Leveraging Knowledge: Transferring Energy Services To New Markets

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ABSTRACT

In newly competitive energy markets long-term customer commitments will be sought and gained from value-added energy services. The concept of selling energy services rather than a regulated commodity is part of an emergent "sustainable development" paradigm which requires transformation of corporate and consumer cultures. Information systems and knowledge management will be central to transferring new energy services concepts and capabilities. Global energy companies will accelerate change as they create collaborations which deploy their information through technology-based knowledge management systems.

INTRODUCTION

Can energy services technology be successfully transferred to new markets in developing countries? This question is of concern on a global scale: the rate at which new technologies are deployed will be a major factor determining whether countries and the world as a whole can achieve sustainable growth paths.[1] It is also of concern on a microeconomic level: what strategies will be effective at matching supply of our services to demand or, perhaps better, at creating demand for

our particular type of supply. In this article we identify trends which are shaping the mechanics and institutions of markets for energy services. From these trends we draw some tentative conclusions about how the energy service business will be practiced and its technology transferred.

At one level transferring energy services technology refers to how technologies such as process alterations and new hardware are deployed by end users.[2] Insofar as end users are continually evaluating their technology options, factor prices, plant age, and so forth, they will eventually make the investments which improve their (economic) efficiency.[3] An energy services model seeks to influence and speed this decision process via entrepreneurship and project development savvy. An energy services company (ESCO) identifies and promotes a project, develops financing, and implements. Under a performance contract, a revenue stream is constructed of avoided energy costs, sufficient to provide the required returns for all parties. While the model seems to be about projects, what underlies it is knowledge about technology operations and energy futures.

A market transformation model shifts the focus away from the ESCO entrepreneur, to collaborations and procurement programs which consciously seek to kickstart markets for new technologies.[4] The individual project disappears within an initiative aimed at impacting a product's market segment, development and production gear-up. Programs use features such as product competitions and incentives to retailers. The key role is that of a knowledge-based catalyst—a role played, typically, by a national research lab, an industry R&D institute, sometimes a utility itself—which has the knowledge resources to identify technology and market parameters and the communication skills to bring together the various parties—producers, distributors, procurement agencies, and end-users.

At another level, transferring energy services technology refers to getting knowledge into the hands of those who will promote and develop projects.[5] This kind of transfer is especially relevant at the early phases of market development: creating a "cadre of extension agents" will promote faster passage through the bottom of the innovation diffusion S-curve. Development agencies have begun encouraging ESCOs to undertake this process. Even more than with market transformation, this process requires effective sharing of information and knowledge amongst a network of participants.

Networked information and knowledge sharing are key to ESCO

practice, especially for new markets. Organizations that understand this and form their business practices, collaborations, and customer offers around it will be successful. Global entities are best positioned to create and manage systems which will facilitate this—and conversely forming such systems may be at the heart of "going global." Local players will be strongly motivated to become part of such networks. Specialists will need to plug their skills into such networks. Comprehending the information technology will open the doorway to participating in the markets. And the more widespread the participation, the more will energy markets be transformed.

WORLD NEWS

Emerging Markets

The long-term growth of energy demand lies in the developing countries. Both population and per capita energy use are increasing faster than in the mature markets of the developed world. Infrastructure of all types is much less energy efficient and is generally in need of replacement and expansion (even though there are still major gains to be made in transforming advanced country infrastructures, such as the giant step to renewables).[6]

But the decades of technology transfer by direct government action financed by multilateral development institutions are largely over. The World Bank has shifted its emphasis from development funding to policy reforms which aim to "get prices right," privatize overgrown public sectors, open markets to international flows of private capital and direct investment.

Such liberalization has allowed contradiction to emerge between the long and the short term. Even though growth and technology transfer are projected for the long term, market conditions are no longer controlled to provide a stable environment in the short term. The recent wave of foreign exchange devaluations called the "Asian flu" has seriously damaged existing private foreign investment in many emerging market power sectors and halted new flows.[7] Dollar (or mark or yen) denominated investments are subjected to devalued returns (revenues) in the local currency. The recommended short-term strategy for internationals trying to stay in these markets for the long haul is to find projects which enhance local positions with limited investment exposure.

Sustainability

The development paradigm at the middle of the twentieth century focused on creating industrial infrastructure for transfer to national monopolies. Large projects were underwritten and risk assumed by international institutions. Government ownership without a clear burden of risk encouraged the pursuit of social goals through price subsidies and employment practices, which contributed significantly to eventual public sector fiscal crises.

At the entry to the 21st century, driven by global environmental concerns, we see this state-based industrial paradigm, having served its basic purpose, giving way to an alternative development model of "sustainability." A new paradigm brings with it a new "technology cluster." For the energy sector, sustainability means technologies for

- cleaner fuels and renewable sources
- process alterations for high efficiency and low emissions
- improved process monitoring and control
- new vehicle designs and transportation systems
- product design for low material use and reusability
- recycling, re-use, and industrial ecology developments

Some of these changes apply to central power stations but in general the implication is greater emphasis on end-use characteristics. End-users become a more active part of the energy sector rather than passive consumers. There will be many participants making independent decisions, in markets influenced, but not directed, by public sector rules and incentives.

Competition & Globalization

In the developed world deregulation of the utility industry has led to a wave of mergers and acquisitions. Through consolidation a class of global corporations is emerging, geared to competition and replacing the structure of local regulated monopolies. In the developing countries, debt crises of the 1980's along with free-market ideology of the 1990's has led to restructuring of the public sector—privatizing the national monopolies created for infrastructure development by sale to interna-

tional consortia of private investors, often led by the new global utilities.

Opening markets brings new entrants. A precursor to full competition, independent power producers (IPPs) became a significant part of the utility industry during the 1980's. They brought to the market relatively small, state-of-the-art plants and altered basic industry concepts of how power resources could be procured. Still more radical was an expanded concept of demand-side management. Under regulatory mandate and incentivizing, utilities procured blocks of "negawatts"—guaranteed energy conservation—demonstrating that end-users and third-party service providers could be structured into the market to provide power via utilization of technologies for improved end-use efficiency.

With competition, most advanced in the United States, energy consumers are seen to be changing from generally passive to active. Major consumers, no longer captive, have new-found market power. The trend is for large users to strategically analyze their energy use and plan their purchasing, to seek specific services, to shop among various suppliers. To serve these customers and to aggregate smaller ones, specialist brokers and marketers have emerged. Options multiply as the many players make offers, develop new products, create rate and service packages etc.

Connectivity and Global Networks

Connectivity is expected. The complex of computers, telecommunications, and the Internet are an essential part of up-to-date business infrastructure. It is a marker of what is world-class. Multinational corporations tie their operations together this way. International agencies such as UNESCO are tracking and promoting the growth of this informational nexus. In the developed world markets are now created and commerce conducted in virtual space.

TRANSFORMATION OF UTILITIES TO AN ENEMY SERVICES MODEL

The transition from sales to service will be an enormous culture shock… It will involve the addition of service oriented marketing practices to more traditional technologically driven corporate practices. The conglomerates of the twenty first century will be built upon the remains of corporations unable to make this transition.[8]

Utilities, which have traditionally been producers and distributors of an energy commodity under regulated monopoly conditions, are in the process of re-visioning their business.[9] A trend of ESCO ownership by utilities is well established, providing a means of experimenting with new services in response to deregulation in home markets. The energy services model will shift from tangential to central in utility practice as competitive markets evolve.[10] While one might argue that knowledge was always embodied in every kilowatt sold, in a services model knowledge moves to the forefront of marketing and sales as packages are tailored for market segments and even specific end-users. The shift to a new business model will be a culture shock to organizations accustomed to regulated service in spatially defined and protected markets.

While initial entry into developing markets may be via power plant projects or privatizations, globalizing utilities will use their knowledge of coordinating energy supply, distribution, and on-site services to expand and solidify their share of local energy markets.

Bundling and Creating New Kinds of Products

In seeking long-term customer commitments under competitive conditions, bundling energy services will be a significant part of strategy. Methods of energy performance contracting will be integrated into utility marketing as a way to add customer value and differentiate product. In differentiating its product, the utility shows that it provides more than an energy commodity. Added value comes from expertise in managing energy and related resources. Talk of becoming former customers' "energy partner," of providing "total solutions" is now rampant. While fast becoming a new orthodoxy of rhetoric, the practice will let a thousand flowers bloom, many in forms yet unimagined.

The offer of creatively financed new equipment can certainly hook a customer. But besides plant upgrading and process alteration projects, the utility can re-direct its resources to offer new kinds of products, modeled after products from the financial services industry, such as

- strategic planning for energy procurement
- energy risk management and annuity plans
- information and expertise sourcing and best practice reference
- energy cost reporting, data warehousing and analysis
- software interface to other business systems
- linking customers for industrial ecology developments

Capitalizing Distributed Resources

Partnerships in their customers' plant operations will lead utility operations and accounting systems to encompass improved efficiency, on-site generation, and alternative energy sources. Such distributed resources will greatly reduce the "lumpiness" of a utility's investment pattern and thus allow a lower risk investment strategy in competing for market share. Once this is fully realized as a strategic advantage, on-site project investments will become part of a utility's corporate finance on the same footing as traditional plant equipment for the generating base.

Metering, Billing and Data Warehousing

Systems to aggregate site data will be necessary for this business model. Existing SCADA and metering technologies will be evolved in this direction, integrating with automated process and building control systems and GIS (geographical information system) tools already used for grid and pipeline management. What we now see as separate metering and verification for ESCO projects will be combined into unitary billing, broken out analogously to an investment portfolio statement. In the investment field, simplicity of investment and ease of tracking ongoing results are promoted as competitive advantage. Moreover, warehousing customers' energy use data can be used to considerable competitive advantage. Through creative "data mining"—making recommendations based on use patterns, in designing win-win rate structures, and so forth—the incumbent supplier can strengthen its relationship.

Participating in Wider Markets

With data aggregated, it becomes possible for on-site projects to be brought into emissions markets. Under present (unaggregated) arrangements most on-site projects are too small to cost-effectively participate. Thus the expansion of utility services, on the one hand, enables these markets to operate more efficiently and, on the other, enables a benefit to be shared between the enduser and the utility. The benefit, of course, is an incentive to further clean energy production.

Building an Information System

Following the model of other globalized industries, the industry leaders will increasingly become "wired" corporations, using information and communication technology to integrate their internal processes, expertise resources and linkages to external partners, allies, and collabo-

rators.[11] A schematic representation as shown in Figure 1 can help put things in perspective. The information system serves as a network channel and also as a means of organizing knowledge. We can assume that the new global utilities have an abundance of knowledge resources but if inaccessible they are without value. So creating the information system framework is a form of corporate resource mining.

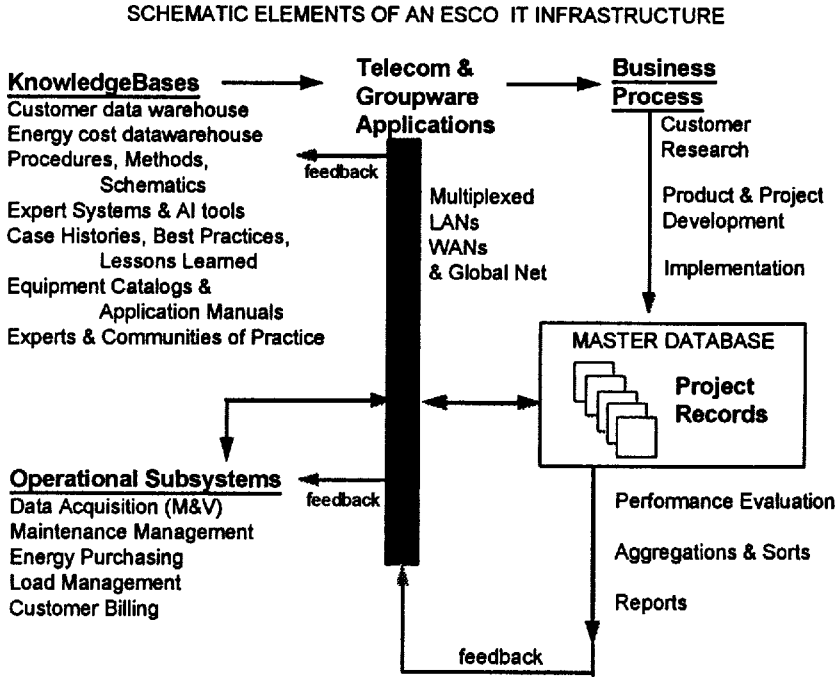

Figure 1

The communication backbone would be developed in joint venture with an international telecom and Internet provider. The utility becomes a "content-provider." Since communications providers earn revenue based on traffic and users are drawn by content, good content providers are evermore valuable and worthy of investment. Negotiating this fundamental relationship needs to be a priority item.

Realizing that the new business model is information-based leads to learning lessons from the information industry.[12] First and foremost is that the same technology/system should be used for many markets.

This spreads the development investment across consumers differentiated by geography, market segments, and time of adoption. Early and later adopters provide "legs" which extend an information product's lifetime. Adapting the technology for a wide variety of users implies "versioning" of features, capabilities, and distinct levels of access, associated with differential pricing. Extending product life implies update releases, a function with tactical dimensions in meeting competitor challenges.

Customer lock-in, another information product concept, approximates the energy marketer's goal of securing long-term purchase agreements. Lock-in starts with acclimating the customer to a user-interface and operating environment which meets needs without unnecessary complication. It continues with tailoring features and information, to such features as personalized on-line research support and links to on-line energy markets. The more comprehensive is the energy-related environment, the more functions the customer will perform in it and the higher his or her perceived switching costs. Getting users to learn how to use the information system is itself a vital piece of technology transfer.

Reaching Out Into New Markets

Students of technology diffusion find that acceptance of innovation follows an S-shaped pattern, as shown in Figure 2. Communication has been identified as the key to the process, starting with early adopters motivated and inclined to experiment who then initiate the spread of positive messages through their social networks; an increasing density of communication accelerates the rate of acceptance until the community (or market) is saturated.[13]

We can anticipate that this pattern will apply to changes in the energy business at several levels. First there is the transformation of utility business by adoption of an energy services model, presently at the early acceptance phase in developed countries but hardly yet exported to emerging markets. As part of this change comes the more specific adoption of information technologies as a way of linking global utilities to local ones, and these collaborations to service providers and to end-users. This step should be viewed as the spread of an enabling technology—in and of itself it does not change energy-producing or energy-using systems. Such change comes only when utilities and customer collaborations put in place new processes and equipment, which are the final level of innovation. It is the scope and pace of this final level

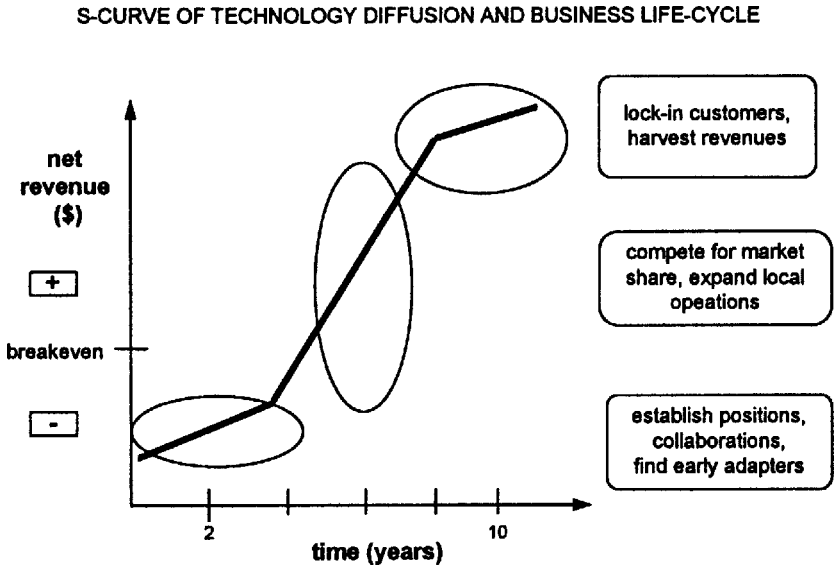

Figure 2

which impacts the world environmental situation. Acceptance of the enabling technologies opens the door to a potentially cascading series of new applications in distributed generation and end-use efficiency. Thus the S-Curve shown as Figure 2 should be understood as a simplification of what will actually be a family of such upward curves as new applications are generated.

The information/knowledge system provides a way of projecting intent and capabilities into a new market and provides a framework for access and interactivity. Focused marketing will help identify early adopters, so a plan based on market segmentation should be tied to system release, licensing and pilot efforts. Advertising, news releases, surveys, seminars and workshops are traditional means of releasing information. On-line conferences add Web networking to this repertoire. The sponsor is able to review wide-ranging comment which provides market insight and contacts. Conferences can spawn on-line communities of knowledge. International agencies have shown interest in this type of interactive mechanism as a means of spreading and transferring knowledge, learning, and sharing information.

But only a broader transformation of understandings throughout the society will hasten the upturn from early acceptance to widespread

participation. Corporate environmental responsibility initiative grew in developed countries only when such concerns were pressed by the public. Another lesson from the information and network industries is where needs are only dimly perceived by customers to build the market rather than to narrowly pursue market share. This means promoting the new possibilities, heightening interest, involvement, and access, developing a communicative network and collaborations beyond specific short-term customer opportunities. A new local competence base is needed to support growth. Understanding these issues leads to various forms of engagement with societal institutions:

Universities and Research Institutes: promote environmental studies, endow faculty positions, provide on-line technical resources, internship opportunities and career paths

Non-Governmental Organizations: support specific project initiatives, attend community meetings, offer on-line technical resources, speakers and seminars

Professional and Industry Associations: create special certification programs, offer speakers and seminars, participate in trade shows, support with corporate memberships

Government Agencies and Local Governments: propose win-win projects, support pilots and demonstrations, provide on-line technical resources for new energy extension services and associated professional training, provide best-practice references for regulations and programmatic incentives

This kind of market development effort goes beyond normal marketing, beyond segmentation and customer strategies. Brand-name recognition will follow.

Conclusion

A little crystal-ball gazing suggests how the game will be played.

- Competition by value-added services to end users—energy services model of utility business

- Transfer of energy services technology cluster by newly emergent global utilities

- IT capabilities created in joint venture with telecom/Internet service provider

- Knowledge management for information access and sharing across global network

- Creation of local partnerships and collaborations, utilizing global information system as keystone

Giant, consolidated utilities are already becoming a major force in global capital flows. We suggest that their accepting an energy-services based business model and deploying information technology based systems can make them also a major force in global knowledge flows. Information and knowledge sharing will strongly impact the rate of technological change ("leapfrogging") and resource use as energy markets in developing countries are transformed.

References

1. An economic analysis of this issue is provided by Duchin and Lange *The Future of the Environment* Oxford Press 1994 using an input-output world model. Under their assumptions about the rate and extent of efficiency change in various sectors, the CO_2 abatement goals of the Rio/Kyoto Conventions will not be met.
2. Such improvements in technology are subsumed by economists under "technical progress" as opposed to increased inputs of labor and/or capital. "Knowledge" has an ambiguous status in the traditional (Cobb-Douglas) production function. The human capital school (see especially by G. Becker) treat knowledge as an attribute of human capital as it is trained and educated. Others categorize it as an element of "the residual" which accounts for growth over and above what can be accounted for by labor and capital inputs.
3. Economic efficiency will encompass energy efficiency insofar as energy is fully priced (i.e., without subsidy) and even more so if taxed to account for externalities.

4. For a recent summary see Scott, M., Parker, G. and Currie, J. "How to Build Markets for Energy-Efficient Technologies" *Strategic Planning for Energy and the Environment* v. 18 no. 4 1999
5. Recent technical economics has begun to treat knowledge creation, focusing on the R&D process. See the literature on endogenous growth such as P. Romer or M. Scott. There has been less economic attention to the spread and use of existing knowledge, such as we are primarily discussing in this article. Japan's astounding growth and that of other East Asian "tigers" are probably suggestive here. Their skill has been in adopting and commercializing technologies not creating them. See also the discussion of R&D by C.I. Jones *Introduction to Economic Growth* 1998
6. This is recognized in the idea of "joint implementation" of CO_2 emissions abatement where a developed country uses its capital to buy a more cost-effective abatement project in a developing country.
7. A. Streicher "The Future of the Global Power Industry" *Hagler-Bailly Perspectives* v. 1 issue 3, 1998
8. Laudis and Graedel "Manufacturing" in D. Richards and G. Pearson, *The Ecology of Industry* National Academy Press 1998
9. Re-visioning and re-inventing are a widely discussed theme in popular social science of the 1990's. Perhaps the best known and most accessible development of this theme for business is G. Hamel and C.K. Prahalad, *Competing for the Future*, Harvard Business School Press 1994
10. See C. Flavin and N. Lenssen, "Reshaping the Power Industry" in L. Brown et al, *State of the World 1994*, Worldwatch Institute/Norton 1994 for a fuller discussion of utility industry events and trends since the 1970's and the shift towards an energy services model. The de-regulation of an industry typically leads to a phase of commoditization and pure price competition as new entrants attack previously protected players. For this reason it appeared that utility deregulation would lead to market dominance by lowest cost sources, particularly coal, wheeled regionally. Initially utilities "stripped down" inessentials such as mandated energy service programs, to gird themselves for price wars. But this phase was short, perhaps because of short-term supply constraints (it takes about 10 years to site, permit, and build a new coal plant) and the large number of existing players (not everyone can be a cost-leader). Instead, the majors have begun competing on the basis of "value-added." See, for example, "The Billion-Dollar Battle" *Energy Manager*, v. 2 no. 1 January 1999. Also see E. Smeloff and P. Asmus *Reinventing*

Utilities: Competition, Citizen Action, and Clean Power, Island Press 1997 for case studies of utilities adopting integrated resource responses to deregulation.

11. See Bartlett and Ghoshal, *Managing Across Borders*, Harvard Business School Press 1989
12. The most accessible treatment is C. Shapiro and H. Varian, *Information Rules: a Strategic Guide to the Network Economy*, Harvard Business School Press 1999
13. Rogers, E., *Diffusion of Innovations*, Free Press 1995 (4111 edition)

ABOUT THE AUTHOR

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