



Sterling Ranch: Sustainability & Education Research Center



Trans-Institutional Programs
David S. Kossom, PI, School of Engineering
Claire Smrekar, Co-PI, Peabody College



STERLING RANCH
COLUMBIA

Sterling Ranch: Sustainability & Education Research Center



Trans-Institutional Programs
David S. Kosson, PI, School of Engineering
Claire Smrekar, Co-PI, Peabody College





3,400 acres, 12,050 homes, 45,000 residents, construction initiated in 2015
first occupancy in 2017, currently approximately 60 homes occupied

- Energy and Cyber-Physical Systems
- Education Ecosystem
- Sustainability & Environmental Quality
- Future - Health, Security, Mobility, Archeology
- Graduate Research
- Design Projects & Honors Projects
- Vanderbilt Week at Sterling Ranch, During Winter Break
- Internships

What is Vanderbilt's Role?

Bringing next generations of innovation - design, education, science and technology

Trans-institutional and multi-disciplinary vertical integration of education and research

Sterling Ranch serves as "test bed"

Partnerships

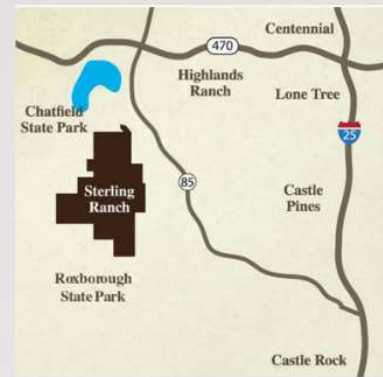
- Current Sterling Ranch Partners
- VU led partnerships



The Vision of Sterling Ranch

Creating a Sustainable Community

- Applied Innovations
- Water Conservation
- Intelligent Energy
- Safety & Security
- Education Ecosystem



"I can say this without a single contradiction of all the 200+ metro areas I've visited as USDOT Secretary, 'there is no more collaborative metropolitan area in the nation, than Denver.'" - Ray LaHood

Vanderbilt and Sterling Ranch by the Numbers

46 total undergraduate immersion events to date

- 12 senior design projects
- 10 summer internships
- 3 Vanderbilt Weeks at Sterling Ranch

87 total number of students/faculty to date

- 66 undergraduate
- 7 graduate
- 16 faculty (College of Arts & Sciences, Peabody College of Education & Human Development, School of Engineering)



Motivated redesign of Civil Engineering undergraduate curriculum



Included in University Course Initiative on Data Science Methods for Smart City Applications

Senior Design Projects

2015-2016 Academic Year

Net Zero Home Design 1

Net Zero Home Design 2

Water Quality Monitoring

Solar Desalination

2016-2017 Academic Year

Smart Home Analytics Interface Applications

Design a Sterling Ranch Home for Race to Zero

Design a Low Energy Home

Innovative Transit Analytics Interface Applications

2017-2018 Academic Year

Design a Sterling Ranch Model Home for Educational Purposes

Design a Cybersecure Information System Based on Smart Light Pole Infrastructure

Design an Energy Storage System Compatible with Xcel Energy Grid

Senior Design Team Accomplishments

Solar Powered Desalination with Capacitive Deionization (CDI) - Awarded 2016 EPA P3 (People, Prosperity, and Plant) Student Design Competition - Phase 1 (\$15,000)

Race to Zero - Selected as finalist to attend the 2017 Race to Zero competition April 22-23, 2017 at the National Renewable Energy Laboratory in Golden, CO



Education at Sterling Ranch

Sterling Ranch TIPs Plan and Purpose

- **Design** an educational "ecosystem" for new community
- **Anchor** innovative education master plan to community assets (private, public, non-profit)
- **Integrate** with DCSD mission, record of excellence (universal choice, rigor)
- **Engage** students in relevant research, in real time



Who?

- Peabody Scholars (5-6): course work, field studies, white papers
- EdD Doctoral Students (5): Capstone project (implementation)

What?

- School district analysis (teacher/admin) interviews, observations, document review)
- Constituent needs assessment (stakeholder/parent interviews)
- Asset mapping (GIS software)
- Design studio production (innovation in context)



Specific Science and Technology Projects

Water

- Design and monitoring system for water cycle and quality; establish baseline
- Reduce discharge of nutrients and pollutants
- New nano-structured membrane water purification
- Provide residents real time feedback and projections on water usage (how & how much)

Energy

- Energy efficiency and net zero energy at the community level
- Next generation sustainable IoT home design
- Micro-grid simulation, design and controls
- Provide residents real time feedback and projections on energy usage (how & how much)

Education

- Education Ecosystem
- Bringing sustainability concepts into education

Quality of Life

- Information tools
- Transportation
- Security



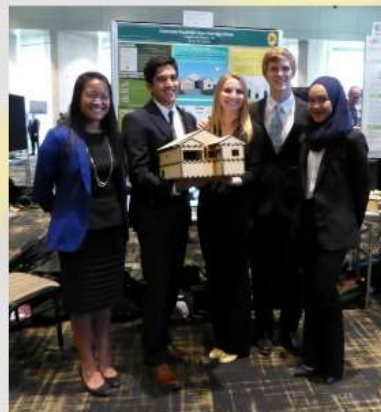


*Vanderbilt Week
at Sterling Ranch
January 2016*

*Vanderbilt Week
at Sterling Ranch
January 2017*



*Vanderbilt Week
at Sterling Ranch
January 2018*



2015-2016 Senior Design Teams

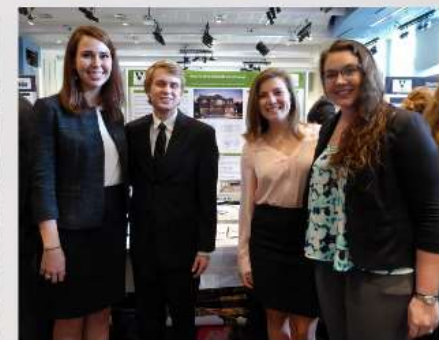
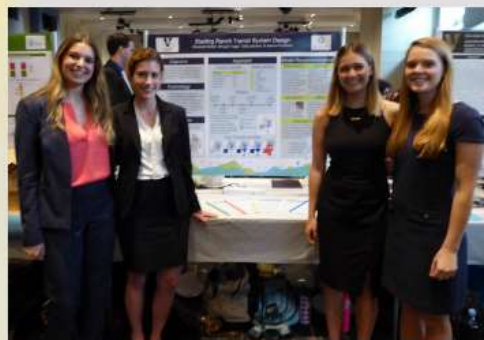
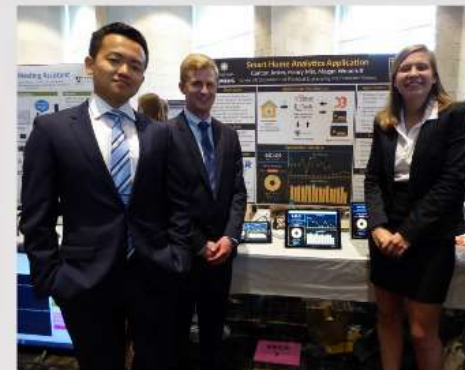


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STERLING RANCH
COLORADO

2016-2017 Senior Design Teams



Vanderbilt Week at Sterling Ranch

January 3-5, 2018



Prefabrication
Site Tour



Senior Design
Team Meetings

Vanderbilt Week at Sterling Ranch

January 3-5, 2018

Sterling Ranch Model Home Tours

Education Panel - CU South Denver, City High School, St. Vrain Valley
School District, Vanderbilt University

Water Resources - Element Water Consulting, Dominion Water

CenturyLink Data Center Tour

Siemens



Vanderbilt Week at Sterling Ranch
January 3-5, 2018

Lockheed Martin Tour

National Renewable Energy Laboratory (NREL) Tour

Xcel Energy Lookout Tower Tour

Xcel Energy, Downtown Denver





STERLING RANCH
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Sterling Ranch, Colorado An Exercise in Teamwork



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Brownstein Hyatt
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ONE.

REDLAND
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Sterling Ranch - Development of Enhanced Energy Efficiency Homes



Home Away From Home

Remote Home Management

Remote home management allows you to control your home's energy systems from anywhere, anytime. This feature is available on all homes in the Sterling Ranch development.

- Monitor energy usage and costs
- Adjust thermostat settings
- Control lighting and other smart home features
- Receive alerts and notifications



Cleaner Breathing Better Living

Healthier air means a healthier home. The Sterling Ranch development features advanced air filtration systems to ensure the highest quality indoor air.

- HEPA Air Filtration
- Activated Carbon Filter
- High-Moisture HEPA Filter
- Remote Air Management

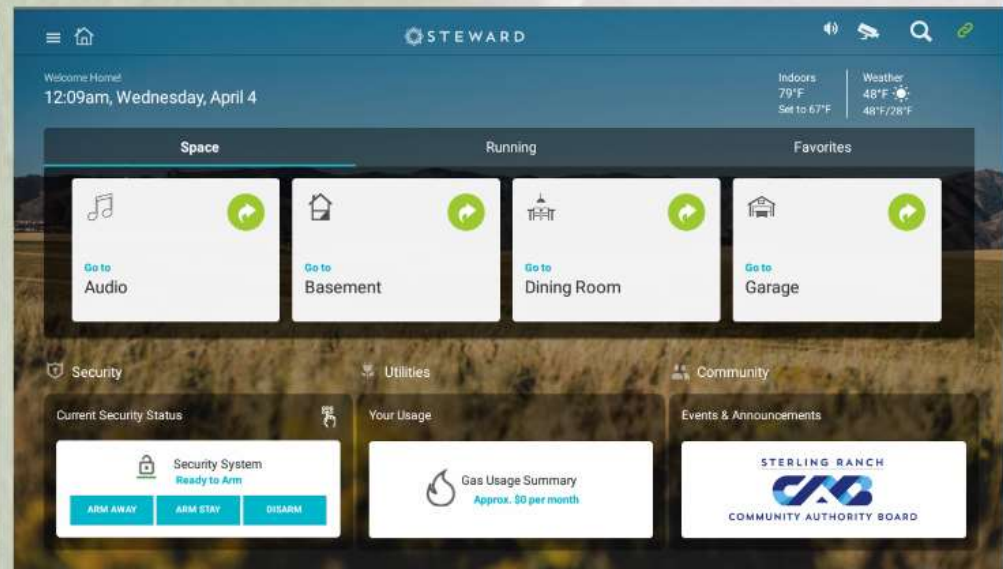
A Cooler Attic Means More Comfort

The Sterling Ranch development features advanced attic cooling systems to ensure the highest quality indoor air.

Filtration That Starts At The Source



Technology Instrumenting Homes & Collecting Data



Sterling Ranch Model Home Tours



