

Special Report - Session 6 REGULATION, MANAGEMENT, ORGANISATION AND RELATED SYSTEMS

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Introduction

For more than 15 years the deregulation, or re-regulation, has been present on the arena of the Electricity Industries in Europe and elsewhere around the world. The main reason why the politicians introduced this measure to the industries was to try to decrease the cost of electricity and of electricity services by making the utilities more efficient in their overall handling of the resources they had and have at their disposal. Included in the term resource is all kind of means the utility utilise to carry out their different tasks, like technological, technical, organisational and financial resources. The term: efficiency based on price and quality. For the Distribution Business sector, from nature is a natural monopoly, different legal framework introduced by the governments. This framework presented to the utilities in the format of regulations, differing from country to country.

For the Directing Committee of CIRED, for the members of the organisation and for the distribution sector as a whole it is of great importance to monitor if the measures applied in the format of regulation are adequate and sufficient. Further on for the take part in the discussion and development of new technological and organisational solutions to promote the increase in efficiency in the industry. At last, but not of less importance, to monitor the development and adjust the course of direction the development is actually taking.

It will obvious be useful for the utilities in either situation, with a free market environment, or those preparing themselves for such operational conditions, to exchange their experience and discuss different approaches and solutions, or to learn from what is the experience so far. It is the purpose of the session to explore and exchange views on the immense and rapid development in this area the many utilities in the different countries have, and to share the experiences gained so far.

The session 6 intends to reflect the situation in organisational development, the tasks of management, the technological evolution, and in strategic and operational issues. The session 6 of 2007 is therefore specially addressing the following subjects:

Block 1 related to Regulation methods and status of Regulators measure. For the block 19 papers were selected, out of which 6 for presentation in the main session. Thirteen papers presented in the poster session.

Block 2 related to Distribution Companies adaptation to

regulation and actions to cope with framework. For this block 31 papers were selected, out of which 6 for presentation in the main session. Twenty-five papers presented in the poster session.

Block 3 related to Customer service considering Commercial Quality and Quality of Supply regulation. For this block 27 papers were selected, out of which 6 for presentation in the main session. Twenty-one papers presented in the poster session.

Block 4 related to Automatic Meter Reading systems and metering data application - AMR. For this block 14 papers were selected, out of which 6 for presentation in the main session. Eight papers presented in the poster session.

In total 91 papers were selected for the session.

Block 1 and 2 presented in the morning session at the conference. Block 3 and 4 at the afternoon session.

At the end of each block in the Special Report two questions are given for consideration and reply by the conference participants.

Block 1: Regulation methods and status of Regulators measure

Status of deregulation processes

Paper 0007 describes the present situation in Jordan regarding deregulation and privatisation. The country is at an early state of the process. The author expects that the privatisation process will create both opportunities and advantages for the customers and the utilities. Regulation will promote cost reflective tariffs and at the same time increase the performance and efficiency of the utilities.

The industry expects regulation to set fair and effective methods for the pricing of energy and network services. It will on the other hand give new challenges to the utilities in adapting to a new way of organising their activity, and to the use of new management systems, methods and tools.

Paper 0010 is dealing with the situation in the Romanian electricity market. The free market will open from the 1st of July 2007. The paper describes the framework the electricity industry has to adapt to and especially the ruling conditions for the electricity suppliers. The author recons

the industry will make the transition to the open market relatively easy. The number of eligible customers in Romania is for the time being 600 000. The introduced structure of the Marketplace expected to impose more discipline within all the Electricity industry in the country.

Paper 0266 from Brazil describes the challenges related to the deregulation and establishing of a free market in he country. It gives an evaluation according to the Regulator point of view of the main problems and conflicts between consumers and the utilities, resulting from the strategy of eligible customers searching for alternative providers of electricity. The suitability of actions from the Regulator regarded of high importance for a successful result of the transition from a captive to a free market situation.

Paper 0353 from Romania describes the status of the development of the deregulation process in compliance with the EU directives in the country. The unbundling and restructuring of the electricity industry has taken place. In the power sector competition and a free market established with several companies participating. Privatisation of the industry also growing and the regulation authority established. The Regulator now focused on improving the methodologies for creating a more competitive climate based on clear rules. In this context the Regulator is looking for international co-operation and new collaboration relationship.

Paper 0400 presents a report on the status of deregulation activities in Serbia. The state owned utility EPS has started the process towards unbundling its different engagements in production, transmission, distribution, supply and marketing of electricity in the country. There is however still not an open market. The driving forces for liberalisation are merely the increase in consumption partly due to low and non-economic prices. This combined with the closing down of production facilities creating a growing deficit in the region. The Energy Treaty will in addition put some pressure to speed up the free market situation in Serbia in the near future.

Paper 0418 from Iran states the situation of deregulation of the distribution sector in the country. The authority has during the recent decades tried to promote competition also in the distribution sector by privatisation. This restructuring has created a new management of the sector with real influence on the development strategy of the company. However, the shortage of financial resources forced the authorities to look for further development of the sector like unbundling. An independence plan concerning distribution companies is underway.

Paper 0484 is dealing with research on regulation of the power industry in China. It at first makes an analysis of electricity as a commodity from an economic perspective. Based on the existing regulation model the author presents recommendation and strategies for the regulation of the industry towards an open market for electricity in the country. A part of this recommendation is a step by step approach in the opening of the market and to define the responsibility and obligations of the Power Regulatory Agency. To improve the over all efficiency they are looking for motivating mechanisms in the industry.

Paper 891 from New Zealand gives an update on the development of the electricity sector structure and the regulatory environment. The principal objective of the reforms made is to deliver lower prices to customers and at the same time to have a supply that is adequate and economical efficient. This objective has not yet reached a new model been introduced. This model is a mixture of market and regulatory forces and a growing tendency towards political direction. Further changes are likely to expect ahead before a decision is made whether the industry should be market or regulatory driven.

Regulatory measures

Paper 0076 from Belgium presents a methodology and model for charging network services in a distribution system where also Dispersed Energy Resources (DER) is included. The methodology been developed as apart of an EU project (EU-DEEP). The impact of DER on the distribution network cost of losses is calculated and shown in fig 5 below.

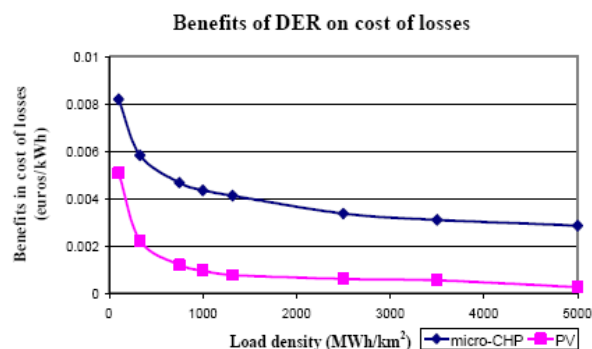
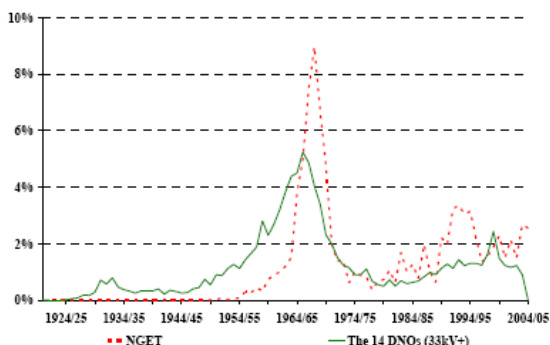


Figure 5 Benefits of DER on cost of losses

The project based on norm models in the analysis. According the paper this method has been useful for analysing distribution systems including DER. The result form this study expected to have an impact on the evaluation of the feed-in tariffs for DER into the distribution system.

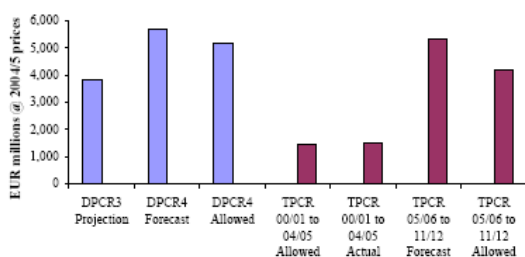
Paper 0160 from United Kingdom is dealing with the replacement of aging transmission and distribution asset base and the challenge this raises to the Regulator. Figure 1 show a comparison of the DSO forecast and the regulatory allowances of the asset value by age.

Figure 1 – Comparison of transmission and distribution asset values by age in Great Britain



The resources of a regulator to perform a budgetary review are limited compared with the DSO’s to prepare the budget. The expenditure required to replace the ageing asset may represent typically half the capital expenditure budget and exhibit a rising trend. Figure 5 shows the difference between the DSO’s forecast and the allowances presented by the Regulator.

Figure 5 – Comparison of operators’ forecasts and regulatory allowances



The paper discusses review techniques used and experience gained over a number of reviews of capital expenditure of network.

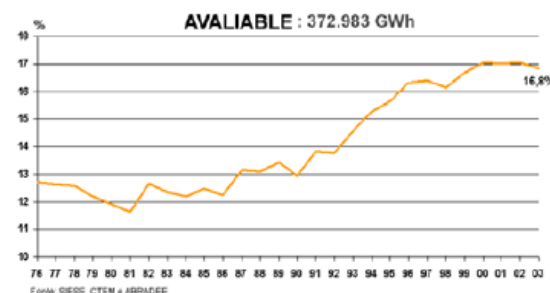
Paper 0192 from United Kingdom presents a tool to analyse the regulatory incentives on distribution network at a project level. Although the network operator faces economic regulation that operates on the whole business level, commercial performance is a result of decisions taken about individual projects. The tool presented based on calculating the Net Present Value (NPV) of a portfolio of relevant projects. The formula used to do the calculation for a specific project shown in equation (1) over a 5 year period and where letters a – e are the cash flows by year and r is the interest rate.

$$NPV = a + \frac{b}{1+r} + \frac{c}{(1+r)^2} + \frac{d}{(1+r)^3} + \frac{e}{(1+r)^4} \quad (1)$$

The model in a state of a spreadsheet calculates the NPV of the expected cash flows for each project in the portfolio of actual projects over the given period of regulatory price control. The tool also investigates the economical links between all the individual projects in the portfolio that assist in establishing a list of priority of the projects. Applying the model to one typical DER scenario demonstrates that the regulatory system does not

financially give distribution network operators incentives to encourage DER connections. Development of the model remains and further testing remains.

Paper 0269 from Brazil is addressing the regulation of the industry related to the processes of commercial losses in the country. Figure 1 shows the development of losses over the last 25 – 30 years.



Source: ABRADÉE/2004

Figure 1: BRAZIL – System loss index

The paper presents the evolution of the regulatory measures related to the DSO activities in identifying irregular consumption in order to be able to make a comparison with the prevailing regulatory rules.

Paper 0356 from United Kingdom is dealing with promoting innovation in liberalised electricity markets. It discusses the barriers to innovation, the challenges to be overcome and an approach adopted with success in the UK to give incentives to innovation and develop new ways of thinking by all the parties involved, from industry to universities to authorities. It draws together the lessons from Ofgem’s work in the field over the last two years and presents a list of 10 practical pointers for success.

Paper 0380 from Norway presents a model for a task - oriented approach for the regulation of the Distribution Network Operator (DNO). The Regulator has established a norm cost model in the income cap regime ruling from January 2007. The norm cost represents in principle the efficient cost level for providing distribution network services in a given area based on Data Envelopment Analysis (DEA) benchmarking. In a task-oriented approach it is assumed that the system configuration is adequate and hence the utility should have the required means to be able

to manage the asset. The system topology and the location will affect the cost of managing the network system (fig 1).

The presented task-oriented model aims at a more transparent establishment of the norm cost through a set of partial norm costs. The main principles stated in equation (3) below.

$$K^* = K_{ncustomer} + K_{ncapex} + K_{nopex} + K_{nlosses} + K_{nCENS} \quad (3)$$

where

- K^* - Total norm cost for a DNO
- $K_{ncustomer}$ - Customer management norm cost
- K_{ncapex} - Capital norm cost
- K_{nopex} - Operation and maintenance norm cost
- $K_{nlosses}$ - Electrical losses norm cost
- K_{nCENS} - Cost of Energy Not Supplied norm

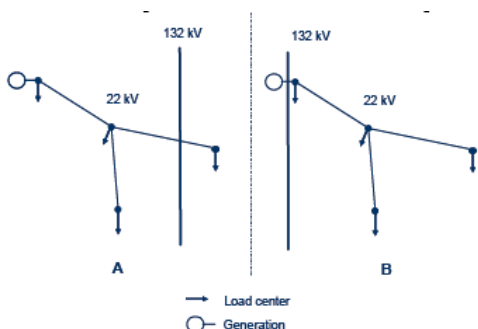


Figure 1 Influence of system topology and point of connections – different location of 132 kV grid

The principle been investigated and the findings in the project show that such costs can be established.

Paper 0609 from Finland presents an example of impacts of amendments in 2005 of market legislation on distribution business. The price development under the new regulatory system has been positive since, and the customers have experienced price decrease over the last two years as shown in figure 1.

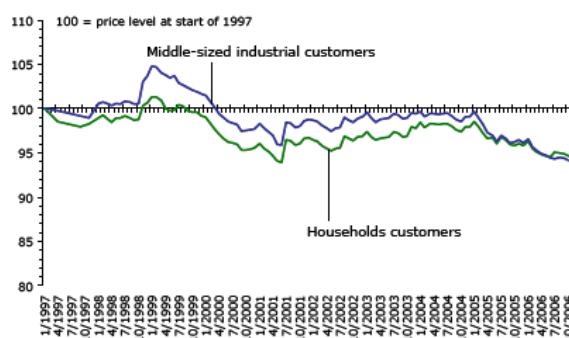


Figure 1. The development of average distribution prices (excluding taxes, adjusted for changes in consumer price index) in 1997-2006 for household and middle-sized industrial customers. (Source: The Finnish Energy Market Authority, available online at www.emvi.fi)

However, as the average outage time per customer from early 1970s until mid 1990s declined gradually per year, the similar development cannot be seen over recent years as presented in figure 2. According to the paper conclusion on the overall price development from the amendment is not yet possible. As to the network reliability it seems to be the fact that the regulatory framework has not established powerful incentives for power quality improvements.

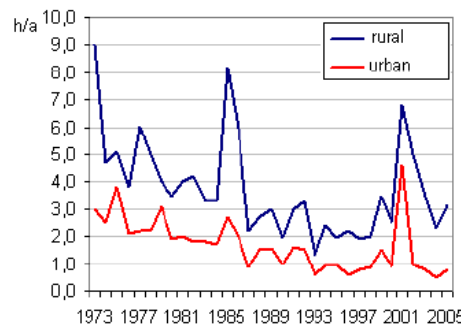


Figure 2. Average interruption time per customer per year in 1973-2005 [11]. The annual peaks of 1985 and 2002 are explained by severe weather conditions.

Paper 0677 from Sweden presents a comparative study of two regulating regimes for interruption of supply in Sweden and United Kingdom, referred to as GL and GS respectively. The two regulating regimes been applied for a case study with rural distribution network in Sweden. The Swedish regime state that the DSO should restore power delivery to customers within 12 hours, while the UK rules says within 18 hours. The number of compensations referred to the two regimes in the case study is presented in figure 1 and 2 respectively.

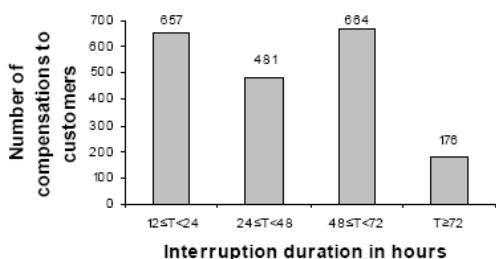


Figure 1. The number of customer compensations within the GL regulation intervals. (Each interruption is represented by its affected number of customers.)

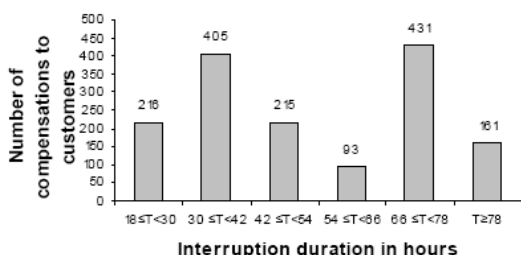


Figure 2. The number of customer compensations within the intervals of the GS2 regulation for normal weather conditions. (Each interruption is represented by its affected number of customers.)

The Swedish model (GL) gives 68 % higher compensation to customers than the UK model (GS) for a 30 hours interruption of supply during normal weather conditions as shown in Table 5.

Table 5. Compensations in the Swedish GL and UK GS regulation for a 30 hour interruption in Flymen.

Regulation	GL, Sweden	GS, UK Weather condition		
		Normal	Cat.1	Cat.2
Total compensation	€180 000	€107 000	€35 000	€0
Average comp./customer	€191	€113	€38	€0

Historical data for interruptions gives 75 % higher compensation with the Swedish model than the UK model. The main conclusion from this study is that the Swedish rule gives higher compensation to customer for outages than the UK model.

Paper 0740 from United Kingdom is addressing asset risk management from a good practice point of view as seen from the Regulator. It provides an account of Regulator interest in asset risk management and describes how good practice is going to be assessed and discuss how asset risk management interfaces with regulatory practice. The Regulator perceives a certification to be a measure of adequacy and to demonstrate competence in asset management. This believed to help provide assurance of long-term asset risk management and establish clarity of the policies and processes that underpin the investment

decisions of network companies. The feedback from DSOs that have attained certification is that they found the preparation and certification process valuable.

Paper 0795 from Thailand is about performance measurement of electricity supply during transition to deregulation. It presents a framework of measuring performance in a situation of deregulation. The organisation commitment is of great importance in the process. Understanding of the strategic paths leading to goal achievements is significant for the organisation. Determination of priority of indicators does not naturally take place in the organisation. In a process of indicator evaluation, correct data are needed.

Paper 0902 from Germany is presenting the network operation challenges faced with regulation claim of cost reduction and quality of supply. It deals with the analysis, modelling and optimisation of recourse management and its influence on quality of supply and total costs of network services. To handle these questions a mathematical model used in the analysis and presented. The regulatory rules related to quality given in figure 1.

Quality Regulation					
		GB	F	I	NOR
Guaranteed standards (GS)	multiple interruption	✓	✓	✓	
	max. restoration time	✓	✓		
	standard for planned	✓	✓		
	severe weather standards	✓ (2002)			
Overall standards (OS)	average standard	✓ (CI, CML)		✓ (CML)	✓ (ENS)
	improvement standard			✓	
	planned interruptions included	✓ (50%)			✓ (seperately)
continuity standards linked to tariffs		✓ (2002)		✓ (2000)	✓ (2001)

Table 1: Overview on quality regulation

The interruption profile the DSO has to consider shown in figure 2 below.

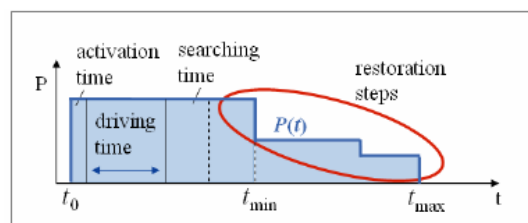


Figure 2: Interruption-profile MV/LV

By setting standards for the continuity of supply linked with outage of supply compensation the Regulator try to avoid cost pressure affecting the quality of supply. With the developed mathematical model for restoration process, it is possible to analyse the dependency between regulatory requirements and the operational strategy. The calculated average system quality of supply (CML) for one year in a given area, with and without exceptional events, and with variation of the number of resources available, is shown in figure 7.

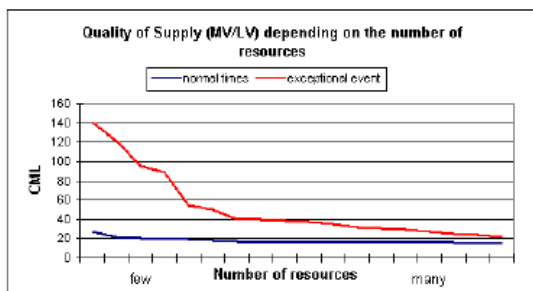


Figure 7: Frequency of faults (urban, semi-urban, rural)

Question 1: Are there possible improvements to be done in the regulatory framework?

Question 2: Is a common European regulation framework something to look for?

Table 1: Papers of Block 1 assigned to the Session

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
0007: Restructuring and regulation Impact on electricity distribution activity in Jordan				X
0010: An electricity supplier's obligations connected with the Romanian market under the electricity market liberalisation				X
0076: Use of System Charges Methodology and Norm Model for distribution system including DER	X			
0160: Replacement of the Ageing Asset Base – the Challenge to Regulators				X
0192: A tool to analyse the regulatory incentives on a distribution network operator on a project level	X			
0266: The Brazilian Electric Energy Free Market – Problems related to the transition from the captive condition				X
0269: The regulation and the processes of commercial losses of the Brazilian electric sector				X
0353: Evolution of regulatory framework for the Romanian electricity market				X
0356: Promoting Innovation in liberalised electricity markets				X
0380: Distribution Network Operator regulation – A Task-oriented approach	X			
0400: Unbundling of the Public Enterprise "Electric Power Industry of Serbia" with the emphasis on the role of the Electricity Trade Department				X
0418: Independence Plan of Distribution Companies "The new approach in Electrical industry in Iran"				X
0484: Research on the Regulation of China's Power Industry Marketization				X
0609: The impacts of recent amendments of electricity market legislation on electricity distribution business - Case Finland	X			
0677: A comparative study of regulation policies for interruption of supply of electrical distribution systems in Sweden and UK	X			
0740: Good practice asset risk management: a regulator's tale				X
0795: Performance Measurement of a Retail Electric Utility during a Transition Period: a Case in Thailand				X
0891: New Zealand's Power Sector Regulatory Environment – an Update				X
0902: Grid Operation in the contrary regulation challenge of cost reduction and supply quality	X			

Block 2: Distribution Companies adaptation to regulation and actions to cope with framework

Organisation and management

Paper 0016 from Portugal presents a report on a project on asset management from the point of organisational solutions with IT tools. The focus put on cost reduction and development of personnel skill involving new technical solutions for IT systems and organisational restructuring. The challenge is seen as having the needed information about the network situation also at the customer site. Further the new organising of the workforce in severe situations with many outages. A set of workstations are on hand to guarantee the actualisation and reliability of the information in the several systems and fields of activity, see figure 2.

FUNCTIONALITY	SYSTEM	WORKSTATION %
Management of materials	MM	49
Management of maintenance works	PM	25
Management of commercial	ISU	11
Others (SW4, Project)	SIT, DM,PS	15

Fig. 2 - Workstation

The goal of the utility were a global cost reduction about 20 %, interruption time (TIE) on more 60% and an increase of 15% in the clients/ workers ratio. The result shown in figure 6 below.

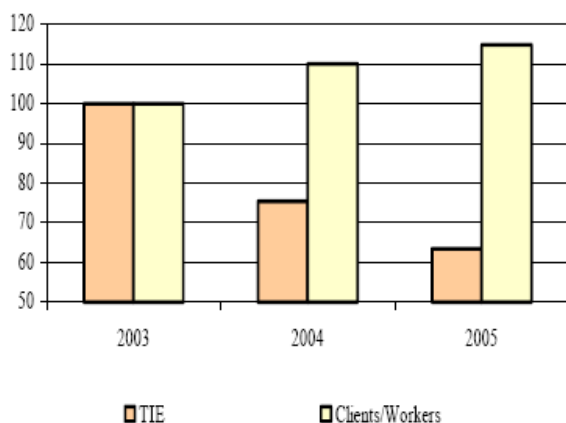


Fig. 6 – TIE and clients/workers

Paper 0182 from Romania describes an intelligent way for an effective human resources management based on team spirit development.

Paper 0318 from Russia describes a methodology for optimisation of planning of repair services in power lines. The method based on dynamic programming involves the

technical quality of the network together with the available financial resources to by analysis to find the optimal priority of projects.

Paper 0320 from Russia deals with problems related to efficiency serving the network organised in a manner to secure a reliable operation. It also discusses the normal operation related to an emergency case.

Paper 0589 from Croatia and Norway describes a training simulator that gives the opportunity for different participants with varying degree of market interest and competence to play and experience market behaviour and consequence. The South East European countries are currently restructuring the energy sector partly as integration with the EU countries. It is important to provide knowledge and skill to the region about new roles and responsibilities for the industry. Principles of the market simulator is shown in figure 1.

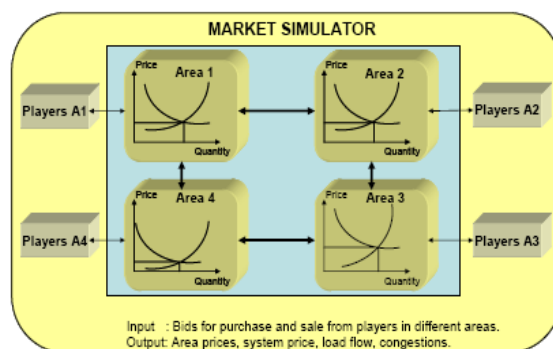


Figure 1. Market simulator

The idea of the method is to promote new business models and prepare for future free market activities.

Paper 0730 from Brazil describes a new training program integrating virtual reality making it possible to display customer- specific site situations virtually to create different learning scenarios. The representations provide information about the most important functions and operational problems of the various systems. The modules performed as a demonstration or as an interactive three-dimensional training resource.

Paper 0808 from Germany describes a new prototype of a virtual maintenance course in future education and training of power system personnel. Training programs integrating innovative techniques such as virtual reality. It is expected that virtual 3D visualization modules may be used intensively in electrical and power engineering in the future.

Paper 0904 from Serbia explains computerised maintenance management systems (CMMS) for power systems enabling full control time for maintenance and render useful reports for the management. The system used contributes in reducing cost of maintenance and in creating value for the company.

Paper 0912 from Argentina underline the importance of

international cooperation as the complexity of planning and operating of the electricity industries are increasing. The situation calls for a culture of shared knowledge. A rapid development in technology expected as well as demanding customers will create challenges for the power companies that are difficult to handle standing alone.

Benchmarking

Paper 0018 from Poland is on benchmarking applied for estimation of effects of management solutions in utilities. Benchmarking is not in common use in the country, but seen as a useful tool in improving the performance of the industry and expected to grow significantly as a part of the decision making processes. The report describes a method that enables objective comparative analysis of distribution companies according to the efficiency of energy distribution. The method said to give full reflection of possible differences between distribution companies.

Paper 0019 also from Poland describing benchmarking applied to evaluate customer satisfaction in distribution companies. The benchmarking was used among 8 companies and based on the establishing of a Customer Service Office in each. The employees trained according to a set of 10 rules related to the expected behaviour of the staff when confronted with the customers. The paper says little about the experiences so far.

Paper 0208 from Argentina presents a methodology using benchmarking as a tool for process improvements. In the benchmarking the best practice and present status are identified to establish “best performance” and to set objectives. The program is dynamic and updated each year together with an analysis of the results. The information reports presented as scoreboards like shown in figure 3.

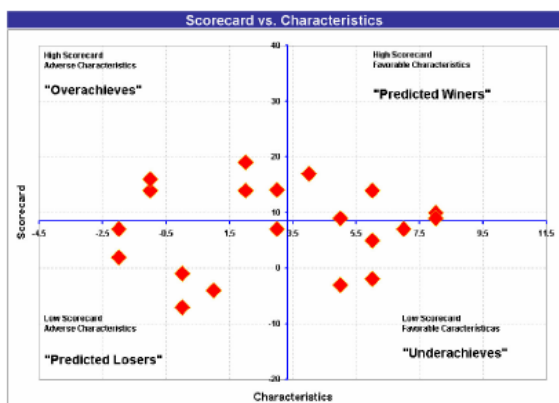


Figure 3: Scorecard and characteristics chart

For the different fields of activity in the company the development of cost within each activity presented as seen from figure 4 below.

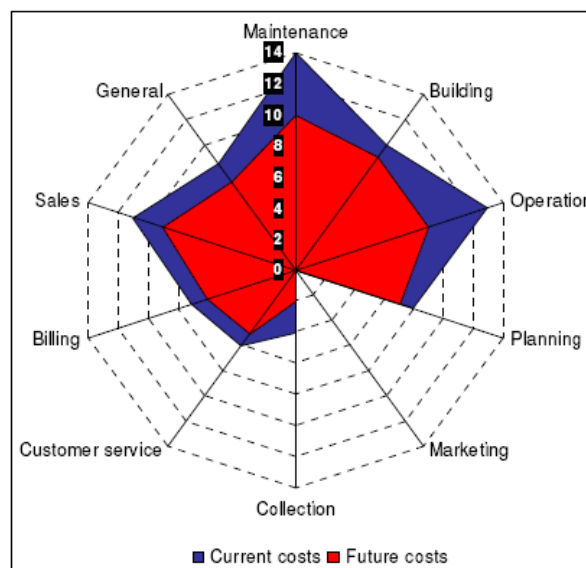


Figure 4: Cost reduction chart

Paper 0296 from France describes a benchmarking method to analyse the efficiency in the distribution companies as an approach to determine the cost drivers as a mean to assess efficiency at a regional level and to compare European utilities. The purpose is by the cost drivers to explain the cost differences between different operating units within the same network or between different utilities or countries. The method tested in France and internationally with good results. The method is a combination of other well known solutions. It does not care about hazardous expertise because it only built from the observed statistics relations that define the way each cost drivers affects cost.

Paper 0391 from Denmark presents the reporting requirements on quality of supply related to the continuity that has been effective since January 2006. It gives a description of development of the rules, and how the Regulator will implement the quality of supply parameters into the regulation. The intention of the Regulator is to apply a simple benchmarking of quality without losing the ability to ensure a sufficient level of quality. In order to achieve overall objectives a special methodology been developed.

Paper 0401 from Finland discusses the challenges in implementing benchmarking in economic regulation of the distribution companies in terms of efficiency parameters. Benefits and barriers of efficiency benchmarking studied, based on theoretical analysis and practical examples. The most critical aspects of the implementation of benchmarking presented. Benchmarking should provide companies with incentives to minimize their total cost included customer power outages as illustrated in figure 1.

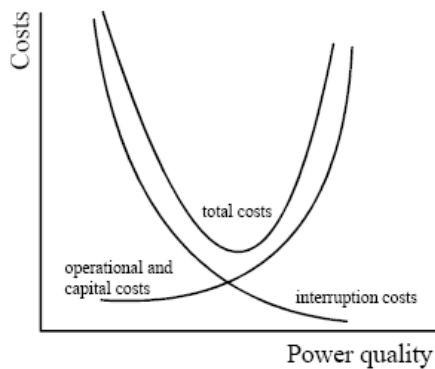


Fig 1. Total costs relative to the power quality level.

Asset management

Paper 0065 from the Netherlands presents a project on practical experience on implementing and certifying a State of the Asset Management approach. The drier for and the essentials of risk based asset management are introduced. The organising of the asset management model used shown in figure 1.

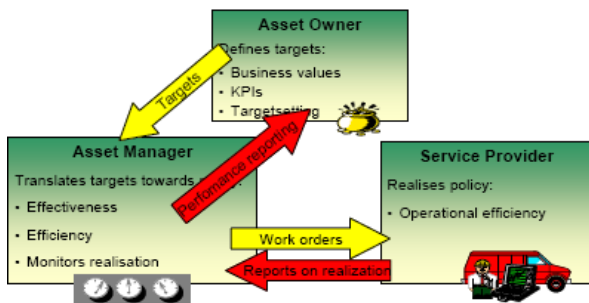


Figure 1. The Asset Management organization model

The process of acquiring desired certificates was organised and operated by staff inside the company. The processes described by working groups involved in the actual department. It took about 1,5 year to complete certification of the Asset Management Department even if the work did not have to start from scratch. The process covers the complete chain from risk identification to implementation of policies and evaluation of their progress and effectiveness seen in figure 2.



Figure 2. Essent Network's proprietary Risk Based Asset Management process

Responsibilities of the unites of Asset management Department for the steps of risk based asset management processes are depicted in figure 3.

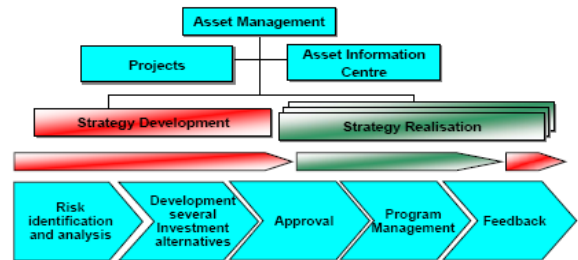


Figure 3. Allocation of the steps of the Risk Based Asset Management process over the Asset Management Department at Essent Network

Paper 0072 from Italy describes a new system applied on integrated plant design and contract management. The system based on defining process steps and sharing of information between network owner and contractors in charge of plant construction. The system operating and has shown synergies between process organisation and information system by achieving a full real-time bi-directional communication channel gaining efficiency and better control in management of work commitment between network owner and contractors.

Paper 0128 from Romania describes a methodology for determining the importance of the different network components by terms of electrical units and by using information existent in the database. By the hierarchy of nodes and lines according to their importance in the supply the information derived from this can be used in the decision -making regarding asset management like maintenance, priority of refurbishment and new investment.

Paper 0213 from United Kingdom outlines a radical approach to treatment of electrical losses in the network towards the energy market. Measures taken to reduce technical losses may, from an investment point of view, regarded as an alternative to investment in new peak generation capacity. Practically, the reduction of losses may be traded in the settlement system and open a new business area for the distribution network operator. The way the Regulators look upon the cost of losses in the different countries may promote such trading.

Paper 0316 from Russia discusses priority of investment in a group of alternative projects in a distribution company in an optimal manner. A logistic system for controlling financial flows for developing energy companies is essential. At the same time to secure the highest growth at lowest possible price and sufficient quality of supply.

Paper 0359 from Argentina describes a method for improvement of the technical losses calculation. The method based on the meter values at the different voltage levels in the total network and use of the data already accumulated in the IT network information system.

Paper 0434 from United Kingdom describes the development and status of a new International Energy Agency (IEA) Implementing Agreement on Electricity Network Analysis, Research and Development (ENARD). The paper concludes by summarising the range of benefits available for amongst others the DNO's, though participation in the Implementing Agreement.

Paper 0493 written by authors from Norway, Finland and France presents a framework of three main stages in the process of risk management for distribution companies. A description of risk related challenges for the DNO is also given. The work based on a survey performed among DNO's in Norway, Finland and France. Figure 1 illustrates these three main stages.

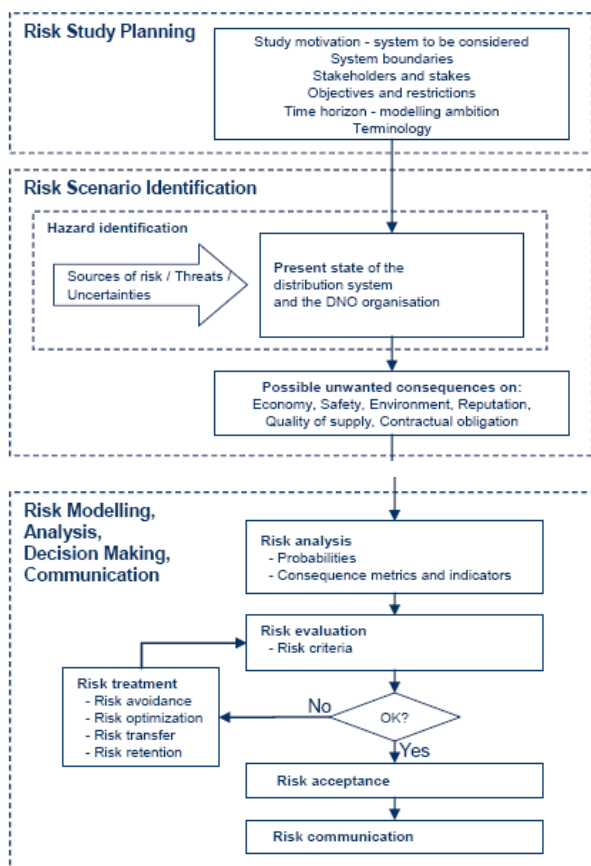


Figure 1 Distribution system risk management process

The risk management methodology presented shows good compliance with the perceptions of the DNO's. Challenges related to make the framework operational in practical use remain unsolved.

Paper 0596 from Slovenia describes a technical solution for implementation of Ethernet in MV/LV substations to improve and offer new services in the distribution sector. Wireless communication between the substations and the company intranet been evaluated in a pilot project to test the proposed solution. The first results show that the sufficient communication bandwidth is important.

Paper 0601 from Norway describes a study of two distribution companies how they organise the data collection procedures for their network information systems asking the question: in what way the outsourcing of network activities affect the quality of data. The paper concludes that benefits from outsourcing on data quality are minor. The indirect benefits are however considerable. The result depends to large extent on how the outsourcing is organised and managed, and on the commitment of the people involved.

Paper 0608 from France describes a prototype for interchange of needed data between the participants in the marketplace during deregulation regimes. The prototype highlighted that standards give different levels of facilitation for application deployment and interoperability between the actors sharing a common Unified Modelling Language. This R&D approach appears, according to the authors, as a proof of concept foreseeing what could be the future application lowering the integration cost of business processes like customer switching as seen in figure 1.

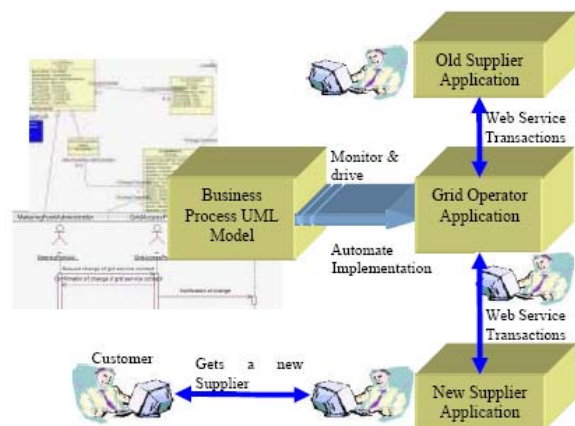


Figure 1: EDF R&D prototype for Customer Switching

Paper 0664 from Sweden presents results from a sensitivity study on the Swedish regulatory tool named Network Performance Assessment Model (NPAM) as an effect of variation in the input data. The NPAM estimates the cost operating a fictive reference network. This value then compared with the allowed revenue for the DNO according to equation 1 giving the output used by the Regulator.

$$Debiting\ rate = \frac{Revenue}{NPA}$$

Equation 1 – Output used by regulating authority

Simulations show that changes in the network design creating small divergences in the in input data could result in significant differences in the output data from the NPAM like values shown in Table 1.

Table 1 – Change depending of location

Location	The resulting change of NPA	
1	- 328 000 Euros	-0,23 %
2	0 Euros	0,00 %
3	+ 6 814 000 Euros	+ 4,7 %

This causes question raised about the robustness of the Swedish regulation method. The studies on the theme included in ongoing work for further clarification.

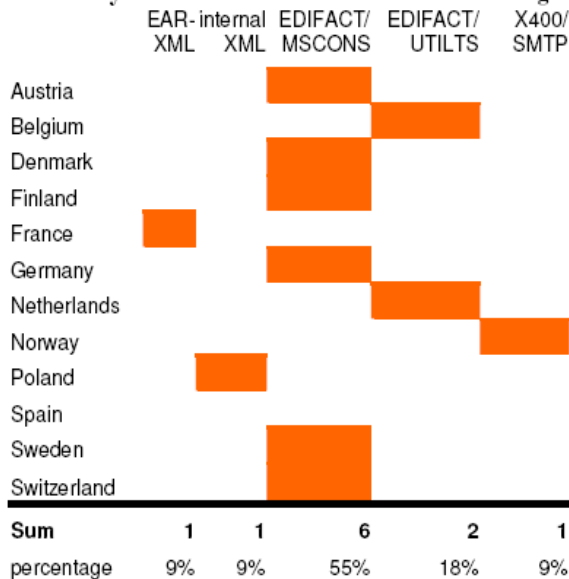
Paper 0711 from Portugal describes advanced management methodology regarding planning and operation of distribution network. The project is a joint Portuguese – Brazilian enterprise. Systems for management of planning studies, scheduling of real-time switching developed based on analysis, simulation and optimisation. Achievements from the method are among other; reduced energy operation cost, improved quality of supply, reduced staff operation cost and optimised investment policies.

Paper 0842 from Brazil describes a method how to handle thermal loads in transformers and voltage level problems by demand side management of hourly-seasonal customers during peak load periods. In context with regulatory rules the problems were solved by shifting the supply and the start of the reduced fee periods. As a result transformers service life is enlarged and a general improvement of voltage levels.

Paper 0905 from Germany describes a methodology for daily calculation of offers based on structured purchasing and portfolio management.

Paper 0906 from Austria presents the international trends and practical experience of metered data exchange between the various participants in the marketplace for electricity. It gives brief overview how modelling is working, which projects are relevant and results ready for use. Harmonisation of rules for exchange of metered data is a basic precondition for creation of a pan-European electricity market. A set of strategically important key documents to harmonise the processes and data content for data exchange and customer switching developed. Some syntaxes used shown in Table 1. The present solutions have proved satisfying results and the author recommends the Regulators should not invent new process definitions but make the present models international market rules.

Tab. 1: Syntaxes Used for Metered Data Exchange



Question 1: Is there still a potential for improvement of organisational efficiency- and how?

Question 2: Is there still a potential for economic gain in asset management – and how?

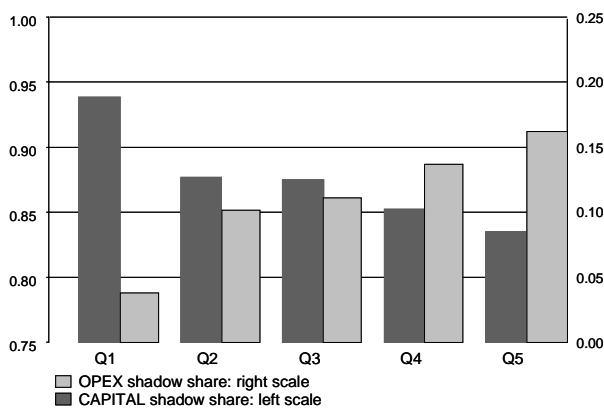
Table 2: Papers of Block 2 assigned to the Session	MS a.m.	MS p.m.	RIF	PS
0016: Organisational solutions with IT systems tools on assets management focusing reduction of costs and workers skills development (Project PSOA)...	X			
0018: Benchmarking comparative analysis used for estimation of effects of management in processes of the distribution of electrical energy in energy companies.				X
0019: The benchmarking evaluation of the customer satisfaction in the energy distribution company				X
0065: Implementing and Certifying a State of the Art Asset Management Approach – Practical Experiences	X			X
0072: Integrated design and contract management application system				X
0128: Quantifying the significance of elements from electric grids within the Romanian power system–A useful tool in the decision -making process				X
0182: Team spirit development: an intelligent way for an effective human resources management				X
0208: Benchmarking as a Tool for Process Improvement	X			
0213: Auctioning 'loss reductions' in the electricity markets				X
0296: Efficiency analysis on electricity distribution companies : a pragmatic and meaningful approach to determine the true cost drivers of utilities				X
0316: The making capital investments program logistic procedure in electricity distribution companies				X
0318: Optimization of planning repair services for power lines				X
0320: The problem of efficiency of servicing power systems				X
0359: Approach to the technical losses calculation				X
0391: Benchmarking Danish Network Operators on Quality of Supply				X
0401: Incentives and obstacles of implementing efficiency benchmarking in economic regulation				X
0434: ENARD:- International Action in Electricity Networks R&D				X
0493: A risk based approach to Distribution System Asset Management and a survey of perceived risk exposure among distribution companies	X			
0589: Knowledge transfer and a decision-making simulator for the European deregulated electricity market				X
0596: Implementation of Ethernet in MV/LV transformer stations				X
0601: Does outsourcing matter? Use of technology and procedures to enhance data quality in NIS for power grid companies				X
0608: Using interoperability standards ease design and automated deployment of Business Processes like Customer-switching				X
0664: A sensitivity study of the Swedish Network Performance Assessment Model investigating effects of changes in input data	X			
0711: Advanced management technologies for distribution planning and operation — a Portuguese-Brazilian cooperation project				X
0730: PM@Siemens: the Program, the Methodology and Culture Expansion of Project Management				X
0808: New Training Programs In Power Engineering Using VRML Visualization Methods				X
0842: Demand Management to Reduce Thermal Loads to Transformers and Voltage Level Problems				X
0904: CMMS For Power Supply				X
0905: Daily offer calculations based on structured purchasing				X
0906: International Trends in Metered Data Exchange and Practical Experience	X			
0912: Knowledge management: a new demand for public utilities of electric distribution session				X

Block 3: Customer service considering Commercial Quality and Quality of Supply regulation

Commercial quality and quality of supply

Paper 0146 from France presents a methodology for a benchmarking model that includes a quality of service indicator in terms of number of interruptions. The analysis is a preliminary step in a project investigating the feasibility of including quality measures into benchmarking models often used by regulatory authorities. The method based on defining only two input variables; capital input (CAPITAL) and non- capital input (OPEX). The methodology involves the estimation of input distance functions using Stochastic Frontier Analysis (SFA) and Data Envelope Analysis (DEA) techniques. Figure 2 shows average OPEX and CAPITAL values using SFA estimations.

Figure 2: OPEX and CAPITAL shadow shares



Note: SFA model estimates. Quintiles are by NINT/CUST.

It appears that distribution units performing lowest quality levels (Q5) are characterised by higher OPEX and lower CAPITAL shadow shares, while the opposite verified for operators reaching higher quality standards (Q1). Nevertheless, these results do not allow to conclude any correlation between the investment policy of a utility and the level of quality since they are inherently linked to the customer density (urban vs. rural) in the supplied area.

Paper 0181 and 291 from Malaysia describes an on going project to create an intelligent system for detection of abnormalities and probable fraud by metered customers. The method based on obtaining a list of abnormal users from the customer database by implementing a support vector machine (SVM), thus saving costs by limiting the inspections at customer site needed. The result seems promising with a prediction accuracy of more than 60 %.

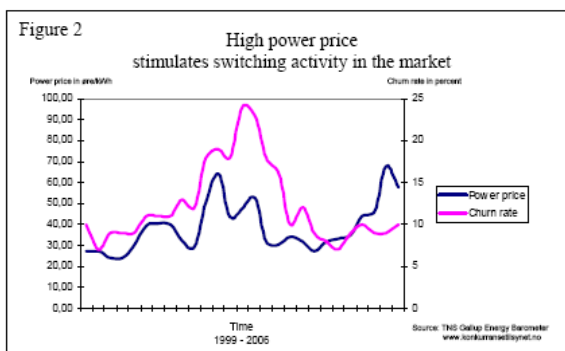
Paper 0319 from Russia reports issues related to the development of methods analyse and evaluate the consequences of emergency scenarios of the energy supply. Implementation of various controlling functions presented as a decision-making process including a number of procedures.

Paper 0390 from China describes present activities in the field of DSM and the importance of DSM in long-term planning in a region with rapid increase in power consumption. Concrete measures to set up the long-term constitution on power DSM evaluated.

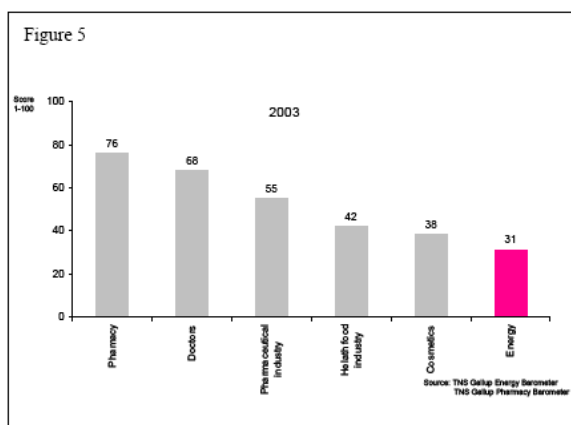
Paper 0424 from Egypt describes a methodology to model performance of electricity distribution companies. The model based on calculating correlation coefficients among the performance indicators and specifying a threshold for those coefficients to indicate proportionality relations. The relations provide a tool for assessing the regulatory actions impact on the DNOs in question. The evaluation carried out whether from reliability or efficiency perspective.

Paper 0487 from India describes a tool for load forecasting named Generalised Regression Neural Network. The tool been used for short term load forecasting using hour and day indicators, temperature data and electric price signals as input. Results show the method able to forecast accurate future loads using price and temperature as input. Further development of the tool is taking place and improvements are expected.

Paper 0499 from Norway presents an example regarding experience in the marketplace of the deregulation and free market situation for electricity. The question asked is to what extent the deregulation of power market affected behaviour of customers and their attitudes towards the power sector. The paper is focusing on the switching behaviour of customers and their confidence in the industry. Figure 2 displays the switching related to the price of power. The findings show that the switching stimulated by the variation in power prices. In figure 5 the confidence of the power industry compared with other industries. The experiences provide insight into and an understanding of what challenges deregulation may present in a marketplace.



Percentage of household customers who have changed their power supplier during the last 12 months and power price development.



There is little confidence in the Norwegian power industry compared to the other industries TNS Gallup has measured.

The customer positive attitude towards liberalised market for electricity has declined from 50 to 35 % over the last 3 years and a majority of customers believe that liberalisation has been of little practical relevance to them as consumers. This seems to be challenging also to the authorities.

Paper 0549 from Finland discusses infrastructure as the electricity supply in a context of security and society. There is no common approach on how to analyse security or vulnerability of electricity distribution on an EU level. To understand power system failures indicators and probabilistic models on the vulnerability of supply systems needed. In addition a deeper understanding and diagnoses of the fears in society and recommendations on both supply and consumer side ought to react before and during crises.

Paper 0599 from Finland is addressing the same question as previous paper from the point of regulation. Consequences of recent large disturbances of supply have shown varies attitude towards the acceptable level of quality and security of supply. Amendments to legislation

and regulation have caused economic strain on DNOs to compensate for customer cost due to outages at the same time improved the status of the consumer. Further, to guide the companies to be better prepared for major disturbances like nature catastrophes.

Paper 0620 from Norway describes studies made on demand response to variable tariffs during periods with shortage of power in the electricity market. The study is made on 4 different alternatives of response based on remotely controlled and automatic load shifting and fixed tariffs with a return option. The method implements automatic meter reading and two-way communication. The main objective is to explore customer acceptance and load curve impact of economic incentive given.

Paper 0632 from Sweden presents a study made on actual customer confidence regarding the power industry and measures taken to regain lost consumer confidence and satisfaction. Opinion polls made on customer confidence was rather little flattering for the industry like points below.

- We do not put the customers first (60%)
- We do not use reader-friendly wording and terms (50%).
- We do not take our responsibility (44%).
- We have no strong commitment to the environment (44%).

The industry has launched a program covering 33 points for joint action aimed at regaining customer confidence. Later some of the points ratified as new law or adapted as internal industry recommendations. Due to these actions improved customer satisfaction observed, like by 15% over the last years in the field of customer-perceived readability of billing information. Further improvements expected in a longer term. The program also resulted in improvements in the day-to-day operation in the companies paved the way for better customer service.

Paper 0701 from Portugal presents an analysis of a multiple issues of power quality based on an example of power quality regulation in Portugal. Regulatory approaches taken on power quality described and application results evaluated pointing out the identified difficulties, the adopted solutions and the issues needing short-term addressing. Figure 1 show a solution for penalty and reward in case of deviation from norm quality.

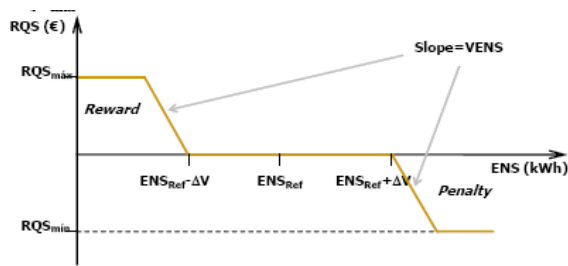


Fig. 1: Portuguese incentive scheme for continuity of supply improvement.

Table 1 show corresponding incentive scheme parameters.

ENS_{REF} (2003-2005)	$0,0004 \times ES$
ENS_{REF} (2006)	$0,00019 \times ES$
ENS_{REF} (2007)	$0,000175 \times ES$
ENS_{REF} (2008)	$0,000161 \times ES$
ΔV	$0,12 \times ENS_{REF}$
VEND	1,5 €/kWh
$ RQS_{max} = RQS_{min} $	5 000 000 €

Table 1: Incentive scheme parameters

An expressive reduction on the number of interruptions and minutes lost per consumer attained in the period 2001 to 2005 together with a clear reduction in network tariffs.

Paper 0798 from Thailand describes a program for organisational training and joint research of a retail utility based upon a cooperation project between the utility and university. Criteria for success in the program was motivation by people involved, sufficient qualifying test during and after the training period and necessary financial resources.

Paper 0864 from Colombia describes a methodology for power market monitoring based on regulation. An IDEFO modelling tool is applied to for structured representation of power market regulatory information allowing identifying indicators and variables to perform regulatory studies. The methodology is still experimental and at development stage.

Paper 0911 from Sweden presents a number of actions taken to improve customer relation in terms of quality of customer communication and customer quality of service. Finding the customer dissatisfaction growing in the past energy companies started a program with aim of increasing improving the situation. Figure 1 show the level and the development over some years measured against a satisfaction index.

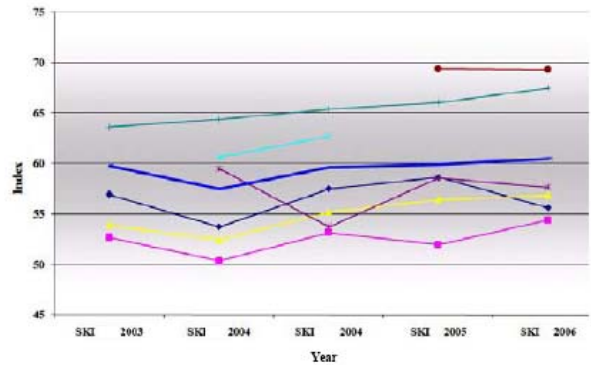


Figure 1. Customer satisfaction for a number of energy companies in Sweden.

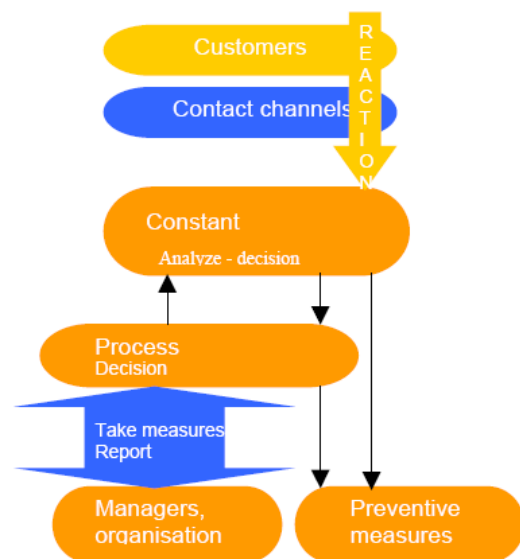


Figure 3. The process for registration and management of customer reactions.

Based on this fact a number of projects started within the program. The objective was to improve customer satisfaction. Figure 3 show the process for registration and management of reactions. Implementation of the program shows a positive change in attitude towards the industry.

Pricing of network services

Paper 0206 from United Kingdom describes the pricing for distribution network charges based on long-run incremental cost development.

Paper 0234 from Russia is dealing with fixing of distribution service prices separately from energy supply prices. Use of normative indicators makes it possible to do the organisational and technical needed to reduce the number and duration of outages in supply.

Paper 0336 from United Kingdom describes an incremental cost-related pricing model for electrical network related to economic use-of system charging. The model meets a number of assessment criteria. Part of the pricing methodology is network expansion planning, the aim to determine timing, volume and cost of future reinforcement. The nodal charges can be either positive or negative giving an economic signal to customers where to connect.

Paper 0423 from United States describes how geographical information systems (GIS) can improve a number of customer care processes. By activities like new customer connect GIS can significantly improve customer service. This also the case by meter reading including rollout of automated meter reading systems, credit and collections, customer analytics, billing and customer communication. GIS is about empowering the DSO to fully care for its customers in the most cost effective and intelligent way

Paper 0476 from United Kingdom describes a method for economic charging for electricity distribution networks. It uses a full AC load flow and N-1 security assessment to identify reinforcement needs and timings. Increments of demand and generation added into the model to identify change in timing of future investment. This is used to derive incremental annual charges for consumption and generation connections. Chart 1 shows examples of nodal prices.

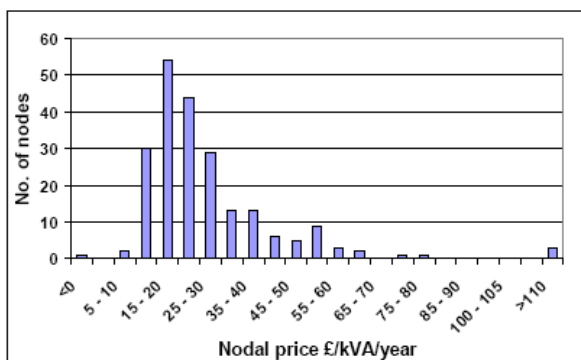


Chart 1: Distribution of EHV nodal prices for winter peak conditions

The method produces among other results cost reflective forward-looking charges.

Paper 0617 from Argentina addresses special services rendered by the industry not explicitly remunerated in the tariffs. Customers in question representing heavy load during start up periods causes technical and economic impact on the design of network. Such consumption also may cause problems regarding quality of supply to other customers connected to the same network.

The paper analyse tools offered by present regulation in these cases proposing alternatives to regulation to provide integral solutions to this type of customers.

Paper 0634 from Spain presents an analysis on distribution repayment regulation in several different power markets deregulated. It describes the problems and advantages the repayment regulation has presented from the point of view of both the distribution industry and the Regulators. The objective is to examine the parameters that should formulate the repaying model that could be applicable for the industry today as well as in the future.

Paper 0717 from China describes and compares method of long-run incremental cost pricing with investment cost-related pricing for electricity distribution network. It demonstrated that long-run incremental cost pricing methodology gives better economic signals regarding ability to reflect the extent of use of the system instead of merely dependent of the length of the circuit.

Paper 0790 from United Kingdom describes a long-run marginal cost (LRMC) pricing model for distribution network based upon both active and reactive use of power in the network. The methodology reflects the long-term cost/benefit of a producer or a consumer based on AC power flow in the line and is according to the author capable of deriving economically efficient charges by encouraging customers to improve their power factor.

Paper 0819 from Colombia describes a methodology applied on monitoring the Latin American electricity market. Indicators and variables related to statistical information in the marketplace obtained and organised in categories as production, infrastructure, consumption and economic environment.

Paper 0838 from Iran discusses the benefit and drawback of metering and billing methods seen from the viewpoint of the supplier. The method of metering kVAh recommended.

Question 1: Can we improve customer relation further and eventually in what way?

Question 2: In what way can we reduce network pricing further?

Table 3: Papers of Block 3 assigned to the Session

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
0146: Incorporating quality of service in productivity measurement: With application to French electricity distribution operators		X		
0181: Intelligent System for Detection of Abnormalities and Probable Fraud by Metered Customers				X
0206: Benefits of Long-run Incremental cost Pricing for distribution network charges				X
0291: Abnormalities and Fraud Meter Reading Detection Using Hybrid SVM-MGA				X
0319: Analysis and evaluation of the consequences of poor quality power supply of consumers				X
0324: Fixing prices for energy distribution services separately from energy supply prices				X
0336: Improved Incremental Cost Related Pricing Model for Use-of-System Pricing				X
0390: Management The DSM Through A New Idea — “Demand Responding”				X
0423: GIS Enhances Electric Utility Customer Care				X
0424: Behavioural Performance Modeling for Electricity Distribution Companies				X
0476: Economic Charging Method for Electricity Distribution Networks				X
0487: An Approach to Short Term Load Forecasting using Market Price Signal				X
0499: The Norwegian power industry's reputation in a deregulated market		X		
0549: Infrastructure, security and society – energy perspective				X
0599: Societies’ reactions to large disturbances				X
0617: Special services that are not remunerated in rates				X
0620: Market Based Demand Response End User involvement and technology experiences from Norwegian pilots				X
0632: Regaining the customers’ confidence		X		
0634: Distribution Repayment Regulation Analysis in Several Power Markets Deregulated		X		
0701: Electricity sector evolution and power quality regulation - The Portuguese experience		X		
0717: Comparison between Long-run Incremental Cost Pricing and Investment Cost-related Pricing for Electricity Distribution Network				X
0790: LRMC pricing based on MW+MVAR-Miles methodology in open access distribution network				X
0798: Organisational Learning Programme of a Large Retail Electric Utility in Thailand				X
0819: Monitoring methodology Latin American electric markets				X
0838: apparent energy & demand tariff				X
0864: Monitoring Electricity Markets through Regulation using IDEF0 Language.				X
0911: Commercial quality: customer focus and improved customer communication		X		

Block 4: Automatic Meter Reading systems and metering data application - AMR

Paper 0186 from Sweden presents examples of potential problems like interfering signals and attenuation with power line communication in the context with remote meter reading. The paper presents three fields of challenges as displayed below.

- *The noise level is too high for the information to reach the receiver*
- *The attenuation at the frequencies used for communication is too high. Several cases have been identified where this made communication impossible. Certain types of end-user equipment cause a large attenuation of the communication signal, so that a too small amount of the signal reaches the receiver*
- *Interference with other equipment. A flicker problem was found due to a modulated 100-Hz signal used for communication*

Figure 2 show the attenuation made from a server connected.

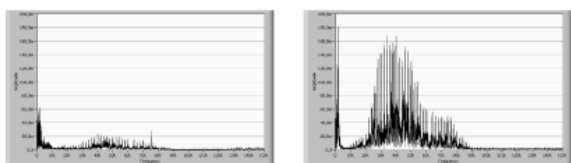


Figure 2, left, communication with the server connected, right, communication when the server was disconnected.

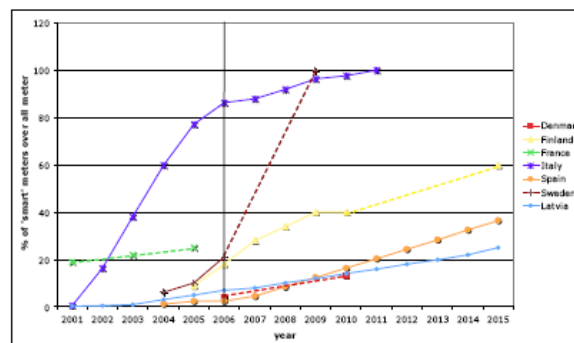
Table 1 show impedance requirements dependant of the length of a cable.

Cable length (m)	Minimum Z (Ω)	Resonance Frequency (kHz)
0	0.30	78.6
1.8	0.35	73.4
3.6	0.44	68.0
7.2	0.58	61.4
25.8	0.90	45.8
45.8	1.27	38.0

Table 1, minimum impedance for the resonance frequency with different cable lengths.

It is of importance to address the problems described at an early stage before widespread implementation of power-line communication for remote meter reading.

Paper 0343 from Austria presents challenges regarding new metering models like automatic meter reading (smart metering). Modern meters can support many requirements in a deregulated energy market and improve efficiency. Graph 1 show the amount of smart meters implemented.



Graph 1: % of smart meters over all meters installed

The many stakeholders to meter values also raises question about the organising of metering operation. Figure 2 show a possible model with a separate entity as a meter service provider.

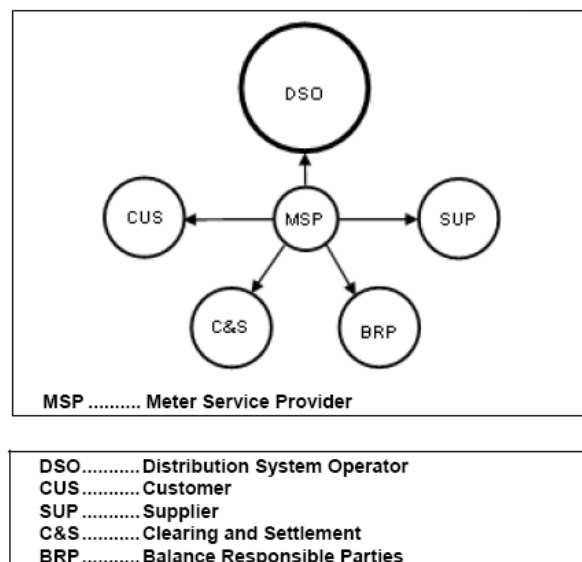


Figure 2: Metering Model – Meter Service Provider

Smart metering and two-way communication is expected to be essential in the free market operation and regulation in the future.

Paper 0396 from Denmark presents challenges regarding the quality assurance of metering data in context to remote meter reading of residential customers. The question calls for development of rules and procedures to ensure the quality and reliability of metered data. Figure 1 show in principle the transfer of data from meter to operator. Establishment of automatic meter reading (AMR) involves a large number of new installations and data transmitted over public network with the danger of unauthorised use or distortion of the data. Rules followed by necessary technical solutions are of high importance.

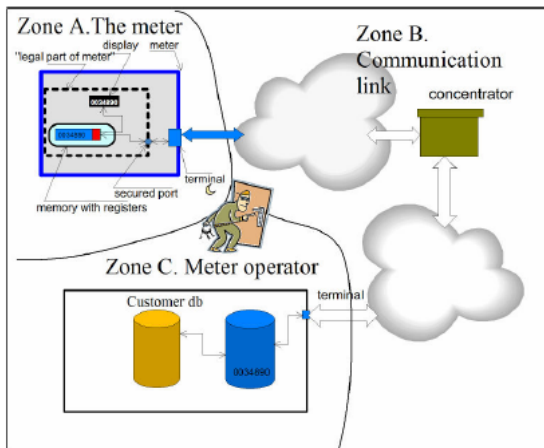


Figure 1 Data transfer from meter to meter operator

Paper 0437 from Italy presents a status of regulation of smart meters and automated meter management systems in the country. Based on regulation requirements a replacement program made effective. Table 1 show the schedule for installation of AMR.

Phase	Percentage of electronic meters installed	By (date)
1	25%	31 December 2008
2	65%	31 December 2009
3	90%	31 December 2010
4	95%	31 December 2011

Table 1 - Plan for the installation of electronic meters with IV customers

In a consultation document important subjects are addressed, as data content, billing periods, data format and communication channel.

Paper 0448 from Spain presents a large roll out project on metering data operation. The complexity of such projects calls for new applications for carrying out installation, operation and maintenance in an efficient manner.

Paper 0560 from Finland describes a project with use of advanced AMR system in management of low voltage distribution network. Using AMR as a smart terminal unit and two-way communication makes it possible to use the system as distribution automation for managing also the low voltage network in case of surveillance og faults and quality.

Paper 0580from Finland describes a study of understanding the business framework for energy measurement in a deregulated environment. A study of life cycle cost for 11 different kind of metering activities carried out. The study concludes that AMR investments may decrease the operational cost when implementation is made considering all aspects of the metering cost.

Paper 0653 from Switzerland describes the possibilities of making investments in the communication sector economically beneficial though cooperation and multipurpose use of existing communication facilities. The development of remote control of energy distribution networks and remote meter reading is one field where such approach could be valuable.

Paper 0685from Switzerland describes use of PLC as a cost effective communication technology supporting automatic meter reading. Smart standards enable the distribution companies to keep control over the communication backbone for crucial business processes.

Paper 0752 from Sweden describes a framework for evaluating Device Management functionality for instalment of AMR systems. A simplified modelling is proposed together with an evaluation algorithm based on extended evidential reasoning. The paper concludes with a description of an application on AMR installation.

Paper 0753from Sweden presents an assessment framework for information security in AMR systems. The result is a set of indicators highlighting the level of security within the system. Figure 1 gives an example of management of passwords in the system.

11.5.3 Password Management System

Control
Systems for managing passwords should be interactive and should ensure quality passwords.

Implementation guidance
A password management system should

- 1.Enforce the use of individual user IDs and passwords to maintain accountability
- 2.Allow users to select and change their own passwords and include a confirmation procedure to allow for input errors
- 3.Enforce a choice of quality passwords
- 4.Force users to change temporary passwords at first login
- 5.Maintain record of previous passwords to prevent re-use
- 6.Not display passwords on the screen when being entered
- 7.Store password files separately from application system data
- 8.Store and transmit passwords in protected (e.g. encrypted or hashed) form

Other information
Passwords are one of the principal means of validating a user's authority to access a computer service.

Figure 1 Example of a clause from [2] regarding how passwords should be managed.

Figure 2 show an example of property breakdown.

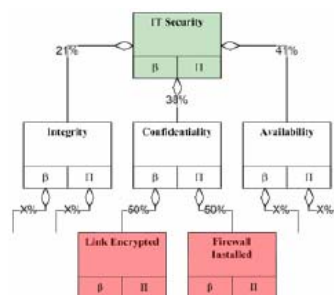


Figure 2 Simplified ATD for the abstract property IT Security..

The framework been applied successfully at a large company.

Paper 0781 from Romania describes a project concerning analysis of aggregated hourly energy patterns for assisting a load-profile approach in the electricity market regulation.

Paper 0835 from Canada describes how new communication technologies have used resent in the distribution companies around the world to provide integrated monitoring and control of network.

Paper 0871 from Iran describes the use of AMR system for the purpose of measure and separate the parts of distribution network losses. Reduction of energy losses is essential to the industry. The project aimed at measuring and separating losses at low voltage.

Question 1: Which entity in the industry should be the meter service provider

Question 2: Do we see new application areas in the network services from the AMR and two-way communication?

Table 4: Papers of Block 4 assigned to the Session

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
0186: Attenuation and noise level - potential problems with communication via the power grid		X		
0343: Smart Metering requires smart regulation		X		
0396: Remote Meter Reading of Residential Customers, quality assurance of the metering data		X		
0437: Regulation of smart meters and Automated Meter Management systems in Italy		X		
0448: Large roll-out project: Metering data operation		X		
0560: Using advanced AMR system in low voltage distribution network management				X
0580: Comparison of life-cycle costs of energy metering processes				X
0653: Clever usage of existing resources to make happens remote control of energy distribution networks and automatic meter reading				X
0685: Smart standards support advanced metering				X
0752: Evaluating Device Management capabilities in Large scale AMR installations using evidential reasoning				X
0753: Use of Evidential Reasoning in Assessment of Information Security Levels in AMR System installations		X		
0781: Customer classification and load profiling for a large supply company				X
0835: New Technologies in Metering for Open Networks				X
0871: The use of AMR system for the purpose of measure and separate the parts of distribution networks losses				X