

IEEE Milestone: 40th Anniversary of 735 kV Transmission System

In November 1965, the world's first transmission line at 735 kV was commissioned into service in Quebec. This line transported electrical power from the hydraulic centers of the Manicouagan River, in the North East of Quebec, to the load centers in the South of Quebec.

In 1955, Hydro-Québec engineers first studied how to transport hydro power from the region of Manic-Outardes in Quebec to the southern load centers of Quebec City and Montreal. By using 300-400 kV transmission lines, the world standard at the time, some 40 lines would have been needed for this task. In view of this, it was logical to consider increasing this voltage level to 500 kV. However, the jump from 315 kV to 500 kV was considered only a modest improvement to find a solution to the problem.

At this point, engineer Jean-Jacques Archambault took the initiative to consider a higher voltage level that had never been considered before. Earlier in 1958-59, he had made calculations at 700 kV with a security margin of 5%, i.e. 735 kV. However, Jean-Jacques had to persevere with this option as the European and American manufacturers of the line equipment were unwilling to build this equipment at this voltage level only for the Quebec market.

Period	Activity
From 1962-65	Construction of the first phase of the project from Manic-Outardes-Levis;
End of 1968	End of the second phase of project with the construction of the line from levis- Boucherville;
In 1970	Construction of a third line from Micoua to Laurentides sub-stations in the north of the river St-Lawrence.
In 1971	Construction of the line between Laurentides and Duvernay sub-stations.

Table 1: Construction Highlights

In August 1962, Hydro-Québec decided to take on this technical challenge and proceed with the construction, within 3 years, of the first phase of this innovative project: the line from Manic to Boucherville sub-station in the South of Montreal. Industry and consultants mobilized to tackle this, one of the world's largest construction projects.



Figure 1: Attachment of 735 kV power lines to insulators with the aid of a crane. The first-ever lines of this type linked the Manic-Outardes generating stations to the metropolitan areas of Québec City and Montréal. Photo courtesy of Hydro-Québec.

this company has had with the development of the transmission network over a sustained period of time.

During the years 1965-85, Hydro-Québec experienced an important construction period of 735 kV lines from the huge hydraulic dams of Manicouagan, Churchill and James Bay. It was a pioneer in the development of a vast 735 kV transmission network. Today the division of Hydro-Québec responsible for transmission system, Hydro-Québec Trans-Énergie, transports some 25,000 MW over the 735 kV transmission system, which is about 5 times the amount originally planned for power handling capacity. This huge increase demonstrates the success that

by Vijay K. Sood

IEEE Canada Secretary, 2006-2007

Homage to a pioneer

Jean-Jacques Archambault is generally considered to be the father of the 735 kV transmission system, and he completed a brilliant career at Hydro-Québec. He is known as an individual with great humanity and compassion by those who met him and worked with him. Before he retired from Hydro-Québec, he represented the company at all major international forums dealing with planning and transmission of electrical energy.

He was a mathematician by training and graduated from Ecole Polytechnique in Montreal in 1944. He joined Hydro-Québec in 1947 in the Planning Department. When the problem of transmission over long distances was submitted to him, he was naturally curious and studied innovative transmission systems from all over the world. After studying a proposed 600 kV system in the Bulletin des électriciens de France, he finally decided that this voltage was not practical for Quebec and he opted for 735 kV. European manufacturers were advised of this and they complied with the specification requirements to transport electrical energy with a minimum of transmission losses and noise pollution. Jean-Jacques closely followed the construction of the first phase of the line Manic-Outardes-Levis. Following this, he left for Rabat in Morocco for teaching at the Mohamed V University for a period of two years. Upon his return to HQ, he represented the enterprise as an ambassador for the transmission network at 735 kV. In 2001, he received the award from the Ordre des technologies professionnels du Québec for his achievements. His feat of transmission at 735 kV has yet to be surpassed.

Hommage à un pionnier

Jean-Jacques Archambault est généralement considéré comme le père du système de transmission à 735 kV et a accompli une brillante carrière à Hydro-Québec. Il fut connu comme une personne d'une grande humanité et compassion par ceux qui l'ont rencontré et travaillé avec lui. Avant de prendre sa retraite d'Hydro-Québec, il représentait la compagnie dans tous les forums internationaux sur la planification et transmission d'énergie électrique.

Il était mathématicien de formation et a gradué de l'Ecole Polytechnique de Montréal en 1944. Il a rejoint le département de planification d'Hydro-Québec en 1947. Lorsque le problème de transmission sur de longues distances lui a été soumis, naturellement curieux il a étudié les systèmes innovateurs de transmission à travers le monde. Après étude du système à 600 kV proposé dans le Bulletin des électriciens de France, il a décidé que ce voltage n'était pas pratique pour le Québec et opta pour 735 kV. Les manufacturiers européens ont été prévenus de ceci et ont obtempéré aux exigences spécifiées pour le transport d'énergie électrique avec un minimum de pertes en transmission et de pollution par le bruit. Jean-Jacques a suivi de près la construction de la première phase de la ligne Manic-Outardes-Levis. Ensuite, il a quitté pour Rabat au Maroc pour enseigner deux ans à l'Université Mohammed V. À son retour chez Hydro-Québec, il devint "ambassadeur" de l'entreprise pour les réseaux de transmission à 735 kV. En 2001, il a reçu le prix de l'Ordre des technologues professionnels du Québec pour ses accomplissements. L'exploit technique que constitue la transmission à 735 kV n'a pas encore été surpassé.

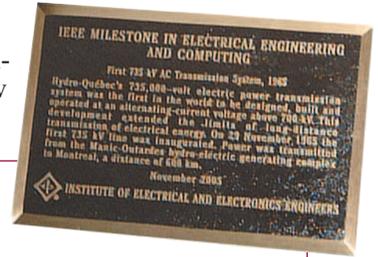
Acknowledgement

Thanks to Hydro-Quebec for providing access to its archives of the 735 kV Milestone celebrations at Montreal.

IEEE Milestone Celebrations, December 13, 2005

Hydro-Québec head office, Montréal

At the recent unveiling of the IEEE Milestone plaque on December 13, 2005, the event was celebrated with dignitaries and Hydro-Québec employees. Mme Denyse Guay-Archambault, widow of Mr Jean-Jacques Archambault, was recognized. Below is the text inscribed on the plaque:



IEEE MILESTONE IN ELECTRICAL ENGINEERING AND COMPUTING

First 735 kV AC Transmission System, 1965

Hydro Québec's 735,000-volt electric power transmission system was the first in the world to be designed, built and operated at an alternating-current voltage above 700 kV. This development extended the limits of long-distance transmission of electrical energy. On 29 November, 1965 the first 735 kV line was inaugurated. Power was transmitted from the Manic-Outardes hydro-electric generating complex to Montréal, a distance of 600 km.



Unveiling of the IEEE 735kV Milestone plaque, December 13, 2005

From left to right: Yves Filion, Président, Hydro-Québec Trans-Énergie; Thierry Vandal, Président-directeur général, Hydro-Québec; Bill Kennedy, President of IEEE Canada 2004-2005; Pierre Corbeil, Ministre des Ressources naturelles et de la Faune du Québec.



IEEE Canada representatives at the 735 kV Milestone

From left to right: Ron Potts, Vijay Sood, Gilles Baril, Amir Aghdam, Ray Findlay, Dominic Rivard, André Dupont (one of the HQ pioneers who worked on the project), Bill Kennedy, Paul Fortier, André Morin and Xavier Maldague.

Seated: Mme Denyse Guay-Archambault; Guy Monty, responsable de la construction des lignes à 735 kV.