ACER
European Union Agency for the Cooperation of Energy Regulators

DECISION No 06/2024
OF THE EUROPEAN UNION AGENCY
FOR THE COOPERATION OF ENERGY REGULATORS

of 2 May 2024

on the European Resource Adequacy Assessment for 2023

THE EUROPEAN UNION AGENCY FOR THE COOPERATION OF ENERGY REGULATORS,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators[1], and, in particular, Article 9(1)(a) thereof,

Having regard to Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity,[2] and, in particular, Article 23(7) and Article 27 thereof,

Having regard to the outcome of the consultation with the European Network of Transmission System Operators for Electricity,

Having regard to the outcome of the consultation with ACER's Electricity Working Group,

Having regard to the favourable opinion of the Board of Regulators of 24 April 2024, delivered pursuant to Article 22(5)(a) of Regulation (EU) 2019/942,

Whereas:

1. INTRODUCTION

(1) The European Resource Adequacy Assessment (ERAA) is a pan-European assessment of power system resource adequacy of up to 10 years ahead aiming to model and analyse possible events which can adversely impact the balance between supply and demand of electric power. The European Network of Transmission System Operators for

[1] OJ L 158, 14.6.2019, p. 22.
[2] OJ L 158, 14.6.2019, p. 54.

Electricity (ENTSO-E) carries out ERAA on an annual basis. The purpose of annual ERAAs is to identify resource adequacy concerns, and to provide a robust and objective basis for policy decisions, in particular when assessing the need for capacity mechanisms. As such, ERAA is expected to have a major role in resource adequacy policies.

(3) Annual ERAAs must be based on the methodology for the European resource adequacy assessment (ERAA methodology),[3] which was developed by ENTSO-E under Article 23(3) of Regulation (EU) 2019/943 (Electricity Regulation) and approved on 2 October 2020 by ACER Decision No 24/2020.

(4) On 15 December 2023, ENTSO-E submitted to ACER its proposal for assessment for 2023, comprising scenarios, sensitivities, assumptions and the results as required by Article 23(7) of the Electricity Regulation (collectively ERAA 2023 or the Report).

(5) This Decision is issued following ACER's assessment of ERAA 2023, and is structured as follows:

Section 2	**Procedure** - describes the key steps leading to this Decision, including engagement before the formal submission to ACER
Section 3	**ACER's competence to decide on ERAA 2023** - sets out the legal basis for this Decision
Section 4	**Summary of the observations received by ACER** - outlines the observations received by ACER during the decision-making procedure
Section 5	**Legal framework** - describes the applicable legal framework for ACER's assessment
Section 6	**Assessment of ERAA 2023** - ACER's assessment against the legal framework
Section 7	**Summary of assessment and reasons for amendments** – summarises ACER's assessment and provides reasoning for ACER's amendments
Section 8	**Recommendations for ERAA 2024** - outlines ACER's key recommendations for the next ERAA

(6) The Decision contains ten annexes. Annexes I.a – I.f set out ERAA 2023 as submitted to ACER, Annex II contains ACER's amendments to ERAA 2023, Annex III ('technical annex') supplements ACER's assessment in section 6 by providing technical

[3] Annex I to ACER Decision No 24/2020.

review of specific elements of ERAA 2023, and Annex IV contains the updated ERAA 2023 results following ENTSO-E's model rerun (see section 2).

(7) ERAA 2023 is the third of ENTSO-E's annual assessments carried out under Article 23 of the Electricity Regulation. ERAA 2021 and ERAA 2022 were not approved by ACER in its ERAA 2021 Decision[4] and in its ERAA 2022 Decision[5] respectively.

(8) In its ERAA 2022 Decision, ACER considered the lack of consistency of input data and assumptions as a major impediment to robust results. In particular, ACER considers that to improve the annual ERAA assessment, input needs to be, on the one hand, (i) consistently applied across the two modules of the ERAA model, and, on the other hand, (ii) consistent with relevant EU and national policy targets and plans.

i. The ERAA model, as implemented by ENTSO-E, relies on two modules, the so-called investment (economic viability assessment or EVA) and risk (economic dispatch or ED) modules. To ensure that the ERAA delivers robust results, consistency between the approaches used in the two modules is paramount.

ii. To represent a coherent view of the future, the ERAA inputs and assumptions also need to be consistent with other ENTSO-E deliverables (e.g. TYNDP) and broader European policy goals and targets (e.g. greenhouse gas reduction targets).

(9) ERAA 2023 represents an important milestone in the implementation of the ERAA methodology which allows for a stepwise approach, to be completed in ERAA 2024. For the next ERAA, ACER also expects that ENTSO-E solidifies the improvements achieved so far by implementing structural solutions to ensure consistency.

2. PROCEDURE

2.1. Engagement with ENTSO-E and other parties before the submission of ERAA 2023

(10) ACER has been in close contact with ENTSO-E on ERAA 2023 since January 2023 in preparation for the formal submission in December 2023. All these early information exchanges between ACER and ENTSO-E were conducted with the shared objective of contributing towards improving ERAA 2023 and allowed ACER to provide feedback throughout the ERAA 2023 development process. In particular:

[4] Decision 02/2022.
[5] Decision 04/2023.

i. On 2 February 2023, the chair of the ACER Board of Regulators and the ACER director sent a letter to ENTSO-E and all transmission system operators (TSOs) reiterating that the consistency of the ERAA model is the key priority for 2023.

ii. On 21 April 2023, ACER submitted its reply to ENTSO-E's public consultation pointing to specific aspects where consistency needs to be improved including: cross-zonal capacities, network development, the use of climate data and the EU's fit-for-55 greenhouse gas reduction target.

iii. In June 2023, ACER presented at two ERAA webinars organised by ENTSO-E and reemphasised that consistency of modelling choices and assumptions is key to achieve robust results.

(11) In parallel, ACER held regular discussions about ERAA 2023 with the regulatory authorities in the context of ACER's Adequacy Task Force and Electricity Working Group. Moreover, throughout the year, ACER closely collaborated with the Joint Research Centre of the European Commission, seeking expert input to effectively tackle methodological challenges related to ERAA. ACER has also engaged on ERAA with the European Commission and Member States via the Electricity Coordination Group.

2.2. Proceedings following the submission of ERAA 2023

(12) On 15 December 2023, ENTSO-E formally submitted ERAA 2023 to ACER for approval. The submission consisted of an Executive Report describing the purpose of the assessment and its main findings and the ERAA 2023's input dataset along with five annexes, including:

Annex 1	Assumptions
Annex 2	Methodology
Annex 3	Detailed results
Annex 4	Country comments
Annex 5	Definition and glossary

(13) On 18 December, ENTSO-E published the Report on its website.[6]

(14) On 18 December, ACER issued a notice informing the public about the initiation of its decision procedure.

(15) Between 15 December 2023 and 12 January 2024, ACER had exchanges with ENTSO-E, seeking additional information and clarifications on the submitted documents.

(16) On 17 January 2024, ACER shared its preliminary position on ERAA 2023 with ENTSO-E and the Member States via the Electricity Coordination Group. The parties

[6] See ENTSO-E's European Resource Adequacy Assessment 2023 Edition.

had an opportunity to provide their views by 31 January 2024 and request an oral hearing.

(17) On 30 January 2024, ENTSO-E provided its views in writing and requested an oral hearing with ACER which took place on 31 January 2024. ACER also received written views from the Federal Ministry of Economic Affairs and Energy (German Ministry), Ministry for Environment, Land and Sea Protection of Italy (Italian Ministry) and the Italian transmission system operator Terna SpA (Terna). The views on ACER's preliminary position are summarised in section 4.1.

(18) By letter of 6 February 2024, ENTSO-E informed ACER about the results of the EVA rerun, performed by ENTSO-E to investigate the impact of a modelling error in the input data for Germany detected in ERAA 2023 in the course of ACER's assessment.

(19) The AEWG was consulted on ACER's draft Decision between 7 – 14 February 2024 and provided its advice dated 16 February 2024 (see section 4.2).

(20) By letter of 19 February 2024, in light of the discussions with the regulatory authorities and the AEWG advice, ACER requested ENTSO-E to rerun also the economic dispatch module of ERAA 2023 for all the target years of the central reference scenario and provide the corrected results for both ERAA modules (EVA and ED) with and without the curtailment-sharing feature[7].

(21) ENTSO-E made the complete rerun results available to ACER on 27 March 2024.

(22) ACER's Board of Regulators issued a favourable opinion on 24 April 2024.

3. ACER'S COMPETENCE TO DECIDE ON ERAA 2023

(23) Article 9(1)(a) of Regulation (EU) 2019/942 states that ACER shall approve and amend, where necessary, the proposals for calculations related to ERAA pursuant to Article 23(7) of the Electricity Regulation.

(24) Pursuant to Article 23(7) of the Electricity Regulation, ERAA's scenarios, sensitivities, assumptions and results shall be subject to the prior consultation of Member States, the ECG and relevant stakeholders, and approval by ACER under the procedure set out in Article 27 of the Electricity Regulation. As specified in Article 27, ACER has three months to either approve or amend ERAA. In the latter case, ACER shall consult ENTSO-E before approving the amended ERAA.

(25) On 15 December 2023, ENTSO-E submitted ERAA 2023 (including scenarios, sensitivities, assumptions and results) to ACER for approval. ACER is competent to

[7] Curtailment sharing is explained in section 6.2.5 of this Decision.

decide on ERAA 2023 based on Article 9(1)(a) of Regulation (EU) 2019/942 and Article 23(7) of the Electricity Regulation.

4. SUMMARY OF THE OBSERVATIONS RECEIVED BY ACER

4.1. Consultation on ACER's preliminary position

(26) This section summarises the views of ENTSO-E and the Member States consulted on ACER's preliminary position.

4.1.1. Feedback from ENTSO-E

(27) In general, ENTSO-E welcomed ACER's preliminary position to approve ERAA 2023. Its detailed feedback focused on three areas: the role of the scenario framework, the robustness of results and the reflection of investor risks and long-term signals.

(28) Regarding the scenario framework, ENTSO-E expressed concerns that ACER's preliminary position unduly restricts the scope and utility of the sensitivity included in ERAA 2023. ENTSO-E pointed out that appropriate sensitivities have a complementary role in the ERAA assessment as they allow a more comprehensive understanding of the potential challenges and risks to resource adequacy. ENTSO-E stressed that the complementary role of sensitivities goes beyond merely "checking the robustness of the obtained results". For ACER`s position see in particular section 6.2.3 and 7.2.

(29) Regarding the robustness of the results, ENTSO-E stated that there are instances where the sensitivity can demonstrate better consistency. ENTSO-E agreed with ACER that the climatic year weights adopted for the central reference scenario improved the consistency with the adequacy runs when selected KPIs are assessed. However, ENTSO-E argued that consistency in strict modelling terms should not be used as judging criteria to present a scenario as more "robust". For ACER`s position see in particular Annex III section 3.5.

(30) Regarding the reflection of investor risks and long-term signals, ENTSO-E explained that both the scenario and the sensitivity use the same climatic years (with different weights applied to each of those years). ENTSO-E added that the climate year weighting addresses an actual and real investor's perception of risk, extending beyond the weighted average cost of capital and hurdle rates. For ACER`s position see in particular section 6.2.5, 7.2 and 8.

4.1.2. Feedback from other concerned parties

(31) The German Ministry, the Italian Ministry and Terna also submitted written views on ACER's preliminary position.

(32) The German Ministry appreciated the efforts of ENTSO-E and ACER in improving the ERAA and acknowledged methodological improvements since last year's edition. The Ministry also outlined the deficits of ERAA 2023, mainly related to the input data error for Germany (see recital (101)) and a number of methodological issues.

(33) Concerning input data, the German Ministry pointed out the data error in fixed operation and maintenance costs for open-cycle gas turbines (OCGT) in Germany. As a result, in the Ministry's view, the cost of a new entry of an OCGT appears higher than one considered in the German calculation of the reliability standard. For ACER's position, see in particular section 6.2.5 and 7.1.

(34) As regards the restrictions to cross-border exchange, the German Ministry emphasised that although ERAA 2023 attempts to address inconsistencies between the two modules of the ERAA model when it comes to the consideration of cross-zonal capacities, these improvements have not resulted in full alignment with the actual cross-zonal exchanges. As a result, cross-border capacities are underestimated, in Ministry's view. For ACER's position, see in particular section 6.2.7.

(35) Regarding the price cap, according to the German Ministry, ERAA 2023 applies a price cap (4,000 €/MWh) much lower than the current maximum clearing prices for intraday or balancing markets e.g. for the latter, there is an additional opportunity to reap prices up to 15,000 €/MWh. The German Ministry pointed out that the combination of LOLE hours (price spikes) and the price cap should result in a so-called implicit revenue in the ED model that should have justified additional gas generation capacity in 2033, at least for some countries, including Germany. For ACER's position, see in particular section 6.2.5 and 8.

(36) In terms of curtailment sharing, the German Ministry suggested that the risks identified by ERAA 2023 could be reduced if the model considered the outcome of the intraday market which takes place after curtailment sharing. For ACER's position, see in particular section 6.2.5 and Annex III, section 3.3. For transparency, ACER also publishes the LOLE and EENS results with and without the impact of curtailment sharing in Annex III, section 5.

(37) As for the residual load, the German Ministry pointed out a steep increase in the maximum residual load in Germany between 2025 and 2033 which could be attributed to the assumption that the growing heat pump and electric vehicle demand is inflexible. For ACER's position, see in particular section 6.2.8.

(38) Finally, in the German Ministry's view, the two modules of ERAA 2023 suffer from certain remaining inconsistencies. For example, the German Ministry agreed with ACER's concerns about the inconsistency of the climate years between both modules, elaborated in last year's decision. The Ministry suggested to compare the results generated by both modules to ensure consistency. Furthermore, the German Ministry noted the constraints in the model limiting investment in gas-fired power plants in France and the Czech Republic. For ACER's position, see in particular sections 6.2.5, 7.2 and Annex III section 3.2 and 3.5.

(39) The Italian Ministry was concerned that according to ERAA 2023, a significant amount of new capacity would be built in Europe, triggered by extreme market prices of several thousand euros per MWh, expected to occur in just a few hours per year yet such an approach does not correctly reflect the risk aversion of a rational investor. The Italian Ministry considered that the sensitivity in ERAA 2023 is more representative of a risk-

averse investor but even the sensitivity is far from considering the risk aversion of a rational investor and triggers an unrealistically large capacity expansion. For ACER's position, see in particular sections 6.2.5 and 7.2.

(40) Regarding the improved consistency, the Italian Ministry stated that recalibrating weights associated with the selection of climate years – as done in the central reference scenario – does not ensure a greater inherent consistency compared to other scenarios or sensitivities. For ACER's position, see in particular Annex III section 3.5.

(41) The Italian Ministry considered that the sensitivity is complementary to the central reference scenario, and both should be considered for the identification of the adequacy concerns. For ACER's position, see in particular sections 6.2.3 and 7.2.

(42) The Italian Ministry saw the need to further improve the modelling investor behaviour including investment into new capacities and viability of existing capacity. According to the Ministry, this analysis should be based on expected producer revenues, rather than on the simplified approach consisting of minimising the total system costs. For ACER's position, see in particular section 8.

(43) Terna welcomed the constructive discussion between TSOs, ENTSO-E and ACER on the gradual implementation of the ERAA methodology. In Terna's view, however, this year's ERAA continues to underestimate the adequacy risks because it neglects some crucial methodological aspects: dependence on the cross-border trade, risk aversion of investors, scenario framework and the approach to assess economic viability.

(44) Concerning the dependence on cross-border trade, Terna highlighted that ERAA editions continuously underestimate the adequacy risk of the Italian electricity system, being heavily dependent on foreign resources and the availability of the interconnection capacities for cross-border trade. For ACER's position, see in particular section 5 and 6.2.7.

(45) As regards the risk aversion of the investors, Terna emphasised that the ERAA methodology calls for reflecting investors' reactions with a use of the parameters modelling the risk premiums on investment derived from academic research and other studies. In Terna's view, this approach does not reflect a realistic decision-making model. Instead, Terna suggested that by lowering the weight of extreme climate years, ERAA could reflect a more risk-averse investor behaviour. Furthermore, Terna stated that risk-averse investors would not build capacity solely based on the expectation of rare and extreme market prices of several thousand euros per MWh. Finally, Terna noted that the applied methodology neglects the time lag between the occurrence of price spikes and the realisation of new capacity. For ACER's position, see in particular sections 6.2.5 7.2 and 8.

(46) In terms of scenario framework, Terna was of a view that the sensitivity in ERAA 2023 should be rather considered a separate central scenario. For ACER's position, see in particular sections 6.2.3 and 7.2.

(47) As for the approach to assessing economic viability, Terna stressed that for ERAA to provide realistic results, it should be based on expected revenues determining economic viability as opposed to the minimisation of the overall system cost. For ACER's position, see in particular section 8.

4.2. Consultation of ACER's Electricity Working Group

(48) The AEWG provided its advice on 16 February 2024 and broadly endorsed the draft Decision, acknowledging the balanced approach regarding the role of the sensitivity. Four regulatory authorities provided written comments during the consultation phase. The AEWG invited ACER to consider these comments, while maintaining the compromise.

(49) ARERA (Italy), CNMC (Spain) and CRE (France) commented on the reflection of risk aversion and the ERAA scenario framework. The comments on investor risk aversion are addressed in particular in sections 6.2.5, 7.2 and 8. Sections 6.2.3, 6.2.5 and 7.2 consider the comments on the scenario framework.

(50) The error in the German input data was discussed at the AEWG meeting of 14 February 2024. BNetzA (Germany) expressed the need to rerun the economic dispatch module in the central reference scenario. The AEWG concluded that ENTSO-E will perform a rerun of the modules on the central reference scenario for all target years. ACER's rerun request and the assessment of the corrected results are discussed in section 6.2.5.

(51) The AEWG also advised to address in the Decision the general comments on the need for future improvements in the ERAA as well as ARERA's specific wording proposals concerning descriptions of national views. The need for future improvements in the ERAA is described specifically in section 8, and the relevant descriptions of national views have been revised as appropriate.

5. LEGAL FRAMEWORK

(52) The relevant provisions governing ERAA, and therefore also ERAA 2023, are set out in Chapter IV of the Electricity Regulation and the ERAA methodology. Section 5.1 recapitulates the intended purpose of ERAA based on the recitals and Chapter IV of the Electricity Regulation. ERAA's role must be also read in light of the Electricity Regulation's objectives and key principles. Sections 5.2 and 5.3 outline substantive and procedural requirements for ERAA provided in Article 23 of the Electricity Regulation and further specified in the ERAA methodology.

5.1. ERAA's role in decision making

(53) Pursuant to Recital (43) and Recital (44) of the Electricity Regulation, ENTSO-E should carry out a robust ERAA to provide an objective basis for the assessment of resource adequacy concerns. ERAA is mainly used to identify resource adequacy concerns and to assess the need for capacity mechanisms. As such, adequacy concerns to be addressed by capacity mechanisms should be primarily identified in ERAA, but ERAA may be complemented by national resource adequacy assessments.

Accordingly, Article 20(1) of the Electricity Regulation requires Member States to monitor resource adequacy within their territory on the basis of ERAA, and allows them to carry out their national assessments to complement ERAA.

(54) The role of ERAA in monitoring resource adequacy and identifying adequacy concerns should be understood in the context of broader EU objectives listed in Article 1 of the Electricity Regulation. In particular, the Electricity Regulation aims to set the basis for an efficient achievement of the 2030 climate and energy framework (including the targets set in the Fit for 55 package) by enabling market signals to be delivered for increased efficiency, higher share of renewable energy sources, security of supply, flexibility, sustainability, decarbonisation and innovation. ERAA is expected to provide insights for decisions relevant for achieving these objectives.

(55) The purpose of ERAA should also be understood in the context of the market operation principles listed in Article 3 of the Electricity Regulation. In fact, ERAA should consider the relevant market trends which are and will be driven by these principles, such as market integration, free price formation, decarbonisation of the electricity system through the deployment of renewable energy and energy efficiency, increased system flexibility and development of DSR including consumer empowerment.[8] ERAA should also consider that pursuant to these principles, barriers to cross-zonal electricity flows will progressively be removed.[9] Finally, according to these principles, market entry and exit should be based on undertakings' assessments of the economic and financial viability of their operations.[10]

5.2. Substantive requirements for ERAA

(56) Pursuant to Article 23(1) of the Electricity Regulation, first sentence, ERAA shall identify resource adequacy concerns by assessing the overall adequacy of the electricity system to supply current and projected demands for electricity at Union level, at the level of the Member States, and at the level of individual bidding zones, where relevant. This requirement is reflected in Article 1 of the ERAA methodology.

(57) Pursuant to Article 23(1) of the Electricity Regulation, second sentence, ERAA shall cover each year within a period of 10 years from the date of the assessment. This requirement is reflected in Article 4 of the ERAA methodology defining the study time period.

(58) Pursuant to Article 23(5) of the Electricity Regulation, ERAA shall be based on the ERAA methodology, which shall be transparent and ensure that the assessment is compliant with a number of requirements listed therein. These requirements are further specified in the ERAA methodology, in particular:

[8] Points (c), (d), (e), (f), (g), (j), (l) and (m) of Article 3 of the Electricity Regulation.
[9] Point (h) of Article 3 of the Electricity Regulation.
[10] Point (n) of Article 3 of the Electricity Regulation.

(a) Article 4 defines the spatial granularity of the modelled zones and Article 1 requires that explicitly modelled systems are those covering at least the region composed of the EU TSOs, in line with Article 23(5)(a) of the Electricity Regulation;

(b) Article 3 sets out the scenario framework and defines central reference scenarios and sensitivities. In particular, it requires that the baseline data for ERAA is based on national forecasts reflecting national policies and that the economic viability assessment is carried out for each central reference scenario. Article 6 specifies how to perform the economic viability assessment, implementing the requirement of Article 23(5)(b) of the Electricity Regulation;

(c) Article 3 defines two types of central reference scenarios, with and without capacity mechanisms, in consistency with Article 23(5)(c) of the Electricity Regulation. In addition, it allows for additional scenarios and/or sensitivities with EU relevance.

(d) Article 4 specifies requirements for modelling of supply, demand and the network, in line with Article 23(5)(d) of the Electricity Regulation;

(e) Article 3 requires that the assumptions of the central reference scenarios are aligned with the measures and actions defined by the Member States pursuant to Article 10(5) of the Electricity Regulation and with the national implementation plans, reflecting the requirement of Article 23(5)(e) of the Electricity Regulation;

(f) Article 3 requires that ERAA is based on two central reference scenarios, with and without existing or planned capacity mechanisms, in line with Article 23(5)(f) of the Electricity Regulation;

(g) Article 4 relates to capacity calculation. In particular, it specifies the requirements for computations based on flow-based approach, where applicable, in line with Article 23(5)(g) of the Electricity Regulation.

(h) Article 4 requires ERAA to use probabilistic calculations as specified therein, in line with Article 23(5)(h) of the Electricity Regulation.

(i) Article 4 requires that the assessment is based on a single modelling tool, in line with Article 23(5)(i) of the Electricity Regulation.

(j) Article 4 requires that resource adequacy is assessed using EENS and LOLE and further defines the two indicators, in line with Article 23(5)(j) of the Electricity Regulation.[11]

[11] According to the ERAA methodology, for a given modelled zone and for a given time period, LOLE is the expected number of hours in which resources are insufficient to meet the demand; Energy not served (ENS) means, for a given market time unit (MTU) and modelled zone, the energy which is not supplied due to insufficient resources to meet demand, while EENS is the expected ENS in a given modelled zone and in a given time period.

(k) Article 8 requires that ENTSO-E identifies the possible source (or sources) of each resource adequacy concern identified in ERAA and specifies how these should be assessed, in line with Article 23(5)(k) of the Electricity Regulation.

(l) Article 3 specifies that ERAA's baseline data come from TSOs' national outlooks. The latter include estimates regarding the state of national networks, taking into account ENTSO-E's ten-year network development plan (TYNDP) and the most recent national network development plans, which is in line with Article 23(5)(l) of the Electricity Regulation.

(m) Article 4 sets out a number of requirements relating to demand, supply, energy storage and network, which ensure that the national characteristics of generation, demand flexibility and storage, as well as the availability of primary resources and the level of interconnection are properly taken into consideration in ERAA, in line with Article 23(5)(m) of the Electricity Regulation.

5.3. Procedural requirements for ERAA

(59) Pursuant to Article 23(2) and the second subparagraph of Article 23(4) of the Electricity Regulation, ERAA shall be conducted by ENTSO-E on an annual basis. Article 10 of the ERAA methodology specifies that ERAA is submitted to ACER by 1 November each year.

(60) Pursuant to the first subparagraph of Article 23(4) of the Electricity Regulation, the TSOs shall provide ENTSO-E with the data it needs to carry out ERAA. Pursuant to the second subparagraph of Article 23(4) of the Electricity Regulation, producers and other market participants shall provide the TSOs with data regarding expected utilisation of the generation resources, taking into account the availability of primary resources and appropriate scenarios of projected demand and supply. The data collection process is further specified in Article 5 of the ERAA methodology, listing the obligations of the TSOs and market participants.

(61) Pursuant to Article 23(7) of the Electricity Regulation, ERAA's scenarios, sensitivities and assumptions on which they are based, and the results shall be subject to the prior consultation of Member States, the ECG and relevant stakeholders and approval by ACER under the procedure set out in Article 27 of the Electricity Regulation.

(62) Pursuant to Article 27(2) in joint reading with Article 23(7) of the Electricity Regulation, before the submission of ERAA to ACER, ENTSO-E shall carry out a consultation involving all relevant stakeholders, including regulatory authorities and other national authorities. It shall duly take the results of that consultation into consideration.

(63) Article 41(2) of the Electricity Regulation requires that ENTSO-E operates in full transparency towards stakeholders and the general public. Article 31, in joint reading with Article 30(1)(c) of the Electricity Regulation, specifies consultation requirements for ERAA. ENTSO-E shall conduct an extensive consultation process which enables it to accommodate stakeholder comments before the final adoption of ERAA and in an open and transparent manner, involving all relevant stakeholders. ENTSO-E's

consultation shall also involve regulatory authorities and other national authorities, supply and generation undertakings, system users including customers, distribution system operators, including relevant industry associations, technical bodies and stakeholder platforms. It shall aim at identifying the views and proposals of all relevant parties during the decision-making process. Pursuant to Article 31(2) of the Electricity Regulation, ENTSO-E shall make public all the documents and minutes related to its consultation. Pursuant to Article 31(3) of the Electricity Regulation, before adopting ERAA, ENTSO-E shall indicate how the observations received during the consultation have been taken into consideration, and provide reasons where observations have not been taken into account. The degree of stakeholder involvement required for each ERAA is further specified in Article 9 of the ERAA methodology, including the establishment of adequate stakeholder interaction channels at different stages of ERAA's development process.

(64) Pursuant to Article 27(3) in joint reading with Article 23(7) of the Electricity Regulation, ACER has three months from the submission date to either approve or amend ERAA. In the latter case, ACER shall consult ENTSO-E before approving the amended ERAA. ACER shall publish the approved ERAA on its website within three months of the date of receipt of the submission.

5.4. Implementation of the ERAA methodology

(65) Article 12 of the ERAA methodology allows for a progressive implementation of the methodology until the end of 2023. In particular, as stated in Article 12(2), the ERAA methodology may be implemented through a gradual process. Such an approach strikes a balance between accuracy and feasibility of the targeted improvements.

(66) As explained in Recital 12 of the ERAA methodology, this gradual approach is intended to allow for some temporary (and properly justified) methodological simplifications during the implementation phase, in order to help ENTSO-E to continuously learn and gain experience over time ensuring efficient implementation of the ERAA methodology in the longer run.

6. ASSESSMENT OF ERAA 2023

6.1. Broader context and ACER's assessment approach

(67) The energy crisis and the Russian war of aggression against Ukraine had wide-ranging effects on the evolution of the electricity sector. As Member States are seeking to ensure security of supply, a robust and coordinated European assessment of long-term resource adequacy has become more important than ever.

(68) ACER recognises that ENTSO-E is still in the four-year phase to gradually implement the ERAA methodology and as such, certain methodological simplifications are still acceptable in ERAA 2023. For this reason, ACER follows the same approach as in the previous year, i.e. checks whether ERAA 2023 considers all high-level requirements of Article 23 of the Electricity Regulation and meets the intended purpose of an ERAA.

(69) ERAA 2023 represents an important step towards the full implementation of the ERAA methodology envisaged for next year. ERAA 2023 still includes many methodological simplifications, and even if ACER considers them justified and acceptable, they inevitably affect, to some degree, the quality of the assessment and the robustness of its results. Given the role of ERAA in decision-making (see section 5.1), it is necessary to carefully assess whether, and to what extent, such simplifications may actually undermine the purpose of ERAA as intended in Chapter IV of the Electricity Regulation. Therefore, in case of simplifications, ACER considers their potential impacts on the functionality of the assessment in terms of its relevance for policy-making. In particular, ACER examines whether such simplifications compromise the robustness of the assessment to the extent that they would materially affect the accuracy and reliability of its results, leading to incorrect findings of resource adequacy concerns and by extension, incorrect policy decisions.

(70) Considering the above, ACER has assessed ERAA 2023 against the applicable legal framework based on a combination of three factors: (1) ERAA 2023 should have regard to the objectives and requirements of the Electricity Regulation, in particular it should reflect the requirements of Article 23; (2) certain methodological simplifications may be allowed in the implementation period; and (3) any such simplifications may not however render the assessment unfit for its intended purpose.

(71) A new aspect of ERAA 2023, compared to ERAA 2022, is the inclusion of a sensitivity assessment, in addition of the central reference scenario. Thus, ACER finds it relevant to clarify that the purposes of central reference scenarios and sensitivities are different. The central reference scenario serves as the basis for the identification of resource adequacy concerns, while the sensitivity assessment has a complementary role aiming, for example, to check the robustness of the obtained results. ACER has decided to amend ENTSO-E's findings in that respect, and this is further discussed in section 6.2.3 (scenario framework), section 6.2.5 (economic viability assessment) and section 7.1 (ACER's reasoning for amendments).

(72) In the following sections, ACER assesses all the key aspects of ERAA 2023 in light of the above considerations. Where relevant, the reader is referred to Annex III where certain aspects are assessed in more detail. A Table summarising ACER's assessment is provided in section 7.1.

6.2. Assessment of substantive requirements

6.2.1. Geographical scope of ERAA 2023

(73) Article 23(1) of the Electricity Regulation provides that adequacy is assessed at Union level, at the level of the Member States, and at the level of individual bidding zones, where relevant. Article 23(5)(a) of the Electricity Regulation further requires that ERAA is carried out on each bidding zone level covering at least all Member States. This requirement is further specified in Article 1 and Article 4 of the ERAA methodology.

(74) ERAA 2023 includes all EU-27 Member States based on the current bidding zone delineation and provides results for individual Member States and bidding zones. In this respect it complies with the applicable requirements.

6.2.2. Temporal scope of ERAA 2023

(75) Article 23(1) of the Electricity Regulation requires that ERAA covers each year within a period of ten years from the date of that assessment; this essentially means the period 2024-2033 for ERAA 2023. Article 4 of the ERAA methodology further specifies the temporal scope of the assessment by defining the study time period and requiring to simulate each target year in this period.

(76) ERAA 2023 models four target years within the study time period, namely: 2025, 2028, 2030 and 2033. This represents an incremental improvement compared to last year's assessment that modelled three target years.

(77) This simplification impacts the functionality of ERAA 2023. A Member State may only introduce a capacity mechanism or sign new contracts in an existing mechanism, if ERAA or a national assessment identifies a resource adequacy concern for this Member State (see section 5.1). Therefore, ERAA 2023 can only identify resource adequacy concerns for the four years modelled in detail but cannot do so for the remaining years. Having said that, ERAA 2023 covers relevant years for taking decisions on capacity mechanisms.[12] The omission of other years has no impact on the accuracy of the results for the modelled target years. Therefore, ACER considers that this simplification is acceptable for ERAA 2023. However, the number of modelled years need to increase in the future (see section 8).

6.2.3. Scenario framework

(78) According to Article 23(5) of the Electricity Regulation, the annual ERAA should be based on appropriate central reference scenarios and appropriate sensitivities.

(79) ERAA 2023 contains a central reference scenario and a sensitivity.

(80) According to Article 2(2)(aaa) of the ERAA methodology, a sensitivity represents a change in a scenario by introducing variation in one or few input parameters that would not involve significant changes in other input parameters. Article 23(5)(b) of the Electricity Regulation allows to develop appropriate sensitivities on *extreme weather events, hydrological conditions, wholesale prices and carbon price developments*. ERAA 2023 includes a sensitivity introducing a variation of the climate data used[13] (see

[12] For example, the modelled year 2028 is important for the introduction of new market-wide capacity mechanisms or the signing of contracts for existing market-wide capacity mechanisms. Market-wide capacity mechanisms usually consist of a main auction four years in advance of delivery (the so-called T-4 auction) and a complementary auction one year in advance of delivery (the so-called T-1 auction).
[13] The variation is introduced to the investment module of the sensitivity.

more in section 6.2.5). Every other aspect (including input data, assumptions and modelling approach) of the sensitivity is identical to the central reference scenario.

(81) As Article 3(6) of the ERAA methodology exemplifies, the complementary nature of additional sensitivities means they could be utilized, for example, in assessing the robustness of the resource adequacy concerns identified in the central reference scenarios. In line with the above, ACER does not agree with ENTSO-E's interpretation of the performed sensitivity as outlined on page 7 of ENTSO-E's Executive Report. ACER found it necessary to amend ENTSO-E's Executive Report to clarify the relevance of this sensitivity for the ERAA results. The related amendments are set out in Annex I of this Decision, and section 7.2 provides reasons for ACER's amendments.

(82) Scenario, as defined in Article 2(2)(zz) of the ERAA methodology, describes a plausible future of the electricity system. The central reference scenarios, representing the most likely future development of the electricity system, have a distinctive role in the identification of adequacy concern according to Article 8(1) of the ERAA methodology. Namely, ENTSO-E identifies a resource adequacy concern only if the reliability standard is not fulfilled for the target year for at least one central reference scenario. Considering the special importance of the central reference scenario for the identification of adequacy concerns, this Decision specifically focuses on the assessment of the robustness of the central reference scenario.

(83) Article 3 of the ERAA methodology specifies that ERAA must rely on two central reference scenarios: one scenario considering the impact of approved capacity mechanisms and another scenario excluding capacity mechanisms (except for contracts already awarded at the time of the assessment). ERAA 2023 only provides one central reference scenario, i.e. scenario without capacity mechanisms and fails to consider the scenario with capacity mechanisms. ACER considers that this simplification is acceptable in ERAA 2023 as the assessment can still be used to identify adequacy concerns. Having said that, the lack of a central reference scenario with capacity mechanisms impacts the full functionality of ERAA as the benefits of additional capacity (brought forward through already approved capacity mechanisms) in one Member State also extend to other Member States.

6.2.4. Greenhouse gas emissions reduction target

(84) Article 23(5) of the Electricity Regulation requires that ERAA is based on appropriate central reference scenarios of projected demand and supply, including measures to reach energy efficiency targets. Article 3 of the ERAA methodology further specifies that the central reference scenarios must be in line with national objectives and targets, and the National Energy and Climate Plans (NECPs). Details on ACER's assessment on the alignment with greenhouse gas emission targets are provided in the chapter 2 of Annex III to this Decision).

(85) The current EU greenhouse gas emissions target for 2030 is to reduce emissions levels by at least 55% from 1990 levels (the so-called 'fit-for-55'). This target was introduced

by the European Climate Law and entered into force in July 2021.[14] In the course of the last two years the European institutions have been working on the details of fit-for-55, i.e., how to reach the greenhouse gas emissions target across all relevant sectors of the energy system. Some of the most pertinent legislation for the evolution of the power system, such as the revised Renewable Energy Directive and Energy Efficiency Directive, were adopted in 2023.[15] The new binding targets are expected to have a significant impact on the EU electricity system.[16] Moreover, in the course of the second half of 2023, the majority of Member States has updated and submitted their draft NECPs to the European Commission for its opinion.[17] ACER expects that the updated NECPs reflect the updated legislative framework. For the avoidance of doubt, ERAA 2023 could not have considered the updated draft Member State NECPs, as these were published too late to be considered in the development of ERAA 2023.

(86) Regarding renewable energy, ERAA 2023 aligns closely with the fit-for-55 target. Overall, the levels of renewable capacity have increased significantly compared to ERAA 2022 (e.g. by 150 GW in 2030) and are relatively well aligned with the updated EU-wide target for the majority of Member States. For some Member States, the levels of renewable capacity deployment even go beyond the levels suggested by the pan-European renewable energy target. On the other hand, the assumptions on renewable energy capacity appear considerably lower compared to the goals suggested by fit-for-55 for a limited number of Member States.[18]

(87) Regarding energy efficiency, the Report suggests that the central reference scenario largely considers the effects of enhanced deployment of energy efficiency measures in line with fit-for-55. ACER's analysis shows that electricity demand projections have increased by around 5% over the long-term (i.e. 2030) compared to ERAA 2022, largely driven by higher electrification rates of the EU economy.[19] Moreover, and similar to ERAA 2022, the Report contains qualitative information about how energy efficiency

[14] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243, 9.7.2021, p. 1.
[15] Directive EU/2023/2413 and Directive EU/2023/1791.
[16] In the context of the Renewable Energy Directive, the EU has agreed to a binding EU-wide renewable energy target in the overall energy mix of at least 42.5% by 2030, with the aim to reach a 45% share. In the context of the Energy Efficiency Directive, the EU has raised the energy efficiency binding target to reducing the EU final energy consumption by 11.7% by 2030, compared to the projected energy use for 2030 (based on the 2020 reference scenario).
[17] As of the end of 2023, 24 Member States had submitted their draft NECPs. Only Austria, Bulgaria and Poland had not submitted an updated draft NECP by this point in time.
[18] This conclusion is supported by the analysis of the ERAA 2023 assumptions against the draft Member State NECPs. ACER's analysis shows that the ERAA 2023 assumptions for Croatia, Hungary, Portugal and Slovenia are considerably lower than the renewable energy goals set in the respective Member States' draft NECPs, with reference to 2030. For more information see chapter 2 of Annex III to this Decision.
[19] For the short-term, i.e. 2025, average annual demand has increased by around 0.5% across the EU's Member States compared to ERAA 2022, while for a number of Member States projections have decreased compared to ERAA 2022. ACER interprets these changes to reflect the impacts of the energy crisis on electricity demand in 2022 and 2023.

measures are considered across the transport, heating and building sectors in the form of a survey with the TSOs. The survey responses suggest that the TSOs have in most cases fully considered energy efficiency measures across these sectors, while in limited cases have only partially considered such measures.[20, 21]

(88) While not perfectly representing the fit-for-55 targets across all Member States of the EU, ACER considers that ERAA 2023 is sufficiently aligned with the current ambition of the EU regarding the development of renewables and energy efficiency. That said, ACER considers that there is still scope for improvement of the underlying scenario assumptions (see more chapter 2 of Anex II).

6.2.5. Economic viability assessment

(89) Article 23(5) of the Electricity Regulation requires that the central reference scenarios include an EVA of generation and that ERAA appropriately considers the contribution of all existing and potential future resources. The EVA-related requirements are further specified in Articles 3 to 7 of the ERAA methodology. Details on ACER's assessment of the EVA are provided in the chapter 3 of Annex III to this Decision.

(90) The EVA module keeps the stochastic model formulation as in ERAA 2022, i.e. it seeks to minimise the total system cost as a probabilistic formulation of the costs incurred in all examined years.[22]

(91) The EVA models explicitly four target years (2025, 2028, 2030, 2033) but contrary to ERAA 2022, intermediate years are not modelled explicitly. Their impact on capacity entry and exit decisions is taken into account in a simplified manner by considering non modelled intermediate years identical to the preceding modelled years. The new approach allows ENTSO-E to remove two simplifications applied in ERAA 2022. First, the optimisation problem is solved in a single run over the whole time horizon[23]. Second, it allows to solve an hourly model, considering 24 hours per day.[24] At the same time, the new approach does not capture system dynamics of intermediate years within the ERAA horizon[25].

[20] As with ERAA 2022, the Report offers quantitative information about electricity demand associated with the uptake of electric vehicles and heat pumps. On the other hand, the Report lacks quantitative information about the impact of efficiency measures in the buildings sector.
[21] For a limited number of Member States, ERAA 2023 assumes no electrification of the heating and/or transport sectors. For example, ACER's analysis suggests that ERAA 2023 assumes there are no heat pumps in Bulgaria, Greece, Romania, Slovenia and Sweden for at least the majority of modelled years considered in ERAA 2023.
[22] ERAA 2023 follows the simplified approach of minimising total system costs, an option allowed in Article 6(2)(b) of the ERAA methodology.
[23] In ERAA 2022 the period was broken down into four smaller periods which lead to capacity entry and exit decisions being taken without a proper long-term foresight.
[24] Compared to only 18 hours in ERAA 2022.
[25] This may influence decisions regarding entry and exit (or mothballing) of capacity, which could further impact adequacy risks.

(92) ERAA 2023 introduces an improved representation of the investment costs by considering costs incurred after the study horizon, i.e. after 2033, and until the end of the economic lifetime of the relevant assets. It does so by assuming that the costs of future years (both in terms of capital expenditures, fixed annual costs and generation costs) are identical to the costs of the last modelled year and using appropriate depreciation factors. This approach is an improvement of the modelling of investment decisions for the last years of the study horizon. However, the effects of dynamic parameters of the period beyond the study horizon, such as the evolution of demand, deployment of renewable electricity sources, fuel and CO_2 prices and the evolution of the maximum clearing price, are still not captured in the EVA.[26]

(93) The EVA module of ERAA 2023 models only three climate years to cope with computational complexity. Based on the same clustering methodology these are the same climate years as in ERAA 2022: 1985, 1988 and 2003. Yet, this simplification introduces a key difference in assumptions compared to the economic dispatch (ED) module where a set of 35 climate years is used. This inconsistency between the investment (EVA) and risk (ED) modules of ERAA 2023 can have a major effect on the robustness of the results.

(94) Full consistency would mean that the economic dispatch of resources (modelled in the risk module) and economic viability of resources (modelled in the investment module) are calculated against the same climatic background i.e. the same 35 climate years. ACER understands, that due to the modelling complexity this was not feasible this year. Thus, to improve consistency between the modules of ERAA 2023, the weight of each of the climate years used in the EVA module of the central scenario were recalibrated using information from ERAA 2022 results. ACER observes that the recalibrated weights increased the consistency of the results of the central reference scenario between the EVA and the ED modules compared to ERAA 2022.

(95) In the sensitivity, ENTSO-E applied the same climate year weights as in ERAA 2022. Comparing the central reference scenario with the sensitivity in ERAA 2023 also confirms that the recalibrated approach increased consistency significantly as for example shown by more than four-fold improvement in consistent representation of price spikes across ED and EVA.[27] Comparison with the central reference scenario also confirms the important effect that inconsistent application of climate years can have on the results. The analysis on bidding zone level shows a similar picture: in a large majority of Member States, the central scenario delivers a better consistency. Details of the analysis are provided in section 3.5 of Annex III to this Decision.

(96) Another inconsistency refers to the different approach in modelling forced (unplanned) outages of interconnectors in the ED and in the EVA module. On one hand, forced

[26] As in its ERAA 2022 Decision, ACER invites ENTSO-E to undertake an ex-post evaluation of the profitability of the resource mix (based on the economic dispatch module results and considering all revenues as per Article 6(9) of the ERAA methodology) to assess the validity of the EVA results.
[27] See more in Section 3.5 of Annex III of this Decision.

outages are considered in the EVA module by simply derating NTCs for the grid, on the other hand in the ED module, outages are taken probabilistically. Averaging out outage patterns in the EVA can have a tempering effect on resource adequacy risk compared to the stochastic representation of outage profiles in the ED which can lead to situations with a significant impact on resource adequacy due to their uncertain nature. The diverging approach is likely more relevant for zones with low interconnection and a generally tight demand-supply situation, where interconnector outages could have a significant impact on results. In particular, ACER notes that LOLE results diverge significantly between the EVA and ED modules for Ireland for the year 2025.[28] This disparity indicates that the final LOLE values for Ireland may be overestimated due to the remaining inconsistencies between EVA and ED.

(97) In ERAA 2022 Decision, ACER pointed out that the investment module and risk module of last year's assessment show significant divergences in terms of scarcity revenues, namely the EVA underestimated the revenue resources could expect. In ERAA 2023, these differences are less prominent, indicating the improved consistency in the central scenario. Details of the analysis are provided in Section 3.5 of Annex III to this Decision. While ACER acknowledges improvements in scarcity revenues compared to ERAA 2022, more consistency between the two modules is needed.

(98) ERAA 2023 considers decision options for commissioning, decommissioning, lifetime extension, mothballing and de-mothballing for gas, demand response and storage.[29] The same options - except for new commissioning - apply to coal, lignite and oil power plants. Nuclear and renewable power generation is considered completely policy driven. While this is largely true for the former, it is not totally true for renewable energy power generation plants, some of which are already competitive.[30]

(99) Capacity expansion of gas units is constrained in the first four years of the analysis to account for the time lag between the investment decision and commissioning date. New capacity expansion implicitly considered in the EVA module is, at times, also constrained by upper levels of investment potential. Such constraints reflect technical or economic potential or policy decisions. ACER considers, some of the constraints restrictive.[31] At the same time, as more and more constraints are considered based on

[28] Interconnection has a major impact is also suggested by the fact that, by 2028, adequacy results improve by two orders of magnitude likely also linked to the commissioning of the new Celtic interconnector to France, expected in 2027. As an island with low levels of interconnection, it would appear there are adequacy benefits to be gained from increased interconnection in Ireland. ACER emphasises the importance of appropriately valuing and modelling interconnectors in resource adequacy analysis generally.
[29] At the same time, other modelling choices, i.e. the reduction of explicitly modelled years to four, limit the scope of the mothballing/de-mothballing and life extension decision variables. Considering that these options are much cheaper than new investments this could have an impact in the final capacity stock.
[30] ENTSO-E should consider enabling also market based renewable energy investments in future ERAA editions.
[31] For example, for France, the EVA considered no gas generation capacity expansion, reflecting the national policy that forbids investment in new fossil generation with the objective to reduce CO2 emissions. For the Czech Republic, the same constraint was used, however ACER could not confirm the national policy basis of this modelling constraint.

policy decisions (e.g. gas), the EVA needs to model the most relevant alternative capacity expansion options (e.g. market driven RES generation, explicit DSR) and the impact of these resource expansion constraints on demand.[32] Policy decisions in one Member State can have an impact on investments in other Member States. In this context, the EU-wide assessment of resource adequacy appears particularly valuable, as it offers relevant insights into such links.

(100) Investors` decision-making process is modelled via the weighted average cost of capital (WACC) and additional estimated risk premium called hurdle rate. While the WACC accounts for the so-called country specific risk and systemic risk, the hurdle rate adds a premium to adjusts for additional risk aversion. The hurdle premium compensates investors of the risk related to regulatory intervention towards the price cap and of the uncertainty of occurrence of price spikes. ACER welcomes that ENTSO-E has updated the technology specific hurdle premiums in ERAA 2023. Finally, investor behaviour should not be attempted to be modelled in parallel via changing other basic parameters such as climatic conditions as it is not in line with the ERAA methodology and leads to an overestimation of risk aversion.

(101) Concerning capacity expansion, in the course of its assessment, ACER has noted that fixed operating and maintenance costs of new OCGT entries in Germany were erroneously overestimated.[33] Following ACER's request,[34] ENTSO-E conducted a rerun of the ERAA model using the correct fixed operating and maintenance costs for OCGT in Germany.

(102) The rerun resulted in additional OCGT capacities assessed as viable in the EVA, and therefore higher domestic capacity in Germany in all target years. Despite this increase in capacity, the rerun resulted in a slight rise in the total expected energy not served (EENS) in Europe. This outcome is not intuitive and, based on information provided by ENTSO-E, can be explained by the fact that the additional capacities resulted in a portfolio with availabilities different from the original pre-rerun outcomes, hence not necessarily contributing to a reduction of EENS. Another factor is the location of the new capacity and how it relates to the geographical distribution of EENS. Despite an overall marginal increase in EENS, a decrease was observed in several Member States. In few instances, particularly in Germany and the Czech Republic, such reduction of EENS was accompanied by an increase in LOLE. According to ENTSO-E, these

[32] This can be done by improving the modelling of implicit demand response, see section 6.2.8.
[33] Due to the error, the cost of a new entry for the German OCGT generators modelled in ERAA 2023 was higher than the actual cost related to this technology, which affected the investments modelled for Germany and several other Member States.
[34] ACER saw necessity in re-running the central reference scenario, but ENTSO-E's rerun covered both the central reference scenario and the sensitivity.

increases are attributable to the way EENS originated in other Member States is redistributed across borders pursuant to the curtailment sharing[35] principles.[36,37]

(103) ERAA 2023 has improved the modelling of local matching and curtailment sharing compared to ERAA 2022.[38] Local matching has been integrated into the economic dispatch module. Curtailment sharing is formulated in a way that it does not influence the dispatch of capacity but only redistributes flows between bidding zones while respecting the network constraints. Both the local matching and the curtailment sharing are not part of the EVA module. Analysis of the results of the economic dispatch module with and without curtailment sharing shows that the adequacy risks generally increase with the introduction of curtailment sharing[39]. Local matching may introduce further inconsistencies between the EVA and the economic dispatch module as it may impact the exchanges between bidding zones and hence the total costs. This could further impact the entry and exit decisions in the model. Curtailment sharing on the other hand should not introduce significant differences in this respect.[40] The implementation of curtailment sharing in the economic dispatch module alone should not introduce further inconsistencies between the two modules. Nevertheless, comparison between the results of the economic dispatch module before and after the implementation of curtailment sharing reveal some non-intuitive cases.[41] Hence, while the new approach on local matching and curtailment sharing reduces the divergence between results compared to ERAA 2022, there is still scope for further improvement.[42] For further transparency, Annex III contains the ERAA results with and without the effect of curtailment sharing for both the central scenario and the sensitivity. This should be applied by ENTSO-E in the next ERAA and all subsequent reports. With

[35] Curtailment sharing redistributes cross zonal exchanges during hours of scarcity to reach a more realistic configuration of the system. This redistribution may lead to a sharing of the deficit of one zone towards other (usually neighbouring) zones, thus increasing the overall adequacy risks.

[36] The non-intuitive increase in LOLE is most visible in target year 2033. In the German zone DE00, when curtailment sharing was applied, EENS *decreased* by 5.7 GWh (from 41.9 GWh before curtailment sharing to 36.2 GWh after curtailment sharing), while LOLE *increased* by 5.5h (from 3.8h to 9.3h). Similarly, in the Czech Republic (zone CZ00), ENS decreased by 1.4 GWh (from 10.8 GWh to 9.4 GWh), while LOLE increased by 5h (from 3.8h to 8.8h). Similar changes take place in target year 2030 – see Tables 1 and 2 in Annex III of this Decision.

[37]Implementation of curtailment-sharing feature impacted the rerun results for the insular systems of Malta and Cyprus to a considerable extent. The comparison between the original and the rerun results shows that the changes in outcomes for these two systems are among the most significant. According to ENTSO-E, these differences are due to the effects of curtailment sharing.

[38] Local matching ensures that zones in deficit do not export energy.

[39] For example, the modelled zones with LOLE value higher than three hours for 2028 increase from four to fourteen after the implementation of the curtailment sharing. This could have an effect on the assessment of adequacy concerns (meeting the reliability standard) in certain Member States.

[40] Differences in cost structures between bidding zones may trigger changes in entry and exit decisions but these should be minor.

[41] For example, there are changes in the LOLE indicators in Cyprus that is a system with a limited interconnection only planned by 2028.

[42] Like introducing the local matching in the EVA and providing further transparency on the resulting ENS before and after curtailment sharing, per bidding zone.

regard to the impact of intraday markets in curtailment sharing, ACER observes that the modelling of intraday markets as such is not foreseen in the ERAA methodology, save for the consideration of intraday price limit; neither it is a given that intraday markets would necessarily offset the application of the curtailment sharing applied in day-ahead markets. Although very similar modelled to the day-ahead market, EVA and ED each aggregate all electricity markets, including OTC trading and the intraday market coupling. Therefore, for the ERAA 2024 ENTSO-E should carry out an analysis (case-study) to assess the impact of trading after day-ahead market coupling on curtailment sharing results.

(104) ERAA 2023 uses an ex-ante estimation of the evolution of the maximum clearing price over the period 2025-2033 taking into account ACER Decision 1/2023[43]. ERAA 2023 uses the results of ex-ante modelling using the ED module and the central scenario assumptions to estimate the evolution of the clearing price based on hourly marginal price estimates. However, climate years with a strong impact on price spikes, like 1985, are not modelled in six out of ten modelled target years. This results in an evolution of the maximum clearing price that is not consistent with the actual outcome the ERAA. Furthermore, ENTSO-E did not verify the results of this simplified approach by comparing them with the actual results of the economic dispatch module of ERAA 2023.

(105) ACER considers that the definition of the maximum clearing price in ERAA 2023, set equal to the technical bidding limit in the day-ahead market, is not fully aligned with the Electricity Regulation and the ERAA methodology. According to the ERAA methodology, the maximum clearing price should consider the technical bidding limits of the day-ahead and intraday markets in conjunction. The current implementation can have a direct impact on the economic viability of investments in new resources (e.g. in gas generation) compared to the actual market framework where generation units sell in both timeframes.

(106) EVA models the market coupling of the modelled zones using the net transferred capacities (NTC) instead of the flow-based approach. Since the latter is used in the economic dispatch module, the modelling approach introduces some differences between the two modules (see more in section 6.2.7.).

(107) Compared to ERAA 2022, ENTSO-E applied new approaches to specific modelling areas including the modelled years, time resolution, representation of investment costs and climate years (in the central reference scenario), electricity exchange constraints, local matching and curtailment sharing. On balance, these changes have improved consistency between the results of the EVA and the economic dispatch module and strengthened the robustness of the results. There is still significant room for improvement in specific areas. Moreover, in order to reliably achieve robust results in

[43] Decision on the harmonised maximum and minimum clearing price methodology for the single day-ahead coupling

the future, the improvements must form a coherent structural solution that provides an enduring solution eliminating the consistency issue (see more in section 8).

6.2.6. Storage

(108) Article 23(5)(d) of the Electricity Regulation requires that the assessment appropriately takes account of the contribution of energy storage, including its contribution to flexible system operation. Article 23(5)(m) of the Electricity Regulation also requires that the national characteristics of energy storage are properly taken into consideration. These requirements are reflected in Article 4 of the ERAA methodology.

(109) As in the first two ERAAs, ERAA 2023 applies the same approach for the consideration of pumped-storage hydro and battery storage,[44] in line with Article 4(5) of the ERAA methodology. The assessment uses bottom-up data reflecting national characteristics and aims at dispatching storage when electricity prices are expected to be high and storing energy when prices are expected to be low, reflecting storage flexibility. Overall, the approach to optimising the use of storage is broadly consistent with the Electricity Regulation. ACER considers that ERAA 2023 sufficiently reflects the applicable requirements of the Electricity Regulation regarding the consideration of storage in the assessment.[45]

6.2.7. Cross-zonal capacities

(110) According to Article 23(5) of the Electricity Regulation, ERAA must properly take into consideration the level of interconnection, interconnection targets, real network development, and ERAA needs to be based on a market model using the flow-based capacity calculation approach, where applicable. Article 23(5) of the Electricity Regulation further requires that ERAA appropriately takes into account the contribution of imports and exports to adequacy, by accurately reflecting the capacity calculation approach used on each bidding zone border. These requirements are further specified in Articles 3 and 4 of the ERAA methodology. Details on ACER's assessment on the cross-zonal capacities are provided in the chapter 4 of Annex III to this Decision.

(111) Regarding interconnectivity and assumed network developments from 2025 onwards in the ED module, ERAA 2023 uses a simplified approach where the flow-based domains are expanded according to the trends identified in NTCs provided by the TSOs for the EVA. The flow-based domains for 2025 are compared with the provided capacities and

[44] ERAA 2023 differentiates between reservoir hydro plants, including run-of-river plants with limited storage capabilities (or pondage hydro plants), and pumped-storage hydro plants. Pumped-storage hydro plants are further split into open- and closed-loop plants, to distinguish between basins with and without natural inflows respectively. Battery storage is categorised between in-the-market (or commonly referred to as grid-connected) and out-of-market (or commonly referred to as behind the meter) battery storage. Out-of-market battery storage is treated on the demand side.

[45] In ACER's view and in line with ACER's comments in the past ERAA Decisions, ERAA 2023 could explain in more detail how storage optimisation in the model reflects operational practices, and how the assessment considers environmental constraints (e.g.: on potable and agriculture uses) at a more granular level.

the expansion needs are analysed. Subsequently, the flow-based domains are expanded to reasonably represent the network developments as dictated by the NTCs. ACER acknowledges the improvement in ERAA 2023 compared to the ERAA 2022 regarding the consideration of network developments in the ED module. Although the best approach would be to derive flow-based domains for every target year, ACER observes that this simplified approach can be a temporary solution to improve the consistency between the ED and the EVA regarding the network development representation. Next year's ERAA should already include differentiated flow-based domains for every target year.

(112) Regarding the flow-based capacity calculation approach, the Core and the Nordic capacity calculation regions (CCRs) are expected to apply it in the period considered in ERAA 2023. For the Core CCR, the central reference scenario of ERAA 2023 reflects the flow-based approach for the economic dispatch module. However, as in the past two ERAA editions, the EVA relies on the NTC approach. Regarding the Nordic CCR, the central reference scenario of ERAA 2023 relies on the NTC approach for both the EVA and risk module. Compared to the NTC approach, the flow-based approach allows to better capture situations of simultaneous scarcity among bidding zones and would likely affect the EVA.

(113) ERAA 2023, as ERAA 2022, uses flow-based market coupling in the ED module and NTCs in the EVA module. However, as ACER highlighted in its ERAA 2022 Decision, this approach creates inconsistences between the two modules, where the EVA could fail to adequately reflect risks and opportunities, leading to overestimation of resource adequacy risks. In 2021, ENTSO-E compared import and export NTCs submitted by the TSOs with the NTCs derived from the flow-based domains (see Figure 11 of ERAA 2021 Annex 1). This analysis showed relevant differences between the TSO-submitted NTCs and the FB-derived NTCs, which confirmed some degree of inconsistency in the treatment of cross-zonal capacities between the two modules. In certain cases, the TSO-submitted NTCs were more than twice the FB-derived NTCs.

(114) To increase consistency in ERAA 2023, ENTSO-E has identified typical market positions in the flow-based market coupling in the ED module and used this information to apply Net Position Constraints (NPC) in the EVA module. Such constraints aim at better reflecting feasibility of simultaneous exchanges on multiple NTC borders. It is worth noting that the NPCs do not directly restrict border-to-border exchanges. In this context, NTCs could be seen as per-border flow constraints, while the NPCs could be thought of as overall flow limits. The purpose of this overall limit is to account for the potential infeasibility of the simultaneous flows at the maximum border capacity across all borders. In addition, positions in ERAA 2023 account for the overall feasibility of flows within the CORE capacity calculation region. As a result, the maximum net positions per bidding zone observed today may not be directly comparable with the net positions in the ERAA model.

(115) As for the improved consistency, in real life, the cross-border exchanges depend on several factors, such as the transmission grid used, the generation dispatch, the RES locational generation and the demand. In the previous ERAA editions, the approach to cross-zonal constraints could consider these factors differently between the ED and the

EVA. On the other hand, ERAA 2023 links cross-zonal constraints between ERAA modules, as described above, and hence improves consistency. ACER acknowledges the improvement in ERAA 2023 compared to the ERAA 2022 regarding the link between the flow-based market coupling in the ED on the one hand and the use of NTCs for the EVA on the other hand. In particular, this approach can be a temporary solution to improve the consistency between the ED and the EVA. Next year's ERAA should include a more solid solution to ensure consistency between cross-zonal capacities in the two models of the ERAA (see more in section 8).

(116) Regarding NTC-based calculations reflecting the minimum 70% target, the Report does not provide sufficient information on how the compliance is ensured. Thus, ACER has carried out an assessment using high-level indicators based on ERAA 2023 NTCs for 2025 and on the latest data provided by TSOs in the scope of the ACER MACZT report for 2022[46]. ACER's assessment suggests that several NTC borders appear to be on average above the 70% capacity, as shown in Annex III of this Decision. However, some borders appear to be close but below the 70% target. Furthermore, ACER's assessment is based on average annual values, therefore being above the 70% does not guarantee compliance with the 70% target across all hours (see more in chapter 4 of Annex III of this Decision). ACER highlights that ENTSO-E needs to ensure compliance with the 70% target for all borders and improve the transparency on this topic in subsequent ERAAs.

(117) ACER observes that the simplified temporary approaches used regarding the consideration of network developments in the ED module and regarding the link between the flow-based market coupling in the ED v. NTCs for the EVA has improved the consistency and limited the impact on the robustness of the results. Overall, ACER acknowledges the improvements made in ERAA 2023, compared to ERAA 2022, with regard to the relevant requirements of the Electricity Regulation related to the appropriate consideration of cross-zonal capacities. However, ACER stresses the need to further improve the consideration of cross-zonal capacities using a more structural approach, such as the use of differentiated flow-based domains for every target year, the use of flow-based market coupling in all modules consistently and the improvement of transparency on the compliance with the 70% target for all NTC borders.

6.2.8. Demand-side response and sectoral integration

(118) Article 23(5) of the Electricity Regulation requires that the assessment appropriately takes account of the contribution of all resources including DSR, and properly reflects national characteristics of demand flexibility. Article 4 of the ERAA methodology further specifies these requirements. In particular, Article 4(3) of the ERAA methodology requires that ERAA considers both implicit and explicit DSR. In addition, Article 23(5) of the Electricity Regulation requires that the assessment appropriately

[46] https://www.acer.europa.eu/sites/default/files/documents/Publications/2023_MMR_MACZT_0.pdf

takes account of the contribution of sectoral integration, including its contribution to flexible system operation.

(119) ERAA 2023 uses the same approach for the consideration of the contribution of DSR with ERAA 2022. As ACER concluded in its ERAA 2022 Decision, the updated methodology represented a relevant improvement compared to ERAA 2021, both for explicit and implicit DSR.[47] Notwithstanding, ACER raised some concerns about some national assumptions regarding explicit DSR and the overall conservative approach related to implicit DSR.[48, 49]

(120) ACER's conclusions for ERAA 2022 remain valid for ERAA 2023. As such, ACER considers that the level of simplifications in the latter is acceptable. Moreover, ACER highlights that the context around DSR is changing [50] and DSR is increasingly recognised as a valuable resource for the power system and the energy transition, including for security of electricity supply, as for example reflected in the agreed Electricity Market Design reforms. With this in mind, ACER expects that the approach for modelling DSR in ERAA 2024 will further improve, including transparency regarding the use of data from national studies, assumptions related to flexibility from

[47] For example, a key improvement regarding the consideration of explicit DSR is the use of data from detailed national studies, where available. Regarding implicit DSR and sectorial integration, a key improvement is the development of a modelling approach to account for the flexible use of electric vehicles and heat pumps.
For more details, see recitals (108) and (109) of the ERAA 2022 Decision.

[48] In some cases, the ERAA 2023 national assumptions for explicit DSR are counterintuitive. In Poland, ERAA 2023 does not consider any potential for DSR after 2028, even though DSR has consistently participated in the existing capacity mechanism. Most recently, the Polish capacity mechanism awarded around 1.5 GW of contracts to DSR for delivery in 2026 and 2027. In France, DSR is exclusively determined exogenously (i.e., there is no potential for new DSR, subject to the EVA). The amount of DSR determined by the national TSO drops from 6.5 GW in 2028 to 5 GW in 2030 (before increasing again to 5.6 GW in 2033). It is unclear what leads to this reduction of DSR post-2028, or why this reduction is not considered as potential DSR in the EVA. That said, ACER expects that the amendment of specific national assumptions would have a limited impact at most on the results of ERAA 2023.

[49] For example, as shown in the ERAA 2022 Decision, the assumed shares of flexible consumers with electric vehicles and heat pumps, i.e. consumers who can respond to electricity prices, is rather limited. (for more information, see section 5.3.1 of Annex I). The same conclusion stands for ERAA 2023, as the assumptions have remained relatively unchanged e.g.: the contribution of the implicit DSR technologies during scarcity follows a rather restrictive temporal redistribution potential of demand of 6-hour windows. In other words, ERAA 2023 assumes that the vast majority of users of the two applications are inflexible across the modelled period. At the same time, ACER acknowledges there is uncertainty about the future levels of responsiveness of consumers to retail prices, particularly in Member States where the roll-out of smart meters is low or negligible. ACER notes that ERAA 2023 neither provides data about the shares of flexible consumers, nor explains how TSOs have determined them.

[50] Compared to the situation last year, when ACER commented in the ERAA 2022 decision that there was significant uncertainty about the future levels of DSR. At the time, Member States implemented short-term emergency measures to unlock demand side flexibility with the aim of reducing electricity prices. On the other hand, several Member States introduced measures to limit the exposure of consumers which could have a dampening effect on the development of demand side flexibility.

electric vehicles and heat pumps and appropriate consideration of changes in market design. (see more in Annex III).

6.2.9. National implementation plans

(121) Article 23(5) of the Electricity Regulation requires that ERAA anticipates the likely impact of the measures referred to in Article 20(3) of the Electricity Regulation, which are set out in the national implementation plans.[51] Article 3 of the ERAA methodology specifies that the assumptions of the central reference scenarios must be aligned with the actions and measures taken to eliminate restrictions to wholesale price formation and with the national implementation plans.[52]

(122) At the outset of the work for ERAA 2023, a significant number of Member States had already adopted their implementation plans or published draft versions of them. Overall, 10 Member States had adopted an implementation plan or developed a draft by 2023. One Member State, Sweden, had developed the draft implementation plan in the course of ERAA 2023's development.[53, 54]

(123) Similar to last year's assessment, ERAA 2023 provides limited information about the market reforms considered in the input data. It is generally unclear which of the implementation plans are reflected at all in the ERAA 2023 assumptions, and how.[55] The Report does not include any quantification of the impacts of the national implementation plans on the assumptions.

(124) Based on the limited information in the Report,[56] ACER is unable to appropriately assess whether ERAA 2023 complies with the applicable requirements, even in a simplified manner.

[51] Information on the implementation plans pursuant to Article 20(3) of the Electricity Regulation is available on the European Commission's webpage on capacity mechanisms.
[52] These measures and actions are defined by the Member States pursuant to Article 10(5) of the Electricity Regulation and aim to eliminate or mitigate those measures or policies which restrict wholesale price formation.
[53] Belgium, Finland, France, Germany, Ireland, Italy, Lithuania and Poland had already adopted their market implementation plans, and Bulgaria, Greece and Sweden had developed draft plans, with the Swedish draft finalised before ERAA 2023 input data was published for public consultation.
[54] The European Commission has published the opinion on the relevant Member States' annual monitoring reports of their implementation plans. More information available on: Commission Opinion on monitoring reports submitted by Belgium, Ireland, Lithuania and Poland.
[55] In the case of Italy and Finland, the Report confirms that the implementation plans are reflected in the assumptions, providing further information, and in the case of Lithuania and Poland, the Report explicitly states that no specific reforms were considered. The majority of the TSOs of Member States with adopted or draft implementation plans in place did not provide any relevant information in response to the ENTSO-E survey on this topic (e.g. the French TSOs responded they could not provide any information, the Belgian and German TSO provided information, which is irrelevant to the adopted implementation plans, and the Irish TSO did not indicate considering any reforms in the data provided for ERAA 2023).
[56] For more information, see Annex I of ERAA 2023 on the input data (section 8.1.8).

6.2.10. Probabilistic assessment

(125) Article 23(5) of the Electricity Regulation requires that ERAA applies probabilistic calculations and includes at least the two indicators – LOLE and EENS. These requirements are further specified in Article 4 of the ERAA methodology.

(126) ERAA 2023 uses the same probabilistic approach to assess the risks to resource adequacy as ERAA 2022 and ERAA 2021. The approach aims at capturing the uncertainty associated with future weather conditions and the availability of generation and interconnection assets, though the Monte-Carlo simulations. A key output of these simulations are the probabilistic risk indicators of LOLE and EENS. As with last year, ERAA 2023 uses a simplified method to ensure the convergence of these simulations or, in other words, that the results of the model are stable enough.[57]

(127) ACER considers that the minor simplifications of the probabilistic assessment are acceptable in ERAA 2023, as they are expected to have a limited impact on the accuracy of the results.

6.2.11. Single modelling tool

(128) Article 23(5) of the Electricity Regulation requires that the assessment applies a single modelling tool, which is then reflected in Article 4 of the ERAA methodology.

(129) ERAA 2023 uses the same modelling tool for all target years. As such, ERAA 2023 meets the requirement of the Electricity Regulation for a single modelling tool.

6.2.12. Out-of-market capacity resources

(130) Article 23(5) of the Electricity Regulation requires that the assessment appropriately considers the contribution of all resources. In this respect, Article 7(10) of the ERAA methodology requires that the assessment projects the risks in the absence of any out-of-market capacity resources and after their activation.[58] Moreover, pursuant to Article 8(1) of the ERAA methodology, the assessment can only identify resource adequacy concerns after considering the impacts of out-of-market resources.

(131) ERAA 2023 only considers out-of-market resources contracted in the context of capacity mechanisms. ERAA 2023 fails to consider other out-of-market resources[59],

[57] The Report suggest that ERAA 2023 has reached a satisfactory degree of convergence. The conclusion is not based on the threshold described in Article 4(2)(f) of the ERAA methodology but rather on the observation that the results change insignificantly after a high number of MC runs. For more information, see Annex 3 of the Report.

[58] Out-of-market capacity resources are resources that lie outside the market, i.e. do not participate in the wholesale market, and TSOs would only use as a last resort if the market fails to meet electricity demand.

[59] Similar to last years, the Report provides information about resources and measures that the TSOs have at their disposal when dealing with scarcity in real-time without necessarily modelling all of them. For details, see section

despite an expectation that these would be used prior to implementing load shedding and some of those measures (e.g. voltage reduction) are widely available to the TSOs.[60] As a way of example, the Report does not consider mitigating measures available in Ireland although they would demonstrably improve its expected adequacy position.[61] The Report does not provide an adequate explanation for the omission of these resources.

(132) Overall, the approach to including out-of-market resources remains similar to that of the last year's assessment and is considered acceptable for ERAA 2023. However, ACER notes that the assessment still underestimates the amount of out-of-market capacity resources that have been proliferating across Member States[62]. Out-of-market resources provide an additional layer of protection for consumers and their consideration could affect the identification of resource adequacy concerns.[63]

6.2.13. Identification of sources of resource adequacy concerns

(133) Article 23(5) of the Electricity Regulation requires that the assessment identifies the sources of possible resource adequacy concerns, in particular whether it is a network constraint, a resource constraint, or both. Article 8 of the ERAA methodology elaborates on the potential drivers to be assessed, including methodological approaches for carrying out the assessment.

(134) Compared with ERAA 2022, the Report does not include the valuable analysis of the sources of scarcity or its correlation with demand and supply that featured last year's edition. For example, ERAA 2023 does not explain the reasons for the exceptionally high risks in Ireland (i.e. LOLE of 372.1 h/year for 2025 in the central reference scenario).[64] While acknowledging the adequacy challenge in the Single Electricity Market of the island of Ireland, ACER stresses the importance of interpreting such outlying results with careful reflections.

(135) ACER considers the limited identification of sources of resource adequacy concerns acceptable for ERAA 2023, as it has no material impact on the results themselves. The Report gathers useful insights concerning the sources of adequacy risks at the national level via Annex IV. Of the Report titled Country Comments. Improvements could

1.2 and Appendix 1 of Annex 1 of the Report. ACER considers that the list of out-of-market measures in ERAA 2023 remains incomplete.

[60] For example, RTE has communicated it is planning to use out-of-market measures in winter 2022-2023, such as voltage reduction, prior to resorting to controlled, demand disconnections.

[61] See Ten-Year Generation Capacity Statement, section 6.3.1

[62] For details, see ACER Report on Security of EU electricity supply in 2022.

[63] This would be the case for hours when the expected non-served energy is lower than the size of the out-of-the-market capacities; in such cases, considering such capacities would reduce the overall LOLE.

[64] Some considerations are brought forward by the Irish TSO. For more information, see: Annex 4 – Country Comments of the Report, section 8 on Ireland.

include a thorough examination of the scarcity drivers and a more European perspective on the drivers' impact on the adequacy situation.

6.2.14. Transparency

(136) Article 41(2) of the Electricity Regulation requires that ENTSO-E operates in full transparency towards its stakeholders. Article 11 of the ERAA methodology sets out requirements ensuring that ERAA is a transparent assessment and that the Report facilitates stakeholders' understanding of the assessment, including inputs, data, assumptions and scenario development.

(137) Overall, transparency in ERAA 2023 remained on the similar level as in the last year's ERAA. ACER is of the view that there is still a considerable scope to enhance the assessment's transparency going forward.

(138) In terms of data availability, ERAA 2023 meets the transparency requirements to a significant degree, similarly with last years' assessments. For example, the Report contains the Pan-European Climate Database, the high-level scenario assumptions, such as fuel and CO_2 prices, and the aggregate LOLE and EENS results. On the other hand, ENTSO-E has not published certain required data items,[65] or has published them with a different (lower) level of granularity.[66]

(139) The Report includes a description of the results and of the methodology and assumptions considered in the assessment. At the same time, the Report does not provide some essential information to enable a comprehensive understanding of the assessment including:

i. ERAA 2023 does not sufficiently explain the methodologies followed by the TSOs to calculate cross-zonal capacities in the NTC based EVA module.

ii. The consultation on flow-based market coupling data needs to be improved as, for example, it is currently not possible for the stakeholders to verify its correspondence with the NTC values used in the simplified EVA module.

iii. The Report does not explain how to interpret certain national assumptions (e.g. the TSOs' best estimates for explicit DSR) or how the TSOs derive certain critical assumptions for the assessment (e.g. the proportion of "flexible consumers" of electric vehicles and heat pumps).

[65] For example, ENTSO-E has not published the assumptions underlying the measures pursuant to Article 20(3) of the Electricity Regulation, nor a full list of the measures associated with the market implementation plans that are expected to significantly impact resource adequacy concerns but not considered in the Report, pursuant to Article 11(6)(c) of the ERAA methodology. The Report does not contain the distribution of LOLE and EENS across all Monte Carlo simulations pursuant to Article 11(4)(e) of the ERAA methodology either.
[66] Such as simultaneous ENS situations between neighbouring modelled zones.

iv. Further, the Report does not explain the effects of local matching and curtailment sharing on the risk indicators. ACER regrets that the Report does not contain the risk indicator results of the EVA.

(140) ACER acknowledges that ERAA 2023 maintains the similar transparency level as in the last year. ACER considers the level of transparency acceptable for ERAA 2023. Nonetheless, ACER also recognizes the need to enhance the level of transparency in forthcoming ERAA editions in light of ENTSO-E's obligation to operate in full transparency towards stakeholders and the general public.

6.3. Assessment of the procedural requirements

6.3.1. Timeline for submission

(141) ERAA 2023 complies with Article 23(2) of the Electricity Regulation, requiring assessments on an annual basis. ENTSO-E submitted ERAA 2023 45 days after the deadline of 1 November set out in Article 10(2) of the ERAA methodology. This delay was caused partly by the fact that ENTSO-E has developed certain aspects of the model parallel to building the production version and partly caused by technical issues. ENTSO-E communicated its plan to delay the submission of ERAA 2023 to ACER with sufficient notice. Therefore, ACER considers this delay as acceptable.

6.3.2. Data collection requirements

(142) Article 23(4) of the Electricity Regulation requires the TSOs to provide ENTSO-E with the data it needs to carry out ERAA. Article 5 and Article 10 of the ERAA methodology specify that ENTSO-E must provide the TSOs with data collection guidelines to ensure coherency of the input data across the assessment and publish these guidelines.

(143) As in the past two years, ENTSO-E has collected data from the TSOs for ERAA 2023, as for example evidenced by the surveys run on the assumptions of the assessment with the TSOs, and has published the data collection guidelines alongside the Report. ERAA 2023 is therefore in line with these requirements.

6.3.3. Stakeholder engagement

(144) Article 31 and Article 30(1)(c) of the Electricity Regulation require that ENTSO-E conducts an extensive consultation process and takes into consideration stakeholders' comments when finalising the annual ERAAs. Article 27 of the Electricity Regulation requires ENTSO-E to consult relevant stakeholders and duly take the results of that consultation into consideration. The requirements are further specified in Article 9 of the ERAA methodology and aim to enable stakeholders to contribute at every step of developing ERAA in a way that is transparent, open, accessible, inclusive, efficient and well-structured. Article 23(7) of the Electricity Regulation requires that ERAA is subject to the prior consultation of Member States, the ECG and relevant stakeholders before it is submitted to ACER for approval. Furthermore, Article 3(8) of the ERAA methodology provides that definition and prioritisation of any additional sensitivities should be subject to public consultation. Member States' and relevant stakeholders'

views on the evolution of the power system and the relevance of any proposed sensitivity should be duly taken into account.

(145) ENTSO-E maintained last years' good practices for stakeholder engagement in ERAA 2023 development process. ENTSO-E consulted stakeholders on the preliminary scenario assumptions for ERAA 2023. ENTSO-E also held public webinars to inform stakeholders about methodological approaches and developments for ERAA 2023. In total, ENTSO-E held four public webinars to inform stakeholders and seek feedback.[67] In addition, ENTSO-E resumed its consultation on the preliminary results with the ECG, after deviating from this practice last year. ACER also commends the commitment of ENTSO-E to collaborate with ACER throughout the development process of ERAA 2023.

(146) Nevertheless, ACER observed that during the process, a number of input data were introduced or amended by ENTSO-E (e.g. capacity expansion constraints) after the consultation on scenario assumptions without duly informing or consulting stakeholders.

(147) ACER also notes that the scenario framework included in ERAA 2023 has not been fully publicly consulted by ENTSO-E. Member States and other relevant stakeholders could not express their views, for example, on the decision to run an additional sensitivity, on the particular choice for it and on its relevance. Recognising that the sensitivity was not subject to public consultation, ACER has also taken this into consideration when assessing its relevance and making corresponding amendments in ENTSO-E's Executive Report.

(148) In summary, ACER recognises ENTSO-E's efforts to engage stakeholder on the matters of assumptions, scenarios and preliminary results and finds it acceptable for ERAA 2023, but subject to amendments discussed in section 7.2.

7. SUMMARY AND REASONS FOR AMENDMENTS

7.1. Summary of ACER's assessment

(149) Table 1 summarises the assessment of the key aspects of ERAA 2023. ACER's conclusions on each aspect are provided in the third column of the table and the colours are explained below. For informational purposes, ACER also indicates how ERAA 2023 compares with ERAA 2022 against the applicable legal requirements; the results of this comparison are summarised in the fourth column of the table.

[67] For more information, on ENTSO-E's stakeholder engagement activities, see ENTSO-E's dedicated webpage on ERAA.

Table 1: Summary of ACER's assessment of ERAA 2023

Colour coding:

Compliant with the applicable requirements.
Simplification acceptable given that impacts on ERAA's purpose are limited.
Simplification not acceptable given material impacts undermining ERAA's purpose.
Unable to assess compliance due to limited information available.

N	Aspect of ERAA 2023 (relevant section)	Applicable requirements (ER[68], ERAAM[69])	Compliance with the requirements following ACER's assessment	Comparison with ERAA 2022
1	**Geographical scope** (section 6.2.1)	Art. 23(1) ER Art. 23(5)(a) ER Art. 1 ERAAM Art. 4 ERAAM	Compliant with the requirements.	No change.
2	**Temporal scope** (section 6.2.2)	Art. 23(1) ER Art. 4 ERAAM	Simplification acceptable in ERAA 2023. Explanation: while ERAA 2023 falls short of the target to model 10 years ahead, key years for decisions on capacity mechanisms are included.	ERAA 2023 models an additional year i.e.: 4 instead of 3 target years.
3	**Scenario framework** (section 6.2.3)	Art. 23(5)(b) ER Art. 23(5)(f) ER Art. 23 (5)(c) ER Art. 3 ERAAM Art. 8 ERAAM	Simplification acceptable in ERAA 2023, subject to amendments (section 7.2) Explanation: while ERAA 2023 contains no central reference scenario with capacity mechanisms, the central reference scenario without capacity mechanisms can be used for the identification of resource adequacy concerns.	Aside from a central reference scenario, ERAA 2023 includes a sensitivity.
4	**Greenhouse gas emissions reduction targets** (section 6.2.4)	Art. 23(5)(b) ER Art. 3 ERAAM	Simplification acceptable in ERAA 2023. Explanation: the ERAA 2023 aligns well with decarbonisation targets for most of the Member States.	Improvement. Better alignment with the relevant targets regarding the assumed deployment of renewable energy and energy efficiency measures.
5	**Economic viability assessment (EVA)** (section 6.2.5)	Art. 23(5)(b) ER Art. 23(5)(d) ER Art. 3 ERAAM Art. 4 ERAAM Art. 6 ERAAM Art. 7 ERAAM	Simplification acceptable in ERAA 2023. Explanation: improved consistency between the investment (EVA) and risk (economic dispatch) modules. However, incomplete link between high LOLE values and economic viability.	Improvement. Important methodological changes compared to ERAA 2022 but further improvements are necessary.

[68] Applicable paragraphs of Article 23 of the Electricity Regulation.
[69] Applicable provisions of the ERAA methodology which implements a given requirement of the Electricity Regulation.

6	**Storage** (section 6.2.6)	Art. 23(5)(d) ER Art. 23(5)(m) ER Art. 4 ERAAM	Simplification acceptable in ERAA 2023. Explanation: broadly consistent with the applicable framework. Any potential impacts on the purpose of ERAA are expected to be limited.	No change.
7	**Cross-zonal capacities** (section 6.2.7)	Art. 23(5)(b) ER Art 23(5)(d) ER Art. 23(5)(g) ER Art. 23(5)(l) ER Art. 23(5)(m) ER Art. 3 ERAAM Art. 4 ERAAM	Simplification acceptable in ERAA 2023. Explanation: although in an approximative manner, the approaches used to model: network developments in the economic dispatch and the link between the flow-based market coupling in the ED and the use of NTCs in the EVA - has improved the consistency and limited the impact on the robustness of the results.	Improvement. Methodological changes improved the consistency of cross-zonal capacities and the representation of network development between the ED and the EVA module. However, these changes do not represent a structural solution, in particular, as the flow-based approach is not yet applied in the EVA module.
8	**Demand-side response and sectoral integration** (section 6.2.8)	Art. 23(5)(d) ER Art. 23(5)(m) ER Art. 4 ERAAM	Simplification acceptable in ERAA 2023. Explanation: broadly consistent with the applicable framework yet some assumptions to be further improved.	No change.
9	**Implementation plans** (section 6.2.9)	Art. 23(5)(e) ER Art. 3 ERAAM	Unable to assess due to limited information available.	No change.
10	**Probabilistic assessment** (section 6.2.10)	Art. 23(5)(h) ER Art. 23(5)(j) ER Art. 4 ERAAM	Simplification acceptable in ERAA 2023. Explanation: minor simplifications expected to have limited impact on the accuracy of the results.	No change.
11	**Single modelling tool** (section 6.2.11)	Art. 23(5)(i) ER Art. 4 ERAAM	Compliant with the requirement.	No change.
12	**Out-of-market capacity resources** (section 6.2.12)	Art. 23(5)(d) ER Art. 7 ERAAM Art. 8 ERAAM	Simplification acceptable in ERAA 2023. Explanation: the assessment consider some but not all relevant measures which has a limited impact on the results.	No change.
13	**Identification of sources of resource adequacy concerns** (section 6.2.13)	Art. 23(5)(k) ER Art. 8 ERAAM	Simplification acceptable in ERAA 2023. Explanation: a number of country-specific remarks partly address the gap left by the missing EU-wide identification of sources of adequacy concerns. No material impact on results	ERAA 2023 does not feature an analysis of the drivers of adequacy concerns.
14	**Transparency** (section 6.2.14)	Art. 41 ER Art. 11 ERAAM	Simplification acceptable in ERAA 2023. Explanation: ERAA 2023 contains description of overall methodology, detailed data on assumptions and results and high-level interpretation of results. However, explanation of some methodologies and assumptions are not comprehensive or lacking.	No change.
15	**Timeline for submission** (section 6.3.1)	Art. 23(4) ER Art. 10 ERAAM	Simplification acceptable in ERAA 2023. Explanation: the delayed submission had limited impact on this year's assessment, and is therefore acceptable.	No change.
16	**Data collection** (section 6.3.2)	Art. 23(4) ER Art. 5 ERAAM	Compliant with the requirements.	No change.

		Art. 10 ERAAM		
17	**Stakeholder engagement** (section 6.3.3)	Art. 31 ER Art. 23(7) ER Art. 27 ER Art. 9 ERAAM Art. 10 ERAAM	Simplification acceptable in ERAA 2023, subject to amendments (7.2). Explanation: significant stakeholder engagement throughout the process for developing ERAA 2023. Yet, the stakeholder consultations did not cover the full scope of ERAA-2023 data and assumptions.	ERAA 2023 process featured an additional session of the Methodology webinar

(150) In Table 1, three out of 17 aspects of ERAA analysed by ACER are marked "green" indicating that they comply with the applicable requirements.

(151) The vast majority of the analysed aspects are marked "yellow". This means that they represent acceptable methodological simplifications in 2023, noting that ERAA 2023 is still subject to a four-year implementation period and that possible impacts of these simplifications are limited enough not to undermine ERAA 2023's application for policy decisions.

(152) No aspect is marked "red". ACER considers that there are no elements in ERAA 2023 which would go against the applicable legal requirements or represent a simplification with such a material impact on the functionality of ERAA 2023 that it would undermine the purpose of the assessment.

(153) One aspect is marked "grey" indicating that ACER is not able to assess it due to the lack of sufficient information in the Report.

(154) Table 1 also allows for a comparison between ERAA 2023 and ERAA 2022, showing the areas of improvement. In ERAA 2022, ACER highlighted three aspects where simplifications or deviations from the ERAA methodology were not acceptable given their material impacts undermining ERAA's purpose. These areas were the following: economic viability assessment, cross-zonal capacities and greenhouse gas emissions reduction targets. In ERAA 2023, ACER has assessed that these aspects have been improved in the following way:

i. By recalibrating weights associated with the selection of climate years in the central reference scenario, the EVA module has been improved through a more consistent consideration of risks and opportunities for capacity expansion that are in line with the results of the ED module.

ii. By applying statistical approximation, cross-zonal capacities used in the EVA module are more aligned with the capacities used in the ED module. Increased consistency of this crucial input data ensures that this aspect does not undermine the robustness of the ERAA results. Furthermore, the use of a methodological approach, albeit a simplified one, to consider the network developments in all modelled target years within the capacity calculation has further improved the robustness of the results.

iii. By ensuring that input data are more aligned with the fit-for-55 EU greenhouse gas emissions target for 2030, the validity of the central reference scenario has been strengthened.

(155) ACER notes that certain simplifications, while acceptable for the ERAA 2023 assessment as a whole, could particularly affect the adequacy results of less interconnected systems. In particular, the approach to model unplanned outages of interconnectors can have a more significant impact on zones with limited interconnection compared to zones benefitting from the meshed continental electricity system. ACER considers that, in the case of Ireland, the identification of adequacy concerns as such is not impacted, but the extent of these concerns may be affected by those modelling choices. In the case of Germany, ACER has requested ENTSO-E to rerun the ERAA investment model with correct input data regarding the cost of OCGT capacities (see more on both cases in section 6.2.5).

(156) While ERAA 2023 still includes several methodological simplifications which would require further development, these simplifications do not, in ACER's view, affect the results of the central reference scenario to the extent that they would undermine its role in the identification of resource adequacy concerns. At the same time, ACER acknowledges that these aspects must be improved over time to fully comply with the requirements of the Electricity Regulation and the ERAA methodology. Therefore, the above conclusion is without prejudice to ACER's assessment of future ERAAs where similar simplifications may be assessed differently by ACER considering that i) the implementation period expires in 2023 and that ii) as electricity markets evolve, the same modelling choices may impact the robustness of the results differently than in ERAA 2023.

(157) ACER also does not agree with ENTSO-E's statement on page 30 of the Executive Report that the ERAA 2023 has reached maturity. On the contrary, a relatively high number of "yellow" aspects in this year's assessment indicates that ERAA 2023 is not yet mature, and that the implementation of the ERAA methodology must continue until all aspects can be considered compliant with the methodological framework.

(158) At the same time, ACER recognises that the implementation of the ERAA methodology has come a long way: gradually improving every year thanks to the dedication of numerous ENTSO-E and TSO experts. Given the experience gathered and the continued commitment of the implementation team, ACER expects that ERAA is on the right track to become an exemplary tool for adequacy monitoring and supporting policy decisions across Europe.

7.2. Reasons for ACER's amendments

(159) ENTSO-E's Executive Report provides the main findings of ERAA 2023. This includes ENTSO-E's findings on the scenario framework, which consists of a central reference scenario and a sensitivity. ENTSO-E states on page 7 of the Executive Report that both central reference scenario and sensitivity (also referred to as 'scenario B') must be read in conjunction. According to ENTSO-E, the approach to climate year representation in the EVA of the central reference scenario leads to results which cannot be interpreted

in isolation for the identification of adequacy concerns in Europe and need to be complemented with a sensitivity. As stated in the Executive Report, both scenarios together can therefore provide a more robust picture of the risks. According to ENTSO-E, the central reference scenario results in substantial investment reaction to price spikes while the sensitivity results in comparably measured investment reaction to price spikes.

(160) ACER acknowledges the value of appropriate sensitivities and their role in the adequacy assessment as envisaged by the Electricity Regulation. As set out in Article 23(5)(b), the European resource adequacy assessment should be based on appropriate central reference scenarios and appropriate sensitivities on extreme weather events, hydrological conditions, wholesale prices and carbon price developments. For a sensitivity to be appropriate, it should be in the first place in line with the requirements of the Electricity Reglation and the ERAA methodology.

(161) Considering the above, ACER does not agree with ENTSO-E's findings on the relevance of the submitted sensitivity, for the following reasons:

(162) First, the central reference scenario should be the basis for identifying resource adequacy concerns.[70] Sensitivities may complement the central reference scenarios to assess, for example, the robustness of the identified adequacy concerns.[71] Indeed, the submitted sensitivity complements the results of the central reference scenario, in that it provides additional comparative considerations regarding the effect of alternative approaches to represent climatic conditions with a reduced set of climate years.

(163) Second, ACER considers that the consistency achieved in the central reference scenario is significantly higher than the consistency achieved in the sensitivity; in that sense, the sensitivity confirms the higher robustness of the central reference scenario. The sensitivity also demonstrates that the climate year selection in the economic viability assessment impacts the overall consistency of the adequacy assessment, and thereby its results (see also Annex III, chapter 3.3.2.).

(164) Third, ACER does not agree with ENTSO-E's description that the sensitivity and the central reference scenario represent different reactions of investors to price spikes. Altering the climate years in the sensitivity changes the operational conditions of modelled resources. In essence, what changes is the amount of price spikes seen by the investors, but not their reaction to the observed price spikes. Instead, investors' reaction, including risk aversion, should be modelled via the weighted average cost of capital and hurdle rates. Thus, the sensitivity should not necessarily be interpreted as representing a different (e.g. a more risk-averse) type of investors' reaction to price spikes.

[70] See also Article 8(1) of the ERAA methodology.
[71] See Article 3(6) of the ERAA methodology.

(165) Finally, the sensitivity has not been appropriately consulted with stakeholders as required by the Electricity Regulation.

(166) For the above reasons, ACER has amended Section 2 of the Executive Report setting out ENTSO-E's findings on the relevance of the performed sensitivity. ACER's amendments are set out in Annex I to this Decision.

8. RECOMMENDATIONS FOR ERAA 2024

(167) The annual ERAA assessments have undergone gradual methodological improvements, with full implementation of the ERAA methodology expected in ERAA 2024.[72] Since the first ERAA in 2021, ACER has been assisting ENTSO-E in the implementation process by providing recommendations for future ERAA editions. This section highlights key areas for further improvement.

(168) ERAA 2023 models only four target years instead of 10 years as foreseen by Article 23(1) of the Electricity Regulation. The number of target years must increase to cover the diverse needs of the Member States and to provide input for cross-border participation in capacity mechanisms to function properly. Both aspects necessitate the full temporal coverage of ERAA as required by the Electricity Regulation.

(169) Although ERAA 2023 has improved the key modelling aspects, increasing the consistency of the modelling input and hence the robustness of the results, some of these improvements are of temporary nature. These temporary solutions may be acceptable in ERAA 2023, but they need to be further developed in the next ERAA edition to form a coherent structural solution. This would entail switching to a so-called 'iterative' modelling approach [73], which would determine the capacity mix by comparing costs and revenues after each iteration[74]. As this approach breaks down the complex calculations into smaller steps (runs all dispatch simulations separately), some temporary simplifications used in ERAA 2023 can be removed, e.g. a reduced set of climate years. Such an improved model would ensure consistency between the EVA and the ED module, and hence the robustness of the assessment. Key modelling aspects to align between the two modules are:

i. Regarding the consistent use of climate data, currently the ED module uses 35 climate years while the EVA module represents the variability of climatic conditions with a reduced set of only 3 climate years. As any data reduction comes with information loss, consistency can only be guaranteed if the same climate years are used in both ERAA modules.

[72] Article 12 of the ERAA methodology.
[73] As a way of example, this approached followed by the TSO Elia.
[74] according to Article 6(2)(a) of the ERAA methodology

ii. Regarding the consistent cross-zonal capacities between the EVA and the ED module, ACER expects that ERAA 2024 applies flow-based market coupling in both modules consistently across all target years in the relevant capacity calculation regions.

iii. Regarding a consistent approach to forced outage profiles, the availability of resources has a significant effect on the adequacy results. The modelling approach should be aligned in the ED and EVA modules, in particular for interconnectors, given their disproportionate effect on modelled zones with low interconnectivity.

(170) ACER observes that small changes in the input tend to have relatively significant and not always intuitive impact on the results. As this especially applies to the effects of curtailment-sharing feature, thus ACER identifies the need to revise and further improve its application.

(171) It is imperative that market risks and opportunities are represented in a balanced manner. According to the ERAA methodology, the maximum clearing price should consider the technical bidding limits of the day-ahead and intraday markets in conjunction. Hence, intraday bidding limit should be adequately considered in the assessment. At the same time, investment behaviour, including risk aversion, is transparently modelled via the estimated weighted average cost of capital and hurdle rates. This approach allows to properly discount revenues received in scarcity periods as a reaction to the risk related to the frequency of the price spikes (model risk) and the risk of policy actions limiting price spikes (policy risk). ACER considers the approach not only in line with the ERAA methodology but as a generally acknowledged best practice. However, to maintain the realism of the assumptions, ACER recommends that the hurdle rates are reviewed periodically in a coordinated manner to account for a potential change in the risk landscape perceived by investors. For example, the model could reflect investors` risk perception with and without long-term contracts. The ‘iterative’ modelling approach could also consider a dynamic adaptation of hurdle rates based on the distribution of modelled revenues.

(172) Additional sensitivities can offer valuable insights into future states of the European electricity system by modelling the impact of extreme weather events, hydrological conditions, wholesale prices or carbon price developments. To better help decision making, in the future, any additional sensitivity analysis in ERAA should have an explicit policy-relevant purpose that is transparently defined ex-ante i.e. before running the model and obtaining the results. In addition, such sensitivity(ies) should be appropriately consulted with the members of the Electricity Coordination Group, regulatory authorities and other stakeholders as required by the Electricity Regulation and the ERAA methodology.

(173) In terms of transparency and stakeholder engagement, ACER recommends that ENTSO-E looks for a more targeted engagement with stakeholders, particularly on complex technical challenges in the assessment. While webinars provide an important forum for stakeholder engagement and increase transparency, they do not allow for a more in-depth exchange. For this reason, ACER recommends ENTSO-E to establish a

stakeholder expert group for more technical exchanges, with a balanced participation of academia, consumers and producers. More transparency and stakeholder engagement in the data collection phase would also help in screening for and filtering out potential input data errors and issues.

(174) It is of vital importance that ENTSO-E continues to engage with ACER throughout the development of the annual ERAAs. This is the time when implementation choices and their likely effect on the robustness of results can be discussed and, if needed, trade-offs can be transparently evaluated. Ultimately, close cooperation with ACER during the development of the ERAA facilitates the subsequent approval process.

(175) The energy transition gives a challenging and dynamic background to ERAA. In particular, the future ERAAs would need to consider and be consistent with any potential future assessments of flexibility needs, currently foreseen by the legislative proposals on the EU electricity market design.[75] According to the proposed rules, these flexibility needs assessments will be delivered at the Member State level as well as at the European level based on a methodology developed by ENTSO-E and the EU DSO Entity and approved by ACER.

(176) ACER recognises the complexity of the ERAA exercise and the efforts of ENTSO-E and the TSO community and remains positive that the implementation of the ERAA methodology continues in line with its recommendations. It is imperative that ENTSO-E continues to dedicate, and be provided with, sufficient resources to carry out this task. In turn, ACER trusts that the annual ERAA assessment gradually becomes a cornerstone of the EU's coordinated adequacy framework,

HAS ADOPTED THIS DECISION:

Article 1

The proposal for European Resource Adequacy Assessment for 2023 is amended and approved, as set out in Annexes I.a – I.f, Annex II and Annex IV to this Decision.

Article 2

This Decision is addressed to ENTSO-E.

[75] Based on the Proposal for a Regulation to improve the Union's electricity market design, 2023/0077(COD), 19 December 2023.

Done at Ljubljana, on 2 May 2024.

- SIGNED -

For the Agency
The Director

C. ZINGLERSEN

Annexes:

Annex I.a – ERAA 2023: Executive Report
Annex I.b – ERAA 2023: Input Data and Assumptions
Annex I.c – ERAA 2023: Methodology
Annex I.d – ERAA 2023: Detailed Results
Annex I.e – ERAA 2023: Country Comments
Annex I.f – ERAA 2023: Definitions and Glossary
Annex II – Amendments to ERAA 2023 Executive Report
Annex II.a – Amendments to ERAA 2023 Executive Report – with track changes (for information only)
Annex III – Technical annex
Annex IV – Results of the ERAA 2023 rerun

In accordance with Article 28 of Regulation (EU) 2019/942, the addressees may appeal against this Decision by filing an appeal, together with the statement of grounds, in writing at the Board of Appeal of the Agency within two months of the day of notification of this Decision.

In accordance with Article 29 of Regulation (EU) 2019/942, the addressees may bring an action for the annulment before the Court of Justice only after the exhaustion of the appeal procedure referred to in Article 28 of that Regulation.