

**Minutes of the University of Wyoming Energy Resources Council  
September 11, 2006**

Council members present:

Ron Harper – CEO& General Manager, Basin Electric Power Coop, (Council Chairman  
Representative Tom Lockhart (Council Vice Chairman)  
Keith Rattie – Chairman, President & CEO, Questar Corporation  
Bobby Shackouls – Chairman (retired), Burlington Resources Inc.  
Tom Stroock – CEO, Alpha Development Corp; former US Ambassador  
Ex officio, UW President Tom Buchanan  
Ex officio, RIENR Director Harold Bergman

Council members absent:

Mark Davies, General Manager - Rio Tinto Energy America  
Senator Bill Hawks  
Paul Lang, President - Western Operations, Arch Coal Inc.  
Rob Wallace – Manager, Government Relations, G.E. Energy

The Council meeting convened at approximately 1:00 p.m. on September 11, 2006 through a conference call in the UW Presidents Board Room.

**Welcome and Approval of the Agenda and Minutes.**

Chairman Ron Harper called the meeting to order. Bobby Shackouls moved and Tom Stroock seconded that the agenda for the meeting be accepted, and the motion passed unanimously. The agenda is attached as Appendix A to these minutes.

Bobby Shackouls and Tom Stroock seconded that the minutes from the meeting on August 10 – 11, 2006, be approved, with corrections identified by Tom Lockhart, and the motion passed unanimously. A copy of the approved minutes from the August 10 – 11 council meeting is attached as Appendix B

**Financial Report**

UW Vice President for Academic Affairs Myron Allen summarized the financial report, clarifying a question from Chairman Harper that the UW fiscal year ends 6/30/2006. The financial report reflects amounts based on 7/1/2006 until 6/30/2007, not a full year. Chairman Harper requested the report be changed to reflect an original amount budgeted for the year, YTD amount spent, and an amount for obligated funds to the end of the year. Allen stated it would be changed. Allen also clarified that the salary amounts would include salary, advertising expenses to fill the four Professorship positions, and moving expenses, but that in the following year, the entire salary amount would be salary. A copy of the financial report is attached as Appendix C.

### **SER Director**

Vice President Allen introduced Carol Frost, Interim Director to the Council, and she summarized her duties and the initial scope of the work for Interim Director. They will include: searching and hiring a permanent director by chairing a search committee of which people have begun to be selected, oversee the hiring of the first four professorships, identifying space for the Director and staff, and assisting UW Vice President of Institutional Advancement Ben Blalock in fundraising by serving as spokesperson for the School of Energy. Frost stated that she would support the School of Energy Academic Coordinator Andy Hansen, and Engineering related fields, and would value any input the council could give her.

Vice President Allen gave an update on what has been done to procure a permanent director by explaining that an advertising schedule is in place in a diverse selection of periodicals which include Mathematics, Engineering, Physics, Economics, Oil & Gas, and Geophysics. The Council discussed the search process for a director indicating that it was the legislature's original intention that the largest sweep possible be made for a director; whether a search firm should be used; the background the candidate should have since the position involves a combination of several energy related areas. All members are to send Vice President Allen names of reputable search firms. A copy of the employment ad used for the Director is attached as Appendix D.

Vice President Allen explains two ways council members could be involved in the process of hiring the director. One is on the front end, which is where we are now, by recommending people, and providing guidance from an industry perspective. Secondly, members could be involved with the final interviewing process. President Buchanan stated that the council would be kept apprised on a regular basis of the status of the search.

President Buchanan explained that the director will report to the VP of Academic Affairs, who reports to the President, and who ultimately reports to the Board of Trustees. The Director will necessarily keep UW Energy Resources Council apprised of the School's activities.

### **Hiring of the Four Authorized Professorships**

Frost stated that these searches are underway, and individual departments would be placing ads, and will review applications in December, 2006, in hopes of faculty beginning in summer or fall of 2007. This gives quality professors time to wrap up current teaching positions and start at UW. Specific ads can be viewed on the UW web site, and specific job descriptions, which all will include teaching, are communicated to faculty by the hiring dean. A copy of the hiring rationale is attached as Appendix E.

### **Links between Academic Units with the University**

Vice President Allen explained how geology and geophysics, physics, engineering, mathematics, and economics are linked together to assist in solving industry related energy issues. A copy of his handout is attached as Appendix F.

### **Review of Annual Report to the Wyoming Legislature**

Vice President Allen began by addressing a question raised by Chairman Harper about the partnership in paragraph three of Appendix B. Vice President Allen explained that the approved budget includes matching funds with the National Science Foundation to fund five undergraduates to the program in the summer of 2007; however, it may not happen until 2008.

### **Interim Director**

Stroock wanted to go on record strongly endorsing the appointment of Carol Frost as Interim Director, and a motion was made and unanimously accepted to endorse Frost's appointment.

### **Arrangement of Council meeting with Board of Trustees**

President Buchanan discussed the following dates of October 26, December 7, 2006, and January 25, 2007 as possible dates for the council and trustees to meet together, and he would communicate with everyone on an acceptable date.

### **Methods, Plans, and Programs for Contacts and Exchanges of view of Industry Players**

This item was tabled for a later date.

Chairman Harper asked the council and they agreed, if it was acceptable for him to discuss future meeting dates with members and get back to them. Council Members will be notified about a future meeting date when minutes are distributed. He thanked the council for their time.

The meeting adjourned at approximately 3:00.

Respectfully submitted,

Ron Harper, Chairman



## Appendix A

### SER Council Meeting Agenda September 11, 2006

- 1) Roll Call
- 2) Approval of Agenda
- 3) Approval of Minutes
- 4) Financial Report
- 5) SER Director
  - a. Introduction of Interim Director
  - b. Review of duties & initial scope of work for Interim Director
  - c. Review hiring procedure of permanent Director
  - d. Determine Council's involvement in process
  - e. Determine relationship of Director with Council
- 6) Discuss process/progress for the hiring of the four authorized professorships
- 7) Discussion of links between academic units with the University
- 8) Review draft annual report to the Wyoming Legislature
- 9) Discuss & arrange meeting with UW Board of Trustees
- 10) Discuss methods, plans and programs for contacts and exchanges of view of key private industry players
- 11) Discuss Council work plans, meeting dates and schedules.

## Appendix B

### **Minutes of the University of Wyoming Energy Resources Council August 10-11, 2006**

#### Council members present:

Ron Harper – CEO& General Manager, Basin Electric Power Coop, (Council Chairman)  
Representative Tom Lockhart (Council Vice Chairman)  
Bobby Shackouls – Chairman (retired), Burlington Resources Inc.  
Paul Lang – President of Western Operations, Arch Coal Inc.  
Mark Davies – General Manager, Rio Tinto Energy America  
Rob Wallace- Manager of Government Relations, GE Energy  
Tom Stroock – CEO, Alpha Development Corp; former US Ambassador  
Keith Rattie – Chairman, President & CEO, Questar Corporation  
Senator Bill Hawks

Ex officio, UW President Tom Buchanan  
Ex officio, RIENR Director Harold Bergman

The Council convened at approximately 8:00 a.m. on August 10, 2006, at the University of Wyoming Centennial Complex.

#### **Welcome and Introductory Remarks**

UW Vice President for Academic Affairs Myron Allen welcomed the Council members and asked the audience to introduce themselves.

President Buchanan thanked the Council members for agreeing to serve on the Council and noted that the School of Energy Resources (SER) initiative received substantial support from the Governor and the Legislature. Buchanan explained that the link between UW's strong geology and geophysics and engineering units will aid in the success of SER and that UW has a significant commitment to the state in this endeavor. Buchanan stated that SER must be connected to industry in the state and guidance from the Council is needed to steer the School in the right direction.

UW Board of Trustees President Richard Davis also welcomed council members.

Speaking on behalf of the Legislature, Senator Hawks, Cochairman of the Joint Minerals, Business and Economic Development Interim Committee, reviewed the legislative history behind the SER enabling legislation, that resulted in the appointment of the Council. Representative Lockhart, Cochairman of the Joint Minerals, Business and Economic Development Interim Committee echoed Senator Hawks' remarks and thanked Vice President Allen for all of his work on the development of the SER.

## **History and Concept of the School of Energy Resources**

Vice President Allen commented that the SER was aligned with the mission of the University of Wyoming and provided a brief history of the development of the SER and the institutional setting at UW which included UW's mission and structure, academic organization and planning, role of the faculty, academic hiring cycles and facilities. Allen's power point is attached as Appendix A to these minutes.

The Council discussed the EOR Commission, its membership and the extent of its authority over Dr. Jim Steidtmann, Director of the Enhanced Oil Recovery Institute (EORI), who is appointed by and reports to Vice President Allen.

## **Overview of the Enabling Legislation & Logistics**

UW Vice President for Governmental, Community and Legal Affairs Rick Miller provided an overview of the enabling legislation and briefed the Council on logistics and statutes applicable to the Council, including Wyoming open meetings laws and the public records act, as well as the appropriation for the SER. The Council meetings are to be open to the public subject to limited exceptions, and the Council may hold meetings by conference call or over the Internet.

## **Institutional Setting**

Vice President Allen introduced Dr. Terry Roark, Interim CEO, Western Research Institute (WRI), and the Council discussed the WRI mission.

Allen provided a briefing on the UW institutional setting, including academic planning. A copy of his power point presentation is attached as Appendix B to these minutes. It was stressed that at UW, every faculty member teaches, without exception.

## **UW Research enterprise**

UW's Vice President for Research and Economic Development, Bill Gern, provided a briefing on the University's research enterprise. A copy of his power point is attached as Appendix C to these minutes.

President Buchanan commented that he has authorized Gern to hire another Associate Vice President to address the increasing workload in the economic development area.

The Council discussed carbon sequestration generally and the possibility of working toward developing a national carbon dioxide reserve. The Council discussed the notion of considering Coal Bed Methane (CBM) water as a commodity, similar to carbon dioxide.

Council member Keith Rattie joined the meeting during the discussion on the UW research enterprise.

Ex officio Council member Harold Bergman, Director of the Ruckleshaus Institute of Environment and Natural Resources (RIENR) provided an overview of the history and mission of RIENR. He noted that RIENR intends to partner with SER extensively.

Lockhart commented that several legislators had experiences with the Ruckelshaus Institute and believed that having Director Bergman on the advisory council would lead to a stronger SER.

Allen stated that RIENR and SER will be distinct but collaborating operations at UW. UW faculty members will be involved in both schools.

### **Governor's remarks**

Governor Dave Freudenthal and Energy and Telecommunications Policy Analyst Rob Hurless joined the Council. Governor Freudenthal expressed his appreciation to the Council members for their willingness to serve and urged them to consider the potential and future for the school. With seven council appointments to make, Governor Freudenthal indicated he appointed three members from the oil and gas industry, two from the coal industry and one that is involved with uranium and nuclear technologies as he wanted all aspects of the energy industry to be represented.

Board of Trustees President Davis emphasized that the Trustees want to listen as well as take advice and direction on how the school will come together. The School of Energy Resources is the highest priority on campus today and it is important to have the expertise that the Council brings to the School. President Buchanan wants UW to assume a larger leadership role in workforce development and addressing state needs. The Council will provide valuable direction to UW as SER is established.

Governor Freudenthal discussed his vision for the SER to raise Wyoming's level of involvement with the energy industry. He expressed his expectation that the Council would be working board that gave direction to the School, and these were not honorary appointments.

The Council discussed measuring progress and identified that SER should produce the kinds of graduates that energy companies want to recruit aggressively, and that when technological questions arise, UW should come to mind as the first resource for answers.

Governor Freudenthal asked the Council to take the ideas for the School of Energy Resources and evaluate them to see if they make sense. He reminded the Council and the University that they need not spend SER funding today if they are not comfortable. There is a sense of urgency with the SER, but there is no obligation to approve anything until the Council has had an opportunity to review the plans, express their views and provide direction. He stressed the importance of the director search the need for thoroughness. He commented that it is a great time to be the Governor of a commodity state and concluded by stating, "Let's build a better America."

President Buchanan briefly discussed SER fundraising efforts and the availability of state matching funds for a facility for SER. The Council discussed the process for hiring a director for the SER.

The Council adjourned at approximately 5:00 p.m.

### **Friday, August 11, 2006**

#### Council members present

Ron Harper – CEO& General Manager, Basin Electric Power Coop, (Council Chairman)

Representative Tom Lockhart (Council Vice Chairman)

Paul Lang – President of Western Operations, Arch Coal Inc.

Mark Davies – General Manager, Rio Tinto Energy America

Tom Stroock – CEO, Alpha Development Corp; former US Ambassador

Keith Rattie – Chairman, President & CEO, Questar Corporation

Senator Bill Hawks

#### Council members absent

Bobby Shackouls – Chairman (retired), Burlington Resources Inc.

Rob Wallace- Manager of Government Relations, GE Energy

The Council convened at approximately 8:00 a.m.

#### **Election of officers**

Representative Lockhart nominated Ron Harper to serve as Chairman of the Council.

Senator Hawks seconded the nomination. Ambassador Stroock moved that nominations cease and the council cast a unanimous ballot. The motion passed unanimously.

Senator Hawks nominated Representative Lockhart as Vice Chairman. Rattie seconded the nomination. Stroock moved that nominations cease and the Council cast a unanimous ballot. The motion passed unanimously.

#### **Approval of the academic plan**

Senator Hawks moved that in accordance with 2007 Wyoming Session Laws, Chapter 69, Section 2, that the University of Wyoming Energy Resources Council approve the academic plan for the School of Energy Resources as contained in the University's October 1, 2005 Academic and Financial Plan prepared for the Joint Minerals, Business and Economic Development Interim Committee of the Wyoming Legislature. However, this approval is conditioned upon and subject to the Council's right, which it hereby reserves, to consider and approve modifications to the plan in the future. Lang seconded the motion.

Rattie commented that he supported the motion on the floor, but would like to cite for the record that in the plan there may not enough emphasis on unconventional gas technology. He cited not just coal bed methane resources, but also tight sands gas and shale, which

are abundant in this state, most of which are uneconomical to recover with today's technologies. The motion passed unanimously.

The Council discussed scheduling the next meeting. Allen pointed out that a report is due to the legislature on October 1 and the suggested that meeting in about six weeks would accommodate that schedule. The Council agreed that the University would poll the Council to determine a suitable date for the next meeting.

### **Search plan for SER Director**

Vice President Allen provided an overview of the search plan for the director. A copy of his power point is attached as Appendix D to these minutes.

The Council discussed the proposed nine-month time line for the director search, which is similar to that undertaken for a college dean or senior faculty member, regarding which UW has substantial experience. The Council indicated a desire to balance the objectives of being thorough and inclusive, including identifying candidates from industry, but ensuring that a thoughtful selection was made and that the person selected would be successful in the position. The Council also discussed the possibility of an interim director.

Stroock moved that the council authorize the administration of the University of Wyoming to recruit an interim director, approve the proposed timeline to recruit a full time director position, and provide that persons from academia and industry will be eligible to be in the recruitment pool. Rattie seconded the motion. After discussion, the motion passed unanimously.

### **Discussion of SER Director job announcement**

Vice President Allen briefed the Council on a draft job announcement for the SER Director. His power point is attached as Appendix E to these minutes.

The Council discussed the draft and issues including the extent to which SER funding is stable, the relationship of the Director to the Council, whether the Director would be required to teach or whether teaching experience is a preferred qualification, and whether fundraising and development responsibilities should be referenced in the job description. Vice President Allen confirmed that he would take the Council's comments into consideration as the recruitment process moved forward.

### **Discussion of faculty hiring**

Vice President Allen briefed the Council on the faculty hiring process and the specific positions targeted in the first year. His power point is attached as Appendix F to these minutes.

The Council discussed the faculty hiring process, including existing University strengths in energy related disciplines, a list of the current faculty chairs at the University by discipline, the need to establish a truly distinctive school, assurance that these new positions who complement and coordinate with current faculty to develop a network of resources, that the initial faculty hiring would focus more on existing UW strengths, but that subsequent hires might be in other disciplines, and that positions would be qualified to address energy issues that might take years to resolve, e.g. gas trapped in tight sands.

College of Engineering Dean Gus Plumb described three principles that guided the identification of the first four faculty positions to be filled:

1. Avoid hiring in a discipline where UW had no existing expertise.
2. Ensure that disciplines relate to energy issues that are of critical importance to Wyoming, e.g. coal research.
3. Identify disciplines where there is national interest to enhance the capability to compete for external funding.

Hawks noted there was an attempt in the legislature to include uranium and other resources in the legislation, but it was rejected. Uranium as such was certainly not rejected, and should be a topic that SER addresses.

President Buchanan indicated that by approving the academic plan, the Council has given UW the formal action that was needed to move forward with the hiring process for the initial faculty positions, and no further formal Council is required. UW will consider and be directed by the Council's discussion as it pursued the recruitment of the four faculty described.

### **Academic coordinator's plan**

Dr. Andy Hansen, Professor of Mechanical Engineering, has agreed to serve as the Academic Coordinator for SER for the coming year. Hansen briefed the Council on the Academic Coordinator's plan for the coming year. His power point is attached as Appendix G to these minutes.

The Council discussed the Academic Coordinator's plan, including SER's participating in existing summer institutes, and expanding them, for K-12 students and teachers, how the curriculum is developed in University academic departments, and the Haub School of Environment and Natural Resources as a model for the interdisciplinary efforts pursued by SER.

### **SER Fundraising and Development Plans**

UW Vice President for Institutional Advancement, and UW Foundation CEO, Ben Blalock noted that Exxon focused their television advertising for the Masters Golf Tournament on its relationship with the Stanford School of Energy. There is clearly an opportunity for SER to collaborate with corporate sponsors. He briefed the Council regarding fundraising activities, including discussions with EnCana with the involvement

and support of the Governor, the State of Wyoming's endowment and academic facilities matching programs which have been extremely successful and continue to be funded by state government, and that fundraising for SER is the University's top development priority, including a \$40 million facility to house it. There will be a meeting with the Governor in Cheyenne with energy industry corporate leaders regarding support for SER, and he asked that the Council be represented there.

Senator Hawks nominated Council member Shackouls to be the contact between the UW Foundation and the Council. Representative Lockhart seconded the motion, and the motion passed.

### **SER Budget**

Vice President Allen briefed the Council on the SER's budget. His power point is attached as Appendix H to these minutes.

The Council discussed the SER budget including confirming that there were adequate funds to hire an interim director if necessary, the need to fund start up expenses of new hires, the expectation that UW provide a status report on the SER budget at each Council meeting, that the budget is part of the block grant but must be accounted for separately, and that funds could be carried forward to a subsequent biennial budget period.

Council member Rattie departed the meeting during the budget discussion.

Chairman Harper thanked the council for its vote of confidence in electing him Chairman. He indicated his management philosophies are communicate, communicate, communicate. He observed that the council has been charged by the governor and the legislature to help the university be successful in establishing and operating SER.

The meeting adjourned at approximately 10:30.

Respectfully submitted,

Ron Harper, Chairman

## Appendix C

### School of Energy Resources Financial Report September 7, 2006

<b>Original budget 7/1/2006</b>		\$12,071,997
<b>Actual expenses and obligations</b>		
Salaries		
Interim Academic Coordinator (A. Hansen)	\$41,065	
Interim Academic Coordinator summer salary	\$ 2,756	
Interim Director (C. Frost)	\$35,445	
Interim Staff Assistant (S. Schulmeyer)	\$28,503	
Miscellaneous Support	\$ 65	
Colloquium Speakers Series*	\$21,600	
Energy Resources Council expenses	<u>\$ 8,500</u>	
Subtotal		\$137,934
Distinguished faculty positions**		
Mathematics (flow through porous media)	\$103,513	
Geology/Geophysics (geophysicist)	\$ 99,442	
Economics & Finance (energy economist)	\$160,000	
Chemical & Petroleum Engineering (coal conversion specialist)	<u>\$135,000</u>	
Subtotal		<u>\$497,955</u>
<b>Balance</b>		\$11,436,108

\* Anticipated (based on 12 speakers)

\*\* Obligated and transferred to appropriate colleges

## **Appendix D**

### **Director University of Wyoming School of Energy Resources**

The University of Wyoming School of Energy Resources is a newly founded academic unit dedicated to energy-related teaching and research and dissemination of scientific, engineering and economic information to support energy-related activities of relevance to the state and nation. With new annual funding from the Wyoming Legislature, the School provides an outstanding opportunity for a visionary leader to build an interdisciplinary organization that will address the globally critical field of energy resources in a higher education setting. We welcome applicants from industry, academia, and other sectors.

The School of Energy Resources has three dimensions: 1) education, 2) research, and 3) outreach and service. The School has permanent funding for up to 12 distinguished professorships, to be allocated by the Director in an array of academic disciplines. Funding is also available for year-long distinguished visiting professorships, to be selected by the Director. Together with faculty from other academic departments, these faculty members will offer curriculum leading to interdisciplinary degrees in energy science and certificate programs in energy-related fields. The research arm of the School includes the Institute for Energy Research, which currently houses the Enhanced Oil Recovery Institute and which will establish other research centers related to the energy economy. An Energy Outreach Center will respond to the needs of Wyoming industry groups and state agencies for state of the art information about energy resources and technologies. For more information about the School, please visit <http://www.uwyo.edu/SER/>.

The Director will report to the Vice President for Academic Affairs. We seek an energetic leader with proven scientific and administrative skills who will work with the faculty in related academic units, who will develop the School of Energy Resources to its full potential as one of the world's top institutions in energy resources, and who will represent the School effectively to the university administration, to the energy industry, to state and national political leadership, and to the public.

Preferred qualifications include: 1) an earned doctorate; 2) an internationally recognized record of teaching and research in energy-related fields; 3) administrative experience that demonstrates vision, managerial ability, and communication skills; 4) the creative leadership needed to create synergy with other university programs and with industry; and 5) a commitment to integrating academics, research excellence, and the outreach mission of the School.

Applications should include a letter describing the applicant's qualifications and experience related to the position. Applicants should also include a curriculum vitae. For finalists, the search committee will ask for the names and addresses of three references. Review of applications will begin in November 2006, but applications will be accepted until the position is filled. The University of Wyoming is an equal opportunity - affirmative action employer with an institutional commitment to diversity. We encourage women and members of under-represented groups to apply.

Please send applications and nominations to:

SER Director Search, c/o Dr. Myron B. Allen  
Vice President for Academic Affairs  
University of Wyoming  
1000 E. University Ave. Dept. 3302  
Laramie, WY 82071

## Appendix E

### Hiring Rationale for Distinguished Faculty Positions in the UW School of Energy Resources

Departments of  
Chemical & Petroleum Engineering  
Economics & Finance  
Geology & Geophysics  
Mathematics

#### Overview

The first four distinguished faculty positions earmarked for the UW School of Energy Resources (SER) will help sustain and optimize the long-term production of fossil energy in the State of Wyoming by establishing a coherent body of expertise that spans the scope of energy-related issues. This new expertise will provide the leadership and interdisciplinary collaborations required to tackle the complex problems that arise in energy research from exploration to production to market analysis. Because the SER is intended to address several key areas of energy research (e.g., oil and gas reservoirs; coal conversion; the economics of energy markets), these first four positions are intended to strike a balance between breadth and depth.

Two of the proposed positions (Mathematics and Geology & Geophysics) focus on better understanding fossil fuel reservoirs. The **Reservoir Imaging/Petrophysics** position (**Geology & Geophysics**) will give UW improved expertise in the three-dimensional (3D) architecture and/or rock properties of fossil-fuel reservoirs, and the **Flow Through Porous Media** (**Mathematics**) position will provide greatly improved scientific computing power and techniques to effectively model and simulate physical problems. The Clean Coal Technology (**Chemical and Petroleum Engineering**) position will directly impact the Wyoming coal industry through the design and implementation of more effective coal conversion technology. Finally, the **Energy Economics** (**Economics and Finance**) position will enhance UW's essential role in providing energy market analysis, environmental impact studies, regulatory guidelines, and guidance to policy-makers, industry/government representatives, and academic researchers; this position will provide an umbrella for evaluating research in oil, gas, and coal technologies in a market perspective.

#### Potential specific interactions

The proposed Geology & Geophysics and Mathematics positions for the SER are directly synergistic in that both focus on the improved understanding of fossil-fuel reservoirs and flow of fluids through these reservoirs (i.e., porous media). The architecture of fossil fuel reservoirs is best determined through 3D seismic data visualization, in coordination with known geologic attributes including the distribution of stratigraphic rock units, unconformities, folds, and faults. The specific rock properties of the reservoir are attributes fundamental in the evaluation of enhanced hydrocarbon recovery and production. The mathematical analysis of flow through porous media involves a combination of analytical and computational approaches to model multiphase and multi-scale flow based on fundamental fluid mechanics and physical properties of the fluid and media. Numerical simulations based on these models are crucial in enhanced oil recovery and reservoir flow applications. We envision an enormous potential for the collaboration of an energy-oriented geophysicist interested in the architecture and rock properties of fossil fuel reservoirs and an applied mathematician focused on the modeling of underground fluid flow. Such collaborations could have significant applications to EOR projects as well as to the fundamental scientific problem of how fluids migrate in the subsurface.

While the proposed Geology & Geophysics and Mathematics positions focus on fundamental research issues of petroleum and gas production, the proposed Chemical & Petroleum Engineering and

Energy Economics positions focus on the practical and applied issues of energy production. The State of Wyoming currently produces almost half of the coal produced in the US and provides a significant portion of the country's electrical power. The reliance on coal as an energy source is not without problems. First, because of the high carbon to hydrogen ratio it produces more CO<sub>2</sub> per unit of energy production than other fossil fuels. Second, it is currently not readily useable as a transportation fuel thus its potential to reduce US reliance on imported oil is currently constrained. Third, in addition to CO<sub>2</sub>, combustion of coal to produce electrical power results in a number of other environmental problems; e.g., SO<sub>2</sub>, nitrogen oxides, mercury, and particulates. Fourth, in the arid locations where most US coal reserves are located there is a shortage of water necessary to provide cooling for conventional Rankine/Brayton/combined cycle power plants. Finally, the addition of new coal uses into the national energy system could have significant impacts in energy markets. Wider integration of coal into national energy system will require both engineering expertise and careful consideration of the potential economic outcomes of such initiatives. The position in Chemical & Petroleum Engineering will initially focus on conversion of coal to transportation fuels and coal gasification. More research is needed to develop the best method to gasify the coal in Wyoming. The position may also conduct research into the best methods of producing liquid fuels from syngas. The Energy Economist will provide essential input necessary to define how Wyoming's coal industry can best exploit a combination of new and existing technologies to optimize economic opportunities. Additionally, the economist will be required to consider the environmental impacts caused by increased energy production of all types on the landscape and local ecology, socioeconomic questions with respect to relevant regulatory and legal institutions and economic development impacts.

While it is anticipated the four initial distinguished SER positions will focus on specific areas of expertise as outlined above, significant interaction and interdisciplinary opportunities are anticipated to exist outside of the scope of these project areas. For example, significant and necessary opportunities will exist for collaboration among the economics and mathematics positions with respect to modeling and numerical simulation of economic outcomes in energy markets. Similarly, natural opportunities will exist between a geophysicist and chemical and petroleum engineer with respect to the definition of optimal production technologies to access underdeveloped energy resources.

#### **Department commitments to energy research and support of SER initiatives**

Each of the four Departments within which the first four distinguished positions will be housed has a pre-existing commitment to the areas research that will allow the SER to develop a coherent and strong body of expertise in energy research. The Department of Economics and Finance has an internationally recognized and established focus in resource and environmental economics and regulation and includes three endowed chairs specializing in these areas including the Stroock Professor of Environmental and Resource Economics (Shogren), the Bugas Professor (Barbier) and the soon to be hired True Chair in Energy Economics. Additionally, all of the economics faculty in the department have specific expertise and are actively involved in environmental, resource and energy research. Further, all hiring in economics, both current and anticipated is conducted with the goal of deepening this existing expertise and this departmental commitment will only be reinforced and further focused by involvement in the SER.

The College of Engineering has a core of faculty working on coal related research including a strong position in CO<sub>2</sub> sequestration and separation (Radosz, Shen, Adidharma, Morrow, Piri, LaForce), activity in enabling technologies like catalysis (Argyle), some base activities in gasification/fuel production (Bell and Harris), expertise in methane production from coal beds and related water problems (Uryniewicz, Bagley, Johnson, Niezgod, Tootle, Ogden), and activities related to clean-up of the products of coal combustion (Argyle, Sharma, Bagley, Radosz, Shen). In the future the department of Chemical & Petroleum Engineering will add at least two more people in Petroleum Engineering and one more person in coal conversion technologies.

The Mathematics Department has a 20-year history of contributions to computational modeling of underground flows, and applications to enhanced oil recovery projects. Existing faculty with expertise in Flows through Porous Media include Myron Allen, Benito Chen, Fred Furtado, and Long Lee; with expertise in Computational Fluid Dynamics include Sri Sritharan, Dan Stanescu, and Stefan Heinz; and with expertise in Scientific Computing include Dan Stanescu, and Manchung Yeung. The Mathematics

Department is committed to expanding its expertise in the modeling of complex systems in the sciences and engineering (see Math Plan Action Item 5), and foresees requesting 2–3 additional faculty in energy-related areas over the coming years.

Geophysics is a major strength in the Department of Geology & Geophysics, and we envision with the upcoming retirement of Professor Scott B. Smithson that we will be adding at least one more geophysicist to our tenure-track faculty within the next few years beyond the proposed SER position. Also, the top priorities for additional tenure-track faculty in the Department of Geology & Geophysics are low-temperature geochemistry and Earth-surface processes. Both of these disciplines have the potential to contribute to the SER as well as the School of Environment and Natural Resources (ENR). As energy development expands in Wyoming, environmental impacts will be critical issues that must be addressed within the SER as well as ENR. Geology & Geophysics anticipates that future hires in the next five years will contribute to the exploration for fossil energy sources and/or environmental aspects of the increased production of fossil-energy sources in Wyoming.

Involvement in the SER through the newly established positions will provide the strength necessary to allow each of the participating departments to take full advantage of federal funding opportunities in energy research while serving the State. Such opportunities will only further enhance the expertise in energy sciences at the University and will create the incentives to ensure that future faculty positions are dedicated to increasing this strength.

## **Attachment 1: Draft position announcements by Department**

### **Economics and Finance: Energy Economics**

The Department of Economics and Finance, in conjunction with the newly established School of Energy Resources at the University of Wyoming is searching for an Energy Economist and invites applications from all qualified applicants. The School of Energy Resources was created by the State of Wyoming to establish a coherent body of expertise that spans the scope of energy-related issues and envisions hiring 12 new nationally- or internationally-renowned faculty members with energy expertise. Candidates for this Economics position must be established scholars with a record of publication and research in the area of energy economics, with preference given to those researchers who have done interdisciplinary work in the areas of energy economics and policy, industrial organization, market structure and regulation, economic development. Only established researchers and faculty at the senior associate or full-professor level should apply. This will be primarily a Departmental research position attached to the School of Energy Resources with a limited and negotiable teaching load (primarily at the graduate level) in areas associated with energy and natural resources. The Department of Economics and Finance has an internationally ranked PhD program with an historic emphasis in natural resource and environmental economics, industrial organization, and regulation. The optimal candidate should also have an established record in the supervision and instruction of doctoral candidates. Consideration will be given to both traditional academic researchers and researchers who are not at academic institutions or currently involved in teaching duties. Salary and teaching load will be determined commensurate with the candidate's qualifications and preferences. Please submit a letter of application, vita, sample research papers, teaching evaluations (if available), and the name of three references. More information can be found at <http://business.uwyo.edu/econfin>.

Contact: Chair-SER Economics Search Committee at [rgodby@uwyo.edu](mailto:rgodby@uwyo.edu), or contact Robert Godby, Chair, Department of Economics and Finance, University of Wyoming, Laramie, WY 82071.

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### **Mathematics: Flow Through Porous Media**

The University of Wyoming Mathematics Department invites nominations and applications for a distinguished professorship in Flow Through Porous Media.

The position will play a key role in UW's newly founded School of Energy Resources (SER), which is dedicated to energy-related teaching and research and dissemination of scientific, engineering and economic information to support state, national and international energy-related activities. The distinguished position is one of SER's 12 permanently funded, distinguished professorships. For more information about the School, please visit <http://www.uwyo.edu/SER/>.

The Distinguished Professor will have broad energy-related mathematical expertise in topics such as the analytic and computational aspects of modeling flow through porous media, the mathematical analysis and numerical simulations of multiphase and multi-scale flow in enhanced oil recovery applications, and reservoir flow simulations.

□□ Candidates must be strongly committed to: shaping and developing the Department's research, curricular, and services roles in SER, developing interdisciplinary research initiatives, and supervising graduate students.

Candidates should possess a distinguished career in the mathematical sciences, an internationally recognized record of teaching, research and granting, and university and professional service appropriate for a tenured appointment at the rank of full professor. Candidates should also demonstrate effective leadership, communication, and administrative skills.

Salary will be competitive and commensurate with qualifications. Applications should include a letter describing the applicant's qualifications, a curriculum vita, and the names and addresses of four references. Review of applications will begin \_\_\_\_\_, but applications will be accepted until the position is filled. Send applications to: Distinguished Mathematics Position, University of Wyoming, 1000 E. University Ave., Department 3036, Laramie, WY 82071. The University of Wyoming is an equal opportunity/affirmative action employer, and encourages women and underrepresented minorities to apply.

**Geology & Geophysics: Senior-level position in geophysics as applied to fossil energy research**

This position is for an Endowed Chair in the newly created University of Wyoming School of Energy Resources (SER). The successful candidate will also be a tenured faculty member in the Department of Geology and Geophysics. We seek an individual who shows the potential to develop an internationally recognized, externally funded research program, will be involved in the undergraduate and graduate teaching mission of the Department, and will build on departmental strengths in structural geology/tectonics, sedimentary geology, geophysics, and environmental geology.

The Department of Geology and Geophysics (<http://home.gg.uwyo.edu>) invites applications for a senior-level position involved in cutting-edge research on reservoir imaging using 3D seismic technology *or* reservoir characterization using petrophysical techniques. In addition, the chair holder will teach undergraduate and graduate students in her/his area of expertise.

As the only public four-year institution of higher learning in Wyoming, the University enjoys a distinctive leadership role in the state and region. The main campus is in Laramie, a city of 27,000 people perched in a scenic valley between the Laramie and Medicine Bow Mountains of the Rocky Mountains. Laramie is a two-hour drive north of Denver, Colorado. More information about the University and its regional setting is available on the University's Web site, <http://www.uwyo.edu>.

The University of Wyoming is a Carnegie Foundation Research/Doctoral Extensive University. It offers the Ph.D. in 24 areas, the Ed.D, numerous M.S. and M.A. and specialized master's degrees in a variety of areas.

Complete applications include a cover letter, curriculum vitae, names and contact data for at least three professional references, and a brief narrative summarizing the candidate's experience in energy-related research and interest in the University of Wyoming. The Search Committee will begin screening on November 15, 2006; however, applications will be accepted until the position is filled. We expect to make an appointment effective Spring 2007. Send applications to: Distinguished Geophysics Position, Department of Geology & Geophysics, Dept. 3006, 1000 East University Avenue, University of Wyoming, Laramie, WY 82071. The University of Wyoming is an equal opportunity/affirmative action employer, and encourages women and underrepresented minorities to apply.

**The Department Chemical and Petroleum Engineering, Senior level position in Coal Conversion Technology**

The Department Chemical and Petroleum Engineering at The University of Wyoming has an opening for a distinguished Professor of Chemical and Petroleum Engineering. This position is for an Endowed Chair in the newly created University of Wyoming School of Energy Resources (SER). The successful candidate will also be a tenured faculty member in the Department of Chemical & Petroleum Engineering. We seek an individual who shows the potential to develop an internationally recognized, externally funded research program, will be involved in the undergraduate and graduate teaching mission of the Department, and will build new strengths in the department in Coal Conversion technologies.

Candidates who possess an earned doctorate in Chemical Engineering or a closely related field and who are interested in developing an externally funded research program in coal conversion, are invited to mail or email their application, resume, statements of teaching and research interests, and contact information for at

least three referees to Dr. Brian Towler, Head, Department of Chemical and Petroleum Engineering, Dept. 3295, 1000 E University Avenue, University of Wyoming, Laramie, WY 82071. Email to [margep@uwyo.edu](mailto:margep@uwyo.edu) Tel: (307) 766-2500. We will begin the application review process in January 2007. The University of Wyoming is an AA/EEO employer.

## **Attachment 2: Proposed advertising venues and modes of recruitment by Department**

### **Economics and Finance:**

Proposed primary advertising venue: Jobs Openings for Economists (JOE) website:

<http://www.aeaweb.org/joe/>

This is a site maintained by the American Economics Association and requires that all member organizations post their job openings on this site as a condition of membership. For this reason, this has become the primary economics position listing for academic researchers and teachers.

Additional Listing sites:

Journals:

Resource and Energy Economics (Elsevier): Top-ranked energy economics journal, Editor Jason Shogren, University of Wyoming, Department of Economics

Energy Journal (International Association of Energy Economics): Official journal of the International Association of Energy Economics (IAEE).

Search –related activities:

In addition to listing the position in the above venues we also propose to conduct an energy colloquium in the early Spring of 2007, inviting important researchers in the field of Energy Economics to present papers and leading to conference volume published as a special issue of Resource and Energy Economics. In this colloquium we will highlight the opportunities for an Energy economist at the University of Wyoming, including the SER and True Chair positions.

### **Mathematics:**

Primary venues:

American Mathematical Society Notices  
Society for Industrial and Applied Mathematics  
Employment Information in Mathematical Sciences (electronic)

Additional venues:

NA-net (list-serve for numerical analysts  
Institute for Mathematics and its Applications website

### **Geology & Geophysics:**

Primary venues: AAPG Explorer, EOS, Geotimes.

### **Chemical & Petroleum Engineering**

Proposed advertising

In CEP (Chemical Engineering Progress, the AIChE publication), in print, as a boxed in ad, two months, on their website, 3 months)

In Chronicle of Higher Education; in print, one month, on their website, 3 months)

Academic Keys (web site and monthly e-flyer, 4 months/one price)

Also at these websites; UW Human Resources, CPE website, HigherEdJobs.com

### **Attachment 3: Proposed job descriptions by Department**

#### **Economics and Finance:**

Duties as a percentage of time in an academic year:

Teaching:	25%	(two 3-credit hour classes/academic year) This load may be split as a 0-2, 2-0 or 1-1 load across Fall and Spring semesters. If necessary, this will be negotiable down to a single 3 credit-hour course obligation in an academic year.
Service	5%	
Research:	70%	

#### **Mathematics:**

##### **Proposed rank: Professor**

Duties as percentage of time in an academic year:

Teaching:	40%	Develop and teach energy-related courses at both the undergraduate and graduate level, supervise student research projects. The typical load is 3 courses/year.
Research:	50%	Conduct interdisciplinary research on Flow Through Porous Media, establish collaborative projects with other members of SER and with faculty in mathematics department, seek external funding to maintain internationally recognized research program. Mentor undergraduate and graduate student research.
Service:	10%	Oversee development of undergraduate and graduate curriculum that provide necessary mathematical tools for energy-related majors, develop material for science/math educators workshops, play active role in ISC, and serve on departmental, college and university committees.

#### **Geology & Geophysics:**

**College:** Arts and Sciences

**Proposed rank:** Professor of Geophysics

#### **Chemical & Petroleum Engineering**

**Salary (9 month):** \$140,000 to \$160,000

##### **Job description.**

Research will be approximately 50%, teaching 37.5% (3 courses per year), service and advising 12.5%.

#### **Attachment 4: Space, support and computational resources required by Department**

*School of Energy Resources, not directly related to any particular department of position:*

##### **Visualization Center for the SER:**

Because fossil fuels are found largely underground, and therefore hidden from direct view, technologies as the above descriptions of the research and potential collaborations among the first four distinguished faculty in the SER make clear, a successful SER will require a modern facility for 3D visualization. Such a center would improve communication and collaboration among all the diverse research groups involved in SER. In that light, we suggest that in the first year of the development of the SER a **Visualization Center** be established on campus. Possibly this center could be located in the existing WYGIS facility. Such a center would be a major infrastructural attraction for the first four faculty hires, as well as for future hires of the SER, many existing faculty and researchers, and industry partners. We recommend that the SER Steering Committee evaluate the possibility of acquiring a new visualization center for UW, perhaps using unexpended first-year funds from the SER budget. For an example of the sort of center that might be built, see <http://www.siovizcenter.ucsd.edu/>.

*Departmental space, support and computational resource needs:*

##### **Economics and Finance;**

Space: Required office space for full-professor is available in Ross Hall in the Department of Economics and Finance. No additional space requirement is anticipated.

Start-up Costs: One-time start-up costs:

Computer: \$5,000 (includes related equipment and software)

On-going Research Support:

Research Support: \$5,000/year Given this is an equivalent position to an Endowed Professorship in our Department, the standard start-up/Research Support budget should be expected. This cost includes support for travel to research conferences, research materials and support.

Research Assistance: 1 RA/GA per year (currently \$14,003/year plus tuition fees and benefits).

##### **Mathematics:**

Space:

Contingent upon receiving promised space in basement of Ross Hall, there should be sufficient office space available for the personal office space of Distinguished Professor, 1-2 Post-Docs, and 2-3 additional graduate students. Space for a Parallel Algorithms Lab for students and researchers, and a related consulting office would be harder to come by. One solution would be to re-model offices in Ross near the existing ISC computer room. This would require securing 2-3 additional offices for faculty and graduate students in Ross Hall.

Estimated start-up costs:

Moving/Relocation	\$15,000
Office/Equipment	\$15,000
Parallel Computing Cluster	\$70,000

Infrastructure needs for Parallel Computing Lab	\$100,000
Total	\$200,000

Role of Computational Science in position:

The position in Flow Through Porous Media significantly involves computational science. Its research focus is on the analytic and computational aspects of modeling flow through porous media, the mathematical analysis and numerical simulations of multiphase and multi-scale flow in enhanced oil recovery applications, and reservoir flow simulations. The position will establish a parallel computing lab under the auspices of UW's Institute for Scientific Computation. This lab will provide the resources and capabilities (e.g. grid computing, algorithm development, and simulation techniques) needed to perform cutting-edge research in energy-related fields. In addition, it will serve as a training lab to equip undergraduate and graduate students with parallel computing skills.

**Geology & Geophysics:**

Space: Required office space for full-professor is available in Earth Science Building in the Department of Geology & Geophysics.

Given that EORI/IER is presently being housed in the Department of Geology & Geophysics, space for post-docs and graduate students of the new SER Endowed Chair in geophysics may be problematic unless EORI/IER is given space in another building in AY07–08. EORI/IER was originally given substantial space in Geology & Geophysics when these combined institutes were formally part of the Department of Geology & Geophysics.

Estimated start-up costs: \$250,000

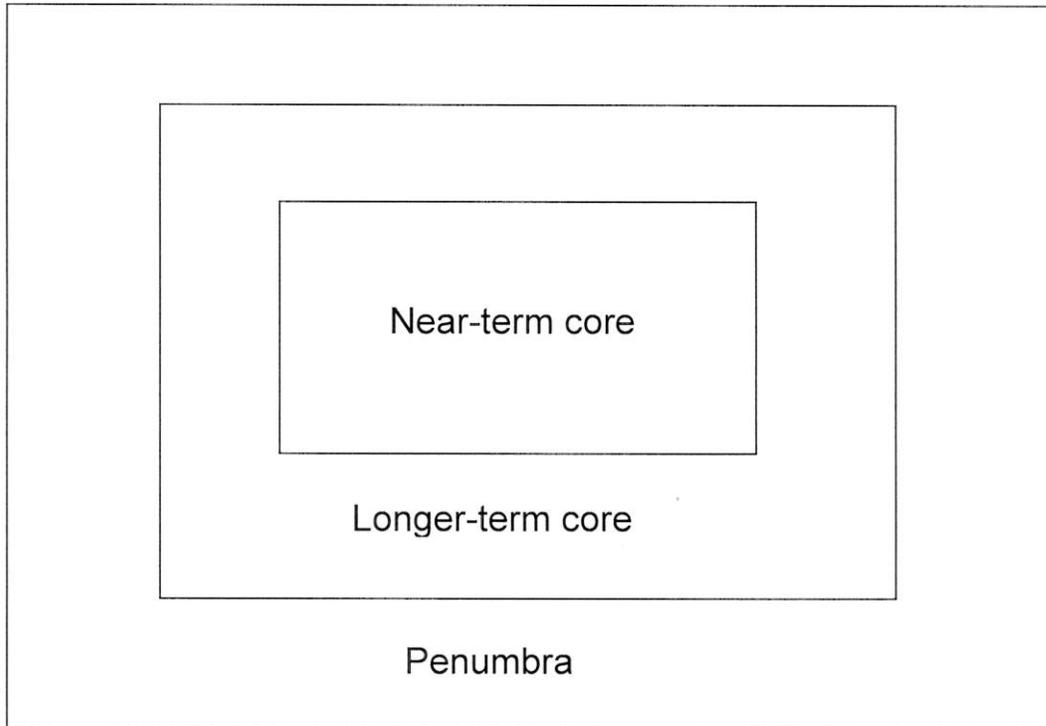
**Chemical & Petroleum Engineering**

Space: Currently we do not have sufficient space for the planned expansion in Petroleum Engineering and we will not have sufficient space for this position either. In addition, space commitments can only be made by the Dean of Engineering. We do have a large lab space in L-30 of engineering which would be a suitable lab space for coal research. But the incumbent may also require off-site facilities such as at WRI's north site. We also have some offices occupied by graduate students and post-docs which could be converted to faculty space but there will not be sufficient office space for this position and their graduate students and research staff. This is a critical situation that would be alleviated by a new building for the School of Energy and/or Chemical and Petroleum Engineering. It would be appropriate to assign one GA to this position on a permanent basis.

Estimated start-up costs: \$300,000.

## Appendix F

### School of Energy Resources: Disciplinary Focus Areas

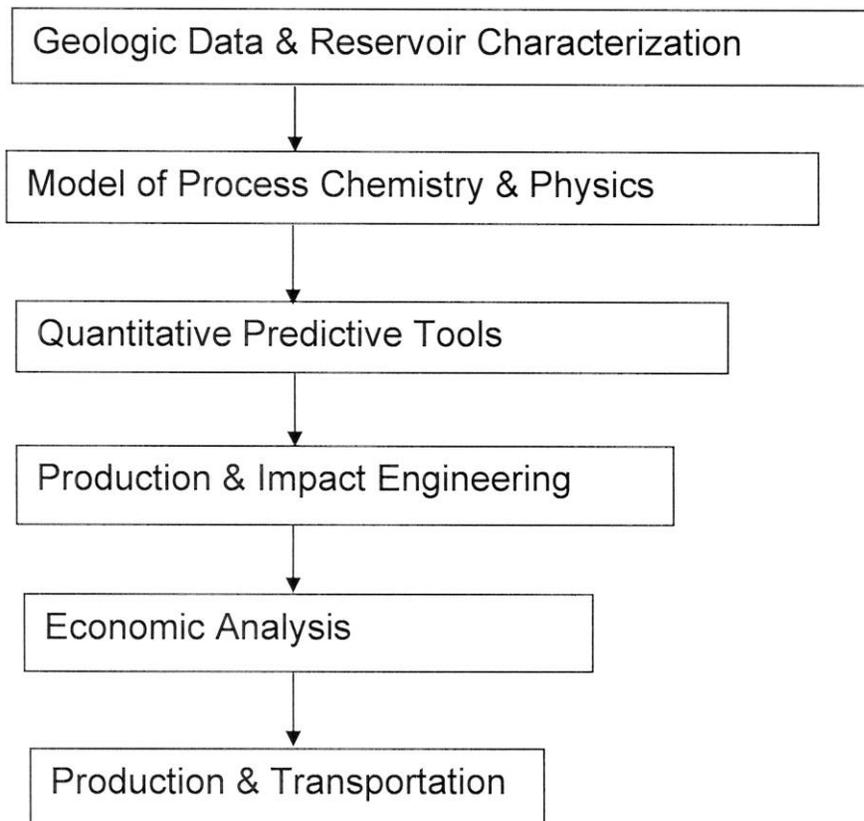


**Near-term core:** Areas of science, engineering, and economics that are directly relevant to major elements of Wyoming's current energy portfolio. (These elements are also of critical interest to the national and worldwide energy picture: fossil fuels and the technologies needed to produce, transport, and utilize them, including the management of their environmental impacts.)

**Longer-term core:** Areas of science, engineering, and economics that are relevant to the longer-term energy picture: wind energy, solar energy, nuclear power, emerging technologies.

**Penumbra:** Disciplines necessary for the analysis of energy policy, community impacts, legal issues, and other aspects.

## Near-Term Core: The Knowledge Cascade



### UW's Expertise:

**Geologic Data & Reservoir Characterization:** Geology & Geophysics, Chemical & Petroleum Engineering, Wyoming Geographic Information Science Center

**Model of Process Chemistry & Physics:** Chemical & Petroleum Engineering, Mechanical Engineering, Chemistry, Mathematics

**Quantitative Predictive Tools:** Chemical & Petroleum Engineering, Mathematics, Computer Science

**Production & Impact Engineering:** Chemical & Petroleum Engineering, Renewable Resources, Civil & Architectural Engineering

**Economic Analysis:** Economics & Finance, Agricultural & Applied Economics

**Production & Transportation:** Chemical & Petroleum Engineering, Civil & Architectural Engineering, Electrical & Computer Engineering