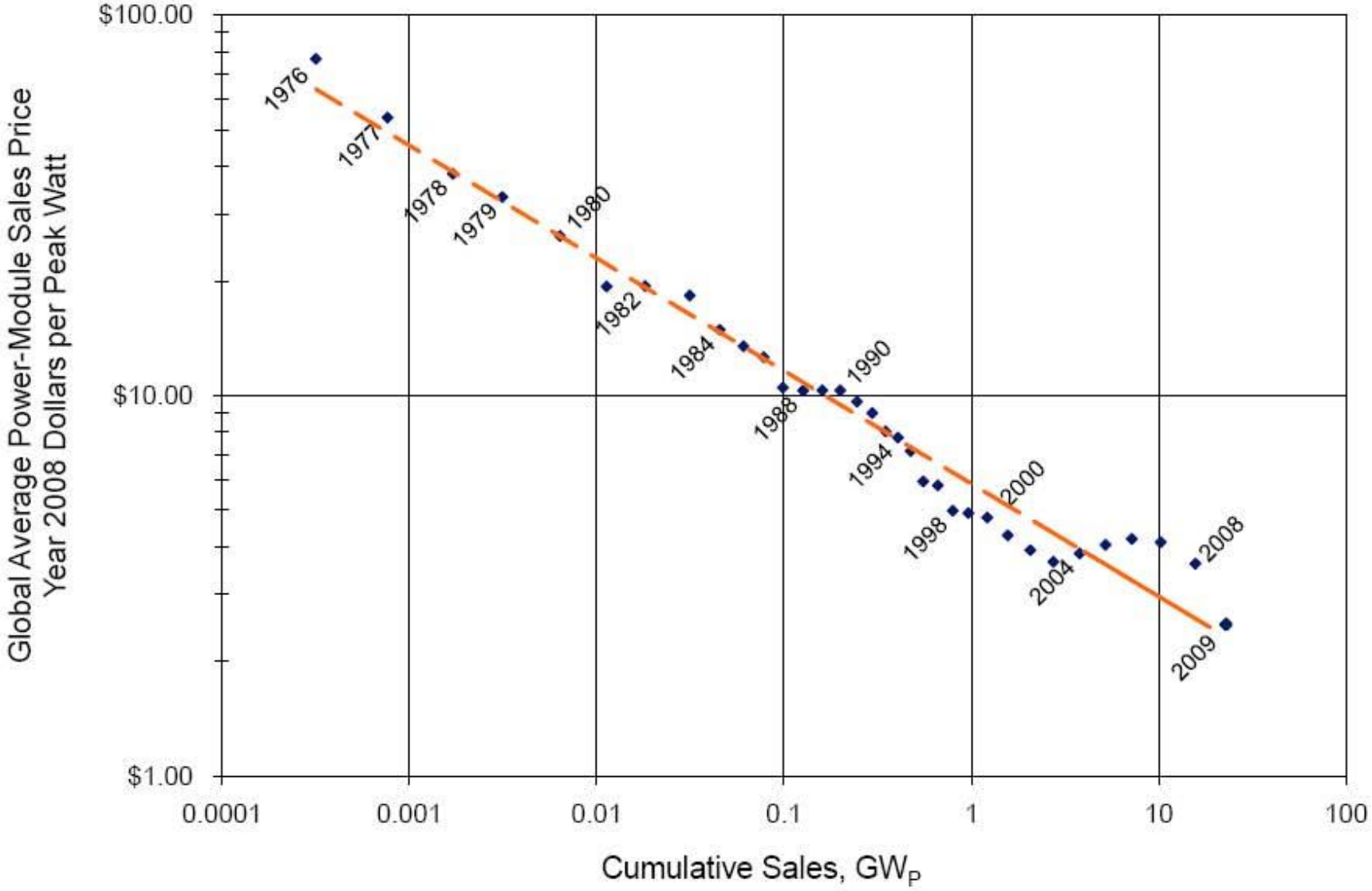
35 States + D.C.

taken from DSIRE: www.dsireusa.org

State Electricity Costs

	Average Price per kWh (2009)	Average kWh Energy use per month	Main Fuel Source
National Average	11.2¢	874	-
Hawaii and Connecticut	Over 20¢	-	-
Several Coal States	7¢ to 8¢	-	-
Southern States North of Florida	10¢	-	Coal
Florida	12.3¢	1,000	Natural Gas
Alabama	10.6¢	1,200	Coal

Module Price Learning Curve



ASP data source: P. Mints, Navigant Consulting PV Service Practice

3/08/10

Residential PV: LCOE Targets

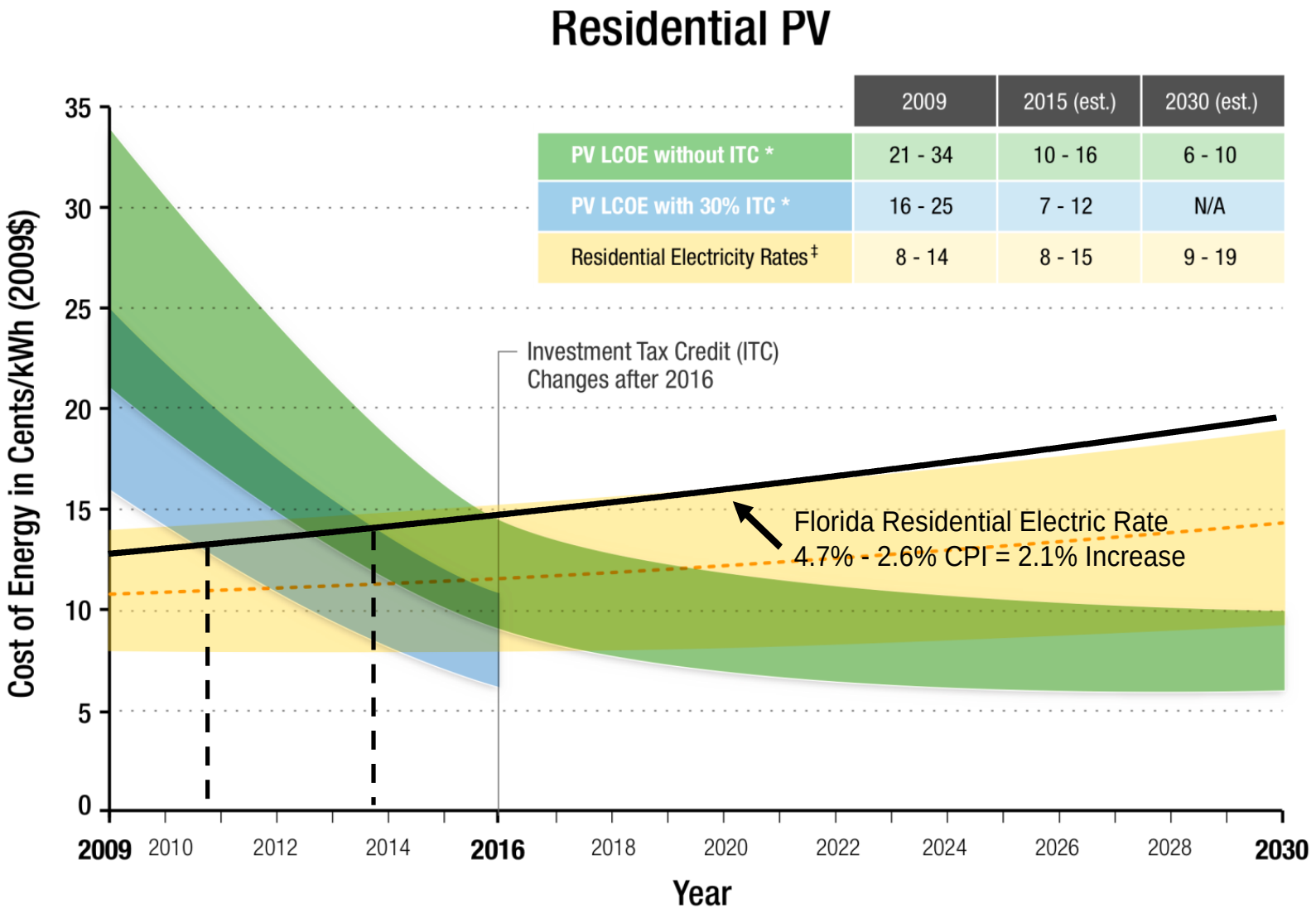
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2015

- With the 30% ITC, PV is broadly competitive with residential electricity rates.
- Without the ITC, PV is broadly competitive under all conditions except that with the most expensive financing and worst insolation.

2030

- Without the ITC, PV has levelized costs that are lower than most residential electricity rates.



* No state, local or utility incentives are included. The range in residential PV LCOE is due to different insolation and financing conditions. For a complete list of assumptions, see DOE Solar Cost Targets (2009 – 2030), in process.

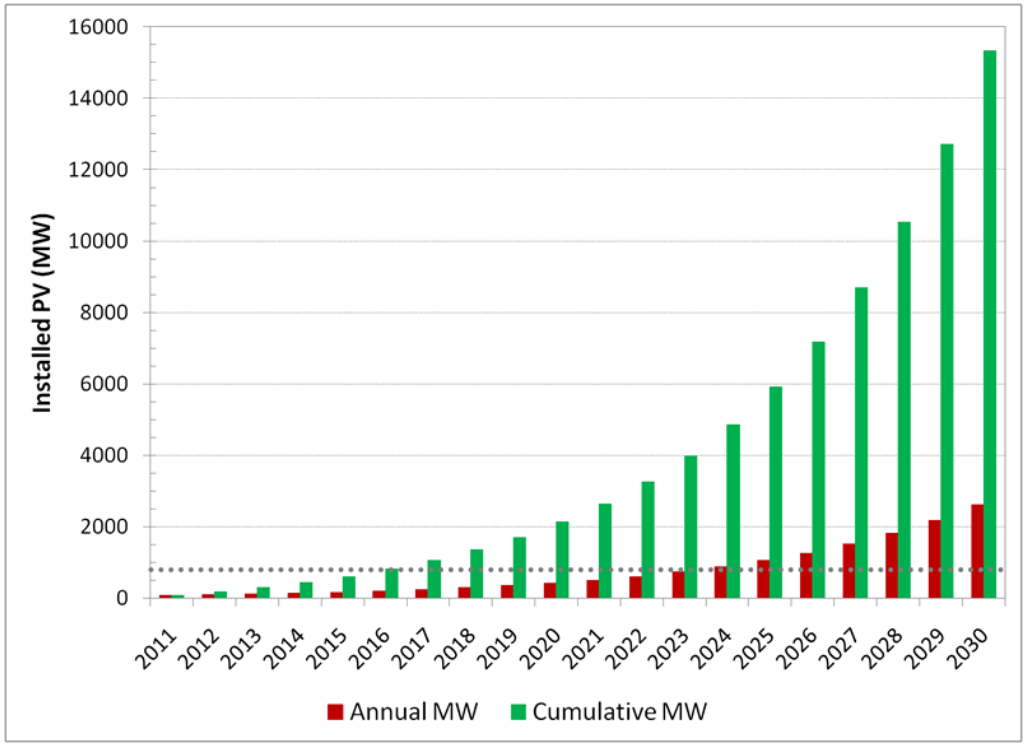
‡ The electricity rate range represents one standard deviation below and above the mean U.S. residential electricity prices.

Projecting Into the Future

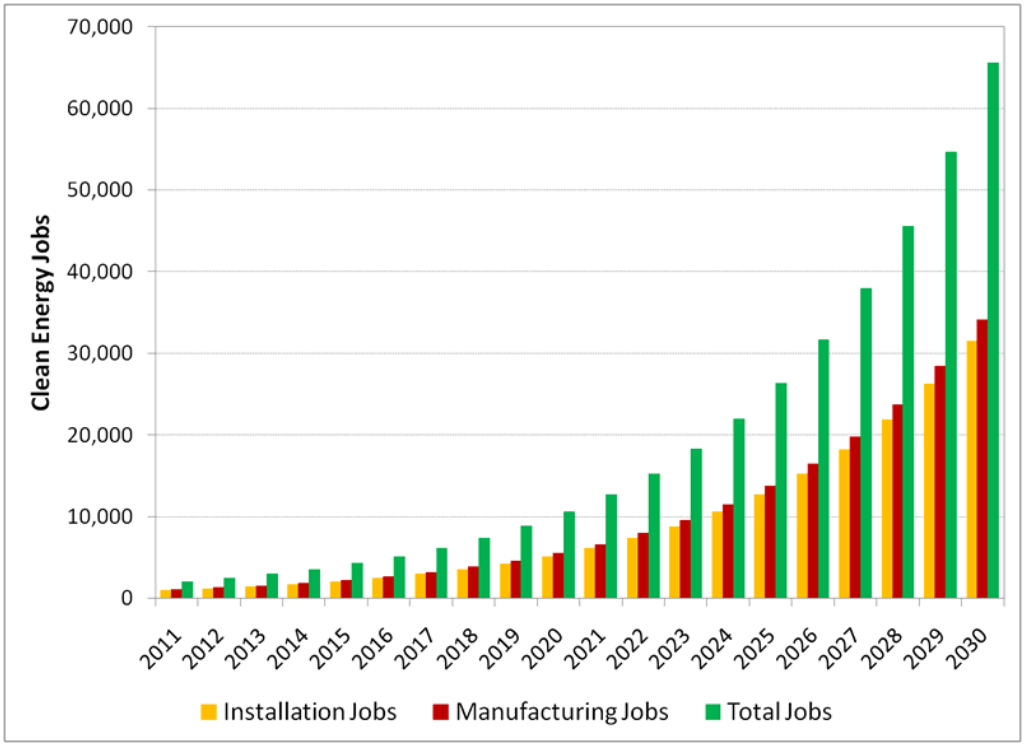
- Assume U.S. DOE projections for future price of residential PV systems
- Assume 4.7% growth rate in conventional electricity prices
- Assume Florida will "grow" its PV market at ~20% per year (less than the global growth rate of 30%)
- Assume 10% of Florida's electricity will be provided by PV at the end of 2030
- Would require initial year (2011) PV installations equaling 82 MW.

Photovoltaic Jobs

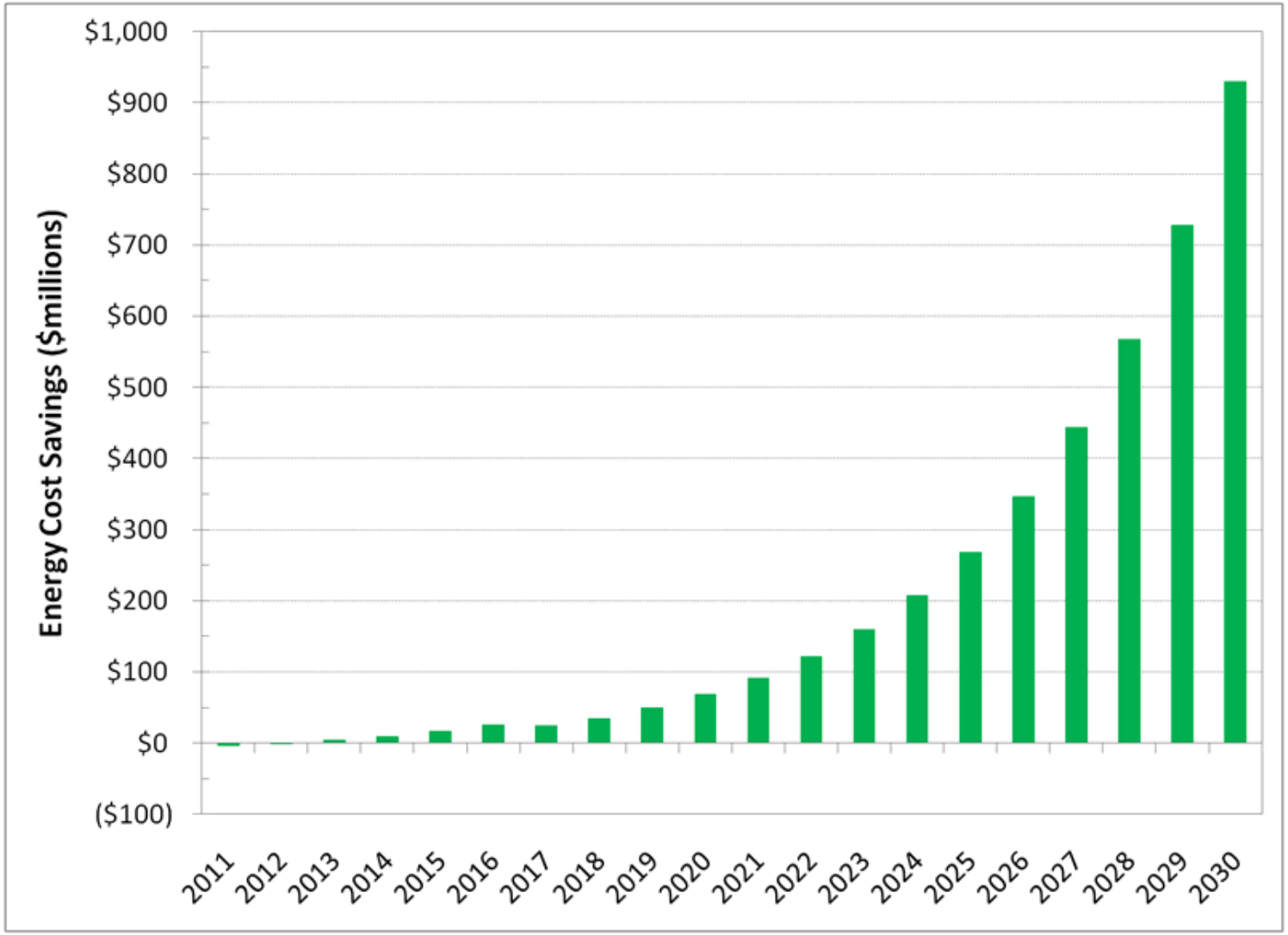
Installed PV



Solar PV Jobs



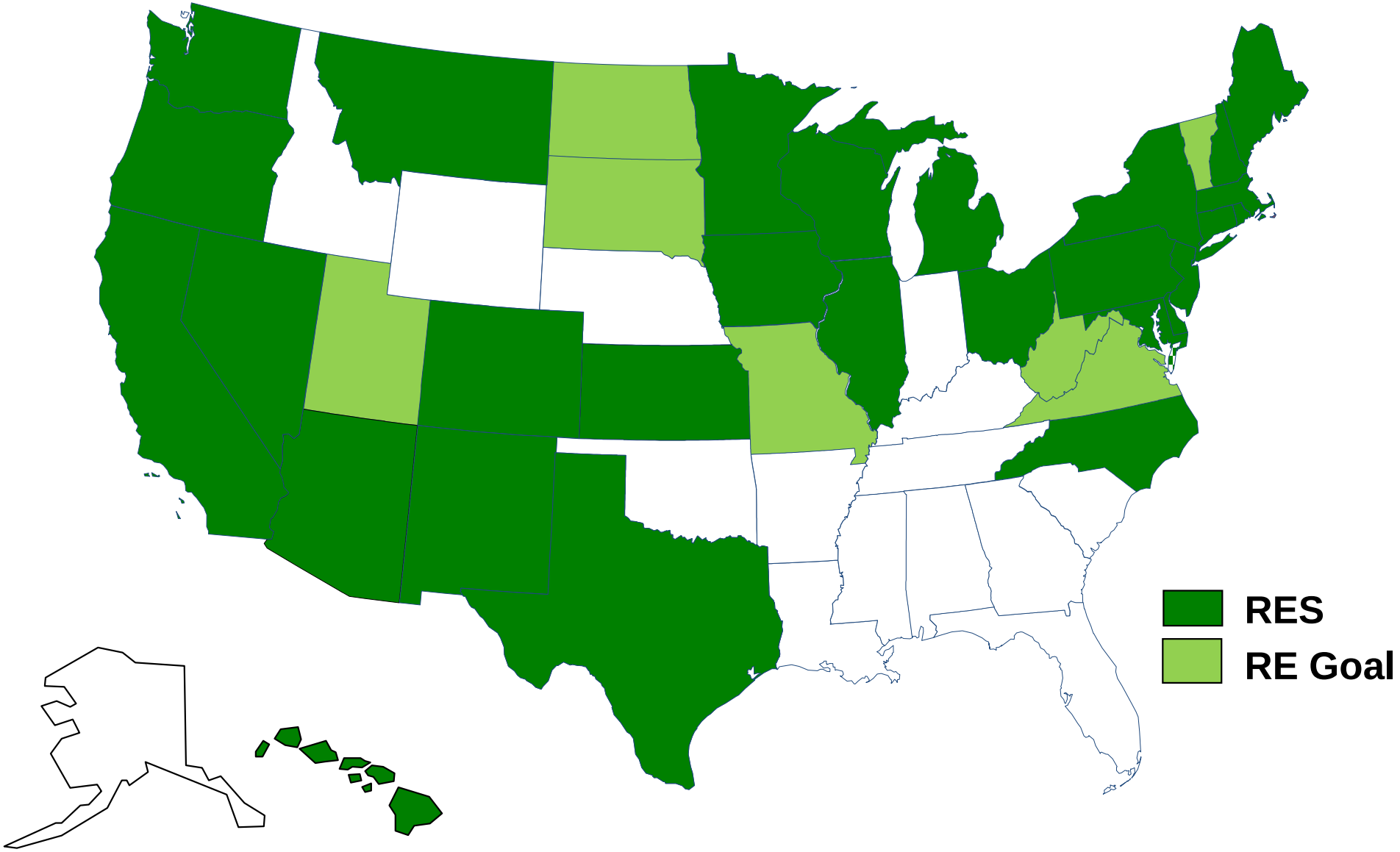
~~Cost of~~ Savings from Solar Jobs



~~Cost of~~ Savings from Green Jobs

	Megawatts	Cost per Month per Customer	Installation Jobs	Manufacturing Jobs
Electricity Cost Today	0	$140	0	0
Doing Nothing 2011	0	**$5 more**	0	0
Doing Nothing 2030	0	**$159 more**	0	0
10% Solar by 2030				
2011	82	**$0.05 more**	**986**	**1,068**
2013	299	**$0.02 less**	**1,419**	**1,538**
2030	15,333	**$7.17 less**	**31,488**	**34,112**

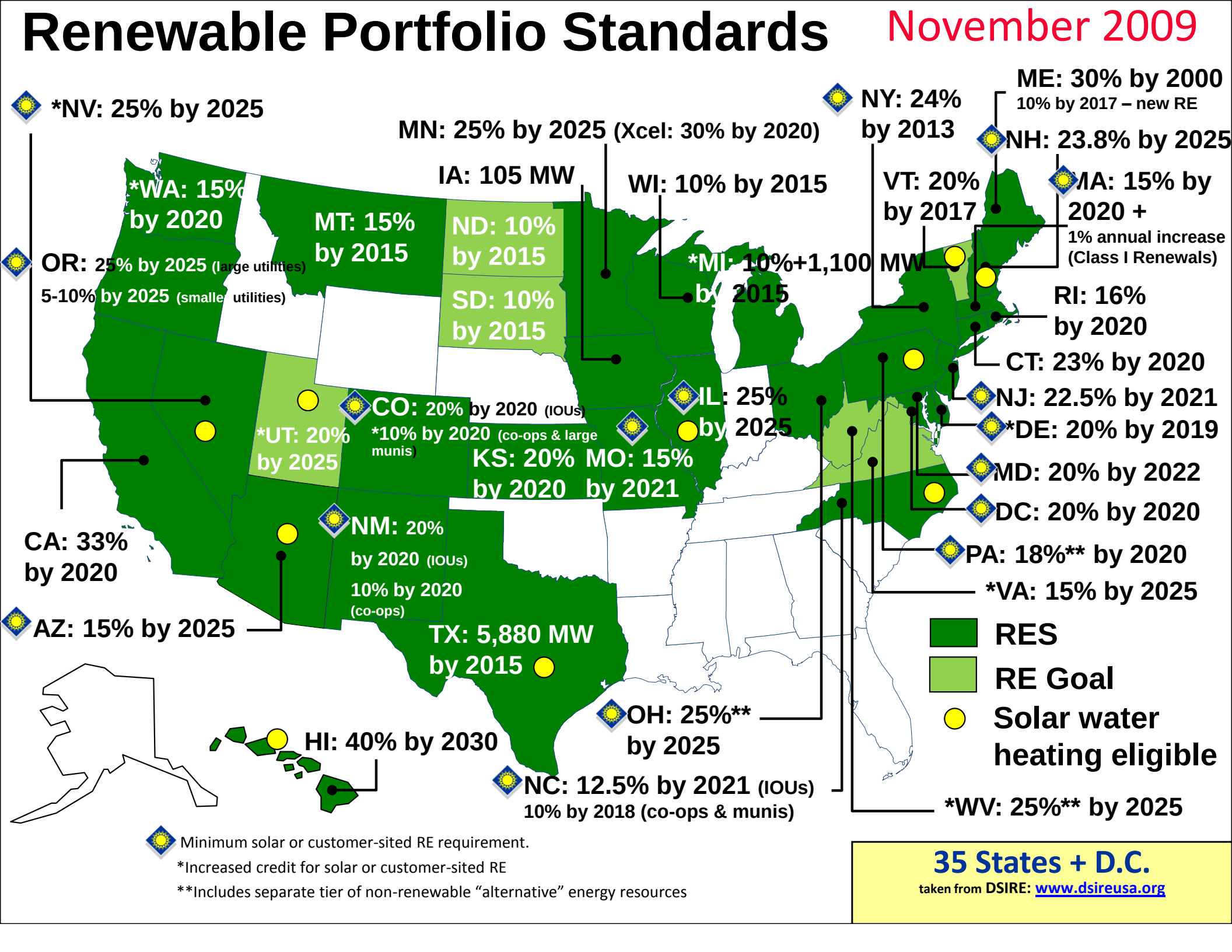
The GREEN JOBS MAP




MYFLORIDA.COM
GRN - JOB
SUNSHINE STATE
Color the
Sunshine State
GREEN

EXTRA SLIDES

Renewable Portfolio Standards November 2009



Minimum solar or customer-sited RE requirement.

*Increased credit for solar or customer-sited RE

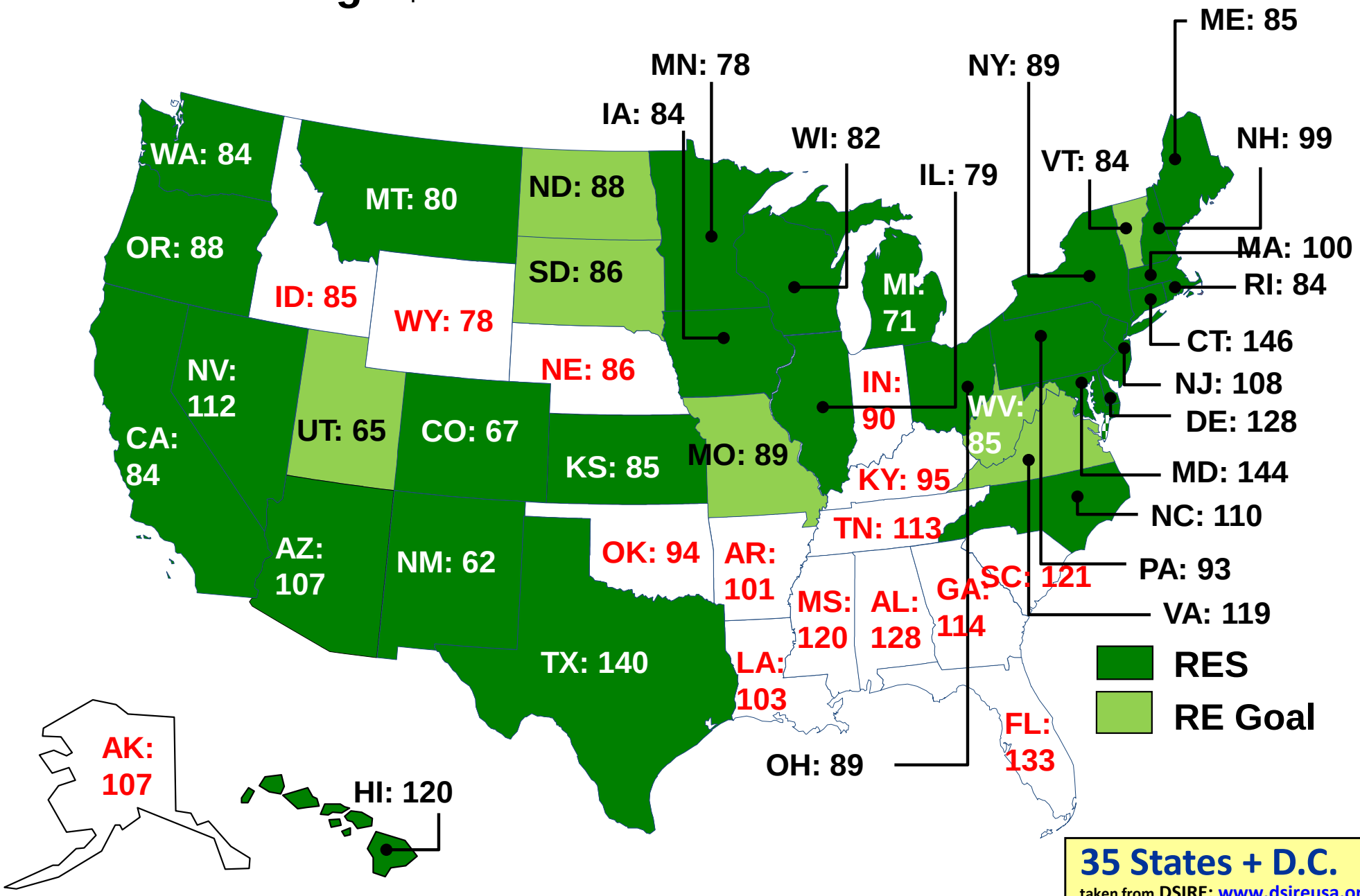
**Includes separate tier of non-renewable "alternative" energy resources

35 States + D.C.

taken from DSIRE: www.dsireusa.org

Alternative Energy Cheaper?

2009 Average Household Monthly Electric Bill ($/mon)
US Average $101/month



35 States + D.C.

taken from DSIRE: www.dsireusa.org

Recommendations to Create an Effective Market for Alternative Energy in Florida?

Communications, Energy, and Public Utilities
Senate
State of Florida

Tuesday, January 11, 2011

David Cartes, Ph.D.
Director

Institute for Energy Systems, Economics and Sustainability
Florida State University
2000 Levy Ave., Suite 360
Tallahassee, FL 32310
Phone: (850) 645-1184
Fax: (850) 645-9209
Email: dave@ieses.fsu.edu
www.ieses.fsu.edu

Today

- Introduction of IESES
- State Florida's Energy Challenge and Critical Components (as I see them.)
- Provide some global context.
- Present a recommended clean energy policy for electrical energy assets and asset management, that represents three years of collaboration of over 40 FESC social science and engineering researchers.

The Institute for Energy Systems, Economics and Sustainability

- Provides insights and analysis to Florida's sustainable energy stakeholders.
- IESES is Part of FESC
- Created in 2008 by HB 7135
- IESES Expertise:
  - Science
  - Governance
  - Economics
  - Decision making

Shameless Plug: Why FESC and IESES are Essential

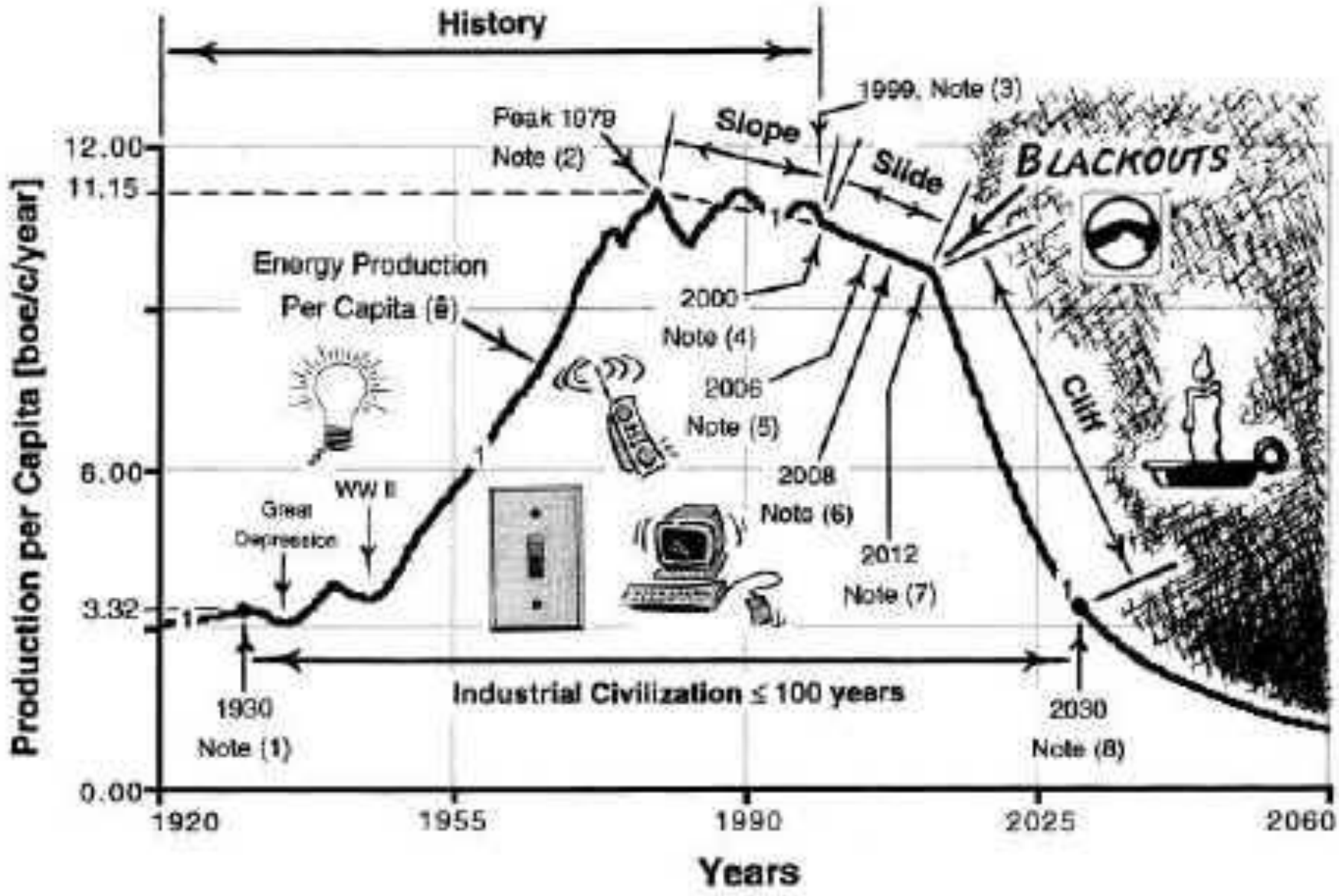
- We need institutions like FESC and IESES that are empowered and responsive to policy setters and executers and capable of optimization at the right level and responding in the right time frame.

- To date, there is no central clearinghouse to collect and evaluate intelligence from the Florida (or the national) smart grid or other alternative energy experiment (s).

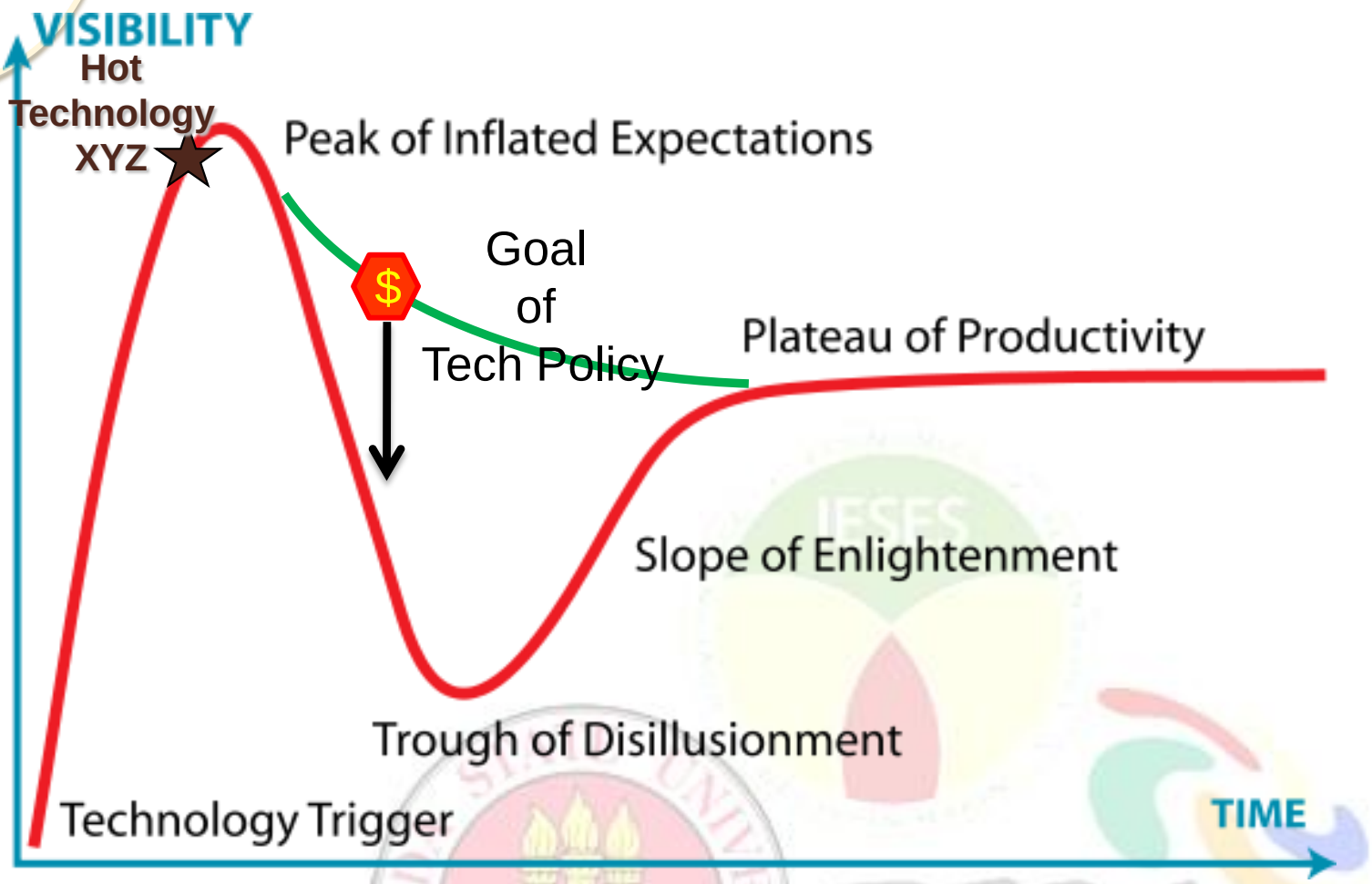
- We need an energy strategy coordinated such that benefits of investment and deployment are realized at the state and local levels simultaneously, statewide.

Does creating a sustainable energy economy feel like this?

Because People Tell You the Sustainable Energy Economy Looks Like this?



We Need Energy Policy That Does This



Need an Objective Assessment of the Potential for Smart Transmission and the Path to Achieve it

The challenge…

- Achieving strategic economic development through the emerging "green tech" sector
- Florida as a regional and International hub of green technology innovation and investment
- Investments in low-carbon energy sources to secure a sustainable energy future for Florida and the nation
- Creating "green tech" market pull

The Challenge: Some Florida Good News

- This briefing will put energy units into Quads
  - A Quad is 10^{15} BTU
  - 1 Million Barrels/Day for a Year Of Oil Is 2.12 Quads
  - 1 Ton HVAC = 12,000 BTU*hr (3T avg/home) Quad = 3.2 million home ACs for one year.

- Some key points (kudos) of reference from 2008:
  - US consumed about 100 Quad of total energy
  - Florida Share of U.S. is 4.5% Total Energy = 4.5 Quad
  - Florida consumed 2 Quad in Petroleum in 2008
  - FLORIDA ranks 43rd in personal energy consumption at 241 Million BTU/per capita
  - FLORIDA ranks second in South East in Efficiency (NREL 2009)

Critical To Create Jobs: Florida Issues

- Investment in Florida Based Advanced Technologies
- Capital Flight
- Purchase Power
- Regulatory certainty/uncertainty
- Market Development
- Workforce revitalization

"It is critical for America that we shift our focus from mitigation of greenhouse gas emissions toward an agenda of building energy and climate resilience."

"Jobs are created when consumers decide they want to spend money to buy stuff. That means that a) consumers have to have money to spend, and b) they have to be confident enough in the future of the economy to be willing to spend their money, and c) they have to be able to afford the stuff for sale."

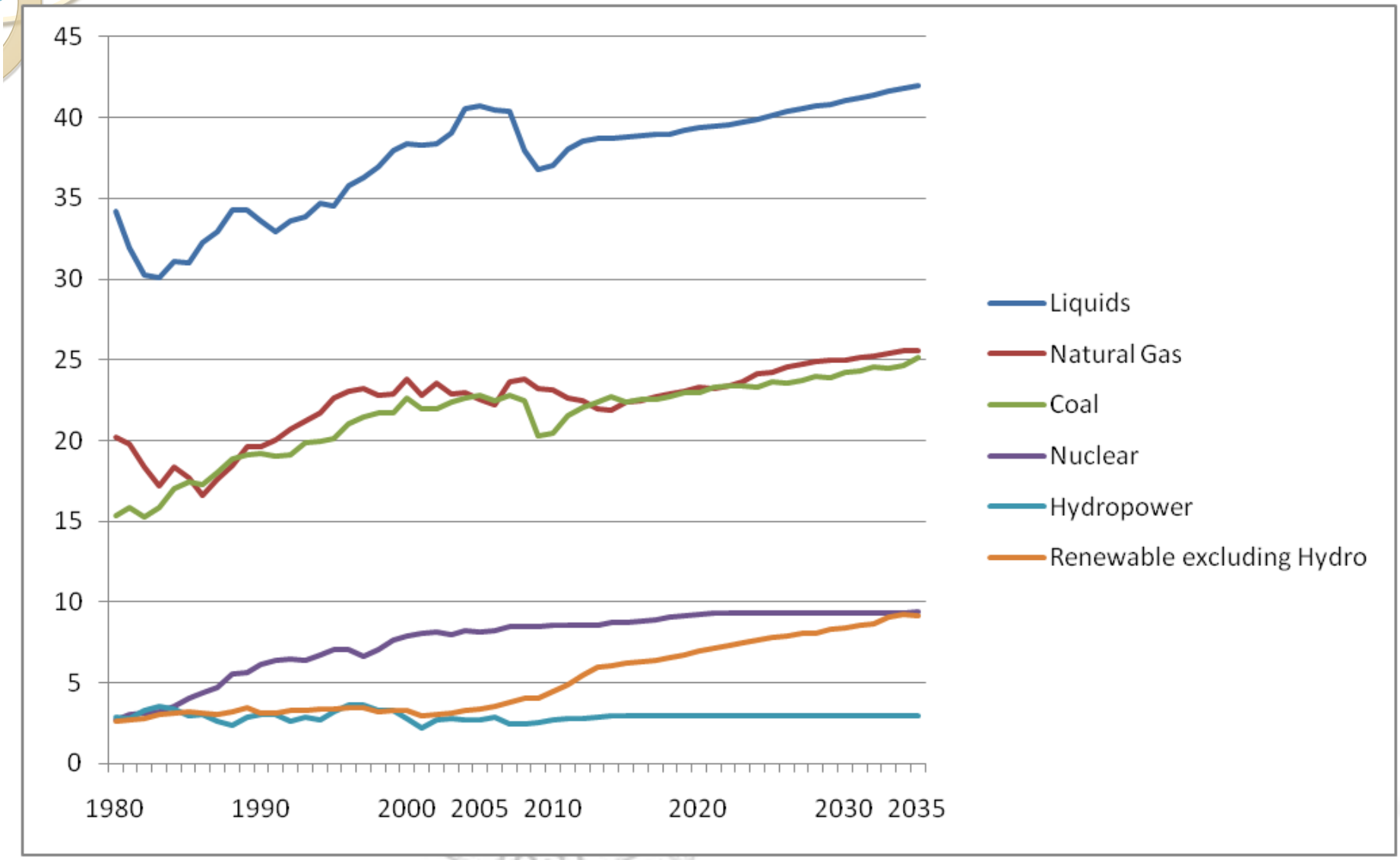
K. Green, American Enterprise Institute 2010

Context: Energy Future

- Fossil fuel is plentiful (and inexpensive)
  - Oil supply is in 10s of years (Lewis*: 40-80)
  - Gas supply is over 100 years (Lewis*: 200-500)
  - Coal supply is several 100 years (Lewis*: 200–2000)
- 85% of the world's energy is supplied by fossil fuel
- No new nuclear energy generation capacity has been added in decades
- Renewable energy sources contribute an extremely small portion of the overall world requirement
- Economic development has been and continues to be dependent on "cheap energy"
  - Some correlate population with energy production
  - More correlate economic development with energy CONSUMPTION.

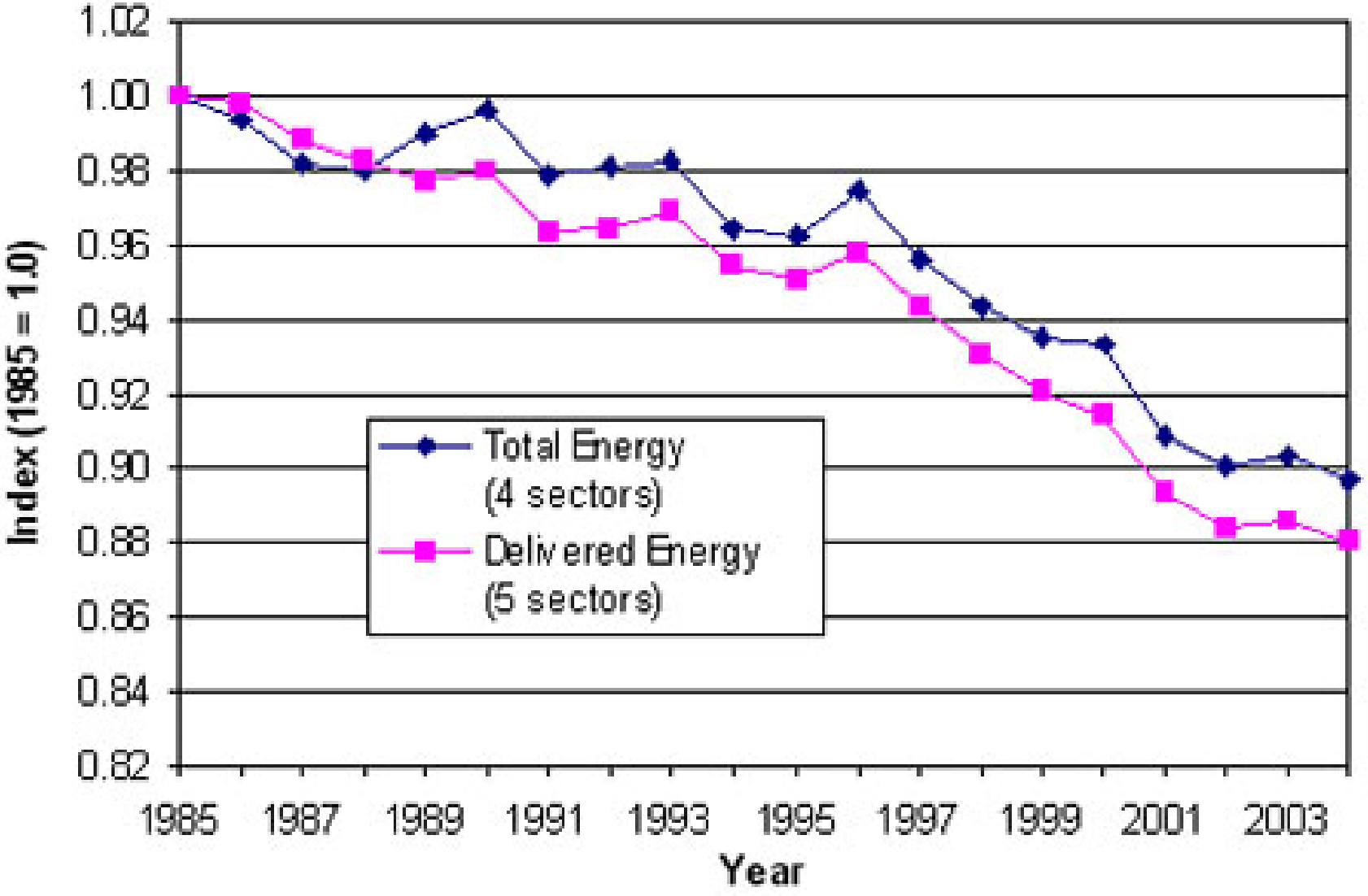
*Nathan

Context: U.S. Energy Consumption by Fuel (1980-2035 in Quads)



EIA 2010

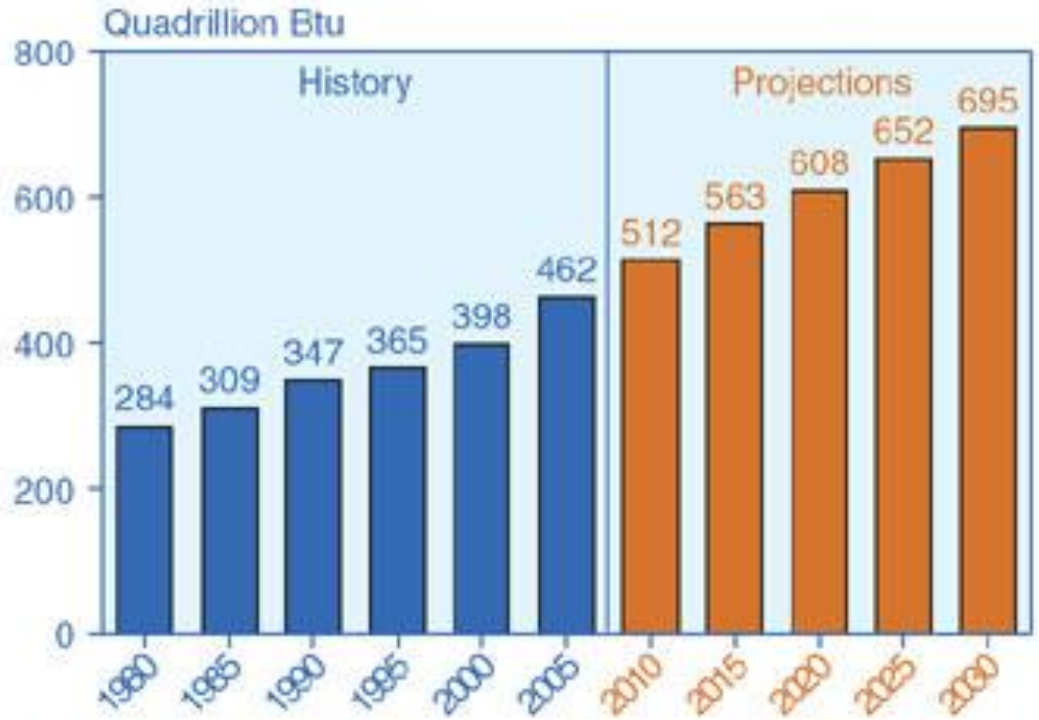
Context: More Good News: Energy Intensity



EI = Quads/$GDP

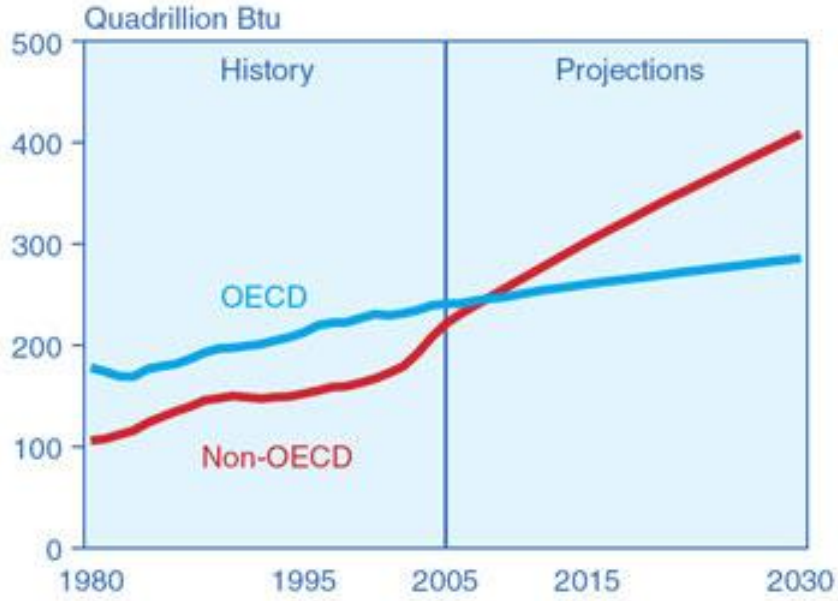
Context: Problems Soon: Projected Energy Growth 2005 (EIA)

Figure 9. World Marketed Energy Consumption, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2005* (June-October 2007), web site www.eia.doe.gov/iea. **Projections:** EIA, World Energy Projections Plus (2008).

Figure 10. World Marketed Energy Consumption: OECD and Non-OECD, 1980-2030



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2005* (June-October 2007), web site www.eia.doe.gov/iea. **Projections:** EIA, World Energy Projections Plus (2008).

Context: Some Sticker Shock

- $8 Billion in Florida's electric infrastructure would result in 123,756 persistent Florida jobs.*
- State of Florida doesn't have $8 B
- "The government's role is to allow the energy and the initiative of the American people to emerge in the marketplace. That's where wealth is created. That's where jobs come from." **
- Policy should provide a positive investment frame work for "the people" to provide most of the $8 Billion.***

* Political Economy Research Institute 2008

** David Taylor, Pennsylvania Manufactures Association 2008, Quoted by Newt Gingrich, Washington Examiner 2009.

*** D. Cartes, today, 2011

FESC: Priority Outcomes for Grid Investment

1. Lower transmission and distribution losses,
2. Provide lower electricity costs to consumers,
3. Provide fewer power interruptions,
4. Improved utilization of current assets
5. Increased utilization of new nuclear and renewable resources,
6. Reduce transmission congestion,
7. Less CO2
8. Lower operation and maintenance costs,
9. Automated Conservation (Demand Side Management),
10. Provide other service opportunities to utilities and third party businesses.

FESC: Significant Outcomes of Energy Strategy

- Focus on providing new market models for unregulated parts of the energy economy,
- Encourage an energy grid asset modernization (particularly transmission and distribution, mileage as well as smartness) that provides reliability, flexibility, and fewer barriers to market entry,
- Accelerates the penetration of nuclear and alternative energy resources,
- Provides financial resources for a broad range of activities that will de-risk and motivate energy investment in the state, and
- Minimizes the financial impact on the rate payer.

12 Tools for Consideration (1-4)

1. Having a **clean energy strategy** with long range clean energy strategy that includes a **mix of fossil, nuclear and alternative energy** source generation targets, **as well as efficiency and conservation targets.** (Create the investment horizon)
2. Providing a longer term (30 to 50 year) **site plan that** is statutory in nature and **effectively drives investment** in its electric grid clean energy strategy. (Let investors know where state is willing to absorb risk)
3. Advancing deregulation by allowing for **independent wholesale** power producers and transmission operators**, (only) when traditional utilities cannot meet the requirements** of the clean energy strategy. (Create more competition to drive better investment and innovation that will create optimal job numbers)
4. Standardizing Florida's local and corporate governance procedures such as siting and permitting to minimize the barriers to infrastructure modernization and capacity building in step with the site plan. (something comprehensive like siting plan for small plants < 75 MW to encourage investment)

12 Tools for Consideration (5-8)

5. Establishing Florida's **benchmark electric grid scenarios**, such as distributed renewable energy penetration scenarios differentiated by location, capacity, number and type. Including pre-conditions and assumptions, normal sequence, alternative/exception sequences, post-conditions and diagrams. (Needed to attract investment)
6. Developing Florida specific **risk reduction and socio-economic** based asset management models and simulation capabilities, that include **better predictions of Florida demographics, particularly trends that impact energy consumption and investment**. (Needed to de-risk investment)
7. Assessing and quantifying the Florida business cases and **markets for innovative and competitive assets**. (Needed to identify investment opportunities)
8. Developing a sound policy for handling investments and **cost recovery of stranded assets and potentially rapid obsolescence**. (Needed encourage continued investment in plan, before ROI/ROE can be established)

12 Tools for Consideration (9-12)

9. Providing a balanced **portfolio of** industry and university electric grid **demonstration projects** to assist in just-in-time decision making on investments and siting of new Florida infrastructure. (Needed to accredit investment choices.)
10. Providing robust **environmental** information and **de-risking** tools that will fast track future siting decisions of potential infrastructure investors for Florida, particularly nuclear and alternative sources and transmission. (Significant need to de-risk siting by investors.)
11. Increasing Florida's emphasis on university **r**esearch and **d**evelopment. (Better ideas and labor force to attract investment.)
12. Providing a recalculation of the **pollutant tax to include an "up-stream" price on carbon** equivalency of fuels and carbon based fuel generated sources of electricity, the proceeds to support an electricity and transportation investment public benefit fund that has as its purpose increasing Florida's energy security and reduced dependence on foreign oil. (An excise tax, FESC hopes to have a study on this option by February 2011. Preliminary findings $1/Ton CO2e will have less than 1c per loaf of bread, KWh electricity or gal gas but yield nearly $100M in revenue annually. Put in Benefit Fund for state to assume its share of risk, in form of guarantees, research and demonstrations, needs to be protected from raiding)

Thank You!

Florida Senate committee on Communications, Energy & Public Utilities

January 11, 2011

Lee Stefanakos and Yogi Goswami

Co-Directors

Clean Energy Research Center
University of South Florida
http://cerc.eng.usf.edu/

CERC's MISSION

- Explore Florida's indigenous energy resources
- Develop and commercialize environmentally clean electric energy production systems

Presentation Outline

- Renewable energy sources in Florida
- Benefits provided and challenges presented
- Cost drivers for renewable energy sources
- Short and long term viability
- Emerging technologies to be explored
- Recommendations to create effective market

Renewable energy sources in Florida

- Wind –not significant in Florida (on land)
- Solar – plentiful
- Biomass - plentiful

Benefits provided – Challenges presented

- Technologies
- Solar
  - Photovoltaics (Solar to Electric)
  - Solar Thermal
    - Solar water heating (< 100 deg. C)
    - Solar steam generation (100-250 deg. C)
    - Solar thermal to electric (> 300 deg. C)

Benefits provided – Challenges presented

- **Benefits**
  - Clean, renewable, local manufacturing, job development
  - Small distributed (kW) systems
  - Large scale grid tied power plants (MW)

Benefits provided – Challenges presented

- **Photovoltaics - present efficiencies 10-20%**
  - **Challenges**
    - Cost reduction (achieve grid parity at $1-1.5 per watt)
      - Small systems $4-5 per watt (present cost)
      - Utility scale $2.5-3 per watt (present cost)
    - Storage (electrical)?

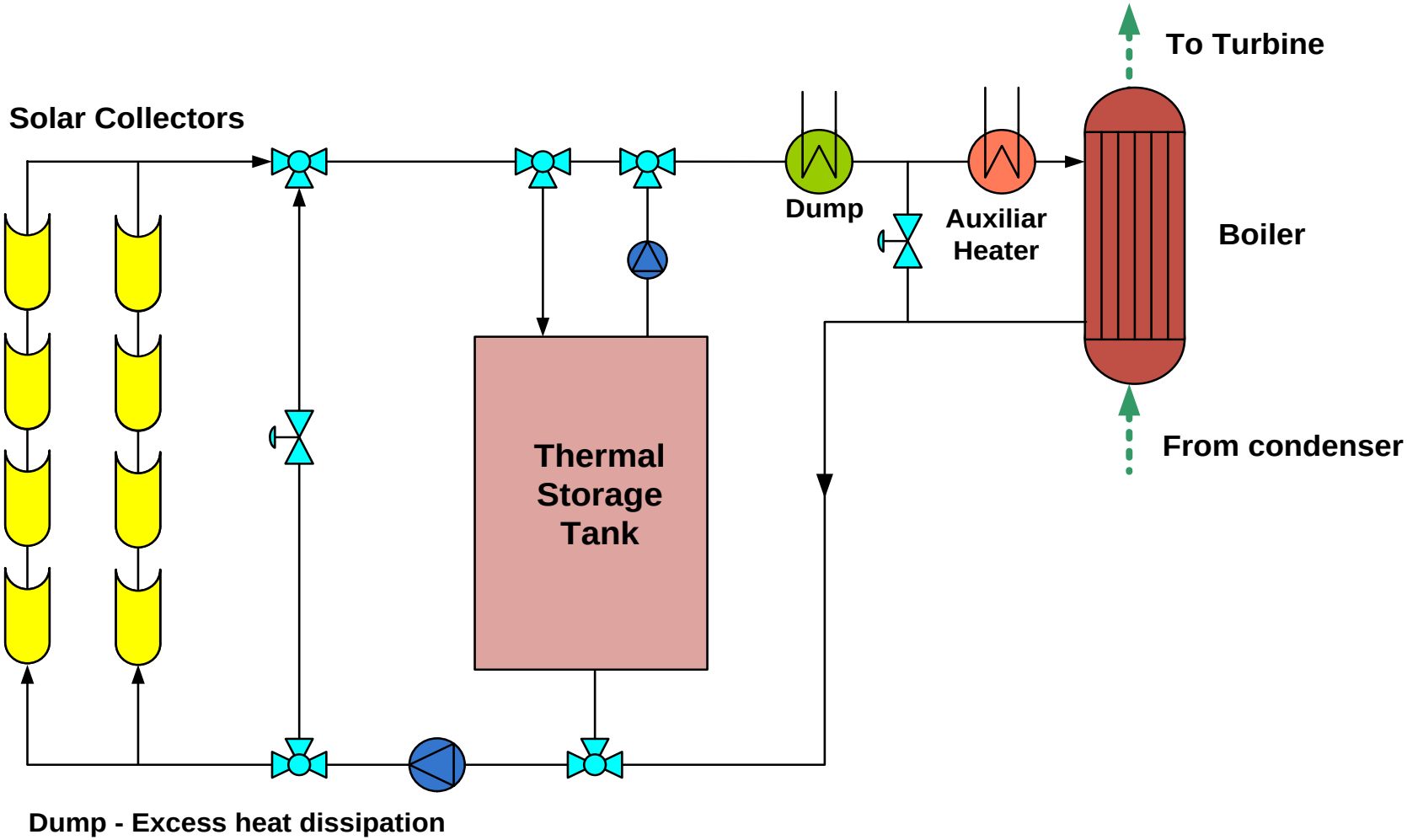
Thin Film Photovoltaic Solar Pilot Line

CERC
Clean Energy Research Center

Establish a world-class thin film PV module capability at USF

Attract PV manufacturing operations to the state

Solar thermal power generation



Benefits provided – Challenges presented

- **Solar Thermal Electric – Eff. 13-25%, Present cost - $3-3.5 per watt)**
  - **Challenges**
    - **Cost reduction (achieve $1.5 -2 per watt)**
    - **Storage (thermal)?**

Storage

Challenges presented

- **Storage**
  - **Biggest Challenge for Solar and wind energy utilization**
  - **Photovoltaics, Wind (Batteries)**
    - **Cost reduction by a factor greater than 10**
  - **Solar Thermal (thermal energy)**
    - **Cost reduction by a factor greater than 3**

Florida Biomass Sources

- Municipal waste, green waste
- Bagasse and sugarcane waste
- Citrus pulp
- Forest residues & thinnings
- Animal waste
- Agricultural residues
- Energy crops from trees such as pines and hardwoods
- Crops such as grasses, corn, sweet sorghum, and sweet potato.

Energy from Biomass

- Burn to produce steam (for heating), electricity
- Convert to ethanol by fermentation
- Convert to syngas by partial combustion and then to clean liquid transportation fuels
- Extraction of oils to produce biofuels e.g. from algal ponds

Florida Biomass Resources

- 16.5 million acres of forest land
- 13 million are commercial forests
- 650 million cubic feet of wood removed and used by forest products industry
- 118 million cubic feet of logging residues
- 4.6 million dry tons of urban dry waste

Florida Biomass Resources

- 3.8 million acres of crop land
- 3.3 million dry tons of biomass residues
- 1.2 million dry tons from bioenergy crops (switch grass etc.)
- 17.3 million tons from sugar cane bagasse burned to produce energy

Costs for Bio-energy crops

Factor	Cost $/MMBTU
Soil Preparation, Seeding, Growing	$0.37
Harvesting	$1.88
Transportation	$0.41
Total	$2.66

Cost of coal produced energy: $1.50-$1.75 /MMBTU
We need to improve yield per acre, harvesting costs

http://www.treepower.org/economics/main.html

Challenges and Opportunities

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Clean Energy Research Center

- Reduce costs of transportation (build many small scale, local biomass to energy conversion facilities)
- Develop small scale direct/indirect conversion facilities
- Increase yield through crop research
- Reduce harvesting costs
- Increase yield from ethanol conversion plants
- Use the synergy of abundant solar energy for biomass conversion (combined solar thermal/biomass conversion facilities)

Cost drivers for renewable energy sources

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Clean Energy Research Center

- Photovoltaics
  - Reduce production cost of PV modules and inverters
- Solar Thermal
  - Reduce production cost of parabolic troughs and heliostats

Short and long term viability

- Photovoltaics
  - Achieve grid parity by 2018
    - PV module production cost - $0.3 to 0.6 per watt
    - Inverter production cost - $0.1 to 0.2 per watt
    - Balance of system costs - $0.4 -0.6 per watt
  - Total system installed cost - $1 – 1.5 per watt

Short and long term viability

CERC
Clean Energy Research Center

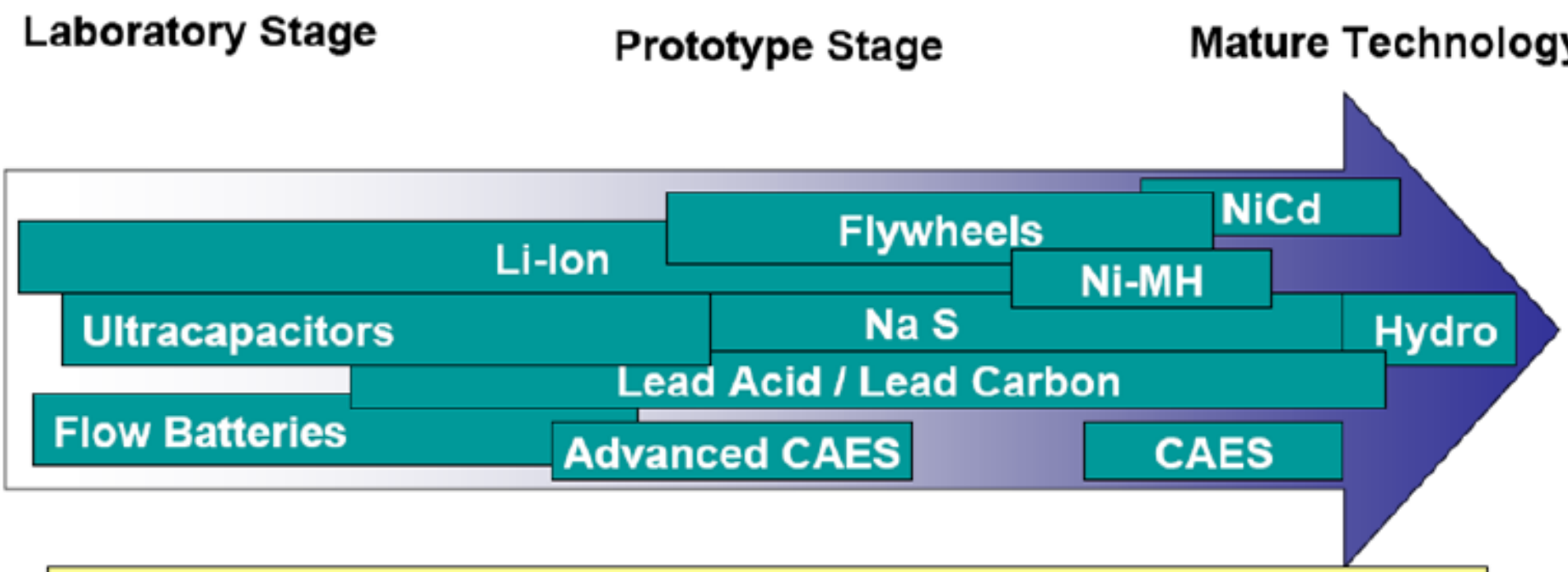
- Solar Thermal Electric
  - Achieve grid parity by 2020
    - Parabolic trough solar field production cost - $1 per watt
    - Power block - $1 per watt
    - Combined cycle most promising

Emerging technologies to be explored

- Storage
  - Electrical
  - Thermal
- Hydrogen and Fuel cells
- Advanced photovoltaic and CSP components
- Biomass conversion to fuel
- Smart grid technologies

GRID-SCALE STORAGE – RANGE OF TECHNOLOGY READINESS LEVELS

Grid Storage Stages of Maturity by Technology



The participants would like to see ARPA-E catapult more of these technologies to maturity, in order to:

1) Increase functionality of renewables
2) Reduce the need for spinning reserves and thereby
3) Cut greenhouse gasses and
4) Reduce the use of fossil fuels

arpa·e

Thermal Storage

- Develop cost effective phase change thermal storage media – reduce cost to $5-10/kwh thermal.
  - CERC at USF has received significant funding from US DOE and EON (Germany) for the development of high T thermal storage (400-500 deg. C) for concentrator solar power (CSP) plants

Recommendations to create effective market

- Review and implement successful policies implemented over the past few years in Germany and other European countries
  - Feed – in tariff
  - Tax credits
  - Other incentives

CERC
Clean Energy Research Center

THANK YOU

Clean Energy Research Center

University of South Florida

College of Engineering

4202 E Fowler Ave, ENB118

Tampa, Fl 33620

(813)974-4787

website: cerc.eng.usf.edu

email: cerc@eng.usf.edu