

FUEL CHEMISTRY
Undergraduate and Graduate Fuel Science and Engineering
Education at West Virginia University

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Introduction

Fuels science and engineering at West Virginia University refers to those educational activities in engineering and science programs whose subjects deal with the extraction and utilization of fossil fuels. In this broader sense, fuels science and engineering are involved with all aspects of fossil fuels. In particular, they deal with combustion, conversion, coking and the utilization of coal, oil shale and tar sands. In a narrower sense, the subject covers chemical and physical changes involved in fuel utilization. The purpose of an educational endeavor in this subject area is to develop the potential in able and interested people for solving complex problems of fuel utilization. The need for such educational programs is expected to intensify in the near term.

West Virginia University is a land-grant university and the comprehensive state university for West Virginia. Tuition is one of the lowest in the nation and admissions are open. Self-selection by students provides an academically oriented student body as described by college-bound test scores and high school grades. As the comprehensive state university, WVU offers programs in professional schools and graduate departments. Agriculture, dental, engineering, law, forestry, medicine, minerals, nursing, and pharmacy schools are supported by graduate programs in basic sciences.

The university is in Morgantown, Monongalia County; a county which customarily ranks first or second among the counties in the state in coal production. West Virginia has ranked first or second in coal production among the states for many years. Other energy resources are also recovered commercially.

Need

The need for fuels-oriented programs is variously viewed. In the scientific and engineering disciplines, the state, regional, and national dependence on imported fuels are considered important reasons for study; faculty have acquired appropriate interests and skills over the years, and student demand has remarkably strengthened over a five year period. Personnel in the science and engineering programs are additionally motivated by their interest in new and improved understanding of nature; a desire to publish, and the increased availability of university, state, and federal support.

Jobs are available in industry, government, and academia. Pressure from recruiters has been strong and effective. Students and faculty alike have received offers of high salary and optimum working conditions. An important co-effect has been the disruption of traditional ivory tower inclinations and reduction of leisure to ruminate among ideas and over problems.

History of Co - Going Effort

Different programs throughout the university have a different historical pattern of response to the perceived educational needs in fuels. Programs vary greatly in their longevity, levels of sophistication, and orientation toward a specific fuel. Some stress science and some are engineering oriented.

As an example of a science department, geology is of special interest. The faculty offer three courses in which coal is of primary concern. Two of these courses - Coal Geology and Coal Petrography - were approved formally within the last two years. Considerable jurisdictional discussion had ensued between faculty in geology and those in the College of Mineral and Energy Resources. A single geology course is offered in Petroleum Geology. Geological research on fuels is centered on characterization and on resource or reservoir definition. A new and major research effort on gas from Devonian Shale is currently underway. The fuels work in geology is often done in cooperation with the West Virginia State Geological and Economic Survey.

In engineering programs, course offerings centered on fuels are extensive. Mining, petroleum, chemical, mechanical, and mineral processing engineering as subject areas are largely committed to design, operation, construction and research dealing with fuels extraction and utilization processes.

Chemical engineering offers two courses on coal conversion at the undergraduate level. Mineral processing engineering offers another sequential undergraduate course on conversion and a graduate course in synthetic liquid fuels. Electrical, mechanical, mining and petroleum engineering have substantial research interest and funding in problems of fuels appropriate to their general charge.

Fuels Research

Before 1970, little activity was apparent in fuel research. From the early 1960's, the state had supported efforts from a semi-autonomous Coal Research Bureau to find, develop, and increase markets for West Virginia coal. The fund supported academic research and technological development to a certain extent. Since 1976, however, a considerable and increasing portion of an ever-larger budget has been allocated under a new charter to academic researchers working in an independent mode. The administration of the research grant procedure has been placed under the direction of a Provost and a committee of university faculty and administrators.

The effect has yet to be evaluated. However, many excellent academicians chose to apply their expertise to the solution on fuels oriented problems. Broad, university-wide, representation among the researchers has become apparent. As part of this effort, the chemistry department and the physics department expanded their research efforts on fuels. Chemistry has aimed toward fuels combustion mechanisms and has additional support from industry and government. Supported by state funds, physics is investigating magnetic effects in pyrite as a function of temperature.

Additional Response to Need

Two goals were visualized for the WVU fuels science and engineering programs in the light of society's need for energy and chemical feedstocks and the students need for preparation in a challenging and rewarding career.

Society's need is likely to be met by utilization of a plentiful fuel resource or by the conversion of a plentiful reserve to a resource. The areas of need to be served are for process plant and utility fuel, metallurgical coke, substitute natural gas and synthetic petroleum. The area of challenge is extended through the science and technology of utilization but with particular attention to the chemical reactions involved.

The fuels science and engineering programs at WVU are career oriented. Orientation for a career is to be viewed within the broad framework of degree candidates who will solve technological problems which are real and present. The expectation is high that the careful selection of students, especially at the graduate levels, and the stress in the programs upon principles and their rigid application will produce future problem solvers.

The educational philosophy at the university has been one of permissiveness, flexibility, and encouragement rather than coercion in the motivation and direction of students.

Organization

Organizational responses have been quite varied. Some programs cross organizational lines while others are within academic units.

Fuels science programs and courses at WVU are concentrated in the College of Mineral and Energy Resources; the College of Engineering, and the College of Arts and Sciences. The College of Mineral and Energy Resources was authorized in January 1975 to offer programs leading to the Bachelor of Science, and Master of Science Degrees in mineral processing engineering, complementing long existing degree programs in mining engineering and petroleum engineering. In 1976, access to the interdisciplinary Ph.D degree with the College of Engineering was authorized. Two options are stressed: one is in coal preparation and the other is in coal conversion. Considerable support in these efforts were required and obtained from the Department of Chemical Engineering.