Homesol Passive House Design Process

Passive Houses are residential, commercial and institutional buildings in which a comfortable temperature can be achieved year-round with a 75% – 85% reduction in energy use. They are not simply "passive solar", although they do optimize passive solar space heating without excessive overheating. They are not necessarily net zero energy buildings, although their small footprint makes adding renewable energy systems much easier. They cost more to build initially but are demonstrably economically superior to standard construction on a monthly cost of ownership basis. Passive Houses must meet very stringent, third-party verified criteria regarding both their design and construction, including:

Annual Heating Demand
Annual Cooling Demand
Peak Heating Load
Peak Cooling Load
Air-tightness
Primary Energy Demand
Overheating

Milestones to certification:

- **Preliminary:** Project Consultation Meeting to discuss proposed Passive House specifications, with Follow-up Summary
- **Feasibility:** PHPP OR WUFI-P Modeling / Basic Analysis of Proposed Design to Achieve Energy Target
- **Start-Up:** PHPP OR WUFI-P Final Modeling, Verification of Assemblies & Specs, Site Meeting, Solar Site Survey
- **Construction:** PH/NZE Pre-Certification & Consulting Support, Inspections, Pre-drywall Air Tests, Energy Modeling & Revisions
- **Completion:** Final Inspection, Air Tests, Vent. Flow Rates, Energy Model Verification & Rating
- **Submission:** PH File Admin., QA & Certification (iPHI, PHIUS or combined), incl. NZE Certification

Client may opt-out of proceeding further with the Passive House design and certification process on completion of any milestone.

Preliminary: Project Consultation Meeting to discuss proposed Passive House specifications, with Follow-up Summary:

In-person meeting with client (may be by teleconference for projects outside of Eastern Ontario) to cover the general outline and scope of the project. The key areas that will be discussed include:

Site location and orientation;
Preliminary design and geometry;
Budget;
Expectations;
Contract; and
A follow-up summary of the meeting.

Feasibility (schematic design stage): PHPP OR WUFI-P Modeling / Basic Analysis of Proposed Design to Achieve Energy Target

Based on the Preliminary Meeting, and when sufficient design information is available from the Project Team to complete a preliminary analysis of the building, Homesol will model one iteration to determine as-designed energy performance and suggest initial upgrades as necessary to meet Passive House criteria.

To begin the energy modeling process, Homesol will require at least a pdf of the proposed geometry of the building including window openings and floor plan.

Initial proposed building assemblies and HVAC specs should be provided if available. If assembly details and components have not been selected or considered at this stage, Homesol will provide examples based on experience.

Homesol provides reports on the results of energy modeling, but does not provide any working energy models or spreadsheets to clients or design teams.

Start-Up (pre-construction stage): PHPP OR WUFI-P Final Modeling, Verification of Assemblies & Specs, Site Meeting, Solar Site Survey

Homesol will work with all the key players in the project - Client, Architect/Designer, Builder, Trades and Suppliers – to help design a building to meet the Passive House criteria.

A site meeting will be held to discuss the project and to ensure that the key players (clients, architect/designer, builder, local building official, subcontractors, etc.,) are all on the same page. Solar and shading conditions will be assessed prior to proceeding

with final modeling (photos, measurements and Google Earth reference provided by others may be substituted on projects outside of Eastern Ontario).

The plans provided by the client for pre-construction start-up verification should ideally have the following details:

- **Site plan** that includes the building's orientation, and the distance of potential shading objects from the building and their heights. This could include neighbouring structures, prominent trees and any other objects that could potentially shade the building. This must be supported with photographs and a Google Earth screen shot.
- **Floor plans** with clearly identifiable dimensions. Exterior dimensions are to the exterior side of the thermal envelope, where vented air spaces and siding may not be included. Interior dimensions should include drywall.
- **Elevation drawings** with clearly identifiable dimensions for floor heights, length of overhangs, such as roof, balcony, etc., and their distance from the top of the windows, and height of basement above grade (if applicable).
- **Window and door** rough opening sizes and the number of units per rough opening.
- **Section and construction details,** which indicate potential thermal bridges. These details should also clearly define the air barrier and the way in which it will be executed.
- **Ventilation system** layout that indicates duct runs and their required flow rates.
- **Schematic drawing** of the heating, cooling, domestic hot water (DHW) systems if applicable.
- **Component list** including all makes and models of all proposed components including: windows and doors, HVAC equipment, insulation, DHW, etc.

Construction: PH/NZE Pre-Certification & Consulting Support, Inspections, Pre-drywall Air Tests, Energy Modeling & Revisions

PH Support - Homesol will provide Passive House technical support throughout the construction process. Any changes to the preliminary plans **must** be communicated to the Homesol team to ensure that PH certification is not jeopardized.

Air Test -A preliminary air tightness test will be performed as soon as the continuous air barrier is complete. This needs to be **as early as possible** so that if the mandatory airtightness is not achieved at this point Homesol can provide diagnostic testing to determine air leakage locations and ensure that they are properly sealed.

Good architectural detailing in the plans should help prevent failure, but site conditions may allow for mistakes to be made. Depending on the planned air barrier system, this could be scheduled before insulation is installed.

Energy Model Revisions - The energy model will continually be updated to reflect any changes in the construction details. Ideally to maintain the integrity of the initial compliant plans and specifications, the only change in the energy model should be the results of the preliminary air test.

Pre-Certification – Documents for the certification submission file will be gathered throughout this stage of construction. Photographs should be taken by the project team throughout the construction process. In particular, construction details that are indicated on the plans that will be hidden will be required. These photos will be the responsibility of the client or the construction supervisor.

Submittals required at this stage from the Project Team:

- Site plan including the building's orientation, neighbouring structures (position and height), prominent trees or similar vegetation and possible horizontal shading from ground level elevations along with photographs of the plot and surroundings.
- Complete construction drawings (floor plans, sections, elevations) with clearly identifiable dimensions, envelope areas, window rough opening sizes, etc.
- Reference plans for all building envelope areas and windows with clearly depicted thermal bridges if present.
- Detailed drawings of all building envelope connections. For example, the exterior and interior walls at the basement ceiling or floor slab; the exterior wall at the roof and ceiling; the roof ridge and verge; horizontal and vertical sections of the window installation; the anchorage of balconies, etc. The details should be given with dimensions and the materials used.
- The airtight layer should be indicated and the way in which it is executed at connection points should be described.
- Ventilation plans: the design and placement of ventilation units, volumetric flows, sound protection, filters, supply and exhaust ducts, air transfer openings, duct diameters and insulation thicknesses, sub-soil heat exchanger (if present), ventilation controls, etc.
- Heating, cooling and plumbing building services including diameters and insulation thicknesses: illustration and design of heating and cooling systems, heat storage, heat distribution systems (pipes, ducts, heating coils, heating surfaces, pumps, control), domestic hot water distribution (circulation, individual pipes, pumps, control) and drain/vent lines.
- Electrical services plans including specifications of lighting, appliances, elevators, etc.

- Concept for efficient electricity use with, for example, specified devices and explanations as well as incentives for the house or apartment owner.
- Supporting documents and technical/product information sheets, especially on insulation materials.
- Information on window and door frames to be installed including manufacturer, type, Uw-value, Ψinstallation and Ψglazing edge as well as drawings of all planned installations in the external wall.
- Information about the glazing to be fitted including manufacturer, type, coatings, Ug-value and spacer type.
- Description of the planned HVAC, hot water and other mechanical systems with schematic drawings, if applicable.
- Manufacturer, type and technical data sheets of all technical HVAC, hot water and mechanical systems, ductwork/piping and accompanying insulation thicknesses, heating coils, frost protection, pumps, etc.
- Information about the sub-soil heat exchanger if present including length, depth and type of installation, soil quality, size and material of tubing and heat recovery efficiency
- Information on the length, dimensions and insulation level of hot water and heating supply pipelines as well as of the ventilation ducts between the heat exchanger and thermal building envelope
- Documentation of air flow rates including the make and model of the ventilation unit, the flow rates and wattages for normal operation and heat recovery ventilation balancing report (within 10%)
- Digital photographs documenting the construction of the PHIUS+ Project should be provided.
- Implementation of plans and specifications must be documented and confirmed by the construction manager. Any variation should be brought to the attention of the project team before implementation. This is to ensure that the changes do not compromise certification.

Please note: All Passive House relevant documents should be examined by Homesol during the planning stage so that potential corrections or suggestions for improvement can be considered early on.

Homesol Deliverables for Pre-Certification:

- Coordination with certifier throughout the pre-certification process, including:
- PHPP OR WUFI-P Worksheet
- Project Verification
- Interior Calculated (Treated) Floor Area (iCFA)
- Climate data

- Summary of areas with allocation of R-values (U-values), radiation balance data and thermal bridges
- List of building elements used including their composition and resulting R-values (U-values)
- Window U-values (glass, frame, spacer)
- List of windows and glazing(s) used
- Shading factors according to the Solar Pathfinder Analysis (Default 25% in lieu of)
- Additional shading factors
- Net Air Volume for air test
- Ventilation efficiency and duct length and insulation levels to exterior
- Summer ventilation, mechanical and/or manual ventilation.
- Specific Heating Demand according to the PHPP OR WUFI-P method
- Specific Cooling Demand according to the PHPP OR WUFI-P method
- Heating Load according to the PHPP OR WUFI-P method
- Cooling Load according to the PHPP OR WUFI-P method
- Frequency of Overheating according to the PHPP OR WUFI-P method
- Portion of domestic hot water demand covered by solar, if present
- Calculated electricity demand
- Primary Energy Demand
- Documentation of the thermal bridge coefficients used in the PHPP OR WUFI-P according to ISO 10211, if required
- Demonstration of summer comfort.
  Note: The PHPP OR WUFI-P procedure for determining the frequency of overheating only shows an average value for the whole building, however, individual parts of the building may overheat.

Upon the completion of this stage, the project should have an energy model that meets the Passive House requirements, and a preliminary air test result that meets the certification criteria.

Completion: Final Inspection, Air Tests, Vent. Flow Rates, Energy Model Verification & Rating

Final inspection – A site visit by Homesol will be required to verify that the certification file for submission matches what has been built or installed.

Air test - The final air test will be performed to ensure that the criterion of ≤ 0.6 ACH50 has been met. The results will be entered into the energy model.

Ventilation system – The ventilation system will be balanced and the air flow rates will be measured and recorded according to the Final Ventilation Protocol.

Submission: PH File Admin., QA & Certification (iPHI, PHIUS or combined), incl. NZE Certification

Certification – The completed submission file then be sent to the Certifying Organization.

Homesol Deliverables for Certification:

- Coordination with certifier throughout the certification process
- Completed Quality Control Checklists, including:
    - Cover Sheet
    - Building Envelope
    - Ventilation
    - Heat + Cool
    - DHW + Lights + Appliances
    - IAQ
    - Water Management
    - Renewable Energy Ready
    - All information provided for pre-certification, updated as necessary