

: Energy Efficiency

INTRODUCTION

With the advent of wind power, nuclear power plants, and solar panels, public conversation around energy and the environment has largely been focused more on finding alternative sources of energy than on examining energy use. However, if society shifted to a more end-use focus on improving energy efficiency, this swing would represent an enormous opportunity for businesses to generate profits, as well as humanity to reduce international energy dependence and combat climate change. To put this potential in perspective, *investing 170 billion dollars a year in efforts to boost energy efficiency from now until 2020 could halve the projected growth in global energy demand.*¹ Such a reduction in energy demand would also have a substantial effect on lowering greenhouse gases.

Energy efficiency is defined as the ability to generate the same economic output with less energy input. While the financial case for consumers and businesses to act in a more energy efficient manner was proven after the “oil shocks” of the early 1970’s—when industrialized countries first started focusing on energy saving measures²—there are still numerous challenges to the adoption of more energy efficient products and processes. Market failures, including the principal agent dilemma and information asymmetries, are obstacles to implementing energy efficiency strategies. Government policy can play a key role in decreasing energy use by subsidizing the development of efficiency technologies, creating tax and loan incentives to help businesses shift to new methods of operation, establishing efficiency standards, and providing objective energy information such as with Energy Star labels, among other methods. In the developing world, the need for government leadership is even more pressing. In the next ten years, developing economies will have built and installed over half their infrastructure.³ The improved technology and know-how available today will allow them to incorporate efficiency into their construction and design efforts, and position them to make the best use of both traditional and alternative energy resources.

The corporate sector also has an integral role to play. From the development of less energy intensive products and new technologies, to financial savings through the adoption of more energy-friendly practices, to increased goodwill and brand awareness, business can benefit financially while also serving a greater societal need. Indeed, even oil companies have begun to implement energy efficiency measures in their operations to reduce their carbon footprint and are educating their customers around purchasing more energy efficient products.⁴ In the software and technology sector, some of the biggest names are investing heavily in “smart infrastructure,” new technology that is able to measure energy use across entire manufacturing and city systems.⁵ Recognizing that energy efficiency presents an important and growing challenge to the future of business, the United Technologies Corporation commissioned this paper and the accompanying [teaching module](#) to help bring the issue front and center in the business school classroom.

1 Farrell, Diana; Jaana K. Remes, «How the World Should Invest In Energy Efficiency,» *The McKinsey Quarterly*, July 2008, p. 1, Retrieved August 26, 2009 from http://www.mckinsey.it/storage/first/uploadfile/attach/140561/file/d_documents_and_settings_cristina_bellini_desktop_a_ito_web_site_a_realizzazione_sito_area_idee_articoli_lu_glio_2008_quarterly_hoth08.pdf

2 Meadows, Donella et al. 1972. *The Limits to Growth; A Report for the Club of Rome's Project on the Predicament of Mankind*. Universe Pub <http://www.amazon.com/Limits-Growth-Project-Predicament-Mankind/dp/0876632223>

3 Farrell, Diana and Jaana Remes, “Promoting Energy Efficiency in the Developing World,” *The McKinsey Quarterly*, February 2009, Retrieved August 22, 2009 from <http://www.globalurban.org/McKinsey%20Global%20Institute%20Report%20on%20Promoting%20Energy%20Efficiency%20in%20the%20Developing%20World.pdf>

4 Crow, Patrick, “Large U.S. Oil Companies Embrace Energy Efficiency,” March 28, 2009, Retrieved August 22, 2009 from <http://newsblaze.com/story/20090328091844tsop.nb/topstory.html>

5 Lohr, Steven, “Bringing Efficiency to the Infrastructure,” *The New York Times*, April 29, 2009, Retrieved August 20, 2009 from <http://www.nytimes.com/2009/04/30/business/energy-environment/30smart.html?ref=businessspecial2&pagewanted=print>

A Closer Look at Business Education

It is a pressing need for our future business leaders to become more widely educated regarding the opportunities and challenges in the energy efficiency realm. This Closer Look provides teaching material and the opinions of a leading academic on this issue.

AN ACADEMIC POINT OF VIEW

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On why energy efficiency matters: We depend increasingly on oil imports from unstable parts of the world, and the world's fossil fuel consumption is (with more than 90% probability) warming the globe (according to the latest reports from the Intergovernmental Panel on Climate Change.) Energy efficiency is the fastest, cheapest, cleanest way to address these problems.

On the state of knowledge on energy efficiency: In the three decades since the energy crises of the 1970's we've learned a great deal about the potential for energy efficiency and the means to deliver it cost effectively and reliably. Back then, many analysts still held to the now discredited "ironclad link" between energy use and economic activity, which implied that any reduction in energy use would make our society less wealthy. Now we know that there are many different ways to produce a dollar of GDP using current technologies, some energy efficient and others not. We know that the available efficiency resources are enormous and largely untapped. And we know that markets, while generally the best way to provide goods and services, can fail in ways that can be fixed by clever policy choices and business incentives, resulting in lower energy use, lower greenhouse gas emissions, and a total cost to society (including the implementation costs of those efficiency policies and programs) that is less than that of preserving the status quo.

On "cost effectiveness": People don't care about energy, they care about the services that energy delivers, like warm rooms, cold drinks, and well-lit houses. The question then is not "how can I make this energy-using device more efficient?" but "how can I accomplish this same task at a lower cost using less energy?" The focus is on the tasks themselves, which leads to many insights about how to achieve a more efficient and cost-effective outcome.

In doing that cost analysis it is important to include all costs, including the program costs and transaction costs associated with getting the efficiency options installed. These costs should be assessed from the societal perspective, not just from the perspective of individuals and institutions in the society. It may be rational for someone to not install an efficient light bulb (if, for example, his landlord pays the utility bill) even though society would be better off if he did. Focusing on the societal perspective allows us to identify real opportunities and to design programs that are truly cost effective for society as a whole.

On promoting rapid adoption of efficiency technologies and practices: Making efficiency profitable for business is one of the fastest ways to make it happen in the real world, although often incentives, government mandates, and other programs are required. Increasing energy efficiency is also a question of innovation, not just in technology but also in institutional arrangements and incentives, and if we're fast and smart about it, that innovation can result in direct economic savings to our economy and products and services that we can sell overseas, generating even more economic activity right here in the U.S.

On policies and programs to promote efficiency: Capturing efficiency opportunities requires both energy pricing policies (in the form of emissions trading or carbon taxes) and non-price policies, including increased effort on product labels like Energy Star, minimum efficiency standards, incentives to consumers for the purchase of efficient products (positive, negative, or revenue-neutral feebates,) incentives to utilities for promoting efficiency, demonstration projects for innovative technologies, prizes

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for achieving efficiency goals, business plan competitions for promoting startup companies, government and business procurement of efficient products, and greater research and development spending, which has fallen to historic lows from the late 1970's.

On whole-system redesign: The central organizing principle for promoting efficiency (and other new energy technologies, for that matter) should be what Amory Lovins calls “clean slate, whole system redesign.” Efficiency by itself often doesn't sell. Instead of promoting incremental efficiency improvements, as is so often done, institutions should redesign energy intensive products from the ground up, making them better in every way (not just more efficient, but also more desirable for their other attributes). This approach will ensure rapid and widespread adoption, which is what we will surely need to face the climate challenge in the decades ahead.

On the role of the academy: Universities must change to confront these new challenges. First, they need to develop new ways to organize faculty researchers around *solving real problems* instead of solely promoting the development of disciplines. Disciplinary knowledge is still important but the climate problem in particular is one that requires the disciplines to combine their tools and knowledge in new and innovative ways. Second, they need to expand the use of student teams for project-based learning, bringing students with different skills together to confront societal problems, including a focus on whole-system redesign as well as a market assessment and a business plan component. And finally, they need to train students in critical thinking and numeracy skills, including the craft skills for research and analysis that are rarely taught but are so essential for successful analysts and entrepreneurs (see my book [Turning Numbers into Knowledge: Mastering the Art of Problem Solving](#) for more details).

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NOTABLE COURSEWORK

The following course descriptions—which all address the topic of energy efficiency in some way—are drawn exclusively from [Beyond Grey Pinstripes](#), a research survey conducted biennially by the Center for Business Education at the Aspen Institute.

■ **The George Washington School of Business**

[Environment, Energy, Technology, & Society](#) (Elective Course)

Instructor: Mark Starik

“This course focuses on the environment, energy, technology, and society and includes attention to topics such as energy emissions, energy efficiency, renewable energy, sustainable development, environmental organizations, and personal sustainability behaviors, among others.”

■ **Monterey Institute of International Studies**

[Environmental Issues in Business: Innovation, Audits, Metrics, and Communications](#)

(Elective Course)

Instructor: Laura A Strohm and Sharon Sarris

“Environmental compliance traditionally handled by Environmental, Health & Safety departments is no longer enough for smart companies. For multi-national corporations or small and medium enterprises, good environmental strategies promise the benefits of liability avoidance, reduced insurance costs, increased regulatory predictability, operational cost savings, new market opportunities, and improved employee morale and public relations. The potential to achieve eco-efficiency and eco-effectiveness appears in strategic planning, operations, product or service specifications, the supply chain, and transport. This workshop will explore how business can benefit from reductions in energy and water use, waste minimization, lower virgin material and energy content in products, innovative business models and management tools, toxics substitution, packaging redesign, and other “green” business practices.”

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- **University of Michigan, Stephen M. Ross School of Business**

[Social Institutions for Energy Production](#) (Elective Course)

Instructor: Thomas P. Lyon

“Balancing the benefits and costs of energy use is one of the major challenges facing humanity. In most developed countries, the marketplace plays the predominant role in determining what energy sources are used, and how. But government policy plays an extremely important role, as well—governments at the local, state, regional, national, and international levels all mold aspects of energy policy. In addition, non-governmental organizations (NGOs) of all sorts affect our energy choices, either by influencing government policy or influencing corporate behavior. In developing countries, government often controls most supplies of non-renewable energy resources, as well as the development of the infrastructure needed to exploit energy resources. This course will give you a solid grasp of the environmental and social impacts of, and the institutions that govern, energy use, so that you can play an effective role in shaping future policy or business decisions.”

- **Dominican University of California, School of Business and Leadership**

[Ecological Economics](#) (Core Course)

Instructor: Robert Piccioni

“Ecological economics offers an alternative approach to mainstream neoclassical economics which is directed toward a goal of allocative efficiency at optimum levels of consumer satisfaction. The goal of sustainability, both ecologically and socially, is a priority. Ecological economics represents a transdisciplinary attempt to integrate the social sciences, primarily economics, with the natural sciences, primarily ecology. In this course we explore how people, acting through the private, public, and nonprofit sectors, can effect change in their communities using an ecological economic approach that includes a redefinition of “efficient allocation”, as well as the overall strengths and weaknesses of current approaches.”

For additional courses on related subjects, or to download select syllabi, search thousands of descriptions at [Beyond Grey Pinstripes](#).



NOTABLE TEACHING MATERIALS

Materials referenced are meant to represent the diversity of related teaching resources available at CasePlace.org. Most are available as free downloads to registered faculty members.

- **Case Study:** [A Model of Clean Energy Entrepreneurship in Africa: E+Co’s Path to Scale](#)

Source: Richard Ivey School of Business

Authors: Oana Branzei and K McKague

The founder and Executive Director of E+Co faces the challenge of ten-fold growth and reviews the core parts of the company’s innovative business model, the changes in the energy markets around the world, and the rationale for local solutions to energy scarcity and inefficiency.

- **Case Studies:** [Save Energy Now Case Collection](#)

Source: U.S. Department of Energy

These case studies highlight energy savings achieved by companies that have participated in Save Energy Now energy assessments and used Industrial Technologies Program software tools to improve energy efficiency.

- **Report:** [Transforming the Market](#)

Source: World Business Council for Sustainable Development

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The project took a bottom-up, market-driven approach to understanding the barriers to lower energy use, based on the most detailed view ever of the current state of energy demand in buildings. Using computer simulations, researchers were able to show the market response to various combinations of financial, technical, behavioral and policy options, identifying the optimum mix to achieve transformation for each market studied.

- **Report:** [Energy End Use Efficiency](#)

Source: Rocky Mountain Institute for InterAcademy Council

Author: Amory B. Lovins

Increasing energy end-use efficiency—technologically providing more desired service per unit of delivered energy consumed—is generally the largest, least expensive, most benign, most quickly deployable, least visible, least understood, and most neglected way to provide energy services. The 46% drop in U.S. energy intensity (primary energy consumption per dollar of real GDP) during 1975-2005 represented by 2005 an effective energy "source" 2.1x as big as U.S. oil consumption, 3.4x net oil imports, 6x domestic oil output or net oil imports from OPEC countries, and 13x net imports from Persian Gulf countries. U.S. energy intensity has lately fallen by ~2.5% per year, apparently due much more to improved efficiency than to changes in behavior or in the mix of goods and services provided, and outpacing the growth of any fossil or nuclear source. Yet energy efficiency has gained little attention or respect. Indeed, since official statistics focus ~99% on physical energy supply, only the fifth of the 1996-2005 increase in U.S. energy services that came from supply was visible to investors and policymakers; the four-fifths saved was not. This source is particularly valuable for its focus on whole-system redesign of technical systems.

- **Testimony:** [Efficiency: The Hidden Secret to Solving Our Energy Crisis](#)

Source: Joint Economic Committee

U.S. Senator Charles E. Schumer, Chairman of the Joint Economic Committee (JEC) held a hearing on July 30, 2008 to examine how energy efficiency programs can drastically reduce our dependence on foreign sources of energy, help us achieve energy independence, and strengthen our economy. Massachusetts Secretary of Energy, Ian Bowles, discussed that state's brand new efficiency law signed this month; and Google's Dan Reicher addressed federal opportunities for new energy efficiency programs and groundbreaking private sector energy-savings programs. The panelists, also including Dr. Jonathan Koomey from Stanford University and Mr. Mark Mills of ICx Technologies, offered their views on future federal government energy and energy efficiency policies. Dr. Koomey's testimony gives broad context and a large number of references for those who want to research this topic further.

ONGOING QUESTIONS:

- How can corporate-academic relationships and other cross-sector collaborations best mine this area of practice and research?
- What role can government policies play in increasing energy efficiency? Are there drawbacks to more government involvement?
- Analyze the significance of energy efficiency as a mechanism for less energy use vis-à-vis alternative or renewable energy or energy conservation tools. Why do some areas generate more media attention?
- How can corporations address this sector? Do most companies view energy efficiency as a cost cutting measure or a market opportunity? Who are the leaders in each of these situations?

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- Why has energy efficiency been traditionally overlooked within domestic energy policy?
Are there groups that stand to benefit from staying in the status-quo?

RESOURCES:

BeyondGreyPinstripes.org – World’s biggest MBA database, including detailed records on thousands of courses and information on extracurriculars, university centers, and more, for 128 schools on six continents.

CasePlace.org – A free and practical on-line resource for up-to-date case studies, syllabi, and innovative teaching materials on business and sustainability. Created for the educators who will shape our next generation of business leaders!

A Closer Look is a regular series of briefing papers on topical issues in MBA education, based on the research and programs of the Aspen Institute. The Aspen Institute’s [Center for Business Education](http://CenterforBusinessEducation.org) encourages future business leaders to innovate at the intersection of corporate profits and social impacts.

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