

# Leadership Clarksville: Energy Project Group of 2023

## Energy Innovation in Clarksville-Montgomery County

Businesses and organizations can dramatically reduce their carbon footprint by drawing electricity from clean, renewable sources. Renewable power technologies commonly include solar, wind, biogas, geothermal, low-impact, hydroelectricity, and other emerging technologies such as wave and tidal power.

Numerous organizations have incorporated alternative energy sources into their strategic plans. For example, the TVA has a plan to reduce their carbon usage up to 70% by 2030, 80% by 2025, and to achieve net-zero by 2050. In recognizing this landscape, Ford Motor Co. has launched a \$5.6 billion Blue Oval project in West Tennessee where they plan to produce the next generation of electric truck and electric vehicle batteries. There are numerous other companies and communities which have also begun similar initiatives.



**LEADERSHIP  
CLARKSVILLE**

LEAD. CONNECT. INSPIRE.

# Leadership Clarksville: Energy Project Group of 2023



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# Presentation Outline

- I. Introduction
- II. Energy Project Team Members 2023
- III. Energy Project Charge 2023
- IV. Energy and Consumption in Clarksville and Tennessee
- V. Power of the Valley: TVA Tennessee Valley of Authority
- VI. Hydroelectric: How it works
- VII. Coal Fuel: Cumberland Fossil Plant
- VIII. Natural Gas: Cumberland Fossil Plant
- IX. Zinc Plant: Nyrstar
- X. Electric Energy: Clarksville Department of Electricity
- XI. Solar Farm: Silicon Ranch and CDE
- XII. EV Batteries: LG Chem
- XIII. Data Center: Google

A logo for the 'Class of 2023' featuring the word 'Class' in a blue cursive font, '-of-' in a smaller blue font, and '2023' in a large, bold, blue block font with a white outline. The logo is set against a light gray background within a white-bordered square.

*Class*  
-of-  
**2023**





Steve Batten, Deputy Chief,  
Clarksville Fire and Rescue



Jennifer Head  
Sr. Program Manager,  
Vanderbilt Medical Center



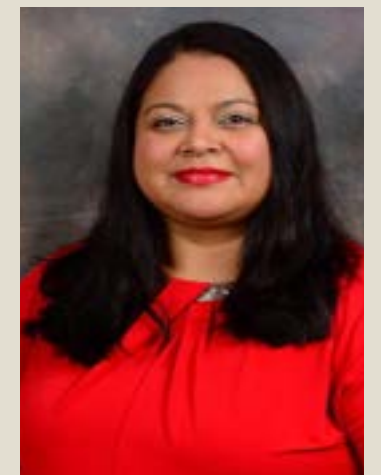
Pamela Holz, Executive  
Director, Association for  
Corporate Growth



Adrienne Fry, Circuit Court  
Judge, State of Tennessee



Sylvester Jenkins III,  
Realtor, Quirion Realty



Jasmin Linares, Director,  
APSU Military Student  
Center



Jane Manning, Owner and  
President, NBalance Hot  
Yoga & Fitness



Dar Place, Owner and  
President, KiniCo Inc.



Christopher Shank, Vice  
President Shank Shelter  
Insurance



Davis Stack, Public Utilities  
Supervisor, Clarksville Gas  
and Water



Daniel Ufford, Attorney,  
Ufford Law & Mediation  
Offices



LaNeece Williams, Chief  
Diversity Officer/Title IX  
Coordinator, APSU

## Energy Innovation



Explore energy innovation opportunities in Clarksville-Montgomery County

## Energy Options



What energy options are most viable as we move into the Future

## Energy Impacts



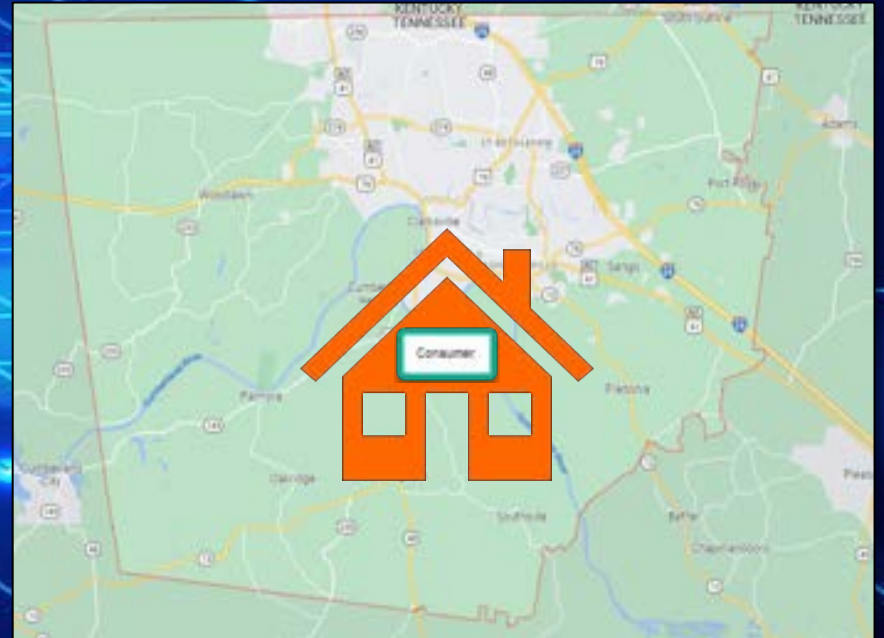
What are some possible paths forward, and what is the impact on environmental stewardship and the economy?



*The average Clarksville “household” consumes around 1500 kWh (kilo-watt hours) per month.*

But what *exactly* is a  
kilo-watt hour?

**Watts\*Time(hours))/1000=kWh**



Metric used by your power  
company to determine your  
consumption/bill

$$\text{Watts} * \text{Time(hours)} / 1000 = \text{kWh}$$

## Practical Example – 60-Watt Lightbulb



1. Find the Lightbulb's Kilowattage

$$60 \text{ Watts} / 1000 = .6 \text{ Kilowatts}$$

2. Determine Hours of Use per Month

$$90 \text{ Hours} * .6 = 5.4 \text{ kWh}$$

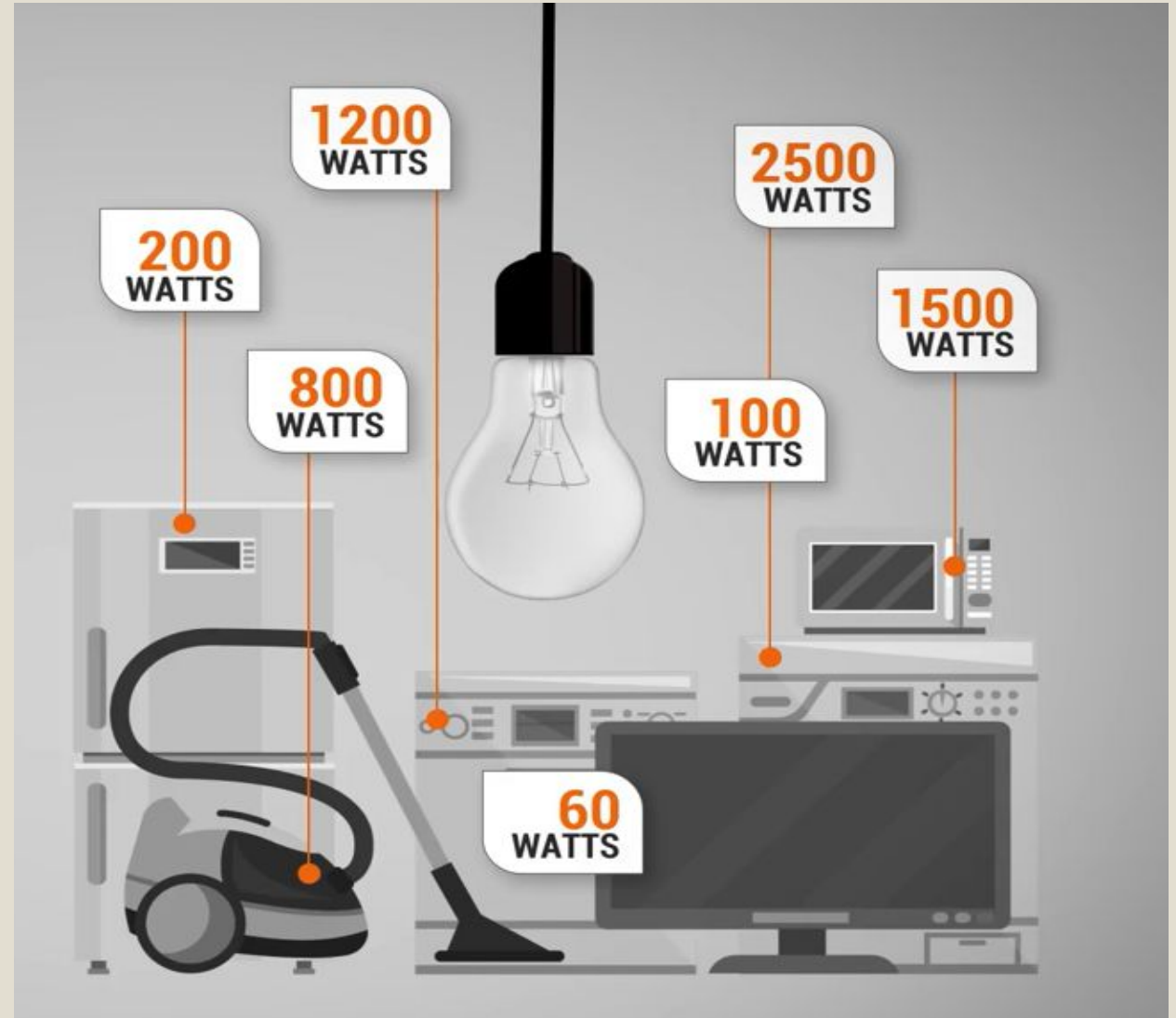
3. Find the local cost per kWh (Clarksville

Average is \$.12/kWh


$$5.4 * .12 = \$.648/\text{month}$$

# Common Appliance Wattage

- 42" Plasma TV (450-600w)
- 42" LED TV (60w)
- Refrigerator/Freezer (150-400w)
- Clothes Dryer (1000-4000w)
- Dish Washer (1200-1500w)
- EV Car Charger (2000-7000w)
- Desktop Computer (200-800w)
- Microwave (600-1500w)
- Electric Oven (2000-2500w)
- Vacuum (800-1000w)





 The average Clarksville “household” spends **\$186**  
**per month** on electricity.

The average Clarksville “household” consumes  
over **18,500 kWh per year**.



Montgomery County consumed over  
**3.2 billion kWh**, but produced **less than 12 million**  
**kWh** in 2022

Montgomery County produced over  
**2.2 billion pounds** of carbon emissions in 2022  
(That’s the equivalent weight of over 600,000  
*sedans*)



◦ Tennessee Energy Retail

(how much energy was sold in each given year)

- 1980: 26.2m kWh
- 2000: 36.6m kWh
- 2020: 41m kWh

# Future Outlook with Energy Types

## Tennessee Coal Consumed

- 1980: 24.6 million tons
- 2000: 28.8 million tons
- 2020: 7.9 million tons

## Tennessee Natural Gas

- 1980: 230 billion cubic feet
- 2000: 271 billion cubic feet
- 2020: 387 billion cubic feet

## Tennessee Petroleum Consumed

- 1980: 91 million barrels
- 2000: 128 million barrels
- 2020: 129 million barrels

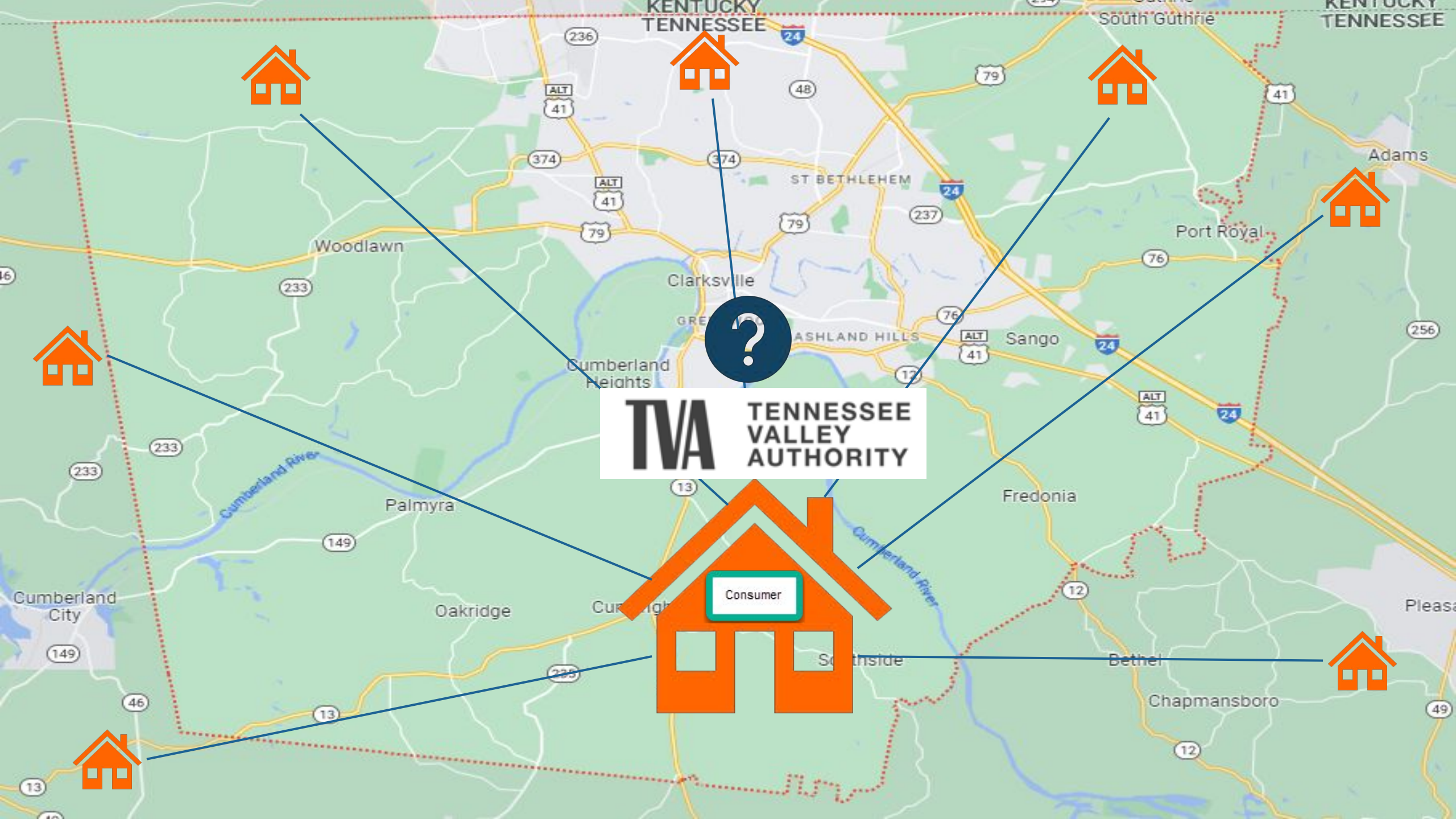
## Tennessee Nuclear Power

- 1980: 519 million kWh generated
- 2000: 25.8 billion kWh generated
- 2020: 36.6 billion kWh generated

## Tennessee Hydro Power

- 1980: 8.7 billion kWh generated
- 2000: 6.3 billion kWh generated
- 2020: 13.4 billion kWh generated





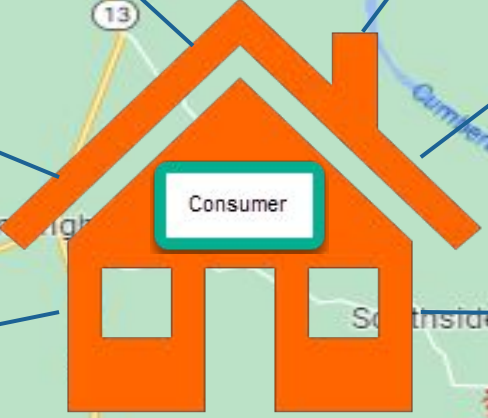
KENTUCKY  
TENNESSEE

South Guthrie

KENTUCKY  
TENNESSEE



**TVA** TENNESSEE  
VALLEY  
AUTHORITY



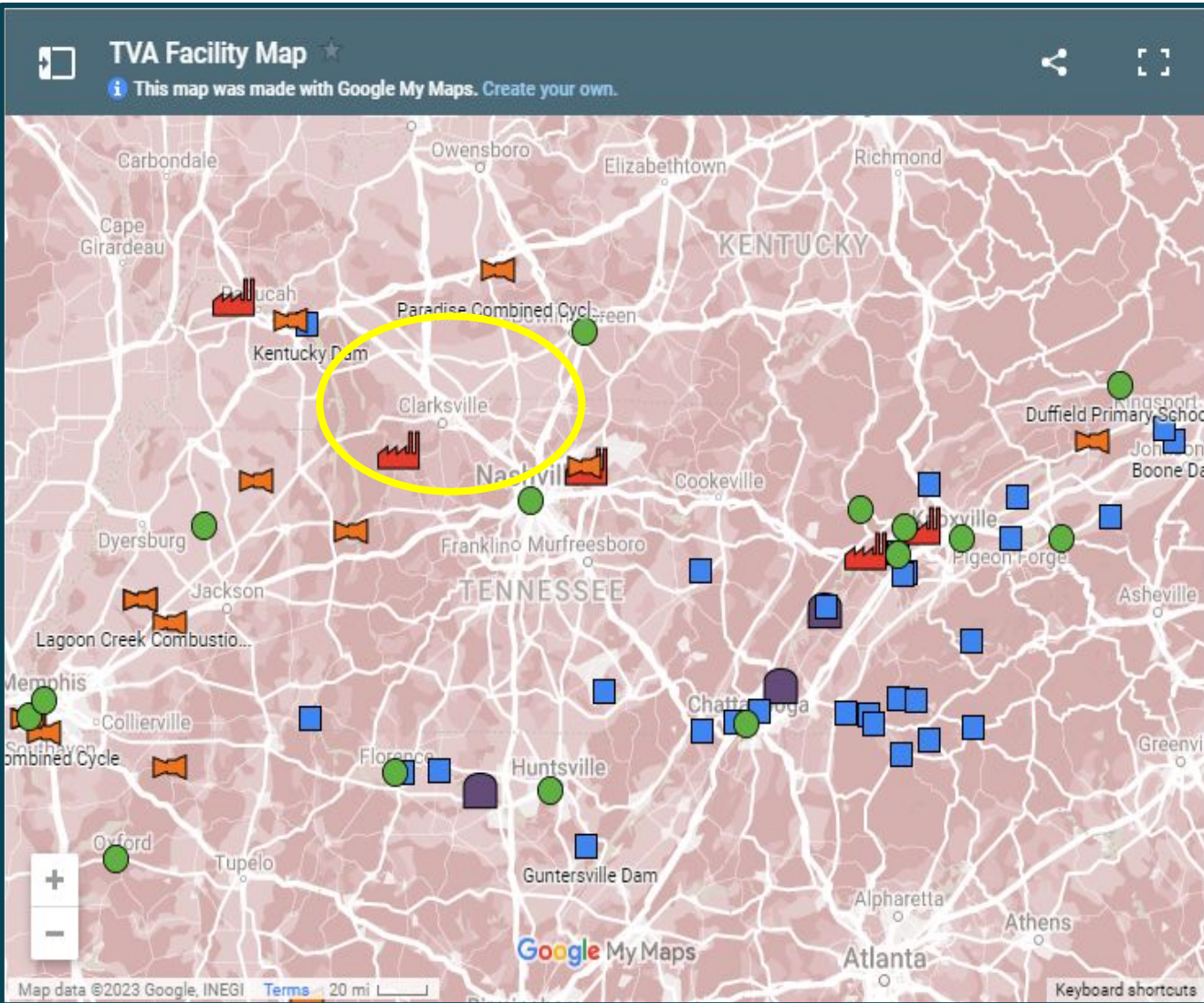


# Public Power for the Valley

- TVA was charged in 1933 by the U.S. Congress to control floods, improve navigation, improve the living standards of farmers and provide the energy needs to the Tennessee Valley Region.
- Therefore, its jurisdiction is generally limited to the drainage basin of the Tennessee River, which covers parts of seven states

Since 1933, TVA has met that charge, and developed its purpose and mission to three main areas, known as the Three E's:

- Energy
- Environmental stewardship
- Economic development



# Diverse Power with Renewable Energy



**36,937 MW**

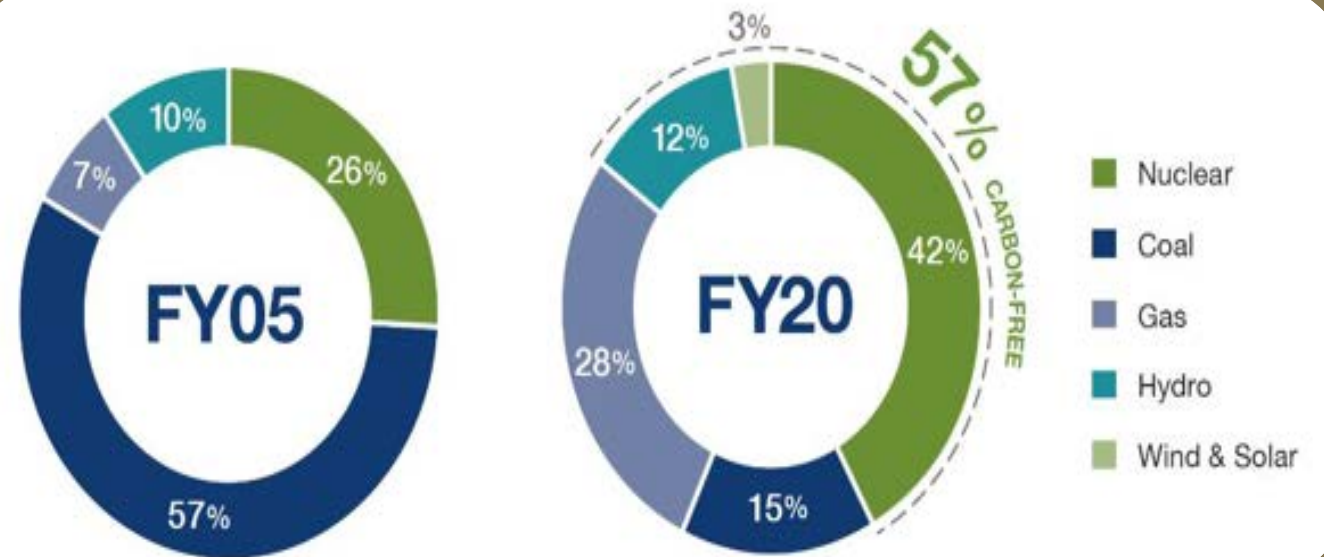
Summer Net Capacity

Adding 7,000 to 10,000 MW of solar energy by 2040

## Generating Assets

- 3 Nuclear Sites (7 Units)
- 5 Coal-Fired Sites (25 Units)
- 29 Hydroelectric Sites (109 Units)
- 1 Pumped-Storage Site (4 Units)
- 9 Combustion Turbine Gas Sites (86 Units)
- 8 Combined Cycle Gas Sites (14 Units)
- 1 Co-Generation Unit
- 14 Solar Energy Sites

## TVA Generating Assets Portfolio





# TVA Innovation & Research



Electric Vehicle  
Evolution



Storage  
Integration



Regional Grid  
Transformation



Advanced Nuclear  
Solutions



Connected  
Communities







### Business & Industry Energy Needs

- Get energy-saving business incentives
- Preferred Partners Network
- Carbon Reduction
- Energy Education

### Residential Energy Needs

- Home Energy Evaluations & Inspections
- Free Home Energy Workshop
- Utility Bill Assistance
- Finance home energy upgrades

### Electric Vehicles



- EV batteries
- EV maintenance.
- Compare Vehicles
- Explore EVs
- Resources and Events

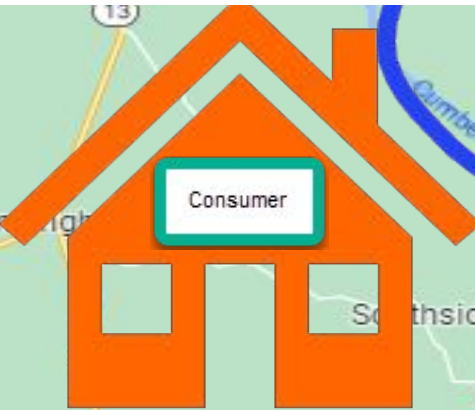


- ELECTRICITY
- ENVIRONMENT
- RUNNING THE RIVER
- THE RIVER
- HISTORY
- WHAT IS TVA?
- HOMEWORK HELPERS



- Services
- Education & Advice
- Workshops
- Energy Bill Assistance
- FAQ

Cumberland River is a feeder to the Tennessee River TVA Dam





# Hydroelectric Power

Hydroelectric power is the cleanest, most reliable, most efficient, and most economical of all renewable energy sources. And thanks to the Tennessee River system, we have plenty of it in our region. It supports our mission of providing clean, reliable, and affordable electricity to the people and businesses of the Tennessee Valley.

TVA's hydroelectric system comprises:

- 29 power-generating dams throughout the Tennessee River system, some of which date back to the TVA's early days in the 1930s
- A pumped-storage plant near Chattanooga called Raccoon Mountain
- Purchased power from eight dams on the Cumberland River operated by the Army Corps of Engineers

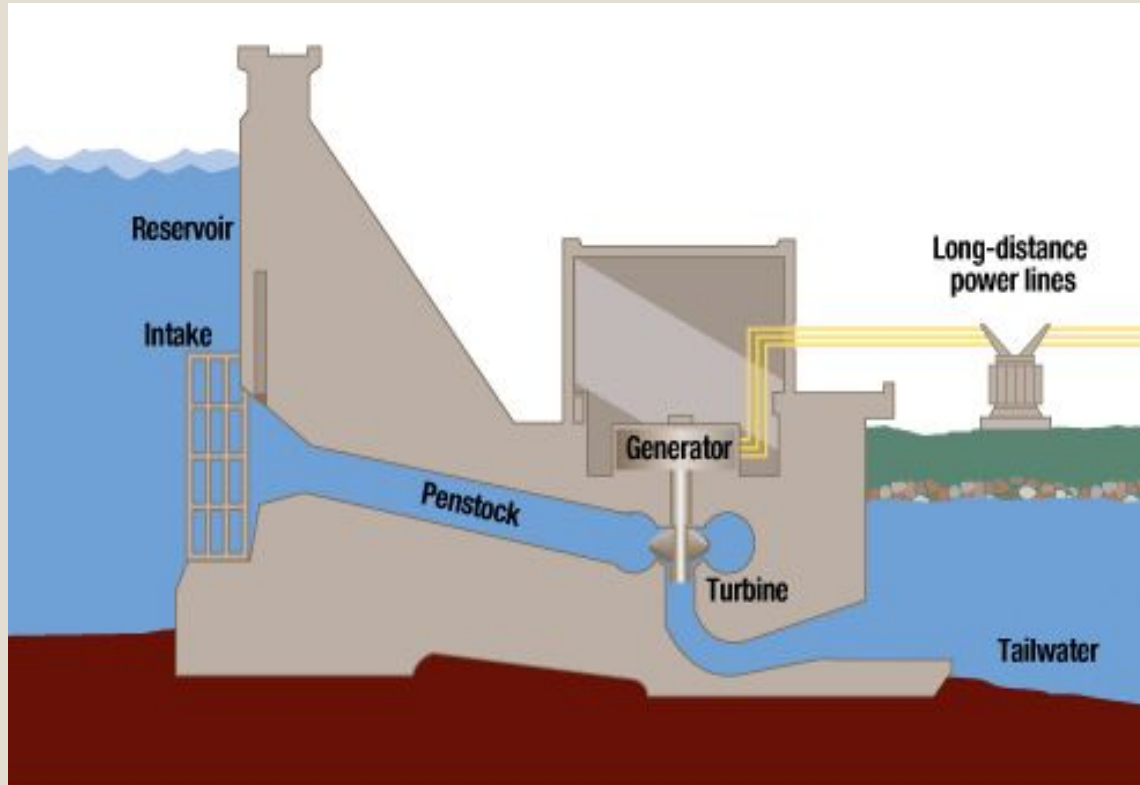
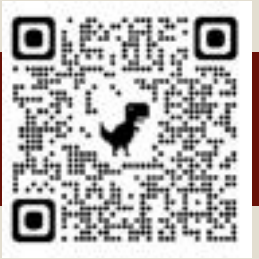
These dams are located on the Tennessee Rivers system, which includes a number of feeder rivers, including the Holston, the Clinch, the Ocoee, the Little Tennessee, the Hiwassee, the Elk, the Duck, the Nolichucky, the Nottely, the Nantahala, the French Broad, the Pigeon, the Cheoah, the Powell and the Cumberland among others.

**TVA** TENNESSEE  
VALLEY  
AUTHORITY





# Hydroelectric Power Work?



A conventional dam holds water in a man-made lake, or reservoir, behind it. When water is released through the dam, it spins a turbine connected to a generator that produces electricity. The water returns to the river on the downstream side of the dam.

[Learn more about how hydroelectric power works](#)



# Hydro-Energy Innovation Options

- **What are some of the energy innovation(s) in this category?**
  - Constant Flow
  - Geo/Hydro Mix
  - Wastewater
  - Tidal/ Wave
- **Who is leading or doing these innovation(s)?**
  - Government / Corps of Engineers
  - Private Industry
- **Where is this occurring geographically?**
  - Tennessee River
  - Mississippi River, Colorado River
  - Coastal States
- **When is the innovation ready for market?**
  - Vortex: Now
  - Constant Flow in R&D on Mississippi
  - Wastewater in R&D
- **Why is this a viable option for Clarksville/ MoCo?**
  - Constant Flow: Cumberland River
  - Vortex: Cumberland/tributaries
  - Geothermal: Yes, shallow Freeze region
- **How is this happening? (i.e., Funding/process)**
  - Grants
  - Private Investment *i.e., Google/Amazon*
  - Corps of Engineers

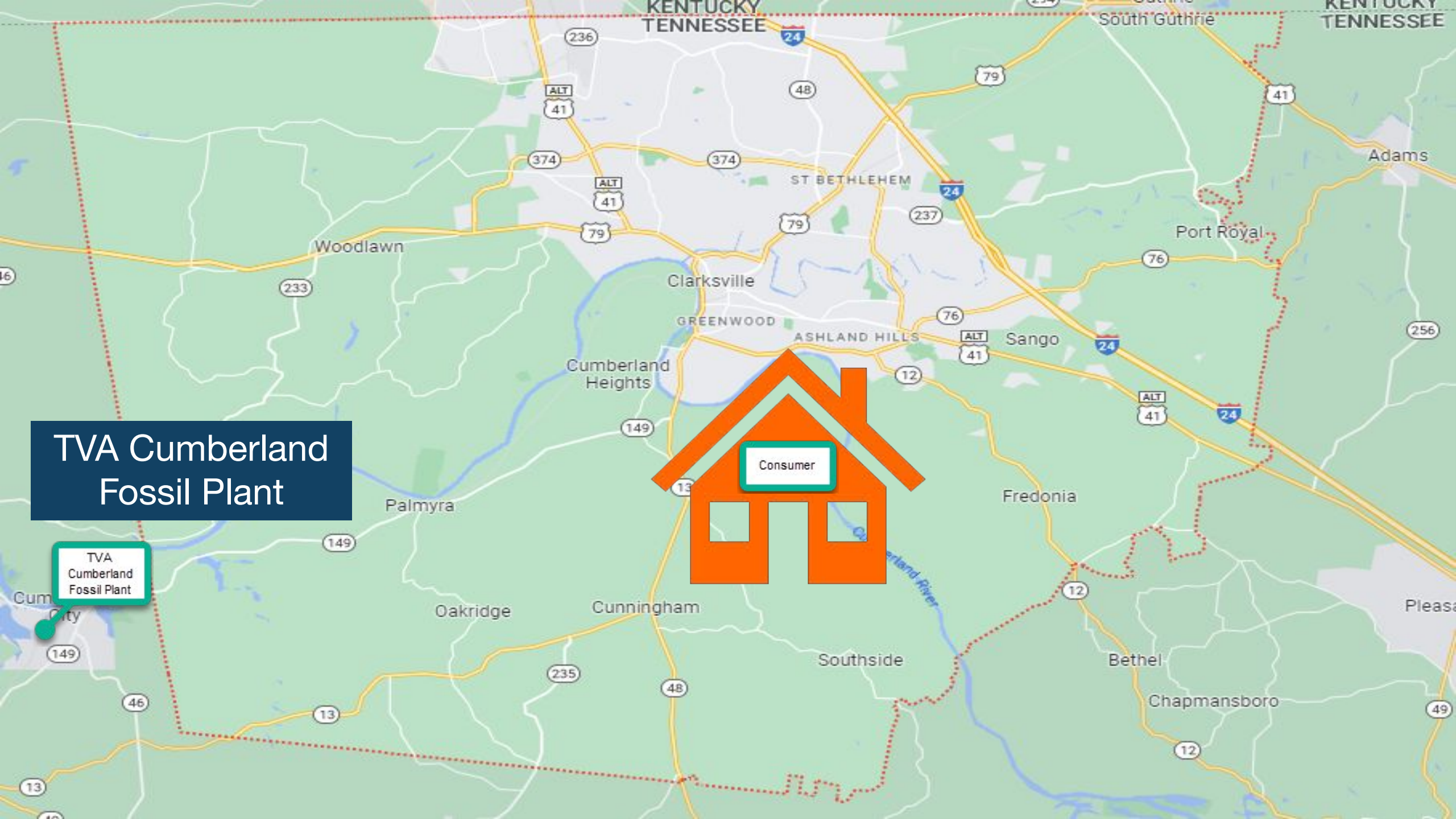




# TVA Cumberland Fossil Plant

TVA  
Cumberland  
Fossil Plant

Consumer





# Cumberland Fossil Plant

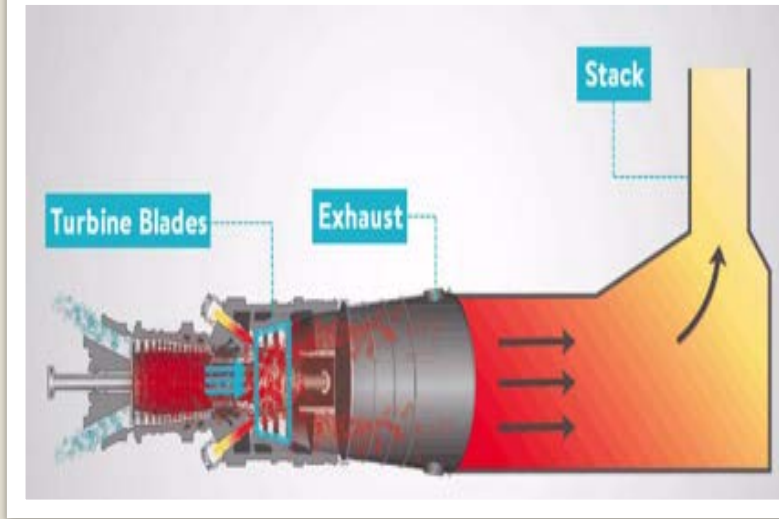


- Cumberland Fossil Plant in Cumberland City Located 22 miles Southwest of Clarksville on the shores of Barkley Reservoir in Cumberland City, the Cumberland Fossil Plant was commissioned in 1968.
- The original stacks were launched in 1973 and started burning coal to heat water from which the steam was used to generate electricity.
- The taller and original chimneys were replaced by two newer ones (during 2003-2004) containing scrubbers that reduce the amount of sulfur dioxide and nitrogen oxide pollutants emitted.
- According to the TVA, “the Cumberland Fossil Plant is their largest generating asset boasting a maximum gross output of 2.470 megawatts, and producing approximately 16 billion kilowatt-hours of electricity annually (which is enough to supply 1.1 million homes).





- The Tennessee Valley Authority is replacing its Cumberland Fossil Plant near Clarksville with a natural gas facility.
- A new 32-mile natural gas pipeline through Dickson, Houston and Stewart counties will be built to supply the planned facility.



- TVA is moving forward with a plan to retire and demolish its high-pollutant two-unit, coal-fired Cumberland Fossil Plant and replace it with a natural gas-fueled combined cycle combustion turbine.
- It consists of two coal-fired units: the first unit will be retired and replaced with a 1,450-megawatt combined cycle natural gas plant by 2026. The second unit will be retired by 2028. TVA has not yet determined how it will replace the second unit.



- The transition will cut carbon emissions from the facility by up to 60 percent, TVA said.
- The utility has said it plans on achieving net zero carbon emissions by 2050.
- That effort will include retiring its final five coal plants by 2035.

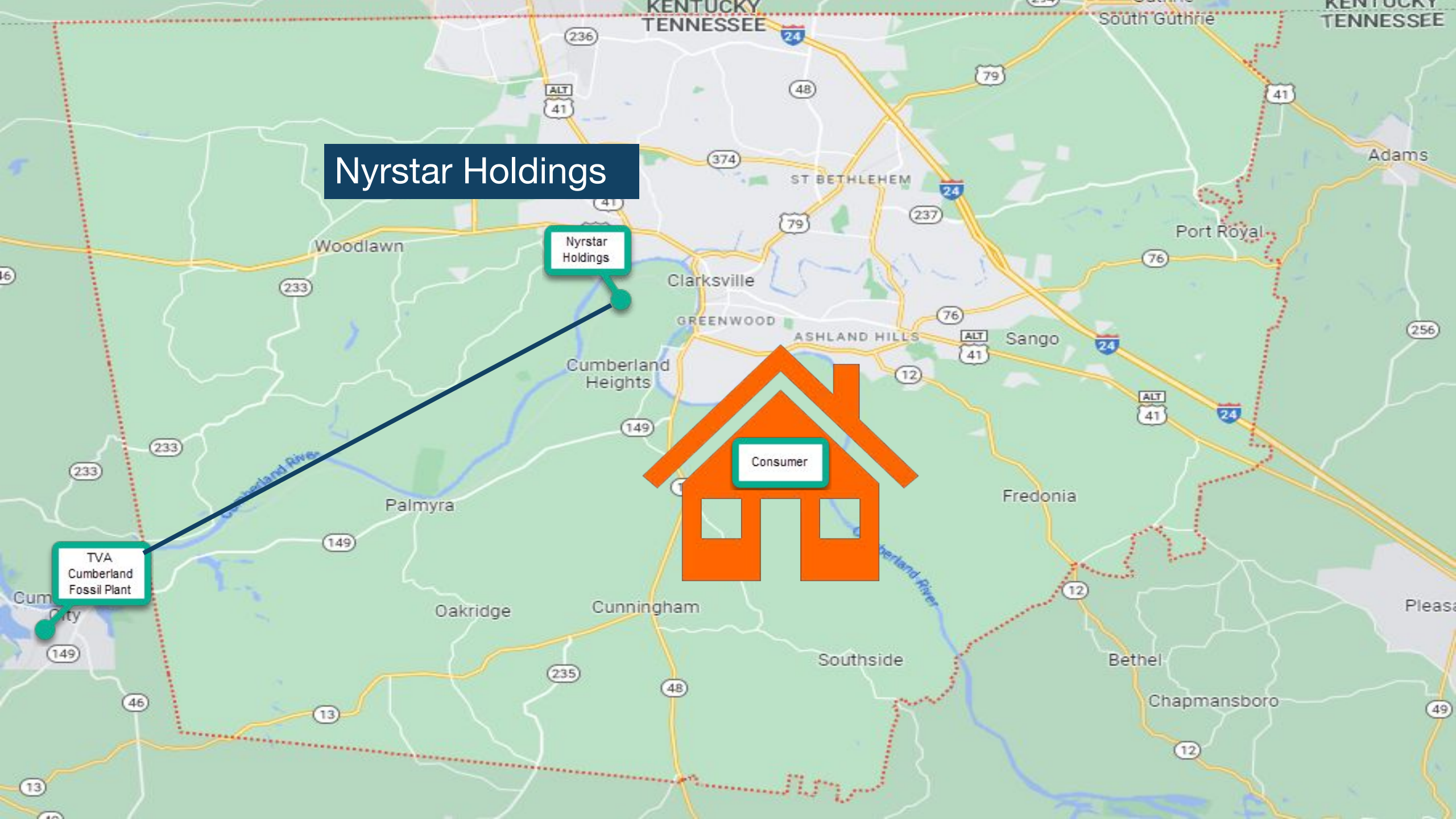


# Nyrstar Holdings

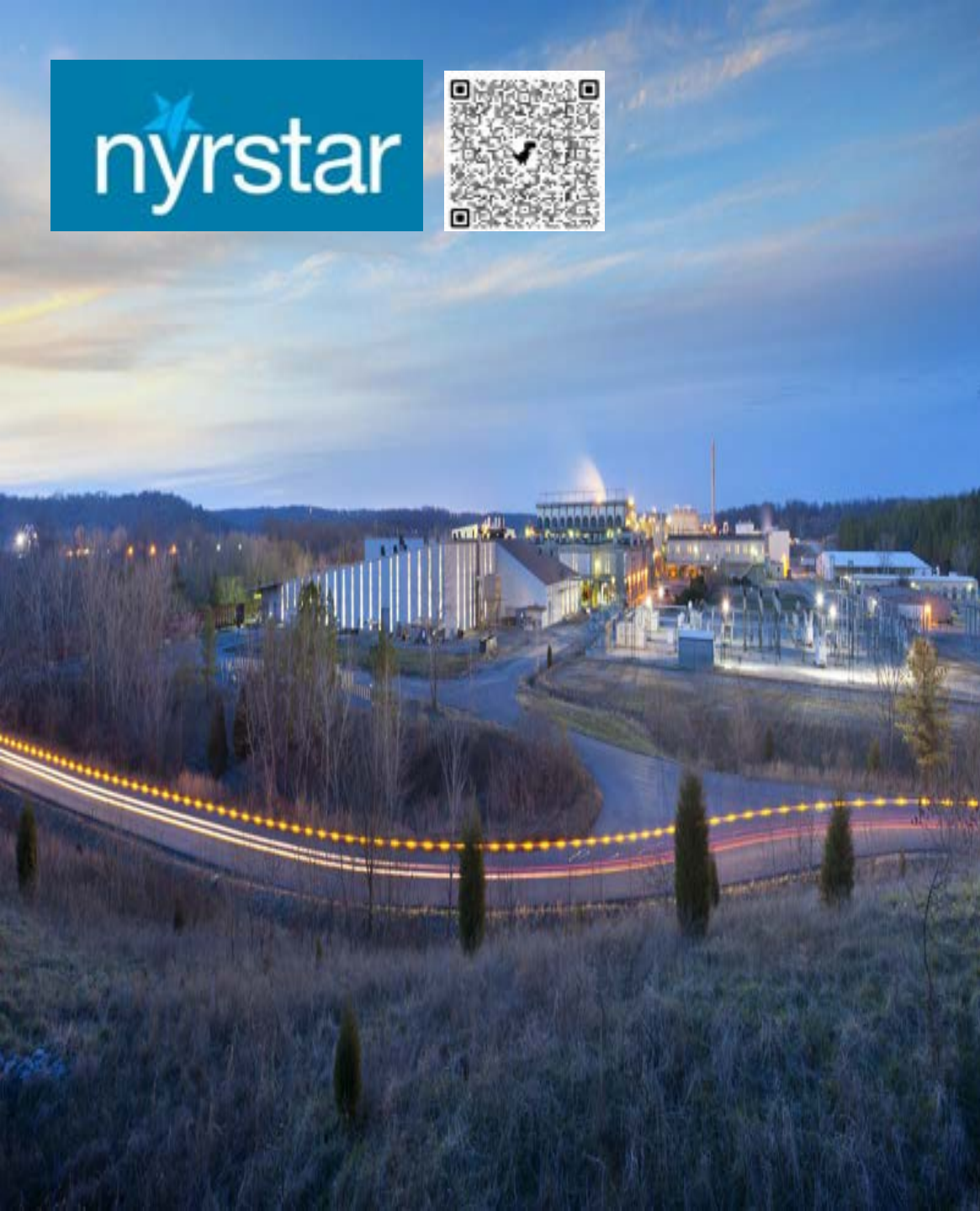
Nyrstar Holdings

TVA  
Cumberland  
Fossil Plant

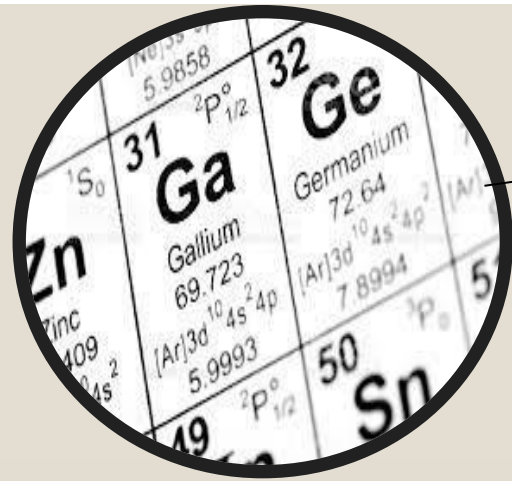
Consumer





The Nyrstar logo features the word "nyrstar" in a white, lowercase, sans-serif font on a blue rectangular background. A small blue star icon is positioned above the letter 'y'.

- Nyrstar is a leading manufacturer of zinc, lead, and other metals and is committed to sourcing, mining, and processing metals in a sustainable way.
- The Clarksville smelter is currently the only primary zinc producer in the United States.
- A large portion of the U.S. zinc market lies within one-day delivery distance from the Clarksville smelter by road and low transport costs provide Nyrstar with a geographic competitive advantage. The smelter has its own river port that allows efficient supply of raw materials.
- Zinc oxide is used in alloys that are widely used in manufacturing paints, rubber, cosmetics, pharmaceuticals, plastics, inks, soaps, batteries, textiles, and electrical equipment.
- This is all done in conjunction with maintaining a buffer zone between the farming areas, river, and operating zones to stay in cooperation with state wildlife agencies to provide a habitat for native waterfowl and mammals.
- Nyrstar being socially responsible in this area is critical because if heavy metals are not handled properly, they can be toxic to different environments.



## Nyrstar plans expansion of the Clarksville plant with a new \$90 million germanium, gallium processing facility.



- The proposed \$90 million dollar facility has received support from the Tennessee General Assembly.
- According to the resolution submitted to the Montgomery County Commission in support of the facility, germanium, and gallium are used in the production of 5G mobile devices, solar panels, electric vehicles, wind turbines, and more.
- In fact, the federal government classifies germanium and gallium as critical materials, all needed in our changing world.
- It is estimated that the Nyrstar facility would process and could produce an estimated 40 tons of germanium and 30 tons of gallium in Tennessee at the new Clarksville facility.
- Which could provide 90 percent of the U.S.'s germanium and gallium needs.
- This new facility would increase the company's contribution to the region with jobs, local procurement, and ongoing investments.



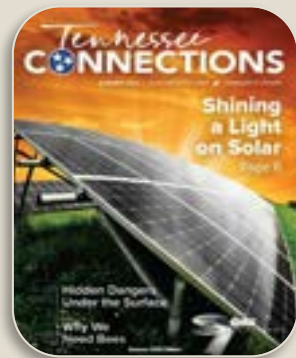




- CDE Lightband is directly connected to over 72,000 households & businesses in Clarksville.
- Fiber Optic Network provides savings of over \$10 million annually in operating costs & provides over \$5 million annually in income for electrical grid improvements.
- Increases home values by 3% or an average of over \$5,000.



- Clarksville has been designated a first 50 “Next Century City.” By offering Electricity, Internet, Video and Voice services with fast speed & superior performance with the additional convenience of 24/7 local support and bundling all your utilities into a single bill.



- Serving Others
- Education
- Tennessee Connections through Tennessee Municipal Electric Power Association
- Safety Demonstration Trailer
- Growth-EDC and Chamber
- Kids Connect
- Promotion-**Project Help**: It is a voluntary program administered by the Clarksville-Montgomery County Community Action Agency that allows customers to add \$1.00 or more to their monthly bill to assist the elderly, people with disabilities and those in economic crisis with their energy costs. *Call 931-896-1800 for more information.*

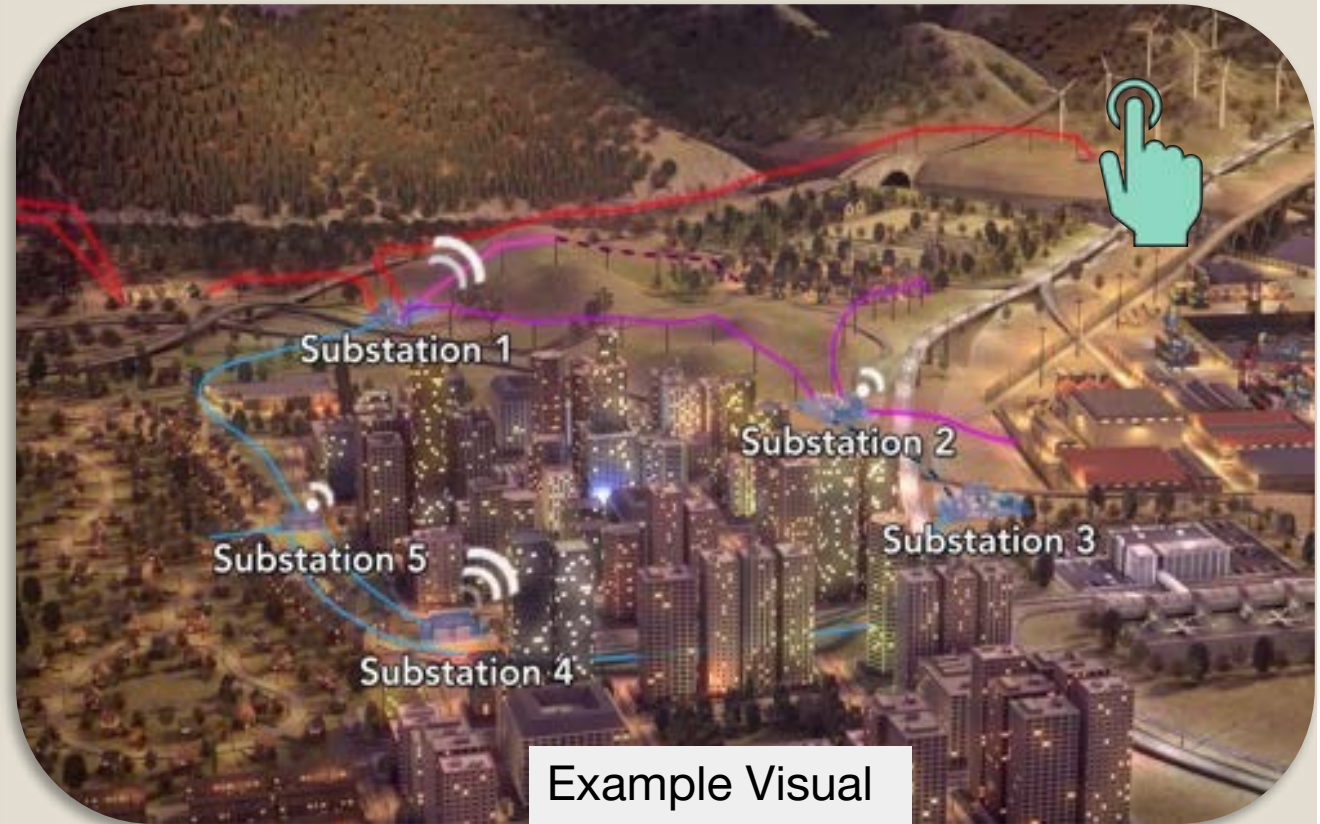


# SCADA

- The SCADA is located at CDE, allows them to control the flow of electricity throughout the entire city of Clarksville.
- SCADA is the acronym for Supervisory Control and Data Acquisition.
- SCADA is a computer-based system for gathering and analyzing real-time data to monitor and control equipment that deals with critical and time-sensitive materials or events.

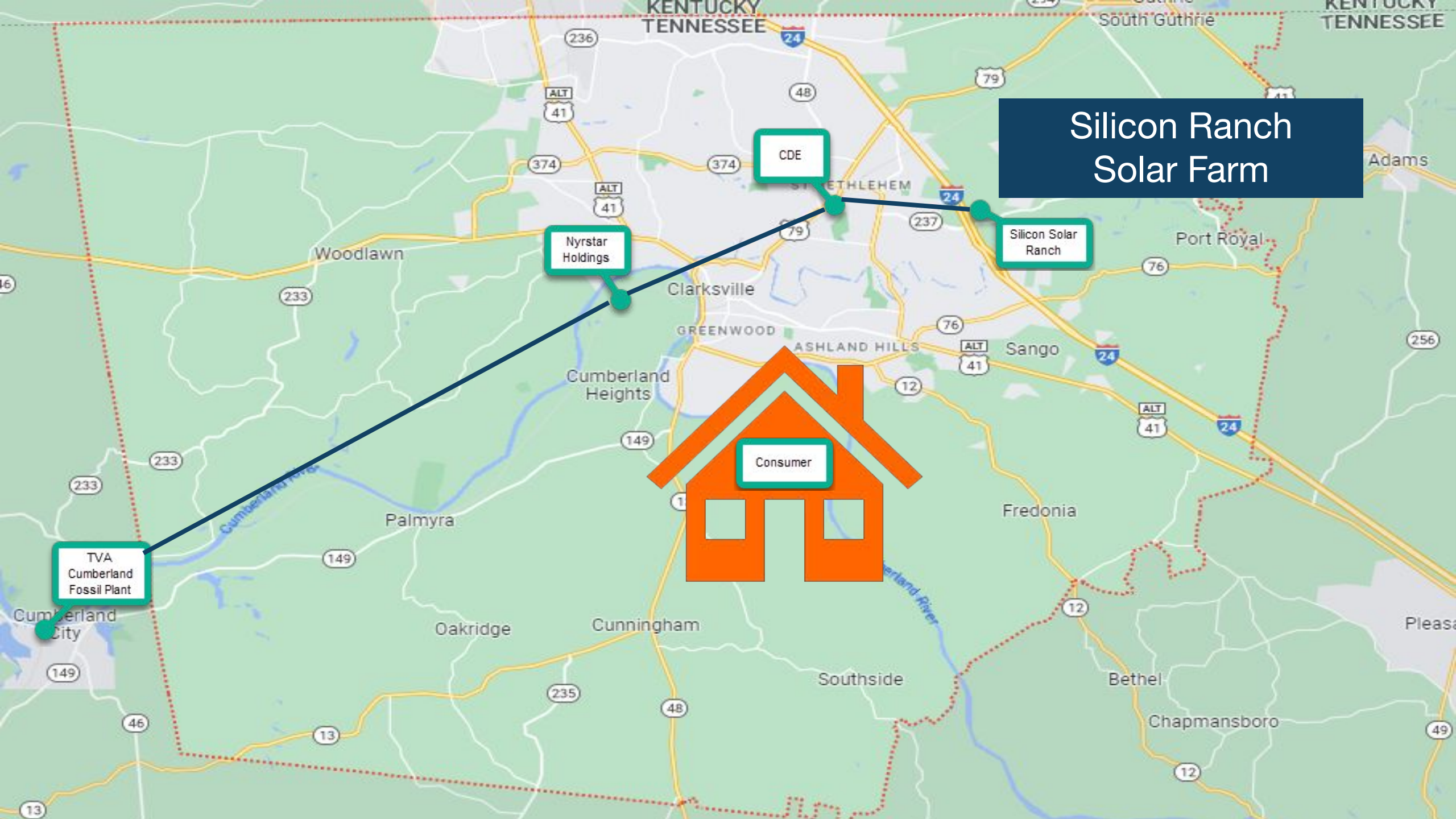


CDE SCADA CENTER



Example Visual





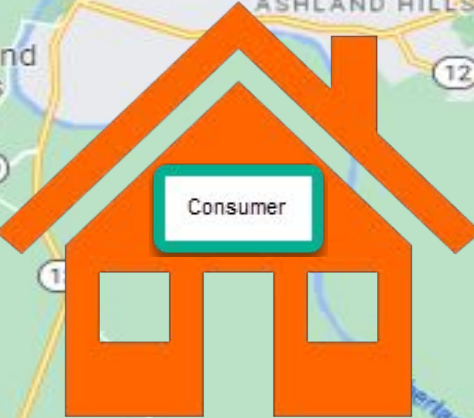
Silicon Ranch Solar Farm

CDE

Nyrstar Holdings

Silicon Solar Ranch

TVA  
Cumberland  
Fossil Plant



Consumer



# Solar Farm: Silicon Ranch & CDE

- Clarksville has more than 175 individual solar arrays already
- Silicon Ranch will build and own the solar farms coming to exit 8 area and Ussery Road.
- CDE will purchase the power from them at a reduced rate.  
**These farms will produce 15 million kilowatt hours of carbon free renewable electric power annually.** Which is equivalent to powering 1,683 households.
- TVA's green sustainable energy program will allow CDE to purchase power from other companies so long as those companies use a green, sustainable source such as solar.
- The partnership allows CDE to buy up to 15 megawatts of power from the solar provider. That amount of power would provide 56 percent of the electricity needed for City of Clarksville government buildings, streetlights and other facilities.





*Be informed.  
Use power smartly.*



Energy Efficiency



Electric Vehicles



Renewable Energy



Talk To An Energy Pro

- [Smart Energy Advice](#) *General energy efficiency advice. This is always a good place to start.*
- [Energy Efficiency Upgrades](#) *Learn about specific energy efficiency measures.*
- [Virtual Solar Education](#) *Learn about solar power in the Tennessee Valley interactively.*
- [TN Valley Solar Calculator](#) *Calculate the economics of installing solar at your home or business.*
- [Choose EV](#) *A comprehensive resource for electric vehicle information and incentives.*
- [Energy Star](#) *Learn about federal energy efficiency programs and incentives.*
- [Solar & Renewables](#) *Learn about renewable energy generation in the TN Valley.*
- [Free energy evaluation](#) *Get a free energy evaluation onsite or virtually.*
- [DIY Home Energy Evaluation](#) *Evaluate your own home with this virtual tool and get a better understanding of how you use energy.*
- [DoE Energy Saver](#) *Explore the Department of Energy's resources and download the Energy Saver Guide for free.*
- [eia RECS Survey](#) *Explore the U.S. Energy Information Administration's Residential Energy Consumption Survey.*
- [Green Switch](#) *Support renewable energy in the TN Valley by purchasing blocks of renewable power.*



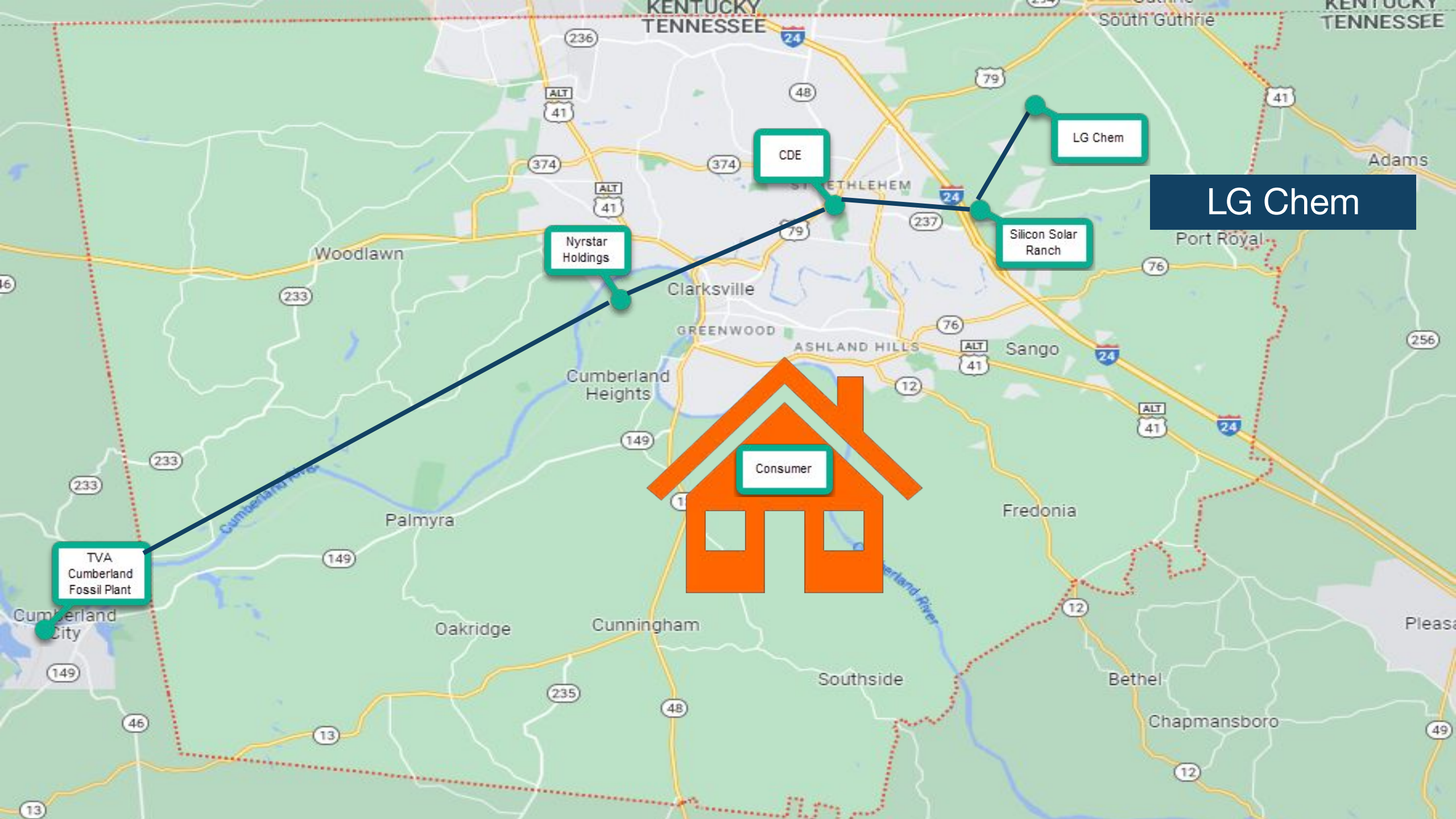
### Meet your Advisors

Levon Gibson (Left), John Jackson (Middle), and Robert Denson (Right) are your Power Partner Advisors

To sign up to be a Power Partner,  
simply Text PARTNERS to 85700.







KENTUCKY  
TENNESSEE

South Guthrie

KENTUCKY  
TENNESSEE

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ALT  
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LG Chem

CDE

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Silicon Solar Ranch

LG Chem

Port Royal

Adams

Woodlawn

Nyrstar Holdings

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Clarksville

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Sango

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GREENWOOD

ASHLAND HILLS

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ALT  
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Cumberland Heights

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Consumer

Fredonia

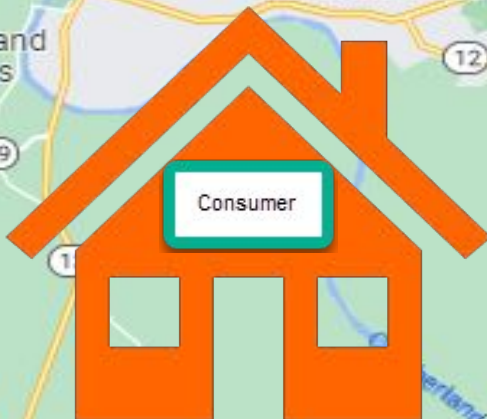
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233

Palmyra

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TVA  
Cumberland  
Fossil Plant



Fredonia

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Bethel

Chapmansboro

Pleasant

Oakridge

Cunningham

Southside

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# EV Batteries: LG Chem

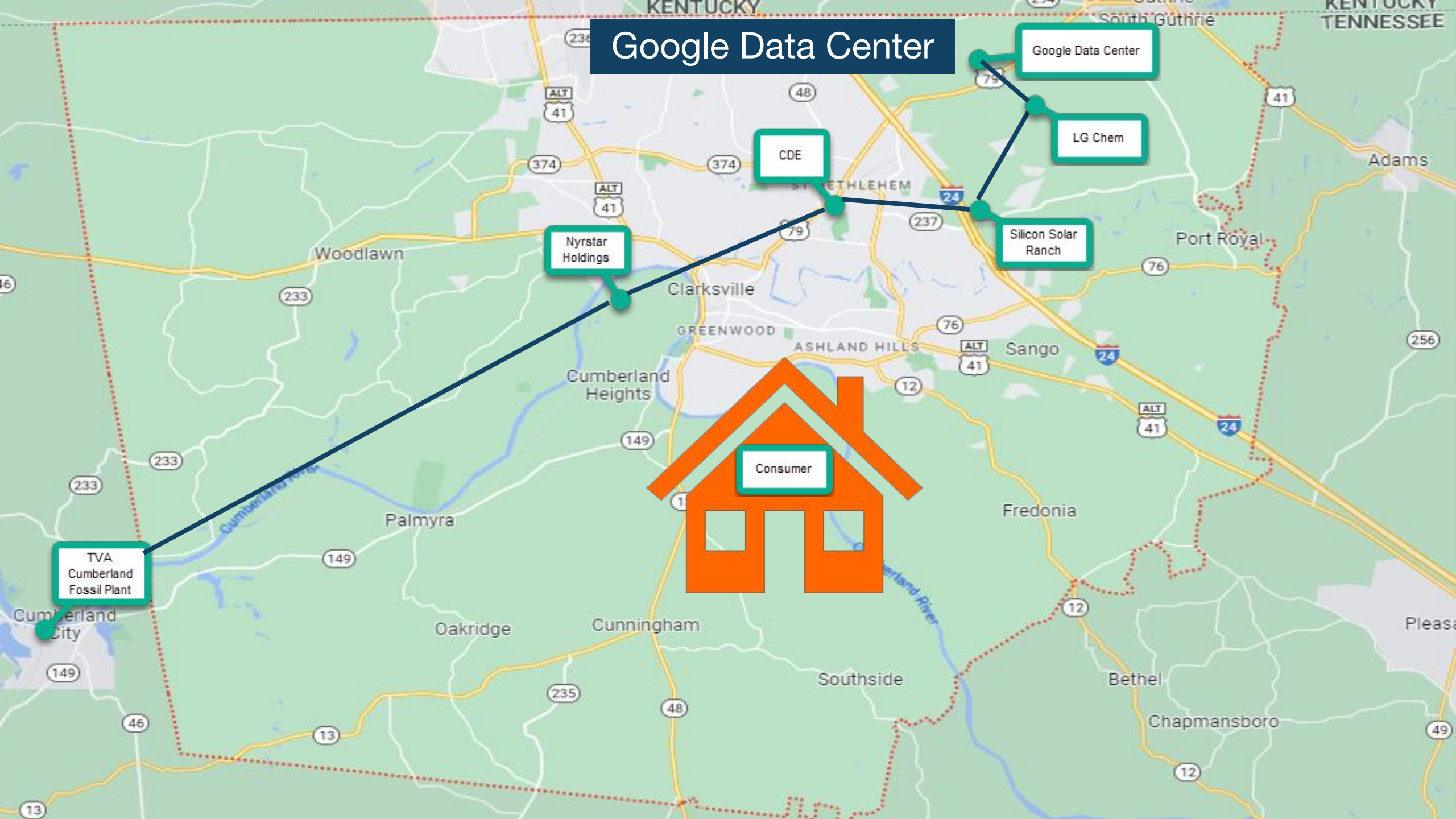


- LG Chem to build \$3.2 billion plant in Clarksville to supply material for EV batteries
- The plant, which will create a key component for electric vehicle batteries, will be the largest of its kind in the United States, covering 420 acres with a production target of 120,000 tons of cathode material annually by 2027.





# Google Data Center

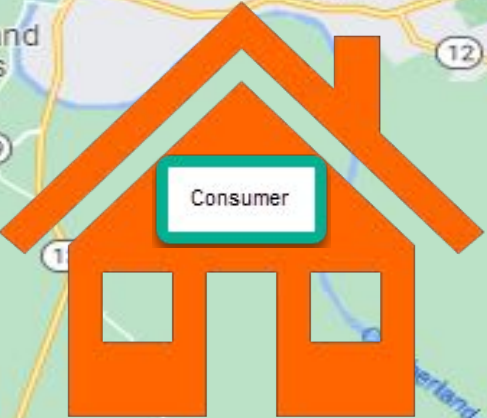


TVA  
Cumberland  
Fossil Plant

Nyrstar  
Holdings

CDE

Silicon Solar  
Ranch



Google Data Center

LG Chem

KENTUCKY  
TENNESSEE

# GOOGLE



- The cloud supports many products at a time, so it can more efficiently distribute resources among many users. That means business and people can do more with less energy.
- In 2013, Lawrence Berkeley National Laboratory published research indicating that moving all office workers in the United States to the cloud could reduce the energy used by information technology by up to 87%.



- Alphabet company DeepMind and the "Google Brain" AI division, are merging to form "Google DeepMind."
- From smartphone assistants to image recognition and translation, machine learning already helps us in our everyday lives; including energy consumption.
- DeepMind AI reduces energy used for cooling Google data centers by 40%



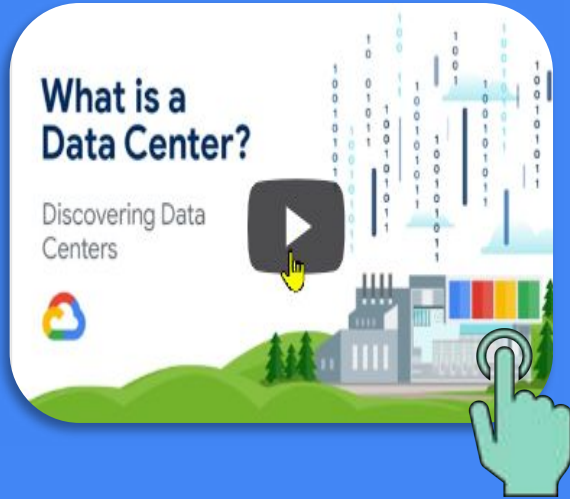
- Related specifically to Google products, a case study of the U.S. General Services Administration (GSA) showed that by switching to Google Apps, they were able to reduce office computing costs, energy use, and carbon emissions by 65-90%.



- Google study has shown that businesses that use Gmail have decreased the environmental impact of their email service by up to 98% compared to those that run email on local servers.



# Data Center: Google



## 2018: Google Clarksville TN Why Clarksville?

Our County had the right combination of energy infrastructure, proximity to users, developable land and a strong business workforce.

### EFFICIENT DATA CENTERS

- 78% of waste diverted
- 27% of components refurbished
- 4.9 million components resold



## CEO of Google and Alphabet: Sundar Pichai

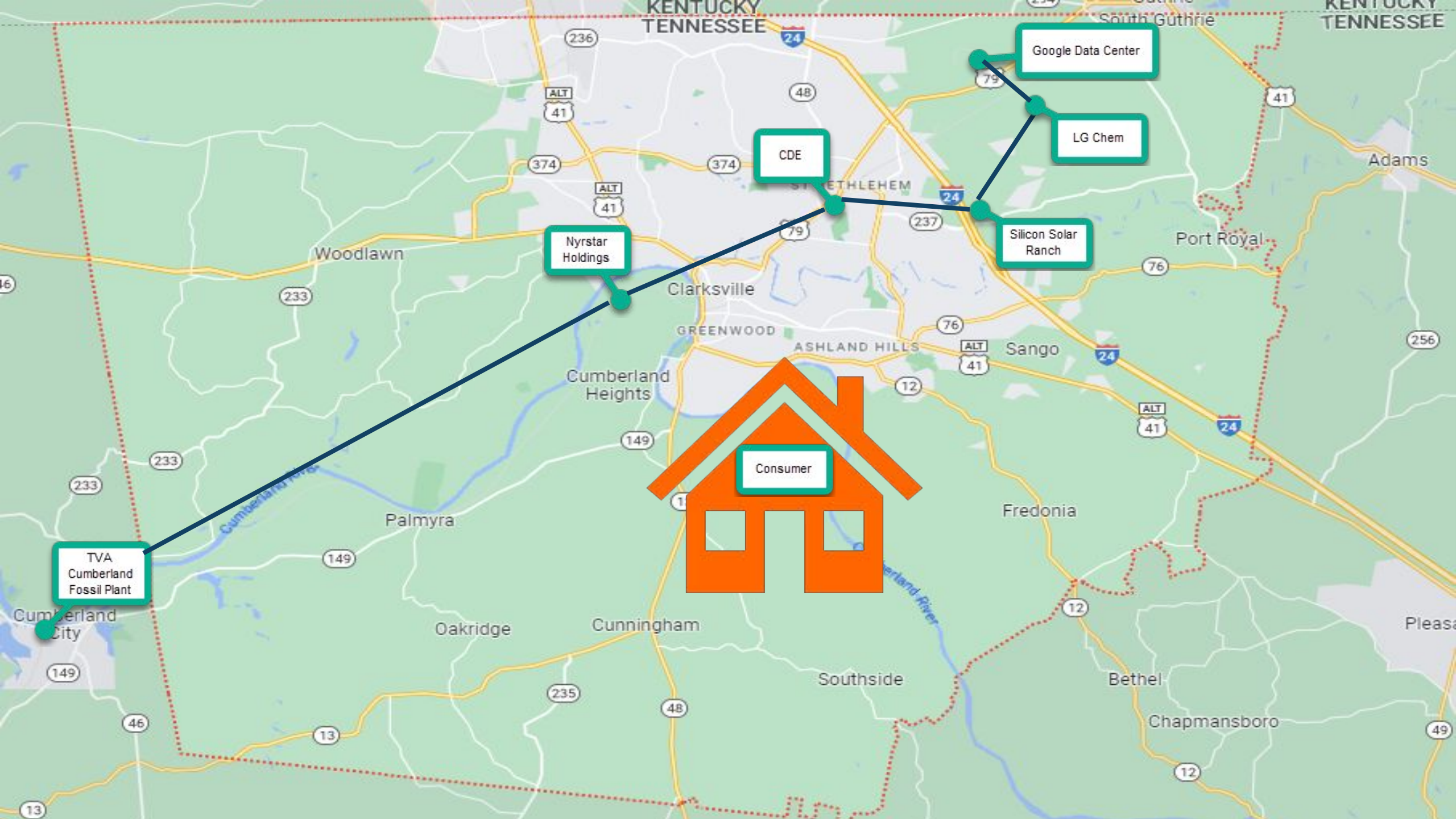
*"We'll do things like pairing wind and solar power sources together and increasing our use of battery storage. And we're working on ways to apply AI to optimize our electricity demand and forecasting."*



## Where the Internet Lives

Google and Southeastern Grasslands Institute are using the large campuses of these Google data centers including Clarksville to transform land back into long-lost prairies – restoring ecological diversity and an important piece of American history

*Director at Austin Peay State University Herbarium: Dwayne Estes*





# References

- I. Introduction
- II. Energy Project Team Members 2023:
  - <https://leadershipclarksville.com/programs/current-class/>
- III. Energy Project Charge 2023:
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  - <https://www.electricitylocal.com/states/tennessee/clarksville/>
  - <https://neccoopenergy.com/how-to-calculate-your-kwh-rate/>
  - <https://www.daftlogic.com/information-appliance-power-consumption.htm>
  - <https://www.tva.com/about-tva/tva-at-a-glance>
  - <https://findenergy.com/tn/montgomery-county-electricity/#clarksville>
  - <https://www.eia.gov/state/seds/seds-data-complete.php?sid=TN#Consumption>
- V. Power of the Valley: TVA Tennessee Valley of Authority
  - <https://www.tva.com/energy/our-power-system>
  - <https://www.tva.com/kids/electricity/hydroelectric-power>
  - <https://www.tva.com/energy/public-power-partnerships>
  - <https://www.tva.com/energy/technology-innovation>
  - <https://www.tva.com/energy/valley-renewable-energy>
  - <https://energyright.com/>
- VI. Hydroelectric: How it works
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  - <https://www.tva.com/energy/our-power-system/hydroelectric/how-hydroelectric-power-works>
- VII. Coal Fuel: Cumberland Fossil Plant
  - <https://www.tva.com/energy/our-power-system/coal/cumberland-fossil-plant>