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Transforming UCTE Rules and Recommendations into binding Security and Reliability Standards

Contents

1 Introduction

1.1 A brief history of UCTE

The UCPTE (Union for the Co-ordination of the Production[1] and Transmission of electricity), the predecessor association of UCTE, was established in 1951. UCPTE's first mission was to contribute to the development of economic activity through the more effective use of energy resources allowed by the interconnection of electricity networks. During these 51 years the association has experienced continuing growth from 8 to 21 member countries, which now compose the "UCTE area" covering the European mainland, from Portugal to Poland and from Denmark to Greece. Nowadays, UCTE members ensure reliable supply of electricity to 400 million customers. Due to military actions in the Balkans during the 90ies, the UCTE area is split into two synchronous systems running separately, although recently asynchronous connected by a DC cable Greece-Italy. UCTE prepares the reconnection of these two zones by the end of 2003. Synchronous interconnections longer than appr. 50 km across sea are not technically feasible. That is why British, Irish and Scandinavian (NORDEL) systems operate separately from each other and from UCTE, but are connected by asynchronous (DC) lines.

1.2 UCTE in the new market environment

Following the process of unbundling of the electricity sector, which was stimulated by the EC 96/92 Directive, responsibilities have been redefined on the national levels and the international playground of European electricity associations has been reshaped, as well. Nowadays, Transmission System Operators (TSOs) co-operate on two levels:

1. *"To keep the lights on":* setting and enforcing technical and operational standards, which ensure the reliability of the electrical system operation and the safety of extensions of the synchronous area. **UCTE is in charge of this task within its own synchronous area**, in co-operation with partner regional organisations (NORDEL, UKTSOA, ATSOI) acting in the same way for their respective systems.

2. *"To make the market happen"* stands for the organisational measures that enable the open market of electricity (the electricity market is not confined in each separate synchronous system: the area of the Internal Electricity market comprises EU members of UCTE, NORDEL members, UK and Ireland). This task is in the hands of the ETSO (European Transmission System Operators) organisation; it covers, a.o. grid access, cross border tariffication, market models for congestion management.

The unbundling process between TSOs and market players has brought about an unbundling on the level of the international associations. In this regard, Eurelectric and UCTE-ETSO have

[1] The „P" was dropped by amendment of the statutes in 1999 in order to focus the whole organisation on the transmission activity only.

set up separate working structures, while Eurelectric, regarding transmission issues, is focussing on interest of transmission users and, for some countries, transmission system owners. UCTE co-ordinates and sets the interconnection standards for the **reliability** of the system in the UCTE synchronous area. This covers two major functional aspects:

Security and **Adequacy**

1. **Security of the UCTE system** is the ability of the system to withstand major or sudden disturbances, such as the loss of production units, grid elements, due to outages or natural catastrophes, but also accidents or even attacks (threat response capability);

   The security issue involves:
   - the setting of standards for the interconnected operation
   - the co-ordination between TSOs of the day-to-day operation of the UCTE synchronous area.

2. Assessment of the **adequacy of the UCTE system**, which is the structural ability of the system to supply the aggregate power and energy demand required by the market at any moment, with well-defined standards for system quality and reliability.

   The adequacy issue involves:
   - The monitoring of the existing and forecast system status, especially the adequacy between forecast load, generation investment and transmission projects, taking into account adequate reserve margins;
   - The identification of new system constraints and needs for new generation or transmission capacities.

Moreover, **UCTE studies and monitors the development of the synchronous area,** under the condition that this should not jeopardise the achieved level of quality and reliability.

1.3 The challenges for UCTE

UCTE faces two main challenges:

- to maintain the security of the electric system at its previous and present high level; this implies a.o. modifications of operational standards made necessary by the development of the electricity market and the emergence of new types of actors (such as traders),
- to implement a coherent strategy for the development of the UCTE synchronous area.

The first challenge comprises:

“To develop binding and transparent reliability standards, for which a legal framework of enforceability must be worked out.”

In the past, voluntary compliance rules were adopted by "peer pressure" between vertically integrated regional utilities. The existing scheme of voluntary compliance with industry reliability rules is no longer adequate for today's IEM. The grid is now being used in ways for which it was not designed and there has been a steep rise in the number and complexity of electricity trade business. As a result, there has been a marked increase in the number and seriousness of violations of reliability rules The users and operators of the transmission system, who used to co-operate voluntary on reliability matters, are now competitors without the same incentives to co-operate with each other or to comply with voluntary reliability rules.. All of these changes are jeopardising the very stability of the electric system, which serves as an essential backbone of our economy. The new unbundled market needs mandatory and legally enforceable standards on international level between TSOs, complemented by national grid codes defining the share of responsibilities between the local TSO and market players.

In this respect, a **UCTE Operation Handbook** is under development. It summarises and updates all relevant existing UCTE rules and recommendations and transforms them into a stringent set of policies, which are intended to serve as a basis for the binding reliability standards. Such standards are needed, a.o. for the settlement of disputes, for the quantification of ancillary services and for the assessment of investment decisions, of congestion management tools, etc. in due respect of related reliability criteria. With respect to the enforceability of these standards, the legal experts of UCTE member companies are investigating different possibilities to set up a binding legal framework. The multilateral contract amongst the CBT parties may serve as an example how to achieve enforceability. EU regulation might be considered as basis for the EU countries. For larger geographic perimeters, it remains to be examined whether the WTO or GATS rules are relevant[2], or if the framework of the Energy Charter Treaty should be taken into consideration.

"To further develop co-ordination on operational level between involved TSOs regarding cross-border congestion management and cross-border grid access."

- to provide operational tools to maintain the system security: a DACF (Day Ahead Congestion Forecast) will cover the central part of the UCTE area in daily-automated cycle. Extension of this system to the whole area will gradually be introduced,
- to introduce an UCTE wide standardized data format for exchange of schedules based on XML-technology,
- to improve the use of the Electronic Highway to enable real time data exchange.

"To co-ordinate congestion management using UCTE technical tools and ETSO market principles."

- to calculate and provide ETSO NTC values and thus to support ETSO information policy

[2] Electricity being a commodity – transmission service and especially „ancillary services" being a service.

- to develop tools for supporting co-ordinated congestion management

"To enhance communication towards market players regarding the adequacy issue."

- UCTE yearly updates power balance forecasts for the whole UCTE area. This powerful tool should evolve into an efficient adequacy assessment, serving as a watchdog for the interested market players.

2 Five Key Characteristics of Electric Transmission Systems

In order for a customer to purchase any commodity at the store in his neighbourhood, it has to be manufactured, transported, and distributed. Likewise, to bring electric power to customers, it must be generated, transmitted, and distributed. A distinctive feature is that unlike most commodities, the transmission and distribution systems are dedicated exclusively to electricity.

A useful analogy is natural gas (or water on a regional basis), where the gas is extracted at the wellhead and transported on pipelines to local distribution companies. The pipelines and distribution lines are dedicated to natural gas. In using this analogy it is helpful to keep in mind that the gas transmission network is more like a tree, while the electric transmission network is more like a web or grid. Because it is like a tree, gas transmission is easier to understand. Seeing the similarities and differences of gas transmission to electricity transmission facilitates an appreciation of the complexities of electricity transmission.

The UCTE transmission system consists of transmission lines and substations carrying voltages of between 110 and 400 kilovolts. Substations at points of connection to a distribution system bring the voltage down to distribution levels. Each transmitting utility typically has several interconnections with the transmission grids of neighbouring utilities (so called "tie lines"). The UCTE transmission system is divided into control areas — most typically by country, although to some extent utilities are joining together to form a control block (a technically and geographically demarcated subsystem able to be operated independently in cases of emergency) consisting of several control areas (e.g. CENTREL, Germany, Switzerland). A control centre oversees the operation of the power system within the control area (such as dispatch of generators under its control) and co-ordinates its activities with neighbouring utilities. Increasingly this co-ordination includes scheduling and implementation of bulk power transfers.

There are five key characteristics of an interconnected electric transmission system:

Line load limits:
Lines can transmit only limited power. During periods of heavy use, lines can be *congested* and can also become overheated, resulting ultimately in a *thermal break* in a line.

Load frequency control:
Continuous balance must be maintained between supply and demand to avoid a system break down or islanding. Balance quality can be derived from system frequency, which should not vary significantly from its set point 50 Hz.

Line losses:
The further power travels, the more of it is lost as heat.

Parallel path flows:
Power flows over the multiple paths between supply and use according to least impedance, not just the shortest path or the path with the most unused capacity.

Location matters:
A distribution of generation across the network is necessary to offset voltage drops and provide reactive power to operate the system at constant voltage.

Each of these characteristics interacts with the other. Therefore operating the highly interconnected UCTE system requires a close co-operation among involved TSOs according to jointly established rules.

3 Scope and Structure of the UCTE Operation Handbook

3.1 UCTE's basic needs for an Operation Handbook

Close co-operation of member companies is imperative to make the best possible use of benefits offered by interconnected operation. For this reason, the UCTE has developed a number of technical and organisational rules and recommendations in the past that constitute the basis for the smooth operation of the power system. The "UCTE Operation Handbook" is the successor of this set of rules and recommendations that have been continually developed during the decades of construction and extension of the power system since 1951 and reflecting the changes in the technical and political framework.

Only the consistent maintenance of the high demands on quality will permit in the future to set standards in terms of security and reliability as in the past. Moreover, the strong interconnections in the UCTE grid requires commonly agreed understandings for grid operation, control

and security in terms of fixed technical rules and procedures. They are comprised in this "UCTE Operation Handbook" in an organised form, to make consultation easier for members and the general public.

3.2 Target audience for the Operation Handbook

The "UCTE Operation Handbook" serves for different parties at the same time, mostly for the following:

- **Transmission System Operators (TSOs) / Grid Operators**. Every TSO in the UCTE interconnected network (SYNCHRONOUS AREAS) has declared to follow the technical rules and procedures that are comprised in this "UCTE Operation Handbook". This operation handbook therefore serves as the "legislation" for the grid operation by the TSOs and guarantees the UCTE's quality and reliability standards.
- **Generation Companies (GENCOs)**. Every party operating a generation unit in the UCTE interconnected network (SYNCHRONOUS AREAS) makes use of the transmission network and may provide system services that are indispensable for the secure and stable grid operation. This operation handbook declares the requirements and capabilities for generation that enable the operation of the grid by the TSOs.
- **Traders, Customers, Policy and Decision Makers**. Operation of an interconnected transmission system is bound to physical principles and technical constraints, which differ significantly from other well-known technical or financial systems. This operation handbook may additionally serve at the same time to explain these differences and characteristics in a transparent manner to the public for a better understanding.

3.3 Main Characteristics of the Operation Handbook

The "UCTE Operation Handbook" has some main characteristics that serve as a guideline for the development and set-up of the handbook:

- **Transparency**. Technical and physical principles of transmission grid operation in the UCTE are clearly described for non-experts in the Operation Handbook.
- **Liability**. Following the signed statutes of the UCTE the rules and recommendations of the Operation Handbook were developed as binding for all (associated) members (TSOs) of the UCTE and their operation of the grid.
- **Unambiguousness**. All rules and recommendations of the Operation Handbook are written to be straightforward and unmistakable for the processes of secure operation of the UCTE SYNCHRONOUS AREA(S). All terms used in the handbook are defined only once.
- **Relevance to the present**. Rules and recommendations included in the Operation Handbook are continually adapted to the changing technical and legislative environment. A version history clearly shows the status of each part of the handbook.
- **Redundancy**. The Operation Handbook is written to have only the minimum of redundancy that is required. For this purpose, references to other chapters within the handbook are used instead.

- **Modularity**. Each chapter / policy / rule / guideline of the Operation Handbook can be seen as a separate document that may be revised independently of the other parts. All chapters use a similar layout and internal structure.

3.4 Main Scope of the Operation Handbook

The main scope of the "UCTE Operation Handbook" as a comprehensive collection of all relevant technical rules and recommendations is the support for the technical operation of the UCTE interconnected grid (synchronous areas), including operation policies for generation control, performance monitoring and reporting, reserves, security criteria and special operational measures.

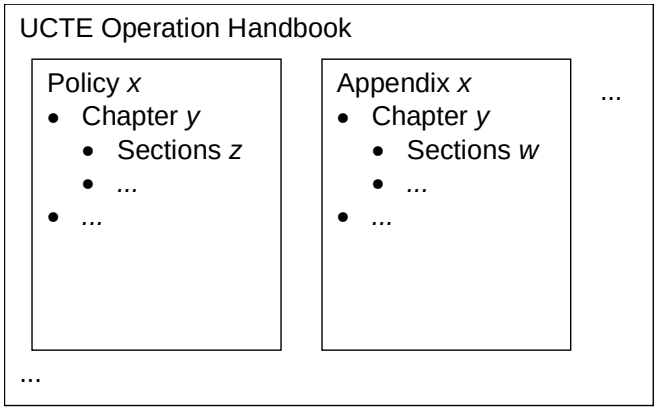
Rules for network access of customers, network tariffs, accounting of inadvertent interchanges / deviations (commercial part), billing procedures and market rules are not in the scope of this Operation Handbook.

3.5 Basic structure of the Operation Handbook

The "UCTE Operation Handbook" clearly separates between policies, technical appendixes, training documents and data collections and basically is structured as follows:

- Preface, general information (UCTE history, organisation,...)
- Overview, table of contents, versions, history
- Introduction, UCTE's structure, organisation
- Basics, operational framework, glossary, procedures
- Operating policies (common structure, list of policies for transport and ANCILLARY SERVICES)
- Technical appendixes (technical criteria, definitions)
- Training documents (calculation methods, theory)
- Collections of data

The formal structure of the handbook into policies and appendixes with chapters and sections is shown in the following figure.



The policies themselves have a clear internal structure of standards, rules, criteria, requirements, rights and obligations. The following list of operational rules / policies is currently drafted or planned:

1. Load-Frequency-Control and Performance (draft available)
2. Scheduling and Accounting (draft available)
3. Operational Security (draft available soon)

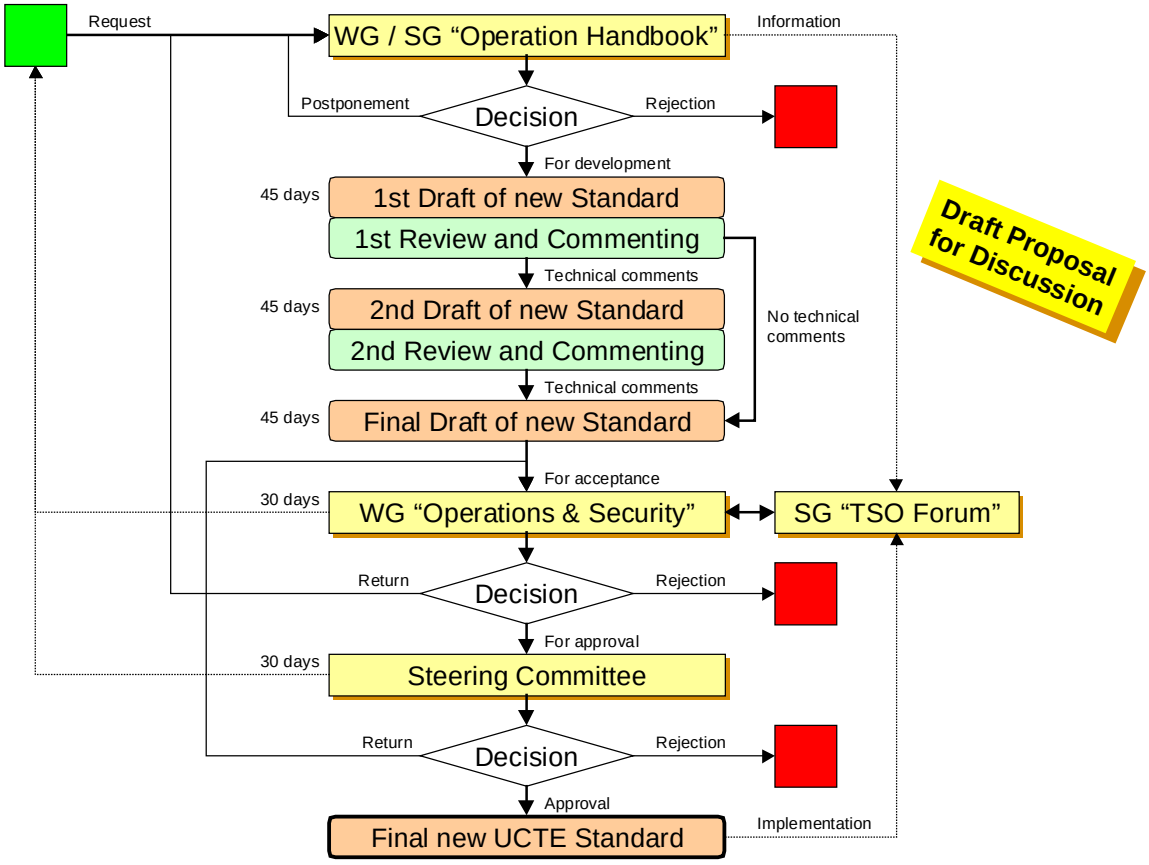
- Network requirements
- Congestion management
- Data exchanges
- ...

The policies of the operation handbook themselves are organised in the following sections:

- **Criteria**. Criteria introduce or define specific values or a specific naming as given facts, that may be used or cited within the policy.
- **Requirements**. Requirements are (technical or organisational) prerequisites that are used within a policy. They have to be fulfilled in total before any standard can be applied.
- **Standards**. Standards define rules that are fixed and binding for the addressees. Standards are usually the core part of a policy.
- **Guidelines**. Guidelines describe practical ways for typical operation or usage as recommendations, as the addressees may use them.
- **Procedures**. Procedures introduce fixed methods and alternatives for operation or usage as common practice.
- **Measures**. Measures name the actions to be taken, e.g. if a requirement is not fulfilled, a standard is violated by an addressee or a procedure is not used.

3.6 Proposed procedure for handbook development

The following flow chart shows the procedure that is proposed for the development of new standards and the revision of existing standards, initiated by requests from the SC or the WG.



4 Binding character and enforceability of the UCTE technical standards

With reference to the issue of how to make the Handbook binding, it is possible to prospect at least three levels of enforcement.

4.1 The binding character and enforceability deriving from the UCTE statute

It is expressly foreseen in the statute that UCTE, through the Steering Committee, develops and adopts technical rules and binding recommendations for its members. However, from a legal point of view, UCTE is an international association according to Belgian law, limiting its purposes to co-ordinate and study of subjects of common interest. Therefore, any clause referring to the binding character of the standards would lack any power of enforcement based on the UCTE statute.

If the binding character of standards were to be reinforced through a penalty mechanism, organized by levels of importance, such penalty mechanism could only be conceived on contractual basis between the members.

More generally, the achievement of UCTE's purposes, which comprises the coordination of the rules and the technical and operational assistance between the TSO's through the adoption of rules and technical standards lacks any legally binding force.

The Steering Committee is the body appointed to adopt such rules and standards (art. 9.3). In the context of a multilateral contract, this body should remain in place as coordination and negotiation platform.

4.2 The Binding character and enforceability deriving from a Voluntary Adherence

With reference to the absence of enforceability, all the Members (which are the 32 TSO's of the UCTE synchronous area assuming the responsibility for the operation of a control area and its inter-area interconnections) could undersign a multilateral agreement, with which they would be contractually committed and bound to observe the provisions indicated in the Handbook (the said provisions would be an appendix to this agreement and would, as such, form an integral part of it).

The agreement should have the structure of a multilateral contract open to the adherence of new members of the association (any adherence would have to be unconditional in order to avoid problems of interpretation in the application of the agreement).
Such agreement should clearly define, between the concerned TSO's, responsibilities and liabilities and have a corresponding penalty system (possibly with liquidated damages) on a contractual basis.

However, one fundamental aspect of the UCTE standards should be kept in mind. For the reliability of an interconnected power systems it is necessary but not sufficient that the concerned TSO's strictly comply to the clauses of such multilateral agreement. Indeed, the UCTE reliability standards also strongly involve the network users, and more particularly: the generators providing ancillary services, the market parties relying on balancing power, the customers having subscribed interruptible or non-interruptible loads, etc. In most countries (including non EU Member States that are part of the UCTE network), the responsibilities and liabilities related to these elements are defined by laws and regulations such as national grid codes. Lack of harmonization or even clarity in these codes with respect to the UCTE reliability standards and/or national standards may cause reliability problems.

In this respect, it must be emphasized that the enforcement of technical reliability standards may not be considered as the imposition of barriers to the opening of the market. Quite the contrary, due to the physical character of electricity (non storable, transmittable within given limits and causing or relieving losses on the system), such standards should be considered as "reliability building blocks" which are prerequisites for developing a well-functioning open market.

4.3 A legislative framework for making the standards enforceable

As mentioned in point 2., the conclusion of a multilateral agreement between TSO's should be completed by a framework of standards ensuring coherence and harmonization towards network users, as far as the reliability aspects of international interconnection are concerned.

Therefore, the Institutional European Organisms could acknowledge the UCTE standards (or, more general reliability principles applicable for the 4 European synchronous areas within the Union) in an apposite act (Regulations, Directives or simple Recommendations).
This solution could have the advantage of providing binding force to the UCTE rules within the EU States, but, on the other hand, this would be applied only to the EU Member States. For non-EU member states which electricity system's are synchronously coupled with one of the 4 synchronous areas, it might be advisable that the national grid codes provide for adherence to the minimum set of "reliability building blocks" which are necessary for the international interconnection. Already today, several national grid codes have adopted such a position.

In the case of a European Directive or Regulation, it would be essential that TSOs' reponsibilities and liabilities are clearly defined, including the liabilities between TSOs of different member states and third countries adhering to the code.