Executive Summary

INTRODUCTION AND OBJECTIVES

Given the ubiquity of electricity to modern society, long-term supply planning impacts everyone. How customers consume and ultimately pay for this critical commodity in the future will be driven by the decisions we make today. Power supply decisions have economic lives measured in decades, and long-term planning is fraught with uncertainty, making it a complicated undertaking. Technology development, electricity and commodity pricing, economic factors, and cultural and social forces all present elements of risk to the long-term planning model.

This Integrated Resource Plan (IRP), developed by The Energy Authority, Inc. (TEA) for Gainesville Regional Utilities (GRU), presents the results of a detailed analysis of alternatives GRU may select to meet the electrical energy and demand requirements of its retail electric consumers for the 20-year period from 2019 through 2039. This analysis includes an assessment of existing resources and alternative options for new and replacement resources. This executive summary provides a look at plan objectives, methodology, existing resources, findings, and an overview of plan recommendations. The complete document package includes a more detailed description.

Table 1: GRU Overview

Location	Gainesville, FL		
Peak Demand	408 MW (2018)		
Total Energy	2,079 GWh (2018)		
Current Generation Resources			
Unit	Fuel	Net Summer Capacity (MW)	Installation Date
JR Kelly CC	NG	108	2001
Deerhaven 2	Coal	228	1981
Deerhaven 1	NG/Oil	75	1972
Deerhaven GT1	NG/Oil	17.5	1976
Deerhaven GT2	NG/Oil	17.5	1976
Deerhaven GT3	NG/Oil	71	1996
Deerhaven Renewable	Biomass	102.5	2013
South Energy Center 1	NG	3.5	2009
South Energy Center 2	NG	7.4	2017

The purpose of this study is to develop a robust resource plan that:

- Identifies the long-term, strategic needs of the utility.
- Utilizes least-cost planning principles and estimates the magnitude of future power supply costs and decisions.
- Allows flexibility to respond to market changes.
- Helps GRU manage risk through a diverse mix of resources.
- Performs well over a range of economic, environmental, and regulatory scenarios.

STUDY METHODOLOGY

The long-term generation expansion production cost model used for this IRP simulates production cost and market price interaction. The optimization criterion is to minimize the incremental Net Present Value of Revenue Requirements (NPVRR). For the purposes of this plan, the NPVRR is the net cost that would need to be recovered for all resources in the utility's portfolio, adjusted for the time value of money. Previous capital investments for existing resources are sunk costs are not included in the NPVRR calculation; however, this IRP does consider future fixed and variable operations and maintenance (O&M) costs for existing resources and all costs for new or bettered resources incurred during the study period. A number of sensitivities and scenarios have been evaluated for this IRP. Results of each simulation have been aggregated in the form of relative NPVRR and Levelized Cost of Energy (LCOE), along with the specific resource retirements and additions resulting from each optimization. The LCOE is an industry-standard metric for comparing scenarios with differing loads, calculated as total plan cost divided by energy usage. Tools used in this study include ABB's PROMOD IV, Velocity Suite, Capacity Expansion, and Portfolio Optimizer.

KEY CONSIDERATIONS AND RISK FACTORS

This study is based on a set of inputs and assumptions that, in TEA's best judgment, will provide GRU with recommendations based on the most reasonable information available at the time of this study. As time passes, some of the assumptions may not transpire as expected, while other unexpected risk factors may become a reality.

Each of the plans, recommendations, actions, and potential futures discussed in this report has the potential to impact or be impacted by regulatory, financial, market, and other types of risk. Because GRU's goal is to provide its customers with reliable and affordable energy, it considers factors such as risk tolerance and reliability thresholds when making electric resource decisions.

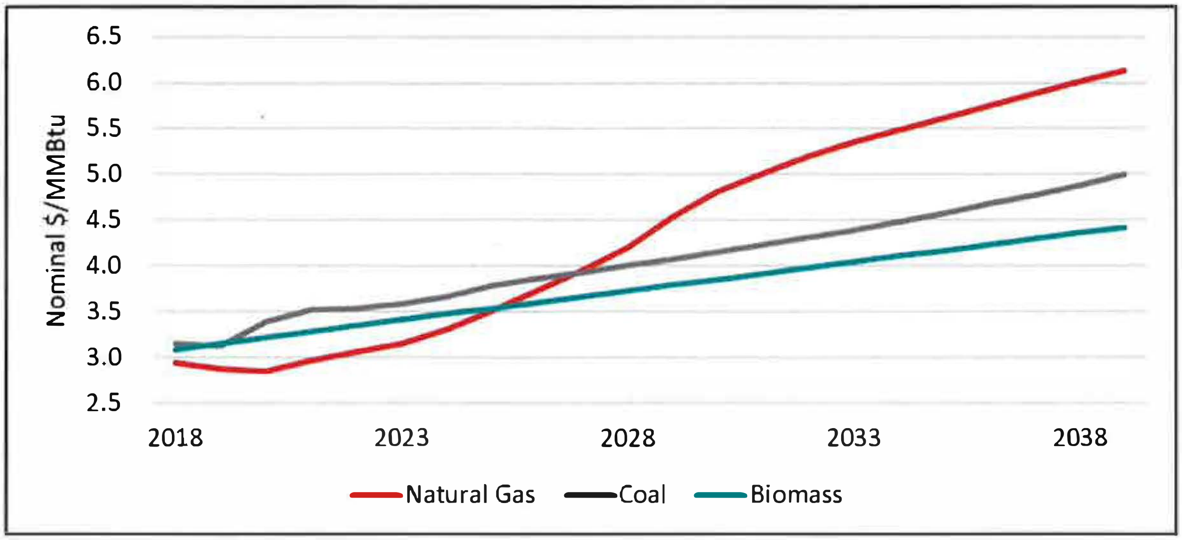
For example, it is GRU's responsibility to balance market risk and the financial risk of incurring additional debt. Significant factors which could impact the conclusions and recommendations include the following:

- Advancement and cost reductions of emerging technologies
- Changes to federal, state, and local tax incentives
- Renewable resource penetration in and around GRU's service territory
- Changes in environmental regulations and other public policy
- Market-wide and GRU-specific fuel diversity
- Rate of electric vehicle (EV) adoption in GRU's service territory

ASSUMPTIONS

- Discount Rate: 3.0%
- Tax Exempt Bond Rate: 3.9%
- Peak Demand and Energy Usage Forecast: 0.4% annual increase
- Import/Export Limit: 120 megawatts (MW)

Figure 1: Reference Case Delivered Fuel Price Forecast



- GRU Minimum Planning Reserve Margin: 15%
- Data specific to GRU's existing load and resources provided by GRU
- Fuel price forecast as shown in Figure 1

Table 2 provides a list of the potential supply-side resource options included in the study. This list was developed through a screening process, which eliminated sizes and technologies that would not be reasonable for GRU. For example, a 1,200 MW combined cycle (CC) or a large nuclear facility would not be reasonable for GRU's system.

Table 2: New Supply-Side Resource Options

Resource Type	Size (MW)	Peak Hour Capacity Planning Factor[1]	Capital Cost (2018$/kW)	Fixed O&M (2018$/kW-Year)	Variable O&M (2018$/MWh)
Siemens SGT-800 2x1 CC	132	100%	$1,102	$11.33	$3.61
Siemens SGT-800 3x1 CC	198	100%	$1,037	$11.33	$3.61
Siemens SGT-800 GT	47	100%	$917	$18.02	$3.61
RICE – Large Size	18	100%	$1,150	$20.00	$7.00
RICE – Mid Size	9	100%	$1,150	$20.00	$7.00
Biomass	103	100%	$3,642	$114.39	$5.70
Solar PPA	20	35%	$0	$0.00	$32.00
Battery Storage	5	100%	$1,357	$36.31	$7.26

[1] Peak Hour Capacity Planning Factor represents the portion of a resource that can be expected to operate during the peak hour used for capacity requirements.

FINDINGS

REFERENCE CASE

The reference case is the scenario to which all other scenarios are compared. Therefore, only base assumptions are included. The plan resulting from this scenario is not necessarily the most advantageous for GRU or its customers from a risk or least-cost perspective.

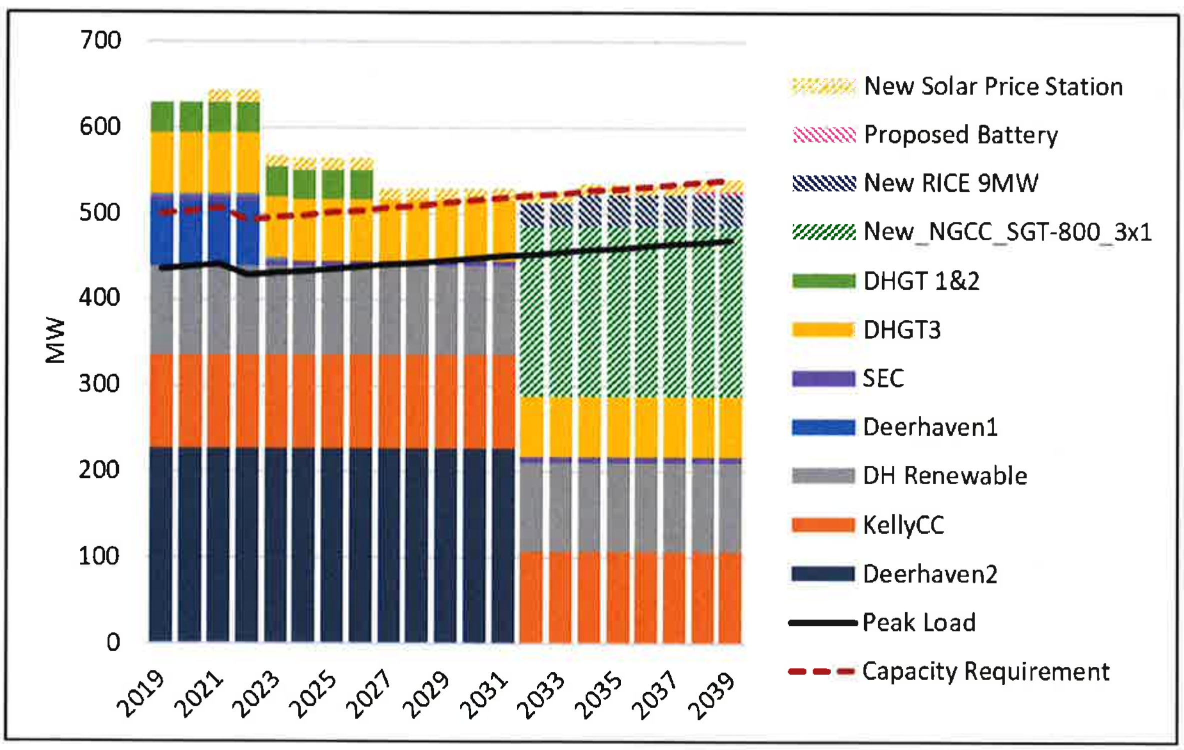
In the reference case plan, an 80 MW solar Power Purchase Agreement (PPA) provides lower cost energy for GRU beginning in 2021. After Deerhaven 2 retires in 2031, a 198 MW natural gas (NG) fired 3x1 CC unit is installed in 2032. Additionally, the plan includes three 9 MW reciprocating internal combustion engine (RICE) units in 2032 and another 9 MW RICE unit in 2034. In 2038, near the end of the term of the study, 5 MW of storage is installed.

The NPVRR of the reference plan is $1,961 million and the LCOE is $44.69 per megawatt-hour (MWh).

SENSITIVITIES AND SCENARIOS

TEA included a sensitivity analysis to assess the performance of the reference case and alternative scenario plans in high and low gas price environments. In addition, TEA utilized ABB's Portfolio Optimizer (PO), a detailed chronological production cost model, to more thoroughly evaluate the impact of unit operating constraints for several key scenarios.

Figure 2: Reference Case Load and Capacity Balance



Scenarios evaluated in the study are grouped into the following categories:

- System scenarios (Scenarios 1-4) examine the effects of changes that GRU requested to its reference electric system.
- Load scenarios (Scenarios 5-7) indicate how the optimum generation plan changes under various peak demand and energy forecasts.
- Area Control Error (ACE) scenarios (Scenarios 8-11) address the recommendations of the ACE study performed by Burns and McDonnell and completed in January 2019.
- Renewable scenarios (Scenarios 12-14) evaluate resource plans with prescribed additions to help GRU achieve the city's renewable energy and greenhouse gas goals.

Figure 3 compares the generation additions, capital investment requirements, and NPVRR for the reference case and two of the 14 scenarios. The NPVRR includes costs of solar as PPAs, not self-built solar. For completeness, the figure shows GRU's direct financing requirements using PPAs for solar and with the assumption that GRU self-finances all solar.

Figure 3: Details of Select Solutions

		Reference Case	ACE REQS-Unlimited Solar- Force 40 MW Solar 2021	Renewable - No Market & No RICE Contribution
New Unit Capacities (MW)	NGCC	198		
	Solar PPA	80	480	780
	Battery	5		195
	RICE	36	216	119.4
	Biomass			103
Total Capital Costs with Solar PPA (2018 $M)		$254	$339	$895
Total Capital Costs with Solar Self-Build (2018 $M)		$362	$987	$1,948
NPVRR (2018 $M)		$1,956	$1,951	$2,547

CONSIDERATION

- GRU's resource plan must provide flexibility to meet the city's resolution to use 100% renewable generation and become a net zero greenhouse gas community by 2045.
- Large amounts of solar, a viable renewable resource for GRU, will require significant land area as well as transmission and distribution upgrades.
- The amount of solar resources necessary to achieve a high renewable energy goal will likely result in some over-building of solar capacity to produce sufficient renewable energy quantities and manage intermittency through solar curtailments and/or usage of storage resources.
- Solar additions require complementary rapid response power resources to adequately respond to sudden and wide swings in power output inherent with intermittent solar power.

- As the cost and technology of solar and battery storage continue to improve, solar plus battery storage options are likely to enhance system performance compared to a system that is heavily dependent on solar alone. The storage component is designed to smooth out some of the variability associated with solar PV energy production.

CONCLUSIONS

- Upgrading GRU's Kelly combined cycle unit by replacing the steam turbine generator delays a significantly larger capital outlay that would be necessary for a replacement resource, maintains distribution system voltage support, and improves flexibility regarding other potential unit replacements.
- Deerhaven 2, GRU's coal-fired generator, and Deerhaven Renewable, its biomass-fired generator, provide fuel diversity and cost savings in a high gas price scenario.
- RICE units are currently more economical than small gas turbines or batteries for rapid response.
- Early additions of up to 80 MW of solar, coupled with up to 40 MW of RICE to facilitate power supply reliability, have an insignificant effect on GRU's NPVRR.
- Based on current cost estimates, a resource plan to shift towards 100% renewable energy will increase GRU NPVRR costs compared to the reference plan by up to approximately $600 million through 2039 and will require additional and significant rate increases compared to the Reference Case. This cost difference is driven in part by capital investment and third-party investment for PPAs.

RECOMMENDATIONS

- Add up to 74.5 MW of a solar resource to lower GRU's average energy cost and advance towards city's goal to utilize 100% generation and become a net zero greenhouse gas community by 2045.
- Add approximately 10 MW of RICE generation per 20 MW of solar.
- Refurbish the Kelly CC to take advantage of the current low-cost NG environment and delay a significant capital expenditure necessary for unit replacement.
- Retain Deerhaven 2 and Deerhaven Renewable at least until the next IRP update.
- Continue to monitor biomass status as a renewable energy source.
- Consider coordination with other FRCC utilities to jointly balance electric systems at a reasonable cost in a high renewable environment.
- Continue to include consistent IRP updates as part of an effective planning process.