

Wyoming's Energy Innovation Landscape

Presented to
The Energy Council
University Advisory Board

December 8, 2023



UNIVERSITY
OF WYOMING

School of
Energy Resources

THE WORLD NEEDS MORE COWBOYS.

Topics

- School of Energy Resources role and background
 - Academics
 - Outreach
 - Applied research
- Wyoming's innovation centers

WHAT EVERY WYOMING LANDOWNER SHOULD KNOW ABOUT CARBON CAPTURE AND STORAGE

A CCS RESOURCE GUIDE AND
FREQUENTLY ASKED QUESTIONS

By Carson Tanner, J.D/M.A.
& Tara Righetti, Professor of Law and Occidental
Chair for Energy and Environmental Policies



SER Background

*THE WORLD NEEDS MORE
ADVENTUROUS SPIRIT.*

SER's Mission:

Energy-driven
economic
development for
Wyoming



*BUCKING
THE SYSTEM
SINCE 1886.*

SER Governance: Energy Resources Council

- **Cindy Crane (Chair)** – *Chief Executive Officer, PacifiCorp*
- **Senator James Anderson (Co-Chair)** – *State Senator, Chair, Senate Joint Appropriations Committee*
- **Representative Don Burkhart** – *State Representative & Chair, House Minerals, Business and Economic Development Committee*
- **Carl Bauer** – *Director, National Energy Technology Laboratory, U.S. Department of Energy (Retired)*
- **Mark Doelger** – *President, Barlow & Haun, Geologists*
- **David Emery** – *Chairman, President and CEO, Black Hills Corporation (Retired)*
- **Vello Kuuskraa** – *President and Chairman of the Board, Advanced Resources International*
- **Randall Luthi (ex-officio)** – *Chief Energy Advisor, Governor Gordon's Administration*
- **Charlene Russell** – *Energy Transition Executive, Baker Hughes*
- **Ed Seidel (ex-officio)** – *President, University of Wyoming*
- **Chad Teply** – *Senior Vice President, Transmission and Gulf of Mexico Operating Area, Williams*
- **Dave True (ex-officio)** – *University of Wyoming Board of Trustees*
- **John Koprowski (ex-officio)** – *Dean, UW Haub School of Environment and Natural Resources*

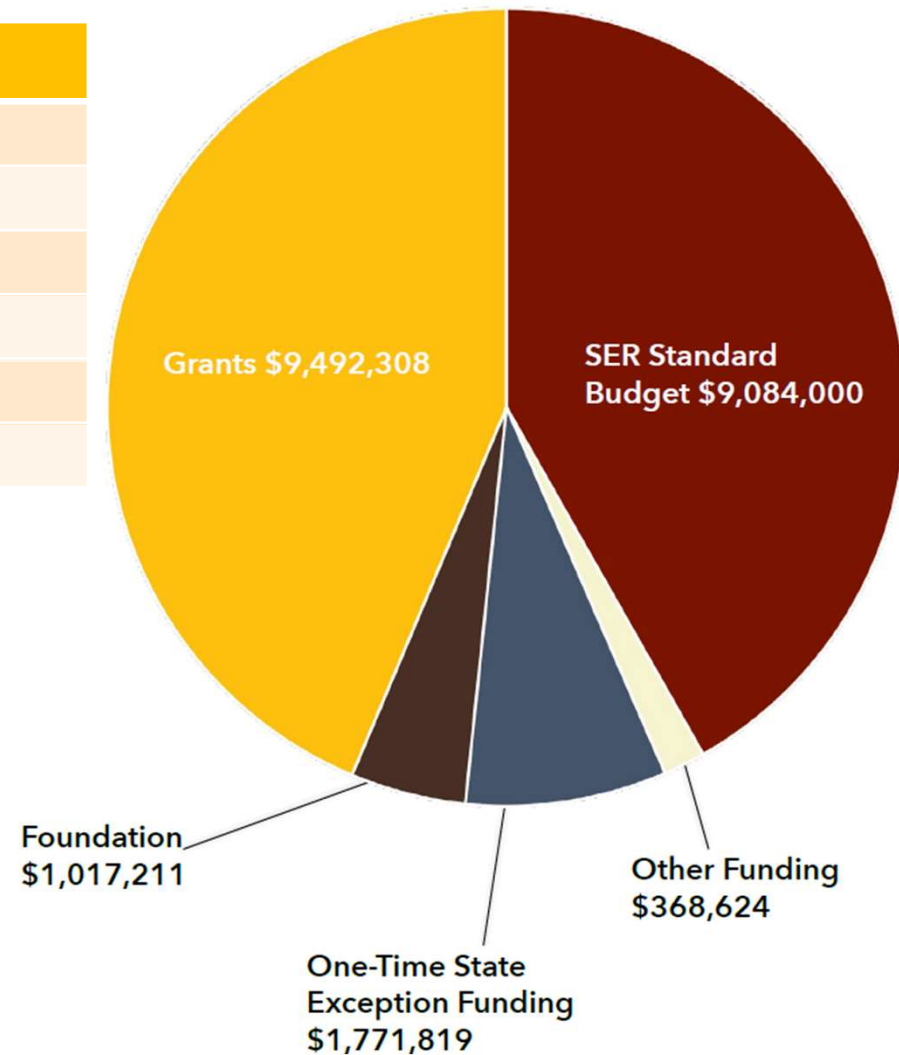
***Established
in 2006 by
Wyoming
SF0037***



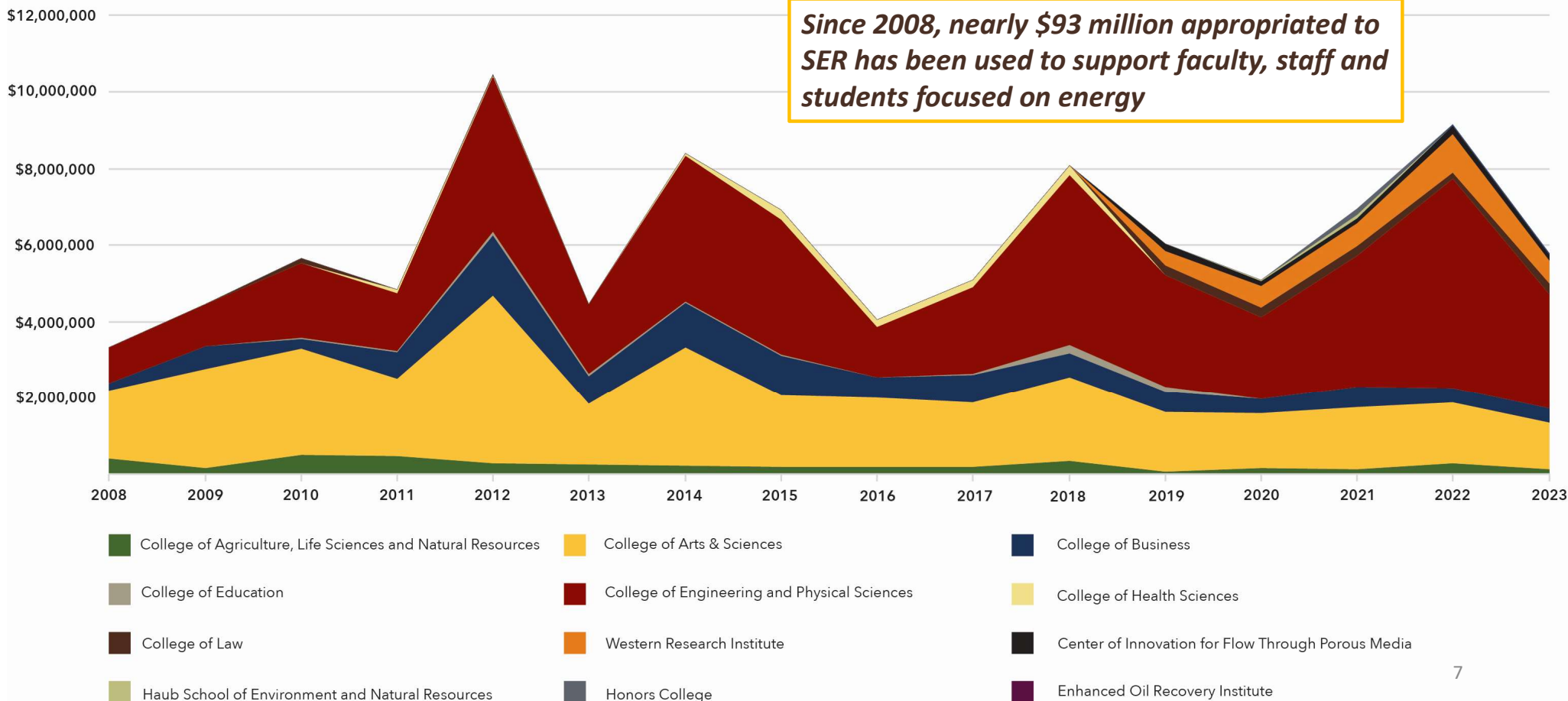
FY23 Financials

SER FY23 Totals	
Standard state funding	\$9,084,000
One-time state	\$1,790,833
External (federal, corporate research)	\$9,492,308
Foundation	\$1,017,211
Other (raise pool, indirects)	\$368,624
Total	\$21,733,961

259 People	
Faculty and Staff	90
Student Support	169
Graduate Assistants (92)	
Hourly, Non-Benefitted (77)	



SER Collaboration Across UW



Academic Offerings

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Bachelor of Science Energy Resource Management and Development (ERMD)

5th

HIGHEST AVERAGE
STARTING SALARY ON
CAMPUS

100%

EMPLOYMENT RATE OR
GRADUATE SCHOOL
PLACEMENT SINCE 2016

2

CONCENTRATION AREAS
OFFERING VERSATILE JOB
OPPORTUNITIES



Professional Land Management Concentration
Energy & Environmental Systems Concentration



Certificates



**Carbon Capture,
Utilization, and
Storage (CCUS)**



**Land
Administration**

*Can be completed online
synchronously for current students
or working professionals*



Minor

**Energy Resource
Management (ERM)**

*Complements any UW degree
with significant overlap in
business, economics, finance,
engineering, sciences, law,
real estate, land management,
political science, sociology,
agriculture, and environment
and natural resources*



3+3 Quickstart

**Accelerated Degree
Program**

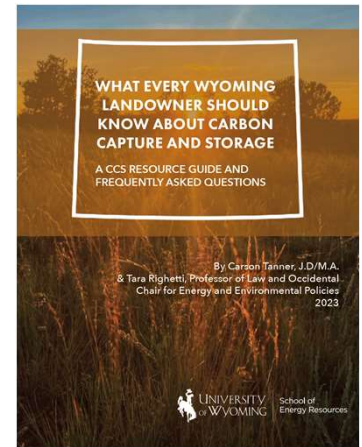
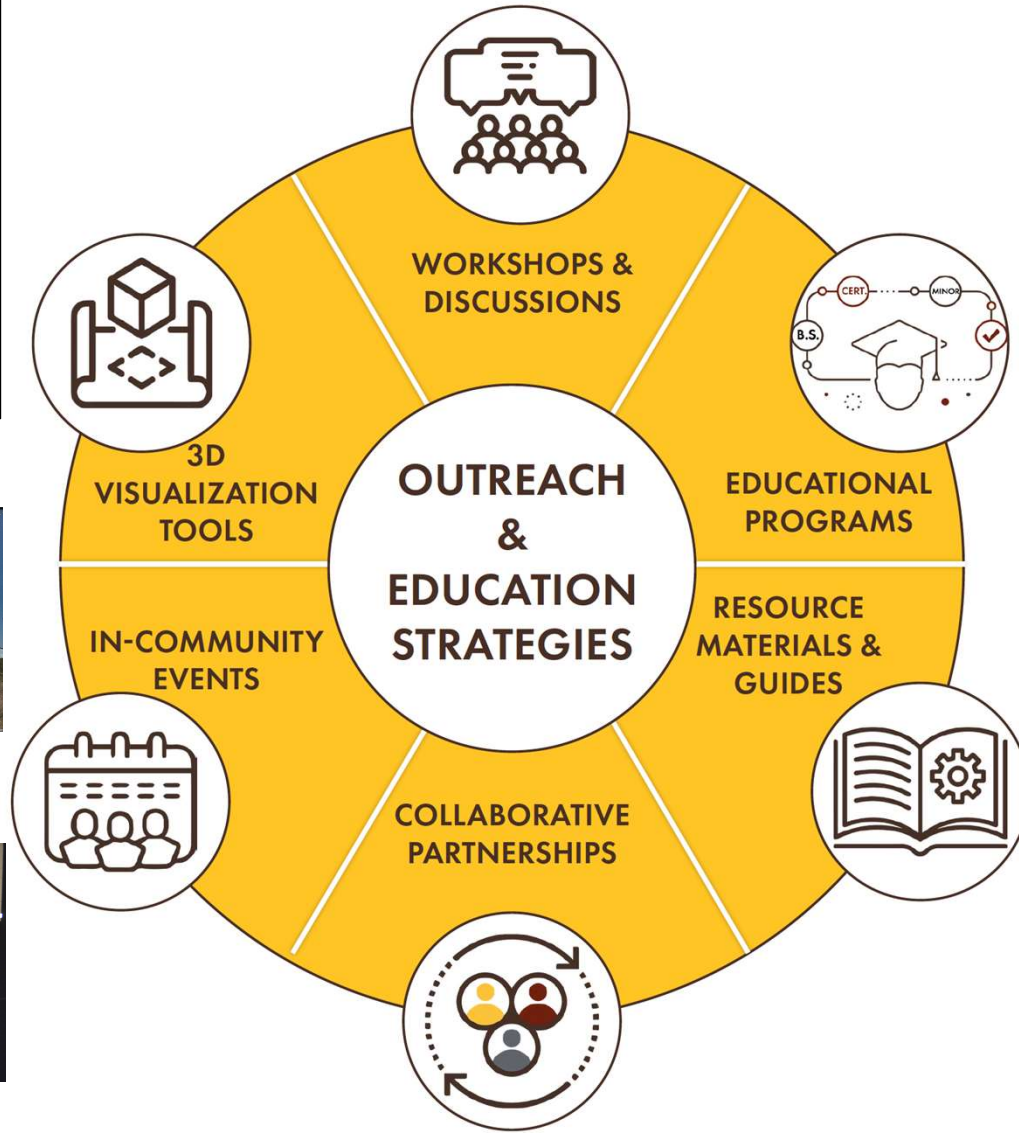
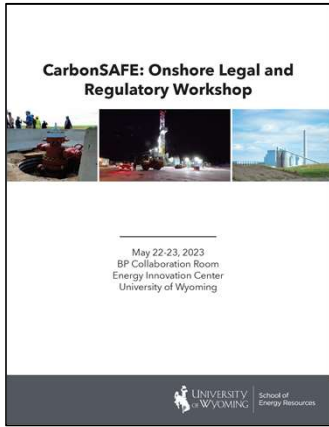
B.S. ERMD + Juris Doctor

*Earn a bachelor's degree
from SER and a law degree
through the UW College of Law
in 6 years for the combined
professional credentials*

Outreach

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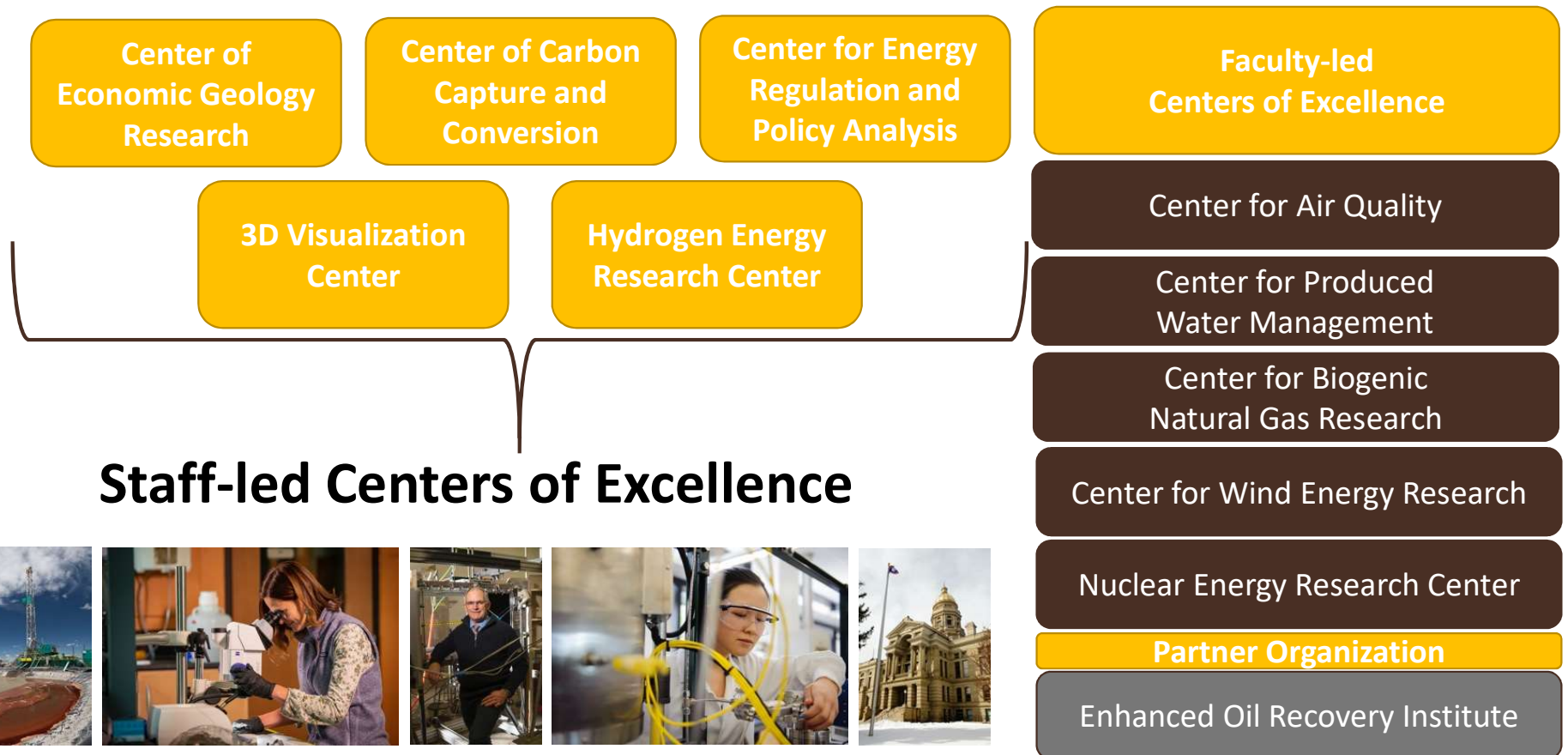
ENGAGEMENT AND EDUCATION



Research

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SER Research Structure



Select Research Topics

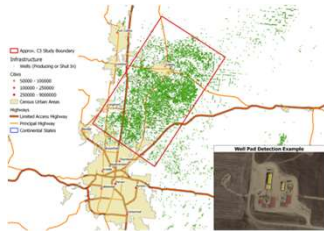
- Carbon capture, use and storage
- Carbon engineering (coal to products)
- Oil and gas production
- Visualization
- Methane detection
- Rare earth elements and critical minerals
- Coal markets and sales
- Combustion
- Energy policy and economics
- Hydrogen
- Nuclear
- Produced water management
- Applied geologic research
- Wind



Air Quality

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RESEARCH PROJECTS



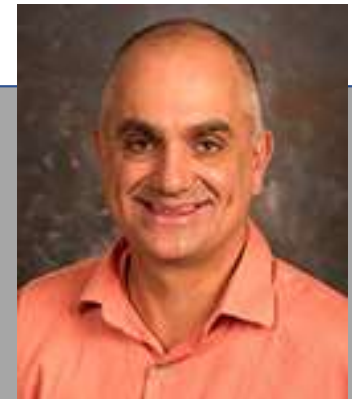
Colorado Coordinated Campaign (C3) making methane emission measurements using a tracer release technology and reconcile measurements made by ground, drone, LIDAR, and airborne teams.



Quantification of methane emissions in the Permian Basin and reconciling various measurements of methane emissions.



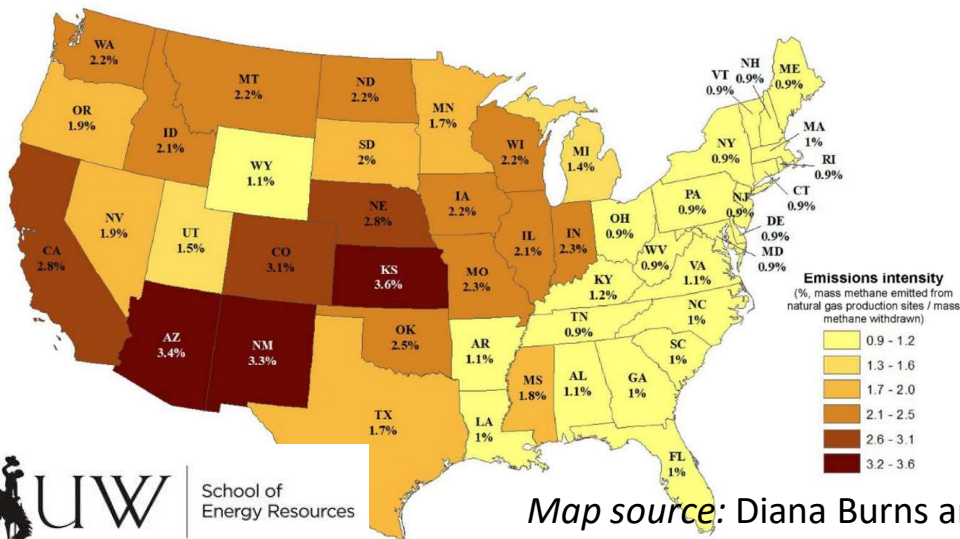
The CAQ is a long-time partner with U.S. oil and gas producer Jonah Energy and has contributed to the company's "Gold Standard" emissions rating from the United Nations.



Director
Shane Murphy, Associate Professor
of Atmospheric Sciences

Engagement with Industry Yields Results

- Wyoming natural gas producers have been internationally recognized
- UW Center for Air Quality Research Program:
 - Research oil and gas emissions
 - Measure and predict emissions
 - Wintertime ozone formation



Map source: Diana Burns and Emily Grubert, Environ. Res. Lett. 16 (2021) 044059



Jonah Energy Completes Responsibly Produced Gas Transaction

DENVER, CO., Nov. 2, 2022—Jonah Energy LLC (“Jonah”), one of the leading sustainable natural gas producers in the U.S., has successfully executed a large natural gas sales agreement to provide gold standard certified natural gas to a major US natural gas utility company.

The agreement represents a milestone contract for [the United Nations’ Oil and Gas Methane Partnership 2.0](#) (“OGMP 2.0”) certified gold standard natural gas, which recognizes the need for a cleaner produced natural gas product in the marketplace. In 2020 Jonah Energy became the first U.S. operator to sign onto OGMP 2.0 and in 2021 was the first U.S. operator to achieve OGMP’s gold standard rating for low emissions and maintained the rating in 2022. The OGMP 2.0 certification process is based on the only comprehensive, measurement-based reporting framework for the oil and gas industry that improves the accuracy and transparency of methane emissions reporting.

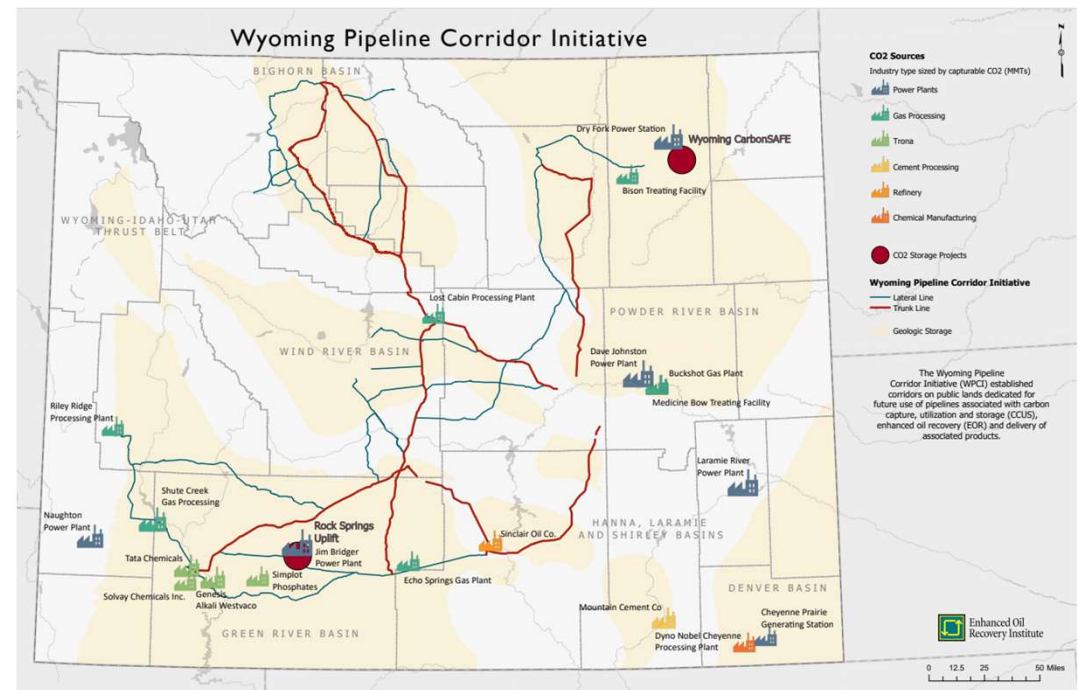
The one-year agreement is for 50,000 MMBtu/day and is priced at a premium to the applicable market index.

Carbon Capture, Use and Storage

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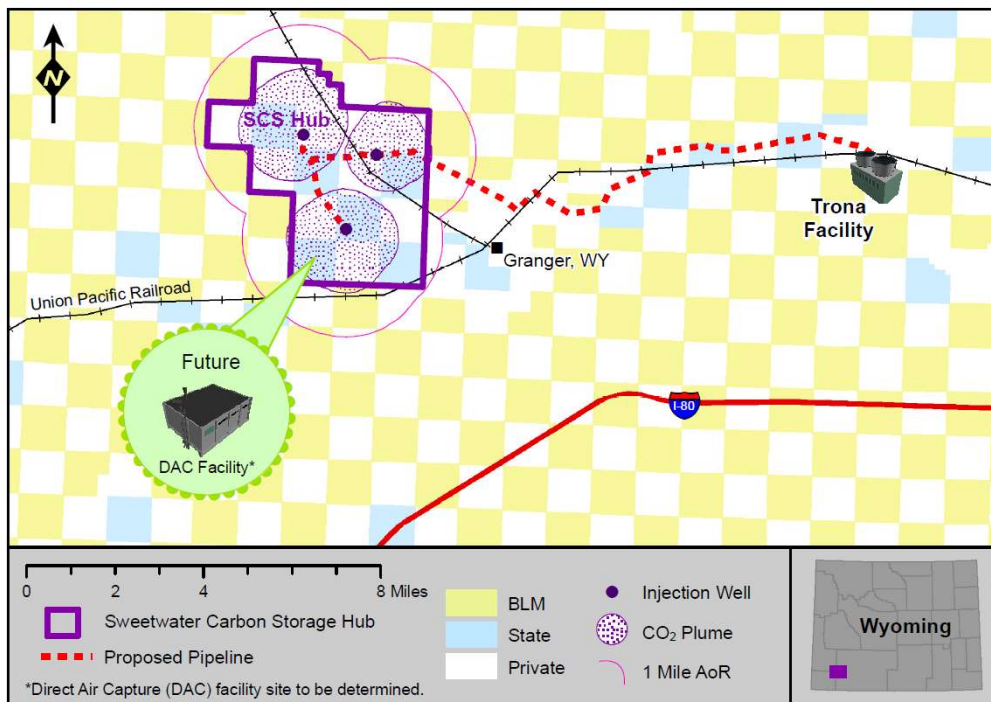
Wyoming is ready to support deployment

- ✓ Wyoming Pipeline Corridor Initiative (WCPI)
- ✓ CCUS friendly regulatory framework
- ✓ Primacy for CO₂ injection
- ✓ Potential CO₂ targets identified in every Wyoming geologic basin
- ✓ Storage capacity for over 26 billion tons of CO₂ storage
- ✓ Wyoming Integrated Test Center
- ✓ National and international reputations in CCUS



Wyoming CarbonSAFE Projects

Sweetwater Carbon Storage (SCS) Hub



The goal of the \$50 million SCS Hub with partner Frontier Carbon Solutions is to provide carbon management opportunities to SW Wyoming, developing storage resources for trona, natural gas processing, direct air capture...

Wyoming CarbonSAFE Phase III

Focused on investigating the **feasibility** of practical, secure, **permanent, geologic storage** of carbon dioxide (CO₂) emissions from coal-based electricity generation facilities near Dry Fork Station Gillette, Wyoming...

Preparing CarbonSAFE Phase 4 Application

Wyoming CarbonSAFE Project

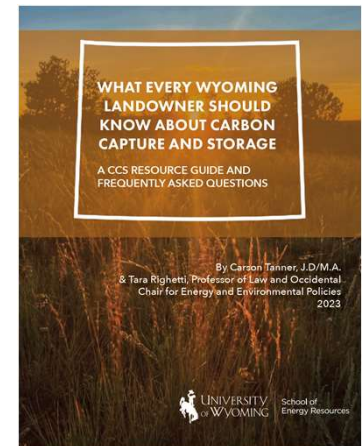
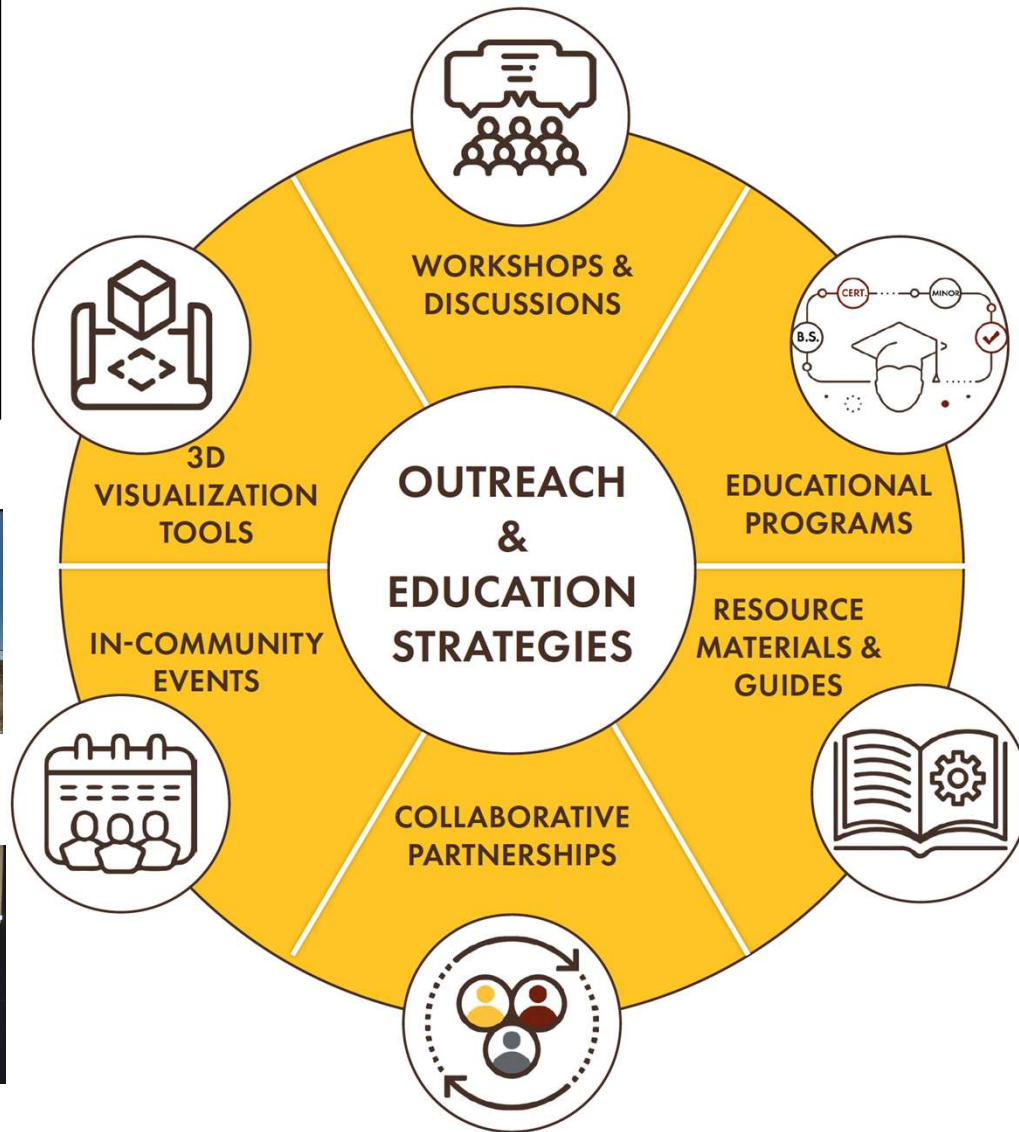
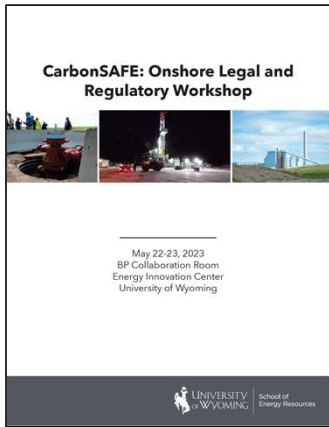
CarbonSAFE firsts in Wyoming...

- Wells drilled and completed for Class VI activities
- Baseline monitoring network
 - Soil
 - Groundwater
 - Passive seismic
- NEPA assessment(s)
- CCUS-focused outreach and education
- Business and economic models
- Publically available project data*

*<https://www.uwyo.edu/cegr/research-projects/carbonsafe-p2-dryfork.html>



ENGAGEMENT AND EDUCATION



Nuclear Energy Instruction and Research

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RECENT PROJECTS

- ❖ Provide funding for UW faculty on nuclear-related research
- ❖ Recipient of Nuclear Regulatory Commission faculty development award
- ❖ Department of Energy funded research grants
- ❖ Developing a nuclear chemistry core facility
- ❖ Hosted a nuclear colloquium



Co-Directors

Tara Righetti, SER Professor of Law; Occidental Chair of Energy & Environmental Policies

Caleb Hill, Associate Professor of Chemistry

ema

Emerging Energy Markets
Analysis Initiative

The **Emerging Energy Market Analysis Initiative** is a collaboration between Idaho National Laboratory, University of Michigan, University of Wyoming, Massachusetts Institute of Technology, University of Alaska, and Boise State University. The initiative is dedicated to advancing the understanding of energy markets options as the world transitions to new energy futures.

CAPACITY BUILDING | EXPANDING NUCLEAR RESEARCH | COLLABORATION

Nuclear Energy Collaboration & Training Program



- Nuclear Energy Research Center (NERC) created
- \$2M exception funding leveraging \$2.4M external funding from DOE, NRC, INL (cash and in-kind) & private sector



ACADEMICS

- Fundamentals of Nuclear Energy course
- Student research



OUTREACH

- RENEW conference
- Webinars



RESEARCH

- Seed grants
- Cost share
- Shared nuclear-focused lab
- Wyoming-specific economic impact assessments

Wyoming's Innovation Centers

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Purpose:

Provide a technology neutral test center to facilitate the development of new CCU technologies...

Operations updates and schedule (lease through 2027)

Current Carbon Capture Technology Deve		2023				2024				2025				2026			
Size	Project Name	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Small	TDA Membrane/Sorbent					0.1	0.1	0.1	0.1								
Small	GTI OSU membrane							1	1	1	1	1					
Small	KHI Sorbent				0.2	0.2	0.2	0.2	0.2								
Small	CSU/UWYO							0.1	0.1	0.1							
Large	MTR								10	10	10	10	10				
Total Flue Gas (Mwe)					0.2	0.2	0.3	1.4	11.4	11.2	11	11	10	0	0	0	0
	Construction																
	Operations																
	Decommissioning																

Engagement

- Hosted Western Governors Association
- WEA state legislators conference
- EPA Administrator Regan
- Japanese government officials and JCOAL



Wyoming Innovation Center (WyIC)

Host site for technology development

- Rare Earth Elements
- Critical Minerals
- Activated Carbon
- Carbon Fiber
- Graphene
- Asphalt
- Agricultural Char
- Much more



Closing Thoughts

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Wyoming residents' preferences for energy activities

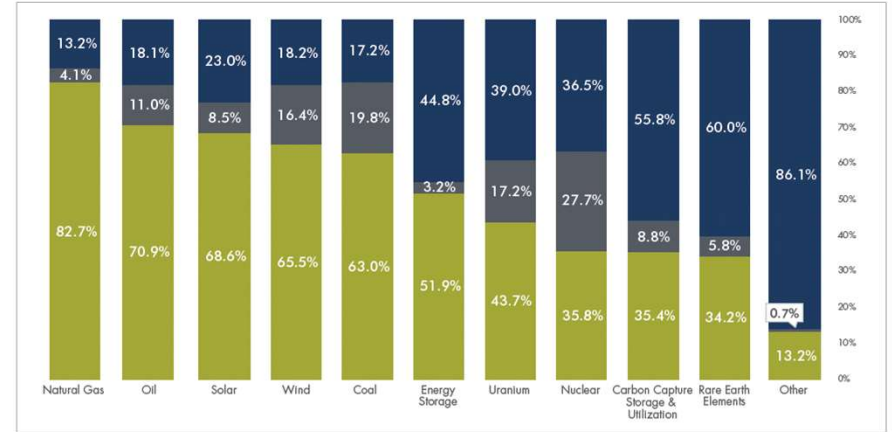
- Increased support for CCUS from 2019 to 2022
- Low levels of opposition to most types of energy activities
- High levels of support for conventional types of energy resources and generation
- Many people report being neutral or not sure about many types of energy activities
- This suggests there are opportunities for education and outreach particularly around less well know energy activities

2019 Support and opposition for Wyoming's energy technologies and production

Percentage of Wyoming residents who support or oppose types of energy technologies and production in Wyoming

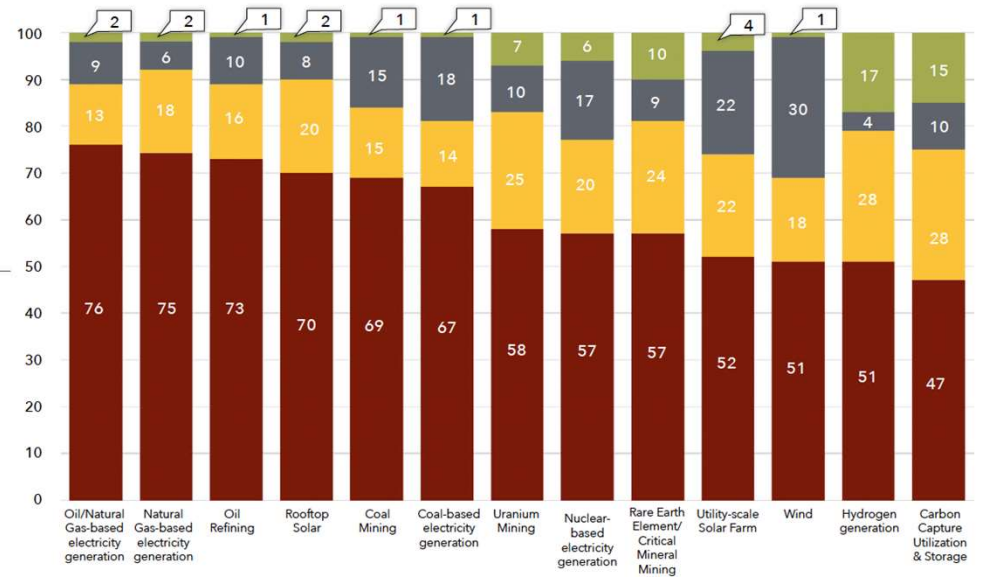
- Support
- Oppose
- Neutral or not sure

Percentages may not total 100 due to rounding.

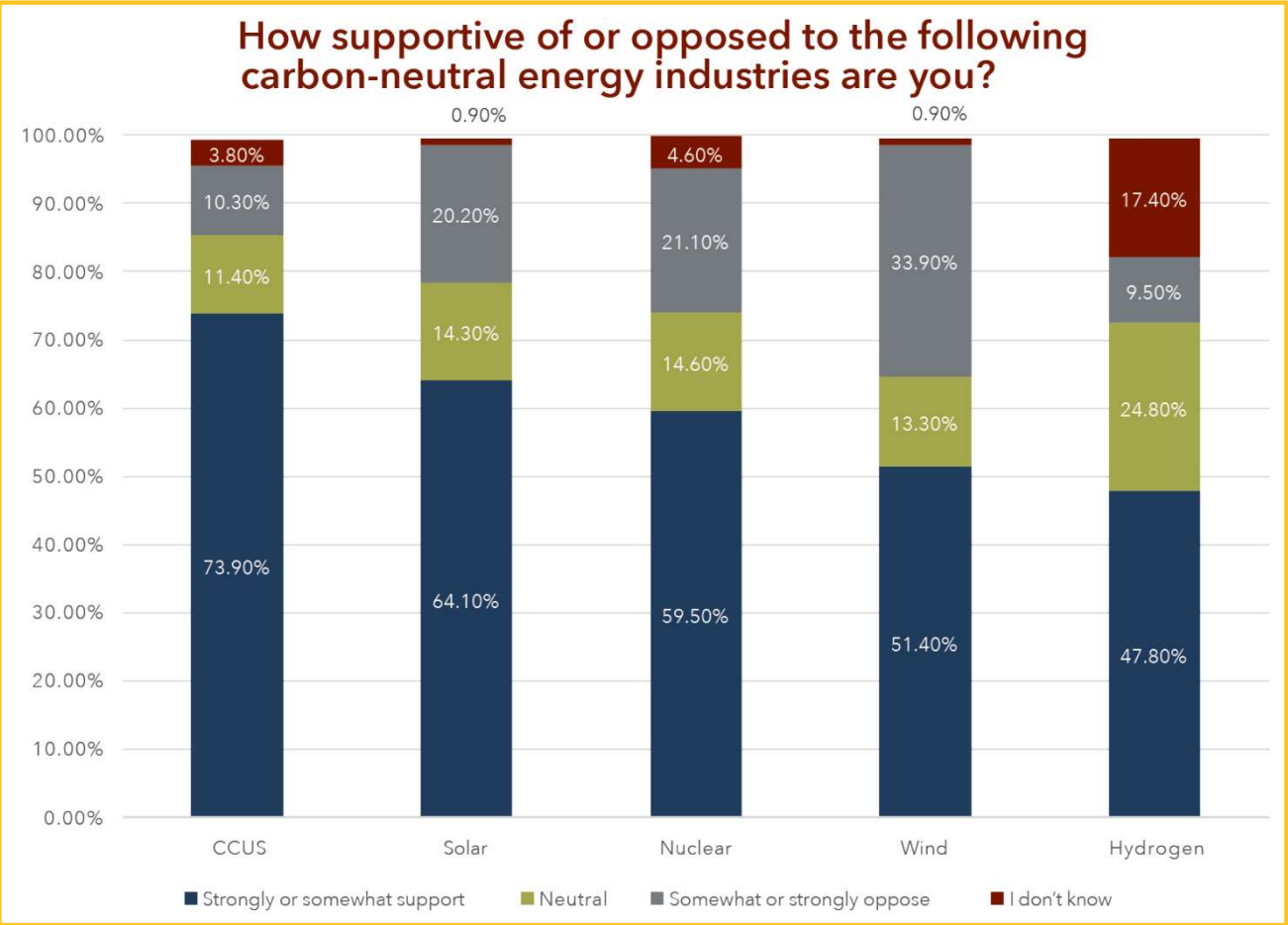


2022 The following is a list of energy related activities that are either being done or could be done in Wyoming. How much do you favor or oppose each one in the future?

- Favor
- Neutral
- Oppose
- Not Sure



Results Differ for Energy Communities





UW Graduate Success and Retention

Of the 51 full-time staff members at SER, 39 have at least 1 degree from the University of Wyoming.

76.5%

With one employee currently working on his first UW degree



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