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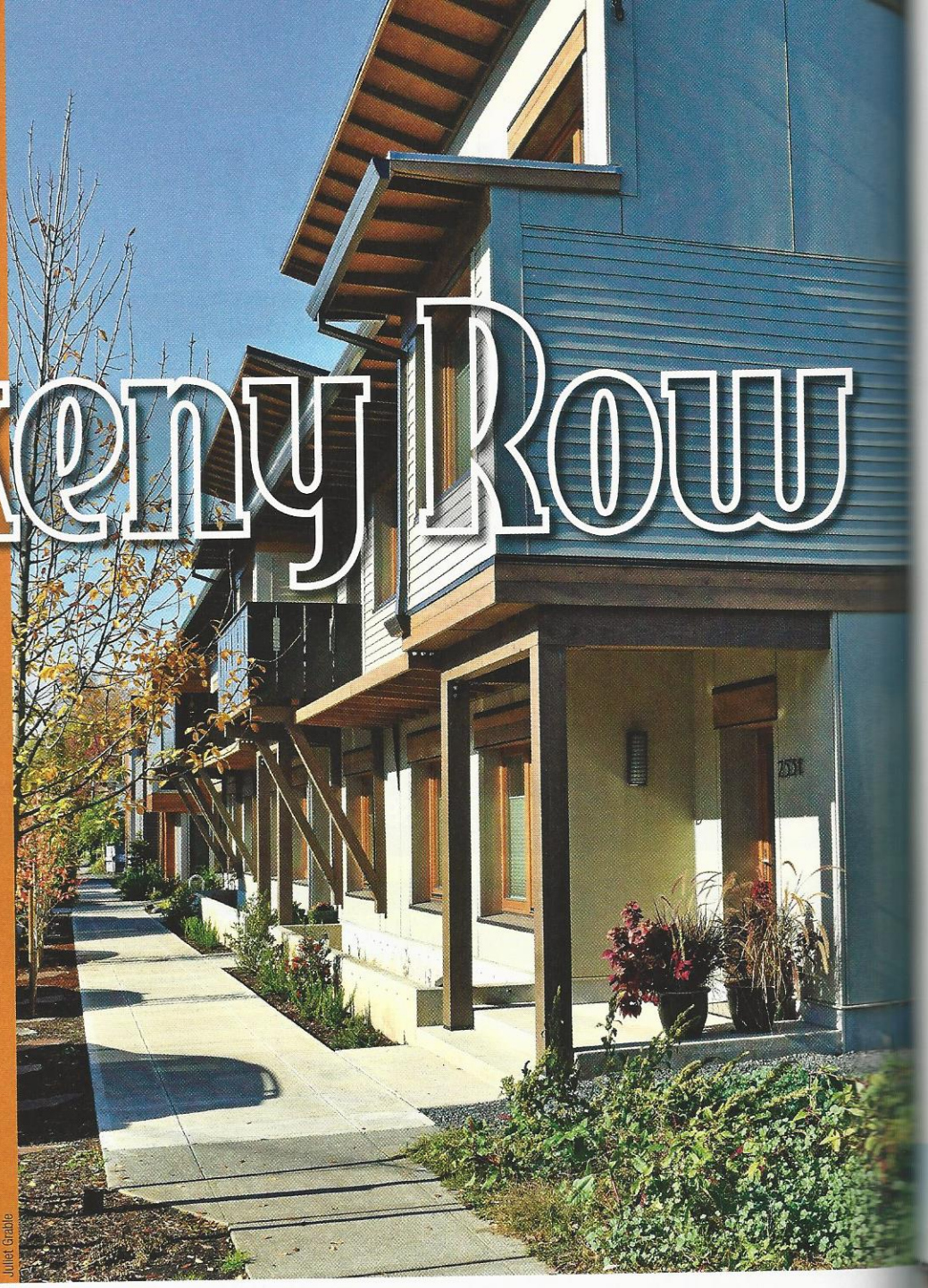
Ankeny Row

A Net-Zero Retirement Community

by Juliet Grable



Juliet Grable

Courtesy Green Canopy

When attorney and Green Empowerment nonprofit founder Michael Royce dreamed of the perfect community in which to retire, he envisioned something akin to his childhood neighborhood in Milwaukee, Wisconsin. The 10 townhouses on Ogden Avenue shared walls and a common backyard. Everyone knew each other, and Michael, his brother, and their friends would run in and out of each other's houses. Neighbors sat on their porches and visited until late in the evening.

Today, Michael is one of 11 residents of Ankeny Row, a "pocket community" in the heart of Portland, Oregon. Ankeny Row shares features with Michael's old Milwaukee neighborhood. The townhouse-style units share walls and a common courtyard. Residents are both neighbors are friends. Parking is conspicuously absent.

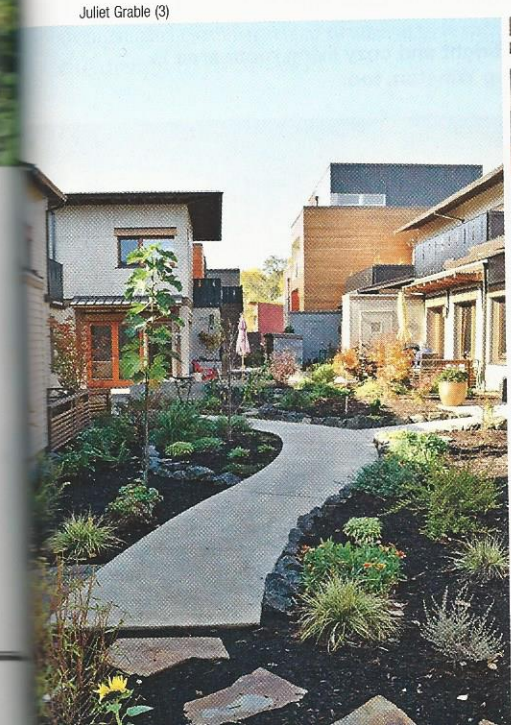
But Michael and his wife Francie, a former city planner, didn't just stumble upon this idyllic community. They helped create it.

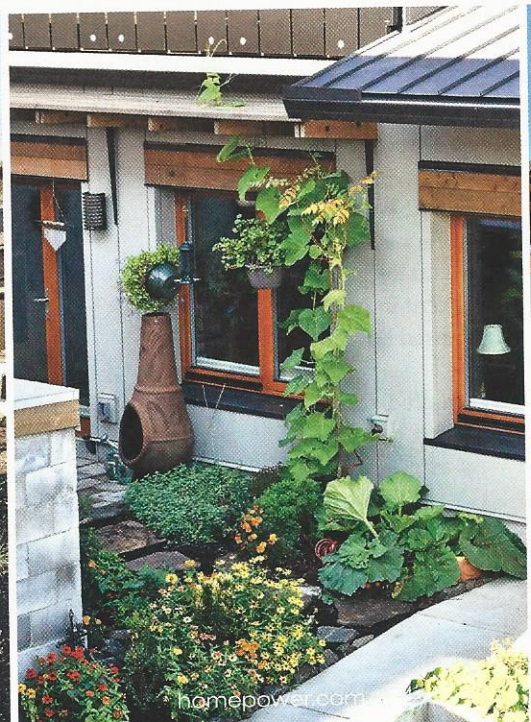
Courtesy Green Hammer

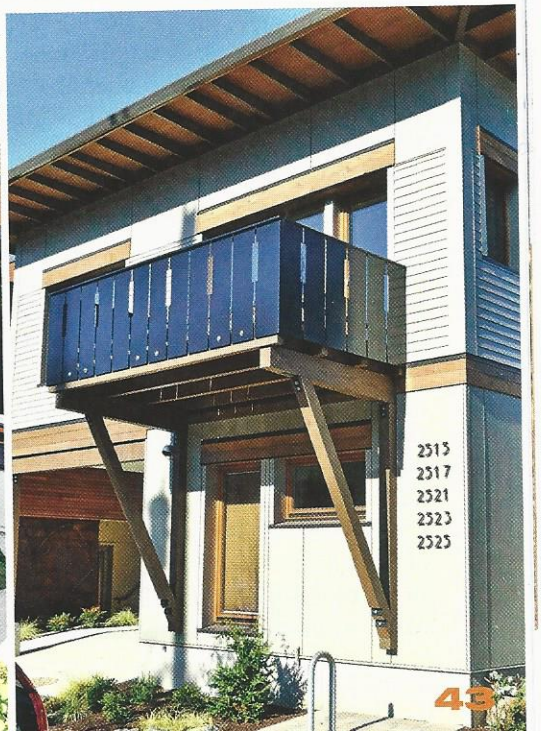
Landscape architect Erin Muir of The Figure Ground Studio was hired to make sure the buildings were well-integrated with the rest of the site, and that it included both private nooks and public gathering places. Her design included a winding path that leads from the common room's patio and terminates at what was to be a shared spa garden. All paths and patios are wheelchair-accessible. Muir also had to meet the city's requirements for dealing with stormwater, which she ultimately solved by integrating deep stormwater planters throughout the site.

The five Craftsman-style two-story townhouses that make up Ankeny Row cluster around a central courtyard. A 500-square-foot common room, which includes a kitchen and open dining/entertainment area, is available to residents for meals and gatherings.

Juliet Grable (3)







Courtesy Green Hammer

Juliet Grable (2)

Dick and Lavinia's kitchen and dining area. No two units are quite the same in layout or interior design and finish.

Creating (More Sustainable) Community

The seeds of Ankeny Row were sown in 2004, when the Royces began brainstorming with friends Lavinia Gordon and her husband Dick Benner. All longtime Portland residents, they shared the desire to downsize and create a different kind of retirement community—one that kept them engaged in their neighborhood and supported their active lifestyles. Their vision aligned with the urban cohousing model: small, super-efficient dwellings, with a shared green space and a common room, set in a vibrant, walkable neighborhood. They couldn't find exactly what they were looking for, so they decided to create it.

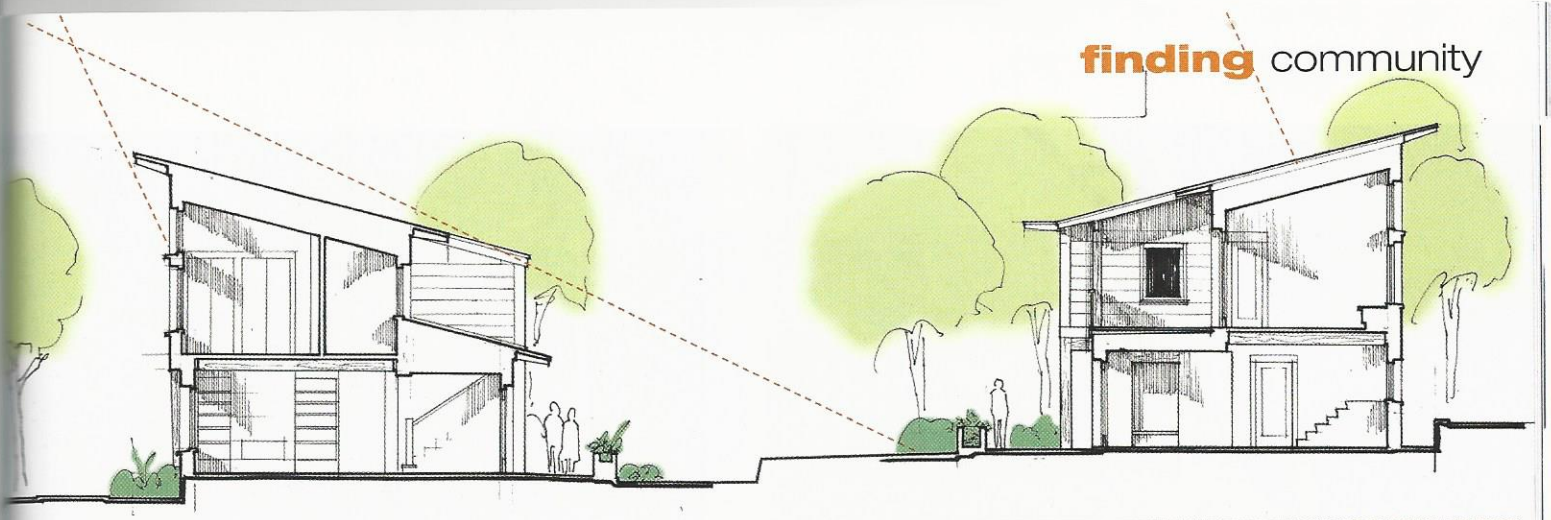
Their backgrounds (law and city planning) helped them navigate the challenges of buying land, setting up a limited liability corporation, and marketing their vision. In 2010, Lavinia's daughter Sarah was riding her bike down a street in southeast Portland and noticed a "for sale" sign on a vacant lot. The location was ideal: in a neighborhood populated by cafes, brewpubs, markets, and a historic theater. Its "walk score"—a measure of how easy it is to get around without a car—is 87 out of a possible 100, qualifying it as very walkable. Portland was still climbing out of the recession, and the lot was priced well. It included an easement to an adjacent industrial site with an ailing warehouse. The group purchased both lots, doubling their canvas to 12,600 square feet.

"As our thinking gelled, we knew we wanted Passive House construction," says Michael. They wanted to rely on the envelope for principal energy efficiency, as opposed to relying on systems.

"My concept of Passive Houses was that they were blocky buildings with small windows," says Benner. "But I was struck by a Passive House in rural New York, which had large windows and just skewered that notion."

Although the group held the vision for green community, they knew that they needed professional assistance to develop it. By the time Francie called Green Hammer, a Portland-based design/build firm, she and her partners had already interviewed 12 architects. The firm impressed the partners with their commitment to sustainable design. Green Hammer specializes in Passive House construction, and their staff includes four certified Passive House consultants.

Francie and Michael's bright and cozy living room area is appreciated by their dog Winston, too.



The community layout was designed with solar exposure in mind. The north row of houses is even terraced 18 inches higher.

Right: The slab foundations are set on 9 to 16 inches of EPS insulation for R-37.8 to R-67.2.

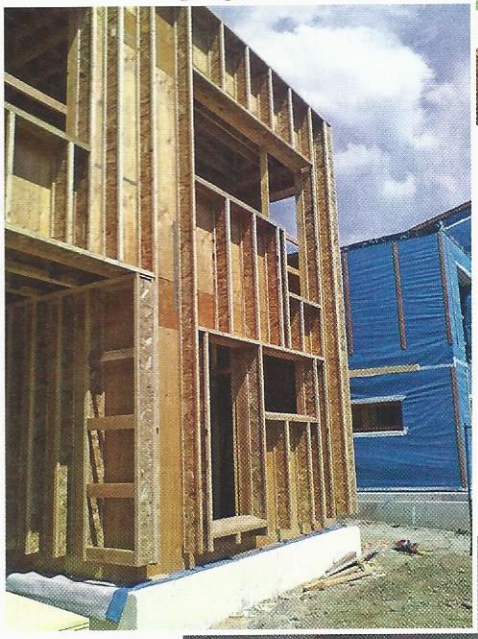
The Green Team

With his contemporary Craftsman style and his commitment to New Urbanism, Green Hammer architect Daryl Rantis was the ideal person to lead the design. Rantis was tasked with balancing the Passive House standard with other design goals, which included creating connectivity among the individual units and complementing the existing neighborhood.

"Daryl was also a firm believer in the relationship between public and private life," says Stephen Aiguier, Green Hammer's founder and CEO. "His design reflects this—the ability to connect with neighbors, but also hide yourself away."

Dylan Lamar, architect and certified Passive House consultant for Green Hammer, worked with Rantis on the design. Lamar provided energy modeling so that they could immediately understand how the design impacted energy performance.

Unfortunately, Rantis died of a heart attack just as the design and development phase was wrapping up. Lamar took the design to completion.



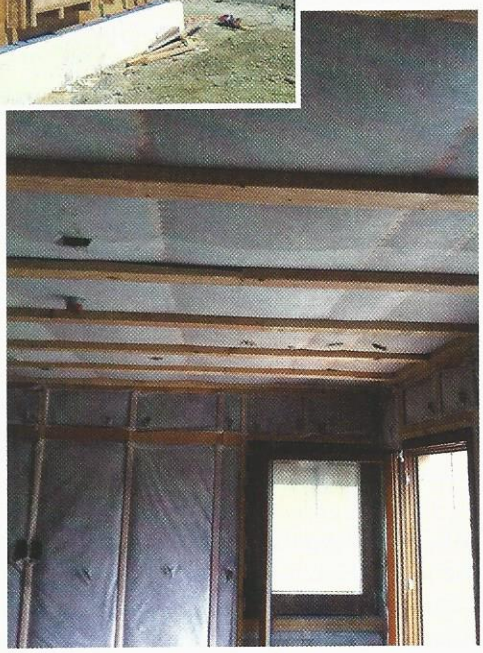
Left: Two-by-four framed walls are combined with 9.5-inch I-joist trusses. The cavities Filled are filled with dense-pack cellulose insulation, creating R-45 walls.

Passive House-Inspired Design

Passive House design uses passive solar siting and airtight, super-insulated envelopes with carefully balanced glazing ratios to optimize energy performance.

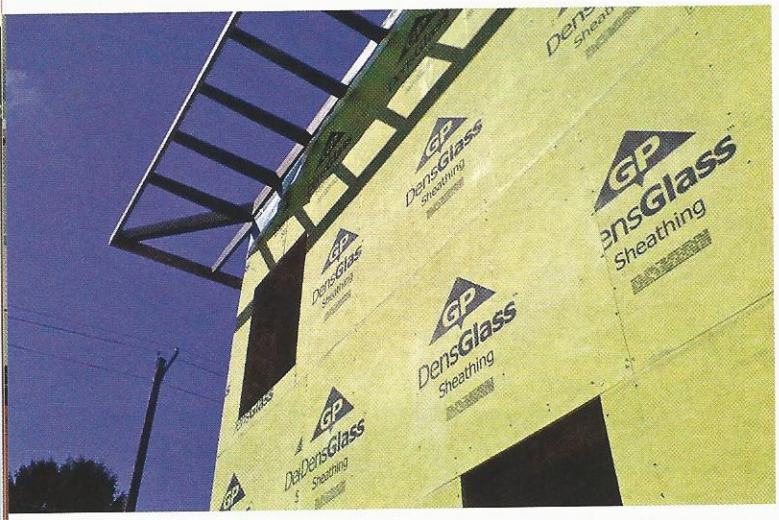
Two rows of dwellings—a block of three units in the back, or north and a block of two units in the front, facing SE Ankeny Street—are set along an east-west axis, with a central courtyard in between. A third building in the southwest corner of the property includes an 800-square-foot residence above the common space. The three back units share walls, as do the front two, which boosts the efficiency of the buildings. The site was graded so that the north units are elevated 18 inches above the south units, which allows more sunlight into the north units in winter.

The buildings have slab-on-grade foundations, mostly to facilitate accessibility for the residents. The design called for 8 inches of expanded polystyrene (EPS) under the slabs, but



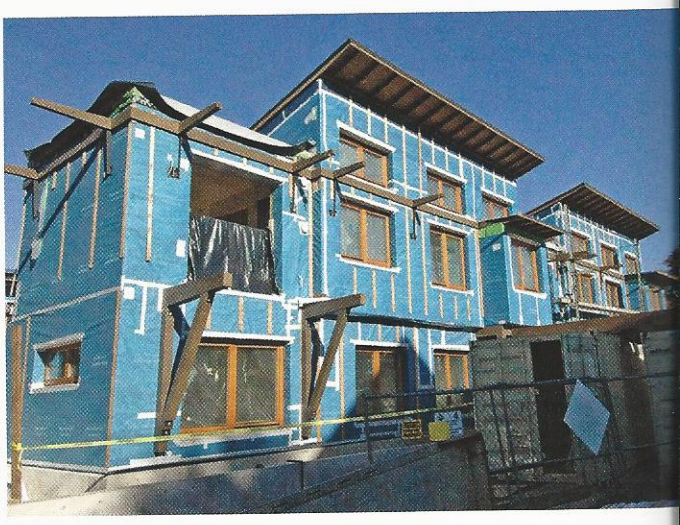
Right: Roof cavities have 30 inches of loose-fill cellulose insulation for R-100 ceilings.

Courtesy Green Hammer (4)



Exterior sheathing is DensGlass fiberglass-faced gypsum for moisture protection—it rains quite a bit in Portland, Oregon.

Courtesy Green Hammer (2)



The moisture and air barrier is SIGA Majvest woven polyolefin, which helps keep air leakage under 1.00 ACH 50.

Green Hammer installed 9 to 16 inches of Geofoam, mostly to accommodate the unconsolidated soils. "We used EPS [instead of XPS, or extruded foam] because it has lower global warming potential, but it still contributes to structure," says Aiguier. (Hydroflurocarbons, known as "super" greenhouse gases, are used to manufacture XPS, whereas EPS uses pentane, which is not an ozone-depleting agent.)

The walls are 2-by-4 wood framing with 9.5-inch I-joists attached. The 13-inch-thick cavities are filled with dense-pack cellulose insulation, achieving approximately R-45. To mitigate potential moisture issues, Green Hammer used DensGlass fiberglass–faced gypsum sheathing because it's permeable, mold-proof, and dries rapidly, and they wrapped the buildings with SIGA Majvest weather- and air-resistant barrier. This woven polyolefin, which Aiguier calls "Tyvek on steroids," has been well-tested in Europe. The ceiling is packed with 30 inches of loose-fill cellulose, which gives it R-100.

Triple-pane tilt-and-turn Zola windows allow a high proportion of glazing without overly compromising energy performance. Seventy percent of the glazing is on the south side, with transom-style windows on the north. The north facades of the south units, which face the courtyard, include more glazing and shading than the northernmost building. Interior blinds help regulate gains.

The five townhomes range from 1,450 to 1,480 square feet, but the square footage is not evenly distributed between the first and second stories. "We didn't want 1,900-square-foot homes," says Francie Royce. "We had a lot of space to play with upstairs, so we cut the room sizes down and added balconies."

Rantis used balconies, awnings, and variation of materials to help break up the facades of the buildings without affecting the thermal envelope. Though all of the units are relatively narrow, the front ones are more square, the back units narrower, with larger great rooms.

In part because of these variations, Ankeny Row is not officially Passive House certified, though the buildings came close to qualifying. Certification depends on meeting thresholds for airtightness, space heating energy demand, and primary energy demand. Airtightness is measured with a blower door test, and cannot exceed 0.6 air changes per hour at 50 Pascals pressure (ACH 50). All three buildings tested at 1.00 ACH 50 or better, and the back three units met the threshold for space heating demand.

At some point, Lamar says, the net-zero energy goal became more important. "The biggest story, as I see it, is that these homes are net-zero energy with such a small solar array," he says. The 25.5 kW batteryless grid-tied array, installed by Portland-based Synchro Solar, consists of 78 327-watt E-Series PV modules from SunPower. It only takes up about 30% of the roof area of the north building, yet the residences are performing at net-zero or better so far.

Metal standing-seam roofing was chosen for its durability and ease of attaching a PV system. S-5! clips attach the array without penetrating the roof.

web extras

"Passive Solar Design from a Passive House Perspective" by Katrin Klingenberg in *HP166* • **homepower.com/166.44**

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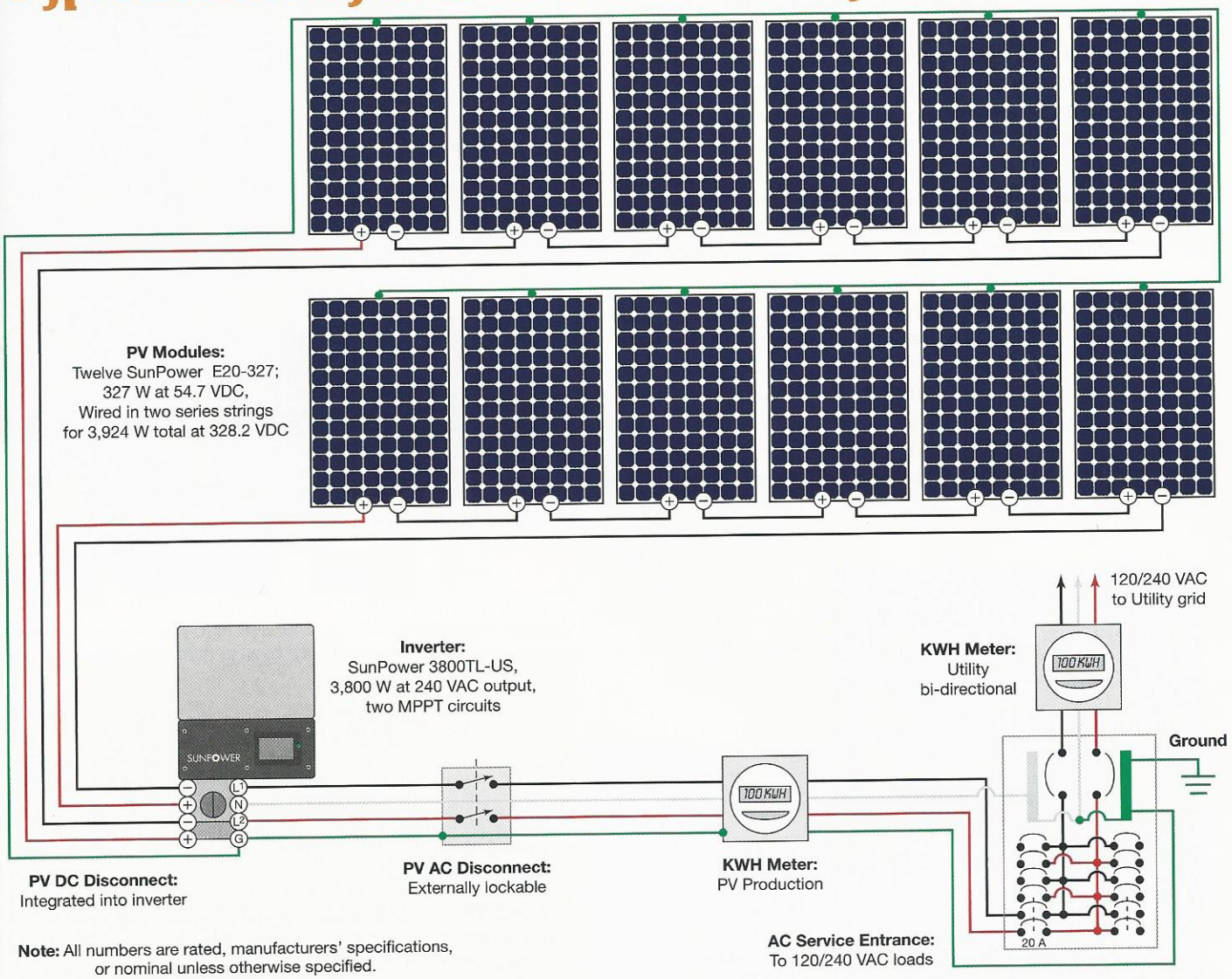
Typical Ankeny Row Grid-Tied PV System



Note: All numbers are rated, manufacturers' specifications, or nominal unless otherwise specified.

Tech Specs

Overview

Project name: Ankeny Row

System type: Batteryless, grid-tied solar-electric

Installer: Synchro Solar

Date commissioned: February 18, 2015

Location: Portland, Oregon

Latitude: 45°N

Solar resource: 4.0 average daily peak sun-hours

ASHRAE lowest expected ambient temperature: 19°F

Average high summer temperature: 89.6°F

Average monthly production: 2,295 AC kWh (estimated, all systems combined)

Utility electricity offset annually: 167% (average for past 9 months)

Photovoltaic System Components

Modules: 78 SunPower E20-327, 327 W STC, 54.7 Vmp, 5.98 Imp, 64.9 Voc, 6.46 Isc

Array: Thirteen six-module series strings, 25,506 W STC total, 328.2 Vmp, 5.98 Imp, 389.4 Voc, 6.46 Isc

Array installation: Unirac mounts installed with S-5! clips on south-facing roof, 20° tilt

Inverters: Six SMA Sunny Boy 3800TL-US, 3,800 W rated output, and one 3000TL-US, 3,000 W; all with 600 VDC maximum input, 175-480 VDC MPPT operating range, 240 VAC output

System performance metering: SunPower monitoring and seven individual production meters

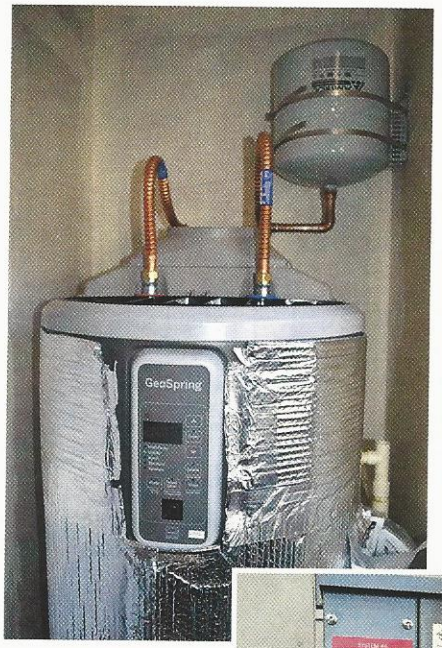
The units are equipped with Mitsubishi minisplit heat pumps, but they have hardly been used. Several of the residents use the ethanol fireplaces for supplemental heat. Because super-efficient buildings reduce heating and cooling loads so drastically, other loads, such as water heating, lighting and appliances, become proportionately greater in energy use. Each residence has a GE GeoSpring hybrid heat-pump water heater. These 80-gallon units harvest heat from the surrounding air to preheat water, making them up to 65% more efficient than conventional tank-style water heaters.

Because the homes are very tight, mechanical ventilation ensures adequate fresh air when windows are closed. Each unit at Ankeny Row has a Zehnder heat-recovery ventilator, which recovers heat from exhausted air in winter and removes heat from incoming fresh air in summer.

The resident-owners are still getting to know some of the systems. For example, the HRV units require some maintenance, including regular cleaning and occasional filter replacement, and the induction cooktops took some getting used to.

Courtesy Michael Royce

Each home has its own PV array, inverter, and production meter. Inverters are SMA Sunny Boy 3800TL-US models rebranded by SunPower.



Juliet Grable

Left: All units have heat-pump water heaters for added efficiency.

Courtesy Michael Royce

Right: Each unit has its own main distribution panel, bidirectional utility kWh meter, and utility-PV interconnection.

Finding Community

After design was completed, the group needed to sell four unclaimed units. Armed with the drawings and six spreadsheets of cost estimates, they approached their closest friends.

"We thought people would be beating down the door," says Michael Royce. "But [at that point], it was still just a concept. We hadn't even broken ground yet." The two couples started talking about a marketing plan, and went so far as to create a flyer, which they distributed to local merchants, but in the end, the couples who bought in were acquaintances or friends of friends.

The townhome-style units are designed to allow the residents to age in place, with open, airy floor plans and bedrooms on each floor. Most couples chose to use the upstairs bedroom as the master, with the option of moving downstairs if they can no longer negotiate the stairs. The upstairs bedroom can also function as a caregiver's quarters.

When it became clear that there would be six unique interiors, Green Hammer hired interior designer Brienne Wasmer of 2Yoke Design to streamline the decision-making process. Wasmer's focus on health also ensured the residents would have high-quality, durable materials and finishes that didn't compromise indoor air quality—from low-VOC paints to wool carpeting.

Michael Royce admits that the degree of customization (along with the rebounding market) drove up the costs. They originally presented the packages, including the land, unit and common area, at $580,000 each. They netted out at around $690,000.

Juliet Grable

Lavinia Gordon and Dick Benner stand in front of their ethanol-fueled fireplace, which is used mostly for ambiance.

At times, the residents are willing to trade efficiency for other benefits. For instance, opening shades in the morning would increase solar gain on a chilly fall morning, but the strong rays can also damage rugs and furniture. Similarly, many of the residents like to keep their windows open all the time, rather than just "night-flushing" the warm air in the evening.

Still, the homes are performing well. "At my 1920s [Portland] house, the total energy bill was around $3,000 a year—and we kept it on the cool side," says Benner. "Here, it will be zero." Benner and Gordon are consuming between 200 and 300 kWh per month. At least three of the units are poised to produce more energy than they consume, with nine-month totals showing excess production between 1,173 and 1,426 kWh.

Since the project was completed, Ankeny Row residents have received several inquiries from people interested in pursuing a similar project. In a nearby neighborhood, a larger-scale 55-and-over cohousing community called PDX Commons is in the works.

"Inevitably, the people who call us want to do 20 units," says Benner. "But I think [limiting it to] six couples makes it feasible." So does affordable land, which is hard to come by in Portland, especially in the desirable core area. The Ankeny Row team benefited from serendipitous timing. Building a medium-density development worked out financially, even though they could have "maxed out" the property with more than 40 units.