Fact Sheet

Underground Transmission

DOES THE AESO CONSIDER USE OF UNDERGROUND TECHNOLOGY?

The AESO considers use of underground technology in planning the transmission system. Two different types of underground technology exist; AC (alternating current) and DC (direct current) with different characteristics that need to be assessed on a case-by-case basis.

Underground technology may also be considered on a project-by-project basis for a component of a project to mitigate a siting or route selection issue. This results in a different decision-making process as the issue is addressed through the route selection work undertaken by the transmission facility owner (TFO) while still including the AESO's input to ensure that system needs are met. The AUC ultimately approves the use of underground in any circumstance.

WHEN IS UNDERGROUND AC TRANSMISSION CONSIDERED?

AC underground transmission lines have different electrical characteristics and different maintenance and outage implications than AC overhead lines. Underground AC technology has most frequently been used in providing service where overhead transmission simply isn't viable and the higher cost of underground transmission is necessitated, such as into the downtown core of a major urban centre like Edmonton and Calgary. In 2008, EPCOR completed a 10 km underground 240 kV transmission line extending from the north edge of Edmonton into the downtown core, adding to two 30-year old circuits feeding the downtown core from the south.

The AESO, working with ENMAX Power, is exploring additional capacity in the Calgary downtown core by replacing older 138 kV oil-insulated underground circuits with higher capacity cross-linked polyethylene (XLPE) cables.

Underground cables have been funded by real estate developers on a case-by-case basis to reduce visual impact on new developments – examples include the Cougar Ridge residential development in Calgary and the Three Sisters development at Canmore, both of which involved 138 kV transmission. In a recent decision, the Alberta Utilities Commission (AUC) also offered the opportunity for the City of Lethbridge to make a cost sharing proposal for a portion of underground 240 kV transmission to mitigate the impact of transmission in a local valley.

Alberta Electric System Operator
2500, 330 - 5th Avenue SW
Calgary, Alberta T2P 0L4
t 403-539-2450
f 403-539-2949

www.aeso.ca

HOW IS THE DECISION TO USE UNDERGROUND TRANSMISSION AS A ROUTE MITIGATION MADE?

For existing technology that has been used before in Alberta, such as 240 kV or 138 kV underground cable, the TFO considers the application on a case-by-case basis, and, subject to verifying with the AESO that the technical performance is acceptable, makes a recommendation to the AUC.

In the case of 500 kV underground cable, which has not yet been determined to be technically feasible in Alberta applications, the AESO is first required to determine the technical feasibility. This is the case in the Heartland transmission reinforcement project in the Edmonton/Fort Saskatchewan area; the AESO is currently undertaking a study to determine if 500 kV underground is technically feasible for use in Alberta. If the study determines that its use is technically feasible, then its use will be considered by the AESO and the TFOs similarly to 240 kV or 138 kV.

UNDERGROUND FEASIBILITY STUDY BEING CONDUCTED BY THE AESO

The AESO is currently conducting a study to assess the technical feasibility and cost of using high voltage 500 kV AC underground cables for the Heartland Transmission Project. In particular, the AESO's study will look at the feasibility of deploying up to an 8 – 20 kilometre section of AC underground cables as one component of a larger AC overhead project.

The AESO's study will focus on 500 kV AC underground. Work completed during the AESO's project alternative analysis determined that DC underground was not an acceptable alternative for the Heartland Project. Factors affecting this decision included:

- Reduced operational reliability (risk of long outage durations);
- Future reduced flexibility (higher incremental cost to increase capacity); and
- Higher cost (higher initial installation and ongoing power losses associated with the conversion of AC to DC).

This study is being conducted by a third party consultant; the AESO has included a local landowner group in the review of the selection of the consultant, and that input has among other considerations led to the selection of a consultant to complete this work.

The study is expected to be completed in mid February 2010, and the AESO expects that this work will be made publicly available upon completion.

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TECHNICAL FEASIBILITY OF 500 KV UNDERGROUND

Technical feasibility refers to factors regarding the maturity of the technology, and whether it can be integrated into an existing transmission system and operated dependably. Technical feasibility for 500 kV underground cables is difficult to determine as there are currently very few other underground 500 kV cables in service in the world and only one with an underground line length greater than five kilometres that we were aware of at time of printing. The AESO's study will include an examination of the technical feasibility of deploying up to an 8 – 20 kilometre section of 500 kV AC underground cables as one component of a larger AC overhead project.

WHEN IS UNDERGROUND DC TRANSMISSION CONSIDERED?

Underground DC transmission generally focuses on the use of the newer "Voltage Source Converter" technology which enables the use of underground high voltage direct current (HVDC) for lengths spanning hundreds of kilometres. In relation to AC systems, these HVDC systems have a relatively higher cost associated with the converter stations needed to integrate the facilities at each end. As well, there is very limited ability to integrate new substations along the circuit. The technology is only now reaching beyond the 300 MW capacity limit, which is still the limit for facilities in service, although higher capacity circuits are under construction.

With these attributes, underground DC technology has most frequently been used to interconnect adjacent jurisdictions, allowing some level of interchange between two larger networks.

While Alberta has a 150 MW HVDC intertie to Saskatchewan in operation, we do not have any underground DC facilities at this time.

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f 403-539-2949

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