USER GUIDE TO OPERATING CODE

A Report for PPC

n/e/r/a LDK NORTON ROSE ESB INTERNATIONAL

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EXECUTIVE SUMMARY

The Operating Code defines the technical rules for licensed users to access the transmission system and establish the responsibilities and operational procedures for the Hellenic Transmission System Operator (HTSO) to perform its authorised role. The Operating Code is a large document and this User Guide provides an overview of the different sections, illustrating some of the key features by means of flow charts.

Some background information outlining the purpose of the Operating Code, its relation to other documents such as licenses and agreements, the need for operation and test procedures to give effect to the Operating Code is first presented. The structure of the Operating Code is then discussed and a brief guide to the key issues of each section of the Operating Code is presented.

The main sections of the Operating Code are summarised as follows:

Glossary

GC General conditions

PC Planning code

CC Connection conditions

OC1 Safety co-ordination

OC2 Information exchange

OC3 Metering code

OC4 Demand forecasts

OC5 Demand control

OC6 System services

OC7 Interconnector management

OC8 Generator maintenance scheduling

OC9 Transmission ,maintenance scheduling

OC10 Monitoring, testing and investigation

OC11 Operational testing

OC12 Emergency control and power system restoration

OC13 Small scale generator conditions

SDC1 Generation scheduling

SDC2 Generation dispatching

SDC3 Special scheduling provisions

This user guide will outline some of the relevant assumptions made in preparation of the Operating Code. A glossary forms part of the Operating Code and unambiguously defines important terms used in the code.

1 DISCLAIMER

The User Guide to the Operating Code is not part of the Operating Code *per se* but is intended to outline some of the assumptions considered and issues arising in preparation of the relevant sections of the Code. This guide is only intended to give an overview of the Operating Code. Great care has been exercised to ensure that the guide gives an accurate reflection of the Operating Code. Nevertheless readers should be aware that in the event of any discrepancies between this guide and the Operating Code, the Operating Code shall prevail.

2 GENERAL DESCRIPTION

2.1 Purpose

The Operating Code is a document critical to the operation of the power system in a liberalised market environment. It is fundamentally a technical document containing the rules governing the operation, maintenance and development of the transmission system and co-ordination of the actions of all users of the transmission system. It is envisaged that it will give all users an understanding of the rules and provide for equitable treatment of all users. The Operating Code is not intended to describe aspects of market operation or the rules for trading and settlement, which are contained in the Power Exchange Code.

For the purposes of this document a user is any party that impacts on the operation of the transmission system and will include transmission connected generators, distribution embedded generators, network operators, transmission connected customers and interconnected systems. It is necessary to clearly specify these rules as they may result in significant financial and technical implications for users.

2.2 Relation of Operating Code to other documents

It is essential that the Operating Code is consistent with other key documents including authorisations, the Power Exchange Code, HTSO/ network operator agreements and Ancillary Services agreements. The HTSO authorisation and user authorisations take precedence over the Operating Code if there is inconsistency between the conditions therein. In the event of any conflict between the provisions of the Operating Code and any other contracts, agreements, or arrangements between the HTSO and a user, the provisions of the Operating Code shall prevail unless the Operating Code expressly provides otherwise.

The Operating Code sets out in broad terms the rules governing operation, maintenance and development of the transmission system. The Operating Code will refer to separate documents that are not part of the Operating Code itself, as illustrated in Figure 1. These documents include planning standards, such as transmission planning criteria, and operating policy documents on issues including transmission system security, power quality, transmission system emergencies, operational communications, transmission system connected equipment, dispatch, outage co-ordination and interconnection. Other policy documents may cover issues including environmental, safety and confidentiality matters. These standards and policies are separate as a matter for the HTSO but the information, in some cases, will be available to the public since it relates to market operation and the Operating Code.

Similarly, detailed procedures, which give effect to what is in the Operating Code, are separate from the Code. These detailed procedures include operating procedures (such as action during a capacity deficiency, emergency operations, load forecasting, reactive power reserve policy, transmission system restoration and transmission operations) and test procedures (such as testing compliance with registered generation unit operating characteristics and ancillary service capabilities, compliance with Operating Code, system tests).

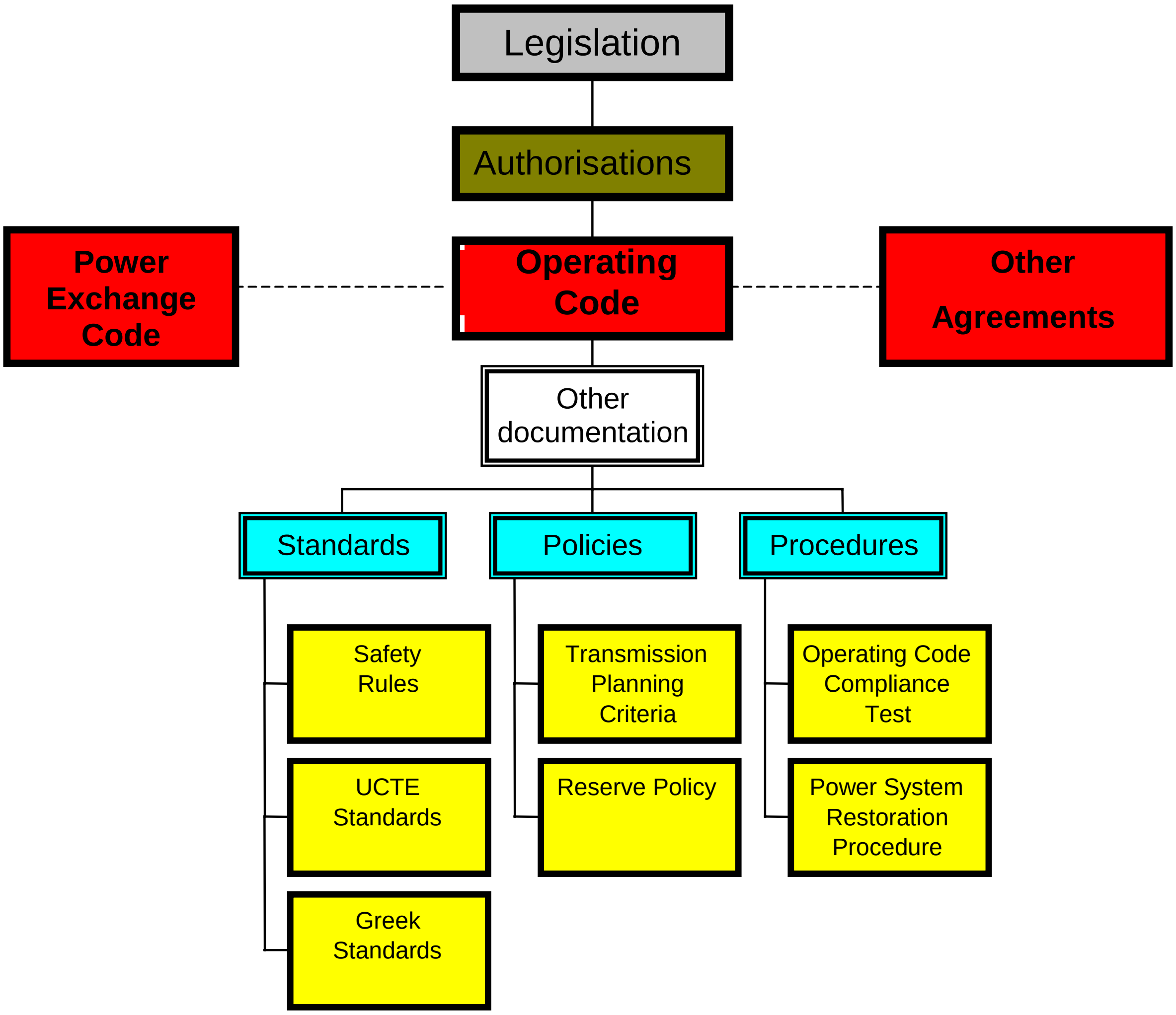

Figure 1 Hierarchy of Documents

2.3 Governance

The Operating Code is approved by the Minister of Development and, similarly, all modifications, updates and derogation requests need to be also approved by the Minister of Development.

The sections of the Operating Code are:
Glossary

GC General conditions

CC Connection conditions

PC Planning code

OC1 Safety co-ordination

OC2 Information exchange

OC3 Metering code

OC4 Demand forecasts

OC5 Demand control

OC6 System services

OC7 Interconnector management

OC8 Generator maintenance scheduling

OC9 Transmission maintenance scheduling

OC10 Monitoring, testing and investigation

OC11 Operational testing

OC12 Emergency control and power system restoration

OC13 Small scale generator conditions

SDC1 Generation scheduling

SDC2 Generation dispatching

SDC3 Special scheduling provisions

Table 1. Scope of Operating Code

Code		HTSO	Network Operator	Transmission Owner (PPC)	Suppliers	CDGUs	Non CDGU	Small Scale Generators	Special Units	External System Operator
GC	General Conditions	✓	✓	✓	✓	✓	✓	✓	✓	✗
CC	Connection Conditions	✓	✓	✓	✗	✓	✓	✓	✓	✗
PC	Planning Code	✓	✓	✓	✓	✓	✓	✓	✓	✗
OC1	Safety Co-ordination	✓	✓	✓	✓	✓	✓	✓	✓	✗
OC2	Information Exchange	✓	✓	✓	✗	✓	✓	✓	✓	✗
OC3	Metering Code	✓	✓	✓	✓	✓	✓	✓	✓	✓
OC4	Demand Forecasts	✓	✓	✗	✓	✓	✗	✗	✓	✗
OC5	Demand Control	✓	✓	✗	✓	✗	✗	✗	✗	✗
OC6	System Services	✓	✓	✗	✓	✓	>2MW	✗	✓	✗
OC7	Interconnector Management	✓	✓	✓	✓	✓	✗	✗	✓	✓
OC8	Generator Maintenance Scheduling	✓	✓	✗	✓	✓	✗	✗	✓	✗
OC9	Transmission Maintenance Scheduling	✓	✗	✓	✗	✗	✗	✗	✗	✗
OC10	Monitoring, Testing and Investigation	✓	✓	✓	✓	✓	>10MW	✓	✓	✗
OC11	Operational Testing	✓	✓	✓	✗	✓	>2MW	✗	✓	✗
OC12	Emergency Control & Power System Restoration	✓	✓	✓	✗	✓	>2MW	✗	✓	✗
OC13	Small Scale Generator Conditions	✓	✗	✗	✗	✗	✓	✓	✓	✗
SDC1	Generator Scheduling	✓	✓	✗	✓	✗	✗	✗	✓	✓
SDC2	Generator Dispatch	✓	✓	✗	✓	✗	✗	✗	✓	✓
SDC3	Special Scheduling Provisions	✓	✗	✗	✗	✗	✗	✗	✓	✗
	Glossary	✓	✓	✓	✓	✓	✓	✓	✓	✓

3 GLOSSARY

It is fundamental to the implementation of the Operating Code that there is a common understanding of all terminology used. To achieve this, the Glossary is included as an important section of the Operating Code that clearly and unambiguously defines all the important terms of the Operating Code. For clarity, terms that are defined in the Glossary section of the Operating Code are in bold typeface throughout the Code. Where the Glossary refers to any word or term that is more particularly defined in a part of the Operating Code, the definition in that part of the Operating Code will prevail over the definition in the Glossary in the event of any inconsistency.

4 GC GENERAL CONDITIONS

4.1 Description

While each individual code in the Operating Code contains the rules and provisions relating specifically to that code, there are provisions of more general nature, which need to be included in the Operating Code. Such provisions are included in a section entitled General Conditions. These General Conditions (GC) ensure that the various sections of the Operating Code form a cohesive document, for the successful operation of the transmission system and for the benefit of the HTSO and all users. These conditions provide a set of principles governing the status and development of the Operating Code, and related issues.

The requirement for the HTSO to establish and maintain the Operating Code Review Panel (OCRP) is included in the General Conditions. The General Conditions also address the procedure for dealing with Operating Code revision requests.

It is acknowledged that some existing generation plant or sections of the transmission system will, in part or in whole, be unable to comply with some of the minimum standards specified in the Operating Code. This may be either because the plant/ system was designed to different standards or because of deterioration over time against design specification. The General Conditions provide for applications for derogation from the Operating Code rather than requiring modification to the plant to meet the current minimum standards (in many cases, to do so would be technically infeasible). The RAE will be responsible for approval of derogation requests and derogation reviews.

It is envisaged that the HTSO would have a duty to implement, and comply with, the Operating Code as approved by the Minister of Development. In order to fulfil its duty to implement the Operating Code the HTSO may, in certain cases, need access across the HTSO/ user boundaries, or may need services and/or facilities from users. It is hoped that these cases would be exceptional and it is not, therefore, possible to envisage precisely or comprehensively what the HTSO might reasonably require in order to put it in a position to be able to carry out its duty to implement the Operating Code in these circumstances. Accordingly, the General Conditions require all users not only to abide by the letter and spirit of the Operating Code, but also to provide the HTSO with such rights of access, services and facilities as provided for in appropriate agreements, and to comply with such instructions as the HTSO may reasonably require in implementing the Operating Code.

The General Conditions address exceptional circumstances that may arise, which the provisions of the other sections of the Operating Code have not foreseen. It would be intended that the HTSO would, to the extent reasonably practicable in the circumstances, consult promptly and in good faith all affected users in an effort to reach agreement as to what should be done.

The General Conditions require the HTSO to act reasonably and in accordance with Prudent Utility Practice in all circumstances. In the event of any conflict between the provisions of the Operating Code and any contract, agreement, or arrangement between the HTSO and a user, the provisions of the Operating Code shall prevail unless the Operating Code expressly provides otherwise.

The General Conditions also provide that if any part of the Operating Code should be found to be unlawful or partially invalid for any reason, the validity of all remaining provisions of the Operating Code would not be affected.

4.2 Contents of General Conditions

GC1 Introduction
GC2 Objective
GC3 Scope
GC4 Purpose
GC5 Operating Code Review Panel
GC6 Operating Code revisions
GC7 Operating Code interpretation
GC8 Derogation
GC9 Plant failures
GC10 Assistance in implementation
GC11 Unforeseen circumstances
GC12 Hierarchy
GC13 Ownership of plant and/or apparatus
GC14 System control
GC15 Illegality and partial invalidity
GC16 Standards

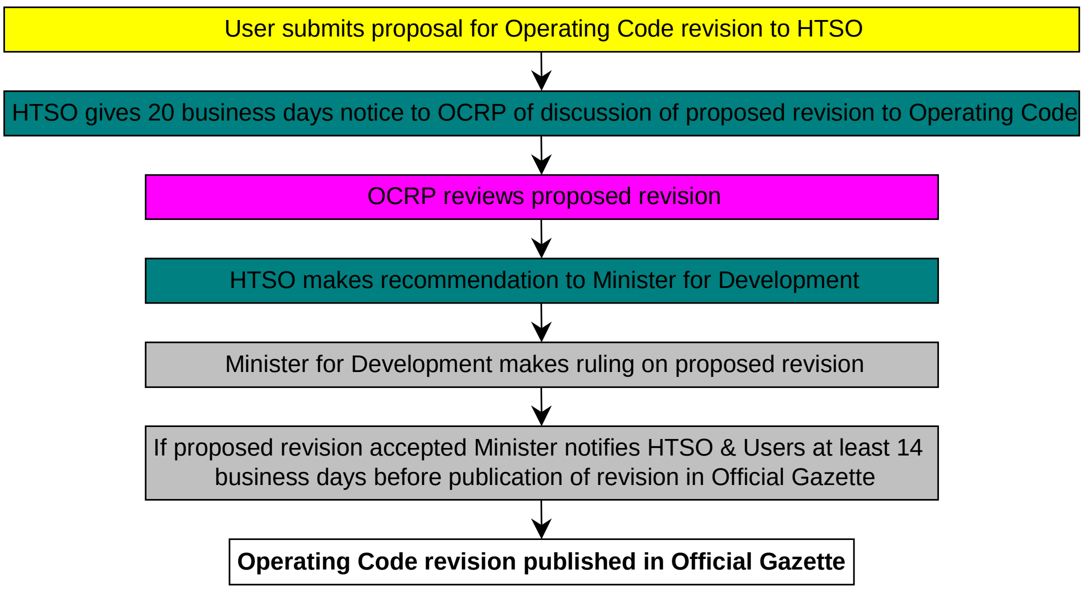

Figure 2 Procedure for revising Operating Code

5 PC PLANNING CODE

5.1 Description

Development of the transmission system, involving its reinforcement or extension, becomes necessary for a number of reasons including demand growth, development or extension of a user system or the introduction of a new connection site.

The time required for the planning and development of the transmission system will depend upon the type and extent of the necessary reinforcement and/or extension work, and the time required for obtaining necessary authorisations.

The planning code provides for the HTSO/user interaction in respect of any proposed development on the user system that may impact on the performance of the transmission system or the direct connection with the transmission system. It will also provide for the supply of information required by the HTSO from users in order for the HTSO to undertake the planning and development of the transmission system in accordance with the planning criteria and other relevant standards and to prepare the forecast statement.

The transmission system is currently planned in accordance with transmission planning criteria as approved by RAE. The "relevant standards" as referred to in section PC7.1 will include the transmission planning criteria, and may include further relevant standards, e.g. as prescribed in authorisation obligations.

There will continue to be a separate document addressing the detail of the connection process. There is a need to provide for efficient planning of the Transmission System and the Network, taken together. This will be addressed in an interface document between HTSO and the network operator.

The planning code addresses a number of necessary circumstances where HTSO can instruct a user to make certain modifications to plant and apparatus. It is anticipated that these will mainly deal with auxiliary plant (e.g. power system stabilisers) and control systems, etc. (refer PC5.3). Commercial consequences which may arise from this, and remuneration to the user (if any) is not a matter for the Operating Code and will be addressed in bilateral agreements between HTSO and users.

The planning code also envisages that a user may be provided with a connection that exceeds standards in certain circumstances. This is anticipated in the case of, for example, some large industrial loads that have critical processes requiring a high continuity of supply. In this event a higher standard supply may be provided, if it is technically reasonable to do so and subject to agreement of terms.

5.2 Contents of Planning Code

PC1 Introduction
PC2 Objectives
PC3 Scope
PC4 Planning procedures for connection
PC5 System planning
PC6 Data
PC7 Planning standards

PC8 Validation and verification of data

5.3 Other documents referenced

- Transmission Planning Criteria
- Forecast Statement
- Connection Agreement
- Interconnector Agreement

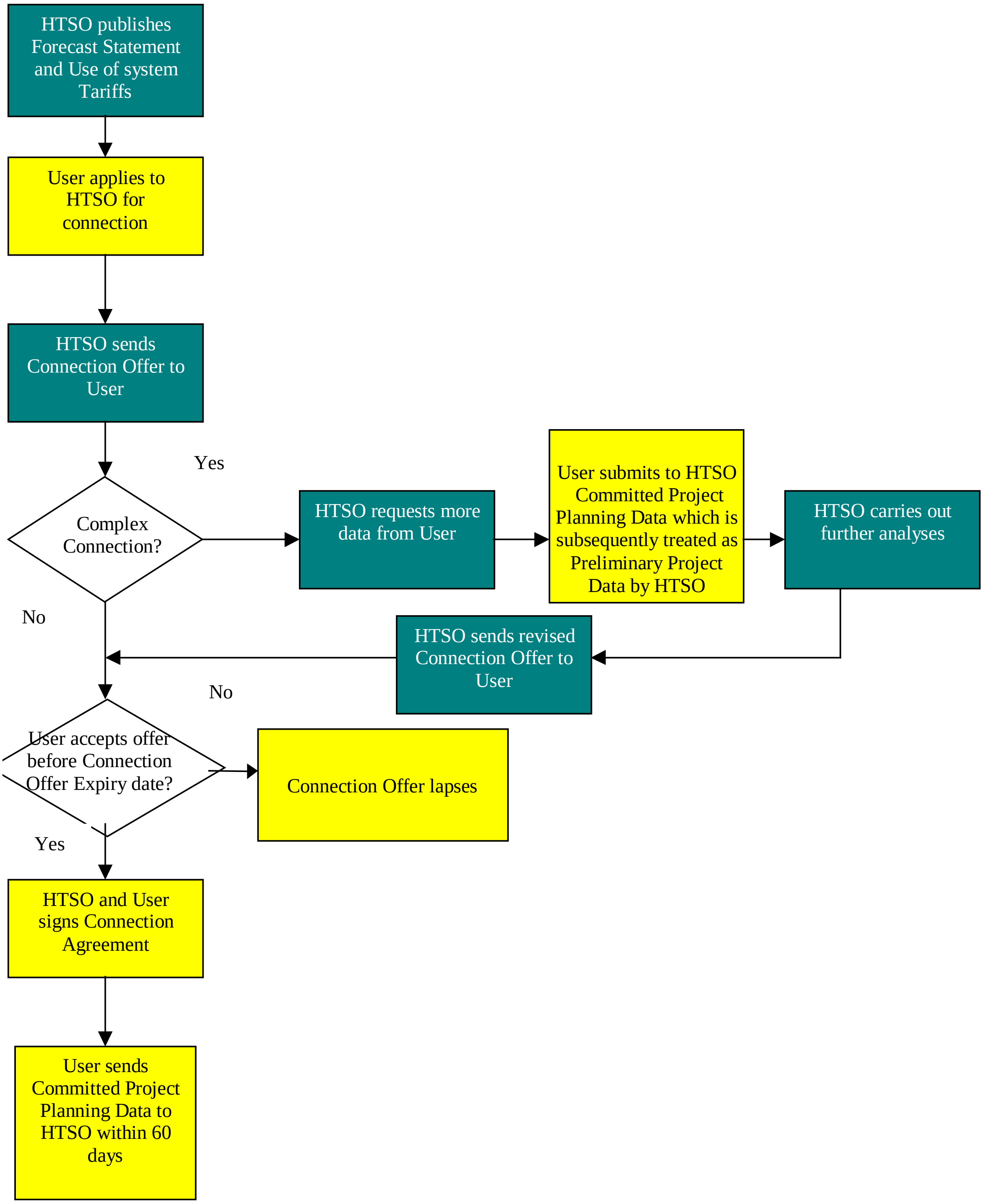

Figure 3 Overview of Planning Code

6 CC CONNECTION CONDITIONS

6.1 Description

To protect the transmission system and all apparatus connected to it, it is necessary that certain minimum technical, design and operational criteria are met by users' plant and apparatus. This is also necessary to permit stable and secure operation of the transmission system for the benefit of all users. The Connection Conditions define the technical, design and operational standards that must be complied with by any user connecting to the transmission system. The performance characteristics of the transmission system at the connection point are also specified. This will enable users and prospective users to design their plant and apparatus and to provide appropriate control systems and plant protection schemes.

These conditions define the specifications for prospective new entrants. In a case where existing plant or apparatus can not reasonably be made perform to these specifications derogation should be sought as provided for in the General Conditions. This is a more appropriate mechanism than diluting the condition for all users. It is necessary to secure RAE approval for any derogation to be awarded.

An overview of the Connection Conditions is illustrated in Figure 4.

6.2 Contents of Connection Conditions

CC1 Introduction
CC2 Objective
CC3 Scope
CC4 Transmission station compound
CC5 Plant designations
CC6 Relevant technical standards applying to user plant and apparatus
CC7 Specific design and performance standards
CC8 Transmission system performance
CC9 Metering
CC10 User protection and power quality
CC11 Communication facilities
CC12 Signals to be provided by users
CC13 Power supplies
CC14 Necessary exchange of information at the interface
CC15 Responsibility for safety
CC16 Commissioning and notification

6.3 Other documents referenced

- Connection Agreement
- PPC Safety Rules

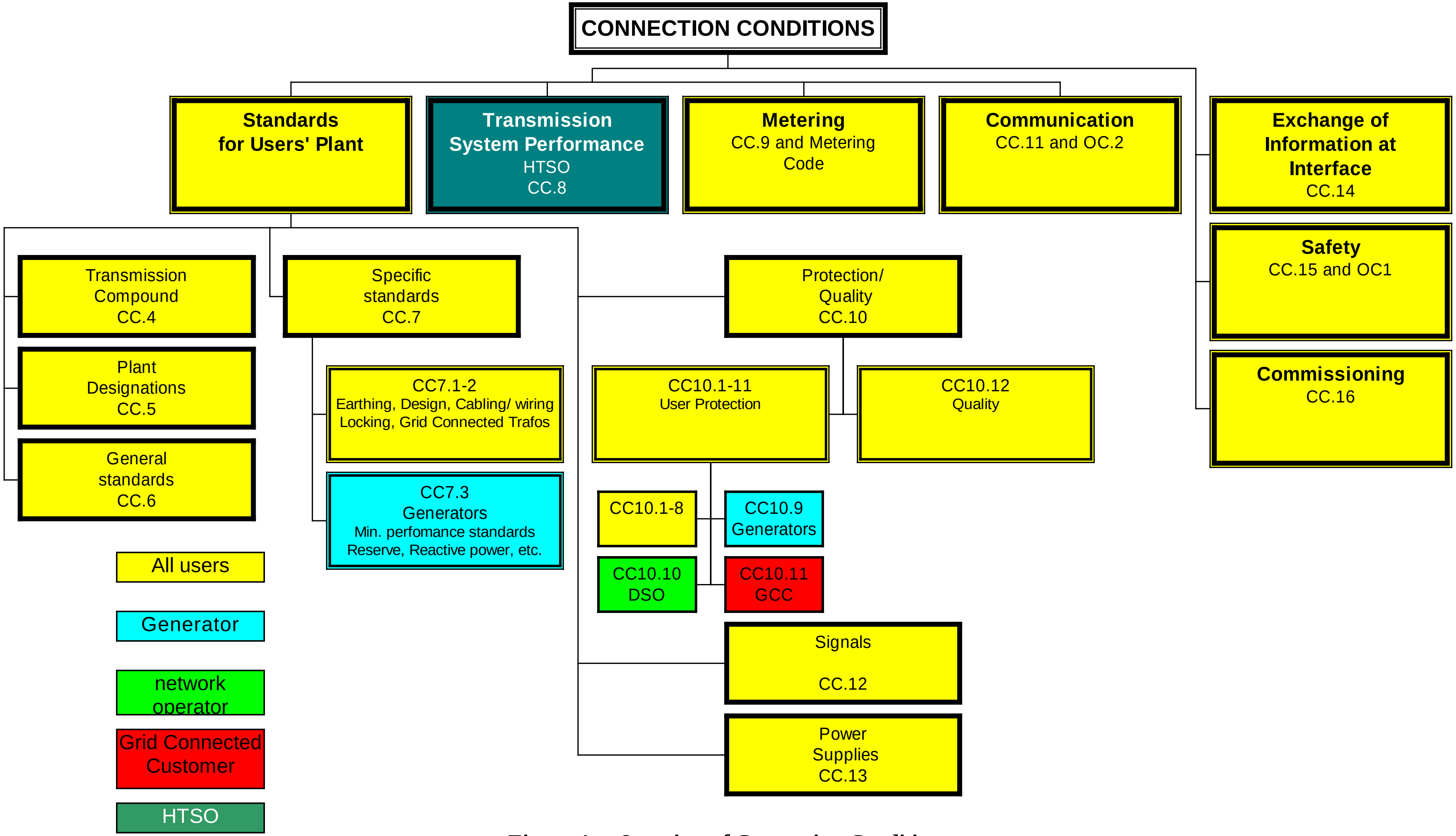

Figure 4 Overview of Connection Conditions

7 OC1 SAFETY CO-ORDINATION

7.1 Description

In order to adequately maintain, test, operate and repair damage to plant and/or apparatus resulting from faults, it will be necessary for personnel to work on or in close proximity to transmission system plant and apparatus, or in close proximity to user's plant and apparatus.

It will also be necessary for users and/or their agents to similarly work on or in close proximity to user's plant and apparatus which is capable of being connected to the transmission system, and from time to time to work in close proximity to transmission system plant and apparatus.

The objective of OC1 is to establish the requirement on HTSO, (or their agents), and users (or their agents) to operate in accordance with approved safety rules. It is assumed that PPC's safety rules will be the default for all parties. However, it is possible that another party will be allowed by the HTSO to use their own safety rules provided that it can be demonstrated that these comply with all relevant international and national legislative requirements and relevant industry standards. This is necessary to ensure safe working conditions for personnel working on or in close proximity to transmission system electrical plant and apparatus or personnel who may have to work at or use the equipment at the interface.

Interconnected systems may have their own sets of safety rules and it should be demonstrated that these comply with all relevant international legislative requirements and relevant industry standards.

7.2 Contents of Operating Code OC1

OC1.1 Introduction
OC1.2 Objective
OC1.3 Scope
OC1.4 The safety rules
OC1.5 Safety at the interface

7.3 Other documents referenced

- PPC Safety Rules

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8 OC2 INFORMATION EXCHANGE

8.1 Description

The objective of OC2 is to provide for the exchange of information so that the implications of an operation and/or an event can be considered. This facilitates possible risks arising to be assessed and appropriate action to be taken by the relevant person, in order to assist in maintaining the integrity of the power system. The general procedures for all forms of communication of operational information between the HTSO and users are also described. However, pre-connection communication is dealt with in the Connection Conditions and is not discussed in this code. Similarly data relating to commercial (energy) metering is specifically not covered by OC2.

8.2 Contents of Operating Code OC2

OC2.1 Notification of events and event reporting

- OC2.1.1 Introduction
- OC2.1.2 Objective
- OC2.1.3 Scope
- OC2.1.4 Requirement to notify
- OC2.1.5 Notification of an operation
- OC2.1.6 Form of notification of an operation
- OC2.1.7 Recording of an operation
- OC2.1.8 Timing in respect of an operation
- OC2.1.9 Notification of events
- OC2.1.10 Form of notification of an event
- OC2.1.11 Provision of further information
- OC2.1.12 Recording of an event
- OC2.1.13 Timing in respect of an event

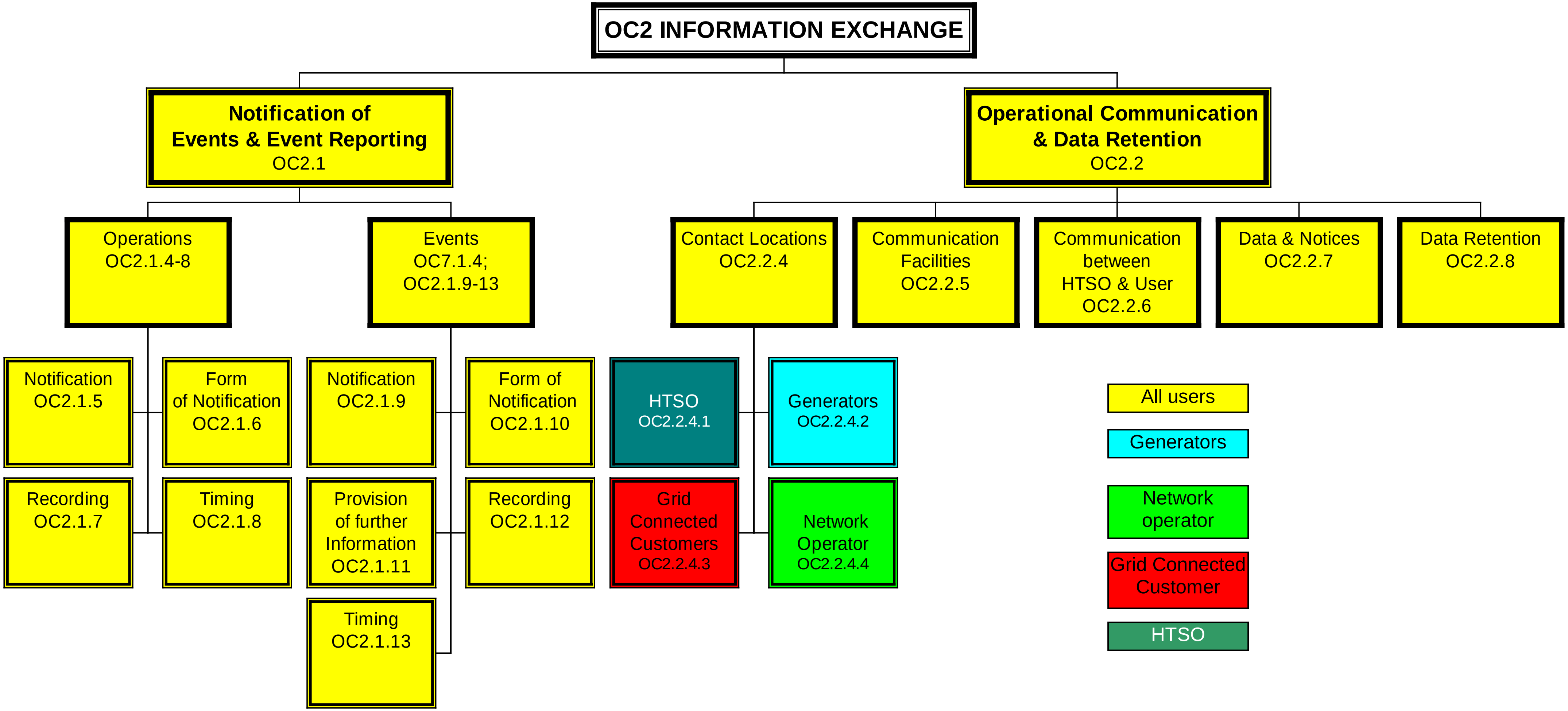
OC2.2 Operational communication and data retention

- OC2.2.1 Introduction
- OC2.2.2 Objective
- OC2.2.3 Scope
- OC2.2.4 Contact locations
- OC2.2.5 Communication facilities
- OC2.2.6 Communication between the HTSO and the user
- OC2.2.7 Data and notices
- OC2.2.8 Data retention

8.3 Other documents referenced

Connection Agreement

Figure 5 Overview of Information Exchange



9 OC3 METERING CODE

9.1 Introduction

This code sets out the minimum standards for the measurement and recording of metered quantities of electricity for the purposes of electricity trading in Greece from the establishment of the competitive electricity market in February 2001, as further defined in the Power Exchange Code.

For settlement purposes, the quantities of electricity (MWh and MVArh) exported or imported at each defined metering point must be measured and recorded through metering equipment installed, operated and maintained as set out in OC3. The Metering Code specifies the minimum technical, design and operational criteria to be complied with for metering and data collection equipment and associated procedures as required under the Power Exchange Code. A settlement system will provide for the calculation of any payments due to or owing by the market entities in respect of sales and purchases of electricity, under the terms of the Power Exchange Code.

Metering Equipment shall be provided by the transmission system owner and the network operator and shall be registered in the appropriate registration system and shall comply with the provisions of the Metering Code.

9.2 Contents of Operating Code OC3

OC3.1	Introduction
OC3.2	Scope
OC3.3	Objective
OC3.4	General requirements of metering equipment
OC3.5	Meter approval, certification and testing 4
OC3.6	Market settlement
OC3.7	Meter provision and registration
OC3.8	Meter data management
OC3.9	Revenue protection
OC3.10	Access
OC3.11	Disputes
OC3.12	Information
OC3.13	Notices
OC3.14	References
OC3.15	Metering point
OC3.16	Main and check metering
OC3.17	Measurement parameters
OC3.18	Metering equipment standards
OC3.19	Equipment accuracy and error limits
OC3.20	Data storage
OC3.21	Timekeeping
OC3.22	Metering access and sealing

9.3 Other documents referenced

- Power Exchange Code

10 OC4 DEMAND FORECASTS

10.1 Summary

In order to match generation with demand for electricity it is necessary to undertake forecasting of real and reactive power demand. This enables the HTSO to fulfil its obligation to engage in effective production planning, thereby, ensuring the real time security of the system and the provision of accurate indicative information to generators.

To fulfil this role it is necessary for the HTSO to receive information from other parties. The HTSO may request profiles of active and reactive power demand and demand control as well as distribution embedded generation on an hourly and Grid Supply Point basis from the network operator and suppliers. This forecast information is required in different timescales as summarised in Table 2.

The HTSO also requires information in the Post Control Phase (data for the previous dispatch day) for forecasting purposes. Information required includes:

- Profiles of Demand reduction from the network operator, Suppliers and Grid Connected Customers
- Details from network operator regarding output of embedded generation plant.
- Demand for reactive and active power across the interconnectors.

The HTSO may also request MW and MVAr information for the previous schedule day, from any Generator. Pumped storage units are treated as negative generation when pumping, rather than as demand, in order to provide more flexibility to the HTSO to operate the system.

It is not the intention of OC4 to place additional overheads upon users of the transmission system. Data obtained to the satisfaction of the HTSO through the metering and settlement process or information provided to the HTSO under other sections of the Operating Code may reduce some of the requirements placed upon users in OC4. For example, some information in respect of centrally dispatched embedded generators, or non-centrally dispatched generators over a minimum threshold size, will be provided under the Scheduling and Dispatch Code SDC1 ("Generation Scheduling"). It is intended that there is no unnecessary duplication, but that all information needs are adequately addressed.

The HTSO will be required to publish demand forecasts, perhaps in a range of time-scales including the Programming Phase (1 week down to 1 day ahead of real-time) and the Control Phase (1 day ahead down to real time). The HTSO will consider multiple factors including user information when conducting load forecasts. The requirements in this area including the means and timing of publication should be reviewed when the HTSO's responsibilities in this area are clarified.

The code avoids making interconnected network operators subservient to the Operating Code of the Greek power system.

10.2 Contents of Operating Code OC4

OC4.1 Introduction

OC4.2 Objectives

OC4.3 Scope

OC4.4 Data required by the HTSO in the operational planning phase

OC4.5 Data required by the HTSO in the programming phase, control phase and post control phase
OC4.6 The HTSO Demand forecasts

Table 2. Overview OC4 Demand Forecast

Phase	Operational Planning		Programming	Control	Post Control
Time relative to Dispatch Day for which information required	Year ahead (Year +1)	2 weeks - 8 weeks ahead	2 days -12 days ahead	1 day ahead	Day following dispatch day
Time for submitting information	Week 22 of Year 0	10.00 each Tuesday	11.00 each Thursday	10.00 each day	08.00 each day
DSO					
Demand at Supply points	Hourly	Hourly	Hourly	Hourly	Hourly
Anticpated demand control >10MW	Hourly	Hourly	Hourly	Hourly	Hourly
MW profiles for embedded generation units > 10MW	Daily	Hourly	Hourly	Hourly	Hourly
MW profiles for embedded generation sites > 5MW	Weekly	Daily	Daily	Hourly	Hourly
MW profiles for critical embedded generation sites >2MW	Weekly	Daily	Daily	Hourly	Hourly
Suppliers:					
Demand at Supply points	Hourly	Hourly	Hourly	Hourly	Hourly
Anticpated demand control >10MW	Hourly	Hourly	Hourly	Hourly	Hourly
Energy Trading to / from Greece					Hourly
Generators					Hourly

10.3 Other documents referenced

Agreements between HTSO and network operators

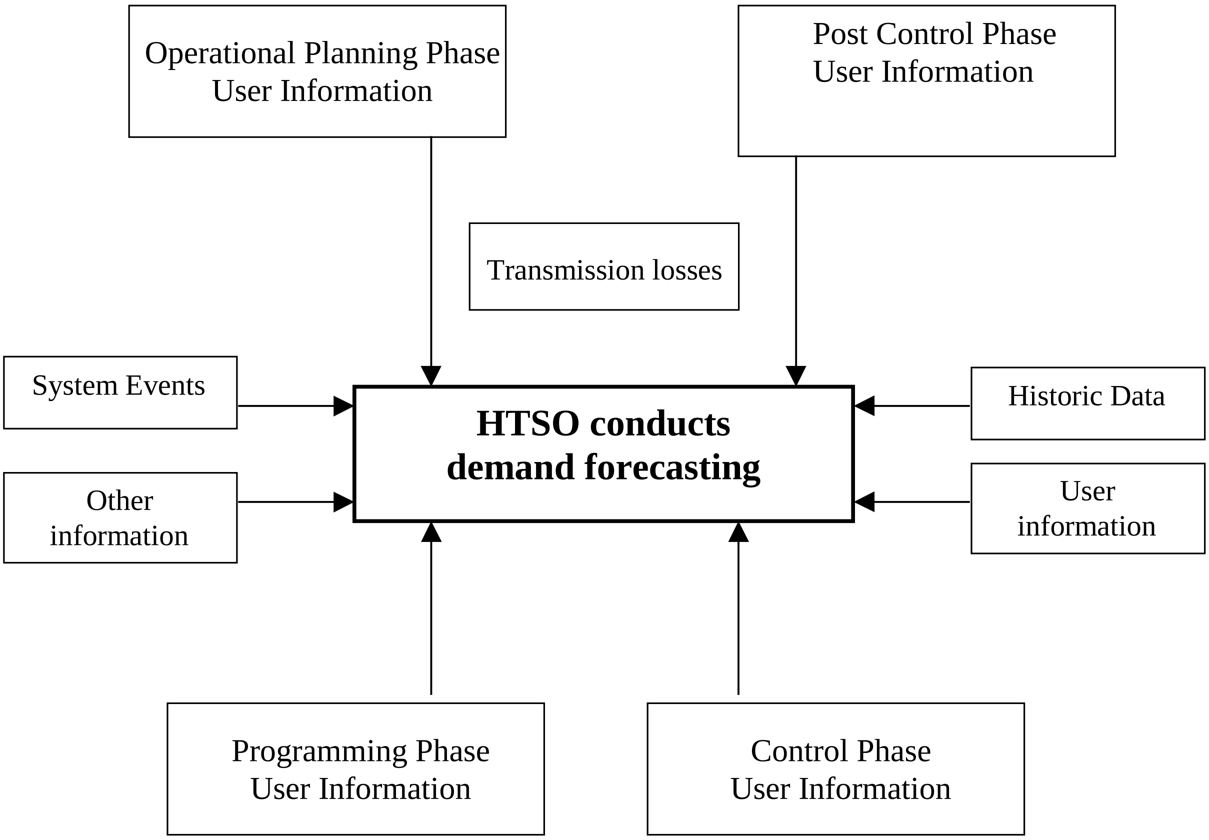


Figure 6 Overview of Operational Planning

11 OC5 DEMAND CONTROL

11.1 Description

OC5 is concerned with the provisions to be made by the network operator and, in certain circumstances, by the HTSO (for transmission connected customers), to permit the reduction of demand. This may be necessary in the event of available generating plant and transfers from external interconnections being insufficient to meet demand, or in the event of plant breakdown or operating problems. Provision will be made for:

- Customer Demand reduction instructed by the HTSO
- Automatic low Frequency Demand Disconnection
- Automatic low Voltage Demand Disconnection
- Automatic Demand Restoration

Demand control is exercised through operation of the network or of the transmission system (in the case of transmission connected customers). In general when performed, demand control will be based on the physical organisation of the total system, and not on any contractual arrangements that may exist. Where demand control is needed in a particular area, the HTSO would not know which supplier or combination of suppliers to contact to effect the demand controls required. This is because of the diversity of contracts that may be held by customers in a region. However, there may be cases where customers have made explicit contracts that entitle them to a lower tariff in return for a higher risk of disconnection. This will be reflected on the settings applied at the customer's plant.

Therefore, in most instances demand control will be exercisable by the network operator. Suppliers should note, however, that although implementation of demand control in respect of their customers may not be exercisable by them, their customers may be affected by demand control exercised by the network operator. The contractual arrangements of suppliers with their Customers may, accordingly, need to reflect this. This will have to reflect any relevant provisions of the energy market.

It will be necessary to define certain customers (e.g. hospitals, emergency services etc.) who are exempt from demand control and to ensure that the physical arrangements necessary to effect this exemption are in place.

11.2 Contents of Operating Code OC1

OC5.1 Introduction
OC5.2 Objective
OC5.3 Scope
OC5.4 Procedure for the implementation of demand control on the instructions of the HTSO
OC5.5 Automatic low frequency demand disconnection
OC5.6 Automatic demand restoration
OC5.7 Automatic low voltage demand disconnection
OC5.8 Exemptions from demand control

11.3 Other documents referenced

Rota Load Shedding Plan

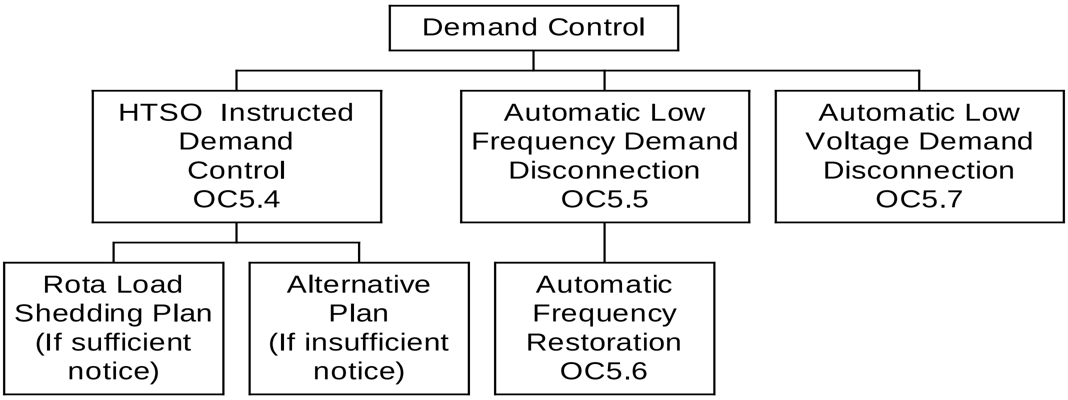


Figure 7 Summary of Demand Control

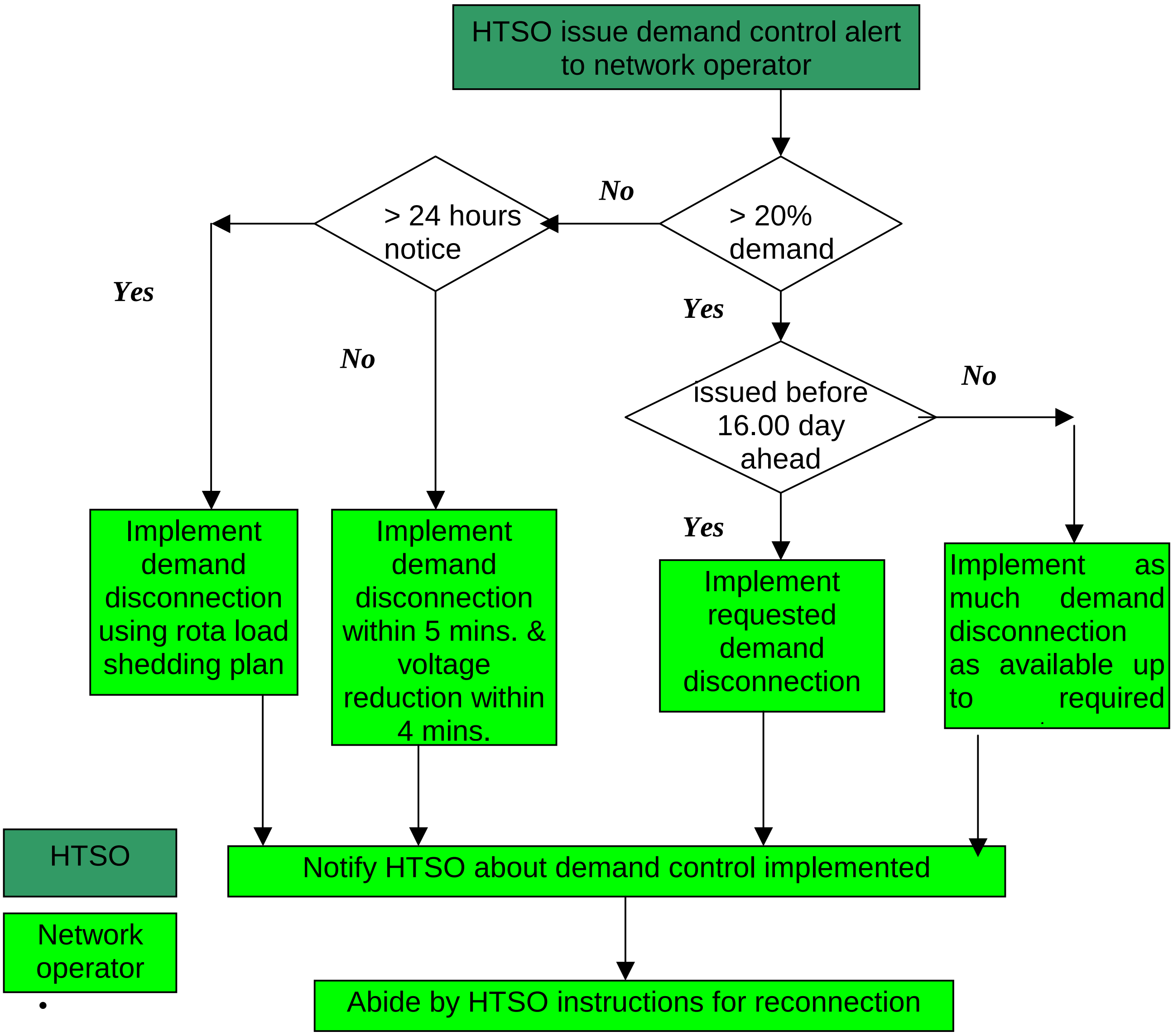


Figure 8 Demand Control

12 OC6 SYSTEM SERVICES

12.1 Description

OC6 describes the system services required on the transmission system and defines the standard of service required from providers. System services refers to the services essential to the proper and stable functioning of the power system in addition to the provision of electrical energy. These services include, but are not limited to:

- Frequency Control
- Voltage Control
- Network Control
- Operating Margin
- Power system restoration

In order to ensure secure operation, the HTSO will have control over all system services, i.e., the HTSO will specify what system services are to be provided, when and by whom. Generator authorisations include a provision requiring generators to offer reasonable terms for the provision of system services, including operating reserve and reactive power.

12.2 Contents of Operating Code OC6

OC6.1 Introduction

OC6.2 Scope

OC6.3 Frequency control

- OC6.3.1 Introduction
- OC6.3.2 Objective
- OC6.3.3 Description of frequency control
- OC6.3.4 Requirements of generation unit governor systems
- OC6.3.5 Automatic Generator Control (AGC)

OC6.4 Voltage control

- OC6.4.1 Introduction
- OC6.4.2 Objective
- OC6.4.3 Description of voltage control
- OC6.4.4 Voltage control policy
- OC6.4.5 Methods utilised in exercising voltage control
- OC6.4.6 Emergency or exceptional voltage control

OC6.5 Network control

- OC6.5.1 Introduction
- OC6.5.2 Objective
- OC6.5.3 Network control actions
- OC6.5.4 Notification to users of network control
- OC6.5.5 Control under fault or emergency conditions
- OC6.5.6 De-energisation of users by the HTSO

OC6.6 Operating margin

OC6.6.1 Introduction

OC6.6.2 Objective

OC6.6.3 Constituents of operating margin

OC6.6.4 Definitions associated with an operating reserve incident

OC6.6.5 Operating margin policy

OC6.6.6 Responsibilities of the HTSO in respect of operating reserve

OC6.7 Black start

OC6.7.1 Introduction

OC6.7.2 Objective

OC6.7.3 Requirements of Black Start Stations

12.3 Other documents referenced

- Connection Agreement
- Operating Agreement
- Ancillary Services Agreements

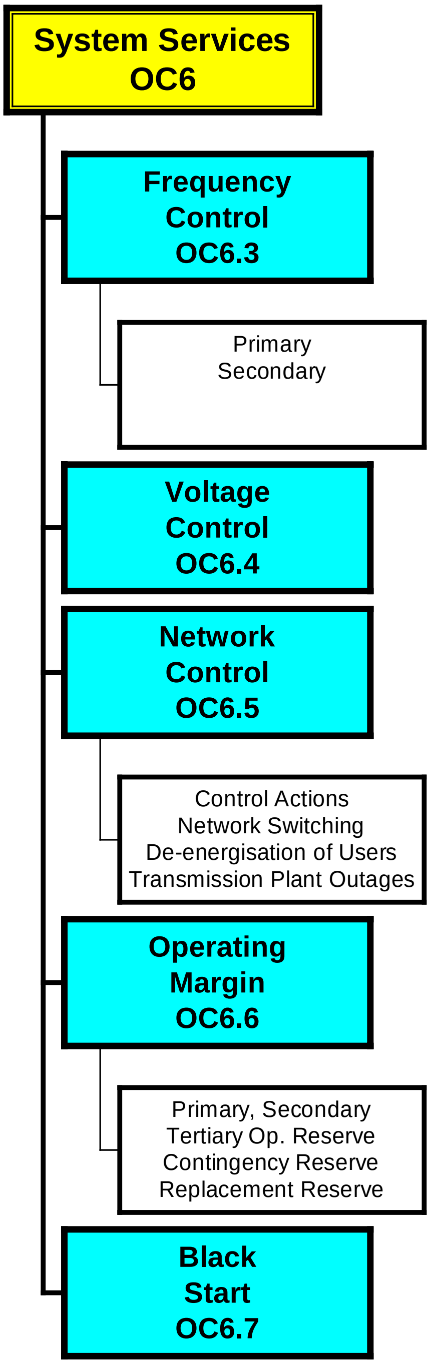


Figure 9 Summary of System Services

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13 OC7 INTERCONNECTOR MANAGEMENT

13.1 Description

It is considered that normal operation of the transmission system by the HTSO is in accordance with the principles and procedures as set out in the Operating Code and other authorisation obligations. OC7 addresses the operational requirements of interconnections with respect to system security and defines certain rights, obligations and procedures in respect of trading across the interconnections between Greece and neighbouring utilities.

The primary objective of OC7 is to manage the day to day operation of the interconnector for the purpose of trade across the interconnector between Greece and neighbouring systems. Arrangements such as reserve sharing and mutual power system restoration agreements are more appropriately dealt with in bilateral agreements between the HTSO and neighbouring system operators.

SDC1 and SDC2 address scheduling and dispatch of energy across the interconnectors. Figure 10 provides and overview of OC7.

13.2 Contents of Operating Code OC7

OC7.1 Introduction

OC7.2 Objective

OC7.3 Scope

OC7.4 Available transfer capacity (ATC) determination and posting

OC7.5 User access and trading

OC7.6 Interchange schedule

13.3 Other documents referenced

- Power Exchange Code
- The HTSO Statement of Charges and Payments

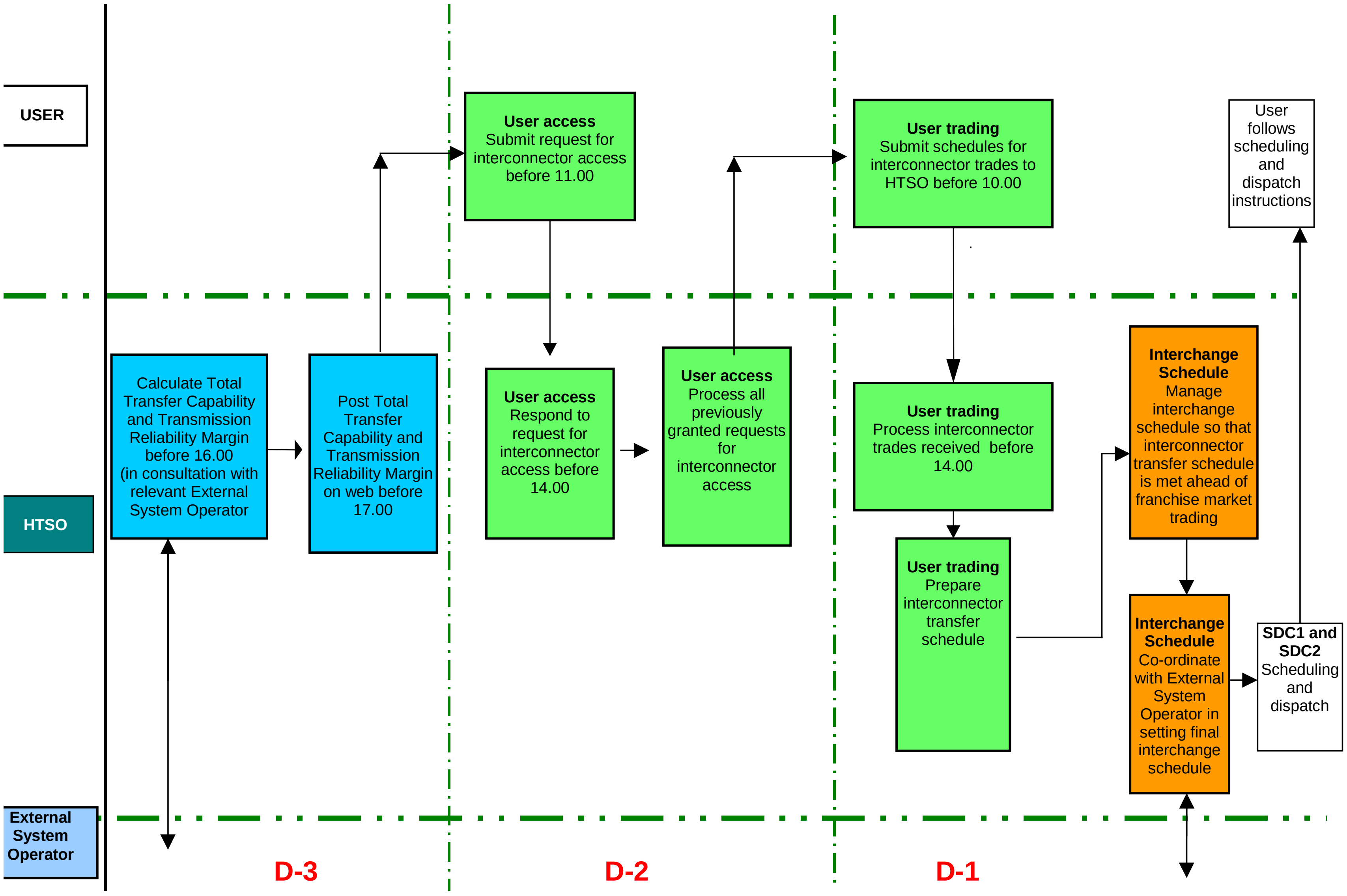

Figure 10 Overview of Interconnector Management

14 OC8 GENERATOR MAINTENANCE SCHEDULING

14.1 Commentary

Timely notification of scheduled generation outages is necessary to permit the HTSO to finalise the transmission outage programme prior to the implementation timeframe. The HTSO should approve the proposed outage schedule from a security standpoint and during implementation of the outage programme, there will be an obligation on generators to endeavour to move outages in response to unscheduled events such as other generator outages or transmission outages.

There is a need to develop mechanisms to resolve conflicts, should any arise, in the scheduling of generator outages, so that capacity adequacy is maintained. OC8 is based on the assumption that HTSO may impose a solution. It is expected that the HTSO will play a role in providing incentives to generators to adhere to the agreed outage programme in the context of ongoing developments to market rules.

The HTSO will require mechanisms to ensure system security, such as the moving of generator outages. This may take the form of negotiated bilateral contracts between the HTSO and generators. This may be necessary, for example, following the unscheduled outage of another item of plant (line or generator). For generators in constrained regions, e.g., the south of Greece where there may be problems with voltage control, special negotiated contracts between the HTSO and generators may provide terms for these arrangements. The HTSO will also require a mechanism(s) to acquire ancillary services to support power system operation.

The HTSO will approve the committed outage programme (COP) from a security standpoint and during implementation of the COP, there will be an obligation on Generators to endeavour to move outages in response to unscheduled events such as other Generator outages or transmission outages.

If, after the COP has been finalised, a Generator wishes to move away from a scheduled outage then the HTSO, upon notification, will endeavour to facilitate the requested change. In the event that this does not adversely affect system security nor require rescheduling of other outages, the COP will be amended accordingly and the generator will be granted firm financial access to the transmission system. This is outlined in Figure 13. In the event that this requires rescheduling of other outages, the HTSO, upon notification, will contact the other users affected and endeavour to facilitate the requested change. The COP will be amended accordingly, if possible and the generator will be granted firm financial access to the transmission system. In the event that this adversely effects system security the COP will not be amended accordingly and the generator will not be granted firm financial access to the transmission system during the time period for which the unit(s) was(were) scheduled out.

OC8 currently provides for issuing of an availability forecast, a demand forecast and a capacity adequacy indicator for each day during the programming phase. This may be revised at a future date to provision of an availability forecast, a demand forecast and a capacity adequacy indicator for each hour.

14.2 Contents of Operating Code OC8

OC8.1 Introduction

OC8.2 Objective
OC8.3 Scope
OC8.4 Outage scheduling
OC8.5 Assessment of capacity adequacy
OC8.6 Changes to the committed outage programme within the implementation time frame
OC8.7 Other information to be notified

14.3 Other documents referenced

- Power Exchange Code
- Ancillary Services Agreements
- System Support Agreements

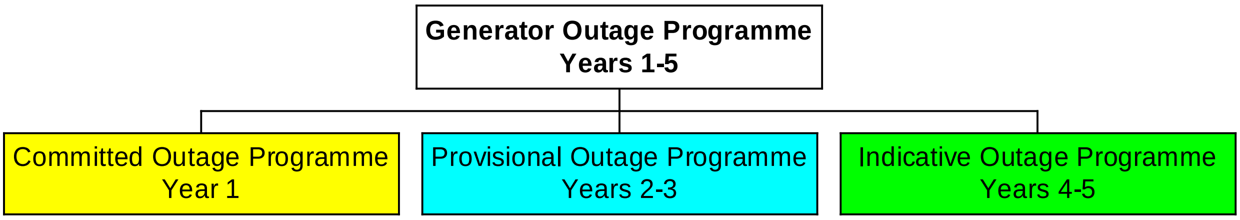

Figure 11 Overview of generation outage programme

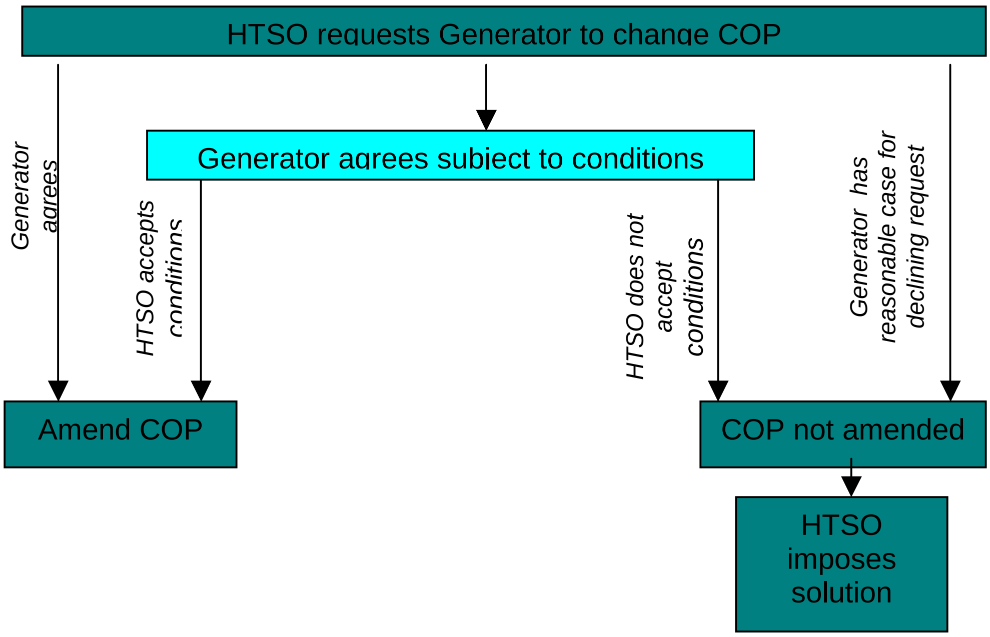

Figure 12 Change request to COP by the HTSO

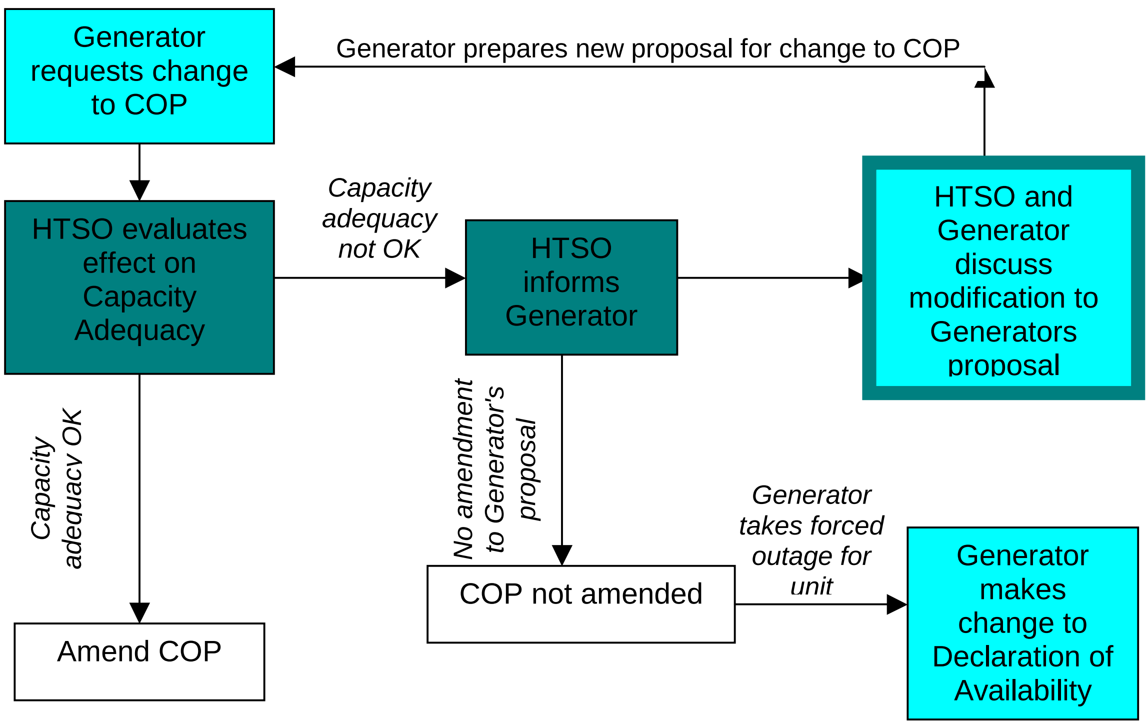

Figure 13 Change request to COP by Generator

15 OC9 TRANSMISSION MAINTENANCE SCHEDULING

15.1 Introduction

The HTSO shall be obliged to schedule maintenance of transmission plant to fulfil its obligations under its authorisation relating to secure operation of the transmission system. The agreement between the HTSO and the transmission owner (Transmission Control Agreement) will have to address issues such as definition of transmission maintenance requirements, scheduling and consequence of changes to the transmission maintenance programme. Transmission maintenance scheduling in the Greek deregulated electricity market will be facilitated by three separate documents referred to directly or indirectly in the Operating Code:

1. Specification of transmission maintenance criteria
2. Statement of transmission maintenance programme requirements
3. The transmission maintenance schedule

To avoid confusion a brief description of the nature of each of these documents is given below:

Transmission maintenance criteria

These are developed by the HTSO in consultation with the transmission owner and approved by the regulator (RAE). They specify the general standards to which the transmission system must be maintained. They can be proscriptive (e.g. “each 400kV breaker must have a complete overhaul every 12/15 years, an inspection every 3 years and a test every year”) or they can be built around more advanced maintenance philosophies such as condition monitoring (e.g."SF6 breakers will have a complete overhaul when circuit breaker timing – pole synchronism and operating time- have degraded to…"). All subsequent documents (programme and schedule) are based on this important document.

Transmission maintenance programme

This document is developed by the transmission owner, based on the transmission maintenance criteria, in consultation with the HTSO. If there is a dispute about how the criteria are interpreted and implemented in the programme this will be arbitrated by the RAE. This document lists the nature of maintenance that will be carried out on an element and the required outage duration (e.g." Breaker XYZ needs an outage of 3 weeks for an overhaul").

Transmission maintenance schedule

This is developed by the HTSO in consultation with the transmission owner. It will give a specific outage (time, date and duration) for specific equipment (e.g. “Breaker XYZ will be on outage from 0700hrs Monday week 23 to 1700hrs Friday week 26”). The maintenance schedule will try to balance the requirements of the transmission asset owner to maintain his asset and preserve its integrity (and hence the overall long term reliability of the transmission system) with the short term security requirements of the transmission system. In the event of a dispute with respect to the transmission schedule the RAE will be called to arbitrate.

Following the production of the maintenance schedule, the actual maintenance work will be carried out by the transmission owner. Maintenance work will be subject to audit by the HTSO.

OC9 details a scheme whereby indicative, provisional and committed programmes and schedules are produced by various parties 3,2 and 1 years ahead of the maintenance year respectively. A graphical representation of the iterations and consultation the committed program and schedule go through is shown in Figure 14 and 0.

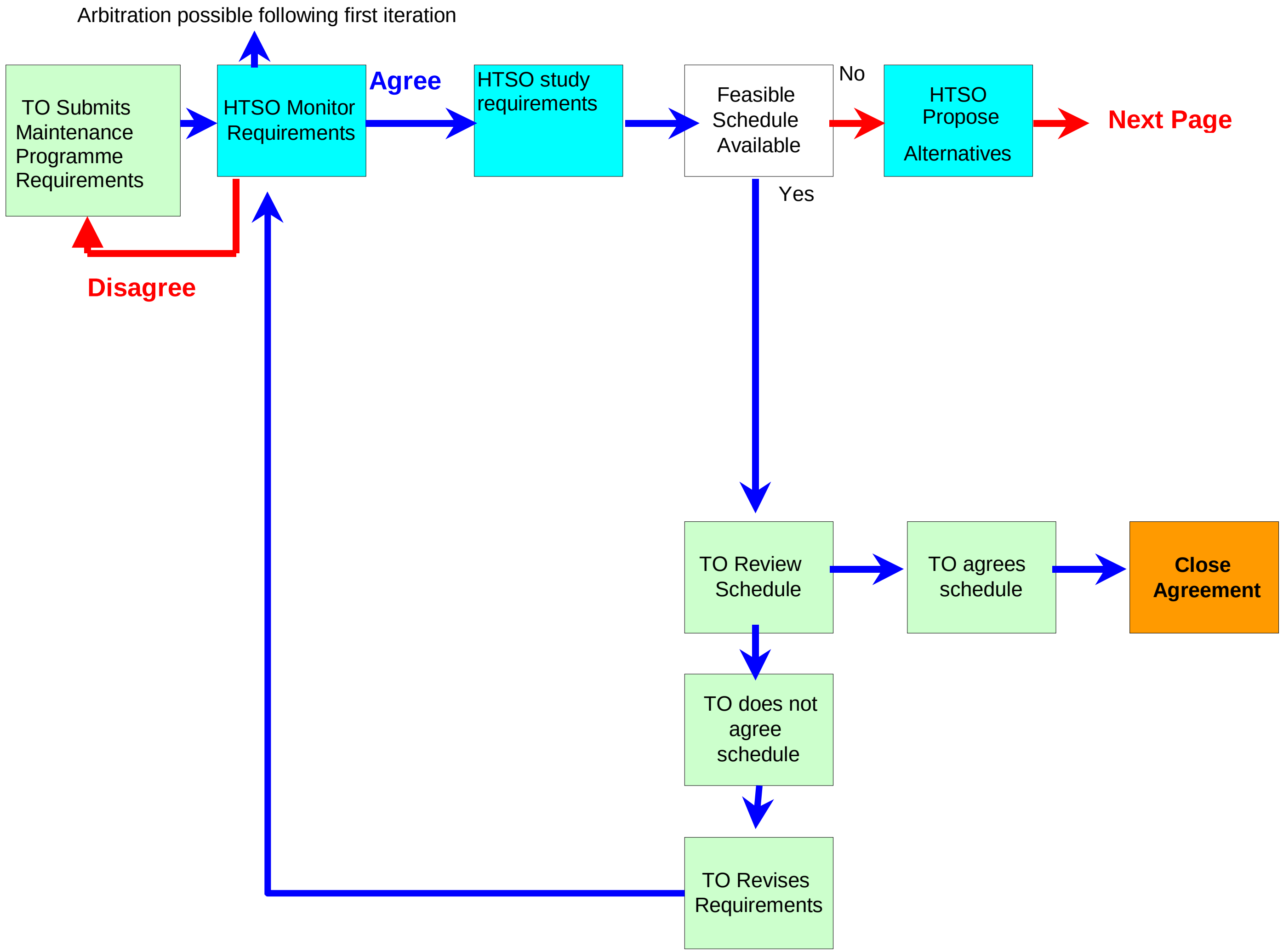

Figure 14 Overview of procedure for transmission Outage Maintenance (part 1)

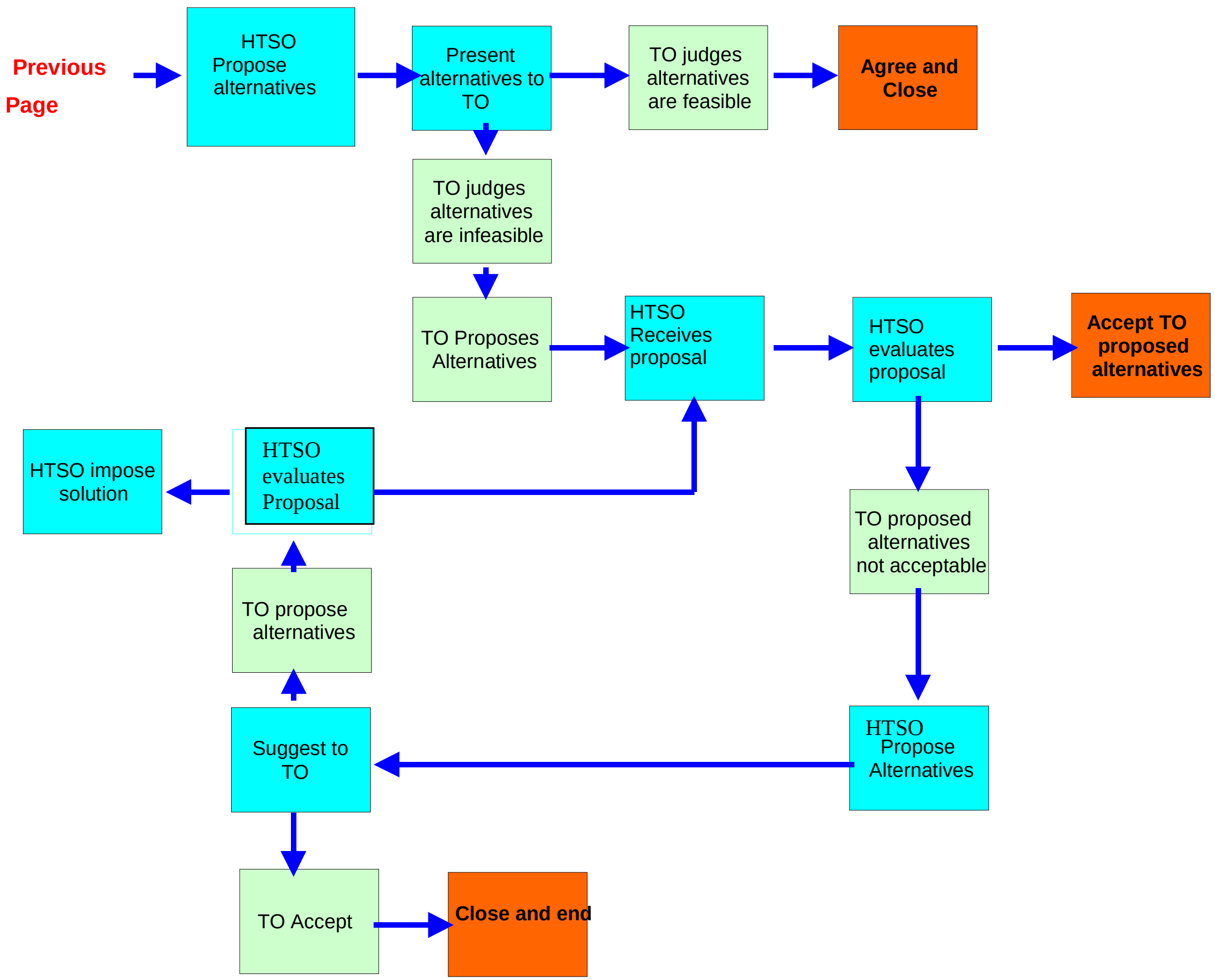

Figure 14 part 2 Overview of procedure for transmission Outage Maintenance

15.2 Contents of Operating Code OC9

OC9.1 Introduction

OC9.2 Objective

OC9.3 Scope

OC9.4 Outage scheduling

OC9.5 Changes to the committed transmission outage schedule (CTOS) within the implementation year

OC9.6 Other information to be notified

15.3 Other Documents referenced

- Transmission Planning Criteria

16 OC10 MONITORING, TESTING AND INVESTIGATION

16.1 Description

As part of its responsibilities in respect of the safe, secure and economic operation of the transmission system and in respect of generation dispatch, the HTSO will need to carry out certain monitoring, testing and investigation in respect of the performance of users' plant. The primary objective of OC10 is to establish procedures for testing that users are operating within their design, operating and connection requirements. Thus the HTSO can ensure compliance with the Operating Code, connection agreements, ancillary services agreements and system support agreements between users and the HTSO.

It is required that detailed procedures and systems are prepared and agreed, to underpin monitoring, testing and assessment of compliance. These procedures will be separate to the Operating Code. Ancillary Service and other bilateral agreements will address test procedures for performance assessment in more detail. Performance penalties may apply in the event of non-compliance of a generator to a dispatch instruction, declared ancillary services, declared operating reserve or declared operating characteristics.

Suppliers are included in the scope of OC10 and although they may not be monitored, tested etc. directly, the effects of their actions shall be (e.g. Demand control activities). If tests involve interconnected parties, these should be enforced through placing obligations on the HTSO to put the necessary procedures in place. The principle behind this is to avoid making ESOs subject to Greek Operating Code.

OC10 does not apply to operational tests, which may be required by the HTSO or by users. Such operational tests may include tests to monitor system behaviour during low voltage conditions and power system restoration test. The procedures by which such operational tests are notified, approved, executed and reported, are covered under operational testing (OC11).

16.2 Contents of Operating Code OC10

OC10.1 Introduction

OC10.2 Objective

OC10.3 Scope

OC10.4 Monitoring

OC10.5 Testing

OC10.6 Investigation

OC10.7 Consequences of monitoring, testing and investigation

OC10.8 Disputation of assessment of non-compliance by a user

16.3 Other documents referenced

- Ancillary Services Agreements
- Connection Agreement
- System Support Agreements
- Power Exchange Code
- Black Start Test procedures

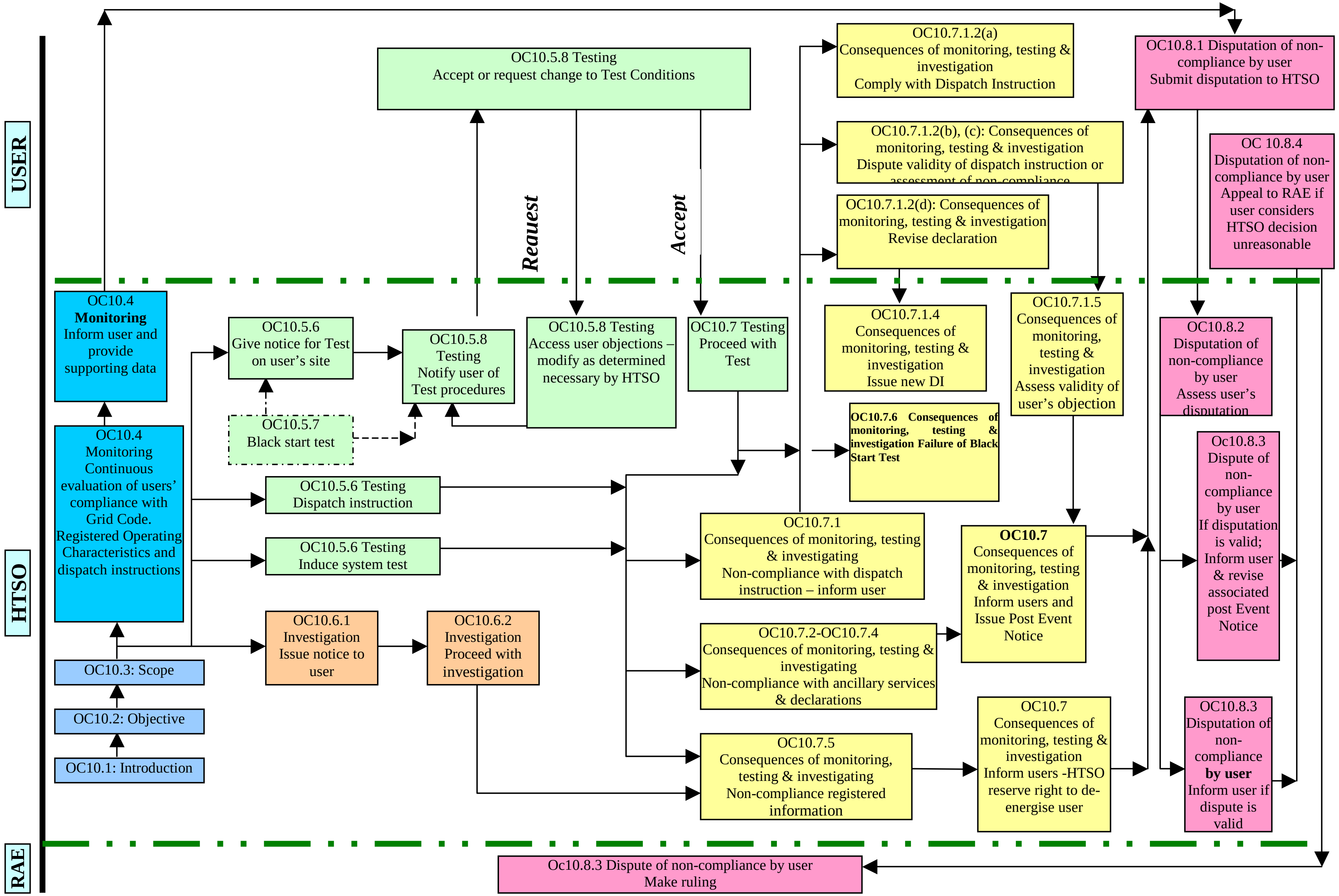

Figure 15 Overview of OC10

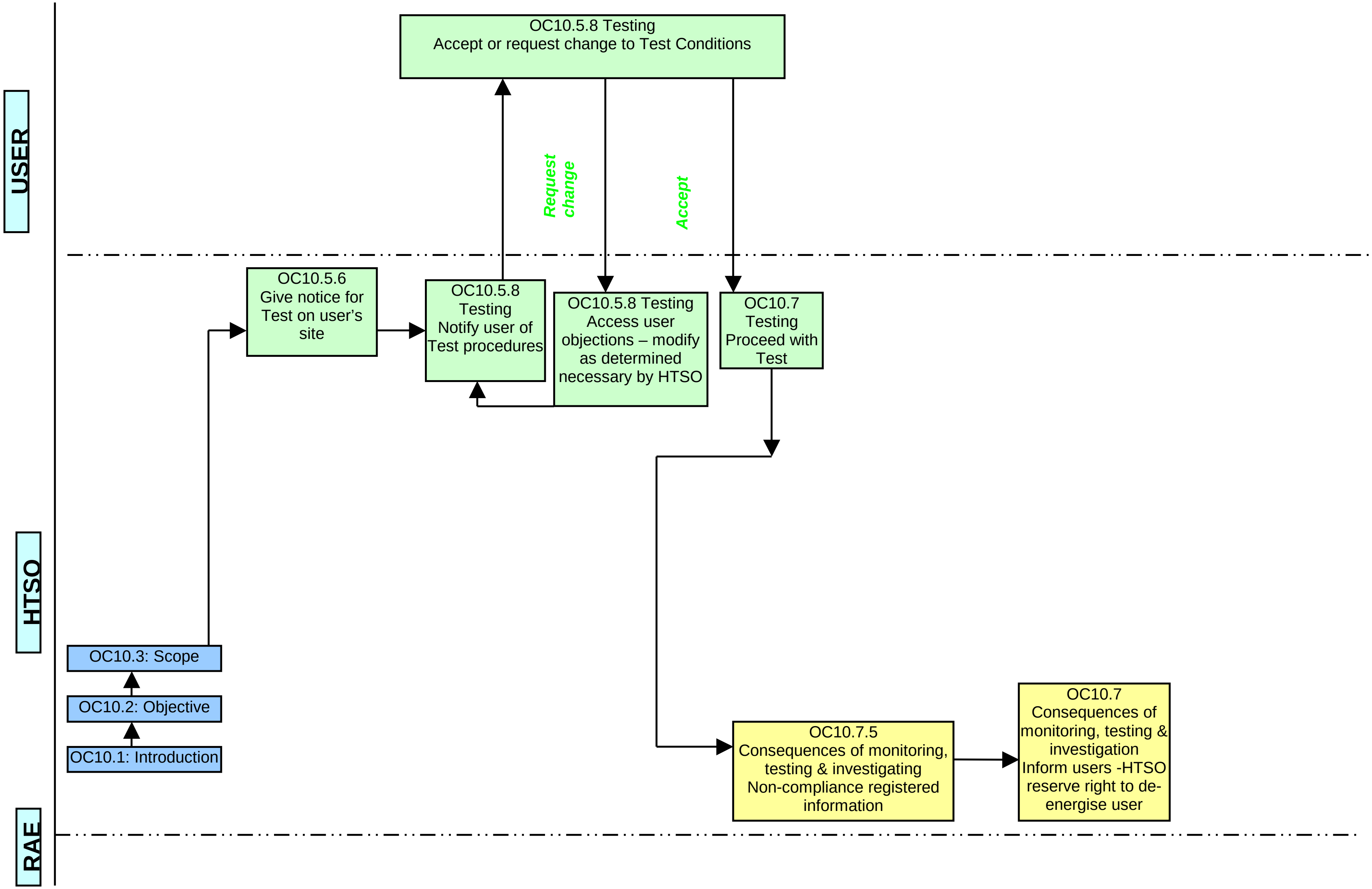

Figure 16   Procedure for scheduling Test at User's site

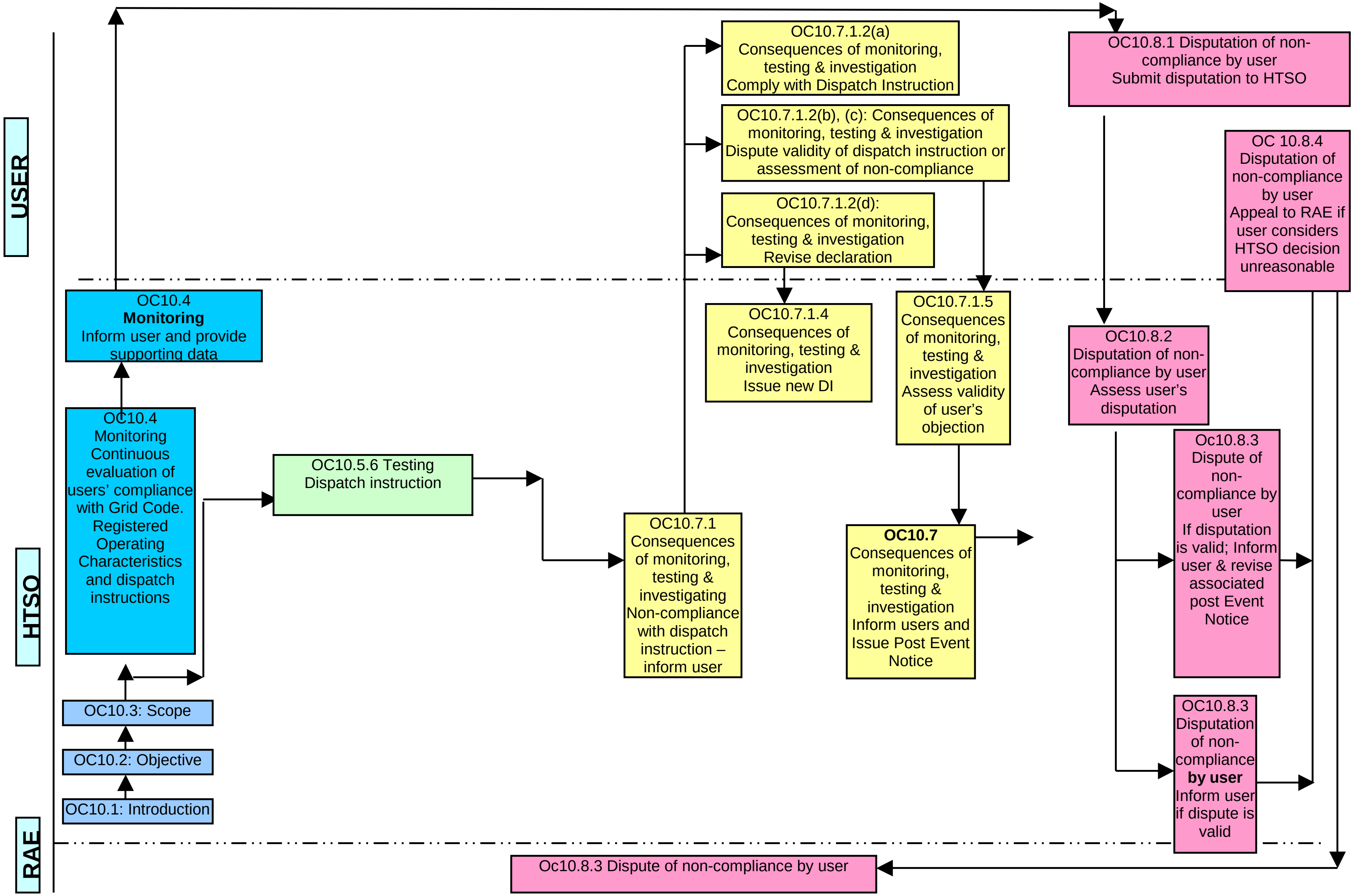

Figure 17 Non-compliance with dispatch instruction

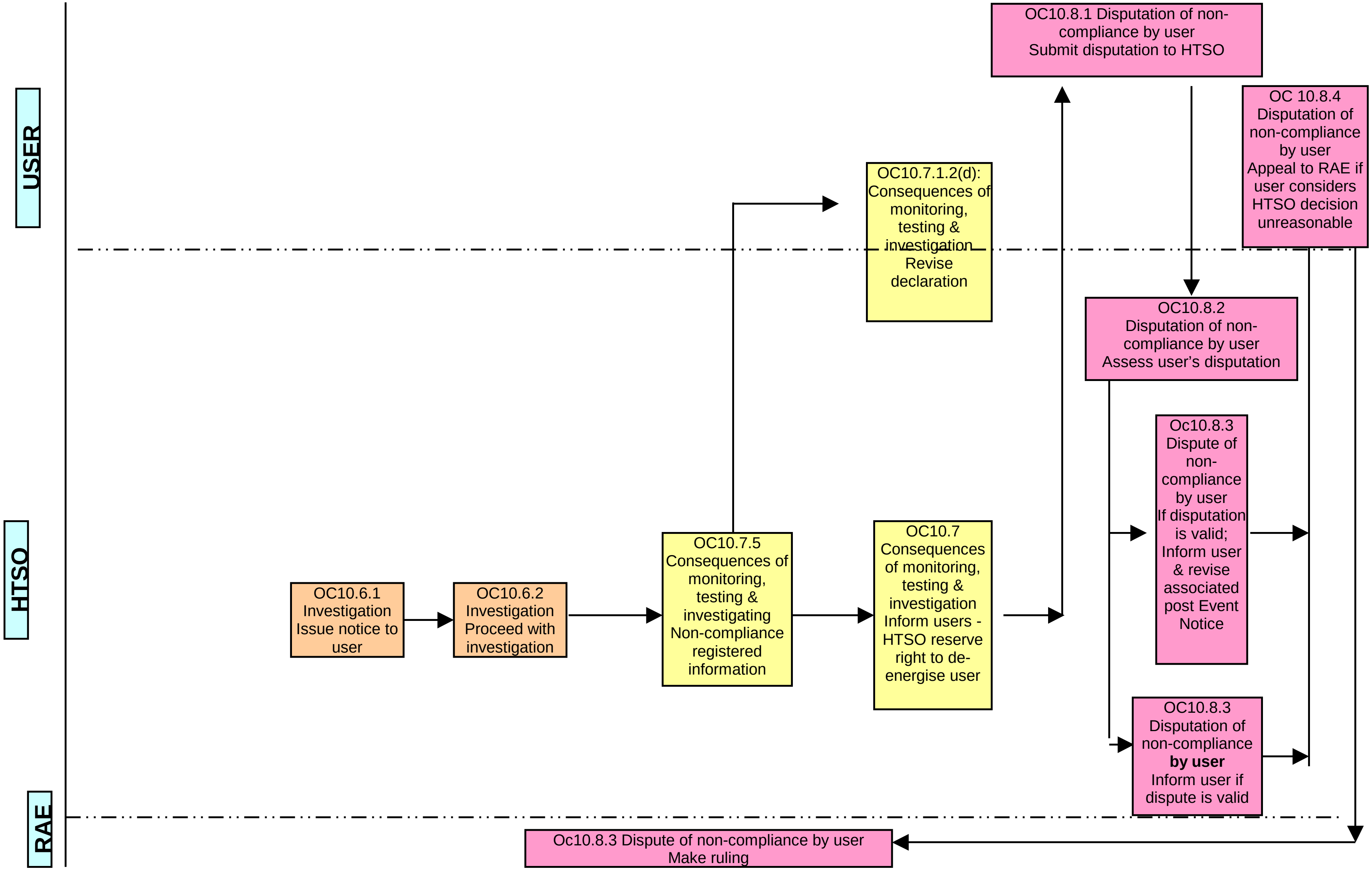

Figure 18 Procedure for investigation

17 OC11 OPERATIONAL TESTING

17.1 Description

OC11 deals with the responsibilities and procedures for arranging and carrying out operational tests that may have an effect on the systems of the HTSO and users. The primary objective of OC11 is to establish procedures for central co-ordination and control of an operational test required by the HTSO or a user, where such test will or may:

- Affect the secure operation of the transmission system
- Have a significant effect on the operation of the transmission system or a user's system
- Affect the economic operation of the transmission system or a user's system
- Affect the quality or continuity of supply of electricity to users

Examples of operational tests that a generator may wish to carry out are:

- Load rejection tests
- Simulated overspeed tests

Examples of operational tests that the HTSO may wish to carry out are:

- Tests involving the controlled application of Frequency and/or Voltage variations aimed at gathering information on Power System behaviour;
- Power System Restoration Tests;
- Testing of standing procedures for System Emergency Conditions and Alert conditions; and
- Testing or monitoring of Power Quality under various Power System conditions and Dispatch configurations.

Scheduling and dispatch of tests are done in accordance with SDC1 and SDC2. Figure 19 and Figure 20 summarise the processes in OC11. Figure 21 is a subsection of Figure 20 and highlights the relevant parts of OC11 when the test proposer rejects the proposed schedule and dispatch of HTSO. Figure 22 is also a subsection of Figure 20 and illustrates the role of other users in OC11 when a test is proposed by a user that will have an operational effect on them. Finally, Figure 23 outlines what happens when the HTSO rejects a test proposal.

17.2 Contents of Operating Code OC11

OC11.1	Introduction
OC11.2	Objective
OC11.3	Scope
OC11.4	Tests required by the HTSO
OC11.5	Tests required by users
OC11.6	Procedure for requesting operational tests
OC11.7	Evaluation of proposed operational tests
OC11.8	Approval for operational testing
OC11.9	Scheduling of operational tests
OC11.10	Dispatching of operational tests

OC11.11 Test reporting
OC11.12 Disputes

17.3 Other documents referenced

- Ancillary Services Agreement
- Connection Agreement
- Power Exchange Code
- Operational test procedures
- Application of frequency and voltage variations
- Power system restoration test
- Tests for standing procedures for system Alerts and system Emergency Conditions
- Power Quality Tests

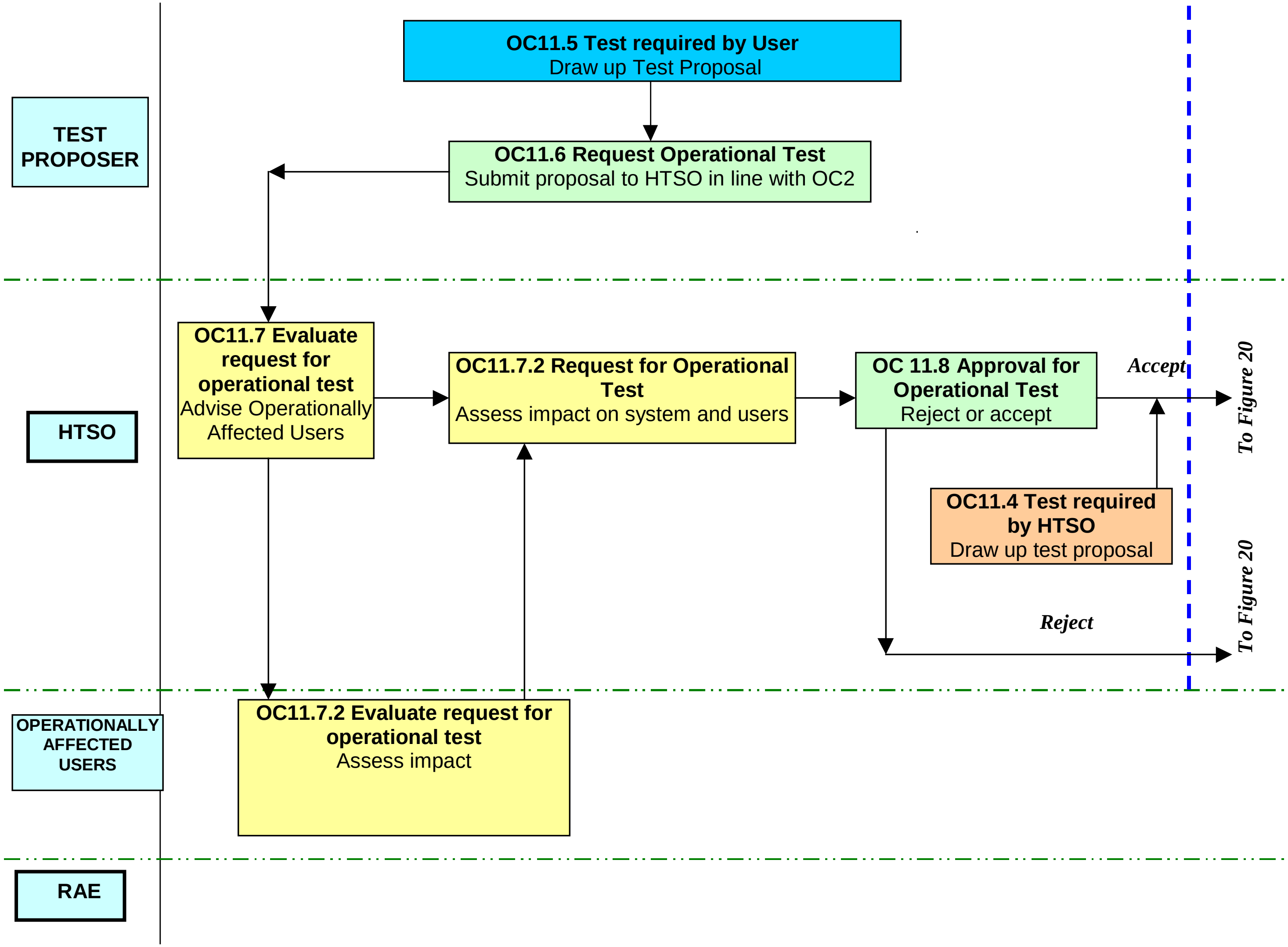

Figure 19 Overview of OC11 part 1

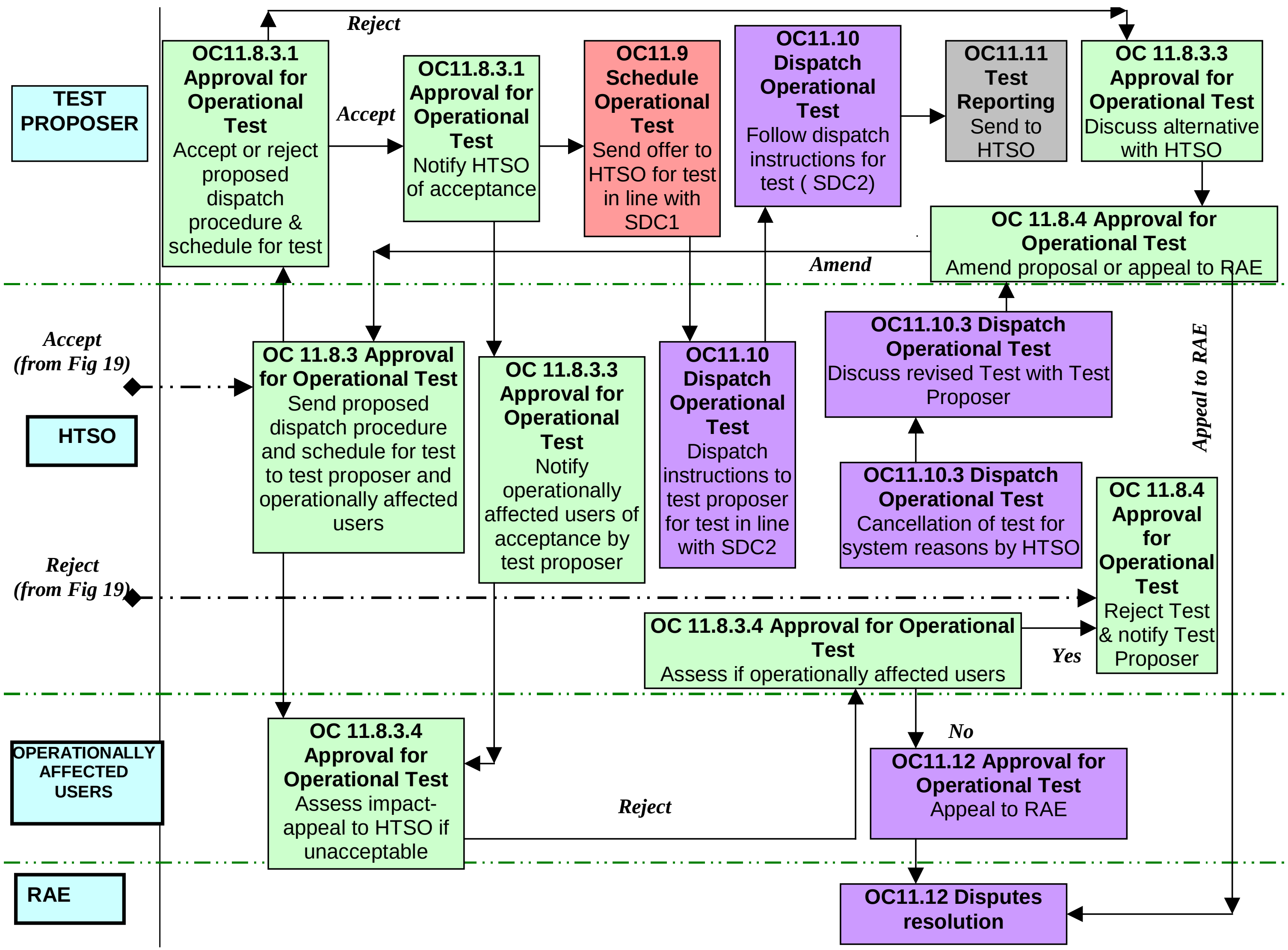

Figure 20 OC11 flowchart part 2

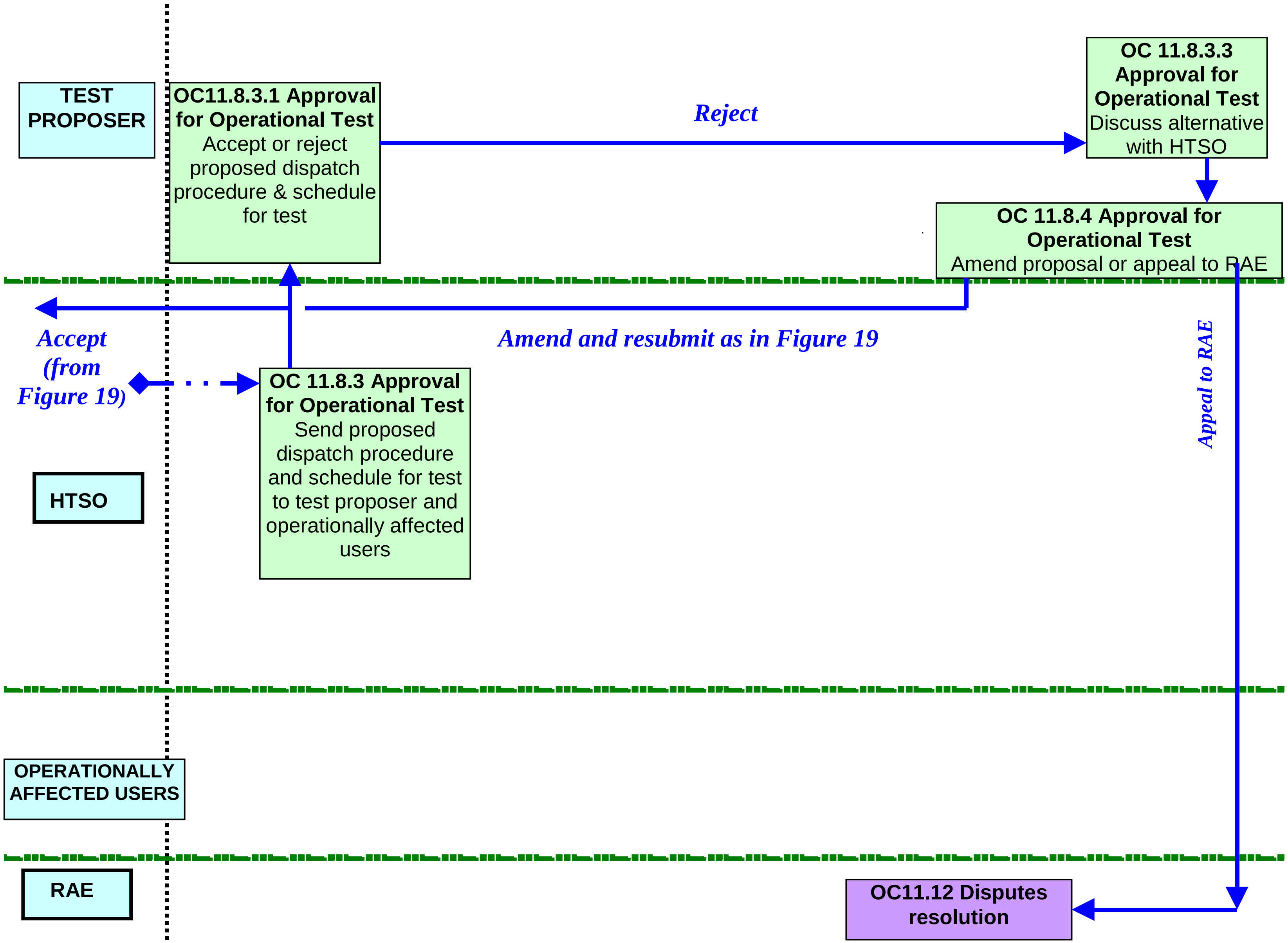

Figure 21 Procedure when Test Proposer rejects schedule and dispatch of HTSO

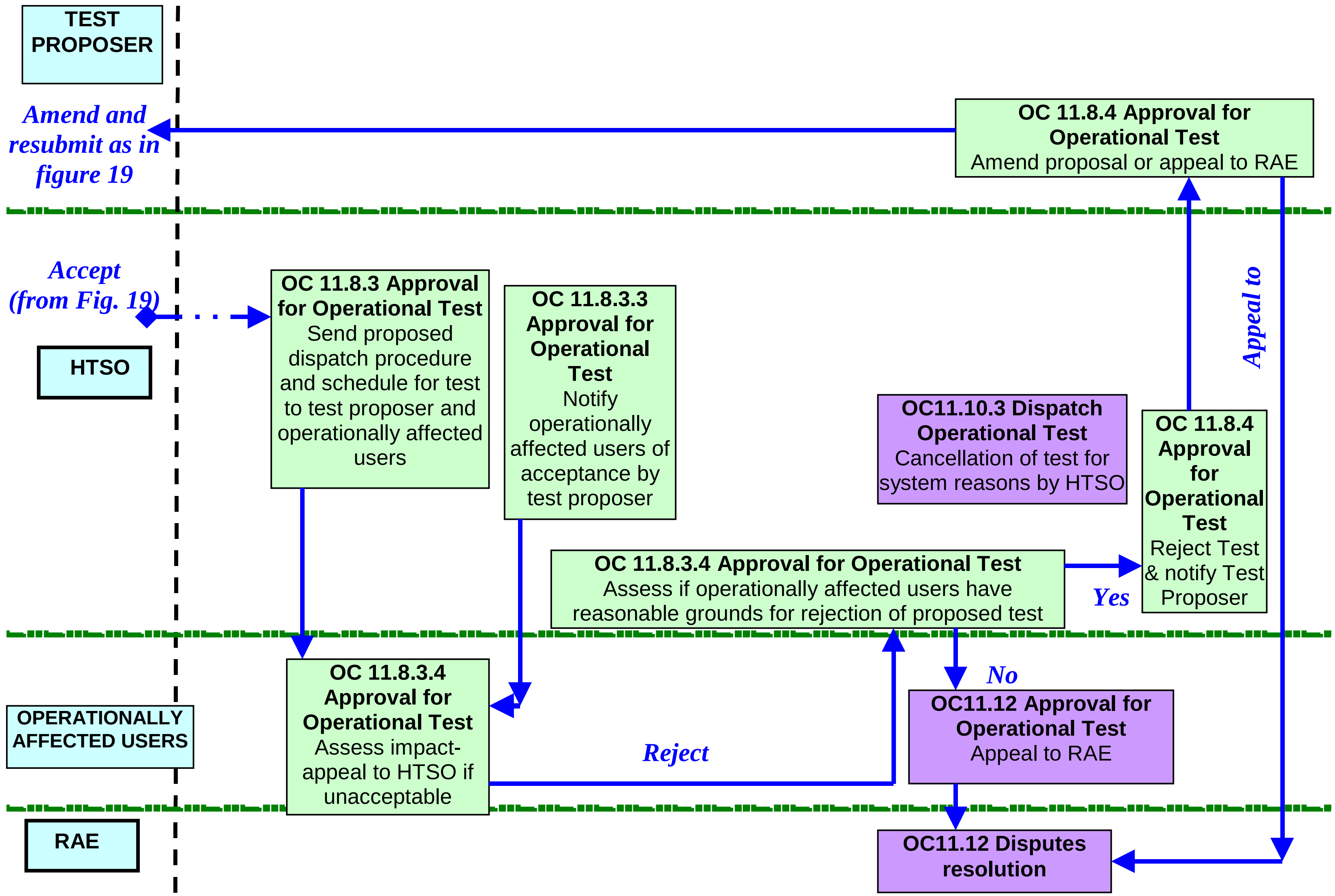

Figure 22 Objection by Operationally Affected Users

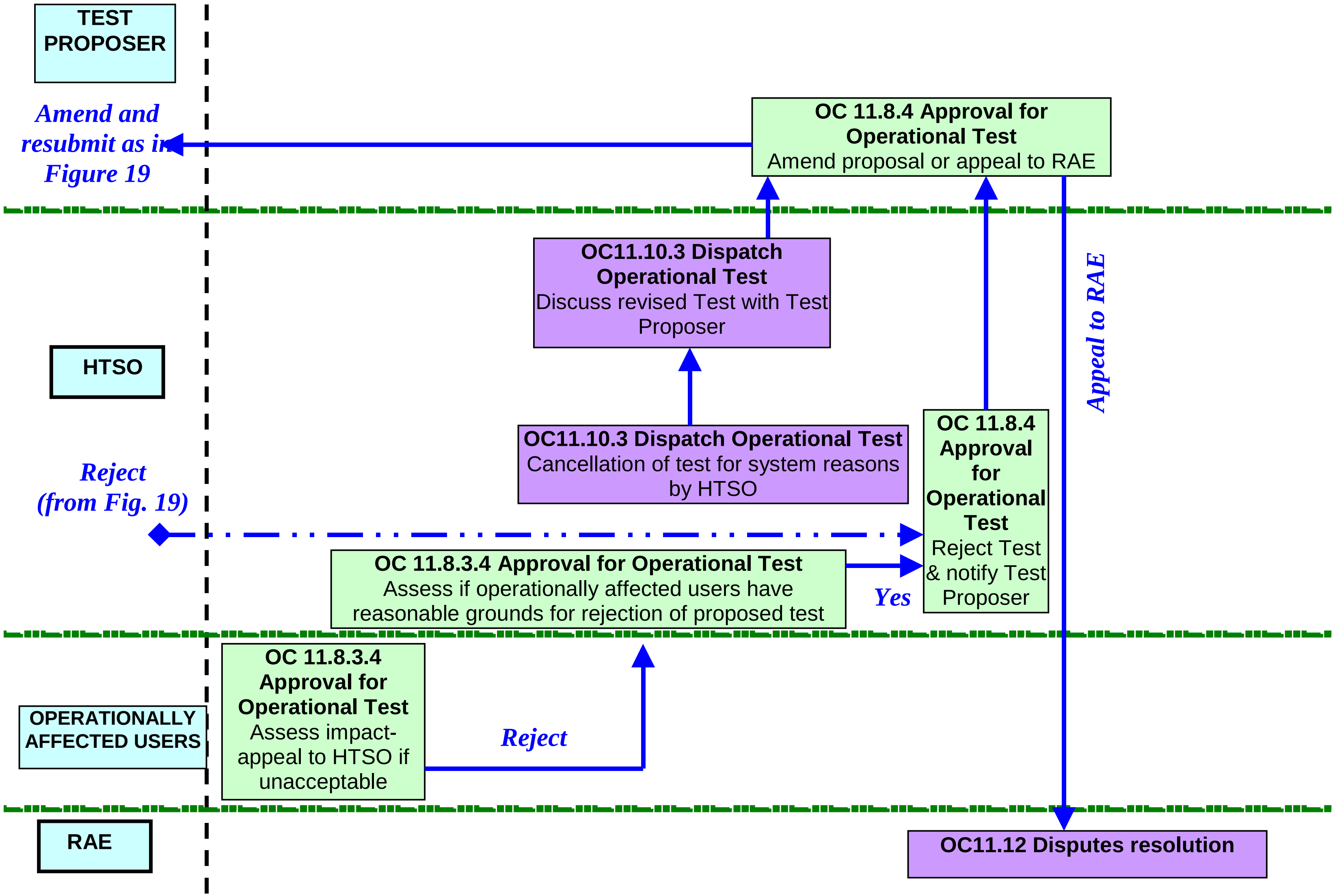

Figure 23   Summary of processes when HTSO rejects test proposal

18 OC12 EMERGENCY CONTROL AND POWER SYSTEM RESTORATION

18.1 Description

Normal operation of the transmission system by the HTSO, is in accordance with the principles and procedures as set out in the Operating Code and other authorisation obligations. However, there may be emergency situations when security of the transmission system is subject to abnormal levels of risk (e.g. during major lightning storms), OC12 provides for specific procedures to address such situations.

In extreme cases electricity supply systems have suffered partial or total shutdown. Collapses can result from a number of root causes, for example, due to a high number of plant failures (generation and/or transmission) from severe weather conditions and/or maloperation of protection systems. It is therefore necessary in the Operating Code to provide for procedures to deal with a partial or total shutdown of the transmission system, and to ensure that the necessary procedures and facilities are in place to support rapid re-establishment of the shutdown parts and restore supply to customers.

The objective of OC12 is to ensure that in the event of a partial or total shutdown of the transmission system, normal supply is restored to all customers as quickly and as safely as practicable in accordance with prudent utility practice. Generator authorisations include a provision requiring generators to offer reasonable terms for provision of black start capability when so requested by the HTSO. The HTSO may test the compliance of parties to the provisions of OC12 under the procedures defined in OC10.

Figure 24 shows the overall structure of OC12.

18.2 Contents of Operating Code OC12

OC12.1 Introduction

OC12.2 Objective

OC12.3 Scope

OC12.4 System alerts

OC12.5 Power system restoration

OC12.6 De-energisation of the user's plant by the HTSO

18.3 Other documents referenced

Power System Restoration Plan

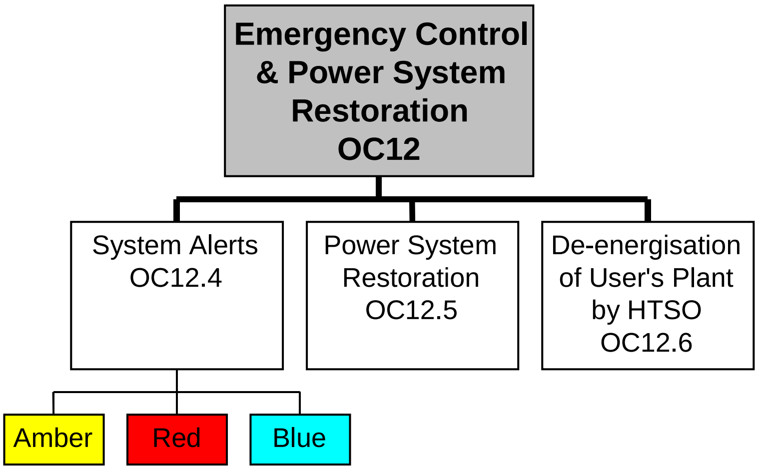

Figure 24 Overview of Emergency Control and Power System Restoration

19 OC13 SMALL SCALE GENERATOR CONDITIONS

19.1 Description

It is acknowledged that some sections of the Operating Code may not be relevant to some small-scale generators. Small-scale generators are defined by the HTSO, e.g., where total generation capacity from units on a single site is less than 5MW. In some sections of the transmission system deemed, in the sole opinion of the HTSO, to be critical, the threshold capacity to qualify as a small scale generator may be reduced to 2MW. This code, OC13, replaces some of the other sections with which such small-scale generators would not be required to comply and OC13 also indicates the clauses of the remaining sections that are relevant for all generators, regardless of size. An example of this is OC8, Generator Maintenance Scheduling. The HTSO needs information regarding seasonal load factors and running patterns from a small wind generator, for example, but does not need the level of detail requested in OC8.

19.2 Contents of Operating Code OC13

The items included in OC13 are:

OC13.1 Introduction
OC13.2 Objective
OC13.3 Scope
OC13.4 Outage scheduling
OC13.5 Changes to the committed outage programme within the implementation time frame
OC13.6 Other information to be notified
OC13.7 Network control

19.3 Other documents referenced

- Connection Agreement
- Operation Agreement

20 SDC1 GENERATION SCHEDULING

20.1 Description

In order for the HTSO to fulfil its obligations with respect to the scheduling and dispatch of generators, the HTSO require timely and accurate information relating to generation and supply arrangements. SDC1 establishes procedures whereby the necessary information is made available to the HTSO. SDC1 also specifies the procedures to be followed by the HTSO when issuing a generation schedule for the trading day and the responsibility to issue a demand forecast.

The objectives of SDC1 are to provide generators with indicative dispatch levels for the following day so that units will be available in the correct time scale to enable the HTSO to dispatch them pursuant to SDC2, whilst maintaining the operating margin and the desired flows on the interconnectors.

Any changes to the market rules will impact on SDC1 and require appropriate revision. Figure 25 gives an overview of the scheduling process.

20.2 Contents of SDC1

SDC1.1 Introduction
SDC1.2 Objectives
SDC1.3 Scope
SDC1.4 Demand forecast
SDC1.5 Declarations by generators
SDC1.6 Daily nominations
SDC1.7 Communication of declarations
SDC1.8 Communication of daily nominations
SDC1.9 Available transfer capability (ATC) for the interconnector
SDC1.10 Production of generation schedule (GS)
SDC1.11 Procedure to be followed in the absence of a daily nomination

20.3 Other documents referenced

- Power Exchange Code

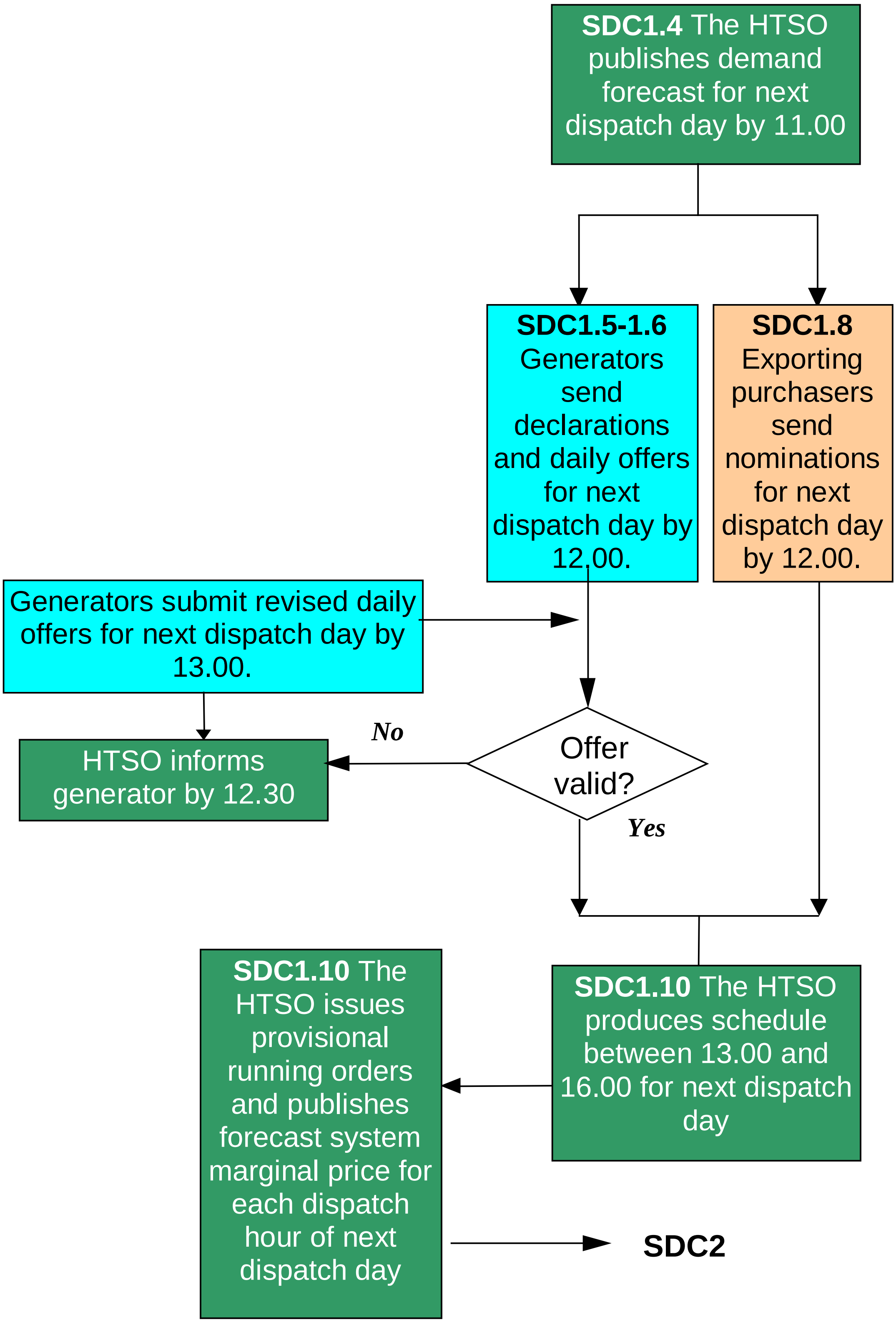

Figure 25 Overview of Generator Scheduling

21 SDC2 GENERATION DISPATCHING

21.1 Description

In order for the HTSO to meet its authorisation obligations with respect to scheduling and dispatch of generation such that available generation is matched to demand, it is necessary to have a structured process of dispatch for all users that may be required to respond to instructions from the HTSO.

SDC2 details the process whereby the HTSO uses the generation schedule and data provided by users to decide upon which generation to dispatch. SDC2 also outlines procedures to be followed by the HTSO and users when communicating on the dispatch instructions. It should be noted that OC2 specifies information exchange requirements and procedures between the HTSO and generators. The appendix to SDC2 gives the form of words to be used when issuing a dispatch instruction. The overall structure of SDC2 is summarised in Figure 26.

21.2 Contents of SDC2

SDC2.1 Introduction
SDC2.2 Objective
SDC2.3 Scope
SDC2.4 Data and process
SDC2.5 Dispatch instruction to generators
SDC2.6 Generation synchronising and de-synchronising times
SDC2.7 Generator active power dispatch
SDC2.8 Generator reactive power dispatch
SDC2.9 Generator operating mode dispatch
SDC2.10 System alerts
SDC2.11 System emergency conditions
SDC2.12 Failure to comply with dispatch instructions

21.3 Other documents referenced

Power Exchange Code

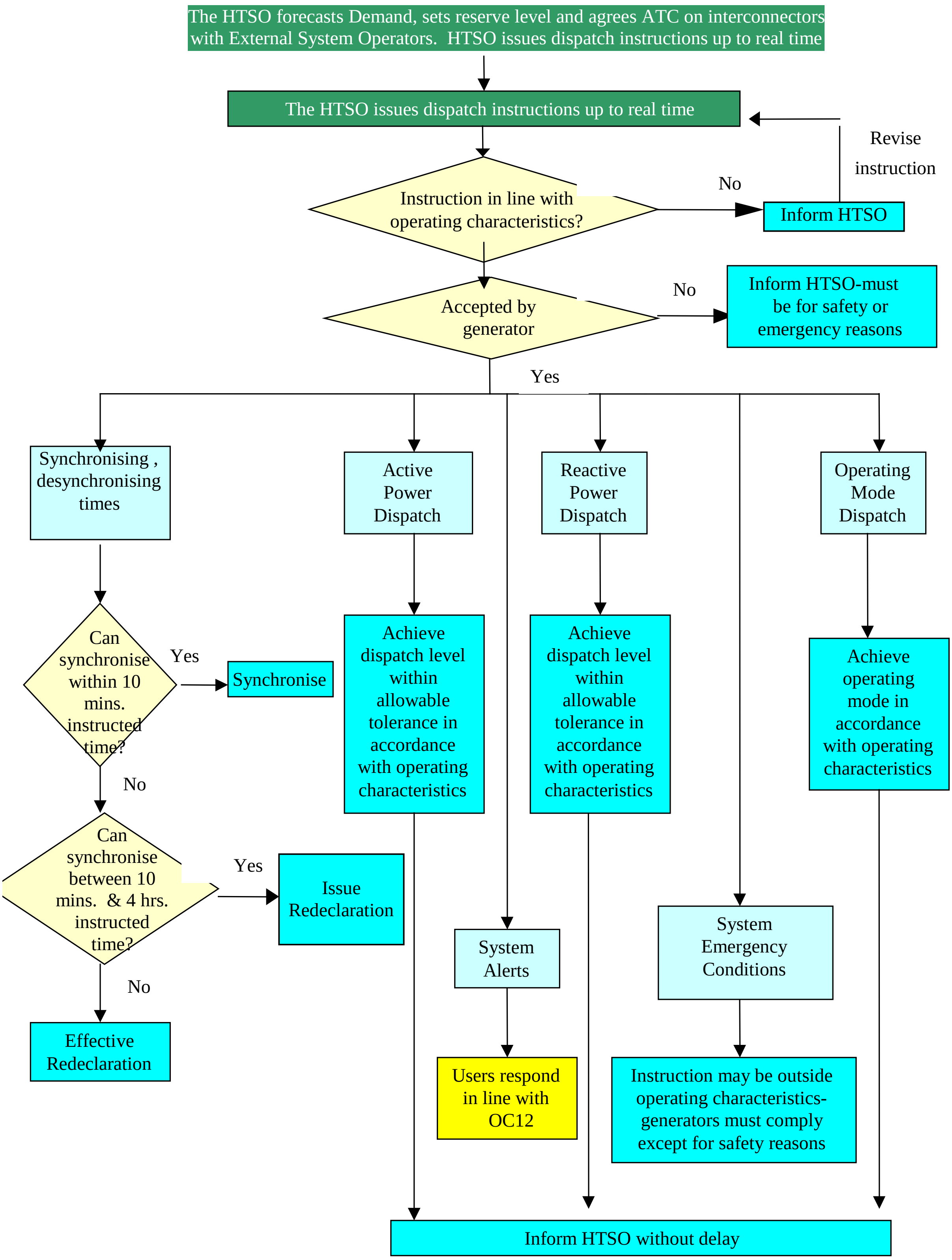

Figure 26 Overview of Generator Dispatching

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22 SDC3 SPECIAL SCHEDULING PROVISIONS

22.1 Introduction

In order for HTSO to fulfil its obligations with respect to the scheduling and dispatch of generators, HTSO shall follow the procedures of SDC3 in the event of certain particular circumstances. These include congestion relief, irrigation constraints, minimum demand provisions, scheduling of hydro dispatch groups and priority scheduling of renewable generation and indigenous generation units.

In the event of congestion occurring or being anticipated by the HTSO on the transmission system, notification of irrigation constraints to the HTSO by users or in the event of minimum demand conditions, HTSO will endeavour to reschedule of generators to alleviate any subsequent problems. Rescheduling will be done taking into consideration the daily offers submitted by the generators and the integrity of the transmission system.

The process for issuing instructions pursuant to SDC3 shall be in accordance with the provisions of SDC1 and SDC2. The provisions of SDC3 do not in any circumstances supersede the provisions in SDC1 and SDC2.

Figure 27 and Figure 28 summarise the processes for generators with irrigation constraints and generators with hydro generation units that they wish to be considered as a single group for dispatch purposes by the HTSO.

22.2 Contents of SDC3

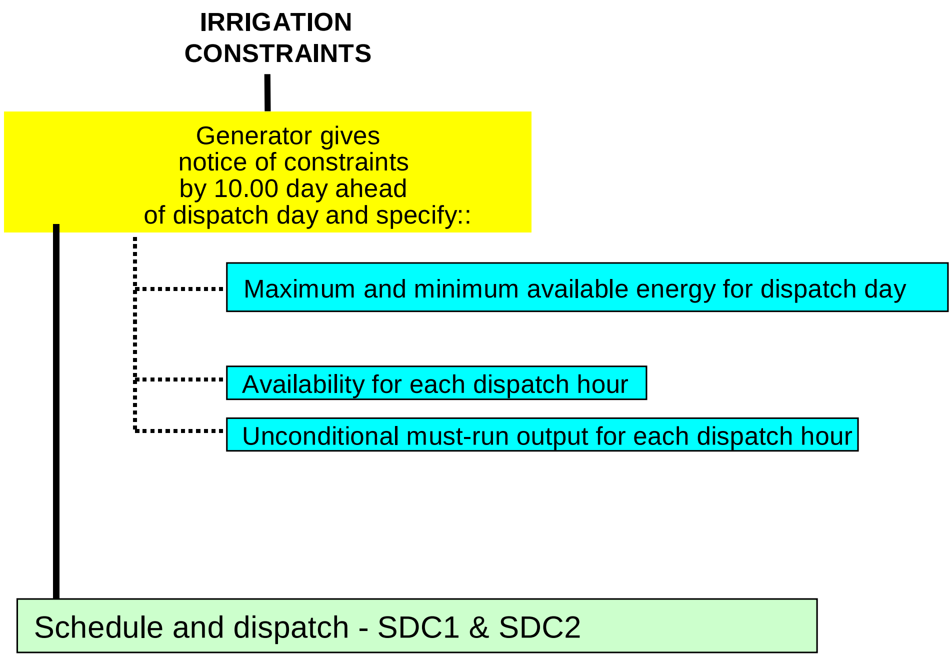

Figure 27 Irrigation constraints

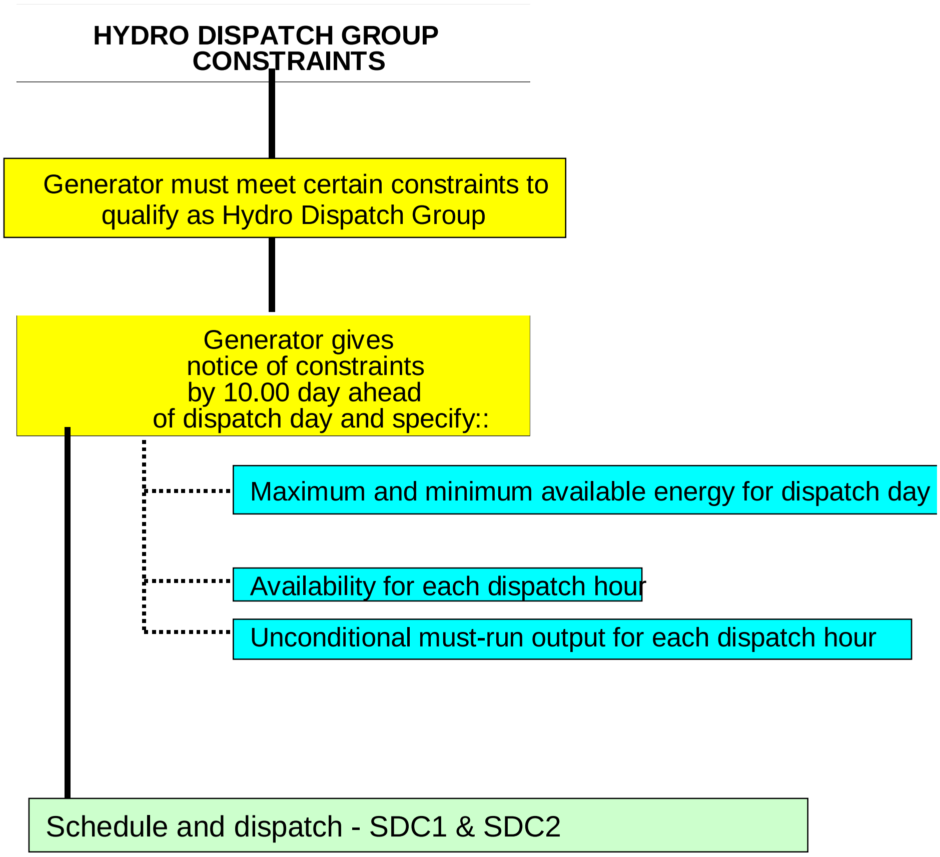

Figure 28 Hydro Dispatch Group Constraints

23 CONCLUSION

The sections of the Operating Code that define the technical rules for licensed users to access the transmission system operated by the HTSO have been presented. The Operating Code relates to other documents including authorisations, the Power Exchange Code, agreements between the HTSO and network operators, agreements with interconnected system operators, etc. A number of documents are also needed to implement the provisions of the Operating Code. These include operational policies and procedures, test procedures, and operational and planning standards.

The Operating Code is a technical document and does not address commercial issues such as penalties for non-performance of generators, violation of dispatch instructions, failure to meet ancillary service requirements, etc. These are dealt with in the Power Exchange Code, ancillary service agreements, connection agreements and other agreements.