

High Voltage Transmissions Lines in Henderson County: Can They be Put Underground?

1) Effect of Current Proposed Transmission Line Project on Henderson County (see *Appendix A* for Project Details)

Henderson County, although only 70th of the state's 100 counties in size (at 106,740 acres), is 15th among all 100 counties in the amount of money that tourists spend in each county. Henderson County's main attraction is its scenic beauty and the availability of outdoor activities. In addition Henderson County produces 65% of the state's apple crop, which also draws tourists. The scenery, accommodations, agricultural retail locations, and outdoor activity opportunities are spread throughout the county and are not centralized in any one location. More recently the addition of wineries, breweries, and upcoming cider facilities, located in scenic rural locations, are having a positive impact on both tourism and the local economy. In addition our local produce, most notably apples, are sold to the public at produce stands and local orchards scattered throughout the county. Tourism and apple growing are inextricably intertwined. Tourists come to our beautiful county to purchase apples in the fall. They come in the spring for apple blossom season. Indeed the county's Tourism Development Authority promotes an Apple Blossom Tour and an Apple Harvest Trail. The North Carolina Apple Festival, held each year on Labor Day weekend, drew nearly a quarter million people in 2014, three-quarters of them from out of the area¹. Henderson County's economy is composed of four basic components: Industrial/Manufacturing, Tourism, Commercial, and Agriculture, in that order. Two (and perhaps three) of the four are threatened by the prospect of enormous transmission towers running through the county from one end to the other.

The installation of large numbers (5 towers for every mile) of extremely tall (on average twice as tall as the tallest building in Hendersonville), will decimate the scenic character of the county which is the basis of the county's attraction to tourists. This is in addition to the negative effect on landowners whose property values will plummet if their land is located under or near the proposed high voltage lines. Farmers, particularly apple growers, could see their orchards bisected by transmission towers in ways that negate the economic viability of their entire orchard.

2) Duke Dismisses the Concept of Using Underground Lines

Duke has held three meetings in the local area all of which were attended by large crowds. People attending were extremely concerned. The suggestion has been made many times that the line should be buried along Interstate 26 on the state right of way. I-26 runs close to both the Asheville Power Plant and Campobello. Planning is currently underway for I-26 widening in Buncombe and Henderson Counties.

¹ <http://www.goupstate.com/article/20131029/ENT/131029650>

Duke's response to the question of putting the line underground² is:

“After we establish the preferred transmission routes, we expect to evaluate the option of an underground transmission alternative. However, based on past evaluations, underground transmission lines have not proven to be better than overhead transmission lines because of extremely high cost and environmental concerns.”

Surely the evaluation of one or more feasible underground routes should be made at the same time as evaluating the overhead route choices. It seems quite unlikely that a route chosen as the best for overhead line usage would de facto be the best for an underground route as well. For example an overhead route may be inappropriate next to I-26 and more appropriate over a granite mountain, but an underground route would be just the reverse. In addition, as we detail below, several underground transmission projects are in process for lines longer than Duke's planned line. Some have already been completed. These show that such a project is feasible.

Duke further responds that underground lines take too long to repair:

“Because a transmission outage can affect a significant number of customers, some customers could experience power interruptions for one to two weeks while a fault is repaired.”

This might be relevant if this line was providing power to Henderson County. But with the gas plant and solar installation providing about double the generating power we currently have it's clear that the power being transported will be going from Asheville to South Carolina and perhaps even on to other states. Perhaps if the new gas plant is knocked out of service, then this line might be called upon to “improve reliability”, by serving as an alternate route, perhaps to another source of power. But it is not serving as a primary source of power, at least not to Henderson County. Furthermore, that emergency use may not even be needed, since we have two combustion turbines, which can produce 324 megawatts of peaking power and also an (unspecified) source of 400 megawatts that is currently used during times of peak demand³. We also note that underground lines are less subject to outages since they are better protected.

And, as reported from the meeting in Landrum⁴

“Jul 23, 2015 — At the Landrum meeting the question of why they aren't planning to just go alongside Routes 25 or 26 was raised to the lead environmentalist and why the pathways proposed zigzag around 'things' on the plan. The gist of his answer: a) along the roadways where DOTs already have easements Duke had approached NC and SC Departments of Transportation and were told 'no', the towers could not be installed there (don't know if they meant within their easement area or adjacent to); additionally, there are often railway tracks adjacent to interstates, making those corridors logical locations for transportation/power/communications. Railway companies were approached and said 'no'. b) same deal with State/Federal forest lands and protected areas designated as parks - already approached and said 'no'. “

This would seem to imply that they did not even ask about using the right of way for an underground line.

Duke's reasons for not considering an underground option are just not convincing, especially given the level of damage that overhead lines will do tourism, agriculture, and county property values.

² See: “Can you put the lines underground?” at: <http://www.duke-energy.com/western-carolinas-modernization/default.asp> under “Frequently Asked Questions”, “Transmission”

³ <http://www.prnewswire.com/news-releases/duke-energy-unveils-11-billion-plan-to-end-coal-era-in-asheville-nc-300085277.html>

⁴ <https://www.change.org/p/stop-the-duke-energy-western-carolinas-modernization-project/u/11487744>

3) Evaluating Underground Transmission Lines

Underground transmission lines, although mile-for-mile may be more expensive to build, could alleviate the opposition to the above ground transmission line proposed to be built in Henderson County. A likely route for the underground line would be along Interstate-26. This route could save miles of construction expense just because it is a more direct route, about 1/3 shorter, than some or all of the proposed overhead lines. Interstate-26 runs near the Asheville plant and also near Campobello, SC. However it seems under the current scheme that Duke Energy will not even consider this option. Since they intend to choose the best route for an overhead line first, and have been told they can't put an overhead line in the highway right-of-way, they are only considering other routes. Only after an overhead route is chosen will they consider the possibility of putting the line underground. But they may have already eliminated the best route to use for that purpose. Surely, this is an odd way to proceed, choosing the best route for purpose X and then see if you can do purpose Y there instead. This is particularly true when you consider that, according to Dr. Denis Imamovic, Director of Power Transmission Lines at Siemens, buried transmission lines require less than 1/10th the width of the right of way required for overhead lines⁵ and the associated towers.

Furthermore, with I-26 is scheduled for major widening in the near future, combining that project with putting the line underground may result in a savings in building an underground transmission line.

Underground high voltage lines are currently in use in the rest of the world. More are being planned.

For example:

Tokyo: A 25 mile 500kV line was buried in Tokyo in 2000, and has had zero maintenance issues.

Vermont: A part-underwater (96 miles), part underground (56 miles) line is being built in Vermont. The nominal operating voltage of the line will be approximately 300 to 320 kV, and the system will be capable of delivering 1,000 megawatts (MW) of electricity. The underground portion of the transmission line, approximately 56 miles in length, will be buried approximately four feet underground⁶ within existing public (state and town) road or railroad rights-of-way. Very short sections of the route at the Lake Champlain entry and exit points, as well as at a converter site, will be located on private land that is controlled by the line operators. (See: <http://www.necplink.com/about.php>)

New York State: A similar line, the Champlain Hudson Power Express⁷ project, is planned for 333 miles from Quebec through New York State to Queens by 2018. Many permits and approvals have already been obtained for this project.

Maine to Massachusetts: The Northeast Energy Link⁸, a 230-mile underground run from Orrington, Maine, to Tewksbury, Massachusetts.

San Francisco's Trans Bay Cable: The Trans Bay Cable between San Francisco and Pittsburg, California, is a 53 mile long cable under San Francisco Bay that transmits enough power to provide 40% of San Francisco's peak power needs. The cable can transmit 400 megawatts of power at a DC voltage of ±200 kV. This cable was completed in 2010.

⁵ <https://blogs.siemens.com/theenergyblog/stories/13542/> see: response of Dr. Denis Imamovic to Antonio

⁶ Duke is reported to have said they would need to bury the line 20 feet underground!

⁷ <http://www.chpexpress.com/>

⁸ http://www.northeastenergylink.com/technical_description/default.aspx

The **Inelfe** line connecting France and Spain was recently completed. Test transmissions are underway and line capacity will be marketed later this year. Two trenches were used totaling approximately 10 feet wide (including both of them and the space between them) and five feet deep. This 40 mile 320 kV line crosses the Pyrenees mountain range using a 5 mile long tunnel that was constructed parallel to an existing railway tunnel. The power can flow in either direction and is easily switched.

Technology for underground and underwater transmission lines has continued to advance and compatibility and costs that would apply to the Duke Western Carolinas project should be evaluated using current data rather than using obsolete cost multipliers. Siemens, the company that helped build the Inelfe line, and ABB, another major provider of underground transmission technology, both have offices and other facilities in North Carolina.

4) Cost Estimates for Underground Power Lines

Because of the above-mentioned projects (and others) there are recent comprehensive studies that have been done on the comparative costs of putting transmission lines underground. For example:

In 2012 a comprehensive study was done by the state government in the state of New Hampshire to determine “whether it is feasible to use existing transportation rights of way to serve as locations for utility infrastructure, including underground installations.” The commission’s final report⁹ concluded, among other findings, that:

- Underground transmission technology is being used extensively throughout the U.S. and internationally.
- Testimony suggests that underground corridors may increase the reliability and security of the electric transmission system.
- Testimony suggests that underground transmission facilities on appropriate State transportation rights-of-way may be technically and financially competitive with other transmission designs and locations.

It should be noted that the commission considered but did not include in the report (as outside the scope of the enacting legislation) two statements, as follows:

- Recommending legislation to require merchant electric transmission projects submit an alternative proposal using underground.
- Recommending legislation to enact a one year moratorium on any new merchant electric transmission projects.

In July of 2015, the U.S. Department of Energy issued a report regarding the proposed 187 mile Northern Pass line in New Hampshire, currently proposed as an overhead transmission line. In evaluating 9 alternative routes involving transmission line burial, the D.O.E. stated¹⁰ that the visual impact of overhead lines, which includes “large industrial-appearing lattice structures,” could negatively impact New Hampshire’s tourism and recreation. And that the proposed overhead route would likely cause the largest drop in residential property values. It has now been noted¹¹ that the New England Clean Power Line project (underground) has leapfrogged ahead in permitting of the Northern Pass project (overhead) due to the lack of controversy associated with the proposed underground route.

⁹ <http://www.briantilton.com/NorthernPass/361Commission-FinalReport113012.pdf>

¹⁰ <http://politics.concordmonitor.com/2015/07/environmental/northern-pass-report-says-burial-of-transmission-line-to-cost-between-1-8-billion-and-2-1-billion/>

¹¹ <https://www.forestsociety.org/blog-post/vermont-transmission-line-jumps-ahead>

Multiple studies have concluded that underground transmission projects, when done appropriately, cost approximately \$5.5 million¹² per mile. For example the Conservation Law Foundation reports¹³ that underground costs for various projects are:

- Champlain Hudson Power Express:¹⁴ \$5.4 million/mile (cost to be borne by private investors, not ratepayers¹⁵)
- Northeast Energy Link:¹⁶ \$5.7 million/mile (project is currently undergoing environmental review)
- New Hampshire Burial Alternate Concept for the Northern Pass project: \$5.3 million/mile. Federal Government estimates indicate that the cost of burying the line is only twice as much as using overhead lines.
- The New England Clean Power Link¹⁷ is projected to cost \$8 million/mile to bury 100 miles of underwater and 50 miles of underground 1000 MW transmission line

Thus a reasonable estimate to build the Duke Transmission line underground would be about \$192.5 million for the 35 miles of line in the state of North Carolina, about 17.5% of the total project cost. (It should also be noted that CLF, in their letter to the D.O.E on OE Docket no. PP-371, also states (p.6) that “generic cost multipliers” of 5 to 10 times as much for underground transmission costs compared to overhead transmission costs “are of very little value” and that DOE “should not rely on them”.) Although cost estimates are specific to particular projects these estimates indicate that underground transmission costs have decreased significantly and are worth investigating for this specific project. It should be noted that the length of the proposed Duke transmission line may require cost evaluation of both an AC line and a DC line so that the two can be compared.

Contrary to the statement made¹⁸ by Tom Williams, Duke Energy’s Director of External Relations, Duke does have experience installing lines underground. An article¹⁹ in the trade journal Transmission and Distribution World October 9, 2013 details Duke’s first²⁰ underground transmission line installation which took place at the Cape Fear River and was completed in 2013. The article, written by two of Duke’s senior engineers, both registered as Professional Engineers in North Carolina, details the installation and maintenance plans for the underground transmission line. This line, the Barnard Creek-Town Creek 230-kV underground line, is the same voltage as the line now proposed to be run overhead through Henderson County. The article notes:

- “Although the cost estimates for the underground crossing were marginally higher, overhead concerns justified choosing the underground option.”

¹² Estimates for different projects range from \$5.3 million to \$5.7 million per mile. See: CLF letter of 11/5/2013 to the U.S. D.O.E regarding OE Docket no. PP-371

¹³ <http://www.clf.org/wp-content/uploads/2013/11/Transmission-Line-Cost-Fact-Sheet-11-6-13.pdf>

¹⁴ <http://www.chpexpress.com/>

¹⁵ See: http://chpexpresseis.org/docs/CHPE_Article_VII_Joint_Proposal.pdf, page 14.

¹⁶ <http://www.northeastenergylink.com/>

¹⁷ <http://www.necplink.com/>

¹⁸ See “Q&A: Duke on transmission lines” at: <http://www.citizen-times.com/story/news/local/2015/07/25/qa-duke-transmission-lines/30672427/>

¹⁹ <http://m.tdworld.com/transmission/underground-backs-overhead-circuits>

²⁰ There is apparently another underground transmission line near the Harris Nuclear Plant which was installed by Progress Energy, which Duke now owns. See last sentence of:

http://www.wilmingtonbiz.com/More_News/2010/08/25/Progress_Energy_to_build_line_under_Cape_Fear_River/1761

- “In the future, any additional underground line installations on the Duke Energy Progress system will be able to leverage the utility’s experiences learned from this most unique and challenging first-time project.”

Although the Cape Fear River line was relatively short, perhaps it is time for Duke to expand their expertise by taking on the longer line proposed for Henderson County.

Duke states²¹ that the transmission line and substation will cost \$320 million – they have not separated out the two, nor have they indicated how much it will cost to acquire private property right of ways or what the cost of the ensuing lawsuits may be. The gas power plant is expected to cost \$750 million. Relative to the size of the overall project (approximately \$1.1 billion), surely Duke can manage to build the line underground.

5) Alternatives Should Be Considered

While the need to replace the coal plant in Asheville is pretty clear, the need for the transmission line is not. That question is beyond the scope of this paper, but it should be thoroughly examined.

If, and ONLY if, the transmission line is necessary for North Carolina, alternatives to the current plan should be seriously considered, including:

- 1) Burying the line adjacent to Interstate-26, as part of the upcoming I-26 widening project, continuing alongside I-26 for the parts of the line corridor that extend beyond the length of the widening project.
- 2) Using existing rights of way associated with current high voltage lines in the area, or other rights of way that have already been established. Since buried lines require a narrower right of way, expanding the right of way could be avoided. Perhaps even lower voltage line rights of way would be usable for this purpose. The option of using the existing right-of-way AND burying the line, while at the same time replacing the existing overhead line with the new underground one would be most attractive. This scenario would minimize damage to Henderson County’s tourism industry, its agricultural industry, and individual property values. Furthermore, instead of damaging the scenic beauty of Henderson County, it would enhance it by getting rid of existing transmission towers.

These alternatives may be surprisingly cost-effective, given the reduced or even eliminated costs of acquiring easements. Furthermore, a buried line would bring Duke transmission projects into the current century and could create a standard for other scenic areas in our state.

²¹ <http://www.duke-energy.com/news/releases/2015051901.asp>

Appendix A

Background: Current Proposed Project

Duke Energy proposes to build a 650 Megawatt gas generation station at the Asheville location, adding a solar component after the current coal plant is discontinued. There also exist two combustion turbines, which can produce another 324 megawatts of peaking power. The existing two turbines will remain. After the gas generation station is built the current coal plant (376 Megawatt) will be retired.

Duke Energy has announced Western Carolinas Modernization Project which includes

- 1) The new Asheville Gas Plant (including retirement of the current coal plant and closure of the ash basin) supplemented by solar generation once the coal facilities are closed.
- 2) Overhead Transmission Lines through Henderson, Polk, and a small part of Buncombe County in NC, and Greenville and Spartanburg Counties in SC. The transmission line will be 230-kilovolt (kV).
- 3) Expansion of the current PSNC gas pipeline from Kings Mountain to Arden.

Duke's description of the substation in South Carolina is: "A new 500-kilovolt transmission substation is planned near Campobello S.C., in Spartanburg County, and will be located off Highway 26, adjacent to an existing Duke Energy transmission corridor. The new substation and transmission line will improve the connection between the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) systems, allowing the company to import and export more affordable generation and increase the electric capacity to serve customers in the region." The substation would be regulated by the SC Public Service Commission. Construction at the substation is scheduled to begin in spring 2016. The entire project is scheduled to be completed in summer 2019.

Relating to the new gas plant, the N.C. Legislature has passed, and the Governor has signed, SB 716 (Session Law 2015-110) which requires the state Utilities Commission to provide an expedited decision on an application for a certificate to construct a natural gas generating facility. The bill requires the Commission to render its decision on an application for a certificate, including any related transmission line located on the site of the new generation facility, within 45 days of the date the application is filed if all of the following apply²²:

- 1) The application is for a facility at the site of the Asheville Steam Electric Generating Plant located in Buncombe County.
- 2) The public utility will permanently cease operations of all coal-fired generating units at the site on or before the commercial operation of the generating unit that is the subject of the certificate application.
- 3) The new natural gas-fired generating facility has no more than twice the generation capacity as the coal-fired generating units to be retired.

Timing

Plans for the new facility must first be approved by the North Carolina Utilities Commission, and Duke Officials expect to submit the proposal for the project sometime near the end of 2015 or a few months into 2016. The transmission line requires a certificate of environmental compatibility and public convenience and necessity to be approved by the NC Utilities Commission.

²² The bill also modifies certain requirements under the Coal Ash Management Act of 2014, PROVIDED THAT on or before August 1, 2016, the North Carolina Utilities Commission has issued a certificate of public convenience and necessity to Duke Energy Progress for a new natural gas-fired generating facility, pursuant to Section 1 of the Act.