a Publication of GDS Associates, Inc.

# TRANSACTIONS

2021 Q3

## *resiliency of the* ELECTRIC DISTRIBUTION GRID

***Our society is heavily reliant on electricity and plans for sustainable energy have put more emphasis on the electric distribution grid to provide reliable power to retail customers.*** The electric grid of the near future will need to deliver additional power for electric vehicle charging, provide a reliable platform for distributed energy resources to help replace fossil fuel dependence, and continue to provide increased connectivity for the Internet of Things (IOT). All of these things are heavily dependent on a continuous and reliable supply of electricity.

Today's electric grid is really pretty reliable. National surveys of utility reliability statistics by IEEE and NRECA shown that the average duration of an outage is only 90 minutes and, on average, customers experience only one outage per year. Said another way, power is available to customers 99.98% of the time in any given year.

## GDS ASSOCIATES

*has expanded to **California**!*

**WE ARE EXCITED TO ANNOUNCE THAT**

**Donald Tretheway,**
*Managing Director*

*and*

**Perry Servedio,**
*Senior Project Consultant*

**have joined our West Coast Team**
*and we are ready to serve*
***California and the surrounding West Coast area***

## LOOK FOR US

**Upcoming Conferences**

**OCTOBER 8**
***Local Energy Solutions Conference***
Concord, NH

**OCTOBER 13-15**
***NASEO Annual Meeting***
Portland, ME

**OCTOBER 17**
***APPA Legal & Regulatory Conference***
Savannah, GA

**NOVEMBER 10-12**
***NREDA Annual Conference***
Louisville, KY

## UPCOMING WEBINARS

**OCTOBER 12**
*Multi-Circuit Design Considerations*

**NOVEMBER 9**
*Methods for Improving Reliability*

**DECEMBER 7**
*Motor Starting*

***Note** All webinars are recorded & available for viewing post-presentation*

***But there remains a continued focus on resiliency in the electric industry – which is the ability to prepare for and adapt to changing conditions as well as withstand and recover rapidly from disruptions.*** Resiliency goes beyond an occasional power outage, but rather concentrates on major disruptions that can affect an entire community or region. Hurricane Ida is a more recent reminder of how vulnerable the electric grid is to a major storm event, but major disruptions can also include tornadoes, wildfires, floods, and ice storms. Some studies suggest Climate Change is increasing the frequency and severity of these events, but at a minimum, as populations continue to grow then more and more people are impacted by these major disruptions.

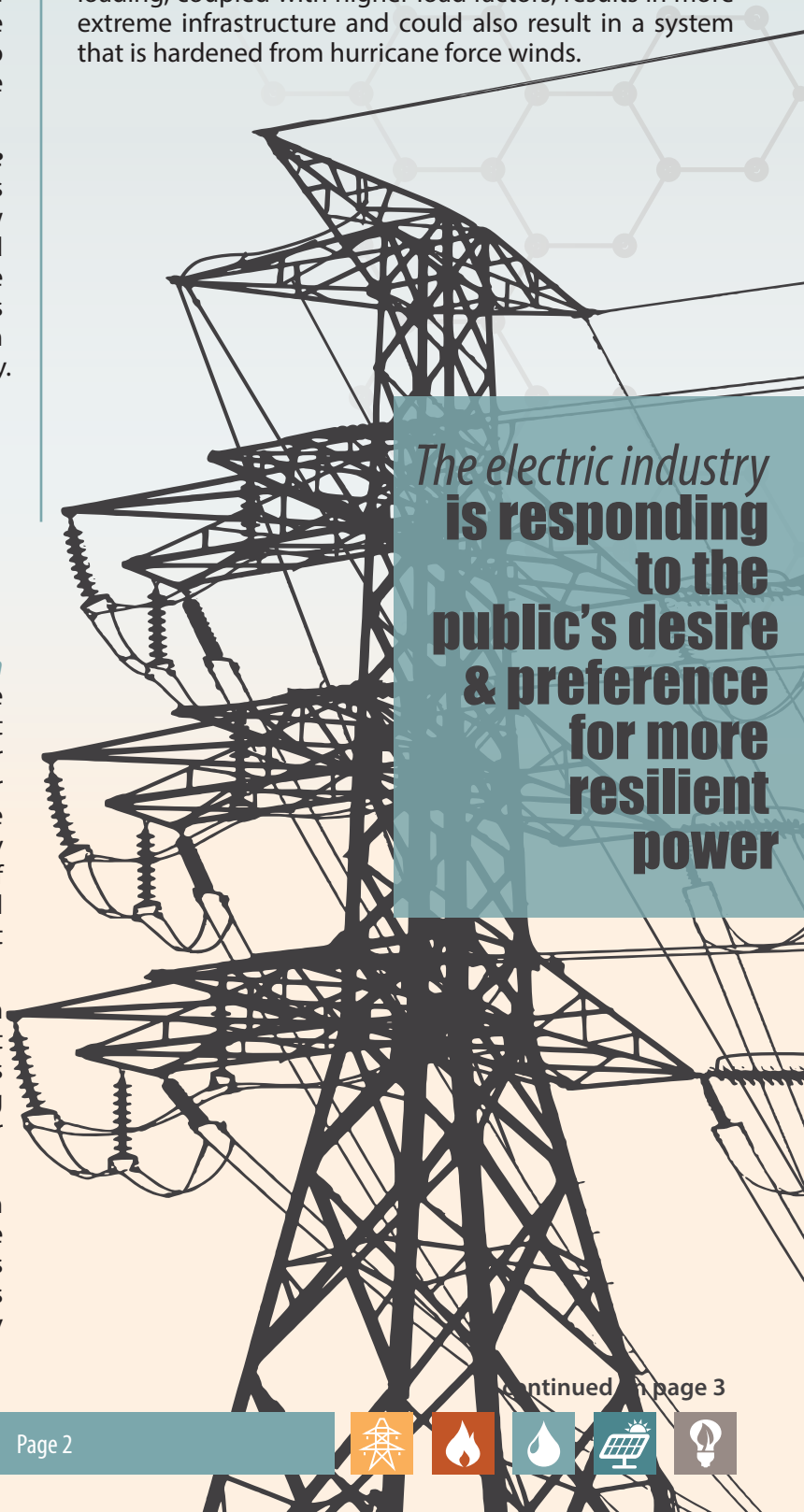
***The electric industry is responding to the public's desire and preference for more resilient power.*** One way this has been expressed is by the increasing frequency of new rules from regulatory agencies based on studies and recommendations from successive White House administrations. It can also be seen in the media headlines following catastrophic events where the hardships from lack of electric power can hamper a community's recovery.

## *How Are Electric Utilities Responding*
# & WHAT MEASURES ARE BEING USED TO MAKE THEIR ELECTRIC SYSTEMS MORE RESILIENT?

***A first step in the process is developing a resiliency plan which includes:*** (1) a vulnerability assessment, such as the likelihood of adverse climate events, (2) the thresholds at which conditions are likely to affect important assets or overall system performance, and (3) the costs or consequences of those adverse climate impacts. The resiliency plan prioritizes a set of actions or resiliency measures to mitigate critical vulnerabilities. The range of measures often include, system hardening to limit initial damage to the system and utilization of techniques that allow for quick restoration and system recovery.

Currently, utilities on the west coast are hyper focused on the impacts caused by wildfires. In general, southeast utilities focus on hurricane impacts and mid-west utilities focus on tornadoes and ice storms. These varying disruption events require different strategies for hardening and different strategies for recovery.

Some common strategies include storm hardening. Storm hardening goes beyond the strength requirements of the National Electrical Safety Code (NESC) that provides performance requirements for the pole strength that is considered safe for the protection of the public and utility workers. Unfortunately, the NESC is not focused on hardening nor resiliency, but rather safety codes. Utilities often will employ higher load (strength) factors such as using Grade B construction for the distribution lines similar to transmission lines. In Florida, many of the electric utilities are using the 50 year mean recurrence internal for three second wind gusts (also known as the extreme wind map in the 2017 NESC) for developing specific loading of distribution poles. Using this increase loading, coupled with higher load factors, results in more extreme infrastructure and could also result in a system that is hardened from hurricane force winds.



*The electric industry* **is responding to the public's desire & preference for more resilient power**

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Another storm hardening strategy is to identify critical poles on a feeder system. These would include the first pole outside a substation and poles supporting three-phase reclosers or normal-open switch poles. Loss of these critical poles can result in longer outages and outages affecting more customers due to the impact of more than one zone of protection. Along these same lines, the use of fiberglass arms can be employed because they have a greater strength than wood crossarms. Then those crossarms, and the supported power lines, may be less likely to break during ice storms or when trees fall on the power lines.

Select undergrounding of electric lines is being used within some communities, but this option comes with significant costs and a perception of improved aesthetics for some customers over other customers. In the District of Columbia, Pepco is undertaking a PSC approved project, referred to as "DC Plug", which has an ambitious goal to underground the primary lines to roughly 30,000 retail customers. Florida Power & Light recently received approval for their Storm Hardening Plan which includes a $10 billion / 10-year program for undergrounding laterals to feeders.

In the West, hardening measures include deployment of non-flammable poles. For wildfire mitigation, the utilities are also taking a more aggressive stance of vegetation management with the concern of falling trees or limbs causing power lines to fall and potentially spark a fire. The use of current limiting fuses is also a consideration to reduce sparks from traditional open cut out fuses. Another common mitigation measure is to change the overcurrent protection scheme from a multiple reclose methodology to a single reclose scheme. Multiple reclosing has been used from many decades to maintain system reliability from animal caused outages and from some vegetation caused outages. Using a single reclose scheme results in more sustained outages but may reduce the likelihood of fire caused by multiple re-energizing of power lines that may be on the ground.

Resiliency of a distribution system is very dependent on the transmission grid and central power sources. If the weather event adversely affects the transmission lines or generation facilities, the distribution system cannot provide power to the end use customer. A helpful mitigation strategy is the use of microgrids and/or distributed generation. These energy sources typically will not have the capacity to restore power to the entire grid. However, ***a strategically placed microgrid could provide power to critical community infrastructure such as emergency infrastructure (i.e. hospitals, fire stations, police, etc.) but also to grocery stores, pharmacies, banks, gas stations, and potential emergency lodging.*** This type of deployment can provide critical services to the community as the utility focuses on permanent restoration of the distribution grid.

It is important to recognize the profound changes in the grid from technology enhancements such as Smart Grid, self-healing systems, and greater visibility of the distribution grid from utility control centers. These technologies improve real-time monitoring of the system and provide faster, more precise outage location information that can speed restoration and improve resiliency.

***Improving resiliency for our community/service areas starts with a vulnerability assessment followed by a resiliency plan.*** These plans need to develop a priority for strategies unique to the utility along with the appropriate benefits and justified cost for the utility's stakeholders/retail customers. ■

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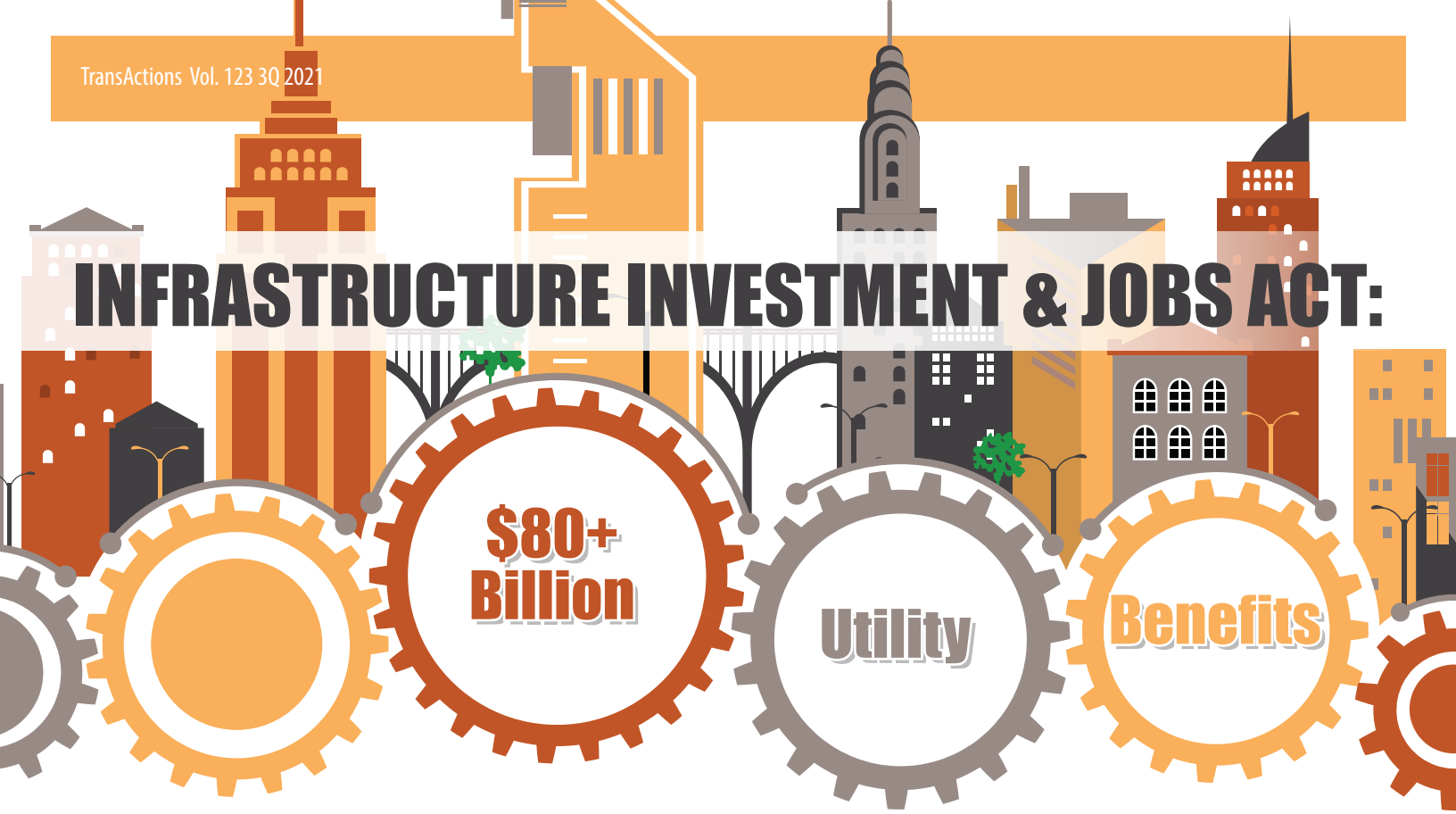
**could provide power to critical community infrastructure such as emergency infrastructure (i.e. hospitals, fire stations, police, etc.) but also to grocery stores, pharmacies, banks, gas stations, and potential emergency lodging.**

For more information or to comment on this article, please contact:
**Kevin Mara,** *Principal*
GDS Associates, Inc. - Marietta, GA
770-799-2381 or
kevin.mara@gdsassociates.com

# INFRASTRUCTURE INVESTMENT & JOBS ACT:




Recently, the United States Congress has been drafting the Infrastructure Investment and Jobs Act (H.R. 3684) and depending on the final version of the bill, there will be potential impacts and benefits for electric utilities. ***The Act contains over $80 billion in funding for energy programs that directly or indirectly will benefit the utility industry, the majority of which is to be expended between 2022 and 2026.*** The bill contains substantial funding for various portions of the electric utility industry to support transforming the energy sector towards a net-zero carbon future, including:

- ***Grid infrastructure and Resiliency***
- ***Clean Energy Supply Chains***
- ***Fuels & technology Infrastructure***
- ***Energy Efficiency***
- ***Nuclear Energy***
- ***Hydropower***
- ***Energy Storage***

Also of interest is the legislation's provisions for electric vehicle charging infrastructure, public transportation, and clean school bus programs.

## STATUS

With bipartisan support, the US Senate passed the $1 trillion infrastructure bill on August 10th, known as the "Infrastructure Investment and Jobs Act" (Act). The legislation is now in the House of Representatives where it is expected to be passed by September 27th. It's too early to determine what the final bill will be, but here is a general summary of items in the current draft legislation that are related to the electric industry.

**$16.5 Billion** for Transmission,
**$1.3 Billion** Small Utility Programs
**$9.2 Billion** for Nuclear Energy
**$9.5 Billion** for Hydrogen
**$6.9 Billion** for Battery
**$13.0 Billion** for Carbon Capture
**$6.0 Billion** for Energy Efficiency
**$1.6 billion** for Cyber Security
**$7.5 Billion** for EV Charging

## SMALL UTILITY PROGRAMS

The Act recognizes the importance of supporting smaller electric utilities which can struggle with funding large infrastructure projects. The Act allocates $1.0 billion to rural or remote areas, defined as having a population of less than 10,000 inhabitants, for the funding of cost-effectiveness of energy generation, transmission or distribution systems siting/upgrades, greenhouse gas emission reduction, electric generation modernization, microgrid development, and energy efficiency. The legislation allocates 30% of the transmission infrastructure funding to utilities that have less than 4,000,000 MWh in annual sales. There is also $250 million allocated to small utilities for cyber security program funding.

## TRANSMISSION

The legislation includes significant transmission policy changes and funding, targeting the problems revealed in litigation of transmission siting that has occurred over the last several years. The bill attempts to fix the federal backstop authority in siting interstate transmission, allowing the federal government to override state-level permitting and establish designate transmission corridors based on current and projected transmission congestion. The nation's aging transmission grid will need large investments if the US is going to achieve a net-zero carbon future by 2050. The Act includes $10.0 billion for

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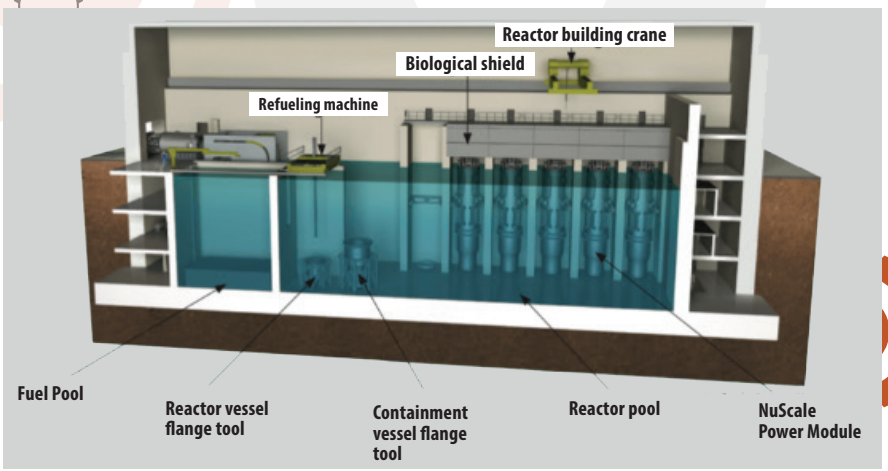
improvements in transmission systems to reduce outages and improve resiliency. There is $1.0 billion targeted to rural and remote areas for transmission and distribution system improvement, including micro grids, increasing energy efficiency, and reducing greenhouse gas emissions. The Act includes $2.5 billion to facilitate the construction of transmission lines and related facilities. The Act also includes $3.0 billion of funding for technologies which enhance electric grid flexibility.

## NUCLEAR POWER

Nuclear power is a zero-carbon source of electric production and will be a key component of net-zero carbon power generation portfolios. Cheap natural gas generation has placed market pressures on nuclear plants which has led to nuclear plant closures over the last several years. The closure of nuclear plants and replacement with natural gas generation has caused an increase in greenhouse gas emissions. In an effort to stem the closure of nuclear plants, the Act includes a $6.0 billion Nuclear Credit Program to prevent future closure of nuclear plants caused by economic factors. Nuclear power also has the potential to play a role in reducing the cost of hydrogen production and is included in the technologies eligible for funding through the fuels and technology infrastructure, and the clean energy demonstration programs portions of the legislation. Last, the legislation includes over $3.2 billion in funds for advanced reactor programs.

**Figure 1.** ***NuScale Small Modular Reactor***




## HYDROGEN

A net-zero carbon electric industry future will require a flexible, clean, and affordable fuel to ensure our electric grid remains reliable. Leading energy officials and scientists see hydrogen as a possible answer for the utility industry because many of the current power generation plants can be converted to burn hydrogen. In addition, as renewable resources grow, hydrogen could become a viable alternative to batteries for storing excess renewable energy production for use during other periods. The problem is net-zero carbon hydrogen production, also called green hydrogen, is expensive to produce, lacks transportation infrastructure, and storage. Because current demand for green hydrogen is low, investment in green hydrogen technology and large-scale projects is lacking. The Act includes $8.0 billion to establish four regional clean hydrogen hubs to demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen. There is $1.0 billion targeted toward improving electrolyzer efficiency R&D, demonstration, commercialization, and deployment. Another $500 million is targeted toward advanced clean hydrogen manufacturing and recycling research/development.

## BATTERY MANUFACTURING AND RECYCLING

Battery technology and availability of critical materials is a critical issue for competitiveness of US industries. Utility scale battery storage is necessary to accomplish any net-zero carbon energy future. The June 2021 White House report, "Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth" identified the need to establish a resilient supply chain for critical materials to ensure US is able to secure critical rare earth metals for use in manufacturing parts, equipment and systems. Lithium Ion used in much of the utility scale battery systems, is a good example of a rare earth metal which will be in short supply, with projected growth of 4,000% by 2040. The act includes $627 million to establish rare earth demonstration facility, mapping of rare earth resources in the US, and research. The Act also includes programs to address lithium ion and battery recycling. One program provides $200 million to improve electric vehicle (EV) battery design, recycling, and second life applications. One potential second life application is the use of EV batteries in the utility industry for use in resiliency projects and other applications. The largest portion of battery funding included in the Act, $6.0 billion, is targeted toward battery manufacturing and recycling. The recycling effort is targeted at recovery of critical elements needed in battery manufacturing. The legislation also includes $505 million for energy storage demonstration projects.

## CARBON CAPTURE UTILIZATION & STORAGE

The technology to extract carbon dioxide from power plant or industrial process emissions has been around since the 1930's. The process results in creating almost pure C02 that then must be transported and stored. The

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problem is where to place all the potential CO2 that could be removed from power and industrial processes and how to get it there. The Act includes $12.0 billion of funding for various programs associated with carbon capture, utilization, and storage. Part of the incentive package includes funds ($350 million) for procuring products derived from captured carbon. There is $3.5 billion for establishing regional hubs for direct air CO2 capture and $2.5 billion for carbon storage and validation. The Act includes $2.1 billion for Carbon Dioxide Transportation Infrastructure and Innovation program (CIFIA). The CIFIA program provides low interest loans for development of CO2 transportation systems. The Act also includes $4.4 billion for carbon capture demonstration projects.

**Figure 1.** ***The Climeworks direct carbon capture plant in Switzerland removes carbon dioxide from ambient air.***

## CYBERSECURITY

The Act recognizes the importance of cybersecurity in protecting the US electric infrastructure from cyber-attacks. The legislation includes provisions for establishing self-assessment and auditing methods, establishing testing processes for cybersecurity products, technical assistance to utilities, and cyber-attack response and recovery funding. It establishes a $1.0 billion grant program to fund state and local governments to assess cybersecurity risks. It also includes $100 million Cyber Response and Recovery Fund that can be used for reimbursement and technical assistance associated with cyber-attacks.

## ELECTRIC VEHICLE CHARGING

Electric vehicle charging infrastructure is an important component for increasing the penetration of electric vehicles (EV) into the US automotive marketplace. The Act includes $2.5 billion grant program to strategically deploy publicly available EV charging stations in designated alternative fuel corridors and local community accessible areas. There is another $5.0 billion for the Department of Transportation to deploy additional charging stations in designated alternative fuel corridors. This funding is going to directly impact the electric utility industry because of the need to provide electric service to the charging stations. Public charging stations in designated alternative fuel corridors are likely to be Level 3 DC rapid charger which can draw up to 400 kW per vehicle. If these charging stations are designed to serve at least 2-4 vehicles, the load could reach 1.2 MW per charging station or more at those locations.

## NEXT STEPS

In addition to approving the Act legislation, the House is also working on $3.5 trillion budget framework that includes programs of importance to the electric utility industry. Between these two legislative packages, there could be major changes in policies on climate and clean energy programs. Once all the legislation is passed into law, the various federal departments will need to turn the various legislation provisions into programs for implementation. Its good for electric utilities to follow the legislation activities because of the impact on various aspects of the business model. It is helpful to consider developing strategies regarding various facets of the legislation and the potential benefits that could be obtained for electric utilities retail customers. ■

For more information or to comment on this article, please contact:

**Rich Polich,** *Managing Director*
GDS Associates, Inc. - Marietta, GA
770-799-2453 or
rich.polich@gdsassociates.com