PAPE VILLAGE

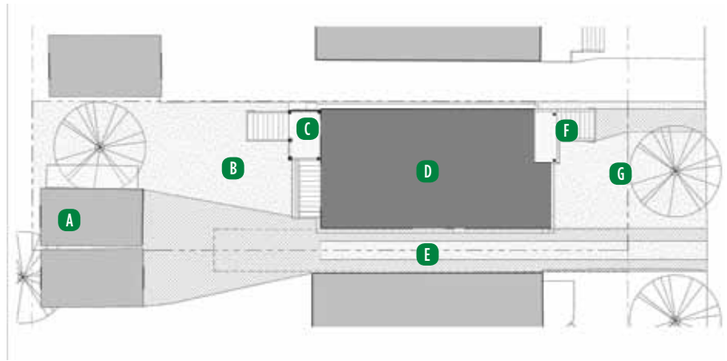
House

Active and passive solar in the city

Our clients had begun to outgrow their small, East Toronto bungalow in Pape Village and wanted to pursue their dream of a well-designed, energy-efficient home. We designed them a new, two-storey home which uses passive and active solar systems and a highly insulated, air-tight envelope. The house actually generates electricity and scores 85 on the EnerGuide scale!

BY MELODIE CONEYBEARE

DETAIL OF THE FRONT ENTRY [1], AND STREETSCAPE [2]. THE REAR ELEVATION WHERE SUN SCREENS BLOCK THE SUMMER SUN. THE PHOTOVOLTAIC [PV] ROOFTOP SOLAR ARRAY IS VISIBLE AND IS CONNECTED TO THE ONTARIO MICROFIT ELECTRICITY BUY-BACK PROGRAM WHERE THE EXCESS ENERGY PRODUCED FROM THE ROOF IS FED BACK INTO THE GRID FOR A PROFIT [3]. TRIPLE-GLAZED WINDOWS WITH FIBERGLASS FRAMES HAVE LOW CONDUCTANCE OF HEAT AND COLD [4].



Site plan

- **A** Garage
- **B** Rear yard
- **C** Deck
- **D** Two-Storey house
- **E** Shared driveway
- **F** Front porch
- **G** Front yard

ACTIVE SOLAR

The house has an active photovoltaic [PV] rooftop solar array. The PV panels are part of a 5-kW system that is connected to the provincial MicroFit electricity buy-back program. With no battery storage on site, all the excess energy they produce from the roof is fed back into the grid for a profit.

This PV system is designed so that each module has a micro-inverter on the back that can be individually monitored and optimized. Generated electricity goes to the mechanical room ready to be used right away, and if efficiency drops [due to blow-on leaves for example], they can know exactly which panels are affected and remedy it right away. There's also an online dashboard which lets the owners monitor the system from wherever they are.

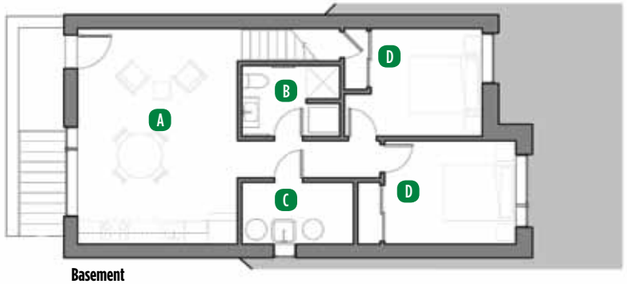
The numbers from their MicroFit participation are very encouraging. From their program start in late March 2014 until the end of December, they generated 4,759 kWh. That electricity was fed back into the grid in exchange for a monthly cheque, which has already amounted to over $2,500.

RETURN ON INVESTMENT

Our energy consultant for this project, BlueGreen Consulting Group, calculated the annual return on investment for the PV system using the initial investment amount of about $22,500 before tax, the MicroFit numbers to date, and climate data for their first eight months in the program. The system will pay for itself in just 7.4 years, a 14% rate of return. The cumulative net profit over the next 20 years, assuming that the available solar radiation stays the same, will be in excess of $35,000.The cumulative net profit is calculated for 20 years to match MicroFit's 20-year contract terms. The system will continue to yield a profit after that time has passed, but the rates are yet to be determined by the Province.

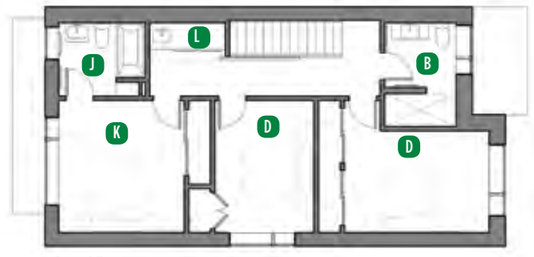
ENERGY EFFICIENCY AND AIR TIGHTNESS

In addition to passive and active solar systems, the house uses triple-glazed windows with fiberglass frames which have low conductance of heat and cold, in-floor radiant heating, ductless mini-splits for air-conditioning, an energy recovery ventilator, lots of ceiling fans for air circulation, LED lighting for all pot lights and compact fluorescents for the rest. The plumbing system uses a shower drain heat recovery system which channels the heat from used shower drain water to preheat hot water used elsewhere in the house. The home is also roughed in for a future greywater system, and all fixtures are low-flow.



Basement

Main floor



Second floor

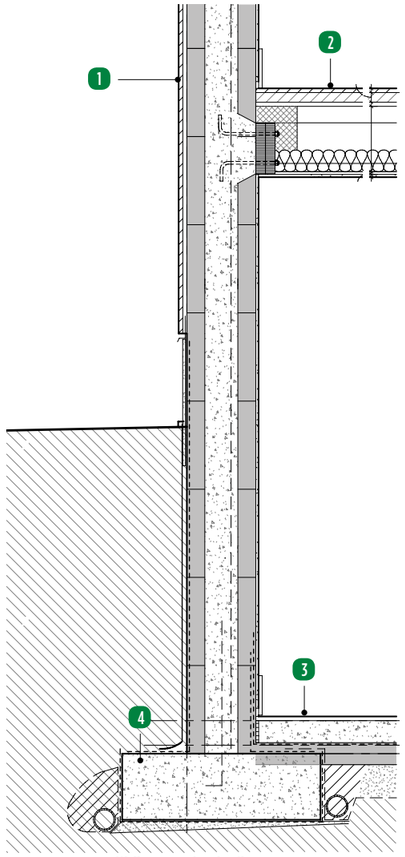
Floor plans

A	Recreation room
B	Bathroom
C	Mechanical
D	Bedrooms
E	Dining room
F	Living room
G	Kitchen
H	Entry
I	Den
J	Master bathroom
K	Master bedroom
L	Linen/laundry closet

PROJECT CREDITS

ARCHITECT Solares Architecture Inc.
CONSTRUCTION Pro ICF
ENERGY TESTING BlueGreen Consulting Group
HVAC DESIGN Shrigley Garcia & Associates
STRUCTURAL Katakkar Engineering Associates
PHOTOS Frank Crawford

INSULATED CONCRETE FORMS [ICF] BY AMVIC ARE USED FOR THE FOUNDATION AND ABOVE-GRADE WALLS. THE ICF UNITS HAVE 3-1/4" OF EPS FOAM ON EACH SIDE OF A CONCRETE CORE AND DELIVER AN INSULATION VALUE OF R22 TO R30, AND AN ALL-IN-ONE VAPOUR AND AIR BARRIER [5, 6 AND 7]. THE FRONT ENTRANCE OPENS ONTO A LARGE KITCHEN-LIVING-DINING SPACE [8 AND 9].



Wall construction detail

1 – Exterior wall
- Cement BD board siding
- Amvic ICF Wall: 5-3/4" poured-in-place reinforced concrete between inner and outer 3-1/4" EPS insulation
- 1/2" GYP board

2 – First floor
- Engineered hardwood on 3/4" OSB
- 1-1/2" Synthetic floor topping with in-floor heating tubes
- Engineered floor truss @ 16" c/c
- 4" Mineral wool thermal insulation
- Resilient channels
- 5/8" GYP board

3 – Basement slab
- Laminate flooring on underlay
- 4" Concrete slab with radiant in-floor tubing
- 6 mil poly VB taped and sealed [between insulation]
- 2-Ply 2" XPS insulation, lap joints
- 6" min 3/4" clear stone
- 4" Dia weeping tile in 12" deep trenches tied into sump
- Landscape fabric continuous to foundation wall

4 – Concrete footing cast in waterproof membrane

Pape Village is our first house built completely with insulated concrete forms [ICF]. The ICF units have 3 1/4" of EPS foam on each side of the concrete core, bringing this wall type's insulation value from R22 to R30. ICF is considered a premium construction material which gives a very air-tight home with an all-in-one vapour and air barrier – both factors that contribute to extremely energy-efficient homes. The increased construction cost incurred by the material was well worth it.

The insulation values of this house are high, with R30 in the walls and basement, R20 in the basement slab, and R56 in the roof. The roof is made using 6" of spray-foam insulation and 3" of polyisocyanurate, making for a highly insulated assembly. With all these strategies, Pape Village achieved one of our best air-tightness ratings yet: a mere 1.05 air changes per hour.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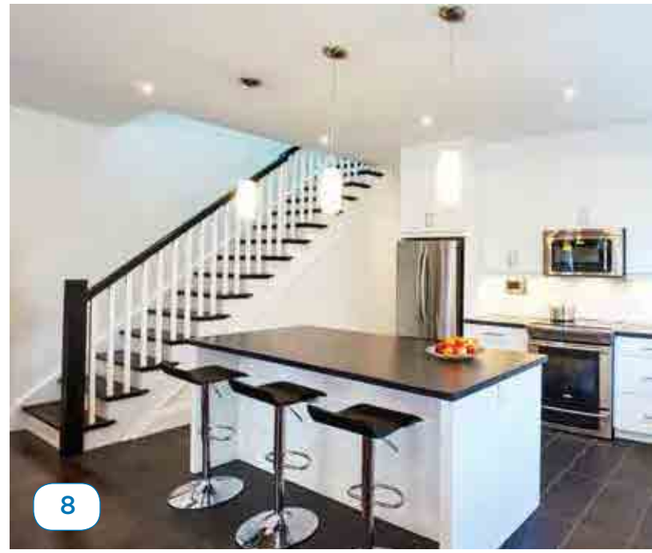
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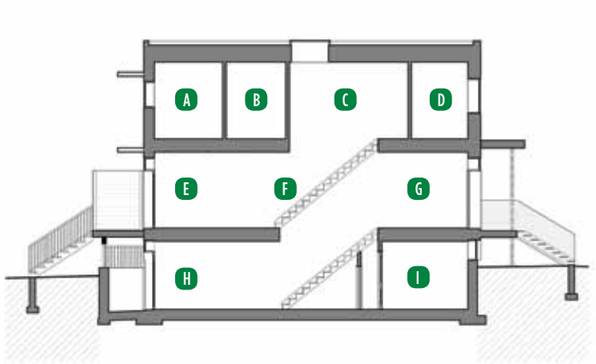

Building section

A Master bathroom
B Linen/laundry closet
C Hallway
D Bathroom
E Dining
F Kitchen
G Entry
H Recreation room
I Bedroom


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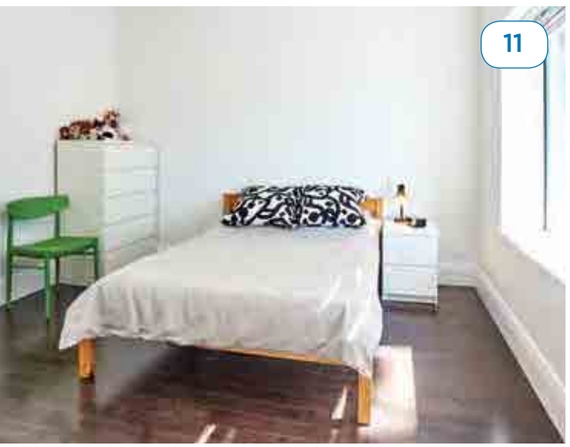
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MATERIALS

Walls constructed with **Amvic+ 3.30** insulated concrete forms [ICF]; parallel chord truss roof insulated with polyiso above roof deck and spray foam insulation below; triple-glazed fibreglass frame low E, Argon windows; **Velux** skylight above stairs, electrically operable with remote control and electrically-operable blackout blind. Flooring is engineered hardwood and unglazed porcelain tile with Mapei tile grout. Energy recovery ventilator and condensing boiler; photovoltaic panels 5 kW system photovoltaic array.

THE VELUX SKYLIGHT ABOVE THE STAIRWELL IS ELECTRICALLY OPERABLE WITH REMOTE CONTROL WHICH ALLOWS FOR NATURAL STACKHOUSE VENTILATION. IT ALSO BRINGS ABUNDANT NATURAL LIGHT INTO THE CORE OF THE HOUSE, BUT IS FITTED WITH AN ELECTRICALLY-OPERABLE BLACKOUT BLIND [10]. THE SECOND FLOOR ACCOMMODATES THREE FULL-SIZE BEDROOMS [ONE ENSUITE], A FAMILY WASHROOM, AND A LAUNDRY AREA SEPARATED FROM THE HALLWAY BY A LARGE SLIDING WALL [11].

DESIGN AND INTERIORS

The owners wanted to use the property they already had and gain more space than their small bungalow allowed, which meant they needed an extra storey on virtually the same footprint. The new home's flat roof and rectangular shape allowed us to maximize floor area [850 sq.ft. per floor] while keeping within municipal height regulations. The skylight positioned above the stairs brings natural light into the deep core of the house. Floor heights are generous, with 9-foot ceilings on the main and second floors, and an 8-foot ceiling in the walk-out basement. The basement is roughed in for a separate two-bedroom suite, and with three bedrooms upstairs this is essentially a 5-bedroom house.

The front entrance on the main floor links with a spacious home office at the front, and then opens onto a large kitchen-living-dining space. This rear, south-facing family zone is the focal point of the house, and looks out over the backyard through a large floor-to-ceiling window with exterior shading. ❖

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