



GTTSi

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Serving the Nuclear Energy Industry
since 1980

December 2021

December 2021 Newsletter



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The best of all gifts around any Christmas tree is the presence of a happy family all wrapped up in each other. - Barton Hillis

Merry Christmas & Happy New Year!

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World's Energy Outlook - NZE by 2050 Calls for Nuclear to Double



“If we are to reach net-zero emissions by 2050 (NZE) the IEA says nuclear power capacity will need to nearly double by 2050. Rapid advancement of advanced nuclear technologies could expand opportunities to include heat, and hydrogen – not just increased electricity production. However, “the outlook for nuclear power depends on decisions yet to be made about both existing reactors and new construction.” Additionally, renewable wind and solar energy will also need to expand with utility-scale battery energy storage systems (BESS). All of this will be costly – NZE by 2050 will not be cheap!

The International Energy Agency (IEA) released its report on the World's Energy Outlook, and if we are to reach net-zero emissions by 2050 (NZE) nuclear power capacity need to nearly double by 2050.

The report also acknowledges that the rapid development of advanced nuclear technologies could expand opportunities for nuclear energy to provide low-carbon electricity, heat, and hydrogen.

However, “the outlook for nuclear power depends on decisions yet to be made about both existing reactors and new construction.” Based on announced plant projects, nuclear power capacity could expand by over 10% by 2030 (**offset by retirements of aging reactors**) with 25 countries planning for new reactors. If this NZE outlook is followed, nuclear power could increase by another 15% by 2030.

Prospects for nuclear power beyond 2030 will depend on the progress

made in the present decade. Examples such as, VC Summer and Vogtle, here in the U.S., have caused some doubt in the processes. “There are over 100 GW of planned projects that have not yet broken ground,” the report states. “There is more uncertainty about the pace of retirements for existing reactors, with many aging reactors in the United States, Europe, and Japan in need of additional investment (**and new regulatory approvals in some cases**) to extend their operational lifetimes.” In addition, “Advanced nuclear power technologies such as small modular reactors expand opportunities for nuclear to produce low-emissions electricity, heat, and hydrogen.”

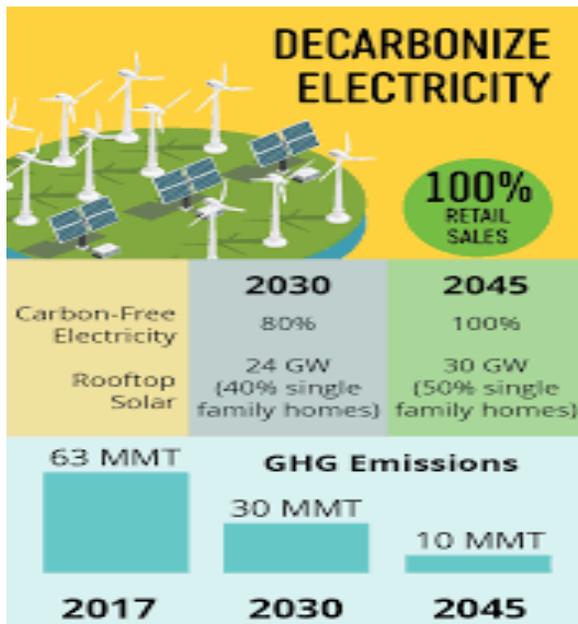
Rapid development of clean energy technologies is especially critical in the IEA's NZE scenario – acceleration is needed - shorter construction and approval times are critical. Innovation could also expand the opportunities for nuclear power beyond electricity - for example, for heat and hydrogen production - “but these efforts also need acceleration to improve their prospects,” the report cautions.

“The time from first prototype to market introduction in the NZE for technologies such as solid-state batteries, small modular nuclear reactors, ammonia-fueled ships, or direct air capture, on

average, is 20 percent faster than the fastest energy technology developments in the past and around 40 percent faster than was the case for solar photovoltaics. The speed at which new technologies are developed is crucial: almost half of the emissions reductions needed in 2050 in the NZE come from technologies that are today at the prototype or demonstration state.”

To achieve NZE by 2050, nuclear generation worldwide would need to nearly double, from 2,692 TWh (**Terrawatt-Hours**) in 2020 to 4,714 TWh. Additionally, renewable wind and solar energy would also need to expand to 48,436 TWh with utility-scale battery energy storage systems (**BESS**). “Such a system will need to operate very flexibly, enabled by adequate capacity, robust grids, battery storage, and dispatchable low-emissions sources of electricity (**hydropower, geothermal and bioenergy, as well as hydrogen and ammonia-fired plants, or small modular nuclear reactors**),” the IEA's report states. “This kind of system will also require digital technologies that can support demand-side response and securely manage multidirectional flows of data and energy.” All of this will be costly – NZE by 2050 will not be cheap!

California's Carbon Neutral Grid by 2045 – Dramatically Stalled



“California’s goal for a carbon neutral grid by 2045 has been stalled as evidenced by recent changes they have had to make. A recent decision by the SLO County Board of Directors has voted to allow 32 new oil wells to be built at the Arroyo Grande oil field over the next three years. One proponent said, this is not just because of good jobs, or use of the product, but we have to follow the science, and the science demonstrates that this operation can be done clean and efficiently.”

California’s goal for a carbon neutral grid by 2045 has been stalled as evidenced by recent changes they have had to make.

For example:

- California Energy Commission (CEC) approved licenses for 5 natural gas-fired generation units to be installed to help the state cope with its continued electricity shortages this summer.
- Growth of carbon-fueled backup generators which now account for 15% of their grid’s capacity.
- SLO (**San Luis Obispo**) County Board of Supervisors voted 4-1 to allow 32 new oil wells to be built at the Arroyo Grande oil field over the next three years.

The decision by the San Luis Obispo County Board of Supervisors denied a 2015 appeal from the Center for Biological

Diversity that refuted a time extension to construct new oil production wells at the field located off Price Canyon Road northeast of Arroyo Grande. By denying the center’s appeal, Sentinel Peak Resources has three years to build these 31 new oil production wells.

Between 2004 and 2015, Freeport McMoRan – operator of the oil field at that time - was permitted to build 95 oil production wells, 30 steam-injection wells, and three steam generators, as well as new and modified well pads at the oil field, but in no more than 10 years.

In 2015, when that building time expired, the oil company hadn’t yet built 31 of those 95 oil production wells. So, it applied for an extension to build them. The county Planning Commission granted a three-year extension, until November 2018, but the center appealed the Planning Commission’s decision due to the environmental impacts and the project was halted.

During the recent decision, 10 members of the public spoke against the project, primarily for ecological reasons and the goal of eliminating a dependence on fossil fuel. Another 10 people spoke in favor of the project noting the people it will employ and the environmental cost of shipping oil from other countries.

Environmentalists were among those disappointed

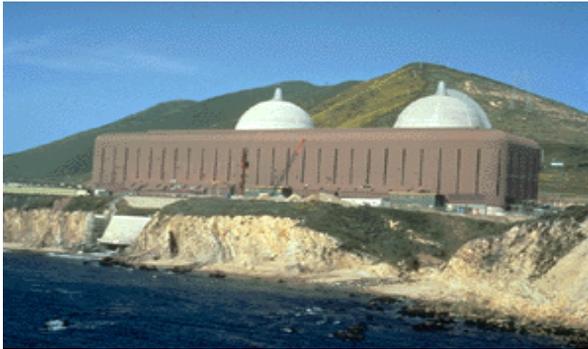
by the board’s vote.

Mary Ciesinski, executive director of ECOSLO (**Environmental Center of San Luis Obispo**) said, “The dangerous drilling processes used in Arroyo Grande draw from the county’s already low water supplies, and the resulting waste pollutes Pismo Creek and nearby groundwater supplies at a rate of over a million gallons a day. The board’s approval threatens our water, air, and climate at a time when we need leaders who will help our community turn away from fossil fuel production and turn toward renewable energy.”

However, Supervisor Dawn Ortiz-Legg said, “I think it’s so important that for us here in California, we’ve had the opportunity to actually understand that while we’re utilizing petroleum in our daily lives, that we’re doing it in the cleanest manner we know how. By supporting this, it’s not just because of the good jobs here, it’s not just because of using the products, but we have to follow the science, and the science is demonstrating that this operation can be done clean and efficiently.”



There's Still Time California - Keep Diablo Canyon Operating



“Diablo Canyon, (pictured above) provides 8% of California’s electricity and cuts their carbon emissions by 7 million metric tons a year, yielding 15% of its carbon-free power.”

Did you know that Diablo Canyon, California’s one remaining nuclear power plant, provides 8% of its in-state electricity and cuts their carbon emissions by 7 million metric tons a year, yielding 15% of its carbon-free power?

Yet they plan to shutdown Unit 1 in 2024 and Unit 2 in 2025.

A recent analysis, performed by a team of researchers from MIT

(*Massachusetts Institute of Technology*) and others, was done on the potential benefits that Diablo Canyon could provide if they were allowed to operate to 2035 or 2045

The results are quite dramatic - they found that Diablo Canyon could simultaneously help to stabilize the state’s electric grid, provide desalinated water to supplement the state’s chronic water shortages, and provide carbon-free hydrogen fuel for transportation.

Extension of their operating license to 2035, would cut carbon emissions by an average of 7 million metric tons a year — a more than 11% reduction from 2017 levels — and save ratepayers \$2.6 billion in power

system costs.

An extension to 2045 would spare 90,000 acres of land that would be needed for renewables to replace the power generated at these two facilities - ultimately saving ratepayers up to \$21 billion in power system costs.

Finally, if Diablo was operated as a poly-generation facility that provides electricity, desalinated water, and hydrogen simultaneously, its value, quantified in terms of dollars per unit electricity generated, could increase by 50%.

There’s still time to prevent the shutdowns – but it is all in the hands of Californians.

Former NRC Chairwoman Joins Southern’s Board of Directors



“Ms. Svinicki joins the board’s Business Security and Resiliency Committee, as well as its Operations, Environmental, and Safety Committee.”

Former chairwoman of the Nuclear Regulatory Commission, Ms. Kristine Svinicki, is now a member of Southern Company’s Board of Directors. She joins the board’s Business Security and Resiliency Committee, as well as its Operations, Environmental, and Safety Committee.

Ms. Svinicki is a longstanding member of the American Nuclear Society, which has twice honored her with its “Presidential Citation” in recognition of her contributions to U.S. nuclear energy policies.

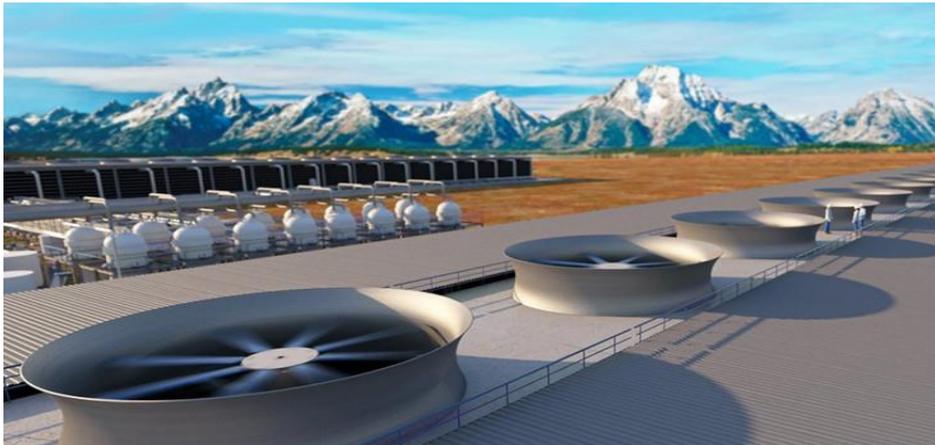
“As the longest-serving member in the history of the U.S. Nuclear Regulatory Commission, Kristine brings to Southern Company a wealth of experience advising energy policy at the federal and state levels,” said Southern chairman, president, and chief executive officer Tom Fanning. “Kristine’s knowledge of and expertise in nuclear technologies will be invaluable as we pursue the full range of energy resources. Moreover, Kristine’s insight into the energy challenges of

tomorrow, places Southern Company in a prime position to serve customers, communities, employees, and stockholders well into the future.”

Ms. Svinicki holds a bachelor’s degree in nuclear engineering from the University of Michigan, and currently serves as an adjunct professor of nuclear engineering and radiological sciences in the College of Engineering.

She also serves on TerraPower’s Board of Directors.

Carbon Capture – Will It Really Work? – What's the Cost?



“The Orca Plant (pictured above) now operational is removing ~10 metric tons of CO2 every day. Owner and operator, Climeworks (Swiss company), said this amount of CO2 is roughly equivalent to the carbon emissions from 800 car per day, and an equivalent amount of CO2 absorbed by 500 trees in a year. They have plans for more plants with a goal to remove 500,000 metric tons of CO2 by the end of this decade. They have a facility planned for Texas that will capture up to 1 million metric tons per year and use it to help pump oil.”

Right in the middle of all the natural beauty surrounding the Hengill Volcano, in southwestern Iceland, sits a CO2 capture machine, called the Orca plant. It is a carbon capture and storage (CCS) unit and considered a "direct air carbon capture facility".

It literally sucks CO2 out of the air, with fans also called metal collectors, like a giant vacuum cleaner. This airflow is passed through chemical filters where the CO2 is captured in just 2 to 4 hours. Then the airflow is halted, and the chemical filters are heated to ~100°C (*Celsius*), where the CO2, dissolved in water, is injected into the ground where it reacts with the natural volcanic rock formation, basalt, that surrounds the plant.

Since the carbonated water is denser than the surrounding water it sinks once it's injected, and the resultant reaction releases elements such as magnesium, calcium, and iron, which combine with the dissolved carbon

dioxide, filling the empty spaces of the volcanic rock. In this state it can remain stable for thousands of years, making it an ideal geological storage receptacle.

Because of the high temperature needed for this process, the Orca plant requires a lot of energy, but that is not a problem in Iceland, where geothermal power is abundant. But it could become a challenge to scale globally. To some, CCS technology sounds like the perfect solution, but it remains highly controversial, and not just because of the amount of energy it needs. Its critics say the world should be aiming for zero emissions, not net zero.

Scientific consensus is pretty clear: some level of carbon capture will soon become necessary. The Intergovernmental Panel on Climate Change (IPCC) has estimated that even if emissions decline dramatically, to keep temperature increases below 2°C will require the

removal of between 10 billion and 20 billion tons of CO2 every year until 2100. The IPCC's latest report showed that the world needs to cut greenhouse gas emissions in half over the next decade and achieve net zero by 2050 to have any chance of keeping global warming to 1.5°C above pre-industrial levels.

Opponents of CCS argue the technology is simply another way for the fossil fuel industry to delay its inevitable demise. According to a database compiled by the Global CCS Institute, a pro-CCS think tank, an overwhelming majority of the world's 89 CCS projects currently in operation, being built, or in advanced stages of development are operated by oil, gas and coal companies.

One remaining risk in this technology is the impact that storing the carbon may have on the Earth, or at least its immediate environment. In its special report on carbon capture and storage, the IPCC said that by far the biggest risk comes from potential leaks. A sudden and large release of CO2 would be extremely dangerous. In the air, a CO2 concentration of around 10% is deadly, but even much lower levels can cause health issues.

Did You Know?



“That Nooshin Behroyan, a single mother of two, broke into “Energy’s Old Boy’s Club” and established Paxon Energy & Infrastructure, a California-based energy services company, into a Powerhouse.



She set out to level the playing field – giving women, minorities, and veterans more opportunities and in under 3 years her company has grown into America’s #9 fastest growing company - focused on improving critical infrastructures in the oil, gas, and utilities



Don’t fall for utility scams Duke warns - nearly 4,000 customers have been targeted in 2021.

That **Duke Energy is warning its customers ... don’t fall for utility scams.** Nearly 4,000 customers have been targeted by scammers so far this year. **“If you get a threatening call, an urgent call that you got to pay your bill now or your power is going to get cut off, hang up the call. Call the number on your bill or look it up on our website. Do not trust what you’re seeing on the caller ID. That’s one of the ways they try to hoodwink you,”** said Bill Norton, of Duke Energy Corporate Communications. Five years ago, 9% of customers were falling for scams. Today, that number is down to less than 4% but Duke Energy said that’s still too high.



New standard for PSPS (Public Safety Power Shut-off)

That in **Southern California, a forecast of 31-mile-per-hour sustained winds or 46 mile-per-hour wind gusts in high-fire danger areas will trigger a PSPS (Public Safety Power Shut-off) and the power company can cut-off power to the affected area(s). This typically occurs about 8 times a year during the “Santa Ana winds” timeframe.** In years past, wind gusts had to reach 92-miles-per-hour to trigger a PSPS, but after many deadly and disastrous fires, the state decided to let the power companies set the standard – thus the change.



FERC’s analysis Texas Freeze recommends 28 fixes for the grid, and also determined that natural gas failed 1st, which made the event worse because the fuel supply was cut-off to the plants that could operate. If plants had been properly weatherized, 67% of the outages could have been prevented.

That **Federal Energy Regulatory Commission (FERC) has released its final report analyzing what went wrong during the 2021 February Texas Freeze. Their analysis lays out 28 recommendations to fix the grid.** Some have already been mandated by the Texas legislature, but others fall short of what FERC is recommending. **Their analysis determined that natural gas failed 1st, which made the power failures even worse because the fuel supply was cut-off to the plants that could operate, in addition to the power plants that had failed. That sequence is important because the natural gas industry said the natural gas production dropped because of the power outages. In fact, it’s the other way around.** Texas lawmakers have passed legislation requiring power generators to weatherize, but they failed to mandate the gas producers to do the same. What good does it do for the natural gas plants to be weatherized if they can’t get fuel? FERC’s report presses Texas state agencies and lawmakers to find a way on how they could enforce gas producers to winterize by the winter of 2022. Other recommendations include compensation for generators and producers who weatherize, and also exploring how Texas could connect to two of the three major power grids in the U.S. However, should Texas decide to tap into its neighbors’ grids, that’s a process that could take more than 20 years to build. **The report also makes clear that if generators were properly weatherized, 67% of the outages - during that timeframe - could have been prevented.**

FERC - Enhanced Scrutiny of Greenhouse Emissions for Applications



“FERC Chairman Glick recently indicated that the commission would strengthen its scrutiny of greenhouse gas emissions when evaluating certificate applications for interstate natural gas projects, in accordance with the Natural Gas Act (NGA) and National Environmental Policy Act (NEPA). Two recent decisions by the U.S. Court of Appeals for the District of Columbia Circuit in which the court either vacated or remanded previous authorization of natural gas projects by FERC, due to insufficient analysis of greenhouse gas emissions and environmental justice impacts.”

Richard Glick, Chairman of the Federal Energy Regulatory Commission (**FERC**) since his appointment by President Biden on January 21, 2021, has indicated in a letter that the commission would strengthen its scrutiny of greenhouse gas emissions when evaluating certificate applications for interstate natural gas projects.

This letter was written in response to Senator John Barrasso (**WY**), a ranking member of the Senate Energy and Natural Resources Committee, questions concerning the FERC's handling of its responsibilities under the Natural Gas Act (**NGA**) and National Environmental Policy Act (**NEPA**).

Chairman Glick defended FERC's process for assessing certificate applications for authorization of natural gas projects, and he reiterated his long-held position that the commission in recent years had inadequately satisfied its obligations under the NGA and NEPA to evaluate the "reasonably foreseeable" upstream and downstream greenhouse gas emissions of such projects when determining whether to authorize them.

Chairman Glick cited two recent decisions by the U.S. Court of Appeals for the District of Columbia Circuit in which the court

either vacated or remanded previous authorization of natural gas projects by FERC, due to insufficient analysis of greenhouse gas emissions and environmental justice impacts. He noted that he has directed the commission staff to conduct additional analysis of the environmental documents submitted along with certificate applications to ensure that FERC orders on them are "legally durable documents" on which natural gas developers could rely. Conceding that these developers had a justified interest in receiving a prompt decision from FERC on their certificate applications, Chairman Glick observed that he had joined the majority of his fellow commissioners in approving certificates to gas projects that presented relatively little legal risk, even where he had individual reservations about the environmental analysis underlying the projects. He opined that this approach appropriately balanced FERC's statutory obligations with developers' interest in receiving a prompt decision.

Chairman Glick also noted that these discrete adjudications are occurring while FERC is simultaneously exploring a more generalized – and definitive – policy change in this arena. In February 2021, FERC issued a

a notice of inquiry (**NOI**) seeking information and comments from stakeholders on whether it should revise its 1999 policy statement on certifying new interstate natural gas transportation facilities. Although the 1999 policy statement had identified a project's environmental effects as one of several factors that FERC would consider when assessing certificate applications, the February 2021 NOI asks whether the commission should broaden the scope of that analysis, including the possible effect that a given project would have on historically marginalized "environmental justice communities." Although the comment period on this NOI was closed on May 26, 2021, FERC has yet to act on it.

Chairman Glick's letter strongly suggests that he will continue to prioritize this issue during his tenure. With the commission's membership currently divided evenly between two Democrats (**Glick and Allison Clements**) and two Republicans (**James Danly and Mark Christie**), how proactive FERC will be in this area will likely depend on whether President Joe Biden's recent nominee to the commission, Willie L. Phillips Jr., is approved by the Senate and, if so, whether he will be as forceful on this issue as Chairman Glick.



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After one year of service as GTTSi Vice-President, Clay Schile has delivered. Perhaps you have seen our new website, as one example - his technical background and leadership experience is reflected in its modern update. He worked closely with the GTTSi Staff during our weekly Staff Meetings, overseeing the project and supported our Technical Specialist, Ms. Chrissy Mulay, who served as the Project Manager for its overhaul.

Clay, a Professional Engineer, retired from General Electric (GE) after 24 years of service was inducted into the Gas Turbine Testing "Hall of Fame" for his career contributions to testing GE engines. His technical skills and experiences at GE are invaluable to GTTSi as our industry transitions from fossil fuels to renewables and nuclear.

Clay, also a member of the American Nuclear Society (ANS) and the Society of Flight Test Engineers (SFTE) has applied their organizational best practices to GTTSi, and it has added great value to our Staff and Team Members – working all across the country.

If you find yourself in close proximity to Seneca, SC please stop by and give us a visit. We would love to share with you our vision for the future and how GTTSi can help lead our industry's transition from fossil fuels to renewables and nuclear.



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