

# Southern Company Coal Ash Management & Beneficial Use



**Brett Mitchell**

*Director, GPC Env. Affairs PMO*

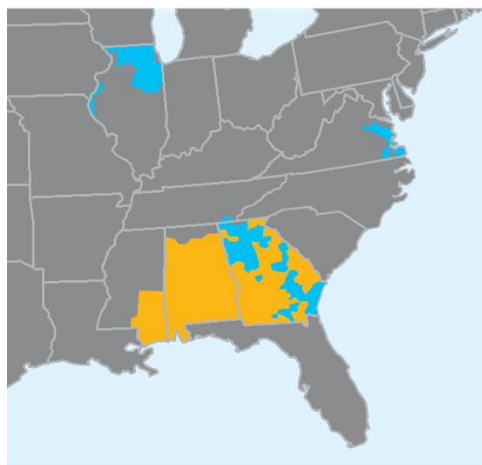


**Nortey Yeboah**

*Principal Engineer, SCS R&D*

# Who we are!

## Southern Company – One of the Largest Utilities in United States



Service territories  
 ■ Electric  
 ■ Gas

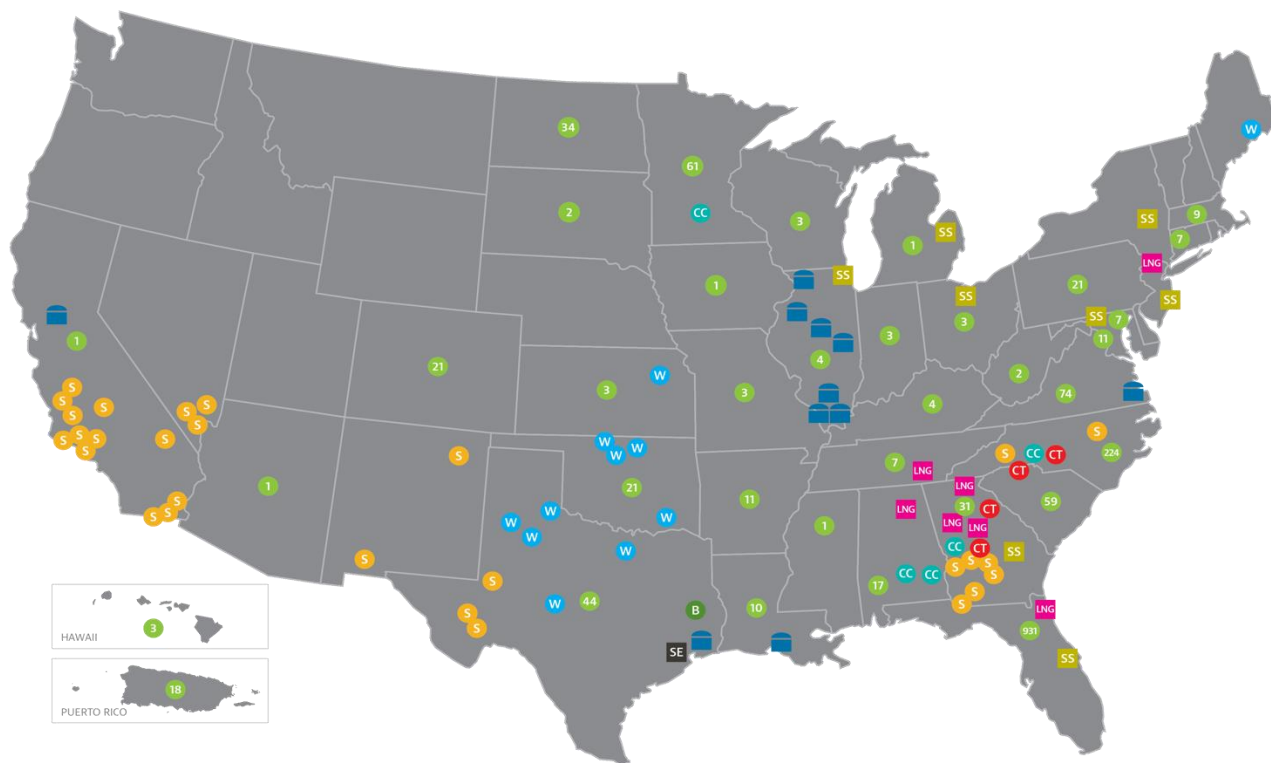
### Electric Utilities



Alabama Power

Georgia Power

Mississippi Power



- |   |  |   |
|---|--|---|
| <p><b>Southern Power</b></p> <ul style="list-style-type: none"> <li>CC Combined-cycle facility</li> <li>CT Peaking facility</li> <li>B Biomass facility</li> <li>S Solar facility</li> <li>W Wind facility</li> </ul> | <p><b>Southern Company Gas</b></p> <ul style="list-style-type: none"> <li>LNG LNG facilities</li> <li>SE Sequent Energy Management</li> <li>SS SouthStar</li> <li>Natural gas storage</li> </ul> | <p><b>PowerSecure</b></p> <ul style="list-style-type: none"> <li># Owned and managed sites per state</li> </ul> |
|---|--|---|

**9 Million**  
Customers

**27,000**  
Employees

Approximately  
**43,000 MW**  
of Generating Capacity

**7**  
Electric & Natural  
Gas Utilities

Capabilities in  
**50 States**

– Electric utilities in 3 states

<sup>1</sup>In November 2018, Southern Power agreed to sell its combined-cycle facility in Mankato, Minnesota.

# Who we are - Georgia Power

## Generation Plant Locations

- Hydro
- Combustion Turbine
- Steam
- Combined Cycle
- Solar
- Nuclear



## Customers

**2,754,203** Georgia Power customers as of Dec. 31, 2023.



Residential  
**2,405,579**



Commercial  
**328,638**



Industrial  
**10,611**



Public Streets & Highways  
**9,375**  
*Total 9,470 Rapid Transit Authority 1*

# GPC Coal Combustion Residuals (CCR) Overview

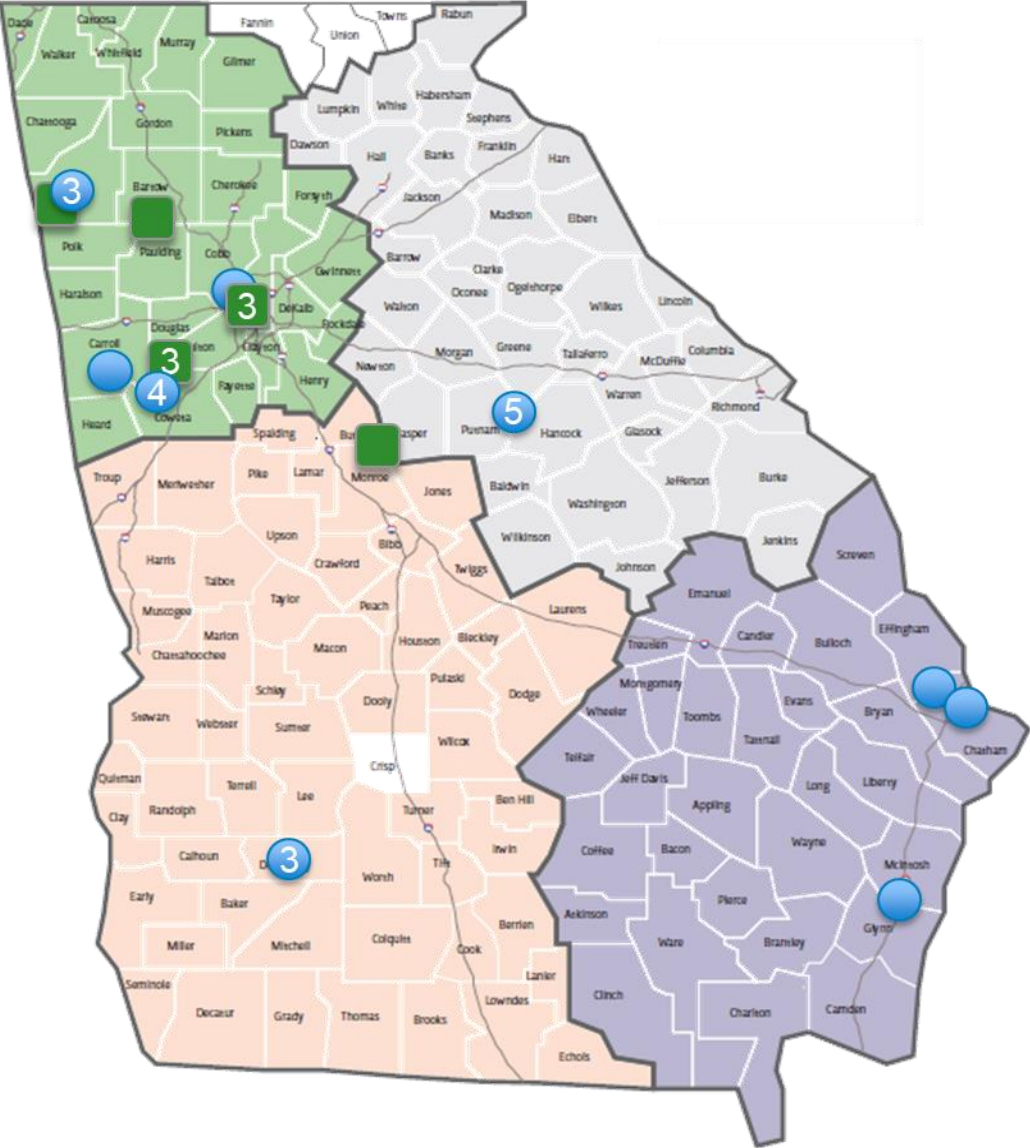
- Two rules in Georgia regulating ash and gypsum
  - Federal CCR Rule (2015)
  - Georgia CCR Rule (2016)
- Georgia Power announced closure of all ponds in 2015; Stopped placing ash in ponds in April 2019
- 29 ash ponds at 12 coal-fired sites
  - 20 ponds to be excavated
  - 9 remaining ponds to be closed-in-place with proven engineering methods
  - Proven engineering methods may include barrier walls, consolidation of ash footprint, cover system enhancements, etc.
  - Third-party experts used for engineering design, water treatment, groundwater sampling and analysis
- 12 existing CCR Landfills, 2 additional to be constructed to support ash pond closures

	Ash Pond Closure Method			Existing CCR Landfills
	Closure by Removal	Closure in Place	Total	
Arkwright				3
Bowen		1	1	1
Branch	5		5	
Hammond	3	1	4	1
Kraft	1		1	1
McDonough	1	3	4	
McIntosh	1		1	2
McManus	1		1	
Mitchell	3		3	
Scherer		1	1	1
Wansley	1		1	1
Yates	4	3	7	2
	20	9	29	12

**~500 KT/year ash production from two sites**

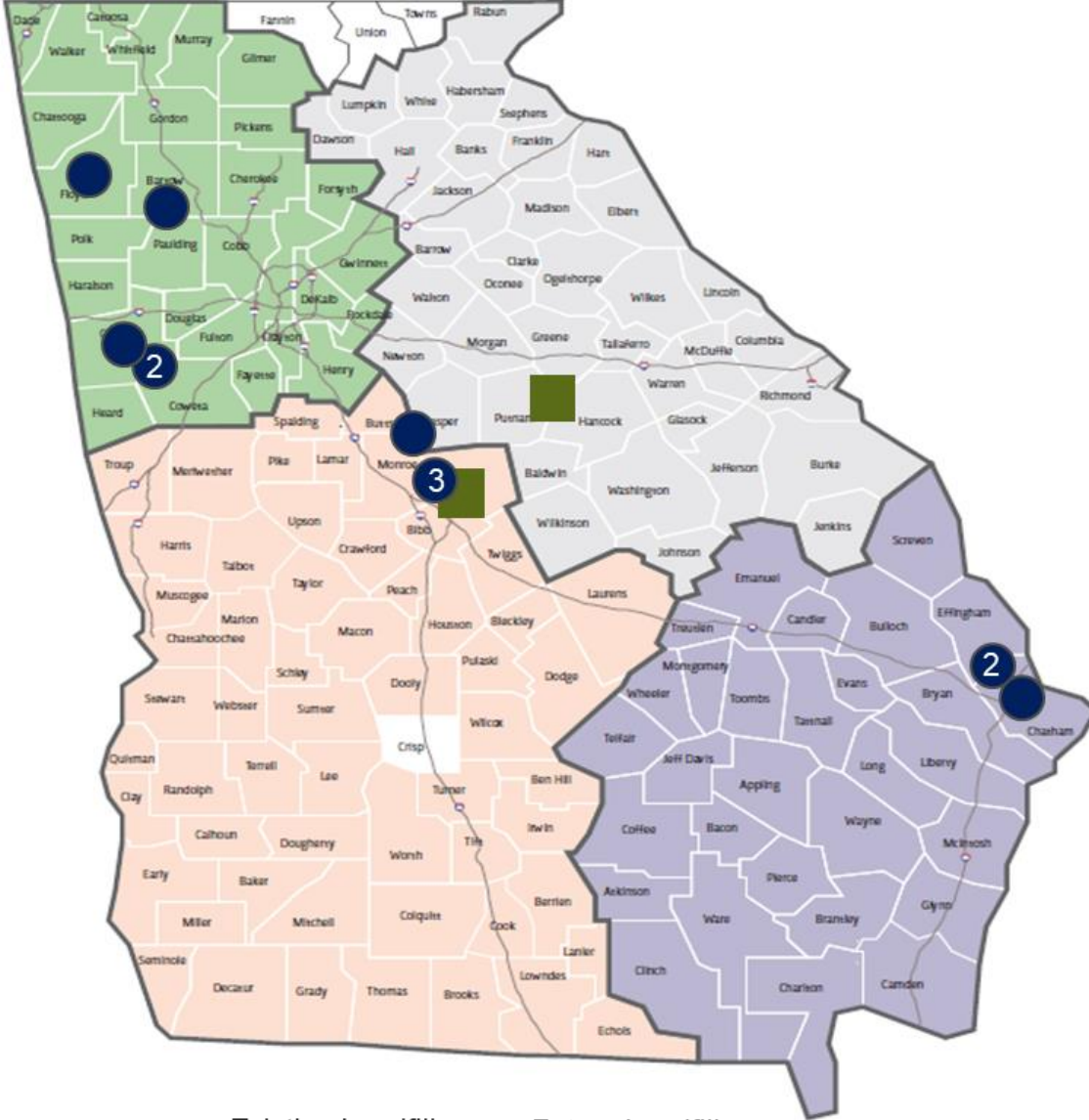
**~100 MT stored in ash ponds & landfills**

# Ash Ponds



● Closure by Removal    
 ■ Closure in Place

# Landfills



● Existing Landfills    
 ■ Future Landfills

# Beneficial Use - Plant Bowen BU Facility

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Georgia Power to launch single largest beneficial use project for coal ash in U.S.



- Partnership with **Eco Materials**
- Operational in January 2024
- Processing harvested ash from on-site ash pond
  - Particle size classification
  - Drying
- Design capacity **~600K tons/yr**



Under construction 2022 - 2023



Complete January 2024

# CCR Beneficial Use R&D

Finding beneficial use outlets for all CCR stored in ash ponds across the Southern Company system

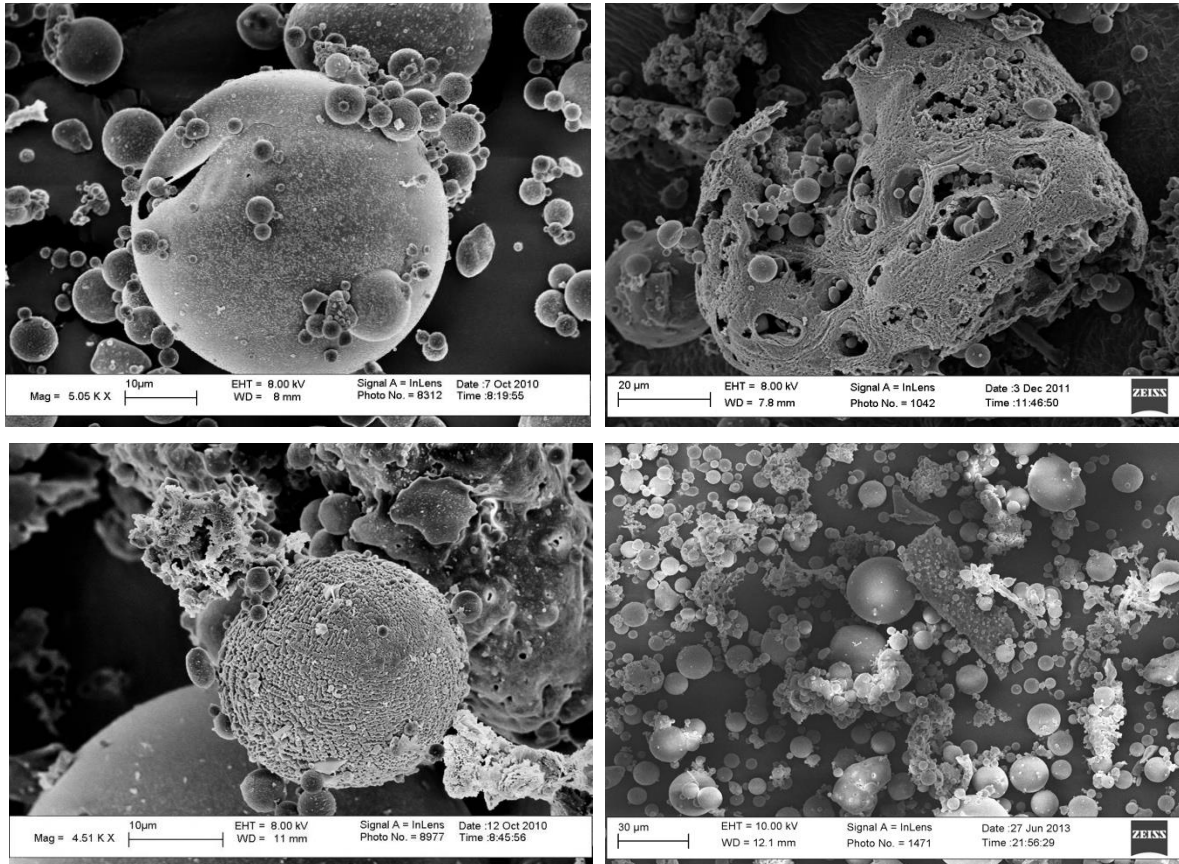


**Improve Ash Processing**

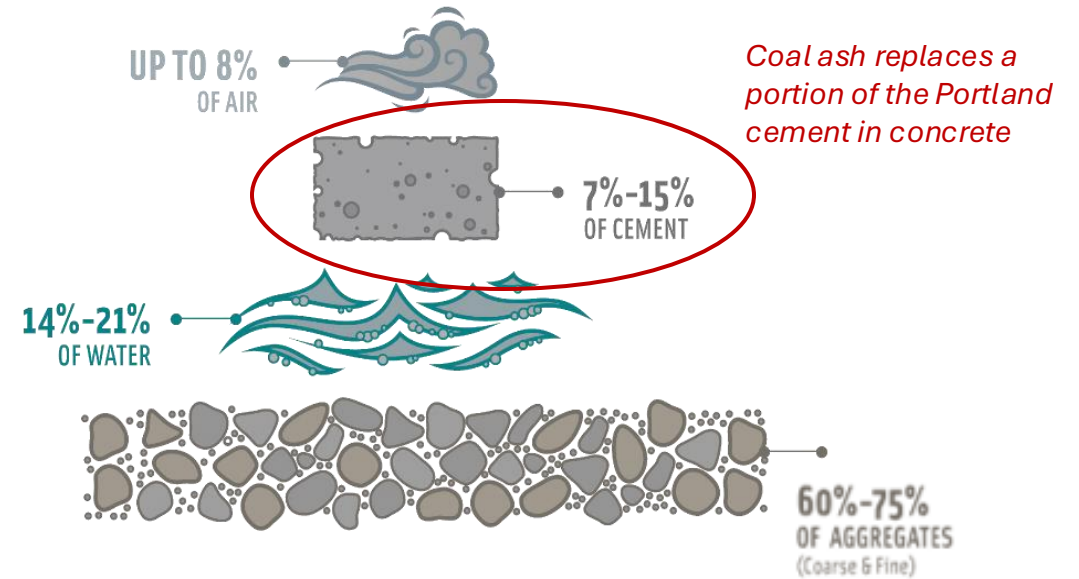
**Develop New Beneficial Use**

# Coal Ash in Concrete

## Coal Ash Particles under SEM Microscope



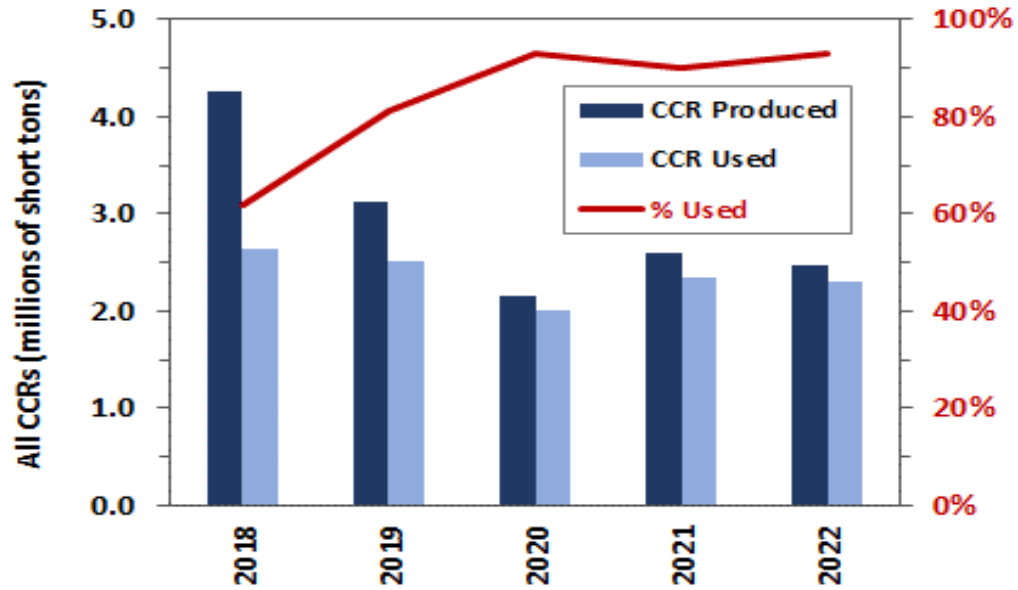
## General Makeup of Ready-Mix Concrete



Coal ash improves concrete's long-term strength and durability when used as a partial cement replacement

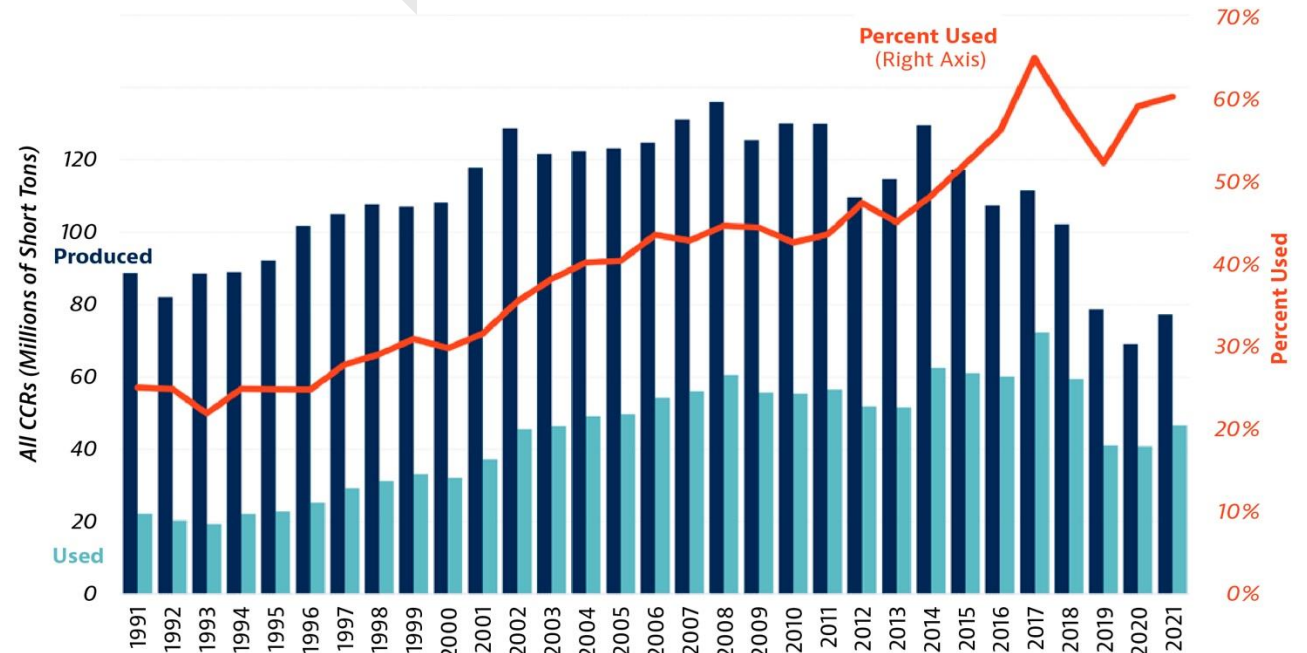


# Declining Fresh Ash Supply & Increasing BU Rates



**Southern Company CCR  
Production & Use 2018 – 2022**

**U.S. CCR Production &  
Use 1991 – 2021\***



\*American Coal Ash Association 2022

# Beneficial Use of Coal Ash

## Ash Beneficial Use Center (ABUC) Commissioned in 2021 at Plant Bowen



### ABUC – CCR Beneficial Use Accelerator

- 2021 SCS, GPC and EPRI research partnership
- Testing bed for commercial-scale facility at Bowen
- Site for future testing of CCR processing technologies
- Pilot-scale pre-processing for DOE- and DOD-funded critical mineral recovery projects in AL and GA

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## Georgia Power, Electric Power Research Institute open Ash Beneficial Use Center

First large-scale center tests emerging technologies for environmental and economic benefits

Center offers potential for new uses of coal ash stored in landfills and closed-in-place ponds

NEWS PROVIDED BY  
Georgia Power →  
Aug 10, 2021, 13:00 ET

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ATLANTA, Aug. 10, 2021 /PRNewswire/ -- Georgia Power, in collaboration with the Electric Power Research Institute (EPRI) and Southern Company, marked the opening earlier this year of the first Ash Beneficial Use Center (ABUC). The ABUC will host pilot projects and lead continued testing of technologies to potentially further develop useful products from recycled coal combustion products (CCPs) such as coal ash.

This facility is located at Georgia Power's Plant Bowen and will allow for testing of pilot project technologies to increase the beneficial use of coal ash. Activities that will take place at this center include reviewing ways to optimize coal ash characteristics to better fit commercial applications, speeding and facilitating development of emerging beneficial-use technologies, understanding performance of re-use products and developing realistic cost profiles.

"As a part of our ash pond closure efforts, Georgia Power is always looking for opportunities to use coal ash that are not only beneficial to our customers, but for our communities and environment," said Dr. Mark Berry, vice president of environmental and natural resources for Georgia Power. "The Ash Beneficial Use Center is paving the way for the latest coal ash technologies. We hope to see closed ash ponds and landfills become resources as new and improved uses are developed and proven through this center."

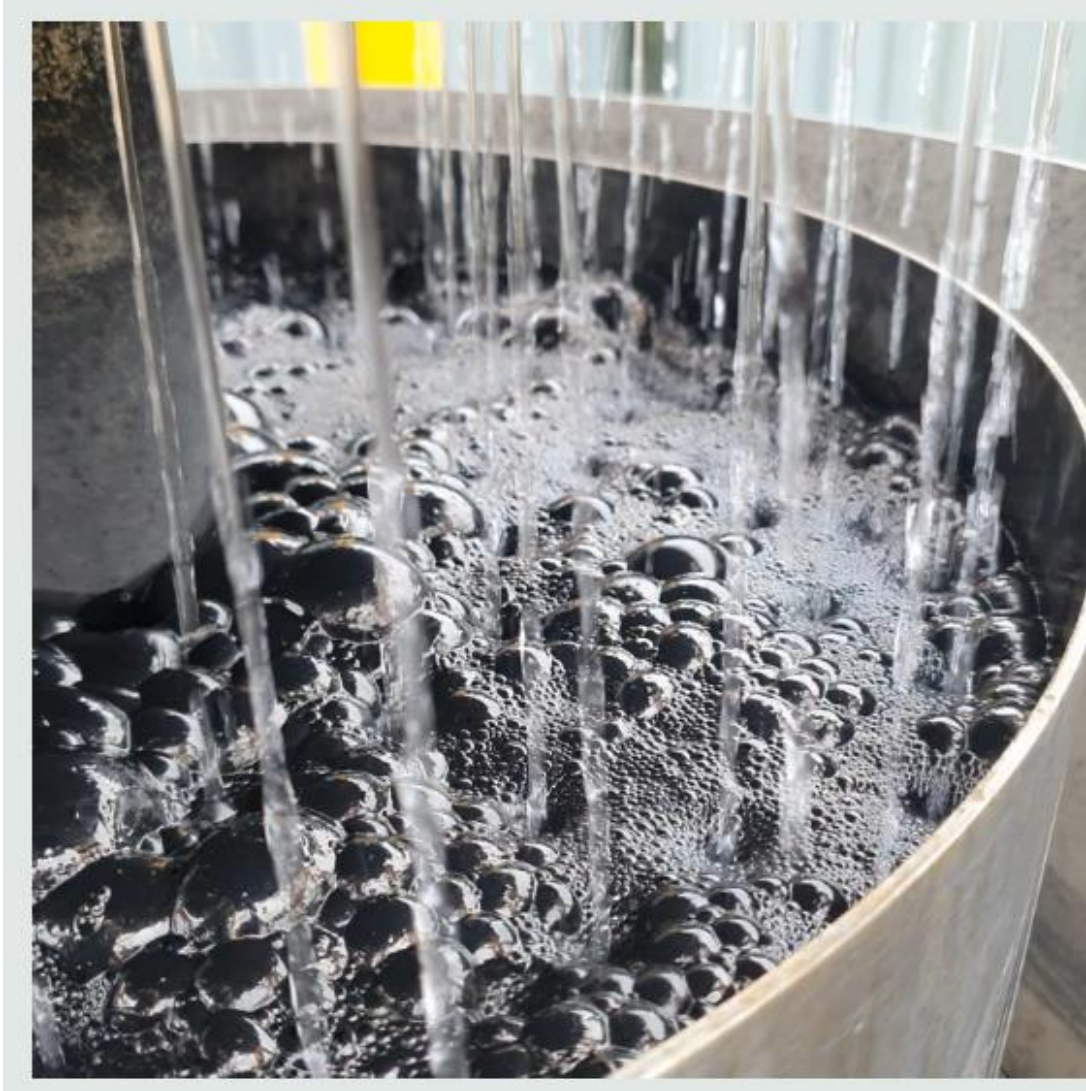
# Reducing Ash Processing Costs



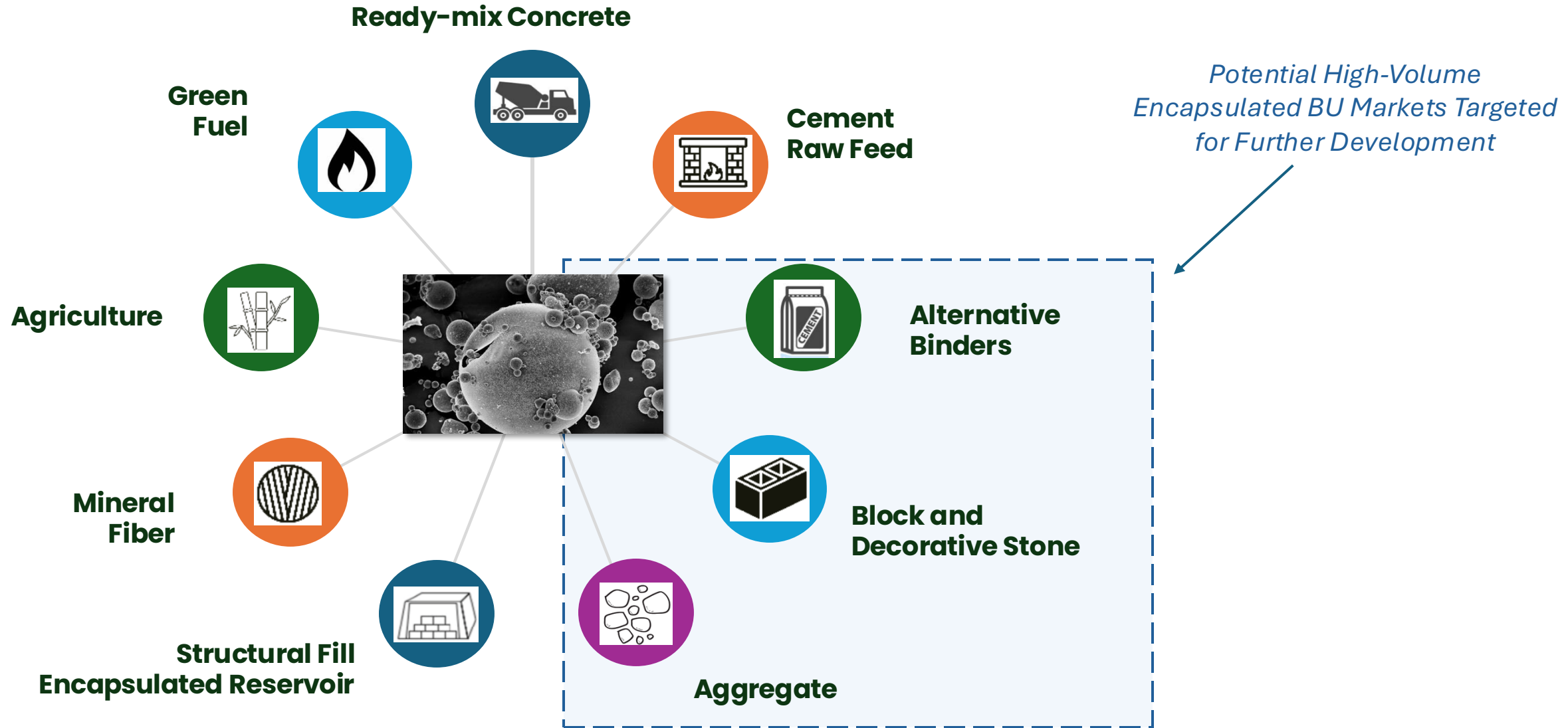
- UK-based Company
- Low-energy Wet Beneficiation Process (Froth Floatation)
- Target Markets
  - Geopolymer
  - Wet ash as concrete ingredient
  - Standard ash in concrete
- Private Funding
- Mining Expertise



# Froth Floatation Demonstration



# Beneficial Use Beyond Cement Replacement

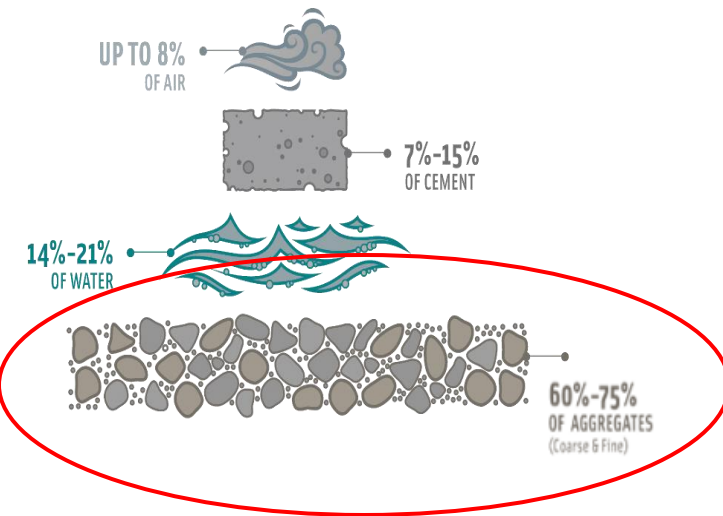
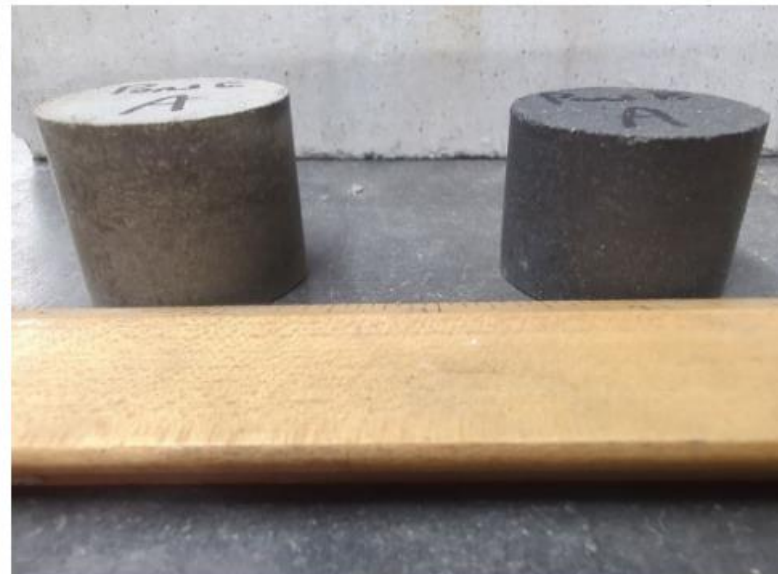


# Standard & Light Weight Aggregate



Brixx Technology utilizes a proven patented process for converting industrial waste from coal-power generating facilities and transforming the waste into non-toxic, high-strength, sustainable building materials.

## Brixx Initial Testing - Plant Branch Ash Ponds B & C Material



### Favorable Initial Results

Compressive Strength

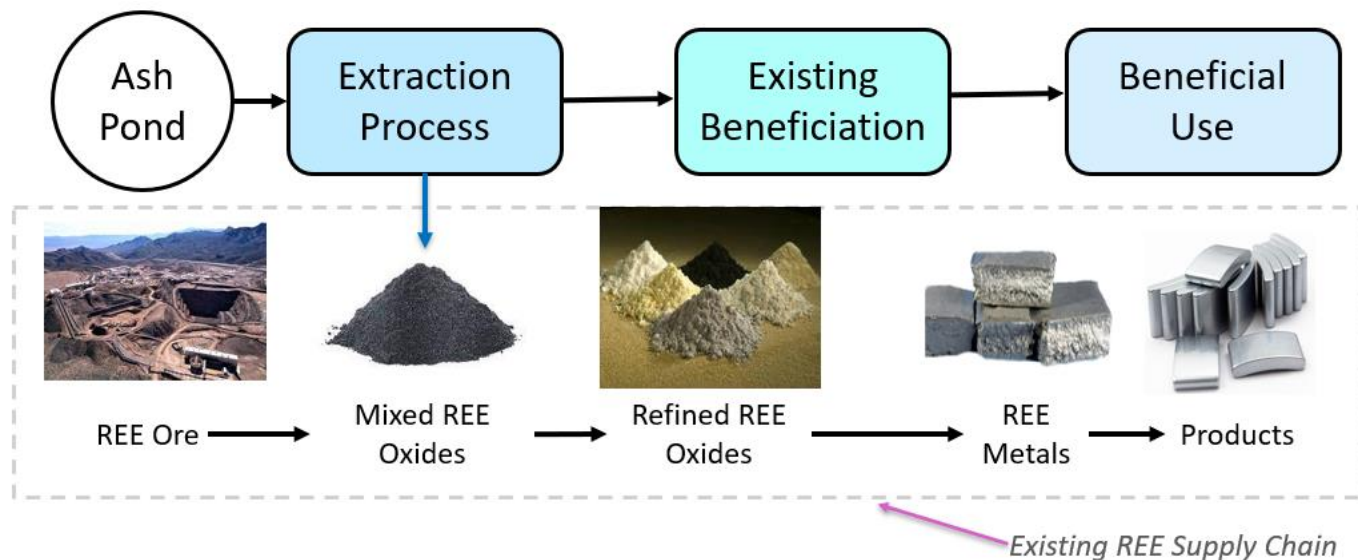
Water absorption

TCLP

*Aggregate represent a significantly larger portion of the material in concrete than cement, and could allow for larger beneficial use volumes*

# Critical Minerals from Harvested Coal Ash

**Coal ash** is a leading potential REE source as part of a US domestic **supply chain strategy**



**HEAVY Rare Earth Elements**  
**LIGHT Rare Earth Elements**  
by Geology.com

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt									
Lanthanides																	
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
Actinides																	
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

## Critical for Energy Transition & National Defense

- China dominates global supply chain
- U.S. imports 10,000 tons/year
- DOD imports 1,000 tons/year



~ 1 ton



~ 500 kg



~ 15 kg



~ 4 ton



# DoD Paves the Way for Critical Mineral Recovery from Coal Ash

/ Published Sept. 20, 2021



# U.S. DEPARTMENT OF ENERGY

# Fossil Energy and Carbon Management

For Immediate Release  
02/15/2024

Contact  
FECMcommunications@hq.doe.gov

### BIDEN-HARRIS ADMINISTRATION INVESTS \$17 MILLION TO STRENGTHEN NATION'S CRITICAL MINERALS SUPPLY CHAIN

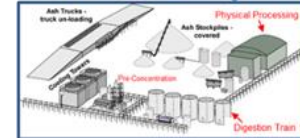
## REE Recovery Demonstration in Alabama



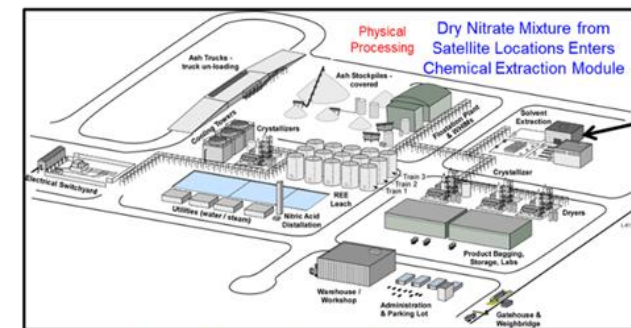
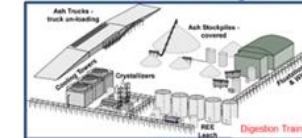
Pilot-Scale REE facility in Sharon, PA

## Front End Engineering Design Study in Georgia

Satellite Ash Processing Facility 1



Satellite Ash Processing Facility 2



Central Processing Hub at Plant Branch, GA



# DOD Funded Demonstration in Alabama



- 55 tons of ash processed
- 2,000 grams of mixed rare earth oxides produced
- >90% mixed rare earth oxide content

**HEAVY** Rare Earth Elements  
**LIGHT** Rare Earth Elements  
by Geology.com

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt									
Lanthanides																	
		La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
Actinides																	
		Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

- Nd 172,000 tons ~ 40-year supply (estimate)
- Dy 62,000 tons ~ 14-year supply (estimate)
- Li 288,000 tons 130-year supply
- Co 110,000 tons 15-year supply
- Ni 252,000 tons 1.1-year supply
- Ir 40 tons 15-year supply
- Pt 600 tons 15-year supply
- Ga 20,000 tons 1,100-year supply
- Ge 130,000 tons 3,900-year supply

U.S. Geological Survey, 2022, Mineral Commodity Summaries



**THANK YOU!**