the CPN. The unfaulted but out-of-service zones will be restored as much as possible with the proposed switching operation plan. The short-term load forecast of each service zone is also included in the restoration strategy. A Taipower distribution system with 68 feeders is selected for computer simulation to demonstrate the effectiveness of the proposed CPN model to solve the service restoration of distribution system.

05/02562 Measuring market power in electricity generation: A long-term perspective using a programming model
Tamaschke, R. et al. Energy Economics, 2005, 27, (2), 317–335.
This paper focuses on measuring the extent to which market power has been exercised in a recently deregulated electricity generation sector. The study emphasizes the need to consider the concept of market power in a long-run dynamic context. A market power index is constructed focusing on differences between actual market returns and long-run competitive returns, estimated using a programming model devised by the authors. The market power implications of hedge contracts are briefly considered. The state of Queensland, Australia, is used as a context for the analysis. The results suggest that generators have exercised significant market power since deregulation.

05/02563 Meeting electrification's social objectives in South Africa, and implications for developing countries
Gaunt, C. T. Energy Policy, 2005, 33, (10), 1309–1317.
Electrification programmes and projects are usually planned and evaluated on the basis of their economic (financial) and socio-economic performance. It is not usually recognized that electrification is often carried out for social objectives of poverty alleviation and political effect. Examination of electrification in South Africa reveals clearly that initial electrification was to meet economic objectives, later socio-economic objectives were adopted, and recently the objectives were social. Social electrification, particularly rural electrification, is not viable according to usual assessment methods, which are frequently distorted to provide the justification for a project to proceed. The technology of network electrification changed to meet the constraints, challenging usual perceptions about the relative costs of urban and rural electrification and the potential for photovoltaic electrification. Adopting a specification for social electrification allows suitable tariffs for electrification to be identified, indicates how capital investment decisions might be modified for social electrification, and identifies implications for electricity industry restructuring. A better understanding of electrification's social objectives has implications for projects and programmes in other developing countries.

05/02564 Modelling the non-linear response of Spanish electricity demand to temperature variations
Moral-Carcedo, J. and Vicéns-Otero, J. Energy Economics, 2005, 27, (3), 477–494.
The demand for electricity is a key variable because its links to economic activity and development; however, the electricity consumption also depends on other non-economic variables, notably the weather. The aim of this study is to analyse the effect of temperatures on the variability of the Spanish daily electricity demand, and especially to characterize the non-linearity of the response of demand to variations in temperature. This article explores the ability of Smooth Transition (STR), Threshold Regression (TR), and Switching Regressions (SR) models, to handle both aspects. As the authors conclude, the use of LSTR approach offers two main advantages. First, it captures adequately the smooth response of electricity demand to temperature variations in intermediate ranges of temperatures. Second, it provides a method to analyse the validity of temperature thresholds used to build the 'cooling degree days' (CDD) and 'heating degree days' (HDD) variables traditionally employed in the literature.

05/02565 Network access charges, vertical integration, and property rights structure-experiences from the German electricity markets
Growitsch, C. and Wein, T. Energy Economics, 2005, 27, (2), 257–278.
After the deregulation of the German electricity markets in 1998, the German government opted for a regulatory regime called negotiated third party access, which would be subject to ex-post control by the federal cartel office. Network access charges for new competitors are based on contractual arrangements between energy producers and industrial consumers. As the electricity networks are incontestable natural monopolies, the local and regional network operators are able to set (monopolistic) charges at their own discretion, restricted only by the possible interference of the federal cartel office (Bundeskartellamt). This paper analyses if there is evidence for varying charging behaviour depending on the supplier's economic independence (structure of property rights) or its level of vertical integration. For this purpose, the authors hypothesize that incorporated and vertically integrated suppliers set different charges than independent utility companies. Multivariate estimations show a relation between network access charges and the network operator's economic independence as

well as level of vertical integration: on the low voltage level for an estimated annual consumption of 1700 kW/h, vertically integrated firms set – in accordance with the proposed hypothesis – significantly lower access charges than vertically separated suppliers, whereas incorporated network operators charge significantly higher charges compared to independent suppliers. These results could not have been confirmed for other consumptions or voltage levels.

05/02566 Network-constrained Cournot models of liberalized electricity markets: the devil is in the details
Neuhoff, J. et al. Energy Economics, 2005, 27, (3), 495–525.
Numerical models of transmission-constrained electricity markets are used to inform regulatory decisions. How robust are their results? Three research groups used the same data set for the northwest Europe power market as input for their models. Under competitive conditions, the results coincide, but in the Cournot case, the predicted prices differed significantly. The Cournot equilibria are highly sensitive to assumptions about market design (whether timing of generation and transmission decisions is sequential or integrated) and expectations of generators regarding how their decisions affect transmission prices and fringe generation. These sensitivities are qualitatively similar to those predicted by a simple two-node model.

05/02567 On the efficiency of US electricity usage since 1900
Ayres, R. U. et al. Energy, 2005, 30, (7), 1092–1145.
This article reconstructs the history of electric power uses in the US from 1900 to 1998 from a number of different sources of data. The uses are grouped into functional categories, viz. lighting, electrolysis, high temperature heat (electric furnace applications), low temperature heat (space heating and hot water), motor drive and electronics (radio, TV and information processing). Motor drive accounts for by far the largest absolute share of consumption, while low temperature heating is by far the most rapidly increasing application. The authors were able to subdivide motor drive into transportation applications (very important in the early years), air-conditioning and refrigeration, and 'other', but a further breakdown has not been possible, based on available data. The article also estimates the efficiency of conversion from electric power to 'secondary work' for each application, based on historical data (where available) and the estimates. Finally, The authors develop an estimate of the overall conversion efficiency of electricity to secondary work. Surprisingly, the overall efficiency has remained almost constant during the past century, even though all individual applications have become more efficient, because the least efficient applications (low temperature heat and fractional horsepower motors) have sharply increased their share.

05/02568 Optimal designs of small CHP plants in a market with fluctuating electricity prices
Lund, H. and Andersen, A. N. Energy Conversion and Management, 2005, 46, (6), 893–904.
Combined Heat and Power production (CHP) are essential for implementation of the climate change response objectives in many countries. In an introduction period, small CHP plants have typically been offered fixed electricity prices, but in many countries, such pricing conditions are now being replaced by spot market prices. Consequently, new methodologies and tools for the optimization of small CHP plant designs are needed. The small CHP plants in Denmark are already experienced in optimizing their electricity production against the triple tariff, which has existed for almost 10 years. Consequently, the CHP plants have long term experience in organizing when to switch on and off the CHP units in order to optimize their profit. Also, the CHP owners have long term experience in designing their plants. For instance, small CHP plants in Denmark have usually invested in excess capacity on the CHP units in combination with heat storage capacity. Thereby, the plants have increased their performance in order to optimize revenues. This paper presents the Danish experience with methodologies and software tools, which have been used to design investment and operation strategies for almost all small CHP plants in Denmark during the decade of the triple tariff. Moreover, the changes in such methodologies and tools in order to optimize performance in a market with fluctuating electricity prices are presented and discussed.

05/02569 Optimal electricity price calculation model for retailers in a deregulated market
Yusta, J. M. et al. International Journal of Electrical Power & Energy Systems, 2005, 27, (5–6), 437–447.
The electricity retailing, a new business in deregulated electric power systems, needs the development of efficient tools to optimize its operation. This paper defines a technical-economic model of an electric energy service provider in the environment of the deregulated electricity market in Spain. This model results in an optimization problem, for calculating the optimal electric power and energy selling prices that maximize the economic profits obtained by the provider.

This problem is applied to different cases, where the impact on the profits of several factors, such as the price strategy, the discount on tariffs and the elasticity of customer demand functions, is studied.

05/02570 Placement of distributed generators and reclosers for distribution network security and reliability

Popovic, D. H. *et al. International Journal of Electrical Power & Energy Systems*, 2005, 27, (5–6), 398–408.

Electricity market restructuring, advances in energy generation technology and agreements on the reduction of global greenhouse gas emissions have paved the way for an increase in the use of distributed generation. This paper formulates and discusses a methodology for the optimal siting of distributed generators and reclosers that a security and reliability constrained distribution network can accept. Optimal siting is determined by sensitivity analysis of the power flow equations. The sizing method for a set of loading conditions, generation penetration level and power factor is formulated as a security constrained optimization problem. The information on optimal generation sites is used further to optimize system reliability assessed via reliability indices calculation. A genetic algorithm is designed to solve for optimal recloser positions when distributed generators are deployed in a securely optimal manner.

05/02571 Power flow and loss allocation for deregulated transmission systems

Teng, J.-H. *International Journal of Electrical Power & Energy Systems*, 2005, 27, (4), 327–333.

This paper proposes a systematic method to allocate the power flow and loss for deregulated transmission systems. The proposed method is developed based on the basic circuit theories, equivalent current injection and equivalent impedance. Four steps are used to trace the voltages, currents, power flows, and losses contributed by each generator sequentially. Using this method, the real and reactive power on each transmission lines and their sources and destinations can be calculated. The loss allocation of each line, which is produced by each generator, can also be obtained. Test results show that the proposed method can satisfy the power flow equation, the power balance equation and the basic circuit theories. Comparisons with previous methods are also provided to demonstrate the contributions of the proposed method.

05/02572 Power sector reforms in Brazil and its impacts on energy efficiency and research and development activities

Jannuzzi, G. D. M. *Energy Policy*, 2005, 33, (13), 1753–1762.

Since the mid-1990s Brazil has implemented significant changes in the country's power sector, including privatization, introduction of competition and the creation of regulatory agency. As reform started in Brazil traditional support to energy efficiency and energy research and development suffered a discontinuation, budget cuts and re-definition of roles of the public agents in charge. At the same time, new regulatory measures and the creation of a national public interest fund have helped to maintain and potentially enhance the country's effort to promote energy efficiency and investments in energy R&D. This paper analyses the impacts of these changes in the areas of energy efficiency and energy research and development and argues for an increased role of developing countries to provide solutions for a meeting energy demand requirements more suitable to their internal markets.

05/02573 Power source roadmaps using bibliometrics and database tomography

Kostoff, R. N. *et al. Energy*, 2005, 30, (5), 709–730.

Database Tomography (DT) is a textual database analysis system consisting of two major components: (1) algorithms for extracting multi-word phrase frequencies and phrase proximities (physical closeness of the multi-word technical phrases) from any type of large textual database, to augment (2) interpretative capabilities of the expert human analyst. DT was used to derive technical intelligence from a Power Sources database derived from the Science Citation Index. Phrase frequency analysis by the technical domain experts provided the pervasive technical themes of the Power Sources database, and the phrase proximity analysis provided the relationships among the pervasive technical themes. Bibliometric analysis of the Power Sources literature supplemented the DT results with author/journal/institution/country publication and citation data.

05/02574 Short term and medium term power distribution load forecasting by neural networks

Yalcinoz, T. and Eminoglu, U. *Energy Conversion and Management*, 2005, 46, (9–10), 1393–1405.

Load forecasting is an important subject for power distribution systems and has been studied from different points of view. In general, load forecasts should be performed over a broad spectrum of time intervals, which could be classified into short term, medium term and long term forecasts. Several research groups have proposed various techniques for either short term load forecasting or medium term load forecasting

or long term load forecasting. This paper presents a neural network (NN) model for short term peak load forecasting, short term total load forecasting and medium term monthly load forecasting in power distribution systems. The NN is used to learn the relationships among past, current and future temperatures and loads. The neural network was trained to recognize the peak load of the day, total load of the day and monthly electricity consumption. The suitability of the proposed approach is illustrated through an application to real load shapes from the Turkish Electricity Distribution Corporation (TEDAS) in Nigde. The data represents the daily and monthly electricity consumption in Nigde, Turkey.

05/02575 Short- and long-run demand for energy in Mexico: a cointegration approach

Galindo, L. M. *Energy Policy*, 2005, 33, (9), 1179–1185.

The objective of this paper is to estimate the demands for the different types of energy consumption for the Mexican economy over the period 1965–2001. These demands are modelled as a function of output and the own real price. The Johansen procedure and the likelihood ratio tests indicate the existence of long-run and stable relationships between each type of energy demand and income with the exception of the industrial sector where the co-integrating vector also includes the relative prices. The weak exogeneity tests indicate that energy consumption and income do not reject the null hypothesis of weak exogeneity when relative prices are weak exogenous. The final econometric models show that relative prices in the short run are relevant in all cases, with the exception of the residential sector. These results indicate that in Mexico the demand for energy is fundamentally driven by income and that the effect of the relative prices is basically concentrated on the short run with the exception of the industrial sector, which also shows a long-term price impact. The strong dependence of energy consumption with respect to income and the price inelastic response indicates that it is necessary to introduce strong measures to decouple energy consumption from output in order to obtain sustainable economic growth in Mexico.

05/02576 Stochastic factor model for electricity spot price – the case of the Nordic market

Vehviläinen, I. *et al. Energy Economics*, 2005, 27, (2), 351–367.

This paper presents a stochastic factor based approach to mid-term modelling of spot prices in deregulated electricity markets. The fundamentals affecting the spot price are modelled independently and a market equilibrium model combines them to form spot price. Main advantage of the model is the transparency of the generated prices because each underlying factor and the dynamics between factors can be modelled and studied in detail. Paper shows realistic numerical examples on the forerunner Scandinavian electricity market. The model is used to price an exotic electricity derivative.

05/02577 Support vector machines with simulated annealing algorithms in electricity load forecasting

Pai, P.-F. and Hong, W.-C. *Energy Conversion and Management*, 2005, 46, (17), 2669–2688.

Accurate forecasting of electricity load has been one of the most important issues in the electricity industry. Recently, along with power system privatization and deregulation, accurate forecast of electricity load has received increasing attention. Because of the general non-linear mapping capabilities of forecasting, artificial neural networks have played a crucial role in forecasting electricity load. Support vector machines (SVMs) have been successfully employed to solve non-linear regression and time series problems. However, SVMs have rarely been applied to forecast electricity load. This investigation elucidates the feasibility of using SVMs to forecast electricity load. Moreover, simulated annealing (SA) algorithms were employed to choose the parameters of a SVM model. Subsequently, examples of electricity load data from Taiwan were used to illustrate the proposed SVMSA (support vector machines with simulated annealing) model. The empirical results reveal that the proposed model outperforms the other two models, namely the autoregressive integrated moving average (ARIMA) model and the general regression neural networks (GRNN) model. Consequently, the SVMSA model provides a promising alternative for forecasting electricity load.

05/02578 The first step in restructuring the US electric industry

Barnett, A. H. *et al. Energy Economics*, 2005, 27, (2), 225–235.

The electric industry lobbied for its first step in restructuring, from local franchises to regulated state monopolies during the early 1900s. The present paper examines this restructuring with an empirical model that includes the introduction of natural gas and steam turbine generators. The restructuring resulted in fewer firms, higher costs, and higher prices, consistent with increased monopoly power and captured regulators.