

# Large-Scale Energy Performance Contracts: Halifax Regional School Board

October 20, 2015



# Overview

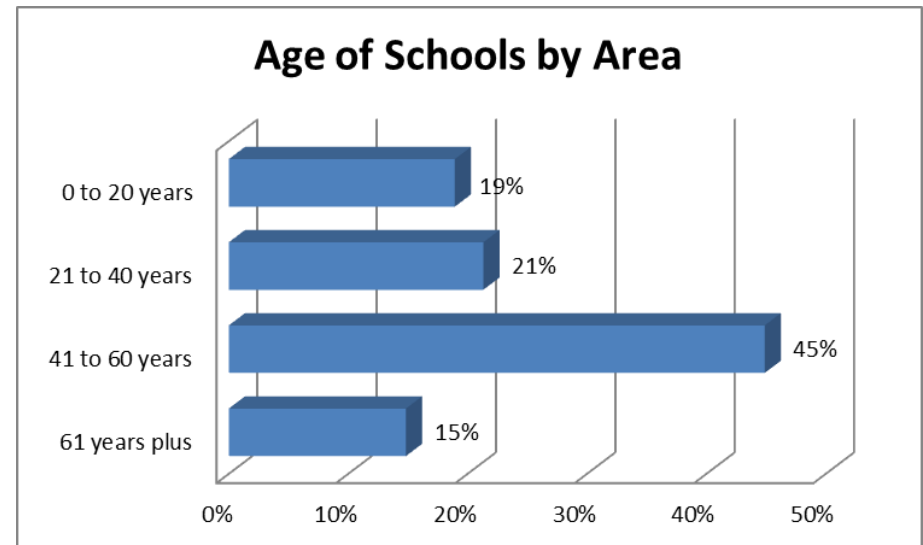
- Background – HRSB
- Energy Performance Contracts
- Model for Change
- Implementation – Energy Improvements
- Barriers and Challenges
- Successes + Results



# Background – HRSB

## ● Halifax Regional School Board

- 48,000 students
- 136 schools
- Area 7,714,000 sq.ft.
  - (717,000 m<sup>2</sup>)
  - (Sep. 2014)
- Average age of school
  - 45 years



# Background – HRSB Schools

School Configuration	Number	Percentage by Number	Percentage by Area
Elementary	84	62%	41%
Junior High/Middle	27	20%	26%
Senior High	13	10%	25%
Other Configurations	12	9%	8%
Primary to Grade 8: 1			
Primary to Grade 9: 8			
Junior-Senior High: 3			
<b>Total</b>	<b>136</b>	<b>100%</b>	<b>100%</b>



# Background – HRSB Utility Usage

## ● Budget for utilities

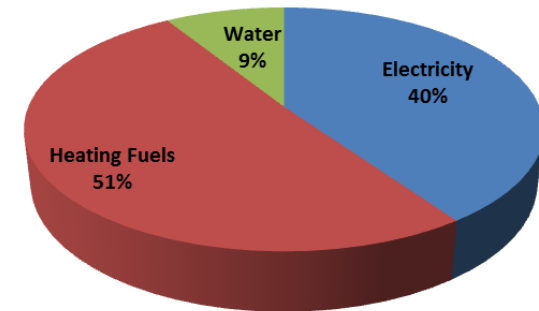
- Electricity \$ 5,394,000
- Heating Fuels \$ 6,798,000
- Water \$ 1,189,000
- **Total** **\$13,381,000**

## ● Heating Fuel Breakdown

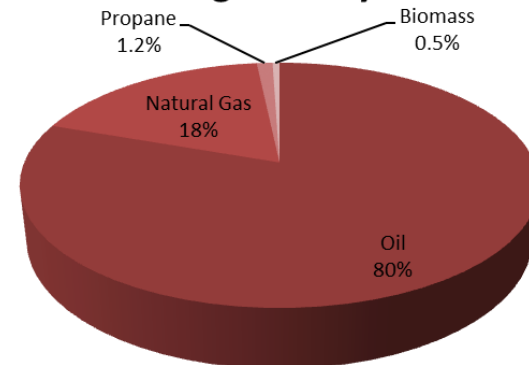
- Oil \$ 5,460,000
- Natural Gas \$ 1,218,000
- Propane \$ 80,000
- Biomass \$ 40,000
- (Electricity) (Included above)
- **Total** **\$ 6,798,000**



Utilities by Cost



Heating Fuels by Cost



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# Energy Performance Contracts

- What is it?
  - Agreement and partnership to provide turn-key design and implementation of improvements with an energy services company (ESCO)
- How does it work?
  - Energy savings amounts pay for the investment over the term of the project
  - Typically, the ESCO arranges and provides financing



# Why Pursue an Energy Performance Contract?

- Opportunity for energy savings and greenhouse gas emissions reduction
- Protection from utility rate increases
- Leverage resources to implement large-scale program
- Leverage funds to implement large-scale program
- Opportunity to incorporate infrastructure renewal requirements
- Incentives from ENSC and Heritage Gas





# Energy Performance Contracts

- What are the benefits?
  - Accelerate investment in cost-effective energy conservation improvements
  - Performance and technical risk is with the ESCO
    - The ESCO guarantees that the improvements will generate energy cost savings sufficient to pay for the project over the term of the contract



# Other benefits

- Meet energy efficiency, water conservation, and emissions reduction goals typically more quickly
- Built-in incentives for ESCO to provide high-quality equipment, timely services, and thorough project commissioning
- Healthier, safer working environments
- Flexible, practical contract and procurement processes
- Reduce vulnerability to budget impacts due to volatile energy prices, weather, and equipment failures



# Energy Performance Contract Process

## ● Step 1: Getting Started

- Gather information
  - Utility benchmarking
- Senior management support
- Assemble the project team
  - HRSB retained outside specialist consultant
- Opportunity assessment
- Business case



# Energy Performance Contract Process

## ● Step 2: Selecting an Energy Service Company

- Develop and issue Request for Proposal and supporting documentation
  - Three sample buildings – Old one, new one
  - 25-page limit
- Review committee and evaluation



# Energy Performance Contract Process

## ● Step 3: Steps to Awarding the Contract

- Plan internal resource requirements
- Briefing note, and approval of Board
- Complete the investment-grade feasibility study
- Finalize contract based on feasibility study



# Energy Performance Contract Process

## ● Step 4: Managing the Contract

- Responsibilities during an EPC
- Approval process – Open-book
  - Design, tender and subcontractor approvals
  - Schedule, completion approvals
- Commissioning of improvements
- Training on improvements
- Energy engagement and communications program
- Measurement and verification
  - Reconciliation reports
  - Track energy use



# Energy Performance Contract Process

- **Step 5: Maintaining the Savings after the Energy Performance Contract Project is Finished**
  - New procedures for operations
  - Guarantee obligations



# Energy Performance Contract – HRSB

- EPC with HRSB and MCW/CES
  - 90 schools (66% )
    - Tangible Capital Assets
  - \$34,000,000 investment (guaranteed maximum price)
  - \$2,500,000 guaranteed savings (2009 prices)
  - 4-year EPC implementation plan (2013-2017)
  - 2009 study, 2013 EPC





# Patience is a virtue...

- 2009 study, then...
  - 2009-2010 - \$4m of capital work
  - 2010-2011 - \$4m of capital work
  - 2011-2012 - \$600,000 of operations work thorough energy efficiency funding
  - 2012-2013 - \$1m of natural gas conversions
- 2013 Energy Performance Contract



- Background
- Energy Performance Contracts
- **Model for Change**
- Implementation – Energy Improvements
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# Model for Change

- Form a roadmap for the vision
- Requires significant effort to change an organization successfully.
  - Careful planning to build the foundation
  - Improve chances of success
- Eight Steps to Transforming Your Organization
  - John Kotter, Harvard Business Review, Mar-Apr 1995



# Model for Change

## 1. Establishing a Sense of Urgency

- Understanding market and realities, benchmarking
- Identifying potential opportunities and risks
  - Early endeavours – ‘Energy Matters’
  - Proof of concepts
  - GHGs, utility rates
  - Natural gas distribution



# Model for Change

## 2. Forming a Powerful Guiding Coalition

- Group established to push project forward
  - Superintendent, Operations Services, Financial Services
  - Sponsor group
- Team effort encouraged



# Model for Change

## 3. Creating a Vision

- Direct the change effort
  - Energy Matters
- Superintendent's plan
- Strategies to achieve the outcome
  - Rebranding campaign
  - Kickstart, Lights Off, Green On!



# Model for Change

## 4. Communicating the Vision

- Using many vehicles to communicate new vision
  - Website
  - Social media
  - Contests
- Teaching of new behaviours



# Model for Change

## 5. Empowering Others to Act on the Vision

- Removal of obstacles
- Changing systems that undermine the vision
- Encouraging of non-traditional ideas, activities and actions
- Change in leadership within HRSB, and continued success of the program





# Model for Change

## 6. Planning for, and Creating Short-Term Wins

- Visible performance improvements
- Creating the improvements
- Recognition and rewarding teachers, staff and students involved



# Model for Change

## 7. Consolidating Improvements and Producing Still More Change

- Increase of credibility to change systems and structures
- Hiring and developing employees to implement the changes
- New projects to re-invigorate the process



# Model for Change

## 8. Institutionalizing New Processes

- Articulating the connections between the behaviours and the success
  - Three Rs – Both ways!
  - Accounting processes
  - Operating processes



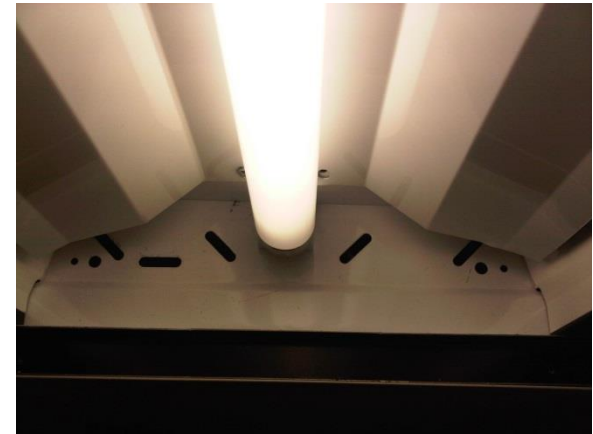
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# What work is being done (physical)

## ● Lighting

- Exterior LED lighting
- Selective LED lighting
- Gym lighting
- Lighting sensors



# What work is being done (physical)

## ● Mechanical

- Natural gas conversions
- Biomass boiler (Millwood)
- Heat recovery
- Hazardous materials

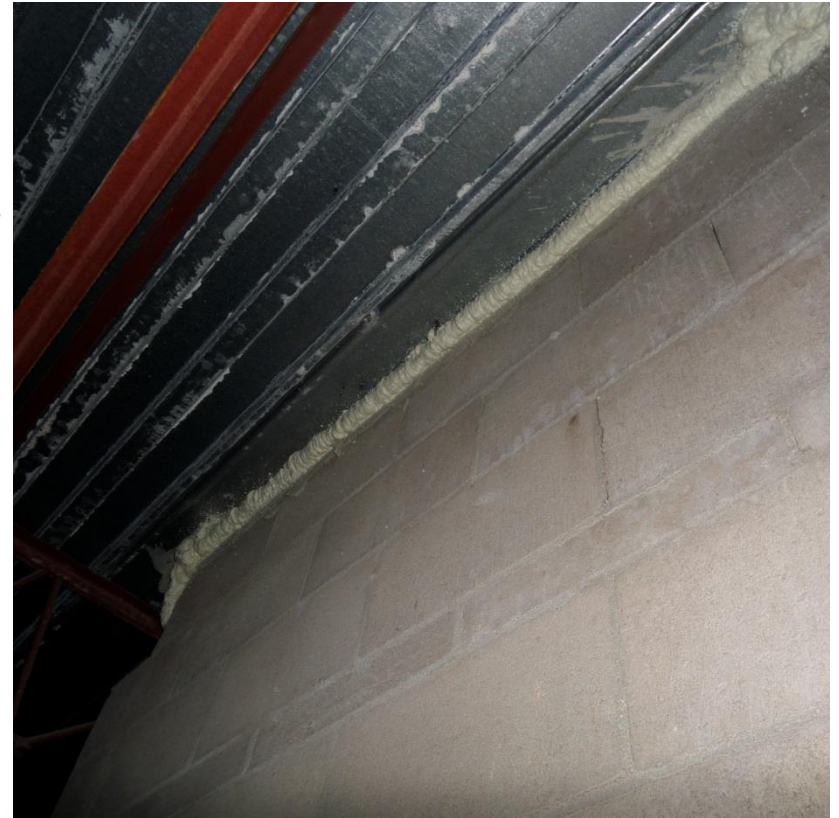


# What work is being done (physical)



# What work is being done (physical)

- Controls – Building automation systems
- Building envelope sealing
- Plumbing fixtures
- Smart meters
- Each building is unique





# What work is being done (behavioural)

- Energy display dashboards
  - Smart metering program
- Portfolio Manager (NRCan)
  - Upload and update utility information into national database,
  - Tracking, monitoring tool
- Energy awareness and engagement
  - Branding, contests, posters
  - Creating sense of involvement and ownership



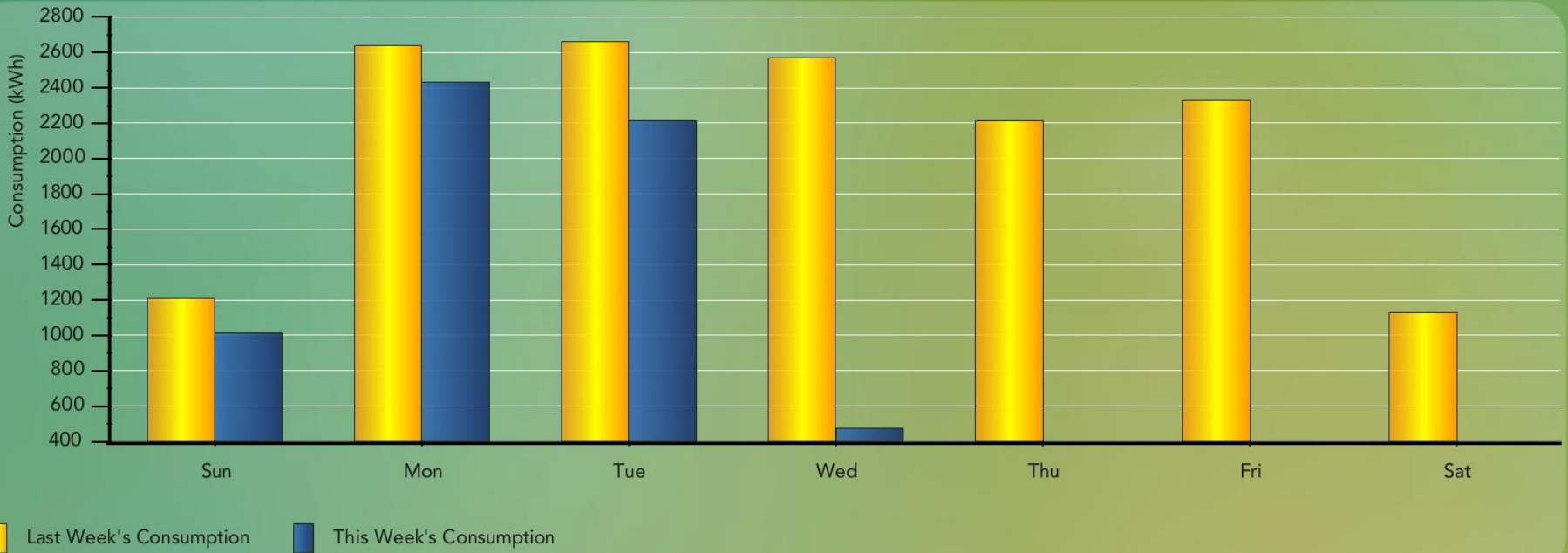
# Energy Display Dashboards



## Weekly Electrical Consumption

Jun 24, 2015 9:58 AM

15° C Outdoor



# ENERGY DASHBOARD

## COMPETITION

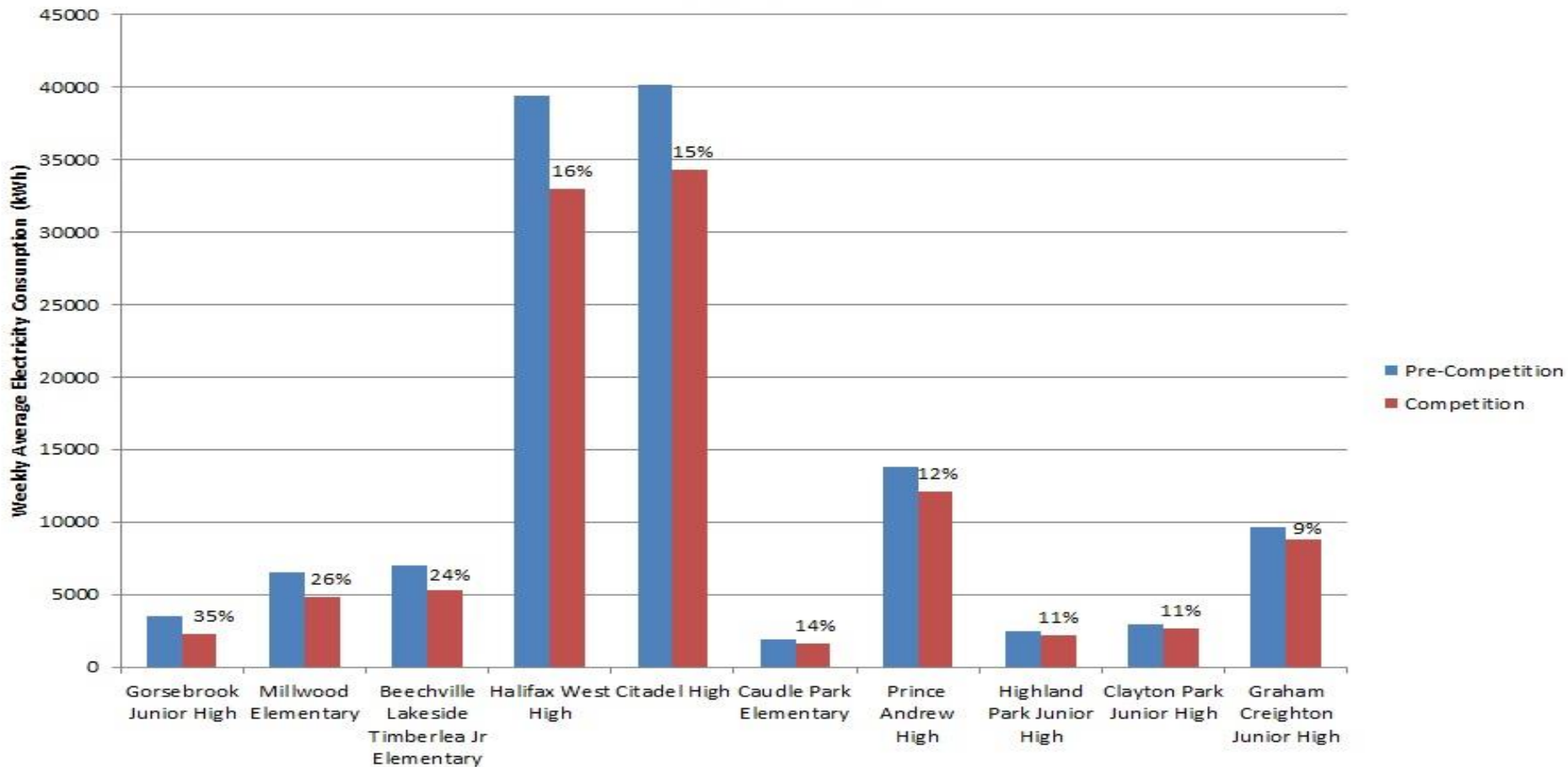
FINAL  
RESULTS



Position	↓↓↓ Impressive ↓↓↓ Great ↓ Some Savings ↑ No Savings	School Name	Baseline Energy Use	Competition Energy Use	Weekly Percentage Decreases			TOTAL
			Average Weekly Electrical Consumption [kWh/week]	Average Weekly Electrical Consumption [kWh/week]	Week #1 Percentage Decrease	Week #2 Percentage Decrease	Week #3 Percentage Decrease	Percentage Decrease
3	↓↓↓	Beechville Lakeside Timberlea Jr.	7,028	5,333	17%	27%	28%	24%
13	↓	Bicentennial	3,339	3,145	12%	4%	1%	6%
6	↓↓	Caudle Park	1,869	1,602	21%	12%	10%	14%
5	↓↓	Citadel High	40,133	34,273	9%	17%	18%	15%
9	↓↓	Clayton Park	2,943	2,624	6%	8%	18%	11%
24	↑	Colonel John Stuart	1,225	1,273	7%	-5%	-13%	-4%
19	↓	Dartmouth High	11,077	11,056	2%	0%	-1%	0%
16	↓	Eastern Shore District High	5,222	4,988	10%	5%	-2%	4%
12	↓	Georges P. Vanier	4,808	4,448	6%	9%	7%	7%
1	↓↓↓	Gorsebrook	3,517	2,276	33%	40%	33%	35%
10	↓	Graham Creighton	9,623	8,754	2%	2%	24%	9%
4	↓↓	Halifax West High	39,393	32,983	24%	12%	13%	16%
8	↓↓	Highland Park	2,472	2,193	13%	19%	2%	11%
20	↑	John W. MacLeod	3,095	3,107	4%	4%	-9%	0%
15	↓	John W MacLeod - Fleming Tower	528	502	11%	3%	1%	5%
25	↑	Kingswood	6,539	9,380	-8%	-61%	-62%	-43%
2	↓↓↓	Millwood Elementary	6,516	4,844	21%	40%	15%	26%
21	↑	Millwood High	9,367	9,415	0%	0%	-1%	-1%
22	↑	Musquodoboit Valley Ed. Centre	3,730	3,757	0%	1%	-3%	-1%
7	↓↓	Prince Andrew High	13,763	12,120	5%	7%	23%	12%
18	↓	Rocky Lake	7,293	7,186	9%	3%	-8%	1%
23	↑	Springvale	2,052	2,098	5%	-3%	-9%	-2%
11	↓	St. Catherine's	2,318	2,141	10%	6%	7%	8%
17	↓	St. Stephen's	2,487	2,415	10%	1%	-2%	3%
14	↓	Tallahassee Community	6,275	5,967	12%	-3%	5%	5%

# Energy Dashboard Competition Results

**Energy Dashboard Competition**  
**Electricity Conservation**  
**Top 10 Schools**



# What work is being done (behavioural)

- Green Schools NS
  - Advisory committees
  - Grassroots involvement
  - Identify actions
    - Recycling, energy, environment
    - Sweater days, community gardens, recycling,
  - 'Vampire' loads – Microwaves, fridges, audits
  - Framework for green teams



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- **Barriers and Challenges**
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# Challenges

- Financing treatment
  - Treasury
  - Finance options
  - Access + Security
- Occupied buildings
  - Costs
  - Hazardous materials



# Challenges

## ● Occupant Comfort

- Replacing equipment and new programming
- Deferred maintenance issues discovered
- Change in setpoint temperatures, changed in culture
- Halifax West – fine-tuned to satisfy, then massive disruption, then period of optimization





# Challenges

- Cultural change
  - Change from current process
  - Maintenance procedures
  - Utility bill processing
  - Automated building controls



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# Successes and Results

- Improved operating costs
- Improved operations and diagnostics
- Capital infrastructure renewal
- Partnership with funders and utility service providers
- Return on investment



# Results – Measurement & Verification

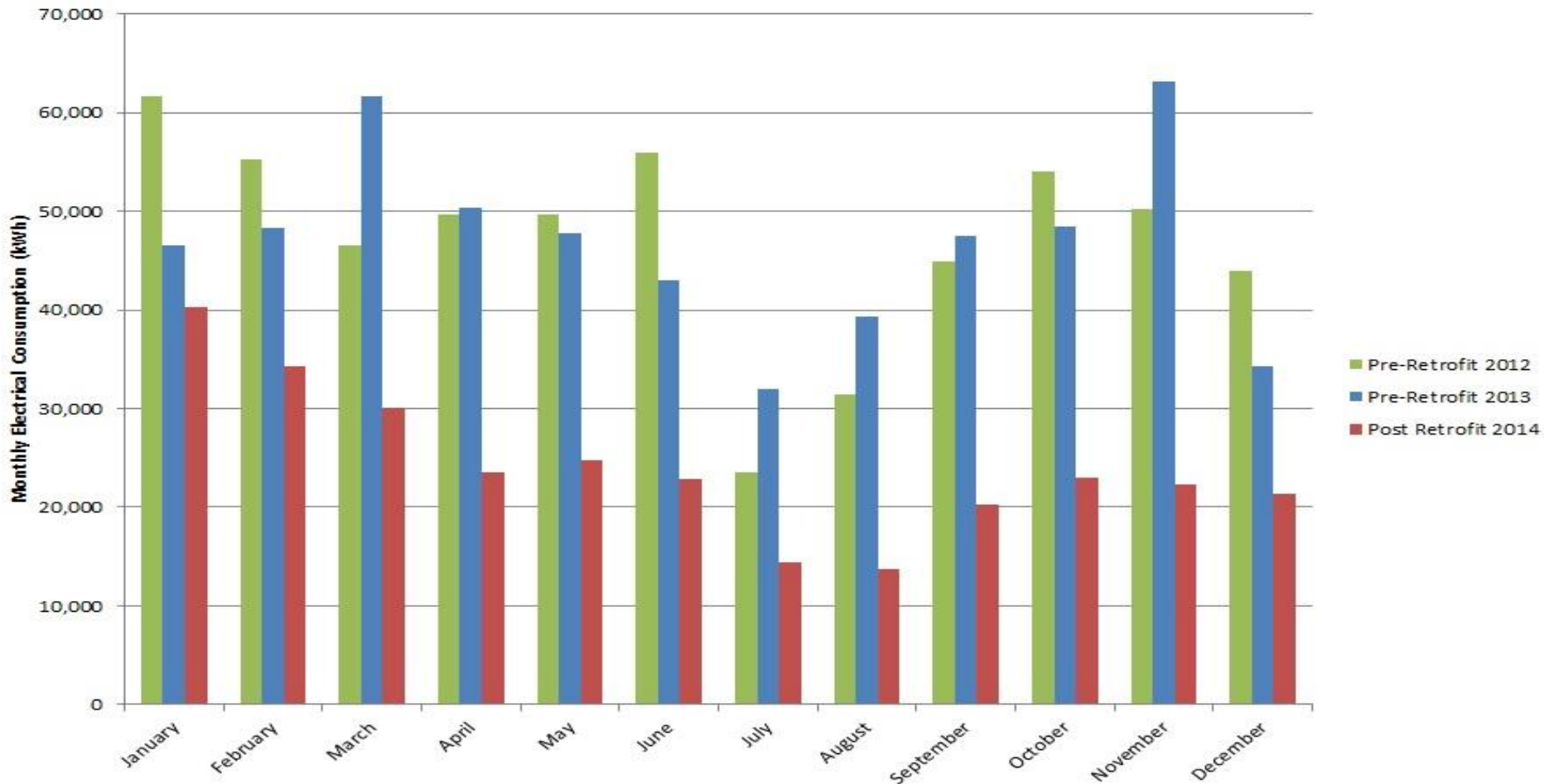
- Calculation of portfolio-wide energy savings
- Flexibility to accommodate changes in use, and other projects
- Under- and over-performance by school that requires investigations
- Currently 30% over-performance in avoided electrical consumption

Code	Name	Electricity Consumption					
		Target		Actual		Performance %	
		kWh	\$	kWh	\$	kWh	\$
010	Rocky Lake Dr. Junior High (183)	24,370	\$ 2,777	70,908	\$ 6,684	290.96%	240.68%
012	Kingswood Elementary (179)	12,436	\$ 1,416	23,949	\$ 2,461	192.59%	173.76%
018	Citadel High (283)	-10,142	\$ 1,136	32,191	\$ 664	-317.40%	-58.46%
019	Oxford Elementary/Junior High (266)	18,998	\$ 2,159	1,278	\$ 181	6.73%	8.37%
020	St. Agnes Junior High (267)	15,948	\$ 1,781	21,052	\$ 2,183	132.00%	122.54%
023	Gorsebrook Junior High (274)	3,248	\$ 333	1,495	\$ 173	46.02%	52.00%
024	Highland Park Junior High (275)	6,723	\$ 753	2,752	\$ 212	40.94%	28.13%
025	Springvale Elementary (264)	7,223	\$ 937	10,447	\$ 1,004	144.64%	107.10%
027	St. Catherine's Elementary (268)	11,231	\$ 1,363	12,243	\$ 1,487	109.00%	109.08%
028	Westmount Elementary (271)	11,868	\$ 1,281	3,084	\$ 367	25.98%	28.64%
031	Sir Charles Tupper Elementary (279)	5,882	\$ 659	-126	\$ -44	-2.14%	-6.64%
034	St. Stephen's Elementary (282)	10,732	\$ 1,154	-1,656	\$ 121	-15.43%	-10.46%
035	Cole Harbour District High (142)	12,788	\$ 1,441	-6,643	\$ 1,710	-51.95%	-118.65%
039	Colonel John Stuart Elementary (143)	6,695	\$ 792	12,349	\$ 1,388	184.46%	175.34%
045	Tallahassee Community Elementary (152)	32,240	\$ 3,547	48,104	\$ 4,748	149.21%	133.88%
046	Dartmouth High School (102)	21,836	\$ 2,337	-30,092	\$ -2,800	-137.81%	-119.77%
047	Bicentennial Junior High (100)	19,897	\$ 2,122	6,577	\$ 824	33.05%	38.83%
061	Eastern Shore District High (161)	678	\$ 77	-1,834	\$ 361	-270.29%	-466.27%
065	Halifax West High (261)	85,296	\$ 9,555	192,318	\$ 17,121	225.47%	179.18%
078	J. L. Isley High (250)	3,871	\$ 410	15,866	\$ 2,263	409.86%	552.28%
088	John W. Macleod-Fleming Tower Elementary (251A)	2,656	\$ 281	-5,429	\$ 444	-204.42%	-158.37%
089	John W. Macleod-Fleming Tower Elementary (251B)	9,572	\$ 540	4,807	\$ 686	50.22%	127.03%
090	Georges P. Vanier Junior High (194)	28,882	\$ 3,171	20,509	\$ 2,197	71.01%	69.29%
091	Harold T. Barrett Junior High (195)	8,721	\$ 977	28,575	\$ 2,584	329.74%	264.48%
100	Millwood Elementary (205)	4,204	\$ 538	5,278	\$ 319	125.55%	59.33%
103	Musquodoboit Valley Education Centre (174)	32,728	\$ 2,665	103,654	\$ 10,165	316.72%	381.34%
105	Prince Andrew High (127)	45,410	\$ 5,049	6,882	\$ 621	15.16%	12.29%
107	Ellenvale Junior High (120)	23,409	\$ 1,734	28,172	\$ 3,183	120.35%	183.58%
112	Ian Forsyth Elementary (122)	10,775	\$ 1,159	11,335	\$ 1,075	105.20%	92.77%
128	Beechville Lakeside Timberlea (Gr P-2) (226)	15,396	\$ 1,820	26,023	\$ 2,654	169.02%	145.78%
<b>TOTALS</b>		<b>484,146</b>	<b>\$ 51,755</b>	<b>633,770</b>	<b>\$ 68,843</b>	<b>130.90%</b>	<b>113.70%</b>



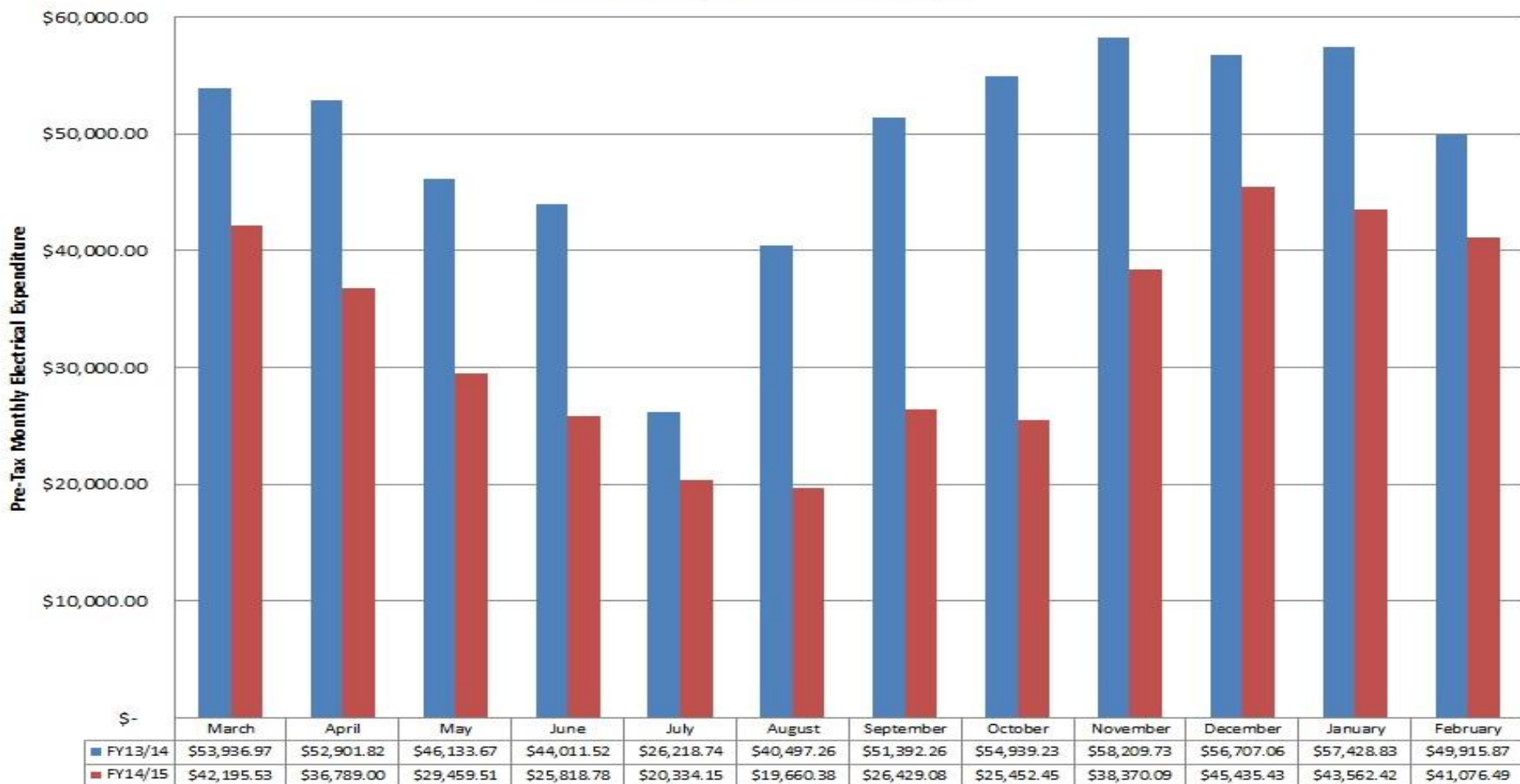
# Sample Results – Controls Retrofit

**Graham Creighton Junior High**  
Monthly Electrical Consumption



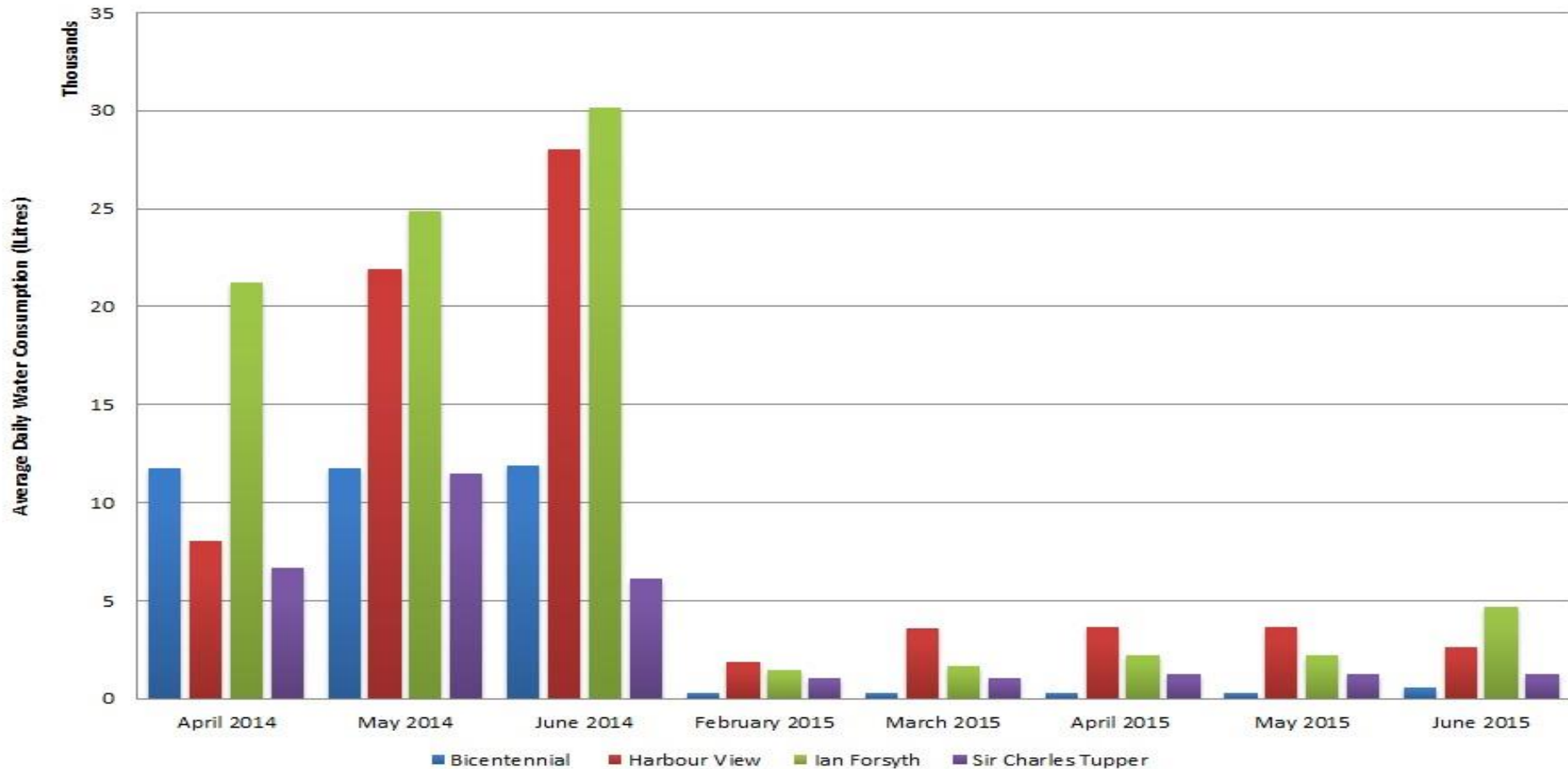
# Sample Results – Controls Retrofit

**Halifax West High Electrical Expenditure**  
Fiscal Year 13/14 vs Fiscal Year 14/15



# Sample Results – Water Retrofit

**Average Daily Water Consumption  
Before and After Water Retrofit**



# Next Steps...

- Complete work, secure Year 4 funding
- Measurement and verification
- Optimization and further integration
  - Use tools of BAS, smart meters
- Develop detailed plan for remaining schools
- Utilize incentive programs





# Large-Scale Energy Performance Contracts: Halifax Regional School Board

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# Energy display dashboard

- Sample energy display dashboard
  - [Gorsebrook Junior High](#)
  - [Prince Andrew High](#)

