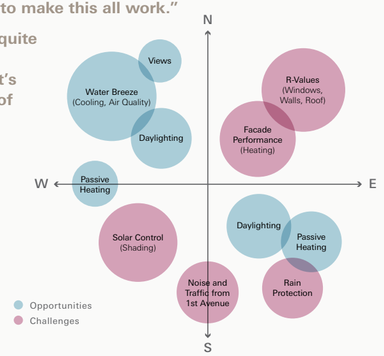
Don't fight Mother Nature. And work as a team. That's the advice on how to achieve high-performance, energy-efficient buildings.

"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 a 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.

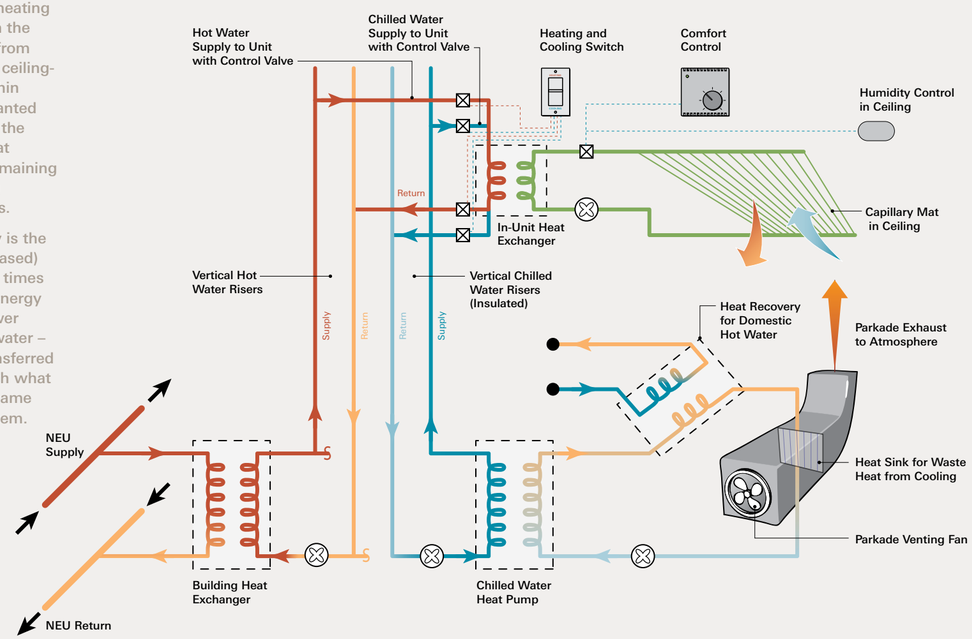
This microclimate diagram highlights the key challenges and opportunities, from a design standpoint, for each façade orientation.



## 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.




**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.**