



European Network of
Transmission System Operators
for Electricity

**ENTSO-E
AUTOMATIC FREQUENCY
RESTORATION RESERVE
PROCESS**

IMPLEMENTATION GUIDE

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APPROVED DOCUMENT
VERSION 1.0

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19 The force of the following words is modified by the requirement level of the document in which
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- 21 - SHALL: This word, or the terms "REQUIRED" or "MUST", means that the definition is
22 an absolute requirement of the specification.
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24 absolute prohibition of the specification.
- 25 - SHOULD: This word, or the adjective "RECOMMENDED", means that there may exist
26 valid reasons in particular circumstances to ignore a particular item, but the full
27 implications shall be understood and carefully weighed before choosing a different
28 course.
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30 may exist valid reasons in particular circumstances when the particular behaviour is
31 acceptable or even useful, but the full implications should be understood and the case
32 carefully weighed before implementing any behaviour described with this label.
- 33 - MAY: This word, or the adjective "OPTIONAL", means that an item is truly optional.
34 One vendor may choose to include the item because a particular marketplace requires
35 it or because the vendor feels that it enhances the product while another vendor may
36 omit the same item. An implementation which does not include a particular option
37 MUST be prepared to interoperate with another implementation which does include the
38 option, though perhaps with reduced functionality. In the same vein an implementation
39 which does include a particular option MUST be prepared to interoperate with another
40 implementation which does not include the option (except, of course, for the feature
41 the option provides.).

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Revision History

| Version | Release | Date | Paragraph | Comments |
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| 0.1 | Draft A | 2018-09-10 | | Initial adaption |
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| 1.0 | | | | Approved by MC. |

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|----|-------------------|---|----|
| 46 | CONTENTS | | |
| 47 | Copyright notice: | | 2 |
| 48 | Revision History | | 3 |
| 49 | CONTENTS | | 4 |
| 50 | 1 | Introduction | 6 |
| 51 | 2 | Scope of the PICASSO project | 6 |
| 52 | 3 | Scope of the IGCC project | 6 |
| 53 | 4 | Scope of the Implementation Guide | 6 |
| 54 | 5 | Normative references | 6 |
| 55 | 6 | Terms and definitions | 8 |
| 56 | 7 | The automatic frequency restoration reserve business process for standard | |
| 57 | | products | 8 |
| 58 | 7.1 | General overview | 8 |
| 59 | 7.2 | Overall business context | 10 |
| 60 | | 7.2.1 aFRR participation status | 10 |
| 61 | | 7.2.2 Imbalance netting participation status | 11 |
| 62 | | 7.2.3 aFRR cross-border capacity limits | 11 |
| 63 | | 7.2.4 Profile limits | 11 |
| 64 | | 7.2.5 Load-flow limits | 11 |
| 65 | | 7.2.6 Local MOLs | 11 |
| 66 | | 7.2.7 Power transfer distribution factor (PTDF) | 11 |
| 67 | | 7.2.8 aFRR demand | 11 |
| 68 | | 7.2.9 Activated aFRR | 12 |
| 69 | | 7.2.10 Correction values | 12 |
| 70 | | 7.2.11 XBMP | 12 |
| 71 | | 7.2.12 Automatic frequency restoration power interchange | 12 |
| 72 | | 7.2.13 Imbalance netting power interchange | 12 |
| 73 | | 7.2.14 Adjusted aFRR power interchange | 12 |
| 74 | | 7.2.15 Adjusted aFRR for local purpose | 13 |
| 75 | | 7.2.16 FRCE | 13 |
| 76 | | 7.2.17 Corrected demand | 13 |
| 77 | | 7.2.18 HVDC delta set-point | 13 |
| 78 | | 7.2.19 aFRR cross-border activated reserves | 13 |
| 79 | | 7.2.20 Invoicing and financial data | 13 |
| 80 | | 7.2.21 Transparency reporting | 13 |
| 81 | 7.3 | Business rules – Non-real-time | 13 |
| 82 | | 7.3.1 General rules | 13 |
| 83 | | 7.3.2 Dependencies governing the reserve bid document | 13 |
| 84 | | 7.3.3 PTDF Import | 24 |
| 85 | | 7.3.4 Dependencies governing the Balancing_MarketDocument | 25 |
| 86 | | 7.3.5 Dependencies governing the | |
| 87 | | EnergyAccount_MarketDocument | 27 |
| 88 | | 7.3.6 Financial amount table | 28 |
| 89 | 7.4 | Business rules – Real-time | 28 |
| 90 | | 7.4.1 Process Data Exchange via IEC 60870-6 TASE.2 | 28 |

| | | | |
|-----|-------|--|----|
| 91 | 7.4.2 | Process Data Exchange via IEC 60870-5-101..... | 29 |
| 92 | 7.4.3 | Process Data Exchange via IEC 60870-5-104..... | 30 |
| 93 | 8 | Contextual and assembly models | 31 |
| 94 | 8.1 | Reserve bid document | 31 |
| 95 | 8.2 | Energy account market document | 31 |
| 96 | 8.3 | Balancing market document | 31 |
| 97 | 9 | XML schema..... | 32 |
| 98 | | | |
| 99 | | List of figures | |
| 100 | | Figure 1: Automatic frequency restoration reserve process overview | 8 |
| 101 | | Figure 2: The automatic frequency restoration reserve process sequence diagram | 10 |
| 102 | | | |
| 103 | | List of tables | |
| 104 | | Table 1 - Local MOL export interface description | 14 |
| 105 | | Table 2 - CMOL export interface description | 21 |
| 106 | | Table 3 - Balancing market document dependency table (submission of clearing prices | |
| 107 | | to transparency platform) | 25 |
| 108 | | Table 4 - Energy account market document dependency table | 27 |
| 109 | | Table 5 - Financial amount table | 28 |
| 110 | | | |
| 111 | | | |

112 **1 Introduction**

113 This document was drafted based on IEC 62325 series. In particular, the IEC 62325-450
114 methodology was applied to develop the conceptual and assembly models.

115 **2 Scope of the PICASSO project**

116 The “Platform for the International Coordination of Automated Frequency Restoration and
117 Stable System Operation” (PICASSO) is the establishment of a platform for the exchange of
118 balancing energy from aFRR in the context of EBGL implementation. The PICASSO project is
119 selected by All TSOs (in terms of EBGL) to be the reference project for such an establishment
120 of an aFRR platform.

121 The aims of the project are to permit:

- 122 • The reduction of balancing costs through the introduction of an optimization based
123 aFRR activation;
- 124 • The increase of the available balancing energy for each TSO with positive impact on
125 the security of supply and on the integration of renewable energy in the electric
126 systems.
- 127 • A more efficient use of cross border interconnectors after intraday markets.

128 **3 Scope of the IGCC project**

129 The “International Grid Control Cooperation” (IGCC) is the establishment of a platform for the
130 process of imbalance netting in the context of EBGL implementation. The IGCC project is
131 selected by All TSOs (in terms of EBGL) to be the reference project for such an establishment
132 of an IN platform.

133 **4 Scope of the Implementation Guide**

134 According to real-time operational purposes, the aFRR cross-border activation process and
135 the IN process are selected by All TSOs (in terms of EBGL) to be implemented by one
136 common platform.

137 The aim of the Implementation Guide is to define normative references, dependencies and
138 communication processes for the real-time and non-real-time electronic data interchanges
139 between aFRR platform (including IN process), respective TSOs systems and the external
140 systems (e.g. ENTSO-E central Transparency platform).

141 This document is prepared by all transmission system operators (TSOs) involved in the
142 PICASSO project and this document is only applicable for multilateral TSO-TSO model with
143 common order list to exchange all balancing energy bids from all standard products for
144 frequency restoration reserves with automatic activation in accordance with Article 21 of the
145 EBGL regulation.

146 **5 Normative references**

147 The following documents, in whole or in part, are normatively referenced in this document and
148 are indispensable for its application. For dated references, only the edition cited applies. For
149 undated references, the latest edition of the referenced document (including any
150 amendments) applies.

151 IEC TS 61970-2, *Energy management system application program interface (EMS-API) –Part*
152 *2: Glossary*

- 153 IEC 62325-301, *Framework for energy market communications – Part 301: Common*
154 *information model (CIM) extensions for markets*
- 155 IEC 62325-351, *Framework for energy market communications – Part 351: CIM European*
156 *market model exchange profile*
- 157 IEC 62325-450, *Framework for energy market communications – Part 450: Profile and context*
158 *modeling rules*
- 159 IEC 62325-451-1, *Framework for energy market communications – Part 451-1:*
160 *Acknowledgement business process and contextual model for CIM European market*
- 161 IEC 62325-451-2, *Framework for energy market communications – Part 451-2: Scheduling*
162 *business process and contextual model for CIM European market*
- 163 IEC 62325-451-3, *Framework for energy market communications – Part 451-3: Transmission*
164 *capacity allocation business process (explicit or implicit auction) and contextual model for*
165 *CIM European market*
- 166 IEC 62325-451-4, *Framework for energy market communications – Part 451-4: Settlement*
167 *and reconciliation business process and contextual model for CIM European market*
- 168 IEC 62325-451-6, *Framework for energy market communications – Part 451-6: Transparency*
169 *business process and contextual model for CIM European market*
- 170 IEC 62325-451-7, *Framework for energy market communications – Part 451-7: Reserve*
171 *resource business process and contextual model for CIM European market*
- 172 *ENTSO-E RG CE scheduling reporting process implementation guide*
- 173 *ENTSO-E RG CE accounting and settlement process implementation guide*
- 174 *ENTSO-E Manual of Procedures for central Transparency Platform v3r1*

175 **6 Terms and definitions**

176 **6.1 aFRR**

177 Automatic frequency restoration reserves; the FRR that can be activated by an automatic
178 control device (load-frequency controller) designed to regulate the Frequency Restoration
179 Control Error (FRCE) to zero.

180 **6.2 mFRR**

181 Manual frequency restoration reserves; Manual FRR Full Activation Time means the time
182 period between the set point change and the corresponding activation or deactivation of
183 manual FRR.

184 **6.3 RR**

185 Replacement reserves; the reserves used to restore/support the required level of FRR to
186 be prepared for additional system imbalances. This category includes operating reserves
187 with activation time from Time to Restore Frequency up to hours.

188 **6.4 IN**

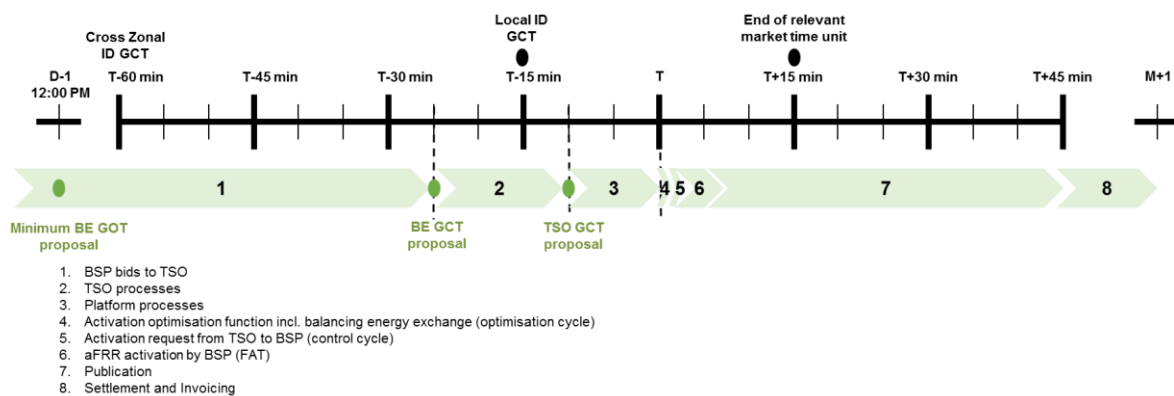
189 Imbalance netting; the IN is a real-time process of netting of aFRR Demands between the
190 TSO in order to avoid aFRR activation in opposite direction in each LFC area.
191

192

193 **7 The automatic frequency restoration reserve business process for standard**
194 **products**

195 **7.1 General overview**

196 The aFRR platform has a number of operational phases that are carried out throughout the
197 day. Figure 1 gives an overview on the operational phases



198

199 **Figure 1: Automatic frequency restoration reserve process overview**

200 The minimum balancing energy gate opening time (BEGOT) is at 12:00 pm the day before
201 delivery (D-1). From this time on balancing service providers (BSP) may submit offers of
202 balancing energy from aFRR to their local TSO. The TSO may define locally a BEGOT earlier
203 than this time, according to local terms and conditions.

204 Cross Zonal ID GCT corresponds to the gate closure time of the Intraday cross-border
205 market.

206 BSPs can submit bids to their local TSOs until the balancing energy gate closure for BSPs
207 (BSP GCT), which is 25 minutes before delivery (t-25 min) time. Note that in case of central
208 dispatch system BSP-GCT could be earlier. After the BSP GCT each TSO creates a local
209 merit order list (MOL) for each of its LFC areas. From this local MOL the respective TSO can
210 flag bids for operational security reasons or for conditional aFRR bids depending on the state
211 of activation of previous balancing processes. Each TSO submits at the TSO energy bid

212 submission gate closure time (TSO GCT) for each of their LFC area the corresponding local
213 MOL to the aFRR platform. The local MOL sent to the aFRR platform contains all the bids with
214 their availability status (available or unavailable). The local MOL might be sent in anticipation
215 and updated by the connecting TSO several times before the TSO GCT. In case of BSP
216 failure or conditional bids, the local TSO may still modify the bid of its local MOL (volume,
217 price, availability status of the bids) after the TSO GCT up to real time. In such a case, the
218 complete local MOL is resubmitted to the aFRR platform. By sending a complete local MOL it
219 is ensured that the local MOL used in the load-frequency controller matches the bids used in
220 the common merit order list. Together with the local MOL, the local TSO may submit
221 additional information to the aFRR platform about commonly procured, shared or exchanged
222 volume with other LFC areas or geographical region with whom the local TSO may have such
223 procurement process in place. This additional information is needed by the aFRR platform to
224 allocate appropriate priority to the bids.

225 Each TSO sends in real-time for each of the aFRR balancing borders the TSO is responsible
226 for, the corresponding aFRR cross-border capacity limit (through a capacity management
227 module when implemented). Additionally, each TSO sends in real-time for each control cycle
228 the aFRR demand for each of its LFC areas, the sum of effective aFRR activation and/or the
229 original FRCE without influence of aFRR and IN interchanges. By this the aFRR platform can
230 deduce one of the three values in case the value is not available.

231 For operational security issue, other type of limits may be provided to the aFRR platform such
232 as Profile limits or Flow monitoring limits. For Flow monitoring limits, a PTFD matrix is
233 determined and submitted to the aFRR platform in advance.

234 Before delivery the aFRR platform reads in the local MOLs for each LFC area and merges the
235 local MOLs to a common merit order list (CMOL). The CMOL can be updated even after the
236 beginning of the relevant market time unit due to modification of bids over the validity period.

237 Once merged and each time the CMOL is updated the aFRR platform sends back to local
238 TSO the CMOL for local consistency check with LMOL.

239 In real-time the aFRR platform optimizes sequentially the aFRR process and then the IN
240 process. Firstly, the distribution of the aFRR demand is optimized based on the CMOL, and
241 the aFRR cross-border capacity limits as well as profile limits and flow monitoring limits. The
242 result of the optimization is the automatic frequency restoration power interchange for each
243 aFRR balancing border and one price for each LFC area. Secondly, the corrected aFRR
244 demand is netted with the aFRR demands of the TSOs participating only to IN process, based
245 on remaining cross-border capacity limits as well as profile limits and flow monitoring limits.
246 The result of the optimization is then the imbalance netting power interchange for each IN
247 balancing border.

248 The aFRR platform also provides on each optimisation cycle the resulting FRCE and the
249 aFRR activation for local purpose for each LFC area (also called adjusted FRCE and adjusted
250 aFRR), based on the distribution of aFRR demand and effective aFRR activation for each LFC
251 area.

252 The aFRR platform sends each optimization cycle¹ a correction value for aFRR Process and a
253 correction value for IN process to each load frequency controller of the participating TSOs.

254 Each LFC automatically activates locally the aFRR taking into account the received correction
255 values.

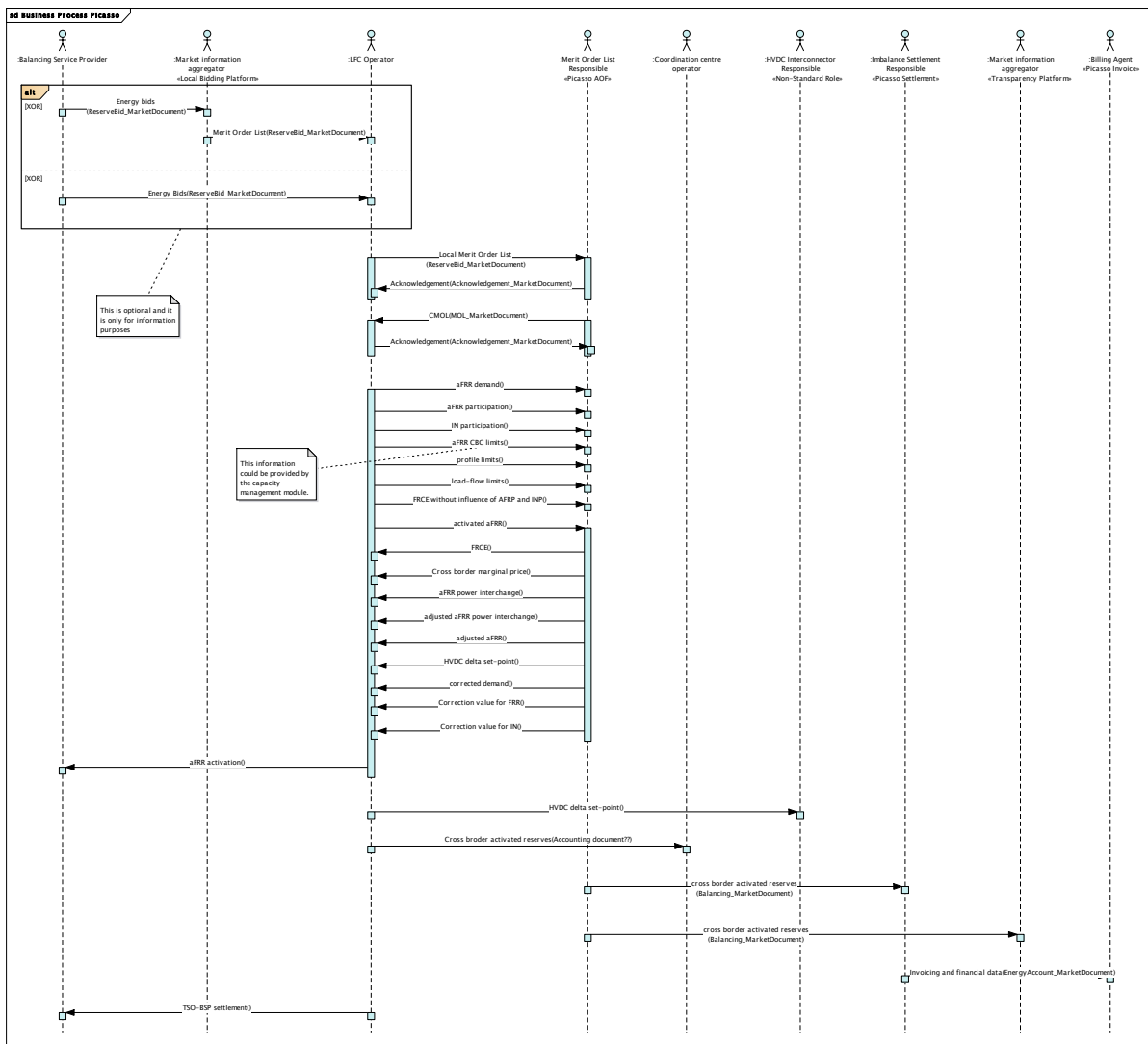
256 At 30 minutes after the relevant market time unit, all the information required for transparency
257 reporting purposes is provided by the aFRR platform.

¹ Optimisation cycle is defined for the aFRR Platform and shall be defined between 1 and 10 seconds

258 **7.2 Overall business context**

259 This Implementation Guide provides the means of exchanging between all concerned parties
 260 the information necessary to satisfy automatic frequency restoration reserve requirements as
 261 outlined in paragraph 7.1. Figure 2 shows the sequence diagram of the PICASSO platform
 262 including the linked agents (e.g. BSPs). The diagram represents the current status of
 263 discussion (e.g. with the usage of a capacity management module to be implemented), other
 264 options (e.g. centralized settlement agent) are possible.

265



266

267 **Figure 2: The automatic frequency restoration reserve process sequence diagram**

268 The information flows are outlined in the following paragraphs.

269 **7.2.1 aFRR participation status**

270 The participating TSOs provide in real-time (on each change of state) to the aFRR platform
 271 the aFRR participation status as a message. This information will be used in each
 272 optimization cycle to determine which of the TSOs will be considered in the optimisation step
 273 for aFRR.

274 Note: in return the aFRR Platform provides the status of online service of aFRR Process.

275 **7.2.2 Imbalance netting participation status**

276 The participating TSOs provide in real-time (on each change of state) to the aFRR platform
277 the imbalance netting participation status as a message. This information will be used in each
278 optimization cycle to determine which of the TSOs will be considered in the optimisation step
279 for aFRR.

280 Note: in return the aFRR Platform provides the status of online service of IN Process.

281

282 **7.2.3 aFRR cross-border capacity limits**

283 The participating TSOs provide in real-time (each control cycle²) (through a capacity
284 management module when implemented) to the aFRR platform the aFRR cross-border
285 capacity limits for each of the aFRR balancing border the TSO is responsible for, as the
286 export and the import limit. For each limit one data point. The range of values is [0 ... inf].
287 This information will be used in each optimization cycle for the calculation of the automatic
288 frequency restoration power interchange. aFRR balancing borders are defined positive in
289 either North-South- or East-West-direction depending on geographical orientation. The default
290 aFRR cross-border capacity limit for each border is given by the IT limitation, which is set by
291 the IT system.

292 **7.2.4 Profile limits**

293 In real-time (each control cycle) each TSO provides the profile limits for import and export for
294 each of their LFC area(s) to the aFRR platform as a data point. The range of the profile limit is
295 [0...inf].

296 **7.2.5 Load-flow limits**

297 In real-time (each control cycle) each TSO provides for each of its defined corridors the
298 relevant lower and upper load-flow limits to the aFRR platform. One data point for the lower
299 load-flow limit and one data point for the upper load-flow limit. The range of the lower load-
300 flow limit is [0...inf]. The range of the upper load-flow limit is [0...inf]. aFRR load-flow corridors
301 are defined positive in either North-South- or East-West-direction depending on geographical
302 orientation.

303 **7.2.6 Local MOLs**

304 Before TSO GCT the TSO provide for each of their LFC area(s) a local MOL to the aFRR
305 platform. The local MOL might be updated after the TSO-GCT due to operational security
306 reasons or conditional bids. The local MOL may contain additional information to the aFRR
307 platform about commonly procured, shared or exchanged volume with other LFC areas or
308 geographical region for which the local TSO may have such procurement process in place.
309 This additional information is needed by the aFRR platform to guarantee prior access to local
310 reserves.

311 **7.2.7 Power transfer distribution factor (PTDF)**

312 Before each validity period PTDF tool provides the PTDF to the aFRR platform

313 **7.2.8 aFRR demand**

314 In real-time (each local control cycle) each TSO provides the aFRR demand of each of their
315 LFC area(s) to the aFRR platform as a data point. The aFRR demand is defined as the sum of
316 the already activated aFRR and the FRCE without the influence of the intended exchange of
317 balancing energy resulting from the cross-border aFRR or INP. The sign convention for aFRR
318 demand is: negative value where the LFC area is in power surplus and indicates that
319 downward aFRR balancing energy needs to be activated; and positive value where the LFC
320 area is in power deficit and indicates that upward aFRR balancing energy needs to be

² Control cycle may differ from optimization cycle

321 activated. For avoidance of doubt, all aFRR demands are aFRR inelastic demands. The range
322 for the aFRR demand is $[-inf...inf]$.

323 **7.2.9 Activated aFRR**

324 In real-time (each local control cycle) each TSO provides the activated aFRR of each of their
325 LFC area(s) to the aFRR platform as a data point. The sign convention for activated aFRR is:
326 negative value where the LFC area activates downward aFRR, positive value where the LFC
327 area activates upward aFRR.

328 Alternatively, the FRCE without the influence of cross-border aFRP and INP shall be provided
329 in real-time (each local control cycle) by TSO for their LFC area(s) as a data point.

330 **7.2.10 Correction values**

331 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
332 participating TSO one correction value for aFRR and one correction value for IN of the
333 respective LFC area. The sign convention for the correction values is: negative value where
334 the LFC area imports power from the platform, positive value where the LFC area exports
335 power to the platform.

336 Note; the aFRR platform may also send the position component of the aFRR correction value
337 split into 4 positions between upward and downward, import and export of aFRR.

338 **7.2.11 XBMP**

339 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
340 participating TSO the cross-border marginal price applicable for the respective LFC area(s).
341 The XBMP is used to remunerate the BSP for activating aFRR.

342 The XBMP is also used for TSO-TSO settlement purpose.

343 **7.2.12 Automatic frequency restoration power interchange**

344 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
345 participating TSO the automatic frequency restoration power interchanges of the aFRR
346 balancing borders adjacent to the respective LFC area. The sign convention is: negative value
347 where the aFRR power interchange is in the opposite of the defined direction of the respective
348 aFRR balancing border, positive value where the flow is in the same direction as the defined
349 direction of the respective aFRR balancing border.

350 **7.2.13 Imbalance netting power interchange**

351 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
352 participating TSO to the IN process the imbalance netting power interchanges of the IN
353 balancing borders adjacent to the respective LFC area. The sign convention is: negative value
354 where the IN power interchange is in the opposite of the defined direction of the respective IN
355 balancing border, positive value where the flow is in the same direction as the defined
356 direction of the respective IN balancing border.

357

358 **7.2.14 Adjusted aFRR power interchange**

359 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
360 participating TSO the adjusted and netted aFRR power interchange to the respective LFC
361 area as a data point. The adjusted aFRR power interchange is the estimation of actual import
362 or export for the respective LFC area based on the activated aFRR. The sign convention is:
363 negative value where the LFC area imports power from the platform, positive value where the
364 LFC area exports power to the platform.

365 **7.2.15 Adjusted aFRR for local purpose**

366 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
367 participating TSO the adjusted aFRR corresponding to the aFRR activation for local purpose
368 of the LFC area(s). The sign convention is: positive value where upward aFRR is activated for
369 local purpose, negative value where downward aFRR is activated for local purpose.

370 **7.2.16 FRCE**

371 The aFRR platform sends in real-time (each optimization cycle) to each LFC area of the
372 participating TSO the FRCE to the respective LFC area as a data point. The sign convention
373 is: positive value where the LFC area is in power surplus and indicates that downward aFRR
374 balancing energy needs to be activated; and negative value where the LFC area is in power
375 deficit and indicates that upward aFRR balancing energy needs to be activated.

376 **7.2.17 Corrected demand**

377 The aFRR platform provides in real-time (each optimization cycle) the respective corrected
378 demand to the corresponding LFC area. The sign convention is: negative value where the
379 LFC area is in power surplus and indicates that downward aFRR balancing energy needs to
380 be activated; and positive value where the LFC area is in power deficit and indicates that
381 upward aFRR balancing energy needs to be activated. The corrected demand might be used
382 in local TSO system for dynamic limitation of the LFC output.

383 **7.2.18 HVDC delta set-point**

384 The aFRR platform send in real-time (each optimization cycle) a HVDC delta set-point for
385 each HVDC to the responsible participating TSOs as a data point. The sign convention is:
386 negative value where the aFRR power interchange is in the opposite of the defined direction
387 of the respective aFRR balancing border, positive value where the flow is in the same
388 direction as the defined direction of the respective aFRR balancing border.

389 **7.2.19 aFRR cross-border activated reserves**

390 The correction values for aFRR and for IN are directly used by the TSO to determine intended
391 aFRR cross-border exchanges through the usage of virtual tie lines. aFRR energy exchanges
392 are matched according to common standard accounting and settlement process. Once
393 matched intended aFRR exchanges are sent by the TSO to their Coordination Center.

394 **7.2.20 Invoicing and financial data**

395 The aFRR platform provides the relevant information for financial settlement to the TSO-TSO
396 settlement function that will carry out financial settlement between the TSOs for aFRR
397 process and IN process.

398 **7.2.21 Transparency reporting**

399 The aFRR platform submits clearing prices, all energy balancing bids and an aggregation of
400 all energy balancing bids to the ENTSO-E central transparency platform for publication.

401 **7.3 Business rules – Non-real-time**

402 **7.3.1 General rules**

403 For each electronic data interchange defined in this document, an acknowledgement
404 document, as defined in IEC 62325-451-1, should be generated either accepting the whole
405 received document or rejecting it completely.

406 **7.3.2 Dependencies governing the reserve bid document**

407 The reserve bid document is used to provide the local merit order of each TSO to the
408 platform. For each validity period a new common MOL document is then created as a merge
409 of the individual local TSO reserve bid documents of the same validity period. Table 1
410 provides the dependencies for the MOL document.

411 **Table 1 - Local MOL export interface description**

| | | OFFER | XSD requirements |
|--|--|-------|------------------|
| ReserveBid_MarketDocument | | | |
| mRID | Unique identification of the Bid Document | Used | Mandatory |
| revisionNumber | Initial transmission shall equal "1" | Used | Mandatory |
| type | A37 = Reserve Bid document | Used | Mandatory |
| process.processType | A51 = automatic frequency restoration reserves (aFRR) | Used | Conditional |
| sender_MarketParticipant.mRID | EIC of the transmitting TSO | Used | Mandatory |
| sender_MarketParticipant.marketRole.type | A04 = System Operator | Used | Mandatory |
| receiver_MarketParticipant.mRID | EIC of common platform operator | Used | Mandatory |
| receiver_MarketParticipant.marketRole.type | A35 = MOL responsible | Used | Mandatory |
| createdDateTime | Date and time of document creation | Used | Mandatory |
| reserveBid_Period.timeInterval | Validity period start time & validity period end time. The duration of the delivery period (initially 15 minutes) | Used | Mandatory |
| domain.mRID | EIC of PICASSO region | Used | Mandatory |
| subject_MarketParticipant.mRID | EIC of the transmitting TSO | Used | Mandatory |
| subject_MarketParticipant.marketRole.type | A04 = System Operator | Used | Mandatory |

412

413

| BidTimeSeries | | Offer | Shared or exchanged volume | |
|----------------------------|--|-------------|---|-------------|
| mRID | Unique identification of the bid assigned by the transmitting TSO | Used | Used | Mandatory |
| businessType | B74 = Offer C21 = Exchanged balancing reserve capacity C22 = Shared balancing reserve capacity | B74 Offer = | C21 = Exchanged balancing reserve capacity C22 = Shared balancing reserve capacity | Mandatory |
| divisible | A01 = quantity may be reduced to the minimum activation quantity by increments of the StepIncrementQuantity A02 = No reduction possible on the quantity | A01 | A01 | Mandatory |
| linkedBidsIdentification | The identification used to associate bids that are to be linked together. If one bid is accepted then all others with the same identification must also be accepted. If the bid is not linked then the attribute is not used. | Not used | Not used | Conditional |
| multipartBidIdentification | The identification used to associate multipart bids. If bid with flowDirection.direction=A01 (Up) is accepted then all associated bids with inferior price must also be accepted. If bid with flowDirection.direction=A02 (Down) is accepted then all associated bids with superior price must also be accepted. If the bid is not multipart then the attribute is not used. | Not used | Not used | Conditional |

| | | | | |
|-------------------------------|---|----------|----------|-------------|
| exclusiveBidsIdentification | The identification used to associate exclusive bids. If bid is accepted then all others with same identification shall be ignored. If the bid is not exclusive then the attribute is not used. | Not used | Not used | Conditional |
| blockBid | Not used. Redundant due to the existence of Divisible attribute. | Not used | Not used | Optional |
| status | A06 = Available A11 = Unavailable Associated multipart, linked and exclusive bids must have the same status. | Used | Not used | Conditional |
| priority | A sequential number indicating the priority of the bid in relation to other bids | Not used | Not used | Conditional |
| stepIncrementQuantity | Not used. For divisible offers the input step increment has been harmonised to 1 MW. | Not used | Not used | Conditional |
| energyPrice_Measure_Unit.name | MWH = Megawatt hours | MWH | Not used | Conditional |
| connecting_Domain.mRID | For offers it corresponds to the EIC identification of the sending TSO's LFC area providing the reserves. For shared/exchanged volume it corresponds to EIC identification of the TSO's LFC area or the region the reserved volume is shared/exchanged to. | Used | Used | Mandatory |
| price_Measure_Unit.name | MWH = Megawatt hours. This unit of measure is only provided in the case of a need where there is a price in the point class. Otherwise it is not used | Not Used | Not used | Conditional |

| | | | | |
|-------------------------------------|---|-------------|---|-------------|
| minimum_ConstraintDuration.duration | Not used | Not used | Not used | Conditional |
| currency_Unit.name | EUR = Euro. This currency is only provided in the case of a need where there is a price in the point class. Otherwise it is not used. | Used | Not used | Conditional |
| marketAgreement.type | The type of the market agreement | Not used | Not used | Conditional |
| marketAgreement.mRID | Identification of the agreement with the resource provider | Not used | Not used | Conditional |
| marketAgreement.createdAtTime | Time stamp used to identify the date and time that a specific offer was received. | Not used | Not used | Conditional |
| provider_MarketParticipant.mRID | The balance service provider (BSP) identification. | May be used | Not used | Conditional |
| acquiring_Domain.mRID | For offers it corresponds to the EIC identification of the region. For needs it corresponds to the EIC identification of the sending TSO's scheduling area or control area. For offers it corresponds to the EIC identification of the PICASSO region. For shared/exchanged volume it corresponds to EIC identification of the sending TSO's LFC area or region the reserve volume is shared/exchanged to. | region | TSO's LFC area, or LFC Block or common exchanged or shared region | Mandatory |
| quantity_Measure_Unit.name | MAW = Megawatts | Used | Used | Mandatory |
| resting_ConstraintDuration.duration | Not used | Not used | Not used | Conditional |
| maximum_ConstraintDuration.duration | Not used | Not used | Not used | Conditional |

| | | | | |
|--|--|-------------|----------|-------------|
| registeredResource.mRID | The identification of the resource used to provide the reserves | Not used | Not used | Conditional |
| activation_ConstraintDuration.duration | Not used | Not used | Not used | Conditional |
| flowDirection.direction | A01 = UP A02 = DOWN Refer to the price payment table for use in relation to price. | Used | Used | Mandatory |
| Auction.mRID | Constant value of "AUCTION-aFRR". It identifies that the bid refers to the auction specifications for an aFRR tender. Other values may be added as the aFRR process further evolves. | Used | Used | Mandatory |
| validity_Period.timeInterval | The period when the bid can be activated | Not used | Not used | Optional |
| standard_MarketProduct.marketProductType | Used when the bid refers to a standard product or a specific product that has been converted into a standard product: A01 = Standard product | Used | Not used | Conditional |
| original_MarketProduct.marketProductType | Used when the bid refers to a specific product or a specific product that has been converted into a standard product: A02 = Specific product A03 = Integrated scheduling process | May be used | Not used | Conditional |

414

415

| Period | | | | |
|--------------|---|------|------|-----------|
| timeInterval | A time interval within the validity period. | Used | Used | Mandatory |
| resolution | PT15M | Used | Used | Mandatory |

416

417

| Point | | | | |
|---------------------------|---|------------------|------------------------------|-------------|
| position | Position within the time interval | Used | Used | Mandatory |
| quantity.quantity | Quantity offered or needed with 1 MW precision. | Quantity offered | Quantity shared or exchanged | Mandatory |
| minimum_Quantity.quantity | Required if divisible = A01. Precision is 1 MW. | Not used | Not used | Conditional |
| price.amount | Not used | Not used | Not used | Conditional |
| Energy_Price.amount | The price of the activated energy product. Precision is 0.01. Note: Refer to the Price payment table for establishing who is paid. | Used | Not used | Conditional |

418

419

420 **Table 2 - CMOL export interface description**

| | | OFFER | XSD requirements |
|--|--|-------|------------------|
| MeritOrderList_MarketDocument | | | |
| mRID | Unique identification of the MOL Document | Used | Mandatory |
| revisionNumber | Initial transmission shall equal "1" | Used | Mandatory |
| Type | A43 = MOL document (used for the CMOL submitted by the connecting TSO) A66 = Final MOL (used for CMOL provided by TSO once delivery period is closed) | Used | Mandatory |
| process.processType | A48 = Automatic frequency restoration reserves (mFRR) | Used | Conditional |
| sender_MarketParticipant.mRID | EIC of the common Operator | Used | Mandatory |
| sender_MarketParticipant.marketRole.type | A04 = System operator A35 = MOL responsible | Used | Mandatory |
| receiver_MarketParticipant.mRID | EIC of the Transmission System Operator | Used | Mandatory |
| receiver_MarketParticipant.marketRole.type | A04 = System operator A35 = MOL responsible | Used | Mandatory |
| createdDateTime | Date and time of document creation | Used | Mandatory |
| Period.timeInterval | The duration of the delivery period (15 minutes) | Used | Mandatory |
| domain.mRID | EIC of the region (PICASSO region has to be created) | Used | Conditional |

421

| | | | |
|---|---|-------------|-------------|
| BidTimeSeries | | | |
| marketAgreement.mRID | Identification of the offer or the need as defined in the receiving TSO submission. | Used | Mandatory |
| MarketAgreement_createdDateTime | The timestamp of when the bid was received | Not used | Conditional |
| priority | A sequential number indicating the priority of the bid in relation to other bids. | Not used | Conditional |
| resourceProvider_MarketParticipant.mRID | The balance service provider (BSP) identification. | May be used | Conditional |

| | | | |
|-----------------------------------|---|------------------------------|-------------|
| registeredResource.mRID | The identification of the resource used to provide the reserves. | May be used | Conditional |
| acquiring_Domain.mRID | For offers it corresponds to the EIC identification of the region. For needs it corresponds to the EIC identification of the receiving TSO's control area or scheduling area. | region | Mandatory |
| connecting_Domain.mRID | for offers it corresponds to the EIC identification of the receiving TSO's scheduling area providing the reserves. for needs it corresponds to the EIC identification of the region providing the reserves | Receiving TSO's bidding zone | Mandatory |
| auction.mRID | Identification of auction as defined in the reserve bid document. | Used | Mandatory |
| businessType | B74 = Offer | B74 = Offer | Mandatory |
| bid_Period.timeInterval | The duration of the delivery period (15 minutes) | Used | Mandatory |
| quantity_Measure_Unit.name | MAW = Megawatts | Used | Mandatory |
| currency_Unit.name | EUR = Euro | Used | Conditional |
| price_Measurement_Unit.name | MWH = Megawatt hours | Used | Conditional |
| energyPrice_Measurement_Unit.name | MWH = Megawatt hours | Not used | Conditional |
| direction | A01 = UP A02 = DOWN Refer to the price payment table for use in relation to price. | Used | Mandatory |

| | | | |
|-------------------------------------|---|--------------------------------------|-------------|
| minimumActivation_Quantity.quantity | The minimum quantity that can be activated | Not used | Conditional |
| stepIncrement_Quantity.quantity | Not used. the output step increment has been harmonised to 0.1 MW. | Not used | Conditional |
| marketObjectStatus.status | A06 = Available (the offer has not been required) A11 = Unavailable or restricted or filtered shall be created | A06 = Available A11 = Unavailable | Mandatory |

422

423

| Period | | | |
|--------------|---|------|-----------|
| timeInterval | A time interval of the length of the delivery period (initially 1 hour) | Used | Mandatory |
| resolution | PT15M | Used | Mandatory |

424

425

| Point | | | |
|-----------------------------|--------------------------------------|--------------------------|-------------|
| position | Position within the time interval | Used | Mandatory |
| quantity.quantity | Quantity offered or needed | Quantity offered | Mandatory |
| price.amount | The price for activating the product | Not used | Conditional |
| Energy_Price.amount | The price of energy | Used when offer accepted | Conditional |
| activated_Quantity.quantity | Quantity activated | Not used | Conditional |

426

427

| Reason (associated with time series) | | May be used | Conditional |
|--------------------------------------|---|-------------|-------------|
| code | A95 = Complementary information | Used | |
| text | Textual information provided by the TSO | May be used | |

428

429 **7.3.3 PTDF Import**

430 The PTDF files are csv-files with the following structure

431

432 Validity period; version number;

433 # Nr; # From; # To; # Name; # LFC name 1; # LFC name 2; # LFC name n;

434 ;;;;LFC name 1;LFC name 2;LFC name n;

435 1;LFC name 1;LFC name 2;name of corridor 1;PTDF 1_1; PTDF 1_2; PTDF 1_n

436 2;LFC name 1;LFC name n;name of corridor 2;PTDF 2_1; PTDF 2_2; PTDF 2_n

437 m;LFC name 2;LFC name n;name of corridor m;PTDF m_1; PTDF m_2; PTDF m_n

438

439 New PTDF files can be imported every 15 minutes.

440

441

442 **7.3.4 Dependencies governing the Balancing_MarketDocument**

443 The balancing market document covers requirements for transmission of the clearing prices
444 from the common platform to TSOs and the ENTSO-E transparency platform per imbalance
445 settlement period. The same document will also be used for transmitting to the ENTSO-E
446 transparency platform the aggregated balancing energy bids.

447 Table 3 provides the dependencies for the balancing market document when the common
448 platform sends clearing prices to the ENTSO-E transparency platform.

449 **Table 3 - Balancing market document dependency table (submission of clearing prices**
450 **to transparency platform)**

| | | Use | XSD requirements |
|--|--|----------|------------------|
| Balancing_MarketDocument | | | |
| mRID | Unique identification of the balancing market Document | Used | Mandatory |
| revisionNumber | Initial transmission shall equal "1" | Used | Mandatory |
| type | A84 = activated balancing price | Used | Mandatory |
| process.processType | A16 = Realised | Used | Mandatory |
| sender_MarketParticipant.mRID | EIC of the PICASSO Operator | Used | Mandatory |
| sender_MarketParticipant.marketRole.type | A35 = MOL responsible | Used | Mandatory |
| receiver_MarketParticipant.mRID | 10X1001A1001A450 = EIC of the ENTSO-E transparency platform | Used | Mandatory |
| receiver_MarketParticipant.marketRole.type | A32 = Market information aggregator | Used | Mandatory |
| createdDateTime | Date and time of document creation | Used | Mandatory |
| docStatus | A01 = Intermediate A02 = Final | Not used | Conditional |
| controlArea.Domain.mRID | Scheduling area described by the document | Used | Conditional |
| Period.timeInterval | The duration of the delivery period covered by the document. | Used | Mandatory |
| allocationDecision_DateAndOrTime | Date and time when the decision on allocation was made | Not used | Optional |

| TimeSeries | | | |
|----------------------------|---|----------|-------------|
| mRID | Unique identification of the time series | Used | Mandatory |
| businessType | A12 = secondary control | Used | Mandatory |
| curveType | A01 = Sequential fixed block | Used | Conditional |
| cancelledTS | If the data for a time series has been cancelled this attribute shall be specified with A02 = Yes | Not used | Conditional |
| quantity_Measure_Unit.name | MAW = Megawatts | Not used | Conditional |
| mktPSRType.psrType | Identification of the source type of the reserve | Not used | Conditional |
| acquiring_Domain.mRID | | Not used | Conditional |
| price_Measure_Unit.name | MWH= Megawatt hours | Used | Conditional |
| connecting_Domain.mRID | | Not used | Conditional |
| currency_Unit.name | EUR = Euro | Used | Conditional |
| flowDirection.direction | A01 = Up A02 = Down | Used | Conditional |

| | | | |
|--|---|----------|-------------|
| type_MarketAgreement.type | Identification of the procurement time unit. | Not used | Conditional |
| standard_MarketProduct.marketProductType | Used when the reported quantities refer to standard products: A01 = Standard product | Used | Conditional |
| original_MarketProduct.marketProductType | Used when the reported quantities refer to specific products: A02 = Specific product | Not used | Conditional |

451

| Series_Period | | | |
|----------------------|--|------|-----------|
| timeInterval | A time interval equivalent to the delivery period | Used | Mandatory |
| resolution | PT15M or PT1M (or PT1S if optimisation cycle data shall be provided) | Used | Mandatory |

| Point | | | |
|--------------------------|--|----------|-------------|
| position | Position within the time interval | Used | Mandatory |
| quantity | The accepted offer quantity identified for a point. | Not used | Conditional |
| secondaryQuantity | The activated quantity | Not used | Conditional |
| activation_Price.amount | The activation price for the quantity of reserve. | Used | Conditional |
| procurement_Price.amount | The procurement price for the quantity of reserve. | Not used | Conditional |
| min_Price.amount | The minimum price for the reserve | Not used | Conditional |
| max_Price.amount | The maximum price for the reserve | Not used | Conditional |
| imbalance_Price.amount | The imbalance price for the quantity of reserve. | Not used | Conditional |
| imbalance_Price.category | Identification whether the imbalance price is due to excess or insufficient balance. | Not used | Conditional |
| flowDirection.direction | A01 = Up A02 = Down | Not used | Conditional |
| unavailable_Quantity | The unavailable quantity | Not used | Conditional |

| Financial_Price (associated with Point) | | Not used | Conditional |
|--|--|-----------------|--------------------|
| amount | | Not used | Mandatory |
| Direction | | Not used | Conditional |

452

453

454 **7.3.5 Dependencies governing the EnergyAccount_MarketDocument**

455 The energy account document is used by the common platform to provide the invoicing
456 financial information for the reserves that have been replaced. The document is used in two
457 cases:

- 458 1. To provide the financial settlement of the net positions and/or for the aFRR balancing
459 borders;
- 460 2. To provide the congestion income;

461 Table 4 provides the dependencies for the energy account market document.

462 **Table 4 - Energy account market document dependency table**

| | | Use | XSD requirements |
|--|---|------|------------------|
| EnergyAccount_MarketDocument | | | |
| mRID | Unique identification of the Energy Account market Document | Used | Mandatory |
| revisionNumber | Initial transmission shall equal "1" | Used | Mandatory |
| Type | A12 = Imbalance report | Used | Mandatory |
| docStatus | A02 = Final | Used | Mandatory |
| process.processType | A06 = Imbalance settlement | Used | Mandatory |
| process.ClassificationType | A01 = Detail type | Used | Mandatory |
| sender_MarketParticipant.mRID | EIC of the common platform Operator | Used | Mandatory |
| sender_MarketParticipant.marketRole.type | A35 = MOL responsible | Used | Mandatory |
| receiver_MarketParticipant.mRID | EIC of the settlement billing agent | Used | Mandatory |
| receiver_MarketParticipant.marketRole.type | A10 = Billing agent | Used | Mandatory |
| createdDateTime | Date and time of document creation | Used | Mandatory |
| Period.timeInterval | The duration of the settlement period | Used | Mandatory |
| domain.mRID | EIC of the region | Used | Conditional |

463

| TimeSeries | | | |
|------------------------|---|----------|-------------|
| mRID | Unique identification of the time series | Used | Mandatory |
| businessType | A24 Total trade where the time series covers financial values; B10 = Congestion income; C03 = price divergence; B76 = Opportunity costs or benefits (settlement of inelastic need netting); B77 = Financial compensation or penalties | Used | Mandatory |
| product | 8716867000016 = Active power | Used | Mandatory |
| objectAggregation | A01 = Area | Used | Mandatory |
| area_Domain.mRID | EIC identification of the control area | Used | Mandatory |
| MarketParticipant.mRID | identification of TSO responsible for the area | Used | Conditional |
| marketAgreement.mRID | Identification of the reserve contract | Not used | Conditional |
| measure_Unit.name | MWH = Megawatts hours | Used | Mandatory |
| currency_Unit.name | EUR = Euro | Used | Conditional |

464

| | | | |
|----------------------------|--|----------|-------------|
| marketEvaluationPoint.mRID | Identification of an accounting point | Not used | Conditional |
| Series_Period | | | |
| timeInterval | A time interval of the settlement period | Used | Mandatory |
| resolution | PT15M | Used | Mandatory |

| | | | |
|-----------------------|---|----------|-------------|
| Point | | | |
| position | Position within the time interval | Used | Mandatory |
| In_Quantity.quantity | Quantity going into an area | Used | Mandatory |
| In_Quantity.quality | The quality of the quantity | Not used | Conditional |
| out_Quantity.quantity | Quantity going out of an area | Used | Mandatory |
| Out_Quantity.quality | The quality of the quantity | Not used | conditional |
| price.amount | settlement amount. This represents the total financial value for the point in respect to the time series businessType. The value may be negative. | Used | Conditionel |

465 Note: The in quantity and out quantity represent a netted value consequently one of the
466 values must always be equal to zero.

| | | | |
|---|--|-----------------|--------------------|
| Reason (associated with Point) | | Not used | Conditional |
|---|--|-----------------|--------------------|

467 **7.3.6 Financial amount table**

468 Table 5 indicates the domain owner that should pay the amount indicated.

469 **Table 5 - Financial amount table**

| | | | |
|------------------|-------------------|-----|-----------------|
| Price.amount | Settlement amount | >0 | <0 |
| Which party pays | | TSO | common platform |

470 **7.4 Business rules – Real-time**

471 Real-time communication is done via dedicated communication lines. Each TSO has to build
472 at least two independent lines. One to the main site and one hot standby to the backup site.

473 Real-time communication via COMO network is being to be investigated.

474 The communication speed is at least 9600 bit/s.

475 The platform supports the following protocols:

- 476 • IEC 60870-5-101
- 477 • IEC 60870-5-104
- 478 • IEC 60870-6 TASE.2

479 The TSO may choose only one of those three protocol for exchanging information with the
480 aFRR platform.

481 **7.4.1 Process Data Exchange via IEC 60870-6 TASE.2**

482 The system must support the TASE.2 conformance blocks listed in Table 3:

483 **Table 1 – TASE.2 conformance blocks**

| Conformance block | Description |
|-------------------|--|
| Block 1 | Basic services DataValue, DataSet and DataSet-TransferSet-items |
| Block 2 | Enhanced status monitoring Allows sending of data points from the server to the client on change ('Report-by-Exception') |
| Block 4 | Messages Sends freely definable data blocks from the server to the client This block is not needed for exchanges of data between TSO and aFRR Platform. This block might be used for internal operation of the Platform. |
| Block 5 | Device control General interface for setting commands and set point specification (e.g. device occupancy with timeout monitoring 'Select-before-Operate') This block might be needed for HVDC operations. |
| Block 8 | Plans, matrices Tables as data type, special types for delivery scheduling, transmission links etc. This block is not needed for exchanges of data between TSO and aFRR Platform. This block might be used for internal operation of the Platform. |

484 It is possible to determine whether the system works as master or slave for each partner
 485 control centre.

486 The partner control centres are redundantly connected via both system locations.

487 Connection to redundant structures of the partner control centre must be possible.

488 For direct file exchange, the platform allows the transfer of larger amounts of information
 489 using block 4 (splitting and joining).

490 The parametrisation of the data to be exchanged via this interface takes place at a central
 491 point.

492 Secured communication in accordance with IEC 62351 must be possible for the IEC 60870-6
 493 TASE.2 protocol.

494 **7.4.2 Process Data Exchange via IEC 60870-5-101**

495 The system supports the IEC 60870-5-101 slave protocol, which allows the reception of data
 496 from IEC 60870-5-101 substations or external systems via a dedicated serial line.

497 The system supports the IEC 60870-5-101 master protocol, which allows data to be sent to
498 external systems via a dedicated serial line.

499 The system supports the IEC 60870-5-101 dual mode, which allows data to be sent to and the
500 reception of data via the same serial line.

501 **7.4.3 Process Data Exchange via IEC 60870-5-104**

502 The system supports the IEC 60870-5-104 slave protocol, which allows the reception of data
503 from IEC 60870-5-101 substations or external systems via a dedicated serial line.

504 The system supports the IEC 60870-5-104 master protocol, which allows data to be sent to
505 external systems via a dedicated serial line.

506 For incoming telegrams, it is checked whether the telemetry address matches the IP address
507 of the sending components or the sending system. Otherwise, the telegram is discarded and a
508 message generated.

509 Secured communication in accordance with IEC 62351 for the IEC 60870-5-104 protocol is
510 used.

511

512 **8 Contextual and assembly models**

513 **8.1 Reserve bid document**

514 The contextual and assembly models for the reserve bid document shall be based on the
515 equivalent models as defined in urn:iec62325.351:tc57wg16:451-7:reservebiddocument:7:1.

516 **8.2 Energy account market document**

517 The contextual and assembly models for the energy account market document shall be based
518 on the equivalent models as defined in urn:iec62325.351:tc57wg16:451-
519 4:energyaccountdocument:4:0.

520 **8.3 Balancing market document**

521 The contextual and assembly models for the balancing market document shall be based on
522 the equivalent models as defined in urn:iec62325.351:tc57wg16:451-
523 6:balancingdocument:4:0.

524 **9 XML schema**

525 All XML schemas for the automated frequency restoration reserve process are available for
526 download from the ENTSO-E website.

527