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Reconducting Existing Transmission Lines Enables Low-Cost Grid Decarbonization

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To support decarbonization mandates in the U.S., many utilities and transco's have proposed new transmission lines to link load centers with new renewable generation assets and move power from one region to another over vast distances. While the U.S. government continues to struggle to find ways to streamline the interstate permitting process, many U.S. utilities are busy increasing the capacity and efficiency of existing transmission and sub-transmission lines using advanced conductors.

With a near term mandate to decrease carbon emissions by 57% from 2019 levels by 2030 – less than eight years from now – utilities are scrambling. The U.S. DOE projects that the grid will need to accommodate 60% more capacity by 2030 and as much as 300% more capacity by 2050. These challenges are not insignificant, and many transmission planners, engineers and policy makers are realizing that we can no longer use dated / legacy technology to accomplish this daunting task.

While a number of utilities have begun using various Grid Enhancing Technologies (“GETs”) such as

Dynamic Line Rating Systems, Load Flow Controllers, and Topology Optimization Software, they have also begun using Advanced Conductors (also considered a ‘GET’) to increase the capacity of their existing transmission corridors by 50 to 150% (supported by substation upgrades, when required). This class of conductors allows utilities to increase existing



ACCC Conductor

corridor capacity using existing structures – which minimizes environmental impact, reduces permitting challenges, and substantially reduces project costs and construction timeframes.

While Advanced Conductors were designed to carry more current and reduce thermal sag, their lighter weight composite cores also allow incorporation of up to 30% more conductive aluminum which reduces electrical resistance and associated line losses under any load flow condition.

Reducing line losses not only helps squeak more power out of existing generation assets, it can also reduce fuel consumption and associated GHG emissions. While ‘technical’ transmission losses in North America are relatively small (~6%), compared to many other countries (as much as 30% - not including ‘commercial’ losses), reducing technical losses by 25 to 40% or more is highly beneficial.

A paper, *“The Climate Mitigation Opportunity Behind Global Power Transmission and Distribution,”* written by Kavita Surana and Sarah M. Jordaan (University of Maryland and John Hopkins University), published in Nature Climate Change (September 2019), attributed nearly one billion metric tons of CO₂ ‘equivalents’ per year with T&D losses. The paper suggested that reducing T&D losses would not only reduce GHG emissions, it would also help consumers access more power from cleaner generation assets.

In a recent (March 2022) Grid Strategies Report *“Advanced Conductors on Existing Transmission Corridors to Accelerate Low-Cost Grid Decarbonization,”* Grid Strategies acknowledged that Advanced Conductors are not widely deployed in the United States “due to outdated transmission planning practices and outmoded economic incentives, among other barriers.” However, the report provided a number of specific recommendations that address institutional and regulatory barriers preventing faster adoption of reconductoring as a decarbonization strategy. To remove some of these barriers the report suggested specific actions that should ‘expeditiously’ be taken by FERC, DOE, Utility Planners, and State Regulators.

These recommendations include: Expansion of planning scenarios to consider the possibility of unforeseen future renewable generation assets; The establishment of transmission conductor efficiency standards; Consideration of Advanced Conductors as a priority for select Power Marketing Administration (PMA)



AEP 345 kV ACCC Reconductor Project

projects and for other projects which DOE supports via grants, loans, or other financing mechanisms; and, Shifting project evaluations by utilities and regulatory authorities from “least cost” to “maximum net benefits” when reviewing project options.

Grid Strategies reported that over 200,000 miles of transmission lines in the U.S. are over 50 years old and will need to be replaced over the next ten years. They suggested that if only 25% of these lines were reconductored with high-efficiency Advanced Conductors then at least 270 Gigawatts (GW) of zero-carbon generating capacity could be interconnected during that period just from the increased capacity enabled by the reconductoring. The report estimated that this increase in renewable capacity over that period would reduce power sector CO₂ emissions by approximately 2.4 billion metric tons - equivalent to immediately retiring 22 large base-loaded coal-fired power plants. The energy savings from the added transmission capacity would also save consumers at least \$140 billion dollars.



SCE Big Creek Reconductor project



SCE Big Creek Reconductor Project with ACCC Conductor

Here is an example of how effective reconductoring can be: In 2019, Southern California Edison (SCE) sought to increase the capacity of their double-circuit 230-kV Rector to Vestal transmission lines and their adjacent 230-kV Vestal to Magunden transmission lines in the Big Creek Transmission Corridor linked to the Big Creek

Hydroelectric Project. SCE's goal was to increase line capacity from 936 amps to 1,520 amps to access more clean energy and improve grid reliability. SCE selected the ACCC[®] Conductor which allowed them to increase line capacity without the need to replace existing structures. The use of this technology also mitigated sag violations. In this case, reconductoring with an Advanced Conductor reduced construction time from an estimated 48 months to 18 months - which freed-up crews and equipment for other reconductoring projects that SCE continues to work on. It also saved consumers an estimated \$85 million dollars compared to the cost of rebuilding with new structures and conventional steel reinforced ACSR conductor.

In 2016, American Electric Power (AEP) selected an Advanced Conductor to help double the capacity of two parallel 120 circuit mile 345 kV transmission lines in the Lower Rio Grande Valley in Texas. In this case, the use of doubled bundled Drake size ACCC[®] Conductor not only allowed them to use existing structures - *and secure project approval on the day their project was submitted* - the use of this Advanced Conductor technology also reduced line losses by ~300,000 MWh per year (at a very low load factor of 34%). Based on the average CO₂ emissions from all combined sources of generation in Texas at that time, that equated to a reduction of CO₂ emissions by ~200,000 metric tons, while also freeing up 34 MW of generation capacity.

The reconductoring formula is highly effective and pays for itself many times over. While policy changes in the U.S. should encourage more utilities to leverage Advanced Conductors, technophobia may still be an issue. After all, utilities are highly risk adverse - and for good reason.

The good news is that, in the case of the ACCC[®] Conductor, nearly 1,100 projects ranging from 11 kV to 1,100 kV have already been completed successfully by more than 250 utilities in 61 countries in every imaginable environmental condition and terrain. And, as of this date, there are an additional 100+ ACCC installations underway and/or in the queue. It's also noteworthy that optical fibers are now embedded in the ACCC Conductor's hybrid carbon fiber core that allow linemen to confirm core integrity before, during and after the conductor is installed. This technology - and 15+ years of extensive testing - not only inspires confidence, it also paves the way for future technical innovation. And isn't that what it's all about?

COST EFFICIENT SOLUTION FOR A MODERN GRID

Reconductoring with ACCC® Conductor can double the capacity of your existing grid without the need to replace or modify existing structures.

Lowest Cost Solution to:

- Mitigate Sag Violations
- Increase Line Capacity
- Reduce Line Losses
- Resolve Project Challenges

Now Available with the InfoCore™ System

Track and verify core integrity every step of the way. Providing fast and effective confirmation of successful installation

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