



Integrated Energy Systems in Canadian Communities: A Consensus for Urgent Action

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Quality Urban Energy Systems of Tomorrow

Jointly supported by:

Canada Green Building Council

Canadian Electricity Association

Canadian Energy Efficiency Alliance

Canadian Gas Association

Federation of Canadian Municipalities

Industry Canada

Natural Resources Canada

Ontario Power Authority

Pollution Probe

An emerging commitment towards an integrated approach for energy services in Canadian communities. Key players from the energy industry, environmental movement, governments, academia and consulting community agree that:

- Meeting ambitious long-term climate change objectives that involve greenhouse gas (GHGs) emission reductions of 60 percent or more by 2050 will need a fundamental transformation of how we produce, deliver and use energy.
- Addressing the 50% of GHGs emissions that come from housing, buildings and transportation is essential to meet this challenge.
- The potential exists to continue our economic growth while significantly reducing our environmental footprint.
- The community is the most promising place for the integration of energy systems and it will achieve the maximum savings and reductions in GHGs.
- Implementation needs to be at the smallest practical level but vision, leadership and policy support are needed at the national and provincial levels.
- Investing in flexible and evolutive energy solutions will allow us to adapt to an uncertain and changing future.
- There are challenges in implementation but also evidence from experience in Canada and elsewhere in the world that the economic, environmental and social benefits are well worth the effort.

There is consensus that serious action requires:

- Pricing carbon appropriately, to take into account the impact that carbon emissions cause to the environment, public health and the economy.
- Increasing the awareness of decision and policy makers about the benefits and challenges facing the implementation of integrated system approaches at the community level.
- Deepening the understanding and quantification of the benefits of the approach and supporting the development of that understanding.
- Improving cross sectoral information exchange and collaboration in order to develop partnerships between the private and public sectors, implement innovative financing mechanisms, and identify opportunities and concrete support for pilot and demonstration projects.

The participants in the workshop have come up with a set of principles for change and these principles received a high degree of consensus among the very wide set of stakeholders who took part in QUEST.

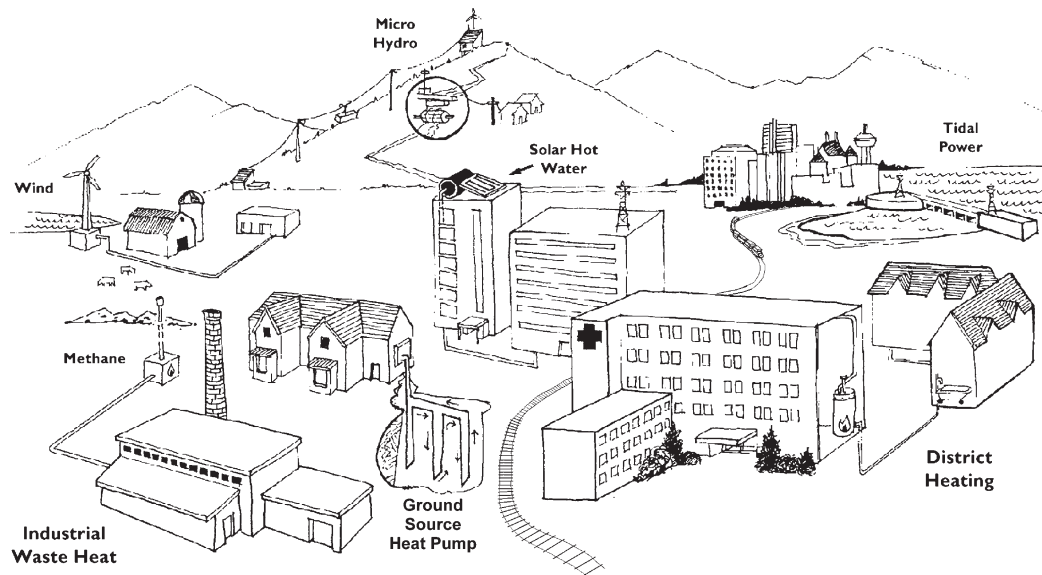
QUEST participants are committed to continue working to make Canada a world leader in urban integrated energy systems.

THE QUEST EVENT



- On November 14-15, 2007 in Niagara-on-the-Lake, ON, over 60 key players from the energy industry, environmental movement, three levels of government, academia and consulting community spent a day and a half discussing options for reducing the environmental footprint of growing communities.
- The workshop was convened jointly by the Canada Green Building Council, Canadian Electricity Association, Canadian Energy Efficiency Alliance, Canadian Gas Association, Federation of Canadian Municipalities, Industry Canada, Natural Resources Canada, Ontario Power Authority and Pollution Probe.
- Through a hands-on process reflecting the real world complexity of coming up with a cohesive, operational plan, participants worked towards the development of a long term energy plan integrating the buildings, transportation and industry sectors.
- Experts / influencers led panel discussions on what changes need to happen to realize the vision of the future, and how to effect these changes.
- This paper is a synthesis of the discussions and conclusions from the workshop and it does not necessarily represent the position of the organizers and participants.

Some Possible Features of an Integrated Energy Future...



Source: *Green Municipalities - A Guide to Green Infrastructure for Canadian Municipalities*;
prepared for the FCM by the Sheltair Group, May 2001

Key Features of Integrated Urban Energy Systems

In an integrated system approach to land-use, energy, transport, water and waste management, greater emphasis is placed upon achieving efficiency for the systems as a whole, and upon creating systems that are more resource efficient, adaptable, resilient and sustainable. This includes:

- Clustered, higher density, self-reliant, mixed use developments of energy efficient housing, commercial space and industry which facilitate implementation of more efficient, accessible and affordable energy, water, waste and transportation infrastructures.
- District energy / utility grids and cascading of energy use between industrial, commercial and residential applications.
- Smaller scale urban energy systems, distributed more widely, located closer to and within buildings, integrated with elements of buildings, and integrated with other infrastructure systems.
- Increasing contribution from multiple local energy sources: solar; geothermal; energy from landfill and municipal, agricultural and forestry waste; wind; hydro; supplemented by larger scale electricity and gas grids as necessary.

Examples in Canada and around the world show that compared to a traditional approach, over 50% reduction in grid energy use can be achieved using an integrated approach.

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QUEST: The Problem

A challenging future for energy in Canada.

- Canadians expect that the energy needed to support their heating and cooling, lighting, plug load and mobility needs is provided in a safe, reliable, secure, affordable and environmentally sustainable manner.
- The federal government, through its *Turning the Corner* policy statement, has committed to a greenhouse gas emission (GHG) reduction target of 60% to 70% below 2006 level by 2050. The National Round Table for the Environment and the Economy (NRTEE) has developed scenarios to achieve these levels of reduction. These scenarios show the need to start immediately on planning to the transition to the medium and longer term.
- Achieving 60% to 70% reduction in energy-related GHG emissions in Canada is a major challenge. It means reductions, starting now and building up to close to 1000 Megatonnes per year (Mt/yr) by 2050, compared to a business-as-usual scenario.
- In such a highly carbon constrained economy, energy will still be needed to provide a comfortable living and working environment, run our institutions, grow our economy, and support commerce.
- Our communities represent close to 50% of total energy end-use and of GHGs in Canada. A growing population and increased urbanization will put further pressures on existing energy and transportation infrastructures.

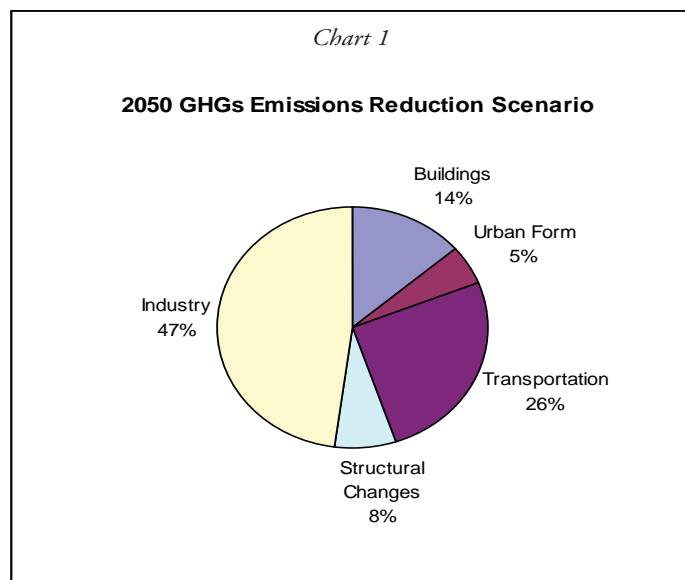
All sectors of the economy need to be engaged.

- The public debate on energy to date in Canada has centred on energy supply, but has been very limited on the end-user side. Measures to address greenhouse gas emissions from industrial large final emitters have been in the forefront of the climate change agenda, but the end-use residential, commercial, institutional and transportation sectors have been neglected.
- This one dimensional thinking is inherently unsustainable and we need a fundamental change in the way we develop our energy system. In addition to regulating emissions from large industry, Canada also needs to turn its attention to “the other 50%” – starting with the environmental footprint of its communities.
- The 2006 NRTEE’s “Advice on a Long-term Strategy on Energy and Climate Change” scenario of 60% reduction by 2050 shows that close to half of the reduction could come from buildings, transportation and urban form.

Chart 1

A silo-based approach will not bring optimal solutions.

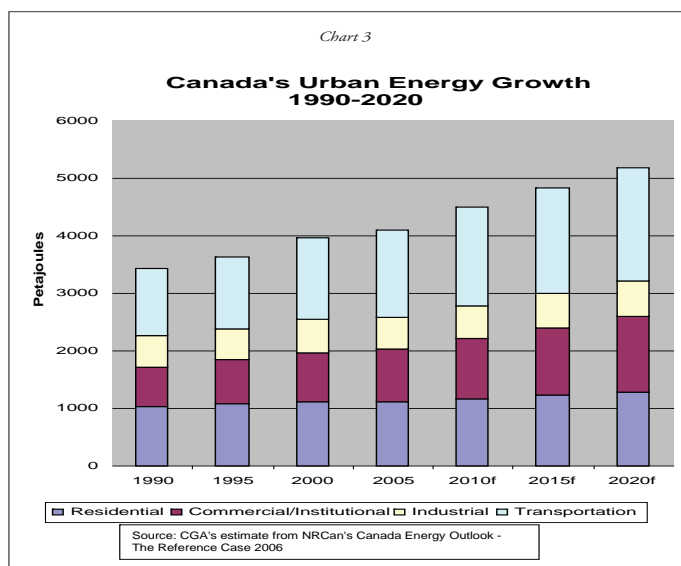
- The present approach to energy planning that focuses mainly on improving the performance of the discrete components of the energy system, is necessary but insufficient to meet the challenge in front of us.
- The historic silo-based approach to planning land-use, energy production, delivery and use, transportation, waste and water, often supported by legislation that specifies the areas of influence that each participant may have, must therefore change.



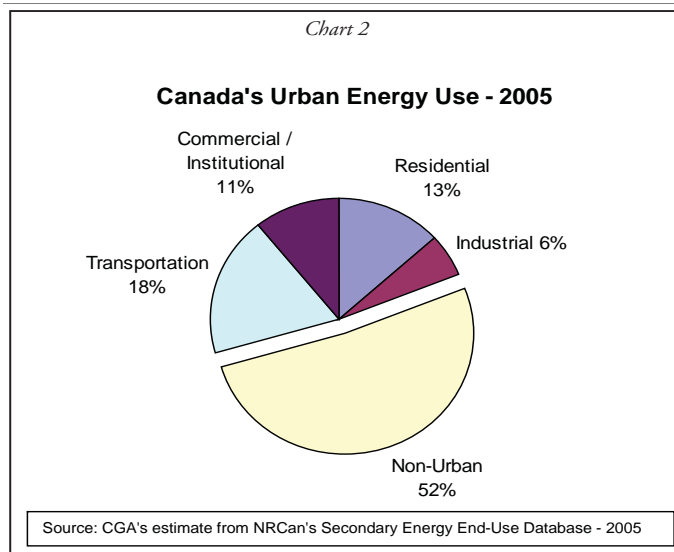
Source: CGA's calculation based on NRTEE's "Advice on a Long-term Strategy on Energy and Climate Change", 2006

The Urban Energy Picture

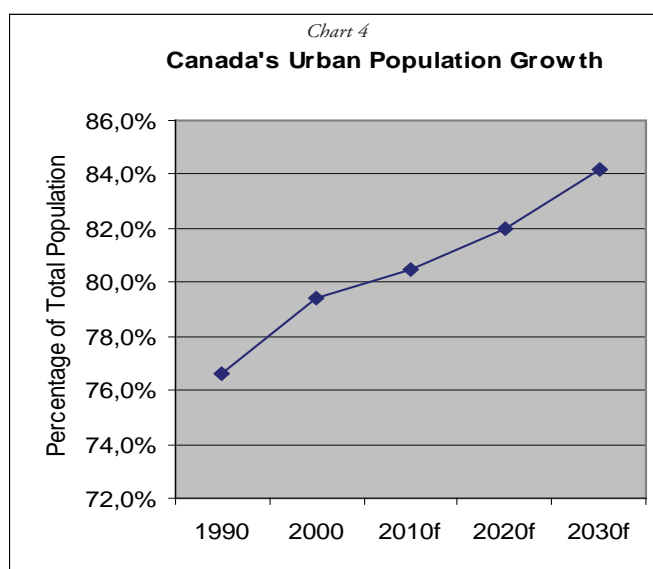
- In 2005, it is estimated that urban energy consumption from houses, commercial and institutional buildings, transportation and small industry represented close to half of Canada's energy end-use. Chart 2



- Canadian population is forecast to reach over 39 million by 2030, a 15% increase from today, with a continuing trend towards increased urbanization. About 80% of Canada's population lives in urban centers and this proportion is rising steadily. Chart 4



- From 1990 to 2005, urban energy use has grown by 20%. This increase was fuelled by the growth in the Canadian population and economy, leading to increased number of households, business activity and travel. Chart 3



QUEST: The Vision

An integrated, community based approach to address energy end-use and reduce GHGs will get the best results.

- An integrated system based approach of thinking, planning and acting allows us to effectively deal with the complexity and interconnectedness of our energy, transportation, water and waste management systems.
- Because of increased diversity and redundancy, integrated systems are more efficient, flexible, resilient, reliable and sustainable.
- The community, with its use of energy in houses, business, institutions, industry and transportation, is the most promising place to act.
- An integrated approach at that level allows balancing energy demand and supply between different sectors, accounting for the impact of one system versus the other, and leads to optimal results in providing community services.
- Integration of energy systems at the community level brings the maximum economic, social and environmental benefits and meets many objectives, it:
 - Meets Smart Growth development principles,
 - Fosters innovation in advanced energy systems technology,
 - Alleviates demand on centralized energy generation and transmission systems,
 - Reduces pressure on water and waste management infrastructures,
 - Facilitates development of efficient urban transportation systems,
 - Creates local employment and economic development opportunities,
 - Leads to much reduced GHGs emissions and improved local air quality, and
 - Makes for better overall quality of life in communities.

Challenging Opportunities

Excellent opportunities exist to accelerate the widespread implementation of community based, integrated energy systems, but there are challenges:

- Integrated approaches have been implemented successfully in several communities, or are in the process of being implemented, but overall benefits have not been adequately quantified and widely publicized amongst decision makers.
- The integration of urban systems leads to longer term benefits for the community but it involves multiple players in the planning and development process which increases upfront complexity, development time and costs.
 - It typically involves investments in urban infrastructures that need longer term financing.
 - It challenges existing planning and regulatory frameworks, which takes time, effort and resources to change.
- Many technologies to improve the overall performance of energy systems do exist, but their integration raise particular challenges, risks and costs which developers, builders and smaller innovative companies cannot support alone.
- Provincial differences in energy mix and costs and their associated environmental impacts, create different opportunities, but also particular challenges that need to be considered in the implementation of projects.

Integrated Energy Systems - From Vision to Reality

Dockside Green -Victoria, British-Columbia

- In Victoria, the Dockside Green community is being developed on fifteen acres of former harbourfront industrial land, incorporating 26 buildings with a planned total of 1.3 million square feet of mixed residential, office, retail and commercial space and it showcases green building and best-practice energy technologies.
- As a LEED Platinum targeted project, Dockside Green will function as a total environmental system in which form, structure, materials, mechanical and electrical systems will be interrelated and interdependent - a largely self-sufficient, sustainable community where waste from one area will provide fuel for another.

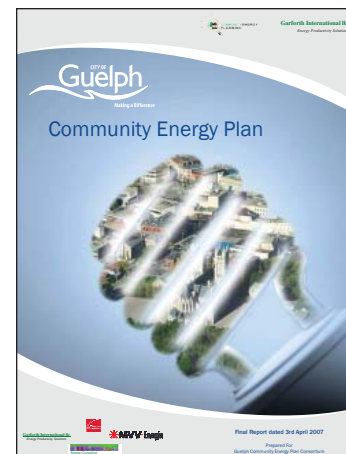


Green Energy Benny Farm Redevelopment - Montreal, Québec

- This urban, landscape and architectural project is a model integration of buildings, infrastructure and community-driven housing development. It involves the sustainable construction and renovation of 187 housing units on four properties, and links each with a shared green infrastructure.
- The project integrates proven solar and geothermal technologies within the constraints of existing buildings, new construction and established urban design guidelines. The shared infrastructure will allow future flexibility in adding renewable heat sources and redistributing these energies between buildings. The backup systems are shared across the site and between buildings meaning they are cheaper and more efficient. Economies of scale bring greater value out of capital expenses, compared to discrete systems for separate projects.

The City of Guelph Community Energy Plan, Ontario

- Guelph, with its current population of 115,000, plus an additional 18,000 students during the academic year, is a thriving city that is attracting significant growth. Guelph's population is expected to grow to 180,000 supported by significant commercial and industrial development. To support this growth, the city has made a commitment to implement a Community Energy Plan (CEP) which outlines several ambitious targets and actions to address barriers to urban integrated energy systems and will ensure the long-term competitiveness and environmental performance of the city.
- Several priorities have been identified in the CEP: maximize energy and water efficiency for buildings, vehicles and industry; maximize use of heat generated in electricity generation and existing industrial processes; incorporate as many renewable energy sources as feasible, and; team with the existing electricity and gas networks to avoid wasteful duplication of assets. The CEP outlines several ambitious targets and actions to address barriers to urban integrated energy systems, including a recommendation to implement the concept through community scale projects.



QUEST: A Framework for Change

Strategy

“Organized central intelligence, implemented through multiple individual actions”.

- The development of an integrated approach to energy systems necessitates a concerted effort from all levels of government to facilitate private sector actions.
- It relies on the collaboration and on the particular responsibilities, strengths and capabilities of all stakeholders from the public and private sectors: federal, provincial and municipal governments, regulators, utilities, planners, designers, developers, builders, and other community stakeholders.
- Federal and provincial governments need to provide leadership and framing of the issue, policies to address market failures, and support to sustain intellectual infrastructure; these policies and actions should be flexible and incremental, with a continuous review of the outcomes.
- Implementation needs to be at the smallest practical level to account for, and adapt to localised circumstances, increasing buy-in from the public.

Actions

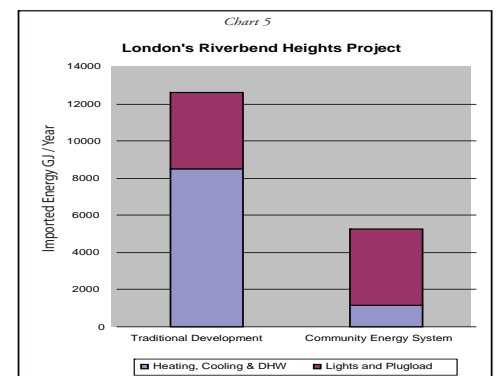
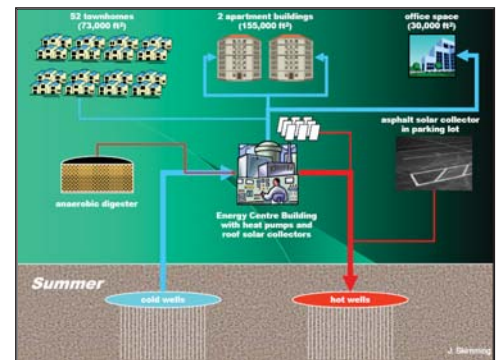
Several actions are needed to set the stage and accelerate the adoption of an integrated approach to energy systems.

- Introduce appropriate market based pricing of carbon to take into account the impact that carbon emissions cause to the environment, public health and the economy, and to send a clear signal to all members of society that the environment cannot be used as a free GHG/waste receptacle, and to accelerate market adoption of technologies that are already widely available.
- Provide leadership, central coordination, clear objectives and information to individuals, households, businesses, and cities on what can be done to improve the delivery of energy services in order to build up commitment and initiate actions by all members of the community.
- Increase the dialogue and collaboration between energy, transport, land-use and technology players, and with all levels of government to improve the alignment of the interventions and optimize solutions.
- Document performance and benefits, make available project experience and case studies, and develop performance targets, metrics and evaluation tools for integrated community energy systems.
- Develop capacity at the municipal, regional and provincial levels for long term integrated energy demand and supply planning and hold municipalities accountable for developing and implementing integrated community development plans.
- Ensure a sufficient revenue base for municipal governments to plan and manage integrated energy plans and implement innovative solutions.
- Encourage more interaction and collaboration, and develop institutional arrangements between the public and private sectors e.g. utility and municipality partnerships for the development and operation of community based energy systems.
- Develop innovative financial mechanisms to manage front-end investment risks and accelerate private sector investments e.g. green financing for home owners and better performing buildings; incremental capital at low interest for long pay back energy systems.
- Fund and implement pilot, demonstration and showcase projects e.g. micro-utilities, on-site distributed generation.

Integration Brings Significant Benefits

The Riverbend Heights Community Energy System - London, Ontario

- Riverbend Heights is a community designed using the “Placemaking” - smart growth principles developed by the City of London, Ontario.
- This mixed-use development would include most of the key features of an integrated energy system: energy efficient buildings; advanced sewage collection and anaerobic digestion of organic waste; combined heat and power generation; low temperature district heating and cooling; aquifer thermal energy storage (ATES); active solar thermal and air source domestic hot water heat pumps.
- The project’s feasibility study shows that, compared to a traditional approach, a community based integrated energy system would lead to a 58% overall reduction in grid energy use and a 86% reduction in energy for hot water, space heating and cooling. Both approaches assume high efficiency housing at the Energy Star level and LEED certified commercial buildings. Chart 5
- The mix of land use and density helps make the ATES-based system feasible and will help encourage sustainable modes of transportation. Inclusion of additional features, such as solar photovoltaic, would bring the development close to a net-zero community.



QUEST: Building on the Momentum

There is a sense of collective urgency coming out of the QUEST Workshop. Physical systems we are building today will define our environment for decades. We need to act now and learn through practice.

- The outcome of QUEST, carried through this White Paper, is the basis for participants to deliver a consistent message to policy and decision makers who have the ability to influence and accelerate implementation of future developments.
- QUEST is a first step towards drawing a consensus and establishing a long term vision for a fundamentally different, carbon-lean urban energy future and will be used as input to other stakeholders’ long term strategic planning exercises, such as NRTEE’s.
- Following the delivery of this White Paper to key policy makers and influencers and its wider distribution, the Steering Group will help promote further discussions and more specialised workshops to overcome strategic gaps, build new partnerships and help develop leadership in community energy efficiency in Canada. More specifically:
 - Surveying QUEST participants on what needs to change to achieve the goal of integrated system approaches,
 - Identifying and developing case studies of integrated systems,
 - Developing baseline indicators and quantifying benefits,
 - Choosing an easily accessed location to accumulate up-to-date information on needs, case experience and measurement tools,
 - Increased networking through mechanisms such as Smart Growth Canada, and
 - Developing partnerships to implement pilot and demonstration projects.

QUEST participants believe that integration is fundamental to meeting the energy and GHGs emission reduction challenge facing Canada. They are committed to making Canada a world leader in urban integrated energy systems.