Track 5D: Business Models, Contracting & Financing

Partnering Across Boundaries: Bringing Global Leadership to Academic-Municipal Collaboration on District Energy

Herbert Sinnock & Katherine Rinas, Sheridan College
February 28, 2019
Can a campus be a catalyst for energy and environmental transformation in its community?
Is there a transformation imperative?

The Copenhagen Diagnosis
www.copenhagendiagnosis.com
When the AMOC Runs Amok

Fortune Magazine
February 9, 2004

Courtesy: National Science Foundation
Besides all known impacts of a shifting climate …

Ice-albedo feedback
Soil carbon feedback
Loss of native habitat to climate shift
If scientific evidence is signaling transformative climate shift ... 

Why do our planning and execution fail to show the same level of transformative effect?
<table>
<thead>
<tr>
<th>Incremental</th>
<th>Breakthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built on Expected Performance</td>
<td>Drives Exceptional Performance</td>
</tr>
<tr>
<td>Uses a Forecasting Approach</td>
<td>Uses a Backcasting Approach</td>
</tr>
<tr>
<td>Builds Technical Case, Then Financial</td>
<td>Builds Both Cases Simultaneously</td>
</tr>
<tr>
<td>Predetermines an Approach</td>
<td>Suggests Approaches, Then Tests</td>
</tr>
<tr>
<td>Uses Simple Financial Models</td>
<td>Uses Integrated Financial Models</td>
</tr>
<tr>
<td>Energy Savings &lt; 20%</td>
<td>Energy Savings &gt; 50%</td>
</tr>
<tr>
<td></td>
<td>Inspires Organization</td>
</tr>
<tr>
<td></td>
<td>Establishes Leadership Position</td>
</tr>
</tbody>
</table>
Breakthrough Goals

7% Internal Rate of Return

40% Reduction in Carbon Emissions

50% Reduction in Source Energy Consumption
Standards for New Buildings
Campus District Energy Infrastructure
Davis Energy Centre (Brampton, ON)
### Sportsplex & Sheridan

<table>
<thead>
<tr>
<th>Investment</th>
<th>Group</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Envelope and window upgrades</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reevaluate thermal load after lighting upgrade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Existing building retrocommissioning and new equipment commissioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sub-metering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finish lighting retrofit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace &amp; Upgrade outdated equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add heat recovery from ice rinks to HW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add heat recovery for swimming pool discharge</td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DH Network (Sheridan)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heating Substations (Sportsplex)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CW Network</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHP Engines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Absorption Chiller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boilers (Sheridan)</td>
<td></td>
</tr>
<tr>
<td>Solar PV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How do we start the conversation in our communities?

Can the tail wag the dog?
Copenhagen District Heating Area Map

worldcitiesnetwork.org
Paris, France District Heating Area Map
Proposed Oakville District Energy Phasing
Starting the Community Energy Conversation

Initial Scope (Limited Scale)

- Can this be viable without Community context?
- Can this be a planning example for community?

Community Energy Plan
Brampton 2040 Vision
“Living the Mosaic”

Community Energy Plan Will Add Energy Layer
Community Energy Plan

Goals

- **Support “Brampton 2040 Vision”**
- **Environment – Support Federal Climate Goals**
  - Cut GHG emissions by 50% by 2041
  - Be on track to cut GHG by 80% from 1990 levels
- **Economic – Positive Economic Development**
  - Energy investments meet acceptable risk-adjusted returns
  - Energy costs will be competitive compared to comparable Canadian and US communities
  - Generate incremental high-quality employment
- **Energy Efficiency – Global Best Practice**
  - 50% below 2016 level by 2041
- **Energy Reliability / Resilience / Flexibility**
  - Energy systems will meet the challenges of changing user expectations, climate uncertainty and new technologies
Community Energy Plan
Energy Planning Districts
Base Case to 2051
Source Energy Use by Sector
Base Case to 2051
Emissions Goals - CEP & Federal-OCAP

Goals Demand Deep Transformation
Developing Integrated CEP Scenarios

Simulation Elements

- Efficiency of new homes
- Efficiency of new C&I buildings
- Efficiency of existing homes
- Efficiency of existing C&I buildings
- Efficiency of industry
- District Energy Areas - Densification
- District Energy Areas – Greenfield Neighbourhoods
- Renewable solar heat generation
- Renewable electricity generation
- Transportation mix and efficiency
- Ontario grid generating mix
- Natural gas network source mix

Simulate Integrated Solutions – Not a Buffet
Brampton Simulation – Reference Case
Source Energy Efficiency by Sector

Falls Short of CEP Goal

*Updated 2018-09-11
Brampton Simulation – Reference Case
GHG Emissions by Sector

Scenario 3: Efficiency - Including DH - 300 MW PV: GHG Emissions by Sector - CEP Brampton - 2016 to 2051

- Marginal Electricity Grid GHG Index
- Decreasing GHG Index - Gas
- Building Efficiency Reference
- Industry Efficiency Reference
- Transportation Efficiency Reference
- Solar thermal included

CEP
FED/OCAP

*Updated 2018-09-11
Brampton Simulation

Aggressive Case

- Existing Home & Building Efficiency
  - Increase share of retrofits to 90% with 20% more efficient packages
- New Home & Building Efficiency
  - Encourage 5% efficiency above code
- Industrial Efficiency
  - Encourage all industry meet global-best practice of 1.5% per year
- District Heating
  - Increase market shares to near 100% and accelerate use of latest CHP technologies
- Solar Thermal
  - Double targeted share to 20%
- Solar PV
  - Increase total installed capacity to 400 MW
- Transportation Energy
  - Encourage double use of electric vehicles and mass transit
  - Design neighbourhoods and policy even more intensively to encourage walking cycling and LEVs

Is This What is Needed to Meet 2050?

*Updated 2018-09-11
Brampton Simulation – Aggressive Case

GHG Emissions by Sector

Built Environment Is Net-Zero GHG
Simulation facilitates robust community discussion of measures and outcomes
Informed by analysis not opinions
Identified pathway to meet Community and Federal Targets
Credible trajectory to “Net Zero” Emissions
Represents complete transformation of energy use and supply for City
Prerequisite to develop meaningful Final Community Energy Plan

Close the Gap between Vision & Reality
But now the dog begins to wag the tail ... 

Sheridan needs to find the appropriate response to take its strategic energy and carbon planning to the next level
Sheridan’s 2050 Plan

- Building retrofits for low-temperature heating networks
- New buildings to passivhaus envelope standards with hydronic
- Interconnection of thermal networks with the community
- Thermal storage
- Waste heat recovery
- Low-carbon thermal energy supply
- Renewable electric and thermal energy supply
- Flexible, optimized controls
Sheridan’s 2050 Plan

- Transportation
- Integration of natural heritage system to built form and infrastructure
- Restoring and enhancing biodiversity
- Reduction of unsustainable materials
- Zero waste to landfill
- Water resource conservation
Thank You!

Katherine Rinas, CEM
Facilities Projects Technologist
katherine.rinas@sheridancollege.ca

Herbert Sinnock, P.Eng., CEM, CMVP
Manager – Sustainable Energy Systems
herbert.sinnock@sheridancollege.ca