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Customer in the capacity market in the context of qualitative regulation model

Abstract

In the recent period the capacity market has been the central point of intensive discussions among power industry professionals and has attracted attention of the legislator who is justifiably concerned about the future of the national power system in Poland. The system's security depends heavily on a number of factors, including *inter alia* generation capacity balance, availability and reliability of generation assets, as well as the technical condition of transmission and distribution systems. Advancing unification of previously individualized operating mechanisms of local energy markets and their consolidation within the community market, as well as the development and promotion of renewable energy sources, effects of efficiency policy and a number of environmental risks all result in a significant reduction of wholesale electricity prices. The observed, expected and increasing downward trend acts as a natural stimulus that slows down investment processes, mostly in the area of construction and restoration of generation capacity. It is thus necessary to look for alternatives for "supply-based" power balance improvement among system solutions and considerations related to the capacity market concept. Processes involving active management of the demand side can be such a solution, or at least a supporting action. However, this particular element requires an improvement in quality and reliability of electricity distribution and adaptation of the measurement and billing infrastructure.

The objective of this paper is to inspire discussion on the assumptions of the new quality-based regulation model developed by the President of the Energy Regulatory Office (URE). Proposed changes in the tariffs structure are a response to reported high indicators reflecting the duration of power supply interruptions. The proposed remedy for improving power supply quality and continuity are new, quality-oriented rules of financing the actions undertaken by distribution system operators (DSOs), whereby their regulated income will depend on power supply quality and reliability improvements. Declarations made by the President of the URE in the media regarding changes to the current principles of calculating distribution tariffs give rise to multiple issues requiring in-depth analysis [A. Pazda, 2014, p. 6; by the time of this

paper going to press the President of the URE had not published any detailed principles and mechanisms of the quality-based regulation].

Which arguments speak in favor of introducing a quality-based tariff for DSOs? What parameters will be monitored as part of the new model? Will the new tariff calculation assumptions stimulate an improvement in power supply reliability in Poland? How will the new model affect the regulated revenues of DSOs? And finally, will the changes proposed by the President of the URE translate into an improvement in the quality of power supply to end users, thus creating possibilities for implementing demand-side management mechanisms? These are but a few questions inspired by the proposed introduction of a quality-based regulation system.

Before proceeding to discuss those questions it needs to be remarked that answering them is not made any easier by the fact that detailed assumptions for the new system are developed without large-scale public consultation. Given the doubts that arise, two issues seem fairly certain. Firstly, the date of introducing changes to the existing rules of financing DSOs: as declared by the President of the URE, such changes are to take effect on January 1, 2016. Secondly, the direction of changes: the key objective of the new regulation is to improve the quality of power supply by reducing the duration of interruptions. The objective is to be achieved by means of monitoring quality indicators (SAIDI, SAIFI, MAIFI) and tying DSOs' revenues to an improvement of those indicators.

Considering the above it goes beyond doubt that the introduction of a "quality tariff" is the key challenge currently faced by the power distribution industry.

In their current version, regulations oblige DSOs to publish information about the duration of interruptions in electricity supply in the previous calendar year. In the context of the proposed changes, the analysis of electricity supply interruption indicators gains particular importance, and so does the answer to the question whether DSOs duly perform their information obligations. Given that the information mechanism has been in place for nearly nine years, it is possible to analyze to what extent it has been adhered to. The results of such analysis, presented later, allow one to prove that the data published by DSOs does not provide the expected information value. Furthermore, the process of supervising the performance of the information obligation is ineffective, which inspires doubts regarding the correctness of assumptions made for the newly proposed "quality tariff" mechanism.

Keywords: delivery of electricity, supply interruption, indexes concerning interruptions, SAIDI, SAIFI, MAIFI

1. Legal aspects of admissibility of power supply interruptions and the related information obligations

The underlying principles of regulations on power supply interruptions can be found among the provisions of the Energy Law Act of April 10, 1997 (Journal of Laws of 2012, item 1059, hereinafter the "Energy Law"). Pursuant to the Energy Law, one of the key objectives of DSOs is to strive to meet electricity quality parameters and customer service quality standards, including admissible interruptions in power supply to end users [*Cf.* Article 3, points 16 to 16b of the Energy Law]. It should also be remarked that pursuant to Article 5(2)(2) of the Energy Law, power transmission or distribution agreements should obligatorily contain provisions specifying such matters as: quality standards, power supply continuity and reliability assurance conditions, as well as compensation for any failure to meet power parameters and customer service quality standards.

From the perspective of the issue discussed here, the provisions of the Regulation of the Minister of Economy on detailed conditions of operation of the power system of May 4, 2007 (Journal of Laws No. 93, item 623, hereinafter the "System Regulation") are of key importance. Allowed duration of power supply interruptions introduced by the legislator is an expression of an objective stipulated in Article 1 of the Energy Law, consisting of balancing the interests of utility companies and electricity consumers. In other words, by introducing the legal limits of power supply interruptions the legislator protects the interests of consumers and yet takes into account the specific nature of the power industry and the fact that the operation of the power grid depends on a number of external factors which are often far beyond the control of transmission companies [*Cf.* Clause 40(2) of the System Regulation].

It needs to be remarked that the classification of interruptions introduced by the legislator in the System Regulation is correlated with information obligations. Thus, in the case of a planned interruption pursuant to Clause 42(4) of the System Regulation, a power company offering power transmission or distribution service is obliged to notify consumers about the dates and durations of planned power supply interruptions [*Cf.* Clause 42(4) of the System Regulation].

The form and timing of performing this obligation depends on the rated voltage of the power grid to which the consumer is connected. Notification methods allowed by the legislator include notices published in the press, on the internet, on the radio or on TV, as well as other methods customarily used in a given area. The time allowed by the legislator ranges from 5 days prior to the planned outage to as much as 3 years in certain circumstances. Should a power company fail to observe the information obligation, the interruption in question is treated as unplanned.

Unplanned interruptions constitute the other type of interruptions. Their reasons are usually attributable to power system failures. In the case of such an interruption power companies are obliged to immediately proceed to remove such failures and to inform consumers – upon their request – about the expected time of restoring power supply interrupted by a system failure.

From the perspective of the issue discussed here, the provisions of Clause 41(3) of the System Regulation are of key importance. The said clause obliges power companies to publish annual reports on the duration of power supply interruptions in the previous calendar year. Such reports are to be published on the company's website until March 31 of each year. [A similar obligation has been imposed on the transmission system operator who additionally informs the public about energy not supplied (ENS) and average interruption time (AIT).]

Consequently, distribution companies are obliged to present the following reliability indicators:

1. SAIDI (System Average Interruption Duration Index) – the basic indicator used to evaluate the duration of long and very long outages. The indicator is measured in minutes per year per consumer and constitutes the sum of products of interruption durations and the number of consumers affected by the interruption during the year divided by the total number of consumers served,

$$SAIDI = \frac{\sum_{i=1}^{n} T_{Pi} L_{OWi}}{L_O}$$

where:

n – total number of long and very long outages,

T_{Pi} *– outage* i *duration in minutes,*

L_{OWi} *– number of consumers affected by outage* i*,*

L_O *– total number of consumers served.*

2. SAIFI (System Average Interruption Frequency Index) reflects the frequency of long and very long outages. The value of this indicator corresponds to the number of consumers exposed to the consequences of all such outages during the year divided by the total number of consumers served,

$$SAIFI = \frac{\sum_{i=1}^{n} L_{OWi}}{L_O}$$

3. MAIFI (Momentary Average Interruption Frequency Index) represents the average system frequency of short outages. This indicator is expressed as the ratio of the number of consumers affected by short outages to the total number of consumers served,

$$MAIFI = \frac{\sum_{i=1}^{m} L_{OWj}}{L_O}$$

where:
m – total number of short outages,

SAIDI and SAIFI indices should be published by distribution system operators separately for planned and unplanned outages, both including and excluding catastrophic events.

Simultaneously it should be remarked that following an amendment of the System Regulation in 2008 the scope of the information obligation was modified. The legislator introduced a deadline by which DSOs should meet the information obligation (i.e. March 31 each year) and clearly stated that the obligation applies to indicators calculated for the previous calendar year. Furthermore, before the amendment DSOs were not obliged to report separate SAIDIs and SAIFIs for unplanned outages including and excluding catastrophic interruptions. After the law was changed, DSOs are now also obliged to disclose the number of customers served assumed upon calculation of each index.

Bearing in mind the above it was considered reasonable to verify how DSOs perform the obligation to publish energy supply interruption indicators. An analysis of the adherence to the legal obligation to publish average outage durations and average number of outages per consumer by the end of March makes it possible to compare the performance of different

operators. However, it should be remarked that the current legislation does not provide the President of the URE with tools for efficient verification and enforcement of the information obligation.

2. Analysis of data on DSOs' adherence to the obligation to publish energy supply interruption duration indices

As the information obligation has been in place for nine years already, it is possible to collect data necessary for analyses and conclusions on the functionality of the mechanism. The research is based on an analysis of data from DSOs' websites, which allows one to determine whether the obligation in question is actually adhered to by utility companies or remains a dead letter. The interpretation of published information makes it possible to answer the question about whether in practice the obligation is performed correctly and whether information is published in an appropriate manner. If both of the above conditions are met cumulatively, one can consider the legal regulation as fulfillment of the legislator's intentions and a solution that creates value for consumers.

The research covered 172 websites of distribution system operators (as of July 13, 2015). Collected information made it possible to calculate the following statistics:

- 111 DSOs (65% of the population) do not publish quality indicators (SAIDI, SAIFI, MAIFI),
- 15 DSOs (9% of the population) do not have a website, or their websites are inaccessible,
- 32 DSOs (19% of the population) publish indicators exclusively for the year 2014; these are presented in detail in Table 1,
- 11 DSOs (6% of the population) publish data simultaneously for 2013 and 2014,
- 5 DSOs (3% of the population) publish data simultaneously for 2012- 2014,
- 3 DSOs (2% of the population) publish data simultaneously for 2011-2014,
- 1 DSO (0,6% of the population) has published data since 2007, i.e. from the introduction of the obligation to publish quality indicators.

An analysis of published data allows one to draw the following detailed conclusions:

- the System Regulation does not specify penalties for non-performance of the information obligation; as a result, 74% of all DSOs do not publish the required data,

- the System Regulation does not specify the detailed form of disclosing the information, which implies full freedom of its presentation, to the detriment of its clarity and transparency,
- considerable part of published information does not comply with the required division into planned/unplanned outages, both including and excluding catastrophic events,
- in most cases, DSOs do not publish archived statistics which makes it impossible to analyze year-on-year changes of the indicators,
- presented information is incomplete (e.g. as regards the number of customers served by DSOs),
- quality indicators are expressed to a varying degree of precision, ranging from x.x to x.xxxx; as a result, values meant to be presented in minutes are presented to an accuracy of a few thousandths of a second,
- indicators are calculated incorrectly – for instance, the value of unplanned outages including catastrophic events is lower than the value of unplanned outages excluding catastrophic events,
- in accordance with the presented information, the total number of consumers served by DSOs in 2014 is approximately 17.1 million, which differs significantly from the value presented in the National Report 2014 of the President of the URE, amounting to 16.7 million [National Report of the President of the URE, July 2014, p. 9].

The new tariff mechanism recommended by the President of the URE is to be based on quality indicators which will be used to determine the level of regulated revenues of DSOs. The concept assumes monitoring of selected quality parameters – if their target values are met, a financial bonus algorithm will take effect, translating directly into the condition of the system infrastructure. At this point, bearing in mind the above conclusions from the authors' research, it should be doubted whether a DSOs' revenues model based on indicators that significantly diverge from European standards makes any sense at all. In addition, both the poor quality of calculated and presented information and non-compliance with applicable laws (i.e. failure to observe the obligation information by DSOs) make one wonder whether it is reasonable to change the tariff calculation methodology. A comparative analysis, the results of which are presented in Table 2 and in Fig. 1, indicates that the average SAIDI and SAIFI levels of Polish operators are significantly different from those of European distributors.

Table 1 Quality indicators published by DSOs for 2014

Nr	Number of customers	SAIDI			SAIFI			MAIFI	
		planned	unplanned		planned	unplanned		planned	unplanned
			including catastrophic events	excluding catastrophic events		including catastrophic events	excluding catastrophic events		
1	5 334 408	104,73	151,06	150,18	0,62	2,74	2,74	3,18	
2	5 225 653	194,62	279,46	241,58	0,7	3,27	3,25	3,51	
3	3 036 404	58,4	203,7	198,3	0,39	3,15	3,14	7,53	
4	2 460 758	106,09	223,49	219,43	0,47	3,21	3,21	1,93	
5	964 802	19,05	64,03	60,78	0,1588	1,2978	1,2945	0,4362	
6	43 340	8,58	22,62	19,24	0,05	0,14	0,1	0,03	
7	2 099	88,65			0,35	0,21		0,074	
8	728	4,9917	0,6181	0,6181	0,1263	0,0068	0,0068	0	
9	347	92,48	0	2,63	0,15	0	0,08	0	0,1
10	334	6,88	33,67	10,66	0,04	0,06	0,06	0	
11	260	33,05	15,61	15,61	1,105	0,07	0,07	0	
12	181	157,5	0	0	7	0	0	0	
13	157	1,815	24,64		0,07	0,096		0,828	
14	139	166	239	153	0,89	2,4	2,37	1	
15	137	90			0,036	0,007		0,022	
16	134	8,4	4,77		0,07	0,21		0	
17	112	178,27	25,63	25,63	0,71	1,76	1,76	0,11	
18	83	326,48	4,1		0,9	0,1		0,14	
19	74	35,59	127,42	127,42	0,24	1,93	1,93	1,16	
20	69	41,83	10,87	10,87	0,9275	0,0434		0,14	
21	57	21,14	1,47		0,09	0,14		0,02	
22	57	624,2982	0,2631		1,8246	0,0175		0	
23	35	427,71	37,29	37,29	1,46	0,67	0,69	0	
24	34	7,06	0,44		0,088	0,029		0,059	
25	30	54	206,23	206,23	0,26	0,06	0,06	0	
26	23	600	0	0	2	0	0	0	
27	18	3,3	125	125	0,055	0,22	0,22	0	
28	18	222,22	34,89	34,89	0,11	0,22	0,22	0,28	
29	14	38,929	87,5	87,5	1,143	0,429	0,429	0	
30	11	65,45	60,69	60,69	0,18	0,64	0,64	0	
31	10	0	16,5	16,5	0	0,3	0,3	0	
32		3,47	1,25		0,62	0,31		0,92	

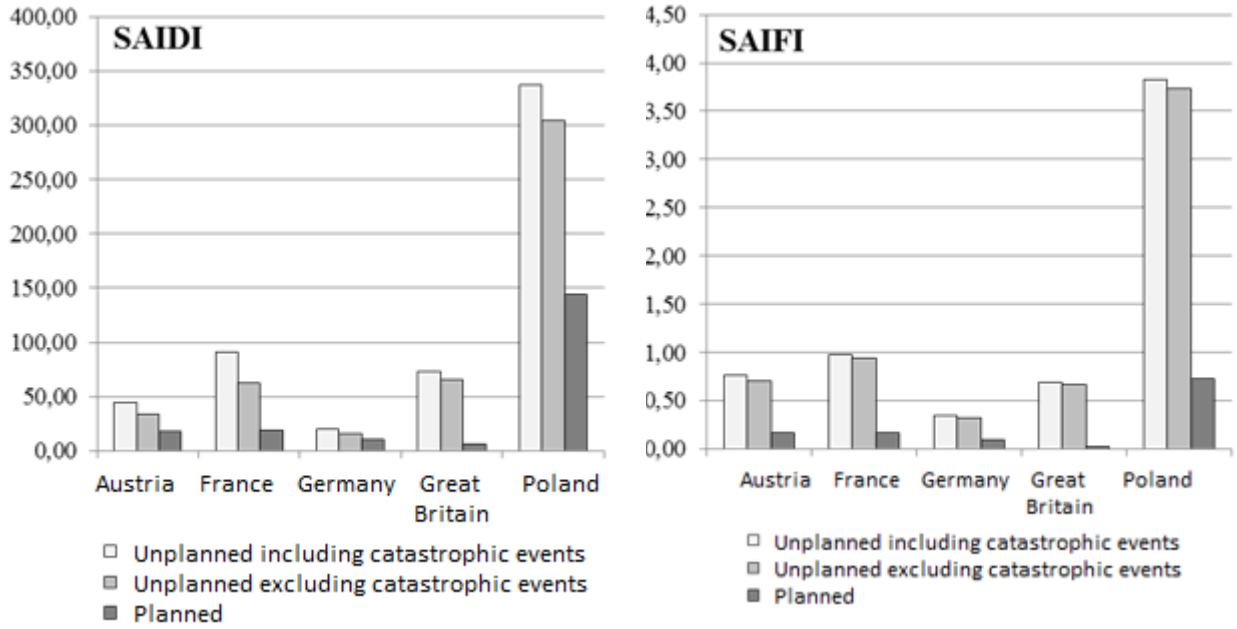
Source: By the authors, based on information published on DSO websites

Table 2. Average quality indicator values in selected EU countries (2008-2013)

	SAIDI			SAIFI		
	Unplanned including catastrophic events	Unplanned excluding catastrophic events	Planned	Unplanned including catastrophic events	Unplanned excluding catastrophic events	Planned
Austria	44.61	34.08	17.87	0.76	0.71	0.17
France	90.57	62.25	19.50	0.98	0.94	0.17
Germany	19.94	15.49	10.59	0.35	0.32	0.10
Great Britain	73.02	65.96	6.33	0.69	0.67	0.02
Poland	336.57	304.70	144.57	3.83	3.73	0.72

Source: CEER Benchmarking Report 5.2 on the Continuity of Electricity Supply; Ref: C14-EQS-62-03 12 February 2015

Fig. 1 Average quality indicator values (2008-2013)



Source: CEER Benchmarking Report 5.2 on the Continuity of Electricity Supply; Ref: C14-EQS-62-03 12 February 2015

In principle, the "quality" approach should stimulate DSOs to take care of the technical condition of the system infrastructure and to ensure efficient technical service. However, the authors are of the opinion that such implementation calls for a long transition period and quick adaptation of all formal, legal, regulatory and "mental" requirements to the new model, possibly including introduction of European models and experiences, for instance with regard to "penalties" for failure to achieve preset energy supply parameters.

3. Proposed quality regulation model vs. discounting

It is worth mentioning that although the legislator has not introduced any penalties for non-publication of SAIDI, SAIFI, MAIFI indicators by DSOs, the very fact of exceeding the allowed energy supply interruption durations specified in the System Regulation obliges DSOs to award discounts to customers upon their written request. [Pursuant to Article 41(1)(1) of the Regulation of the Minister of Economy on detailed conditions of developing and calculating tariffs and on settlements in electricity sales: "The end user connected to a system of rated voltage not exceeding 1kV is eligible for a discount for each unsupplied unit of electricity, amounting to ten times the price of electricity in the period in which an interruption occurred."]

In addition, a reference should be made to the recent discussion among theorists of law regarding the legal nature of the above discount, having direct effect on the operation of DSOs. Bearing in mind the constraints of the thematic scope of this paper, it will only be remarked that the dispute was partially settled by the resolution of the Supreme Court of September 18, 2014 (file No. III SZP 1/14). Previously, DSOs had refused to award discounts on the grounds that interruptions were caused by circumstances beyond their control, such as unfavorable weather conditions. In the opinion of the Supreme Court such refusals were unjustified, and discounts should be awarded to customers irrespectively of the underlying causes of the interruption.

The Supreme Court's decision is in keeping with the position of the President of the URE, who has often stressed that discounts should be awarded irrespectively of the utility's fault or occurrence of force majeure. [President of the URE insists on customers' right to receive discounts for unsupplied energy http://www.ure.gov.pl/pl/urzad/informacje-

ogolne/aktualnosci/3463,Prezes-URE-stanowczo-broni-prawa-odbiorcow-do-bonifikat-za-niedostarczona-energi.print].

To conclude, one should add that the President of the URE has repeatedly called for simplification of the discounting procedure, e.g. by means of adjusting the amount in the electricity bill, thus relieving customers of the obligation to submit separate requests in writing.

Proposals to change the discounting scheme are presented on a recurring basis in discussions on how DSOs should provide their customers with adequate energy supply quality. Such proposals appeared also in the debate on new solutions related to the "quality-based tariff". The importance of the discussed issue, determined by the scale of non-compliance with statutory limits on interruption durations, makes one consider the possibility of changing the current rules of awarding discounts.

Bearing in mind the statement of grounds presented in the aforementioned resolution of the Supreme Court and the proposed "quality-oriented" solutions one should conclude that introduction of a new discounting mechanism should take into account reasonable interests of utility companies on the one hand and protection of consumers on the other. However, it should be remarked that such a change would involve amendment of the current legislation and would significantly affect DSOs' budgets.

Summary

An overview of data published by DSOs on their websites and an analysis made on that basis confirm that concerns regarding the operating assumptions of the quality oriented regulation model based on SAIDI, SAIFI and MAIFI indicators published by DSOs are fully justified. When evaluating DSOs' performance of their information obligation one should remark that the importance of the problem was noticed already in 2012 by the President of the URE who – due to the inconsistence of published data – requested DSOs to unify methodologies used to calculate energy supply reliability indicators [Communication of the President of the URE No. 16/2012 of June 21, 2012]. The authors' research suggests however that although three years have already passed since the communication was published, it has never brought the expected results.

Bearing in mind the above deliberations one should point out to the fact that making efficient use of quality indicators published by DSOs is currently possible to a limited extent only. Furthermore, existing legislation does not provide the President of the URE with instruments that would "inspire" DSOs to adhere to the information obligation and to calculate and present their indicators with due diligence, care and transparency.

Consequently, since it is impossible to enforce the information obligation, a risk arises that the implementation of the quality model will not bring the desired effect. As a result, the stream of regulated revenues may be reduced, thus slowing down system infrastructure construction, extension and modernization processes, which in its turn may adversely affect the operating security of the electric power system. From the perspective of a broadly understood capacity market, including in particular demand side management, it is important to ensure a transition period in the structure of the new tariff mechanism. Constant monitoring of quality indicators during such a transition period will be an important tool for appropriate structuring and optimization of the tariff mechanism. Such an approach coupled with large-scale public consultation among power industry communities and institutions will provide the President of the URE with a complete set of background information and enable appropriate parametrization of the quality model.

The paper addresses the problem of DSOs' adherence to the obligation to publish indicators reflecting the duration of energy supply interruptions in the context of planned changes in tariff calculation related to the introduction of the so-called "quality regulation".

Pursuant to the provisions of the System Regulation, DSOs are obliged to publish electricity supply continuity indicators. As rightly pointed out in the 2014 Report of the President of the URE, only "a well-defined and calculated electricity supply quality level can constitute a basis for comparative analyses covering different utility companies and for determining the quality level of electricity supply to end users in comparison to similar levels observed in other countries" [National Report of the President of the URE, 2014, p. 18].

Bearing in mind concerns related to the performance of the information obligation by DSOs and proposed use of data published by them in the new tariff calculation model, the authors ask whether the planned "quality-oriented" solutions will in fact bring the desired results. To answer this question it was necessary to analyze quality indicators published by distribution system operators on their websites.

Inconsistent methodology of calculating the indicators and different incoherent interpretation of the information obligation stipulated in Clause 40(1) of the System Regulation make one wonder whether the introduction of a model based on SAIDI, SAIFI and MAIFI indicators published by DSOs is reasonable. Undoubtedly, only reliable and transparent adherence to the statutory information obligation will ensure comparability of those indicators and can constitute a starting point for introducing new, "quality-oriented" solutions. A condition *sine qua non* for introducing the quality regulation are relevant and reliable interruption duration indicators published by DSOs pursuant to applicable legislation.

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