

UW 2-13 Review Committee Report Template

Committee: <i>Petroleum Engineering and Geology & Geophysics</i>	Restructuring UW for the Future Recommended Action: Keep independent departments
Committee Members: <i>Daniel Dale, Pejman Tahmasebi, Lamia Goual, Dario Grana, John Kaszuba, Scott Quillinan, Chelley Schneider</i>	Submitted to Provost Carman on: <i>01 October 2021</i>

Executive Summary (Limit to 250 words)

The discussion about the future of Petroleum Engineering (PETE) and Geology and Geophysics (G&G) has been extremely challenging, due to the differing structures, sizes, traditions, and visions of the departments. Both departments feel strongly about keeping their own identity and autonomy. The two departments share research interests in energy and environmental studies, which are both areas of interest to the state of Wyoming; however, the research directions of G&G are more focused on Earth science whereas the research directions of PETE concentrate mostly on the sustainable exploitation of the subsurface for energy and water. G&G is concerned about losing its high national ranking in Earth science graduate education if consolidated with a department predominantly focused on engineering and applied science. Likewise, PETE is concerned about a drop in its national ranking if the word engineering is removed from the name of the department. The imbalance in faculty numbers and diverging visions may obscure the core mission of PETE and compromise its ability to offer degrees in petroleum engineering. The consensus is that it is necessary to preserve identity, autonomy, and capabilities, including personnel crucial for the departments' activities and reputation. G&G and PETE's preference is to remain independent. Both departments see substantial drawbacks and few clear efficiencies in a consolidation, and both will work on widely beneficial collaborations in research and teaching as independent, autonomous departments. These include forward-looking interdisciplinary projects and new courses and programs in environmental studies, geoengineering, and energy sustainability.

Benefits (Limit to 1 page)

In this section, describe the benefits of the proposal, including benefits to organizational structure, staffing efficiencies, research and scholarly synergisms, improvements in educational programs, and community engagement.

In terms of budget, consolidating the two Departments would not result in any cost savings via removal of a DH stipend, as PETE has a \$5 Million Le Norman Endowed Leadership Chair in Petroleum Engineering (\$2.5 Million gift, doubled through state matching funds) for the salary of their DH.

In terms of undergraduate education, joint degrees will not be beneficial as recruiters traditionally look for majors in petroleum engineering or earth sciences with potential minors in specific areas, which are achievable without consolidating the two Departments.

For the PETE department, there are some potential benefits in a closer collaboration between the two units, which might lead to interesting new cross-disciplinary course offerings and research projects. In fact, most PETE stakeholders are in favor of the restructuring proposal, which comes at the same time as the American Association of Petroleum Geologists (AAPG) and the Society of Petroleum Engineers (SPE) are exploring a merger to create a professional organization built for a new energy future. They unarguably agree that combining engineering and earth sciences across the exploration and production spectrum will break silos and offer better opportunities for knowledge sharing and fundraising. The restructuring provides the potential for more cross-disciplinary peer-to-peer and academic exposure to students within the departments. Exposure outside of a student's discipline is not easy to come across given high workloads, demanding schedules, and educational programs with often well-defined structures. Thus, the consolidation may provide a well-rounded education with a broader scope which will help students stand out and contribute new and innovative ideas during their academic and professional careers. However, considering the current faculty mindsets, numerical imbalances between the two programs, and diverging visions, the consensus reached among PETE faculty is to not rush this decision, to allow for more time to more clearly vet the pros and cons and the ideal path moving forward. PETE prefers to remain as an independent department.

For the G&G department there are no potential benefits from a consolidation, even though there are some potential benefits in a closer collaboration between the two units. Based on the recent surveys in the G&G department, stakeholders, alumni, faculty and students unanimously agree that the G&G department should be an independent unit and view the consolidation as extremely negative for the future of G&G. It is also worth pointing out that nation-wide few institutions group earth scientists and engineers in the same unit or division. Both departments agree that research collaborations do not require the consolidation of the two departments and can be efficiently implemented by the two independent units.

Organizational Restructure (Limit to 3 pages plus org chart)

In this section, describe the organizational structure that is needed to achieve the intended goals of the restructure (i.e., to position UW for the future and to respond to a significant reduction in the university's budget). Provide a recommended organizational chart that includes positions (by job title only) needed to administer and support the new organization/academic unit. Include a rationale that supports the recommendation. Specifically address how the recommended structure enhances synergism among disciplines, improve student experiences and success, emphasize growth of programs for 21st century themes, incorporate better efficiencies, better position the University for R1 research classification, and provide economic support to the state of Wyoming.

Independent departments in CEPS

*The discussion initiated by the UW 2-13 review committee between faculty representatives of G&G and PETE departments and the subcommittees revealed critically divergent visions and strategic plans for the future (see **Appendix A**). Because of the different research interests, funding opportunities, structures, and cultures of the two departments, consolidating the two Departments is problematic as shown by the list of unintended consequences.*

Each department has a good reputation in its respective field, but they differ so greatly in focus, that consolidating the two Departments will compromise the national recognition of both. G&G and its stakeholders are concerned that consolidation with an engineering program might compromise its reputation as a cutting-edge program in basic earth science, whereas PETE and its stakeholders are concerned that consolidation with a large department such as G&G might dilute its focus and program offerings. Each department wants to retain its identity and autonomy. For this reason, both departments and affiliated stakeholders (students, alumni, industry, donors, and advisory boards) believe that having two independent departments in the new College of Engineering and Physical Sciences (CEPS) would be the best solution for all parties. PETE will change its name to the Department of Energy Engineering, to reflect the interest in the broad energy transition and increase its competitiveness for federal funding, while G&G will change its name to the Department of Earth Science, in sync with similarly high-performing programs across the nation. Based on stakeholder feedback, such generic names have far-reaching implications that speak to the diverse skills of UW students. It would also likely allow both departments to expand without changing names again in the foreseeable future. Stakeholders believe that employers would like to see students come from broader disciplines instead of being pigeonholed into specific ones.

An alternative model that was discussed by the faculty is the creation of a new School or Division of Earth, Energy, and the Environment in CEPS, without consolidating into a single department. In this case, it is critical that the numerical imbalance of faculty numbers in the two departments does not result in silencing a minority view relative to the direction of the Division. Following the Dean's recommendation, the PETE department suggests that the Division should develop by-laws governing its operations to ensure the focus and goals of the original departments are appropriate. In this manner, the two departments will be allowed to preserve their autonomy and identity. The G&G department does not agree with this solution as its faculty strongly believe that all department citizens should have equal vote in order to create an inclusive workplace. Regardless of its governing by-laws, the Division will have close collaborations with the Haub School and the School of Energy Resources (SER) and will require seed funding in place to provide joint seminars, conferences, and help faculty engage into interdisciplinary research work addressing the strong nexus between energy, water, and climate. The Division will also require additional costs for the administration of the overarching structure.

At the undergraduate level, each department will continue to offer its traditional degrees, including the BS in Geology, BS in Geography, and the BS in Petroleum Engineering. Despite the name change of PETE to Energy Engineering, it is important to continue offering Petroleum Engineering degrees in the department. The Hathaway scholarship and a huge portion of UW's budget are funded by severance tax dollars. There will be a marketing need to explain the new department vision and its broader impact to PETE alumni and stakeholders.

*Given that both PETE and G&G have experienced recent declines in undergraduate majors, possible new undergraduate programs (i.e., majors, minors, tracks, concentrations, etc.) related to future Earth and Energy challenges will be proposed with the Haub School, SER, and other engineering and physical sciences departments. Potential topics include natural hazards; climate change; geoengineering; energy sustainability; and environmental geoscience. PETE plans to develop minors in Energy Engineering and Energy Sustainability as well as options in Process Control and Renewable Energy. G&G has been working on minors in Petroleum Geology and Economic Geology, a new concentration in Geophysics, and a professional MS in Geology. The two units could develop joint programs in Data Analytics and Artificial Intelligence as well as Environmental Engineering and Geoscience, with the collaboration of the new School of Computing (SoC), SER and the Haub School. The new programs will include training in oral communication, technical writing, business, commercialization, and entrepreneurship. PETE stakeholders emphasized the importance of training students in multiple disciplines so that they are better prepared to join the workforce. They should have a solid foundation in engineering with the proper tools to solve complex challenges of the 21st century, and be able to interact effectively, understand a broad range of topics, and move across sectors. Additionally, PETE plans to offer a new graduate program in Energy Engineering (MS-Quick Start, MS, and PhD) to cover a broad range of fundamental and applied courses that encompass energy resources and the environment. Each department is also working on new ideas to improve recruitment (see **Appendix B**), and the G&G faculty involved in DEI initiatives will share their expertise to recruit a more diverse student population.*

Although the committee recognizes that the research directions of the two departments are mostly divergent, it also sees potential convergence on: a) establishing collaborations on interdisciplinary projects, such as carbon sequestration, hydrogen storage, geothermal energy, rare earth elements, and water resources management; b) pursuing funding opportunities through the Department of Energy (DOE) and the National Science Foundation (NSF); and c) collaborating with SER, SoC, and the Haub School.

Finally, the organizational restructuring will have critical implications for the administration and staffing of G&G. G&G has four staff members that are shared with the Department of Anthropology as part of one A&S business cost center. Meanwhile, PETE has one staff member, reflecting the more centralized, college-level, department administration in the College of Engineering and Applied Sciences. We recommend that University administrators work toward a solution that accommodates the needs of the staff members in the Department of Geology and Geophysics.

Efficiencies (Limit to 1 page)

In this section, address strategies for improving efficiencies in the new organization/academic unit that will be needed to meet budgetary constraints and provide students with a high-quality educational experience.

Consolidating G&G and PETE into a single department provides no efficiencies. A&S has established a system that ensures staffing efficiencies, whereby multiple departments are serviced by a small team of in-house office staff plus grant accounting support out of the Dean's Office. Geology & Geophysics share with Anthropology one Business Manager, two Office Associate Seniors, and one Office Associate. The tentative plan for a hard merger is to move 3 of the 4 office staff to Engineering and Physical Sciences, presumably to join forces with existing PETE office staff. Additional grant accounting support would need to be provided from the Engineering & Physical Sciences Dean's Office. CEAS has established a similar system that ensures staffing efficiencies where accounting is centralized at the college level. PETE is a very lean program with only 1 office staff member and has been functioning at minimum capacity.

Academic/Discipline Specific Expertise (Limit to 3 pages)

In this section, provide recommendations for areas of faculty expertise that should be emphasized to position the new department to be nationally and internationally competitive in its research activities, especially in areas of significant anticipated growth in funding from federal agencies (e.g., see NSF's key priority areas) and in areas of importance in attracting and growing corporate partnerships. Also include in your recommendation the ideal number of faculty positions that will be needed to provide students with a high-quality education experience and to deliver current and/or future degree programs.

Research Directions

The G&G and PETE departments include existing research overlaps as well as possible future research collaborations that extend beyond current research endeavors. Between the two units, people with an 'energy' skillset are well prepared for collaborative and interdisciplinary projects. Energy is intrinsically linked with the environment, and it may be possible to leverage both perspectives moving forward. Both departments are well positioned to continue and build upon research that is relevant to Wyoming and the region. Looking forward, the two departments could consider adding personnel with research focus at the intersection of "energy and environment", which is currently lacking in both units.

G&G highlights the following potential overlapping research interests that exist in the environmental domain: surface and subsurface fluids; past, present, future climates; processes that shape modern and past Earth landforms; intersection of climate change and surface processes; paleoenvironmental and paleoecological reconstructions.

Themes for possible research collaborations include, but are not limited to: energy systems, energy transitions, geothermal, energy storage, subsurface R&D for energy resources; connections to hydro-fluids and porous materials; water, climate, energy nexus in the western U.S.; environmental engineering: mitigation and protections related to climate extremes; quantitative modeling, numerical and visual modelling associated with Shell 3D Viz Center.

The DOE and NSF have extensive energy and water funding programs that are well suited for top-down large teams (see **Appendix C**). In addition to potential corporate partnerships with natural resources companies operating in Wyoming, these major external funding sources are investing in collaborative research that necessitates analytical capabilities for intellectual merit and strong outreach infrastructure for broader impacts. Thus, to best capitalize on the areas mentioned above, it is best to have identifiable departments working on both applied and fundamental research in both energy engineering and in the earth sciences. The reorganization of the units in two autonomous departments with names that reflect the new vision will increase competitiveness for federal sponsorship. Looking forward, the two departments could consider adding people with research focus at the intersection of "energy and environment". Neither unit has appropriate personnel related to the social elements of human-environment-energy challenges, which is both a growing research domain and one relevant to Wyoming's economic future. However, it is currently unclear how filling these identified research and academic weaknesses may relate to the future university-level research vision and priorities during the VP-ORED transition.

Computational Earth Sciences and Engineering

Through harnessing the abundant computational resources available through ARCC and NWSC, the computational earth scientists and engineers in G&G and PETE have made tremendous progress in advancing the capabilities in Earth system simulation, earth science data assimilation, and machine-learning-based geoinformatics. In the past decade, the close collaboration between the computational earth scientists and engineers in G&G and PETE and ARCC/NWSC has resulted in approximately ninety peer-reviewed publications and about 4 million dollars of externally funded grants. Multiple undergraduate- and graduate-level earth science courses, focusing on computational literacy and high-performance computing, have been developed and taught to students across campus.

In particular, the physics-based computational modeling performed at the Center of Innovation for Flow through Porous Media (COIFPM) has gained international recognition in the past decade with over 45 publications in multiscale modeling and more than 7 million dollars in external funding used in part to build hybrid CPU-GPU supercomputers and to conduct collaborative research. The key distinguishing factor is that the computational predictions are validated against multiscale experimental data also generated at COIFPM. The Center attracts high caliber scientists and visiting scholars from all over the world and has been developing leading-edge technologies for pore-to-core upscaling of multiphase flow and transport in porous media. Access to high-performance computing platforms is an essential

element of this endeavor as it allows to bridge the gap between the scales. With this vision, the Center has been a trailblazer in developing state-of-the-art digital rock technology platforms capable of modeling multiphase flow at the pore and core scales in vast three-dimensional digital domains representing the disordered pore space in man-made and natural porous media found in geosystems, energy materials, pharmaceutical products, and beyond. In environmental applications for instance, such platforms can produce physics-based predictions of key flow and transport properties that are then used to significantly reduce uncertainties associated with the predictions of CO₂ storage capacity in geologic formations or the transport behavior of nonaqueous phase liquids in contaminated aquifers. The Center is home to a commercialization platform that is equipped with all the mechanisms needed to deploy Intellectual Properties for industrial applications. With more than 30 PhD students and 10 post-doctoral research associates, COIFPM is leading the way in innovation and entrepreneurship that will help UW achieve its goal of becoming a Carnegie R1 research institution.

The computational earth scientists and engineers in G&G and PETE are well prepared to develop and advance close collaboration with the newly established School of Computing (SoC) in support of its strategic goals in research, teaching, and entrepreneurship, and take the earth science and engineering computational research and teaching activities at UW to a level that will be nationally prominent.

In addition to Earth system modeling and integration, computational earth scientists and engineers, together with SoC faculty and staff, will pursue new opportunities of mutual interest and of high relevance to the post-pandemic recovery and development of Wyoming and the nation's economy. Potential areas of collaboration may include model-based optimization, which is critical to the exploration and utilization planning of geosystems and the design and management of energy systems and applications. Geosystems represent a type of high-dimensional, complex system that usually requires large amounts of computational resources for realistic modeling. Recent advances in machine learning, in particular deep learning, have opened new possibilities for modeling that has the potential to substantially reduce the computational cost of realistic geosystem modeling and data assimilation or to develop a new capability for upscaling model results to create real-time decision-making metrics with reduced uncertainty. Furthermore, earth scientists have always been working on big data and have developed sophisticated methods in the field of geostatistics that can consider more complexity compared to the currently available methods in machine learning, which can be beneficial to the SoC by bringing those concepts and introducing them to students and other faculty members. By combining the computational expertise of SoC and the computational earth scientists and engineers in G&G and PETE, we will be well-posed to make breakthrough contributions that are innovative to earth science, engineering and computer sciences and have a far-reaching impact on the energy industry of Wyoming and the US.

Unintended Consequences, Mitigation Strategies, and Suggestions for Alternative Approaches (Limit to 2 pages)

In this section describe unintended consequences the proposal may result from implementation of the proposal (including any budgetary consequences). Make recommendations on how such unintended consequences might be mitigated. If you have alternate suggestions for how to achieve budget reductions or achieve optimal organizational structure, please provide them here.

Here below, we list several challenges that make a consolidation extremely difficult due to differing structures, sizes, traditions, and visions of the departments:

Staffing G&G shares office staff with Anthropology. This tight-knit group will likely be broken apart, with one line remaining in A&S and three moving to a new college. The staffing structures differ between the two colleges, with A&S utilizing Business Managers overseeing Office Associates and CEAS relying on accountants to lead the staffing units. Additionally, the A&S Dean's Office has one accountant that heads the grants accounting for units like G&G; it is unclear if this line would move to the new college, since there still will need to be grants accounting done for the units that remain in A&S.

Operations A&S generates operational funding for its 20 units through a socialized system of Distance Ed revenue sharing (not the model adopted by CEAS).

Advising G&G will need to transition to full 4-yr professional undergraduate advising. Currently the A&S Advising Center only has the capability to offer 4-yr professional advising for half of its 20 units; G&G is among those units that still desire to provide advising for their juniors and seniors.

Foundation Existing and potential G&G donors have expressed dismay at consolidating the two Departments. Some of them have reached out to the committee and indicated that, in light of potential consolidation, they either regret their previous gifts or no longer plan to donate to the G&G program. PETE faculty and Stakeholders are concerned about losing Le Norman Endowed Leadership Chair in Petroleum Engineering for a new DH position.

Research and Teaching The research and teaching expectations in the two units are substantially different.

CPM In any numerically-imbalanced consolidation (25:12 in the faculty ranks for this case), the mechanics of the merger will need to be carefully devised lest the smaller unit gets outvoted in most/all important situations. At the same time, individual voices in the larger unit must not be discounted as all faculty deserve an equal voice and an inclusive workplace.

Indirect Cost Return The two departments have different policies for redistributing IDCs to PIs.

Tenure & Promotion The two units differ in their approach to who is allowed to vote on T&P cases at each level.

Contrasting Mission PETE needs to stand as a top tier engineering program, while GEOL needs to continue as a top tier basic science program.

Salary Inequity A consolidation of G&G and PETE would create substantial faculty salary inequity.

Budget Reduction A budget reduction in G&G can potentially lead to significant losses of capabilities.

National Ranking Both departments strongly believe that a consolidation would penalize their national rankings in their disciplines.

Numerical Imbalance G&G is twice larger than PETE. If the two were to be consolidated within the same Division, it is critical that the numerical imbalance in the two departments does not result in unfair decision-making regarding the Division. The College of Engineering and Applied Sciences proposes to solve this issue by introducing a clause into its bylaws such that the Division would have a voting system that puts the larger and smaller departments on equal footing. The G&G department strongly believes that all department citizens should have

equal vote and that giving a lower weight to G&G faculty members is a sign that they are not welcome and that their opinions are not valued.

Conflicts PETE faculty have sensed misconceptions and strong biases against the petroleum field and engineering discipline, which may create internal conflicts within the Division. PETE is a very diverse and inclusive department, its faculty work on a very broad range of research topics that are basic and applied in scope. The G&G department states that its faculty do not have biases or misconceptions; the G&G faculty wants to preserve their autonomy and independence because the future of earth sciences does not only include energy, but also natural resources and environmental studies.

Shared Vision PETE faculty have reached out to G&G faculty numerous times to discuss a shared vision but did not feel enough interest and engagement towards energy-related research to warrant a consolidation. However, there might be potential for collaborations on groundwater resources. G&G faculty discussed the PETE proposal in multiple occasions, and although they see a value in potential collaborations for energy related topics, they feel that the PETE vision is divergent from the G&G one and does not cover the broad range of research topics in earth science; indeed the two departments could not even reach a consensus on the name of the unit, in case of a consolidation.

Department Name Defining an appropriate name for the consolidated department has been a challenge for both programs. After several weeks of meetings and deliberation, most PETE faculty voted for “Earth Science and Energy Engineering” whereas G&G faculty voted for “Earth, Energy, and the Environment”. G&G faculty believe that including the word “Engineering” would compromise their national ranking, ability to recruit graduate students, and secure extramural funding while PETE faculty believe that eliminating the word “Engineering” would damage their standing in the engineering community. If the two programs were to remain as stand-alone departments, PETE faculty would prefer to have “Energy Engineering” as a department name instead of “Energy and Petroleum Engineering” or “Petroleum Engineering”. Having the word “Petroleum” in the name may seriously hinder their ability to raise external funding in the future. G&G unanimously voted to have “Earth Science” as the name of their autonomous department, consistent with similarly high-performing programs across the nation.

PETE Stakeholders PETE stakeholders could see the big picture behind the restructuring proposal but feared that the Petroleum Engineering program would lose its identity in the new structure. More feedback from the PETE Industry Advisory Board can be found in **Appendix D**.

G&G Stakeholders G&G stakeholders strongly opposed the consolidation and expressed several concerns, well summarized by the letter of the Geologists of Jackson Hole sent to the Governor, the President, the Provost, and the Board of Trustees (**Appendix E**). Similar concerns have been expressed by Dr. Charles Keefer, alumnus of the G&G department and Dr. Camelia Okpodu, Dean of the College Arts and Sciences, in the narrative document submitted to the Provost and the President.

Mitigation Strategy Both departments strongly believe that preserving their autonomy as two independent units will avoid the unintended consequences listed above. Both departments are committed to improve collaborations and develop recruitment strategies to meet the university’s mission and overcome the current weaknesses of the programs.

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Other
Additional information may be provided as appendices.

APPENDIX A - DEPARTMENT VISIONS

A.1. G&G: THE CHANGING SCOPE OF EARTH SCIENCE

The Department of Geology and Geophysics (G&G) stands ready to contribute to a more streamlined University focused on high-impact teaching and research aligned with both the land-grant mission and the priorities of Wyoming. Here we outline how we will contribute through innovations in curriculum, strengths in research, and synergies with new and existing programs at UW.

The need to adapt and innovate has never been greater as fast-changing job markets of the 21st Century drive seismic shifts in demand for higher education in Earth science. Keeping up will require embracing the grand challenges of geohazards, climate change, and the energy transition. To meet these challenges, we are developing a new concentration in geophysics and new minors in petroleum geology, economic geology, and Earth's environment. In addition, we are developing a new program of core courses that will serve existing majors in Petroleum Engineering, the School of Energy Resources, and the Haub School. Together, these innovations promise to strengthen cross-campus interdisciplinary collaborations while attracting new students to UW's strong Earth-oriented programs.

We are also developing a professional master's program that would focus on career advancement in industry rather than academia. The goal is to increase revenue; improve curricular efficiencies; develop interdisciplinary cross-campus partnerships; and increase the digital footprint of our course offerings. By providing a pathway for career advancement in industries that are relevant to the state, this program will also contribute to the land grant mission of the University and to the economy of Wyoming.

To further improve recruitment and retention of undergraduate and graduate students alike, we are striving for greater diversity, equity, and inclusion (DEI) within the department. This effort is spearheaded by a new DEI committee, which last year consisted of >20% of the faculty and

~25% of the graduate students. This high participation rate in the DEI effort indicates there is great potential to improve the department's environment for everyone, including underrepresented groups that have historically participated at very low levels both in G&G and in Earth science nationwide.

With its strong international reputation in Earth science research and graduate education, and its continued access to top-end analytical and computational facilities at UW, G&G is poised to contribute substantially to UW's push toward R1 status in the Carnegie research rankings. Our track record of impactful research puts us in prime position to capitalize on the planned diversification and growth in external funding sources, such as NSF's new Directorate for Technology, Innovation, and Partnerships and its 19% increase in its Earth science budget. Exploiting these and other similar opportunities will help us increase our overall and per-capita output of research expenditures and our throughput of both PhD students and postdocs, thus increasing our contribution on key R1 metrics.

Over the past decade, our research has become increasingly digital, as several faculty in G&G have harnessed the Advanced Research Computing Center and the NCAR Wyoming Supercomputing Center to advance Earth system simulation, Earth science data assimilation, and machine learning in geoinformatics. Today, these faculty are poised to help the new School of Computing (SoC) achieve its strategic goals in research, teaching, and entrepreneurship. Such collaborations promise to yield breakthrough contributions that have far-reaching impacts on the Earth science industry in Wyoming and nationwide, thus increasing the reputation of computational Earth science at UW.

In summary, G&G recognizes the pressing need to adapt and innovate as UW faces the 21st Century challenges of fast-shifting job markets and shrinking budgets. The adaptations and innovations that we can contribute include: a new curriculum that increases online offerings and increases undergraduate and graduate enrollments; increased research output through new Earth-oriented opportunities from external funding sources; and cross-campus, interdisciplinary teaching and research collaborations with new and existing programs at UW.

A.2 PETE: THE ENERGY TRANSITION

The department of Petroleum Engineering is beginning an appropriate expansion of its focus into broader areas of interest in energy engineering, starting with an emphasis on the subsurface domain to include geothermal energy, carbon capture, utilization and storage (CCUS), and underground hydrogen storage. In partnership with the Haub School, G&G and Civil Engineering faculty, the potential exists for expansion into water resources. The new Computing School and the Computer Science faculty offer the potential for data analytics and blockchain applications for the energy industry. This broadening of the department's focus capitalizes on its existing expertise and leverages collaborations in the College of Engineering and Physical Sciences to address critical issues during the early stage of the global energy transition. As this transition matures and if resources allow, the PETE department will integrate expertise and collaboration in surface energy sources, including wind and solar energy in collaboration with various units on campus (e.g., SER, Mechanical Engineering, Chemical Engineering, and Chemistry). The well-reasoned, methodical shift in research focus will keep

the department positioned to make significant contributions to the energy sector, broaden its funding landscape, and help the State of Wyoming diversify its economy. As a highly accomplished community of scholars and practitioners, PETE faculty are committed to providing outstanding educational opportunities, conducting internationally recognized research, and improving the well-being of the people of Wyoming and the world through education, technical innovation, and economic development. The department will prepare graduates to apply engineering and scientific knowledge to help the state of Wyoming and become a transformational leader while addressing subsurface energy, midstream, underground storage, renewable energy, data analytics, sustainability, and the environment. The department will have three primary resources to accomplish its mission; a broad range of expertise among the faculty, established world-class facilities, and two major degrees along with multiple minor and option opportunities.

- *The PETE department provides technical expertise in multiscale physics of flow through porous media, reservoir engineering, unconventional resources, enhanced oil recovery, geomechanics, CCUS, clean energy technology development, and energy sustainability. The Faculty have a distinguished record of publications and external funding from industrial, state, and federal sources.*
- *Several core facilities are available to help achieve the mission, including the Center of Innovation for Flow through Porous Media (COIFPM) at the High Bay Research Facility, Hydrocarbon Laboratory, High-Pressure/High-Temperature Differential Scanning Calorimetry Laboratory, Drilling and Completions Simulator Center, and Energy and Environmental Technology Laboratory.*
- *The department will offer a B.S. degree in Petroleum Engineering with a modernized curriculum that includes several options/minors in Energy Engineering, Energy Sustainability, Renewable Energy, Process Control, Data Analytics, Artificial Intelligence, and Environmental topics. It will also offer graduate degrees in Petroleum Engineering and Energy Engineering.*

APPENDIX B - RECRUITMENT

B.1. G&G

The national and international reputation of the faculty and facilities in G&G at UW attracts excellent graduate students, which contributes to its reputation as a top tier department. G&G has redoubled its efforts in undergraduate student recruitment, retention, and reinvestment. Surveys of new G&G majors suggest increasing interest in the environment and Earth systems over extraction and energy development. One concern is whether jobs in the latter, more traditional fields can be sustained over career timescales in the 21st Century. Because the G&G undergraduate program emphasizes fundamental geology, which is essential to both career paths, it can robustly keep open opportunities for students whose career interests span a broad range.

Recruitment is a multi-pronged effort that uses and promotes G&G resources. The department reaches younger recruits through K-12 activities, classes, tours, and visitation at the UW

Geological Museum (23,000 annual visitors). At the college-level, G&G has first-year experiential courses such as Geology of National Parks, Preparing for the Apocalypse: Natural Hazards, and The Anthropocene: Human Control of Nature. G&G proposes to broaden recruitment efforts through field trips and career fairs across the state and region. Retention is vital, and G&G strives to be an inclusive department with a thriving diversity, inclusivity, and equity initiative, including a formal committee composed of undergraduates, graduates, and faculty. This allows G&G to react nimbly to concerns that arise and create a comfortable work environment for students, staff, and faculty. G&G is also actively developing opportunities for community and colleague engagement through new field-based courses and department funded Spring Break and Geology Club excursions. Reinvestment in G&G students is integral to its efforts and commitments to student success. Undergraduates regularly participate in research opportunities as laboratory and field assistants and in independent studies with graduate students and faculty. Experiential learning differentiates G&G students in a competitive job market after graduation.

Curriculum innovations. *The G&G department has formed an ad-hoc committee to modernize its curriculum. including a new core set of 1000/2000 level courses to attract students and then open their thinking to potential career paths in earth sciences, engineering, and environmental studies. Service-type core classes that meet the needs of several majors in engineering and physical sciences would include new classes at the lower level, such as Earth as a Chemical System, Earth as a Physical System; Quantitative Approaches to Earth's Problems; and Computation and Data Science for Earth Science Solutions.*

Given the high demand for graduate students and employment in geophysics, a concentration in geophysics could be a highly visible and impactful degree option. Such a new track can be accommodated within the current curricular structure and with existing faculty. Mathematics requirements and additional upper division geophysics courses beyond the BS in Geology degree will be needed. One option to accommodate the advanced coursework may be to create a new 1 year, course-based master's degree in geophysics for G&G graduates, rather than a new track within the existing degree. Two new minors will be proposed: a minor in Petroleum Geology and a minor in Economic Geology.

The Department of Geology and Geophysics is also developing a proposal for a professional master's program that would focus on career advancement in industry rather than academia, with an internship, rather than a thesis, as the capstone experience. This program would capitalize on the strong demand demonstrated every year when the department receives graduate school applications from as many as 10 times more students than can be supported on state assistantships and faculty research grants. In meeting this demand with a professional master's program, the department seeks to increase revenue, through a new stream of tuition and fees; improve curricular efficiencies, by filling currently undersubscribed graduate level courses with a new cohort of students; and develop interdisciplinary cross-campus partnerships in graduate education, leveraging contributions from PETE; the School of Energy Resources; the life and ecosystems sciences in the new College of Agriculture and Life Sciences; and the Haub School. By providing a pathway focused on career advancement in industries that are relevant to the state, this program would contribute to the land grant mission of the University and to the economy of Wyoming.

B.2. PETE

The Petroleum Engineering degree program at UW has a global reputation for excellence. The graduate program has continuously recruited top students from national and international institutions. Evidence that this successful recruiting will continue is the steady number of graduate students over a chaotic time frame containing budget cuts at UW, a significant downturn in the energy industry, and the pandemic. In fact, the Petroleum Engineering Department has the largest and most diverse graduate program in CEAS (nearly 50 students from over 25 countries) and has the third-largest Ph.D. program at UW in Fall 2021. The quality of the graduate education in Petroleum Engineering is demonstrated by student-authored publications in top-tier journals and student awards and recognitions at the top professional conferences in the field.

The undergraduate enrollment in Petroleum Engineering has decreased significantly in recent years. The enrollment at UW mirrors the trend in US Petroleum Engineering Departments, indicating that no local conditions are responsible for the decreased enrollment. Therefore, the efforts to address the undergraduate enrollment are based on distinguishing the UW Petroleum Engineering educational experience from its competitors. Specific actions include:

- *The Drilling and Completions Simulation Laboratory is a state-of-the-art digital simulator in the Engineering Education and Research Building. Advanced digital simulation equipment allows students to gain experience in drilling and well completion that has traditionally required fieldwork. Students are now trained in the simulator and can earn industrial certification prior to graduation. PETE faculty provide regular tours of the simulator to K-12, university, industrial, and community groups to build awareness of the excellent facility and program. They have developed online simulator access to training remote students during the pandemic, which is a distinguishing characteristic of the program.*
- *The Center of Innovation for Flow through Porous Media is a world class facility that hosts annual tours and first-hand lab immersions to students attending the Wyoming Summer High School Institute and the Wyoming State Science Fair. The Center also provides competitive scholarships and research experiences for undergraduate students across campus.*
- *The College of Engineering and Applied Science has a dedicated K-14 Recruiting Coordinator that plans events for on-campus and off-campus. On-campus events include the Engineering Summer Program. The Petroleum Engineering faculty regularly participate in the multi-day Engineering Summer Program through field trips to nearby oilfield sites.*
- *The College of Engineering and Applied Science has a dedicated Recruiting coordinator that provides a blended approach of both on-campus and off-campus events to publicize the engineering degree programs. This effort has resulted in a series of on-demand information videos for each engineering discipline and webinars to engage potential students and their families.*
- *The Petroleum Engineering Department's Office Staff provides on-campus student visitation opportunities for potential students interested in Petroleum Engineering. This effort is coordinated with the Admissions Office. The Department's Office staff has also*

worked with the College Recruiting Coordinator to extensively update all recruiting literature and coordinate recruiting efforts.

- *To increase diversity, the Petroleum Engineering Department renewed its first international transfer memorandum of understanding with the Southern Alberta Institute of Technology (Canada) in 2017. This agreement has been successful in attracting international students to UW to complete their BS degrees. A similar agreement with the American University of Ras Al Khaimah (United Arab Emirates) is now under review by the UW Office of the General Counsel. The third agreement with Sepuluh Nopember Institute of Technology in Surabaya, East Java (Indonesia) is in the preliminary discussion stage. A fourth agreement with Aims College in Colorado is also in the initial discussion and review stages.*

The combination of these undergraduate recruiting activities provides a balanced approach to effective recruiting and increased enrollment. PETE nurtures a close-knit culture of inclusion among its faculty and staff and prioritizes the recruitment and resilience of minorities and underrepresented students.

Curriculum innovations. *The Petroleum Engineering Department has begun planning for the global energy transition with appropriate modifications of both the graduate and undergraduate curriculum. Maintaining strength in the core areas of petroleum engineering is critical, with expansion into novel areas as the global energy transition matures. At the graduate level, the department is broadening its focus into energy engineering, focusing on convergence education. This new program will require a customized interdisciplinary curriculum in order to meet the learning outcomes necessary for the 21st century. In addition, Department faculty have initiated a research focus and coursework in blockchain technology for energy applications. These changes will provide graduates with an expanded set of skills and knowledge sets to lead the energy discipline into the future.*

At the undergraduate level, several curriculum innovations are in progress:

- *Department faculty have initiated a data analytics course for Petroleum Engineering majors in collaboration with Computer Science. This effort will be expanded into a minor after the implementation of the School of Computing and the availability of data science courses.*
- *The Department is restructuring its undergraduate elective areas to allow students to complete coursework in two new areas: process control and renewable energy. These options will expand employment opportunities for graduates.*

The Petroleum Engineering Department has also begun discussion of a multi-disciplinary degree offering in energy engineering or sustainable energy development. The goal of the Petroleum Engineering Department is to introduce curriculum innovation in a methodical manner consistent with trends in the energy industry.

APPENDIX C - RESEARCH FUNDING

C.1. NATIONAL SCIENCE FOUNDATION (NSF)

NSF plans to repurpose its engineering budget for the new “Directorate for Technology, Innovation, and Partnerships” while growing the Geoscience budget to \$1.0B (+19%).

Additionally, NSF is requesting significant funding (\$347 million for FY22) for the 10 Big Ideas Initiative, which include significant emphasis on collaborative efforts around strongly-grounded science centers. The NSF's 10 Big Ideas Initiative highlights cross-disciplinary efforts that can, or must, rely on fundamental input from earth scientists, such as the Growing Convergence Research, NSF Includes, Understanding the rules of Life, and Mid-scale Research Infrastructure. NSF's Clean Energy Technology program investments create new understanding and innovations for increasing energy efficiency, enhancing sustainability and resilience, and reducing and mitigating climate change. NSF-supported areas of fundamental research and education include the production, conversion, storage, and distribution of diverse electricity and fuel sources; the science and engineering of energy materials, energy use, and energy efficiency, including novel data and computational approaches to advance these frontiers; and the ways that people think about and use energy. Clean-energy investments also create vital research and education partnerships in response to national and international developments in sustainability science. The FY 2022 NSF budget requests \$440M for clean energy technology. Specific focus areas in the Clean Energy Technology program invest in fundamental research and education on the production, conversion, storage, and distribution of diverse electricity and fuel sources; the science and engineering of energy materials, energy use, and energy efficiency, including novel data and computational approaches to advance these frontiers; and the ways that people think about and use energy

US Global Change invests in climate and global change research spans climate science, climate impacts, climate adaptation and mitigation strategies, and climate solutions. As part of NSF's holistic approach to addressing global change, NSF's USGCRP investments are complemented by investments in research to advance America's clean energy future—from fundamental physics, chemistry, and materials science to large-scale systems engineering and cyber-infrastructure. The FY 2022 NSF budget requests \$760M for US Global Change research.

One potential program of interest is the Advance Scientific Knowledge of The Integrated Natural and Human Components of the Earth System. The sub-topic of Earth System Understanding aims to improve the knowledge of the Earth's past and present climate variability and change through activities to document and understand long-term climate cycles across the globe, as well as to better understand the natural variability of climate and the processes responsible for global changes using a range of paleoclimate and instrumental data and modeling approaches. NSF Ocean Sciences program Recently funded research (2021) focuses on the effect of hydrocarbons on ocean ecology. NSF has an agency-wide focus on computational studies, particularly data-driven modeling, to address interdisciplinary topics. A focus on machine learning for reservoir characterization and blockchain technology for energy/environmental issues could be a good opportunity. The FY 2022 budget request for the Engineering Directorate increased 20% to \$917M, with \$179M targeting Clean Energy Technology. The FY 2022 budget request for the Geosciences Directorate increased 19% to \$1.2B with \$482M targeting US Global Change research.

C.2. DEPARTMENT OF ENERGY (DOE)

The mission of the DOE is to support the Nation's prosperity by addressing its energy, environmental, and nuclear security challenges through transformative science and technological solutions (see Figure below). The DOE supports competitive funding opportunities

through the Office of Science (OS), Energy Efficiency and Renewable Energy (EERE) and Fossil Energy and Carbon Management (FECM). The DOE OS is the largest federal sponsor of basic research in physical sciences (recommended for 7.49B in FY22 +6% over FY21). The DOE OS funds geoscience research, with opportunities such as Earth and Environmental Systems Modeling and Integrated Computational and Data Infrastructure for Science Research. The Critical Materials Institute lists Diversifying Supply as one of its four focus areas. The EERE is recommended for historic levels funding in FY22 (\$3.89B +26% over FY21) to re-energize every EERE effort. The Office of Fossil Energy recently added “and Carbon Management” to the name. The switch was meant to refocus the recommended \$850M in funding to FECM on carbon management and carbon removal technologies. Surprisingly the flagship program for oil and gas research under FECM was not recommended for continuation in FY22, which further underscores the change in direction from FECM.

Within DOE, the FY 2022 Budget Request invests more than \$8 billion in clean energy and climate innovation. From investing in advanced nuclear reactors, electric vehicles, and green hydrogen, to funding innovative approaches to air conditioning and refrigeration, the requested funding puts the Nation on a path to quadruple clean energy research in four years, emphasizing U.S. pre-eminence in innovating the technologies needed to tackle the climate crisis.

\$890M for the Fossil Energy and Carbon Management Research and Development (R&D) program conducts research that focuses on early-stage technologies that help to ensure clean and affordable energy for all Americans, facilitate the transition towards a carbon-pollution-free economy, rebuild a U.S critical minerals (CM) supply chain, and retain and create good paying jobs with a free and fair chance to join a union and collectively bargain. To meet these challenges, the FY 2022 budget re-focuses funding from traditional fossil combustion-centric activities (e.g. Advanced Energy Systems and Cross-cutting Research) to climate-centric activities (e.g. Carbon Capture, Utilization, and Storage).

\$4.732B for the Office of Energy Efficiency and Renewable Energy (EERE) to achieve a carbon pollution-free electricity sector by 2035 and net zero emissions, economy-wide, by no later than 2050. Four focus areas were identified in the FY 2022 budget request: Decarbonizing the electricity sector, Decarbonizing the industrial sector, Reducing the carbon footprint of buildings, and Decarbonizing agriculture.

APPENDIX D - PETE INDUSTRY ADVISORY BOARD FEEDBACK

Dean Cam Wright & Department Head Denny Coon,

Please share as you see fit with the university administration and the PETE/G&G Restructuring Committee. The Industrial Advisory Board met on September 16th and 17th to discuss and provide advice on the proposed move of the Geology and Geophysics Department (G&G) into the College of Engineering and merge with the Petroleum Engineering Department.

At the close of the session on the 16th, we were informed that the administration is open to a recommendation to keep the departments separate but still move the G&G Dept into the College of Engineering. Due to the strong sentiment on the committee for the two departments to remain separate, the IAB feels a recommendation from the restructuring committee to remain separate is virtually certain. Nonetheless, the potential to merge the two Departments is still a possibility so we thought it would be worthwhile to provide our advice and input.

New “Department” Structure: The new department should have single focal point Department Head, with separate “Directors” to lead and guide the G&G side of the Department and the Petroleum Engineering side of the Department. This structure allows for a “Soft Merger” where each Department maintains a significant degree of autonomy via the Discipline Director who will be selected/appointed from the current department faculty.

Department Head - Roles & Responsibilities:

1. Represent the Department at the College and University levels and with External Stakeholders
2. Ensure alignment of scope, goals and mission for the G&G and Engineering Disciplines.
3. Ensure the dedicated funds via the UW Foundation that currently support the two separate Departments remain focused on the intent and scope of the donor.

Discipline Directors – Roles & Responsibilities:

1. Accountable for the direction of each discipline to meet the needs of students, faculty and stakeholders under the direction of the Department Head.
2. Accountable for the Graduate Program and Research within the Discipline – Sub Director focal point likely needed.
3. Accountable for the Undergraduate Program within the Discipline – Sub Director focal point likely needed.

New Department Name:

Background: There has been much discussion on the name of the Department which for both students, staff and faculty provides a sense of identity and belonging. The current names of the two Departments are “Geology and Geophysics” and “Petroleum Engineering”. However, at the Spring 2021 IAB meeting the Faculty requested IAB support for changing the name to the Department of Energy and Petroleum Engineering. The request was unanimously supported by the IAB, the Dept was to propose the name change to the Dean. At the IAB meeting in

September, the board was informed that the PETE/G&G Restructuring Committee is going to recommend “Department of Earth, Energy and Environment” as the overarching Department name. Sub-Departments would be the Departments of Energy Engineering and Dept of Earth & Environment.

The IAB recommends an initial department name that all current stakeholders can identify with to promote a sense of inclusion. Thus a simple combination of the two current names is recommended: “Department of Geology, Geophysics, Energy and Petroleum Engineering. Such a title clearly references the two existing departments and the IAB feels allows all current students, staff and faculty to identify with the department name. The name also suits a “Soft Merger” which is the practical recommendation of the IAB. Over time as the two disciplines become more integrated and aligned, a new name can be considered.

The IAB Chair also discussed the proposed merger with David LeNorman who provided the funds for the endowed Department Head Chair. Dave is very supportive of the proposed merger and strongly supports any initiative to better align the two disciplines. Dave also expressed a strong opinion that the department name continue to include the reference to Petroleum and Engineering in the title to meet the intent of his donation to the endowed Department Head Chair.

Discipline Integration: The IAB sees the movement of the G&G Dept into the College of Engineering, either as a separate department or a merged department as a positive, welcome change. The benefits to the Petroleum Geology side of the G&G program and the Engineering side are obvious. We also strongly feel that there is significant opportunity for the environmental side of G&G to positively influence the production side of Petroleum Engineering and Vice-Versa. However, feedback from the committee members who participated in our conversations indicated that this view is not shared by the majority of faculty in the G&G department. We find this situation to be disappointing. Going forward as the G&G Department moves into the College of Engineering, we strongly recommend that faculty and staff that are willing to engage and help develop the path forward for both disciplines to constructively engage should be publicly recognized for their efforts. Such recognition should be used as positive example to those faculty and staff in either discipline who do not want to (and have not) engaged in the effort to develop a working relationship going forward, either as separate or a merged department.

Feel free to contact the IAB Chair if you have any questions or comments.

Sincerely,

Joseph Leimkuhler,

Chair Petroleum Engineering Dept – Industrial Advisory Board.

APPENDIX E - G&G STAKEHOLDERS FEEDBACK



250 NW Ridge Road, Jackson, WY 83001

307-699-2621

To: Governor Mark Gordon
Univ. of WY President Ed Seidel
Univ. of WY Provost Kevin Carman
Univ. of WY Board of Trustees Chairman Jeffrey S. Marsh

Cc: Mr. Scott Quillinan; G&G Dept. Head Dr. Mark Clementz

Subject: Proposed Merger of the University of Wyoming's Geology & Geophysics Department into the Petroleum Engineering Department

The Geologists of Jackson Hole (GJH) organization has been requested to provide feedback regarding the proposed merger of the University of Wyoming's Geology & Geophysics Department into the Petroleum Engineering Department. After review we offer this response based on input from organization members with careers in industry, academia, and government. The GJH Organization is a non-profit, all volunteer body (founded in the mid-1990s) whose mission is to provide our local community - and beyond - insight into earth science matters and their importance to us all.

A list of points about the proposed merger is found below, but they can all be summarized by our stating that we believe said merger would do great disservice to the State of Wyoming and cause negative ramifications that we strongly believe would greatly outweigh the short-term cost savings. In short, we see no merit in this proposal. We sincerely hope that you, the Wyoming Legislature, and Board of Trustees will seek alternative measures to address the budgetary issues driving these proposed measures.

Very respectfully,



Mr. John Willott, President, Geologists of Jackson Hole



Mr. John Hebbinger Jr, Vice President, Geologists of Jackson Hole

Comments Regarding Proposed Merger

The stated goals of the proposed merger are:

- to improve student experiences and success,
- emphasize growth of programs,
- better position the University for R1 research classification,
- provide economic support to the state of Wyoming
- to respond to a significant reduction in the university's budget

The points below are reasons we see the proposed merger NOT accomplishing these goals, and hence as strong reasons to ***not*** pursue the proposed merger:

- Students' competitiveness for industry and academic positions would be reduced under the proposed reorganization, proposed merger.
 - Reduced G&G faculty & funding will significantly diminish Univ. of WY research scope & capability.
 - Major corporations (such as ExxonMobil, Chevron) look for new employees who have had broad exposure to diverse fields of earth science and the opportunity for involvement in significant research programs.
 - Academic & government recruitment requires even deeper student development.
- The competitiveness of any program requires funding that enables it to attract and retain young, highly talented faculty.
 - The future of earth science research & education at UWy depends on its younger, more recently hired faculty. If these are severed, there is no future for the G&G Department at UWy. For example, the Department has already lost a recent, brilliant, young hire due to insufficient financial support. UWy G&G Dept. faculty member Dr. Kimberly Lau departed UWy for Penn State because UWy couldn't (or wouldn't) fund the lab setup she needed for her research. (see: <https://www.geosc.psu.edu/directory/kimberly-lau>) If you look at her CV you will see that she was of exceptional caliber, the kind of young researcher that any department needs, and would be thrilled to capture and retain. UWy will no longer be able to attract and hire such talent if the merger occurs - and already may be too handicapped to manage such a hire.
 - Quality faculty involved in cutting edge research are a major reason for corporate interest in Univ. of WY's G&G Dept. Both interest in and potential corporate financial support following such a merger would be diminished. This would cripple attempts to grow or even maintain the program.
- The UWy's stated aspiration is to be rated as an R1 institution (per Carnegie Classification; it is currently rated R2).
 - The UWy G&G Dept has been ranked a "BEST VALUE GEOLOGY DEPARTMENT IN THE COUNTRY IN 2019, 2020 AND 2021", and 46th in the country as an earth science department by US News & World Report. As a shrunken entity within the PE Dept it would not be seen to:
 - Be a significant educational or research body.
 - Effectively compete with current high-end peer departments in universities across the US.

- Be able to attract (or retain) strong faculty or students.
 - The essential disappearance of the nationally highly rated G&G Department would **not** assist in moving the University towards the goal of an R1 rating.
- It would diminish the ability of the University to provide economic support to the state of Wyoming.
 - The State of Wyoming is currently heavily dependent on energy & minerals for State revenue. Research by G&G faculty have had & continue to have the potential to contribute directly to multiple aspects of these industries.
 - The current federally ordered search for rare earths and critical minerals being carried out by the Wyoming State Geological Survey (WSGS). It has been assisted by a young G&G faculty member Simone Runyon. This is but one example of how the G&G Dept is critically important to accessing the mineral resources in the State.
 - The mission of the Geology & Geophysics Department is exceptionally broad, tied to research and application in elements of physics, chemistry, biology, climate, hydrology, mineralogy, energy, botany, energy, and hazards assessment. All of these areas of research and applied science have the potential to benefit the State of Wyoming.
 - There is likely no resource in WY more important than water. The G&G Dept.'s study of state hydrologic resources is one example of the great value brought to the State by the Department.
 - Significant funding flows to the G&G Department from Federal sources (most importantly the National Science Foundation). We expect such funding to greatly diminish, or even end should the proposed merger occur.
- Ramifications of organizational restructure and budget cuts are often not fully recognized.
 - As former employees of ExxonMobil and Chevron we are very familiar with the results of major mergers due to perceived budget pressure. Promised cost savings rarely materialize. Most mergers disappoint, not infrequently fail.
 - Before any merger is contemplated, a zero-base review should be performed.
 - Should early retirement packages be offer
 - Can major activities be contracted out, such as:
 - Facility operation and maintenance
 - Accounting & billing services
 - Food services and transportation fleets
 - In our view, to merge or not merge, is not the key issue. Focus should be placed on how to re-vitalize the departments and curricula, to seek more financial support from industry and the federal government to lobby state legislators to maintain/increase funding, and mount other similar efforts to improve the quality of both departments and programs and enhance the image of U of W for potential prospective students.
- Education, at the University of Wyoming and at all levels in the State, should not be considered a business, one measured against a financial bottom line. Rather it is an investment in the future capabilities of the citizens of the state. The proposed organizational change will negatively and seriously impact the ability of the University to prepare students for the future.

- What are potential unintended consequences of the proposed restructuring of PETE and G&G?
 - Based on current economic trends, on federal policies and mandates, petroleum engineering has a few decades of life expectancy. Geology and geophysics will continue to be useful far beyond that timeframe, far out into the future. Economic geologists have a future in mineral extraction and environmental analysis and remediation but not in petroleum extraction. Placing Geology under Petroleum Engineering will at best diminish, and quite possibly kill the University's Geology program.
 - The mission of the Petroleum Engineering Department (PED) is very narrow and with a limited research focus. It is tied to a single industry (petroleum production) that has limited scope for future growth. It is impossible to see how a vibrant earth science entity could thrive or even exist within Petroleum Engineering.
 - The message the proposed consummation of the G&G Dept by the PE Dept sends is that earth science is not valued by the University or by the State. This will without doubt:
 - Destroy morale across current faculty and enrolled students.
 - Lead to departure of some of both (faculty, students).
 - Ensure that the highest quality prospective faculty and students look elsewhere for their needs.
 - Ensure that cutting edge research that might benefit WY and beyond does NOT occur at the University of Wyoming.
 - The Wyoming State Geological Survey (WSGS), a small but critically important resource of the State for current & future income sources, depends on its relationship with and access to a strong University G&G Department. The WSGS is already understaffed. The essential loss of the G&G Department would be a serious impediment to WSGS' ongoing assessment of resources and hazards across the State.

Unfortunately, the merger alone—no matter how creative or well accomplished—won't fix the problem but will reduce the quality of both programs. We very sincerely hope that alternative plans will be pursued.