

Living Systems and Waste

Developed by Zack Bishop
and Matthew Lagomarsino
Narrated By Peter Brooks



Land Acknowledgement

We acknowledge that the University of Maryland is built upon the ancestral and unceded lands of the Piscataway. As students and scholars at the University of Maryland, we recognize that we have historically, personally and collectively benefited from the occupation of Piscataway lands. We recognize that it is our responsibility to acknowledge this occupation and the negative impacts that our occupation of Piscataway lands has had on the Piscataway people, their lands, and the ecosystems which are vital to their way of life.



What is reACT?

- reACT (resilient Adaptive Climate Technology) is the University of Maryland competition house for the 2017 Solar Decathlon.
- Solar Decathlon - international competition to build a sustainable solar powered house.
- reACT features many interdisciplinary sustainability innovations. The design was heavily informed by Native American knowledge systems.
- This learning module focuses on living systems and waste within reACT.





Learning Objectives

1. Understand the origins of reACT's living systems
2. Understand core components of the living systems
3. Realize core themes within the living systems
4. Understand how the Piscataway use native plants
5. Be inspired to contribute to the sustainability field





Core Themes of reACT



- Protection of ecological integrity
- Local food production
- Modular systems
- Conservation of resources
- Interconnectedness of all systems
- Collaboration of academic disciplines

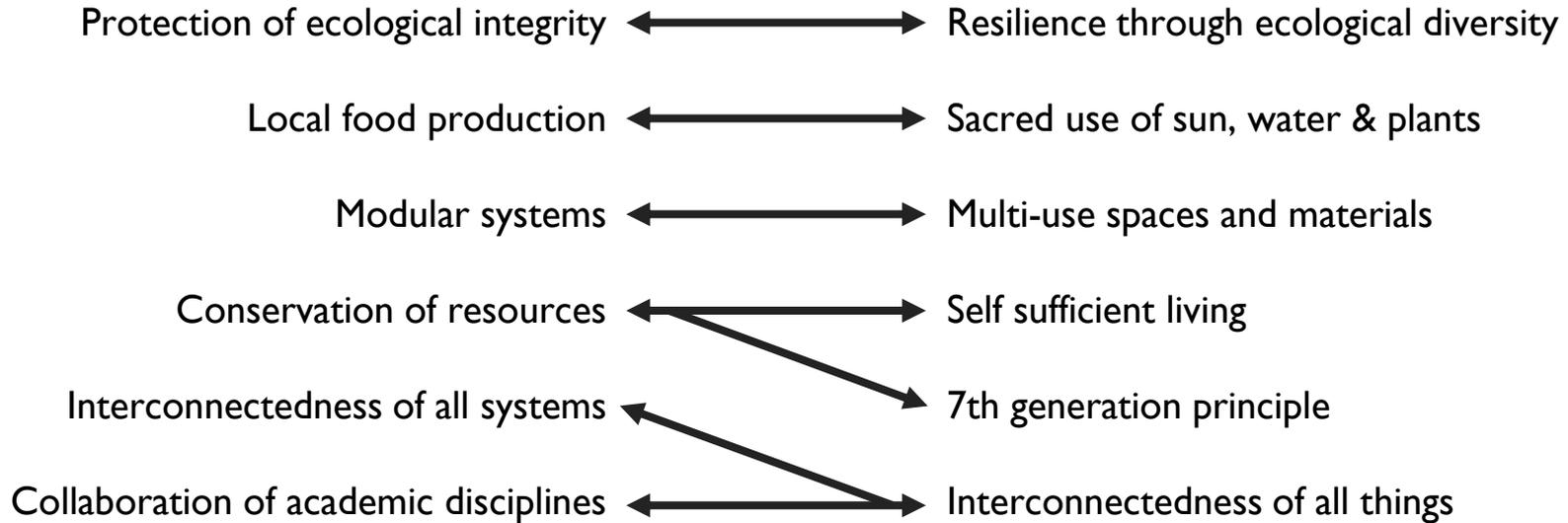




Connection to Local Native Principles

Core Themes of reACT

Native American Cultural Principles





Why Living Systems?

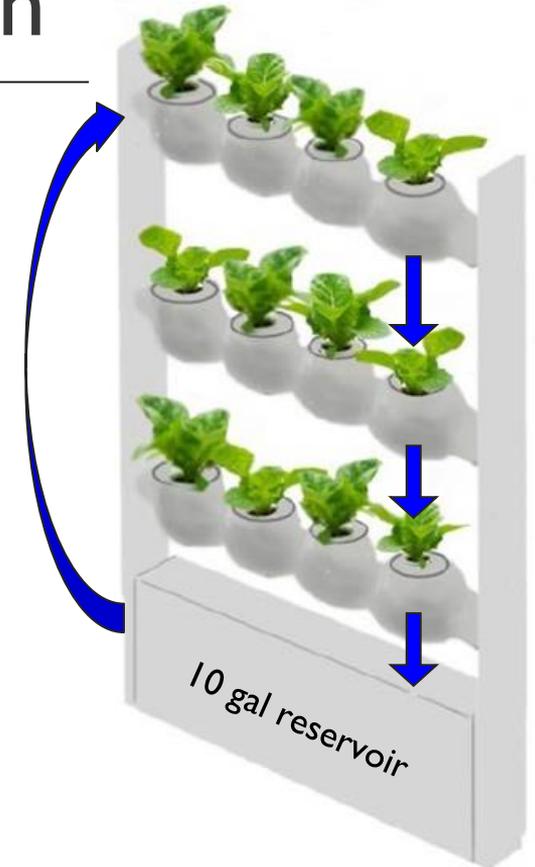
- Reduce your **ecological footprint**
 - Ecological footprint - the amount of land needed to produce resources consumed by a population and absorb its waste.
- Think in terms of **systems ecology**
 - Systems ecology focuses on the energy and material flows within ecosystems.
 - reACT's human and nonhuman systems are interconnected.





Hydroponics Garden - Design

- Ceramic planters sit in rows on a steel frame.
- Planters hold edible plants in 3” pots.
- Plant roots dangle in liquid nutrient solution.
- Submersible pump sends water from reservoir to top planter.
- Water flows via gravity to each ceramic planter below.
- Water flows back into 10 gal reservoir.
- Liquid nutrients and water are added to 10-gal reservoir as needed.





Hydroponics Garden - Benefits

- Produces edible greens and herbs
- Uses water efficiently
- Requires minimal nutrients
- Uses no soil
- Free from pesticides and herbicides
- Makes use of previously unused vertical space
- Acts as a 'green screen' for indoor windows



Theme: Conservation of Resources

- Recirculating water flow minimizes water usage.
- Indoor environment minimizes evaporation.

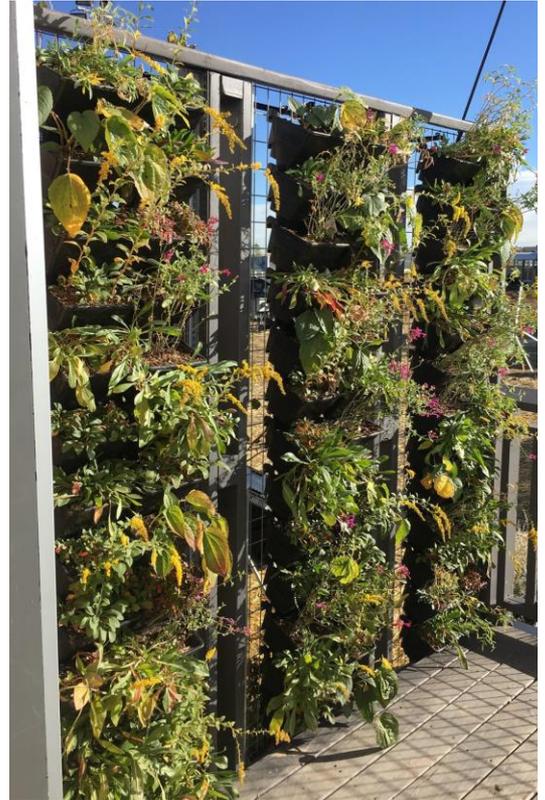
Can you think of creative ways water can be reused in your own home?



Green Walls - Design

- One exterior green wall faces South on the deck.
- Two interior green walls face each other in the *Green Court*.
- Plantable trays fit on 3x2” wire mesh panels.
- Trays can be arranged for varying aesthetics and functions.
- Drip irrigation nozzles efficiently deliver reclaimed grey-water and rainwater.
- Irrigation is automated based on data inputs from soil moisture sensors and local weather data.

'VGP Tray Living Wall System' by Tournesol Siteworks, LLC





Green Walls - Benefits

Exterior walls:

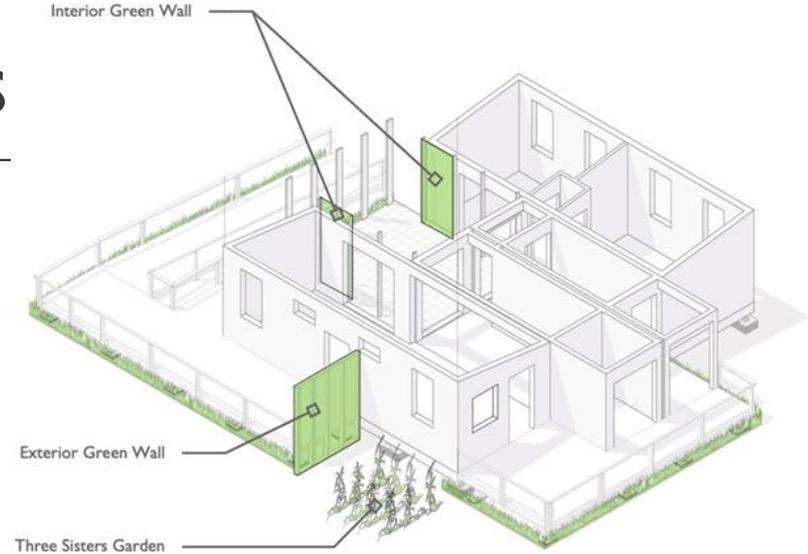
- Grows native flowering species.
- Acts as habitat for beneficial pollinators.

Interior walls:

- Grows medicinal/ceremonial herbs and botanicals.
- Promotes psychological wellness for humans.
- Improves indoor air quality in the *Green Court*.

Both walls:

- Make use of previously unused vertical space.
- Use water efficiently to grow plants.
- Constructed of 100% recycled plastics.
- Low maintenance systems.



Theme: Modular Systems

- The 3 green walls are modular in their design to allow for a seasonal crop rotation.
- During the winter months, exterior trays can be placed on interior green wall panels to keep plants alive.

*What plants would you grow if you had a green wall inside your house?
How about outside?*

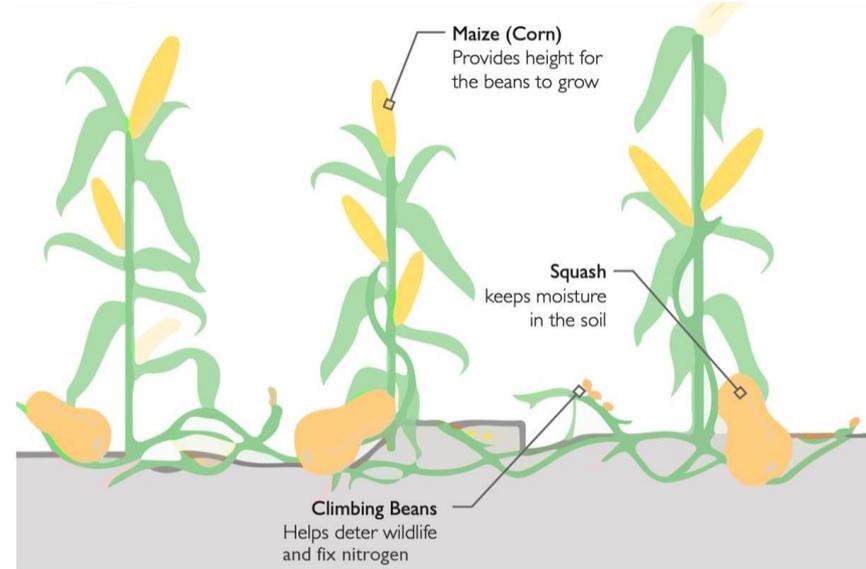


Exterior Raised Beds - Design

- Two 12' x 12' above ground planter beds constructed of water-resistant lumber grow edible crops off the ground.
- Drip irrigation efficiently delivers reclaimed grey water and/or rainwater on a fixed interval schedule.

Plant Palette:

- Native edible crop species fit the climate wherever reACT is placed.
- Three Sisters Garden, a Native American growing technique, is featured in reACT as a method of companion planting that predates colonization.



Three Sisters Garden consisting of corn, squash and beans.



Exterior Raised Beds - Benefits

- Production of healthy local foods, including vegetables, legumes, fruits, and herbs
- Reduction in food miles
- Physically and spiritually fulfilling activity for homeowners
- Habitat and food for native pollinators
- Protection from burrowing animals



Theme: Honoring the Sense of Place

- For the 2017 Competition in Colorado, plants were used that can survive in Plant Hardiness Zone 5b and 6a.

Do a web search, and see what hardiness zone you live in. What kind of native plants could you grow?



Composting Toilet - How it Works

1. Solids and urine are separated into two different compartments of the toilet.
2. Solids are mixed with a carbon source such as peat moss and are aerated after each use via a hand-crank.
3. Bacteria begin to break down the solid waste.
4. A fan ventilates the toilet to the exterior of the house to prevent odors indoors.
5. When full, the solid waste compartment is emptied outside into a compost bin and covered with soil.
6. This compost is broken down by heat-loving bacteria called 'Thermophiles', after a minimum of 6 months.
7. The broken down compost is used as fertilizer for non-edible plants in the landscape.
8. Urine is diluted with water and applied directly on non-edible plants as a nitrogen fertilizer.



Composting Toilet - Benefits

- Conserves water (waterless)
- Produces no waste-water
- Requires no plumbing
- Odorless
- Treats human waste as a valuable resource
- Leads to the creation of fertile soil for non-edible plants in the landscaping
- Educates humans in their role in greater systems of our planet



'Natures Head Self Contained Toilet' by Nature's Head Inc.



Barrel Composter - Design

Basics:

- Food scraps and grass clippings are termed “Green Compost”
- Yard wastes are termed “Brown Compost”
- Barrel composter is ideally placed in sun to heat up.

How to:

1. Green compost and brown compost are inserted into the barrel composter at a ratio of 4:1.
2. The Barrel composter is ‘tumbled’ about every 3-5 days to mix the compost and aid in the breakdown of material.
3. When the bin is about 75% full, stop adding to it to allow the bacteria inside to have enough oxygen to thrive.
4. In 1-2 months, your compost will be ready to fertilize your garden!



Barrel Composter - Benefits

- Minimizes food waste from the kitchen, and yard waste.
 - Less food going to landfills and septic tanks
 - Less export of yard waste from property
- Creates compost high in organic matter that can be used on edible crops.
- Reduces the need for fertilizer, saving money and fossil fuels.
- Raises the humans' awareness to soil fertility and nutrient cycling.

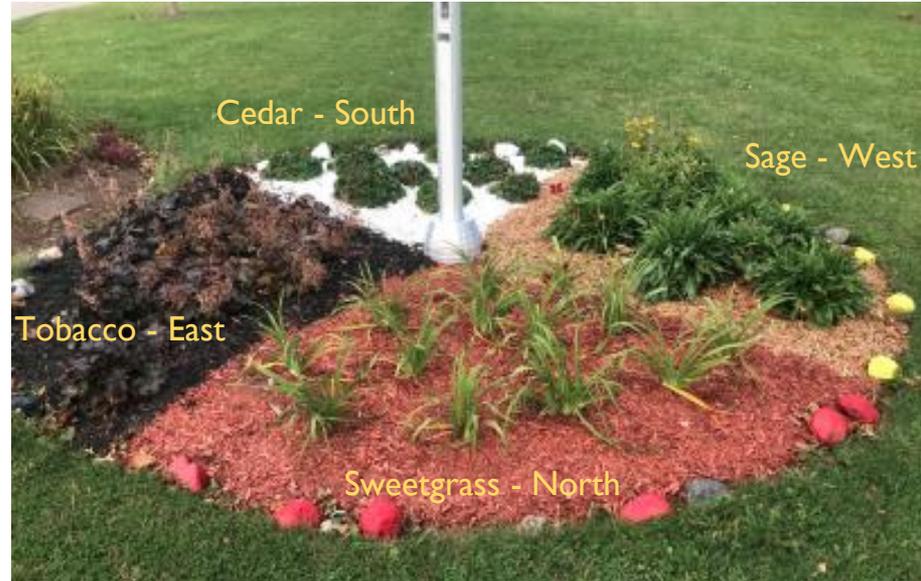


Dual Composter By YIMBY

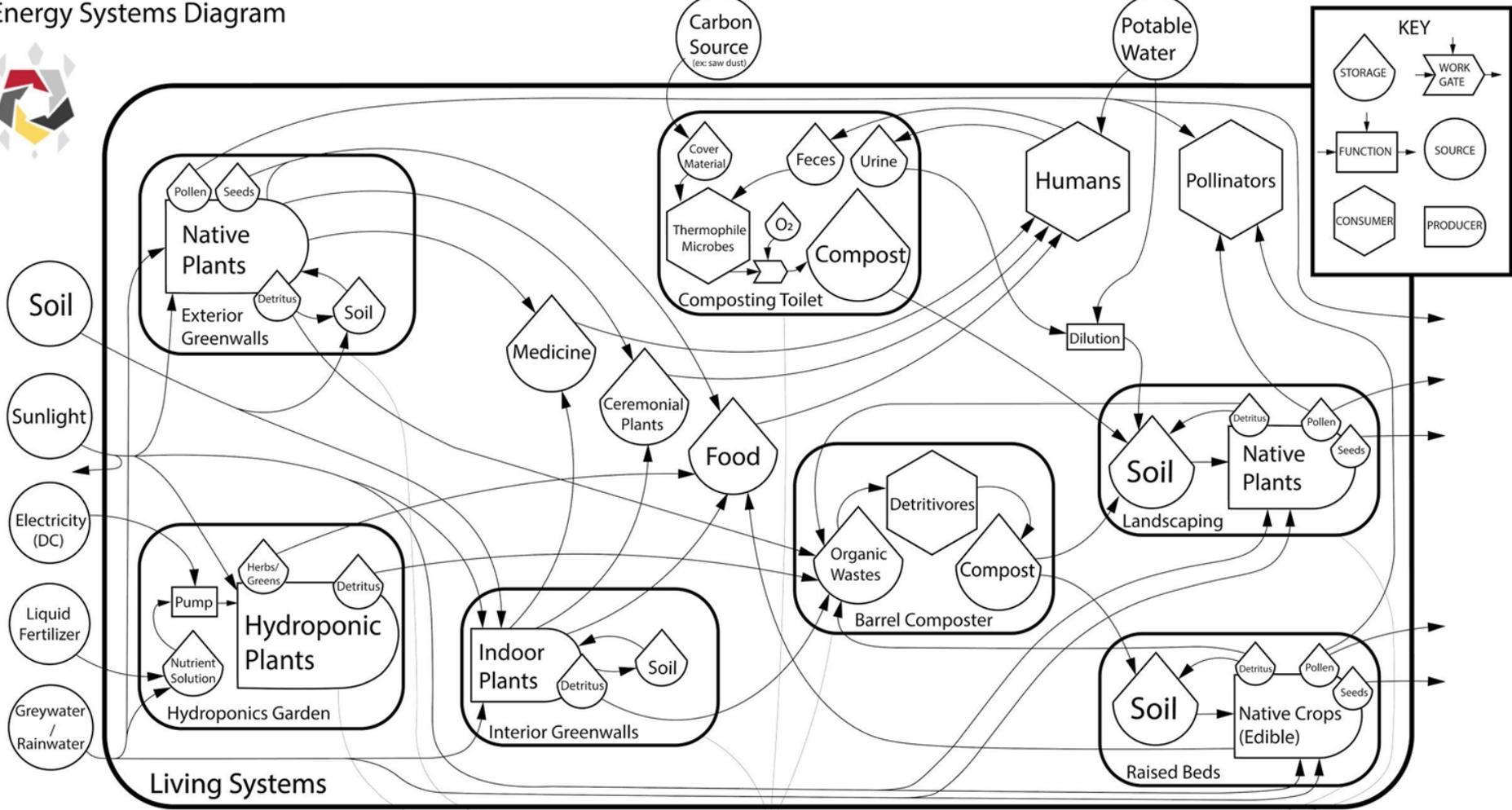


Example use of Living Systems: Native Herbs

- A variety of edible and nonedible plants can be grown within reACT.
- The Piscataway people use tobacco, cedar, sweetgrass, and sage for a variety of uses.
 - Sweetgrass can be woven together.
 - Tobacco commonly used as a gift for visitors.
- Cultural and Symbolic Uses:
 - All 4 sacred plants can be used for ceremonies if grown organically.
 - Represent cardinal directions.
 - Replant tobacco when harvesting each herb to give back to the earth.

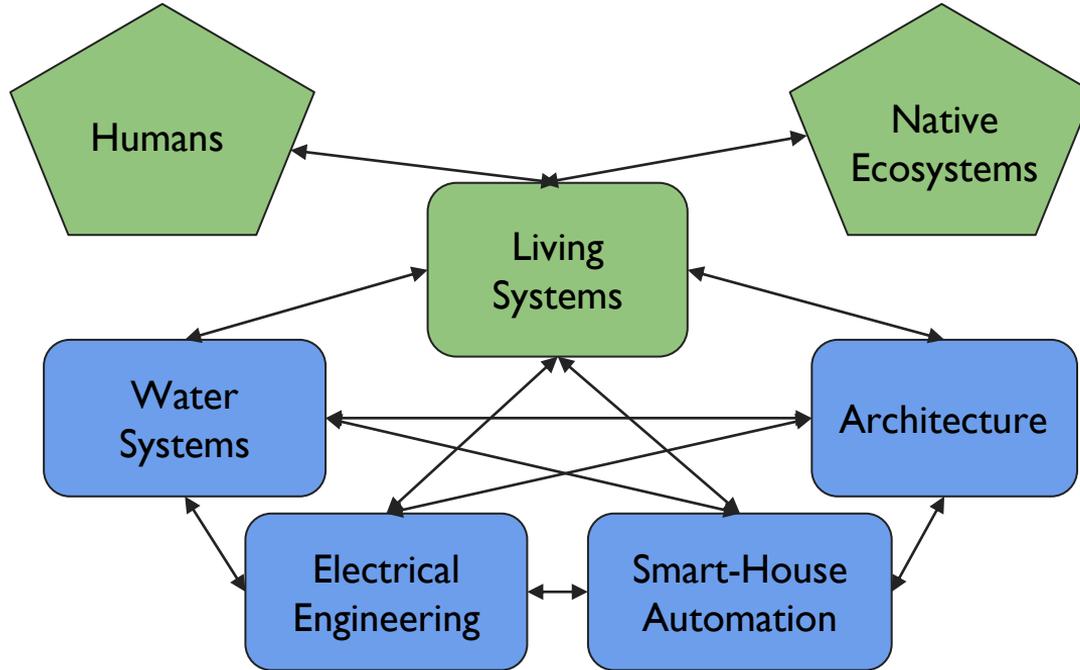


Energy Systems Diagram





Interconnected Systems of reACT





Get Inspired!

- YOU can build these living systems for your home or community!
- YOU can collect your own data and expand on the research!
- YOU can help to foster harmony between humans and the environment!

... Be part of the movement!

How?

- Get involved at UMD with the American Ecological Engineering Society, or join ENST!
- Volunteer and participate in events hosted by local tribal organizations!

This expanding field is evolving rapidly!





Local Tribal Resources

- Piscataway Conoy Tribe - <http://www.piscatawayconoytribe.com/index.html>
- Nanticoke Tribe - <https://www.nanticokeindians.org/>
- Nanticoke Historic Preservation Alliance Chicone Village Project
https://www.restorehandsell.org/?page_id=42
- Baltimore Native Indian Center - <http://baltimoreamericanindiancenter.org/>
- Maryland Commission of Indian Affairs <https://goci.maryland.gov/maryland-commission-on-indian-affairs/>
- Native American Lifelines - <http://www.nativeamericanlifelines.org/>



reACT Readings & Resources

- Videos and Tours
 - [Watch the competition tour](#)
 - [Watch the Inhabitat video](#)
 - [Watch the virtual tour](#)
- Solar Decathlon 2017 D-8: Market Potential Narrative
 - <https://drum.lib.umd.edu/handle/1903/24862>
- Solar Decathlon 2017 D-8: Innovations Narrative
 - <https://drum.lib.umd.edu/handle/1903/24866>
- Solar Decathlon 2017 competition page
 - <http://2017.solarteam.org/makingitreal/architecture/livingsystems>



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Image Credits by Order of Appearance

Green court of reACT during daytime by Josh Bauer

Wooden model of reACT by Paige Andros

reACT exterior by Paige Andros

Green court during evening by Paige Andros

Butterfly by Matthew Lagomarsino

Solar drier with fruit by Paige Andros

reACT exterior and deck by Zack Bishop

Diagram of hydroponics garden by Elizabeth O'Keefe

Hydroponics garden by Matthew Lagomarsino

Green wall by Matthew Lagomarsino

Diagram of green walls by Emma Schrantz, Greg Goldstein, Wadiah Akhbar, and Ryan Banger

Diagram of three sisters garden by Emma Schrantz, Greg Goldstein, Wadiah Akhbar, and Ryan Banger

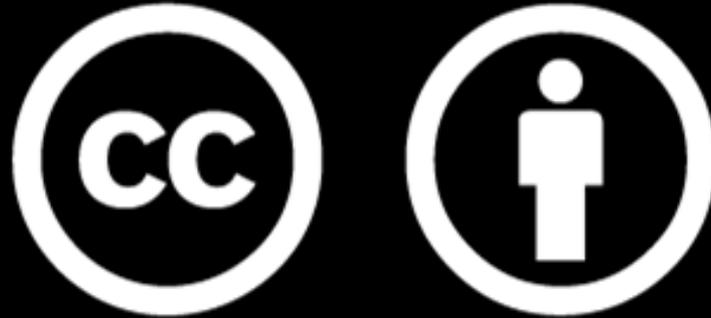
Raised beds by Matthew Lagomarsino

Composting toilet by Paige Andros

Barrel composter by Zack Bishop

Herb garden by Rico Newman

Energy systems diagram by Matthew Lagomarsino



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