

ERC Meeting Minutes
Teleconference – SER Conference Room
Strategic Planning Discussion
January 28, 2011
8 am - Noon

ERC Members Present via Telecom:

Ron Harper, Tom Lockhart, Jim Kleckner, Keith Rattie, Paul Lang, Tom Buchanan, Rob Wallace, Indy Burke, Kit Jennings

ERC Members Absent:

Carl Bauer
N. Maha Mahasenan

SER Staff In Attendance

Mark Northam, Mary Byrnes, Diana Hulme, Don Roth (via Telecom), Pam Henderson, Sarah Schulmeyer, Cath Harris, Ron Surdam, Shanna Dahl, David Mohrbacher

Others Attending – via Telecom:

Kari Gray – Chief of Staff, Governor's Office
Shawn Reese – Policy Director, Governor's Office

Agenda and Background information: *Appendix A*

Meeting commenced at 8:00 AM

Ron Harper conducted the meeting. Thanked members for participating in the meeting. Meeting was voice recorded. (MP3 File archived by SER and available by request)

Ron Harper – Goal is to look at what has been accomplished and to identify what is to be accomplished in the future.

Mark Northam – Three main topics to discuss. 1) Present the baseline and seek concurrence that the goals in the original visioning document have been achieved. 2) Review Don Richard's memo and make assignments. 3) Begin discussions for creating a 5-year strategic plan for SER.

Agenda Topics

Item 1: Concurrence of status of SER versus expectations set forth by Vision Document of October 2005. *Appendix B and C.*

Summary: After discussion of accomplishments and modifications to original goals (i. e., investing in development of an editorial/journal within Outreach, hiring a research professional instead of the 12th faculty member and not developing a teacher intern program on campus), ERC generally concurred that the original vision for building SER has been essentially met. ERC

noted that initiatives described above were not accomplished due to a change in strategic change in direction not a failure to initiate and complete.

Action Taken:

Lockhart moved to archive the original 5 year vision document and commence new vision/strategic plan. Lang – Seconded the motion adding the council was satisfied with the progress and modifications of the original visioning document.

Council voted unanimously in favor of the motion. (9:00 AM)

Item 2: Addressing critical recommendations from Don Richards' brief (Appendix D)

Action Taken – Directives:

Mark Northam & SER staff directed to draft one-page descriptions of the roles and responsibilities of SER, ERC, and CCTF. Furthermore, Mark Northam and SER staff were directed to facilitate drafting a Memorandum of Understanding between the CCTF and UW, sample contracts for CCTF-funded projects, and a request to the WY Attorney General for advice on legal representation. Tom Buchanan will ask Don Richards to be available to assist.

Process- Mark will send out draft documents for concurrence to the ERC requesting their reply via email. This record of approval will be considered as “approved – pending formal action at the next ERC meeting. All agreed.

Timeline:

- Draft one page description of the roles and responsibilities of SER, ERC, CCTF to communicate clarity to stakeholders (UW Administration, Legislature, Board of Trustees)
 - ✓ Draft by Feb 11th
 - ✓ Final by Feb 28th
- Clear articulation of the different roles and structures between CCTF and ERC, including
 - ✓ MOU between CCTF and SER/UW for organizational and operational relationships
 - Draft – Feb 11th
 - Final – Feb 28th
 - ✓ Contracts directly between CCTF and grant recipients, managed by SER, or SER/UW delegated responsibilities for contracts –This will be organized after WY Attorney General advises on legal representation for CCTF, and the MOU is in place.
 - Draft – April 15th
 - Final – April 29th
- ✓ Legal representation as recommended by the Attorney General's office
 - In place by March 31

In addition, Ron Harper agreed to send a letter to BOT President Jim Neiman and cc Tom Buchanan requesting a BOT member to serve on the ERC as ex-officio.

Timeline: Feb 11th

Item 3: 5-year strategic plan

Mark with SER staff was charged to develop a 5-year strategic plan for continued operation and development of SER.

Process:

This is the first stage in creating a comprehensive strategic planning document. Mark will compose a draft for ERC and seek concurrence. It will then be taken to UW administration for review and comment. Roll it out to deans and directors for their feedback. It will be finalized and sent to ERC for final review. Incorporate it into the SER annual report by mid July. This document will be introduced to Minerals committee in September following the current report schedule and support the budget request for FY 13/FY14. The document will recognize UP3, 10 year capital facilities plan and the 50 year long range development plan of the University.

- Roundtable discussion of each energy sectors resulted in :
 - ✓ Help identifying gaps in knowledge via outreach to industry, communicating what SER is doing to help industry recognize potential and value.
 - ✓ ERC provided input on the macro trends in the industry that will help reach a consensus to provide a basis to be sure school is moving in the right direction. Also suggested interactive meetings with key sector stakeholders for the same purpose.
 - ✓ Metrics – revenue stream, policy development, potential improvement and potential detriment from challenges by policy and technology. Need to formalize metrics and where macro trends are taking WY.
 - ✓ Focus on economic drivers and impacts of all fuels.

a. Expectations of Stakeholders: Revalidation with Legislature and Governor.

ACTION: Tom Lockhart will follow up with Speaker of the House, Senate President, and JAC Chairs

ACTION: Ron Harper and Tom Lockhart will meet with the Governor on Feb 3.

b. Achieving Appropriate Balance of Funding Among SER Areas (Academics, Research, Outreach, and Administration)

- Emphasize importance of interdisciplinary programs: Focus on economics, law, and policy of great importance in addition to science and engineering. Important for UW to strive to get back to the 1990's level of preeminence in delivery of curriculum, development of technology and graduate focus (Petroleum Engineering, for example).

No change in funding balance across faculty, research, outreach and administration suggested.

- Budget: Under the belief that AML funding will come to an end, SER may be rolled into the UW Block Grant. The budget request will come from UW and not the Governor as in the past. Tom Buchanan told the ERC members that SER would not compete for funds with colleges and other UW current activities. Growth would be factored into the budget. Tom Buchanan is advising legislators that to keep the core business of SER it would take \$6 M per year, and that opportunity creation would be budgeted at an additional \$4 M per year. Tom Buchanan advised that the legislature does not fund O&M for new buildings and this expense is not attractive for, or generally included in, private donations.

Growth for the energy assets of SER is for the university and not to grow the school. To capitalize on the past state investment on energy related assets will require new talents and focused personnel.

- Centers of Excellence: SER provides / provided seed money to Centers of Excellence (CoE) but over the long term they are to become self-sufficient. There are 9 centers up and running and Carbon Management, Center for Fundamentals of Subsurface Flow , Wyoming Reclamation and Restoration Center and Wind Energy Research Center are on their way to becoming sustainable. Other centers are younger and have not begun to seek outside funding. How long does SER carry the centers and help them continue to evolve to self-sufficiency? How does the money we invest in the centers help the state in the long run?

c. What metrics should SER develop to evaluate and report effectiveness and success? Mark explained the metrics he informally uses to navigate the efforts SER should be taking on. These are based upon each energy resource's contribution to the state – past, present and potential, 1) revenue stream, 2) potential for technology improvement, and 3) potential detriment from challenges by policy. The council agreed these need to be formalized and explained in the strategic document.

d. Appropriate balance among the energy sectors: The council discussed the importance of creating a new center focused on Oil and Gas to primarily take advantage of natural fracturing, early stimulation of oil shale plays with CO₂ and horizontal drilling. Discussion also included that SER organize industry/stakeholder meetings by energy sector to investigate the critical issues needing to be addressed in coal, oil and gas arenas. The strategic plan should take stock of WY resources putting them on a common metric as a way of communicating to stakeholders the rationale for shifts in emphasis.

e. Defining appropriate balance of focus and cooperation (State, Regional, National and International): ERC agrees that out of state collaboration and expending money on outreach is appropriate so long as it benefits Wyoming's interest and attracts other funding sources into the

state. No funds will be invested outside the state. Mark will include in the strategic plan how past dollars have been spent to Wyoming's benefit.

f. Commercialization: this is Research Office's responsibility – but it is imperative for SER to demonstrate return on investment and success. Expectation of UW is to “create and publish” whereas expectation of ERC is to create, publish and commercialize. Will continue to work with the Research Office to have the same level of emphasis for commercialization.

g. Reporting structure of SER: The council discussed this and concluded that the reporting structure of the SER should not be changed.

Meeting adjourned at 12:00 PM.

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General Background to set the stage for the discussion. Outline organized to correspond to the agenda on pages 3 and 4.

- 1) SER has now been in existence for just over four and a half years. The original plan for SER was expressed in the vision document authored by Myron Allen. The vast majority of the goals set forth in that document have been realized. A brief review of status and unattained goals is presented in *Review of Goals and Accomplishments.pdf*.
- 2) President Buchanan requested that Don Richards conduct an evaluation of ERC, SER, and CCTF in September 2010. He authored a brief that contained some suggested actions, most of which are still pending. A brief discussion of several items is intended so that direction can be provided and responsibilities assigned.
- 3) The heart of the teleconference is intended to discuss topics of importance to constructing a strategic plan for SER for the next 5 years. What follows is intended a background and to set the stage for discussion of each item.
 - a) Expectations vary somewhat among the principle stakeholders of SER. UW's main expectation remains consistent with the original vision: that SER focus resources on impacting the university's teaching and research missions – specifically to encourage an energy focus and to promote interdisciplinarity – and to facilitate stronger links to the state's schools and to the energy industry. I believe the Legislature shares that expectation, but places a higher degree of emphasis on SER focusing resources on incentivizing technical solutions to challenges faced by Wyoming's energy stakeholders. Defining the expectations of industry is more problematic. Those expectations range from SER supporting workforce development, appropriate technology development, and knowledge transfer, to more problem-solving specific to their particular interests. I believe all stakeholders share an expectation that SER remain focused on activities that will bolster Wyoming's economic development in the energy sector. Have we achieved the correct balance in allocation of resources to achieve the expectations?
 - b) Current budget allocation is:
 - 41% Academic (Faculty salaries, grad student support, K-12, support)
 - 38% Research (10% salaries for research directors and support, 20% Center of Excellence Support – growing, 8% opportunity creation – shrinking)
 - 10% Outreach (staff salaries, speaker series, workshops, symposia, marketing)
 - 11% Administration and office support
 - c) Open for discussion.
 - d) The distribution of funds allocated to SER over the past 4 years has been heavily influenced by legislative direction. The availability of AML funds and the governor's and legislature's desire to direct them back into specific energy sector interests has, perhaps, skewed funding in a direction that might have been different otherwise. The state has directed SER to invest the following funding:
 - \$32 million for clean coal
 - \$50 million for coal gasification
 - \$53 million for carbon management

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- \$1.6 million for uranium recovery

Clearly, the outside observer is led to conclude that SER's focus is coal. The distribution of SER's biennial budget is far more balanced across all energy sectors, but the magnitude of the directed funding masks that. This has become an issue, especially among those oil and gas companies that provided significant early support for SER.

- e) The source of funds for continued support of SER in the future is in question. With the building of the Energy Resource Center, the GE gasifier, the NCAR supercomputer, and the WY-CUSP storage project UW will have new research facilities, capabilities for collaboration and teaching, etc. A discussion of scenarios for growing the capabilities to use these resources to advantage and to incorporate them into UW's academic mission is proposed.
- f) Follow-on for the above but more externally focused.
- g) SER's mission is first and foremost directed by the needs of Wyoming. Opportunities exist to collaborate with those with like interests from outside of the state. Advice is being sought for the creation of guidelines for development of relationships and efforts external to Wyoming.
- h) Seeking a more definitive of ERC's views in the area of commercialization of SER-supported technology development in preparation for discussions with the Research Office.
- i) Do the existing structure of SER and reporting relationship of the director continue to be the optimum going forward (Item 3.c. in Don Richards' memo)

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ERC Teleconference – January 28th, 2011 Strategic Planning Discussion

Agenda Topics:

- 1) Concurrence of status of SER vs. Expectations set forth by Vision Document (see *Review of Goals and Accomplishments.pdf* for background)
 - a) Is the Vision Statement still appropriate?
 - b) Goals largely achieved or completely achieved
 - c) Expectations not achieved
 - i) Distinguished Teaching Internships – WY K-12 teachers on campus for academic year.
 - ii) Editorial Outreach Unit.
 - d) Remaining challenges to original intent
 - i) Achieving sustainability and independence of the Centers of Excellence
 - ii) Maintaining and engaging broad campus interest, support, and cooperation
- 2) Addressing critical recommendations from the Richards' Brief (*ERC Issue Brief.pdf*). Discussion topics might include:
 - a) One Page description of the roles and responsibilities of SER, ERC, CCTF to communicate clarity to stakeholders (UW Administration, Legislature, Board of Trustees, etc.)
 - b) An *ex officio* position for a member of the Board of Trustees on the ERC?
 - c) Don's suggestion not to change the structure or reporting relationship of SER, but to address tension through improved communication.
 - d) Clear articulation of the different roles and structures between CCTF and ERC, including:
 - i) MOU between CCTF and SER/UW for organizational and operational relationships
 - ii) Contracts directly between CCTF and grant recipients, managed by SER, or SER/UW delegated responsibilities for contracts.
 - iii) Legal representation directly from the WY Attorney General's office.
- 3) 5 year strategic plan (see background above). Discussion topics might include:
 - a) Define forward expectations of the key stakeholders in SER (UW, Board of Trustees, Legislature, Industry, Public).
 - i) Have they evolved from 5 years ago?
 - ii) How to balance differing and/or conflicting expectations of each?
 - b) Should the current emphasis of funds distribution (faculty, visiting faculty, and grad student salaries; matching funds for grant capture, seed money for new research centers, outreach events free to attendees, etc.) change?

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- c) What metrics should SER develop to evaluate and report effectiveness and success?
- d) Discuss what the appropriate balance among the energy sectors (oil, gas, coal, uranium, wind, solar, geothermal) should be in areas of research funding, outreach activities, faculty representation, degree offerings...
 - i) What should determine the balance (revenue to the state; potential revenue to the state; challenges and threats to current business; partner contributions; others)?
 - ii) How to seek concurrence among stakeholders for an appropriate balance?
- e) Should the next 5 year plan include growth in staff and/or faculty to meet expectations or achieve appropriate balance?
 - i) Define critical gaps in expertise (i.e., drilling, nuclear engineering, catalysts, material science, etc.)
 - ii) What are the benefits of SER vs. colleges filling those gaps
- f) SER services to non-UW stakeholders aside from traditional outreach – what areas, how to fund, how to manage.
 - i) ERC building – visualization, distance collaboration, short courses and training facilitation, laboratory research.
 - ii) Consulting through Centers of Excellence
 - iii) Privately funded research and technical services
 - iv) Publication of a Technical Journal
 - v) Others?
- g) Define appropriate balance of focus and cooperation (State, Region, National, International) going forward.
 - i) Should SER continue to seek international research collaboration and partners and what criteria should be used to guide us?
 - ii) Should SER seek to influence policy? If so, at what level and through what means?
- h) Should SER devote financial and human resources to commercialize research successes (understanding that we would have to work with the Research Office to reach agreement)?
- i) Given answers to all of the above, is there any imperative to suggest a change in the structure or reporting relationship of SER.

Primary Reference Documents:

1. 2005 Vision Document for SER authored by Myron Allen (Appendix A. in *ERCappendices.pdf*)
2. *Review of Goals and Accomplishments.pdf*
3. *ERC Issue Brief.pdf* – (Don Richards' memo dated November 4, 2010).
4. *General Counsel re clean coal task force erc 2.pdf*

APPENDIX B

Agenda Topic 1. Review of Goals and Accomplishments

January 2011 Status of SER compared to the Original Vision Document prepared October 2005, pages 3-5.

Vision Statement: *To ensure that Wyoming fulfills its promise to be a global leader in building a secure and sustainable energy future.*

A. Academics :

| | Goal | Accomplishment / Status |
|---|--|--|
| 1 | <u>Faculty</u> - permanent funding for 12 distinguished professors to attract faculty members who have achieved international recognition for their scholarship in fields related to energy. Professors who have expertise to teach in areas related to oil, gas, coal, CBM, renewable energy, and the economics of Wyoming's energy resources. | Have hired 11 or 12 Faculty Members in 7 departments – 5 full profs, 3 associate profs, 3 assistant profs. |
| 2 | <u>Curriculum</u> – a. Measures, such as augmented degree options and possibly a professional masters' degree program in energy science, to promote greater interdisciplinarity in energy related fields b. Re-institute the baccalaureate degree in Petroleum Engineering (not SER) c. Exploration of other curricular measures – d. Internship opportunity development | a. Energy Resource Science, B.S. fall 2009 – 29 students are enrolled; Energy Systems Engineering, B.S. fall 2009. b. BOT reinstated undergrad PE degree in 2005. c. Executive Certificate/Masters degree to be considered by BOT this spring. d. Active, and under development - tying scholarships to research to internships which can also lead to credit hour achievement. |
| 3 | <u>Links to Industry</u> a. Visiting professionals / professors b. Program of industrial subscribers, through which corporations can help fund faculty directed student research, provide venues for summer internships, and open doorways into energy-related careers. | a. 5 visiting faculty over past 3 years. Ultra Petroleum Visiting Chair in Energy established. b. Partnerships formed with the help of UW Foundation, internship work is being developed; Anadarko Fellowships awarded to faculty and grad students; Nielson scholarships for women, minority students in energy degrees. |

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| 4 | <p><u>Links to Wyoming's Educational System</u></p> <ul style="list-style-type: none"> a. Distinguished teaching internships for WY high schools and community college faculty members, providing opportunities for fully funded sabbatical leaves to teach classes at UW and to enhance their own backgrounds in energy related fields. b. Summer programs for high school teachers, offered either on the Laramie campus or through WEN, the statewide videoconferencing network. c. A summer program for Wyoming high school students interested in exploring potential careers in earth sciences, engineering and other fields related to energy production and research. d. A series of annual articulation meetings with Wyoming community colleges offering energy-related curricula. | <ul style="list-style-type: none"> a. Distinguished teaching internships investigated and rejected – insufficient interest from teachers. Energy Academies conceived to replace. b. Through the Summer Energy Institute 18 teachers attend energy content workshops to date. Additionally, SER co-sponsored the <u>2010 Math Institute</u> which 15 Wyoming middle/high school teachers attended and in 2009 SER co-sponsored a teacher workshop for 15 Wyoming teachers (HS/Community College/UW) <u>Teaching Geosciences in the Classroom</u>. c. SER has developed the Summer Energy Institute which 73 high school students have attended in the past four years; Energy Clubs are being developed in several WY community HS. d. Ongoing discussions are taking place with LCCC, Sheridan College, Gillette College, Central Wyoming Colleges. Annual articulation meetings have not been held. |
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B. Research

| | Goal | Accomplishment / Status |
|---|---|--|
| 1 | <p><u>Research Staff</u> - Permanent research staff and operating budget of UW's existing Institute of Energy Research (IER) which will continue to house the Enhanced Oil Recovery Institute and will incubate other research institutes related to Wyoming's energy economy as scientific advances and external funding permit.</p> | <p>Seven individuals hired solely to support research endeavor, including EORI. 9 centers funded with about \$3 million per year (FY11 & FY 12).</p> |

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| 2 | <u>Incentives for broad faculty contributions.</u> Three-year appointments that include half-time support and dedicated graduate assistants for faculty members in existing academic departments. These appointments will furnish the school's director with the capacity to offer sustained incentives for UW's departments to fill vacant faculty positions in areas that can support the IER – especially oil and gas, coal, coalbed natural gas and renewable energy resources. The appointments will be renewable at the discretion of the director. | This objective was considered and altered. Instead, 6 Adjunct Faculty have been appointed; 52 Graduate assistantships supported; various amounts of start-up funding for 12 newly hired non-SER faculty in energy related positions. |
| 3 | <u>Grant matching.</u> A \$1 million pool of matching funds. Faculty members participating in IER will continue to seek competitive external funding to support their energy related research. The proposed grant-matching fund will enable faculty members to compete for federal research grants from agencies, such as the US Dept. of Energy that require significant institutional or state matching commitments. | \$5 Million has been committed – \$24 Million total research value. Program being scaled back to accommodate increased funding to centers of excellence |
| 4 | <u>Links to Industry</u> An interdisciplinary technical advisory board to help steer the scientific work conducted under the aegis of IER. This board will include experts from internationally recognized industrial laboratories and national laboratories, representation from Wyoming's energy industries and state government, and academic representation from other universities with distinguished programs in energy research. | Energy Resources Council – created per statute. Governor continues to appoint appropriate new members as terms expire; Considering adding BOT member <i>ex officio</i> ; no representation from other universities. |

C. Statewide Outreach and Service

| | Goal | Accomplishment / Status |
|---|--|--|
| 1 | <u>Outreach.</u> A permanently staffed Energy Outreach Center dedicated to technical reports to support (a) sound energy project design, (b) scientifically-based analysis of energy resources, and (c) effective long-term energy planning. Purpose is to respond to needs of WY industry and state agencies for information about resources and the technologies and economic factors needed to produce, transport and use them. | Not accomplished nor in design or development. |
| 2 | <u>Links to Industry.</u> A team of non-faculty consulting specialists assigned to provide technical consulting, workshops, and regular symposia for independent energy producers, government agencies and communities. | ERC and EORC; individually selected steering committees for symposia. |
| 3 | <u>Statewide Coordination.</u> Cooperation and data sharing with other agencies directly associated with energy related activities, including the Wy State Geological Survey, the Western Research Institute, the Rocky Mtn Oilfield Testing Center, the Wy Oil and Gas Conservation Commission, the Wyoming Infrastructure Authority, the Wyoming Pipeline Authority and other appropriate agencies. | On-going collaboration with all listed; also, heavily involved with DEQ on carbon storage and air quality. |

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APPENDIX C

UNIVERSITY OF WYOMING SCHOOL OF ENERGY RESOURCES ACADEMIC AND FINANCIAL PLAN

October 1, 2005

CONTENTS

Abstract

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This version of the report incorporates a change in the name of the University of Wyoming Energy Resources Council, made on October 31, 2005 to avoid duplicating the corporate name of a previously registered organization.

ABSTRACT

In response to a legislative request, the University of Wyoming proposes to establish a School of Energy Resources. The school's mission will bolster Wyoming's economic development and the preparation of students in three major ways:

- Academics, through the addition of 12 new faculty positions, permanently dedicated to energy-related teaching and research in appropriate disciplines; curriculum and certificate programs relevant to Wyoming's energy economy; and stronger links to the state's schools and to the energy industry.
- Research, through a stably funded Institute for Energy Research that will include the existing Enhanced Oil Recovery Institute as well as additional externally-funded research centers focusing on such other energy resources as coalbed natural gas, coal conversion, and renewable energy. In the long term, these centers may change over time, depending on emerging trends in energy research and the availability of external funding. All research centers in the Institute for Energy Research will focus on energy resources of importance to Wyoming.
- Service, through a new Energy Outreach Center, whose mission will be to disseminate scientific, engineering, and economic information to support Wyoming's near-term and long-term energy-related activities.

To maximize the school's impact on the university's teaching mission — and hence its capacity to prepare students for energy-related careers relevant to Wyoming — the director will report to the Vice President for Academic Affairs. This reporting line, together with the state resources assigned permanently to the school, will enable the director to influence curriculum and scholarly activities in all seven of UW's colleges as well as in other key academic units. We also propose the establishment of a University of Wyoming Energy Resources Council, appointed by the Board of Trustees, that will provide guidance to the Trustees, President, and Vice President for Academic Affairs on the school's academic directions, research accomplishments, and outreach effectiveness. A staged funding plan will allow for the development of the school, including the hiring of a director, new faculty members, and other staff members, over the span of fiscal years 2007, 2008, and 2009.

1. INTRODUCTION

In response to a request by the Wyoming Legislature, the University of Wyoming proposes to establish a School of Energy Resources. The school's mission will have three dimensions:

- I. Academics. Strengthen baccalaureate and graduate teaching, to produce UW graduates who are equipped to work in fields integral to Wyoming's energy economy.
- II. Research. Advance the state of the art in energy-related science, technology, and economics through world-class research that attracts premier scholars and teachers to Wyoming.
- III. Statewide outreach and service. Support scientific, engineering, and economic outreach for near-term and long-range energy planning, through the open dissemination of information needed for energy-related activities in Wyoming.

Core questions. The organizing principles underlying the school will be a set of broadly framed core questions related to Wyoming's energy portfolio:

- ☐ How can Wyoming sustain and optimize the long-term production of fossil energy resources, through better geologic understanding, more powerful engineering design, more refined process modeling, more sophisticated economics, better business and regulatory practices, and enhanced reclamation?
- ☐ What curriculum will be required to prepare UW students for careers in Wyoming's current and future energy economy?
- ☐ To what extent can Wyoming produce energy from renewable and sustainable resources, including wind, solar energy, and possibly other resources?
- ☐ What are Wyoming's roles in the emerging and potential markets for carbon dioxide sequestration, hydrogen production, and transportation fuels derived from coal?
- ☐ What are the potential land-use and environmental benefits of optimizing production, for example through more efficient utilization of already developed fields and more effective management and utilization of byproducts, such as flue gas, fly ash, and coalbed natural gas water?
- ☐ What planning measures — technological, economic, environmental, and policy-related — will smooth Wyoming's transition to a long-range energy economy that may involve greater use of non-fossil energy resources?

Technological focus. The technological focus of the school will be in areas that (a) are directly related to Wyoming's energy portfolio and (b) have a foundation in UW's existing faculty expertise. In the near term, this portfolio includes oil, natural gas (including coalbed natural gas), coal, and renewable sources such as solar and wind energy. The school will also help UW maintain supporting expertise in such related fields as energy economics, reclamation ecology, carbon sequestration, coal conversion, energy conservation, legal and permitting issues, and electric power generation and transmission.

In the longer term, Wyoming's active energy portfolio may expand to encompass greater production of uranium, hydrogen, and possibly other resources. Recognizing that the specific research initiatives will need to evolve over time, we propose a structure that avoids over-specification, retaining the capacity to anticipate and accommodate intermediate-term and long-term changes in Wyoming's energy economy as well as to address the state's current needs.

Structural elements. The structural elements of the school will include the following, each of which is described in further detail in section 4:

I. Academics

- ☐ Faculty. The school will have permanent funding for 12 distinguished professorships, to help attract faculty members who have achieved international recognition for their teaching and research in fields related to energy. The intent of these positions will be to attract high-profile, senior scholars from outside the university who can (a) help in the ongoing recruitment of talented junior faculty members and (b) advance UW's teaching and curriculum in directions that both support the state's economic health and strengthen UW graduates' preparation for careers in energy-related fields. To ensure that these professorships remain focused on energy, the positions will belong permanently to the school, with the director of the school retaining control over their allocation among specific academic disciplines. Of special interest for the foreseeable future will be professors who have expertise to teach in areas related to oil and gas, coal, coalbed natural gas, renewable energy resources, and the economics of Wyoming's energy resources.

☐ Curriculum. Curricular initiatives will include:

- Measures, such as augmented degree options and possibly a professional masters' degree program in energy science, to promote greater interdisciplinarity in energy-related graduate programs.
- Re-institution of a baccalaureate degree in Petroleum Engineering¹. This initiative will be a matter for the university's Trustees to consider during the 20052006 academic year, independent of the legislature's action on the proposal for a School of Energy Resources.
- Exploration of other curricular measures — such as certificate programs in natural resource accounting and mineral property law and an area of emphasis in these subjects for MBA students — that can enhance the employability of UW graduates in energy-related fields. Such measures will also include the development of internship opportunities that will provide practical industrial experience for baccalaureate and masters'-level students.

☐ Links to industry. These links will include:

- Distinguished visiting professorships, aimed at attracting year-long teaching and research appointments for scientists, engineers, and other professionals who have attained wide recognition for their applied energy-related work in the industrial sector and in other applied settings.
- A program of industrial subscribers, through which corporations can help fund faculty-directed student research, provide venues for summer internships, and open doorways into energy-related careers.

☐ Links to Wyoming's educational system. These links will include:

- Distinguished teaching internships for Wyoming high-school and community-college faculty members, providing opportunities for fully funded sabbatical leaves to teach classes at UW and to enhance their own backgrounds in energy-related fields. Summer programs for high school teachers, offered either on the Laramie campus or through WEN, the statewide videoconferencing network.
- A summer program for Wyoming high school students interested in exploring potential careers in earth sciences, engineering, and other fields related to energy production and research.
- A series of annual articulation meetings with Wyoming community colleges offering energy-related curricula.

II. Research

- ☐ Research staff. Permanent research staff and an operating budget for UW's existing Institute for Energy Research (IER), which will continue to house the Enhanced Oil Recovery Institute and will incubate other research institutes related to Wyoming's energy economy as scientific advances and external funding permit.
- ☐ Incentives for broad faculty contributions. Three-year appointments that include halftime support and dedicated graduate assistants for faculty members in existing academic departments. These appointments, will furnish the school's director with the capacity to offer sustained incentives for UW's departments to fill vacant faculty positions in areas that can support the IER — especially oil and gas, coal, coalbed

¹ UW already offers the M.S. and Ph.D. in Petroleum Engineering, as well as a petroleum option in its baccalaureate program in Chemical Engineering.

natural gas, and renewable energy resources. The appointments will be renewable at the discretion of the director.

- Grant matching. A \$1 million pool of matching funds. Faculty members participating in IER will continue to seek competitive external funding to support their energy-related research. The proposed grant-matching fund will enable faculty members to compete for federal research grants from agencies, such as the U.S. Department of Energy, that require significant institutional or state matching commitments.
- Links to industry. An interdisciplinary technical advisory board to help steer the scientific work conducted under the aegis of IER. This board will include experts from internationally recognized industrial laboratories and national laboratories, representation from Wyoming's energy industries and state government, and academic representatives from other universities with distinguished programs in energy research.

III. Statewide outreach and service

- Outreach. A permanently staffed Energy Outreach Center dedicated to technical reports to support (a) sound energy project design, (b) scientifically-based analysis of energy resources, and (c) effective long-term energy planning. The purpose is to respond to the needs of Wyoming industry groups and state agencies for state-of-the-art information about energy resources and the technologies and economic factors needed to produce, transport, and use them.
- Links to industry. A team of non-faculty consulting specialists assigned to provide technical consulting, workshops, and regular symposia for independent energy producers, government agencies, and communities.
- Statewide coordination. Cooperation and data sharing with other agencies directly associated with energy-related activities, including the Wyoming State Geological Survey, the Western Research Institute, the Rocky Mountain Oilfield Testing Center, the Wyoming Oil and Gas Conservation Commission, the Wyoming Infrastructure Authority, the Wyoming Pipeline Authority, and other appropriate agencies.

IV. Administration

The school's director will report to the Vice President for Academic Affairs. Thus, in addition to managing a significant array of permanent resources, the director will have the administrative stature needed to address energy-related issues that cross existing departmental and college boundaries, as well as the academic reporting line required to influence curriculum, research, and faculty hiring. In addition, we propose the formation of a nine-member University of Wyoming Energy Resources Council, appointed by the Board of Trustees, whose mission will be to provide guidance from an industrial perspective to the Trustees, the President of the University, and the Vice President for Academic Affairs. Section 4 below reviews the details and rationale for this structure.

Deliverables. The mission of the school will be to answer the core questions posed above, which are long-term in scope, and to identify and address new energy-related issues as they emerge. To lay a solid foundation for this mission, the school will deliver several tangible benefits over the next five years:

- I. Academics: Stronger integration of energy issues in UW's academic mission, to support better interdisciplinary teaching in energy-related undergraduate and graduate programs.

These programs will produce graduates who are better equipped to contribute to Wyoming's energy economy. Specific initiatives include:

- a) Twelve new distinguished faculty positions permanently dedicated to energy-related subjects and having regular teaching assignments in academic departments (initiated in Fiscal Year 2007 and fully in place by Fiscal Year 2009);
- b) Stronger ties with the energy industry via visiting professorships (initiated in Fiscal Year 2008 and fully implemented by Fiscal Year 2009);
- c) Richer links to high-school and community-college curricula, through teaching internships, summer programs for high school teachers, and summer programs for high school students (initiated in Fiscal Year 2007 and fully implemented by Fiscal Year 2009);
- d) A revitalized baccalaureate program in Petroleum Engineering (initiated in Fiscal Year 2006; producing graduates by the end of the 2008-2009 academic year); and
- e) Exploration of curricular enhancements — such as a professional masters' program and certificate programs in energy resource accounting and legal issues associated with natural resource extraction — that can enhance our graduates' access to energy-related careers in Wyoming (initiated in Fiscal Year 2007 and ongoing after that).
- f) Establishment of an annual articulation conference involving Wyoming community colleges planning or delivering energy-related curricula, including Casper College, Western Wyoming College, and others as appropriate.

II. Research: The university will broaden the scope of the existing Institute for Energy Research. IER now houses the Enhanced Oil Recovery Institute. By the end of Fiscal Year 2007, IER will produce an incubation plan, outlining an array of new, externally funded research centers dedicated to other elements of Wyoming's energy portfolio. Examples of research centers envisioned for the near term include:

- a) The Enhanced Oil Recovery Institute, already in existence; b) A Coalbed Natural Gas Center;
- c) A Center for Coal Conversion Technologies; d) A Center for Renewable Energy Resources.

Groundwork for two such centers — a center for coalbed natural gas research and a center for research into coal conversion technologies — is currently under way at the university, in response to the federal Energy Act of 2005. Research centers focusing on long-term energy markets, carbon sequestration, and other topics may also prove viable. IER's incubation plan will examine the viability of centers of this type, based on estimates of the availability of external research funding from federal agencies, industry groups, and state agencies.

III. Statewide outreach and service: By the end of Fiscal Year 2007, the university will establish a new Energy Outreach Center, dedicated to:

- a) Dissemination of technical information on best practices in energy production;
- b) Statewide workshops and symposia on energy-related science, technology, economics, and legal and permitting issues, to support the needs of the energy industry as well as short-and long-term energy planning;
- c) Data sharing, as appropriate, with the Wyoming State Geological Survey, the Western Research Institute, the Rocky Mountain Oilfield Testing Center, the Wyoming Oil and Gas Conservation Commission, the Wyoming Infrastructure Authority, and the Wyoming Pipeline Authority.

The discussion below briefly describes Wyoming's setting in the energy economy, reviews the university's existing foundation in energy-related education and research, and describes in further detail the new school's structure and funding.

2. WYOMING'S ENERGY PORTFOLIO

Wyoming has a remarkable portfolio of energy resources. Oil, natural gas from various sources, and coal have been traditional mainstays of the state's natural resource base, and the state enjoys ample supplies of uranium, wind, and solar energy. While Wyoming's future economic health will depend in part on its ability to foster economic diversification beyond energy and minerals, production of energy resources is certain to be one of the state's economic anchors, not only for the near term but also for the more distant future.

The near term. For at least the next decade, four natural resources are likely to dominate:

- Oil. Wyoming has significant oil resources. As in many of the nation's oil provinces, most of the state's oil reservoirs are in declining production, despite the fact that the vast majority of the oil originally in place is still underground. Much of this oil is recoverable only through the application of enhanced and improved oil recovery. This suite of technologies requires geologic, engineering, and computational expertise more demanding and less firmly established than those used in exploration and primary recovery. Anadarko's carbon dioxide floods in the Salt Creek field and in the Monell Unit are indicators of the industry's current interest in enhanced oil recovery.
- Gas. The discovery and production of large natural gas reserves have increased over the past two decades. Much of this increase is attributable to two trends: (1) improved scientific methods for finding large, geologically anomalous gas deposits and (2) the emergence of technologies for producing natural gas from coal beds. The production of coalbed natural gas, in particular, has led to a distinctive set of engineering, environmental, legal, and socioeconomic issues. Among the most visible of these issues are those associated with split-estate property and the disposal of produced water. However, there are subtler issues of comparable importance, such as the unanswered engineering and scientific issues surrounding optimal production techniques.
- Coal. Wyoming continues to be the nation's largest producer of low-sulfur coal; indeed, the state's coal deposits rank with the largest in the world. Among the economically significant issues associated with this resource are: (1) Wyoming's distance from the nation's largest coal markets and the attendant interest in converting coal to other fuels, (2) the technologies and costs associated with effective mine-land reclamation, (3) the difficulty of mining Wyoming's enormous reserves of deep coal, and (4) emerging economics of carbon dioxide emissions and the resulting interest in advanced coal combustion and flue-gas separation technologies.
- Renewable energy sources. Wyoming is home to an increasing number of wind farms. While harvesting wind energy for electric power generation has many attractive aspects, significant barriers remain. One is the issue of land use and site selection, which has important environmental and social dimensions. Another is the array of technological problems associated with power conditioning and wind-turbine design. Tackling these problems will require advances in structural design, materials science, power-grid control, and electric power engineering. Wyoming also has hydroelectric generating capacity associated with the state's major water reservoirs. This capacity already plays a significant role in the regional power grid.

The longer term. Anticipating the energy economy of the more distant future is a less straightforward project. Arguments abound about how long traditional fossil fuels will remain viable and, therefore, how long they can sustain Wyoming and the nation. And there are many disparate opinions about which energy sources, production technologies, processing methods, and transmission and transportation modes deserve the most focused attention. Among the most vigorous debates are those surrounding solar power, nuclear fission, nuclear fusion, hydrogen, and such unconventional carbon-based resources as oil shale and synthetic fuels.

Although it is impossible to identify all of the critical energy-related issues that will emerge in Wyoming over the next few decades, the following observations seem reasonable:

- Enhanced and improved oil recovery techniques. The worldwide oil economy is undergoing fundamental change. Owing in part to rising demand in Asia, global oil consumption is growing faster than global production capacity. As these curves cross — possibly within the next decade or two — the attractiveness of oil as a *fuel* may diminish in favor of alternative energy sources. Even so, oil will remain an indispensable industrial feedstock for plastics, pharmaceuticals, and other products. Unless other raw materials are found, the manufacturing sector is likely to accommodate the high prices needed to support enhanced and improved oil recovery, regardless of the extent to which other resources replace oil as an energy source.
- Reclamation. Because Wyoming's coal resources are enormous, mine-land reclamation will continue to be an economically, environmentally, and socially significant activity. Similar considerations apply to the reclamation of lands and waters disturbed by energy development of all types. Reclamation ecology is already an important area of applied research, yielding practical advances that transfer quickly from the laboratory to the field.
- Coal conversion. Wyoming's distance from major coal markets and the depth of some of the state's large coal deposits will continue to spur interest in processes that convert coal to more desirable energy sources, such as hydrocarbon liquids or hydrogen. These processes may be of special significance in Wyoming's deep coal seams, where underground coal gasification offers a technically and environmentally promising way to extract energy, and at power plants, where integrated gasification combined-cycle processes can help control carbon dioxide emissions.
- Carbon sequestration. Burning fossil fuels releases carbon dioxide, the most important of the greenhouse gases. Owing both to the production of carbon dioxide from gas wells and to the venting of flue gas from large, coal-fired power plants, Wyoming is one of the world's largest per-capita emitters of greenhouse gas. By the same token, Wyoming has extraordinary capacity to sequester carbon dioxide underground. An unusually fortuitous opportunity for carbon sequestration exists in some of Wyoming's old oil reservoirs, where carbon dioxide injection can enhance the production of oil. Emerging interest in cap-and-trade systems for controlling carbon dioxide emissions may stimulate national and international markets for carbon sequestration, further increasing the economic viability of carbon dioxide flooding in several of Wyoming's important oilfields. Comprehensive economic and financial analysis of these markets and trends is essential for long-term energy planning in Wyoming,
- Long-range electric transmission. Wyoming possesses raw materials with which to generate electricity, but at present the transmission infrastructure limits our capacity to export this form of energy to other regions. Advances in power-grid capacity and stability, coupled with cleaner technologies for generating power, can help overcome this limitation.
- Local energy systems. Large-scale power generation and long-distance transmission will continue to dominate the electric power market for decades to come. But community-scale distributed power systems — such as those based on wind generators, active and passive solar systems, low-head hydroelectricity, and improved energy conservation — have the potential to meet many local needs. Although the lifestyle and infrastructural changes required will slow the widespread adoption of these systems, it is increasingly possible for these systems to mesh with large power grids and to reduce costs to consumers. In addition, local systems are less vulnerable to region-crippling failures resulting from accidents, human error, or sabotage.

- State and regional impacts. Global changes in the energy economy and their effects on the energy economy in Wyoming will have lasting impact on the region's development. These changes also have implications for the state's budgetary practices. Analysis of the economic and fiscal impacts of energy development is an integral part of planning for sustainable growth in the state.
- Nuclear power. Worldwide pressure to reduce carbon dioxide emissions is reviving interest in nuclear power generation. However, in contrast to the 1960s and 1970s, the public economics of nuclear power now includes the costs and risks of power-plant decommissioning and nuclear waste disposal. These costs may suppress the demand for uranium for many years to come, at least within the U.S. Still, despite the misgivings that dominate today's discussions, it is conceivable that advances in nuclear waste management and reactor design will rekindle interest in Wyoming's vast uranium deposits in the foreseeable future.
- Oil shale. The Rocky Mountain region — especially Wyoming, Colorado, and Utah — is home to enormous deposits of oil shale. As world prices for oil increase, the economics of in situ oil-shale conversion become more attractive. While these technologies have yet to prove profitable, the current world market for oil suggests that interest in oil-shale technologies may increase in the next few years.

Wherever these trends may lead, the long-term importance of energy resources for the Rocky Mountain region and the nation at large is clear. For Wyoming, with its rich natural endowment, energy-related education and research will be sound investments under any scenario.

3. THE UNIVERSITY'S EXISTING ASSETS AND PLANS

The University of Wyoming has significant assets in energy-related education, research, and service, including existing faculty expertise and curricula. The university also has a proven record of effective planning and allocation of faculty resources to strengthen its areas of distinction. These assets furnish solid ground upon which to build national prominence in energy-related education and research in Wyoming.

Existing assets. Among UW's longest-standing areas of faculty expertise is in earth and energy sciences. The Department of Geology and Geophysics is arguably the premier example. In addition to a strong faculty, nationally recognized degree programs, and outstanding classroom and laboratory facilities, the department is home to the Brinkerhoff Library of Earth Science and the Geology Museum, and it is adjacent to offices of the Wyoming State Geological Survey.

Other departments have maintained nuclei of energy-related expertise over several decades:

- The Department of Chemical and Petroleum Engineering houses expertise in petroleum reservoir engineering, coal conversion, catalysis, and gas separation. It also home to the current appointee to the Wold Energy Chair, Dr. Norman Morrow, one of only three faculty members in Wyoming's history to be elected to a national academy.
- The Department of Economics and Finance is recognized internationally for its contributions to regulatory and resource economics. It is home to several endowed faculty positions focused on natural resources, including the Stroock Professorship and Bugas Professorship, and it has recently secured an endowment for the True Chair in Energy Economics.

- The Department of Mathematics has a 20-year history of contributions to computational modeling of underground flows — a field that is critical to advances in the understanding and design of enhanced oil recovery projects and other processes for utilizing underground energy resources.
- The Department of Renewable Resources is home to the Wyoming Reclamation Ecology Center and several scientists having nationally recognized expertise in the impacts of coalbed natural gas production, carbon sequestration, and the utilization of coal conversion byproducts.
- The Department of Agricultural and Applied Economics houses faculty expertise in the community impacts of economic development as well as in the economics of carbon sequestration and coalbed natural gas water production.
- The Department of Chemistry is home to faculty members conducting research into fuel-cell technology.
- Many other departments contribute in areas relevant to the energy industry. For example, the Departments of Chemistry, Mechanical Engineering and Physics and Astronomy have launched a research program in materials science. The Department of Electrical and Computer Engineering has faculty expertise in electric power transmission and network control. The Department of Civil and Architectural Engineering has expertise related to water resources and energy-efficient building design. Several of UW's engineering, life-science, and social science departments house research into the atmospheric, biological, and social implications of energy production.

In addition to mainstream academic departments, the university has several institutes and centers dedicated to disciplines having close links to energy resources:

- The Enhanced Oil Recovery Institute (EORI) and Institute for Energy Research (IER) have served for two decades as institution-wide platforms for interdisciplinary research, involving faculty members from several academic departments as well as research scientists of its own. After a decade of diminished industrial funding for enhanced oil recovery, these two institutes have recently launched a legislature-funded suite of research activities aimed at fundamental research and technology transfer related to improved waterflooding, CO₂ injection, and separation of power-plant flue gases.
- The Ruckleshaus Institute and Haub School of Environment and Natural Resources recently established an Energy Working Group, focused on natural-resource management aspects of enhanced oil recovery, coalbed natural gas, mine-land reclamation, carbon sequestration, and Wyoming's long-term energy planning. The Ruckleshaus Institute maintains a highly regarded and heavily used web-based Coalbed Methane Clearinghouse, and the Haub School recently launched a new course series in environmental sustainability, including important aspects of energy efficiency and renewable energy. At the request of Governor Freudenthal, the Ruckleshaus Institute has developed an extensive review of management options for the vast quantities of water brought to the surface during coalbed natural gas production.
- Western Research Institute (WRI), UW's technology development partner, serves private clients, industry, and government agencies on a contract basis. In addition to its research in transportation materials and environmental engineering, WRI houses expertise in alternative fuels, coal, oil and gas production, and heavy oil refining. WRI's Advanced Technology Center houses facilities to examine advanced coal combustion, coal-to-liquids conversion, fuel-cell and biofuel technologies, and environmental remediation technologies.

- The Wyoming Geographic Information Science Center, established as an outgrowth of UW's 1999 *Academic Plan*, is a national-caliber facility for the computational analysis of spatial data and remote sensing — tools that are critical to the design, siting, and monitoring of energy-related projects ranging from enhanced oil recovery to coalbed natural gas production to the reclamation of abandoned mine lands and the siting of wind farms. Geographic information science plays an increasingly important role in the reservoir characterization phases of energy project design.

In several of these units, programmatic strength and numbers of contributing faculty have fluctuated. UW is one of the nation's smallest public research universities. Consequently its energy-related expertise in any single department is sometimes one or two faculty members deep and vulnerable to unexpected resignations. At an institution of UW's size, effective depth typically requires interdisciplinary clusters of faculty, staff, and students working together for sustained periods of time. One purpose of the proposed school will be to serve as a nucleation site for clusters of this type, to sustain the curricular strength needed to train UW graduates for energy-related careers.

Another purpose of the proposed school will be to stabilize and broaden the scope of UW's externally funded energy research centers. For example, the existing Enhanced Oil Recovery Institute can focus on only one of many key energy research issues of importance to Wyoming, albeit an important one. Once a stably funded core is in place, the Institute for Energy Research will have the capacity to incubate and oversee an array of such centers, focusing on research in other critical energy-related technologies, depending on the availability of external research funding. In the foreseeable future, examples may include but are not limited to coalbed natural gas production, coal conversion technologies including underground coal gasification, and renewable energy research including wind energy production.

Institution-level planning. Academic depth also requires consistent, focused leadership. The university's *Academic Plan II*, approved by the Trustees in May 2004, calls for a new era in energy-related education and research, along with a commitment to dedicate resources to build and integrate the relevant disciplines. The plan calls for increased faculty strength in earth and energy sciences over the next five years, to be accomplished in part by the reallocation of faculty positions to these fields (Action Item 32).

Backing up these plans are several important management tools. Key among these tools is a system of central position management, which allows for the reallocation of faculty positions vacated by resignations and retirements. This system — relatively rare in public universities — allows the institution to redirect staffing resources toward areas of distinction identified in the *Academic Plan* and provides incentives for departments to align their faculty position requests with institution-level planning imperatives.

As necessary as the reallocation of existing faculty positions may be, it is not sufficient. It is unrealistic to expect that internal resource shifts away from other areas of the curriculum will be sufficient to build the faculty strength needed to ensure lasting national distinction in energy-related scholarship. The competition from larger institutions is simply too intense. To achieve national prominence, one must turn to more ambitious models, such as the Jackson School of Geosciences at the University of Texas at Austin and the Sarkeys Energy Center at the University of Oklahoma. Both of these organizations enjoy substantial and stable funding; they provide effective forums for cooperation among faculty from a wide variety of disciplines; and they help their host institutions to attract outstanding permanent faculty members from other institutions around the world. There are no such schools in the Rocky Mountain West.

In addition, it is unlikely that internal reallocation alone will allow UW to develop effective energy outreach within the time frame needed. Effective dissemination of information about energy technologies requires not only technological and academic expertise but also infrastructure: an editor, publishing facilities, consulting engineers and scientists, and production staff. Sustaining such an enterprise also requires the capacity to release faculty experts temporarily from their core teaching

duties, compensating their home departments to avoid adversely affecting the university's fundamental instructional mission. The budget proposed below includes resources to allow for these temporary changes in assignment.

Long-range flexibility. It is ill advised to prescribe for the long term how to allocate the school's permanent assets — such as faculty positions — among different areas of energy research. One reason is that the teaching and research needs associated with various energy resources overlap. The physics associated with coalbed natural gas production has important elements in common with those associated with enhanced oil recovery, for example. Another reason for not trying to apportion the school's funding strictly along resource categories or academic department lines is that the scientific principles used to recover energy resources change over time. For example, two decades ago the effects of geologic variability were a significant barrier to the realistic modeling of oilfield projects. But today, as a result of intensive research at major universities around the world, there are multiscale computational tools for this stage of project design, and the focus of computational modeling research has changed. Finally, as the past thirty years have demonstrated, the demand for energy resources changes over time, and as a result the research interests and workforce needs in energy-related fields fluctuate. Giving the school's director the permanent ability to shift faculty resources among disciplines to match these interests and needs — while still maintaining the focus on energy — is critical to the school's long-term success.

Impact on UW's mission. The most important impact that a School of Energy Resources can have on UW's mission is to enhance the university's stature in nationally recognized education and research in areas vital to Wyoming. By bolstering UW's ability to recruit high-caliber faculty members and by focusing on education in disciplines critical to the state's future, the school will enhance several of UW's existing strengths. It will promote greater interdisciplinarity in teaching and research, reinforcing the institution's contributions to Wyoming's economic development both through more effective preparation of graduates for energy-related careers and through the advancement of the state of the art in these fields.

4. PROPOSED STRUCTURE FOR THE SCHOOL

The School of Energy Resources will be an integral part of the university's academic mission, as shown in the first organization chart below. In particular, the school will be an academic unit managed by a director, who reports to the Vice President for Academic Affairs. To ensure lasting connections between the academic mission and the state's energy economy, we propose the establishment of a nine-member University of Wyoming Energy Resources Council that can provide guidance, from the perspective of Wyoming industries and state agencies, to the Board of Trustees, the President of the University, and the Vice President for Academic Affairs, as described in more detail below.

The director's role will be analogous to that of a dean of one of UW's seven existing colleges. Unlike a college, however, the school will not have a separate faculty or curriculum. Instead, the faculty and curriculum associated with the school will have homes in existing colleges, to ensure the stable and influential embedding of energy-related scholarship in a broad swath of the university's teaching and research missions.

However, the school's resources will not be entitlements. Instead, the director will be able to redirect them, as necessary, to departments and colleges that can make the most substantial commitments to the school's mission. The school will therefore have the administrative stature, fiscal resources, and infrastructure to influence the faculty hiring and curricular decisions made by college deans.

Rationale. The rationale for this structure is threefold: administrative stature, broad impacts on the university's educational mission, and market-like incentives for college deans to contribute.

The school's position in the university will give it significant administrative stature. The director will report to the university's chief academic officer, as shown in the diagram below. The director will also control a significant set of the most highly prized resources available in academic institutions: faculty positions. This structure will position the school to work influentially with the deans of UW's seven academic colleges and directors of other programs, will allow the director to draw on the talents of faculty members and students from many different disciplines, and will help insulate the school from college-specific budget decisions — decisions sometimes driven as much by transitory enrollment pressures as much as any long-range vision.

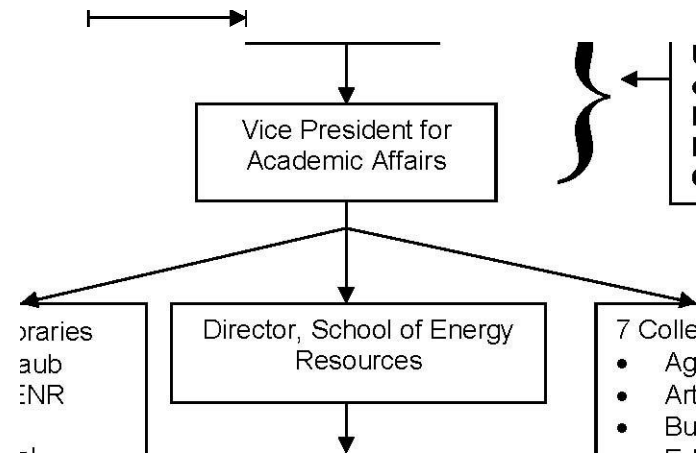
Other, more traditional structures — such as a separate college of energy resources or a separate institute dedicated to applied energy research and reporting outside the scope of the Office of Academic Affairs — hold much less potential for broad-reaching and lasting impacts on the university's core mission. For example, a separate college of energy resources would be limited by the natural dynamics of college deans' competing with other colleges for resources. Compounding this limitation would be the lack of concrete incentives for other colleges to contribute curriculum, faculty positions, and other resources to energy-related teaching and research. Such a structure would result in a college that had little leverage over the missions of other colleges. On the other hand, a separate institute dedicated to applied energy research, analogous to the University of North Dakota's Energy and Environmental Research Center, may have significant immediate impacts on energy research and development. But institutes of this type have no direct connection to the university's teaching mission, and their employees face constant pressures to generate external funding. For these reasons, a separate research institute, operated independently of the university's faculty, would have little capacity to influence graduates' preparation to work in the state's energy economy.

Having a School of Energy Resources whose director controls resources for which college deans want to compete creates market-like forces that can augment the state's investment in the school. Specifically, it provides leverage: deans from many colleges will seek to build strength in energy-related teaching *and* research, precisely because they stand to gain access to resources from the School of Energy Resources.

See chart below for structural details

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President
Organization. The school will house three units as described below and shown by the accompanying diagram.



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- To coordinate courses across department and college lines, to ensure greater opportunities for interdisciplinarity in upper-division and graduate curricula related to energy resources. This responsibility will require the ability to fund undergraduate research fellowships and interdisciplinary graduate assistantships, to provide incentives for departments to develop and deliver of cross-departmental and cross-college coursework. ←
- To explore new curricular measures, including (a) certificate programs in areas such as natural resource accounting and legal issues in natural resource extraction, (b) a professional masters' program in energy science, and (c) augmented degree options in traditional disciplines. Examples of such options include certificate programs in natural resource accounting and mineral property law and an area of emphasis in these subjects for MBA students.
- To recruit talented Wyoming high-school and community-college faculty members to participate in funded sabbatical leaves at UW. During these leaves, these distinguished teaching interns will teach classes at UW in appropriate disciplines, such as science and mathematics, and take courses in fields that enrich their careers. These internships will not only facilitate continuing professional development of Wyoming's educators; they will also provide an effective long-term vehicle for articulation in critical high-school-to-college transition courses.
- To run summer programs. One such program will be a summer school in energy science for high school students. This program will provide opportunities for

University of Wyoming Energy Resources Council

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- Dean of Libraries
 - Director, Haub School of ENR
 - Director, International Programs
 - Other directors 7 College Deans □ Agriculture □ Arts & Sciences □ Business □ Education □ Engineering □ Health Sciences □ Law
- outstanding Wyoming high school students to spend several weeks on the UW campus, working with professors and undergraduate mentors on energy-related projects. The purpose will be to enrich these students' preparation for college and to help recruit talented young people into energy-related undergraduate majors. Another program will be a set of summer internships for undergraduates studying energy-related fields, to allow baccalaureate candidates to develop industrial field experience and to help facilitate opportunities for future employment. A third program will be a series of summer courses for high school teachers on topics related to energy science, technology, and economics. These courses, formulated as part of UW's existing Summer School, can be delivered either on the Laramie campus or via WEN, the statewide videoconferencing network, depending on demand.

- To initiate a series of regular articulation conferences with Wyoming community colleges to coordinate the development and delivery of curricula related to Wyoming's energy industry.

II. The Institute for Energy Research (IER). UW's existing IER will have a broader scope of activity, serving as UW's primary incubator for outstanding interdisciplinary research and graduate education in energy-related fields of relevance to Wyoming. The director of the school will manage this institute, which will be the umbrella for externally funded research centers dedicated to specific areas of energy-related research. Examples of external funding might include competitive grants from the National Science Foundation and U.S. Department of Energy, legislative initiatives, and industrial sponsorships or contracts.

Currently, IER houses the Enhanced Oil Recovery Institute, funded by the state legislature and, in part, through federal and industrial research grants. Additional centers to be studied in the near term include a center devoted to coalbed natural gas research, a center for research in coal conversion technologies, and a center dedicated to renewable energy resources. The viability of these centers — and others that may be established in the future — hinges not only on the ability of the director to provide start-up resources but also on the availability of sustained external funding to support equipment purchases, faculty summer research, postdoctoral fellowships, research scientists, and graduate research assistantships. By the end of Fiscal Year 2007, the IER director will analyze the prospects for establishing new centers of this type and will present a plan for incubating centers in viable areas.

Planning is already underway at UW for two such research initiatives. One is a coalbed natural gas research center, currently being considered in the Energy and Water appropriations bill presently before Congress. The other relates to language in the federal Energy Act of 2005 calling for the Secretary of Energy to "establish Coal Research Centers in institutions of higher learning." UW currently is planning a proposal to the Department of Energy to establish a sub-bituminous coal process research center.

Also, UW, together with the Idaho National Laboratory, assisted the Wyoming Natural Gas Pipeline Authority and the Wyoming Infrastructure Authority in preparing a report entitled "Adding Value to Wyoming's Coal Resource – the Next Generation". This report, submitted to the Wyoming Legislature's Joint Minerals, Business and Economic Development Committee, provides extensive discussion of emerging technologies for processing Wyoming's sub-bituminous coals. And it outlines the need for Wyoming to be aggressive in pursuing a demonstration project utilizing sub-bituminous coal combusted at elevation — a project specifically called for in the Energy Act of 2005. In this project, UW would play a critical research-and-development role, in cooperation with the state and federal governments, Idaho National Laboratory, and industry.

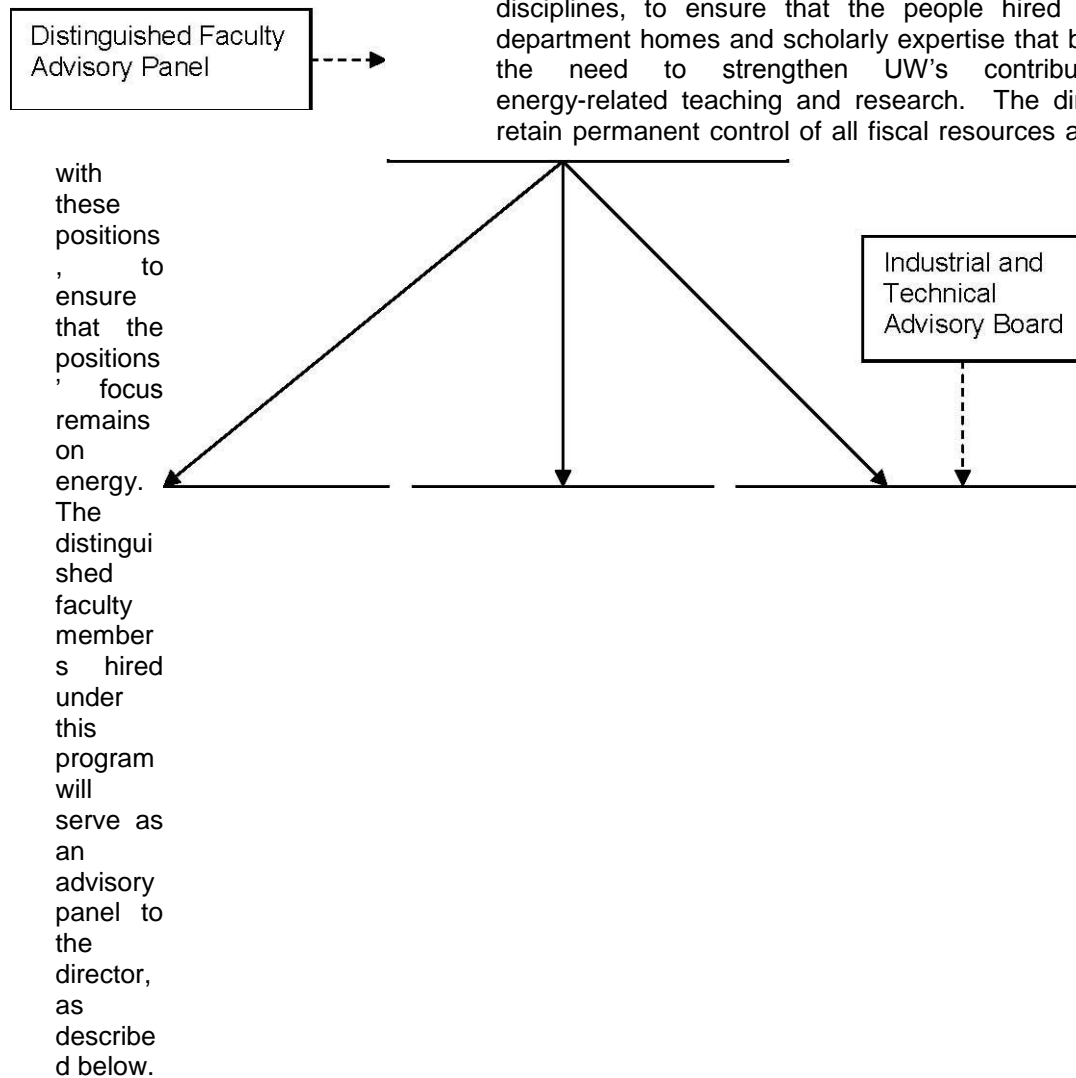
We intend for these efforts to help jump-start UW's incubation of new research centers critical to Wyoming's near-term energy economy.

To help guide and assess IER's scientific research, the director of the school will establish an Industrial and Technical Advisory Board. This board will include experts from internationally recognized industrial laboratories and national laboratories, representation from the Wyoming state government, and academic representatives from other universities with distinguished programs in energy research.

- III. The Center for Energy Outreach. This new center will have a two-part mission. The first part will be to provide technical reports and long-term energy planning. The center will house a permanent staff dedicated to the editing and production of reports and the organization of workshops and symposia to support these activities. It will also have a budget that can temporarily release regular faculty members from part of their normal research and teaching responsibilities, to provide the applied expertise required. The second part of the center's mission will be to provide technical consulting, short courses, and annual forums for independent energy producers, state agencies, and community leaders. The center will employ four consulting specialists with full-time responsibility for this type of outreach. The center will also develop systems for data sharing, as appropriate, with the Wyoming Geological Survey, the Western Research Institute, the Rocky Mountain Oilfield Testing Center, the Wyoming Oil and Gas Conservation Commission, the Wyoming Infrastructure Authority, the Wyoming Pipeline Authority, and similar organizations.

Role of the director. The director will have management responsibility for all three units, shown in the diagram above. Among the director's specific roles are the following

- ☐ To oversee the recruitment of distinguished faculty positions and their assignment to academic disciplines, to ensure that the people hired will have department homes and scholarly expertise that best serve the need to strengthen UW's contributions to energy-related teaching and research. The director will retain permanent control of all fiscal resources associated



- ☐ To recruit distinguished researchers from industrial and national laboratories for one-year visiting appointments to the UW faculty, to help enrich the connections between academic, industrial, and government-sponsored research.

Director, School of Energy Resources

- ☐ Allocation of distinguished professorships
- ☐ Visiting professorships
- ☐ Industrial sponsorships

Academic Coordinator

- ☐ Curricular coordination, including undergraduate fellowships and graduate assistantships
- ☐ Analysis and recommendations for new certificate programs and degree options
- ☐ Distinguished teaching internships
- ☐ Summer program for high school students and teachers; internships for undergraduates
- ☐ Regular articulation with community colleges

Center for Energy Outreach

- ☐ Technology analysis and planning
- ☐ Consulting specialists
- ☐ Data sharing with other agencies

Institute for Energy Research

- ☐ Enhanced Oil Recovery Institute
- ☐ Other externally funded, technology-specific research centers
- ☐ Half-time funding incentives for faculty in mainstream departments
- ☐ \$1 million grant-matching pool
- ☐ Permanently funded core research staff

| Category | Brief description |
|-------------------------------|--|
| Academic Coordinator's office | Academic Coordinator, staff, 18 undergraduate fellowships & 18 graduate assistantships |

- ☐ To solicit industrial subscribers, whose sponsorships can provide corporate financial support for students to participate in research projects related to energy production.

The university will hire the director through a search to be conducted in fiscal year 2007. The search will be international in scope. The qualifications will include (1) an earned doctorate or commensurate record of industrial or applied contributions to an energy-related discipline, (2) experience in managing a complex research organization, (3) a distinguished record of professional leadership in at least one energy-related field of relevance to Wyoming, and (4) demonstrated awareness of the relationships between teaching, research, and service in the university setting and the potential for these functions to benefit Wyoming's energy economy.

University of Wyoming Energy Resources Council. To ensure long-term links between the school and the energy industry, the university proposes to establish a nine-member University of Wyoming Energy Resources Council. The council members will be appointed by the Board of Trustees, upon recommendation of the President of the University, for three-year terms, with the initial appointments staggered so that three new members are appointed annually. The council's membership will consist of representatives from energy industries operating in Wyoming and the Rocky Mountain region as well as representatives from the executive and legislative branches of the state government. The council's function will be to provide guidance to the Trustees, President, and Vice President for Academic Affairs regarding the school's academic directions, research accomplishments, and outreach effectiveness.

Distinguished Faculty Advisory Panel. To ensure stable connections between the school's mission and the academic departments who receive resources from the school, the 12 faculty members occupying the distinguished faculty positions will serve as a formal advisory panel reporting to the director. The primary function of this expert panel will be to identify promising directions for curricular innovation, opportunities for ground-breaking research, and important themes for statewide service and outreach.

5. STATE FUNDING REQUIRED

Key elements of the school requiring state funding will include the following. Specific budget estimates appear below.

I. Academics:

- ☐ An Academic Coordinator, along with a budget for undergraduate fellowships and interdisciplinary graduate assistantships to support cross-department and cross-college curricular development and coordination. This budget will also support annual articulation conferences with Wyoming community colleges on energy-related curricula.
- ☐ Twelve new distinguished faculty positions in energy science, analogous to existing Wold Chair in Energy Research and True Chair in Energy Economics. These fully funded positions will enable the university to lure prominent senior experts in energy-related teaching and research from other institutions. In turn, these senior-level faculty members will increase the institution's overall effectiveness at recruiting outstanding younger faculty members in these areas. The faculty members hired will have academic homes and regular teaching assignments in such cognate departments as Geology and Geophysics, Chemical and Petroleum Engineering, Mathematics, Economics and Finance, Renewable Resources, and other departments that have previously demonstrated a commitment to hiring in energy-related fields. However, the positions will remain under the permanent control of the school's director, who may elect to reallocate positions among departments to ensure a sustained focus on energy and to adapt to emerging trends in Wyoming's energy economy. The intent of the positions is to strengthen UW's international stature and presence in scholarship directly related to oil and gas, coal, coalbed natural gas, and renewable energy resources.

- Fully funded visiting professorships, aimed at attracting year-long teaching and research appointments for scientists and engineers who have attained national or international recognition for their energy-related work in the industrial sector, in national laboratories, or at other universities.
- Fully funded one-year distinguished teaching internships at UW for Wyoming high-school teachers and community-college faculty members. These competitive internships, offered at full salary and benefits (or full reimbursement to the teachers' school district) with a cost-of-living stipend, will help cultivate effective citizenship in a world facing difficult, energy-driven challenges. Teachers participating in these internships will take coursework in curriculum-enriching topics as geographic information science, resource economics, and energy technology. At the same time, they will teach university courses in their disciplines, including basic sciences, mathematics, and social sciences. Through this mechanism, the school will foster both the curricular enrichment and the subject-matter articulation needed to effect a more seamless transition from high school to college throughout the state.
- Funding for a summer program for high school students. This program will attract 16 outstanding high school students to the UW campus, to work with faculty members and undergraduate mentors on energy-related projects. The program will include funding for the students' travel, room, and board. The school's director will explore effective funding arrangements for the summer field internships for undergraduates with interested industry representatives. The university will run summer courses for high school teachers as part of its normal Summer School funding mechanisms.

II. Research:

- Permanent funding for core research staff and an operating budget for UW's Institute for Energy Research. This institute will continue to house the Enhanced Oil Recovery Institute and will accommodate other research centers in energy-related problems, as scientific advances and external funding permit. Initially, these additional centers may include a center for coalbed natural gas studies, a center focusing on coal conversion, and a center for renewable energy resources. A permanent budget will help provide start-up funding for new research centers, which will be expected to develop sustained external funding after their initial incubation periods. IER will provide state-funded base staffing, with each new center being responsible for seeking competitive external research funding to support research projects conducted by faculty members, postdoctoral fellows, and graduate students from cognate academic departments.
- A fund to offer half-time appointments to selected faculty members who have proven expertise directly relevant to oil and gas, coal, coalbed natural gas, and renewable energy resources. These appointments, offered competitively for renewable three-year terms, will carry summer-salary enhancements, funding for half of each salary, and dedicated graduate assistants for the duration of each appointment. By freeing a portion of selected faculty members' normal General Fund salary for other uses in their home departments, these appointments will create strong, lasting incentives for departments to align their hiring with the school's focus areas.
- Grant matching. Since the U.S. Department of Energy typically requires institutional matching funds for research grants, we are requesting a \$1 million/year pool of grant-matching funds. This pool will enhance the competitiveness of UW faculty members in seeking externally funded grants to support research equipment, undergraduate- and graduate-student training, and laboratory technicians.

III. Statewide outreach and service:

- ☐ Editorial and production staff for the Center for Energy Outreach, together with a budget to support released time for faculty members and other employees who can temporarily devote time to the dissemination of applied knowledge through reports and workshops.
- ☐ A permanent staff of consulting specialists. These positions will be filled by non-faculty scientists and engineers who have the expertise needed to provide technical consulting and short courses for independent energy producers, government agencies, and community leaders.

IV. Funding for the Director of the School of Energy Resources, including the director's salary, office staff, and a support budget.

Table 1 summarizes the specific budget estimates for these elements.

Table 1. Proposed ultimate state funding for the School of Energy Resources

Center for Energy Outreach

- Technology analysis and planning
- Consulting specialists
- Data sharing with other agencies

Institute for Energy Research

- Enhanced Oil Recovery Institute
- Other externally funded, technology-specific research centers
- Half-time funding incentives for faculty in mainstream departments
- \$1 million grant-matching pool
- Permanently funded core research staff

| Category | Brief description | Annual budget |
|--|--|---------------|
| Academic Coordinator's office | Academic Coordinator, staff, 18 undergraduate fellowships & 18 graduate assistantships | \$765,900 |
| Distinguished faculty chairs in energy resources | 12 distinguished chairs, with fringe & discretionary funds | \$3,312,000 |
| Visiting professorships | 2 visitors from industry or national labs, with moving and travel allowances | \$600,000 |
| Distinguished teaching internships | 3 teaching interns from Wyoming schools or community colleges, with moving and travel allowances | \$303,000 |
| Summer program for high school students | 2 faculty members, 2 undergraduate mentors, and travel, room, and board for 16 student participants per year | \$63,600 |
| Institute for Energy Research | Postdocs, technicians, equipment, grant matching funds, and office support | \$518,550 |
| Half-time faculty appointments | 9 half-time appointments, with summer stipends and fringe | \$1,230,296 |
| Startup assistance | Funds to help college deans to hire in targeted areas | \$500,000 |
| Grant matching pool | Funds to provide institutional matching required for research grants from some federal agencies | \$1,000,000 |
| Center for Energy Outreach | Director, editor, staff, released time, with | |

6. FINANCIAL PLAN, SCHEDULING, and FACILITIES

The development of the school will require three years. During this development period, it is possible to stage the funding of the school, to allow time for the national and international searches required to fill many of the positions. Table 2 summarizes a plan for ramping up state funding over fiscal years 2007-2009, with full funding in place in fiscal year 2009. Table 3 provides details of this staged funding plan as well as cumulative funding totals.

Table 2. Overview of staged funding proposal for the School of Energy Resources

| Table 3. Detailed funding proposal School of Energy | Center for Energy Outreach | Institute for Energy Research | staged for the |
|--|---|--|-----------------------|
| | <input type="checkbox"/> Technology analysis and planning <input type="checkbox"/> Consulting specialists <input type="checkbox"/> Data sharing with other agencies | <input type="checkbox"/> Enhanced Oil Recovery Institute <input type="checkbox"/> Other externally funded, technology-specific research centers <input type="checkbox"/> Half-time funding incentives for faculty in mainstream departments <input type="checkbox"/> \$1 million grant-matching pool <input type="checkbox"/> Permanently funded core research staff | |

| Center for Energy Outreach | Institute for Energy Research |
|---|--|
| <input type="checkbox"/> Technology analysis and planning <input type="checkbox"/> Consulting specialists <input type="checkbox"/> Data sharing with other agencies | <input type="checkbox"/> Enhanced Oil Recovery Institute <input type="checkbox"/> Other externally funded, technology-specific research centers <input type="checkbox"/> Half-time funding incentives for faculty in mainstream departments <input type="checkbox"/> \$1 million grant-matching pool <input type="checkbox"/> Permanently funded core research staff |

| Category | Brief description | Annual budget |
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| Academic Coordinator's office | Academic Coordinator, staff, 18 undergraduate fellowships & 18 graduate assistantships | \$765,900 |
| Distinguished faculty chairs in energy resources | 12 distinguished chairs, with fringe & discretionary funds | \$3,312,000 |
| Visiting professorships | 2 visitors from industry or national labs, with moving and travel allowances | \$600,000 |
| Distinguished teaching internships | 3 teaching interns from Wyoming schools or community colleges, with moving and travel allowances | \$303,000 |
| Summer program for high school students | 2 faculty members, 2 undergraduate mentors, and travel, room, and board for 16 student participants per year | \$63,600 |
| Institute for Energy Research | Postdocs, technicians, equipment, grant matching funds, and office support | \$518,550 |
| Half-time faculty appointments | 9 half-time appointments, with summer stipends and fringe | \$1,230,296 |
| Startup assistance | Funds to help college deans to hire in targeted areas | \$500,000 |
| Grant matching pool | Funds to provide institutional matching required for research grants from some federal agencies | \$1,000,000 |
| Center for Energy Outreach | Director, editor, staff, released time, with fringe and support | \$561,000 |
| Consulting specialists | 4 full-time scientists and engineers to provide technical consulting and short courses | \$432,000 |
| Director's office | Director, staff, fringe, support /Director | |

Facilities. We foresee the need for one-time funding for remodeling and construction of facilities:

- ☐ to provide office space for the school's director, the academic coordinator, and staff;
- ☐ to house laboratory and office space for faculty members affiliated with the Institute for Energy Research; and
- ☐ to develop conference facilities and a physical home for the director and staff of the Center for Energy Outreach.

In view of the need for more specific facilities planning to estimate the expenditures involved, we propose to develop a detailed plan for the configuration, costs, and siting of these facilities in time for the 2007 Legislature.

An investment of this type, made at a time when Wyoming enjoys an extraordinary budget surplus owing to its wealth of energy resources, can help guide the state through the most pressing energy issues of the coming decades. In addition, by helping to make the University of Wyoming one of the world's premier centers of expertise in energy-related science, technology, and economics, such an investment can help build a sound long-term energy future for the state, the Rocky Mountain region, and the nation.

APPENDIX A: LEGISLATION RELATED TO THE SCHOOL OF ENERGY RESOURCES

ORIGINAL SENATE **ENGROSSED** FILE NO. 0001 ENROLLED ACT NO. 90, SENATE FIFTY-EIGHTH LEGISLATURE OF THE STATE OF WYOMING 2005 GENERAL SESSION

[UNIVERSITY ENERGY INSTITUTE]

Section 337.

(a) By October 1, 2005, the University of Wyoming shall develop an academic and financial plan for the development and operation of a proposed energy institute. The plan shall be submitted to the governor and a legislative committee designated to receive it by the legislature's management council. The plan shall include:

(i) The mission of the energy institute and its goals, objective and structure including:

(A) Its relationship and relevance to energy and natural resource issues facing Wyoming;

(B) The contributions the institute is likely to make to university research and scholarship and to assisting the state and its people in sustaining and developing the state's economy;

(C) The impact the institute would have on the university's mission.

(ii) A summary of the personnel by rank and academic discipline needed to achieve the institute's goals and objectives;

(iii) An analysis of the level of funding necessary to sustain a meaningful, long term presence in research and scholarship related to energy and natural resources;

(iv) Identification of other financial resources, especially research grants and contracts, that may reasonably be sought for continuing support of the institute;

(v) A time schedule for raising matching funds and for implementation of the institute and the plan;

(vi) The means by which the leadership of the institute will be recruited, including the industrial and academic qualifications of that leadership;

(vii) A statement of the laboratory and other facility needs for the institute and their estimated cost;

(viii) In its development, extensive consultation with leaders of Wyoming's renewable and nonrenewable energy industry. The university shall consult with the legislative committee on how and with whom this consultation will occur.

(b) Business leaders participating in the development of the plan under this section at the request of the university shall be entitled to receive travel and per diem expenses in the manner and amount provided for state employees under W.S. 9-3-102 and 9-3-103. Five thousand dollars (\$5,000.00) is appropriated from the budget reserve account to the university which shall only be used to pay the per diem and travel expenses authorized under this subsection.

APPENDIX B: SHORT RESPONSES TO SENATE FILE 0001, SECTION 337

The legislation called for responses to the following items.

- (i) The mission of the energy institute and its goals, objective and structure including:
 - (A) Its relationship and relevance to energy and natural resource issues facing Wyoming;
 - (B) The contributions the institute is likely to make to university research and scholarship and to assisting the state and its people in sustaining and developing the state's economy;
 - (C) The impact the institute would have on the university's mission.

Response: The school's mission will have three dimensions:

Academics. Strengthen baccalaureate and graduate teaching, to produce UW graduates who are equipped to work in fields integral to Wyoming's energy economy. Research. Advance the state of the art in energy-related science, technology, and economics through world-class research that attracts premier scholars and teachers to Wyoming. Statewide outreach and service. Support technology outreach, public decision-making, and long-range energy planning, through both the open dissemination of information needed for expert project design and sound, objective policy analyses.

The text of the proposal describes the school's structure in more detail, together with its relevance to Wyoming's energy portfolio, its relationship to the state's economy.

The most important impact that a School of Energy Resources would have on UW's mission will be to enhance the university's stature in nationally recognized education and research in areas vital to Wyoming. By bolstering UW's ability to recruit high-caliber faculty members and by focusing on disciplines critical to the state's future, the school will enhance several of UW's existing strengths. It will promote greater interdisciplinarity in teaching and research, reinforcing the institution's contributions to Wyoming's economic development both through more effective preparation of graduates for energy-related careers and through the advancement of the state of the art in these fields.

- (ii) A summary of the personnel by rank and academic discipline needed to achieve the institute's goals and objectives;

Response: The proposal calls for 12 new, senior faculty positions, to be filled through national or international searches. These positions will be interdisciplinary in nature, with departmental assignments to be determined through a bidding process in which academic departments commit to additional future faculty hiring in energy-related areas. Among the departments most likely to submit successful bids are Geology and Geophysics, Chemical and Petroleum Engineering, Economics and Finance, Mathematics, Renewable Resources, and Electrical and Computer Engineering. This list is not exhaustive; the aim will be to build interdisciplinary strength analogous to that found in industrial research organizations and national laboratories.

- (iii) An analysis of the level of funding necessary to sustain a meaningful, long term presence in research and scholarship related to energy and natural resources;

Response: The level of direct state funding required is \$9.8 million/year. The funding can be staged over three fiscal years: \$4.4 million in FY 2007, \$7.7 million in FY 2008, and \$9.8 million in FY 2009. Complementing this funding will be (a) the university's internal reallocation of five faculty positions to earth and energy sciences during the period of the 2004-2009 Academic Plan, (b) additional reallocation of internal funding to restart the baccalaureate degree in Petroleum Engineering, (c) ongoing state and external support for the Enhanced Oil Recovery Institute, (d) other external funding, through continuing industrial support for faculty research as well as through such federal agencies as the US Department of Energy and the National Science Foundation.

- (iv) Identification of other financial resources, especially research grants and contracts, that may reasonably be sought for continuing support of the institute;

Response: The university will continue to seek external research funding from industry and in the form of competitive research grants. The School of Energy Resources will enhance the university's ability to attract funding of this type (a) by adding the capacity to incubate new research centers under the umbrella of the existing Institute for Energy Research, (b) by adding a mechanism for corporate financial support for students to participate in research projects related to energy production, and (c) by creating a grant-matching fund to help support grant proposals to the US Department of Energy and the National Science Foundation.

- (v) A time schedule for raising matching funds and for implementation of the institute and the plan;

Response: The university will begin raising matching funds — in the form of industrial sponsorships, competitive grants, and private gifts — as soon as authorizing legislation is passed. The implementation of the school will span three fiscal years, ending in FY 2009, as detailed in the staged funding proposal in Table 2 of the text.

- (vi) The means by which the leadership of the institute will be recruited, including the industrial and academic qualifications of that leadership;

Response: The university will hire the director through a search to be conducted in fiscal year 2007. The search will be international in scope. The qualifications will include (1) an earned doctorate or commensurate record of contributions to an energy-related discipline, (2) experience in managing a complex research or academic organization, (3) knowledge of at least one energy-related field of relevance to Wyoming, and (4) demonstrated awareness of the relationships between teaching, research, and service in the university setting.

- (vii) A statement of the laboratory and other facility needs for the institute and their estimated cost;

Response: We foresee the need for one-time funding for remodeling and construction of facilities:

- ☐ *to provide office space for the school's director, the academic coordinator, and staff;*
- ☐ *to house laboratory and office space for faculty members affiliated with the Institute for Energy Research; and*
- ☐ *to develop conference facilities and a physical home for the director and staff of the Center for Energy Outreach.*

In view of the need for more specific facilities planning to estimate the expenditures involved, we propose to develop a detailed plan for the configuration, costs, and siting of these facilities in time for the 2007 Legislature.

(viii) In its development, extensive consultation with leaders of Wyoming's renewable and nonrenewable energy industry. The university shall consult with the legislative committee on how and with whom this consultation will occur.

Response: Appendix C summarizes the process used for this consultation.

APPENDIX C: PROCESS FOR DEVELOPMENT OF THE REPORT

In collaboration with the co-chairs of the Joint Minerals, Business, and Economic Development Committee, the University of Wyoming developed this report through a process that involved several stages and input from several sets of stakeholders:

- ☐ An interdisciplinary report drafting team composed of UW faculty members,
- ☐ The Joint Minerals, Business, and Economic Development Committee,
- ☐ A small group of non-university stakeholders, selected by the Joint Committee,
- ☐ A broader group of industry representatives and stakeholders,
- ☐ UW college deans and affected department heads,
- ☐ The UW Board of Trustees.

1-day workshop with *small group* of industry stakeholders and legislators

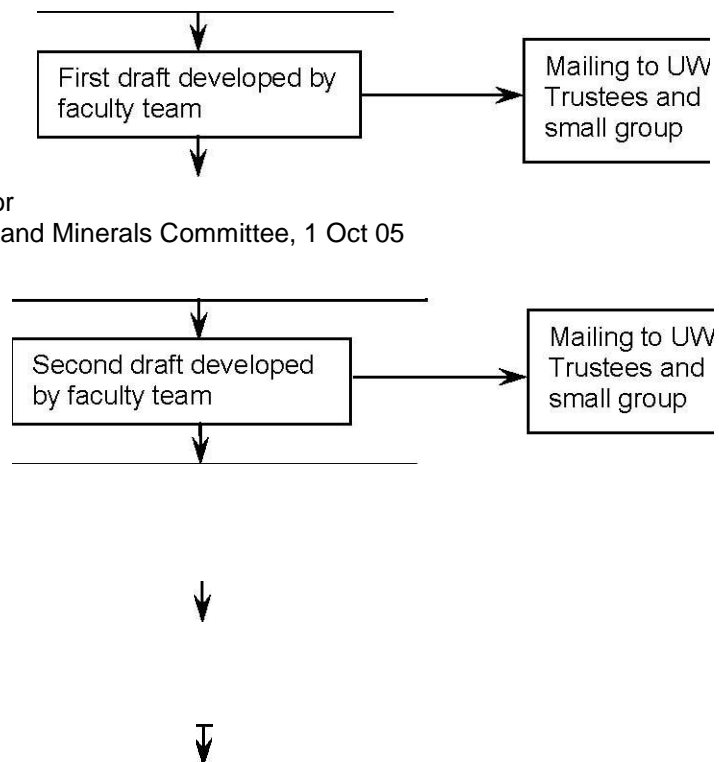
Review and comment by broader group of industry representatives and stakeholders

Draft available on website for public review and comment, with ongoing revision

Draft submitted for review by UW Trustees

Final report submitted to Governor

and Minerals Committee, 1 Oct 05



Acknowledgments

The following UW faculty members and administrators developed early drafts of this report:

Dr. Myron B. Allen, Vice President for Academic Affairs Dr. Morris Argyle, Assistant Professor of Chemical and Petroleum Engineering Dr. Mark Balas, Professor and Head of Electrical and Computer Engineering Dr. Nicole Ballenger, Associate Vice President for Academic Affairs Dr. Ed Barbier, Professor of Economics Dr. William Gern, Vice President for Research Dr. Steven Holbrook, Professor of Geology and Geophysics Dr. Katta J. Reddy, Professor of Renewable Resources Dr. James Steidtmann, Director of the Institute for Energy Research Dr. Brian Towler, Professor and Head of Chemical and Petroleum Engineering

In addition, Dr. Norman Morrow, Professor of Chemical and Petroleum Engineering, and Dr. Harold Bergman, Director of the Ruckelshaus Institute for Environment and Natural Resources, provided valuable insights and perspectives.

The following industry and state-agency representatives provided essential guidance, and many important elements of the report reflect their thoughtful suggestions:

Mr. Loren Barritt, Williams Co. Mr. Cary Brus, Nerd Gas Co Senator Bill Hawks Senator Kit Jennings Representative Tom Lockhart Mr. Michael Moody, PPM Energy Mr. Steve Reynolds, Encana Mr. Greg Schaefer, Arch Coal Inc. Dr. Ron Surdam, Wyoming Geological Survey Mr. Kyle True, True Companies Mr. Peter Wold, Wold Oil Properties, Inc.

Many other industry representatives and state officials offered helpful comments and clarification throughout the development of the drafts. Although it is impossible to list them all, the following people deserve special mention: Dr. Jim Barlow, Bryan Hassler, Rob Hurless, Steven Morzenti, Ambassador Thomas Stroock, Hank True.

Ms. Kathleen Hull and Dr. Ed Paradis provided crucial editorial and logistical support. The cover photographs are by David Jost, a University of Wyoming student.

Appendix B

§ 21-17-117. School of energy resources; creation authorized; University of Wyoming energy resources council established; reports.

(a) Subject to legislative appropriation, the University of Wyoming shall operate the school of energy resources.

(b) The school of energy resources shall have the following objectives:

(i) To provide nationally competitive undergraduate and graduate instruction in energy related disciplines, particularly those of importance to develop Wyoming's energy resources;

(ii) To advance the state-of-the-art in Wyoming energy related science, technology and economics research; and

(iii) To support scientific and engineering outreach through dissemination of information to Wyoming's energy industries, companies, community colleges and governmental agencies.

(c) The school of energy resources shall:

(i) Establish relationships with Wyoming energy companies and coordinate with other energy industry organizations to sustain and optimize the development of Wyoming's energy portfolio. For the purposes of this section, Wyoming's energy portfolio includes both nonrenewable and renewable resources;

(ii) Establish relationships with the Wyoming community colleges creating local programs to enrich students' education in the Wyoming energy industry operations;

(iii) Maintain flexibility in its focus and structure to be capable of responding to the changing needs of Wyoming's energy industries with regard to instruction, research and outreach.

(d) The university's board of trustees shall establish the structure and policies for operation of the school of energy resources consistent with this section, and shall engage as many academic departments and colleges as possible in support of the school.

(e) The University of Wyoming energy resources council is created and shall provide direction to the school of energy resources regarding identifying and prioritizing issues which should be targeted for research and outreach. The University of Wyoming energy resources council shall consist of eleven (11) members, including the president of the university and the director of the Ruckleshaus institute of environment and natural resources, both of whom are ex officio nonvoting members.

One (1) member of the house of representatives shall be appointed by the speaker of the house and one (1) member of the senate shall be appointed by the president of the senate. Each appointed legislative member shall serve a two (2) year term. The remaining seven

(7) members shall be appointed for terms of three (3) years, except that for the initial appointments two (2) members shall be appointed for one (1) year and two (2) members shall be appointed for two (2) years. These seven (7) members shall represent to the greatest extent practicable the diverse components of Wyoming's energy industries, and shall be appointed by the governor and approved with the advice and consent of the senate, in accordance with W.S.

[28-12-101](#) through [28-12-103](#). The council shall select a chairman and vice-chairman from among its members.

(f) The university shall report annually, not later than October 1, to the joint minerals, business and

economic development interim committee, the joint appropriations interim committee and the joint education interim committee regarding all revenues to and expenditures by the school of energy resources during the preceding fiscal year, accomplishments of the school of energy resources and its benefits to Wyoming's energy economy. (Laws 2006, ch. 69, § 1.)

Cross references. — As to clean coal research task force, see § [21-17-121](#).

Editor's notes. — Laws 2006, ch. 19, § 1 and Laws 2006, ch. 69, § 1, both created a § [21-17-116](#). The section added by ch. 19 has been redesignated as § [21-17-117](#) by the Wyoming legislative service office.

Laws 2009, ch. 57, § 5 provides:

“(a) Any funds remaining from the appropriation provided in 2007 Wyoming Session Laws, Chapter 186, Section 3(b), as amended by 2008 Wyoming Session Laws, Chapter 48, Section 325(b) are hereby reappropriated to the account created under W.S. 39-14-802 for the purpose of clean coal technology research.

“(b) Any funds remaining under the appropriation provided in 2007 Wyoming Session Laws, Chapter 186, Section 3(a) are hereby reappropriated to the governor's office for expenses incurred by the clean coal task force.

“(c) There is appropriated seven thousand five hundred dollars (\$7,500.00) from the general fund to the legislative service office for compensation of legislative members serving on the clean coal task force.

“(d) Funds appropriated under subsections (b) and (c) of this section are appropriated for the period beginning with the effective date of this act and ending June 30, 2010. These appropriations shall only be expended for the purpose of staffing the clean coal task force and for expenses incurred by the clean coal task force. Notwithstanding any other provision of law, the appropriation under subsection (a) of this section shall not be transferred or expended for any other purpose and any unexpended, unobligated funds remaining from this appropriation shall not revert as provided by law on June 30, 2010. The appropriations under subsections (b) and (c) of this section shall be included in the governor's and the legislative service office's 2011-2012 standard biennial budget requests.”

Effective dates. — Laws 2006, ch. 69, § 4, makes the act effective immediately upon completion of all acts necessary for a bill to become law as provided by art. [4](#), § [8](#), Wyo. Const. Approved March 23, 2006.

**Center for Energy
Outreach**

- ☐ Technology analysis and planning
- ☐ Consulting

**Institute for Energy
Research**

- ☐ Enhanced Oil Recovery Institute
- ☐ Other externally funded, technology-specific

Appendix C-1

FIFTY-NINTH LEGISLATURE OF THE STATE OF WYOMING 2007 GENERAL SESSION

AN ACT relating to clean coal technology; creating an account; creating a clean coal research task force; requiring a report; providing appropriations; and providing for an effective date.

Be It Enacted by the Legislature of the State of Wyoming:

Section 1. W.S. 39-14-802 is created to read:

39-14-802. Clean coal research account created; funds deposited; use of funds.

(a) There is created the clean coal research account into which shall be deposited revenues as provided by law. Interest on earnings from funds in the account shall be credited to the account.

(b) Deposits into the account created by subsection

(a) of this section shall only be expended upon appropriation by the legislature.

Section 2.

(a) There is created a clean coal research task force consisting of the members of the Wyoming energy resources council created pursuant to W.S. 21-17-117(e), or their designees.

(b) The task force shall meet at the call of the chairman. The task force shall issue requests for proposals for research projects into clean coal technologies. The task force shall review and evaluate proposals for research into clean coal technologies, subject to the following:

ORIGINAL HOUSE BILL
NO. 0301

ENROLLED ACT NO. 121, HOUSE OF REPRESENTATIVES

FIFTY-NINTH LEGISLATURE OF THE STATE OF WYOMING 2007 GENERAL SESSION

(i) Proposals may be received from academic institutions and private industry proponents;

(ii) Proposals shall be evaluated competitively on their probable benefits to the state of Wyoming and coal programs within this state;

(iii) Proposals shall enhance and improve clean coal technologies with an emphasis on methods of combusting sub-bituminous coal at high altitudes.

(c) The task force shall issue a report to the governor and the joint minerals, business and economic development interim committee no later than September 30, 2007 including, but not limited to, recommendations regarding funding specific proposals for research into clean coal technologies in Wyoming.

(d) The task force shall be staffed by the governor's office with support from the University of Wyoming school of energy resources. The task force may contract for administrative and research services to aid in preparation of the task force report. The governor's office shall convene the task force no later than May 1, 2007.

(e) The task force shall exist until September 30, 2008. Members of the task force who are not legislators shall not receive a salary but shall receive reimbursement for necessary travel and per diem expenses in the manner and amount provided for state employees under W.S. 9-3-102 and 9-3-103. Members of the task force who are legislators shall be paid salary, per diem and travel expenses as provided in W.S. 28-5-101 for their official duties as members of the task force.

Section 3.

ORIGINAL HOUSE BILL
NO. 0301

ENROLLED ACT NO. 121, HOUSE OF REPRESENTATIVES

FIFTY-NINTH LEGISLATURE OF THE STATE OF WYOMING 2007 GENERAL SESSION

(a) There is appropriated one hundred thousand dollars (\$100,000.00) from the general fund to the governor's office for expenses incurred pursuant to this act.

(b) There is appropriated two million five hundred thousand dollars (\$2,500,000.00) from the general fund to a separate account for the purpose of clean coal technology research. Funds deposited in the account shall not be expended until a dollar for dollar match has been provided from nonstate funds, and only upon appropriation by the legislature. Notwithstanding W.S. 9-2-1008 or 9-4-207, unexpended funds shall revert on June 30, 2009.

ORIGINAL HOUSE BILL
NO. 0301

ENROLLED ACT NO. 121, HOUSE OF REPRESENTATIVES

FIFTY-NINTH LEGISLATURE OF THE STATE OF WYOMING 2007 GENERAL SESSION

Section 4. This act is effective immediately upon completion of all acts necessary for a bill to become law as provided by Article 4, Section 8 of the Wyoming Constitution.

(END)

Speaker of the House President of the Senate

Governor TIME APPROVED: _____ DATE APPROVED: _____

I hereby certify that this act originated in the House.

Chief Clerk

Appendix C-2

§ 21-17-121. Clean coal research task force; members; compensation; proposals; report.

(a) The clean coal research task force created pursuant to 2007 Wyoming Session Laws, Chapter 186, Section 2 shall exist until June 30, 2013. The task force shall consist of the voting members of the Wyoming energy resources council created pursuant to W.S. [21-17-117](#)(e), or their designees.

(b) The task force shall meet at the call of the chairman. The task force shall issue requests for proposals for research projects into clean coal technologies. The task force shall review and evaluate proposals for research into clean coal technologies, subject to the following:

(i) Proposals may be received from academic institutions and private industry proponents;

(ii) Proposals shall be evaluated competitively on their probable benefits to the state of Wyoming and coal programs within this state;

(iii) Proposals shall enhance and improve clean coal technologies with an emphasis on methods of combusting sub-bituminous coal at high altitudes.

(c) The task force shall issue a report to the governor and the joint minerals, business and economic development interim committee annually, no later than September 30, including, but not limited to, recommendations regarding funding specific proposals for research into clean coal technologies in Wyoming.

(d) The task force shall be staffed by the governor's office with support from the University of Wyoming school of energy resources. The task force may contract for administrative and research services to aid in preparation of the task force report.

(e) Members of the task force who are not legislators shall not receive a salary but shall receive reimbursement for necessary travel and per diem expenses in the manner and amount provided for state employees under W.S. [9-3-102](#) and [9-3-103](#). Members of the task force who are legislators shall be paid salary, per diem and travel expenses as provided in W.S. [28-5-101](#) for their official duties as members of the task force.

(f) The clean coal task force may award funds in the clean coal technology account to proposals for clean coal after submitting the task force's recommendations to the joint minerals, business and economic development interim committee. (Laws 2009, ch. 57, § 1.)

Effective dates. — Laws 2009, ch. 57, § 6, makes the act effective immediately upon completion of all acts necessary for a bill to become law as provided by art. [4](#), § [8](#), Wyo. Const. Approved February 26, 2009.

UNIVERSITY OF WYOMING

Appendix D

Office of General Counsel
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August, 2010

TO: President Tom Buchanan

FROM: Susan Weidel, General Counsel

RE: Clean Coal Task Force

Pursuant to your request, I am providing you with background information on the Clean Coal Task Force (CCTF).

Background on Legislation

- 1 The CCTF was created by legislation in 2007 (W.S. Sec. 21-17-121); CCTF expires on June 30, 2013 unless extended by legislative action (*See Attachment – Wyoming Statute*).
- 2 The CCTF provides funding for research projects to promote clean coal technologies.
- 3 The Governor's Office is charged with providing primary staffing; UW, through the School of Energy Resources (SER), provides support.
- 4 In 2010, the Wyoming Legislature provided \$14 million in AML funds for the research grant program.

Current Procedures

- 1 The Governor's Office has de facto delegated its staffing responsibilities to SER under the current administration.
- 2 SER Director Mark Northam identifies confidential peer reviewers who review each proposal. CCTF discusses these reviews and approves proposals for funding.
- 3 The UW Research Office handles all awards of CCTF funding through contracts and provides management of all CCTF funds as UW, not simply as a fiscal agent of CCFT.
- 4 Contracts are between UW and the grant recipient **not** between CCTF and the grant recipient.
- 5 When the award is made to a UW faculty member, there is a letter of award, but no contract is created. The accounting is handled in a normal manner and the UW Office of Sponsored Programs examines all expenditures, requests and draw

Appendix D

downs to insure they meet the contract requirements just as with any other external awards.

Intellectual Property Rights /Funding

1 The Bayh-Dole Act (the federal law that controls transfer of new technology from university laboratories to the private sector) contains restrictions that are applicable to AML funds. CCTF will have limited opportunity for any licensing revenue on grants made to Universities. If grants are with private companies, Bayh-Dole does not apply but the licensing revenues are generally inconsequential. If AML funds are “swapped,” Bayh-Dole restrictions do not apply to University grants but once again, the licensing revenues are likely to be limited. (*See Attachment—Technology Transfer Statistics*).

2 Restrictions on disbursement of funds – As an entity of Wyoming state government, CCTF cannot donate funds to SER/ERC from earnings on grants, e.g., licensing revenues. Any income generated by CCTF must go to the State Treasurer’s Office and then be appropriated through the legislative process.

3 The legislation creating CCTF does not include any language permitting a profit sharing plan in the grant process.

4 Even if licensing did generate some revenue, the expected value of a share of the revenue is most likely to be a very small fraction of the current SER budget.

Procedural Recommendations

1 Use the Enhanced Oil Recovery Institute (EORI) as an organizational model.

2 Create an organizational/operational MOU between CCTF and UW.

3 Obtain the designation of an Assistant Attorney General (similar to the arrangement EORI has) to provide legal support to CCTF.

4 Revise grant procedures so that all contracts are between CCTF and grant recipient and signed by CCTF, or designee, e.g., the Governor’s Energy Advisor.

5 UW serves solely as fiscal agent for funds on behalf of CCTF.

Action Items

1 Draft MOU between UW & CCTF.

2 Explore assignment of AG to CCTF.

3 Provide draft contracts and information on UW fiscal process to CCTF.

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APPENDIX D

To: Tom Buchanan, UW
President
Ron Harper, ERC Chair
Representative Tom Lockhart,

ERC Vice-Chair
Myron Allen, UW Provost
Mark Northam, SER Director

From: Don Richards

Date: November 5, 2010

Re: ERC, SER, and CCTF Evaluation

As you will recall President Buchanan directed me to provide a short evaluation of ERC, SER, and CCTF on September 23, 2010, by responding to specific questions. Attached, please find my response to the evaluative issues outlined in his directive.

Within the available time, I conducted several formal interviews of internal and external parties with interest or participation in SER, ERC, or CCTF. I also reviewed legislation, visioning documents, SER reports, and other relevant materials provided by those I interviewed. This is not intended to be a full program/performance evaluation adhering to traditional protocols, such as the Government Accountability Office handbook. Nor is the paper a summary of the activities of the evaluated entities. Annual reports and other internal documents provide that information in sufficient depth and to do so would be redundant.

Although I made every attempt to prepare this paper from the viewpoint of an independent, objective observer, I acknowledge I am neither independent nor entirely objective. Rather, I am an advocate for UW (and SER) and serve as a liaison for UW with external constituencies, in particular the Legislature. One cannot untangle that relationship or confine those responsibilities. I therefore acknowledge that I have both an institutional and self-interest in the success of UW and SER.

I appreciate your considered, thoughtful input throughout the process. It is now time to forward you my final draft and share it with a broader audience: ERC, Board of Trustees, etc. My intent is to frame identified issues which may warrant action or at least discussion as "items for consideration." Please regard these in the spirit they are offered: opportunities to frame a manageable number of issues for further discussion and deliberation, the outcomes of which could be noticeably divergent from my suggestions.

cc: Members, Energy Resources Council
Members, Board of Trustees
SER leadership staff

Issue Brief:

ERC, CCTF, and SER: A Short Evaluation and Identification of Opportunities and Improvements for the Future

November 4, 2010

by:

Don Richards

Questions

1. Describe the structure, authorities, and evolution of SER, ERC, and CCTF.

The Wyoming Legislature charged the University of Wyoming (UW) with developing an academic and financial plan for an energy resources unit within UW in 2005. UW reported back to the Legislature on October 1, 2005.¹ The Legislature created the School of Energy Resources (SER) and the UW Energy Resources Council (ERC) with near unanimous support in the 2006 Budget Session. That statutory charge, with minimal amendment, remains as the overarching framework for SER and ERC. Subsequently, the ERC organized itself; an interim director was hired; and about a year later, the first full-time SER director was selected. SER and ERC also established an operational mission statement which provides direction for the School.

¹ See Appendix A, University of Wyoming School of Energy Resources Academic and Financial Plan, October 1, 2005.

The statutes creating SER and ERC provide broad charges to both entities.² Two interviewed observers noted the fact that the conceptual design and statutes were broad directly contributed to the extraordinary legislative support for the creation of SER and ERC. There appears to be recognition that whatever subsequent confusion has arisen largely lies with the implementation and operationalization of this broad statutory direction.

² See Appendix B, W.S. 21-17-117.

The majority of those interviewed believe that the current statutes adequately articulate the mission and expectations of SER and ERC. But, that statutory charge is not well understood by all constituencies, e.g., UW faculty, SER personnel, ERC board members, UW administration, Wyoming industry, etc. It seems clear that while the statute provides sound direction, there remains confusion and differing interpretations as to roles and responsibilities. It seems different individuals, perhaps even including this author, might read into the statute what he or she would want the structure to be, rather than what it is. Three substantive examples are discussed below:

- i) The 2005 UW visioning document recommended the

membership of ERC would be appointed by the UW Board of Trustees. This structure differs from the structure subsequently prescribed by the Legislature. The final ERC includes two ex-officio, non-voting members, one member appointed by the leader of each legislative chamber and seven members appointed by the Governor and confirmed by the Senate. Unlike most UW boards, this structure seems to imply enhanced external involvement, or as some interviewees put it, an externally appointed board would reinforce the importance of substantive changes in UW's approach to energy-related teaching, research, and service.

ii) The final statute also states ERC —shall provide direction to the school of energy resources regarding identifying and prioritizing issues which should be targeted for research and outreach.¶ Further, the UW Trustees —shall establish the structure and policies for operation of the school of energy resources...¶ More plainly, the instructional charge of the school is left to the School and the UW Trustees, while direction for prioritizing outreach and research is the articulated purpose of the ERC.

iii) Finally, many individuals interviewed, including some members of the ERC, noted ERC's advisory capacity. The term —advisory¶ is never used in the statute. Although there are on the order of 100 advisory boards created in Wyoming statute, there remains a broad, conventional view that the ERC is an advisory board akin to many other state advisory boards or UW college advisory boards. The evidence seems to suggest otherwise. While the ERC charge is limited to providing direction

regarding the identification and prioritization of research and outreach, it is unlike most other UW advisory boards. Most other UW boards are not created in statute. Most other UW boards are not appointed by the Governor. Many other UW advisory boards have well-defined advisory tradition. Few other UW-related boards have some formal statutory authority relative to specific projects, e.g., Wyoming Carbon Underground Storage Project (WY-CUSP). Therefore, it seems clear that the ERC is unique. It is something different. It is important for the scope of ERC's role not to interfere with the responsibilities of the Board of Trustees, but compliment them. It seems reasonable to acknowledge it is more than simply advisory.

A. Item for consideration: Although the author would recognize that the interpretations of the SER/ERC/UW roles and responsibilities likely differ among parties, including among 90 legislators, the statutory charge seems sufficiently broad and flexible that a reasonable agreement as to authority, responsibility, and accountability can be made among ERC, UW Trustees, UW administration, and SER personnel. There seems to be an expectation among key policymakers that ERC should assert itself in providing direction, insight and guidance to SER, especially on private sector needs and provide an external, business perspective on the diverse components of Wyoming's energy industries. The expectation continues that UW and SER personnel will respect and incorporate those external views,

where appropriate for a university unit. Further, the Board of Trustees will be responsible for the structure and policies for operation of SER. No changes to the legislation authorizing ERC and SER are recommended, but a discussion and greater understanding of the roles and responsibilities described above (and modified where necessary) is worthy of consideration.

The Legislature created the Clean Coal Task Force (CCTF) in 2007, a year after the creation of SER and ERC. Initially, a clean coal research account was statutorily created, and the CCTF was developed in a non-codified section of the same legislation.³ Later, in 2009, the CCTF was codified with essentially the same language as in the 2007 Session Laws.⁴

³ See Appendix C-1, '07 Laws, Ch. 186, Section 2.

⁴ See Appendix C-2, W.S. 21-17-121 created by '09 Laws, Ch. 57.

The CCTF consists of the voting members of the ERC. The fact that the same members sit on both the Clean Coal Task Force and the Energy Resources Council and traditionally meet on the same day, though in separate morning/afternoon meetings, may lend itself to confusion. CCTF and ERC are not the same. Despite having similar memberships, they have completely different statutory charges, different and nonoverlapping budgets, and different expectations.

When sitting as the ERC, the charge is to provide direction to certain SER activities. SER is funded through UW's budget.

When sitting as the CCTF, the statutory charge is to issue requests for proposals for research projects into clean coal technologies, evaluate the proposals and award the most promising proposals with matching funds.

In contrast to the ERC, the CCTF —shall be staffed by the Governor's office with support from the University of Wyoming School of Energy Resources.¶ The Governor's office can presumably delegate its staffing responsibilities to UW, or other state agencies. Further, the CCTF, unlike the ERC, has explicit authority to —contract for administrative and research services to aid in preparation of the task force report.¶ In practice SER, and to an even larger extent the UW Office of Research - Sponsored Programs, acts as the fiscal agent for CCTF awards. This creates an awkward arrangement. At minimum, formal clarification of roles is necessary.

UW faculty can, and have, competed successfully for CCTF awards, but UW faculty compete on equal footing against other researchers from public or private academic institutions, private enterprise, or public, private, or not-for-profit laboratory enterprises.

Considerable effort should be made to distinguish between the activities taken as the ERC as separate and distinct from activities undertaken as CCTF. Again, they are different entities. As just one example, WY-CUSP is a project that includes statutory reporting requirements to ERC, not CCTF. As a result, different budgetary, statutory, and structural parameters apply.

B. Item for consideration: The CCTF-run enterprise has matured since inception. It appears that some current practices could and should be improved, particularly as they apply to awarding research projects, managing research, and engaging in contracts. At least two approaches could be considered to implement these improvements: (i) in the absence of legislation, CCTF may wish to adopt some or all of the recommendations noted on page 2 of the August 2010 memo from UW General Counsel regarding the Clean Coal Task Forces or (ii) the CCTF may wish to forward legislative changes that would revise the internal processes and structure of CCTF to be more in line with ERC.

⁵ See Appendix D.

2. Summarize the challenges and successes of each entity (SER, ERC, and CCTF) since inception.

Based upon the interviews held, there are high levels of pride, support, and confidence in SER, ERC, and CCTF's varied accomplishments. To a person, enthusiasm to further build SER and UW in order to advance the energy industries of Wyoming is convincing. Notwithstanding this pride and support, the most common challenges identified relate to improved communication, multiple inherent tensions in the structure of SER, and respect and understanding of the appropriate roles and responsibilities.

SER – numerous successes were noted regarding the activities of SER in its first four and a half years. Interviews yielded an especially remarkable and unexpected result - individuals external to UW regularly noted the

internal, academic successes such as attracting exceptional faculty, providing additional resources for graduate assistants, hiring a capable director, and creating new academic degrees. In contrast, many of the individuals internal to UW noted the success in outreach programs to connect with and advance the state's energy industry and pursue research that shows promise in bolstering Wyoming's energy economy. In sum, chief successes include:

- ☐ Hiring a capable director for SER, creating a strong structure and strong ties with UW's academic colleges, hiring SER associate directors and staff
- ☐ Hiring a range of quality faculty
- ☐ Building graduate assistantship opportunities in a broad swath of energy-related disciplines
- ☐ Establishing the Energy Resource Science degree and the Energy Systems Engineering Degree in the College of Engineering and Applied Sciences
- ☐ Expanding energy outreach throughout the state, providing a platform for examination and dissemination of information related to energy
- ☐ Incubating energy-related research, though this success is qualified by most as a —work in progress given the lead time needed for the success of high-quality research programs
- ☐ Engaging K-12 students and teachers

Looking back to the inception of SER and to the 2005 visioning document, in just four and a half years SER has arguably far exceeded

the original expectations. This is especially evident in terms of achieving, or at least making progress toward, most of the initial goals; securing robust state, federal and private support; and establishing the structure and processes for a viable, on-going entity.

With respect to challenges for SER several remain:

- ☐ Resolving tensions arising from the presence of a nontraditional structure — SER amidst the traditional curriculum-delivering structure of colleges and academic departments
- ☐ Achieving sustainability or independence of the Centers of Excellence
- ☐ Identifying appropriate transitions for supported faculty in areas of low performance or modified priorities
- ☐ Identifying transitional budget support given the expected conclusion of historic AML funds currently relied upon to support SER
- ☐ Continuing communication to constituencies
- ☐ Refining and resolving attendant expectations for the coming decade
- ☐ Assessing and evaluating internal reporting structures
- ☐ Maintaining and engaging broad campus interest and support
- ☐ Addressing or affirmatively electing not to pursue goals in the original 2005 visioning document, including establishing one or more graduate degrees, developing an editorial outreach unit, and engaging K-12 educators in a sabbatical-like arrangement

ERC - ERC might be called a broadly defined experiment just four and a half years ago. Since then the ERC has been populated with committed, qualified, and highly-recognized industry leaders on a volunteer basis. Further, this Council has coalesced around several key goals. As one external individual noted, —Recall that this effort started from ground zero just a few years ago... it takes time to get an organization in place.‖ Chief successes include:

- ☐ Populating the Council with perhaps the most prestigious, high-caliber individuals of any board within the State of Wyoming
- ☐ Engaging private sector expertise and insight into traditional academic structures for which such counsel is foreign
- ☐ Advancing a unique structure that is being recognized by both the energy industry and other academic institutions
- ☐ Securing state and private support at levels beyond those initially imagined
- ☐ Providing a formalized venue to advocate for the state's energy resources and doing so through research on efficiency, environmental sustainability, and commercial viability.

One interviewee suggested that among ERC's primary responsibilities is to avoid expenditure of state appropriations as —business as usual‖ and to insure this energy-related effort didn't —simply morph into the [university's] block grant.‖ By that direct measure, ERC's presence has certainly met expectations.

Nonetheless, numerous challenges remain as ERC and SER mature. Chief challenges include:

- ☐ Maintaining sufficient interest and opportunities for meaningful contribution of a high-caliber board with substantial demands on their time. Put differently, one interviewee noted ERC will

not be successful if their role is simply to be a —rubber stamp.¶

- Better articulating the roles, responsibilities, and expectations of ERC, SER, UW administration, and UW Trustees
- Insuring open lines of communication
- Continuing to provide a sense of urgency. Perhaps somewhat oddly, more than one internal UW interviewee noted that SER looks to ERC to set the pace and press for more urgent action.
- Providing stewardship to SER to bring major initiatives to fruition and identify and advocate for state and private resources

CCTF – In the course of this evaluation, perhaps the most universal agreement lay in the impressions of CCTF. Overwhelmingly, interviewees noted that the mission of CCTF was well understood and that the request, evaluation, and selection of research projects had made great strides since its inception. Most individuals indicated that the selection process has evolved and improved in recent requests for proposals and adding a component criterion for commercialization potential was needed. Therefore, the successes of CCTF include

- Developing into a well-recognized source for competitive research funding to advance clean coal technologies, especially those with applicability to Powder River Basin (PRB) coal
- Adapting the selection process to target gaps in technology and opportunities which hold the highest promise for commercialization
- Attracting a range of meritorious proposals which include significant matching funds
- Agreeing to select only the most promising initiatives that meet identified criteria, even in the event that the full, available funding is not expended

The CCTF successes are substantial and appear to have broad agreement; nonetheless, there appear to remain two important procedural challenges:

- The awarding of CCTF funding is ripe for disagreements between energy sectors based upon the technology and policy trends and, at worst, potential conflicts of interest. Prior meetings illustrate the current CCTF takes these issues very seriously. Aggressive adherence to protocols will require continue observance in future distributions of awards.
- Perhaps most importantly, the day-to-day handling of the awards would benefit from more formalization between CCTF and UW. Currently, UW staff are signing and monitoring contracts on behalf of CCTF without formal direction or protocols. As one interviewee noted, unlike the responsibilities and relationships of ERC, I'm —not sure anyone has thought seriously about the accounting and legal counsel [relating to these awards]; ...there are differences organizationally,

legally, and fiscally [between ERC and CCTF].

3. a. Does the University and the ERC have defined expectations for SER and to what extent has the School met them?

The University's expectations for SER can be found largely within the text of the 2005 visioning document and to a lesser extent a handful of deliverables within University Plan 3 (UP3), the university's strategic plan. The ERC has further defined expectations for SER through the development and approval of mission statements and reviews of the annual reports. Without addressing each expectation, it appears to an independent observer that SER has met or is in the process of meeting the majority of the expectations outlined in the above guiding documents. In fact, a large proportion of the goals contained within the visioning document is in progress or completely addressed. This being the case, the time may be ripe for an updated strategic plan that provides guidance for the coming decade.

C. Item for consideration: SER and ERC (with appropriate contribution of UW administrators and approval by the UW Trustees) may wish to prepare and agree to a follow-up, —five-year plan with identifiable goals, outcomes, and measures. The exact time period for any plan should be adjusted so that it aligns with the University Plan in future years. SER is maturing and has been largely successful in its first four years. But, circumstances evolve such that goals, priorities, and vision should also be revisited. Institutionally, UW follows a similar process for academics, athletics, and capital facilities.

b. Given the unique nature of SER and CCTF and their funding, missions, and relations with ERC and other external interests, what is the best reporting relationship?

With respect to CCTF, please refer to item for consideration, B. CCTF procedures may merit serious consideration as to the appropriateness of internal clarification or legislative revisions.

As to the reporting structures of SER, there are at least two levels to consider. The first is the reporting, responsibility, and authority within and among SER and UW faculty. Interviews identified a number of potential, hypothetical challenges in incentivizing, measuring, and being accountable for success at the faculty level. By and large, these were just that – hypothetical challenges. Undoubtedly, there will be conflicts in the distribution of resources, evaluation of personnel performance, etc. However, there is established leadership and structure, including the Department Heads, College Deans, SER Director, and Provost to work through those challenges. Not to dismiss the nature or depth of these challenges, but there appears to be at least some agreement that these issues can, and will be, internally managed as they arise. There is little evidence to the contrary.

Continuing with a consideration of the internal reporting relative to the SER Director, several individuals both internal and external, commented on challenges inherent in the reporting structure for the SER Director. A common, but not universal theme, suggested a structure of continued

reporting to the Provost for academic and administrative matters, increased communication with the Vice President for Research and Economic Development for research-related matters, and direct line of communication and reporting from the SER Director to the UW President on issues of vision, direction, and School priorities, especially related to high-profile research and outreach. In some cases, a title enhancement of the SER Director was suggested.

In the event a revision in reporting is considered, critical to any deliberations is the original purpose of SER: to embed energy-related teaching, research, and service irreversibly into UW's academic fiber. A change in structure or reporting lines that removes SER from the Division of Academic Affairs for academic reporting risks working at odds with this purpose by isolating SER from UW's colleges, which house the faculty, curriculum, and research enterprise, and by diminishing, rather than enhancing, the SER Director's ability to influence the college deans. The goal should not be to diminish or make the structure more onerous.

D. Item for consideration: W.S. 21-17-116(d) states, —The university's board of trustees shall establish the structure and policies for operation of the school of energy resources...‖ Despite the potential appearance of deflecting this issue, the reporting relationship practically and statutorily appears best resolved by the involved parties, i.e., SER Director, Provost, and UW President. Any changes would be considered by the Board of Trustees, if appropriate. Any suggested reporting structure put forward externally, from this author, or from any other constituencies would be unlikely to be embraced. This issue seems appropriate for internal UW discussion and deliberation.

Secondly, the highest level of reporting for SER, involves communication between the ERC, UW President, Board of Trustees, and the Wyoming Legislature, principally the Joint Interim Committee on Minerals, Business, and Economic Development. Several external entities applauded the re-engagement and commitment to regular participation by the UW President as an ex-officio member of the Board. That high-level connection appears to be both appreciated and critical to the success contribution of the ERC Board.

Arguably given the fact that two members of the Legislature serve on the ERC Board and the Joint Interim Minerals Committee receives regular reports from SER, at least a segment of the Legislature appears to be more informed of the activities of SER and ERC than the UW Board of Trustees.

On a slightly different note, one external interviewee suggested that —Conflict can be good; the true test is how you manage that conflict.‖ Another suggested that the UW President informally share his or her vision and aspirations with the Chair and Vice-Chair of the ERC in a private forum, especially on sensitive areas. In sum, a re-commitment to the goals and principles of ERC, SER, UW, in recognition of the State's interests, by all parties should facilitate candid discussions of the roles and reporting expectations.

While the goal is not perfect unanimity, a structure for candid and constructive communications would benefit the overall mission of SER.

E. Item for consideration: There are two areas of high-level reporting and communication worthy of consideration:

- a.* Continued participation by the UW President appears critical to the success of the ERC and SER.
- b.* There could be merit in considering whether a member of the UW Board of Trustees should formally or informally serve as an ex-Officio member of the ERC, or at least attend its meetings, when possible. It appears that there may be a hunger for additional information by at least some Trustees with respect to developments within ERC and SER. Several other Boards such as the UW Alumni Association and UW Foundation include one or more members of the Trustees as a liaison.

c. What are the advantages and limitations to the design of SER?

With respect to the design and structure of SER, ERC, and UW, this arrangement is unique and imperfect; filled with tension and potential for friction; relies heavily on leadership qualities of key personnel (UW and SER Administration, UW Trustees, ERC Board members, Deans, Department Heads, faculty, etc.); depends upon open, regular, and constructive communications; and at worst, is flawed. At the very least the current design does not appear to facilitate communication. Special recognition of this situation might benefit all interests.

However, as the 2005 visioning document explains in a compelling fashion, alternative structures such as a separate Institute, would be expected to perform far worse at leveraging existing energy-related expertise on campus and incentivizing interdisciplinary contributions. Improved design and structure are perhaps only limited by imagination of alternatives. However, it seems likely that the Winston Churchill statement, —Democracy is the worst form of government, except for all those other forms that have been tried is an applicable parallel for the existing SER/ERC design. Although unique and imperfect, it remains the best identified alternative.

The advantages and disadvantages of the design appear to be quite similar. Based upon multiple interviews, the advantages include interdisciplinary opportunities to transcend traditional academic disciplines and structures. The design also can provide a forum for regular feedback from policymakers, energy-related business leaders, and faculty with a range of expertise. This interaction offers a forum for more timely inputs, contributions, and returns from a broad range of constituencies including potential students, employers, elementary and secondary educators, state leaders, and business and industry.

These same advantages can pose hurdles as well. For example, many interviewees noted that the SER structure set up an internal tension between SER's objectives and those of the traditional academic units. Differences in culture are inherent

between the business world and the academic world. Confusion, even conflict, can arise between priorities among various energy sectors ranging from coal, oil, gas, nuclear, biomass, wind, and solar industries. Entrenched interests (business, administrators, faculty, politicians, etc.) might view SER as an extraordinary opportunity, while in other instances the same interests might view SER's agenda as threatening.

In sum, the SER design can present dichotomies that place a premium on those involved to clearly communicate, facilitate, and manage multiple interests – attributes foreign to many traditional researchers, administrators, and even advisors. Personalities, approaches, and relationship building cannot be overlooked.

F. Item for consideration: Unless or until policymakers and administrators (UW Board of Trustees, Legislators, ERC Board members, UW President, UW Provost, SER Director) determine and agree that the existing ERC/SER model is unworkable or an identified alternative is superior, it seems the best use of energy might be to encourage constructive operation within the existing design, which includes exercise of prudent leadership and open communication. Put differently, in the absence of evidence to the contrary, involved parties may wish to proceed under the current structure and affirmatively set aside other options, at least for the near future.

The successes of the last four years do not appear to offer evidence that a wholesale change in the structure and design of SER is needed.

d. Are there any identifiable improvements that SER, ERC, CCTF, or UW Administration should make in order to optimize SER's contributions going forward?

In addition to each of the previous items for consideration, there are three additional areas, or items, that may be worthy of consideration.

G. Item for consideration: Item A calls for a reflection and greater understanding of the existing SER/ERC/UW structure. Item B calls for revisions to procedures and practices related to CCTF, and Item C suggests the implementation of a second five-year plan. Collectively, those efforts may be necessary yet insufficient. The magnitude of feedback relative to the roles, authorities, and responsibilities for SER from interviewees was substantial. Key words used to describe this arrangement included: clumsy, confusing, and lacking trust. Some felt their contributions have been —isolated or, at worst, —looked at as an annoyance.¶

Nevertheless, the interviews also demonstrated that the current ERC members and UW leadership share a strong commitment to success. ERC members are seeking guidance and desire opportunities to contribute in the most meaningful way. Internally, UW personnel desire their contributions to be valued and their roles to be respected.

It is also important to acknowledge ERC members, legislators,

administrators, and trustees change over time. Given the expected change in statewide leadership and appointed members of governing boards, there is an expressed need to institutionalize the political, structural, and leadership support for ERC and SER to insure each remains a going, productive concern for the State and contributes to the state's energy sector.

Therefore, in conjunction with a five-year plan, a one-page description of ERC, SER, and CCTF roles and responsibilities, perhaps taken from the response to question #1 in this *Brief*, if agreed to, would provide additional clarity of purpose. Once prepared and approved at various levels, it could be disseminated to key interested constituencies (ERC members, UW Trustees, members of the Joint Minerals Committee, UW Administrators, and all SER faculty and staff.).

H. Item for consideration: Despite rigorous, abundant, and well-articulated support for and loyalty to SER, ERC, UW, and the State of Wyoming's energy interests, there is a strong undercurrent of frustration from the lack of a team effort. While not stepping back from aggressively asserting each interest's position, there appears to be significant opportunity to take special strides to listen, understand, and respect the positions and opinions of other interests. As previously noted, there are multiple, inherent areas of potential tension from the faculty of SER through the administration to the differing cultures of business and academia.

All parties should have a vested interest in exercising their support for ERC, SER, and UW by contributing toward the common goal, and providing, receiving, and responding to

to consider opportunities for enhanced, open, and clear communication. Nowhere is this task more critical than in the role of the SER Director, where interaction and management of faculty, ERC members, and UW administrators connect. The Director's position is at the nexus of communication and can serve as a positive conduit to relay, organize, and deliver information. But, involvement seems to be critical. It is a tremendous challenge and one that needs support from others to be successful.

I. Item for consideration: The ERC requested a financial audit in the spring of 2010. The request was highly unusual and received outside the traditional assignments to UW Internal Audit.

The vast majority of those interviewed, both internally and externally, noted a clear misunderstanding of the desired fiscal review and did not offer any indication of suspicion of the existing fiscal practices.

Nonetheless, two interviewees raised independent, differing, and non-specific concerns with the fiscal practices associated with SER. With full acknowledgment of the lack of appetite to revisit this issue by ERC members or UW

Partially

with

administration, the author would be a
remiss if these issues were not raised for iscal audit that is well beyond the scope
others to revisit. There may be merit in of this paper.
f

Table 1.
Summary
of Items
for

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| Item | Action | Responsible Party(ies) |
|-------------|---|--|
| A | Deliberation of and agreement to (or revision of) ERC, SER, and UW structure, roles and responsibilities. No legislative changes suggested. | ERC, SER, UW Administration, and UW Trustees |
| B | Reconcile CCTF statutory expectations and current procedures | CCTF, Governor's Office, UW Administration, UW Research Office |
| C | Create updated five-year plan | Primarily SER and ERC, with approval by UW Administration and UW Trustees, as needed |
| D | Consider revisions to internal reporting structure | SER Director, Provost, UW President; UW Trustees (if conditions warrant) |
| E | a. Active commitment from UW President; b. Consideration of adding UW Trustee to ERC as ex-officio member | a. UW President; b. UW Trustees (including possible legislation) |
| F | Reaffirm existing ERC/SER structure | SER, ERC, UW Administration |

Consideration.