SURP 824
ENERGY AND CITY BUILDING: THE FUTURE OF DISTRICT ENERGY IN THE NATIONAL CAPITAL REGION

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Standards Limitations

Graduate students at Queen’s University in the School of Urban and Regional Planning program developed this report as part of the SURP 824 project course. The report was prepared for Public Services and Procurement Canada and their Energy Services Acquisition Program.

This report does not necessarily reflect the views and policies of Public Services and Procurement Canada, any of its subsidiaries, or affiliates. The contents were developed exclusively by the SURP 824 project course team.
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The various individuals and organizations who provided us with important information and advice on district energy in the National Capital Region.
EXECUTIVE SUMMARY
**Objective**

As part of the Queen’s University School of Urban and Regional Planning (SURP), the SURP 824 Project Course Team (“the team”) was retained by Public Services and Procurement Canada (PSPC) to evaluate the feasibility of expanding the National Capital Region’s (NCR’s) district energy system (DES). The team conducted a multi-level government policy context analysis, a case study review, a geographic information systems (GIS) land-use analysis, and a Strengths, Weaknesses, Opportunities, and Challenges (SWOC) analysis to form recommendations for the Energy Services Acquisition Program (ESAP). The team worked in partnership with ESAP over a four-month period from September 2017 to December 2017, developing recommendations for moving ESAP forward on the expansion of the NCR’s DES.

The team was tasked with the following:

1. Demonstrate an understanding of the ESAP DES;
2. Evaluate existing planning policy and government context in the NCR and identify key stakeholders;
3. Create a list of “lessons learned” from successful and unsuccessful DES case studies in comparable places to the NCR;
4. Identify potential locations for expansion of the DES in the NCR by analyzing supportive land use policy conditions and potential users; and
5. Recommend next steps for ESAP on how to achieve expansion of the DES in the NCR.

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**Energy Services Acquisition Program**

*Phase One* of the program includes upgrading the system from steam-powered to low temperature hot water and chilled water. This phase also includes the testing of new carbon-neutral fuels to reduce the system’s environmental impact.

*Phase Two* includes using the successful alternative fuels as well as the system expansion to new buildings in the NCR.
The Findings

Government Context

A rigorous review of relevant government policies was conducted, in order to gain a complete appreciation for the multi-jurisdictional playing field within which ESAP’s DES must function. Policy and legislation from the Government of Canada, National Capital Commission, Provinces of Ontario and Québec, and municipalities of Ottawa and Gatineau were reviewed. Overall, it was found that while all jurisdictions are supportive of the environmental benefits and objectives that ESAP’s system provides, they were not always perfectly aligned with, or supportive of the system itself. In many cases, different organizations used different metrics for calculating or determining which environmental initiatives to pursue. In the case of Gatineau, this largely precluded it from future DES expansion due to the municipality’s focus on reducing greenhouse gas emissions. Due to HydroQuébec’s existing cheap and low emission hydroelectricity, the environmental benefits of connecting to the DES in Gatineau are not the same as elsewhere in the NCR. Conversely, the Province of Ontario’s Provincial Policy Statement was explicitly supportive of DES technology being implemented and included in Ontarian planning. These diverging policy frameworks led to a larger focus on the Ottawa portion of the NCR.
An analysis of 18 DESs from all over the world were investigated to understand the benefits and drawbacks of implementing district energy systems. By looking at small rural towns, universities, major cities, and everything in-between, the case study analysis proved district energy systems can work at all city sizes and scales. Through this analysis of the challenges and innovations found in district energy around the world, three overarching themes began to emerge. These themes are: Land Use & Expansion, Growing the Client Base, and System Governance. These three themes were pulled out of the case studies because we found that land use policies are intrinsically tied to the success of expanding a DES. Furthermore, the land use policies and patterns also helped in identifying potential clients. This in turn, aided the addition of clients connecting to district energy. Lastly, the selected case studies consistently proved that a competent and effective model of system governance must be employed in order for the system to run effectively, efficiently, and successfully.

- **Burnaby**, British Columbia, Canada
- **North Vancouver**, British Columbia, Canada
- **Vancouver**, British Columbia, Canada
- **Gibsons**, British Columbia, Canada
- **Île-des-Chênes**, Manitoba, Canada
- **Duluth**, Minnesota, USA
- **St. Paul**, Minnesota, USA
- **Aberdeen**, United Kingdom
- **Bunhill**, United Kingdom
- **Nashville**, Tennessee, USA
- **Guelpth**, Ontario, Canada
- **Princeton**, New Jersey, USA
- **Charlottetown**, PEI, Canada
- **Paris**, France
- **Denmark**
- **Sydney**, NSW, Australia
SWOC Analysis

A SWOC Analysis was conducted for DES expansion in the NCR with the developed understanding of the existing DES, policy context, projected growth in the NCR, and lessons learned from the case studies. The most important findings from each of the three themes established in the case study review are detailed in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Land Use &amp; Expansion</th>
<th>Growing Client Base</th>
<th>System Governance</th>
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<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td>- The system is being modernized and will run on renewable energy</td>
<td>- Several plants are already located in close proximity to mixed-use, dense areas well suited for connecting</td>
<td>- All governments and agencies support green initiatives</td>
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<tr>
<td><strong>Weaknesses</strong></td>
<td>- Several opportunities for connecting to greenfield developments near the network have been missed</td>
<td>- Several competing DES’s exist or are being developed</td>
<td>- Private sector connections and engagement have been prioritized</td>
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<tr>
<td></td>
<td>- Expansion in highly developed core areas is expensive and disruptive</td>
<td>- Poor communication with private actors has hindered ESAP’s ability to bring in new connections</td>
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<td><strong>Opportunities</strong></td>
<td>- The Government of Canada desires and has the capacity for expansion</td>
<td>- The completion of ESAP’s phase 1 and 2 can stimulate interest and marketing potential in the DES</td>
<td>- ESAP is well-positioned to take a leadership role in initiating expansion and bringing all stakeholders together</td>
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<tr>
<td><strong>Challenges</strong></td>
<td>- Capitalizing on the existing political support for the environmental objectives DES can serve</td>
<td>- Developers need both heating and cooling to connect</td>
<td>- Meeting divergent environmental priorities across stakeholders</td>
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<td>- There is a lack of awareness about ESAP’s DES</td>
<td>- Lack of dialogue and buy-in from potential customers</td>
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Land Use Analysis – Conceptualizing DES Expansion in the NCR

From the lessons learned in the case studies and SWOC analysis, it was concluded that DES is best supported by a mix of uses, high density, high concentrations of building, and anchor users with high energy demands. The purpose of the land use analysis was to identify areas with land use policy that supports a mix of uses, and intensification of density and built form. Following this, areas within those that demonstrate potential for a high concentration of users from planned new development and from existing built form were identified. The results of this analysis yielded the figure below, which highlights the priority areas for DES expansion.
Recommendations: A Roadmap for Expansion

From the lessons learned a variety of recommendations for the expansion of ESAP’s DES in the NCR were generated. These recommendations come together to form a roadmap charting out a long-term process for expansion. The chart below displays an overview of these recommended steps. Three stages are recommended for long-term implementation: Preparation, including completion and streamlining of the internal federal system and engagement with key stakeholders; Planning, including further analysis of conditions and the creation of a clear implementation strategy for expansion in the market; and Implementation, which covers the ongoing operation of the DES with an aim of continual expansion and improvement. As an ultimate outcome, DES in the NCR is envisioned as a sustainable, financially feasible product that delivers high quality service to clients while meeting the environmental goals of stakeholders.

<table>
<thead>
<tr>
<th>1 - PREPARATION</th>
<th>2 - PLANNING</th>
<th>3 - IMPLEMENTATION</th>
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<tbody>
<tr>
<td><strong>Connect Federal Buildings</strong></td>
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<tr>
<td>• Connect additional federal buildings to existing DES</td>
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<tr>
<td>• Utilize ministerial business planning, cross-departmental communication</td>
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<td>• Create an internal accounting structure to track operational costs and energy savings</td>
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<td>• <strong>Outcome:</strong> A network of federal buildings in DES acts as a pilot project to prove feasibility of system, build public confidence for expansion</td>
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<td><strong>Engage Key Stakeholders</strong></td>
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<tr>
<td>• Establish formal standing committee to enable collaboration</td>
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<tr>
<td>• Share information to develop common understanding of DES</td>
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<tr>
<td>• Develop a shared vision for future of DES</td>
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<tr>
<td>• Create standing committees to maintain engagement</td>
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<tr>
<td>• <strong>Outcome:</strong> Major stakeholders are aware of and interested in system, ESAP has the information needed to effectively plan and operate</td>
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<td><strong>Create Implementation Strategy</strong></td>
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<tr>
<td>• Develop a business model &amp; marketing plan</td>
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<td>• Determine location for new biomass CHCP and select target expansion areas</td>
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<tr>
<td>• Align policies, develop guidelines, incentives, and requirements</td>
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<tr>
<td>• <strong>Outcome:</strong> ESAP is prepared to roll DES out to clients as a service</td>
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<tr>
<td><strong>Build on Energy and Land Use Analysis</strong></td>
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<tr>
<td>• Bolster findings with information from stakeholders</td>
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<tr>
<td>• Assess energy use and feasibility by area and propose target service areas and priorities</td>
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<tr>
<td>• Identify barriers and opportunities for expansion</td>
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<tr>
<td>• <strong>Outcome:</strong> A firm understanding is developed of which locations and potential clients are best suited for DES</td>
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<tr>
<td><strong>Implementation and Operations</strong></td>
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<td>• Market DES to potential clients in the region as building heating/cooling systems need replacement</td>
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<td>• Develop policies that mandate or incentivize connection to DES for new development or major retrofits within certain proximity to DES</td>
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<tr>
<td>• <strong>Outcome:</strong> DES is a sustainable, expanding service that meets the needs of clients and stakeholders</td>
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</table>
Table of Contents

1.0 Introduction........................................................................................................................................................................2
  1.1 Purpose of the Report..............................................................................................................................................................2
  1.2 Context ....................................................................................................................................................................................2
    1.2.1 Client ....................................................................................................................................................................................2
    1.2.2 Study Area..........................................................................................................................................................................2
    1.2.3 Growth ................................................................................................................................................................................3
      1.2.3.1 General Trends...............................................................................................................................................................3
      1.2.3.2 New Development ..........................................................................................................................................................4

2.0 District Energy Systems..............................................................................................................................................................8
  2.1 How District Energy Works.......................................................................................................................................................8
  2.2 Benefits of District Energy.......................................................................................................................................................9

3.0 Current Conditions ..................................................................................................................................................................12
  3.1 NCR DES Current System......................................................................................................................................................12
  3.2 Energy Services Acquisition Program (ESAP)..........................................................................................................................14
    3.2.1 Phase 1: Modernization.......................................................................................................................................................14
    3.2.2 Phase 2: Greening and Expansion......................................................................................................................................15
  3.3 Government Context ..................................................................................................................................................................15
    3.3.1 Government of Canada.......................................................................................................................................................16
    3.3.2 National Capital Commission ..........................................................................................................................................18
    3.3.3 Province of Ontario...............................................................................................................................................................20
    3.3.4 City of Ottawa ......................................................................................................................................................................22
    3.3.5 Province of Québec ..............................................................................................................................................................23
    3.3.6 Ville de Gatineau .................................................................................................................................................................25

4.0 Case Study Review..................................................................................................................................................................30
  4.1 Method of Review..................................................................................................................................................................30
  4.2 Land Use and Expansion.........................................................................................................................................................31
    4.2.1 Determining Growth Areas..................................................................................................................................................31
    4.2.2 Community Planning and DES Expansion............................................................................................................................33
    4.2.3 Timing and Phasing..............................................................................................................................................................35
    4.2.4 Lessons Learned..................................................................................................................................................................37
  4.3 Growing Client Base .................................................................................................................................................................38
    4.3.1 Identifying Potential Clients..................................................................................................................................................38
    4.3.2 Financial Tools for Client Attraction....................................................................................................................................40
    4.3.3 Attracting Clients for Environmental Sustainability..........................................................................................................41
    4.3.4 District Energy Marketing.....................................................................................................................................................42
    4.3.5 Lessons Learned..................................................................................................................................................................44
4.4 System Governance ........................................................................................................................................45
  4.4.1 Establishing a Governance Model........................................................................................................45
  4.4.2 Citizen Engagement and Consultation..................................................................................................46
  4.4.3 Reviewing the Legislative and Policy Context.......................................................................................47
  4.4.4 Ensuring Successful Operations ............................................................................................................48
  4.4.5 Lessons Learned ....................................................................................................................................49

4.5 Summary of Lessons Learned ................................................................................................................50

5.0 SWOC Analysis ...........................................................................................................................................56
  5.1 Land Use and Expansion ........................................................................................................................56
  5.2 Growing Client Base ..................................................................................................................................57
  5.3 System Governance ....................................................................................................................................58

6.0 Land Use Analysis .......................................................................................................................................60
  6.1 Data and Limitations ....................................................................................................................................60
  6.2 Supportive Land Use Policy .......................................................................................................................61
    6.2.1 Ottawa Official Plan High Density and Mixed-Use Nodes ....................................................................61
    6.2.2 Ottawa and Gatineau Transit Oriented Development ........................................................................62
    6.2.3 Ottawa Secondary Plan Areas ...........................................................................................................62
  6.3 Supportive Built Environment ....................................................................................................................64
    6.3.1 Potential Growth Areas .......................................................................................................................65
    6.3.2 Existing Buildings ..................................................................................................................................66
  6.4 Discussion ....................................................................................................................................................70
    6.4.1 Phasing ..................................................................................................................................................71
    6.4.2 Infrastructure Costs ............................................................................................................................72
    6.4.3 Ownership ............................................................................................................................................73
    6.4.4 Anchor Users .......................................................................................................................................73
    6.4.5 DES Compatibility ..............................................................................................................................73

6.5 Results ..........................................................................................................................................................74

7.0 Implementation Recommendations .............................................................................................................76
  7.1 Overview .....................................................................................................................................................76
  7.2 Preparation ..................................................................................................................................................76
    7.2.1 Connect Federal Buildings .................................................................................................................76
    7.2.2 Engage Key Stakeholders ....................................................................................................................79
  7.3 Planning .......................................................................................................................................................80
    7.3.1 Build Upon Energy and Land Use Analysis .......................................................................................81
    7.3.2 Create Implementation Strategy .........................................................................................................82

7.4 Implementation ............................................................................................................................................82

8.0 Conclusion .....................................................................................................................................................85

Appendix A: Acronyms....................................................................................................................................87
Appendix B: Energy Demand Calculations ................................................................. 89
Appendix C: Case Studies .......................................................................................... 93
Appendix D: Maps ..................................................................................................... 144

List of Figures

Chapter 1.0
Figure 1: The National Capital Region (NCR)
Figure 2: Map of Light Rail Transit (LRT) line in Ottawa

Chapter 2.0
Figure 1: UBC District Energy Utility Centre
Figure 2: ESAP requirements for building heating and cooling systems connected to PSPC DES
Figure 3: United Nations district energy diagram

Chapter 3.0
Figure 1: CHCP plant locations in the NCR map
Figure 2: Parliamentary and Judicial Precinct map

Chapter 4.0
Figure 1: Selected global case studies map
Figure 2: Guelph, ON heat map
Figure 3: Sydney, Australia low carbon zones map
Figure 4: Burlington’s Community Energy Plan’s governance organizational structure
Figure 5: Driving forces behind Gibsons, BC DES
Figure 6: Gibsons location and phasing of DES
Figure 7: Phase 1 Gibsons DES
Figure 8: Map of the best potential district energy zones in Vancouver, BC
Figure 9: St. Paul, Minnesota cogeneration plant
Figure 10: Planned, existing and potential heating networks in Islington map
Figure 11: Southeast False Creek energy centre
Figure 12: Princeton’s four sources of energy
Figure 13: Metro Nashville connections map

Chapter 6.0
Figure 1: Supportive policy layers analysis
Figure 2: Supportive policy areas GIS map for DES in Ottawa
Figure 3: Identified new development areas map
Figure 4: Large buildings in supportive areas map
Figure 5: Priority areas for DES expansion map
Figure 6: Four factors establishing the land use assessment framework

Chapter 7.0
Figure 1: Strategic plan for DES expansion diagram
Figure 2: Roadmap for expansion
Figure 3: Land use assessment framework
Figure 4: Recommended inputs to target expansion locations and clients
Figure 5: Three key initiatives of the recommended implementation strategy

Chapter 8.0
Figure 1: Parliament Hill in the NCR
# List of Tables

**Chapter 1.0**

Table 1: Summary of major new/proposed developments in the NCR

**Chapter 3.0**

Table 1: CHCP current information
Table 2: Governing policy context for the DES

**Chapter 4.0**

Table 1: Key lessons learned from 18 case studies

**Chapter 5.0**

Table 1: Land Use and Expansion SWOC
Table 2: Growing Client Base SWOC
Table 3: System Governance SWOC

**Chapter 6.0**

Table 1: Supportive and unsupportive Ottawa secondary plans
Table 2: Policy characteristics summary
Table 3: Characteristics and challenges of new development areas
Table 4: Areas with a high concentration of large buildings
Table 5: Building concentrations within secondary plans
Table 6: Key priority area
Table 7: DES piping installation costs