


City of Edmonds

Energy Plan

Appendices

Prepared by Cascadia Consulting Group

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CITY OF EDMONDS Inc. 1890

Appendix A. Ranking Tables

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Facilities	**Add additional occupancy/vacancy sensors in Public Safety building**	Recommended from the facility audit.	Considering that Public Safety is open 24/7 and a high energy user, this could be a good option.	$7,600	$45,000	$18,078	Low
Facilities	**Occupancy and lighting controls in City Hall**	Recommended from facility audit.	Occupancy/vacancy sensors in conference rooms, kitchens, break rooms, and restrooms.	$3,800	$1,567	$9,613	Low
Facilities	**Occupancy and lighting controls in Public Works**	Recommended from facility audit.	Consider occupancy/vacancy sensors in conference rooms, kitchens, break rooms, restrooms, and locker rooms.	$2,400	$15,000	$6,159	Low
Wastewater	**Investigate the feasibility of wastewater plant methane as an alternative fuel for CHP or vehicle use under future, higher wastewater input scenario**	Currently, the WWTP treats an average 5 mgd. However, the WTTP is an 11.8 mgd rated facility. As input increases with population growth and perhaps additional contracts, Edmonds could produce ~3,000 kWh per day with a microturbine/digester system.	An article published in the journal "Sustainability" found that wastewater treatment plants with treatment capacities more than 5 million gallons per day produce enough biogas to make electricity generation feasible and cost-effective (Stillwell et al. 2010). Research from the Electric Power Institute (EPRI) shows that anaerobic digestion with biogas utilization can produce about 350 kWh of electricity for each million gallons of wastewater treated at the plant. This would be equivalent to $51,000 in electricity produced per year. Primary limitation here would be the size of the WWTP - 5 mgd is just at the cutoff point for being cost effective. A cogeneration system in Olympia's wastewater treatment plant uses methane gas from the sewage to fuel the system, which is expected to save $228,000 a year in utility costs (http://www.prnewswire.com/news-releases/waste-not-new-cogeneration-system-enables-wastewater-treatment-plant-to-use-treatment-byproducts-as-fuel-92663074.html). In the town of Essex Junction, VT, two methane-powered 30 kW microturbines were installed to generate electricity and heat for their wastewater treatment plant. Although a 2 MGD plant, the system was cost-effective within 7 years.	$1,000,000	$1,861,500	-$205,156	Medium-High
Facilities	**De-lamp or change bulb type of exterior lighting on SE corner of Public Safety building**	Recommended from the facility audit.	Because the Public Safety building is one of the highest energy users and is open 24/7, this could result in significant savings. One fixture type that may work for the exterior of the building is the LED Shoebox, with 4320 lumens.	$5,400	$14,700	$1,816	Low

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Facilities	**Enforce use of pool cover**	The Yost Pool is the second-highest user of natural gas in the city - consuming $14,000 in natural gas a year. Insulated pool covers save 40 to 50% of pool heating costs. Although Edmonds already has a pool cover, it has been noted that the cover is not consistently used. Use of this cover should be enforced with an official system of enforcement.	This analysis assumed that 30% of the total Yost Pool costs were for heating the pool, and that use of the blanket would increase by 30% (source: http://www.fillionassociates.com/products_-_pool_cover_systems.htm)	$500	$2,520	$1,512	Low
Facilities	**Reduce outer 5 garage parking lights by 6 hrs a day at City Hall**	Recommended from facility audit.	Move photo sensors in garage to take advantage of the daylight better. There are currently two rows of lighting in the underground garage along the row closest to the open side of the building that could be turned off during the day while the back row would illuminate the areas that need lighting the most. There is a possible 1095KWh savings per year by reducing the five outer lights' use by six hours per day.	$170	$1,150	$486	Low
Outdoor Lighting	**Work with PUD to continue converting streetlights to LED and negotiate lower rates**	Early in 2011, SnoPUD did a pilot study in Emerald Hills in which they exchanged 21 incandescent streetlights to LEDs. The conversion was very highly praised by the public. Currently, they have high pressure sodium lights. One limitation to this opportunity is that PUD would have to go out and replace the heads, it cannot be done in-house. This would require convincing PUD that they should be changed out. Secondly, Edmonds currently pays a flat per-head fee for the lighting. To truly realize the savings associated with this opportunity, PUD would have to lower its rates to reflect the lower energy use.	Has also been done in Palo Alto (http://www.paloaltoonline.com/news/show_story.php?id=19105). Also in LA. Most projects have been conducted with federal stimulus funding. Would likely need to find grant funding for this.	$1,052,057	$3,304,000	$198,150	Medium
Outdoor Lighting	**Continue choosing solar for new school zone signals.**	Currently, one school zone light is solar-powered, and they've had a positive experience. Tod (streets manager) was very keen on continuing to convert traffic signs to solar.	Currently, pay about $2,000 on school zone lighting a year (in 2010) for 10 lights ($200/light). Installing a solar flashing school zone light costs about $4,000 per light (http://www.cityofbryan.net/PR20070906.asp). The city of Carrollton, Texas installed 30 PV-powered school zone flashing lights for 15 schools. Installation of a grid-connected safetu light (including the wire, pole, controls, sign, and flashers, and underground trenching) costs $7,000. The city also pays a $50/site fee for yearly preventative maintenance. (source: http://cru.cahe.wsu.edu/CEPublications/eb1832/eb1832OP.html)	-$4,000	$10,000	$23,000	Low

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Outdoor Lighting	**Continue converting all signal lights to LED**	32 incandescent lights still remain.	This represents the "low hanging fruit," where the remaining signal lights remain to be converted because of some obstacle or introduced difficulty in doing so. Nonetheless, conversion of these lights should be pursued. LED traffic signals use 6-25 watts in typical operating conditions, while incandescent signals use 70 to 150 watts. The improvement in energy efficiency makes LED traffic signals 80 to 90% more energy efficient than incandescent signals.	$60,000	$74,000	-$10,000	Low
Outdoor Lighting	**Work with PUD to negotiate lower rates for LED street lights**		Progress Energy Carolina, Raleigh's electricity utility, just introduced two new options for reduced rates on LED street lights: 1) a bundled all-in-one utility-owned rate where the municipality pays a monthly fee, like before, that has both a fixed and variable component. As the price of LED fixtures decrease, Progress Energy Carolinas can adjust its pricing accordingly (hence the variable part) without having to seek commission approval for the rate change. The second option allows the city to purchase LED streetlights from the manufacturer. Cities can use stimulus funds, grants, or low-interest loans to purchase the fixtures and their monthly rate to cover installation, electricity used, and maintenance will be roughly half of the cost of the first option (source: http://www.ledcityblog.com/2010/03/04/utilities%E2%80%99-love-hate-relationship-with-led-street-lighting/). The Clinton Climate Initiative (CCI) has developed a spreadsheet model to assist municipalities with determining which option is best for them and provide an idea of the paybacks offered by a switch to LED (under Progress Energy Carolinas rate structure). The CCI did an excellent case study on LA's streetlight conversion - we'll use this data for our financial analysis. LA's project was financed through a rebate provided by the LA Department of Water and Power and a 7-year $40 million loan at a 5.25% interest rate - repaid through energy and maintenance savings. Anchorage, Alaska also conducted a retrofit project that installed 4,650 lights and saw a 45-58% drop in energy use. At a $0.12/kWh electricity price, the city anticipates a 6.5 year payback period.	$1,000,000	$3,000,000	$1,000,000	Medium
Facilities	**Boiler system update in Parks Maintenance Building**	Jim noted that the boiler system is inefficient and has problems. It's a gas-fired boiler. Jim noted it as the top energy using piece of equipment under his supervision. Natural gas costs for this building are moderate, about $3,000 a year - small compared to the big natural gas users ($21,000 for Francis Anderson Center and $14,000 for Yost Pool).	US DOE estimates lifetime energy cost savings of $16 to $40 k. City Park Building only composes small proportion of total facility energy use, however (3%).	$7,000	$12,650	-$1,599	Low

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Fleets	**Join Evergreen Fleets**	Evergreen Fleets is a regional organization that can help leverage resources, exchange ideas, and gain regional recognition	Members include City of Seattle, Snohomish County, King County, City of Mercer Island, Bellevue, Issaquah, Des Moines, Kirkland, Lakewood, Lynnwood, and Bothell.	$5,000	$286,250	$121,159	Medium-Low
Facilities	**Public Safety Roof Top Solar - 10kW**	Recommended from the facility audit. Had highest NPV of all the other solar options considered (Public Works, Public Safety, and City Hall)	Consider solar for the roof as it would be a good candidate due to location and lack of obstructions from the sun.	$38,700	$38,800	-$29,207	Medium-High
Fleets	**Install an idling power management device in police fleet vehicles**	EnergyExtreme makes an idling management system that has been installed in may city fleets.	Dallas Police Department estimated they would save $11.86 a day and $3,131 a year per police vehicle. Costs about $5,000 per vehicle.	$25,000	$150,000	$96,000	Medium-Low
Fleets	**Install better systems for tracking mileage, fuel use, and costs**	Currently, the systems for tracking fuel use and costs are limited. Mileage estimates for 2010 were unreliable and so not included in this inventory.	An automated fuel fleet management system incorporates both hardware and software to track, monitor, and manage fuel inventory, fuel dispensing, and accounting and billing processes. Such advanced systems can also transmit vehicle driving data via radio frequency. This system could or could not include a GPS tracking system - the analysis for a GPS tracking system is included in another opportunity assessment. Assuming an 8% energy cost savings with better fleet management systems. Assetworks' FleetFocus offers maintenance, operating expenses, vehicle equipment usage, and integration of an automated fuel managements system in their fleet management software. It also can be integrated with Network fleet's GPS technology and NAPA's Integrated Business Solutions. Used in the City of Redmond.	$50,000	$171,750	$48,006	Low
Facilities	**Public Works Roof Top Solar - 10 kW**	Recommended from facility audit.	Although it does have some obstructions to the west, there may be benefits from the time it does have sun coverage. There are other roof locations on this site that would be additional candidates for solar that have fewer obstructions and would offset the main buildings limitations, including the maintenance shop, large truck carport and smaller truck carport.	$38,700	$38,800	-$29,207	Medium-High
Fleets	**Introduce hybrid police vehicles**	Currently, no hybrid police vehicles in the fleet.	It cost New Jersey $1,500 more for a hybrid than a Crown Vic. Hybrid Escapes average 17-22 mpg and 6-11 mpg. Mercer Island's hybrid cost $36,000, $13,000 more than a standard patrol car. Estimate on a per-vehicle basis. Police vehicles account for large proportion (40%) of total fleet fuel costs. Capital costs are about $5,000 per vehicle. Estimated cost parameters are based on converted 3 Crown Vics to Ford Escape hybrids.	$39,000	$32,000	-$11,565	Medium-Low

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Fleets	**Introduce a GPS Fleet Tracking System**	Currently, one GPS tracking system has been installed in Edmonds (on the water shutoff truck) to track idling and optimize routing. GPS tracking systems can prevent excessive idling, speeding, and personal vehicle use. Can also monitor, record, and distribute vehicle idling time statistics each month to Will and help build awareness, which helps change driving behavior.	According to FieldLogix (a GPS Fleet Management company), tracking fleet vehicles with GPS helps the average fleet reduce fuel costs by 13%, equivalent to $29,000 a year (likely an exaggeration, as this statistic is likely based on delivery-based companies). The City of Eau Claire, Wisconsin installed GPS tracking devices in its vehicle fleet, and expects the ROI for the system to be two years via fuel savings and improved routing (http://www.government-fleet.com/News/Story/2011/10/City-of-Eau-Claire-Installing-GPS-Tracking-Devices-in-Fleet.aspx). In 2011, the City of Fayetteville, NC installed Mentor BBX in their 218-vehicle fleet. Huntsville, TX estimated to save nearly $20,000 a year by installing GPS systems in its 400-vehicle fleet.	$100,000	$173,350	$16,319	Medium-Low
Fleets	**Introduce minimum fuel efficiency standards for new fleet vehicles and require consideration of fuel efficiency in evaluating new fleet vehicle purchases.**	Currently, there are no explicit fuel efficiency goals or standards for Edmonds' fleet vehicles. Expressing a clear goal or standard can ensure that the most fuel-efficient vehicle is purchased when possible.	It was noted in the interviews that many staff members are assigned larger and more fuel-inefficient vehicles than are needed for their day-to-day use. Passenger cars get approximately 8 additional miles per gallon than light trucks. If Edmonds switched 25% of its current 1/2 ton pickups to sedans, it could save $2,000 a year on fuel costs. Replacing vehicles that are at the end of their lives anyway will avoid any additional capital costs.	$0	$20,000	$16,000	Low
Fleets	**Pilot natural gas-powered vehicle conversion for a subset of Crown Victorias**	Crown Victorias use more fuel than any other vehicle type in the Edmonds fleet. Alliance AutoGas has developed a Police Interceptor that converts vehicles to run on propane. The vehicle conversion system is EPA-certified for a broad range of makes and models, include the Ford Crown Victoria, Lincoln Mercury Town Car and Grand Marquis, Chevrolet Silverado, and GMC Sierra. Propane has the advantage of costing significantly less than gasoline and diesel per gallon, requires less maintenance, and contributes toward reducing our country's dependence on foreign oil. (http://www.worldlpgas.com/gain/autogas-is-best/propane-autogas-police-interceptor-cleans-up-more-than-streets/_	Conversion comes to around $5,000 a car (http://springfield.kval.com/news/news/250697-springfield-tests-propane-police-car). Has been tested and employed in Springfield, Knightdale, NC, Kingsport, TN, and Raleigh, NC. Would have to create a propane station for fueling. Knightdale received federal stimulus funding (http://www2.nbc17.com/news/2011/jul/11/knightdale-police-cars-switching-propane-ar-1198492/). Virginia has "Clean Cities Propane Autogas Corridor Project" that funds conversion of police vehicles to accept propane. Mostly still in pilot stages. Raleigh introduced 10 patrol cars that can switch between propane and gasoline - was funded by federal stimulus dollars. Also better for air quality. Propane costs approx. 30% less than unleaded regular gasoline. To convert 5 vehicles with 3-year lifespans, capital costs of $29k and $7.5k savings each year. NPV of -$9k.	$29,000	$22,500	-$9,672	Medium

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Fleets	**Formally incorporate fuel-efficient driving practices into on-boarding and employee training protocols**	Current hiring and training programs do not provide overview of City idling policies, appropriate fuel use for vehicles, or the importance of monitoring mileage.	A straightforward and inexpensive addition to the City's training policies that can raise awareness of the City's fuel usage, energy goals, and vehicle use protocols. The City of Edmondton recently launched a new driver training program called Fuel $ense, which teaches fuel-efficient and safe driving techniques to drivers through a 2-4 hr on-road course. In the first year, the 2,500-vehicle city fleet saved $205,000 in fuel costs. (http://fleetsmart.nrcan.gc.ca/index.cfm?fuseaction=docs.view&id=municipal-edmonton)				Low
Fleets	**Consider propane- or electric-powered leaf blowers and weed eaters**	A possible fuel switch for parks maintenance.	These compose a small proportion of total fuel costs per year, the technology isn't there yet, and there is little track record of success elsewhere.				High
Facilities	**Install weather stripping on entry doors of Public Safety**	Suggested from facility audit.	Public Safety building is one of the highest energy users, so this could have a bigger impact than for other facilities. Was the first recommendation from the audit, so likely a good candidate for this building.				Low
Fleets	**Investigate feasibility of a car-share program**	Car share programs, such as City CarShare in Berkeley and San Francisco, allow a portion of the City fleet to be replaced with Carshare vehicles that are shared with members of the community.	The City of Berkeley replaced 16 of its old fleet cars with 4 shared hybrids.				Medium-High
Fleets	**Designated a high efficiency "community vehicle" for staff to use when storage space is not required**	This would contribute to the "right vehicle, right job" approach and allow staff to use smaller vehicles when larger ones aren't needed.					Medium
Facilities	**Consider upgrading incandescent lighting in the courtroom to LED bulbs/fixtures (Public Safety building)**	Recommended from the facility audit.	A straightforward upgrade with minimal capital costs.				Low

Category	Opportunity	Detail	Notes	Capital Cost Estimate	Lifetime Savings Estimate	NPV	Risk
Fleets	**Employ a 'right vehicle, right job' approach to fleet management**	One fuel savings strategy is the match each employee's job to the smallest possible vehicle for that job. For example, if an SUV is necessary for a particular job, a midsize SUV that gets 24 mpg might be a more appropriate choice than a full size SUV which runs at 15 mpg. (http://www.epa.gov/region9/climatechange/transportation/efficiency.html)		$1,000			Low
Facilities	**Investigate in a solar or geothermal water heating component when planning for Yost Pool boiler replacement**	Jim noted that the boiler used to heat the pool is energy-intensive. He also noted that it's "down in a hole and surrounded by a bunch of trees," so perhaps not a great solar opportunity.	Dan recommended that this application presented a relatively safe solar investment. Should follow up with him on what these parameters might be.				Medium-High
Fleets	**Annually publish and distribute actual vs. expected fuel efficiency for each vehicle**	Will help target maintenance and operation adjustments	A straightforward way to track and monitor fleet efficiency, driving practices, and need for operation adjustments. Will also raise awareness of driving practices and provide benchmarks for tracking progress and setting goals. Will require better infrastructure for monitoring fuel efficiency, so capital costs are set to medium. In Edmonton, all city departments receive a quarterly report that details the fuel consumption of each vehicle. The report also indicated fuel consumption for the same quarter in the previous year, which allows drivers and departments to compare their performance under similar weather conditions. Averages for the entire city fleet are also provided. (http://fleetsmart.nrcan.gc.ca/index.cfm?fuseaction=docs.view&id=municipal-edmonton)				Low
Wastewater Treatment Facility	**Recover energy from incinerated biosolids**	Currently, biosolids are incinerated and the ash is hauled out as a byproduct. According to Stillwell et al. 2010, using either multiple heat or fluidized bed furnaces, biosolids incineration can be used to power a steam cycle power plant, where heat from incineration is transferred to steam that turns a turbine connected to a generator, producing electricity. Reliable electricity generation that does not depend heavily on auxiliary fuels requires large amounts of biosolids, making incineration suitable for medium to large wastewater treatment plants.	The Hartford Water Pollution Control Facility in Hartford, CT, is incorporating an energy recovery facility into furnace upgrade projects and anticipates that biosolids incineration will generate 40% of the plant's annual electricity consumption (Stillwell et al. 2010).				Medium

Appendix B. Background Calculations

Assumptions and Calculations Used for Opportunity Savings

Assumed discount rate:	0.08
Calculator for fleet savings:	www.afdc.energy.gov/afdc/prep/index.php

Outdoor Lighting

Continue converting all signal lights to LED		Expected to reduce energy use by 90% (Source: Boulder 2008 Sustainable Energy Report)
	$3,695	If all converted to LED, current traffic, flashers, and fire signals would accrue this many cost savings annually (60% of current costs)
	$60,000	Capital costs to convert 20 signals to LED (at $3k per light - source: http://erc.sedacog.org/EnergyConservation/LocalGovernment/LEDTrafficSignalProject/tabid/81/Default.aspx)
	$73,900	Lifetime energy savings estimate (20 year life)
	-$23,721.95	NPV (20 year life)

***Idleright* fuel management system**	*IdleRight* Fuel Management System		http://www.swps.com/idleright.html http://www.hendonpub.com/resources/articlearchive/details.aspx?ID=207673
	$400/vehicle		
	50%	of previous fuel use when idling	
	16	gallons/day	1,984,000
	Assumes 2 hours of idling a day per vehicle		
	Also reduces wear on the vehicle!		
	$21.39	/MMBTU - Average cost of fuel per MMBTU	
	From Dallas Police Estimates:		
To convert five Crown Vics:	$5,000	Capital Cost per vehicle	
	$3,000	Annual cost savings per vehicle	
	$25,000.00	Total Capital Costs for five vehicles	
	$150,000.00	Lifetime cost savings for five vehicles	
	$75,651	NPV	

Fleets	**NYC/New Jersey information**		http://webapps.icma.org/pm/9006/public/feature1.cfm?author=robert%20s.%20hoffmann&title=hybrid%20police%20patrol%20vehicles%20praised
Introduce hybrid police vehicles	20	Crown Victoria average gallons used per 12 hour shift	
	6	Ford Escape Hybrid average gallons used per 12 hours shift	
	70%	reduction in fuel consumption	
	711	Estimated Annual MMBTU used by 3 crown vics (average of all crown vics for 2010 times 3)	
	497.7	Annual Energy Savings from Converting to hybrids	
	$10,645.80	Annual Cost Savings	
	$31,937	Lifetime Cost Savings (assumes 3-year lifetime per vehicle)	
	$39,000.00	Capital Costs	
	-$11,564	NPV (10 year lifetime)	
Wastewater Treatment Facility	6,104	Energy Recovery from Biosolids Incineration (kWh/day)	
Recover energy from biosolids	2.23E+06	kWh/year	
	7,602	MMBTU/year	
	$ 169,375	Cost Savings	
	7	Wastewater flow rate (mgd)	
	800	Wastewater dry solids content	
	11500	Biosolids Heating Value	
	10550	Steam electric heat rate	
	$22.28	/MMBTU	
Solar in Public Safety facility	$776	**Total Estimated Annual Energy Cost Savings**	
10 KW	$38,700	**Total Estimated Installed Cost**	
	50	**Estimated Lifetime**	
	$38,800	**Lifetime Energy Cost Savings**	
	-$29,207	**NPV**	

Passenger vs. Light Truck Staff Vehicles source:http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html		
MPG New Passenger Car	33.7	
MGP New Light Truck	25.1	
Passenger cars are If Edmonds switch 1/4 of its 1/2 ton pickups to sedans, would save $2,000 a year in fuel costs	26%	more fuel efficient that light trucks
	$13,420.16	Net Present value over 10 year period:

Methane Recovery from WWTP

Electricity for the WWTP costs $0.08/kWh

Edmonds is average about 2,500,000 kWh a year used at the WWTP

The plant usually processes 5 million gallons of wastewater a day

Estimated capital costs: $1,000,000

Based on 350 kWh per million gallons wastewater processed (source: Electric Power Institute (EPRI)):

766,500	**Energy production a year (kWh) - for 6 mgd**
$61,320	**Cost Savings from Energy production a year**
31%	**Proportion of total WWTP energy use that could be produced on-site**
-$345,423	**NPV for 25 year lifetime**

Based on 3,000 kWh per day (EPA - based on 6.8 MGD):

1,095,000	Energy production a year (kWh)
$87,600	**Cost Savings from Energy production a year**
44%	**Proportion of total WWTP energy use that could be produced on-site**
-$64,890	**NPV for 25 year lifetime**

Average of both approaches:

930,750	**Energy production a year (kWh) - for 6 mgd**
$74,460	**Cost Savings from Energy production a year**

37%	**Proportion of total WWTP energy use that could be produced on-site**	
-$205,156.16	**NPV for 25 year lifetime**	
$1,861,500	**Lifetime Energy Savings (25 yrs)**	

GPS Fleet Tracking System Background Info:		
	Reduces fleet fuel costs by 13%.	
$229,000	Current total fuel costs:	
13%	Estimated reduction in fuel costs by using GPS tracking systems	source: FieldLogix
400	Number of vehicles in Huntsville ,TX fleet	
$20,000	Expected annual savings with Huntsville ,TX fleet	
$50	Average savings per vehicle	
	Edmonds:	
98	Number of vehicles in Edmonds fleet	
$4,900	Min: Total Savings for all vehicles	
$29,770	Max: Cost reduction based on 13% savings	source: City of Sacramento (http://www.fieldtechnologies.com/city-of-sacramento-cuts-60000-per-month-in-gas-costs-with-gps-fleet-management-system/)
$100,000	Estimated capital cost	
$49,000	Min: 10-year lifetime cost savings	
$297,700	Max: 10-year lifetime cost savings	
($67,120.60)	Min NPV	
$99,759.12	Max NPV	
$16,319	Average NPV	

Conversion to Propane Police Vehicles		
30% less	**Cost savings for converting to propane:**	http://www.force911.com/propanefaqs.html
$5,000	**Average Edmonds Crown Vic Annual Fuel Costs:**	
$1,500	Average Cost Savings for Average Crown Vic:	
$29,000	**Capital costs for converting 5 vehicles:**	
$7,500	**Annual cost savings for converting 5 vehicles:**	
$19,328	**Present Value Savings over 3 years (assumed vehicle lifetime)**	

-$9,672	**Net Present Value Investment:**

Solar School Zone Lighting

per light:

$4,000	**Capital costs to install**
$194	**Average electricity costs per light (each year)**
$7,000	**Avoided installation costs per light**
-$3,000	**Net capital costs to install a new solar vs. grid-connected school zone light**
$1,937	**Total lifetime (10 year) energy cost savings for installing one new solar vs. grid-connected safety light**
$4,300	**NPV investment (per light)**

for five lights (estimated for new lights over next 10 years)

($15,000)	**Net capital costs to install 5 new solar vs. grid-connected school zone light**
$9,685	**Total lifetime energy cost savings**
$21,499	**NPV investment (for 5 lights)**

LED Streetlighting Retrofit

assuming a 4-year endeavor

From LA Pilot Project:

140,000	**Number of street lights being replaced**
$57,000,000	**Total projected project cost**
$10,000,000	**Annual energy and maintenance cost savings**
$407	**Average cost per light**
$71	**Average annual cost savings per light**
59%	**Percent energy savings in retrofitted fixtures**

For Edmonds:

25	**years - estimated lifetime of project**		
2,584	**Number of street lights being replaced**		
$224,000	**2010 Municipal Street lighting bill**		
$1,052,057.14	**Total projected project cost**		
$132,160	**Estimated annual cost savings**	$263,014	**Year 1 project cost**
$0	**Year 1 energy cost savings**	$263,014	**Year 2 project cost**
$33,040	**Year 2 energy cost savings**	$263,014	**Year 3 project cost**

	$66,080	**Year 3 energy cost savings**	$263,014	**Year 4 project cost**
	$99,120	**Year 4 energy cost savings**		
	$3,304,000	**Lifetime cost savings**		
	$198,150.32	**NPV**		
Boiler System Update in Parks Maintenance				
	$2,300	**Current Annual Natural Gas Costs in Parks Maintenance building**		
	$22	**Average Annual Estimated Savings for every $100 of fuel costs (Source: EPA - http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12530)**		
	$506	**Total Estimated Annual Savings for More Efficient Boiler**		
	$12,650	**Lifetime Savings for 25-year boiler**		
	$7,000	**Estimated Capital Costs (source: http://wiki.answers.com/Q/How_much_does_it_cost_to_replace_a_heating_system)**		
	4800	**City Parks Maintenance Square Footage**		
	-$1,599	**NPV**		
Enforce use of pool cover	$14,000	**Current annual natural gas costs at Yost Pool**		
	$4,200	**Approximate proportion towards heating the pool**		
	0.12	**Proportion cost savings from using the blanket 30% more (with 40% cost savings from use)**		
	$504	**Estimated annual cost savings**		
	$2,520	**5 year lifetime savings**		
	$500	**Capital costs (minimal because only a change in enforcement policy - already have the cover)**		
	$1,512	**NPV**		
New Fleet Management System				
	$50,000	**Capital Costs**	source: http://www.government-fleet.com/Article/Story/2011/09/Fleet-and-Fuel-Management-Systems.aspx	
	5%	**Estimated savings**		
	$229,000	**Current fleet fuel costs**		
	$11,450	**Estimated total annual cost savings**		

	$171,750	**Estimated lifetime annual cost savings (15-years)**
	$48,006	**NPV**
Occupancy and Lighting Controls in City Hall	$3,800	**Total Estimated Installed Cost**
	$1,567	**Total Estimated Annual Energy Cost Savings**
	15	**Lifetime**
	$9,613	**NPV**
	$23,505	**Lifetime Savings**
Reduce Outer 5 Garage parking lights by 6 hrs a day	$170	**Total Estimated Installed Cost**
	$77	**Total Estimated Annual Energy Cost Savings**
	15	**Lifetime**
	$486	**NPV**
	$1,150	**Lifetime Savings**
De-lamp or change bulb type of exterior lighting on SE corner of Public Safety building	$735	**Total Estimated Annual Energy Cost Savings**
	$5,400	**Total Estimated Installed Cost**
	20	**Estimated Lifetime**
	$14,700	**Lifetime Energy Cost Savings**
	$1,816	**NPV**
Add additional occupancy/vacancy sensors in Public Safety building	$3,000	**Total Estimated Annual Energy Cost Savings**
	$7,600	**Total Estimated Installed Cost**
	15	**Estimated Lifetime**
	$45,000	**Lifetime Energy Cost Savings**
	$18,078	**NPV**

Solar in Public Works facility	$776	**Total Estimated Annual Energy Cost Savings**
10 KW	$38,700	**Total Estimated Installed Cost**
	50	**Estimated Lifetime**
	$38,800	**Lifetime Energy Cost Savings**
	-$29,207	**NPV**

Add additional occupancy/vacancy sensors in Public Works building	$1,000	**Total Estimated Annual Energy Cost Savings**
	$2,400	**Total Estimated Installed Cost**
	15	**Estimated Lifetime**
	$15,000	**Lifetime Energy Cost Savings**
	$6,159	**NPV**

Appendix C. Facility Audit Reports

City of Edmonds Commercial Energy Audit Report

For this project, Fluid Market Strategies performed three Energy Assessments on buildings for the City of Edmonds.

Three buildings were identified by Cascadia Consulting Group and Fluid Market Strategies as contenders for energy assessments: City Hall, Public Works and Public Safety. The degree of complexity for these assessments was determined based on Scope of Work, building conditions and priorities identified by the City of Edmonds.

Approach and Methodology
The approach for this project began with the collection of data on the buildings in question. The following data was reviewed for each building:

- Review of public documents available for each building
- Review of Energy Audits performed in 2005
- ENERGY STAR Portfolio Manager benchmarks
- Plan reviews

All three buildings had the collected data confirmed through the following processes:

- Interviews with Jim Stevens, Facilities Manager from the City of Edmonds
- Physical assessments of the buildings and components
- Bill analysis

Analysis of the buildings consisted of:

- Experienced peer discussion
- Historical evidence of energy saving measures
- Simple solar calculator with feedback from local experts
- Computer Energy Modeling of the City Hall building

Based on the above criteria, it was determined the building with the largest potential for improvement, and thus requiring the greatest degree of inspection, analysis and reporting, was the City Hall building.

The final report consists of:

- Project Overview
- Individual building assessment reports
- Conclusions and Recommendations, including:
    - Capital Investment Analysis (full detail for City Hall, solar only for remaining buildings)
    - Minor Investments
    - Behavior

Computer Energy Modeling
As part of this detailed analysis, the City Hall building was modeled in TREAT energy modeling software to assess the effects of a variety of energy efficiency retrofit measures. TREAT is a powerful energy simulation tool tailored for use on large commercial and multifamily buildings and allows for the model's projected energy use to be calibrated based on data from actual utility bills. When compared with weather information, monthly bill data allows us to accurately determine how much of the energy was used by the building's HVAC systems and how much was used for other purposes, providing crucial insight as to how the building is used. Using this insight to inform the model's projections, we can more accurately predict which measures will be most cost-effective to implement and yield the greatest return on investment.

Solar Recommendations

When considering solar for a particular location, many separate items must be considered. The first step is to determine solar radiance (insolation), or the amount of solar energy received on a specific surface area in a given time, commonly expressed in kilowatt-hours per square meter per day (kWh/sq m/day). This measurement varies based on the weather and latitude of the given location. Typically, a system is recommended based on the amount of energy offset the site is capable of producing. This amount is determined by taking the average daily energy usage and dividing it by the solar radiance times 80% (used to adjust for the inherent inefficiencies in solar power systems such as inefficiency due to soiling, utility and module inefficiencies). Roof size is another important consideration; more roof area will allow a larger offset of energy savings. The approximate roof size needed to accommodate a solar power system can be determined by dividing the size of the system by 10 to determine the square footage (watts/sq ft).

Recommendations for the Edmonds City Hall, Public Safety and Public Works buildings include a solar analysis provided by the "BP Solar Economic Estimator." This tool is provided by BP to give estimates of the energy savings created by installing a solar system at a given location. By inputting specific location and energy use data, the program can determine the estimated cost and energy savings as well as Federal, State and local utility incentives and rebates (when available). The use of this program is the best first step to determine size and cost effectiveness when considering using solar to increase energy efficiency of a building. Each building was evaluated with the same size system, based on the ability to maximize incentives.

Savings to Investment Ratios

In order to determine the cost effectiveness of each measure recommended, we have calculated a Savings to Investment Ratio or SIR. SIRs greater than 1.0 indicate the savings over the life of the measure outweigh the cost of the measure. Costs are based on an average "cash" market estimate of the work to be done. Financing can impact the overall SIR of installed measures as can maintenance of equipment. In this case, we used the simple SIR methodology that did not include maintenance costs and interest on the financed pieces.

In some cases, we have listed as a recommendation a measure that does not have an SIR over 1.0. We either included these recommendations as an example for comparison or because the existing equipment is nearing its expected life run. Measure lives for these calculations are based on either the Regional Technical Forum's database or on industry experts that have been interviewed.

Recommendations and Savings to Investment Ratios listed for each building are based on industry standards. For the solar recommendations, we discussed pricing and incentives with local solar installation experts prior to finalizing the recommendation tables below. This report is the result of a simplified level 2 audit. As such, annual cash flow is not calculated. This would require detailed knowledge of business practices, tax status, predicted loan rates and down payments, as well as actual bids from contracting companies.

Edmonds City Hall Audit

As a part of Cascadia Consulting Group's sustainability plan, a walk through energy assessment of the City Hall building was performed on July 20th 2011. City Hall is a three story office building that was originally used as leased tenant space. The City of Edmonds took over ownership of the building in 1992.

Information Provided by the 2005 Audit
This structure is approximately 34,000 sq. ft. and was built in 1980. The building is Concrete Masonry Unit (CMU) wall construction with 3-1/2" insulation between metal studs. The windows are double-pane. The roof was redone in 2002 as pre-cast roofing with 2"-3" of Styrofoam under a torch-down tar covering. The lighting has been retrofitted to T-8s, with the exception of some T-12 U-bends which remain. The first and second floors were remodeled in 1997, reconfiguring ductwork and adding make-up air units to serve all three floors.

From the previous audit a number of items were recommended and subsequently performed by the city:

- Replace heat pump fan coil units throughout building.
- Fix zoning problems in the Chamber of Commerce, Clerk, Utilities and Sever Room.
- Fix zoning problems on the 2nd floor offices.
- Fix zoning problems on the 3rd floor conference rooms/offices.
- Install EMS controls, start/stop fan coil units and make up air units and add 10 temp sensors.
- Install emergency generator.

All of these measures were completed with the exception of the generator.

Our assessment process began with data collection of plans, previous retrofit and audit reports and bills. We then confirmed the data to the best of our ability through in-field confirmation and interviews. To determine the next steps, Fluid staff met with Jim Stevens on Wednesday July 20th 2011 to start the audit. We began at his office looking at plans for each building to get an idea of the lighting fixture count from plan review. Beginning with the City Hall building, we performed a walk through to confirm that the counts were accurate. We also reviewed HVAC controls and air handlers and checked internal temperature and humidity (72 degrees and 45% humidity overall) during the walk through of all three floors and the basement garage area.

Overall, the building has had a number of upgrades, both unique and as recommended by the 2005 audit, as well as areas that would benefit from improvement:

- The lighting has all been upgraded to T8s.
- One conference room on the third floor had an occupancy sensor installed.
- The heating controls were all older Honeywell models with lever control for settings.
- Thermostats are located in offices and open common areas but control temperatures in other rooms. Comfort issues have been reported because of the poorly placed thermostats—an issue that could be addressed with digital programmable thermostats.
- The audit from 2005 indicated the city was replacing the condenser units on the roof of this building; however, while examining the roof we were told most units were 20 years old and only two appeared to be newer. One condenser unit was not working at all.
- The interior uses zoned heat controls with separate air handlers located throughout each floor.
- The server room is conditioned with a continuously-run ductless heat pump. The load on this dedicated cooling system may be reduced by the addition of a fresh air intake for this room.
- The water heating for the building is served by one 50 gallon domestic hot water tank that has been put on a timer already.
- All of the windows in the building are double pane aluminum framed with some tint. They were replaced within the past 10 years.
- The roof is a torch down composition that is light gray and could possibly be considered low reflective and thus may help with the building's solar loading.
- The exterior of the building is CMU construction and is in good condition. There is one elevator that serves all three floors plus the basement parking garage.
- The elevator entrance in the garage is exposed to the exterior and could be a source of stack effect on the building.

- The garage has two rows of lighting that we were told are on a photo cell; however all of the lights were on during our visit at about 10 or 11 am.

Conclusions and Recommendations

For this project, we looked first at capital investments for the building in question and then reviewed minor investments and behavior changes.

Investments are listed below first by category and then in a data table that analyses Savings to Investment Ratio. With SIRs, we typically recommend only measures that have an SIR over 1.0. The exception to this rule would be when replacing equipment at the end of its serviceable life.

All cost projections used in calculating SIR are based on regional averages. In addition, each utility may have its own methods for calculating costs and savings associated with lighting recommendations.

Capital Investments:

- Replace heat pump condenser units on the roof that are nearing their end of useful life to more efficient units (commissioning could be acceptable on units in good working order). It is always recommended to choose units with a high SEER rating.
- Enclose the elevator access in the garage area to eliminate stack effect through the elevator shaft by installing a vestibule around the elevator doors[1].
- Consider solar for the roof as it would be a good candidate due to location and lack of obstructions of the sun[2].
- Consider upgrading windows to ENERGY STAR qualified windows.

Minor Investments:

- Prior to adding fresh air ventilation, install a metering device on the DHP unit that conditions the server room to determine if the unit is operating in cooling mode continuously.
- Have an HVAC company perform balancing and flow measurements in offices that have closable doors separating them from the thermostats in open areas.
- Occupancy/vacancy sensors in conference rooms, kitchens, break rooms, and restrooms.
- Daylight harvesting controls in offices near the windows.
- Install smart strips.
- Set computers to sleep after 30 minutes.
- Put all applicable auxiliary equipment on timers.
- Move photo sensors in garage to take advantage of the daylight better. There are currently two rows of lighting in the underground garage along the row closest to the open side of the building that could be turned off during the day while the back row would illuminate the areas that need lighting the most. There is a possible 1095KWh savings per year by reducing the five outer lights' use by six hours per day.
- Replace or remove older refrigerators in break rooms and kitchens.
- Update the ENERGY STAR Portfolio Manager benchmark post completion of recommendations.

Occupant Behavior:

- Participate in the Snohomish PUD Energy Challenge for businesses[3].

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[1] The installation of the vestibule is an option that would also potentially improve the indoor air quality in the building. Warm air rises in buildings due to a force called "stack effect," which becomes greater as a building becomes taller. While warm air rises, the force tries to push the air out of the building. This action then pulls new air in lower in the building. When buildings are located on top of parking garages, it is possible that this new air is coming into the building directly from that parking area. Therefore, a vestibule built to be tight around the elevator in the garage could reduce this airflow into the building. There would be very little energy savings included with this measure.

[2] Information on the Edmonds Community Solar Co-op and initial data from a simple solar calculator is available at: http://solarwashington.org/announcement/edmonds-community-solar-co-op-seeks-charter-members.

[3] Information on the Energy Challenge can be found at: http://www.snopud.com/?p=1138.

City Hall Improvements					
	Total Estimated Annual Energy Cost Savings	Total Estimated Installed Cost	Estimated Life/Years	Simple Annual Payback Years	Savings to Investment Ratio[4]
City Hall Rooftop Solar - 10KW	$776.00	$38,700.00	25	49.87	0.50
Replace Rooftop Units to 9.5 hspf/14.5 SEER	$560.00	$150,000.00	20	267.86	0.07
Replace Rooftop Units to 8.0 hspf/13 SEER	$280.00	$116,996.00	20	417.84	0.05
Upgrade from 8.0 hspf to 9.5 hspf[5]	$280.00[6]	$33,004.00[7]	20	117.87	0.17
Base Load Reduction -25%[8]	$2,579.00	$6,600.00	15	2.56	5.86
Base Load Reduction -15%	$1,567.00	$3,800.00	15	2.43	6.19
Window Replacement	$216.00	$99,110.00	20	458.84	0.04
Occupancy and Lighting Controls	$1,567.00	$3,800.00	15	2.43	6.19
Replace Refrigerators	$63.00	$1,800.00	15	28.57	0.53
Reduce Outer 5 Garage parking Lights by 6 hrs a day	$76.65	$170.00	15	2.22	6.76

Incentives may be available (time limited) for up to 70% of a project through Snohomish County PUD.

[4] SIR Calculation = Life * Savings / Investment

[5] Cost difference versus savings difference of 9.5 hspf and 8.0 hspf. Due to the fact that the majority of the existing roof top units are nearing or past their useful life, the question becomes, “Does upgrading to a higher efficiency heat pump pay for itself?” While the savings to investment ratio for increasing heat pump efficiency is better than for replacing the roof top units in general, they do not pencil out as “cost effective” (an SIR over 1.0). The “heating slope” of this building (which is determined by necessary load and energy introduced) is so shallow that heating efficiency means very little in an improvement analysis. Therefore, our recommendation is to replace units with the highest SEER rating (cooling efficiency) as can be afforded.

[6] Savings difference

[7] Cost difference

[8] Base load reductions were factored at 15% and 25%. 15% included all the lighting controls; 25% included all the lighting controls in addition to smart strips, setting computers to sleep after 30 minutes and putting all applicable auxiliary equipment on timers. Expected life of 20 years.

Edmonds Public Works Audit

Information Provided by the 2005 Audit

The Public Works Operation and Maintenance Complex include a two story main building, approximately 28,000 square feet of offices and a shop, and a fleet garage building, approximately 6,000 square feet, all built in 1992. The building is steel frame construction with metal siding. The windows are double-pane. The lighting is primarily T-8s. The building is heated and cooled with a mix of systems: gas heating/ventilating units for storage areas, heat pumps for administrative areas and radiant heat and make-up air units for the shop bays. The HVAC system is controlled by an Alerton energy management system.

The Public Works Complex is served by 6 gas-fired heating/ventilating units and 2 heat pumps, which serve the office areas. The two shop bays each have a radiant heater, make-up air unit (MAU) and an exhaust fan. The MAU and exhaust fan are interlocked and, when operating in occupied mode, the outside air (OA) dampers are open to provide 100% OA. These units are equipped with gas heat that operates as needed to maintain 60°F space temperatures in the bays. The location of the outside air opening, which faces the vehicle yard, causes the air handlers to bring contaminants into the building office areas. The fleet building on the complex has five bays, which are served by three radiant heaters, a make-up air unit, and several exhaust fans. The mechanical systems in both the fleet and Public Works buildings are controlled through an older version of the Alerton direct digital control (DDC) system; the operator interface on this system is not user friendly and makes schedule and temperature adjustments difficult to accomplish.

From the previous audit a number of items were recommended:

- Commissioning to fix infiltration of auto/truck exhaust into building.
- Add door switches to bay doors; tie to HVAC control.
- Insulate or replace two bay doors.
- Commission existing HVAC systems.
- Upgrade EMS to latest software/firmware revisions.
- Add occupancy sensors in common/meeting areas; tie to EMS and HVAC control.

A walk through of this building was completed on the afternoon of July 21, 2011. All areas of this building were inspected and the work proposed in the previous audit was confirmed as having being completed through conversations with Jim Stevens, inspections and bill and plan review.

Overall, the building was found to be in very good condition with many energy efficient measures already in place:

- The HVAC system was inspected and found to be in good working order with current controls that allowed programming of the different areas.
- The lighting was all T8 with some incandescent bulbs found in janitor closets.
- Occupancy sensors have been installed in restrooms and conference rooms.
- Vending misers were found on one of two vending machines.
- LED lighting has been installed in most working exterior areas except the front parking area that has six pole lights.

Conclusions and Recommendations

In this building, the primary recommendation for improvement would be the addition of solar to the building. As indicated above, this building already has several energy efficient items in place. In addition, several locations could take advantage of occupancy sensor technology. Making use of reduced lighting in areas not in constant use is one of the most cost effective measures in any commercial setting.

Capital Investments:

- Consider solar for the roof—although it does have some obstructions to the west, there may be benefits from the time it does have sun coverage. There are other roof locations on this site that would be additional candidates for solar that have fewer obstructions and would offset the main buildings limitations, including the maintenance shop, large truck carport and smaller truck carport.

Minor Investments:

- Consider occupancy/vacancy sensors in conference rooms, kitchens, break rooms, restrooms, and locker rooms.
- Air balancing to create a positive pressure between the office area and shop bays will reduce contaminants being brought into the building.
- Door weather stripping.

Occupant Behavior:

- Participate in the Snohomish PUD Energy Challenge for businesses[9].

Public Works Improvements					
	Total Estimated Annual Energy Cost Savings	Total Estimated Installed Cost	Estimated Life/Years	Simple Annual Payback Years	Savings to Investment Ratio
Public Works Roof Top Solar - 10KW	$776.00	$38,700.00	25	49.87	0.50
Occupancy and Lighting Controls	$1,000.00	$2,400.00	15	2.40	6.25

[9] Information on the Energy Challenge can be found at: http://www.snopud.com/?p=1138.

Edmonds Public Safety Complex Audit

Information Provided by the 2005 Audit

The Public Safety Complex houses the Police Department, the Council Chambers and Court Room and the Municipal Court Offices. It covers 33,000 square feet and was completed in 2000. The building is wood frame with steel interior columns on slab-on-grade concrete. The walls are GWB and CMU constructions. The exterior of the building is wood siding with some decorative metal paneling and synthetic stucco finish. The roof is also constructed of metal panels. There are 4" to 6" of loose or batt insulation in the exterior walls, attic floor and under the roof. Drop ceiling tiles conceal the electrical and mechanical systems that are run in the space above the tiles. The final completion of the Public Safety Complex was complicated and the City has found many partially completed components; there is a question as to whether a final balancing and commissioning was completed before final building turnover.

There are four air handling units (AHU) that serve the Public Safety Complex: AHU-1 and 2 serve the Police Building and AHU-3 and 4 serve the Court Building. All four units are equipped with chilled-water coils for cooling and hot-water coils for heating. The supply and return fans in AHU-1, 2 and 3 are controlled through variable frequency drives (VFD). AHU-4 is a constant volume system. The conditioned air from AHU-1, 2 and 3 is delivered to the space through series-flow, fan-powered terminal units with electric reheat coils. The mechanical systems are controlled through an Alerton direct digital control (DDC) system. The chilled-water is produced by a 90 ton air-cooled liquid chiller, Trane model #RTAA90. This chiller also serves Fire Station #17.

The chilled water piping has displayed corrosion on the exposed piping. This may be from either condensation on the pipe or galvanic corrosion. The hot-water is produced by a Lochinvar Copper-Fin II boiler, model #CHN0750, 750,000 BTUH input, 630,000 BTUH output, with an efficiency of 84%. As noted earlier in the Building Description section, this building would benefit from a rebalancing and commissioning of the mechanical systems. The occupants complain of insufficient airflow at the ends of the air distribution systems. Also, the location of the outside air opening (near ground level facing a play field) is causing the air handlers to bring contaminants into the building and causing odor and dust problems. Additionally, there are control issues wherein simultaneous heating and cooling is taking place.

The City has worked with Reed Lyons and Aardvark Engineering Services to provide a design to move the outside air intake louvers for AHU-1 and 2 from below the street level to above the roof. Quantum will work with contractors to incorporate this design into the construction project.

From the previous audit a number of items were recommended:

- Commission existing HVAC systems; eliminate simultaneous heating/cooling, fix comfort/zoning problems, etc.
- Re-balance all units on AHU-2, commission each box and AHU.
- Solve return air issue.
- Investigate corrosion on chilled-water piping and insulate exposed fittings.
- Install occupancy sensors; tie to zone boxes and connect to EMS (later found to be an unviable option).
- Verify hot-water flow to AHUs; look at secondary loop piping and flow (later verified as adequate).
- Relocate outside air intake for air handlers, implement Aardvark Engineering Design dated 12/23/04.

A walk through of this building was performed on the afternoons of July 20th and 21st, 2011. Most areas of this building were inspected but as the complex includes the police department some areas were restricted. The work proposed in the previous audit had been confirmed as having been completed through conversations with Jim Stevens, inspections, and bill and plan review.

Overall, the building was found to be in very good condition with many with many energy efficient measures already in place:

- The HVAC system was inspected and found to be in good working order with current controls that allowed programming of the different areas.
- The lighting was all T8 with some incandescent bulbs found in the court room that was necessary to allow dimming for the use of a projector during court proceedings.
- There were occupancy sensors being used in restrooms.
- The exterior of the building has three double bulb and one single bulb large parking lights and some accent lighting. The accent lighting around the southeast corner of the building consists of eight 100w metal halides.

Conclusions and Recommendations
In this building, there were opportunities both in capital investments and in lighting changes. However, much like the Public Works building, the overall recommendations are significantly less than in the City Hall building.

Capital Investments:

- Consider solar for the roof as it would be a good candidate due to location and lack of obstructions from the sun.

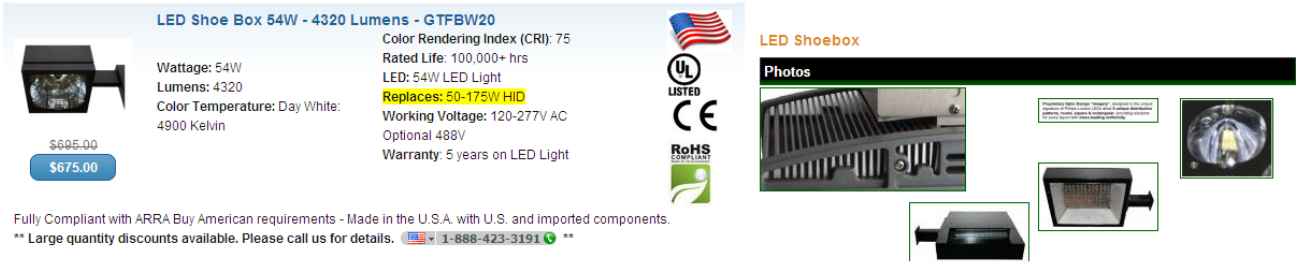
Minor Investments:

- Door weather stripping on entry doors.
- Change bulb type of exterior lighting on the southeast corner of the building to LED bulb/fixtures.*
- Consider upgrading incandescent lighting in the courtroom to LED bulbs/fixtures.
- Add additional occupancy/vacancy sensors.

Occupant Behavior:

- Participate in the Snohomish PUD Energy Challenge for businesses.[10]

*One fixture type that may work for the exterior of the building is:



Public Safety Improvements					
	Total Estimated Annual Energy Cost Savings	Total Estimated Installed Cost	Estimated Life/Years	Simple Annual Payback Years	Savings to Investment Ratio
Public Safety Roof Top Solar - 10KW	$776.00	$38,700.00	25	49.87	0.50
Change Out SE corner lights to 55 watt replacement	$735.00	$5,400.00	20	7.35	2.72
Occupancy and Lighting Controls	$3,000.00	$7,600.00	15	2.53	5.92

[10] Information on the Community Energy Challenge can be found at: http://www.snopud.com/?p=1138.