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A new generation of optimised 120 kV cable systems at Hydro-Quebec

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Electric utilities around the world are facing more difficulties in adding new overhead high voltage transmission lines to their network, particularly in urban areas. Increasing environmental pressures as well as the unavailability of right of way at a reasonable cost are some of the main factors.

Underground transmission lines are not considered as a competitive alternative. However, should the cost of new underground transmission lines be reduced, they could offer a reliable and attractive solution to the above problem.

Hydro-Québec has identified this topic as a strategic objective. A technical group of cable specialists, involved in every aspect of cables systems was formed in 1999 to address the challenge. Specifically, the objective of the group was to reduce the total cost of cable systems rated 120 kV for installation in urban areas, (over 75% of HV cables in Hydro-Québec), while maintaining their excellent reliability.

The group examined all aspects of underground transmission lines such as cable design, construction and installation techniques, as well as procurement of needed materials. A rigorous procedure was established that permits the application of innovative and practical solutions.

Thirty-six possible avenues were identified and prioritized based on their degree of impact on potential cost reduction as well as their applicability at short and medium term.

Eight recommendations were retained. Each was individually examined to establish the conditions for its application and its interaction with the other proposed elements. The optimal combination of all these avenues was adopted.

Cable insulation thickness was reduced, resulting in smaller and lighter cables. Average length of cable section between joints was almost doubled. A smaller prefabricated joint bay was developed to replace the existing manhole design. Negotiation of a partnership with Pirelli for the supply of the cable system permitted Hydro-Québec to reduce delays in procurement. The total project duration was reduced accordingly.

Type tests of the new complete cable system had to be carried out. All field activities had to be adapted to the new civil design of the underground line.

The first application of this new optimized cable system was done in 2002 in Montreal. It consists in the construction of 4,2 km of 120 kV underground line. The new line is terminated at one end into a substation and at the other end into a transition compound where the underground section is connected to an existing overhead line. The average cable section length between joints is 700 m.

The total project cost reduction achieved to date using this new optimized cable system design is more than 25 %. Some further improvements are still under study, namely the replacement of the cable lead sheath by a lighter one.