BOONE PICKENS
SCHOOL OF GEOLOGY
College of Arts and Sciences

Boone Pickens School of Geology
Strategic Plan 2020-2030

Oklahoma State University

Table of Contents

Background

The Boone Pickens School of Geology (BPSoG) began a process in 2012 that increased clarity and focus on how it should invest its valuable resources to satisfy the wants, preferences, and needs of its students, faculty, alumni, and other stakeholder groups. As part of this effort, the BPSoG Advisory Board, together with the faculty, developed a long-term strategic plan to facilitate the identification of future needs of students, faculty, alumni, and other identified stakeholders and OSU's options for satisfying those needs. This evergreen document is meant to be utilized for the advancement of the school and alignment of its future.

Boone Pickens (with guests at his Mesa Vista Ranch in 2018 during an annual Oklahoma State University Boone Pickens School of Geology alumni faculty retreat.

Overarching Goal

The Boone Pickens School of Geology shall be a leading academic institution in the fields of petroleum, energy, and environmental geosciences.

Vision

To grow our national and international reputation in geoscience research and education and become a leader in the 21st century through scholarship, research, student learning/success, and alumni engagement. To make a positive impact upon Oklahoma, the nation, and the world through an integrated understanding of the Earth, particularly in the fields of petroleum, energy, and environmental geosciences.

Mission

To provide students with the highest quality education while conducting basic and applied interdisciplinary research that will prepare them as leaders to meet the global challenges of tomorrow and to expand the frontiers of geosciences. To engage diverse students, faculty, and staff with industry and government to deliver excellence in advanced learning, leadership, relevant and innovative research, and benefits to society in the broader field of geosciences.

BPSoG Core Values

- ***Professionalism*** in research, teaching, field work, and services.
- ***Collegiality*** and mutual respect to all.
- ***Mentorship*** that matters to all our students, faculty, and staff.
- ***Safety*** in the laboratories and field applications.

BPSoG Brief History

The Boone Pickens School of Geology at Oklahoma State University, named for the famed Oklahoma energy pioneer and tycoon, excels in geoscience research and has provided its students with a basic and applied geoscience education designed to prepare them for a career in the petroleum and environmental industries as well as other fields.

Interest in geology was spurred by the 1920s oil boom in Payne County, and a Bachelor's Degree was established in 1946. Geology became a standalone department in 1947 under Dr. V. Brown Monnett as department head. Only three years later, the program grew to 230 majors to become the largest program in the College of Arts and Sciences at OSU. Undergraduate enrollment at the school has been as high as 350 and as low as 16, all depending on the financial health of the oil and gas industry. Dr. Gary Stewart, distinguished professor emeritus, states: "As a land grant university, we always try to provide a very practical education for our students."

A Ph.D. program in Geology was approved in 2007, with the first two such degrees awarded in 2010. An Advisory Board of alumni and friends was established in 2006 to help guide and develop the School. The Geology Advisory Board has raised millions of dollars for the School in support of continual improvement. Improvements include the rebuilding of the OSU Geology Field Camp in Cañon City (CO), hiring a technician, establishing four new endowed chairs to a total of seven, currently, a significant growth in the number of undergraduate and graduate scholarships and fellowships, and a new core research facility to be opened in Fall 2019 and named after Gary Stewart.

An external evaluation of the School in 2017 recommended: “Now is an opportune time for the School to focus and expand its efforts in petroleum, energy, and environment-related Earth sciences while adding ten to eleven new faculty.”

A Vivid Description of the Desired Future

External Environment

- National praise by the scientific and business community.
- Graduates are sought by industry, the federal government, and other universities based on research and teaching excellence.
- Participation by highly involved alumni through mentoring, service and outreach, advisory board, and financial support.

Faculty and Staff

- Internationally recognized faculty of 20+ geoscientists.
- Outstanding staff, including a minimum of 3 highly skilled administrative staff colleagues.

Students

- Maintain a stable student enrollment of:
    - ~100 undergraduate students
    - ~100 graduate students, ~70 M.S. and ~30 Ph.D.
    - Faculty/Student Ratio of 1:5 for the graduate program.
- Upper quartile scholarship funding for graduate students compared with our peer institutions.
- 85% of Master’s students finalize their thesis within one year of completing coursework; 85 % of Doctoral students finalize their dissertation within two years of proposal defense.

- Internationally recognized postdoctoral program.

Alumni

- The Geology Advisory Board's relationship with the School and University is a national model.
- Advisory Board: 150 members strong, with >50% active.

Infrastructure

- The BPSoG has plans to have buildings with laboratory and teaching space that comfortably house the faculty, staff, and students.

Goal Areas

- The following represents goal areas for the next 10+ years. These are areas in which the BPSoG will explicitly state the conditions or attributes it wants to achieve. These outcome statements help define and provide direction for future success. The achievement of each goal will move the organization toward the realization of its vision.
- Objectives provide direction and actions on how the association will accomplish its articulated goals. Strategies to achieve these goals are reviewed annually by the BPSoG .

School Goal Areas

Academic Excellence: Research and Scholarship

- Petroleum and Energy Geosciences
- Water, Environment, and Climate
- Earth Structure and Dynamics
- Computational Geosciences

Students

- Student Learning, Success, and Diversity
- Student Support and Enrichment

Faculty/Staff

- Growth/Retention/Advancement

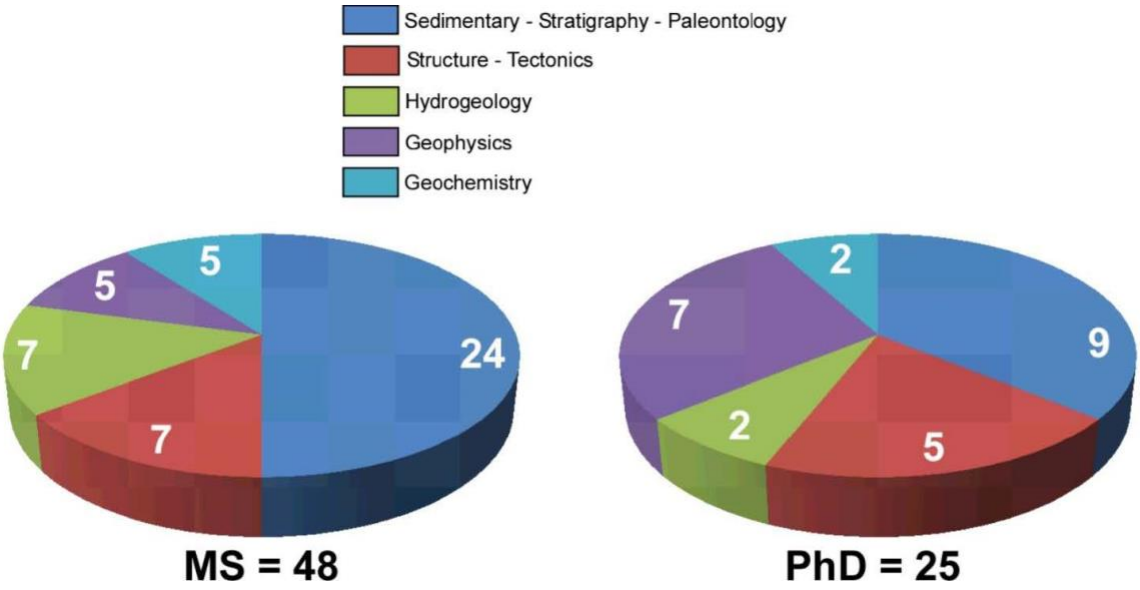
Facilities

- Field Camp
- Research and Teaching Computer Lab
- New School Building

External Relations

- Consortia
- Marketing and Branding of the School
- Alumni Engagement/Resource

Graduates' Research Focus and Placement (Fall 2020)



School Goal Area: Academic Excellence
Research and Scholarship

Goal

- Grow our national and international reputation in geoscience research and become a leader in the 21st century through research and scholarship.

Strategy

- Reduce the teaching load of faculty to 2 courses per year.
- Acquire postdocs, graduate, and undergraduate students to support research productivity.
- Acquire research seed grants of $10,000 to support research fund acquisition.
- Acquire more funds to the Student Enrichment Fund to support travel to conferences.
- Promote and support the establishment of international MOUs.
- Provide space and resources for hosting visiting scholars.
- Provide resources for the organization of workshops, short courses, or conferences.
- Hire the best scholars.
- Provide enhanced mentoring to faculty with respect to funding.
- Promote interdisciplinary grant programs to faculty.
- Disseminate information on accountability to faculty on managing grant proposals.

Metrics

- 100% of faculty have active research grants in a 3-year cycle.
- 100% of faculty supervise BS, MS, and Ph.D. students.
- Significant participation at AAPG, GSA, SEG, and AGU annual conferences.
- 100% of faculty give a presentation at a minimum of one major national/ international conference per year.
- Maintain a minimum of 40 publications per year in peer-reviewed journals in a 2-year cycle.
- Establish MOUs with at least 10 other universities/countries.
- Host at least 1-2 prominent visiting scholars per year.
- Organize a minimum of one workshop, short course, and/ or conference on campus annually.
- At least 20% of the faculty serve as editors of peer-reviewed journals.
- At least 20% of the faculty serve on federal grants panels.
- At least 30% of research expenditures are in interdisciplinary projects.
- A minimum of 40 external grant proposals to be submitted annually.

School Goal Area: Research
Petroleum and Energy Geosciences

The Petroleum and Energy Geosciences Research program continues to build on a rich legacy of Petroleum geology research at OSU. Our expertise in stratigraphy, sedimentation, paleontology, geochemistry, petrology, geophysics, structure, tectonics, flow modeling and spectral analysis allows us to model the evolution of petroleum systems from the molecular scale to the basin scale. Our faculty and students also evaluate issues involving geologic carbon storage, fluid

disposal in petroleum reservoirs, enhanced oil and gas recovery, and reservoir compartmentalization.

Goal

- Continue to build our integrated and interdisciplinary approach to the study of petroleum systems by combining a strong background in the geological sciences coupled with the incorporation of new and evolving technology and advances in data acquisition and management.

Strategy

- Maintain strong programmatic capability through integrated geoscience courses, including geochemistry, geophysics, hydrogeology/geologic fluids, sedimentology/stratigraphy, and structure/tectonics with a focus on petroleum and energy geoscience.
- Integrate the new Gary Stewart Core Research Facility in BPSoG research, teaching, and outreach initiatives.
- Continue to emphasize and grow integration skills across multiple sub-disciplines in geology as well as energy engineering, computer science, and business/economics.
- Maintain and grow research groups of M.S. and Ph.D. level graduate students with a large proportion working on industry and government-supported energy-related theses and dissertations.
- Continue to increase the involvement of undergraduate students in faculty research.
- Build on traditional core and outcrop-based research combined with subsurface datasets to develop surface-to-basement 3D models and simulations of all fluids extracted to the benefit of industry and local municipalities.
- Utilize integrated models and simulations to evaluate geologic carbon storage, fluid disposal in petroleum reservoirs, enhanced oil and gas recovery, and reservoir compartmentalization.

Metrics

- Increase the percentage of interdisciplinary and multidisciplinary focused topics of research to 50% of all funded research in petroleum and energy geosciences.
- Increase opportunities for undergraduate research so that ~50% of faculty are actively working with undergraduate students on independent or collaborative research projects.
- Increase diversity of funding sources to include federal, state, and local entities as well as industry support and industrial consortia.

School Goal Area: Research
Water, Environment, and Climate

The Water, Environment, and Climate Group is a broad group of researchers dealing with fluids in the Earth. This includes water supply and contaminant impact issues, but also includes issues evaluating the effects of microbial activity in the subsurface and changes to mineral surfaces due to fluid and biochemical interactions. In addition, the group deals with deeper fluid systems containing hydrocarbons to evaluate biochemical changes and flows. This can be to evaluate the production of hydrocarbons for energy or for carbon sequestration to mitigate climate change. The Group engages in significant basic and applied research and is closely affiliated with industry partners in the Hydrocarbon and Environmental Consulting Industry.

Goal

- Develop an academically rigorous Water, Environment, and Climate program that ensures all graduates are technically advanced in fundamental geological and geophysical principles and applied research in order to be competitive and excel in industry, technical consulting, government, or academic positions.

Strategy

- Generate questionnaire/feedback from industry partners as to core courses or skills needed.
- Develop applied industry-style courses/short courses to provide accelerated learning.
- Integrate relevant industry presentations/exercises into existing courses, via direct involvement from industry professionals where possible, to emphasize interpretative variability and real-life applicability.
- Strengthen established research at OSU on carbon sequestration and incorporate the newest technological findings into the curriculum.
- Establish strong analytical hydrogeochemistry capabilities, including instrumentation to analyze elements, compounds, isotopes, and chemical/biotic reactions in water, produced water, and contaminated sediments.
- Be an industry leader in groundwater education (supply, remediation, management).
- Establish a Professional Groundwater Training Committee: develop multiple participants through alumni and industry contacts.

Metrics

- Develop a training partnership with at least one national groundwater organization.
- Research grants have been acquired to support interdisciplinary science.
- Professional Master’s Program in Hydrogeology established.

- Students and faculty are collaborating and publishing jointly with industry and government.

School Goal Area: Research
Earth Structure and Dynamics

The Earth Structure and Dynamics Group investigates the geological, geophysical, and tectonic processes in the lithosphere. We study deformational structures and composition, and properties of rocks at various scales from thin sections and outcrops to continental rifts and mountain belts. Our basic research aims to understand the kinematics and strain along plate boundaries, the growth and breakup of continents, and the signatures of melting, metasomatic change, magmatic activity, and diffusion in the upper mantle. We apply active source seismology, potential fields, remote sensing, structural mapping, petrography, and petrology to decipher the structure, composition, and physical properties of the Earth's crust and upper mantle. Our work has implications for a better understanding of plate interactions, strain localization, crustal strength, and tectonic evolution of continents. Furthermore, our work has a fundamental impact on the fields of seismic hazards and economic geology.

Goal

- Establish the Earth Structure and Dynamics Group as an internationally recognized leader in research and scholarship of the structure and plate tectonic evolution of the Earth.

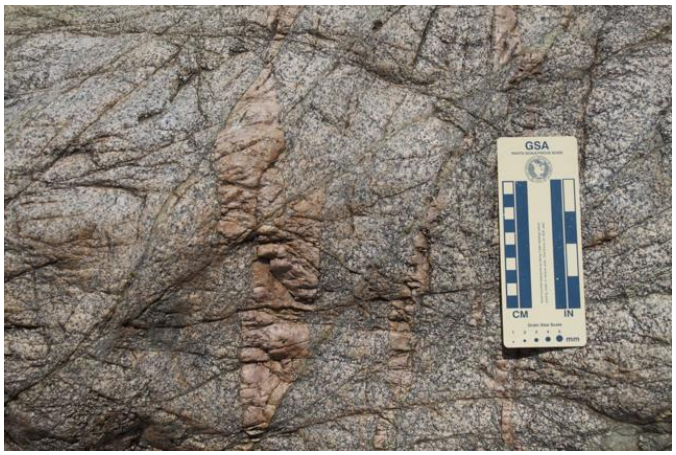
Strategy

- Hire new faculty members with specialties in earthquake seismology, petrology, geochronology.
- Invite internationally recognized scientists to the Tectonics and Geophysics Group meetings.
- Establish interdisciplinary research programs.
- Establish research centers such as the North American and African Plate Tectonic Center.
- Establish collaborative connections with other institutions to enhance the capabilities of our research program

Metrics

- New faculty have been hired with the desired research focus.
- At least two internationally recognized scientists have presented at our meetings per semester.

- Research grants have been acquired to support interdisciplinary science in a 3-year cycle.
- A research center has been established in the School.
- Students and faculty are collaborating in other research labs and publishing jointly with collaborators.



School Goal Area: Research
Computational Geosciences

The computational geosciences working group develops new and innovative methods of analyzing large-scale geological and geophysical datasets using cutting-edge computational and artificial intelligence methods. In collaboration with departments such as physics, electrical engineering, computer science, and the high-performance computing center, our main goal is to develop capacity and to advance the fundamental tools, techniques, and methods for integrating large geoscientific datasets across multiple communities, stakeholders, and disciplines. The group works on advancing the two main research frontiers. The first, “Attaining a Carbon Neutral Tomorrow (ACT)” will use principles of big data and advanced computing to ensure an environmentally sustainable CO2 injection and storage in offshore and onshore geologic formations. Development of modeling codes on a hybrid computer architecture for seismic wave propagation and Bayesian inversion is an ongoing effort of the group. The second, “Securing American Homes from Environmental Disasters, (Se AHED),” will use principles of big data and advanced computing for predicting infrastructure health and safety in response to changes in geological conditions due to natural and human-induced reasons. Sustained collaboration to advance the two frontier research topics will be achieved by building on current collaborative strengths, including joint field exercises, annual seminars, and multi-departmental research papers and proposals.

Goal

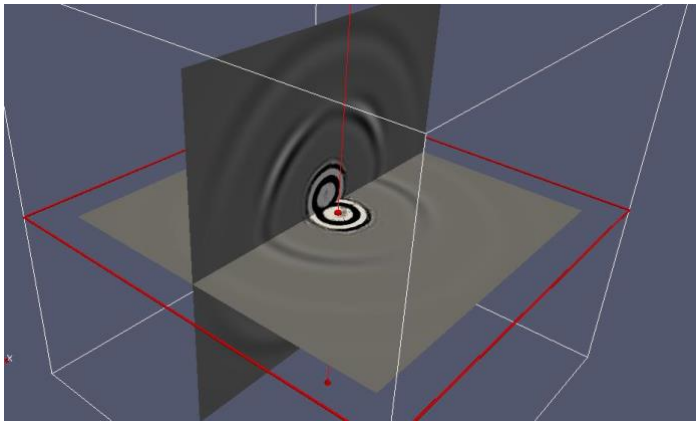
- Establish the Computational Geosciences working group as a recognized member of the big data and advanced computing international community.

Strategy

- Build synergy within the OUS campus by actively collaborating with relevant disciplines.
- Build active collaborations with internationally recognized data and computation scientists.
- Network with like-minded peer groups to remain at the forefront of the technology curve.
- Communicate with the relevant industry to attract high-quality datasets and relevant research opportunities.

Metrics

- One research grant has been acquired to support interdisciplinary science in a 3-year cycle.
- Interdisciplinary collaboration with civil engineering has been initiated.
- Two advanced computing courses for geophysics students have been made available.
- Students and faculty are collaborating in other research labs and publishing jointly with collaborators.



School Goal Area: Students
Student Learning, Success, and Diversity

Goals

- Recruitment, retention, and progression to graduation of a high-quality and diverse student body.

- Enhance higher-order learning in undergraduate and graduate education by incorporating the use of:
    - Research in undergraduate education
    - Enhanced experiential learning
    - Written and oral communication
    - Collaborative work
    - Analytical and critical thinking
- Prepare students for a successful career.

Strategy and Metrics

- Recruiting and retaining a minimum of 100 undergraduate students.
- Accept undergraduate students with ACT/SAT scores above the university average.
- Average Geology GPA > 3.0.
- Diversifying degree options.
- 80% of undergraduate Geology majors graduate within 4 years.
- 80% of MS students graduate within 2 years.
- 80% of Ph.D. students graduate within 4 years.
- At least 30% are under-represented and non-traditional students.
- Have at least one summer program for high school students.
- 30% of undergraduate majors are involved in research.
- 80% of faculty mentor undergraduate research.
- New teaching and research facilities to stimulate collaborative and interdisciplinary experiential learning.
- Offer at least 30% of classes online.
- 80% of students have geoscience-related opportunities beyond graduation.

School Goal Area: Students
Professional Science Master's in Geosciences

OSU's Professional Science Master's program creates the next generation workforce for the U.S. and the world. This cutting-edge, interdisciplinary program prepares students to take on the most complex challenges of the 21st-century workplace, where students are in control of their education path and able to select courses based on their career interests. Geophysics, Petroleum Geosciences, Hydrogeology, and carbon capture, utilization, and storage (CCUS) are the core areas augmented with a series of interdisciplinary courses in management, engineering, geospatial intelligence, and data science. The complementary cross-disciplinary courses lead to certification opportunities.

The program culminates with a state-of-the-art capstone project tailored specifically to the students' career aspirations. Capstone projects address industry-relevant problems in close collaboration with industry and academic mentors while providing the opportunity to apply, test, and demonstrate all the skillsets learned and transferrable to industry workplaces. The program allows students to tap into OSU's vibrant alumni network and to obtain career mentoring by industry and academic experts, a win-win for all.

Goals

- To create an alternate path for existing and aspiring professionals that provides cutting-edge industry-standard skillsets within a flexible schedule.
- To provide career mentoring to the students.

Strategy

- Build synergy within relevant disciplines, including but not limited to physics, electrical engineering, computer science, and the high-performance computing center.
- Build active collaborations with internationally recognized professional societies such as SEG and AAPG.
- Network with industry leaders and industry veterans who believe in the culture of sharing their knowledge and expertise.
- Offer the program from a location that is easily accessible and has a vibrant urban culture.
- Communicate with the relevant industry to attract high-quality datasets.

Metrics

- Build a program with a minimum of 5 graduates per year.
- Build a pipeline of a minimum of 5 industry partners to send students to the program.

School Goal Area: Students
Student Support and Enrichment

Goals

- Expand student financial support for scholarly and educational activities.
- Promote a culture of rewarding excellence in scholarly pursuit.

Strategy and Metrics

- Increase the level of undergraduate scholarships to >$150,000 per year.
- Increase the level of graduate scholarships and fellowships to >$300,000 per year.
- Create a student enrichment endowed fund of >$500,000.
- Generate at least 10 new named graduate fellowships from industry and donors.
- Increase donations of new datasets and equipment for instruction.
- Establish awards for undergraduate and graduate academic excellence.
- Increase alumni participation in student educational experience by having at least three industry professional-led lectures every year and continued support for the Imperial Barrel Award.
- “Take a Cowboy to Work” program to >15 students per

School Goal Area: Faculty
Growth, Retention, Advancement

Goal

- Grow and retain an internationally recognized faculty of researchers and educators.

Strategy and Metrics

- Grow to 20+ tenured/tenure-track faculty.
- Mentor early-/mid-career faculty by at least two professors.
- Promote mid-career faculty within 10 years of tenure.
- Compensate faculty at least 15% above peer institutions.
- Establish five School awards and advancement opportunities for faculty.
- Create a faculty retention/recruitment/excellence fund at $50,000/year.
- Endow a postdoctoral fellowship program for 2-5 fellows annually.

School Goal Area: Staff
Growth, Retention, Advancement

Goal

- Grow, maintain, and appropriately reward talented and satisfied staff to support the mission of the School.

Strategy and Metrics

- Maintain a minimum of three administrative staff positions.
- Hire a dedicated IT support specialist.
- Maintain Geochemistry facilities research staff support.
- Secure Geophysical facilities staff support.
- Secure core research facility staff support.
- Establish two staff awards per year.

School Goal Area: Facilities
Field Camp, Geology Instructional Computer Lab, New Building

Field Camp

- Construct modern multipurpose serving and kitchen facilities with a dining area that also serves as a meeting/classroom.
- Add additional workspace for students.
- Increase digital mapping and computational capabilities.
- Upgrade the water supply.

Geology Instructional Computer Lab

- The Geology Instructional Computer Lab to be housed in the Nobel Research Center will be a specialized teaching and learning facility in support of computer-based coursework, training, workshops, and group collaboration. Furthermore, the facility will be compliant with the student accessibility requirements. This much-needed modern facility will support:
    - Classes that require the use of specialized geologic software
    - Departmental training programs, as we commonly host short courses provided by industry experts or alumni, and
    - Collaborative student projects such as the AAPG Imperial Barrel Award (IBA) or SEG EVOLVE international competitions organized by the American Association of Petroleum Geologists and the Society of Exploration Geophysicists, respectively.
- This instructional computer lab will host 20 instructional workstations with enhanced RAM, CPU, and graphics processing power to run contemporary modeling and

simulation software. It will also be furnished with two large side-by-side smartboards and additional peripherals such as printers and scanners. This lab will enable students in the BPSoG to receive instruction and perform exercises in a classroom/computer lab environment where they will be able to observe examples and immediately practice newly acquired skills.

Geology New Building

- A new building is a long-term goal.
- The new Geology home will have provisions for:
    - Installation of appropriate venting, emergency power, and lab spaces.
    - Space for moving, reinstalling, and recalibrating instruments.
    - Room for a clean lab for trace metal analyses.
    - Computational and data visualization space.
    - Space for new instruments and upgrades.
    - Loading zone and freight elevator.
    - Wet teaching labs.
    - Classrooms that support active learning and group work in a lecture setting.
    - Space for students to study outside of classrooms.
    - Space for students to study outside of classrooms.

School Goal Area: External Relations
Consortia

Goals

- Based on the success with the Mississippian Limestone Consortium, the next step is to fund a large petroleum consortium of university and industry partners with in-state and out-of-state stakeholders.
- Building on the existing CCUS funding capacity in the school, build a carbon research consortium starting with the implementation of Artificial Intelligence in CCUS.

Strategy

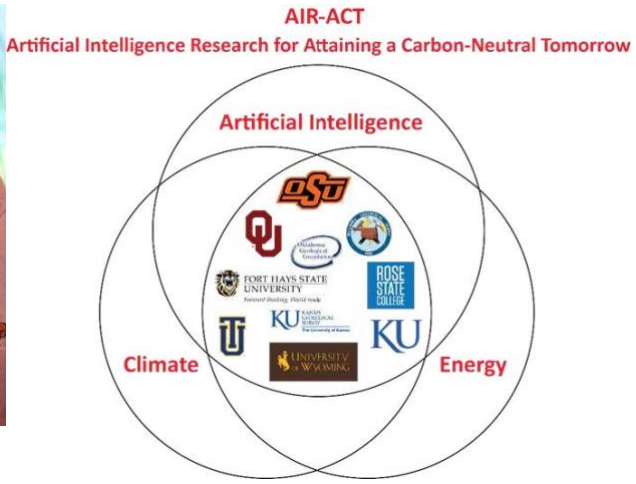
- Establish a Steering Committee with alumni and faculty to identify new topics and/or trends for developing consortia:
    - Themes: petroleum, energy, and sustainable water resources.
    - Recruit participants through alumni and industry contacts.
    - Develop clear deliverables and cost structure.
- Consortia

- Continue to expand the breadth and integrated nature of consortia to enhance the participation of BPSoG faculty members and students from multiple disciplines.
- Respond to federal agencies' call for proposals for building consortia.

- Utilize consortia to advance the global standing and recognition of the BPSoG.
  - Publications, workshops, short courses, and presentations at national and international meetings.
  - Leverage consortia activities to advance the research and educational missions of the BPSoG both nationally and internationally.

Metrics

- Receive funding for a university-industry consortium in the next three years.



School Goal Area: External Relations
Marketing, Branding, and Alumni Engagement

Goal

- Promote a global image of the School of excellence in learning and research in geosciences.

Strategy

- Develop a process for handling marketing and branding for the department that will effectively and uniformly promote and enhance the reputation of the department.
- Develop a marketing and social media program that will elevate the BPSoG strengths of the school.
- Design a professional webpage that will include scholarship of faculty and students, and academic and professional events provided by experts.
- Identify funding for the web page/social media branding campaign.

- Create an “OSU Geoscience Industry Council.”
    - Recruit established alumni as representatives of their companies to form an “OSU Geoscience Industry Council” to provide a point source contact to effectively disseminate relevant information from the BPSoG as well as to effectively gather information on industry issues and interests.
- Develop a mentoring program for geology students.
    - Develop guidelines.
    - Coordinate additional industry student mentoring.
- Increase alumni board participation of recent graduates from the last 10 years.
    - Nominate one for the “Young Alum of the Year” award.

Metrics

- Annual evaluation of the development of the marketing and branding process.
- Annual evaluation of the marketing and social media program.
- Annual evaluation of the effectiveness of the webpage.
- Increase the number of donors by 10%.