



Carbon Capture Research

PPL Corporation

Research & Development

About PPL Corporation



PPL Corporation's family of companies has \$37B+ in assets and 3.6M customers.

- **Mission:** To provide safe, affordable, reliable, sustainable energy to our customers and competitive, long-term returns to our shareowners.
- **PPL Electric Utilities (formerly Pennsylvania Power & Light)**
 - Provides electricity distribution and transmission services to ~1.4 million customers in Pennsylvania
- **Louisville Gas and Electric (LG&E) and Kentucky Utilities (KU)**
 - Electric and gas utilities that serve ~1.3 million customers in Kentucky and Virginia. LG&E is home to the Cane Run Generating Station.
- **Rhode Island Energy (RIE)**
 - Provides electricity and natural gas distribution services to ~770,000 customers in Rhode Island.

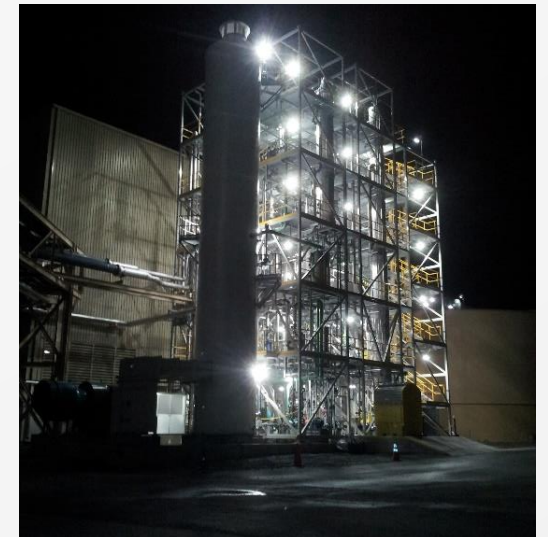
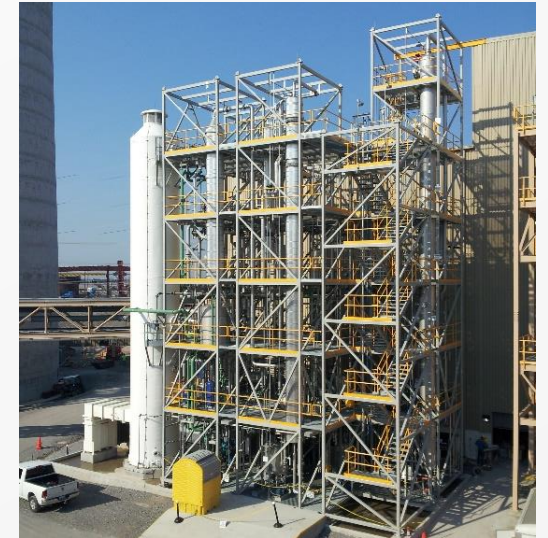


Capturing Carbon Dioxide With UK Since 2006



PPL is committed to net-zero carbon emission by 2050.

- 2006: Founded Carbon Capture Program at University of Kentucky (UK)
- 2007: Member of EPRI Carbon Capture Program (P222)
- 2007: Built Carbon Capture Unit (0.1 MW) at University of Kentucky
- 2008: Founding Member of Carbon Management Resource Group (CMRG)
- 2009: Kentucky drilled two test sequestration wells at 3,500 and 8,100 ft.
- 2014: Built Operational CCS Pilot (0.7 MW or 15 ton/day) at E.W. Brown
 - One of few operational carbon capture systems at a power plant.
 - Costs of capture reduced from \$75 to \$45 per metric ton.
 - Reduced capital costs by 20% relative to DOE reference case.
 - Tested various capture processes and amine-based solvents.
- 2020: Founding Member for EPRI Low Carbon Resource Initiative (LCRI)
- 2021: Net-Negative Natural Gas Carbon Capture (DE-FE0032134)
- 2022: Full Scale 640 MWe DOE FEED study at Cane Run (DE-FE0032223)
- 2023: Direct Air Capture with Hydrogen Production (DE-FE0032255)
- 2023: Member of Appalachia Direct Air Capture Hub (DE-FE0032387)
- 2024: Carbon Capture Large Pilot at Cane Run (Award Announced Feb. 2)



Cane Run 7 NGCC – CCS Host Site



Cane Run 7 is our newest unit and host site for current carbon capture research.

Location: Louisville, Kentucky

Capacity: 640 MW

Fuel: Natural Gas

Opened: 2015

Cane Run 7 is Kentucky's first natural gas combined-cycle (NGCC) generating unit.

2 Gas Turbines x 1 Steam Turbine

Retirements:

Coal units 1 through 6 were demolished in 2019.

Capacity Factor:

~85% from 2016-2021



20 MW Large Carbon Capture Pilot at NGCC



The award negotiations are underway, and some project details could change.

- **Scale:** A 20 MWe Equivalent Slipstream of Flue Gas at ~350 klb/hr.
 - Could Reduce Cane Run CO₂ Emissions by 3-4%, ~237 US Tons Per Day
 - We have a buyer for 100% of the captured carbon dioxide.
- **Technology:** Advanced amine-based post-combustion CO₂ capture system with 95% capture and 99.9% CO₂ purity developed with the University of Kentucky.
 - Solvent Independent, Process Intensified Technology
 - Low Cost, Reductions in Capital Cost, CO₂ Capture Cost & LCOE
 - Strategies for Enhanced Operational Flexibility
- **Research**, leading to commercialization, on the scale-up volumetric gas/liquid distribution effectiveness; gas pressure drop variation; solvent robustness; secondary emissions; operational flexibility; integration with GT and HRSG
 - Complimentary commercial scale FEED currently ongoing to lower risk.



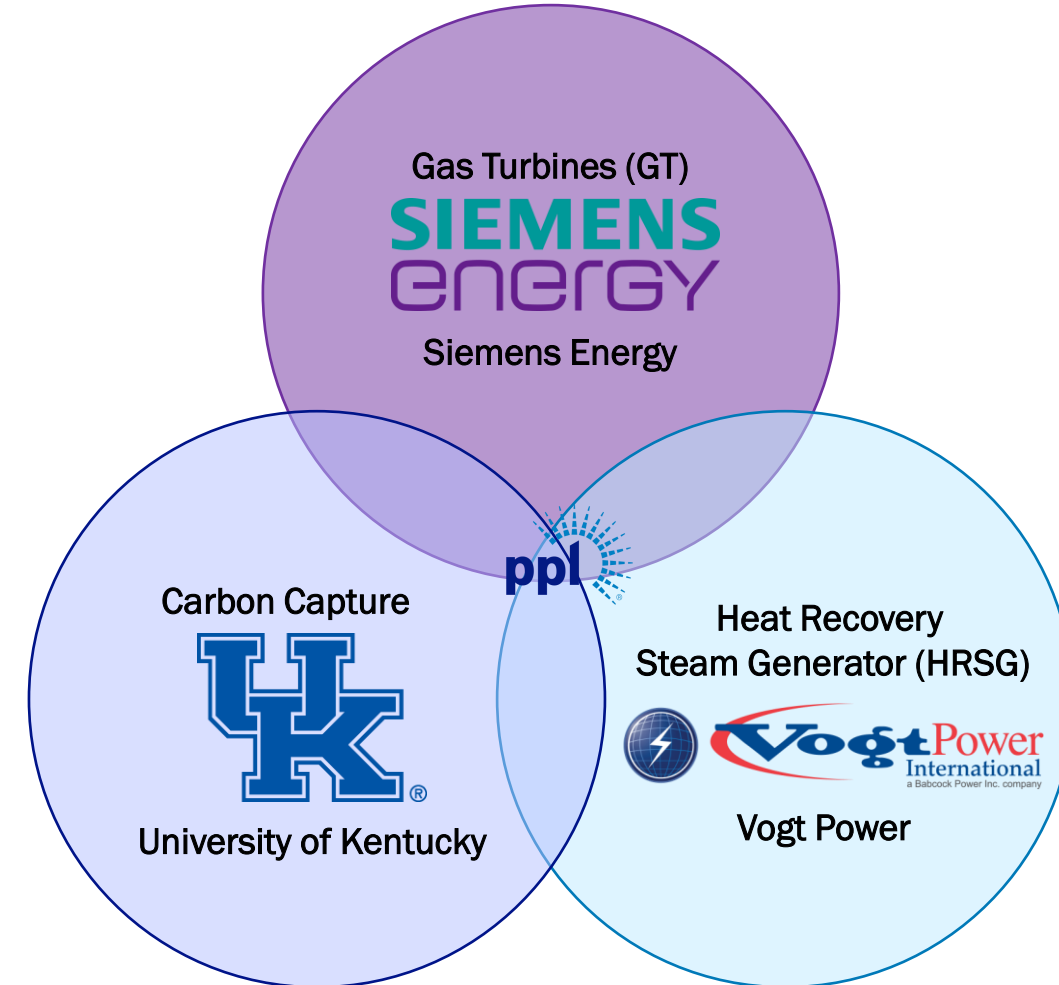
Collaboration can address R&D challenges.



Include the OEMs while integrating carbon capture equipment to improve the design.

- Learnings from the 20 MW large pilot could enable:
 - Improved Capture Performance
 - Derisk Technology from Retrofit Integration with HRSG & GT
 - Volumetric Effectiveness of the Liquid/Gas Distribution
 - Solvent Degradation and Quality Management
 - Reduced Cost and Increased Reliability
- Example learnings from the full-scale FEED with EPRI and UK:
 - Increasing backpressure on the gas turbine is a possible mechanism to eliminate flue gas booster fan.
 - Collaboration with GT, HRSG, and Carbon Capture
 - Optimizing the steam extraction point location on an NGCC requires full HRSG and steam turbine models.
 - Collaborate with OEMs to understand repercussions from equipment performance and service agreements.

Cane Run Carbon Capture Project



Thank you!

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