BZRR CE output data description

This document accompanies the output data publication from the BZRR CE for the Bidding Zone Review study.

Data files per scenario

For each scenario (combination of an alternative bidding zone configuration, climate year and sensitivity) a separate zip file is included with the content as described in the sections below. The zip files are named as CONFIGURATION_CLIMATE-YEAR_SENSITIVITY.zip, where the following codes have been used.

CONFIGURATION
SQ0: Status quo configuration
DE2: DE2 configuration, identifier 2*
DE3: DE3 configuration, identifier 12
DE4: DE4 configuration, identifier 13
DE5: DE5 configuration, identifier 14
FR3: FR3 configuration, identifier 5
IT2: IT2 configuration, identifier 6
NL2: NL2 configuration, identifier 7
DE2+NL2: Combination of DE2 and NL2
DE4+NL2: Combination of DE4 and NL2
DE5+NL2: Combination of DE5 and NL2

CLIMATE-YEAR
CY09: Climate year 2009
CY89: Climate year 1989
CY95: Climate year 1995

SENSITIVITY
s0: Base sensitivity
s1: Sensitivity 1, higher fuel and emission prices

** Identifiers conform ACER's Decision on the alternative bidding zone configurations to be considered in the bidding zone review process - Annex 1.*

Output capacity calculation

The table below gives an overview of output data files related to the capacity calculation. In the capacity calculation, no allocation constraints have been used nor any (non-costly) remedial actions. Therefore there are no output files related to this.

Filename	Description
B_1_a_ntc.csv	NTC timeseries per bidding zone border in **MW** that were the input for the allEU NTC market coupling simulation.
B_1_a_cntc.csv	NTC timeseries per bidding zone border in **MW** following the coordinated NTC calculation that was part of the capacity calculation. These values were used as input for the flow-based market coupling simulation.
B_1_b_cnec_list.csv	List of CNECs including the identifier of the critical network element in the grid model, the identifier of the contingency in the grid model and the type of the critical network element.
B_1_b_fb_domains.csv	For each MTU and (presolved) CNEC the PTDF values for each hub in the FB domain, the PTDF values corresponding to the flows on the cross-zonal HVDCs and the RAM values in **MW**.

Output day-ahead market dispatch

The table below gives an overview of output data files related to the day-ahead market dispatch. Most files in this section include both output data for the bidding zones in the CE region, as well as output data for the other European bidding zones. The data for the bidding zones in the CE region is based on the output of the (CE FB) Market Coupling calculation as described in section 6.1.1 of the BZR report. The data for the bidding zones that are not part of the CE region is based on the output of the (All EU NTC) Base Case Creation calculation as described in section 6.1.1 of the BZR report. For data that is provided per bidding zone border (cross-zonal exchanges), the data for internal CE borders are based on the (CE FB) Market Coupling, whereas the data for all other borders (including borders between a CE and non-CE bidding zone) is based on the (All EU NTC) Base Case Creation calculation.

Filename	**Description**
B_2_a_market_welfare.csv	Total market welfare per bidding zone and per MTU in **EUR**. The total market welfare is the sum of the consumer surplus, the producer surplus and the congestion rent.
B_2_b_consumer_surplus.csv	Consumer surplus per bidding zone and per MTU in **EUR**. For price insensitive demand, the consumer surplus is calculated as the product of the demand and the difference between the market clearing price and the value of lost load (VOLL). For price sensitive demand (demand side response), the consumer surplus is calculated as the product of the demand and the difference between the market clearing price and the threshold price at which the demand is activated. A uniform VOLL of 5000 EUR/MWh was used in all bidding zones. However, given that the BZR only looks at the change in consumer surplus from an alternative bidding zone configuration, the value of the VOLL is not relevant for the outcome.
B_2_c_producer_surplus.csv	Producer surplus per bidding zone and per MTU in **EUR**. The producer surplus is calculated as the producer revenues, which is the product of the generation and the market clearing price, minus the generation costs.
B_2_c_generation_cost.csv	Generation cost per bidding zone and per MTU in **EUR**. The generation cost is calculated as the sum of the fuel cost, emission cost, start/stop costs, charging cost and additional cost.
B_2_d_ congestion_revenue.csv	Congestion revenue per bidding zone and per MTU in **EUR**. The congestion revenues are calculated for each bidding zone border as the product of the price differential between the two bidding zones and the flow across he bidding zone border. Each bidding zone is allotted halve of the congestion revenue on each of its borders.
B_2_e_generator_dispatch.csv	Generator dispatch per bidding zone, generator type and per MTU in **MW**. The generator dispatch includes the dispatch of batteries and pumped storages and

	therefore reflects the injections and withdrawals from these storages.
B_2_f_g_h_available_capacity.csv	The available capacity includes the following values for each bidding zone in **MW**. The average available market capacity is the average amount of generation capacity available for the market. For variable renewable energy sources (solar and wind) this is the average generation across the year. For dispatchable generation this is the installed capacity minus unavailability due to maintenance or otherwise. The average available upward redispatch capacity considers the margin that is available between the dispatch of the generator and the maximum generation for all generators that can provide upwards redispatch (considering potential unavailability). The average available downward redispatch capacity considers the margin between the dispatch of the generator and the minimum generation (including shutdown) for all generators that can provide downwards redispatch. The average unavailable capacity is the average capacity which is unavailable due to maintenance or otherwise.
B_2_j_explicit_dsr_activation.csv	Explicit DSR activation per bidding zone and per MTU in **MW**. A negative number indicates that the demand is reduced.
B_2_k_implicit_dsr_activation.csv	Implicit DSR activation per bidding zone and per MTU in **MW**. A negative number indicates that the demand is reduced. A positive number indicates that the demand is increased.
B_2_l_energy_dumped.csv	Dumped energy, or generation (RES) curtailment, per bidding zone and per MTU in **MW**.
B_2_l_energy_not_served.csv	Energy not served, or demand curtailment, per bidding zone and per MTU in **MW**.
B_2_m_market_clearing_prices.csv	Market clearing prices per bidding zone and per MTU in **EUR / MWh**.
B_2_n_net_positions.csv	Net positions per bidding zone and per MTU in **MW**.
B_2_o_cross_zonal_exchange.csv	Cross-zonal exchange per bidding zone border and per MTU in **MW**.
B_2_p_cnec_flow_and_shadow_price.csv	For each MTU and (presolved) CNEC the flow in **MW** and the shadow price in **EUR / MW**.

Output operational security analysis

The table below gives an overview of output data files related to the operational security analysis. Data related to the precise network configuration when a violation occurs is described in the Grid models section.

Filename	**Description**
B_3_b_c_d_e_osa_results.csv	For each (clustered) MTU and each CNEC in which the Fmax is violated, the Fmax and the amount of violation in **MW**. The BZR

	has only considered power violations, i.e. situations where the power flow on a critical network element exceeds the maximum permissible power flow. No other kinds of OSL violations have been considered.

Output remedial action optimization

The table below gives an overview of output data files related to the remedial action optimization. Data related to the network models updated to include all preventative remedial actions is described in the Grid models section. Data related to the cost of ensuring the availability of redispatching units is described in the B_4_a_redispatch_availability_cost.csv section. The RAO calculations have been performed for a representative set of 50 days. Data related to the clustering of these 50 days is included in the RAO clusters section. The RAO calculation has not been performed for bidding zones outside the CE region.

Filename	**Description**
B_4_a_rao_cost.csv	Total RAO cost per bidding zone, per cost category and per (clustered) MTU in **EUR**. The following cost categories are considered. Cost for upward redispatch, cost for downward redispatch, cost for generator startup and cost for DSR activation.
B_4_c_upward_dispatch_change.csv	Total upwards redispatch per bidding zone and per (clustered) MTU in **MW**. (Not including DSR.)
B_4_d_downward_dispatch_change.csv	Total downwards redispatch per bidding zone and per (clustered) MTU in **MW**.
B_4_e_generator_dispatch_change.csv	Change in generator dispatch in RAO per bidding zone, generator technology and per (clustered) MTU in **MW**. (Not including DSR.)
B_4_e_generator_dispatch_after_rao.csv	New generator dispatch after RAO per bidding zone, generator technology and per (clustered) MTU in **MW**. (Not including DSR.)
B_4_f_net_positions_after_rao.csv	New net positions after RAO per bidding zone and per (clustered) MTU in **MW**.

Additional input data

Input data was already published previously. Some additional input data is included below and in the Other data included in output data publication section to reflect some specifics related to the newly created bidding zones.

Filename	**Description**
A_3_a_load.csv	Load timeseries per bidding zone in **MW**. While load timeseries were already part of the input data publication, this did not yet include the load timeseries splitted across the new bidding zones.

Other data included in output data publication

Besides the data described in the Data files per scenario section some additional data that spans all scenarios is provided in a file called additional_data.zip. The contents of these files are described below.

A_2_b_generating_capacities.csv

Input generating capacities per bidding zone and per technology were already published with the input data. This did not include however the allocation of generating capacities over the newly created bidding zones in the alternative configurations. Therefore, an additional file (A_2_b_generating_capacities.csv) has been included with the output data in which for each new bidding zone of the alternative configurations, the installed capacities in **MW** are provided for each generator type.

A_3_c_d_explicit_dsr.csv

Input (explicit) DSR capacities per bidding zone were already published with the input data. This did not include however the allocation of DSR capacities over the newly created bidding zones in the alternative configurations. Therefore, an additional file (A_3_c_d_explicit_dsr.csv) has been included with the output data in which for each new bidding zone of the alternative configurations, the explicit DSR capacities in **MW** are provided, the activation price in **EUR / MWh** and whether the explicit DSR capacity is available on the day ahead market (DA) or in the redispatch optimization (RD).

A_4_a_reserves_requirements.csv

Input reserves requirements per bidding zone were already published with the input data. This did not include however the allocation of reserves requirements over the newly created bidding zones in the alternative configurations. Therefore, an additional file (A_4_a_reserves_requirements.csv) has been included with the output data in which for each new bidding zone of the alternative configurations, the reserves requirements (FCR and FRR+RR) in **MW** are provided.

B_4_a_redispatch_availability_cost.csv

Total cost for ensuring the availability of units for redispatch per scenario (combination of an alternative bidding zone configuration, climate year and sensitivity) in **EUR**.

RAO clusters

In order to reduce calculation time, the operational security analysis and remedial action optimization calculations have been performed for a set of 50 representative days instead of for the full 365 days of the year. A clustering algorithm was used to determine which 50 days best represent the full year. The RAO clustering files include for each climate year a mapping for the MTUs of the full year to the clustered MTUs. This file can be used to scale up the RAO result files to the full year. Each cluster mapping file contains two columns. The first column “Timestamp” is a list of all 8760 MTUs of the full year. The second column “Timestamp clustered” includes the corresponding MTU out of the representative 50 days.

Grid models SSH data

The CGMES grid model that was used in the CE Bidding Zone Review has already been published as part of the data publication for the LMP study. This data can be requested via the BZR webpage on the ENTSO-E website.

For the output data publication, the TSOs are required to publish the precise network configuration(s) when operational security violations occur (pre RAO), and the network model updated to include all preventative remedial actions (post RAO). In order to minimize the data size, the output data publication includes only those data points that change between calculation. This information is included in the Steady State Hypothesis (SSH) files that are part of the CGMES grid model. This SSH data has been filtered for the following attributes which are relevant for DC power flow calculations.[1]

- RotatingMachine.p, representing generator active power
- EnergyConsumer.p, representing load active power
- EquivalentInjection.p, representing generic active power injections or absorptions
- ExternalNetworkInjection.p, representing generic active power injections or absorptions
- TapChanger.step, representing transformer and PST tap positions

Each data file includes an identifier of the element to which the attribute belongs (rdfID), the attribute type and the attribute value. The rdfID can be matched to the rdfIDs that are found in the SSH file of the CGMES grid model that has been published.

For each alternative bidding zone configuration and the status-quo configuration, the SSH data for the pre RAO and post RAO grid models is included for 1 MTU. For this, the MTU t6426 from climate year 1995 was selected. This MTU was selected based on the criteria that it should have at least congestion (operational security violation) in the status-quo configuration, in each of the 4 bidding zones for which an alternative bidding zone has been assessed, and that the amount of congestion is as close as possible to the average amount of congestion in the status-quo configuration.

Disclaimer: In order to protect sensitive information in the German grid models, anonymization was carried out so that some elements (i.e., PST tap changers) were removed. This could significantly impact the results of direct current power flow calculations and should be kept in mind when using the anonymized grid models.

[1] AC power flow calculations have not been performed as part of the Bidding Zone Review study. Therefore no data related to reactive power flows is included in the data publication.