NASEO – Southeast Regional Meeting
EPA’s Proposed Clean Power Plan

May 18, 2015
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- Summary & Overview of Georgia’s Proposed Targets
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- Cost of CO2 and Potential Impact on Rates
# Navigant Consulting and the Energy Practice

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<tr>
<th>Navigant Consulting (4,500 Employees)</th>
<th>Global Energy Practice</th>
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<tbody>
<tr>
<td>» Core business areas: Management consulting, Economics, Financial Advisory, and Disputes &amp; Investigations</td>
<td>» <strong>Our clients:</strong> 50 largest electric and gas utilities, 20 largest independent power generators, 20 largest gas distribution and pipeline companies, leading oil &amp; gas companies, international, federal, and state government organizations, and numerous new energy market entrants and investors.</td>
</tr>
<tr>
<td>» Publicly traded since 1996 (NYSE: NCI)</td>
<td>» <strong>Our 400+ consultants</strong> comprise the largest energy management consulting team in the industry. Our team has an average of 15 years’ of experience, <strong>60% have an advanced degree</strong>, and 51% have an engineering degree.</td>
</tr>
<tr>
<td>» 2014 revenue: $859.6 million</td>
<td>» Our consultants serve leading energy companies to address their most complex business opportunities and challenges.</td>
</tr>
<tr>
<td>» 35 offices in North America, Europe, and Asia</td>
<td>» Focused on <strong>high value, high quality</strong> projects.</td>
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</tbody>
</table>

**Navigant named "Best Advisory – Renewable Energy" in the 9th and 10th Annual Environmental Finance and Carbon Finance Market Surveys**
By partnering with our clients, Navigant helps businesses define and resolve complex challenges within the energy industry through innovation, objectivity, deep industry experience, and operational knowledge.
Navigant’s extensive experience and expertise in many areas drive and inform our interdisciplinary solution offerings.
Navigant’s Energy Practice – Solutions & Capabilities

- Business Strategy and Implementation
- Innovation and R&D Management
- Organizational Design
- Change Management
- Technology Advisory
- Merger & Acquisitions
- Integrated Resource Planning

- Market Strategy and Pricing
- Customer Engagement
- Emerging Technologies (renewables, distributed generation, storage, micro grids and others)
- Energy Efficiency
- Demand Response
- Customer Analytics

- Business Case Development
- Risk Management
- Physical and Cybersecurity
- Regulatory Compliance
- Federal and State Regulatory Support
- Policy Development and Code & Standards

- Operational Excellence
- Asset Management
- Grid Operations
- Distributed Resource Management
- Restoration and Outage Management
- Manufacturing Impact Analysis
- Equipment / Appliance Testing

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Guiding Clients through Industry Transformation

**TODAY**

**One-Way Power System**

- Large, centrally located generation facilities
- Designed for one-way energy flow
- Utility controlled
- Technologically inflexible
- Simple market structures and transactions
- Highly regulated (rate base) and pass through

**EMERGING**

**The Energy Cloud**

- Distributed energy resources
- Multiple inputs and users, supporting two-way energy flows
- Digitalization of the electric-mechanical infrastructure: smart grid and behind the meter energy management systems
- Flexible, dynamic, and resilient
- Complex market structures and transactions
- Regulation changing rapidly around renewables, distributed generation (solar, micro-grid, storage), net metering etc.
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GEFA requested Navigant to undertake a high-level review of energy efficiency ("EE") compliance options with the Clean Power Plan ("CPP").

- This assessment focuses primarily on secondary research to provide GEFA guidance and insight into Georgia’s compliance with the CPP.
- Task 1 – Assessment of Building Block 4 (BB4) costs, the CPP’s Energy Efficiency goals, compared to Building Blocks 1, 2 and 3 (BB1, BB2 and BB3).
- Task 2 – Benefit-Cost Analysis to Achieve a 1.5% Savings Target.
- The assessment will also help inform GEFA in drafting formal comments on the CPP rulemaking by December 1st, 2014.
The objective of Task 1 was to provide GEFA with an understanding of the structure and relative costs of each CPP building block.

- **Assessment of Costs Compared to the Other CPP Building Blocks (1-3)**

1. **Make fossil fuel power plants more efficient** in targeting an average heat rate improvement of 6% for coal steam electric generating units (EGUs)
2. **Maximize utilization of NGCC generation** through dispatch of existing and under-construction NGCC units to up to a 70% capacity factor
3. **Expand use of zero and low-emitting power sources** including new nuclear generation under construction, deployment of new renewable generation, and continued use of existing nuclear generation

- This includes a high-level assessment of costs for building blocks 1, 2 and 3
The objective of Task 2 is to help GEFA determine if Georgia can achieve a 1.5% savings target through energy efficiency.

- **Analysis of achieving a 1.5% savings target**

- A review Georgia Power’s recent EE results (e.g. Georgia Power’s Q2 Budget and Targets) - Navigant extrapolated EE costs and savings to determine whether Georgia can achieve a 1.5% savings target per the CPP

- The analysis was assessed through an EE Benefit-Cost approach using ratios for GA Power scaled to reflect the state as a whole
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Cost of CO2 and Potential Impact on Rates
EPA’s Four Building Blocks – Implications for Georgia

Georgia’s goal under the CPP is to reduce the carbon intensity of its electricity generation from 1500 to 834 lbs. CO\textsubscript{2} per MWh through 2029.

- Georgia may utilize alternate strategies to reach compliance with the goal; however, the EPA has developed 4 Building Blocks as the Best Strategy for Emissions Reduction (BSER) proposition
  - Goals are calculated based on improvement from a 2012 baseline year
  - Mass-based targets equivalent to the prescribed CO\textsubscript{2} rate reduction are also acceptable

<table>
<thead>
<tr>
<th>EPA's Four Building Blocks</th>
<th>Actions Prescribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Heat Rate Improvements</td>
<td>• 4-6% Reduction in CO\textsubscript{2} emissions per unit of output</td>
</tr>
<tr>
<td>2) Optimize NGCC Dispatch</td>
<td>• Maximize utilization of NG capacity to a 64%-70%* Capacity Factor</td>
</tr>
<tr>
<td>3) Expand Low-Carbon Generation &amp; Renewables</td>
<td>• Grow renewable energy (RE) in Georgia from 3% of Total Generation (2012) to 10% through 2029</td>
</tr>
</tbody>
</table>
| 4) Energy Efficiency                       | • 2029 Cumulative savings goal: 9.8%  
  • 0.2% annual growth until 1.5% annual growth is reached |

Note: While EPA models used 70% as a target, this factor was controlled by the historical performance of a state’s NGCC resources. For 29 states 64% was the maximum CF utilized and we have used 64% for GA in our cost estimates.
BB3 is the largest element of GA’s goal as a result of the Vogtle 3 & 4 reactors under construction.

- EPA sought comment on including under construction Nuclear in its goal setting.
- Including Vogtle is a potential risk for Georgia – in the event they are not completed, GA’s total goal will be more difficult to reach.
- Overall, EE/DSM plays an important role in achieving the EPA goals - also, EE is not created equal in terms of carbon displacement.

**EPA’s BBs as Share of GA’s Total Goal**

- BB1: Heat Rate Improvements, 10%
- BB2: NG Dispatch Optimization, 33%
- BB3: Vogtle 3 & 4, 30%
- BB3: Renewables/Low Carbon Gen, 14%
- BB4: EE/DSM, 14%

*Data Source: EPA Goal Computation TSD, June 2014, Navigant Estimate of Vogtle Production*
EPA’s reduction goals are set relative to economic achievability and a state’s 2012 base emissions rate.

States with under-construction Nuclear have the largest BB3 goals. GA, SC, and TN are the only such states in the U.S.

Source: SEEA 2014
The study finds it is possible for GA to meet the CPP goals with constraints.

**Executive Summary of the CPP Building Block Analysis**

### GA’s Ability to Comply with BBs 1, 2 and 3

#### BB1: Heat Rate Improvements

<table>
<thead>
<tr>
<th>EPA Modeled Cost: $7.7/Mton CO2</th>
<th>Ability to Meet Targets (9.8% by 2029)</th>
<th>Program Levelized Cost of Saved Energy (Net)</th>
<th>First Year Program Costs (Net)</th>
<th>TRC Test Benefits To GA</th>
<th>Participant Cost Test Benefits to GA</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Cost</td>
<td>$22,534,858</td>
<td>$33,802,287</td>
<td>$4.4 BB through 2029</td>
<td>$10.6 BB through 2029</td>
<td>$21.2 BB through 2029</td>
</tr>
<tr>
<td>Low Cost</td>
<td>$11,267,429</td>
<td>$16,901,144</td>
<td>$21.2 BB through 2029</td>
<td>$36.4 BB through 2029</td>
<td>$72.6 BB through 2029</td>
</tr>
</tbody>
</table>

#### BB2: Re-Dispatch to NGCC

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Estim. BB2 costs based on EPA Carbon Avoidance ($21/Mton CO2)</td>
<td>~$2.2 Billion</td>
</tr>
<tr>
<td>Total Estimated Fuel Cost for NG Dispatch vs. Coal 2020-2029 ($2013)</td>
<td>$296.6 Million</td>
</tr>
</tbody>
</table>

#### BB3: Expand Low-Carbon and Renewable Resources

<table>
<thead>
<tr>
<th>Factor</th>
<th>Any of the following can Individually Meet the BB3 Goal</th>
<th>2017-29 Gross Cost (LCOE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>1,536 (MW)</td>
<td>$3.2 B</td>
</tr>
<tr>
<td>Onshore Wind</td>
<td>1,024 (MW)</td>
<td>$2.0 B</td>
</tr>
<tr>
<td>Biomass</td>
<td>512 (MW)</td>
<td>$2.9 B</td>
</tr>
</tbody>
</table>

### GA’s Ability/Cost to Meet Building Block 4’s Goal

**Low**

- 25% Incentive Level (Assumes all utilities can achieve the same level of savings as GA Power)
- Program Levelized Cost of Saved Energy (Net): $0.6 BB by 2029 ($0.024 / kWh to $0.033 / kWh)
- First Year Program Costs (Net): $4.4 BB through 2029 ($0.20 / kWh)
- TRC Test Benefits To GA: $10.6 BB through 2029
- Participant Cost Test Benefits to GA: $21.2 BB through 2029

**High**

- 100% Incentive Level (Assumes GA Power is the only admin. of EE programs)
- Program Levelized Cost of Saved Energy (Net): $1.0 BB by 2029 ($0.041 / kWh to $0.058 / kWh)
- First Year Program Costs (Net): $7.6 BB through 2029 ($0.35 / kWh)
- TRC Test Benefits To GA: $18.2 BB through 2029
- Participant Cost Test Benefits to GA: $36.4 BB through 2029
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Task 1 – BB1: Heat Rate Improvements (HRIs) – Overview

BB1 Heat Rate Improvements: Reduce the overall carbon intensity of existing Coal EGUs 4-6% through best practices and technology investments.

**Concept:** Improve plant efficiency to reduce coal consumption per output unit thus reducing overall carbon intensity

- EPA’s BB1 margin is based on a 4-6% reduction in CO₂ output vs. 2012 base year
  - 4% Best Practices + 2% Equipment Upgrades = 6% Gross

- **EPA Cost Estimates:** $6-$12/Metric Ton of CO₂ avoided; projected cost is $7.7/ton
  - HRIs are engineering projects – costs will vary by plant age and configuration
  - HRIs will also reduce variable fuel costs, which is deducted from the EPA’s cost estimates
  - Net cost of HRIs will decline with increasing fuel supply costs

- EPA’s HRI technical analysis drew from a 2009 Sargent & Lundy Report: *Coal-Fired Power Plant Heat Rate Reductions*. This report was funded and reviewed by the EPA but not published by the agency.

**HRI Measures**

No Cost and Low-Cost Options
- Condenser Cleaning
- Intelligent Soot Blowers
- ESP Modification
- Boiler Feed Pump Rebuild
- Air Heater and Duct Leakage Control
- Neural Network
- SCR System Modification
- FGD System Modification
- Cooling Tower Advanced Packing

Higher Cost Options
- Economizer Replacement
- Acid Dew Point Control
- Combined VFD and Fan Turbine Overhaul

*Source: EPA GHG Abatement TSD, June 2014. Pg. 2-33*
The economics of HRIs are tied to cost of fuel supply and individual plant characteristics and constraints.

- On average, HRIs may be economic on their own if average coal supply prices rise to $3.25/MMBtu, current EIA forecast suggests $2.6/MMBtu in 2020.

### Estimated Net Cost of HRIs for GA’s 2012 Coal Fleet

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Low Cost</th>
<th>EPA Projected $7.7/Mton Cost</th>
<th>High Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>4% Improvement</td>
<td>$11,267,429</td>
<td>$14,459,867</td>
<td>$22,534,858</td>
</tr>
<tr>
<td>6% Improvement</td>
<td>$16,901,144</td>
<td>$21,689,801</td>
<td>$33,802,287</td>
</tr>
</tbody>
</table>

*Data Source:* Navigant estimate based on 2012 EIA generation data (base year) and EPA carbon avoidance cost projections.
BB2 Optimized Dispatch: Maximize the utilization of existing, cleaner, NG capacity.

**Concept:** Fully utilize existing, cleaner NG Capacity (EPA has modeled improving utilization to a 64% NG Capacity Factor on average)

- **EPA Basis:** Nationally, NG plants in 2012 saw roughly 45% utilization—historical performance data shows utilization rates can reliably climb into the 70%+ range
- **Per unit of output, NG generation emits roughly half the CO2 of Coal generation**
  - EIA 2012 Emissions Factors: Coal: 2220 lbs./MWH, NGCC: 907 lbs./MWH - this does not account for Methane emissions from hydraulic fracturing or Coal mining
- **In practice, utilizing a higher share of NG capacity can be limited by physical infrastructure constraints** – may not be as simple as linear dispatch changes
- **Based on Navigant cost data from the Southeast in Q4 2013, Coal O&M and Fuel Costs were ~4.4% lower than NG per MWh**
- **Navigant used its GKS coal and natural gas data which is based upon actual costs for GA and surrounding states and chose not to model EIA price projections due to large variances (EIA variance = 100%) through 2040**

### NGCC Cost/MWH – Q4 2013 $

<table>
<thead>
<tr>
<th></th>
<th>O&amp;M $ Inc. Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>38.50</td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>40.50</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>33.03</td>
</tr>
<tr>
<td>Upper Decile</td>
<td>53.94</td>
</tr>
<tr>
<td>Lower Decile</td>
<td>28.72</td>
</tr>
</tbody>
</table>

Source: Navigant GKS Data

### Coal Cost/MWH – Q4 2013 $

<table>
<thead>
<tr>
<th></th>
<th>O&amp;M $ Inc. Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>36.82</td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>44.49</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>34.34</td>
</tr>
<tr>
<td>Upper Decile</td>
<td>46.25</td>
</tr>
<tr>
<td>Lower Decile</td>
<td>30.06</td>
</tr>
</tbody>
</table>

Source: Navigant GKS Data
Georgia Power is more exposed to BB2 due to a heavy reliance on Coal, but Georgia overall may be better positioned.

- Charts show MWh (how capacity was used) in 2012 base year, rather than installed capacity (MW) – 111(d) is focused on how is capacity is used (MWh)
- Georgia Power is more exposed to BB2 than Georgia at large as a result of traditionally relying on a greater share of less expensive coal generation—currently NG fuel supply costs are ~4.4% more expensive than Coal in the Southeast
- Coal share expected to decrease due to retirements and fuel switching to NG by 2015 due to mercury regulatory liabilities
- Including Vogtle brings nuclear to 36% of total generation along with 1% solar and the other generation sources decrease correspondingly
EPA’s goal for Georgia is to utilize existing NG plants at a ~64% CF. This will reduce the overall CO₂ emissions rate by 217 lbs./MWh as compared to meeting the same generation level with Coal.

- The base year of 2012 shows Georgia NG Plants at a 45% CF which is near the 2012 national average of 46% (EIA Data)
- *Re-dispatched fuel cost analysis shows that Georgia would spend approximately $29 Million more on natural gas fuel costs annually at 2013 supply prices operating NG plants at a 64% CF (includes savings from coal capacity reduction)*
- Linear analysis based on Q4 2013 supply costs only — does not contemplate fuel price variability or changes to the economics of fixed cost recovery at existing coal plants
  - Fuel price variability was excluded from the analysis due to the substantial variance in supply costs forecasted by the EIA through 2030 for NG and Coal supply prices

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value</th>
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<tbody>
<tr>
<td>Surplus 2012 Annual NG MWH in GA*</td>
<td>17,656,454</td>
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<tr>
<td>Additional Annual Cost of Re-Dispatch to NGCC ($2013)</td>
<td>$29,662,842</td>
</tr>
<tr>
<td>Total Estimated Fuel Cost for NG Dispatch vs. Coal 2020-2029 ($2013)</td>
<td>$296.6 Million</td>
</tr>
</tbody>
</table>

Source: Navigant estimate based on EIA data and Navigant supply 2013 supply prices

* Assumes NG generation increases to a 64% Capacity Factor, and displaces an identical amount of Coal generation. Capacity expansion modeling would be required to determine the share of coal that could truly be reduced.
Infrastructure constraints may affect the ability to easily re-dispatch generation.

- **Load must be served reliably**—Plant Bowen, one of North America’s largest Coal EGU, is located in close proximity to GA’s largest load center (Atlanta)
- Transmission constraints & available NG supply play roles here

**Generation Infrastructure in the Atlanta Region**

Data Source: EIA 2014

Plant Bowen: ~3500 MW, ~23 Million Annual Tons CO₂
Task 1 – BB3: Low-Carbon Generation & RE – Overview

BB3: Grow RE in Georgia from 3% of Total Generation in 2012 to 10% through 2029 - planned Vogtle additions are included, but increase the net goal by the same quantity as their contribution.

- Concept: Expand use of RE and low-carbon generation to offset other high-carbon capacity
  - As proposed, BB3 represents the largest share of GA’s total CO₂ reduction goal at 38%
    - The Vogtle 3&4 reactors are estimated to comprise ~68% of BB3, or 26% of GA’s total reduction goal
    - Capacity from Vogtle considered by EPA to have a $0.00 incremental cost towards goal
  - EPA has developed goals for individual states based on a maximum RE target and an annual RE growth rate. These factors were developed for Georgia based on the regional performance and RPS policy of Georgia’s selected peer states:
    - Peer States: Alabama, Florida, Kentucky, Tennessee, Mississippi, North Carolina, and South Carolina
    - Note: North Carolina was the only peer state with an existing RPS policy; GA and peer states have had their goals set based on this policy – NC’s RPS included a goal of 10% for IOUs by 2020
  - EPA Proposed Method for Calculating Georgia’s RE Targets:
    - {(North Carolina’s RPS RE target in 2020) * (2012 Regional Total Generation)} = Gross 2029 MWH Regional Goal
      - Calculate regional RE growth factor to reach 2029 MWH goal, and apply to each state’s 2012 generation
        - Note: for some states with RPS standards in place (not GA) target amounts are less than existing RPS targets for 2030
GA has strengthened its RE portfolio since 2012; including planned RE additions GA is currently poised to achieve ~67% of its RE goal by 2029 (this is only RE, doesn’t include Vogtle)

- GA 2017 at left represents annual RE generation from GA in 2012 plus the planned RE addition of 900 MW of Solar capacity (GA Power) and 250 MW of Wind (GA Power Oklahoma PPA) – Vogtle is represented in BB3 as planned capacity-this detail only focuses on RE
- GA 2012 Base year: 3,278,536 MWh of RE generation

EPA does not assume a specific RE type

- Conventional hydro is excluded though new incremental capacity can count towards the BB3 goal
- Fuels included for the Southeast in 2012: Wind, Solar Thermal & PV, Biomass/Wood & Wood Derived
  - ‘Wood Derived’ fuels are a significant contributor to 2012 base year generation in the Southeast and include fuels such as black liquor and various heavy wood wastes

Cumulative RE generation goal for GA through 2029:

- 106,649,571 MWh, Current Path leads to: ~71,660,370 MWh through 2029 or ~67% of the net goal
- By Comparison: Vogtle 3&4 ≈ 228,967,128 MWh of Expected Net Generation through 2029

Data Source: EPA TSD Support Analysis, June 2014
Comparing the economic competitiveness of utility-scale RE supply to other sources based on their lifetime costs shows that EE and NGCC are the most competitive (when including avoided costs as the benefit).

- **Note:** Nuclear offsets extremely high construction costs with low variable operating costs and significant lifetime output/revenues and is more competitive when including avoided costs. Experience with Nuclear capacity additions in the U.S. has showed that significant construction delay and capital cost overrun risks can dramatically alter their long-term economics.

**Levelized Avoided Cost Minus Levelized Cost - Based on EIA 2019 Cost Forecast & 2019 EE Estimates for GA Power - $/MWh**

- Solar PV, 45
- Biomass, 39
- Conventional Coal, 33
- Onshore Wind, 25
- Nuclear, 24
- Natural Gas CC, 2
- Energy Efficiency, -6.8 (Georgia Power 2019)

Task 1 – BB3: Resource Cost Comparison – *LCOE Only*

Cost of energy *(which doesn’t include avoided costs)* shows Nuclear, Coal, and Solar are less competitive than other resources - EE is competitive even without avoided costs.

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**Data Source:** Lazard LCOE Analysis 2014, Navigant Estimate for Georgia
Task 1 – Summary

BB1: Heat Rate Improvements

<table>
<thead>
<tr>
<th></th>
<th>4% Improvement</th>
<th>6% Improvement</th>
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<tbody>
<tr>
<td>EPA Modeled Cost: $7.7/Mton CO₂</td>
<td>$14.4 MM</td>
<td>$21.6 MM</td>
</tr>
<tr>
<td>High Cost</td>
<td>$22.5 MM</td>
<td>$33.8 MM</td>
</tr>
<tr>
<td>Low Cost</td>
<td>$11.2 MM</td>
<td>$16.9 MM</td>
</tr>
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</table>

*Based on EPA estimates; $2014 Net Costs; HRI economics are closely tied to fuel costs.*

BB2: Re-Dispatch to NGCC

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Estimated BB2 costs based on EPA Cost of Carbon Avoidance</td>
<td>~$2.2 B</td>
</tr>
<tr>
<td>($21/Mton CO₂)</td>
<td></td>
</tr>
<tr>
<td>Total Estimated Fuel Cost for NG Dispatch vs. Coal 2020-2029 ($2013)</td>
<td>$296.6 MM</td>
</tr>
<tr>
<td><em>Based on Q4 2013 Southeast U.S. Supply Costs Only</em></td>
<td></td>
</tr>
</tbody>
</table>

BB3: Expand Low-Carbon and Renewable Resources

- Including recent wind and solar commitments and assuming Vogtle 3 & 4 are completed by 2017, Georgia is poised to achieve 67% of its BB3 goal. *Any of the below RE source estimates, individually, would allow GA to meet the BB3 goal.*

<table>
<thead>
<tr>
<th>Individual Estimated Installed Capacity Requirement to meet BB3</th>
<th>2017-2029 Gross Cost (LCOE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar 1,536 (MW)</td>
<td>$3.2 B</td>
</tr>
<tr>
<td>Onshore Wind 1,024 (MW)</td>
<td>$2.0 B</td>
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<td>Biomass 512 (MW)</td>
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Task 2 – Overview of BB4 (Achieving the 1.5% Goal)

Task 2 examines the costs and benefits of meeting the energy efficiency targets proposed in EPA BB4 focusing on Scenario 1.

- **Scenario 1:**
  - EPA Scenario 1 ramps up savings by 0.2% annually starting in 2017 with a capped goal of 1.5% annual savings additions.
  - Scenario 1 reaches 9.8% cumulative annual net savings by 2029 factoring in the decay of added savings over time.

- **Scenario 2:**
  - EPA Scenario 2, an alternative, ramps up savings by 0.1% annually starting in 2017, with a capped goal of 1.0% annual savings additions.
  - Scenario 2 reaches 7.0% cumulative annual net savings by 2029 factoring in the decay of added savings over time.

Source: EPA 111(d)
Georgia’s ability to meet the BB4 targets will likely require participation in EE programs from utilities other than GA Power.

- A 2012 GA Power Potential Study indicates that the maximum achievable savings between 2012 and 2023 is 6.1%, 9.3%, and 15.3% corresponding to 25%, 50% and 100% incentive levels respectively

- **Overall results: Georgia Power - 2012-2023**

<table>
<thead>
<tr>
<th>Year</th>
<th>Analysis period (years)</th>
<th>Electricity potential ($ of sales)</th>
<th>TRC b/c ratio</th>
<th>TRC benefits (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum achievable</td>
<td>Low</td>
<td>Mid</td>
</tr>
<tr>
<td>2012</td>
<td>12</td>
<td>Tech 26.5% Econ 22.2%</td>
<td>6.1%</td>
<td>9.3%</td>
</tr>
</tbody>
</table>

- The maximum achievable efficiency for GA Power in 2023 is only 0.5% less than the EPA target in 2029 (9.3% vs 9.8%)
- This suggests that GA Power could meet their share of the EPA targets at the 50% incentive level and possibly the 25% incentive level as another 6 years remain between the 2023 and 2029 deadlines
- **However, the ability of the state as a whole to meet the EPA targets depends on the ability of other utilities (munis/co-ops) to replicate the same potential levels as GA Power**
GA Power could likely meet their share of the EPA targets at the 50% incentive level and possibly the 25% incentive level as another 6 years remain between the 2023 and 2029 deadlines.

Sources: Nexant 2012. Achievable Energy-Efficiency Potentials Assessment. Submitted to Georgia Power and EPA BB4 Base Scenario Models
Task 2 – Ability to Meet the BB4 EPA Targets

If other utilities do not contribute to meeting the EPA goal, a level approaching the 100% incentive level for GA Power may be necessary.

- If GA Power is the only program administrator, the company will have to achieve savings of approximately 15.8% of sales in 2029.
- The 2012 potential study indicates that this will require funding near or at a 100% incentive level.

9.8% Target / 62% of Sales from GA Power = 15.8% of GA Power Sales

With regard to cost, scaling GA Power first year costs to reflect the state (as a whole) results in an average of $0.20 per kWh net program costs.

- Navigant examined GA Power 10-Ks and GA Power DSM Program Certifications and employed the following steps to derive an average of $0.20 per kWh net program costs:
  1. Calculate gross first year costs by sector (residential, commercial and industrial)
  2. Correct for the fraction of sales in each sector represented by other utilities (GA Power disproportionately represents a larger share of commercial and industrial customers)
  3. Adjust from gross to net to reflect the actual first year costs of savings attributed to the utility
  4. Compare against other regional comparable states and national leaders in energy efficiency to create a range of possible investments
The first year program costs of acquiring energy efficiency are a major driver of the overall cost of meeting the targets of BB4.

The following slides reflect the range of expected annual costs examining these first year costs as inputs.
To meet the EPA BB4 targets, GA will need to fund programs at a comparable rate to long-running EE portfolios.

Only long-running portfolios were achieving the rates of savings needed to meet the 1.5% goal by funding energy efficiency at a higher rate ($0.35 per kWh)

- To achieve the levels of savings as indicated by the EPA Targets, GA will likely need to fund programs at a much higher rate than it has historically
- As illustrated on the following slide, the Southeast represents a body of states with less mature energy efficiency programs than the national leaders
- While the Georgia PSC has long required filing of an IRP, it was only in 2010 that the PSC first approved multiple energy efficiency programs filed by GA Power.
  Note: GPC has had EE programs prior to 2010, but 2010 was the first year a portfolio of programs was certified by the commission.
- In contrast, national leaders in energy efficiency have had utility administered programs dating back to the 1990s and some as far back as the 1980s
- In 2011, the Southeast was funding energy efficiency programs at a rate of between $0.07 and $0.15 per kWh saved (first year net program costs) and achieving savings of between 0.08% and 0.4% annual savings

Source: ACEEE State Spending and Savings Tables 2012 and 2013, ACEEE State Policy Scorecards
National leaders in energy efficiency are funding programs at a rate between three and five times most states in the Southeast.
The net present cost of investments needed to achieve the 9.8% target ranges from $4.4 billion to $7.6 billion.

- The net present cost (in 2014) of future investments in EE programs to meet the 9.8% target by 2029 ranges from $4.4 billion to $7.6 billion.
- Projections are based on scaled GA Power first year costs and the current rate of investment of later stage EE programs leaders, respectively.
- This range was developed through the discounted cash flow based upon the prior slides.

**Range of Net Present Cost of First Year Program Investments (2014-2029)**

- Scaled off GA Power (2014): $4.4 billion
- Top 5 National Leaders (2011 Average): $7.6 billion

Sources: Navigant Analysis of GA Power Scaled First Year Costs of Savings, ACEEE Spending Savings Tables (2012-2013), and the EPA BB4 Model (Scenario 1)

Note: Assumes 3% discount rate as specified in EPA BB4 Scenario 1
**Task 2 – Benefits of Meeting the BB4 EPA Targets**

The 2012 GA Power Potential Study outlines the benefit to cost ratios for various tests: *The overall EE benefits would out weight the costs in GA - it’s estimated that total net benefits to GA could be $5.7 BB*

<table>
<thead>
<tr>
<th>State/utility</th>
<th>Average annual maximum achievable savings (%)</th>
<th>Benefit/cost results</th>
<th>TRC benefits (million $)</th>
<th>TRC costs (million $)</th>
<th>TRC net benefits (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RIM</td>
<td>UCT</td>
<td>TRC</td>
<td>PCT</td>
</tr>
<tr>
<td>Washington DC*</td>
<td>2.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michigan</td>
<td>1.5%</td>
<td></td>
<td>2.73</td>
<td>2.71</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>1.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ameren (MO)</td>
<td>1.1%</td>
<td>0.54</td>
<td>1.65</td>
<td>1.24</td>
<td>6.23</td>
</tr>
<tr>
<td>Mississippi</td>
<td>1.3%</td>
<td>4.5</td>
<td>2.5</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Georgia Power</td>
<td>1.3%</td>
<td>0.6</td>
<td>2.4</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>FirstEnergy OH</td>
<td>1.3%</td>
<td>2.1</td>
<td>1.2</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Southwest</td>
<td>1.9%</td>
<td>2.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Studies with analysis period of 10-15 years*

Sources: 2014 ACEEE Cracking the TEAPOT, Technical, Economic, and Achievable Energy Efficiency Potential Studies
Task 2 – Benefits of Meeting the BB4 EPA Targets

At a minimum, benefits are expected to exceed $10.6 BB using the total resource cost test and $21.2 BB using the participant cost test.

- Benefit to cost ratios identified for GA Power range from 2.4 to 4.8 for the TRC and PCT, respectively
- The TRC benefits range from $10.6 Billion to $18.2 Billion
- PCT benefits range from $21.2 Billion to $36.4 Billion

Source: Navigant Analysis of GA Power Scaled First Year Costs of Savings, ACEEE Spending Savings Tables (2012-2013), and the EPA BB4 Model (Scenario 1), and 2014 ACEEE Cracking the TEAPOT
GA can meet the 9.8% savings target as proposed by EPA with net present program costs ranging from $4.4 BB to $7.6 BB and returning between $10.6 BB and $18.2 BB in benefits using the TRC.

<table>
<thead>
<tr>
<th>Range</th>
<th>Ability to Meet Targets (9.8% by 2029)</th>
<th>Program Levelized Cost of Saved Energy (Net)</th>
<th>First Year Program Costs (Net)</th>
<th>Total Resource Cost Test Benefits</th>
<th>Participant Cost Test Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>25% Incentive Level (Assumes all utilities can achieve the same level of savings as GA Power)</td>
<td>$0.6 BB by 2029 ($0.024 / kWh to $0.033 / kWh)</td>
<td>$4.4 BB through 2029 ($0.20 / kWh)</td>
<td>$10.6 BB through 2029</td>
<td>$21.2 BB through 2029</td>
</tr>
<tr>
<td>High</td>
<td>100% Incentive Level (Assumes GA Power is the only administrator of EE programs)</td>
<td>$1.0 BB by 2029 ($0.041 / kWh to $0.058 / kWh)</td>
<td>$7.6 BB through 2029 ($0.35 / kWh)</td>
<td>$18.2 BB through 2029</td>
<td>$36.4 BB through 2029</td>
</tr>
</tbody>
</table>

Source: Standard Practice Manual, Economic Analysis of Demand-Side Programs and Projects
Table of Contents

Navigant Consulting Overview

Overview of the Project – CPP 111(d) Assessment

Summary & Overview of Georgia’s Proposed Targets

Task 1 – Relative Costs of EE to BBs 1-3

Task 2 – Benefit-Cost Analysis of Achieving 1.5%

Cost of CO2 and Potential Impact on Rates
Impacts of proposed regulation

» Energy efficiency is likely to become more cost-effective
  – Significant energy efficiency has the potential to reduce overall compliance costs by ~10%
» Coal units with marginal economics risk becoming uneconomic
» Existing natural gas plants are likely to see additional revenue
» Natural gas infrastructure could be stretched
  – This strain has will likely put upward pressure on wholesale electricity prices
» States able to comply with existing renewable targets more easily
» Renewable development expands beyond states with existing policies
EPA’s Estimated Costs of Carbon Avoidance by Building Block

EPA’s estimated cost per metric ton of CO2 reduction (*carbon avoidance*) by BB – *these are national carbon avoidance estimates.*

<table>
<thead>
<tr>
<th>Building Block</th>
<th>Cost per Metric Ton CO₂ Reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB1</td>
<td>(Low / EPA Projected / High) – $5.81 / $7.75 / $11.63</td>
</tr>
<tr>
<td>BB2</td>
<td>$21 (65% Capacity Factor*)</td>
</tr>
<tr>
<td></td>
<td>$30 (70% Capacity Factor*)</td>
</tr>
<tr>
<td></td>
<td>$33 (70% Capacity Factor*, Constrained to In-State Generation)</td>
</tr>
<tr>
<td></td>
<td>$40 (75% Capacity Factor*)</td>
</tr>
<tr>
<td>BB3</td>
<td>$10 - $40</td>
</tr>
<tr>
<td>BB4</td>
<td>$16 - $24</td>
</tr>
</tbody>
</table>

* Represents Capacity Factor Goal; not all states achieve this level in EPA models.
This project did not propose including a detailed analysis of the potential impact on consumer rates in Georgia. But in order to provide general direction to GEFA, Navigant is providing the following general guidance.

- **Since EE programs are to be implemented in a cost-effective manner:**
  - The above benefit-cost analyses show that net benefits are likely to accrue to GA through implementation of EE programs
  - This would likely have a positive impact on rates over the long-run
  - *EE participants will see an overall decrease in costs, while non-participants may see a slight increase in costs*

- **Other state rate impact analysis generally found:**
  - **Where efficiency savings are 0.5% or less:**
    - Rate impacts are probably noise and insignificant
    - Participation rates typically very low
  - **Where efficiency savings are 1.0% to 0.5%:**
    - Rate impacts probably small
    - Participation rates typically low to moderate
  - **States where efficiency savings is 2.0% or greater:**
    - Rate impacts: short-term and modest, long-term probably also modest
    - Participation rates typically high to very high
    - Participation rates nearly offset the rate impacts

A study of Georgia Power’s EE program impacts on rates through 2023 found that:

• Rates are reduced for the majority of customers (if scaled to national EE leader levels of 1% savings per year or more)

• Over 10 years, the study found that cumulative average savings of approximately 17% with cumulative participation of 60%

### Potential GP Bill Impacts - Example

<table>
<thead>
<tr>
<th>Georgia Power Enhanced Portfolio</th>
<th>Participation Rate through 2023 (Cumulative)</th>
<th>Participant Impact 2014-2023 (Cumulative)</th>
<th>Non-Participant Bill Impact 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>56%</td>
<td>5% Savings</td>
<td>3% Rate Impact</td>
</tr>
<tr>
<td>Commercial</td>
<td>52%</td>
<td>18% Savings</td>
<td>2% Rate Impact</td>
</tr>
<tr>
<td>Industrial</td>
<td>62%</td>
<td>12% Savings</td>
<td>2% Rate Impact</td>
</tr>
</tbody>
</table>

Source: ACEEE National Conference on EE as a Resource, – J. Wilson, Southern Alliance for Clean Energy, September 2013
A study in Massachusetts found that EE program participants would see a decrease in rates, while non-participants would experience a slight increase in rates in the short-run. Long-term rates would decline for all.

Source: Bill Impact of EE Programs (in MA) – T. Woolf, MA Dept. of Public Utilities, February 15, 2010
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