The Hydro-Québec Distribution Smart Grid Zone

Jeju 2011 Symposium on Microgrids

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Vice-présidence - Réseau de distribution

Presentation Overview

❑ Distribution System Roadmap

❑ Distribution Smart Grid Zone

– Description

– Deployment Roadmap

– Technologies

❑ Microgrids Research

❑ Summary

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2010 International Benchmark and Drivers

	Europe	U.S.	Canada
Availability of energy	X	X	X
Control of peak power	X	X	X
Political targets for green energy (distributed generation)	X		Ontario British Columbia

Smart Grid – Technology Innovation Group Report

May 26, 2010
Tokyo, Japan

European **SmartGrids** Technology Platform

Vision and Strategy for Europe's Electricity Networks of the Future

THE SMART GRID

Natural Resources Canada

Ressources naturelles Canada

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Distribution Smart Grid Roadmap

Challenges in Smart Grid Implementation

1. Telecommunications infrastructure

2. Information technology

Smart grid

3. Standardization in the field

4. Management of equipment-grid interaction

SYNERGY OF TECHNOLOGIES

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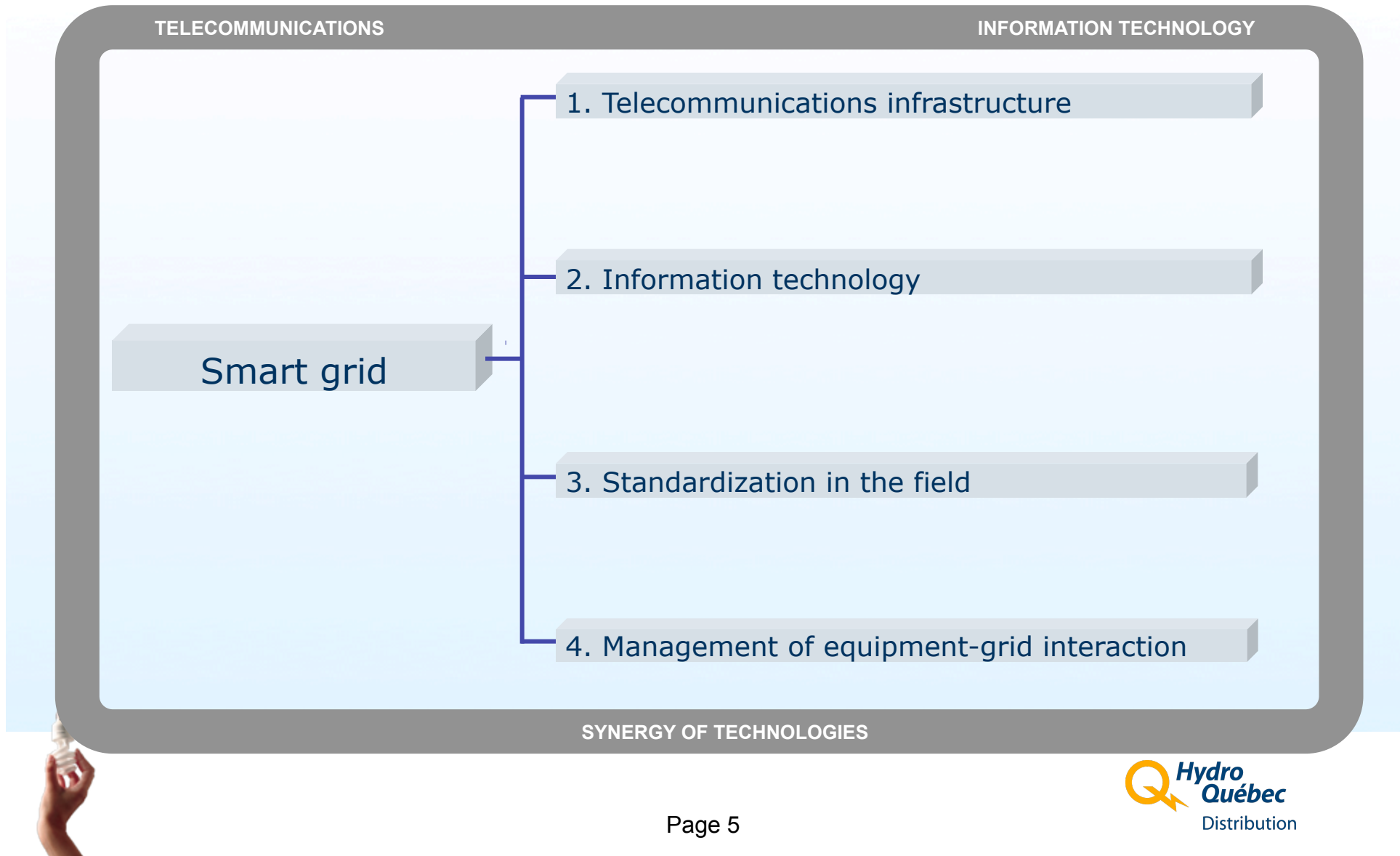
Distribution Smart Zone Overview
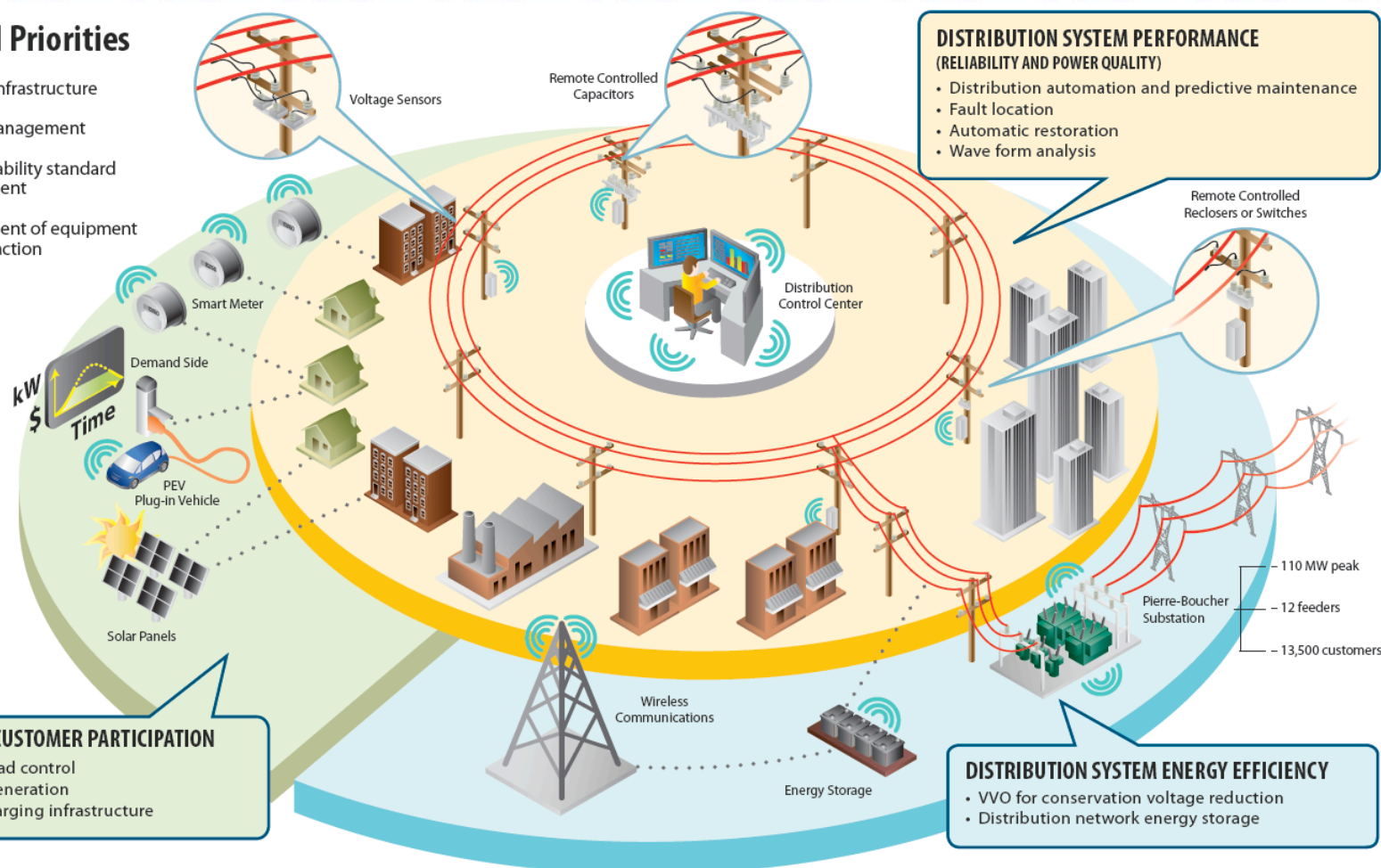
Distribution Smart Grid Zone

- ➢ **1 substation**

- ➢ **12 feeders**
  - ➢most sections overhead
  - ➢averaging 10 km

- ➢ **Consumption**
  - ➢110 MW (peak)
  - ➢450 GWh (annual)

- ➢ **13 500 clients, mixed load**
  - ➢Residential
  - ➢Commercial
  - ➢Industrial

- ➢**Not a preliminary test lab**

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Smart Grid Zone Technologies
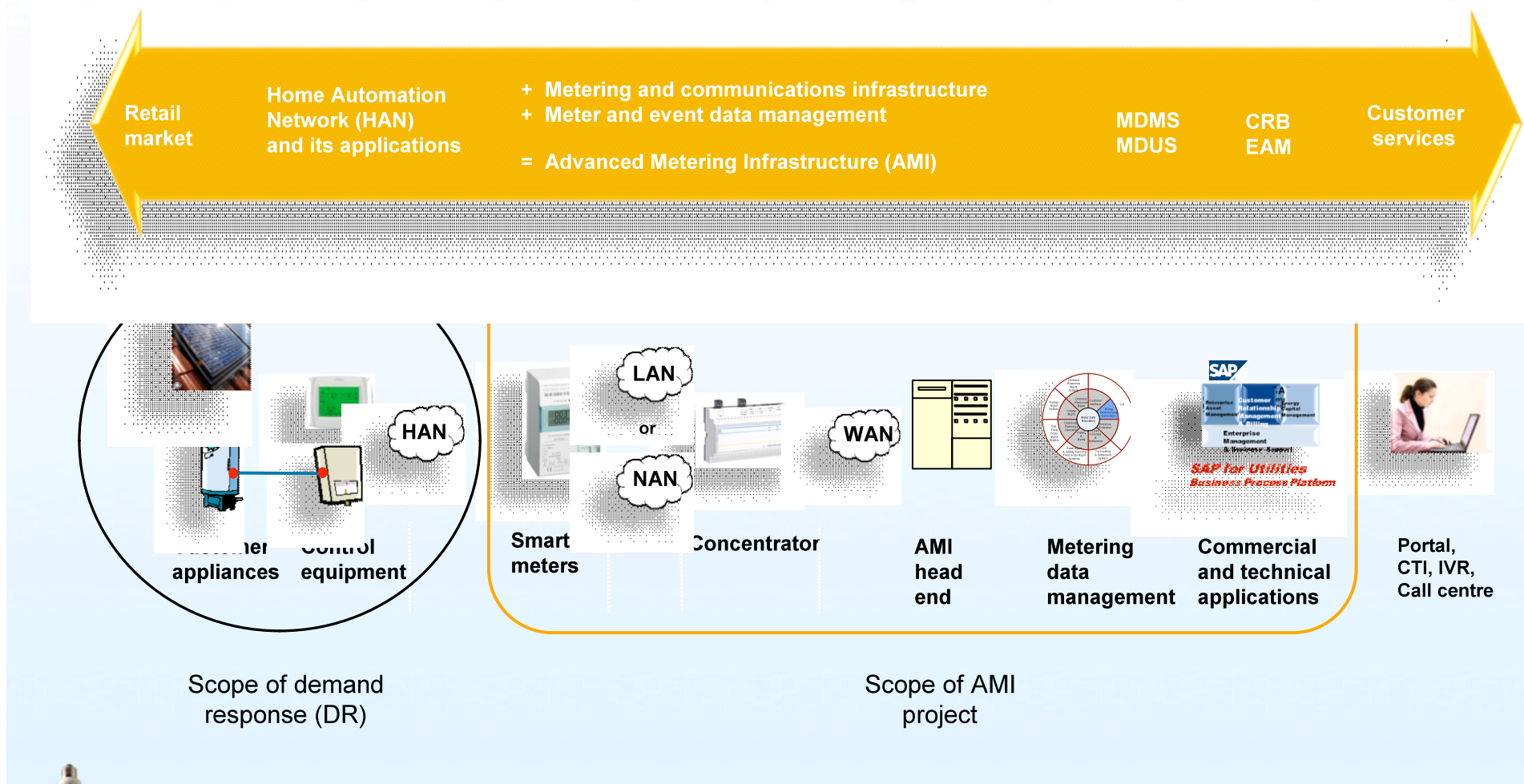
Electric Vehicle Charging Stations

- **Charging station infrastructure (test phase)**

  - Our goal is to master charging station technology and agree on how such stations are to be integrated into the power system.

- **Approach: Target for late 2012**

  - In the Boucherville smart grid project zone, deployment of 75 charging stations for the Mitsubishi iMiev.

  - In Communauto parking lots, installation of 50 charging stations for the Nissan Leaf.

iMiev

AMI and Demand Response

Retail market

Home Automation Network (HAN) and its applications

+ Metering and communications infrastructure
+ Meter and event data management

= Advanced Metering Infrastructure (AMI)

MDMS
MDUS

CRB
EAM

Customer services

HAN

LAN

or

NAN

WAN

SAP

SAP for Utilities
Business Process Platform

Customer appliances

Control equipment

Smart meters

Concentrator

AMI head end

Metering data management

Commercial and technical applications

Portal, CTI, IVR, Call centre

Scope of demand response (DR)

Scope of AMI project

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Renewable Energy Integration

- **Smart Grid for DG integration**

- **Monitoring: smart meter for profiling and forecasting of renewable energy production**

- **Protection: smart grid based protection strategies**

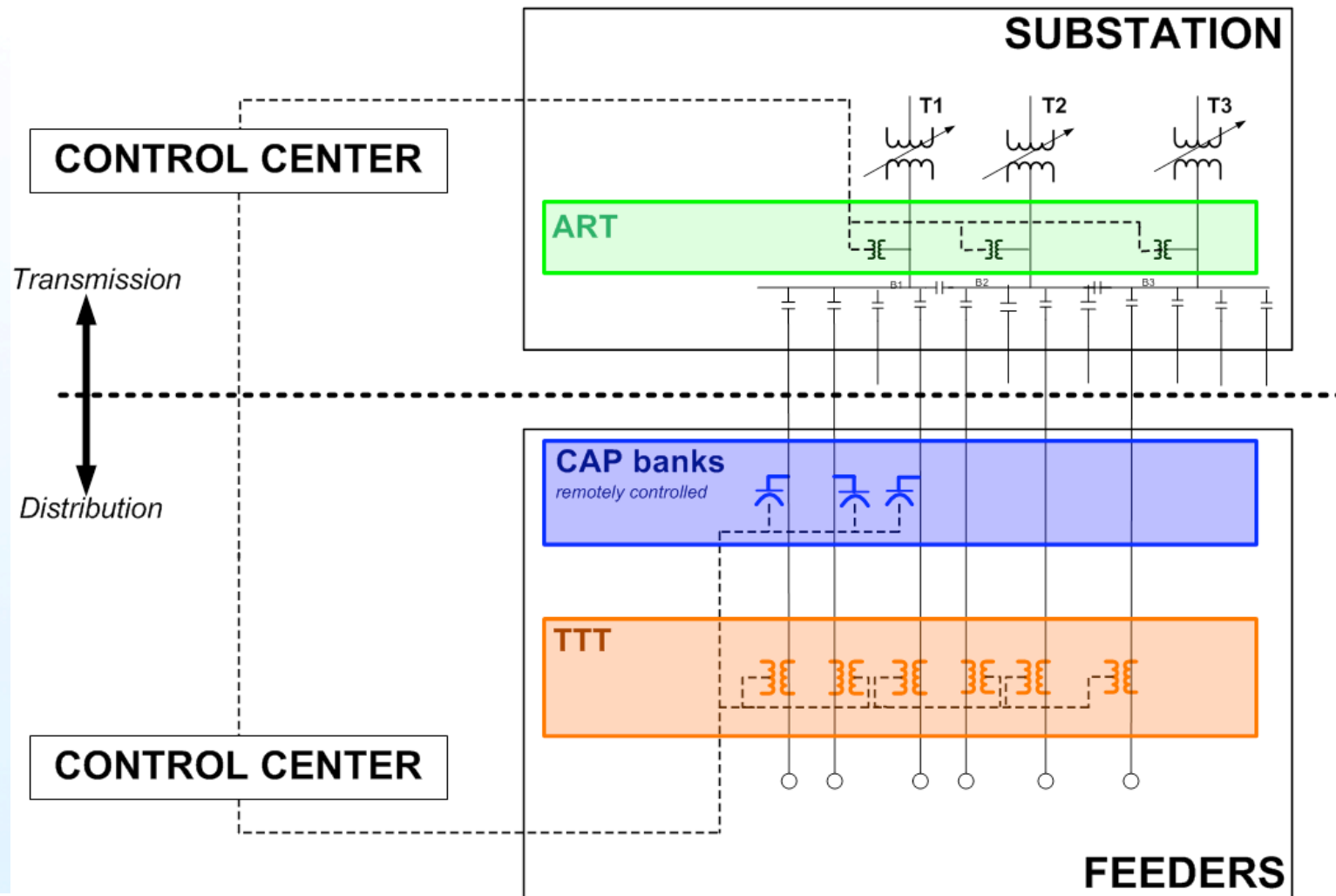- **Control: eventually integrate DG into DMS for participation in Smart Grid applications**
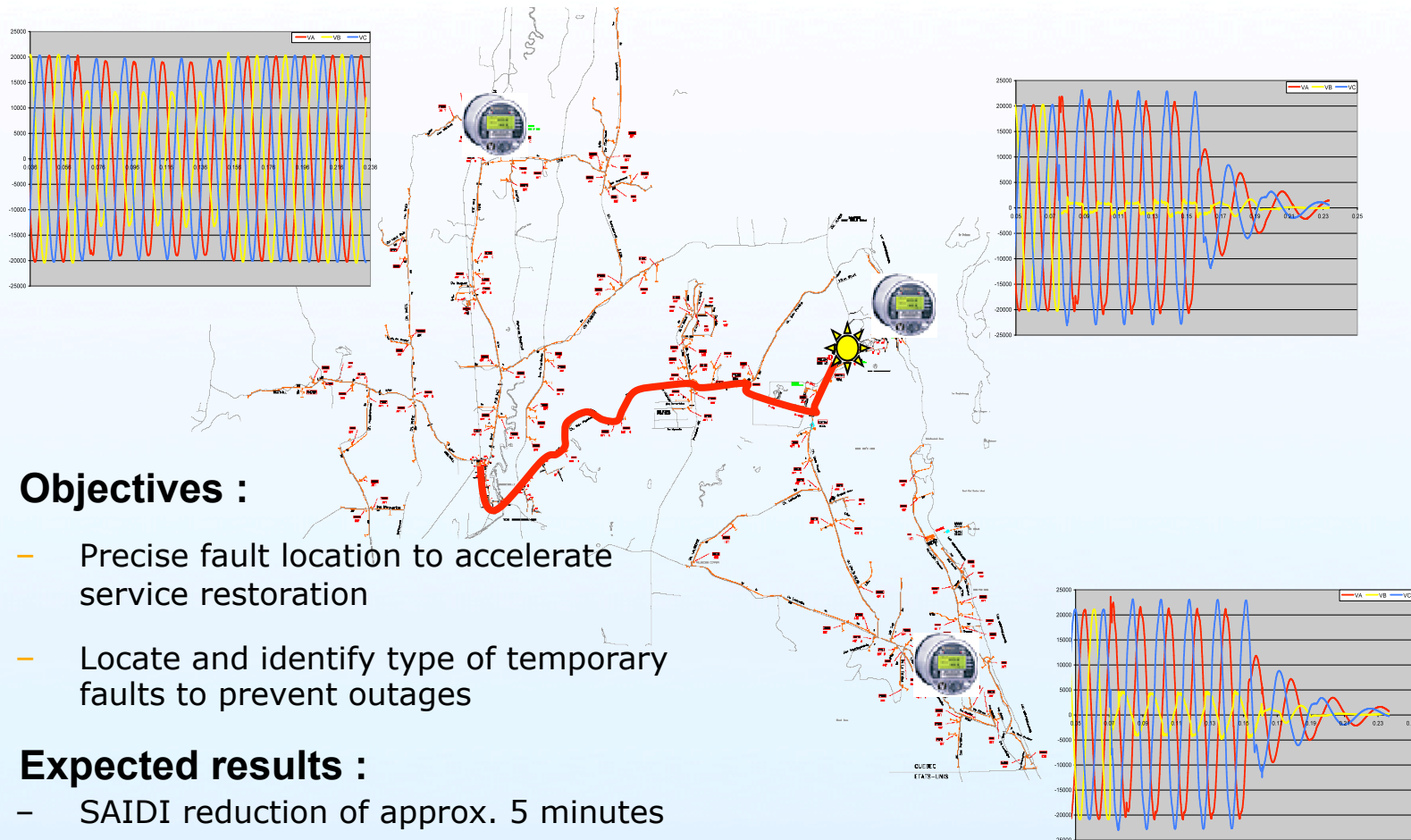

Example of PV concentrator

Source :
http://www.electron-economy.org/article-13200027.html

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Volt-Var Optimization (CAT-VAR project)

Automatic Fault Location

Objectives :

– Precise fault location to accelerate service restoration

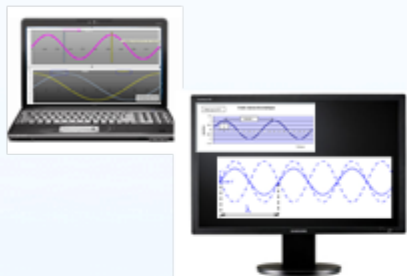– Locate and identify type of temporary faults to prevent outages

Expected results :

– SAIDI reduction of approx. 5 minutes

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Distribution Innovation Strategy

Testing facilities	Labs Test lines (IREQ)	SGZ Smart grid zone (Boucherville)	Fibre-optic network (Downtown Montréal)
IT Environment Simulators Offline database Real-time data access	**Labs with metering equipment** **Lines with typical grid equipment**	**Why Pierre-Boucher substation?** Typical substation near IREQ Test site: BPL, CATVAR, etc.	**Fibre-optic network** Connecting underground chambers in the high-density economic zone
Site for concept development: Algorithm testing Power system simulation Leveraging of historial data Scenario playback Calculating gain Data quality assessment	**Site for establishing proof of concept:** Equipement testing Interoperability testing Equipment certification testing	**Demonstration site for:** Fault location Automatic restoration Advanced protection (automatic disconnect switches) Electric vehicle charging infrastructure Load control (smart meters) Energy storage (MV and quick-charge stations) Distributed generation (solar concentrator Wireless telecommunications (WiMax, etc.)	**Demonstration site for:** Remote monitoring of the grid Remote maintenance of equipment Telecommunications with intelligent underground chambers

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IREQ Distribution Test System
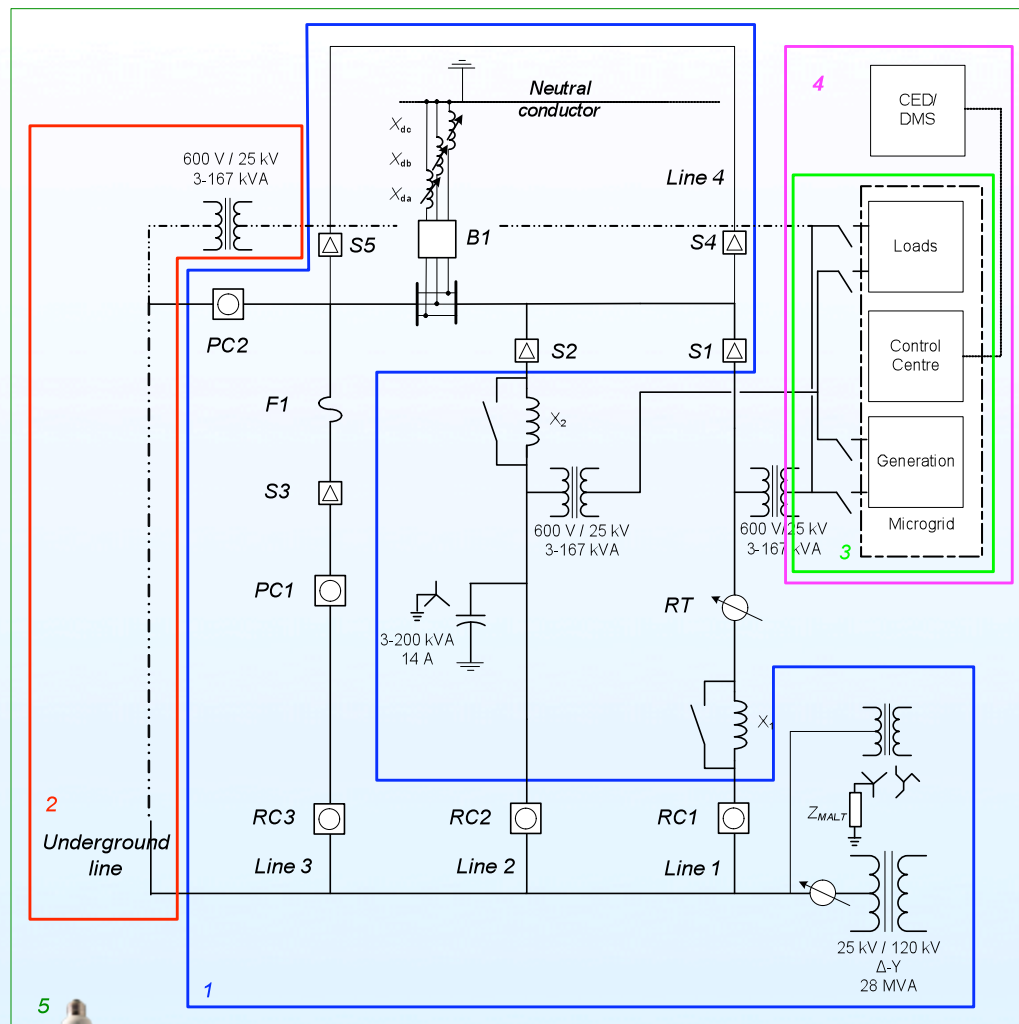
- **Distribution protection**
- **Underground distribution**
- **Distributed energy resources**
- **Advanced applications**
- **Monitoring, Telecom, IT**

Microgrid Research

- ❑ Business drivers
  - – Reliability improvement
  - – Optimization of capacity
  - – Enabling customer participation
- ❑ Past projects
  - – Senneterre thermal plant was used to island a small community during maintenance period
- ❑ Innovation project
  - – Integration of DER with smart distribution applications
  - – Microgrid controller testing and validation
  - – IREQ's distribution test line as research tool
  - – Participation in the NSERC Strategic Network

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Concluding Remarks

❑ Smart Zone applications
  – Volt-Var Optimization (CAT-VAR project)
  – Electric vehicle integration and smart charging
  – AMI and demand response
  – Renewable energy integration
  – Automatic fault location
❑ Future technologies
  – Application of advanced recloser technologies
  – Automatic reconfiguration
  – Remote management of distribution automation equipment
❑ Microgrids and innovation
  – Isolated use of islanding
  – Integration of multiple smart grid applications in Smart Zone
  – Other research resources to evaluate its feasibility

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