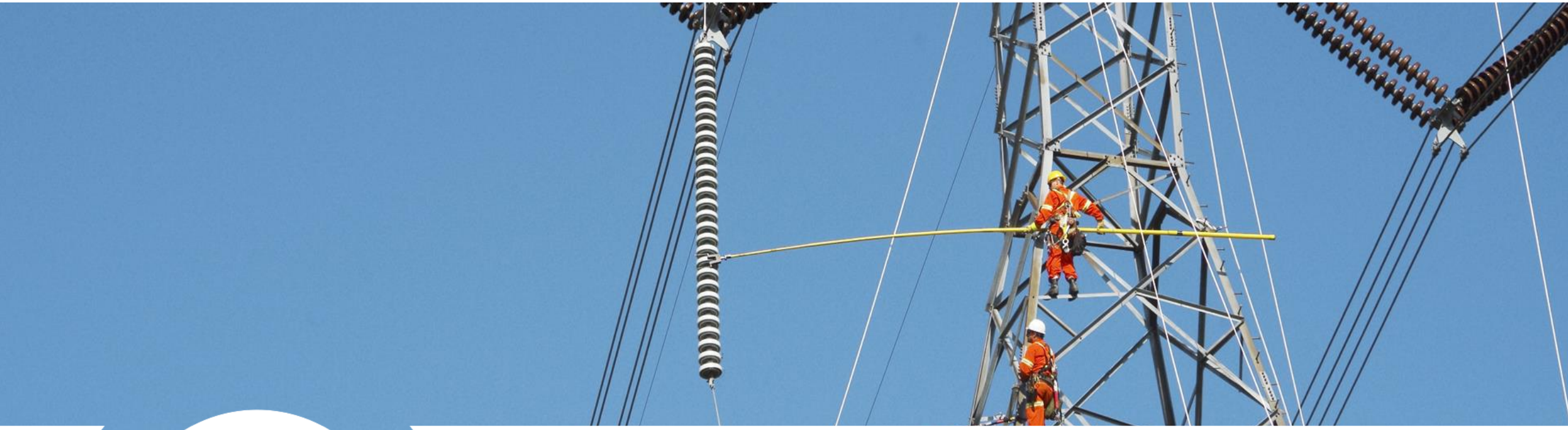


SETTING NEW SIGHTS

WITH OUR CLEAN AND RENEWABLE ENERGY

Ahmed Daoud, Reseach Scientist, IREQ

Our energy

Over **99%**

CLEAN AND RENEWABLE

Who we are

63

HYDROELECTRIC GENERATING STATIONS

INSTALLED CAPACITY OF HYDRO-QUÉBEC'S HYDROPOWER GENERATING FLEET

36,767 MW

Hydro-Québec
At a glance

Net income
$2,846 million
in 2017

Workforce
19,786
permanent and temporary employees

Installed capacity
37,309 MW
From 87 generating stations operated by Hydro-Québec

Electricity sales
205.6 TWh
including 34.9 TWh in exports

Residential rate
7.07¢/kWh
The lowest in North America

* Annual Report 2017

Hydro-Québec's strategies for 2018+

- Focusing our culture on customers and on our employees' health and safety
- Seizing growth opportunities outside Québec
- Launching a new era of electrification in Québec
- Optimizing our resources and processes

A world-class research centre

Mission |Through R&D, make the most of existing and emerging products and services to keep Hydro-Québec on the leading edge of scientific advances and technological solutions related to all elements critical to improving the company's performance in the short and long terms.

L'INSTITUT DE RECHERCHE D'HYDRO-QUÉBEC (IREQ), Hydro-Québec's research institute

Two research sites	400 talents for creating value	Annual budget over $115 million

LABORATOIRE DES TECHNOLOGIES DE L'ÉNERGIE (LTE), Hydro-Québec's energy technology laboratory

MAKING A DIFFERENCE
for Hydro-Québec and our customers

Cutting-edge expertise

IREQ’s solid expertise, in sharp alignment with the company’s divisions, bolsters Hydro-Québec through its energy transition challenges

- Simulation of facilities and equipment
- Energy resources and hazards management
- Asset sustainment
- Asset characterization and performance
- Grid development and simulation
- Grid control and management
- Inspection and maintenance robotics
- Electrification and integrated energy systems
- Digital systems
- Data science and high-performance computation

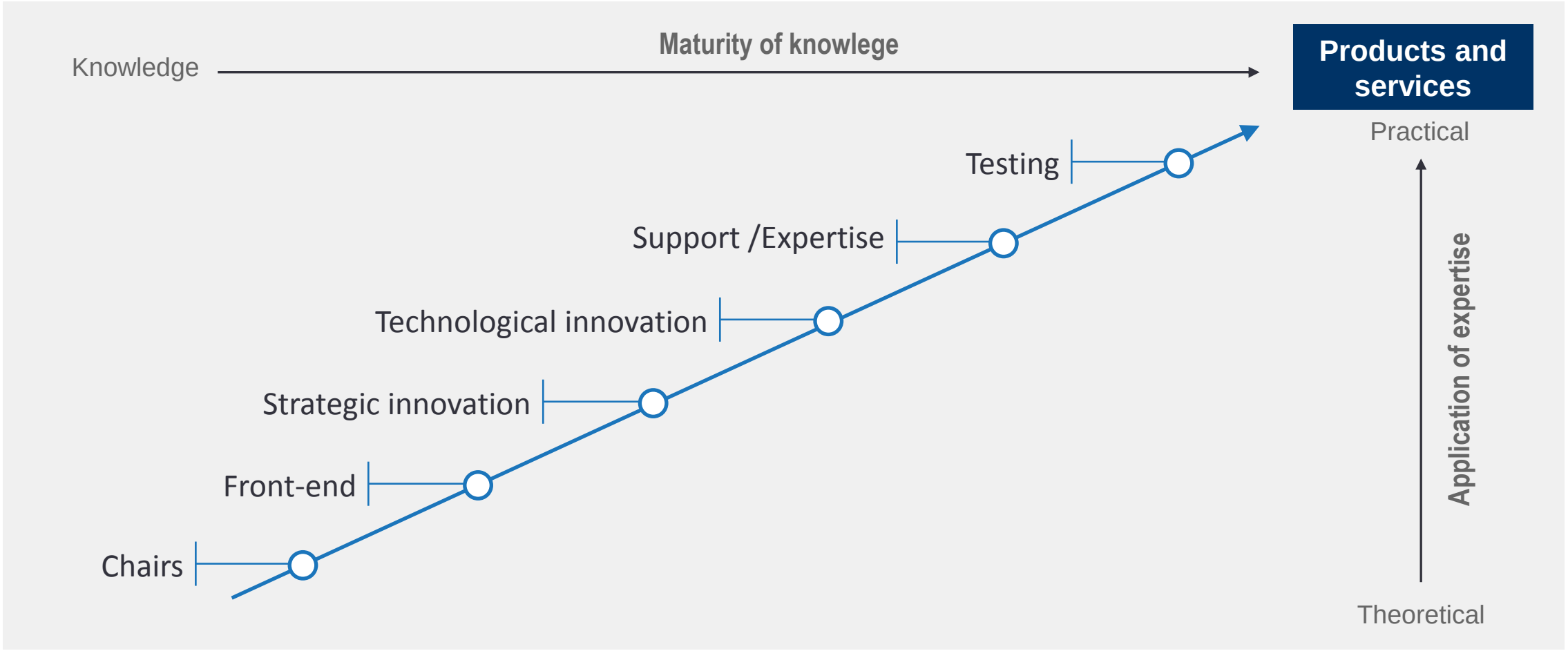
Teams are also dedicated to high-voltage testing and equipment calibration

***

Experts are also in charge of development and partnership strategies, as well as technological vision and roadmapping

Our profession

Inventing and developing new ways of doing things



Services for Hydro-Québec and the industry

Research and development
- Technological innovation projects aligned with the needs of Hydro-Québec's major business units and their customers

Support, expertise and testing
- Technical support to solve a broad range of equipment and operating issues

Innovation
- Areas that create value
- Position Hydro-Québec as an innovative player worldwide

Licensing and technology transfer
- Areas of R&D with important market value

Business environment

The market, new technologies, the demand for clean energy, trends in next-generation behavior, and emerging customer needs are transforming the power industry and, of course, Hydro-Québec.

Transformation triggers:

- Distributed energy resources
- Participatory customers
- Climate change
- Decarbonization
- Aging assets
- Market volatility
- Digital technology
- Creation of the TEQ (Transition énergétique Québec)

To bolster Hydro-Québec through these challenges, IREQ has develop a technological vision 2035 for the company.

This vision, harmonized with Hydro-Québec's Strategic Plan, has **three main orientations** and will be reviewed each year.

Hydro-Québec's technological vision 2035

3 orientations | 8 goals

01.

AT THE HEART OF OUR TRANSFORMATION: *OUR CUSTOMERS*

02.

OUR *ASSETS*: A STRATEGIC STRENGTH IN A CHANGING ENVIRONMENT

03.

LOOKING TOWARDS THE *POWER SYSTEM* OF THE FUTURE

A changing market

1. Technology will enable customers to produce, use, store and sell power| participatory customer
2. Electricity suppliers will become more lifestyle-oriented service providers
3. The power grid will be a smart system, integrating advanced equipment features and customer connectivity to maximize all operations
4. Data will play a critical role in this change

IREQ

Energy Transition, Innovation and Efficiency

Project portfolio overview

Project portfolio overview

1	Experimental homes
2	Demand Response in CI buildings
3	Experimental Distribution Network
4	Lac Mégantic Microgrid
5	Efficient electrification
6	ConnEC

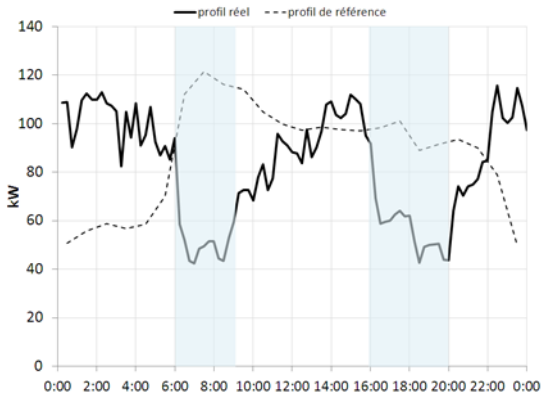
LTE experimental homes

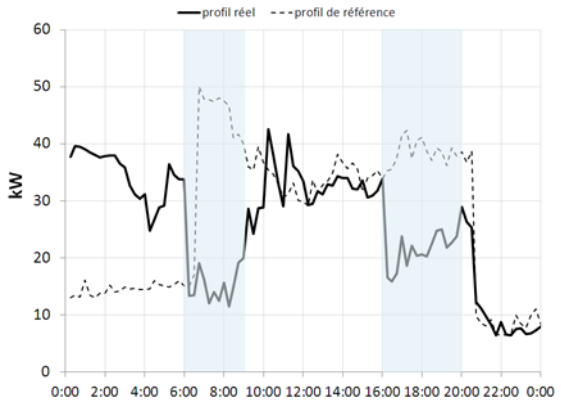
- Platform for testing energy services and technologies of the future
  - In order to anticipate their impact on the grid and to help customers make technological choices
- Adapted into net-zero-energy houses to better understand the issues related to advanced smart houses, electric vehicles (V2H-V2G) and distributed generation
- Technologies being tested: a smart-home system, a bidirectional EV charging station, and photovoltaic solar panels

Demand Response in C-I Buildings

DR Program in order for Winter Peak Demand reduction

- 2015-2016 : 26.7 MW (Goal 10MW)
- 2016-2017 : 184 MW (Goal 130MW)





GESTION DE LA DEMANDE DE PUISSANCE

Le programme Gestion de la demande de puissance (GDP) vise à inciter les clients des marchés commercial et institutionnel (CI) ainsi que les petites et moyennes entreprises (PME) industrielles à réduire la demande de puissance de leurs bâtiments pendant les périodes de pointe hivernales d'Hydro-Québec. Ainsi, Hydro-Québec pourra répondre aux besoins de puissance (kW) de sa clientèle à meilleur coût.

Le programme GDP est reconduit pour l'hiver 2017-2018.

Aucune modification n'a été apportée aux modalités du programme pour l'hiver 2017-2018. Toutefois, le processus d'inscription a été simplifié. Les nouvelles versions du *Guide du participant* et du formulaire **sont maintenant en ligne**. Pour participer au programme, vous devez soumettre le formulaire d'inscription au plus tard le 8 septembre 2017.

Si vous avez participé au programme GDP à l'hiver 2016-2017 et que vous souhaitez le faire à l'hiver 2017-2018, vous devez soumettre un nouveau formulaire d'inscription.

Experimental Distribution Network

- Controllable loads: 300 kW, ±150 kvar, 93 kW motor load
- Diesel generator : 320 kW
- Wind generation emulation : 149 kW
- Solar generation emulation : 250 kW
- Solar panels : 3 kW
- Induction generator : 93 kW
- Battery storage : 100 kWh, 250 kVA
- SCADA, switchgear, voltage regulators, underground distribution system, etc.

Lac-Mégantic Microgrid project

About
30
buildings

Area of
150 000 m^2

More than
300 kWh of energy storage

Up to **1 000**
solar panels to produce electricity

Microgrid's perimeter

Accelerate efficient electrification

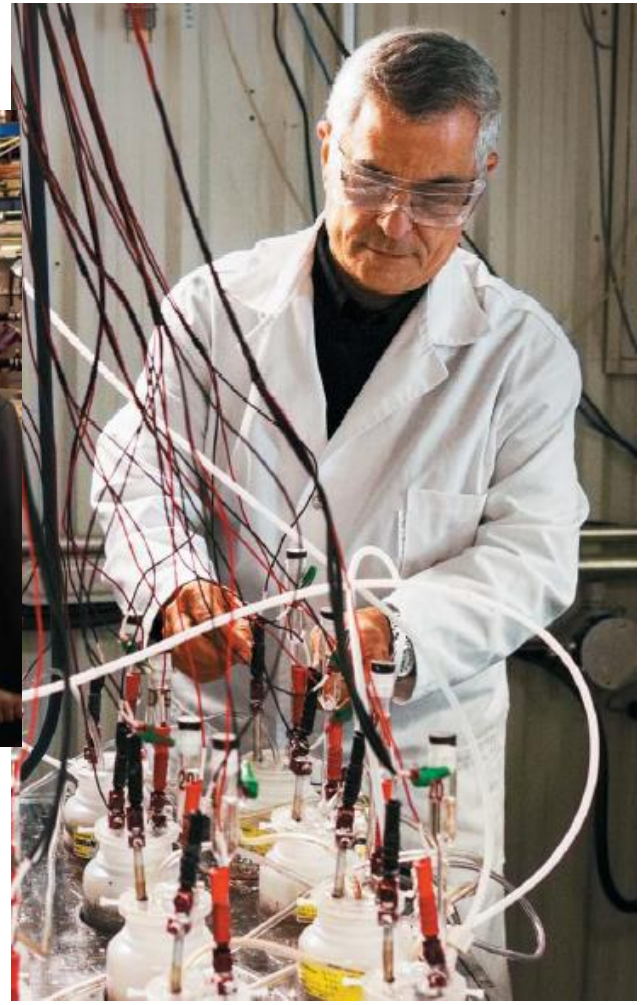
High frequency heating

Electrochemistry

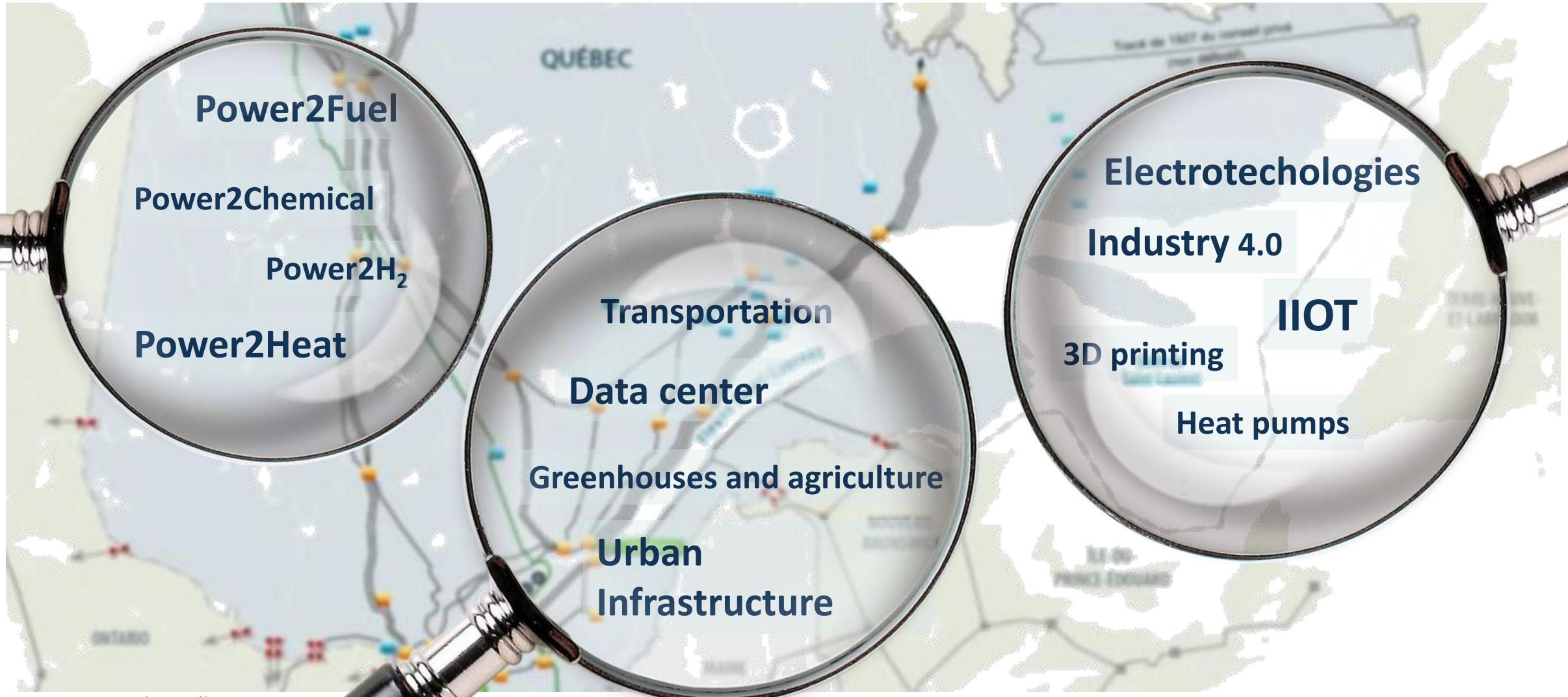
Electrolysis

Heat pumps

Electrodialysis



Accelerate efficient electrification



Projet ConnEC

Connaissance et **É**volution des **C**lients

In this fast-changing world…

we must anticipate plausible changes in order to satisfy our customers and insure profitabiliy

We use personae-based scenarios to envision innovative products and services for our customers of the future. And we tell the story.

Why?
Agility
Innovation
Education

Who ?

How ?
Energy & social sciences research
Collaborations with universities
Long term trends watch
Understanding customer latent needs


Hydro
Québec