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Prospective expansion of the ENTSO-E transparency platform to include TSO–DSO interaction and wider market participation

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Abstract: The increasing integration of renewable energy resources connected to the distribution networks has led to an increased installed capacity of distributed generation. In this context, new technical and operational challenges have arisen concerning data exchanges between transmission system operators (TSOs) and distribution system operators (DSOs), requiring scalable, secure and standardised data exchange between them at different timeframes. The aim of this study is to investigate prospects for wider usage of the transparency platform developed by the European Network of Transmission System Operators for Electricity and critically evaluate them with its information and data requirements. The evaluated prospects are based on the designed use cases of Work Package 2 in the TDX-ASSIST project. The proposed approach in this study has the potential to provide a wider range of stakeholders and participants as data providers to energy market-related information and data.

1 Introduction

Transparency between stakeholders is a crucial aspect for the implementation of the European Internal Electricity Market (IEM) (https://www.europarl.europa.eu/factsheets/en/sheet/45/internal-energy-market) [1] as well as for the creation of efficient and competitive strategies not only for the implementation of the wholesale markets but also for the implementation of other types of markets. In addition, transparency between markets is also critical for creating a level playing field between market participants, avoiding, for instance, the scope for market power to be abused. Within the context of the electricity market, transmission system operators (TSOs) are responsible for essential information and data exchange in relation to electrical power transmission systems. In particular, TSOs collect and assess large amounts of information from the transmission network for system operation and associated electricity market purposes. Since 2006, before Commission Regulation (EU) 543/2013, the European TSOs have voluntary made this fundamental market information available for the public through an online data platform developed by the European Network of Transmission System Operators for Electricity (ENTSO-E) called the Transparency Platform (TP) [2]. The TP enables the development of efficient and competitive energy markets all across Europe, supporting their steady evolution in terms of integration and competition by providing the information required by the electricity transmission systems for the future and further facilities.

Currently, the TP consists of 50 data providers, including TSOs, Power Exchange Auction Offices and third parties [2, 3]. All of them have access and can publish data via the TP based on different categories of data including generation, transmission, balancing, outages, and congestion management.

The TP could be scaled, extended and updated regularly to co-operate with other stakeholders like distribution system operators (DSOs) [3]. In particular, DSOs have long demonstrated to be capable of handling large amounts of data, being the relation between delivery points at the distribution and transmission networks about 60.000:1. In this context, including DSOs information and data in a common platform with TSOs, such as the TP, has been proposed in the literature to provide scalable, secure and standardised data management in electrical power systems, which is considered an essential feature in regard to the Smart Grid Architecture Model (SGAM) [4]. In this paper, the need for enhanced coordination between DSOs, TSOs and third parties, in terms of operational and market perspectives, is addressed based on the bidirectional behaviour of the data and energy flows from the generation to the last mile of the network shown in Fig. 1. In particular, the evaluation of prospective expansions and developments of the TP with regard to data categories based on the data configuration, standards and timeframes, is presented. The evaluated potential prospects are based on the designs of Use Cases (UCs) as specified in the H2020 TDX-ASSIST project [5].

2 Data exchange

The Manual of Procedures (MoP) (https://www.entsoe.eu/data/transparency-platform/mop/) [6], as required in Regulation 543/2013, is a technical guide developed by ENTSO-E following the discussions with stakeholders, public consultation and reviewed by ACER. It provides users valuable information in terms of the functionality and usability of the TP. The ACER's visions about it are described in [6], published in 2017, by the Opinion of the Agency for the Cooperation of Energy Regulators No 02/2017 [7]. According to the Manual of Procedures, the data exchanges of the TP are all based on the Common Information Model (CIM) and are available on the ENTSO-E EDI library [8].

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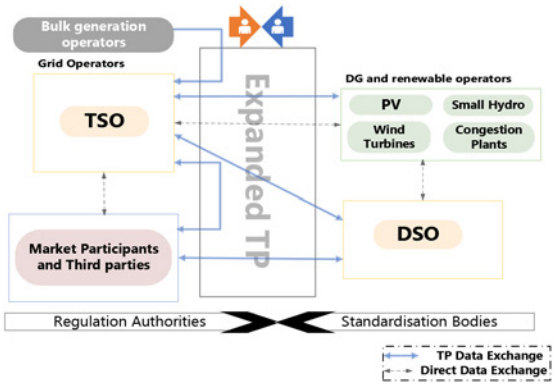

Fig. 1 *Consideration of data flows within an expanded TP*

Nowadays, the TP specifies a total of 51 data items to be published, grouped in six categories, viz., load, generation, transmission, balancing, outages and congestion management. Since January 2015, all this data must be available on the TP as well as for all time steps [9].

Missing data, that is, data that have not been published is one of the most common and challenging problems the TP users have to face. In these cases, where there is no information about the missing data, users usually have to resort to alternative solutions to validate their data by comparing and evaluating their accuracy with reliable comparable data. Although ENTSO-E works hard to constantly improve the quality of the comparable data available on the TP, users argue that they need to have access to more information about the missing data as well as to broader coverage, where they could see data beyond what it is prescribed in Regulation 543/2013. In this paper, the evaluation of prospective expansions and developments of the TP with regard to data categories based on the integration of DSOs and third parties is proposed. In particular, the proposed expansions are based on the designs of UCs as specified in the H2020 TDX-ASSIST project.

3 Integrating DSOs and third-parties to the TP

According to the Commission Regulation (EU) 543/2013 [10], market participants are responsible for timely reporting their expected consumption and its actual outturn. The provided information should be regularly updated and provided for different timeframes. In the current market, where there has been an increase of DG, the planned and unplanned unavailability of power generation and consumption units has become vital supply-demand information for generation units. In this context, it is essential to provide TSOs detailed information about where, when and why units are not or will not be available to generate or consume as well as when they are expected to return to operation. In this way, TSOs will be able to better allocate reserves, reducing, for instance, the probability of blackouts.

In recent years, it has been shown that the inclusion of DSOs information in a common platform with TSOs allows for scalable, secure and standardised data management [3]. Although the TP does currently integrate data from TSOs and third parties, there exist further potential alternatives for integrating more actors so that the use of the TP can be expanded. In this paper, the proposed integration is based on the change of the published data limits rather than on the inclusion of new data themselves. In the Commission Regulation (EU) 543/2013, several articles state a lower limit of 100 MW [10]. This limit usually supposes a technical and financial barrier to small-scale distributed energy resources (DERs). Note to the reader that power plants producing 10 MW, which is relatively small plants, do not usually have the technical skills to provide the amount of data required by the TP. In these cases, integrating the DSO can provide the required aggregated data to the TP from its network. These data are likely to be better suited for the TP purposes, making it possible to further decrease the 100 MW limit allowing for more involvement of third parties interested in access to the provided information via the TP. Moreover, this is expected to make the TP not only attractive to users seeking information, but also to users intending to publish information on the energy market.

3.1 Application of the TP within the context of the UCs of the TDX-ASSIST project

In this paper, prospective expansions of the TP are evaluated based on the series of UCs specified in deliverable 2.2 of the TDX-ASSIST project [5]. These UCs need reliable infrastructures for the exchange of information. In this line, a well-established platform developed and mandated by the EC, such as the TP one, is expected to be well-suited for implementing the wider perspective. In Table 1, the feasibility of implementing the UCs of WP2 in the TDX-ASSIST project [5] within the current

Table 1 Analysis of the relationship between UCs (BO) [5] and the TP data

UC1	BO	consumer information management of consumption data
	TP data to be used	actual total load [6.1.A], day-ahead total, load forecasts [6.1.B], week-ahead total, load forecasts [6.1.C], year-ahead total load [6.1.E]
UC4	BO	market information new actors demand
	TP data to be used	installed generation capacity aggregated [14.1.A], day-ahead generation forecasts for wind and solar [14.1.D], cross-border balancing – volumes of exchanged bids and offers [17.1.J], cross-border balancing – prices [17.1.J], cross-border balancing – energy activated [17.1.J]
UC7	BO	new operational paradigm for network connection demand information and forecasts market data providing load and generation information
	TP data to be used	actual total load [6.1.A], day-ahead total, load forecasts [6.1.B], week-ahead total, load forecasts [6.1.C], year-ahead total load, [6.1.E], installed generation capacity aggregated [14.1.A]
UC9	BO	congestion information
	TP data to be used	total actual load [6.1.A], re-dispatching [13.1.A], countertrading [13.1.B], costs of congestion management [13.1.C]
UC10	BO	imbalance settlement
	TP data to be used	actual generation output per generation unit [16.1.A]
UC10	BO	data analysis in operational planning (OP)
	TP data to be used	scheduled commercial exchanges [12.1.F], installed generation capacity allocated in distribution and transmission grid [14.1.A], planned unavailability of consumption units [7.1.A], changes in actual availability of consumption units [7.1.B]
UC11	BO	real-time supervision and control
	TP data to be used	actual total load [6.1.A]
UC12	business objects	OP activities for DSO, municipalities and conceding agencies
	TP data to be used	scheduled commercial exchanges [12.1.F], installed generation capacity allocated in distribution and, transmission grid [14.1.A], planned unavailability of consumption units [7.1.A], changes in actual availability of consumption units [7.1.B]

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Table 2 Analysis of the UCs BOs [5] which are not currently available in the TP

UC1-acting as a data manager: collecting, providing and processing raw data from DSO level (IED data, contracts data, metering data)	BO	consumer information management of consumption data
	constraints for the TP	TP is not a data manager, who is responsible for collecting, providing and processing consumption data; consumption data have not been included (sent by DSO)
	constraints mitigation	new category for consumption data could be added on TP
UC2-contracting different flexibility services at DSO level at different timeframes	BO	flexibility contracts
	constraints for the TP	contract data for flexibilities are not yet available on the TP
	constraints mitigation	new category for flexibilities could be implemented
UC3-activating different flexibility services at DSO level at different timeframes	BO	flexibility activation
	constraints for the TP	limitation depends on the kind of flexibility used (short, mid or long-term flexibility data)
	constraints mitigation	new category for flexibilities could be implemented
UC4-enabling new products for energy markets, facilitate market development	BO	market information new actors demand
	constraints for the TP	real-time market data and processing is not possible on the TP (sent by the DSO)
	constraints mitigation	new category for markets could be added on TP
UC5-providing data management services based on regulated services environments	BO	data management data security regulated service environment
	constraints for the TP	TP is not created for storing, achieving and transferring any kind of data on the TP security measurement data is not yet available
	constraints mitigation	standardised security restrictions could implemented based on the IEC standards
UC6-operation, roll-out and de-commission as well as governance of a smart metering infrastructure for third parties	BO	smart meter roll-out smart meter governance smart meter decommission
	constraints for the TP	smart meter data (roll-out, governance and decommission) is not yet included in the TP (sent by DSO)
	constraints mitigation	smart meter data could be implemented in the new category for consumption data
UC7-creating new operational paradigms for network connection	BO	demand information and forecasts; voltage regulation; market data providing; load and generation information
	constraints for the TP	consumption data have not yet been included; analysis data for demand forecasts is not yet available on the TP; voltage data for regulation are not available; the TP partly contains market data; load and generation data are possible on the TSO area, but not on the DSO area
	constraints mitigation	consumption data for forecasts as well as voltage and market data should be (partly) added
UC8-providing metering and service provision monitoring infrastructure for future electric vehicles	BO	EV user information
	constraints for the TP	EV's user, online application and meter installation data are not included (sent by DSO)
	constraints mitigation	EV's user data could be implemented in new category for consumption data
UC9-managing electricity grid congestion	BO	congestion information
	constraints for the TP	TP is not used for congestion information
	constraints mitigation	implementation of communication possibilities between actors, e.g. new market category
UC10-balancing supply and demand	BO	imbalance settlement
	constraints for the TP	consumption and SCADA data are not available at the distribution grid nor included in TP (sent by DSO)
	constraints mitigation	amount of electricity that a company has contracted to generate has to be implemented
UC10-balancing supply and demand	BO	data analysis in OP
	constraints for the TP	TP can depict the generation output per generation unit, but there is no data item for the amount of electricity that a company has contracted to generated (sent by DSO)
	constraints mitigation	UC10 constraints mitigation could be applied
UC11-enacting real-time control and supervision	BO	real-time supervision and control
	constraints for the TP	real-time control and supervision is not possible on the TP
	constraints mitigation	real-time processing should be enabled
UC12-enacting OP activities for DSO, municipalities and conceding agencies in close relationships	BO	OP activities for DSO, municipalities and conceding agencies
	constraints for the TP	data for OP between DSO, municipalities and agencies is not yet included (sent by the DSO and other market actors)
	constraints mitigation	implementation of communication possibilities between actors; data could be implemented in a new category for market
UC13-making the necessary network design evolutions in consistency with an appropriate functional improvement of OP	BO	network plan
	constraints for the TP	there is no data item on the TP that could be used for the planning of the network
	constraints mitigation	3–5 years planning data could be implemented in new category consumption data

operation and data sections of the TP is evaluated. In particular, Table 1 analyses which data available in the TP could be used within the context of different WP2 UCs with different business objects (BOs).

3.2 Possibilities of TP expansions based on the UCs of the TDX-ASSIST project

Table 1 shows that there are several UCs in the WP2 of the TDX-ASSIST project that can be implemented within the TP context. In this paper, the UCs shown in Table 1 are further developed towards expanding the TP application by improving the DSO/TSO communication and interaction. As a result, the potential TP expansions shown in Table 2 are obtained.

4 Conclusions

In this paper, prospective expansions of the ENTSO-E's TP integrating DSOs and third parties have been evaluated based on the series of UCs specified in deliverable 2.2 of the TDX-ASSIST project. In particular, the capability of the proposed UCs and their associated BO to anticipate future applications of the TP based not only on the existing regulation but also on the proposed new features, has been analysed. According to the obtained results, in order to provide the amount of information currently requested by the Bills of Service developed at the TDX-ASSIST project, the exchanged data should be obtained not only through the data already published on the platform but also through new data. In this paper, this new data is proposed to be obtained through the inclusion of more actors to the TP. According to the Commission

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Regulation (EU) 543/2013, the TP presents high thresholds that, if decreased, can allow more participants, such as market aggregators, to use and even publish new data into the TP. For instance, unavailability of consumption as well as forecast and actual generation could have their limits decreased below the current limit of 100 MW and be published in the TP. In this direction, the discussion held in this paper has shown that, on the one hand, the data currently published by the TP can play a crucial role in the inclusion of these new actors using the TP data; whereas, on the other hand, DSOs can also provide aggregated data about the generation and consumption at their networks and feed the TP with these data. Here, it is important to highlight that the proposal of decreasing the current limit of 100 MW might contradict the Clean Energy Package, which states that 'Member States shall organise the management of data' [11]. Nevertheless, to determine whether (and to what extent) the existing technological solutions employed in the current TP for cross-border exchanges of electricity can be scalable is out of the scope of this paper.

Finally, the different alternatives proposed in this paper to expand the ENTSO-E's TP by including DSOs and third parties, establish a useful starting point for further discussions about the participation of new actors capable of sharing information through the TP. In this line, the authors suggest that for further improving the TP to allow new data publication, legally mandated topics, such as the Electricity Balancing and the System Operation guidelines should be taken into account. In fact, these topics are currently under development by ENTSO-E and are expected to be integrated by another market participant for specific usages.

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