Sterling Ranch - A Unique Vanderbilt Sustainability and 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

- Energy and Cyber-Physical Systems
- Education Ecosystem
- Sustainability & Environmental Quality
- Future - Health, Security, Mobility, Archeology

- Research
- Design Projects & Honors Projects
- Immersive Spring 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

- Undergraduate research and honor's projects
- Senior design projects
- Graduate research and capstone projects
- Internships
- Vanderbilt Week at Sterling Ranch

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
- Promoting Fulfilling Lifestyles
- All-Encompassing 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

**32 total undergraduate immersion events to date**
- 9 senior design projects
- 8 summer internships
- 2 Vanderbilt Weeks at Sterling Ranch

**73 total number of students/faculty to date**
- 52 undergraduate
- 5 graduate
- 16 faculty (College of Arts & Sciences, Peabody College of Education & Human Development, School of Engineering)

Motivated redesign of Civil Engineering undergraduate curriculum
Senior Design Projects

2015-2016 Academic Year

Net Zero Home Design 1
Net Zero Home Design 2
Water Quality Monitoring
   Energy Community
   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 Analysis Interface Applications
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

Graduate Research Proposals Submitted

NSF Proposal: "SCC-IRG Track 1: Investigating Metropolitan Social-Cultural Applications of Physical and Environmental Systems (MetroSCAPES) to Enhance Resource Allocation and Quality of Life in Smart and Connected Communities" ($5,000,000)
D. Kosson, PI, G. Biswas, C. Smrekar, P. Speer, A. Dubey, Co-PI's

NSF Proposal: "NRT (Research Training): Sustainability Transitions in Coupled Human-Natural Systems - a New Approach for Research and Education on Complex Environmental Systems" ($3,000,000)
S. Goodbred, PI, H. Baroud, C. Brady, J. Gilligan, D. Hess, Co-PI's
2015-2016 Senior Design Teams

Water Quality Monitoring Team

Solar Desalination Team

Zero Energy Home Team 2

Zero Energy Home Team 1
Vanderbilt Week at Sterling Ranch
January 2017
Vanderbilt Week at Sterling Ranch
January 3-6, 2017 Agenda

Tuesday, January 3

Smart Home Analytics Interface Applications - Siemens (Marty Skolnick, Account Executive)

Design a Sterling Ranch Home for Race to Zero / Design a Low Energy Home - Lennar Homes (Jay Steinberg, Purchasing Analyst)

Innovative Transit Analytics Interface Applications - Fox Tuttle Hernandez (Carlos Hernandez, Molly Veldkamp)
Vanderbilt Week at Sterling Ranch
January 3-6, 2017 Agenda

Wednesday, January 4

- Municipal Financing & Issuing Bonds - Elizabeth Funk, Director of Municipal Securities Division, Citi Bank
- EPA Net Zero Lessons Learned / Smart Metering - Michael B. Nye, U.S. EPA
- "Building an Innovative Education System at Sterling Ranch: Research & Models" - Eve Rifkin & Kristin Baese, Peabody College, Vanderbilt University -
- Denver Regional Economic Development - Tom Clark, CEO, Metro Denver Economic Development Corporation
- Sterling Ranch Site Tour
- Home Technology Overview - Marty Skolnick, Account Executive, Siemens
Vanderbilt Week at Sterling Ranch
January 3-6, 2017 Agenda

Thursday, January 5

- Overview of National Center for Atmospheric Research - James Done, Project Scientist
- Water Supply & Demand - Mary Kay Provaznik, Dominion Water
- Colorado Department of Transportation - Shailen Bhatt, Executive Director
Vanderbilt Week at Sterling Ranch
January 3-6, 2017 Agenda

Friday, January 6

• Lockheed Martin Spacecraft Center Tour

Xcel Energy

• Grid Management & Integration of Renewable Energy - John Welch, Director of Power Operations

• National Energy Trading Floor (Tour) - Kirk Scheitler, Manager, Policy & Outreach

• Colorado’s Utility & State Legislative Climate - Wes Parham, Manager, State Government Affairs

• David Eves, President & CEO of Public Service Company of Colorado

• Xcel Energy Regulatory Environment - Robin Kittel, Director, Regulatory & Strategy
Specific Science and Technology Projects

- **Water**
  - Design 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 & 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 & projections on energy usage (how & how much)

- **Education**
  - Education Ecosystem
  - Bringing sustainability concepts into education

- **Quality of Life**
  - Information tools
  - Transportation
  - Security
Sterling Ranch Water Plan

1st Holistic Integration of Demand Management with Land Plan

- Homes will use approximately 1/3 of county requirement
- Reduction integrated into land plan with look-back adjustments
- Required appealing the standards
- Water usage analytics for individuals & cohorts

State's 1st Rainwater Harvesting Pilot
- Required changing Colorado law

Regional water supply solutions
- Conjunctive use with renewable supplies
- Water for neighbors
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 work, white papers
EdD Doctoral Students (3): 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)
All who engage with Sterling Ranch become stewards of the values inherent in an elevated, authentic and responsible style of living. Sterling Ranch, Colorado - a mixed-use, master-planned community vitalized by mindful, sustainable resources and forward-thinking technologies, brought together is a shared experience.