
Sterling Ranch: Sustainability
& Education Research Center
Trans-Institutional Programs
David S. Kosson, PI, School of Engineering
Claire Smrekar, Co-PI, Peabody College
VANDERBILT
STERLING RANCH

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 Initative 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 Renewal 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 usuage (how & how much)

Energy

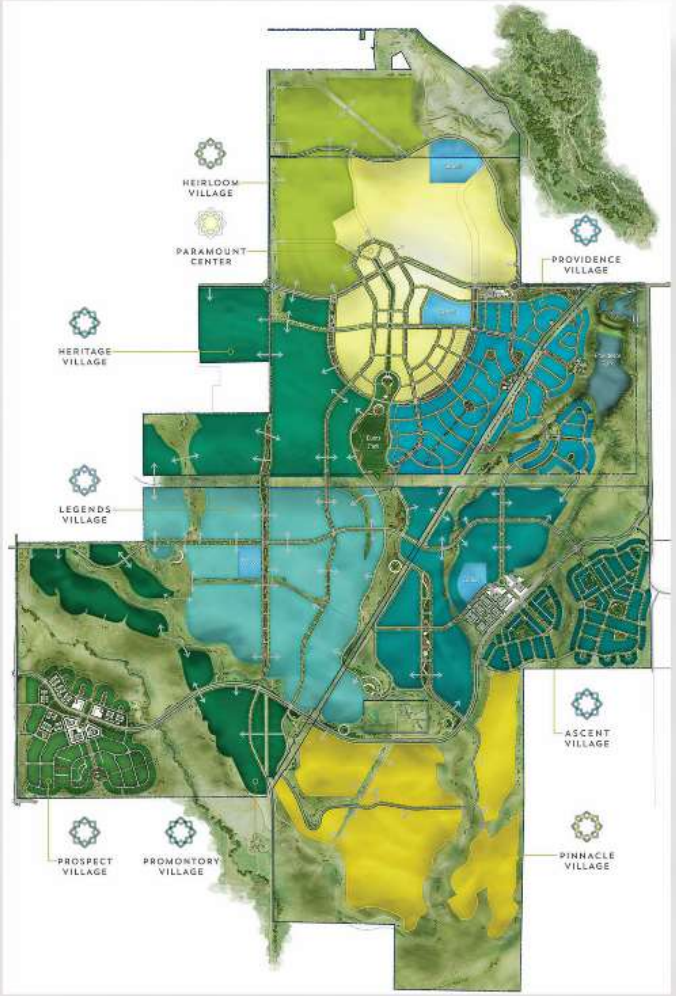
- Energy efficiency and net zero energy at the community level
- Next generation sustainable IoT home design
- Micro-grid simulation, design and controls
- Provide residents real time feedback and projections on energy usage (how & how much)

Education

- Education Ecosystem
- Bringing sustainability concepts into education

Quality of Life

- Information tools
- Transportation
- Security



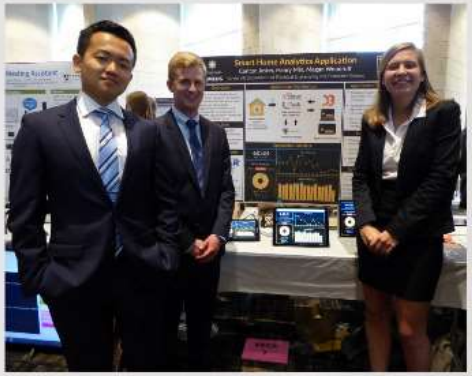
Vanderbilt Week
at Sterling Ranch
January 2016

Vanderbilt Week
at Sterling Ranch
January 2017

Vanderbilt Week
at Sterling Ranch
January 2018

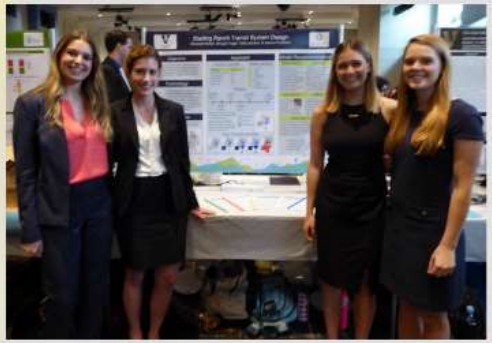
2015-2016 Senior Design Teams

VANDERBILT UNIVERSITY®



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

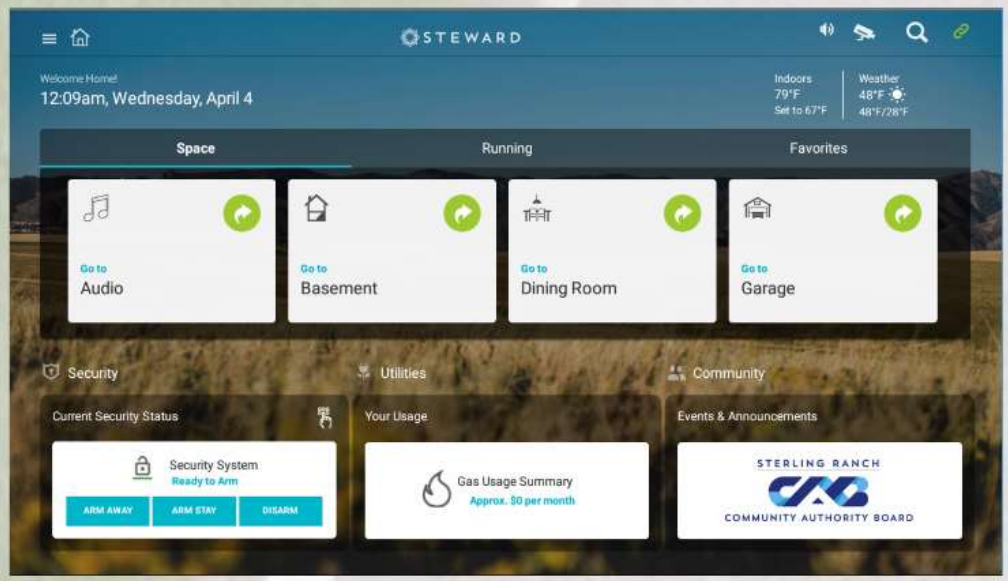
Xcel Energy Lookout Tower Tour

Xcel Energy, Downtown Denver

Sterling Ranch, Colorado
An Exercise in Teamwork

Sterling Ranch - Development of Enhanced Energy Efficiency Homes

Technology Instrumenting Homes & Collecting Data



Sterling Ranch Model Home Tours