



Quality Urban Energy
Systems of Tomorrow



**MOVING FORWARD:
THE INTEGRATED ENERGY SYSTEMS APPROACH
IN CANADIAN COMMUNITIES**

MARCH 2009



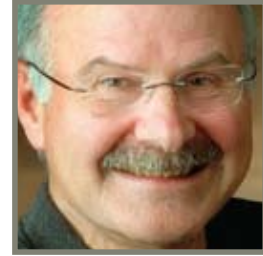
This document contains content excerpted from “QUEST Policy and Next Steps” Ken Ogilvie, November 17, 2008; and, documents provided by Scenarios to Strategy (S2S) Inc.

TABLE OF CONTENTS

CHAIRMAN'S MESSAGE	1
EXECUTIVE SUMMARY	3
INTRODUCTION	7
QUEST	7
QUEST Context	8
QUEST SCENARIOS	10
NEXT STEPS	13
QUEST 2009	13
Moving Ahead	14
APPENDIX ONE: THE EVOLUTION OF QUEST	16
APPENDIX TWO: QUEST SCENARIOS	18
APPENDIX THREE: QUEST SUPPORTERS	19

CHAIRMAN'S MESSAGE

Currently 95 percent of Canadian's live in or within an hour of one of our 120 larger city centers. Cities are where the majority of our resources are consumed and the majority of our greenhouse gas and air pollutant emissions are produced. Decisions we take today about land use in our cities and their energy, transportation, water and waste management infrastructures will have consequences in decades to come. A better integration of these infrastructures and systems will address energy end-use and significantly reduce emissions. QUEST's vision, mission and six guiding principles are the basis to ensure a cleaner, more efficient, affordable and reliable energy system for Canadians.



A handwritten signature in black ink that reads "Mike Harcourt". The signature is written in a cursive, flowing style.

Michael Harcourt
QUEST CHAIRMAN

EXECUTIVE SUMMARY

Canada's energy use is rising. Urban areas are a major source of Canada's greenhouse gas emissions. To reach the federal government's 2020 target of reducing national emissions by 20% from 2006 levels, addressing energy use and emissions in urban areas and communities must be part of the solution. Preliminary results of a study commissioned by QUEST on the potential energy savings and GHG emissions reduction of urban integrated energy systems are promising and indicate that significant reductions would be possible through stringent land use policies, and that these policies would enable implementation of several technologies and further reductions.¹

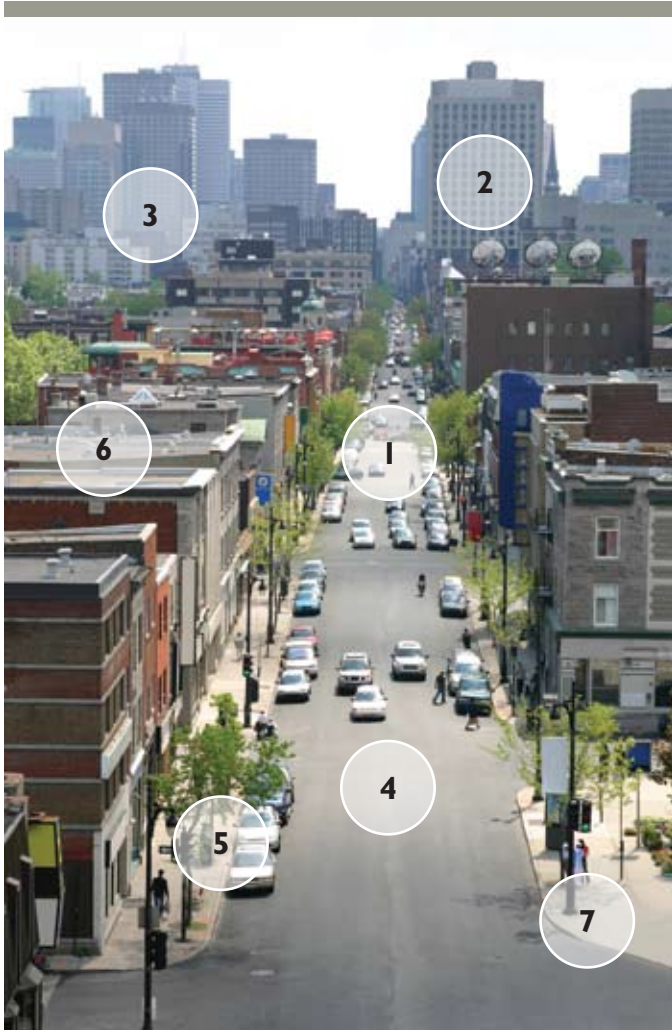
QUEST (Quality Urban Energy Systems of Tomorrow) is a collaborative of key players from industry, the environmental movement, governments, academia and the consulting community that is encouraging all levels of government, industry and citizens to support integrated approaches to providing energy services in Canadian communities.

The underlying QUEST proposition is that meeting Canada's climate change and clean air goals will require large reductions in energy consumption in urban areas and communities, as well as greater integration of on-site renewable sources of energy with existing energy grids.

The **QUEST mission** is to foster a community-based integrated approach to land-use, energy, transportation, waste and water and reduce related greenhouse gas, air pollutant emissions and waste.

The **QUEST vision** is that by 2050 every community in Canada is operating as an integrated energy system, and accordingly, all community development and redevelopment incorporates an integrated energy system.

¹ Exploration of the capacity to reduce GHG emissions by 2020 and 2050 through application of policy to encourage integrated urban energy systems. MK Jaccard and Associates Inc., January 2009.



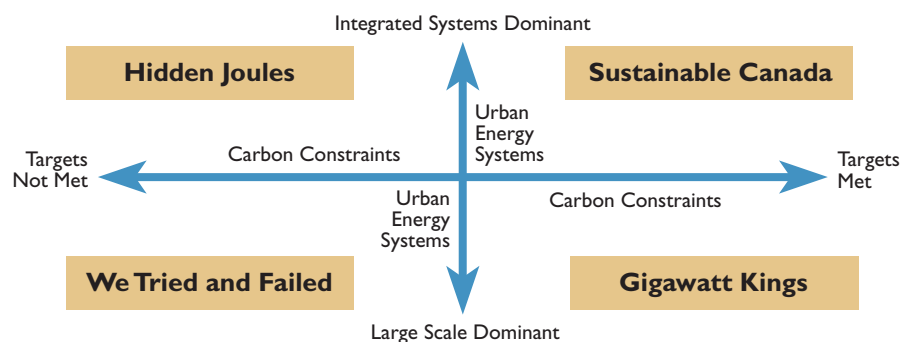
A mixed-use, higher density community is the foundation for an integrated energy system.

1. Mixed-use and higher density development allows the cost-effective integration of systems, including transportation.
2. LEED certified buildings reduce energy use and environmental impacts.
3. The unique characteristics of each energy form is matched with its end-use.
4. A district energy system allows thermal energy to be effectively managed across the different end-uses.
5. Energy from waste, such as from the sewer system and garbage, is recovered.
6. Local renewable energy contribution, like solar energy, is maximized.
7. Electricity and gas grids allow optimization of the overall system and ensure reliability.

Individuals from across the QUEST collaborative developed four scenarios with a goal of building understanding about the complex, interacting forces and key uncertainties shaping the future of carbon-constrained energy end use in Canada and the adoption of Integrated Urban Energy Systems (IUES).

The four scenarios describe substantially different yet plausible paths for Canada’s energy future; paths that diverge based on decisions made today regarding carbon constraints and IUES.

SCENARIO FRAMEWORK



Of note is that the Sustainable Canada scenario represents a plausible way to simultaneously achieve greenhouse gas emissions targets while building more sustainable communities. These communities optimize infrastructure investments and implement innovative technologies to reduce energy use and the associated costs and environmental impact, while improving the energy system’s reliability and making better use of local energy resources. In doing so, these investments create local jobs and reduce each community’s dependence on distant resources and exposure to volatile commodity markets. While implementing these concepts will have the largest impact in urban settings, many of the practices and technologies can be applied in smaller communities.

The four scenarios were examined and discussed at the QUEST II Conference in Victoria in November 2008, which was a successful staging ground for generating new ideas and launching new efforts to further build momentum. Conference participants agreed that additional progress needs to be made along two key paths.

1. Move to Action, and
2. Develop a Knowledge Base.

1. Move to Action

QUEST needs to expand its network and appeal to a wider range of perspectives. Such an expansion should proceed along the following lines:

- Build political champions,
- Develop regional and provincial QUEST models,
- Engage key stakeholders, and
- Develop federal and provincial government relationships.

2. Develop a Knowledge Base

QUEST will undertake the development of a knowledge base containing the following elements:

- Study on the Potential Energy Savings and Associated Environmental Benefits,
- Develop an inventory / case studies of successful projects, best practices and funding sources, and
- Work with municipalities to develop a toolkit to facilitate implementation of IUES.

To succeed QUEST needs ongoing support from all levels of government and active engagement from environmental groups, builders, utilities and other private-sector stakeholders that are doing leading edge work in the area. When QUEST principles are reflected in their decisions, the QUEST vision will be achieved.

INTRODUCTION

QUEST

Meeting Canada's climate change and clean air goals will require large reductions in energy consumption in all sectors of the economy, including the 50% of energy used in urban areas and communities, by matching the type of energy with its use, better heat management across applications and sectors, converting waste to energy, as well as greater integration of on-site renewable sources of energy with existing energy grids.

QUEST (Quality Urban Energy Systems of Tomorrow) is a collaborative of key players from industry, the environmental movement, governments, academia and the consulting community that is encouraging all levels of government, industry and citizens to support integrated approaches to providing energy services in communities.

The first QUEST workshop in November 2007 in Niagara-on-the-Lake, ON saw the emergence of a commitment towards an integrated approach for energy services in Canadian communities. Participants agreed that integration is fundamental to meeting the energy and GHG emission reduction challenge facing Canada.²

The QUEST vision builds on progress that has been made on energy-efficient appliances, eco-efficient buildings, district heating systems, renewable energy technologies, waste heat utilization, waste recycling and landfill gas capture, net zero energy homes, green roofs, and many more innovations that have paved the way for radical changes in the way quality energy services can be provided. The vision calls for greater integration of these innovations in



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community-wide energy systems in order to address energy end-use and reduce greenhouse gases.

The Drake Landing Solar Community in Okotoks, Alberta has successfully integrated solar energy and seasonal energy storage with grid energy for a fifty-two R-2000 energy efficient homes development.

The **QUEST mission** is to foster a community-based integrated approach to land-use, energy, transportation, waste and water and reduce related greenhouse gas, air pollutant emissions and waste.

The **QUEST vision** is that by 2050 every community in Canada is operating as an integrated energy system, and accordingly, all community development and redevelopment incorporates an integrated energy system.

² Integrated Energy Systems in Canadian Communities: A Consensus for Urgent Action. QUEST, March 2008.

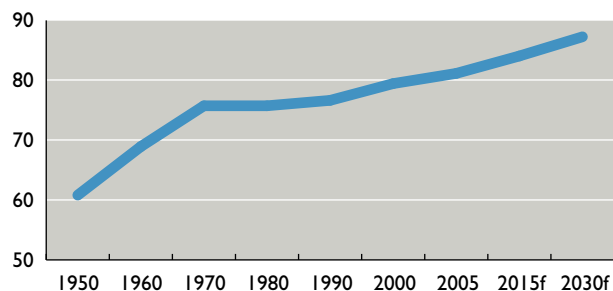
The mission is premised on **six principles that guide sustainability in urban energy systems**:

- **Improve efficiency** – first, reduce the energy input required for a given level of service;
- **Optimize “exergy”** – avoid using high-quality energy in low-quality applications;
- **Manage heat** – capture all feasible thermal energy and use it, rather than exhaust it;
- **Reduce waste** – use all available resources, such as landfill gas, gas pressure drops and municipal, agricultural, industrial and forestry wastes;
- **Use renewable resources** – tap into local biomass, geothermal, solar, wind energy and hydraulic; and
- **Use grids strategically** – optimize use of grid energy and as a resource to optimize the overall system and ensure reliability.

QUEST Context

Fifty percent of Canada’s greenhouse gas emissions come from large-scale energy resource developments, large industry and centralized power generation. The other fifty percent is emitted in urban areas and communities where over eighty percent of Canadians live. The federal government has set targets of reducing Canada’s greenhouse gas emissions 20 percent by 2020 and 60-70 percent by 2050 while reducing industrial emissions by as much as 50 percent by 2015 for key air pollutants.

Figure 1: CANADIAN URBAN POPULATION (%)



Source: Globalis
Note: f = forecast

The challenge facing Canada is to achieve the environmental targets and standards in ways that have broad public support, that improve competitiveness and create new investment and jobs and improve overall quality of life in our communities. To meet this challenge, current macro-energy policies, which focus on decarbonising large-scale fossil fuel resource development and use, must be complemented by micro-energy policies that reduce the demand for energy, and related emissions, in urban areas while providing the energy services that Canadians expect.

Urban areas are a major source of Canada’s greenhouse gas emissions. This is not surprising given that about 80% of Canadians live in urban areas. Furthermore, the urban population is growing faster than the non-urban, and has been doing so for some time (Figure 1), making urban areas a core feature of ongoing economic growth. In addition, while implementing the QUEST vision will have the most impact in urban settings, most of QUEST’s principles can be applied in smaller communities.

As a result, more efficient use of energy in Canada's urban areas and communities is needed to address environmental goals and, increasingly, to ensure that these growing communities are not built to be reliant on cheap energy. The environmental and economic imperatives coincide in this case – more sustainable energy systems, particularly at the community-level, serve to protect the environment, create local jobs and reduce energy costs.

Preliminary results of a study commissioned by QUEST on the potential energy savings and GHG emissions reduction of urban integrated energy systems are promising and indicate that stringent land use policies to encourage densification, including constraints on the geographic footprint of cities, specification of densification corridors with fast and reliable transit, and reform of the property tax system, have the capacity to significantly reduce direct and indirect urban emissions, and that these policies would enable wide scale implementation of technologies such as district heating, combined heat and power, waste recovery systems and other alternative energy sources with accompanying additional reductions.³

The current policy setting, while focused on large industries and centralized power, provides some support for improvements to urban energy systems, but the design of the support does not encourage integration across sectors. Canada needs to move quickly on the QUEST vision to ensure investments in community energy infrastructure are made in a way that will allow implementation to provide the most short and long-term economic, environmental and social benefits.

Examples of relevant programs, incentives and initiatives that support elements of the QUEST vision

- Federation of Canadian Municipalities, Green Municipal Fund
- Municipal Rural Infrastructure Fund
- Technology Early Action Measures
- Sustainable Development Technology Canada
- NRCan (various program, such as at the Office of Energy Efficiency and CANMET Energy Technology Centre)
- Urban Transportation Showcase Program, Transport Canada
- Infrastructure Canada
- EcoTrust
- Moving on Sustainable Transportation
- Ontario Power Authority programs and incentives (e.g., Renewable Energy Standard Offer, Clean Energy Standard Offer, Demand Response Program)
- Ontario Greenbelt
- Vancouver and area initiatives (e.g., EcoDensity, Translink, Greenways Plan, Community Visions Program)
- Revi-Sols, Montreal and Quebec City

A major challenge in achieving the QUEST vision will be to cross-link existing programs and incentives to enhance their effectiveness by integrating them into a more cohesive framework.

³ Exploration of the capacity to reduce GHG emissions by 2020 and 2050 through application of policy to encourage integrated urban energy systems. MK Jaccard and Associates Inc., January 2009.

QUEST SCENARIOS

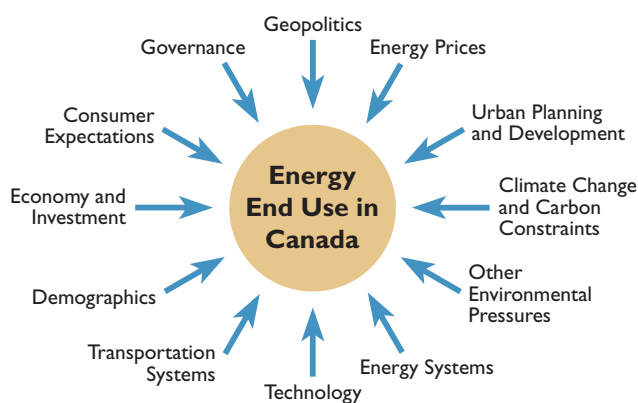
In the Fall of 2008, individuals from across the QUEST collaborative developed four scenarios with a goal of building understanding about the complex, interacting forces and key uncertainties shaping the future of carbon-constrained energy end use in Canada and the adoption of Integrated Urban Energy Systems (IUES). The IUES approach, involving integrated, smaller scale, more-distributed energy systems, is dramatically different from our current approaches to energy systems and would require major changes in thinking, planning, investment and policy.

The scenarios were discussed at the QUEST II Workshop in November 2008 where participants used them as a tool to help develop a more broad understanding about the future, the external environment and strategic risk. Participants built a shared understanding of the forces driving change and the key uncertainties shaping the future. The scenarios are now being used to help QUEST more fully understand strategic risk and make better strategic decisions.

Of the 12 driving forces identified, two critical uncertainties were identified as most important:

- Urban Energy Systems – whether they are large-scale dominant or integrated systems dominant, and
- Carbon Constraints – whether targets are met or not met.

12 DRIVING FORCES

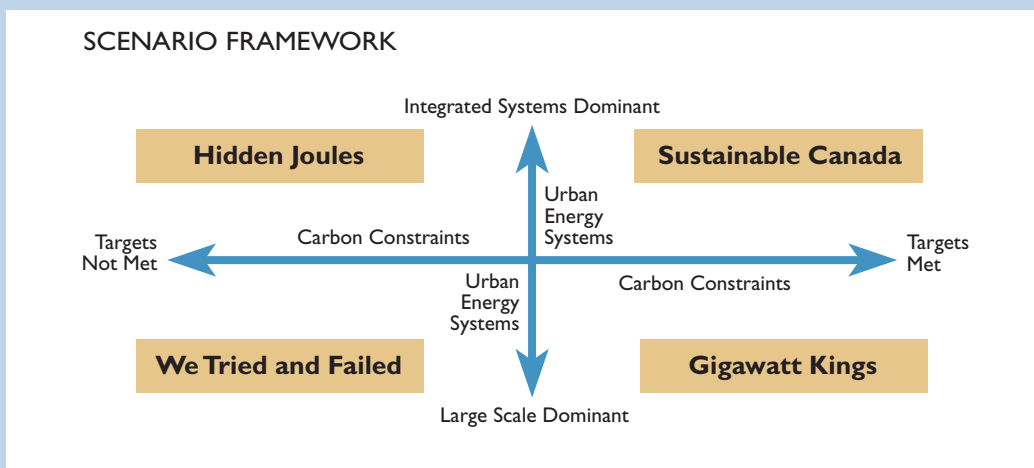


Scenarios

Scenarios are a vehicle for strategic conversation to build shared understanding, encourage creative thinking and provide a context for strategy development and action. Scenario planning is particularly valuable in turbulent uncertain environments facing structural change.

Scenarios are not predictions; they are stories about the future designed to gain insight into the forces driving change and the major uncertainties shaping the future. Scenarios chart the waters ahead so that the consequences of today's decisions can be played out, evaluated and tested against the uncertainty of the future. Scenarios are intended to challenge assumptions, explore issues and broaden understanding of the range of future paths to better inform decision-making.

Understanding the influence and range of outcomes for each critical uncertainty is important to developing challenging scenarios for energy end use in Canada. The two critical uncertainties define a space with four different energy futures for Canada. These four scenarios demonstrate paths representing both success and failure in achieving emissions targets and taking full advantage of IUES' with an integrated approach to urban energy systems.



Hidden Joules

Despite competing priorities and conflicting signals from senior governments, a number of municipalities lead in initiating projects to increase energy efficiency and reduce GHGs emissions across urban systems.

Sustainable Canada

Significant shifts in social values drive acceptance of environmental costing and new paradigms for urban energy systems in Canada.

Gigawatt Kings

Urgency and determination to deal with climate change as a national issue leads to increased central regulation, control and focus on large scale solutions.

We Tried and Failed

Carbon concerns drive policy. Canada focuses on large-scale solutions with little emphasis on small-scale solutions. Other nations embrace alternative energy. Diverging paths lead to trade barriers that undermine economic growth.

The four scenarios describe substantially different yet plausible paths for Canada's energy future; paths that diverge based on decisions made today regarding carbon constraints and IUES.

Of note is that the Sustainable Canada scenario represents a feasible way to simultaneously achieve greenhouse gas emissions targets while building more sustainable communities. These communities optimize infrastructure investments and implement innovative technologies. By doing so they reduce energy use and the associated costs and environmental impact, improve the energy system's reliability, make better use of local energy resources, create local jobs and reduce each community's dependence on distant resources and exposure to volatile commodity markets.

The implications of the four QUEST scenarios are varied and QUEST II participants discussed a range of implications for QUEST moving forward. To focus discussions, participants addressed the following question:

How do we shift our paradigm to advance the potential of integrated urban energy systems (including our approaches to energy, water, waste and transportation systems) to reduce the carbon footprint of urban areas and to make Canadian cities sustainable?

Conference participants recommended the general framework for moving forward should include:

- Enhanced political mobilization track to put QUEST on the agenda of all levels of government and reach out to a wider stakeholder group; and,
- Developing a base of knowledge for both the macro level (e.g. community level metrics, quantification of the potential benefits, road map for implementation) and the micro level (e.g. inventory of successful projects, case studies, a 'how to' manual or checklist for municipal governments).

They also recommended a more formalized organization/secretariat for QUEST, with dedicated resources to support the higher level of effort needed to advance the action-oriented vision.

NEXT STEPS

QUEST 2009

QUEST II participants called for a significant increase in QUEST activity for 2009, from gaining the interest of key policy makers to working with a variety of current public and private stakeholders while simultaneously completing research into the implementation of and benefits provided by IUES.

As a first requirement to implementing an aggressive plan for 2009, QUEST is in the process of establishing a permanent secretariat with dedicated resources. To maintain momentum and follow up on the advice received at the QUEST II workshop, additional progress needs to be made along two key paths.

1. Move to Action, and
2. Develop a Knowledge Base.

I. Move to Action

QUEST needs to expand its network and appeal to a wider range of perspectives. Such an expansion should proceed along the following lines:

- Build political champions,
- Develop regional and provincial QUEST models,
- Engage key stakeholders, and
- Develop federal and provincial government relationships.

Build Political Champions

Awareness and support of the QUEST vision will be expanded by increasing political awareness and building political champions that support the value of community-level initiatives and local environmental progress.

Develop Regional and Provincial QUEST Models

To advance leadership, a framework for provincial and municipal models for QUEST will be developed wherein provincial stakeholders can work to further QUEST's vision while working within the unique structure of any given province's energy system and legislative framework. Municipal stakeholders will also have access to a coordinated regional approach to developing IUES within their communities.

Engage Key Stakeholders

As was identified in the 2008 Study on Stakeholder Engagement and Government Initiatives, builders are a key stakeholder group for QUEST success. In 2009, QUEST will pursue more involvement from builders and other key groups.

Develop Federal and Provincial Government Relationships

Specific engagement with Sustainable Development Technology Canada (SDTC) and the National Roundtable on the Environment and the Economy (NRTEE) will be pursued to establish IUES as a key attribute for funding; and to raise awareness of IUES and their potential contribution to greenhouse gas emissions reductions.

2. Develop a Knowledge Base

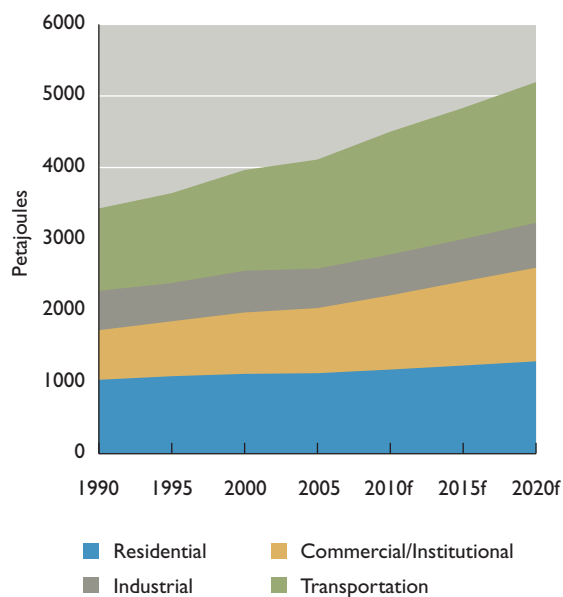
A common observation from QUEST II was the need for a more in-depth knowledge base to help in developing policies, programs and activities in support of IUES. Inline with this directive, QUEST will undertake the development of a knowledge base containing the following elements:

- Study on the Potential Energy Savings and Associated Environmental Benefits – Initial findings of Phase 1 of this study, initiated in 2008, indicate promising results, and therefore the objective is to proceed with Phase 2. Phase 2 would consist of an in-depth analysis/modeling of the energy savings and GHGs emissions reduction impact of the IUES approach for Canada.
- Develop an inventory and case studies of successful projects, best practices and funding sources, and
- Work with municipalities to develop a toolkit to facilitate implementation of IUES.

Moving Ahead

Canada's energy use is rising. Urban areas are a major source of Canada's greenhouse gas emissions (Figure 2). To reach the federal government's 2020 target of reducing national emissions by 20% from 2006 levels, urban areas, and smaller communities, must be part of the solution. Decisions made today about the infrastructures of our cities and communities will affect energy use and our environment for decades and centuries to come.

Figure 2: CANADA'S URBAN ENERGY GROWTH 1990-2020



Source: CGA's estimate from NRCan's Canada Energy Outlook – The Reference Case 2006

QUEST is calling for an integrated approach to land-use, energy, transport, water and waste management in all Canadian communities – one in which emphasis is placed on achieving much greater efficiency in these systems as a whole, rather than treating each in isolation. The result will be more resource efficient, adaptable, resilient and sustainable urban energy systems.

QUEST's plans for 2009 build on the 2008 momentum and represent early steps towards achieving the QUEST vision. QUEST is securing dedicated resources, developing provincial models, engaging more stakeholders and pursuing in-depth analysis and energy system modelling.

To succeed QUEST needs ongoing support from all levels of government and active engagement from environmental groups, builders, utilities and other private-sector stakeholders that are doing leading edge work in the area. When QUEST principles are reflected in their decisions, the QUEST vision will be achieved.

APPENDIX ONE: THE EVOLUTION OF QUEST

2006

- Canadian Gas Association and Pollution Probe agree to work together on developing a credible view on the consumption end -‘the other 50%’- of the energy system and contribute to the policy conversations.
- An outreach effort attracts additional stakeholders from the energy industry, building industry, environmental groups, academe and representatives from municipal; provincial and federal governments.
- The stakeholders resolve to hold a structured dialogue to explore the benefits and opportunity for collaboration.

2007 – QUEST I

- A core group composed of 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 coalesces around the need to focus on an integrated approach to energy, transportation, land-use, waste and water at the community level.
- In November, in Niagara-on-the-Lake, Ontario, over 60 key players from the energy industry, environmental movement, three levels of government, academia and consulting community spent a day and a half at the QUEST I workshop discussing options for reducing the environmental footprint of growing communities. The stakeholders observed:
 - Meeting ambitious long term greenhouse gas reductions of 60 per cent or more by 2050 needs a fundamental transformation of how we produce, deliver and use energy in Canada.
 - Integration of energy systems with land use, transportation, waste and water at the community level is essential to maximize energy savings and reductions in greenhouse gas emissions while continuing economic growth.
 - A broad based coalition under the banner of QUEST is necessary to bring about the change.
- The group identified the need to develop better information on the stakeholder community, current government programs that support the QUEST vision as well as the barriers. The group also identified the need for undertaking a credible study that quantifies the green house gas reduction potential of implementing the QUEST vision.
- The QUEST White Paper was presented to the Deputy Ministers of Natural Resources Canada, Transport Canada, Environment Canada and the Presidents of the National Round Table on the Environment and Economy (NRTEE) and Sustainable Technology Development Canada (SDTC) as well as provincial politicians and senior officials in Ontario, British Columbia and Saskatchewan.

2008 – Outreach, Studies and QUEST II

- The core group membership expanded beyond the founding group to include representatives from Transport Canada, the Government of British Columbia, the Canadian Urban Institute, BC Hydro, Ontario Power Authority, the Canadian GeoExchange Coalition, the Canadian Institute of Petroleum Producers, Karen Farbridge, Mayor of Guelph and Michael Harcourt ex-Premier of British Columbia as Chair.
- The study on stakeholders and government programs was completed and the potential study launched.
- Natural Resources Canada embarked on a federal/provincial/territorial initiative to develop a Community Energy Solutions Road Map for review by the Council of Energy Ministers, coordinating with QUEST work and interacting with the QUEST community.
- The QUEST II workshop in Victoria B.C. in November attracted 80 stakeholders from a broader stakeholder base than the previous year, including more industry representatives, a wider representation of environmental organizations, a larger number of federal and provincial government representatives, of academics and many more municipal leaders from British Columbia.
 - Participants considered a number of scenarios for the future of Canada’s energy system that had been developed over the course of the preceding six months based on interviews with prominent stakeholders and a working session with a small select sub-group of the stakeholders. The scenarios provided an excellent framework for a conversation among the participants and helped crystallize the QUEST vision.
 - The end result was a resounding confirmation of the need for the QUEST initiative and coalescence of opinion that it is time QUEST focused its efforts on implementation of the vision.

APPENDIX TWO: QUEST SCENARIOS

SCENARIO FRAMEWORK	
Hidden Joules – Integrated Systems Dominant, Targets Not Met	Sustainable Canada – Integrated Systems Dominant, Targets Met
<ul style="list-style-type: none"> ■ Limited commitment to GHG targets; senior governments distracted by competing priorities ■ Municipal champions overcome barriers & build partnerships to initiate projects ■ Initially focus on small & manageable opportunities ■ Conflicting signals lead to “system stuck in transition” ■ Diffusion slow then accelerating; projects to integration to institutional planning ■ By 2028 targets not met but IUES accelerating 	<ul style="list-style-type: none"> ■ Significant shift in social values, environmental costing accepted ■ New paradigms in Canada about urban development and urban energy systems ■ Thinking supported by alternative energy technology ■ Optimize existing investments ■ Progressively advance and adopt new approaches and technology over time to effect a system-wide transition ■ By 2028, targets for a 30% reduction in GHG emissions are achieved and Canada is on track to achieve a 60% reduction by 2050
We Tried and Failed – Large Scale Dominant, Targets Not Met	Gigawatt Kings – Large Scale Dominant, Targets Met
<ul style="list-style-type: none"> ■ Carbon concerns mount with solutions predominantly focused on large-scale emitters ■ Environmental management efforts fall to basic enforcement and compliance ■ Green trade barriers emerge ■ Environment degrades, Canadian competitiveness is hampered, Canada’s social fabric affected ■ As the world starts to embrace alternative energy, Canada does not have the capacity to embrace new opportunities and we remain dependent on silos & large-scale energy systems ■ By 2028, having missed its GHG targets, Canada is at risk of falling further behind 	<ul style="list-style-type: none"> ■ Climate change urgent national issue; commitment to targets ■ US leads in developing system of GHG constraints ■ Focus on regulation & control ■ Large scale infrastructure & technology solutions seen as only path to meeting GHG targets; massive investment in nuclear, IGCC, CCS, natural gas ■ Problem-solution “fix-it” mentality precludes long term systems thinking ■ Cities little influence; suburban growth; car-centred society ■ By 2028, GHG target met through massive investment in nuclear & CCS

APPENDIX THREE: QUEST SUPPORTERS

QUEST is a collaborative among a range of organizations across Canada. Participants in QUEST workshops and other initiatives include federal, provincial and municipal officials, industry associations and company representatives, academics, environmental organizations, charitable foundations, technical experts and consultants.

Supporters include:

- BC Hydro
- Canada Green Building Council
- Canadian Association of Petroleum Producers
- Canadian Electricity Association
- Canadian Energy Pipeline Association
- Canadian Gas Association
- Canadian GeoExchange Coalition
- Canadian Petroleum Products Institute
- Canadian Urban Institute
- Federation of Canadian Municipalities
- Government of British Columbia
- Imperial Oil Foundation
- Natural Resources Canada
- Ontario Power Authority
- Pollution Probe
- Transport Canada

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