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Discussion Paper

E-Business in the Deregulated German Wholesale Electricity Market

An Expert Survey

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Executive Summary

- Market Development (from 2000 to 2002)
  - Overall trading volumes are expected to increase more than twofold from 218 TWh in 2000 to 552 TWh in 2002
  - Volumes in physical trading are expected to increase from 188 TWh to 271 TWh, while volumes in financial trading are expected to increase from 30 TWh to 281 TWh
  - Wholesale trading will shift from a primarily physical to a balanced physical and financial trading market
  - Exchange markets supplement OTC markets in both physical and financial trading
  - OTC markets remain the dominant market places for physical transactions
  - Roughly 20% of physical transactions will be conducted on power exchange spot markets
  - Exchange future markets are estimated to gain a 50% market share in financial trading
- Transactions and Contracts in the OTC markets
  - On average, each company conducts 900 spot transactions á € 50 and 100 forward transactions a € 700 each month
  - Deal completion of a spot transaction takes between 43 seconds and 5:27 minutes; of a physical forward transaction between 8.58 hours and 178.91 hours
  - "Forwards" represent the most frequently traded contracts in the physical forward market, "Day Ahead Peak" contracts in the spot market and "swaps" in the financial forward market
  - 68.75% of the respondents did not trade derivatives with a cash settlement at all
- Electronic Trading
  - 62.5% of the respondents use electronic OTC trading platforms
  - Electronic trading platforms are almost always used for information search (in 63.11% of all transactions)
  - Anonymity is not considered an important advantage of electronic trading platforms
  - Most respondents could imagine using an automated negotiation and price discovery by means of electronic trading systems

1 Introduction

1.1 Motivation

The amendment of the German Energy legislation in April 1998 breaks up the regulated monopoly and transforms the monopolistic electric utility industry into a competitive electric power industry (cf. Erdmann 2000). The new energy legislation introduces competition in the generation and trading business, whereas the free choice of supplier on the wholesale and retail level creates additional competitive pressure on the trade chain (cf. Haupt and Pfaffenberger 2000). As a consequence of the liberalization process, transaction relations, trading processes, contract designs, and market structures are undergoing radical changes (cf. Bower et al. 2000).

Even though the mutual exchange of electric energy has been a business activity among vertically integrated utilities for a long time, wholesale electricity trading in a deregulated market has only recently become a critical success factor for market participants. The formerly exclusive group of market participants on the wholesale level increased in number by domestic and foreign players (cf. Strecker and Weinhardt 2000). New market participants, e. g. marketer, broker and pure trader, alter the intermediation chain and create new business opportunities. New market places add a dimension of complexity to the trading process. Electric energy becomes a commodity traded at power exchanges and off-exchange on an informal bilateral basis, i. e., over the counter (OTC) markets. Financial derivatives become part of the trading process and augment the trade with contracts for physical delivery. Maturities range from day ahead spot to 20 year forward contracts. Internet-based electronic trading platforms, e. g. EnronOnline and HoustonStreet, offer automated price discovery mechanisms. Altogether, wholesale electricity trading in a deregulated market takes place in different market segments on various market places, characterized by varying usances, rules and regulations. A discussion about wholesale electricity trading thus requires a differentiated investigation. Yet, reports on the wholesale market are mostly anecdotal and lack an empirical foundation.

How will the market develop? Which market segments and trading instruments are preferred by the market participants today and will be in the future? What are the characteristics of transactions and contracts? These questions have given rise to this study conducted in the German wholesale market between April and June 2000. The results describe the market development in the German wholesale market, the usage of risk management and trading software as well as electronic trading platforms and enables market participants to position their own trading activities.

1.2 Overview of Related Work and Data Sources

Wholesale electricity trading denotes electricity trading at the level of transmission lines with transaction relationships between generators, resellers, intermediaries and large-scale industrial consumers. Wholesale transactions cover pure energy without affiliated services and each market participant is required to manage a portfolio of energy contracts. The survey investigates wholesale trading within the German part of the pan-European grid. Wholesale electricity trading in a German context has been discussed by Klopfer (1997) and Schiffer (1999), among others. Reports on the situation in the competitive wholesale trading market have, for example, been given by Otten (2000) and Canty (2000). While these sources provide valuable insights, a literature analysis revealed a lack of empirical investigations of wholesale trading in the deregulated German electricity market. The only related expert survey known to the authors has been conducted by consulting company Arthur Andersen (2000) and been published in May 2000 by the Industry Group Energy & Utilities in German. The study refers to a survey period between January and February 2000 in which 340 companies in Germany, Austria and Switzerland received a structured written questionnaire. The sample consists of 293 German, 26 Swiss and 21 Austrian market participants including all supra regional utilities in Germany, Austria and Switzerland. The 293 German addressees divide into 6 supra regional and 26 regional utilities, 135 municipalities, 23 pure gas utilities and 103 broker, marketer, financial service provider and industrial consumer, among others. 83 companies (24.41%) participated in the survey of which about 82% classified themselves as utilities, about 21% as marketer and pure trader, 10% as broker, 6% as independent power producer, 4% as financial service provider, 2% as aggregator and power pools and 8% as other types of companies (multple entries were allowed).

Arthur Andersen concludes that energy trading is of great importance to the participants but the individual decision for market entry depends on an exact estimation of the expected trading volume. The report also stresses the urgent need for sophisticated IT systems, especially for risk management purposes. Arthur Andersen did not investigate the characteristics of transactions and contracts in detail in favor of a broader approach considering organisational issues, e. g. human resources in energy trading. Moreover, the survey did not solely focus on electricity trading but also on gas trading.

Further data sources on a transactional level are not publicly accessible since market participants are not required to report transactions to a central repository. Likewise, market participants are not willing to reveal their internal data to maintain a secret market position. Some companies even refuse to publish their total trading volume in either quantity or value. On the other hand, aggregated data on supply and demand is available from industry associations, cf. e. g. DVG (2000a), VDEW (2000), and from the Federal Ministry of Economics and Technology (BMWi). The BMWi (1999) quarterly publishes aggregated statistics on electricity generation and consumption with respect to industries and sources. In summary, knowledge about the deregulated German wholesale trading market is restricted to personal experiences and to case studies given at conference talks. Accordingly, the survey presented in this paper empirically investigates the characteristics of wholesale trading in the deregulated German electricity market in five market segments concerning volumes, transactions and contract characteristics.

1.3 Methodology

1.3.1 Assessment of Relevance

For the assessment of relevance, eleven experts at industry associations and in academia were contacted, sent a research proposal by e-mail and asked to comment on the feasibility and relevance of the planned survey between October and December 1999. All interviewees confirmed our findings in that no other study was known and rated our endeavor as relevant and meaningful, encouraging us to proceed.

1.3.2 Survey Design

The purpose of this explorative study was to examine the situation and condition in the German wholesale electricity market by interviewing experts at all relevant groups of market participants using a structured questionnaire to gather key numbers and expert estimations. The market situation was explored using a three dimensional space with the bipolar dimensions: physical and financial, OTC and exchange, spot and forward trading, leading to an investigation of contracts, transactions and market development in five seperate market segments (OTC spot, exchange spot, OTC physical forward, OTC financial forward and exchange financial futures segment). The role of information technology and electronic trading platforms were analyzed using a transaction chain model derived from Picot et al. (1995). We chose a survey design because of our positive experiences in earlier expert surveys, e. g., comparatively high rates of return (cf. Weinhardt and Krause 1997), and relatively low costs. Furthermore, we chose a cross-sectional design instead of single case studies to rule out setups specific to individual companies. As data collection instrument a mailed questionnaire has been chosen to increase the probability of returns, i. e., the acceptance with the audience since it allows the respondents to choose place and time of the completion, e. g., the weekend. Due to our experiences in the pilot study, it seemed difficult to reach the audience by telephone and conduct an interview, especially considering the pretested time of completion of about 45 minutes.

Derived from the explorative nature of this study, we designed the study as a non-experimental field research, because the objective was to obtain a snapshot of a fast moving market at a certain point in time, instead of testing a theory. This descriptive approach investigates the essential structure of the wholesale market, but it does not explain the underlying causales. In fact, an important objective is to systematize and classify the multitude of data into a logical framework. In this context, a cross-sectional design is particularly suited for the exploration of market situations and conditions as well as for their description by relative frequencies (Nieschlag et al. 1994).

1.3.3 Population and Sample: Sampling Procedure

The target population of the survey comprises all companies actively trading in the German wholesale electricity market as of 1 April 2000. However, the size and composition of the target population is indeterminable because a compulsory registration for participants in the wholesale market has not been established in Germany yet. Moreover, due to the recent regulatory modifications, the market structure constantly changes in size and composition.

The sampling of potential respondents therefore relied on interviews with experts at market participants and industry associations as well as directories published by industry associations, see, for example, (Richmann 1999), (DVG 2000b), (VIK 2000). Besides these sampling frames, the sampling included those companies known to operate in the market due to press releases, news reports and public relations material. Hence, the selection procedure can be described as a purposive expert sampling with an modal instance ("typical cases") sampling in mind and thus does not utilitze methods of random sampling. Consequently, the resulting sample is not representative for the entire market since the selection of potential respondents is based on availability rather than on random probability. That is why, statements in this report cannot be generalized without making implicit assumptions on the overall market structure (Schnell et al. 1999, p. 286).

Between March and April 2000, the heads (directors) of trading or an equivalent position at 82 companies (47 with headquarters in Germany and 35 with headquarters abroad) were contacted by telephone and asked for their cooperation and an approval to send the questionnaire by mail. The distribution of the sample by type of company is shown in Tab. A.1 on page 22 and by country in Tab. A.2 on page 22. All 82 experts approved the inquiry and were thus included in the final sample. Sixteen experts participated in the survey and returned the questionnaire. That corresponds to a rate of return of 19.51%. All responses were usable for the data analysis. Sixty-six addressees or 80.49% did not return a questionnaire. The rate of return seems unusally low with respect to the need expressed in the assessment of relevane. In this regard, the effort to fill-in the questionnaire has to be taken into account as well as the reluctance of market participants to allow insights into their trading business.[1] Each prescribed category of market participants is represented at least once in the sample (cf. Tab. A.3 on page 23). The majority (9 or 56.25%) of the participating companies classifies themselves as new market participants (marketer, broker, industrial consumers) while the remaining companies rank themselves as utilities (43.75%). More than two-thirds of the participants operate a small trading floor with less than 21 employees. A large trading floor with more than 40 employees in energy trading is run by two companies (12.50%). The reported quantitative turnover in 1999 exhibits an even distribution of the sample. Three companies contract less than 1,952.5 GWh (1.9525 TWh), three companies between 1.9 and 8.5 TWh, four companies between 8.5 and 12 TWh and two large companies trade more than 12 TWh of electric energy per year including physical and financial obligations. On average, the quantitative turnover was 8.6 TWh. Only four companies stated their turnover by value. The mean of turnover in electricity trading by value amounts to € 306.25 million in 1999 with a range from € 22.5 to 970 million. The sum of turnover by value equals € 1.837 billion. The sample thus represents a well-balanced cross section of small and large companies with respect to size of the trading floor as well as turnover by quantity and value.

1.3.4 Survey Instrument

The survey used a self-designed structured and standardized written questionnaire as data collection instrument (cf. Sec. C on page 41 in the Appendix for cover letter, questionnaire, and

[1] Some nonrespondents explicitly expressed their concerns about answering the questions on such a detailed level in the telephone follow-up.

instructions). The questionnaire consisted of seventy-six items on eleven pages. The majority of questions asked for factual information and expert estimations, such as the participation at various exchange markets or the delivery quantities laid down by contracts. Other questions were based on Likert-like rating scales from "extremely important" to "extremely unimportant". The information used in the analysis was derived from the questionnaire data. In a pilot study, a first version of the questionnaire was conceived and sent to eight experts (2 at utilities, 2 at brokers, 1 at a marketer and 3 in academia) for an evaluation in form and content, especially with repect to consistency and comprehensibility. Their suggestions entered the final questionnaire. The pretested time to completion reported by the pilot testers was about 45 minutes. For the main survey, we cooperated with a market research institute (cf. Luenendonk Consultancy and Research) to enhance the credibility and professionalism of the survey.[2] Luenendonk contacted most of the potential respondents, distributed the questionnaire by mail and collected the returned questionnaires. On April 26th 2000, a German version of the questionnaire was sent to 55 addressees by mail. One German addressees was sent a questionnaire on May 8th 2000. On May 9th 2000, an English version of the questionnaire was sent to the remaining 26 English-speaking addressees by mail. The mailing included a non-stamped preaddressed envelope. All contact persons were asked to return the questionnaire within three weeks after reception. To increase the rate of return, a telephone follow-up started May 31st 2000 and lasted for four weeks. The data collection phase ended on June 30th 2000.

1.3.5 Methods of Data Analysis

For the data analysis, the items in the questionnaire were uniquely coded and data from the returned questionnaires was entered into the German version of SPSS 10. According to the research design, descriptive statistics, mainly methods of univariate data analysis, were used for the analysis. The questionnaire contained items on nominal, ordinal and ratio scale. A typical nominal item was "Are you actively trading and/or brokering contracts with physical delivery?" (cf. question 5 in the questionnaire) with predefined answers "yes" and "no". For nominal items, we state the number of valid answers (n) and the percentage of frequency of entries (%) for an answer (see, e. g., Tab. A.3 on page 23) in this report. For nominal-categorical items, multiple entries were sometimes allowed and a note will be attached to the table caption (see, e. g., questions 7 and 9 or Tab. A.7 on page 24). We used a five point bipolar response scale (1 to 5) to measure the personal judgement of importance where "1" meant "extremely important" and "5" meant "extremely unimportant" (see, e. g., question 57). The response scale is not intended to achieve interval scale items (as, for example, in Likert or "summative" scales) but to gather tendencies in expert judgements on an ordinal scale. For these ordinal scale items, we report the number of valid answers as n as well as median (Md), mode (Mo), minimum and maximum values (min, max) as statistics of central tendency. We also supply bar chart diagrams for these items using three categories: important, indifferent or unimportant, and missing (see, e. g., figure B.11). The categories "important" and "indifferent or unimportant" were aggregated from ranks "1" (extremely important) and "2" (important) respectively "3" (indifferent), "4" (unimportant), and "5" (extremely unimportant) to obtain better readability. The majority of items asked for relative and absolute numbers either in

[2] This was suggested by two experts in the pilot study.

preset dimensions such as MWh or in percent of a certain context (e. g. the usage in transaction phases in relation to the total volume of transactions, see Fig. B.10 on page 34). For these ratio scale items, we state the number of valid answers (n), and the statistics for mean (M), standard deviation (s), median (Md), mode (Mo), minimum and maximum values (min, max). Tables and associated diagrams can be found in the appendix. When appropriate, the percentage of missing values is shown. A discussion of the findings follows in the next section.

2 Data Analysis

2.1 The Wholesale Trading Market

In 2000, the core trading activities centered around contracts for physical delivery. The majority of participants (87.5%) contracted on the physical market whereas only 25% traded cash-settled contracts. This is expected to change fundamentally. The segments in wholesale trading will shift from a primarily physical to a balanced physical and financial trading. Physical trading is expected to grow by 145% from 188 TWh in 2000 to 271 TWh in 2002 while financial trading is expected to increase by 938% from 30 TWh in 2000 to 281 TWh in 2002 (cf. Tab. A.4 on page 23 and Fig. B.1 on page 30). Concerning the overall trading volume, the participants expect a rise by 250% from 218 TWh in 2000 to 552 TWh in 2002. This asserts an estimation by the largest electricity supplier in Germany, RWE (Schiffer 1999, p. 200). In 1999, RWE predicted for Western Europe the physical trading volume to increase sevenfold from 256 TWh in 1999 to 1,944 TWh in 2003 and the financial trading volume to increase from 51 TWh to 2,778 TWh in 2003, roughly 50 times the volume in 1999.

The five market segments were used in different frequencies (cf. Fig. B.2 on page 30). In 1999, most respondents traded on the OTC physical forward market (68.75%) followed by the OTC spot market (50.00%), the OTC financial forward market (25.00%) and the spot markets at the Amsterdam Power Exchange (APX), European Energy Exchange (EEX) and Leipzig Power Exchange (LPX) with 18.75%. No respondent traded at the futures markets (ElTermin and ElOption) of the Scandinavian power exchange NordPool. The usage of market places shifts from OTC to power exchanges, however OTC trading remains the dominant market place (cf. Tab. A.5 on page 24, Tab. A.6 on page 24, Fig. B.3, and Fig. B.4 on page 31). The experts expect a decline in OTC trading concerning physical (OTC physical forward: -7% and OTC spot: -10%) as well as financial (-37%) trading relative to institutional market places. Exchange spot markets will gain a market share of approximately 22% of the physical trading volume increasing by 15%. OTC physical forward trading is expected to remain the dominant market place for physical trading with a share of 60% while OTC spot trading decreases relative to trading on an exchange spot market. Arthur Andersen (2000) estimates that the trading volume in spot markets will amount to 15% to 25% of the net electricity generation (roughly 500 TWh), i. e., between 75 and 125 TWh. According to the findings of this study, the spot market will amount to 103 TWh (38% of 271 TWh) and the physical forward markets to 163 TWh. Albeit, we have to reiterate a conclusion by Arthur Andersen (2000): the amounts of expected trading volumes are afflicted with great uncertainties and our findings are no exception. Concerning financial trading, one has to be aware of the fact that the first futures market opened on 1 March 2001 at the EEX and had not been established in Germany at the time of the survey. Trading derivatives at exchanges therefore meant trading at ElTermin and ElOption, respectively. Hence, the low estimation about futures trading (13%) in 2000.

The experts expect an even split between market places in financial trading in the future. 75% of the participating companies trade or plan to trade at the EEX and LPX spot market (cf. Tab. A.7 on page 24 and Fig. B.5 on page 32). This reflects the ongoing head-to-head race over leadership in German energy exchanges. The other European spot markets, available to German market participants, fall behind with 6.25% at NordPool ElSpot and 18.75% at the APX. With respect to futures and options markets, the EEX leads with 75% planning to trade on the EUREX platform while only 43.75% intend to trade on the LPX SAPRI system. Again, the Scandinavian markets fall short with only 12.50% trading or planning to trade at ElTermin and 6.25% trading or planning to trade at ElOption.

In summary, the participants anticipate three substantial shifts in wholesale trading: a) trading volumes are expected to increase more than twofold, b) physical trading will be accompanied by financial trading, and c) power exchanges supplement OTC markets. Yet, OTC trading will remain dominant in physical trading and the overall dominant market segment.

2.2 Characteristics of Transactions

The prevalence of OTC trading is also reflected in the frequency of transactions (cf. Tab. A.8 on page 25). OTC trades represent the most frequently executed transactions. On average, OTC spot trades are executed approximately 900 times per month; transactions on the physical forward markets approximately 100 times per month. Only 4 and 3 participants, respectively, entered figures for the financial forward market (25 transactions per month) and exchange spot market (17 transactions per month), respectively. The minimum and maximum values show, however, a wide range of frequencies and thus restrict the expressiveness of the answers. With the advent of electronic trading systems, the immediacy of deal completion comes into focus, part of which refers to the delay between the initial desire for a transaction and its completion. The means of the delay show the expected order from spot to forward trading (cf. Tab. A.9 on page 25). Computer-based power exchanges speed up the execution process and that is why there is a noticable difference between OTC and exchange spot trading ranging from 38 seconds at least to 173 seconds (2:52) at most. The time to complete forward transactions in either the financial or physical market takes considerably longer than spot transactions. The average time of about 22 hours (79,284 seconds) to complete transactions on the physical forward market presumably contains a potential for reduction, e. g., by electronic trading systems. Yet, no participant entered figures for the exchange futures market rendering an adequate comparison impossible. As with the frequency of transactions, the large standard deviations restrict the expressiveness of the statements above. When asked about an estimation of their cost per transaction (cf. Tab. A.10 on page 25), the participants implicitly assumed different notions of (transaction) costs as we conclude from the fact that one participant specified average costs as €0.0005 per transaction (on the OTC physical forward market) and another participant estimated €2,000 for the same kind of transaction. Such a large fluctuation points to different perceptions of costs associated with transactions. We consider it probable that transaction costs of €0.0005 stem from the spread between bids and offers of a market maker (implicit transaction costs) while €2,000 are due to full costs (including explicit transaction costs such as fees for intermediaries as well as costs for human resources, information technology, etc.). In comparison, the costs associated with forward transactions are estimated to be, on average,

about 14 times higher than spot transactions. The complexity of forward transactions is reflected by the time to complete a deal, by transaction costs and transaction frequency. Forward transactions take longer to complete and have higher transaction costs than spot transactions but they are conducted less often. Yet, spot transaction become an important cost factor considering the transaction frequency, although they take only seconds to complete. At about 900 spot transactions per month with an average cost of € 50, spot trading costs an average of approximately € 45,650 per month roughly 40% less than forward trading which costs on average € 70,500 per month.

2.3 Characteristics of Contracts

The deregulation in Germany initiated a commoditization process, i. e., electric energy becomes a standardized tradable good, valued by price signals emerging through negotiations between supply and demand. The degree of contract standardization indicates the level of commoditization of a good.

Otten (2000) stated, for example, in February 2000 that a wide variety of contract types with different maturities, delivery periods and delivery quantities were traded in the wholesale market. Therefore, we asked the participants in an open question to name and classify different contract types and to relate them to each other in terms of quantitative trading volumes. Figures B.6, B.7, B.8 on page 33 display a list of contract types and reveal that a standardization of contract types had begun and was underway in June 2000 but not finished (cf. the umbrella terms “forwards”, “options”). Contract types in the spot and physical forward market appear to be more mature reflected by a standardized terminology and definition of contracts. However, the early stage of development of contract types in the OTC financial forward market can be attributed to the fact that only one participant specified contracts with an underlying index (SWEP, CEPI) or exchange reference rate (APX). Typical financial forward contracts (swaps, options) were specified by four participants, but still 68.75% of those interviewed did not trade financial OTC contracts at all. Since contracts in the OTC markets can, in theory, be constructed of arbitrary parameters and parameter values, we assessed the maturity, delivery period and quantity for forward contracts in the OTC physical and financial forward markets as well as delivery quantities for the OTC spot markets. The results give an overview of the average maturity, delivery period and quantity traded in the market segments, but we abstained from differentiating these parameters for contract types (forwards, various types of options) to restrict the length of the questionnaire. Tab. A.11 on page 25 shows that forward contracts were contracted for a physical delivery starting between 1.4 months and 3 years and 7 months in the future which is more than twice the ranges for cash-settled contracts (1.1 to 11.5 months). This also contributes to the observation that financial derivatives had just been started to gain acceptance with traders. A similar picture is found for delivery periods of the underlying (cf. Tab. A.12 on page 25). The extent of derivatives with a physical delivery range from 1.6 months to 4.5 years (54 months) while financial derivatives refer to a delivery period from 1.7 months to 1 year and 8 months. Although, the results rely on only two respectively three respondents and have therefore limited significance. The delivery quantities in Tab. A.13 on page 26 show the expected order. Spot contracts contain less megawatthours than financial and physical forward products. The high values for physical forward contracts (up to 1.5

TWh) can be attributed to fact, that the contract types include full supply contracts as well as scheduled deliveries besides the typical forward products such as month ahead and year ahead forwards.

It has to be noted that the results given in this section show averages on the level of market segments, i. e., for a wide range of contract types in single figures (mean, median, mode) and thus simplify the complexity to a great extent. The level of markets segments can, of course, only produce these results, which give a first indication. Future investigations will have to proceed on a more detailed level of individual contract types.

2.4 Electronic OTC Platforms for Wholesale Trading

Electronic platforms for OTC trading have been changing the way of wholesale trading fundamentally. Although screen-based trading lacks the personal contacts and emotional aspects of traditional (telephone and fax-based) trading processes, market research institutions predict electronic energy trading to be a $150 billion business in 2003 (Forrester Research 1999). Furaro and Wilcox (2001) state that electronic platforms will "change the face of energy trading". Our findings support this observation: Electronic trading has been adopted by the majority of respondents: 62.5% use electronic trading platforms while 25% explicitly denied the usage (cf. Fig. B.9 on page 34). The usage of electronic trading in certain transaction phases reveals that in 63.11% of all transactions, respondents use platforms to search for market information, but only in 5% to route orders, even less for price discovery as well as clearing and settlement. This is not very surprising, considering the limited possibilities of price discovery mechanisms, clearing and settlement systems on electronic OTC platforms at the time of data collection (cf. Tab. A.14 on page 26 and Fig. B.10 on page 34). The discussion of voice versus screen-based trading has been fueled again by recent innovations in information technology. Advocates of voice trading usually refer to advantages of telephone and face-to-face trading with respect to personal contact, emotional aspects and so forth. Likewise, supporter of electronic trading often cite the disadvantages of telephone trading as rationale for the advent of electronic trading platforms. We investigated the arguments and our findings show that a major argument often cited as a reason to trade on electronic platforms is of much less importance to the respondents of this survey, namely anonymity (cf. Fig. B.11 on page 35 and Fig. B.12 on page 35). The respondents rate the personal contacts (81.25%) and knowledge about the counterparties and their respective creditworthiness (56.25%) as main advantages of human interaction of telephone trading. Block trading and the anonymity of brokered deals are of lesser importance. At the same time, the respondents rate the limited liquidity (56.25%), price transparency (56.25%) and number of potential counterparties (50%), typically associated with telephone trading, as main drivers for the increased usage of electronic trading platforms. Cost (25%) and the lack of anonymity (31.25%) in bilateral deals play an inferior role. The denial of importance of anonymity surprises, since market participants often express their concerns about the indeterminableness of their market position by potential counterparties, which is a typical feature of electronic trading platforms. Eventually, the findings show the trade-offs between electronic and telephone trading and deliver reasons for each opposite side in the discussion. The majority of respondents rates electronic platforms for OTC trading in the market segments OTC spot, physical forward and financial forward "important"

or “very important” (cf. Fig. B.13 on page 36). Especially the OTC spot market (62.5%) is rated suitable for electronic trading platforms. Concerning the applicability of electronic platforms in the transactions phases, the majority of respondents see a potential in the information search (75%) and negotiation and price discovery (62.5%) phases. Only half and only 31.25% of the experts rate platforms suitable in the order routing as well as clearing and settlement phases, respectively (cf. Fig. B.15 on page 37). The limited interest in an electronic support for clearing and settlement is surprising because of the often discussed potential for cost savings due to an electronic clearing and settlement. The rating of requirements the respondent make on electronic platforms reveals five major prerequisites (cf. Fig. B.14 on page 36): high reliability (93.75%), liquidity (87.5%), security (87.5%), low transaction costs (81.25%), and high availability (81.25%). The remaining requirements are still rated important by the majority of respondents, yet anonymity in deal making is again the least important feature for an electronic platform.

We asked the participants if they could imagine using automated negotiation and price discovery facilities by means of electronic platforms. A feature which was lacking most of the existing platforms. 81.25% of the respondents affirmed the question while only 12.5% explicitly negated (cf. Fig. B.16 on page 37). From the 10 respondents using electronic OTC trading platforms, we wanted to know which platforms were known and in which transactions phases they were used. Seven experts knew EnronOnline, six EnronStrommarkt and pbi powerbroker and four NetStrom and SKM Marketplace (cf. Fig. B.18 on page 38). Additionally, EnronOnline was used most frequently. When asked in which transaction phases which platform was used in relation to others, only a few participants stated proportions (cf. Tab. A.15 on page 27). The results show that EnronOnline leads in terms of mean frequency of usage and usage in transaction phases. According to general usage in transaction phases, the information search phase was used most frequently. Here, EnronOnline is followed by EnronStrommarkt, pbi powerbroker, NetStrom and SKM Marketplace. Yet, the findings rely on very few statements and therefore need to be handled with care (cf. Fig. B.17 on page 38).

2.5 Software for Electricity Trading

Information and communication technology (ICT) in the electric power industry embraces every process within the entire value chain from metering to risk management. In the trading business, ICT affects processes in the front, middle, and back-office, e. g., trade capture, portfolio management, and settlement. An integrated software solution along the value chain enables businesses to achieve competitive advantages. Tab. A.16 on page 28 lists the software packages and their respective vendor associated with a process according to the statements of the respondents. The respondents prefer a single vendor solution in core trading processes (portfolio and risk management), i. e., once a certain vendor has been chosen, the respondents try to cover as many processes as possible with software from this vendor, see e. g., Contango, ZAI*Net, POSITION. Yet, no single vendor supports the entire value chain, which raises questions towards the interoperability and integrability of software packages in a multi-vendor environment. The participants also deploy in-house solutions (IS) besides or instead of commercial off-the-shelf software packages (COTS). Tab. A.17 on page 29 compares the deployment of inhouse packages versus COTS and reveals a dominance of inhouse solutions

in market analysis, transmission, customer relation, credit risk and grid management.

The issues with the deployment of software in the value chain are shown in Tab. A.18 on page 29. Important issues comprise the user interface (50%) and customization problems (37.5%), the substantial integration costs (37.5%) as well as high complexity (31.15%). Surprisingly, performance and hardware requirements are of less importance (18.75%). Two respondents additionally listed problems of mapping business processes to software features and the need for better validity and plausibility checks.

3 Summary

This expert survey represents an extract and snapshot of the German wholesale electricity market of June 2000 based on a non-representative cross-section of the market structure. Its purpose was to examine the situation and condition in the market by interviewing experts at all relevant groups of market participants using a structured questionnaire to gather key numbers and expert estimations. The results describe the market development in the German wholesale market on the level of market segments, taking into account the characteristics of transactions and contracts. Electronic trading and risk management and trading software are discussed as well. Despite the partly large fluctuation margins resulting from the small sample, the results presented in this report offer new insights into the German trading business and provide market participants with a framework to position their trading activities. The study complements the results of the Arthur Andersen (2000) market study highlighting the increasing importance of electricity trading, and will be continued in a follow-up investigation in 2002.

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A Tables

Table A.1: Distribution of Sample by Type of Company

	Total		Domestic		Foreign	
Type of Company	*n*	%	*n*	%	*n*	%
Supra Regional Utilities	9	10.98	8	9.76	1	1.22
Regional Utilities	2	2.44	2	2.44	0	0.00
Municipalities	19	23.17	11	13.41	8	9.76
Wholesale Marketer	21	25.61	9	10.98	12	14.63
Wholesale Broker	16	19.51	4	4.88	12	14.63
Large Industrial Consumer	15	18.29	13	15.85	2	2.44
Total	82	100.00	47	57.32	35	42.68

Table A.2: Distribution of Sample by Country

	Potential Respondents		Respondents		
Country	*n*	%	*n*	%	%
Germany	56	68.29	10	62.50	17.86%
U.K.	10	12.20	1	6.25	10.00%
Switzerland	7	8.54	1	6.25	14.29%
The Netherlands	4	4.88	2	12.50	50.00%
Austria	2	2.44	1	6.25	50.00%
Sweden	1	1.22	1	6.25	100.00%
Ireland	1	1.22	0	0.00	0.00%
Belgium	1	1.22	0	0.00	0.00%
Total	82	100.00	16	100.00	

Table A.3: Structure of Respondents (Figures for 1999)

Category	*n*	%	**Employees**	*n*	%
Supra Regional Utilities	4	25.00	<10	7	43.75
Regional Utilities	1	6.25	11 to 20	4	25.00
Municipalities	2	12.50	21 to 30	1	6.25
Wholesale Marketer	4	25.00	31 to 40	1	6.25
Wholesale Broker	2	12.50	>40	2	12.50
Large Industrial Consumer	3	18.75	Missing	1	6.25
Total	16	100.00	Total	16	100.00
Turnover in GWh	*n*	%	**Turnover in Mill. Euro**	*n*	%
<1,952.5	3	18.75	<32	1	6.25
1,952.5 to 8,500	3	18.75	32 to 195	2	12.50
8,500 to 12,000	4	25.00	195 to 558	2	12.50
>12,000	2	12.50	>558	1	6.25
Missing	4	25.00	Missing	10	62.50
Total	16	100.00	Total	16	100.00

Table A.4: Average Estimated Trading Volume

	2000						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
Physical Trading	8	188	100.0	50	213.39	0.01	550
Financial Trading	6	30	12.5	10	36.47	5.00	100
	2001						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
Physical Trading	7	212	180.0	180	247.61	0.04	750
Financial Trading	7	112	100.0	150	102.22	0.02	300
	2002						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
Physical Trading	7	271	200.0	200	241.26	0.10	750
Financial Trading	7	281	300.0	500	215.43	0.04	500

Table A.5: Average Estimated Share of Physical Trading Volume

	2000						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Physical Forward	11	67.27	75.0	80	28.22	20	100
OTC Spot	11	26.00	24.0	30	21.84	0	60
Exchange Spot	10	7.40	5.5	1	9.17	0	30
	2001						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Physical Forward	11	62.36	75	15	31.04	15	97
OTC Spot	11	18.82	15	2	15.50	2	45
Exchange Spot	11	16.00	15	5	12.56	1	35
	2002						
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Physical Forward	11	59.55	70.0	80	31.10	5	97
OTC Spot	11	16.36	10.0	10	14.22	2	40
Exchange Spot	11	21.73	20.0	15	14.57	1	50

Table A.6: Average Estimated Share of Financial Trading Volume

	2000						
Figures in Percent	*n*	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Financial Forward	8	86.50	90.0	100	14.91	67	100
Exchange Futures	7	12.57	5.0	0	14.76	0	33
	2001						
Figures in Percent	*n*	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Financial Forward	7	66.43	60.0	50	18.42	50	90
Exchange Futures	7	33.57	40.0	50	18.42	10	50
	2002						
Figures in Percent	*n*	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Financial Forward	7	49.71	50.0	50	24.88	20	85
Exchange Futures	7	50.29	50.0	50	24.88	15	80

Table A.7: (Intended) Usage of Exchange Markets (Multiple Entries Allowed)

Spot Markets	*n*	%	**Futures Markets**	*n*	%
EEX Spot Market	12	75.00	EEX Futures Market	12	75.00
LPX Spot Market	12	75.00	LPX Futures Market	7	43.75
APX Spot Market	3	18.75	NordPool ElTermin	2	12.50
NordPool ElSpot	1	6.25	NordPool ElOption	1	6.25

Table A.8: Frequency of Transactions

Figures in Months	*n*	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
OTC Spot	7	912.9	900.0	900.00	551.5	90.00	1,500
OTC Physical Forward	10	107.6	60.0	150.00	135.0	1.00	450
OTC Financial Forward	4	24.6	4.0	0.33	43.7	0.33	90
Exchange Spot	3	17.0	20.0	1.00	14.7	1.00	30
Exchange Futures	0	n/a	n/a	n/a	n/a	n/a	n/a

Table A.9: Duration of Transactions

	At least			**On average**			**At most**		
Figures in Seconds	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
Exchange Spot	2	5	1	2	14	9	2	154	207
OTC Spot	7	43	37	7	116	127	7	327	321
	At least			**On average**			**At most**		
Figures in Hours	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
OTC Physical Forward	9	8.58	23.81	10	22.02	136.31	9	178.91	330.48
OTC Financial Forward	2	3.01	4.23	1	0.08	n/a	2	45.08	63.52
Exchange Futures	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Table A.10: Cost of Transactions

	At least			**On average**			**At most**		
Figures in Euro	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
OTC Spot	3	33	29	3	50	50	3	117	161
OTC Physical Forward	4	418	723	4	705	927	4	1,393	1,581
OTC Financial Forward	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a

Table A.11: Maturities

	At least			**On average**			**At most**		
Figures in Months	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
OTC Physical	9	1.4	1.1	9	4.7	3.7	9	43.1	74.9
OTC Financial	4	1.1	0.7	4	2.3	1.0	4	11.5	9,0

Table A.12: Delivery Periods

	At least			**On average**			**At most**		
Figures in Months	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
OTC Physical	8	1.6	1.1	7	9.4	7.4	8	54.0	76.7
OTC Financial	3	1.7	1.1	2	3.0	0.0	3	20.0	6,9

Table A.13: Delivery Quantities

	At least			On average			At most		
Figures in MWh	*n*	*M*	*s*	*n*	*M*	*s*	*n*	*M*	*s*
OTC Spot	4	3,796	7,496	4	5,525	9,651	4	11,980	10,577
OTC Physical	7	8,853	14,372	7	30,457	52,987	6	1,526,667	1,816,576
OTC Financial	2	11,750	13,081	1	6,000	n/a	2	110,000	84,853

Table A.14: Usage of Electronic OTC Trading Platforms in Transaction Phases

	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
Information Search	9	63.11	60.0	100	34.44	3	100
Order Routing	7	5.00	0.0	0	7.64	0	20
Price Discovery	10	4.50	2.5	0	4.97	0	10
Clearing and Settlement	9	3.44	0.0	0	6.56	0	20

Table A.15: Frequency of Usage of Electronic OTC Platforms

Information Search							
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
EnronOnline	7	48.57	40.0	0	41.40	0	100
EnronStrommarkt	6	39.17	27.5	0	38.26	0	100
pbi powerbroker	6	8.83	0.0	0	16.13	0	40
NetStrom	5	6.40	0.0	0	13.22	0	30
SKM Marketplace	6	3.33	0.0	0	8.16	0	20
Order Routing							
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
EnronOnline	3	38.33	10.0	5	53.46	5	100
EnronStrommarkt	3	6.67	0.0	0	11.55	0	20
pbi powerbroker	2	0.00	0.0	0	0.00	0	0
NetStrom	2	0.00	0.0	0	0.00	0	0
SKM Marketplace	2	0.00	0.0	0	0.00	0	0
Price Discovery							
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
EnronOnline	3	43.33	30.0	0	51.32	0	100
EnronStrommarkt	4	5.00	5.0	0	5.77	0	10
pbi powerbroker	2	0.00	0.0	0	0.00	0	0
NetStrom	2	0.00	0.0	0	0.00	0	0
SKM Marketplace	2	0.00	0.0	0	0.00	0	0
Clearing and Settlement							
	n	*M*	*Md*	*Mo*	*s*	*Min*	*Max*
EnronOnline	4	26.50	3.0	0	49.05	0	100
EnronStrommarkt	3	0.00	0.0	0	0.00	0	0
pbi powerbroker	2	0.00	0.0	0	0.00	0	0
NetStrom	2	0.00	0.0	0	0.00	0	0
SKM Marketplace	2	0.00	0.0	0	0.00	0	0

Table A.16: Software Packages in the Value Chain

Process	Software Package	
	Product Name	Vendor
Market Analysis	Elfin, Gasflo, Gridflo	Matrica
	Excel	Microsoft
	MarketingManager	Update Marketing
	SPSS	SPSS
Customer Management	Harmony	Palm
Credit Risk Management		Dun & Bradstreet
Portfolio Management	Contango	FSD
	KW2000	KW Int'l
	POSITION	Cap Gemini
	ZAI*Net	Caminus
Clearing and Settlement	Contango	FSD
	EWIS	EnBW and IDOS
	POMAX	OM Group
	POSITION	Cap Gemini
	ZAI*Net	Caminus
Risk Management	Contango	FSD
	Power Trade	MMT
	HydroThermal Coordination AMS	Pereira
Metering		Fröschel
		Görlitz
		Landis&Gyr
		LEOAN
		Wemdas
		ZeBis
Sales	DGC500	Siemens
	EVI	
	MarketingManager	Update Marketing
	R/3	SAP
	Vantine	
Grid Management	Contango	FSD
	EWIS	EnbW and IDOS
Other software	BalancePlus	ABB Infosystems
	Powerclick	Nordpool
	Telerate	Bridge

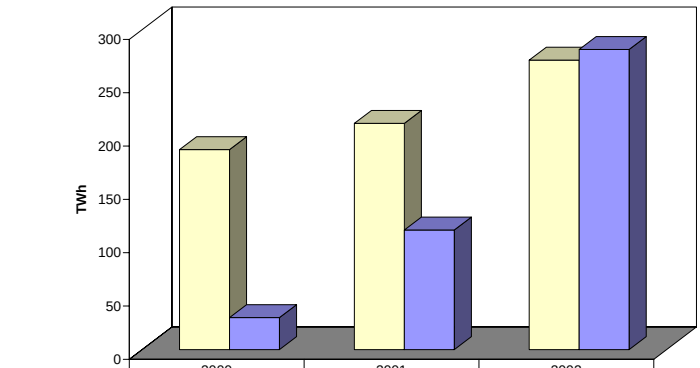
Table A.17: IS versus COTS (Multiple Entries Allowed)

Figures in Percent	IS	COTS	Missing
Market Analysis	31.25	12.50	56.25
Grid Management	31.25	12.50	62.50
Customer Management	25.00	6.25	68.75
Credit Risk Management	25.00	6.25	75.00
Sales	18.75	12.50	68.75
Clearing and Settlement	25.00	25.00	50.00
Risk Management	18.75	18.75	62.50
Portfolio Management	18.75	25.00	56.25
Other software	0.00	18.75	81.25
Metering	0.00	37.50	62.50

Table A.18: Issues with Software Packages

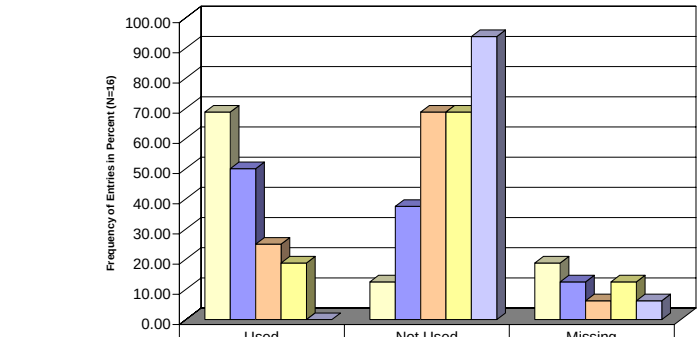
Figures in Percent	*n*	*Md*	*Mo*	*Min*	*Max*
User Interface	9	1.0	1	1	3
Customization	9	2.0	2	1	3
Integration Costs	9	2.0	2	1	4
Performance	9	3.0	2	2	4
Complexity	9	2.0	3	1	3
Hardware Specifications	9	3.0	3	1	4

B Diagrams



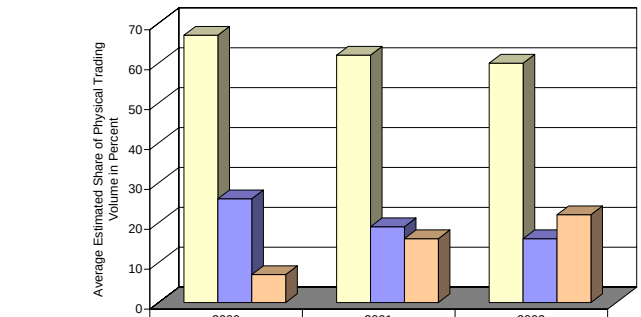
	2000	2001	2002
Physical Trading	188	212	271
Financial Trading	30	112	281

Figure B.1: Market Development



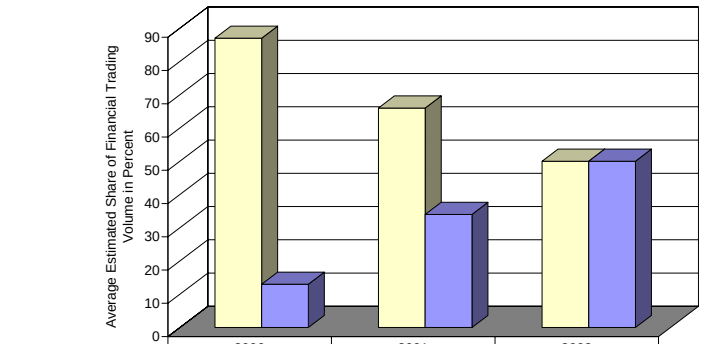
	Used	Not Used	Missing
OTC Physical Forward	68.75	12.50	18.75
OTC Spot	50.00	37.50	12.50
OTC Financial Forward	25.00	68.75	6.25
Exchange Spot	18.75	68.75	12.50
Exchange Futures	0.00	93.75	6.25

Figure B.2: Usage of Market Segments



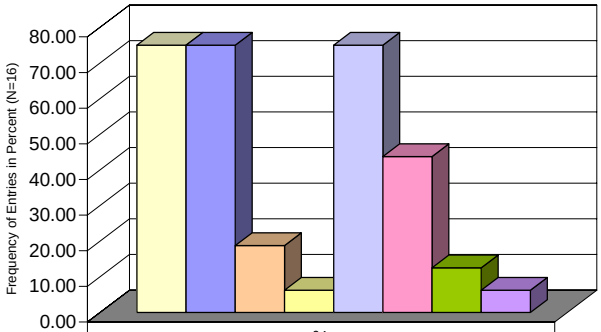
	2000	2001	2002
OTC Physical Forward	67	62	60
OTC Spot	26	19	16
Exchange Spot	7	16	22

Figure B.3: Development of Physical Trading



	2000	2001	2002
OTC Financial Forward	87	66	50
Exchange Futures	13	34	50

Figure B.4: Development of Financial Trading



	%
EEX Spot	75.00
LPX Spot	75.00
APX Spot	18.75
Nordpool ElSpot	6.25
EEX Futures	75.00
LPX Futures	43.75
Nordpool ElTermin	12.50
Nordpool ElOption	6.25

Figure B.5: (Intended) Usage of Exchange Markets (Multiple Entries Allowed)

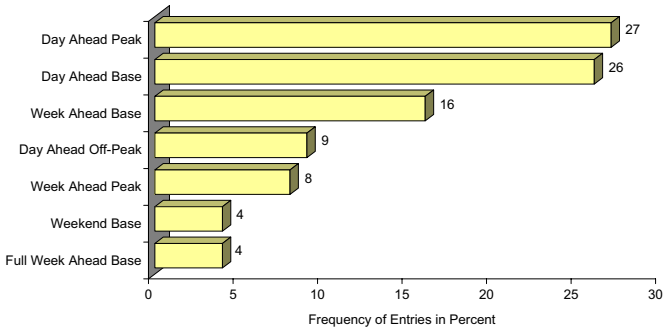


Figure B.6: Contracts in the OTC Spot Market

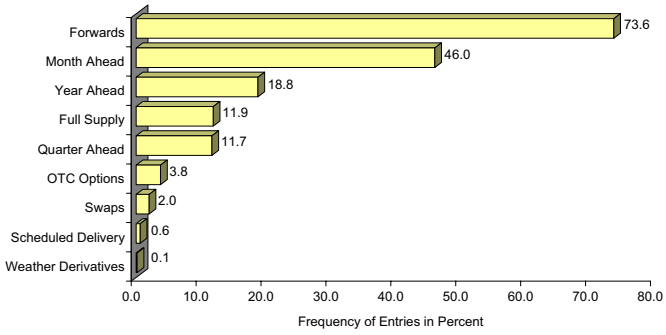


Figure B.7: Contracts in the OTC Physical Forward Market

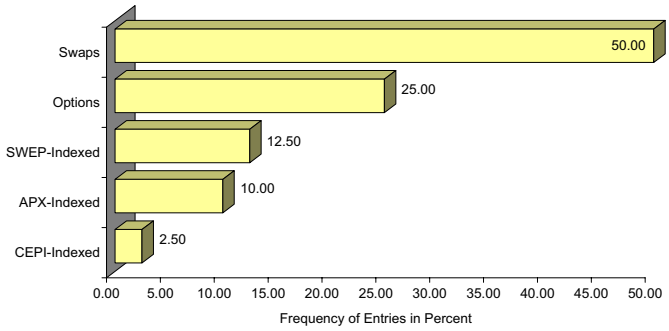
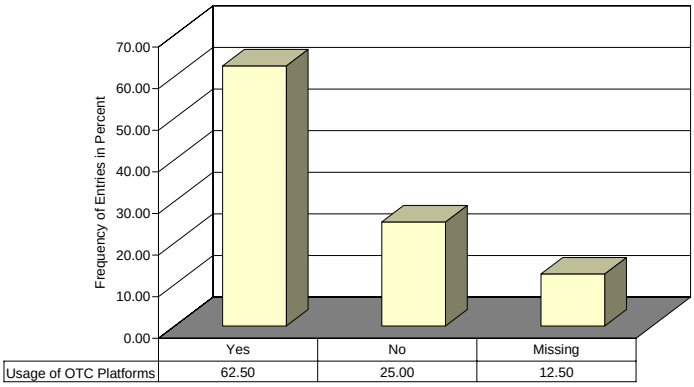
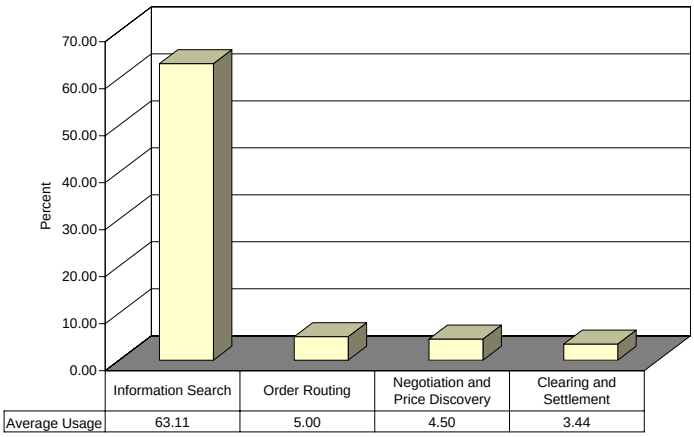


Figure B.8: Contracts in the OTC Financial Forward Market



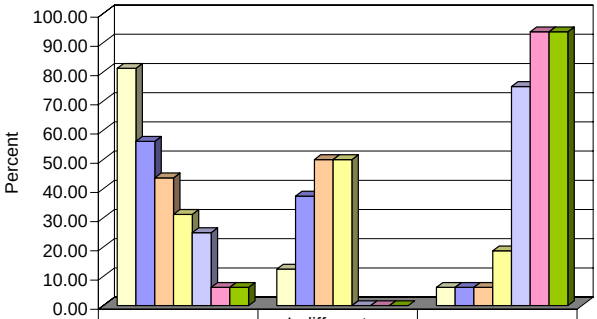
	Yes	No	Missing
Usage of OTC Platforms	62.50	25.00	12.50

Figure B.9: Usage of Electronic OTC Trading Platforms



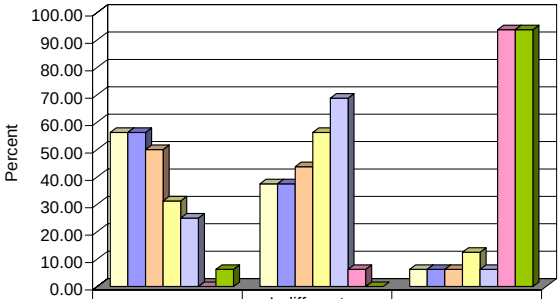
	Information Search	Order Routing	Negotiation and Price Discovery	Clearing and Settlement
Average Usage	63.11	5.00	4.50	3.44

Figure B.10: Usage of Electronic Trading in Transaction Phases



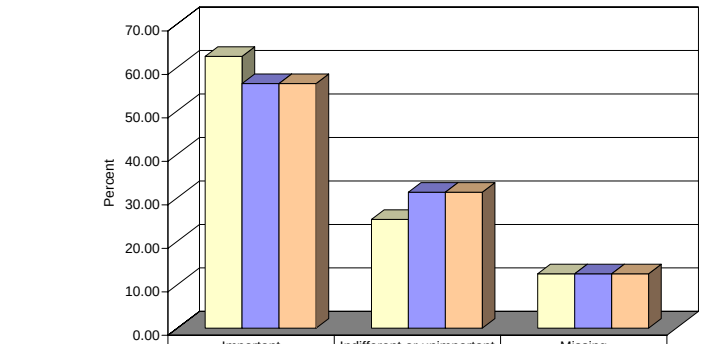
	Important	Indifferent or unimportant	Missing
Personal Contacts	81.25	12.50	6.25
Creditworthiness	56.25	37.50	6.25
Anonymity	43.75	50.00	6.25
Block Trading	31.25	50.00	18.75
Tailor-made Products	25.00	0.00	75.00
Independence	6.25	0.00	93.75
Market Information	6.25	0.00	93.75

Figure B.11: Perception of Advantages of Telephone Trading



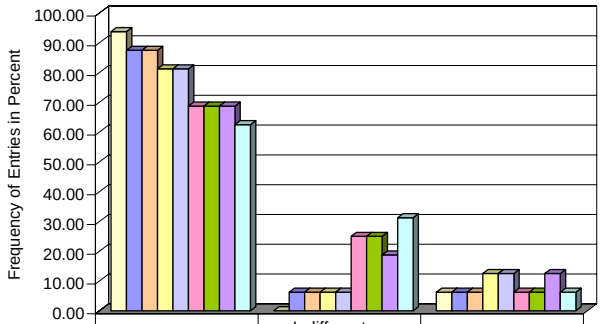
	Important	Indifferent or unimportant	Missing
Limited Liquidity	56.25	37.50	6.25
Limited Price Transparency	56.25	37.50	6.25
Limited Counterparties	50.00	43.75	6.25
Lack of Anonymity	31.25	56.25	12.5
High Transaction Costs	25.00	68.75	6.25
High Credit Risk	0.00	6.25	93.75
High Settlement Risk	6.25	0.00	93.75

Figure B.12: Perception of Disadvantages of Telephone Trading



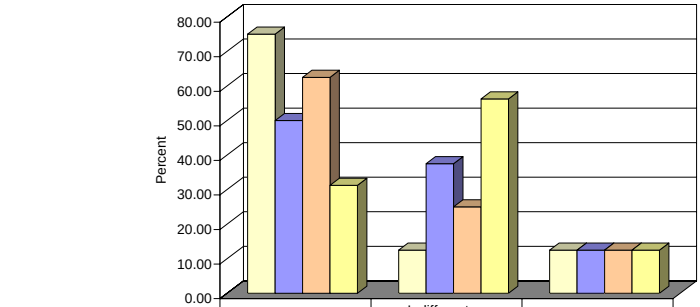
	Important	Indifferent or unimportant	Missing
OTC Spot	62.50	25.00	12.50
OTC Physical Forward	56.25	31.25	12.50
OTC Financial Forward	56.25	31.25	12.50

Figure B.13: Applicability of Electronic OTC Trading Platforms in OTC Market Segments



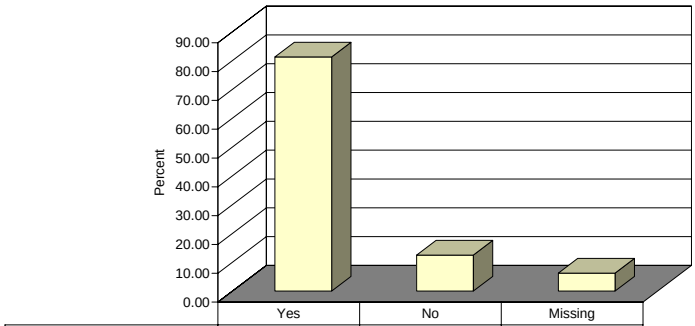
	Important	Indifferent or unimportant	Missing
High Reliability	93.75	0.00	6.25
High Liquidity	87.50	6.25	6.25
High Security	87.50	6.25	6.25
Low Transaction Costs	81.25	6.25	12.50
High Availability	81.25	6.25	12.50
Neutral Operator	68.75	25.00	6.25
Low Complexity	68.75	25.00	6.25
Standard Interfaces	68.75	18.75	12.50
Anonymity	62.50	31.25	6.25

Figure B.14: Requirements for Electronic OTC Platforms



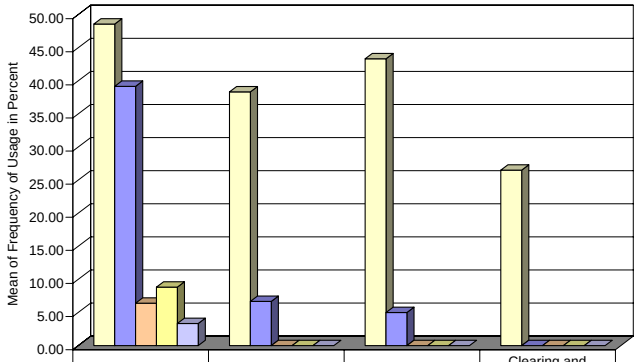
	Important	Indifferent or unimportant	Missing
Information Search	75.00	12.50	12.50
Order Routing	50.00	37.50	12.50
Negotiation and Price Discovery	62.50	25.00	12.50
Clearing and Settlement	31.25	56.25	12.50

Figure B.15: Applicability of Electronic Platforms in Transaction Phases



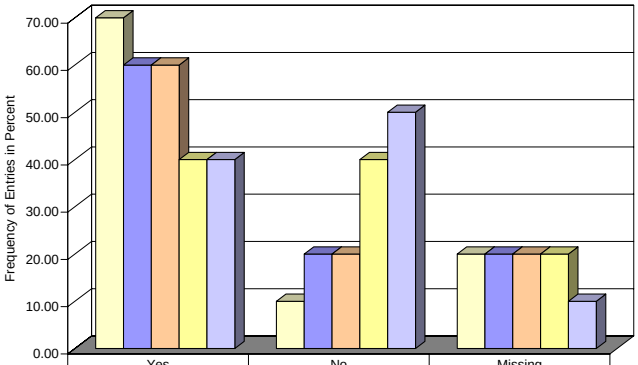
	Yes	No	Missing
Can you imagine using automated negotiation and price discovery by means of electronic OTC trading platform?	81.25	12.50	6.25

Figure B.16: Automated Negotiation and Price Discovery



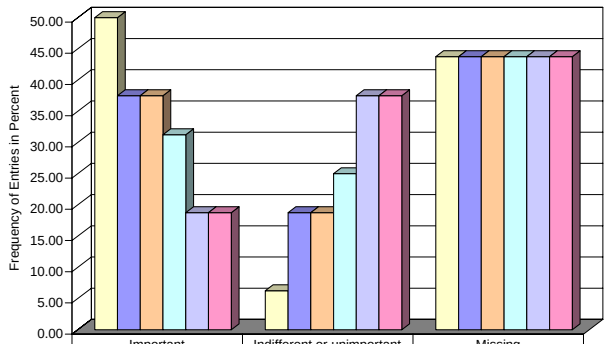
	Information Search	Order Routing	Price Discovery	Clearing and Settlement
Enron Online	48.57	38.33	43.33	26.50
Enron Strommarkt	39.17	6.67	5.00	0.00
NetStrom	6.40	0.00	0.00	0.00
pbi powerbroker	8.83	0.00	0.00	0.00
SKM Marketplace	3.33	0.00	0.00	0.00

Figure B.17: Frequency of Usage of Electronic OTC Platforms



	Yes	No	Missing
Enron Online	70.00	10.00	20.00
Enron Strommarkt	60.00	20.00	20.00
pbi powerbroker	60.00	20.00	20.00
SKM Marketplace	40.00	40.00	20.00
Netstrom	40.00	50.00	10.00

Figure B.18: Knowledge of Electronic OTC Platforms



	Important	Indifferent or unimportant	Missing
Interface	50.00	6.25	43.75
Customization	37.50	18.75	43.75
Integration Costs	37.50	18.75	43.75
Complexity	31.25	25.00	43.75
Performance	18.75	37.50	43.75
Hardware Specifications	18.75	37.50	43.75

Figure B.19: Issues with Software Packages

C Cover letter, Questionnaire and Instructions

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Giessen, May 8th 2000

"E-Business in the Deregulated German Wholesale Electricity Markets"

Dear Mr / Ms [..],

New energy legislation fundamentally changes the market structure, transaction relationships and trading processes in electricity markets, transforming the electric utility industry into a competitive electric power industry. How will the markets develop? What will be the role of "e-business"? Which trading instruments are preferred by the market participants today and will be in the future?

These questions have given rise to this survey, "E-Business in the Deregulated German Wholesale Electricity Markets", conducted by the Department of Information Systems at the University of Giessen in Germany. We have focused our questionnaire on your trading and brokerage activities with electricity and electricity derivatives in the German wholesale markets.

You will profit immediately from our research: You will be sent a summary of our findings including a list of participants. Soon after, you will also receive a detailed analysis with in-depth information about the German electricity markets.

It will take you approximately 30 to 45 minutes to complete the questionnaire, which mainly consists of multiple-choice questions. As a matter of course, we guarantee that your reply will be treated in the strictest confidence and analysed anonymously in statistical form only. Your name and address will not be associated with the findings in any way.

We would be delighted if you could take the time to fill in the questionnaire and return it using the enclosed addressed envelope. Should you have any queries, please contact Mr Uwe Rainer of Luenendonk Consultancy and Research (Tel. +49 40 64 86 16 21) or Mr Stefan Strecker of the University of Giessen (Tel. +49 64 19 92 26 20).

We would like to thank you very much in advance for your support of our research project and remain yours sincerely

Prof Dr Christof Weinhardt
(Head of the Department)

Stefan Strecker
(Research Assistant)

Survey

E-Business in the Deregulated German Wholesale Electricity Markets

- Questionnaire -

1. Introduction

The objective of this survey is to compare the exchange and off-exchange, i. e., over-the-counter (OTC) trading with respect to automation through information and communication technology (ICT) in the trading process. The questionnaire focuses on your trading and brokerage activities with electricity and electricity derivatives in the German part of the pan-European (UCTE) grid.

We are interested in your personal expert opinion and your estimations. We would be grateful if you could estimate quantitative values that are not available at the time of writing and if you would answer all relevant questions fully. This will guarantee the quality of the results and enable us to provide you with reliable information about the markets.

A short glossary in section 9 defines our terminology for this questionnaire.

2. Personal Information

1) Name of Company

_____

2) Your title, full name and function

_____

3) Address

_____

4) Telephone, Facsimile, E-Mail, Homepage

Telephone _____ Facsimile _____

E-Mail _____ Homepage _____

3. Wholesale Electricity Trading

3.1 Physical Electricity Trading

5) Are you actively trading and/or brokering contracts with physical delivery ?

Yes ❑

No ❑ *(→go to question no. 35)*

3.1.1 Power Exchange Spot Markets

6) Are you actively trading and/or brokering on power exchange spot markets ?

Yes ❑ *(→ go to question no. 8)*

No ❑

7) Do you plan to trade on the following spot markets ?

Nord Pool ElSpot ❑ LPX ❑ Not planned ❑

APX ❑ EEX ❑

Others: _____ _____ _____

→go to question no. 15

8) Which spot markets are you using and in what proportions ?

Nord Pool ElSpot _____ %

APX _____ %

Others _____ _____ _____

9) Do you plan to trade on the following spot markets ?

Nord Pool ElSpot ❑ LPX ❑ Not planned ❑

APX ❑ EEX ❑

Others: _____ _____ _____

10) How often do you conduct transactions on power exchange spot markets ?

_____ times per day ❑ / per week ❑ / per month ❑

11) What are the ultimate reasons for your participation on power exchange spot markets and what percentage of your total quantitative trading volume is traded for which reasons ?

Peak load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%
Medium load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%
Base load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%

12) What percentage of your total quantitative trading volume is traded on power exchange spot markets today and what percentage do you expect to be traded in the future ?

today _____ % in one year _____ % in 2 years _____ %

13) What percentage of your transactions on power exchange spot markets is mediated by intermediaries and what percentage is executed directly on the exchange ?

	today	in 1 year	in 2 years
a) Intermediaries	_____ %	_____ %	_____ %
b) directly on the exchanges	_____ %	_____ %	_____ %

14) How long is the delay between the initial desire for a transaction and its completion on the power exchange spot markets?

a) at least _____ seconds ❑ / minutes ❑
b) on average _____ seconds ❑ / minutes ❑
c) at most _____ seconds ❑ / minutes ❑

3.1.2 OTC Spot Markets

15) Are you actively trading and/or brokering bilateral contracts with physical delivery and a maturity of one week or less ?

Yes ❑
No ❑ *(→ **go to question no. 24**)*

16) Which products (e.g. day ahead peak 5x12) do you trade on OTC spot markets and how do these products relate to each other in terms of quantitative trading volumes ?

_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
Σ 100 %

17) What quantities for delivery are laid down by your bilateral spot contracts ?

a) at least _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
b) on average _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
c) at most _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

18) How often do you conduct transactions on the OTC spot markets ?

_____ times per day ❑ / per week ❑ / per month ❑

19) What are the ultimate reasons for your participation on OTC spot markets and what percentages of your total quantitative trading volume are traded for which reasons ?

Peak load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%
Medium load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%
Base load:	Self-consumption ____ %	Resell ____ %	Sale ____ %	Brokerage _____%

20) What percentage of your total quantitative trading volume is traded on OTC spot markets today and what percentage do you expect to be traded in the future ?

today _____ % in 1 year _____ % in 2 years _____ %

21) What percentage of your transactions on OTC spot markets is mediated by intermediaries and what percentage is negotiated bilaterally ?

	today	in 1 year	in 2 years
a) intermediaries	_____ %	_____ %	_____ %
b) bilateral negotiation	_____ %	_____ %	_____ %

22) How long is the delay between the initial desire for a transaction and its completion on the OTC spot markets ?

a) at least _____ seconds ❑ / minutes ❑ / hours ❑ / days ❑
b) on average _____ seconds ❑ / minutes ❑ / hours ❑ / days ❑
c) at most _____ seconds ❑ / minutes ❑ / hours ❑ / days ❑

23) What is your estimation of your cost per transaction on the OTC spot markets ?

a) at least _____ € per transaction
b) on average _____ € per transaction
c) at most _____ € per transaction

3.1.3 OTC Physical Forward Markets

24) Are you actively trading and/or brokering bilateral contracts with physical delivery and a maturity of more than one week ?

Yes ❑
No ❑ *(→ **go to question no. 35**)*

25) Which products / derivatives (e.g. forwards) do you trade on OTC physical forward markets and how do these products relate to each other in terms of quantitative trading volumes ?

_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
Σ 100 %

26) What is the maturity of your bilateral physical forward contracts ?

a) at least _____ months ❑ / years ❑
b) on average _____ months ❑ / years ❑
c) at most _____ months ❑ / years ❑

27) What delivery periods are laid down by your bilateral physical forward contracts ?

a) at least _____ months ❑ / years ❑
b) on average _____ months ❑ / years ❑
b) at most _____ months ❑ / years ❑

28) What quantities for delivery are laid down by your bilateral physical forward contracts ?

a) at least _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
b) on average _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
c) at most _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

29) How often do you conduct transactions on the OTC physical forward markets ?

_____ times per day ❑ / per week ❑ / per month ❑

30) What are the ultimate reasons for your participation on OTC physical forward markets and what percentages of your total quantitative trading volume are traded for which reasons ?

Peak load: Self-consumption ____ % Resell ____ % Sale ____ % Brokerage _____%
Medium load: Self-consumption ____ % Resell ____ % Sale ____ % Brokerage _____%
Base load: Self-consumption ____ % Resell ____ % Sale ____ % Brokerage _____%

31) What percentage of your total quantitative trading volume is traded on OTC physical forward markets today and what percentage do you expect to be traded in the future ?

today _____ % in 1 year _____ % in 2 years _____ %

32) What percentage of your transactions in OTC physical forward markets is mediated by intermediaries and what percentage is negotiated bilaterally today, and what percentage do you expect in the future ?

	today	in 1 year	in 2 years
a) intermediaries	_____ %	_____ %	_____ %
b) bilateral negotiation	_____ %	_____ %	_____ %

33) How long is the delay between the initial desire for a transaction and its completion on the OTC physical forward markets ?

a) at least _____ minutes ❑ / hours ❑ / days ❑ / weeks ❑
b) on average _____ minutes ❑ / hours ❑ / days ❑ / weeks ❑
c) at most _____ minutes ❑ / hours ❑ / days ❑ / weeks ❑

34) What is your estimation of your cost per transaction on the OTC physical forward markets ?

a) at least _____ € per transaction
b) on average _____ € per transaction
c) at most _____ € per transaction

3.2 Financial Electricity Derivative Markets

35) Are you actively trading and/or brokering exchange-traded contracts with cash settlement ?

Yes ❑ *(→go to question no. 37)*
No ❑

3.2.1 Power Exchange Futures Markets

36) Do you plan to trade on the following futures markets ?

Nord Pool ElTermin ❑ LPX ❑ Not planned ❑
Nord Pool ElOption ❑ EEX ❑

Others: _____ _____ _____

→go to question no. 44

37) Which spot markets are you using and in what proportions ?

Nord Pool ElTermin _____ %
Nord Pool ElOption _____ %

Others: _____ _____ _____

38) Do you plan to trade on the following futures markets ?

Nord Pool ElTermin ❑ LPX ❑ Not planned ❑
Nord Pool ElOption ❑ EEX ❑

Others: _____ _____ _____

39) Which products / derivatives do you trade on futures markets and in what proportions of your total quantiative trading volume ?

Futures _____ %
Options _____ %

40) How often do you conduct transactions on the futures markets ?

_____ times per day ❑ / per week ❑ / per month ❑

41) What percentage of your total quantitative trading volume is traded on futures markets today and what percentage do you expect to be traded in the future ?

today _____ % in 1 year _____ % in 2 years _____ %

42) What percentage of your transactions on futures markets is mediated by intermediaries and what percentage is executed directly on the exchange today, and what percentage do you expect in the future ?

	today	in 1 year	in 2 years
a) intermediaries	_____ %	_____ %	_____ %
b) directly on the exchanges	_____ %	_____ %	_____ %

43) How long is the delay between the initial desire for a transaction and its completion on the futures markets ?

a) at least _____ seconds ❑ / minutes ❑
b) on average _____ seconds ❑ / minutes ❑
c) at most _____ seconds ❑ / minutes ❑

3.2.2 OTC Financial Forward Markets

44) Are you actively trading and/or brokering bilateral contracts with cash settlement and a maturity of more than one week ?

Yes ❑

No ❑ *(→ go to question no. 54)*

45) Which products / derivatives (e.g. swaps) do you trade on OTC financial forward markets and in what proportions of your total quantitative trading volume ?

_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
_____ _____ %
Σ 100 %

46) What is the maturity of your bilateral financial forward contracts ?

a) at least _____ months ❑ / years ❑
b) on average _____ months ❑ / years ❑
c) at most _____ months ❑ / years ❑

47) What delivery periods are laid down by your bilateral financial forward contracts ?

a) at least _____ months ❑ / years ❑
b) on average _____ months ❑ / years ❑
b) at most _____ months ❑ / years ❑

48) What quantities for delivery are laid down by your bilateral financial forward contracts ?

a) at least _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
b) on average _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
c) at most _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

49) How often do you conduct transactions on the OTC financial forward markets ?

_____ times per day ❑ / per week ❑ / per month ❑

50) What percentage of your total quantitative trading volume is traded on OTC financial forward markets today and what percentage do you expect to be traded in the future ?

today _____ % in 1 year _____ % in 2 years _____ %

51) What percentage of your transactions in OTC financial forward markets is mediated by intermediaries and what percentage is negotiated bilaterally today, and what percentage do you expect in the future ?

	today	in 1 year	in 2 years
a) intermediaries	_____ %	_____ %	_____ %
b) bilateral negotiation	_____ %	_____ %	_____ %

52) How long is the delay between the initial desire for a transaction and its completion on the OTC financial forward markets ?

a) at least _____ minutes ❑ / hours ❑ / days ❑
b) on average _____ minutes ❑ / hours ❑ / days ❑
c) at most _____ minutes ❑ / hours ❑ / days ❑

53) What is your estimation of your cost per transaction on the OTC financial forward markets ?

a) at least _____ € per transaction
b) on average _____ € per transaction
c) at most _____ € per transaction

4. Estimation of the Development of German Electricity Markets

54) What is your estimation of the total quantitative trading volume per year in Germany today and in the future?

in 2000: physical: _____ financial: _____TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
in 2001: physical: _____ financial: _____TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑
in 2002: physical: _____ financial: _____TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

55) What percentage of the estimated *physical* trading volume will be traded on power exchanges and what percentage will remain on the OTC spot respectively OTC physical forward markets ?

		Share Power Exchange Spot Market	Share OTC Spot Market	Share OTC Physical Forward Market
in 2000:	*physical:*	_____ %	_____ %	_____ %
in 2001:	*physical:*	_____ %	_____ %	_____ %
in 2002:	*physical:*	_____ %	_____ %	_____ %

56) What percentage of the estimated *financial* trading volume will be traded on power exchanges and what percentage will remain OTC?

		Share Power Exchange Futures Market	Share OTC Financial Forward Market
in 2000:	*financial:*	_____ %	_____ %
in 2001:	*financial:*	_____ %	_____ %
in 2002:	*financial:*	_____ %	_____ %

5. Electronic OTC Trading

57) How do you rate the following advantages of trading with telephone and facsimile in the OTC trading process (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
personal contacts	❑	❑	❑	❑	❑
knowledge of creditworthiness / rating	❑	❑	❑	❑	❑
block trading w/ adverse selection	❑	❑	❑	❑	❑
anonymity through brokers	❑	❑	❑	❑	❑

Other advantages:

_____	❑	❑	❑	❑	❑
_____	❑	❑	❑	❑	❑

58) How do you rate the following disadvantages of trading with telephone and facsimile in the OTC trading process (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
lack of liquidity	❑	❑	❑	❑	❑
lack of price transparency	❑	❑	❑	❑	❑
limited number of potential counterparts	❑	❑	❑	❑	❑
lack of anonymity in bilateral negotiations	❑	❑	❑	❑	❑
high transaction costs	❑	❑	❑	❑	❑

Other disadvantages:

_____	❑	❑	❑	❑	❑
_____	❑	❑	❑	❑	❑

59) How often and in which transaction phases do you use electronic OTC trading platforms in relation to the total number of transations ?

Information Search	Order Entry Order Routing	Negotiation Price Discovery	Clearing / Settlement
_____ %	_____ %	_____ %	_____ %

We do not use electronic OTC trading platforms: ❑ *(→ **go to question no. 62**)*

60) How often and in which transaction phases do you use the following OTC trading platforms in relation to each other ?

	Information Search	Order Entry Order Routing	Negotiation Price Discovery	Clearing / Settlement	Platform unknown
Enron Strommarkt	_____ %	_____ %	_____ %	_____ %	❑
Enron Online	_____ %	_____ %	_____ %	_____ %	❑
NetStrom	_____ %	_____ %	_____ %	_____ %	❑
pbi Powerbroker	_____ %	_____ %	_____ %	_____ %	❑
SKM Marketplace	_____ %	_____ %	_____ %	_____ %	❑

Other Platforms:

_____	_____ %	_____ %	_____ %	_____ %
_____	_____ %	_____ %	_____ %	_____ %
_____	_____ %	_____ %	_____ %	_____ %
_____	_____ %	_____ %	_____ %	_____ %
	Σ 100 %	Σ 100 %	Σ 100 %	Σ 100 %

61) Please compare and rate the suitability of the following OTC trading platforms in the transaction phases (please use 1 for first place, 2 for 2nd and so forth)!

	Information Search	Order Entry Order Routing	Negotiation Price Discovery	Clearing / Settlement	Platform unknown
Enron Strommarkt	_____	_____	_____	_____	❑
Enron Online	_____	_____	_____	_____	❑
NetStrom	_____	_____	_____	_____	❑
pbi Powerbroker	_____	_____	_____	_____	❑
SKM Marketplace	_____	_____	_____	_____	❑

Other platforms:

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

62) How do you rate the application of electronic OTC trading platforms in the following market segments (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
OTC Spot Market	❑	❑	❑	❑	❑
OTC Physical Forward Market	❑	❑	❑	❑	❑
OTC Financial Forward Market	❑	❑	❑	❑	❑

63) How do you rate the application of electronic OTC trading platforms in the following transaction phases (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
information search	❑	❑	❑	❑	❑
order entry, order routing	❑	❑	❑	❑	❑
negotiation, price discovery	❑	❑	❑	❑	❑
clearing, settlement	❑	❑	❑	❑	❑

64) How do you rate the following requirements for electronic OTC electricity trading platforms (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
neutral operator	❑	❑	❑	❑	❑
low transaction costs	❑	❑	❑	❑	❑
high liquidity	❑	❑	❑	❑	❑
anonymity	❑	❑	❑	❑	❑
high security	❑	❑	❑	❑	❑
high reliability	❑	❑	❑	❑	❑
high availability	❑	❑	❑	❑	❑
low complexity	❑	❑	❑	❑	❑
standard interfaces	❑	❑	❑	❑	❑

Other requirements:

_____	❑	❑	❑	❑	❑
_____	❑	❑	❑	❑	❑

65) Can you imagine using automated negotiation and price discovery by means of electronic OTC trading platforms ?

Yes ❑
No ❑

6. Information and Communication Technology in the Value Chain

66) What software do you use in the front, middle, and back office for the following tasks (please mark in-house solutions as [IS]) ?

	Name and Vendor of Software		
market analysis	_____	_____	_____
customer management	_____	_____	_____
rating / creditworthiness	_____	_____	_____
portfolio management	_____	_____	_____
settlement	_____	_____	_____
risk management	_____	_____	_____
Other software:	_____	_____	_____

67) What software do you use for the following pre-trading and post-trading tasks in the value chain (please mark in-house solutions as [IS]) ?

	Name and Vendor of Software		
metering	_____	_____	_____
sales	_____	_____	_____
grid management	_____	_____	_____
power plant management	_____	_____	_____
Other software:	_____	_____	_____

68) What problems arise when using the software in the value chain (1 = „extremely important" to 5 = "extremely unimportant") ?

	1	2	3	4	5
interface issues	❑	❑	❑	❑	❑
performance problems	❑	❑	❑	❑	❑
customization problems	❑	❑	❑	❑	❑
high integration costs	❑	❑	❑	❑	❑
high complexity	❑	❑	❑	❑	❑
high requirements for hardware	❑	❑	❑	❑	❑

What other problems arise ? _____

_____ _____

What solutions do you suggest ? _____

_____ _____

69) Please give a brief description of your requirements for an ideal ICT support in the value chain!

_____

_____

7. Company Information

70) To which category of companies do you belong ?

supra regional utility	❑	power broker	❑
regional utility	❑	financial service institution	❑
local utility (municipality)	❑	bank	❑
power marketer	❑	industrial consumer	❑

71) Are your headquarters located in Germany ?

Yes ❑ in region: North ❑ South ❑

No ❑

72) What turnover did you generate by wholesale electricity trading in 1999 and what turnover do you expect in 2000 ?

1999: _____ 2000: _____ € ❑ / DM ❑ / £ ❑ / USD ❑

73) How much electricity do you transact per year today and how much do you expect to transact in the future ?

today: _____ in 1 year: _____ in 2 years: _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

74) How much electricity do you produce per year today and how much do you expect to produce in the future ?

today: _____ in 1 year: _____ in 2 years: _____ TWh ❑ / GWh ❑ / MWh ❑ / kWh ❑

75) How many workers do you employ in the front, middle, and back office of your electricity trading department ?

	Total	Front office	Middle office	Back office
less than 10 employees	❑	❑	❑	❑
11 to 20 employees	❑	❑	❑	❑
21 to 30 employees	❑	❑	❑	❑
31 to 40 employees	❑	❑	❑	❑
more than 40 employees	❑	❑	❑	❑

8. Closing Remarks

76) Your opinion of this questionnaire is important to us. If you have any closing comments, please do not hesitate to make them here.

_____

_____

_____

_____

Please send the questionnaire to:

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9. Glossary

This section explains the terminology used in our questionnaire:

Electricity trading is the process of purchase, sale and mediation of electricity and financial derivatives based on electricity, independent of generation assets, transmission and distribution lines.

We define **retail electricity trading** as electricity trading at the level of distribution lines (in Germany 20 kV and lower) with reseller-to-end consumer transaction relationships. Market participants in the retail market are small- to medium-size end consumers, typically private households, as well as small and medium enterprises (SME) with an electricity consumption, that does not allow them to manage their own energy contract portfolio. A typical contract for electricity delivery in the retail market covers electric energy plus affiliated services such as maintenance, metering, energy and load management.

Wholesale electricity trading denotes electricity trading at the level of transmission lines (380 kV, sometimes 220 kV) with transaction relationships between generators, intermediaries and large-scale industrial consumers. A typical wholesale transaction covers pure energy without affiliated services. Furthermore, wholesale trading requires each market participant to manage and control his own energy contract portfolio, i. e., each wholesale market participant ensures that the portfolio meets his consumption and delivery needs.

Physical electricity trading comprises (1) exchange and off-exchange trading with delivery contracts providing for immediate *physical* delivery, as well as (2) forward trading in electricity derivatives leading to a future *physical* delivery.

Financial electricity trading comprises exchange and off-exchange trading in electricity derivatives leading to a cash settlement (the so-called "paper market").

Exchange-based electricity trading comprises the spot and the futures markets. The **spot market** is typically organized as a „day ahead" market with contracts for physical delivery for each hour on the following day. The **futures market** is a secondary market dealing with highly standardized electricity derivative contracts, with either physical delivery or cash settlement.

The term "over the counter (OTC)" describes a market for off-exchange trading in electricity and electricity derivatives. We talk about OTC trading when parties bilaterally negotiate individual, tailor-made contracts.

The OTC markets comprise an OTC spot and an OTC forward market. The **OTC spot market** is a market for trading with contracts for physical delivery, a maturity of one week or less and an arbitrary delivery period. The **OTC forward market** is a market for trading with contracts for physical delivery or cash settlement, a maturity of one week or more and an arbitrary delivery period.

Electronic OTC trading platforms are ICT systems enabling trade between an arbitrary number of parties in electricity and/or electricity derivatives ideally supporting all transaction phases (information search, order routing, negotiation / price discovery, clearing / settlement).