PNWER Roadmap to Net Zero Construction and Deep Retrofits by 2030

PNWER WEBINAR
OCTOBER 2, 2014

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PNWER Roadmap Webinar Outline

- → PNWER Executive Direction – July 2014
- → Energy Efficiency Benefits
- → Case Studies of Net Zero and Deep Retrofits
- → Policy Best Practices
- → PNWER Roadmap Next Steps
- → Establishing the PNWER Net Zero Network
- → Discussion

PNWER Executive

- Hon. David Ramsay, PNWER President, Minister of Justice and Industry, Tourism and Investment, Minister Responsible for the Public Utilities Board, Government of Northwest Territories
- Ms. Alana DeLong, PNWER Vice-President, MLA for Calgary-Bow, Alberta Legislative Assembly
- Colin Smith, Private Sector Council Co-Chair, and Former President of the Association of Professional Engineers and Geoscientists of British Columbia
- Hon. Norm Letnick, Minister of Agriculture and MLA for Kelowna-Lake, Government of British Columbia
- Mr. Herb Cox, MLA for Battlefords, Saskatchewan Legislative Assembly
- Rep. Deb Boone, Oregon Legislature
- Rep. Elaine Smith, Idaho Legislature
- Rep. George Eskridge, Idaho Legislature
- Rep. Gael Tarleton, Washington Legislature
- Sen. John Coghill, Alaska Legislature

PNWER Executive Direction – Jul 23, 2014

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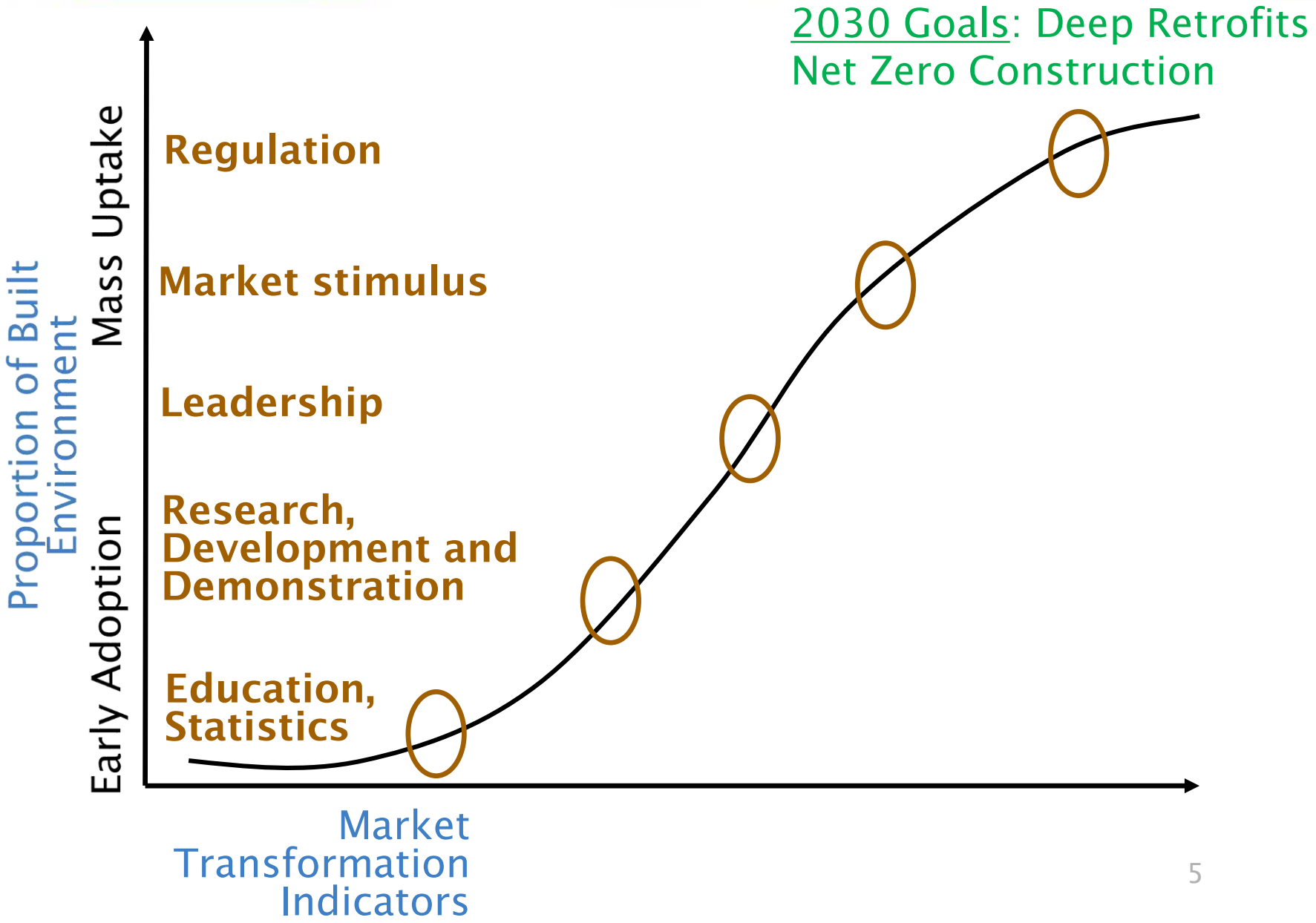
- Creation of a Roadmap to Net Zero Construction and Deep Retrofits by 2030
- This roadmap would focus on two targets, premised on cost-effective energy efficiency improvements in residential, commercial and industrial settings:
  1. Facilitate the achievement of net zero emissions for new buildings
  2. Encourage the reduction of energy/emissions in all sectors
- Through the accomplishment of these targets, the roadmap would increase energy efficiency, resulting in:
  - More affordable energy bills for consumers;
  - Demand for advanced knowledge and manufacturing jobs in both rural and urban communities;
  - Increased productivity and competitiveness across the built environment; and,
  - Improved long-term resilience to the PNWER region.

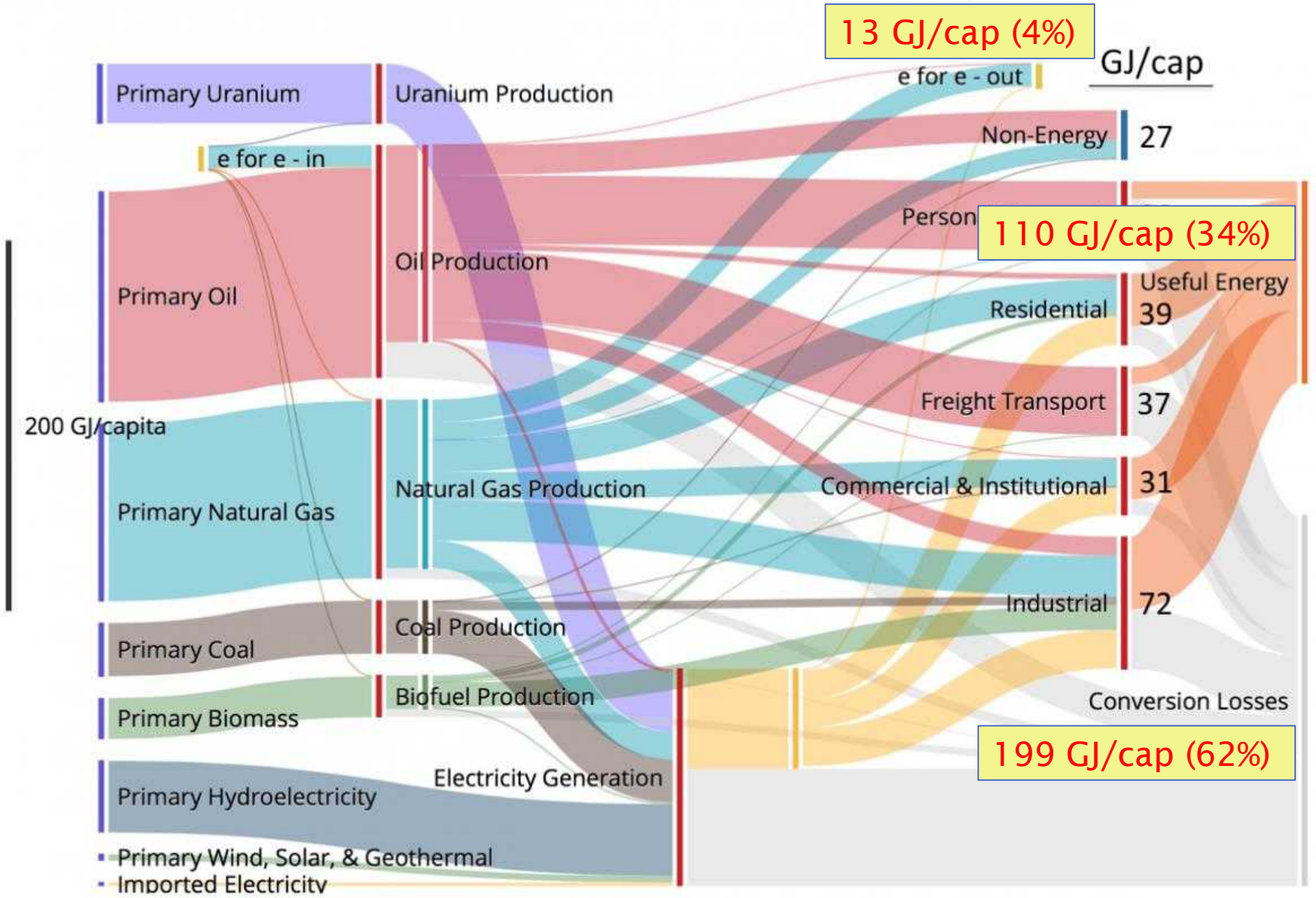
Market Transformation Measures



What is Energy Efficiency?

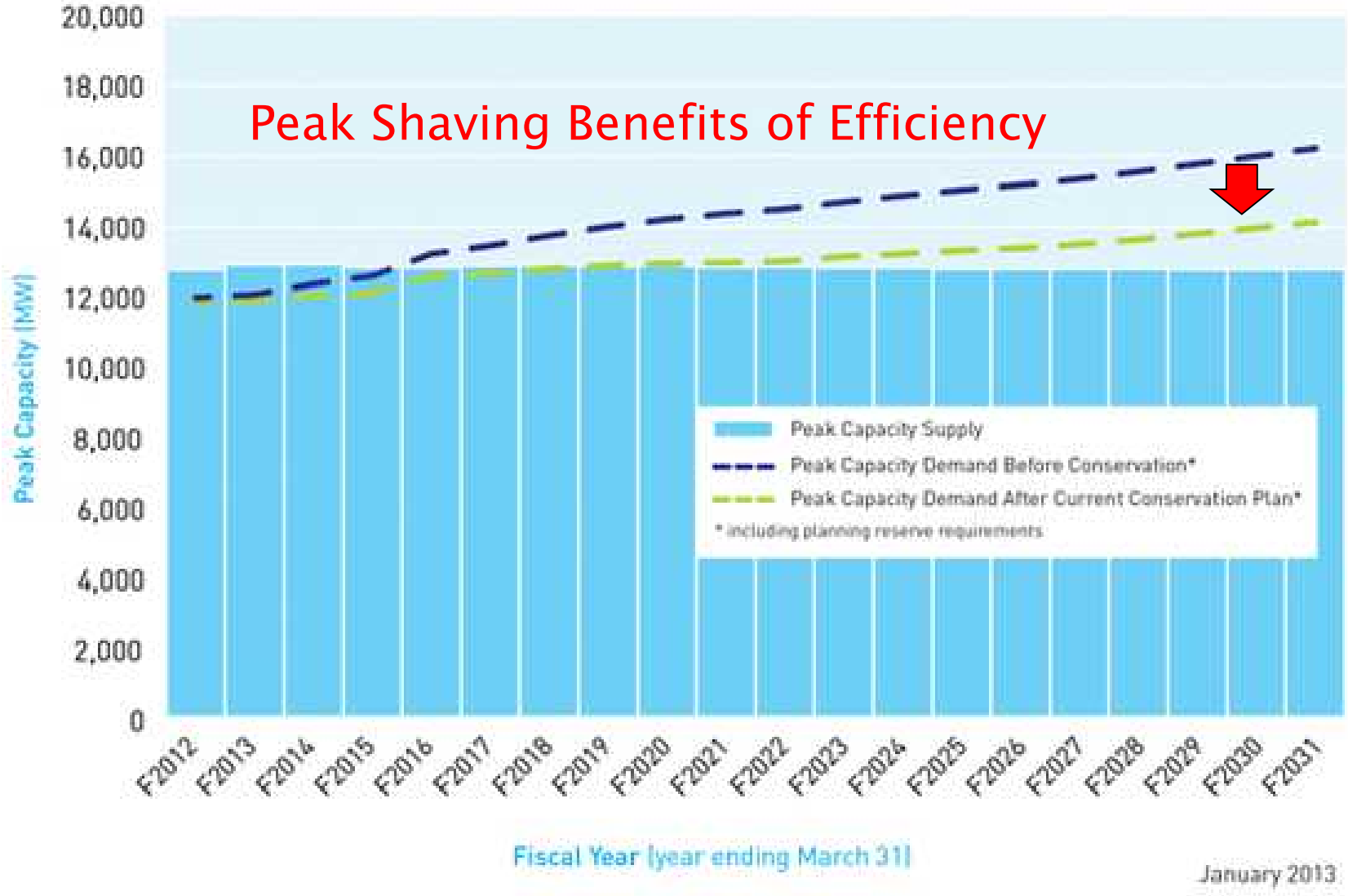
- Reduced energy waste (efficiency)
  - More airtight building envelope with lower thermal loss
  - More efficient heating equipment (condensing boiler)
  - Heat recovery ventilation (recycled heat)
- Conservation
  - Setback thermostat temperature for space heating
- Peak load management
  - Curtailable load during critical peak; “smart appliances”
- On-site, or community-based energy supply
  - Solar PV and thermal
  - Geo-exchange, district energy, regional wind power

Canada's Energy Systems in 2010, per capita



Source: CESAR

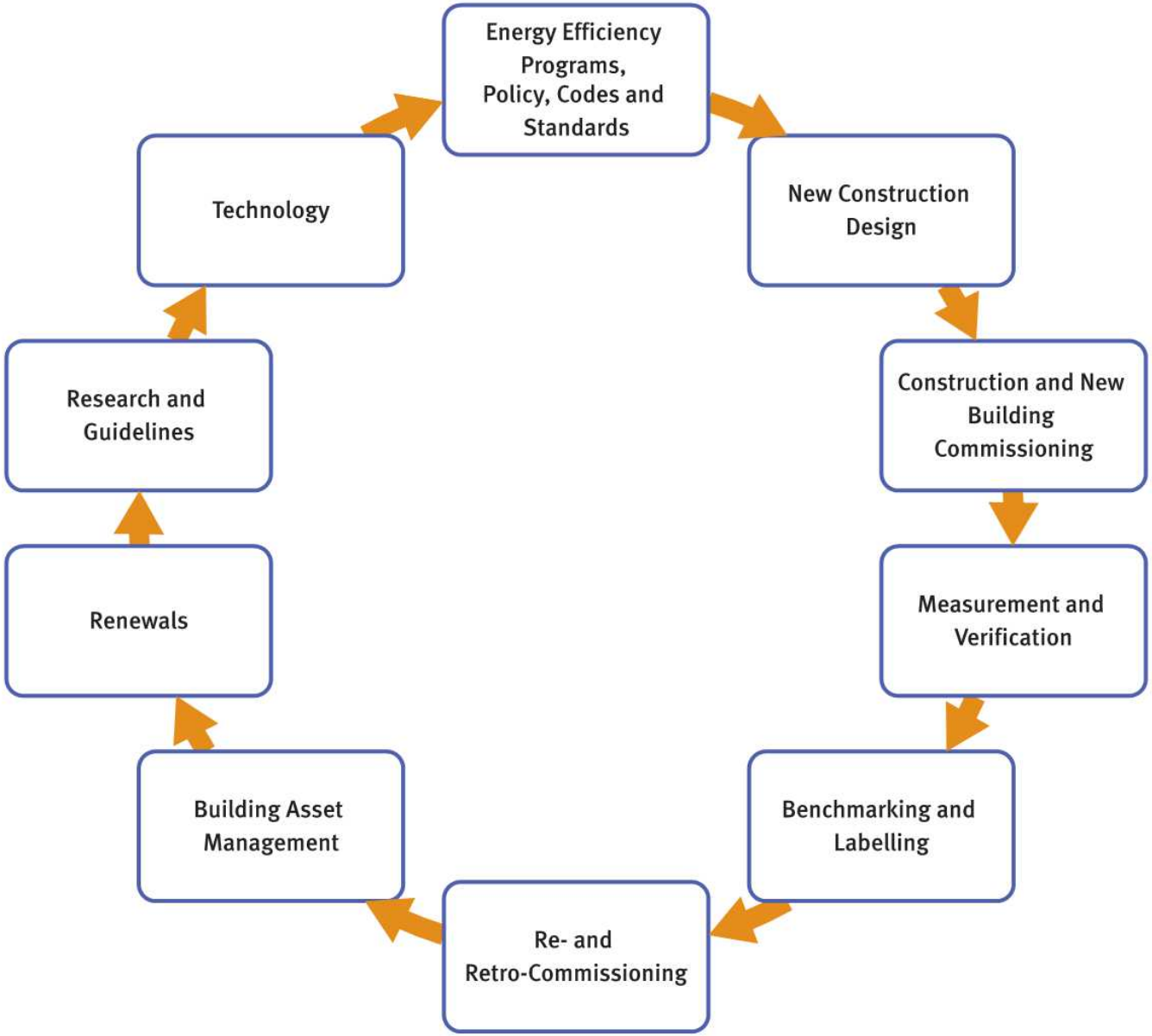
BC HYDRO'S LOAD RESOURCE BALANCE—PEAK CAPACITY



Energy Efficiency Benefits – examples for buildings

- → Financial dividends to consumers:
  - → reduced energy costs
  - → paybacks over and above higher capital costs
- → Delays capital replacement costs
- → Improves building occupant comfort and health
- → Reduces noise transmission / improves acoustics
- → Increases property resale value
- → Creates jobs and supports economic development
- → Improves productivity and competitiveness for business
- → Lowers ecological footprint

Building Life-Cycle Events



Net Zero Construction

- Net-zero carbon new buildings
  - Super-efficient building design, construction, commissioning and operations (70%-90% lower consumption)
  - Use of on-site, neighborhood or community-based, renewable energy
  - Purchase of renewable energy credits, GHG offsets and/or renewable natural gas

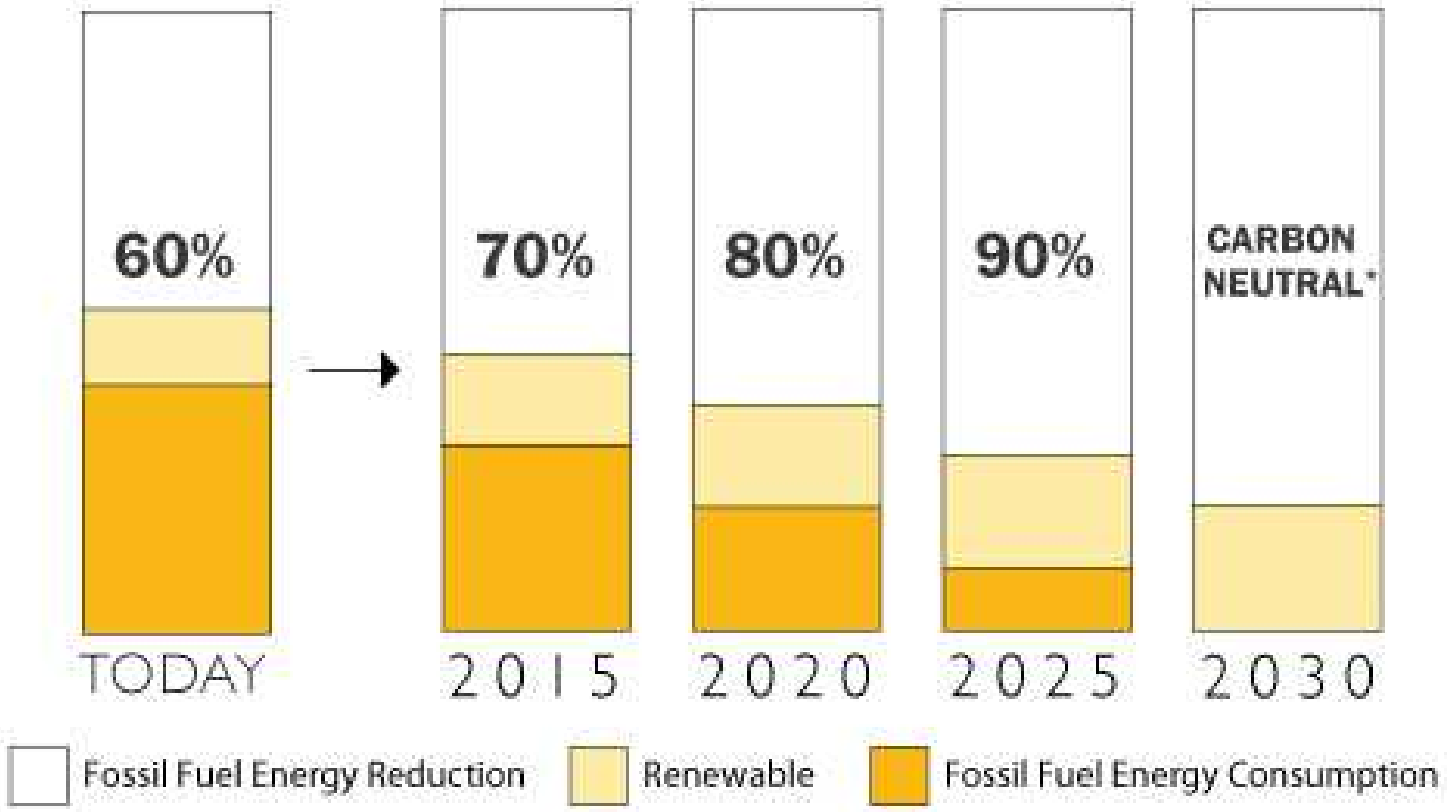
Deep Energy Retrofits

- Retrofitting existing buildings, infrastructure, industrial plants
  - Cost-effectively optimizing energy efficiency
  - Prioritizing target buildings based on benchmarking data
  - Whole facility approach – including building enclosure, equipment and processes
  - Ensuring health
  - Aligning with major building renewal events
- 30-60+ percentage reduction in demand

Case Studies – Standards and Practices

- Net Zero Construction
  - Architecture 2030 Challenge
  - Living Building Challenge
  - Saskatchewan research houses
  - Passive House standard
- Deep Retrofits of Buildings and Infrastructure

Architecture 2030 Challenge



Source: Architecture 2030

Architecture 2030 – Ramona Apartments

Living Building Challenge

→ Bullitt Center, Seattle

Source: Bullitt Foundation

Saskatchewan "Factor 9 Home"

- → Research house constructed in Regina, SK in 2006
- → Consumes 33 kWh/m^2
- → Average Saskatchewan Consumption: 250 kWh/m^2
- → 87% reduction

Passive House – Victoria

6 residential unit, super-efficient building
http://bernhardtcontracting.com/NorthPark/

Passive House – Belgrade, Montana

http://habitatbozeman.org/other/passive-house-affordable-ecohabitats

http://www.passivehouse.us/project_detail.php?id=1095

Case Studies – Standards and Practices

- Net Zero Construction
- Deep Retrofits of Buildings and Infrastructure
  - Multifamily Residential Building Renewals
  - 2030 District
  - Yukon Housing Corporation
  - ISO 50001 Energy Management Systems Standard

Case Study – Background

- 13 storey multifamily residential building in Vancouver, BC
- 37 two-bedroom units
- Constructed in mid 1980s
- Building renewals pursued at decision of owners to upgrade original building enclosure

Case Study – Primary Drivers

- Replace aging building enclosure components
  - Primarily windows
- Repair water ingress issues
- Improve durability and reduce future maintenance costs
- Improve comfort in suites
- Create a modern aesthetic
- Increase property value
- …and save some energy

East Elevation – Colour Scheme 1

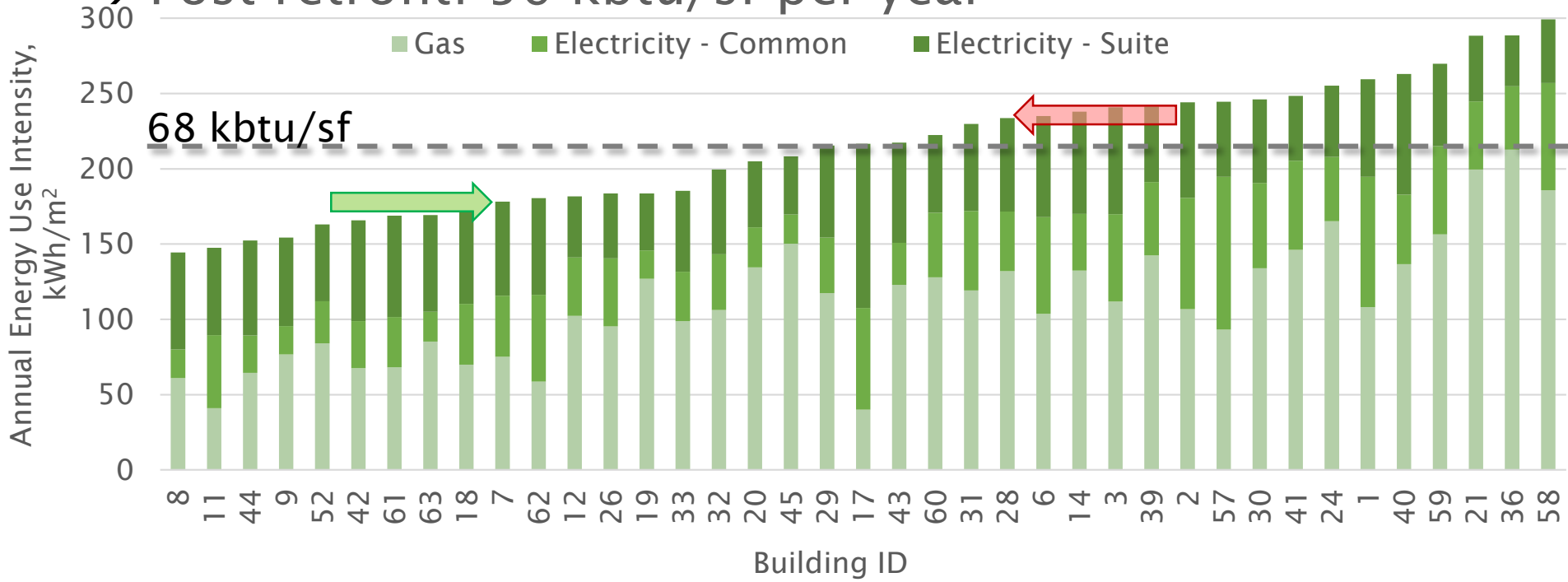
Case Study – Financial Analysis

Energy Efficiency Measure / Incremental Upgrade	% Total Energy Savings (% Electrical Heat Savings)	$ Savings per year	Incremental Cost with Utility Incentives	Simple Payback
Low Conductivity Cladding Attachment	4% (19%)	$4,800	$0	Immediate
Double Glazed Fibreglass Windows	7% (30%)	$7,600	$2,700	0.4 years
Triple Glazed Fibreglass Windows	10% (44%)	$11,000	$60,000	6 years
Airtightness	2% (7%)	$1,800	$0	Immediate
Fireplace Replacement	2% (8%)	$2,100	$14,000	7 years
In-Suite HRV Installation	6% (-32%)	-$4,400	$74,000	n/a
Make-up Air Unit Replacement	5% (0%)	$1,600	$23,500	15 years
Enclosure EEMs (triple glazed)	20% (87%)	$21,900	$60,000	2.7 years
Enclosure & Mechanical EEMs (triple glazed)	30% (62%)	$19,700	$166,800	8.5 years

Benchmarking Against Similar Buildings

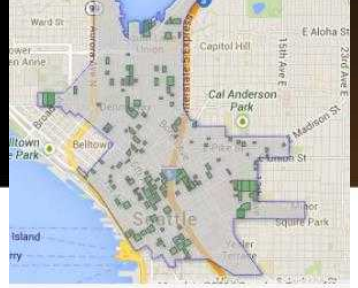
→ Pre-retrofit: 71 kbtu/sf per year

→ Post-retrofit: 56 kbtu/sf per year



Energy Consumption and Conservation in Mid- and High-Rise Residential Buildings
http://www.hpo.bc.ca/sites/www.hpo.bc.ca/files/download/Report/MURB-EnergyStudy-Report.pdf

Seattle 2030 District



Seattle 2030 District

- NEW BUILDINGS, MAJOR RENOVATIONS, AND NEW INFRASTRUCTURE:
  - Energy Use: an immediate 60% reduction below the National average, with incremental targets, reaching carbon neutral by 2030.
  - Water Use: An immediate 50% reduction below the current District average.
  - CO2e of Auto and Freight: An immediate 50% reduction below the current District average.
- EXISTING BUILDINGS AND INFRASTRUCTURE OPERATIONS:
  - Energy Use: A minimum 10% reduction below the National average by 2015 with incremental targets, reaching a 50% reduction by 2030.
  - Water Use: A minimum 10% reduction below the District average by 2015, with incremental targets, reaching a 50% reduction by 2030.
  - CO2e of Auto and Freight: A minimum 10% reduction below the current District average by 2015 with incremental targets, reaching a 50% reduction by 2030.

Yukon Housing Corporation

RDH

27 Donjek - Figures

	Original	Ext Retrofit	Int Retrofit
Floor Area	1075 ft^2		
Wall R val (nom.)	12	22	45
Windows	Dbl clr	Dbl clr	Trple clr
ELA (in^2)	384	204	73
ACH @ 50 Pa	13.4	~ 7	2.78
EGH Rating	32	62	76
Oil (Annual)	$ 9,245	$ 4,702	$ 2,276
Electricity (Annual)	$ 1,900	$ 1,900	$ 1,855
Total	$ 11,145	$ 6,602	$ 4,140

Industrial Energy Management

- → NewGold: New Afton Mine, British Columbia
- → ISO 50001 Energy Management System standard
- → Prism Engineering

Monitoring, Targeting and Reporting

EMIS Status Report

Status Report: New Gold-New Afton

Start Date: 7/18/2014 7:12:31 AM

Level 3	EAC	Electricity (105%)	Gas (105%)
Crushing/Conveying	Conveying	179.17%	
	Crushing	128.34%	
Mill Processing	Assay	103.79%	
	Compressed Air	90.38%	
	Cooling	102.08%	
	Dewatering	102.08%	
	Flotation	100.09%	
	Grinding	94.82%	
	HVAC	97.70%	100.22%
	Reagents	99.76%	
	Regrind	100.10%	
	Tailings	103.03%	
	Utilities	100.30%	
	Water	121.89%	
Mining	Batch Plant	105.48%	
	Dewatering	99.55%	

Policy Best Practices

- → Deep Retrofits
  - → Seattle Energy Benchmarking
  - → Vancouver Greenest City Action Plan
- → Net Zero
- → Community, Jurisdiction and Regional approaches

Building Energy Benchmarking

- Reporting and comparison of building energy use data
  - Establishes a baseline from which to suggest improvements and measure future performance
  - Encourages building owner action to reduce inefficiencies
  - Enables governments and utilities to target largest opportunities
  - Informs development of programs and policies
  - Enables strategy/program/policy evaluation
  - Supports market demand for improved energy performance

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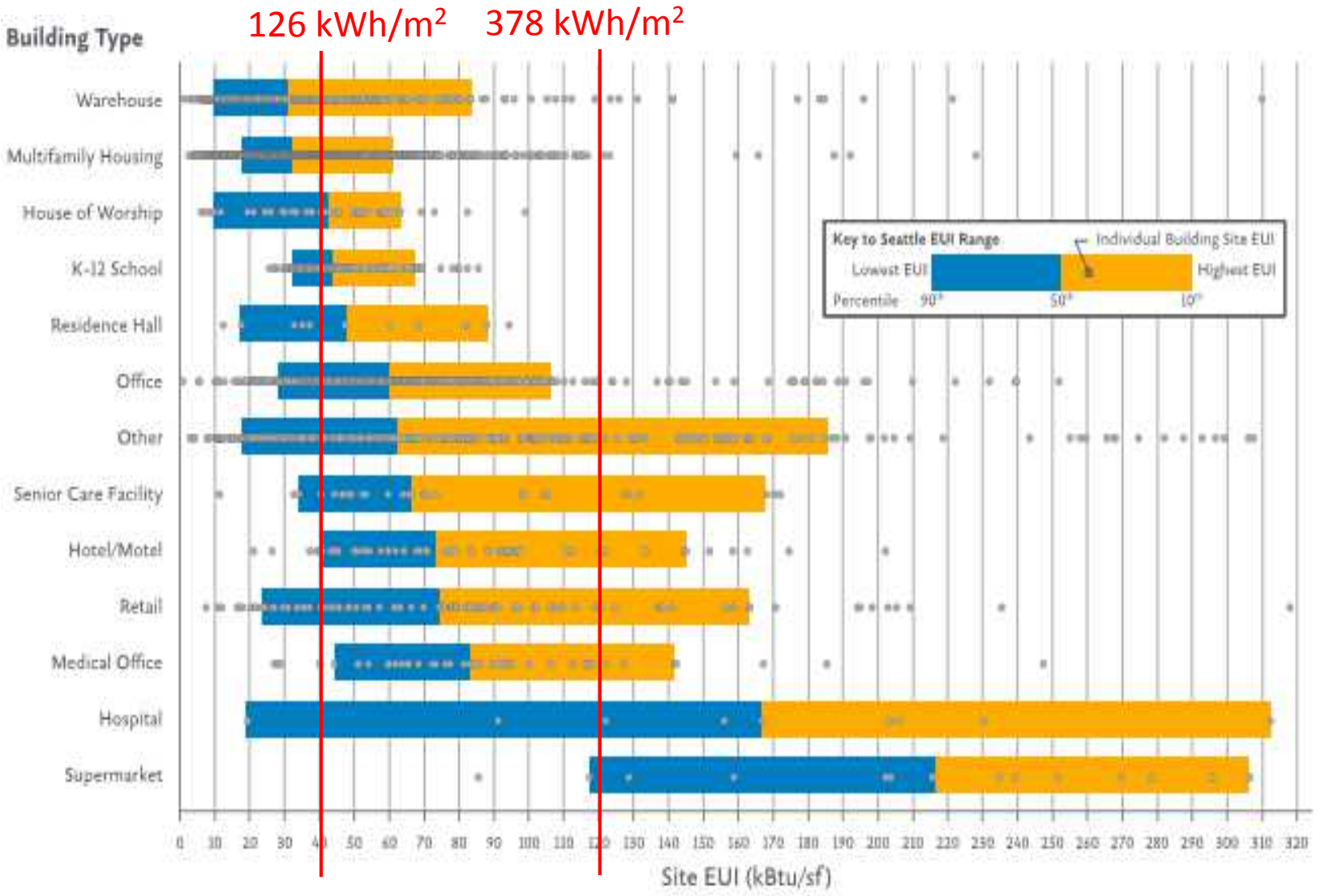
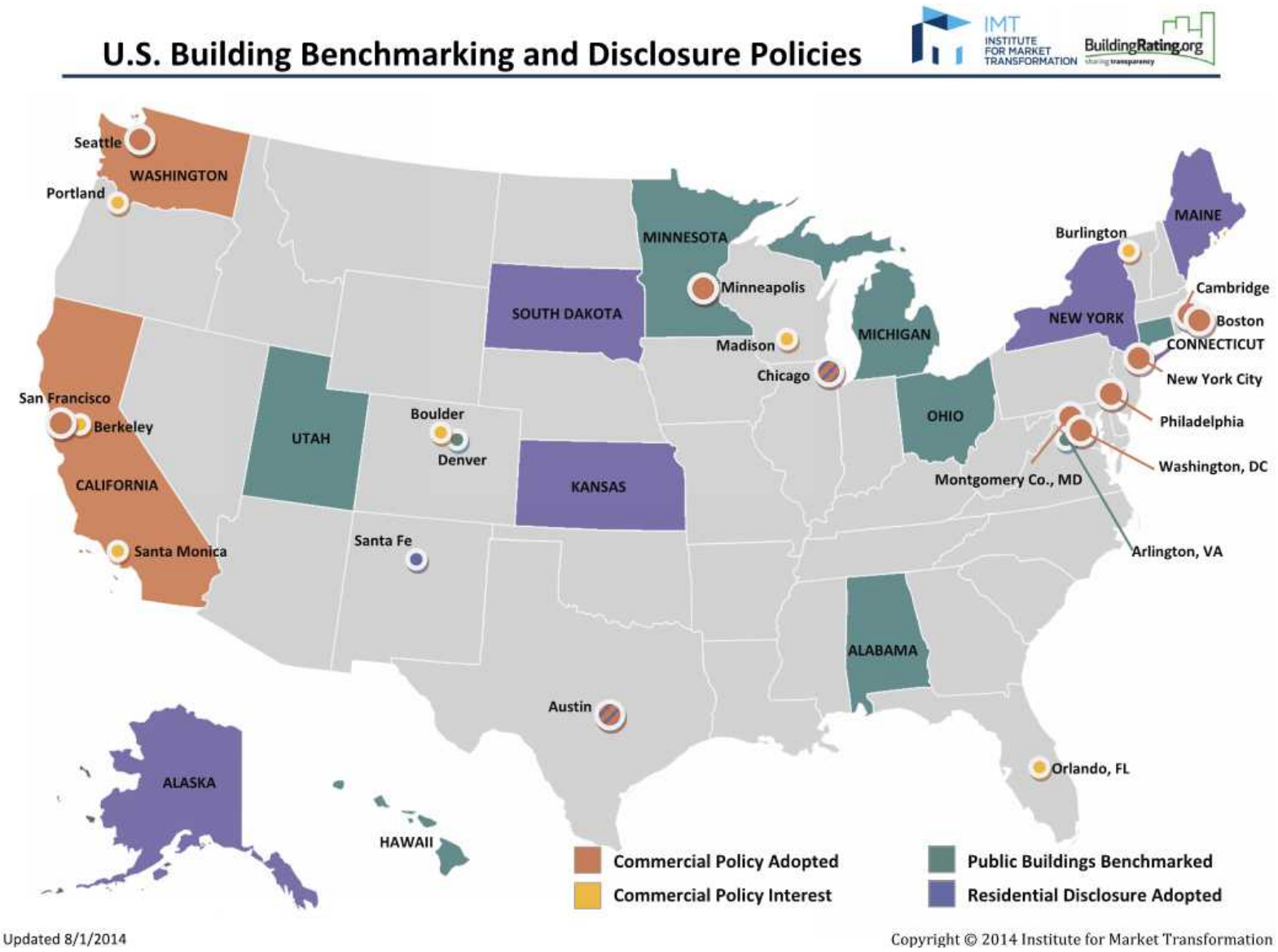
Seattle Report (2012 data set)



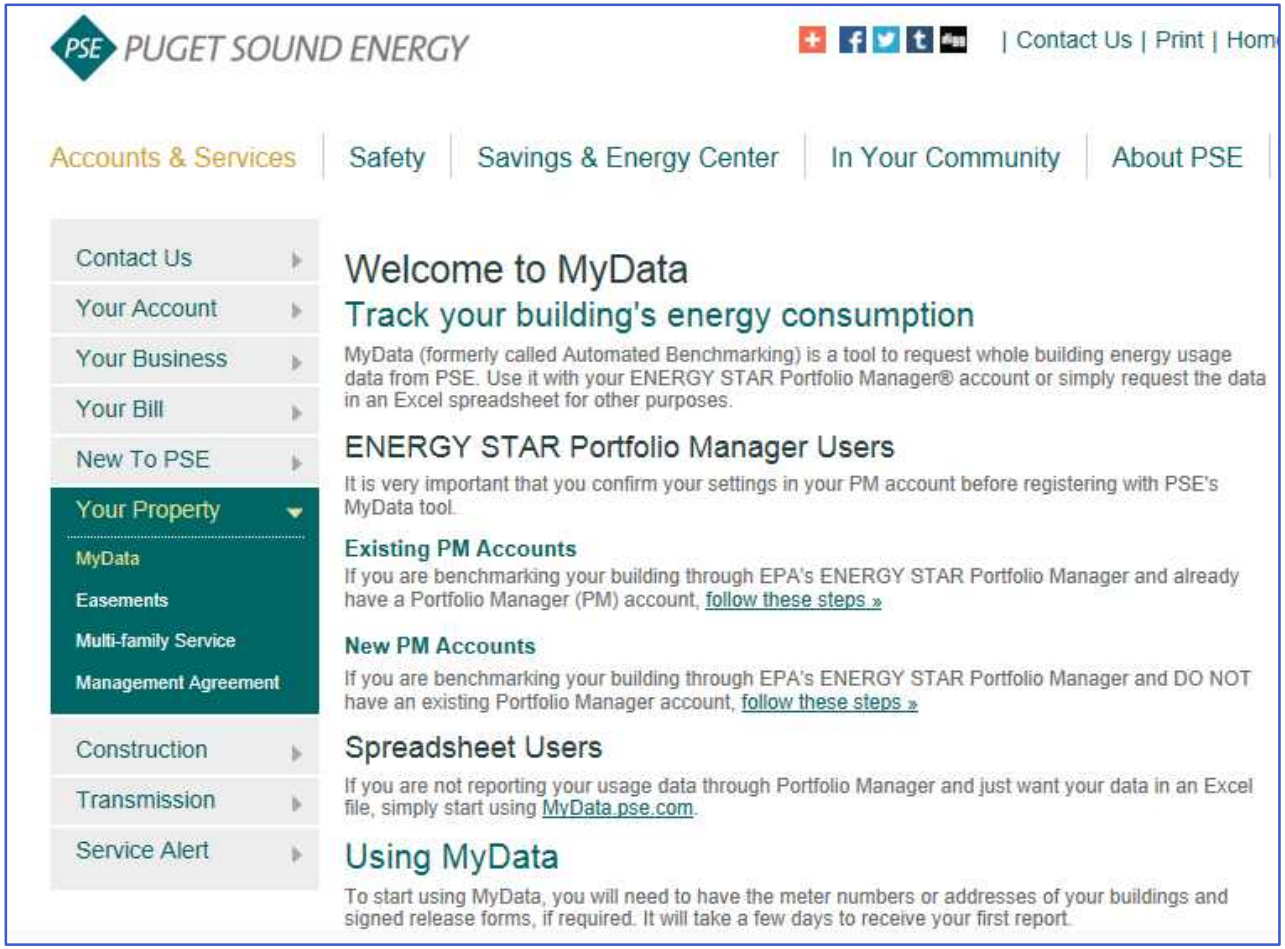
Benchmarking/Labelling Regulations



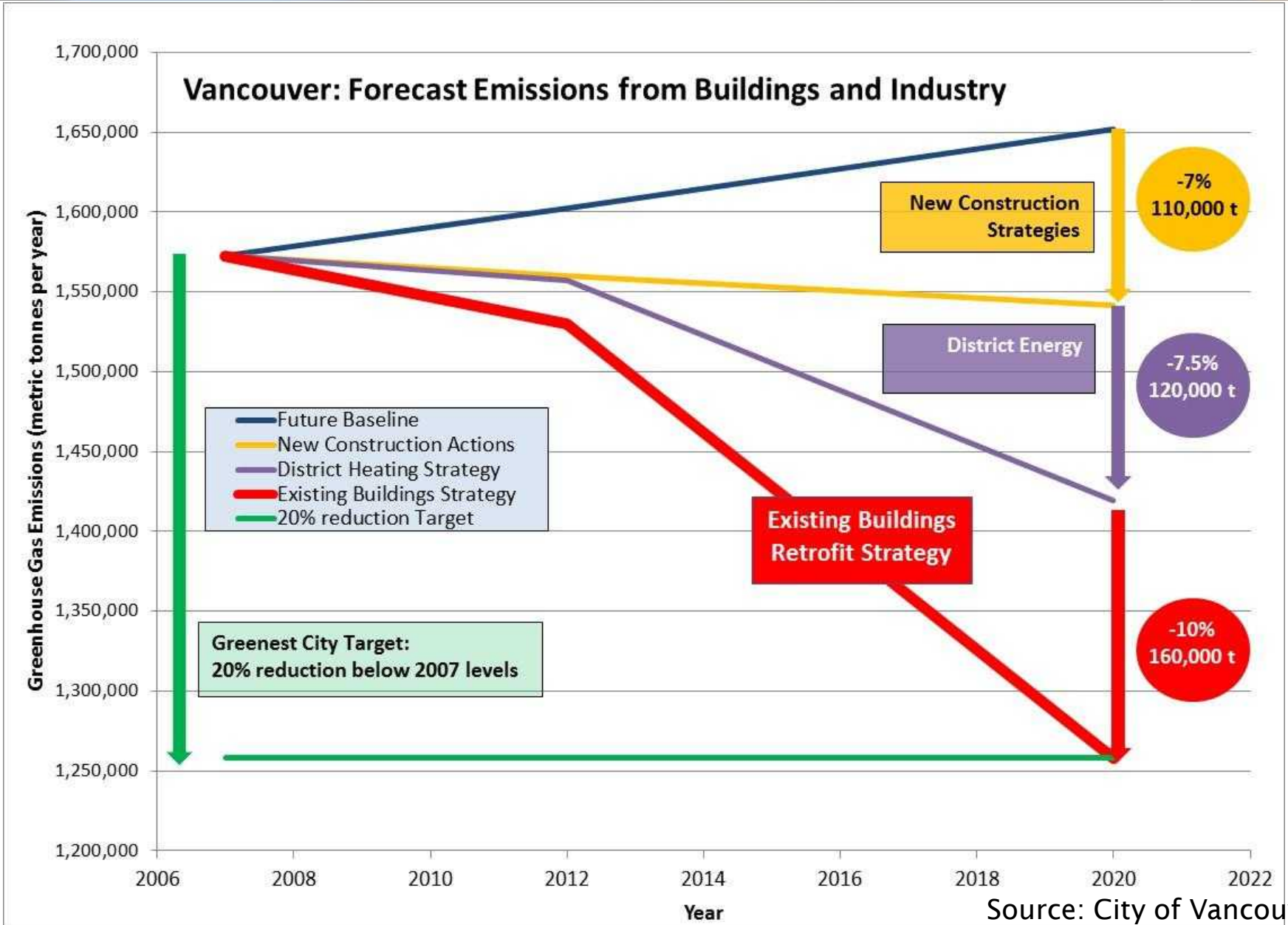
Source: Institute for Market Transformation

Benchmarking – Access to Data

- → State of Washington mandate to utilities
- → Energy data upload

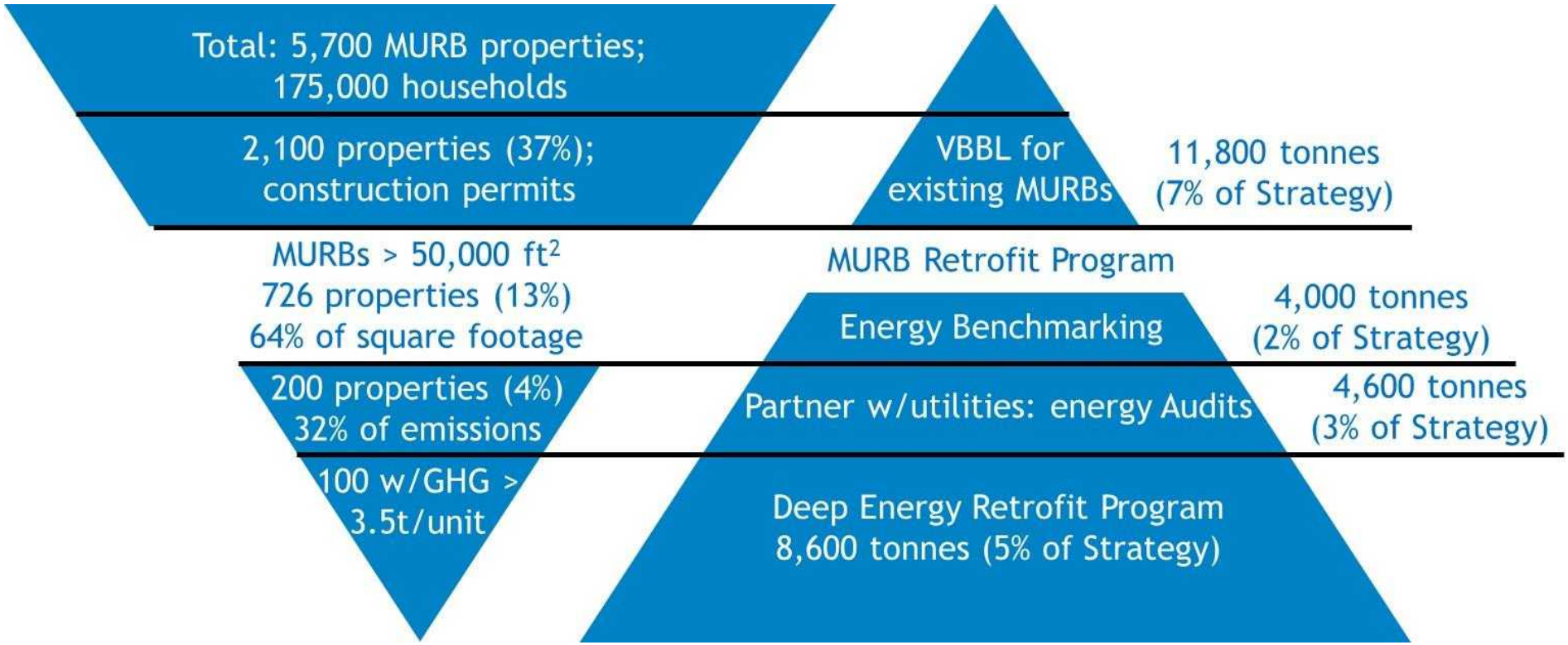


Vancouver: Greenest City Action Plan



Source: City of Vancouver

Priority Multifamily Buildings

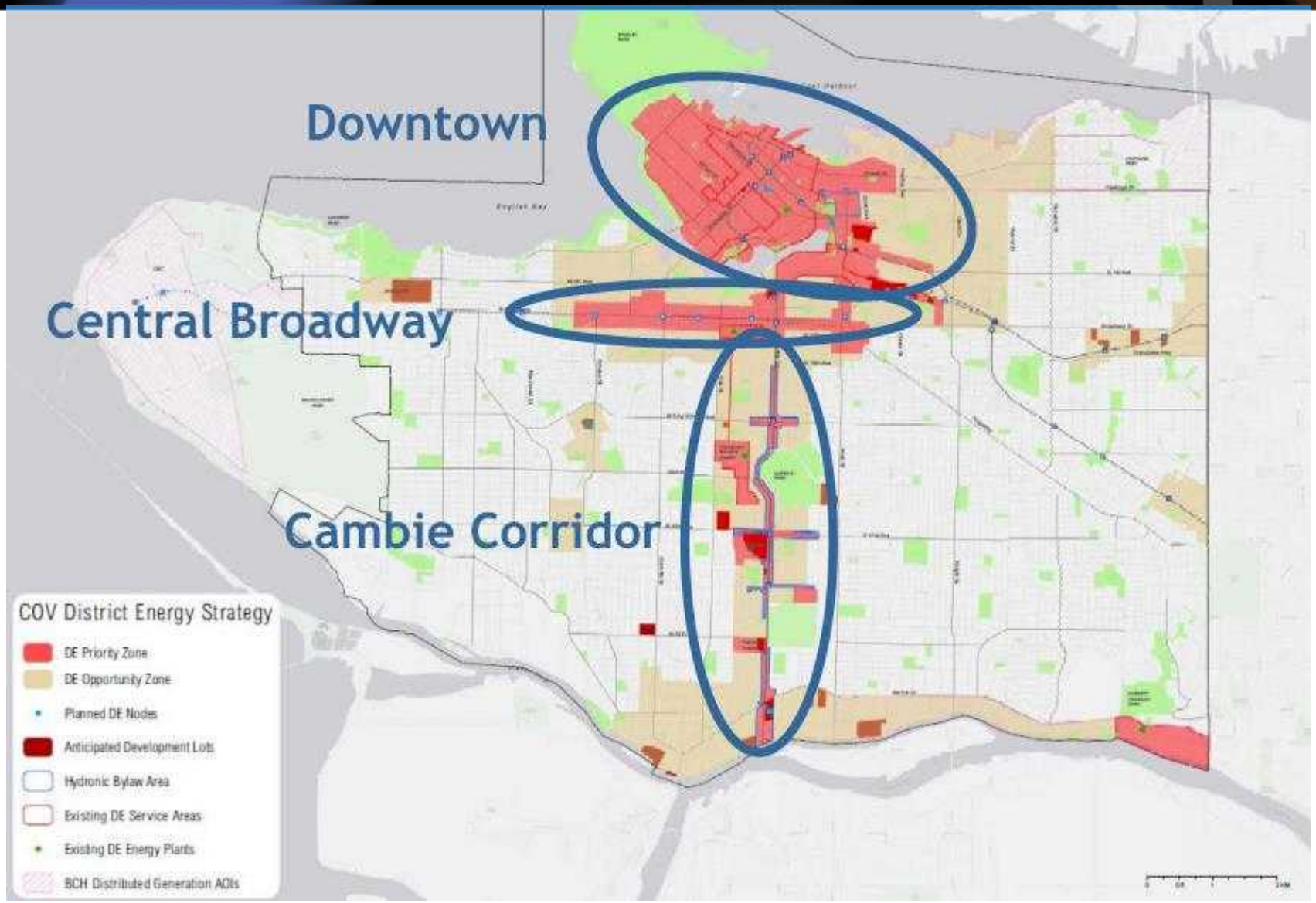


Source: City of Vancouver and RDH Building Engineering Ltd.

Vancouver Strategy Emission Targets - 2020

	Institutional	Houses	Multi-family	Commercial	Industry	Target Emission Reductions (tonnes)
Government Commitments	✓					11,000
Benchmarking			✓	✓		19,000
Support Voluntary Improvements		✓	✓	✓	✓	80,000
Regulations	✓	✓	✓	✓	✓	50,000
Target Reductions (tonnes)	27,000	31,000	29,000	40,000	33,000	= 160,000 tonnes
Target Savings (million $)	$22M	$4M	$23M	$44M	$6M	= $99M

Vancouver Neighbourhood Energy Strategy



http://vancouver.ca/home-property-development/neighbourhood-energy-strategy.aspx

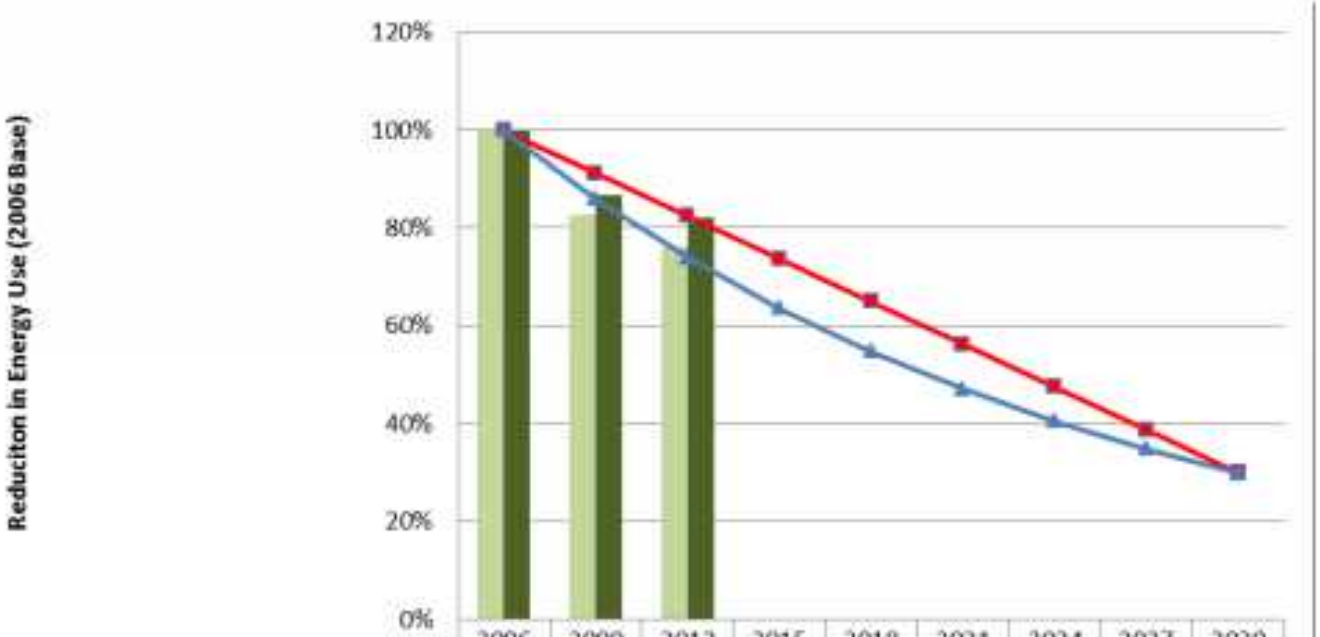
Policy Best Practices

- Deep Retrofits
- Net Zero
  - WA State Energy Code (and Seattle Energy Code)
  - Energy labelling of new houses

WA State 2014 Update

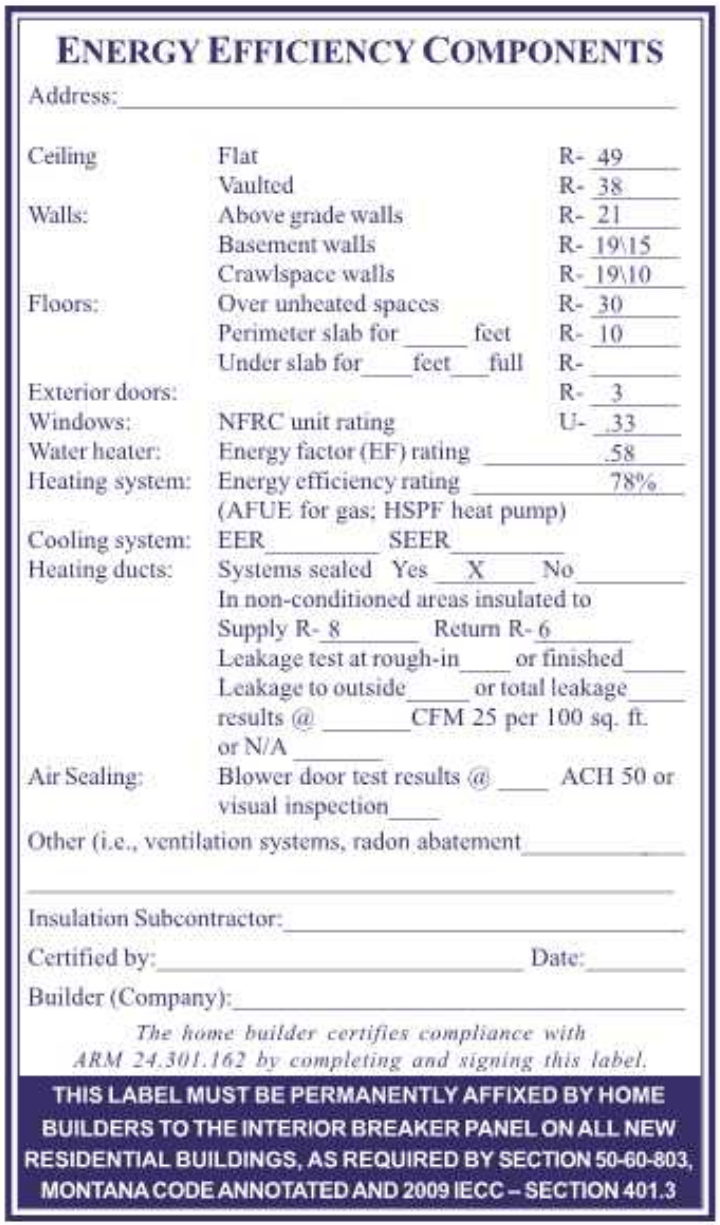
→ WA Department of Commerce. "Energy Efficiency- Building Strategy Update 2014". Report to the Legislature.

Figure 1. Incremental Code Improvement Compared to Targets



	2006	2009	2012	2015	2018	2021	2024	2027	2030
Residential	100%	83%	76%						
Commercial	100%	87%	82%						
Target: 8.75 % savings compared to the 2006 WSEC	100%	91%	83%	74%	65%	56%	48%	39%	30%
Target: 14% savings compared to each previous code	100%	86%	74%	64%	55%	47%	40%	35%	30%

Home Energy Labels



ENERGY EFFICIENCY COMPONENTS

Address: _____

Ceiling	Flat	R- 49
	Vaulted	R- 38
Walls:	Above grade walls	R- 21
	Basement walls	R- 19\15
	Crawlspace walls	R- 19\10
Floors:	Over unheated spaces	R- 30
	Perimeter slab for ____ feet	R- 10
	Under slab for ____ feet ____ full	R-
Exterior doors:		R- 3
Windows:	NFRC unit rating	U- .33
Water heater:	Energy factor (EF) rating	.58
Heating system:	Energy efficiency rating	78%
	(AFUE for gas; HSPF heat pump)	
Cooling system:	EER _____ SEER _____	
Heating ducts:	Systems sealed Yes X No _____	
	In non-conditioned areas insulated to	
	Supply R- 8 Return R- 6	
	Leakage test at rough-in ____ or finished ____	
	Leakage to outside ____ or total leakage ____	
	results @ _____ CFM 25 per 100 sq. ft.	
	or N/A _____	
Air Sealing:	Blower door test results @ ____ ACH 50 or	
	visual inspection ____	

Other (i.e., ventilation systems, radon abatement _____

_____

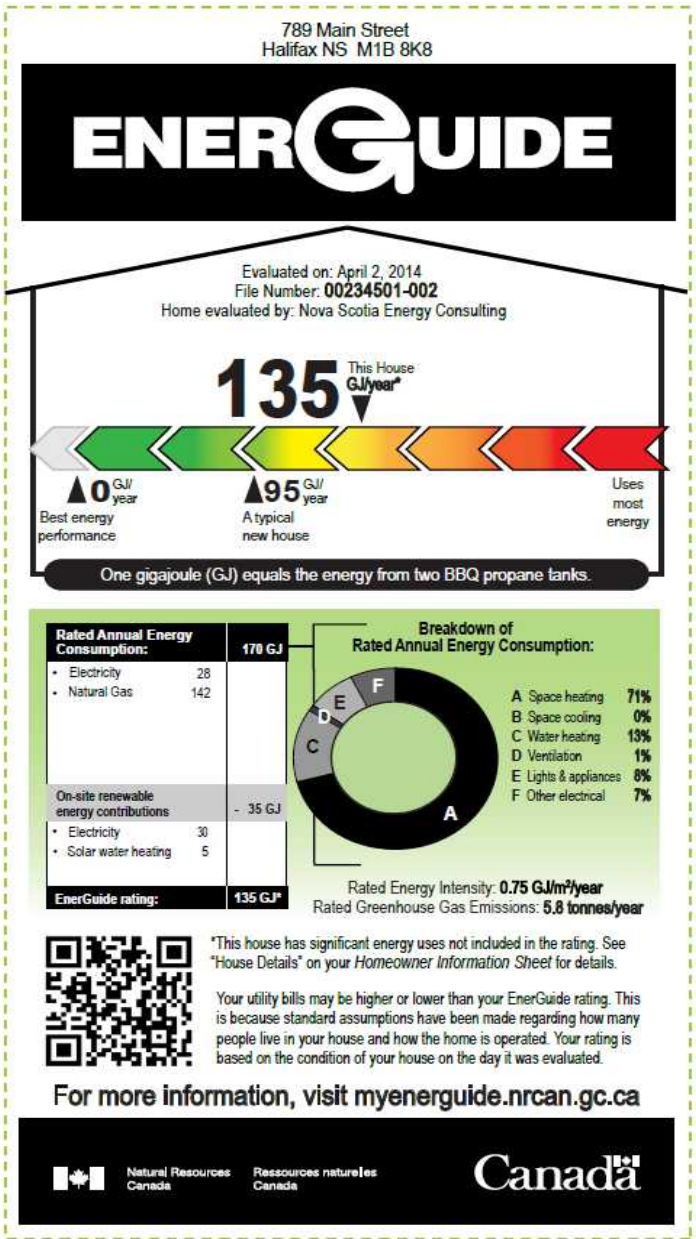
Insulation Subcontractor: _____

Certified by: _____ Date: _____

Builder (Company): _____

The home builder certifies compliance with ARM 24.301.162 by completing and signing this label.

THIS LABEL MUST BE PERMANENTLY AFFIXED BY HOME BUILDERS TO THE INTERIOR BREAKER PANEL ON ALL NEW RESIDENTIAL BUILDINGS, AS REQUIRED BY SECTION 50-60-803, MONTANA CODE ANNOTATED AND 2009 IECC – SECTION 401.3



789 Main Street
Halifax NS M1B 8K8

ENERGUIDE

Evaluated on: April 2, 2014
File Number: **00234501-002**
Home evaluated by: Nova Scotia Energy Consulting

135 This House GJ/year*

0 GJ/year — Best energy performance
95 GJ/year — A typical new house
Uses most energy

One gigajoule (GJ) equals the energy from two BBQ propane tanks.

Rated Annual Energy Consumption:		170 GJ
• Electricity	28	
• Natural Gas	142	
On-site renewable energy contributions		- 35 GJ
• Electricity	30	
• Solar water heating	5	
EnerGuide rating:		135 GJ*

Breakdown of Rated Annual Energy Consumption:

A Space heating	71%
B Space cooling	0%
C Water heating	13%
D Ventilation	1%
E Lights & appliances	8%
F Other electrical	7%

Rated Energy Intensity: **0.75 GJ/m²/year**
Rated Greenhouse Gas Emissions: **5.8 tonnes/year**

*This house has significant energy uses not included in the rating. See "House Details" on your *Homeowner Information Sheet* for details.

Your utility bills may be higher or lower than your EnerGuide rating. This is because standard assumptions have been made regarding how many people live in your house and how the home is operated. Your rating is based on the condition of your house on the day it was evaluated.

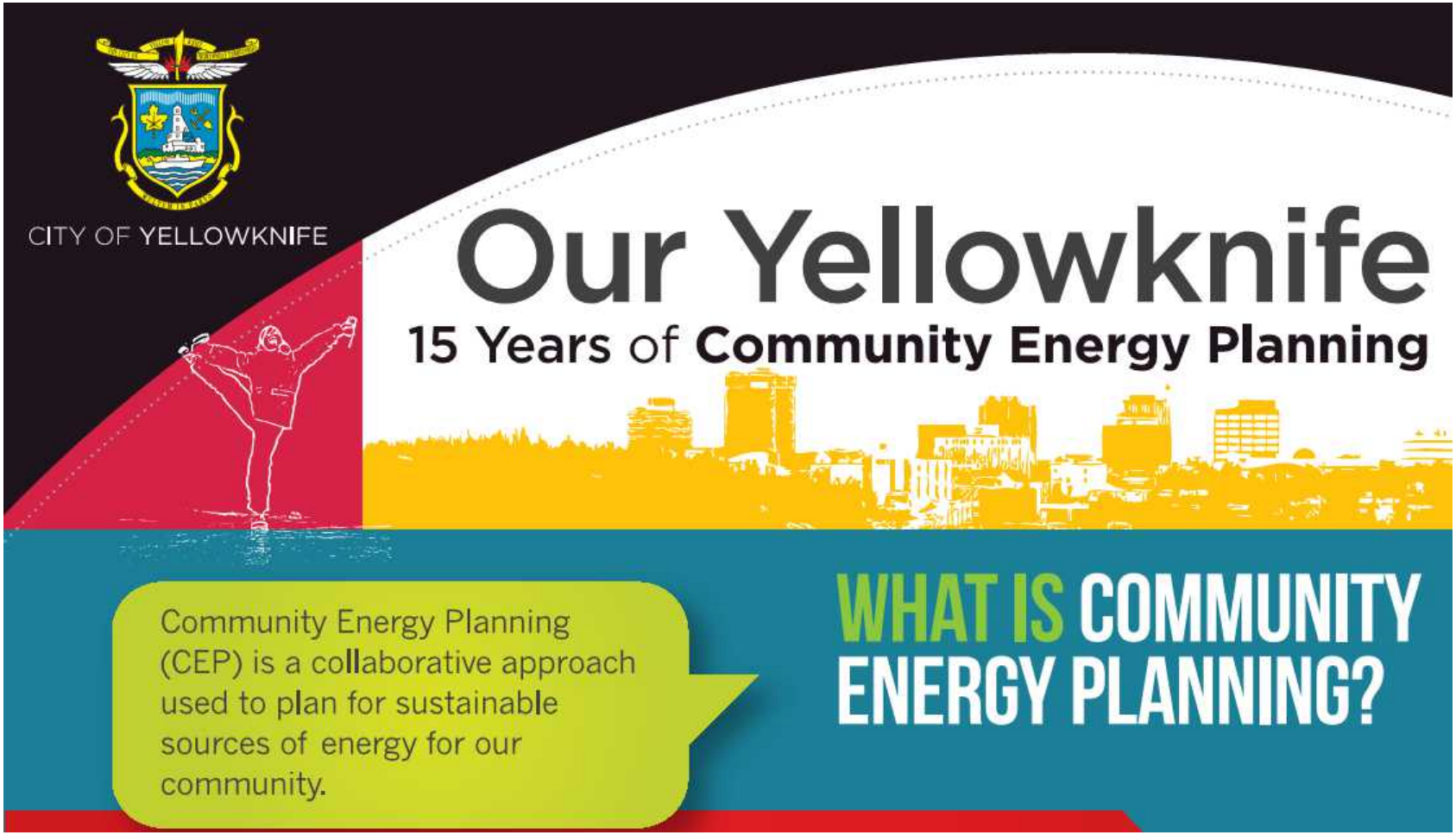
For more information, visit myenerguide.nrcan.gc.ca

Natural Resources Canada | Ressources naturelles Canada — Canada

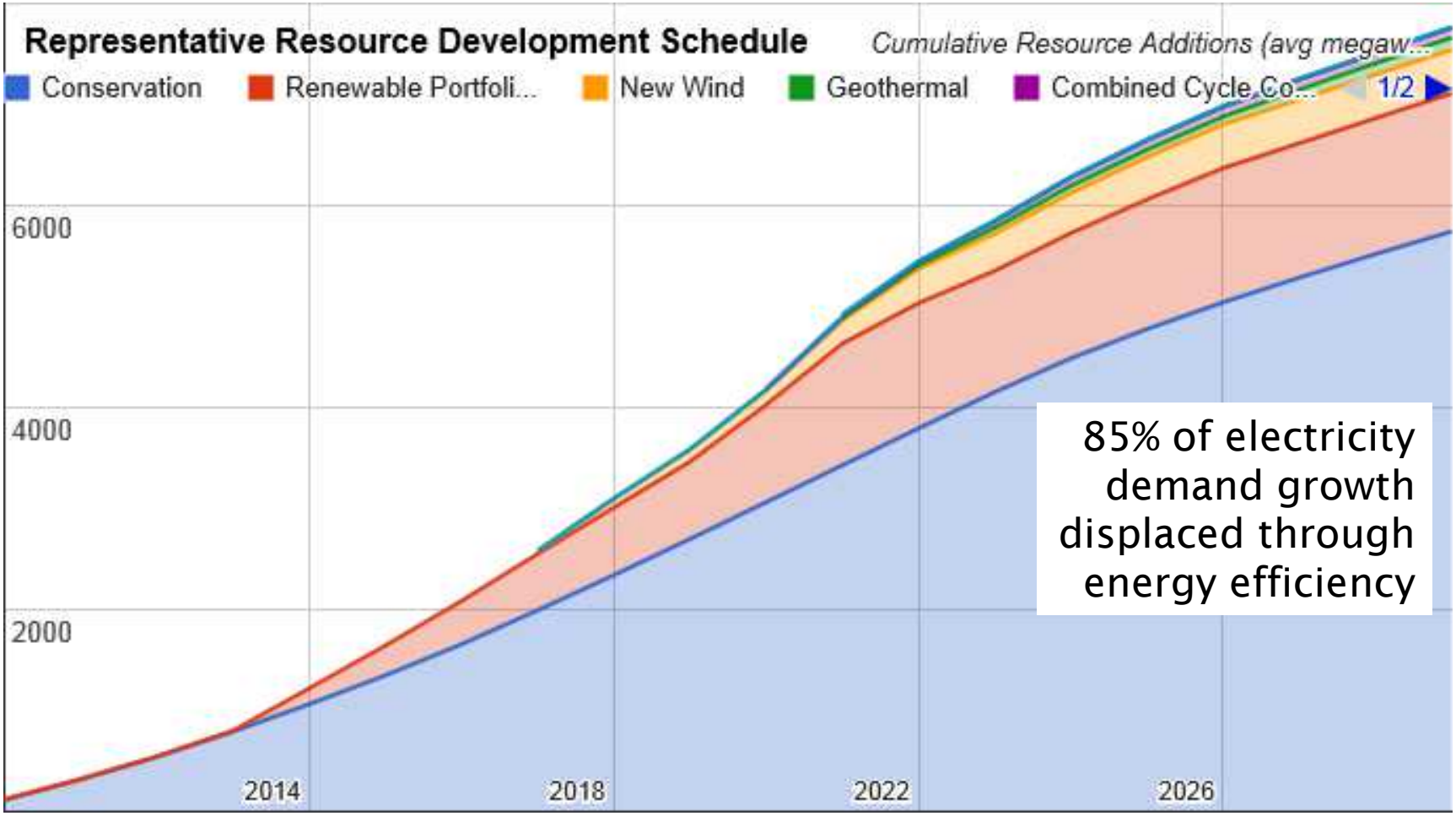
Policy Best Practices

- → Deep Retrofits
- → Net Zero
- → Community, Jurisdiction and Regional approaches
  - → Yellowknife Community Energy Plan
  - → Northwest Power Plan
  - → Pacific Coast Collaborative

Yellowknife Community Energy Plan



6th NW Power Plan



Innovation Partnerships

- Pacific Coast Collaborative
  - West Coast Action Plan on Jobs (2012)
  - West Coast Clean Economy Report

http://www.pacificcoastcollaborative.org/Pages/ThirdAnnualLeadersForum.aspx

Innovation Partnerships

- → Pacific Coast Collaborative
  - → Pacific Coast Action Plan on Climate and Energy (2013)

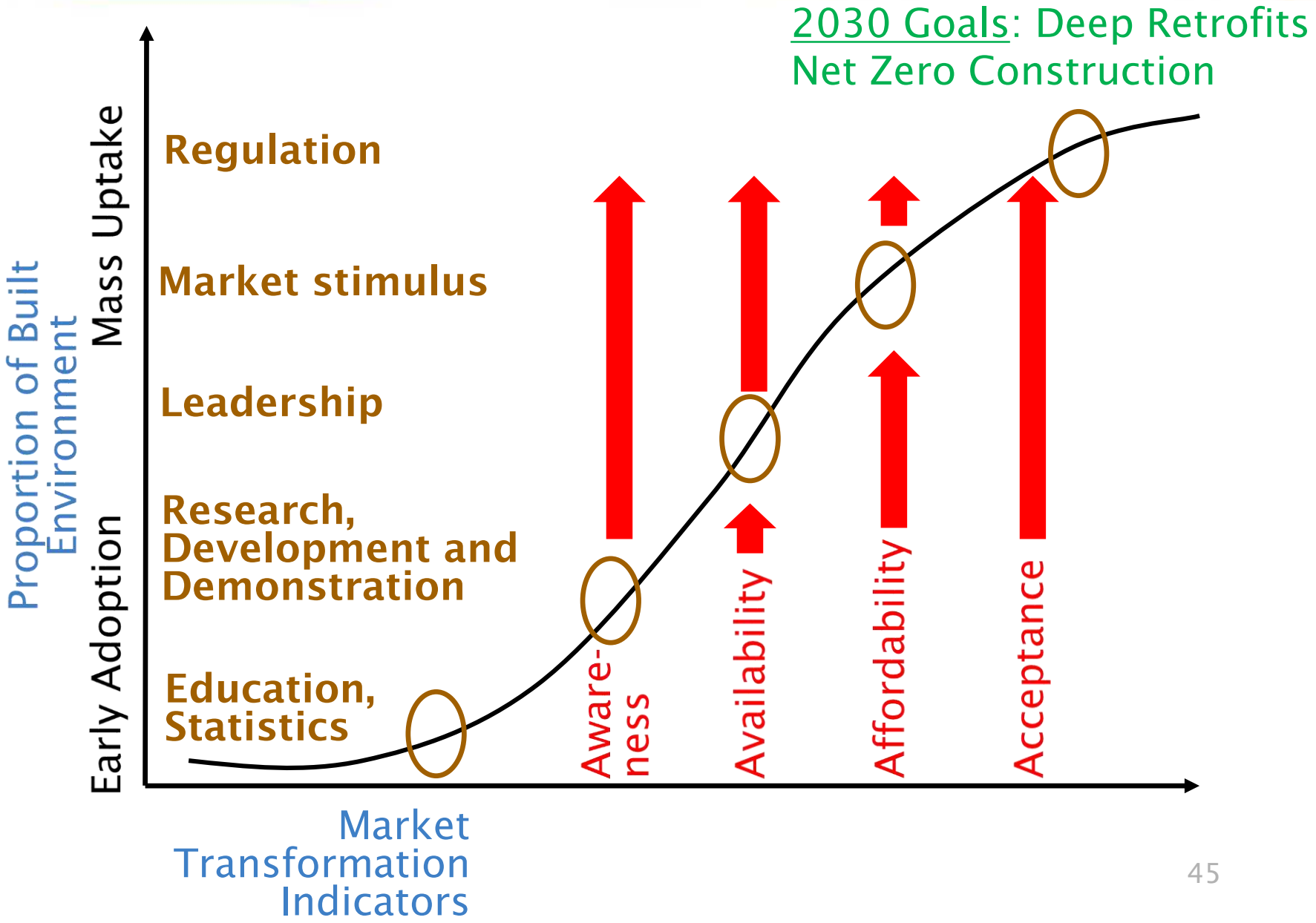
http://www.pacificcoastcollaborative.org/Documents/Pacific%20Coast%20Climate%20Action%20Plan.pdf

III. Invest in clean energy and climate-resilient infrastructure with actions to:

1) Transform the market for energy efficiency and lead the way to "net-zero" buildings.

Energy efficiency is the lowest cost way to reduce greenhouse gas emissions while creating good local jobs. The governments of California, British Columbia, Oregon and Washington will work to harmonize appliance standards, increase access to affordable financing products, and support policy that ensures that energy efficiency is valued when buildings are bought and sold. Our efforts intend to build a vibrant, growing regional market for energy efficiency products and services.

Market Transformation Measures



PNWER Roadmap Components

- Goals
- Policy Best Practices – education, leadership, program and regulatory options
- Proposed targets
- Estimated costs and benefits
- Roles and responsibilities
- Timeline and milestones
- Risk identification and management
- Measurement, evaluation and reporting

PNWER "Net Zero Network"

- Comprised of key influencers
  - Construction industry associations
  - Professional associations
  - Net zero developers/builders/contractors
  - State/provincial/territorial governments
  - Energy utilities
  - Energy efficiency agencies
  - Local governments
  - Public interest organizations
- One Network "node" per jurisdiction (10 in total)
  - Chairing organization needed

PNWER Roadmap Next Steps

- → Endorse Terms of Reference at PNWER Winter Meeting
- → Establish PNWER Net Zero "Network"
- → Develop White Paper on context and best practices
- → Prepare PNWER Net Zero "Roadmap"
- → Present at PNWER Summit, seek endorsement
- → Create ten PNWER Net Zero Network "Nodes"
- → Conduct in-depth consultations

Questions and Discussion

→ rdhbe.com

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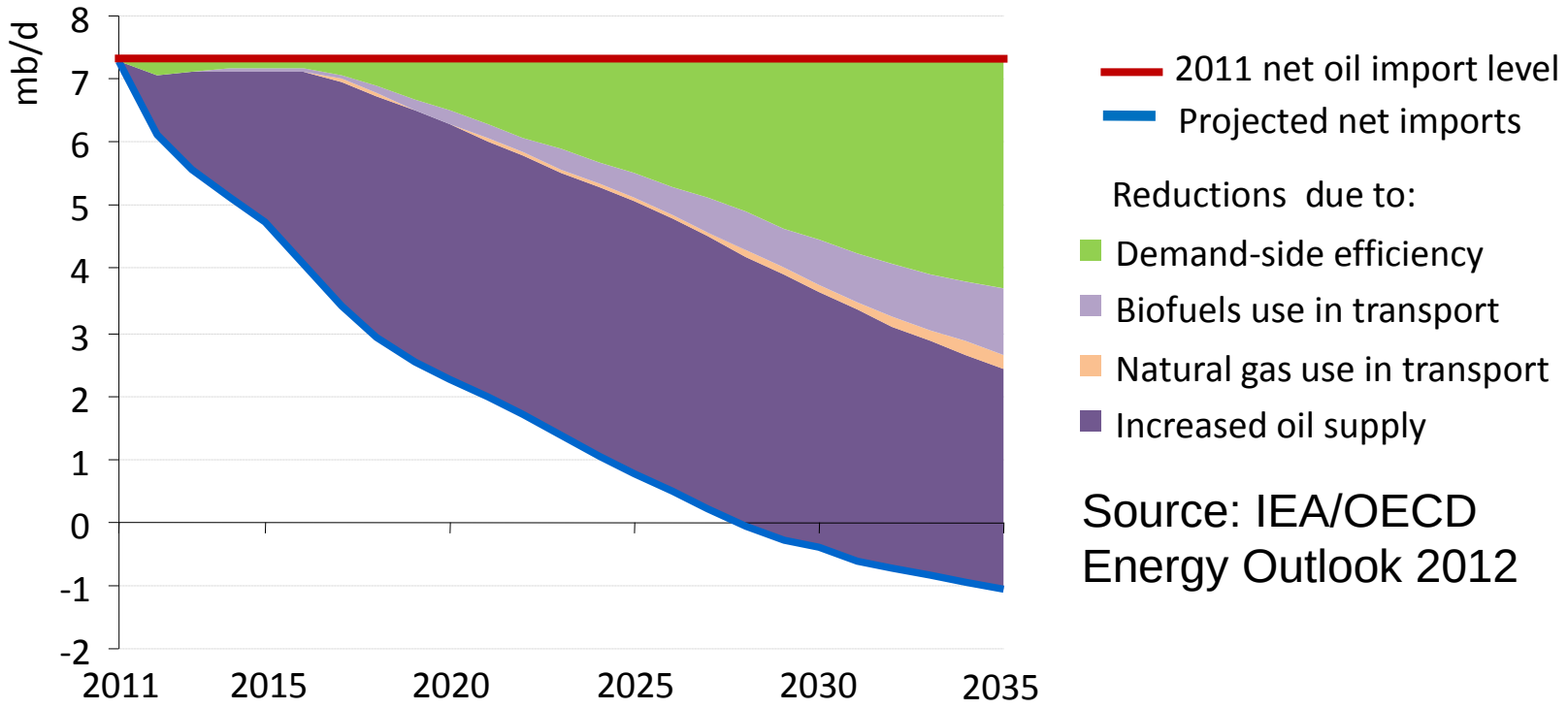
What about Transportation?

Reductions in North American oil imports by source



Source: IEA/OECD Energy Outlook 2012

Benchmarking/Labelling Regulations

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	Legislation				Building Type & Size Threshold			Disclosure				Rating System		Additional Elements		
	Jurisdiction	Short Name	Enacted	First Compliance Deadline	Municipal	Commercial	Multi family	To Gov't	On Public Website	Time of Transaction	To Current Tenants	Energy Star	Other	Utility Req't	Water Use Tracking	Additional Requirements
Cities	Austin	Energy Conservation Audit & Disclosure (ECAD) Ordinance	Nov 2008	June 2011	✓	10K SF+	Audits	✓	-	Buyers	-	✓	ACLARA	-	-	Audits & mandatory upgrades for multifamily buildings
Cities	Boston	Boston Energy Reporting and Disclosure Ordinance	May 2013	May 2014	✓	35K SF+	35+ units or 35K SF+	✓	✓	-	-	✓	-	-	✓	Periodic energy assessments and/or actions
Cities	Chicago	Chapter 18-14. Building Energy Use Benchmarking Ordinance	Sept 2013	June 2014	50K SF+	50K SF+	50K SF+	✓	✓	-	-	✓	-	-	-	Verification of benchmarking data by licensed professional 1st year, then every 3 years
Cities	District of Columbia	Clean and Affordable Energy Act of 2008	July 2008	April 2013	10K SF+	50K SF+	50K SF+	✓	✓	-	-	✓	Energy Star Target Finder	-	✓	-
Cities	Minneapolis	Chapter 47.190. Commercial Building Rating and Disclosure Ordinance	Jan 2013	May 2014	25K SF+	50K SF+	-	✓	✓	-	-	✓	-	-	✓	-
Cities	New York City	Local Law 84 (additional requirements in LL 87, LL 88)	Dec 2009	August 2011	10K SF+	50K SF+	50K SF+	✓	✓	-	-	✓	-	-	✓	ASHRAE level II audits & RCx (LL 87), lighting upgrades & submetering (LL 88)
Cities	Philadelphia	Bill NO. 120428-A	June 2012	October 2013	-	50K SF+	-	✓	✓	Buyers, Lessees	-	✓	-	-	✓	-
Cities	San Francisco	Existing Commercial Buildings Energy Performance Ord.	Feb 2011	October 2011	10K SF+	10K SF+	-	✓	✓	†Buyers, Lessees, Lenders	✓	✓	-	†	-	ASHRAE level I or II audits or RCx every 5 years
Cities	Seattle	CB 116731	Jan 2010	October 2011	20K SF+	20K SF+	20K SF+	✓	-	†Buyers, Lessees, Lenders	✓	✓	-	✓	-	-
County	Montgomery County, MD	Bill 2-14 Environmental Sustainability – Buildings – Benchmarking	Apr 2014	June 2015	✓	50K SF+	-	✓	✓	-	-	✓	-	-	-	Verification of benchmarking data by licensed professional 1st year, then every 3 years

† Required by previous action

Source: Institute for Market Transformation