Implementation of the Network Code on Interoperability and Data Exchange in the Energy Community

- Assessment Paper -

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I. INTRODUCTION

1. About ECRB

The Energy Community Regulatory Board (ECRB) operates based on the Energy Community Treaty. As an institution of the Energy Community[1] the ECRB advises the Energy Community Ministerial Council and Permanent High Level Group on details of statutory, technical and regulatory rules and makes recommendations in the case of cross-border disputes between regulators.

ECRB is the independent regional voice of energy regulators in the Energy Community. ECRB's mission builds on three pillars: providing coordinated regulatory positions to energy policy debates, harmonizing regulatory rules across borders and sharing regulatory knowledge and experience.

2. Background and scope

Interoperability of connected gas transmission networks is a key requirement for undisturbed cross border flows. Regulation (EC) 2015/703 establishing a network code on interoperability and data exchange rules (IO NC)[2] sets interoperability standards for EU gas networks and is still not applicable in the Energy Community Contracting Parties (EnC CPs). Its coherent application in the Energy Community is essential for ensuring interoperability.

In most of the EnC CPs gas markets do not exist or they are still on a low level of development. Also the gas systems of the EnC CPs lay behind European developments as regards network intensity and interconnections. Implementation of the IO NC is important for already connected systems but also in the light of future network constructions. Pipeline projects in countries without gas infrastructure also should be in line with IO NC.

The ECRB Gas Working Group (GWG) Work Program 2016[3] foresees the GWG Task Force I Interoperability to make a survey on Energy Community's compliance with Regulation (EC) 2015/703 on interoperability and data exchange.

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1 www.energy-community.org. The Energy Community comprises the EU and Albania, Bosnia and Herzegovina, Macedonia, Kosovo*, Moldova, Montenegro, Serbia and Ukraine. Armenia, Georgia, Turkey and Norway are Observer Countries. [**Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence*].

2 Commission Regulation (EU) 2015/703 of 30 April 2015 establishing a network code on interoperability and data exchange rules, OJ of the EU L113 of 1.5.2015., p.13-26 (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0703&from=EN)

3 https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3964378/295DDB83E3EA4979E053C92FA8C0AF35.pdf

The assessment will focus on identification of differences in interoperability rules on interconnection points (IPs) between EnC CPs' TSOs and neighbouring EU TSOs. Next step is a proposal how and when to implement IO NC on IPs between EnC CPs' TSOs and EU TSOs.

3. Methodology and scope

Data and analyses provided in present report are exclusively based on information provided by the regulatory authorities of the analyzed markets.

The report covers Bosnia and Herzegovina, Moldova, Serbia and Ukraine as Energy Community Contracting Parties, and Austria, Italy, Poland, Romania, Greece and Hungary as EU countries neighboring the Energy Community Contracting Parties. Data for Poland are related to the IPs with Ukraine.

Albania, Kosovo* and Montenegro did not provide information due to absence of gas infrastructure.

Other EU Neighboring Countries did not provide information.

II. FINDINGS

The present paper compares the actual practice implemented on IPs in natural gas transmission systems in the Energy Community Contracting Parties and some EU Neighboring Countries with rules for Interconnection agreements (IA), Units, Gas quality and Data exchange defined in Regulation (EC) 2015/703 on interoperability and data exchange.

1.Interconnection agreements (IA)

IO NC defines rules for content of an IA. Two adjacent transmission system operators should define terms and conditions for natural gas flow control, measurement principles for gas quantities and quality, rules for matching process, rules for the allocation of gas quantities, communication procedures in case of exceptional events, settlement of disputes arising from interconnection agreements and amendment process for interconnection agreement.

In order to see the complexity of work of a TSO, the first question set was related to maximum number of network users on IPs in the last 5 years. The replies show huge differences among countries. The first group of countries has really small number of network users:

- Bosnia and Herzegovina had 2 network users on the IP with Serbia,
- Moldova had 1 network user on the IP with Romania and 1 on the IP with Ukraine (Moldova did not send data for Trans Balkan Pipeline)
- Greece 2-3 and
- Serbia had 2 network users on IP to BIH and 4 on IP to Hungary.

The second group includes countries whose IPs have substantial number of network users:

- Poland had 1 network user on IP from Ukraine and 7 on IP to Ukraine;
- Ukraine has 16 IPs and provided the numbers of network user for three IPs with IAs: There were 15 network users on IP from Poland, 20 network users on IP from Slovakia and 23 network users on IP from Hungary;
- In Romania there was the maximal number of 19 network users on IP with Hungary;
- Austria had more than 50 network users on IPs and
- Italy had more than 100 network users.

General set of questions about the IAs included the following: does an IA exist on an IP, does TSO invite network users to comment text of the IA before concluding or amending an IA and is an IA prepared based on ENTSOG template. Answers on these questions may be found in Table 1.

Table 1. General information about IA

Country	Does an IA exist on an IP?	Does TSO invite network users to comment the IA?	Is the IA prepared based on ENTSOG template?
Bosnia and Herzegovina	NO	NA[4]	NA
Moldova	NO/NO	YES/NO	Partially/NO
Serbia	YES/NO	NO/NA	NO/NA
Ukraine	IPs with EU and CP:YES(4)/NO(4) IPs with 3rd countries (Russia, Belarus): NO	NO	Partially (2 from 4)
Austria	YES	NO	NO
Italy	YES	YES/NA	YES
Poland	YES	NO	NO
Romania	YES/NO	YES	YES
Greece	YES/NO	YES	YES
Hungary	YES	NO	YES

The table above shows that **an IA does not exist on the IP between Serbia and Bosnia and Herzegovina and on a lot of IPs in Ukraine, but also on some IPs in Romania and IP Kipi between Greek and Turkey**. IA between Romanian TSO and TSOs from Bulgaria, Ukraine and Moldova will be active from 1st October 2016. Reasons for IA does not exist on some IPs is long term supply contract and/or limited number or only one network user on both sides of an IP in some cases.

TSOs did not invite network users to comment proposed text of the IA before concluded or amending it in majority of analyzed countries. There are no changes of the IA in Italy after 1.05.2016. If changes are made to rules affecting network users, they will be invited to comment proposed text of the IA.

ENTSOG template was used for preparation of the IA only in limited number of cases (e.g. in Italy, on IPs in Hungary and Greece, on the IP between Romania and Hungary and partially on some IPs in Ukraine and Moldova).

4 Throughout the document abbreviation “NA” stays for “not applicable”

All IAs contain rules of flow control and these rules included designation of the TSO responsible for steering the gas flow across the IP.

All IAs contain details on measurement standards on IPs for gas quantity and quality. IO NC defines very detailed list of measurement principles on which the adjacent transmission system operators shall agree. This list comprises 16 measurements principles and the survey showed that on most of the IPs the IAs include all required measurements principles. **On one IP in Poland and Romania and on both IPs in Moldavia the IAs do not include one measurement principle and in case of one IP in Ukraine (Hermanowice) 8 measurement principles are not part of the IA**. **IAs do not include rules between TSOs for access, additional verification and modification of the measurement facility in Hungary. IAs do not include the method of determining a correction to a measurement in case of failure and rules between TSOs for modification of the measurement facility in Greece.**

Matching process is very important on IPs where different network users on two sides of the IP exist. The adjacent transmission system operators have rules dealing with the matching process. Unless otherwise agreed between the adjacent transmission systems operators in their IAs, the lesser rule has to be applied as default rule.

Also, transmission system operators perform the matching process, if not agreed in any other way, in the following sequential steps:

- calculating and sending processed quantities of gas by the initiating TSO within 45 minutes of the start of the nomination or re-nomination cycle;
- calculating and sending of confirmed quantities of gas by the matching TSO within 90 minutes of the start of the nomination or re-nomination cycle;
- sending confirmed quantities of gas to network users and scheduling the gas flow across the IP by the adjacent TSOs within two hours of the start of the nomination or re-nomination cycle.

Minor differences in steps of the matching process exist on IPs in Greece, Serbia and on one IP in Moldova.

Meanwhile, there are difficulties with matching process in Ukraine on IPs (flow direction from Ukraine to EU countries) due to the fact, that network users do not provide Ukrainian TSO with the required information.

IO NC defines the minimum harmonised information contained within the data exchange for the matching process: IP identification; network user identification; identification of the party delivering to or receiving gas from the network user; start and end time of the gas flow for which the matching is made; gas day; processed and confirmed quantities and direction of gas flow. **In all analysed countries the IAs specify information for data exchange for matching process.** Ukraine informed that despite of the fact, the IA between TSOs of Ukraine and Hungary was concluded also on the IP (UA-HU) in accordance with the Regulation (EC) 2015/703 requirements network users do not provide adjacent TSOs with all harmonized information defined by IO NC, due to the supply contract signed in the previous period. Table 2 provides information on matching process per country.

Table 2. Matching process

Country	Rules for the matching process	Is the matching process during nomination cycle in line with IO NC?	Does an IA specify information for data exchange for matching process?
Bosnia and Herzegovina	NA	NO	NA
Moldova	Lesser rule	NO/YES	YES
Serbia	Some other rules	NO	YES
Ukraine	Lesser rule	YES (for IPs with Poland, Hungary and Slovakia - from EU to Ukraine) / NO	YES
Austria	Lesser rule	YES	YES
Italy	Lesser rule	YES	YES
Poland	Lesser rule	YES	YES
Romania	Lesser rule	YES	YES
Greece	Lesser rule	YES	YES
Hungary	Lesser rule	YES	YES

Rule for the allocation of gas quantities for TSOs in Austria, Italy, Greece, Hungary, Moldova (on one IP), Poland, Romania and Ukraine is an operational balancing account (OBA). On the IP between Poland and Ukraine OBA is used, but it is settled to zero in the end of each month. On another IP in Moldova allocation is based on measurement. On Serbian IPs with Bosnia and Herzegovina and Hungary, the biggest network user allocation is based on measurement and for all other allocation is equal to nomination.

Communication language between transmission system operators in case of exceptional events is English on the most IPs. Russian is language on the IPs between Poland and Ukraine, Russian and Romanian in Moldova and Serbian on the IP between Serbia and Bosnia and Herzegovina.

Dispute settlement mechanism is defined in the majority of IAs. On the IPs between Poland and Ukraine IAs define that disputes shall be settled by negotiations and does not specify the applicable law, the court of jurisdiction or the terms and conditions of the appointment of experts of an institutional forum.

2.Units

IO NC specifies that the reference conditions for volume are 0°C and 1.01325 bar and that for GCV, energy and Wobbe-index the default combustion reference temperature shall be 25°C. Also, common set of units for any data exchange and data publication are defined. Units are: bar for pressure, °C for temperature, m^3 for volume, kWh/ m^3 for gross calorific value (GCV), kWh for energy and kWh/ m^3 for Wobbe index.

Referent pressure on IPs in all countries is equal to the value defined in the IO NC, but referent condition of 0°C for temperature is only applied on IPs of the analyzed EU countries and partially in Ukraine. In Italy units additional to the common sets are used accordingly to Art. 14 of Interoperability NC. In Bosnia and Herzegovina and Serbia referent condition for temperature is 15°C and Moldavia and partially Ukraine use 20°C in line with import contracts. Combustion reference temperature for calorific value, energy and Wobbe index are 25°C in all countries except Bosnia and Herzegovina and Serbia where 15°C is in use. Gross calorific value is used in all countries except Bosnia and Herzegovina, Serbia and Moldavia. Also **unit for energy is KWh in all countries except Bosnia and Herzegovina and Serbia, where MJ is in use**, **Moldova where both MJ and KWh are used. Ukraine KWh is used at IP with EU countries and kcal is used with others.** Referent conditions and units per countries are also given in the table 3.

Table 3. Natural gas referent conditions and units for energy on IPs

Country	Temperature and pressure for volume	Combustion temperature and type of calorific value,	Unit for energy
Bosnia and Herzegovina	15°C and 1.01325 bar	15°C and Lower	MJ
Moldova	20°C and 1.01325 bar	25°C and Lower	MJ and kcal
Serbia	15°C and 1.01325 bar	15°C and Lower	MJ
Ukraine	0°and 20°C and 1.01325 bar	25°C and Gross	KWh/ kcal
Austria	0°C and 1.01325 bar	25°C and Gross	kWh
Italy	0°C and 1.01325 bar 15°C and 1.01325 bar	25°C and Gross 15°C and Gross	kWh MJ
Poland	0°C and 1.01325 bar	25°C and Gross	kWh
Romania	0°C and 1.01325 bar	25°C and Gross	kWh
Greece	0°C and 1.01325 bar	0°C and Gross	kWh
Hungary	0°C and 1.01325 bar	25°C and Gross	kWh

3.Gas quality

IO NC defines transmission system operators obligation to publish on their websites for each IP, with a frequency of at least once per hour during the gas day, the Wobbe-index and gross calorific value for gas entering their transmission networks at all IPs**. In Bosnia and Herzegovina, Ukraine and on one IP in Moldova, transmission system operators did not publish Wobbe-index and gross calorific value for gas at all.** T**his data is published for one IP in Moldova on weekly level**, **in Austria, Greece, Hungary Romania and Serbia on daily level** and only **in Poland** the transmission system operator publishes Wobbe-index and gross calorific value for gas **on hourly level**. **In Italy activities aimed at making available on TSO website and on ENTSOG Transparency Platform Wobbe-Index and gross calorific value on hourly basis are currently on progress and will be soon finalised.**

All analysed countries informed that **gas quality differences never caused a restriction in cross- border trade**.

Also, all countries confirmed that **differences in odourisation practices never caused a restriction in cross- border trade**.

Although it is not part of the IO NC, the survey included an investigation of parameters of gas quality that are prescribed in applicable natural gas quality standards. The results of this investigation are presented in the table below.

Table 4. Natural gas quality parameters

Country	C1	C2	C3	C4+	N2	Iso butan	n-butan	Iso pentan	n-pentan	CO_2 (mol)
Bosnia and Herzegovina	Min 92%	Max 4%	Max 2%	Max 2%	Max 2%	NA	NA	NA	NA	NA
Moldova 1	Min 40%	Max 15%	Max 6%	NA	Max 15%	Max 4%	Max 4%	Max 2%	Max 2%	Max 2%
Moldova 2	Min 90%	Max 7%	Max 3%	Max 3%	Max 5%	NA	NA	NA	NA	Max 2%
Serbia	Min 90%	Max 4%	Max 2%	Max 2%	Max 3%	NA	NA	NA	NA	Max 2%
Ukraine	Min 90%	Max 7%	Max 3%	Max 3%	Max 5%	NA	NA	NA	NA	Max 2%
Austria*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Italy**	NA	NA	NA	NA	NA	NA	NA	NA	NA	Max 3%
Poland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Romania	Min 70%	Max 10%	Max 3,5%	Max 1,5%	Max 10%	NA	NA	Max 0,5%	Max 0,5%	Max 8%
Greece	Min 75%	NA	NA	NA	Max 6%	NA	NA	NA	NA	NA
Hungary										

* The Austrian standard for gas quality gives information about Wobbe index, HHV and relative density and the combination of these three values return the chemical composition of the gas mix. But the standard does not give any direct indication for the chemical hydrocarbon composition of the natural gas.

** In Italy the values for C1, C2,C3, C 4+, N2, iso-butan, n-butan, iso-pentan, n-pentan are intrinsically limited by the acceptability Range of the Wobbe index.

Table 5. GCV, Wobbe index and sulfur, oxygen and water dew parameters range

Country	GCV (KWh/m^3)	Wobbe (KWh/m^3)	Total sulfur (mg/m^3)	Mercaptane sulfur (mg/m^3)	H2S (mg/m^3)	Oxygen (%mol)	Water dew point (°C)
Bosnia and Herzegovina	10,076 – 11,374	13,650 – 16,412	Max. 20	Max. 6	Max. 5	NO	-5/40 bar
Moldova	Min. 10,343	12,074 – 15,937	NO	Max. 36	Max.20	1	NO
Serbia	10,562 – 11, 212	13,650 – 14,950	Max. 20	Max. 5,6	Max. 5	NO	-5/40 bar
Ukraine	10,102 – 10,659	11,402 - 15,085	NO	Max. 20	Max. 6	0,02	-2,5/70 bar
Austria	10,700 – 12,800	13,330 – 15,700	Max. 10	Max. 6	Max. 5	0,5	-8/40 bar
Italy	10,234 – 13,259	13,852 - 15,322	Max. 158	Max. 16,35	Max. 5	0,6	-5/70 bar
Poland	Min. 10,556	12,500 – 15,806	Max. 20	Max.16	Max. 7	0,2	-5/55 bar
Romania	Min. 9,094	NO	Max. 100	Max.8	Max.6,8	0,02	
Greece	10.200 – 13.710	13.100 – 16.370	Max. 80	NA	Max. 5.4	0,2	5/80 bar
Hungary							

Data in Table 5 show defined minimum and maximum values for natural gas characteristics using reference conditions: 0◦C and 1.01325 bar for volume, gross Wobbe index and gross calorific value at 25◦C for combustion in line with IO NC- Chapter III Units. Data at another referent conditions for combustion/ metering are transferred to (25◦C/0◦C) in accordance with IO NC- ANNEX Conversion factors between reference conditions. Relations 1 kWh = 3,6 MJ and 1 kcal = 4,1868 MJ are also used.

4.Data exchange

IO NC defines different types of data exchange:

- document based data exchange,
- integrated data exchange and
- interactive data exchange.

Austria confirmed usage of document based data exchange and integrated data exchange. In both types of data exchange data format is Edig@s/HML.

On Poland Ukraine IPs due to the lack of data exchange solutions on Ukrainian side, matching is done with excel sheets exchanged as email attachments.

On the IP on Romanian Hungarian border integrated data exchange and interactive data exchanged are used.
On IPs in Italy for document based and interactive data exchanges the solutions described in Article 21 of Regulation (EC) 2015/703 are applied, while for integrated date exchange the implementation of the solution envisaged by this Article is currently in progress.

On the IP in Moldova with Ukraine another type of data exchange is used: Modbus TCP-IP. On the second IP with Romania also other type of data exchange is used: the encrypted manufacturer.
In Greece and on IPs between Hungary and Serbia and Serbia and Bosnia and Herzegovina the transmission system operators exchange information by sending emails.

Different security measures can be taken to protect data exchange.

On Austrian IPs and on the IP between Romania and Hungary data exchange security measures are: protection of the confidentiality by encryption, integrity and authenticity by signature of the sender and security measure to prevent unauthorized access to IT infrastructure.

Restricted list of email addresses is used in the information exchange on the IPs between Poland and Ukraine. It means that only emails sent by authorized persons are accepted and processed.
On IPs in Italy the data exchange system security and availability requirements set by Regulation (EC) 2015/703 are met.

Integrity and authenticity by signature of the sender is used as a security measure on the IP in Moldova with Ukraine. On the other IP with Romania protection of the confidentiality by encryption, integrity and authenticity by signature of the sender and security measure to prevent unauthorized access to IT infrastructure are used.

On the IPs between Hungary and Serbia and Serbia and Bosnia and Herzegovina there are no sophisticated measures for data protection. If any strange information appears during email correspondence, two transmission system operators check it by phone call.

5. Summary of findings

The survey showed that the Interconnection Agreements do not exist on IPs between the Energy Community Contracting Parties' transmission system operators, but also on some IPs between Energy Community Contracting Parties' transmission system operators and neighboring EU's transmission system operators. All Interconnection Agreements contain rules for flow control and details on measurement standards on IPs for gas quantity and quality. Matching process is defined in Interconnection Agreements, but some differences exist in rules for matching process, steps and timeframe. Rule for the allocation of gas quantities is OBA on the most of the IPs. Also, on some IPs communication language is not English and on one IP Interconnection Agreement does not define details on dispute settlement mechanism.

On all IPs on the side of the Energy Community Contracting Parties reference conditions, set of units and calorific values used are different from those in IO NC. IO NC defines that referent condition for volume shall be 0°C. In the Energy Community Contracting Parties, on the other hand, referent conditions for volume are 15^0C and 20^0C. For calorific values, energy and Wobbe index the reference temperature in the IO NC shall be 25^0C, but Energy Community Contracting Parties use 15^0C and 0^0C. In IO NC usage of gross calorific value is prescribed, but Energy Community Contracting Parties use lower calorific value. In the Network Code on Interoperability and Data Exchange Rules units are: kWh for energy and kWh/m^3 for calorific value and Wobbe-index. In the Energy Community Contracting Parties the units are: MJ and kCal for energy and MJ/m^3 and kCal /m^3 for calorific value and Wobbe- index. Only exceptions are new IPs between EU transmission system operators and Ukrainian transmission system operator.

All countries informed that gas quality differences or differences in odourization practice never caused a restriction in cross-border trade. The most Energy Community Contracting Parties' transmission system operators do not publish Wobbe-index and gross calorific value for gas entering in their transmission networks at all IPs and no one publishes these data on the hourly level.

Transmission system operators in the Energy Community Contracting Parties on all IPs exchange data information via email instead of using one of three solutions defined in IO NC: document based data exchange, integrated data exchange and interactive data exchange. Some transmission system operators from the Energy Community Contracting Parties implemented security measures defined in IO NC on some IPs.

III. CONCLUSIONS

Regulation (EC) 2015/703 establishing a network code on interoperability and data exchange rules is applied in the EU as of 1 May 2016. The implementation of this regulation is still not obligatory in the Energy Community Contracting Parties.

The Energy Community Contracting Parties should implement this network code on interconnection points with a goal to create preconditions for attracting new shippers, increase gas flow from different gas sources and facilitate gas trade in the region for the benefit of final customers of natural gas. But, for final customers of natural gas in the Energy Community Contracting Parties it is probably even more important to implement the IO NC provisions on the IPs between EU countries and the Energy Community Contracting Parties.

Realistic deadline for the Energy Community Contracting Parties' transmission system operators to implement all solutions from IO NC should not be less than two years after the adoption of the act. At the same time a framework for the implementation of the IO NC on IPs between the Energy Community Contracting Parties' and neighboring EU countries' transmission system operators should be ensured.

Provisions of the IO NC should be also the default rules for all new IPs in the Energy Community Contracting Parties.