Milken Institute

STRATEGIC ACTION [SAVE] VOLUNTEER EFFORT

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Financial Innovations and Applications for Energy Services:

Toward a Second Green Revolution

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The Milken Institute is an independent economic think tank whose mission is to improve the lives and economic conditions of diverse populations in the United States and around the world by helping business and public policy leaders identify and implement innovative ideas for creating broad-based prosperity. We put research to work with the goal of revitalizing regions and finding new ways to generate capital for people with original ideas.

We do this by focusing on human capital—the talent, knowledge, and experience of people and their value to organizations, economies, and society; financial capital—innovations that allocate financial resources efficiently, especially to those who ordinarily would not have access to such resources, but who can best use them to build companies, create jobs, and solve long-standing social and economic problems; and social capital—the bonds of society, including schools, health care, cultural institutions, and government services that underlie economic advancement.

By creating ways to spread the benefits of human, financial, and social capital to as many people as possible—the democratization of capital—we hope to contribute to prosperity and freedom in all corners of the globe.

Introduction

In April 2006, the Milken Institute launched its Strategic Action Volunteer Effort, or SAVE, which enlists volunteer partners who tackle major economic and public policy problems in search of market-based solutions and financial innovations. The volunteer team brings real-world capital market experience and acumen, and collaborates with researchers at the institute, as well as at universities and think tanks worldwide. The institute produces SAVE Financial Innovation Labs—proprietary research tools—that draw additional experts from a range of disciplines, industries, and businesses.

SAVE's first project, begun in April 2006, focused on "Achieving Energy Security" and the need to identify financial solutions to accelerate the transition from oil to cleaner alternative energies. SAVE members studied business and policy opportunities, new financial instruments, mobilization of capital, and market-based products. They paid particular attention to the oil-dependent transportation sector and alternative domestic fuel sources. The insights and findings from SAVE's first year are summarized in a Financial Innovations Lab Report, also released in April 2007.

For 2007–2008, SAVE will continue its work of identifying capital market solutions to energy independence and global warming, and address the challenge of accelerating the adoption of energy efficiency and clean technologies. It is clear that there are many cost-effective technologies and potentially profitable business opportunities that will promote both energy security and the reduction of greenhouse emissions. The project, "A Second Green Revolution," will identify financial and policy barriers, and use the Milken Institute's Financial Innovation Labs to demonstrate solutions.

When Regulations and Goodwill Are Not Enough

Interest in energy policy skyrocketed in the past two years from a confluence of events: the influential movie *An Inconvenient Truth*; unusual extremes of weather worldwide; a stream of reports from the United Nations; and a push for action by world leaders outside the United States. Politicians and regulators are responding. There are also hundreds of action programs based on goodwill, such as the carbon offset gift certificates for celebrities at the 2007 Academy Awards or the lower green-energy prices offered to utility customers. Google, Wal-Mart, and Colorado ski resorts are all finding good media buzz in going green.

But despite the media attention, regulators, legislators, and goodwill are not enough. Already scientists warn that the planet faces irreversible consequences unless carbon emissions are reduced to 1970s' levels. And from a security standpoint, U.S. policy analysts and politicians caution about the hidden costs and substantial risks of importing 60 percent of our nation's oil from a few unstable countries. Consider the following:

- California, which leads the nation in global warming and environmental initiatives, aims to reduce its greenhouse emissions 25 percent by 2020, back to 1990 levels. But scientists are asking for a much larger reduction. The political challenge is difficult, as it appears to force a choice between economic growth (with cheap energy) and clean air (with more expensive energy.)

- Only Oregon and California currently allow utilities to profit from reducing energy use. In all other states, higher sales are the only way utilities can obtain higher profits. While fourteen states have small, financially capped programs to encourage investment in energy efficiency, the bottom line is that the nation's institutional structures limit the market for clean technology and energy efficiency in all but two states.

- A recent study by the American Council for an Energy-Efficient Economy found that 50 percent of U.S. residential energy use and 90 percent of commercial leased-space energy use is subject to principal-agent barriers, in which one party (landlords, builders) buys the energy-using appliance and another party (renters, leasees) pays the energy bill. This market fragmentation is another a barrier to change.

Despite the call for political change, our efforts through policy, regulation and goodwill will not be enough. The magnitude of challenge requires the full engagement of the free market.

The Problem Is Not a Lack of Technology

The market has responded to increased awareness of energy-related business opportunities. Risk-taking investors have flocked to clean technologies, which have grown from an environmentalist's dream to a sphere of active funding by venture capital and private equity.

Some of the most interesting clean technology startups are working in metering and information flow.

In 2006, more than $2 billion was invested in startups promising new sources of energy, cheaper storage, and greater energy efficiency. America's largest companies—such as ADM, Cargill, GE, and DuPont—have kept pace with a stream of innovation for the ethanol, biofuel, battery, wind turbine, and clean coal markets. John Doerr, the noted venture capitalist who backed Sun Microsystems, Netscape, Amazon.com, and Google, has said that business opportunities for

new energy technologies are greater than those of the dot.com era. The innovation center of the private sector has moved into gear and appears to be doing its job well.

So if we have economically attractive, clean technologies and a well-funded pipeline of innovation, what is the problem? To understand the bottleneck issues, consider the market for energy efficiency—a stream of investments in heating and cooling systems, insulation, innovative engines and storage technology, and the simple light bulb—that will reduce energy use. Experience over the past ten years has shown that investments in energy efficiency cost approximately three cents per kilowatt hour (kwh) saved. In contrast, the nation's lowest-cost domestic fuel, coal, costs seven cents to nine cents per kwh delivered to the customer. Study after study shows that the United States can provide for half its growth in energy use by investing in energy efficiency, in all regions of the country. Yet we rely on utilities—not known for their sophisticated marketing—to promote energy efficiency.

Another barrier to adoption involves up-front costs. Studies show that a one-dollar subsidy to the up-front cost of a new energy investment is eight times more effective than a one-dollar energy price subsidy. Yet utilities don't benefit from the energy savings and thus provide only limited subsidies of up-front costs. Private capital can be drawn into the market for energy efficiency if there are profits in energy savings. Metering is a key technology for monetizing energy savings or on-site energy generation. Some of the most interesting clean technology startups are working in metering and information flow, technologies that are critical to creating active local energy markets.

Finally, note that the national electric grid was built to provide reliability and smooth prices. Although U.S. demand varies by time of day and season, almost all customers pay a flat rate for power. One recent study shows that utilities use their full capacity less than 5 percent of the year and that there would be sufficient off-peak capacity in the industry to recharge 84 percent of the nation's auto fleet, assuming all autos were immediately converted to plug-in hybrids. It is difficult to think of another industry that has developed such a large physical infrastructure without using price signals to smooth the seasonal and daily shifts in demand and supply. As transportation and stationary markets for energy converge, new contracts and financial instruments could significantly reshape power demand and avoid high-cost capacity.

In sum, impressive and ever cheaper technologies are at hand, but for substantive and speedy change, we must introduce modern markets and innovative financial instruments and business models.

Can Your Local Utility Do This?

Adopting clean technologies and energy efficiency requires getting customers to do something different and new. Startups and experienced companies struggle with new-product adoption and experience a high rate of failure. Are utilities ready?

Consider the marketing of the Toyota Prius. In 2000, with gasoline prices at a record low of ninety-nine cents per gallon, trucks and SUVs dominated the U.S. automotive market. Public policy focused on electric vehicles, and Toyota was not considered a technology leader. But that July, against these prevailing winds, Toyota introduced the hybrid Prius. The company hoped to sell only a modest number of cars, 12,000, and used the Internet to target early customers with a detailed technology and environmental advertising message. In retrospect, Toyota believes, those first customers, the "Prius Pioneers," were the company's best marketing tool.

In 2003, competition picked up when Honda introduced its Civic Hybrid. Toyota was forced to adopt a broader distribution strategy, do an expensive sales training program and evolve its advertising message. The company still supported the Prius Pioneers, who continued to educate others. By late 2003, Prius was selling 36,000 units per year. Finally, Toyota launched a second-generation model, using viral marketing techniques to generate buzz and again using the Pioneers. It was only five years after launch that the Prius was sold through mainstream channels with a global marketing campaign.

Do local utilities have the marketing sophistication to pull off a similar new product introduction? Probably not. New business entities are necessary to accelerate the adoption of clean and energy efficient technologies.

The Bottleneck: Too Few Modern Markets and Business Models

Modern times are characterized by fast change and easy adoption of new technologies. It took only five years, for example, for the majority of Americans to acquire television sets. The iPod has become the most quickly adopted consumer electronics product in history. But these two technologies share a feature that makes adoption easy: simple infrastructure. To use their first television, a family simply plugged the cord into a socket and adjusted the antenna. To use an iPod required the simple purchase of transferred songs from the music store, iTunes. These experiences are the exceptions. More frequently, adoption rates are much slower.

Consider the problems in buying a first car in the 1920s: Where was the mechanic? Where was the gas station? Where were the paved roads? How did one obtain financing? It is not surprising that it took forty years before automobiles were used outside of urban centers.

The adoption of energy efficiency and clean technologies will be more like buying a first car than a first iPod. Technologies and business practices that make investments more valuable and attractive must evolve together. One example is net metering, the practice of both buying and selling electricity from the local utility. Because the cost of generating power during peak periods of demand can be five times higher than at other times of the day, it can be profitable for a homeowner to reduce home energy use and sell excess power back to the utility. A recent study from the University of California, Berkeley, showed that with time-of-use pricing, photovoltaic solar energy would be 30 percent to 50 percent more valuable than under current flat-rate pricing practices. Utilities can accelerate the adoption of solar power by changing from flat-rate pricing to net metering. New technologies require new business practices.

0.5 Percent Market Share

Imagine a product that has been on the market for twenty years and is cheaper than its alternatives. This product has a web site (http://green.yahoo.com), a conference, and a country (Australia) that may restrict consumers from buying any substitute. It has been heavily subsidized by utilities for years. Yet the compact fluorescent light bulb (CFL) has only one-half of 1 percent market share.

CFLs are a leading example of the challenges of the adoption of clean and energy-saving technologies. Studies show that adoption is slowed by two key factors:

- CFLs are not sold where customers are buying. Most light bulbs are purchased in grocery stores, while CFLs are sold in home centers.
- CFLs are more expensive to buy, even though they're cheaper to operate. Manufacturers find that CFL sales stall until prices get down to a one- to two-dollar increment over conventional lighting. As with other technologies, consumers are sensitive to up-front costs.

CFLs have captured the imagination of environmentalists; if every American took the estimated 18 seconds needed to swap out a conventional light bulb for a CFL, the country could eliminate the need for $8 billion in electric power per year. The lack of CFL adoption, however, demonstrates the limits of goodwill, subsidies, and utility marketing: what we have been doing has not worked. We need new, profitable business models that can make money off of the energy savings provided by CFLs and other energy-saving technologies.

The Next Financial Instrument: Energy Strips?

Coal is the cheapest domestic source of energy, and hundreds of coal plants are on the drawing boards. But events in early 2007 gave pause to coal plant investors. First to act were the regulators, who slowed the growth of coal projects. California regulators announced that new coal plants or contracts to buy electricity from coal must be as clean as power generated from natural gas. South Carolina turned down a proposal from Duke Energy to build two coal plants, allowing only one. And that plant was burdened with green technology and carbon cleanup concessions. In Texas, private equity funds proposed to take over the state's largest utility (TXU) in a bid that dropped TXU's plans to build eleven coal plants. Then in late February 2007, JPMorgan unveiled a bond index measuring the cost of the uncertainties surrounding the continued use of coal. The rating includes a "relative carbon beta score," and companies that rely on coal will see their bonds ranked lower.

The regulators have made their first moves, and financial markets have begun to react. A more explicit pricing of emissions could extend the reach of emerging carbon markets, such as the Chicago Climate Exchange and the European Union's Emission Trading Scheme.

Consider a unit of generated energy as a bundle of:
1) units of energy for use
2) tons of carbon and other greenhouse gases
3) units of energy to be counted toward renewable energy credits (RECS) or emission reduction allowances

In other financial markets, such as mortgage-backed securities, it is common to "strip away" the separate pieces of value (principal, interest, credit risk, and so on) and to price and trade each part separately. Similarly, generated energy could be parsed and priced into three or more pieces leading to a cheaper and more efficient reduction in greenhouse gases.

Wanted: A Second Green Revolution

The revolution uses profit opportunities and market change to accelerate the adoption of energy technologies.

At the end of World War II, global starvation loomed. Mexico was critically short on food. Populations in India, China, and Pakistan were growing faster than food supplies. Russians were starving, and the United States was shipping food to Europe. A mere twenty-five years later, in 1970, researcher Norman Borlaug received the Nobel Peace Prize for leading the Green Revolution, a program of improved seed, fertilizers, and farming practices that averted massive starvation worldwide. More incredible is how quickly individual countries moved from crisis to self-sufficiency. In 1965, India was receiving five million tons of emergency wheat from the United States. Only nine years later, India was self-sufficient in all grain crops.

The focus has been on the science, but a less well-known aspect of the Green Revolution is also central to the success story. A recent biography of Borlaug (*The Man Who Fed the World*, by Leon Hesser) recounts a heated exchange between Borlaug and the deputy prime minister of India. Borlaug argued that pilot projects were a success, but that real change depended on making cheap fertilizer available in each village before the planting season, offering lines of credit to farmers so they could buy the new hybrid seeds, and assuring the farmers that they would receive a fair, world-market price for their crops.

Each element of Bourlag's argument required government action: rapid and massive investment in fertilizer plants and distribution; government subsidies and guarantees of loans with local banks; and the abandonment of a decades-old policy to subsidize the price of food for the poor by paying farmers only half the world price.

The Economist notes that new technologies were a necessary condition for the Green Revolution, but not a sufficient one. After receiving the Nobel Prize, Borlaug was lured out of retirement by the challenge of taking the Green Revolution to Africa. Despite laboring there for more than twenty years, he achieved only limited success and continues to argue that infrastructure investments—paved roads, grain marketing systems, and agricultural research and extension services—have been woefully inadequate. In South Asia, he says, the British built roads everywhere. But Africa is not expected to have the equivalent transport infrastructure until 2030. Without good roads, local farmers remain at the mercy of local monopolistic grain dealers and seed suppliers. The first Green Revolution underscores the importance of infrastructure investments for speedy adoption of new technologies.

Country	Km of Paved Roads/ Millions People	Country	Km of Paved Roads/ Millions People
USA	20,987	Guinea	637
France	12,673	Ghana	494
Japan	9,102	Nigeria	230
South Africa	1,402	Tanzania	114
India	1,004	Uganda	94
China	803	Ethiopia	66

Source: The Man Who Fed the World by Leon Hesser, p. 158

The first Green Revolution is an inspiration for a second one, a revolution that uses profit opportunities, financial innovations, and market change to accelerate and expand the adoption of energy technologies that benefit countries around the world.

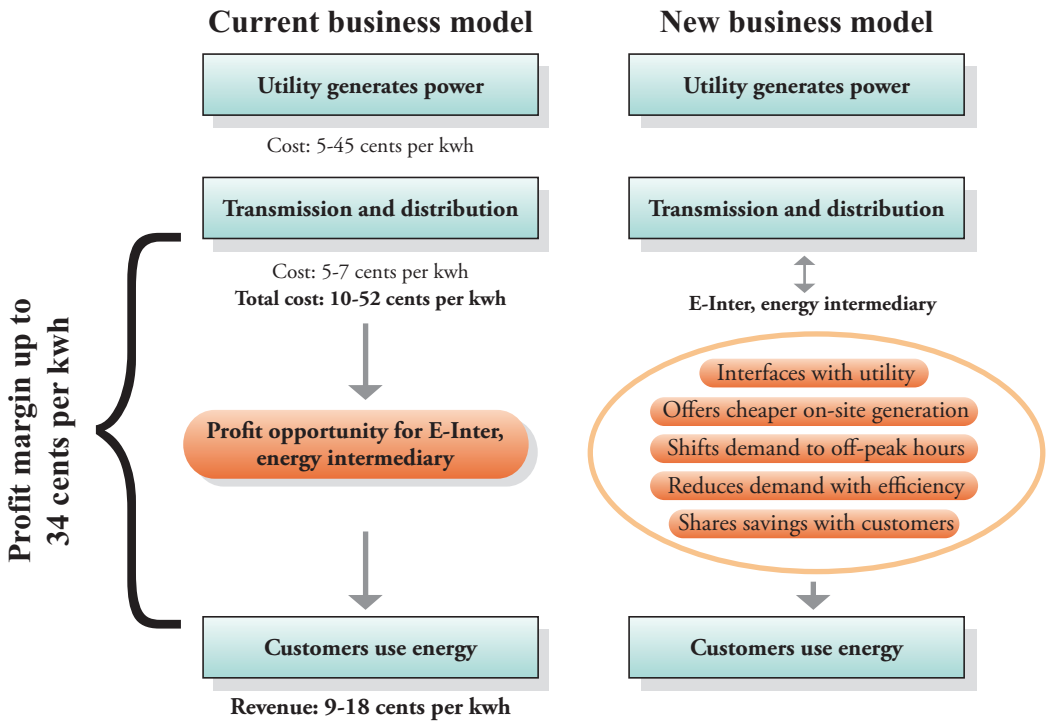
Accelerating Change Through Profit Opportunities

SAVE's focus is on the profitable migration from dependence on imported oil and inefficient technologies to a cleaner, more efficient future. Too often suggested solutions begin with legislative or regulatory agendas, and fail to exploit the profit motive for the greater good. The SAVE team looks instead at existing opportunities to invest in clean on-site technologies and energy efficiency.

A new business—let's call it E-Inter (for energy intermediary)—sits between the utility and the end user, managing the latter's interface to the electric grid. E-Inter provides the up-front capital to the end user to invest in clean technologies and energy efficiency in exchange for a share of the energy savings. In today's energy markets, the simple business model will be profitable immediately, if the stream of future energy savings can be monetized.

The energy intermediary makes money by reducing its customer's energy needs and shifting energy use to cheaper time periods. E-Inter will also install on-site generation when profitable and sell excess power back to the grid. E-Inter can even make private deals with the customer, paying for reduced load during peak hours and then selling additional power back to the utility. Through innovative contracts and monetization of the savings, E-Inter uses a modern business model to gain full value from energy technologies.

A new sandwich: The energy intermediary sits between the utility and its customers



Some components of the E-Inter business model are currently seen in energy service companies, known as ESCOs. ESCOs range from large business units of major oil companies and property management firms to small local operations.

ESCOs provide a range of services, including energy audits, construction, energy price risk management, and financing. The ESCO business model offers several advantages for the speed and scale of change:

- The ESCO is an informed buyer, which speeds technology adoption.
- The ESCO often provides up-front financing, removing an important constraint on the market.
- The ESCO continues to seek out profit opportunities that arise from reducing energy use.
- The ESCO can change customer behavior through introducing time-of-day pricing, payment for reduction of load and other contractual features.

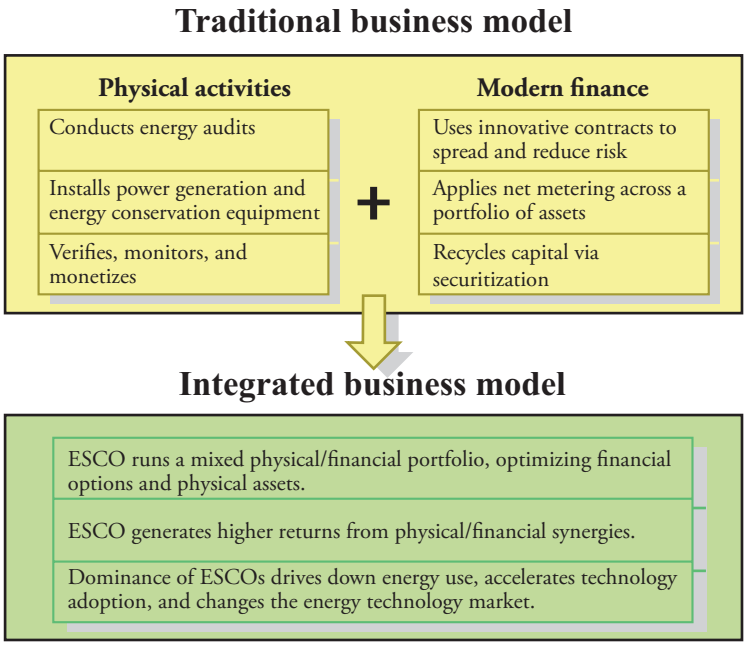
Venture-backed startups are also using ESCO-like business models. For example, one new company finances and installs solar panels on the roof of its customer's site. The customer reduces its use of electricity from the grid and buys the solar energy as needed and available from the startup.

Mixing It Up in a Modern Way

Uncertainty permeates the energy markets, and thus we need to accelerate adoption of the energy intermediary's business model. One company, Suez Energy Resources, for example, provides its customers in the northeastern United States with a menu of electricity rate choices, ranging from flat-rate pricing to full market exposure. Using its acumen in financial contracting and energy investments, the company provides hedging services more cheaply than the local utility. In contrast, utilities use only one asset, their physical plants, to set flat-rate prices.

The energy intermediary's business model will evolve in this direction, as well. Initially, financial contracting will wrap around an established base of physical assets, but over time the physical and financial assets will be rebalanced into an integrated portfolio. When financial options are a cheaper way of addressing uncertainty than building capacity, the energy intermediary profits from its financial acumen. When offering the customer a choice between physical or financial alternatives (such as between supplying electricity or paying to avoid use) returns greater profits, the energy intermediary will run an integrated portfolio. The tools of modern finance can force energy use to be priced at its marginal cost, in every hour and in all locations, and will drive down energy use while providing gains to the customer and energy intermediary.

2 + 2 = 5: The integrated energy intermediary model profits from the synergies between real and financial assets



Our proposed E-Inter business model incorporates features seen separately in the current market:

- the ESCO attention and know-how for technology and the physical aspect of energy-using facilities
- the opportunity to open markets through financing packages
- the startup's innovative use of new technologies
- increased profits from the integration of physical and financial assets.

The Business Model as a Spotlight

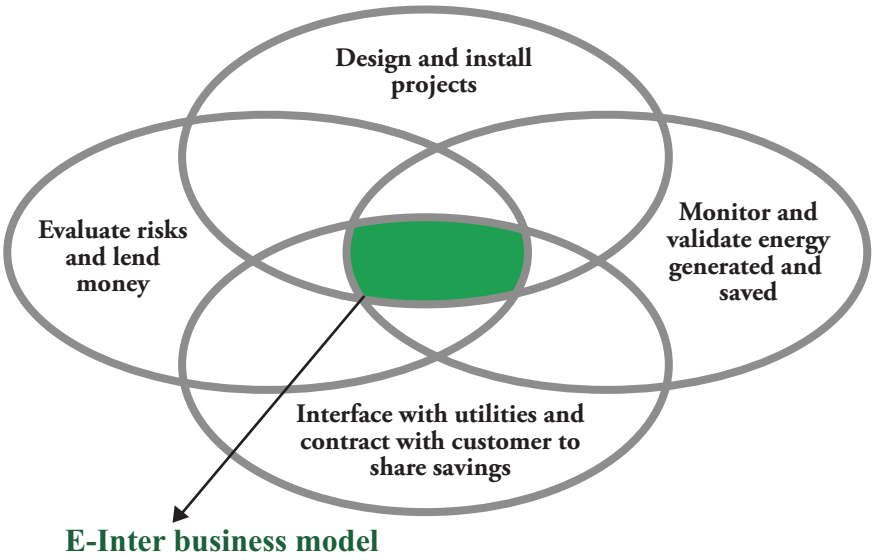
It may seem odd for the Milken Institute to devote attention and resources to a business model already in use. SAVE's intent is to use the E-Inter business model as a framework for identifying capital market gaps and to use the institute's network to catalyze change.

The business model sits at the center of change for the energy industry. If E-Inter cannot profitably induce customers to adopt new technologies, it shines a spotlight on the market and institutional barriers. If E-Inter cannot profitably shape energy demand so that capacity is more efficiently utilized, it shines a spotlight on the impediments to using financial contracts to more cheaply displace investments in physical assets.

Structuring a Green Loan: It Takes a Village … or a New Business Model

Up-front capital is a significant barrier to adoption of even the most economically attractive clean technologies. Conventional financing sources are often unable or unwilling to lend because of the complexities involved. As this diagram illustrates, successful green loans arise from an intersection of expertise.

A green loan: a new business model rises from an intersection of expertise



While it is useful to think of a single business model encompassing all the activities proposed for E-Inter, in fact, these functions can be performed separately by one of the many parties who act at the interface between utilities and their customers: building contractors who install energy-efficient equipment, commercial property managers, clean-technology providers, financiers, and utilities that have energy service offerings. Examining the E-Inter business model provides a checklist of who is doing what, and who is bearing risk. Finally, because the E-Inter business model interfaces with so many players, it tells us who should be at the table and who has the expertise and vested interest in smoothing the bumps of the model, or more precisely, the functions of the energy intermediary.

The Power of a Relentless Focus

Nowhere buried in the daily flow of news stories about energy security, global warming, cool technologies, and the politics of change is there mention of the companies that profit by helping others save energy; this business model is still a novelty. Yet it is the relentless focus on profits that will drive the Second Green Revolution. The SAVE team may not have gotten the details of the E-Inter business model quite right at this time, but we have identified a key—and missing—ingredient for success: putting a for-profit company at the center of the drive for clean energy and energy efficiency.

A for-profit company will act every day; it cannot afford to be politically gridlocked. A for-profit company will adapt its approach to fit local conditions and changing market needs, without prodding from regulators. A for-profit company can attract capital at the scale needed to make a substantive change. A for-profit company will be stay focused and will spread that focus across an entire ecosystem of suppliers, vendors, partners, customers, and financiers.

The seeds of the Second Green Revolution have been planted, and the ground is fertile. We have enough technologies to make a real difference in how we use energy, to make changes that are beneficial to both energy security and the reduction of green house emissions. Capital markets, financial innovations, and new business models can accelerate the change.

SAVE's Initiative on Energy Services

Over the next twelve months, SAVE's volunteer network will apply a capital-markets focus to accelerating the adoption of energy efficiency and clean technologies. Below we show the connection between national concerns and the role of capital markets:

- There is great national concern about energy security and global warming.
- Sufficient "ready" technologies exist, but the historically constrained market side needs incentives in order to change.
- The profit motive will encourage business to adopt new technologies.
- In order to adopt new technologies, businesses must adopt "financeable" plans, which will involve new business models.
- Businesses must monetize their savings with innovative metering and contracts.
- What is the best business model to accelerate change?

Planned events and publications include:

- Financial Innovation Labs that bring together experts and industry participants from a wide range of perspectives, businesses, and expertise. The Labs identify bottlenecks and demonstrate potential capital-market solutions (see "Who Should Be at the Table?").
- A *Clean Technology and Energy-Efficiency Opportunities Index* (CTEEO), mapping regional differences and the national scope of the profit opportunities from clean technologies and energy-efficiency investments. The methodology will be similar to other indices published by the Milken Institute, in which the sub-components of the index tell a story of barriers, advantages, and untapped opportunity. The CTEEO Index will be calculated for selected cities and locales, and updated annually.

- An academic conference to catalyze the cross-disciplinary research in support of new financial instruments, contracts, and regulatory change. Such a conference, with web presence, will serve as a source of ready information and an incentive to draw researchers to the topic area.
- A Living Project Lab, an outgrowth of Financial Innovations Labs. During the year, we will search out opportunities to facilitate capital-market solutions for specific local opportunities and then monitor their progress through a Living Lab format for more nuanced and effective recommendations for capital market solutions.

A Diverse Set of Parties Is Needed to Effect Change

Customers
- Fixed energy budgets (schools, hospitals)
- Need to rebuild using monetized savings
- New construction, tighter codes
- Efficiency through outsourcing energy services

Monetizing Savings
- ESCOs to plan savings & implement projects
- Metering technology
- Financial savvy to monetize
- Trading markets

The Grid
- Utilities
- State regulators
- Local governments
- Advocates

Capital Pools
- Private equity
- Large financial institutions
- Boutique banks

Physical change
- ESCOs
- Technology startups
- Venture capitalists
- Private equity investors

About the Authors

Martha Amram is Co-Founder of Growth Options Insights and a Senior Fellow at the Milken Institute. She is leading the Institute's energy services initiative, which comes under the Strategic Action Volunteer Effort (SAVE) umbrella to move the U. S. economy toward energy independence. The purpose of the initiative is to identify profitable business models and financial instruments to accelerate the adoption energy efficient and clean technologies. Amram is a co-founder of Growth Options Insights, which focuses on research and investments in young, pre-profit companies. An experienced consultant, author and speaker, Amram is the co-author of *Real Options* (Harvard Business School Press, 1999) and *Value Sweep* (Harvard Business School Press, 2003). She holds a Ph.D. from the Massachusetts Institute of Technology in applied economics.

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