



# GTTSi

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## November 2019

### November 2019 Newsletter



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***In this season of thankfulness, we are especially grateful to YOU; our employees and clients.***

***It has been a challenging year for ALL - our clients, the utilities we serve, and YOU.***

***But together, we continue our goal of being the BEST by doing the job right the first time, every time!***

***Alone ... each of YOUR accomplishments are impressive but TOGETHER, they are a record of achievement, few if any, companies can match!***

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## Net-Zero Carbon Emissions – A Different Take on Carbon Capture



***“Net-zero carbon emissions – takes CO2 out of the air and uses it to create a synthetic fuel that can be used in combustion-type engines, resulting in net-zero carbon emissions, since the CO2 is essentially recycled. A Canadian company, Carbon Engineering, has been operating the pilot plant, picture above, since 2015 – proving this process works – recycling 1 ton of CO2 per day to create 1 barrel a day of this synthetic fuel. In 2009, Carbon Engineering convinced Bill Gates and a Canadian oil sands financier, Norman Murray Edwards, to back them with their idea which was a different take on the carbon capture idea.”***

Capturing carbon dioxide (CO<sub>2</sub>) from the air – have you heard of this?

This idea was first developed by a scientist named Klaus Lackner in the mid 90's. Since then, several technology companies have built prototypes to do this but, in the end, they were just too expensive – around \$600 per ton, while this Canadian Company, Carbon Engineering, can capture carbon for under \$100 a ton.

In 2009, Carbon Engineering convinced Bill Gates and a Canadian oil sands financier, Norman Murray Edwards, to back them with their idea which has a different twist to the carbon capture idea. And, since 2015, they have been operating a pilot plant that captures about one ton of CO<sub>2</sub> per day. Their process – “net-zero carbon emissions” – takes CO<sub>2</sub> out of the air and uses it to create a synthetic fuel that can be used in combustion type engines, resulting in “net-zero carbon emissions”, since the CO<sub>2</sub> is essentially recycled.

This process starts with an "air contactor," (pictured above on the left) it looks like an oversized semitrailer with a huge fan on top, in the middle. In the front of the air contactor there is a black grill that has a potassium hydroxide solution flowing down it - it almost sounds like a waterfall. Once the solution meets the air

flowing across it, the solution captures and retains the CO<sub>2</sub>.

That sounds simple, but it's not – the actual concentration of CO<sub>2</sub> in the air is pretty small - about 0.04%. Therefore, a lot of air must flow across the solution to obtain enough CO<sub>2</sub> – one of the largest challenges of the entire process.



Next, more chemicals are added, and the new solution is heated - creating white pellets that look like the filling in a bean bag chair (pictured above). These tiny pellets are about 50% CO<sub>2</sub> and they are heated to 900°C or 1,652°F, concentrating the CO<sub>2</sub> into a gas. At this point, the CO<sub>2</sub> could be injected underground, but there is no business model for carbon capture in today's market, so Carbon Engineering looked for an alternative way to make a profit and allow continued expansion of their technology.

To that end, they take the CO<sub>2</sub> gas and combine it with hydrogen - extracted from water – to make a clear, synthetic fuel similar to crude oil. Jenny McCahill, a chemist and engineer who works for Carbon Engineering said, their synthetic fuel is a lot

purer than crude oil, it doesn't contain impurities like sulfur and nitrogen, and once it is put through a refinery, it can be turned into products such as gasoline, diesel, and jet fuel (pictured below).



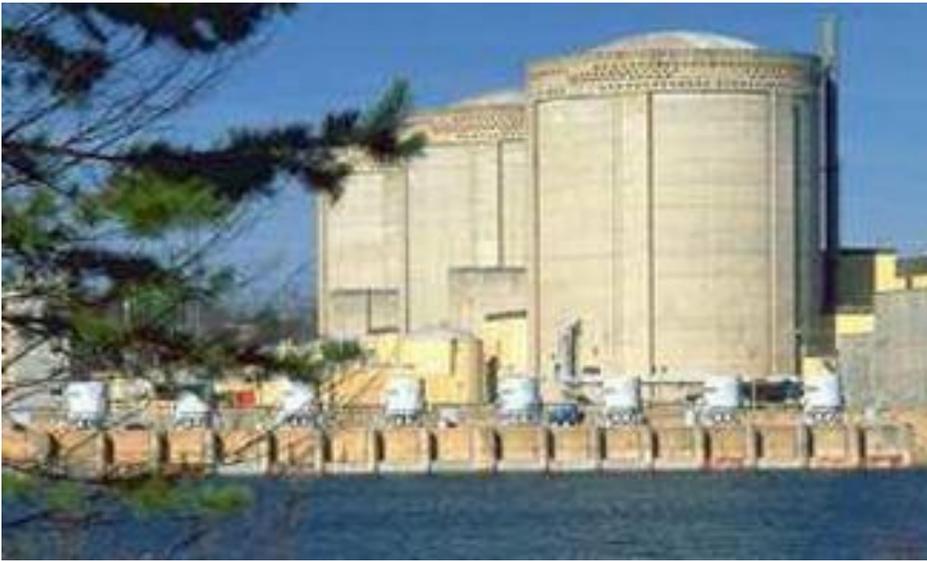
Carbon Engineering see themselves as an emissions-cutting technology company – no net removal of CO<sub>2</sub> from the atmosphere but instead a recycling of CO<sub>2</sub>. They will use the CO<sub>2</sub> as a key raw material for creating a synthetic liquid fuel by combining it with hydrogen derived from water, using renewable energy.

Although the pilot plant is only making around one barrel a day, they see their next plant as a commercial facility making around 2,000 barrels a day.

Below is an artist conception of a full-sized air contactor – several would be needed to capture 1 million tons of CO<sub>2</sub> per year.



## Duke Energy Seeks License Renewal for All Eleven Nuclear Plants



***“Oconee Nuclear Station, (pictured above) will be the first on Duke Energy’s agenda to obtain license renewal. One unit has already completed the process. Most of the country’s nuclear utilities are expected to seek license renewals because it is just good business. Duke is planning for license renewal for all 11 of their nuclear plants”***

Duke Energy plans for license renewal at all eleven of their operating nuclear power plants in North and South Carolina.

However, the process is rather lengthy, and Duke Energy experienced it firsthand. They filed for license renewal at Oconee Unit 1 in 1998, and at that time, it was the second nuclear plant to apply for license renewal - the process took almost two year to complete - the new license took effect in 2013 – it expires in 2033.

Although, Duke Energy has announced their intentions to file for license renewal at the remaining 10 reactor units, they do not plan to start until 2021, and the remaining units at Oconee Nuclear Station will be first on their agenda.

The license renewal process includes opportunities for public comment. Although every licensed reactor has previously gone through

this phase of the process before, but things can change over the 20-year license period, so the renewal process includes a public comment period, as well. According to Scott Burnell, a spoke person for the NRC (Nuclear Regulatory Commission), there have been cases where the utility or the state have temporarily stepped away from license renewal or agreed to a shorter extension – less than 20 years.

The renewal process primarily focuses on safety and maintenance at each plant, along with other issues, such as, how the concrete and/or other components have held up over the license period and what action(s) have been taken to upgrade or validate its condition.

Most of the country's nuclear utilities are expected to seek license renewal, because it is just good business - since the nuclear plant construction

costs have usually been 'paid off' during the 40 year initial license period, and it would be difficult, if not impossible, for the utility to obtain comparable - reliable and resilient power generation from renewables, which share with the nuclear plants, a large up-front investment.

Duke Energy previously announced plans to reduce their carbon footprint to net-zero by 2050, but they explained, it would be impossible to do so, without nuclear.

Because nuclear not only supplies reliable and resilient electricity, but they provide it with zero carbon emissions.

The Carolina’s nuclear plants generate enough power for 7 million homes and in South Carolina, their nuclear plants provide almost 60% of South Carolina's electricity.

Listed below are the Carolina Duke Energy plants:

- Brunswick – two BWR Units in Southport, N.C
- Catawba – two PWR Units (jointly owned with three other entities), in York, S.C.
- Harris – PWR Unit in New Hill, N.C.
- McGuire – two PWR Units in Huntersville, N.C.
- Oconee – three PWR Units in Seneca, S.C.
- Robinson – PWR Unit in Hartsville, S.C.

## Energy Consumption Will Grow 50% - Worldwide by 2050



**“World Energy consumption will grow nearly 50% by 2050 – most from developing nations - worldwide. Wind, solar, & hydro are expected to meet the challenge”**

According to the U.S. Energy Information Administration (EIA), the world’s energy consumption will grow nearly 50% by 2050.

Most of the growth is anticipated to come from developing nations, particularly in Asia – global industrial energy consumption is expected

to rise more than 30% to about 315 quadrillion British Thermal Units (BTU).

The EIA predicts that electricity consumption will increase by 79% through 2050. Rising population and better standards of living in the developing nations will be the cause, as it will result in a greater demand for appliances and personal equipment.

However, wind, solar & hydro will meet the challenge of these greater demands, says the EIA.

The buildings sector, both residential and commercial, is expected

to see a 65% increase in electricity consumption from now until 2050, up to 139 quadrillion BTU’s. Transportation energy consumption will increase by 40% worldwide, but that sector’s growth in the developing world will be significantly higher.

Global renewable energy consumption will increase an average 3.1% per year up to 2050, compared with weaker 0.4% and 1.1% annual growth in coal and natural gas, respectively. But overall natural gas will be 40% higher by 2050 – nearly 200 quadrillion BTU’s.

## FERC Issues NOPR - PURPA Regulations Need Modernization



**“In 1978 PURPA laid the foundation but a lot has changed since then, and it’s time to modernize FERC’s implementation of PURPA to reflect those significant developments.”**

The Federal Energy Regulatory Commission (FERC) issued an NOPR (Notice of Proposed Rule Making) to modernize its regulations for small power producers and co-generators under the Public Utility Regulatory Policies Act of 1978 (PURPA). to better address consumer concerns and market changes in the energy landscape in recent decades.

FERC first formed these rules in 1980, after Congress enacted PURPA to address the national energy crisis, the country was experiencing at the time. Congress wanted to encourage the development of small power producers and co-generation units to reduce our demand on traditional fossil fuels, which were considered to be in short supply.

FERC Chairman Neil Chatterjee said, PURPA laid the foundation but a lot has changed since 1980. It’s time to modernize FERC’s implementation of PURPA to reflect those significant developments.

The proposed rule will provide flexibility to state

regulatory authorities so they can accommodate recent wholesale power market developments and streamlines the Commission’s policies and practices, for example; incorporate market pricing into avoided cost energy rates, modifies the “one-mile rule,” and lowers the threshold presumption for power markets from 20 MW’s to 1MW for small power production, but not co-generation, facilities.

It also requires states to establish objective and reasonable standards for QFs to obtain legally enforceable obligations for the purchase of their power.

**DARPA Cybersecurity Exercises Continue at Plum Island, NY**



**“Plum Island (light house pictured above) has served at the edge of U.S national security for 120 years. It housed gun batteries during the Spanish-American War, a torpedo storage facility during the First World War, and in recent decades it has been the government’s home for studying animal-borne diseases, and for the past few years it has been the guinea pig for a 21<sup>st</sup> century threat – a cyberattack on our power grid.”**

One year ago, the DOE (Department of Energy) and DARPA (Defense Advanced Research Projects Agency) conducted the Liberty Eclipse Exercise - 7-day event, with more than 100 people gathered on Plum island.

Although it was fictional, it was designed to mimic all the hurdles and uncertainty of a real-world cyberattack that takes out power across the nation, referred to in the electrical industry as a “black start” condition.

A team of grid operators, from electric utilities across the nation, were charged with recovery and power restoration - creating initial power transmission - using a diesel generator, building cyber-secure “crank paths” through a series of electric substations that would increase transmissions’ voltage until they were capable of powering two utilities and delivering redundant power to the “critical asset”. Because, in a real-

world attack, the “critical asset” could be a hospital, a military base, or something needed for the nation’s functioning during an emergency.

While operators were working to restore the power, cyber researchers - from seven different industry groups - were using their custom-built grid recovery technology tools to protect the grid operators’ efforts from the cyber attackers (who were also part of the exercise). These adversaries were working to thwart their protection efforts every time they seemed to be making any headway.

In May 2019, another exercise was conducted by DARPA’s RADICS (Rapid Detection, Isolation and Characterization Systems) team to continue testing the grid recovery technology tools and learning more on how to manage such an event.

Through these exercises, now six in all, we have learned that grid recovery technology tools are the key to hunting down the source of the attack,

situational awareness and physical detection of the cyber-attack platform, and the generation of an emergency network configuration.

As a result, these tools have become so user-friendly that grid operators or anyone else without specialized cyber training could use them to re-establish power. This is important, as we might need personnel (i.e., National Guard) without specialized cyber training to re-establish power to a specific asset or restart power in a specific sector.

Over the past few years, the threat of our electrical grid being hacked has morphed from a distant possibility into a stark reality. Two cyberattack blackouts, believed to have been perpetrated by Russian state-sponsored hackers, occurred in the Ukraine in 2015 & 2016.

The Department of Homeland Security has warned repeatedly that they have detected extensive Russian probing of our US electrical grid.



## Did You Know?



**“That Vermont’s Green Mountain Power Corporation (GMP) announced their President and CEO for 12 years, Mary Powell will leave the company at the end of the year after more than two decades of leadership in energy and innovation – Mari McClure, Senior Vice President and a 10-year veteran at GMP, will become the next President and CEO. GMP was chosen as Fast Company’s Most Innovative Companies in the World - three years in a row, and J.D. Power’s latest rankings put GMP among the top utilities for customer satisfaction.**



**major driver**

That **Nuclear Energy is a major driver of the U.S. economy, contributing \$60 billion annually to the nation’s gross domestic product and supporting more than 100,000 direct jobs?**



**NV Energy terminating Crescent Dunes**

That **NV Energy** notified the Crescent Dunes Solar Facility, near Tonapah, NV, they were **terminating their power contract after they “failed to produce” the energy required by the contract?** SolarReserve, the project’s original developer, claims that the Department of Energy (DOE) had “sought to amass increased control” over the \$1 billion project and its operator – originally, DOE backed the Crescent Dunes Solar Project with a guaranteed loan of \$737 million in 2011. **But NV Energy plans to continue adding solar to its portfolio. In June, they announced that they were seeking to build ~1,200 MW’s of solar generation with ~600 MW’s of battery energy storage.**



**71% equipped for disasters**

That **71% of U.S. utilities say they are extremely or very equipped to prepare, respond, and recover from disasters but only 35% of consumers feel extremely or very confident that the utilities can do this, and only 26% of consumers personally feel extremely or very prepared for a disaster?** How about YOU are you prepared?



**NextEra Energy Inc. to reduce CO2 emissions by 65% by 2021**

That **NextEra Energy Inc.**, already one of the nation’s largest renewable energy producer, **announced plans to reduce CO2 emissions 65% by 2021?** Part of the plan is to **bring online 4,300 MW of wind energy in the next two years.** They already have >14,000 MW of wind and their subsidiary Florida Power & Light has 930 MW (14 plants) of utility scale solar with plans to **add an additional 12 new plants over the next year.** Just last year, Florida-based NextEra, achieved its lowest-ever emission rates for CO<sub>2</sub>, sulfur dioxide and nitrogen oxide from its power plants; 96% (SO<sub>2</sub>), 76% (NO<sub>x</sub>) and 55% (DO<sub>2</sub>) lower than the average U.S. utility sector.



**NYPA to establish a 20-MW BESS in Franklin County**

That **New York Power Authority (NYPA)** announced their plans to move forward with their first large-scale energy storage project? They **will establish a 20-MW BESS (Battery Energy Storage System) alongside one of its substations in Franklin County. The estimated project cost is almost \$30 million, and it will include a one-hour lithium-ion battery system which can absorb excess power generation for later delivery.** NYPA officials say this project supports New York Gov. Andrew Cuomo’s renewable and energy storage mandates, including a goal of 3,000 MW in energy storage capacity by 2030



**wind capacity at record levels**

That the **U.S. wind capacity is expected to approach the record level set in 2012 for both 2019 and 2020. This year, we already have added 3.7 GW’s and another 8.5 GW’s is expected by the end of year. The EIA (Energy Information Administration) is forecasting an additional 14.3 GW’s for 2020 – even more than 2019.**

## NASA Claims - 10% Chance of a Geomagnetic Storm - This Decade



***“Blasts of charged particles from our sun are called coronal mass ejections, or solar storms. It is just a matter of time before one of these blasts’ reaches Earth – this wave of particles can bend and snap the Earth’s magnetic field, generating effects on our electrical systems, such as voltage disruptions, which can lead to power outages. They can cause changes to soil voltage - enhancing corrosion in oil pipelines, cause disruption in satellite, radio, and cellular communications networks, expose us to elevated levels of radiation, and affect airline flights due to GPS interruptions.”***

Blasts of charged particles from our sun, as illustrated above, are called coronal mass ejections, or solar storms. These storms can pack explosive energy, equal to thousands or even millions of nuclear bombs. It is just a matter of time before one of these blasts’ reaches Earth – this wave of particles can bend and snap the Earth’s magnetic field, triggering powerful geomagnetic storms, resulting in the induction of electrical currents throughout the planet – called a GMD (geomagnetic disturbance).

We first learned about “geomagnetic storms” on September 1, 1859, when solar astronomer Richard Carrington witnessed sunspots that suddenly and briefly flashed brightly before they disappeared. Just before dawn the next day, auroras erupted over most of the Earth, as far south as the Caribbean and Hawaii, while the southern lights were seen as far north as Chile. This event - Carrington Event - not only produced a visible light show in areas where they do not typically

appear, but it also caused electrical shock to telegraph operators, shooting sparks out of pylons, and causing paper fires.

Today, it could result in grinding our technological infrastructure to a halt by overloading, disrupting, or knocking-out modern technologies, like satellites and cellphones. A very real threat to our electrical infrastructure and power grid due to grounding and digitalization.

Since our electrical grids are grounded, they are susceptible to electrical currents induced from these storms, deep inside the Earth.

Although the voltage is relatively low, just one or two volts – our power transmission lines extend for miles, even hundreds of miles, so the voltage can add up and become significant. The total amount is dependent on the size of the storm and the specific geology of an area or region – we are most vulnerable in the Midwest and Northeast.

Also, this uncontrolled voltage is being introduced into a system designed to work with a controlled voltage signal, and the voltage is not an alternating current, but more like a direct current which can result in transformer coil heat up - frying the coils. And, when power transformers go down, the damage is rarely isolated;

disruptions can ripple across power grids and cause catastrophe.

Most geomagnetic storms are smaller in strength than the Carrington Event, but they are expected to occur more often - every 100 years — five times more frequently than a "500-year" storm like the Carrington Event.

NASA claims we have a 10% chance of a GMD event occurring this decade - similar to the Carrington Event. Today, it is estimated, that such an event would inflict \$2 trillion worth of damage and a recovery effort that might drag out for months or years.

In 1989, a GMD storm caused the entire Canadian province of Quebec to go dark when a Canadian hydroelectric plant went off-line - nearly 100 US electrical utilities, connected by grid to the hydro-plant, were disrupted as well. In addition, GPS signals were lost for about 10 minutes, and auroras were seen as far south as Cuba. And all it took, was a geoelectric surge of about 2 volts / kilometer.

We have many areas in the US that could exceed this voltage, so try and prepare for the worst. While the electric industry catches up - the best we can hope for is that Earth dodges the next solar storm - one barely missed us in July 2012.



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# FERC Approves Eagle LNG Export Facility Project



FERC (Federal Energy Regulatory Commission) recently approved construction for another Liquefied Natural Gas (LNG) Export Facility in the Jacksonville, FL area. After many years and countless hours of work, Houston – based, Eagle LNG, finally received authorization for siting and construction of this facility.

At a cost of \$500 million, this is one, of only a handful of greenfield LNG projects obtaining authorization. This facility will be devoted to providing U.S. LNG to the Caribbean basin, which is greatly needed to reduce their power costs and carbon emissions.

Once completed, Eagle LNG, expects this facility to produce up to 1.65 million LNG gallons per day and contain 12 million LNG gallons of storage, plus marine and truck-loading capacity on-site. Since one LNG gallon is equivalent to about 83 cubic feet of natural gas - 1.65 million LNG gallons would be equivalent to about 136 million cubic feet per day.

Eagle LNG's business model includes LNG export to South America and the Caribbean for power generation. They are already exporting small volumes of LNG from their Maxville facility located just west of downtown Jacksonville. This facility features a 1,000,000-gallon storage tank, an LNG truck loading system, and it can also load LNG ISO containers for transport to nearby island markets.

IHS Markit recently reported the dramatic impact of the U.S. shale gas drilling revolution on power generation goals not only domestically, but globally. Domestic demand has grown by more than 14 billion cubic feet per day, driven by the shift from coal-fired to gas-fired power plants, but American production is averaging closer to 90 billion cubic feet per day and shows no sign of decreasing.

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