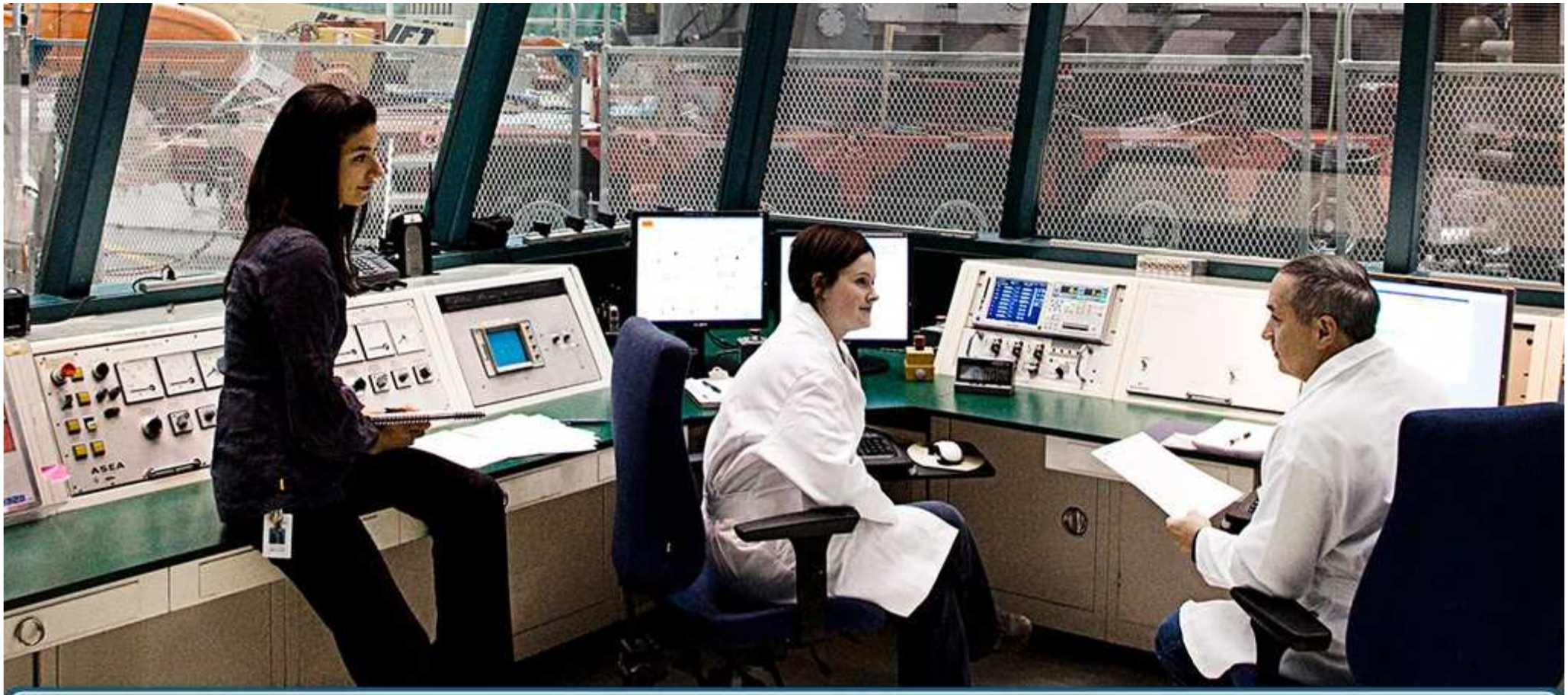

Hydro-Québec Research Institute

JETRO – McGill University
June 20, 2013

Charles Gagnon
Manager, Technology Business Development
Hydro-Québec Research Institute

Overview

1. **Hydro-Québec**
2. Hydro-Québec Research Institute
3. Our Business Model
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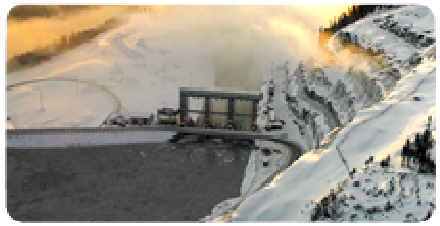
5. Conclusion

Hydro-Québec

Hydro Québec

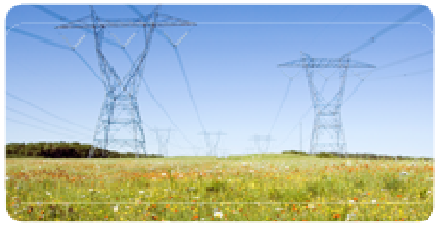
2012
21 600 employees
$12B total revenue
$2,7B net income

Hydro Québec Production



98% hydro
38,8 GW peak power demand

Hydro Québec TransÉnergie



33 639 km of transmission lines

Hydro Québec Distribution

4 M customers
114 649 km of distribution lines

Hydro Québec Équipement et services partagés

Projects under construction:$2,3B

Hydro Québec

Hydro-Québec Strategic Plan 2009-2013

Energy Efficiency

11 TWh ***Objective 2015***

Renewable Energy

10% ***Wind Power 2015***

Innovation

Grid Development Electric Transportation

Hydro Québec

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Hydro-Québec Research Institute

- **Mission : Innovate through R&D to the benefit of Hydro-Québec**
- **Vision: To be a world leader in innovation, at the heart of the strategic issues of Hydro-Québec**

IREQ in brief

- ~ 500 employees
- ~ 100 M$ annually
- ~ 150 projects
- ~ 5 M$ for universities (21 chairs)
- ~ 150 partnering agreement
- ~ 1100 patents
- ~ 200 M$ fall outs over 5 years
- ~ 125 licences

Technological innovation

Allows Hydro-Québec to:

- Stay at the leading edge of its industry
- Further improve performance
- Improve customer service
- Improve worker safety
- Contribute to the development of Québec's technological base

Hydro Québec

Seven fields of expertise

- Electrical equipment
- Materials science
- Robotics and civil engineering
- Mechanical engineering, metallurgy and wind-hydro power
- Measurement and information systems
- Power systems and mathematics
- Energy use

Hydro Québec

Over 150 Collaboration and Partnering Agreements Worldwide

Hydro Québec

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Key Success Factors

- **Commitment of senior management**
- **A solid link between R&D and the business units**
- **A network of partners**

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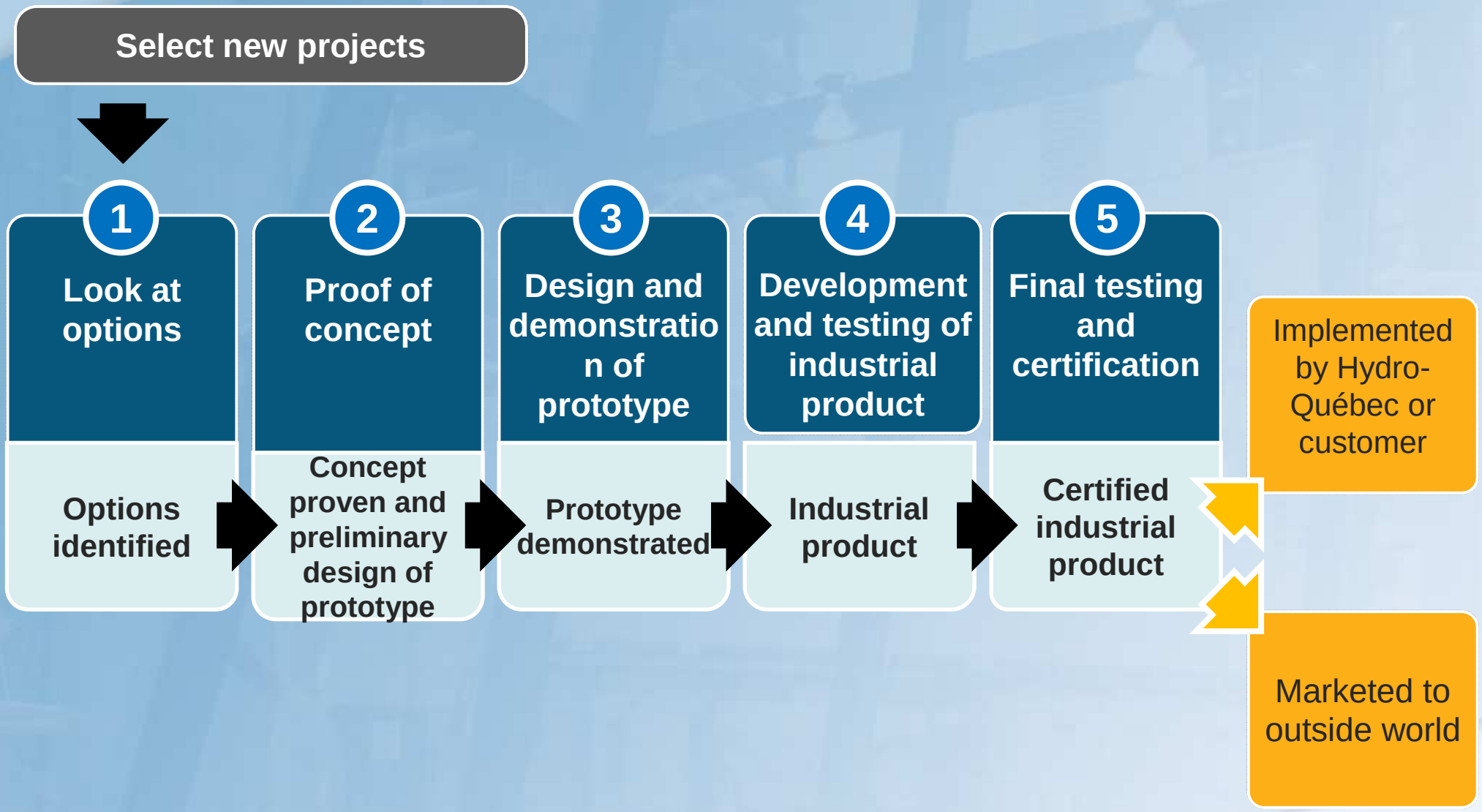
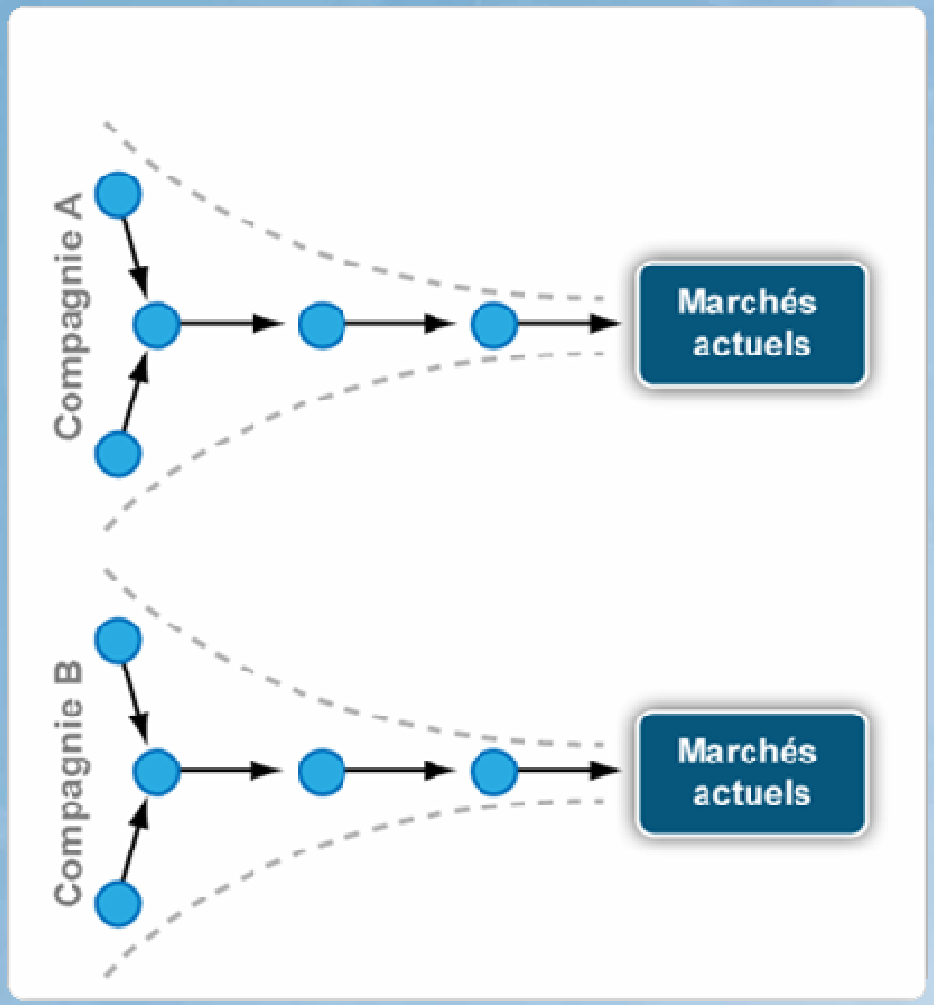
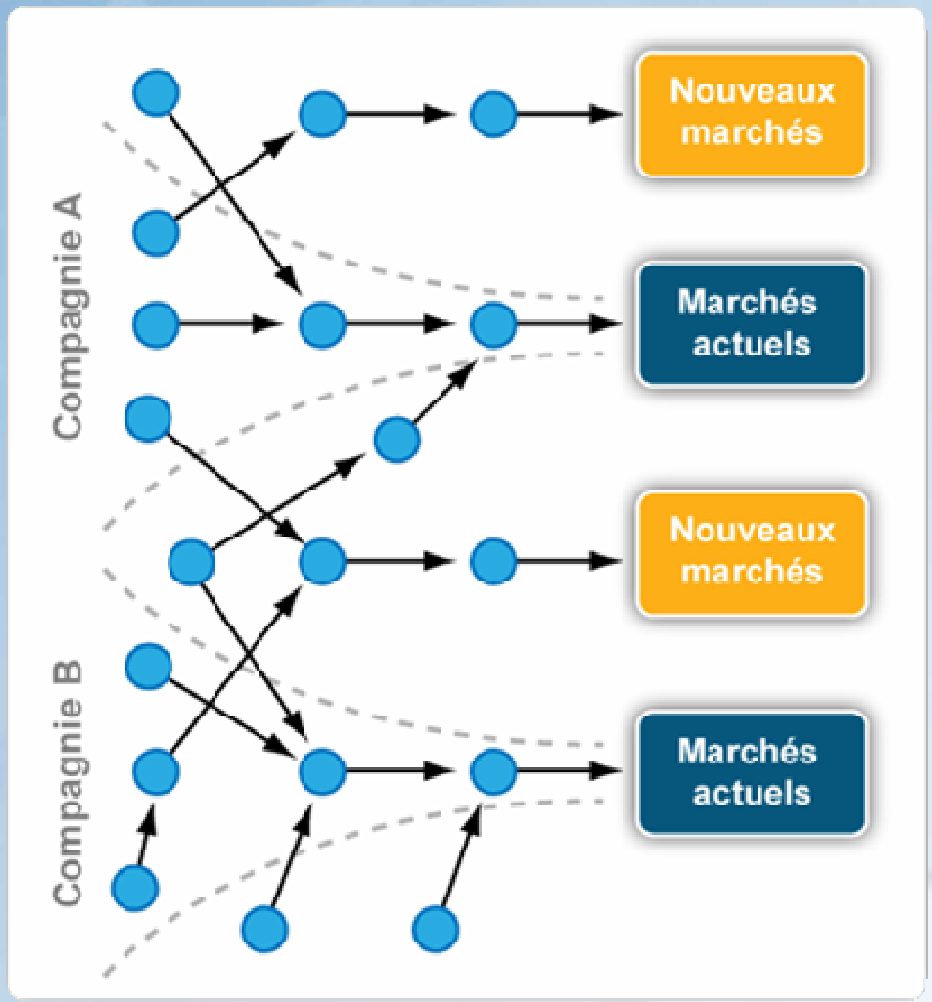
Integrated Innovation Management



R&D Partnering Approach

Open innovation





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Experience with Japanese Companies

- **1996 : Spin off : TEQSIM**
- **80 % HQ – 20 % Mitsubishi Electric**
- **State-of-the-art Real-Time Power System Simulators developed and sold around the world**
- **Commitment of both companies**

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Experience with Japanese Companies

- **8 Japanese companies have commercial agreements with HQ (licenses) for state-of-the-art Li-ions battery materials developed at IREQ**
- **3 Japanese companies have joint IP with HQ**
- **Major Japanese licensees : SONY, Mitsui Engineering & Shipbuilding, Sumitomo Osaka Cement**

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Conclusion

Research Institute:

- A world-class laboratory
- In tune with the needs of the company's business divisions
- Creates value for Hydro-Québec, its partners and customers

Hydro Québec

Additional information

Examples of recent innovations

Example Innovations in Generation

- **GMON:** Continuous monitoring of snow water equivalent to improve the quality of spring flood forecasting.

- **MIDA**: Helping to better target maintenance jobs by providing a more precise assessment of generator condition and the causes of degradation.

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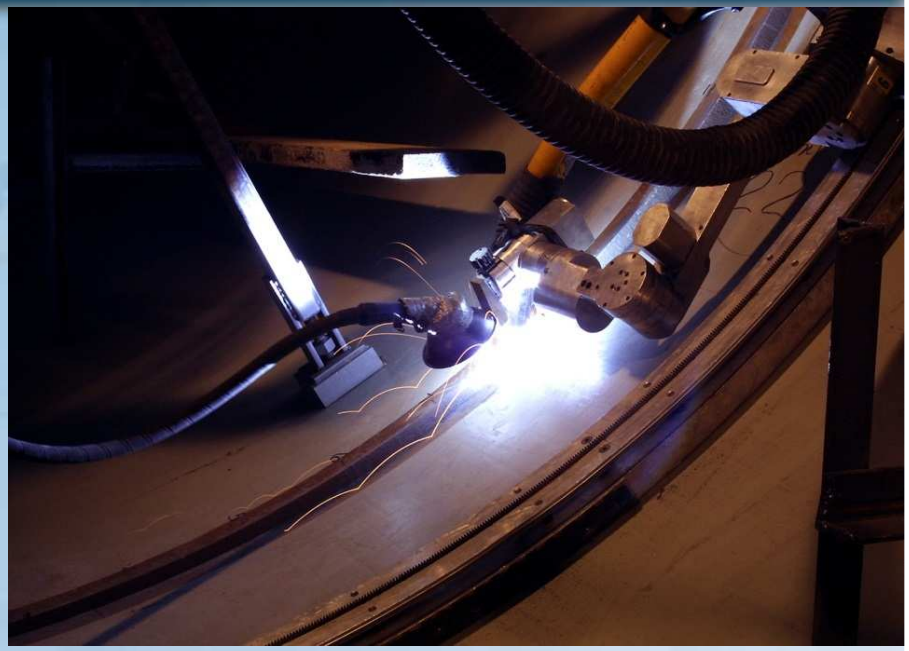
Example Innovations in Generation

- **SCOMPI:** Robotic system for repairing cavitation damage on the largest turbine runners and other jobs in generating stations, automatically performing all operations required.



- **MASKI**: Robot for inspecting underwater structures when such work is hazardous for humans. Maski makes inspections safer and quicker, and thus helps reduce generating unit down time.

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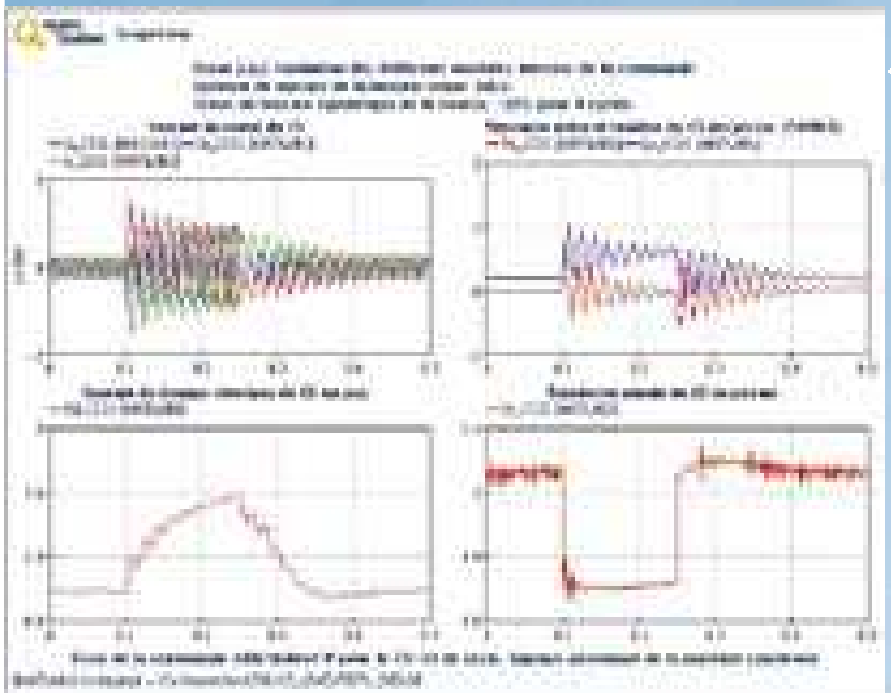
Example Innovations in Transmission

- **MB-PSS:** The multiband power system stabilizer innovates through its flexible settings, making it possible to improve the dynamic and transient stability of power systems and make them more robust.



- **HYPERSIM**: This real-time digital simulator provides in-depth analysis of transient electromagnetic and electromechanical phenomena, and validates power grid control and protection systems.

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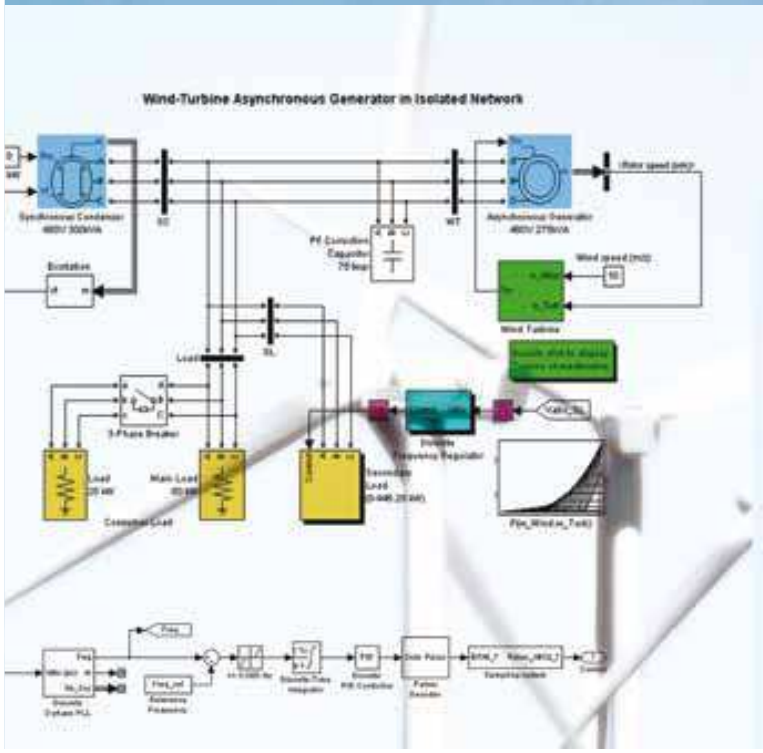
Example Innovations in Transmission

- **LineScout:** This robot helps perform inspections where it is difficult for line workers to reach. Using its cameras, live transmission lines can be inspected safely without compromising their operation.



- **SimPowerSystems** (SPS): This power system modeling and simulation software has many features for modeling electricity generation, transmission and distribution, especially when designing associated monitoring and control systems.

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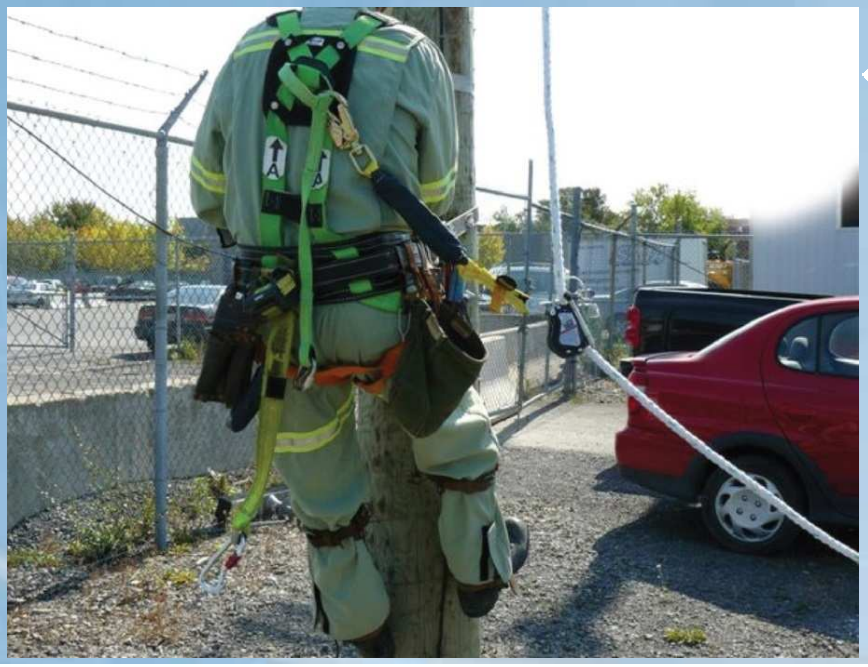
Example Innovations in Distribution

- **SIMLOC:** This simulation and locatio tool makes the time it takes to locate a fault shorter and more uniform. It also reduces the risk of damaging cables or other equipment through repeated thumping.



- **Hook**: *New insulating hook.* Line workers now have an improved fall arrest device incorporating an insulating hook that enables them to climb poles and clear obstacles safely, without having to constantly detach and re-attach themselves.

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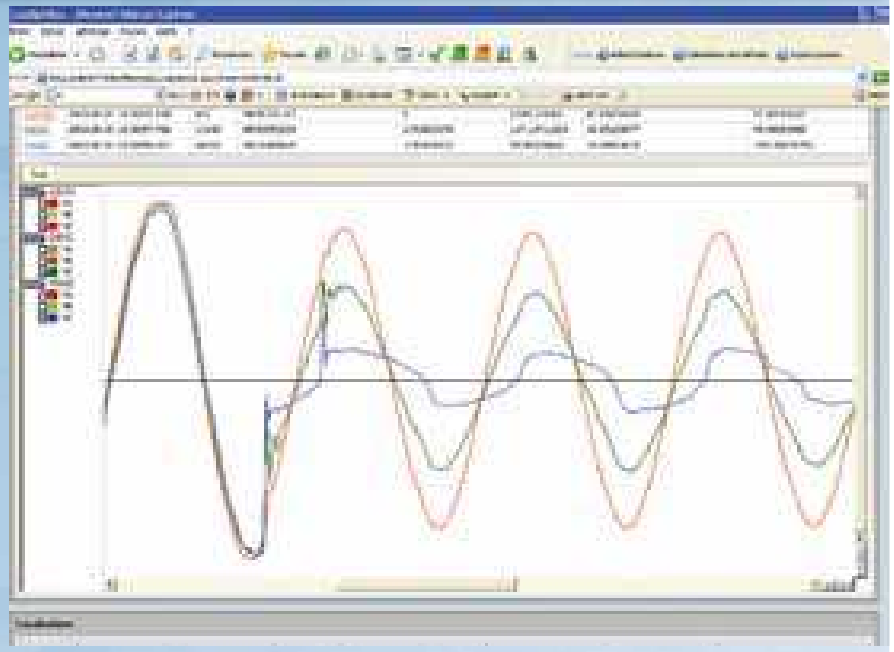
Example Innovations in Distribution

- **MILE:** This smart maintenance system is used to locate transient faults, measure power quality and collect other types of information to better target maintenance jobs.



- **SNIFFER**: The sniffer has numerous advantages over existing tools. It is a first-level PD detector that can accurately determine the presence of partial discharges in about 10 seconds per component tested.

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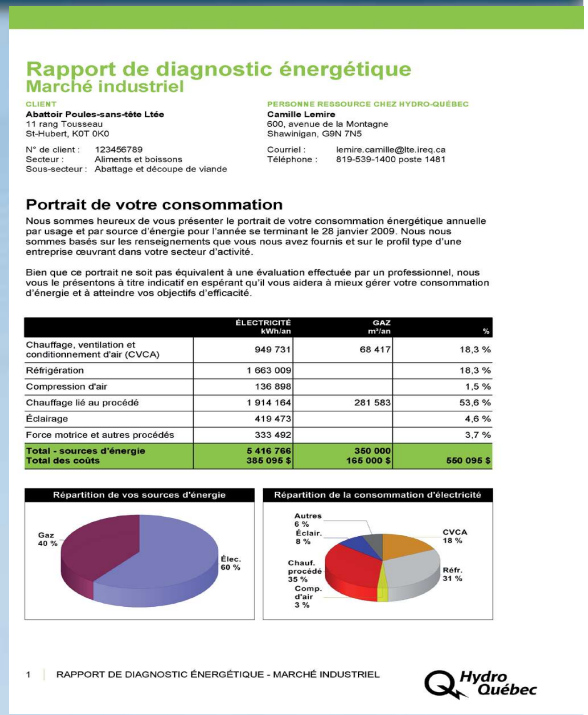
Example Innovations for Customers

- **Energy Diagnostic Tool – Industrial Market:** This tool offers industrial customers a way to obtain their consumption profile and avenues for improving their energy performance. It automatically generates a consumption profile featuring customized recommendations related to Hydro-Québec's energy efficiency programs.



Rapport de diagnostic énergétique
Marché industriel

CLIENT
Abattoir Poules-sans-tête Ltée
11 rang Tousseau
St-Hubert, K0T 0K0

N° de client : 12345789
Secteur : Aliments et boissons
Sous-secteur : Abattage et découpe de viande

PERSONNE RESSOURCE CHEZ HYDRO-QUÉBEC
Camille Lemire
600, avenue de la Montagne
Shawinigan, G9N 7N5

Courriel : lemire.camille@lte.ireq.ca
Téléphone : 819-539-1400 poste 1481

Portrait de votre consommation

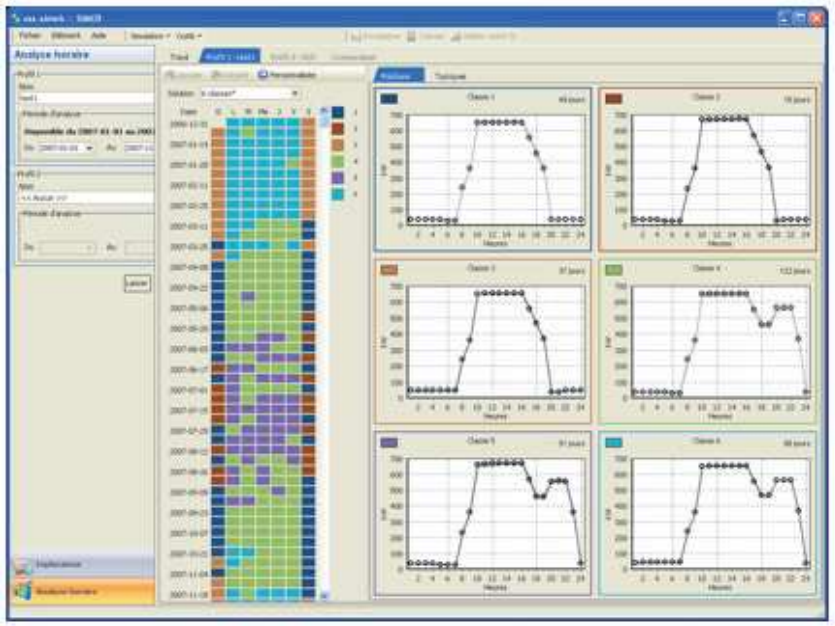
Nous sommes heureux de vous présenter le portrait de votre consommation énergétique annuelle par usage et par source d'énergie pour l'année se terminant le 28 janvier 2009. Nous nous sommes basés sur les renseignements que vous nous avez fournis et sur le profil type d'une entreprise œuvrant dans votre secteur d'activité.

Bien que ce portrait ne soit pas équivalent à une évaluation effectuée par un professionnel, nous vous le présentons à titre indicatif en espérant qu'il vous aidera à mieux gérer votre consommation d'énergie et à atteindre vos objectifs d'efficacité.

	ÉLECTRICITÉ kWh/an	GAZ m³/an	%
Chauffage, ventilation et conditionnement d'air (CVCA)	949 731	68 417	18,3 %
Réfrigération	1 663 009		18,3 %
Compression d'air	136 898		1,5 %
Chauffage lié au procédé	1 914 164	281 583	53,6 %
Éclairage	419 473		4,6 %
Force motrice et autres procédés	333 492		3,7 %
Total - sources d'énergie	**5 416 766**	**350 000**	
Total des coûts	**385 095 $**	**165 000 $**	**550 095 $**

Répartition de vos sources d'énergie

Répartition de la consommation d'électricité



- **SIMEB**: This software gives users an energy consumption portrait based on the building characteristics they enter. Users may then adjust these parameters to evaluate the impact of implementing possible energy efficiency measures.

Example Innovations for Customers

- **Thermal waste transformation** for small and medium-sized industry to produce heat, electricity or cooling so such industrial companies in Québec can reduce their energy consumption. Five prototypes available.

- **ThermElect Hydronic**: This electric central heating system uses off-peak power to store large amounts of heat and releases it during peak periods.

Hydro Québec