Assessment and Planning of Decarbonization Research and Training at University of Texas Rio Grande Valley (FE0032199)

Principal Investigator: Maysam Pournik, PhD, Mechanical Engineering Department

Students: Alexa Martinez, Sofia Ramirez, Gerardo Salinas, Jose Chapa

Project Duration: January 2023 – August 2024 (with NCE)

2024 FECM/NETL Spring R&D Project Review Meeting (April 24, 2024)

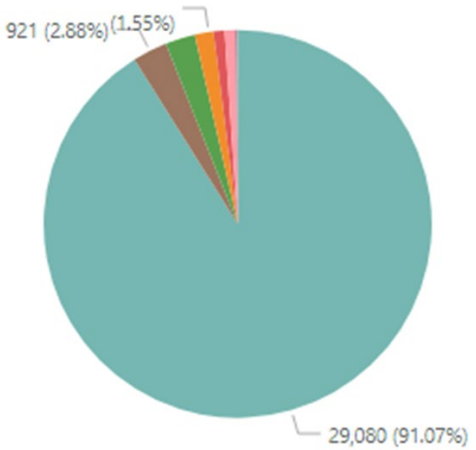
UTRGV?

#2 **For Awarding** Bachelor's Degrees to Hispanic/Latino Students

› (Hispanic Outlook on Education Magazine, 2022)

Level Description	Fall 2023
Lower Level Undergraduate	12,135
Upper Level Undergraduate	15,495
Masters Level	3,472
Doctoral Level	542
Medical	287
Total	**31,931**

Hispanic or Lati... White International Asian Black or Afric..

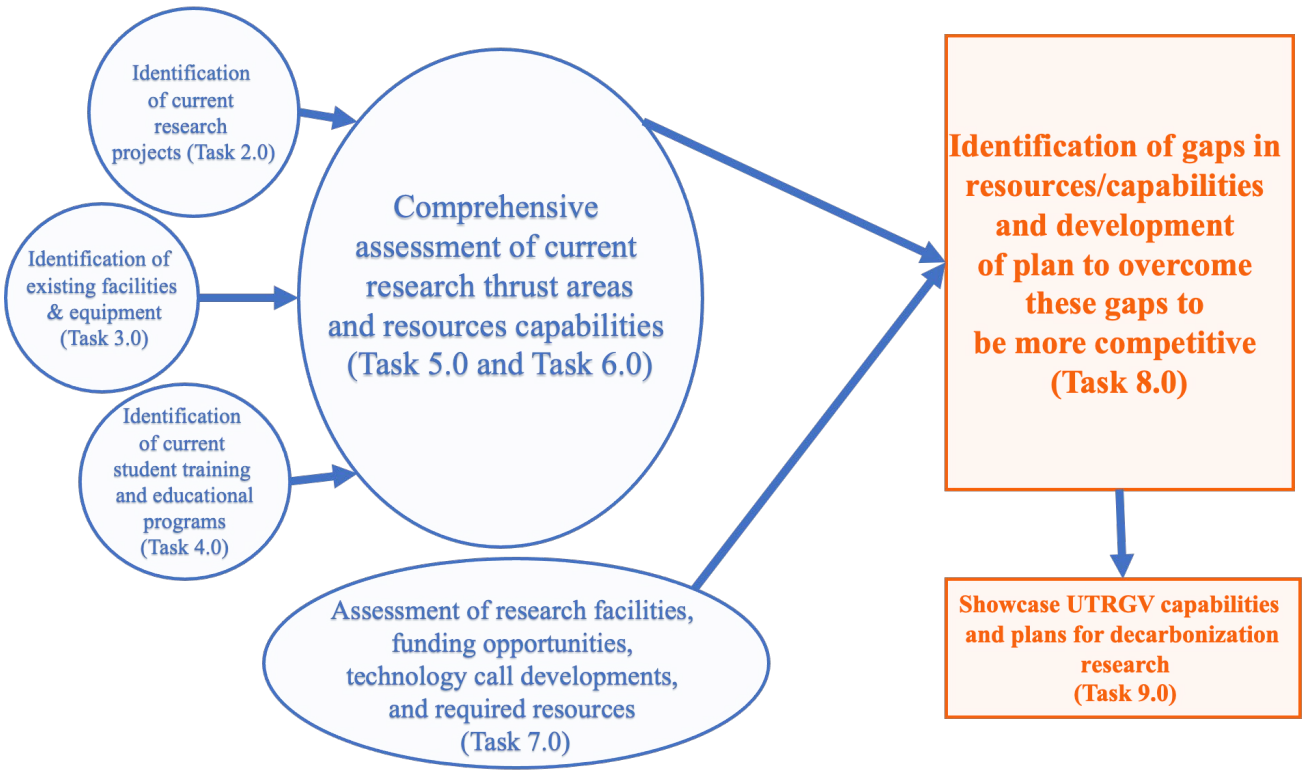


UNDERGRADUATE AVERAGE COST OF ATTENDANCE

Resident Living With Family:	Resident Living On Campus:	Resident Living Off Campus:
$17,887	$23,245	$24,615

Objectives

1. Conduct an R&D scoping study and self assessment of current capabilities
2. Identify gaps in capabilities and determine enablers
3. Identify and provide student educational training & professional development



Tasks Completed

- Task 2 : Proposals/Publications
- Task 2 : Thesis/Dissertation
- Task 3 : Equipment
- Task 4 : Courses & Educational Programs
- Task 6: Trainings

Task 2 : Proposals/Publications

- Obtained list of 2695 proposals submitted by faculty (09/2016 to 03/2023) from Office of Research
- Searched publications from UTRGV faculty using online resources (Google Scholar, ResearchGate, library databases)
- Matched proposals and publications, leading to final list of 42 decarbonization related projects
- Grouped projects into specific themes
  - *Upgrade UTRGV Solar Radiation Lab to Measure Ground Infrared Radiation that creates Climate Change – Jaime Ramos-Salas*
  - *Development of Machine Learning and Molecular Simulation Approaches to Accelerate the Discovery of Porous Materials for Energy - Relevant Applications – Haoyuan Chen*
  - *Carbon Sequestration in the RGV Reef – Richard Kline*
  - *Consortium of Advanced Additive Manufacturing Research and Education for Energy Related Systems – Jianzhi Li*
  - *Desalination using Solar Thermal Evaporation and Natural Convection-Radiative Cooling Achieving Zero Waste Discharge – Ben Xu*

Task 2 : Thesis

- Obtained list of 744 thesis/dissertation completed (09/2016 to 03/2023) from Graduate College
- Identified 36 decarbonization related thesis/dissertation
- Grouped thesis/dissertation into specific themes
  - *Life-Cycle Cost Analysis of the Efficient Water Fixtures and Electric Appliances Used to Minimize Water and Energy Consumption in Homes in the U.S. - Miranda Garcia*
  - *Towards Sustainable Cities: Life Cycle Cost Analysis of the Construction of a Novel wastewater Management System - Bibhas Tanmoy*
  - *Investigation of a Simultaneous Direct and Indirect Contact Dehumidifier Using Parallel Strings for HDH Desalination - Josue Perez*

Task 3 : Equipment

- Visited laboratory facilities on the two main campuses
- Identified 65 equipment with relevance to decarbonization

HAAS VF-2 CNC Machine

Rockwell Hardness Tester AR-20

Grizzly G0782 – 13” x 40” Gearhead Lathe

Fisher Scientific Isotemp Oven Model 750F

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Task 4 : Courses & Educational Programs

- Reviewed all courses (>5,000) in the online course catalog (undergraduate and graduate)
- Examined syllabi of promising courses for decarbonization relevance
- Identified 18 decarbonization related courses from 3 different Colleges
  - *Renewable Energy*
  - *Sustainable Development*
  - *Geo-Environmental Engineering*
  - *Environmental Toxicology*

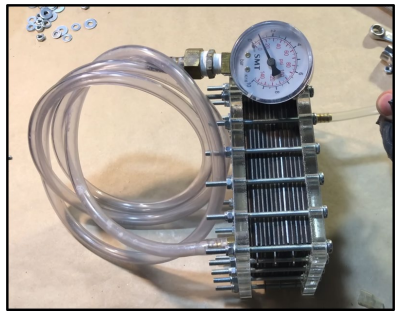
Task 6 : Trainings

In-person seminar by our collaborator, Dr. Mehdi Zeidouni from LSU

- Importance and challenges of Carbon Capture, Utilization and Storage (CCUS)
  - Determining underground capacity for CO_2 storage
  - Ensuring containment through pressure measurements to track CO_2 migration
  - Utilization of temperature variations underground as indicators of CO_2 movement and leakage detection
  - Identification and management of geological faults to prevent CO_2 escape
- Energy Transition: The Role of CCUS in Reducing Global Warming
  - Urgency to limit temperature rise to 1.5 °C above preindustrial levels
  - Use of innovative technologies: renewable energy, electrification of transport, and development of CCUS
  - Ideal regions for CCUS due to high industrial activity, favorable geology, and robust infrastructure

Task 6 : Upcoming Trainings

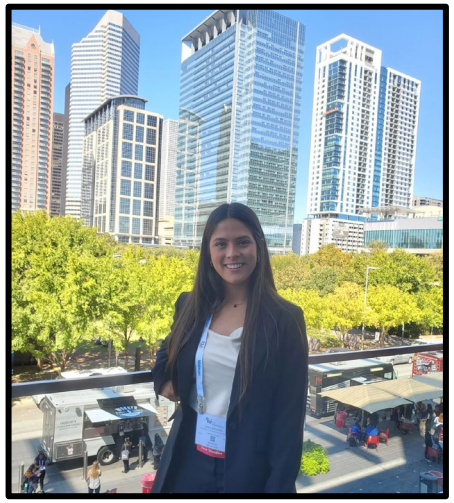
- Workshop by Students: Decarbonization Towards a Sustainable Future
  - **Debate on Climate Change Reality:** Engage participants in a debate to challenge and discuss differing opinions on the reality of climate change
  - **Understanding Decarbonization as a Solution:** Present decarbonization as the necessary response, emphasizing the urgency through current impacts
  - **Decarbonization Exploration:** Solicit ideas from attendees on how to reduce carbon emissions, encouraging creative and proactive thinking
  - **Focus Areas of Decarbonization:** Discuss strategies like hydrogen with carbon management, carbon transport and storage, CO_2 removal and conversion, point-source carbon capture, and the use of green energy
- Hackathon by Students: Decarbonization Solutions
  - Dynamic competition where participants innovate and develop prototypes
    - Device that can capture carbon dioxide emissions from a local point source
    - Design of a CO_2 scrubber and conversion unit
    - Design a miniature electrolyzer



Future Tasks

- Task 5 : Gather all the identified parties to discuss current research activities and resources along with synergic activities to address decarbonization at UTRGV
- Task 6 : Hold laboratory visits and specialized training sessions to prepare students to conduct research
- Task 7 : Assess current and future research trends, funding opportunities, and technological developments
- Task 8 : Identify gaps in resources to conduct frontier research activities and develop a detailed plan to overcome resource gaps to be competitive
- Task 9 : Public outreach to showcase UTRGV's capabilities on decarbonization research and training

Students



Sofia Ramirez

Hometown: Monterrey, Mexico

Ethnicity: Hispanic

Education: Bachelor of Science in Mechanical Engineering (December 2025)

Previous Experience: Lockheed Martin Systems Engineer; Toyota Body Weld Logistics Engineer

Future Plan: MS in Mechanical Engineering

Alexa Martinez

Hometown: Matamoros, Mexico

Ethnicity: Hispanic

Education: Bachelor of Science – Biology; MS in Agricultural, Environmental and Sustainability Sciences (May 2025)

Previous Experience: Intern at Palo Alto National Historical Park; Research assistant at UTHealth

Future Plan: Work for USDA

Students

Gerardo Salinas

Hometown: Monterrey, Mexico

Ethnicity: Hispanic

Education: Bachelor of Science in Mechanical Engineering, MS in Mechanical Engineering (December 2024)

Previous Experience: Graduate teaching assistant

Future Plan: Work for Space X

Jose Chapa

Hometown: Mission, Texas

Ethnicity: Hispanic (First Generation)

Education: Bachelor of Science in Mechanical Engineering, MS in Mechanical Engineering (May 2024)

Previous Experience: Toyota; INVISTA; NASA

Future Plan: Quality Engineer in Automotive Industry

Reflections by Students

- Helped me improve and gain valuable skills such as communication, leadership, creativity, and respect
- Gained valuable insights into the power of teamwork. Working together, we've exchanged ideas to enhance the project's outcomes
- Gave me the opportunity to understand what decarbonization is and its key concepts
- Realized just how extremely important decarbonization is….it is not just for academics but crucial for our future
- Appreciated that issues related to climate change have much more impact than I even realized…the more research about organizations that are willing to deal with it we do, the more I realize how meaningful our contributions really are
- Realized how little information is currently being shared out there for students
- Grasped the critical importance of raising awareness about this issue
- **Committed to spreading awareness among my colleagues and community, emphasizing the significance of our collective actions**

Acknowledgement

- UTRGV students, administrators, staff, and faculty
- Collaborator at LSU, Dr. Mehdi Zeidouni
- Funding from NETL
- Support and encouragement from our Federal Project Manager, Andrew Downs

Thank you for the opportunity

University of Texas Rio Grande Valley