

CONNECTION NETWORK CODES – RESPONSE TO THE COMMENTS RECEIVED DURING THE PUBLIC CONSULTATION OF THE DRAFT REVISED IMPLEMENTATION GUIDANCE DOCUMENTS (2023)

Period of consultation: 16/01/2023- 16/02/2023 (found [here](#))

From: Steering Group Connection Network Codes

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1. Introduction

Overview of connection codes

The European Connection Network Codes - [Requirements for Generators \(RfG\)](#), [Demand Connection Codes \(DCC\)](#) and [High Voltage Direct Current Connections \(HVDC\)](#) – have been developed in accordance with Regulation (EU) 714/2009 and are cornerstones to fulfil the internal market for electricity (IEM Regulation) third.

The first connection network code, which entered into force on 17 May 2016, is the Commission Regulation (EU) 2016/631 of 14. April 2016 establishing a network code on requirements for grid connection of generators (RfG). The Commission Regulations on DCC and HVDC followed after that - (EU) 2016/1388 of 17. August 2016 establishing a network code on demand connection (DCC), entering into force on 18 August 2016, and the Commission Regulation (EU) 2016/1447 of 26. August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules (HVDC), entering into force on 8 September 2016 respectively.

In order to support the implementation of network codes at national level, and as required by the codes, ENTSO-E has produced non-binding guidance on implementation, which are also consulted by the stakeholders. This guidance is provided through so-called Implementation Guidance Documents (IGDs).

Legal background for IGDs

Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (RfG), (Article 58), Commission Regulation (EU) 2016/1388 of 17. August 2016 establishing a network code on demand connection (DCC) (Article 56) and the Commission Regulation (EU) 2016/1447 of 26. August 2016 establishing a network code on requirements for grid connection of high voltage direct current systems and direct current-connected power park modules (HVDC) (Article 75) – Non-binding guidance on implementation - stipulate:

- 1. No later than six months after the entry into force of this Regulation, the ENTSO for Electricity shall prepare and thereafter every two years provide non-binding written guidance to its members and other system operators concerning the elements of this Regulation requiring national decisions. The ENTSO for Electricity shall publish this guidance on its website.*
- 2. ENTSO for Electricity shall consult stakeholders when providing non-binding guidance.*
- 3. The non-binding guidance shall explain the technical issues, conditions and interdependencies which need to be considered when complying with the requirements of this Regulation at national level.*

ENTSO-E and its dedicated body Steering Group Connection Network Codes (CNCs) produced several Implementation Guidance Documents (IGDs) in topics that were important and in cases complex to support the national implementation of the CNCs.

Last set of IGDs was published in 2021 and complying with the maintenance period as mentioned above in the extract of the Regulation, Steering Group CNC has reviewed the IGDs and provided first revisions.

The revised drafts were submitted for a public consultation from 16 January 2023 until 16 February 2023.

Objectives of IGDs

The main objective of the implementation guidance is to support system operators in the process of determination on national level of non – exhaustive requirements during the national implementation. The objectives of the implementation guidance documents are:

- to facilitate a common understanding of technical issues specified in the connection network codes, in context of new technologies and new requirements (e.g. synthetic inertia)
- to deliver broader explanations and background information and to illustrate interactions between requirements,
- to recommend coordination/collaboration between network operators (TSO) where either explicitly required by the connection codes or reasonably exercised from a system engineering perspective,
- to give guidance to national specifications for non-exhaustive requirements, and
- to express the need of further harmonisation beyond what is requested by the CNCs when reasonable from a system engineering perspective.

List of IGDs subject to the consultation

No	Titles of IGD	Status	Short descriptions
1	Compliance Verification - Using Electrical Simulation Models	Updated	<p>The scope of the present document is to guide the RSOs and if applicable the relevant TSO on the application of simulation models in the process of demonstrating compliance partly or completely and to make guidance on the mandatory and supplementary onsite tests required to demonstrate full compliance with the grid connection requirements for granting a grid connection and the operational notification according to the signed connection agreement.</p> <p>The scope of the document does not include the specifications for issuing certificates on simulation models as this is up to the relevant standardization bodies and the authorized certifiers and</p>

			authorized laboratories to agree on a harmonized set of conditions and specifications for issuing certificates on simulation models applicable for demonstrating compliance according to the relevant CNC.
2	Compliance Verification - Compliance Monitoring after final operational notification	Updated	<p>The scope of the present document is to guide the RSOs and if applicable the relevant TSO on the application of compliance monitoring in the process of securing compliance of the grid connection requirements for carrying the operational notification according to the signed connection agreement. It also emphasizes the strong obligation of the power-generating facility owner to support the RSO unsolicited throughout the compliance monitoring procedure by provision of all necessary information about the relevant facility and any changes of capabilities by modifications throughout the lifetime of the facility.</p> <p>This guidance document is addressing the phase after a facility have been accepted for operation.</p>

2. Individual comments

Compliance Verification - Using Electrical Simulation Models

Commenter	Type of comment	Comment and proposal	Accepted/ Rejected	Remarks
EU DSO Entity	Clarification	Large Networks - not a very clear title. What does "large" mean in this context	Accepted	The "large networks" in this case it means that a part of medium or high voltage grid is represented in the EMT environment.
	Clarification	Are other forms of prime mover apart from turbines not needed?	Accepted	The text has been updated: "Dynamic RMS model of turbine-governor and other prime movers"
	General	Are we supposed to know what the WECC is? Could a link to it be provided?	Rejected	WECC stands for Western Electricity Coordinating Council in the US. This reference has been taken from Expert Group Interaction Studies and Simulation Models (EG ISSM)
	Technical	For Type A the EqC can often certify the PGM in its entirety. The para third from the bottom states the opposite and is not generally true.	Rejected	(1) Article 40, paragraph 1 from regulation states "The power-generating facility owner shall ensure that each power-generating module complies with the requirements applicable under this Regulation throughout the lifetime of the facility. For type A power-generating modules, the power-generating facility owner may rely upon equipment certificates, issued as per Regulation (EC) No 765/2008."; (2) It is the equipment certificate not the entire module certificate.
		In the 4th para it is not clear what the obligation is for RSOs to specify a list of accepted EqCs. Where is this obligation?	Accepted	The text has been updated: "The detailed list of compliance tests and simulations to be foreseen in EqCs may be specified at a national level"
		There is no need for the voltage criterion here, (or in the next line) - by definition Art 14 only applies to <110kV	Rejected	The specified voltage level is informative.
EUGINE	Technical	The measurement institute and certification body must be accredited, manufacturer's products must be proved to be Grid code compliant. However, the requirements on simulation software are missing. Proposal The simulation software should be proved to be reliable for Grid code simulation analysis. 1) The grid code simulation must be kept software neutral. i.e. Simulation software must be compliant to a common standard, that models can be transferred among accredited simulation software. The simulation results are valid regardless which software imports the model.	Rejected	It has been considered that requirements of simulation software are out of the scope of this document and, in case of any requirement is established, it should be done at national level.

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		<p>2) Accreditation or certification of simulation software should follow a common, compatible interface.</p> <p>3) Simulation software manufacturers shall guarantee that new software revisions are backward compatible with older versions; existing validated simulation models will therefore remain usable without additional efforts or investigations.</p>		
	Technical	<p>The concepts of NPGU, NPPGU, PPGU and SPPGU could be substituted by ONE PPGU or PPU (Power Park Unit); this would reduce the variability and align with the two definitions in the NC RfG of SPGM and PPM).</p> <p>Proposal Delete the concepts of NPGU, NPPGU, PPGU and SPPGU, and substitute by PPGU (Power Park Generating Unit).</p>	Rejected	These definitions are the ones used in the IGD "General guidance on compliance verification – compliance testing and use of equipment certificates", and for consistency reasons are included in this document.
	Technical	<p>The definition of SPGM and SPGU hasn't been defined in the NC RfG in this way; an SPGM could be interpreted as EACH unit within a facility. This implies that accepting the given definition changes the interpretation some members states have regarding this definition. The proposal is to clarify this in one of the GC ESC or similar forums before implementing it in an IGD.</p> <p>Proposal Use the following definitions:</p> <p>'Synchronous power-generating module' or 'SPGM' means an indivisible set of components which can generate electrical energy such that the frequency of the generated voltage, the generator speed and the frequency of network voltage are in a constant ratio and thus in synchronism; each synchronous power generating unit (SPGU) will be considered a synchronous power generating module (SPGM); SPGU and SPGM shall be used interchangeably.</p> <p>'Synchronous Power generating unit' or 'SPGU' shall be used interchangeably with SPGM.</p>	Rejected	<p>(1) It is defined in IGD - GENERAL GUIDANCE ON COMPLIANCE VERIFICATION – COMPLIANCE TESTING AND USE OF EQUIPMENT CERTIFICATES.</p> <p>(2) We should focus on the IGD instead of doing it on RfG.</p>
	Technical	<p>The simulation model definition given in this section refers to the FACILITY. Proposal: change to "Facility simulation model" instead of "simulation model". This is to avoid confusions later on in case this definition is included in further version of the NC RfG or grid codes.</p> <p>Proposal Change to "Facility simulation model" instead of "simulation model". This is to avoid confusions later on in case this definition is included in further version of the NC RfG or grid codes.</p>	Accepted	The word "facility" has been substituted with "PGM"
	Technical	<p>Simulation software manufacturers should be in fair competition</p> <p>The simulation model requirements must be simulation software neutral.</p>	Rejected	Totally agree, but there are no references to any specific software in the text. Thus, we consider that no change is needed.

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	Editorial	<p>The text states "The table attached to this report as Annex I is based..."; this is incorrect, as this is seen in section 1.15. Proposal: change to "The table attached to this report in section 1.15 is based..."</p> <p>Proposal Change to "The table attached to this report in section 1.15 is based..."</p>	Accepted	<p>The text has been updated: "The table attached to this report in section 1.12 is based...". The section numbering has been changed.</p>
	Technical	<p>The text states " A reduced order model in accordance with IEEE Std. 421.5 is preferred"; this will be an issue, as it is known that no generic AVR models are capable of the needed level of accuracy to properly validate a model for FRT capability. Proposal: change to " A reduced order model in accordance with IEEE Std. 421.5 may be insufficient, but may be used if the model has been validated accordingly"</p> <p>Proposal Change to " A reduced order model in accordance with IEEE Std. 421.5 may be insufficient, but may be used if the model has been validated accordingly"</p>	Rejected	<p>The existing sentence is clear, in our view. Besides, it has been taken from already published Expert Group Interaction Studies and Simulation Models (EG ISSM)</p>
	Technical	<p>The PSS requirement is ONLY applicable to units bigger than a certain size (member state dependent); the way it is presented in this section, it seems it is a MUST for ALL module types and sizes. Proposal: add the following "(b) Dynamic RMS model of PSS (Power System Stabilizer): when required, the model shall..."</p> <p>Proposal Add the following "(b) Dynamic RMS model of PSS (Power System Stabilizer): when required, the model shall..."</p>	Rejected	<p>Units with bigger size is covered by already mentioned in NC RfG Article 15. We understand that a PSS model is only going to be included in the SPGM model if it exists.</p>
	Technical	<p>The text states "The model shall simulate the turbine-governor including the actuators and valves with their specific curves"; the level of detail required is NOT needed for such GAS ENGINE models, as the key point is that the ELECTRICAL behaviour needs to be simulated; additionally, any curves specific to components (e.g. Turbo charger curves) are IP protected and cannot be shared. Proposal: change to "The model shall simulate the turbine-governor electrical behaviour and shall be validated accordingly"</p> <p>Proposal Change to "The model shall simulate the turbine-governor electrical behaviour and shall be validated accordingly"</p>	Rejected	<p>The proposed sentence is too general. In the text more detailed description is provided. Besides, it has been taken from already published Expert Group Interaction Studies and Simulation Models (EG ISSM)</p>
	Technical	<p>The text states "A model in accordance with IEEE or CIGRE is preferred"; this is NOT recommended for gas engines, as no specific models are available that could show the proper behaviour during dynamic events; similar to the AVR, this model would NOT capable of the required level of accuracy or to show actual behaviour during FRTs. Proposal: change to "A model in accordance with IEEE or CIGRE may be insufficient, but may be used if the model has been validated accordingly"</p>	Rejected	<p>In IGD we provide just recommendation according to the experience with the model. In the section we refer to large network studies that is why we prefer simplified models. Besides, it has been taken from already published Expert Group Interaction Studies and Simulation Models (EG ISSM)</p>

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		<p>Proposal</p> <p>Change to "A model in accordance with IEEE or CIGRE may be insufficient, but may be used if the model has been validated accordingly"</p>		
	Technical	<p>The validation of FRT models is performed in RMS. This model CAN be used for EMT simulations but performing an additional validation procedure to the existing one is not necessary and would imply considerable additional effort. Proposal: add the following extra letter "(k) The model validated against RMS measurements can be used for EMT simulations"</p> <p>Proposal</p> <p>Add the following extra letter "(k) The model validated against RMS measurements can be used for EMT simulations"</p>	Rejected	We disagree on such strong statement as it is not stated that validation of FRT model is performed in RMS or in any other particular way.
	Technical	<p>The text states "For type A, the installation document must include the EqCs and other relevant information"; this is not always correct, as not all member states required certificates. Proposal: change to "For type A, the installation document must include the EqCs (when applicable) and other relevant information"</p> <p>Proposal</p> <p>Change to "For type A, the installation document must include the EqCs (when applicable) and other relevant information"</p>	Accepted	The word "must" has been substituted with "shall". It is in line with RfG.
	Editorial	<p>The text states, "It at the discretion of the RSO to..."; Proposal: change to "It is at the discretion of the RSO to..."</p> <p>Proposal</p> <p>Change to "It is at the discretion of the RSO to..."</p>	Accepted	The text has been updated: "It is at the discretion of the RSO to..."
	Clarification	<p>The text states "- (wind turbine) equipment manufacturers will typically provide validation of the equipment (wind turbine) models to the owner"; why only "wind turbine"? This should be applicable to any manufacturer. Proposal: delete "(wind turbine)"</p> <p>Proposal</p> <p>Delete "(wind turbine)"</p>	Accepted	The IEC 61400-27-2 2020 (wind farms) is used as example "such as...". The words "wind turbine" have been deleted from the text and the words "wind farm" has been added in general description next to standard.
	Clarification	<p>The text states "- (wind turbine) equipment manufacturers will typically provide validation of the equipment (wind turbine) models to the owner"; The use of "equipment" is not clear, unless it refers to either a component, unit or module. Proposal: either define what "equipment" stands for or instead of "equipment manufacturers" it should read "power generation unit (PGU) manufacturers"</p> <p>Proposal</p>	Accepted	The word "equipment" has been deleted.

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		Either define what "equipment" stands for or instead of "equipment manufacturers" it should read "power generation unit (PGU) manufacturers"		
	Technical	<p>Steps 1 through 3 are usually performed BEFORE the UNIT has even been sold. It would be good to make clear that when existing certified models are available, these steps DONT need to be repeated; the models would be used for facility specific simulation studies. Proposal: add the text in RED "the following steps are usual when a third party is involved (steps 1 through 3 shall not be repeated in case a certified model for the corresponding unit is available):"</p> <p>Proposal Add the text in RED "the following steps are usual when a third party is involved (steps 1 through 3 shall not be repeated in case a certified model for the corresponding unit is available):"</p>	Rejected	If the existing certified model is available then this model has already gone through all steps, these steps describe the procedure to get validated model. The comment is acknowledged but it is considered that the steps do not request for repetition i.e., it is not being forbidden to use a certified model if the authorized certifier confirms that corresponds to the unit.
	Technical	<p>The text states: "4) Verification of compliance: The accredited laboratory shall use the simulation model to run the compliance simulations established in the evaluation programme and prepare a simulation report. The simulation report shall be provided to authorized certifier, to be issued the certificate of compliance"; this implies that ONLY an accredited laboratory could perform the simulations and create a report; this should not be the case, as external parties such as manufacturers or specialized companies (e.g. DIgSILENT) should be able to offer this service. Proposal: change text to "4) Verification of compliance: The simulation model shall be used to run the compliance simulations established in the evaluation programme; a simulation report shall be prepared by an external party (e.g. accredited laboratory, manufacturer, etc) . The simulation report shall be provided to authorized certifier, to be issued the certificate of compliance"</p> <p>Proposal Change text to "4) Verification of compliance: The simulation model shall be used to run the compliance simulations established in the evaluation programme; a simulation report shall be prepared by an external party (e.g. accredited laboratory, manufacturer, etc) . The simulation report shall be provided to authorized certifier, to be issued the certificate of compliance"</p>	Accepted	<p>The IGD does not impose that constraint, it is said "the following steps are usual when a third party is involved"</p> <p>Point 4 has been merged with point 3.</p>
EUTurbines	General	<p>"RfG Art 44 - Compliance tests for type B is today not applicable for simulation models: simulation models are requested only for type C and D (see art 15(6)(c)).</p> <p>It seems that some articles related to simulation models are missing. art 15(6)(c) (art 32(2)(e)) art 41(2); 41(3)(c)</p>	Accepted	The section 1.1 has been revised.

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		<p>Chapter 5 art 51 (note that there is reference to compliance simulation, but as per art 15(6)(c) simulation models are requested only for Type C and Type D generating units art 52 art 53 art 54 art 55 art 61</p> <p>Kindly revise applicable articles."</p> <p>Proposal Delete and add correct reference articles.</p>		
	Technical	<p>"""".. the RSO and where applicable the relevant TSO has the right to request the owner of power-generating facilities, demand facilities and HVDC facilities to carry out compliance verification tests and develop, maintain, and validate representative simulation models according to a compliance verification process.."""</p> <p>RfG does not have such requirements for Type A and Type plant. In addition, the RfG does not spell on how maintenance of the model is intended."</p> <p>Proposal Type A and B technologies are not requested to provide a simulation model, according to RfG. The statement should be amended to reflect such scenarios. The different approach can have an impact on the approach used by manufacturers and associated costs.</p>	Accepted (partially)	It is an introduction, a general overview without any details distinguishing categories.
	Technical	<p>""""... 1. Authorized certifiers to issue the relevant Equipment Certificate (EqC) as requested by the facility owner with the purpose of partly or completely demonstrating the compliance of components, units or modules with the required functionalities and capabilities based on the specifications in the relevant CNC and the corresponding national implementation and based on compliance tests and/or simulations.."""</p> <p>This sentence needs a complete revision. EqCs is not necessarily provided at the beginning of the process and not just based on a simple requested by the facility owner.</p> <p>Not all generating units or equipment, or component are expected to have an EqCs. The process to achieve the EqCs could happen during the on-site tests, and it could be an extensive process involving appropriate testing.</p>	Accepted (partially)	The text has been updated.

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		<p>EqCs are eventually available for some generating unit, but they are not available for BoP components (step-up trafo EqCs? MV&LV distribution EqCs?) EqCs contents are not harmonized among MSs, including acceptability, who is accredited to issue them etc.</p> <p>Following points (2, 3 and 4) need also a revision. Or remove the process and specify only relevant sentence.</p> <p>The description is an incorrect description and not necessarily in line with present practice."</p> <p>Proposal This process needs a complete revision. The way as it is described does not reflect typical steps (at least temporarily) and create confusion. Therefore, we recommend to remove this description or strongly revise it in cooperation with stakeholder that are facing the process (certifiers and manufacturers).</p> <ol style="list-style-type: none"> EqCs are issued by certifier to manufacturers. This covers apparently the test activities up to the FON (Final Operation Notification) Consider compliance simulation models as if issued after the FON, but in reality, they are already in use to issue EqCs as described in (1.) and part of the validation test in (2.) 		
	General	The scope should have included minimum information that simulation should cover. In fact, this is the basis for the model to be used to assess compliance. We recommend to use the wording "validation)	Rejected	We have minimal information in the Scope of the document. The comment should be more specific, and it is not provided any proposal.
	Technical	<p>We disagree on some of the acronym proposed since they are NOT in line with RfG definition. To introduce new acronym can create unnecessary confusion being them misaligned with other reference and binding documents.</p> <p>Proposal Remove all acronym which are not aligned with RfG (such as NPGU, PPGU, SPPGU).</p>	Rejected	It is complete list of acronyms. We need these definitions in IGD. Acronyms are the ones used in the IGD "General guidance on compliance verification – compliance testing and use of equipment certificates", and for consistency reasons are included in this document
	Technical	<p>Modify "simulation Model" definition to "Facility Simulation Model". The content of the definition is also too generic and it can be said this can create issues. There is also no definition of model content and model structure.</p> <p>Proposal</p>	Accepted (partially)	The detailed simulation model is used.

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		Remove "simulation model" as an additional definition. This definition is too generic and provide no added value as it is written. It can be added eventually Facility simulation model to avoid confusion, but then additional clarification (to distinguish from a generic model is expected). It could be interesting to add "simplified" simulation model (text proposal to be added).		
	Technical	"The RSO in corporation with the relevant TSO is responsible for specifying the minimum set of requirements for providing the facility simulation model. It is expected that the minimum set of requirements shall be reasonable and in line with typical available information. It is recommended to that RSOs coordinate and harmonize requests so that they can be found. It is also recommended that the requests for information are structured in a format which is easy to be completed and make sense, not just a proforma." Proposal To be added sentence covering recommendation on how RSOs shall approach definition of requirements for models. Note: the model requirement needs to be limited as such that simplified model can be used. Complex models require specific knowledge and environment to be properly used and have in general compatibility issues when it comes to importing them in different simulation environment. It is also recommended the use as much as reasonable a common/harmonized approach when it comes to specify such requirements; this will improve data gathering and uniformity of information. Data gathering shall also be structured in a user-friendly manner, to facilitate the data collection.	Rejected	The RSO defines the requirements of the models since the RSO has to use it later in grid models. For sure the defined requirements will be mutually discussed with the FPGO in the individual project.
	Technical	Maybe this is too simplified. It seems to just refer to a simple component and does not reflect the reality associated to complex facility. This chapter either need to be enlarged with more detailed information a reasonable best practice or to be deleted Proposal Recommended to be deleted	Rejected	It is important to mention in the IGD to have and to require a documentation. For sure this section can only be written non-exhaustively. Scope of documentation can be clarified in the project.
	General	This chapter does not provide any value added. Either the chapter shall be better detailed (with some recommended best practice or examples or reference to EGs) or deleted. Proposal	Rejected	It does not harm to mention that the documentation of the models is requested but this should be done anyway and bilaterally agreed.

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		Recommended to be deleted		
	Technical	<p>"(b) Dynamic RMS model of PSS (Power System Stabilizer): The model shall simulate the PSS and be fit for ... hysteresis). A reduced order model in accordance with IEEE Std. 421.5 is preferred. "</p> <p>PSS is installed only in big power plant... Only if applicable (recommended to add in the intro that model of installed/applicable component...)</p> <p>Proposal Add at the beginning of the chapter that only applicable models need to be provided.</p>	Rejected	PSS is referred to RfG art. 15(6)(c)(ii), so for type C. That is mentioned in the first section of this IGD 1.10.2. We understand that a PSS model is only going to be included in the SPGM model if it exists.
	Technical	<p>"(c) Dynamic RMS model of turbine-governor: The model shall simulate the turbine-governor including the actuators and valves with their specific curves. It shall be fit for small-signal stability simulations as well as for rotor angle transient stability simulations and include the initial response of the turbine-governor in the seconds following a grid disturbance or islanding (e.g. the concept of fast-valving) and be fit for grid frequency deviations within +/- 5 % from the rated frequency. The model shall also contain internal limiters, dead bands and where applicable automatic switch-over between power control and speed control. A model in accordance with IEEE or CIGRE is preferred."</p> <p>IEEE and CIGRE models do not include valve and valve actuators representation. Governor models do not represent valve and actuators behaviours.</p> <p>Proposal Recommended to modify the wording in this way:</p> <p>(c) Dynamic RMS model of turbine-governor: The model shall simulate the turbine-governor including the actuators and valves with their specific curves. It shall be fit for small-signal stability simulations as well as for rotor angle...</p> <p>The representation of valves and actuators does not necessarily provide any value added in term of model fidelity for Gas Turbine technology, in fact they are not considered in IEEE and CIGRE models; they could be part of model representation of other technology like steam turbine or hydro unit. Adding specific reference to component can create unnecessary complexity to the model and complex explanation without improving the model quality itself.</p>	Rejected	Depends: 1.10.2(c) obviously is only applicable for steam turbines. For gas turbine models it needs to be rephrased or kept more generally. it has been taken from already published Expert Group Interaction Studies and Simulation Models (EG ISSM)

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	Technical	The model shall correspond to the installed hardware.	Rejected	We consider that this is covered by the definition of simulation model in 1.5.
	Technical	"...the RMS simulation models of PPMs shall include the following points: (c) be open source/standard generic model for cross border network stability studies;" Proposal Add reference standards for PPM generic models as provided for SPGMs.	Rejected	The ISSM report does not mention a standard for PPM models, only refers to IEEE 421.5 for SPGMs and therefore we keep it in order to have no deviations from ISSM.
	Technical	"In case Battery Energy Storage Systems (BESS) are included in a facility and having an impact on response of the system frequency and voltage the simulation model must include the complete characteristics of all subsystems (and/or different equipment) assembled at the connection point. The capability characteristics in generation mode and demand mode must be included in the facility simulation model and assembled at the connection point of the combined facility." Proposal BESS and in general energy storage are not in scope of the current NC-RfG. The model requirements should be defined after RfG include such technology. Or this shall be noted in the document.	Rejected	In the IGD it is meant the BESS integrated in the facility, not as a stand-alone BESS or next to the PGM, PPM or demand facility. For clarification "... voltage at the POC" has been added to the text.
	Technical	"Submission of an installation document For type A, EqC will preferably cover the whole PGM. " ... "EqCs typically certify the compliance of specific equipment, but not of the entire power generating module." EqCs can cover a PGU or a component. EqCs by definition do not apply for a facility. Proposal Sentences are contradicting themselves. Recommended to be replaced by EqCs can cover a PGU or a component.	Accepted	The text has been updated.
	General	The title focus on simulation models, but the chapter seems to focus on EqCs. The issue is that EqCs are an option. Proposal to adapt the content to align with present situation regarding big generating unit. Table to be updated? Proposal We recommend to better highlight in the chapter that not all units have EqCs, but they can have validated models.	Rejected	The tables below indicate the fundamental basis for issuing an EqC based on either testing and/or simulation. In the paragraph 2 of section 1.12 is written: to demonstrate the compliance of the required capability the power-generating facility owner may use equipment certificates to demonstrate the compliance issued by an authorised certifier to demonstrate compliance with the NC requirement.

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	Technical	<p>EU regulation 2016/631 NC RfG compliance tests and simulations</p> <p>Proposal In case of specific requirements like ROCOF or island capabilities, simplified model could be not enough detailed to properly describe the unit behaviour/capability. For such studies very detailed complex could be needed which includes specific manufacturer know-how (IP protected). Therefore, studies should be carried out in cooperation with manufacturer and manufacturer declaration of conformity should be acceptable. As alternative the use of Black Box could be used for such studies.</p>	Rejected	<p>We consider that there is no need for adding this clarification, since encryption topic is already mentioned in the IGD.</p>
	Technical	<p>The harmonized guideline for issuing an EqC is stating the conditions and methodology to be applied.</p> <p>There is no harmonized guideline as far as now to issue an EqCs in European MSs.</p> <p>Proposal Clarify or delete or state that it would recommend to have a common and harmonized process for EqCs.</p>	Accepted	<p>The sentence has been deleted.</p>
	Technical	<p>Title and content of the chapter seems to be mismatching.</p> <p>What exactly is the role of 3 parties? Gas Turbine and Steam Turbine are not listed as potential users?</p> <p>Proposal Recommended to change the title (text proposal to be issued). Add Gas Turbine and Steam turbine as stakeholder (text to be proposed) or delete the chapter, no clear which is the value added.</p>	Accepted (partially)	<p>The role is clearly described in this chapter. The text was updated.</p>
	Technical	<p>"The role of authorized certifiers and authorized laboratories is to assure harmonized methodology, criteria, and degree of evaluation of equipment or components versus CNC requirements (mandatory and non-mandatory) as was specified in EC regulation and national regulation for EU countries. "</p> <p>Proposal Maybe for better clarity a text proposal. The role of 3rd parties is to provide an independent evaluation of the test results. 3rd parties follow rules and defined by others, in the specific case could be standardization process (and eventually RSOs and TSOs). Harmonization shall be achieved through cooperation of high-level entities (or referring to European std, for example when existing).</p>	Accepted (partially)	<p>With respect to independency of third party, the word "independency" has been added to role of 3rd Party in IGD.</p>
	Technical	<p>The description in point 1, 2, 3 and 4 are partly true when applied to PGU verification, typically small generating unit.</p>	Accepted	<p>The text has been updated. The proposal has been added to point 3.</p>

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		<p>The role as described is wrong when it comes to Facility Verification of compliance and Facility Simulation Model.</p> <p>3rd parties are also used to verify compliance of Plant facility based on EqCs when these are available and using correspondent validated model. In case EqCs are not available, for example in case of big power generating unit, 3rd parties can be involved in the verification test at site, providing final assessment eventually based on simulation, based on validated simulation model. Sometime test for model validation are part of the site activities.</p>		
	Technical	<p>"...1) Simulation model development: The manufacturer of equipment or the PGM owner shall run a set of laboratory or field test campaign in order to fine tune the manufacturer specific model, ..."</p> <p>Also generic model can be tuned through testing,</p> <p>1) Simulation model development: The manufacturer of equipment or the PGM owner shall run a set of laboratory or field test campaign in order to fine tune the manufacturer specific or generic model,</p>	Accepted	The words "... or generic model" have been added.
	General	<p>Simulation model Black box and IP protection</p> <p>Simulation model can be "simple" model based on software libraries and "complex" model which many times is developed by manufacturers.</p> <p>Simple models can be easily used on any software, but they a lower fidelity level.</p> <p>Complex model can provide a higher fidelity level, but they frequently include know-how or IP protected information from the manufacturer. The sensitive information shall be properly protected, this is normally done by including Black Box that cannot be accessed for such elements of the model.</p> <p>It is responsibilities of all involved parties to ensure sensitive information are protected and not disclosed.</p> <p>To cope with sensitive information, when it comes to studies requiring complex model which include sensitive information, such studies can be carried out by the same manufacturer, if it has the capabilities; the outcome of the studies can be part of a manufacturer declaration.</p> <p>Proposal</p> <p>Simulation model, when it comes with complex model deals with sensitive/proprietary information from the manufacturers.</p> <p>Protection of know-how and sensitive/proprietary information shall be acknowledged by all involved parties.</p> <p>A dedicated chapter to such important topic is missing and shall be added to the present document.</p> <p>Include previous text as indicated in the "comment" column.</p>	Rejected	It is more or less already integrated in the text, with the appropriate level of detail or this IGD. Higher level of detail should be included either in EG ISSM report or national level.

		We can eventually contribute to additional text proposal.		
EuropGen	General	The acronym "SSTI" is missing. Proposal Please add "SSTI: Sub Synchronous Torsional Interactions" to the list.	Accepted	The "SSTI: Sub Synchronous Torsional Interactions" has been added to the list.
	Technical	Simulation model definition is not accurate. Proposal A simulation model is a mathematical representation of an equipment or a component, that consists of, e.g., transfer functions as well as model parameters. A single model or several combined simulation models can be integrated into a grid topology and demonstrate the system characteristics of defined knots (e.g., PoC or terminals). In common practise, the simulation model is often implemented in certain simulation software.	Accepted (partially)	The text has been updated.
	Technical	Fair competition is an important market principle, also in software market. RSO or TSO must not restrict usage of certain simulation software and give privilege to certain software manufactures. Proposal The model requirements shall be simulation software neutral.	Accepted	
	Technical			
	Technical	The definition is counter-productive, the generic IEEE or CIGRE model cannot guarantee model accuracy in various conditions, because it might be tuned for a single condition only. Nevertheless, IEEE or CIGRE model parameters can not be achieved directly from real AVR and engine controller settings or other parameters. Proposal High accuracy level manufacture specific model is preferred.	Rejected	This is only for the large network studies. Please, refer to EG ISSM report.
	Technical	As long as the active power and reactive power are validated at PGU terminal, detailed information of the engine internal structure and limiters are not essential. Proposal Delete detailed engine model definition.	Rejected	The internal elements of the PGU describe the behaviour of PGM. A reasonable detail of the connected facility is required.
	Technical	"...the RMS simulation models of PPMs shall include the following points: (c) be open source/standard generic model for cross border network stability studies;" We request the STG CNC to add reference standards for PPM generic models as provided for SPGMs.	Rejected	No references to standards for PPM models in the ISSM. To be aligned we won't reference in the IGD.

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	Technical	As long as harmonics tests or measurements can prove compliance, there is no advantage for modelling efforts. Proposal Delete the section.	Rejected	According to article 54.3 of HVDC: It should be the model that can be used for the purpose of verifying compliance with the requirements of this Regulation including, but not limited to, compliance simulations as provided for in Title VI and used in studies for continuous evaluation in system planning and operation.
	Clarification	""""In case Battery Energy Storage Systems (BESS) are included in a facility and having an impact on response of the system frequency and voltage the simulation model must include the complete characteristics of all subsystems (and/or different equipment) assembled at the connection point. The capability characteristics in generation mode and demand mode must be included in the facility simulation model and assembled at the connection point of the combined facility."" BESS are not in scope of the current NC-RfG, i.e., ""EU 2016/631"". Can BESS simulations be considered after the scope of NC-RfG is extended through an amendment?"	Rejected	In the IGD it is meant the BESS integrated in the facility, not as a standalone BESS or next to the PGM, PPM or demand facility.
	Technical	"Family definition" is missing by the assessment. Proposal A group of equipment can be regard as a "family", if they share the same model structure, and vary only in model parameters. General criteria are: 1) Same technology. 2) From the same manufacturer that guarantee the same produce quality and accuracy. 3) Regardless of absolute voltage and power ranges, since models are often per unit based. Please refer to the EG HCF report for full proposed definition.	Rejected	We consider that this is out of the scope of this document and should be decided at national level. In some countries there exists a threshold in maximum capacity of the PGU to be included in the same family and in others there is no acceptance of families and each PGU must provide individual simulation model.
	Technical	"Simulation model development: The manufacturer of equipment or the PGM owner shall run a set of laboratory or field test campaign in order to fine tune the manufacturer specific model," Harmonization of compliance simulations require the use of generic models. It is proposed the above statement is updated as: "...Simulation model development: The manufacturer of equipment or the PGM owner shall run a set of laboratory or field test campaign in order to fine tune the manufacturer specific-/generic model,"	Accepted	The text "or generic" was added.
VGBE		"According to IGD ", GENERAL GUIDANCE ON COMPLIANCE verification – Compliance testing and use of Equipment Certificates", Third parties could be any additional stakeholder to the owner of a PGM and must be understood as authorized certifiers and/or authorized laboratories. Such acknowledgement was not inserted in this IGD.	Rejected	Authorized certifier / laboratories are independent. This is ensured by accreditation. This constraint is not inserted in this IGD since we are talking about running simulation studies instead of tests. IEC 17025 covers entities for testing and this is

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		The VGBE interpretation of this provision is that a third party acting on behalf of the owner of a PGM has identical rights as an authorised certifier / laboratory. Is this interpretation correct?"		
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Compliance Verification - Compliance Monitoring after final operational notification

Commenter	Type of comment	Comment	Accepted/ Rejected	Remarks
EU DSO Entity	Clarification	Why is the term "self-assessment" used? What is the significance of this terminology?	Accepted	(1) „self-assessment" means that the operator can carry out the tests himself and then confirm the validity of the tests. (2) Updated: the sentence was updated.
	Technical	Why should the RSO care about the validity of EqCs for existing plant and how can such an EqC become invalid, unless there has been a change to the RfG that is applied retrospectively? Surely it would require a change to the RfG itself, and to be applied retrospectively, to make an EqC invalid. We do not accept this is a DSO responsibility	Rejected	Article 41 of RfG allocates this responsibility to the RSO. The relevant system operator requires connection requirements in the connection point that have to be fulfilled throughout the lifetime of connected facilities. The facility owner shall ensure that its facility is complied with the connection requirements applied at the time of connection throughout the entire lifetime. When the facility is significantly modified, and new connection requirements are applied then new compliance verifications are required (the previous certificate/test result/simulation results proving the compliance is invalid).
	Technical	We do not accept that DSO have any role in keeping track of the validity of EqCs.	Rejected	Article 41 of RfG allocates this responsibility to the RSO. The DSO is responsible for the connection to its network. The way in which it fulfils this responsibility is described in this IGD. The responsibility itself is a legal issue.
EUTurbines	Editorial	The scope seems to be repeated twice. Maybe 1.3 can be integrated in 1.2.	Rejected	It should be repeated for formal reasons.
	Editorial	"... It also emphasizes the strong obligation of the power-generating facility owner to support the RSO unsolicited throughout the compliance monitoring procedure by..."	Clarification is needed	The proposal text is the same as original.
	Editorial	".. The RSO in corporation with the relevant TSO is..." "The RSO in cooperation with the relevant TSO is" or "The RSO in coordination with the relevant TSO is"	Accepted	Updated: the word "corporation" was substituted with "cooperation".
	Editorial	"... may involve the following third parties partly or fully ..." 3rd parties are not described here.	Accepted	Updated: the word "the following" was removed.

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	Editorial	"... large angel deviations inside a synch..." " <u>... large ANGLE deviations inside a synch...</u> "	Accepted	Updated: the word "angel" was substituted with "angle".
	Technical	Maybe the text of the chapter can be improved a bit to make it more readable. Proposal Text improvement for more readability (example, separate with subchapters for CNC).	Accepted	The numbering is added.
	General	" .. The scope of the specific tests could be limited to specific SGU types and/or service providers depending on needs for actions based on system instability observations, near system split situations, large angel deviations inside a synchronous area (PMUs), low frequent active power oscillations etc. ..." Not clear if this is really relevant to compliance monitoring. Probably to re-worded. Proposal To be deleted or to be referred to specific compliance condition. System studies (at least as described) are not direct part of the compliance process.	Rejected	This is only the specific tests (line above the three dots). For clarity, the numbering was added.
	Editorial	".. related functions and the implemented parameter ranges. The following guidance could be given on compliance monitoring according to the NC DCC. The following guidance could be given on compliance monitoring according to the NC DCC. Compliance monitoring of demand facilities could include but are not limited to the following ..."	Clarification is needed	The proposal text is the same as original
	Technical	"According to the IGD "GENERAL GUIDANCE ON COMPLIANCE verification – Compliance testing and use of Equipment Certificates", as well the IGD "GENERAL GUIDANCE ON COMPLIANCE verification – using simulation models" Third parties like authorized certifiers and/or authorized laboratories could be included by the RSO as well as the owner of a facility to perform the compliance monitoring procedure(s). ... " The IGD are not a binding document. Maybe reference to such document can be made in a more generic way. Proposal Please delete sentence or refer to documents since IGDs are non-binding document.	Accepted (partially)	Updated: the sentence was updated.
	General	It is recommended to clearly state that RSOs will be responsible and maintain full ownership of the compliance monitoring activities even when the compliance monitoring activities are fully outsourced to a 3rd party.	Rejected	It is mentioned in this document (and in RfG/DCC), that TSO and RSO are responsible. Article 41 of RfG allocates this responsibility to the RSO

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		<p>3rd parties are not responsible for compliance.</p> <p>Proposal To be added: RSOs and TSOs are responsible and maintain full ownership of the compliance monitoring activities even when the compliance monitoring activities are fully outsourced to a 3rd party.</p>		
VGBE		<p>"If third parties are involved in accomplishing the compliance monitoring procedure(s) their role and responsibility might differ depending on the degree of involvement, but the role and responsibility of the third party(s) involved must be clearly specified in the agreement with the RSO or the relevant TSO. Typically accredited certified company or laboratories could be involved as an independent party taking care of executing, reviewing, and reporting of results from the compliance monitoring procedure of facilities and related documentation. Who is the other party in the „agreement with the RSO or the relevant TSO“? Is it the “third party” or the owner of the PGM? This question because the opinion of the owner of the PGM about the “third part” is important for the compliance monitoring."</p>	Accepted (partially)	<p>It is the owner of the facility. Updated: „...in the agreement between the facility owner and the RSO or the relevant TSO."</p>