# TECHNICAL REPORT

# IEC 62195

2000

AMENDMENT 1
2002-04

Amendment 1

**Power system control and associated communications – Deregulated energy market communications**



International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE C

For price, see current catalogue

## FOREWORD

This amendment has been prepared by IEC technical committee 57: Power system control and associated communications.

The text of this amendment is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 57/558/DTR | 57/575/RVC, 57/576A/RVC |

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2003. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

---

Page 4

**0.1 Reference documents**

*Add the following reference to the list:*

ISO/IEC 14662, *Information technology – Open-edi reference model*

Page 35

*Add the following new annex E:*

## Annex E

## Use of Internet technologies

### E.1 Technological advancement

The report gives an overview of market models at the time of writing and possible communication platforms based on UN/EDIFACT messages or Internet technologies as HTML over HTTP. Whereas EDIFACT messages were widely used (e.g. in the Edie System of Scandinavia and now also in some other European countries and elsewhere), the Internet approach at the time of writing had the drawback that no standardized messages in HTML were available leading to proprietary solutions. Also security of the Internet was an issue.

In the meantime the Internet Language Definition Standard XML (eXtensible Markup Language) was defined by W3C as a subset of SGML (Standard Generalised Markup Language). With XML applications can share data using a Schema as DTD (Document Type Definition) or XSD (XML Schema Definition) which defines the grammar. One of the outstanding features of XML is that data can be given a name tag which makes it easier to map data to data bases. Whereas the main purpose of XML is data transmission between applications and data bases the content can also easily be visualized with an Internet Browser using CSS (Cascaded Style Sheets) or XSLT (Extensible Stylesheet Language for Transformation) together with CSS

UN/EDIFACT and XML are not competing solutions and can be combined in what is now called "Web-EDI". Already regional new initiatives are taken to define their own XML/EDI solutions. Many XML architectures have been proposed, so far none of these is a global Standard and they compete against each other. The most promising architecture seems to be ebXML (electronic business XML) supported by UN/CEFACT (The United Nations Centre for Trade and Electronic Business) which is intended to become an International Standard. This architecture can be combined with EDIFACT messages mapped to XML. The mapping is already done by CommerceNet, XML/EDI Group and ANSI ASC X12 Working Group and will be soon available in the Internet. Alternatively, the content of EDIFACT messages is re-engineered using so called core components from a future and hopefully standardized global e-business XML vocabulary under the auspices of UN/CEFACT.

Business processes can be modelled with the meta language UML (Unified Modeling Language of Open Management Group (OMG)). Figure E.1 shows the modelling with UML and the production of XML Schemas with the XMI (XML Meta Interchange) of OMG.

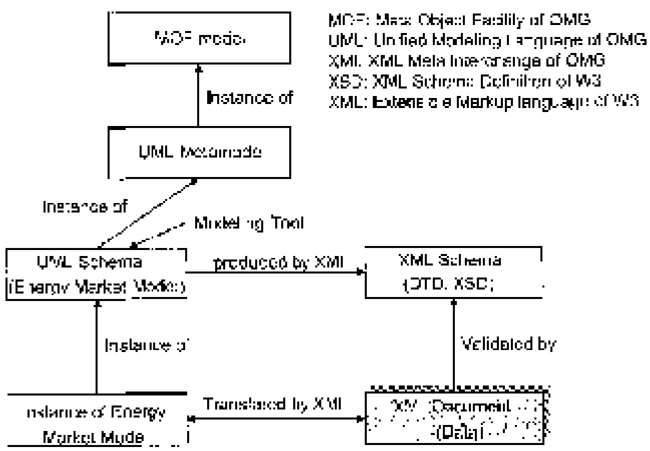



**Figure E.1 – UML-Modelling and XML Schema**

Electronic business with XML-messages is estimated to have the potential to become a big global market within the next couple of years if a single global International Standard can be successfully implemented. Given the potential of XML it will be wise to base the communication of electricity markets on the coming XML Standard Architecture of UN/CEFACT. This allows vendors to offer products across different markets with lower cost. Using general used platforms has also advantages regarding implementation, test and future development. In the meantime, besides EDIFACT, also non-standard XML solutions are possibly which may migrate in the future to the Standard Architecture.

## E.2 Generic e-business architecture

The technical Standard Architecture of e-business based on XML should follow the "Open-edi reference model" (ISO/IEC 14662) and the e-business semantic of the UN/CEFACT UMM (Unified Modeling Methodology), Document N090, where applicable. The content and structure of existing EDIFACT messages already used for the electricity market should be taken into account. Whereas EDIFACT is more intended for large business, the future XML communication architecture should be scalable and also affordable for small business.

Figure E.2 below shows the Open-edi environment according to ISO/IEC 14662.

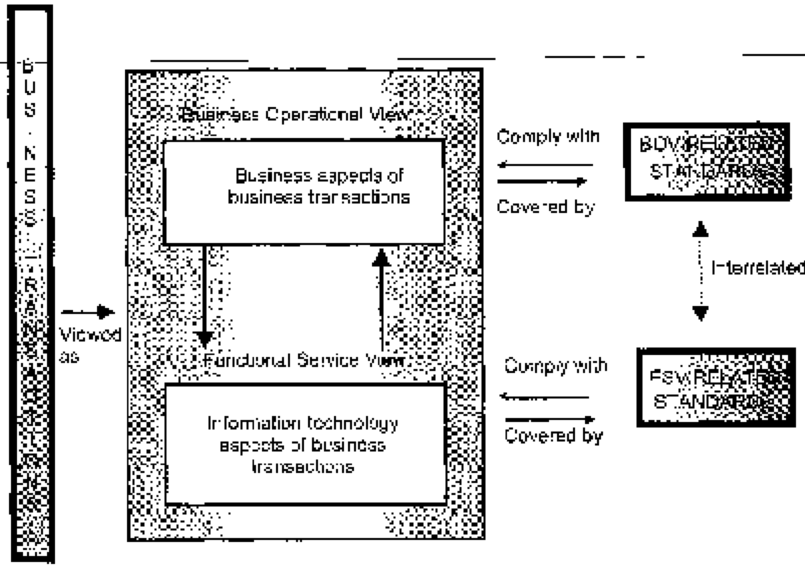



**Figure E.2 – Open-edi environment**

Fundamental to standardization is the notion of *generic* Open-edi standards: Business Operational View (BOV) languages, tools and methods, Functional Service View (FSV) used by all industries and sectors and *sectorial* Open-edi standards (BOV Open-edi models with contents and processes of the business transactions) to facilitate the re-use of Open-edi components. The same is true for the de-coupling of BOV and FSV to allow the use of the same BOV above evolving new or other FSV related technologies.

Presupposition for e-business and transactions in deregulated electricity markets are harmonized *market rules* that may span a country or even a whole region consisting of many countries. An incomplete list may include the legal and regulatory framework, legal and security aspects of e-business, technical market rules (network access, balance management, schedule management, congestion management), identification schema of market participants and e-business objects, metering rules (service and access to metering values), grid rules (operation), distribution rules (operation), load profiles (synthetic and analytical). The model has to comply with these rules and must include all market participants and transactions to allow seamless communication. The BOV includes all applications from trading over supply to balancing generation and consumption and billing. Congestion management and ancillary services are closely related to the process but may use at least the same FSV platforms.

Because market rules of regions may differ from each other also the BOVs may be different but may also include generic models and messages.

The e-business standard framework ebXML that can be used for electricity markets is more than just an exchange format for data and may include (references B.N.N to the Open-edi reference model are given in brackets):

a) a standard mechanism for describing a *Business Process* and its associated information model (B.2.2);
b) a mechanism for registering and storing *Business Process and Information Meta Models* so they can be shared and reused (B.2.3);
c) discovery of information about each participant including:
   - the *Business Processes* they support,
   - the *Business Service* Interfaces they offer in support of the *Business Process*,

- the *Business Messages* that are exchanged between their respective *Business Service Interfaces*,
- the technical configuration of the supported transport, security and encoding protocols;

d) a mechanism for registering the above-mentioned information so that it may be discovered and retrieved (B.3.2, B.3.3);

e) a mechanism for describing the execution of a mutually agreed upon business arrangement which can be derived from information provided by each participant from item c) above;

f) a standardized business *Messaging Service* framework that enables interoperable, secure and reliable exchange of *Messages* between *e-business Partners* (B.3.1, B.3.2);

g) a standardized business *Transport Service* framework (as SMTP, FTP, HTTP, ... over TCP/IP) (B.3.2);

h) a standardized *security* framework for Integrity, Signature, Authentication, confidentiality and authorization that can be applied using customized profiles (B.4);

i) a mechanism for *configuration* of the respective Messaging Services to engage in the agreed upon Business Process in accordance with the constraints defined in the business arrangement;

j) a migration path from the EDIFACT environment and messages to the XML architecture (B.6).

For part 1 the use of the graphical meta modelling language UML (*Unified Modeling Language* of OMG) based on a semantic subset of UMM (see above) is recommended but not mandatory. From the model XML models and message schemas can be generated automatically by XMI (XML Meta Interchange of OMG).

## E.3 Re-use of components

One of the main advantages of the architecture is the re-use of not only the IT-infrastructure (FSV, Functional Service View) but also of the Business Process (BOV, Business Operational View) itself.

For the electricity industry there may be specific BOV/FSV for different geographical regions. This is shown in figure E.3 below.

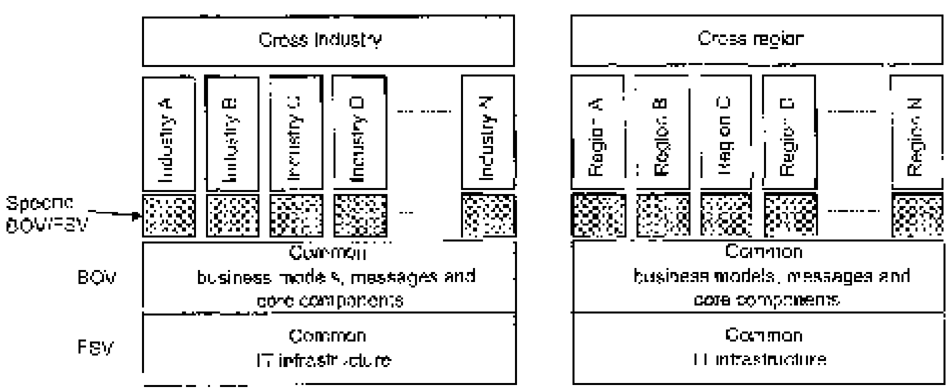



**Figure E.3 – Re-use of core components across industries and regions**

By all limitations the success of EDIFACT was due to the fact that messages could be used in principle not only in one industry but for many other industries and cross industries following the supply chain. So generic EDIFACT messages (e.g. DELFOR for schedules, MSCONS for metering values, ...) defined by industries very different to electricity markets are also used today in some regional electricity markets. The same is expected for XML messages.

It is important to note that no restrictions are imposed on regional standards in defining their market model, use cases and messages according to the market rules stated above. With ongoing convergence of market rules one or more generic core models with associated messages (so called re-usable components) might be feasible for all regional markets but this is left for the future.

Taking all this into account the standardization process for electricity markets may follow:

1) definition of a global generic standard communication architecture by UN/CEFACT (in the mean time regional proprietary architectures may be necessary),
2) definition of an electricity market specific profile of this architecture,
3) development of generic core components (models, processes and messages),
4) development of electricity market specific components by regional initiatives based on 3).

Steps 2) and 3) are within the scope of the IEC.

ISBN 2-8318-6284-1

ICS 33.200

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND

# TECHNICAL REPORT

# IEC TR 62195

First edition
2000-04

**Power system control and associated communications – Deregulated energy market communications**

*Conduite des systèmes de puissance et communications associées – Communications dans un marché d'énergie déréglementé*

IEC

Reference number
IEC/TR 62195:2000(E)

## Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

## Consolidated publications

Consolidated versions of some IEC publications including amendments are available. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Validity of this publication

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology.

Information relating to the date of the reconfirmation of the publication is available in the IEC catalogue.

Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is to be found at the following IEC sources:

- **IEC web site***
- **Catalogue of IEC publications**
  Published yearly with regular updates
  (On-line catalogue)*
- **IEC Bulletin**
  Available both at the IEC web site* and as a printed periodical

## Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary* (IEV).

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

# TECHNICAL REPORT

# IEC TR 62195

First edition
2000-04

**Power system control and associated communications –
Deregulated energy market communications**

*Conduite des systèmes de puissance
et communications associées –
Communications dans un marché d'énergie déréglementé*



International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http://www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE Q

For price, see current catalogue

# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# POWER SYSTEM CONTROL AND ASSOCIATED COMMUNICATIONS – DEREGULATED ENERGY MARKET COMMUNICATIONS

## FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this technical report may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

Technical reports do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful by the maintenance team.

IEC 62195, which is a technical report, has been prepared by technical committee 57: Power system control and associated communications.

The text of this technical report is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 57/431/Q | 57/457/RQ |

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

This document which is purely informative is not to be regarded as an International Standard.

# POWER SYSTEM CONTROL AND ASSOCIATED COMMUNICATIONS – DEREGULATED ENERGY MARKET COMMUNICATIONS

## 0 Scope

This technical report deals with electronic communication in deregulated markets.

### 0.1 Reference documents

IEC 61334 (all parts) *Distribution automation using distribution line carrier systems*

IEC 60870-6 (series) *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations*

## 1 Introduction

### 1.1 Task defined by TC 57

The task of the AHWG05 is to identify requirements and functional needs for communications in deregulated markets. In so doing, a clear distinction should be made between communications for control of energy systems and communications for the market. On the other hand, the interrelation and interworking between these separate fields have to be addressed.

The subject should include, but not be restricted to, the 'transport capacity market', the 'energy spotmarket', 'bilateral trades', 'accounting and billing' and general communication services such as electronic mail.

For the next TC 57 session (Lucerne) a report should be prepared including a proposal for a scope and a work programme.

In response to concerns on the objectives of this ad hoc group the following statement was also made:

The goal of the ad hoc working group is not (yet) to elaborate a standard, but to analyse whether and where a standard should be elaborated. It is not the intention of TC 57 to become involved in political issues nor to advise utilities how to organize the competition in the electricity market.'

### 1.2 Background

There had been some preliminary discussions on electricity trading within the UNIPEDE NORMICT group, particularly concerning trading across borders. This issue was subsequently raised at the TC 57 Plenary in Dresden in September 1996 where it was decided that, if there is need for standardization of communication protocols concerned with deregulated electricity markets, then this would fall within the scope of TC 57. A meeting was called at Dresden to discuss how to proceed and a possible scope. The response was greater than expected, but no conclusion was reached regarding scope. The Plenary then decided to create AHWG05 to study the matter.

AHWG05 has since studied existing and proposed solutions to deregulation in order to learn what the requirements should be. In this respect the initial approach has been 'bottom up'. In addition, the group has further refined its scope.

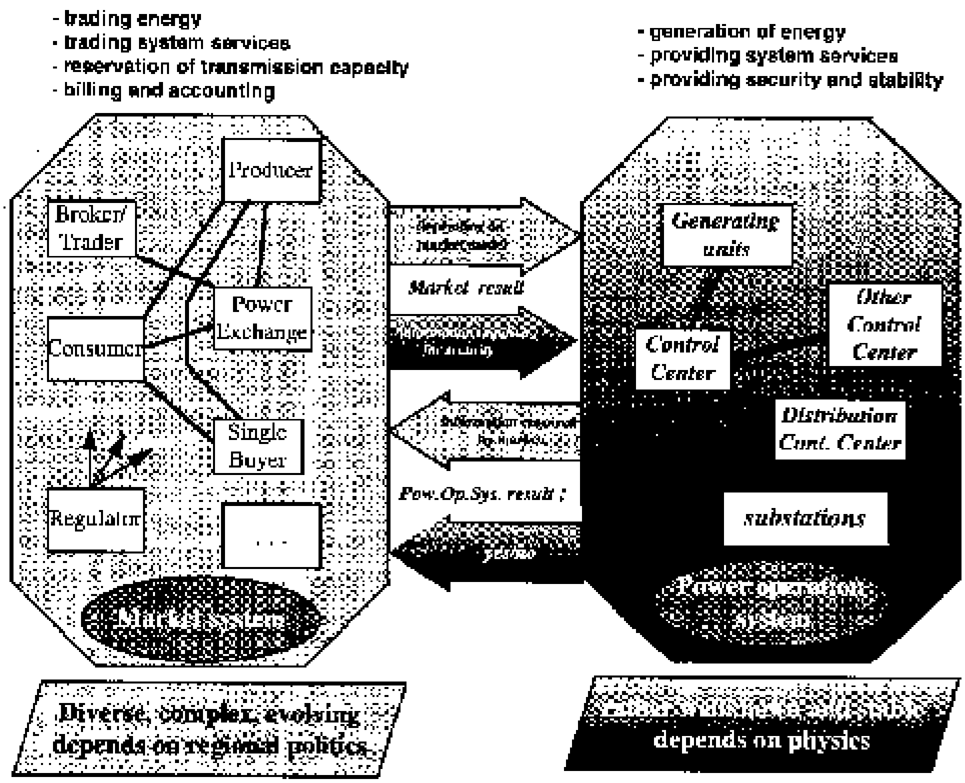



**Figure 1 – Market system and power operation system**

Firstly, a distinction has to be made between market and power operation communication systems. Figure 1 shows the main characteristics of these two worlds and their interfaces. Of course, the actors (boxes) and transactions (lines) have to be taken as an illustration and not as a reliable description of reality, that is far more complex.

The left-to-right arrows represent the information provided by the market to the power operation. One arrow (coloured in plain grey) is determined by regional organization (grid code, market organization, etc.). The other arrow (coloured in shaded grey) is the information the market has to provide to the ISO(Independent System Operators) in order to secure power system operation.

The right to left arrows represent the information provided to the market by power operation. The colouring code is similar to the above, but the first arrow provides data which depends on regional organization (metering, etc.) and the second that which is necessary for security.

An actual example of this model, representing the system in England and Wales, is given in annex D.

### 1.3 Quadrant diagram

The following diagram (figure 2) completes the former by a second classification: transactions and protocols. That leads to the structure with four quadrants:

Quadrant 1: Market information system (market applications and actors and transactions between them)

Quadrant 2: Available protocols for market transactions.

Quadrant 3: Technical information system (power system operation applications transactions)

Quadrant 4: Available protocols for technical transactions

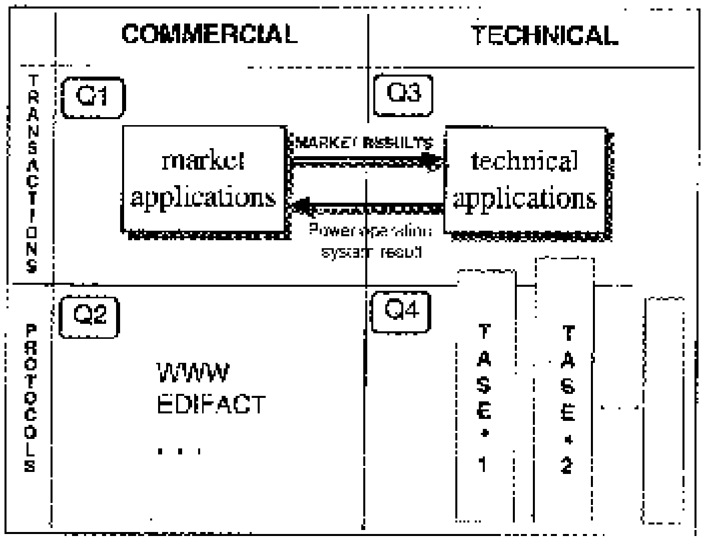



Figure 2 – Quadrant diagram

## 2 Transactions (quadrants 1and 3)

In deregulated energy markets, the notion of transaction model is important. This includes the actors, the transactions itself and the exchanged objects involved. With deregulation the transaction effort increases significantly in respect to integrated utilities because there are more interfaces between now independent functions and actors. It should be the aim of any standardization to decrease the transaction effort by use of advanced ICT (Information and Communication Technology). There are many examples of other markets that make extensive use of ICT. This report deals only with electronic communication interfaces. Standardization of these interfaces for more than one market would make these tools cheaper and new markets would benefit from the experiences of more advanced markets.

Transactions are basically split in this report into market transactions and technical (process) transactions. The process produces products as energy, transmission capacity with associated transmission schedule (firm or not firm) and interconnected system operation services (community services: generation and demand balance, transmission security, emergency preparedness, individual services: local power losses, energy imbalances, backup supply, load following) for the market. One-time integrated products of integrated utilities are now de-bundled into separate products and so billing and accounting becomes an issue from the reading of the meters, collection of accounting data, settlement of accounts to the bill. In some market models (UK) competition has been introduced into the supply and reading of meters.

Accounting becomes even more complicated because energy exchanges in deregulated markets become third party (customer) driven and may cross multiple control areas affording a whole chain of settlement of accounts (transactions are paid on the basis of contracts and differences between scheduled transactions and physical delivery).

Each market has its own regulatory framework to ensure non-discriminatory open access of end customers/load aggregators/generators/traders/etc., to the network to allow free trading of energy. The task of the process in full deregulated markets is limited to implementing the schedules decided by the market (generation and transmission) and to provide interconnected system operation services, and security and stability of system operation according to the laws of physics with paid and predefined quality of products.

In deregulated markets, many actors have two faces and therefore appear on the process side as well as on the market side. On the process side, the actors are concerned with the production process and on the market side with offering and trading of the products. Some of these products such as generation and demand balance, for example, cannot be traded and are mandatory for the functioning of the power system. On the other hand, 'end customers', i.e. those who finally consume the energy, only appear on the market side.

Because in full deregulated markets, the market decides who is contracted to deliver how much and to whom, and also the price, the 'interface between market and process' mainly deals with giving the market decision (trading of energy, capacity, optional services) to the process and getting the answer of the process if the market decision can be put into operation. The answer in most cases can be simply 'yes or no', but it can also be associated with additional information such as system constraints and curtailments. Then it becomes clear that many traditional transactions such as scheduling of energy generation (self-committed generators) and scheduling of energy transmission (third-party driven) move to the market side and control the process, whereas the process side implements it physically or makes it possible. Within the market process, it is not simply a question as to whether the supply can match the demand; there is the possibility of an iterative loop where demand is altered depending on the cost of supply.

The actors of full deregulated markets are Power Exchange (PX, bidding of generation and load), Traders/Brokers, System Operators Transport and System Operators Distribution, Independent System Operators (ISO) separated legally from Generation and Transport Providers, Security Co-ordinators (see USA), Transmission Providers ('wires'), Generation Providers, Distribution Providers ('wires'), Suppliers (purchasing and selling energy to distribution customers) and End Customers of both transport and distribution. The definition and naming of actors as well the interaction between them may be different in different markets and depends, besides logic, also on politics, history, regulation, experience and culture. To make it even more complicated, deregulated markets never are established overnight and develop in course of time by experience. So some markets have a history of 10 and more years of deregulation development.

One characteristic of these evolving market structures is the movement of responsibility for certain activities from the "technical" to the "commercial" domain (from quadrant 3 to quadrant 1), which makes any future model very sensitive to market factors. The boundary between quadrants 1 and 3 depends heavily on the market structure and requires specific consideration and more detail for standardization. Some markets (current state of OASIS/TLS in USA) implemented a simple customer interface ignoring the rules of physics (contract path) and are changing now to a more sophisticated mapping of the market to the process (parallel power flow analysis computed by power distribution factors applied to so called flowgates) to reconcile the market with the process.

It is also important to note the level of transactions is related only to the number of active traders and the frequency of trading. However, on the continental scale, the market transaction effort is greater in markets with high load, large population and industrial density and geographical size if these markets are based on multiple energy systems (control areas or zones with balancing generation and load) sometimes with a hierarchical control structure.

A first inventory of transactions and their implementation in observed or projected deregulated energy markets is given by annex A. The aim was to give a first comparison of different markets. Please note that this inventory is probably not comprehensive, and that names may have different meanings from one market to another (see definitions in annex B).

### 2.1 Market transactions (quadrant 1)

This subclause addresses transactions within the commercial market environment, instead of the technical and engineering environment covered by quadrant 3. Transactions in quadrant 1 are based on two broad classes of market structure models:

physical bilateral contract model, and

power exchange for spot energy and ancillary services.

Most markets mix both structures. The EU models TPA (Third Party Access) / NTPA (Negotiated Third Party Access) and Single Buyer both belong, in respect to the results, to the physical bilateral contract model, whereas the Electricity Pool of England and Wales in the UK is a Power Pool model with power exchange (load forecast instead of load bidding). The open access rules of FERC in the USA are like TPA. Besides this, pure financial markets for futures (price hedging) exist which are out of the scope of this report. The same is true for so called contracts of differences.

The following examples of market transactions, which may not be complete, are given from observed markets.

**(1) Market transactions of Physical Bilateral contracts are:**

Contracting generation and auxiliary services (deals on paper)

Transmission capacity market

- Offer of transmission capacity
- Reservation of transmission capacity
- Splitting and aggregation of transmission capacity
- Re-sale of transmission capacity
- Accounting and billing

**(2) Market transactions of Power Exchange are:**

Power Exchange (both energy and auxiliary services)

- Bidding of generation and demand
- Result of bidding
- Settlement of accounts
- Billing and accounting of traded energy services

or

Power Pool

- Bidding of generation and forecast of demand
- Result of bidding (price)
- Settlement of accounts
- Billing and accounting of traded energy

## 2.2 Technical transactions (quadrant 3)

Technical transactions are exchanged between 'technical actors' (i.e. control centres, generation units, substations, etc.) for power system real time operation. It is assumed that 'real time' represents 'what is concerned with power system on line operation'. That might include some provisional information (e.g. short term production schedules) and a *posterior* data (post mortem archives, realized load curve, historic protection relays operation, etc.).

As an example, the following technical transactions frequently happen in power system operation:

- status signals and events (switching device positions, transformer tap changer positions, protection relays events, alarms, etc.) transmitted from substations to control centres;
- measurements (voltage, active power and reactive power, current, primary reserve, etc.) and counter values transmitted from substations and generation units to control centres;
- inter control centre communication within a utility and between interconnection utilities (topology, measurements of tie lines, counter values, energy transmission schedules between control zones, operator messages);
- area or local switch commands (breakers, transformer tap changers, load shedding equipment, etc.) from control centres to substations;
- instructions (set point commands) from control centres to generation units;
- power generation schedules (P – f(t)) from control centres to generation units (this is not true for self-committed generators, see 2.3);
- unit commitment from control centres to generation units (this is not true for self-committed generators, see 2.3);
- exchange of information on transmission schedules between control centres;
- ...

Process information is also exchanged between the transport network and transport network customers (end customers, generators, distribution networks) for the security of power system operation. These transactions are part of the technical information system.

## 2.3 Interface between market and technical information system (quadrant 1/3)

In addition to what is used today power system operators in deregulated markets will need additional information to cope with bilateral trade and power exchanges in the TPA (open third party access to the network) environment. Note that the actors of the process have two faces and here only the interface between the market and technical information systems is described.

The observation of deregulated electricity markets shows some general trends:

a) By spot market or bilateral trade, the market gives to the process a first draft of schedules ('who produces, where, when, for whom, how much over time'), with or without reservation of transmission capacity. Examples are:

Energy transmission scheduling

- Request of transmission schedule
  - After reservation of transmission capacity
  - Without reservation of transmission capacity (all-in-one)
- Confirmation of transmission schedule
- Meter readings
- Settlement of accounts
- Billing and accounting

Generation schedules

- Aggregated schedules for system operator
- Meter readings
- Settlement of accounts
- Billing and accounting.
- ...

b) The final decision to implement the schedules is up to the system operators after transmission capacity and security analysis. In case of network constraints, counter purchasing of production and splitting of markets can be done either by the ISO, any other operational authority, or the market itself. As an example, this information could be:

- Simply 'yes' or 'no'
- Notifications of constraints by the system operator, curtailments in case of disturbed operations
- Information on subsequent operational requirements that may have an effect on the market in terms of costs
- Actual operation costs
- ...

## 3 Available protocols

This clause covers 'available' protocols. In this context 'available' is taken to mean a protocol which is either already being used in support of deregulated energy market communications, or is suitably defined as a 'paper' specification, preferably as a published standard.

### 3.1 Protocols available for market transactions (quadrant 2)

#### 3.1.1 EDIFACT

EDIFACT is a standard created by the UN for exchanging structured data. UN/EDIFACT is being recognized as the single international standard for EDI. In document SB3/73/INF IEC Sector Board 3 endorses this and makes recommendations to formalize this.

In Scandinavia, EDIEL is now the standard for Electronic Data Interchange for the ELectricity Market trading. The aim was to reduce the use of fax and manual interfaces. EDIEL makes use of the existing EDIFACT standard, which is structured like a table of data elements. The first implementation used X.400 messaging over X.25 channels. It has also been implemented over ISDN and TCP/IP. EDIEL can easily adapt to the SMTP protocol and Internet instead of X.400 and X.25.

EDIEL is implemented over both public and private networks and links all market participants with non real-time communications associated with the market. It is used for transactions such as bidding, billing and exchange of production schedules (next day) but not for more immediate operations such as secondary regulation which is done by telephone. Information providers also have access for the provision of bulletin boards (Dow Jones, Reuters, etc.) of energy prices.

#### 3.1.2 WWW

WWW is a world-wide used Internet technology with a great future including commercial applications. Security and performance are critical issues and should be taken into account. WWW is a client / server technology and uses HTML, FTP, JAVA applets and e-mail. For clients, cheap or free browsers can be used which run on every PC providing a graphical user interface. WWW has no standardized message formats for applications (to be individually standardized).

In the US. open transmission access is mandated by the Federal Energy Regulatory Commission (FERC) government and implemented via OASIS (Open Access Same Time Information System), which began operation in 1997 for Phase 1. Technical specifications for OASIS are based on recommendations from the industry and formally adopted by FERC in Standards and Communication Protocols for Open Access Same Time Information System (OASIS). OASIS allows the reservation of transmission capacity and the booking of auxiliary services. This is done by standardized messages based on HTML templates. NERC intends to use WWW also for the future TIS (Transaction Information System) to allow transmission scheduling subsequent to capacity reservation with OASIS. WWW will also be used for the customer interface of the PX in California.

#### 3.1.3 Protocols used in the UK deregulated market

Domestic electricity competition began on 14 September, 1998. Prior to that, the electronic Data Transfer Network had been operating for more than one year. During the majority of this time, it carried testing information, although the difference between data flows which carry a test flag and those which carry an operational flag is not material to the service. In the transitional period until June 1999, when full competition was introduced, the service carried both live data and test information for these market participants who had not yet qualified to open their markets. Whilst the data Transfer Network has a major role in the collection of metering data, it is not restricted to that. The service applies between all players in the industry. A large number of data flows have been defined between players and these are then carried by the Data Transfer Service. The Principal Users of the service are the settlement agencies (the Electricity Pool and the Scottish Settlements Organisation, suppliers including the Public Electricity Suppliers and the second tier entrants, data aggregators, etc.)

In the first phase of implementation of the DTN bids, schedules, operational data, ancillary services, charging and pool boundary metering remain with the existing system and initially so will remote metering of 'second tier' suppliers (i.e. those operating on another companies network) supplying customers above 100 kW peak demand. However, the collection of both MOST (Metering Outside Settlement Timescales) and MIST (Metering Inside Settlement Timescales) Settlement data for customer below 100 kW peak demand are a function of the new network. This links the agent of the 'Pool' in the guise of ISRA (Initial Settlement Reconciliation Agent) with all market participants which include distribution companies, the transmission grid operator (NGC), the grid operator of vertically integrated companies (Scotland), supply companies, data collectors (half hourly and non half-hourly), data aggregators (half-hourly and non half-hourly), meter operators (half-hourly and non half-hourly), PES Registration Service Agents and the MPAS (Metering Point Administration Service).

Since at the time when this report was originally written, the Data Transfer Network was not in service for live data, and little detailed information was available. it did not fit the definition of 'available' in clause 3 above and therefore was not considered in further detail in this report. However, the information in the above paragraphs has been updated to reflect the current position.

### 3.2 Protocols available for technical transactions (quadrant 4)

Protocols already in use include ICCP and ELCOM 90. These are realized in TASE.2 and TASE.1 respectively and form part of the IEC 60870-6 series of standards. Further information is given below.

DLMS forms part of the IEC 61334 series of standards. Although originally intended for distribution automation, the interest has shifted to its use for metering communications although it has yet to be used on a commercial scale.

### 3.2.1 TASE.2 / ICCP

TASE.2 is primarily for providing real-time control of the network between control centres. Its use is therefore not intended to be for electricity market trading, but to be used as a direct consequence of market trading.

MMS (Manufacturing Messaging Specification) is used for real-time control in the factory environment. In 1990, work began on TASE.2 by standardizing the Inter-Control Center Protocol (ICCP), which is based on MMS. The UCA 2 and possible IEC substation bus is also based on MMS.

TASE.2 is for real-time control between Control Centres, including the scheduling of power flow between control areas and the state of circuit breakers at the end of tie lines in the remote station. It also can be used for communication between Control Centres and substations/power plants. It forms part of the Utility Communications Architecture Version 2 (UCA 2) which has been sponsored by EPRI and has now become an IEEE report.

In general, factory networks operate at higher speeds than control centres communications which typically use event oriented transmission. In order to meet these requirements, TASE.2 uses a subset of MMS but adds extra services and object modelling. The most fundamental change is grouping which defines certain data sets for information transfer. There are different modes for transferring groups of measurands. For example, one mode may transmit a whole group if one measurand changes, whereas another may only transmit those in the group which have changed.

TASE.2 uses client server technology. There is no status update, but all values can be scanned periodically (6 s) and the time interval can be changed, for example, to 10 s by changing a parameter. TASE.2 also features access rights and firewall security. The main advantages are its scaleability, flexibility and use of proven technology (MMS). Also there is no limit to the number of object definitions, which are independent of the communication protocol. Scheduling objects can be represented as a table (like a spreadsheet format) and TASE.2 can use this to put market decisions into action in real-time.

### 3.2.2 TASE.1 / ELCOM 90

At present, there are ELCOM-90 software systems running or under installation at close to 400 control centres, substations and energy measurement centres in 22 countries.

The ELCOM-90 service specification complies with the services and application programming interface specified by IEC 60870-6-501 (TASE.1 services). The impetus for the development of ELCOM/TASE.1 was the need for communication of energy management in an energy market with application software from different manufactures.

Software for transfer of market information based on EDIFACT with ELCOM-90 as communication provider is implemented. In addition to the installations mentioned above ELCOM is also integrated in systems for gas distribution and railway control systems.

The strategy of IEC expressed in IEC 60870-6-501 and IEC 60870-6-502 supports a smooth transition from the present situation to a situation with a complete OSI stack. Utilities worldwide have made up their strategy relying on the IEC strategy. Utilities have however been reluctant to introduce a complete OSI-stack as specified in the IEC 60870-6 series.

An implementation of TASE.1 running on different platforms and with a complete ISO-stack was presented as a result from a project of several vendors in January 1995 at an IEC TC 57 WG07 meeting.

### 3.2.3 DLMS

DLMS is related to MMS in having the same concepts as regards the main objects, but describes fewer services (22, of which only four are obligatory), and is therefore a 'light' form of MMS. It also adds important attributes to manage access rights to objects in terms of a 'virtual association' object, and the rules for operation of objects have been widely simplified. For instance, DLMS does not enable objects to be created dynamically, which reduces the memory requirement in equipment.

Although based on the same principles as MMS, DLMS is therefore simple enough to be used for low cost applications (e.g. metering, demand side management, etc.).

DLMS is independent of all layers below, and of the communications medium used, i.e. although it began as part of a DLC-based communication specification, it can be (and has been) implemented in systems using other media. For this reason, it is now referred to as '*Device Language* Message Specification' rather than '*Distribution Line*'.

DLMS defines a 'virtual system', i.e. a system in which the behaviour of the devices involved in the exchange of data is standardized and defined irrespective of practical implementations. It is then for a manufacturer ultimately to translate this defined behaviour into a real piece of equipment, which will then be interoperable with any other manufacturer's similar equipment implemented to the same system. The 'virtual equipment' included in this system (meters, concentrators, remote terminal units, protective relays, etc.) contain resources (e.g. data or other elements) related to its application, which are known as 'objects', i.e. abstract entities with specific characteristics. Each object type has available to it a set of services, and is defined by attributes, describing their features. The most common object is the 'variable', a variable being defined as 'one or more data elements that are referred all together by a single name'. Examples of real items that can be referenced are coded as variables are: tariff registers, serial number, status of a rate switch, etc. Another object is the 'task' which controls the communications transfer process.

DLMS assumes that the behaviour of every DA/CA equipment can be modelled with these two types of objects. The strict separation between the objects and the access services allows the manufacturer to design his equipment freely by using the building stones (objects) of DLMS.

There is an initiative to define metering objects through the DLMS User Association.

### 3.2.4 Other standards

Other IEC standards which may be relevant to deregulated energy market communications are:

IEC 60870-5-101:1995, Telecontrol equipment and systems – Part 5: Transmission protocols Section 101: Companion standard for basic telecontrol tasks

IEC 60870-5-102:1996, Telecontrol equipment and systems – Part 5: Transmission protocols Section 102: Companion standard for the transmission of integrated totals in electric power systems.

IEC 60870-5-104, Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 870-5-101 using standard transport profiles[1]

---

[1] To be published.

## 4 Need for standards and work programme

This clause examines the need for standards in each of the quadrants and for the interface between quadrants and, where applicable, suggests a work programme.

### 4.1 Market transaction and protocols (quadrants 1 and 2)

**Quadrant** 1

This quadrant holds the definition of information to be exchanged for commercial operation of the electricity market and is setting the requirements and characteristics for protocols in quadrant 2.

The models of information and transactions in quadrant 1 also complete the base standard protocol products so that a higher level of interoperability between systems can be reached. An example is EDIEL. Standardization in both quadrants is necessary not only for the sake of interoperability but also for the 'openness' of the market: any external party should be able to join the market place without having to implement a complete new communication infrastructure for every market it wants to enter.

Regarding quadrant 1, the situation is such that international standardization of information models is at this moment an unrealistic objective. Energy markets all over the world are either not defined in detail, not yet stable or very different from each other. Intercontinental trading is not foreseen.

So there is no task for IEC TC 57 in this area at this moment.

There will be an increased demand for transport of data and information within and between interconnected systems. It could therefore be very worthwhile to define regional standards for international markets. The example of this case in Europe is the Scandinavian market that uses the EDIEL information infrastructure. If work has to be done on a regional level is a market decision: when utilities and/or manufacturers feel the need for standardization in this area, they can address the appropriate bodies. For example UCPTE or UNIPEDE could could set the requirements and take an initiative and address CEN/CENELEC to do this work.

Market driven regional initiatives will also increase the speed of standardization compared with an international approach.

**Quadrant 2**

In quadrant 2 there are existing and already used base standards (EDIEL in Scandinavia based on EDIFACT, OASIS and TIS in the USA based on the WWW) that are not ISO/IEC standards at the moment. The use of base standards is recommended. Use depends on the type of transaction. For some transactions EDIFACT as well WWW can be used, for others only EDIFACT or WWW should be used.

*EDIFACT* is

- recommended by IEC SB3 to be used for electronic commerce;
- already standardized in some degree in regard of standard message formats;
- already used with success for certain types of market transactions (EDIEL).

A standard made available for the industry or a recommendation to use a common EDI-standard will be an asset for the market process. For settlement of accounts, accounting and billing and perhaps collecting of metering data there is no alternative standard to EDIFACT and EDIFACT is therefore recommended. The EDIEL solution also provides a communication interface for power exchanges (see Nord Pool) based on EDIFACT, which may be used in other markets. Up to now EDIEL provides no means for transmission scheduling which, according to the EU directive, is needed for TPA/NTPA but it could be extended for this.

*WWW* is

- an Internet technology used world wide with great acceptance and a great future
  - messages can be formatted as HTML text templates (to be standardized)
  - a cheap graphical user interface is already available (browser).

Applications of WWW in the USA are OASIS for offer and reservation of transmission capacity and, in the future, TIS for transmission scheduling (MW over hours). Because of its graphical user interface the WWW can also be used for general information exchange between customers and utilities.

EDIFACT, and to some extent for certain transactions WWW, are the recommended base standards for message layout and transaction definitions for commercial transactions in the electricity market.

As soon as preliminary studies on national market definitions provide more detailed requirements and the situation is stable enough, then, firstly on a regional level and possibly on an international level, the final choice for the basic standard and the standardization of the information models can take place. Again this is a market decision: regional bodies could express the need and formulate the objective of standardization work to be done.

### 4.2 Technical transactions and protocols (quadrant 3 and 4)

It is often heard that 'market law has now replaced Ohm's law'. However, Ohm's law is intractable, and actual electricity flows in interconnected power systems may not match with commercial flows decided by the market.

In contrast to many products, electricity cannot be stored, apart from exceptions such as pump storage, etc. and for the main part production must meet instantaneous demand. The problem of energy transmission cannot be considered independently from the physical characteristics of the transmission support (the network), for example commercial bilateral IPA-transactions between two points result in parallel power flows.

The type of transactions considered here have been outlined in 2.2 (quadrant 3).

The open energy market will bring changes to the real-time operation of the power systems by:

- organizational split of generation, transmission and distribution, interconnected system operation;

  This means there is no more a single body that takes care for the secure and economic operation of the entire power system. Instead, several technical bodies will show up which have to exchange information correctly, comprehensively and on time. This is of particular importance in the presence of congestion and emergencies.
- orders of magnitude, more energy interchange transactions that have to be managed, filtered, processed and communicated between the technical bodies;
- energy trading that will become more and more transregional and international thus compelling more and more of the above-mentioned technical bodies to talk to each other;
- the first versions for generation and load schedules will be dictated by market rules and, depending on actual power system circumstances (availability of equipment, weather, etc.), may be far away from technical feasibility.

  This means that those schedules will have to be compiled by system operators and communicated between each other (and with the market) again and again until technical feasibility is reached.

Such a complex technical system can only work with efficient communication procedures. Standardization highly contributes to this.

Specifications exist today or are being defined for quadrant 3:

- within utilities;
- between interconnected utilities of a country;
- between countries, for example UCPTE working group.

An international communication standard defined by IEC would help to

- establish common levels of security for power system operation in deregulated markets;

  By applying the IEC standards for exchanging information between technical participants, new emerging markets can leverage the experience made in other markets.
- promote the growth of energy trading across regional and national borders.

  By applying the IEC standards for exchanging information between technical bodies, those would be well prepared for the ever increasing number and amount of energy transactions across all borders.

To be helpful in making power system operation in deregulated markets secure at internationally high levels, the standard needs to describe the 'how' of the communication based on the definition of the 'what'.

### 4.3 Transactions between market and power system operation

The type of transactions considered here has been outlined in 2.3.

Communication partners at the border between market and power system operation are

- several market place providers;
- several technical bodies providing transmission, distribution, metering, etc.;
- many individual producers, consumers, traders, brokers, etc.

The large number of communication partners calls for standardized communication procedures.

As already stated in 4.1, how the energy markets are organized is highly inhomogenous and the structure is likely to change over a period of time. Inside markets, various regional, national or even transnational communication standards will emerge.

On the other side, power system operation has a high similarity all over the world.

This will lead to communication procedures at the interface between market and power system operation that, at least at the technical side, will have much communality at all places. While inside the markets there will be very few communalities; at the interface it will be necessary to use generic physical terms such as kWh, MW, location, time, etc.

An international standard for this interface would help to

- establish common levels of security for power system operation in deregulated markets;

  By applying the IEC standards for exchanging information between market and the technical bodies, new emerging markets can leverage the experience made in other markets.
- promote the growth of energy trading regional as well as across regional and national borders.

  By applying the IEC standards for exchanging information between market and the technical bodies, any new producing, consuming or trading body can easily take part in any energy market in its region and beyond.

To be helpful in making the energy trading work within the limitations given by the technical side, the standard needs to describe the 'how' of the communication based on the definition of the 'what'.

### 4.4 Proposal

#### 4.4.1 Generic technical tasks

A short list of the main technical actors should be created, independent of specific market implementations comprising, for example, control centres, generating units, energy management centres for a portfolio generator, distribution control centres, substations and perhaps industrial plants. Some sub-classifications might be useful (large/small units, SCADA/EMS, and so on), following the technical impact of each actor type.

NOTE Some generators may be said to have a 'portfolio' of different types of generation contracts. Hence, the use of the term portfolio generator.

It is recommended that IEC TC 57, WG13, which is working on the CIM (Common Information Model) should take into account existing IEC protocols for data exchange and requirements of deregulated markets.

#### 4.4.2 Conceptual data model for information exchange

The first task will consist of setting up a list of real time information exchanged between each pair of actors. We assume that 'real time' represents 'what is concerned with power system on-line operation'. That might include some provisional information (short term production schedules, for instance) and *a posterior* data (realized load curve, historic protection relays operation, etc.).

This information should be described with standard attributes (priority, periodic or spontaneous, confidentiality requirements, minimal accuracy, etc.) and then structured into a conceptual data model (CDM).

In order to be accepted, the list of information should be strongly aligned with present and past works of operational organizations as, for example UCPTE 'real time information exchanges' working group, NERC recommendations.

However, real time information is useless without comprehensive descriptive configured data (power system topology, electrical characteristics of lines, generators, etc.). In a second step, equivalent work should also be done for this data, deduced mainly from the former.

All of this has to be done by both system operation and telecommunication experts.

It is again recommended that IEC TC 57, WG13, which is working on the CIM (Common Information Model) should take into account existing IEC protocols for data exchange and requirements of deregulated markets.

#### 4.4.3 Check against existing protocols

A check should be made whether existing IEC standards are comprehensive enough to convey the information between power system bodies themselves and between system operation bodies and market participants in the deregulated market. This work should be done by the appropriate working groups of IEC TC 57.

If the existing IEC standards are comprehensive enough, the work plan is finished and no changes of protocols are necessary.

#### 4.4.4 Extend existing protocols

If the existing IEC standards are not comprehensive enough, the existing protocols will have to be extended. It is recommended that such work should be done by the appropriate working groups of IEC TC 57.

## 5 Conclusions

**Market transactions (quadrant 1)**

a) A regional standard is necessary for a given market to work.

b) Market transactions obviously differ between systems and evolve even in the definition of terms.

c) The definition of a set of market transactions is regional work.

**Recommendation**

No immediate IEC work.

This should be re-examined in some years when the situation is more stable for the determination of common items.

**Market protocols (quadrant 2)**

a) The technical support for the market is a regional choice.

b) De-facto solutions already exist or are in development, notably OASIS and the future TfS (USA), ISO/PX in California based on WWW and EDIEL (Scandinavia) based on EDIFACT.

c) IEC Sector Board 3 has already made a recommendation concerning EDIFACT (ref. SB3/13/INF).

**Recommendation**

1) The use of EDIFACT as a base standard is recommended. Although WWW is not a complete standard, its use is supported for appropriate transactions provided that adequate authentication and security measures are employed. The choice between these two and the possible integration into one solution depends on the type of transaction and the overall system design. For some transactions EDIFACT as well WWW can be used, for others only EDIFACT or WWW should be used. What is appropriate is a regional decision.

2) EDIFACT should be confirmed as a recommended standard for business transactions. The opportunity to make EDIFACT evolve towards an IEC standard for this purpose should be studied subsequently, in particular to preclude 'dialects' developing.

**Process transactions (quadrant 3)**

a) Process transactions differ little from one network to another.

b) Deregulation leads to a split:

- scheduling transmission and generation belongs to the market, and
- operation and security including system services belongs to the system operator (process);
- this split means that there is an interface between 'market' and 'process' which needs special consideration.

c) Then standard protocols are necessary in order to:

- secure power operation in the new context;
- deal with the probable increase in energy exchanges.

**Recommendation**

A transaction model, limited in the first instance to control centre communication, should be defined together with other technical actors to check existing IEC protocols (see 4.4.1 and 4.4.2). The model shall cover 'process' transactions and those transactions with the 'market' that were mapped to quadrant 4.

**Process protocols (quadrant 4)**

IEC protocols already exist and seem to be sufficient.

**Recommendation**

1) Check that they match with the new transaction model (see 4.4.3)
2) If there is insufficient match then the IEC protocols should be made more comprehensive (see 4.4.4)

**Interface 'market to process'**

**Recommendation**

1) The two communication systems of 'market' and 'process' should remain separated with an interface between.
2) This interface is of primary interest to the system operators in order to implement the market decision. System operators should therefore define the requirements based on the regional market rules to allow the standardization of this interface.
3) Selections still have to be made as to which transactions of this interface have to be mapped on quadrant 2 protocols and which have to be mapped on quadrant 4 protocols.

# Annex A

## Comparison of markets and related transactions

The following three tables show the functions, transactions of different energy markets and generic services. The market transactions may be supported by electronic communication. In annex B the definitions and terms of markets are shown and these are sometimes different for each market.

It is not possible to map market transactions in a uniform way to the market participants in different markets because functions, terms and definitions are different. Therefore, market transactions are mapped (>) to generic services which are then mapped to real market participants. The methodology is as follows:

Identification of market functions and associated transactions lead to

**a) functions and transactions of markets**

See table A.1.

**b) mapping transactions > generic services**

See table A.2.

**c) mapping market participants > generic services**

See table A.3.

**Definitions of generic unbundled actors and associated services**:

- Transmission Provider: Transmission in a system [wires] (Tra),
- Distribution Provider: Distribution in a system [wires] (Dis)
- Generation Provider: Generation of electricity (Gen),
- Supplier: Wholesale Purchasing & Retail Selling (P&S),
- Single Buyer: Purchasing & Selling in one system without knowing the price (SB),
- Trader: Wholesale Purchasing & Selling (Mer),
- Broker: Brokering without Purchasing & Selling,
- System Operator: System Operation dealing with system services, security, stability (SO),
- Power Exchange: Central trading with generation and demand or in case of power pool only with generation (PX),
- End Customer: Demand of energy for own use (Cus).

The generic services can be mapped 'n to 1' to market participants in different markets. Real market participants may or may not provide de-bundled services. Examples are Tra, P&S, SO > control area utility, Mer, Cus > load aggregator, SO > ISO (Independent System Operator).

Market functions are of a dynamic nature and may change in course of time. Electronic communications supporting market transactions must therefore be generic and flexible enough to adapt to this.

**Table A.1 – Functions and transactions of deregulated markets**

| Market functions<br>Market transactions (>) | M 1:<br>EU | M 2:<br>Scan | M 3:<br>UK* | M 4:<br>Au/NZ | M 5:<br>USA | M 6:<br>NEng | M 7:<br>Cal |
|---|---|---|---|---|---|---|---|
| Market scope | | | | | | | |
| • Single grid per country | Yes | Yes | Yes | | | | |
| • Multiple grid per country | Yes | Yes | | Yes | Yes | Yes | Yes |
| • Single country or region | | | Yes | Yes | Yes | Yes | Yes |
| • Multiple countries or regions | Yes | Yes | | | | | |
| Competition | | | | | | | |
| • Generator | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| • Wholesale | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| • Retail | Yes | Yes | Yes | Yes | No | Yes | Yes |
| Bilateral contracts | | | | | | | |
| • Physically: producer / consumer | Yes | Yes | No | No | Yes | Yes | Yes |
| • Financially: price hedging | ? | Yes | Yes | Yes | Yes | No | Yes |
| Open access to network | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| • TPA / NTPA | Yes | Yes | Yes | No | Yes | Yes-ex | Yes |
| • point-to-point tariff | Yes | | | | Yes | Yes | Yes |
| • point-of-connection tariff | ? | Yes | Yes | | No | No | ? |
| • Single Buyer (SB), contract | Yes | No | No | Yes | No | Yes-in | No |
| • point-to-point tariff | ? | | | No | | No | |
| • point-of connection tariff | ? | | | Yes | | Yes | |
| Power pool with generation bid | | No | Pool | Yes | No | Yes | Yes |
| • > Generation bid and forecast | | | Yes | Yes | | Yes | Yes |
| • Wholesale | | | Yes | Yes | | Yes | Yes |
| • Retail (end consumer) | | | Yes | Yes | | Yes-fu | Yes-fu |
| • Dealing with constraints | | | No | Yes | | Yes | Yes |
| Power Exchange (PX) | ? | Yes | No | Yes | ? | Yes | Yes |
| • Spot Market (SM) | | Yes | | Yes | | Yes | Yes |
| • > information | | Yes | | Yes | | Yes | Yes |
| • > generation bid | | Yes | | Yes | | Yes | Yes |
| • > load bid | | Yes | | Yes | | Yes | Yes |
| • > adjustment bid ISO inc/dec | | No | | | | | Yes |
| • wholesale | | Yes | | Yes | | Yes | Yes |
| • retail (end consumer) | | Yes | | Yes | | Yes | Yes |
| • dealing with constrains (ISO) | | Yes | | Yes | | Yes | Yes |
| • splitting the market | | Yes-N | | Yes | | Yes | Yes |
| • counter purchases | | Yes-S | | No | | No | Yes |
| • > Billing and accounting | | Yes | | Yes | | Yes | Yes |
| • Ancillary Market (AM) | | Yes-S | No | Yes | Yes-fu | Yes | Yes |
| • > generation bid | | Yes-S | | Yes | | Yes | Yes |
| • > regulation bid | | Yes-S | | Yes | | Yes | Yes |
| • Combined market SM and AM | | No | No | Yes | Yes-fu | Yes | Yes |
| • Future market | | | | | | | |
| • > bidding | ? | Yes | No | Yes | Yes | No | Yes |

* excluding Scotland and Northern Ireland

**Table A.1 (continued)**

| Market functions<br>Market transactions (>) | M 1<br>EU | M 2<br>Scan | M 3<br>UK | M 4<br>Au/NZ | M 5<br>USA | M 6<br>NEng | M 7<br>Cal |
|---|---|---|---|---|---|---|---|
| Transmission market | ? | No | No | | Yes | ? | ? |
| ▪ Capacity | | | | | | | |
| ▪ > information | | | | | Yes | | |
| ▪ > capacity reservation | | | | | Yes | | |
| ▪ > splitting/aggregation | | | | | Yes | | |
| ▪ wholesale | | | | | Yes | | |
| System Operator (SO) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ Integrated System Operator (SO) | Yes | | Yes | Yes | | | |
| ▪ Independent SO (ISO) | ? | Yes | | Yes | Yes | Yes | Yes |
| ▪ Security Co-ordinators (SC) | No | | | | Yes | | Yes |
| ▪ Co-ordinated SC | Yes | | | | Yes | | |
| ▪ Load frequency control / AGC | | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ Generation scheduling | | | | | | | |
| ▪ SO economic dispatch | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ SO re-dispatch | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ > spot PX committed | ? | Yes | Yes | No | mixed | Yes | Yes? |
| ▪ > ancillary PX committed | Yes | No | No | No | mixed | No | Yes? |
| ▪ > self-committed | ? | Yes | No | Yes | mixed | No | Yes |
| ▪ > Adjustment bid to SO nodes | | Yes | | | | | |
| ▪ > Scheduling transmission | | | | | Yes | | |
| ▪ > Buying ancillary services | | | | | Yes-fu | | |
| ▪ Balance of system | | | | | | | |
| ▪ ISO, SO | | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ co-ordinated regional SO | Yes | Yes-S | | | | | |
| ▪ > Settlement of accounts | | | | | | | |
| ▪ central service (ISO, ..) | Yes | Yes | Yes | Yes | | Yes | Yes |
| ▪ decentralized service | | No | | | Yes | | |
| Meter reading and settlement | | | | | | | |
| ▪ > Remote meter reading | | | | | | | |
| ▪ utility | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| ▪ service company | | | | | | | |
| ▪ > Collection of readings | | | | | | | |
| ▪ utility | Yes | Yes | | Yes | Yes | Yes | Yes |
| ▪ service company | | | Yes | | | | |
| ▪ > Billing and accounting | Yes | Yes | Yes. | Yes | Yes | Yes | Yes |
| ▪ > End customer changing | Yes | Yes | Yes | ? | ? | ? | Yes-fu |
| ▪ > Market information | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

'>' means a market transaction which may be supported by electronic communication, otherwise without '>' means a market function or market feature

EU = European Union, Scan = Scandinavia, UK = entries for market of England and Wales only, Au/NZ = Australia/New Zealand, USA = United States of America, NEng = New England (USA), Cal = California (USA)

Yes-fu = Yes future

Yes-N = Yes Norway, Yes-S = Yes Sweden

NOTE The entries for UK (England & Wales) will change substantially with the revised trading arrangements in April 2000.

**Table A.2 – Mapping of market transactions to generic services**

| Market transactions | Cus | Tra | Dis | P&S | Mer | SB | Gen | SO | PX |
|---|---|---|---|---|---|---|---|---|---|
| Power pool with forecast | | | | | | | | | |
| • > Generation bid and forecast | | | | Pool | | | X̲ | | |
| Power Exchange (PX) | | | | | | | | | |
| • Spot Market (SM) | | | | | | | | | |
| • > information | X | | | X | X | | X | | X̲ |
| • > generation bid | | | | | | | X̲ | | X |
| • > load bid | X̲ | | | X̲ | X̲ | | | | X |
| • > adjustment bid ISO inc/dec | | | | | | | | X̲ | X |
| • > Settlement of accounts | X | | | X | X | | X | | X̲ |
| • Ancillary Market (AM) | | | | | | | | | |
| • > generation bid | | | | | | | X | | X |
| • > regulation bid | | | | | | | | X̲ | X |
| • Combined market SM and AM | | | | | | | | | |
| • Future market | | | | | | | | | |
| • > bidding | X̲ | | | X̲ | X̲ | | X̲ | | X |
| Transmission market | | | | | | | | | |
| • Capacity | | | | | | | | | |
| • > information | X | X | | | X | | | X̲ | |
| • > capacity reservation | Or X̲ | | | | Or X̲ | | | X | |
| • > splitting/aggregation | Or X̲ | | | | Or X̲ | | | X | |
| • > Scheduling transmission | Or X̲ | | | | Or X | | | X | |
| • > Ancillary services | Or X̲ | | | | Or X | | | X | |
| System operator (SO) | | | | | | | | | |
| • > Spot PX committed | | | | | | | | X | X̲ |
| • > Ancillary PX committed | | | | | | | | X | X |
| • > Self-committed | | | | | | | X̲ | X | |
| • Settlement of accounts | | | | | | | | | |
| • > Central service (ISO, ...) | X | X | | X | X | X | X | X̲ | |
| • > Decentralized service | | | | | | | | | |
| Meter reading and settlement | | | | | | | | | |
| • > Remote meter reading | X | | | X | | | X | | |
| • utility | | | | | | | | | |
| • service company | | | | | | | | | |
| • > Collection of readings | X | | | X | | | X | | |
| • utility | | | | | | | | | |
| • service company | | | | | | | | | |
| • > Billing and accounting | X | | | X̲ | | | X | | |
| • > End customer changing | X̲ | | | X | | | | | |
| • > Market information | X | | | X | X | | X̲ | | |

X – participant X̲ – initiating participant

Transmission in a system (wires) (Tra), Distribution in a system (wires) (Dis), Generation (Gen), Purchasing and Selling (P & S), Single Buyer in one system (SB), Trading (Mer), System Operation (SO), Trading on Power Exchange (PX), End Customer (Cus)

**Table A.3 – Mapping of market participants to generic services**

| Markets / participants | Cus | Tra | Dis | P&S | Mar | SB | Gen | BO | PX |
|---|---|---|---|---|---|---|---|---|---|
| M1: EU Directives | | | | | | | | | |
| • Independent producer | | | | | | | X | | |
| • Vertical integrated undertaking | | X | X | X | | | X | X | |
| • Distribution system operator | | | X | X | | | | X | |
| • Transport system operator | | X | | X | | | | X | |
| • Customer | | | | | | | | | |
| • and | X | | | | | | | | |
| • wholesale | | | | Or X | Or X | | | | |
| • Single buyer | | (X) | | | | X | | | |
| M2: Scandinavia | | | | | | | | | |
| • Power exchange | | | | | | | | | X |
| • ISO | | | | | | | | X | |
| • Power supplier | | | | | | | X | | |
| • Grid | | X | | | | | | | |
| • Balance responsible company | X | | X | X | | | | | |
| • Trader | | | | | X | | | | |
| • End customer | X | | | | | | | | |
| M3: UK (excluding Scotland and Northern Ireland) | | | | | | | | | |
| • Gensets | | | | | | | X | | |
| • Supplier | X | | | X | | | | | |
| • Distributor | | | X | | | | | | |
| • Grid | | X | | | | | | X | |
| • Pool | | | | | | X | | | X |
| • End customer | X | | | | | | | | |
| M4: Australia/New Zealand | | | | | | | | | |
| • Gensets | | | | | | | X | | |
| • Supplier | X | | | X | | | | | |
| • Distributor | | | X | | | | | | |
| • Grid | | X | | | | | | X | |
| • Pool | | | | | | X | | | X |
| • End customer | X | | | | | | | | |
| M5: USA | | | | | | | | | |
| • Control area | | X | | X | | | X | X | |
| • Generation provider | | | | | Or X | | Or X | | |
| • Independent system operator | | | | | | | | X | |
| • Purchasing-selling entity | Or X | Or X | Or X | Or X | Or X | | | | |
| • Transmission customer | Or X | | Or X | | | | Or X | | |
| • Transmission provider | | X | | | | | | | |
| • Load serving entity | | Or X | Or X | | | | | | |
| • Power marketers | | | | | X | | | | |
| M6: New England | | | | | | | | | |
| • ? | | | | | | | | | |
| M7: California | | | | | | | | | |
| • Power Exchange | | | | | | | | | X |
| • Independent system operator | | | | | | | | X | |
| • Transmission provider | | X | | | | | | | |
| • Distribution provider | | | X | | | | | | |
| • Supplier | | | | X | | | | | |
| • End customers | X | | | | | | | | |
| • Generators | | | | | | | X | | |
| • Trader | | | | | X | | | | |

Or X = or X

# Annex B

## Definitions

**EU (terms of EU directive 92/96/EG)**

1) Generation means the production of electricity.
2) Producer means a legal or natural person generating electricity.
3) Independent producer (IPP) means a producer who does not carry out electricity transmission or distribution functions in the territory covered by the system.
4) Customers means wholesale or end purchasers of electricity and distribution companies.
5) Wholesale customer means any natural or legal person, who purchases or sells electricity and who does not carry out transmission, generation or distribution functions inside or outside the system where he is established. ("Trader")
6) End customer means a customer buying for is own use.
7) Supply means the delivery and / or supply of electricity to customers.
8) Single buyer means any legal person who, within the system where he is established, is responsible for the unified management of the transmission system and / or for centralised electricity purchasing and selling.
9) Negotiated Third Party Access (NTPA) means electricity producers and supply undertakings and eligible customers to be able to negotiate access to the system so as to conclude supply contracts with each other on the basis of voluntary commercial agreements.
10) Third Party Access (TPA) means electricity producers and supply undertakings and eligible customers to be able to have access to the system on the basis of published tariffs so as to conclude supply contracts with each other on the basis of voluntary commercial agreements
11) Eligible customer means a customer who has the right to chose his own producer.
12) Distribution system operator means an entity responsible for operating, ensuring the maintenance and, if necessary, developing the distribution system in a given area and its interconnections with other systems.
13) Transmission system operator means an entity responsible for operating, ensuring the maintenance and, if necessary, developing the transmission system in a given area and its interconnections with other systems, to guarantee security of supply.
14) Vertical integrated undertaking means an undertaking performing two or more of the functions of generation, transmission and distribution of electricity

**UK**

1) Supplier means any legal person who purchases electricity as a wholesale customer, sells electricity to end customers and who does not carry out transmission, generation or distribution functions. The supplier has no geographical limitation.
2) Distributor means any legal person who does carry out the distribution function ("wires company").
3) Gensets means independent generators.
4) Grid means the transmission network. The National Grid Company operates the system in England and Wales and provides transmission services. There are three other TSOs in the UK.
5) Pool (Electricity Pool of England & Wales) means a place of trade with generation bidding and selling electricity to suppliers. The schedules are based on forecasts of the National Grid Company.

6) Hedging contract means a treaty between producer (generator) and wholesale customer (REC) to protect against peak Pool prices ('Contract of Differences').

**Scandinavia**

1) Power Exchange means a place of trade with both generation bidding and load bidding and selling electricity to customers and traders.

2) ISO means an independent system operator who operates but does not own the network and is responsible for system security and the ancillary services (interconnection operation services).

3) Balance Responsible Company is a company who balances the system so that generation meets the load.

4) Bilateral Contracts means a treaty for delivery of electricity between a producer and a customer.

5) Grid Company means a company who is responsible for maintenance and construction of the national transport network.

6) Settlement of Accounts means a service where a balance of energy exchange is made for billing purpose.

7) Power Supplier means a legal or natural person generating electricity.

8) Trader means any natural or legal person, who purchases or sells electricity and who does not carry out transmission, generation or distribution functions inside or outside the system where he is established.

**USA (FERC's OASIS, NERC's operation rules)**

General Comments: Table entries refer to a deregulated environment within which transmission-access related transactions are conducted using OASIS (Open Access Same-Time Information System demanded by FERC for reservation of transmission capacity), and that other market infrastructures (e.g. power exchange, ISO) will co-exist with OASIS to perform other necessary functions for operating deregulated power systems.

Most of the terms are taken from NERC.

1) Ancillary Services means Interconnected Operations Services (IOS) identified by FERC Order 888 as necessary to effect a transfer of electricity between purchasing and selling entities (PSE) and which a Transmission Provider must include in an open access transmission tariff.

2) Bilateral Contracts means a treaty for delivery of electricity between two parties. The contract may be for physical delivery of electricity, or for providing financial hedge against price volatility.

3) Control Area means an electric system or systems, bounded by interconnection metering and telemetry, capable of controlling generation to maintain its interchange schedule with other Control Areas and contributing to frequency regulation of the Interconnection. (See Host Control Area and Metered Control Area.

4) Generation Provider means An entity that provides capacity and energy to the power system. A Generation Provider may purchase and/or generate the power and energy delivered to its customers.

5) Independent System Operator (ISO) means an entity, which is independent from other market players, that operates a sub-region of a power system. The ISO may or may not be a Control Area. If the ISO is not a Control Area there primary duties will focus on transmission security.

6) Load Serving Entity (LSE) means an entity that either aggregates and serves load indirectly (wholesale) or directly serves load (retail).

7) Security Co-ordinator means a legal person who carries out the security function (part of ancillary services) over more than one system.

8) System Operator means an individual electric system control centre whose responsibility it is to monitor and control that electric system in real-time.

9) Open Access means the third party access to the transport network for the purpose of direct bilateral wholesale trade between customer and producer / wholesale company. May also mean retail trade access to the network by some states.

10) OASIS (Open Access Same-Time Information System) means an electronic posting system for transmission access data (transmission capacity, auxiliary services) that allows all Transmission Customers to view the data simultaneously.

11) Operating Authority means the entity responsible for a specific aspect of power system operation. For example, Control Areas are normally responsible for the generation/demand balance process and as such are the Operating Authority with respect to generation/demand balance. Operating Authority is composed of various functions (generation/demand balance, transmission system security, etc.) which may be the responsibility of multiple entities.

12) Power Broker means a third party who establishes a transaction between a seller and a purchaser. A Power Broker does not take title to capacity or energy.

13) Power Marketer means an entity that performs a power marketing function (buying and selling) and does not operate generation or serve customers directly. A Power Marketer takes title to energy and capacity and markets the product to wholesale and retail customers. = Mer.

14) Power Pool means two or more interconnected electric systems planned and operated to supply power for their combined demand requirements. There are two general types of Power Pool; loose and tight.

15) Purchasing-Selling Entities (PSE) means those that operate generation or serve customers directly, and 2) those that perform marketing functions only and do not operate generation or serve customers directly. Types of PSE include Generation Providers, Load Serving Entities and Power Marketers.

16) Transmission Customer means an entity which purchases transmission service from a Transmission Provider. Transmission Customers may be individual customers, Control Areas, Transmission Providers, etc. There are three distinct types of Transmission Customer:

- Those who simply connect to the transmission system
  - For example, a generator providing reserves
- Those who wheel across the transmission system
  - For example, a Power Marketer
- Those who directly serve load or are aggregators of load.

17) Transmission Providers means in the strictest sense, entities that are responsible for providing transmission service to Transmission Customers. In the practical sense, most Transmission Providers also operate generation, and many are Control Areas.

**California**

Terms of USA and additional:

1) Power exchange means a place of trade with both generation bidding and load bidding and selling electricity to customers.

2) ISO means an independent system operator who operates but does not own the network and is responsible for system security and the ancillary services.

3) Bilateral Contracts means a treaty for delivery of electricity between two parties. The contract may be for physical delivery of electricity, or for providing financial hedge against price volatility.

**Australia/New Zealand**

1) Single Buyer for Open Access to Network means transmission grid security and congestion is managed by a single entity, who is also responsible for operating the spot energy market and ancillary service market.

2) Bilateral Contracts means a treaty for delivery of electricity between two parties. The contract may be for physical delivery of electricity, or for providing financial hedge against price volatility.

3) Generation Scheduling means Pre-dispatch schedule for the next day and Real time dispatch for the current time. They are all based on bids and offers submitted by market participants, and respect physical and system operating constraints. The function is performed by the independent market/system operator.

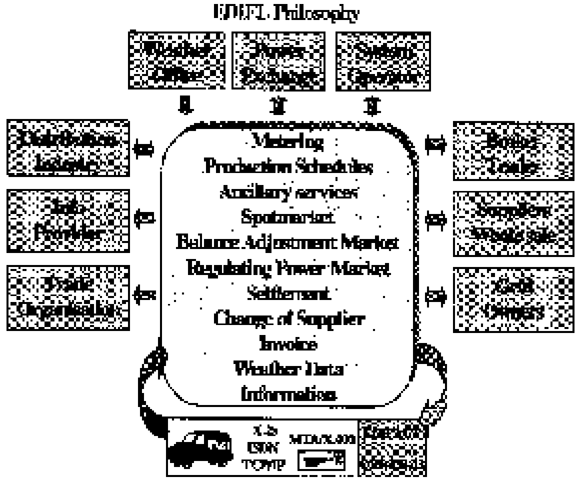
SO Re-Dispatch means the independent market/system operator re-determines generation dispatch profile following re-bidding by market participants within the permissible re-bidding time window.

# Annex C

# Existing solutions

## C.1 EDIEL: a nordic EDI forum for the power industry

EDIEL Philosophy




EDIEL communication system

### The power industry

The Nordic electrical power production and consumption is an industry with a turnover of about 350 billion kilowatt-hours valued to approximately 25 billion dollars.

The Nordic countries: Denmark, Finland, Norway and Sweden have deregulated the power industry. A common power exchange for Norway and Sweden was established in 1996. From 1998/99 both Denmark and Finland will be integrated as a part of the common power exchange. Nord Pool ASA is responsible for the administration of the power exchange. This includes distribution of market information to all participants and system operators in the Nordic countries.

One result of the deregulation is that a multinational company can purchase power from one supplier for all their installations in the Nordic countries. The grid and the power lines are still a monopoly. Free competition within production of power gives the users the freedom to choose supplier within each country.

The deregulation has increased the trade with electrical power and increased the need for metering. The settlement is based on hourly metering. This has further more given a focus on EDI (Electronic Data Interchange) as a tool for handling the increased needs for information and transport of data between the participants, the System Operator, and the Power Exchange.

### EDIEL - Nordic Forum

To deal with the increased need for information data and the interchange between different parties in the power industry, EDIEL Nordic-Forum was established. The Forum was established in the autumn 1995.

The scope of the EDIEL Nordic-Forum is to standardize the use of EDI based on the UN/EDIFACT standard in the Nordic power industry. The standard EDIEL is supposed to cover all needs for interchanging of data, except on-line data between participants, System Operators and trade organisations in the power industry. Both domestic and interchange between the countries is to be handled by EDIEL. EDIEL Nordic-Forum will maintain and develop the standard and also handle topics in connected areas, as standards for communication, security and communication network, Internet.

The EDIEL Nordic-Forum has members from the following organisations:

- Nord Pool ASA
- Svenska Kraftnät, Sweden
- Sydkraft, Sweden
- Statnett SF, Norway
- Viken Energinett, Norway
- ELTRA, Denmark
- ELKRAFT, Denmark
- Imatran Voima Oy, Finland
- PVO-Group, Finland
- Fingrid, Finland

The chairman of EDIEL is for the time being Nord Pool ASA.

**Advantages**

The standardisation of the communication protocol for transport of data and information in the Nordic power industry gives the participants a clear and precise description on how to interchange messages. This documentation includes description of the messages, the use of communication protocols and security functions.

The EDIEL specifications are based on international standard UN/EDIFACT. EDIEL can be used across country borders without any adjustments.

Use of the EDIEL standards is a tool to achieve an efficient exchange of data between all participants in the deregulated power industry.

**EDIEL Message Handbook**

To ensure that interchanging of information in the power industry is based on the same framework, the first product from EDIEL Nordic-Forum was a «Message Handbook». This Message handbook contains Implementation Guides for common used message types in the power industry.

In addition a functional description, which contains common descriptions for the different Implementation Guides, was made. This includes relations between the different message types, use of codes and code lists. Special conditions between the countries, time zones, terms and notation, use of header and trailer segments and the use of the CONTRL message are documented.

EDIEL Nordic-Forum is responsible for the documentation and further maintenance. This covers:

- Make documentation of good quality
- Have knowledge about the parties using the documentation

- Provide necessary support and help to the users of the documentation.
- Have knowledge to maintain the documentation as EDIFACT develops and the user-requests amends.

The Message Handbook is primarily written for persons who are going to implement UN/EDIFACT messages in applications and EDI-software vendors.

Implementation guides developed by EDIEL Nordic-Forum are:

- DELFOR. Used for generation production schedules and consumption forecast. The message is also used for meteorological information;
- MSCONS. Used for metered values and bilateral contracts;
- APERAK. Acknowledgement on application level;
- QUOTES. Used for bids to the Power Exchange, System Operator or bilateral trade;
- SLSRPT. Used for price information from the Power Exchange and System Operator.

An expansion is planned for:

- Invoice message (INVOICE);
- 'Request for quotation' used to inform the players at the Power Exchange before bidding is taking place (REQOTE);
- Information about change of supplier (PRODAT).

**Communication**

The communication infrastructure differs a bit between the different Nordic countries.

In a situation with many participants exchanging information between each other, it is recommended to use Email systems as carriers of EDI messages. The current recommended protocol in the EDIEL area is X.400, but in the future it may be more convenient to use the Internet mail protocol SMTP/MIME over the public Internet. Eltra, which is the independent system operator on the Jutland/Funen area in Denmark, has already chosen this.

X.400 has so far been the most used communication standard, especially in Norway and Sweden. Both X.400 P7 and P1 communication protocols over X.25, ISDN and asynchronous lines are in use in the countries. A number of participants have combined the same X.400 implementation for EDI and email.

**Security**

EDIEL Nordic-Forum is working with definition of security recommendations. So far, a solution based on DES encryption has been defined. The DES solution is not widely used today.

**EDIEL and the Power Exchange**

Standardized EDI based on UN/EDIFACT has been used against the Power Exchange, Nord Pool ASA since 1994.

The use of EDIEL has increased since the start and today more than 70 participants use EDIEL.

The message types used are bidding information (REQOTE), bids (QUOTES), price information (SLSRPT), application error and acknowledgement message (APERAK) and syntax error and acknowledgement message (CONTRL).

In addition, the message type Delivery Schedule (DELFOR) and Metered Services Consumption Report (MSCONS), is used between Nord Pool ASA and Svenska Kraftnät in Sweden.

The communication is today mainly based on X.400 over X.25 or ISDN.

**EDIEL in Denmark**

The deregulation of the Danish power industry will start in 1998. The country is divided into two electricity areas: The Zealand area, where Elkraft is an independent system operator and the Jutland/Funen area, where Eltra is an independent system operator.

In the Eltra area, EDIEL will be used for exchange of 'non real-time' information between Eltra and the electricity companies. The DELFOR message will be used for forecasting production and consumption of electricity. From 1999, metered consumption and production will be transmitted by MSCONS message. All communication will be over the public Internet.

At Elkraft UN/EDIFACT is in use for communication with Nord Pool (bids and price information). Furthermore an EDIEL communication with Svenska Kraftnät will be put into operation in March 1998 (DELFOR, MSCONS, CONTRL and APERAK).

The communication to Nord Pool and Svenska Kraftnät is based on X.400.

**EDIEL in Finland**

The development of EDIEL in Finland is co-ordinated by a national working group consisting of Fingrid (The national grid company responsible for the system operation in Finland), power companies, EDI vendors and Finnish Electricity Association. EDIEL has been used in energy trade since 1997. Nearly 30 companies or groups are using EDIEL at present, covering more than one third of the distribution network companies' needs for energy data transfer on the free energy market. The number of EDIEL users is continuously increasing. The message types used are MSCONS for measured energy values, DELFOR for delivery forecasts and CONTRL for the control of message transfers between EDI-converters. SLSRPT and APERAK will be taken in use in the near future. Communication is mainly based on FTP, especially in small companies, but X.400 over TCP/IP or X.400 over X.25 are also used.

**EDIEL in Norway**

Standardized EDI based on UN/EDIFACT has been used in the power industry in Norway since 1994. A Norwegian EDIEL group, which is responsible for EDIEL standardisation in Norway, is established.

The System Operator and all Norwegian suppliers and grid owners will exchange data for the settlement based on the MSCONS message.

In addition the message type Delivery Schedule (DELFOR), is used for production schedules and ancillary services to Statnett and meteorological information from the Norwegian Meteorological Institute to Statnett and the production companies in the power industry.

The communication today is based on X.400, X.25 or ISDN

**EDIEL in Sweden**

In Sweden Svenska Kraftnät is responsible for EDIEL. Today there are about 275 users using EDI. Over 6 million messages a year are routed through the X.400 MTA (Message Transfer Agent) at Svenska Kraftnät and about 2.1 million of these are sent to or from Svenska Kraftnät. The EDIEL system at Svenska Kraftnät is one of the largest EDI-systems in Sweden.

The message types used is MSCONS (Metered services consumption report), DELFOR (Delivery schedule message), APERAK (Application error and acknowledgement message) and CONTRL (Syntax error and acknowledgement message).

The communication towards EDIEL in Sweden is mainly based on X.400 through a P1 protocol over X.25 or through a P7 protocol against a Message Store at Svenska Kraftnät. TCP/IP (P1) and ISDN (P7) will be new alternatives in 1998.

**EDI and UN/EDIFACT**

EDIEL will use the standard UN/EDIFACT as the basis for message types when describing information interchanged between participants in the power Industry.

When data are interchanged between different parties by teletransmission methods, a common 'language' should be used with an agreed mode of expressing it, i.e. common protocols, message identification, agreed abbreviations or codes etc.

If a universally accepted standard is not used, the 'language' has to be agreed bilaterally between each pair of interchange partners. Taking into account the large number of parties with need of exchanging data and the ever-increasing number of potential users of teletransmission techniques, it is obvious that such a bilateral approach is not viable.

Besides using compatible systems, Interchange partners should follow uniform rules in respect of communication procedures which include the types of messages acceptable, identification of parties, reference to previously agreed protocols or agreements on character set, language, transliteration and interchange structure.

The principles mentioned above led to the development of the United Nations Electronic Data Interchange for Administration, Commerce and Transport (UN/EDIFACT) syntax rules and standard messages.

The UN/EDIFACT comprises a set of internationally agreed standards, directories and guidelines for the electronic interchange of structured data, and in particular that related to trade in goods and services between independent, computerised information systems.

Recommended within the framework of the United Nations, the rules are approved and published by UN/ECE in the United Nations Trade Data Interchange Directory (UNTDID) and are maintained under agreed procedures.

EDIEL Nordic Forum

Oslo, 3. March 1998.

## C.2 OASIS

The NERC (North American Electric Reliability Council) took a proactive stance which lead to the formation of OASIS (Open Access Same-time Information System), which is used for the reservation of transmission capacity for bilateral trading.

The FERC (Federal Energy Regulatory Commission) gave its support to this industry initiative. Certain codes of conduct have been instituted to limit the flow of information between some parties and to limit movement of staff, for instance from power production to power marketing.

The FERC initiated the process via document FERC 888/889 which gave a 6-month warning. The industry set up a task force to implement the Joint Transmission Services Information Network (JTSIN) to implement OASIS. Production Operations began on January 3, 1997. Access is 'browser-based'. However, now that OASIS is operational it had only encouraged local trading rather than over long distances. The conflict between Contract Path and Physical Path had always been recognized, but was addressed minimally during Phase 1 OASIS. It is getting much more attention, as follow-up phases of OASIS are being planned.

Requirements for OASIS, as specified in the Standards and Communication Protocols for Open Access Same Time Information System (OASIS), include:

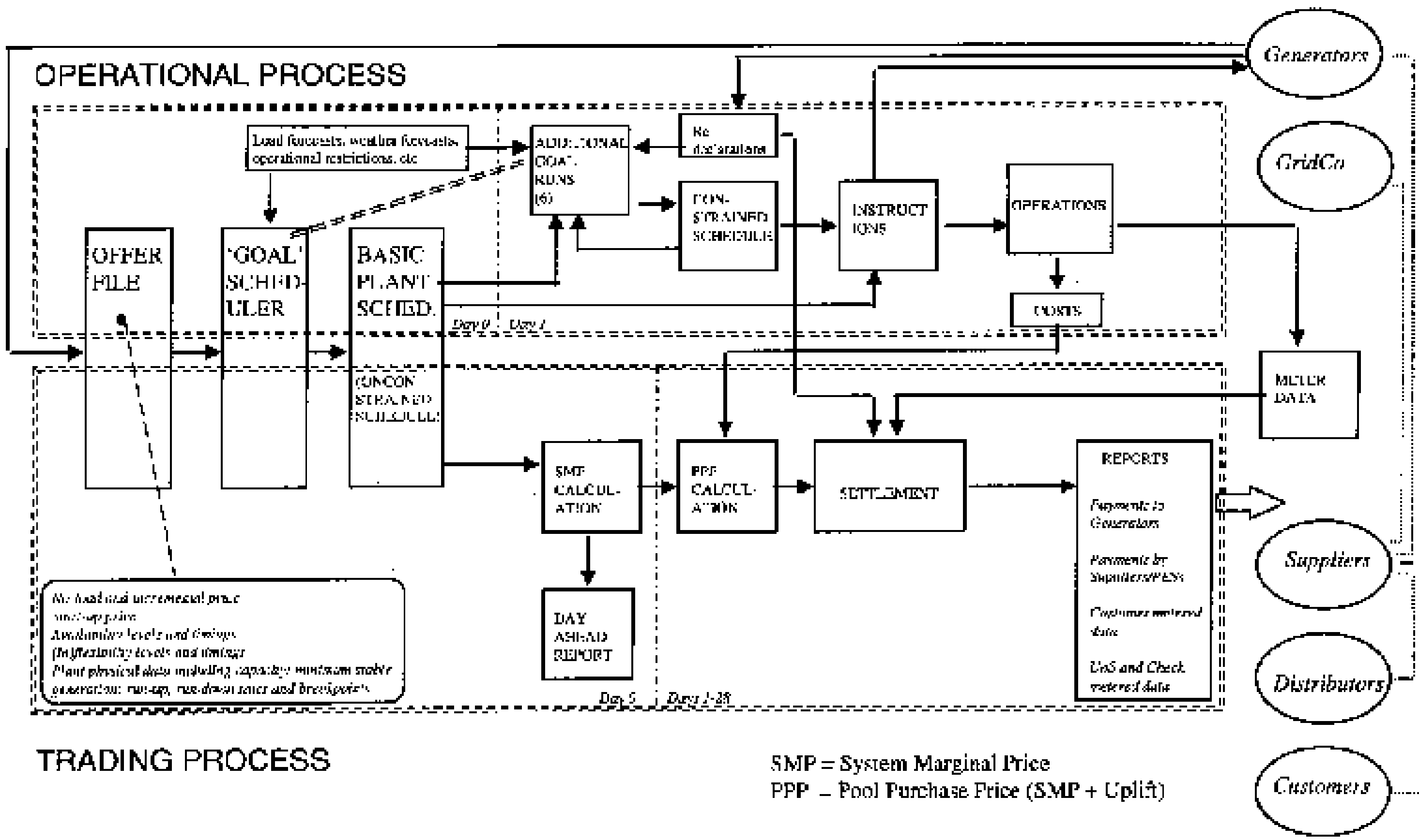
- Internet-based OASIS network architecture and web-browser. (Subscriber notification after Phase 1 to avoid performance degradation due to excessive subscriber 'pinging' the system.)
- ASCII-based OASIS templates and file structures for defining information presentation in graphical displays and up/downloading files
- OASIS Naming conventions, data element dictionary, and general rules for OASIS templates.
- User request and response procedures
- Security, availability, and performance requirements

The following is a list of OASIS user-interactions and associated templates.

1. Post ATC, TTC and Offerings *(transpost)*
2. Query Offerings *(xxx offering)*
3. Purchase Transmission Services (transrequest, transtatus, transell, transcust)
4. Seller Posting of Transmission Services *(transpost, transmodify)*
5. Purchase Ancillary Services (ancrequest, ancstatus, ancsell, anccust)
6. Seller Ancillary Services Posting *(ancpost, ancupdate)*
7. Seller to reassign service rights to another customer *(transassign)*
8. Query Schedule *(schedule)*
9. Post/Update Schedule (postschedule, updateschedule)
10. Curtailment Posting *(postcurtail)*
11. Query Curtailment *(curtail)*
12. Query/Response of Lists *(list)*
13. Query/Response for Audit/Log *(auditlog)*
14. Update /View Informal Messages *(messagepost)*
15. Delete Messages *(messagedelete)*
16. Standard of Conduct *(stdconduct)*
17. Maintenance *(many)*

# Annex D

## An actual example for figure 1 model (market in England and Wales)




**OPERATIONAL AND TRADING PROCESSES - MARKET IN ENGLAND & WALES**

IEC

## Standards Survey

**The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!**

Customer Service Centre (CSC)
**International Electrotechnical Commission**
3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC/CSC** at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

Nicht frankieren
Ne pas affranchir

Non affrancare
No stamp required

**A Prioritaire**

**RÉPONSE PAYÉE**

**SUISSE**

Customer Service Centre (CSC)
**International Electrotechnical Commission**
3, rue de Varembé
1211 GENEVA 20
Switzerland

**Q1** Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.......................................................

**Q2** Please tell us in what capacity(ies) you bought the standard *(tick all that apply)*. I am the/a:

- purchasing agent ☐
- librarian ☐
- researcher ☐
- design engineer ☐
- safety engineer ☐
- testing engineer ☐
- marketing specialist ☐
- other.....................................................

**Q3** I work for/in/as a: *(tick all that apply)*

- manufacturing ☐
- consultant ☐
- government ☐
- test/certification facility ☐
- public utility ☐
- education ☐
- military ☐
- other.....................................................

**Q4** This standard will be used for: *(tick all that apply)*

- general reference ☐
- product research ☐
- product design/development ☐
- specifications ☐
- tenders ☐
- quality assessment ☐
- certification ☐
- technical documentation ☐
- thesis ☐
- manufacturing ☐
- other.....................................................

**Q5** This standard meets my needs: *(tick one)*

- not at all ☐
- nearly ☐
- fairly well ☐
- exactly ☐

**Q6** If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

- standard is out of date ☐
- standard is incomplete ☐
- standard is too academic ☐
- standard is too superficial ☐
- title is misleading ☐
- I made the wrong choice ☐
- other .....................................................

**Q7** Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

- timeliness .....................................................
- quality of writing.....................................................
- technical contents.....................................................
- logic of arrangement of contents .........
- tables, charts, graphs, figures.. .........
- other .....................................................

**Q8** I read/use the: *(tick one)*

- French text only ☐
- English text only ☐
- both English and French texts ☐

**Q9** Please share any comment on any aspect of the IEC that you would like us to know:

.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................
.....................................................

ISBN 2-8318-5204-6

9 782831 852041

ICS 33.200

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND