

An Action Plan for Growing District Energy Systems Across Canada

June 2011

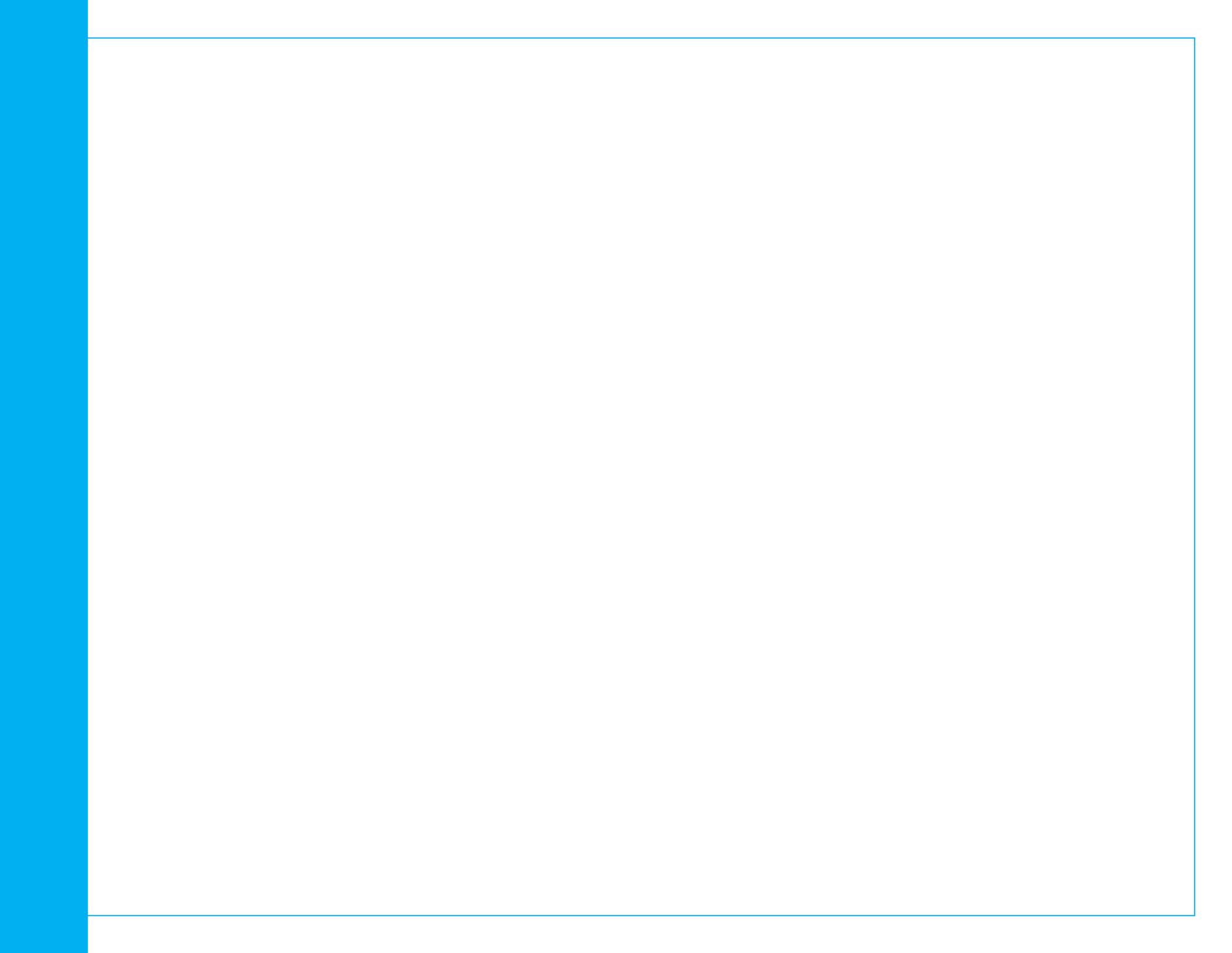


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EXECUTIVE SUMMARY

Introduction

The 200 stakeholders that participated in this study, widely agreed that the District Energy (DE) solution was a sensible, if not essential, element to the future of Canadian energy systems. Many were familiar with the ways that DE had contributed to energy, economic and environmental sustainability in other countries around the world. Respondents largely shared a vision for DE that involved significantly growing DE penetration in their communities.

Given this view, it is not surprising that there existed considerable frustration amongst participants that DE systems have not gained the market penetration that many wish to see. These are not new technologies. Feedback overwhelmingly indicated that DE solutions involve well-understood and well-applied technologies, and have had positive economic, energy and environmental results in many jurisdictions. Despite this, the Canadian DE industry remains small and fragmented.

It is for this reason that this study, commissioned in 2010 by Natural Resources Canada (NRCan) is so important and timely. Policy makers across Canada are faced with the coincident challenges of urban intensification, growing energy demands, aging energy infrastructure and rising replacement costs for new and refurbished energy services. Finding new innovative approaches to meeting community energy demand, while also meeting environmental and energy efficiency imperatives, were goals desired by all of the stakeholders we interviewed. This research provides insight into future visions for DE, better understanding of the perceived and

existing challenges to developing or expanding DE systems and views on the most effective means of overcoming these challenges.

The findings contained within this study are informed by results obtained through three research methods—a web-based on-line summary, in-person group consultation sessions, and a series of individual in-depth telephone interviews.

Key Research Findings

Stakeholders Optimistic About Future of DE

The research found respondents generally held positive and often bold visions for DE, with almost all participants believing that the DE industry is poised for significant future growth. Respondents also felt that this future growth would accelerate as DE is seen as an integral element of both community planning and sustainable energy solutions.

Respondents were positive about growth across all development sectors: residential, commercial, institutional and industrial. Participants were the most optimistic about growth in municipal, university, school and hospital building stock (MUSH buildings), and significant growth was also envisioned in the residential sector. For example, in the short term (5-10 years), approximately 80% of respondents considered that up to 5% of residential building stock would be connected to DE. This in itself represents considerable growth in the residential sector.

Section 2.0 of the report provides an overview of the stakeholders' vision of how DE fits into Canada's energy future.

Challenges are complex and interconnected

The research revealed both the depth and complexity of challenges facing the DE industry, as well as the cascading impact of one set of challenges on another. Of the key challenges cited, the following five broad challenge areas were cited most frequently: knowledge, leadership, economic, human resources and sustainability challenges. The challenges can be viewed sequentially. That is, one challenge contributes to the others, as DE systems are considered, tested, adopted and managed.

Knowledge Challenges

Education and awareness were raised by stakeholders as a critical element to enable DE deployment, at each of the global, macro and micro levels.

The overarching challenge identified was that there is simply not enough knowledge, awareness and understanding of DE for it to be understood to be a viable option in developing integrated community energy solutions. Simply put, there has been a lack of awareness of the importance of the thermal component of our energy needs and a lack of awareness of the need and the impact of integrating thermal energy planning with land use planning in community development.

We also heard that there are significant knowledge gaps to fill in all orders of government. Many situations were identified where policy and political decision makers were not aware of DE, or its relevance, because they did not have access to the information which would make its relevance clear. This comment is applicable at many policy levels, beginning with federal and provincial policy development (legislation, regulation), integrated land-use planning

and energy system design and in DE implementation (e.g. municipal bylaws, permitting) and DE system management (e.g. connection requirements).

Overall, people cannot understand the relevance of things that they are truly unaware of. As a result of this lack of knowledge, there is a tendency to default to conventional energy solutions, based on short term economic drivers. In a country with relatively low energy and land costs, and with no carbon pricing, the limits of sustainable community growth are often masked.

Leadership Challenges

The need for project champions, political leadership and a defined policy framework

The lack of project champions to drive DE was seen as a major barrier to new projects. Champions in both the public and private sectors were seen as essential. There was also an appreciation for the role that NGOs and groups such as CDEA could play in championing the cause for DE. Even in areas with political champions, project momentum can be stalled due to lack of enabling policy.

A lack of a defined policy framework was seen as a major challenge for the DE industry. Unlike other energy grids in most parts of Canada, there is a lack of a robust, enabling legislative and regulatory framework to accelerate DE deployment. This lack of a stable and certain policy environment increases investment risk in DE.

Leadership in municipalities was seen as particularly critical to successfully advancing DE projects. Generally, respondents identified the need for better municipal level understanding of how

Integrated Community Energy solutions are introduced, implemented, and sustained, given the interrelationship between energy and land use, and the potential to significantly impact GHG emissions.

Economic Challenges

Developing a viable business case proposition for DE

The challenge of creating viable business case propositions for DE projects, and managing financially sustainable projects over time was a recurring theme. Respondents identified the challenges presented by relatively low energy prices, the lack of carbon pricing and a fiscal regime that biases energy investment towards other types of energy infrastructure (e.g. renewable electricity generation)..

Not only were DE project developers hampered by a lack of understanding of the key business drivers of DE projects, they were also constrained by a lack of project financing for DE infrastructure. Generally, the DE grid is not viewed as essential municipal infrastructure, municipalities are strapped financially in meeting the needs of their communities, and private financing is difficult to attract when there is neither certain nor supportive policy.

Human Resource Challenges

Strengthening local capacity to design, build and operate DE

A general lack of technical awareness was considered a key barrier to getting DE “on the table” for consideration. It was highlighted that education and awareness amongst engineering, architects, planners, and contracting professions, will be critical in moving more DE projects from vision to reality.

A lack of practical experience designing, building and operating DE systems in a Canadian context, was identified as a significant challenge. For example, this lack of experience was compounding more detailed design challenges, such as correctly sizing a system to respond to the needs, character and resources of a local community. The development of systems that are viable and acceptable to Canadian communities was paramount to building a sustainable industry.

Sustainability Challenges

Communicating the benefits of DE for the environment

Finally, linked to -and compounding all of these challenges - has been the DE industry’s inability to effectively position and market DE as a “green energy option”. Improved communication of the connection between DE and environmental and energy efficiency goals was seen as important.

As a result of growing concerns about climate change, municipalities – sometimes as required by government – are setting firm targets for the reduction of Greenhouse Gas Emissions (GHGs). Positioning DE as part of a strategy to help municipalities achieve their GHG objectives is viewed by a wide range of stakeholders to be a constructive and mutually beneficial proposition. Engaging with constituents comprising the MUSH sector (municipalities, universities, schools and hospitals) was also considered critical to higher levels of acceptance and take-up of DE.

Section 3.0 of the report provides a deeper overview of the challenges identified by stakeholders and how they connect to each other.

DE challenges vary across Canada

The research identified that regional factors significantly impact the deployment of DE across Canada. These factors can include: local political, policy and regulatory frameworks, cultural attitudes, local resources, labour force and economic conditions, ownership of local utilities, environmental conditions, as well as the size and intensity of urban settlements in the region. DE solutions must be adapted to reflect the different regional conditions experienced across Canada.

Respondents expressed a strong sense that BC was leading the way in progressing new DE projects. Respondents across Canada generally applauded BC for their suite of progressive climate change policies and the investment they have made in green energy. Participants from other Canadian provinces often expressed significant frustration that DE is being overlooked as a viable option by legislators, policy makers, investors and utility companies to contribute to green energy solutions for their local communities.

Section 3.0 and Appendix 1 provides an overview of the regional challenges identified.

Project development continuum is a useful basis to understand and segment challenges

The development cycle of any large project proceeds along a continuum from concept, to feasibility study, to design, building, owning and then operation and maintenance. The research includes responses from DE proponents and policy makers at every stage of this project continuum. In better understanding these challenges, actions can be developed to support proponents to progress from one stage of the continuum to the next. The continuum also provides a useful reminder of the importance of integrating knowledge, cooperation and effort along the DE development chain. It was suggested that (at worst) a lack of

integrated knowledge across the DE chain could result in communities defaulting to conventional systems and/or costly development errors that could ultimately impact system viability and the overall reputation of DE.

Section 4.0 of the report provides an overview of the project continuum, and the types of challenges experienced at each stage.

Most challenges were identified at the community and project level

Given the division of policy and project responsibility among levels of government and project proponents, respondents also identified stakeholders who had the capacity to address various challenges. Challenges were discussed at the ‘global’ (i.e. federal and provincial policy) level; the “macro” level (municipality, community); and at the “micro” level (i.e. at the project level).

The majority of challenges identified were at the municipal, community and project level (67% of all challenges discussed). Similarly, municipal parties were seen as having the most influence in tackling those challenges, reflecting the strong sense that municipalities have the most influence over the speed and success of DE development. It was emphasized that municipalities are responsible for community visioning, administering land use planning, building the operational and community culture, training municipal staff, and building and managing local infrastructure-- all of which can dramatically impact DE deployment. Moreover, municipalities are the level of government closest to the community, with the credibility to provide outreach and education on the importance of energy and sustainable development.

Section 5.0 of the report provides an overview of the types of challenges experienced at each level.

An Action Plan for the DE industry

This study developed an Action Plan to address the five challenge areas identified, by applying four types of actions. These types of actions include: Education and Capacity Building Actions; Legislative and Regulatory Actions; Knowledge Exchange and Networking; and, Products, Tools and Marketing Actions

Overall, the Action Plan has identified a total of 32 actions to respond to the key challenges identified for the DE industry. These actions have been broken down into the four action categories, as follows: 9 education and capacity building actions; 8 legislative and regulatory actions; 5 knowledge exchange and networking actions; and, 10 for products, tools and marketing actions.

The Action Plan promotes education, capacity building and knowledge exchange so that major knowledge gaps across the DE industry can be addressed. Products (e.g. education modules), tools (e.g. business case analysis framework) and marketing actions (e.g. case study development, robust website deployment) also support education, as well as provide the communication tools necessary to spread the DE message. All of these actions aim to contribute to the development of a stronger, more informed, coordinated and effective DE Industry.

Section 6.0 of the report outlines an Action Plan for the DE industry.

Moving Forward: Everyone has a role

The results from this research indicate that respondents are increasingly positive about DE being able to grow into the future. However, they recognize significant expansion of the industry will depend on overcoming a range of challenges. Namely, the creation

of more supportive economic and political conditions for DE, as well as growing general and technical awareness about DE and getting the message out that DE has the potential to bring a wide range of benefits to communities.

Against this background it is clear that everyone can play a role in creating more supportive conditions for DE. Across all levels of government, to the private sector, developers, engineers, planners, environmentalists, industry associations and NGOs, , as well as communities across Canada. These groups can each identify the areas in which they are able to bring the most power, knowledge and experience in the jurisdictions in which they operate, to positively contribute to growing DE's role across Canada.

The CDEA will continue to focus its own efforts on growing DE through the channels at its disposal. The CDEA is committed to strengthening the industry and poising it for success alongside broader policy motivators. Specifically, as a champion of DE across the industry, the CDEA can play a role to promote DE through effective industry wide marketing strategies, developing best practice tools, undertaking research, and designing and delivering educational programs. In this way, it will support knowledge transfer and build industry capacity throughout the DE development continuum.

Section 7.0 of the report provides an overview of the top 5 actions for the CDEA in moving DE forward.

1.0 INTRODUCTION

1.1 Research commissioned by NRCan

In 2010, Natural Resources Canada (NRCan) entered into a Contribution Agreement with the Canadian District Energy Association (CDEA) to reach out to stakeholders with an interest in district energy (DE) to identify ways to overcome barriers to the expansion of the DE sector across Canada. The project was undertaken in parallel with research related to the EQuilibrium™ Communities Initiative (EQCI).

EQCI is a sustainable community demonstration project, led jointly and equally funded by the Canada Mortgage and Housing Corporation (CMHC) and Natural Resources Canada's (NRCan) ecoENERGY Technology Initiative (ecoETI), a component of the Government of Canada's ecoACTION. EQCI has supported six neighbourhood development projects that provide a best practice model to energy-efficient community development. These communities have each explored opportunities to incorporate DE systems into their communities.

This report is being managed by CDEA with the support of the Canadian Urban Institute (CUI) and C2C Strategies (C2C).

This report summarizes the results from research conducted throughout the months of September and October 2010 via an extensive online survey; 33 in-depth interviews; six interviews with EQCI project teams and two focus groups that took place in Halifax and Edmonton.

1.2 Purpose of the study

The stated purpose of this research project was to identify a vision for DE, better understand the nature of barriers to developing or expanding DE systems, as well as to identify what steps need to be taken or recommended to allow communities to take advantage of opportunities to integrate DE systems into their development process.

The scope and scale of this research project is extensive. A variety of stakeholders were included in the interview process. Questions were structured to examine a range of issues, ranging from an examination of policy at the federal, provincial and municipal levels, to the identification of economic and financial constraints and exploration of issues related to the capacity of the sector to take advantage of the growing interest in DE as an essential element of sustainable, integrated energy delivery.

The research presented in this discussion paper will be submitted to NRCan to help inform their strategy and future vision with respect to Integrated Community Energy Solutions (ICES).

1.3 How the research was carried out

A detailed consultation initiative with stakeholders from across the DE industry was undertaken. This consultation program was designed with input from a project Steering Committee comprised of NRCan and industry stakeholders. The Committee provided advice on the proposed research approach and the research sample of individuals and organizations that were to be included in the study.

The research had four major components: an on-line survey, analysis of comments made at two workshops (in Halifax and

Edmonton), detailed interviews with a subset of industry leaders and detailed interviews with representatives the EQCI communities. Each of the research activities were designed to gain greater understanding of the industry from both those involved in project development to those looking to increase project opportunities; the challenges typically faced in the DE industry across Canada; and to gain information on what respondents considered to be the most effective means of overcoming these challenges. The research activities were also designed to investigate potential roles for CDEA in supporting the DE industry to overcome many of these obstacles.

A summary of participants and the research activities undertaken is included below:

Summary of Research Activities

Type of Survey	No. # Participants	Description
Short Electronic Survey	113 Participants	<p>Organized into 5 sections:</p> <ul style="list-style-type: none"> • Respondent Information • Company/Organizational Profile • National District Energy Vision • District Energy - National Vision of Opportunities and Barriers • District Energy - National Vision of Opportunities and Barriers (<i>Respondents were only District Energy Providers</i>) • Concluding Questions, Strategic Approach <p>The online survey was delivered during the summer to more than 1000 stakeholders with commercial, policy and planning interests in DE. The survey generated 113 responses.</p>
In-depth Interviews with DE experts and providers	33 Participants	<p>An interview guide was developed to cover social, technical, economic, political and environmental/health drivers for DE. The template comprised five key areas of interest:</p> <ul style="list-style-type: none"> • The history of DE development. • Critical business viability conditions. • The vision for DE systems and specific plans for expansion. • Factors that can enable, accelerate or constrain the deployment of DE (eight specific elements are addressed in the

		summaries stemming from the surveys, interviews and focus groups). <ul style="list-style-type: none"> • Key stakeholders critical to enabling DE development.
		In-depth interviews were conducted with 33 key stakeholders beginning in August through October. Each interview was summarized and the findings analyzed with a data management software tool to identify of key highlights and insights.
In-depth interviews with 6 EQCI Communities	6 Participants	The same interview template (as above) was utilized to interview key project leaders on the EQCI projects. These interviews provided greater insight into the role of integrated energy planning in new and/or retrofitted communities.
Stakeholder Workshops (Edmonton & Halifax)	~ 40 Participants	Two focus groups were held in October with a total of 37 participants: one in Halifax and another in Edmonton. Please turn to Appendix A for a summary report of these sessions.

1.3.1 Method of analysis to carry out survey

This research paper is based on feedback from over 200 participants with an interest in District Energy Systems. These participants were drawn from across the industry, including but not limited to: elected officials; municipal, provincial and federal staff; DE owners, operators and investors; and utility providers.

As a result of the broad sample, the views and opinions expressed by participants and their understanding and perceptions of the DE industry are highly varied. In fact, this research paper has often had to balance opposing and sometimes contradictory views from different respondents on the future of DE.

As a result, while the CDEA may not necessarily endorse individual viewpoints, the research presents the opinions expressed by respondents, and demonstrates the complexity of the subject matter.

We believe that the diversity of understanding and opinions provides us with insight as to some of the misperceptions and/or knowledge gaps across the DE industry. We believe this to be a critical benefit of this research, setting the stage for these areas to be targeted by specific efforts to promote and grow awareness of DE.

The CDEA is grateful to participants who have been generous with their time to provide their views and insights into what they personally consider to be the biggest barriers to increased DE deployment in Canada, and how these barriers can be overcome.

This research aims to provide a clear and balanced picture of DE in Canada. It is hoped that all participants feel that their views have been appropriately represented and considered by this research study.

1.4 This study reached out across Canada and *importantly* to stakeholders not previously associated with District Energy (DE)

This research report provides a critical and timely overview of the opportunities and challenges for DE development in Canada, building on the knowledge we have collectively gained from previous work, and infusing it with more current data and a broader perspective.

This report demonstrates a marked shift from prior publications. Specifically, one factor that distinguishes this report from previous work is the range of stakeholders that have been consulted, which goes beyond just those who are currently involved in the DE industry, and who have a known commitment to DE. As will be seen, the viewpoints and knowledge of the intricacies of the field vary considerably, depending on the role of the participant.

A further strength of this report is that its findings are derived from both a national overview and regionally specific examinations of the barriers that face DE, along with concrete recommendations for actions at distinct challenge levels. The comparison of DE narratives between provinces or delineated stakeholders allows for more advanced understanding of specific challenge areas and the development of targeted action plans.

Overall, this report has been designed to inform and support CDEA's mission to increase capacity within communities to support the development and implementation of DE projects in all regions of Canada.

Want to know more about DE?

Past research reports that may be of interest include previous studies sponsored by NRCan available on the CDEA website, the International Energy Agency's Report on Cogeneration and District Energy, which provides an overview of successful policy initiatives undertaken world wide; the Integrated Community Energy Solutions (ICES) Toolkit, which offers more tangible strategies for enabling DE deployment across Canada, focused at the municipal and provincial level; the Ontario Power Authority's District Energy Research Report, which outlines some of the typical challenges and case studies for DE at a community level; an article titled "*In the pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities,*" also offers insights to DE.

These studies can be accessed at the following links:

- **International Energy Agency's Report on Cogeneration and District Energy:**
<http://www.iea.org/files/CHPbrochure09.pdf>
- **Integrated Community Energy Solutions (ICES) Toolkit:**
<http://www.canurb.org/sites/default/files/reports/2010/PU-B-2010-ICES%20Municipal%20Policy%20Toolkit.pdf>
- **Ontario Power Authority's District Energy Research Report:**
http://enfants.chaquekilowattcompte.ca/Storage/122/16923_CRM_OPA_District_Energy_Management_Briefing_Note_20Feb10rev15May10.pdf
- **Burch S. (June 2009) "In the pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities," Energy Policy, doi:10.1016/j.enpol.2009.06.070**

1.5 How this report is organized

To facilitate comprehension of an admittedly complex set of issues, the report uses a variety of graphics to illustrate the interrelationships among stakeholders and their place or role within the sector. Care has been taken to distinguish between the diverse opinions of those engrossed with the day to day business of owning or operating a DE facility and those whose interests are more peripheral but nevertheless important to the mix. The report attempts to present a logical progression of issue identification through to specific actions. Detailed commentary has been included in appendices. The final section of the report is presented as a stand-alone Action Plan.

We are hopeful that this approach will allow readers to more easily gain an overall understanding of the vision, challenges and actions that can be taken to overcome these challenges. Notwithstanding differences in perspective, there was remarkable clear consensus on the key opportunities, challenges and actions needed to propel DE to a much larger presence, nationally.

2.0 STAKEHOLDERS ARE OPTIMISTIC ABOUT FUTURE OF DE GROWTH

2.1 Visions for DE

The research found that respondents generally held positive and often bold visions for DE. Almost all participants believed that the DE industry is poised for significant future growth.

For example, the vision expressed by participants in the Edmonton, Alberta Workshop, was that they aspired to “get to where Denmark is today,” over the next 20 years—with DE accounting for 25% of new construction. Waste-to-energy was also seen as having an increasingly important role to play in establishing Alberta as a self-reliant jurisdiction in terms of delivering energy.

2.1.1 Part of the “green” energy solution – moving away from fossil fuel dependency

Respondents wanted to see DE positioned as part of the mainstream, being top of mind and being understood for its potential to contribute to green energy solutions. Many respondents saw DE as part of the increased interest in green solutions, with interviewees acknowledging that the most productive way forward is through integrated energy solutions that incorporate solar, wind and other renewables, including biomass. A large number of respondents also articulated the inherent benefits of the flexibility offered by DE to substitute renewable fuel sources as a driver for successful growth of DE in the longer term.

Respondents felt that this future growth would be greatly aided if the DE industry were able to effectively position itself as part of the green energy solution, and as an integral element of community

planning. Several people commented on the lack of a compelling storyline for communicating the value of DE, highlighting the benefit of communicating the role of DE in helping Canada meet its goal for sustainability through reductions in GHG emissions. Inspirational DE champions and spokespeople would help in this effort.

2.1.2 DE is a key outcome and component of integrated energy and land use planning

DE was envisaged as a key part of the overall trend towards intensification, with the relationship between DE and urban intensification goals being mutually beneficial and reinforcing. One respondent from Halifax suggested that “*DE will be the accepted way to deliver community energy.*”

Many interviewees associated the potential for DE with any form of concentrated development, including downtown cores, suburban clusters or areas under a single ownership such as a university or hospital campus. It was envisaged that the potential role of DE in the municipalities, universities, schools, and hospitals (“MUSH”) sector would be particularly critical in the shorter term (up to 10 years) and that this could be broadened in the longer term.

Overall, respondents had **optimistic and encouraging visions for DE** to grow into the future. These **visions** were **tied** largely to **sustainability goals** and effective **land use planning** and development. The potential for **synergies between DE** and recent **environmental and sustainability trends** could be explored in future.

2.2 DE is a small but growing industry

Respondents considered DE to be a “*small industry*” but one with good prospects for growth. There is a strong sense of momentum and a sense that the time is right to step up education and awareness initiatives. This optimism is tempered by veteran players who continue to be frustrated by the high level of unrealized potential, fragmentation, lack of support from government or even counter-productive interventions from within lobby groups representing the municipal sector. Overall, interviewees noted that there is receptivity to moving forward on initiatives to improve the enabling conditions that would see DE grow and expand.

A number of respondents commented on recent growth in the industry. This was particularly relevant to interviewees operating in Western Canada, where the actions of the BC government have stimulated wider interest. Any increase in the level of awareness with respect to DE appears to be linked to the movement towards “green” in general and GHG emission reductions in particular. The downside of this trend is that other DE is not always recognized for the role it can play in the ‘greening’ movement—other initiatives related to greening the electricity generation portfolio with renewable options- like solar and wind- tend to get more attention and fiscal support, to the exclusion of DE. Respondents felt that rising energy prices can only have a positive impact on the willingness of developers and others to consider DE as a way of managing overall energy costs.

For those working with utilities, the prospects for future growth are linked directly to decisions about certainty of pricing, which is linked to decisions about whether or not DE should be regulated. Utilities were seen as having the potential to have a much more significant and proactive role in driving new DE projects.

2.2.1 Focusing on downtowns and core urban areas

Respondents generally felt that efforts to grow DE should target downtowns, denser urban settlements and/or a critical mass of buildings, where economies of scale would allow for DE to deliver the greatest benefits. One respondent commented that it would be “*really helpful to start focusing on more systems in core urban areas where there is load to support DE.*” Respondents often highlighted the synergy between DE and trends towards urban intensification. Urban intensification presents the thermal load density and infrastructure replacement opportunities that improve the shorter term economics of DE infrastructure. DE provides the opportunity to install infrastructure that supports sustainability in terms of energy efficiency and fuel substitution over time.

Respondents expressed that cities should “*innovate*” and adopt DE systems in downtown areas that are able to exploit local opportunities. For example, “*Yellowknife (is) looking at recovering heat from an abandoned mine, to heat the downtown community. Innovation is exciting,*” while others discussed the deep lake water cooling system in Toronto and its ability to serve the downtown office market. It was confidently expressed that DE could play a growing role in transforming the energy and/or heating or cooling requirements of Canadian downtowns; both in terms of traditional core areas and newly developed “greenfield” downtowns such as Markham Centre.

Overall, it was considered that future efforts should be focused on building well supported and viable systems, as the emergence of strong systems will contribute to the strength of the DE industry, as a whole.

2.2.2 Targeting the MUSH sector

"Almost half of respondents believe that up to 10% of MUSH will be connected in 5-10 years"

"One third of respondents believe more than 50% of MUSH will be connected over 30 year period"

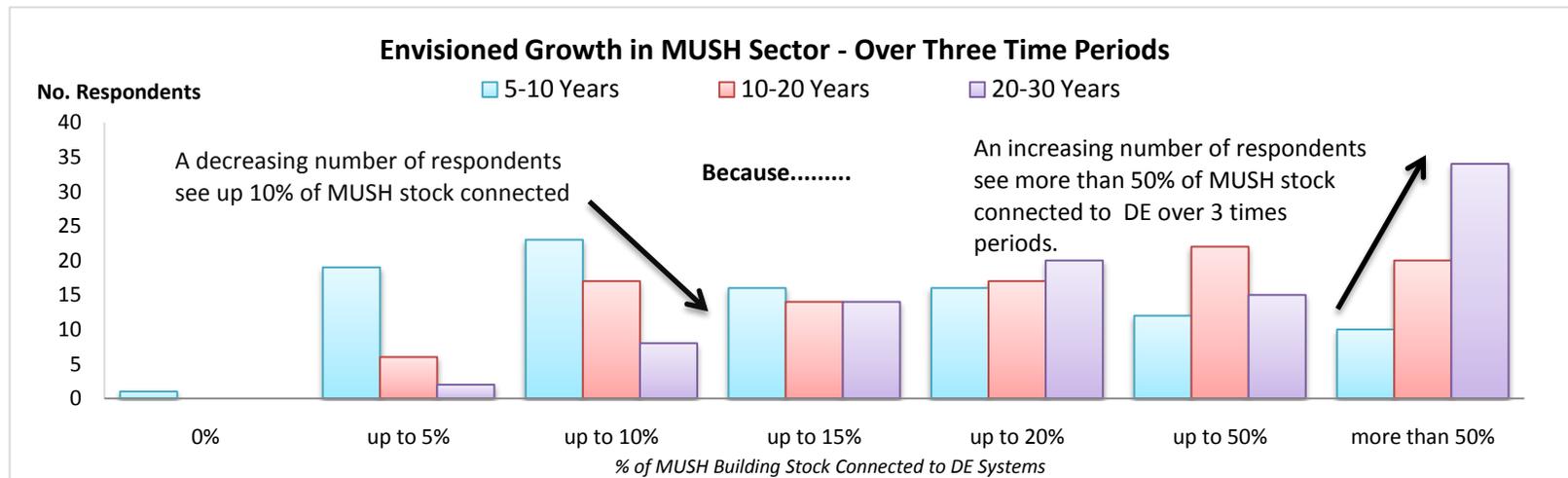
Respondents were asked to estimate the percentage of building stock, by type, which will be connected to DE within several different time periods.¹

Respondents were the most optimistic about growth in municipal, university, school and hospital building stock (MUSH buildings).

In the short term (5 years) a quarter of respondents considered that up to 10% of MUSH building stock would be connected to DE. Several respondents predicted that more than 50% of MUSH buildings would be connected to DE in the next 5 years.

In the long term (20-30 years), over one quarter of respondents estimated that more than 50% of MUSH buildings would be connected to DE. Clearly, this represents significant optimism for DE growth.

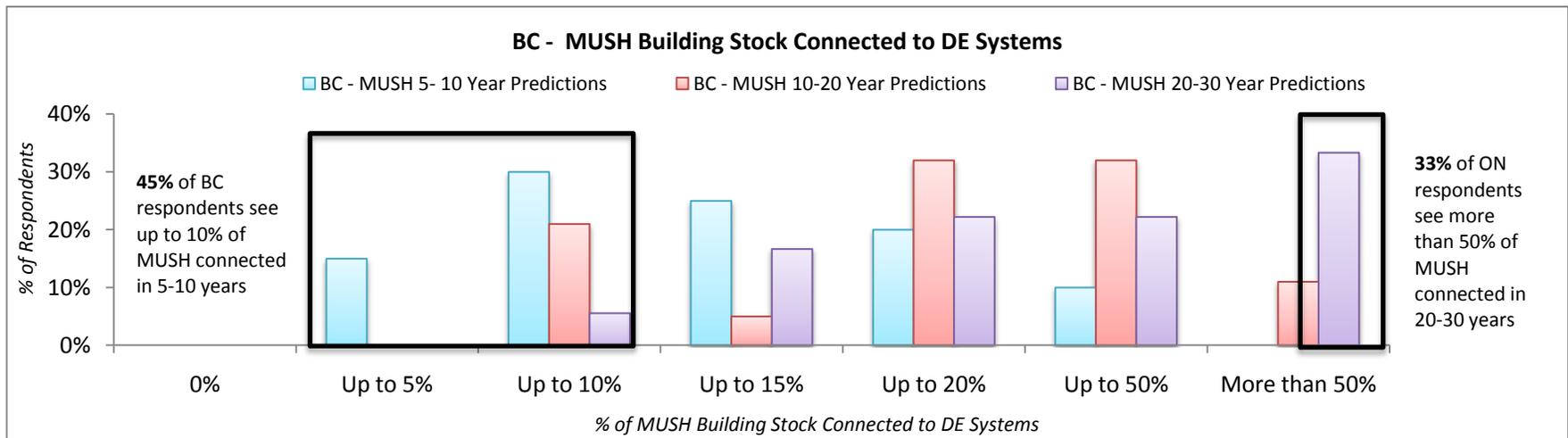
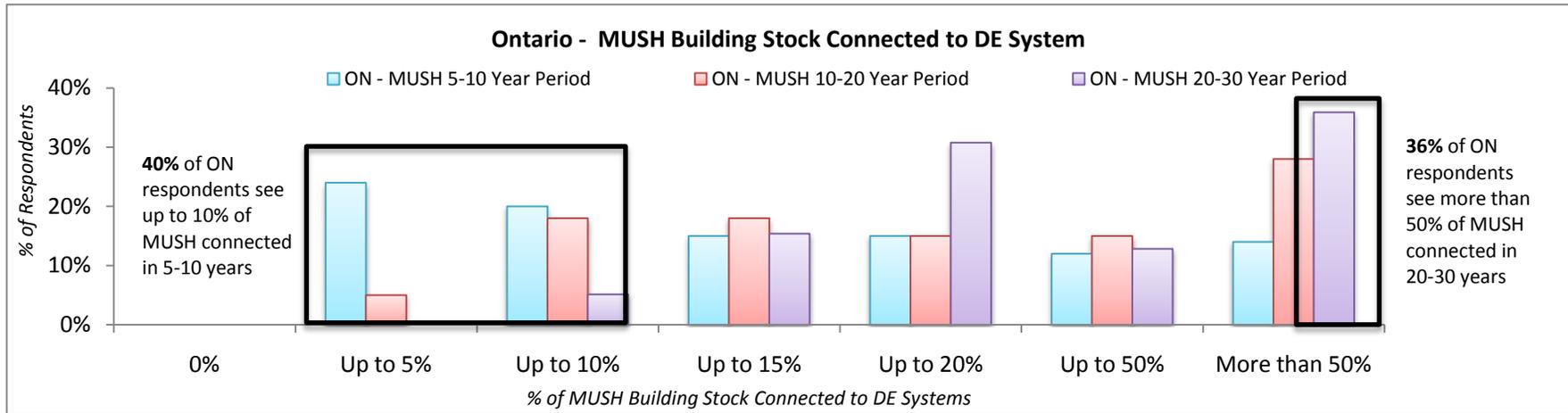
Respondents also commented positively on the continued role of the CDEA in reaching out to the MUSH sector, and advised that this outreach be a priority for the Association, given its perceived prospects for future growth.



¹ Whether the estimated percentage is the total building stock or the marginal increase in new buildings was deliberately left open to interpretation.)

Data has also been presented on a regional basis to help readers understand different opportunities for growth across Canada. BC and Ontario respondents anticipate similar growth in the MUSH sector. BC respondents are more confident about MUSH growth in the medium term (10-20 years), with 75% of BC's participants

(compared to 58% of Ontario respondents) estimating that in 10-20 years more than 15% of MUSH buildings will be connected to DE. In 20-30 years, 77% of BC's participants (as compared to 80% of Ontario participants) estimate that more than 15% of MUSH buildings will be connected to DE.



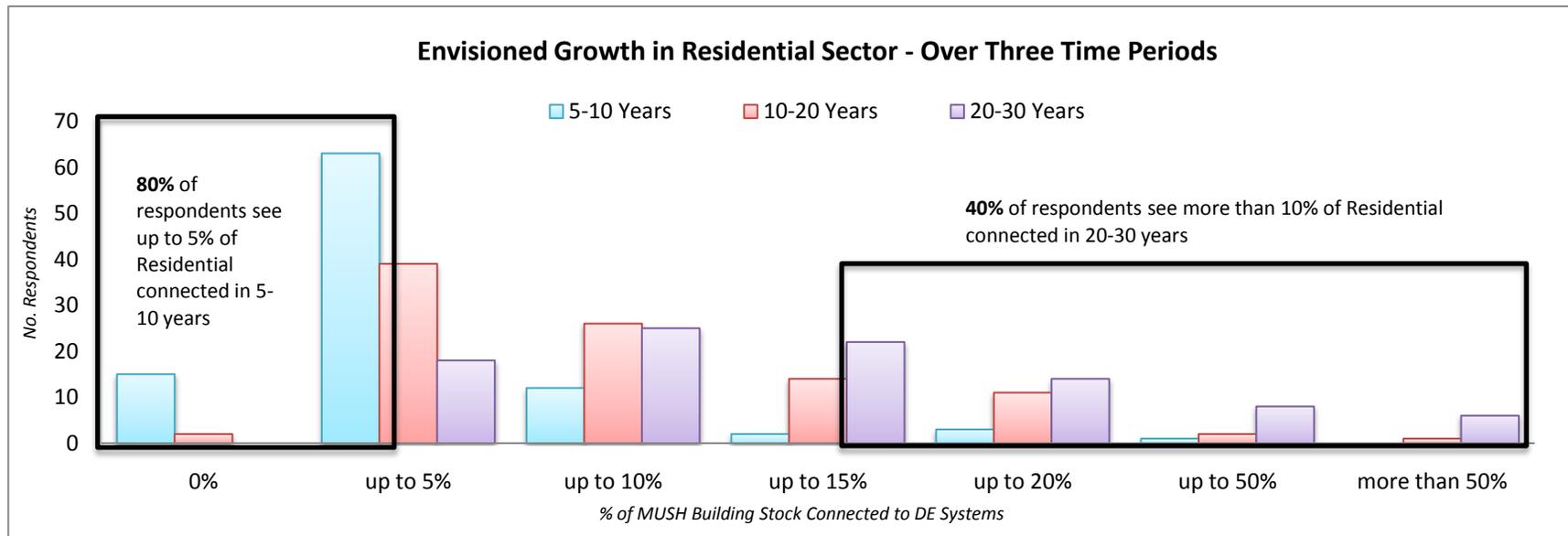
2.2.3 Optimism for DE growth in residential sector

"Three quarter of respondents see up to 5% of residential building stock connected in 5-10 years"

"Two thirds of respondents see up to 15% of residential stock connected over 30 year period"

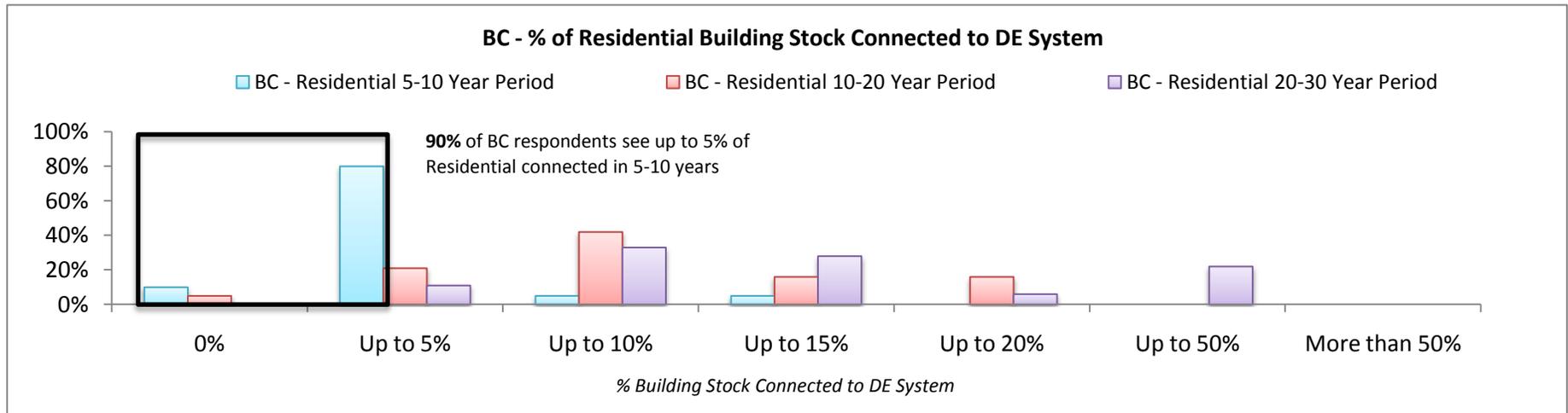
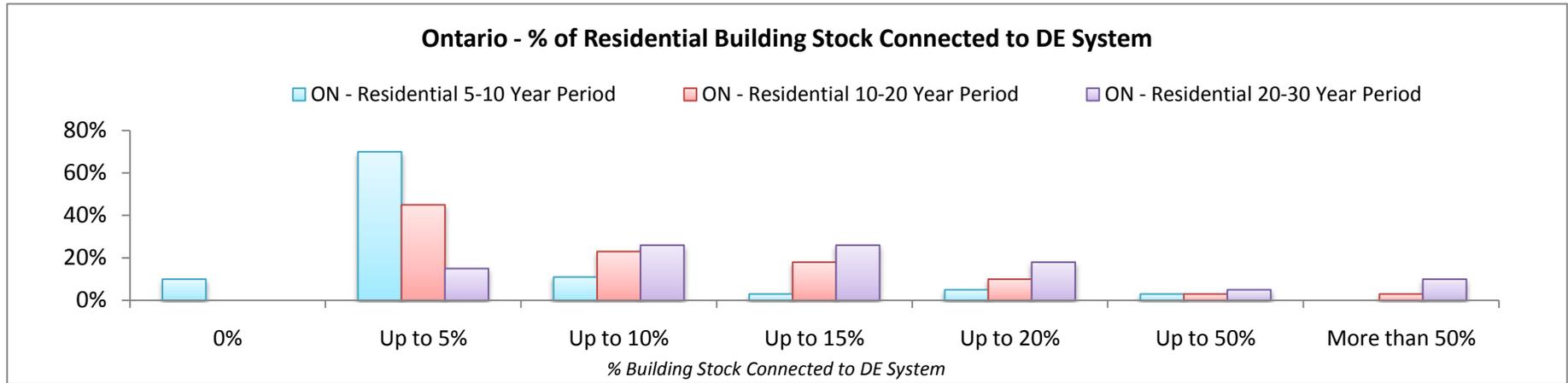
Growth is also envisioned in the residential sector. In the short term, approximately 80% of respondents considered that up to 5% of residential building stock would be connected to DE. This in itself represents significant growth, given the limited role DE currently plays in servicing residential developments.

In the longer term the residential sector showed even better prospects. In 20-30 years, almost half of the respondents estimated that more than 10% of residential building stock would be connected to DE systems. This illustrates the desire and the optimism respondents have as to the opportunity for DE to emerge as part of the mainstream community energy options in 20-30 years.



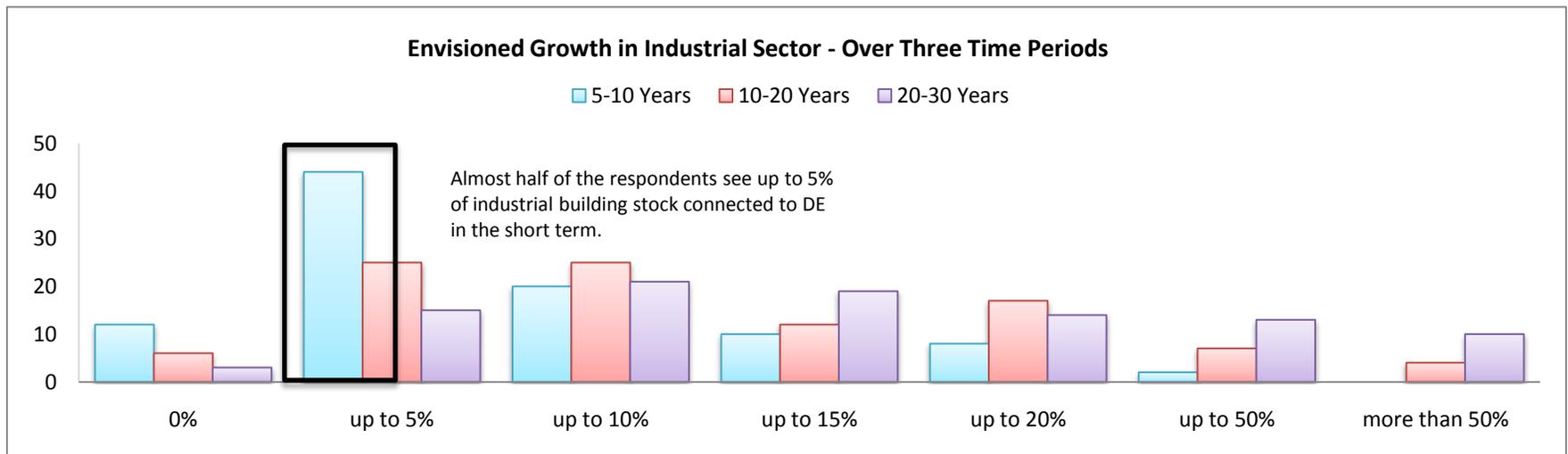
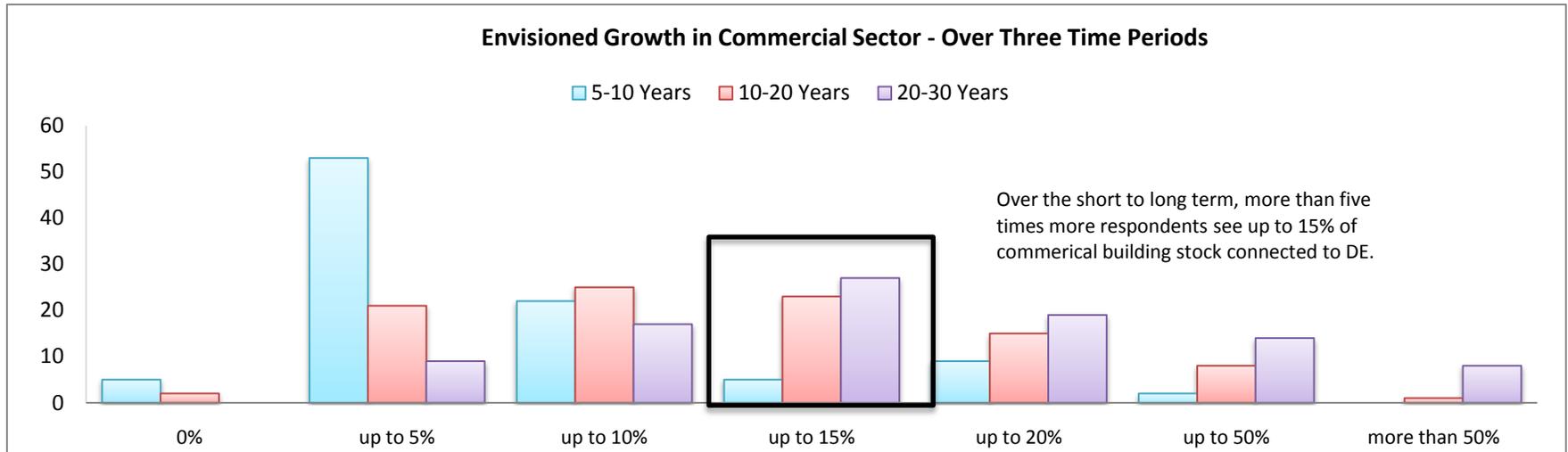
When presented provincially, similar levels of growth are anticipated in the residential sector. However, BC respondents have shown slightly more openness to residential growth, particularly in the

short term, with 90% of BC's respondents expecting that up to 5% of residential building stock will be connected to DE in 5-10 years, compared to 80% of Ontario respondents.



2.2.4 DE Growth is envisaged in other sectors

Growth is also envisaged in the commercial and industrial sector. Growth is anticipated to be stronger in the commercial sector than the industrial sector.



3.0 DE CHALLENGES ARE COMPLEX AND INTERCONNECTED, BUT VARY ACROSS CANADA

3.1 Five DE challenge areas identified

Our research offers a clear sense of both the depth and complexity of challenges facing the DE industry, as well as the range of opportunities to better integrate DE into development practices.

To provide a way to think about the wide range of challenges that were discussed by participants, we have grouped these findings into five key challenge areas. The challenges can be viewed sequentially. That is, one challenge contributes to the others, as DE systems are considered, tested, adopted and managed.

Knowledge Challenges

Education and awareness challenges were widely discussed at all levels of government, across the private sector and in the community. Knowledge challenges were considered to be at the root of all barriers to DE. If people hold misconceptions or are unaware of the potential benefits of DE, DE will continue be overlooked as an energy option by policy makers, planners, developers, elected officials and communities. Increased general knowledge of DE is considered to be of fundamental importance to enabling DE as a future mainstream option for thermal energy provision.

Leadership Challenges

Leadership challenges include the identification and education of individual thought leaders, DE project champions, and stronger political leadership. Leadership challenges also include the creation of a more supportive regulatory and legislative environment

because DE regulatory and legislative certainty contributes to a positive investment regime for DE projects. Progressive and supportive policies can also alleviate many of the economic challenges associated with expanding DE systems.

Economic Challenges

Financial challenges impact the overall economic viability of DE systems. In particular, feasibility can be negatively affected by low energy pricing and a lack of carbon pricing, high upfront capital costs, the length of time required to realize economic returns, a lack of access to capital, biased fiscal policy with low financial incentives and supportive inadequate financing support mechanisms, market penetration risks, and access to a sustainable customer base. In addition, some respondents noted that “DE systems are not always viewed in the same way as other basic enabling municipal infrastructure,” demanding economic returns that did not take into account the other enabling, qualitative and development benefits of community scale energy systems.

Without relatively attractive, risk-adjusted economic returns, it is widely believed that DE projects will struggle to attract willing investors to finance new DE projects. Attracting large-scale investors, such as utilities and pension funds who may be more capable and willing to bear the substantive upfront risk, and relatively long payback periods, will be critical to growing DE into the future. These investors may instead be drawn to relatively lower risk energy investments in assets that are eligible for fiscal incentive programs.

Human Resource Challenges

Human resource challenges relate to availability of expertise in envisaging, designing, building and operating DE systems. While

many respondents considered that DE expertise was sufficient in Canada, others highlighted the complexities associated with human resource challenges; these include a lack of overarching knowledge across the DE sectors, and a lack of local knowledge in designing a DE system to meet the diverse needs of Canadian communities. Additionally, many owner/operators reported challenges in finding experts skilled in operating their own DE systems.

Sustainability Challenges

The sustainability challenges associated with DE relate to the need to position, promote, design and build DE as a mechanism that supports sustainability goals. Many respondents expressed frustration that DE is overlooked as a strategic tool that can contribute to the public's "green" agenda, particularly one that could contribute to communities moving away from fossil fuel dependency, and reducing GHG emissions.

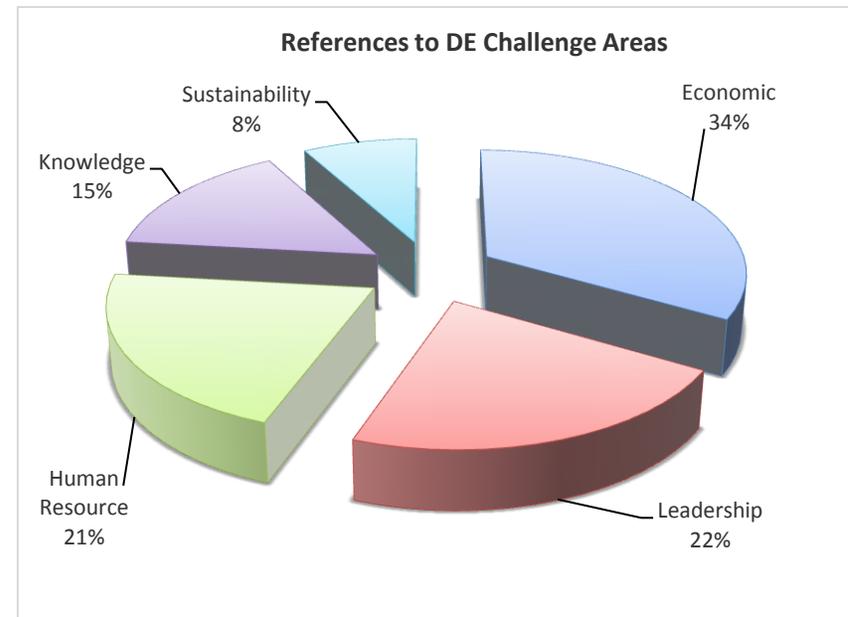
3.1.1 References to challenge areas

DE challenges relate to people not technology

Respondents discussed the above challenge areas with varying frequency. Economic challenges were discussed most frequently (34% of all challenges referenced). This was closely followed by discussions about leadership challenges and human resource challenges (22% and 21% respectively). Discussions about knowledge challenges (15%) sustainability challenges (8%) followed.

Interestingly, most discussions identified challenges that focus on people. Knowledge and human resource challenges relate to a lack of understanding, awareness and technical knowledge about DE.

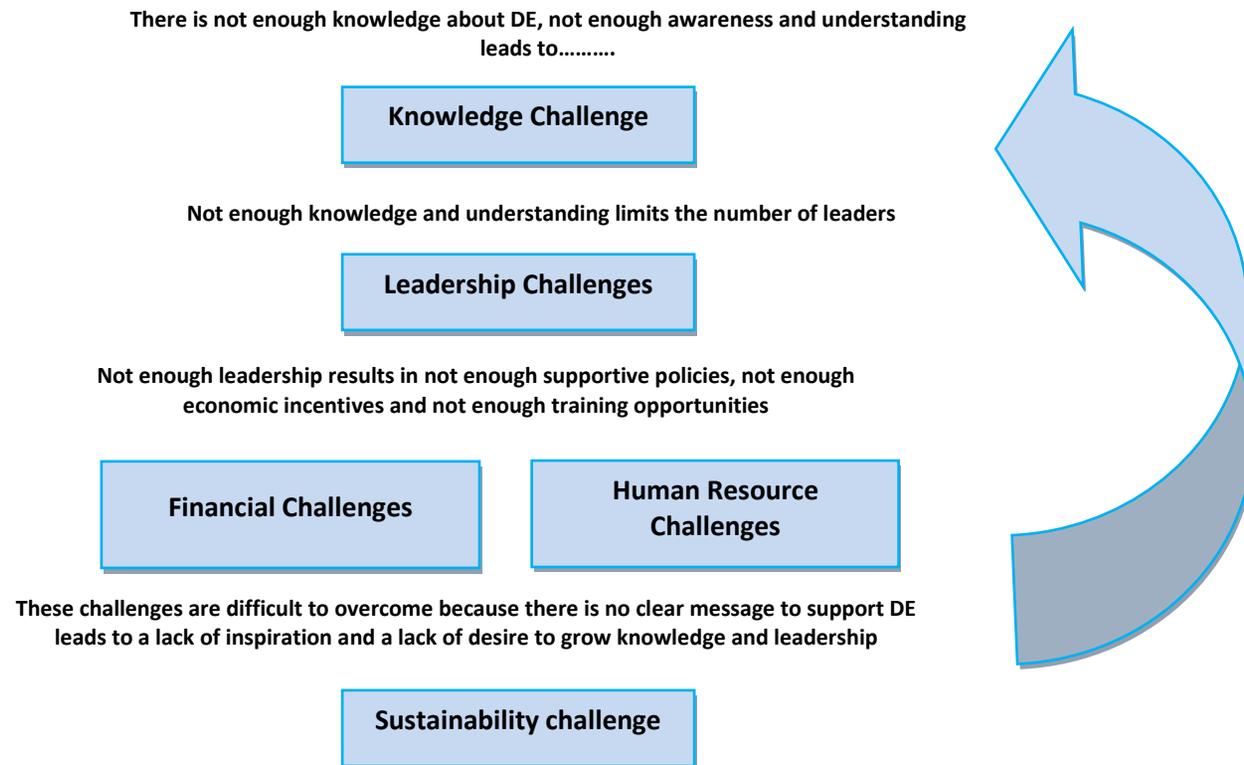
Leadership challenges relate to a lack of champions to drive DE projects and the establishment of a progressive policy framework. Economic challenges also often relates to people creating more supportive policies. Sustainability challenges relate to a lack of ability for the DE industry to promote a strong message that resonates with communities. As DE moves forward, it will be important that it can connect with people in overcoming challenge areas and attract new audiences that can learn about the value of DE to communities.



3.2 Relationship between DE challenge areas

These five key challenge areas are linked and interconnected and build upon each other. For example, our research revealed that there is not enough knowledge about DE (knowledge challenge). General awareness about DE is very low and understanding across the industry is not well integrated across the DE chain. This lack of knowledge leads to a lack of leaders (leadership challenge), there are not enough politicians, planners, engineers, private developers etc that have enough of an understanding about DE and its benefits that they are willing and able to drive individual DE projects or

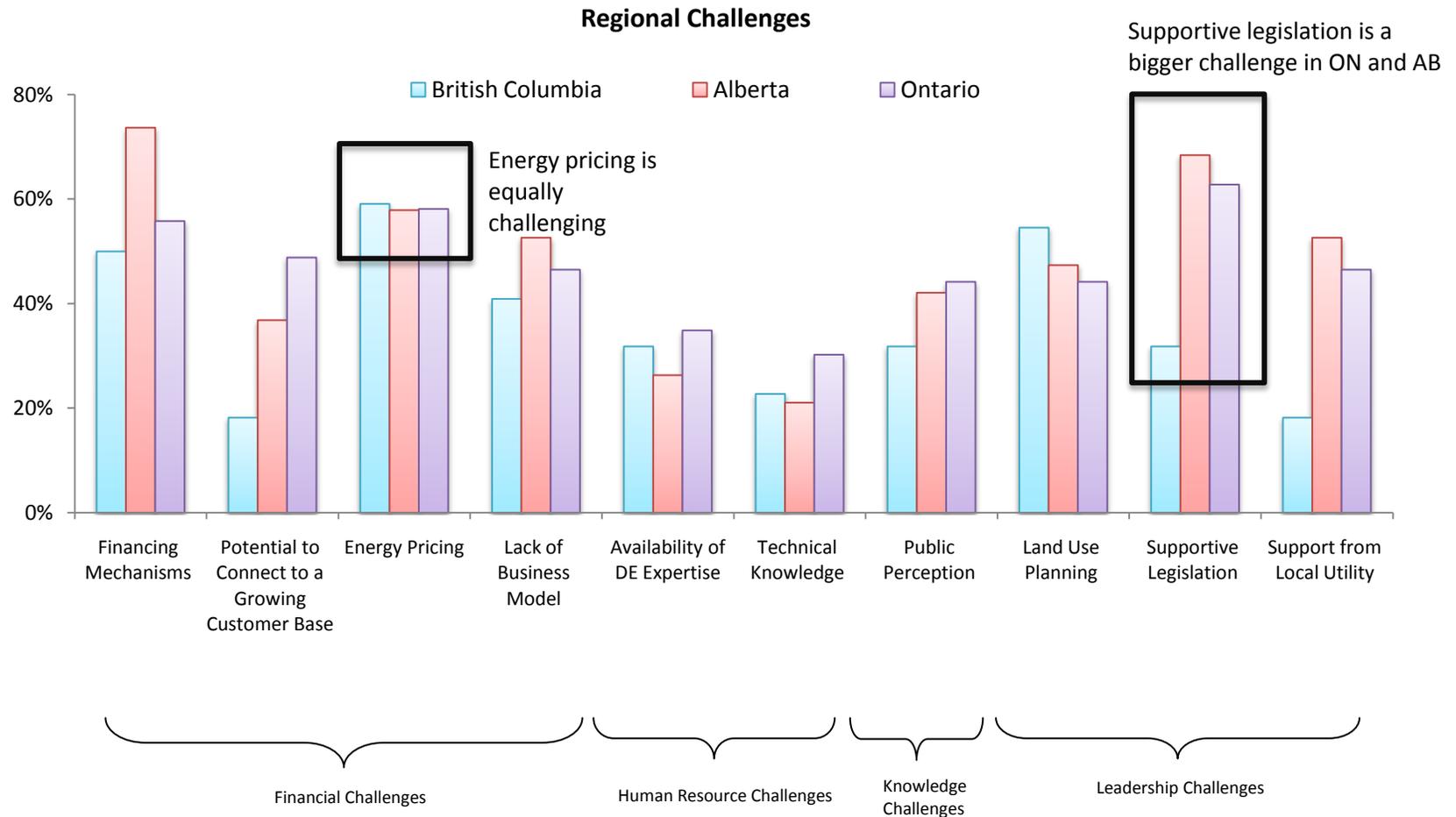
supportive policy initiatives. This lack of leadership, particularly lack of supportive policies, often results in a lack of funding programs for both projects (economic challenges) and for training practitioners (human resource challenges). Moreover, linked and compounding all of these challenges has been the lack of ability for DE to sell and position itself as a green energy option (sustainability challenge). If DE is unable to develop a message that is capable of inspiring leaders, it will be unable to gain the momentum it needs to experience significant growth into the future.



3.3 Variation in DE challenges across Canada

Our research also revealed that regional factors can significantly impact on the deployment of DE across Canada. DE is affected by the local political context; cultural attitudes; local alternative resources (e.g. forest biomass) and historic use of these resources;

local labor force, industry and economic conditions; ownership of local utilities; environmental conditions (i.e., landscape and topography), as well as the size and intensity of urban settlements in the region.



The chart above is based on the short electronic survey: respondents were split regionally and percentages have been developed based on the number of respondents who considered the ten challenges listed to be either “very limiting” or “limiting to a large extent.”

Interestingly, BC respondents generally expressed that they experienced less limitations on the expansion of DE systems. The only category where BC respondents experienced more limitations than Alberta and Ontario respondents was in land use planning matters. BC respondents expressed relatively similar levels of limitations with regard to energy pricing, availability of DE experts and technical knowledge. The key challenges identified in BC are largely experienced at the project level. More specifically, energy pricing contributes to the fuel source powering the system being economically viable, technical knowledge relates to designing and operating the DE system and land use planning relates to gaining support and approval of the DE system and subsequent establishment of a necessary critical mass of development.

Respondents from Alberta and Ontario identified relatively similar challenges, and experienced these challenges to similar degrees. While not considered a significant issue in BC, supportive legislation was considered to be a key challenge by Alberta and Ontario respondents. This could largely be attributed the highly progressive climate change legislation that has been developed in BC and its success in inspiring interest in new DE projects. Likewise, support from local utilities is a key concern for Alberta and Ontario respondents. Again, this is much less of an issue in BC, possibly because of the overarching role BC Hydro plays in delivering and implementing provincial policy. Moreover, the potential to connect to a growing customer base is a key issue in Alberta and Ontario,

but not in BC. This disparity could be attributed to that fact that mandatory connections and government support are more common in many of BC’s DE systems.

Obviously and perhaps most importantly, the use of alternative energy delivery systems is impacted by local energy resources and delivered energy pricing. Electricity produced from hydraulic resources is considered “green” and sustainable. Provinces, such as Manitoba, British Columbia and Quebec, with abundant hydraulic energy resources and relatively low domestic electricity prices, have historically not looked at alternative energy systems. However, in recent years there has been a dramatic increase in activity in BC, driven by environmental imperatives, a change in local feedstock availability and industrial prospects in the forestry sector and an appreciation that future investment in the electricity sector will dramatically affect electricity pricing. There has been an increase in interest in Quebec as well, for some of the same reasons.

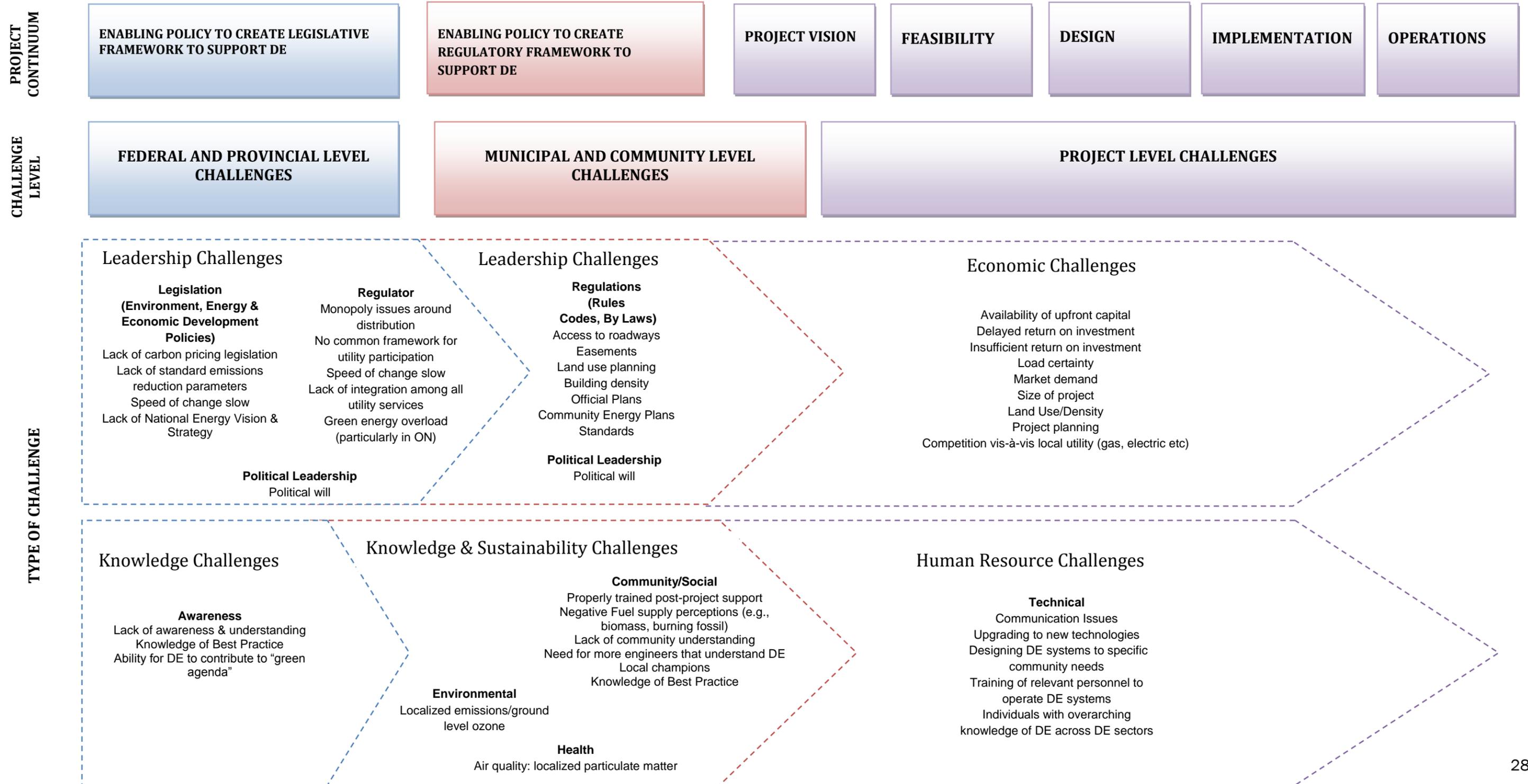
These findings suggest that any effort to promote DE should be tailored to the different regional conditions across Canada.

Overall, the data is reflective of views expressed by respondents in interviews. In summary, BC has been experiencing high levels of success in growing its DE systems across the Province, while respondents from other provinces have expressed a sense of frustration that DE is often being overlooked as a viable option by legislators, policy makers, investors and utility companies.

For additional information on provincial challenges, Appendix A contains a summary of the comments that we heard, relating specifically to local experiences of a province.

4.0 PROJECT CONTINUUM IS A USEFUL BASIS TO UNDERSTAND AND SEGMENT CHALLENGES

There are many challenges involved in getting a project from vision to reality. Respondents identified challenges that tended to relate directly to where they were along the DE project continuum i.e., respondents that were investigating feasibility tended to discuss challenges around economic viability of their future system, while those at the operating stages tended to discuss challenges related to implementation and running their systems. Research for this project has provided the opportunity to speak with respondents from across the entire project continuum, and provided insight into the challenges at each stage, which has allowed us to understand the extent of the project continuum; the different levels at which challenges are discussed; and the nature and types of challenges that have been identified at each level. This is depicted in the diagram below:



5.0 OPINIONS DEPEND ON PERSPECTIVES AND WHERE A STAKEHOLDER IS IN THE PROCESS BUT MOST ISSUES ARE AT THE COMMUNITY AND PROJECT LEVEL

Respondents discussed challenges at many levels: at the ‘global’ (i.e. federal and provincial policy) level; the “macro” level (municipality, community); and at the “micro” level (i.e. at the project level).

The following table provides a summary of where challenges were discussed and referenced.

Please note, the following data references the number/proportion of challenges discussed by respondents at the different project levels, in response to questions 5, 6, 8, and 10 in the in-depth survey.

	Top Two Challenges		% of References at Challenge Level
Federal Government Level Challenges	Leadership	Financial	13%
Provincial Government Level Challenges	Leadership	Financial	20%
Municipal and Community Level Challenges	Leadership	Knowledge and Financial (equal)	41%
Project Level Challenges	Financial	Human Resource	26%

- Overall, the majority (67%) of challenges identified were at the project and community level.
- Challenges were discussed most frequently at the municipal level (41% of challenges discussed).
- Challenges were discussed least frequently at the federal government level (13%).
- Leadership challenges were considered the top challenge at all government levels.

- Knowledge challenges were (equally) the second top challenge at the municipal and community level. Knowledge challenges discussed at this level related to both increasing knowledge in governing bodies and educating the wider community.
- Human resources challenges were discussed extensively at the project level.

The following table provides a summary of what types of challenges were discussed at each level.

<i>% of References to Challenges at Different Level</i>	Knowledge Challenge	Leadership Challenges	Financial Challenges	Human Resource Challenges	Sustainability Challenges
Federal Government Level Challenges	20%	24%	23%	4%	24%
Provincial Government Level Challenges	8%	24%	23%	4%	24%
Municipal and Community Level Challenges	60%	41%	24%	43%	38%
Project Level Challenges	12%	11%	30%	49%	14%

- 60% of knowledge challenges were discussed at the municipal level. This related to both knowledge within municipalities (staff and elected officials), as well as the need to educate the broader community.
- Leadership challenges were discussed at all levels of government with a focus on municipal and community levels. Leadership challenges discussed at the project level related to local project champions driving individual projects.
- Financial challenges were discussed relatively evenly across all levels. At the higher levels of government it was a challenge to increase levels of fiscal incentives available to build DE infrastructure, and at the community and project level it was challenges associated with accessing funding.

- 92% of human resources challenges were discussed at the project level (49% of references) and municipal and community level (43%).
- Sustainability challenges were discussed across all levels of government. At the federal and provincial level (48% combined), challenges were focused on positioning DE to provide a response to the global threat of climate change. At the municipal level, challenges related to leveraging DE in the development of more sustainable and greener communities.

Understanding where challenges exist also allows for a more targeted approach to managing these challenges into the future. More specifically, drawing out these challenge levels gives us an understanding of the most effective areas in which to direct efforts to start overcoming these challenges.

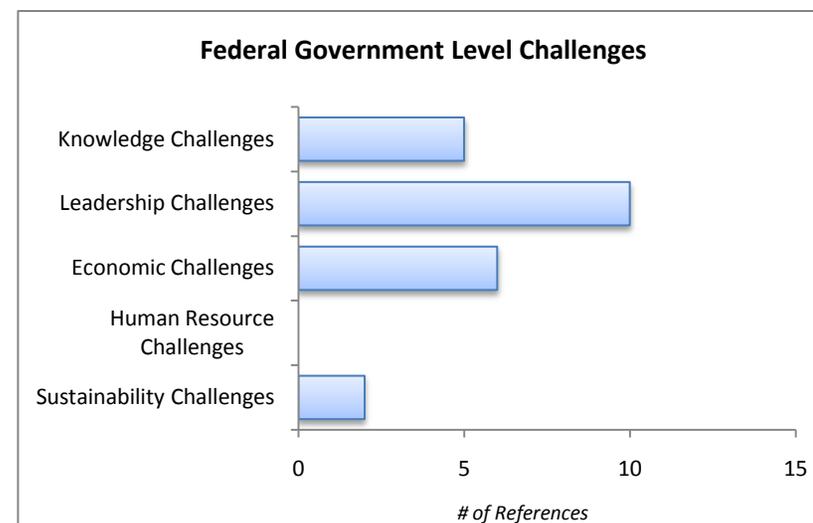
5.1 Federal level challenges

Respondents discussed DE challenges at a federal level, less often than challenges at provincial, municipal and project level.

Responses focused on leadership challenges, particularly the need for a national energy strategy, as well as the establishment of supportive policies and financial programs that can contribute to the increased deployment of DE on a broader level.

Knowledge challenges were also discussed in relation to general knowledge about DE, understanding how it supports global sustainability aims and how it could contribute to reduced dependency on fossil fuels across Canada.

In relation to economic challenges, responses generally related to the need for the federal government to develop DE focused policies or to provide more capital funding for DE projects. This differs from the economic challenges identified at the municipal, community

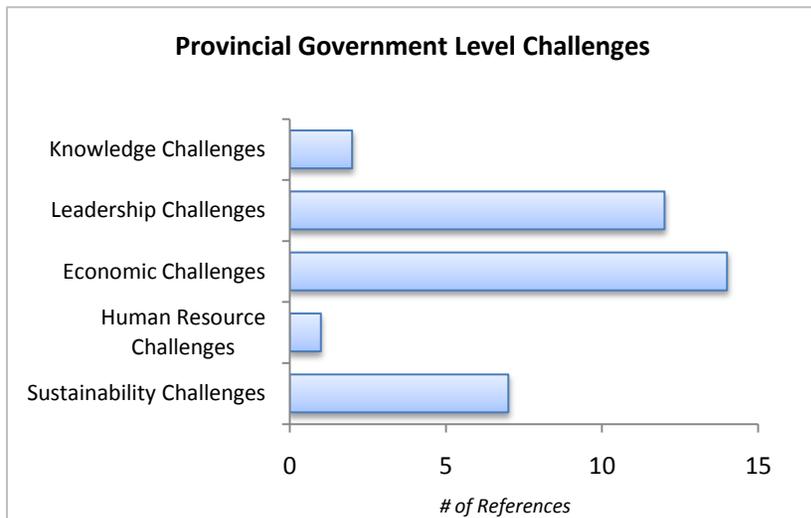


and project levels, which involve accessing capital. This, again, emphasizes the close relationship between financial feasibility and policy directions.

Lastly, discussions around sustainability challenges at the federal level focused on ways that DE could grow its profile in order to emerge as a recognized strategic tool in mitigating the impact of climate change, as well as a provider of a greener energy source.

5.2 Provincial level challenges

Provincial challenges were largely aligned with federal challenges. However, they were referenced more often, which could imply that respondents considered the provincial government to have a more significant role and greater influence over DE than the federal government, as provincial governments have responsibility for municipalities and municipal corporations. This is also logical given the provincial jurisdiction over energy policy.



Leadership and sustainability challenges were predominantly discussed in relation to the importance of supportive policy. Frequently, references were made to the successful provincial level policy initiatives in British Columbia, which have set sustainability priorities in which DE has been identified as a critical solution. This linkage has also been identified as crucial in Ontario, where funding for sustainable energy projects has been focused on wind and solar and has not been extended to DE.

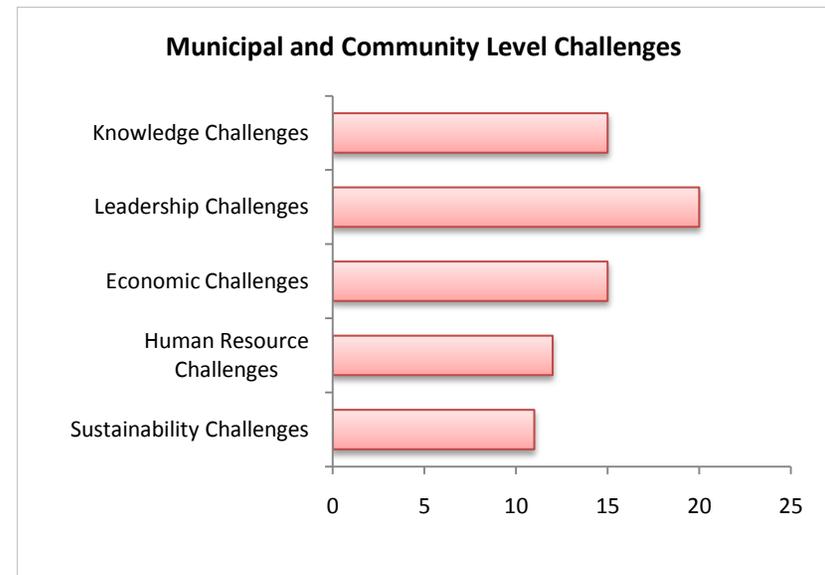
Economic challenges were discussed more often at a provincial level than at the federal level, and included the lack of policies making capital available for DE projects; i.e. financial support to undertake a feasibility study. The need to level the playing field so DE could compete with other renewable energy sources at the provincial level was seen as paramount.

Knowledge challenges were not frequently discussed by respondents at the provincial level. However (as previously noted)

a lack of leadership can result from a lack of knowledge. Therefore knowledge challenges could be an important component of the identified leadership challenge.

5.3 Municipal and community level challenges

The majority of challenges were identified at the municipal and community level.



Leadership challenges, the need for stronger leadership, policy and the need for champions were identified at all levels of government. Yet almost half (47%) of the leadership challenges discussed, were at the community level. This reflects what we heard about municipalities being the key drivers of DE projects. Respondents often highlighted that municipalities not only have the jurisdiction to drive a DE project, but also contribute to the longevity and success of a project. Municipalities have the authority to introduce progressive policy related to urban form, which would contribute to

creating cities and nodes with the critical mass to support district energy. Moreover, they are responsible for local infrastructure, often own local utility companies and are in a position to either directly or through a public/private partnership invest in DE projects.

Knowledge challenges were also frequently referenced. Most commonly discussed were challenges associated with a general lack of awareness about DE, compounding a lack of local champions and a lack of understanding of how DE could best serve communities. There was also a strong focus on knowledge challenges which are resulting from misconceptions about DE technology, particularly in relation to air quality issues associated with biomass. This was seen to be leading to opposition to DE projects (mostly in BC). It was highlighted that some DE fuel sources could be intimidating to a community if what was being proposed was not fully understood. In response to this challenge, some respondents suggested that municipalities need to “*stay in front*” of any community opposition by educating and building awareness of DE from the outset.

The issue of accessing capital to support DE projects was considered to be a key economic challenge the municipal and community level.

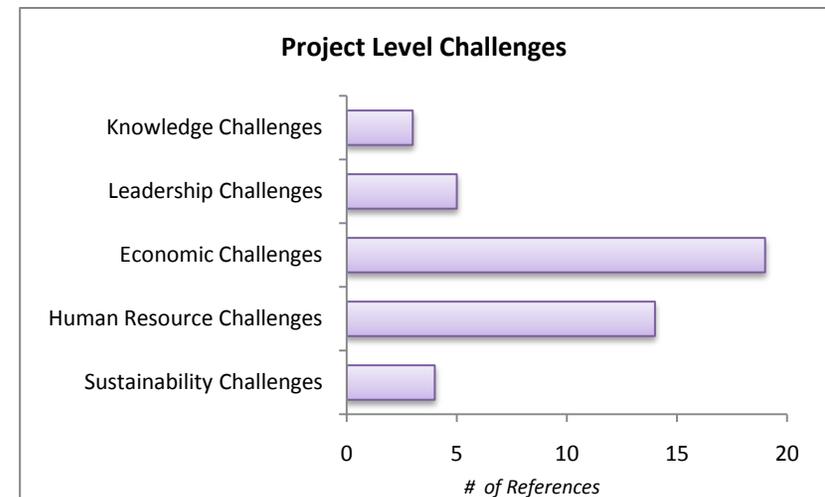
Human resource challenges were largely discussed at the project level (43% of references). Discussions largely revolved around how to design, build and operate DE systems.

5.4 Project level challenges

Almost half of the human resource challenges discussed were at the project level (49%). Discussions largely revolved around how to design, build and operate DE systems. This could be attributed to human capacity constraints being extremely obvious at this point—where the ‘rubber hits the road’, so to speak.

The challenges that were most commonly discussed were a general lack of awareness about DE, resulting in a lack of local champions and a lack of understanding of how DE could best serve communities. There was also a strong focus on challenges resulting from misconceptions about DE technology, particularly in relation to air quality issues associated with biomass. This was seen to be leading to opposition and the politicization of DE projects.

Economic Challenges were most frequently referenced at the project level. Within the project level of analysis, financial challenges were overwhelmingly discussed in relation to project feasibility. Some financial challenges were also identified at the implementation and operation stages of DE. Financial challenges were also discussed in relation to policy and risks associated with a less supportive policy. Overall, this indicates that economic challenges are increasingly apparent at levels closer to project implementation.



6.0 CHALLENGES INFORM THE ACTION PLAN TO ATTAIN THE INDUSTRY'S VISION FOR DE

6.01 Identifying goals for the DE industry

Challenges and actions are entwined and inter-connected

Challenges cited throughout this report have been grouped into five key challenges areas. These challenges areas are inter-connected, with one challenge often contributing or leading to another challenge.

This interconnected relationship can create difficulties in developing clear pathways to help overcome challenges. Challenges and actions are so closely entwined that respondents often expressed similar ideas as challenges and as actions. For example, one respondent may consider that a key challenge is a lack of awareness about DE at the community level. While another respondent may have highlighted the same idea as an action, describing the need to develop DE education programs at a community level. To simplify consideration over the entwined relationship between challenges and actions, we have created broad **goals** for the DE industry. This allows for ideas expressed by all participants to be consistently presented throughout the study.

Creating goals also allows for greater flexibility in determining a way forward for the industry. Goals can provide direction to industry members on where and how future tools and opportunities could be most effectively utilized and applied to help move the DE industry forward.

6.02 Creating an Action Plan to achieve DE goals

Four types of actions

We developed four categories of actions to manage DE challenges. These compartments are discussed below:

- **Education and Capacity Building Actions** seek to address the Knowledge, Leadership and Human Resource Challenges by building well informed, strong practitioners, champions and opinion leaders who can drive DE projects and supportive policy forward.
- **Legislative and Regulatory Actions** are intended to support policy leaders enable DE deployment by identifying the progressive and supportive policy environment that minimizes investment risks associated with DE projects.
- **Knowledge Exchange and Networking**, as well as **Products, Tools and Marketing Actions** support all five challenge areas, by growing the profile and strength of the DE industry and providing (both current and future) stakeholders with the resources they need to accelerate DE projects.

An overarching theme of the proposed Action Plan is to promote education and capacity building actions, as well as information exchange so that major knowledge gaps across the DE industry can be addressed. Products (e.g. education modules), tools (e.g. business case analysis framework, system performance research) and marketing actions (e.g. case study development, robust website deployment) support the communication tools necessary to spread the DE message. All of these actions contribute to the development of a stronger, more informed, coordinated and effective DE Industry.

Selecting actions

While actions have been categorized into types, the actions which comprise the Action Plan have been selected in two key ways. Firstly, actions respond to the highly detailed challenges that have been identified. Secondly, actions have been directly suggested by participants. For example, a participant suggested a specific type of tool that would have helped them move forward in their own DE projects. It is hoped that this research captures the many ideas that were expressed by participants of this study.

One action can help achieve multiple goals

Actions have also been selected for their ability to leverage the interrelationship occurring across the challenge areas. For example, a community education program focused on improving community perceptions about biomass could benefit DE through increasing levels of awareness about DE generally, and its potential benefits to the community. Additionally, this type of education programs could help increase the number of local DE project champions and/or contribute to marketing DE as part of the sustainability solution. It is important to realize this relationship and prioritize actions that are mutually beneficial and reinforcing to the industry as a whole.

6.04 Moving toward DE goals

Achieving DE goals will require commitment

Given the complexity of DE challenges, it is important to note that they will not quickly and easily be overcome. The actions proposed in this report will not likely offer a quick fix to DE problems. Almost all DE challenges are linked to bringing about change in attitudes and cultural norms, which will invariably require time, patience and commitment from a wide range of players.

Everyone has a role to play

Overcoming the challenges identified in this study, will require input from all levels of government, as well as the private sector, industry associations and NGOs. The role of each of these stakeholders will

vary depending on the challenge and their jurisdiction over the challenge. It will be important that stakeholders start to develop clear understanding of the different powers, opportunities and strengths that they bring to overcoming DE challenges and work most effectively to increase DE deployment across Canada.

6.1 Knowledge Goals and Actions

Education and awareness challenges were raised by stakeholders as a critical element of enabling DE deployment. These challenges were discussed at all levels of government, across the private sector and in the community. It was frequently expressed that knowledge challenges are at the root of all challenges. If people misunderstand or are unaware of the potential benefits of DE, it would continue to be overlooked as an energy option by policy makers, planners, developers, elected officials and communities. Increased general knowledge will allow for DE to emerge as a “top of mind option” in meeting energy requirements.

The following “knowledge outcomes” were considered critical to the future success of DE:

- Growing general knowledge and awareness about DE amongst all levels of government;
- Engaging communities to grow knowledge about DE;
- Addressing knowledge gaps and disconnects across the industry;
- Connecting engineers, private developers and potential investors to DE; and
- Developing a stronger understanding of business case drivers.

These outcomes have been discussed in detail below and are coupled with actions designed to support these outcomes.

Growing general knowledge and awareness about DE amongst all levels of government

Respondents expressed significant levels of frustration with the low level of attention that DE was receiving from all levels of government. Respondents felt that DE was being overlooked relative to other types of renewable technology. This was often attributed to a general lack of knowledge about the potential

benefits that DE could offer. It was considered that if DE was able to grow its profile it would be able to inspire increased support, and create many benefits for DE in the longer term.

As one participant remarked, “DE is at the beginning of a typical innovation adoption curve.”² This observation has merit. Innovation requires information and awareness and individual subjective perceptions often influence the diffusion of innovation through social systems. Access to key information to grow general awareness early on in the process was seen as a necessary precursor for creating leadership. At the moment, there are many situations where policy and political decision makers are not aware of DE, or its relevance, because they do not have access to the information that would make its relevance clear.

The impact of low general awareness and poorly integrated understanding across the industry is that there have been relatively few champions, innovators and ‘early adopters’ - a condition necessary to drive any new innovation.

It was also expressed that there has been a lack of awareness of the importance of the thermal component of our energy needs and a lack of awareness of the need and the impact of integrating thermal energy planning with land use planning in community development. Instead, we tend to think of our energy needs in terms of electricity demand, or natural gas demand—as opposed to the customers’

² In 1962 [Everett Rogers](#), a professor of rural sociology published [Diffusion of Innovations](#). Rogers defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption. Innovation diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Rogers’ model highlights the importance of communication to accelerate the diffusion of knowledge and ultimately, implementation of innovation. His model also highlights the role of opinion leaders and change agents in supporting social systems to evaluate and adopt change. Many of the Canadian DE systems in place today have resulted from visionary local leadership.

need for energy to heat and cool their homes, or places of business. In Ontario, for example, 60-70% of total energy used in the residential and commercial sectors is related to stationary uses of energy (i.e. heating and cooling). Once the significance of the thermal needs of communities is understood, we can then turn our collective attention to how best to meet those needs.

Engaging communities to grow knowledge about DE

Misconceptions in the broader community about DE technology were a major concern for participants. Misconceptions, particularly in relation to air quality impacts associated with biomass, were often seen as leading to community opposition to DE projects in BC.

Respondents felt that some DE fuel sources can be intimidating to the community if they do not fully understand what is being proposed, and that this lack of knowledge can be exploited or played upon. For example, a respondent from a municipality cited an example of a journalist recently quizzing him about what alternative fuels might be used in their future DE system. The City's recently commissioned study made reference to a long list of alternatives, including pelletized waste. When it was confirmed that this was one of the options, the newspaper reported on the front page that the City was planning on burning waste in the downtown. These misrepresentations of DE can compound knowledge challenges and fears associated with DE systems. The need to explore ways to communicate clearly, communicate early and to mitigate unintended consequences is an area deserving more attention in terms of education.

Additionally, it was expressed that if the DE system runs on natural gas, *"the reaction is relatively negative -i.e. 'you are just using natural gas,'" as communities are unable to see the environmental benefits of this approach. In this instance, education may also be required on the longer term fuel source flexibility offered by a*

community scale DE system and how this could benefit their communities into the future.

"... where wind is accepted, municipalities have been out in front and driving it. In other municipalities, where the municipalities are unsure or against wind, wind has failed."

Overall, it was felt that community issues largely stem from a lack of knowledge about the potential benefits of DE projects. Once communities are aware of the benefits of DE, they are far more willing to support projects. One respondent likened this phenomenon to what has been seen in the renewable generation market, stating: *"... where wind is accepted, municipalities have been out in front and driving it. In other municipalities, where the municipalities are unsure or against wind, wind has failed."* Similar examples were cited of successful DE projects, such as the deep lake water cooling system in Toronto, which was highlighted for having both a high level of understanding and high level of buy-in. The need to educate the broader community about the role and contribution of DE is considered to be a critical element of successful growth into the future.

Addressing knowledge gaps and disconnects across the industry

Many respondents highlighted the need for overlapping knowledge across the DE industry. This means that DE would benefit from more people understanding issues along the entire DE "value chain." One respondent from Halifax commented *"There is the need for 'horizontal' education and awareness across silos, particularly in the municipal sphere."* Others note that specialized participants in the industry do not necessarily understand or appreciate concerns or issues relevant to colleagues that occupy different but equally important roles.

“...There is the need for ‘horizontal’ education and awareness across silos, particularly in the municipal sphere.”

There were also significant knowledge gaps highlighted within and between ministries and departments, at all levels of government, as well in the private sector. This comment is applicable to virtually all players within the value chain, beginning with policy development (legislation, regulation), integrated energy and land-use planning, energy system design and concluding with DE implementation and management.

Overall, stronger connections and a mutual understanding of other stakeholder needs along the entire chain could influence or even accelerate the success of DE projects. Similarly, a greater appreciation of the integrated nature of land, energy and environmental decisions could increase the likelihood that synergistic decisions would be made.

Connecting engineers, private developers and potential investors to DE

A significant gap in education and awareness is also visible within the engineering sector, whose advice is critical in moving projects from vision to reality. One respondent expressed frustration that practitioners are not bringing DE projects forward as an option for consideration. For example, *“when we ask consultants why certain technologies (e.g. energy from waste or biomass) are not on the table for consultation, we don’t get a good answer— it leaves (us) confused.”* The respondent was unsure if this occurred due to a lack of capacity, a technical oversight or the practitioner having their own agenda.

Developing a stronger understanding of business case drivers

A better understanding of the business case for DE, the economic, environmental gains, and the appropriate governance models for implementation, were all seen as critical needs by municipal project developers. Without this understanding a case cannot be made to municipal decision makers to support DE.

6.11 Knowledge Action Plan

Knowledge Goals	Actions to Achieve Knowledge Goals			
	Education Actions	Knowledge Exchange Actions	Product, Tools, and Marketing Actions	Legislative / Regulatory Actions
Growing general knowledge and awareness about DE amongst all levels of government	Awareness and Understanding of DE (government) - Education programs designed to grow awareness of DE at federal, provincial and municipal level, focused on key role DE could play in delivering green and sustainable energy to communities.			
Engaging communities to grow knowledge about DE	Awareness and Understanding of DE (community) - Develop education programs to grow community awareness about DE, particularly on ways that DE can effectively and efficiently meet community energy needs.			
Addressing knowledge gaps and disconnects across the industry	Training to Expand and Connect DE Knowledge Base Across DE Chain - Develop diverse training programs attended by: federal and provincial policy makers, municipalities, engineers, planners and owners/operators etc. These training programs must be across disciplines, so the DE knowledge base can be broadened and each player can understand the challenges experienced by the other in developing a DE system.			
Connecting engineers, private developers and potential investors to DE	<p>Training Private Developers - Training private land developers on the ways that DE could be integrated into new developments (greenfield, greyfield and brownfield sites).</p> <p>Training Engineers - Training engineers on best practice approaches to system design in a Canadian context. Expose engineers to newest technologies, experiences of Canadian engineers and how to propose new DE projects to development industry.</p>			
Developing a stronger understanding of business case drivers	Training Programs about DE Business Models - Provide education to municipalities, developers and owner/operators about how to best develop a strong and sustainable business model for DE.		Resource and Tool to Develop Business Case - Develop a resource that provides information on key drivers of the DE business case and showcases local success stories. One element of this resource could be a screening tool that supports initial DE assessments and provides guidance on the next steps to developing a system.	

6.12 Moving knowledge actions forward

To address the underlying knowledge limitations that were identified by participants in this study, actions must focus heavily on education and capacity building. To accomplish this task, governments' at all three levels can play a role in both the development of training modules, as well as their participation in education programs to increase levels of DE literacy.

The CDEA has a role to play in the development of education programs and can also serve in an advocacy role to encourage the creation of education campaigns and participation across the public and private sector and the community. The CDEA can also advance knowledge of potential areas for DE expansion; of particular relevance would be developing successful business models that could serve to increase knowledge at the community and project level.

6.2 Leadership Goals and Actions

Leadership challenges involve attracting more DE project champions, visionaries, thought leaders and stronger political advocates to promote the application of DE projects. Leadership challenges also include the creation of a more supportive regulatory and legislative environment for DE, in order to mitigate investment risk associated with DE projects and possibly level the investment ‘playing field’ amongst options for investments in energy infrastructure.

The following “leadership outcomes” were considered critical to the future success of DE:

- Coordinating leadership efforts across government and government levels;
- Cultivating project champions to drive DE projects;
- Municipalities to drive DE through supportive leadership and regulation;
 - Drive community support for DE projects;
 - DE to leverage best practice approaches to urban development;
 - Integrating land use planning and energy planning;
 - DE as necessary infrastructure;
 - Reducing uncertainty through approvals process;
 - Support for DE project in the long term;
- Creating a more supportive legislative framework;
 - At a provincial level;
 - At a federal level.

These outcomes have been discussed in detail below and are coupled with actions designed to support these outcomes.

Coordinating leadership efforts across government and government levels

To develop sustainable community solutions require coordinated effort both within governments (municipal and provincial and federal), and between governments. Leaderships in the form of coordinated energy, environmental and land use policy approaches can greatly accelerate DE deployment.

Coordination is complex given the fragmented policy jurisdiction. Climate legislation is a federal mandate. Energy policy is provincial responsibility. Land use is under municipal jurisdiction, and municipalities are “creatures of the provinces”. There is a clear role for strategic policy – all levels of government. Underlying concerns about financial viability were reflected when interviewees expressed the idea that DE is not seen as “necessary infrastructure,” at any level of government—and an underlying attitude that it is incremental cost rather than enabling service to accomplish community energy, economic development and environmental goals.

Thoughtful and integrated public policy support was identified as an essential element to accelerating the progress of DE implementation. Coordinated energy, environment and land-use policies (e.g. legislation, regulation, municipal bylaws) could be significant enablers of progress. In the absence of enabling policy, community development will most likely continue using conventional energy solutions, losing the opportunity to embed new thermal infrastructure for multiple decades.

Cultivating project champions to drive DE projects

The lack of project champions to drive DE was seen as a major barrier to generating interest in new projects. Recruiting champions across both the public and private sectors was seen as essential. There was appreciation for the role that NGOs could play in

championing the cause for DE. Yet, even in areas with political champions, it was noted that project momentum could still be stalled due to lack of enabling policy.

There was also wide appreciation of the role that CDEA can play in championing the cause of DE. NGOs generally were also seen as having a key role. Organizations such as the Union of British Columbia Municipalities (UBCM), Association of Municipalities of Ontario (AMO), and Federation of Canadian Municipalities (FCM) were cited, as well as the QUEST group (Quality Urban Energy Systems of Tomorrow) and the Technical Safety and Standards Association (TSSA). The role of the CDEA conference, which actively reaches out to planners and municipal officials, was identified as an important communications opportunity. A number of respondents felt that utilities have a significant role to play in promoting DE to their various audiences, provided that the way is cleared for these organizations to firm up their commitment to DE.

Overall, it was considered that DE needs to reach out, share information and recruit more champions. Part of this was thought to involve clear messaging that would be meaningful to environmental, business, political and community leaders.

Municipalities to drive DE through supportive leadership and regulation

Drive community support for DE projects: Municipalities were generally considered to be the most important leaders to enable DE growth into the future. Successful DE projects were largely attributed to the efforts of a proactive and committed municipality.

One respondent said: *“(A) municipality must take continued leadership, and stay in front of the community opposition, otherwise it can take off and overwhelm the project.”* Similar views have been expressed during this research, again emphasizing the major role

that municipal leaders have in contributing to the realization of new DE projects across Canada.

Another respondent observed: *“Municipalities have to be the driver, because they have to continue to be the champions locally. If they are not constantly communicating the positives with their citizens, projects can quickly get derailed.”*

“Municipalities have to be the driver, because they have to continue to be the champions locally. If they are not constantly communicating the positives with their citizens, projects can quickly get derailed.”

Moreover, it was further noted that: *“Community engagement is key. The municipality is closest to the citizens, and if you don’t engage them early on, misperceptions become reality very quickly.”*

Overall, respondents felt that municipalities had a major role in leading communities through energy visioning processes and development of individual DE systems. This support was considered critical to the success of DE projects into the future.

DE to leverage best practice approaches to urban development: Another way municipalities can support DE is by shaping the urban form through effective and progressive land use planning policies, to achieve denser, mixed use urban communities. Fortunately for DE, current approaches to planning are already focused on achieving urban intensification. The economics of DE systems are improved with higher levels of thermal energy density.

“Well the new urban model is mixed use. You live, work and play, all in the same place; a high density urban environment.....so if you have mixed land use, you probably have mixed energy use. For

example if you have people living where they work, you don't just have a midday peak for energy for the office tower you have an evening load for the residential uses....so your system is more efficiently used. Even in a place like downtown Toronto where all the condo development is in complement to the commercial development, it really lends itself to that. I would see that as an opportunity in terms of explaining to people why district energy systems make so much sense. They fit so well with the energy needs of a community."

"...Well the new urban model is mixed use. You live, work and play, all in the same place if you have people living where they work, you...have a midday peak for...the office tower and you have an evening load for the residentialso your system is even more efficiently used... I would see that as an opportunity...(to explain)... why district energy systems make so much sense. They fit so well with the energy needs of a community."

Greater consideration of local energy patterns and requirements, and how these can be efficiently met is also critical. Governments need to talk more to their communities and developers to create land development patterns that are less energy intensive and support DE. The interrelationship between energy and land use, and the potential to significantly impact GHG emissions is not being widely recognized.

Integrating land use planning and energy planning: A key challenge emerging from the "departmental silos" structure of municipal governments is that land use and energy solutions are not well coordinated. This is further exacerbated by the lack of awareness of the potential for integrated energy planning in

business and operational planning, which is undertaken across all municipal departments. Even in jurisdictions where integrated energy planning is underway, there are challenges in understanding how to move from vision to implementation—municipal culture and operations, community awareness, land use and building bylaws all need to be demonstrably supportive through coordinated actions in order to achieve community-based integrated community energy solutions. There is clearly a need to better understand how these solutions are introduced, implemented, and sustained within a municipal environment and culture.

Simply put, there has been a lack of awareness of the importance of the thermal component of our energy needs and a lack of awareness of the need and the impact of integrating thermal energy planning with land use planning in community development. Instead, we tend to think of our energy needs in terms of electricity demand, or natural gas demand—as opposed to the customers' need for energy to heat and cool their homes, or places of business. In Ontario, for example, 60-70% of total energy used in the residential and commercial sectors is related to stationary uses of energy (i.e. heating and cooling). Once the significance of the thermal needs of communities is understood, we can then turn our collective attention to how best to meet those needs.

DE as necessary infrastructure: Underlying concerns about financial viability were reflected when interviewees expressed the idea that DE is not seen as "necessary infrastructure," at any level of government—and an underlying attitude that it is incremental cost rather than enabling services like other public infrastructure. It was considered municipalities could begin to change these attitudes by broadly considering the many benefits delivered by DE systems to communities.

Reducing uncertainty through approvals process: It was noted that municipalities could contribute to reducing uncertainty through the planning and building approvals process by enforcing supportive by-laws that facilitate development of DE systems. One respondent suggested developing a by-law package that could be adopted universally by municipalities across Canada to streamline the approvals process. This would reduce uncertainty not only for developers of DE systems, but also for municipalities who would be clearer on all matters that they should be considering for the new DE system that will be developed in their community.

Support for DE project in the long term: While DE systems need to be self-sustaining economically, there are a variety of positive measures that municipal government can take to support the system; e.g., educating developers about the benefits of connecting to the system, mandating that new or existing buildings connect to a DE system or encouraging urban intensification around a DE plant. Overall, it was expressed that successful DE systems generally benefit from ongoing support offered by the local municipality.

Creating a more supportive legislative framework

At a provincial level: Respondents considered that the provincial government could have a significant role in driving successful DE projects. To support this viewpoint, respondents frequently referred to the progressive suite of climate change policies in BC, which they considered to have been catalytic in generating new interest in DE systems. Respondents often expressed hope that other Canadian provinces would develop similar legislative tools to those which have been developed in BC to help grow interest in DE. It was noted that these types of legislative changes were unlikely to occur without growing general awareness about DE across provincial levels of government.

At a federal level: It was widely remarked that a major hurdle was the lack of a national framework within which the strategic application of DE can be implemented. This overarching framework is an essential condition that needs to be addressed if a consensus around the “value proposition” of DE is to be developed.

Federal support for DE could also include: carbon policy, education initiatives, research support, coordinating communications and adopting a ‘good neighbor policy’ whereby federal buildings are connected to proximate DE systems wherever practical. It was highlighted that the federal government has already made many strides towards promoting and funding education programs to grow the profile of DE across Canada.

6.21 Leadership Action Plan

Leadership Goals	Actions to Achieve Leadership Goals			
	Education Actions	Knowledge Exchange Actions	Product, Tools, and Marketing Actions	Legislative / Regulatory Actions
Coordinating leadership efforts across government and government levels	Awareness and Understanding of DE (government) - Education programs designed to grow awareness of DE at federal, provincial and municipal level, focused on key role DE could play in delivering green and sustainable energy to communities.	General Networking Opportunities - Create networking opportunities to strengthen relationships across the industry. Transfer Knowledge About Risks Along the Project Continuum: Opportunities for knowledge transfer across the DE industry so all players can learn of the risks associated with different stages of project development.		
Cultivating project champions to drive DE projects	Awareness and Understanding of DE (community) - Develop education programs to grow community awareness about DE, particularly on ways that DE can effectively and efficiently meet community energy needs.	General Networking Opportunities - Create networking opportunities to strengthen relationships across the industry and grow knowledge and understanding of the various applications of DE.	Clear Messaging and Marketing - Develop a clear, unified message to market DE. Spread this message nationally. Ensure this message becomes synonymous with DE. This message must be capable of inspiring action and champions.	
Municipalities to drive DE through supportive leadership and regulation	Awareness and Understanding of DE (community) - Develop education programs to grow community awareness about DE, particularly on ways that DE effectively and efficiently meet community energy needs. Municipal Awareness - Connections between Energy and Land Use Planning – Grow awareness in municipalities about the benefits of integrating land use, environmental and energy planning efforts. This could include information on how other municipalities have realized these connections, the ways to get there and how organizational changes can be realized to develop this connection.		By-law Package - Develop a standardized by-law package to encourage and/or manage the DE application process.	Progressive Land Use Planning Policies - Municipalities to develop policies that can contribute to smarter cities, which jointly consider urban intensification and how this can be leveraged by DE. More specifically, municipalities could look to examples of integrated land use and energy planning. Develop Financial Incentives - Develop financial incentives that can support DE, such as financing to assist in undertaking feasibility studies or low interest loans to help support upfront capital costs.
Creating a more supportive legislative framework				Provincial Carbon Pricing – Provinces could take the lead in developing carbon pricing. Provinces across Canada could collaborate to adopt consistent and effective approaches to carbon pricing. Revise Building Codes to Consider DE in Major New Developments - Revise building codes to be more supportive of DE projects. For example, DE could become a key element in new green field developments. Revise Provincial Policy to Consider Connections Between Energy and Land Use - Revise PPS to provide a stronger focus on integrating environmental, energy and land use planning. Allow for Mandatory Connections to DE - Develop legislation across Canadian provinces to allow for mandatory National Energy Strategy - Develop a National Energy Strategy. This strategy would likely deal with the issue of introducing national carbon pricing and/or energy pricing scheme.

6.22 Moving leadership actions forward

Leadership a key challenge group throughout this study, and it is therefore unsurprising that the actions proposed to address this challenge area spans across the four action categories.

Leadership actions have a strong focused on education. As it will be important to develop a solid base of understanding amongst government and community leaders before they can take action to advance DE.

Leadership actions also have a strong focus on legislative and regulatory actions. All levels of governments will have an important role to play in the development of a more supportive legislative and regulatory framework for DE. The federal and provincial governments have strong ability to move a supportive legislative framework for DE forward. At the municipal level, a vision for DE can be promoted and adopting integrated land use and development.

The CDEA has a specific role to play within leadership actions to develop education modules for leadership and facilitate the exchange of knowledge between DE actors. Although the development of supportive legislation for DE is crucial to advancing it at the leadership level, the role of the CDEA is limited to advocating for the development of various policies.

6.3 Economic Goals and Actions

Economic challenges refer to those matters identified by respondents that impacted the financial feasibility and/or sustainability of DE projects. In particular, feasibility and long term viability can be negatively affected by energy pricing, high upfront capital costs, length of time required to realize economic returns, lack of access to capital and financial incentives, lack of supportive financing mechanisms, the rate of market penetration and customer connection risks, the need for a stronger business case and access to a sustainable customer base. Without supportive economic conditions that would mitigate some of the long term capital risk, it is largely considered that DE projects will struggle to attract willing investors to grow DE systems into the future.

The following “economic outcomes” were considered critical to the future success of DE:

- Reducing risks associated with building a DE system over time;
- Attracting new investors with a long view;
- Competitive energy pricing;
- Understanding how energy pricing affects economic feasibility;
- Developing a stronger business case for DE;
- Creating innovative government incentives and supportive programs;
- Identification of the best governance model Integrating DE with infrastructure upgrades.

These outcomes have been discussed in detail below and are coupled with actions designed to support these outcomes.

Reducing risks associated with building a DE system over time

One of the most critical challenges for DE is the real and perceived economic risks of developing a DE project. On the ground this often relates to how to best size DE systems initially, and then build them incrementally so as to phase the development of a system

coincident with load growth. In this way, DE systems can grow with a lower risk to economic viability, while simultaneously meeting the growing and changing needs of a community. One respondent commented the best approach is *“build a bit, wait, build a bit, wait.”* Another respondent commented that it is best to approach development in terms of: *“marginal cost marginal revenue. The goal is not to overbuild.”* The idea is to just to *“build enough so that you only build when revenue is guaranteed or a known quantity.”*

The importance of customer connection and a secured revenue stream was of paramount importance to many respondents, and often repeated. Absent a regulatory environment that mitigates the risk of distribution system expansion, and customer connection, there is considerable uncertainty and risk in building out DE systems in a ‘just in time’ manner to match community development. One respondent commented: *“What we struggle with (in terms of capital investment).....is how far we put the pipes in the ground. Do we service first and wait for the customers, or do we have the customers knock on our door and then put the pipes in? So there are pre-servicing questions that we are struggling with. Because what happens if we put this infrastructure in place and the buildings we can’t incent them enough that they don’t want to connect then we’re stuck with an investment in the ground that has no return. We’re kind of struggling with that right now.”* It is clear that avoidance of stranded investment achieved through certainty of a solid customer base and connections is absolutely critical to all owners, operators or investors in a DE system.

“...What we struggle with (in terms of capital investment).....is how far we put the pipes in the ground. Do we service first and wait for the customers, or do we have the customers knock on our door and then put the pipes in?”

This comment encapsulates one of the most significant business dilemmas for investors building a DE system. The risks are substantial. Almost all owners and operators discussed issues

around the potential for their DE system to be able to connect to the potential customer base. The key factor remains the ability to gain support and be confident from the outset that they had a secure source of revenue.

Attracting new investors with a long view

There is a need to attract new investors to DE projects, as well as investors committed for the long term. One respondent noted that *“DE requires a different type of investor, not somebody that’s in it for the short term.”* Because of the concerns about the high upfront capital cost, it was expressed that investment from organizations with deep pockets, like pension funds or utilities could be the focus of efforts to grow the number of DE investors.

There were concerns that returns on DE investments, particularly in the short term, may not be high enough to attract interest from significant investors, such as utilities. One respondent commented *“private companies won’t get involved with things that have less than 10% return.”* Another commented: *“Ontario...is raising the return on capital for utilities—moving from 8.5 to 9.8% rate of return...”* which would mean that *“8-9% will not attract Union Gas--- (rather, they) would want to look at something with a higher return. Pension funds might weigh in.....because of the ability to earn on that capital in the long term.”*

To be successful in attracting larger investors, the DE market has to position itself and operate at a greater order of magnitude to gain the interest of these pension funds and utilities. It was suggested that this is where federal tax legislation could be instrumental in creating interest. Interviewees cited the CDEA’s positive contribution with respect to improvements in capital cost allowance provisions. Additional actions along these lines might be helpful in moving towards addressing these challenges and attracting such investors.

Competitive energy pricing

It was highlighted that Canada offers some of the world’s cheapest energy and that this makes it incredibly difficult for DE to compete. In the short survey component of this study, energy pricing ranked as the most critical challenge for DE, and it was considered equally challenging across all regions of Canada and the industry. This suggests that government policy could have a significant impact on improving the economic viability of DE through, for example, fiscal policy (incentives); carbon pricing policy; bylaws and/or permitting processes that reduce the risk of customer connection; developing a DE regulatory framework which provides certainty of system expansion cost recovery and investment rate of return . This would not only affect DE, but would have implications more broadly to other energy forms. Such policy changes need therefore to be done thoughtfully.

Government could explore fiscal policy (incentives) that could help support DE. Particularly, carbon pricing policy; bylaws and/or permitting processes that reduce the risk of customer connection; developing a DE regulatory framework which provides certainty of system expansion cost recovery and investment rate of return.

Understanding how energy pricing affects economic feasibility

Another key economic challenge related to energy pricing, is ensuring that practitioners understand how energy pricing and pricing risk affects the economic feasibility of a system.

According to one participants: *“There often tends to be engineering expertise, the people running the project are very good at construction....(and).....at project management, etc., but the commodity aspect, the price risk aspect of buying (natural) gas and selling energy, (and understanding) the margin between those two and how (they) move, and affect my bottom line is often not well understood.”*

It was expressed that people developing projects typically come *“from the utility side so they tend to be unfamiliar with how the commodity works and the volatility of gas prices...often they don’t take that appropriately into account in their planning economics. They come to a realization too late. So two or three years before the project goes into service they make some assumptions about what (natural) gas is going to cost them and they don’t think about gas again until a month before they’re ready to fire up the plant and they find that the gas price is a little different now than it was then. We’ve often seen situations where the operating economics are fundamentally different than what was assumed and often not for the better. So there’s a risk management issue there.”*

“...We’ve often seen situations where the operating economics are fundamentally different than what was assumed and often not for the better. So there’s a risk management issue there.”

Again, this comment underlines the need for knowledge transfer across the entire DE industry. This will result in a stronger ability to respond to challenges and recognize risks that cut across many project stages; i.e. design, feasibility, risk management and project management. It is important that all parties involved in the project have an understanding of the economics and the economic assumptions being made so that a feasible system can be designed and delivered.

Developing a stronger business case for DE

Respondents indicated that they had challenges creating and communicating the business case propositions for DE projects, in light of relatively low energy prices and the absence of a carbon pricing framework was a recurring theme. A deficit of information related to fuel sources, technology options and energy pricing, typical load growth has made it difficult to develop credible business case analyses. Weak or even incorrect economic analysis can create future issues for projects, and repetitive mistakes.

It was also noted that many DE systems are being considered and or built where the business case may not exist to support DE. One respondent said they know of a specific situation where: *“[The] business case ...(is poor)... and is unlikely to work out—developers are saying there are better ways to make energy, with highly efficient buildings—building density is not there, distances from the lake are too long—other, better ways, to meet the energy needs of the community exist.”*

It was broadly believed that if a DE system was not economically viable it should not be built. Respondents were concerned that developing a DE system that proves to be non-viable could adversely impact on the reputation of the DE industry, and potentially also tarnish the reputation of more profitable projects.

Creating innovative government incentives and supportive programs

This lack of policy leadership in many Canadian provinces, has also resulted in a lack of an enabling fiscal regime to build academic programs to train practitioners. In fact, some regulatory requirements (e.g. standards) related to boiler operation add to the financial burden of operating small-scale DE systems, This situation is compounded in jurisdictions that in effect bonus other forms of renewable development or in cases where more traditional energy sources have the benefit of a regulatory framework within which to plan and operate. Some jurisdictions are able to require new development to connect, but in most places connection is voluntary. This has an impact on the speed at which critical thermal load— and financial viability – can be achieved.

DE systems require different types and levels of support over the project development and operation continuum. One respondent suggested that having cost-sharing programs for initial investments could increase likelihood of successful projects. There was also the suggestion that the establishment of programs for feasibility studies

and advice on DE systems, legal support, and risk assessments could help DE systems to be advanced. Once the DE system is up and running, it is critical that government support of the system continues through policies and programs that encourage local businesses and new developments to connect. This support can take many forms—from bylaws that require new developments to connect, to those that require certain energy and environmental performance, to moral suasion. The continued recognition of the interrelationship between municipal development and energy development, and support to ensure a positive and reinforcing development relative to community goals—in many forms—was what was seen as critical for ongoing economic viability.

Identification of the best governance model

For a number of interviewees, a major concern related to the lack of guidance about how to identify and select appropriate ownership and governance models.

“...So the big question for local government is whether they should own and operate the system, should they be more hands off or arms length and establish and arms length organization to run it, or should they engage in partnerships to capitalize, operate and run the system?”

Creating a governance model for DE is of particular concern to municipalities as reflected by one respondent: *“So the big question for local government is whether they should own and operate the system, should they be more hands off or arms length and establish and arms length organization to run it, or should they engage in partnerships to capitalize, operate and run the system?”* Similar comments were made by respondents from other municipalities. Each model obviously represents different levels of risk and reward to the municipality, the DE system operator and the DE customers. These matters need to be carefully considered relative to the goals

of development communities, and more support is desired so as to understand and evaluate the costs and benefits of each.

Integrating DE with infrastructure upgrades

Many respondents suggested DE could benefit from integration with infrastructure upgrades. More specifically, there could be increased thought about *“integration of bylaws (land use planning) and DE.”* For example, *“When (a) city (is) tearing up roads, (the DE operator could) get some priority access to lay pipe in...And not bear any of the excavation cost.”* This approach would help create logistical and therefore economic efficiencies associated with installing DE infrastructure. This integration would further allow DE to start emerging as an essential component of municipal infrastructure.

More broadly, the need to replace aging infrastructure across the country could usefully be tied to the “infrastructure deficit” issues that are frequently discussed. This synergy occurs for DE at the project level, where the capacity to ensure that projects meet their budgets both in construction and operations is essential.

Overall, better integration allows for more cost and time efficient redevelopment of municipal infrastructure. At the same time, integration could help overcome financing constraints experienced by project developers. Full integration is likely to occur only when DE is seen as an essential municipal infrastructure.

6.3.1 Economic Action Plan

Economic Goals	Actions to Achieve Economic Goals			
	Education Actions	Knowledge Exchange Actions	Product, Tools, and Marketing Actions	Legislative / Regulatory Actions
Reducing risks associated with building a DE system over time		<p>Strong Knowledge Base that Can be Leveraged: Start to develop a strong knowledge base to design DE systems that specifically meet the needs of Canadian communities i.e. size of systems, fuel source, supply chain etc. Allow this knowledge base to be leveraged by new municipalities and/or owners and operators starting out in developing a system.</p> <p>Transfer Knowledge About Risks Along the Project Continuum: Opportunities for knowledge transfer across the DE industry so all players can learn of the risks associated with different stages of project development.</p>		<p>Develop Financial Incentives - Develop financial incentives that can support DE, such as financing to assist in undertaking feasibility studies or low interest loans to help support upfront capital costs.</p>
Attracting new investors with a long view	<p>Grow Awareness and Understanding Amongst Potential Investors on DE - Develop an awareness program targeting potential investors, such as utilities and pension funds, which could take the long view on a DE project.</p>	<p>General Networking Opportunities - Create networking opportunities to strengthen relationships across the industry.</p> <p>Connect to Potential Investors - Develop a strategy to connect DE to potential investors, such as utilities and pension funds, which could take the long view on a DE project.</p>		
Competitive energy pricing				<p>National Energy Strategy - Develop a National Energy Strategy. This strategy would likely deal with the issue of introducing national carbon pricing and/or energy pricing scheme.</p> <p>Provincial Carbon Pricing – Provinces could take the lead in developing carbon pricing. Provinces across Canada could collaborate to adopt consistent and effective approaches to carbon pricing.</p>
Understanding how energy pricing affects economic feasibility	<p>Training to Expand and Connect DE Knowledge Base Across DE Chain - Develop diverse training programs attended by: federal and provincial policy makers, municipalities, engineers, planners and owners/operators etc. These training programs must be across disciplines, so the DE knowledge base can be broadened and each player can understand the challenges experienced by the other in developing a DE system</p>			
Developing a stronger business case for DE			<p>Resource and Tool to Develop Business Case - Develop a resource that provides information on key drivers of the DE business case and showcases local success stories. One element of this resource could be a screening tool that supports initial DE assessments and provides guidance on the next steps to developing a system.</p>	
Creating innovative government incentives and supportive programs				<p>Develop Financial Incentives - Develop financial incentives that can support DE, such as financing to assist in undertaking feasibility studies or low interest loans to help support upfront capital costs.</p>
Identification of the best governance model	<p>Training Programs about DE Business Models - Provide education to municipalities, developers and owner/operators about how to best develop a strong and sustainable business model for DE.</p>			
Integrating DE with infrastructure upgrades				<p>Integration of Infrastructure Upgrades- Integrate DE into infrastructure upgrades, to save future costs. For example, if the city is excavating for sewers etc, DE pipes could be laid at the same time.</p>

6.3.2 Moving Economic Actions Forward

Addressing the economic concerns that were raised by participants will also require the implementation of actions from various categories. These actions can be broadly characterized as those that are designed to reduce uncertainty through supportive legislation and funding availability, and those that target the project level to educate developers on designing an effective business model and finding funding for their projects. The CDEA has a defined role to play in each of these areas, firstly as an advocate for favorable legislation and financing opportunities, and secondly to develop best practice models and support their transmission through networking and education programs.

6.4 Human Resources Goals and Actions

Human resources challenges relate to a lack of expertise in envisaging, designing, building and operating DE systems. Some respondents believed that DE expertise was sufficient in Canada. Others highlighted the complexities associated with human resource challenges, such as a lack of overarching knowledge across the DE sectors, a lack of local knowledge or designing a DE system to meet the diverse needs of Canadian communities. Additionally, many owner/operators reported challenges in finding experts to operate their own DE systems.

The following “human resource outcomes” were considered critical to the future success of DE:

- Growing experience in designing DE systems for Canadian communities;
- Correctly sizing systems to meet community needs;
- Designing systems that respond to local character;
- Building local knowledge base;
- Expanding knowledge beyond DE industry;
- Understanding greenfield and retrofitting opportunities;
- Keep pace with green building technologies;
- Experienced project managers and technicians to implement DE projects.

These outcomes have been discussed in detail below and are coupled with actions designed to support these outcomes.

Growing experience in designing DE systems for Canadian communities

In the in-depth interviews, many respondents said there were “*no technical challenges.*” However, other respondents acknowledged that while the technology was understood broadly, there were still challenges due to the relative immaturity of the industry in Canada—and the relative scarcity of supply capacity to meet a

burgeoning market demand for DE expertise—at all points in the DE development cycle.

One interviewee suggested that “*I would say that one of the greatest scars that I wore (in rolling out a new DE project)....was the learning curve of the engineering consulting industry.*”

“.....I would say that one of the greatest scars that I wore (in rolling out a new DE project)....was the learning curve of the engineering consulting industry.....”

The respondents that considered there were *no* technical challenges in the DE industry generally took the view that DE is an old, tried and tested technology. They argued DE has been around for decades and is so wide spread, particularly in Europe and other countries around the world, that there is ample expertise to build DE systems. Many respondents considered that Scandinavian examples of DE provide all the technical understanding required to design and build DE systems in Canada.

To balance these opposing viewpoints, it may be worth considering that DE is relatively new in the context of Canadian communities. Theoretically Canada’s engineers have more than enough capacity and knowledge to build these DE systems, yet practically, few have experience. One respondent commented “*there have been situations where Canadian engineers have been hired out but have never put in a DE system before.*” Moreover, engineers have limited opportunity to consider how to best adapt this technology to meet the needs of Canadian communities. The large scale systems designed in Europe may offer little help here, as they are reflective of a very different energy culture to that which exists in Canada—specifically they typically are developed in an environment where there is much less risk of customers not connecting..

One respondent commented, “*education has to span to the engineering community to teach them how to build a system*

correctly.....most engineers think they can design anything but they don't have the wherewithal to put one of these sophisticated systems together..... Just like we teach people how to build houses the right way and how to do the newest latest insulation methodology ..., we need to spread the understanding to more engineers so they understand how to build these systems so that we have more engineers designing them out there. The more people we get doing the right things, the systems will sell more and more."

This comment also raises an additional point, in that the better engineers become at designing DE systems, the more confident they will be in promoting and championing these systems into the future.

Overall, it is important to highlight that technical knowledge does not end with practitioners understanding how a DE system works. It is about Canadian practitioners developing their own in-depth and well considered technical understanding of how DE can be most useful in the Canadian policy, technical, energy market and demographic context.

Correctly sizing systems to meet community needs

The current lack of technical knowledge and experience is symptomatic of an immature market. As market demand grows, however, supply capacity must quickly be developed to meet market demand. The lack of human capacity is causing delays in system development and may also be resulting in DE systems being designed that are unable to meet the needs of communities.

It is important that the industry quickly starts to develop its own body of technical knowledge of DE suitable for specific Canadian regions and communities. This will allow for the full benefits of DE infrastructure to be realized.

The current shortage of technical DE design expertise is most acute in markets which are seeing substantive activity—such as British Columbia and Ontario. Inadequate numbers of technical design experts, lacking knowledge and experience in the Canadian context

is compounding the inherent risk that DE systems are inappropriately scoped and sized. Oversizing systems has a negative impact on both the initial capital investment, and the ongoing economic viability of systems. One respondent commented *"they (engineers responsible for designing system) kept on adding way more boilers than we needed because there's no accepted engineering design manual for district energy. These guys would simply take the ASHRAE model to determine technical requirements that ended up oversizing requirements. I think they.....learned from that.....it was the technical engineering community that was most challenged, but I think they got the most out of it in terms of learning."*

One respondent highlighted the challenges experienced in having a DE system designed to meet the needs of their project: *"When the DE file landed on my desk and I didn't know what district energy was, it came with a two inch thick consulting engineers report that was so divorced from reality that it was an almost useless document.....It was a very good engineering study from the perspective of what that company knew to be district energy, but it was essentially the cookie cutter model that came out of Europe..... The solution did not reflect the ability and the capacity of the community to accept that solution."*

Clearly, if DE systems are not designed with the needs of the community in mind, it will not be seen as a relevant and feasible and could be dismissed as a legitimate option for meeting community energy needs. If such a system is built, there is a risk that these systems will not deliver the economic, environmental and social benefits that the community values.

Appropriate system design to meet Canadian communities' needs is critical in each region in which activity is taking place. System design is complicated by the fact that—while there are guiding principles to optimize system profitability, there are no 'cookie cutter' DE system solutions. Instead, each system must be designed bearing in mind local geography, topography, resource availability, load profile

and competitive options. There are significant regional differences across Canada.

There is, therefore, a need for both general and regional training to build design knowledge. On this subject, one respondent added that *“the focus could be on heating systems at this time, since cooling is hard to justify in the Canadian climate. Be realistic about where they (DE systems) make sense, and then grow.”*

“.....the focus could be on heating systems at this time, since cooling is hard to justify in the Canadian climate. Be realistic about where they (DE systems) make sense, and then grow”

Designing systems that respond to local character

Respondents also expressed that some communities have concerns relating to the presence of stacks and local generation facilities as part of their residential communities. There was a sense that education from the outset would help rally the high level of community buy-in and support needed to ensure the success of the project.

One respondent commented *“it’s a power plant and you have the situation of not in my backyard. We’ve experience where they’ve built these power plants to be able to sit in a residential community and they blend them in and construct them in a way you don’t even know it’s there. There’s one that’s built right on the side of a high school... it was blended into the architecture of the high school and you can’t even tell. It has only been there for five years. It looks like it has been there thirty years, like the school. There’s another one where it’s in the middle of a residential housing area and it was built of brick and with triple insulation so that it could exist there and not bother the residents. So those are the ways they do it”. The sentiment expressed by this respondent suggests that aesthetically, well designed DE plants can be important for rallying community*

support behind a system. Respondents in Alberta cited the commitment to good design by Enmax in Calgary.

Building local knowledge base

As with all nascent industries, Canada will need to build, organize and coordinate its own knowledge about DE design and operation. Much can be learned by collecting information over time so as to correct mistakes and capitalize on successful experience. This knowledge can be used to improve industry performance over time.

This knowledge can also be used to support communities who are new to DE but who face similar circumstances to those who have already built or considered a DE system. One respondent suggested that DE community archetypes could be developed, which would support and expedite knowledge transfer. One example of this was the community of Revelstoke: *“You’ve got a biomass system in Revelstoke from the mill feeding the downtown core. Now why does another community that has a mill in transition need to totally start from the ground up in district energy considerations? Can we not get to a point where we can fast track or increase their literacy and simplify district energy such that they may look at two or three or four options, but not a smorgasbord of options that will simply serve to confuse them.”*

“...You’ve got a biomass system in Revelstoke from the mill feeding the downtown core. Now why does another community that has a mill in transition need to totally start from the ground up in district energy considerations?”

Expanding knowledge beyond DE industry

Interviewees expressed considerable frustration with the lack of technical knowledge beyond the key participants in the DE sector. As a result, DE is frequently overlooked as a feasible option.

For DE to grow over time, education initiatives aimed at key municipal staff (e.g. community energy managers) and the support professions (e.g. engineers, architects, planners) will be necessary.

The more practitioners that are aware of DE, the more likely it will be considered among feasible options. It will be critical that this education is not just general education about DE and how it works, but must also address how DE could be designed to meet energy requirements within Canadian communities.

Understanding greenfield and retrofitting opportunities

DE has a role in both greenfield developments and retrofitting of existing development. It was generally considered that *“if it’s a greenfield (development) there are limited technical challenges.”*

A retrofitting process is more complex. *“If it’s an existing development with a myriad of different types of equipment with different operating parameters it’s very tough to design one consistent system that will be able to interface effectively, efficiently, and economically with all of them. I think if you’ve got a neighbourhood block of different vintages of buildings and steam or hot water, or electric, or forced air heating, or hydronic heating and you’re trying to bring one solution to meet the criteria of all the different operators, it’s very tough (to make DE work).”*

Keeping pace with green building technologies

There has been considerable progress made in improving building envelope, HVAC and other in-building technology that improves energy efficiency. There has also been a commensurate increase in knowledge, supply capacity and market understanding about these new approaches and technologies. Despite the fact that little audited evidence of building and operating efficiency is publicly available, there exists a perception that conventional energy supply solutions are superior to those offered by DE systems.

This, combined with a strongly entrenched conventional energy infrastructure and delivery system, represents an ongoing challenge for DE operators and developers who wish to build and connect to customers.

Experienced project managers and technicians to implement DE projects

Project management can also be a challenge, as many project managers have not had past experiences in developing DE systems. *“We as project managers, we take the risk. We have to do our expressions of interest, RFPs, etc. and hopefully we’re asking the right questions in order to get the right consultant assistance and the right project providers out there. So if the CDEA is trying to put together better templates for people to ask the right questions, that’s important.”* It is apparent that increased support could be provided to help project managers through the challenges they individually experience.

It was also expressed that it can be difficult to locate DE builders, and have the systems delivered smoothly. One respondent commented that: *“the main supply chain issue is there’s not sufficient visibility of district energy builders, service providers. There are some barriers when it comes to suppliers, transparency, meeting the timing of the proponents who want to build such systems.”* Other respondents discussed the difficulty with having systems delivered on time and on budget.

6.4.1 Human Resource Action Plan

Human Resource Goals	Actions to Achieve Human Resource Goals			
	Education Actions	Knowledge Exchange Actions	Product, Tools, and Marketing Actions	Legislative / Regulatory Actions
Growing experience in designing DE systems for Canadian communities	Training Engineers - Training engineers on best practice approaches to system design in a Canadian context. Expose engineers to newest technologies, experiences of Canadian engineers and how to propose new DE projects to development industry.		Build Resource of Local Knowledge Base - Start to collect local knowledge that can be accessed by project managers or leaders investigating DE systems. Develop database of projects archetypes that will allow those investigating DE to cut down options.	
Correctly sizing systems to meet community needs	Training Engineers - Training engineers on best practice approaches to system design in a Canadian context. Expose engineers to newest technologies, experiences of Canadian engineers and how to propose new DE projects to development industry.	Transfer Knowledge About Risks Along the Project Continuum: Opportunities for knowledge transfer across the DE industry so all players can learn of the risks associated with different stages of project development.	Build Resource of Local Knowledge Base - Start to collect local knowledge that can be accessed by project managers or leaders investigating DE systems. Develop database of projects archetypes that will allow those investigating DE to cut down options.	
Designing systems that respond to local character	Awareness and Understanding of DE (community) - Develop education programs to grow community awareness about DE, particularly on ways that DE effectively and efficiently meet community energy needs.	Information Base on Successful Approach to Consulting Community – Municipalities can share knowledge and information on how they have educated and connected with communities, particularly in relation to issues such as bio-mass.	Develop DE Design Guidelines - Develop a set of design guidelines that would provide important considerations for how to best integrate a new DE system into an existing development. Develop Engineering Standards for Canadian DE Projects: Develop engineering standards that are relevant to developing a DE system within a Canadian context.	
Building local knowledge base		Strong Knowledge Base that Can be Leveraged: Start to develop a strong knowledge base to design DE systems that specifically meet the needs of Canadian communities i.e. size of systems, fuel source, supply chain etc. Allow this knowledge base to be leveraged by new municipalities and/or owners and operators starting out in developing a system. Transfer Knowledge About Risks Along the Project Continuum: Opportunities for knowledge transfer across the DE industry so all players can learn of the risks associated with different stages of project development. General Networking Opportunities - Create networking opportunities to strengthen relationships across the industry. Information Base on Successful Approaches to Engaging Community on DE – Municipalities can share knowledge and information on how they have educated and connected with communities, particularly in relation to issues such as bio-mass.	Build Resource of Local Knowledge Base - Start to collect local knowledge that can be accessed by project managers or leaders investigating DE systems. Develop database of projects archetypes that will allow those investigating DE be able to quickly identify like projects and technology options that would be most relevant to their local context. Develop Engineering Standards for Canadian DE Projects: Develop engineering standards that are relevant to developing a DE system within a Canadian context.	
Expanding knowledge beyond DE industry	Training to Expand and Connect DE Knowledge Base Across DE Chain - Develop diverse training programs attended by: federal and provincial policy makers,			

	municipalities, engineers, planners and owners/operators etc. These training programs must be across disciplines, so the DE knowledge base can be broadened and each player can understand the challenges experienced by the other in developing a DE system.			
Understanding greenfield and retrofitting opportunities			Research into Opportunities for DE Retrofits - Undertake research into opportunities to increase the inclusion of DE as part of community retrofits.	Revise Building Codes to Consider DE in Major New Developments - Revise building codes to be more supportive of DE projects. For example, DE could become a key element in new green field developments.
Keeping pace with green building technologies			Monitor Performance of DE Systems - A body of knowledge could be developed by the DE industry in order to track thermal performance over time. It is only through developing credible evidence that we will all begin to better understand—and continuously improve—Canadian DE performance. The marginal increases in efficiencies from investment in DE have to be clearly articulated. This in turn will serve to enhance capacity within the engineering community in terms of having a broader understanding of how to get DE considered, evaluated and appropriately designed.	
Experienced project managers and technicians to implement DE projects		<p>Transfer Knowledge About Risks Along the Project Continuum: Opportunities for knowledge transfer across the DE industry so all players can learn of the risks associated with different stages of project development.</p> <p>General Networking Opportunities - Create networking opportunities to strengthen relationships across the industry.</p>	<p>Resource Package to Support Project Managers - Provide a resource to support project managers to launch DE projects. For example, this could include a template so project managers can ask the “right questions” when preparing an RFP for exploring a DE system</p> <p>Directory of Qualified Experts – Develop a publically accessible database that allows stakeholders to find qualified practitioners to support their DE system. This would be most effective if achieved on a national basis.</p>	

6.4.2 Moving Human Resource Actions Forward

To address human resource concerns, actions are generally focused on knowledge exchange and the creation of products, tools and marketing actions that will help move DE forward. These actions are generally designed to build capacity and integrate knowledge within the industry. The actions focus on the development of tangible educational products that could assist project managers, DE owners and operators, engineers and municipal staff etc in the creation of a DE project. In fact many of these actions were suggested by respondents, who considered that the existence of a particular product would have helped move their own projects forward. Actions are also focused on building stronger relationships across the industry and integrating knowledge along the DE chain.

The CDEA has the opportunity to have a very significant role in helping to overcome Human Resources challenges. The CDEA has and will continue to be active in growing expertise within the DE industry and growing interest in DE as a whole. The CDEA can undertake research, collect data and create tools that are designed to help the industry and practitioners grow their systems into the future. Governments could have an important role in providing support and getting involved in communicating and coordinating such efforts across jurisdictional boundaries.

6.5 Sustainability Goals and Actions

The sustainability challenges associated with DE relate to the need to position and promote DE so that it is seen as supporting sustainability goals. Many respondents expressed frustration that DE is overlooked as an option that can contribute to the “green” agenda, particularly one that could contribute to communities moving away from fossil fuel dependency. This can result from a general lack of awareness of what DE is, and how it can contribute to meeting community energy goals. As noted above, this might also result because of asymmetrical knowledge of DE versus other “conventional” solutions—such as energy efficient design for “green” buildings. Some respondents expressed their view that DE systems are less important because of the perception that the desire to “build green” can be accomplished with less effort by designing green buildings.

The following “sustainability outcomes” were considered critical to the future success of DE:

- A unified and clear message to promote DE as part of the green energy solution
- Promoting DE’s ability to increase energy security
- Promoting DE’s ability to adapt to renewable fuel sources

These outcomes have been discussed in detail below and are coupled with actions designed to support these outcomes.

A unified and clear message to promote DE as part of the green energy solution

One of the biggest challenges for DE is how it will position itself as a strategic tool in supporting the sustainability agenda. Historically, respondents felt that DE had been overlooked as part of Canada’s green energy solution by policy makers, legislation and sustainability advocates. It was evident that climate change legislation prioritized support for renewable energy (i.e. wind and solar) and energy efficiency over DE.

Moreover, DE is challenged by the fact it can be so many different things to so many different communities. If the DE sector was able to develop a clearer message around the benefits that derive from DE, it would be easier to communicate to various important audiences, including regulators, developers, political and policy officials, project champions and the public. This would support the growth of a strong base of support for DE projects. It was also expressed that DE needs a clear driver as part of that message (e.g. energy efficiency, environmental benefits, health impacts, local economic development, etc). It was also suggested that the CDEA could take on the responsibility of articulating this message and ensuring that it is widely promoted across the nation.

It was also considered that DE is getting lost in broad discussion of how energy usage contributes to GHG emissions, and thus energy-efficiency related issues. In this respect, interviewees cited the positive leadership role provided by the BC government in stimulating – through policy and the enabling programs of BC Hydro – action at the municipal level. In these provinces, several municipalities have identified DE as a critical part of their GHG reduction strategies.

It was suggested that CDEA could work with industry to develop a clear message to articulate and promote DE. This message could be widely promoted across the nation and inspire leaders or potential project champions to grow their knowledge about DE projects and how they could serve their communities.

Promoting DE’s ability to increase energy security

The reliability of DE was also acknowledged. References were made to the 2003 blackout on the North Eastern Seaboard, where one of the few lights visible from space at night was in Markham – where the CHP plant was able to continue to serve customers. Energy security and system resilience could become an increasingly important feature as more and more pressure is placed on conventional systems.

Promoting DE's ability to adapt to renewable fuel sources

DE was not credited for its role as an enabling infrastructure to support distributed renewable generation, to offer the opportunity to support community scale thermal storage, use waste heat, and add CHP units, thus improving overall energy efficiency and significantly reduced GHG emissions. Research participants also noted that DE systems offer the flexibility to adapt to different energy sources – particularly renewables. Participants spoke of the ability to introduce locally available fuel sources (e.g. animal and municipal waste) as other reasons to support DE.

Overall, respondents felt that the industry has not been effective in communicating that DE is part of sustainable energy solutions--highlighting key energy efficiency, local economic development, climate change and system security attributes to key stakeholder audiences. The need for more effective advocacy was seen as critical by many, who felt that the industry needs to sharpen its message, improve its outreach efforts and ability to connect with environmental champions and other opinion leaders. Such efforts will accelerate the diffusion of this innovative approach to community energy delivery.

6.5.1 Sustainability Action Plan

Sustainability Goals	Actions to Address Sustainability Challenges			
	Education Actions	Knowledge Exchange Actions	Product, Tools, and Marketing Actions	Legislative / Regulatory Actions
<p>A unified and clear message to promote DE as part of the green energy solution</p> <p>Promoting DE's ability to increase energy security</p> <p>Promoting DE's ability to adapt to renewable fuel sources</p>			<p>Clear Messaging and Marketing - Develop a clear, unified message to market DE. Spread this message nationally. Ensure this message becomes synonymous with DE. This message must be capable of inspiring action and champions.</p>	

6.5.2 Moving sustainability actions forward

Although the actions to overcome sustainability challenges appear limited, the effective marketing of DE as a sustainable energy source is a complex task that requires involvement from actors at all levels to ensure that it is able to garner support through these avenues. The CDEA can take a leading role in the articulation and dissemination of this message to the other actors, defining why DE is a sustainable choice, while overcoming some of the negative assumptions of DE. The ability to successfully communicate and market the benefits of DE will be fundamental to the growth of the industry as a whole.

7.0 MOVING FORWARD: TOP 5 ENABLING ACTIONS FOR THE CDEA TO GROW DE SYSTEMS ACROSS CANADA

This study has identified far reaching goals and actions for the DE industry. This study has also identified the broad range of stakeholders from all levels of government, technicians, investors, environmentalists and the broader community that will be critical in helping the industry reach these goals and implement these actions to mature, unify and grow into the future.

Within the far reaching context in which DE actions need to be taken, the CDEA can focus its own efforts to enable DE growth through the channels over which it has the most influence. There are defined steps that the CDEA can take to advance the position of DE, strengthening the industry and poising it for success alongside broader policy motivators. Specifically, as a champion of DE across the industry, the CDEA can play a role to promote DE through effective marketing strategies, develop best practice tools, and encourage knowledge transfer throughout the DE chain.

Based on the findings of this study, the top five enabling actions for the CDEA are listed below:

1. Articulate marketing strategy to promote DE beyond industry

One of the benefits of DE systems is their flexibility. Ironically, the capacity for DE to mean many things to many people has made its positioning within sustainability and energy planning difficult. The CDEA can play a role in clearly articulating the benefits of DE to representatives within all levels of government, the developers and communities. The CDEA can do this through the development of a clear communication and marketing strategy for the entire DE

industry that effectively positions DE as a beneficial energy option for communities across Canada.

2. Develop best practice tools and research, focused at the community and project level

Aiding the development of human resource capacity through the sharing of best practice and case study information is a task suited to the CDEA. One method that was recommended was to develop project archetypes that communities could follow as context-specific examples representative of their specific needs. The CDEA should also continue to undertake research activities, such as investigation of regulatory and legislative tools; and operating, financial and thermal performance of systems over time. It will be important that research and tools are focused on helping municipalities and project managers overcoming knowledge gaps standing in the way of getting their DE projects built and operating successfully.

3. Encourage knowledge transfer among all players along chain

One of the prominent knowledge deficiencies that CDEA can serve to address is the lack of individuals with an overarching and integrated knowledge of the entire DE process. While this research identified many experts and champions of DE from a policy, business, or operations background, it also highlighted the need to have professionals aware of the constraints on DE development throughout and across these sectors. The CDEA can work to strengthen relationships and communication occurring across the industry to ensure that there is high levels of understanding and interconnection across the entire project chain.

4. Support development of education programs, particularly for municipalities

Knowledge capacity was seen as the most crucial challenge to begin the process of a significant DE deployment. To overcome this, developing education modules that would target all levels of governance to inform and overcome misperceptions of DE was identified as an important action that the CDEA could effectively execute or support. These education programs could have a strong focus on educating municipalities who have been consistently identified as having a lead role in the growth of DE.

5. Support training programs for technical practitioners (planners, engineers etc)

Training programs would be able to address some of the human resource constraints that have been identified. The CDEA could have a leading role in developing, hosting, funding and/or promoting these training programs. It will be important that these training programs grow the confidence of technical experts in presenting DE as an energy option for communities. These programs could also help to integrate knowledge and strengthen relationships along the DE development continuum as well with buildings connected to DE systems that wish to optimize compatibility and system performance.

APPENDICES

Appendix A: Session Summary - District Energy Learning Forums, March 2011

Appendix B: Summary of Regional Challenges

British Columbia

British Columbia has shown a strong local commitment to reversing trends that are propelling global climate change. Progressive policies that have been developed in BC, i.e. the carbon tax, the Carbon Neutral Charter and Bill 10 and 27, are considered to be strong, effective and catalytic in moving DE projects forward.

These policies are driving DE projects as they generate commitment from municipalities to reduce GHGs, in addition to supporting municipalities through a process of strategically considering how GHG reductions could be achieved. Many municipalities have been considering how DE could contribute to GHG abatement. For example, one respondent commented that *“out of the 180 communities in BC, about 60 have said that one of the strategies they are going to look at for GHG emission abatement is DE.”* These policies are helping DE emerge as a mainstream option for community energy and BC respondents have described DE as “top of mind” across the province.

Respondents were generally very positive about the provincial policies, and they also considered BC to be providing exemplary leadership to other jurisdictions. Some respondents, however, were concerned that efforts to abate climate change in BC were fragmented and uncoordinated. There was also concern that in the rush to reduce GHG emissions, the economics of some DE systems were not being well thought through. It was highlighted that non-viable DE systems could be damaging to the entire industry in long term.

There is strong momentum behind DE across BC. This was partly attributed to the effective promotion of local success stories, such as the DE system at the Olympic Games. It was explained that once a system demonstrates its ability to perform well in meeting local energy needs, it is promoted around the province, which in turn helps grow increased interest in DE as a concept for community energy. Additionally, respondents commented that as growth occurs it helps build the body of local knowledge and technical expertise, as well as a stronger local supply chain, which in turn leads to even more growth.

Other respondents did not have such a positive picture of DE. For example one respondent considered that DE was still in the pioneering stages, and supporting a DE project remains a major political risk. Another respondent commented that DE does not emerge as an option for consideration as often as it could or should, and he was not sure why. Yet overall, BC is still managing to drive a large number of DE projects forward.

Mandated connections to DE systems, for example, the City of North Vancouver’s mandated connections to Lonsdale and False Creek were generally seen in a positive light. Respondents from other provinces considered this to be a positive step forward for DE. Yet others respondents expressed more cautious opinions, suggesting that new DE systems should be built on a strong business case and self-sustaining in its own right.

Public perceptions about negative impacts of biomass on air quality, was continually referred to as a threat to DE. This issue was compounded in Vancouver, as the City’s air shed resides in a valley where residents are extra vigilant about the potential threats to air quality. Conversely, other parts of BC have shown less concern about air impacts. For example, respondents from

rural communities in BC with large forestry sectors and a history of using wood as a fuel source are more accustomed to these emission sources. This is an example where better metrics and communication could mitigate negative impressions. For example, the introduction of a DE system is rarely compared with cumulative air emissions of a conventional ‘business as usual’ development with multiple individual boilers and furnaces.

Overall, DE is experiencing significant momentum and growth in BC as a foundational concept for integrated community energy solutions. Respondents have commented that this growth is helping build local knowledge and technical experts, and a stronger local supply chain behind DE. The key caution is the need to ensure strong connections between government and the needs of business, to ensure the development of strong financially self-sustaining systems.

British Columbia

Strengths	Challenges and Threats	Opportunities
Carbon Tax in place that is strong and effective.	City of Vancouver has reported difficulties in organizing finance for DE projects.	Education to grow social awareness/acceptance on bio-mass.
Climate change is helping move DE forward.	Public concerns about negative air quality from bio-mass. Notably, Vancouver’s air shed is in a valley.	Local expertise in BC is growing.
Carbon Neutral Charter – voluntary, signed by many local municipalities to get to carbon neutral in their own operations by 2012.	Energy prices are very low, makes it harder for DE to compete.	DE is at the forefront of thinking. For example, out of the 180 communities in BC, about 60 have said that one of the strategies they are going to look at for GHG emission abatement is DE
Bill 27 – requirement for municipalities to have a community emissions target.	Lots of hydro energy in BC, provides less incentive for DE.	DE systems being developed cross province, in large urban centres and small townships.
Bill 10 – carbon neutral public owned facilities, including the provincial ministries.	Supply chain issues identified for bio-mass and wood.	BC building code could be strengthened to support DE.
Legislation is helping move DE forward.	Price of feedstock can be high.	
DE systems being built that use a wide range of fuel sources.	Pine Beetle threatens wood supply.	
Growing interest in DE. i.e. The Olympic project has brought DE to front of mind in Vancouver.	Metro Vancouver Region is not responsible for economic development and not tuned into the needs of business.	
In North Vancouver, the City has mandated connections to Lonsdale and Falls Creek.	Concerns that non-viable DE systems are being built, which could be damaging to industry in long term.	
	Rate of return has not been high enough to attract private money	
	Need to have a BC wide strategy, efforts are disjointed.	
	Political risk involved for leaders that support and champion DE projects.	

Ontario

Ontarian respondents expressed major frustrations over a lack of knowledge and interest in DE projects at the provincial level. As a result, it was often expressed that energy policies are too focused on renewable electricity generation projects, and overlook the potential contribution DE could make to “green” energy. There was also a strong sense that multiple Ontario entities (e.g. the Ontario Energy Board, Hydro One, Ontario Power Authority, the major gas and electricity utilities) were all moving in opposite directions on DE and that this lack of coordination was further limiting the development of DE projects.

It was noted that Ontario is home to many large DE projects. For example, Toronto’s Deep Lake Water Cooling System is part of North America’s largest DE system. These large systems are modeled after DE systems being built in Europe and have relied on major financial contributions, from governments, at their inception. While successful in building large DE systems, it was mentioned that Ontario could also consider smaller scale projects for the benefits they could provide Ontario’s communities.

Ontario

Strengths	Challenges and Threats	Opportunities
Ontario is home to many successful and large DE plants.	A lack of knowledge about DE at Provincial level. Government and OPA are not interested in DE.	Energy prices have increased significantly, DE could become more attractive.
The Deep Lake Water Cooling System is the biggest in Canada and North America.	Government has provided total support for wind, solar etc, this has not extended to DE.	Cap and trade could be a major windfall to Deep Lake Cooling in City of Toronto.
Total community support for Toronto’s system, stable customers and improved local air quality.	There is ignorance in government about the future role of renewable energy sources i.e. wind power can’t displace coal power, this is not fully understood.	Pan Am Games could allow for new DE opportunities.
The City of Toronto is concerned with reducing CO2 emissions and achieving increased energy security.	Green Energy Act – does not place enough emphasis on DE.	Pension funds have a long term view to investments, could have potential for DE.
	The most feasible fuel source for DE in Ontario is natural gas, minimizing gains in efficiency and GHG reductions between a DE and a conventional thermal solution.	
	Stakeholders have different opinions and are moving in different directions: OEB, Enbridge, HONI, OPA, Union Gas.	
	OPA moves slowly, which could hamper potential DE projects.	

DE business models in Ontario have often reflected European models - large scale, big investment, wealthy partner. I.e. Sudbury and Cornwell.

City of Toronto Deep Water Cooling DE system has a short circuit capacity issue.

Public concerns over bio-mass and pollution.

Utilities are looking for ROI 8-9%.
Investors have to be patient to experience returns.

Alberta

Alberta respondents expressed that the province has a long history with fossil fuels, and as a result there is a strong desire to move towards greener sources of energy. The view was expressed that there has historically been a strong commitment to sustainable urban development and acknowledgment that DE could play a critical role in achieving these aims. In contrast, it was highlighted by one respondent that the oil sands will remain the main energy priority of the province and would distract interest from DE projects.

A potential drawback in the Alberta environment is that *“Albertans detest rules,”* to quote one respondent. This characteristic may be a liability in terms of establishing legislation that would be capable of supporting DE. In response it was offered that rather than more regulations, the province could develop standards that are less prescriptive and more enabling to drive industry and the market towards DE.

Alberta

Strengths	Challenges and Threats	Opportunities
<p>Historically, there has been a focus on fossil fuels in the Province, but there is a strong desire to change and move to greener energy sources.</p> <p>Alberta has a price on carbon of \$15 per tonne, yet this has not been enough price incentive to stimulate DE projects.</p>	<p>Lack of political leadership in support of DE at all government levels and in the private sector/developers.</p>	<p>Alberta has a deregulated energy market and approach to let market dictate, this will create opportunities for DE systems with a strong market case.</p> <p>Alberta could potential draw a strong community base.</p>
	<p>No legislation to support DE in MUSH sector.</p>	<p>The Government is committed to improving Alberta’s environmental image.</p>
	<p>Lack of developer awareness and buy-in to support DE systems.</p>	<p>Alberta is resistant to a more regulations, but would be open to prescribing standards that are less prescriptive and more enabling to drive industry and the market place rather increase incentives to drive DE.</p>
	<p>The Government is distracted by oil sands, as a major energy priority.</p>	<p>Alberta respondents identified the positive contribution of the Edmonton Waste Management Centre of Excellence. Interest in addressing issues related to garbage, with the increasing recognition that diverting from landfill is a worthy goal.</p>
	<p>Alberta’s building code could be strengthened. Energy efficiency goals could be mandated.</p> <p><i>“Albertans detest rules”</i> and that this ethic may be a liability in terms of establishing and getting a positive response to effective environmental legislation.</p>	

Quebec

Quebec does not yet have a well established DE industry, even by Canadian standards. One reason cited that Quebec has a significant hydro-electric energy market, which reduces the incentive to investigate other green energy options.

It was highlighted that there may be an opportunities for DE to leverage Quebec's substantial forestry industries. One respondent explained that in Quebec, wood allocation is a responsibility of municipal governments, which has resulted in community leaders being increasingly involved in considering and promoting bio-energy projects.

Quebec

Strengths	Challenges and Threats	Opportunities
Quebec has a very large forestry industry and ample supply of wood.	Distribution of energy, issues with Quebec Hydro and providing the grid with additional electricity.	Wood allocation is responsibility of communities, this has allowed for mayors and leaders to be involved in considering bio-energy projects.
	Complicated negotiations with Hydro Quebec at stalling projects and limiting feasibility.	
	QC has a large hydro electric supply, which reduces the incentive to investigate other green energy options.	

Nova Scotia

It was suggested that DE is not yet in the "DNA" of Nova Scotia. Alignment needs to occur across Provincial and Municipal departments. However, participants in the Halifax Workshop were confident about growth and considered it was "only a matter of time" before Halifax acquires a major DE system. Key factors in support of this are the rising price of energy, the need to foster a culture of resilience and practical issues such as the coming need to replace aging infrastructure.

It was also noted that very recently the Premier commented that the days of offshore gas are numbered and therefore need to develop a more sustainable footing in other areas could lead to opportunities for DE.

The Environmental Goals and Sustainability Prosperity Act (EGSPA) was also referenced as having set aggressive goals to reduce GHGs. The fact that the EGSPA addresses energy comprehensively rather than focusing exclusively on electricity was mentioned as an important factor with respect to DE. As well, improved access to natural gas feedstock to replace oil was seen as influential in the positioning of DE.

Overall, Atlantic Canada participants felt that the desire of communities to reduce their GHG emissions can be an important driver for change. In that regard, the lack of understanding or awareness of the potential of DE is making it difficult for DE proponents to negotiate effectively with potential customers. Participants also pointed out that there are differences between the

perspectives of customers and the developers that would need to be overcome for DE to grow into the future.

Nova Scotia

Strengths	Challenges and Threats	Opportunities
	DE is not in the DNA of Nova Scotia. Alignment needs to occur across Provincial and Municipal departments.	
Concerns about carbon emissions are causing Province to re-look at energy. Increased provincial spending on energy efficiency initiatives.	General lack of understanding about DE across three tiers of government and the business community.	Municipal and Provincial alignment has been initiated with QUEST processes that focus on integrated community energy planning.
Using X fuel, could have real environmental benefits.	Provincial legislation has very little to do with the business side of DE.	Provincial Energy Strategy is continually updated as new technology evolves.
Growing support for DE in Halifax Regional Municipal Council, but acceptance that the projects are difficult to initiate.	Concerns at the community level about negative air quality impacts of DE.	Very recently the Premier noted that the days of offshore gas are numbered and therefore need to develop a more sustainable footing in other areas; and will see a decline in royalty revenue;
FCM has been working actively with the Halifax Regional Municipal Council to put DE in the agenda.	Heritage Gas system in the Maritimes was a challenge.	
	Lack of understanding of links between DE and mitigating climate change.	

INFORMATION ON PROJECT TEAM



The Canadian District Energy Association

This project was led by the Canadian District Energy Association (CDEA).

The CDEA is an industry association made up of approximately 80 members and represents the owners, operators, suppliers and municipalities with an interest in District Energy (DE) systems.

The CDEA, as an organization, has the goal of supporting the building of the DE industry in Canada by execution of the following mission:

“The CDEA will support the creation of a shared understanding of DE systems, increased community receptivity, and expanded industry capacity so that District Energy (DE) project implementation will be accelerated across Canada”

For more information visit: www.cdea.org

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Report prepared for the Canadian District Energy Association by the Canadian Urban Institute and C2C.

With stakeholder consultations and contributions from: Emay Cowx CPF, Principal, C2C Strategies

The Canadian Urban Institute



The Canadian Urban Institute (CUI) is Canada's applied urban policy institute with a mission to identify, develop and deliver policy and planning solutions to enable urban regions to thrive and prosper. The CUI was established in 1989 by the City of Toronto and the Municipality of Metropolitan Toronto with a mandate to connect urban decision-makers at all levels of government with the corporate and community sectors to enhance policy making and management of urban areas. Today, the CUI operates as a fully independent, not-for-profit organization that researches, models and demonstrates solutions to urban challenges; develops strategies, partnerships, methodologies and toolkits to achieve urban public policy outcomes; organizes people, capital and ideas to implement significant urban projects; and, convenes groups of decision-makers throughout Canada and abroad to facilitate the exchange of information between urban areas within Canada and internationally.

The CUI has a number of specialized areas of expertise:

- Project Management
- Policy scans, policy testing and strategic analysis
- Education and Research
- Strategic stakeholder and public engagement

For more information visit: www.canurb.org

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C2C Strategies



C2C Strategies

C2C Strategies managed the stakeholder consultation processes, project managed the two closing education sessions in Ontario and Alberta, and contributed to the report framework and writing.

C2C Strategies is a management consulting firm that specializes in advising, developing and supporting an organization's strategic initiatives and plans. We do this through the application of customized engagement, facilitation and consultation strategies. Our goal is to help clients deliver successful outcomes that are based on three principles: Collaboration, Co-creation, and Innovation.

We are knowledgeable in regulatory affairs, business planning, market development, and policy creation. C2C transforms these insights into efficiently delivered engagement strategies that allow organizations to work effectively with a broad range of internal and external stakeholders. C2C also has experience in engagement and outreach involving First Nations and Métis people.

Principal Consultant and owner, Emay Cowx, is an IAF Certified™ Professional Facilitator with over 25 years of experience in the energy industry in North America.

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