

**REPORT OF THE EARTH AND MINERAL SCIENCES DEAN'S ADVISORY
COMMITTEE ON THE ENERGY BUSINESS FINANCE MAJOR**

June 2, 2006

By

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EXECUTIVE SUMMARY

Dean Baron convened the Committee to advise him on how to make the Energy Business Finance (EBF) major and Global Business Strategy (GBS) minor sustainable and how to attract new faculty to these programs. The major has grown since it was offered in 2004 to approximately 60 undergraduates, which is comparable in size to many other EMS majors. It has three faculty members, no teaching assistants (TAs), and no Department affiliation. The Committee reviewed the history and content of the program, spoke with stakeholders, and formulated the following conclusions and recommendations:

First, EBF and GBS provide considerable value to EMS and the University. They help grow enrollment in EMS, they offer courses needed to better prepare students for jobs in industry and government, they re-engage the generally successful Mineral Economics (Min Ec) alumni, and they could attract research dollars for important, timely issues, such as energy cost and availability. The undergraduate program also “feeds” the graduate programs in Economics, the Smeal College of Business, and Agricultural/Applied Economics.

Second, the EBF major needs a permanent home. Assuming the Provost approves the split of the Energy and Geo-Environmental Engineering (EGEE) Department into two Departments, the Committee recommends EBF be housed in what we refer to as “the Energy Department.” This report spells out some conditions for placing the EBF/GBS program in the Energy Department. If those conditions cannot be met, we recommend creating an Institute or center to house the EBF program.

Third, a “critical mass” for the program requires four tenure-track faculty positions¹ an administrative assistant, two lecturers, two teaching assistants (TAs), about 120 undergraduate students, and (highly recommended), a graduate program (if not possible to be housed in the “Energy Department” it can be offered jointly with and housed in the Agricultural Economics Department). There are three EBF faculty now located in three different EMS Departments. If a senior faculty member leaves, we recommend two junior faculty be hired in his place. The immediate investment to reach critical mass need not be high. The program should also attract “Professors of Practice” -- senior industry or government officials who wish to “give back” to their profession and teach courses.

Fourth, the “critical mass” discussed above should be sufficient to attract new faculty. The Committee feels that recruitment of two junior faculty will be feasible now, especially if a permanent home is defined for the major.

Fifth, some minor adjustments to the curriculum are needed, which are spelled out in the report. More cooperation with Smeal and the Agricultural Economics Department will help, as will more faculty, TAs, and Professors of Practice. The program also is ripe for student internships in industry and government, and Min Ec alumni as well as Professors of Practice can help establish such internships.

¹ When the number of majors exceeds 120, five faculty members will be needed.

I. OBJECTIVES

Dean Barron invited a group of outside experts/stakeholders to visit Penn State (PSU) and provide their advice on how to provide business and finance training to all the students in the Earth and Mineral Sciences (EMS) Departments and how best sustain the Energy, Business, and Finance (EBF) program. The charter appears in Attachment 1.

The Committee (Attachment 2) held a conference call, reviewed the EMS strategic plan and other materials, and then met for 1 ½ days in University Park in May, 2006 to gather information from the EBF Professor in charge, the EMS Department Heads, the Associate Dean for Undergraduate Programs, EBF students, professors in Agricultural Economics, and faculty formerly with the Department of Energy and Environmental Economics. The Agenda is Attachment 3.

The Committee was formulated by the Dean, and consisted of six alumni of EBF: 2 Min Ec PhD alumni; 2 undergraduate Min Ec alumni (one of whom went on to law school, and one who has become a money manager); a Meteorology PhD who also obtained an MBA; and a Petroleum Engineering PhD who also later obtained an MBA. A prominent professor from another major university with expertise in energy and environmental economics rounded out the committee.

The crucial questions addressed by the Committee included:

- How to make EBF sustainable
 - Governance model
 - The ideal number of faculty, students and the appropriate involvement with a graduate program. How to leverage faculty in other Departments to avoid adding several new faculty positions
 - Key to recruiting EBF faculty members
- Value of EBF to EMS Departments and vice versa; value of EBF to PSU
- Market for EBF graduates and core knowledge requirements
- Funding sources, opportunities

The report is organized to communicate information collected during the interviews that the Committee believes important for the Dean, followed by the Committee's recommendations.

II. BACKGROUND

The Mineral Economics Department was founded in the 1950s. By the early 1980s, it had trained many of the faculty for the nation's other mineral economics departments. By the mid-1980s, the Department shifted its focus as its graduates mainly entered industry. In the early 1990s, the Department's focus broadened to cover a range of energy and natural resource topics, and environmental economics. The fifteen PhD graduates between 1993 and 2003 primarily went into research, and the MS students from

this period mainly entered industry and government. In the mid-1990s the Mineral Economics Department changed its name to the Department of Energy, Environmental, and Mineral Economics, though the names of its undergraduate and graduate programs remained “Mineral Economics.”

The GBS minor was established in 2000. An EBF curriculum was largely devised in 2001- 2002. Currently, GBS is basically a subset of EBF. The Energy and Environmental Economics Department was then dissolved in 2002 by the Provost, and its remaining three faculty and associated teaching assistant (TA) positions were transferred to three different EMS Departments — Geography, Meteorology, and EGEE. The Department was disbanded because of the high cost of maintaining a program with so few students (approximately 20 undergraduate and 12 graduate students), and because of a belief at the PSU Board of Trustees that there were too many economics programs at Penn State (Economics, Agricultural Economics, and Forestry).

The EBF major opened to students in 2004 within EMS, with the support of the Smeal College of Business. It is currently run out of the office of EMS’s Associate Dean for Undergraduate Education. The EBF major has now grown to approximately 60 undergraduate majors, comparable in size or larger than long-standing EMS majors in Environmental Systems, Geosciences, and Petroleum and Natural Gas Engineering. The curriculum comprises introductory economics, business, and finance courses; introductory and advanced EMS electives; math; computer science; and EBF core classes taught in EMS by the three remaining faculty, plus a professor of Mining Engineering, Andrew Schissler, and a part-time lecturer. One of the three remaining faculty, Adam Rose, has made known his intentions to leave the university. EBF lacks faculty, faculty lines, staff support, and adequate TAs, especially given its current size and potential for future growth.

III. SUMMARY OF STAKEHOLDERS’ VIEWS

A, “Voice of the Faculty”

- Geosciences Department and Geography Department – Both Department Heads value the GBS minor over the EBF major. The GBS minor is seen as providing valuable business skills and perspective to all EMS graduates, which are increasingly important to prospective employers.
- Meteorology Department – The Meteorology Department Head similarly values the GBS minor and views the EBF program as quite important. Meteorology wants to grow its program in weather, business and risk management, which would build in part on the EBF program. In addition, Meteorology would like to see its students have the opportunity to gain a double major with EBF and its own program, or a GBS minor. The Meteorology Department favors an Institute management structure because it allows equal access to the program by all EMS Departments. The Department is also willing to house the major. Thirty-eight percent of the GBS minors have been Meteorology students.

- EGEE Department – The EGEE Department Head indicated his Department was splitting into two, a department of Petroleum and Mining Engineering, and an “Energy Department” to be named later. The EGEE Department head will become the head of the Energy Department, and he indicated that he would like the EBF program in his Department. The EGEE Department Head stated that if EBF is not placed in his Department, he would end up constructing a major that looks similar to EBF.

The Department Heads generally viewed Institutes as mainly for research, rather than teaching, and cited challenges with joint appointments of faculty to an Institute and a Department, because of tenure and divided loyalty considerations.

All felt that a graduate-level program associated with EBF would be important for attracting and maintaining quality faculty.

B. “Voice of EBF Students”

The Committee split up into three groups and met with 2 to 3 EBF students each. The messages from these students, summarized below, were generally consistent among the three groups.

- Students are attracted to the interdisciplinary, practical nature of the EBF program; nevertheless “Energy” label in the title is the main attraction. Suitability of the program to a concurrent degree (double major) makes it attractive. Students also believed that program is a good preparation for graduate school.
- Students enjoyed the broad application of the education, thus each student’s ability to pursue individualized careers is a plus for the program. At the same time, the students are a bit confused by how to carve out a cohesive major among the electives, and are uncertain of the future of the major. They would like more clarity in courses available from other programs both within EMS and the University to help organize their education.
- The combination of business and policy aspects with the natural resources industries is a strong attracting factor to the program. Students feel it can differentiate them from a straight business major.
- The diverse backgrounds and prior interests of the students (engineering, math, and advertising) indicate the diverse appeal of the program. It also attracts students who find the math in meteorology or the EMS engineering programs too daunting. Students are pleased with the student focus of the EMS (small size, well defined cohort, access to faculty, Deike facilities). The EBF student club is important in getting students together and forming a home, as well as serving as a sounding board for surviving college and preparing students for internship and job interviews.
- Interviewed students were happy to recommend the program to their friends and most actually did. They believe EBF enrollment could triple easily if the program is advertised.
- EBF courses were useful but titles did not match the content. The course titles need to be less misleading and more descriptive to the material taught.

- Students prefer a larger selection of courses to be offered both spring and fall to avoid so many scheduling conflicts with the outside classes they need to take. Students would like more senior-level EBF classes, and some would prefer senior science classes, and hands-on technology classes. Students would like a senior level class that pulls the program together in addition to a capstone class.
- They expressed concern with restricted access to courses in the Smeal College of Business.
- The recruitment opportunities for EBF students are not well defined within EMS. EBF can join other EMS programs for on campus interviews, but the program is not known well outside of EMS, and thus does not attract recruiters.
- The students are a bit insecure about the major not being attached to a Department, and some students did not know where to go to for advice.

C. Other stakeholders: Prospective employers of EMS graduates strongly feel that EMS graduates need some basic business training to make them more immediately valuable in new jobs. Successful EMS graduates such as Ed Dowling and the other members of the EMS Industry Advisory Committee have repeatedly expressed this need. The Min Ec alumni, generally fairly successful professionals, feel “adrift” with nowhere to focus their donation of time and money to PSU, now that their Department has been disbanded.

III. CONCLUSIONS AND RECOMMENDATIONS

A. Value of EBF

The Committee first considered whether the EBF program had value, and, if so, what. They agreed it had value (and it would have even more value with a graduate program in addition to the undergraduate program), and characterized the benefits as the following.

To EMS: The significant benefits of EBF to EMS are fourfold:

1. The rapid growth in the number of majors, including students who entered the University as “undeclared” clearly demonstrate the major is helping increase and maintain undergraduate enrollment in EMS.
2. The EBF major and associated GBS minor both provide business/finance skills accessible to all EMS schools. This is especially important because EMS students are not generally allowed access into most Smeal College courses
3. The EBF major helps “round out” EMS by offering curricula that cover all aspects of earth resources, from the basic science, to the engineering, to the management of earth and mineral sciences.
4. The program can attract national visibility to the EMS College (and to PSU), especially if it can establish a reputation in the energy and environment debate.

To the University: The Committee enumerated at least five benefits of EBF to the University:

1. The major and minor better prepare PSU graduates for successful careers
2. The major broadens PSU's opportunities for research dollars (also a benefit to EMS).
3. The EBF major can feed majors in other PSU Colleges, such as the Smeal MBA and the Economics and the Agricultural Economics graduate programs.
4. It strengthens PSU's existing reputation for excellence, especially in the mineral industries.
5. The EBF major can re-engage Min Ec alumni in contributing to PSU (also a benefit to EMS).

B. EBF Focus

The Committee recognizes that the "Energy" in EBF attracts students and is a hot topic, but advises the program be expanded to "earth resources" business and finance or management. All Departments could benefit from this broader focus, including mining and petroleum engineering, environmental engineering, meteorology, materials science and earth sciences. The broader perspective could also hedge the typical boom and bust nature of the energy industry. The program name does not necessarily need to change in the short term.

C. Home for EBF

The Committee spent much effort on discussing where to house the EBF program. We considered three main options: 1. Create a Center or Institute to house it; 2. put the program in the Meteorology Department; 3. put the program in the new "Energy Department" that will be created when/if the Provost approves splitting EGEE. The "pros" of a Department home rather than a separate Institute or Center included:

- Clear faculty lines owned by a Department
- Departments are intended for teaching and research, whereas PSU Institutes tend to focus on research only.
- Easier to manage tenure process within a Department, rather than within an Institute
- Likelihood of easier access to (or dedication of) TAs if the major is in a Department, rather than an Institute
- The EMS Department Heads and the EBF student majors generally favored housing EBF in a Department.
- It should satisfy Min Ec alumni who might want to endow a chair, as it is easier to have a chair in a Department than in an Institute.

On the other hand, there are some relative advantages to an Institute or Center. They could include:

- The major could suffer more from parochial politics within a Department. A Department could "hijack" the major, and make it less beneficial to all EMS Departments.

- An Institute might be better able to attract a “benefactor” after whom it is named.
- An Institute might also be more attractive for recruiting a senior faculty member if the position is Institute Director.

The Committee recommends housing EBF in the new “Energy Department”, formed from part of the EGE department. We felt the fit in Energy was better than Meteorology because “meteorology”, is likely to be too specialized to house an interdisciplinary major focused on the business and finance of energy, minerals, environment, and earth resources in general. Also, the “Energy Department”, with EBF in it, would be comparable in size to the other EMS Departments; the Committee does recognize the importance of the major, however, to Meteorology.

The recommendation is conditional upon the following:

- EGE department is actually split, and a new “Energy Department” is created.
- The EBF major be designated a program, and the head of the program report to the Head of the Energy Department. The Department Head fully embraces the EBF program by recognizing it in the name of the Department, such as adding “policy,” “business,” or “management” to the name of the Department. This is required to attract faculty and to make students feel they have a true home.
- The “Energy Department” create its own undergraduate program in Energy Science and/or Energy Engineering
- The “Energy Department” include the relevant and applicable EBF courses in its new undergraduate program
- The “Energy Department” commit to making the program equally accessible to students of all EMS Departments.

If these conditions cannot be met, the Committee recommends the EBF major be housed in a new Institute. The Institute head would report to the Dean. The faculty lines would have to be tied to Departments that house faculty who participate in the Institute. Also, the College and its faculty would have to adapt to an Institute whose focus is teaching rather than research. In addition, the “Energy Department” would be precluded from opening up a major competing with the EBF major.

The Committee recommends that Andrew Kleit be head of the program, recognizing his strong track record in growing the major. We recommend he hold a 50% appointment to the “Energy Department” and 50% in the Meteorology Department to maintain ties with Meteorology and continue to take part in the Meteorology Department weather risk management initiative. The program head would be responsible for administering the EBF major, the GBS minor, and ties with the graduate program in Applied Economics.

The Committee recommends that EMS allocate an administrative assistant to the EBF program located in the same office building as the new “Energy Department” to better integrate the program, and also dedicate two TAs. The current number of majors warrants this immediate help.

The EBF program will also require:

- Two new tenure-track faculty hires at the junior level, replacing the Adam Rose position once he leaves. Two junior faculty hires are recommended over one senior because more people are needed to teach courses, and it could be difficult to attract a senior person at this stage of the major. We recommend Adam's position move from Geography to the new Energy Department.
- A strong advisory board and strong alumni involvement in capstone class. This will serve to attract industry and government experts to help the EBF program by, for example, teaching part of capstone class and helping gain industry support to a strong internship program.

The Committee also recommends:

- The program attract "Professors of Practice" – senior retired industry or government officials who are willing to spend time on campus to teach courses for a semester at a time or longer. Alternatively, it may be possible to have actively employed senior people offer a course in, e.g., 2 or 3 long, full-time weekends.
- Hiring lecturers to help teach the courses.
- Establishing a graduate program. If this program cannot be established in the "Energy Department" it could be housed in the proposed "Applied Economics" Department and housed in the College of Agriculture. A graduate program is needed to attract faculty and to have graduate students who would assist with research. The College that houses the major advisor for the graduate student would receive credit for the graduate degree.
- Pursuing a five-year MS degree for EMS majors. The Committee is somewhat concerned about job opportunities for a BS recipient.

In order to lessen the cost to EMS of new tenure-track faculty, a Dean might consider a cost-share with, for example, the Agricultural Economics Department.

D. Critical Mass

The Committee feels the following would provide a "critical mass" and is possible for the program within two to four years, if the recommendations in Section III.C are followed: four tenure-track faculty (increasing to five when the major exceeds 120 students), two lecturers, two TAs, a staff assistant and approximately 120 undergraduate students. The Committee did not have much time to address number of undergraduates, but, based on enthusiasm for the major among students we interviewed, the growth in majors in the past two years, and the fact the program is not advertised or marketed at all in PSU led the Committee to believe the program could easily double in size. The job market for business and finance in the weather area, as well as in energy (oil, gas, and chemicals, utilities, and renewable energy, energy efficiency) and mineral resources should remain strong.

E. Keys to attracting faculty to EBF:

Most of the keys to attracting new faculty have been addressed in the recommendations above, but to summarize them, they include:

- Graduate program in Applied Economics; offering an MS initially and eventually a PhD.
- Immediate access to graduate students in EMS
- Dedicated TAs to the program – two TAs initially, growing to three TAs
- A Department that looks like a long-term home, with a name that will assist in attracting faculty, e.g., “management,” “finance,” or “policy” in name of Department
- “Professors in Practice” who would help serve as cohorts for new faculty members
- Hire lecturers (long-term basis) as a way of getting courses covered to relieve teaching load of tenured and tenure-track research faculty.
- Critical mass of students and faculty--120 students, and four tenure-track faculty members (excluding lecturers)
- Need dedicated, full-time administrative assistant to support program.
- At the discretion of the Dean, rotate the program chair among EBF faculty—an opportunity to serve as chair might be attractive to a member who wants to play a major role in shaping the curriculum, research program, and focus.

F. Market for Students

The Committee started out somewhat skeptical about the market for a BS degree in EBF, with some members feeling that it is critical to get a strong analytical framework and a strong foundation in one discipline before going on to graduate school or a job. The Committee generally became optimistic about the opportunities for program graduates, assuming a few changes are made to the curriculum (discussed in the next section of this report).

The opportunities for graduates should include, in both the US and abroad:

- Market analyst within a corporation or an investment house
- Graduate school in Business, Finance, Economics, or Management
- Law school
- Corporate finance
- Government
- Analyst for a bank (for two years)
- Risk management, risk analysis
- Consulting
Trading

In addition, it is important that the GBS minor remain open students.

G. Improving the Curriculum

The Committee feels that it is important to help a student develop a framework in which to analyze choices in the EBF area. Examples of problems that a graduate might be faced with are:

- how to measure and reduce weather-related risk,
- how to analyze markets for new energy products and services,
- how to monetize energy or mineral-related environmental impacts,
- how to attract or analyze investment alternatives in the earth resources-related industries, and
- how to assess the impacts of a new regulation in the energy area.

The Committee recommends the following with respect to the curriculum. The curriculum is quite good, but needs to be “tweaked” in some areas. We also recognize the need to students to graduate in four to five years, and do not necessarily recommend adding more core courses. We focus below on things we think needed to be added, changed, or emphasized most

1. Within EBF:
 - a. Use of case studies to teach more advanced principles of EBF.
 - b. Develop more 400-level courses in EBF, and courses listed need to be available—reaching a critical mass through more faculty and lecturers will help meet this goal.
 - c. Ensure course titles match course content—some titles are left over from the Mineral Economics Department, but have changed considerably since they were named.
 - d. Add a survey course on energy policy unless it is agreed that ENNEC 484W covers this ground.
 - e. Articulate EBF requirements better so you help students develop a specialty or a “track” –they are having trouble picking electives that make up a cohesive major that gives them a foundation attractive to graduate school or a job. While students may start asking for it, be careful to not offer too many tracks or specialties. The Committee offers the following, but substitutions are possible: earth resources finance, accounting, or management and a technology-based track.
 - f. Develop a five-year MS program.
2. With Smeal
 - a. Offer risk management, decision analysis, and risk management (or possibly with Agricultural Economics or Industrial Engineering)
 - b. Obtain access to more upper-level courses in Smeal.

3. With Agricultural Economics:
 - a. Develop an MS and PhD program (described in III.C above).
 - b. Consider joint faculty appointments.
4. Require enough math and science to ensure EBF doesn't become "an easy major" that dilutes the strength of the college, or ensure that SAT scores in math and verbal are comparable to the rest of the Department. (It appeared to the Committee that SAT scores in this major currently are comparable to the rest of the Department.)

H. Funding Source Opportunities

The Committee briefly considered opportunities for EBF research topics or funding. They include:

- Appeals to Min Ec alumni for donations to develop funding for chairs, building renovations and other physical plant improvements, scholarships, and travel funds for internships. For example, the Min Ec alumni might readily pull together to fund a Min Ec Chair.
- Strengthen Pennsylvania's position for major Department of Energy demonstrations like "Future Gen" (A billion dollar demo of coal gasification, hydrogen production, a combined cycle plant, and CO₂ sequestration). Governor Rendell has announced Pennsylvania's intent to host the demonstration, and having a program focused on how to analyze the business benefits and commercialize the results might help on future demos.
- Attract studies from industry for business studies of, for example, the coal industry (where Chevron's and Sasol's gas-to-liquid alliance could be a subject). The studies could complement technical research going on elsewhere in EMS, and make both programs stronger.
- Expand renewable energy R&D at PSU. This field is very attractive to students, and the industry is still in the fledgling state and in need of good business sense.
- Climate change economics coupled with work going on in meteorology or in fuel sciences
- Energy and weather trading, carbon trading, carbon sequestration
- Risk management for, e.g., coastal flooding from climate change
- Links to materials science and nanotechnology, such as economies of recycling

For a summary of the Committee's recommendations and conclusions, please see the Executive Summary.

ATTACHMENT 1. Charter

ENERGY BUSINESS AND FINANCE ADVISORY COMMITTEE CHARTER

Role: To advise the Dean of Earth and Mineral Sciences on program strategy and objectives for the Energy, Business and Finance Program and Global Business Strategies Minor.

Scope of Review:

- A. Review program goals and curriculum and advise on degree requirements.
- B. Identify synergies with other majors in EMS and opportunities in the new EMS Energy Initiative.
- C. Advise on technical and economic trends that will affect the field in the next five to ten years and on the implications for program graduates and possible research areas for the faculty.
- D. Identify opportunities for alumni involvement in the program
- E. Consider mechanisms to ensure the sustainability of the program within the context of EMS departments and institutes
- F. Determine whether the program would benefit from the formation of a standing advisory committee.

Mode of operation: Teleconference and 1 ½ day meeting on campus to review strategy, resources, progress against goals and objectives, and identify ties to stakeholders and constituents.

Eric J. Barron
January 2006

ATTACHMENT 2: Advisory Committee members

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ATTACHMENT 3. Committee Meeting Agenda

Agenda
Energy, Business, and Finance Advisory Committee

Thursday, May 4th EMS Dean's Conference Room

12:30 Introductions and review of objectives, and committee assignments
–Trocki

1:15 Objectives/strategy of College of EMS -- Rob Crane

2:00 Overview of EBF program – Andy Kleit

History/context
Goals
Curricula
Challenges
Governance models

3:00 Committee informal meeting with Department Chairs as a group

Tim Bralower – Head, Geosciences
Roger Downs – Head, Geography
Nels Shirer – Associate Head, Meteorology
Yaw Yeboah – Head, Energy and Geo-Environmental Engineering

4:30 Committee informal meeting with Adam Rose and Tim Considine

5:00 Pre-arranged meetings with students -- Committee splits into 3 subgroups
and each subgroup meets with 2 - 3 students in pre-arranged meetings

5:45 Committee reconvenes and shares information, thoughts from student
meetings and rest of day (Closed session)

6:15 Review of draft report outline and lead committee assignments (closed
session)
- Prioritization of activities on Friday to discuss ideas and draft a report

6:30 Break

7:00 Cocktails and dinner, with presentation by Dave Willis, EMS Director of
Development and Alumni Relations (Nittany Lion Inn)

Friday, May 5th EMS Dean's Conference Room

8:00 Working breakfast with Eric Barron

8:45 Discussion of the Ag Econ program

Jim Shortle – Graduate
Steve Smith -- Undergraduate

9:30 Working session

Intra-university issues:

- Governance
- Intra-university leverage
- Sustainability – ideal number of students? Graduate program? Core faculty size?
- Market for students and core knowledge requirements for graduates
- Funding sources, opportunities & context for EMS as a whole

10:15 Break

10:30 Working session, individual writing completed, if possible

11:30 Group discussion of all recommendations (Closed session)

12:00 Working lunch & writing (closed session); visit to museum as time allows

1:00 Discussion of recommendations with Eric Barron,

1:45 Discussion of recommendations with Andy Kleit

2:30 Wrap-up, next steps