

Executive Summary

The following Review Report represents an assessment of the construction documents and drawings prepared for the South Peace Community Multiplex.

Project Name:	South Peace Community Multiplex (SPCM)
Reviewer:	Demand Side Energy Consultants Inc.
Project Owner:	City of Dawson Creek
Project Consultant:	Field Bowen Hutchison in Joint Venture Inc.
Date of Review:	May, 2007
Date of Construction:	July 2005 to September/October 2007
Project Description:	South Peace Community Multiplex, located in Dawson Creek, BC, is a three-building recreational facility, including an Agricultural Centre, an Aquatic Centre and an Event Centre linked at the 2 nd floors.

At the request of the City of Dawson Creek, and in order to provide the municipality with an assessment of the facility's energy use performance, Demand Side Energy Consultants Inc. was retained to review the construction documents and drawings prepared by Field Bowen Hutchison in Joint Venture Inc.

The purpose of this review is to provide an estimate of the energy use of the South Peace Community Multiplex (SPCM) for the purpose of operational budgeting. In addition, insights into the construction details and potential alternative energy projects and greenhouse gas emission reduction were assessed.

South Peace Community Multiplex is a three-complex facility, including an Agricultural Centre, an Aquatic Centre and an Event Centre. The Multiplex is approximately 25,492 m² and includes the Kenn Borek Aquatic Leisure Centre, which houses a competition swimming pool, smaller pools, saunas, waterslides and change rooms; The EnCana Centre, which provides permanent and moveable seating for 6,500 people as well as skyboxes, kitchen facilities and a 2,500 m² indoor ice surface; and The Lakota Agri-Centre, which includes a riding surface, 100 stalls for horses and cattle and dedicated truck parking. Other amenities offered by the Multiplex include conference and meeting facilities, food stands and a fitness/wellness centre.

Due to the staged-construction of the facility, final equipment data was unavailable at the time of this review, therefore this report is based on construction drawings and specifications current as of July 29, 2005. Following a review of the construction drawings and specifications, a heating, ventilation and air conditioning and refrigeration equipment was compiled.

An energy use profile was compiled from the building's HVAC and design data to capture the thermal characteristics as well as the mix of energy-consuming equipment within the building. The energy use profile recognizes that the Multiplex is still under construction, and equipment and operating schedules may change once the building is fully occupied. As well, improvements included as part of the emissions reductions strategy assume building system selection is not changed. In certain instances where provisions have been made on the drawings for future equipment, such as kitchen equipment and an ice plant, assumptions have been made based on equipment and schedules at similar facilities.

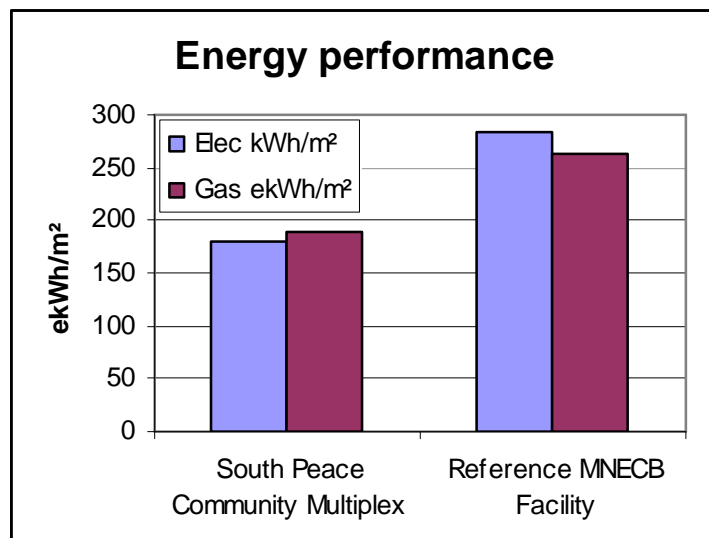
Greenhouse gas (GHG) emissions were derived from estimated facility energy consumption, estimates of the installed equipment inventory and assumptions made based on typical facilities. The table below provides an estimate of the energy use and GHG emissions at SPCM for a base case design.

Baseline Case	eMWh/yr	kWh/m ²	\$/m ²	GHG (Tonnes/yr)
Electricity				
Lighting	942	37	\$ 1.86	19
Fans & pumps	2,392	94	\$ 4.73	48
Ice plant & A/C	717	28	\$ 1.42	14
Events & services	521	20	\$ 1.03	10
Subtotal	4,599	180	\$ 9.10	92
Natural Gas				
Building Heating	1,697	98	\$ 2.91	429
Domestic Hot Water	908	36	\$ 1.06	162
Combustion Losses	249	10	\$ 0.29	45
Kitchen Equipment	1,370	54	\$ 1.60	245
Pool heating & services	576	23	\$ 0.67	103
Subtotal	4,800	219	\$ 6.52	984
Total Energy	9,399	400	\$ 15.63	1,076

The base case design detailed includes an electric chiller for cooling and an ice plant for an indoor ice surface. Equipment operating schedules used in the base case are estimated using similar facilities as models, such estimates include the operating hours of the pool, typical event programming, kitchen equipment and service use. Please note that estimates are based on typical facilities and may not be a true reflection of operations at the South Peace Community Multiplex.

The facility and equipment were reviewed relative to the Model National Energy Code of Canada for Buildings (MNECB). Based on an analysis of similar buildings constructed to the MNECB standards, SPCM may perform 32% better than a facility that meets minimum MNECB standards.

The following graph provides a side-by-side comparison of the South Peace Community Multiplex with a similar “facility”. The reference “facility” consists of an aggregate of multiple facilities including municipal pools, sporting arenas, and event or agricultural centres, built to meet MNECB minimum requirements. Compared to MNECB facilities, SPCM is more energy efficient in both natural gas and electricity consumption.



Based on the facility equipment and construction review, an energy use review was performed to evaluate potential energy savings from alternative energy systems. Two such systems considered for SPCM are a

solar air heating system to serve the air handling units in the Event Centre and a solar water heating system to serve the Aquatic Centre. There is potentially enough space on the South side of the Event Centre and the south side of the Aquatic Centre for these systems.

Analysis performed on the solar air heating options indicates that emissions may be reduced by as much as 30 to 58 tonnes per year. However, extensive heat recovery is currently employed in the design so a solar air heating system is not economically recommended due to the long payback (34 to 26 years).

The SPCM's Aquatic Centre is an ideal place for a solar water heating system due to the extensive use of hot water. A system covering 100m² will provide 22,000 kWh of energy and result in the reduction of 7 tonnes of GHG emissions per year. It is estimated that a solar water heating system would have a simple payback of 15 years, making this an attractive demonstration project for the SPCM.

The Multiplex was modeled for energy and GHG emissions based on several scenarios, including a minimum Model National Energy Code of Canada for Buildings design the base case building with an electric chiller and ice plant; the base case building with the alternative gas-fired absorption chiller; the base case building with building commissioning; base case building with chiller upgrades; and, finally, renewable energy options.

1. Model National Energy Code of Canada for Buildings (MNECB)
 - A similar building designed to minimum MNECB standards would be designed with lower insulation in the walls and roof, as well as lower efficiency air handling units and boilers.
2. Base Case – as designed
 - The base case building is the current Multiplex design, including all changes to May 2007, including an electric chiller and an ice plant. The Multiplex may be 32% more energy efficient than a building designed to minimum MNECB standards and cost \$170,000/year less to operate.
3. Base case with a gas-fired absorption chiller
 - As indicated on the original drawings, a gas-fired absorption chiller option for cooling the Multiplex is under consideration. The Multiplex would save 27% energy over minimum MNECB design. However GHG emissions would be 20% higher than the base case designed with an electric chiller.
4. Chiller Upgrades
 - The base building energy use was calculated based on a standard efficiency chiller, however chiller efficiencies with as high a Coefficient Of Performance (COP) of 6.0 are possible for chillers in the range of 150 to 300 tons. A higher efficiency chiller will result in 2% overall energy savings and lower emissions over the base case.
5. Building Commissioning
 - Commissioning is a systematic process of documenting and verifying a facility's operational needs as well as ensuring building systems perform efficiently and building maintenance personnel and operators are properly trained. Commissioning the Multiplex may result in energy savings of 8-10% over the base case.
6. Solar Water heating
 - The SPCM's Aquatic Centre is an ideal place for a solar water heating system due to the extensive use of hot water. A system covering 100m² will provide 22,000 kWh of energy and result in the reduction of 7 tonnes of GHG emissions per year over the base case.

Under present design considerations the South Peace Community Multiplex may be 32% more energy efficient than a similar facility constructed to minimum MNECB standards. However, due to the staged construction of SPCM, future system selection and operational consideration may affect the facility's energy performance. The table below details energy savings and costs associated with various design scenarios and recommendations at the SPCM.

South Peace Community Multiplex Annual Operating Summary								
	Electricity		Natural Gas		Total \$/yr	Emissions Tonnes	Savings	
	MWh	\$/yr	eMWh	\$/yr			%	\$/yr
1- MNECB	7,300	\$350,000	6700	\$199,000	\$549,000	1,342		
2- Base Case	4,600	\$232,000	4800	\$143,000	\$375,000	1,080	32%	\$ 174,000
3- Base case with Abs. Chiller	4,200	\$194,000	5900	\$177,000	\$371,000	1,272	27%	\$ 179,000
4- Chiller Upgrades	4,400	\$215,000	4800	\$143,000	\$358,000	1,077	34%	\$ 190,000
5- Controls Commissioning	4,100	\$209,000	4300	\$129,000	\$338,000	984	39%	\$ 211,000
6- Solar Water Heating	4,600	\$232,000	4800	\$143,000	\$375,000	1,076	33%	\$ 175,000
6- Renewables option 1	4,600	\$232,000	4700	\$139,000	\$371,000	1,052	34%	\$ 178,000
7- Renewables option 2	4,600	\$233,000	4500	\$134,000	\$367,000	1,023	35%	\$ 183,000
8- Recommendation	4,000	\$195,000	4200	\$125,000	\$320,000	944	41%	\$ 230,000

Conclusions & Recommendations

The current design for the SPCM with an electric chiller and ice plant is anticipated to save 262 tonnes (or 20%) of emissions per year over the standard MNECB design. As well, anticipated operating costs will be \$375,000 per year, 32% less than an MNECB building.

Considering that the chiller system and ice plant have not been specified yet, there is opportunity to specify an energy efficient electric chiller and design an efficient ice plant system.

The SPCM includes well over 50 fan systems and associated pumps, piping and ducts. As well as numerous pool systems, heating system and domestic hot water. These systems serve three activity areas with distinct occupancy schedules, equipment and operations. It is essential to commission and test the HVAC and associated control system to ensure proper operation and operator training of all systems.

Installing energy efficient chillers and ice plant systems, as well as commissioning all of the Multiplex's HVAC systems will result in 9% savings over the base case design along with a reduction of 135 tonnes of emissions. Total operating costs are highly impacted by the facility activity and are expected to be in the range of \$320,000 to \$400,000 per year, based on today's energy rates.