EPA Climate Showcase Communities Grant

Welcome Home! Community That Works

Final Technical Report for Tompkins County, NY

Dates Covered by Report, February 1, 2011- November 30, 2014

Overview Summary

The Tompkins County Climate Showcase Communities project set out to demonstrate and document how greenhouse gas emissions can be dramatically reduced in new residential dwellings while, at the same time, creating highly desirable living environments. Building on 20 years of "lessons learned" from the experience of building EcoVillage at Ithaca and three model projects under development locally, we set out to show how greenhouse gas emissions could be reduced by 80% compared to typical homes in the county, and use the results to drive change in new residential development. Although the economic recession of 2008 impacted the schedule for build-out of these projects and, thus, our ability to fully achieve all of the expected emissions reductions we anticipated during the duration of the project, we have been able to demonstrate the hoped-for results. This grant helped to spur the construction of some of the most energy efficient homes in the U.S. - ones that are available to middle-class people.

The Welcome Home! Community That Works project shows that with the inclusion of standard rooftop PV, it is both possible and practical to build net-zero or near net-zero energy homes that provide extremely high levels of resident satisfaction. These houses can be built to create urban, suburban or rural neighborhoods that offer multiple quality of life advantages over standard subdivisions and can be constructed at costs comparable to other high quality new homes.

We have shown that practical technologies and building methods are available that, if broadly adopted, would dramatically reduce, if not eliminate, greenhouse gas emissions generated from occupying new housing. In the coming months and years we firmly believe that the overall projected emissions reductions will be attained and, going forward, we see even more opportunities to incorporate this knowledge into new residential development, both locally and regionally. This is Community That Works - not only for people, but also for the planet.

Introduction: Leveraging a Local Success Story

Under this grant, project partners aimed to document and apply lessons learned from a local example of sustainable community development, EcoVillage at Ithaca, which has achieved national and international recognition. Residents report an exceptionally high quality of life, while using 40% less resources than typical Americans. (Note: over the span of this grant, current residents actually lowered their ecological footprint to 63% less than typical Americans.)

Utilizing the Danish Cohousing model, the three neighborhoods at the EcoVillage have built vibrant, intergenerational communities of densely clustered homes, centered around winding pedestrian streets, with access to a large "Common House" used for frequent community meals, celebrations and meetings. While residents have complete privacy in their own homes, they cooperatively share many amenities, including laundry facilities, a swimming pond and sauna, indoor recreation rooms, community gardens, wood-working and metal-working shops, community libraries of DVDs and books, a Re-use room, children's playrooms, and more.

Three onsite organic farms provide fresh, organic vegetables, fruit and berries through Community Supported Agriculture (CSA) businesses. A full 90% of the 176 acre EcoVillage land is set aside for natural areas and farming, with 100 homes clustered together on just 15 acres of land. Approximately half of all working adults are able to work at least part-time on site in home offices. For the most part, this is a successful, appealing model that combines the latest technologies with the best of traditional village life.

Utilizing the principles and lessons learned from this whole systems approach to sustainable development, Tompkins County planned to create models for new zoning and building codes, support the creation of three pilot projects (hamlet, village, and urban), monitor and measure GHG reductions in these projects, and promote widespread dissemination of these replicable models through multiple educational strategies.

It was envisioned that while 72 new residential units were planned to be constructed during the grant period, each achieving an 80% reduction in GHG emissions over average Tompkins County, NY households, the bulk of the greenhouse gas emissions reductions associated with this project would be seen over time, from leading by example.

Highlights of the Results/Outcomes

1. Two of the three pilot projects were built (rural hamlet of TREE, urban pocket neighborhood) for a total of 28 buildings completed during the grant period, and another 15 under construction. Homes are extremely energy efficient, with all TREE homes achieving LEED Platinum and 7 achieving Passive House (PH) certification- out of only 84 such buildings in the U.S.- representing 7% of the total PH buildings in the country.
2. One pilot project, Cayuga Trail town homes, attracted a national affordable housing developer, but met with stiff opposition from a local neighborhood group, including a lawsuit. The project was abandoned after it was found that a designated wetland on the site was larger than originally known and precluded development at the scale needed to be financially viable.
3. Outreach, or "leading by example" was very effective, with over 4,500 people reached directly through workshops, conferences, or tours. Hundreds of thousands of people were reached through extensive local, national and international media, and another 13,688 unique visitors through the website, videos, and Facebook. In addition, a number of studies including 3 PhD dissertations, a DOE Zero Energy Ready study, and a Landscape Architecture Foundation case study were ripple effects of the grant.
4. A new model zoning code, the Pedestrian Neighborhood Zone, or PNZ, was written as a floating zone which could be applied to rural, suburban, or urban areas.
5. Several new projects have been inspired or influenced by the grant activities, including:
    - Amabel, a planned 25 house project within one mile of Downtown Ithaca being developed by the builder of the Aurora Pocket Neighborhood.
    - A conceptual design for Hillside-North, an inner-city neighborhood in Troy, NY, which is expected to apply the lessons learned at EVI to new infill construction in the neighborhood as it re-develops over the next 10 years or so.
    - A 130 unit project of single-family and duplex homes in the Town of Ithaca, about 2 miles from Downtown, in which the developer is interested in net-zero homes.
    - A number of the professionals who were involved in the grant are now exploring how a form-based-code for the City of Ithaca can reduce transportation GHG emissions in the Ithaca area,

through more compact and pedestrian oriented development patterns. This work is being done with support from the New York State Energy Research and Development Agency (NYSERDA).

- In addition, cohousing and ecovillage projects outside of the region have been directly inspired by the TREE model, including an ecovillage in Sydney, Australia, and a cohousing project planned in the city of Rochester, NY.

Activity under the Grant/Cooperative Agreement

1. Update, document and package EVI best practices for widespread use.

a) **Report:** Project Manager Liz Walker wrote a 25 page paper entitled "*EcoVillage at Ithaca: Principles, Best Practices and Lessons Learned,*" in January, 2012. This document is available on the project website, www.community-that-works.org. It formed the basis for the RFP for developers of the Cayuga Trail development, as well as for the videos created (also on the website). It also helped to inform the work done with Hillside North, an inner-city neighborhood in Troy, NY which won a contest for free consulting work from grant partners.

b**) Analyze and Update Historical EVI data on energy consumption.**

This took place through several avenues: two residents, Dr. Richard Franke, a retired professor, studied energy and water use, and Dr. Francis Vanek, a Cornell adjunct professor of engineering worked with his graduate students in 2011 to capture historical use (see p. 13 & 14 of Lessons Learned document.)

In addition, two graduate students, Jesse Sherry from Rutgers, and Justin Hostetter from the Netherlands carried out dissertation research that included detailed studies of the energy and water use of the FROG and SONG neighborhoods in 2012-2014. Sherry's dissertation, published in early 2014, found that ***the first two EcoVillage neighborhoods represented a total per capita ecological footprint that was 63% LESS than a standard American ecological footprint.*** In other words, EcoVillagers are using a little over a third of the resources of other Americans. This also means that these villagers substantially lowered their ecological footprint from prior years, (measured at 40% less than typical Americans) primarily by adding a 50 KW solar array in 2012. To read abstracts or download the entire dissertations, see the EcoVillage Ithaca website: http://ecovillageithaca.org/publications/

2. Create model building codes, policies and zoning ordinances.

a) **Create zoning ordinance for rural hamlet, urban and suburban nodal development.** The purpose of this proposed regulation is to promote higher density, energy-conscious, people-centered developments within the existing framework of predominantly automobile-centered zoning. This “pedestrian neighborhood zone” (PNZ) is designed as a “floating zone” to be overlaid onto parcels within existing zones in urban, suburban and rural contexts, and potentially serve as a guideline for developing PUD’s and other types of “planned development areas”. It has been written to be applicable to subdivisions as small as 4 houses, but also as large as a village. The PNZ is meant to be a “surgical insertion” where higher or focused density is deemed appropriate by a municipality, or as an overall model for new development.

A pedestrian zone is built around the spatial scale of the human, not around the spatial needs of the automobile. As such, all pedestrian zones will have a similar scale internally, regardless of context.
To download the PNZ, go to the website: http://community-that-works.org/tools/pedestrian-neighborhood-zoning/

b) **Create incentives for developers**. Incentives would be discussed as part of the process of adopting the PNZ. Since the two primary target communities of the City and Town of Ithaca were both engaged in updating their

comprehensive plans throughout the duration of this project it was not an appropriate time to approach them regarding adoption of new zoning standards. It is envisioned that incentives could include expedited review processes for PNZ projects.

c**) Create model "EcoVillage RFP" for county land**. This was created in order to seek developers for 26 acres of county land, which became the plan for the Cayuga Trails development. The RFP can be viewed here: http://www.tompkinsco.org/planning/documents/RFPCountyLandWestHillFinal.pdf
The RFP called for developing two 35 unit densely clustered pedestrian-based neighborhoods on just 8 out of the 26 acres. The project is based on the Pedestrian Neighborhood Zone (PNZ) standards. Two-thirds of the land was planned to remain as open space. The development incorporated pedestrian-oriented design with motor vehicles parked at the periphery, and all homes were oriented to take advantage of passive solar gain and natural light.

The project included a community garden, a community building with a variety of shared-use facilities, green infrastructure for stormwater management, and pedestrian trails for recreation and connection to a nearby transit stop. Homes were planned to be affordable and middle income rentals that could be transitioned to ownership units in the future. A community association was planned to play an active role in decision-making regarding management of common areas.

3. <u>Apply these principles to three demonstration settings as pilot projects:</u>
a) **Rural hamlet:** EcoVillage Ithaca's new TREE neighborhood aims to cut GHG emissions by 80% compared to typical American homes, thus doubling the efficiency of existing EcoVillage homes, while keeping affordability and adaptability for aging in place as key goals.
The TREE neighborhood was a key grant focus. Unfortunately there were multiple delays in the design and construction phases due to many factors, including prolonged Town approvals, a change in construction managers, an architect who retired, and severe winter weather in 2013-2014. At the time of this writing, 25 out of 40 homes are completed and occupied, with the final Common House (community center) and its 15 apartments due for completion in Spring, 2015. All homes to date have reached the very rigorous LEED Platinum certification, and seven homes have reached the extremely rigorous Passive House certification. Neighborhood residents are thrilled to be living in their new homes, and feel a strong sense of community bonding.

b) **Urban:** The Aurora Pocket Neighborhood was planned to demonstrate ecovillage concepts applied to a classic urban neighborhood. It provides a micro-neighborhood that is within walking distance of the heart of downtown Ithaca. Originally planned for 5 homes sharing one city lot, the project was built to contain three new homes sharing a lot with one existing home. The project was downsized by one unit and the remaining houses made larger because of difficulty marketing the original design. All new homes are extremely energy efficient.

c) **Village:** The County owns 26 acres of land that had been slated for development. The plan was to write an RFP based on EcoVillage principles that would attract developers to create one or two densely clustered, walkable neighborhoods, surrounded by conserved open space and within easy walking distance of public transportation (see 2.a.) While the RFP attracted a nationally well-known housing developer (NRP) which partnered with a local affordable housing agency Better Housing for Tompkins County, the project did not move forward because an updated wetlands delineation showed a larger area than indicated on previous inventories. This limited the size of the project and made it no longer financially feasible for the developer.

d) **Evaluate "before and after" resource use** (heating, electricity, water and transportation) and quality of life for incoming residents. This proved to be a surprisingly difficult task.

All TREE households were given a 10 page questionnaire when they joined (or when the grant started, for those who were already members). They were then asked to fill out quarterly data on energy and water use. Incentives were given to those who filled out their reports.

Despite this organized approach, we found it very hard to obtain the "before" data. TREE residents changed dramatically over the course of the grant, with over half the group dropping out at one point when prices rose dramatically and the group had to re-design the project and choose another construction manager. Residents' lives also changed over the course of the three years, with households changing with marriage, divorce, extended travel, children leaving home, etc. People moved from all over the country and from Malaysia, and their "before" homes varied widely from small city apartments to huge, leaky rural homes. Many households moved to Ithaca and then lived in temporary rental units, sometimes living in two or three places before their TREE homes were complete. Many renters didn't have access to energy or water usage data, since it went to their landlords.

The "after" data has been similarly complex. Since the construction was greatly delayed, only 11 TREE homes had data for the first nine months to a year of occupancy. For many, PV installations lagged at least 4 months behind occupancy, giving added complexity in interpreting results. In addition, some units added solar thermal (hot water), and this was also added at different times, based on the contractor's schedule. We were, however, able to draw some meaningful conclusions about the performance of the TREE houses by grouping houses that had reasonable similarities, including their building envelope standards. See appendix for full Energy Study Results.

The Aurora Pocket Neighborhood also had trouble with gathering data with no residents reporting before move-in energy use, and only 2 of the 3 houses reporting after move-in. More importantly, the 2 houses reporting had vastly different heating and energy systems, despite having nearly identical building envelopes. These houses appear in the Energy Study Results, but are not factored into any evaluations with the TREE homes since their building envelopes differ.

4. Document Building Performance

a) **Conduct performance testing during construction**. Both TREE and APN did regular performance testing, including blower door tests with licensed third party inspectors. The grant supported these tests with funding for about half the costs. In addition, TREE hired Steven Winter's Associates (SWA) to help with building certification programs. Lois Arena, one of the engineers, did a study of TREE for the U.S. Department of Energy's (DOE) Building America research program (see appendix for link to draft study, to be published in January, 2015.)

TREE found its construction methods resulted in 0.52 air changes/ hour (ACH) at 50 Pascal's. This surpassed the extremely rigorous Passive House standard, which is 0.60 ACH 50. TREE homes performed at a Home Energy Rating System (HERS) score of 15 with a 4 kWh PV system installed, or 56 without PV. A typical home built to code would achieve a HERS score of 100, while a home that produces as much energy as it consumes would achieve a HERS score of 0. In other words, **Arena's study found that TREE homes with PV were 85% more efficient than a typical new home built to code.** Arena's study was based on modeling software. **The actual performance of the TREE homes is even better.** (see p. 8 for more details)

In addition, TREE homes are DOE Zero Energy Ready homes, meet ENERGY STAR Certified Homes Version 3.0, the U.S. EPA's Indoor AirPLUS and WaterSense, and the insulation requirements of the 2012 International Energy Conservation Code. They also meet the DOE solar-ready program requirements, which require homes to have solar water heating and solar photovoltaics (PV) either installed or ready to install.

As mentioned earlier, TREE homes also meet LEED Platinum, and seven meet the Passive House Institute U.S. certification. http://www.phius.org/home-page. According to PHIUS, **TREE currently has the most certified PH homes of any development in the U.S., with 7% of all PH units in the U.S.**

APN's buildings resulted in 0.41 ACH 50 during blower door tests - even lower than TREE's ACH.

b) **Document electric usage through smart metering system.** We chose not to use smart meters, but instead used that money to help with the building performance testing, which was more costly than we had expected. However, we collected electricity usage for all TREE households, then broke that down further for the 11 households that moved into their homes in mid-September (seven families)or mid-November (four families), 2013. We also collected data on how much energy was produced by the PVs. (charts in appendix)

5. Develop educational materials and modules

a) **Create presentations suitable for conferences**. We hired a local design and marketing group, Stream Collaborative, to create a series of short videos, a logo, an attractive website, www.community-that-works.org, a marketing plan, and a Power Point presentation which has been used by project team members for dozens of presentations locally and nationally. In addition, we hired a NYC based firm, Brandloft, to help us establish a name, "Welcome Home! Community That Works," reflecting the qualities that we wanted to convey in our "brand": friendly, practical and inclusive.

b) **Create workshops for planners, municipal boards, developers and architects among other professionals.** We held one special half-day event on September 30, 2013, for 40 municipal officials and planners from Tompkins County, representing 6 towns. This included tours of APN, EcoVillage and TREE, a local-foods meal, and a presentation by the project team, with some discussion by participants.

We presented at the 2014 Neighborhoods, USA Conference in Eugene, Oregon and the 2014 International Builders Show in Las Vegas, Nevada. We also held a 3 hour accredited workshop for the Southern Tier Chapter of the American Institute of Architects, and presented at the Annual Conference of the New York Planning Federation, the Climate Smart Climate Ready Conference geared toward officials and residents of Tompkins and Cortland Counties, and the Cornell Local and Regional Options for Energy and Climate Change Resiliency Conference in Poughkeepsie, New York.

c) **Create web-based materials to educate the public, including short videos** introducing basic concepts, and featuring resident interviews. We worked closely with Insights International (under the contract with Stream Collaborative) to produce four videos, one about each of the pilot projects, and one overview video all of which appear on the website homepage. They range from three to four minutes long, and have been very well-received, including by the mayor of Ithaca, who is featured in one.

In addition, we have made the Lessons Learned report, the PNZ, and detailed information about each of the projects available on the website.

Results

As noted earlier, due to numerous factors, there were just 28 homes completed during the grant period, rather than the 72 hoped for. This is largely the result of TREE's delay in construction (with 15 more units still under construction, to be completed April, 2015), and the abandonment of the hoped-for Cayuga Trails project of 70 homes.

TREE homes have extremely well-insulated building envelopes, with great attention to air-sealing, and top of the line windows. (see Figure 3). They are passive solar and thus face due south, with large windows on the south side, allowing for daylight and solar heat gain. Additional back-up space heat is provided by just five to ten feet of electric baseboard heaters per floor. Hot water is provided by an electric water heater, which in most homes is offset by solar thermal. Excellent indoor air quality is maintained by an Energy Recovery Ventilator (ERV) in each home, which pre-heats incoming cold air in the winter through exchanging heat with the outgoing stale air.

Homes that were completed in the pilot projects met or surpassed project goals for energy savings of 80% compared to typical household use. **The 11 TREE homes submitting energy use data had an average savings of 78% over a typical Tompkins County household, and homes with renewable energy systems installed during the study period achieved a 92% average savings, with several at or close to net-zero operation.** Since many homes had their PV and/or solar thermal installed partway into the 9-12 month residency period, we fully expect that after a full year of data collection occurs after PV installation, many of these homes will also achieve Net Zero operation. For more extensive results, please see appendix.

The following charts show per household annual greenhouse gas reductions, based on comparison to typical Tompkins County homes, as well as to existing EcoVillage neighborhood homes. Note: EcoVillage First Resident Group "FROG" neighborhood added 56 KW of PV during the grant period, and the electricity produced offsets about 42% of the usage, but there is still natural gas used as back-up space heat, whereas TREE and APN homes are all-electric.

Figure One: Comparison of TREE Homes Actual Energy Usage with Typical TC Homes and EVI Existing homes

	Nat Gas Used (Therms)	Electricity Use (kWh)	Electricity Produced (kWh)	Net Electricity Used (kWh)
Typical U.S. Household[1]	399	12,013	0	12,103
Typical Tompkins County household	470	7,835	0	7,835
TREE Household[2]	0	6,233	3,742	2,491
TREE hh with PV[3]	0	6,177	5,361	816
FROG hh	432[4]	4,830[5]	2,047[6]	2,783

[1] Typical U.S. household is based on the Climate and Air Pollution Planning Assistant (CAPPA) tool from EPA and ICLEI, specifically the measure called "Strict Residential Energy Code," which compares electricity and natural gas usage in new, more energy efficient units, to existing units.

[2] Average of six TREE households reporting at least ten months of data spanning extreme seasons (winter/summer). Included one house without any PV, two houses without PV through part of their reporting period, and 3 houses with PV. (see evaluation spreadsheet F in appendix)

[3] Average of four TREE homes with PV through winter months reporting at least nine months of data spanning extreme seasons (winter/summer). The months not reported were autumn months, which are similar to spring months in that they have a similar ratio of electricity demand and solar production, and as such excluding them would not affect the average. (see evaluation spreadsheet D in appendix)

[4] Based on April 29, 2011 study by Dr. Francis Vanek (data from 28 out of 30 homes for 2010)

[5] Based on 30 home FROG neighborhood data collection in 2013 (Jeff Gilmore) divided by 30 hh

[6] Based on 50 KW array for FROG, and 6 KW array for Common House (community center) divided by 30 hh

Figure Two: GHG Emissions and Energy Saved by TREE HH as Compared to the Tompkins County Average HH

Households	Nat Gas Savings	Nat Gas Savings	Electricity Savings	Electricity Savings	Total GHG Reduction Over TC Avg	Total GHG Reduction Over TC Avg
	Per HH	All 25	Per HH	All 25	Per HH	All 25
Units	Therms	Therms, MCF	kWh	kWh	lbCO2e	lbCO2e, MTCO2e
TREE (25 Magenta-Turquoise Houses)	470	11,750 (converts to 1,204 MCF*)	5,344	133,600*	12,996	324,900 lbCO2e (converts to 147 MTCO2e*)

* Figure Used in the CSC Reporting Template

Figure Three: Renewable Energy Generation in TREE Households

Households	Avg PV electricity generated	PV electricity generate
	Per HH	All 25
Units	kWh	kWh
TREE	3,742	93,550*

* Figure Used in the CSC Reporting Template

Figure Four: GHG Emissions and Energy Saved Only TREE HH with PV and FROG Neighborhood Existing HH

Households	Nat Gas Savings	Electricity Savings	Total GHG Reduction Over TC Avg
	Per HH	Per HH	Per HH
Units	Therms	kWh	lbCO2e
TREE w/ PV	470	7,019	15,263
First Residential Neighborhood	38	5,052	7,304

Figure Five: Insulation of Pilot Project Homes

	Walls	Attic	Foundation	Windows
TREE HH	12" double-wall, 3.5" closed cell foam, 8.5" cellulose, R-52	25" cellulose, R-90	5.5" rigid foam under slab, R-36, with stem walls, footing and skirt insulation	Triple pane, low-e, U=0.17 R-5.88
Aurora Pocket	5” closed cell foam. R-35	8” closed cell foam R-56	3” rigid to footing R-15	Triple pane low-e, u=.18 R-5.55

Figure Six: Unit Types in TREE (40 units: 25 houses, 15 apartments)

Unit Type	# of Units	Square Feet	# of Bedrooms	Total cost:[7]
Turquoise	7	1664	3-4	$285,000
Magenta	8 (4 duplexes)	1280	2-3	$219,000 *
Blue	10	1248	2	$239,000
3BR apartment	7	1150	2-3	$$243,000
1 BR apt.	6	692	1	$164,000 *
Studio	2	420	0	$97,000 *

Figure Seven: Constituencies Reached

At this point, we have reached approximately 5,370 people with direct outreach, such as presentations at conferences and meetings, class projects, class lectures, tours, and targeted interviews. Of these we estimate the following breakdowns:

Subgroup	Actual Number Reached	Target Number in Proposal
Municipal planners from Tompkins County	42	20
Municipal planning board members from Tompkins County	101	95
Elected officials from Tompkins County	113	91
Zoning board members from Tompkins County	90	68
Developers in Tompkins County	178	100
Citizens in Tompkins County	1,490	5,000
Developers in NYS	91	n/a
Citizens in NYS	1,065	n/a
Developers in USA	492	n/a
Citizens in USA	1,269	n/a
International	440	n/a
Total	**5,371**	**5374**

In addition to the figures above, large local, national, and international audiences have been reached over the life of this grant through the publication of various media that discuss the projects, including: four books, four magazine articles, 20 newspaper articles, 21 online articles, seven radio interviews, five scholarly articles, four television reports, four video productions.

We are also tracking website traffic to www.community-that-works.org, and those hits are not included in the chart, above. Since the website was launched a year ago, we have received 13,688 distinct visits, 28,540 entire page views, and a total of 188,627 hits. Daily average hits have ranged from a low of 350 a day to a high of 834 day. This is a remarkable amount of activity for a new website.

[7] These are estimated costs, based on TREE Finance Committee projections, including cost overruns. *Asterisked units were designated as more affordable units. The Magenta units are the only ones that are not accessible.

Two major proposed projects – Cayuga Trails (70 units) and Amabel (35 units) are new developments which came directly out of the work of the grant team. Although Cayuga Trails was later cancelled in the proposed location, the national developer who won the RFP was very intrigued with the concepts, and we hope they will seek to apply them elsewhere. The County may also consider a smaller project on the site that will apply the principles and lessons learned from this project. There is also an effort emerging in the community to directly engage developers of new housing projects to inform them of alternatives to continued reliance on fossil fuels. The options demonstrated by this project serve as examples of how this can be achieved.

Qualitative Outcomes

The four videos provide great interviews of TREE and APN residents, who clearly love their new neighborhoods. The videos can be watched here: www.community-that-works.org. In addition to the videos, TREE members have shared impressions of their quality of life over email and in-person:

Here are some quotes from TREE neighborhood people:

"It's wonderful to be surrounded by a community that we've helped to develop."

" The two [EcoVillage] neighborhoods that are already here have demonstrated that it can work, that people can live here happily, and honestly, and reduce their carbon footprint, reduce their energy use, and work with others to reduce it even further."

"We have nice gardens and chickens and a lot more land than you could afford on your own."

" I am 68, widowed, and find myself dealing with Stage 4 Breast Cancer. Here I am in TREE, which has a mission of allowing people to 'age in place.' ...I have a whole community of friends, which is actively working to be ready to meet my needs. Think of the positive effect on the immune system! When my oncologist says, 'your cancer is certainly not advancing as fast as one would expect,' I smile, because I have the best medicine: love."

"As a single person I really appreciate being able to call on others for help."

"I thought it was really neat to call a birthday party for my son at 10am, and have people show up that night. Having lived in a neighborhood where houses were 100 feet apart and no one spoke to each other, this is really a nice change."

"As a parent, it's a double-edged sword. My boys are always out playing, going to friend's houses or the Common House. I really like them being independent, and I miss seeing them."

"I really enjoy all the activities and events going on. There's always something happening. This is our social home."

"Everyone is passionately interested in something. I'm learning a lot."

"I like the proximity, not just physical, but social. Everyone knows me, and I know everyone. There is a built in sense of belonging. You know that you are loved and that you're cared for. It takes hard work to build those relationships, but we're doing that work."

"This is the most comfortable house I've ever lived in."

"In our old house we used to keep two space heaters going to stay warm. This house is so cozy, even with the heat set really low. There are no drafts, and the house is warm throughout."

"It's December 2, and I still haven't turned the heat on."

"I used to live in a house with a wood-stove. It was constant work. It was a huge worry. Psychologically and physically it's a good feeling to know that my energy needs are taken care of by solar."

A few quotes from APN residents:
"We're only 5 blocks away from the center of town. It's pretty quiet, pretty nice."

"Designing these houses to be facing each other has made such an immense difference in how easy it is to interact. And because we interact more, we check in with each other more, like 'Oh, can you watch the boys for five minutes while I run to the store?"

"Living with neighbors in a pocket neighborhood in which we treat each other like an extended family means that we can share resources with each other. We don't all have to have a lawnmower or tools or even a big house."

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It is clear that by creating a built environment that is designed for facilitating easy social interaction, sharing occurs naturally. Whether it means that people share rides, community meals, caring for a child or an elder, swapping kid's clothing, or offering free computer advice, there is more emphasis on using fewer resources, and relying on each other. The culture of sharing is a key part of cutting greenhouse gas emissions, and it leads to a very high quality of life. When people feel a sense of belonging, they are also happier. These neighborhoods point the way to "community that works" for both people and the planet.

Challenges & Lessons Learned

Each of the pilot projects faced immense challenges, which will be discussed in detail. These challenges caused timing delays and cost overruns. However, the overall project had immense appeal to many different constituencies, and attracted a great deal of interest from the public, the media, as well as the green building professions (see constituencies reached on page 11.)

TREE Neighborhood:
The initial planning for TREE began in 2008. The founding group's goals were to create a neighborhood that was reasonably affordable, sustainable and accessible. These goals often competed with each other as the group strove to balance them. Eventually each of the goals was met, some more than others.

Affordability was partially achieved by using a non-profit building method, in which the group took on the developer role and assumed all decision-making and financial risk, while hiring an experienced construction manager. Design and construction was standardized to achieve cost savings. Materials chosen emphasized both long-term durability and low-medium cost. Value engineering helped reduce costs further. For instance, multiple wall systems were tested for energy efficiency by computer modeling, and ultimately the building envelope was based on very simple construction methods that would be easy to replicate, such as double walls with blown in cellulose insulation.

The group chose to subsidize some units to make them more affordable, and to build apartments which allowed for studio and 1 BR units which were less expensive. In addition, **8 of the 40 units (20%) are rental units**, which

were purchased by individual members of the group in order to help TREE reach its goals. This has allowed a more diverse and younger set of people to live in TREE**.**

When one single mom with three kids struggled to afford a home in TREE, several members chipped in to buy her home and rent it back to her, so that she could stay in the group. This sub-set of investors is called the TREE Willing Investors Group or "TWIG."

Finally, **overall construction prices on the homes have averaged only $100/square foot**[8] (not counting infrastructure, land, soft costs, or share in the Common House.) This is very competitive, especially when factoring in the extremely energy efficient design. The average cost in this part of New York State is $138/ square foot. It should be noted that the $100/square foot does not include profit, since it is a non-profit building method.

Total costs of the homes including land, infrastructure, soft costs and share in the Common House are estimated to range from $171/square foot for the largest units to $192/square foot for the one and a half story units.[9] TREE's total project cost is estimated to be $9.02 million.

In addition, **utility costs are very low, with the average monthly energy bill among the 4 TREE houses with PV through the winter being $38.85**. The lowest average bill was $16.87, and the highest was $55.83. This is in contrast to typical winter energy bills of hundreds of dollars per month in this area. For the 5 months of the year with peak solar production (typically May-September), all four households paid only the $16.04 delivery charge to connect to the grid. In 2013, New York State Electric and Gas, the local utility, reported the average NYSEG customer paid an average annual monthly bill of $156/month, with $70 spent for electricity and $86 for natural gas.

Lessons learned: TREE proves that it is possible to build extremely energy efficient homes that use standard construction techniques (double-wall, stick-built construction with cellulose insulation) that are also relatively inexpensive to build. Utility costs are low to almost non-existent.

Sustainability was a key goal which was largely met, although after plenty of challenges. As mentioned earlier, 7 of the 25 homes built to date in TREE have achieved Passive House certification (out of only 84 in the entire U.S.) All homes to date have also met LEED Platinum.

Because TREE members first heard about and decided to strive for Passive House standards in 2011, several years after the start of planning, the site plan and general layout of the homes were already approved, without reference to PH requirements. Because the densely clustered homes were oriented towards a pedestrian street for cohousing design, it meant that some homes had too much shading to reach PH standards. Still other homes were specifically designed to be very small (1050sq.ft), with an accessible ground floor, and a half story above. These homes do not fit the current PH standards, which tend to inadvertently penalize small homes. Thus many TREE homes are about 90% of the way to PH, but fall short of certification. On average, it cost TREE members approximately $9,000/ house in additional construction costs and fees to reach PH certification.

TREE decided to keep homes all electric, to avoid use of fracked natural gas, and to be able to offset some or all of the heat, hot water and electricity needs through solar PV and solar thermal.

[8] TREE homes ranged from $94.40/sq. foot for duplex units to $102.56/sq. ft. for 1.5 story units.
[9] This is an estimate only, since the total project is not yet finished, and thus total costs are unknown.

At least two of the 11 homes monitored are at Net Zero...that is, they produce more energy than they use. This is an even better outcome than was anticipated, and reflects homeowners who are very committed to saving energy. One man stated that when it gets cold in his house, he either bakes cookies or invites over his friends. The oven heat and/or the body heat alone is often enough to warm up the house to very comfortable levels.

Lessons Learned: Homes in TREE save 79-93% of typical energy used for homes in Tompkins County. Of these, some achieved PH standards and others did not, and some had renewable energy systems while others did not. A combination of solar electric, solar thermal, and committed lifestyle changes enabled some homeowners to reach Net Zero energy use.

Accessibility goals have largely been met. Out of TREE's 40 units, 32 are (or will be) accessible to someone in a wheel chair. This also allows for graceful aging in place, since residents can live completely on one floor. The remaining 8 units were changed to become four duplexes that are more vertically oriented in the interest of keeping some homes more affordable. Both duplex design and a full two-story, (rather than one and a half story design), are somewhat less expensive to build (by about $10,000/unit.)

Lessons Learned: Aging in place is a worthy goal, allowing for neighbors to help care for each other, and for people to live in a community over their life-span. While increasing some construction costs (larger foundation footprint, larger first floor, wider doors) it ultimately helps build more sharing and sense of belonging over the long-term.

Changes in Design and Building Team:
TREE initially wanted to use an integrated design framework, in which the architect and building professionals would do value-engineering together, and have a very close working relationship. Unfortunately almost the exact opposite happened. Over the rocky course of its six years (starting with the 2008 economic collapse), TREE hired three different construction managers and two different architects. The main architect, Jerry Weisburd, had worked with the first neighborhood in EcoVillage Ithaca in the mid-90s as both designer and builder. He came out of retirement in 2010 to work on the project, but by mid-2013 he was more than ready to retire again. He also moved from PA to CA during the course of the project, which made direct communication problematic. Luckily TREE found a local architect, Noah Demarest, to take over as architect of record for the final year of building.

At the time of the grant award, in February, 2011, TREE had started working with a large production building firm from Rochester, who had no experience in cohousing design. A year later, in January, 2012, the builder suddenly raised the cost estimates by $3.3 million, or 44% of the total project cost, only six months since the last cost estimate. Since the future homeowners in TREE were paying for the development out of their own pockets, this caused a major crisis, and many households dropped out. After a period of shock, TREE decided to leave this builder and search for another. Within a month, a contract was signed with Michael Carpenter, a long-time local builder, who had served as the Construction Manager in the second EcoVillage neighborhood, 8-10 years earlier. Mike was joined by his son Kendall. Their small business was one of 23 builders to win a DOE Zero Energy Ready Home Award in fall, 2014.

Despite the diverse architects and construction managers, TREE has managed to get built. However, communication, especially across distances, has proven tricky.

Lessons Learned: An integrated design/build framework using local contractors is by far preferable. In some cases, TREE could have avoided months of costly delay by having an architect and builder who worked well together as a coordinated team.

Delays: A distinct challenge to affordability has been severe delays in the construction schedule. In addition to changing design and construction team members over the 6.5 year process, and other internal group hurdles (such as members dropping out), TREE has been hampered by a challenging relationship to the Town Building Department. The neighborhood did not receive its final building permit for the 4-story Sustainable Living Center from the Town of Ithaca until November, 2013. Because of this delay, and severe winter weather, the foundation could not be finished until April,2014, and the building is not expected to be finished until April, 2015, at least 9 months later than expected.

Non-Profit Building Method: Ithaca is a relatively small community with a limited number of developers, and none that were willing to take the risks involved in working with a very unusual cohousing project. Because of this, the future residents formed their own development company, TREE, LLC. Residents invested their own funds to develop the project in order to hire professionals, purchase land, pursue town approvals, and secure a $4 million line of credit construction loan from a local credit union. Each prospective TREE household invested the equivalent of 20% down on their homes before the foundations were poured. While future residents assumed great risk, it also meant that they were in control of all decisions on design and construction, and that they were very highly motivated to make the project work. Many people put in (and continue to put in) many hours of volunteer time a week, with one woman (affectionately called an "extreme volunteer") who has contributed at least 50 hours a week for the last two years as a construction management assistant.

Having TREE future residents function as their own developers, allowed for a "non-profit" building method. TREE hired professional construction managers who supervise the building of the neighborhood, but they earn an hourly wage. Thus there is no motivation to cut corners. There are pluses and minuses to this system. The huge plus is that even with the current cost overruns, TREE is saving at least $2 million by choosing to build in this way. The minus is that without a stream-lined construction company that is used to production building, the combination of using small local contractors and volunteers can be very time-consuming and less efficient.

Lessons Learned: The "non-profit building method" has the potential to save literally millions of dollars. It allows for residents to make all their own decisions, and it makes unusual projects like TREE possible if there are no developers able or willing to take the risks. However, it can also be relatively slow and inefficient compared to developer-driven, production-style building, and it may rely heavily on volunteer labor.

Cost Overruns: While the cost of construction is below average for New York State, TREE is still experiencing major cost overruns - approximately $900,000 at present, which means a 12% increase in the price of the houses, since estimates were made in 2012. This overrun has multiple causes.

The biggest cause is that construction, which was originally slated for 2012, started late and will now continue into 2015. Each month of delay easily costs the project a minimum of $35,000 in a combination of construction management costs, construction loan interest, as well as rising labor and materials costs.

The multiple delays in obtaining Town approvals and building permits are a factor, as was the exceptionally harsh winter in 2013-2014. In addition, a relatively simple project (moving the village water pumping station closer to the village) ended up costing substantially extra time and money. The engineering work was extremely complicated, and there were multiple problems and delays. While the final costs are unknown until the end of construction in Spring, 2015, we don't expect a lot more surprises.

Finished homes in 2014, including all land, infrastructure, shared 5,000 square foot Common House, construction cost overruns, and soft costs range from $97,000 for a studio apartment to $285,000[10] for a 4 BR stand-alone house. While much higher than residents had hoped for, these prices are still very reasonable for Tompkins County. In comparison, the median price of a home in Tompkins County in 2014 was $250,000, which does not have access to the multiple amenities that EcoVillage homes enjoy.

Sustainability and Replication

Inspiring other residential developments:

This project has already inspired at least five other residential building projects, including those mentioned under "Results" on page 3 of this report. Specifically, two members of the project team who were the principals in developing the Aurora Pocket Neighborhood are now involved in developing a 25 house project a mile from downtown Ithaca, called "Amabel." In addition, a 130 unit project two miles from downtown Ithaca is being planned in which the developer is exploring building net-zero energy homes. In addition to the local projects, Welcome Home! pilot projects have helped to inspire cohousing groups in Rochester, NY and Sydney, Australia.

It is significant that the project team has sought to create "Community That Works" for different income levels. Although the Cayuga Trails project did not get built, a conceptual design was produced through a participatory process for Hillside-North, an inner-city neighborhood in Troy, NY, which is expected to apply the lessons learned at EVI to new infill construction in the neighborhood as it re-develops over the next 10 years or so.

Other exciting spin-offs include a new model zoning code, the Pedestrian Neighborhood Zone, or PNZ, which was written as a floating zone that can be applied to rural, suburban, or urban areas.

In addition, a number of the professionals who were involved in the grant are now exploring how a form-based-code for the City of Ithaca can reduce transportation GHG emissions in the Ithaca area, through more compact and pedestrian oriented development patterns. This work is being done with support from the New York State Energy Research and Development Agency (NYSERDA).

Relevant Research Projects:

Besides direct inspiration, a number of key research studies, spurred in part by the existence of the EPA Climate Showcase grant and its pilot projects, took place over the grant period. These included **2 PhD dissertations which studied energy and resource use at EcoVillage Ithaca, as well as a PhD in planning** on the role of "niche" communities, such as EcoVillage, in helping to influence change in the broader community. The abstracts for these three dissertations are in the appendix, and the websites where the dissertations can be downloaded are included.

Two other important national research studies chose TREE and EcoVillage as case studies, during the course of the grant. One of these was the **DOE Building America program**, **for which TREE was selected as part of a national set of case studies.**

The ultimate goal of the Building America research program is to develop market-ready, cost- effective efficiency packages that result in energy reductions in new homes of 30 to 50% over the Building America Benchmark reference building, which is representative of 2010 construction practices. The final result should be innovations that can be implemented cost effectively in production-scale housing. Community scale projects are the final step in demonstrating and documenting the viability of designs that meet these goals. Through these projects,

[10] These prices are estimates at this time, because construction is not yet complete, and TREE has not yet chosen one of several formulas by which to allocate cost overruns.

critical information is obtained about the true costs to implement energy-efficient solutions packages on a production scale and the remaining gaps that require additional research.

According to the final report for the DOE Building America program[11], because of their commitment to sustainability and energy efficiency, EcoVillage was chosen as a Building America research partner with two specific goals in mind. The first goal was to develop a commercial and economically viable 50% source energy savings package. Two separate packages were developed, one for the homes attempting to achieve PH certification, and one for those who were not. The packages developed resulted in predicted source energy savings of 47.5% and 47%, respectively. In addition to energy savings, these homes were cost-effective to construct. Construction methods used have been successfully implemented for years in previous projects and can easily be adopted by contractors that have not used them before. The products used are commercially and readily available. Finally, and most significantly, construction costs were $100/ft2 compared to an average of $138/ft2 for that area of NY State. Based on the builder's feedback, successful implementation of the energy solutions package, and several successful certifications, it can be concluded that this solution package was economically and commercially viable.

Another significant research project was the **Landscape Architecture Foundation's 2014 Case Study Investigation (CSI) program**. CSI is a unique research collaboration that matches faculty-student research teams with leading practitioners to document the benefits of exemplary high-performing landscape projects. TREE was chosen as one of just 21 projects nationwide.

Michele Palmer, from Cornell University said, "There is nothing particularly innovative about EcoVillage Ithaca in terms of what is conventionally thought of as 'landscape.' Planting native trees and shrubs is standard sustainable practice now." However, she continued, "What is innovative is your overall approach to live in a socially conscious, pedestrian friendly clustered neighborhood that limits road development and has an overall smaller footprint."

Palmer and team worked to evaluate the performance of TREE and produce a Landscape Performance Series Case Study Brief. Projects are selected based on design innovation, availability of baseline information, potential for quantified performance outcomes and the firm's commitment to the research collaboration. Their final paper is in peer review, and not yet available.

Ongoing Media Interest:

To date, there has been tremendous public and media interest already expressed about this project via significant mention in four books, four national magazine articles, 19 newspaper articles, 20 online articles, seven radio interviews, five scholarly articles, four television reports, and three video productions.

This interest continues, with several upcoming national stories: Andrew Revkin of Dot.Earth (a popular New York Times blog, on climate issues) plans to write a feature on EcoVillage Ithaca. An NPR program, Re-Imagine America, scheduled to be aired in the spring, will feature the TREE neighborhood as part of an hour long show

- [11] U.S. Department of Energy (DOE) Energy Efficiency and Renewable Energy, Building Technologies Program. "EcoVillage: A Net Zero Energy Ready Community" , by Lois Arena and O. Faakye. http://www1.eere.energy.gov/library/default.aspx?page=2&spid=2 (report available in January, 2015 on this website)

on renewable energy in the Tompkins County area. On January 8, a NYS Climate Smart Communities webinar will feature project principals for a 90 minute program on "Getting to Net Zero Homes."

Upcoming Green Building Programs:
Learn@EcoVillage and Taitem Engineering plan a series of accredited training sessions for green building professionals in 2015. The one and two day programs will feature TREE homes, to demonstrate how to approach Net Zero energy buildings.

A program for the Southern Tier chapter of the American Planning Association featuring the Community That Works project will be held at EcoVillage in the spring of 2015.

Overall, there is tremendous interest in both the pilot projects and the practical concepts they demonstrate. For the foreseeable future, Learn@EcoVillage plans to keep hosting the website, offering workshops, and giving tours to visitors. The ripple effect from this grant is just beginning.

Summary: The Welcome Home! Community That Works project shows that with the inclusion of standard rooftop PV, it is both possible and practical to build net-zero or near net-zero energy homes that provide extremely high levels of resident satisfaction. These houses can be built to create urban, suburban or rural neighborhoods that offer multiple quality of life advantages over standard subdivisions and can be constructed at costs comparable to other high quality new homes.

We have shown that practical technologies and building methods are available that, if broadly adopted, would dramatically reduce, if not eliminate, greenhouse gas emissions generated from occupying new housing. In the coming months and years we firmly believe that the overall projected emissions reductions will be attained and, going forward, we see even more opportunities to incorporate this knowledge into new residential development, both locally and regionally. This is Community That Works - not only for people, but also for the planet.

Financial Information

The entire $375,450 grant funds awarded were spent in support of the grant and all drawdowns are complete.

Major expenditures during the grant period from February 1, 2011 – November 30, 2014 were: $178,677 for Project Manager activities; $66,138 for branding, marketing, website development and video production educational activities; $50,000 for building performance testing of the TREE homes; and $35,850 for Education Coordinator activities.

By March, 2014, cost share tracked for the project totaled $195,382, which was over the promised $187,725 in the grant proposal, so tracking was discontinued at that time.

Deliverables/ Products

- website www.community-that-works.org
- four videos: overview and 3 pilot projects (see website homepage)
- Lessons Learned document:

  http://community-that-works.org/docs/EcovillageLessonsLearned.pdf
- Sample press coverage:

Journal of Planning, Education and Research (JPER)

http://jpe.sagepub.com/content/34/4/451

Green Building & Design Magazine, http://gbdmagazine.com/2013/22-ecovillage-ithaca/

Empire State Future: http://www.empirestatefuture.org/geography/state/smart-growth-spotlight-ecovillage-ithaca/

Green Right Now Blog: http://www.greenrightnow.com/keye/2013/10/29/neighborhood-redefined-a-photo-tour-of-the-ecovillage-at-ithaca/

New York Times, http://www.nytimes.com/2013/03/13/business/retirementspecial/retirees-choose-intergenerational-cohousing.html?_r=4&

numerous media stories on EPA website:

http://www.epa.gov/statelocalclimate/local/showcase/tompkins.html#media

- Pedestrian Neighborhood Zone - on website:

  http://community-that-works.org/tools/pedestrian-neighborhood-zoning/

- Hillside North neighborhood in Troy, NY: Report & schematic (see attached)

- DOE Zero Energy Ready Home Award to TREE builders:

  http://energy.gov/eere/buildings/downloads/doe-zero-energy-ready-home-case-study-aquazephyr-ithaca-ny

- U.S. Department of Energy (DOE) Energy Efficiency and Renewable Energy, Building Technologies Program. "EcoVillage: A Net Zero Energy Ready Community" , by Lois Arena and O. Faakye. http://www1.eere.energy.gov/library/default.aspx?page=2&spid=2 (report available in January, 2015 on this website)

- Model RFP for county land is on county website:

  http://www.tompkins-co.org/planning/documents/RFPCountyLandWestHillFinal.pdf

Three Abstracts of PhD Dissertations on energy use & planning at EcoVillage Ithaca during course of grant:

Sherry, Jesse. 2014. Community Supported Sustainability: How Ecovillages Model More Sustainable Community. New Brunswick, New Jersey: Rutgers University Ph. D. dissertation in Planning and Public Policy. 208 pages plus appendices.
Contrasts sustainability accomplishments and causes among Ecovillage at Ithaca, Earthaven and Sirius. EVI discussed throughout the text and especially on pages 35 – 73. http://ecovillageithaca.org/publications/

- Author's abstract: Ecovillages are small, intentional communities which focus on reducing environmental impact while creating a community that incorporates the natural world. Despite varying approaches, each ecovillage attempts to create a community that integrates the social, economic, and environmental dimensions of sustainability. This study investigates several of these communities to better understand two key questions: 1) to what extent do ecovillage residents have a lower environmental impact than residents of nearby communities and the national average? and 2) how is the reduction in environmental impact achieved? These questions are addressed through the use of life cycle assessment and qualitative case studies of three sites, specifically one suburban and two rural ecovillages. Comparisons with nearby communities and the national average are made, and the results show that the case study ecovillages have a much lower per capita environmental impact. My research suggests that this is achieved through a

combination of physical (village building and planning) and behavioral adaptations supported by community ideals and norms.

Boyer, Robert Harvey. 2013. Transitioning to Sustainable Urban Development: A Niche-Based Approach. Ph. D. Dissertation in Regional Planning. University of Illinois at Urbana-Champaign. 271 pages. Click on https://www.ideals.illinois.edu/handle/2142/44301. EVI is contrasted with Dancing Rabbit and Los Angeles ecovillages. Most EVI materials are found on pages 89–90. 140–178 and 211.

- Author's abstract: Solving the 'wicked' and 'persistent' environmental problems of the twenty-first century will require changes in the social and technological structures that guide urban development. While modern planning offers a century's worth of solutions to environmental problems at the local scale, many of these 'first-order' solutions exacerbate problems at larger scales (e.g. sprawl, auto dependency, climate change). Change of the 'second-order' is necessary to address problems such as climate change, energy scarcity, and the destruction of finite ecosystems. The Multi-Level Perspective of Socio-Technical Systems (MLP) claims that 'second order' structural change is resisted by *socio-technical regimes*—a tangle of mutually reinforcing rules, physical structures, and social networks. While regimes are critical for day-to-day functioning in a complex world, the regime structures that guide urban development in North America have resulted in human settlements that consume life-supporting resources faster than they can replenish, and result in diffuse social and environmental consequences that are difficult to 'solve' at the local scale. According to the MLP, regimes begin to transform under the exogenous pressure of *sociotechnical landscape* forces (e.g. demographic shifts, national politics, armed conflict, resource scarcity) and with alternatives incubated in *socio-technical niches*, or networks of actors that play by different 'rules of the game.'
- This dissertation looks specifically to the relationship between local urban development regimes and ecovillages—grassroots niche projects ideologically committed to low-impact living. Ecovillages are a locally-rooted response to the inadequacies of government environmental policy in the twenty-first century. They exist in urban, suburban, and rural areas on six continents. They attempt to model alternative housing, transportation, energy production, food production, and social governance all on one site. In recent years, multiple ecovillages have earned media attention for partnering with local policy makers on climate change and other environmental initiatives. Some have helped craft new land use regulations that allow for a broader mix of uses and cooperative spaces. Others are less influential. Why are certain ecovillages *influential* and others less so – especially in terms of urban policy? Drawing from Smith (2007), I hypothesize that the most influential ecovillages share some but not all elements of the urban development regime. That is, they are 'intermediately' situated relative to the mainstream and the radical grassroots. This enables them to translate their innovative practices to mainstream actors.
- I test this relationship by disseminating a survey to ecovillages across the United States and Canada and scoring them on two scales: *regime distance* (independent variable) and *regime influence* (dependent variable). The survey results confirm Smith's hypothesis. "Intermediacy" is a necessary but insufficient condition for ecovillage projects to influence mainstream planning policy. I elaborate on these results by conducting several ethnographic case studies that compare 'influential' ecovillages against their less influential counterparts. Taking up residence in ecovillages and conducting semi-structured interviews with ecovillage member-residents, I find that 'intermediacy' is a dynamic and liminal state. Influential ecovillages exist simultaneously inside and outside the urban development regime, but they do not start as intermediate. Rather, they "earn" this status by 'settling in' to the regime, accepting some regime rules, and demonstrating their feasibility to institutional actors in the mainstream. It is through these connections that the regime begins to 'warm up' to the niche experiments, and begins to adopt their practices as municipal code.
- The results of this dissertation offer planners a path toward a clearer understanding of systemic change for sustainable communities and support interpretive/pragmatic conceptions of planning, which frame planners as facilitators of communication amongst diverse entities rather than objective analysts or experts. Future

research and practice might use the MLP and similar theories to frame innovative local and regional environmental policies as *regime transition*.

Hostetter, Justin. 2012. How Ecovillages Are Contributing to a Residential Energy Transition in the United States. Master's Thesis: Free University of Amsterdam. 83 pages.

- Author's abstract: This report assesses the residential energy systems of two ecovillages in the United States (Ecovillage Ithaca, New York and Twin Oaks Community, Virginia) in an effort to determine how these developments can contribute to an overall energy transition in the country. The report finds that both ecovillages studied are living more sustainably with regards to their residential energy systems. EVI consumes about 46% less residential energy per resident than the average New York resident, and produces approximately 11% of all residential energy consumed. Twin Oaks consumes about 31% less residential energy per resident then the average Virginian, and produces approximately 41% of all the residential energy it consumes. Interviews with residents suggest that the social and economic institutions at each ecovillage - which allow for different forms of communal investment and agency – enable many built form investments and behavioral changes to improve residential energy systems. 'Built form' improvements are found to be more easily replicated in broader society than behavioral changes, due to the ease of implementation and the compatibility with the current regime. External interaction with the local, state, and federal governments as well as the private market is seen to be greatly dependent on the specific ecovillage in question – including the institutions established within the village, the community's relationship with local authorities, and the methods of adaptation used. The report concludes that these two small-scale community energy systems offer many lessons for broader society and other emerging intentional communities. However, their contribution to an overall energy transition is minimal due to a lack of cohesive policy towards such a transition from the national government.
