Energy Conservation and Art Facilities

Webinar for Ontario Presents
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BLUE SKY
Energy Engineering & Consulting Inc.

Agenda

- Introductions
- Energy Data Re: Arts Facilities
- How is Energy Charged?
- Where is Energy Used?
- How Can Arts Facilities Conserve Energy?
- Funding Incentives and Opportunities
- Questions?

ArtsBuild Ontario

Helping Ontario's arts organizations
build, manage and finance sustainable facilities

ArtsBuild provides tools, training and resources that support the development and sustainability of creative spaces such as theatres, galleries, concert halls, museums and other arts facilities.

www.artsbuildontario.ca

ARTS BUILD ONTARIO

BLUE SKY Energy Engineering & Consulting Inc.

Our Mandate

- ✓ Provide *strategic* and *effective* energy conservation expertise to commercial, arts and industrial clients.
- ✓ Support the delivery of breakthrough energy savings through leading edge technologies and organizational best practices.

Our Services

Business Planning	Energy Conservation	Engineering Services
• Energy Management Planning • Policy Development • Benchmarking • Scorecard Development • ISO 50,001 Implementation	• Audits • Modeling • Baseline Assessments • GHG Reporting • Training • KPI Development • Government Incentives	• Project Management • Alternative Energy Selection • LEED Certification • Process, Mechanical, Industrial and Environmental Engineering

Goals of This Webinar

- Better understanding of how your facility consumes energy

- Better understanding of what is best for your facility

Why Be Energy Efficient?

- Conscious decision to support the environment in which we live

- To save money on operating – putting money back into our art

Energy Consumption

What are we consuming as a sector? A snapshot!

Energy Consumption – A Snapshot!

SURVEY OF THE ONTARIO SECTOR

- 73 buildings (removed the largest consumer)
- Energy Consumption totaled 57,716,608 KW per year
- Canadian average = 10.5¢/kWh = over $6,000,000
- If the sector is able to save 5% through conservation?
- = $4,150 per year in savings for each of the 73 buildings

http://powerforthefuture.ca/the-value-of-electricity/electricity-pricing/

Energy Audit Findings – A Snapshot!

ArtsBuild Ontario Energy Conservation Program

- 10 audits
- Majority were theatres including mixed use spaces.
  - Gallery spaces also audited.

Top 5 Identified Opportunities

1. Lighting
2. HVAC
3. Insulation
4. Windows/doors/weather stripping
5. Domestic Water

Energy Grant Findings – A Snapshot!

- $1,750 contribution to 17 organizations
- 17 projects
  - 11 – lighting
  - 3 – windows and doors
  - 3 – HVAC upgrades, high efficiency fridge replacement and low flow toilets

How is Energy Charged?

Electricity:

- Fixed Monthly or Daily Charge, Customer Charge
- Consumption (Energy) = $/kWh *(how much is used)*
- Demand (Peak) = $/kW *(how fast it is being used)*
- Other charges and adjustments:

  Global Adjustment - Ontario

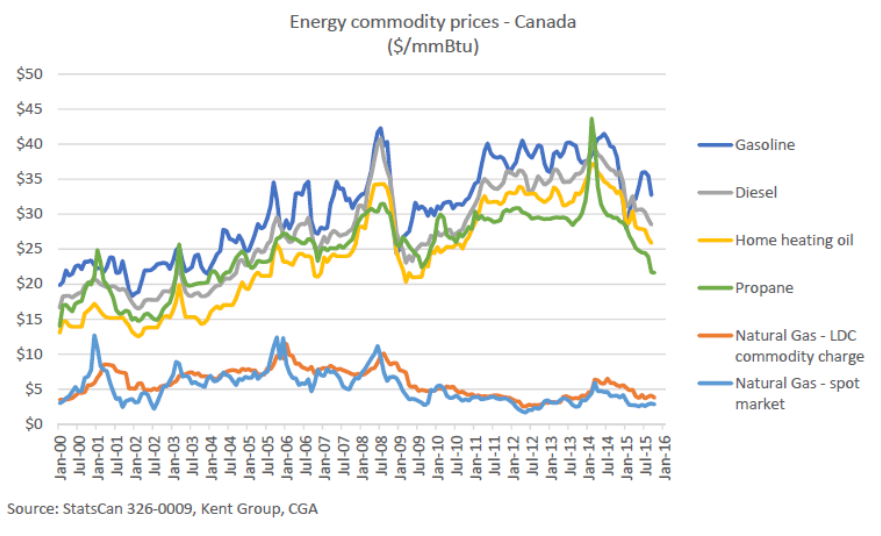
  Power Factor – a ratio of usable power (kW) to reactive power (kVar) in a circuit. Normally shown as a percentage and a surcharge is applied if the power factor drops below 90%.

Remember: Consumption (kWh) = Demand (kW) x Time

How is Energy Charged?

Natural Gas:

- Fixed Customer Charge
- Consumption or Commodity (Gas Usage) = $/m^3
- Long Range Pipeline Transmission Charge = $/m^3
- Local Distribution and Storage Charge = $/m^3



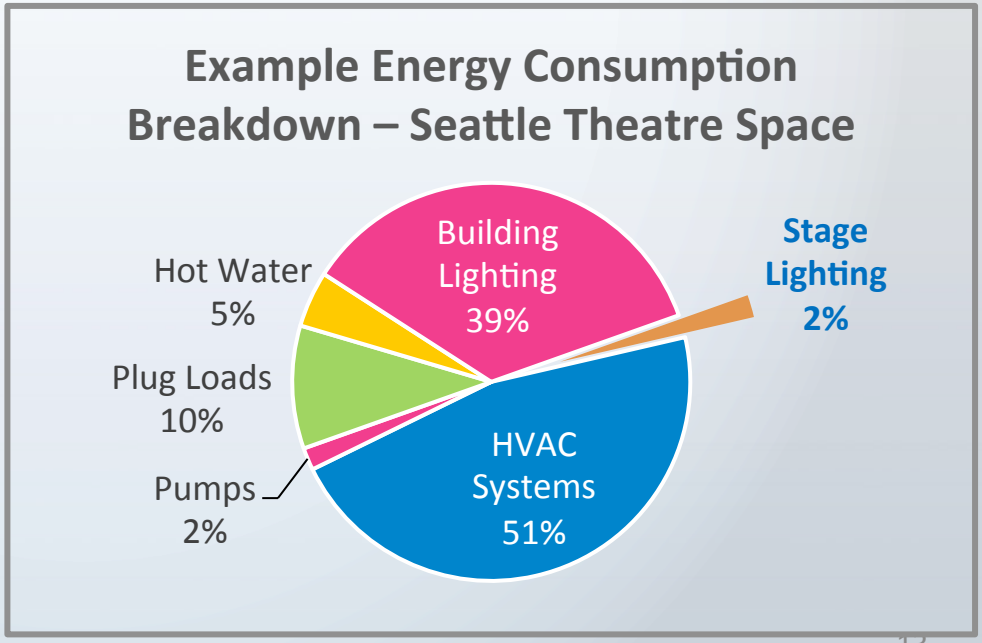
Where is Energy Used?

Electricity:

- Cooling
- Lighting: Area Lighting, Stage Lighting
- Electric Boilers for Domestic Hot Water (DHW)
- Heating: Baseboards, Unit Heaters, Space Heaters
- Motors, Fans, Equipment
- Plug Loads

Natural Gas:

- Space Heating
- Boilers
- Kitchen Equipment



How to Identify Savings?

Energy Audits

- ASHRAE Level I: Walk Through Audit – some provided by LDCs.
- ASHRAE Level II:
  - ✓ More detailed review of historical use, benchmarking, end use analysis and system review (HVAC, lighting, building envelope, plug loads etc.).
  - ✓ Options discussed in detail with feasibility grade costing and savings estimates.
  - ✓ This is often subsidized by incentive programs

Building Recommissioning

- Hands on review of building automation systems (BAS) focusing on HVAC controls
- Some incentives available

How to Identify Savings? Cont'd

Building Recommissioning (RCx)

- Re-optimization process that ensures existing building equipment and systems are set up to run optimally.
- Systems are reviewed in detail identify and reduce energy consumption and improve performance
  - Ventilation dampers, chiller operations, zone temperature set-points, diagnostics for systems integration issues

Why Recommission?

- ✓ Building systems can become inefficient for a variety of reasons: renovations, reprogramming of space controls, changing occupant needs, obsolete equipment.
- ✓ NRCan estimates that recommissioning can result in an average of 16% savings in energy consumption.

HVAC System Optimization

Energy Efficient Controls:

- During the winter set your building to a maximum of 21^{o}C when occupied and 17^{o}C when unoccupied.
- Outdoor air damper controls for the ramp-up period in the morning
- In multipurpose facilities where there may be a gallery, invest in a high accuracy outdoor air enthalpy meter for a tighter control of humidity levels.
- Avoid cooling the building when it is unoccupied
- Maximize use of cool outdoor air in the summer to flush the building just before the end of the night before staff arrives
- Employ temperature resets (to avoid overheating or overcooling).

HVAC System Optimization

Shut off equipment when not needed:

- Hydronic boilers in summer if reheat is not required
- Domestic hot water distribution pumps when the building is unoccupied
- Shut outdoor air dampers and supply air fans when building is unoccupied.

Maintain HVAC Components:

- Clean equipment regularly (air inlet screens, refrigerant coils etc.)
- Service air handling units to ensure proper performance
- Change air filters – reduces amps on fan motors

Building Envelope and Systems

Minimize Heat Loss / Gain

- Insulate any bare ducts which carry conditioned air and pipes with chilled or hot water.
- Replace cocking around building windows and reseal exterior doors.
- In loading areas add controls to heating system to shut down when the doors are open.
- Consider installing ceiling fans in rooms higher than 10ft

General Area Lighting

Lighting Facts:

- Electricity into a light fixture transforms into light and waste heat.
- Light, once absorbed into a surface, also becomes heat.
- A reduction in lighting electricity consumption will result in a reduction in cooling load (less heat) and a slight adjustment in building heating load.

Conservation Opportunities

- Install room occupancy sensors and timers (saves 10%)
- Replace incandescent bulbs wherever possible
- Consider LED tubes to replace fluorescent tubes for up lighting and service areas (19W vs. 32W).
- LED lamps for spot lighting, outdoor wall packs and parking lot lighting.
- Purchase high efficiency 4ft T8 Fluorescent Tubes vs the standard. Will save 4W/bulb (28W vs. the standard 32W).

Stage Lighting

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Reference Paper:

"Stage Lighting and the Environment, Results from a Year-Long Study", by Katie Oman, Published in PROTOCOL Magazine, Fall 2013

- Tracked the energy use of stage lighting over the duration of 6 different productions in one season.

Conclusions:

- Although stage lighting can draw significant power at times, the lighting was not on for long periods and therefore only consumed 2% of the total energy for the theatre in question.
- General building lighting consumed 35% of the total energy for the same theatre.
- The highest energy demand (in excess of 75kW) were mostly cues where incandescent cyc washes were used at high intensities. Higher efficiency cyc lighting (LED) was recommended as a starting place for stage lighting improvements.

Plug Loads

- Turn off idle equipment (a photocopier left on at night and weekends can cost $150/yr. in wasted energy)
- If they can't be removed altogether, replace any electric space heaters with radiant panels (use 10% of the power)
- Install misers on vending machines and de-lamp
- Night time shutoff of computers (can save $28/yr. in wasted energy)
- Replace older fridges and purchase only energy efficient appliances (Energy Star)

Water Conservation

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Washrooms

- Install low flow faucets with auto off, low flow toilets and urinals
- Faucet aerators are inexpensive and easy to install

HVAC Systems

- Eliminate any once through water cooling systems

Food services

- Install water efficient spray nozzles on kitchen sinks

Landscaping

- Consider Xeriscaping options
- Install timers on watering systems. Only water at night and during dry conditions.
- Maintain sprinkler nozzles and optimize spray areas

Incentives

Incentives: Each province has different programs for saving electricity and natural gas. Visit: http://bit.ly/1kUqF0p

Several examples below:

Ontario

- saveONenergy

British Columbia

- BC Hydro and Fortis BC

Manitoba

- Power Smart

Saskatchewan

- SaskEnergy and SaskPower

Nova Scotia

- Province Initiative

Incentives

- Goal of these programs is to reduce energy use.
- Many of the programs province to province are quite similar and include support for retrofits incl;

  - ✓ Lighting
  - ✓ HVAC systems
  - ✓ Refrigeration
  - ✓ Audits

- Visit the site on the previous slide to search for the incentives available in your province and applicable to you.

Financing

Low Interest Loans

Canada

- Community Forward Fund (Canada wide)

Ontario

- ABO Energize Microloan for the Arts
- Better Buildings Partnership (Toronto)
- Toronto Atmospheric Fund (Toronto)

Grants

Grants

- Canada Wide
  - Canada Cultural Spaces
- Ontario
  - Ontario Trillium Foundation, Capital Grant
- Saskatchewan
  - Community Initiatives Fund
    - Community Places and Spaces Program
- Alberta
  - Community Initiatives Fund
    - Community Facility Enhancement Program

Other Options – Are They Right for Us?

Energy Management Plan

Benefits:

- Aligns Organizational and Energy Conservation Objectives.
- Sets specific long and short term goals which help drive continuous improvement.
- System wide approach which includes both people and processes.
- Key programs include staff engagement, specific action plans, training, and energy monitoring and targeting.
- Defines ownership and team required to deliver the goals.
- Makes energy visible to all levels of the organization.

Other Options – Are They Right for Us?

LEED Canada for Existing Buildings

Categories Audited: Sustainable Site, Water Efficiency, Energy & Atmosphere, Materials and Resources, Indoor Env. Quality, Innovations in Operation

Benefits:

- Offers proof to peers and public at large that you have achieved specific environmental and energy goals.
- Will confirm that your building is performing as designed

Challenges:

- Involves a rigorous third-party commissioning process
- Significant commitment of staff time to both apply for, and maintain the designation
- May require capital to improve systems to meet minimum requirements

Other Options – Are They Right for Us?

Solar Panels (PV Cells)

Benefits:

- Renewable Energy Source – Reduces GHG Emissions
- Supports green business objectives and can be a visible commitment to energy conservation
- Prices are becoming more affordable

Challenges:

- Simple payback period is typically quite high (8 - 12 years)
- Requires a specific roof orientation and structure
- Need to be committed to facility location

Resource Page

- ArtsBuild Ontario: www.artsbuildontario.ca
- Blue Sky Energy Engineering: www.bskyeng.com

- Canadian Gas Association (CGA): www.cga.ca
- Canada Green Building Council (LEED): www.cagbc.ca
- List of Energy Programs by province / municipality http://bit.ly/1kUqF0p
- Stage Lighting and the Environment (white paper): http://bit.ly/1Ii6cr1

Resource Page

- Museum Lighting: http://www.techtimes.com/articles/75898/20150811/museums-led-van-gogh.htm
- http://www.getty.edu/conservation/our_projects/science/lighting/case.html
- http://www.havells-sylvania.com/documents/documents/Museums%20and%20Galleries%20-%20Brochure%20-%20English.PDF

Thank You!

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