TELUS Garden

Best Practice for Commercial Building Performance

The TELUS Garden development, located in the heart of Downtown Vancouver, includes a 93,000m^2 22-storey office tower at the corner of West Georgia Street and Seymour Street and a 53-storey residential tower [to be completed in June 2016] at the corner of Robson Street and Richards Street.

The project consists of 50,000m^2 of office space, 4000m^2 of retail space, and 424 residential units; transforming an entire city block into one of North America's most technologically advanced commercial developments.

By Jubin Jalil and Gary Rhode

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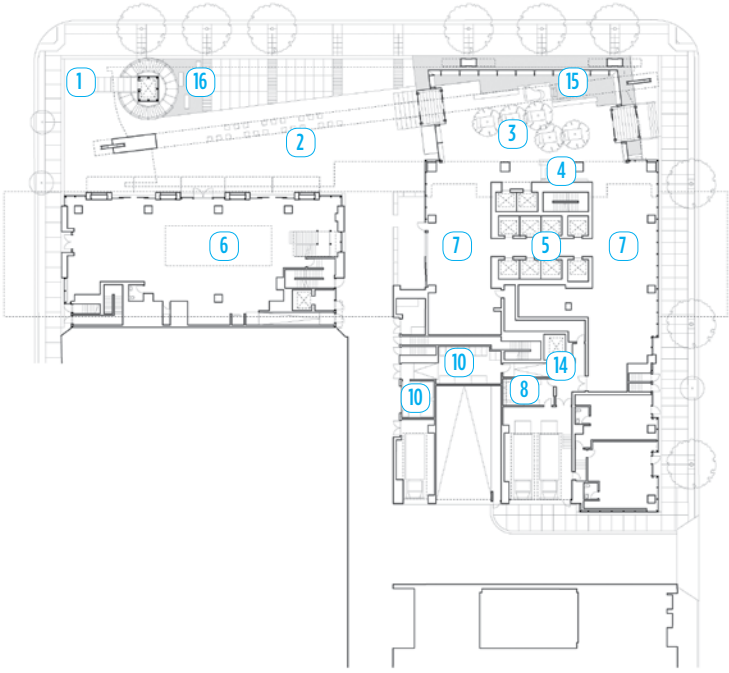
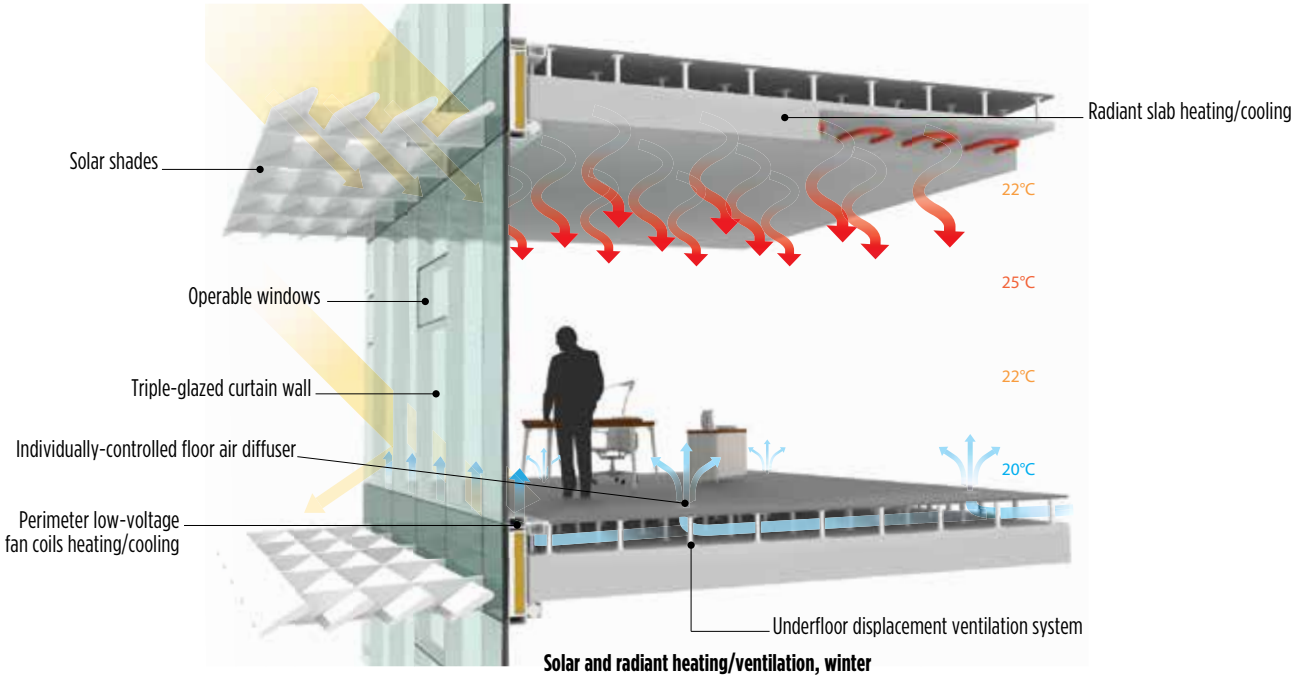
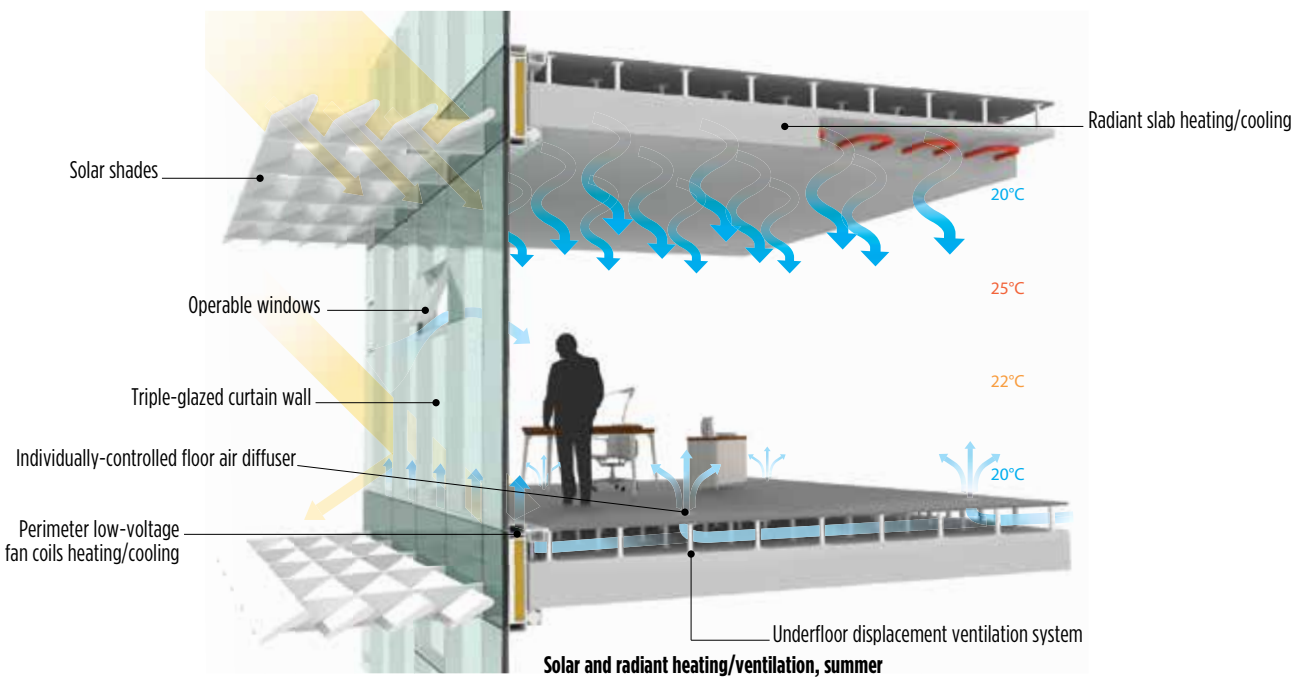


Ground floor plan

1	Retail entry elevator	**9**	Gas meter room
2	Plaza	**10**	Recycling/garbage room
3	Office lobby	**11**	Parkade entrance
4	Security/reception	**12**	Loading
5	Elevator lobby	**13**	Laneway
6	Restaurant	**14**	Service elevator
7	Retail	**15**	Koi pond
8	Shipping/mail office	**16**	Water feature



Solar and radiant heating/ventilation, winter



Solar and radiant heating/ventilation, summer

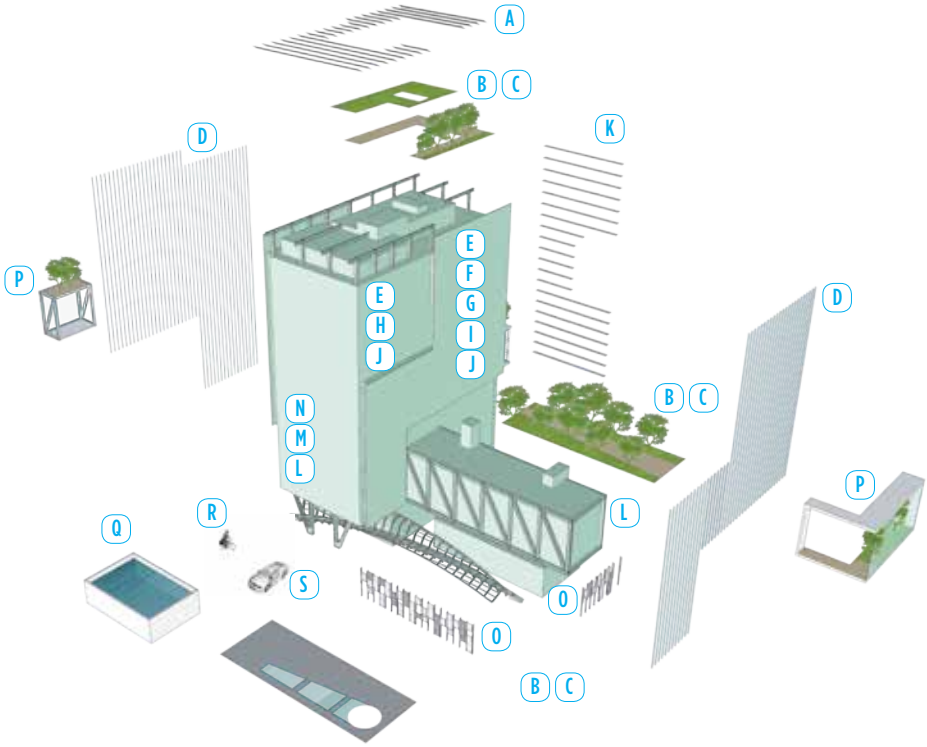
With a total of 91 LEED points achieved, TELUS Garden is the highest scoring LEED Platinum certified office building in Canada. With exemplary energy performance, a mixed use program and the animation of the adjacent streets and lanes, the project contributes both environmentally and socially to the City of Vancouver's goal to become the greenest city in the world by 2020.

Energy Conservation

TELUS Garden is the result of an integrated design process in which ambitious energy conservation targets were set, met and ultimately exceeded through a multidisciplinary approach to the design of the building envelope, mechanical and electrical systems. The initial energy target was 35% below the ASHRAE 90.1-2007 baseline. Through the integrated design approach, the design and energy model came in at 3,300 MWh/year or an energy intensity of 69.9 kWh/m^2/year. This figure is 43% below the energy intensity of a reference baseline building.

TELUS Garden features a triple-glazed curtain wall. Each facade is responsive to its own environmental aspect, be it vertical glass fins and frit on the East and West facades or horizontal sunshades on the South. The design team worked with the curtain wall manufacturer to optimize energy performance while addressing the technical challenges of integrating these solar control elements in the curtain wall.

Operable windows were introduced into the office spaces, a departure from the traditional approach of hermetically sealed facades. This was possible because the displacement ventilation system [see below] does not need to be balanced in the same way as traditional mechanical systems. The introduction of natural light and ventilation was also a purposeful demonstration of TELUS and Westbank's corporate commitment to create a healthy workplace for its employees.



Sustainable diagram

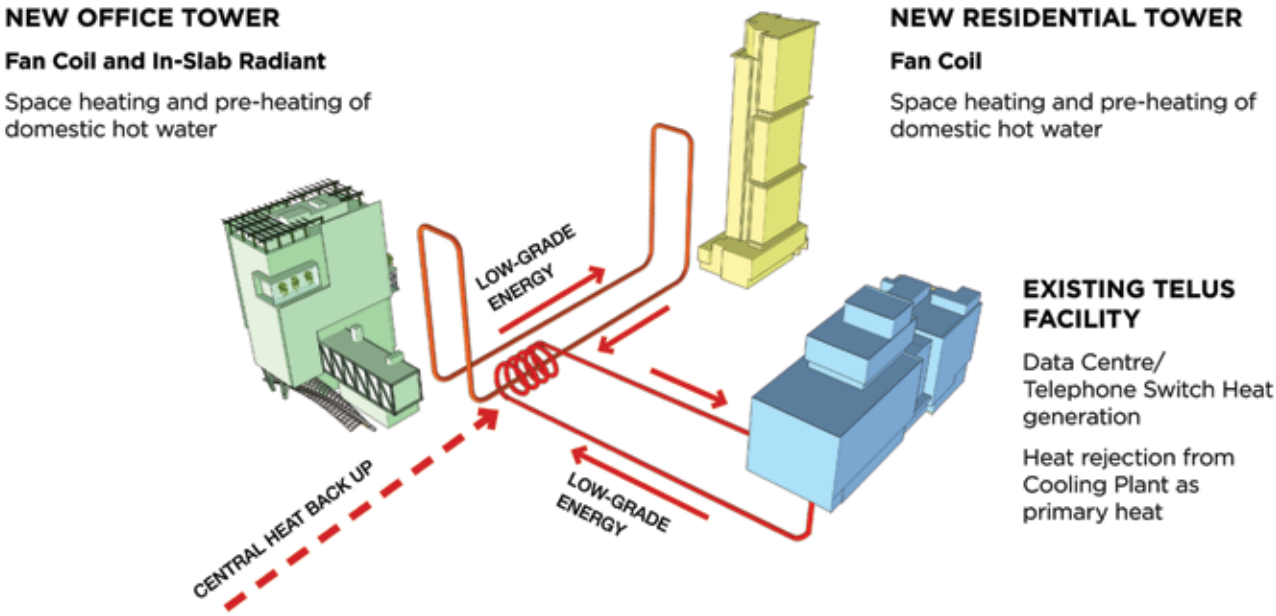
- **A** Photovoltaic panels
- **B** Stormwater management
- **C** Rainwater harvesting
- **D** Exterior vertical glass solar shade fins
- **E** High-performance, triple-glazed curtain wall
- **F** 70/30 Glass/solid wall ratio
- **G** Fritted glass
- **H** 80/20 Glass/solid wall ratio
- **I** Operable windows [natural ventilation]
- **J** Interior automated shading system
- **K** Exterior horizontal aluminum solar shades
- **L** Concrete and steel with recycled content
- **M** High-efficiency heating and cooling with hydronic radiant floor [heavy mass] and fan coils
- **N** Demand control and displacement ventilation
- **O** 50/50 Glass/solid wall ratio
- **P** Sky Gardens—preheat of ventilation air
- **Q** Cistern for non-potable water
- **R** End-of-trip facilities
- **S** Electric car charging station [3%]

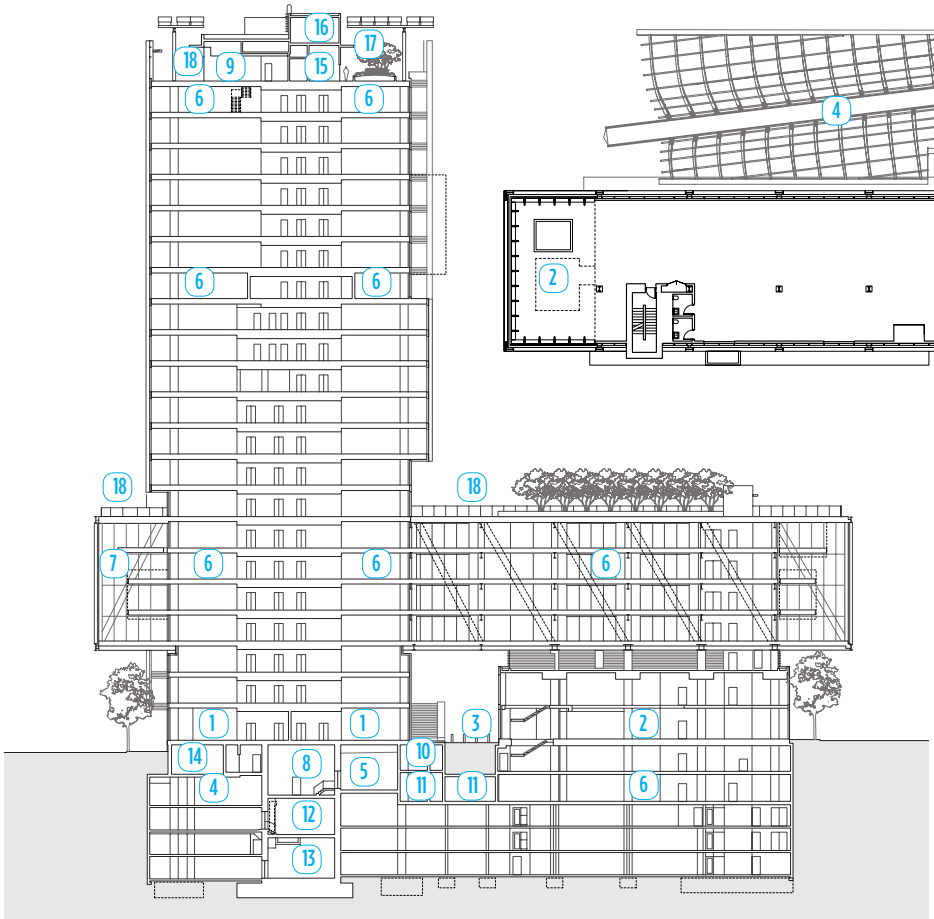
PROJECT CREDITS

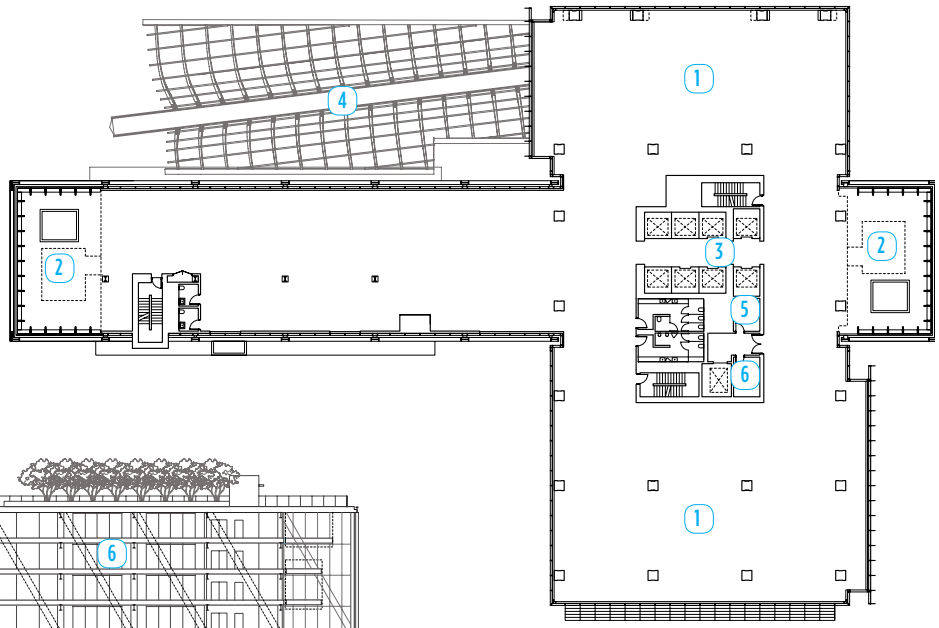
OWNER Westbank Corporation
ARCHITECT Henriquez Partners Architects
MECHANICAL Integral Group
ELECTRICAL Integral Group [Office only]
SUSTAINABILITY Integral Group
STRUCTURAL Glotman Simpson
INTERIOR DESIGN mcfarlane green biggar Architecture + Design Inc., Henriquez Partners Architects, the Design Agency
LANDSCAPE ARCHITECT Phillips Farevaag Smallenberg

Environmental Benefits

DISTRICT ENERGY SYSTEM







Typical floor plan

1 Offices
2 Sky garden
3 Elevator lobby
4 Glass pavilion below
5 Electrical room
6 Telecom room

Building section

1 Retail
2 Restaurant
3 Laneway
4 Parkade
5 Parkade entry ramp
6 Office
7 Sky garden
8 Elevator pit room
9 Amenity
10 Bicycle storage
11 Building services
12 Transformer room
13 Electrical room
14 End of trip facilities
15 Storage
16 Machine room
17 Terrace
18 Roof garden

In addition to these passive strategies, TELUS Garden also incorporates a range of active energy conservation strategies including the following.

District Energy System [DES]

Most notable among many innovative strategies is the project's district energy system, constructed and operated in partnership with FortisBC Alternate Energy Services.

A central plant located within the building provides heating and cooling for both the office and the residential tower. Low-grade waste heat from the existing TELUS Data Centre [located on the same site] is directed to the central plant and used as a passive heat source. Surplus heat rejected from the cooling system serving the office and retail space is also captured. The combination of these sources of waste heat is upgraded and transformed into useful heating energy for reuse in the building.

Auxiliary heating, when required, will be drawn from the pre-existing Downtown Vancouver steam-based district energy system now operated by Creative Energy.

By capturing and redistributing low-grade waste heat throughout the development, the heating demand from Creative Energy Steam DES utility is anticipated to be reduced by 80% as compared to a conventional system. This is projected to reduce carbon dioxide emissions by one million kilograms annually - an amount equivalent to planting 25,000 trees.

Rooftop Photovoltaic Array

TELUS Garden hosts Vancouver's largest photovoltaic [PV] array. With a total of 288 PV panels and 70kW of electrical capacity, the installation is projected to generate approximately 65,000 kWh of electricity per year.

The PV array contributes five points to the LEED Core and Shell accreditation: four points for EAc2, and one point for EAc1. Based on the EAc1 template, the PV array will generate nearly 2% of the electrical energy consumed by TELUS Garden office.

The PV array has also been designed to collect rainwater, with sloping surfaces directing the water to gutters and ultimately to a storm water storage cistern. The water is then recycled to irrigate the many rooftop gardens and to flush toilets. The array has been positioned at the building edge so as to be a highly visible symbol of TELUS and Westbank's corporate commitment to environmental sustainability.

Energy Efficient Elevators

The office tower at TELUS Garden is serviced by 11 Destination Dispatch elevators. Passengers are directed to the elevator that will get them to their destination in the shortest possible travel time through digital displays and audio cues. By grouping people together in this way, based on the floor that they will be travelling to, the number of stops is reduced. This increases capacity, improves efficiency and results in less energy being used overall.

Energy Recovery Ventilation

Ventilation air is provided by an Energy Recovery Ventilator [ERV], which reduces the energy consumption by up to 60% as compared to a conventional system, by capturing the heat content from the stale air stream before it is exhausted to outdoors.

By combining the ERV with an underfloor air distribution system, it is possible to deliver 100% tempered and filtered outdoor air more directly to the occupied zone of the building, and to draw stale air away at ceiling level. Occupant control is provided through operable floor-mounted air diffusers.

Hydronic Heating and Cooling

Heating and cooling energy is efficiently distributed via a network of hydronic piping to support the radiant heating and cooling ceiling slabs and energy efficient low voltage perimeter hydronic fan-coil units. These operate at relatively low temperatures and provide an energy efficient and comfortable work environment.

Throughout the building, all systems are designed with resilience in mind. Future compatibility is assured through common wiring infrastructure, common communication protocols and the ability to adapt to changes in available primary fuels.

Control Systems

As one might expect from a leading communications company, TELUS embraced the idea of further improving building performance through the design and specification of leading edge digital control systems.

Standard Control Systems

Traditional control systems within buildings [HVAC, lighting, emergency power, access control and energy metering] typically use proprietary communications protocols and separate network infrastructures. Protocols are the languages that building technologies speak. Common non-proprietary protocols include DALI, LONworks, Modbus and BACnet. Unless there is a gateway performing protocol translation, these discrete systems cannot communicate. Typical design and construction processes do not allow for the convergence of these systems resulting in a building with sub-optimal performance, segregated information and more challenging to operate.

Integrated Control Systems

From the outset, the objective was to make TELUS Garden a Smart Building that would deliver higher quality building services, [such as illumination, thermal comfort, and indoor air quality] to ensure maximum productivity and comfort for its 2,000 occupants.

Reaching this goal required the integrated implementation of strategic measures to increase the 'intelligence' of the building systems, stressing compatibility, and enhanced inter-communication. To achieve this, Integral Group designed TELUS Garden to use information technology during operation, and the Stuart Olsen Centre for Building Performance developed, tested and verified interfaces that connect a variety of subsystems which typically operate independently. The intent is to manage data for multiple stakeholders, provide actionable information and realize efficiencies in real time. Enabling all systems to communicate with one another in this way optimizes total building performance throughout the service life of the building.

From a sustainability perspective it is important to audit and verify the building performance scorecards in real time. The development has a central plant sharing heat, a photovoltaic array, UPSs, generators, HVAC, security, addressable lighting controls, dynamic architectural lighting controls, digital metering [for power and thermal energy], environmental monitoring, electric car charging stations, life safety systems, and irrigation, all requiring interoperability. These integrated systems generate an enormous amount of data that required an information management program- rather than simply analytics and data management.

Through converged network infrastructure, verification and strategic software design, TELUS Garden has an integrated building automation system complete with analytics and high resolution building graphics, optimizing the building's total performance. For more detail, see the sidebar on next page.

Communication Protocols

At TELUS Garden, we moved forward to a true integrated Building Management System requiring a completely new approach. The vision for this building was to have all systems connected and accessible through a browser for real time information and control. All systems needed a common wiring infrastructure that meets international standards and fully integrated, non-proprietary communication protocols. This also provided some degree of future proofing for the building. Any technologies considered for this project were to be open, non-proprietary systems where multiple vendors could provide service and sole-sourcing could be reduced.

The preferred communications infrastructure was IP based and the preferred communications protocol BACnet. These two choices provided a single open and inter-operable platform, thereby eliminating a single-source supplier for building automation systems. Effort was also made to ensure that the vast array of connected equipment was selected for optimal integration to the system. This ensured that possible failure points were reduced and available device data was robust.

We then normalized wiring infrastructure, the same as a typical office. Office computer networks are designed to Telecommunication Industry Association Standards [TIA]. This allows IT managers the ability to remove and add computers by different manufactures at will without affecting the computer operations. We would apply the same standard to building systems. Gone was the traditional bell wiring between devices. A communication cabling network would take its place. Each IP device would be fed back to a common network switch.

Editor's Note

As an employer, TELUS supports flexible work days and remote working by employees. Prior to embarking on the TELUS Gardens project, the company conducted a survey of work habits. The results indicated that at any given time, only 70% of work stations were occupied; the other 30% of employees were on vacation, sick leave, working remotely or at meetings. Recognizing that most had access to all the data [both archival and current] they required for work purposes on a mobile device or cloud storage, TELUS instigated an online workspace sharing system.. Employees book a work station when they want to come into the office, just as they might book a meeting room if working for another organization. This enabled TELUS to reduce the amount of floor space it had to build for its own operations by 25% - an upfront savings in energy that will continue over the life of the building.

THE LEED PLATINUM TELUS GARDEN DEVELOPMENT TRANSFORMS AN ENTIRE CITY BLOCK INTO ONE OF NORTH AMERICA'S MOST TECHNOLOGICALLY ADVANCED COMMERCIAL DEVELOPMENTS [1]. THE GLASS PAVILION PROVIDES SHELTER AND ANIMATION AT STREET LEVEL [2]. THE STRUCTURE OF THE GLASS PAVILION FROMS PART OF THE OFFICE LOBBY [3].

In-service Performance

We understood simple solutions are the best approach, without ignoring opportunities that take advantage of new technologies and design strategies to reduce energy use and increase occupant control. We returned to the building after it was fully occupied to review the current energy use. We compared the month of December 2015 to the LEED energy model. The result was that the actual electricity use for December was lower than Integral Group's original energy model.

Water Conservation

The vision for TELUS Garden included 1,000 m^2 of rooftop terraces and gardens where employees could relax, conduct informal meetings and even grow their own vegetables. Recognizing that clean potable water is one of Earth's most valuable resources, the design team wanted to create this green oasis in the city centre without placing an undue burden on the municipal water system. At TELUS Garden, a multitude of measures were implemented to reduce the total potable water consumption to the minimum. For instance, the lowest flow fixtures and waterless urinals were selected for this building to reduce the water consumption by an additional 15% as compared to today's typical low-flow fixtures.

Rainwater Harvesting

The building has a rainwater harvesting system to reuse captured rainwater. 25% of the water used for toilet flushing is sourced from captured rainwater. In maintaining the vast greenery landscape in the building, only captured rainwater is used. To make best use of the available rainwater, the "drip-type" irrigation system efficiently and precisely provides water to the roots of the vegetated areas for maximum water savings. The combined water conservation measures reduce the building's potable water consumption by 60% as compared to a reference baseline building.

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