Croatian Electricity Company (HEP), Zagreb, Croatia
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Power System Department, Zagreb (FER), Croatia
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Training Center for Energy Trading
Executive Summaries

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Trømse, Trondheim, Zagreb, February 2006

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Training Centre for Energy Trading – Executive Summaries

Preface

The Electricity Sector in the South East European region is about to enter an entirely altered status, a complete new situation with a deregulated and liberalized market and with a third party access to the network. Under these circumstances, and within this new framework, it will be mandatory for the Industries in the South East European countries to adapt their organization and business procedures in accordance with this the new situation, in the same manner as the utilities in the rest of Europe have done.

The objective of the project at this stage is: (i) to establish a platform for transferring knowledge and skills related to challenges that a utility will be confronted in the planning, installation and operation of a Training Centre for trading of Energy, (ii) to develop the curricula and to train the Trainers for future operation of the Training Centre for Energy Trading and (iii) to make the analysis of the possibilities and challenges which Electricity Sector faces, in order to develop recommendations for strategies by which the HEP may further develop as a participant with the competence necessary to be an important player on the electricity market in the region.

The project is a joint effort of Croatian Electricity Company (HEP), Faculty of Electrical Engineering and Computing - University of Zagreb (FER) and co-operating partners from the Croatian side, and Technor and co-operating partners from the Norwegian side.

This book, with the topic "Training Centre for Energy Trading–Executive Summaries", presents executive summaries and development curricula of all the material printed in five different books.

We wish to thank the Norwegian Ministry of Foreign Affairs and the Croatian Electricity Company (HEP) for funding the Project "Training Center for Energy Trading", as well as for supporting the publication of this book and teaching the first group of market participants.

Contents

Croatian Electricity Company (HEP), Zagreb, Croatia
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An Analysis of the Croatian/South East European Situation Regarding the Free Energy Market Implementation

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Executive summary

According to the project plan, a Training Centre for Energy Trading (TCET) is to be established at the Faculty of Electrical Engineering and Computing, Power System Department (FER) of the University of Zagreb, within the second quarter of 2006.

The objective of this report is to analyse the Croatian/ South East European (SEE) situation regarding the free energy market implementation.

The aim of power system liberalization is to increase the competition, plus the economic efficiency in operating the electrical power system.

The Directive and Strategy of the European Commission is the basis for developing the potential future market in the SEE region. The 5th Athens Forum has presented options for the implementation of Energy Community Treaty.

- Sufficient number of participants both on supply and demand side is a prerequisite for a well functioning market. In Bulgaria and Romania there are several producers and distributors, but in other regional countries there are few vertically integrated companies dominating the region.
- Regulators are established in all countries, but it is a challenge to establish neutral and independent system operators, which would arrange for open access and equal rights for transmission.
- For the region as a whole there is a surplus in the power balance for 2005. As to the consumption increase in the coming years, generation investments are important and interconnections would play a crucial role.
- The transfer capacity does not seem to be an obstacle to system security. The participant trade in the international market will determine the flow and whether congestion points could appear.
- The physical market should include all countries in the region and the adjacent countries in the EU. The confidence in the market price increases with liquidity.
- There are power exchanges in Romania (OPCOM), Slovenia, Austria and Italy. A single exchange is a guarantee for high liquidity and right prices.
- Implicit auction (market splitting) will optimize utilization of the grid.
- The participants, the exchanges and the system operators must be obliged to provide information to the market.
- In general, non-household consumers are to be eligible by 1 January 2008, while household customers will be included by 1 January 2015.

Conclusion: There is a strong motivation for implementing a deregulated and liberalized market in the SEE- countries.

Energy Charter, Energy Strategies, Energy Directives, Energy Laws

The EU directives and strategies related to electricity are the foundation, and constitute the overall views of electricity market in Europe. Liberalization process in energy sector, i.e. introduction of competition, economic efficiency, profit maximization and market energy prices, were started by Energy Charter process. It is the broadest multilateral framework of rules in existence under international law governing energy cooperation. The goal of the European Energy strategy in liberalized energy market with focus on trading is the EU becoming the most open and integrated single electricity and gas market by the 2007. Competitive electricity markets must deliver a secure, reasonably priced and continuous service to final energy customers. This process has been continued through Electricity Directive 2003/54/EC and Regulation 1228/2003/EC on conditions for access to the network for cross-border exchanges in electricity, as well as with ETSO 2005 CBT mechanism. In South East Europe region and in EU member states (total: 34 countries) Energy Community Treaty has been introduced to implement European Directives into energy sector.

Table 1. EU Electricity Directives (Source: Vasconcelos (2004))

	Most common Form pre-1996		1996 Directive		2003 Directive
Generation	Monopoly	→	Authorization Tendering	→	Authorization
Transmission **Distribution**	Monopoly	→	Regulated TPA Negotiated TPA Single Buyer	→	Regulated TPA
Supply	Monopoly	→	Accounting separation	→	Legal separation from transmission and distribution
Customers	No Choice	→	Choice for Eligible Customers (=1/3)	→	All non-household (2004) All (2007)
Unbundling T/D	None	→	Accounts	→	Legal
Cross-Border Trade	Monopoly	→	Negotiated	→	Regulated
Regulation	Government Department	→	Not specified	→	Regulatory Authority

Congestion management in European region has also been described. Croatian laws in energy (electricity) sector have also been described – they main goals are in compliance with European Directives.

Organisation of Energy Markets

The different participants in the electricity market have different roles. Participants in energy market are as follows: system operators (TSO, DSO), the transmission service provider, the distribution companies, the generators, the end-users (customers), the suppliers, the market operator and regulator. Three market models can be implemented:

the single buyer, the open access (third-party) model and the power pool (wholesale power exchange). Some experiences from the Nordic market have been described.

Organisation of Energy Utilities

The organization of energy utilities in a modern, deregulated regime in the present context comprises the following elements - ownership structure, level of unbundling activities, internal company structure. Common drivers behind organizational changes, factors influenced by ownership strategies, motives of unbundling, rules of thumb for internal organization have been described with a review of trends in Nordic countries. There is an example of organization of HEP Group.

Power Balance Overview

The power balance overview for the year 2004 has been made for the analyzed countries in SEE region (Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), Greece (GR), FYR Macedonia (MK), Romania (RO), Serbia and Montenegro (CS)) and neighbouring EU countries - Austria (AT), Hungary (H), Italy (IT), Slovenia (SI). This has been done by the UCTE System Adequacy (former Power Balance) methodology. Three aspects are analyzed: power balance, energy balance and transmission system, especially main congestions.

The total generating capacity of the countries concerned was 169.2 GW in December 2004. In the year 2004 total generation in the observed countries was 604.2 TWh (increase of 3.3%), while consumption reached 645.6 TWh. The most remarkable production and consumption was registered in Italy. Overall, the considered countries represent a net importing region as total amount of net imports was about 8.8% of their consumption (less than in the year 2003 when it was 10.3%). When looking into more detailed data within the region, - some of the countries exporting and some of them importing - it is obvious that electrical energy flows from the east to the west, i.e. towards Italy. As regards the system development, the most significant event was the reconnection of UCTE synchronous zones 1 and 2 on 10 October 2004. This removed some of the barriers for market development and opened opportunities for the countries in the region. The prices on markets were more stable in 2004 than in 2003 because there were no extraordinary conditions such as the 2003 heat wave and drought.

The experiences from the Nordic countries in power balance have also been described.

The Situation in SEE Region, Hungary, Slovenia, Austria, Italy and Norway

Whether the structural conditions in each of the countries are arranged for a well functioning market depends on some characteristics. The characteristics of energy market in Italy, Romania, Bulgaria, Serbia and Montenegro, Bosnia and Herzegovina, Macedonia, Austria, Slovenia, Hungary and Norway have been described.

Table 2. Eligible consumers

Country	Approx. market size (TWh)	Current threshold	Planned date of full deregulation	Number of firms (of some size)
Austria	54	All	-	100+
Bosnia and Herzegovina	10	Currently no eligible cons.	1/1-2015	3
Bulgaria	37	100 GWh. Non-households by 1/1-2007	1/7-2007	8 distributors About a dozen generators
Croatia	16	20 GWh/yr	1/7-2008	1
FYROM	7	Currently no eligible cons.	1/1-2015	1 (with 37 subsidiaries)
Hungary	38	6.5 GWh/yr	1/7-2007	5 major producers, 15 traders
Italy	305	100 MWh/yr	1/7-2007	About a dozen, but 1 very dominant
Romania	54	20 GWh/yr (2003)	Level reduced by 1 GWh/yr	10 major producers, 60 suppliers
Serbia and Montenegro	38	25 GWh/yr (Serbia), Montenegro: no eligibility yet	1/1-2015	2 (one in each republic)
Slovenia	12	Non-household	1/7-2007	2

Customer choice of supplier / supplier choice of generator

A competitive market should be arranged to grant customers' benefits both in the business and the household sector in terms of sufficient energy supply at competitive energy prices. Some remarks have been made on results from the South East European region review. To make a profit, suppliers try to diversify, ie find ways to stand out from the crowd. Some theoretical background on strategy and consumer choice has been shown – such as value to the customer (microeconomics, marketing, industrial organization theory, service level, convenience, risk, patriotism, image), as well as conditions for end user competition in SEE. Some experiences from the Norwegian end user market have been shown.

The profits from end-user sales are independent of whether or not you have own production such as cross-subsidizing, "buy" of customers using the capital accumulated in the generation facilities. They are also independent of your actions in the financial market - buy long-term agreements at low levels or sell to end users at below market price, "buy" customers, this time paying with capital from financial portfolios. Market price is the benchmark. Why sell to end users at a lower price than you would get by selling it on the market?

Possibilities in competition and trade

Criteria for a well functioning market are: the sufficient number of participants on supply and demand side, no participant has a dominating position, open access and equal rights in transportation, good market liquidity, open information about relevant conditions etc.

There are more detailed descriptions of participants in the market, grid access and flow, utilization of the grid, export and import capabilities and liquidity in the market

Development Curricula

Organization of modules

1. **Legislation**
   - 1.1. European energy legislation
   - 1.2. European Directives and Regulation 1228/2003
   - 1.3. Croatian energy legislation
2. **Organization of energy markets**
   - 2.1. Market participants (entities)
   - 2.2. Market models
   - 2.3. Experiences from Nordic market
3. **Organization of energy utilities**
   - 3.1. Ownership, unbundling and structures
   - 3.2. Trends in Nordic countries
   - 3.3. Organization of HEP Group
4. **Situation in SEE region, Austria, Slovenia, Italy, Hungary and Norway**
   - 4.1. Bosnia and Herzegovina
   - 4.2. Bulgaria
   - 4.3. FYROM
   - 4.4. Romania
   - 4.5. Serbia and Montenegro
   - 4.6. Austria
   - 4.7. Hungary
   - 4.8. Italy
   - 4.9. Slovenia
   - 4.10. Norway
5. **Power balance overview**
   - 5.1. The region
   - 5.2. Nordic countries
6. **Possibilities for competitive electricity market in the region**
   - 6.1. Customers choice of supplier / supplier choice of generator
   - 6.2. Competition and trade

Table 3. Training agenda (based on WG2 work only)

Module #	Module title	Maximal duration (class hour)	Minimum duration (class hour)
1	Legislation	3	1
2	Organization of energy markets	2	1
3	Organization of energy utilities	1	1
4	Situation in SEE region, Austria, Slovenia, Italy, Hungary and Norway	4	2
5	Power balance overview	2	1
6	Possibilities for competitive electricity market in the region	2	1
		14 (2 days)	**7 (1 day)**

Note: 1 class hour = 45 minutes

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Elements for Electricity Trading

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Executive summary

The objective of this task is to create support learning materials for the Training Centre for Energy Trading. The report contents will serve as a starting point for learning the fundamentals of electricity trading. This covers the roles and responsibilities in market interactions, rules of participating in electricity markets etc. Examples and experiences from Nordic power market are supplied. Moreover, the report includes Croatian and regional specifics.

An overview of the report content and the proposed is given here, along with the proposed schedule of lessons.

Overview of system operator responsibility

Electricity cannot be stored and it must be used the moment it is generated. A system operator must therefore ensure that supply and demand are balanced at all times. The basic system operator tasks and responsibilities are stated. The ETSO and UCTE organizations are introduced. The description of transmission system operator (TSO) tasks in Nordic area is provided. The Croatian TSO tasks are also described.

Network Access and Tariff Systems

The most fundamental condition for an open electricity market is that all market players have access to the market. This means that customers are free to buy electricity from all suppliers independent of location in the network. Cost of electricity supply and transport costs have to be separated. The current situation in Europe is reviewed and analysis of currently used grid tariffs is provided, especially in Norway, Sweden and Croatia.

Analyzing the Network Capacity and Flow

The interconnectors between national power systems have initially been designed to enhance the security of power system operation. Nowadays, these interconnectors are crucial for electricity trading across Europe. Electricity trading is closely related to physical electricity delivery and influenced by the power network transport capabilities. The flow in the network depends on geographical location of production and consumption. An analysis of the Croatian status is provided. A comparison of the current situation and the situation before reconnection of UCTE synchronous zones is provided. Nordic case is given as well.

This chapter and the accompanying lesson closely follow Power Balance Overview introduced in Analysis of the Croatian / South East European (SEE) situation regarding the free Energy Market implementation (TCET WG2).

Congestion Management and Cross-Border Arrangements

Congestion is a situation in which an interconnection linking national transmission networks cannot accommodate all physical flows resulting from international trade requested by market participants. This occurs as a result of a lack of capacity of the interconnectors and/or the national transmission systems concerned. It is possible and recommended to manage such congestion problems with market based solutions. Different arrangements for dealing with them are described in this chapter.

Information in the Market

Open access to the relevant information is a prerequisite for efficient functioning of all open markets. The authorities have to define requirements for open information in the market. A description of information accessible to authorities, system operators, exchanges and others are provided. The Croatian TSO's and DSO's responsibilities considering publishing of information are presented.

Spot price formation - function and process

In general economic terms, a spot price of a certain commodity is the price that is quoted for immediate, or spot settlement, namely payment and delivery. In power markets, the spot concept is based on bids for purchase and sale of power contracts for specified duration ie trading period in the following day. The basic principles of forming the spot market price are described and a detailed real-life example from German electricity exchange (EEX) is provided. Examples from Borzen, Opcom and Nord Pool exchanges are provided as well.

Balancing Market

The system operators use the balancing market to establish balance between production and consumption in operational phase and related to constraints. The balancing market activity and bidding process are described. This chapter, besides describing the TSO tasks in Nordic countries, describes the general TSO's operational tasks as well. Network constraints and maintenance schedules are interesting to market participants and thus affect the participants' policy. TSO's obligations related to maintenance and distributing information to market participants are described. The rights and obligations for all participants in the market must balance physically. The balance for each of the participants must be reported to the system operator that calculates and controls the settlement.

Trading with Physical and Financial Bilateral contracts

The trading with physical and financial contracts is described here. The description of standardized contracts is provided. There is also an explanation of trading of contracts in relation to the spot market. Example of contract trading in Nordic power exchange is given.

Trading in Financial Markets at Exchanges

There are different financial markets at exchanges. The basic principles of using financial instruments from EEX and Nordpool financial markets are provided.

Clearing

The exchange appears as a counterpart between purchasing and selling participants in financial markets. The clearing process and settlement for financial products that are to be cleared are explained here.

Development curricula

Short description of lessons

Day 1

Lesson 1: Overview of system operator responsibility

Basic system operator tasks and responsibilities (according to EU directives) are stated. The ETSO and the UCTE organizations are introduced. TSO tasks in Nordic area are described, along with description of NORDEL. Description of TSO tasks in Croatia according to Croatian laws is provided.

Lesson 2: Network Access and Tariff Systems

Current situation, supplying data from benchmarking report, is described. Review and analysis of currently used grid tariffs is provided.

Lesson 3: Analyzing the Network Capacity and Flow

Electricity trading is closely related to physical electricity delivery and influenced by the power network transport capabilities. The flow in the network depends on geographical location of production and consumption.

An analysis of the Croatian situation is provided. A comparison of current situation and situation before reconnection of UCTE synchronous zones is provided. Nordic case is given as well. This lesson closely follows Power Balance Overview introduced in Analysis of the Croatian / South East European (SEE) situation regarding the free Energy Market implementation.

Lesson 4: Congestion Management and Cross-Border Arrangements

Different arrangements for dealing with structural and temporary grid constraints are described.

Lesson 5: Information in the Market

The authorities have to define requirements for open information in the market. A description of information accessible to authorities, system operators, exchanges and others are provided. The Croatian TSO's and DSO's responsibilities considering publishing of information are presented.

Day 2

Lesson 1: Spot price formation - function and process

The basic principles of forming the spot market price are described. A short overview of German power exchange (EEX), Slovenian power exchange (Borzen) and Romanian power exchange (Opcom) is provided.

Lesson 2: Balancing Market

The system operators use the balancing market to establish balance between production and consumption in the operational phase and related to constraints. The balancing market activity and bidding process are described. A simple numerical example is provided.

The rights and obligations for all participants in the market must balance physically. The balance for each of the participants must be reported to the system operator that calculates and controls the settlement.

Lesson 3: Trading with Physical and Financial Bilateral contracts

The trading with physical and financial contracts is described here. The description of standardized contracts is provided. Trading of contracts in relation to the spot market is also explained. Example of contract trading in Nordic power exchange is given.

Lesson 4: Trading in Financial Markets at Exchanges

There are different financial markets at exchanges. The basic principles of using financial instruments from EEX and Nordpool financial markets are provided.

Lesson 5: Clearing

The exchange enters in as counterpart between purchasing and selling participants in financial markets. The clearing process and settlement for financial products that are to be cleared are explained here.

Table 4. Day 1, Elements for Electricity Trading

Time	
08:00 – 08:30	Introduction
08:30 – 09:30	Lesson 1: Overview of system operator responsibilities
09:30 – 09:45	Break
09:45 – 11:00	Lesson 2: Network Access and Tariff Systems
11:00 – 11:30	Break
11:30 – 13:00	Lesson 3: Analyzing the Network Capacity and Flow
13:00 – 14:00	Lunch break
14:00 – 15:00	Lesson 4: Congestion Management and Cross-Border Arrangements
15:00 – 15:15	Break
15:15 – 16:30	Lesson 5: Information in the Market

Table 5. Day 2, Elements for Electricity Trading

Time	
08:00 – 09:15	Lesson 6: Spot price formation - function and process
09:15 – 09:30	Break
09:30 – 11:15	Lesson 7: Balancing market
11:15 – 11:30	Break
11:30 – 13:00	Lesson 8: Trading with physical and financial bilateral contracts
13:00 – 14:00	Lunch break
14:00 – 15:00	Lesson 9: Trading in financial markets at exchanges
15:00 – 15:15	Break
15:15 – 16:30	Lesson 10: Clearing

Minimum required time

An alternative schedule requires 1 day with emphasis on these lessons:

- Spot price formation – function and process
- Balancing market
- Trading with physical and financial bilateral contracts
- Trading in financial markets at exchanges
- Clearing

Table 6. Minimum required time

Time	
08:00 – 08:15	Introduction
08:15 – 09:00	Lessons 1-5 overview: System operator responsibilities; Network access and tariff systems; Network capacity and flow; Congestion management; Information in the market
09:00 – 09:15	Break
09:15 – 10:30	Lesson 6: Spot price formation - function and process
10:30 – 10:45	Break
10:45 – 12:00	Lesson 7: Balancing Market
12:00 – 13:00	Lunch break
13:00 – 14:30	Lessons 8 & 9: Trading with physical and financial bilateral contracts; Trading in financial markets at exchanges
14:30 – 14:45	Break
14:45 – 16:00	Lesson 10: Clearing

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Operations and Strategies

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Executive Summary

The activities in WG 3 are connected to the synthesis of the possible energy trading system and the strategy planning for energy trading in Croatia by the time the market for electricity is open and liberalized.

The objective of the task 3.2 was to examine the future electricity market from participant's point of view.

Architecture of the liberalized electricity market is much more complex than traditional centralized monopolistic system. It consists of many market players and several institutions such as regulatory authorities, market operator (exchange) and system operators. There is an interaction of market and regulated activities that has to be governed wisely.

Every liberalized electricity market needs a set of laws, regulations and rules giving a framework for market operations. These are needed not only to provide a fair market game but also to secure proper functioning of the power system and security of supply.

Market participants -producers, suppliers, traders and brokers- will find themselves in a completely new environment. Therefore, they need to adapt their operations and strategies to make success in such conditions. They will need to change their organization, operations and finance. But first of all, they will need to change their way of thinking.

The electricity market in Croatia has not been completely opened yet, and its future structure cannot be accurately anticipated. In such circumstances it wasn't possible to provide a clear picture of operations at a specific market and strategies for market participants. Nevertheless, general principles are the same for all deregulated electricity markets. This report is made with that approach – to give a general knowledge about market processes adaptable to the future structure of electricity market in Croatia or anywhere else.

The contents in this report include trading issues, contractual problems, analyses, forecasting, spot market bid, customer obligations, information obligations and economic obligations, and a brief look at the probable future structure of the industry.

The report consists of 12 chapters, development curricula, list of abbreviations and two enclosures.

Terminology

Terminology used in different electricity markets is not unique, but it derives from the terminology used in other commodity and financial markets.

There is a glossary of terms related to types of electricity transactions, markets and market participant.

Contractual participating conditions

Regulations and rules are essential for the functioning of electricity market. They determine the framework for operations of market participants, and dictate their obligations and rules of the game. In Croatia there are the following regulations and rules: Electricity Market Operation Rules, Rules on Balancing Energy, Rules of Cross-border Transmission Capacities Allocation, Grid Code and General Terms of Electricity Supply.

The Ethical Guidelines set higher standards for the conduct and ethics of the participants in the market, and their aim is to maintain strong confidence in the market and the market participants.

Strategic long-term, mid-term and short-term motivation and planning

Each participant on the electricity market has its own interest for trading, and makes its own strategy. However, we can distinguish between the two main participant groups – hedgers (producers, suppliers) and traders.

Hourly variations in demand, a lack of storage and a lack of customer response to changing conditions lead to extreme variations in hourly spot prices. Participants exposed to price risk - producers, supplier - want to eliminate or reduce the risk. Volatility of short-term prices leads most firms to want to enter hedging instruments such as forwards or option contracts. Traders are risk-takers and their motivation for trading is to enter the market as opportunists, take risk on themselves and make pure profit.

Price forecasting

Price forecasting is a fundamental condition for the decision-making process of energy trading. The wholesale price of electric power is settled through market mechanisms and tends to fluctuate according to the latest information available to the market and to external factors. There are different methods and models for price forecasting. The spot price forecasting is typically based on the following: the prices in the futures market, observed prices in the past days or week and prices forecasted by a simulation tool or a regression model. A typical price forecasting procedure is presented here.

Use of different Trading Products

Every organized market (power exchange) has specific products defined by the rulebook. There are usually several trading products on the spot and more at the forward markets. Various trading products, their specifications and their usage are explained by the example of the European Electricity Exchange (EEX) in Leipzig as products on the future Croatian electricity market are not defined yet.

Bidding strategies, bilateral and on Power Exchanges

Strategic bidding involves generating firms bidding some prices above the variable production costs of their units, with the intent of forcing the market-clearing price above competitive levels. If the market is competitive with a sufficiently large number of

generators, participants cannot affect the price by changing its own bid. In that case, its profit-maximizing strategy is to submit a bid equal to its own costs.

Participants can choose a strategy depending on the available products on the market, and they can decide whether they want to participate in bilateral trade and/or at the exchange, or trade with forward/futures contracts.

Cross-border trade & Grid tariffs

Cross border trade is a physically related matter as one can trade financially on any exchange as a participant. In a decision - making process a market participant must take cross border tariffs into consideration.

Grid tariffs should be fair, incentive, compatible, and as low as possible. It is important that the grid tariffs do not influence the efficiency of the market.

Only a general view on these subjects from the perspective of market participants is presented here as they are further explained in WG 2 and WG 3.1.

Customer processes

The end-user market in Croatia will be gradually opened by July 1 2008. *General Terms of Electricity Supply* settles the most important provisions regarding consumers, like the process of changing the supplier.

Metering, billing and information transfer becomes more a complex system of information and control than under the old integrated utility.

Economic obligations

There is a set of economic obligations towards exchanges, regulator and other participants, that market participants have to obey

Trading in a market implies a certain need for capital. Trading in forward markets involves the demand for security. In bilateral trades counterparties often demand bank guarantees and there is often a demand for a certain size of proprietary capital on balance sheet. All trading on exchange also imply the payment of a participant fee and a fee per traded volume unit, and also a clearing fee. Brokers also charge a per unit fee for trades.

Information obligations and activities concerning products and service

Transparency is very important for a deregulated market. All information that can affect the prices on a general basis should be public on an aggregated level. A functioning market will require that all the players have more or less symmetrical information. In order to have a liquid market, the participants need to believe that the price formation is done solely out of fundamental factors and not from one player's monopoly information.

The participants are obliged to provide information defined by the authorities, the system operator and the exchange. There are also obligations to other parties in the market. Several rules and regulations in Croatia define the participants' information obligation.

Business structures for market based operations

Deregulation of electricity market will have a substantial impact on the business structure in Croatia. Decisions will be decentralized and only the price will trigger reinvestments. As focus changes and grows on earnings and efficiency, the number of employees in the industry will fall. Changes in the organizational culture are essential, and the employees will have to adapt to this in a dynamic and quick way. Care for customers and attitude toward them will have to improve. Metering and billing will be an important issue.

For getting a functioning market it will be vital to have many independent players trading on the market, with many suppliers, producers and traders participating.

Development curricula

Short description of lessons

Lesson 1: Introduction & Terminology

General view on electricity market from a participant perspective. Types of electricity transactions. Types of markets. Types of market participants.

Lesson 2: Contractual participating conditions

Trading arrangements. Croatian rules and regulations. Rules for the Operation of the Electricity Market. Rules on Balancing Energy. Rules of cross-border transmission Capacities Allocation. Grid Code. General Terms of Electricity Supply. Ethical Guidelines

Lesson 3: Strategic long term, mid term and short term motivation and planning

Interests and motivations of market participants. Two main types of participants (hedgers and traders). Volatility of market prices. Long-term and short-term goals. Strategic decisions. Risk and risk management.

Lesson 4: Price forecasting

Wholesale and retail electricity prices. Market uncertainties and volatility of prices. Importance of price forecasting. Future and spot market prices. Price forecasting models. Price forecasting procedures.

Lesson 5: Use of different Trading Products

Trading products are explained by the example of EEX. Products on the Spot Market. Products on the Derivatives Market. Unconditional and conditional forward transactions. Futures, forwards and options.

Lesson 6: Bidding strategies, bilateral and on Power Exchanges

Short-run marginal costs (SRMC) and long-run marginal costs (LRMC). Market clearing price. Bidding and bidding behaviour. Bidding strategies and models. Simple bids, block bids, flexible bids.

Lesson 7: Cross border trade & Grid tariffs

Cross border trade is a physically related matter. Grid tariffs should be fair, incentive compatible and as low as possible.

Lesson 8: Customer processes

Wholesale and retail market. Customer service. Billing. Changing the supplier. Meter readings and ownership of meters.

Lesson 9: Economic obligations

Agent and proprietary trading account, trading accounts for hour contracts. Charges on the spot market. Settlement of trades in power futures and power options. Daily settlement of futures trades. Cash settlement of futures transactions. Physical delivery of futures transactions. Cascading. Settlement of the premium in options transactions.

Lesson 10: Information obligations and activities concerning products and service

The need for symmetric information. Information obligations on Nord Pool. Information obligations on EEX. Croatian rules and regulations on information obligation.

Lesson 11: Business structures for market based operations

Structure of the industry. Organization, Culture and Decision making. Human resources. Customers. New business areas. Financial issues

Proposal of daily and hourly schedule of training/lectures

Table 7. Proposal of daily and hourly schedule of training/lectures

Lecture No.	Lecture title	Minimum duration (class hour)	Maximum duration (class hour)
1	Introduction & Terminology	1	1
2	Contractual participating conditions	2	3
3	Strategic long-term, mid-term and short-term motivation and planning	1	1
4	Price forecasting	1	2
5	Use of different Trading Products	1	1
6	Bidding strategies, bilateral and on Power Exchanges	1	2
7	Cross border trade & Grid tariffs	0	1
8	Customer processes	1	2
9	Economic obligations	1	2
10	Information obligations and activities concerning products and service	1	1
11	Business structures for market based operations	1	1
	TOTAL	**11**	**17**

Note: 1 class hour = 45 minutes

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Risk Management and Hedging

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Executive Summary

Risk Management

Risk limits and reporting routines are decided on a management level and are normally a part of company's long-term strategy. Various definitions of limits are used, such as Value at Risk (VaR), Profit at Risk (PaR), Earnings at Risk (EaR), and Cash Flow at Risk (C-far). Three main techniques for calculating VaR are described: analytic VaR, Monte Carlo, and historical simulation. They are complementary, but each offers a different view of portfolio risk. The advantages and deawbacks are also described, and usage of different methods presented. Most risk measurement methodologies are based on the analysis of a set of scenarios. First, calculate a profit or revenue for each scenario, then aggregate those results to form a distribution and extract the mean value and variability of the profit, portfolio value, or revenue level for the set. PaR is a more realistic approach than VaR, because this measure takes into account the full financial risk of highly volatile spot prices. EaR is used more because accounting rules prohibit energy companies with portfolios of physical assets from marking these assets to market, nor can these companies liquidate or acquire their assets as quickly as companies with purely financial portfolios. C-far is designed to forecast earnings volatility one quarter to one year ahead, and it is used to enhance financial strategy and long-term investment planning. Two VaR-analysis of end user sales examples from Troms kraft are given. The calculations are made using the Elviz Trading and Risk Management package. Which portfolio to prefer would depend on the risk attitude of the company's shareholders.

Term risk management includes specifying events that could have adverse financial consequences and then taking actions to prevent and/or minimize the damage caused by these events.

This chapter contains a discussion of financial instruments and options - futures and forward contract, an option, forward rate agreements, interest - rate swaps also known as derivatives. Derivatives are securities whose values are determined by the market value of some other asset.

It is also explained what are the risks (market and credit) involved in using those instruments.

Futures and forward contracts allow investor to lock in the purchase or sales price of transaction at specified maturity date. Goods are actually delivered under forward contract. A future contract is similar to forward but with three key differences: 1) future contracts are "market to market" on a daily basis, meaning that gains and loses are noted and money must be put up to cover losses, 2) with futures, physical delivery of the underlying asset is virtually never taken – the two parties simply settle up with cash for the difference between the contracted price and the actual price on the expiration date; 3) futures

contract are generally standardized instruments that are traded on exchanges , whereas forward contract are generally tailor-made, are negotiated between two parties, and are not traded after they have been signed.

An **option** gives the buyer the right, but not the obligation, to buy or sell a good at a specific quantity at a specific price ie strike price, on or before a specific date in the future, ie maturity date.

Forward rate agreements (FRAs) are private contracts between two parties, which guarantee a client the borrowing or lending interest rate at a future time.

Interest - rate swaps the most common is the plain-vanilla or generic swap that involves two parties called counterparties swapping fixed payments for floating-rate payments.

The main strategies in using those instruments to manage (lower) risk – hedging:

- **Financial futures** markets permit firms to create hedge position to protect themselves against fluctuating interest rates, stock prices, and exchange rates.
- **Commodity futures** can be used to hedge against input price increases.
- **Long hedges** involve buying futures contracts to guard against price increases.
- **Short hedges** involve selling futures contracts to guard against price declines.
- **Perfect hedges** occur when the gain or loss on the hedge transaction exactly offset the loss or gain on the unhedged position.

Development Curricula

Daily schedule of lessons

Table 8. Daily schedule of lessons

Module	Module Title	Max. duration [h]	Min. duration [h]
1st Day			
1.	Financial Instruments	1	1
2.	Financial Options	2	1
3.	Identifying Types of Risk	1	1
4.	Responsibilities in Risk Management	2	1
5.	Risk Limits and Reporting	2	2
	Subtotal	**8**	**6**
2nd Day			
6.	Portfolio Theory	2	1
7.	Hedging	2	1
8.	Hedging portfolio	1	1
9.	Tools & Techniques	1	1
10.	Real time trading & hedging examples	2	1
	Subtotal	**8**	**5**
	Total	**16**	**11**

Note: 1 class hour = 45 minutes

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Models for Power System Planning

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Executive Summary

The objectives of restructuring of energy sector and opening of the market are as follows: all the energy suppliers should obtain equal opportunity to supply the buyers with clear and impartial conditions; the buyers provided with a safe and stable supply of energy at the realistic, and in some cases even at the minimum prices. Energy entities should be enabled to perform energy activity without discrimination, as well as to establish the contents and mechanisms of control and regulation of energy sector and energy industries, which will enable attaining such set objectives.

The adjusting of the organization and the way of functioning of the energy sector and market to the standards of the organization is, besides the way of functioning of energy market in EU countries, one of key strategic determinants of energy development of the Republic of Croatia.

The opening of the electricity markets and the ruling EU Directives on the energy sector supporting these worldwide trends has changed, or will radically change the way electricity supply systems are planned, designed, operated and maintained.

The objective of this report is to analyze and evaluate the present Croatian and Norwegian situation regarding the models of power system planning.

Conclusion: For more than fifty years, the Croatian electric power system has functioned as a wholly state-owned and controlled business monopoly. regulated by state laws. Electricity supply was regarded as part of the public infrastructure and hence financed and operated as such more or less according to a least cost principle. The power system was basically dimensioned and designed according to technical criteria. Consequently, overcapacities and low effectiveness in the utilization of the systems could be observed.

Scandinavian energy market is regarded as one of, if not, the world's most well-functioning example of such. It is also believed that this is partly caused by previous broad experience, acquired by applying certain principles and methods in power system planning and operation. Businesses and work procedures are basically divided into two groups. The one comprises activities that can be made subject to competition - i.e. production, marketing, sales and services - while the other is the so-called natural monopolies, i.e. transmission and distribution. The first group is operated according to common market principles, while the latter is regulated by an institution or body authorized under state laws.

In this document, the Nordic approach has been compared with those currently used or planned to be used in Croatia, and as such, adapted to the conditions and frameworks we find here.

The TCET (Training Centre for Energy Trading) work group 3.4 document on **Models of Power System Planning** consists of the following ten chapters:

1. Introduction
2. List of abbreviations
3. Grid Development Plan: Short-term, Medium and Long-term
4. Local, Regional and European Context
5. Production investments
6. Reserve planning
7. Power system security
8. Authority monopoly regulations
9. References
10. Appendices

Throughout the whole document, focus has been given to the conditions found in Norway and the Scandinavian countries today and in Croatia respectively, and with regard to

- reference to actual legislation
- distribution of responsibilities
- work organization and work processes
- principles and methods used
- available software

The knowledge base used in compiling this document varies from chapter to chapter, partly depending on the nature of the contents and partly depending on the region/nation from which it originates.

From the Norwegian side most of the material are retrieved from institutional sources such as The Norwegian State Authority for Water and Energy, from NORDEL (a cooperative body in the energy sector for the Scandinavian countries), from NordPool (the Scandinavian power pool) and from Sintef Energy Research Institute and secondary sources.

From the Croatian side, the materials dealing with the planning of generation and transmission networks are retrieved from the HEP (Croatian Electricity Company). These describe the procedure of traditional planning, methods and software presently used in Croatia. Chapters written by Croatian authors dealing with grid and production planning in deregulated (open market) conditions are based on studies made by researchers from FER (Faculty of Electrical Engineering and Computing, Zagreb) and EIHP (Energy Institute Hrvoje Požar, Zagreb). Materials dealing with the authority monopoly regulation in Croatia are retrieved from the CERA – Croatian Energy Regulatory Council.

Grid Development Plan: Short-term, Medium and Long-term

This chapter addresses grid planning in a long, medium and short perspective.

Most of the material from the Norwegian side was retrieved from NORDEL. NORDEL is the Nordic countries' common organization for joint planning of overall grid structures and for issuing common guidelines for grid development planning. This is to safeguard high standards of security and reliability in the Nordic grid system, which are tightly interconnected. After the first subchapter defining the purpose of planning and target groups, the following subchapter deals with the definition of direct current and alternating current transmission capacity. The subchapter named grid planning for interconnections between the Nordel area and other areas deals with principles of the planning code for planning the Nordic transmission system. Conclusively, planning criteria and some other important aspects of system planning and design are given.

Croatia, due to its geographical position and historical circumstances has had different stages in its power sector development, especially in transmission grid planning and implementation of those plans. Being today in the middle of reforms and opening towards markets principles, Croatian grid planning has started to change significantly. However, in order to achieve stability and security of the system, as well as to allow new business opportunities which arise from an excellent transitional geo-position, it is necessary to implement transparent and expert planning procedures. Furthermore, rich professional experience from previous decades must be taken into account and whenever possible, combined with new market based methods.

This chapter gives an overview of current situation in Croatian transmission grid development, and sheds a light on possible new planning procedures. First, the introduction gives the short insight in historical development of transmission network in Croatia. The next subchapter introduces a reader to three most important uncertainties in current Croatian grid planning, while the following subchapter explains the basics of transmission network planning methodology. It describes the procedures which have been used recently, as well as the new recommendations, which are defined according to the new circumstances that are expected to occur.

Local, Regional and European Context

The chapter describes how the local/national planning procedures are influenced by wider contexts, either by law or by established practices/agreements.

From the Norwegian side, the guidelines ruling the connections to the European main continent are described in detail. Taken into account that local (national) planning is ruled to a greater extent by the common NORDEL guidelines, a special discussion on local conditions is omitted in the Norwegian contribution. This section is appended to the so-called Nordic Grid Connection Code.

The Croatian contribution consists of three subchapters. The first subchapter gives the general overview of rules, mechanisms and incentives related to investments in transmission networks at Union level. Furthermore, authorisation and tendering procedures proposed by electricity Directive with regard of construction of new generating facilities are shortly described, as well as possible criteria that may be adopted

by Member States when dealing with these procedures. In addition, this chapter briefly mentions the responsibilities of Directive on Electricity Infrastructure and Security of Supply and Trans European Energy Networks guidelines. The second subchapter deals with the regional level planning. The last subchapter deals with the national level planning where the key planning documents in Croatia for energy sector development framework are listed. It also details the procedures for construction of new generation facilities with regard to the procedure and responsibilities in organizing.

Production investments

The basic idea of the chapter on production investment is to give the student an insight in the drivers behind the production investment projects and the methods and tools used in the planning process. Production investment planning has always been a matter of strategic importance for power security in each power system, as well as a question of national interest for each country.

The chapter starts with the description of the legal framework for hydropower development in Norway, i.e. Industrial Concession Act, Watercourse Regulation Act and Water Resources Act. What follows is the description of distribution of responsibilities, work organization and work processes and principles, methods and software used related to production investments in Norway.

The Croatian contribution comprises six subchapters with a quite thorough discussion on initiating mechanisms, including impacts from global trends. The introduction explains the reasons for diversification when considering various energy options. After the introductory subchapter, the second subchapter deals with the "necessity of continuing power planning". In the third subchapter, initiating mechanisms for the production investments are listed, such as:

- Demand
- Time table for shutting down the existing power plants
- Kyoto protocol and rise of costs for green certificates
- Rise of fuel prices
- Rise of electricity prices
- Local administrative barriers
- Plans for new production investments

The demand growth is elaborated - it is based on the so called Croatian master plan of the needed development of new power plants and facilities in the Republic of Croatia in the period from 2001 till 2020, and Generation Investment Study financed by EC. The time table for shutting down the existing power plants in Croatian is given according to official Strategy of energy development in Croatia. As Croatia has signed the Kyoto protocol, the Kyoto protocol and increase in the costs for green certificates, along with rise of fuel prices and rise of electricity prices influence on new generating facilities have been examined. The following subchapter explains the main differences between planning procedures in traditional conditions and market environment. Finally, concluding subchapter tries to stress the importance of a regional approach and deregulated conditions which are expected to occur soon in Croatian power sector.

Reserve planning

The chapter describes planning procedures for safeguarding spare capacity and reserves in production facilities.

From the Norwegian side, the Scandinavian experiences with the open markets for balancing and reserve options are presented. The chapter starts with a definition of reserves, or more generally, ancillary services. The next subchapter gives in detail ancillary services in a system dominated by thermal generation and in the Norwegian/Nordic system. A description of costs of providing active reserves and a simple model for pricing of reserves follow. The purpose of the model described is to illustrate some basic mechanisms with the impact on the price of capacity reserves, as well as on other electricity prices. The next subchapter deals with the so called consumer side reserves. In November 2001 Statnett established a new power reserves market, the Reserve Option Market (ROM). In the subchapter called "Practical Experiences", authors describe practical arrangements concerning balancing and reserve option market. As there have been some changes over the years and the description is based on the rules applied before August 2004.

Croatian contribution consists of three subchapters. The first one is introductory. The second one describes features of WASP program which is a widely used model in developing countries for power system planning (over 100 countries). The last subchapter elaborates the current practice of reserve capacity planning in Croatia. As an example the Master plan has been given.

Power system security

The chapter describes planning and operational procedures for safeguarding power system security. It starts with the definition of long-term and short-term security and adequacy of electricity supply. The next two subchapters deal with the regulations regarding power system security and distribution of system responsibilities in Nordic countries. What follows is a description of harmonization of operational rules and practices, harmonization of grid investments, principles, methods and software used in the Nordic area.

The Croatian contribution consists of four subchapters. The first one explains the (N-1) security criteria. The second one, the technical analyses used for the purpose of transmission system planning such as N-1 security, power flow, short circuit and stability done by PSS/E software. The third subchapter deals with the monitoring of the N-1 criterion, which is TSO's responsibility. The chapter includes the definition of the most probable contingencies, general measures to be taken to prevent bottlenecks and the operational network reserve. The last subchapter gives the analyses that shall be performed by TSO for the verification of operational security.

Authority monopoly regulations

The chapter describes the relevant authorities and monopoly regulating bodies, constituting the legal and formal framework around the energy sector in Norway and Croatia respectively.

The Norwegian income cap regulation model and experiences gained have been elaborated in detail.

The next two subchapters describe the responsibilities of Croatian Energy Regulatory Agency in issuing the approvals for performing energy activities, regulation of prices of energy, and energy services and settlement of disputes in Croatia. Presently used compensations for the use of transmission and distribution networks in Croatia have been elaborated.

References

In this chapter, 58 references are given for further reading and better understanding of the document.

Appendices

In appendices to the document you find sections on the Norwegian regulations relating to the power system operations, an agreement regarding operation of the interconnected Nordic power system and a special section from the Croatian side on reliability and security.

- Appendix 1: Method, models and tools for system engineering studies
- Appendix 2: Norwegian Regulations relating to power system operation
- Appendix 3: AGREEMENT regarding operation of the interconnected Nordic power system (System Operation Agreement)
- Appendix 4: Reliability/security (Croatia)
- Appendix 5: The Nordic Grid Connection Code
- Appendix 6: Comparison of Nordic benchmarking methods

Lessons learned

The lesson expected to be learned from studying chapters of these document can be summarized as follows – insight in and understanding of:

- grid development planning procedures being practiced in Norway/Scandinavia and Croatia respectively. In this context the term "planning" covers short, mid and long term aspects. From the Croatian side there is also a discussion on the impact of the energy market opening on transmission network planning.
- the impact on power system planning of the fact that electrical networks today are meshed together in synchronous grids covering both local, regional, national and continental levels.
- the planning of investments in production systems. Criteria, initiating mechanisms and legal frameworks are covered.
- the planning of reserves on the production side.
- demands on power system security in a deregulated market regime.
- the way state authorities can regulate and monitor the operation of the natural monopolies.

Development Curricula

Lesson 1: Grid development plan – short-term, medium & long-term

Purpose of planning and target groups in Norway. Definition of direct current and alternating current transmission capacity. Principles of the planning code for planning the Nordic transmission system. Planning criteria. Important aspects of system planning and design.

Overview of current situation in Croatian transmission grid development. Historical development of transmission network in Croatia. Uncertainties in current Croatian grid planning. Basics of transmission network planning methodology - procedures presently used and new recommendations.

Lesson 2:Local, regional and European context

Guidelines ruling the connections to the European main continent. Rules, mechanisms and incentives related to investments in transmission networks at Union level. Authorisation and tendering procedures proposed by electricity Directive Responsibilities of Directive on Electricity Infrastructure and Security of Supply and Trans European Energy Networks guidelines. Regional level planning. National level planning. Key planning documents in Croatia for energy sector development framework.

Lesson 3:Production investments

Drivers behind production investment projects and the methods and tools used in the planning process in Norway. Legal framework for hydropower development in Norway (i.e. Industrial Concession Act, Watercourse Regulation Act and Water Resources Act). Distribution of responsibilities, work organization and work processes and principles, methods and software used related to production investments in Norway.

Initiating mechanisms for the production investments. Croatian master plan for the necessary development of new power plants and facilities in the Republic of Croatia. The time table for shutting down the existing power plants in Croatia. Kyoto protocol. Rise of costs for green certificates. Rise of fuel prices and rise of electricity prices influence on new generating facilities. Planning procedures under traditional conditions and market environment.

Lesson 4:Reserve planning

Planning procedures for safeguarding spare capacity and reserves in production facilities. Scandinavian experiences with the open markets for balancing and reserve options. Definition of reserves (ancillary services). Ancillary services in a system dominated by thermal generation and in the Norwegian/Nordic system. Cost of providing active reserves. Simple model for pricing of reserves. Consumer side reserves. Reserve Option Market (ROM).

WASP. Current practice of reserve capacity planning in Croatia.

Lesson 5:Power system security

Planning and operational procedures for safeguarding power system security in Nordic countries. Definition of long-term and short-term security and adequacy of electricity supply. Regulations regarding power system security and distribution of system responsibilities in Nordic countries. Harmonisation of operational rules and practices. Harmonisation of grid investments, principles, methods and software used in the Nordic area.

(N-1) security criteria. Technical analyses used for the purpose of transmission system planning in Croatia. Monitoring of the N-1 criterion. Contingencies. Analyses for the verification of operational security.

Lesson 6:Monopoly regulatory authority

Relevant authorities and monopoly regulating bodies constituting the legal and formal framework around the energy sector in Norway and Croatia. The Norwegian income cap regulation model. Experiences gained. Responsibilities of Croatian Energy Regulatory Agency. Regulation of prices of energy and energy services and settlement of disputes in Croatia. Compensations for the use of transmission and distribution networks in Croatia.

Table 9. Proposal of hourly schedule of training/lectures

Module #	Module title	Maximal duration (class hour)	Minimum duration (class hour)
1.	Grid development plan – short-term, medium & long-term	1	1/2
2.	Local, regional and European context	1/2	1/6
3.	Production investments	1	1/2
4.	Reserve planning	1/2	1/4
5.	Power system security	1/2	1/4
6.	Monopoly regulatory authority	1/2	1/6

Note: 1 class hour = 45 minutes