BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

1515 DOUGLAS

STEP 2

750 PANDORA

STEP 3

Project Type: Part 3
Location: 1515 Douglas St, Victoria BC
Year Built: 2018 (under construction)
Square Footage: 290,000 SF
Developer: Jawl Development Corporation
Designer/Architect: D'Ambrosio Architecture + Urbanism
Contractor: Campbell Construction Ltd.

Mechanical Engineer/Energy Modeling: Integral Group
Estimated project cost: not provided
Energy model used: Yes
Blower door test performed: No
Other Certification Achieved? LEED Platinum targeted (CaGBC v2009 CS)
Energuide rating (if applicable)? N/A

Project Description

The guiding principles for this project were to create an office and retail complex of market leading quality standards, that would add vibrancy to the public realm and prioritize environmental and operational building performance. From the outset the project goal was to achieve Platinum certification under the v2009 Core & Shell system, with priorities placed on practical and tangible benefits such as increased energy efficiency, reduced site impact, and provision of excellent indoor environmental quality. Through the course of design development and construction documentation, aspects of the design were required to be revisited and adjusted, such as components of the exterior envelope. All adjustments were tested against the energy model target inputs and implemented by the consultant team with extreme care, to ensure the anticipated energy performance would be maintained.

Energy Conservation Measures incorporated

Building Envelope

- Elevations designed to limit **window-to-wall ratio**; 1515 Douglas is approx 52%, 750 Pandora is approx 43%
- U-0.28 high-performance double glazing
- R-26 exterior walls
- R-40 roof
- R-15 exposed floor/soffit
- Potential thermal breaks were thermally modeled with insulation added to reduce heat loss

Mechanical Systems

- All-electric **Hybrid Air/Ground-Source Heat Pump System** uses no fossil fuels for space conditioning or ventilation heating/ cooling
- Modular metal-panel **Radiant Heating/**

Cooling System serves all office spaces to provide optimal thermal comfort and space conditioning without fans

- Central ventilation and exhaust system uses commercial-scale **Heat Recovery Ventilators (HRVs)** to recapture energy from exhaust air, and decrease heating demand for fresh air intake
- **Demand-Controlled Ventilation** varies ventilation supply air based on CO2 in each office space
- **Variable-Speed Motors** reduce pump and fan energy throughout entire project including heating and cooling pumps, parkade fans, and central ventilation system
- Underfloor air plenum provides low-velocity **Displacement Ventilation** for optimal indoor air quality (once-through supply at low-level, extract at high-level) (750 Pandora building only)
- Semi-conditioned rotunda space conditioned by **In-floor Radiant Heat**
- All retail spaces served by hydronic fan coil units connected to base building system for **Internal Heat Recovery and Load Diversity** (i.e. air-conditioning of retail spaces provides heating to offices)
- **High-Efficiency Condensing-Type Natural Gas Water Heaters** provide domestic hot water for all offices and common areas
- **Building Automation System** uses Direct Digital Controls (DDC) to monitor weather and optimize heating/cooling plant performance, enable night/unoccupied setback, and track consumption of water, natural gas, electricity, and thermal energy by end-use for ongoing optimization and accountability.

Electrical Systems

- **High-efficiency LED lighting** used throughout the project.

Builder Notes and Lessons Learned

- Use energy modeling at schematic design stage, and be very specific about goals of modeling, e.g.:
  - investigate various envelope and wall systems and test sensitivity of total annual utility consumption and energy cost,
  - identify potential thermal breaks or sources of high-intensity consumption,
  - develop energy targets for LEED,
  - develop energy targets in terms of EUI (Energy Use Intensity) and TEDI (Thermal Energy Demand Intensity) especially for new BC Energy Step Code
- For ground-source heat pump systems, identify optimal area (in terms of square-footage and location) for borehole field early in design, as this has impact on overall excavation sequence and construction schedule.
- Implementation of an underfloor Displacement Ventilation systems requires consideration of total building height, floor-to-floor heights, and elevations (i.e. glazing placement, elevator stops, stair layouts, etc.) – this type of system offers significant flexibility benefits and increased ventilation effectiveness, but requires buy-in from tenant/end-user early in design stage.
- Develop Measurement & Verification plan for implementation of digital controls and metering of utilities – define granularity of information required, and how it will be used by the operator/landlord.

Content provided by: Jawl Development Corp, D'Ambrosio Architecture + Urbanism, and Integral Group (Fall 2017)

BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

THE EMERSON

STEP 2

Project Type: Part 3
Location: 1015 Rockland Ave, Victoria BC
Year Built: 2016
Square Footage: 16,000 SF
Developer: 1015 Rockland Holdings Ltd. c/o Abstract Development Group of Companies
Designer/Architect: KPL James

Contractor: Abstract Construction Inc.
Estimated project cost: $188/sf
Energy model used: Yes
Blower door test performed: Yes
Other Certification Achieved? Built Green Silver
Energuide rating (if applicable)? 81

Project Description

We intended for this project to be an infill project targeting the downtown professional or first-time home buyer. We aimed to provide a quality home that would allow walkability to all the local amenities that downtown Victoria has to offer, with the understanding that a walkable lifestyle is a more sustainable lifestyle. As well, our company's commitment to quality made the Built Green program a natural fit, allowing us to provide a more energy efficient home of excellent quality to our purchasers. The added cost of attaining Built Green certification was planned for from the outset of the project, with design development and construction phases keeping sustainability top of mind throughout. We had a sold-out building upon completion and achieved our target of Built Green Silver as well.

Energy Conservation Measures incorporated

We were able to use the HOT2000 energy modeling software to achieve our sustainability goals. We based the initial design off of the Built Green Worksheet to ensure we'd reach Built Green Silver as well. Some specific measures taken include:

Envelope and Energy Systems

- R-7.5 (above code) exterior insulation on exterior of foundation
- R12 above building code for under basement slab
- Insulated lintels
- Advanced insulation sealing around window, door, and attic openings
- Insulated hot water lines for first six feet from hot water tank

- Installed fireplace fan kit for circulation of warm air
- Rough-in a ceiling fan and switch
- ENERGY STAR refrigerator, dishwasher, clothes washer and dryer, and convection based oven
- Project was built "solar ready" following NRCAN guidelines
- Installed a central "all-off" switch to disable all non-essential electrical loads in the home

Materials and Methods

- Natural cementatious siding for greater than 90% of exterior cladding
- All insulation certified to contain a minimum of 25% recycled content
- Natural carpet pad
- 30-year warranty roofing material
- Rain screen system separating cladding from the wall sheathing
- Deck made from low maintenance material
- Lifetime finish on all faucets and door hardware

Indoor Air Quality

- Low formaldehyde insulation, sub floor sheathing, underlayment, and cabinets
- Low VOC paint used on all interiors and all site built millwork
- CRI IAQ label on all underlay and carpet in the home

Ventilation

- All ductwork joints and penetrations sealed with low toxic mastic or aerosolized sealant system
- All bath fans have a noise level of 1 sone or less
- All ventilation fans meet or exceed ENERGY STAR requirements

Waste Management

- Implemented a comprehensive recycling program during building, ensuring that a minimum of 35% of the materials collected from the site have been diverted from the waste stream
- Installed a permanent recycling center for the home owner

Water Conservation

- Installed a 1.28 GPF toilet in the bathrooms
- Installed low flow faucets throughout the home, a water saving dishwasher, and a front-loading clothes washer
- Supplied minimum of 8" of topsoil as finish grading throughout the site

Builder Notes and Lessons Learned

From the beginning of this project, we worked to demonstrate and implement the criteria from the Worksheet regarding energy-saving construction methods to achieve a Built Green Silver certification. Compared to the base case for the BCBC this means that our project is 20 to 30% more energy efficient, which would meet Step 2 of the proposed Step Code legislation.

BERNHARDT PASSIVE HOUSE

STEP 5

Project Type: Part 9 (Duplex)
Location: 1535 Oak Crest Dr, Saanich BC
Year Built: 2013
Square Footage: 3,800 SF
Developer: Bernhardt Family
Designer/Architect: Cascadia Architecture

Contractor: Bernhardt Contracting
Estimated project cost: $200/sf
Energy model used: Yes (PHPP)
Blower door test performed: Yes (0.46 ach @ 50)
Other Certification Achieved? Passive House
Energuide rating (if applicable)? 88

Project Description

This was our first Passive house built by our team, was the first on Vancouver Island, and third in Canada at the time. The house was built for the Bernhardt Family, but also to demonstrate what was possible. At the time, there really wasn't much out there of this type, so it was a big experiment. The biggest surprise was how well it worked.

Energy Conservation Measures incorporated

Super Insulation, 2x8 structural insulated (cellulose) wall with 2x4 service cavity (Roxul). OSB and Tape Air barrier. Zehnder 550 HRV, Euroline 4700 series Windows. Careful planning and design achieved the biggest benefits.

Builder Notes and Lessons Learned

We were very particular about the products used and details of install. Quality control is essential.

The shape of the building has a major effect on the performance. It also has a major effect on the cost. Simple buildings perform better and are less expensive to build. Designers need to decorate the envelope, not decorate with the envelope.

BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

NORTH PARK PASSIVE HOUSE

STEP 5

Project Type: Part 9 (6 Unit MURB)
Location: 860 Queens Ave, Victoria BC
Year Built: 2015
Square Footage: 5,800 SF
Developer: Bernhardt Developments
Designer/Architect: HCMA Architecture + Design

Contractor: Bernhardt Contracting
Estimated project cost: $230/sf
Energy model used: Yes (PHPP)
Blower door test performed: Yes (0.42 ach @ 50)
Other Certification Achieved? Passive House
Energuide rating (if applicable): N/A

Project Description

The North Park Passive House is a 6 unit MURB. Each suite is two bedroom and one bath. It was the first Multifamily Passive House in the Country, and was built for the open market. It was the first building of this standard to be sold in the country. It was built to demonstrate the business case for high performance building. This project sold for 8% above appraised market value in 15 days. This was achieved even with a very public murder occurring in the house next door the day before listing. The market at the time was also much slower than it is today.

This was the second project completed by this team, so we felt confident we could make Passive House, and started working on other sustainable aspects of the build. This building has 7.5 kW solar PV as well as edible and native landscaping.

Energy Conservation Measures incorporated

Super Insulation, 2x8 structural insulated (cellulose) wall with 2x4 service cavity (Roxul). Fabric and Tape Air barrier. Zehnder 200 HRV in each suite, Euroline 4700 series Windows. Careful planning and design acheived the biggest benefits.

Builder Notes and Lessons Learned

This Project is a prime example of how simplicity really matters. It has two dormers on the top floor. These were added after feedback from the community to "fit the neighborhood". This change resulted in a 10% loss in building efficiency and occupies a lot of space on the roof so the building could not achieve net zero with solar panels. They also resulted in a major build cost increase.

BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

MARY ST PASSIVE HOUSE

STEP 5

Project Type: Part 9 (Duplex)
Location: 732/736 Mary St, Victoria BC
Year Built: 2016
Square Footage: 3,000 SF
Developer: Bernhardt Developments
Designer/Architect: HCMA Architecture + Design

Contractor: Bernhardt Contracting
Estimated project cost: $210/sf
Energy model used: Yes (PHPP)
Blower door test performed: Yes (0.6 ach @ 50)
Other Certification Achieved? Passive House
Energuide rating (if applicable): N/A

Project Description

The Mary St Passive House is a duplex that was built on spec and sold on the open market. It is two stories with 1500 sqft on each side. Each side as 3 bedrooms and 2.5 baths. The goal of this project was to increase the efficiency of the building from previous results and to reduce the build cost. The project has successfully reached the efficiency goals and costs were reduced somewhat although they did not meet the original goal. Some of the cost increases were a result of the hot market at the time.

Builder Notes and Lessons Learned

We found the exterior insulation to be very challenging to work with and extremely costly. Although the performance numbers are good, we will not use this wall system again.

Energy Conservation Measures incorporated

Super Insulation, 2x4 structural wall plus 7.5" of exterior (Roxul). Fabric and Tape Air barrier. Novus 300 HRV in each suit, Euroline 4700 series Windows. Careful planning and design achieved the biggest benefits.

BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

WILSON ST PASSIVE HOUSE

STEP 5

Project Type: Part 9 (Duplex)
Location: 408/406 Wilson St, Victoria BC
Year Built: 2017
Square Footage: 3,000 SF
Developer: Bernhardt Developments
Designer/Architect: HCMA Architecture + Design

Contractor: Bernhardt Contracting
Estimated project cost: $215/sf
Energy model used: Yes (PHPP)
Blower door test performed: Yes (0.5 ach @ 50)
Other Certification Achieved? Passive House
Energuide rating (if applicable): N/A

Project Description

The Wilson St Passive House is a duplex that was built on spec and sold on the open market. It is two stories with 1500 sqft on each side. Each side as 3 bedrooms and 2.5 baths. The goal of this project was to increase the efficiency of the building from pervious results and to reduce the build cost.

This building saw our best outcomes to date in terms of relative cost and efficiency. The methods used were easy for carpenters and trades to work with and install. The actual cost was higher but when we correct for market inflation it was the most cost effective building.

Energy Conservation Measures incorporated

Super Insulation, 2x4 structural wall 9.25" TGI joist mounted on the outside, which create a cavity for dense pack cellulose. Fabric and Tape Air barrier. Novus 300 HRV in each suit, Euroline 4700 series Windows. Careful planning and design achieved the biggest benefits.

Builder Notes and Lessons Learned

The TGI wall system (the puffy jacket) was by far the most economical wall system we have used to date. It was also the fastest to install and least weather dependent. We will be using this wall system on our next builds.

BC ENERGY STEP CODE CASE STUDY – CAPITAL REGION

URBAN GREEN

(Fifth St Passive House)

STEP 5

Project Type: Part 9 (Duplex)
Location: 2750 Fifth St, Victoria BC
Year Built: 2017
Square Footage: 3,100 SF
Developer: Aneesa Blake & Reed Cassidy
Designer/Architect: Cascadia Architects
Contractor: Interactive Construction

Estimated project cost: $250/sf hard cost, $300/sf with soft costs
Energy model used: Yes (PHPP & HOT2000)
Blower door test performed: Yes (0.34 ach @ 50)
Other Certification Achieved? Passive House Classic & Built Green Platinum
Energuide rating (if applicable)? 85

Project Description

Low energy consumption was the main goal, with limited global resources and rising energy costs being what they are. Some secondary goals were low building maintenance needs, simple yet elegant design and spaces, and quality building materials and practices. Passive House met these goals, because of the demonstrated low energy demand and the use of existing (and free) heat sources rather than high-tech heating/cooling systems.

Being a young professional couple, the owners wanted to build something with passive income generation, so a duplex satisfied that desire. The lot has rezoning potential for further future development as well.

The outcome is a building that the neighborhood loves and we are happy to be living in.

Energy Conservation Measures incorporated

We wanted to build to a high standard of energy efficiency while utilizing local and traditional construction practices as much as possible, rather than doing something that was and unfamiliar for everyone involved. This proved to be easier than anticipated.

The Passive House principles were all adopted: high levels of insulation, air-tight construction, high-performance windows and doors, a heat-recovery ventilation system, eliminating thermal bridging through well-designed building assembly details, and proper building orientation to make use of solar gains and shading. Utilizing the Passive House principles was easy to do, but this must be done right from the very first step of the very first phase of the project. The total added cost to build to Passive House standards was 15% above Building Code minimum, which isn't all that much.

Content provided by: A. Blake, R.Cassidy & Interactive Construction (Fall 2017)

There are some easy things to do that are "green", such as permeable concrete paved surfaces, local building materials, and reusing any parts of an existing tear-down building into the new project.

There are people available to help builders/designers/owners understand how to go high-performance rather than Building Code minimum, so someone doesn't need to try and learn it all for themselves. Rather, they can contract people to make it easier.

Builder Notes and Lessons Learned

Incorporate energy modelling early on and concurrently with the design process, to help provide design guidance and ensure project design is incorporating energy efficiency considerations throughout the design process.

All the trades need to be on the Passive House wagon, and doing some course work is very beneficial. If nothing else, the site supervisor needs to be on top of people and do a quick discussion with trades before they begin, especially around air barrier assemblies and their importance.

Plan the work, and work the plan. Hit the ground running with a well thought out building design, assembly details (i.e. window & door header/jamb/sills, wall intersections, floor to wall intersections, air barrier details, etc) and energy model, and don't deviate from these plans on site. Doing so will ensure the building meets the original intents. Making it up along the way will not work if high-performance is the goal.