



**Synapse**  
Energy Economics, Inc.

# Big Risks, Better Alternatives: An Examination of Two Nuclear Energy Projects in the U.S.

**Southern Alliance for Clean Energy Webinar**

December 6, 2011

# Overview of Presentation

- Introduction and Background
- Vogtle 3 & 4
- Levy 1 & 2
- Subsidies for Vogtle 3 & 4
- Impact on ratepayers
- Better alternatives: energy efficiency
- Better alternatives: renewable energy
- Conclusions and recommendations

***Energy System modeling, analysis,  
expert testimony, and stakeholder representation  
for...***

- Consumer Advocates and Public Interest Groups in more than 25 states
- More than 20 PUCs and Attorneys General
- Over 40 Environmental Groups and Foundations

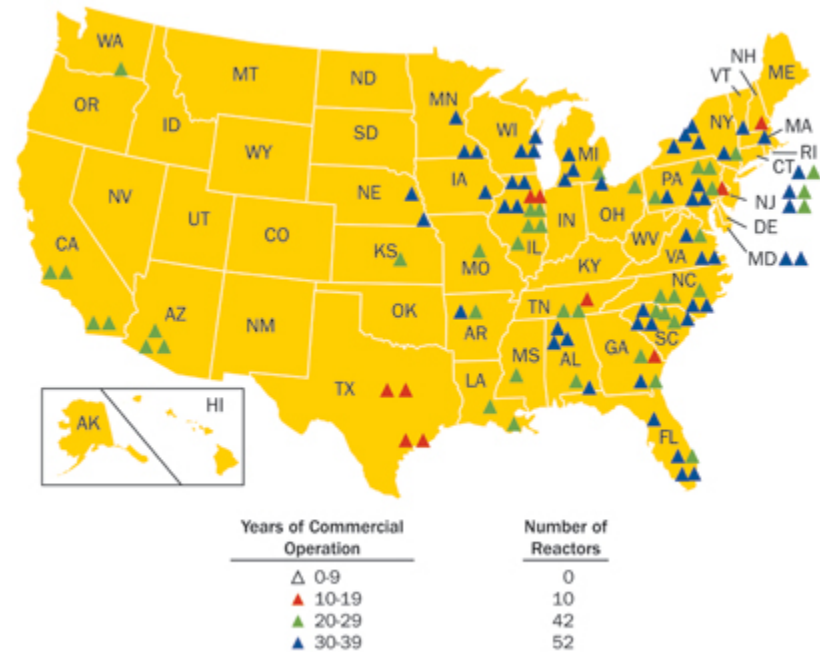
Report Available at: <http://www.synapse-energy.com>

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# State of Nuclear Power in US

- No plant ordered since 1970's
- 104 reactors operating in US
- Generates approximately 20% of electricity in US

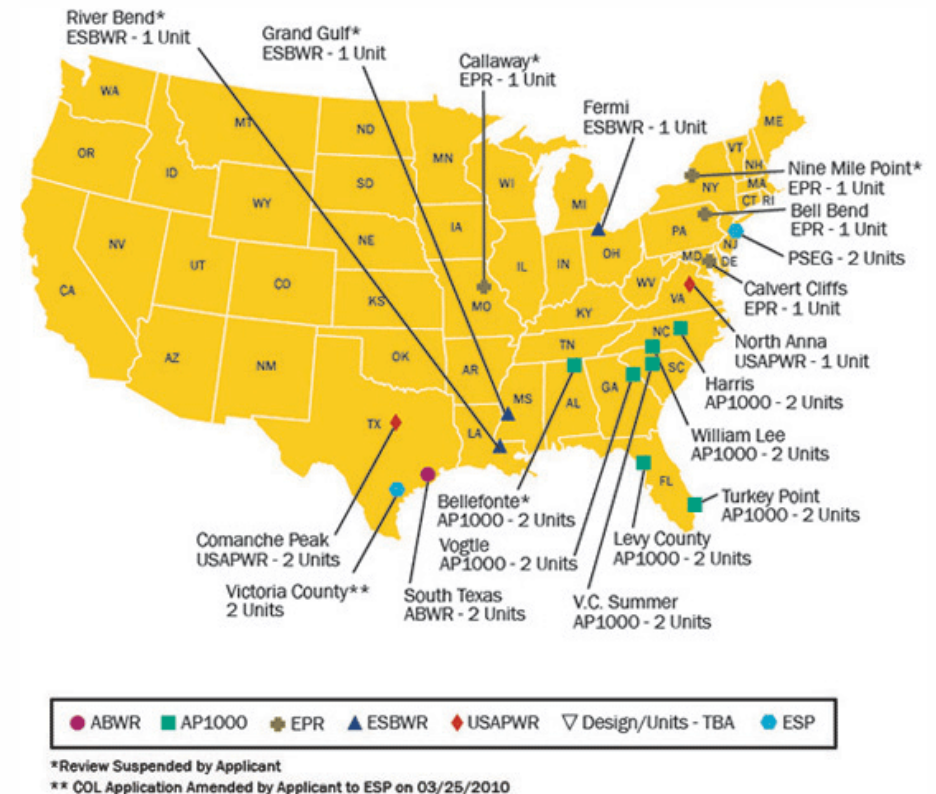
U.S. Commercial Nuclear Power Reactors—Years of Operation



Source: U.S. Nuclear Regulatory Commission

# Proposed Reactor Application Locations

- 18 applications for 28 reactors
  - 8 reactors have suspended review or have announced cancellations
    - NRG has cancelled STP Units 3 & 4
    - Exelon has abandoned plans for Victoria County Units 1 & 2
    - UniStar looking for a partner to develop Calvert Cliffs Unit 3



# Case Studies of Proposed Plants: Vogtle 3 & 4 and Levy 1 & 2

## • Similarities

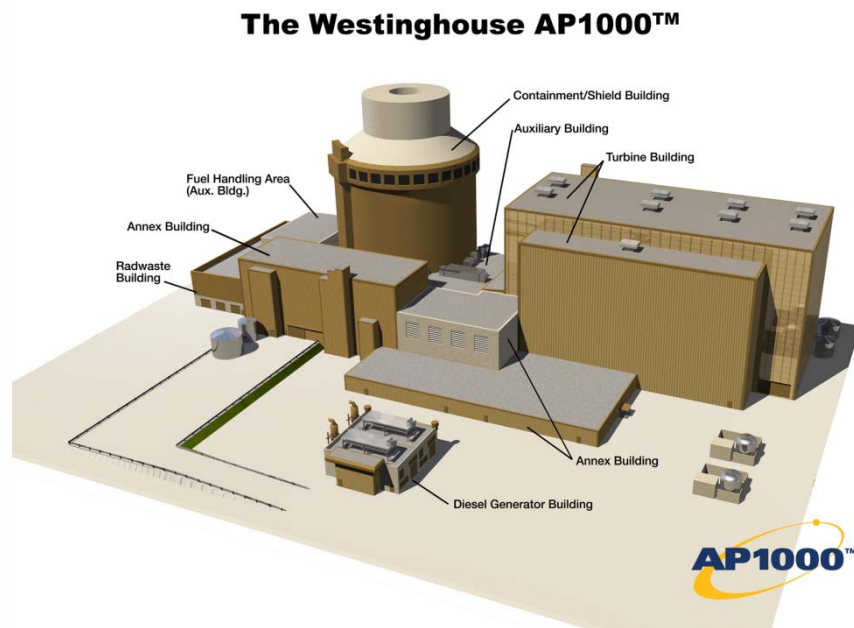
- Favorable regulatory environment
  - Recovery of costs before completion
- Plans to build announced in 2006

## • Differences

- Greenfield site versus expansion of existing site
- Federal Loan Guarantee for Vogtle 3 & 4
- Production Tax Credit for Vogtle 3 & 4

Factor	Levy	Vogtle
<b>Ownership (Percentage)</b>	Progress Energy (100%)	Georgia Power (45.7%)
<b>Boilers</b>	Westinghouse AP1000	Westinghouse AP1000
<b>Number of Units</b>	Two	Two
<b>Estimated Capacity (MW)</b>	2,200	2,200
<b>Greenfield Site</b>	Yes	No
<b>Expansion of Existing Site</b>	No	Yes
<b>Expected First Unit Delivery Year</b>	2021	2016
<b>Expected Second Unit Delivery Year</b>	2023	2017
<b>Federal Loan Guarantee</b>	No	Yes
<b>Early Financing Cost Recovery</b>	Yes	Yes
<b>Ongoing Reporting to State Commission</b>	Yes	Yes
<b>Current Total Cost Estimate</b>	\$22.5 billion	\$14 billion

# AP1000: Design Intent



- Modular design:  
pressurized water reactor
- NRC expected to issue design certification end of 2011???
- Singular design for streamlined approval process
- AP1000 currently in construction in China (Sanmen & Haiyang)
- Has not been built in US

## Vogtle 3 and 4

- Georgia Power (45.7%)
  - Oglethorpe Power, MEAG, City of Dalton
- Existing site (Vogtle 1 and 2)
- 1,100 MW each unit
- Expected delivery: 2016 Unit 3, 2017 Unit 4
- Published cost estimate \$14.1 billion; Georgia Power Share (\$6.1 billion)



# Timeline of Events and Announced Costs

Year	Month	Event	Completion Date	Cost Estimate
2006	Aug.	Early site permit application filed with NRC	2016 Unit 3 2017 Unit 4	\$14 billion
2007	Aug.	Limited work authorization application filed with NRC		
2008	March	Construction and operating license application filed with NRC		
2008	March	Georgia Power files certification request with Georgia Public Service Commission		
2008	April	Contract signed with Westinghouse for reactor design		
2008	Aug.	Environmental Impact Statement filed		
2009	March	Georgia PSC approves new Vogtle units. Total cost of project estimated at \$14 billion. Georgia Power's share will be \$6.4 billion		
2009	Aug.	NRC grants Early Site Permit		
2010	Feb.	Georgia PSC approves cost of new units. Stipulation lowers cost from \$6.4 to \$6.1 billion		
2010	Feb.	Federal loan guarantees granted. Total guaranteed borrowings would not exceed 70 percent of the company's eligible projected costs, or approximately \$3.4 billion, and are expected to be funded by the Federal Financing Bank. Any guaranteed borrowings would be full recourse to Georgia Power and secured by a first priority lien on the company's 45.7 percent ownership interest in the project.		
2010	Sept.	NRC's draft Supplemental Environmental Impact Statement states that it has not found an environmental reason to deny a COL		
2011	Jan.	Beginning of early cost recovery plan upon ratepayers		
2012		Anticipated approval of construction and operating license application		

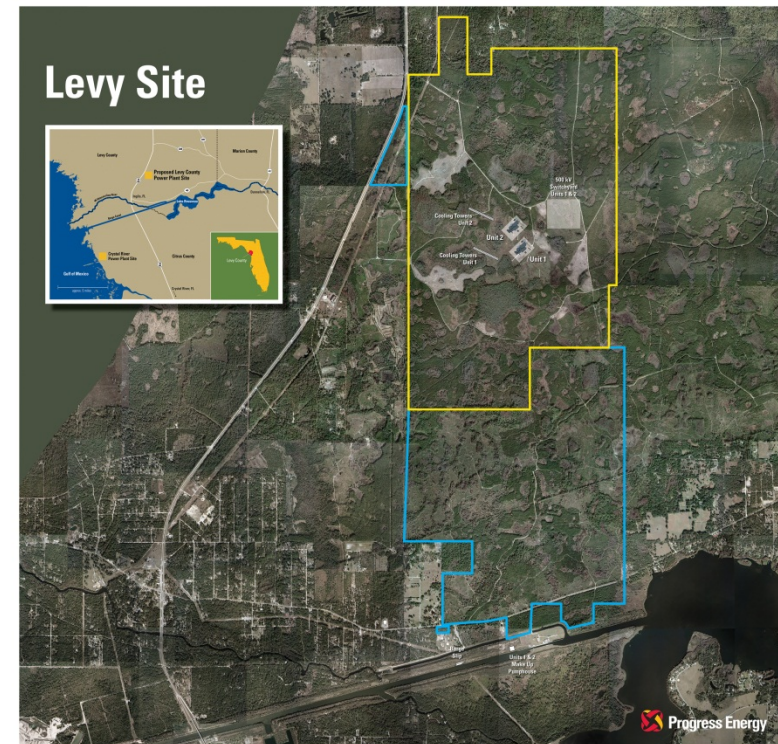
# Vogle 3 & 4: Levelized Cost Estimates

- Range informed by Company's experience with Vogtle 1 & 2. Initial cost projection: \$660 million. Final cost: \$8.87 billion
- **Low Estimate:** (\$14 billion): levelized \$63/MWh
- **Mid Case:** \$115/MWh or 1/2 of trajectory of high estimate
- **High Estimate:** 200% or 2/3 of cost estimate from Vogtle 1 and 2. \$168/MWh

Category	Units	EE	NG CC	Biomass	Wind On-Shore	Coal	Wind Offshore	Solar PV	Vogle (Mid)
Capital Cost	\$/kW	N/A	\$1,200	\$4,400	\$2,250	\$3,000	\$6,000	\$3,300	\$10,775
Capital Cost	\$/MWh	\$40	\$17.44	\$57.73	\$83.64	\$43.61	\$167.28	\$184.01	\$101.53
Fuel Cost	\$/MWh	0	\$47.08	\$30.13	\$0.00	\$20.49	\$0.00	\$0.00	\$8.58
O&M (Fixed and Variable)	\$/MWh	0	\$3.72	\$16.02	\$12.02	\$8.64	\$25.30	\$6.95	\$13.13
Emission Cost	\$/MWh	0	\$14.91	\$0.04	\$0.00	\$36.45	\$0.00	\$0.00	\$0.00
Tax Credits	\$/MWh	0	\$0.00	-\$13.63	-\$13.63	\$0.00	-\$13.63	-\$55.20	-\$7.89
<b>All-In Costs</b>	<b>\$/MWh</b>	<b>\$40</b>	<b>\$83.15</b>	<b>\$90.30</b>	<b>\$82.04</b>	<b>\$109.19</b>	<b>\$178.96</b>	<b>\$135.76</b>	<b>\$115.35</b>

# Levy 1 and 2

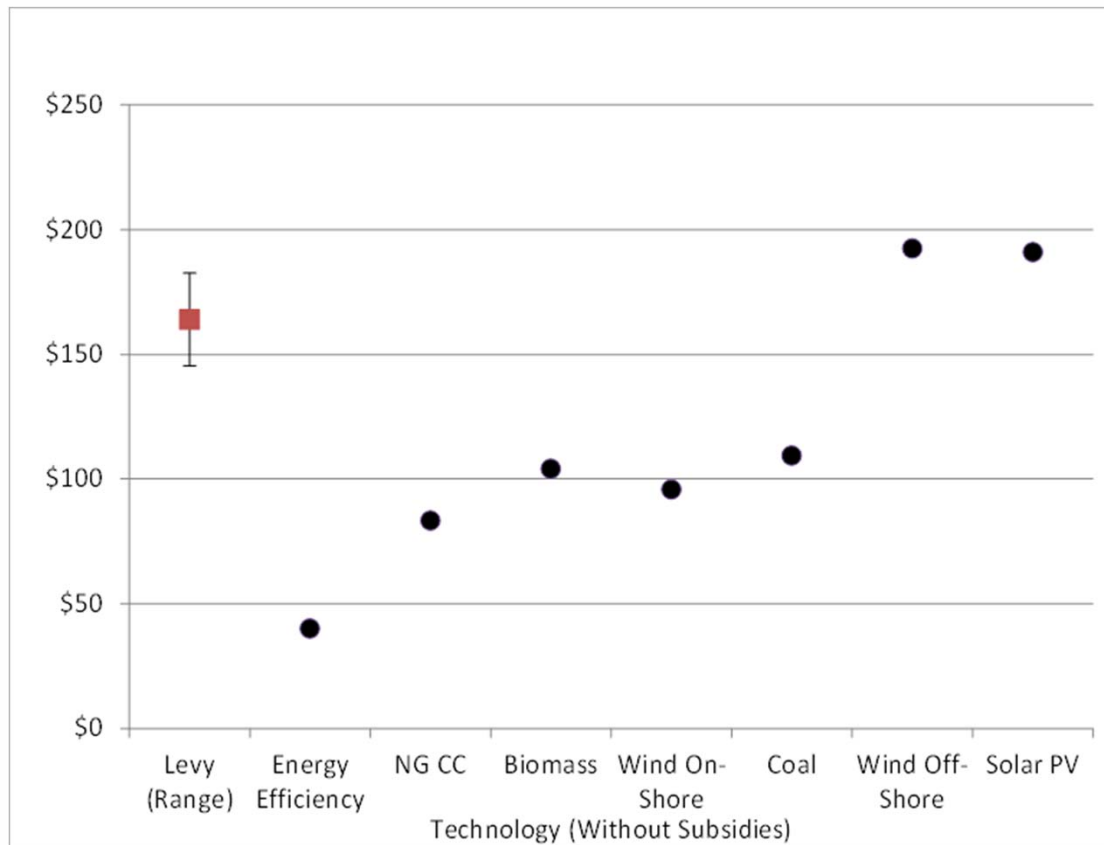
- Progress Energy Florida (100%)
- Greenfield site
- 1,100 MW each unit
- Expected delivery 2021 Unit 1, 2023 Unit 2
- Published cost estimate at \$22.5 billion



# Timeline of Events and Announced Costs

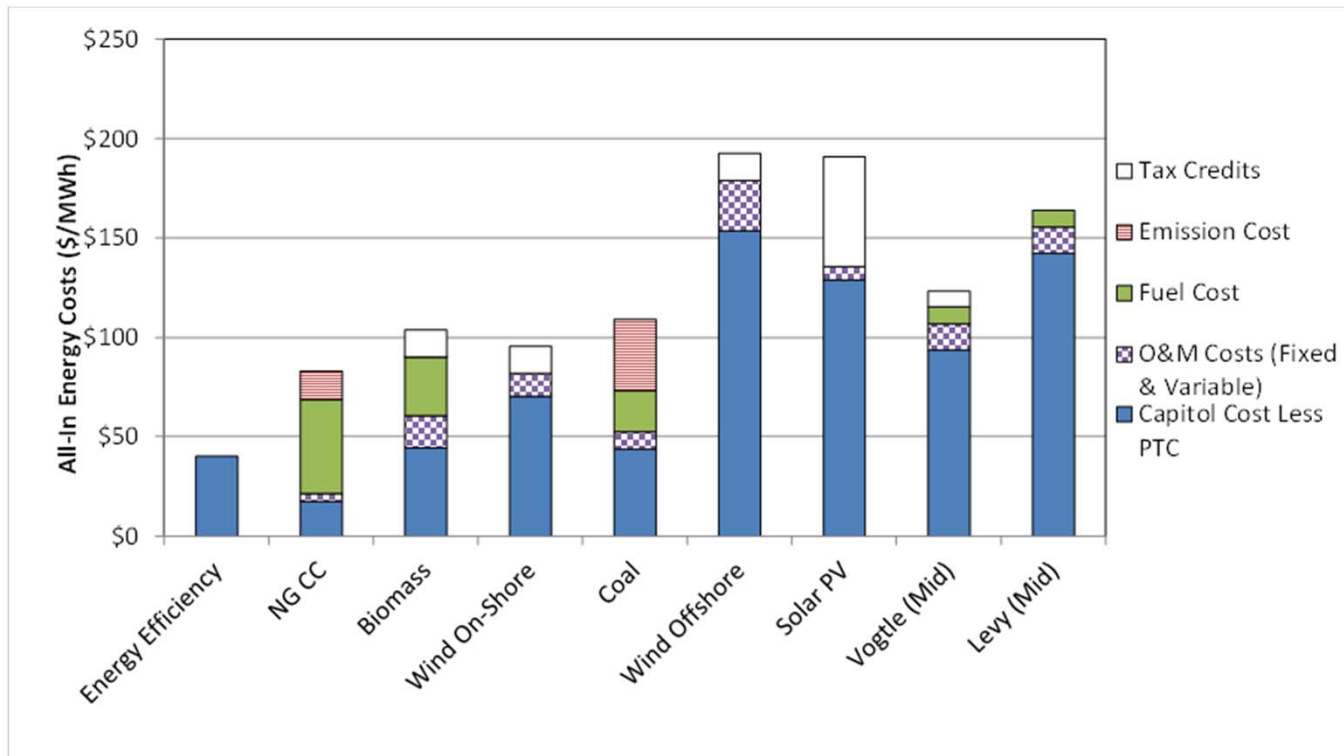
Year	Month	Event	Completion Date	Cost Estimate
2006	Dec.	Progress selects Levy site for single unit	2016 Unit 1	\$2.5 to \$3.5 billion
2008	March	Progress triples cost estimates for Levy Units 1 and 2 to \$17 billion		\$17 billion
2008	July	Florida PSC approves need for two units		
2008	Aug.	Construction and operating license filed with NRC		
2008	Aug.	Approval given to project from governor and his cabinet		
2009	Jan.	Progress signs contract for reactor design		
2009	May	Progress files 2010 cost recovery plan to PSC		
2009	May	Progress announces at least a 20-month delay on planned reactors	2016 Unit 1 2018 Unit 2	\$17 billion
2010	Jan.	Progress announces unspecified delays to Levy project based on Florida PSC decision that denied \$500 million rate hike request		
2010	Feb.	Progress extends delay on Levy project to at least 36 months	2019 Unit 1 2021 Unit 2	\$22.5 billion
2010	May	Cost estimate for project increases from \$17.2 billion to \$22.5 billion		
2010	May	The timeline for the Levy project is delayed to 2021 for Unit 1 and 2023 for Unit 2	2021 Unit 1 2023 Unit 2	

# Levelized Cost Estimates



- **Low Estimate:** (\$22.5 billion): levelized \$146/MWh
- **Mid Case:** 15% increase of project costs \$25.9 billion or \$164/MWh
- **High Estimate:** 30% increase of project costs or \$29.3 billion. \$183/ MWh

# Comparison of Mid-case Cost Estimates for Both Proposed Plants



- Impact of Tax Credits shown for nuclear and alternatives

# Differences Between Proposed Projects Driving Cost Estimates

- Federal Loan Guarantee
  - \$8.33 billion DOE loan guarantee announced February 2010
  - Allows Georgia Power to borrow at below market rates
  - Allows Georgia Power to increase debt fraction (Synapse increases debt fraction to 75%)
- Production Tax Credit (PTC)
  - 1.8 cents per kWh for first 1,000 MW
  - Cap at \$125 million per year for first eight years of operation
  - PTC extends through December 31, 2020
  - Synapse's analysis assumed only Vogtle 3 & 4 would receive PTC

## Impact on Ratepayers

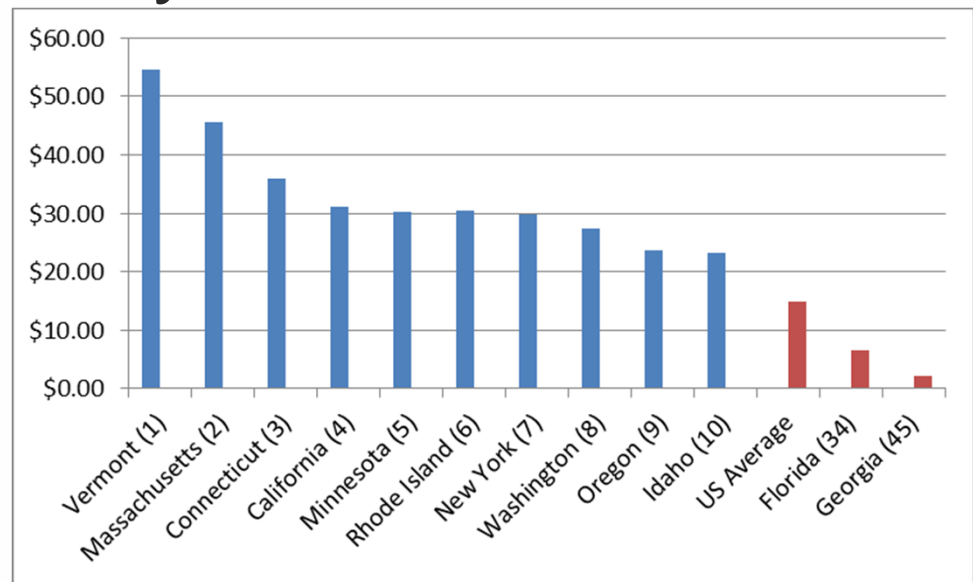
- Ratepayers will be paying for the plants before single kilowatt-hour is generated
- Impact based on **current** cost estimates. Could be higher if costs of plants increase
- Georgia Power
  - Recovery of financing costs
  - Georgia Power's estimate is that by 2018 ratepayer (1,000 kWh/month) is paying \$120 per year
- Progress Energy Florida
  - Recovery of preconstruction and construction costs
  - By 2021, amounts to \$717 per year for Progress ratepayer (Based on 2010 testimony)

# Better Alternatives: Energy Efficiency

## Energy Efficiency

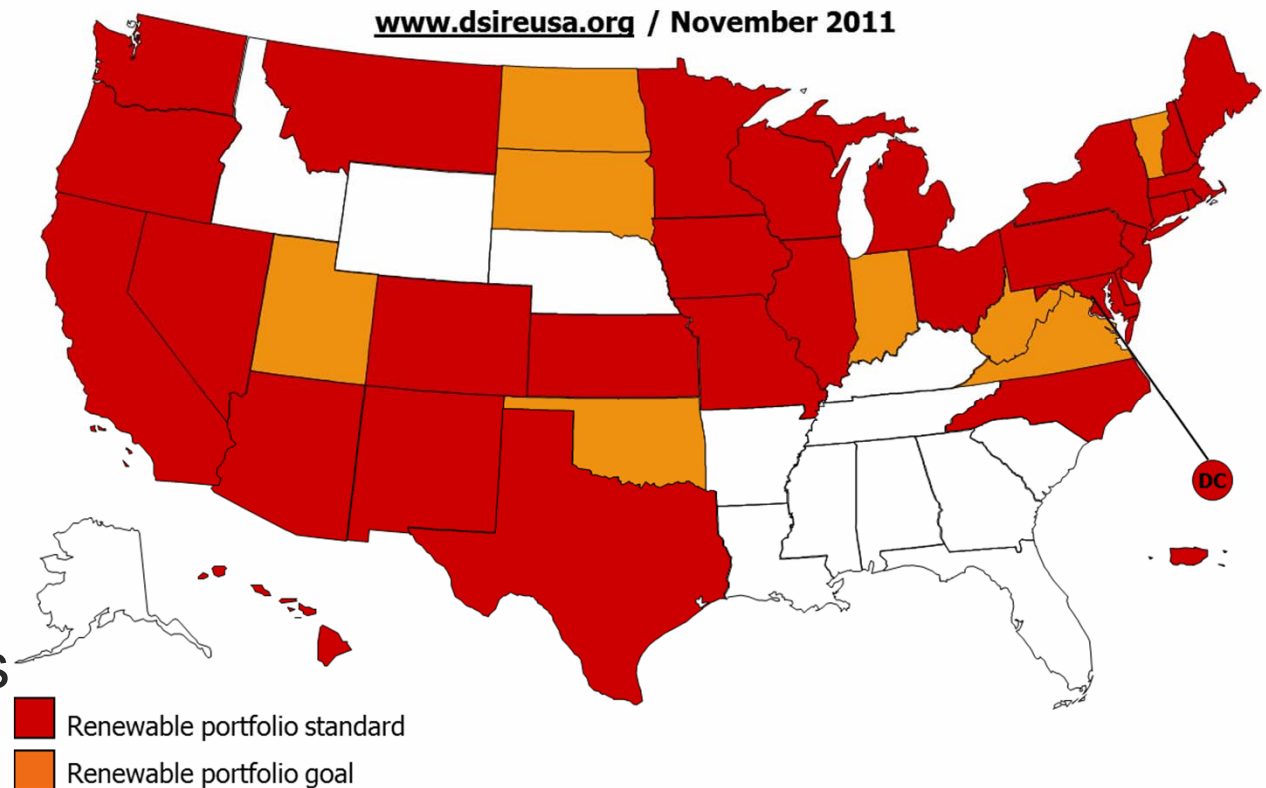
- Georgia has no energy efficiency targets
- Florida reduced targets this year

## American Council for an Energy Efficient Economy (ACEEE): Survey of 2010 Per Capita EE Spending:



# Better Alternatives: Renewable Energy

- 29 other states and territories have targets
- 8 states have goals
- Georgia and Florida have neither renewable energy targets nor goals!



# Better Alternatives Florida: Renewables

- 2008 Navigant Consulting prepared study for Florida Public Service Commission identifying Renewable Energy (RE) potential in the state.  
(<http://www.floridapsc.com/utilities/electricgas/RenewableEnergy/Assessment.aspx>)
- Study identified range of 136,393 to 142,862 MW of RE potential in state
- Florida's current capacity 59,073 MW (2009 EIA data)
- Levy 1 & 2's capacity: 2,200 MW

Resource	Technical Potential Megawatts (MW)
Photovoltaic on rooftops	52,000
Photovoltaic in ground arrays	37,000
Concentrated solar power	380
Solar water heating	1,136
Onshore wind	186
Offshore wind	40,311
Biomass (available but not collected)	400 - 1,359
Biomass (potentially available)	3,945 - 9,555
Landfill gas (new sites)	110
Anaerobic digester gas	35
Waste heat (sulfuric acid conversion)	140
Ocean current	750
<b>Total</b>	<b>136,393 - 142,862</b>
Levy 1 & 2	2,200

# Better Alternatives Georgia: Renewables

- Georgia has not commissioned a study on renewable energy potential in the state
- 2009 SACE analyzed renewable energy potential in the South, including Georgia
- Study identified that by 2025; RE could generate 99,809 GWh of electricity for state
- Georgia's current generation at 128,698 GWh (2009 EIA data)
- Vogtle 3 & 4 annual generation 16,380 GWh (Synapse calculation)

SACE Maximum Annual Feasible Potential Generation (gigawatt-hours) for Georgia by Source	
Energy Source	2025 (GWh)
Onshore Wind	3,635
Offshore Wind	52,788
Biomass	22,703
Hydroelectric	2,015
Solar	18,668
<b>Total</b>	<b>99,809</b>
<b>Total (Vogtle 3 &amp; 4)</b>	<b>16,380</b>

From: SACE 2009, Calculation for Vogtle 3 & 4

# Conclusions and Recommendations: Georgia

- Our analysis suggests that the final project cost is far from certain, and is likely to be much higher than the current estimate.
- Our mid-range estimate of the levelized cost for Vogtle 3 & 4 is \$115 per MWh based on history of Vogtle 1 & 2. This estimate is above all of our mid-range cost estimates for energy efficiency, renewable resources (except off-shore wind and solar PV), and conventional generation.
- Georgia Power ratepayers will pay an estimated \$120 per year by 2018 in financing charges based on the *current* cost estimate. Should the cost of the project increase, then the impact on customer bills will also increase.
- Available studies show that there is substantial energy efficiency and renewable energy resource potential in Georgia that could be utilized to meet the state's future energy needs at far lower cost and risk.
- Georgia should commission new, independent energy efficiency and renewable energy studies for the entire state to help inform and guide policymakers in weighing the costs and benefits of different alternatives for meeting future energy needs. The last energy efficiency potential study was conducted in 2005 and the state has never commissioned a study to assess the renewable resource potential.
- Georgia should take immediate steps to set statewide energy efficiency and renewable energy targets that are consistent with those of leading states.

# Conclusions and Recommendations: Florida

- The project schedule for Levy 1 and 2 has been significantly delayed from the initially proposed operating dates. Concurrently, Progress has increased its construction cost estimates. Between 2008 and 2010, the cost estimate increased by \$5 billion, or approximately 30 percent.
- Our mid-range analysis of the levelized cost for the project is \$164 per MWh. This is well above our mid-range cost estimates for alternatives such as energy efficiency, renewable energy resources, and conventional generation.
- Progress Energy's own filings show that, based on current cost estimates, its residential ratepayers will pay \$718 per year by 2021 for the Levy project—even **before** it generates any electricity. Should project costs increase further, customers will see a corresponding increase in their bills.
- Florida should take steps to increase its energy efficiency targets to levels more consistent with leading states.
- Florida has ample renewable energy potential to meet electricity load growth. Additionally tapping into the renewable energy potential will help diversify Florida's resource mix.
- Any additional demand growth in Florida can be met through available and cost-effective renewable energy resources and conventional resources such as natural gas.