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Understanding the Electricity System in Georgia

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Southface

VOTE SOLAR

Introduction

This primer aims to present a comprehensive and informational overview of the electricity sector in Georgia, from how electricity is generated in the state, to how electricity is sold and who regulates the production and sale of electricity. This primer also provides a special look at clean energy resources, such as energy efficiency and renewable energy.

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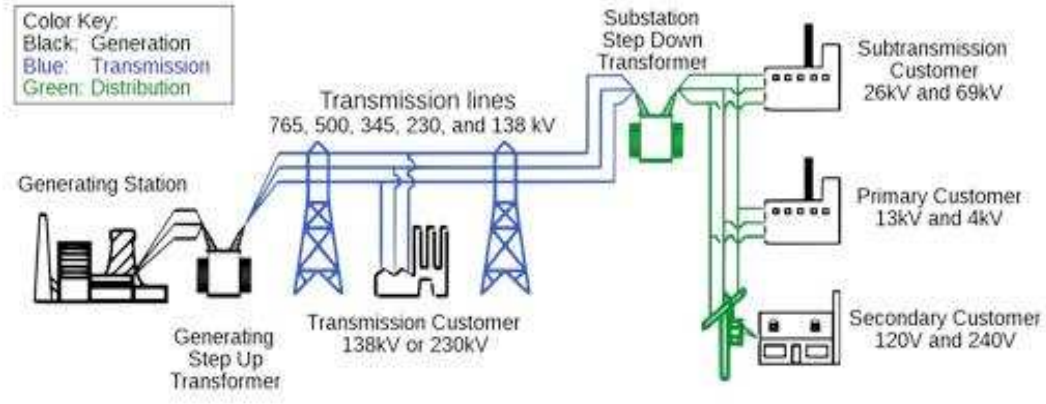
1. Understanding the Electricity Supply System

Overview of Electricity System Functions

Figure 1 provides a simplified diagram of the electricity delivery system, portraying the path of electricity from the power plant to the customer. There are several important electricity system functions not depicted in Figure 1, including resource planning and grid coordination and dispatch. Table 1 provides a brief description of each of these functions.

Figure 1. Diagram of Electricity Delivery System



Source: U.S. Department of Energy

Table 1. Functions in the Electricity Supply System

Generation	Power-sector[1] electrical generating units (EGUs) produce electricity and transmit that electricity to the grid. These EGUs may be owned by a vertically-integrated utility that also markets the electricity to retail, end-use customers or the EGUs may be owned by separate entities that sell the electricity to other companies that in turn "resell" the electricity to retail, end-use customers.
Generation / Resource Planning	Long-range planning to ensure adequate generation resources to meet system peak demand. For traditionally-regulated, vertically-integrated utilities, like Georgia Power, this "integrated resource planning" is overseen by the state utility commission. In deregulated markets, this function is typically performed by the regional transmission organization or independent system operator.

[1] Electric power sector EGU refers to those electrical generating units that produce electricity for transmission and resale to end-use customers. Some examples include Plant Bowen, owned and operated by Georgia Power and the Wansley Combined Cycle units, owned by Southern Power - an independent power producer. There are many generating units in Georgia that are not power sector EGUs, such as the oil-fired internal combustion units at Athens Regional Medical Center or the black-liquor fired steam turbine units at Inland Paperboard Packaging in Rome.

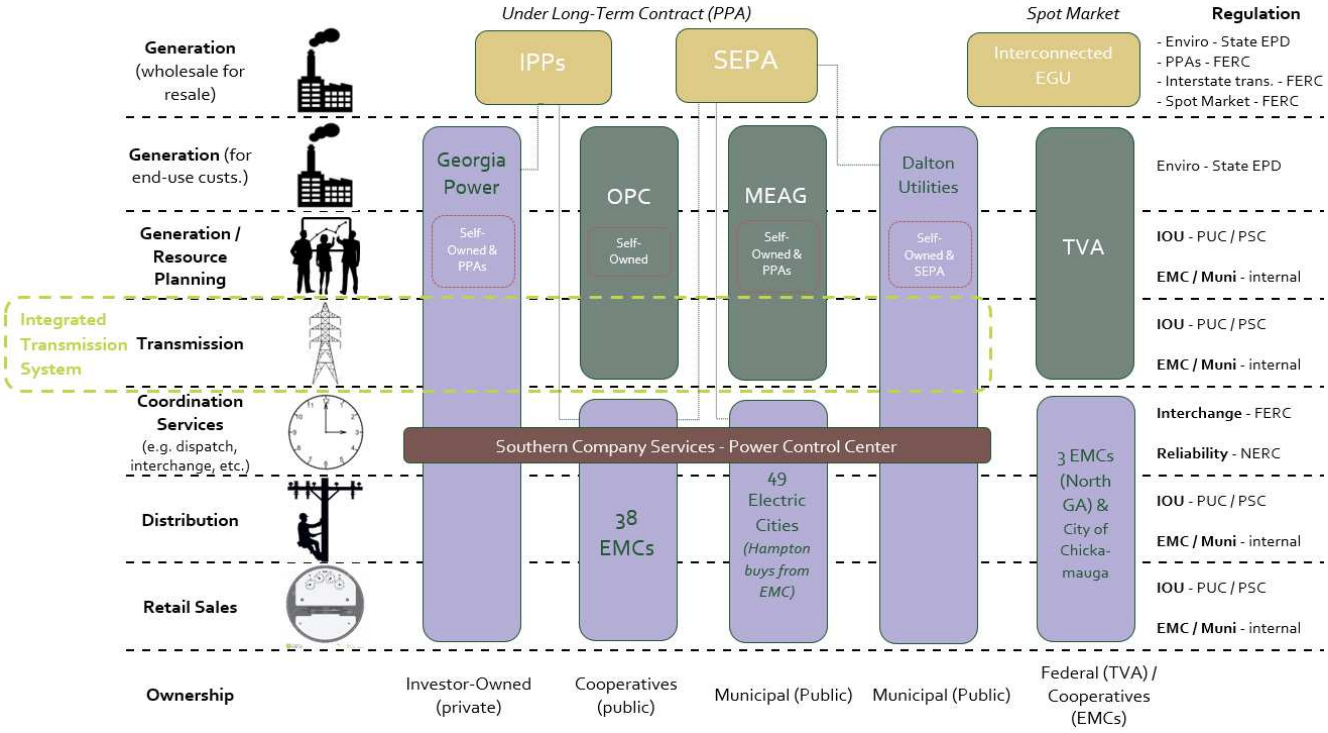
Transmission	Most large power plants are located far from load centers, such as cities. To enhance the efficiency of moving electricity over long distances, the voltage of electricity leaving a central power plant is stepped up and transmitted over high-voltage transmission lines. Transmission is the "highway" of the electrical grid. Equal access to transmission by various power providers is a crucial element of electrical competition.
Coordination Services (dispatch, balancing, interchange)	At the highest level, the US power system is made up of three main interconnections. Each of these interconnections are made up of some number of balancing areas. For instance, the Eastern Interconnection covers about half of the US and parts of Canada and consists of 36 balancing areas.[2] Within each balancing area, a single entity is responsible for a series of coordination activities, such as load balancing, dispatching power plants, managing interchanges with other balancing areas, etc.
Distribution	After electricity has been transmitted over high-voltage lines to a point that is close to end-use customers, the voltage of the electricity is stepped down at substations and transmitted across lower voltage distribution networks to end-use customers. In keeping with our transportation analogy, the substation is akin to the highway interchange and the distribution system are local surface streets that connect to businesses and houses.
Retail sales	The retail sale of electricity entails a number of functions, including maintenance of rates and tariffs, meter reading, billing, customer service, etc. Vertically-integrated utilities span all of these function, including retail sales. Alternately, these functions may be handled by multiple parties. In Georgia's deregulated natural gas market, meter reading is done by Atlanta Gas Light (regulated IOU that owns and operates gas transmission system up to the meter), while rates, billing and customer service are performed by natural gas marketers.

Structured and Restructured Electricity Markets

While certain areas of the United States underwent some degree of electricity "deregulation," Georgia's electricity marketplace remains a traditionally regulated market served by vertically integrated utilities (mostly) supplemented with limited wholesale competition from independent power producers (IPPs). The Georgia Territorial Act also allows for limited competition in electricity retail sales. Figure 2 depicts how the functions described in Table 1 are delivered and regulated in Georgia.

[2] See U.S. Energy Information Administration's *U.S. electric system is made up of interconnections and balancing authorities* (July 20, 2016), available at https://www.eia.gov/todayinenergy/detail.php?id=27152.

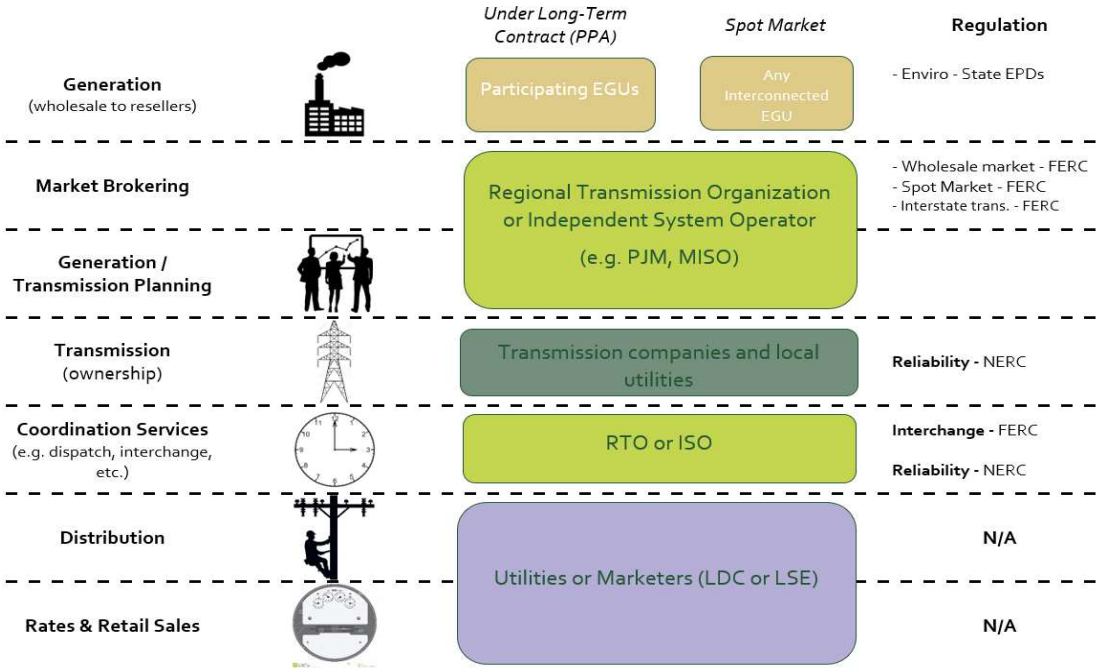
Figure 2. Georgia's Electricity Market



Source: Southface

For contrast, Figure 3 depicts how these functions are delivered and regulated in a restructured or "deregulated" market.

Figure 3. Electricity System Services in Restructured Market



Source: Southface

2. Electric Utilities in Georgia[3]

Retail Electricity Service in Georgia

There are 94 retail electric utilities in Georgia. These 94 utilities fall into three ownership types - investor-owned, electric membership cooperatives and electric cities (municipals).

- Investor-owned – There is one investor-owned electric utility in Georgia today - Georgia Power
  - *What*: Georgia Power is a subsidiary of the Southern Company. Other subsidiary companies of Southern Company include Gulf Power, Alabama Power, Mississippi Power, Southern Gas, Southern Power and thirteen other companies.[4]
  - *History*: In various incarnations, Georgia Power has operated in Georgia since the advent of electric service in the late 19th century. Savannah Electric Company was another electricity IOU in Georgia, but it merged with Georgia Power in 2006.
  - *Sources of power*: Georgia Power owns and operates a diverse portfolio of electrical generating units and generates most of the electricity it sells, though Georgia Power also purchases power from independent power producers under long-term power purchase agreements.

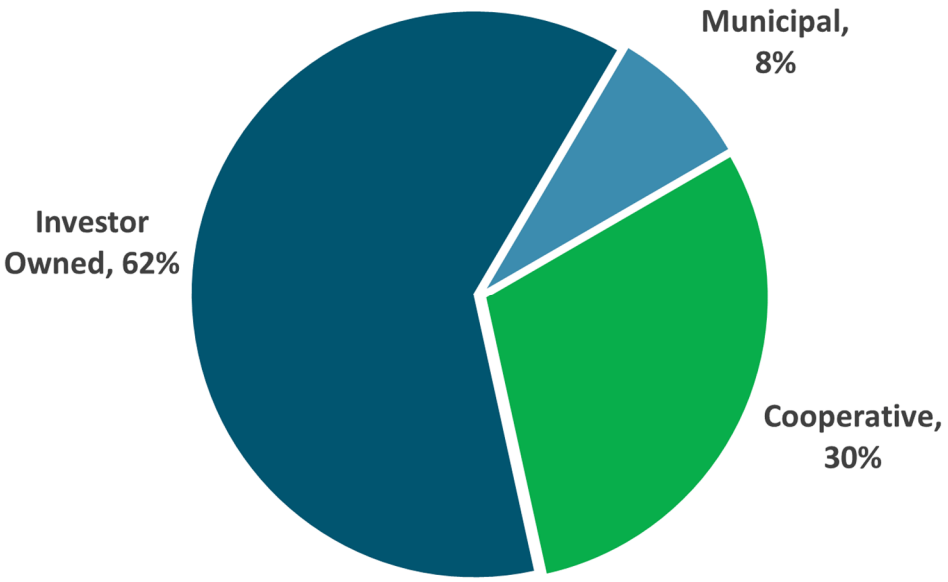
- Electric Membership Cooperative – There are 41 electric membership cooperatives (EMC) in Georgia.[5]
  - *What*: EMCs are customer-owned local corporations governed by boards of directors elected by each EMC's members.
  - *History*: EMCs came into being in the 1930s with the creation of the Rural Electrification Administration (1935) and the passage of the Rural Electrification Act (1936) and the Electric Cooperative Corporation Act (1937).
  - *Sources of power*: Thirty-eight of Georgia's 41 EMCs are members of Oglethorpe Power (see below) and buy a portion of their power from Oglethorpe Power. Three of Georgia's 41 EMCs purchase power from the Tennessee Valley Authority (Blue Ridge Mountain EMC, North Georgia EMC, and Tri-State EMC). These three EMCs serve customers in north Georgia.
    - Oglethorpe Power meets approximately 2/3's of its member power requirements.[6]
    - Some individual EMCs also contract with the Southeastern Power Administration and independent power producers for power supply.

[3] Section 2 - Electric Utilities in Georgia is courtesy of Southern Environmental Law Center (SELC). This section was prepared by Kevin Kelly on behalf of SELC and is reprinted here.
[4] See Southern Company's *Our family of companies* (2016), available at https://www.southerncompany.com/our-companies.html.
[5] This does not include Haywood EMC, headquartered in Waynesville, NC. Haywood serves a small slice of northern Rabun County in Georgia.
[6] See *Oglethorpe Form 10-K: For the fiscal year ended December 31, 2017*, at 1 and 16 (Mar. 29, 2018), available at http://opc.com/wp-content/uploads/2018/03/10K-123117.pdf.

- Electric Cities ("Munis") – There are 51 cities and 1 county that operate their own electric utilities in Georgia.
    - *What*: Cities and counties across America provide both general governmental services, such as public safety, judiciary, public works, etc., and distinct business-like services, such as water, sewer, solid waste or electricity. The operations of the municipal electric utility are governed by the city council or county commission.
        - These utilities typically operate as "enterprise funds," a type of proprietary fund within the financial structure of the local government, that is used to account for the income and expenditures of the "business" function, like electric service.
    - *History*: City electric utilities, including ones in Georgia, have been in operation since the early days of electrification.
    - *Sources of power*: Forty-nine of Georgia's 52 "municipal" utilities participate in the Municipal Electric Authority of Georgia (MEAG).
        - The city of Hampton buys from one of the state's EMCs, the city of Chickamauga buys from the Tennessee Valley Authority and Dalton Utilities owns its own generation assets.
        - Crisp County participates in MEAG, but also owns its own generation assets.

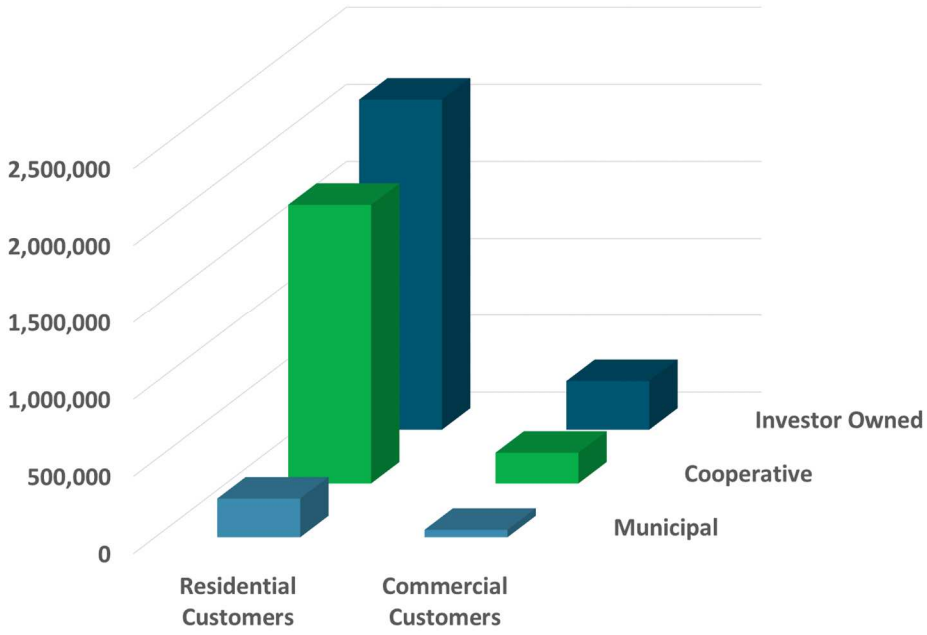
Figures 4 and 5 provide a relative sense of size of these utility types, both in terms of total retail sales, in megawatt-hours, and number of residential and commercial customers.

Figure 4. Retail Electricity Sales (MWh) by Utility Type, 2016[7]



[7] See U.S. Energy Information Administration's Form 861 Electric power sales, revenue, and energy efficiency - detailed data files (Nov. 6, 2017), available at https://www.eia.gov/electricity/data/eia861/.

Figure 5. Residential and Commercial Customers by Utility Type, 2016[8]



Electric Utility Service Areas - The Georgia Territorial Act

In 1973, the Georgia General Assembly adopted the Georgia Territorial Electric Service Act, establishing assigned territories for Georgia utilities. Within their assigned territories, Georgia utilities have the responsibility and the privilege to serve all residential, small business and existing large commercial and industrial customers. The purpose of the Territorial Act was to avoid duplication of electric lines and assure efficient and orderly electric service in the state.[9] The Act also preserved limited retail competition for large loads.

Under the Territorial Act, every geographic area within the state was either assigned to an electric supplier or declared unassigned as to any electric supplier by the Commission. Customers with connected loads of less than 900kW (about the size of a modern grocery store) must take electricity from the franchised supplier. However, if any customer with a load of 900kW or more locates within the corridors of an electric supplier's lines, that customer may have a choice of suppliers. Once a customer chooses a supplier, the Territorial Act provides that the chosen electric supplier has the exclusive right to serve that customer for the life of the premises.[10]

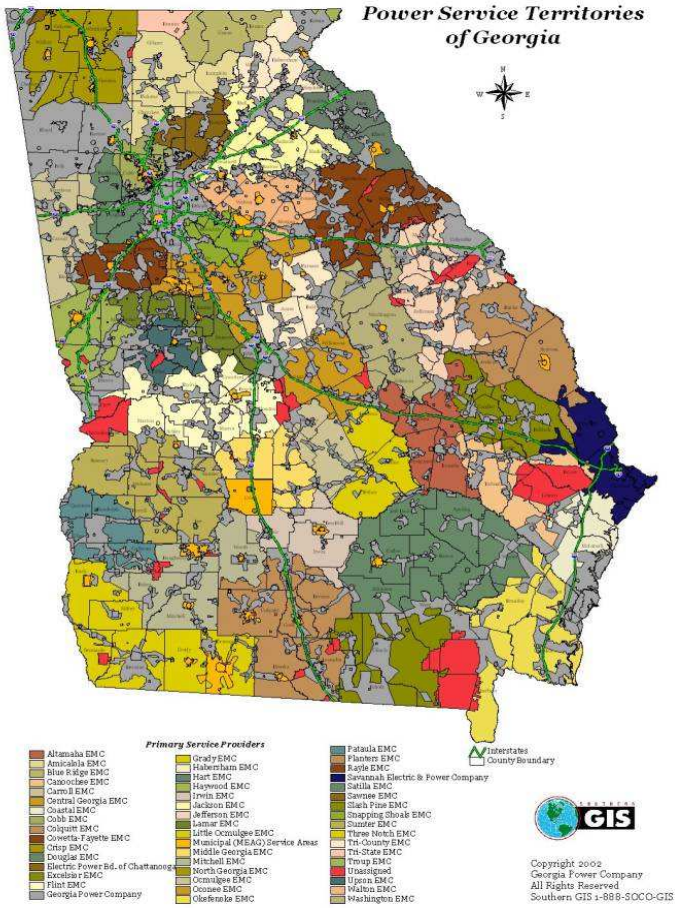
[8] Ibid.
[9] See O.C.G.A. § 46-3-2. Legislative findings and declaration of policy (1973), available through Georgia General Assembly or Georgia Secretary of State websites.
[10] See Georgia Public Service Commission's *Staff Report on Electric Industry Restructuring* at 24, Dkt. 7313 (Jan. 1998), available at http://www.psc.state.ga.us/electricindust/Final%20Draft%2012398.pdf.

Wholesale Power Providers in Georgia

There are several wholesale power providers in Georgia that play a key role in the state's electricity supply chain.

- Oglethorpe Power Corp
  - ***What***: Oglethorpe Power Corp (OPC) is an electric membership corporation that is owned by its 38 retail EMC members. Its principal business is providing wholesale power to its members.[11]
  - ***History***: OPC was created by the Georgia General Assembly in 1974. In 1997, OPC restructured into three separate, interrelated cooperatives: Oglethorpe Power, which continues to provide power to its members; Georgia Transmission Corporation, which owns and operates the transmission lines and substations; and Georgia System Operations Corporation, which coordinates system dispatch, etc.[12]

Figure 6. Power Service Territories in Georgia



Source: GEFA Georgia Energy Review, 2005

  - ***Sources of power***: OPC owns numerous electrical generating units in Georgia, including portions of Plant Hatch, Plant Vogtle (units 1, 2, 3 & 4), Plant Scherer, Plant Wansley and the state's largest pump hydro facility - Rocky Mountain. OPC also fully owns several other generating units.

- Municipal Electric Authority of Georgia
  - ***What***: MEAG Power is a public power entity that supplies bulk electric power to political subdivisions of the State of Georgia that own and operate electric distribution systems.[13]
  - ***History***: MEAG was created by the Georgia General Assembly in March 1975.

[11] See *Oglethorpe Form 10-K: For the fiscal year ended December 31, 2017*, at 1 (Mar. 29, 2018), available at http://opc.com/wp-content/uploads/2018/03/10K-123117.pdf.

[12] See Georgia Public Service Commission's *Staff Report on Electric Industry Restructuring* at 17, Dkt. 7313 (Jan. 1998), available at http://www.psc.state.ga.us/electricindust/Final%20Draft%2012398.pdf.

[13] See See MEAG's *Annual Information Statement for Fiscal Year Ended December 3, 2016* at 10 (Jun. 30, 2017), available at https://www.meagpower.org/NewsPublications/AnnualInformationStatement.aspx. See also MEAG's History (2008), available at https://www.meagpower.org/AboutMEAG/History/tabid/62/Default.aspx.

- ***Sources of power***: MEAG owns numerous electrical generating units in Georgia, including portions of Plant Hatch, Plant Vogtle (units 1, 2, 3 & 4), Plant Scherer and Plant Wansley. MEAG also owns Plant Wansley unit 9.[14]

- Tennessee Valley Authority
  - ***What***: The Tennessee Valley Authority (TVA) is a federally-owned corporation that provides electricity for customers and local power companies in parts of seven southeastern states, including small sections of north Georgia.[15]
  - ***History***: TVA was created by the US Congress in 1933.
  - ***Sources of power***: TVA operates a diverse portfolio of generating units.

- Southeastern Power Administration
  - ***What***: The Southeastern Power Administration (SEPA) is a division of the U.S. Department of Energy. SEPA markets the electric power and energy generated at reservoirs operated by the U.S. Army Corps of Engineers throughout the Southeast.[16]
  - ***History***: The U.S. Secretary of the Interior created SEPA in 1950 to carry out the functions assigned to the Secretary by the Flood Control Act of 1944. In 1977, SEPA was transferred to the newly created Department of Energy, and its headquarters are in Elberton, Georgia
  - ***Sources of power***: The U.S. Army Corps of Engineers operates hydroelectric facilities in Georgia, Virginia, Florida, Alabama, South Carolina, Tennessee and Kentucky, including hydroelectric facilities in Georgia or along the state's borders.[17]

- Independent Power Producers
  - ***What***: Independent power producers (IPPs) are non-utility companies that own and operate electrical generating units and produce electricity for sale to utilities, often under long-term power purchase agreements. Some IPPs currently operating in Georgia include: Baconton Power LLC, Southern Power Co, SOWEGA Power LLC, Tenaska Georgia Partners LP, and numerous solar LLCs. [18]
  - ***History***: Between 1978 and 1992, Congress passed a series of laws (e.g. the Public Utility Regulatory Policies Act or PURPA) that laid the foundation for the introduction of IPPs, which emerged in the early 1980s.[19]
  - ***Sources of power***: The IPPs in Georgia operate a range of electrical generating units, including natural gas combustion turbines, landfill gas engines and solar plants.

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[14] See MEAG's *Facilities* (2008), available at https://www.meagpower.org/PowerGeneration/Facilities/tabid/70/Default.aspx.
[15] See TVA's About (undated), available at https://www.tva.com/About-TVA.
[16] See SEPA's *History* (Undated), available at https://www.energy.gov/sepa/about-us.
[17] See SEPA's System Map (Undated), available at https://www.energy.gov/sepa/maps/southeastern-power-administration.
[18] See US Energy Information Administration's *Form 860 detailed data: 3_1_Generator_Y2016.xlsx* (Nov. 9, 2017), available at https://www.eia.gov/electricity/data/eia860/.
[19] See The University of Texas at Austin Energy Institute's The History and Evolution of the U.S. Electricity Industry, at 3, 7 and 8 (July 2016), available at http://sites.utexas.edu/energyinstitute/files/2016/09/UTAustin_FCe_History_2016.pdf.

Other Key System Players

- Integrated Transmission System
  - ***What***: Through the Integrated Transmission System (ITS), Georgia Power, Georgia Transmission Corporation (previously part of Oglethorpe Power), MEAG and the City of Dalton jointly own the majority of the electrical transmission system in Georgia. The ITS permits the sharing of transmission resources and avoids the duplication of transmission lines for different utilities. The ITS also permits the utilities to compete for new large loads (greater than 900 kW connected load) anywhere in the State, as directed by the Georgia Territorial Electric Service Act.
  - ***History***: The participating parties came to this arrangement in the 1970s, as part of the agreements that permitted Oglethorpe Power, MEAG and Dalton Utilities to purchase ownership interest in two nuclear and two coal generating plants.[20]

- Southern Company Services
  - ***What***: The Southern Company has four regulated utility subsidiaries that serve customers in four southeastern states. This geographic area served by these utilities makes up the Southern Control Area, a sub-region of SERC- the Southeastern Electric Reliability Council. Southern Company Services, Inc., an affiliated company, operates the Southern electric system from Southern Company's William R. Brownlee Power Control Center (PCC) in Birmingham, Alabama. The PCC was established to provide integrated and coordinated operation of the generation and transmission systems of Southern's operating companies. The PCC is responsible for coordinating the operation of the bulk power supply resources. The PCC's responsibilities include:

Figure 7. SERC Sub-Regions

Source: SERC Reliability Corporation

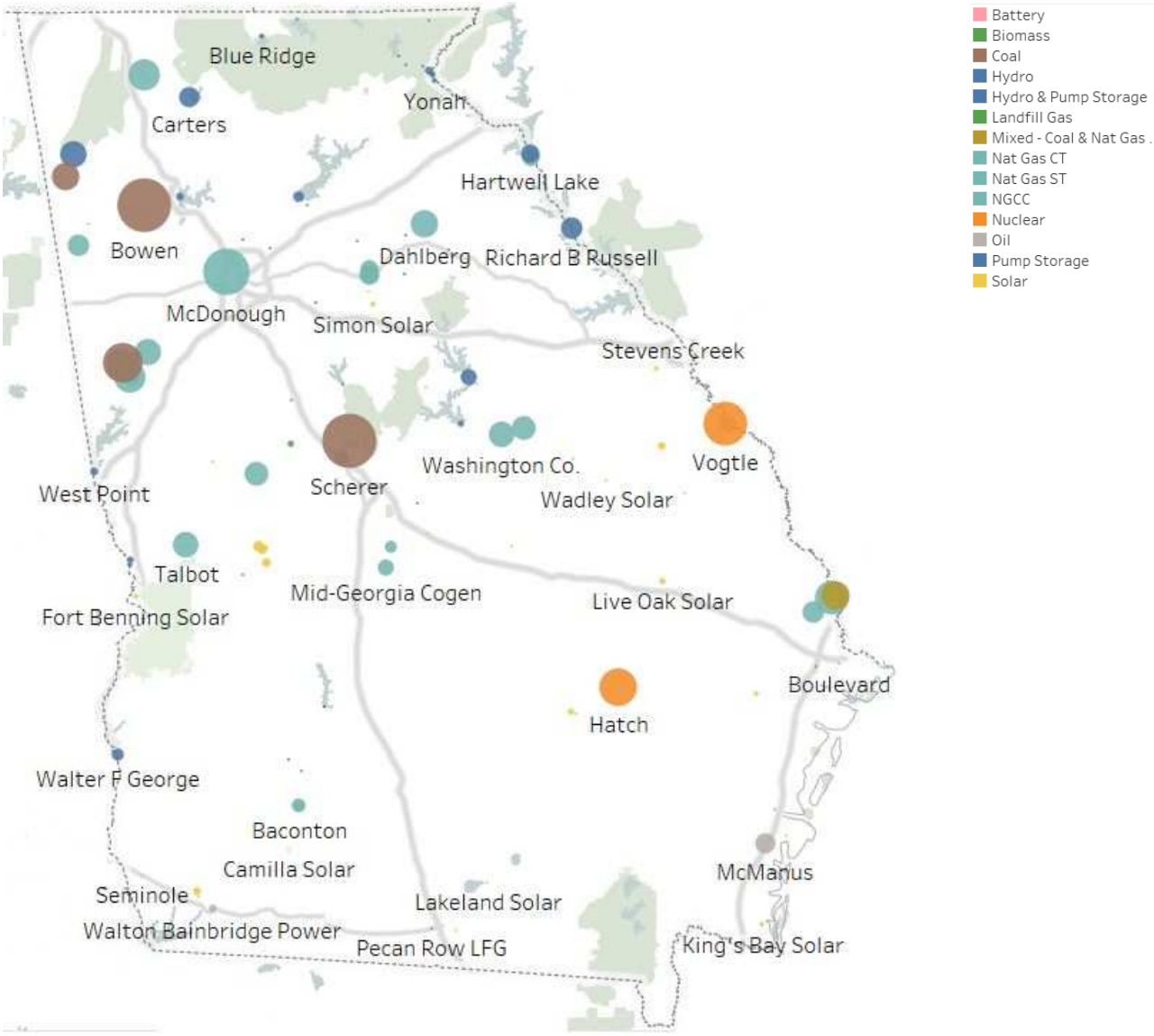
    - *Unit Commitment* – Determine the appropriate set of generating units and other power supply resources required to economically meet projected integrated system demand on a daily basis;
    - *Economic Dispatch* – Determine the desired loading of the generating units and power supply sources connected to the integrated system;
    - *Common Interchange* – Implement the interchange of power with the non-associated companies that are interconnected with the Southern electric system;

[20] See Georgia Public Service Commission's *Staff Report on Electric Industry Restructuring* at 19, Dkt. 7313 (Jan. 1998), available at http://www.psc.state.ga.us/electricindust/Final%20Draft%2012398.pdf.

- *Bulk Power Transmission Security* – Evaluate the reliability of the bulk power transmission system (500 kV, 230 kV and all interconnections) and concur on actions required to ensure its integrity under first contingency conditions;
- *Maintenance Outage Coordination* – Coordinate the unit maintenance outage requirements of the operating companies, including any auxiliary equipment which could curtail unit capacity, in such a way as to minimize cost to the system;
- *Record Keeping* – Maintain specified operating data and records.[21]

3. Generating Electricity - Electricity Supply in Georgia

Figure 8: Map of Generating Units in Georgia
(Note - the size of the mark is proportional to the nameplate capacity of the plant)



[21] See Georgia Public Service Commission's *Staff Report on Electric Industry Restructuring* at 14, Dkt. 7313 (Jan. 1998), available at http://www.psc.state.ga.us/electricindust/Final%20Draft%2012398.pdf.

Types of electric generating units in Georgia

- *Power Plant and Electrical Generation Units* - A power plant contains one or more electric generating units (EGU) that convert primary energy, such as fossil fuels, uranium, or moving water, into electric energy. For instance, Plant Bowen has four coal-fired EGUs. In Georgia, 139 electric power sector plants comprise a total of 344 generating units.

- *Prime Movers and Generators* - The two principal parts of a generating unit are the prime mover and the generator. The prime mover is the turbine, engine, water wheel, or similar machine that drives the electric generator. The generator creates the electric current. A shaft connects the prime mover to the generator.

- *Steam turbines* - A significant amount of Georgia's electricity is produced by steam turbine generating units that rely on either coal combustion or nuclear fission for heat. At a steam turbine generating unit, the heat generated from combustion or fission boils water or other fluid in a boiler to create high pressure steam. The expanding steam pushes against the turbine blades, causing the turbine to spin. The spinning turbine turns the shaft of the generator.

- *Gas turbines* - Gas turbine generating units employ a turbine prime mover as well, but in a different configuration. In a gas unit, the combustion of natural gas and distillate oil produces expansive hot gasses, which pass directly through the turbine to spin the generator shaft, much like a jet engine.

- *Combined cycle units* - Georgia's electricity generating units also include a number of combined cycle units that use both of these generating technologies in tandem. First, hot gas produced from the combustion of natural gas spins a turbine. Combined cycle units then "recover" the heat from the gas, after it has passed through the turbine, to boil water. The steam produced from the boiling water spins a steam turbine. In this way, combined cycle units use the heat twice from a single instance of combustion to produce energy, increasing the thermal efficiency of the units compared to a single-cycle gas turbine or a steam turbine alone.

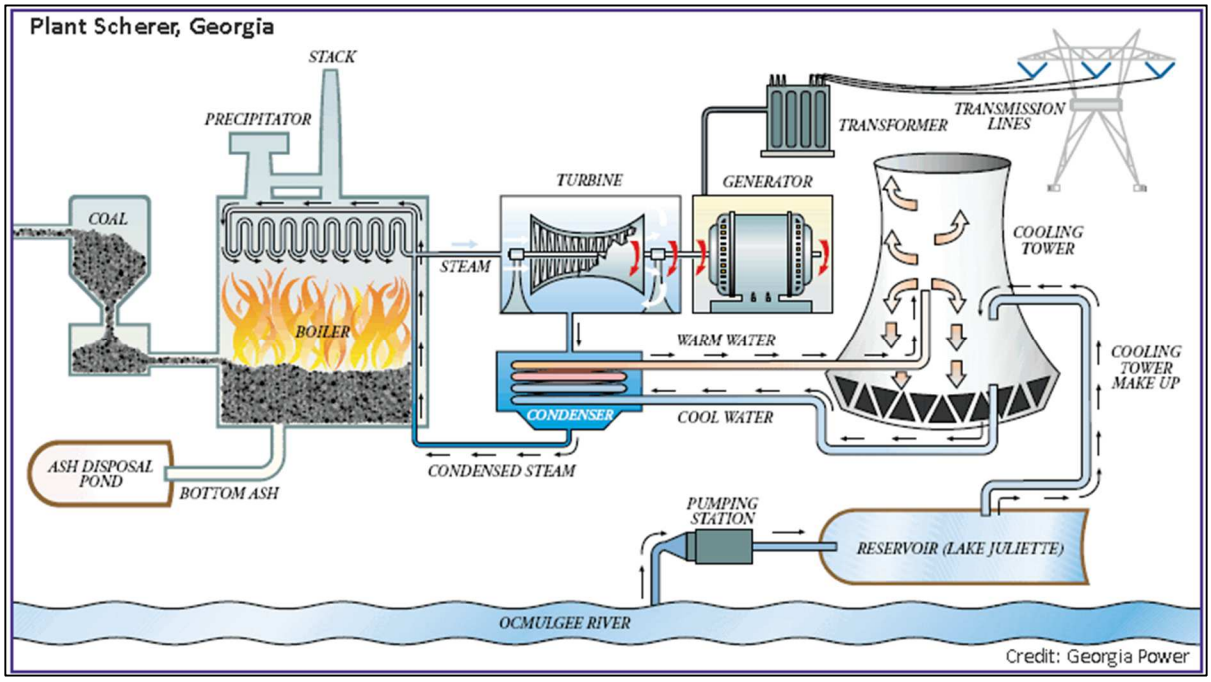
- *Water turbines* - Water turbine prime movers are called hydroelectric generating units. In hydroelectric power generation, flowing water applies pressure to the blades of the turbine, thus spinning the turbine and the generator shaft. Although 116 of the 293 (40%) generating units in GA are hydroelectric, they account for only 4% of the electricity generated in the State. This is true for several reasons. Hydroelectric generating units are typically small, generally less than 50 MW each (many much smaller with a few larger ones). Additionally, water availability may vary during the year, impacting the output of hydroelectric units. However, hydroelectric units require no fuel, making them inexpensive to run and emissions free.

- *Solar Photovoltaic (PV)* - Solar PV cells produce electricity directly from sunlight. They are made of semi-conducting materials similar to those used in computer chips. When these materials absorb sunlight, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material and produce electricity.

- *Combined Heat and Power (CHP)* - CHP is a technology that integrates energy generation and heat recovery in a single system. CHP is designed to recycle waste heat during the conversion of fuel to

electricity. CHP is often used as a distributed generation technology though it can also be deployed within the power sector (e.g. with recovered heat provided to an adjacent facility for end-use). CHP can be useful for businesses that require reliable energy inputs and have significant heating or cooling loads such as hospitals, hotels, office buildings, wastewater plants and data centers. Like combined cycle systems (described above), CHP systems achieve high levels of fuel conversion efficiency.

Figure 9. Diagram of Typical Coal-Fired Steam Turbine EGU



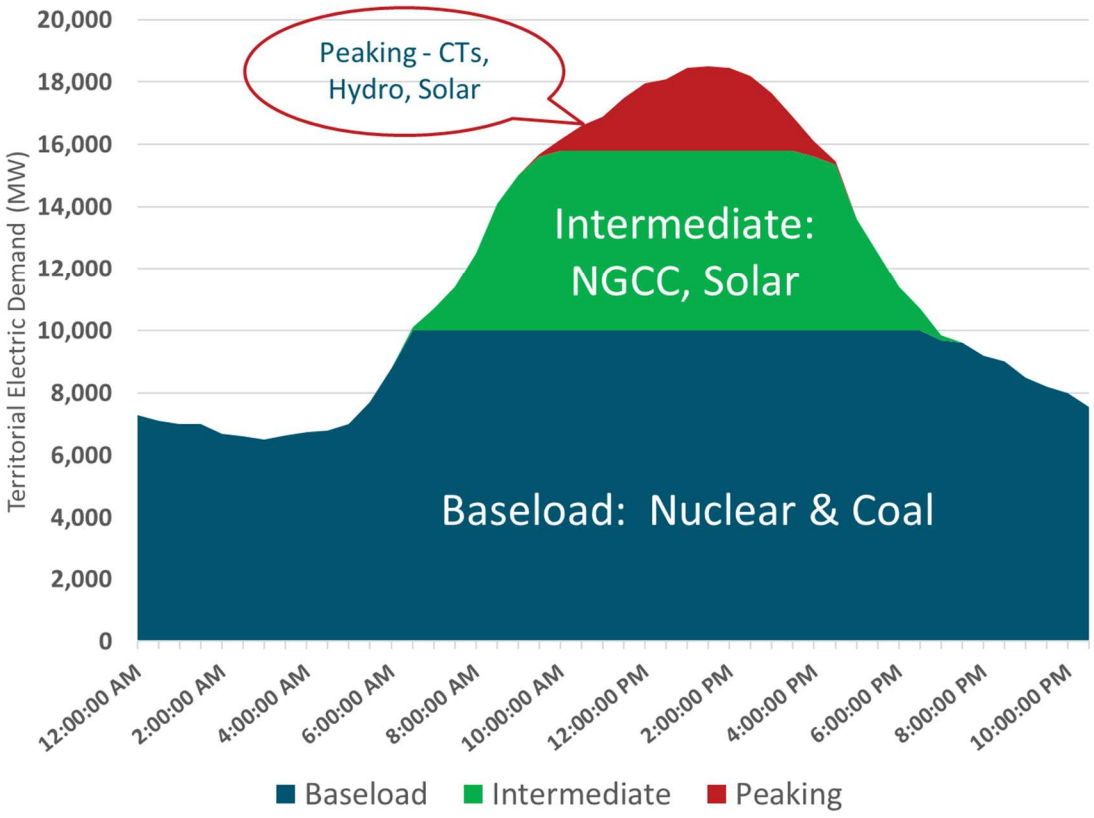
Source: USGS

"Roles" of Generating Units

Electricity delivery is, perhaps, the ultimate "real-time" market - electricity demand within any electric service territory changes minute by minute and system operators must match this ever-changing demand with output from a portfolio of electrical generating units. While electricity storage has evolved in recent years, the grid is still a real-time market - generation must ramp up and down in real-time to match changing demand.

The process of matching changing demand and supply is typically called electricity balancing and it involves dispatching EGUs - calling EGUs into operation as demand rises and dismissing units as demand falls back down. The primary driver of the dispatch order is the operating cost for each unit, though many other factors must also be taken into account such as availability and grid constraints. Certain types of units often play specific roles. Certain units are considered "baseload" units that operate nearly all the hours of the year, while other may only be called into operation to meet peak demands. Figure 8 provides a conceptual picture of EGU "roles" in meeting daily electricity demand.

Figure 10. Conceptual Diagram of EGU Roles in Meeting Daily Demand



CT = combustion turbine
NCCC = natural gas combined cycle

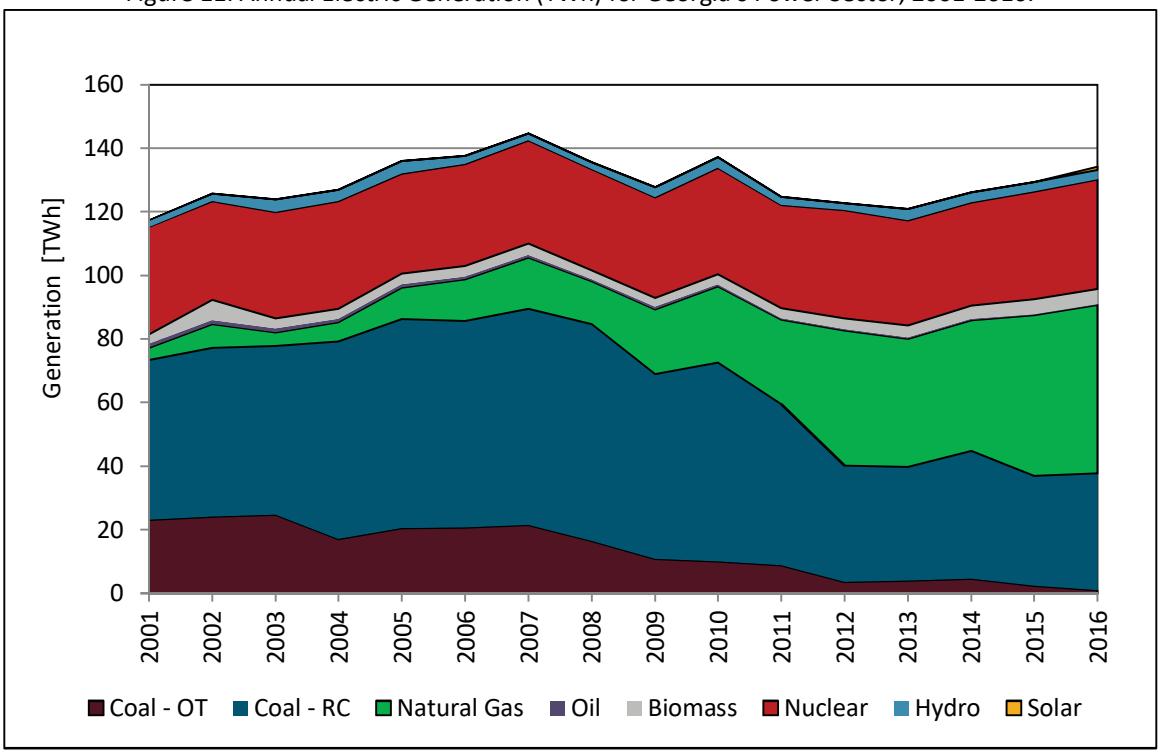
Ownership and Use of Generating Units

- *Electric Power Sector* - EGUs that belong to the electric power sector are those EGUs that produce electricity for transmission and resale to end-use customers.
    - *Utility-owned* - Some electric power sector EGUs are owned by vertically-integrated utilities that operate generation and sell retail electricity. An example is Plant Bowen that is owned and operated by Georgia Power to serve its own retail customers.
    - *Independent Power Producers* - Some electric power sector EGUs are owned and operated by independent entities that do not own transmission and distribution assets and do not sell electricity to end-use customers. They are commonly referred to as independent power producers, or IPPs, and they typically sell their power to load-serving utilities under long-term power purchase agreements. The Wansley Combined Cycle units, owned by Southern Power, are examples of IPP power sector EGUs.
- *Onsite Distributed Generation* - There are many generating units in Georgia that are not power sector EGUs. Many are back-up power units, such as the oil-fired internal combustion units at Athens Regional Medical Center. Some are units powered by an industrial by-product, such as the black-liquor fired steam turbine units at Inland Paperboard Packaging in Rome.

Georgia's Electricity Generation by Fuel Type

Georgia's mix of power plants and electricity generation has changed over the years. Figure 10 reflects the changes in Georgia's generation mix over the last 15 years. Whereas coal generation used to dominate, the role of natural gas units has expanded significantly in the last decade. Please note, Figure 10 only reflects power sector units and breaks coal generation into two segments - coal units with once-through cooling systems and coal units with recirculating cooling systems.

Figure 11. Annual Electric Generation (TWh) for Georgia's Power Sector, 2001-2016.



OT – once through cooling; RC – recirculating cooling; NGCC – natural gas combined cycle.
Source: Cadmus and CAN - Derived from EIA Form 923 data.

Chapters Coming Soon