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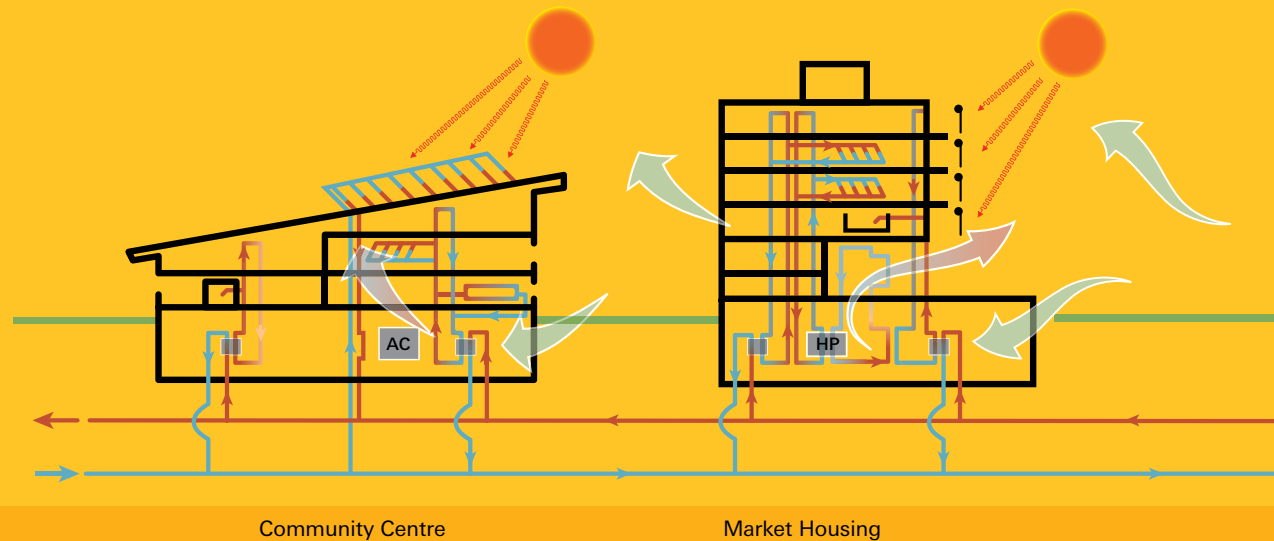
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SHIFTING THE PARADIGM

“How on earth can that work? Hot air rises.”

That’s the response of most North Americans who have contemplated the radiant heating system embedded in the ceilings of the Olympic Village. When hot air systems are all you’ve experienced, it’s a struggle to understand how heat energy carried by water can “come down” from above.

This is just a single example of the paradigm shifts – outside our experience and often beyond our current understanding – that we must make to achieve a sustainable society.

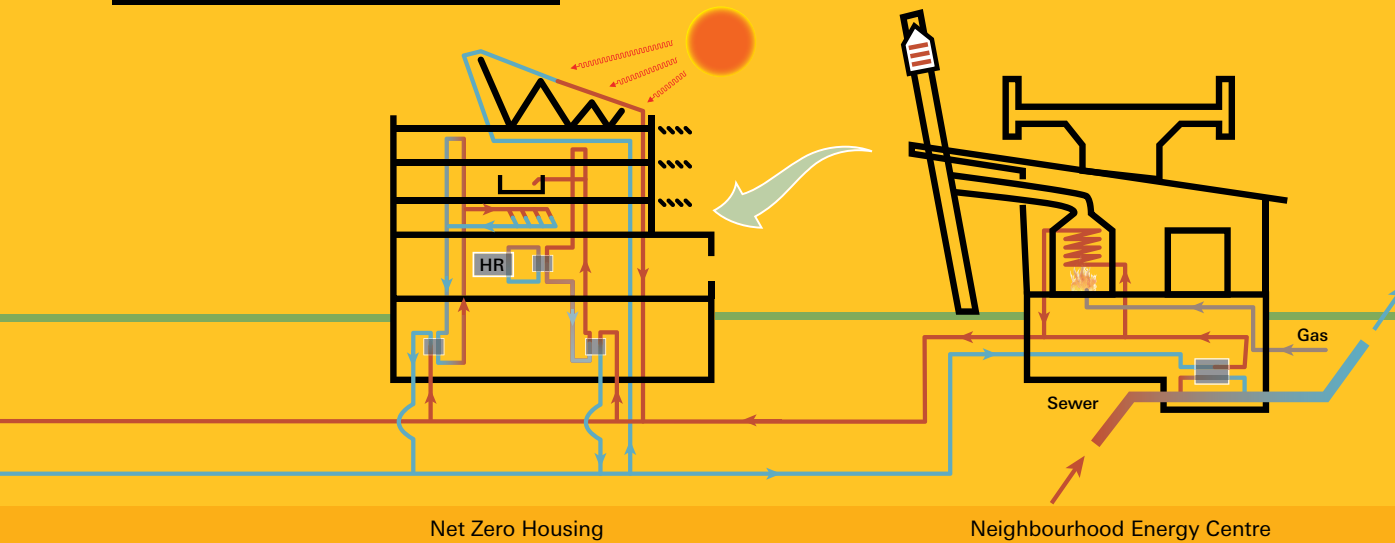
As the globe warms, alarmingly more quickly than originally forecast, we need to challenge almost all of our existing paradigms. And we need unprecedented collaboration and buy-in, across a diverse set of professions and individuals, if the necessary paradigm shift is to occur.

To achieve the energy efficiency goals of the Olympic Village, designers, engineers, contractors and trades had to drop traditional boundaries. Architects worked within passive design constraints aimed at satisfying engineering standards for thermal comfort. Engineers supported trades

in learning how to install unknown technology. There was risk involved – how do you quote on a job when you’ve never done it? Yet, as the work progressed, new capacity was developed. Numerous firms in the Vancouver area now have experience with a highly energy-efficient alternative – from estimates to installation.

The paradigm shift still lacks a final piece, however. Future Village inhabitants must also learn the technology – from a thermostat that doesn’t show air temperature, to knowing how to treat their ceilings. They will be provided with a device that will report how much energy they are using – but they must choose whether to care, and whether to reduce their consumption to a sustainable level.

An integration of skills and knowledge was necessary for the energy systems to be designed and implemented at the Olympic Village. But an integration of intent – from designer through to resident – is required to deliver the project’s potential. This is certainly a new paradigm: working across differences to solve a global problem. The Olympic Village provides hope that we may be able to arrive at such an integration of intent, and make the paradigm shift we need.



This schematic shows four different building typologies from an energy systems perspective, and how they are all connected to the district heating and cooling system.

This chapter tells the story of energy systems at the Olympic Village, from sewage to ceiling. The details of the systems themselves – while rich with innovation at present – may fade in relevance as technology continues to improve. Critical in these pages, however, is the story of shared problem-solving, learning, patience and cooperation. The tone of urgency is appropriate too – driven on this project by the tight deadline, but looming over us much more widely as the world’s climate changes.

The story begins at the end, with the closed-loop concept of energy being drawn from what has already been thrown out. The Southeast False Creek Neighbourhood Energy Utility will produce from sewage much of the energy required by the Olympic Village and adjacent

neighbourhoods yet to come. The chapter moves on into radiant energy and energy design, and includes stories of implementation. Finally we detail the behavioural supports – the how and why of measuring energy use and the hoped-for results of providing that information to residents.

Energy is, without question, a critical topic in a shift to sustainability. Not only does energy efficiency correlate in most jurisdictions with greenhouse gas reduction, it is also an area of sustainability where problems and progress can be precisely measured and subjectivity kept to a minimum. If you save energy, you generally save money. For all these reasons, raising the bar in this area is critical to gaining the momentum we need.

“We need unprecedented collaboration, across a diverse set of professions and individuals, if the necessary paradigm shift is to occur.”

Blair McCarry – An Energy Challenge to Building Professionals

If you're in the building industry, it's time to start looking ahead if you want to serve your clients well. To date, Canadian jurisdictions have been slow to adopt energy codes, so a lot of building professionals haven't had to pay attention to energy efficiency. But there's big change on the horizon.

Two key factors in energy standards are changing: energy-efficiency goals are increasing and the way we assess efficiency is shifting.

Most energy codes are based on ASHRAE [American Society of Heating, Refrigerating and Air-Conditioning Engineers] standards. Basically, they set insulation levels, amounts of glazing, equipment

performance levels, etc. Either you follow this thick rule book or you have to do some energy modelling to prove your building is energy efficient. The Province of BC, which does have an energy code, bases its code on ASHRAE 2004 standards; the City of Vancouver, which has been a leader in this area, has a code based on ASHRAE 2007. It all sounds good, but generally, good construction would have met these standards anyway.

Since 1989, the ASHRAE standards have slowly improved by about 18%. But the next standard, due in 2010, is going to be a 30% increase in efficiency over the 2004 code. That's going to hit some people like an Exocet missile – those who haven't

been paying attention and aren't ready for it.

Meanwhile, the City of Vancouver has indicated that they're headed towards a performance-based code. That means energy intensity, the energy use per square metre, will be measured. This is how many European countries already do it. They don't dictate 92 pages of building specifications – they say, "do what you want, but this is all the energy you get." They're controlling what they want to control: energy consumption. A lot of jurisdictions are looking even further ahead – starting to target Net Zero energy and Net Zero greenhouse gases. And some cities – such as New York – are

mandating building energy retrofits, not just looking at new construction.

Building professionals need to get on this, fast. Building to code is like making the worst building you can without getting sued. If you're doing a good job for your client, especially if they want to do any environmental flag-waving, you instead have to aim ahead of today's standards, because by the time that project is actually designed and built, it could be lagging behind.

This is an exciting time, a time of really big change. We're doing catch-up in Canada, but we're getting carried along on the wave.

Blair McCarry
PEng, PE, LEED AP, ASHRAE Fellow

...by the time that project is actually designed and built, it could be lagging behind.

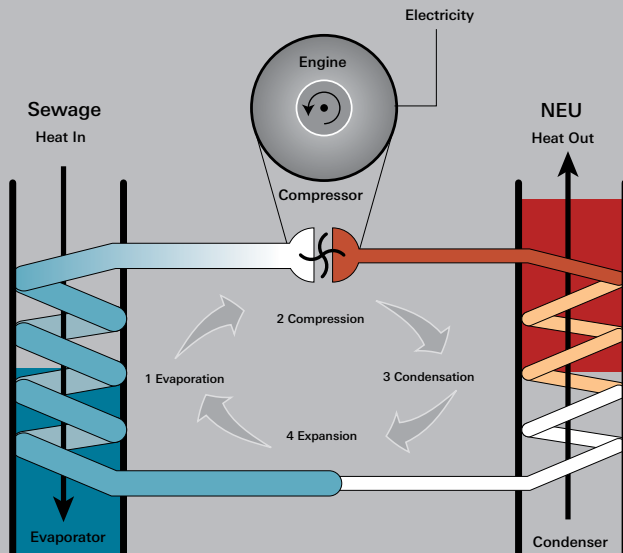
Heat = Energy

We're accustomed to thinking of heat in terms of what it does in our daily lives. We purchase energy to heat our food and warm our homes. We don't often think of heat as a form of energy that can be captured and transferred, replacing the need to purchase other forms of energy. That concept, however, is at the heart of this chapter – the reduction of fossil fuels by capturing heat that already exists.

Heat is caused by the movement of molecules – the infinitesimally small particles that make up ourselves and the things around us. Molecules are in constant motion, spinning and bouncing against one another as they move through space. What we call temperature simply describes how fast these molecules are moving. In a fresh cup of coffee, the water molecules are moving fast, and we feel this thermal motion as heat radiating from the cup when we hold it. Like billiard balls striking each other, fast-moving water molecules bounce against the

slower-moving (cooler) molecules of the mug, warming the cup (and cooling the coffee). The transfer of heat is a transfer of energy.

At the False Creek Neighbourhood Energy Utility (NEU), circulating coolant (water) is warmed as it moves through a heat exchanger past municipal sewage (never mixing with it). An engine adds pressure to the warmed coolant, intensifying its low-level heat. It then moves through a heat exchanger with the water that circulates throughout the Village. It loses pressure as it goes, which releases energy – transferred as heat. The hot water goes to the Village where it will transfer its heat (energy) to each building's separate system (and come back cooler). The coolant, having released its heat, travels back to the sewage heat exchanger and starts its warming cycle again. The heat in sewage is a source of renewable energy, augmented by natural gas when the Village's energy demand is high.



A heat pump is a machine that moves heat from one location to another using mechanical work. Most often, the technology is designed to move heat from a low temperature heat source to a higher temperature heat sink. Common examples are food refrigerators and freezers, air conditioners, and reversible-cycle heat pumps that provide thermal comfort.

PROFILE

Olympic International

Experts in heating, ventilation, air conditioning and automation control equipment since 1963, Olympic International was central to the design and installation of heating and cooling systems at the Olympic Village. President Mike Mahannah says working on the Olympic Village was an opportunity to implement ideas he has learned elsewhere in the world.

"In Germany, there's such a different paradigm in construction," says Mahannah. "For example, everyone working in an office must sit within six or seven metres of a window, to have access to daylight. Their building shapes are different because of that one law.

"They also build buildings to last 350 years, unlike our throwaway mentality in North America, where we consider buildings old when they're 30. It's a different mindset in terms of quality."

Olympic International tackled many challenges that arose as new technology was implemented at Olympic Village. The company trained installers, developed detailed ceiling designs and helped a specialty manufacturer scale up to handle production of the energy transfer centres for each suite.

"Part of our vision as a company is to bring world-leading products to the local marketplace," says Mahannah. "Our work on the Olympic Village was a part of that vision."

District Heating: Why do It?

District energy systems distribute heat generated in a centralized location for residential and commercial hot water and space heating requirements. Heat energy from a district energy system is distributed through underground insulated pipes that connect to buildings. District energy systems eliminate the need for a boiler or furnace in each individual building and can provide higher efficiencies and better pollution control than localized equipment. Beyond fossil fuels traditionally used for heat production, district energy systems are adaptable to a wide variety of alternative energy sources including geo-exchange, solar, biomass, waste heat recovery and nuclear power.

“District energy was the vehicle for meeting our renewable energy supply objectives”

Chris Baber, NEU Manager, City of Vancouver

Among the guidelines that governed the redevelopment of SEFC were ambitious greenhouse gas reduction and energy-efficiency objectives. In 2003, Brian Crowe, the City of Vancouver’s Assistant City Engineer for Water and Sewers, championed the idea of implementing a district energy system as a means of meeting energy efficiency and sustainability targets. District energy systems offer the flexibility of using a wide range of renewable energy resources. For this reason, the City of Vancouver’s Neighbourhood Energy Utility (NEU) team had their choice of technologies.

“First we had to determine our objectives,” says Chris Baber, the City of Vancouver’s NEU Manager, “by identifying the types of energy usage and quantifying the demand.” Designing an efficient district energy system requires a holistic approach to system design. To choose an appropriate energy source, the team had to determine which technology would best meet the social, environmental and economic objectives and constraints of the new community.

To help with this, FVB Energy and Compass Resource Management were retained by the City of Vancouver to conduct a district energy feasibility analysis. FVB Energy analyzed a wide variety of energy source options, producing a “Heat Source Options” report for the City. Two viable alternatives emerged from this process: biomass or sewer heat recovery. Compass Resource Management, led by Trent Barry, produced a business analysis report evaluating the economic, environmental and social performance of the two heat source options.

Based on the results of this study, the City of Vancouver approved the development of the NEU in spring 2006. The NEU team explored the two options in depth, hosting a series of public consultations before eventually arriving at a decision.

THE CONTENDERS: BIOMASS VS. SEWER HEAT RECOVERY

Biomass

A biomass facility is a boiler-based energy plant that efficiently burns wood or other organic waste. Modern biomass plants are equipped with state-of-the-art emissions controls to mitigate adverse effects on air quality. As an energy source, biomass is considered to be greenhouse gas neutral since wood waste emits carbon dioxide into the atmosphere regardless of whether it is burned or left to decompose naturally. Biomass has gained popularity in northern Europe due to its low environmental impact. There are a few examples of biomass plants locally, in Seattle, Washington, and Revelstoke, BC.

Sewer Heat Recovery

Sewer heat recovery, in contrast, is a less proven technology than biomass. There are only three sewer heat recovery systems worldwide that recover heat from untreated sewage, two in Oslo, Norway and one in Tokyo, Japan. Sewer heat recovery captures waste heat from municipal sewage. Similar to a geo-exchange system, electric heat pumps transfer thermal energy from warm sewage (12–25 degrees Celsius) to a higher temperature useful for residential space heating and domestic hot water. Compared to geo-exchange, sewer heat recovery is more efficient due to higher heat source temperature and lower installation costs.

“Nobody’s ever captured heat from mid-system in the middle of the city.” Ray Tarnai, Sandwell

Public Consultation

The City of Vancouver initiated a public consultation process to determine which technology would be implemented. As both biomass and sewer heat recovery were relatively foreign concepts, the public responded with both a keen level of interest and a high level of concern.

For the biomass option, there was a widely held perception that the combustion process would result in harmful air pollution, that the neighbourhood would be negatively impacted by fuel deliveries, and that it would require an unsightly industrial smokestack. The public was more supportive of sewer heat recovery, though concerns were raised about the possibility of odour and contamination.

“Implementing a new technology requires a great deal of public education,” says Chris Baber. “The public’s perceptions are not always based on technological facts. If you don’t have sufficient materials to present when you go public, people’s imaginations are left to fill the gaps. If we had had (an additional) six or twelve months, we would have continued to work with the public to address the perception issues.” In the case of this project, in order to stay on schedule the NEU team had to decide which system to implement. Sewer heat recovery prevailed as the technology of choice.

The City initiated a second public engagement process concerning the design of the False Creek Community Energy Centre, the facility that would house the NEU operations (see page 12). At the outset, the public was apprehensive about the construction of an industrial facility amidst a high-density residential neighbourhood. “People were fearful of opening up the sewer in their neighbourhood...but it became educational,” says Ray Tarnai of Sandwell, the engineering consultants who held the contract for the design of the Energy Centre.

Despite the fears that were raised, “We thought, we’ve got to do something, we can’t do nothing. We needed to find the right solution for the future,” remembers Tarnai. “In the end, the public said, ‘we’re okay, as long as we don’t notice it.’”

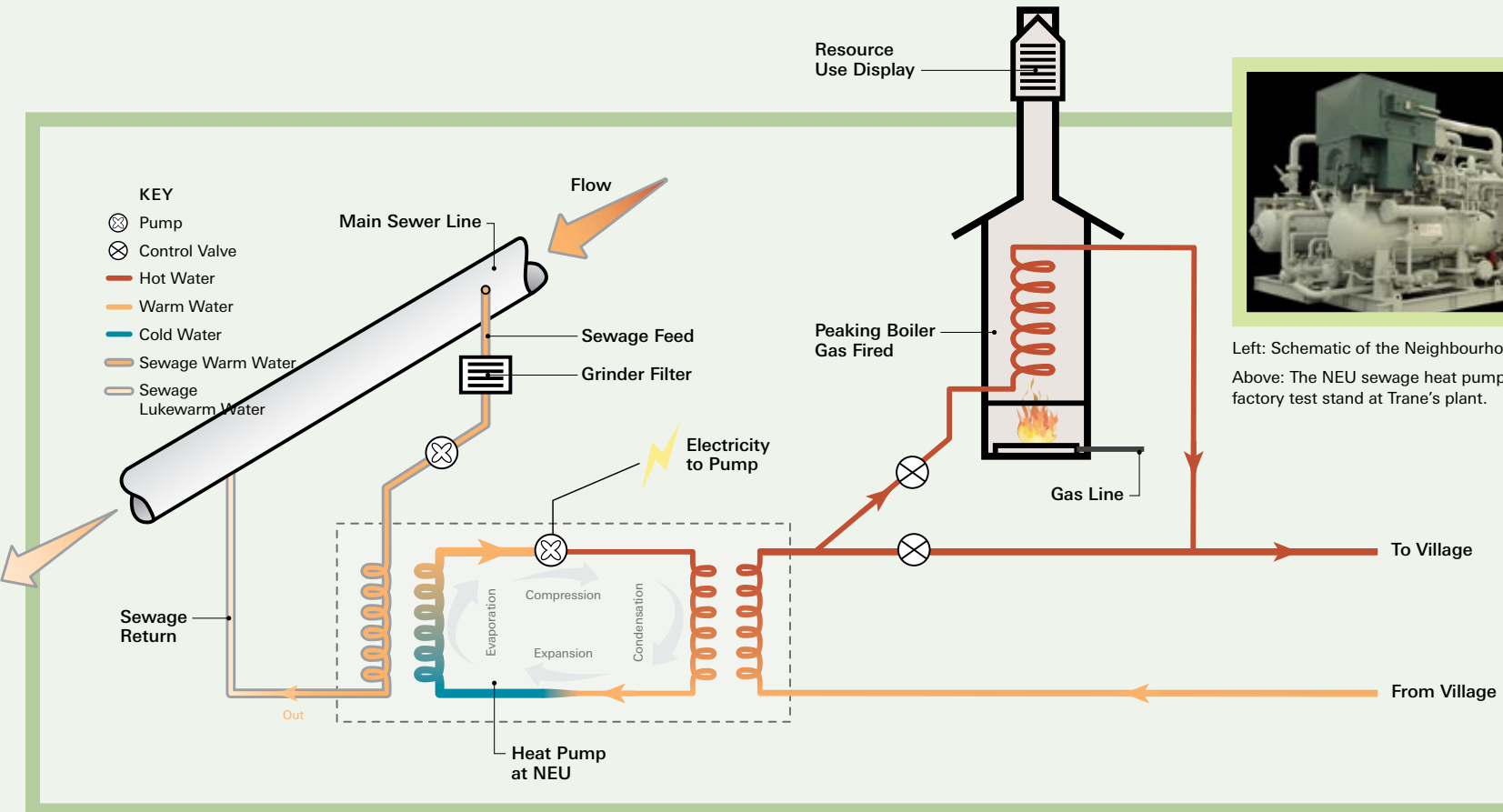
CHALLENGE

To municipalities and utilities: to future-proof their energy infrastructure by implementing energy distribution and supply systems that support renewable technologies and prioritize the use of locally available sources of energy.

SEFC Taps into a Local, Renewable Heat Source

The SEFC NEU is a community energy system designed to use and distribute heat energy from a variety of renewable sources. In the first phase of development it will get the bulk of its energy from heat recovery from an existing municipal sewer line adjacent to the SEFC site. This means that heat is captured and used in close proximity to its source, rather than transferring it from an off-site sewage treatment

plant, reducing the cost and inefficiencies of transmission over a distance. The NEU's localized sewer heat recovery system is the first application of this technology in North America and is ideal in a dense urban environment. "This type of sewage heat recovery system should be replicable and transferable to future urban district energy projects that will be developed in other areas," says Baber.



Left: Schematic of the Neighbourhood Energy Utility
Above: The NEU sewage heat pump photographed on the factory test stand at Trane's plant.



A distribution pipe system runs beneath the streets at SEFC, delivering thermal energy in the form of heated water from the Energy Centre to each of the buildings. Pipes are well insulated in order to reduce or eliminate energy loss through the distribution process.

How it Works

You cook a pot of pasta – and drain the boiling water down the sink. Water from hot showers, clothes washers and dishwashers join it – “waste” heat that represents a significant amount of available energy. But how does the warmth captured from the sewer become usable energy to heat a condominium at SEFC?

The answer lies in a heat exchange process integrated with a new municipal sewage pump station. Similar to a geo-exchange (or geothermal) system, heat pumps transfer thermal energy from the warm sewage supply to a higher temperature range that’s effective for residential space heating and domestic hot water. While similar in concept, sewage heat recovery is more efficient and cost effective than typical geo-exchange systems. The

heat source (raw sewage) has a higher temperature than ground-source heat (on average 18 degrees Celsius as opposed to 8), so it requires less energy to upgrade. Secondly, accessing the sewer line is less invasive and less capital cost intensive than drilling into the earth to access geothermal heat. It also utilizes a continuous supply of waste heat, closing the loop on a fundamental energy >> waste >> energy stream. According to the City of Vancouver, the sewage heat recovery will supply approximately 70% of the neighbourhood’s annual heating and hot water energy demand, and will produce 50% less greenhouse gas emissions compared to conventional energy sources.

PROFILE

Chris Baber

PEng
NEU Manager, City of Vancouver

As the City of Vancouver’s NEU Manager, Chris Baber has played the lead role in implementing the Southeast False Creek Neighbourhood Energy Utility. His involvement has ranged from management of NEU infrastructure, business development and bylaw enactment to regulate energy services, to managing the utility once it is operational.

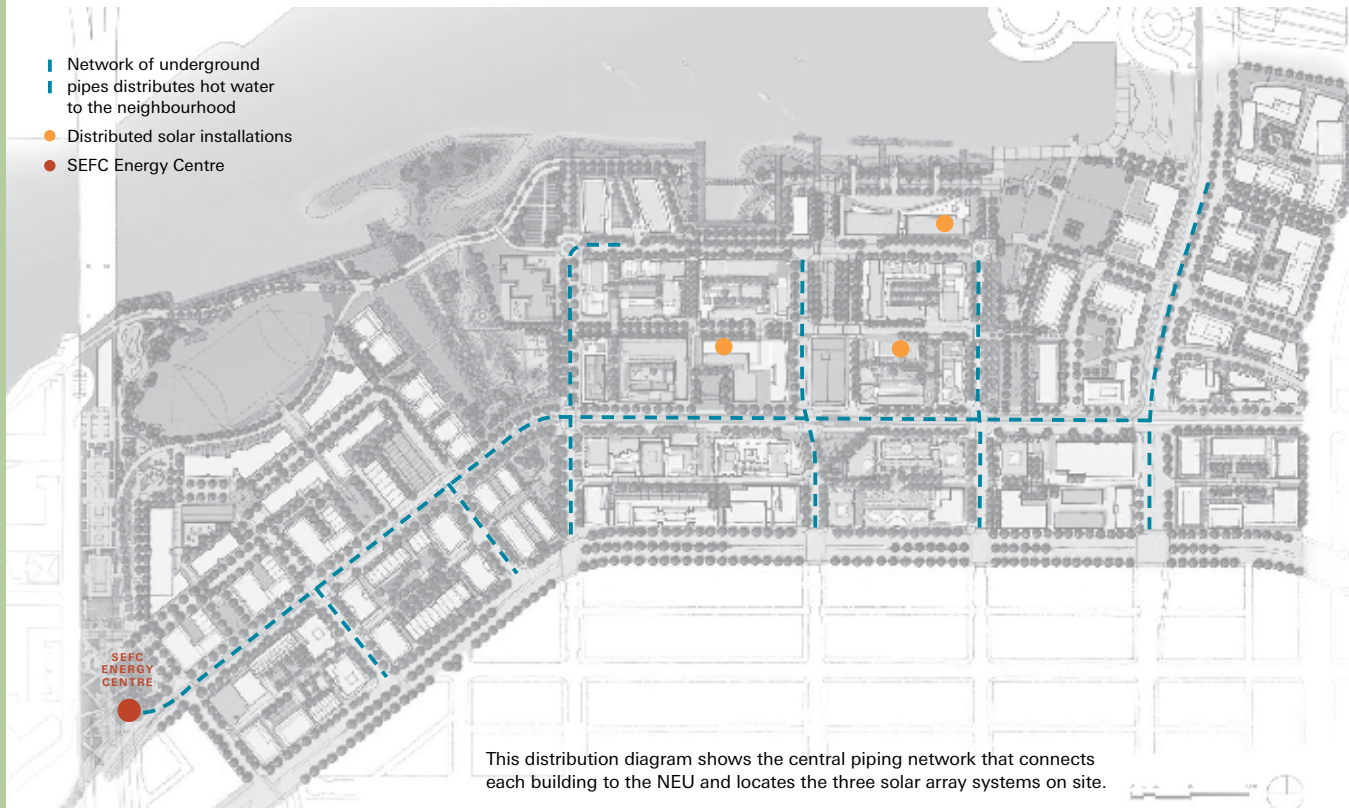
Baber and his team have overcome many challenges along the way throughout concept design, implementation and construction. Beyond the technical and schedule challenges, complexity was added through stakeholder engagement requirements and the implementation of a new municipal utility business model that needs to (through its customer rates) recover its costs associated with capital intensive renewable energy infrastructure while being cost competitive with traditional forms of heating.

Baber’s job description changed considerably as the project moved from concept stage to implementation and operations. By assembling and managing a skilled team of City staff, consultants and contractors, the project’s challenging objectives were achieved. Having worked hard to address the challenges, Baber says, “I am excited to get the plant up and running and build on this experience to see district energy expanded to serve other areas of this city.”

Efficiency and Adaptability

All buildings at the Olympic Village are connected to the NEU by a system of underground piping that distributes the thermal energy. There are three main components to the NEU: the NEU Energy Centre, distribution pipe system and energy transfer stations. The following is an overview of the energy transfer process:

1. The sewage heat recovery process is co-located with a sewage pump station at the False Creek Community Energy Centre, under the south end of the Cambie Street Bridge. On cold days when the heat demand is the highest, the system will be augmented by heat produced by three high-efficiency natural gas boilers. Using natural gas for backup and peak demands ensures reliability and competitive costs.
2. Distribution pipes circulate hot water from the energy centre to buildings and return slightly cooler water back to the energy centre. The pipes are well insulated to minimize energy loss during the distribution process.
3. Energy Transfer Stations located within each SEFC building produce space heat and domestic hot water to be distributed to occupants by the customer building’s mechanical system. Metering will be incorporated in the Energy Transfer Stations for energy measurement and billing purposes.



This distribution diagram shows the central piping network that connects each building to the NEU and locates the three solar array systems on site.

Future-proofing

The NEU is designed to service all 32 hectares of SEFC: an estimated 16,000 people, plus commercial and institutional facilities. The NEU was built in such a way that it can be expanded to meet growing demand. At the moment, its primary energy source is sewer heat recovery. The system will also accept heat energy from a variety of waste heat and renewable energy sources, and was designed on the basis that new energy supply would be added as the system expands in the future. This flexibility enables the system to keep pace with technology advancements, future-proofing customer buildings and ensuring long-term energy security and affordability. “This project could become a real benchmark system in North America,” says Tarnai.

INCORPORATING RENEWABLE TECHNOLOGIES

Integrated Renewable Energy: Thermal Net Metering

Three of the buildings at the Olympic Village feature roof-mounted solar thermal arrays. This technology captures the energy from the sun for domestic hot water heating. During peak sunlight periods, the solar systems will generate a surplus of heat energy – in excess of the building’s demand for hot water. Rather than waste this free, renewable energy, excess heat from the solar arrays is sold to the NEU through energy transfer stations. The energy is then redistributed through the NEU pipes for use in other buildings. The energy transfer is regulated through a ‘thermal net metering’ provision in the City’s Energy Utility System Bylaw, whereby the NEU purchases excess energy from the individual customer. This two-way energy transfer system design enables any micro-producer of thermal energy that is connected to the system to sell their excess energy to the utility.

Long-Term Outlook

District energy systems are not new. Vancouver has a number of legacy steam heat systems that serve the downtown core, and three of the city’s large hospital sites. The City of Vancouver is exploring future opportunities to introduce the district energy model, with staff mapping potential future sites and identifying sources of waste heat as part of a city-wide district energy study. Areas that are being developed to support a dense population are prime candidates for an infrastructure and utility program similar to the NEU. In addition, the City is exploring the opportunity of switching the local legacy steam heat systems from fossil fuels to renewable energy sources.



Photos of the solar array structure being installed on the roof of the Net Zero building on parcel 9.

PROFILE

Kieran McConnell

PEng, LEED AP
NEU Systems Engineer, City of Vancouver

As Systems Engineer for the NEU, one of Kieran McConnell’s responsibilities during the design of the utility and the Olympic Village was to integrate the NEU system with the buildings at SEFC. “You don’t design buildings independently [of their energy systems],” says McConnell, who spent a good deal of time liaising with the engineers and architects of the Olympic Village buildings.

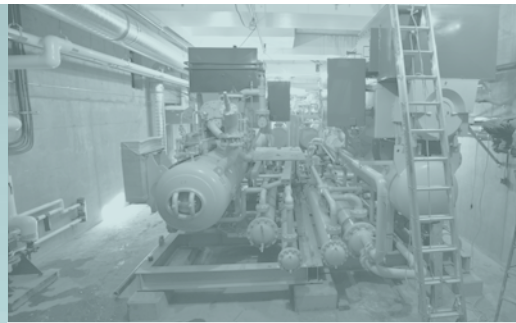
McConnell provided technical oversight for the entire project. There were a number of challenges in designing the system, largely because “low temperature district energy is new territory for Vancouver’s engineering community.” Where there were no precedents to some of the engineering challenges that arose, McConnell worked with the team to arrive at alternate solutions.

McConnell says that when the community moves into the Olympic Village and the NEU is operational, he is “looking forward to seeing actual usage data – how much (energy) is being used and at what time – and how our system is able to meet the demand.”

The False Creek Community Energy Centre building is designed as an interpretive facility to showcase the innovative use of sustainable technology. The building, designed by Walter Francl Architecture, is targeting LEED™ Platinum Gold certification. “There is an emphasis on information and public education, and a high degree of transparency to the building,” says Francl, alluding to the street level portals that allow the public to view the machinery down below. The City of Vancouver had a strong interest in showcasing this innovative technology, so it initiated a public dialogue about how the building would be designed, including design charrettes with local residents and two well-attended open houses. Francl comments that “though the building is, in essence, an infrastructure project, we didn’t want to contain it completely in a windowless box. We were challenged with designing an attractive building form for a sewage pump station.” The designs were well received. At the City’s open houses, recalls Baber, “the public expressed overwhelming support for the technology and design.”

One of the challenges of designing the building was keeping its footprint as small as possible in an effort to preserve public right-of-ways in the vicinity of SEFC. “The building responds to existing urban design form,” says Francl. “Three-quarters of what’s happening in this building takes place underground.” The Energy Centre is located directly underneath the Cambie Street Bridge, a car, bike and pedestrian bridge that leads to Vancouver’s central business district. Given the close proximity of the bridge footings, specialized excavation methods had to be used to ensure that the structural integrity of the bridge was not compromised. The building’s small footprint freed up half of the site for landscaping, and its above-ground portion is designed to accommodate tours and serve as a public education resource.

Left: Architect’s rendering of the False Creek Community Energy Centre, nestled under the Cambie bridge.
Below (group of four): Recent photos taken of the False Creek Community Energy Centre as it nears completion.



PUBLIC ART

Artistic Interpretation Adds Visual Appeal to the NEU

In an effort to make the new building aesthetically appealing and to draw attention to the sustainability and innovation of the NEU, the project commissioned local artists to provide a design that would transform the system's emissions stacks to a community amenity. Local designers Pechet and Robb Art and Architecture were up to the challenge, coming up with a design both attractive and functional.

The NEU has five exhaust flues: three for the three natural gas boilers, one for an odour control system and one linked to an emergency generator. Pechet and Robb's approach was to instill a "human quality" to these flues, their rationale being, "it seemed significant that the [Energy Centre] will be heating people with existing

body heat," says designer Stephanie Robb. The stacks extend into a sculpted stainless steel "hand," with each 22-metre long "finger" (flue) topped by an inclined "fingernail". The fingernails are LED lighting fixtures that will change colour to reflect the amount of green energy being produced by the system.

This artistic interpretation adds visual appeal to the NEU, inspiring residents and passersby to take an interest in the neighbourhood's sustainable infrastructure. "Initially, at the public consultations, people raised concerns about the appearance of the stacks," says Baber, "Today that's the part that people are most excited about. It's a great example of how good design and a good public process can bring people on board."

"It's a great example of how good design and a good public process can bring people on board"

Chris Baber, NEU Manager, City of Vancouver



Above, the artists' rendering and schematic drawing of the Energy Centre's sculpted stainless steel hand. The fingernails are LED lighting fixtures that will change colour to reflect the amount of green energy being produced by the system.

PROFILE

FVB Energy

FVB Energy Inc. is a management and engineering consultancy specializing in community energy. The Canadian company was founded in 1992 as a subsidiary of a Swedish parent company that has over 40 years of district energy experience globally. FVB was responsible for the feasibility study and conceptual system design of the NEU. FVB contributed to the design and construction of the Energy Centre, distribution system and building connection interfaces.

Bard Skagestad was the Engineer on Record for the NEU energy transfer stations (ETs) – the interface between the NEU system and each building's internal heating system. A key element of the district energy delivery system, ETs consist of heat exchangers, controls and meters, piping and miscellaneous equipment.

"The most challenging part of the project was coordinating between all of the various disciplines, particularly given the imposition of a tight project schedule," remarks Skagestad. The system's capacity to accommodate other renewable sources of energy, is, to Skagestad, "perhaps the most innovative feature of the energy system."

"My belief and hope is that this project will set a new standard for sustainable and adaptable energy supply systems for future developments in Metro Vancouver and beyond."



Thermal Comfort in the Home

What makes you feel warm? What makes you feel cool? If you're like most North Americans, when you think of these things in the context of your home, you'll think of that little box on the wall: the thermostat. We've been trained by years of forced-air heating systems and baseboard heaters to believe that air *temperature* equates to *feeling comfortable*. But that's not necessarily true.

"Think about being outdoors on a cold sunny day," says Goran Ostojic of Cobalt Engineering. "It's 10 degrees Celsius, yet you can sit in a nice sunny spot protected from the wind and enjoy your coffee. Now imagine a cloud blocks the sun. Suddenly you become cold because the air temperature is actually only 10 degrees. It was the *radiant energy from the sun* that was keeping you warm."

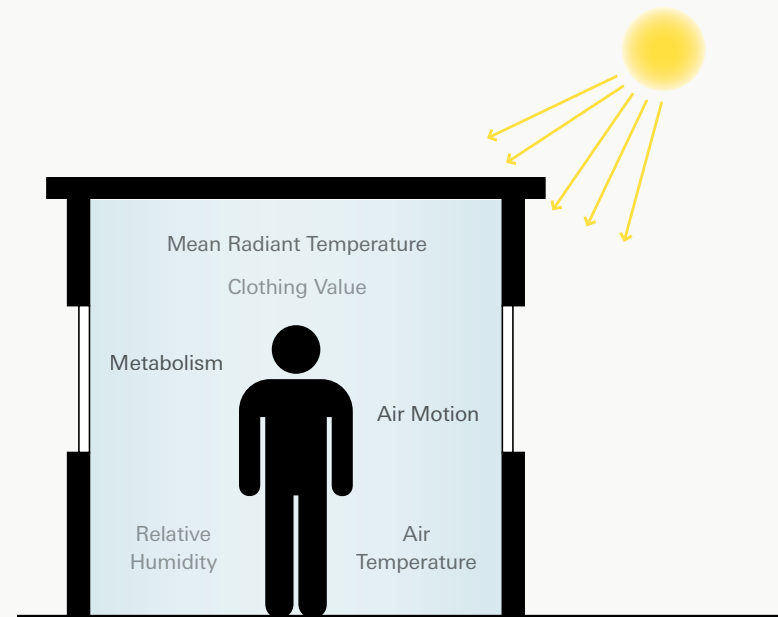
Feeling comfortable indoors comes from a variety of elements (see diagram) – many of which, such as humidity and air movement (drafts) are addressed

Radiation is how energy reaches us from the sun

in building design. Air temperature does play a role – but we've given it too much focus in the way we design our homes.

"Air is a very bad heat transfer mechanism – it's actually an excellent insulator," says Peter MacLellan of Olympic International (see page 17). "That's why forced air systems use so much more energy – they're designed to maintain a particular air temperature. With radiant heat, we can have people be comfortable without concentrating on changing the temperature of the air. And it turns out to be much more efficient because you don't have to pump all that air around all the time.

"So with a radiant system you have no thermostat giving an air temperature readout. It doesn't have a direct correlation to comfort."



Feeling comfortable indoors comes from a variety of elements – many of which, such as humidity and air movement (drafts) are addressed in building design.

HOW RADIANT HEAT WORKS Snowflakes falling in the air while you sit comfortably under an outdoor restaurant radiator. Shivering uncomfortably next to the cold glass of an office window despite a normal air temperature. Feeling relief near a cool concrete wall on a hot sunny day.

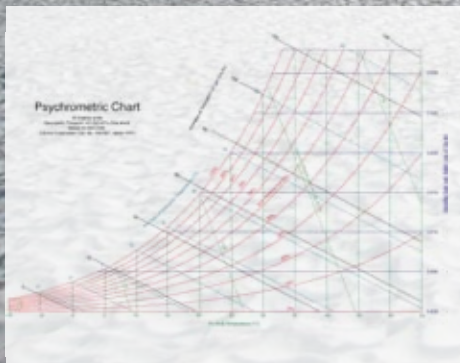
All these are examples of radiant energy transferring heat from one body to another.

“Heat transfers in three modes only: convection [fluid movement that carries heat, such as forced air heating], conduction [heat transferring without movement, such as a mug growing warm from holding coffee], and radiation,” says Goran Ostojic of Cobalt. “Radiation is how energy reaches us from the sun. It crosses a vast distance of universe with no air and warms

the earth. A radiant exchange occurs between two objects or elements with mass that have different temperatures. The air is completely insignificant.”

So radiant heating and cooling systems *act directly on your body* as you absorb or release heat energy to the other objects around you. Understanding the power of radiant energy – particularly what comes from the sun – is the first step to recognizing the importance of integrated, passive design in creating comfortable, energy-efficient places to live.

The psychrometric chart is a graph of the physical properties of moist air at a constant pressure (often equated to an elevation relative to sea level); it is a useful tool for engineers concerned with thermal comfort and passive design. The chart graphically expresses how various properties (dry bulb temperature, wet bulb temperature, dew point and relative humidity) relate to each other.



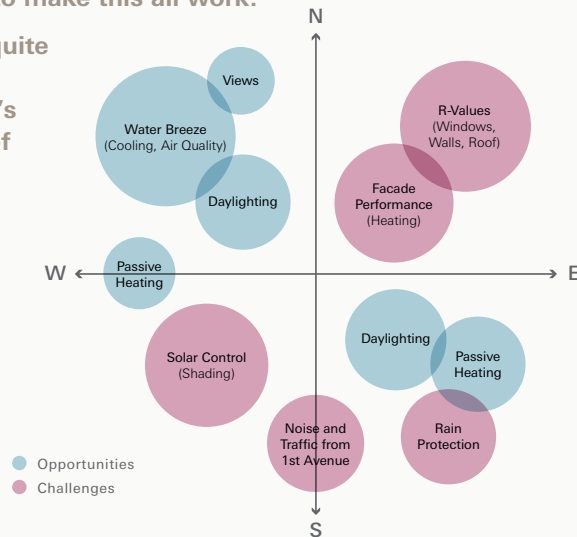
Don't fight Mother Nature. And work as a team. That's the advice on how to achieve high-performance, energy-efficient buildings.

“First, take advantage of the environment through passive design – a proactive approach to achieving comfort,” says Albert Bicol, one of Cobalt's engineers on the Olympic Village project. “Then use mechanical systems – which are reactive – to supplement as needed.” This approach uses less energy because it's not battling the glaring heat of summer (thanks to solar shading) or losing energy to the chill of winter (due to high-value insulation).

It makes sense, but it's not how most North American buildings are designed. “Buildings are becoming a commodity service, where various building design professionals operate in their independent silos,” comments Cobalt engineer Vlad Mikler. “We've had very low cost energy, so we're not motivated to get as much as we can out of passive design, because it requires multi-disciplinary coordination to a much higher degree.”

Mike Mahannah, President of Olympic International, agrees. “There was no way this [radiant heating] technology could have been applied if the architects and engineers didn't work together – the needs for heating and cooling would be too intense. You have to build a better building. It takes cooperation to make this all work.”

“The results appear quite extraordinary,” says Mikler. “But in fact it's just the proper way of designing buildings. There's nothing magical about it.”



Energy Modelling

To determine how a building design will perform in terms of comfort and energy usage, engineers use energy modelling. A three-dimensional computer model of the building is established, and then information about a wide variety of elements is assembled: the insulation value of the walls; the interior conditions to be maintained (i.e. ideal temperature and humidity); the schedule of occupancy; and the planned mechanical systems. Engineers then add the weather.

“For Vancouver we have database of standardized weather data for every single hour in an entire typical year,” says Vlad Mikler. “The simulation allows us to calculate the peak conditions for heating and cooling, as well as the building's aggregate energy consumption over the whole year.”

Mikler says the simulation is run twice – once for the building being designed and once for a hypothetical

building with the same dimensions and location, designed to meet only minimum code standards. The hypothetical building establishes a benchmark against which the planned building can be compared. Modelling for the Olympic Village buildings predicts they will be 30% to 70% more energy efficient than their reference cases.

Cobalt's engineers say they are lobbying against the current system of energy modelling, since it provides a comparison only between a building and its own minimum-code reference case (which can be somewhat subjective). A better system is one now being adopted in Europe, which assesses energy intensity – the amount of energy used per square metre. This system provides a standardized baseline, which allows different buildings to be compared and supports policy that regulates the total energy a building may consume. (See page 4, Global Voices).

It makes sense, but it's not how most North American buildings are designed. Buildings are becoming a commodity service.

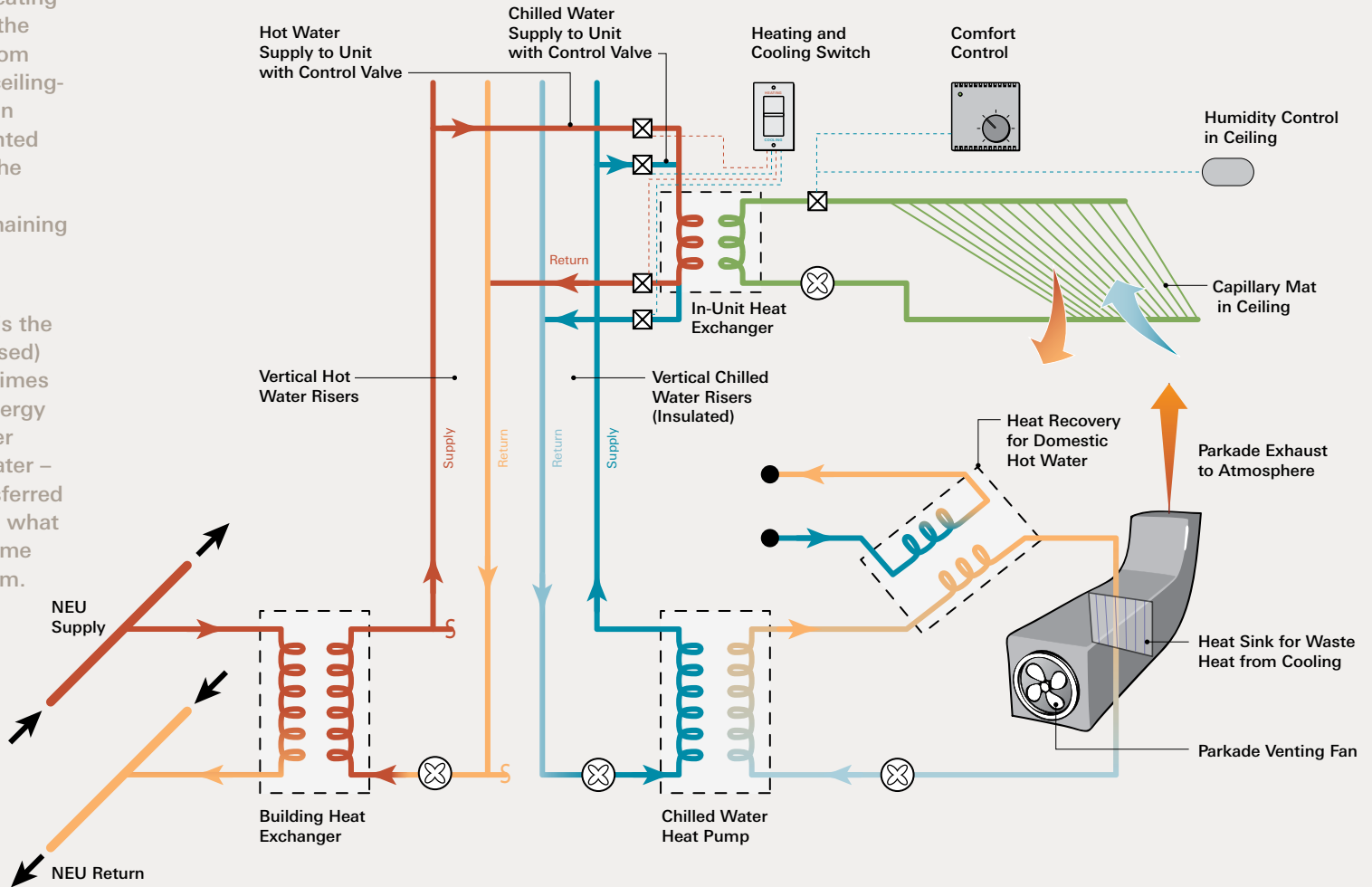
This microclimate diagram highlights the key challenges and opportunities, from a design standpoint, for each facade orientation.

Water: The Key to Moving Energy

This schematic shows the heating and cooling systems within the Olympic Village buildings, from the NEU supply through to ceiling-installed capillary mats within units. During cooling, unwanted heat energy is collected by the system and used to pre-heat domestic hot water. Any remaining heat is vented into building parkade ventilation systems.

A key element to efficiency is the system's hydronic (water-based) technology. Water is 3,000 times more efficient at carrying energy than air. Therefore, the power used for pumping heated water – per unit of heat energy transferred – is approximately one-tenth what is required to transfer the same heat using a forced air system.

- KEY**
- ⊗ Pump
 - ⊠ Control Valve
 - Hot Water
 - Warm Water
 - Cold Water
 - Cool Water
 - Capillary Mat



CHALLENGE

To all bodies establishing and applying energy standards and/or energy codes: to focus on performance-based measures related to energy intensity (energy usage per area), rather than specific components of building design such as insulation or window types. Energy intensity places the necessary emphasis on energy consumption and building performance, allowing alternate building designs to be compared.

Capillary Mats

With passive design planned and hydronic radiant energy the most efficient space-heating option, the Olympic Village's design team had to select a specific system for thermal comfort in the Village's many homes.

They chose a radiant "capillary mat" system invented by Donald Herbst in Germany in 1981 and installed extensively in commercial and residential buildings in Berlin. The inventor likens the system to the capillary veins in a leaf – or those in a human body, which maintain body temperature at a constant 37 degrees. Mats made of multiple thin-gauge tubes circulate water (warm or cool) across an extensive surface area, exchanging energy with any nearby mass.

"Radiant heat always moves in one direction only – always from the warmer element to the colder element," says Goran Ostojic of Cobalt. "During the winter we heat the ceiling to a slightly higher temperature than we want to

achieve in the space. The ceiling radiates to all the solid objects in the room, whether it's a human body or the furniture or your pot of coffee, and the opposite occurs in the summer, when we cool the ceiling to a temperature below what we want to achieve in the space. Then all the solid objects are losing heat towards it, so a human body is losing heat."

The system is governed by a simple control where the resident can shift the system between "heating" and "cooling" and adjust the intensity depending on their comfort level. (Non-market housing does not include a cooling mode.) The system has no blowing air, so maintenance is reduced, and there is no noise from fans, nor movement of dust or allergens. And since the system doesn't produce hot air, a resident can opt for warming while also having a window open for fresh air – and not "let all the heat out" of their space or waste significant energy.



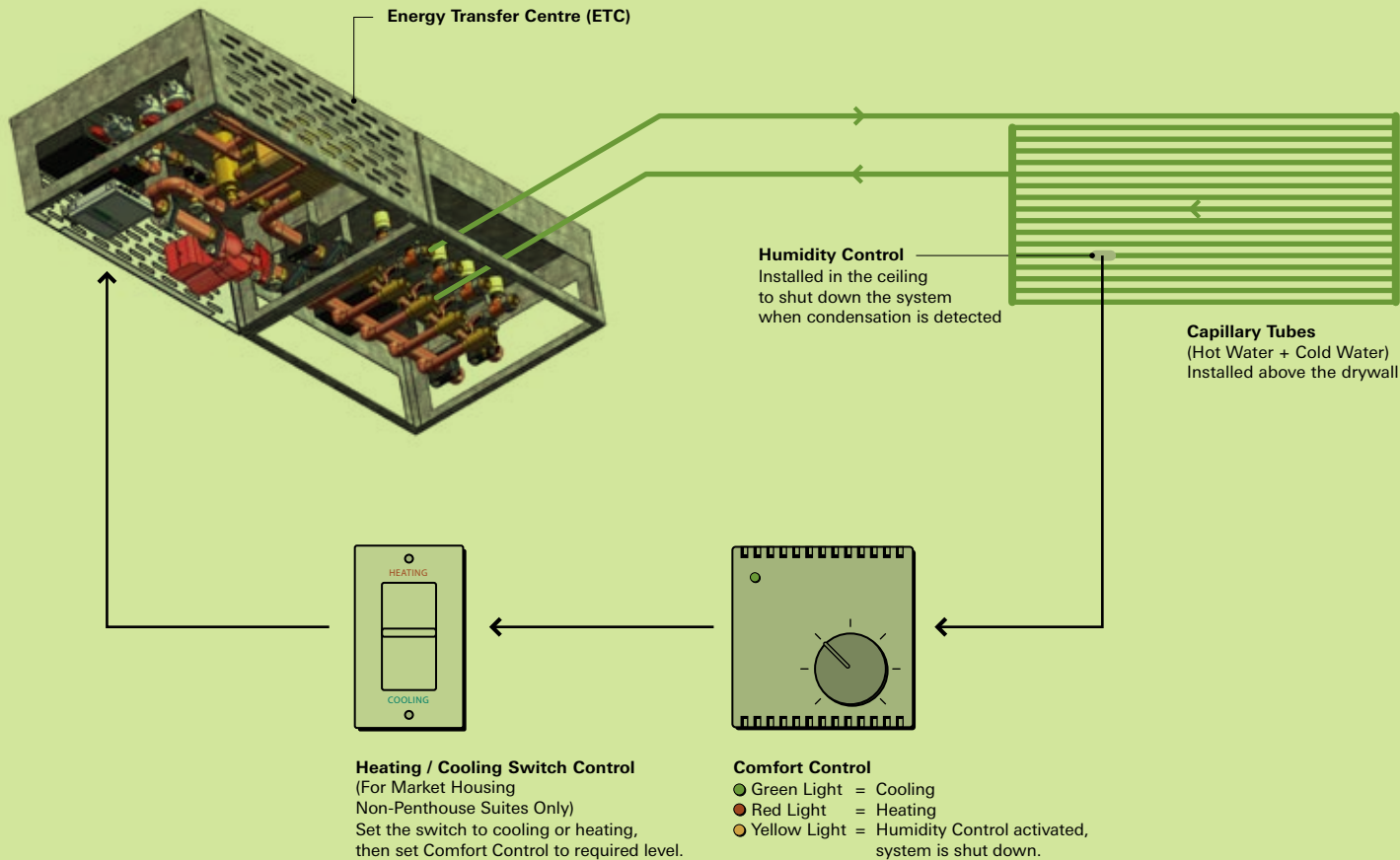
Left and center: Radiant energy transfers heat from a mass with higher temperature to one with lower temperature, in the same way we are warmed by the sun. When the radiant system is switched to cooling, it draws heat from objects – including bodies – that are warmer than the water, giving a cooling effect.

Right: Capillary mat heating is a "low intensity" system. Due to the extensive area covered by the mats, the temperature differential between the circulating water and the bodies it interacts with does not need to be extreme (i.e. water heated to 38–41 degrees Celsius). This contributes to the system's energy efficiency.

Energy Transfer Centre

The operating systems for each suite includes: hot/cold circulating water; a circulation pump; an expansion tank; control valves connected to the comfort control (room by room); and monitor wiring for usage reporting (see pages 26-29). These components are located in a panel, called the Energy Transfer Centre, which is mounted in storage rooms or closets in the suites. The system also includes a sensor to determine whether unacceptable condensation has developed (during cooling mode), which then shuts off cooling until humidity subsides.

In-Suite Radiant Heating and Cooling System



Each suite comes with a manual to teach owners about their capillary mat heating system.

PROFILE

Goran Ostojic

P. Eng, LEED
Partner, Cobalt Engineering

Goran Ostojic moved to Canada from Europe in 1994. Ostojic has been the lead partner on Cobalt Engineering's Olympic Village project team, overseeing mechanical design issues across the site. He says the tight timeline, new technology and sheer size of the project added to its complexity.

"We had to integrate and understand the new technology, and we had to implement the new technology across 1.5 million square feet – you need people to build it, so they have to buy in and get understanding," he says. "We went through some upsets and a lot of hoops together, but it was a great experience."

"People could see the benefit and opportunity," he says. "From the City's ODP [official development plan] and its sustainability direction, to an open-minded client, it's a great opportunity to create something different. And also the design team being brave enough to take this challenge and keep pushing the limits. We've had the chance to create something that's not done every day, that's going to be a benchmark of sustainability in North America on this size and scale.

"It's an amazing project. We'll reflect in the future and say hey, it was a challenge, but it turned out pretty good."

Lighting Design

Lighting design at the Olympic Village had to balance a mandate for energy efficiency with the need to create inviting, enjoyable spaces. Efficiency measures included motion sensors that dim corridor lighting when no one is present, and multiple zone design, so that residents can choose to turn off light in areas they're not using.

But the company that handled lighting design for the majority of the Village's buildings opted against sustainability's poster child: the compact fluorescent lamp (CFL). "They're poor sources of light, in terms of quality," says Steve Nemetz, of Nemetz (S/A) and Associates, the company that handled electrical engineering in the Village. "It's flat light, with poor colour rendering, and some people react badly to it."

Instead, the company chose low-wattage MR16s, a halogen lamp. (In BC Housing properties, some CFLs were mandated.) "CFLs always require a ballast [a device that limits the amount of current the lamp draws]," says Nemetz. "A 13 watt CFL with a ballast uses about 15-16 watts of power, and

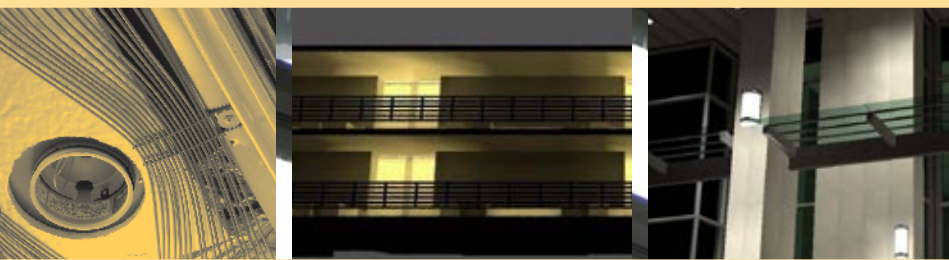
dimnable ballasts are expensive. Instead, you can use a long-life 20 watt MR16 and get the same amount of light, but with better colour rendering, much better atmosphere and similar longevity."

Another feature of sustainable lighting design (worth a LEED credit) is to minimize light trespass – the unwanted entry of exterior light from one home into the next. After that, it was time to set the mood.

"You'll see many architectural features that are highlighted," says Daisy Chan, lighting designer with Nemetz. "We've worked to ensure there's good feature lighting, in lobbies for example. Light can make or break a space. If it's lit improperly, you'll have a different impression."

"At the end of the day we're very happy with the lighting and the distribution," says Nemetz. "We'll be able to be proud of it. It's quite amazing."

We aimed for energy efficiency and colour temperature, not too bright or too dim. It's about quality of light, not quantity. Steve Nemetz



Background: Mood-enhancing pendant lighting in a building lobby, using compact fluorescent bulbs
 Inset left: Capillary mats and lighting fixtures must share ceiling space, requiring detailed shop drawings
 Inset centre: Rendering of Parcel 9 exterior corridor with LED lighting
 Inset right: Rendering of Parcel 6 building exterior

Power Smart New Construction Program

The Olympic Village is the largest project ever to participate in BC Hydro's Power Smart New Construction Program. The program funded an energy study to identify energy conservation measures and estimate potential savings. It found that the Village's conservation strategies – ranging from radiant heating to Energy Star-rated appliances – will save enough electricity to power 1,040 homes per year. Based on the energy saved, the program provided capital incentives to offset part of the upfront costs of the efficiency measures.

"At BC Hydro, our motto is to consider generations to come," says George Crowhurst, BC Hydro's key account manager for the Olympic Village. "This project will show our children what we did, that this was the innovative way to go at this time, and it gives a baseline for going further. Innovation for saving energy will only grow."

Educating the Market

One challenge faced by those involved in energy design was dealing with current perceptions about what the market demands in a new residential suite. While the superior performance of radiant heating sounds luxurious, for example, marketers say buyers demand floor-to-ceiling glazing (windows) to maximize views. You can't have both – windows lose too much heat.

"People may think they want huge windows, but not when they realize that there's a trade-off – these impact on comfort," says Vlad Mikler. "We tend to focus on what we marketed in the past. Now we have to educate buyers rather than just promoting what we've already done for 20 years. We can turn comfort and efficiency into a marketing advantage, but few [marketers] are doing it."

consider
generations
to come

Installation Challenge

The decision to use radiant capillary mat heating technology introduced a twist into Olympic Village construction – an installation learning curve for everyone involved.

“This system is integral to the drywall ceiling,” says Peter MacLellan of Olympic International. “So the mechanical contractor had to work very closely with the guys doing drywall – not something that usually happens. And the capillary mat installers had to work with the folks doing the lighting – all the trades really had to work together.”

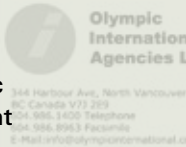
Because we used new products the construction trade isn’t used to, there were no established ground rules or traditions on who handles what. Mike Mahannah, Olympic International

Installation companies found it challenging to provide cost estimates for technology they didn’t know, says Mike Mahannah, President of Olympic International. “Initially there was some resistance. We had a lot of upfront meetings where we showed them the tools, showed them it’s not that complicated. Then the guys on site really got into the rhythm of it.

“Since it was such a big job, we now have five different mechanical contractors who are really comfortable with the process. That capacity will assist these systems to be much more easily adopted in future.”



Above, Energy Centres are installed in the ceiling of each suite. Background, a detailed layout diagram for installation of the capillary mat system. “Our company got very deeply involved in the design and layout of the ceilings,” says Peter MacLellan of Olympic International. “We needed to make everything as simple as possible, to not leave any guesswork.”



Client: BCL

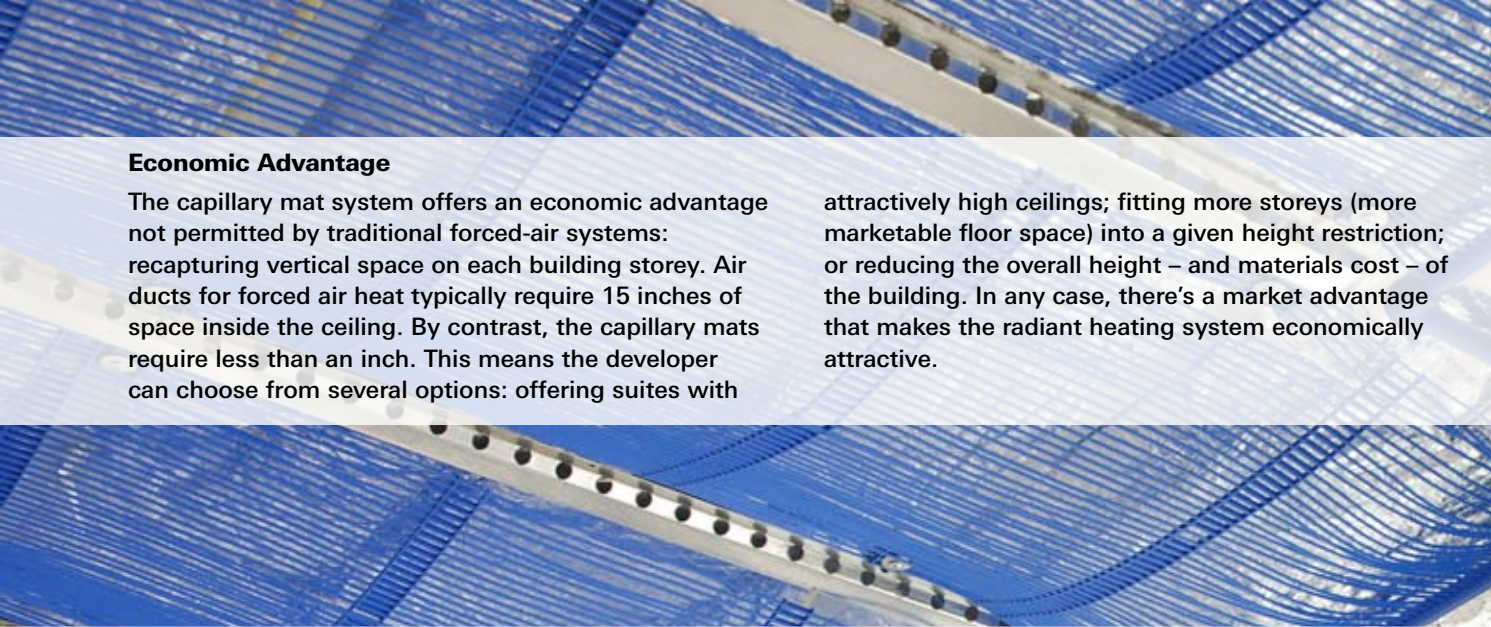
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Key Plan:

Project:

MILLENNIUM WATER

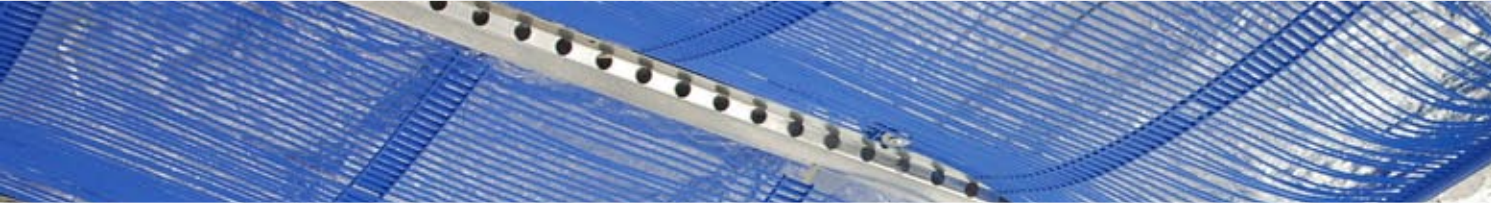
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Economic Advantage

The capillary mat system offers an economic advantage not permitted by traditional forced-air systems: recapturing vertical space on each building storey. Air ducts for forced air heat typically require 15 inches of space inside the ceiling. By contrast, the capillary mats require less than an inch. This means the developer can choose from several options: offering suites with

attractively high ceilings; fitting more storeys (more marketable floor space) into a given height restriction; or reducing the overall height – and materials cost – of the building. In any case, there’s a market advantage that makes the radiant heating system economically attractive.



The capillary mat heating system is made of polypropylene, making it easy to repair (though tenants are reminded not to puncture the ceiling!). Hidden from sun damage, they are extremely durable and long-lasting.

PROFILE

Peter MacLellan

ESc Engineer
Partner, Olympic International

“We had a vision of what we wanted to do at Olympic Village,” says Peter MacLellan, of Olympic International. “We wanted to reduce energy consumption, increase the comfort of occupants, do it on a large scale and have it be commercially viable. We’ve been making it work – a big piece of the puzzle in making change.”

MacLellan is the lead project engineer for Olympic at the Millennium Water site. He says the fast paced and complex nature of the project was part of its attraction.

“It’s not like a regular project where you design it, then everybody agrees and then you start building. In this case, they started before the design was completed and we had to keep up. There were many challenges coming up that you couldn’t foresee, so we solved them as we went.”

MacLellan says the integrated design process was a great experience. “Working with all the people we needed to, to make this thing go – often things were getting decided in a room with people from all different trades. Usually that’s a long process, but this was all about getting everyone in a room and deciding right there what you’re doing to do. For me, the experience was amazing.”

CHALLENGE

To marketers and buyers of real estate: to promote (marketers) and request (buyers) the comprehensive measurement, assessment and reporting of ‘performance values’ associated with all building design features, including energy consumption, resource use, health, livability transportation and amenities.

Solar Powered Absorption Chiller

Throughout the Olympic Village, hydronic (pumped water) radiant energy systems are used for cooling as well as heating. At the Community Centre there's an added feature: the building is cooled using the sun.

"We're using solar hot water thermal collectors to generate cooling through an absorption chiller," says Vlad Mikler of Cobalt Engineering. "It requires very little electricity, only enough for a small circulating pump, so it uses a few orders of magnitude less electricity than conventional cooling equipment. But – it requires an input of hot water to power the cycle."

Absorption chillers use waste heat (usually steam or hot water – in this case, heated by the sun) to generate cooling. Inside the absorption chiller, this heat is transferred to a brine solution, causing evaporation. The resulting fresh

water vapour is condensed and sprayed onto pipes holding water that will circulate inside the building, cooling it. Due to a strong affinity between the condensed brine and the fresh water spray, the brine attracts and reabsorbs the spray. This creates a vacuum, lowering the boiling point – meaning that heat from the sun is adequate to continue the cycle of evaporation and cooling.

Mikler says it's believed this is the first time a solar powered absorption chiller cooling system has been used in North America, especially at such a northern latitude. He points out that weak sunlight in the wintertime is not a problem – because that's when cooling isn't needed. "The demand for cooling is really proportional to the solar radiation intensity," he says. "So it's a perfect match."

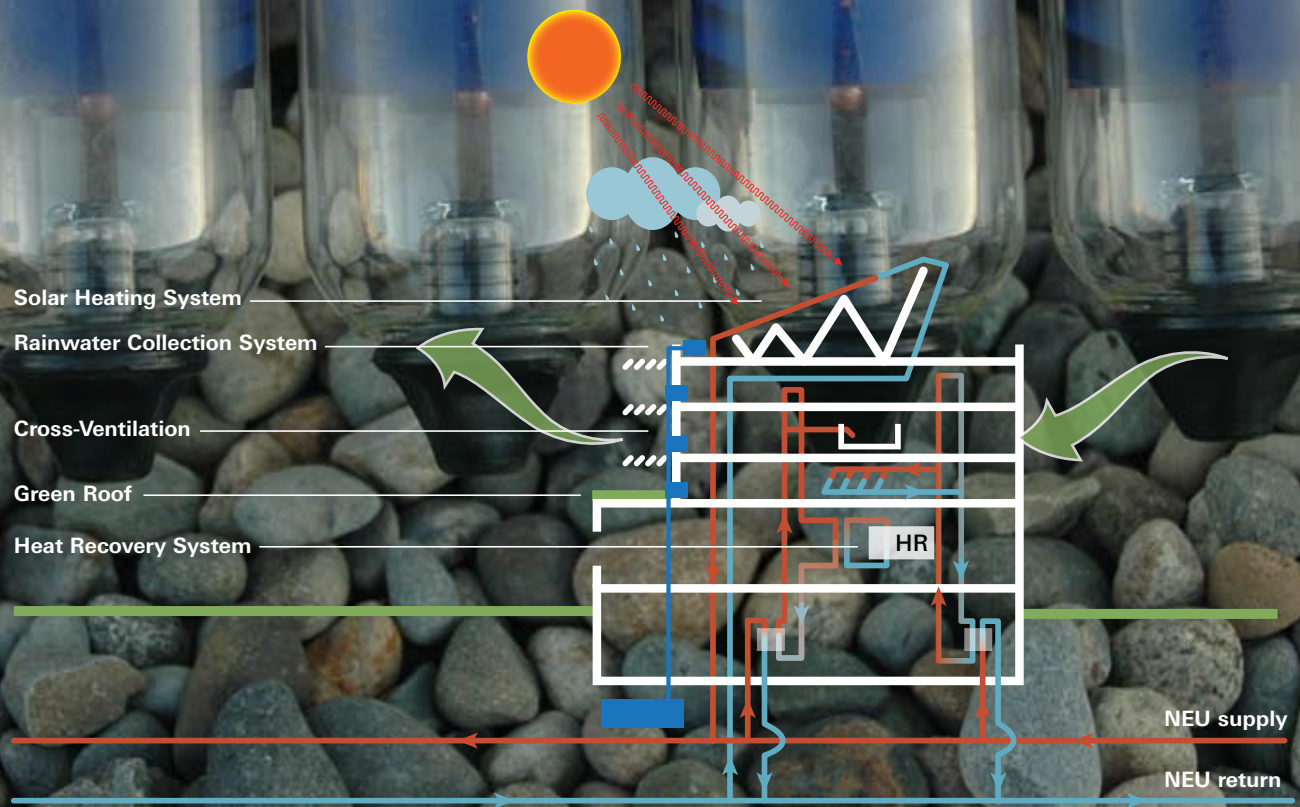
Weak sun energy in the winter is not a problem – the need for cooling only occurs when solar radiation (heat) is most intense.

Free solar energy warms the Community Centre's solar array, driving the building's cooling system.

Our Energy Future

Buildings at the Olympic Village are estimated to be 30–70% more energy efficient than comparative buildings designed to minimum codes. This demonstrates that passive design, district energy, radiant heating and efficient appliances and fixtures can make a significant difference in energy consumption.

However, in a world facing the serious challenges of climate change, peak oil and population growth, there is still room for improvement. For this reason, Parcel 9 includes a building that demonstrates the next step: Net Zero. A Net Zero building produces as much energy as it consumes. Chapter 8 of *The Challenge Series* will include a special focus on the Olympic Village Net Zero building.



Schematic of the Net Zero building showing the many integrated features that add up to a building that produces as much, if not more, energy than it consumes.

Why We Measure Energy Consumption

Despite the use of energy-efficient technology throughout the Olympic Village, effective conservation also requires individual residents to shift their energy consumption behaviour. For this reason, the Village is equipped with energy metering systems that provide a baseline and encourage people to improve their behaviour.

Nick Farina is president of Enerpro, the company that provided iEMS – the integrated energy management system used in the Olympic Village. He says the business case for the system comes in lowering capital costs, saving money and creating comfort.

Farina says making savings visible helps to build awareness on many levels. For example, the information from the system provides residents with an economic incentive to cut their showers from ten minutes to two. On a larger scale, savings at the household level translate into efficiencies such as downsized infrastructure for water and sewer, and in the operation of building equipment such as boilers and HVAC systems. In fact, changes and adjustments based on information from the iEMS monitoring system have been shown to result in energy savings of 10%–15% without retrofitting the actual heating or cooling equipment.

At Millennium Water, each tenant pays only for energy that they use. “If you use less, you pay less. This model should be financially painless,” says Farina.

Summary of Economic Benefits of the integrated Energy Management System (iEMS):

1. A revenue stream is produced for the lifetime of the equipment after it is installed.
 - The lifetime revenue stream is created through the bulk buying and selling of wholesale power from the utility and supplying it directly to the building’s occupants.
 - Property owners improve their competitive position by way of lower operating costs through reduced energy pricing.
2. Life-cycle costs are reduced by extending the longevity of the energy-consuming mechanical equipment installed in a building.
3. The capital value of the building increases, as it is more efficient and less prone to equipment failures and breakdowns.
4. The system contributes to green building rating systems, such as LEED.

If
you
use
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Energy Aware – Technology + Application

“Sustainability is supposed to be a lifestyle,” explains Janice Cheam, President of Energy Aware Technology Inc. Energy Aware enables consumers to make lifestyle choices by seeing how much energy they are using as they go about their normal routines. The system displays the usage of cold and hot water, energy for heating and cooling, as well as electricity. Electricity use is monitored in real time, displaying either cost or kW per hour. This means that when you turn off a light or the dishwasher, you immediately see your energy cost go down.

Energy Aware provides a display called the PowerTab that connects to Enerpro’s sub-metering system and is included in every Olympic Village residential unit. The display consists of a 128 X 64 graphic LCD screen that uses wireless communication for maximum mobility. There is a different screen for each resource, which shows residents’ current rate of consumption and estimated bill each month. Three LEDs indicate whether consumption is average (amber), above average (red) or better than average (green).

“The first reaction people have when we explain our product is, ‘I can’t wait to show my kids’,” says Cheam. She says education is a positive feedback system that helps change people’s attitudes over time as well as their behaviour. It also offers rewards: real-time feedback on energy consumption enables homeowners to adjust their routine and save money.



The Energy Aware PowerTab is a display unit that communicates real-time energy and resource use in each suite.

PROFILE

Janice Cheam

President, Co-founder of Energy Aware Technology Inc.

“We really need to upgrade our energy infrastructure,” says Janice Cheam. Her interest in this challenge led her to launch her energy-related company.

After discussing the acceleration of climate change with a friend who had just returned from a United Nations conference, Janice became passionate about helping society waste less. Learning about climate change led her to an appreciation for energy conservation as a key area capable of delivering real environmental improvement. In 2005, Janice co-founded Energy Aware Technology with partner Lauren Kulokas.

Based in Vancouver, Energy Aware provides demand management solutions for today’s changing electrical grid. Energy Aware’s products allow utilities to gain maximum benefit from increased data flow with their customers, and allow individuals to better understand and control their consumption habits. By promoting resource-efficient behaviour and demonstrating sustainable practices, Energy Aware aims to protect and improve the well-being of future generations.

CHALLENGE

To policy makers and building code authorities: to require the installation of resource metering technology in all new residential and office units, to promote awareness of resource usage and opportunities for energy and potable water savings.

How We Monitor/Measure Energy Consumption

With 1,100 residential units and a goal of achieving LEED Gold certification, energy management for the Olympic Village had to be taken very seriously. Enerpro was responsible for a solution that involved coordinating meters, communications strings and data for 5,500 related meter points. Installed in each suite is a visual display meter developed by Energy Aware, that will show consumption of heating energy (BTUs), cooling energy (BTUs), domestic hot water consumption (US gal), domestic cold water consumption (US gal) and electricity (kWh)* use for that unit only.

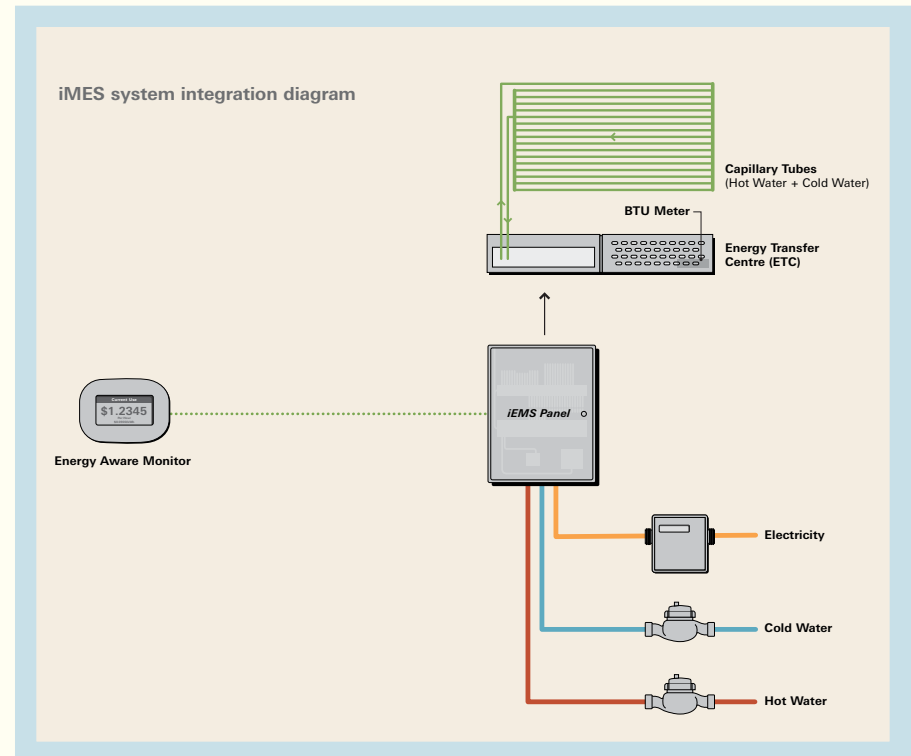
Nick Farina, the president of Enerpro, recognized that understanding the entire system and the relationships between a variety of people would be critical from the very start. “Our model put Millennium Water in the middle and assembled stakeholders such as project managers, mechanical engineers, financial specialists, post-construction advisors, and property managers,” he says. As a team they selected the tools that would integrate the consumption, measurement and purchasing of all types of energy and water. Enerpro’s experience guided the team towards an integrated solution, which included in-suite display monitors.

Awareness is a central element in making smart energy choices – for developers, owners and occupants. The efficiencies for new construction and infrastructure upgrades in retrofitted buildings speak for themselves. Whether a project consists of a 5 million square foot shopping centre or a 500 square foot condo, knowing what quantities of water, gas or electricity are consumed is important for cost-effective management (quite different from simply paying a flat cost each month, or never knowing how much of a resource was used). Enerpro’s results show the national water use average of 344 L/day can be cut in half as a result of behavioural change driven by awareness.

Enerpro’s iEMS brings together technology, knowledge and people in an integrated energy management system designed for each project, explains Farina. Technology from all over the world combines for effective energy management by measuring energy consumption, water volumes, air quality,

temperature and occupancy in buildings, and providing ongoing real-time monitoring and adjustments that maximize efficiencies. This supports the sustainable use of energy and preservation of natural resources, and reduces building operating costs too.

League Assets Corporation, a private Real Estate Investment Trust, has established a sustainable energy fund providing financing for the capital costs of the energy management system. There is a ten-year lease for the infrastructure and equipment, after which Millennium Water strata will own it and their ongoing costs will drop.



The Commissioning of Mechanical and Lighting Control Systems

Commissioning is a process that adds an additional perspective to the design and construction of building systems, and provides guidance to the operation phase such that proper maintenance is assured. It's a step performed by an independent group that helps assure quality in building design and construction, and is encouraged by the LEED certification program.

During the design phase of a project, commissioning input is provided that affects system selection, as well as other integrated design aspects such as envelope, shading and orientation choices that play a role in minimizing heating and cooling loads and in making sure that mechanical systems are more efficient and durable in the long run.

During construction, commissioning ensures that systems are performing optimally and as intended, and that problems are caught that would affect the longevity of the system. In the post-construction phase, commissioning ensures that building operators are trained and documentation is provided so that the commissioned systems can be properly maintained in the commissioned state.

"KD Engineering has a couple of hats on the [Olympic Village] job as the mechanical commissioning agent and as the LEED commissioning authority," says Chris

Leaming of KD. The LEED commissioning authority completes the LEED EA (Energy and Atmosphere) pre-requisite 1: Fundamental Building Systems Commissioning, as well as LEED EA Credit 3: Best Practice Commissioning, worth one point in the LEED system. This role joins the design team before the design is finalized, to contribute to the design process focusing on the mechanical systems and some aspects of the lighting system, create a commissioning plan included in the project specifications, oversee the commissioning process, orchestrate a "near-warranty-end" review and produce a final LEED commissioning report. Under the Mechanical Commissioning Agent hat, KD performs the hands-on testing that verifies the proper functionality of the mechanical systems.

Leaming says commissioning was an important process for the Olympic Village project. "This is not a standard residential tower project," he says. "It has more sophisticated mechanical systems, and it will be LEED certified. As such, a full commissioning process makes sense. As well, the Energy Transfer Cabinets that control the heating and cooling to the capillary mat zones in the suites are a new product in this part of the world, and therefore required extra commissioning attention."

PROFILE

Nick Farina

President of Enerpro Systems Corp.

Nick Farina, the co-founder of Enerpro, designs his systems with the future in mind. "When I look at my 4-year-old granddaughter," he says, "I ask myself if we are moving forward fast enough. How do we collectively stop wasting our resources?"

Farina's awareness of environmental issues, combined with his construction background led him to the world of energy management. Since 1996, Enerpro has offered full-service, customizable, energy management solutions. Enerpro's programs maximize efficiencies in energy and water use, reduce consumption and provide numerous economic benefits for a diverse portfolio of new construction and infrastructure upgrades in retrofitted buildings.

Enerpro brings all the fragmented steps of energy management together in one centralized iEMS (Integrated Energy Management System) that supports the on-demand characteristics and complexities of energy and water management.

Enerpro Systems Corporation is a North American market leader in intelligent energy management of both traditional energy systems as well as new technologies such as geo-thermal, solar, wind and fuel cell. For Millennium Water, Enerpro has supplied energy management technology for 1,100 residential suites that will allow occupants to monitor their own energy and water use from an in-suite display.

Farina concludes, "When I see the results from our Energy Management programs, I know that we're on the right track. There are tremendous opportunities ahead."

CHALLENGE

To policy-makers and municipal authorities: to require comprehensive building commissioning for all new construction to ensure optimum energy efficiency and systems performance.

Acknowledgements

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PLATINUM



Millennium Southeast False Creek Properties Ltd.

Millennium Group is an award-winning Vancouver-based team of professionals and the developers of Millennium Water Olympic Village. They are renowned for their disciplined commitment to high quality architecture and luxurious design. At 1.4 million square feet, Millennium Water is the largest single-phase development in Canada. It is designed to be Canada's largest LEED Gold neighbourhood and a leading model of how to build a sustainable residential community.



The City of Vancouver

The City of Vancouver prides itself as being one of the most livable cities in the world. The City has now also adopted the target of being the "Greenest City" in the world by 2020. Vancouver has received several awards for its various services and programs, including a United Nations (UN) award for Innovation in Public Service and being among the four inaugural cities invited to join the UN's Carbon Neutral Network. To further support these goals Vancouver has spent over a decade in conceiving, and now developing, the South East False Creek Olympic Village as a global model for sustainable urban development.



Metro-Can Construction (OV) Ltd.

Metro-Can Construction is among the top 50 general contractors in Canada and the top five in British Columbia. Focusing on turning visions into buildings and delivering value to their clients, Metro-Can has completed over 280 institutional, commercial and multi-family residential projects. Since placing the first foundations on the Millennium Water project in June 2007, Metro-Can has proceeded to construct 10 LEED Gold buildings incorporating 540 condominiums, 250 social housing units, 60,000 square feet of retail space and a LEED Platinum community and boating centre.



ITC Construction Group

ITC Construction Group has proven capabilities in multi-unit residential, commercial and social housing construction projects. Established in 1983, they have successfully completed over 100 projects for private developers and public initiatives in BC and Alberta. ITC is proud to be the General Contractor of the eight luxury waterfront towers at Millennium Water. These LEED Gold certified structures consist of 315 condominiums and will be complemented by 13,619 square feet of commercial/retail space at the ground level. Quality Counts.



Rennie Marketing Systems

Rennie Marketing Systems (RMS) proudly leads the sales and marketing campaign for the residential component of Millennium Water. Led by Bob Rennie, RMS works closely as 'Millennium's representative' to bring to market the most innovative sustainable community in North America. Maintaining the project's identity of environmental awareness, RMS utilizes eco-friendly elements throughout the marketing campaign. RMS marketing objectives extend beyond sales achievements and include increasing global awareness of a new standard of development.

GOLD



VANOC



Merrick Architecture



gBL Architects



Cobalt Engineering Co. Ltd



VIA Architecture



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Pioneer Consultants Ltd.
Contrada Enterprises Ltd.
Energy Aware Technology Inc.
Sandwell Engineering Inc.
FAMA Industries Corp.
Inform Projects Partnership
PricewaterhouseCoopers LLP
Trane



Durante Kreuk Landscape Architects

Durante Kreuk is an award-winning landscape architectural firm with over thirty years' experience in the private and public realms of design and development. A broad perspective and diverse thinking are the key to creating a wide range of sustainable, people-focused urban places. At Millennium Water, the unique challenge of creating a sustainable neighbourhood through an integrated design process was both complex and rewarding. The result speaks for itself.



Olympic International Inc.

Olympic International creates comfortable, healthy and energy-conscious indoor environments. As a manufacturers' representative, they are committed to bringing the world's most innovative and sustainable technology to local markets. The Millennium Water project utilizes radiant heating and cooling technology, which will substantially reduce energy consumption and system noise, increase available ceiling height and improve overall thermal comfort and indoor air quality.



Enerpro Systems Corp.

Enerpro Systems Corp. are market leaders in intelligent energy management for new construction and infrastructure upgrades to existing buildings. Since 1996, BC's only customizable energy management programs have been providing no-cost, full-service solutions that maximize efficiencies in energy and water use, reduce consumption and provide numerous economic benefits. This groundbreaking innovation has spurred a series of firsts in energy management, such as the ability to view a real-time display of all energy and water consumption within 1,100 housing units at Millennium Water.



Keith Panel Systems

Keith Panel Systems (KPS) is North America's leader in the design, manufacture and installation of rainscreen wall systems. They are proud to be part of constructing Millennium Water. The wall systems installed by KPS will preserve the performance integrity of the exteriors, reduce the heating and cooling loads, provide an extended service life and are virtually maintenance free. Alucobond®, Swisspearl® and specialty glass are the quality exterior finish products featured on proprietary systems by KPS.



Wilco Landscape Westcoast Inc.

Wilco has become expert in the construction and delivery of built landscapes. Offering project management and landscape construction services for civil, parks and development projects, Wilco is a leader in successfully delivering complex projects to its clients. Wilco thrives on diversity and challenges and seeks out projects that require the depth of experience and knowledge that they have accumulated through the vast array of projects the company has built throughout BC and Western Canada.

PARTNERS

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Information Sources

[pages 12-13](http://vancouver.ca/sustainability/building_neu.htm): http://vancouver.ca/sustainability/building_neu.htm; [pages 18-19](#): Report on the Application of BEKA Radiant Heating/Cooling Systems using Katube Capillary Mats. Submitted to Millennium by Merrick Architecture.

Next Chapter: Water + Landscape

Chapter 6 looks at how we can manage water and build landscapes that will be more sustainable. Although British Columbia is known for its abundance of water, as the population increases the need to reduce water use – as well as learn to use it in smarter ways – has become critical. Topics include stormwater management, rainwater collection for toilet flushing and irrigation, water metering, green roofs and the role of urban agriculture and community gardens in sustainable communities.

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FRONT COVER The False Creek Community Energy Centre building, located under the south end of the Cambie Street Bridge, is designed as an interpretive facility to showcase the innovative use of sustainable technology. **BACK COVER** The inner workings of the False Creek Community Energy Centre rely largely on a giant electric heat pump that works to recover heat energy from sewage and send it back through the district heating system.