Burying HVDC Transmission Lines in New England – an Overview

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Burying High Voltage Direct Current (HVDC) transmission lines in New England is a practical solution to the concerns raised by proposals to construct overhead lines to move Canadian power south through New England. This overview presents basic background information about buried transmission lines, and specific information about projects in neighboring states that incorporate buried lines into viable business models that significantly reduce public objection.

High Voltage Direct Current

In North America, the electricity we use from the outlets in our homes is alternating current (AC), and power generated in typical power plants is alternating current. When power plants are near their ultimate user, this is not a problem. When power is generated some distance from its ultimate consumer and must be transmitted over that distance via electrical transmission cable, this becomes something of a problem due to the significant percentage of electricity that is lost during long line transmission.

In the early 1950s, HVDC was developed specifically to address the issue of line loss during long distance transmission. This technology produces significantly lower loss over long distances. It is the dominant form of long line transmission technology in North America.

How does an HVDC transmission line operate?

In short, AC power is converted to HVDC close to its generation source. In the case of Northern Pass, for example, this conversion would take place in Windsor, Quebec.

The HVDC line then carries the electricity most of the distance, until it gets close to where it will enter the regional power grid, where it is converted back into AC power. In the case of Northern Pass, this converter station is planned for Franklin, NH.

Converted back to AC, the power then enters the grid and can be use by consumers. In the case of Northern Pass, HVAC power would run from Franklin to Deerfield, where it would then enter the New England grid and move to southern New England where its ultimate consumers are.

HVDC transmission technologies

Until the 1990s, almost all HVDC transmission was done using overhead lines. Complexities involving heat loss/insulation, EMF and existing cable technology made overhead the preferred method.

In the 1990s, a leading European engineering firm, ABB, pioneered an innovative cable and converter technology that made underground lines practical, economical and technically much less complex. This technology is called “HVDC Light” by its originator, ABB. Other companies such as Siemens also now market similar technology. Incidentally, ABB was the firm that pioneered HVDC back in the 1950s.

This type of system involves burial of two 5-inch cables in a shallow trench, roughly 4 feet deep and 6 feet wide. It does not require concrete conduit or pipe ducts and can be laid directly in the ground with some insulating soils packed around the cables. This HVDC Light technology requires converter stations on both end of the cable system that are of a different design that the converter stations presently proposed by NP for Windsor, QUE and Franklin, NH.

In the early stages of development, HVDC Light cable carried fairly low loads of a few hundred megawatts. This increased steadily as the technology was refined. Until recently, the top load this type of cable could carry was 1100 MW. However, in the fall of 2014 ABB announced that is has now developed HVDC Light cable capable of carrying up to 2600 MW of power. For reference, Northern Pass is planned for 1200 MW.

Underground HVDC lines are now in use around the world – in Europe, Australia, and here at home in the US. Hydro-Quebec's subsidiary, TransEnergie, is a leader in the design and installation of underground HVDC systems.

Costs and installation

A common application for HVDC Light installations is either underground, underwater, or a combination of both.

A typical figure cited for cost per mile of overhead HVDC lines is around $3 million per mile.

Underwater installation of HVDC Light is quoted at about $3 million.

Underground installation for HVDC Light projects currently under development in New England and Upstate New York quote a burial figure of about $5 million per mile. Land installation is typically done in softened areas with easy direct access, such as roadsides and rail beds.

Underground projects in New England

There are a half dozen underwater/underground HVDC projects in development in our region – all designed to move Canadian power south. One of these projects in Maine is also designed to move electrons from rural Maine wind farms to the greater Boston area. This overview highlights two of these projects. I'd be glad to furnish information on the others as well.

Champlain-Hudson Power Express

Designed to bring Canadian hydro power from Quebec to New York City, this project replaced an earlier project, New York Regional Interconnect, which was rejected by the people of New York because it ran tall metal lattice towers through one of NY's scenic recreational areas, the Catskills.

CHPE runs about 100 miles under Lake Champlain on the New York side. It then runs about 130 miles total underground along roads and rail beds, with a central segment of about 90 miles under the Hudson River, finally emerging in Astoria, Queens where it will tie in with ConEdison's distribution system.

Developed by the Blackstone Group and Transmission Developers Inc. (TDI), the project has received all of its permits and expects to begin construction this year, and to be in service in 2018, delivering 1,000 MW of power to the metropolitan NYC area.

There was very little objection to this project from the public, environmental groups, or the business community. The permitting process was begun in January of 2010 and took about 4 ½ years to complete. By contrast, Northern Pass filed for its Presidential permit in the fall of 2010 and, after over 7,000 public comments, is waiting for the US Department of Energy to issue a *draft* Environmental Impact statement, which will then be subject to a round of public review. The draft EIS is expected in late June or July, if then. Northern Pass has no federal or state permits of any kind in hand.

New England Clean Power Link

Similar to the Champlain Hudson Power Express, New England Clean Power Link (NECPL) also carries Canadian power south. With a load of 1000MW, NECPL would run for 100 miles under the Vermont side of Lake Champlain and then 50 miles underground from Benson to Ludlow, Vermont. Here the power would be converted back to AC and enter the New England power grid.

This project is expected to be in service in 2019. US DOE published a draft Environmental Impact Statement on June 3, 2105, and is scheduling hearings in Vermont on the draft EIS in June 2015.

There was nearly zero objection to this project in Vermont. The two required scoping hearings held by the US Department of Energy drew fewer than 10 people. By contrast, Northern Pass scoping hearings drew several thousand citizens in person, overwhelmingly opposed to it. The final tally of scoping comments received by the DOE either in person or online has surpassed 7,500.

Jobs

While I do not believe that energy policy and planned infrastructure should be driven by the number of possible jobs that might be involved, Northern Pass promoters have made this an issue. "Black box" econometrically modeled estimates quoted a total of 1200 jobs over its construction period. This figure includes not only all direct work on the line itself but a multiplier that estimates jobs resulting in accommodations, meals and other ancillary sectors. Of this number, only a small number would continue after the project's completion, mainly 5 to 7 people to operate the converter station in Franklin.

The company did not estimate the effects on businesses in the communities impacted by its project. However, the North Country Chamber of Commerce, and the Chambers of Littleton, Franconia Notch, Lincoln-Woodstock and Plymouth have all expressed their opposition to the project because of the negative effects on business in their areas.

The company has pledged to hire NH workers first. However, it is unknown how many NH workers possess the skills and training to do the highly specialized HVDC line work, or to erect the steel lattice towers. This affects the lineman of IBEW Local 104.

A new converter station proposed for Franklin would need to be built regardless of which transmission method is used. This affects the inside electricians of IBEW Local 490.

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