IMPACTS OF MARKET LIBERALISATION ON ENERGY EFFICIENCY POLICIES AND PROGRAMMES

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Energy Charter Secretariat

PREFACE

Evolving liberalisation and market forces transform the mindset of energy industry as well as energy consumers. Within this new environment, energy will be generated, traded and consumed like other commodities. Competition and new incentives have a profound influence on energy efficiency policies, both on the supply and on the demand side. Lower energy prices, which are the objective of the whole liberalisation process, may stimulate efficiency on the supply side but may be the main threat for energy efficiency measures on the demand side.

This report aims at identifying the possible effects of a new competitive climate on energy efficiency and to figure out how energy efficiency policies and programmes should adapt in the best manner to the challenge of liberalisation. The report aims to assist mainly those in charge of promoting energy efficiency policy and measures on the demand side, being end-users or supply companies interested to invest in Demand Side Management programmes. It is intended to stimulate dialogue and an exchange of experiences between the participating countries in the Energy Charter process. The findings are also intended to support policy discussions within the fora of the International Energy Agency (IEA) and to foster co-operation between the energy efficiency specialised bodies of the Energy Charter and the IEA.

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Ria Kemper

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SUMMARY AND CONCLUSIONS

Introduction

The intention of this report is to identify and analyse the effects of electricity sector liberalisation on energy efficiency policies and programmes. In a political context, the energy efficiency subject includes a broad range of issues such as consumption growth patterns and economic efficiency in addition to developments in energy efficiency in the physical meaning of the term.

This report will address energy efficiency issues throughout the energy cycle from generation, transmission to consumption. Emphasis will be placed on end use efficiency, as this is the focus of most energy efficiency policies.

Electricity liberalisation experiences referred to in this report originate in market economies in Northern Europe and North America. Some results and mechanisms may not be immediately applicable to the energy sectors of former east block countries. An applicability assessment is not part of the scope of this report.

Market liberalisation

Several forces have pushed governments into rethinking the organisation of the electricity sector. Centralised energy system planning and monopolised supply structures have failed to deliver the economic efficiency notable for competitive markets. The lack of consumer choice in the electricity sector is inconsistent with general societal trends and is politically unsustainable in market economies.

The general trend towards increased international trade and the removal of trade barriers have enhanced the need to address energy liberalisation. This is further supported by the fact that significant regional price differences have put manufacturing industries in some regions at a serious competitive disadvantage. As some nations have embarked on electricity restructuring, further competitive disparities have been spurred. This has made widespread electricity liberalisation a political imperative and now an irreversible process.

The most profound change and most important driving mechanism in liberalisation of energy markets are the introduction of consumer choice and the simultaneous abandonment of institutionalised and geographical monopolies. Generally, competition will cause a downward pressure on prices and costs. This effect is mostly due to a combination of excessive monopoly cost structures and "structural overcapacity" which surfaces when multiple previously contained trading areas are merged into one market.

From a macroeconomic point of view, the advantages of liberalisation are mainly attributable to improved utilisation of fixed assets (generation plants and grids) leading to economically correct investment decisions, and to reduced consumption of resources within the overall system i.e. reduced operations expenses through restructuring and cost cutting.

From an income distribution point of view, the issue is who shall benefit from the creation of value, i.e. the distribution of wealth between the energy industry and the consumer. Introduction of competition and consumer choice will transfer value from monopoly suppliers to the consumers through the market mechanism i.e. through reduced end user prices. Lower prices are inextricably associated with higher demand in spite of a short-term inelasticity of demand. Irrespective of the macroeconomic effects, energy consumers are placed in a more powerful position in a competitive market place.

Energy sector liberalisation is intended to offer a combination of advantages including:

- more efficient use of resources within electricity generation, transmission and distribution;
- efficient pricing of electricity reflecting demand fluctuations/trends, costs and availability of natural resources;
- improved competitiveness of electricity dependent industries due to falling end user prices - redistribution of wealth;
- market based pricing of electricity which will lead to an efficient fuel mix and efficient energy mix (market share of electricity compared to other energy carriers), and
- an industry receptive to economic signals, which creates a sector more responsive to the use of taxes and instruments for the internalisation of environmental costs.

This report provides an introduction to the main features of liberalised electricity markets and discusses some critical issues determining the success of liberalisation. Imperfections such as monopoly powers, transmission bottlenecks etc may however impede the efficient functioning of markets and taxation measures may upset the benefits to consumers and industry.

Subsidisation of consumer groups may not be sustainable in a competitive market environment. Some energy companies have historically cross-subsidised consumer groups, or some governments have offered consumer groups favourable treatment that cannot be maintained. For these groups such as large industrial consumers and some residential consumer groups particularly in economies in transition, liberalisation may not necessarily mean reduced electricity prices.

Redefinition of roles and incentives

This report discusses the traditional structure and incentives of the electricity supply industry followed by a presentation of the predominant changes taking place during liberalisation.

The changes in industry following liberalisation are dramatic. This complete transformation of an industry is caused by a combination of legal and regulatory requirements, mounting market forces and widespread privatisation of energy industry.

The realignment of incentives primarily follows the legal unbundling of industry into monopoly functions (transmission and systems operation), which are regulated to limit profits and to encourage cost efficient operation and; competitive functions (generation, retail), which have incentives to profit maximise. When introducing such regulatory and structural changes into the energy sector, the consequences are, for good and bad, a profit-oriented industry with the characteristics of most other competitive industries.

Transmission companies will become regulated monopolies. Regulation will limit profits, but reward those companies that demonstrate an ability to improve efficiency and cut costs. Thus monopoly regulation will contribute to a concentration of this industry into a small number of large and more efficient grid companies.

Regulation shall satisfy multiple objectives. A central aim is to attain fair and non-discriminatory transmission charges. Tariffs should be kept low by controlling the profits and the cost level of the natural monopolies. Regulation should incentivise economic efficient operation of the grid system, economically correct supply security i.e. correct levels of investments, "debottlenecking" and loss reduction efforts, and enhance the functioning of the market place.

An income cap approach is frequently used to regulate transmission. By regulating the total revenue level, the grid company can improve its profits by cutting cost, but this also provides an incentive to increase the energy throughput i.e. consumption levels. By enforcing a restrictive attitude towards new grid investments, the regulator may provide incentives for grid companies to engage in efforts towards reducing or shifting load among consumers.

Generation and retail of electricity will develop into two distinctly different but very competitive industries. Substantial overcapacity will punish high cost generators. Short-term marginal cost will determine the order of dispatch. With the exception of depreciated generation plants with low to moderate marginal cost, generation will be a low margin business. Industry will focus on the cost structure and make efforts to improve the efficiency and utilisation of their assets.

Unlike most other commodity businesses, electricity retailing is characterised by low capital investments. No "warehouses", "shops" or "delivery trucks" are needed. The grid company takes care of the physical supply and no electricity customer needs to be concerned about supply security when choosing a supplier. Retail of electricity will be a low margin business where economies of scale require substantial volumes of customers in order to reach adequate returns.

Electricity may be bundled with supply of other services or products to the consumer or may supplement the product range of companies with no relation to the energy business. This forces a consolidation of industry, especially the many local distribution companies. The limited need for infrastructure welcomes new entrants and the successful retailer may not originate in the electricity business at all.

In competitive electricity markets, consumers move into focus. Escaping captivity to enjoy choice makes consumers powerful individually and as a group. When markets are liberalised, consumer expectations are focused on price cuts and savings. Liberalisation and competition contribute to a stronger consumer focus on energy costs in general, which could make the consumer more receptive to economic efficiency projects. However, increasing price risk may put consumers in a more cautious mode when evaluating long-term projects.

The introduction of market forces and private ownership in the energy sector require a much clearer division of responsibilities, roles and a legal framework that is clear, fair and predictable. In general, this must originate in a political and legislative process, which results in a set of laws and regulations and an enforcement mechanism i.e. a regulator.

In liberalised markets, policymakers recognise that industry no longer acts receptively to policy statements, but mainly follow the rules of the market and act according to clear and unambiguous laws and regulations. The structure of management and control also adapts to this. Survival and profitability require a fully competitive behaviour. This fuels political discussions regarding ownership, which increasingly conclude with the initiation of privatisation or part-privatisation processes.

As governments legislate and reorganise a new industry structure, attention is also directed towards the internal organisation of public policy and policy implementation. Governments organise functions such as policymaking, licensing, ownership, regulation and policy implementation in a clearer way.

Following the fading energy efficiency incentives of energy supply industry, energy efficiency programmes are increasingly handled by dedicated and professional agencies or companies. Increasingly, energy efficiency policy is translated into quantitative and measurable goals to facilitate management and evaluation of programmes.

Effects of liberalisation on energy efficiency

Generation

The most significant and profound consequence on the energy generation business is improvement in overall economic efficiency. Competitive pressures force generators to examine every opportunity to cut cost and restructure their businesses.

Liberalisation will hit the least cost-efficient plants, specifically those with high operations and fuel costs, which consequently face prospects of immediate mothballing or retirement. Typically, such plants are the least fuel-or energy efficient plants in industry. The development of environmental regulation and emission taxes/quotas will further punish such capacity and contribute to an improvement of energy efficiency.

In the longer run when considering the effects of investments in new capacity, liberalisation will favour a different technology mix in power generation. Environmental policy instruments will contribute significantly to this development. The new market environment with important elements of price risk and environmental policy risk will move industry into a shorter-term investment horizon. New investments in generation are likely to be directed towards smaller size plants with higher efficiencies and more favourable environmental impacts. Such projects are characterised by lower capital investments and much shorter lead times.

Transmission

Grid companies are natural monopolies, which will be subjected to regulatory control. Within an efficient regulatory framework, grid companies, which are able to demonstrate efficiency improvements, will retain a higher profit. Conditions such as previous investment levels, the structure and the cost level of the transmission industry collectively indicate a significant potential for efficiency improvements.

However, efficiency of operation cannot be decoupled from other performance indicators such as security and quality of supply, energy efficiency/loss levels and the ability of the transmission system to facilitate structural changes in electricity supply and demand following the introduction of market forces. The effects of market liberalisation on generation dispatch and generation investments may place new and different requirements on grid capacities.

By imposing a restrictive practice on accepting grid investments, the regulator may reward grid companies for better utilisation of existing capacity and for stimulating end-use energy efficiency. The latter incentive is however counteracted by the fact that increases in grid throughput i.e. consumption growth represent an important revenue source.

Altogether this sends a mixed energy efficiency signal, which through a reduction of grid investments and higher loads and energy throughput, eventually may lead to higher transmission losses i.e. lower energy efficiency in the transmission system. A good market architecture and regulatory system, which accommodate correct incentives and price signals may mitigate this and ensure an optimal level of energy efficiency. Liberalised markets are still in an evolutionary phase in approaching these issues.

Energy mix

If electricity sector liberalisation leads to a sustained electricity price reduction, energy consumption patterns will shift. Lower prices will fuel electricity demand growth and consumers will eventually substitute other energy forms with electricity. This may sidetrack the development of district heating schemes/heat pumps and make natural gas and fuel oil less competitive heating sources. From an energy efficiency point of view this is undesirable as electricity often is a less efficient heating source. Liberalisation of the natural gas market may lead to natural gas prices that may counteract this effect.

End use of electricity-consumer behaviour

Price signals are the most important drivers in energy efficiency development. When energy prices fall, consumers are less likely to initiate energy efficiency investments due to poorer project economics. Fewer new technologies are economical. On the contrary, lower energy prices fuel demand for energy. Liberalisation in one energy market such as electricity may change relative prices between energy carriers and cause substitution effects, which may significantly escalate demand for electricity.

Another potential challenge to energy efficiency is the uncertain price environment caused by liberalisation. Markets are characterised by price volatility and especially in a period of transition into a mature market environment, price developments may be hard to predict. Price risk may deter consumers from investing in energy efficiency technologies until the general understanding of markets and market mechanisms mature. This transitional challenge is exacerbated by consumer expectations, which, in a normal case of liberalisation, are biased towards the prospects of immediate price reductions. Without adequate information about the long-term effects of market liberalisation on prices, this may shift consumer behaviour and focus away from the long-term savings potential of energy efficiency investments.

Industry incentives

Energy liberalisation is aiming at creating a competitive market place for energy. This changes the incentives of energy industry dramatically. Industry becomes profit-oriented and governments can no longer rely on energy industry to maintain its role as an energy efficiency policy instrument.

The economics of a competitive supply business basically give energy industry an incentive to maximise energy turnover. This is the case for generation, it is the case for transmission (subject to the regulatory framework) and it is a strong incentive in the retail business. These incentives do not coincide with end use energy efficiency incentives; on the contrary there are few apparent incentives for the supply industry to promote end use energy efficiency.

The remaining industry incentives are related to improving end use efficiency as an alternative to investments in electricity transmission. Investments in end use efficiency may in some instances be the economically preferred option. This can be furthered by a regulatory regime providing supportive incentives.

In the retail end of electricity business, some suppliers view energy efficiency information and services as a means of developing customer loyalty and electricity is bundled with energy efficiency services to add value to the customer. These efforts are commercially driven. The basic opposite incentives of industry cause some credibility challenges for such marketing measures. It remains to be seen if these efforts are transitional or sustainable marketing strategies in an increasingly competitive electricity market.

CHP and distributed generation in liberalised markets

Traditionally, successful development of cogeneration has relied on favourable national policy frameworks. However, some of the policy instruments used to support development of cogeneration are not consistent with competitive energy markets. Central planning favouring specific solutions, purchase obligations and favourable tariff conditions are examples of instruments which may not be suitable. The greatest threat to cogeneration remains however with the prospects of low electricity prices, which would defer most investments in new generating capacity. This is especially the case in a potentially extended transition period in which demand growth is allowed to pick up abundant generation capacity without providing the price effects needed to justify new investments in generation capacity. However, favourable developments in natural gas prices following gas liberalisation may partly offset the effects of falling electricity prices.

Another barrier to cogeneration in liberalised markets is the increased short-termism of industry demonstrated notably in relation to large capital outlays. This is mainly caused by risks related to prices and the behaviour of non-captive customers. In particular large district heating schemes requiring long pay back periods may suffer from investor hesitance.

A key element of market liberalisation is third party access to the transmission system at fair and transparent transmission tariffs. Transmission access has been an obstacle to cogeneration and distributed generation. The unbundling of electricity utilities combined with regulation should create less destructive incentives and a more favourable environment.

Experience shows however, that dominant actors may abuse the transition period into a regulated transmission environment by charging excessive grid tariffs or imposing other onerous conditions. Such barriers could be lengthy administrative procedures, high emergency supply costs, technical connection requirements and connection costs and lack of recognition of the potential system benefits of distributed generation. These can be serious barriers to market access for small and independent generating plants. This is an issue that needs to be addressed by regulators, but the problem will most likely abate as competition and regulation evolves.

The introduction of distributed power generation plants may have varying implications on grid systems and systems control. Load conditions in the overall grid systems may reward or punish new load or generation input. Adding consumption in a geographical area with excess generation capacity may induce lower transmission losses. Similarly, new generation in a geographical area with a generation deficit may cause lower losses. Such consequences should be reflected in the transmission charges. This could advantage CHP; as such plants in most cases are located in consumption areas and consequently should enjoy favourable transmission charges.

On balance, several factors point to important opportunities for cogeneration in liberalised markets, especially following a transition marked by weak electricity prices. However, these opportunities are predominantly present for industrial and small-scale cogeneration. Prospects of environmental policy instruments would provide further support to CHP and distributed generation.

Third Party Financing in liberalised markets

In broader terms, third party financing is the funding of energy savings investments by an outside company, using energy savings to pay for the investment. In third party financing schemes, investments, operating costs, energy costs, and savings performance must be measured and defined in such a precise way that profits and risks can be clearly distributed among the parties involved. In such schemes most risks are on the energy services provider who receives a share of the documented energy savings as compensation.

As electricity deregulation is a very recent phenomenon in most countries, there is not much empirical evidence and analytical work available to support very clear conclusions regarding the effects of deregulation on third party financing.

The prospect of significantly lower electricity prices is a threat to third party financed project due to weaker project economics. The profitability of energy efficiency investments is very dependent on energy prices, and to the extent electricity prices will fall, project economics will become correspondingly poorer.

Third party financing is a mechanism for the medium sized to large sized electricity users that also represent the customer groups who will enjoy the lowest prices in a competitive market. As demonstrated by independent studies of third party financing, good and undisputable economics characterise TPF, as they are prerequisites to support the profit sharing mechanism.

The liberalised electricity market adds a new risk element to the equation of TPF-economics. Price will depend on more factors and volatility is more pronounced than previously experienced. Despite the general prospect of falling prices, there are important price risks that need to be addressed especially in a long transition period into an efficient market situation. Important issues are i.a. price volatility/variations, transmission tariffs, market power and unpredictable political issues that may cause investors to hesitate.

This risk could cause a setback to third party financing especially in a period of transition, as this is when the most dramatic price adjustments would normally occur. It could cause hesitance to embark on new projects in the anticipation of falling prices and it could offset the profit sharing mechanism of ongoing projects.

A new breed of energy services companies will emerge in the wake of liberalised energy markets. Energy brokers and portfolio managers offer their services to energy consumers with the aim of reducing their energy cost. The introduction of a professional outsourced energy purchasing function brings added benefits to the client such as improved energy consumption statistics and data management.

This enables the end user and the services company to better assess the economics of optional energy efficiency measures. In some instances the portfolio managers supplement energy purchasing with energy efficiency services, which are often subcontracted to consulting or hardware companies. Third party financing schemes fit well within the scope of these services concepts.

A development may be envisaged where an integration of these services creates large energy services companies that purchase energy cost effectively, initiate energy efficiency projects and operate energy facilities all within a compensation mechanism where the energy services company's main incentive is to reduce energy costs and maintain supply security on behalf of the client.

Demand Side Management in liberalised markets

Demand Side Management programmes were originally designed as utility programmes to improve end use efficiency. In the early 1980s, the California Public Utility Commission led the way in requiring utilities to implement DSM-programmes. DSM has since that, become a popular description of utility managed energy efficiency and load management programmes, a concept that has been adopted by numerous countries.

In the past, the primary objective of most DSM programmes was to provide cost-effective energy and capacity resources to help defer the need for new sources of power, including generating facilities, power purchases, and transmission and distribution capacity additions. Electric utility DSM refers to programmes implemented by utilities to modify customer load profiles.

Many DSM-programmes capture cost-effective energy savings that would not otherwise be achieved. However, this is most frequently societal or macro-economic cost effectiveness. Most DSM programmes were planned in an integrated resource-planning (IRP) framework in which utilities compare the benefits and costs of DSM with the cost of additional generation.

From the viewpoint of a profit-oriented utility, DSM is often uneconomic. Contributing to improved energy efficiency among its customers reduces energy sales and revenues. In the first instance this loss is replaced by increased sales to other customers without the need to increase generation capacity. However, the DSM cost causes a profit loss, which cannot be recovered unless the utility is allowed to adjust rates or is somehow compensated by e.g. public contributions. US regulatory authorities attempted to address this disincentive by using revenue adjustment mechanisms that allowed utilities to recover revenues lost as a result of conservation programmes net of any cost savings. In the United States, the electric utility industry has been in a process of deregulation for some time, but competition is still in its infancy. Industry is gradually exposed to a tougher competitive environment. The reduction in the volume of DSM activity in the USA is generally attributed to the introduction of competition. Some utilities have chosen to abandon DSM altogether.

Many utilities are however, using DSM as a means of providing a value-added service to their industrial customers, in some cases only for "at-risk" customers — customers that may choose to purchase power elsewhere. The purpose of and need for DSM in the current more competitive supply market have consequently changed.

Recognition of stronger commercial incentives causes a refocusing of energy efficiency policies relaxing the expectations and requirements placed on the energy industry. Increasingly, the financing of energy efficiency programmes is transferred to fixed grid charges or transmission tariff elements. Governments seem to relax requirements on utility participation in such programmes (e.g. Norway) due to the recognition of incompatible or unclear incentives.

The prospects of utility financed DSM-activity in liberalised markets consequently look dim. Some efforts will be retained by energy suppliers that believe in DSM as a means of adding customer value and building customer loyalty. Provided a proper regulatory approach, incentives may however be created to establish DSM (load shifting) as a cost-effective alternative to grid expansion projects.

Implications on energy efficiency policies

Energy efficiency policies are developed by Governments with the aim of improving energy efficiency within the overall energy cycle. Most often, policies and instruments portrayed as energy efficiency policies serve political goals of reducing the growth in energy consumption and of mitigating adverse environmental effects of energy production and consumption.

Energy liberalisation is part of an overall policy reorientation aiming at higher reliance upon market forces and economic mechanisms. This includes less government intervention and increased focus on establishing efficient market architectures. This has called for a re-thinking of energy efficiency policies and choice of instruments. The most significant challenges facing energy efficiency policies in an environment of energy competition are:

- prospects of falling energy prices followed by consumption growth,
- fading incentives of energy industry to perform end use energy efficiency measures, and
- the need to device policy instruments that function consistent with a new market framework in which commercial motives and economic signals become more important.

These assumptions are based on the anticipation that governments are able to establish a competitive environment in which price mechanisms and signals are not distorted by exertion of market power and general taxation measures.

Prospects of price reductions constitute a significant challenge as instruments need to be selected that accommodate deteriorating economics of efficiency projects. This has necessitated a general discussion of the role of the market as an efficiency driver as opposed to the need for policy instruments to compensate for failing incentives. Policies seem to aim at avoiding discontinuities in energy efficiency measures and governments assume an active role in promoting energy efficiency in a more challenging environment.

Liberalisation, ideally, satisfies the political objectives of lower consumer prices and improved sector efficiency. The political flip side however, is that falling prices fuel energy demand and consumption growth. At the same time, the economics of innovative and efficient energy technologies deteriorate. However, gradual technological change and technology replacement are still likely to improve energy efficiency despite accelerating consumption growth. Such improvements may however be of limited political comfort.

From a macro-economic point of view, the emergence of efficient energy markets brings advantages that monopolies and regulation fail to deliver. Liberalisation transfers the valuation of energy resources from an environment of central planning and monopoly control to the market place where demand and supply conditions determine prices. Available resources are applied more efficiently and prices tend to reflect the availability or the "value" of resources. This leads to "correct" energy prices provided that environmental or other external effects of production, transmission and consumption are accounted for through regulation or taxation.

Prices provide the most important signal to determine the level of energy efficiency. Energy efficiency policy needs to address the question whether the market delivers an economically efficient level of energy efficiency. Reduced energy efficiency incentives due to lower prices may not be wrong as long as the market functions correctly. A careful combination of market forces and environmental policy instruments has the potential of contributing to a politically acceptable fuel mix in generation, end-use energy mix and consumption growth pattern.

Accepting these basic principles of resource allocation, energy efficiency policies would predominantly be driven by the existence of market imperfections and failure of markets to accommodate continuity in development and implementation of energy efficient technologies.

Energy Efficiency projects will also represent relevant tools for achieving the objectives of environmental policies.

Energy liberalisation has the added advantage of making the energy sector more receptive to effective environmental policy instruments. This is due to the fact that energy liberalisation introduces new economic mechanisms and incentives. This creates a framework, which facilitates the use of efficient economic environmental incentives: The effects of environmental instruments should become more transparent, measurable and predictable when instruments are applied on an industry which is increasingly responsive to economic signals.

The new emphasis on market mechanisms and economic incentives in the energy sector also places requirements on the choice of energy efficiency instruments. Instruments should be designed to function within a new and economically oriented environment. Finding mechanisms that work with the market forces and not against means identifying least cost solutions, promoting competition among vendors and energy suppliers and introducing other economic incentives.

Economical energy efficiency has gradually been adopted as a common interpretation of energy efficiency actions. An implication of liberalised energy markets would be to place even stronger emphasis on this interpretation of the term. In the competitive sectors of generation and retailing, emphasis must be placed on facilitating the effective functioning of the market and safeguarding a competitive market structure.

Markets and private ownership are behaviourally more biased towards short-term considerations than governments and centrally planned sectors. This will most likely lead to market cycles and greater variability in energy prices. Governments need to accommodate this fact in formulating government policy and in the choice of policy instruments.

One such area is the negative effect that a temporary but potentially long low-price situation would have on the development of efficient technologies. As electricity prices fall, many new technologies will be uneconomical and industries will re-orientate commercial research and development programmes. Governments may take a stronger responsibility in bridging the gap caused by a temporary situation of low prices caused by generation overcapacity e.g by maintaining acceptable levels of energy R&D. The more cyclic nature of markets and prices may translate into similar patterns for associated activities. This may also require a reorientation of long term government policies particularly in the areas of technology development and information.

Another policy challenge in liberalised markets is the clarification of roles and focusing of incentives. Industry incentives will change dramatically in liberalised markets. Previously, many utilities were instruments in implementing energy efficiency policies in a setting of vague roles and responsibilities. It should not be expected or required that generators or retailers maintain a significant role in the implementation of energy efficiency policy. Energy efficiency contributions from industry should be purely commercially motivated.

Transmission companies are natural monopolies and as such, their economic incentives are subject to regulation. Setting up a regulatory body with adequate legal powers and resources is an important prerequisite for the development of a competitive market as well as addressing the proper incentives for cogeneration and energy efficiency.

Regulation shall stimulate cost-efficient operation of monopolies as well as providing balanced incentives for investments and DSM activities. Regulations must address market mechanisms and market access in order to secure full and fair opportunity for distributed generation. Investments in energy efficiency projects and distributed generation may constitute an economic alternative to grid investments.

In addition to these general policy recommendations, this report discusses the suitability of a selection of energy efficiency policy instruments in liberalised markets. The selected instruments are labelling and standards, fiscal policies, financial incentives and voluntary agreements.

This report also provides a brief summary of the results of two EU and IEA sponsored studies examining the effects of energy liberalisation on energy efficiency programmes. Finally, four case studies are presented showing 1) Norwegian experiences with the role of utility DSM in energy efficiency policy implementation, 2) Example of a third party financing project from the Czech Republic, 3) Challenges facing CHP and distributed generation in liberalised electricity markets - some developments in UK and Sweden and 4) Four national approaches to using voluntary agreements: Australia, Finland, Korea and the Netherlands.

1. INTRODUCTION

Background

The Energy Charter Treaty and the Protocol on Energy Efficiency and related Environmental Aspects (PEEREA) entered into force in April 1998. Subsequently, a specialised Working Group has been established

Energy Efficiency in the Energy Charter Process supports balancing supply, demand and environmental considerations. In addition to the provisions of the Treaty requiring improved energy efficiency throughout the entire Energy Cycle, the Protocol includes specific commitments, which are essential in improving energy efficiency and reducing harmful environmental impact. The Protocol requires Governments to:

- have aims and strategies (art. 5);
- establish policies (art. 3.2);
- develop, implement, update programmes (art. 8.1);
- create the legal (art. 3.2), regulatory (art.3.2), institutional (art. 8.3) environment necessary;
- co-operate/assist internationally (art. 3.1).

All these policies and measures are affected by the challenges the energy industry is facing during market liberalisation and climate change negotiations.

The PEEREA Working Group has as its main tasks: to organise periodic reviews and to identify measures for improving energy efficiency; to act as a forum for exchanging experiences; to develop proposals for specific activities under the Protocol; and to report to the Charter Conference on progress of implementation of the Protocol every year. In this context, an analysis of the ways in which market liberalisation affects "classic" energy efficiency programmes is an important issue to be addressed by the Working Group in an East-West perspective.

Objectives

The Protocol has the objective of creating a forum for dialogue and exchange of experiences among the participating countries. Both country specific reviews as well as thematic approaches are used in this process.

Some participants have progressed far down the route of market liberalisation; others have recently embarked on the process while others are still reviewing the merits and national applicability of a competitive market environment. The opening of energy markets will affect energy efficiency throughout the energy chain as will be demonstrated in this report. Energy efficiency implications and environmental effects have been important considerations in the reform processes. Competition, new incentives and rapidly changing industry structure call for revisions of traditional energy efficiency policies.

Enough process-understanding and empirical evidence are now available to support some policy conclusions for the benefit of nations still evaluating their energy sector architecture and policy options.

Scope of study

The intention of this report is to explore the effects of electricity sector liberalisation on energy efficiency policies and programmes.

Energy efficiency being the ratio of the energy output to the energy input is, when used within a political context, frequently associated with efforts to reduce energy consumption. Energy efficiency is therefore often used interchangeably with the older term energy conservation, which is not the same. From a political viewpoint harnessing consumption growth, which is often associated with adverse environmental impacts, is more important than improvements in efficiency in the physical meaning. This report will address both applications of the term energy efficiency.

The report shall address the following issues:

- Effects on the organisation of energy efficiency policies and the redefinition of roles and responsibilities in energy efficiency work between agencies, regulators, energy companies and customers. New incentives and energy efficiency products in a market in full process of liberalisation
- Main implications for supplier and consumer behaviour in the energy efficiency market depending on price developments and elasticities of supply and demand
- The effects of liberalisation on the different categories of traditional policy instruments to promote energy efficiency - such as regulatory instruments (labelling and standards), financial incentives (energy efficiency budgets), information programmes, training programmes, voluntary agreements and various demand side management programmes.
- The effects on combined heat and power (CHP) projects, both district-heating schemes and small cogeneration
- Experience with third party financing in liberalised markets.
- Compatibility of liberalised markets with Demand-Side-Management (DSM-programmes)
- Relevant examples of best practices in liberalised markets.
- New opportunities for new international cooperation.

For the scope of this study, energy will be interpreted as electricity. Most available and relevant experience regarding energy efficiency programmes in deregulated environments can be found in the electricity area. However, many of the findings are generally applicable and may serve as an indicator of challenges facing energy efficiency policies in conjunction with natural gas deregulation.

To the extent possible, the report should be based notably on existing studies and reports prepared under the umbrella of national or international organisations.

The report will address energy efficiency issues throughout the energy cycle from generation, transmission to consumption. However, emphasis will be placed on end use efficiency, as this is the focus of most energy efficiency policies.

Energy deregulation experiences referred to in this report originate in market economies in Northern Europe and North America. Some results and mechanisms may not be immediately applicable to the energy sector organisation of former east block countries. An applicability assessment is not part of the scope of this report.

PART I MARKET LIBERALISATION

2. A NEW REGULATION APPROACH

2.1 Introduction

Several forces have pushed governments into rethinking the organization of the electricity sector. Centralised energy system planning and monopolised supply structures have failed to deliver the economic efficiency notable for competitive markets. The lack of consumer choice in the electricity sector is inconsistent with general societal trends and is politically unsustainable in market economies.

The general trend towards increased international trade and the removal of trade barriers have enhanced the need to address energy liberalisation. This has further been supported by the fact that significant regional price differences put manufacturing industries in some regions at a serious competitive disadvantage. Industry consumer groups and associations have consequently been important promoters of liberalisation. This leads to a different approach for regulating activities focussing on issues of access to networks and establishing market-based principles for tariff formulation.

As some nations embarked on electricity restructuring, further competitive disparities were spurred. This has made widespread electricity liberalisation a political imperative and now an irreversible process.

Despite the technological properties of the electricity system, all experience supports that electricity as a product behaves like any other traded commodity when subjected to market forces.

There is no evidence that competition when introduced as part of a carefully designed and consistent market architecture has any adverse impact on systems management or supply security.

2.2 Purpose

The advantages of market liberalisation may be discussed from the perspective of macroeconomic benefits and from an income distribution point of view.

The popular impression of the "old" industry was that of the overstaffed and over-invested local and regional monopolies with few incentives to change. With the exception of privately owned utilities where stock markets and private owners constantly push hard towards cost efficient operation, much of the industry has been dominated by public ownership and political control, and has been managed according to a combination of societal and economic criteria.

From a macroeconomic point of view the advantages of liberalisation are mainly attributable to:

- improved utilisation of fixed assets (generation plants and grids) leading to economically correct investment decisions (many planned investments will be deferred due to overcapacity)
- reduced consumption of resources within the overall system i.e. reduced operations expenses through restructuring and cost cutting

It is generally accepted that the introduction of competition and restructuring of ownership and incentives will initiate such changes.

From an income distribution point of view, the issue is who shall benefit from the creation of value, i.e. the distribution of wealth between the energy industry and the consumer. Irrespective of the macroeconomic effects as discussed above, energy consumers are placed in a more powerful position in a competitive market place.

Introduction of competition and consumer choice will immediately transfer value from monopoly suppliers to the consumer through the market mechanism i.e. through reduced end user prices. General economic efficiency improvements are realised through competitive behaviour and market adaptation of the monopolies.

Generally, competition will cause a downward pressure on prices and costs. These market mechanisms as well as the preconditions for falling prices and efficient market structures will be addressed in more detail later in this chapter.

The end result of liberalisation is very often a combination of i.a. these advantages:

- more efficient use of resources within electricity generation, transmission and distribution,
- efficient pricing of electricity reflecting demand fluctuations/trends, costs and availability of natural resources,
- improved competitiveness of electricity dependent industries due to falling end user prices - redistribution of wealth,
- market based pricing of electricity which will lead to an efficient fuel mix and efficient energy mix (market share of electricity compared to other energy carriers), and
- an industry receptive to economic signals, which creates a sector more responsive to the use of taxes and instruments for the internalisation of environmental costs.

By examining the economics of liberalisation, it may be shown that economic efficiency gains from liberalisation will increase with the level of end use energy efficiency. For this reason, economies in transition, often characterised by poor end use energy efficiency, should be particularly aware of the added benefits for the society of combining liberalisation with a strong emphasis on energy efficiency incentives and measures.

2.3 Main features of a liberalised market

Consumer choice

The most profound change and most important driving mechanism in liberalisation of energy markets are the introduction of consumer choice and the simultaneous abandonment of institutionalised monopolies.

Consumer choice implies that an electricity customer shall have the right of choosing the electricity supplier. In principle every consumer - a single household or a large industrial plant should have this right. Many countries have opted for a political compromise whereby the market is opened initially for the larger consumers (eligible consumers) and then gradually smaller and smaller consumers are allowed into the market.

The introduction of consumer choice requires the introduction of a market architecture which in order to be successful, must encompass a series of reforms and measures.

Third Party Access

Electricity distinguishes itself from most other commodities by being delivered to the customer through a dedicated transportation system. In a road system where the roads are predominantly publically owned, competing suppliers can run delivery trucks freely to any customer.

In the electricity system, the "roads" used to be owned by the electricity supplier - i.e. the local distribution company. Choosing another supplier requires that this supplier - the third party - is able to deliver electricity through the wires of a competing supplier as the construction of a parallel set of wires in most instances would be economically prohibitive. Third Party Access is the right of suppliers to non-discriminatory use of the wires be it the central, regional or local grids.

Due to the nature of electricity distribution, there needs to be a co-ordinated flow of electricity throughout the system and one single company controlling the flows in one grid area. In the road-analogy this means that there is only one truck company carrying goods in each area and every supplier/consumer should have an equal right to use the services of that truck company (common carrier).

Transmission tariffs

Equal access to the services of the "truck company" is a necessary requirement but not a sufficient condition to obtain fair and equal competition. The company must serve each client in a non-discriminatory and transparent way offering equal and fair terms of service to all.

If the owner of a grid also would be a competing electricity supplier, which is very often the case, the grid owner would have every incentive to complicate access to the grid, to set unfavourable terms or even differentiate tariffs. These problems are frequently experienced during the initial phases of liberalisation and are the origin of regulatory initiatives such as unbundling and monopoly regulation.

Regulation and natural monopolies

In a market economy, regulation of a power market would be limited to the control of monopoly powers i.e. the operation of "natural monopolies" [1] and market concentration. The regulator would also have a facilitative function in stimulating an efficient operation of the market.

Grids or transmission lines are in most cases looked upon as natural monopolies because the construction of parallel or competing wires would in most cases be uneconomical. Suppliers have consequently few options but to use existing wires to reach a consumer.

This puts the owner of the grid in a position to charge excessive tariffs and gain large profits. Regulation of natural monopolies aim at limiting the profits of the owners to a "reasonable" return on invested capital. The regulator also ensures that the tariffs are transparent and applied non-discriminatory.

Transparency means that tariffs are predictable, accessible, published and billed separately. In most cases transmission tariffs will appear as a separate item on the electricity bill. The separation of the transportation cost will also make the electricity cost a transparent element and comparisons between the electricity prices of competing suppliers can be made more easily.

[1] Natural monopolies: A natural monopoly is an industry where the ratio of fixed to variable costs is very high and where there is potential for economies of scale. Marginal costs of increasing output are low. As a result of this, a natural monopoly arises because one firm can supply output to a market at a lower average total cost than could two or more firms.

Unbundling

Unbundling is an issue of regulation and asset management, which interacts closely with energy policy and public ownership policy.

Unbundling is the separation of large integrated electricity companies into separate companies for competitive and monopolistic functions. This is considered a very important contribution to regulating the natural monopolies thus ensuring fair and non-discriminatory access for all users to the transmission system.

Regulation of natural monopolies within large integrated corporations have proved difficult due to the many cross-subsidization possibilities that exist within the confines of one company. The cost level of transmission can be escalated by charging an excessive portion of shared services to the regulated business resulting in lower cost and competitive advantages for the electricity supply business.

A complete separation of accounts and the establishment of separate business areas are considered a minimum remedy to this, whereas the choice of splitting into different corporate identities and ownership structures would be preferable.

A consequence of this regulatory approach is the emergence of professional grid companies concentrating on different grid levels some of which will develop from a concentration of numerous distribution-grid companies previously owned by distribution utilities.

Regulation and market power

For any market place to perform efficiently, there is need for a large amount of buyers and sellers. For competition to evolve, no single market participant should be able to manipulate the market.

The electricity industry is in many countries characterised by a high level of concentration and quite often state-controlled generators have a dominating market share. Efforts to introduce competition within such an environment have not always delivered the results desired. The prospects of high valuations have tempted politicians to privatise companies with dominating market shares, leaving regulators with years of work to deal with market power.

Market power can be addressed by adopting divestment policies, whereby dominating generators are required to sell off capacity to new entrants or competitors thereby creating a more competitive environment.

Market power may also develop as a consequence of mergers and acquisitions within industry. Competition authorities and the energy regulator normally review and, if acceptable, approve such transactions prior to implementation.

Independent systems operator

The properties of electricity and electricity supply do not change during liberalisation and what becomes a market also remains an integrated physical system in need of systems services and balancing mechanisms.

System safety, supply security and quality need to be maintained by an independent “traffic control centre”. Basically, the systems operator should have no incentive to favour any particular user be it the generators, consumers or the grid owners. Efficient and market based options should be selected to deal with congestions, balancing the system and acquiring systems services.

Market places

Consumer choice stimulates the development of multiple supply options. Numerous players enter the market and consumers may choose from buying from traditional electricity distributors (utilities), directly from the generators, through new players such as retailers, marketers, aggregators, brokers etc or from the wholesale market/power pool directly i.a. by the use of brokers or portfolio managers. Sales channels range from direct mail offers, door and phone sales, direct marketing, advertising, e-trade etc.

A wholesale market based on bulk trades by generators, suppliers and large consumers is a key part of every power market. Contracts range from bilateral contracts to auctions i.e. power exchanges/pools/bourses/spot markets that trade power contracts on day ahead basis or short-term adjustment trade up to runtime. The systems operator runs specific markets to acquire least cost options for systems balancing services.

Trading liquidity (volume of trades) and price transparency facilitate the introduction of electricity derivatives. Electricity derivatives such as forwards, futures and options are mainly used for risk management purposes, attempting to control the fundamental price risk prevalent in electricity markets.

2.4 Market architecture - market mechanisms

In competitive markets, the demand supply balance determines prices.

Electricity demand

The short-term price elasticity of electricity demand is low which means that the demand for electricity is not very much influenced by price changes. In the short term, electricity consumers have few substitution options and responsiveness is limited because electricity cost represents a moderate budget share.

In the very short term, demand responds primarily to factors such as changes in environmental conditions (wind/temperatures) and varying load due to short-term production cycles in the commercial and industrial market segment. In the medium term, substitution opportunities increase and demand will depend on seasonal climate, macroeconomic and industry cycles.

In the longer term, price developments and the economics and availability of technology/efficiency options and competition from other energy carriers such as fuel oil and natural gas have a significant impact on electricity demand.

Electricity supply

Short-term electricity supply is primarily determined by power generation and transmission capacity. Deregulation of the market entails an aggregation of previously segregated markets into one large interconnected supply area.

Historically, in particular due to security of supply policy, most supply areas [2] had access to enough generation and transmission capacity to accommodate peak demand. When merging the capacities of several supply areas into one market place, the end result is typically excess capacity.

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[2] Historically, in many countries, the energy supply industry has been segregated into geographically limited supply areas where integrated energy companies enforced a monopoly including an obligation to supply.

In this situation, the price mechanism will punish the most expensive generating facilities, which will be retired or kept idle. Generation dispatch will be determined in the wholesale market where the key parameter is marginal operations cost. Capital cost is of no significance in the dispatching order.

In competitive markets, each generator will act as though he has no influence on the market price and he will run his plant as long as market prices are above short-term marginal cost. No further investments are made until the investor is confident that future market prices will cover capital cost plus variable costs.

2.5 Electricity prices - critical issues

As explained above, liberalisation of markets very often lead to reduced commodity prices through general market mechanisms. Competition coupled with overcapacity is the main driving force. However, some qualifications should be made regarding this general statement.

Transmission bottlenecks may limit physical electricity trade and thereby complicate the utilisation of excess generation capacity. Systems operators can introduce incentives and tariff schemes that give grid owners incentives to debottleneck systems, as this in many cases is the cheaper option compared to investments in new generation capacity.

Monopoly or oligopoly power may seriously impede the functioning of the market place and could in the worst-case cause electricity prices to rise rather than fall. Energy regulators and competition authorities monitor market power. However, the critical decisions are the initial policy decisions regarding privatisation, divestments and removal of international trade barriers.

Subsidisation of consumer groups may not be sustainable in a competitive market environment. Some energy companies have historically cross-subsidised consumer groups or some governments have offered consumer groups favourable treatment that cannot be maintained. For these groups such as energy intensive heavy industries and domestic consumer groups liberalisation may not necessarily mean reduced electricity prices.

Another critical issue is the level of energy taxation. There is evidence, i.a. from Norway that end user electricity taxes increase with falling wholesale prices. This has also been a widespread practice in several countries in the area of gasoline taxation. The introduction of competition immediately reduces energy company profits and hence their taxation potential. There is a great temptation among the treasuries and politicians to regain this loss by writing new taxes on end-use.

Increased electricity demand and consumption due to lower prices also explain this reaction. This development would significantly reduce the benefits of liberalisation as seen from the consumer, possibly with the exception of very large electricity consumers who could be exempted from such taxes. From an energy efficiency point of view, this would contribute to maintain the economics of new technologies and energy efficiency investments.

A last remark on electricity prices is that the repeated claim that energy liberalisation causes prices to fall should not be interpreted as an absolute price forecast. The claim relates to an isolated effect of liberalisation and competition, which as such, constitutes an important vector in determining final prices. However, several factors as explained above and e.g. unexpected developments in fuel prices may alter the final direction of price movements.

3. Liberalisation and competition- redefinition of roles

3.1 Introduction

The changes in industry following liberalisation are dramatic. This complete transformation of an industry is caused by a combination of three main driving forces:

- Legal and regulatory requirements
- Mounting market forces
- Privatisation

The realignment of incentives primarily follows the division of industry into:

- Monopoly functions (transmission and systems operation), which are regulated to limit profits and encourage cost efficient operation
- Competitive functions (generation, retail), which have incentives to profit maximise

When introducing such regulatory and structural changes into the energy sector, the consequences are, for good and bad, a profit-oriented industry with the characteristics of most other competitive industries.

3.2 Industry structure prior to liberalisation

The old structures of energy industry vary to some extent between countries. This is explained by a series of historical, political and other reasons that will not be discussed in this report. However there are some features that seem to characterise the "old" structure as opposed to market based models.

Local and regional monopolies.
Electricity consumers basically faced one supplier and no freedom of choice - they were captive customers. On the retail level, there were local distribution companies supplying the consumer through their own grid system. On the wholesale and generation level, generators had monopoly in dedicated regions, or distribution, transmission and generation were often part of large integrated companies with regional monopoly control.

Supply obligation and self sufficiency
Energy suppliers had a supply obligation, which normally meant a commitment to meet the demand of the customers in their specific supply region. The lack of interregional or international trade made it an imperative for regional companies to secure adequate generation capacity locally to be able to meet any demand growth by their customers.

Vertical integration
Very often electricity companies were vertically integrated, which means that the companies contained all functions of the supply chain from generation to transmission, local distribution and sales to its customers. This structure provided incentives to adapt generation and transmission capacity to demand or conversely, adapt demand to generation or transmission capacities.

Cross subsidization and cost recovery
Monopoly powers enabled suppliers to recover the full cost of investments and other cost elements. This situation represented few incentives to cost efficient operation particularly in the

combination with public ownership and in lack of regulation. A consequence of this could be over-investments in capacity and "gold plating [3]" often "justified" by referring to security of supply considerations.

The pricing or tariff schemes did not necessarily reflect supply-demand conditions of various customer groups, but could be subjected to differentiation according to societal or political considerations. Cross-subsidisation could be seen in the pricing of different products such as electricity and heat, between customer groups such as industrial and residential consumers and internally in energy companies to "adjust" the performance and economics of various business areas.

The vertically integrated nature of business and accounts facilitated internal cross-subsidization of activities and made the economics of various transactions less transparent. Investments in costly renewable energy capacity could be recovered by being integrated in the total asset or tariff-base.

Public ownership

The public utility nature of electricity supply originates in a public services mindset, which has characterised the electricity supply industry. This has been amplified by a high level of public ownership especially in the transmission and distribution end of the business, but in many countries also within generation.

The close interaction between energy industry and energy policy also made it difficult to identify the division between policymaking and energy supply business. Some large energy companies with dominating positions were developing energy policies and implementing them. In other instances energy companies were receptive to political trends and requests, sometimes to an extent which could make energy legislation and formal regulation seem superfluous.

The many public owners have handled their ownership differently, but very often a mix of societal and political considerations have been introduced into the management of energy companies. Such conditions clouded the criteria according to which the companies were run, raised energy costs and often provided an excuse for poor efficiency or mismanagement.

3.3 Industry structure - post liberalisation

Changes in industry structure and incentives will be pushed by a combination of legislation/regulation, market forces and privatisation.

Legal and regulatory requirements

Liberalising an energy market normally requires a comprehensive legislative reform, which will impact industry structure in many different ways. However, some legal requirements will have an immediate and direct influence on the organisational structure of the electricity industry.

The imperative of unbundling vertically integrated companies re. Ch 2 requires the introduction of new legislation and regulatory requirements. The consequence is a separation of the transmission and systems operation functions from generation and electricity sales. The function of transporting electricity according to fair and non-discriminatory terms needs to be clearly separated from competitive functions such as generation and retail.

[3] Excessive over-investment in functionality of facilities – "luxury".

Several regulatory practices have been adopted to achieve this. A minimum solution is a complete separation of the functions into individual entities with separate and transparent accounting. The clear-cut option is the establishment of separate legal entities with different ownership and board structure.

Over time, new corporate cultures evolve and the focus of the companies turns to their prime business areas.

Monopoly regulation

Transmission companies will become regulated monopolies. Regulation will limit profits, but reward those companies that demonstrate ability to improve efficiency of operations.

Regulation shall meet a number of objectives. A central aim is to attain fair and non-discriminatory transmission charges. Tariffs should be kept low by controlling the profits and the cost level of the natural monopolies. Focus will be on economic efficient operation of the grid system including an economically correct level of reinvestments, "debottlenecking" and loss reduction efforts. Tariff schemes should both enhance competition and supply security and provide the right incentives for new grid investments.

An income cap approach is frequently used to regulate transmission. By regulating the total revenue level, the grid company can improve its profits by cutting cost. Such schemes provide an incentive to increase the energy throughput i.e. generation/consumption level, but may also reward efforts to shift load in order to defer investments.

The organisational consequences are primarily a concentration into bigger companies. Initially, there will be a high number of local grid companies spun off from the electricity supply business of the local utilities. These companies will gradually merge to take advantage of significant economies of scale.

Those grid companies that are forerunners in this restructuring will be able to capture a fair return on capital. Thus monopoly regulation will contribute to a concentration of this industry into a small number of large and more efficient grid companies.

Generation and retail are competitive functions, and regulation will be focusing market power. Energy generators with a dominant position may be required to divest generation assets in order to establish a structure with enough generating companies to achieve effective competition. Competition authorities will keep an eye on mergers and acquisitions and discourage too strong concentration of the generation and retailing sector.

Generally, a successful regulatory approach is based on a combination of a good market architecture and clear regulations and sanctions. If the regulatory function develops into a large bureaucracy with its focus biased towards regulating competition and energy prices rather than regulating monopolies and transmission tariffs, it may be due to basic failures in the market structure, regulations or regulatory powers.

Market forces

Market forces will be the strongest driving force behind industry restructuring.

Substantial overcapacity will punish high cost generators. Short-term marginal cost will determine the order of dispatch. Generation plants with high fuel cost and low energy efficiency will be retired or mothballed. Companies with recent investments and high capital cost may be facing long payback periods and may be acquisition/bankruptcy-candidates.

With the exception of depreciated generation plants with low to moderate marginal cost, generation will be a low margin business. Industry will focus on the cost structure and make efforts to improve the efficiency and utilisation of their generation assets.

Retailing will be an extremely competitive business. Unlike most other commodity businesses, electricity retail is characterised by low capital investments. No "warehouses", "shops" or "delivery trucks" are needed. The grid company takes care of the physical supply and no electricity customer needs to be concerned about supply security when choosing a supplier.

Creativity and skills in electricity marketing, efficient settlement and billing systems and good energy trading skills are critical preconditions for successful retailing. Electricity retail will be a low margin business where economies of scale require substantial volumes of customers to reach adequate returns.

From a margin point of view, the electricity retail business may resemble gasoline retail, where gas stations make negligible profits on gasoline, but make their living on selling soft drinks and groceries.

Electricity may be bundled with supply of other services or products to the consumer or may supplement the product range of companies with no relation to the energy business.

It is a widespread opinion that electricity retail will develop to become a low margin - high volume business dominated by retailers with very high numbers of customers. There is clear evidence of this when observing the restructuring and concentration processes in North America and Europe.

This forces a consolidation of industry, especially the many local distribution companies. The limited need for infrastructure welcomes new entrants and the successful retailer may not originate in the electricity business at all.

New players offering specialised services such as portfolio management and brokering may occupy niches. Such vendors will add value to the energy procurement of primarily medium to large size consumers.

Consumer attitudes

In competitive electricity markets, consumers move into focus. Escaping "captivity" to enjoy choice makes consumers powerful individually and as a group. Being subjected to supply monopolies for an extended period of time, consumers have developed attitudes ranging from indifference to impatience. The transformation of the energy sector into a market place also requires a maturing of consumer attitudes and actions, which may take a number of years.

When markets are liberalised, consumer expectations are focused on price cuts and savings. Large consumers such as large and medium sized enterprises are the first to actively explore opportunities. Due to their energy consumption levels, savings may be significant. Experience from liberalising markets show that large consumers initially gain the most with less price reductions for residential consumers who demonstrate a stronger supplier loyalty.

Over time as markets mature, consumer loyalty abates. Electricity is a homogenous and "faceless" product with limited differentiation possibilities. Suppliers consequently must find innovative ways of building consumer loyalty. Cost-consciousness varies among consumer groups and increases as the electricity bill takes a larger budget share.

Liberalisation and competition contribute to a stronger consumer focus on energy costs in general, which could make consumers more receptive to economic efficiency projects. However, increasing price risks may put consumers in a more cautious mode when evaluating long-term investment options.

Government - redefinition of roles

The introduction of market forces and private ownership in the energy sector require a much clearer division of responsibilities, roles and a legal framework which is clear, fair and predictable. In general, this must originate in a political and legislative process, which results in a set of laws and regulations and an enforcement mechanism i.a. a regulator.

In liberalised markets policymakers recognise that industry no longer acts receptively to policy statements, but mainly follow the rules of the market and act according to clear and unambiguous laws and regulations.

Legislation

Fundamental changes to the energy sector are based on an administrative and parliamentary legislative process, which formulates the basic legal framework according to which the actors will perform their functions.

In this process, governments will normally obtain the powers to introduce detailed regulations. Licenses are normally used to supplement general legislation and regulations and provide transparent and specific guidelines to the operation of entities such as grid companies, generation plants, power exchanges etc.

An effective regulator is an important precondition for the enforcement of liberalisation. Main functions are to enhance the effectiveness of the market mechanisms, conduct monopoly regulation and mitigate market power. In most cases, countries have existing competition authorities, which have to work closely with the energy regulator to control concentration and market power in industry.

As competition evolves and political and commercial roles are separated, governments need to rethink their ownership of energy companies. The political imperative to control industry through ownership and commercial participation is removed with the introduction of new policy instruments.

Policy is implemented through legislation and regulation and not through influencing commercial entities and decisions. Competitive pressures force publically owned companies to adapt and act commercially. The structure of management and control must also observe this. Survival and profitability require a fully competitive behaviour. This fuels political discussions regarding ownership, which increasingly conclude with the initiation of privatisation or part-privatisation processes.

Government organisation

As governments legislate and reorganise a new industry structure, attention is also directed towards the internal organisation of public policy and policy implementation. Governments seem to organise functions such as policymaking, licensing, ownership, regulation and policy implementation in a clearer way.

Policymaking is concentrated in ministries or departments while implementation and licensing are delegated to government agencies or directorates. Market regulation can be performed by a separate government body or using the concept of independent regulation i.a. a regulatory commission/secretariat. There is need for a clarification of roles and responsibilities between the energy regulator and the existing competition authorities.

Ownership to energy companies needs to be handled separately from policy implementation and regulation in order for industry to rest assured that all players in the market place are handled in an equal and non-discriminatory way.

Energy efficiency policy implementation is increasingly handled by dedicated and professional agencies using specialised operators and companies to run specific programmes. Increasingly, energy efficiency policy is translated into quantitative and measurable goals to facilitate management and evaluation of programmes.

PART II EFFECTS

4. Effects of liberalisation

4.1 Introduction

This chapter will identify the most significant effects that electricity market liberalisation has on energy efficiency developments and incentives. The discussion will mainly focus on end-use efficiency, however the total energy supply cycle including energy generation and transmission will also be addressed.

Specific attention will be devoted to a discussion of three specific topics i.e. the effects of liberalisation on CHP and distributed generation, Third Party Financing and Demand Side Management in liberalised markets.

4.2 Effects on the supply cycle

4.2.1 Generation

The most significant and profound consequence on the energy generation business is improvement in overall economic efficiency. This effect is also influenced by changes in the energy efficiency of power generation. However, economic efficiency is a better indicator of success when measured against the macroeconomic and political justification of energy deregulation.

As demonstrated in Ch 3, deregulation of the power industry stimulates competition among generators. Competitive pressures force generators to examine every opportunity to cut cost and restructure their businesses.

Increased regional and international trade tends to expose substantial generation overcapacity, which will favour the low cost producers. The dispatching order of generators will follow the marginal cost curve i.e. short-term operational costs. The consequence being that some generation capacity will be mothballed or permanently retired. The improved utilisation of generation capacity will defer new investments until electricity price prospects exceed the cost of new capacity.

Liberalisation will hit the least cost-efficient plants, specifically those with high operations and fuel costs. Typically, such plants are the least fuel-or energy efficient plants in industry. The development of environmental regulation and emission taxes/quotas will further punish such capacity.

Efficiency improvements in industry are further sparked by the rearrangement of assets following frequent mergers and acquisitions, a process yet in its infancy in Europe. Additional push is provided by privatisation of generation assets, which introduces the discipline of the stock markets into increasingly more power generation businesses.

Failure by governments to address market power may lead to high generation prices. Without powerful regulatory measures, current mergers and acquisitions in Europe may eventually develop further and turn European power generation into an oligopoly.

In the longer run, including the effects of investments in new capacity, liberalisation will favour a different technology mix in power generation. Environmental policy instruments will contribute significantly to this develop-ment. The new market environment with important elements of price risk and environmental policy risk will move industry into a shorter-term investment horizon.

In a briefing paper from the Royal Institute of International Affairs, Walt Patterson and Michael Grubb examine impacts from liberalising European electricity on generation and environment:

"In a competitive market-based electricity system, the traditional large-scale plant, coal-fired or nuclear, with its long construction time, its costly capital structure and its inflexibility in operation, is starting to look like a technological dinosaur"

New investments in generation are likely to be directed towards smaller size plants with higher efficiencies and more favourable environmental impacts. Such projects are characterised by lower capital investments and much shorter lead times. The availability and abundance of natural gas combined with the emergence of a competitive natural gas market is expected to facilitate the extended use of natural gas as a generation fuel (demonstrated by developments in i.a. the UK).

In conclusion, market forces will improve the cost efficiency of power generation substantially and in most cases improve overall energy efficiency as well as environmental impacts.

4.2.2 Transmission

Transmission of electricity may be considered a natural monopoly and should be regulated with the aim of limiting profits to a reasonable return on invested capital. The regulation model should also provide incentives for correct investments and cost efficient, safe and secure operation.

Within an efficient regulatory framework, transmission of electricity has a potential of significantly improved cost effectiveness. By adopting a revenue cap approach in regulation rather than controlling the rate of return, grid companies, which are able to demonstrate high efficiency improvements, will retain a higher profit. By programming a declining revenue curve, the regulator forces grid companies to cut costs in order to maintain profit levels. However, in a broader perspective, efficiency of operation cannot be decoupled from other performance indicators such as security and quality of supply, energy efficiency/loss levels and the ability of the transmission system to facilitate structural changes in supply and demand following the introduction of market forces.

Energy efficiency incentives in transmission companies are mixed. The regulator must approve an escalation of the income cap i.a. following new investments. By imposing a restrictive practice on accepting grid investments, grid companies are rewarded for:

- better utilisation of existing capacity
- stimulating end-use energy efficiency.

On its own, a termination of grid investments and higher throughput will eventually lead to higher transmission losses i.e. lower energy efficiency in the transmission system. However, this cannot be viewed independently from the effects of market liberalisation on generation dispatch and generation investments, which may place new and different requirements on grid capacities. It is critical that price mechanisms both for electricity and transmission as well as regulatory interventions provide adequate incentives for timely and sufficient grid investments.

Many profitable end-use energy efficiency opportunities for grid companies can be identified and specifically load shifting may prove to be an economic alternative to capacity expansion. Regulation must however observe that technological barriers still restrict cost effective implementation of load management of large consumer groups.

On the other hand, increases in grid throughput i.e. consumption growth will reward the grid owner through an adjustment of the income cap. As such, this regulation concept is an energy efficiency disincentive.

Experiences from Norway show a marked reduction in investments on the high voltage grid level starting some 10-15 years back. Since that time energy throughput has increased substantially and investments are mainly related to debottlenecking and upgrades. The main reason for this is that the central grid was dimensioned to handle generation capacities, which were underutilised. Virtually no new generation capacity has been installed and the grid has been able to take the expanding use of available generation capacity.

From a pure energy efficiency point of view, efficiency has become lower due to increased transmission losses in a continuously busier grid. However, this shows that significant improvements in economic efficiency may call for an optimal rather than maximum energy efficiency. On the lower grid levels investment activity has remained fairly constant to be able to meet expanding demand.

In conclusion, previous investment levels and restrictive regulation delay new grid investments. This will lead to higher utilisation of existing assets, which in some instances may lead to higher losses but with the advantage of improved economic efficiency. Regulation model and price mechanisms influence efficiency incentives.

4.2.3 Energy mix

If electricity sector liberalisation leads to a sustained electricity price reduction, energy consumption patterns will shift. Lower prices will fuel electricity demand growth and consumers will eventually substitute other energy forms with electricity. This may sidetrack the development of district heating schemes/heat pumps and make natural gas and fuel oil less competitive heating sources. From an energy efficiency point of view this is undesirable as electricity may be a less efficient heating source. Liberalisation of the natural gas market may lead to natural gas prices that may counteract this effect.

4.2.4 End-use of electricity

Consumer behaviour

The principal effects of energy market liberalisation on energy efficiency depend on energy price developments. In most cases energy liberalisation introduces strong downward pressures on energy prices. This is caused by competition combined with international trade and structural overcapacity.

In the absence of efficiency regulation, price signals are the most important drivers in energy efficiency development. When energy prices fall, consumers are less likely to initiate energy efficiency investments due to poorer project economics. Fewer new technologies are economical. On the contrary, lower energy prices fuel demand for energy. Liberalisation in one energy market such as electricity may change relative prices between energy carriers and cause substitution effects, which may significantly escalate demand for electricity.

It is important to note that energy demand growth as such not only contributes to reducing energy efficiency. Gradual improvements of end use technologies are likely to continue. Higher energy consumption will in many cases be associated with replacement of technologies leading to an overall improvement in energy efficiency. From a political point of view, however, consumption growth is undesirable as higher energy production and consumption cause negative environmental impacts.

The prospects of falling energy prices is not a rule without exceptions. Formerly centrally planned economies in East Europe and the former Soviet Union had energy policies marked by substantial energy price subsidies. The liberalisation of energy sectors in these economies may on the contrary bring higher energy prices and improved energy efficiency incentives. This is similarly the case for some consumer groups in market economies (such as energy intensive heavy industries), which for different reasons enjoyed low energy prices due to political regulations or cross-subsidisation schemes.

Another potential challenge to energy efficiency is the uncertain price environment caused by liberalisation. Markets are characterised by price risk and especially in a period of transition into a mature market environment, price developments may be hard to predict. This adds another risk element to the volatile nature of energy prices. Price risk may deter consumers from investing in energy efficiency technologies until the general understanding of markets and market mechanisms mature.

This transitional challenge is exacerbated by consumer expectations, which are biased towards the prospects of price reductions. The increasing short-termism experienced in the supply sector following liberalisation and privatisation may consequently also influence consumer behaviour.

Another behavioural effect of liberalisation is the stronger emphasis on economics and consumer choice issues. This changes consumers' attitudes into a more economic mindset, which could make consumers more receptive to the savings potential of efficiency measures as a supplement to substitution opportunities and savings caused by changing supplier.

Efficiency programmes

Energy liberalisation is aiming at creating a competitive market place for energy. This changes the incentives of energy industry dramatically. Industry becomes profit oriented and governments can no longer expect that industries satisfy social objectives.

The economics of a competitive supply business basically give energy industry an incentive to maximise energy turnover. This is the case for generation, it is the case for transmission (subject to the regulatory framework) and it is a strong incentive in the retail business. These incentives do not coincide with end-use energy efficiency incentives; on the contrary there are few apparent incentives for industry to promote end-use energy efficiency.

The remaining industry incentives are related to end-use efficiency as an alternative to investments in electricity transmission. Investments in end-use efficiency may be a profitable alternative to grid expansion. This can be furthered by a regulatory regime providing supportive incentives. This issue is explored in more detail in Ch 4.4

In the retail end of electricity business, some suppliers view energy efficiency information and services as a means of developing customer loyalty and they bundle electricity with energy efficiency services to add value to the customer. These efforts are commercially driven. The basic incentives of industry cause some credibility challenges for such marketing measures. It remains to be seen if these efforts are transitional or sustainable marketing strategies in an increasingly competitive electricity market.

The general conclusion however is that energy industry does not maintain its role as an energy efficiency policy instrument. Industry incentives are discussed in more detail in Ch 4.4 Demand Side Management in Liberalised Markets and Case study 1.

Changes in industry structure and incentives welcome the establishment of new commercial entities targeting energy efficiency and outsourced services. Energy services companies provide services on behalf of energy consumers ranging from energy purchasing and management to efficiency projects. With the objective of minimising energy bills, such specialised companies focus on finding the cost effective trade off between supply options and energy efficiency measures.

Energy efficiency policy

Energy liberalisation is part of an overall policy reorientation aiming at higher reliance upon market forces and economic mechanisms. This includes less government intervention and increased focus on establishing efficient market architecture. In many cases, this calls for a thorough re-thinking of energy efficiency policies and choice of instruments.

The realignment of roles and incentives following energy liberalisation presents a challenge to energy efficiency policies. Governments must assume a more pronounced role, as industry no longer can be expected to maintain voluntary contributions to social goals.

Price reductions constitute another challenge, as instruments need to be selected that accommodate deteriorating economics of efficiency options. This also calls for a general discussion of the role of the market as an efficiency driver as opposed to the need for policy instruments to compensate for market failures. A decoupling of environmental policy instruments from energy policy instruments may move emphasis to environmental policy tool such as taxes. Policy implications are discussed in more detail in Ch. 5.

4.3 CHP and distributed generation in liberalised markets

4.3.1 Introduction

The issue of distributed generation [4] and combined heat and power is a comprehensive topic, which deserves a broad discussion. The issue covers use of renewable energy resources in distributed applications, which is often discussed in parallel with energy efficiency and cogeneration as important energy and environmental policy targets. In this report, emphasis will be placed on cogeneration. Renewable energy issues will be discussed briefly.

When discussing consequences of liberalisation, a distinction has to be made between the various forms of cogeneration and small-scale energy production. A thorough differentiation of the challenges and barriers facing each generation form is not possible within the context of this report, but attempts will be made to identify the main issues.

[4] Distributed generation or decentralised generation are equivalent terms for describing localized or on-site energy systems supplying individual, or small-groups of energy loads. The definition includes local cogeneration in addition to a wide range of connected small/medium scale generating plants based on a variety of energy sources i.a. renewabls.

The political attraction of cogeneration is related to energy efficiency levels (i.a. the utilisation of electricity and heat) and/or the utilisation of local renewable or waste resources.

Liberalised markets bring both opportunities and threats to CHP and small-scale energy generation. The most immediate challenges are related to overcapacity within generation, price reductions and transitional grid access barriers.

4.3.2 CHP and cogeneration

Cogeneration or CHP (Combined Heat and Power) is the simultaneous production of electricity and space or process heating and cooling as opposed to the separate production of electricity and heat. For an optimal or most efficient configuration the cogeneration plant needs to be sized according to the heat demand. From an energy efficiency point of view, cogeneration plants use the energy input much more efficiently than conventional electricity plants. As a rule of thumb cogeneration raises the overall fuel efficiency to some 85-90 % as compared to i.a. the approximately 35 % of a conventional coal fired electricity plant.

For the purpose of discussing impacts from liberalisation, a distinction needs to be made between the many various applications of cogeneration technologies. In broad terms a division should be made between centralised systems in which the products i.e. electricity and heat need to be transported to the customers via electricity networks or district heating grids, and decentralised or embedded systems where plants are located where the energy is consumed i.e. typically industrial and small-scale cogeneration plants.

Centralised systems normally encompass large-scale generation plants connected to district heating schemes. Decentralised systems offer the advantages of being optimally configured to meet the demand of the local customers as well as yielding greatly reduced heat and electricity transport losses.

Small-scale cogeneration is a fairly recent phenomenon (last decade) due to the emergence of cost-efficient engine-based technologies. Including the even more recent micro-scale generation plants, small-scale cogeneration can be defined by the output range from 1 kW to 50 MW with most plants typically in the 2-20 MW range. Plants are mostly designed according to heat demand and electricity is either consumed internally or regarded as a secondary product to be exported to the grid.

Industrial cogeneration is used in industries with high electricity and steam demand. Natural gas and bio fuels (wood processing) are predominant fuels. Production of electricity is secondary to that of heat. Central cogeneration schemes predominantly consider electricity as the main product. Heat production is connected to large community/city district heating networks.

When examining the role of cogeneration in liberalised markets, developments in key economic drivers must be considered. The economics of cogeneration rely critically on electricity and fuel price differentials. High electricity prices increase the value of displaced electricity purchases from other sources including the value of excess output of electricity sold to the grid. High electricity prices also improve the competitiveness of heat as a district-heating product as compared to electricity heating. Low input fuel prices obviously improve the economics of generated heat and electricity.

4.3.3 CHP and distributed generation in liberalised markets

Traditionally, successful development of cogeneration has relied on favourable national policy frameworks. Some of the policy instruments used to support development of cogeneration are:

- National and central energy planning promoting district heating schemes
- Strong environmental policies favouring high efficiency energy solutions
- Purchase obligation on local utilities to take excess electricity
- Favourable tariff conditions relating to excess electricity
- Minimum efficiency requirements
- Tax regimes

Nations lacking such incentives also often fail to address some market barriers to cogeneration such as technical and commercial conditions relating to grid access, which makes cogeneration reliant upon the attitudes and incentives of energy utilities. EU has set a goal of 18 percent penetration of cogeneration in the electricity market within 2010. Such a goal is hardly achievable under current conditions without member-states addressing market barriers and new incentive mechanisms.

In a study [5] performed for COGEN Europe, ILEX of UK and Ramboll of Denmark have analysed barriers to the introduction of cogeneration. Experience seems to indicate that strong national monopolies and structures of competing gas and electricity utilities demonstrate barriers to the development of cogeneration whilst publicly owned local and regional utilities and horizontally integrated utilities seem to be favouring cogeneration schemes.

By examining these characteristics of cogeneration in relation to the features of a competitive market, some conclusions can be drawn concerning the potential of cogeneration in liberalised markets.

National and central planning are features of energy policy that are normally abandoned with the introduction of market forces. Liberalisation rests on the anticipation that markets are better equipped to develop the best energy supply portfolio. In liberalised energy markets, prices are determined by supply and demand and the concept of imposing purchase obligation and price conditions is not consistent with effective markets.

Nations offering favourable treatment to cogeneration schemes through taxation instruments or other financial incentives are unlikely to be able to maintain such instruments within a greater international energy market as international energy trading will require a level playing field. Governments may justify preferential treatment to cogeneration plants as part of environmental policy initiatives provided that such instruments are within agreed and reasonably harmonised support levels.

As is the case for energy efficiency, falling electricity prices may constitute an important obstacle or defer further development of cogeneration. As electricity prices fall, developers of cogeneration plants will face poorer economics due to cheap electricity being a tougher competitor to the heat output and the preferred option in supplying internal electricity needs.

However, as was experienced in UK, developments in natural gas prices following gas liberalisation may work to the benefit of cogeneration and may compensate for falling electricity

[5] "The impact of Liberalisation of the European Electricity Market on Cogeneration, Energy Efficiency and the Environment" 1997, by ILEX, UK and Ramboll, Denmark for COGEN Europe and co-financed by the European Commission (DG XI), Sponsored by The Danish Energy Agency, Powergen, Transpower, Elkraft, European Gas Turbines and the UK Department of the Environment.

prices. The relative success of liberalising the natural gas market (measured by energy prices) as compared to liberalising the electricity market may consequently swing cogeneration economics in different directions.

Another barrier to cogeneration in liberalised markets is the increased short-termism of industry in relation to large capital outlays, which is mainly caused by the introduction of risk factors such as price risk and the behaviour of non-captive customers. In particular large district heating schemes requiring long pay back periods may suffer from investor hesitance. This is underlined by ILEX and Ramboll and lead to their conclusion that:

"For cogeneration with district heating, however, liberalisation is likely to have an adverse impact. This is principally due to the high capital costs associated with district heating and lower cost-effectiveness which, with the removal of a guaranteed customer base, will mean that utilities cannot be sure they will be able to recover their investment. In addition, for privately-owned utilities, the private capital markets use higher discount rates and shorter time periods to evaluate investments, which will work against capital-intensive technologies"

A key element of market liberalisation is third party access to the transmission system. The new framework shall ensure that consumers and generators have free and unrestricted access to transmission networks at fair and transparent transmission tariffs. One of the main tasks of the energy regulator is to enforce these principles. Transmission access has been an obstacle to cogeneration and distributed generation in some countries and the unbundling of electricity utilities and regulation should create less destructive incentives and a more favourable environment.

The introduction of distributed power generation plants may have different consequences for grid systems and systems control. Large power plants may require grid improvements and distributed generation with large power output variability (such as wind farms) may due to the variability, cause loads on the system that require back up and systems services that command a transmission premium. Small power plants basically cause few operational challenges and behave in principle like a consumption load. However, a proliferation of embedded generation may raise some power quality/stability issues, which require attention and cost increases i.e. voltage control, harmonics and flicker disturbances.

Load conditions in the overall grid systems may reward or punish new load or generation input. Adding consumption in a geographical area with excess generation capacity may induce lower transmission losses. Similarly, new generation in a geographical area with a generation deficit will cause lower losses. Such consequences should be reflected in the transmission tariffs.

Consequently, it may be difficult to present general conclusions as geographical location, size of plant and load conditions call for different levels of connection charges and transmission tariffs. However, a general rule is that connection to and the use of the grid should be charged according to the cost they impose on the grid and the operation of the grid.

This could advantage CHP; as such plants in most cases are located in consumption areas and consequently should enjoy favourable transmission charges. It is however important to recognise that the load dependent elements of transmission tariffs are small because transmission pricing mostly is an issue of distributing significant fixed costs (investments).

Experience shows however, that dominant actors may abuse the transition period into a regulated transmission environment by charging excessive grid tariffs or imposing other onerous conditions. Such barriers could be lengthy administrative procedures, high emergency supply costs, technical connection requirements and connection costs and lack of recognition of the potential system benefits of distributed generation. These can be serious barriers to market access for small and independent generating plants. This is an issue that needs to be addressed by regulators, but the problem will most likely abate as competition and regulation evolve. Administrative obstacles to the development of decentralised cogeneration have been examined in detail in a study performed by ETSU and COGEN.[6]

When a grid company is facing a decision to invest in grid expansion, conditions are present to look at distributed generation schemes as an alternative. In this situation, investors in CHP and the grid company may reach a common ground for improving the economics of both businesses.

Purchase obligations from distributed plants and favourable tariff conditions are not sustainable in a competitive market environment. Terms and conditions for receiving excess electricity from cogeneration plants would be subject to bidding or negotiations with wholesale companies. However, the combination of grid access with participation in power pools should remedy this problem. Excess power can be offloaded to the pool and will receive the hour-by-hour prices set by pool bidding or prices in the regulation power market. For small-scale distributed generation plants, pool participation may however involve excessive transaction costs. Net metering may consequently be an interesting option to facilitate grid access for small-and micro-scale distributed generation.

The electricity market may provide opportunities for cogeneration plants not yet exploited. By introducing heat storage facilities ("diurnal storage"), electricity generation can be made dispatchable i.e. excess generation can to some extent be scheduled at times when electricity spot prices are high, thereby also contributing positively to grid load-management. Markets for ancillary services/regulation power or reserve capacity may also provide a revenue source for distributed generation.

On balance, several factors point to important opportunities for cogeneration in liberalised markets, which environmental policy instruments could support further. However, these opportunities are predominantly present for industrial and small-scale cogeneration. This conclusion is supported by ILEX and Ramboll who concludes that:

"The overall impact of liberalisation on cogeneration is likely to be beneficial, and could be enhanced by government policies applied to liberalised markets. The main reason for the benefit is that liberalisation effectively neutralises the ability of utilities to frustrate cogeneration developments, and thus removes the biggest barrier to its development in pre-liberalised markets. This will be of principal benefit to industrial and small-scale cogeneration.

The greatest threat to cogeneration remains however with the prospects of low electricity prices, which would defer most investments in new generating capacity. This is especially the case in a potentially extended transition period in which demand growth is allowed to pick up abundant generation overcapacity without providing the price effects needed to justify new investments in any generation technology option.

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[7] "The administrative obstacles to the development of decentralised cogeneration" 1999 by ETSU, COGEN Nederland and COGEN Europe.

This concern is one of the major conclusions of a recent report commissioned by the European Commission addressing impacts on cogeneration in Europe [7]. The report states:

"Recognised uncertainties in the market during the transition period may cause either a temporary or a permanent recession for the CHP/DHC sector"

An evaluation of the economics of several CHP/DHC options under market preconditions leads to the conclusion that:

"The figures show that only the large scale natural gas fired CHP-plant and the gas turbine CHP-plant are feasible under the assumed preconditions"

The report furthermore concludes that no new CHP is feasible, as prices for a transition period of many years will not reflect the full cost of new supply options, unless environmental costs are fully internalised.

Experiences

Experiences from Norway and Sweden show that in spite of strong political emphasis and financial incentives, the market place has failed to deliver a desired development in distributed generation and water based heating. This is caused by a continuous decline in wholesale power prices and a recognition that incentives are inadequate to make up for the loss in profitability.

The UK has experienced growth in industrial cogeneration throughout a period of liberalised electricity and natural gas markets. The experiences from the liberalised markets of Sweden and the UK are presented in Case study 3.

4.3.4 Distributed generation from renewable energy sources

Small-scale renewable generation has traditionally relied upon financial support or other favourable conditions to attract investor interest. Technological innovation will continuously reduce generation cost, but many renewable technologies will still for some time more costly than conventional power generation sources.

Renewable energy basically faces two significant challenges in the wake of liberalisation. Firstly, differentials between electricity market prices and generation cost for renewable based electricity are likely to expand. Secondly, existing imbalances in financial incentives among nations come under pressure and will be subjected to international harmonisation in order to reach a level playing field for industry.

As liberalisation develops, electricity prices are likely to fall. Introduction of new generation capacity from renewables will consequently require even stronger financial incentives. However, subsidised and "non-economic" investments may exacerbate generation overcapacity and contribute to keeping wholesale prices low even longer.

Current EU-policies prescribe a doubling of the penetration of renewable energy from 6% to 12% within 2010. This policy requires that electricity generation increase its share from 14% generated from renewables to 22.1% within the same time horizon. This increase

[7] "Evaluation of the impact of the European Electricity Market on the CHP, district heating and cooling sector-"SAVE-CHP/DHC" August 2000 – a report funded by the SAVE II programme, performed by COWI in co-operation with Euro Heat & Power, the Danish Energy Agency, Elkraft and PLA Energy

constitutes a capacity expansion of some 350 TWh/yr. The 2001 EU RES E - directive prescribes reference values for establishing indicative targets among member countries, which is currently subject to inter-EU negotiations. The same directive also includes new rules that may facilitate administrative procedures and grid connection of renewable electricity generating plants.

Electricity liberalisation enables consumers to purchase electricity from whichever energy source or supplier they prefer. This opportunity has been welcomed by environmental organisations based on the anticipation that consumer preferences may contribute to promote renewable energy generation. Developments so far do not indicate that consumer preferences, to any significant extent, will be able to initiate investments in new renewable-based capacity.

The implementation of EU-policies must therefore observe the realities of emerging electricity competition. Substantial financial contributions are required if goals are to be reached.

EU recognises that electricity liberalisation and free energy trade will demand some form of harmonisation of financial incentives to small-scale electricity generation. New EU-state aid rules will address this issue.

Developments in many European countries seem to move away from direct subsidies towards mandatory purchase requirements imposed on electricity consumers. This instrument requires consumers to include a minimum level of electricity generated from renewable energy resources in their total consumption portfolio. This creates a demand driven price for renewable electricity generation which is intended to trigger new investments. This instrument is compatible with national renewable demand targets and does not discriminate between the national origin of the renewable energy supply.

However, recent EU- discussions seem to indicate that the European renewables market will be based on a continuance of national incentive mechanisms for still considerable time. In this mixed regime, national purchase obligations will be tested and they will most likely coexist with concepts such as the feed in tariff system which is looked upon favourably by some countries.

New market-based instruments are also available to improve the effectiveness and credibility of green energy certification schemes. Green certificates provide a way to trade the environmental value of renewable energy separately from the trade of the physical commodity. Green certificates can be traded in a large geographical area and will lead to a more efficient allocation of electricity generation resources.

Green certification will serve the purpose of proof of origin in the green power market as well as being a financial instrument in the wholesale energy market. As a financial instrument, trading will eventually lead to an improved allocation of resources primarily in the form of better investment signals. Capital will flow to the most competitive forms of renewable energy, the most cost efficient location and at appropriate timing. The system of green certification can easily be expanded to brand CHP-power or electricity from plants exceeding specific efficiency thresholds.

Overall, this is expected to improve the competitive position of renewable electricity in the market place and reduce the macro-economic costs related to the introduction of more renewable energy production.

International trade in renewable energy including green certificates will introduce a strong imperative to level financial incentive mechanisms in the geographical trading area. However, with EU failing to harmonise the level of international subsidies and incentive mechanisms, the green certificate market is likely to be a limited and possibly an imperfect market place.

CONCLUSION.
Market liberalisation is a threat to small-scale renewable generation and to the incentive mechanisms used by many countries. New market rules will require a harmonisation of support levels. Market price developments are likely to increase the price tag for increased penetration of renewable technologies. Sustainable policy objectives and forceful instruments are required to expand the role of small-scale renewable generation.

4.4 Third Party Financing in liberalized markets

4.4.1 Introduction

When implementing energy efficiency policies it is important to observe the fact that consumers, when acting on their own, do not adopt many commercially available and cost-effective efficiency measures. This non cost-effective consumer behaviour may seem like a market anomaly, but such behaviour may be explained by many reasons such as:

- Energy cost being an insignificant cost element and the savings do not justify the burden of a disruptive project
- Other investment projects are considered more important, notably projects within the end users' core business area
- Lack of administrative capacity to initiate and manage efficiency projects
- Different assessment of risks regarding costs, technology and savings
- Financing barriers caused by internal organizational reluctance or the availability or cost of external financing

Energy services providers with a better understanding of technology, costs, risks and a large portfolio of potential projects have adopted the concept of third party financing thereby removing some of these barriers to energy efficiency improvements.

4.4.2 Description of Third Party Financing.

Third party financing (TPF) is the funding of energy savings investments by an outside company, using energy savings to pay for the investment. A third party financing package consists of three elements; an energy efficiency action/-investment, a performance contract and a financing package. Three parties each with a role put the package together; the energy consumer, the energy services supplier and the financier. In large businesses, the provider of the TPF-project may often act as an energy systems manager/operator or manager of energy purchasing.

In third party financing schemes, investments, operating costs, energy costs, and savings performance must be measured and defined in such a precise way that profits and risks can be clearly distributed among the three parties. The energy services provider assumes responsibility for all phases of the project including the financing of the investment. Thereby the energy consumer is relieved of many of the burdens, which constitute obstacles to the implementation of economic projects. In such schemes most risks are on the energy services provider who receives a share of the documented energy savings as compensation.

The consumers need not relate to the financing issue or the source. The energy services provider

includes the project within the scope of a larger portfolio of TPF - projects in order to spread risk and obtain a favourable financing arrangement.
The concept of third party financing is illustrated in figure 1 and 2 below:

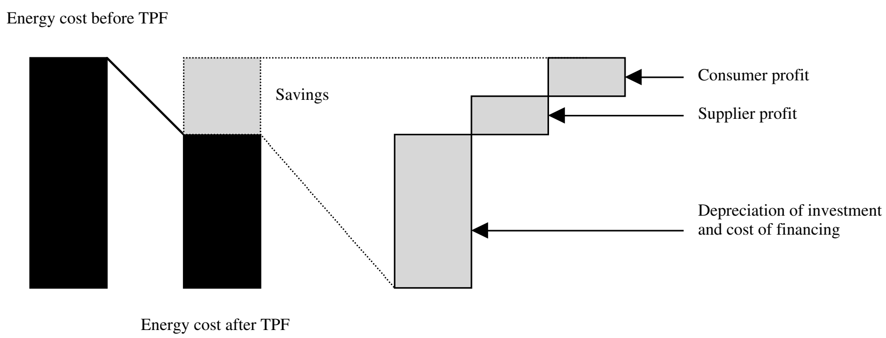

Figure 1 Third party financing

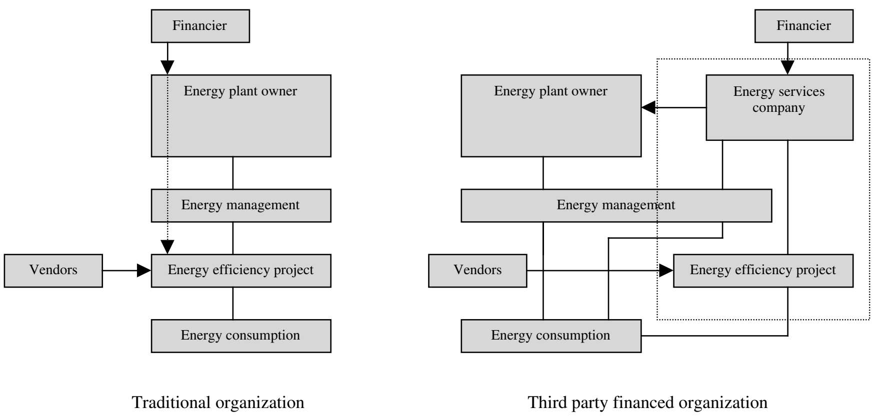

Figure 2 Organisation of third party financing

As can be seen from figure 2 above, the traditional organisation of an energy efficiency project involves a financing scheme put together by the owner of the energy plant. The owner is responsible and equipment vendors and project managers provide normal contract services and supplies.

In a third party financing project, as can be seen from figure 2, the Energy Services Company has a contract with the plant owner to supply energy savings and has contracts with equipment vendors and consultants to assist in the project. The Energy Services Company takes care of the financing and implementing the efficiency project “on behalf of” the plant owner. The “ESCO” monitors the energy management of the plant to measure the performance of the investment project.

4.4.3 Performance contracts

The purpose of performance contracts is to introduce a compensation mechanism, which ties payment to performance i.e. the supplier, guarantees a certain energy efficiency improvement. The supplier is then paid according to measured compliance. Performance contracts may be applied irrespective of the financing mechanism, but they are a key element of third party financing schemes.

Performance contracts applied within third party financing schemes expands the risk elements for the energy services supplier. If performance is measured according to energy costs, the energy services company must cope with the following risk factors;

- Counterpart risk - i.e. the financial risk that the client may not be able to honour the contractual obligations
- Energy price risk
- Technological risk - the risk that the energy technology does not perform according to expectations
- Project risk - the risk of underperformance during installation (i.a. schedule, budget)
- Project liquidation risk - the risk that clients terminate projects following substantial prestudies
- Operational risk - the risk that the client is not able to utilise the potential of the technology
- Financial risk - interest rate risk

A third party financing contract must regulate the distribution of these risks among the parties. As more of these risks are assumed by the energy services company (ESCO), a larger share of the profits will go to the ESCO.

4.4.4 Experiences with third party financing

As electricity deregulation is a very recent phenomenon in most countries, there is not much analytical work available to support very clear conclusions regarding the effects of deregulation. However, a discussion of general experiences and preconditions for successful application of TPF will reveal some issues that relate critically to the properties of the new competitive environment.

Dr. John Butson of Ecotec [8] rated European countries according to the success of their energy services companies and developed criteria for the success of third party financing. The critical criteria seemed to be:

1. The energy cost. Energy costs should exceed 60-100.000 ECU to make a TPF-project economical.
2. Energy efficiency potential. Savings should be at least 30 per cent to make it economically feasible.
3. Use of proven technology. TPF projects need to apply known technological solutions to mitigate risks.
4. Cost effective investments. Investments need a pay back of 5 years or less.

[8] Dr. John Buston – Ecotec Research and Consulting Ltd " The potential for Energy Service Companies in the European Union" 1998

In addition to these very critical preconditions, a number of facilitative conditions were desirable:

1. Dissemination of information about Third Party Financing
2. Compliant institutional barriers to energy services
3. Removal of regulatory obstacles
4. Efforts to improve the credibility of vendors (credit rating, experience etc)

Based on these observations, Belgium, France, Netherlands, Spain and UK were classified in the first category.

Some unsuccessful efforts have been made to establish a concept of TPF in Norway. PricewaterhouseCoopers [9] in their study of TPF in Norway compared Norwegian conditions with those of the most successful European nations and North America. They concluded that these countries are characterised by:

- higher electricity prices,
- a smaller number energy suppliers (which according to PWC may explain the higher electricity price),
- more subsidies and tax incentives aiming at energy revisions and efficiency and,
- generally higher attention towards TPF-methods and information dissemination than Norway.

UK privatised its electricity industry and partly liberalised the market in 1990. However, the market organisation and industry structure in UK have not spurred competition and prices and consumer choice have not developed favourably until recent initiatives to improve the market architecture (NETA).

There is no evidence that the deregulation of Scandinavian electricity markets has been conducive to TPF.

4.4.5 Third Party Financing and liberalisation

Economics

The prospect of significantly lower electricity prices is a threat to third party financed project due to weaker project economics. The profitability of energy efficiency investments is very dependent on energy prices, and to the extent electricity prices will fall, project economics will become correspondingly poorer.

Third party financing is a mechanism for the medium sized to large sized electricity users that also are the customer groups who will enjoy the lowest prices in a competitive market (in many countries they have experienced the highest price reductions). As demonstrated by ECOTEC and PricewaterhouseCoopers, good and undisputable economics characterise TPF, as they are prerequisites to support the profit sharing mechanism.

Risk

The liberalised electricity market adds a new risk element to the equation of TPF-economics. Price will depend on more factors and volatility is more pronounced than previously experi-

[9] PricewaterhouseCoopers, "Tredjepartsfinansiering av enøktiltak" (Third Party Financing of energy efficiency measures) Oslo 1999

enced. Despite the general prospect of falling prices, there are important price risks that need to be addressed especially in a long transition period into an efficient market situation. Important issues are i.a. price volatility/variations (in a short and long perspective), transmission tariffs, market power and unpredictable political issues that may cause TPF-investors to hesitate.

This risk could cause a setback to third party financing especially in a period of transition, as this is when the most dramatic price adjustments would normally occur. It could cause hesitance to embark on new projects in the anticipation of falling prices and it could upset the profit sharing mechanism of ongoing projects.

One could easily envisage that a TPF-project could lose much of its profitability over a period of 1-2 years. For the energy consumer, price decline would obviously reduce the overall energy bill and offset poor project economics. For the ESCO however, it would be critical if compensation is linked to project economics and how the contract accommodates price risk i.a. how prices or energy cost are defined in the baseline and performance indicators.

There are solutions to dealing with all risk, but generally risk commands a premium, which also must be compensated for within the project economics.

Incentives

Energy Services Companies are primarily companies specialising in providing energy services most of them originating in the energy consulting or hardware industry. However, energy suppliers have also been part of TPF-projects directly or through energy services subsidiaries. Many energy suppliers offer facilities management and contract portfolio management services, which are services closely, related to the energy efficiency segment.

The liberalisation of the electricity markets will bring a clarification of roles, responsibilities and new incentives as explained in chapter 7. Energy suppliers on the retail and generation level will have fewer incentives to embark on energy efficiency projects. Their incentives will primarily be towards maximising turnover and margins, which will severely complicate their efforts to credibly market energy efficiency services.

Some energy companies still hold the opinion that energy efficiency services will improve customer loyalty thus enabling them to keep clients and maintain margins at a level that justifies the cost of their efficiency programmes. Consequently, there may still for some time be participation from energy suppliers in TPF-programmes. Particularly, the large energy companies involved within distributed energy plant construction and facilities management will consider TPF as a viable mechanism.

Grid companies may have a commercial incentive to initiate energy efficiency improvements as a cost effective alternative to grid extensions. Load management programmes which shift load off peak periods would best facilitate this. In an efficient power market such initiatives would also be encouraged by market prices which reflect load changes. Involvement in energy efficiency programmes by grid companies is also an issue of regulation, as it would require that grid companies be allowed to add efficiency investments to their asset base. Load shifting as such may not comply with the pure definition of energy efficiency improvements, but some projects do reduce total consumption and grid losses.

In conclusion, third party financing is expected to be increasingly dependent on the combined incentives of the energy consumer and the equipment and services vendors.

Emerging services

A new breed of energy services companies will emerge in the wake of liberalised energy markets. Energy brokers and portfolio managers offer their services to energy consumers with the aim of reducing their energy cost. In competitive electricity markets, large end-users can benefit from purchasing energy directly from the wholesale market.

The energy purchasing functions may be outsourced to service companies specialising in energy purchasing and risk management. Their compensation is normally fixed or performance based in order for their incentives to coincide with those of their clients.

The introduction of a professional outsourced energy purchasing function brings added benefits to the client such as improved energy consumption statistics and data management. This enables the end user and the services company to better assess the economics of optional energy efficiency measures. In some instances the portfolio managers supplement energy purchasing with energy efficiency services, which are often subcontracted to consulting or hardware companies. Third party financing schemes fit well within the scope of these services concepts.

Another area where the general business trend of outsourcing coincides with the challenges of a competitive market is the area of energy facilities management and operation. Many large commercial and industrial consumers have large on site energy generation facilities - cogeneration, multifuel boilers etc. These may be managed by energy divisions within the company or leased from energy companies owning and operating the plants.

Specialised services where energy service companies manage such energy facilities are emerging. Some traditional energy suppliers running plants still view this area as a strategic service to keep large consumers, while others seem to spin off engineering to concentrate on core business.

A development may be envisaged where an integration of these services creates large energy services companies that purchase energy cost effectively, initiate energy efficiency projects and operate energy facilities all within a compensation mechanism where the energy services company's main incentive is to reduce energy costs and maintain supply security.

4.5 Demand Side Management in liberalized markets

4.5.1 Introduction

Energy supply was until the emergence of privatisation and liberalisation, considered by many countries as a public services industry dominated by public ownership. For this reason and due to the monopolistic nature of the business, it was both convenient and feasible for governments to impose various societal goals on the energy supply industry.

Many utility managed energy efficiency programmes originate in such policies, which in many cases have been legislated requirements. As more energy industries are moving towards a state of competition, governments need to draw a clear distinction between energy supply as a business and the ethical and environmental aspects of energy use.

A recognition of stronger commercial incentives causes a refocusing of energy efficiency policies relaxing the expectations and requirements placed on industry. This chapter will place emphasis on experiences gained by electricity utilities in various regions of the world.

Demand Side Management programmes were originally designed as utility programmes to improve end use efficiency. In the early 1980s, the California Public Utility Commission led the way in requiring utilities to implement DSM-programmes. This initiative, which was fuelled by further regulatory push both from state and federal legislators throughout the 80ies, caused an explosive development of DSM-activities in the USA.

DSM has since that become a popular description of utility managed energy efficiency and load management programmes, which can be found in numerous countries.

4.5.2 Demand Side Management [10]

Demand-side management (DSM) programmes consist of the planning, implementing, and monitoring activities of energy efficiency programmes among utilities.

In the past, the primary objective of most DSM programmes was to provide cost-effective energy and capacity resources to help defer the need for new sources of power, including generating facilities, power purchases, and transmission and distribution capacity additions.

However, due to changes that are occurring within the industry, electric utilities are also using DSM as a way to enhance customer service. Electric utility DSM refers to programmes implemented by utilities to modify customer load profiles.

The US Public Utility Regulatory Policies Act of 1978 (PURPA) identified and helped to focus attention on the benefits of “increased conservation of electric energy” and “load management techniques.” Responding to this potential, US State regulators supported and utilities implemented rebate and other DSM programmes. Such programmes had a variety of objectives.

- Energy-efficiency programmes reduce energy use, both during peak and off-peak periods, typically without affecting the quality of services provided.
- Peak load reduction programmes focus on reducing load during periods of peak power consumption on a utility’s system or in selected areas of the transmission and distribution grid.
- Load shape flexibility can be achieved by programmes that modify prices, cycle equipment, or interrupt service in response to specific changes in power costs or resource availability.
- Load building programmes are designed to increase use of electrical equipment or shift electricity consumption from peak to off-peak hours thereby increasing total electricity sales.

Many DSM programmes capture cost-effective energy savings that would not otherwise be achieved. However, this is most frequently societal or macroeconomic cost effectiveness. Most DSM programmes were planned in an integrated resource-planning (IRP) framework in which utilities compare the benefits and costs of DSM with the cost of additional generation.

From the viewpoint of a profit-oriented utility, DSM is often uneconomic. Contributing to improved energy efficiency among its customers reduces energy sales and revenues. In the first instance this loss is replaced by increased sales to other customers without the need to increase generation capacity. However, the DSM cost causes a profit loss, which cannot be recovered unless the utility is allowed to adjust rates or is somehow compensated by public contributions etc.

[10] Reference: Energy Information Administration publication: “U.S. Electric Utility Demand-Side Management: Trends and Analysis”-1997

US regulatory authorities attempted to address this disincentive by using revenue adjustment mechanisms that allow utilities to recover revenues lost as a result of conservation programmes net of any cost savings, or have adopted other compensation mechanisms such as DSM performance incentives that were paid to utilities based on the savings achieved.

Electricity utility DSM or energy conservation information has been adopted in several countries outside the US. Case study 1 examines the faith of electric utility programmes in Norway over a period starting prior to liberalisation in 1991, ending in a current proposal to Parliament to change the obligations of the utilities altogether.

4.5.3 Experiences with Demand Side Management [11]

The history of DSM encompasses a vast number of energy efficiency programmes, which range from success stories to failures. The cost of saved energy differs correspondingly. Numerous studies have been made to evaluate the effectiveness of DSM.

Between 1990 and 1998, U.S. electric utilities spent over $18 billion, reaching a peak of nearly $3 billion in 1993, on demand side management programmes (EIA, 1999) By 1998, annual spending on DSM had fallen by about half to $1,6 billion.

A study from the USA performed by Eto et al [12] examines 40 major US DSM programmes from 1992. The researchers find that the programmes as a whole saved energy at a cost of 3,2 c/kWh. The authors conclude that compared to the cost of the energy they allowed the sponsoring utilities to avoid generating or purchasing, the programmes as a whole were cost effective.

In the United States, the electric utility industry has been in a process of deregulation for some time, but competition is still in its infancy. Industry is gradually exposed to a tougher competitive environment. The reduction in the volume of DSM activity in the USA is generally attributed to the introduction of competition.

Some utilities have chosen to abandon DSM altogether. Many utilities are however, using DSM as a means of providing a value-added service to their industrial customers, in some cases only for “at-risk” customers — customers that may choose to purchase power elsewhere. Others are providing “energy services,” which may include a wide variety of services designed to benefit their customers such as productivity improvement audits, financing for energy efficiency improvements, and assisting the customer to link with other resources that may benefit them (environmental services, for example).

All these efforts are part of a strategy to build customer loyalty by making stronger efforts to become good business partners and provide value-adding services to their customers.

Another shift in the United States has been to move away from traditional end-user focused DSM programmes toward more comprehensive programmes focused on all actors in the market. The goal of these efforts is “market transformation.” Market transformation, in the context of DSM programmes, is said to occur when a lasting beneficial change in the behaviour of some group of actors within a market system is induced.

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[11] Experiences form the USA – Information i.a. provided by the US Energy Information Service, “U.S. Electricity Demand-Side Management: Trends and Analysis” 1997

[12] ”Where Did the Money Go? The Cost and Performance of the Largest Commercial Sector DSM Programmes” Eto, Keto, Shown and Sonnenblick, Energy Journal

Such changes should lead to increases in the adoption of energy efficient technologies, and or changes in the market for energy services such that new, more efficient products, processes, and practices are widely available and used. By definition, these changes persist long after such programmes have been modified or discontinued.

While traditional utility DSM programmes have focused almost exclusively on achieving impacts by influencing end-user demand, the broader goal of market transformation encourages participation by other actors in the market such as manufacturers, equipment vendors, and other trade allies. The success of these market transformation efforts is yet to be determined. However, it is clear that there can be a significant impact from leveraging the significant resources of trade allies, and the power of government regulations and standards.

The purpose and need for DSM in the current more competitive supply market have changed. The need to reduce rates and provide customer service to ensure loyalty and retain key large customers is the primary driver for DSM in a deregulated environment.

As the macroeconomic rationale of DSM programmes collides with the profit-oriented behaviour of competitive utilities, governments have adjusted their policies towards utility programmes. Increasingly, the financing of energy efficiency programmes is transferred to fixed grid charges or transmission tariff elements.

In Norway, as is explained in the case study, there was serious concern that significant energy efficiency efforts by the utilities would be lost following the deregulation in 1991. A regulation was introduced in the Energy Act that could be used to require a continuation of such activities. This requirement was put on the grid companies and not on the energy suppliers for incentive reasons.

Grid companies were required to offer neutral information and advisory functions to consumers funded by a regulated grid charge. Experiences with this concept have been mixed and the government is in the process of preparing a proposal to parliament to discontinue such a legal requirement. Grid charges will be kept to maintain funding levels. But, grid companies will be decoupled from the management of these funds.

4.5.4 Demand Side Management in liberalised markets

Introduction

The most significant threat to utility DSM programmes is the lack of economic incentives to embark on programmes, which reduce electricity demand. Energy conservation efforts are contrary to the interests of the supplier. A strategic imperative for an electricity supplier is to find outlets for increased volumes in a business marked by diminishing margins.

The remaining incentives for utilities to conduct DSM programmes are related to load management for grid companies and customer services/customer loyalty programmes for electricity retailers.

When suppliers who basically benefit from higher sales attempt to teach customers how to buy less, a serious credibility problem emerges. This is an unusual marketing strategy in other energy markets and in competitive markets in general. However, current strategies are still influenced by the market being in a transition from a regulated environment to competition. The jury is still out with respect to the whether DSM is a sustainable customer relations strategy.

Suffice to say, some electricity companies consider DSM to be a viable strategy to secure customer loyalty. Irrespective of the long-term success of these efforts, the conclusion is that some DSM-contributions can still be expected from electricity suppliers.

Demand Side Management and incentives.

In assessing the incentives of the energy supply industry, it is important to bear in mind the unbundling of the industry into three separate business areas; generation, transmission/distribution and sales/retail.

Often these areas are organised as separate companies or at least separate business areas. The consequence of this is a clarification of incentives and a focussing on business development and profits within each segment.

Generation.

In a competitive market, the effects of significant efficiency programmes will be to reduce demand and to lower the market price of generation services. This downward pressure on generation prices could reduce utility profits. Given that generation revenues in a fully competitive market will be recovered at market prices, instead of on a cost-of-service basis, the interests of utilities in operating such programmes will change.

In a competitive market for generation services, it is in the interest of the generation supplier, to sell more generation services at a higher market price. Efficiency programmes will bring this interest into conflict with the utility's traditional service objective of helping customers reduce their total energy bills.

In the regulated environment, utilities have an obligation to serve, including the obligation to build or acquire generation resources. Energy-efficiency programmes offer a way to avoid the need for investments in new capacity.

In a fully competitive environment, the obligation to serve is discontinued and the grid companies assume an obligation to provide access to the transmission and distribution grid and an obligation to be the supplier of last resort.

Increased competition will improve the productivity and production efficiency of existing generation. These effects can perpetuate already significant overcapacity and hold down market prices for generation. In the long run, however, liberalisation might produce higher prices for generation services. This is due to both the potential of industry concentration and market power, but mainly due to the fact that demand conditions sooner or later will produce prospects of a supply shortage, which will spark price increases and initiate investments in new generation capacity.

In a connected electricity market, investment decisions will be based on an overall assessment of future electricity demand and prices in the overall market area, and not on finding a solution to an incremental demand increase in a limited supply area. New generating capacity will not be added until prices have risen sufficiently above the cost of new facilities to ensure generation suppliers a reasonable return at variable and uncertain market prices. The concept of investing in energy efficiency measures to accommodate increasing demand is a very remote option in a competitive generation market.

Even if generation is part of a vertically integrated corporation, the generation business is often profit maximised separately from the retail business. This means that generation output increasingly is adapted to wholesale market-conditions and that hedging of generation revenues in the financial market is conducted separately from the retail end of business.

A legal obligation to pursue DSM-programmes even combined with economic compensation mechanisms, would be less effective in the generation segment as this by nature is not an end-use oriented business. Generation, which in most cases will be organised as separate companies or profit centres has its focus and incentives squarely on wholesale price-maximisation, cost-efficiency and output volumes. To the extent energy industry should be incentivised to participate in end use efficiency programmes, such incentives should target the operations of grid and retail companies.

Demand Side Management in grid companies

Grid companies are regulated natural monopolies that provide non-discriminatory, reliable and cost effective transmission services. Transmission services are regulated with the aim of capping profits and encouraging cost effectiveness.

Numerous models are used to regulate monopolies and incentives may vary accordingly. However, some incentives may be included to improve the utilisation of existing assets prior to investing in new capacity. This would make load management programmes an interesting option for grid companies. On the other hand income cap regulation schemes offer incentives to increase energy throughput in the grids, which counteracts energy efficiency incentives.

Shifting demand from peak demand periods to off peak, could ease congestion management, defer investments, reduce transmission losses and non-delivery penalties all of which would be bring economic rewards to the grid company within an effective regulation model. Reduced peak demand could defer investments in new transmission capacity, which could be rewarded contingent on a favourable regulation model.

A study performed by the California Energy Commission [13] examines options in which energy efficiency and distributed generation investments may be integral parts of transmission grid planning. The study looks at several options and concedes that energy efficiency and distributed generation may contribute to system adequacy (capacity) and grid reliability. Difficulties arise however, in designing and implementing investment programmes, which may defer or displace specific transmission projects. The study, therefore, concludes that the principal role of energy efficiency and privately owned distributed generation appears to be reducing total load growth before transmission options are evaluated.

The load management option still relies on the introduction of cost effective communications, metering and management systems. With the introduction of these instruments combined with innovative tariff schemes, several business opportunities arise that could bring advantages to both consumers and industry.

An issue of transaction costs and attitudes also influence grid companies DSM interest. Grid companies are by nature investment oriented and may have in-house construction and engineering capabilities which struggle to maintain their level of employment in a liberalised environment.

[13] SB 735 The Role of Energy Efficiency and Distributed Generation in Grid Planning, Report to the Governor and Legislature - Publication # 300-00-003 - May 3, 2000

From a transactions cost point of view, DSM may entail a significantly higher administrative burden compared to "simple" investment decisions. Using DSM investments to successfully displace grid investments rely on decisions and successful implementation of maybe thousands of individual DSM projects.

Demand Side Management and electricity retailing

In the eye of the retailer, access to generation is unlimited because the wholesale-market is able to serve demand adequately. The need to serve new customers is a question of buying power from the wholesale market and not a question of investing in the least cost capacity option. Demand and supply conditions including transmission congestions will determine regional wholesale prices hour by hour. The retailer may hedge his acquisition cost by entering into financial contracts which set the price for a specified period.

As electricity sales are independent from electricity transmission, the customer need not be concerned about physical supply security. The grid companies and the systems operator are responsible for delivering power to the meter at specified quality and charge a separate grid tariff for that.

Consequently, electricity retailing is a business without need for large investments such as in other retailing where shops, warehouses, delivery trucks etc are needed. Electricity retail rather becomes an issue of creative marketing, intelligent bundling of services, customer loyalty programmes, and effective customer management applications incl. effective settlement and billing systems etc. The electricity retailer also needs to handle the wholesale market and generally understand the financial power market in order to be able to hedge price risk and possibly make a profit on trading.

Electricity retail is becoming increasingly competitive and margins are falling. There is a general agreement among large energy suppliers that customer volume is critical to spread cost.

The incentive of the retailer is definitely related to maximising margins and increasing volumes. The challenge for the electricity retailer is the reliance on one single homogenous commodity, which leads to cutthroat competition, and pressure on margins. Efforts are therefore directed towards supplementing electricity with other related services or even selling electricity together with a portfolio of completely different products.

Examples are multiple, such as Internet connections, telephony, broadband services, home surveillance and management systems. Other strategies are bundling of electricity with other energy supplies such as natural gas, fuel oil and other utility services such as water, cable TV etc.

An interesting comparison is the much older and very competitive gasoline retail market where oil companies and independent gas stations struggle to make money on gasoline sales. This has lead to a development where gas stations survive on soft drinks, hot dogs and groceries.

What the "hot dog" of the electricity industry will be is yet to be determined. As far as DSM is concerned, the point is that such efforts can only be justified by evidence that energy efficiency services are generating improved customer loyalty and add new clients.

Those who argue in favour of utility energy efficiency measures in competitive markets claim:

- Energy efficiency is a value added service to customers willing to pay for efficiency

- Energy efficiency may add value to the supplier by adding a product to a range of services such as energy plant management, portfolio management, electrical engineering services etc
- Increases customer satisfaction
- Builds and protects a customer base

Energy efficiency among customers adds cost and reduces volume. To be a sustainable strategy, it must support higher margins or add new customers to compensate for the higher cost/lost revenues. Compared to independent consulting companies and ESCOs, an electricity supplier is facing a credibility challenge when trying to teach customers how to save energy.

From a public policy point of view, encouragement of utility DSM programmes in a competitive environment may work against basic incentives, which may not be adequately resolved by providing cost compensation to the utilities.

Conclusion

Some electricity suppliers are maintaining DSM-efforts to explore if such measures serve business interest, and some energy suppliers will maintain this as a customer relations and sales strategy. However, liberalised electricity markets are on the whole likely to see significantly reduced utility involvement in energy efficiency programmes. Government programmes seem to relax requirements on utility participation in energy efficiency programmes due to recognition of incompatible incentives.

PART III IMPLICATIONS ON ENERGY EFFICIENCY POLICIES

5. Energy efficiency policies

5.1 Introduction

For the purpose of this study, energy efficiency policies are defined as government policies and instruments to improve energy efficiency within the overall energy cycle. Most often, policies and instruments portrayed as energy efficiency policies serve political goals of reducing the growth in energy consumption and of mitigating adverse environmental effects of energy production and consumption.

Some countries also use energy efficiency instruments to support other policy goals such as improvement of housing conditions for low-income families or supporting the business development and marketing of domestic technology suppliers.

A number of public policy instruments may have indirect or secondary effects on energy efficiency developments. Such instruments will not be addressed in this report.

The purpose of this chapter is to explore how energy efficiency policy and policy instruments are affected by the liberalisation of the energy sector. At the outset, it is important to recognise however, that energy efficiency policy should be an integrated part of a total energy policy in which energy sector liberalisation is one efficiency instrument. Liberalisation or re-regulation should not be introduced without a simultaneous examination or reorientation of other energy efficiency instruments.

The most significant challenges facing energy efficiency policies in an environment of energy competition are:

- prospects of falling energy prices followed by consumption growth,
- fading incentives of energy industry to perform energy efficiency measures - with a corresponding increased reliance on public policy measures, and
- the need to device mechanisms that function consistent with a new market framework in which commercial motives and economic signals become more important

These challenges may not be generally applicable within all liberalisation regimes. Firstly, falling energy prices are conditional upon the new marketplace becoming a real competitive environment. Experience shows that this may not always be the case as some governments fail to establish a sufficiently competitive industry structure or are unable to deal with accelerating industry concentration (mergers and acquisitions).

Secondly, falling energy prices tempt politicians and treasuries to impose consumption taxes in order to moderate consumption growth and to recover lost revenues from industry taxation. Such taxation measures are also increasingly politically motivated by environmental concerns relating to climate change. End use energy taxation is not a targeted tool in this respect, but constitutes a simple and less controversial policy tool than some other available instruments.

Furthermore, price development predictions may not be applicable to specific conditions in some previously centrally planned economies in Eastern Europe and the former Soviet Union. Here, electricity, gas and heat prices have been partly used as social policy tools and residential as well as industry energy prices did not reflect the supply cost. As a result, prices were low for a long period of time. In recent years, they increased and in general cover costs, but their level is still relatively low and unlikely to decrease further in the near future as an effect of competition.

Price cross-subsidisation between customer groups is another obstacle to the implementation of liberalisation policies. The applicability of the policy conclusions in this report will hence depend on prevailing national conditions.

5.2 Energy efficiency objectives and policies

Currently, energy efficiency policies predominantly originate in concerns relating to the environmental effects of energy generation and consumption. Some years back, energy efficiency policies primarily originated in concerns over long-term resource depletion and sustainability issues.

Energy efficiency policies dating less than three decades back were influenced by some forecasts that some energy resources would not be able to meet energy demand before the turn of the century. Supply security concerns triggered by the oil crisis in the 70's accelerated resource conservation and efficiency policies.

In the late 80's the World Commission on Environment and Development [14] (The "Brundtland Commission") issued its report "Our common Future" which significantly contributed to shift attention to climate policy and the use of fossil fuels in energy generation. The report addressed the need to level out energy consumption towards the end of the century.

Regardless of the environmental or energy security rationale, energy efficiency policies have also been facilitated by the fact that significant economic efficiency improvements are associated with efficiency improvements. However, such potential exists in many other sectors and does not in itself justify government intervention or incentives.

Consequently, efficiency policies are developed within a political environment of many and potentially conflicting opinions and stakeholders. The effects of this are seen in the fact that energy efficiency instruments frequently encompass several objectives such as mitigating environmental effects, reducing consumption growth in addition to improving energy efficiency in the technological meaning of the term.

Liberalising electricity markets often originate in a reorientation of the overall political mindset towards:

- higher reliance on market forces and economic incentives,
- advantages of international energy trade,
- reduced government intervention and reliance on the private initiative.

[14] An independent commission set up by the UN General Assembly in 1983 with the brief to develop "a global agenda for change".

This change of political focus could, as such, support the logic of leaving energy efficiency developments to the marketplace. However, energy efficiency policies remain on the political agenda due to higher priorities on environmental issues combined with political concerns over weaker incentives, market failures, consumer protection and market power.

5.3 Energy liberalisation and policy challenges

Liberalisation, in most cases, satisfies the political objectives of lower consumer prices and improved sector efficiency. The political flip side however, is that falling prices fuel energy demand and consumption growth. At the same time, the economics of innovative and efficient energy technologies deteriorate. However, gradual technological change is still likely to improve energy efficiency despite an accelerating consumption growth. Such improvements may however be of limited political comfort.

From a political viewpoint, consumption growth, which is often associated with environmental impacts, is more of an issue than technical energy efficiency. Energy efficiency improvements, i.e. using less energy/electricity to perform the same function, are often associated with increased energy consumption! This is due to the fact that energy efficiency technologies and measures in industrial and commercial applications often are only feasible at the time of major investments or plant extensions. The political attraction however, is that energy efficiency programmes moderate the growth path of energy consumption

From a macro-economic point of view, the emergence of efficient energy markets brings advantages that monopolies and regulation fail to deliver. Available resources are applied more efficiently and prices tend to reflect the availability and “value” of resources. This leads to “correct” energy prices provided that environmental or other external effects of production and consumption are accounted for through regulation or taxation.

As shown in this report, there are areas of conflict between energy liberalisation and environmental goals. However, energy liberalisation has the added advantage of making the energy sector more receptive to efficient environmental policy instruments. This is due to the fact that energy liberalisation introduces new economic mechanisms and incentives. This creates a framework, which facilitates the use of efficient economic environmental incentives and makes the effects of environmental instruments transparent, measurable and more predictable

Energy efficiency policy needs to address the question whether the market delivers an economically- efficient level of energy efficiency. Reduced energy efficiency incentives due to lower prices may not be wrong as long as the market functions correctly. Failing to respond to all political goals, market-induced energy efficiency could be enhanced by government policies rectifying typical market imperfections or failures such as i.a. inadequate or biased information, securing continuity of technology development etc. Energy efficiency policy needs to be re-examined with a view to identifying instruments which effectively target such imperfections.

5. 4 Policy recommendations

5.4.1 Introduction

This chapter will address some of the most important consequences of energy liberalisation on energy efficiency policies and provide some general recommendations. The purpose is not to provide specific recommendations regarding choice of energy efficiency policy instruments. The international Energy Agency, national governments and others have performed substantial work to evaluate various policy options in the area of energy efficiency. The choice of energy efficiency measures will depend on specific conditions, which may differ from country to country.

Emphasis will be placed on the challenges following the liberalisation of electricity markets and which impacts the effects of this have on energy policy formulation.

Policymaking in a liberalised environment needs to take account of the changing environment within which new instruments shall function. This environment is characterised by:

- consumer choice among alternative energy suppliers;
- stronger economic mindset of consumers - emphasising electricity costs;
- a profit oriented industry with new incentives;
- a privately owned industry;
- redefinition of roles - energy policy subject to transparent implementation through legislation and regulation;
- environment of increased energy price risk;
- removal of trade barriers and international markets for energy.

In addition to these characteristics, a general trend of increased environmental awareness and stricter environmental legislation support stronger political emphasis on energy efficiency.

5.4.2 General recommendations

Market driven energy efficiency

Liberalisation transfers the valuation of energy resources from an environment of central planning and monopoly control to the market place where demand and supply conditions determine prices. Prices provide the most important signal to determine the level of energy efficiency.

In markets, available resources are applied more efficiently and prices tend to reflect the availability or the “value” of resources. This leads to “correct” energy prices provided that environmental or other external effects of production and consumption are accounted for through regulation or taxation.

Energy efficiency policy needs to address the question whether the market delivers an economically- efficient amount of energy efficiency. Reduced energy efficiency incentives due to lower prices may not be wrong as long as the market functions correctly. A careful combination of market forces and environmental policy instruments has the potential of contributing to a politically acceptable fuel mix, energy mix and consumption growth pattern.

Accepting these basic principles of resource allocation, energy efficiency policies should predominantly be justified by the existence of market imperfections and failure of markets to accommodate continuity in development and implementation of energy efficient technologies. Energy efficiency developments will contribute to meeting environmental goals, however, as will be explained below, policies and markets would benefit from a clearer separation of environmental targets and instruments from efficiency targets and instruments. Market imperfections could be conditions such as lack of or biased information, monopoly powers, irrational behaviour etc.

Energy efficiency and environmental policies

Environmental policies embrace energy efficiency due to the general perception that reduced growth in energy consumption is beneficial in view of the environmental challenges associated with production, transmission and end use of energy. However, targeted environmental policy instruments have the potential of more effectively mitigating environmental impacts. Consequently, both energy policy and environmental policy would benefit from clarifying and focussing their objectives and choosing instruments that effectively target each of these policy areas individually.

Environmental policies and instruments should primarily target environmental impacts. In economic terms, internalising externalities means imposing an economic burden on environmental effects in such a way (i.a. a tax) that markets penalise generation and consumption of resources causing adverse environmental effects.

The environmentally justified taxation of end-use of electricity is an example of a non-focused environmental policy instrument. End-use of electricity rarely involves direct adverse environmental impact.

Rightly, increased electricity prices stimulate energy efficiency improvements and reduce demand growth. However, the tax does not send targeted economic signals, which translate into incentives for cleaner electricity generation. The combination of demand side effects and the non-discriminatory effects on the power generation sector explain the political attraction of the instruments. Being the choice of least resistance makes the use of this instrument an easy political option.

However, if governments wish to target environmental impacts efficiently, the "polluter pays" principle should be adopted. This would i.a. entail the use of emissions taxes or quotas in power generation and end use segments.

Market oriented instruments

The new emphasis on market mechanisms and economic incentives in the energy sector also put requirements on the choice of energy efficiency instruments. Instruments should be designed to function within a new and economically oriented environment. Finding mechanisms that work with the market forces and not against means identifying least cost solutions, promoting competition among vendors and energy suppliers and introducing other economic incentives.

An implication of this would be to focus on economic energy efficiency rather than the physical definition of energy efficiency. Economic considerations may call for an optimal level of efficiency rather than the best available efficiency. A substantial share of the technical energy efficiency potential is both macro- and micro-economically efficient. However as electricity prices fall, economically justifiable efficiency projects become fewer.

Accepting new roles

Another policy challenge in liberalised markets is the clarification of roles and focussing of incentives. As emphasised previously, industry incentives will change dramatically in liberalised markets. Previously, utilities were instruments in implementing energy efficiency policies in a setting of a vague distribution of roles and responsibilities.

It should not be expected or required that generators or retailers maintain a significant role within energy efficiency policy. Energy efficiency contributions from industry will be purely economically motivated.

As far as transmission or grid companies are concerned, economic incentives may exist to influence demand side conditions and policy instruments may have the potential of enhancing these incentives.

Long and short term

Markets and private ownership are behaviourally more biased towards short-term considerations than governments and centrally planned sectors. This will most likely lead to market cycles and greater variability in energy prices.

In formulating government policy and in the choice of policy instruments, governments need to accommodate this fact. One such area is the negative effect that a temporary but potentially long low-price situation would have on the development of efficient technologies. As electricity prices fall, many new technologies will be uneconomical and industries will reorientate the directions of commercial research and development programmes. Governments may take a stronger responsibility in bridging the gap caused by a temporary situation of low prices caused by generation overcapacity.

Regulation

As explained in other parts of this report, market mechanisms and market access may facilitate energy efficiency developments and investments in distributed generation. Regulatory approaches to monopoly control of transmission companies may provide incentives for end-use efficiency investments as alternative to grid expansion investments.

Setting up a regulatory body with adequate legal powers and resources is an important prerequisite for the development of a competitive market as well as addressing the proper incentives for cogeneration and energy efficiency.

5.5 Policy instruments

5.5.1 Introduction

This chapter aims at briefly discussing some energy efficiency policy instruments and their suitability in liberalised electricity market. The instruments are labelling, standards, fiscal policies, financial incentives and voluntary agreements. Finally, some recommendations from other relevant studies will be presented.

5.5.2 Labelling and standards

Labels and standards include a variety of policy instruments that are designed to encourage the development, marketing and sale of energy efficient products.

Labels show product's energy use or efficiency according to a common measure. Labels are voluntary and alert consumers to the energy use and costs of appliances and equipment and enable the direct comparison of energy use or efficiency among different models. An example is the Energy Star label used on computer equipment.

An associated labelling concept is the ecolabel system in which the manufacturing of products are environmentally measured according to a variety of criteria involving the use of raw materials, energy, manufacturing processes, emissions etc.

Standards are regulations stipulating the minimum efficiency level or maximum energy use levels acceptable in a particular country or region. The minimum efficiency levels in regulatory standards are typically designed to lower the consumer's overall costs without compromising product performance and features. In some countries, standards are dictated by what is technically and economically feasible. In other countries, they are based on the availability and performance of products in the marketplace at the time of writing. Examples of standards could be US fuel economy standards for automobiles and insulation standards in building codes.

A comprehensive overview of existing standards and labels is provided in the publication "Energy Standards and Labels" IEA 2000. The report concludes:

"Energy efficiency labels and standards for appliances and equipment are playing key roles in governments' strategies to meet energy and environmental goals. They are already widely used to improve the efficiency of home appliances and office equipment, and are increasingly being implemented for electric motors, home electronics and lighting equipment. At present, labels are used in 37 countries, standards in 34 countries. The market influence of labels and standards is increasing as countries expand and strengthen their programmes, and as developing countries and as countries with economies in transition initiate new programmes"

and:

"Regrettably, there have been few studies of the actual results of the labels and standards programmes. Nonetheless, those studies that have been made show clearly that labels and standards, when well designed, can be effective in encouraging the development, marketing and sale of energy efficient products, without compromise to the product's services, performance and features. In addition, they enhance the effectiveness of other market transformation activities, such as targeted procurement, financial incentives, information, training and research and development".

The planning of future standards and labels need to accommodate alternative price development scenarios and the fact that the energy market place will become a very dynamic environment. Standards and labels need to accommodate stability and predictability. In a scenario of falling and volatile energy prices, standards could develop to be onerous and lose their credibility and justification. The public acceptance of standards and labels is likely to improve if there is economic justification. At the end of the day, a political decision needs to be made with respect to weighing the importance of consumer energy cost against efficiency targets.

Another important challenge lies in the need for international co-operation. As energy liberalisation evolves, national energy markets disappear and energy becomes a traded commodity in a borderless market. This leads to levelling of energy prices where transmission constraints and cost differences dictate end user price differentials. Harmonisation of energy taxes will eventually contribute to further harmonisation of energy prices.

The consequence of this is that energy prices become a common denominator in assessing the viability of national standards and labelling programmes. Combined with a general globalisation of economies and removal of trade barriers, this provides rationale and ample justification for close international co-operation in developing and implementing energy efficiency standards and labels. However, different levels of economic development and levels of consumer purchasing power make it politically impossible to achieve internationally uniform efficiency standards.

5.5.3 Fiscal policies

Fiscal policies encompass the use of taxes in promoting energy efficiency. Such instruments are typically designed to reduce the overall consumption of energy through the price mechanism. By making energy more expensive, more energy efficiency projects and technologies become economical. From the economists' point of view, the price mechanism is a crude but very simple and effective mechanism to influence demand and supply for any commodity.

From a public policy point of view and from the view of the treasurer, taxes are tempting instruments as they bring money to the coffers as opposed to incentive mechanisms, which mostly increase spending of public funds.

The liberalisation of energy markets causes a redistribution of value between consumers and producers. Taxes from the energy industry are likely to be reduced. New taxes on energy use compensate for these losses and seem to be politically preferred by many countries.

Falling end user prices provide a convenient occasion for writing the tax. This can be observed in many countries. The gradual introduction of gasoline taxes in Europe in a period of low crude oil prices is a good example.

Other political considerations also support the use of end-use taxes. Environmental policies call for a reduction of power generation from polluting power plants. This is most cost effectively influenced by measures targeting the polluters using instruments such as carbon taxes, quotas etc. However, a general tax on end use of electricity is non-discriminatory with respect to the source of generation as opposed to taxes on generators. This is obviously less effective as an emission reduction policy, but less controversial politically.

Both from a consumer and industry point of view, end-use taxes on electricity come across as a breach of the intentions and purpose of market liberalisation. For industry, taxes reduce the wholesale price and profits and take the steam out of demand growth. Efforts to reorganise and improve efficiency are "punished". For consumers, many of them very vocal supporters of liberalisation, savings from lower energy costs become a source of taxation, which brings consumers back to the energy economics of pre liberalisation.

Fiscal instruments used for environmental purposes should target the emission source. If emissions or other adverse environmental effects originate in generation or transmission of energy, taxes should be imposed on the source of these effects. However, a natural first step in targeting environmental impacts from electricity generation would be to remove an extensive set of financial support mechanisms, i.e. coal subsidies, in many countries.

If consumption of energy has environmental effects such as oil products and natural gas, taxes would prove effective when imposed on the consumption of such energy.

If fiscal instruments are used solely for the purpose of tax collection and redistribution, care must be taken to handle all forms of energy equally in order not to distort the effective functioning of the energy market.

Grid charges

Following the changing role and incentives of energy industry with respect to DSM programmes and energy efficiency contributions, new funding mechanisms have evolved to compensate the level of industry funding.

Utilities have been allowed to put a regulated charge on top of the transmission tariff to finance energy efficiency initiatives. This is a "levy" on electricity use, which is earmarked for the purpose of efficiency investments. Compared to a general energy tax, energy consumers could be more receptive to this mechanism as they would recover the funds through improved energy efficiency information, counselling and efficient technologies.

As shown in the case of Norway (case 1), utilities are no longer allowed to spend the grid charge on efficiency activities as current policies aim to decouple energy industry from implementing public policy programmes. This is implemented together with abolishing the legal requirement on utilities to perform neutral energy efficiency information and advice. The grid charge can be looked at as a "tax" which should be subjected to government control and management, and provides a supplementary funding source to public budget allocations.

5.5.4 Financial incentives

Financial incentives are mechanisms which contribute to improving the economics of purchasing/investment decisions or reducing operating cost, thereby influencing the behaviour of energy consumers towards improving energy efficiency. Such financial incentives could be i.a. soft loans or grants. Soft loans or grants either originate in funds based on accumulated tariff charges, or are public funds or annual budget allocations. There are numerous other financial incentives ranging from tax exemptions to subsidised appliances, light bulbs, showerheads etc, which will not be discussed in their entirety.

A constant challenge in devising energy efficiency policies is the irrational behaviour of consumers or what could be interpreted as economically irrational behaviour. This is caused by the established fact that consumers simply do not implement energy efficiency actions despite very favourable economic returns. The economical energy efficiency potential is documented to be very significant in most countries. There may be many reasons explaining why such opportunities are disregarded.

However, the basic complication of targeting financial incentives is the fact that financial incentives are to be introduced into an environment of efficiency opportunities, which are economical at the outset. The challenge is to target individuals who consider the economics to be inadequate and to avoid the individuals who would implement the energy efficiency action regardless of available incentives. The inability to avoid the so-called "free riders" has compromised some incentive programmes (i.a. Norway) and has made governments avoid such policies.

Another more basic issue is the question if energy efficiency policy should employ financial incentives at all. Following earlier discussion concerning consumer choice and economic behaviour, it can be argued that as long as adequate infor-mation is available, energy consumers are able to make informed choices related to their well being and to weigh the benefits of alternative behaviour.

Financial incentives have been used in combined programmes where incentives perform an income distribution function as well as improving energy efficiency. This could be programmes targeting selected consumer groups such as low-income families, retirees etc.

5.5.5 Voluntary agreements [15]

Voluntary agreements for energy efficiency involve a formal agreement between a responsible government body and a business or organisation. The agreement may require that the business or organisation will carry out specified actions to increase the efficient use of energy. A voluntary agreement between government and a business or organisation can provide a framework for achieving specified cost-effective energy efficiency outcomes through a commitment to action from the business/organisation and appropriate support from government. Agreements can be legally binding agreements with obligations upon the parties, or legally non-binding or "moral" commitments.

A voluntary agreement programme can target companies within specific sectors or can be broad ranging, and include all commercial enterprises and organisations, which use energy. Some general principles that can be adopted in a voluntary agreements programme to engage business interest include:

- the status of the agreement should be clearly stated (such agreements are rarely entirely "voluntary" and may be introduced as an alternative to harsher measures, such as a carbon tax, which may be used as a sanction if the agreements do not produce the required outcome);
- the specification of the agreement should state whether the outcomes of "business-as-usual" energy efficiency actions might be included in the results from the agreement;
- the commitments made in an agreement should allow flexibility to change agreed activities if the required outcomes are not being achieved;
- agreements should not interfere with competition, or create disputes;
- agreements may be industry-wide or business-specific;
- agreements should recognise international business activities.

Energy efficiency targets must be set high to obtain energy savings that are greater than the "business as usual" case. However, in the case of voluntary participation, targets cannot be set too high; otherwise, businesses and organisations will not participate. This leads to the conclusion that voluntary agreements are unsuitable when instruments are needed to induce significant behavioural changes.

Agreements need to be backed by proper monitoring and be enforceable. The effectiveness of the voluntary agreements in actually achieving energy efficiency should be periodically evaluated to ensure that the agreements are efficiently and effectively achieving the government's objectives.

The energy efficiency measures nominated by the business/organisation for the agreement are likely to be limited to those that are clearly cost-effective, with relatively short payback periods for investments.

Governments may promote voluntary agreements for a number of reasons including:

- aversion to adopting more prescriptive mechanisms;
- more traditional mechanisms (e.g. regulation, taxes, information) may not be working successfully;

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[15] Sources: "Developing Mechanisms for Promoting Demand-side Management and Energy Efficiency in Changing Electricity Businesses" July 2000. Research Report No 3 Task VI of the International Energy Agency Demand-Side Management Programme and "Achieving environmental objectives through the use of market instruments – A cogeneration industry perspective" May 1997 COGEN Europe

- consensus with business should lead to more a higher level of achievement of energy efficiency targets;
- cooperation rather than conflict may already be a part of a country's culture;
- voluntary agreements can be seen as a useful first step toward stronger policies (if required);
- blame for failure to perform is directed at business rather than government.

Typically, governments may provide a series of supportive actions to businesses participating in voluntary agreements. Such support could range from information and training to access to funding sources or tax exemptions etc.

The resources required to manage a voluntary agreements programme could be quite extensive. The participating businesses and organisations are normally responsible for the bulk of the funding required to achieving increased energy efficiency.

Voluntary agreements are adapted to liberalised market structures. Energy suppliers may offer support to the implementation of voluntary agreements in order to gain a competitive advantage.

For many energy-consuming industries, voluntary agreements have been favoured instruments in achieving energy efficiency and emissions reductions, particularly in view of the prospects of optional instruments such as taxation. Voluntary agreements provide an opportunity for industries to meet efficiency standards or emissions restrictions in a more cost effective way than being exposed to stricter taxation.

For this mechanism to be successful, government and business must be willing to interact in a co-operative rather than adversarial fashion. The mechanism will be difficult to implement in a political framework that favours strong control of industry rather than a more co-operative approach. Government must also be willing to commit to this type of mechanism before applying more prescriptive mechanisms if this one does not succeed.

There is some concern that the energy efficiency targets to be achieved through voluntary agreements may be set too low to encourage a large number of businesses/organisations to participate. However, accurate target setting may be difficult if quantitative data on the energy saving outcomes of specific energy efficiency measures are not readily available.

The transaction costs of achieving energy efficiency through voluntary agreements may be perceived as being high because of the additional expenses involved in administering the agreements as compared with the costs of simply implementing energy efficiency programmes.

However, in addition to actually achieving energy efficiency targets, participants in voluntary agreement are also gaining experience in carrying out energy efficiency activities, experience which they may otherwise never have gained. Comparatively high transaction costs should be measured against the benefit of this increased experience.

The voluntary agreement should target services to all participants. If certain participants benefit to the detriment of others, then government will need to review the voluntary agreement, e.g. encourage activities for other participants or in neglected areas and/or reduce activities in areas already covered.

Voluntary agreements and liberalisation

The introduction of energy liberalisation does not introduce new barriers to the adoption of this instrument as such. Energy liberalisation may lead to other energy prices and incentives among industrial energy consumers, however this is a general challenge. Large energy consumers and industry organisations favour this mechanism because the instrument is considered a more cost effective solution to achieving efficiency goals, as opposed to indiscriminate instruments such as mandatory standards and taxes.

Case study 4 encompasses an overview of experiences with voluntary agreements from Australia, Finland, Korea and the Netherlands.

5.5.6 Relevant studies

Energy efficiency policy implications of the liberalisation of energy markets have been addressed by other research reports and surveys. In particular reference is made to works performed by the International Energy Agency Demand - Side Management Programme and studies funded by the EU SAVE- programme.

IEA - "Mechanisms for promoting DSM and Energy Efficiency in changing electricity businesses" [16]

Task VI of the International Energy Agency Demand-Side Management Programme [17] titled "Mechanisms for promoting DSM and Energy Efficiency in changing electricity businesses" served the purpose of developing in detail a range of practical mechanisms for promoting the implementation of economically justifiable DSM in changing electricity businesses, such as in restructured electricity industries and competitive electricity markets. A subtask of the work has been to evaluate public policy implications. Studies commenced in 1997 and a preliminary final report has recently been made available to the project participants.

25 primarily existing mechanisms were identified for detailed examination. The report evaluates these mechanisms against a series of criteria to determine their suitability for adoption in competitive market environments. Among these criteria are whether the mechanisms would be effective in restructured electricity industries and whether the mechanisms would require modification to become effective in restructured electricity industries.

The Task VI experts also undertook a brainstorming workshop to identify any "new" mechanisms, which could be developed to promote DSM and energy efficiency in restructured electricity industries. Despite considerable effort put into this activity, very few "new" mechanisms were identified. With the exception of "demand side bidding" which is facilitated by the emergence of power exchanges, no new mechanisms were introduced as a consequence of the new market framework.

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[16] "Developing Mechanisms for Promoting Demand-side Management and Energy Efficiency in Changing Electricity Businesses" July 2000. Research Report No 3 Task VI of the International Energy Agency Demand-Side Management Programme

[17] The International Energy Agency Demand-Side Management (DSM) Programme is a relatively new collaboration. Since 1993, the seventeen Member countries and the European Commission have been working to clarify and promote opportunities for DSM.

The mechanisms were grouped into four different categories of measures:

- **Control mechanisms** - direct energy businesses to change behaviour
- **Funding mechanisms** - provide funding for other mechanisms
- **Support mechanisms** - provide support for behavioural changes by end-users and energy businesses
- **Market mechanisms** - use market forces to encourage behavioural changes by end-users and electricity businesses

The main products of the study are several research reports and working papers as well as a database of over 100 existing mechanisms for promoting DSM and energy efficiency and a database of 25 developed mechanisms. These products may be of practical use particularly to government policy makers and industry regulators.

When evaluating the effectiveness of each mechanism, the effects are checked against four aspects or phases of industry restructuring which individually or combined constitute different challenges or levels complications:

- Unbundling - vertically integrated utilities are separated into different corporate entities for generation, transmission and distribution/retail
- Commercialisation - the introduction of commercial objectives into the management and operation of public electricity businesses
- Privatisation - private ownership of public utilities
- Competition- wholesale and retail levels

While it is possible to evaluate the functionality of mechanisms against each of these aspects, the authors claim that a simultaneous implementation of all these restructuring measures may complicate the evaluation due to the complexity of anticipating the effects and interactivity of these. Some conclusions from the report are listed below.

Recognising that industry and government previously shared the implementation of DSM and energy efficiency mechanisms, the authors conclude that many of the mechanisms as such can still be used successfully within a framework of competition.

"But, in competitive industry structures, the form of the electricity industry is radically altered. In this structure, greater responsibility falls on government to:

- *Continue or expand funding mechanisms and those market mechanisms which include financial incentives*
- *Initiate, finance and encourage support mechanisms*
- *Undertake the further development of market mechanisms*

In general, there is not so much need to develop new mechanisms as there is to further evaluate and refine "newer" mechanisms that have come into use in the last few years or are just now in the process of being implemented".

The report addresses the need for a strategy to handle change and periods of transition into a fully competitive marketplace.

"Funding, taxation and market transformation mechanisms are only minimally affected by changes in industry structures, making these mechanisms particularly effective during periods of transition".

......

"The recognition of the need for flexibility is part of a successful transition strategy."

The evaluation of all mechanisms shows that with the exception of one mechanism i.e. Integrated Resource Planning which is less effective in restructured markets and taxation schemes, tax exemptions and incentives which remain unchanged, all mechanisms are judged to be more relevant or useful under the various aspects of restructured markets.

The report concludes:
"Under competition, the majority of the developed mechanisms are more, or much more useful or relevant. Therefore the developed mechanisms are likely to become more effective in promoting DSM and energy efficiency as restructuring of an electricity industry proceeds."

The report finally groups the mechanisms into four categories of instruments that may prove useful in deregulated environments:

Information Provision Mechanisms

"Mechanisms that provide accurate and useful information will be particularly important for competitive electricity markets. Therefore general information provision mechanisms should be given a high priority. Consumer protection activities are also closely related to general information requirements."

Funding and Action Mechanisms

"Financial incentive mechanisms to collect funds to promote DSM and energy efficiency work well together with mechanisms which lead to action in implementing DSM and energy efficiency initiatives." Typical examples are tax incentives, funding of entrepreneurial businesses, ESCOs, financing energy efficiency actions performed by energy utilities etc.

Market-shaping Mechanisms

"New market shaping mechanisms that capture the value gained from implementing DSM and energy efficiency initiatives will particularly help to overcome some of the problems of split incentives, where the organisation which implements DSM and energy efficiency may not gain any benefit from doing so." Examples are DSM as alternatives to network expansion, demand side bidding etc.

Market Transformation Mechanisms

"Market transformation mechanisms that are designed to alter the way in which DSM and energy efficiency is sourced or procured are critically important for competitive markets. These include mechanisms moving from regulations and financial incentives to strategic market interventions designed to result in more efficient products and services." Examples are license conditions for electricity businesses, voluntary agreements, developing ESCOs, energy performance contracting etc.

Comment

The main findings of the IEA-report have been included in this report as the IEA work is a very recent and a very significant contribution to one of the main issues within the scope of this report. It is not possible to carry out a thorough evaluation of the comprehensive documentation following its conclusions. It will however appear from the conclusions of this report that this author is less optimistic with regard to DSM contributions from energy supply industry and the effectiveness of regulating electricity suppliers to conduct energy efficiency work.

SAVE - Public Policy based DSM in the Nordic Power Sector

The objective of the project, Public Policy based DSM in the Nordic Power Sector: Pilot Action Activities for Implementing DSM and Energy Efficiency Services in a Nordic Restructured Energy Market, was to demonstrate robust and transferable strategies for introducing DSM and EE services that are not otherwise adopted in a restructured and competitive market on a commercial basis.

The project results were based on relevant experience in the Norwegian, Finnish, Danish and British power sectors, which are all undergoing changes resulting from introduction of competition. The project, which was completed early 1999, was co-funded by the European Commission SAVE-II programme (40%), Norwegian Hydro resources and Energy Administration - NVE (25%) and the project team members [18] (35%).

The project tasks included

- Identification of traditional barriers to cost-effective DSM and EE i.e. market imperfections and how these may change as result of competition and restructuring;
- Identification of options and constraints for promoting DSM and EE - Identification of general issues facing the Nordic power sector, major drivers behind the restructuring, interests and concerns of the market actors, and their impact on promotion of DSM and EE services;
- Evaluation of the restructuring process and its possible implications for implementing DSM and EE services;
- Through pilot action activities (PAAs) demonstrate possible options for promoting DSM and EE services projects in the participating countries;
- Monitoring and evaluation of results from programmes in restructured power sectors and recommendations to possible adaptations to other EU-member countries, and;
- Development of possible policy and programme options for promoting DSM and EE services in the Nordic countries.

The principal findings and recommendations of the work are quoted in the following.

The emphasis and structure of the “needed” public policy DSM activities will and do change as a result of market change - not the general need for these activities. None of the investigated pilot action activities are new in concept. Only the organisation of the implementation, funding and monitoring has changed slightly.

Governments increasingly outsource direct DSM activity to government agencies or private, commercial enterprises. This structure of the prevailing public policy DSM has shifted to more complex activity structures. Also more attention is given to involving the producers of energy consuming equipment i.e. the availability of energy efficient solutions.

“A distinct public policy DSM profile, which prescribes success, is not obvious. It seems one approach, which may be successful, is to build on an existing interest if the government wishes to interfere minimally with the market forces. In this case the government may provide a neutral forum where the parties can meet an communicate their interest.”

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[18] Energy Savings Trust (UK), SRC International (Denmark), VTT Energy (Finland), MOTIVA (Finland), DEF (Denmark) and FRES (Norway)

The report prescribes two guidelines:

"The government should strive to operate according to the following two guidelines:

- *Create a framework, which does not hamper the interest of the market actors in energy efficiency - the market actors being producers, utilities, local authorities, equipment suppliers etc.*
- *Make sure that those who undertake public policy DSM remain neutral in relation to the activities they are involved in, i.e. that they hold no interest in distorting the activities into certain direction for profit reasons*

The report elaborates this principle:

"So as not to hamper the competitive energy market, the government should focus on the development of energy efficient solutions and in as far as possible leave it to the commercial enterprises to use these as part of their energy services. To support the promotion of commercial energy efficient solutions, the governments may provide the consumers with the information necessary to act upon their conscience. The provision of information is as mentioned earlier an important government tool in the correct functioning of the competitive market Public policy DSM should thus not neglect the weaker actor groups such as the smaller consumers who are more exposed to the market power of the large actors."

PART IV EXPERIENCES AND BEST PRACTICES - CASE STUDIES

CASE STUDY 1:

Norway - the role of electricity industry in energy efficiency policy

Scope

This case study reviews briefly the role of electricity industry within the Norwegian energy efficiency policy framework from the early 80's, through deregulation in 1991 and ending with the presentation of a proposal to the Norwegian Storting in the fall of 2000.

History

The role of electricity suppliers within the framework of energy efficiency policy was addressed for the first time in the energy white paper of 1979-80 to the Norwegian Storting (parliament):

"..utilities are integrated in the planning of concrete actions to achieve more efficient use of available energy resources. It may be desirable that utilities i.a. get involved in various energy efficiency information efforts." [19]

In the energy efficiency white paper to the Norwegian Storting (parliament) of 1984-85, a stronger emphasis was placed on the role of utilities in energy efficiency measures:

"The Ministry considers it an imperative that regional and local authorities, local utilities and generators, the association of utilities, oil companies and industry organisations etc. which have a broader relationship to energy users than the state, are actively involved in energy efficiency activities." [20]

One specific measure introduced was the requirement that all local utilities purchasing state generated power, were required to perform an analysis of the energy efficiency potential within distribution and end-use of electricity in their respective supply area.

At this time utilities in some regions had already developed significant energy efficiency capacity fuelled by a fear of a supply shortage. These efforts were funded by a fixed charge included in the tariff.

The government decided however to speed this up by introducing a financial incentive to the utility sector which involved a direct financial contribution to the employment of expertise within the utilities. The programme was discontinued after four years and an assessment showed an improvement in the level of energy efficiency involvement among the utilities.

The importance on utility involvement in energy efficiency measures was reiterated in the 1988-89 report to parliament on "Energy economising and energy research":

[19] unofficial translation
[20] unofficial translation

"The energy suppliers have by virtue of their role as both producer and distributor of electric power, an important role in the implementation of energy economising measures."

Other statements stimulate utilities to become actively involved in end user energy efficiency measures. The document did however recognise that suppliers would be differently positioned with respect to favouring energy efficiency measures depending on their energy supply situation.

Despite the efforts by government to stimulate energy efficiency among utilities, at least two reports issued in the mid 90's conclude that the utility industry only accounted for a minor share of the end-user energy efficiency investments in the 1980's (approx 10%)

A year later, the Government presented a proposal to parliament for a new Energy Act, which represented a dramatic change in the organisation and functioning of the electricity sector. This liberalisation was one of the first global attempts to liberalise an electricity industry and was more far reaching than the UK-reform, which preceded the Norwegian proposal.

An important concern in the preparation of the market reform was the fear that the introduction of competition would damage the increasing contributions by utilities within energy efficiency. The Ministry recognised that industry incentives would change. A remedy was sought by introducing a legal requirement, which was intended to maintain spending levels within industry.

In the proposal for a new Energy Act to the parliament, the Ministry explains:

"Investments in energy efficiency measures among customers should be evaluated against new power generation capacity or procurement from the market. Adoption of such a balancing principle in the planning of power acquisitions should be an integral part of the utility business. According to this principle, utilities must be given a clear responsibility to assess energy efficiency measures among customers."

In another statement, the Ministry anticipates that an efficient market will level out electricity prices and eventually lead to prices equivalent to the cost of new generation. Such a development would facilitate a real comparison of the cost of energy efficiency measures against alternative power "sourcing".

The legal implementation of the energy efficiency requirement was introduced as an authority or power to formulate terms when awarding the "area license."

Energy Act Section 3-4 [21]

"When awarding a license according to §3-1 and § 3-2, the following apply:
....
8. Terms may be introduced regarding energy efficiency and the development of plans for efficient energy supply within the area"
....."

[21] unofficial translation

The area license is a license that applies to the operation of the grid system. Consequently, the rules apply to the local grid companies and not to the electricity retail companies. The intention of the Act was that the licensee should perform a minimum acceptable level of efficiency information/advisory services and energy efficiency planning.

The license term is specified in Regulations pursuant to the Energy Act section 3-7 a:

"Energy efficiency (re Act §3-4)

The licensee shall contribute to an efficient use of energy resources by providing neutral information and advice about energy efficiency to the energy users in the license area. The Norwegian Hydro Resources and Energy Administration will introduce specific guidelines for this activity and shall ensure that the licensees comply with the terms."

The grid companies may as part of this regulation, finance their costs by adding a fixed transmission charge (up to NOK .003 per kWh) on every kWh supplied. Most grid companies decided to spin off the energy efficiency activities into separate entities organised as individual companies. Some 20 regional energy efficiency offices with almost 200 employees have mushroomed following this regulation. The overall level of utility based energy efficiency activity increased (1998: NOK 140 mill.) following the introduction of these regulations.

Consequently, two distinctly different public funding sources developed in Norway - partly the government energy efficiency programmes funded by the taxpayers and managed centrally by the energy administration and partly a decentralised structure based on a "local tax" on the electricity bill. Over time this evolved into a fragmented and uncoordinated structure where substantial economies of scale in planning and operation of energy efficiency measures remained unexploited.

Much good energy efficiency information and advisory services came out of the new structure of regional offices. For regulatory reasons, restrictions were put on the scope of services performed by the regional centres as many enjoyed favourable financing and an effective monopoly position within their service areas. To some extent, competitive frictions evolved between the structure of regional offices and the structure of private energy efficiency operators funded by government.

It became increasingly evident that the grid companies lacked the commercial motivation to perform energy efficiency services and their involvement was primarily motivated by regulatory requirements. Grid companies developed an increasing business oriented focus. A growing number of mergers and acquisitions in energy industry started moving grid companies into a more concentrated structure. Reasonable profitability relied on an ability to respond to regulatory incentives and those companies that were forerunners in improving efficiency were rewarded.

The anticipated commercial motivation that grid companies would symmetrically consider energy efficiency investments and grid investments has not materialised often and is not a common planning concept.

The Ministry, after an evaluation of the experiences with regulated energy efficiency services, decided in 2000 to discontinue the legal obligations on grid companies. In the fall of 2000 a parliamentary proposal will be submitted for review and decision by the Storting (parliament). The proposal, which is currently through an external review/hearing process, proposes to discontinue the license terms and proposes to redirect the grid charge to a national energy efficiency fund. The energy efficiency fund will be centrally managed by a new and independent energy organisation, which will also take over all administrative energy efficiency functions from the current Norwegian Hydro Resources and Energy Administration.

The reform basically terminates the regulatory motivated role of energy companies within the area of energy efficiency. Efforts will still be made to explore how monopoly and grid regulation can provide incentives to grid companies to evaluate energy efficiency in their grid planning, and retailers will continue their involvement based on individual assessments of the commercial potential of energy efficiency services.

CASE STUDY 2:

Third Party Financing - Energy Services Company

Czech Republic - Bulovka Hospital [22]

The following project has been awarded a best practices status by the World Energy Efficiency Association. A complete description of the project can be obtained by contacting the organisation or the companies involved in the project

Introduction

In 1995, Energy Performance Services Czech Republic (EPS CR) completed implementation of two performance-contracting projects to provide energy efficiency services to two hospitals in the Czech Republic. These are the Bulovka Teaching Hospital in Prague and the Jilemnice District Hospital in northeast Bohemia. Both hospitals needed a significant upgrade in their central heating systems and were facing a situation of no available funding and operating expenditures that were rising more rapidly than incoming revenues or government subsidies would cover would cover. The performance contract with EPS CR provided the long-term financing for the upgrade and generated savings that permitted the hospitals to reduce their operating costs without reducing the level of services. Both projects focused on modernizing heating systems, and did not include lighting renovations. Excluding construction time, the term of the performance contract for these projects is eight years. The Bulovka Hospital project includes four energy conservation measures that were installed at a cost of about U.S.$2.7 million. The Bulovka project may provide a model for similar projects elsewhere in Eastern and Central Europe.

Organizational Overview

THE CUSTOMER: Bulovka Teaching Hospital was one of the largest in the Czech Republic. The hospital complex included 19 buildings totalling approximately 80,000 square metres (or about 860,000 square feet) and had 1,640 beds. Its annual revenues were U.S.$23-25 million.

Prior to the performance contract, the hospital complex had been heated with steam generated from its own central steam plant. Total energy bills had been about U.S.$ 2.5 - 3 million annually. Of this amount, 53% was for generating steam, 27% was for electricity, and 20% for generating hot water.

THE ESCO: EPS CR was the Czech subsidiary of Energy Performance Service, Inc. (EPS), a privately owned energy services company (ESCO) headquartered in King Of Prussia, Pennsylvania. EPS were at the time majority-owned by PECO Energy Company, a $4 billion per year U.S. electric and gas utility headquartered in Philadelphia, Pennsylvania. EPS specialized in implementing and financing energy efficiency projects on a performance basis for industrial, commercial and government facility owners. In its performance contracts, EPS guaranteed the facility owner that the total cost of implementing the project will be paid from savings achieved. EPS had offices and operates in the U.S., Canada, Chile, Portugal, Czech Republic,

[22] Abbreviated version of "ESCO Case Study: Bulovka Teaching Hospital Prague, Czech Republic. Edited by James B. Sullivan World Energy Efficiency Association (WEEA).December 1995

Slovak Republic and Poland. EPS were one of the most active U.S. ESCOs in entering international markets. In later years, the international operations of EPS have been divested and PECO has left their ownership position. The company currently trades under the name Energy Assets.

EPS CR completed the two hospital projects in the Czech Republic with its construction team and its professional staff, which were all Czech. The U.S. based parent company, EPS, contributed technical expertise and has facilitated project scoping, contractual terms and arranged the long-term financing. According to EPS, the approach it took on this project was to package a maximum combination of savings opportunities into an integrated paid-from-savings programme. Long-term financing was provided to implement 100% of the project. Bulovka were guaranteed that the savings would pay for all on-going project costs, including debt service, monitoring and related maintenance.

Project Overview

Energy costs that increased greatly during the transition to market prices in recent years had forced the Bulovka Teaching Hospital to look at ways to reduce energy costs. This first ESCO project with EPS CR is what resulted from this need.

EPS CR installed four energy conservation measures as part of the total project: (1) switching the existing central steam system to district heating; (2) implementing a new energy management system; (3) installing a new air handler recovery system; and (4) converting and upgrading to a new high efficiency natural gas boiler. Total installed cost of these measures was about U.S.$2.7 million. All of the measures operating together will produce an annual savings of about U.S.$700,000, resulting in a four-year simple payback. All four measures were put into operation in September 1995.

EPS CR closed the original steam plant and connected the hospital to the local district heating system, which now provides the space heating, and, through heat exchangers, the hot water. EPS CR also installed control and monitoring equipment, and replaced much of the existing 50-year old piping. The computerized energy management control system was installed to control the flow of hot water going to each building and provide direct metering data for monitoring the energy consumption on a remote basis. To measure savings, EPS developed a baseline using historical energy consumption data.

Installation of the new Landis & Gyr energy management system provided more precise control of indoor temperatures, hot water, and space heating. On-line monitoring by EPS CR and Landis & Gyr from their respective offices in Prague, coupled with a preventive maintenance programme ensured that the long-term energy savings will persist and that all energy-using systems are kept in top operating condition.

Prior to the project, air handling units in the hospital had used 100% fresh air, because it was thought that fresh air was needed to keep the rooms clean. Directly exhausting heated room air wasted a lot of energy and so heat exchangers were installed in the intake and exhaust ducts in two large buildings. The new system preheats air coming into the building, taking heat from the output and transferring it to input air.

While the hospital previously generated its own steam for heating, it now generates steam only for more limited uses, primarily sterilization and laundry. The old, inefficient plant used expensive #4 fuel oil. EPS CR installed a small four-ton natural gas-fired boiler for this purpose. This conversion to natural gas substantially reduced the costs of steam generation.

All of the new equipment—a combination of European and local—is owned by the hospital. Controls were provided by Landis and Gyr, the large Swiss multinational manufacturing and service company, and the heat recovery system was provided by Czech manufacturers.

Financing Plan

The Bulovka Hospital energy efficiency project was financed with 100% debt under the terms of a performance contract. EPS and Landis & Gyr were the project sponsors. The term of the performance contract included construction time and an eight-year amortization period during which the hospital is guaranteed that the savings will cover all debt service payments. If the hospital decides to cancel the contract along the way, it would pay a cancellation fee, which is precalculated based on anticipated revenues.

Project sponsors state that financing the project was difficult and took about one year to arrange. The main barriers encountered were the difficulties of qualifying for long-term financing and finding terms with a reasonable interest rate. Financing was ultimately provided in hard currency, not Czech crowns, and was secured by a Landis & Gyr corporate guarantee.

Conclusions

While this is a small project and small projects are difficult to finance, it is representative of the typical size of investment in energy efficiency projects. Many companies consider U.S.$ 10 million as the lower limit of what they can develop or finance profitably, given the high transaction and development costs of doing business abroad. The apparent success of this case, however, may illustrate a broader opportunity that exists in improving the energy efficiency of the industrial and commercial sector in countries with economies in transition. The key issue here is whether the project's approach can be replicated many times over. This would spread the development costs over many similar projects.

But while the facts presented above about this project indicate that there may be a replicable energy efficiency investment opportunity here, it should be kept in mind that this Bulovka project, and its sister project at the Jilemnice Hospital, are essentially the first of their kind. While the payback period seems attractive, an ample supply of possible problems and risks lurk behind those numbers that could make the projects fail. Some of these problems will most likely be similar to those experienced by ESCOs in the United States, for example, problems with adherence to terms of the contract on either side or less than optimal management and maintenance leading to less than expected savings.

Other problems will be particular to the Czech Republic situation. According to the project sponsors, a big issue in the Bulovka project was how to structure a contract under Czech terms. The language of a performance contract is fairly unique. While U.S. contracts are often extremely complex, Czech contracts tend to be much simpler. Reaching an accommodation of concepts among the various parties was, according to the project sponsors, quite a challenge. With a different culture and bureaucratic environment, the Bulovka model may have to be altered several times before it is easily replicable in the Czech Republic.

Despite these potential problems, EPS's Bulovka Teaching Hospital project will certainly serve as a model for similar projects in the Czech Republic and possibly elsewhere in Eastern and Central Europe.

CASE STUDY 3:

CHP and distributed generation in liberalised markets - UK and Sweden

UK

The United Kingdom privatised its electricity industry in 1990 and embarked on a gradual opening of electricity markets to competition. A parallel process took place in the natural gas sector. Privatisation did not create widespread competition from the outset. The development has been an evolution, which in the case of electricity will culminate with this year's introduction of the new electricity trading arrangement (NETA). This new framework is likely to create an environment, which is more conducive to electricity trading and competition than the previous regime.

In the early years, the market structure was dominated by a duopoly, which exerted market power. Electricity prices did not fall to the extent expected or desired. However, two regulators were established to control and promote competition in the electricity market (OFFER) and in the natural gas markets (OFGAS).

Historically, there were limited opportunities and lower prices available for exports of electricity from CHP plants in the UK. The liberalisation of the British electricity market contributed however to the development of CHP in Britain by helping to reduce the barriers to introduction of the technology. However, an active involvement was needed from the regulator to help overcome some of the old barriers during the liberalisation process. CHP developed from being considered a threat to traditional generation to become an interesting business opportunity for incumbent generators.

Critical for the success of CHP was the availability of a well-developed natural gas grid, access rights to electricity grids, access to market places and customers and fair connection and transmission charges.

Electricity privatisation and liberalisation coincided however with environmental policies promoting CHP. These policies originated in the climate change challenges and the need to device policies, which would enable UK to meet their Rio commitments. The energy efficiency of cogeneration, the reduction in atmospheric emissions - particularly CO_2, and the economic benefits were presented as the main rationale behind the support of cogeneration.

In 1990, the UK Government set the first official target for CHP of 4000 MW installed capacity by the year 2000. This constituted a doubling of the capacity available at that time. In 1993, the target was increased to 5000 MW based on the anticipation that this target would contribute 3 million tonnes of carbon towards the UK's climate change reduction policies. By 1998, close to 4000 MW of CHP capacity had been installed. CHP had demonstrated a steady growth from 1988. With an annual growth rate averaging 8.5%, CHP-capacity more than doubled by 1998.

Several factors have influenced the growth in CHP in UK. The government role in promoting CHP as a means of reducing greenhouse gas emissions has however been instrumental. This promotion was translated into favourable economic conditions for the operation of combined heat and power. CHP plants were exempted from the fossil fuel levy (10%), certain licensing requirements, distribution use-of-system charges, transmission use-of-system charges and other benefits.

The second contributing reason for the success of CHP was the fall in natural gas prices in the early part of the 90's due to the deregulation of natural gas markets. Another noteworthy facilitating factor was the important role of third party financing schemes in the implementation of industrial cogeneration schemes.

Important barriers to cogeneration lie in prospects of reduced electricity prices following more competition in the UK electricity market. This was demonstrated as the eligibility threshold was lowered and small consumers consuming less than 100 kWh entered the competitive market. Significant electricity price reductions caused a set back to small scale cogeneration.

The COGEN-report "Administrative barriers to the development of decentralised cogeneration" November 1999 summarises the barriers and opportunities to cogeneration in UK. Barriers remain in the area of connection and connection/transmission charges:

"In UK the main barriers to cogeneration include:

- *Electricity prices offered to cogeneration for exported electricity are low compared to the prices for imported electricity*
- *Charges for use of the distribution system do not reflect the actual cost incurred - which deters wheeling exports from cogeneration to other customers;*
- *Inconsistent costing and procedures for connections to the electricity and gas networks;*
- *Minimal recognition of the benefits of embedded generation for system security and network operation*

Positive elements include:

- *Cogeneration will play a key role in achieving UK's climate change policy and commitments;*
- *Gradual improvements have been made to the licensing and regulatory regime to assist the development of cogeneration - to meet climate change targets;*
- *Some of the connection issues have been recognised and some regulatory action has been taken - yet to see how effective these changes have been."*

UK provides a good example of how electricity liberalisation interacts with cogeneration developments and how the existence of natural gas grids and emerging natural gas competition plays into the electricity and heat markets. UK demonstrates that policy instruments compatible with markets can promote quantitative targets of cogeneration penetration. It also proves that administrative obstacles can remain a barrier for cogeneration for an extended period of time despite regulatory efforts.

Sweden

In 1997, Sweden introduced an energy transformation programme aiming at establishing an ecologically sustainable energy system. The programme encompassed instruments to promote development of energy efficiency tech-nology, CHP/district heating, bio-fuels and solar and wind power. New capacity was supposed to substitute capacity losses following retirement of two nuclear reactors at Barsebäck.

Since the implementation of the energy market reforms in Sweden in 1996 and particularly since the inclusion of small consumers and simplified settlement mechanisms, end users prices have fallen. Producer prices have fallen correspond-ingly and have caused a reduction in interest for CHP and small-scale generation incentives. This has delayed development of new generation capacity. In order to meet political objectives, new and stronger financial support mechanisms for small scale distributed generation are needed.

The conditions for closing the second reactor at Barsebäck rely on the successful implementation of the energy transformation programme. A preliminary evaluation was carried out in 1999, which concluded that objectives would not be met under the original programme architecture. The 2000 budget consequently included a reorientation of measures to reduce the use of electricity in room heating.

The government has furthermore submitted a proposal to Riksdagen (parliament) to introduce a comprehensive system for promotion of renewable energy sources. A new system based on the adoption of green certificate trading and consumer quotas are to be operational from 2003 with temporary mechanisms for the years 2001 and 2002. The quota system is intended to replace financial incentives. The current support level of SEK .09 per kWh small-scale power is to be maintained throughout 2001 and 2002.

By introducing a minimum quota on all consumers, which is supposed to increase over time, the government hopes to stimulate investment activity through the dynamics of the market place and to avoid disruptions to the effective functioning of the electricity market.

CASE STUDY 4

Voluntary energy efficiency agreements

Experiences from Australia, Finland, Korea and the Netherlands

Australia

Late in 1994, the Commonwealth Government agreed to drop its proposals for a carbon tax in return for voluntary agreements with industry regarding greenhouse gas emission reductions. This led to the development of the Greenhouse Challenge Programme, with government relying on voluntary agreements to achieve some 75% of projected emission reductions. The Government established the Greenhouse Challenge Programme within the Australian Greenhouse Office to assist businesses to develop and implement voluntary agreements.

The Electricity Supply Association of Australia responded with a cooperative agreement to assist its membership, collectively or individually, to develop voluntary agreements with Government. Within the first year some 30 electricity businesses had indicated their willingness to participate in the programme. Within the state of New South Wales, and separate to the Commonwealth programme, the State Government, through its Sustainable Energy Development Authority (SEDA) implemented the Energy Smart Buildings Programme. This programme aims to reduce energy consumption of government buildings in NSW by 25% of the current level by 2005.

Government agencies joining the Energy Smart Buildings Programme sign a voluntary Memorandum of Understanding (MOU) with SEDA to upgrade all facilities within an agency's portfolio over the next seven years wherever it is cost effective to do so. One of the important features of the programme is that, for the first time, the New South Wales Treasury is allowing participating government agencies to keep the cost savings they make through energy efficient upgrades. The MOU sets out a number of 'milestones' - such as undertaking an energy efficiency upgrade of one space within six months of signing the MOU and completing one building space upgrade within two years. Upgrades include lighting, heating and cooling, ventilation and equipment.

Considerable resources are being invested by SEDA to ensure that participating government agencies have access to free, objective assistance and advice to assist them to carry out activities such as: conducting an energy audit; securing innovative financial packages for energy efficiency upgrades, and ensuring staff are trained and motivated to 'own' their agency's individual energy efficiency programme.

Finland

Voluntary energy efficiency agreements are an important element of Finnish energy policy. Voluntary agreements have been developed with industry and the public sector and were introduced in 1992. It was then that the Ministry of Trade and Industry (MTI) signed the first agreements with industry and with the local government sector. Industrial energy efficiency policy relies mainly on voluntary agreements. In November 1997, MTI signed six new framework agreements on energy efficiency with the organisations representing industry and employers, and energy producers and distributors.

In signing the framework agreements, the organisations are committed to promoting energy efficiency and to encouraging their members to sign individual energy efficiency agreements. A private sector company signing an energy efficiency agreement is committed to appointing a specific person to take charge of energy efficiency activities, auditing and analysing energy use, preparing an energy efficiency plan, implementing measures in accordance with the plan, and reporting annually to the relevant sector organisation.

A public sector agreement was signed with the organisation representing local and regional authorities and another with the City of Helsinki in 1993. The local government sector agreements were renewed in 1997. Each municipality concluding such an agreement will be committed to carry out measures similar to those taken by private sector companies. The target is to have 10% less specific heat consumption in municipal buildings in 2005 as compared with 1990.

Currently, voluntary agreements in Finland cover about 75% of industry, 50% of the energy sector and 30% of local government. The financial incentives for companies and organisations to sign voluntary energy efficiency agreements are an additional 10% subsidy for the energy audits and a 10% subsidy for the implementation of the investments proposed in the energy audit report.

The voluntary energy efficiency agreements will remain in effect until 2005. The follow-up and reporting systems are under development. The goal is to develop systems that will enable an enterprise to produce the data required both for the follow-up to the energy efficiency agreement and for reporting to the environmental authorities.

Korea

In Korea, voluntary agreements on greenhouse gas reduction were the most important greenhouse policy measure of an initiative termed 'countermeasures for climate change mitigation' which was confirmed by a meeting of related government Ministers, under the chairmanship of the Prime Minister, in December 1998.

Voluntary agreements are a cooperative programme between the Korean Government and private sector companies. The programme is co-managed by the Government and the private sector.

A company, which intends to join the programme, must set energy consumption and greenhouse gas emission reduction targets and then submit a concrete action plan within three months after submitting a letter of intent to the Korean Energy Management Corporation (KEMCO). The action plan must contain details of how the plan will operate, an energy efficiency improvement target, a greenhouse gas emission reduction target, and a detailed process design.

After receiving the action plan, KEMCO reviews the plan and verifies the calculations relating to the energy efficiency and greenhouse gas reduction targets. KEMCO then executes the agreement if the company qualifies. A company which joins the voluntary agreement programme will be supported with low interest loans and tax incentive for energy efficiency and greenhouse gas reduction measures. Technical guidance and public relations promotion for the company will also be offered.

The voluntary agreement programme was implemented in 1998 after one year of case study and close investigation of the programme. During the first year of its implementation, 15 companies, including Pohang Iron & Steel Co. Ltd (POSCO), the largest energy consumer of the

Korean industrial sector, joined the programme. Up to September 1999, the total number of companies that have joined the programme had reached 46, including Hyundai Motors Co and LG Chemical Ltd. Twenty more companies are expected to join before December, 1999.

The companies that have joined the voluntary agreement programme will reduce greenhouse gas emissions by 3,774 kilotonnes of carbon in five years through adoption of energy efficiency technology, installation of alternative energy utilising facilities such as combined heat and power, improvement of manufacturing process, utilisation of clean energy sources, waste heat collection, and improvement of operations management.

The Netherlands

Since 1992, the Dutch Government has promoted the development of Long Term Agreements (LTAs) on energy efficiency across the economy. The LTAs are a contract under civil law and are based on negotiated targets. These pre-empt the threat of future regulatory requirements for energy efficiency. Government financial support from the Ministry of Economic Affairs, and through the Agency for Energy and the Environment, is provided in the form of subsidies and audits to LTA participants.

By the beginning of 1997, LTAs had been signed with 30 industry associations and six end user groups from the services sector. This represents about 1000 industrial companies and covers more than 90% of industrial primary energy consumption. Monitoring has shown that overall energy efficiency in 1995 had improved by 10% compared to the reference year of 1989.