industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development."

Although this definition of sustainable development leaves many fundamental conceptual and value questions in need of further analysis (e.g., What are human needs? What is meant by "environmental quality"?), it provides a general framework for inquiry. It also identifies a variety of fundamental areas of concern (e.g., food, transportation, and waste management). Of course, responsibilities in these areas do not fall only on engineers. Government officials, economists, business leaders, and the general citizenry need to be involved as well. Thus, a basic question relates to how those who need to work together might best do so and what role engineers might play. We offer three illustrations for discussion. The first is an early effort to involve students from different disciplines in a project that supports sustainable development. The second is the recent proliferation of centers and institutes for sustainability on college campuses throughout the country. The third is service learning opportunities in support of sustainable design and development.

RENEWABLE ENERGY[107]

Dwayne Breger, a civil and environmental engineer at Lafayette College, invited junior and senior engineering, biology, and environmental science students to apply to be on an interdisciplinary team to design a project that would make use of farmland owned by Lafayette College in a way that supports the college mission. Twelve students were selected for the project: two each from civil and environmental engineering, mechanical engineering, chemical engineering, and Bachelor of Arts in engineering, plus three biology majors and one in geology and environmental geosciences. These students had minors in such areas as economics and business, environmental science, chemistry, government, and law. The result of the project was a promising design for a biomass farm that could provide an alternative, renewable resource for the campus steam plant.[108]

Professor Breger regards projects such as this as providing important opportunities for students to involve themselves in work that contributes to restructuring our energy use toward sustainable resources. ABET's *Engineering Criteria* 2000 for evaluating engineering programs includes the requirement that engineering programs demonstrate that their graduates have "an understanding of professional and ethical responsibility," "the broad education necessary to understand the impact of engineering solutions in a global and societal context," and "a knowledge of contemporary issues." Criterion 4 requires that students have "a major design experience" that includes consideration of the impact on design of such factors as economics, sustainability, manufacturability, ethics, health, safety, and social and political issues.[109] Discuss how the Lafayette College project might satisfy criterion 4, especially the ethical considerations.

ACADEMIC CENTERS FOR SUSTAINABILITY

Historically, joint research in colleges and universities is done within separate disciplines rather than in collaboration with other disciplines. Thus, biologists collaborate with other biologists, chemists with other chemists, economists with other economists, and political scientists with other political scientists. The recent emergence of centers and institutes for sustainability represents a significant and important break from that tradition.

In September 2007, the Rochester Institute of Technology initiated the Golisano Institute for Sustainability.[110] Noting that it is customary for new programs to be run by just one discipline, Nabil Nasr, the institute director, comments, "But the problem of sustainability cuts across economics, social elements, engineering, everything. It simply cannot be solved by one discipline, or even by coupling two disciplines."[111]

Dow Chemical has recently given the University of California at Berkeley $10 million to establish a sustainability center. Dow's Neil Hawkins says, "Berkeley has one of the strongest chemical engineering schools in the world, but it will be the M.B.A.'s who understand areas like microfinance solutions to drinking water problems."[112] The center is in Berkeley's Center for Responsible Business, directed by Kellie A. McElhaney. Commercialization of research undertaken by students and professors is expected. However, McElhaney notes, "Commercialization takes forever if the chemical engineers and the