RECOMMENDATIONS RELATING TO THE COORDINATION OF TECHNICAL COOPERATION BETWEEN UNION AND THIRD-COUNTRY TSOs

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European Network of
Transmission System Operators
for Electricity

entsoe

Recommendations relating to the Coordination of Technical Cooperation between Union and Third-Country TSOs

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1 INTRODUCTION

The purpose of this document is to provide recommendations for the cooperation of ENTSO-E with third-country Transmission System Operators (TSOs). The recommendations are adopted in accordance with Article 8(3)(c) Regulation (EC) No 714/2009, which requires ENTSO-E to adopt 'recommendations relating to the coordination of technical cooperation between Community or Union[1)] and third-country transmission system operators'. This document fulfils this requirement, though these recommendations are not binding rules.

This document highlights the role of ENTSO-E in facilitating the cooperation and coordination between TSOs to ensure effective and transparent access to the transmission systems and to provide coordinated and forward-looking planning. Supporting the technical evolution of the transmission system, including the creation of interconnection capacities with third-party TSOs, is a fundamental aspect of ENTSO-E's remit. Sharing best practices for traditional and new issues is part of ENTSO-E's purpose and will help all involved parties on their way towards a sustainable energy future. Indeed, for some of the heavy tasks required in integrating the EU and European neighbourhoods, substantial support from governments and the EU might be required.

1.1 PURPOSE OF ENTSO-E

ENTSO-E was established by Regulation (EC) No 714/2009 to allow the cooperation of TSOs at the European Union (EU) level. ENTSO-E's Articles of Association[2)] define the purpose of the organisation in terms of its objectives, roles and responsibilities as follows:

The Association shall, on a non-profit-making basis, pursue the co-operation of the European TSOs both on a pan-European and regional level. It promotes the TSOs' interests and has an active and important role in the European rule setting process in compliance with EU legislation.

Its objective is to promote the reliable operation, optimal management and sound technical evolution of the European electricity transmission system in order to ensure security of supply and to meet the needs of the IEM.

The Association may undertake any activity, which, directly or indirectly, enables it to achieve the above-mentioned purposes. The activities of the Association shall thus include for example:

a) coordinating the development of an economic, secure and environmentally sustainable transmission system. The emphasis lies in the coordination of cross border investments and meeting the European security and quality of supply requirements, while the implementation of investments lies with the TSOs;

b) developing network codes for the interoperability and coordination of system operation in order to maintain the reliability of the transmission system and to use the existing resources efficiently;

c) developing market related network codes in order to ensure non-discriminatory access to the transmission system and to facilitate consistent European electricity market integration;

d) monitoring and, where applicable, enforcing the compliance of the implementation of the network codes;

e) monitoring network development;

f) promoting R & D activities relevant for the TSO industry;

1) In the Regulation 714, the term "Community" is used as the Regulation was adopted before the Lisbon Treaty when the EU was not yet a legal entity and where only the Communities existed. After the entry into force of the Lisbon Treaty, the EU is used and in the EC's legislative proposals, the term "Union" is substituted for "Communities".

2) https://www.entsoe.eu/Documents/General%20ENTSO-E%20documents/General%20ENTSO-E%20documents/140930_Articles_of_Association.pdf

g) promoting public acceptability of transmission infrastructure;

h) taking positions on issues that can have an impact on the development and operation of the transmission system or market facilitation;

i) enhancing communication and consultation with stakeholders and transparency of SO operations; and

j) performing other tasks of relevance to the Association.

The Members of the Association can enter into multilateral agreements to formalise and enhance their cooperation in specific areas. The Association can act as a facilitator in the establishment of such agreements and in the monitoring and arbitration of their implementation.

Rule-setting and other activities of the Association shall be carried out in close consultation with stakeholders. The Association shall continuously exchange views with stakeholders on issues related to power system planning, operation and market facilitation.

1.2 ENERGY POLICY AND TSO COOPERATION

Operators of transmission systems have a long history of cooperation, particularly since liberalisation started and TSOs were unbundled. In addition to the actions related to the internal energy market, sharing best practices with third-country TSOs fosters the advancement of efficient power systems and economies. The technical cooperation between EU TSOs and third-country TSOs is one of the key goals of the EU.

In terms of EU TSOs' own objectives to developing cooperation with third-country TSOs, the recently approved guideline on electricity transmission system operation[3] states that: 'Synchronous areas do not stop at the Union's borders and can include the territory of third countries. The Union, Member States and TSOs should aim for secure system operation inside all synchronous areas stretching on the Union. They should support third countries in applying similar rules to those contained in this Regulation. ENTSO-E should facilitate cooperation between Union TSOs and Third-country TSOs concerning secure system operation'.[4]

TSOs and Distribution System Operators (DSOs) now have to redefine their relationship, in particular about the integration of renewables into the distribution systems. The guideline on electricity transmission system operation addresses the importance of TSO/DSO coordination in the management of emergency situations in the planning phase (design of defence plans), as well as in the operational processes in real time and in emergency situations.

In order to achieve the European and national energy policy objectives, a new global approach in the generation, transmission, distribution, metering, supply, storage and consumption of energy is necessary. The network codes will create a Europe-wide harmonised power system operation framework with cross-regional and pan-European geographical coverage, setting up the fastest and most efficient, secure and reliable way to ensure the highest electricity supply standards in Europe.

1.3 STRUCTURE OF THIS DOCUMENT

This document is structured as follows:

Section 2: a definition of third-country TSOs is provided to explain the classification of TSOs given their status outside of the EU;

Section 3: describes the different aspects of technical coordination and cooperation experienced to date with ENTSO-E;

Section 4: provides criteria for determining different categories of third-country TSOs;

Section 5: provides recommendations on coordination of technical cooperation, taking into account the categories of third-country TSOs as identified in Section 4.

Annex 1: describes the feedback received from external parties that provided a response to these recommendations.

3) https://ec.europa.eu/energy/sites/ener/files/documents/SystemOperationGuideline%20final%28provisional%2904052016.pdf

4) http://ec.europa.eu/energy/en/topics/wholesale-market/electricity-network-codes

2 DEFINITION OF THIRD-COUNTRY TSOs

Legally, the category of 'third country TSOs' should be understood as the group of all TSOs that are not located in the EU where Regulation (EC) N° 714/2009 requires them to collaborate through ENTSO-E.

As ENTSO-E membership goes beyond the EU and includes 42 TSOs from 35 countries, it is nevertheless preferable to recommend a different definition. The term 'third-country TSOs' will therefore be understood as the group of all TSOs that are not ENTSO-E members (full member, associated member or observer member under the terms defined in ENTSO-E's Articles of Association).

3 TECHNICAL COOPERATION

As described in Section 1, ENTSO-E's Articles of Association provide for the entering into agreements to formalise and enhance cooperation with TSOs in specific areas[5]. Since ENTSO-E's establishment, technical cooperation has advanced in the key areas of Data Sharing and Information, Expert Knowledge on Network Equipment, Technical Standards, Network Development Planning, Coordinated System Operation, Security Management and Interconnection. This section describes each type of cooperation in more detail in terms of why it was established in each case.

3.1 DATA SHARING AND INFORMATION

The European Commission stresses the need for better coordination between the member states and the external dimension of the EU, such as third-country TSOs, regarding communicating the energy policy decisions considered as fundamental decisions on energy.

Decision No 994/2012/EU of the European Parliament and of the Council of 25 October 2012 establishes an information exchange mechanism with regard to intergovernmental agreements between Member States and third countries, and particularly the possibility to develop standard provisions.

The Energy Union objective is already in progress, with its main scope to create a mechanism that will allow the member states to inform each other about the relevant decisions in the energy field prior to their adoption. In this Union, the third-country TSOs may play a role. In this sense, ENTSO-E views its role as assisting in the promotion of energy sector reforms in all the participating countries, supporting the modernisation of the energy system and integrating all energy systems in the EU energy regulatory framework.

3.2 EXPERT KNOWLEDGE

ENTSO-E has knowledge and technical expertise gained in its mandated tasks and, for that reason, it could be a starting point for regional energy policy coordination. The goal is to ensure the security of supply in a regionally coordinated way, based on the principle of solidarity. In this case, solidarity refers to a seamless interaction between EU member states to ensure the security of supply for all, as well as cost efficiency through better use of resources. In cases of closer cooperation with third-country TSOs, ENTSO-E is ready to broaden its regional assessments of system adequacy and flexibility based on its evolving European methodology that is of interest to its own member TSOs and third-country TSOs.

ENTSO-E TSOs have been collecting experience in the procurement and management of network assets such as transformers, overhead lines, cables, substations and high voltage equipment. This experience comprises, among other aspects, life-cycle management of components, design considerations for all kinds of equipment, route selection for lines, real-time monitoring systems, design of air-insulated and gas-insulated switch bays, and testing of equipment. For ENTSO-E, closer cooperation with third-country TSOs means having bi-directional coordination and cooperation to share the technical experiences and knowledge of network equipment.

5) ENTSO-E's Articles of Association dated 30.09.2014, Chapter 1, Article 4 I, www.entsoe.eu.

3.3 TECHNICAL STANDARDS

Standards are the basis for defining interfaces in increasingly complex systems such as transmission and distribution systems. It is highly recommended to implement standardisation from the beginning of a process to ensure long-term sustainability.

The implementation of the EU network codes, which is applicable to EU TSOs, would, if also implemented for third-country TSOs, have the advantage of creating a level beyond EU borders with mutual interest for both ENTSO-E's and third-country TSOs. Economies of scale could be exploited in equipment connected to the network by having the same technical standards. Where it is not efficient to implement the network codes in third-country TSOs because these countries already have a profound framework of technical standards for grid connection, it might be helpful to agree at least on common minimum requirements in order to foster the standardisation of equipment.

3.4 NETWORK DEVELOPMENT PLANNING

As the European electricity system requires a more reliable, competitive and sustainable electricity supply, there is an urgent need to renew existing grids and to ensure timely development of infrastructure. ENTSO-E's guiding principle is that infrastructure investments be made where the socioeconomic gains are largest. The development and renewal of the transmission infrastructure is central and is a recognised issue within the EU. Investments in transmission infrastructure should be facilitated through the launch of a pan-European communication plan to support critical infrastructure projects, and these are detailed in ENTSO-E's Ten-Year Network Development Plan (TYNDP). Another important aspect of the network development planning is to share common criteria and technical rules for designing, implementing and operating interconnected grids.

In addition, the need for network development has significantly increased by the integration of Renewable Energy Sources (RES). RES are not always decentralised but can also be found concentrated in remote areas (e. g. offshore wind power), and directional power flows over long distances are playing an increasingly important role. Several members of ENTSO-E are already addressing that challenge by planning additional backbone transmission corridors (e. g. HVDC technology connected to the existing Alternating Current (AC) network). RES integration into the market can be done by upgrading the current market design, empowering end-consumers and improving market incentives.

A truly integrated and competitive internal energy market not only needs a common regulatory framework but also significant development of energy infrastructure for cross-border interconnections among ENTSO-E member states and between ENTSO-E member states and third-country TSOs. Common criteria of cost-sharing and cost-allocation analysis as well as an identification of financial schemes could help to develop a long-lasting business model for international energy exchanges.

Another aspect of network development is the increased need for mechanically switched reactive power compensation devices and Flexible AC Transmission Systems (FACTS). The decommissioning of conventional generation has an impact on the steady state load-flow situation and on network stability. For this reason, knowledge sharing can provide essential information and feedback on system stability studies undertaken by TSOs.

Storage and demand side response need to be fully integrated within power systems to foster innovations and new technologies. These new technologies can reduce the primary energy demand, diversify and consolidate supply options (both external and indigenous) and optimise energy network infrastructure to fully benefit from diversification. New technologies can deliver efficient and cost-effective solutions to improve the efficiency of buildings and local heating systems.

3.5 COORDINATED SYSTEM OPERATION

ENTSO-E and its members are ready to share experiences on how to coordinate system operation among numerous TSOs. Given the potential for increased trading with other areas, coordination of the flexibility requirements of the European system with its neighbours increases reliability and reduces costs. Planning methods and tools to quantify and ensure sufficient power system flexibility are being developed and will benefit both ENTSO-E and third-country TSOs.

External coordination between ENTSO-E and third-country TSOs relating to the conventions and emerging best practice for data visualisation, human factors' issues and alarm management will help to ensure that appropriate tools are continuously being developed.

Renewable production forecasting, plant power flow and dynamic model validation, ancillary services from RES and the associated communication control scheme and algorithms are key areas in which the global industry as a whole could benefit significantly from international coordination and cooperation. Smart transmission and distribution grids, properly coordinated, are the backbone of an integrated energy system and a foundation for a sustainable environment, climate and innovation.

3.6 SECURITY MANAGEMENT

Security of the supply is of key concern for every TSO, and is of particular concern for less integrated and connected systems. Often energy security issues are addressed only at a national level without taking into account the interdependence of member states. The European Commission has started to develop a policy to address the physical protection of critical infrastructure against threats, hazards etc., which includes cybersecurity.

In times of terrorist threats, protection against intentional destruction of network equipment and cyber-attacks on Energy Management Systems and System Control and Data Acquisition (EMS/SCADA) is a worldwide challenge. Given the global scope and scale of these issues, ENTSO-E puts a strong emphasis on coordination and the promotion of best practices in preventing cyber-attacks, which is critical for the public good. Sharing this best practice is recommended for cooperation with third-country TSOs.

3.7 INTERCONNECTION

An interconnected energy community facilitates solidarity and trust, energy security, a fully integrated European energy system, energy efficiency, decarbonisation requests, research, innovation and competitiveness. The challenges of an interconnected power system include areas such as system stability, resource variability, uncertainty, intermittency, new connections, changed power flows, timely and adequate infrastructure development, acceptance and permitting. ENTSO-E strives for a compatible parallel operation for new interconnections. This means that any potential negative technical impact on ENTSO-E's regional areas and the newly connected TSO should be avoided by individually defined measures and rules for the interface.

An example of a negative technical impact is when the power system has structural oscillation modes[6]. Among the most critical modes, there are low frequency modes, which correspond to interactions between groups of generators located at different zones of the electric systems. They can lead to the so-called inter-area oscillations. A poor damping of these kinds of oscillations may lead to severe risks to system security. These phenomena are generally linked with bulk power transits via a high impedance interface. The remedy for these oscillations can be the limitation of transits at the interface. As this goes against the economic interest of the interface, Power System Stabilizers are usually installed on the generators in order to damp the oscillations.

The application of technical rules for interconnection may be impossible to implement in third-country TSOs because they have different structures and sizes. Moreover, it has to be understood that a synchronous extension may benefit from a smaller system being connected, but it brings increased complexity and operational risk for the larger system.

Unlike synchronous connections, asynchronous HVDC connections are not prone to inter-area-oscillations. Moreover, they do not transmit fault levels and avoid the propagation of disturbances. In case of Voltage Source Converters, they can also contribute to reactive power control in the AC network. Lead times to construct HVDC connections are shorter than in case of HVAC connections.

Therefore, for new interconnections with third countries, ENTSO-E recommends, in principle, an interconnection operation via HVDC.

If, however, an AC connection is requested, then a technical study must be carried out to prove its feasibility, demonstrate that such an AC connection does not increase the risk for the synchronous area, and show the benefits, in terms of security of supply, for the connecting party of using an AC connection compared to a HVDC connection.

6) Having their origin in the 'elastic' characteristics of the electromagnetic link between generators, associated with the inertia effects of the rotating elements in the generators and in the effect of the controllers, mainly the voltage controllers of the generators.

4 FRAMEWORK FOR THIRD-COUNTRY TSOs

4.1 CRITERIA TO CATEGORISE THIRD-COUNTRY TSOs

ENTSO-E considers the following criteria that influence the different categories of third-country TSOs and that affect the recommendations for technical coordination:

The third country's **Relationship to the EU** is an important consideration, for example, whether the country is a party to the Energy Community Treaty[7] and especially if it is bound to implement the following rules:

- Directive 2009/72/EC of the European Parliament and of the Council, 13 of July 2009, concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC.
- Regulation (EC) No 714/2009 of the European Parliament and of the Council, 13 of July 2009, on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003.
- The future Regulation establishing a guideline on electricity transmission system operation Guideline

The nature of the interconnection: AC or DC connection is assessed as to whether the third-country TSO is connected to an ENTSO-E member TSO or to an ENTSO-E synchronous area through an AC or DC connection. Where a third-country TSO has no AC or DC connection, it does not prevent a potential future possibility to share expertise and knowledge.

On the other hand, third countries that request interconnection to the ENTSO-E synchronous area or an ENTSO-E member should have implemented the third energy package or should be bound to implement it by a negotiated contract with the EU. Such a contract, for example, is the membership in the energy community.

7) Or similar agreement with the EU with the objective to export the EU Energy law in the third country.

4.2 CATEGORIES OF THIRD-COUNTRY TSOs

In light of the criteria identified in section 4.1, ENTSO-E identifies three categories of third-country TSOs:

1. TSO of an Energy Community country[8] that is (a) electrically connected via AC, (b) electrically connected via DC or (c) not connected to a member(s) of ENTSO-E or to an ENTSO-E synchronous area;

2. TSO in a country that is not a contracting party of the Energy Community but which, nevertheless, has or is in negotiation to sign a specific agreement to accommodate or implement EU legislation and is: (a) electrically connected via AC, (b) electrically connected via DC or (c) not connected to a member(s) of ENTSO-E or to an ENTSO-E synchronous area;

3. TSO in a country that is not a contracting party of the Energy Community and that does not have or is not in negotiation to sign a specific agreement to accommodate or implement EU

Legislation, and is (a) electrically connected via AC, (b) electrically connected via DC or (c) not connected to a member(s) of ENTSO-E or to an ENTSO-E synchronous area.

Not all categories of third-country TSOs have been experienced by ENTSO-E, as it may be the case that no country yet falls into one of these categories. In the following table, the above categories, which have been experienced to date by ENTSO-E, are shown.

Nature of the interconnection

Relationship to the EU	(a) AC interconnection	(b) DC interconnection	(c) No interconnection
1. Energy Community country	Western part of Ukraine, Albania, Kosovo*	Georgia	Rest of Ukraine, Moldova
2. Specific agreement with EU	Morocco, Algeria, Tunisia, Maghreb Agreement		
3. No specific agreement with EU	Russia, Belorussia	Russia	All other countries in the world

Table 1: Technical Cooperation with Third-Country TSOs experienced to date by ENTSO-E

Of course, the rest of the Ukraine, Moldova and Georgia can also be seen as countries under category 3 (a) because they are over Russia and Belorussia indirectly but synchronously connected to the Baltic synchronous area. However, these countries are mentioned in the table only from the point of view of categorisation, which makes them eligible for a stronger cooperation with ENTSO-E.

8) Or similar agreement with the EU with the objective to export the EU Energy law in the third country. This comment is applicable to the other mentions of the Energy Community.

5 RECOMMENDATIONS

This section sets out the ENTSO-E recommendations on the coordination of technical cooperation, taking into account the categories of third-country TSOs as identified in Section 4. The following set of recommendations also takes into account the feedback received from external parties, including ACER and the European Commission. ENTSO-E undertook a consultation, and Annex 1 provides the table of responses to the consultation, including how the feedback was addressed.

5.2 CATEGORY 1 (A)

These third countries are members of the Energy Community, and their TSOs are synchronously connected with one of the ENTSO-E synchronous areas. For this type of TSO, a long-term agreement or a connection agreement with ENTSO-E, or at least an operational agreement with a TSO belonging to this synchronous area, is in place. These countries have already implemented or are in the process of implementing the same technical standards and market rules as the TSOs of ENTSO-E. Therefore, the technical cooperation is at its highest possible level including all aspects of cooperation regarding system operation, system development and market.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data and Information Sharing: The scope of technical cooperation is per the Operation Handbook (OH)/System Operation Guideline and Emergency and Restoration Code.

Expert Knowledge: Full sharing of expertise and knowledge is necessary for operating and developing the common synchronous areas.

Network Development Planning: These TSOs are included in network development plans of their synchronous areas.

Security Management: This cooperation is fully agreed on with these TSOs.

5.3 CATEGORY 1 (B)

These third countries are members of the Energy Community, and their TSOs have a DC connection with one of the ENTSO-E synchronous areas. These countries do not have the same technical standards as the TSOs of ENTSO-E; nevertheless, they are implementing the same market rules that are already in place in EU countries. If such TSOs are interested in applying ENTSO-E rules relating to system operation and grid planning, then ENTSO-E can arrange corresponding workshops and participation in conferences organised by ENTSO-E.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data and Information Sharing: This would not be based on EU regulations but on common interests and needs, which would have to be developed together. Cooperation is at the level of expert knowledge. ENTSO-E supports the transfer of knowledge to these TSOs, if desired. ENTSO-E can help to develop system operation planning methods and tools to quantify and ensure sufficient power system flexibility that are of benefit to both ENTSO-E and third-country TSOs.

Expert Knowledge: ENTSO-E is supportive of the transfer of expert knowledge to those countries depending on their interest and needs.

Network Development Planning: As these countries are neighbours to one of ENTSO-E's synchronous areas, they can be included in the ENTSO-E development plans.

Security Management: ENTSO-E recommends the coordination and promotion of best practices in the prevention of cyber-attacks, which is critical for the public good, and it is willing to share its knowledge in this area.

5.4 CATEGORY 1 (C)

These third countries are members of the Energy Community, but their TSOs have neither an AC nor a DC connection with one of ENTSO-E's synchronous areas. These countries do not have the same technical standards as the TSOs of ENTSO-E. Nevertheless, they are implementing the same market rules that are already in force in EU countries. If such TSOs are interested in applying ENTSO-E rules relating to system operation and grid planning, then ENTSO-E can arrange corresponding workshops and participation in conferences organised by ENTSO-E.

If these countries are interested in establishing future AC or DC connections with one of the ENTSO-E synchronous areas based on principles described in Section 3 and on positive outcomes of corresponding feasibility studies, ENTSO-E can investigate the feasibility for a connection and, if deemed feasible, arrange to sign a connection agreement.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data and Information Sharing: This would not be based on EU regulations but on common interests and needs that would have to be developed together. In case of an AC connection agreement, the scope of technical cooperation would be as per the Operation Handbook/System Operation Guideline and Emergency and Restoration Code. Otherwise, the cooperation is at the level of expert knowledge. ENTSO-E supports the transfer of knowledge to these TSOs, if desired. ENTSO-E can help to develop system operation planning methods and tools to quantify and ensure sufficient power system flexibility.

Expert Knowledge: ENTSO-E is supportive of the transfer of expert knowledge to those countries depending on their interest and needs.

Network Development Planning: In case of an AC or DC connection agreement, these countries can be included in the ENTSO-E development plans.

Security Management: ENTSO-E recommends the coordination and promotion of best practices in the prevention of cyber-attacks, which is critical for the public good, and it is willing to share its knowledge in this area.

5.5 CATEGORY 2 (A)

These countries are synchronously connected with one of ENTSO-E's synchronous areas, and their TSOs have an operation agreement with a TSO belonging to this synchronous area. It can also be the case that they have signed or are in the process of signing specific agreements with the EU to accommodate certain provisions of the EU acquis, particularly in the energy sector. These countries do not have the same technical standards as the TSOs of ENTSO-E. There is a need or convenience for these TSOs to apply certain ENTSO-E rules relating to system operation, grid planning and market. ENTSO-E can arrange corresponding workshops and invite these TSOs to conferences organised by ENTSO-E. Further collaboration, in the form of voluntary groups or in the form of regional cooperation, is also suitable.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data Sharing and Information: Due to synchronous operation, the scope of technical cooperation should be consistent with the one in the Operation Handbook/System Operation Guideline, and Emergency and Restoration Code. The aim is to motivate these TSOs to implement these technical standards in their countries. Cooperation can include the possibility to co-work in voluntary groups of interest, especially to promote a minimum consistency with EU rules in managing power exchanges.

Expert Knowledge: ENTSO-E is ready to intensify the transfer of expert knowledge to those countries.

Network Development Planning: Such TSOs can be included in ENTSO-E development plans.

Security Management: ENTSO-E recommends the coordination and promotion of best practices in the prevention of cyber-attacks, which is critical for the public good, and it is willing to share its knowledge in this area.

5.5 CATEGORY 3 (A) AND (B)

These countries are neither members of the Energy Community nor have a specific agreement for implementing the provisions of EU acquis. Their TSOs are synchronously or asynchronously connected with one of ENTSO-E's synchronous areas. These third-country TSOs have an operation agreement with a TSO or TSOs belonging to this synchronous area. Their approach to system operation, grid planning and market can be based on different philosophies.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data and Information Sharing: This would not be based on EU regulations but on common interests and needs that would have to be developed together. Neighbouring TSOs can maintain the exchange of knowledge of coordinated system operation.

Expert Knowledge: Knowledge may be transferred according to mutual interests and needs.

Network Development Planning: Such TSOs can be included in ENTSO-E's development plans.

Security Management: Neighbouring TSOs can maintain the exchange of knowledge on security management.

5.6 CATEGORY 3 (C)

These countries are neither members of the Energy Community nor have a specific agreement for implementing the provisions of EU acquis. They are not connected with one of ENTSO-E's synchronous areas. Therefore, operation agreements with ENTSO-E TSOs do not exist either. ENTSO-E can share learning and best practice as deemed helpful and invite these TSOs to conferences organised by ENTSO-E, where such information can be shared in open forums.

In terms of the more specific levels of cooperation, the following can be stated:

Coordinated System Operation, Data and Information Sharing: This would not be based on EU regulations but on common interests and needs that would have to be developed together

Expert Knowledge: Knowledge may be transferred according to mutual interests and needs relating to areas such as system operation, grid planning and market.

Network Development Planning: Such TSOs are not relevant for ENTSO-E development plans. Nevertheless, expert knowledge on system development practices can be exchanged with these TSOs in open forums.

Security Management: This would depend on the shared need to provide expertise and policies to each other.

6 SUMMARY AND FUTURE DEVELOPMENTS

This document provides recommendations for the cooperation of ENTSO-E with third-country TSOs and is adopted in accordance with Article 8(3)(c) Regulation (EC) No 714/2009. In this document, the role of ENTSO-E is to facilitate the cooperation and coordination between TSOs to ensure effective and transparent access to the transmission networks and to provide coordinated and forward-looking planning. Supporting the technical evolution of the transmission system, including the creation of interconnection capacities with third-party TSOs, is a fundamental aspect of ENTSO-E's remit. Sharing best practices on traditional and new issues will help all involved parties on their way towards a sustainable energy future.

In maintaining and continuously improving these recommendations, ENTSO-E will continue to review and update these recommendations, taking into account practical experience of their implementation. In addition, ENTSO-E intends in the future to consult with third-country TSOs with the intention of making changes that would be beneficial to this framework for technical cooperation.

ANNEX 1 – ENTSO-E CONSULTATION ON RECOMMENDATIONS (2015)

Proposal made by	Proposal	Action by ENTSO-E	Explanation for ENTSO-E action
VDE/DKE	Standards are the base for defining interfaces in increasingly complex systems, which influence Transmission Systems (TS) today and tomorrow. Standards are also a step ahead, not only reflecting current but also future developments. The standardisation work done in IEC/TC57 'Power systems management and associated information exchange', e. g. in IEC 61850 together with ENTSO-E, is an example for taking present and future grid developments into account. It is highly recommended to involve standardisation from the very beginning to provide sustainability.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
VDE/DKE	Based on the positive experiences of the ENTSO-E/CLC cooperation, the contact group BTWG143-2 should enlarge its focus to IEC. This group could not only facilitate the coordination on the European level but also take into consideration the international standardisation at IEC.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
VDE/DKE	The IEC System Committee 'Smart Energy' could also support. The scope of this System Committee includes standardisation in the field of Smart Energy to provide systems level standardisation, coordination and guidance in the areas of Smart Grid and Smart Energy, including interaction in the areas of heat and gas. Also included are Advanced Metering, Cybersecurity, Microgrids and Active Distribution grids.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	ENTSO-E members have made a significant contribution to the industry through the development and adoption of the CIM. This experience should continue to be shared and updated with third-party TSOs and vendors.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	The ongoing transition to the IEC 61850 standards will require close collaboration between a wide range of TSOs, vendors and tool developers to increase efficiency of deployment and operation.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance of the message content
EPRI International	ENTSO-E has been at the vanguard of system interoperability through the development of the Network Codes. A specific area of mutual benefit relates to the integration of inverter interfaces with the synchronous system. The value of these codes increases as they are socialised and implemented by TSOs internal to ENTSO-E as well as external, as well as the commercial software and hardware vendor community.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance of the message content
EPRI International	The Ten Year Network Development Plan (TYNDP) process for transmission planning is an excellent example of TSO cooperation. As planning methods evolve to consider a wider range of factors and become more robust and risk based in nature, knowledge sharing between TSOs on planning methods, as well as coordination on planning activities, will become increasingly important.	Not accepted	This message is obvious. The challenges of TYNDP are broadly described in the already existing text.
EPRI International	In both planning and operations, management of data and upkeep of system models has become a more complex task. In conjunction with the CIM, dissemination of experience as well as system data information sharing will intensify.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance

Proposal made by	Proposal	Action by ENTSO-E	Explanation for ENTSO-E action
EPRI International	Flexibility metrics and assessment tools: As the penetration of variable generation increases, operation of the power system has changed to require fast and responsive generation. Planning methods and tools to quantify and ensure sufficient power system flexibility are in development and will benefit both ENTSO-E and third-party TSOs. Given the potential for increased trading with other areas such as North Africa and the Middle East, coordination on the flexibility requirements of the continental European system with its neighbours increases reliability and reduces costs.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	Coordination between TSOs and DSOs is evolving with the presence of distributed resources in many international systems. A key example of this includes developments in New York State, where processes and tools are evolving rapidly. Sharing experiences and information capture are important for other TSOs to learn and implement appropriate procedures in future.	The following has been accepted: Coordination between TSOs and DSOs is evolving with the presence of distributed resources in many international systems. Sharing experiences and information capture is important for third-party TSOs to learn and implement appropriate procedures in future.	The example of developments in New York State is too specific for this rather general paper.
EPRI International	As the proliferation of power electronic interfaces to the grid continues, developments to existing system study techniques, as well as accurate models, will be required.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	ENTSO-E and its members can benefit from the work of the North American SynchroPhasor Initiative and standard development through groups such as the IEC and IEEE. Shared experiences between ENTSO-E members and third parties relating to data validation and archives will increase the speed at which the technology is deployed in a constructive manner for the industry. Growing insights into the data quality needs associated with each application of synchrophasor measurements as well as the robustness of those applications are useful to third parties for developing the tools and technologies needed for future operations.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance of the message content
EPRI International	As the quantity of data increases, data visualisation and situational awareness tools are being refined to present the most important data to the operator at each time. External coordination between ENTSO-E and third parties relating to the conventions and emerging best practice for data visualisation, human factors and alarm management will help to ensure that appropriate tools continue to develop at the same pace as the quantity of information increases.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	The growth of stochastic generation and demand, as well as the new power electronic interfaces to the grid, have changed the time scales associated with real time operational security assessment. The development of tools to address these needs is a significant burden that does not need to be shouldered by a small subset of the industry. Coordination across the global community in this regard will ensure that the appropriate tools and methods are identified and brought to service in an efficient manner.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	Europe is already a leader in the area of renewable integration, and the benefits of that experience would be considerable to third parties. Specific areas such as renewable production forecasting, plant power flow and dynamic model validation, ancillary services from RES and the associated communication control scheme and algorithms are key areas in which the global industry as a whole could benefit significantly from international coordination and cooperation.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance

Proposal made by	Proposal	Action by ENTSO-E	Explanation for ENTSO-E action
EPRI International	As is evident in the recent European Commission energy package, empowering consumers is critical to the evolution of the power system. The mechanics of how that empowerment is realised will be a global issue; communications standards, consumer tariffs and dynamic pricing, load forecasting issues, and consumer expectations of reliability in the future will require close coordination and development in an international and cross-functional approach.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	As consumers become engaged and the penetration of DER increases, the coordination between TSOs and DSOs will play a significant role in the effectiveness of system operation. This coordination is starting to emerge in Europe as it is in other parts of the world. Shared experiences and practices will help third-party TSOs and DSOs as well as the industry at large adopt these practices and provide the tools and control schemes necessary.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance of the message content
EPRI International	Despite the differences between the design of electricity markets within and outside of Europe, common issues have emerged relating to the integration of emerging resources into the market. Strong coordination on these issues with the international community will aid the transition to the future power system.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance
EPRI International	In North America, the ISO/RTO Council (IRC) exists to coordinate the roles of the Independent System Operator and Reliability Transmission Operators in terms of market design and other areas. Coordination between the IRC and ENTSO-E can provide greater coordination of market design between North America and Europe.	Not accepted.	This is not related to the direct cooperation with third-country TSOs
EPRI International	As Europe looks to the development of capacity remuneration mechanisms, capital cost recovery mechanisms as well as reliability metrics are evolving in the international community.	Not accepted.	This is not related to the cooperation with third-country TSOs
EPRI International	Numerous markets around the world are evaluating the potential for distributed resources to participate in the wholesale or retail markets.	Not accepted.	This is not related to the cooperation with third-country TSOs
EPRI International	Reports have shown ways of comparing (ancillary) services between regions for apples to apples comparison. Significant variations make ancillary service comparisons very difficult.	Not accepted.	This is not related to the cooperation with third-country TSOs
EPRI International	Cyber-attacks on EMS/SCADA: Emerging attacks aimed at the critical infrastructure through which the operation of power systems is a pertinent concern for the industry as a whole. Active research and development in this area is required to keep pace with the possible threats. Given the global scope and scale of these issues, coordination and promotion of best practices in the prevention of cyber-attacks is critical to the public good.	Accepted and point is reflected in Section 3	Explanation not needed due to full acceptance

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