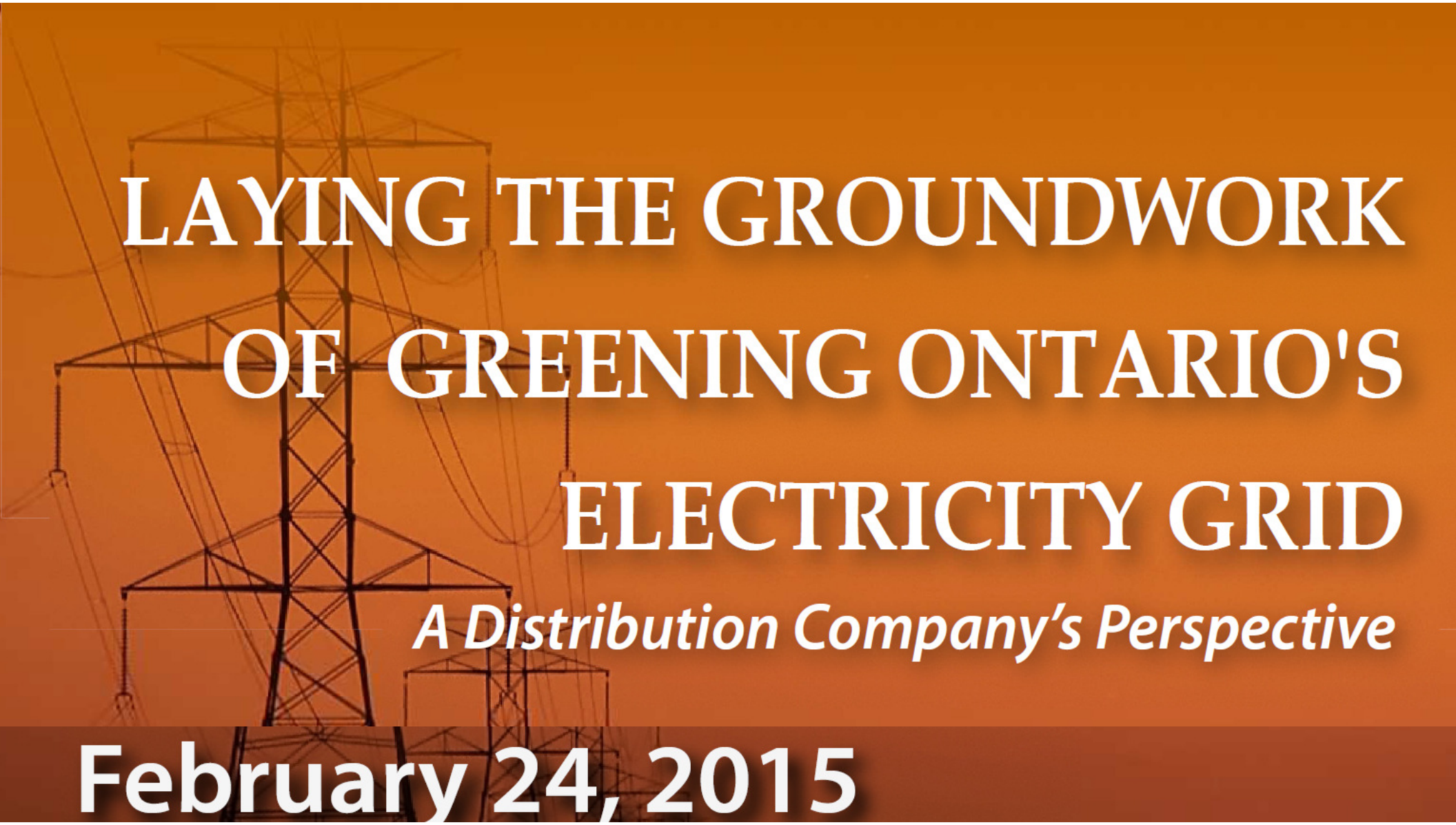


LAYING THE GROUNDWORK OF GREENING ONTARIO'S ELECTRICITY GRID

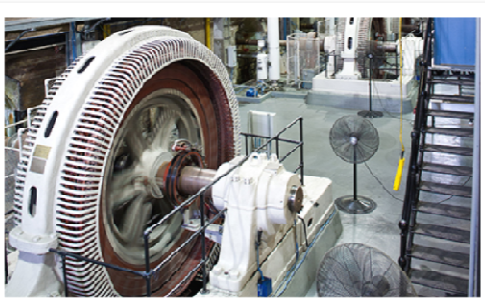
A Distribution Company's Perspective

February 24, 2015

Disclaimer & Notice of Intent

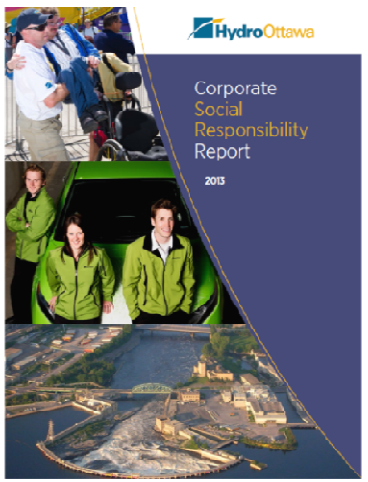
- The information and opinion presented may not have been endorsed by or reflect the opinion of Hydro Ottawa (or its employees), those of IEEE or its members, or those of anyone else except the presenter – Raed Abdullah, P.Eng., SMIEEE.
- The information and opinion presented will hopefully be informative and challenging of your thinking.
- If you disagree with or are dismayed with what is presented, take it up with the presenter – Raed Abdullah, P.Eng., SMIEEE.

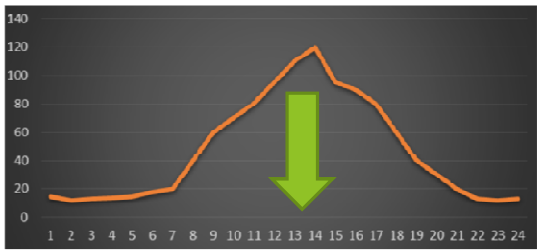
Agenda



Generation

Perspective

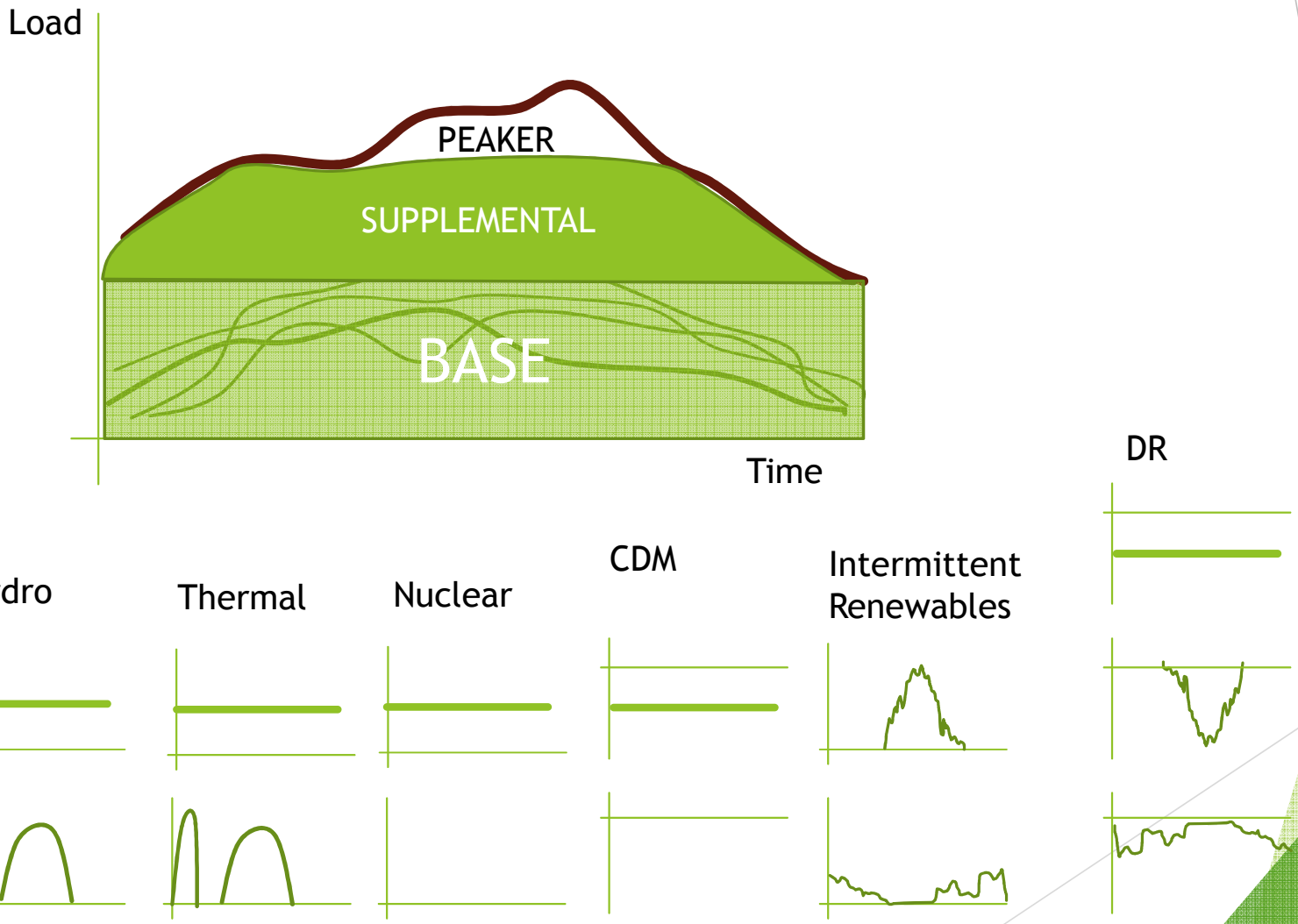


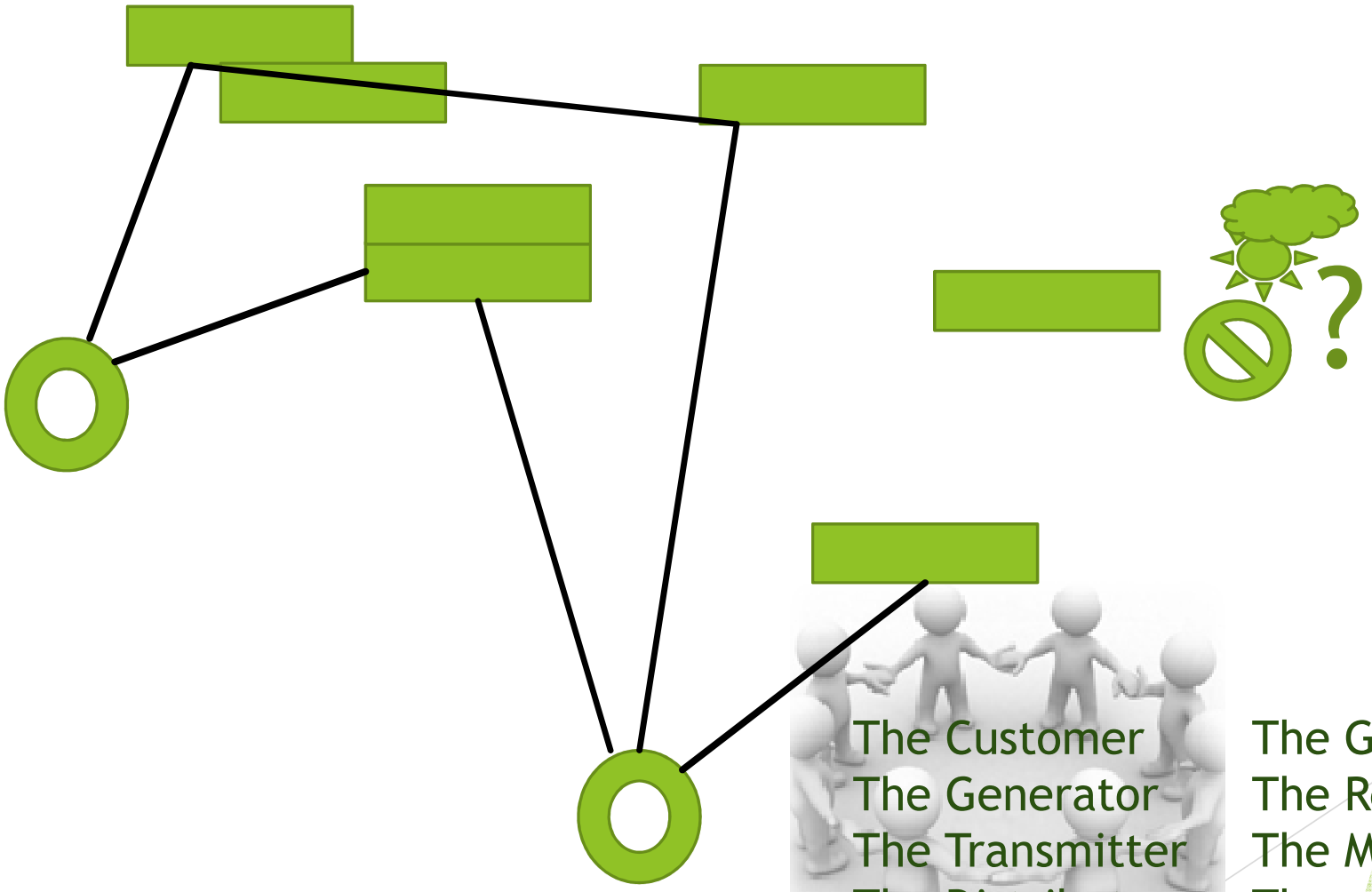


CDM

- Regulator
- Continuity
- Consistency
- Voter
- Special Interest Group
- Partisanship
- Community
- Customer
- Industry Peers
- Shareholder
- Core mand
- Time
- People
- Skill Set
- Own Resources
- Economy
- Risk Tolerance
- Personal Gratification
- Personality, Ego
- Ability
- Bias
- Preservation
- …..

?“Good” Policy?





The Customer
The Generator
The Transmitter
The Distributor

The Government
The Regulator
The Market Operator
The …

The functions carried out by Ontario's LDCs include the following:

- **Plan:** Review performance and trending, project consumer demand growth, develop capital and maintenance plans;
- **Design:** Apply standards and rigor to projects and retrofits and execute plan;
- **Build:** Bring the conceptual design to construction;
- **Operate:** 24/7 operations;
- **Maintain:** Manage physical assets;
- **Restore:** Outage management, customer communications;
- **Meter:** Measure the customer's consumption;
- **Bill:** Obtain all the usage information and send the bill to the customer;
- **Settle:** Act as the billing agent for other organizations in Ontario's electricity system;
- **Collect:** Manage payment collection;
- **Conserve:** Promote conservation and demand management programs; and
- **Customer Care:** Manage the relationship with customers.

What's the core role?
What else is expected?

Foundation:

$MM-$B Asset base (~60:40 Debt:Equity)

Capex good; Opex bad

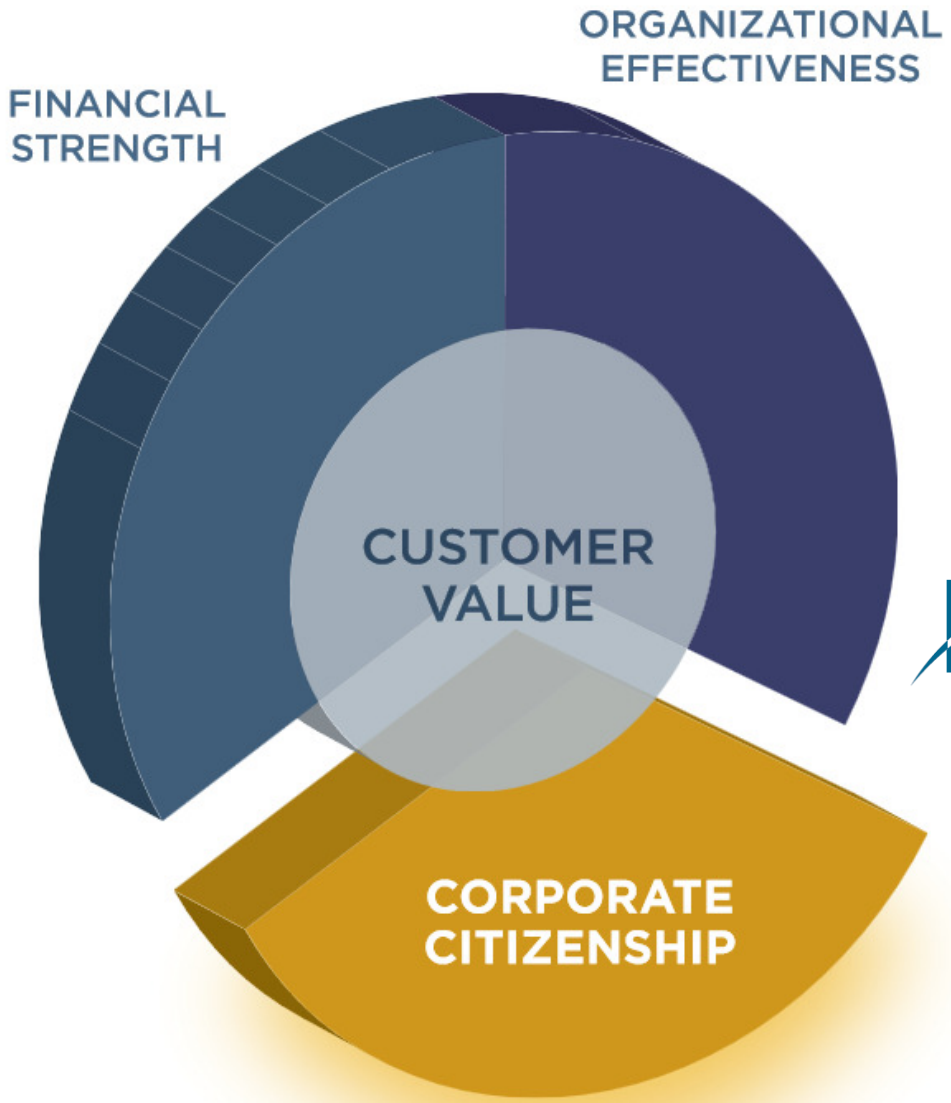
Credit Rating = stable (…risk to weak?)

Economic engine

Trusted, Dependable

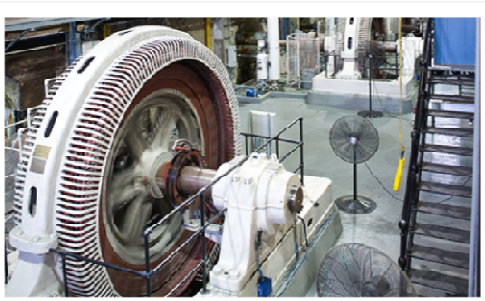
Changes:

Commissions	->	**Incorporated**
At Cost Service	->	For-Profit (regulated)
Peer Competitive	->	Market Competitive
Low Tech	->	Higher Tech
Risk Averse	->	(spectrum)



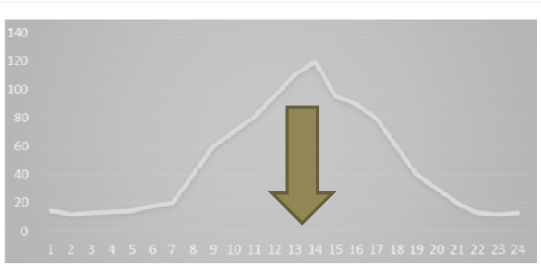
HydroOttawa

Agenda

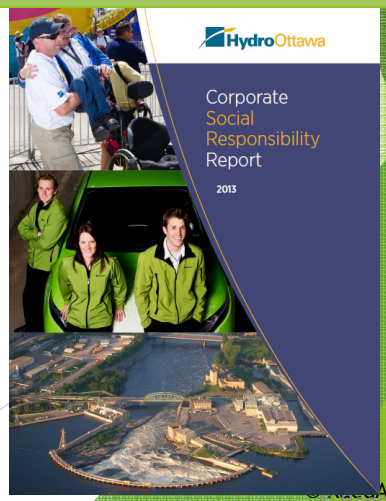


Generation

Perspective



CDM



2000-2012: Doubled Green Generation Capacity.

In-Service
18MW hydro-electric in service

10.2MW landfill gas in-service (two stations, joint ventures)

~0.130MW solar PV owned

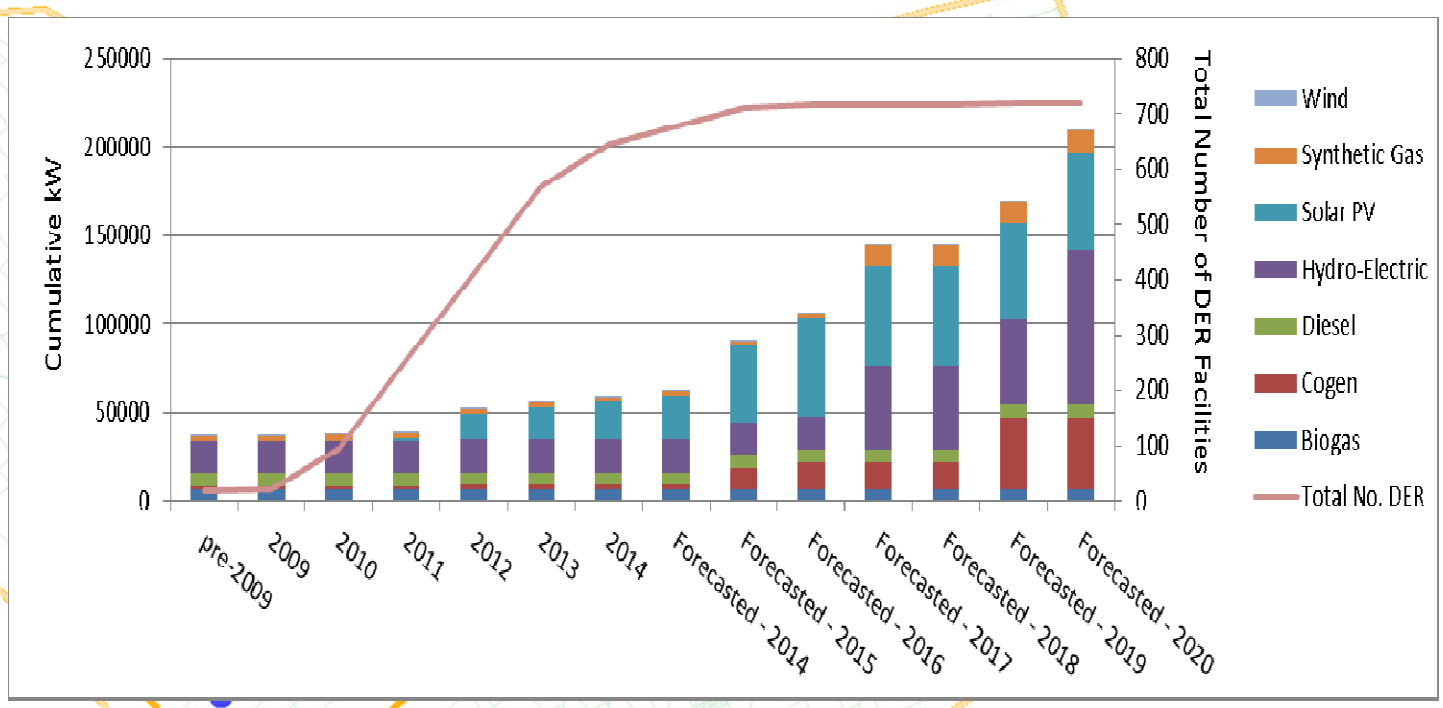
Coming soon
29.35MW hydro-electric planned 2017

[ ] kW solar PV managed & owned

"Hydro Ottawa has quietly emerged as the largest municipally owned producer of green power in Ontario."

320,000 MWh/year of Renewable Power Generation (enough for ~38,000 homes)

Hydro Ottawa Holding Inc. – 2013 Annual Report

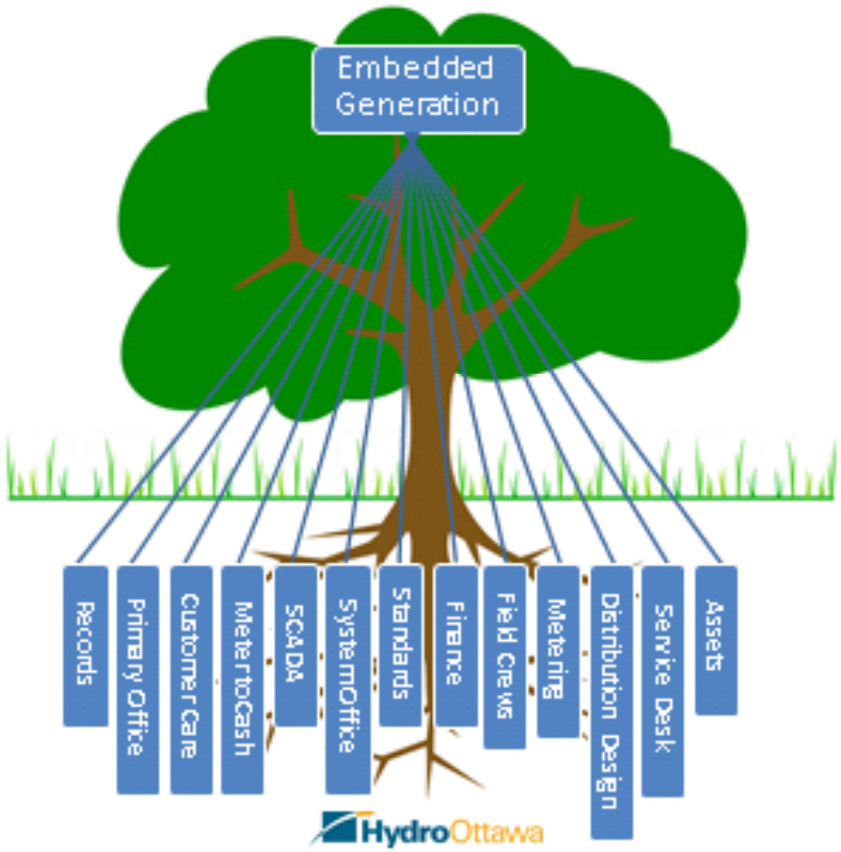


Connected (by end of 2014): ~69MW, 679 Energy Resource Facilities

Initial Consultations:

- 69.4MW Hydro
- 38MW NG Cogen
- 18.3MW Solar PV
- 16MW Synthetic Gas

Internal Affairs



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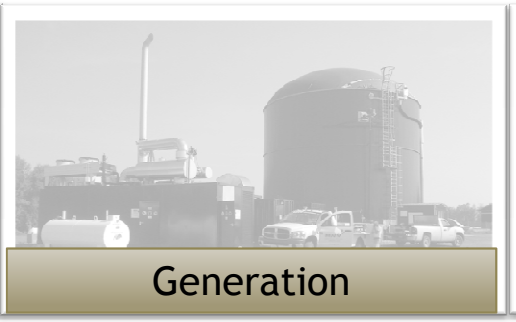

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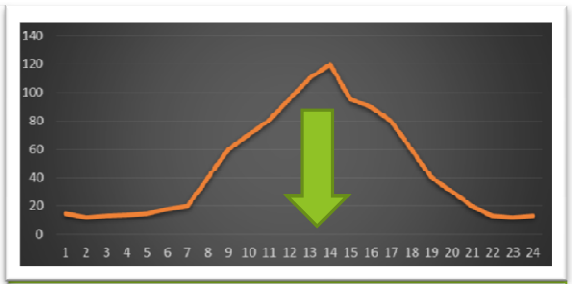
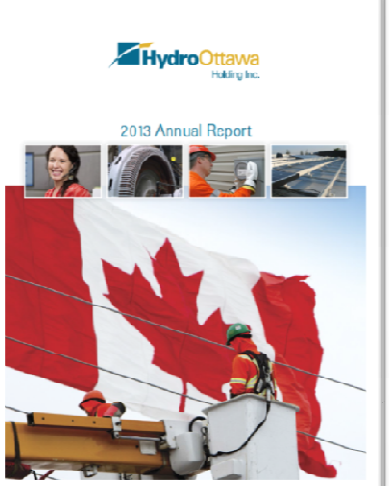
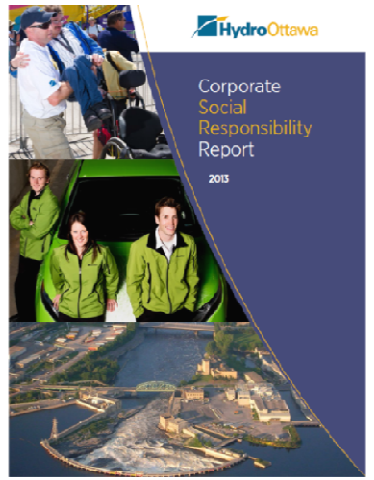


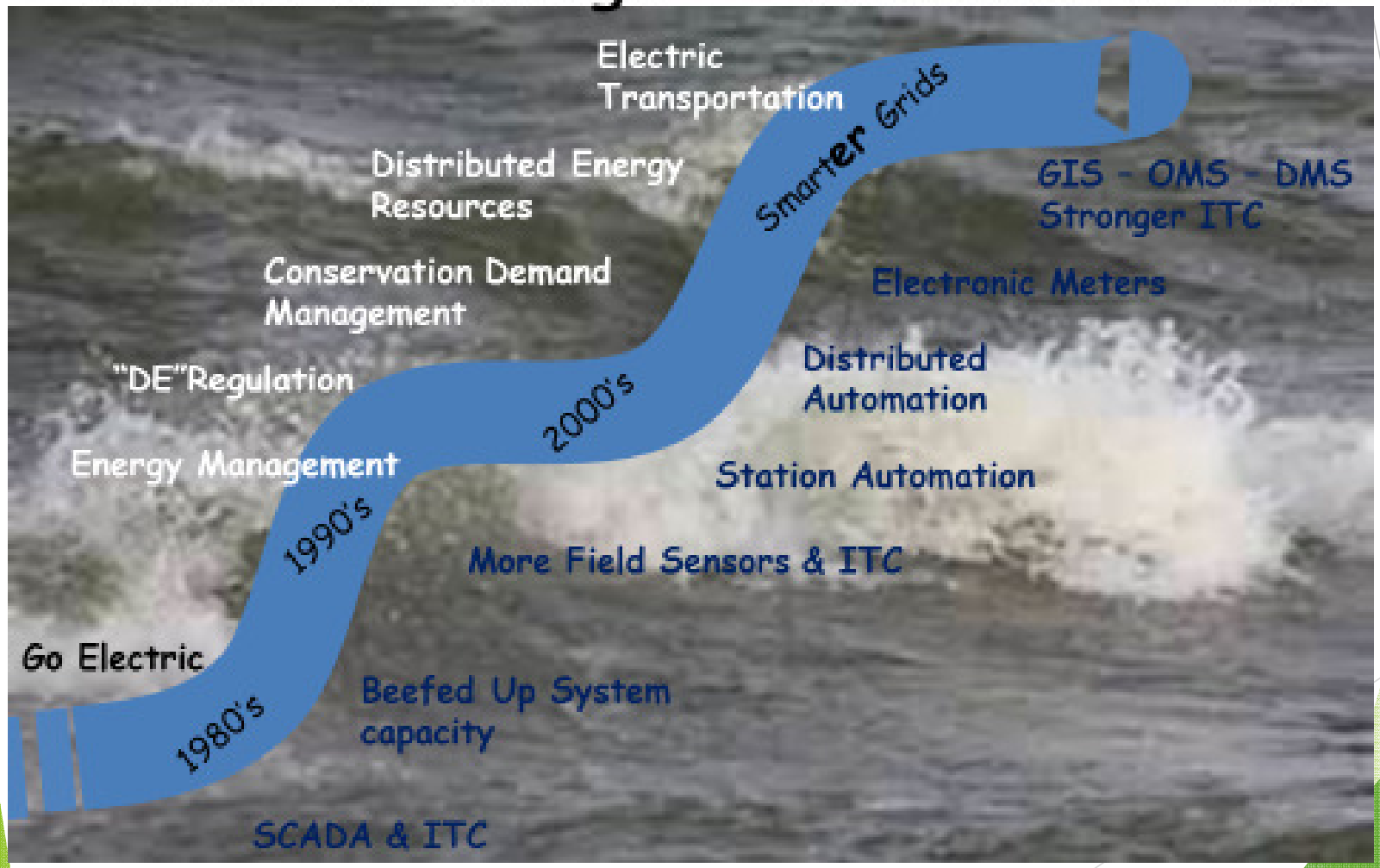
CDM

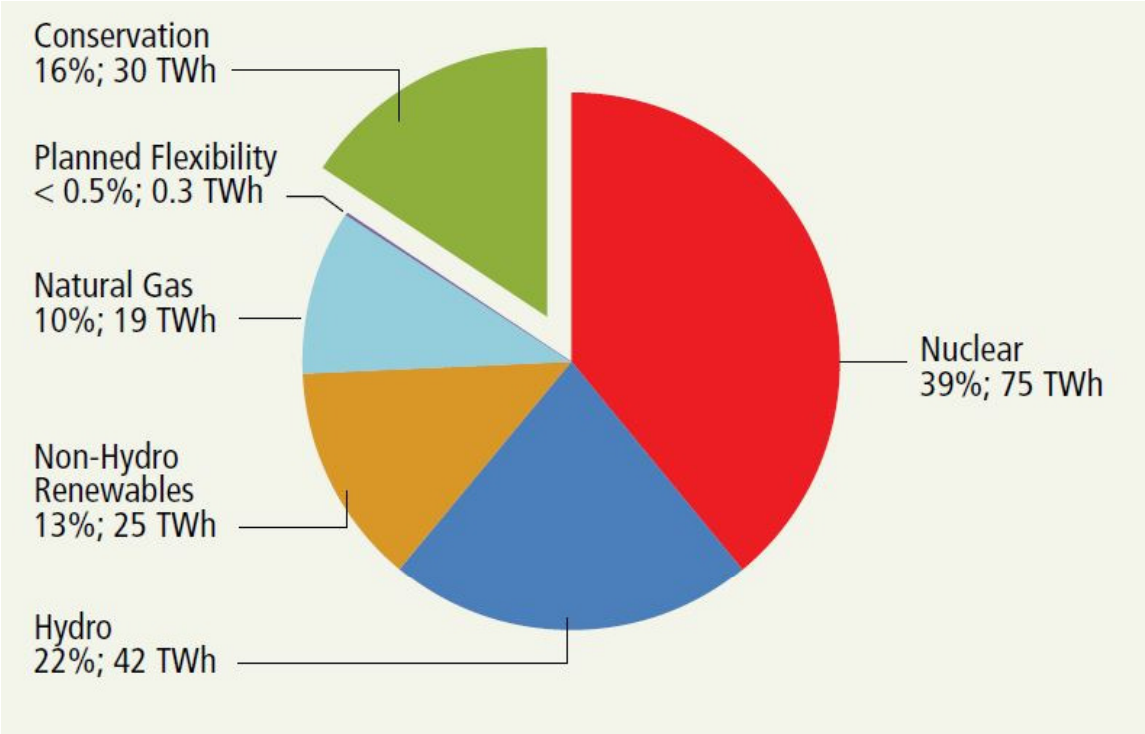
Perspective





Waves of Change >>> Smarter Grids

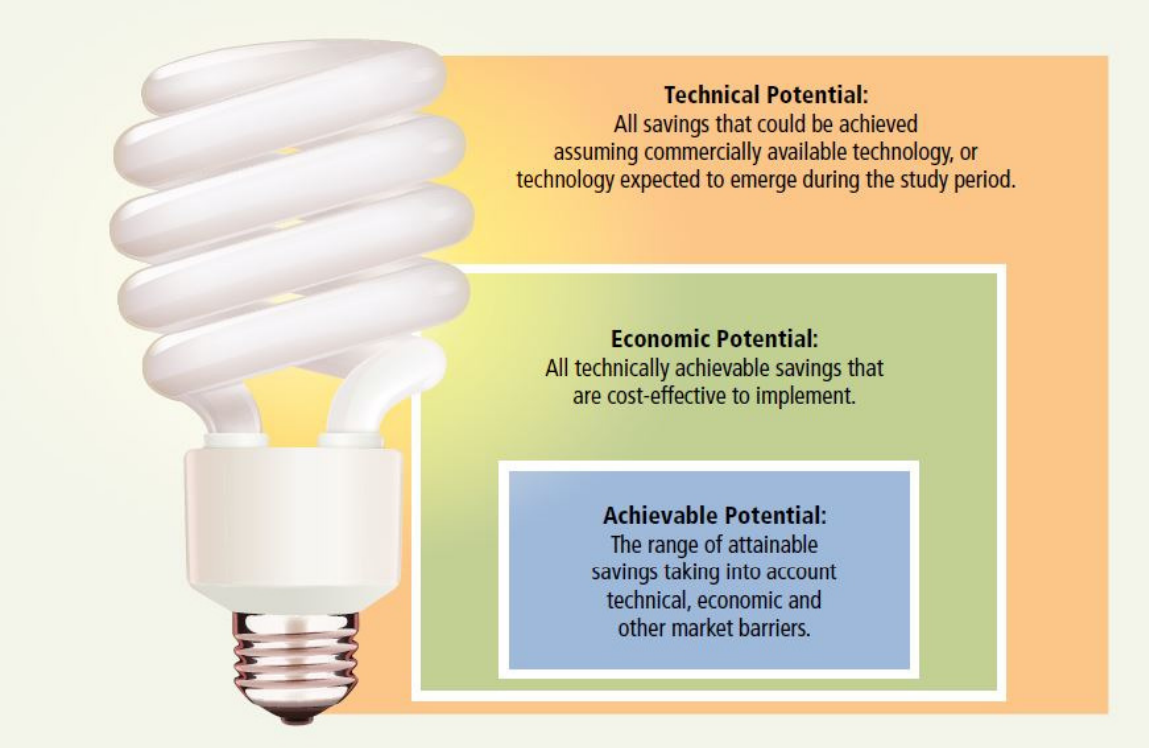




Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://embed.scribblelive.com/Embed/post.aspx?Id=141137004#

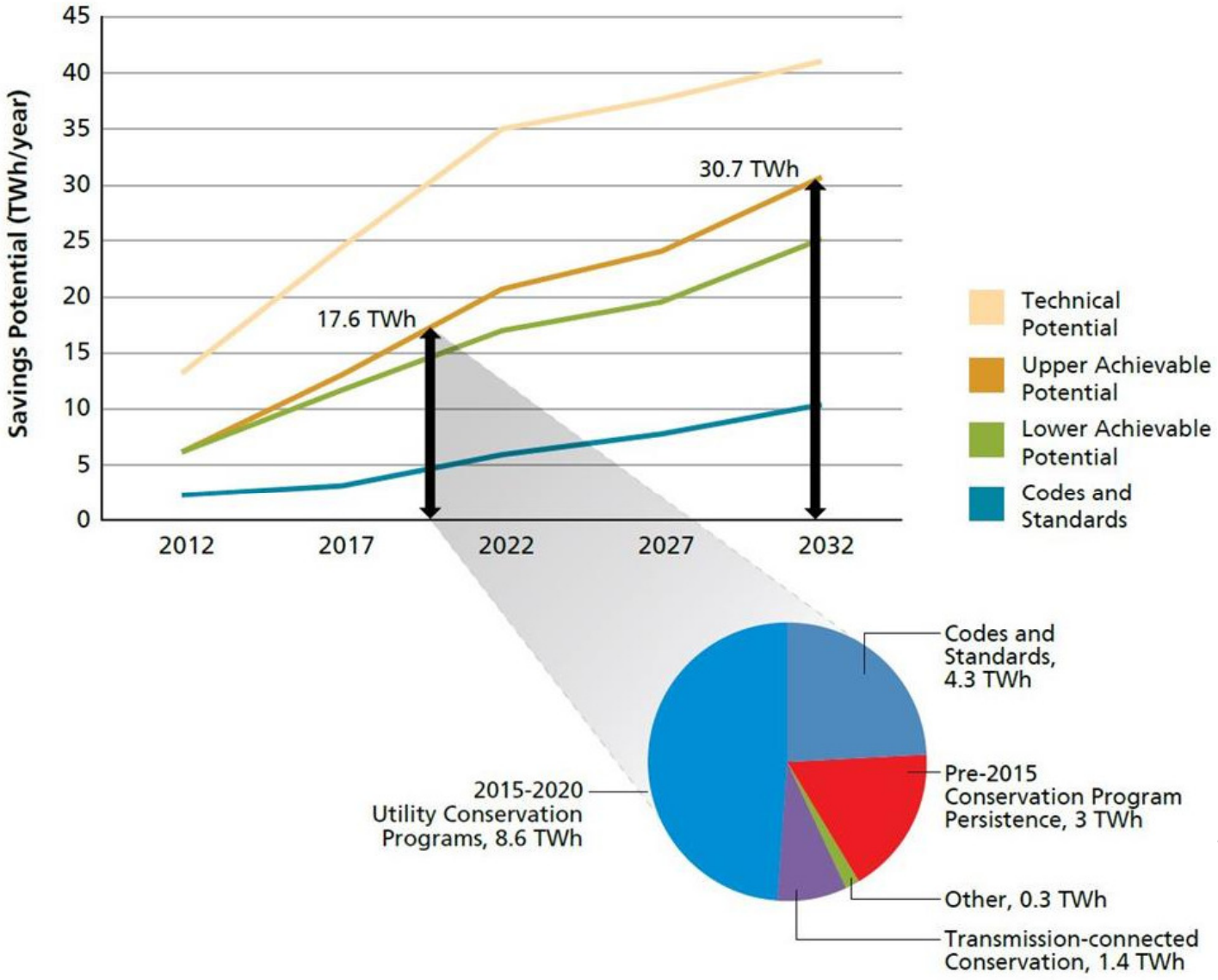
Illustrating CDM goal needed to service electrical needs by 2032.



Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://embed.scribblelive.com/Embed/post.aspx?Id=141137004#

Illustrating magnitude of potential savings through CDM.



Environmental Commissioner of Ontario, 2014 Energy Conservation Report

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Save Energy

Smart Thermostat Rebates

Receive a rebate of up to $150 on a Smart Thermostat for your home.

Coupons

Save instantly on a wide range of energy-efficient products.

Heating & Cooling Incentive

Receive up to $650 in rebates when replacing your furnace or central air conditioner.

Fridge & Freezer Pickup

Thank you to all who participated in the FRIDGE & FREEZER PICKUP program.

peaksaver PLUS®

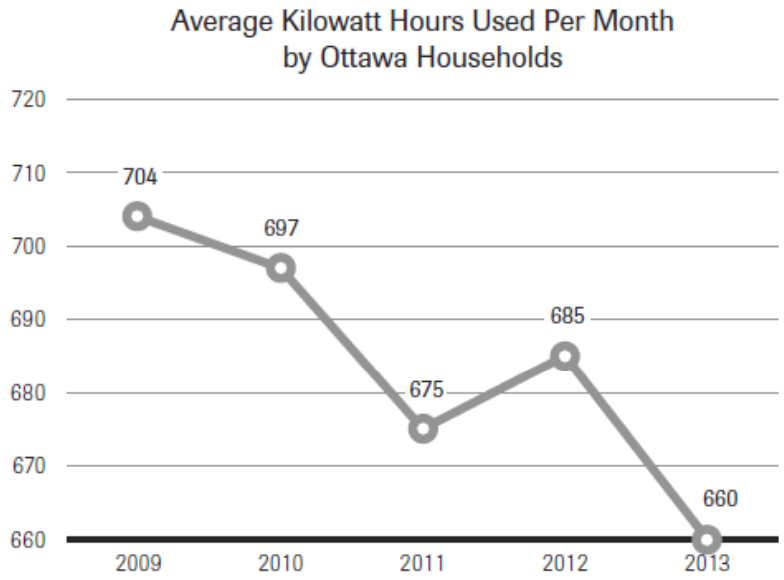
Thousands of Ontarians are working together to manage electricity use.

	MW of Peak Demand Reduced	Total Kilowatt Hours Saved	Dollars Invested	Number of Homes taken off the Grid for a year
2006	19.7	23,301,000	$2.1 M	2,427
2007	46.5	73,578,000	$4 M	7,665
2008	55.4	72,657,000	$3 M	7,568
2009	59.5	106,067,000	$4.2 M	11,048
2010	70.2	120,586,000	$4.3 M	12,561
2011	61.6	175,556,000	$9.6 M	18,288
2012	77.96	216,591,000	$10.8M	25,785*
Total	**390.86**	**788,346,000**	**$38M**	**85,342**

4.8¢ / kWh

**The average use of electricity by Ottawa households has declined approximately 14% over the last decade due to a range of factors including conservation programs, more efficient appliances and higher awareness of the need to conserve. Previous years "Number of Homes" calculations were based on 800kWh/month average household usage. In 2012 we are using 700kWh/month average household usage.*

Hydro Ottawa Corporate Social Responsibility Report 2013



32,600 households on *peaksaver*PLUS®

2013 professionally installed energy efficient lighting: 1,100 small businesses; 780 larger commercial business –

Hydro Ottawa Holding Inc. – 2013 Annual Report

Hydro Ottawa's "Brighter Tomorrows Fund" (2011-)

> "The Brighter Tomorrows Fund is a partnership between United Way Ottawa and Hydro Ottawa that looks at investing dollars in the community. The Hydro Ottawa community benefits from participating in investing in a community that they live in. Hydro Ottawa's Brighter Tomorrows Fund and its employees really allow for the homeless to live in a comfortable, warm, safe environment, something that you and I take for granted."
>
> *Carole Gagnon, Vice President, United Way Ottawa*

Hydro Ottawa + Employees matched funds = $360k+ energy efficient projects for community agencies helping homeless or at risk of being homeless

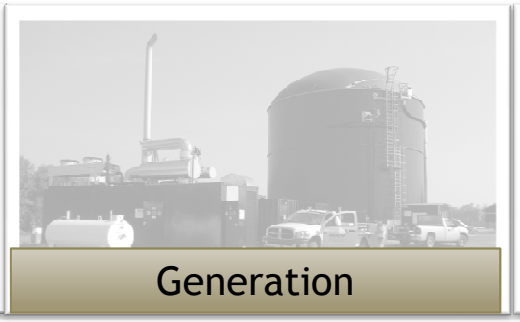
Qualifying low-income households with complementary energy audits & professional installation of energy efficiency measures:

2012 – 505

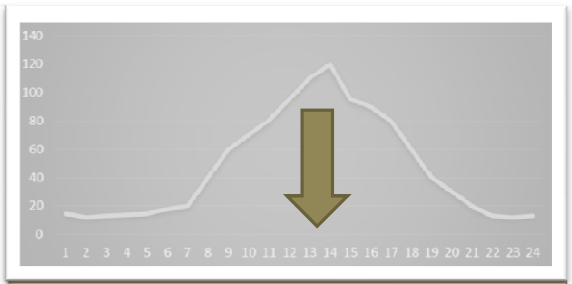
2013 – 1,003

Hydro Ottawa Corporate Social Responsibility Report 2013 (for 2012); 2013 Annual Report

Agenda

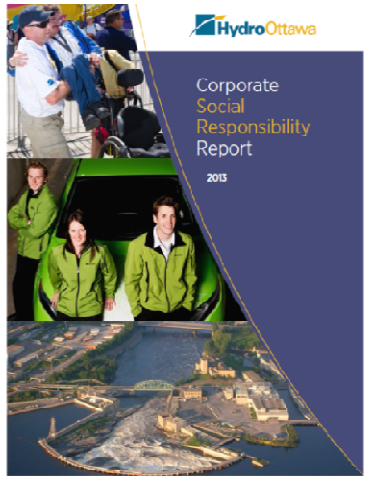


Generation

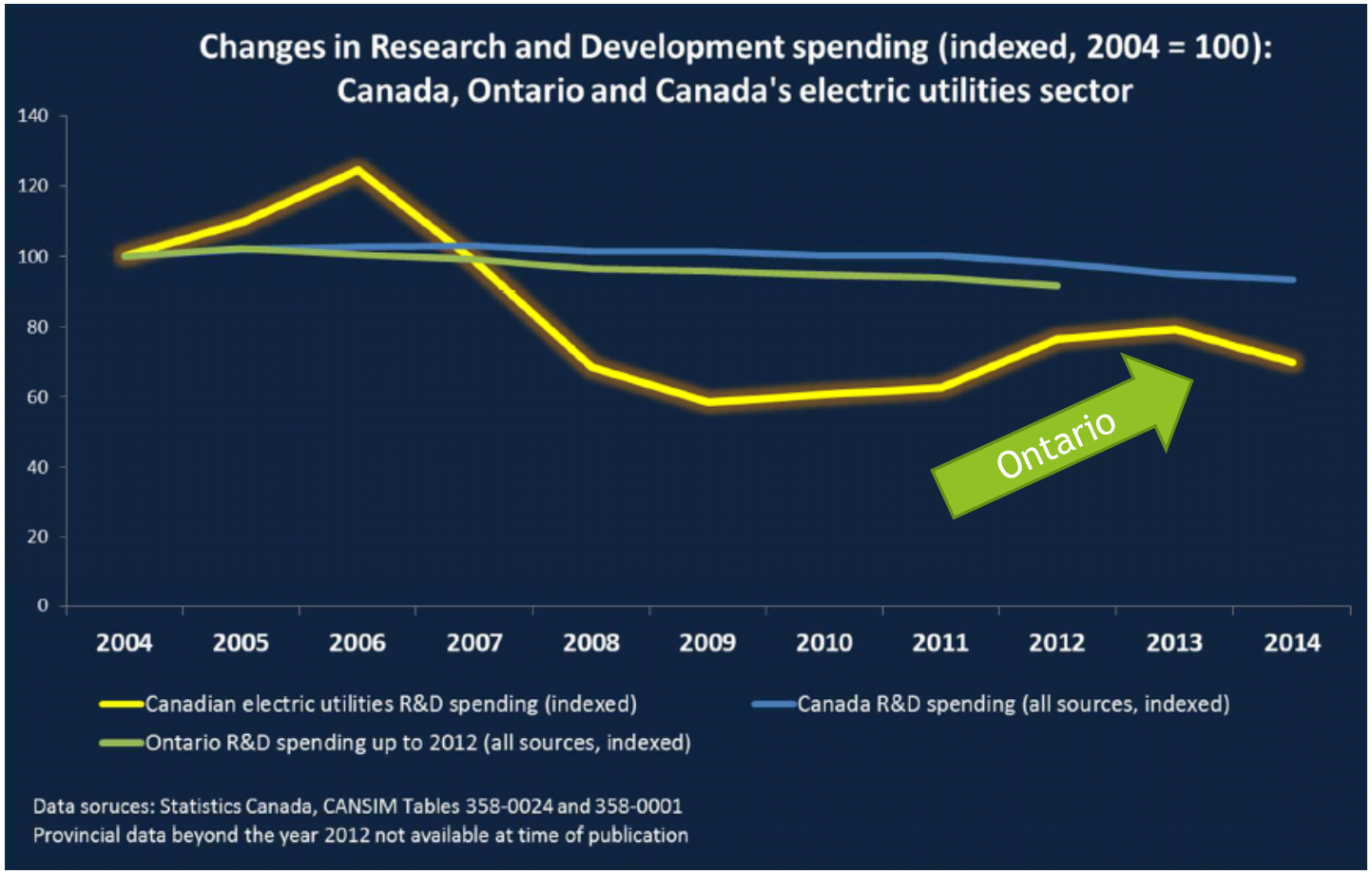


CDM

Perspective



SPARKS ST. AT ELGIN LOOKING WEST c1898



Hydro Ottawa's Community & Organisation Partnership

Hydro Ottawa Corporate Social Responsibility Report 2013

"Smart Grid" Research

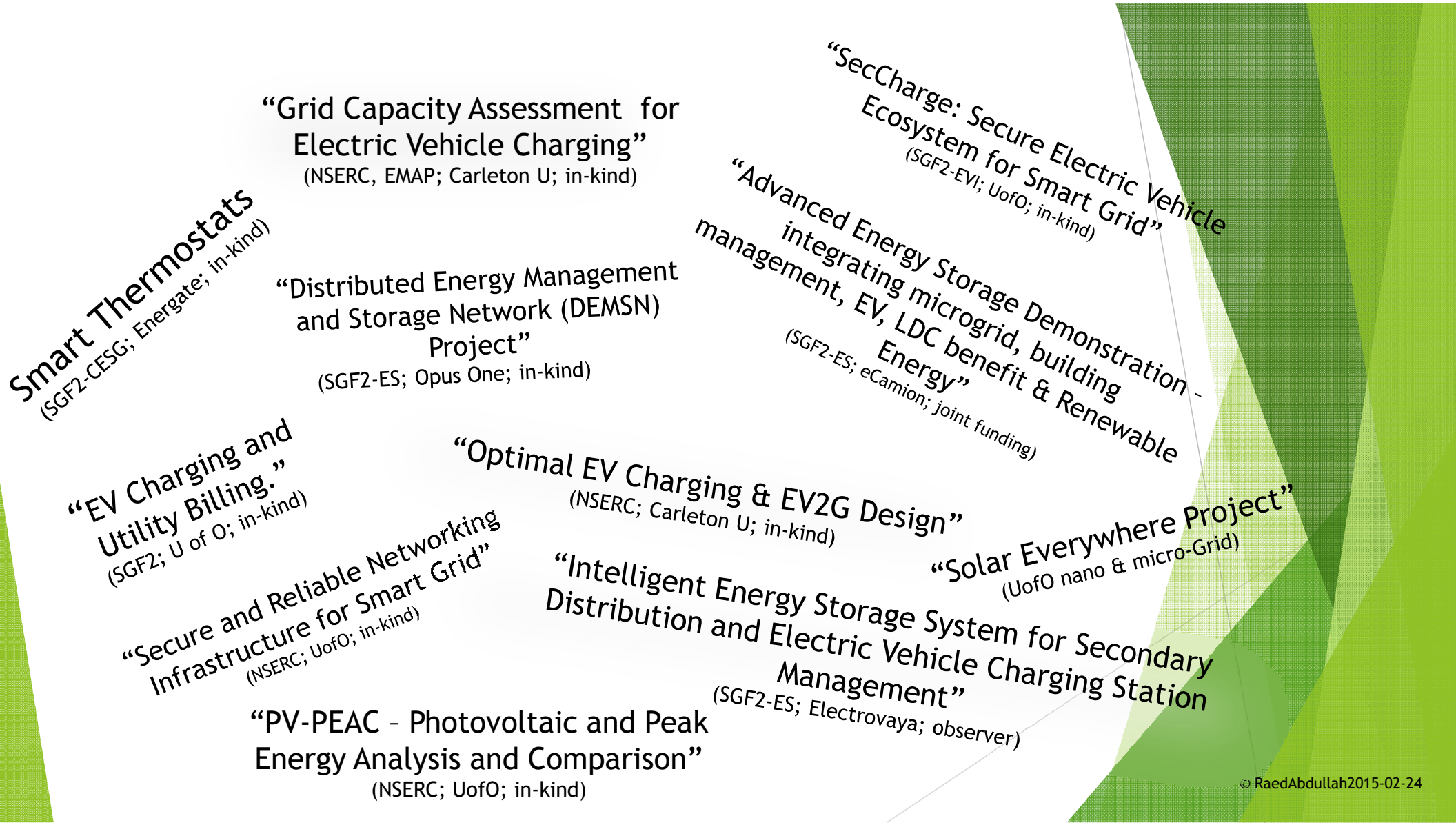
Electric Mobility Adoption & Prediction (EMAP) project with Pollution Probe, Carleton U

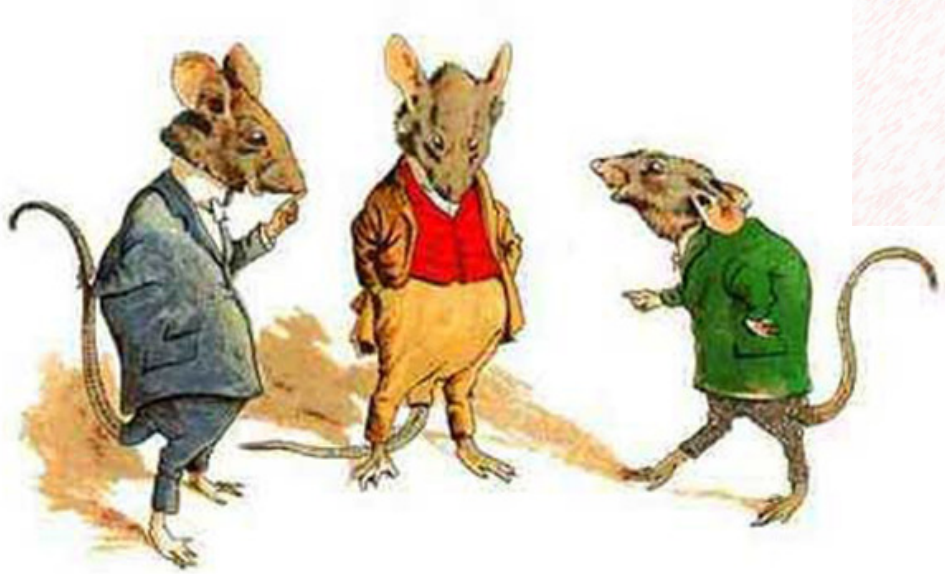
UofO Strat24 – 2012 Downtown EV Public Charging Model, 2014 Suite Meter

ecoDistrict Ottawa

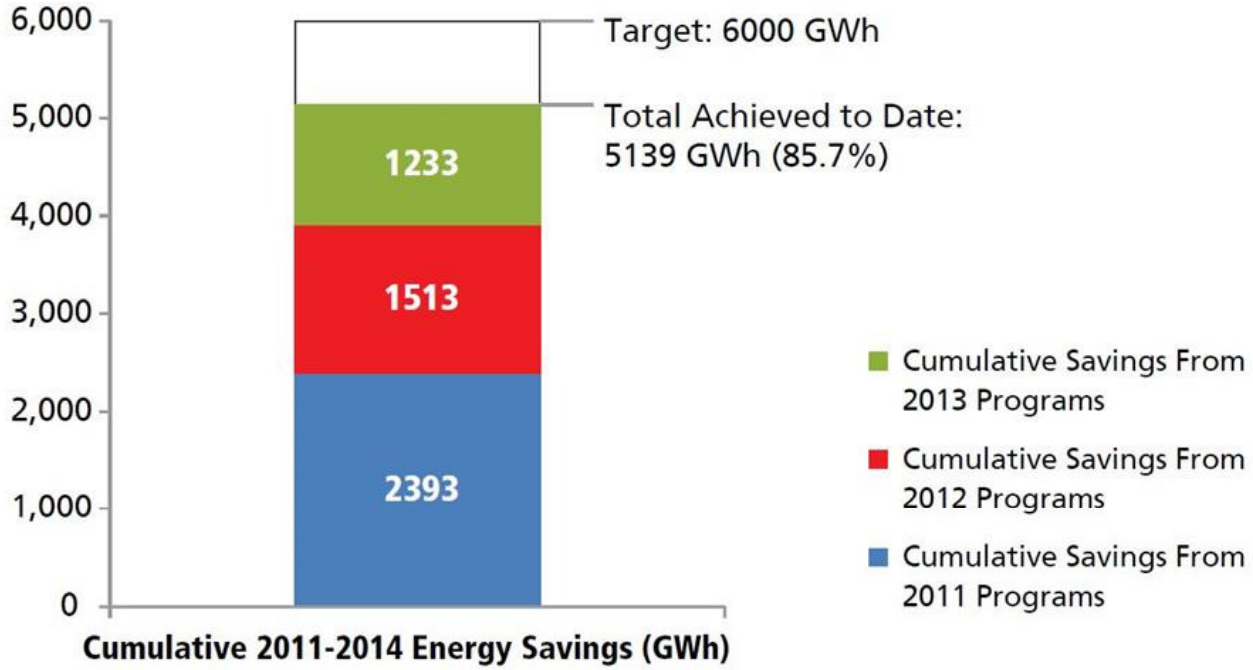
Observers or Participants in:

- Ontario Smart Grid Forum
- Centre for Energy Advancement through Technological Innovation (CEATI)
- IEEE
- Smart Grid Interoperability Panel (SGIP)
- Electricity Distributors Assocation (EDA)
- Ontario Energy Association (OEA)
- Ontario Energy Network (OEN)
- Canadian Electricity Association (CEA)
- Canadian Solar Industries Association (CanSIA)
- Canadian Standards Association (CSA)
- Electric Mobility Canada (EMC)
- Electricity Human Resources Canada (EHRC)





Q&A



Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://embed.scribblelive.com/Embed/post.aspx?Id=141137004#

Anticipated remaining CDM savings needed to achieve the 6,000 GWh 2011-2014 target.

OPA status Q3/'14 HOL report: 94% kWh target achieved; 57% kW target achieved

Table 2: Evolution of Ontario's Demand and Consumption Reduction Targets 2007-2013

	Framework Targets					
	IPSP-2007		LTEP 2010		LTEP 2013	
Target Year	Peak Demand Reduction (MW)	Consumption Reduction (TWh)	Peak Demand Reduction (MW)	Consumption Reduction (TWh)	Peak Demand Reduction (MW)	Consumption Reduction (TWh)
2005	Base Year from which progress against targets is measured*					
2010	2,700	No Target				
2015	No Interim Target	No Target	4,550	13	No Interim Target	No Interim Target
2020	No Interim Target	No Target	5,840	21	No Interim Target	No Interim Target
2025	6,300	No Target	6,700	25	Use Demand Response to meet 10% of peak demand**	No Interim Target
2030			7,100	28	No Target	No Interim Target
2032					No Target	30

Source: Government of Ontario.

*With the exception of the 2025 Demand Response target.

**LTEP commits demand response to meet 10 per cent of forecast peak demand by 2025, or about 2,400 MW.[37] Conservation programs and energy efficiency codes and standards will also provide additional peak demand reduction, but do not have a specific target, so the peak demand reduction target in the LTEP 2013 cannot be directly compared with the peak demand reduction targets in previous plans.

No target = no target was set for the year within the framework timeframe.

No interim target = a long-term target was set within the framework timeframe, but no interim targets prior to the long-term target were set.

Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://www.eco.on.ca/uploads/Reports-Energy-Conservation/2014/2014%20Energy%20Conservation%20Report%20Final.pdf

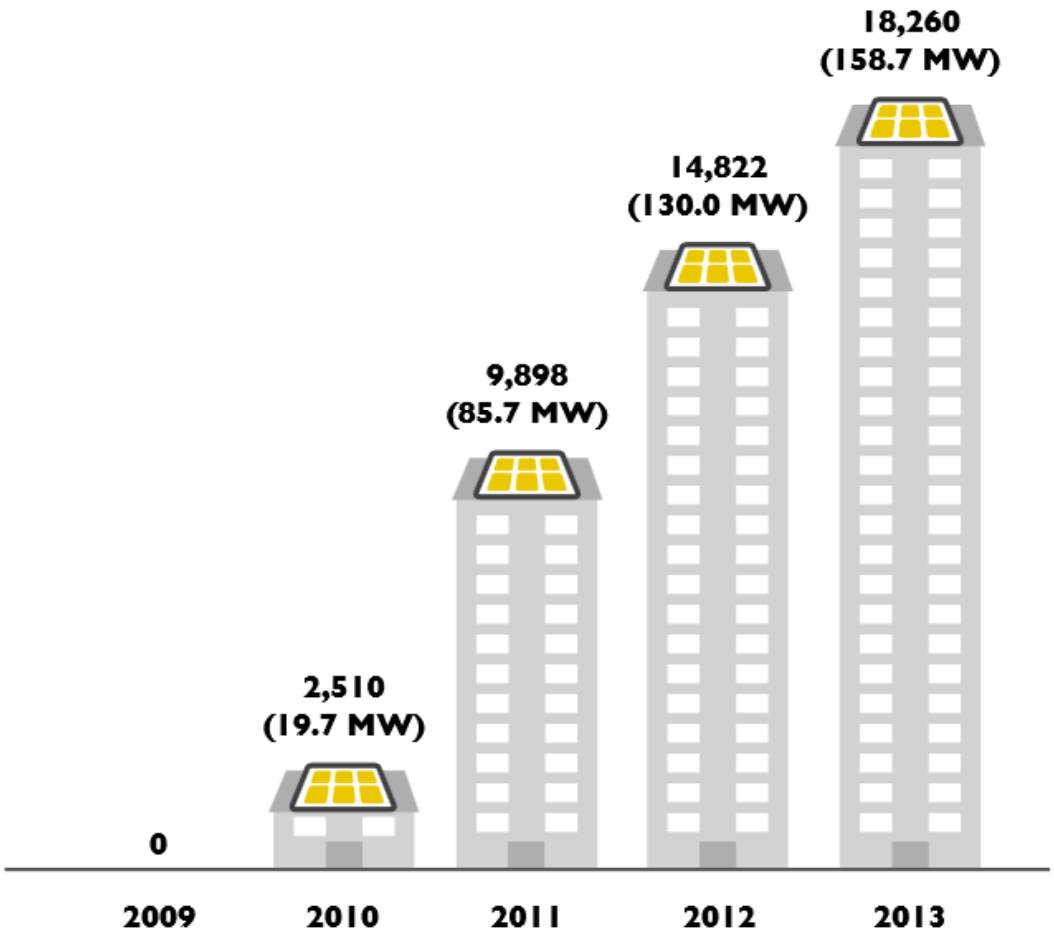
Table 4: Differences between the 2011-2014 Framework and the 2015-2020 Framework

"The Old" 2011-2014 Conservation and Demand Management Framework	"The New" 2015-2020 Conservation First Framework
Spanned a four-year period from 2011 to 2014, with no mid-term review.	Spans a six-year period from 2015 to 2020, with a mid-term review.
Contained two targets – energy conservation and peak demand reduction, which were allocated on an LDC's share of provincial electricity consumption.	Contains one energy conservation target allocated on regional electricity conservation potential and an LDC's share of residential and non-residential provincial electricity consumption.
Province-wide programs were designed by the Ontario Power Authority (OPA), with LDC input.	Province-wide programs are designed by an LDC working group, with final approval by the OPA.
Program cost-effectiveness calculation did not account for the non-energy benefits (e.g., environmental, economic and social benefits) of conservation.	Calculation of conservation program cost-effectiveness will include a 15 per cent adder to account for the environmental, economic and social (i.e., non-energy) benefits of conservation.
LDCs sought approval from the Ontario Energy Board (OEB) to deliver custom conservation programs.	The OPA reviews LDC proposals for custom programs. The OEB will not be responsible for program approval but will publish LDC program results annually.
A single performance incentive mechanism applied to both OPA programs and custom conservation programs. A distributor would begin receiving incentives per kilowatt and kilowatt-hour of savings achieved once it reached 80 per cent of both of its targets, up to 150 per cent of each target.	Two incentive mechanisms are available on a program-by-program basis, including Full Cost Recovery (similar to previous framework mechanism) and Pay for Performance. Under Full Cost Recovery, LDCs receive incentives for achieving or exceeding their final target and will also be eligible for a mid-term incentive payment if they are on track to meet their target at the Framework's halfway point.
Savings that resulted from time-of-use prices could count toward an LDC's peak demand Conservation and Demand Management (CDM) target.	The Minister of Energy's directive excluded activities related to the price of electricity from the definition of CDM. The directive expanded the definition of CDM to include "behind the meter" generation (on-site generators designed for a single building or facility that feed electricity directly to the facility without using the transmission or distribution system).[58]
The OPA-LDC relationship was guided by the 2011-2014 Framework's Master CDM Program Agreement. Changes to province-wide programs could be made through the agreement's program change management provision.	The OPA-LDC relationship will be guided by the 2015-2020 Framework's Energy Conservation Agreement. CDM Plan amendments can be made by an LDC or the OPA through consultation with each other.

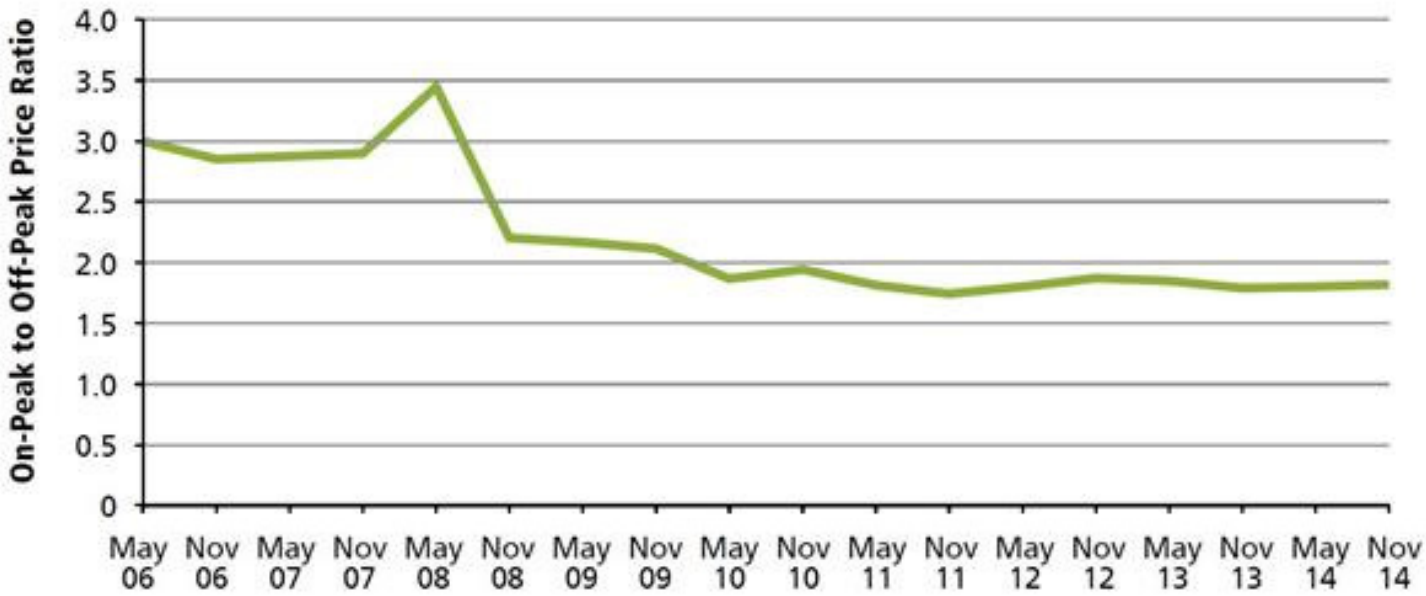
Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://www.eco.on.ca/uploads/Reports-Energy-Conservation/2014/2014%20Energy%20Conservation%20Report%20Final.pdf

Number of MicroFIT Solar Projects In-Service



Environmental Commissioner of Ontario, 2014 Smart from Sunrise to Sunset http://www.eco.on.ca/uploads/Reports%20-%20Background,%20Discussion,%20Roundtable/2014%20Smart%20Grid%20Primer.pdf



Environmental Commissioner of Ontario, 2014 Energy Conservation Report

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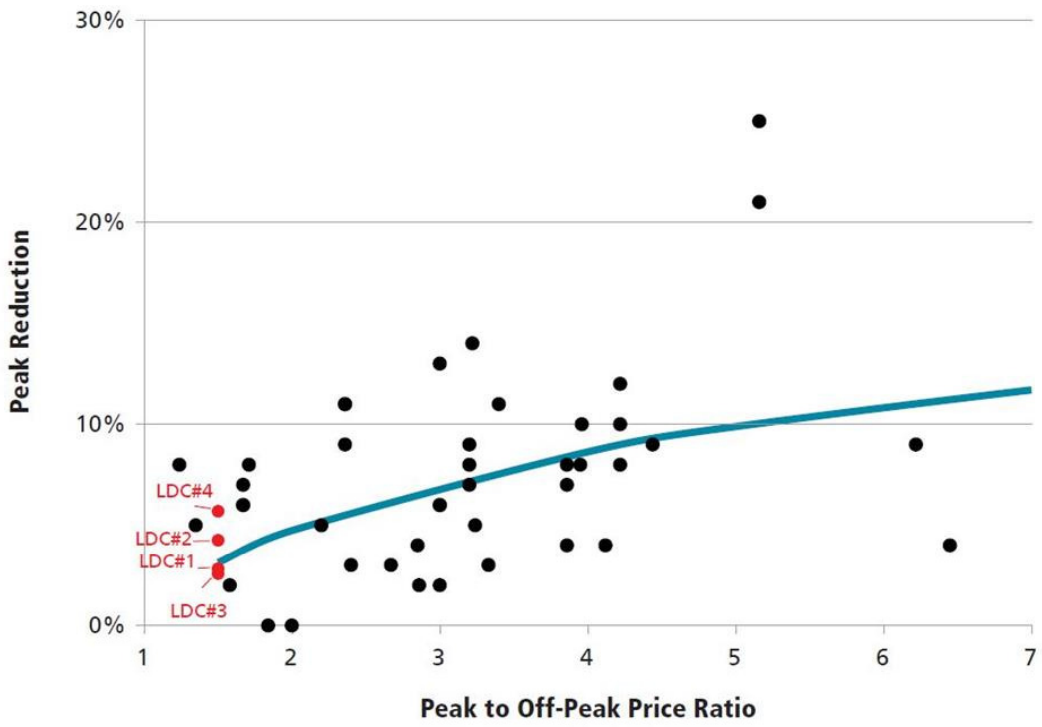
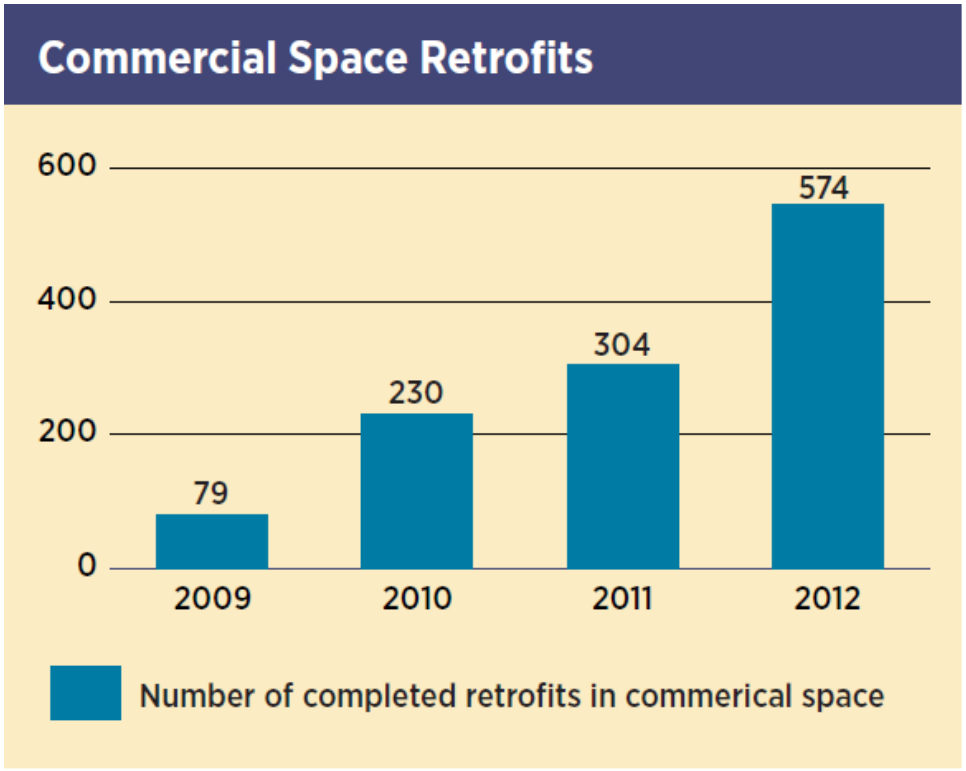
History of Peak:Off-Peak electricity price.



Environmental Commissioner of Ontario, 2014 Energy Conservation Report

http://embed.scribblelive.com/Embed/post.aspx?Id=141137004#

Results from 42 international studies on affect of Peak:Off-Peak pricing on peak reduction



Hydro Ottawa Corporate Social Responsibility Report 2013