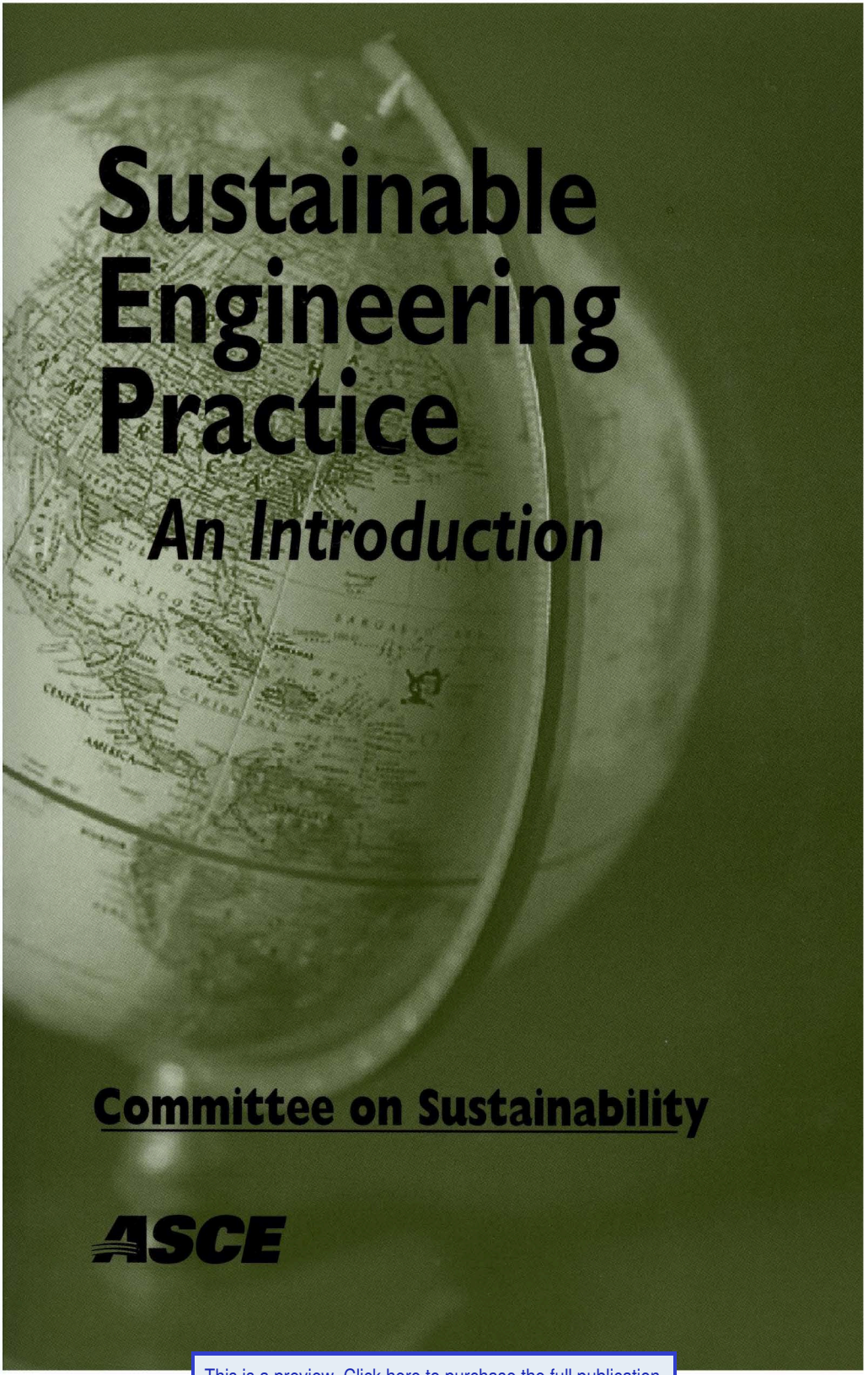

Sustainable Engineering Practice

An Introduction

Committee on Sustainability

ASCE

SUSTAINABLE ENGINEERING PRACTICE

An Introduction

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Preface

"Creating a sustainable world that provides a safe, secure, healthy life for all peoples is a priority for the US engineering community. It is evident that the US engineering must increase its focus on sharing and disseminating information, knowledge and technology that provides access to minerals, materials, energy, water, food and public health while addressing basic human needs. Engineers must deliver solutions that are technically viable, commercially feasible, and environmentally and socially sustainable."

This declaration comes from a "Dialogue on the Engineers Role in Sustainable Development – Johannesburg and Beyond" that was held at the National Academy of Engineering in Washington, D.C. on June 24, 2002 (NAE, 2002). The participants represented a "who's who" of professional engineering organizations, federal departments and agencies, and others with interests and responsibilities in sustainable development. The Declaration also committed its signatories "...to moving forward in support of the US engineering community to meet societal needs through capacity building, improved education, training, information development and dissemination, and engaging the engineering profession in all stages of the decision process."

The Committee on Sustainability of the Technical Activities Committee of ASCE prepared this Committee Report in part, as a response to the Declaration. The Report provides a starting point for engineering students and young engineering professionals in practice to gain an understanding of the basic principles of sustainability and their application to engineering work. It is intended to fill a need for a "primer" on sustainability that can be introduced early in an engineer's career: it brings together all the basic dimensions of its history, concepts, and applications; and through a variety of examples and references, can inspire and encourage engineers to pursue and integrate sustainable engineering into their work on life-long basis.

The Report also responds to a common issue, the achievement of development that is sustainable, which poses an opportunity and a challenge to the engineering profession, which according to Hatch (2002), are: "...opportunity for greater public service (and economic gain) and challenge to our traditional education, our methods, our technologies and even our ethics." Hatch further states that achievement of sustainable development will change how the public, clients, students, employees, and the youth that professions and industries seek to attract, perceive engineers. The relevancy and reputation of engineering will depend largely on the willingness and demonstrated contribution of the profession to achieving sustainability. This is a

vision, an ethic, not a strategy and supporting tactics, not a set of specific technologies, processes, laws, regulations or standards.

The World Commission on Environment and Development took the lead in outlining a sustainable future, culminating in the 1987 publication of Our Common Future (WCED, 1987). This report (often referred to as the Brundtland Report) provided a focused definition for the concept that has endured: "[Sustainable Development]...is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations." In other words, it is "Meeting the needs of the present without compromising the ability of future generations to meet their own needs."

According to Hatch (2002), this definition focuses on environmentally sustainable development. Over the years he has been adding other adverbial modifiers to the phrase "sustainable development" to better express the context of sustainability, beginning with the obvious one in a market economy – economically sustainable. In a free democratic society (or even in one that is not), he adds politically sustainable. Furthermore, in a socially conscious society, he adds socially sustainable. More recently, he also has added ethically sustainable as people have become more aware of the religious and ethical underpinnings of so much of human behavior – particularly the extreme. These adverbs are not independent but are clearly interdependent and any successful endeavor must address and satisfy them all.

The Report is structured as follows:

Chapter I - Background begins with a challenging statement of a Pulitzer Prize-winning environmental scientist, as we enter what he calls "The Century of the Environment." It is followed by a summary of the role and accomplishments of engineers in sustainable development. (The complete report, "Engineers and Sustainable Development," is contained on a CD appendix to this report.) Chapter I concludes with a summary of the major commitments made and implementation activities agreed upon at the World Summit on Sustainable Development, held in Johannesburg, South Africa, in September 2002, and the initial steps being taken by the US engineering community and its global partners in moving "beyond Johannesburg." The definition of, and policy for, sustainability by the American Society of Civil Engineers is shown in Sidebar 1, at the end of Chapter I.

Chapter II - Selected Readings offers a broad spectrum of examples, which describe how sustainability principles can and are being integrated and applied in engineering education, research, and practice.

Chapter III - Sustainability Definitions, Policy Statements, and Principles will give the reader a broad sense of the visionary and ethical goals and strategies of sustainable engineering practice.

Finally, *Appendix A - References, Resources, and Tools* contains a wealth of additional information that can be used to pursue the basic material in the Report in greater depth and detail.

Chapter I
Background

The Century of the Environment – A Challenge[1]

"The twentieth century was a time of exponential scientific and technical advance, the freeing of the arts by an exuberant modernism, and the spread of democracy and human rights throughout the world. It was also a dark and savage age of world wars, genocide and totalitarian ideologies that came dangerously close to global domination. While preoccupied with all this tumult, humanity managed collaterally to decimate the natural environment and draw down the nonrenewable resources of the planet with cheerful abandon. We thereby accelerated the erasure of entire ecosystems and the extinction of thousands of million-year-old species. If Earth's ability to support our growth is finite–and it is–we were mostly too busy to notice.

As a new century begins, we have begun to awaken from this delirium. Now, increasingly post-ideological in temper, we may be ready to settle down before we wreck the planet. It is time to sort out Earth and calculate what it will take to provide a satisfying and sustainable life for everyone into the indefinite future. The question of the century is: How best can we shift to a culture of permanence, both for ourselves and for the biosphere that sustains us?

The bottom line is different from that generally assumed by our leading economists and public philosophers. They have mostly ignored the numbers that count. Consider that with the global population past six billion and on its way to eight billion or more by mid-century, per-capita fresh water and arable land are descending to levels resource experts agree are risky. The ecological footprint—the average amount of productive land and shallow sea appropriated by each person in bits and pieces form around the world for food, water, housing, energy, transportation, commerce, and waste absorption—is about one hectare (2.5 acres) in developing nations but about 9.6 hectares (24 acres) in the United States. The footprint for the total human population is 2.1 hectares (5.2 acres). For every person in the world to reach present U.S. levels of consumption with existing technology would require four more planet Earths. The five billion people of the developing countries may never wish to attain this level of profligacy. But in trying to achieve at

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1 This section is an abstract from "The Future of Life" by E. O. Wilson (2002), Pulitzer Prize-winning author and environmental scientist, who sets out a challenge to engineers and scientists in the "Century of the Environment." This material is included in this report with permission.