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 m²)
  - (Sep. 2014)
- Average age of school
  - 45 years
## Background – HRSB Schools

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

Energy Performance Contracts

Model for Change

Implementation – Energy Improvements

Barriers and Challenges

Successes + Results
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
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
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
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
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

Barriers and Challenges

Successes + Results
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

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
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
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
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
8. Institutionalizing New Processes

- Articulating the connections between the behaviours and the success
  - Three Rs – Both ways!
  - Accounting processes
  - Operating processes
• Background
• Energy Performance Contracts
• Model for Change
• Implementation – Energy Improvements
• Barriers and Challenges
• Successes + Results
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

- Sun
- Mon
- Tue
- Wed
- Thu
- Fri
- Sat

Consumption (kWh)

Last Week's Consumption
This Week's Consumption
# ENERGY DASHBOARD COMPETITION

## FINAL RESULTS

<table>
<thead>
<tr>
<th>Position</th>
<th>School Name</th>
<th>Baseline Energy Use</th>
<th>Competition Energy Use</th>
<th>Weekly Percentage Decreases</th>
<th>TOTAL</th>
<th>Percentage Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Average Weekly</td>
<td></td>
<td>Week #1</td>
<td>Week #2</td>
<td>Week #3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical Consumption [kWh/week]</td>
<td></td>
<td>Percentage Decrease</td>
<td>Percentage Decrease</td>
<td>Percentage Decrease</td>
</tr>
<tr>
<td>1</td>
<td>Georges P. Vanier</td>
<td>3,517</td>
<td>2,276</td>
<td>33%</td>
<td>40%</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>Millwood Elementary</td>
<td>6,516</td>
<td>4,844</td>
<td>21%</td>
<td>40%</td>
<td>15%</td>
</tr>
<tr>
<td>3</td>
<td>Millwood High</td>
<td>9,367</td>
<td>9,415</td>
<td>0%</td>
<td>0%</td>
<td>-1%</td>
</tr>
<tr>
<td>4</td>
<td>Halifax West High</td>
<td>39,393</td>
<td>32,983</td>
<td>24%</td>
<td>12%</td>
<td>13%</td>
</tr>
<tr>
<td>5</td>
<td>Highland Park</td>
<td>2,472</td>
<td>2,183</td>
<td>13%</td>
<td>19%</td>
<td>2%</td>
</tr>
<tr>
<td>6</td>
<td>John W. MacLeod</td>
<td>3,095</td>
<td>3,107</td>
<td>4%</td>
<td>4%</td>
<td>-9%</td>
</tr>
<tr>
<td>7</td>
<td>Musquodoboit Valley Ed. Centre</td>
<td>3,730</td>
<td>3,757</td>
<td>0%</td>
<td>1%</td>
<td>-3%</td>
</tr>
<tr>
<td>8</td>
<td>Prince Andrew High</td>
<td>13,763</td>
<td>12,120</td>
<td>5%</td>
<td>7%</td>
<td>23%</td>
</tr>
<tr>
<td>9</td>
<td>Rocky Lake</td>
<td>7,293</td>
<td>7,186</td>
<td>9%</td>
<td>3%</td>
<td>-8%</td>
</tr>
<tr>
<td>10</td>
<td>Springvale</td>
<td>2,052</td>
<td>2,068</td>
<td>5%</td>
<td>3%</td>
<td>-9%</td>
</tr>
<tr>
<td>11</td>
<td>St. Catherine's</td>
<td>2,318</td>
<td>2,141</td>
<td>10%</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>12</td>
<td>Tallahassee Community</td>
<td>6,275</td>
<td>5,967</td>
<td>12%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>13</td>
<td>Bicentennial</td>
<td>3,339</td>
<td>3,145</td>
<td>12%</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>14</td>
<td>Citadel High</td>
<td>40,133</td>
<td>34,273</td>
<td>9%</td>
<td>17%</td>
<td>18%</td>
</tr>
<tr>
<td>15</td>
<td>Colonel John Stuart</td>
<td>1,225</td>
<td>1,273</td>
<td>7%</td>
<td>5%</td>
<td>-13%</td>
</tr>
<tr>
<td>16</td>
<td>Dartmouth High</td>
<td>11,077</td>
<td>11,056</td>
<td>2%</td>
<td>0%</td>
<td>-1%</td>
</tr>
<tr>
<td>17</td>
<td>Eastern Shore District High</td>
<td>5,222</td>
<td>4,988</td>
<td>10%</td>
<td>5%</td>
<td>-2%</td>
</tr>
<tr>
<td>18</td>
<td>Georgetown</td>
<td>4,808</td>
<td>4,448</td>
<td>6%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>19</td>
<td>Georges P. Vanier</td>
<td>3,517</td>
<td>2,276</td>
<td>33%</td>
<td>40%</td>
<td>33%</td>
</tr>
<tr>
<td>20</td>
<td>Graham Creighton</td>
<td>9,623</td>
<td>8,754</td>
<td>2%</td>
<td>2%</td>
<td>24%</td>
</tr>
<tr>
<td>21</td>
<td>John W. MacLeod - Fleming Tower</td>
<td>528</td>
<td>502</td>
<td>11%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>22</td>
<td>Kingswood</td>
<td>6,539</td>
<td>9,380</td>
<td>-8%</td>
<td>-61%</td>
<td>-62%</td>
</tr>
<tr>
<td>23</td>
<td>Millwood Elementary</td>
<td>6,516</td>
<td>4,844</td>
<td>21%</td>
<td>40%</td>
<td>15%</td>
</tr>
<tr>
<td>24</td>
<td>Musquodoboit Valley Ed. Centre</td>
<td>3,730</td>
<td>3,757</td>
<td>0%</td>
<td>1%</td>
<td>-3%</td>
</tr>
<tr>
<td>25</td>
<td>Rocky Lake</td>
<td>7,293</td>
<td>7,186</td>
<td>9%</td>
<td>3%</td>
<td>-8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Halifax Regional School Board
Energy Dashboard Competition 2015
June 8, 2015
Energy Dashboard Competition Results

Energy Dashboard Competition
Electricity Conservation
Top 10 Schools

Weekly Average Electricity Consumption (kWh)

<table>
<thead>
<tr>
<th>School</th>
<th>Pre-Competition</th>
<th>Competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gorsebrook Junior High</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td>Millwood Elementary</td>
<td>26%</td>
<td>28%</td>
</tr>
<tr>
<td>Beechville Lakeside</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>Timberlea Jr Elementary</td>
<td>16%</td>
<td>18%</td>
</tr>
<tr>
<td>Halifax West High</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>Citadel High</td>
<td>14%</td>
<td>16%</td>
</tr>
<tr>
<td>Caudle Park Elementary</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>Prince Andrew High</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>Highland Park Junior High</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>Clayton Park Junior High</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>Graham Creighton Junior High</td>
<td>9%</td>
<td>11%</td>
</tr>
</tbody>
</table>
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
- Background
- Energy Performance Contracts
- Model for Change
- Implementation – Energy Improvements
- Barriers and Challenges
- Successes + Results
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
Background

Energy Performance Contracts

Model for Change

Implementation – Energy Improvements

Barriers and Challenges

Successes + Results
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

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Electricity Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>010</td>
<td>Rocky Lake Dr. Junior High (183)</td>
<td>$28,370 $2,777 $70,908 $6,684</td>
</tr>
<tr>
<td>011</td>
<td>Kingswood Elementary (179)</td>
<td>$29,366 $1,416 $23,949 $2,461</td>
</tr>
<tr>
<td>015</td>
<td>Citadel High (283)</td>
<td>$10,142 $1,136 $32,191 $664</td>
</tr>
<tr>
<td>019</td>
<td>Oxford Elementary/Junior High (266)</td>
<td>$19,988 $2,159 $21,052 $2,461</td>
</tr>
<tr>
<td>020</td>
<td>St. Agnes Junior High (160)</td>
<td>$15,948 $1,781 $24,370 $2,777</td>
</tr>
<tr>
<td>023</td>
<td>Gorsebrook Junior High (274)</td>
<td>$3,248 $333 $12,436 $1,416</td>
</tr>
<tr>
<td>024</td>
<td>Highland Park Junior High (275)</td>
<td>$6,723 $753 $2,752 $2,045</td>
</tr>
<tr>
<td>025</td>
<td>Springvale Elementary (264)</td>
<td>$7,223 $937 $3,084 $367</td>
</tr>
<tr>
<td>027</td>
<td>St. Catherine’s Elementary (268)</td>
<td>$11,333 $1,383 $24,370 $2,777</td>
</tr>
<tr>
<td>028</td>
<td>Westmount Elementary (271)</td>
<td>$11,868 $1,281 $30,191 $3,100</td>
</tr>
<tr>
<td>031</td>
<td>Sir Charles Tupper Elementary (279)</td>
<td>$5,882 $659 $10,447 $1,004</td>
</tr>
<tr>
<td>034</td>
<td>St. Stephen’s Elementary (282)</td>
<td>$10,732 $1,154 $21,052 $2,461</td>
</tr>
<tr>
<td>035</td>
<td>Cole Harbour District High (140)</td>
<td>$12,788 $1,441 $32,191 $3,100</td>
</tr>
<tr>
<td>039</td>
<td>Colonel John Stuart Elementary (143)</td>
<td>$6,695 $792 $12,349 $1,383</td>
</tr>
<tr>
<td>045</td>
<td>Tallahassee Community Elementary (152)</td>
<td>$32,240 $3,547 $48,104 $4,748</td>
</tr>
<tr>
<td>046</td>
<td>Dartmouth High School (102)</td>
<td>$21,836 $2,337 $21,052 $2,461</td>
</tr>
<tr>
<td>047</td>
<td>Bicentennial Junior High (104)</td>
<td>$19,897 $2,122 $6,777 $824</td>
</tr>
<tr>
<td>061</td>
<td>Eastern Shore District High (161)</td>
<td>$678 $77 $1,834 $361 $270.29% $466.27%</td>
</tr>
<tr>
<td>065</td>
<td>Halifax West High (261)</td>
<td>$85,296 $9,555 $192,318 $17,121</td>
</tr>
<tr>
<td>078</td>
<td>J. L. Foley High (260)</td>
<td>$3,872 $410 $15,866 $2,262</td>
</tr>
<tr>
<td>086</td>
<td>John W. Macleod-Fleming Tower Elementary (251A)</td>
<td>$2,656 $281 $5,429 $444 $204.42% $158.37%</td>
</tr>
<tr>
<td>089</td>
<td>John W. Macleod-Fleming Tower Elementary (251B)</td>
<td>$9,572 $540 $4,877 $686 $50.22% $127.03%</td>
</tr>
<tr>
<td>090</td>
<td>Georges P. Varner Junior High (194)</td>
<td>$28,882 $3,171 $20,509 $2,197</td>
</tr>
<tr>
<td>091</td>
<td>Harold T. Barrett Junior High (195)</td>
<td>$8,712 $977 $28,757 $3,100 $284.48% $264.48%</td>
</tr>
<tr>
<td>096</td>
<td>Millwood Elementary (205)</td>
<td>$4,204 $538 $5,278 $319 $125.55% $59.33%</td>
</tr>
<tr>
<td>097</td>
<td>Musquodoboit Valley Education Centre (174)</td>
<td>$32,728 $2,665 $103,654 $10,165 $316.72% $361.34%</td>
</tr>
<tr>
<td>105</td>
<td>Prince Andrew High (127)</td>
<td>$45,458 $5,049 $8,882 $621 $15.16% $12.29%</td>
</tr>
<tr>
<td>107</td>
<td>Elmsdale Junior High (128)</td>
<td>$3,872 $410 $15,866 $2,262</td>
</tr>
<tr>
<td>112</td>
<td>Ian Forsyth Elementary (122)</td>
<td>$10,778 $1,159 $1,834 $1,004</td>
</tr>
<tr>
<td>128</td>
<td>Beechville Lakeside Timberlea (Gr P-Z) (226)</td>
<td>$15,396 $1,820 $26,021 $2,654 $169.02% $145.78%</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td>$484,146 $51,755 $633,770 $58,843</td>
</tr>
</tbody>
</table>
Sample Results – Controls Retrofit

Graham Creighton Junior High
Monthly Electrical Consumption

- Pre-Retrofit 2012
- Pre-Retrofit 2013
- Post Retrofit 2014
Sample Results – Water Retrofit

Average Daily Water Consumption
Before and After Water Retrofit

- April 2014
- May 2014
- June 2014
- February 2015
- March 2015
- April 2015
- May 2015
- June 2015

Legend:
- Bicentennial
- Harbour View
- Ian Forsyth
- Sir Charles Tupper
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

October 20, 2015
Sample energy display dashboard

- Gorsebrook Junior High
- Prince Andrew High