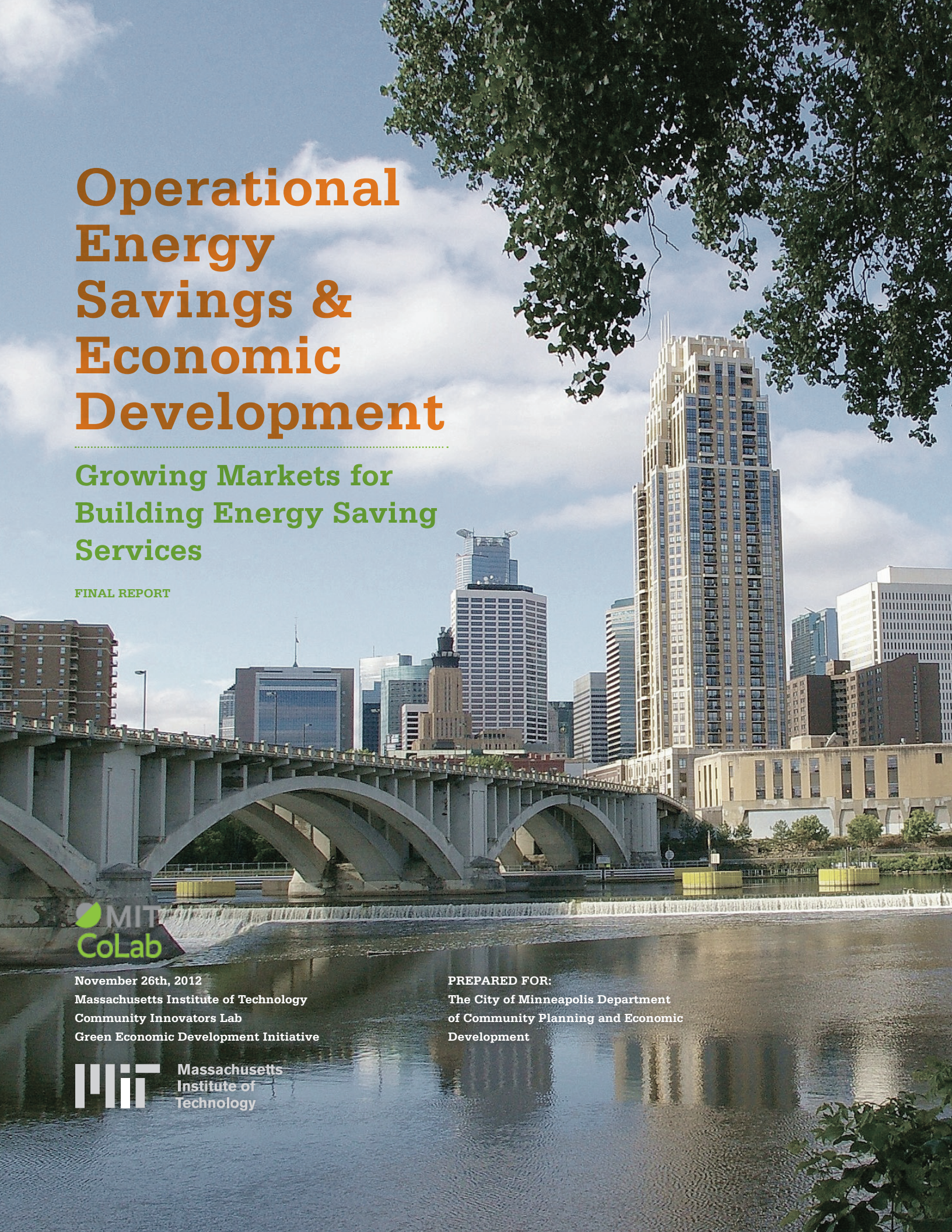
Operational Energy Savings & Economic Development

Growing Markets for Building Energy Saving Services

FINAL REPORT



MIT CoLab

November 26th, 2012
Massachusetts Institute of Technology
Community Innovators Lab
Green Economic Development Initiative

PREPARED FOR:
The City of Minneapolis Department of Community Planning and Economic Development

Massachusetts Institute of Technology

Executive Summary

This report investigates how economic development organizations can stimulate **Operational Energy Savings** in existing buildings. "Operational energy savings" (OES) strategies entail diagnosing buildings' energy use and suggesting low-cost means to save energy via improvements to building operations, controls, systems, and equipment. OES encompasses a range of diagnostic strategies, including:

- Benchmarking building energy use against past performance and other similar buildings.
- Walk-through building audits.
- Commissioning, retro-commissioning and re-commissioning – the testing of existing buildings' mechanical equipment for faults, and the optimization of their schedules to minimize energy use and achieve greater comfort.
- Comparisons of buildings' performance with building energy models, to identify energy saving opportunities.
- Real-time monitoring of building systems using automated diagnostics facilitated by computer applications, or 'ongoing commissioning.'

OES investments entail low-cost equipment replacements, and optimizing buildings' operations and scheduling; these investments are often made through **operations budgets**. OES is an integral part of good **energy management**, which also includes capital-intensive building upgrades and ongoing occupant behavioral changes. This study focuses on opportunities in commercial office buildings, though multifamily buildings and industrial spaces can benefit from similar practices.

The energy savings potential of OES is vast. For example, the most comprehensive study of commissioning practices found that the median commercial office retro-commissioning project yields **energy savings of 22%** (16% for all building types), with a **return on investment of 91%**.[*] Yet industry estimates indicate that **only five% of the cost-effective market potential of building commissioning is implemented**.[†] Other promising OES services, such as automated diagnostics and performance comparisons against energy models are even more nascent, serving just a tiny% of the potential market.

Economic development organizations have a variety of reasons to support good energy management, of which OES is an integral part. Businesses stand to save on energy costs. Properly functioning building HVAC systems may lead to healthier building occupants, improving productivity and quality of life, and potentially reducing healthcare costs. OES provides direct employment; moreover, energy savings allows businesses and households to invest greater amounts in other sectors of the local economy, an effect that fosters further employment. Lastly, OES reduces climate change pollution and other environmental impacts of energy use.

Economically rational investments in OES are **hindered by a variety of market barriers**. This study uses the Minneapolis-St. Paul region as a test case, assessing how an economic development organization, the City of Minneapolis' Department of Community Planning and Economic Development, may intervene to grow OES services and activities. We use a tripartite model of **market transformation**, investigating strategies to grow demand, develop businesses, and support a **skilled workforce**.

We find that the Minneapolis-St. Paul region is positioned to grow as a **cluster of innovation in OES and building energy related services**. A wide range of firms in the region offer OES services, and some are national leaders in their fields serving markets across the USA. There is significant, though by no means universal, participation in energy programs by the private sector and public building owners. Developing this nascent cluster can lead to long-term positive economic ramifications and spin-offs.

Markets for OES services in the region are still underdeveloped. While reliable data is unavailable, industry participants estimate that the majority of suitable buildings have not benefited from OES services, and others lack frequent service. Moreover, industry participants note the opportunity to deepen and improve the quality of OES services delivered, realizing greater energy savings.

To help grow the market for OES services, and facilitate the highest quality OES activities and innovation, we recommend that the City convene a collaborative **OES Taskforce** consisting of **industry stakeholders** and **staffed by a fulltime City project manager** and a **half-time analyst position**. This Taskforce could be a working group of the regional Thinc.Green initiative, and/or incorporate the Existing Building Commissioning (EBCx) service providers' collaborative, as proposed by the Center for Energy and Environment. The OES Taskforce would coordinate efforts to expand the scope of OES in the region, including demand stimulation, business development, and workforce development.

DEMAND STIMULATION

- Build knowledge and social norms of OES services among building owners, managers, tenants, and the brokerage community.
  - Conduct outreach and education, providing information on the nature of OES services, costs, and available programs.
  - Encourage the brokerage community to explore the use of mandatory energy disclosure data to provide understandable building energy cost information.
  - Support a forum to connect property managers with OES service providers.
  - Continue to support programs by demand side industry associations, such as the Building Owners and Managers Associations' involvement in the Kilowatt Crackdown program.
  - Support peer to peer networking amongst building operators, to share best practices in building energy management.
  - Have City elected officials, and other leaders, serve as vocal advocates for strong energy management. The City should recognize leadership in OES and other energy management activities.
- Lead by example in City buildings. Engage in innovative OES services, documenting their economic case and lessons learned.
- Aggregate small businesses to engage in building commissioning services. Assist with contractor procurement, financing, and implementation of OES.
- Consider regulatory mandates requiring detailed building assessments, lighting upgrades, regular commissioning activities and other energy services.

BUSINESS DEVELOPMENT

- Encourage the development of a forum for industry coordination among OES suppliers. Important priorities include:
  - Defining typical service offerings, and building clients understanding of the

* Mills, Evan. Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions in the United States. LBNL. http://cx.lbl.gov/documents/2009-assessment/lbnl-cx-cost-benefit.pdf

† Mills, E. 2011. "Commissioning: Capturing the Potential." *ASHRAE Journal*; National Energy Management Institute. Building Commissioning, Testing, Adjusting, and Balancing. July 15, 2005.

technical scope of these services and ability to manage projects.

- Engaging in joint marketing.
- Provide a forum where service providers can connect with potential clients.

- Provide a forum for ongoing industry engagement and understanding OES providers' needs.

WORKFORCE DEVELOPMENT

- Facilitate the development of highly skilled professional OES service providers.
  - Convene forums for peer to peer learning.
  - Facilitate the rationalization of building commissioning credentials, coordinating with national efforts. The current range of credentials for professional commissioning services is confusing.
- Facilitate greater energy literacy amongst building operators and managers, in order to better engage with OES practices and communicate with OES service providers.
  - Provide a forum for peer to peer learning involving the Greater Minneapolis BOMA Engineers Association.
  - Investigate opportunities to provide existing building operators with energy management and building commissioning credentials.
  - Investigate opportunities to incorporate energy management education as a part of building operator education through the region's technical colleges. Notably, Anoka Technical College's Corporate Center is considering an Energy Management curriculum and credential to complement its professional development offerings to manufacturing workers, and has expressed interest in expanding to building energy management. Other technical colleges may also provide good opportunities for integrating richer energy management into building operations curricula.

By undertaking this comprehensive market transformation framework, the OES Taskforce can establish a larger, innovative, and prosperous cluster in OES services and related building energy management industries.

Table of Contents

EXECUTIVE SUMMARY 2

I. INTRODUCTION 6
- A. PURPOSE OF THIS REPORT 6
- B. WHAT ARE OPERATIONAL ENERGY SAVINGS SERVICES? 6
- C. MARKET POTENTIAL OF OES SERVICES 8

II. OES AND ECONOMIC DEVELOPMENT PRIORITIES 10
- A. ENERGY COST SAVINGS 10
- B. POSITIVE COMFORT, HEALTH AND PRODUCTIVITY OUTCOMES 10
- C. ADDED REAL ESTATE VALUE 11
- D. OPPORTUNITIES FOR LOCAL BUSINESS 11
- E. EMPLOYMENT GROWTH 12

III. MINNEAPOLIS-ST. PAUL METROPOLITAN AREA INDUSTRY & POLICY SNAPSHOT 14
- A. OES DEMAND IN COMMERCIAL PROPERTIES 14
  - *1. Real Estate Market in Minneapolis-St. Paul* *14*
  - *2. Current State of Demand for Operational Energy Savings Services* *16*
- B. SUPPLY: SERVICE PROVIDERS 18
  - *1. Current State of Supply for Operational Energy Savings Services* *18*
  - *2. Challenges to Improving Supply* *19*
- C. WORKFORCE DEVELOPMENT 20
  - *1. Professional service providers* *20*
  - *2. Building Operators and Technical Staff* *21*
- D. PROGRAMS AND POLICIES 22
  - *1. Utility Programs* *22*
  - *2. Nonprofit Organization Programs* *24*
  - *3. Government Policies* *24*
- E. SUMMARY 25

IV. KEY FINDINGS AND RECOMMENDATIONS 28
- A. CONVENE AND STAFF AN OES TASKFORCE 28
- B. DEMAND STIMULATION 29
- C. BUSINESS DEVELOPMENT 32
- D. WORKFORCE DEVELOPMENT 33

V. CONCLUSION 36

APPENDIX A: CREDENTIALS RELATING TO BUILDING OES 38

I. Introduction

A. Purpose of This Report

This report assists local and state economic development organizations in realizing greater uptake of **operational energy saving** strategies in commercial buildings. "Operational energy savings" (OES) strategies entail diagnosing buildings' energy use and suggesting low-cost means to save energy via improving buildings' operations. OES services represent a significant opportunity to realize environmental sustainability and economic development objectives.

This report was prepared by the Green Economic Development Initiative (GEDI) at the Community Innovators Lab (CoLab) of the Massachusetts Institute of Technology, in collaboration with the Community Planning and Economic Development Department of the City of Minneapolis. GEDI researched OES service markets in the Minneapolis-St. Paul metropolitan region, interviewing industry stakeholders and analyzing market trends. Based on this case study, and a review of nationwide research on OES, this report recommends strategies to transform markets for OES and grow the sector. In particular, this report:

- Describes the market for a range of OES services in the private commercial building sector.
- Articulates the value of energy savings from a local economic development perspective.
- Outlines a tripartite market transformation framework, including:
  - Demand Stimulation.
  - Business Development.
  - Workforce Development.

The Green Economic Development Initiative (GEDI) supports economic development organizations pursuing the triple bottom line of environmental sustainability, social justice and economic opportunity. GEDI's goal is to have this triple bottom approach broadly applied in the economic development field. For more information, please visit http://web.mit.edu/colab/work-project-gedi.html.

The specific market transformation strategy and analysis in this report focuses on the Minneapolis-St. Paul region; however, OES markets operate in a similar manner in other regions, and economic development practitioners from many localities will benefit from the findings and recommendations in this report.

B. What Are Operational Energy Savings Services?

OES entails implementing low-cost improvements to building operations, controls, systems, and equipment to reduce energy use. OES services typically involve a thorough diagnostic investigation of building energy use and its savings potential, a process which can be technically complicated and data-intensive. OES is part of good building energy management, complementing other energy management practices such as major capital upgrades and occupant behavior change campaigns; together, these energy management efforts can minimize building energy use. Unlike capital upgrades and physical retrofits, OES services mostly focus on energy savings through improving building operations, or small low-cost equipment replacement. Thus, OES can often be funded via buildings' operating budgets. Operational energy efficiency is a product of joint commitment and coordination among multiple stakeholders, including building owners, property managers, building engineers, operations staff, and third-party consultants. Besides reducing energy use and expenses, the benefits of operational services may include less frequent maintenance, increased equipment longevity, and improved health and comfort of building occupants.

A variety of OES diagnostic techniques exist, and the field is fast evolving. Moreover, multiple diagnostic methods may occur concurrently. The aim of these diagnostic procedures is to identify means of saving energy, and improving the comfort and function a building. Diagnostic methods can identify a range of low-cost measures to save energy, including adjusting temperature and humidity set-points; fixing broken equipment; calibrating sensors; making upgrades to lighting, water fixtures, and other easily replaceable equipment; improving building controls; and improving building scheduling, so that spaces are not unnecessarily conditioned. OES services are usually performed by mechanical or electrical engineering firms, HVAC or controls contractors, or specialized OES firms. Broad categories of OES diagnostic methods include:

- **Benchmarking.** Benchmarking involves comparing a buildings' energy use to historical usage, and against similar buildings in a portfolio. It is used to prioritize the most energy intensive buildings for improvements, to identify building issues leading to excess energy consumption, and to provide stakeholders with comparative information about energy costs and pollution. Benchmarking tools like Energy Star Portfolio Manager use consumption data from monthly utility bills. Benchmarking tools that use interval meter data are also available to compare buildings' energy use over time and from different loads. Benchmarking aids in prioritizing buildings, diagnosing OES opportunities, and the ongoing monitoring of buildings.
- **Walk-through, checklist-based energy audits.** Walk-through audits are helpful to propose simple equipment upgrade measures, and to improve operations schedules and protocols. Such audits are relatively simple to perform, and can identify energy savings opportunities within a short time frame. However, audits often focus on the most common energy deficiencies of building operations and may not be tailored to specific building conditions.
- **Commissioning, Retro-commissioning and Re-commissioning.** The Building Commissioning Association defines existing building commissioning as "a systematic process for investigating, analyzing, and optimizing the performance of building systems through the identification and implementation of low/no cost and capital intensive Facility Improvement Measures and ensuring their continued performance." Commissioning services involve detailed assessment of the performance of equipment, control systems, and operations schedules and protocols. Based on this analysis, the commissioning service provider proposes a range of low-cost or no-cost strategies to achieve greater building energy efficiency, and other building system operations improvements.

The range of techniques and detail of services encompassed by the term 'commissioning' is quite varied. "Commissioning" can refer to: Testing whether equipment functions; calibrating sensors; reviewing building temperature and air-conditioning set-points; and logging measurements of conditions in multiple parts of buildings over time (perhaps months), to identify equipment problems and potential scheduling improvements, a technique referred to as "trending". Moreover, commissioning services can range from solely energy-specific investigations to assessments of a diverse range of building systems, such as fire protection and water supplies.

This report refers to "commissioning" as services intended to identify energy savings.

Retro-commissioning refers to the notion that building commissioning services are applied to existing buildings, ensuring building equipment and operation systems function correctly and efficiently. Re-commissioning is for buildings that have already been commissioned and undergo the commissioning process again. It is typically carried out due to building operational problems or changes in building ownership and function.*

- **On-going commissioning and automated diagnostics.** The installation of data logging devices and trending software makes it possible to implement automated on-going commissioning. With the introduction real-time usage data from smart meters, and more granular space data from sub-metering, automated diagnostics identify energy savings opportunities in real-time. A number of firms offer computer applications and software services that perform diagnostic algorithms to identify building issues and savings opportunities on an ongoing basis.

- **Comparisons with building energy models.** Various organizations have developed building modeling tools to diagnose energy savings opportunities. During construction or major renovations, designers may develop detailed energy models of buildings. Additionally, computer applications populate building information on an ongoing basis, to construct a progressively refined model. These modeling tools facilitate OES in a number of ways. Modeled energy consumption can be compared with actual energy consumption data to identify energy savings potential. Additionally, models suggest whether OES measures are cost effective. Such modeling tools reduce the costs of auditing buildings' savings potential, and identify the most promising energy efficiency opportunities across a portfolio of buildings.

OES service markets are evolving rapidly, driven by increasingly sophisticated technology and analytic methods and the growing availability of energy and building asset data. Moreover, the boundaries between the methods noted above frequently blur. In practice, clients and providers specify a particular combination of services according to the goals and objectives in their OES projects.

OES is typically most cost-effective when performed in larger and more energy-intensive buildings. However, smaller and less energy-intensive buildings present opportunities for improvement and savings..

C. Market Potential of OES Services

While markets for OES are growing, few private sector building owners in the United States engage in OES services, and the range and quality of services need further improvement. The building commissioning industry accounts for $200 million per year nationally, yet the potential level of annual investment could be $4 billion.† Likewise, an industry survey in 2005 indicated that only 5% of "commissionable" existing buildings had been commissioned.‡ Other OES services, such as automated diagnostics or comparisons with detailed building energy models are even more nascent, serving a small%age of their potential market.

Energy management and OES services have greatest penetration in government buildings, as well as the MUSH (municipalities, universities, schools and hospitals) sectors. Penetration in commercial buildings is lower, though larger and more energy intensive commercial buildings are increasingly served. The green building rating systems, LEED for Existing Buildings and ENERGY STAR, reward buildings for undertaking OES services. Great potential exists to expand demand for OES in commercial buildings.

Commercial and industrial buildings account for over $200 billion in annual energy costs and generate almost 50% of U.S. national greenhouse gas emissions.*

In addition to expanding demand, opportunities exist to increase the quality of OES services. Even buildings that receive regular OES attention and services may benefit from more rigorous and skillful service provision. A widespread perception amongst OES providers and program administrators is that the adoption of better practices by providers and building operators can lead to greater savings, even in buildings regularly receiving such services. Thus, efforts to enhance the uptake of OES must address two factors: increasing the market for OES, and ensuring that the OES services provided are of the highest quality. The latter involves enhancing the skills of OES service providers and building operators, and fostering strong industry standards with contract oversight and quality control.

* Portland Energy Conservation, Inc. California Commissioning Guide: Existing Buildings. http://www.cacx.org/resources/documents/CA_Commissioning_Guide_Existing.pdf. June 14, 2006.

† Mills, E. 2011. "Commissioning: Capturing the Potential." *ASHRAE Journal.*

‡ National Energy Management Institute. Building Commissioning, Testing, Adjusting, and Balancing. July 15, 2005.

* ENERGY STAR. Fast Facts on Energy Use. http://www.energystar.gov/ia/business/challenge/learn_more/FastFacts.pdf.

II. OES and Economic Development Priorities

Increasing the extent of OES in a region contributes to a variety of positive economic outcomes. This section summarizes these benefits, illustrating how they correspond to economic development organizations' priorities.

A. Energy Cost Savings

Achieving greater OES reduces local businesses' and residences' energy costs. Collectively, these savings contribute to the economic well-being of a region. The most comprehensive national survey of building commissioning reveals a median normalized project cost of $0.30/ft^2, leading to a median 22% savings in commercial office buildings (16% for all building types), with a payback time of 1.1 years.* Our interviews with, and survey of OES service providers in the Minneapolis-St. Paul region reveals similar results; however, there is large variation in estimated average energy savings, ranging from 8-35%. This may reflect the range of energy saving potential across building types, as well as in the scope of commissioning projects by different providers. Since energy costs are ultimately born by tenants, these savings help reduce business tenants' operating costs, enhancing their competitiveness and profitability.

* Mills, Evan. Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions in the United States. *Energy Efficiency*, 2011(4): 145-173.

B. Positive Comfort, Health and Productivity Outcomes

In addition to energy savings, OES services yield positive comfort, health and productivity outcomes for building tenants that further stimulate economic development. Improving building operations can raise the standards of thermal comfort and lighting quality. Better ventilation and humidity controls elevate indoor air quality, enhancing the health conditions of building occupants. The specific benefits of an improved indoor environment include reduced:

- Respiratory illness.
- Allergies and asthma.
- Sick building syndrome symptoms.
- Absence from work.

Improved occupant comfort and health contribute to greater worker performance and productivity. Empirical evidence suggests that improved air quality through higher ventilation rates decreases illness risk and lowers rates of absence from work or school.† According to one study, four common commissioning measures may reduce health costs for office workers by $29 billion annually, if implemented in all appropriate buildings across the USA.‡

† Lawrence Berkeley National Laboratory. Impacts of Building Ventilation on Health and Performance. http://www.iaqscience.lbl.gov/vent-summary.html.

‡ Fisk, W., D. Black & G. Brunner. Benefit and costs of improved IEQ in U.S. offices. *Indoor Air*, 2011 (21): 357-67.

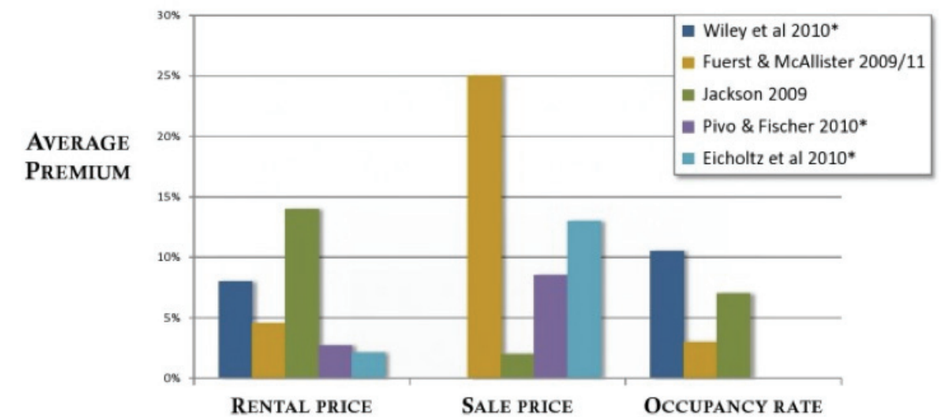


Figure 2-1 Price Premiums in LEED and Energy Star Buildings. (Source: IMT 2012)

Additional OES measures garner further savings.

Improved health and productivity in commercial properties have great potential to realize economic development objectives. One study found that improved building conditions could save the US economy $6 to $14 billion from reduced respiratory illness, $1 to $4 billion from reduced allergies and asthma, $10 to $30 billion from reduced sick building syndrome symptoms, and $20 to $160 billion from non-health related improvements in worker performance.*

C. Added Real Estate Value

Greater energy efficiency and healthier buildings can increase building values and rents, as tenants are willing to pay more to locate in such buildings. The Institute for Market Transformation's meta-analysis of national studies investigating the impact of LEED and the ENERGY STAR rating on real estate performance finds that certification results in premiums on rents, sales price, and occupancy (See Figure 2-1)†. Higher property values benefit local governments that rely on property taxes for much of their revenue. It is important to note, that participants in the Minneapolis-St. Paul study expressed that these premiums have not been observed in their local market.

* Fisk, W. Health and Productivity Gains from Better Indoor Environments and Their Relationship with Building Energy Efficiency. *Annual Reviews of Energy and the Environment*, 2000(25): 537-566.

D. Opportunities for Local Business

Current levels of investment in OES are far below potential. Tapping this potential represents a substantial opportunity for local business expansion and growth. Growing the sector results in new businesses and growth in existing OES firms. Engineering services firms, mechanical and controls contractors, software development firms, and other businesses stand to benefit from such market growth. Moreover, many OES services involve rigorous analysis of building data; increasing investment in OES may lead to new knowledge in building sciences, engineering and architecture. Efforts to stimulate the OES sector foster innovation, improved services, and new business opportunities in related sectors.

† Source: Institute for Market Transformation.

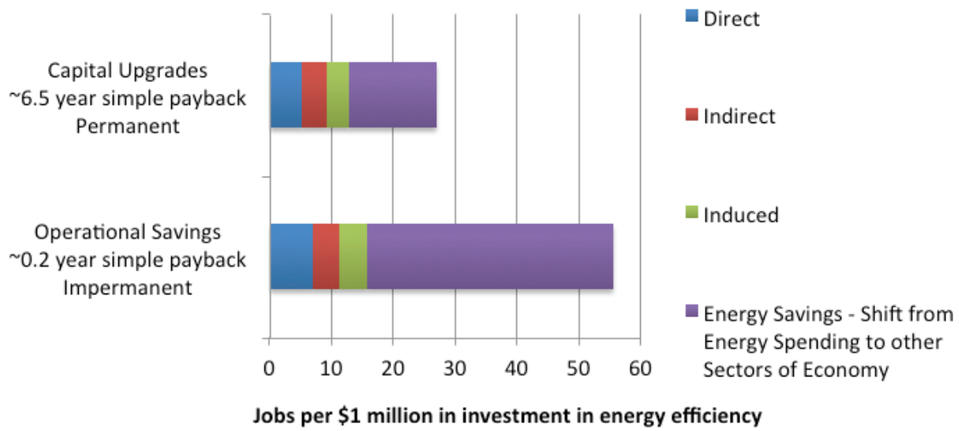


Figure 2-2 Employment in Different Energy Efficiency Improvements (Data: IMT & PERI 2012). "Permanent" refers to upgrade measure that last the lifetime of the financial analysis. "Impermanent" measures last three years.

E. Employment Growth

Greater uptake of OES will lead direct jobs in OES providing firms, indirect jobs along supply chains, and induced employment due to the spending by direct and indirect job holders.* However, the potential for direct job creation from energy efficiency should not be overstated. Direct employment associated with providing energy efficiency services will not comprise a sizeable%age of a region's employment. Moreover, jobs directly related to OES services, such as mechanical and electrical engineers, require high knowledge levels and experience, limiting the availability of entry level work for lower skilled or disadvantaged communities.

The total USA workforce in energy efficiency services sector is estimated to comprise approximately 114,000 person-years of employment (PYE) and 380,000 individuals working full-time or part-time on energy efficiency activities in 2008. Research projects that the workforce size can quadruple from 2008 to 2020 with sufficient public spending and supportive policies.†

Indeed, the largest employment impact may stem from the energy savings realized by OES. As buildings save energy, owners shift their spending from utilities to other sectors of the economy. This spending in the rest of the economy results in more job creation than spending on utilities; utilities reinvestment of those funds is less job-intensive than the typical range of goods and services that businesses and households procure. Moreover, it is likely that more of this job growth will occur in local economies than if spending had been on energy; in most regions, businesses and households are more likely to reinvest locally than utilities. Efficiency measures with high internal rates of return generate greater job growth per dollar invested, as greater net savings are reinvested into other sectors of the economy.

One recent input-output analysis suggests that the high return OES measures supports more than three times the job creation than direct jobs created;* Figure 2-2 illustrates this effect for a suite of operational energy savings averaging a 0.2 year simple payback, compared with a suite of capital upgrades with a 6.5 year payback.†

* "Direct" jobs are those involved in delivering a service like OES. "Indirect" jobs are those not immediately associated with the service but which are created due to its delivery; indirect jobs include the manufacturing of installed building components. "Induced" jobs are those generated by direct and indirect employees further spending their wages in the economy.

† Lawrence Berkeley National Laboratory. Energy Efficiency Services Sector: Workforce Size and Expectations for Growth. http://eetd.lbl.gov/ea/emp/reports/lbnl-3987e.pdf. September 2010.

* Garrett-Peltier, H. Employment Estimates for Energy Efficiency Retrofits of Commercial Buildings. http://www.usgbc.org/ShowFile.aspx?DocumentID=9531. June 2, 2011.

† These employment figures are developed from analysis which presume a certain suite of energy efficiency measures. Different suites of measures will have different employment outcomes. 'Permanent' measures last for the life of the building. 'Impermanent' measures are assumed to last an average of three years, at which point the energy savings garnered from these operational measures is lost as building systems fall into disrepair. Generally, the greater the return on investment, the more energy savings can stimulate economic activity in other sectors of the economy.

III. Minneapolis-St. Paul Metropolitan Area Industry & Policy Snapshot

GEDI selected the Minneapolis-St. Paul Metropolitan Area as a case to investigate how economic development organizations can enhance markets for OES services and engender greater energy savings. In particular, this report focuses on OES services in private office buildings, as they account for a large portion of real estate inventory and energy consumption in the region. Much of the market transformation activities we recommend also positively impact OES services in multifamily building and the manufacturing sector.

Based on secondary data, prior studies, and interviews and surveys with key industry stakeholders, this section summarizes the existing market conditions for OES services, noting demand side, business, workforce, and energy program issues.* It then outlines the opportunities and challenges for the OES services industry to grow in the region.

A. OES Demand in Commercial Properties

1. Real Estate Market in Minneapolis-St. Paul

The Minneapolis-St. Paul Metropolitan Area is a major economic hub in the Midwestern United States and one of the largest economic regions in the United States, ranked thirteenth in gross regional product.† The strong presence of commercial, industrial, and government activities in the region contributes to the large size of Minneapolis-St. Paul's commercial real estate market. With signs of economic recovery and employment growth, the commercial real estate market in the region is expected to strengthen in the coming years. Increasing building occupancy has the potential to generate more demand for OES services.

With an economic base in manufacturing and service providing industries, the region is a popular office and industrial market destination and is currently home to 19 Fortune 500 firms.

The regional economy is projected to recover from the recession. Unemployment fell by 1.1% to 5.9% in 2011, and industries such as manufacturing, finance,

* Interviewees informing our analysis of regional conditions include:

- Providers of OES services;
- Clients of OES services, including commercial real estate owners and managers;
- Representatives of government and public agencies, including city councilors and local government staff;
- Major nonprofit organizations promoting energy efficiency;
- Workforce development organizations, including technical and community colleges, and employment training centers.

† Greyhill Advisors. Gross Metropolitan Product. http://greyhill.com/gross-metropolitan-product. 2011.

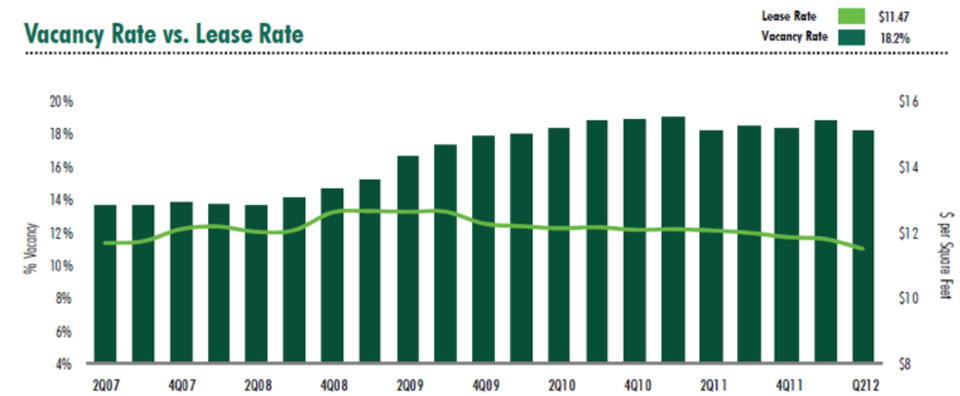


Diagram 3-2 Vacancy Rate and Lease Rate of the Rental Office Market in Minneapolis-St. Paul Metropolitan Area, 2007-2012.

Source: CBRE[‡]

trade and transportation, and professional and business services have seen substantial employment expansion and revenue growth.*

The Federal Reserve summarized in early 2012 that the Minneapolis District has reported "stronger demand" for commercial real estate and "growing demand" for industrial space.†

In the Minneapolis-St. Paul's office real estate market, the three classes of tenant office space are at different points in recoveries from recession (see Table 3-1).‡ The market is recovering, with decreasing vacancy in 2011 (see Diagram 3-2).§ However, vacancy rates are still high in Class B and C properties. In general, Class A properties realize greater returns and lower vacancy than Class B and C. The Minneapolis Central Business District (CBD), the most established and upscale submarket, has recovered more than other submarkets. These trends are due to the "flight to quality" by tenants who chose to relocate from Class B properties to Class A space during the downturn.¶ High vacancy rates and lower rents decrease the likelihood that Class B and C properties will undergo OES.

Type	Building Quantity	Inventory	Quarterly Net Absorption	Vacancy Rate
Class A	120	30,711,483	94,145	13.5%
Class B	304	33,275,663	(132,070)	20.7%
Class C	57	5,169,980	6,198	20.8%
Total Market	**481**	**69,157,126**	**(31,727)**	**17.6%**

Table 3-1 Twin Cities Office Market Statistics, Second Quarter 2012

Source: Cassidy Turley[‡]

Other real estate sectors in the Minneapolis St-Paul Region are exhibiting signs of the economic recovery. The demand for industrial space, especially office warehouse and bulk warehouse, has grown dramatically since 2011, with expected positive absorption and decreasing vacancy rates in coming years. Retail real estate has seen a slow

* Cassidy Turley. Annual Market Report: Minneapolis-St. Paul, Minnesota, 2012. http://www.cassidyturley.com/research/market-reports/market-report/mktid/12/interior/1. 2012.

† The Federal Reserve Board. Summary of Commentary on Current Economic Conditions by Federal Reserve District. http://www.federalreserve.gov/fomc/beigebook/2012/20120111/FullReport.htm. January 11, 2012.

‡ Commercial real estate is typically categorized into Class A, B, and C properties, reflecting progressively lessening rents and property values.

§ The discrepancies in vacancy rates found between Table 3-1 and Figure 3-1 are due to the differing sources of data.

¶ CBRE. MarketView: Minneapolis/St. Paul Office, Second Quarter 2012.

recovery with higher demand for quality products in the core city and first-ring suburbs with good accessibility. Multifamily residential housing is likely to be in strong demand, driven by demographic transformation and economic recovery.

2. Current State of Demand for Operational Energy Savings Services

The key stakeholders in the energy management of commercial buildings include:

- Building owners.
- Property managers.
- Building operators.
  - Building engineers.
  - Building facility operation and management staff.
- Tenants.

Dynamics between these different stakeholders determine the extent to which OES opportunities are investigated, and implemented over time. Important factors impacting the level of demand for OES include the following.

UNDERSTANDING THE VALUE OF OES BY OWNERS, PROPERTY MANAGERS, AND BUILDING OPERATORS

Interview respondents, especially local OES service providers, state that the biggest obstacle to OES growth is a lack of awareness and interest among owners and managers. Although a growing number of building owners and property managers understand the value of energy efficiency generally, few of them truly understand the nature of OES services and their potential benefits. Some reasons for low awareness include:

- Many owners, property managers, and building operators have limited understanding of commissioning services such as equipment functional testing or trending. Moreover, they may be ignorant of OES service options entirely, due to the novelty of more computationally intensive methods. Thus, they have difficulty independently defining the scope of OES service requests, and monitoring the quality of work once they have engaged a service provider.
- Owners and managers are skeptical of potential OES savings.
- The local brokerage community does not share building energy performance, or promote buildings based on their energy management practices.
- For buildings in which tenants are responsible for energy expenses, there is less incentive for building owners to invest in energy savings. The vast majority of leases in the Minneapolis-St. Paul region are triple net leases,* and tenants typically pay all utilities either via direct metering or as a portion of base-building operations fees.

This client reluctance leads many OES service providers to take a reactive approach to marketing OES to potential customers, rather than actively promoting such services. Some providers believe it is in their best interest to find clients who are cooperative and responsive to their work. Many OES service providers point out that it is very difficult to directly engage property owners and managers who are indifferent to energy savings benefits. As a result, some providers have chosen "responsive marketing", focusing on clients who are concerned about energy efficiency and actively seek out or are referred to OES service providers for solutions.

Some larger property managing firms are active pioneers in promoting operational energy efficiency, engaging their own building energy management protocols, installing and utilizing on-going commissioning devices, and developing internal benchmarking tools and programs.

TENANTS DEMAND FOR GREEN, LOW-ENERGY SPACE

Minneapolis CBD market participants suggest that tenants' demand for more environmentally sustainable, lower cost buildings is the key driver for increased energy efficiency services in the region. Many property management firms attribute the rising awareness of operational energy efficiency to "growing peer pressure," indicating that there are basic market expectations to deliver better energy performance in order to cater to the needs of tenants. High-end building owners and tenants, and organizations with younger and more environmentally conscious employees, demand greener space. Such tenants increasingly look for buildings with LEED certification, and it is now an expected standard that Class A office space in the region to be ENERGY STAR rated. Moreover, many building owners and tenants have adopted model "green lease" language, promoted by the Building Owners and Managers Association to align the incentives for owner and tenant investments in energy efficiency.

Some local OES service providers note that while government and MUSH buildings account for the greatest portion of their clientele, the number of private building owners seeking OES services is on the rise in recent years. While many commercial OES projects are focused on industrial complexes or research laboratories, there is growth potential for OES services in private office buildings.

Tenants are limited in their capacity to demand greener office space, however. Tenants are largely focused on their core business and can devote limited attention to buildings' performance. Moreover, some interviewees noted that better energy efficiency has not been translated into higher rents or real estate values in the local market. Owners of buildings with better energy performance can theoretically recoup their investments with higher rent or sales prices, but this has not occurred in the Minneapolis-St. Paul market to-date. This perceived lack of a market signal may reduce some owners' impetus to implement OES.

CONCERNS ABOUT ASSESSMENT COSTS FOR OES STUDIES

Detailed building commissioning projects are typically labor intensive and require an extensive investigative phase in order to diagnose building deficiencies and propose potential improvements. Every building has distinct operating systems, facilities, and managing protocols, and commissioning service providers cannot always accurately estimate energy savings potential. Some building owners and managers are thus hesitant to make initial investment on building energy assessment without knowing the energy savings potential.

Many property owners and managers do not earmark operating expenses for OES services and may be financially constrained to engage in OES projects. However, given the short payback period of OES services in existing buildings, especially building commissioning projects that emphasize low- and no-cost intervention, there are potential opportunities to address this shortfall with modest amounts of financing. Moreover, innovative diagnostic strategies, such as benchmarking buildings against modeled performance or ongoing commissioning, can screen buildings for likely cost efficacy and reduce the risk of detailed diagnostic studies.

THE NEED TO IMPLEMENT AND SUSTAIN OES MEASURES

Once OES diagnostic services are provided, many clients face challenges implementing and sustaining energy efficiency measures. Without proper implementation, OES benefits are not fully realized. Besides lack of financial support for implementation, operational challenges occur with insufficient building operator training and with complicated procedures to approve implementation by building management and financial teams. Implementing OES measures requires coordination and commitment between building operators, managers, and owners.

Time considerations are another common barrier to promoting commissioning services in commercial buildings. As the initial assessment and follow-up implementation typically takes at least several months to complete, many building owners and managers are concerned that the long time span of the projects may interfere with the routine operation of their properties.

TECHNICAL AND FINANCIAL CONSTRAINTS IN OLDER, SMALLER AND CLASS B AND C PROPERTIES

OES in older, smaller buildings may not achieve as high a rate of return as larger facilities, though there are many economically attractive upgrades. Such buildings often contain older mechanical and controls systems that cannot be programmed to

* In triple-net leases, the tenants are responsible to pay taxes, insurance, maintenance, and utility expenses in addition to the monthly rents.

achieve deep savings. Moreover, owners are hesitant to undertake OES measures in buildings that may sit vacant; the higher rates of vacancy in class B and C properties can further discourage such owners from engaging OES services. Additionally, such owners typically have fewer financial resources, are reluctant to take on debt, and employ less sophisticated building management teams.. Unfortunately, as these building owners forgo OES opportunities, their properties are less competitive in the marketplace with larger class A properties.

B. Supply: Service Providers

1. Current State of Supply for Operational Energy Savings Services

OES service providers in the Minneapolis-St. Paul market vary in the nature of services they offer, size and structure, geographic service areas, and major clients.

TYPES OF PROVIDERS

There is a diverse mixture of OES service providers in the Minneapolis-St. Paul Metropolitan Area. Though there are several smaller-sized firms that are fully committed to OES services as their sole business, most local service providers are larger firms which provide a wider array of services.

The OES services market is mainly comprised of four types of firms:

- Energy service companies.
- Building mechanical and electrical engineering firms.
- HVAC and controls contractors.
- Specialized OES service firms, such as automated diagnostic technologies or computerized platforms to compare buildings' energy use to modeled expectations.

This diversity holds the potential to foster a climate of innovation; however, it also contributes to confusion amongst the market in defining particular OES services, and in educating the demand side about these options.

SIZES AND STRUCTURE OF PROVIDERS

The sizes and structure of the local OES service providers vary significantly. A survey of major building commissioning service providers in the region reveals that the average firm has roughly 2-3 full-time equivalent employees devoted to building commissioning services; however, the number fluctuates greatly across firms. Some OES service providers are small businesses with one or two employees, while some larger firms have more than 10 full-time employees practicing OES services.

Similar to employee size, the revenue from OES services also varies across different providers. Our survey suggests that for firms with their primary businesses in engineering or architecture and design, OES services only account for less than 10% of their revenues, but for many smaller firms, OES services is their sole business area and constitutes their primary source of revenue.

GEOGRAPHIC SERVICE AREAS OF PROVIDERS

Most OES service providers in the Minneapolis-St. Paul region target businesses within the Metropolitan Area. Based on survey response, almost half of the providers obtain more than three-quarters of their OES revenue from clients within the Minneapolis-St. Paul region. However, some providers, especially those with a longer history, occasionally undertake projects in other states, as far away as Texas and on the East and West Coasts, through referrals by previous clients.

OES CLIENTS

OES firms serve a wide variety of clients in the region. A typical provider undertakes around 10 projects totaling two million square feet of floor area every year, though activity levels vary with the employee size, project scope, and market condition.

Most providers serve an even mix of new constructions and existing buildings. A sizeable majority of this work occurs in government and MUSH buildings. These firms report recent growth in OES projects in commercial buildings, including office, industrial, and retail facilities, although these still constitute a small share of the total market.

The OES service providers use multiple channels to market their services and recruit more clients. The most typical marketing channels include presentations in conferences or vendor-organized seminars targeting building owners and managers, and referral through contractors and OES service programs (discussed in the next section).

A NASCENT CLUSTER OF OES INNOVATION

The OES service sectors in the Minneapolis-St. Paul region are nascent, and far from saturating even the regional potential for cost-effective OES activity. Nevertheless, the region is positioned to become a cluster of OES expertise, serving both regional and export markets. The region houses a number of firms recognized as national industry leaders in model-driven OES services and commissioning. Moreover, the extensive data analysis that characterizes OES can stimulate development of knowledge pertaining to building systems that is useful to other fields. Thus, cultivating the OES sector can also encourage innovation and growth in other sectors, including architecture and engineering design, building sciences, manufacturing, and renewable energy development. Markets for OES services and supplier quality can be improved in a number of respects; nevertheless, the prospect for continuing innovation and development in the region is strong.

2. Challenges to Improving Supply

With recovery in the real estate market, growing awareness of energy efficiency, and better public and utility support, the demand for OES services is likely to grow in the long run. In order to capitalize on the opportunities for OES industry development, providers need to address several issues that pose challenges to expanding and improving their capacity to supply of OES services.

INDUSTRY STANDARDS AND QUALITY CONTROL

The lack of industry standards is a common problem recognized by many of interviewees. Creating a "standard" does not mean imposing a standardized set of procedures or requirements on providers; rather, it aims to establish a consensus on ways to ensure consistent highly quality services and support healthy development of the industry.

As indicated before, the great diversity of providers presents of a variety of service options to clients, but this diversity also results in considerable variation in how OES services are delivered. Indeed, interviewees suggested that some providers occasionally deviate from optimal OES service practices. The confusion around services' scope and varying levels of performance complicate markets for OES, and may reduce the benefits that clients' gain from OES. These dynamics can disorient and discourage potential clients from using OES services.

The Center for Energy and Environment (CEE) has proposed an industry collaboration network for existing building commissioning providers in Minnesota, providing firms a platform to better develop the commissioning services market through communication and mutual support.

ASSURING HIGH QUALITY SERVICE DELIVERY

Some market participants were concerned that building commissioning services were not consistently delivered in a high quality manner by all providers. Quality service delivery is dependent on having bid a sufficient budget to meet stipulations in the contract; good project management; clear communications with building operations staff and property owners; and highly skilled OES service providers and employees. Commentators variously noted that the following practices would ensure better quality OES services:

- Industry standards, and guidelines on pricing to inform clients' review of bids.
- More rigorous quality assurance and oversight mechanisms, to ensure accountability.
- Training service providers, in hard technical

skills and soft interpersonal and management skills.

C. Workforce Development

A skilled workforce is critical to a strong OES service industry and rigorous OES practices by building operators. Moreover, good workforce development programs are means to expand access to OES job opportunities. This section summarizes the current state of workforce development services for two key occupations: OES professional service providers and building management and operations staff.

1. Professional service providers

Delivering OES services requires engineering and building science expertise, including experience with a wide range of HVAC systems and controls, as well as strong project management and communications skills. To develop these skills, OES service providers' development consists of the following components:

FORMAL EDUCATION

OES services professionals typically hold either a four-year university degree in engineering, science, architecture or related academic fields, or a two-year technical or vocational college degree in HVAC systems, electrician contracting, building facilities management, or related professional fields. Many OES services professionals, especially professional engineers in higher level positions, also hold graduate degrees in electrical engineering, mechanical engineering, or other specific fields that are related to OES services.

WORK EXPERIENCE

Professionals' education in OES services typically entails extensive on the job training. Indeed, industry participants note that formal education and credentialing cannot fully equip providers with the technical and interpersonal skills to implement OES. Moreover, education and work experience in related fields, such as mechanical design engineering, do not necessarily translate into proficiency in OES techniques; this fact makes developing a highly proficient workforce a challenge, as the decline in new construction in recent years has lead some design engineers to move into OES services.

After hiring staff with no prior exposure to OES services, many providers assign the new employees to work with experienced colleagues and gain onsite experience. In addition to the technical skills or OES, many providers stress that experience in communicating with building operator and clients, and managing contractors, are critical to being able to effectively deliver OES services.

Professional service providers could benefit from greater opportunities for ongoing learning, complementing on-the-job training. Some interviewees noted that professionals would benefit from interaction and learning between peers, both within and especially across firms. An industry network for OES services professionals in the Minneapolis-St. Paul region could enhance mutual learning, and provide a forum for other industry development initiatives. The California Commissioning Collaborative (CaCx)* provides an example of an organization serving this professional and industrial development role.

CONTINUING EDUCATION, PROFESSIONAL DEVELOPMENT, AND CREDENTIALING

Many OES services providers also receive professional training and credentials through various certification programs. Typical certification programs have eligibility requirements based on applicants' education and work experience background, and include several course modules and an examination. Most certification programs are administered and operated by national organizations; however, some programs, notably the Accredited Commissioning Process Authority Professional program run by the University of Wisconsin-Madison, are particularly popular among local OES services professionals in the Minneapolis-St. Paul region due to geographic proximity. Appendix A catalogues a number of the credentials associated with the building commissioning industry.

However, some service providers note that professional credentialing programs are condensed, and cannot replace on the job learning and continual professional development. Moreover, the industry does not seem to be of one mind regarding which credentials best designate OES expertise. Our survey suggests a range of credentials amongst firms delivering retro-commissioning projects.

* California Commissioning Collaborative. http://www.cacx.org/.

UTILITY PROGRAM TRAINING

Utilities offer professionals training as a requisite to being certified contractors in their energy efficiency programs. Training for Xcel's Recommissioning Program (see below) includes training in building commissioning procedures. However, some industry participants note that this training focuses heavily depend on using spreadsheets and checklists to deliver retro-commissioning and other OES services. They express concern that this emphasis 'commoditizes' the art and science of commissioning services, and that these relatively simple, inflexible tools limit good commissioning practice.

2. Building Operators and Technical Staff

In addition to deep involvement of OES services professionals, the assessment and implementation of OES projects also require active participation and support from operations staff in office buildings, including building engineers and operations and management personnel. Both the diagnostic and implementation stages of OES services are aided by operations staff with a good working knowledge of energy management principles and OES techniques, as well as appreciation of the economic and environmental value of energy savings. Moreover, they will ideally feel empowered to work proactively with OES service providers; not feel threatened that service providers may identify energy savings opportunities; and have incentive to achieve OES. Nevertheless, given their broad range of duties, building operators and managers typically possess less expert knowledge of energy management principles, though they are frequently highly familiar with their buildings' systems.

Building operations staff differ substantially in their educational attainment, experience, and energy management sophistication. Larger facilities and property management firms often have more experienced staff, and staff specialized in energy management.

Relevant workforce development opportunities include:

FORMAL EDUCATION

Operations staff are frequently trained in vocational programs, though other education paths prevail as well. Minnesota's public and private community college systems provide technical training and employment assistance to students interested in careers in building science and engineering, property operation and management, and other related fields. They offer four year Baccalaureate degrees, two years Associates degrees, and diplomas. Community colleges typically engage extensively with employers on curriculum design. This coordination with industry helps ensure that the training and credentials offered are recognized by employers, and can also serve to build relationships between students and potential employers.

CONTINUING EDUCATION AND CREDENTIALING

The region also features a strong professional education infrastructure, primarily delivered via the community college systems, allowing professionals to receive ongoing training and credentials. However, industry participants noted there is limited demand for specific energy-related credentials in the building operators labor market.

Appendix A lists some credentials associated with energy management in commercial buildings.

LOCAL OPPORTUNITIES

Some relevant training opportunities in the Minneapolis-St. Paul region which were reviewed in this research include:

Anoka Technical College: Anoka's Corporate Center offers a range of building operations and maintenance credential, as well as a focus on manufacturing credentials. They also offer Associates degrees and diplomas in Mechanical systems. Notably, Anoka is considering developing professional development training focused on energy

management for the industrial and manufacturing sectors. They could be supported in extending these resources to the commercial sector.

Minneapolis Community & Technical College (MCTC): includes technical education programs on architectural technology, and manufacturing, construction and trades, and classes on energy conservation and renewable energy. MCTC also develops customized certification and continuing education programs with employers for students who want to enhance their skill sets for employment through noncredit courses.

Saint Paul College: offers customized training and continuing education that is available both classroom and online, including programs such as Green Certification for Builders, and Solar Installer Certificate Training programs that are part of the RENEW training project.

Dunwoody College of Technology: offers post-high school technical training with various related programs available, including building energy auditing, and facilities operation and maintenance. Many of its relevant offerings are short term training programs (1 to 5 days) but also have three-quarter certification evening programs (36 weeks) and several degree programs.

The buildings operations courses noted above typically include classes on energy management as part of their core curriculum. However, a number of educational institutions and industry participants note that the quality and extent of focus on energy management is not adequate to prepare building and facility managers to engage in the optimal level of OES in buildings. Indeed, many note that insufficient focus on OES in building operation education is partly responsible for some buildings' poor operational performance.

D. Programs and Policies

The fourth factor influencing the OES markets in the Minneapolis-St. Paul Region are the programs and policies that support OES services, and other energy saving activities. These programs and policies are administered by various entities, including state and local government agencies, utility companies, and nonprofit organizations. These programs and policies serve to:

- Promote OES services to potential clients.
- Recruit qualified OES services providers, and establish business connections between providers and clients.
- Provide financial incentives for OES services, including rebates and low-interest loans.

1. Utility Programs

The Minnesota state legislature has set energy efficiency requirements for utilities in its Next Generation Energy Act of 2007. Under this law and its regulations, investor-owned electric and gas utilities are required to invest in energy efficiency programs, and achieve certain savings levels. Xcel Energy, the largest investor-owned utility company in the region, is required to spend 2% of its Gross Operating Revenue on energy efficiency programs, and to achieve an annual 1.5% reduction in energy use starting in 2010.* As a result, Xcel Energy has established multiple programs to promote energy efficiency services among its clients, including Recommissioning (RCx) and Turn Key Services to provide OES services to commercial real estate.

RECOMMISSIONING (RCX) PROGRAM

Xcel's RCx Services, launched in 2000, is available to all business customers in Minnesota. It comprises two stages (1) diagnosis, when customers' RCx services requests are approved and on-site energy assessments are completed; and (2) implementation, when customers choose measures to implement energy-saving recommendations identified in the diagnostic stage. Xcel Energy reimburses customers for as much as 75% of the diagnosis costs (not exceeding $25,000) and up to 60% of the implementation costs.

* American Council for Energy-Efficient Economy. State Energy Efficiency Policy Database—Minnesota. http://www.aceee.org/sector/state-policy/minnesota.

Xcel provides a list of approximately 20 RCx Service Providers, but customers can choose other providers on their own. The RCx Service Providers are divided between controls contractors and building engineering firms. Providers are asked to use a checklist and spreadsheet tool to document common commissioning measures, although they may engage in more detailed commissioning services as well. Xcel provides two types of training services to Providers, and other interested parties:

- A **RCx Introduction/Overview program** runs about every two years. It outlines basic commissioning practices.
- A **RCx Training series** run about every two to three months. In these training sessions, staff introduces Xcel's assessment tools to professionals new to the RCx program. About 30 to 40 individuals attend each such training.

Different types of OES service providers use different business models under the Xcel RCx program. Many controls contractors tend to carry out both diagnosis and implementation together, as the recommended energy-saving measures typically also include installation of their products. These providers often break-even when conducting the initial energy assessment, and seek profits in the implementation work. However, most engineering firms choose to only focus on the diagnosis stage due to their limited capacity. Their clients typically hire contractors through referral, or ask their own regular contractors to implement the recommendations.

The RCx program has an annual participation of approximately 60 new studies per year, most of which are office buildings with a smaller number of government buildings and school facilities. The RCx program is strictly defined to only provide low- or no-cost recommendations so that the typical payback periods are less than one year. Currently, Xcel staff estimate that 80% to 90% of all customers decide to implement some component of the provider's recommendations; however, some firms tend to wait for some time (more than 20 months in some cases) to implement the energy-saving recommendations, and they may not implement all measures.

TURN KEY PROGRAM

To encourage firms to implement steps more quickly and completely, Xcel initiated a Turn Key Program in 2012, which focuses on achieving more complete and expedient implementation. The Turn Key Program provides rebates for customers seeking various levels of assessments, ranging from simple walkthrough assessments, to more complicated ASHRAE Level II assessments and detailed engineering studies. Xcel selected Franklin Energy to conduct energy assessments, but allows customers to choose their own contractors to implement the OES recommendations. Under the Turn Key program, more attention is paid to engaging building owners, property managers, and operators, to determine the correct scope of work and ensure findings are implemented. While the RCx services tend to be more in-depth, comprehensive, large-scale, and appealing to customers with higher expectations, the Turn Key Program mostly caters to customers who are in need of quicker fixes.

PROMOTIONS AND RECRUITMENT

Both RCx and Turn Key services recruit customers through two channels. Xcel serves major clients with individual account managers. The account managers help their clients set energy-saving goals and budgets, and direct them to appropriate programs. Usually the account managers work with Xcel's RCx and Turn Key programs to customize specific services for the customers.

For small business customers, Xcel has also established a Business Solutions Center that is devoted to communicating with larger numbers of smaller clients. The Business Solutions Center reaches out to Xcel's small business clients and answers their questions and concerns through email and telephone.

KILOWATT CRACKDOWN – OUTREACH WITH THE BUILDING OWNERS AND MANAGERS ASSOCIATION

Xcel has also collaborated with the Greater Minneapolis and Greater St. Paul chapters of the Building Owners and Managers Association (BOMA) to administer the Kilowatt Crackdown Challenge, targeted on achieving greater energy efficiency in large-scale commercial office real estate in the

region. The Challenge is sponsored by funding from Xcel and the St. Paul Port Authority's Trillion BTU program, while BOMA works as the major publicity and recognition channel. The Challenge has set up a series of award categories to recognize the best performing properties in the competition. Buildings are served with Xcel's Recommissioning Program, Turn Key Program, and other energy services.

In its pilot program of 2011, Kilowatt Crackdown Challenge attracted 86 buildings in both Minneapolis and St. Paul, and saved over 13 million kilowatt hours of electricity, significantly surpassing the original expectation of having 20 buildings participating in this program.

UTILITIES' LIMITED INCENTIVE TO ENGAGE IN MARKET TRANSFORMATION

Despite their strong efficiency targets, Minnesota utilities are largely incented to pursue energy efficiency projects which they can easily document and readily attribute to their actions. Thus, they have less incentive to engage in market transformation activities such as consumer capacity building, rigorous workforce development, industry standardization, research and development, and building operators capable of delivering strong energy management. Instead, utilities' actions are largely focused on driving customers through their efficiency programs. These incentive structures limit the establishment of robust markets for OES, and strong building energy management practices.

2. Nonprofit Organization Programs

The Center for Energy and Environment (CEE) is a Minnesota organization that provides energy efficiency programs to homeowners, businesses, nonprofits, and governments. CEE has launched numerous energy efficiency programs and market transformation initiatives over its 33 year history.

PUBLIC BUILDING ENHANCED ENERGY EFFICIENCY PROGRAM

CEE ran the Public Building Enhanced Energy Efficiency Program State (PBEEEP State) that improves energy performance in Minnesota's state-owned public buildings through OES measures. PBEEEP State is composed of four stages of services, including screening, investigation, implementation, and verification. The initial screening and investigation costs are paid through federal stimulus funds while the costs for implementation and verification are paid for with tax-exempt lease-purchase financing. CEE has recruited nine OES service providers to engage in PBEEEP State, most of which are engineering and architecture/design firms. So far almost all state public buildings in Minnesota have been involved in PBEEEP State, among which the largest participants include the Minnesota State Colleges and Universities system, the Department of Corrections, and the State Capitol Complex. Providers identified an average 9% energy savings opportunities in participating buildings.

ONE STOP EFFICIENCY STOP LIGHTING PROGRAM

CEE administers a One Stop Efficiency Stop program for small businesses, providing lighting upgrades for small businesses in Xcel's service territory. The program offers technical assistance, connections with certified contractors, incentives and loan financing.

3. Government Policies

Minnesota public agencies have played a strategic role to promote energy efficiency at the state, regional, and local levels. Besides broad state level energy efficiency targets and utility policy, governments have sought to catalyze commercial building energy efficiency with the following programs and policies:

MINNESOTA SUSTAINABLE BUILDING 2030 (SB 2030)

SB 2030, initiated by the State of Minnesota Department of Commerce and coordinated by the Center for Sustainable Building Research at the University of Minnesota, is developing standards for sustainable building practices required for all state buildings. Others may join SB 2030 on a voluntary basis. It is developing standards for commissioning new and existing buildings.

THINC.GREEN MSP INITIATIVE

Thinc.Green is a regional collaborative initiative between the municipal governments of Minneapolis and St. Paul, dedicated to the development of the region's green economy by expanding local markets for green products and services, branding the Minneapolis-St. Paul region as an ideal destination for green businesses and manufacturing, and constructing a friendly environment for green businesses. Thinc.Green has established a Green Building Sub-committee, which includes representatives from multiple stakeholders in the region, including real estate firms, government agencies, and utilities. This sub-committee is engaged in ongoing efforts to develop green building policy and industry initiatives. It has focused particularly on improving existing buildings.Building Energy Rating and Disclosure Policy

Based on the Thinc.Green Building Committee's input, The City of Minneapolis is considering building energy rating and disclosure policy. Under such policy, building owners would be required to make their buildings' energy consumption data public, using the EnergyStar Portfolio Manager system. By allowing greater transparency of energy usage, markets will function better to take energy use into account, providing greater incentive to reduce building energy consumption.

LEADING BY EXAMPLE AND PROMOTING ENERGY MANAGEMENT

It should be noted that local and State government have an important role to play in simply promoting good energy management to firms, and stimulating markets via their own procurement of OES services. Many market participants noted that government can play an important role promoting efficiency – building owners take note when a Mayor promotes an energy efficiency program or recognizes a green building. Likewise, many market participants emphasized that they can learn much from government documenting its experiences implementing OES and other energy management activities, and that innovative OES service areas can be stimulated via government procurement.

E. Summary

This review of market conditions in the Greater Minneapolis-St. Paul region suggests some conclusions that are pertinent to efforts to expand OES services:

DEMAND

- There is still extensive latent demand for OES services in the region. Many buildings with strong energy saving opportunities have received little or no OES services. Even those buildings that have received OES services can benefit from more frequent service, deeper engagement, and higher quality service provision.
- Class B and C properties, and smaller properties, especially have received little OES services. These properties generally face special barriers to engaging in OES, including: greater vacancy; less extensive building management and operations capacity; and older building mechanical control systems, which are less easily programmed to reap energy savings. These factors make OES in these markets less attractive than in larger Class A properties. Nevertheless, substantial cost-effective OES potential exists in smaller buildings and Class B and C properties.
- Tenant demand is an important driver for OES. Most leases in Minneapolis are triple net leases, wherein base building utility costs are passed through to tenants. Thus, owners have no financial interest in lowering buildings' energy use, unless tenants demand it. Tenants differ in how they value efficiency. Many tenants of Class A spaces recognize and demand Energy Star Portfolio Manager and LEED designations; this expectation has not extended to Class B and C properties. The vast majority of tenants in any property class probably have little understanding of the true cost-effective efficiency potential of their buildings.
- Initiating and implementing OES projects is affected by the relationships and communication between building owners,

property managers, and building operations personnel. Property managers typically will not advocate strongly for an idea not embraced by a building owner. Building operations personnel may likewise be hesitant to engage deeply in OES unless encouraged by owners and management. Successful OES delivery requires buy-in from all of these parties.

- Some property management firms have developed more sophisticated systems to monitor and benchmark buildings, and undertake continuous improvements. Other owners and managers have less capacity.

- Building owners, property managers, and building operators all have limited knowledge of the range of OES services available. They have difficulty specifying OES services and monitoring service providers' performance and adherence to work scope terms.

BUSINESS DEVELOPMENT

- The Greater Minneapolis region features a diversity of OES firms, some of which are national leaders in their field. The region is positioned to develop into a tradeable cluster of energy management innovation, with potential for growth in OES services, as well as spillover effects into design services, building systems manufacturing, building sciences, renewable energy, and other sectors.

- Service providers have difficulty responding to clients that often have a poor understanding of the work they are requesting. Firms note that prices for scopes are extremely disparate, indicating that low-bid firms are not delivering the quality and depth of services specified in contracts. There is a need to develop guidelines and standards for OES practices, notably commissioning, for which many clients do not understand the techniques.

- Interviews with many service providers suggest they feel little 'common destiny'. Despite the market for OES being largely untapped, they appear hesitant to coordinate efforts to transform the market, concerned that they may assist their competition. Some providers have more vision for an expanded market and the value of coordination in developing it, however.

WORKFORCE DEVELOPMENT

- Professional service providers largely learn technically and managerially complex OES competencies from their peers via on the job training.

- There is a need to rationalize the credentials for professional OES providers, particularly in the commissioning space. Currently, there are a number of different commissioning related credentials, and market confusion regarding the competencies they convey. The appropriate credentials for different project roles could be better communicated. Many credentials offer insufficient career pathways for technicians and building operators to become credentialed in the professional service provider space.

- Building operators and managers require more sophisticated energy management education, as well as opportunities to learn from the good practices of other operators and managers.

- The local real estate industry does not consistently value energy management credentials amongst building operations and management professions. Additionally, the industry reports that the energy literacy developed in available credentialing programs is insufficient to consistently realize best OES opportunities.

PROGRAMS AND POLICIES

- Minnesota features a strong mandate for utilities to achieve energy efficiency, and Xcel programs facilitate commissioning services. However, there is limited utility incentive to engage in market transformation activities that expand the long-term capacity of the market to capture OES, as it is hard to document discrete, demonstrable energy savings from such efforts. However, government and non-profit groups are positioned to engage in market transformation, and utilities can be encouraged to provide greater support for market transformation practices.

- Utilities' programmatic quality assurance protocols are limited. There is little oversight to ensure that the maximum amounts of cost-effective measures are identified, even within the bounds of clients' financial constraints. Likewise, monitoring of the quality of installations is limited.

- Minneapolis' energy disclosure policy has the potential to increase market transparency and spur energy efficiency; other local governments in the region will need to follow suit for this potential to be maximized. Mandatory cost-effective energy upgrades could also support industry development, especially for buildings with the most obvious energy saving measures.

- Networks like BOMA have proven effective at stimulating participation in energy programs amongst their members.

IV. Key Findings and Recommendations

This section outlines actions that the City of Minneapolis can undertake to stimulate the market for OES services, and encourage good energy management practices more broadly. These recommendations specifically address obstacles to industry development in the Minneapolis-St. Paul region; however, many of them are also applicable to the expansion of OES services in other localities.

Chiefly, we recommend that the City convene and staff an OES Taskforce, to coordinate efforts to expand the scope of OES in the region. We then make recommendations of priority actions for the Taskforce, organized along three lines:

- **Demand stimulation** - Increase awareness of, and participation in, building energy efficiency among commercial properties, as well as other applicable sectors including multifamily and industry.
- **Business development** - Provides businesses with opportunities to grow, and facilitate better organization of OES service industries.
- **Workforce development** - Enhance the knowledge and skills of both OES service professionals, as well as building operators and managers.

Successfully implementing these recommendations can transform and grow the OES service space. These recommendations are further detailed in the sub-sections below.

A. Convene and Staff an OES Taskforce

We recommend that the City convene a collaborative **OES Taskforce**. This Taskforce might exist as a working group of the regional Thinc.Green initiative, and/or incorporate the Existing Building Commissioning (EBCx) service providers' collaborative, proposed by the Center for Energy and Environment. The OES Taskforce would be responsible for a range of market transformation activities, aimed at: Growing markets for OES services; improving the quality of OES services; and building the capacity of building operators, managers, and owners to engage in stronger energy management and achieve greater operational savings. The first two to three years of the OES Taskforce will largely be spent further developing and implementing the recommendations outlined below. As time progresses, the OES Taskforce will likely identify further priorities based on engagement with regional market stakeholders, and informed by state and national policy direction.

The Taskforce should be directed by a diverse set of stakeholders, who might meet quarterly, as well as engage more deeply on recommendations particular to individual stakeholder groups. The City will need to structure the Taskforce's engagement to make best use of these groups expertise in addressing particular recommendations, and to ensure that stakeholder have a useful space to develop these initiatives.

TASKFORCE COMPOSITION

The City should recruit a diverse range of organizations to participate in the OES Taskforce, including representatives from the following communities:

- OES service providers. The City should recruit a number of service providers, representing the variety of OES service types found in the region. This list includes engineering firms, commissioning service firms, building modeling and diagnostics firms.
- Building owners and managers. The Building Owners and Managers Association is a clear choice for participation. The City may also recruit individuals who have shown particular leadership in adopting energy management.
- Building operations personnel. The City should recruit leading building superintendents who have led energy projects. The City should also consider representatives of the educational Building Owners and Managers Institute, which provide building operator credentials.
- The commercial property brokerage community.
- Xcel utility personnel, involved in commercial building energy efficiency program planning.
- Civil society organizations engaged in energy efficiency market transformation, notably the Center for Energy and Environment.
- The workforce development community, particularly members of community colleges engaged in energy management and building operators education and professional development.
- Other local governments, and state government agencies, which express interest in fostering more robust markets for energy efficiency.

STAFFING REQUIREMENTS

We recommend that the City budget for 1.5 full-time staff people to coordinate the Taskforce, and assist in implementing its activities. Staffing should consist of one program manager, supported by additional part time analyst level personnel. These staff would likely be housed within the Department of Community Planning and Economic Development. Investing in sufficient staff is necessary to expeditiously undertake the multiple market transformation opportunities appropriate in the OES sector, and to realize its full economic development potential.

To mitigate the costs of staff, the City could explore opportunities to share staffing costs with other local governments, state government, utilities, and OES service provider networks, especially once the OES Taskforce becomes more established and impactful.

City staff should lead the OES taskforce in the following market transformation opportunities.

B. Demand Stimulation

Stimulating demand for OES services requires engaging building owners, managers, operators, tenants, and brokers to enhance:

- The **financial case** for action.
- These parties' **knowledge** of energy saving opportunities. This includes making sure that they understand the gains typically realizable via OES. It also includes educating managers and operators about the specific techniques, outputs and costs of various OES services, so that they can better administer contracts for such services.
- The **social norms** around realizing OES and other green opportunities. This includes engaging professional networks and tenants to make them expect energy performance, and ultimately may include regulating cost effective energy measures.
- The **alignment of incentives to achieve energy savings**. The split-incentive is particularly acute in Minneapolis where net leases predominate and tenants pay all energy costs – under these conditions, investments in energy management will only occur when demanded by tenants or when owners perceive the opportunity to charge greater rents in exchange for lower energy bills.

BUILD KNOWLEDGE AND NORMS AROUND ENGAGEMENT IN OES

Though the stakeholders noted above have grown increasing sophisticated about energy use, they still require information on the nature OES services; cost ranges; best practices; available programs; and the range of benefits associated with OES including environmental performance, energy savings, and health and productivity of tenants. We recommend the Taskforce and its partners undertake the following:

- Engage tenants and the brokerage community around the importance of OES. Property managers suggested that tenants are the most important actors in increasing demand for green buildings. The Taskforce could communicate directly with regional commercial tenants via a number of avenues, including government economic development networks, the Minnesota Commercial Association of Real Estate communications, regular government mail, and engagement with networks like the Minnesota Retailers Association. The Taskforce should develop socially normative messages, noting how many tenants are already demanding such services, and make sure these message reach tenants repeatedly. Provide information on the health, productivity, and energy saving values of OES.

- Encourage the brokerage community to explore the use of energy disclosure data to provide readily understandable building energy cost information for potential tenants. As a follow-on to the City's energy disclosure policy, the Taskforce can engage with brokers and with EPA's Portfolio Manager system (the platform for the disclosure policy), to help articulate the specifications for a system whereby brokers provide energy use information for all property listings. Additionally, the City should investigate opportunities to provide EnergyStar ratings, LEED ratings, and building asset ratings (discussed below) to better contextualize the energy and environmental performance of properties.

- Support a forum to connect owners, property managers and operators with OES service providers. This forum would provide an opportunity for service providers to collectively market their services, as well as better articulate the nature of various commissioning services. With this information, property managers can better understand what deliverables they can expect when articulating a scope of work.

- Provide City leadership and endorsement of good OES practice. City political leaders should be vocal leaders, calling for greater energy management activity in the public and private sectors. The City should recognize industry leaders publicly.

- Continue to support initiatives in the real estate industry that support and recognize improved energy performance, notably Xcel Energy and BOMA's Kilowatt Crackdown. Such programs are proven as an effective channel to promote OES services and increase building energy efficiency among commercial clients, and it is important to sustain funding and institutional support to these initiatives.

LEAD BY EXAMPLE

The City should undertake deep OES services on their own properties. Showing leadership in this way has a number of benefits. Firstly, it will reduce the City's energy spending and operations costs, and can realize positive health and productivity benefits for City employees. Second, it supports OES providers. Third, it can illustrate the cost-efficacy of OES, and the nature of such services, to private building owners and other governments. Indeed, the City occupies a large portfolio of institutional buildings, many of which share characteristics with smaller commercial buildings that face barriers to engaging in OES services. Building owners and managers interviewed during this study noted that the City documenting the efficacy of OES measures would influence their willingness to engage in such work. Lastly, undertaking procurement of OES services early in the OES Taskforce engagement will provide city staff with richer experience from which to provide technical assistance to private building owners. Thus, as the City engages in procuring OES services, it should seek to document lessons learned from the process, as well as the energy savings and the financial case for investing.

AGGREGATE PROPERTIES THAT FACE BARRIERS TO PARTICIPATION

Smaller properties and Class B & C commercial real estate often face greater hurdles to participation in energy programs. Nevertheless, worthwhile energy savings projects can be had in these properties. The Taskforce could recruit a number of properties willing to engage as early adopters of OES into a "Smaller Property Leaders" pilot. Participants should receive recognition from the Mayor, and potentially more attractive financing for OES (see below). The Taskforce can provide assistance developing the specifications the scope of work to be implemented, procuring and monitoring contractor work, and facilitating the ongoing implementation of OES measures. The City can explore with OES service providers the potential for reduced rates with multiple smaller properties participating.

Properties participating in the Leaders pilot should disclose measures, energy savings data, and lessons learned from their process, to inform other small property owners and assist in the Taskforce's outreach activities.

EXPERIMENT WITH FINANCING PRODUCTS TO SUPPORT OES IN PROPERTIES WITH BARRIERS TO OES

Many OES measures are low cost. However, while still providing a good return on investment, OES services in smaller buildings and older buildings with less sophisticate controls often entail a greater level of investment, and entail longer pay-back periods. Thus, these building owners may require financing. A number of financing products offering below-market interest rates are available in the state, including the City of Minneapolis' Energy Efficiency Business Loan Program and the St. Paul Port Authority's Trillion Btu program. Nevertheless, further experimentation is needed to provide financing and funding that entices a greater number of buildings into undertaking OES studies and efficiency improvements.

The City should experiment with attractive lending and grant products to fund OES in small buildings and Class B & C properties. The City can document savings that these projects achieve, and use them as the proof of concept when marketing OES to further clients. Building on the City's existing Business Loan Program, a number of offerings are possible. For instance, the City could provide a forgivable loan, which would decrease the repayment obligations for properties that do not achieve projected savings. Other opportunities to reduce the costs of financing include providing a matching grant for OES investments, or an interest rate buy-down on bank loan financing.

In the longer term, the Taskforce should investigate opportunities for financing repaid via utility bill tariffs, which can finance energy measures. On-bill tariff repayment overcomes the split-incentive problem facing commercial real estate, as the utility bill payer is responsible for repayments. Owners need not spend on energy saving improvements, nor use up their limited capacity to assume debt.

GREEN LEASES

BOMA has developed guidance for commercial property owners, managers and tenants, outlining a model green lease mechanism that aligns incentives for energy efficiency and other sustainability-related building features. This lease language allows property owners to more readily make investments in building energy efficiency, allowing the costs of improvements to be passed through to tenants; tenants benefit by paying less of the combined costs of energy and rents. Many properties in the region have adopted this lease language. The Taskforce could survey the industry to determine the extent of green lease adoption, and work with BOMA to promulgate the green lease where it has not been adopted. Additionally, the Taskforce survey could indicate buildings' tenure schedules, so that the Taskforce can anticipate when leases expire and opportunities to integrate green lease language and energy management services.

ENERGY DISCLOSURE

The City of Minneapolis has show leadership in forwarding its energy disclosure policy. The Taskforce could provide technical assistance to buildings that are out of compliance with the policy. Additionally, the Taskforce can serve to advocate that other local governments in the region follow suit in adopting mandatory energy disclosure.

In addition to energy disclosure, disclosure of a

building "asset rating" allows market participants to understand the physical qualities of buildings that dictate energy consumption, and what OES and capital upgrade measures a building could benefit from. An "asset rating" is based on information about the physical systems in a building. It provides a useful complement to energy-only disclosure systems, such as that the City is developing. There is no industry standard asset rating currently available, and asset rating is in its infancy. However, some states and the US Department of Energy are in the process of developing standardized asset ratings. Indeed, some firms in the Minneapolis-St. Paul region are leaders in developing lower cost asset assessment tools. As these tools become available, the Taskforce could facilitate buildings' rating with an asset score, and the ultimately integrate asset scoring into future iterations of the City's energy disclosure policy.

MANDATES

Beyond energy data disclosure, government can also explore regulatory mandates to require adoption of OES measures on a regular basis, including lighting upgrades, building assessments and diagnostics, and OES measures with a high internal rate of return. While building owners and property managers are wary of government regulation, mandates can actually decrease transaction costs. Moreover, mandates can stimulate markets, giving service providers the opportunity to innovate and provide superior services. The City does not intend to explore mandatory mechanisms at this time. However, in the future, the Taskforce may explore with Minnesota State government cities' authority to mandate low-cost energy improvements to existing buildings.

The City of New York includes mandatory energy improvement measures in buildings over 50,000 square feet. Its Greener, Greater Buildings Plan introduces new Local Laws which require that buildings undertake an ASHRAE Level II audit and recommissioning to improve energy performance every 10 years. Additionally, it requires that existing buildings meet the New York City Energy Conservation Code lighting standards, and that non-residential spaces be sub-metered.

UTILITY REGULATORY REFORM

As it engages in market transformation initiatives, the City should to investigate utilities' incentives to invest in greater market transformation activity, and convene stakeholders to address this problem. Currently, utilities have strong energy efficiency targets, which entail reporting to regulators particular investments that lead to discrete energy savings outcomes. Thus, utilities have little incentive to engage in activities that would permanently change the structure of energy service markets like OES – utilities are not directly and substantially rewarded for educating consumers, reducing split-incentives, training a more skilled workforce, or other market transformation initiatives. This problem extends beyond just OES services, with the same problems generally holding true for all energy service markets in which utilities engage. Properly aligning utility incentives and efforts towards market transformation would provide a power stimulus to OES markets. Indeed, greater capacity for utilities to invest in such activities could help the OES Taskforce be better funded.

City staff associated with the Taskforce could take on convening stakeholders to address this problem. Ultimately, any efforts to improve utility regulation will involve extensive engagement to impact state legislation and/or Minnesota Public Utilities Commission regulation of energy efficiency programs. The City should aim to establish a multi-stakeholder group, comprised of local government, industry, and non-profit advocates, to engage in these forums.

C. Business Development

INDUSTRY ORGANIZATION

The OES services industry is relatively nascent and in the process of defining itself. A number of observers noted an important part of developing the industry is establishing a forum for peer communication and organization. In response, the CEE proposed establishing an Existing Building Commissioning (EBCx) Collaboration group to serve as a forum for industry coordination among different OES service providers. Some priorities of this initiative include:

- Establish guidelines and standard scopes of work for OES services, to better inform clients of what different OES services entail, and what cost ranges to expect for quality work. The EBCx Collaboration group can serve as a platform for the industry to describe these norms. Additionally, it could inform the development of more technically related quality assurance and oversight mechanisms, which are currently lacking from utility programs.

- Engage in joint marketing. Joint marketing may be able to reach a larger client audience effectively, allow for competitors to pool resources to engage in studies of demand, and reduce the marketing costs for providers. Additionally, such industry convening can provide a forum where service providers can connect with potential clients.

The Taskforce could either assume these functions, or support any EBCx organization in these activities. Additionally, it is important that OES service providers have a forum in which they can articulate their interests as an industry. Service providers may need to coordinate to establish standards, providing recognition for credentials, establishing quality assurance regimes, engaging with the workforce development system, and engage in a range of other industry rationalization initiatives. It is important that City staff continue to engage service providers, to identify industry needs as they arise.

OES RESEARCH

As the Minneapolis-St. Paul region implements more extension OES practices and collects more data on building operations and energy use, this information could be a valuable resource for improving the science and technology of building design and operations. A research and development initiative around improving building design and operations for energy efficiency and employee health and productivity objectives that is based on an extensive regional-wide OES data mining process could provide a larger impetus and funding for OES implementation and contribute to the region's competitive strengths in building science. The Taskforce can initiative discussions with universities and research institutions about the interest and opportunities around this type of research collaborative.

D. Workforce Development

Improving the quality and extent of OES requires developing capacity skilled workforce amongst both OES service providers and building operators.

INCREASE THE CAPACITY OF PROFESSIONAL SERVICE PROVIDERS

OES service providers can benefit from ongoing opportunities to hone expertise in their craft, as well as a more rationalized credentialing system. The Taskforce should support:

- Forums for services providers to engage in peer-to-peer learning. CEE's EBCx Collaboration group could serve as such a forum. Additionally, the City provides ongoing education opportunities relating to commissioning and energy management to its building inspections personnel, which could be offered to private service providers.

- The rationalization of credentialing for building commissioning, and other OES related sectors (automated diagnostics, energy modeling, etc.) as credentials emerge. Currently, a number of different commissioning and energy management credentials are offered by various organizations to designate professional competency. The diversity in credentials leads to confusion over what credentials are demanded by employers and clients. Moreover, most of these credentials require extensive professional experience and education, with poorly articulated career ladders for early university graduates or HVAC and controls technicians. The City could convene service providers, the demand side, and community colleges' professional development personnel,

to identify what credentials are in demand. Additionally, the City and its partners could consider developing pilot intermediate credentials, in partnership with accrediting bodies, to provide career ladders for personnel entering the market.

INCREASE THE CAPACITY OF BUILDING OPERATORS AND MANAGERS

Improving the energy literacy of building operators and managers will allow them to perform better management of facilities energy use, as well as better prepare them to communicate with OES service providers. Some potential measures and resources to implement this recommendation include:

- Foster a forum for peer-to-peer learning among building managers and operations staff. With coordination from the Taskforce, the Greater Minneapolis BOMA Engineers Association could integrate this role.

- Investigate opportunities to provide existing building operators with energy management and/or building commissioning credentials and training opportunities. Midwest Energy Efficiency Alliance (MEEA) has a building operator certification program specifically focusing on energy efficiency, which provides practical training sessions to building operation and maintenance staff and technicians. MEEA has previously collaborated with Minnesota Power to provide training for commercial property operators in northern Minnesota. The City and its partners could promote this existing program among current building managers and operations staff.

- Investigate opportunities to provide greater energy management education as part of building operator education among the Region's technical colleges. Notably, Anoka Technical College's Corporate Center is considering developing an Energy Management curriculum and credential to complement its professional development offerings to manufacturing workers. Anoka also offers professional development to for building operators, and associates degrees, diplomas, and certificates in engineering and construction. Anoka has expressed interest in expanded from a focus in manufacturing energy management to building energy management as well. Likewise, other technical colleges may be positioned to integrate such curricula.

- Work with existing education and training programs for building operators and managers to incorporate an expanded and improved curriculum around building energy management and OES services.

V. Conclusion

Fostering strong OES service markets, and increasing the capacity of buildings operations personnel to undertake OES, can realize positive economic development outcomes. A more vibrant OES sector can position the Minneapolis-St. Paul region as a cluster energy innovation; increase the regional employment in OES services and supply chains, as well as increasing employment and economic activity due to re-spending energy savings; make for healthier buildings, with enhanced employee productivity; and reduce the City of Minneapolis' environmental footprint, helping to realize climate change mitigation goals. Unfortunately, a variety of market barriers hinder the function of markets for OES, including insufficient access to information about OES opportunities; misaligned incentives between owners and tenants; a breakdown in implementation between owners, building managers, and building operators; and an insufficiently trained workforce.

Local government and economic development organizations' can engage in market transformation to lessen these barriers, and thereby realize improved economic development outcomes. The City of Minneapolis should establish an OES Taskforce to stimulate demand for these services, and further develop the capacity of OES businesses and their workforce. By cultivating its OES service industry, the City can forward its goals of job creation, economic development, and environmental performance. Moreover, the City will assert itself as a national leader in fostering the important, dynamic and growing OES service sector.

Appendix A: Credentials Relating to Building OES

This Appendix catalogues some of the credentials in the OES services market, and those relating to energy management in buildings' operation. The list does not strive to be comprehensive, but does note credentials listed by our survey of service providers.

Organization	Credential Program	Website	Credential Requirement	Notes
AABC Commissioning Group (ACG)	Certified Commissioning Authorities (CxA)	http://www.commissioning.org/membershipcertification/	▪ Open to independent commissioning companies that meet the requirements for membership and have at least one individual representative pass the CxA exam. ▪ Exams are open to professional engineers (P.E.s), licensed archivtects, and others with demonstrated commissioning experiences, who work for qualified, independent commissioning companies. ▪ CxA applicants cannot have any affiliation with general or installing contractors, manufacturers of systems or equipment, or other entities that present significant potential conflicts of interest in providing unbiased commissioning services. ▪ Upon approval of the application, the CxA applicant company's designated individual will be permitted to take the CxA certification exam (3 hours) at the next available offering of a Workshop (one-day event, offered approximately once every two months in various cities nationwide), or alternatively the candidate can attend a Webinar (2.5 hours) and take the exam at a local testing center in the ACG network. ▪ Qualification information here: http://www.commissioning.org/selectingacx/qualifications.aspx; http://www.commissioning.org/membershipcertification/policies_member.aspx ▪ Application information: http://www.commissioning.org/membershipcertification/applicationmember.aspx ▪ Workshops/webinars information: http://www.commissioning.org/membershipcertification/upcomingexam.aspx	For firms instead of individuals
AABC Commissioning Group (ACG)	Certified Commissioning Technician (CxT)	http://www.commissioning.org/membershipcertification/commissioningtechnician.aspx	▪ A second-tier certification for those who do not yet possess the technical, industry, or commissioning experience to qualify for the CxA. ▪ CxT candidates must work for an ACG member company, under the supervision of a CxA. Additional prerequisites for CxT certification include a minimum of two years field testing experience, at least 6 months working for the ACG member company at which the candidate is presently employed, and endorsement by a CxA at that company. In addition, candidates must attend an ACG workshop or webinar prior to becoming certified. ▪ The CxT exam is a 3-hour, closed-book, multiple-choice examination based on material in the ACG Commissioning Guideline and the CxT Study Guide. The test is available through ACG's network of testing centers across the country. ▪ Application and study guide information: http://www.commissioning.org/downloads/2009/CxT_Application_Study_Guide_v.1.pdf	

Organization	Credential Program	Website	Credential Requirement	Notes
AABC Commissioning Group (ACG)	Energy Management Professional (EMP)	http://www.commissioning.org/energyprogram/overvi.aspx	▪ Only open to ACG-cerfified CxAs. ▪ EMP is explicitly commissioning based, and promotes a combination of existing building commissioning and sound energy management analysis. ▪ Applicants need to attend an Energy Management Process Seminar (1.5-day event, offered multiple times a year) and pass the EMP exam. ▪ Energy Management Guideline: http://www.commissioning.org/energyprogram/energy.aspx ▪ Seminar information: http://www.commissioning.org/documents/EMP%20Seminar%20Oct%202012%20New%20Flyer%2092012.pdf	
Building Commissioning Association (BCA)	Certified Commissioning Professional (CCP)	https://netforum.avectra.com/eweb/DynamicPage.aspx?Site=BCA&WebCode=Certification	▪ To earn the CCP designation, participants must complete an application along with the documented education, experience, and client references that is reviewed by the Building Commissioning Certification Board and pass a comprehensive two-hour examination. ▪ Eligibility requirements include: a high school diploma, GED, or higher-level degree; at least 36 continuous months of experience as a commissioning-services provider in a lead project role (within 5 years preceding the date of application); three completed commissioning projects with client references, etc. ▪ The examination is computer-based and lasts two hours. It consists of 125 multiple-choice questions. The examination is available electronically through BCA's testing partner ISO-Quality Testing. ▪ Candidate bulletin: https://netforum.avectra.com/temp/ClientImages/BCA/213f5e93-ef4f-441c-ac10-784486d7911e.pdf	
Building Commissioning Association (BCA)	Associate Commissioning Professional (ACP)	https://netforum.avectra.com/eweb/DynamicPage.aspx?Site=BCA&WebCode=Certification	▪ Targeted on those who are on the path to become a CCP but do not yet have the education and experience required to achieve that certification. ▪ To earn the ACP designation, participants must complete an application that is reviewed by the Building Commissioning Certification Board and pass a comprehensive two-hour examination. ▪ Eligibility requirements include: a high school diploma, GED, or higher-level degree; a minimum of one year of building related experience depending on education level achieved. ▪ The examination is computer-based and lasts two hours. It consists of 125 multiple-choice questions. The examination is available electronically through BCA's testing partner ISO-Quality Testing. ▪ Candidate bulletin: https://netforum.avectra.com/temp/ClientImages/BCA/28f9b1b5-0dfd-480f-b2cb-7bdfd1171944.pdf	

Organization	Credential Program	Website	Credential Requirement	Notes
Association of Energy Engineers (AEE)	Certified Building Commissioning Professional (CBCP)	http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3666	▪ Eligibility includes requirements on school education and experience. For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3666#Eligibility ▪ Each applicant for the CBCP certification is required to attend AEE's three-day "Fundamentals of Building Commissioning" training program or the "Comprehensive 5-Day Training Program for Building Commissioning Professionals". ▪ The four-hour CBCP exam is given in conjunction with the AEE's preparatory training seminars. The exam is administered at the seminar site following each scheduled seminar. The exam is open book, and the questions are a mixture of multiple choice and true or false. ▪ Information on seminars: https://www.aeeprograms.com/store/detail.cfm?id=807&category_id=4; https://www.aeeprograms.com/store/detail.cfm?id=923&category_id=4	
Association of Energy Engineers (AEE)	Master's Level Certified Building Commissioning Professional (MCBCP)	http://www.aeecenter.org/i4a/pages/index.cfm?pageid=4094	▪ New for 2012 and developed with grant funding from the U.S. Department of Energy, MCBCP certification is intended for energy professionals already involved and experienced in building commissioning who want to take their skills and credentials in the field to the next level, including establishing expertise in the use of life cycle building commissioning. ▪ Eligibility: possession of one AEE certification and a minimum of 3 years of verifiable experience in building commissioning and/or retro-commissioning. ▪ Candidates must attend the Life Cycle Building Commissioning preparatory training seminar (5-day event) ▪ Candidates must pass a four-hour written examination. The examination is open book, and questions are a mixture of multiple choice and true/false. ▪ Information on Life Cycle Building Commissioning seminar: http://www.aeecenter.org/files/certification/MCBCP%20Exam%20Study%20Guide.pdf ▪ Study guide: http://www.aeecenter.org/files/certification/MCBCP%20Exam%20Study%20Guide.pdf	
Association of Energy Engineers (AEE)	Certified Building Commissioning Firm (CBCF)	http://www.aeecenter.org/i4a/pages/index.cfm?pageid=4019	▪ Eligibility requirements: employment of at least one CBCP; no affiliation with people or firms that may have conflict of interest, including manufacturer of equipment; completion of at least three building commissioning projects; been in business for a minimum of 24 months and in good stand.	
Association of Energy Engineers (AEE)	Certified Energy Auditor (CEA)	http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3365	▪ Eligibility includes requirements on school education and experience. For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3365#Eligibility ▪ Candidates must attend one of AEE's preparatory CEA training seminars, either the 3-day live Fundamentals of Energy Auditing training program at one of its scheduled locations, or the web-based seminar, Certified Energy Auditor Preparatory Training Program (12 hours in 6 two-hour online sessions) offered several times each year. ▪ Candidates must complete and pass the four-hour written CEA examination. The exam is open book, and questions are a mixture of multiple choice and true/false. ▪ Information on seminars: http://www.aeeprograms.com/store/detail.cfm?id=1005&category_id=4; http://www.aeeprograms.com/realtime/CEAprep/ ▪ Study guide: http://www.aeecenter.org/files/certification/CEAStudyGuide2011.pdf	

Organization	Credential Program	Website	Credential Requirement	Notes
Association of Energy Engineers (AEE)	Certified Energy Auditor in Training (CEAIT)	http://www.aeecenter.org/i4a/pages/index.cfm?pageID=4018	▪ Eligibility includes requirements on school education and experience (lower than CEA). For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageID=4018#Eligibility ▪ Other certification requirements, including seminars and examinations, are the same with CEA.	
Association of Energy Engineers (AEE)	Certified Energy Manager (CEM)	http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3351	▪ Eligibility includes requirements on school education and experience. For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3351 ▪ Candidates must attend one of AEE's preparatory CEM training seminars, either the Comprehensive 5-Day Training Program for Energy Managers at one of its scheduled locations, or the web-based seminar, Fast Track CEM Preparatory Course for Energy Managers. ▪ Candidates must complete and pass the four-hour written CEM examination. The exam is open book, and questions are a mixture of multiple choice and true/false. ▪ Information on seminars: http://www.aeeprograms.com/store/detail.cfm?id=745&category_id=4; http://www.aeeprograms.com/realtime/FastTrackCEM/ ▪ Study guide: http://www.aeecenter.org/files/certification/CEM-LiveSeminarCompleteApplication2012.pdf; http://www.aeecenter.org/files/certification/CEM-RemoteTestingCompleteApplication2012.pdf	
Association of Energy Engineers (AEE)	Certified Energy Manager in Training (CEMIT)	http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3359	▪ Eligibility includes requirements on school education and experience (lower than CEM). For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3359 ▪ Other certification requirements, including seminars and examinations, are the same with CEM.	
Association of Energy Engineers (AEE)	Existing Building Commissioning Professional (EBCP)	http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3478	▪ Eligibility includes requirements on school education and experience. For details: http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3478#Eligibility ▪ Candidates must attend AEE's three-day "Fundamentals of Existing Building Commissioning" training program. ▪ Candidates must complete and pass the four-hour written EBCP examination. The exam is open book, and questions are a mixture of multiple choice and true/false. ▪ Information on seminar: http://www.aeeprograms.com/store/detail.cfm?id=1044&category_id=4	
American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	Commissioning Process Management Professional (CPMP)	http://www.ashrae.org/education--certification/certification/commissioning-process-management-professional-certification	▪ Candidates must have been involved with at least three projects utilizing the commissioning process, and must meet certain requirements on academic education and work experience. For details: http://www.ashrae.org/File%20Library/docLib/Certification/Guidebooks/Commissioning-Process-Management-Professional-Long.pdf. ▪ Candidates must pass a closed-book, 2.5-hour, 115-item multiple-choice test. Examinations are available at AMP Assessment Centers nationwide. ▪ Certification is required to be renewed every three years. 45 ASHRAE Continuing Education (ACE) units during each three-year period is needed for the renewal.	

Organization	Credential Program	Website	Credential Requirement	Notes
American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	High-Performance Building Design Professional Certification (HBDP)	http://www.ashrae.org/education--certification/certification/high-performance-building-design-professional-certification	▪ Candidates must meet certain requirements on academic education and work experience. For details: http://www.ashrae.org/File%20Library/docLib/Certification/Guidebooks/HBDP-Certification-catalog-long-version.pdf. ▪ Candidates must pass a closed-book, 2.5-hour, 115-item multiple-choice test. Examinations are available at AMP Assessment Centers nationwide. ▪ Certification is renewable every three years. To retain certification, each certificant must earn 45 PDHs during the three year period following initial certification or the last renewal.	
University of Wisconsin-Madison, Department of Engineering Professional Development	Commissioning Process Authority Professional (CxAP)	http://cx.engr.wisc.edu/	▪ Acknowledges applicants who have served as the primary commissioning authority during all project stages (pre-design through occupancy) on a minimum number and size of projects. ▪ Candidates must complete The Commissioning Process for Delivering Quality Constructed Projects course, plus at least one of the UW specialized commissioning topic courses (5 days). ▪ Candidates must complete an examination. ▪ For more information: http://epdfiles.engr.wisc.edu/cxcertifications/UWCxCertifications_Information.pdf	
University of Wisconsin-Madison, Department of Engineering Professional Development	Commissioning Process Manager (CxM)		▪ Distinguishes applicants who have managed commissioning process activities within their organizations, such as university or government in-house programs. ▪ Other requirements and information similar to CxAP. See: http://epdfiles.engr.wisc.edu/cxcertifications/UWCxCertifications_Information.pdf	
University of Wisconsin-Madison, Department of Engineering Professional Development	Commissioning Process Technical Service Provider (CxTS)	http://cx.engr.wisc.edu/	▪ Highlights the skill and experience of applicants who have provided commissioning services primarily in select project stages, on small or limited scope projects, or who provide key technical support to commissioning activities. ▪ Other requirements and information similar to CxAP. See: http://epdfiles.engr.wisc.edu/cxcertifications/UWCxCertifications_Information.pdf	
University of Wisconsin-Madison, Department of Engineering Professional Development	Green Commissioning Process Provider (GCxP)	http://cx.engr.wisc.edu/	▪ Recognizes those who lead the commissioning process activities as commissioning authorities (the CxP team leader) on new or existing building projects that emphasize green and sustainable building principles. ▪ Other requirements and information similar to CxAP. See: http://epdfiles.engr.wisc.edu/cxcertifications/UWCxCertifications_Information.pdf	
University of Wisconsin-Madison, Department of Engineering Professional Development	Qualified Commissioning Process Provider (QCxP)	http://cx.engr.wisc.edu/	▪ Applicants who do not yet have sufficient professional experience in the commissioning process to qualify for one of the above certifications will receive accreditation as a Qualified Commissioning Process Provider upon successful completion of the training and examination. ▪ Valid for five years to allow the applicant time to acquire the necessary experience for other UW-Madison credentials. ▪ Other requirements and information similar to CxAP. See: http://epdfiles.engr.wisc.edu/cxcertifications/UWCxCertifications_Information.pdf	

Organization	Credential Program	Website	Credential Requirement	Notes
BOMI International	Offers a range designations (higher attainment) and certificates. Those relating to OES include: ▪ Building Systems Maintenance Certification ▪ Systems Maintenance Technician & Administrator Designations	http://www.bomi.org/Educational-Offerings/Designations-and-Certificates.aspx	▪ Coursework required of certification ▪ Coursework and some experience required of designations	
Building Performance Institute (BPI)	Multi Family Building Analyst	http://www.bpi.org/tools_downloads.aspx?selectedTypeID=1&selectedID=6	▪ Pre-examination training is not required, but courses are available through Independent Training Organizations nationwide. BPI has a Training Organizations Locator Tool: http://www.bpi.org/tools_locator.aspx?associateTypeID=AFF ▪ Candidates must take a 100-question exam. ▪ Certification is renewable upon obtaining 30 Continuing Education Units every three years. ▪ For details: http://www.bpi.org/Web%20Download/BPI%20Standards/Multi%20Family%20Building%20Analyst%20Prof%20FD%203.0%202-20-08.pdf	
Building Performance Institute (BPI)	Multi Family Energy Efficient Building Operator	http://www.bpi.org/tools_downloads.aspx?selectedTypeID=1&selectedID=7	▪ Pre-examination training is not required, but courses are available through Independent Training Organizations nationwide. BPI has a Training Organizations Locator Tool: http://www.bpi.org/tools_locator.aspx?associateTypeID=AFF ▪ Candidates must take a 100-question exam. ▪ Certification is renewable upon obtaining 30 Continuing Education Units every three years. ▪ For details: http://www.bpi.org/Web%20Download/BPI%20Standards/Multi%20Family%20Energy%20Efficient%20Building%20Operator%20FINAL%20DRAFT%202.1%20ma.pdf	For building operators
Midwest Energy Efficient Alliance (MEEA)	Building Operator Certification (BOC)	http://www.mwalliance.org/programs/building-operator-certification; http://www.boccentral.org/	▪ Operators earn certification by attending technical training, completing exams and performing energy-efficiency focused project assignments in their facilities. ▪ BOC has two levels of certification. Level I focuses on Building Systems Maintenance; Level II focuses on Equipment Troubleshooting and Maintenance. ▪ Candidates usually have two or more years experience in building operation and maintenance. Specific requirements can be found at: http://www.boccentral.org/content/eligibility-requirements. ▪ Candidates must complete training courses, pass exams, and finish project assignments to become certified. ▪ BOC Level I training requires seven classes over eight days for 74 instruction hours: http://www.boccentral.org/level-i; Level II training requires four core courses and two supplemental courses for 61instruction hours. ▪ BOC training (Level I only) is currently available in Minnesota, but not in the Minneapolis-St. Paul Metropolitan Area. See: http://www.boccentral.org/training-minnesota.	For building operators

Organization	Credential Program	Website	Credential Requirement	Notes
U.S. Green Building Council	LEED AP Operations + Maintenance (O+M)	http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2195	▪ The LEED AP O+M credential provides a standard for professionals participating in the operation and maintenance of existing buildings that implement sustainable practices and reduce the environmental impact of a building over its functional life cycle. ▪ Eligible applicants must have experience, within three years of application, with a project registered for or certified in one of the LEED Rating Systems. ▪ Applicant must pass a 4-hour, 2-part exam. The first part of the exam, the LEED Green Associate section (100 multiple choices), is designed to measure the ability to understand and support green design, construction, and operations. The second part of the exam (100 multiple choices) is the LEED AP specialty section on building operations and maintenance. ▪ LEED AP O+M credential holders are required to complete and report 30 Continuing Education (CE) hours each reporting period; 6 of these hours must be LEED-specific. ▪ Candidate handbook: http://www.gbci.org/Libraries/Candidate_Handbooks/LEED_AP_O_M_Candidate_Handbook.sflb.ashx	