Memorandum

To: *Georgia Regional Water Planning Energy Sector Stakeholder Advisory Group*
cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *November 10, 2020*

Subject: *Update of Georgia Energy Sector Water Demand Forecast*

This memorandum summarizes the approach and data used to update the estimates of water requirements for thermoelectric power generation for Georgia's Regional Water Planning process and to inform the next updates of the Regional Water Plans. Georgia's Regional Water Plans are reviewed and updated every 5 years, and the energy sector forecast is also revisited and updated every 5 years. The results for this iteration of the energy sector forecast are provided below and discussed in detail.

Introduction

An energy sector water demand forecast was developed for the 2011 Regional Water Plans. The water demand forecast was based upon 2005 data on thermoelectric generating facilities in the state. The Regional Water Plans were updated in 2017 and the statewide energy sector water demand forecast was subsequently re-visited in 2016 to support the update. That updated forecast incorporated:

- 2015 energy generation by statewide sources (thermoelectric, hydroelectric, nuclear and renewable)
- Previous statistical correlation of statewide energy generation to population
- 2015 statewide population projections to 2050
- Estimates of future statewide energy generation from thermoelectric, hydroelectric, nuclear and renewable
- Estimates of water withdrawal and water consumption per megawatt-hour (MWh) by thermoelectric fuel types
- Estimates of future water withdrawal and water consumption in million gallons per day (mgd) by thermoelectric fuel types
- Generating capacity of current and planned thermoelectric generating facilities
- Regional distribution of future water withdrawal and water consumption in mgd by location and generating capacities of thermoelectric generating facilities

This iteration of the energy sector water demand forecast incorporated the assumption that all coal-fired generating facilities in Georgia will be retired by the year 2040. During the preparation of this forecast, the owners of Plant Scherer Unit 4 announced their intentions to close that Unit.[1] However, because the specific timeline and details for that closure are not yet final, this forecast does not reflect any specific change in water use for Plant Scherer Unit 4 beyond the assumptions used for all other coal-fired generating facilities.

In this forecast, the need for additional future generating capacity is assumed to be an estimated 50 percent natural gas generated and 50 percent renewable energy. Note that for renewable energy to meet estimated future generation, advances in storage technology may be necessary. However, based on input from the stakeholder group, the use of storage technology will not result in any significant amounts of water use. A list of the participating stakeholders is included in **Appendix A**.

It should also be noted that water requirements (i.e., stream flow) for hydropower generation are not included in the energy sector water demand forecast as these facilities are designed to pass water through and do not entail consumptive use of water.

Figure 1 shows the statewide water demand by major sector for 2015 and 2020 (forecasted) from the 2017 Regional Water Plans. In 2015, the energy sector water demand (i.e., water withdrawals) were estimated at 1,819 mgd, or 35 percent of the total statewide water demand. The 2017 forecast for the year 2020 expected the energy sector demand to decrease to 728 mgd, or 17 percent of the statewide demand. This decrease was projected given the identified retirement of certain coal-fired facilities with once-through cooling.

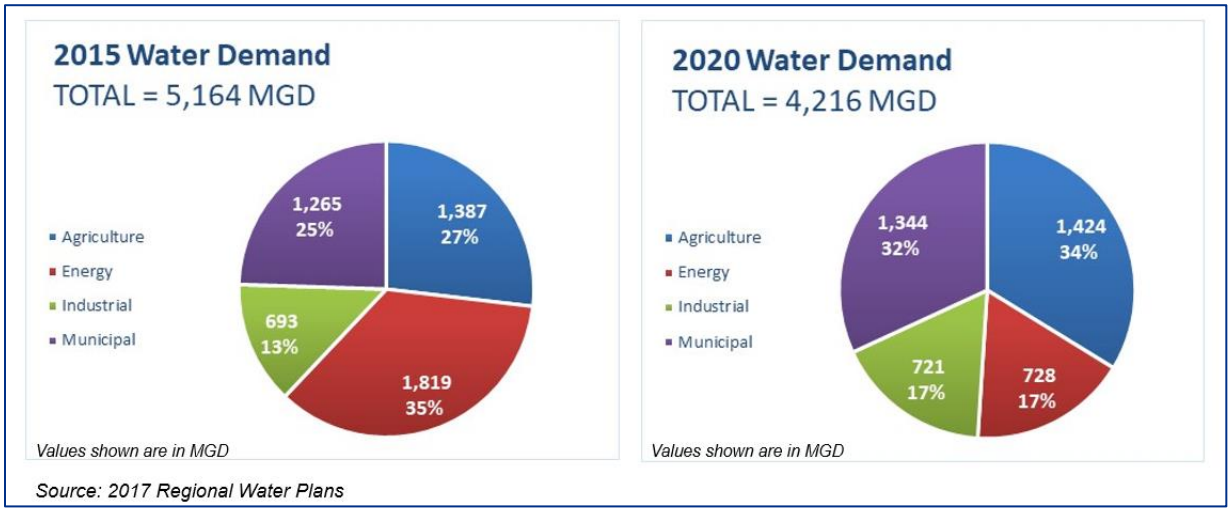
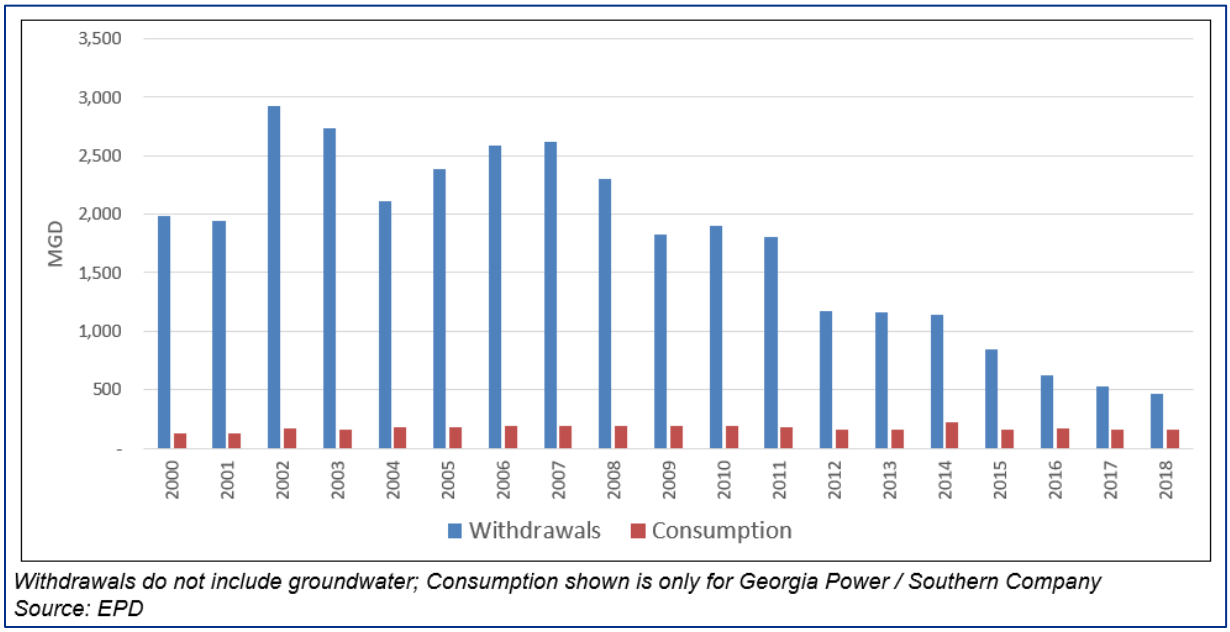


Figure 1. 2017 Forecast of Statewide Water Demand

[1] Plant Scherer Unit 4 is jointly owned by the Jacksonville Electric Authority and Florida Power & Light. See related article at https://www.powermag.com/unit-at-largest-u-s-coal-plant-will-close/.

Figure 2 shows the permitted surface water withdrawals by thermoelectric facilities from 2000 to 2018. Surface water accounts for 99.5 percent of energy sector withdrawals. Water withdrawals for energy have declined since 2007 as certain coal-fired generating facilities with once-through cooling have been retired. Also shown on Figure 2 is estimated water consumption for Georgia Power/Southern Company facilities for the same time period[2]. Water consumption has remained relatively constant over time.



Withdrawals do not include groundwater; Consumption shown is only for Georgia Power / Southern Company
Source: EPD

Figure 2. Historical Surface Water Withdrawals for Energy Generation

Estimating the Future Energy Generation Need

Previous estimates of future energy demand in MWh were developed based on the historical relationship between population and energy usage (in MWh). Projected statewide population was used to estimate an "Expected Demand" scenario and a "High Demand" scenario. **Figure 3** shows the historical energy production compared to statewide population. Energy generation has declined over the last decade despite population growth. Energy demand decreased from around 14 MWh per capita in 2007 to a low of 10 MWh per capita from in 2019. Much of this decline is attributed to improved energy efficiency in lighting, appliances, and equipment.

In the first energy sector water demand forecast for the 2011 Regional Water Plans, a statistical relationship was estimated from historical data available in 2005 that showed energy generation was increasing over time in relation to population. This relationship held true until about 2006, as seen on Figure 3. Since 2010, MWh per capita has remained between 10 and 11 MWh per capita. For the

[2] Consumption data for other facilities were not available.

current energy sector water demand forecast update, a value of 10 MWh per capita is assumed for the Expected Demand scenario and 11 MWh per capita for the High Demand scenario. Energy use per capita may continue to decrease in the future with improved energy efficiency, however for estimating future water demands, these values are held constant into the future.

The Governor's Office of Planning and Budget (OPB) releases revised statewide and county-level population projections each year. The OPB's October 2019 population series provided projections from 2019 to 2063. These projections showed an increase in statewide population from approximately 10.8 million in 2020 to approximately 15.1 million in 2060, as summarized in **Table 1**.

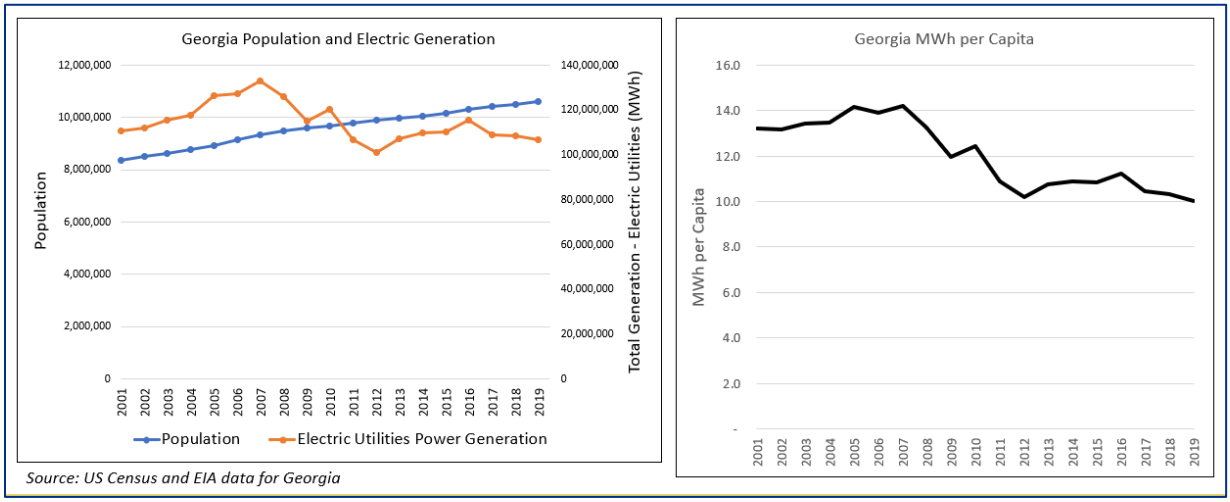


Figure 3. Historical Population, Energy Generation, and Per Capita Energy Use

Table 1. Statewide Population Projections from 2019 to 2060

2020	2030	2040	2050	2060
10,833,472	12,292,423	13,298,742	14,186,991	15,106,503

Source: OPB

Using the OPB population projections and the assumed values of 10 MWh per capita for the Expected Demand scenario and 11 MWh per capita for the High Demand scenario results in an estimated statewide energy need in 2060 of 151.1 million MWh for the Expected Demand scenario and 166.2 million MWh for the High Demand scenario. The future energy demand scenarios are summarized in **Table 2**.

Figure 4 is a comparison of the updated projections of future energy needs with prior state water plan projections relative to historical generation. Note the data in this graph are in gigawatt-hours, which is equivalent to 1,000 MWh. Figure 4 illustrates the progressive decline in anticipated future energy needs for this forecasting effort vs. prior forecasting efforts, which is the result of both lower population projections and the change to the MWh per capita approach.

Table 2. Estimated Future Statewide Energy Needs from 2020 to 2060 in MWh

Power Generation Scenario	2020	2030	2040	2050	2060
High Demand Scenario	119,168,192	135,216,653	146,286,162	156,056,901	166,171,533
Expected Demand Scenario	108,334,720	122,924,230	132,987,420	141,869,910	151,065,030

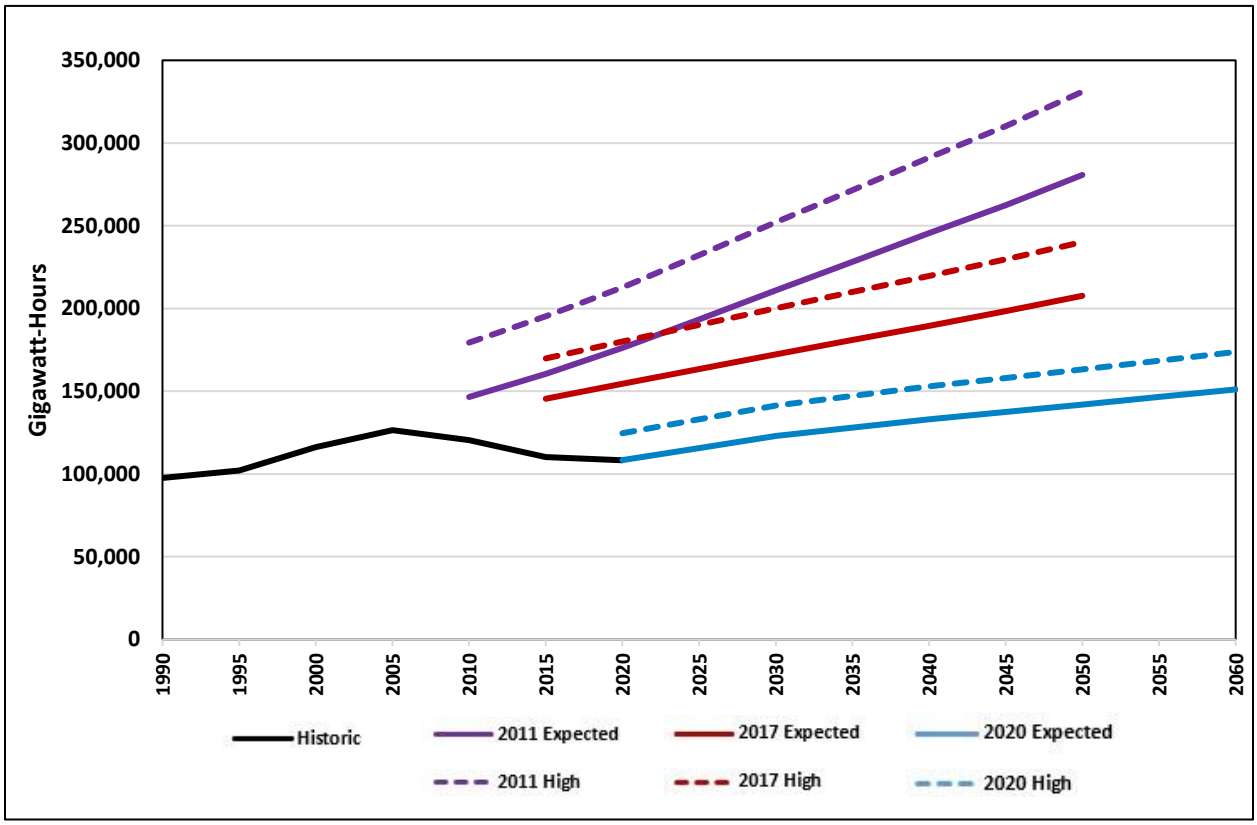


Figure 4. Comparison of Energy Projections from the Current and Previous Regional Water Planning Efforts in 2011, 2017, and 2020

Thermoelectric Generating Facilities in Georgia

The list of power generating facilities in Georgia from the 2017 energy sector water demand forecast was reviewed and updated. This list includes one facility in Alabama on the west bank of the Chattahoochee River that has a water withdrawal permit from Georgia EPD. Data used to update the list of facilities were obtained from the U.S. Department of Energy, Energy Information Administration (EIA) for 2018 and EPD air quality permits (2019) for new and planned facilities. Information on planned facility retirements was obtained from the Georgia Power 2019 Integrated Resource Plan (IRP). The updated list of facilities was distributed to the stakeholder advisory group for review. This list of facilities is included in **Appendix B**.

The list of thermoelectric generating facilities is limited to those facilities that provide electricity to the grid for distribution and public consumption (i.e., public services and independent power producers). Electric generation for private use is not included.

Most facilities have more than one generating unit. Generating units vary by fuel type (coal, natural gas, bio-fuel, or nuclear), prime mover (steam or gas), and cooling system (once-through cooling or cooling tower). The list of facilities in Appendix B is presented by generating unit and includes the fuel type, prime mover, generating capacity in megawatts (MW), 2018 generation in MWh, source of water (surface water or groundwater), and 2018 permitted water withdrawals by source. Water withdrawal permits are required for the withdrawal of more than 100,000 gallons per day. Some generating facilities use less than this amount and may have non-permitted wells (i.e., below the requirement threshold) or may be served by municipal water. None of the facilities in operation today use once-through cooling. Therefore, unlike prior reports, this cooling type is not included on the list of generating facilities.

Table 3 summarizes the summer generating capacity in MW and the 2018 generation in MWh by fuel type. For each fuel type, the generation (MWh) can be calculated as a percent of the capacity (MW) when the generating capacity is multiplied by the number of hours in a year (8,760). For example, generation from coal-fired facilities operated at an annual average of 39 percent of capacity while nuclear generation operated at 97 percent of capacity.

Note that in 2018, coal-fired, natural gas-fired, and nuclear energy generated 95 percent of the electricity for public use in Georgia. Hydroelectric power generated 3 percent and renewable (solar, wind, wood, landfill gases, geothermal, etc.) generated almost 2 percent.

Table 3. Current Generating Capacity by Fuel Type

FUEL TYPE	Summer Capacity (MW)	2018 Generation (MWh)	% of Capacity
COAL	9,399	31,983,005	39%
NATURAL GAS	16,416	51,378,557	36%
NUCLEAR	4,061	34,362,676	97%
DISTILLATE FUEL OIL	852	197,306	3%
RENEWABLE & other	3,056	2,386,858	9%
HYDROELECTRIC	2,042	3,686,227	21%
TOTAL	**35,826**	**123,994,629**	**40%**

Source: EIA 2018 data

Estimating Future Generation by Fuel Type

At the national level, the EIA produces its Annual Energy Outlook (AEO), which evaluates numerous alternative scenarios for energy generation in the U.S. **Figure 5** shows the AEO reference case projections for electric generation by fuel type. Electric generation from natural gas and renewables is projected to increase from now to 2050, while nuclear and coal-fired generation is expected to decrease on the national level. Solar generation is projected to provide 48 percent of the renewable generation in 2050, or about 15 percent of total generation (AEO 2019).

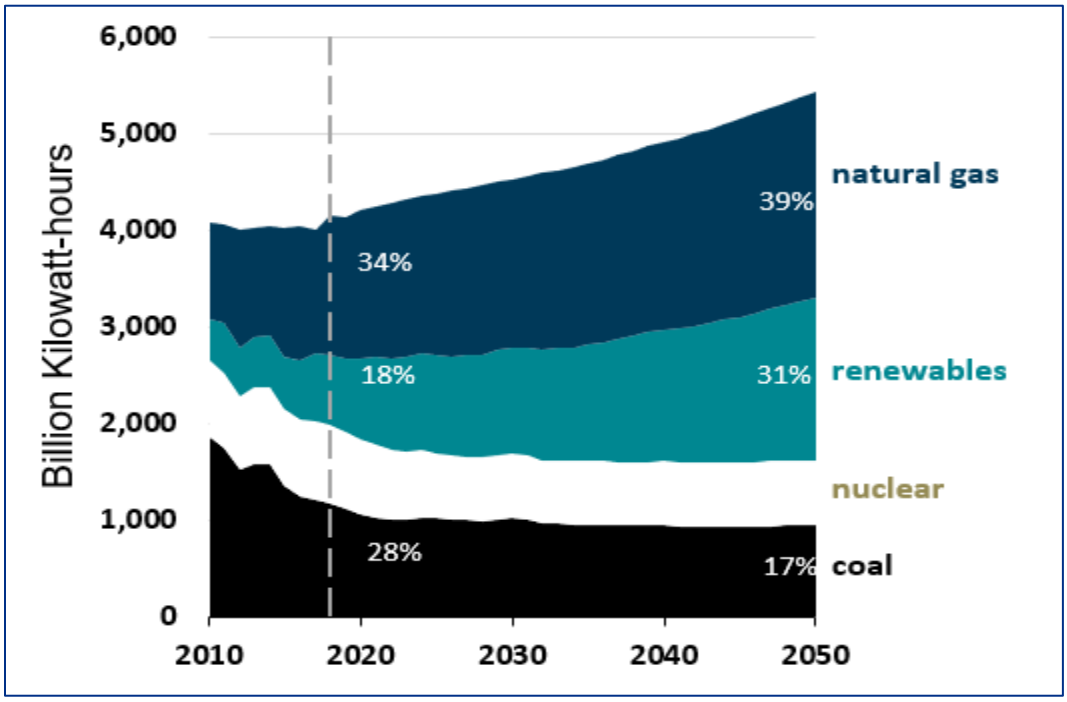


Figure 5. AEO 2019 Nationwide Electric Generation from Selected Fuel Types
Source: AEO 2019

The Southeastern Reliability Commission (SERC) manages electric power in the southeastern U.S., as shown on **Figure 6**. Most of Georgia and Alabama, along with portions of Mississippi and the Florida panhandle, comprise the SERC southeastern subregion. The SERC Reliability Review Subcommittee Annual Report (2018) stated that from 2018 to 2027, the SERC region is expected to have demand increase at an annual compound growth rate of 0.77 percent, while a growth rate of 0.41 percent is expected for the southeastern subregion. At the regional level, the net capacity resources are expected to increase from 2018 to 2022 and then level off as natural gas-fired capacity increases and offsets the retirement of coal-fired capacity (SERC 2018).

Locally, the Georgia Public Service Commission's 2019 IRP order approved the retirement of certain coal-fired facilities. The Georgia Power 2019 IRP reflects the expansion of the Plant Vogtle nuclear facility in Burke County, investment in maintaining hydropower structures, and an increase of renewable energy (mostly solar) to a capacity of 5,390 MW by 2024 (Georgia Power 2019).

For this analysis, it is assumed that coal-fired facilities in Georgia will be retired by 2040, and that it is reasonable to assume that additional future capacity will be met by an estimated 50 percent natural gas-fired and 50 percent renewable energy with advances in storage technology.

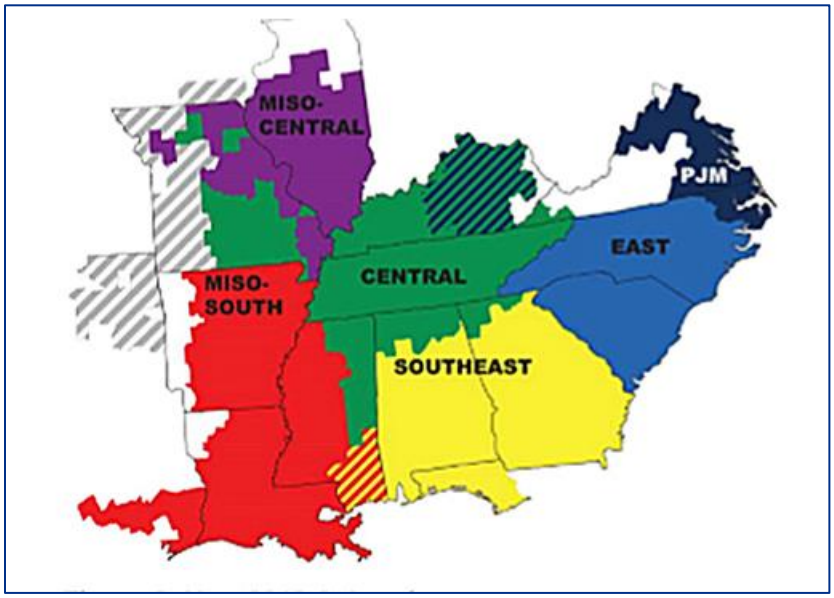


Figure 6. 2018 SERC Region and Subregions
Source: SERC Reliability Review Subcommittee Annual Report 2018

Future Generation by Fuel Type

Units 3 and 4 of the Plant Vogtle nuclear facility are expected to be on-line in late 2021 and 2022, respectively. Each unit will add 1,117 MW of capacity to Georgia's nuclear generation portfolio, which will increase from the current 4,061 MW capacity up to 6,261 MW. This generating capacity is likely to remain in place through the 2060 planning period.

The current generating capacity from coal-fired facilities is 9,399 MW. This capacity will not increase and is assumed to be retired by 2040. The current generating capacity will "stair-step" down as facilities are retired. However, the exact timing for retirement of existing operations is unknown at this time. Therefore, the coal generation capacity is assumed to taper down from 9,399 MW in 2030 to zero in 2040.

The current generating capacity of hydroelectric is assumed to be maintained through 2060. Potential generation by fuel oil is negligible and not expected to increase in the future.

The Georgia Power 2019 IRP describes a plan to increase the use of renewable energy (mostly solar) to a capacity of 5,390 MW by 2024 (Georgia Power 2019). Therefore, a renewable capacity of 6,000 MW is assumed in that year, assuming that other utilities may also add renewable capacity.

These future conditions are illustrated on **Figure 7** relative to the Expected and High Demand scenarios of generation need, assuming that each fuel type maintains the current level of operation as a percent of capacity. Under the Expected Demand scenario of future electric generation needs, additional generation will be necessary in 2036. Under the High Demand scenario, additional electric generation will be necessary in 2033.

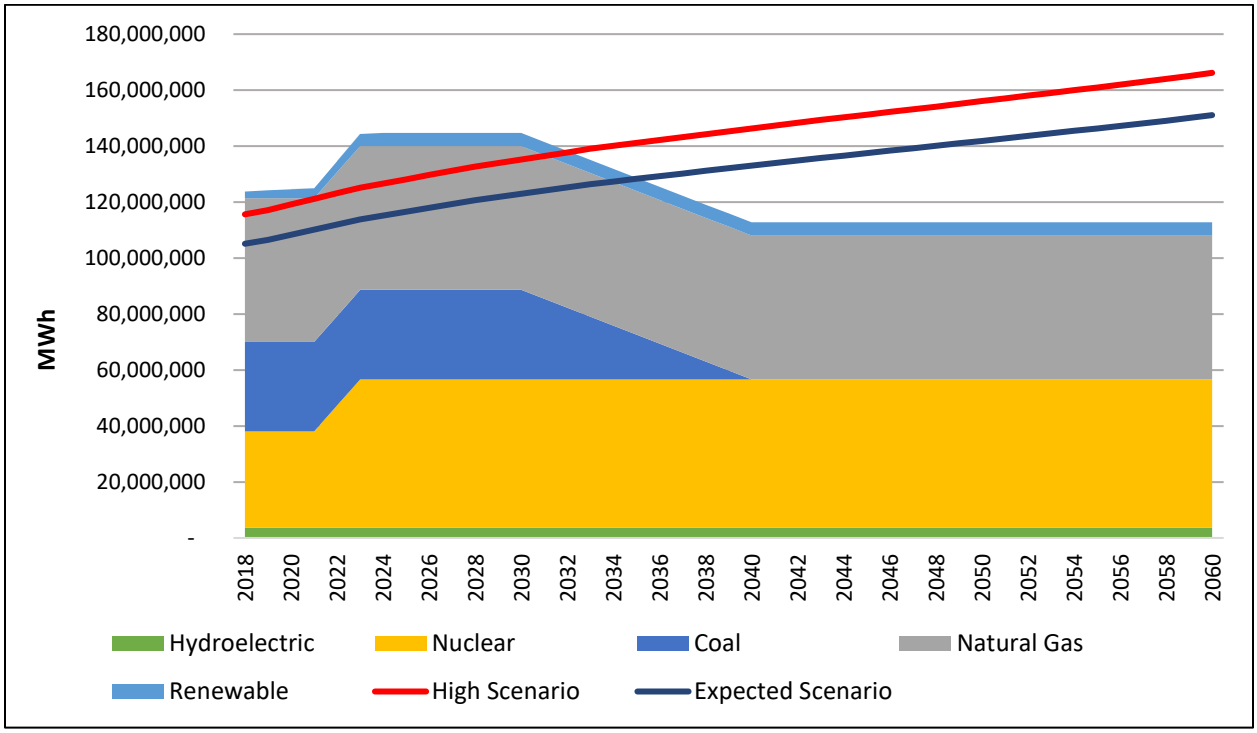


Figure 7. Estimated Future Needs and Energy Generation by Fuel Type under Current Conditions

The current generation as a percent of generating capacity for each fuel type was previously shown in Table 3. These operating percentages are held constant in the future condition depicted on Figure 7. Each fuel type has a maximum potential percent of capacity at which facilities can be expected to operate. Discussions with stakeholders during the development of the previous energy sector water demand forecasts resulted in the estimated maximum potential percent of capacity by fuel type shown in **Table 4**. These percentages were reviewed by the advisory stakeholder group.

Table 4. Maximum Generation by Fuel Type

FUEL TYPE	Maximum Potential % of Capacity Used
COAL	60%
NATURAL GAS	40%
NUCLEAR	97%
DISTILLATE FUEL OIL	5%
RENEWABLE & other	15%
HYDROELECTRIC	30%

Given the generating capacity of a fuel type, generation in MWh by that fuel type can be increased in future years by assuming an increase in the percent of capacity at which facilities are operated. However, coal-fired generation is being phased out and nuclear generation is already operating at its maximum percent of capacity. It is assumed that Plant Vogtle Units 3 and 4 will also be operating at 97 percent of capacity. Therefore, future generation can be increased by assuming increases in operating percentages for natural gas-fired, renewable, and hydropower generation.

In the planning scenarios discussed below, any need for additional generating capacity in future years is assumed to come from 50 percent natural gas-fired and 50 percent renewable energy with advances in storage technology.

Estimating Future Generation by Planning Scenario

The Expected Demand Scenario

The Expected Demand scenario estimates a future energy generation need of 151,065 GWh in 2060. Currently, planned generation levels are sufficient to meet the expected need until 2036, at which time coal-fired generation is estimated to be in decline. In 2036, maximizing renewable and hydroelectric operations from current percentage of capacity (shown in Table 3) to the maximum percent of capacity (shown in Table 4) will generate additional electricity to meet the expected demand. Natural gas-fired operations can be increased to 38 percent of capacity in 2036 to provide sufficient electricity to meet the expected demand in that year.

In 2037, natural gas–fired operations can be maximized at 40 percent of capacity, however, an additional 100 MW capacity will be needed to meet the expected demand. An additional 1,900 MW capacity will be needed each year in 2038, 2039 and 2040 as coal-fired generation expires. A subsequent 410 MW per year would be needed to meet the expected demand through 2060. Total new capacity is estimated to be 14,000 MW by 2060. This scenario is illustrated on **Figure 8**.

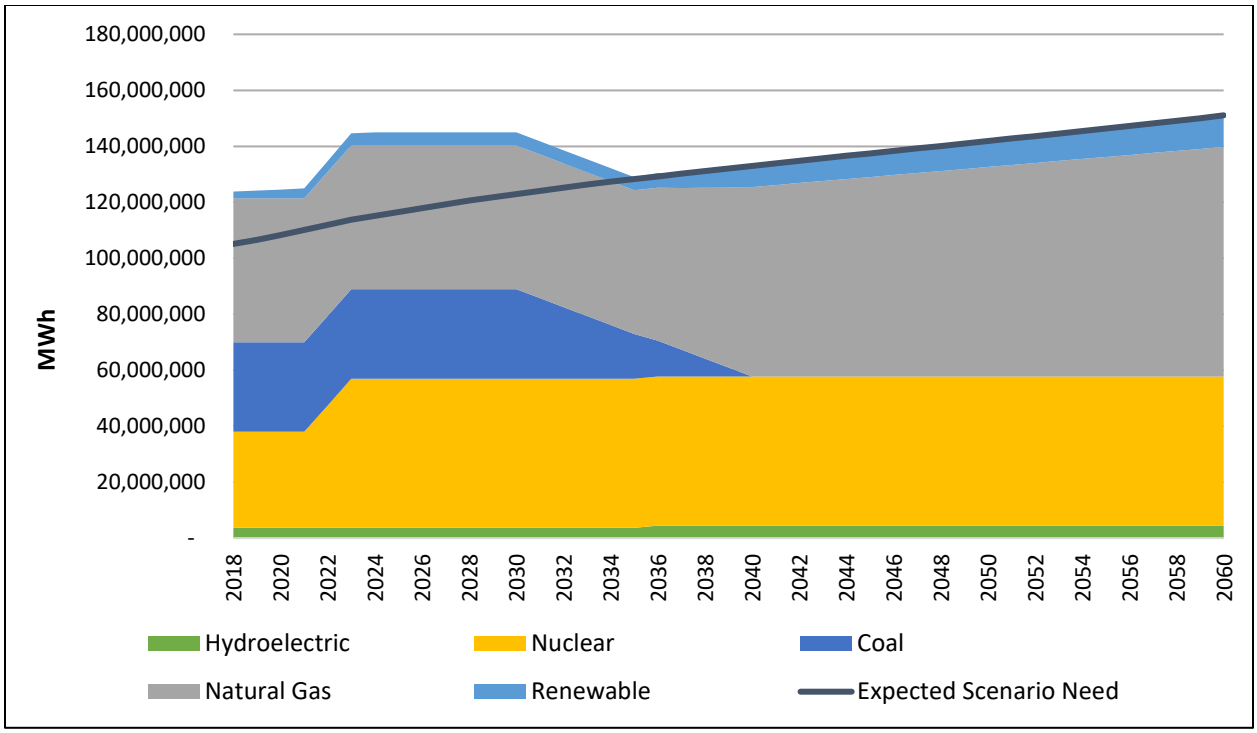


Figure 8. Estimated Future Needs and Future Generation by Fuel Type under Expected Demand Scenario

The High Demand Scenario

The High Demand scenario estimates a future generation need of 166,172 GWh in 2060. Currently, planned generation levels are sufficient to meet the estimated demand for generation under the High Demand scenario until 2033. Maximizing renewable and hydroelectric operations to 15 percent and 30 percent of capacity, respectively, in 2033 and increasing natural gas-fired operations to 38 percent of capacity will generate sufficient electricity to meet the estimated demand in that year. Natural gas-fired operations can be maximized at 40 percent of capacity in 2034, however, an additional 250 MW capacity will be needed to meet the estimated demand. An additional 1,950 MW capacity per year in 2035 through 2040 will be needed as coal-fired generation expires. After 2040, a subsequent 450 MW per year will be needed to meet the estimated demand under the High Demand scenario through 2060. Total new capacity is estimated to be 20,950 MW by 2060. This scenario is illustrated on **Figure 9**. The changes in operations as percent of capacity and annual additional capacity for the Expected and High Demand scenarios are shown by year from 2030 to 2060 in **Table 5**.

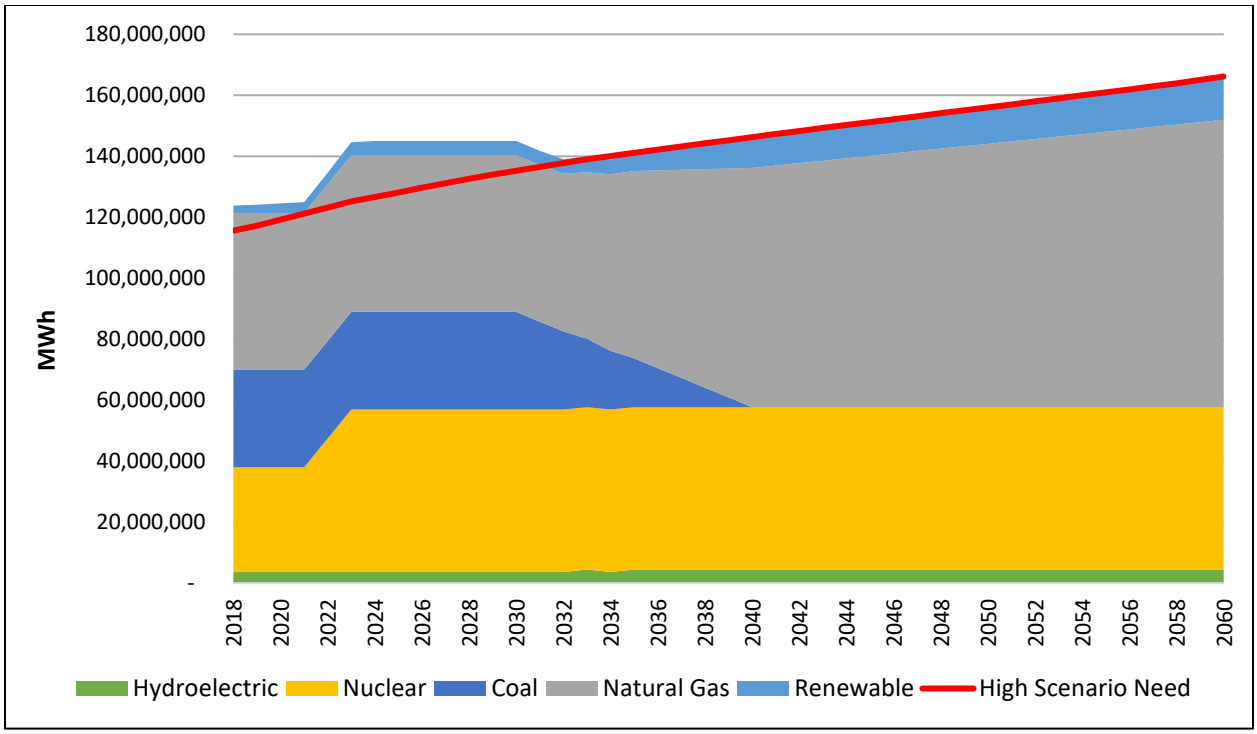


Figure 9. Estimated Future Needs and Future Generation by Fuel Type under High Demand Scenario

Table 5. Estimated Future Operations and Additional Capacity by Scenario

Year	Expected				High			
	Hydroelectric % Capacity	Renewable % Capacity	Natural Gas % Capacity	Added MW	Hydroelectric % Capacity	Renewable % Capacity	Natural Gas % Capacity	Added MW
2030	21%	9%	36%	-	21%	9%	36%	-
2031	21%	9%	36%	-	21%	9%	36%	-
2032	21%	9%	36%	-	21%	9%	36%	-
2033	21%	9%	36%	-	25%	10%	38%	-
2034	21%	9%	36%	-	25%	10%	40%	250
2035	21%	9%	36%	-	25%	10%	40%	1,950
2036	25%	10%	38%	-	25%	10%	40%	1,950
2037	25%	10%	40%	100	25%	10%	40%	1,950
2038	25%	10%	40%	1,900	25%	10%	40%	1,950
2039	25%	10%	40%	1,900	25%	10%	40%	1,950
2040	25%	10%	40%	1,900	25%	10%	40%	1,950
2041	25%	10%	40%	410	25%	10%	40%	450
2042	25%	10%	40%	410	25%	10%	40%	450
2043	25%	10%	40%	410	25%	10%	40%	450
2044	25%	10%	40%	410	25%	10%	40%	450
2045	25%	10%	40%	410	25%	10%	40%	450
2046	25%	10%	40%	410	25%	10%	40%	450
2047	25%	10%	40%	410	25%	10%	40%	450
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2056	25%	10%	40%	410	25%	10%	40%	450
2057	25%	10%	40%	410	25%	10%	40%	450
2058	25%	10%	40%	410	25%	10%	40%	450
2059	25%	10%	40%	410	25%	10%	40%	450
2060	25%	10%	40%	410	25%	10%	40%	450
Total Capacity Added (MW)				**14,000**	**Total Capacity Added (MW)**			**20,950**

Note: Shaded cells represent a change in operational percent

Estimating Future Water Demand by Planning Scenario

Research conducted by CDM Smith Inc., analysis of EIA and EPD data for Georgia Power generating facilities, and input from the previous energy sector forecast stakeholder group were used to develop water use estimates of water withdrawal and water consumption for five configurations of fuel type, prime mover, and cooling system. These estimates of gallons per MWh for withdrawal and consumption are shown in **Table 6** and were reviewed by the stakeholder advisory group. Note that the water use factors for the fossil fuel (coal-fired or natural gas-fired)/steam turbine/once-through cooling configuration are no longer necessary, as generating units with once-through cooling have been retired.

Table 6. Water Withdrawal and Consumption in Gallons per MWh by Fuel Type

POWER GENERATING CONFIGURATION	WATER WITHDRAWALS	WATER CONSUMPTION
	Gal/MWh	Gal/MWh
Fossil Fuel/Biomass, Steam Turbine, Once-Through Cooling	41,005	0
Fossil Fuel/Biomass, Steam Turbine, Cooling Tower	1,153	567
Fossil Fuel/Biomass, Gas (Combustion) Turbine	0	0
Natural Gas, Combined-Cycle, Cooling Tower	225	198
Nuclear, Steam Turbine, Cooling Tower	1,372	880

Source: Averages from EIA and EPD data for Georgia facilities

Using the water factors for withdrawal and consumption per MWh and the projected future generation by fuel type for the two scenarios results in a water demand forecast of water withdrawal and water consumption in mgd for the Expected Demand and High Demand scenarios. These water demand forecasts are summarized in **Table 7**.

Forecasted statewide water withdrawals for thermoelectric generation under the Expected Demand scenario reach 361 mgd in 2060. Of this volume, about two-thirds (or 248 mgd) are consumed. Under the High Demand scenario, forecasted statewide water withdrawals are projected to reach 377 mgd in 2060 with consumption of 262 mgd. These forecasts are illustrated on **Figure 10**.

The water withdrawals and corresponding water consumption for thermoelectric power are the same for both the Expected Demand and High Demand scenarios in 2020, and again in 2030. During that timeframe, coal-fired generation has not yet begun to decline, no operational change or new capacity is needed, and the anticipated generation is sufficient to meet the generating needs of both scenarios. Therefore, the water demand forecast of the two scenarios in 2020 and 2030 is the same.

After 2030, the water demand forecasts in both scenarios decreases as coal-fired facilities are assumed to be retired. The water demand forecasts of the two scenarios begin to change with the timing of operational changes in the percent of capacity used to generate electricity and with the timing of additional generating capacity.

Table 7. Water Withdrawal and Consumption Forecast in mgd

Scenario	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	383	487	364	371	378
Withdrawals - Expected Demand Scenario	383	487	354	360	367
Consumption - High Demand Scenario	235	301	250	256	263
Consumption - Expected Demand Scenario	235	301	242	247	253

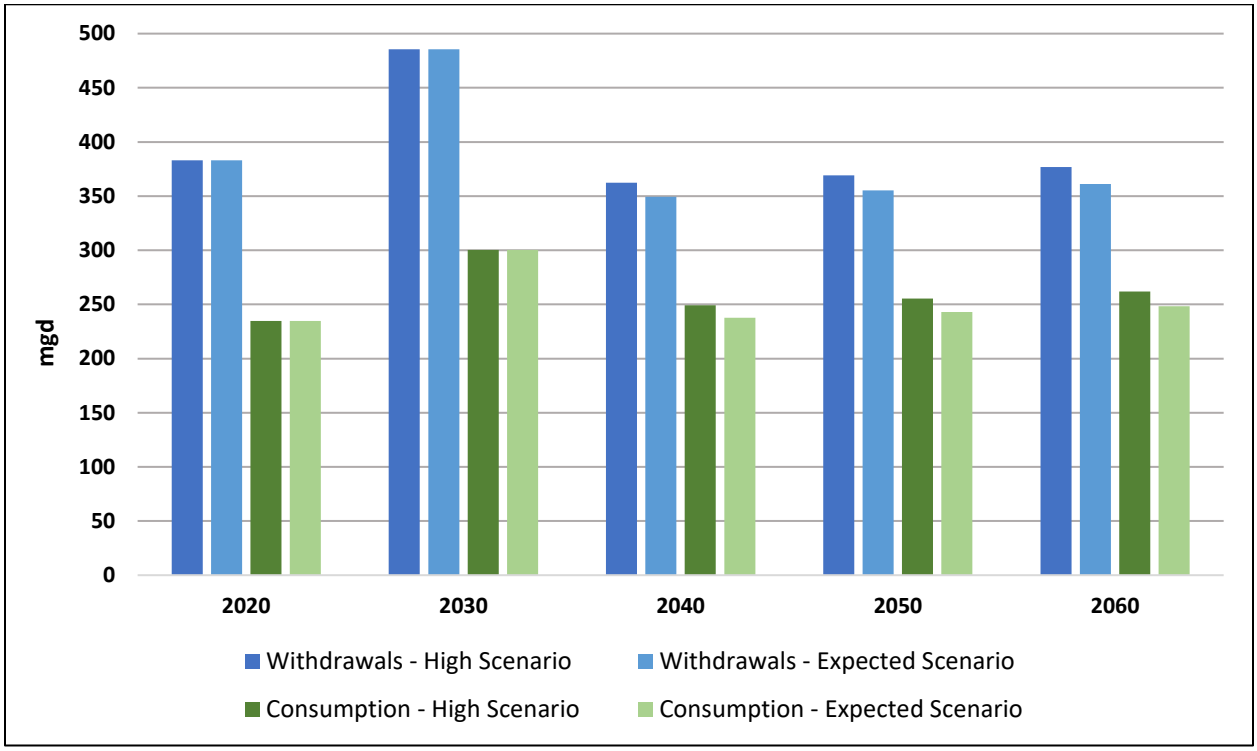

Figure 10. Forecasted Statewide Water Withdrawals and Consumption in mgd by Scenario

Estimating Future Water Demand by Planning Region

The location of power generating facilities is known by county and planning region as shown in **Figure 11**. The facility numbers on Figure 11 correspond with the list of facilities in Appendix B. The generating facilities are listed in order by size of 2018 generation (MWh) for all generating units at each facility. The forecasted water withdrawals and consumptive use can be allocated among the regions given the fuel types and location of generating facilities. The location of the additional generating capacity is assumed to be co-located with existing facilities. No effort was conducted to identify or evaluate potential new locations of generating facilities.

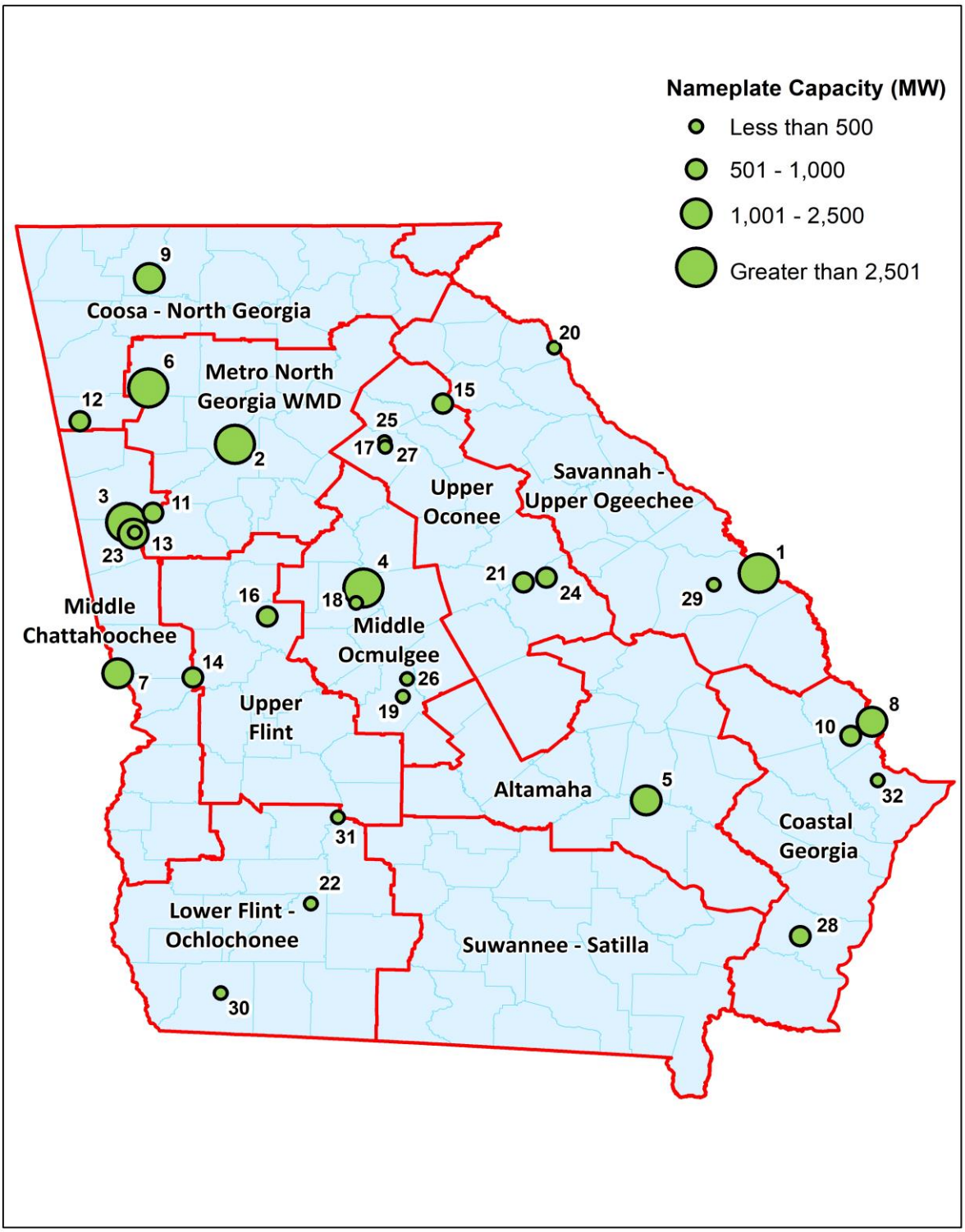

Figure 11. Thermoelectric Generating Facilities in Georgia by Planning Region

The location of coal-fired and nuclear generation throughout the state is known, including the expansion of Plant Vogtle Units 3 and 4. The future increase in nuclear generation, and the associated increase in nuclear generation forecasted water withdrawals and consumption, will occur in Burke County in the Savannah-Upper Ogeechee planning region. The location of future added capacity of natural gas-fired generation is unknown. Therefore, it is assumed that future increases in natural gas-fired capacity will be proportional to the current natural gas-fired generation by planning region. The increase in future renewable energy capacity is assumed to not require water, therefore location is not an issue in this analysis. **Table 8** through **Table 17** provide summaries of the withdrawal and consumption water demand forecasts by scenario for each planning region.

Similarly, water sources are identified for most of the current generating facilities (See Appendix B). Water sources are identified as either surface water (SW), groundwater (GW), or municipal/non-permitted. Nearly all (99.5 percent) of permitted water withdrawals for thermoelectric energy generation are from surface water. Large generating facilities using surface water for cooling may also have groundwater (or municipal water) for domestic uses at the facilities. Small natural gas-fired generating units with low water requirements may use groundwater below the EPD permit level of 100,000 gallons per day or may be municipally-supplied.

Water sources identified as either surface water or groundwater are further identified by the name of the river, lake, or aquifer, where known. Thus, the energy sector water demand forecast for each planning region can be allocated to specific water sources by name.

Table 18 through **Table 21** show the withdrawal and consumption water demand forecasts by planning region and water source for each scenario. Note that while EPD is not responsible for the energy sector water demand forecast of the Metropolitan North Georgia Water Planning District (Metro District), there are thermoelectric generating facilities located within that region. Thus, estimated water demands for future thermoelectric generation in the Metro District is included in the following tables to provide a complete picture of future thermoelectric water demands for the state.

Forecasted water withdrawals and consumption associated with Plant Vogtle nuclear facility Units 3 and 4 will increase the future water withdrawals and consumption in the Savannah-Upper Ogeechee planning region. This forecasted increase will nearly double the surface water withdrawals from the Savannah River.

Conversely, the forecasted decrease in coal-fired generation over time will decrease surface water withdrawals and consumption in the Middle Chattahoochee and Middle Ocmulgee planning regions, as well as in the Metro District. In the Middle Chattahoochee planning region, the forecasted decrease in surface water withdrawals and consumption by coal-fired facilities is partially offset by projected increases in surface water withdrawals and consumption for natural gas-fired generation. Other planning regions are also forecasted to have small increases in water demand for natural gas-fired generation.

Table 8. Water Withdrawal and Consumption Forecast in mgd: Altamaha

Altamaha	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	79.21	79.21	79.21	79.21	79.21
Withdrawals - Expected Demand Scenario	79.21	79.21	79.21	79.21	79.21
Consumption - High Demand Scenario	50.80	50.80	50.80	50.80	50.80
Consumption - Expected Demand Scenario	50.80	50.80	50.80	50.80	50.80

Table 9. Water Withdrawal and Consumption Forecast in mgd: Coastal Georgia

Coastal Georgia	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	8.02	8.02	12.08	13.30	14.51
Withdrawals - Expected Demand Scenario	8.02	8.02	10.42	11.53	12.63
Consumption - High Demand Scenario	7.01	7.01	10.63	11.70	12.77
Consumption - Expected Demand Scenario	7.01	7.01	9.17	10.14	11.12

Table 10. Water Withdrawal and Consumption Forecast in mgd: Coosa-North Georgia

Coosa-North Georgia	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	4.29	4.29	6.55	7.21	7.87
Withdrawals - Expected Demand Scenario	4.29	4.29	5.65	6.25	6.85
Consumption - High Demand Scenario	3.78	3.78	5.77	6.34	6.92
Consumption - Expected Demand Scenario	3.78	3.78	4.97	5.50	6.03

Table 11. Water Withdrawal and Consumption Forecast in mgd: Lower Flint-Ochlockonee

Lower Flint-Ochlockonee	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	0.12	0.12	0.18	0.20	0.21
Withdrawals - Expected Demand Scenario	0.12	0.12	0.15	0.17	0.19
Consumption - High Demand Scenario	0.10	0.10	0.16	0.17	0.19
Consumption - Expected Demand Scenario	0.10	0.10	0.14	0.15	0.16

Table 12. Water Withdrawal and Consumption Forecast in mgd: Metro District

MNGWPD	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	76.29	76.29	20.00	22.01	24.01
Withdrawals - Expected Demand Scenario	76.29	76.29	17.25	19.08	20.91
Consumption - High Demand Scenario	42.60	42.60	17.60	19.36	21.13
Consumption - Expected Demand Scenario	42.60	42.60	15.18	16.79	18.40

Table 13. Water Withdrawal and Consumption Forecast in mgd: Middle Chattahoochee

Middle Chattahoochee	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	32.09	32.09	29.23	32.16	35.10
Withdrawals - Expected Demand Scenario	32.09	32.09	25.21	27.89	30.56
Consumption - High Demand Scenario	23.21	23.21	25.72	28.30	30.89
Consumption - Expected Demand Scenario	23.21	23.21	22.19	24.54	26.90

Table 14. Water Withdrawal and Consumption Forecast in mgd: Middle Ocmulgee

Middle Ocmulgee	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	71.89	71.89	0.52	0.58	0.63
Withdrawals - Expected Demand Scenario	71.89	71.89	0.45	0.50	0.55
Consumption - High Demand Scenario	35.49	35.49	0.46	0.51	0.55
Consumption - Expected Demand Scenario	35.49	35.49	0.40	0.44	0.48

Table 15. Water Withdrawal and Consumption Forecast in mgd: Savannah-Upper Ogeechee

Savannah-Upper Ogeechee	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	109.89	213.84	213.91	213.93	213.95
Withdrawals - Expected Demand Scenario	109.89	213.84	213.88	213.90	213.92
Consumption - High Demand Scenario	70.51	137.19	137.25	137.26	137.28
Consumption - Expected Demand Scenario	70.51	137.19	137.22	137.24	137.25

Table 16. Water Withdrawal and Consumption Forecast in mgd: Upper Flint

Upper Flint	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	0.60	0.60	0.91	1.01	1.10
Withdrawals - Expected Demand Scenario	0.60	0.60	0.79	0.87	0.96
Consumption - High Demand Scenario	0.53	0.53	0.80	0.88	0.97
Consumption - Expected Demand Scenario	0.53	0.53	0.69	0.77	0.84

Table 17. Water Withdrawal and Consumption Forecast in mgd: Upper Oconee

Upper Oconee	2020	2030	2040	2050	2060
Withdrawals - High Demand Scenario	0.72	0.72	1.10	1.21	1.32
Withdrawals - Expected Demand Scenario	0.72	0.72	0.94	1.05	1.15
Consumption - High Demand Scenario	0.63	0.63	0.96	1.06	1.16
Consumption - Expected Demand Scenario	0.63	0.63	0.83	0.92	1.01

Table 18. Expected Demand Scenario Forecasted Water Withdrawal in mgd by Region and Source*

Planning Region	Source	2020	2030	2040	2050	2060
Altamaha	Altamaha River	77.92	77.92	77.92	77.92	77.92
	Floridan	1.29	1.29	1.29	1.29	1.29
Coastal Georgia	Savannah River	7.56	7.56	9.81	10.86	11.90
	Municipal/ No Permits	0.46	0.46	0.61	0.67	0.74
Coosa-North Georgia	Municipal/ No Permits	4.29	4.29	5.65	6.25	6.85
Lower Flint-Ochlockonee	Lake Blackshear	0.01	0.01	0.01	0.01	0.01
	Floridan	0.11	0.11	0.14	0.16	0.17
Metro District	Etowah River	63.20	63.20	0.00	0.00	0.00
	Chattahoochee River	13.09	13.09	17.25	19.08	20.91
Middle Chattahoochee	Chattahoochee River	19.07	19.07	8.06	8.92	9.77
	Surface Water Reservoir	12.90	12.90	17.00	18.80	20.61
	Municipal/ No Permits	0.12	0.12	0.15	0.17	0.19
Middle Ocmulgee	Ocmulgee River	21.53	21.53	0.00	0.00	0.00
	Lake Juliette	49.92	49.92	0.00	0.00	0.00
	Crystalline Rock	0.10	0.10	0.00	0.00	0.00
	Municipal/ No Permits	0.34	0.34	0.435	0.50	0.55
Savannah-Upper Ogeechee	Savannah River	107.97	210.23	210.23	210.23	210.23
	Cretaceous and Gordan	1.79	3.49	3.49	3.49	3.49
	Unknown	0.13	0.13	0.17	0.18	0.20
Upper Flint	Municipal/ No Permits	0.60	0.60	0.79	0.87	0.96
Upper Oconee	Cretaceous	0.01	0.01	0.01	0.01	0.02
	Dublin-Midville	0.05	0.05	0.07	0.07	0.08
	Municipal/ No Permits	0.66	0.66	0.86	0.96	1.05
Total		383.11	487.07	353.96	360.44	366.92
Surface Water		373.17	475.43	340.28	345.81	351.35
Groundwater		3.48	5.18	5.17	5.21	5.25
Municipal/ No Permits		6.46	6.46	8.52	9.42	10.32

*Volumes are allocated from Tables 8 through 17 by source based on current distribution.

Table 19. Expected Demand Scenario Forecasted Water Consumption in mgd by Region and Source*

Planning Region	Source	2020	2030	2040	2050	2060
Altamaha	Altamaha River	49.98	49.98	49.98	49.98	49.98
	Floridan	0.83	0.83	0.83	0.83	0.83
Coastal Georgia	Savannah River	6.61	6.61	8.64	9.55	10.47
	Municipal/ No Permits	0.41	0.41	0.54	0.59	0.65
Coosa-North Georgia	Municipal/ No Permits	3.78	3.78	4.99	5.50	6.03
Lower Flint-Ochlockonee	Lake Blackshear	0.01	0.01	0.01	0.01	0.01
	Floridan	0.10	0.10	0.13	0.14	0.15
Metro District	Etowah River	31.08	31.08	0.00	0.00	0.00
	Chattahoochee River	11.52	11.52	15.18	16.79	18.40
Middle Chattahoochee	Chattahoochee River	11.76	11.76	7.09	7.85	8.60
	Surface Water Reservoir	11.36	11.36	14.96	16.55	18.40
	Municipal/ No Permits	0.10	0.10	0.13	0.15	0.16
Middle Ocmulgee	Ocmulgee River	10.59	10.59	0.00	0.00	0.00
	Lake Juliette	24.55	24.55	0.00	0.00	0.00
	Crystalline Rock	0.05	0.05	0.00	0.00	0.00
	Municipal/ No Permits	0.30	0.30	0.40	0.44	0.48
Savannah-Upper Ogeechee	Savannah River	69.25	133.84	133.84	133.84	133.84
	Cretaceous and Gordan	1.15	2.24	2.24	2.24	2.24
	Unknown	0.11	0.11	0.15	0.16	0.18
Upper Flint	Municipal/ No Permits	0.53	0.53	0.69	0.77	0.84
Upper Oconee	Cretaceous	0.01	0.01	0.01	0.01	0.01
	Dublin-Midville	0.05	0.05	0.06	0.07	0.07
	Municipal/ No Permits	0.58	0.58	0.76	0.84	0.92
Total		234.67	301.34	241.60	247.30	253.00
Surface Water		226.69	292.28	230.70	235.56	240.43
Groundwater		2.29	3.38	3.41	3.44	3.48
Municipal/ No Permits		5.69	5.69	7.49	8.29	9.09

*Volumes are allocated from Tables 8 through 17 by source based on current distribution.

Table 20. High Demand Scenario Forecasted Water Withdrawal in mgd by Region and Source*

Planning Region	Source	2020	2030	2040	2050	2060
Altamaha	Altamaha River	77.92	77.92	77.92	77.92	77.92
	Floridan	1.29	1.29	1.29	1.29	1.29
Coastal Georgia	Savannah River	7.56	7.56	11.38	12.52	13.66
	Municipal/ No Permits	0.46	0.46	0.71	0.78	0.85
Coosa-North Georgia	Municipal/ No Permits	4.29	4.29	6.55	7.21	7.87
Lower Flint-Ochlockonee	Lake Blackshear	0.01	0.01	0.01	0.01	0.02
	Floridan	0.11	0.11	0.17	0.18	0.20
Metro District	Etowah River	63.20	63.20	0.00	0.00	0.00
	Chattahoochee River	13.09	13.09	20.00	22.01	24.01
Middle Chattahoochee	Chattahoochee River	19.07	19.07	9.34	10.28	11.22
	Service Water Reservoir	12.90	12.90	19.70	21.69	23.67
	Municipal/ No Permits	0.12	0.12	0.18	0.19	0.21
Middle Ocmulgee	Ocmulgee River	21.53	21.53	0.00	0.00	0.00
	Lake Juliette	49.92	49.92	0.00	0.00	0.00
	Crystalline Rock	0.10	0.10	0.00	0.00	0.00
	Municipal/ No Permits	0.34	0.34	0.52	0.58	0.63
Savannah-Upper Ogeechee	Savannah River	107.97	210.23	210.23	210.23	210.23
	Cretaceous and Gordan	1.79	3.49	3.49	3.49	3.49
	Unknown	0.13	0.13	0.19	0.21	0.23
Upper Flint	Municipal/ No Permits	0.60	0.60	0.91	1.01	1.10
Upper Oconee	Cretaceous	0.01	0.01	0.02	0.02	0.02
	Dublin-Midville	0.05	0.05	0.08	0.09	0.09
	Municipal/ No Permits	0.66	0.66	1.00	1.10	1.20
Total		383.11	487.07	363.68	370.79	377.90
Surface Water		373.17	475.43	348.58	354.65	360.73
Groundwater		3.48	5.18	5.23	5.27	5.32
Municipal/ No Permits		6.46	6.46	9.87	10.86	11.86

*Volumes are allocated from Tables 8 through 17 by source based on current distribution.

Table 21. High Demand Scenario Forecasted Water Consumption in mgd by Region and Source*

Planning Region	Source	2020	2030	2040	2050	2060
Altamaha	Altamaha River	49.98	49.98	49.98	49.98	49.98
	Floridan	0.83	0.83	0.83	0.83	0.83
Coastal Georgia	Savannah River	6.61	6.61	10.01	11.02	12.02
	Municipal/ No Permits	0.41	0.41	0.62	0.68	0.75
Coosa-North Georgia	Municipal/ No Permits	3.78	3.78	5.77	6.34	6.92
Lower Flint-Ochlockonee	Lake Blackshear	0.01	0.01	0.01	0.01	0.01
	Floridan	0.10	0.10	0.15	0.16	0.17
Metro District	Etowah River	31.08	31.08	0.00	0.00	0.00
	Chattahoochee River	11.52	11.52	17.60	19.36	21.13
Middle Chattahoochee	Chattahoochee River	11.76	11.76	8.22	9.05	9.88
	Service Water Reservoir	11.36	11.36	17.60	19.08	20.88
	Municipal/ No Permits	0.10	0.10	0.16	0.17	0.19
Middle Ocmulgee	Ocmulgee River	10.59	10.59	0.00	0.00	0.00
	Lake Juliette	24.55	24.55	0.00	0.00	0.00
	Crystalline Rock	0.05	0.05	0.00	0.00	0.00
	Municipal/ No Permits	0.30	0.30	0.46	0.51	0.55
Savannah-Upper Ogeechee	Savannah River	69.25	134.84	134.84	134.84	134.84
	Cretaceous and Gordan	1.15	2.24	2.24	2.24	2.24
	Unknown	0.11	0.11	0.17	0.19	0.20
Upper Flint	Municipal/ No Permits	0.53	0.53	0.80	0.88	0.97
Upper Oconee	Cretaceous	0.01	0.01	0.01	0.01	0.02
	Dublin-Midville	0.05	0.05	0.07	0.08	0.08
	Municipal/ No Permits	0.58	0.58	0.88	0.97	1.06
Total		234.67	301.34	250.15	256.40	262.66
Surface Water		226.69	292.28	238.00	243.34	248.69
Groundwater		2.29	3.38	3.46	3.50	3.54
Municipal/ No Permits		5.69	5.69	8.69	9.56	10.43

*Volumes are allocated from Tables 8 through 17 by source based on current distribution.

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Appendix A
List of Stakeholder Advisory Group Participants

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Appendix B

List of Thermoelectric Facilities for the Energy Sector Water Demand Forecast (2020)

Note that generating facilities are listed in order by size of 2018 generation (MWh) for all generating units at a given facility. Facility numbers correspond with numbering on Figure 11.

APPENDIX B

LIST OF THERMOELECTRIC FACILITIES FOR ENERGY WATER DEMAND UPDATE 2020

	Plant Name	County	Units	Fuel Type	Mover	2018 Capacity (MW)	2018 Generation (MWh)	Water Source[1]	Surface Water - 2018 Annual Average Withdrawals (mgd)	Groundwater - 2018 Annual Average Withdrawals (mgd)
1	GA Power Plant Vogtle Units 1 & 2	Burke	1 & 2	Nuclear	ST	2,320	19,959,126	SW/GW	64.53	1.07
	GA Power Plant Vogtle Units 3 & 4	Burke	3 & 4	Nuclear	ST	2,234	-	SW/GW	0.00	0.43
2	GA Power Plant McDonough	Cobb	3	NG	GT	42	16,799,157	SW	10.81	
	GA Power Plant McDonough	Cobb	4 - 6	NG	CC	2,470				
3	GA Power Plant Wansley	Heard	1 & 2	Coal	ST	1,957	2,795,602	SW	42.59	
	Wansley Combined-Cycle	Heard	6 & 7	NG	CT/CA	203	8,655,108			
	Oglethorpe Power Chattahoochee Energy Facility (Wansley Unit 8)	Heard	8	NG	CT/CA	540	2,681,322			
	Wansley Unit 9	Heard	9	NG	CT/CA	594	2,084,949			
4	GA Power Plant Scherer	Monroe	1 - 4	Coal	ST	3,564	15,406,982	SW/GW	48.70	0.10
5	GA Power Plant Hatch	Appling	1 & 2	Nuclear	ST	1,722	14,403,550	SW/GW	62.36	0.16
6	GA Power Plant Bowen	Bartow	1 - 4	Coal	ST	3,499	13,582,918	SW	36.18	
7	Southern Power Plant Franklin (in AL)	Lee (AL)	1 - 3	NG	CT/CA	1,996	12,248,562	SW	6.96	
8	GA Power Plant McIntosh	Effingham	1	Coal	ST	178	22,901	SW/GW	55.83	0.04
	GA Power Plant McIntosh	Effingham	CT 1 -8	NG	GT	810				
	GA Power McIntosh Combined Cycle Facility	Effingham	10 & 11	NG	CC	1,377	9,053,313			
9	Oglethorpe Power Smith Energy Facility	Murray	1 & 2	NG	CT/CA	1,192	5,342,648	No Permits		
10	Effingham County Power Project	Effingham	1 & 2	NG	CT/CA	597	1,808,046	Municipal		
11	GA Power Plant Yates	Coweta	6 & 7	NG	ST	648	1,177,991	SW	19.10	
12	Oglethorpe Power Sewell Creek Energy	Polk	1 - 4	NG	GT	570	547,294	No Permits		
13	Oglethorpe Power Hawk Road Facility	Heard	1 - 3	NG	GT	495	538,686	No Permits		
14	Oglethorpe Power Talbot County Energy	Talbot	1 - 6	NG	GT	726	492,347	No Permits		
15	Southern Power Plant Dahlberg	Jackson	1 - 10	NG	GT	919	386,065	No Permits		
16	Southern Power Plant Addison	Upson	2 - 5	NG	GT	701	328,880	No Permits		
17	Walton County Power	Walton	1 - 3	NG	GT	494	336,791	No Permits		
18	Oglethorpe Power Smarr Energy Center	Monroe	1 & 2	NG	GT	242	234,699	No Permits		

APPENDIX B
LIST OF THERMOELECTRIC FACILITIES FOR ENERGY WATER DEMAND UPDATE 2020

	Plant Name	County	Units	Fuel Type	Mover	2018 Capacity (MW)	2018 Generation (MWh)	Water Source[1]	Surface Water - 2018 Annual Average Withdrawals (mgd)	Groundwater - 2018 Annual Average Withdrawals (mgd)
19	Mid-Georgia Cogeneration Facility	Houston	1 & 2	NG	CT	213	135,274	Municipal		
	Mid-Georgia Cogeneration Facility	Houston	ST1	NG	CA	110	59,603			
20	Oglethorpe Power Hartwell Energy Facility	Hart	1 & 2	NG	GT	360	173,053	GW		0.00
21	Washington County Power, LLC	Washington	1 - 4	NG	GT	796	111,702	GW		0.00
22	Sowega Power	Mitchell	2 & 3	NG	GT	100	92,306			
	Baconton Power Plant	Mitchell	1, 4 - 6	NG	GT	242	67,566			
	Gum Pond LLC	Mitchell						GW		0.11
23	Tenaska Georgia Generation Facility	Heard	1 - 6	NG	GT	1,099	66,852	No Permits		
24	AL Sandersville Energy Facility	Washington	1 - 8	NG	GT	692	73,109	GW		0.002
25	Oglethorpe Power Doyle Energy Facility	Walton	1 - 5	NG	GT	409	62,756	No Permits		
26	GA Power Plant Robins	Houston	1 & 2	NG	GT	184	24,501	No Permits		
27	MPC Generating	Walton	1 & 2	NG	GT	386	14,356	No Permits		
28	GA Power Plant McManus	Glynn	3 & 4	Fuel Oil	GT	499	9,808	No Permits		
	GA Power Plant McManus	Glynn	1	Fuel Oil	IC	2	13			
29	GA Power Plant Wilson	Burke	1	Fuel Oil	IC	3	4,093	No Permits		
	GA Power Plant Wilson	Burke	5	Fuel Oil	GT	319				
30	South Eastern Electric Plant Bainbridge	Decatur	1 & 2	Fuel Oil	GT	80	1,036	Municipal		
31	Crisp County Power Comm - Steam	Worth	1	Coal	ST	13	29	SW	0.01	
	Crisp County Power Comm - Steam	Worth	GT1	NG	GT	5	102			
32	GA Power Plant Boulevard	Chatham	1	NG	GT	16	43	No Permits		

1. Water source information is from EPD permit data.

NG = Natural Gas

ST = Steam

CC = Combined-Cycle

CT = Combustion Turbine of CC

CA = Steam component of CC

GT = Gas Turbine

IC = Internal Combustion

SW = Surface Water

GW = Ground Water