AUGUST 2023

Global Technical Training Services, Inc. Newsletter

The State of the Industry

Sid Crouch, GTTSi Chief Technical Consultant

North and South Carolina are at the forefront of achieving decarbonization goals while maintaining a reliable and dependable source of electricity. Their baseload nuclear plants have a capacity of ~11,715 MW – SC plants provide ~56% of that baseload (***~95% of SC's carbon-free electricity***) and NC plants provide ~44% of that baseload (***~70% of NC's carbon-free electricity***). Carolina's governors and state leaders have long embraced nuclear as part of their energy mix, and their universities have been at the forefront of nuclear development and research for decades. One specific university stands out - NC State. It's Nuclear Engineering graduate program is ranked in the top 3 among public and private institutions, 1st in the southeast, and shares 2nd nationally. So why are we not seeing more interest in nuclear? Some say it's the public's fear..some say it's the issue of spent fuel and high-level waste storage…some say it's over regulation, while others blame it on the process of designing and licensing which in the past has driven up cost. All these challenges exist; however, a big issue is the simple fact that we can't seem to deliver a new plant on time and on budget. It's time for the government, regulators, utilities, owners, and vendors to work together to fix this. One way to do this may involve a closer look at how Southern Company managed construction at Vogtle Units 3 & 4 after Westinghouse's bankruptcy Once they took over managing the project, continuous progress was made and observed. We have lessons to learn from their achievement. Let's not let it go to waste.

I welcome your comments or questions - sid.crouch@gttsi.com

Highlights

Minority and Woman-Owned MWBE Business Enterprise

GTTSI
807 Bypass 123 – Suite 31
Seneca, SC 29678
864.882.3111
ginfo@gttsi.com
www.gttsi.com

CONSTELLATION ENERGY SETS NEW RECORD FOR HYDROGEN BLEND

Constellation Energy Corporation, touted as the nation's largest producer of carbon-free energy, recently set a new record for blending hydrogen with natural gas (***38%***), demonstrating that hydrogen can be an effective tool in reducing greenhouse gas emissions for natural gas power plants. In addition, Nitrogen Oxide (***NOx***) emissions did not increase during the blending test, confirming that there was no negative impact to local air quality.

Constellation, headquartered in Baltimore, Maryland, provides electric power, natural gas, and energy management services for approximately two million customers across the continental United States.

Working with Siemens Energy and EPRI, the hydrogen blending test was conducted at Constellation's Hillabee Generating Station (***pictured below***), a 753-megawatt combined-cycle (***Siemens SGT6-6000G***) natural gas plant in central Alabama that began operating in 2010. The test showed that with only minor modifications, an ageing ***(~13 years***) natural gas plant can safely operate on a blend of 38% hydrogen, nearly doubling the previous record for similar generators.

Photo Credit: Sargent & Lundy

Constellation is the largest locally headquartered public company in Baltimore, Maryland. Photo Credit: Baltimore Business Journal

The Environmental Protection Agency recently released new guidelines aimed at reducing carbon emissions from electric power plants, citing hydrogen blending as a primary technology to achieve these goals.

"This test proved what we've suspected for years - that blending clean hydrogen with natural gas can safely reduce emissions without major modifications to an existing plant that's well over a decade old," said Joe Dominguez, president, and CEO of Constellation. "As the EPA and numerous climate experts have acknowledged, the availability of affordable clean hydrogen at scale will be essential if we are going to prevent the ravaging effects of climate change."

Based on EPA data, a 38% blend rate reduces Hillabee's carbon emissions by ~270,000 metric tons annually, the equivalent of taking more than 60,000 passenger cars off the road.

TVA HITS BARRIERS TO REPLACE COAL-FIRED WITH GAS-FIRED PLANTS

Just one day after the Biden administration proposed its plans to limit greenhouse gas emissions from power plants, TVA announced plans to build a new natural gas power plant to replace their Kingston coal-fired plant, site of a massive coal ash spill in 2008. In response, conservation groups have filed a lawsuit to stop the project. The lawsuit claims TVA violated a requirement of federal agencies under the National Environmental Policy Act to give serious consideration to other alternatives. The challenge also argues that TVA did not sufficiently consider the failures at certain coal and gas plants that led to rolling blackouts in December last year and did not appropriately account for renewable energy incentives in the Inflation Reduction Act.

Earlier this year, Appalachian Voices, the Center for Biological Diversity, and the Sierra Club challenged TVA's decision to build a natural gas-fired power plant at their Cumberland Fossil Plant in Tennessee. The lawsuit contended that the power provider didn't properly consider cleaner energy options or correctly factor in climate and economic impacts. They implied that the federal utility moved forward with their plan despite concerns raised by the Environmental Protection Agency that the utility's analysis of alternative power sources was faulty, and the project was at odds with President Biden's clean energy goals.

TVA has said that they will retire the first of two coal burning units at the Cumberland plant by the end of 2026 and expect to have the 1,450-megawatt gas plant up and running before then. TVA also plans to retire Cumberland's second coal-burning unit by the end of 2028 with a plan to replace part of that lost electricity production with a 900-megawatt gas plant and 400-megawatt battery storage system in Cheatham county, Tennessee.

TVA said the new gas plants will provide the flexibility needed to add 10,000 megawatts of solar to its overall system by 2035 and still meet peak demand periods. TVA's energy mix — topping out at about 38,000 megawatts — includes 43% nuclear, 26% natural gas, 13% coal, 14% hydroelectric and 4% of other types of renewables, such as solar, according to a May filing with the Securities Exchange Commission.

Photo Credit: The Tennessean

The Kingston Plant Coal Ash Spill was a major environmental disaster that occurred on December 22, 2008, in Harriman, Tennessee. It involved the release of over 1 billion gallons of coal ash slurry from a containment pond due to a dike failure. The spill flooded homes, farmlands, and rivers, causing millions of dollars in damage to the environment and local communities. Cleanup cost TVA over $1B.

CONVERSION FROM COAL TO NUCLEAR COULD REDUCE EMISSIONS UP TO 90%

Since 2012 the U.S. has retired over 96,000 MWs of our coal-fired power plants. The pace of these retirements is expected to slow down over the next several years, with the largest expected retirement to occur in 2028 with 9,842 MW. These planned retirements continue to be focused on relatively older facilities but the need for reliable and affordable electricity is still required. At the latest 2023 EEI (***Edison Electric Institute***) Conference the need for increased electrical generation was of great concern, because it appears we will not be able to keep up with the demand that is expected in the near-term future.

To date, a large fraction of coal's displacement has been replaced with natural gas generation. But environmentalists continue to remind us that although it is cleaner than coal, natural gas is still a fossil fuel and therefore has associated greenhouse gas emissions.

Renewable sources like wind and solar power are scaling rapidly, but there are several challenges in using them to displace coal-fired power.

First, these sources tend to be decentralized and require a lot of area for the power they produce. Second, these sources are intermittent, and therefore require much more capacity to displace the same capacity from a coal-fired power plant. Certainly these renewable sources will continue to grow in importance, but in the short-term, we can't expect coal-fired power plants to be replaced with intermittent renewables.

Nuclear power, however, is a viable option for meeting our electrical needs as a clean, reliable, dispatchable baseload power source. A report "***Investigating Benefits and Challenges of Converting Retiring Coal Plants into Nuclear Plants***" was released in 2022 by the U.S. Department of Energy. This report estimated that approximately 80% of retired or active coal plant sites in the United States are suitable to host advanced SMRs (***small modular reactors***). The report noted conversion of coal plants to SMRs could save money and reduce emissions. The report estimates that converting a coal plant to nuclear power could save the plant owner up to $1 billion over the lifetime of the plant, and that converting a coal plant to nuclear power could reduce emissions by up to 90%.

The International Energy Agency (***IEA***) published its own report on the potential for the displacement of coal-fired power in November 2022. The report, ***Coal in Net Zero Transitions***, examined the role of coal in the *(continued)*

global energy transition and identified various strategies for reducing coal-related emissions in a way that would be rapid, secure, and people-centered. Their report stated that globally, coal is the largest emitter of energy-related carbon dioxide (CO2), accounting for 15 billion metric tons in 2021. Coal is also the largest source of electricity generation, globally, accounting for 36% in 2021.

The report identified three main pathways for reducing coal-related emissions:

- **Rapid phase-out of unabated coal power**: This pathway involves phasing out all coal power plants that do not capture and store their emissions, by 2030. This pathway would require significant investment in clean energy technologies, but it would also deliver the largest emissions reductions in the shortest time.
- **Gradual phase-out of unabated coal power:** This pathway involves phasing out unabated coal power plants over a longer period, such as by 2040. This pathway would require less investment in clean energy technologies than the rapid phase-out pathway, but it would also deliver smaller emissions reductions.
- **Continued use of coal with carbon capture and storage (CCS):** This pathway involves using CCS technology to capture and store the emissions from coal power plants. CCS technology is still under development, but it has the potential to significantly reduce coal-related emissions.

The report sees the rapid phase-out of unabated coal power as the most effective way to reduce coal-related emissions, and nuclear power is expected to play a key role in replacing that coal-fired electricity generation.

Over 30 countries have demonstrated their interest in expanding nuclear capacity, expecting about 18 GW's (***gigawatts***) annually from 2026 to 2030 – tripling the average of 6 GWs from 2017 to 2021.

While China leads the nuclear expansion – accounting for almost 40% of all new nuclear capacity to 2030 — other countries such as France, India, Poland, the United Kingdom, and the United States have announced support or plans to invest in new nuclear projects. The IEA expects an average of 20 GWs of nuclear capacity to be added each year from 2030 through 2050, including small modular reactors that offer lower upfront costs and improved safety and waste management features.

There are certainly challenges and opportunities associated with converting coal plants to nuclear power. The biggest challenge is the cost and time to build new nuclear power plants, as well as the regulatory hurdles. Converting coal plants to nuclear power, however, could help retain work forces at coal plants and stabilize the economy, while helping the United States meet its climate goals.

Carbon Power Plant, Utah's oldest coal-fired power plant, was taken offline in 2015.
Photo Credit: the Salt Lake Tribune

GTTSi TEAM MEMBER HIGHLIGHT: BEN CARLIN

Meet GTTSi employee, Ben Carlin. Ben is certified as a Level II – ITP Test Engineer, as well as Field Engineer, and has provided services at twenty-four different nuclear sites, including Diablo Canyon, Surry Power Station, St. Lucie Nuclear Power Plant, and Duane Arnold Energy Center. His most recent assignment has been at Plant Vogtle as a Test Engineer for Vogtle Units 3 and 4 since 2020.

Ben has over 17 years of experience as a mechanic, senior valve / AOV (***air-operated valve***) technician, junior tester, and rigger. During his assignment at Plant Vogtle his work has included the review of procedures and documentation to assure that the work is being performed in compliance with code requirements, manufacturer specifications, and plant specific procedures. Ben understands and internalizes the use of human performance improvement tools, nuclear safety culture, and procedural use and its adherence.

Over the past three years, Ben has identified and documented over 300 condition reports in support of his duties as a Test & Field Engineer. In support of the Plant Vogtle Project, he has worked with all departments - RCC, LOTO, Operations, Chemistry, NI, BOP, Digital, and the TCC. In addition, he assisted the construction department with emergent troubleshooting while performing his duties for the components group as an AOV specialist.

Georgia Power's Plant Vogtle Units 3 & 4 are the first newly constructed nuclear units built in the United States in more than three decades. Plant Vogtle plays an essential role in Southern Company's goal of net zero greenhouse gas emissions by 2050 and is the largest carbon-free generation asset in the country. GTTSi is proud to be a part of this monumental undertaking, and our participation is made possible by working with extraordinary people like Ben.

Photo Credit: Ben Carlin, GTTSi

Ben is just one of the many industry experts at GTTSi - check us out at www.gttsi.com or on LinkedIn www.linkedin.com/company/gttsi

DID YOU KNOW?

Photo Credit: Geo.tv

Pakistan and China recently signed a $4.8 billion deal to build a 1,200 MW nuclear power plant called Chashma 5. Work on the project is expected to begin immediately and will be their 7th nuclear power plant – increasing their nuclear energy capacity to 2,600 MW. The project was planned to start a couple of years ago but was delayed. The Pakistan government expressed gratitude to China for not increasing the overall cost due to the delay. To help get the project underway, China disbursed an initial 30 billion Pakistani rupees (***$104.53 million***). It is unclear if this investment is part of the $65 billion that China has pledged in infrastructure building for Pakistan under its "Belt and Road Initiative".

Tritium is radioactive hydrogen generated in nature by the interaction between cosmic rays and the atmosphere. Although naturally occurring, significant amounts of tritium are also generated by human activity, including the operation of nuclear power plants, the manufacture of nuclear weapons, and atomic bomb testing. Nuclear power plants release tritium into the air as a gas (***HT***) and into the water (***HTO or 3HOH***). Since no economically feasible technology exists to filter tritium from a nuclear power plant's gaseous and liquid discharges, the EPA has placed limits on the amount of tritium that can be released .

Tritium emits a very weak beta particle but has a half-life of 12.3 years. Since tritium is in the environment, it can enter the human body as a gas or as a liquid by ingestion or inhalation and through the skin by absorption. Since its most common form is in water, it goes directly into soft tissues and organs but is excreted through the urine within a month or so after ingestion. Organically bound tritium (***tritium that is incorporated in organic compounds***) can remain in the body for a longer period of time.

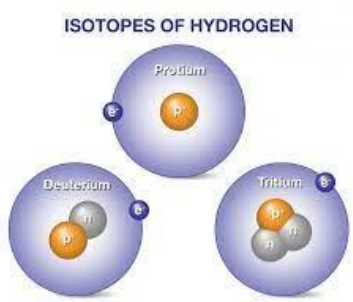

Photo Credit: DOE

Russian RTG
Photo Credit: Wikipedia

During the years of the USSR (***United Soviet Socialist Republic***), more than 2,500 RTGs (***Radioisotope Thermoelectric Generators***) were scattered around the Russian coast to power lighthouses and navigation beacons. Hundreds are still unaccounted for. RTGs are not nuclear reactors or nuclear batteries, but instead they convert the heat from radioactive decay into electricity. RTGs are currently used in space exploration as a source of power with plutonium. The Soviet Union used much cheaper radioactive sources for their RTGs, such as Strontium-90, Cesium-137, or Cerium-144. Their RTGs are about 1.5 meters by 1.5 meters, weighing about one metric ton and producing up to 1000 watts for 10-20 years. Recently, three residents from the village of Lia, Georgia (***Russia***) found a canister in the mountains. After using it to stay warm overnight, all three woke up vomiting and dizzy. A military hospital diagnosed the three with radiation sickness. After dozens of skin grafts and months in the hospital, only two of them survived. The US and the EU partnered with Russia to clean up the RTGs, reclaiming more than 1,000 for processing, but the program fell apart in 2014 following Russia's invasion of Crimea and their expulsion from the G8.

AUGUST 2023

GTTSI
807 Bypass 123 - Suite 31
Seneca, SC 29678
Phone: 864.882.3111
Fax: 864.882.1026
ginfo@gttsi.com

Marshalla Schile
President
Phone: 864.882.3111
marshalla.schile@gttsi.com

Clay Schile
Vice-President
Phone: 864.882.3111
clay.schile@gttsi.com

Chrissy Mulay
Technical Staffing Manager
Phone: 864.506.4647
chrissy.mulay@gttsi.com

Lisa Peach
Technical Staffing Specialist
Phone: 864.360.7554
lisa.peach@gttsi.com

Debbie Scott
Administration
Phone: 864.882.3111
debbie.scott@gttsi.com

Sid Crouch
Chief Technical Consultant
Phone: 843.861.0431
sid.crouch@gttsi.com

Ken Schaaf
NRC Exam Developer
Phone: 864.882.3111
kenneth.schaaf@gttsi.com

GTTSi Job Board

GTTSi has been providing professional services to the energy and nuclear industry since 1980. We are an MWBE (***minority woman-owned business enterprise***) and have served over 80% of the US commercial nuclear facilities, 8 Federal agencies and prime contractors, and one foreign government. If you are qualified and interested in any of the job opportunities listed below, please contact us at ginfo@gttsi.com or call **864.882.3111.**

- Engineering Subject Matter Experts -Remote
  - Synthetic Fuels
  - Hydrogen
  - Ammonia/Urea
- Procurement Engineer/Materials Mgmt. -Waynesboro, GA
- Project Manager -Offshore Wind -Remote
- Mechanical Engineer -Fluids/Hydraulics –Remote
- Account Specialist -North Palm Beach, FL

For updates to your newsletter subscription, please email ginfo@gttsi.com

---

GTTSi

P.O. Box 307
Hartsville, SC 29550-0307

COMPANY or PERSON's NAME
STREET ADDRESS
CITY, STATE, ZIP