

# Barriers and Incentives for Utility Energy Efficiency Programs in Deregulated Markets

*Joel N. Swisher, UNEP Collaborating Centre, Risø National Laboratory*

There is a trend in numerous countries, in both the industrialised and developing parts of the world, toward deregulation in the electricity sector. This trend makes it increasingly unlikely that electricity suppliers in many countries will adopt energy-efficiency programs similar to those of the regulated North American utilities. The first indications, from Norway and Britain, suggest that deregulation will increase the barriers to energy-efficiency improvements through demand-side management (DSM) investments. The goal of deregulation is generally to harness competitive forces to improve the efficiency of the electricity supply system. Achieving this goal makes it more difficult for energy-efficiency programs to compete economically with new electric supplies. However, the real problem is that deregulation tends to fragment the market, such that it is difficult to identify a major participant in the electricity market (supplier, distributor, customer or other) that perceives both the (potentially high) long-run marginal cost of new supplies and the possibility to invest in energy-efficiency improvements.

In both Sweden and New Zealand, the former state electric power boards have been corporatised, with the eventual aim of privatisation. For the time being, this situation is the worst of both worlds for DSM: the new corporate monopoly faces neither competitive market pressure nor public oversight via binding regulation. These organisations' business strategies thus become a matter of positioning themselves to defend and perhaps increase their market position in case of real competition being introduced in the future. One possibility is that the utility uses DSM as a tool to defend its market share against new competition by making their service more attractive and economical to the customer. Rather than reducing the customers' rates to respond to competition, the utility can thus reduce their bills, including perhaps maintenance and other fuel costs, making continued service from the utility relatively attractive compared to the competition. Although the utility could recover only part of its costs and lost revenues from the DSM recipients and variable cost savings, the lost revenues must be compared to the alternative case where customers are lost, taking all of their revenues with them.

In developing countries, there are similar pressures toward deregulated markets. While there are clear gains to achieve, at least in improving supply-side efficiency, it is also unclear in these countries whether such restructuring can help to improve their generally poor end-use efficiencies. Increasing energy prices will have some effect, but the price signal is confused by many well-known institutional barriers to energy efficiency investments. In Argentina, for example, the result of deregulation is likely to be similar to that described above, and the deregulation trend makes it difficult to impose regulations regarding energy efficiency or pollution. On the other hand, however, increased vertical reintegration and rising marginal supply costs might provide real incentives to develop DSM. Another situation is illustrated by Sri Lanka, where the state owned utility is opening the possibility of private suppliers, in order to help defer building several coal-fired plants power stations. Continuing subsidies to residential customers discourage energy-conserving behaviour, but at the same time the utility has strong incentives to use DSM to reduce supply costs, particularly if the more liberal structure allows some new resources to be provided from DSM programs.

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## Introduction

In the U. S., the last ten years have seen a drastic shift away from the construction of large central power stations by electric utilities. This has been the result of two trends, which are somewhat opposed to one another. The first is

the advent of the Public Utilities Regulatory Policy Act (PURPA) legislation, which was meant to stimulate the development of renewable energy sources for utility power. In addition to introducing more renewable energy,

PURPA has stimulated a general deregulation of the electric supply industry, allowing greater access to smaller, independent power producers (IPPs) and the advent of competition for supplying utility power. The second trend is the widespread adoption in the U.S. and Canada of demand-side management (DSM), to reduce electricity demand while still meeting customer energy-service needs. The arrival of DSM, however, has been driven by the close regulatory oversight of the state-level public utility commissions (PUCs) in several states and provinces, especially those with ambitious environmental agendas.

The trend in numerous countries, in both the industrialised and developing parts of the world, is toward deregulation in the electricity sector. There is generally no corresponding trend toward the type of proactive regulation that has facilitated the adoption of DSM in North America. To the extent that utility involvement in energy end-use efficiency is discussed, as in Denmark and the Netherlands for example, it is assumed that it must be in a different context than that of “American style” DSM. In many other countries, the emphasis is clearly on the deregulation and/or privatisation of the power sector, with little direct consideration of the implications for energy efficiency and DSM. This trend seems to have reached the U.S., as a recent decision by the California Public Utilities Commission (CPUC) will allow electricity wheeling at the wholesale and eventually the retail level.

The assumptions behind the deregulation trend are firmly grounded in economic theory (Anderson 1993). Its implementation, however, is often based more on ideology than realistic analysis. The basic expectations are that private ownership gives stronger performance incentives than public, that regulation is inherently costly and inefficient because it reduces choices available in the market, and that competition increases innovation by rewarding more efficient performance. An important question, of course, is at what level should privatisation, deregulation and competition be applied. Ownership does not seem to have a great effect on DSM, as both public and privately-owned utilities practice DSM in the U.S. Regarding the more important structural issues of regulation and competition, it seems that the key question is what structure gives the market more choices, and therefore more chances to choose the most efficient solution.

The successful implementation of end-use energy efficiency measures requires at a minimum that their adoption does not depend solely on the customers’ present economic criteria. The implicit discount rates applied by energy-users to energy-efficiency investments range from 20% to 200%, compared to utility discount rates of 6-10% (Ruderman et al. 1987). The many barriers to the adoption of cost-effective efficiency improvements by customers are well known, and it is clear that other criteria, closer to the

supply-side criteria, must be applied for even a fraction of the potential for energy efficiency to be realised (Fisher and Rothkopf 1989, Jochem and Gruber 1990). In other words, some energy-supply entity (i.e., generators, distributors or energy-service companies) must be in a position to choose, on a relatively equal basis, between financing energy efficiency or paying the potentially high marginal costs of new electricity. In addition, if the marginal supply costs include environmental costs and other externalities associated with power supplies, DSM becomes more attractive.

A key element of utility DSM programs is bringing the economic evaluation of energy efficiency onto an equal basis with supply expansion through a process of integrated (supply and demand-side) resource planning (IRP). In North America, active province and state-level regulation of vertically integrated utilities has made this kind of evaluation a routine aspect of utility business. The resulting DSM investments may reach US\$3 billion in the U.S. in 1994 and C\$1 billion in Canada by 1996 (Bauer and Eto 1992, Canadian Electrical Association 1992). In Europe, however, vertical integration is not as common. A more common model is municipal distribution utilities that buy their power from larger (often nationalised) generation utilities. Although there are a few fully-vertically integrated utilities, such as Oslo Energi and Stockholm Energi, they may be broken up as a result of the deregulatory policies now taking effect. Moreover, the regulatory intervention that made DSM possible in North America is not apparent in Europe, where utilities operate more independent from government oversight. This seems to be the trend world-wide.

## **The Pioneers: England and Norway**

Beginning in 1990, the Central Electric Generating Board (CEGB), the national electric utility of England and Wales, has been simultaneously deregulated and privatised, except for the still publicly-owned Nuclear Electric. The privatised CEGB was divided into two (mostly coal-fired) generating companies and one transmission company. These private suppliers, however, must use a certain amount of British coal, and distributors must take nuclear power from Nuclear Electric, which is subsidised through the rate base by a fossil-fuel levy on other sources.

All power goes through the newly-created power pool, or spot market, to be bought by distributors, the Regional Electricity Companies (RECs). The generators get the marginal pool purchase price, determined by hourly bidding, plus a capacity payment based on hourly estimates of value-of-service. The RECs sell power for the pool price plus a transmission charge. The pool is backed up by a forward market that reduces the effective price

range by providing a contractual floor and ceiling to the pool price (Tenenbaum et al. 1992).

The transmission and distribution network serves as a common carrier under the National Grid Company, which operates the power pool and wheels power between all generators and customers. Users of more than 1 MW can contract for power supplies from any source they choose. The 1 MW limit is expected to be removed eventually, so that all customers could theoretically shop for power, thus allowing full wholesale and retail wheeling. The RECs continue to have an obligation to serve customers with less than 10 MW demand, as long as they continue to buy from the REC. Retail customer rates are capped, with the supply price passed through in full to customers. The results of this new market structure to date are that the competitive rates for large customers have decreased, and the captive residential rates have increased, prompting some complaints of excess profits to the RECs.

In this kind of environment, it is not surprising that there is little interest in DSM. Because the supply costs are passed through in full, there is no incentive to reduce them via DSM, and there is no room to increase rates even slightly to recover DSM costs or lost revenues. With no vertical integration, no player in the market is in a position to perceive the full benefit of DSM, except the end-use customer. However, any DSM investor would have to pay the full cost, with no cost-recovery mechanism. Recent activity in DSM in England and Wales, predictably, has been minimal.

In Norway, the new Energy Act that took effect at the beginning of 1991 similarly deregulates the utility industry, but does not directly influence ownership. Most of the 60 (almost exclusively hydroelectric) generating and 240 distributing utilities (for a population of 4 million) are still publicly-owned corporations, but they are now in a position to compete with each other for sales and supplies. In this non-integrated environment, the few integrated companies like Oslo Energi can operate as both generator and distributor. The key change is that the national transmission monopoly Statnett is clearly separated from both generators and distributors. The wholesale power pool is an hourly spot market, with no imposed capacity credit as in the UK. However, only short-term spot transactions go through the pool; the remaining power is sold via longer-term firm contracts. Statnett adds a cost-based transmission charge to the power sales (Moen and Johansen 1993).

In theory, this system allows full wholesale and retail wheeling, although only customers with 250 MWh or more annual demand participate in the market due to the transaction costs, which are capped at NOK 5000 (\$US

700). In addition, spot buying requires hourly metering, which costs about NOK 10,000 (\$US 1400) and is paid over 4 years. At present, the utilities are not really able to handle all the new information demands of this market system, and they are not ready for the likely-needed introduction of direct load control, two-way communication, and other technical measures. While distributors continue to have an obligation to connect customers, this is not fully an obligation to serve, i.e. to meet all reasonable demands. Meanwhile, residential customers remain captive, but theoretically they too could organise into purchasing blocks to participate in the market, although the metering requirements in such an arrangement are unclear. Residential meters are presently read only once annually, despite the likely energy-efficiency benefits of more frequent metering and informative billing (Ling and Wilhite 1991).

In the last three years, the spot price has been very low, as supply has greatly exceeded demand as a result of warm winters and wet summers. As a result of the low short-term spot price, the distributors' avoided cost is now low. Large customers participating in the competitive market are paying reduced rates, while the captive residential customers' rates have stabilised after successive increases during the 1980s. With low variable costs, utilities want to maximise sales in order to cover their fixed costs. The competition for firm contracts encourages rate minimisation. The industry expects a gradual market reaction to higher marginal costs in dryer years, although a more volatile response is also possible. Meanwhile, Statnett has firm export contracts with Sweden, and proposed firm sales via undersea cable to the Netherlands could increase demand enough to lead to dry-year power shortages by the year 2000, requiring imports or new investments in generation or DSM.

The effect of present market forces is to shift the time horizon for planning and investment toward the short-term. Decisions are guided by the spot price of electricity, i.e. by the low short-run marginal cost, rather than the potentially high long-run marginal cost. The result is little investment and no interest in DSM. DSM is further discouraged by the rate-minimising strategy driven by retail competition, and by the sales-maximising strategy driven by the need to cover fixed costs and the weakening of the obligation to serve. DSM is not attractive to a utility trying to earn as much as possible from each kilowatt-hour, as it might be to a utility trying to provide a certain level of service and reliability at the least total cost. The Energy Act originally called for a level playing-field for DSM in utility planning, but this requirement has since been scrapped without any attempt at implementation (York 1993).

## Other Industrialised Countries: Sweden and New Zealand

In the last ten years in New Zealand, the economy has been transformed from one of the world's most regulated to one of the least regulated, and the energy sector is no exception to this trend. The Ministry of Energy's (MoE) last national Energy Plan was produced in 1985. In 1987, the State-Owned Enterprises Act corporatised the MoE Electricity Department to become Electricorp New Zealand (ECNZ), along with eight other state entities, several of which have since been privatised. In addition, the Energy Research and Development Committee of the MoE was eliminated in 1987, along with much of the country's activity in energy research, and the MoE itself was disbanded in 1989.

The corporatisation strategy was a more gradual approach to electricity deregulation than the shock treatment imposed in England. To date, essentially all that has happened is that the state monopoly has been replaced by a corporate monopoly in the form of ECNZ. There have been no competitive pressures to stimulate operational efficiency, and there is even less public oversight than there was over the MoE Electricity Department. In theory, however, electric generation is now deregulated, and it is proposed to separate ECNZ's transmission and generation functions and to privatise them. In addition, the Energy Sector Reform Bill corporatised the distribution utilities or electricity service authorities (ESAs) for eventual privatisation. Some power-wheeling transactions have been negotiated, and the eventual aim is to create a spot market for electric power, with vertical disintegration and competition at various levels of the market (Ministry of Commerce 1992).

Thus, the present structure of ECNZ is similar to many European electricity wholesalers, such as Sweden's Vattenfall, who serve only large industrial customers directly, with the residential and service sectors served by intermediary electric authorities, the ESAs in New Zealand's case. As mentioned above, the lack of vertical integration can discourage interest in DSM by dividing the expected benefits. In New Zealand, the corporatisation of ECNZ decreased interest in DSM even further, as there was little public oversight to advocate the potential economic and environmental advantages of DSM.

In theory, the State-Owned Enterprises Act allows for unprofitable social investments to be subsidised in a transparent process, but this provision has never been invoked. It could, however, be used to encourage environmental protection via energy efficiency (assuming that DSM is considered unprofitable by ECNZ). However, the government has chosen to leave environmental questions

to be addressed under the Resource Management Act, which deals with mitigating the effects of, but not preventing the causes of, environmental impacts.

There has been some progress and increasing interest in DSM in New Zealand, although it has been mostly on the part of some of the ESAs, such as South Power in Christchurch. Also, the government has recentered the field with the establishment of the Energy Efficiency and Conservation Authority (EECA), which is charged with performing many of the essential information functions needed to accelerate energy efficiency improvement, including conducting demonstrations, setting up trade allies, and financing improvements in public-sector buildings (Gummer 1993). EECA is trying to stimulate activity by energy service companies (ESCOs), although it is unclear the extent to which they are simultaneously competing with young ESCOs. Another concern is that ECNZ may try to establish itself as a monopoly in ESCO services, excluding competition that is probably needed to stimulate innovation and weed out poor performers in the trial-and-error field of DSM implementation.

Even on the supply-side, electricity deregulation has not benefited New Zealand much. The theoretical expectation of competition is unlikely to be realised to a sufficient extent to improve efficiency, as the New Zealand market is already too small for significant competition to develop even in much less capital intensive markets (James 1992). ECNZ was able to go on quietly about its business, under the universal assumption of a large excess of generating capacity, until a combination of dry weather and mismanagement of the hydro reservoirs created a severe electricity shortage in 1992. Meanwhile, the take-or-pay contracts under which New Zealand's natural gas is extracted encourages inefficient and unnecessary use and may lead to the depletion of the gas resource before 2010 (Cocklin 1993). Despite the real possibility of both shortages and environmental damage, the current electric industry structure offers no incentive to develop long-term contingencies, such as making new equipment and buildings more energy efficient with measures as simple as double-glazing.

In Sweden, the structure of the electricity system is similar to that of New Zealand. The majority of the existing generating capacity is hydroelectric, and very little new hydro capacity is expected to be built in the future. In Sweden, however, nearly half of the total electricity generated comes from twelve nuclear stations, although Swedish voters approved in 1980 a national referendum calling for the phase-out of nuclear power. There is presently no legislation in force to impose a timetable for implementing the phase-out, which at one point was due to begin in 1995, so it now appears that the

existing stations will operate until the end of their technical-economic lifetime. However, a new wave of anti-nuclear sentiment, such as that caused by the Chernobyl accident, could accelerate the phase-out process. Although the phase-out policy is being ignored in practice, it makes future nuclear power expansion unlikely in Sweden.

As in New Zealand, the entire Swedish utility industry is in the early stages of a restructuring process toward greater competition and less government control. In January 1992, Statens Vattenfall, previously the state power board, became Vattenfall AB, a state-owned, limited-liability corporation. The national transmission grid is now a separate entity that will remain state-owned, while the remainder of Vattenfall is expected to be privatised sometime in the future. The key element of the planned deregulation is extending the access to the transmission and distribution network, so that any generator can "wheel" electricity to any wholesale customer, and perhaps to the retail market. The expected result of this process is greater competition and less government involvement in the utility industry (Fritz 1992).

For the distribution utilities to begin to consider DSM cost-effective, they must, at some point, be faced with the potentially high marginal costs from the supply utilities, regardless of whether they buy from Vattenfall or from many smaller new generation utilities. It is unclear whether this will happen under deregulation, as the short-term effect of increased access and competition will possibly be lower bulk electricity prices, based on average costs. However, load uncertainties would prevent distributors from contracting for 100 percent of their demand. Thus, these low prices might apply to long-term bulk power purchases, covering 80-90 percent of the distributors' demand, while the remaining supply would have to be bought on the spot-market at potentially high costs, at least during dry years. The need to minimise purchases of this high-cost energy could motivate DSM investments by distribution utilities, although it is unclear whether they would focus on energy efficiency or only on peak-load management.

With the exception of strict thermal standards for residential buildings, Sweden presently does not have strong policies and programs with regard to efficient energy use in buildings. Much of the technical information presently available on energy efficiency options in Sweden comes from the recently-completed "Uppdrag 2000," (project 2000) a field study of energy-efficiency options by Vattenfall (Eklund et al. 1992). The study produced the first detailed statistical picture of energy use in the Swedish service sector and evaluated the potential cost and performance of a wide range of energy-saving measures (Hedenstrom et al. 1992). The strategy of Vattenfall in

conducting Uppdrag 2000 was to focus on retrofit measures that could be implemented quickly, in a situation where electric rates are increased by 30-40 percent. This strategy is not presently being carried out, partly due to the continuing surplus of electric supply and uncertainty over the future effects of deregulation. Moreover, Uppdrag 2000 scarcely considered the more cost-effective energy-saving potential in new buildings and equipment.

If the large supply utilities break up into many small companies, it is difficult to imagine their role in implementing DSM. However, if the present large supply utilities, including Vattenfall, survive nearly intact, they will strive to maintain or even increase their market share to the extent possible. These existing utilities will face competition for new and existing customers from other suppliers, who might offer a range of electricity prices, the lowest of course having the most chance to win over the customer. Assuming that a utility cannot defend certain customers by reducing their rates and cross-subsidising them at the expense of others, it must make its services more attractive while minimizing its lost revenues.

Although the Swedish government is not likely to impose integrated utility planning techniques that would stimulate DSM investment, some utilities could decide to do so for their own benefit. One option is for the large Swedish utilities to begin using DSM as a tool to defend their market share against new competition by making their non-residential service more efficient and economical. Rather than reducing the customers' rates, the utility can thus reduce their bills, including perhaps maintenance and other fuel costs. These savings would make continued service from the utility relatively attractive compared to the competition. Without raising rates, it will be possible to recover only part of the costs and lost revenues from the DSM recipients and from variable cost savings. However, the lost revenues must be compared to the alternative case where customers are lost, taking *all* of their revenues with them.

Depending on the competing supply price, retaining customers can justify a certain level of investment in DSM programs. For non-residential end-uses, one analysis suggests that the threat of competition from other suppliers could stimulate utilities to invest in DSM measures with marginal costs nearly up to the cost-effectiveness threshold of the societal (total resource cost) perspective (Swisher and Hedenstrom 1993). DSM would be less attractive in the residential sector where the customer is essentially "captive." However, the relatively centralised management of multifamily housing in Sweden could enable groups of residential customers to bargain collectively with utilities, and thereby participate in a competitive market for energy services.

It therefore appears that a deregulated utility could perceive an incentive to help reduce or minimise the customers' total cost of energy services. For a certain share of customers (who may be difficult to identify), the prospect of competition could increase the incentives for utility-sponsored DSM measures. In contrast to the regulatory approach to least-cost utility planning in North America, these incentives could encourage least-cost planning via market pressures. The driving force would not be the customers' explicit interest in saving energy (which may be negligible), but the competitive pressure applied by other suppliers trying to capture the customers' business. This prospect would probably require relatively long-term electric-service contracts, and it is unclear whether this will occur or whether competition will push the planning and contractual time horizon further toward the short-term.

Future marginal electricity costs in Sweden are expected to be significantly higher than present costs, due to environmental constraints and the use of more expensive resources than the existing hydroelectric system. Even without such a supply constraint, the prospect of integration with the European energy economy will make the value of electricity (and thus saving electricity) much higher, because it will be driven by the higher marginal production cost on the continent, as opposed to that in Scandinavia. In the long term, therefore, as supply constraints and market integration increase the price or at least the *value* of electricity, DSM measures could be used to "rescue" electric supplies from inefficient customers (even those customers who continue to pay low prices) and sell that energy to high-price customers.

## **A Developing Country Example: Argentina**

Proposals abound for various forms of deregulation and private sector involvement in the power sector of developing countries. However, Argentina is perhaps the first developing country to implement a full policy of deregulation, first launched in 1990. The changes, which have many similarities to those undertaken in England, include vertical disintegration and privatisation of electricity generators and distributors. Participants at one level of electricity market cannot participate in another. The wholesale power market, between generators on one hand and distributors and large users on the other, is managed by a wholesale market company, which does seasonal supply planning. There is a spot market for generators' power, which is sold to distributors and large consumers on a seasonal average-cost basis. Wholesale wheeling is allowed, based on fixed-term contracts executed via common-carrier access on the national grid (Hasson et al. 1993).

Regional distributors are granted concessions to serve smaller customers, and they have the obligation to serve these customers' needs. The state is not obliged to provide back-up capacity to ensure that these obligations are met. The apparent contradiction between distributors' obligations and their prohibition to participate in the generation business may be leading to a deterioration in the quality of service; in fact there have been power cuts beginning in 1992. Although customers have complained and tried legal action, little action has been taken. In theory, this problem could force distributors to maintain reserve capacity by forming new companies to build new generating capacity. However, their main interest is cost reduction in the wholesale market for peak power, as they do not receive enough revenues to cover new capacity, back-up generation, or DSM measures.

In practice, there has been a lack of adequate regulation on concessions and competition as planned. The resulting tariffs have increased, and wholesale prices have increased even more, with strong fluctuations, depending on the hydro supply, of up to 70%. As might be expected, there has been some reintegration of generators with other generators, distributors, and petroleum companies. Because the spot market does not allow full cost recovery for marginal generating units, they do not represent a viable business, despite their importance to system stability and reliability. This has resulted in the dismantling of some combustion turbines in the northern part of the country.

The generators are not investing in new capacity, in anticipation of the last major state-backed hydro project coming on-line in 1999. At present, generators earn rents from high spot market prices in dry years but lose in wet years, discouraging long-term investment. There has been a transfer of profit to generators, and the distributors claim they are losing money. There is little competitive pressure to reduce generators' prices and profits, due to the annual variations in supplies and prices. The distributors want fixed-term contracts to reduce price fluctuations, but suppliers are confused and hesitant to make contractual commitments. The current trend is thus moving toward less capital-intensive generation, i.e., natural gas-fired combustion turbines, for which the generator can pass on fuel costs via the wholesale market, at the expense of capital-intensive nuclear and hydro-power, although substantial hydro potential remains unexploited.

As in the case of the deregulating industrialised countries, essentially no incentives have developed for energy-efficiency improvements and DSM. There should also be strong incentives to reduce technical losses in the transmission system, which cost distributors potential revenue for energy they must buy from generators, but much of

the losses are non-technical, resulting from illegal connections, tampering with meters, etc. Although the distributors' difficult situation with respect to backup capacity might suggest some incentive for peak-load DSM, they have not chosen such options. Given the general deregulation trend, pursued vigorously by the multilateral financial community, the government lacks the ability to reassert any regulatory influence. In the name of system reliability, energy efficiency or environmental protection. Thus, it appears that the most likely stimulus for DSM is if partial reintegration makes DSM a competitive tool for larger supply utilities, as discussed above in relation to Sweden, but it is unclear whether such a process will develop in Argentina or other developing countries.

## **Other Developing Countries**

While few other developing countries have pursued power-sector deregulation as aggressively as Argentina, many have begun at least partial deregulation of the generation industry. This restructuring has been principally through allowing access to private-sector development and financing of new generating plants. Countries such as Pakistan, Indonesia and the Philippines have developed major private-power projects, and this trend seems to be accelerating. The other major trend in developing countries is to try to remove price subsidies for electricity use. Increasing energy prices will have an effect, but the price signal is still confused by institutional barriers to energy efficiency investments (Reddy 1991).

The commercialisation and corporatisation of the power sector in developing countries is being aggressively pursued by multilateral institutions such as the World Bank (World Bank 1993). Many national utilities in developing countries operate as arms of state bureaucracies, as in the case of the former MoE Electricity Department in New Zealand. Although it is unlikely that many of these utilities will go as far toward commercialisation and privatisation as in New Zealand and Argentina, they are being pushed to operate as commercial businesses independent of the ministries. This means more financial accountability and, presumably, more discipline in terms of collecting revenues from customers. Often the customer most in arrears to the state utility is the government itself, a situation which makes it very difficult to operate the utility in an efficient and professional manner.

Two general differences between the power sector in developing countries and that of most industrialised countries are that demand is growing much faster in developing countries, exceeding 10 percent per year in some Asian countries, and that supply-side efficiency improvements are at least as urgently needed as DSM. The current trend toward greater private-sector participation addresses

both of these problems. On the one hand, private capital is needed for the simple reason that public-sector financing simply cannot keep up with the rate of growth in some countries. On the other hand, it is hoped that private-sector competitive forces will stimulate better management and improve the poor efficiency of the electric supply sector.

Sri Lanka is an example of a small developing country with many of the problems common to other countries in Asia. Electric demand has been growing at almost 10% per year, sometimes exceeding supply, and power curtailments have occurred during dry years (Perera 1992). Only 35% of households presently have electrical service, although this number is increasing due to the national rural electrification program of the Ceylon Electricity Board (CEB), mostly financed by the Asian Development Bank. This program doesn't help CEB's finances, as these new customers pay subsidised rates. Although the CEB is a branch of the Ministry of Energy and Power, as in other countries the state is one of the least reliable customers with regard to paying their bills. Recently, the CEB has been trying to get a major electric rate increase approved. The increase would raise most rates 25-30%, with the lowest rate tiers increasing as much as 100%, thus eliminating much of the existing price subsidies. It is unclear, however, if such a rate increase will be allowed, at the highest political levels, to take effect (Wijeratne 1993).

Most existing generating capacity is hydroelectric, but nearly all large-scale potential has been developed. The CEB's expansion plan calls for building several thermal power stations including diesel- and coal-fired plants. The first coal-fired station would begin construction as soon as 1996 to come on-line beginning in 2002. This would put a large financial burden on CEB and increase pollution and greenhouse-gas emissions. The most economical and environmentally-sound site for electricity expansion is at Trincomalee, on the east coast, where the government plans to build a large complex of coal-fired generating stations.

The existing CEB expansion plan, which was conducted at a high professional standard by the CEB engineering staff, shows the need for coal-fired stations after 2000 (Ceylon Electricity Board 1993). The government proposes, however, to accelerate this schedule, by building the stations through a build-own-operate (BOO) or a build-operate-transfer (BOT) arrangement with private-sector developers. Although this would relieve the CEB of the burden of financing the plant themselves, it would significantly increase the total cost of power. Moreover, it would force CEB to accept the risk of signing a take-or-pay contract for power produced in an area that is subject to frequent political violence and terrorism involving the so-called Tamil Tigers. Finally, the environmental impact of the

coal-fired stations could be reduced by delaying or reducing the scale of the plant through the implementation of DSM, distribution loss reduction, cogeneration, and renewable sources of electricity. These resources have not yet been fully addressed and weighed against the planned fossil-fuel development in the expansion plan.

If DSM can slow Sri Lanka's demand growth, it would seem to be a convenient way out of some dangerous economic, environmental, political and security problems, or at least a way to delay making these problems more serious by rushing into the Trincomalee plant. Like most developing countries, Sri Lanka does not employ the most efficient electrical end-use equipment. There appears to be major energy-saving potential in lighting, motors, cooling and other end-uses. The largest demand category is industry, although other subsectors such as hotels and commercial buildings are growing rapidly. Some industrial energy-efficiency projects were launched during the 1980s, but these often focused on oil consumption, or on house-keeping measures with low investments.

To capture the electric efficiency potential, and to head off the accelerating growth in the service sector, an immediate need is to overcome information limitations regarding energy end-uses and technology trends, DSM technology and program options, and practical tools for integrating such information in a planning framework. The little reliable data on energy end-use patterns, technologies available, etc., is relatively scattered. The CEB has developed its first strategic plan, which emphasises three areas: rural electrification, private power generation and integrated resource planning (IRP). The management of CEB has committed to pursuing IRP and implementing an energy-efficiency plan, including both supply and DSM options. A solid IRP framework, with consistent data and planning methods based on realistic DSM options, could make DSM investments more attractive to the lending community and attract private-sector participants. At the same time, however, a growing stream of private-power proposals, some credible and some less so, are competing for the attention of CEB's understaffed planning department. In the absence of explicit regulatory guidelines, this makes it difficult to conduct planning work and develop the IRP framework.

## **Conclusions: DSM and the Deregulation Experiences to Date**

The early results of deregulation, in terms of eliminating inefficiency and reducing costs of supply, have been mixed. Norway has experienced clear short-term benefits, although they are partly the result of favorable recent weather conditions, while the results in England and the other countries are less convincing. It appears, however,

that introducing deregulation (as in New Zealand) and/or privatisation (as in England) without stimulating real competition is a no-win proposition, as the accountability to regulatory oversight is removed before the discipline of market forces is imposed. For the time being in New Zealand and Sweden, this kind of situation is the worst of both worlds for DSM: the new corporate monopoly faces neither competitive market pressure nor public oversight via binding regulation. While it seems advantageous to restructure before privatisation, avoiding the confused situation of England, it is still essential to put a regulatory system in place to prevent abuse of the new rules and to promote public objectives which may include encouraging DSM.

To the extent that real competition is achieved, market incentives will stimulate efficient production. Even with efficient competition, however, deregulation is really designed only to solve supply inefficiencies. There is not necessarily any incentive for end-use efficiency and DSM, in part because deregulation tends to shorten the time horizon for investment decisions. Another serious problem is that deregulation tends to fragment the market, such that it is difficult to identify a major participant in the electricity market (generator, distributor or other) that perceives both the (potentially high) long-run marginal cost of new supplies and the possibility to invest in energy-efficiency improvements. As mentioned above, if only the consumer perceives the full benefit of energy efficiency investments, these benefits are not likely to be captured.

If a deregulated, segmented power market simply passes costs from one level to the next with no mechanism to reduce these costs via efficiency improvements, the market tends to encourage the sort of rate minimizing, sales maximizing behaviour observed in the case studies above. Ironically, this is the same behaviour that was encouraged by traditional rate-of-return regulation of North American utilities before the advent of DSM and IRP. One can question whether this type of investment behaviour is efficient, in that it captures preferences revealed in the market by choices between competing alternatives. The issue of market choice is important, and it helps explain why deregulation stimulates supply-side efficiency more readily than DSM. Open competition can encourage the entry of new technologies and suppliers, increasing market choice. However, the resulting short-term investment criteria and market fragmentation reinforce the barriers to end-use efficiency, thus removing DSM from the choices available in the market for providing energy services.

In developing countries, continuing subsidies to residential customers discourage energy-conserving behaviour, but even correct price signals are insufficient to produce

major improvements in end-use energy efficiency. At the same time, however, utilities could have incentives to use DSM to reduce the costs of meeting fast-growing demand, particularly if a more liberal structure allows some new resources to be provided from DSM programs. This will not be accomplished by driving the government completely out of the power sector, but by maintaining consistent and transparent regulatory structures that encourage the market to find efficient energy solutions, including DSM measures. Note that while countries in the midst of privatisation, such as Argentina and Chile, have taken no interest in DSM, the first major program for DSM implementation in a developing country is underway in Thailand, where the power sector is centrally controlled. This is not to say that this is the best or only solution, or that private-sector power development has no role (in fact, it already has an important role in Thailand). The market alone, however, may not optimise DSM investment.

## **A Way Forward for Utility Energy Efficiency?**

If DSM does not easily become part of competitive environment, can it still be justified? One of the principal reasons for pursuing energy-efficiency improvements is that energy consumption leads to pervasive externalities, ranging from local pollution and global greenhouse gases to energy and nuclear security risks, that are not reflected in energy supply costs and planning efforts. By mitigating these problems with technical improvements that are cost-effective relative to new energy supplies, energy-efficiency programs such as DSM offer a “win-win” solution. Moreover, it appears that such cost-effective technical opportunities are also abundant in developing countries (US OTA, 1992).

The investment behaviour of energy users does not account for the long-term costs of energy supplies, even without the externalities. Thus, one cannot expect that energy price increases, although a necessary measure in many cases, will lead to sufficient investment in energy-efficient technologies. The need for other measures to help implement energy efficiency is the justification for government policies and utility programs such as DSM. This need seems especially strong under deregulation, which tends to have the effect of shortening the time horizon for energy-investment decisions.

Given the difficulties of implementing DSM in an environment of deregulation, is there any chance for capturing the benefits of utility energy efficiency? There do appear to be some options for creating DSM incentives. These strategies are definitely departures from the North American model of regulator-imposed DSM. They are not as easily

managed, but they may allow some degree of progress in DSM despite the challenges posed by deregulation.

One approach that is consistent with the deregulation trend is to establish private-sector ESCOs, as subsidiaries of utilities and independently, and to encourage third-party financing of DSM. To the extent that long-term power transactions are contracted on the basis of competitive bids, it may be possible to emulate the all-source bidding procedures that some American utilities have used to include DSM resources in competitive procurements (Goldman and Kahn 1993). This may not be the most widely applicable or the least expensive approach to DSM, but it provides a lever into a competitive market.

In industrialised countries such as in Scandinavia, the competition between utilities could be harnessed in favour of DSM. As discussed above, there are possibilities for utilities to use DSM as competitive tool to defend their market share. The success of this strategy depends partly on the availability of long-term power-purchase agreements with customers, to assure that customers do not exploit one utility for DSM investments and then switch to another for cheaper kilowatt-hours.

In a country that is successful in keeping its power supply costs at a low level compared to other countries, there would appear to be relatively little incentive for DSM. However, if that country is able to sell power to countries with more expensive supplies, as Norway can with the Netherlands, the value of saved energy increases to the level of costs in the importing countries, not just the domestic costs. This raises the possibility of using DSM to “rescue” low-price electricity for export to higher-paying customers. A less attractive alternative, from the national perspective, would be to allow power exports to force up the domestic electric prices. This strategy may also apply to individual utilities.

Another strategy is for distributors to use DSM for reducing area-specific costs, which depend most on distribution and local transmission costs. Recent analytic advances in accurately determining utilities’ area-specific costs allows the precise targeting of programs in areas where the avoided costs are relatively high (Orans et al. 1992). A utility DSM strategy, built on intensive campaigns with limited geographical coverage, rather than broad coverage but modest impact, can avoid capital investment costs in transmission and distribution that are driving the current investment needs of utilities with relatively slow total load growth.

In developing countries, it is important not to discard the potentially positive role of the government in providing information and incentives for energy efficiency. In particular, it is important to develop programs to work with

manufacturers and importers at the upstream end of the equipment-supply chain and to encourage the introduction and promotion of energy-efficient products (World Bank 1992). In addition, there is still a need for public programs to stimulate the development of ESCOs and investment in DSM by electric suppliers. Where public sector involvement remains, simple rules are needed to allow utility DSM cost recovery. In more deregulated environments, incentives are needed at the national level to encourage private-sector investment in DSM, not just in new combustion turbines. As marginal supply costs increase and the fragmented power industry begins to re-integrate, DSM options, if they are credible and easily available, may become more attractive than some supply-side options.

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