


City of Edmonds

Energy Plan

Prepared by Cascadia Consulting Group

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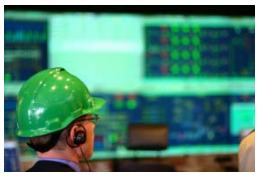
CASCADIA CONSULTING GROUP

CITY OF EDMONDS Inc. 1890






Executive Summary

This plan summarizes key energy-saving accomplishments and highlights future energy opportunities for the City of Edmonds' municipal operations. Overall, Edmonds has made great strides in reducing its energy use. **From 1999 to 2010, energy use by the municipal government declined by 15%.** Over the period from 2006 to 2010, direct energy costs declined by 6% representing a cumulative savings of over $400,000.[1] Much of this decline can be attributed to a number of facilities upgrades, including $1.8 million in investments made primarily at the wastewater treatment facility.[2]

Thirty opportunities for the City to further reduce its energy use and save taxpayer dollars were identified. Economic analyses for seventeen of the thirty identified opportunities were performed. These analyses included assessments of the financial benefits, implementation risks, and energy savings potential of each opportunity. The top four sets of opportunities contain an estimated **$4 million in potential energy cost savings over the next 20 years**. The results from our assessment suggest that the City consider the following actions:

1) Invest in a **more efficient police vehicle fleet**;
2) Invest in **targeted small-scale facilities upgrades**;
3) Work with the local PUD to continue to improve **streetlight efficiency**;
4) Conduct **strategic de-lamping** and installation of **solar powered signage**, and;
5) Motivate **changes in behavior and practices** by formalizing and institutionalizing trainings, incentives, sharing of best practices, and tracking/reporting of energy use and expenditures across City departments.

In addition, we recommend that the City conduct follow-on engineering and economic analyses for an additional set of options, identified in Table 7 on page 17 of this report.

Based on an energy expenditure risk modeling exercise utilizing energy price forecasts,[3] the City of Edmonds' **total *facility-related* energy expenditures over the next five years are projected to average $317,000 per year** (actual 2010 costs equaled $275,994)[4] **with an upper range extending to $463,000 per year**.[5] Wise investments in

[1] Relative to a 2006 expenditure baseline.

[2] $0.3 million of the $1.8 million invested was supported by utilities incentives.

[3] Energy price forecasts for the next five years were obtained from the Snohomish PUD 2010 Integrated Resources Plan and the Northwest Gas Association 2010 Gas Outlook.

[4] Includes South County Senior Center and Wade James Theater. Excludes various parks meters.

[5] This value represents the upper 95th-percentile of the distribution of the modeled possible future annual outlays. (See Page 6 for further details)

geothermal, wind, solar, and other non-fossil fuel energy generation infrastructure can reduce the City's exposure to these future cost risks and unforeseen energy price shocks. These investments can be made directly by the City, or through partners such as the local utilities. Such investments should be made with caution, however; a proposed installation of a 10kW rooftop solar system on the City Hall Building, absent additional external financial subsidies or incentives, does not appear to meet investment thresholds (i.e., a calculated payback period of fifty years exceeds most estimates of solar system lifespan).

Based on our analysis, implementation of the top seventeen opportunities identified in this report would realize a **net present value savings of approximately $300,000** for the City.[6]

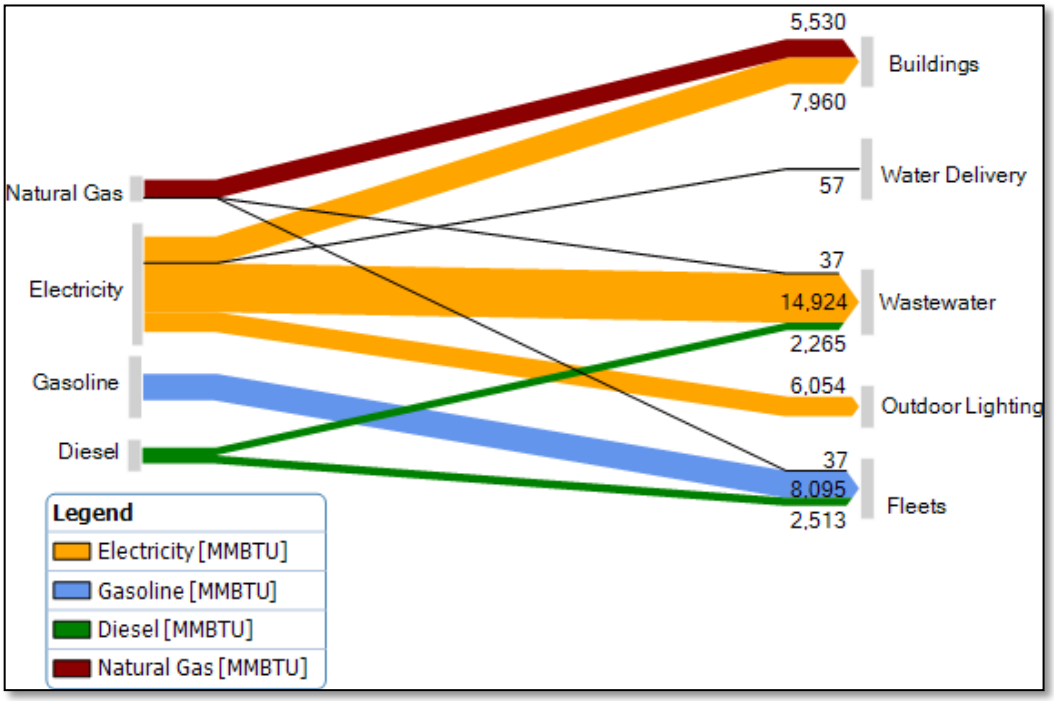
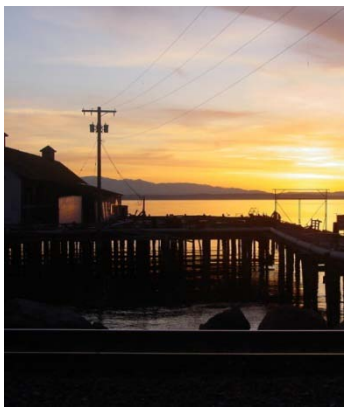


Figure 1. City energy use by sector and energy type.

[6] Net Present Value calculations for this report used a discount rate of 8%, a relatively conservative number, and an assumed average twenty-year energy efficiency asset lifespan. NPV values > 0 represent sound investments.






I. Introduction

Background

In March 2011, the City of Edmonds contracted with Cascadia Consulting Group to develop an Energy Plan for its municipal operations. This plan has two primary objectives: 1) to tell the story of municipal energy use in Edmonds, including a description of the trends in use and the strides the City has made in reducing consumption and lowering costs, and; 2) to identify and assess opportunities for further reducing energy use and expenditures within its municipal operations. This report summarizes Edmonds' energy story and provides a basic roadmap for strategic energy-related investments moving forward.

The City of Edmonds consists of ten departments working in eleven facilities to serve approximately 40,000 residents. Providing those residents with safe, pleasant areas to live, work, and play requires smart energy planning. With government budgets tightening, it is vital that Edmonds continue to work to maximize efficiencies and minimize risks in its expenditures. This Energy Plan serves as a road map for Edmonds to not only save money, but also to realize the co-benefits of improved environmental quality and public health that typically accompany smart energy investments.

Accomplishments

The City of Edmonds has already made great strides in reducing its energy use and lowering expenditures associated with its city operations. From 1999 to 2010, energy use by the municipal government declined by 15%. Between 2006 and 2010, Edmonds realized over $400,000 in reduced municipal government energy costs, equivalent to a 6% reduction over that time frame (Figure 2).

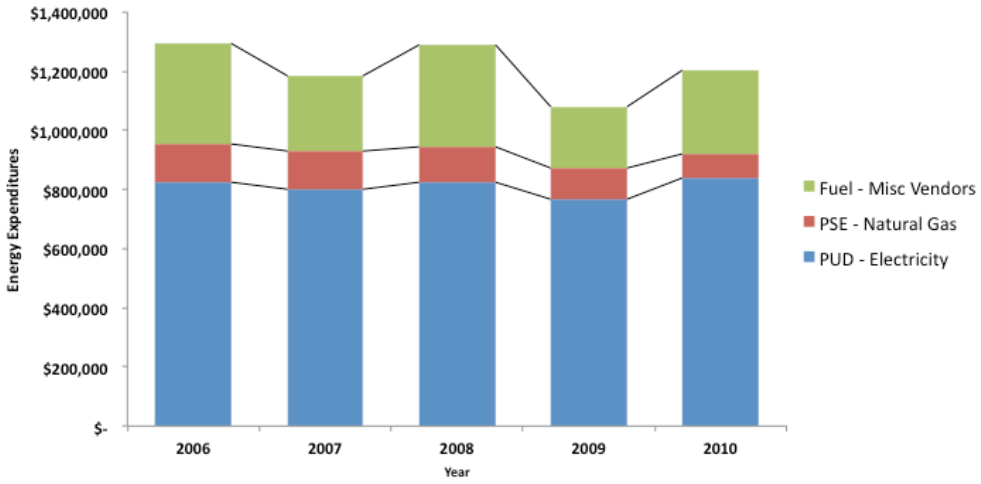


Figure 2. Edmonds municipal operations energy expenditure trends from 2006 to 2010.
Despite population growth, the City has realized over $400,000 in reduced municipal government energy costs, equivalent to a 6% reduction. These values are rough estimates based on billing from vendors. *Note: expenditures in one year may account for some energy use in the year prior or after, as energy use precedes billing.*

Since 2006, the City has worked closely with energy service companies (ESCOs) to implement energy conservation measures in its municipal facilities. The $1.8 million invested in these projects is estimated to render $100,000 in energy and operational savings *per year*.[7] The city has also successfully converted its entire diesel-based fleet to a biodiesel mix, has four hybrid vehicles and two recently acquired Nissan Leaf electric vehicles, and has installed eight electric vehicle charging stations throughout the community. As of August 2011, Edmonds had upgraded 95% of its 588 traffic lights and 100% of its 132 pedestrian signal lights to LED, resulting in a 60% reduction in energy use for those signals. The City recently installed a solar-powered school zone flasher and is working to install more. In 2010, the City upgraded its water pumping stations with new variable frequency drives and alarms that monitor inefficiencies and ensure proper pump functioning. The City has also recently re-convened its internal "Green Team," a group of staff members committed to making City operations more green and sustainable. All of these accomplishments have helped the City save taxpayer money and reduce the City's risks to energy price fluctuations.

Goals

Driving Edmonds' energy accomplishments are actionable goals that Edmonds has laid out for reducing its energy use, minimizing environmental impacts, and improving quality of life for its residents and businesses. In 2006, Edmonds became one of over 1,000 cities nationwide to commit to the U.S. Conference of Mayors Climate Protection Agreement, which aims to reduce greenhouse gas emissions to 7% below 1990 levels by 2012. In 2010, Edmonds worked with its community to lay out a Climate Action Plan for the City, which includes goals to limit City vehicle idling, increase renewable energy use, and develop internal "green" committees in City government. In 2011, the City worked closely with Climate Solutions' New Energy Cities program in a daylong workshop to create a road map for a sustainable energy future in Edmonds. Most recently, in 2011, Mayor Mike Cooper tasked the City staff with a new ambitious goal: to reduce municipal energy use by 25%. This Energy Plan is a concrete step towards meetings this important goal.

[7] $0.3 million of the $1.8 million invested were supported by utility incentives.

II. Key Findings & Recommendations

Overall Government Operations

In 2010, Edmonds spent approximately $1.2 million on energy to power City operations, or $28 per resident (Figure 3).[8] This purchased 47,929 MMBTU of energy.[9] Compared to other moderate-sized Washington cities, energy use and energy expenditures per-capita is quite good.

The majority of the city's energy costs result from electricity use. Electricity expenditures represent 68% ($768,568) of the total 2010 city energy expenditures. Vehicle fuels account for the second-highest energy expenditure within the city (25%; $272,009) and natural gas, the third-highest (8%; $83,875).

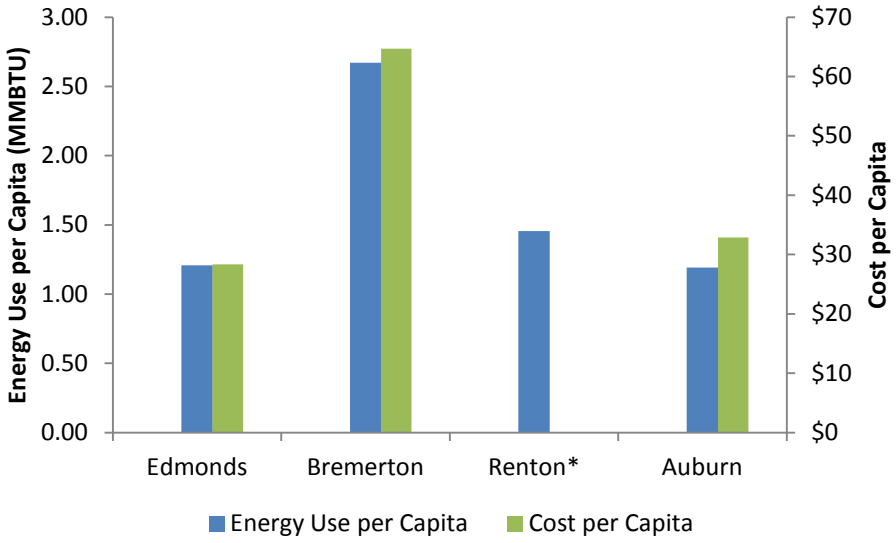


Figure 3. City operations energy use per resident for select WA cities.
Energy use from city staff commuting and business travel was not included. Because of the many variables associated with these inventories and inter-year differences, this analysis should be viewed only as an indication of Edmonds' relative energy consumption and costs. For a more rigorous comparison, a more detailed analysis is recommended. (**Energy cost information was not available for the city of Renton*)

[8] This value includes expenditures outside of the general fund. If non-general fund expenditures are excluded, 2010 energy expenditures per capita would lower to $18 per resident.

[9] MMBTU = Million British Thermal Units. One BTU is defined as the amount of heat needed to raise the temperature of one pound of water by one degree Fahrenheit; this is roughly the amount of energy that comes from burning one wooden match.

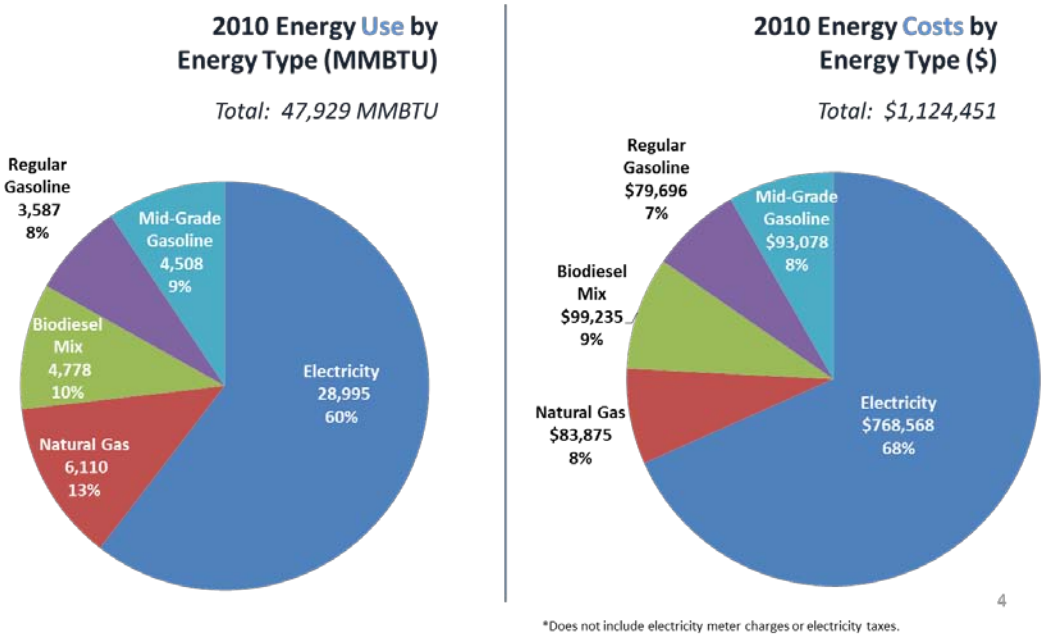


Figure 4. City energy expenditures by source and sector for 2010.

The highest energy-using sector in 2010 was wastewater treatment, which accounted for 37% (~17,00 MMBTU) of the total energy used in City operations and 35% ($395,140) of the total energy costs. City buildings (23%; $256,416) and the City's vehicle fleet (20%; $229,271) also accounted for a large proportion of the City's energy expenditures. In 2010, the City's total energy expenditures were 6% lower than those in 2006, in spite of higher energy commodity costs. This represents real energy efficiency gains.

Applying Statistical Analysis to Estimate Future Energy Expenses

Selected Example: Edmonds' Facilities

We applied a Monte Carlo analysis technique to generate estimates of facility-related energy costs covering the next five years. The approach integrates future energy price projections with Edmonds' past facility energy use and local weather data to generate a distribution of estimated future energy expenditures.[10] The projections account for variability in weather and energy price, and suggest that Edmonds could face a total facility energy budget increase of up to 68% within the next five years.[11] The prospect of higher future energy expenditures further underscores the importance of this Energy Plan. Every kWh, gallon, or MBtu reduced by the City will insulate Edmonds against future expenditure risk. In addition, budget planning can now explicitly incorporate the City's acceptable level of risk (see Table 1). This type of analysis can be extended to other elements of Edmonds' energy portfolio, as well as be used in evaluating specific energy investment options. Given the scope and budget of this project, we limited our analysis to this one example addressing facility related energy expenditures.

[10] The methodology we employed was developed by Jerry Jackson of Texas A&M University and is referred to as "eBaR" which is an acronym for "energy budgets at risk."

[11] Total facility energy costs in 2010 were $275,994, so a 68% increase would represent $145,000 in additional cost. This value corresponds to the upper end of the distribution (a 5% risk) – see Table 1. Analysis included the South County Senior Center and Wade James Theater, both of which were excluded from the formal energy inventory. Costs from various city park electricity meters, included in the "Buildings" sector of this Plan's energy inventory, were excluded from this analysis framework.

Table 1. Estimated facility-related energy expenditures over the next five years at varying levels of risk. Actual 2010 costs equaled $275,994.

	Level of Risk	VARIANCES			ADJUSTED BUDGETS		
		Electricity	*Natural Gas*	*Total*	*Electricity*	*Natural Gas*	*Total*
$EBaR_{budget,mean}$					$212,886	$104,407	**$317,812**
$EBaR_{budget,90}$	**10%**	$116,092	$33,837	**$122,154**	$328,978	$138,243	**$439,966**
$EBaR_{budget,95}$	**5%**	$138,323	$40,316	**$145,545**	$351,209	$144,723	**$463,357**
$EBaR_{budget,97.5}$	**2.5%**	$158,083	$46,075	**$166,337**	$370,969	$150,482	**$484,149**

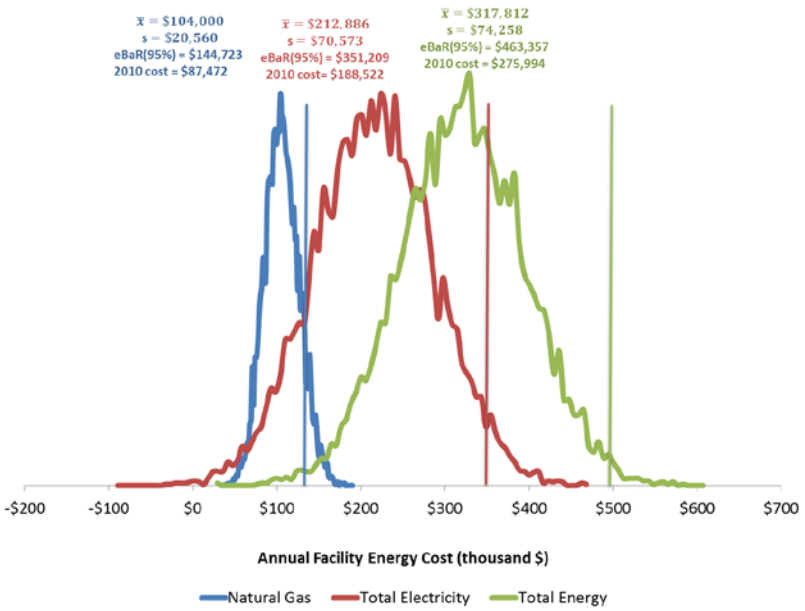


Figure 5. Distributions of expected facilities energy costs for the City of Edmonds over the next five years.

From over thirty identified opportunities, we recommend five overarching actions to reduce near- and mid-term energy costs for the City of Edmonds: 1) Invest in a more efficient police fleet, 2) Invest in additional key short-term facilities upgrades, 3) Work with PUD to improve streetlight efficiency, 4) Conduct strategic de-lamping and installation of solar powered signage, and; 5) Motivate changes in behavior and practices by formalizing and institutionalizing trainings, incentives, sharing of best practices, and tracking/reporting of energy use and expenditures across City departments. In addition, we recommend that the City conduct follow-on engineering and economic analyses for an additional set of options, identified in Table 7 on page 17 of this report.

Taken together, these opportunities would involve approximately $1.3 million in capital investment, generate an estimated $4 million in lifetime energy savings, and represent $300,000 in *present value* energy costs savings. Over a 20-year timeframe, this equates to a present value energy cost reduction of 2% as compared to the status quo. Increasing the time-in-service of the City's police cruisers from three to six years could realize an additional $37,000 in present value energy cost savings.[12]

[12] Investments in hybrid police vehicles and propane-powered vehicle conversion have 3.7- and 3.9-year payback periods, respectively. Therefore, extending the lifetime of police vehicles even one year beyond the current City practice (3-year lifetime) will realize net savings for the City.

Table 2. Primary energy recommendations for City operations. Options were evaluated by calculating and comparing financial metrics such as Net Present Value (NPV) and Return on Investment (ROI).

Recommendation	Capital Costs	Lifetime Energy Cost Savings	Potential NPV (Asset Lifetime)	ROI
1. Invest in more efficient police fleet • Install idling management devices in newer police fleet vehicles • Pilot hybrid police vehicles • Introduce more advanced fleet management and tracking systems • Pilot propane gas-powered vehicle conversion for a subset of Crown Victorias	$243,000	$445,000	$57,000 (3 years)	80%
2. Invest in key short-term facilities upgrades • Add occupancy/vacancy sensors in City Hall and Public Safety building • Investigate installation of fresh air ventilation to the server room to reduce the load on the mini-split system	$6,000	$17,000	$15,000 (15 years)	170%
3. Work with PUD to improve streetlight efficiency • Establish monitoring technologies to assess actual vs. billed streetlight energy use • Push for additional pilot LED projects • Work with PUD to negotiate lower rates for LED streetlights	$1,052,000	$3,304,000	$200,000 (25 years)	210%
4. Targeted solar & infrastructure lighting • Continue choosing solar for new school zone signals • De-lamp or change bulb type of exterior lighting in Public Safety building • Reduce usage of outer five garage parking lights by 6 hrs/day at City Hall	$1,500	$25,800	$25,000 (20 years)	1,500%
5. Conduct engineering and economic analysis of higher capital cost options • Recover energy from incinerated bio-solids • Solar or geothermal water heating component when planning for Yost Pool boiler replacement • Cooler temperature asphalt mixes • Methane recovery from wastewater treatment plant	*Further analysis recommended*			
TOTAL	**$1,300,000**	**$3,800,000**	**$296,000**	

In the following sections we lay out detailed findings and recommendations for the following energy use sectors:

- Facilities
- Fleets
- Outdoor Lighting
- Wastewater
- Water Conveyance

Facilities

Energy efficiency upgrades conducted as a result of ESCO projects have realized significant energy savings for the City. Between 2007 and 2010, total energy expenditures at City facilities fell by 12%, realizing a cumulative energy cost savings of $34,000.

Those facilities that used the most energy are presented in Figure 6. The Public Safety building/Fire Station 17 (both under the same energy account) are by far the largest energy consumers, both absolutely (3,581 MMBTU; $58,400 in 2010) and on a per-square-foot basis (88 kBtu/sq.ft.; $1.90/sq.ft.). The most dramatic declines (36% and 23% since 2007) in energy costs have occurred in the City Park Building and Yost Pool, respectively, which have collectively contributed $9,000 in cumulative energy savings from 2007 to 2010.

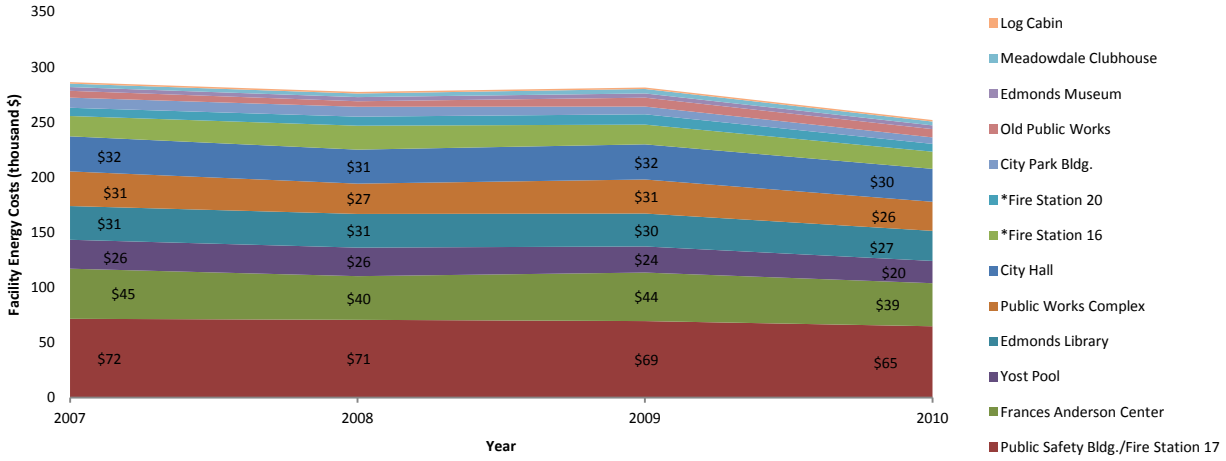


Figure 6. Facility energy costs. *Energy costs for fire stations are now covered by the District, not the City.

Interviews conducted with City staff as well as formal audits of the Public Safety, City Hall, and Public Works buildings conducted by Fluid Market Strategies helped us to identify the opportunities listed in Table 3. A more detailed overview of these audits is presented in Appendix C.

Table 3. Opportunities identified for City facilities.

Facility	Opportunity
City Hall	City Hall Rooftop Solar – 10kW
	Replace Rooftop Heat Pump Condenser Units to 9.5 hspf/14.5 SEER
	Replace Rooftop Heat Pump Condenser Units to 8.0 hspf/13 SEER
	Upgrade from 8.0 hspf to 9.5 hspf
	Base Load Reduction -25%
	Base Load Reduction -15%
	Window Replacement
	Occupancy and Lighting Controls
	Replace Refrigerators
	Reduce usage of outer 5 Garage parking Lights by 6 hrs per day
Public Works	Public Works Roof Top Solar – 10kW
	Occupancy and Lighting Controls
Public Safety	Public Safety Roof Top Solar – 10kW
	Change Out SE corner lights to 55 watt replacement
	Occupancy and Lighting Controls
Parks Maintenance	Boiler system update
Yost Pool	Investigate solar or geothermal water heating component when planning for Yost Pool boiler replacement

(kW = Kilowatt, hspf = heating seasonal performance factor; SEER = Seasonal Energy Efficiency Ratio)

For those opportunities where quantifiable information was available, evaluations were made using the standard set of financial metrics. Those with favorable cost savings are summarized in Table 4 below. These represent a cumulative potential savings of over $77,000 over the next twenty years, or a present value savings of approximately $36,000. Additional opportunities, deemed to possess strong energy use savings potential (but lacking specific data), are also listed in the table below for consideration.

Table 4. Recommended opportunities for City facilities.

Opportunity		Capital Cost Estimate	Lifetime Savings Estimate	NPV	Implementation Risk
Analyzed and Recommended Opportunities	Add additional occupancy/vacancy sensors in Public Safety building	$7,600	$45,000	$18,078	Low
	Occupancy and lighting controls in City Hall	$3,800	$1,567	$9,613	Low
	Occupancy and lighting controls in Public Works	$2,400	$15,000	$6,159	Low
	De-lamp or change bulb type of exterior lighting on SE corner of Public Safety building	$5,400	$14,700	$1,816	Low
	Reduce usage of outer five garage parking lights by 6 hrs per day at City Hall	$170	$1,150	$486	Low
Short-term, Low-cost Opportunities	Enforce use of pool cover				Low
	Door weather stripping on entry doors of Public Safety				Low
Longer-term Opportunities and/or Further Analysis Needed	Boiler system update in Parks Maintenance Building				Low
	Consider upgrading incandescent lighting in the courtroom to LED bulbs/fixtures (Public Safety building)				Low
	Investigate solar or geothermal water heating component when planning for Yost Pool boiler replacement				Medium-High
	Consider propane- or electric-powered leaf blowers and weed eaters				High
Total		**$19,730**	**$77,417**	**$36,153**	

Fleets

In 2010, Edmonds had 132 fleet vehicles, 98 of which are passenger vehicles. Fleet energy use accounted for 20% of City energy expenditures in 2010, equivalent to $229,271. Compared to the significant energy reductions achieved for Edmonds' facilities (12% decline since 2007; $34,000 savings), Edmonds' fleet energy use has experienced a more modest reduction since 2006 (3% decline, or a savings of 2,833 gallons).

Police department vehicles are responsible for the highest percentage of the City's fuel costs (41% of all City fuel expenditures; over $92,000 in 2010). The majority of the police department's fuel consumption can be attributed to Ford Crown Victorias, seven of which are among the top-ten fuel users of all fleet vehicles.

Key actions the City has taken to reduce its fleet fuel consumption include:

- ✓ Scheduled, routine **maintenance protocol** to maximize efficiency of vehicles
- ✓ Procured four **hybrid** vehicles for its fleet
- ✓ **Track** fuel consumption and generate reports
- ✓ Use **biodiesel mix** for all diesel vehicles and heavy equipment
- ✓ Installed two electrical vehicle charging stations to power two **Nissan Leafs**
- ✓ Installed **six electrical vehicle charging stations** for community use
- ✓ Installed **GPS tracking system** on water shutoff truck to track idling and optimize routing
- ✓ **Communicate regularly with departments** to ensure that vehicle size and function align with actual staff needs
- ✓ **Downsize** vehicles when appropriate
- ✓ Use of **battery jump boxes** to power flashers and radio for stationary vehicles (instead of idling the vehicle)

We identified eighteen total opportunities to reduce fleet energy use in Edmonds, six of which underwent more thorough quantitative analysis. In total, the analyzed opportunities sum to an estimated $445,000 in lifetime energy savings and a net present value of $57,000 for the City (Table 5). An additional $37,000 in present value energy cost savings can be realized by increasing the time-in-service (i.e., decreasing the replacement rate) of the City's police cruisers from three to six years.[13]

Table 5. Identified opportunities to reduce fleet energy use.

Opportunity		Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Analyzed and Recommended Opportunities	Install an idling power management device in police fleet vehicles	$25,000	$45,000	$13,000	Medium-Low
	Install better systems for tracking mileage, fuel use, and costs	$50,000	$171,750	$48,006	Low
	Introduce hybrid police vehicles (3.7 yr. payback period)[13]	$39,000	$32,000	-$11,000	Medium-Low
	Introduce a GPS Fleet Tracking System	$100,000	$173,350	$16,319	Medium-Low
	Pilot natural gas-powered vehicle conversion for a subset of Crown Victorias[13]	$29,000	$22,500	-$9,000	Medium
Short-term, Low-cost Opportunities	Formally incorporate fuel-efficient driving practices into on-boarding and employee training protocols				Low
	Join Evergreen Fleets				Medium-Low
	Introduce minimum fuel efficiency standards for new fleet vehicles and require consideration of fuel efficiency in evaluating new fleet vehicle purchases.				Low
	Employ a 'right vehicle, right job' approach to fleet management				Low
	Annually publish and distribute actual vs. expected fuel efficiency for each vehicle				Low
	Designate a high efficiency "community vehicle" for staff to use when storage space is not required				Medium
	Enable a 5-minute auto shut-off control on fleet vehicles				Low
	Require destination logging to hold staff accountable for miles driven				Medium
	Monitor, record, and distribute vehicle idling time statistics each month				Medium
	Enforce use of battery jump boxes when flashers are needed for parked vehicles				Low
Longer-term Opportunities and/or Further Analysis Needed	Investigate feasibility of a car-share program				Medium-High
Total		**$243,000**	**$445,000**	**$57,000**	

Outdoor Lighting

Outdoor lighting accounted for 22% of total City energy costs in 2010, equivalent to $241,359. The vast majority (92%; $223,954) of outdoor lighting energy is used to power municipal streetlights.

[13] Investments in hybrid police vehicles and propane-powered vehicle conversion have 3.7- and 3.9-year payback periods, respectively. Therefore, extending the lifetime of police vehicles beyond current City policy (3-year lifetime) would make the NPV value for both of these vehicle energy efficiency options positive and realize net savings for the City. Specifically, we estimate that an increase in vehicle lifetime from three to six years would increase the NPV of the hybrid and propane vehicle investment options to +$10,214 and +$5,672, respectively.

Edmonds has successfully reduced its outdoor lighting energy use since 2006 by switching traffic signals, fire signals, and flashers to LED. The 95% of traffic lights and 100% of pedestrian signals that were converted to LED saw a 60% (69,826 kWh; $18,853) reduction in energy costs (Figure 7). Most recently, Edmonds was chosen by Snohomish PUD to be the site of an LED street-lighting pilot project in Emerald Hills, which successfully installed 21 LED municipal streetlights. The city has also installed one solar-powered school zone flasher and is working to install more.

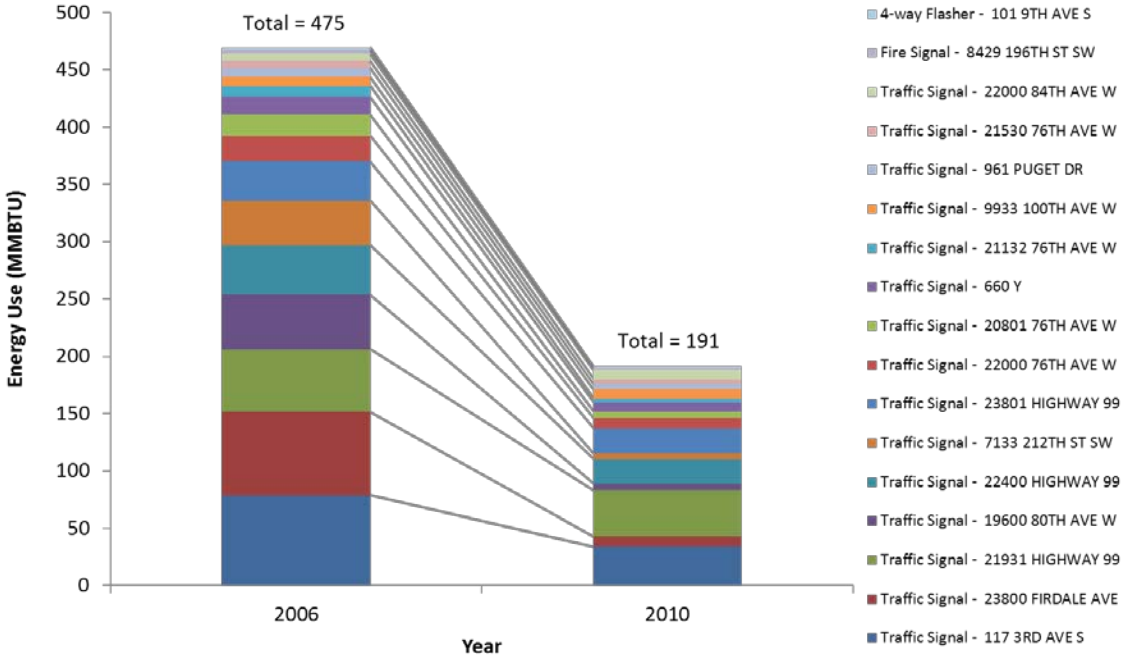


Figure 7. Energy use reductions for traffic lights switched to LED technology.

Because municipal street-lighting composes such a large proportion of electricity use in the City, we recommend that Edmonds continue working with Snohomish PUD to push for the conversion of Edmonds' streetlights to LED technology. Although implementation of LED streetlight conversion in the U.S. is still largely in the pilot stage, the potential dividends are impressive. A pilot project in Los Angeles, for example, saw a 59% energy savings in retrofitted fixtures. Such a reduction would reduce energy costs by $132,000 a year if Edmonds converted all its streetlights to LED. Even after accounting for the initial capital investment, this lighting technology shift would result in a net present value cost savings of approximately $200,000.

Water Conveyance

Water conveyance composes a very minor proportion of Edmonds' total energy expenditures (0.2%; $2,265). The City has taken the following actions to reduce its water conveyance costs:

- ✓ Installed **computerized irrigation systems** at 6 ballparks, providing more accurate tracking and reduced water use
- ✓ Over past 5-10 years, **installed rain clicks** that automatically shut off irrigation system when it rains
- ✓ Implemented water conservation, watershed awareness, and storm water **outreach and educational programs**
- ✓ **Use of gravity** to deliver 100% of water. Water pump station used infrequently.
- ✓ **Upgraded water pump station** (in 2010) with new pumps, motors, variable frequency drives, controls, and a new generator.
- ✓ Installed **new alarms** to monitor inefficiencies and ensure proper pump functioning.

Because water conveyance composes such a small proportion of total energy expenditures and Edmonds has already implemented energy-saving practices in this arena, we provide only a few minor recommendations for reducing the City's expenditures related to water conveyance:

- ✓ **Consider battery or solar-powered irrigation controllers City Park locations.** There are seven irrigation meters with virtually zero consumption around the City for which the City is paying meter fees. Conversion of these irrigation controllers to self-sustaining battery or solar power could save ~$1,200/yr. on current meter fees.
- ✓ **Monitor and report pump efficiencies.** Install more transparent and comprehensive systems (such as the *MultiSmart*) to monitor, track, and report wire-to-water efficiencies of pumps on a consistent basis.
- ✓ **Ensure informed purchase decisions.** Enforce the consideration of historical use data (from monitoring system mentioned above) to inform future purchasing and configuring decisions.

Wastewater

Providing service to over 70,000 people, wastewater treatment and conveyance accounts for the highest energy cost component of Edmonds municipal operations (35% of total energy expenditures; $395,140). Most of these costs do not impact the City general fund, however. The Edmonds wastewater treatment facility serves not only the City of Edmonds, but also Mountlake Terrace, Lynnwood, Olympic View Water and Sewer, and the Ronald Wastewater District.

Recent ESCO projects are estimated to have reduced wastewater treatment energy expenditures by $160,634 annually, a 50% reduction in annual energy costs for the facility. A summary of these projects is provided in Table 6.

Table 6. ESCO projects at the wastewater treatment facility.

Measure or Practice	kWh Savings	Annual $ Savings
Completed or Ongoing:		
Turbo Blowers (2009) → Replaced 1 existing blower with 300 HP turbo-blower and upgraded the D-O control.	329,189	$20,639
Diffusers → Installed diffusers in bottom of sludge tank to improve aeration.	43,309	$2,495
Energy Monitoring → Big energy users (aerator blower, incinerator, pumps) are constantly monitored to ensure adequate functioning and identify potential problems.		
Variable Frequency Drives → Installed variable frequency drives on some motors.		
Passive Heating → Rely primarily on passive heating from equipment to heat facility in winter. Employees turn on/off heat when enter/leave building, as needed.		
Soft Starts → Installed soft starts on blowers.		
In Design Phase:		
Lighting → Re-lamping T8s from 32- to 28- watt & some circuit control changes.	49,000	$7,000
Aeration Basin → Converting one basin from 790 standard round fine bubble diffusers to new low-flow rectangular fine bubble diffusers.	170,000	$51,000
Effluent Pump Station → Change the outfall orifice sizes located on each effluent discharge line going out into the bay. Reduces back pressure and allows for more gravity-driven (as opposed to pump-driven) flow.	175,000	$52,500
Non-Potable Water → Addition of a small booster pump and control changes, resulting in system pressure reduction.	90,000	$27,000
Total	**856,498**	**$160,634**

Despite the significant energy savings associated with these ESCO projects, a number of energy efficiency and potential energy generation opportunities remain within this sector. We identified the following additional opportunities for further energy use reduction at the facility:

- ✓ Investigate the feasibility of district heating in the wastewater treatment plant area
- ✓ Recover energy from incinerated bio-solids
- ✓ Methane recovery as alternative fuel (unlikely given current facility operating configuration)
- ✓ Install a heat exchanger to the incinerator heat plume (could increase incinerator capacity (burn fewer hrs/day))
- ✓ Install micro-turbines where flowing water to generate electricity
- ✓ Install solar panels on roof
- ✓ Recover waste heat from incinerator and cooling water outflow
- ✓ Switch incinerator fuel from diesel to natural gas
- ✓ Install turbo blowers

Because this plan aims to minimize energy expenditures from the General Fund, we did not focus our analysis efforts as intensively on Edmonds' wastewater treatment facility. However, we recommend that Edmonds conduct further, more detailed analyses of the opportunities listed above to identify those most promising.

III. Ranking & Analysis Approach

Seventeen opportunities, spanning multiple City functions, were evaluated using a combined quantitative and qualitative ranking process that assessed each opportunity's merits based on the following criteria: 1) energy cost savings potential, 2) required capital outlays, 3) track record of success/implementation risk, and 4) net present value. Independent research conducted by Cascadia along with an assessment of other jurisdictions' experience with analogous energy saving approaches informed the rankings. Notes, descriptions, rankings, and financial analyses of these opportunities are described in Appendix A. Background calculations used in generating financial estimates are provided in **Error! Reference source not found.**.

Opportunities and their respective rankings are represented visually in the bubble chart below (Figure 8). High value opportunities (those with high net present values and low implementation risk) emerge in the upper left quadrant in the chart.

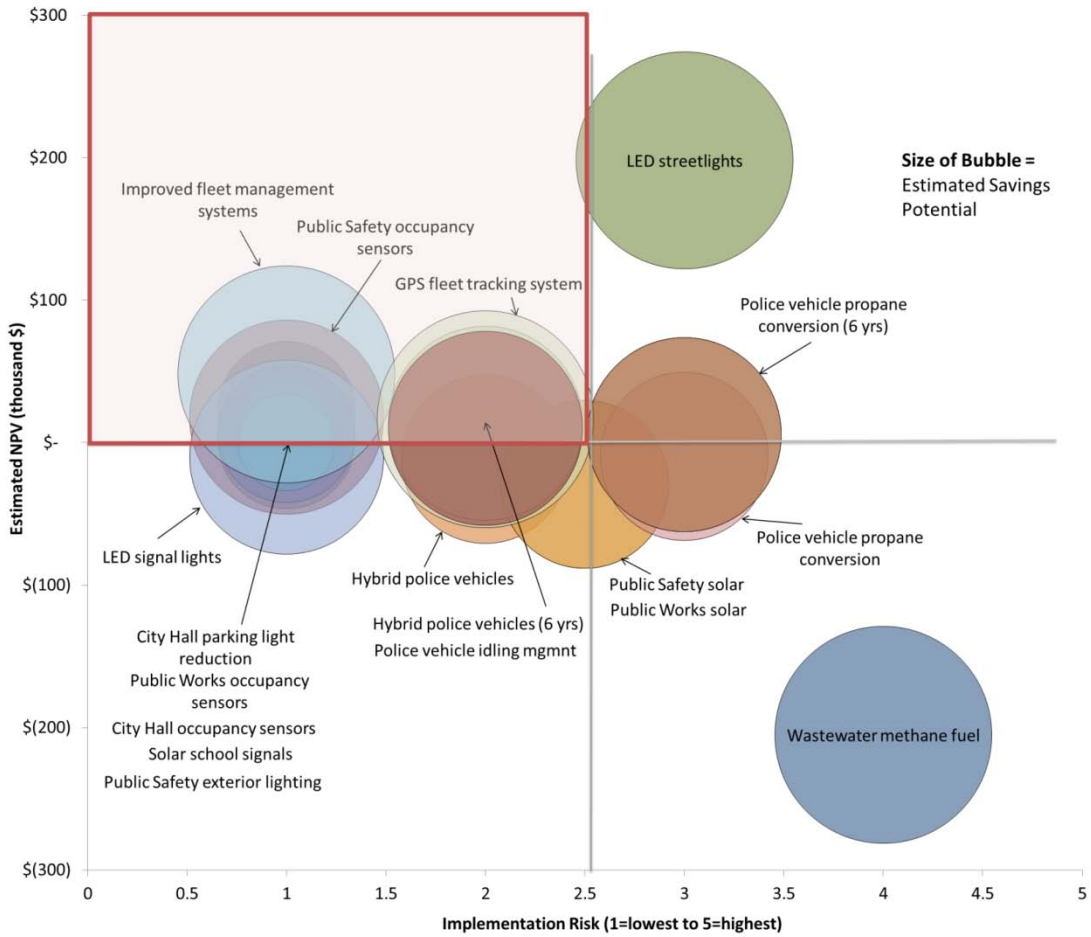


Figure 8. Relative rankings of energy savings opportunities.
(Note: the LED streetlights option, which has the highest NPV of the opportunities assessed, was placed in a "higher risk" category solely because the extent to which this strategy is deployed is largely outside the control of the City – our assumption is that this work would be under the purview of SnoPUD.)

The most viable opportunities identified in the bubble chart were compiled and organized to formulate our primary recommendations for the plan. Opportunities that presented a positive (> $0) net present value were selected as primary recommendations.

Promising opportunities that either 1) did not lend themselves to straightforward, dependable quantitative analysis or, 2) did not require further analysis to verify their merit are listed in Table 7.

Table 7. Energy saving opportunities

Category		Opportunity
Short-term, Low-cost	Fleets	Join Evergreen Fleets
	Fleets	Install better systems for tracking mileage, fuel use, and costs
	Fleets	Introduce minimum fuel efficiency standards for new fleet vehicles and require consideration of fuel efficiency in evaluating new fleet vehicle purchases.
	Fleets	Employ a 'right vehicle, right job' approach to fleet management
	Fleets	Annually publish and distribute actual vs. expected fuel efficiency for each vehicle
	Fleets	Designate a high efficiency "community vehicle" for staff to use when storage space is not required
	Fleets	Formally incorporate fuel-efficient driving practices into on-boarding and employee training protocols
	Fleets	Introduce minimum fuel efficiency standards for new fleet vehicles and require consideration of fuel efficiency in evaluating new fleet vehicle purchases.
	Facilities	Enforce use of pool cover at Yost Pool
	Facilities	Door weather stripping on entry doors of Public Safety
	Facilities	Upgrade incandescent lighting to LED bulbs/fixtures in the courtroom (Public Safety building)
Further Analysis Needed	Equipment	Consider cooler temperature asphalt mixes
	Facilities	Boiler system update/upgrade in Parks Maintenance Building
	Facilities	Consider propane- or electric-powered leaf blowers and weed eaters
	Facilities	Investigate solar or geothermal water heating component when planning for Yost Pool boiler replacement
	Wastewater	Recover energy from incinerated bio-solids at treatment plant
Overall City Practices		Install and formalize systems to track, assess, and communicate energy use across departments and sources on a quarterly or semi-annual basis
		Provide formal incentives or implement a challenge for employees to reduce their energy use (e.g., improving a vehicles' fuel efficiency against a historical baseline)
		Incorporate daily best practices for conserving energy into on-boarding and annual staff training protocols
		Convene an annual training and brainstorming session with City staff to review best practices, discuss the newest relevant technologies, and share ideas
		Sustainable, dependable energy funding strategies (e.g., revolving energy fund)
		Energy considerations into standard City operations language

IV. Recommendend Next Steps & Future Opportunities

This Energy Plan serves as an important step toward a cleaner and more energy efficient City of Edmonds. The cost savings presented in this plan could help save taxpayer dollars now and also help the City hedge against future energy cost risks related to uncertainties in electricity, natural gas, and petroleum prices.

Although the recommendations in this plan have been vetted and assessed carefully, we recommend that the City consider incorporating uncertainty and risk analysis in its assessment of significant energy-related investments. Investments that might initially appear marginal based on simple payback calculations may actually be considerably more attractive and justifiable when examine under the lens of future energy cost risk avoidance. Such analyses could tip the scales and help inform better long-term financial decisions for both the City and its residents.

Clearly, some of the opportunities considered in this Energy Plan did not prove financially viable. Opportunities, such as installing solar panels on the City Hall, did not meet the financial criteria we used to judge feasibility. However, solar energy systems should not be completely discounted by the City. Although conventional photovoltaic roof-mounted solar systems do not meet the payback and return on investment criteria at this time, new financial incentives and technology advances (e.g., thin film technologies) may make this option more attractive in the coming years. We recommend that the City of Edmonds continue to refine and redevelop its energy strategies on a recurring basis to account for such changes in the energy landscape; Edmonds is well positioned to maintain its status as a regional leader and forward thinker in energy efficiency and creative energy solutions.

V. Acknowledgements

We would like to extend our personal gratitude to Mayor Mike Cooper, Director of Public Works Phil Williams, Facilities Manager Jim Stevens, and Recycling Coordinator Steve Fischer for the opportunity to conduct this work. We would also like to thank the many City staff members who devoted invaluable time and insight to inform this work.

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