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**ERGEG public consultation on "Treatment of Losses by Network Operators"**

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Dear Mrs. Geitona,

EnBW Energie Baden-Württemberg AG is grateful for the possibility to take part in ERGEG's consultation 'Treatment of Losses by Network Operators' and offers the following comments in response to the issues and the specific questions raised in the consultation document.

## Regulatory definition of losses

*Questions:*
*1. What is considered an acceptable definition of losses?*

Primarily we should differentiate between technical losses (TL) and non-technical losses (NTL).
Technical losses are losses on power lines (such as Joule losses and losses by corona effect) and losses in transformers (such as losses in magnetic cores). These losses are the result of the inherent resistance of electrical conductors. Non-technical losses include more or less all energy, which gets lost because of energy theft, errors in metering, billing und data processing as well as differences between real consumption of customers with annual meter reading within a year and the estimated consumption within an accurately defined period (i. e. 01.01. – 31.12.). In general this energy can not be detected, rests unknown for the system operator and there is nobody who pays for it. In-house consumption such as lighting and building consumptions in the substations and non-metered supplies such as public lighting should not be included in losses but rather metered (if reasonably possible). Otherwise the consumption should be estimated and only the difference between real and estimated consumption should be added to the non-technical losses.
Operating consumption of voltage transformation substations (e.g. the cooling of the transformers, communications, control and metering equipment...) is included conceptually in the amount of technical losses but they may be supplied from distribution networks, although they are in the transmission system.

For TSOs, losses can be defined as the difference between the amount of electricity entering the system (by generation of power plants or import from neighboring transmission grids) and the electricity leaving the grid (by consumption of end-users, export to other transmission grids or delivery to lower voltage levels). In the transmission grid of EnBW all injection and feeding points are measured every quarter of an hour (related to metering whereas measuring takes place more often) so that the calculated losses as a result of the balance correspond with the real physical losses. Non-technical losses according to the definition above can be disregarded in the transmission grid.

For DSOs, at the HV-level losses can be defined as the difference between the amount of electricity entering the system and the electricity leaving the grid. In lower voltage-levels technical losses have to be calculated because most of the connection points are subject to register metering with the result that only one data (kWh) is available for the metering period which is mostly one year. Non-technical losses are the difference between energy input and output minus technical losses.

We would like to note that there might be different legal or regulatory definitions. In Germany definitions were appointed for example in line with the allowance of the application of the Use of System Charges.

*2. Should power losses refer only to technical losses or is it acceptable to include also non-technical losses?*

As far as possible power losses should only refer to technical losses (see answer to question 1). But especially for the lower voltage levels this is not practicable, because of the multitude of connection points, which can not be globally measured. Furthermore not corrigible metering errors might occur which lead to an inaccuracy in the measured or calculated losses. Therefore it should be acceptable to include also non-technical losses to a certain extent. But power losses should clearly be separated into technical losses and non-technical losses.
Operating consumption is partially included in the amount of losses, e.g. operating consumption of voltage transformation substations, but in the transmission grid this is nearly insignificant and in order to avoid it globally a lot of efforts would be necessary. Besides, operating consumption of voltage transformation substations can be seen as technical losses.

*3. Which are the key components for defining losses?*

The key components for defining losses are the physical losses in transport/distribution of electricity. The "hidden" non-technical losses (e.g theft, metering, billing and data errors) are more or less side effects, which are difficult to avoid completely especially at low voltage levels but everyone should try to reduce them as far as the costs are reasonable comparable to the savings. In-house consumption and public lighting are "normal customers" and - if possible and done with reasonable costs - should be treated (metered and billed) like normal customers.

Valuation procedures

*4. What ways exist to improve the evaluation of losses in distribution networks?*

By introducing Smart metering with meter reading each quarter of an hour the meters with annual reading will be substituted. When all meters with annual reading are substituted, it will be possible to allocate the losses (technical and non-technical) more exactly to each quarter of an hour within a year. Inadequate estimations of the consumption of small customers will be reduced significantly.
Another way to reduce non-technical losses is to start field-investigations and to compare the results with the data in the billing systems or to subject the data to a plausibility check. As for any other effort cost and expenditure of time have to be proven. They should be in due proportion to the possible improvements or savings.

Values

*Concerning values, the figures reported for each country should be carefully compared since they have been computed according to national regulatory definitions. The percentage of losses in transmission networks varies from 1% (Slovakia) to 2.6% of output (Romania). In contrast, distribution losses are significantly higher and widely range from 2.3% of input (Sweden) to 13.5 % of output (Romania).*

***5. What should be a reasonable and acceptable level of power losses at the distribution level and the transmission level?***

Before determining a reasonable and acceptable level of power losses it would be necessary to point out the influencing factors of power losses (especially for technical power losses) and to define an adequate reference value (e.g. losses relating to input or to output) taking into account the possibilities of the system operator to influence the determining factors. In this context the definition of power losses is important, too.

In the German transmission network international transits have a high impact on technical power losses, because of the central position of Germany in Europe. Another specialty is the exceptional expansion of wind energy plants in the North of Germany and the nuclear energy phase-out affecting particularly the generation in the South of Germany. The development of the allocation of load and generation involved as well as the energy trade between the countries lead to an increasing average transport distance. These factors, which have a significant impact on the level of power losses in the German transmission grid, are different from country to country or even from region to region, so that a fixed global level related for example to input or output would not be appropriate.
In the transmission network theft is irrelevant and metering is much more exact than in the distribution network. For the system operator correct metering is essential because of different reasons for example to generate the contour integral (the sum of the instantaneous measured active power transfers on the tie lines). There remains hardly any potential for optimizations. The connection and disconnection of lines dependent on network load is in Germany already done for voltage reasons and gives only a little scope because the load of the lines is rarely very low so that most of the time the lines have to be connected.

The main loss drivers such as transits, load and the average transport distance mainly caused by the allocation of load and generation are not influenceable by the TSOs. The TSO has neither an influence on the allocation and generation of power plants nor on the allocation and consumption of end-users. That's why it would not be adequate to define a fixed uniform level of power losses at the transmission level.

**At the distribution level** the general conditions are different. The variation of the levels of power losses is much higher because of different tasks of supply. Within an urban area the technical losses are lower than within a rural area. Within an urban area the load density is higher than within a rural area and therefore the distances between feed-in-points (higher grid level or decentralized generation plant) and feed-out-points (customer, retailer or lower grid level) causing higher losses are larger. In addition to that the transformers in rural areas are smaller and have higher specific losses.
Apart from this the general design of the grid has to be taken into account. The MV-Net can substitute parts of the LV-Net. Therefore depending of the design of each grid level technical losses can occur increased either in the MV or in the LV-Net.
Another aspect is that the reference value for calculating the percentage of losses in each voltage level has to be chosen carefully. Because of decentralized generation the load and the transported energy might decline (in extreme situations the direction of power flow can change from top – down to bottom-up) and therefore the comparability of the percentage of losses might not exist even more.

There are already a lot of problems to define reasonable levels of power losses within one country with similar net-designs, and there will be even more problems to define loss-levels for Europe. As mentioned above, there should be at least two levels within the different distribution networks: one for technical losses and one for non-technical losses. For the level of non-technical losses it is particularly decisive, if in-house-consumption and public lighting belong to non-technical losses or not, because these two factors have the greatest impact on the level.

### *6. Which types of losses could be most easily reduced?*

In the German transmission grid non-technical losses (commercial losses) are insignificant and the possibilities for the system operator to reduce the technical power losses are very limited, because of many external influencing factors (wind feed in, increasing power flows etc.). In case of new investments reduction of losses could be taken into account.
We suppose for DSO that billing and data errors could be reduced most easily.
Since energy theft is very rare in Germany, the costs to search for and to find a theft are mostly significant higher than the price of the embezzled energy. Therefore most energy theft is detected fortuitously. Also in case of new investments the aspect of reduction of losses is taken into account.

## Procurement of losses

*6. Who should be responsible for procuring electric energy to cover losses?*

We think the system operator as central and administrative coordinator has the best data available to calculate and accordingly estimate the losses in his system. There are many influencing factors, which can not be considered by or assigned to single market participants (like power plants or traders). Therefore he should be responsible for procuring electric energy to cover loses.

*7. How should electric energy to cover losses be procured in a market-oriented way? Which solution is the most efficient?*

Compliant with German national legislation, all TSOs and most of the larger DSOs procure their system services and losses by taking a market-based approach.
The German Energy Law ("Energiewirtschaftsgesetz") and the specified regulation on grid access ("Stromnetzzugangsverordnung") provide for market-oriented, non-discriminatory and transparent procedures for the procurement of grid losses. Besides, the German regulator is going to publish a guideline, which will regulate the procurement of power losses. This guideline will be binding for all TSOs and all DSOs with more than 100.000 customers.

In general, the procurement of the energy to cover losses has to be realized in open invitations to tender, unless there are essential reasons which are opposed to it or the system operator has less than 100.000 customers.
Since 2006 German TSOs and some DSOs initiate such open invitations to tender. These tenders take place on different days in order to level the risk of high market prices. Thereby, the predicted hourly profile is divided into several lots in order to have more participating traders. Therefore one lot should neither be too big nor too small.
The described procedures were continuously developed within the last two years. Currently, there are ideas and advancements for the long term procurement discussed that go towards a procurement of standard products instead of the estimated hourly exact profiles. This could then be done through the power exchange instead of invitations to tender. However, this analysis is still working in progress.

In any case we advocate for a market-based, transparent, harmonized and non-discriminatory approach to procure electric energy to cover losses.

*8. Should the costs of losses be covered by a special tariff?*

In Germany costs for the use of grid infrastructure, system services (e.g. voltage and frequency control, system operation and restoration of supply) and losses are contained in the overall tariff. In order to minimize the grid losses and to give incentives to the market participants (especially to power plant operators and the industry) it might be reasonable to cover the costs of losses by a special tariff for example with locally different fees.

Regulatory incentives

*Finally, several regulatory incentives have been implemented in both absolute and relative terms. For instance, in Norway costs related to network losses are treated like any other cost within the regulatory model used, whereas in Austria and Czech Republic there is a maximum percentage value for losses. For distribution losses, the Czech Republic employs an annual loss efficiency factor mechanism, and in Portugal the DSO is rewarded (or charged) if registered losses are below (or above) a pre-set reference value.*

*9. What are the advantages and disadvantages of the aforementioned incentive mechanisms?*

In our opinion a maximum percentage value for losses (particularly technical losses) is not adequate especially for the TSO because there are nearly none possibilities to influence the amount of losses (see our explanations to question No. 5) within a regulation period of 5 years and the external influencing factors will overcompensate each such effort. A pre-set reference percentage value would ignore external influencing factors which can vary from year to year such as the weather (e.g. the year is very cold which leads to an increasing consumption or there is much wind and therefore much generation in the North of Germany and has to be transported to the other parts of Germany). If the costs related to network losses are treated like any other cost within the regulatory model they would be fixed for a relatively long period (e.g. for five years under the "Revenue Cap Regime" which is currently being implemented in Germany). As a consequence, the particularities of the network losses might be disregarded, which is not acceptable for the system operator because the costs related to network losses have a significant volume and depend on very volatile and recently extremely increasing market prices.
There is only a very limited influence of the system operator to reduce the technical losses as to redesign his grid or to buy transformers with fewer losses. However network planning involves other considerations like security of supply, investment costs, congestion management, safety rules, environmental restrictions etc., which may have priority in planning and investment decisions.

*10. Which key elements should be considered when assessing different regulatory incentive mechanisms?*

When assessing different regulatory incentive mechanisms it should be considered that there are different external factors which have much more influence upon the level of technical losses than the system operators have. Therefore a maximum percentage of losses especially for the transmission network would not be adequate. There should be incentives for economically reasonable procurement and a reasonable mains operation (relating to a voltage-reactive optimization as it is in Germany already implemented) as well as for the reduction of non-technical losses. In any case regulatory incentive elements should be:

- forward looking
  performance targets have to be based on expected future conditions (e.g. forward prices) rather than past events (e.g. historical procurement costs).

- fair
  they should offer both risks and rewards to an equal extent; cost savings and cost increases should be shared between the regulated entities and their customers.
- moderate
  the risk exposure of the regulated entity should be limited and compliant with the business model of TSOs (which is basically the safe and secure operation of Transmission grids)

If there are regulatory or political obligations because of public interests, for example a cabling or a detour when a power line is replaced, which both cause higher power losses, the system operator has to compensate these losses by procuring the accordant energy.

A consideration of operating costs (like power losses) for investment decisions would be favorable (consideration of overall costs instead of only investment costs).

*11. Are there advantages in setting separate mechanisms for technical and non-technical losses?*

Yes, because they result from completely different circumstances. Technical losses occur whenever electricity distribution or transportation takes place. Non-technical losses such as theft and data and billing errors can be theoretically avoided but the efficiency of any effort has to be proven.

*12. Are there advantages in setting separate mechanisms for transmission and distribution losses?*

Yes, because the general conditions are very different. Transits as an influencing factor for example are just a topic for the TSO and lead to losses in the transmission grid which are much more difficult to predict well in advance. There are also less non-technical losses in a VHV- and HV-grid as in a LV-Grid.

EnBW hopes that these comments prove to be useful in the further development of the ERGEG paper concerning Treatment of Losses by Network Operators.

Yours sincerely

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