Building Green and Beyond

Providing an ecological balance for commercial and institutional building in the Yukon

Yukon Development Corporation

energy solutions centre

YUKON ENERGY

Building green and beyond

In the 21st century, nobody should consider designing a commercial or institutional building in the Yukon without planning for insulation or thinking about heating costs.

But how many builders think about the sources of energy used for lighting, space heating and hot water? Who thinks about the amount and kind of energy required to produce the construction materials in the first place? Who considers the impact of the building on transportation energy costs, or the impact it may have on its site, or how much water (cold and hot) the occupants of the building will use?

Also, it has become more apparent in recent years that the quality of air and light in commercial and institutional buildings can affect the health and attitudes of the people who spend time there. These conditions affect workplace productivity, sociability, and perhaps even costs to the health care system. Healthy workplaces pay big dividends for employees, employers, building owners and society as a whole.

Supposing one wanted to consider all of these factors, how would they go about it?

More and more Yukon businesses, building owners and designers are addressing these questions because the answers can help them plan for a better bottom line and a cleaner environment, as well as make indoor spaces more comfortable for those who use them.

Commercial and institutional buildings consume about one-third of the energy used annually in Canada. They are also responsible for a fifth of the greenhouse gases produced in the country, so there are good reasons to design and build greener.

If the right questions are asked up front, it is possible to produce buildings that consume fewer resources, use renewable energy, offer improved indoor air quality and more appropriate lighting, and minimize environmental impacts. On top of all that, properly designed ecological buildings will cost less to operate than "conventional" buildings, making potentially higher upfront costs pay off during the lifespan of the buildings.

PETER LONG

Yukon College, designed in the late 1980s by CJP Architects, uses pleasing methods to bring natural light into the hallways, creating a relaxing green space complete with trees, benches and artwork.

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Cover photo: J.V. Clark School, Mayo, Yukon was designed by Kobayashi + Zedda Architects. Photo courtesy of the architect.

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ENERGY SOLUTIONS CENTRE

After an early morning fire in 1997, Yukon Energy took the opportunity to construct an energy efficient administration and technical services building in Whitehorse.

Working places and public spaces

Commercial and institutional buildings in our communities are the stages upon which we act out our public lives. In a time of tight budgets and increasingly clearer impacts of human activities on the environment, new buildings can provide models for better structures and systems that cost less to operate and maintain, and are easier on the earth.

Commercial buildings provide the space for retail sales, manufacturing, and distribution of products and services. Stores, restaurants, hotels, offices and government buildings usually make up the bulk of any downtown core. Service and supply depots, garages, dealerships and warehouses dominate industrial areas.

Institutional buildings house public services including schools, colleges and universities, places of worship, community halls, visual and performing arts facilities, recreation facilities and hospitals. In the Yukon, most federal, territorial and municipal government services are delivered from institutional buildings.

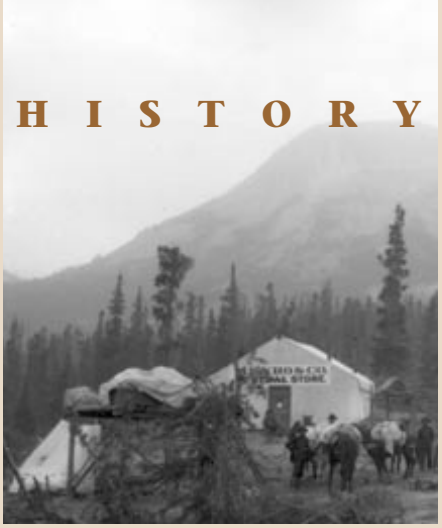
This publication tells the story of commercial and institutional building in the Yukon. The main story examines the characteristics of commercial and institutional buildings, the technologies and people that produce them, and some of the problems that they encounter. It shows the potential for better building practices — practices that can produce more efficient buildings that have lower impacts on the environment and provide good working and public spaces.

The story in the brown shaded boxes follows the history of commercial and institutional building practices in the Yukon and the forces that have shaped the Yukon's "built" landscapes.

The Whitehorse Travel building on Lambert Street was built in 1992 to accommodate that business and Rainbow Tours. It made a design statement for its owners by maintaining as many trees as possible on the site and using distinctive zinc siding.

PETER LONG

HISTORY



YUKON ARCHIVES, E.H. HAMACHER FONDS (MARGARET & ROLF HOUGEN COLL.) ACCESSION #2002/118, #1037

Commerce from a tent at Bullion.

Trade and commerce have always been a part of human existence. There are few locations where all that people need to live can be found right around them.

Before European traders and miners arrived in the north, Yukon First Nations congregated at trading places to exchange goods with others.

What is now called Fort Selkirk was a traditional trading place for Northern Tutchone, Chilkat, Hän and Mountain Dene. Artifacts found on the site reveal that it was used as a seasonal gathering place for hundreds of years.

When Robert Campbell arrived in the Yukon in 1848 in search of furs for the Hudson Bay Company, he built a trading post at Fort Selkirk, one of the first commercial buildings in the Yukon.

Campbell and other European traders built with what was at hand — first the tents they carried with them, then more permanent structures built from logs and poles cut from surrounding forests. Later, those who came with the 1887 gold rush to Forty Mile and the 1898 Klondike gold rush followed this pattern.

Institutional presence

Even before the gold rush began, the Canadian government had dispatched members of the North West Mounted Police (NWMP) to the Yukon. These "builders-in-

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Characteristics of commercial and institutional buildings

Commercial and institutional structures are usually built on a larger scale than houses and are designed for different combinations of functions. Like houses, they still have to keep out the weather, safely support the structure, provide a combination of natural and artificial light, maintain appropriate temperatures and good air quality, supply clean water, and remove waste water. But they also have to accommodate a variety of activities.

This often requires elaborate heating, cooling and air handling systems to maintain different temperatures and good air quality in different parts of the building. And it demands more durable building finishes to accommodate high traffic levels.

The size and complexity of larger buildings, plus the wide range of functions they serve, mean that a variety of professionals are involved in their planning, design and construction — and ultimately, in their operation.

Commercial and institutional buildings are investments for their owners. For that reason, decisions about design and operating features should be subjected to detailed financial analysis.

YUKON GOVERNMENT

Built in the early 1990s as a visitor reception centre, this building (now the Beringia Centre) has several features that make it interesting from an energy standpoint. The shell itself is quite energy efficient. The curved west wall contains maximum space with minimum materials, optimizing surface to volume ratio. The four-element window system on the east side of the display area controls solar heat gain while admitting a large fraction of the visible light. This type of window is very energy efficient and significantly reduces heating and cooling costs in this part of the building.

How well commercial buildings perform — how much energy they use, and how much it costs to operate and maintain them — helps to determine the profitability of the businesses that own or occupy them.

Similarly, how government buildings perform can make the difference between dollars available for programming and the need for increased taxes to finance high operating costs.

Although a long-lasting, efficient building can save the owner money, the top priority in most commercial construction is usually getting a building up and into service as inexpensively as possible. Builders want to get the most out of their capital outlay.

New or expanding businesses are often strapped for cash. That means that when they build they may have to fight for every dollar they borrow from the bank. Banks do look at both the upfront construction costs of a building and the lifetime costs of owning and operating it. However, when companies have limited resources, the banks look most closely at what the companies can initially afford. Building features that cost more to include at the time of construction, but could reduce operation and maintenance costs over the lifetime of the building, become a secondary consideration, even when the owner realizes that they provide long-term benefits.

Governments, too, often focus on the initial capital budget cost of new facilities without factoring in the energy costs that will show up year after year in the operation and maintenance budget.

The Whitehorse aquatic centre is the first building of a multiplex being built as part of the city's commitment to host the 2007 Canada Winter Games.

PETER LONG

Life-cycle costing

Life-cycle costing looks at both the capital costs of construction and technology, and the operational costs over the anticipated life of a building. Detailed life-cycle costing can help build a business case for energy efficiency.

In recent years, life-cycle costing has included both behavioural and societal factors. Low-cost buildings, with poor

PETER LONG

Room was left in the Whitehorse aquatic centre boiler room to accommodate electric boilers. Once they are installed in 2004, the centre will be able to use "green power" — surplus hydroelectricity. This will mean a reduction in carbon dioxide emissions of 1,079 tonnes CO_2 equivalent greenhouse gas emissions, as well as savings in operating costs.

heating, ventilation and air quality systems resulting in poor to bad indoor air quality and environmental quality, may create an end result of high absenteeism and low productivity. The cost of this phenomenon is many times greater than the additional cost of a well designed and energy efficient building.

Life-cycle costing should factor in societal changes such as flextime schedules, family structures, job sharing, work at home, and satellite offices.

This comprehensive approach to life-cycle costing provides an ecologically balanced building that is green, northern appropriate, and climate sensitive, in addition to being easier on the overall costs of running it.

Energy efficient buildings

- Yield continuous savings by reducing energy costs.
- Maintain superior comfort with less noise and better indoor air quality.
- Increase resale value and marketability.
- Cut costs through the use of new technology, more efficient materials, and the downsizing of mechanical systems.
- Enhance the reputation of their builders and owners as environmentally conscious professionals and business people.
- Offer a competitive advantage.
- Reduce production of greenhouse gases.

YUKON ARCHIVES, VOGEE COLL., #132

YUKON ARCHIVES, DAWSON CITY MUSEUM COLL., #6344

YUKON GOVERNMENT

1 1898 NWMP detachment, Lindeman. 2 Northern Commercial Company store, Dawson City, heated by a boiler built into the river bank. 3. Administration building, Dawson City.

...Institutional presence

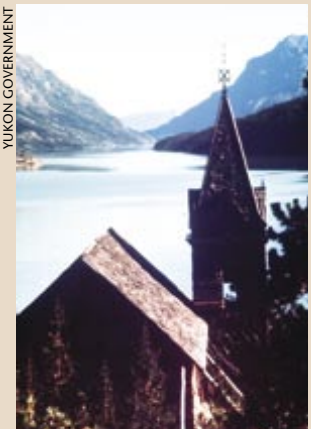
uniform" represented Canadian sovereignty in the face of an invasion of American prospectors and gold miners. The posts they built became symbols of government authority.

The first Yukon NWMP post was Fort Constantine, across from the Forty Mile settlement. However, by the time the post was completed in 1896, prospectors and would-be miners from Forty Mile had rushed to the Klondike after the gold discovery on Rabbit Creek — quickly renamed Bonanza Creek.

In a continuing bid to maintain law and order, the Mounties moved to Dawson City in the spring of 1897 and began to build Fort Herchmer.

When word of the gold discovery burst on a world that was mired in depression, thousands set off for the Klondike to seek gold. The Chilkoot Trail between Dyea, Alaska and Bennett Lake in Canada was the preferred route.

By the winter of 1898 there was an NWMP post at the summit of the Chilkoot Trail, a palisade log post farther along at Lindeman, and another at Lake Bennett.



YUKON GOVERNMENT

St, Andrew's Presbyterian Church at the gold rush town of Bennett.

Klondike commerce

Business people on the trail to the Klondike operated commercial enterprises — ranging from restaurants to brothels — out of tents. Some had more faith and built with logs, or milled timber and constructed wood frame buildings. As the stream of goldseekers passed by, many pulled up stakes and headed up the trail for Dawson City, the destination of the stampeders.

In Dawson City, businesses moved from tents to log and frame structures as fast as they got materials. Gold flowed from the creeks into Dawson City, which became the centre for Klondike commerce and a port for river traffic supplying both the Yukon and Alaska. White Pass and Yukon Route's British Yukon Navigation Company steamboats plied the waters from Whitehorse to Fort Selkirk to Dawson City and on to Yukon River towns in Alaska.

But, by 1901, even as the finishing touches were put on a new administration building, courthouse and post office, Dawson City's population was shrinking. New gold strikes in Alaska and prospects in the Mayo area drew away many who had failed to find riches in the Klondike.

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Planning and design

Architects, engineers and building owners all agree that the best buildings are produced when planning starts early. When new technology is considered, this becomes even more important.

Recent experience with energy efficient buildings has revealed that the secret to high efficiency is not necessarily high technology, although it has its place. Consistent results show that the most efficient buildings are those in which all the design elements work well together. When they do, the performance of the whole building is greater than the sum of its parts.

To produce these kinds of results, Natural Resources Canada's C-2000 high performance building program promotes a method called an integrated design process. Right from the beginning, it involves the building owner, architect, engineer and energy-modelling specialist. This means that as members of the team develop design options, the whole group can see the impact on the energy efficiency of the building.

Architectural firm Maurer Kobayashi and its successor, Kobayashi + Zedda Architects, were the first in the Yukon to use the formal integrated design process, as well as the Commercial Building Incentive Program. Their first C-2000 building, the Yukon Energy administration and technical services building, was designed by Antonio Zedda and Florian Maurer. It received the 1999 National Energy Efficiency Award for commercial and industrial buildings, and helps Yukon Energy to showcase the potential of energy efficient technology and design.

YUKON GOVERNMENT

Clerestory windows high in the walls of Hidden Valley School provide lots of light for open areas. This school design was duplicated in the later Holy Family School with plan changes to allow flexibility for additions and expansions.

KOBAYASHI + ZEDDA ARCHITECTS

The J.V. Clark School in Mayo, which opened in 2002, was one of three buildings nominated to represent Canada at the Sustainable Building 2002 conference held in Oslo, Norway. Designed by Kobayashi + Zedda Architects, it was built under the C-2000 program and received the maximum grant under the Natural Resources Canada Commercial Building Incentive Program.

Bob Baxter was one of the mechanical engineers involved in the design of the heating, ventilation and air conditioning system of the building. He says that the early involvement of an engineering consultant to conduct the energy analysis on building design options helped to identify efficiencies that might otherwise have been missed.

Kobayashi + Zedda Architects used the same approach and programs to design the new J.V. Clark School in Mayo.

Commercial construction incentive programs

Natural Resources Canada (NRCan) has a good track record of improving energy efficiency in Canadian buildings. Several NRCan programs are pushing progress in the Yukon design community.

C-2000 challenges participating designers and builders to improve on the energy efficiency potential of commercial office buildings through use of the integrated design process, energy modelling, the setting of energy efficiency and water conservation targets, and the use of low off-gassing finishing materials.

The **Commercial Building Incentive Program** (CBIP) provides a funding incentive for commercial and institutional buildings designed to be 25% more efficient than buildings constructed to meet the Model National Energy Code for Buildings.

The **Model National Energy Code for Buildings** (MNECB) sets higher energy efficiency standards than the National Building Code. MNECB specifies construction methods and components that have been found to save energy and have the lowest life-cycle costs. Its individual requirements should save as much or more in energy costs than they cost to implement.

Builders who follow MNECB are factoring life-cycle costing into their design choices. They are also building to a standard that is based on climatic information and tailored to different parts of the country — with regional zones identified for the Yukon.

In 1996, the Yukon government adopted its own **Yukon Design Standards** for its construction projects. The standards were built on the lessons learned from previous government construction projects and the 1992 **Yukon Architectural Guidelines** to encourage climate-appropriate design and construction.

Some say that Yukon designers already had an effective approach to energy efficient design. Established Yukon architect, Charles McLaren, and engineers, Ross Dorward and Bob Baxter, say that they have always worked closely on projects. Small firms and a limited number of practitioners make it necessary — and relatively easy — to get together to brainstorm. And the result has been Yukon commercial and institutional buildings built to a high energy efficiency standard.

For example, Whitehorse's Hidden Valley School, built in 1992, shows up very well on the Energy Solutions Centre's Public Buildings Energy Tracking System, with energy consumption figures equal to the C-2000 Mayo school. McLaren, the architect for Hidden Valley, says that it was designed to suit its program needs. It features an efficient floor plan, reasonable air handling volume, a tight envelope and lots of natural light — all the basics that he builds into each of his projects.

McLaren likes the idea of C-2000 and appreciates the value of computer energy modelling. However, he believes that

YUKON ENERGY

The multi-storey Yukon Energy building points south. Two narrow wings allow natural lighting throughout the structure, reducing the need for electrical lighting. With one wing facing southeast and the other southwest, solar heat gains are split, distributing the building's heat gain over the course of the day and cutting peak cooling demands by half. A high water table allows ground water to be used to cool the building. Siting options were limited by existing powerlines and the need for a clear line of sight to the hydro dam control structures.

...Klondike commerce

In the years following the gold rush, dredges replaced individual miners in the gold fields. Construction shifted out to the Klondike valley where mining companies built the Twelve Mile power plant in 1907, the North Fork power plant in 1911 and, later, the Bear Creek industrial complex.

Dawson City dwindled even more in the 1920s when downriver traffic to Alaska and the coast ended. But it remained the Yukon capital until 1953, and gold dredges kept working until 1966.

The Cassiar Asbestos mine at Clinton Creek on the Fortymile River, which operated from 1967 to 1977, helped to sustain Dawson City's faltering economy.

In the meantime, Parks Canada and the Klondike Visitors Association worked together to develop a tourism industry for Dawson City. Parks Canada and businesses rehabilitated 60- to 70-year-old commercial buildings, and new hotels were built to accommodate increasing numbers of visitors.

Mayo region

In the years after the Klondike gold rush, some disappointed miners moved up the Stewart River to prospect its tributaries. By 1903, there was enough activity in the Mayo River area for the government to survey a townsite near its confluence with the Stewart River.

In 1904, the same year the government completed a winter road from Dawson City, the Mounties established a detachment to police the 80 or so miners who worked creeks in the district.

A silver rush in 1919 brought many prospectors to the Keno City area. The hills were soon dotted with mines and mine buildings.

For the first few years, ore was shipped to Dawson City and then downriver to outside smelters. In 1922, the *S.S. Keno* paddlewheeler, designed for shallow draft navigation, was placed in service on the Stewart River. The ore could now be shipped upriver to Whitehorse where it was transferred to the White Pass and Yukon Railway to be transported to tidewater.

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1 Power house at Bear Creek. 2 Over 100 years after the gold rush, the Arctic Brotherhood Hall is now Diamond Tooth Gertie's gambling hall. 3 Gene Binet bought the entire town-site of Mayo after it was surveyed in 1903. His hotel was one of the first commercial buildings in the region.

KLONDIKE NATIONAL HISTORIC SITES BINDER 42/167

YUKON ARCHIVES, VANCOUVER PUBLIC LIBRARY COLL., #2031

JOHN SCOTT COLL.

the modelling programs used by C-2000 and the Commercial Building Incentive Program rely too heavily on reducing lighting loads to save energy through day-lighting and automatic controls. "In the north," he points out, "Ventilation is also a major factor to consider."

McLaren would like to see five-year follow-ups on buildings with designs based on computer energy-use simulations. This would allow the comparison of the energy consumption predicted by the modelling to actual performance in the Yukon climate.

To encourage better planning, use of energy modelling tools and adoption of the integrated design process, the Energy Solutions Centre conducted the Green Building Design Competition in 2002. This competition challenged Yukon designers to develop conceptual designs for an arts education building on the Yukon Arts Centre site. The judges recognized three firms which submitted designs: Sinclair and Associates for best technical solution, Kobayashi + Zedda Architects for best artistic solution, and Ferguson Simek Clark Engineers and Architects for best integrated design solution. (A workbook about the process and the submissions is available from the Energy Solutions Centre.)

Franchise designs

McDonald's, one of the first franchises in Whitehorse, was built in 1986 by Malamute Construction. Mel Olson, one of the builders, says that the U.S. designers were not interested in adapting the design to the north. His crew could only "shove in extra insulation where it was possible."

PETER LONG

Gordon Clark and Karen Russell, who have brought three franchise restaurants to Whitehorse — both of the Tim Hortons outlets and Boston Pizza — also have found it difficult to negotiate design changes.

Clark says that franchisers work with cookie-cutter plans, a strict project management time schedule, and sometimes their own builders. Because he owned the land for the downtown Tim Hortons, he was able to use a local builder, Cardinal Contracting. The result is an upgraded design with better insulation and triple pane windows. The building uses 50% less energy than the first Tim Hortons, which was built by a Calgary contractor.

In the case of Boston Pizza, Clark and Russell were able to convince the franchise architect of the need to eliminate a large deck access door and to improve insulation levels for the Yukon climate. But other energy improvements are being made after the fact because further change approvals would have delayed the whole project. Retrofits include electrical heating to take advantage of surplus hydro power sales and a two-speed kitchen make-up air fan so that less cold outside air has to be heated — a major energy drain in restaurant operations.

At the new Ricky's All-Day Grill, owners Carson Bell, Setnam Rai and Ken Eby worked with the Energy Solutions Centre to tweak the design so that it qualified for the Commercial Building Incentive Program. Energy efficient features include a specially designed low-volume kitchen exhaust fan, a "heat wringer" to recover heat from refrigeration compressors, and an air-to-air heat pump.


PETER LONG


PETER LONG

The Silver Centre, on Black Street at Second Avenue, has a torched-on membrane over the structure and insulated curtain walls over that. It features lots of natural day-lighting and operable windows, and has no automatic light switches — although the lights do have lots of switching so that users can light just the areas they are using. Dan Shier, whose law offices are in the building, says that the building has given them "...a much better environment, with better air quality and more natural light" than their previous accommodations. "Everybody has a window, including staff," he says. "It's a cheerier environment." The architect, Charles McLaren, maximized the net interior space by using only 10% to 12% of the interior for public space, washrooms, service areas, stairwells and corridors, compared to a usual 25%. So a smaller building produces more revenue space.

PETER LONG

Territorial Auto Parts owner Chuck Suley asked his contractor to build in any energy saving features that would pay for themselves in five years or less. The result is a well insulated building with perimeter insulation around the slab and a forced air oil system that features two furnaces. The secondary furnace only comes on when the receiving door is open.

A design gap

"A set of plans for a small commercial building used to be 20 pages long," says Todd Hardy, former Carpenters Union business agent. "Now plans are more general."

Today, in an increasingly competitive design climate where budgets are tight and few institutional and commercial buildings are being constructed, designers sometimes bid low to get work.

Larry Turner, a project superintendent with Ketza Construction, says that when architectural firms bid too low they sometimes scrimp on design details. This poses a dilemma for the contractor.

Calls to the design firm to seek clarification or detailed drawings may hold up the project. On the other hand, moving ahead without approval from the architect may make the builder liable for future problems. To cover themselves, contractors often seek approval for specific change orders that document "as-built" details.

To help workers in the construction trades who have been affected by this trend, the Carpenters Union has offered its members training in computer drafting. With that training under their belts, they can work with the contractor on-site to develop drawings for building details where specifications are not clear.

YUKON ARCHIVES, A.K. SCHELLINGER FONDS, #5903

YUKON ARCHIVES, WILLIAM S. HARE COLL., #6838

1 The Elsa mill was destroyed by fire in June 1949. A new mill was rebuilt and in production by October that same year.
2 Today's Keno City mining museum is housed in the historic false front building shown in this 1920s photo.

...Mayo region

These developments brought stability to the Mayo region. During the 1920s and 1930s, about 1,000 people worked the mines which were a mainstay of the Yukon's economy.

After the second world war, more than half a dozen mines were in production in the Keno Hill area. In 1952, the Government of Canada had enough faith in the future of mining here that it built a hydro dam on the Mayo River to supply power to the mines and communities in the Mayo district.

United Keno Hill Mines Limited continued to operate until 1989. Several efforts to revive the mine since then have failed. The mine buildings still stand, empty and quiet. Much like Dawson City in recent years, the Mayo regional economy today relies less on mining than it has for 100 years.

The Mayo dam and power plant, no longer needed for mining, now supply hydropower to Dawson City.

Whitehorse

In 1900, the White Pass and Yukon Railway completed a 110-mile line from Skagway to the Yukon interior. The terminus was Whitehorse, a brand-new company town located at the end of steel and the head of Yukon River navigation.

Whitehorse became an important distribution centre. The town featured a mix of commercial and institutional buildings, including an elaborate wood frame railway depot. Although much of the downtown core was destroyed by fire in 1905, it was swiftly rebuilt.

Whitehorse was also a mining centre. From 1900 to 1920, thousands of tonnes of high-grade hand-cobbed (sorted) copper ore from mines in the Whitehorse Copper Belt were shipped to tidewater by rail.

Whitehorse became a boomtown in the second world war. Just as the gold rush had been driven by Americans, so too was the

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In the first half of the 20th century, the White Pass and Yukon Route's warehouses dominated the Whitehorse waterfront. Anything headed for the central Yukon mining sites was transferred from rail to sternwheeler here.

YUKON ARCHIVES, MACBRIDE MUSEUM COLL., #4075

Land selection and site planning

As an urban planner, Ian Robertson of Inukshuk Planning and Development knows from experience that site planning is a critical step in the building process. Everyone has a role to play, including the building owner, design consultants and regulatory authorities. Robertson suggests the following as a basic site planning checklist.

Zoning and building bylaws

- ☐What opportunities and constraints flow from these bylaws?
- ☐How do the bylaws affect site layout, building massing and orientation?
- ☐Are the building setback requirements restrictive or flexible?
- ☐Is the proposed use appropriate for the location?

Site history

- ☐If the property is being redeveloped, has a thorough check for any environmental liability been done?
- ☐How was the site used in the past?
- ☐Is the site contaminated?
- ☐Was the site part of a larger site and subdivided?
- ☐Is the site in a floodplain?
- ☐Is there a geotechnical report?
- ☐If a building already exists, can it be refurbished or can the materials be recycled or salvaged?

Access

- ☐How do existing traffic patterns and volumes affect access to the property?
- ☐How will the building's orientation, visibility and parking locations affect access?
- ☐If access points are limited and good access is the priority, how will this affect other site plan elements such as buildings or elevation?
- ☐Where will the garbage dumpster go? Is it accessible to building users and to the waste removal company?

The original Federal Building on Main Street featured a well-used green space in front.

Sun

- ☐Does the site allow orientation of the building for solar heat gain, better day-lighting and energy cost savings?

Wind

- ☐How will wind affect heating costs and the quality of air drawn into the building?
- ☐How will wind affect building doors, air intakes and chimneys?
- ☐Can landscaping and screening diminish the negative effects of wind?
- ☐How will winter winds affect snow buildup around the site and where will the snow on the site be stored?

Land clearing

- ☐Does the entire site need to be cleared?
- ☐Can any existing vegetation be salvaged for future landscaping?
- ☐How can blow-down be avoided and trees be protected from construction damage?

Landscaping – interior, exterior

- ☐What will the landscaping look like in different seasons?
- ☐What are the right plant materials for this climate zone and where should they go?
- ☐What are the right plant materials to enhance the building appearance and property value?
- ☐How and who will maintain the interior and exterior landscaping?
- ☐Can roof run-off be used for irrigation and if not, where will it be discharged?
- ☐Could graywater from the building be used for irrigation?

Grading

- ☐Does the slope of the site offer opportunities for earth-sheltered construction?
- ☐Could access be obtained from multiple levels?
- ☐Can site grading reduce drainage problems and site maintenance costs?

Water infiltration and run-off management

- ☐How will surface water and groundwater be managed?
- ☐Does a high water table offer an opportunity to use groundwater heat?
- ☐Can roof surfaces and parking lots be designed to capture, recycle, filter or slow water discharge rates?

The 1986 Andrew A. Philipsen Law Centre in Whitehorse was originally designed for the Hanson Street site where the Visitor Reception Centre is now located, with its main entrance to be on Second Avenue. Rows of solar collecting office windows would have faced south. However, time pressures and lot development problems on Hanson Street led to the building's relocation to Wood Street. To maintain its main entrance on Second Avenue, the building was rotated 180° from the original plans. As a result, most of the windows in the building now face north, losing the opportunity for light and solar gain.

PETER LONG

The building where Yukon Housing is located on Jarvis Street uses rainwater captured from the roof to water plant boxes at street level.

Site lighting

- ☐ Could timed or graduated intensity parking lot lighting save energy costs?
- ☐ Does the lighting plan create problems with glare for neighbours or night lighting for wildlife?

Fencing, shading and screening

- ☐ Where and how can fencing, shading and screening be placed to mitigate wind, reduce air conditioning costs, enhance security, and screen utility pedestals and garbage dumpsters?

Safety and security

- ☐ How can building location and landscaping, as well as the choice of lighting and parking layout, affect safety and security on the site?

YUKON GOVERNMENT

The Watson Lake municipal building, shown here under construction, illustrates the tradeoffs that may have to be made when siting a building. The decision to face the building with a view over Wye Lake put most windows on the north side. An earth berm on the south side of the completed building now rules out solar gain.

...Whitehorse

Yukon's wartime burst of activity. In 1942, thousands of American troops arrived to construct the Alaska Highway as a defensive measure. The U.S. Army surrounded the small downtown core with airport hangars, office buildings, warehouses and barracks.

After the war, the Canadian military took over operation of the highway and airport, and the federal government began transferring its offices from Dawson City to Whitehorse. In 1950, the first year-round road built north from Whitehorse tied Mayo, but not Dawson City, to the new Alaska Highway. In Takhini, Canadian military officials and government bureaucrats moved into the imposing new Northwest Service Command buildings on Range Road as they took over responsibility for the highway.

Whitehorse grew into its new role as a government town. Two new schools were built: Christ the King School (now the Wood Street Centre) in 1948 and, in 1952, Whitehorse High School (now Whitehorse Elementary). By 1954, a new federal building housed the post office, courthouse and government offices.

In the late 1950s, a steady flow of federal money helped build the bridge to Riverdale, a new hospital, the Whitehorse hydro dam and government housing. This construction activity, along with several mining projects, boosted the confidence of the private sector. Military families and government employees living in Takhini, Valleyview and Hillcrest helped support the development of retail businesses.

Prosperous times

The 1960s were a busy period for mining and construction in the Yukon, but the Faro mine, which came into production in 1969, overshadowed them all.

The Cyprus-Anvil mine development included an open-pit mine, mill, industrial service

...history continues, page 11

1 YUKON GOVERNMENT

2 YUKON GOVERNMENT

3 YUKON GOVERNMENT

4 ROLF HOUGEN COLL.

1 U.S. Army barracks at Whitehorse. 2 Main Street and Third Avenue corner of the 1954 Federal Building. 3 This building at 200 Range Road, part of the Northwest Service Command complex, still houses federal government offices. It, and other buildings in the complex, were once heated by a district boiler plant. 4 Rolf Hougen began to build his company in the 1940s, working out of his parents' business. By 1949, the Hougens store was located between Third and Fourth avenues, on Main Street. The business expanded in 1952 by taking over the bowling alley next door. In 1960, construction began on the two-storey, 10,000-square-foot, concrete building seen here beside the then-Taku Hotel.

The building envelope

The building envelope is the combination of air-vapour barrier, windows, doors, insulation and wind barrier that keeps heat or coolness inside and weather out.

Building envelopes on commercial buildings vary, depending on construction materials. On larger, steel-framed buildings, torched-on membranes can form an air-vapour barrier between the structure and the insulation that is applied to the outside of the building.

Since 1990, Ferguson Simek Clark Engineers and Architects, known for its work in severe climates, has used what it calls an "exoskeleton" on all of its buildings. A single membrane, which acts as both an air and vapour barrier, is applied to the exterior of the structural elements and then covered on the outside by layers of foamboard insulation.

Smaller-scale, stick-frame commercial construction generally uses a combination of insulated 2x6 walls and an air-vapour barrier, with 2x3 strapping on the studs or 2x3 steel studs set 19 mm inside the 2x6 wall. The air-vapour barrier inside and an exterior air barrier keep moisture out of the building structure.

In the course of his work in commercial buildings, energy specialist Mike Youso of Arctech Associates often finds unsealed openings around mechanical vents, ducts and chimneys, and around electrical penetrations. He points out that air testing (depressurizing the structure to identify envelope air leaks) is done on R-2000 houses and during residential energy audits but seldom happens on commercial level buildings.

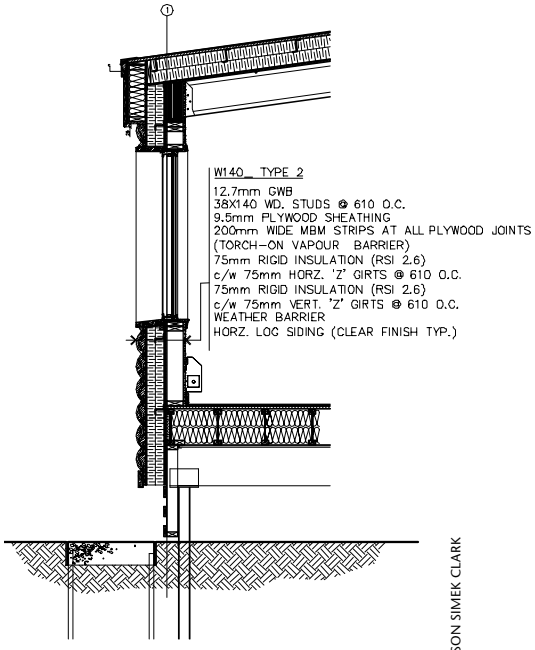
Todd Hardy, long-time Yukon builder and Carpenters Union business agent, offers an explanation for what Youso has observed. He says that the trend in the project management approach to commercial construction contributes to a "breakdown" of the trades into narrower specialities. Workers with highly specific skills move in and out on strict schedules and journey carpenters with a full understanding of how the pieces work together are not as common on the job.

In his view, this approach blurs accountability on the worksite, leads to missed details, and places a heavy onus on inspectors to ensure that construction details are properly executed. "Inspectors are not able to see everything that happens," he notes.

He worries that workers with limited specialized skills may not understand the importance of building envelope integrity. Subtrade workers may not appreciate that leaks left around a mechanical installation may actually sabotage the operation of the systems they are installing.

Ferguson Simek Clark Engineers and Architects designed the Chief Zzeh Gittlit School and the administration building (below) in Old Crow using similar designs. The school uses less heating and electrical energy per square foot than any other school in the Yukon, despite Old Crow's severe climate.

FERGUSON SIMEK CLARK



FERGUSON SIMEK CLARK

Typical wall section

YUKON HOUSING

YUKON HOUSING

The structure of the Thompson Centre ceiling and roof featured many intersections that complicated installation of the air-vapour barrier. This, combined with a change in building use that generated higher humidity levels, resulted in moisture buildup in the roof's structure and serious deterioration.

The Yukon's own window maker

Northern Windows, established in Whitehorse in 1985, builds high-end windows for the north. According to president David Borud, "They are the best tested window you can get for the north."

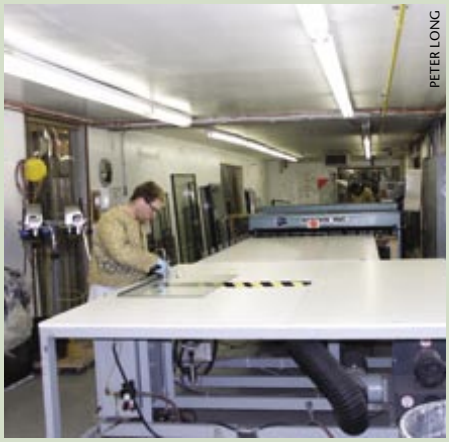
Their product tests out so well that it is being considered for the internationally used ENERGY STAR® rating which recognizes energy efficient products.

Northern windows rate at the top of the class for insulation values and structural strength. Under the Canadian Standards Association window rating system, they also score top ratings for airtightness, watertightness, wind load resistance and resistance to breakage.

These windows easily meet the energy conservation requirements for climatic zones C and D — the colder parts of Canada — as set by the Model National Energy Code for Buildings.

From its plant in Whitehorse, Northern supplies markets in the Yukon, northern British Columbia, the western Arctic and southeast Alaska. The balance of the Alaskan market is served from its production facility in Anchorage.

PETER LONG



PETER LONG

YUKON GOVERNMENT

The Faro mine drove the Yukon economy through the 1970s and 1980s.

...Prosperous times

complex, small shopping centre and an entire townsite, complete with recreation centre. Its construction brought a wave of workers to the territory. At its height, the mine employed over 1,000 workers. Overnight, Faro became the second most populous community in the territory.

White Pass, by then the Yukon's major transportation company, scaled up to handle the Faro mine ore haul. It shifted activity to the Marwell industrial area where it moved its truck maintenance facility from downtown.

In Marwell, steel-framed metal-clad buildings went up, manufactured by companies such as Butler or Permasteel. Local contracting companies built the foundations and outside steelworkers erected the structures. Quick to put up, they were costly to operate. The buildings leaked heat through their steel frames, even when the walls and ceilings were insulated.

By 1972, the Government of Canada had invested more than $28 million in infrastructure support for the Faro mine, including construction of the road from Carmacks to Faro and the powerline from Whitehorse to Faro.

The power needs of the Faro mine led to expansion of the Whitehorse Rapids generating plant's capacity and, in 1975, the construction of the Aishihik hydro dam and powerline.

The commercial and institutional sectors in Whitehorse grew to meet the demands of construction activity and infrastructure development.

The Yukon government building on Second Avenue expressed the confidence of the 1970s in architectural terms with its big-scale, open concept office design.

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By 1976, when the Yukon government building (seen here under construction) was fully commissioned, it accommodated almost all Whitehorse-based Yukon government employees. Built with an open concept, it was later carved up into office spaces with permanent partitions that challenged the heating, ventilation and air conditioning systems and generated concerns about air quality.

YUKON GOVERNMENT

Windows and day-lighting

The R-value of windows has improved exponentially since the end of the 1980s, making them heavy-duty performers in energy efficient buildings. When installed on southern exposures, they can mean a net energy gain allowing a building to capture solar energy, and thus reduce heating costs. Their good insulating values also allow designers freedom to use more of them to increase day-lighting and reduce a building's electrical lighting energy needs. Those daylight savings can be increased by the use of complementary electrical lighting systems.

Designing for day-lighting in the Yukon poses special challenges. Drastic differences in the sun's angle from season to season, long winter nights and long summer days all have to be factored into design decisions. Windows that work well for lighting during the middle of summer may let in too much heat and glare in spring and late summer when the sun's angle is lower. Skylights that diffuse light during spring and fall might overheat an interior in the summer or be covered by snow during the winter.

Clerestory windows, set high in interior walls, can assist solar gain at appropriate seasons and limit it during the peak of summer when the sun is high overhead. They can also diffuse glare with the selection of appropriate glazing.

Northerm Windows worked with the architects designing the Yukon Energy building to develop windows that would complement that building's daylight sensing lighting system.

Sunshades and windows

The Yukon Energy building (top) features external sunshades, or "brise-soleil," mounted a quarter of the way down the windows. These sunshades are designed to limit sun penetration into the building when the sun is most intense between mid-May and mid-August. In the heat of summer, this helps to ease the load on the cooling system.

In the early spring and late fall, the shades allow solar gain during days of low-angle sun. Combined with light shelves and a reflective ceiling, the sunshades can bounce natural daylight (again, during spring and fall) through a south-facing room.

The spacing of the shading "blades" prevents snow build-up and reduces glare.

Low-e soft coatings on two of the six triple pane window surfaces offer a two-way benefit. In the winter, they bounce heat back into the interior. In the summer they reflect incoming solar energy to keep the building from overheating.

Interior lighting in the building is controlled by daylight-sensing switches that turn lights off when there is enough natural light, and on again at dusk.

The lighting system itself uses a combination of direct and indirect fluorescent fixtures that bounce light off the ceiling to provide more even, diffused light in the workspace.

On the south face of the Mayo school (bottom), triple pane low-e windows have a "Solar Cool" coating that reflects 85% of the sun's rays so that the building does not overheat during long spring days. The windows are equipped with large exterior one-piece sunshades. Photo and occupancy sensors maintain minimum light levels throughout the building.

PETER LONG

KOBAYASHI + ZEDDA ARCHITECTS

Electrical systems

According to electrical engineer Ross Dorward, workplace and technology changes have created opportunities for more efficient use of electrical energy for lighting in commercial and institutional buildings. Paper-oriented offices used to have lighting levels of up to 100 or 120 foot-candles. Today, with most offices using computers, light levels between 40 and 50 foot-candles offer better energy efficiency and improved workplace atmosphere.

In practical terms, this often means that four-tube, T-12 fluorescent fixtures can be replaced by more efficient two-tube, T-8 lamps with electronic ballasts.

Building owners who upgrade their lighting often find they can recover their costs within three years.

Other electrical improvements can generate savings. When Dorward conducts an electrical energy audit, he completes an analysis of a building's electrical system and provides recommendations for changes. These go to the owner, along with estimated costs and calculated payback periods.

In new construction, good engineering design requires the use of energy efficient products whenever possible, within the limits of the client's budget.

A range of new technology is available to the designer. Occupancy sensors, daylight sensors and low voltage control systems for lighting are all part of contemporary lighting design for energy efficient buildings.

PETER LONG

The interior of the workers' compensation building on Fourth Avenue in Whitehorse has clerestory windows high in the south-facing wall. They have translucent glazing that allows for solar gain and natural light without creating hard shadows. The building is built for expansion upwards with a roof insulation system that can be removed to allow construction of an additional floor. The glue-laminated beams could be re-used if the building were ever demolished.

Occupancy sensors turn on or shut off lights depending on whether a building space is being used or not. Daylight sensors vary light levels in a given area according to the natural lighting available. Low voltage control systems allow for computer-programmed remote control of the lighting in a building.

A low voltage control system can be programmed to switch on building lighting at the start of the working day and switch it off after working hours. A key in an entrance door might be programmed to trigger hallway lighting. Manual overrides or occupancy sensors allow janitors or employees working late to light just the areas actually used. Systems can be programmed to do timed scans of a building through the night to shut down any lights left on.

Dorward says that in other areas of electrical systems, high efficiencies are already being realized. When he worked with CBIP on the Yukon Energy building and the Mayo school projects, he could only make improvements to his standard design practices by bringing in new technologies such as the daylight sensors.

As someone who cares about how power is used, Dorward is delighted with the Renewable Power Sales Incentive Program, which sells surplus hydroelectricity at discount rates. He calls it "the most positive thing in five years" and says it has meant major savings for owners, as well as work for contractors and engineers. Best of all, hydropower is not being wasted by spilling it over the dam. It is being put to work.

...Prosperous times

By the end of the 1970s, with the Faro mine well established and expectations of an Alaska Highway natural gas pipeline running high, Whitehorse witnessed the construction of some substantial private sector buildings as well, including the Optometrists Building on Second Avenue and the Keith Plumbing and Heating building on Burns Road.

In the early 1980s, the Yukon government built the Mayo administration building, and by the mid-1980s, Whitehorse banks all had modern buildings.

Times change

The Faro mine, combined with government spending, appeared to offer the Yukon unprecedented economic security. But in 1982, a new mine owner shut down the mine in the face of a strike, pulling the plug on the territorial economy.

The construction of the Financial Plaza Building on Second Avenue at Lambert Street mirrored the ups and downs of the Faro mine. The first floors were built in 1980, prior to the shutdown. Additional floors were added in 1987 following the restart of the mine in 1986. The

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PETER LONG

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YUKON GOVERNMENT

1 The Optometrists Building, looking more sophisticated than most downtown buildings, is a steel-framed structure with concrete floors. Built in 1978 at the peak of the first Alaska pipeline frenzy, it showcased the cultured stone that Wayne Richardson, one of the building owners, was selling at the time and features bronze trim ordered from Winnipeg. Energy improvements made over time include installation of more efficient lights and oil-heated service hot water. After a second-floor fire in 2001, low-e windows were installed on the second floor, as well as a better insulated roof. 2 A series of improvements made to the 1978 Keith Plumbing and Heating building make it an efficient energy performer today. Direct digital controls for the HVAC system were installed in 1996. A lighting retrofit in 1998-1999 reduced energy use by 30%. The roof was renovated in 2000 with a torched-on membrane and four inches of rigid foam insulation. In 2003, antiquated walk-in freezers were replaced with ozone friendly new units that may reduce energy consumption by 25%. 3 In the early 1980s, government buildings were constructed in a number of Yukon communities. This administration building in Mayo shows as having good energy performance on the Public Buildings Energy Tracking System.

Heating, ventilation and air conditioning

Heating, ventilation and air conditioning (HVAC) systems have evolved significantly over the last 20 years, as have the challenges faced by mechanical designers.

At one time, designing for the north meant coming up with systems that could economically heat buildings during winter extremes. Today, building envelopes are efficient enough that northern designers also have to give consideration to cooling. This is especially true when buildings are designed to collect passive solar heat — a plus during the winter months, but a possible problem during long spring and summer days.

Good air quality and make-up air for combustion and exhaust appliances also require more attention in today's tighter buildings.

The push for energy conservation during the 1980s and 1990s encouraged the development of more efficient burners, boilers and air exchange units. It also accelerated development of technology that is not based on fossil fuels like oil or propane. Ground source or air-to-air heat pumps, and hybrid systems are now economic options for heating and cooling commercial buildings. Surplus hydroelectricity at discount rates also makes electrical boilers and heating systems a greenhouse gas reducing alternative.

In the Mayo school, high indoor air quality was a goal of the designers, so they chose low volatile organic compound finishes such as natural wood, linoleum and latex paint finishes. Note the use of clerestory windows to light the interior.

KOBAYASHI + ZEDDA ARCHITECTS

Air quality

HVAC designers have to plan fresh air input and stale air exhaust to maintain good interior air quality. In the Yukon's cold climate, heating outdoor ventilation air is one of the greatest energy costs.

Heat recovery ventilators that use heat from building exhaust air to pre-heat incoming fresh air can lower energy costs in two ways: by reducing the amount of energy that has to be used to heat incoming air, and by allowing for smaller heating units. These heat recovery ventilators significantly reduce the cost of winter ventilation air and maintain indoor air quality.

To help ensure better indoor air, designers can also specify finishing materials, floor covering, adhesives and paints that emit fewer, volatile organic compounds.

Commercial buildings that use electrical heating and alternative heating approaches that do not burn fuels offer better air quality because they do not emit particulates that could be drawn back into the building's supply air.

Direct digital controls

Direct digital control systems (also known as DDC) for HVAC systems are an increasingly common component in commercial and institutional buildings. Installed as an integrated part of new systems or as add-ons to existing ones, they allow programmed operation of HVAC systems. Heating and ventilation can be programmed to drop down to lower levels overnight and to come back on-line when buildings are in use.

These controls can also modify the blend of outdoor air and recirculated air supplying the HVAC system, depending on factors such as indoor/outdoor temperature differential and the concentration of carbon dioxide from occupant respiration. CO_2 control can very effectively reduce ventilation costs in buildings with intermittent, large occupancy loads like community centres.

PETER LONG

The direct digital control system for the Whitehorse aquatic centre can be adjusted from this computer.

The community centre in Haines Junction uses this type of ventilation control.

On new HVAC systems, digital controls are frequently used to efficiently maintain occupant comfort in distributed heating and ventilation systems that supply different zones in a building.

Digital controls are a sub-system within the HVAC systems designed by mechanical engineers. Electrical contractors, such as Arcrite Northern and Dynamic Systems, usually supply and install direct digital control systems and employ specialized electronics technicians to program their controls.

Andre Fortin, a partner in Dynamic Systems, says that retrofitting existing ventilation systems with digital controls can be very cost effective. He says that digital controls and a multi-speed fan installed at Peak Fitness in Riverdale Plaza reduced power bills by 50% and paid for the installation in just three months.

The Silver Centre has air-handling units mounted on balconies to allow the use of less expensive off-the-shelf units, reduce the amount of ducting required and allow individual control of the environment on each half floor. Separate metering of both HVAC units and lighting in the same areas encourages friendly competition about who has the best conservation ethic and lowest utility bills.

PETER LONG

Mike Youso, who specializes in balancing HVAC systems, also works with digital controls. He advocates controls with user friendly software and display screens which clearly show the building operator what the system is doing.

To be effective, digital controls require programming specifically adapted to the changing demands of the climate and the various activities within the building.

Complaints about comfort and air quality in new buildings often stem from poorly adjusted systems, not from their actual design. These sophisticated control systems can only work correctly when the information on the control screen actually matches what is going on in the HVAC system.

For example, especially in the north, there may be problems if there is no budget for commissioning and balancing. This testing, fine tuning and tweaking of HVAC systems ensures they are delivering what the design engineers intended and what the users need.

Heat pumps and earth energy systems

HVAC engineer Eric Albertini says that although there has been a large push for the use of heat pumps in the Yukon in the last year, they are not a universal tool. "They definitely have their applications if you are designing for simultaneous heating and cooling loads," he says. In that kind of situation, they are more likely to generate energy savings.

Albertini sees good potential for the use of heat pump technology in the new multiplex where there will be heating demands for the swimming pools and cooling demands for the ice rink surfaces.

Heat pumps can move heat between two fluids or from air-to-air. Even if the inside of a fridge is cold, it can be made colder by removing additional heat. This is also true on a larger scale. Even outside air has heat that can be taken from it with a heat pump and transferred inside to heat a building.

The Yukon Brewing Company uses a heat pump to cool tanks in the building at the same time it heats the interior air. Another energy efficiency at the brewery is the use of a fresh water coil to cool the beer wort (malt extract). The heat removed from the wort preheats water which is saved in a tank for the next brewing batch.

PETER LONG

The Financial Plaza Building on Lambert Street was originally a two-storey building erected in 1980. In 1987, new floors were added. The new construction featured spray-on insulation and coated windows to improve energy efficiency. More efficient lighting was installed in 2002-2003 and a SOLARWALL® installation is under consideration. This would use solar energy to pre-heat the air brought into the building.

...Times change

new construction was more energy efficient with better windows and more insulation.

There was renewed confidence in the second half of the 1980s, shown by the construction of the Shoppers Drug Mart and Sword buildings.

In the 1990s, Yukon architects came into their own. Locally designed schools became the centrepieces in a number of Yukon communities: Ferguson Simek Clark's Chief Zzeh Gittlit School in Old Crow, Charles McLaren's Ross River School and Kobayashi + Zedda's J.V. Clark School in Mayo.

The Watson Lake School is connected to a waste heat recovery system that uses heat generated by The Yukon Electrical Company Limited's diesel power plant in that community. This gives the building

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YUKON GOVERNMENT

YUKON GOVERNMENT

YUKON GOVERNMENT

1 The Robert Service School in Dawson City was the first of a number of new schools constructed in the Yukon, beginning in the late 1980s. 2 The Watson Lake School uses waste heat from diesel electric generators. 3 The Shoppers Drug Mart and Sword buildings on Main Street were constructed in 1986, joined by a pedestrian overpass on Third Avenue.

In the Yukon climate, earth energy systems may have greater potential since air-to-air systems decrease in efficiency as air temperatures decrease.

Ten metres down, earth or ground water remains at a remarkably consistent temperature — with a value close to the average annual air temperature. This allows ground source heat pumps to work efficiently year-round.

Earth energy systems can offer energy use reductions of 30% to 70% when used for heating and 20% to 95% when used for cooling.

Commercial earth energy systems can feed a variety of systems: air-based or hydronic (water-based) in either central or distributed systems. Distributed systems that use heat pumps connected in parallel can allow one heat pump in the circuit (say, on the north side of a building) to pump heat from the loop into the room while another (on a solar-heated side) takes heat from that area, cooling the area and feeding the heat removed into the loop.

Centralized systems using larger heat pumps can feed fan coil units in various zones of a building. Four-pipe fan coil systems can heat or cool different areas simultaneously. During the summer, a four-pipe system can use the cool ground for free cooling.

Setnam Rai, owner of Yukon Honda, is looking forward to the day when he will have a water licence that will allow him to use two wells drilled on his property to heat his car dealership. He says he was looking into being more environmentally friendly when he planned the building. He worked with the Energy Solutions Centre to investigate options and earth energy was the option chosen. Studies showed that an aquifer under the property would more than meet his heating needs.

Earth energy system benefits

- Lowest life-cycle cost.
- Lower operating and maintenance costs.
- Small mechanical room.
- Aesthetic design with no roof penetrations.
- Improved comfort with individual room control.
- Even temperatures.
- Lower humidity.
- Renewable energy option.
- Lowest greenhouse gas emissions.

Ian Stallabrass, of True Scale Design and Drafting, says "We should have started talking about earth energy systems six months before we did." As it happened, construction was well underway and heat pump equipment was ordered before it became apparent that the Yukon Water Board approval would not be secured before the building was commissioned. The result is a crowded HVAC room and a hybrid system that will generate savings so long as discount surplus hydropower sales are available.

Stallabrass says that Rai was an unusual client in that he was willing to make a bigger upfront commitment to install energy saving components. For example, make-up air for the shop exhaust system is preheated by a large reversing flow heat exchanger, which the manufacturer claims is 85% to 95% efficient. In the shop, where huge air exchanges take place when the shop door is opened, oil-fired radiant heat comes on only when the door opens. That way, the normal balance of the primary heating system is not affected.

The heat pump system in the building is organized in zones that allow solar heat gains in the showroom to compensate for heat losses in the shop.

Rai believes that the energy costs to operate his new building will be significantly lower than those for other car dealerships of comparable size. He is convinced that his investment in energy efficiency will pay off for years to come.

PETER LONG

Extra cooling was easily added to this utility room at Yukon Energy. The building draws groundwater from a well at a constant 5°C for building cooling, and discharges the warmer water into a rock pit. Four pipes, two hot and two cold, serve fan coil ventilation units distributed throughout the building. This allows the building to be managed by zones, drawing heat or cold when and where needed.

The Yukon Honda building, which opened in 2003, is currently heated with a hybrid heat pump system that can use either oil or electric boilers for heat but is designed to work as an earth energy system when connected to a ground loop on the property. The roof-mounted reversing flow heat exchanger is 85% to 95% efficient.

PETER LONG

PETER LONG

Hot water heating

Solar hot water systems use roof-mounted evacuated tube panels to pre-heat water supplying a conventional oil, propane or electrically heated hot water tank.

Gold Rush Inn owner, Doug Thomas, is sold on the merits of solar hot water. His hotel has had a commercial-scale solar water heating system for almost 20 years. When the initial system reached the end of its economic age, he re-invested in efficient evacuated tube replacement panels.

He found that high solar productivity from May to the end of August was a good match for his hotel which usually experiences its highest occupancy rates then.

Seasonal swimming pools at Dawson City and Haines Junction also use solar heating.

Ron Hatton, who has installed many Yukon solar systems, finds them simple and almost maintenance free. "Solar hot water systems all work," he says. "Whether they're cost effective depends on the expectations of the user."

Hatton recommends the following:

- Document the water use requirements. Hot water use at the Gold Rush Inn was monitored for six months and then matched with occupancy rates to get firm numbers to guide system design.
- Anticipate a 10- to 15-year payback term. Solar hot water provides long-term economic benefits.
- Consider your seasonal hot water requirements.
- Orient your building and roof to take advantage of solar gain and allow for mounting of solar panels.

ENERGY SOLUTIONS CENTRE

Doug Thomas showing off vacuum tube solar collectors on the roof of the Gold Rush Inn.

PETER LONG

PETER LONG

PETER LONG

1 The 1992 workers compensation building has a love-it or hate-it "industrial" exterior with yellow playmobile-like windows set off against dark blue metal cladding. Space was left on the site for trees and plantings. 2 The Elijah Smith federal building on Main Street features a large open courtyard backed by a wall of windows on the atrium. 3 Home to l'Association franco-yukonnaise, this French-style building is a real eye-catcher.

...Times change

the best school energy consumption figures in the territory.

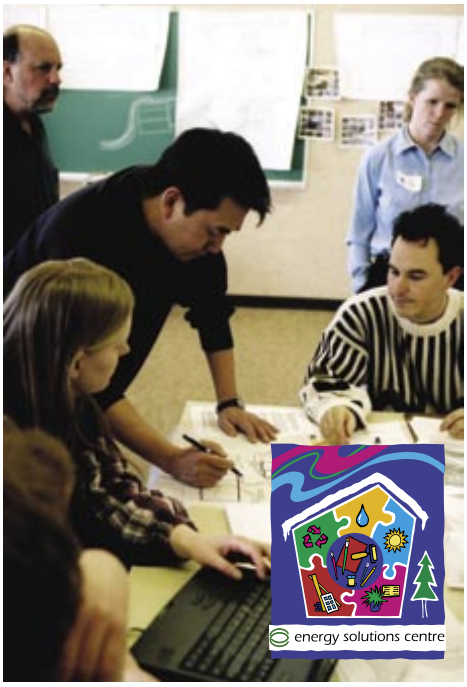
The look of Whitehorse changed significantly in the 1990s. A new federal building gave Main Street a more contemporary look, as did local store owners who renovated the exteriors of their buildings. The Yukon Workers' Compensation Health and Safety Board building on Fourth Avenue, the Whitehorse Travel and L'Association franco-yukonnaise buildings on Third Avenue, the Silver Centre on Black Street, and the new Yukon Visitor Reception Centre on Second Avenue all contributed to a new visual appeal.

The new century ushered in the era of the box-store in Whitehorse with construction of Wal-Mart on the Argus site and the Real Canadian Superstore on a site that used to be a transfer yard for White Pass ore trucks.

A combination of economic uncertainty and increased environmental awareness has led designers to factor more energy efficient features into their buildings. Today, nationally and internationally recognized buildings such as the Yukon Energy building and the Mayo school provide models for Yukon designers to emulate.

The Energy Solutions Centre worked with the designers of the new Real Canadian Superstore, which opened in 2003, to incorporate some energy efficient features. These included waste heat recovery from store refrigeration and use of secondary electrical boilers to work with surplus hydroelectricity.

PETER LONG



ENERGY SOLUTIONS CENTRE

The integrated design process workshop at the Green Building Design Competition provided training opportunities for Yukoners. The logo for the green building design program is inset above.

Putting it all together

Energy efficient buildings with good indoor air quality are especially important in the Yukon, given the amount of time we spend indoors during our long, cold winters.

Building must begin with a solid plan. To be successful, all the design elements have to work together. Using an integrated design process will assure collaboration amongst all the parties involved.

From land selection and site planning, to the way the building goes up, to the electrical, heating, ventilation and air conditioning systems, everything needs to work together.

The plan for the building must also include maintenance and upkeep of the structure and its systems into the future.

The way of constructing buildings is changing to take into account all of these factors that contribute to green buildings. In the process, Yukon designers, architects and engineers are winning awards and setting trends for the future.

Energy Solutions Centre

The Energy Solutions Centre, established in 2000 as a joint project of the Government of the Yukon and Natural Resources Canada, is a resource for building owners, designers and builders who are interested in constructing energy efficient and ecologically appropriate buildings or increasing energy efficiency of existing buildings.

To do this, the Energy Solutions Centre provides technical services, supports the development of private sector energy expertise, conducts research, and supports demonstration projects for efficiency and renewable energy technologies. It also promotes energy awareness and delivers territorial and federal efficiency and renewable energy programs that provide integrated energy solutions.

Most popular among these today is the Renewable Power Sales Incentive Program, which encourages commercial building retrofits to allow the use of surplus hydroelectricity.

The Energy Solutions Centre also offers comprehensive efficiency and renewable energy audits for commercial buildings to look at the operating efficiency of current buildings, propose options for increasing energy efficiency or employing renewable energy, and provide estimates of payback periods for those options.

Partnerships

Through the Professional Development for Sustainable Energy Solutions Cooperation Agreement, Yukon Development Corporation and the Energy Solutions Centre have partnered with the Association of Professional Engineers of Yukon, to develop the Yukon's technical capacity by assisting the professional development of Yukon engineers, allied professionals and technical occupations.

DOUG MACLEAN

The Energy Solutions Centre operates out of a private sector building that is acting as a test bed for energy efficient construction alternatives. The dark panel on the south face of the building is a SOLARWALL®. Even in cold temperatures, it can harvest solar heat. On the roof are three solar array panels which heat the hot water for the building.

Green building design support service

If you are planning a new commercial or institutional structure in the Yukon, you can take advantage of the green building design support service offered by the Energy Solutions Centre. Contractors are available to work with you investigating and evaluating sites, including selection of northern-appropriate approaches to siting a building. They will also help you with selection of a design team and can arrange for an integrated design process. You can chose to continue contact with the contractors for any questions or concerns that arise throughout the life of the project.

The service is currently working on a variety of buildings, including a co-op housing project, the athletes' village that will be part of the 2007 Canada Winter Games complex, and a resort near Carcross.

This service is available at no charge to the public.