Hydro Québec Distribution

Hydro-Québec's Distribution Automation Vision and Roadmap

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Summary

1. Hydro-Québec's Distribution Automation: Project Description
2. Distribution Automation Roadmap: Vision and guiding Principles
3. Distribution Automation Roadmap: from 2005 to 2015 in 4 steps
4. Distribution Automation Standards Evolution
5. Conclusion

Hydro-Québec's Distribution Automation: Project Description

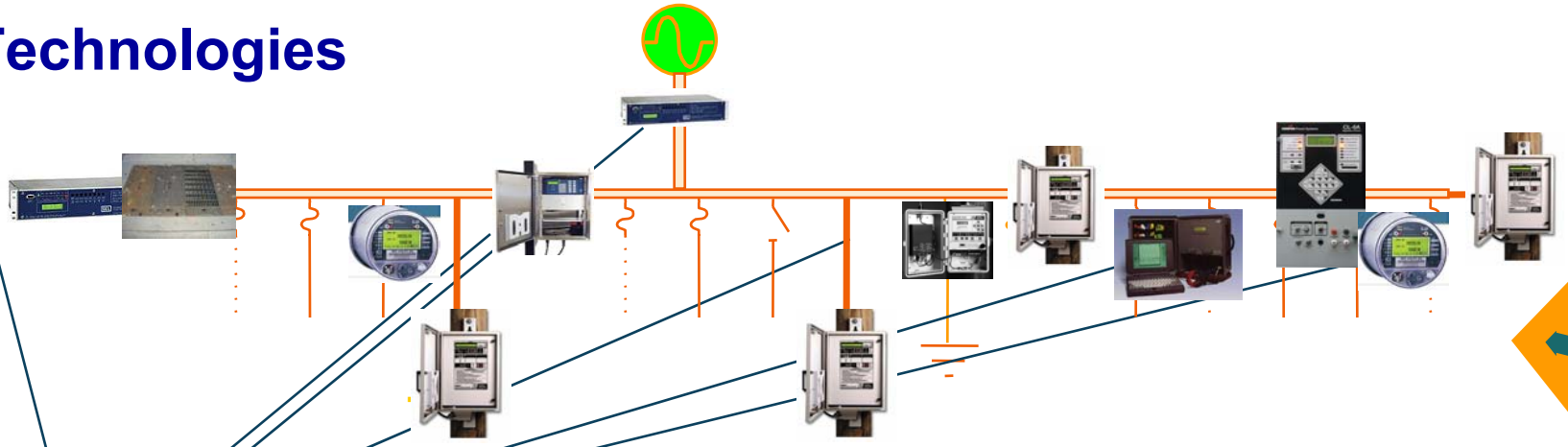
- **Hydro-Québec's Distribution Automation Program includes**
  - Remote control of 3750 MV switches and breakers (188 M $ - CDN over 6 years)
- **"*Distribution Automation*" is much more than remote controlling of switching equipment on the MV feeders**
  - Hydro-Québec's roadmap expresses a vision how the actual distribution network evolves toward an intelligent distribution network, which includes:
    - Network monitoring
    - Equipment monitoring, and
    - Product monitoring

Hydro-Québec's Distribution Automation Vision

- **Vision**
  - The distribution network must become more intelligent
  - Choosing to retain today's design standards and equipment, opting for small incremental changes in the way that business is done today, will result in an un-profitable future for a distribution utility.
- **Vision confirmed by**
  - CEATI's Technology Roadmap (May 2004)
  - EPRI's ADA Report (June 2004)

Distribution Automation Flow of Information

Technologies



DATA
(Using what?)

Voltage
Fault Currents
Load Currents
Temperature
Number of Operations
Alarms
…

Applications
(How?)

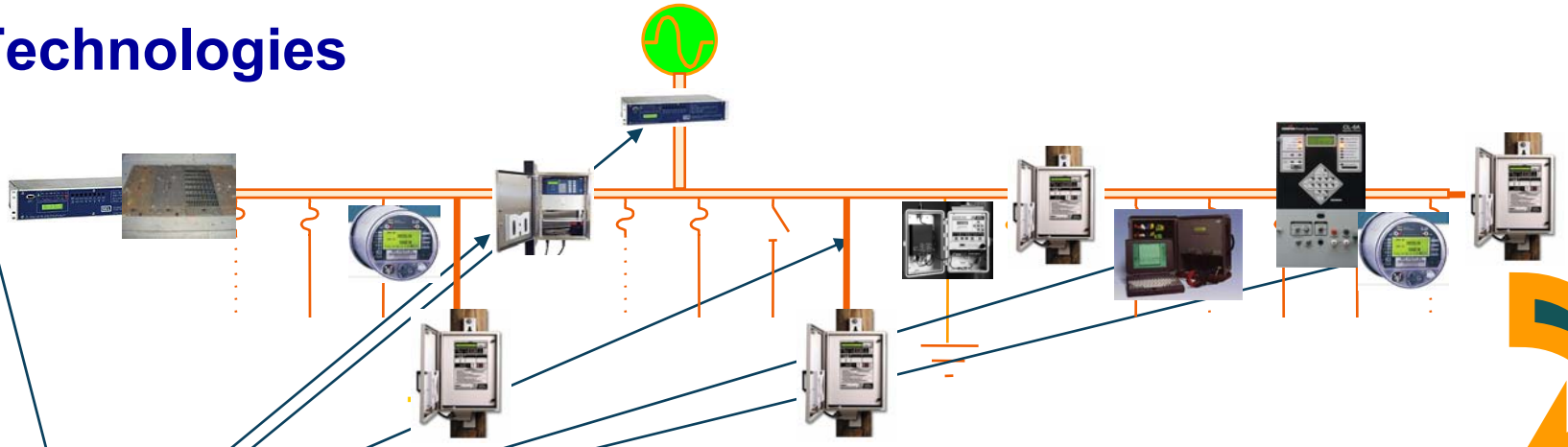
Voltage Control
Optimised Load Flow
Fault Location
Faulty Equipment
Power Quality Evaluation
…

Business needs
(Why?)

Energy Efficiency
Reliability
Distributed Resources
Power Quality
Customer Satisfaction

Distribution Automation Flow of Decision

Technologies



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Reliability
Distributed Resources
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Customer Satisfaction

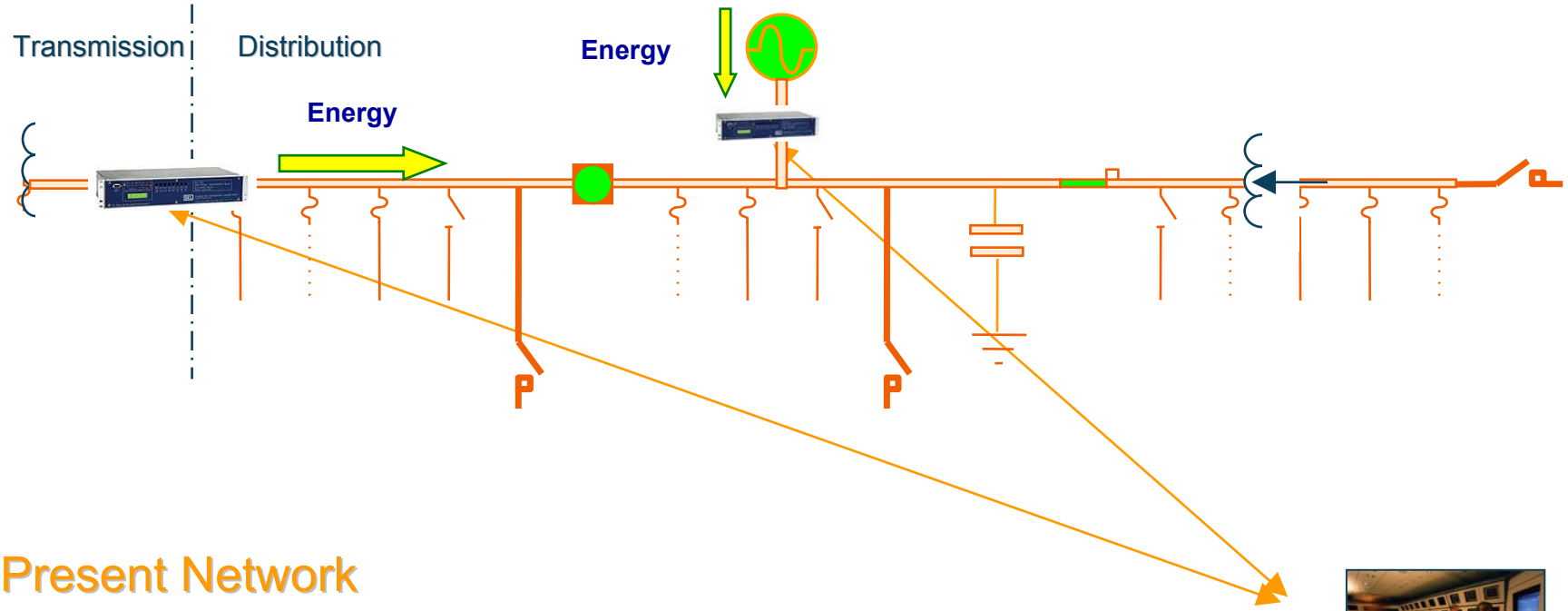
Distribution Automation Roadmap: Guiding Principles

- **The distribution network evolution must start from the actual network and gradually moves toward an intelligent grid**
- **The remote control infrastructure shall be used to gather network information**
  - This information is needed to add intelligence to the network in order to increase its performance
- **The multiple task possibilities of modern digital equipment (i.e. smart meters, digital relays, ...) should be integrated to reduce cost**
- **Distribution network evolution shall consider the growing interconnection of DER**

Distribution Automation Roadmap: Guiding Principles

- **Use transmission grid experience with automation to transpose on distribution networks (i.e. equipment, standards, …)**
- **The telecommunication structure of the distribution network should evolve toward a compatible network with the transmission level**
  - The ultimate goal is to develop standards (utilities with the manufacturers) defining a "*Plug and Play*" concept
- **Distribution feeders should be seen as an extension of the substation busbar**
- ***Distribution Automation Roadmap* is influencing Hydro-Québec's R&D program**

Distribution Network 2006 - 2007



Present Network

Remote control of substation MV breakers

Remote control of MV DER breakers

Operation Center
SCADA

Existing remote control

New remote control

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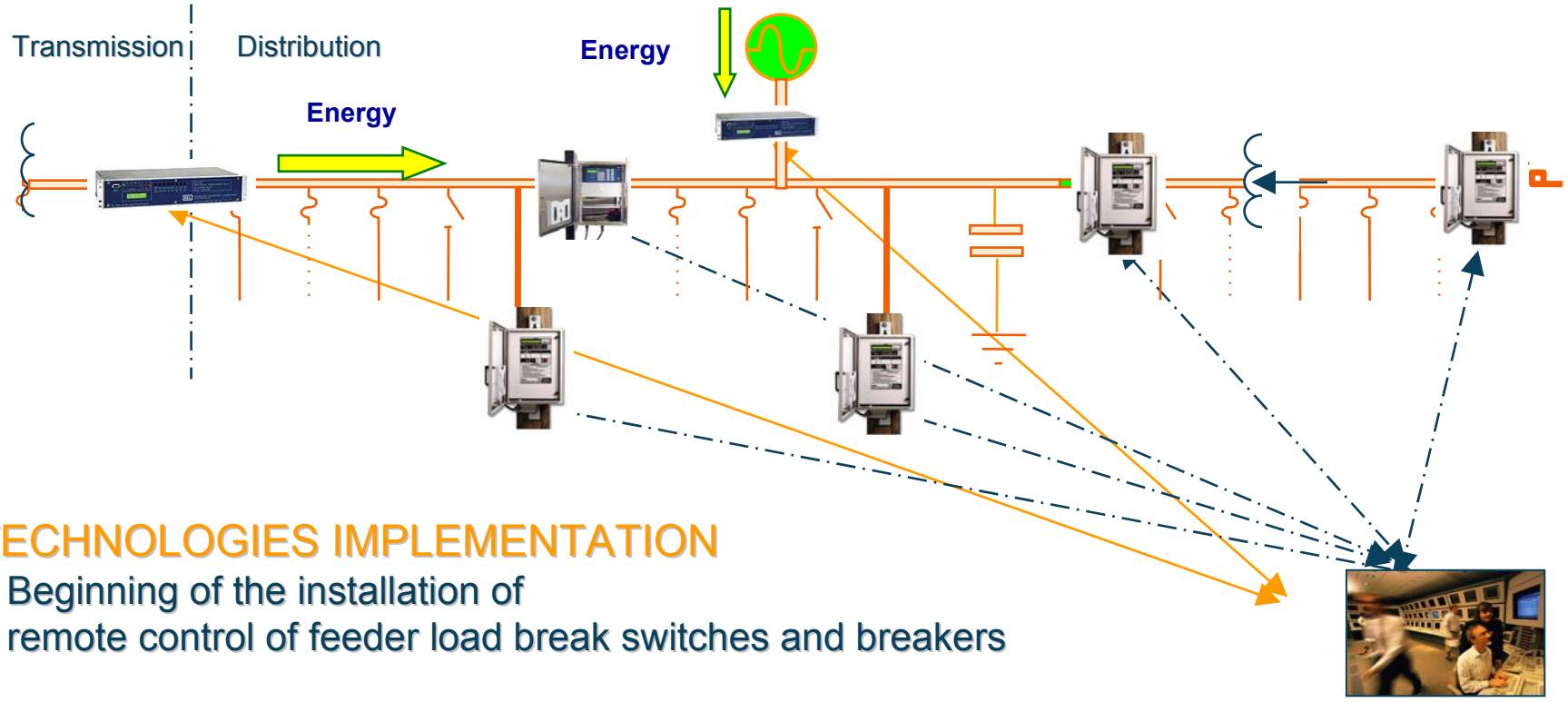
Distribution Network 2006 - 2007



TECHNOLOGIES IMPLEMENTATION

- Beginning of the installation of remote control of feeder load break switches and breakers

INTERNAL DEVELOPMENT

- Voltage control
- Fault location

STUDIES

- Telecommunication architecture
- Network information acquisition and management
- Distribution capacitors optimisation

Operation Center
SCADA

Existing remote control

New remote control

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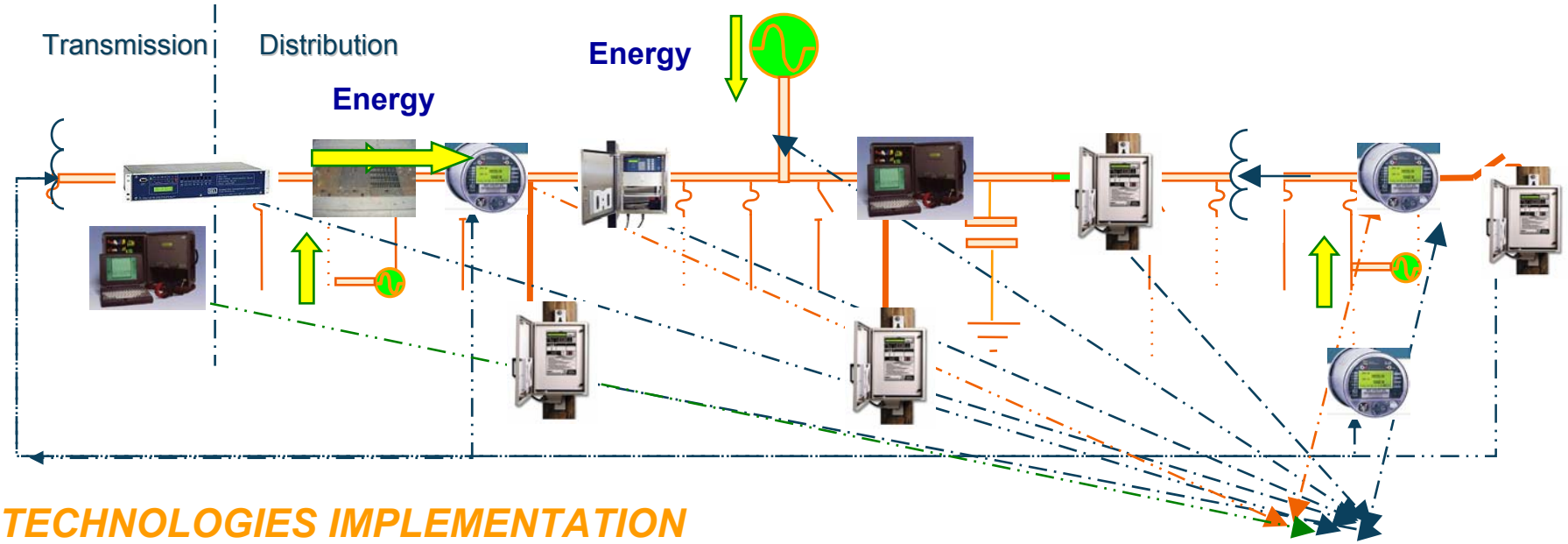
Distribution Network 2007 - 2010



TECHNOLOGIES IMPLEMENTATION

- ***Addition of sensors for voltage control and fault location***
- ***Gathering of information from remote control cabinet***
- ***Addition of DER LV net metering***
- ***Power Quality qualification***
- ***Intelligent underground equipment***

Distribution Automation Program undergoing

INTERNAL DEVELOPMENT

- Telecommunication architecture
- Intelligent maintenance system

STUDIES

- Automatic network reconfiguration
- Data structure

SCADA, Maintenance, Planning…

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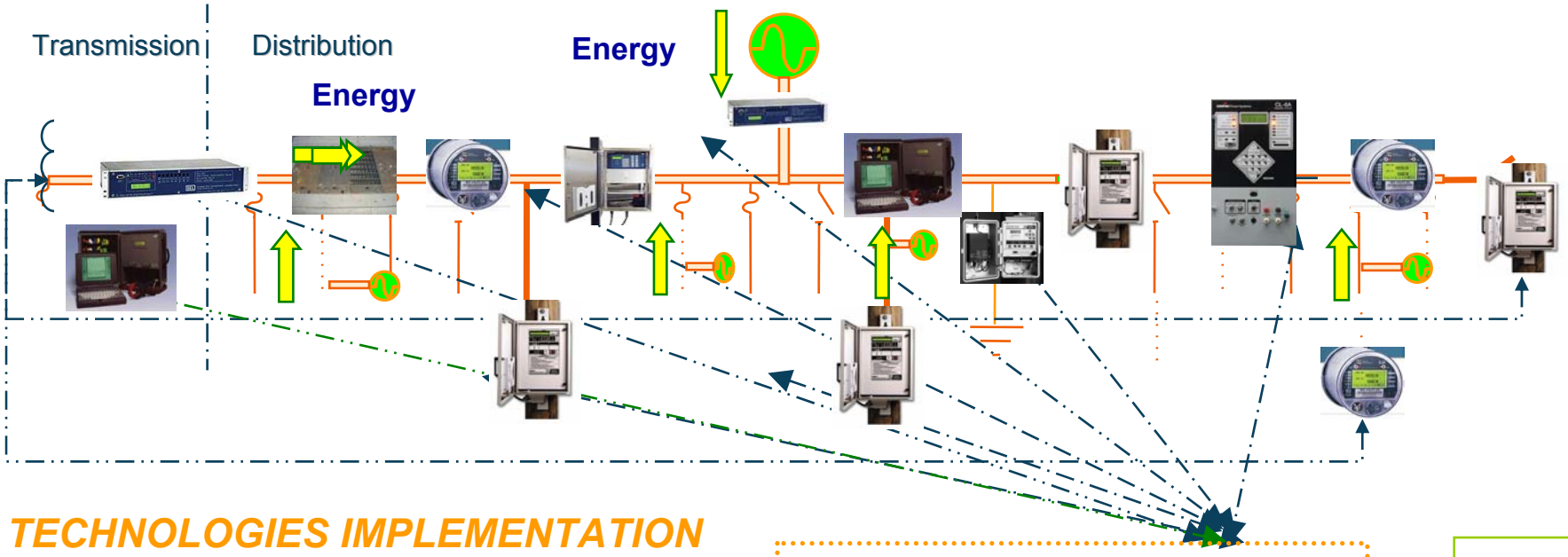
Distribution Network 2010 - 2015



TECHNOLOGIES IMPLEMENTATION

- *More DER on the distribution grid*
- *Automatic reconfiguration*
- *Voltage regulator control*
- *Capacitors control*

Real Time | **Delayed Time**

Distribution Automation Program completed

INTERNAL DEVELOPMENT

- Telecommunication architecture
- Intelligent system of predictive maintenance

STUDIES

- Automatic reconfiguration with DER (micro islanding)
- Demand side management

Residential

Industrial

Institutional

Customers

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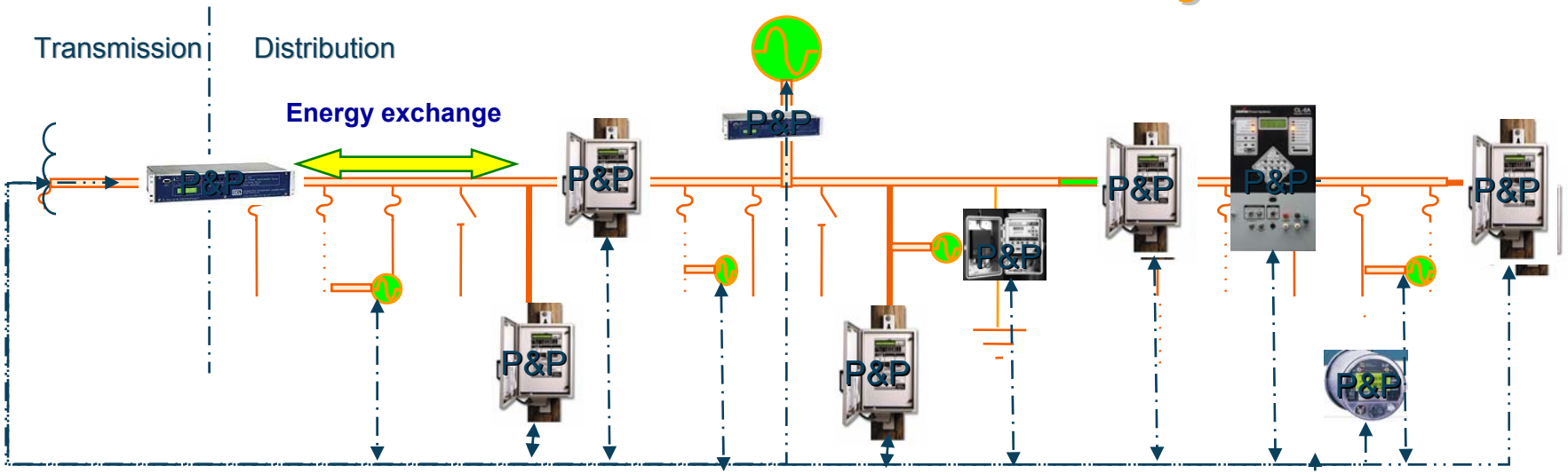
Distribution Network 2015 and beyond



TECHNOLOGIES IMPLEMENTATION

- Beginning of installation of *Plug and Play* equipment
- Implementation of integrated data and telecommunication architecture
- Demand side management

INTERNAL DEVELOPMENT

- Automatic reconfiguration with DER
- Energy exchange network

STUDIES

- Energy portal for consumers

Architecture IEC 61850

Real time

Delayed Time

Residential

Industrial

Institutional

Customers

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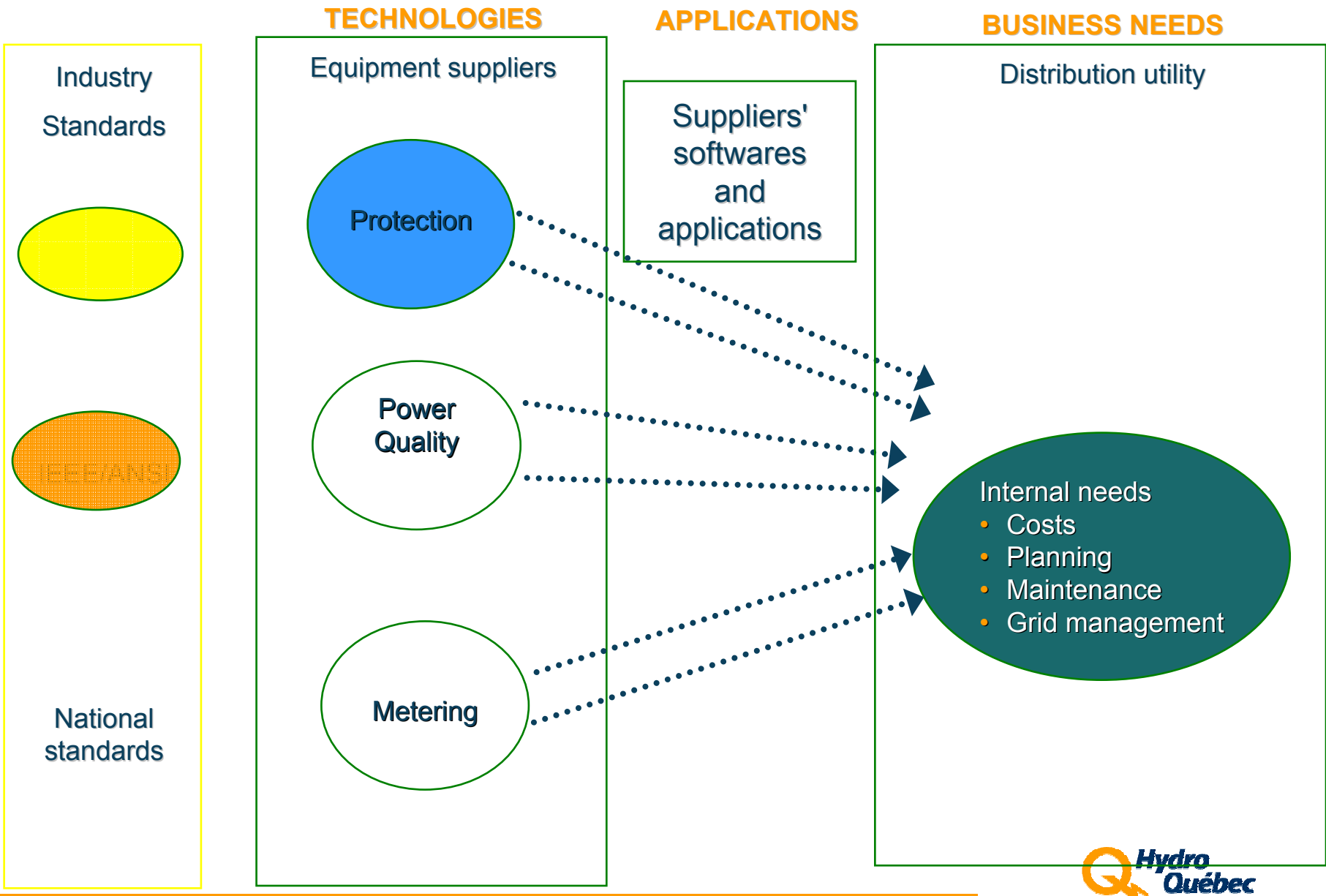
Distribution Automation Standards -Past situation



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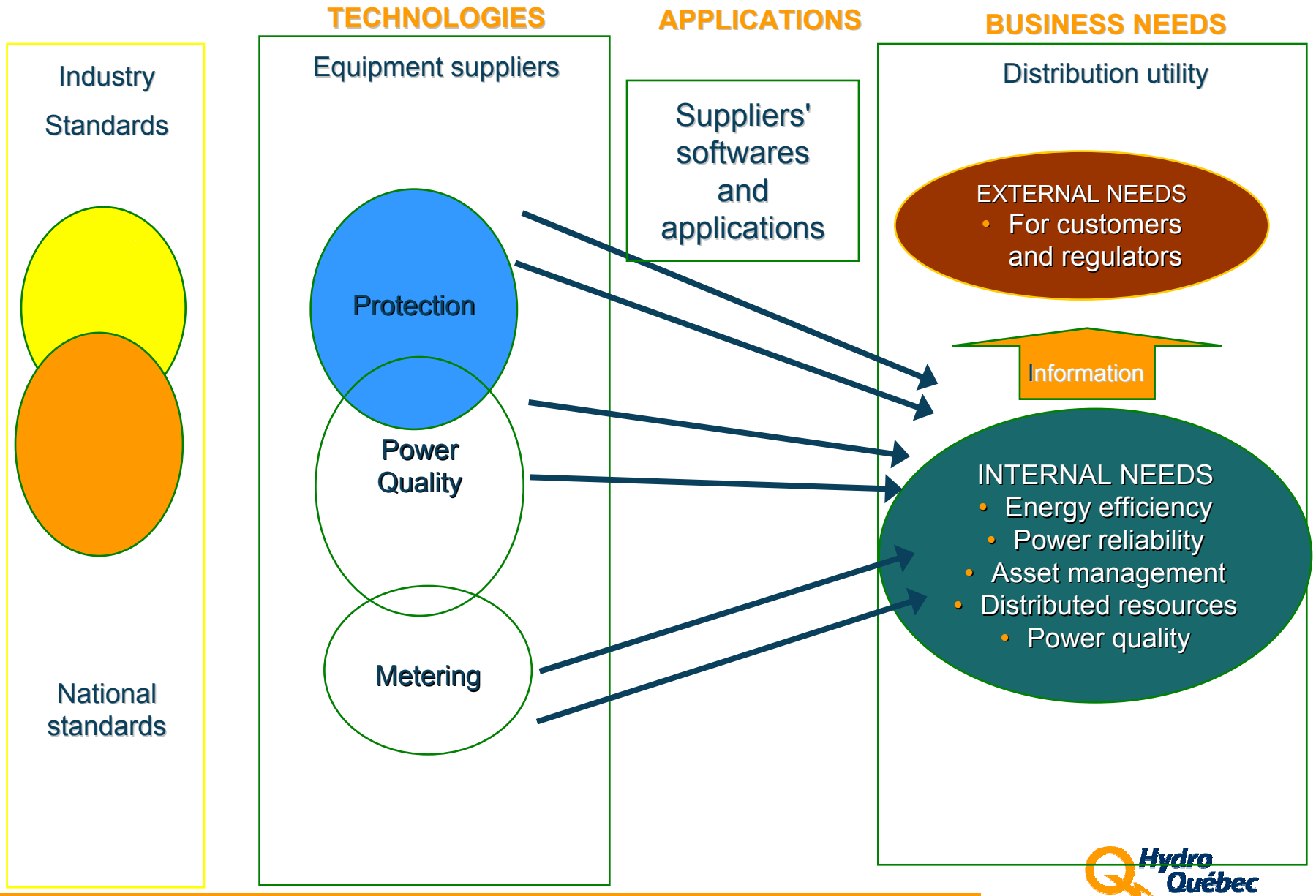
Distribution Automation Standards -Present situation



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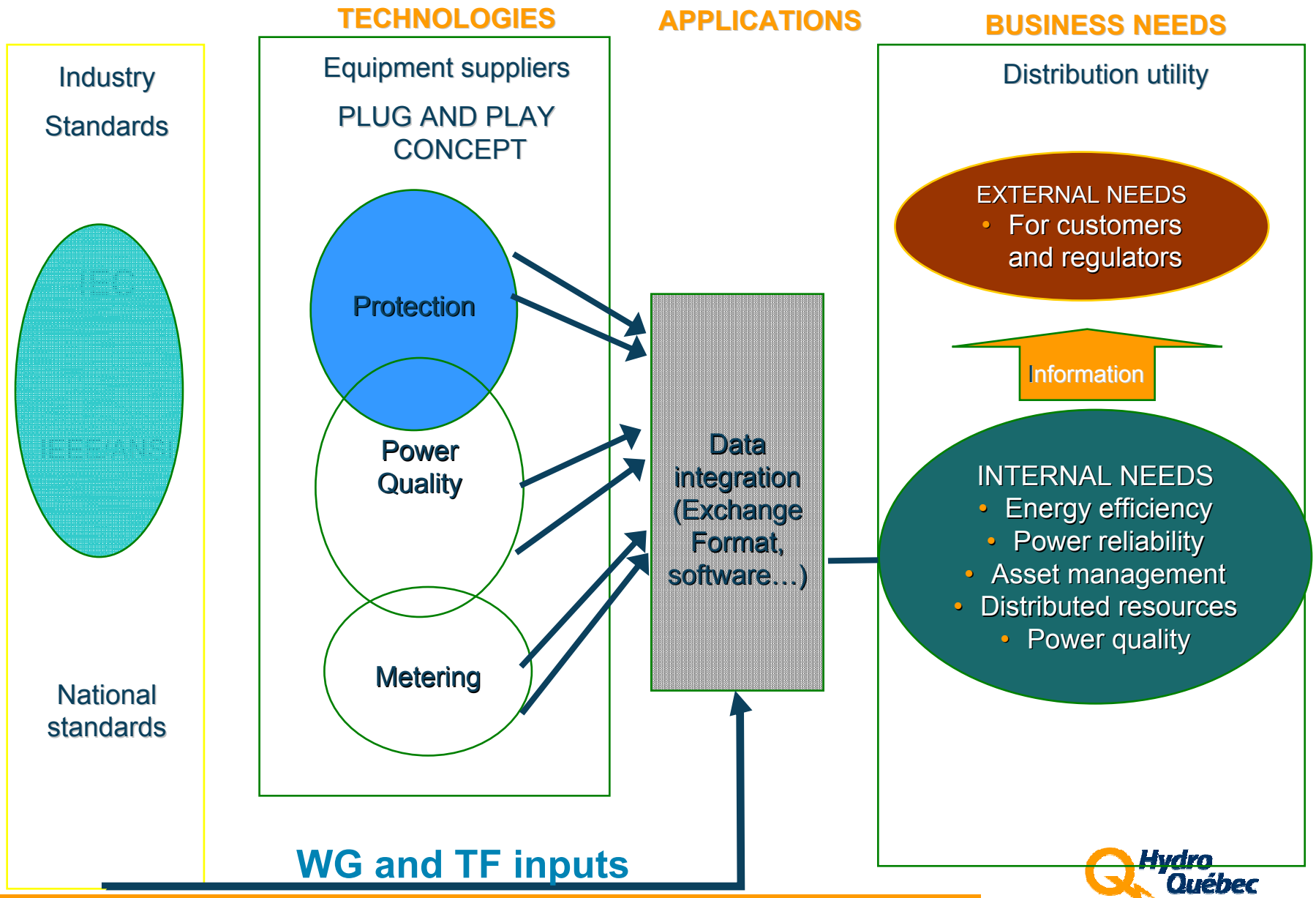
Distribution Automation Standards -Ideal situation



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Hydro-Québec's activities in DA/DER

- **Hydro-Québec has a 2006 project to evaluate data integration software with existing sensors on its distribution test line.**
- **Hydro-Québec is participating to EPRI'S ADA #124.005 "First generation Integrated sensor and Monitoring system for ADA"**
- **Hydro-Québec is participating and influencing forums on Distribution Automation and DER**
  - IEEE DA Group
  - EPRI's ADA
  - IEC TC 57 / 61850 Standard
  - CEATI's DALCM and PQIG who established a list of DA/DER projects
  - CEA Regulatory Innovation Task Group
  - Exchange with other utilities on DA/DER projects (BCHydro, Manitoba Hydro, EDF and others…)
  - Participation with CANMET (Canada Natural Resources) on DER
  - …

Conclusion

- **Hydro-Québec distribution network roadmap is adaptable and takes into account key elements such as:**
  - Business needs of Hydro-Québec Distribution (HQD)
  - Available technologies and their evolution
  - Local context (i.e. Province of Quebec)
- **The HQD roadmap is compatible with other industry roadmaps (CEATI and EPRI)**
- **Distribution Automation is the backbone of the future intelligent distribution network**
- **IEEE/IEC working groups must develop integrated Distribution Automation and DER standards to prepare the industry to the future intelligent Distribution Network**

Distribution Strategic Planning

Asset management

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