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ETSO Comments on Average Participation method

The Average Participation (AP) method has been proposed by CEER for determining the « external use factors », which is the electrical use that is made of each individual TSO's network by network users outside this TSO's service area.

The method is based on the idea that it is possible to identify the particular generators and loads which are responsible for the flow in each element of the European grid.

It is applied on the UCTE network: the model has more than 3,500 lines and 2,500 nodes for 17 countries in continental Europe. It makes use of a simple heuristic rule to trace the source and the destination of the actual flow in each line of the whole European system.

This document presents a set of comments on the AP method, the most important ones, possibly in a logical and understandable way, without going into too deep theoretical analysis:

- *The AP method is based on an arbitrary assumption that contradicts the laws of physics*
- *It ignores history and borders*
- *It mixes the evaluation of the cost claims and the financing of the fund*
- *Operational difficulties to run the method still have to be overcome*

More information, including a deeper analysis on all proposed methods and simple examples, is available from ETSO.

1. The AP method is based on an arbitrary assumption

The first comment is that AP method introduces a « simple heuristic rule » which is an arbitrary assumption that besides determines the results.

AP method is based on the idea that it is possible to identify the particular generators and loads which are responsible for the flow in each element of the European grid. For each generator a set of loads is artificially identified as the exit points of the produced MWs, and for each load a set of generators is artificially taken as the origin points of the consumed MWs. In other words, paths are traced for the MWs flowing on the network, from each generator and to each load.

Unfortunately this idea cannot be derived from the laws of physics. Therefore, even if these hypothetical paths are compatible with the topology of the network, the method introduces an arbitrary assumption in order to trace electricity flows from generators to loads.

This assumption is the following: the power flow arriving at one node must be shared between the local load and the exiting flows in the other lines at that node. The AP method assumes that it is shared in proportion of local loads and exiting flows. But many other solutions are possible, which would lead to different responsibilities of generators and loads with respect to a given grid element, thus leading to different compensations. In particular, the laws of physics establish that an increment in the flow in a line entering at one node would be distributed among all other lines at that node, not only those with exiting flows. Therefore, the results depend strongly on a particular but arbitrary choice**. The AP method appears somehow arbitrary and unnecessarily distant from the physical properties of the electrical system.**

The allocation of grid costs to external users will then be flawed by this arbitrary hypothesis. The AP method will wrongly assign the influence of international interchanges hosted by a system to only a reduced set of lines.

However, as laws of physics determine, the international interchanges hosted by a system, affect its full «horizontal network » contributing to the flows of all transmission elements since all electrical sensitivities are non zero.

> *In the ETSO approach, compensations are calculated by using a simulation model based **only** on the laws of physics, with no supplementary assumption.*

2. The AP method ignores history and borders

The second comment is that the AP method ignores that networks have been first developed for native users, and that a large part of their costs is already covered by the national transmission tariff. No place is left to subsidiarity in the method. Borders are “artificially” added as a last step.

As stated by CEER, one aim is to determine the «external use factors », which is the part of each individual TSO’s network used by generators or loads outside this TSO’s service area.

2.1 Networks have been first developed for native users

Obviously, looking at the historical development of the electrical systems, the result will be that the main part of each network is to be allocated to native users. Tie lines and associated reinforcement of the networks have been developed later, at first to increase the reliability of electrical supply and then to allow cross border trade.

One could think reasonable to tackle this question of « external use » by studying directly for each country separately how the power interchanges affect the physical parameters which drive the costs on a network, mainly the flows in the lines.

It could be recalled that a parallel approach has been adopted for tariffs: they have been designed country by country, without beginning with an overall analysis on an European level.

2.2 The AP method is a wide monolithic european approach

The philosophy of the AP method does not take into account this historical experience. It is based on a wide European monolithic approach, whose steps could be described in those words:

1) allocating to each generator (nearly 700 generation nodes) a set of lines used by this generator and compute which percentage each line is used,
2) doing the same for loads (more than 1,800 demand nodes).

The result of these first two steps is the following: each line has been split into several parts, measured in percentage. There are as many percentages of this line as users of it. The network is thus split into a huge amount of pieces, each of them being a percentage of a line (3,500 lines, each of them being split …). Those thousands of pieces are thus allocated to users in 2,500 nodes.

It now must be recalled that this allocation is based on the arbitrary assumption already underlined. The network has been split into thousands of pieces allocated to users by tenths of thousands of arbitrary decisions.

The two following steps tend to reconstitute the network of each country

3) for each country, adding “percentages of lines” (more exactly as percentages of the European network) allocated to all internal users,
4) for each country, adding “percentages of lines” allocated to all external users.

It is expected that the cost allocated to internal users will be the major part of the network of a country while the minor part for external users. It will certainly be the case since it is a very strong reality.

But how much confidence can one have in the precision of the computation of this sharing of the networks between internal and external users, since this result comes from thousands of repetitions of an arbitrary choice, especially when the final aim is to exchange money?

2.3 The AP method has never been used in Europe to design tariffs: it is a non needed round trip

In fact, the AP method allocates the costs of 3,500 lines to 2,500 generation or demand nodes. Its very nature is to set nodal tariffs, based on infrastructure costs. The allocation of costs to internal users could have been used to design national tariffs.

But it has never been used for that purpose. More generally, tracing methods have never been applied in practice neither for tariffs setting nor for transmission cost allocation of any kind. Moreover, in Europe they have been tested (at least in a couple of countries) and decided not to use them due to the fact that obtained results were considered arbitrary. Its proposed use for inter TSO compensation is then a non needed round trip.

In the approach proposed by ETSO, it is not needed to split arbitrary the system in so many parts of lines, and then to make a reconstitution in two categories, internal and external users. The impact of transit flows is directly known by the difference between two physical situations ;

a) for the next year, by identifying the lines impacted by transit flows to define the "horizontal network" and using the "transit key" as a mean value to find how far the network is impacted,

b) in a longer term, when needed recorded data (also necessary for the AP method application) are available, by identifying for each lines how much it is impacted.

As the results come from well known load flow computation, they can be analysed and checked looking at physical parameters, which explain the physics of the phenomenon, an which explains where the claimed costs come from.

3. <u>The AP method mixes the cost claims and the financing of the fund</u>

The AP method calculates the net payment for each country as the difference between :

- the compensation that it should receive for the use of its own grid by external users and,
- the compensation that it should pay to the other countries for the use of their grids by its own users.

Three things could then be stated:

1) Once again, these two terms take large values, while their difference is much smaller. This can lead to irrelevant results and shows the lack of robustness of the method.

2) Those two parts are already depending on the 50-50% costs sharing between generation and consumption that the AP method uses.
   A **predefined** sharing of grid costs between generators and loads is therefore required from the very first step of the method. The costs allocated to external users then depend on this sharing. It is not comparable with ETSO cost claims.

3) This sharing is very similar to the sharing of grid costs between generators and loads in the design of a national transmission tariff.
To fit with the spirit of the AP method, this sharing should be necessarily the same throughout Europe. Of course, this is not the case presently.
If we take the present average sharing in Europe (which is closer to « 100% on loads - 0% on generators » than to «50% - 50% »), the AP method will lead to huge charges for importing countries, which they are very unlikely to accept.

Furthermore, it could be added that the AP method would require identical unitary costs of transmission assets throughout Europe. If that was not the case, the method would lead again to subsidies from one country to another, even if the sharing of the grid costs between generators and loads were harmonised.

> *In the approach proposed by ETSO, the determination of cost claim does not depend on the sharing of grid costs between generation and load. This is just a physical and auditable result. As compensations are limited to transit flows, the impact on national transmission tariff is therefore minimised.*
> *The necessary agreement between all involved parties in the CBT mechanism can thus be reached separating clearly the question of estimating the amount of a nearly physical total cost claim, and the question of the financing of those costs.*
> *ETSO approach gives a general framework, lets place to subsidiarity either in the operational computation of cost claims, while ensuring auditability, and in the way each country will reflect their contribution to the fund in their national tariffs.*

4. Operational difficulties to run the method still have to be overcome

The AP method calculates compensations due to TSOs in a given system scenario. If the method were to be applied operationally, it would have to be run on each hourly state of the European power system. Obviously, this would require a huge amount of data to be exchanged between TSOs.

Another possibility would be to identify compensations, not as the results of complex hourly calculations, but as simple functions of a limited number of system variables (supposed to be easily measured). The coefficients of these compensation functions would have to be adjusted by applying the AP method on a small number of scenarios.

But this remains to be done, and presently there is no proof that the approach would be feasible. The problem is the same for future development of the method proposed by ETSO

> *Operational calculation of compensations is recognised as a difficult issue by ETSO. The operational work will be done in 2003 in order to get the needed data. It will then remain to test future methods from an operational point of view.*
> *This is why ETSO will propose, for the new 2003 compensation mechanism, an intermediate solution, still using the concepts of horizontal network and transit key for simplicity of operational use, but with a determination of horizontal networks founded on real network simulations.*