Smart Metering
The Canadian Experience

Electricity Measurement Sector

OIML *Seminar on Smart Meters*
Brijuni, Croatia – 2-5 June 2009

Regulatory Jurisdictions

Federal Government

- Measurement Standards
  - National Research Council of Canada – INMS
  - Measurement Canada – EGIA

Provincial / Territorial Governments

- Rates
- Contracts
- Consumers (sales)

Regulatory Jurisdictions

Federal Government

Industry Canada (Measurement Canada)

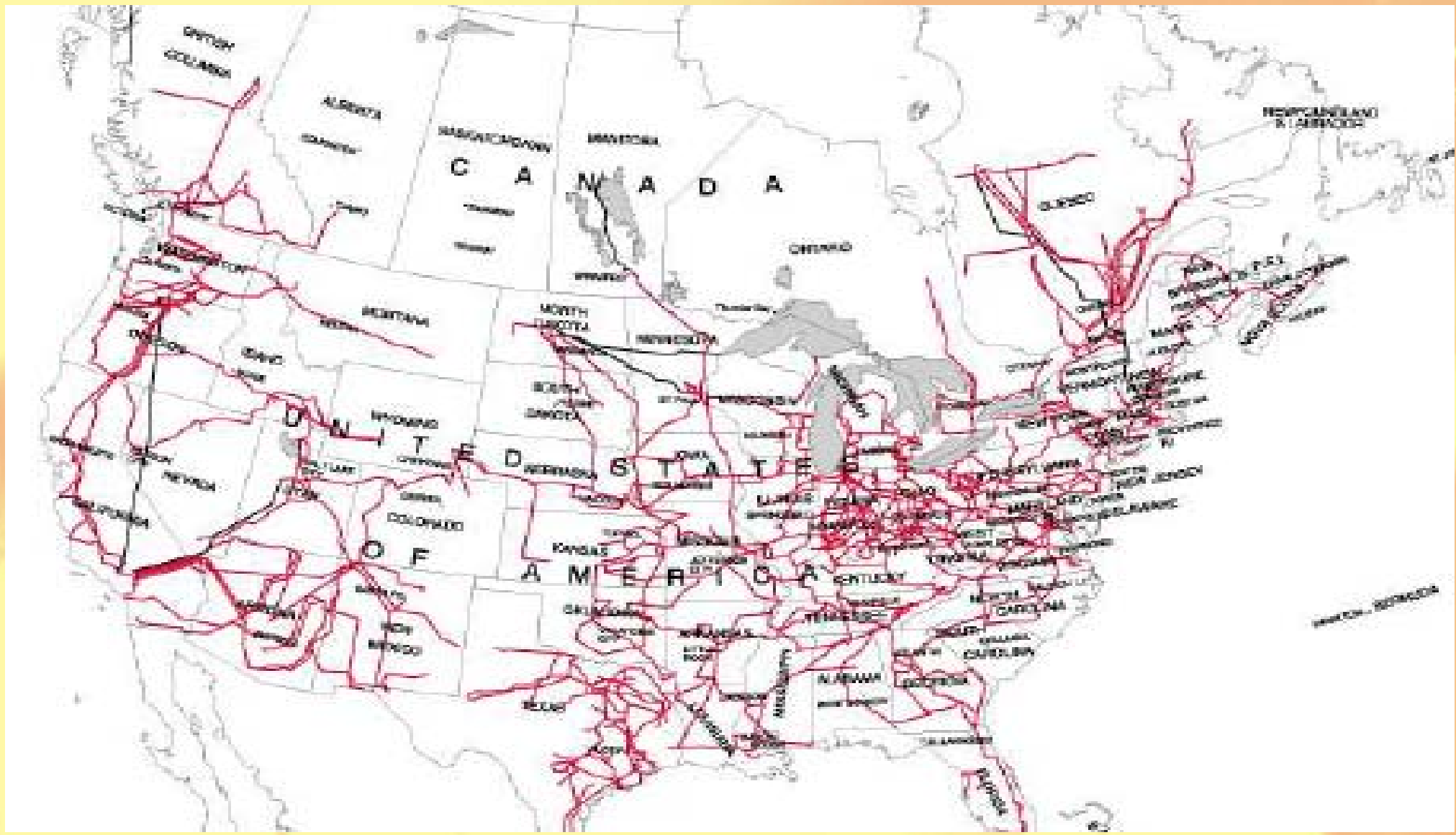
Provincial / Territorial Governments

Departments / Ministries of Energy

Energy Boards / Commissions

Public Utilities Commissions / Boards

Canadian Electricity Distribution Overview



Canadian Population

People

33,500,000

Meters

≥ 10 000 000 meters installed

≥ 1 000 000 commercial/industrial meters

Energy Generation

Canada 2008 – 598.8 TWh

Ontario -159.5 TWh (more than 50% nuclear)

QC – 188.4 TWh mostly hydro

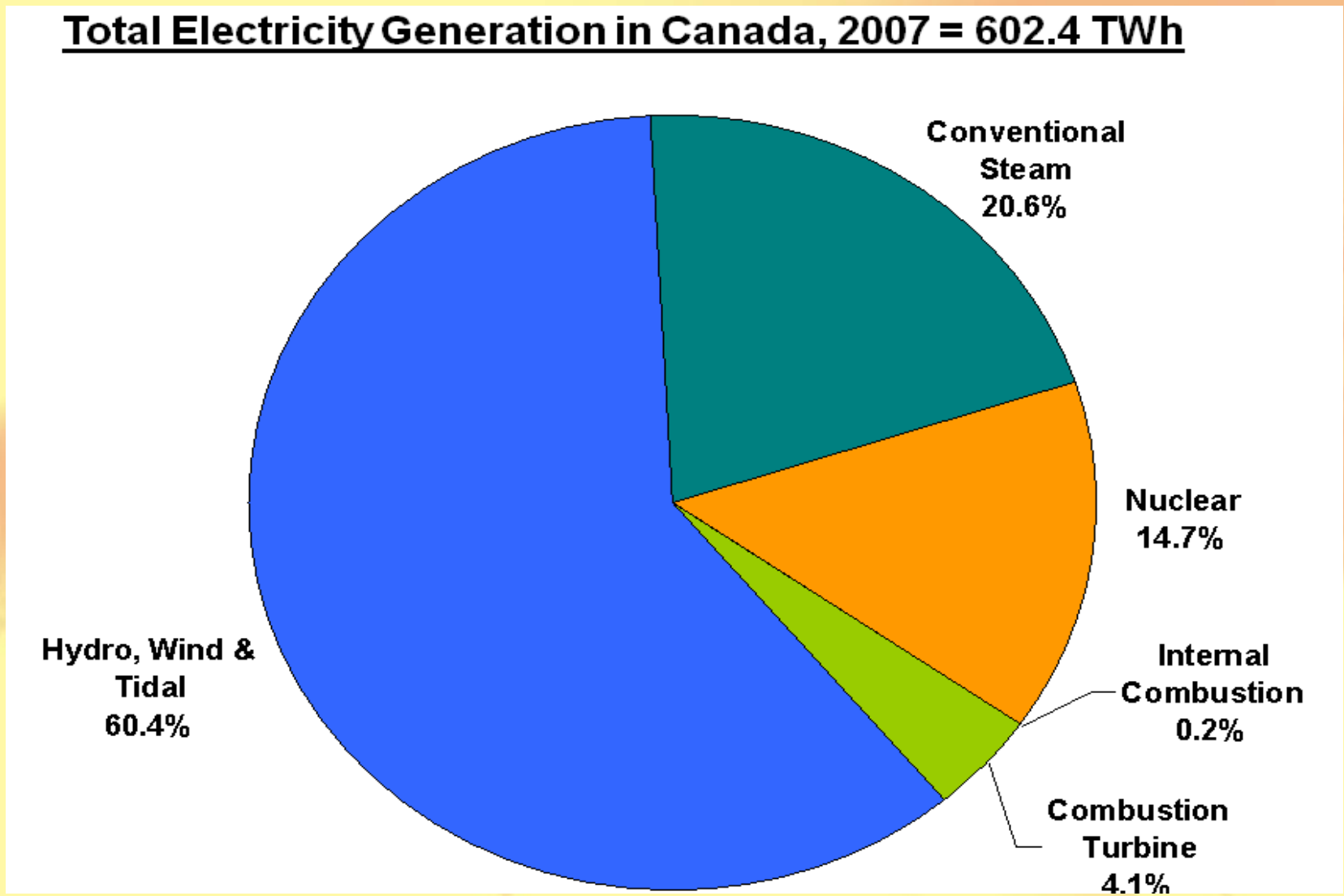
BC – 65.8 TWh mostly hydro

MB - 35.1 TWh mostly hydro

NLFD – 43.2 TWh mostly hydro

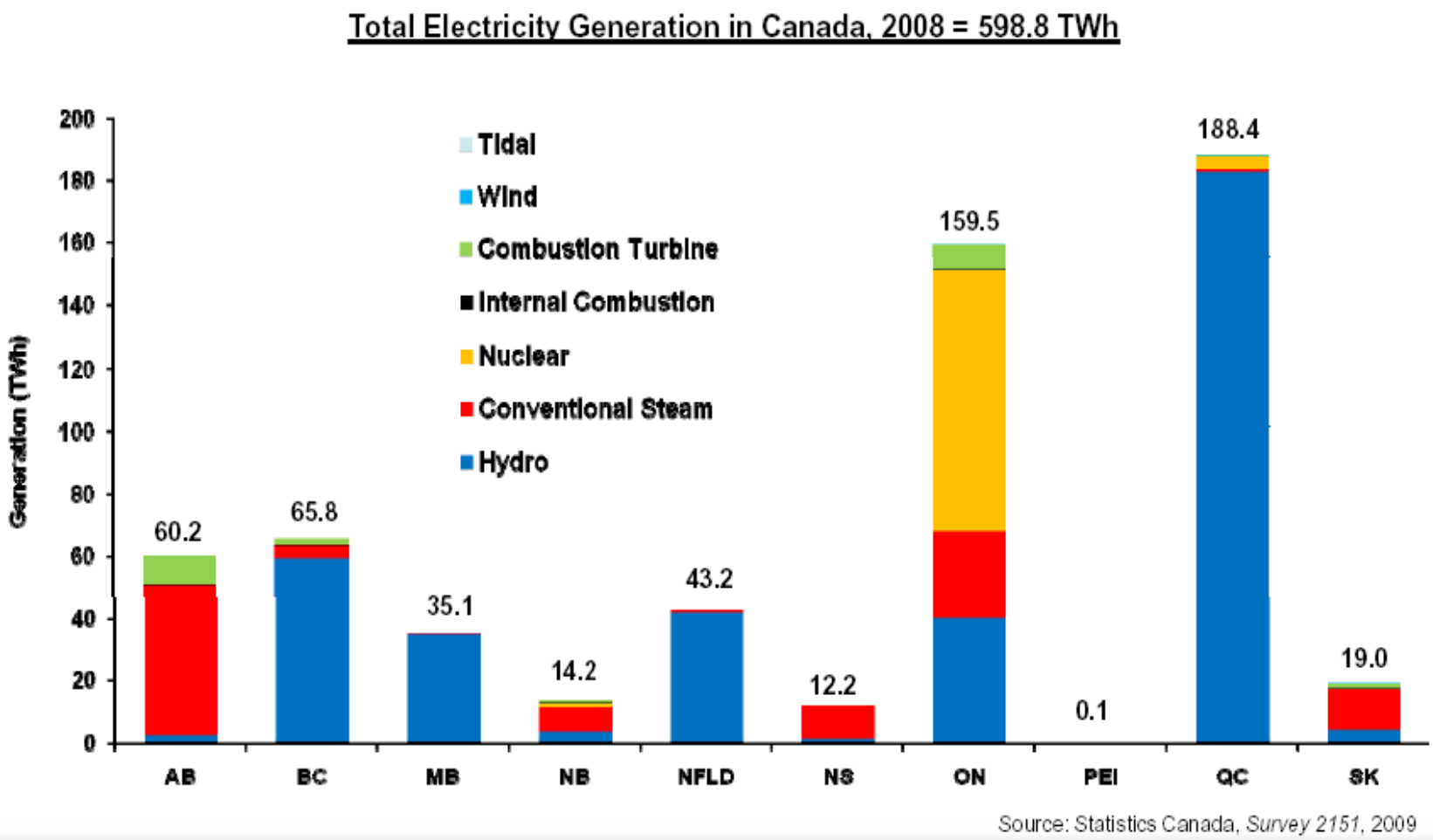
AB SK NB NS mostly conventional steam

Energy Generation



Energy Generation

Electricity Generation in Canada by Province and Fuel Type, 2008



Source: Statistics Canada, *Survey 2151*, 2009

Canadian Utility Ownership

Most Canadian utilities still publicly owned

- Provincial crown corporations
- Municipal corporations or agencies

Ontario

- Mostly municipally owned – over 80 (was over 200)

Other Provinces

- Mostly provincial crown corporations
- Few investor-owned province-wide distribution utilities

BC and Alberta

- Some smaller investor owned distribution utilities

Canadian Market Structure

Traditionally

- Integrated Market
- Little competition
- Utilities primarily viewed as “wires only

Now

- Wide diversity of structural models
- Unbundled by function
- Accommodates wholesale competitive market
  - Generation/transmission/distribution/retail
- Responsible for Conservation and Demand Management

Ontario and Alberta (½ Canadian total consumption)

- Full retail competition
- Many Independent Power Producers

Surveyed Canadian Utilities Meter Population

Utility	Residential (or total)	C + I	"Smart"
Hydro Quebec	3,620,000	282,000	3200
BC Hydro	1,600,000	200,000	2500
Hydro One	1,200,000	100,000	850,000
Manitoba Hydro	455,000	66,000	4700
FortisAlberta	390,000	70,000	150,000
Hydro Ottawa	265,000	26,000	281,000
Burlington Hydro	(63,100)		6300
Newmarket Hydro	26,000	3,000	26,500

Surveyed Canadian Utilities Peak Load and Service Area

Utility	Peak load	Service Area (sq. km.)	
Hydro Quebec	36,000 MW	1,670,000	G / T / D
BC Hydro	10,000 MW	940,000	G / D
Hydro One	27,000 MW	640,000	T / Rural D
Manitoba Hydro	4,273 MW	650,000	G / T / D
FortisAlberta	3,150 MW	200,000	Rural Dist.
Hydro Ottawa	1,170 MW	1104	Urban-sub
Burlington Hydro	346 MW	188	Urban-rural
Newmarket Hydro	160 MW	200	Urban-rural

AMI Regulatory Structure

Ontario
- Ministry of Energy
- OEB
- IESO

Alberta
- Department of Energy
- AUC
- PPA
- AESO

BC
- Department of Energy
- BCUC
- BCTC

AMI Mandated by Regulation
(utilities surveyed)

Ontario Full residential deployment by: **December 2010**

(C+I already implemented)

- Hydro One
- Hydro Ottawa
- Burlington Hydro
- Newmarket Hydro
  - (one of only two in Ontario to have TOU pricing currently in effect)

BC Full residential (and C+I) deployment by: **December 2012**

- BC Hydro

AMI Mandated by Regulation

Ontario

"Smart Meter" prescribed definition:

- Allows for measurement in hourly (minimum) intervals, stores data, and transmits meter readings to central billing system on a daily basis for customer access and billing purposes

"Smart meter" additional functionalities:

- Additional "at the meter" functionalities
- Power quality, outage notification / restoration, voltage and frequency monitoring, remote connect / disconnect / load limiting, tampering, firmware upgrades
- Support for HAN

AMI Mandated by Regulation

BC

Expected “Smart Meter” characteristics:

- 2-way communication
- Allows for measurement in hourly (minimum) intervals
- Provide energy usage to customers
- Support outage / restoration and diversion detection

AMI as Business Case
(utilities surveyed)

Manitoba Hydro

- Gain operational efficiency
- Understand current technologies
- Prepare for future use of current and emerging technologies

"Smart Meter" definition – Provides:

- 2-way communication
- Interval data
- Additional "at the meter" functionalities

AMI as Business Case
(utilities surveyed)

Hydro Quebec

- Pilot project (Heure Juste) TOU
- Pilot project (AMI) CPP

"Smart Meter" definition – Provides:

- Bi-directional communication
- Additional "at the meter" functionalities
- Remote connect / disconnect, load control, energy theft detection, real time information

AMI as Business Case
(utilities surveyed)

FortisAlberta

- Meter reads: frequency ↑ cost ↓
- Data Accuracy: ↑ estimate reads ↓
- Prepare for AMI: Provincial Energy Strategy (clean energy / energy efficiency)

"Smart Meter" definition – Provides:

- Automatic transmission of daily / hourly consumption data to central billing system
- Additional "at the meter" functionalities
- Power quality, outage notification / restoration, voltage monitoring, remote connect / disconnect / load limiting
- Support for HAN

Technologies and Methods

Technologies

- GPRS
  - SmartSync
  - Itron OpenWay RF/GPRS cellular
- Mesh Spread Spectrum RF
  - Trilliant
  - Elster (EnergyAxis)
- Powerline Carrier
  - Cannon PLC
  - Landis+Gyr TS2 PLC
- LAN / WAN (long range tower)
  - Tantalus
  - Sensus

Benefits expected / realized

Utility Benefits

- Minimize “incorrect reads”
- Reduced amount of customer billing inquiries
- Reduced resources to validate “exceptional” meter read

- Load shifting
- Real time system monitoring and control
- System optimization

- Theft reduction

- Multi-utility metering
- Prepare for future innovations – PEV, customer generation

Benefits expected / realized

Customer Benefits

- Access to real-time information – empowered
- Save energy + money, manage energy use
- Eliminate estimated billing
- More information provides better overall customer service and faster resolution of CS issues
- Improved responsiveness to customer meter reading concerns

- Customized conservation packages
- Capabilities for HAN devices
- Faster outage restoration

Obstacles

- Labour and data management - rapid deployment
  - Meter change-out process (10 times normal)
  - Automate the meter change out process (from paper)
  - Higher volumes of the exceptional mistakes
- Few approved technologies at start-up
- Physical limitations (different meter dimensions)
- Manage multiple communication technologies (GPRS, PLC, WiMax)

Obstacles

- Diverse service territory and geography
  (dense urban / remote isolated communities)

- Upgrades to CIS's required
- Integrate billing systems with MDM/R
- Integrate head-end computer with billing systems via MV-90

- Lack of commercial network coverage in vast rural areas

Experiences

Unexpected

- **Very few significant problems**
- **Some supplier production issues**

Good

- **“Off the shelf” technology** → ease of use and installation
- **Ability to blend RF solutions** if PLC capacity exceeded

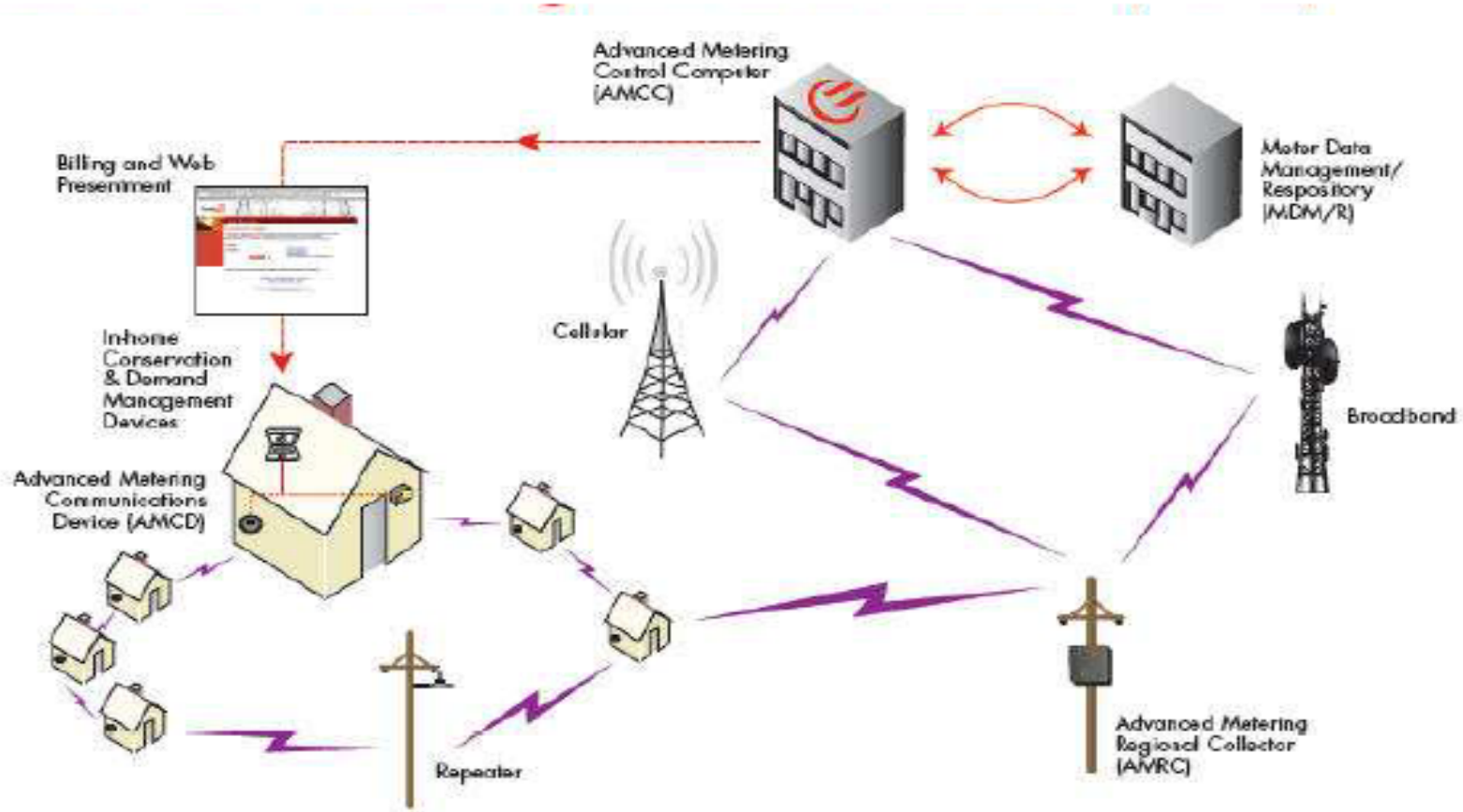
Experiences

Bad

- **Evolving technology** → additional incurred costs
- **Adapting to changing marketplace** → changes to deployment strategies, added complexity
- **Size of load profile data** → more communication errors
  → need additional interrogations
  (More complex than simply downloading register data)

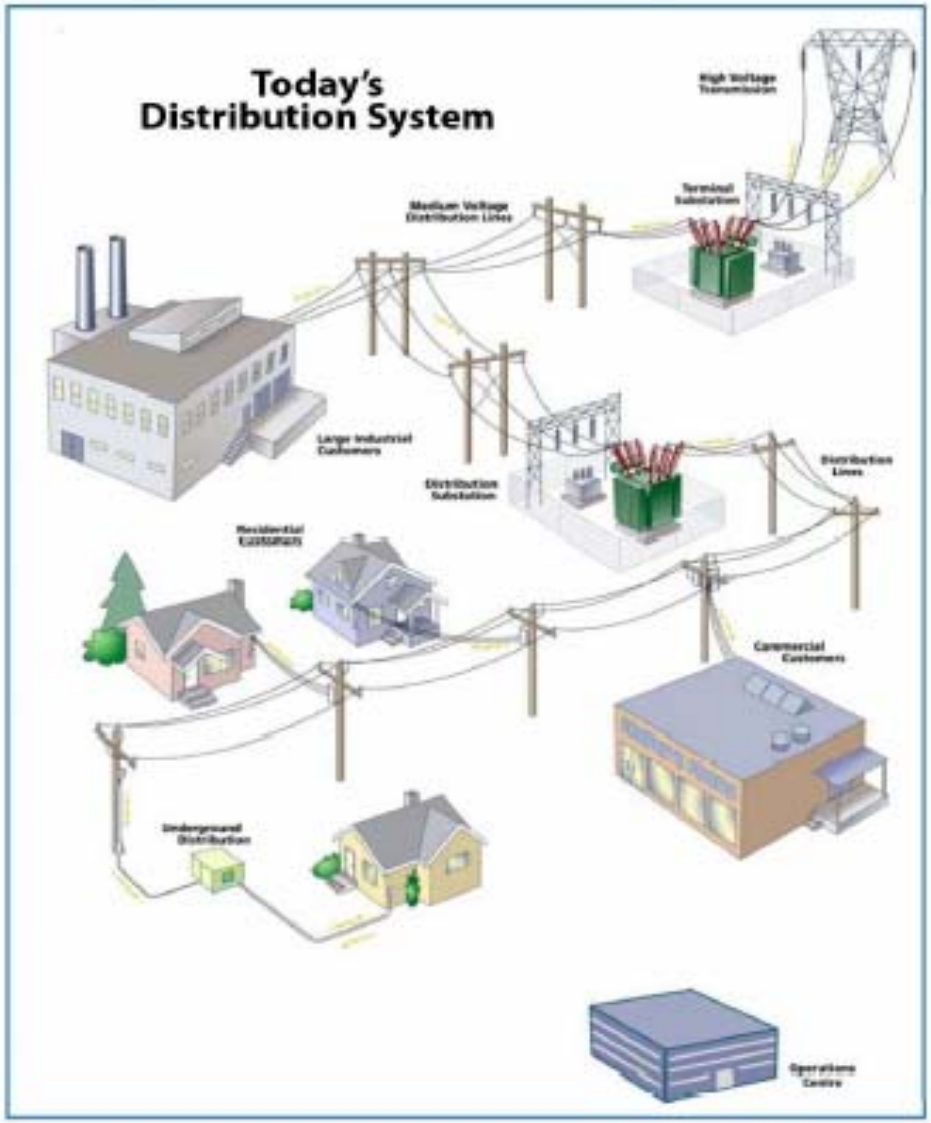
Hydro One

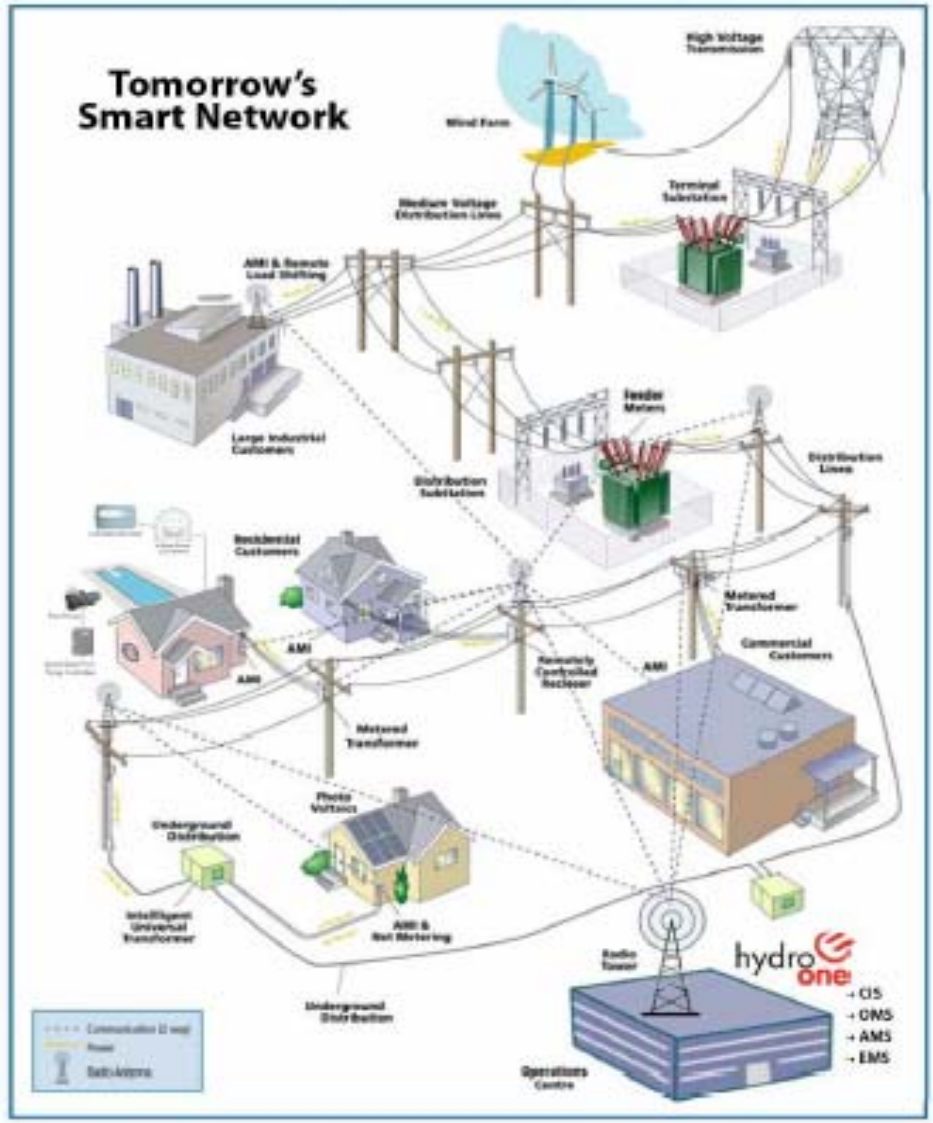
Smart Metering System



smart meter project

Today - Future



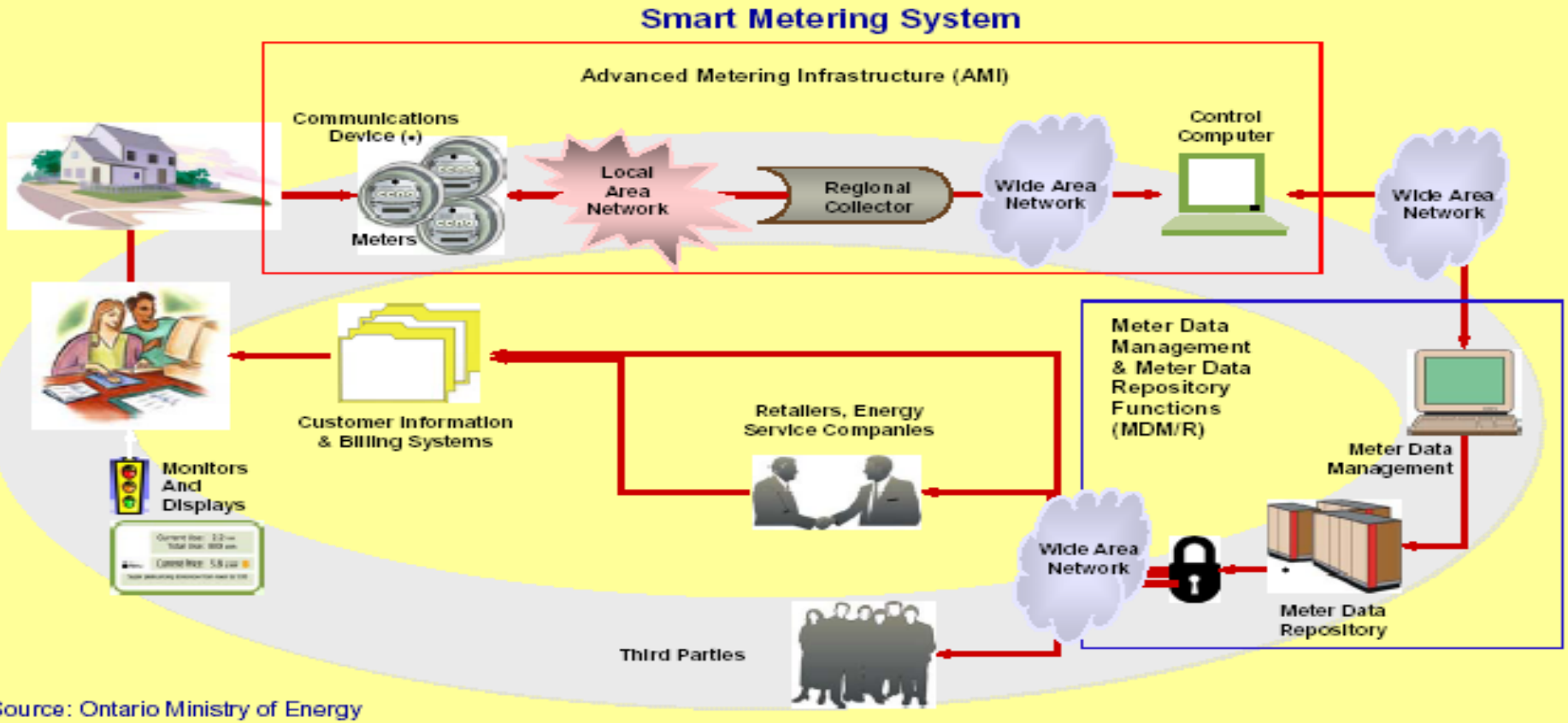


Ontario AMI

Meter-to-Bill Walkthrough – The Meaning of "Meter-to-Bill"

SMSIP
Smart Metering System Implementation Program

- At the highest level, the Smart Metering Initiative has been characterized by the Ministry of Energy's Conceptual Model of the flow of information through the smart metering system:



Source: Ontario Ministry of Energy

Information Overload?

Hydro One – Quote

- The current grid produces enormous volumes of data, most of which cannot be analyzed, or is analyzed in an isolated context.

- The Smart Network will produce exponentially more data, so if a utility does not change how it processes and analyzes that data, it will flounder operationally and competitively.

Challenges for MC as Measurement Regulator

- MC regulates metering and measurement in the traditional sense (EGIA)
  - Asses metrology for accuracy and conformity
  - All meters treated essentially equally
  - Statutory definition of a “Contractor” (electricity distributor) no longer fits the deregulated /unbundled market.

- Federal / Provincial jurisdiction crossover
  - Measurement - Rates
  - TOU
  - CPP
  - Smart Meter
  - Utility Functionalities

Challenges for MC as Measurement Regulator

- Smart meters are much more than just “measurement devices”
- Utilities see meter as their “connection” to the customer for many purposes
- Functionalities integrated with metrology

- Need to separate metrology from utility features – different level of reg. oversight
  - Approval
  - Sealing
  - Verification

Smart Metering
The Canadian Experience

Thank you !

Mike Abraham

Senior Program Officer – Electricity

Measurement Canada

Michael.Abraham@ic.gc.ca