

## ECM SUMMARY

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Summaries of each ECMs (Energy Conservation Measures) presented to the City of Missoula at the preliminary Performance Contract meeting are listed below and have been selected for detailed development.

### **Water Conservation (25 Irrigation Sites to 35 gpm well)**

During the preliminary energy audit of the Parks Department it was noted that water supplied to the city owned irrigation sites was from either of two sources, Mountain Water (city water) or by a private supply well. It has been mandated by Mountain Water that 39 parks owned and operated by the city be converted from flat rate billing to meter measurement. These 39 sites must be converted to metered measurement over the next four years. The city will then be required to perform leak detection of each of the sites following their conversion. The city currently has a capital improvement fund for the water project, which includes; parks, city boulevards, and common areas. It is recommended that the city drill their own private wells to supply water at 14 of the 39 sites selected to be converted. Additionally, it is recommended that 10 metered sites be converted to wells. Also, it is recommended that smart irrigation systems be implemented to control water consumption. This type of system utilizes real time data to measure climatic conditions and will initiate a new schedule to replenish only water that is actually needed.

### **Solar Thermal for Pool Heating & Domestic Hot Water**

#### **SPLASH MONTANA**

During the preliminary energy audit of the Splash Montana water park it was determined that there may be potential in implementing a solar thermal pool heating system. After further review and recent meetings with the parks department it is determined that there is a sufficient available amount of real-estate to install the required number of solar panels to meet approximately 70% of the heating load of the 50 meter lap pool. In addition to the solar thermal pool heating system it is recommended that a pool cover be utilized at the beginning of the season when the pool is being filled for the first time significantly reducing fuel cost when first heating the pool to temperature and in the evenings during the operating season when solar productions minimal. The solar thermal heating systems will reduce fuel consumption, usually on the order of 45% to 70% while water consumption remains relatively constant.

## High Efficiency Lighting Retrofit

City wide existing fixtures consist of T12 Lamps & ballast, 1st Generation T8, T5 Fluorescent, Compact Fluorescent, Halogen Incandescent, Pulse Start Metal Halide, Mercury Vapor, Standard Metal Halide, & Standard Incandescent. A room-by-room audit identified improvements to lighting quality and to reduce the electrical usage and environmental impact. Additionally, it is recommended that occupancy sensors be installed in selective areas to shut off lighting when it is not needed. The reduced environmental impacts by implementing the lighting measures are as follows:

**Central Maintenance** – Some high efficiency lighting, including lamps and ballasts have been installed in approximately 80% of the building and the City of Missoula is commended in their effort to achieve sustainability. Inefficient lighting is identified and it is recommended that all metal halide be upgraded to efficient T5 lighting systems installed by the city in other high bay areas. Additionally, any older T12 lighting systems should be upgraded to high efficiency Super T8 lighting systems and high efficiency ballasts.

**Fire Stations 1 and 4** – The lighting systems at Fire Station1 consists of first and second generation T8 lighting systems with some older T12 installations. Exit signs are compact fluorescent technology. It is recommended that the existing T8 and T12 lighting systems be upgraded to new Super T8 lighting systems and the exit signs be upgraded to LED.

**Parks Department** – The parks department lighting consists of exterior lighting at numerous trails and parks, pedestrian bridges, parking areas, and several ball fields (i.e. the Osprey Stadium and McCormick). During the lighting audit it was noted at Currents that the pool area lighting is mainly 400 watt pulse start metal halides, it is recommended that these be retrofitted with 200 watt induction lamp prism glow fixture kits and occupancy sensors for control. The exterior sun deck lighting consists of 1 pole 175 watt metal halides and it is recommended that these be replaced with new shoe box fixtures with 80Watt induction systems.

**Parks exterior lighting** consists mainly of older metal halide and mercury vapor lamps, with a lamp life of between 10 to 20 thousand hours. It is recommended that these existing lighting systems be replaced with new high efficiency low wattage induction lighting systems with a lamp life of approximately 100 thousand hours. The Induction system offers a full coverage (material, labor, needed lifts etc.) comprehensive warranty and has overall better system performance and life cycle costing than the existing system.

**Parking Commission** – Banks Street Garage and the Central Parking Garage were audited as a part of the energy performance contract. Lighting at the Banks Street Garage on the exterior lot consists of metal halide lighting systems and it is recommended that this system be upgraded to a high efficiency induction lighting system. It is recommended that the interior metal halide systems be upgraded to new Super T8's and high efficiency ballasts.

At the Central Parking Garage exterior lighting consists mainly of metal halide and exit signs are compact fluorescent. It is recommended that the metal halide be upgraded to a new high efficiency induction lighting system and the exit signs be replaced with LED exit signs. Lighting of interior areas such as offices, elevator lobbies, the break room, the maintenance shop etc. consists mainly of incandescent and older T12 lighting technology and it is recommended that these systems be upgraded to CFLs and Super T8 and high efficiency ballasts respectively.

**Cemetery** – It is identified that there is an opportunity to upgrade existing lighting systems at the cemetery office and shop. The office and shop mainly consists of in-efficient T12 lighting systems and a few high wattage incandescent bulbs. It is recommended that the existing systems T12 systems be upgraded to 32 Watt Super T8s and hi-efficiency ballasts. Also, it is recommended that the standard incandescent bulbs be upgraded to low wattage CFLs.

### **Building Envelope & Air Sealing**

Air leakage is defined as the "uncontrolled migration of conditioned air through the building envelope". Caused by pressure differences due to wind, chimney (or stack) effect, and mechanical systems it has been shown to represent the single largest source of heat loss or gain through the building envelopes of nearly all types of buildings. Sealing gaps in a facility's envelope structure to reduce infiltration (air leaks that impact heating or cooling functions) reducing system energy costs. Heating and cooling systems will work more efficiently the more complete the integrity of the physical structure. The associated energy conservation also impacts the sustainability of the facility.

**Central Maintenance** – During the building envelope audit of the Central Maintenance facility it was identified that daylight was visible around all exterior doors and it is recommended that the doors be weather stripped. One office window was identified for weather stripping. Some overhead doors were noted as having damaged weather stripping and leaking at the top and sides. It is recommended that the identified overhead doors be weather stripped on all sides with new.

### Building Envelope & Air Sealing - *continued*

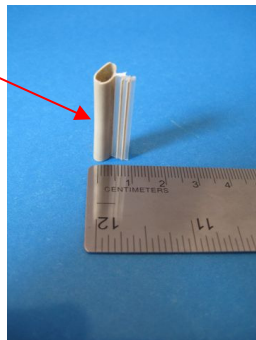
On the roof of the facility leakage was identified at steel roof caps to fiberglass curbs and it is recommended the areas be sealed to prevent leakage. Several roof top ventilators have been identified and sealing is recommended around the perimeter of each. Additionally, it is recommended that the perimeter of steel roof caps covering previous sky lights be sealed, see below.



**Council Chambers** – During the building envelope audit of the facility air leakage was detected at the two rear entry doors into the facility and it is recommended that the two rear entry doors be fitted with weather stripping.

**Fire Stations 1 and 4** – During the building envelope audit of Fire Stations 1 and 4 it was identified as follows. Leakage was identified around various doors around the Fire Station 1 building; Parking lot entry doors, S/E corner door, S/W stairwell door, and North and South entry doors of the garage. It is recommended that weather stripping be installed around the identified doors.

Additionally, window leakage was detected at the bottom of vertical slider windows, predominantly on the east and south side of the building. It is recommended to replace the bottom 3' strip of weather-strip on all 42 windows, see below.



During the building envelope audit of Fire Station 4 leakage was detected around most doors on the North, West, and East sides of the building and it is recommended that the areas be weather stripped.

### **Energy Management System / Controls**

At the City of Missoula buildings the various mechanical systems are controlled with a mix of pneumatic, electric and electronic control systems. These older control systems require relatively high maintenance cost and often cause increased energy use due to poor calibration, failure of components, improper control sequences or lack of occupancy schedules. A centralized energy management control system (EMCS) based on direct digital control components is proposed to replace existing mechanical equipment controls at the Council Chambers/MRA.

The new EMCS system will have many advantages over the existing systems. Better control of HVAC systems will improve employee comfort. New controls will improve system reliability and reduce excessive energy use from failed, unnoticed components.

### **HVAC Mechanical Systems Upgrades**

#### **Council Chambers**

##### **Packaged Roof-top-Units & DDC Controls**

As part of the preliminary energy audit it was identified at the Council Chambers that three of the four existing packaged roof-top-units is beyond its useful life. It is recommended that the three (3) older packaged roof-top-units be replaced with newer high efficiency units. Additionally, all mechanical (HVAC) equipment at the location will be connected to a direct-digital controls system.

#### **Cemetery Shop**

##### **Irrigation Pump Repl. W/New Hi Efficiency 60hp Pump Motor**

As part of the preliminary energy audit a 50 year old standard efficiency irrigation pump motor was identified for replacement. The irrigation pump is located in a pump house east of the cemetery shop. It is recommended that the existing pump motor be replaced with a premium efficiency pump motor. High efficiency motors provide the same shaft output but use less input power (kW) than a standard efficiency motor. There is a savings potential of 2% to 15% of energy consumption with installing premium efficiency motors.



## Additional Energy Conservation measures (ECMs)

### Vending Machine Power Management

“Plug loads” such as vending machines can consume a significant amount of energy in many facilities. Some equipment such as vending machines are left on 100% of the time even during unoccupied hours, such as nighttime. This creates an energy savings opportunity as these machines run all year long. This energy conservation measure offers the advantage of reduced energy consumption with a significant impact on energy consumption. Typical savings are on the order of 30 to 50% of baseline usage. There should be no impact on existing operation and maintenance programs. This retrofit will reduce energy usage and costs. It is recommended that the measure be implemented at the following locations: City Hall Building, Fire Departments 1 and 4, and Currents.

### Ice Max - Energy Efficient Ice Maker

As a part of the preliminary energy audit it was noted that at Fire Station 1 there is an opportunity to replace the standard efficiency ice maker with the Ice Max high efficiency ice maker. By utilizing a unique two-stage counter-flow exchange technology, the Ice Max pre-cools the incoming water to an ice machine by recovering the energy from the purged ice water exiting the ice machine. Reducing the incoming water temperature directly lowers the cooling load of the icemaker's refrigeration system and improves performance, resulting in reduced energy consumption and increased energy savings.