

**Hilary
Olson**



**Sabrina
Ewald**



Engaging with Teachers to Encourage Energy Literacy



TEXAS

The University of Texas at Austin

**Hildebrand Dept. of Petroleum and
Geosystems Engineering
and
Center for Subsurface Energy and
the Environment**

Higher Ed Institution Outreach



Hildebrand Dept. of Petroleum & Geosystems Engineering

*Our expertise: **Subsurface Energy Resources***

*Domains: **Research & Education***

Outreach Initiative Lens:

1. Advance Education outside of the university setting
2. Contribute to Energy Literacy across the spectrum

Higher Ed Institution Outreach

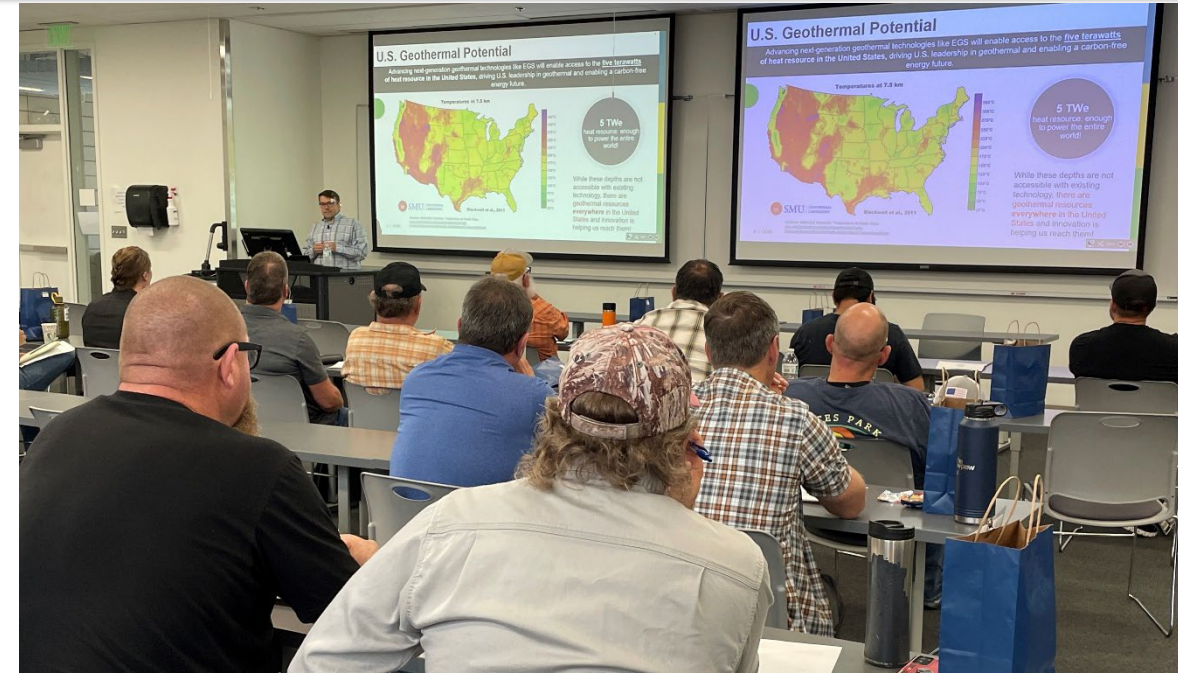
Example:



*Professional Development for
Oil & Gas Field Inspectors*

Outreach Initiative Lens:

1. Advance Education
outside of the university
setting
2. Contribute to Energy
Literacy across the
spectrum



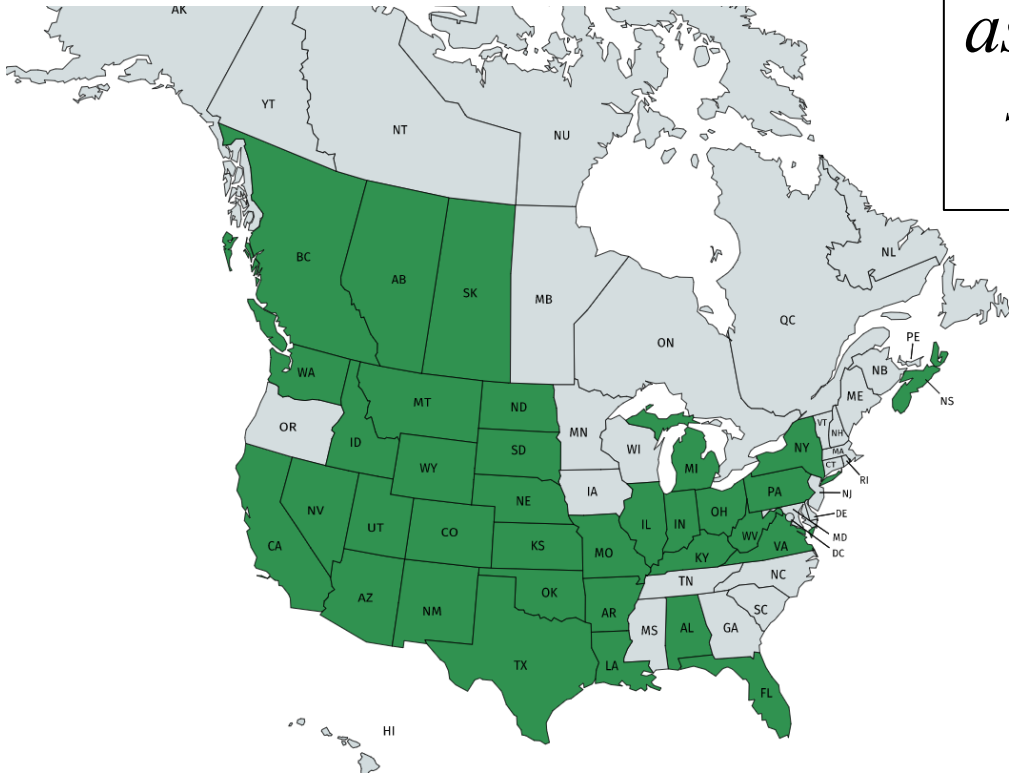
Higher Ed Institution Outreach

Example:



*Professional Development for
Oil & Gas Field Inspectors*

**Needs
assessment
stakeholder
goals*



Participants from **37**
govt/regulatory agencies
totaling
~60,000
person-hours of training

Higher Ed Institution Outreach

Choose Energy

K-12 Teacher Outreach Initiative

Choose an energy career and tackle the earth's complex resource challenges and lead the way to a sustainable and equitable energy future.

Teachers are the great multiplier

Energy Educators Rejuvenating Their Energy Curriculum

- Courses being taught contain content related to subsurface energy resources.
- Approximately half (4 classes) of teachers' schedule is teaching one of these courses.

Teachers as Energy Ambassadors

- Teachers have approximately 130 students in their classes each year.

What do K-12 teachers need?

Classroom resources

- relevant
- correlated to standards
- easy to integrate into their existing curriculum

Continuing education hours



Professional Development meets these needs



Teachers can help inspire and create the next generation of leaders in subsurface energy engineering.

Hands-on Activities



HOW we engage with teachers to encourage energy literacy

Choose Energy

MISSION

Teach K-12 STEM educators about subsurface energy resources.

Connect
with K-12
STEM
Educators:

- 1. Summer teacher workshop**
- 2. Online energy classroom resources**
- 3. Educator Outreach Events**

HOW we engage with teachers to encourage energy literacy

Choose Energy

1. Summer teacher workshop

Energy Science and Technology Institute (ESTI)

2. Online energy classroom resources

3. Educator Outreach Events

Who teaches the workshop?

The five-day summer workshop is led by numerous faculty from the Hildebrand Department of Petroleum and Geosystems Engineering.

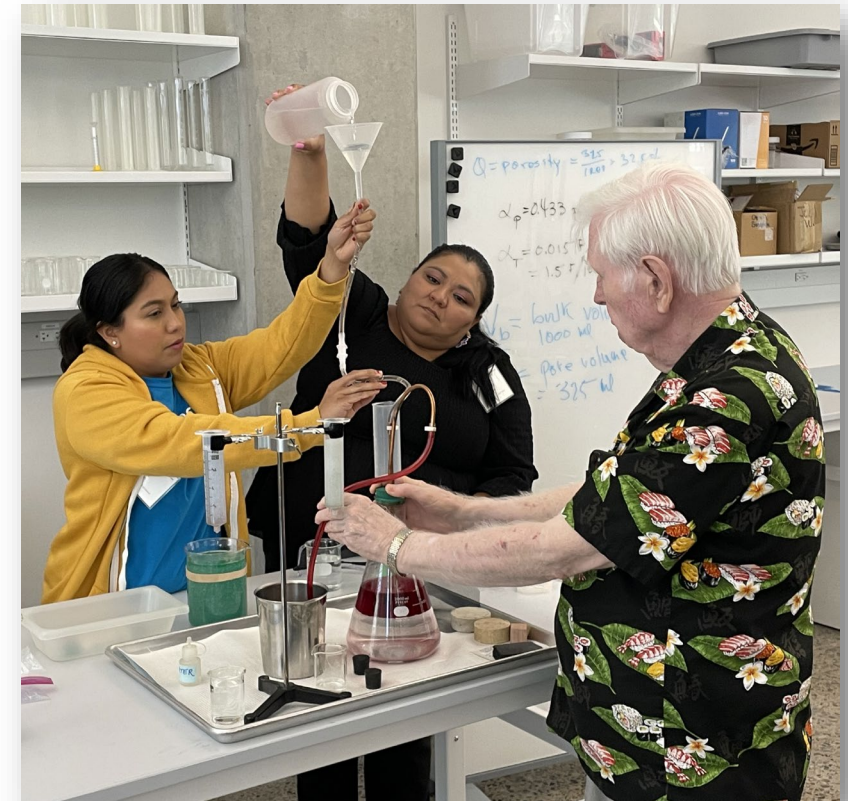
Dr. Wen Song



Dr. Zoya Heidari



Dr. Larry Lake



How do we select participants?

High School Subjects Taught

Aquatic Science

Biology (on-level, honors, AP, IB)

Chemistry (on-level, honors, AP, IB, OnRamps)

***Environmental Science (on-level, AP, IB)**

***Earth and Space Science (on-level, OnRamps)**

Integrated Physics and Chemistry

Physics (on-level, honors, AP, IB, OnRamps)

***Career and Technical Education Courses
(engineering, robotics, computer science, etc.)**

Math (algebra, geometry, etc.)

**We prioritize
educators who teach
these courses.*

How have we leveraged other outreach assets?

We leverage and customize hands-on activities and labs, discussion sessions, breakout sessions, and online coursework from other programs such as TOPCORP.

Carbon Storage Design Project

Field inspectors learning about stratigraphy and reading well logs. (UT Austin TOPCORP Workshop 2024)



How do we involve sponsorship partners?

Saurabh Limaye
Drilling Engineering,
Shell



Drilling Simulator Activity

Sponsorship partners bring different perspectives (industry, regulatory) and career insights.

Drilling Mud Activity



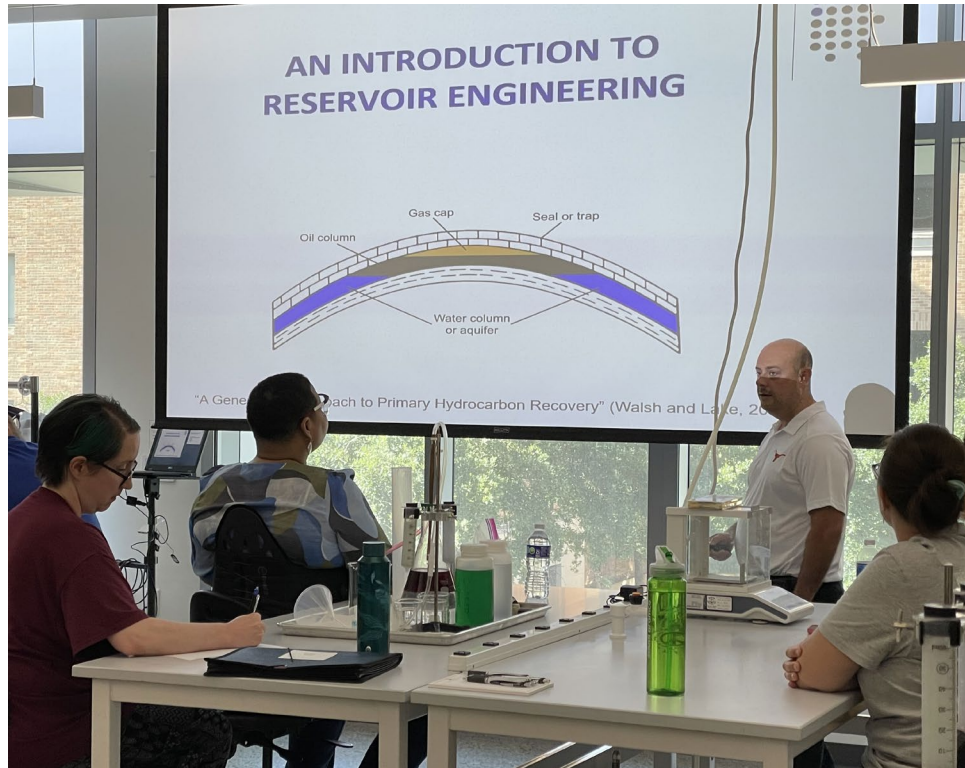
What is the format of the workshop?

The first 3 of the 5 days are spent in UT Austin classrooms and labs to showcase a variety of energy themes, such as the global energy marketplace, petroleum engineering, water-energy connection, energy portfolio mix, geothermal energy, and carbon storage.

Reservoir Engineering Activities



Hydraulic Fracturing Simulation with Jell-O



How do we connect the classroom to the real work done in energy?

The final 2 days are spent in Houston and Galveston: **ConocoPhillips industry visit to learn more about prospective careers in the energy industry.**



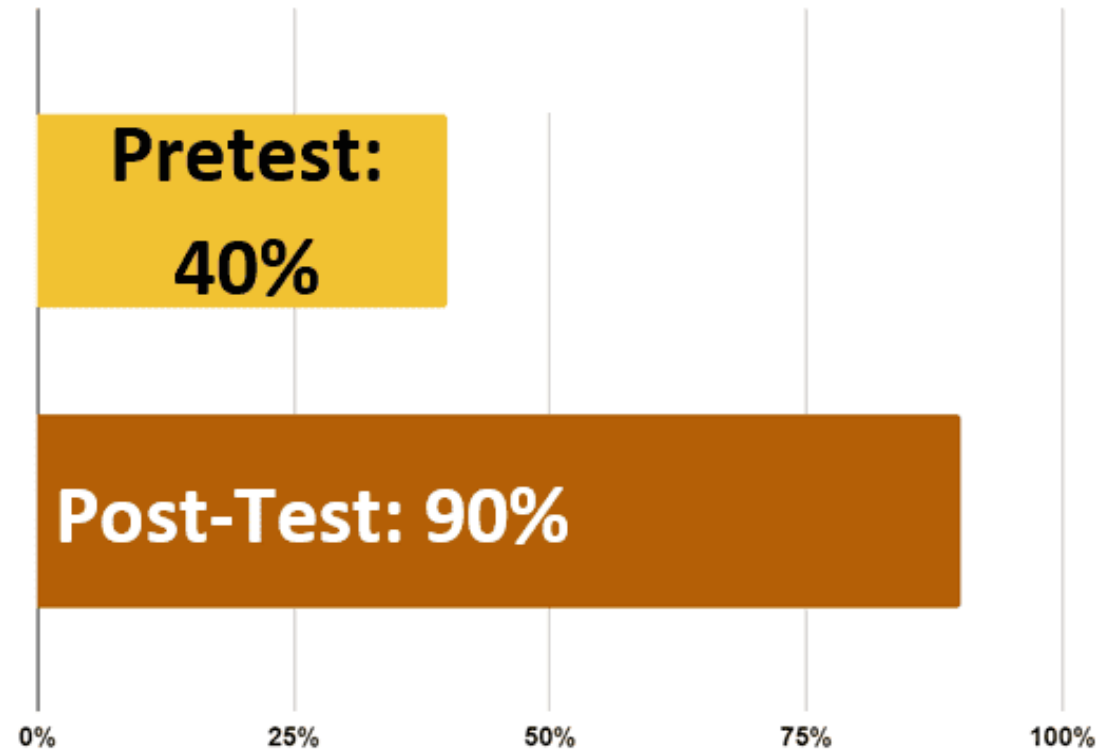
How do we connect the classroom to energy technology?

The final 2 days are spent in Houston and Galveston: Touring the Ocean Star Museum in Galveston.

Visit to the Ocean Star Museum - Galveston, TX



What is the knowledge gain of teachers who attend our summer workshop?



What is the student impact of our summer workshop?

All ESTI Teachers (2019-2025) Cumulative Impact

1. Energy Educators Rejuvenating Their Energy Curriculum	13,600 students
2. Teachers as Energy Ambassadors	40,000 students

HOW we engage with teachers to encourage energy literacy

Choose Energy

1. Summer teacher workshop

Energy Science and Technology Institute (ESTI)

2. Online energy classroom resources

EnergyExcursions.com

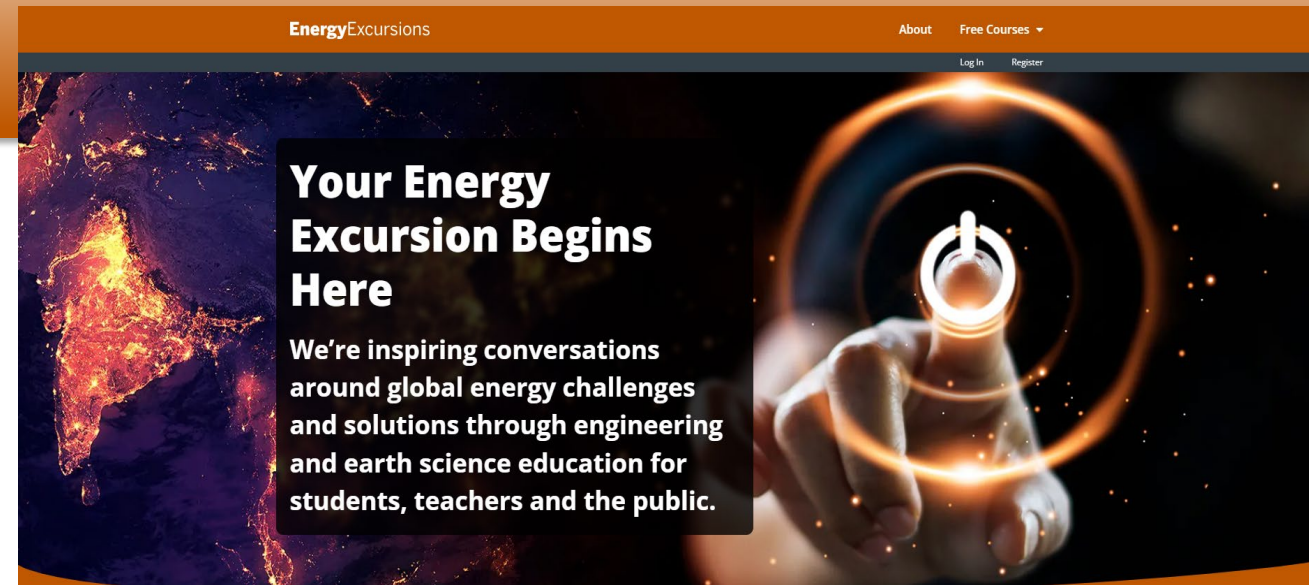
3. Educator Outreach Events

OVERVIEW

FREE online courses that provide an in-depth look at the subsurface energy industry.

All courses correlated to:

- 24-25 high school science Texas high school science standards (TEKS)
- AP Environmental Science Standards
- Next Generation Science Standards (NGSS)



The image shows the top portion of the EnergyExcursions.com website. At the top, the logo 'EnergyExcursions' is on the left, and navigation links 'About' and 'Free Courses' are on the right. Below the navigation, there are links for 'Log In' and 'Register'. The main hero section features a dark background with a glowing orange ring and a hand pointing at it. The text reads: 'Your Energy Excursion Begins Here' and 'We're inspiring conversations around global energy challenges and solutions through engineering and earth science education for students, teachers and the public.'

Whether you're a teacher, a student, or just interested in learning about energy, Energy Excursions is for you.



Energy Excursions provides teachers with resources and professional development opportunities to support energy-related curriculum in their classroom.

[Learn More](#)



Energy Excursions provides students with free, online courses and career information related to engineering and earth sciences in the energy industry.

[Learn More](#)



Energy Excursions shares self-guided educational content with the public about the complexity and challenges that engineering, science and technology are addressing in order to achieve a sustainable energy future.

[Learn More](#)

Preparing Today's Students to Solve Tomorrow's Energy Challenges

Energy Excursions provides teachers with resources and professional development opportunities to support energy-related curriculum in their classroom.

Mini Courses

- **Drilling Engineering** (*In Pursuit of the Safe Well*)
- **Carbon Storage** (*Put It Back*)
- **Energy-Water Nexus** (*How Much Water Does It Take?*)
- **Energy Portfolio Mix** (*Energize the Future*)
- **Geothermal** (*Energy is a Hot Topic*)

EnergyExcursions

[About](#)
[Free Courses](#)
[Teachers](#)

Log Out
Admin Panel

Course Content

Expand All

- What is a Well?
 - Types of Wells
 - Regulatory Oversight of Wells
 - Oil and Gas Wells
 - Well Construction
- Geologic Considerations When Drilling a Well
 - Topics
- Engineering Considerations When Drilling a Well
 - Topics
- Continuum Risk
 - Topics
- Primary Well Control
 - Topics
- Drilling Mud
 - Topics
- Cement and Casing
 - Topics
- Design Challenge: Casing Program
 - Topics
- Secondary Well Control
 - Topics
- Tertiary Well Control
 - Topics
- Miscellaneous Well Case Study
 - Topics

Return to In Pursuit of the Safe Well

Types of Wells

In Pursuit of the Safe Well - What is a Well? - Types of Wells

LESSON PROGRESS

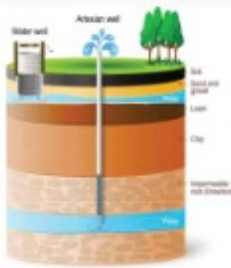
A well is a structure that is drilled into the ground for several purposes.

We will discuss two basic types of wells throughout this lesson. They are known as (1) extraction wells and (2) injection wells.

Extraction wells, also known as recovery wells, are drilled for the purpose of accessing natural resources, such as:

- Extraction of water
- Sampling of rock or soil
- Extraction of mineral resources, like oil and gas

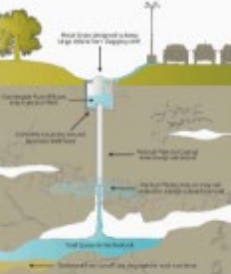
This figure shows an artesian well for the purpose of extracting freshwater. The well pipe has been drilled into a confined aquifer, which is under pressure, to extract water at the surface. An artesian well represents the special case where the pressure in the aquifer is high enough to push the water all the way to the surface against gravity.



Injection wells are used for injecting a number of different materials for various purposes, such as:

- Injection of wastewater or other waste fluids
- Injection of water for secondary oil recovery
- Injection of CO₂ for enhanced oil recovery

This figure shows an injection well for the purpose of disposing of wastewater through the subsurface, where discharge may come in contact with the groundwater table or aquifer. Injection wells are often used for stormwater discharge to alleviate potential flooding. In this case, gravity alone (rather than pumping or air) is sufficient with some injection wells (shown as the figure to the right) to push the water all the way to the surface against gravity.



As shown in the figure above, the same material can be considered a resource we extract, or a waste product we dispose of through injection. For example, artesian wells (top figure) are typically drilled to extract water stored in pressurized, confined aquifers. In contrast, we can drill an injection well into a confined space below ground to dispose of wastewaters, such as stormwater runoff (bottom figure).

Oklahoma Academic Standards

- Environmental Science: ESD.2
- Earth and Space Science: ESS.2

TDEC Standards

- Earth Systems Science: 1.A, 2.C, 3.D, 1.SA, 1.SB
- Environmental Systems: 1.D, 2.B, 2.D, 3.C, 4.A, 4.C, 6.A, 6.C, 6.A, 8.B, 9.A, 10.A, 10.B, 10.C
- Engineering Science: 4.D
- Principles of Applied Engineering: 2.B, 3.B, 3.C, 6.A
- Living and Physical & Chemistry: 1.D, 1.B, 2.D, 4.B, 4.C
- Oil and Gas Production: 1.A, 2.A, 2.C, 2.D, 2.F, 2.P, 3.B, 3.H, 3.I, 3.J, 3.K, 3.L, 3.M
- Oil and Gas Production: 3.A, 3.B, 3.C, 3.D

College Board Units and Topics

- AP Environmental Science: 1, 4, 5, 6, 7, 8, 9, 10

New Generation Science Standards

- Earth and Space Sciences: HS-ESS-1, HS-ESS-2, HS-ESS-3, HS-ESS-4
- Engineering, Technology, and Applications of Science: HS-ETS-1, HS-ETS-2, HS-ETS-3

Educator Community

Continued Classroom Support

Lesson Plans & Activities

Looking for lesson plans or activities for a particular high school course or to match one of our Energy Excursions online courses? Click on one of the items below to link to our content. Looking for Phenomenon Science demos or activities to engage your students? We have you covered there as well.

[View Lesson Plans & Activities](#)

Professional Development

Are you looking for professional development opportunities around earth science and energy topics? Look no further. We offer a variety of asynchronous modules to help you advance your knowledge, earn continuing education units and satisfy your professional development requirements. Even better, it's free!

[View Continuing Education Courses](#)

All Lessons & Activities

Free lessons and activities are available to teachers and all resources are correlated to 24-25 TEKS, NGSS, and AP Environmental Science Standards. Lessons and activities are organized by high school courses and Energy Excursions courses. We are also building a library of phenomena-based activities that focus on engineering concepts.

High School Course Activities

Visit this page to view lessons and activities specifically designed for AP Environmental Science, ESS, and Environmental Systems/Science.

[View Lessons & Activities](#)

Energy Excursions Course Activities

If you are interested in student activities or full lessons built for a specific Energy Excursions course, visit this page to view available resources.

[View Lessons & Activities](#)

Phenomena in Science and Engineering Activities

Phenomena-based activities can spark student engagement, while connecting classroom content to everyday observations. Phenomena-based activities can help kick-off your lessons and spark student curiosity.

[View Lessons & Activities](#)

Earth and Space Science/ESS

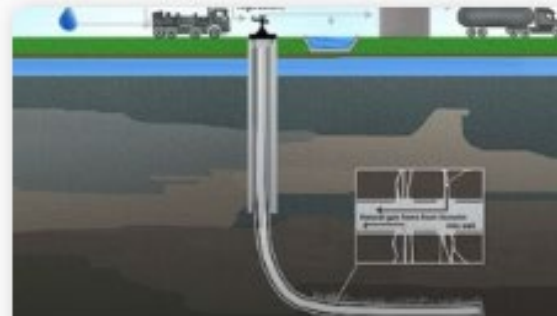
Featured Lessons & Activities



CO2 Emissions from Fossil Fuels at the Global Scale

This activity examines carbon dioxide emissions related to fossil fuel consumption. Students will use data from the *Statistical Review of World Energy*, an industry benchmark ...

[READ MORE »](#)



Hydraulic Fracturing Experiment With Jell-O

During this hands-on activity, students will simulate hydraulic fracturing of a well to visualize how rocks can fracture when fluids are injected at high pressure. ...

[READ MORE »](#)



Climate Analysis Using Planktonic Foraminifera

The focus of this lesson is to integrate data analysis as part of teaching Geologic History and understanding how scientists determine historical atmospheric conditions. Data-driven ...

[READ MORE »](#)

HOW we engage with teachers to encourage energy literacy

Choose Energy

1. Summer teacher workshop

Energy Science and Technology Institute (ESTI)

2. Online energy classroom resources

EnergyExcursions.com

3. Educator Outreach Events

Educator Conferences and Partnerships

Educator Conferences

Our department faculty and staff attend educator conferences to engage with K-12 STEM educators and to provide hands-on workshops.



Upcoming conference workshop topics in November 2024:
hydraulic fracturing, carbon storage, geothermal

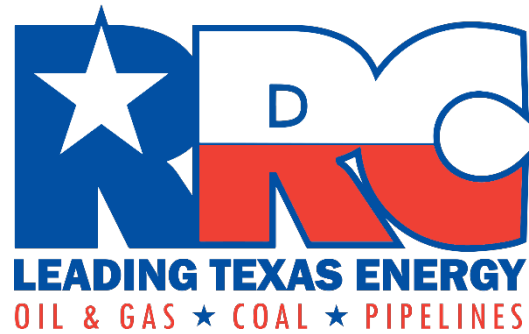


Partnerships

By leveraging relationships and opportunities, we can work together with our partners to accomplish shared goals.

- 1. State Regulatory Agencies**
- 2. Professional Societies**
- 3. Industry Associations**
- 4. University Partnerships**

State Regulatory Agencies



State Regulatory Agencies - Railroad Commission of Texas
Through our regulatory training programs, UT Austin has formed partnerships with the RRC to collaborate on EnergyExcursions.com content and K-12 educator outreach events.



State Regulatory Agencies

Nevada Division of Minerals (NDOM)

Through our TOPCORP program, we formed a partnership between UT Austin & the Nevada Division of Minerals:

1. NDOM field trip to help create online geothermal course.
2. To collaborate on educator outreach events.

In March of 2025, UT Austin will be presenting at the NDOM annual Spring teacher workshop.



Field trip in October assisted with the development of our *EnergyExcursions.com* Geothermal Course.

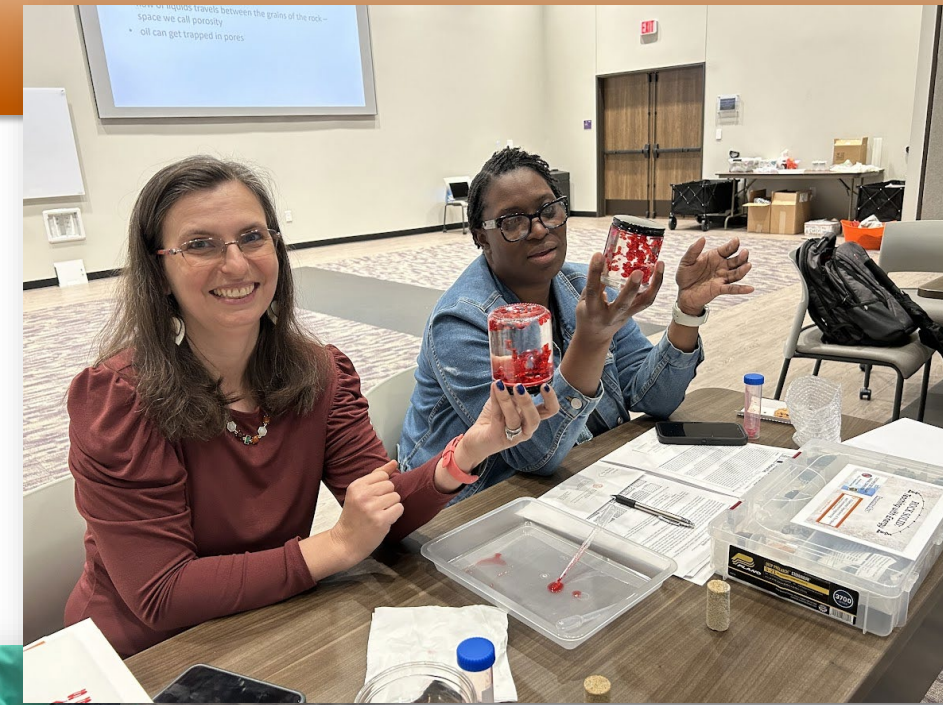
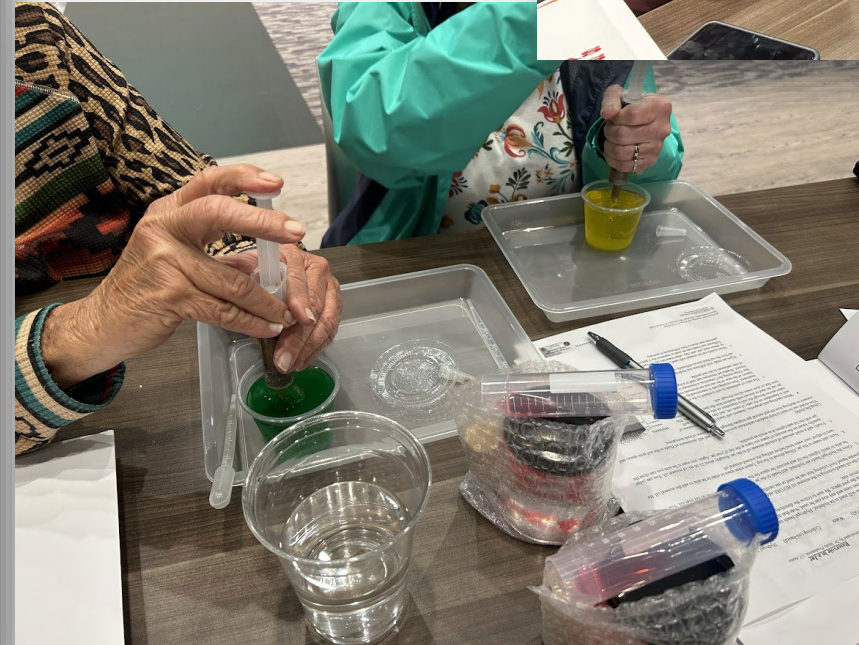


Reservoir Rock at Fervo's Project Red

Sabrina Ewald (UT Austin) and Steve Fercho (Fervo) examine reservoir rock at Fervo's Project Red in Nevada.

Professional Societies

Southwest Section of AAPG – Our outreach team provides the content and instruction for their K-12 energy/earth science workshop. This annual convention workshop is sponsored by Southwest Section members and local geological societies.



**Next workshop
will be Saturday,
April 26th in Fort
Worth, TX**

Professional Societies



SPE-Permian Basin

- Our outreach team is collaborating with the Permian Basin chapter of SPE to design and provide an energy education workshop for high school teachers in the Midland/Odessa area.
- The *West Texas Energy Summit* is a 2-day workshop which includes classroom activities and site visits.
- Workshop will be held on June 11 – 12, 2025 in Midland, TX



Workshop Sponsors

Industry Associations

TEXAS MINING AND RECLAMATION ASSOCIATION (TMRA)

Surface mining



TMRA Teacher Workshops

The Texas Mining and Reclamation Association (TMRA) offers 5 summer week-long teacher workshops for science teachers and each gives an in-depth look into surface mining and reclamation and energy production.

Cross-pollination: surface mining / subsurface resources / regulatory

***UT Austin
Choose Energy***

***Railroad Commission
of Texas***

University Partnerships

University of Tulsa, Dept. Chair Mohan Kelkar



+



=

**Energy Science and
Technology Institute**





+



**Petroleum Science and Energy
Transition Institute**

2023, 2024

Oklahoma Academic Standards

-  Environmental Science: ESS3.2
-  Earth and Space Science: ESS2.2, ESS2.5, ESS3.1

Thank You!

Questions?

Please contact Sabrina Ewald and Hilary Olson for more information:

sabrina.ewald@austin.utexas.edu
holson@austin.utexas.edu

The screenshot shows the 'Choose Energy' website for High School STEM Teachers. The header includes the University of Texas at Austin logo and the text 'Choose Energy' with the tagline 'Choose an energy career to tackle the earth's complex resource challenges and lead the way to a sustainable and equitable energy future.' Below the header, there are sections for 'Energy Science and Technology Institute for High School STEM Teachers', 'Energy Excursions.com High School Energy Curriculum', and 'Educator Outreach Events'. The 'Energy Excursions.com' section includes a small image of a classroom and text describing the online curriculum. The 'Educator Outreach Events' section includes a small image of a workshop and text describing the events. At the bottom, there is contact information for Sabrina Ewald.