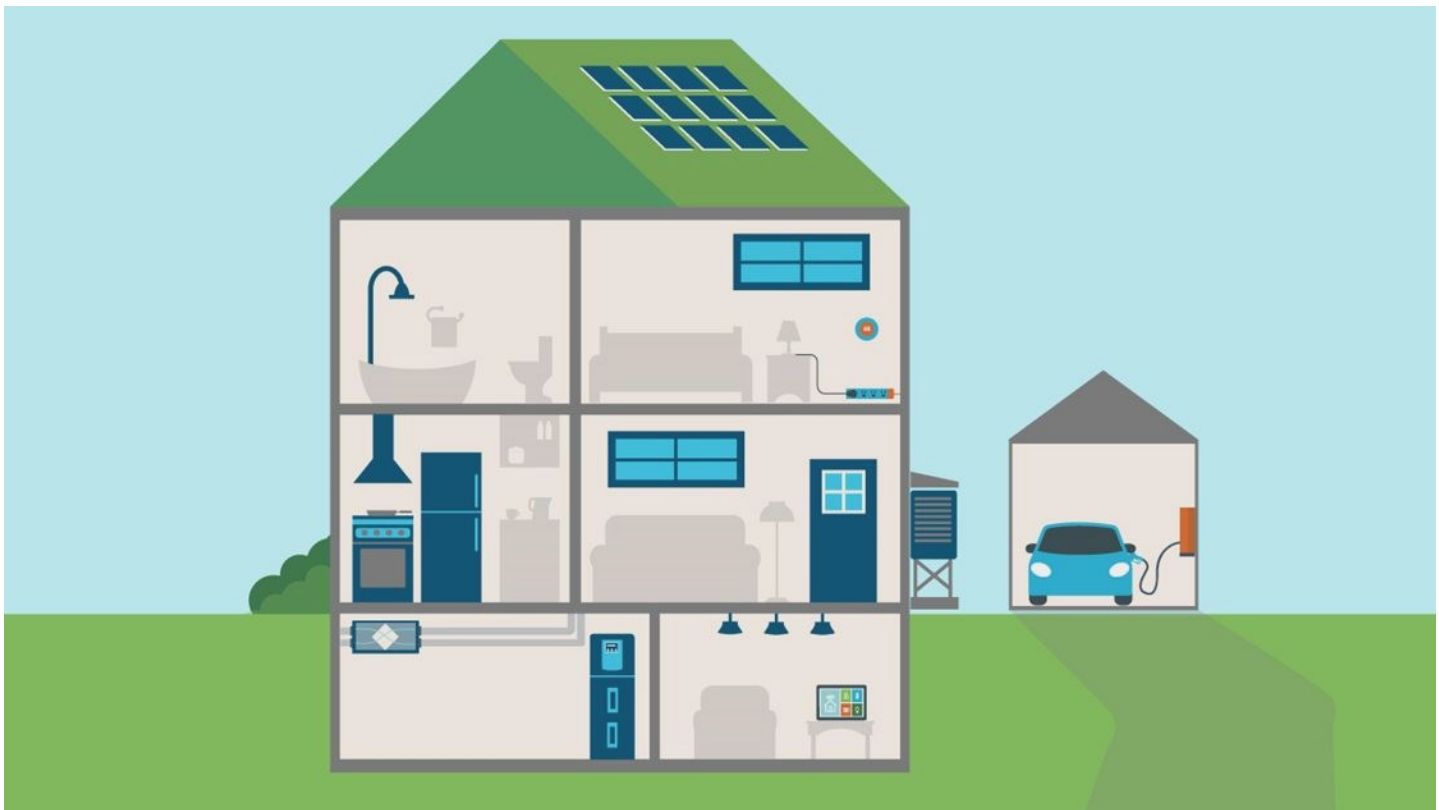


How to Build a Net Zero Home - Construction Guide

Bloom Court Site Visit

Zero Energy Building Demonstration Project



Summary

The plans and specifications provided herein are everything needed for a general contractor with basic competency to build a Zero Energy home. This approach is keeping with CCHC's track record of successfully developing 12 Energy Star Certified homes, 8 Zero Energy Ready homes, and 2 Zero Energy homes. CCHC has designed an approach that was created to maximize the adoption of Zero Energy construction across the state of Rhode Island.

Step 1: Take a set of plans off your shelf

Step 2: Send plans and efficiency improvements to an energy modeler such as CLEAResult

Step 3: Send annual kWh consumption # from energy model along with house plans to a solar array vendor such as Newport Solar to design an array that will produce at least 100% of the estimated annual consumption

Step 4: Update house specs to reflect efficiency improvements and requirements to achieve 1 ACH tightness, RI RNC Top Tier, Energy Star and RI Stretch Code Compliance

Step 5: Include the specs and PV proposal in the construction contract, noting that the specs supersede the plans where conflicts or inconsistencies occur

Step 1:

Take a set of plans off your shelf.



Step 2:

Provide those plans along with the following specifications to an energy rater (such as CLEAResult):

- Exterior insulated sheathing: Zip-R12
- Walls: 2x6 studs 24" o.c. bays filled with dense packed or wet blown cellulose to R-22
- Attic: Cellulose 20" deep R-74
- Windows: triple glazed, w krypton gas (if available) or argon (U-value .20 or less ideal) (European windows not required - typical double-hung such as Harvey Tribute work great)
- Doors: R-5 including any sliding glass doors (ThermaTru and Harvey Tribute for example)
- Simple ERV: Panasonic FV-04VE1 or Broan B110H65RS
- Rim joist insulation: open cell spray foam to R-20 at all floors
- Soffit ends: PVC baffles and open cell spray foam
- Mini-splits: 1 (or 2 max) per floor (Fujitsu model: MUZ-FH06NA (MSZ-FH06NA))
- Heat pump water heater such as RHEEM XE50T10HD5OU1
- Model air tightness at 1 ACH @ 50 pascals to be achieved via Aerobarrier (SealTight Inc.) or similar envelope sealing system (done prior to wall insulation)

Slab on grade:

- Below slab: R-15 either rigid foam sheets or closed cell spray foam
- Slab perimeter: R-20 either rigid foam or closed cell spray foam

Basement (alternate):

- Closed-cell spray foam on interior of basement walls to R-20
- Closed-cell spray foam or rigid foam underneath basement slab to R-15
- Insulation sequencing — next page

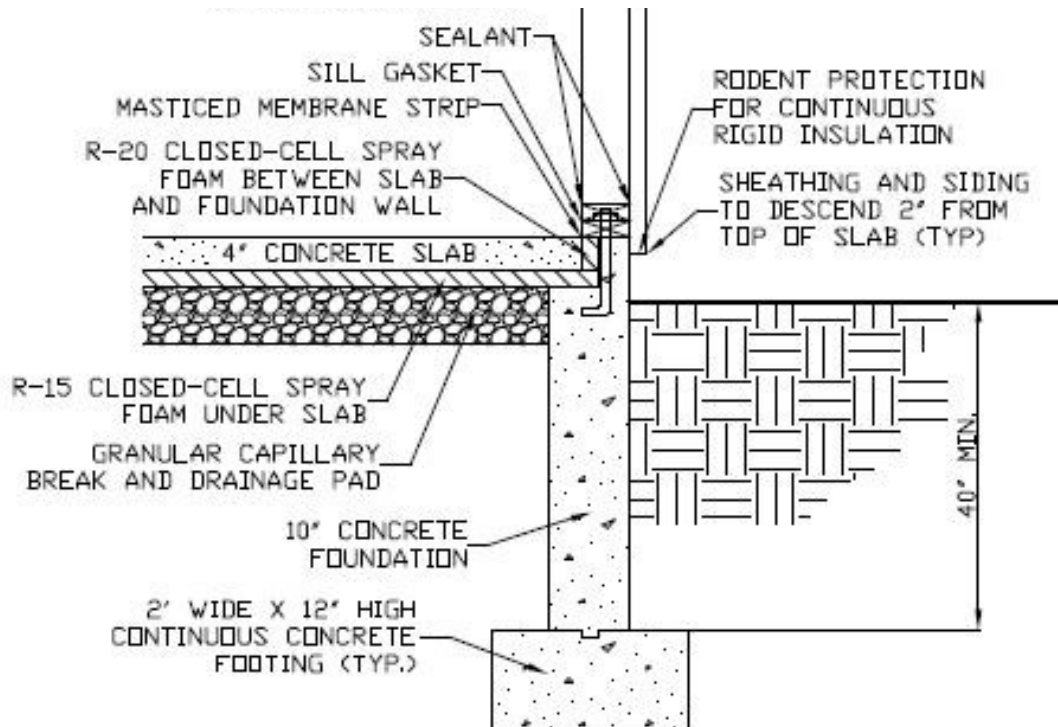
CLEAResult®

Step 2 (cont'd):

Building Insulation Sequencing:

1. Soffit detail - baffle installation with spray applied foam
2. Gypsum board - hang second floor ceiling flat
3. Attic floor - manual air seal and blown-in cellulose insulation
4. Rim joist, air seal windows and doors and basement slab - open cell at rim joist; closed cell below slab
5. Install Aerobarrier
6. Wall insulation
7. Gypsum board - all other interior surfaces

Slab-on-grade Foundation Detail:



Step 3:

Provide the total annual kWhs from the rater provided energy model to a PV array vendor/installer (such as Newport Solar) and ask them to provide a proposal for an array that will offset 100% of the estimated annual consumption.

Energy Model: Summary

Property CCHC 15 Bloom Court Middletown, RI	Organization CLEAResult 866-342-9989 Jeremy Dagold	HERS Projected Rating Rater ID:9866141
---	--	---

Annual End-Use Consumption

Heating (kWh)	1917
Cooling (kWh)	123
Water Heating (kWh)	892
Lights & Appliances (kWh)	4822
Total (kWh)	7754



Step 3 (cont'd):



Church Community Housing Corp

15 Bloom Ct
Middletown RI 02842
Proposal Date: 3/10/2022

Newport Solar

RI RE Professional: REPC-102
Electrical License: AC004943
Contractors License: 24487
NABCEP Certified: ✓

System Summary:

- Proposal Type: • NET METERING PRELIMINARY
- Mounting Type: • Asphalt Roof Mount

- Solar: • Solaria 400 Watt Black
• 25 Year Product & Performance Warranty

- Inverter: • Enphase Microinverters
• 25 Year Warranty & Lifetime Monitoring

- Workmanship: ✓ 15 Year Full System & Workmanship Warranty

Electricity Usage:

12-Month Electricity Use (kWh) **7,754** *Estimate provided by client*

Solar Array Summary:

Number of Panels	16
System Size (kW)	6.4
1st. Year Solar production (kWh)	8,151
% produced by the sun	105.1%
Tree Trim Assumed?	YES

Step 4:

Incorporate into the overall specs the requirements to achieve 1 ACH tightness, RI RNC Top Tier, Energy Star, and RI Stretch Code compliance, along with these additional specs to help the builder achieve them:

- Require a blower door test before sheetrock to find and seal any air leaks before dealing with them gets much more difficult and expensive
- Require venting of bath fan and range hood (required by Energy Star)
- Provide links to Energy Star approved HVAC contractors and EPA Watersense approved products to assist with compliance with RI RNC, Energy Star, and Stretch Code programs

Single Family House Outline Specifications

For 12 & 15 Bloom Court Middletown

General Notes

All work shall conform to the local, state, and national building codes.

Upon completion house must achieve the highest performance Tier of the National Grid Rhode Island Residential New Construction (RNC) Program, receive DOE's Zero Energy Ready (ZER) certification, receive Energy Star Home label, and be compliant with current version of the RI Residential Stretch Code (RIRSC).

Builder is responsible for enrolling in RNC, DOE's ZER, Energy Star, and RIRSC programs and performing all steps in process required to achieve RNC and DOE ZER certification, Energy Star label and RIRSC compliance. These programs require among other things the hiring of an approved HVAC sub-contractor. Approved HVAC subcontractors can be found here:

<https://www.nationalgridus.com/media/pdfs/resi-ways-to-save/rhode-island-electric-mshp-contractors.pdf> The RIRSC program requires the utilization of EPA WaterSense approved fixtures/products and leak testing of plumbing. List of approved WaterSense products found here: <https://www.epa.gov/watersense/watersense-products>

Additional requirements of RIRSC can be found here:

<http://www.energy.ri.gov/documents/leadbyexample/stretch-code/RIRSC%20Compliance%20FINAL%202002-16-18.pdf>

Upon construction completion the house MUST achieve a blower door tested building envelope air tightness of 1 Air Change per Hour (ACH) or less at 50 Pascal's of pressure. Two blower door tests are required. The 1st blower door test is required after MEP rough-in and attic insulation, but before wall insulation and Aerobarrier. See Building Insulation Sequencing on last page of house plans. A blower door test done by SealTite (or other air tightness vendor) can satisfy the 1st blower door test requirement. A 2nd blower door test is required by the RNC program at the end of construction.

Contractor and their subcontractors are responsible for all required permitting and RNC, Energy Star, RIRSC coordination; however, all rebates and incentives are paid to Church Community Housing Corporation.

Step 5:

Include the specs and PV proposal in the construction contract, noting that the specs supersede the plans where the conflicts or inconsistencies occur. Additionally, require cooperation between the general contractor and the PV array contractor.



...and those are the five steps to achieving a net-zero home!

Additional Notes:

Options for balancing HVAC:

When HVAC unit(s) are in a common area:

- Use louvered doors for bedrooms and bathroom, or
- Undercut doors by 1.5" or more

When HVAC unit(s) are in a bedroom, or other enclosed room:

- Use an inline fan and flex duct to move air between connected rooms by placing supply in room with HVAC unit and return in last room connected via air pathway kits. Fantech Incline Fan and Quiet Cool ZAP-140Z Air Pathway kits shown below



Heat pump hot water heater location and ducting (if needed):

- Requires a 10' x 10' open area to work properly. If unavailable, they can be placed in confined spaces such as closets if a manufacturer supplied duct kit is used to ensure adequate air supply

Ovoid oversizing HVAC:

- HVAC contractor will oversize mini-splits if not told it's a super-insulated, super-tight home. Rely on energy modeler to reassure sizing of mini-splits. The smallest mini-splits are the most efficient. Oversized units will increase electrical consumption and thereby increase size of PV array needed