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REPORT

CEER Benchmarking Report 7.1 on the Continuity of Electricity and Gas Supply

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CEER Benchmarking Report 7.1 on the Continuity of Electricity and Gas Supply

Data Update 2019-2024
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Energy Quality of Supply Work Stream (EQS WS)

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INFORMATION PAGE

Abstract

This document (C26-EQS-110-03) provides an update of key data related to continuity of electricity and gas supply found in the more extensive 7th CEER Benchmarking Report published in 2022. CEER aims to provide such updates in between the more detailed reports, in order to provide accurate and up-to-date information on a more regular basis.

Target audience

European Commission, energy suppliers, traders, gas/electricity consumers, gas/electricity industry, consumer representative groups, network operators, Member States, academics and other interested parties.

Keywords

Electricity; Gas; quality of supply; continuity of supply; benchmarking; SAIDI; SAIFI; CAIDI; interruptions

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Related documents

CEER Documents

- 7TH CEER-ECRB BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY (December 2022)
- CEER Benchmarking Report 6.1 on the Continuity of Electricity and Gas Supply (July 2018)
- 6TH CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY - Introduction, Chapter 1-2 (September 2016)
- 6TH CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY - Chapter 3-4 (September 2016)
- 6TH CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY - Chapter 5-7 (September 2016)
- 6TH CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY AND GAS SUPPLY – Annexes (September 2016)
- CEER Benchmarking Report 5.2 on the Continuity of Electricity Supply (February 2015)
- CEER Benchmarking Report 5.1 on the Continuity of Electricity Supply (February 2014)
- 5TH CEER BENCHMARKING REPORT ON THE QUALITY OF ELECTRICITY SUPPLY (May 2012)
- 4TH BENCHMARKING REPORT ON QUALITY OF ELECTRICITY SUPPLY (December 2008)
- THIRD BENCHMARKING REPORT ON QUALITY OF ELECTRICITY SUPPLY (December 2005)
- SECOND BENCHMARKING REPORT ON QUALITY OF ELECTRICITY SUPPLY (September 2003)
- QUALITY OF ELECTRICITY SUPPLY: INITIAL BENCHMARKING ON ACTUAL LEVELS, STANDARDS AND REGULATORY STRATEGIES – 1st Benchmarking Report (April 2001)

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EXECUTIVE SUMMARY

Since 2001, the Council of European Energy Regulators (CEER) has repeatedly undertaken a survey and analysis of the quality of electricity supply in its member and observer countries, the results of which are presented in its Benchmarking Reports, the latest of which was the 7th CEER-Energy Community Regulatory Board (ECRB) Benchmarking Report (7th BR), published in 2022. That report was the first to cover the quality of electricity and gas supply for both the CEER and the ECRB participants in the main body of the report, enabling easier benchmarking for most of Europe. Inclusion of the ECRB Contracting Parties is continued in this Benchmarking Report 7.1 (BR 7.1). CEER Observer Switzerland is also included making the total number of participants 39.

While the 7th Benchmarking Report addressed three areas of the Quality of Supply of electricity networks (Continuity of Supply, Voltage Quality and Commercial Quality) and three areas of the Quality of Supply of gas networks (Technical Operational Quality, Natural Gas Quality, and Commercial Quality), this Benchmarking Report 7.1 only updates key data in Continuity of Supply of electricity and Technical Operational Quality of gas. All other areas of the Quality of Supply will again be addressed in detail in the next CEER Benchmarking Report.

For this update, the CEER Energy Quality of Supply Work Stream mainly focused on recent Continuity of Supply data. Following the 7th CEER-ECRB Benchmarking Report, the BR 7.1 includes the same types of figures while comprehensive additional information can be found in tables included as annex. In addition to the update of the Continuity of Supply indicators, the most recent data on circuit length and share of underground cables is presented for each responding country.

Since data for the 7th CEER-ECRB Benchmarking Report was collected in 2019, the latest values obtained were for the year 2018, even though that report was published in 2022. For that reason, this report focuses on the period from 2019 to 2024 and covers the following Continuity of Supply (CoS) indicators:

- System Average Interruption Duration Index (SAIDI),
- System Average Interruption Frequency Index (SAIFI),
- Customer Average Interruption Duration Index (CAIDI),
- Momentary Average Interruption Frequency Index (MAIFI),
- Average Interruption Time (AIT) and
- Energy Not Supplied (ENS).

All 39 participants monitor the indicators SAIDI and SAIFI in their electricity networks (some under a different indicator name) but two of them could not provide the values for SAIFI. The values of unplanned electricity SAIDI and SAIFI seem to be stable or improving over time. In 2024, the latest year covered by this report, unplanned SAIDI including exceptional events had a range between 8.46 and 29,712 minutes per customer while unplanned SAIDI without exceptional events was between 7.48 and 2,370.60 minutes per customer in distribution (with one country providing only the SAIDI for transmission, which was 6 minutes in 2024, both excluding and including exceptional events). The former indicator includes all interruptions regardless of their cause and is possibly more reliable for benchmarking because of significant differences in definitions of exceptional events across Europe. The 2024 values of unplanned SAIFI including exceptional events were between 0.21 and 168.05 interruptions per customer

while unplanned SAIFI excluding exceptional events ranged from 0.18 and 42.34 interruptions per customer in distribution (with one country providing only the SAIFI for transmission, which was 0.20 interruptions per customer in 2024, both excluding and including exceptional events).

As in the 7th BR, the comparison of continuity indicators is complicated by the fact that voltage levels are taken into account in different ways across reporting countries. Ideally, interruptions on all voltage levels would be included, but differences in collecting and reporting the data across Europe render this goal impossible.

Continuity of Supply indicators are also used in gas, but they are monitored in fewer countries than the CoS indicators for electricity. Gas networks have very high technical requirements and offer a possibility of storage which means that reaching or maintaining a good level of CoS is not the main factor in the decision-making process of system operators. Nevertheless, the typically used interruption indicators are good tools for international benchmarking of continuity of supply.

The SAIDI values for gas are generally much lower than in electricity since the underground gas pipelines are not exposed to forces of nature in the same way as overhead power lines. The values of unplanned SAIDI and SAIFI in gas seem to be stable in the observed time frame with occasional spikes in some years. In 2024, unplanned gas SAIDI had a range between 0.05 and 223.09 minutes per customer while unplanned SAIFI was between nearly zero[1] and 0.04 interruptions per customer. The indicator dealing with the average duration of unplanned gas interruptions (unplanned CAIDI) ranged from 54.00 to 5,988.37 minutes per interruption.

Trend lines for the observed period (2019 to 2024) were determined for each of the main indicators and each country, provided that enough values were obtained. For every individual indicator, a percentage of countries with stable, ascending (worsening) and descending (improving) trends was calculated and presented in the relevant (sub)chapter. Combining all CoS indicators for electricity and all CoS indicators for gas and calculating a single trend line for electricity and gas each, showed an increasing (worsening) trend in only 14% of countries for electricity and 5% of countries for gas. The remaining countries have either an improving or a stable trend of the CoS indicator values.

In addition to Continuity of Supply, the most recent data on circuit length and share of underground cables in electricity and pipeline length in gas are presented for each responding country. Moreover, the topics of infrastructure for natural gas storage and for liquefied natural gas (LNG) in Europe are addressed in the gas chapter.

[1] In actuality 0.000995.

1 Introduction

This Benchmarking Report 7.1 (BR 7.1) aims to provide a partial update of the indicators related to Continuity of Supply (CoS) for Electricity and Gas included in the 7th CEER-ECRB Benchmarking Report (7th BR), published in 2022. While the full Benchmarking Reports address three areas of the Quality of Supply of electricity networks (Continuity of Supply, Voltage Quality and Commercial Quality) and three areas of the Quality of Supply of gas networks (Technical Operational Quality, Natural Gas Quality, and Commercial Quality), this BR 7.1 does not include Voltage Quality, Natural Gas Quality or Commercial Quality. All these areas of the Quality of Supply will be addressed in detail in the next CEER Benchmarking Report.

Therefore, the CEER Energy Quality of Supply Work Stream (EQS WS) focuses only on recent CoS data for this update. This report provides a descriptive update and limited trend analysis of data submitted by National Regulatory Authorities (NRAs) but does not seek to provide a comprehensive causal assessment or policy recommendations. It only serves to present the most recent data on CoS and technical characteristics in electricity and gas networks including the length of cables and overhead lines, the share of underground cables, the length of gas pipelines and the infrastructure for natural gas storage and liquefied natural gas (LNG).

In an improvement over previous editions, the 7th CEER-ECRB Benchmarking Report from 2022 was the first to cover the quality of electricity and gas supply for both the CEER and the ECRB participants in the main body of the report, enabling easier benchmarking for most of Europe. The same approach is continued in this BR 7.1 which is based on input from 39 participants that are sometimes listed by their abbreviations in tables. The participants include the following CEER Members and Observers and ECRB Contracting Parties: Albania (AL), Austria (AT), Belgium (BE), Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czechia (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Georgia (GE), Germany (DE), Great Britain (GB), Greece (EL), Hungary (HU), Ireland (IE), Iceland (IS), Italy (IT), Kosovo*[2] (KS*), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Moldova (MD), Montenegro (ME), the Netherlands (NL), North Macedonia (MK), Norway (NO), Poland (PL), Portugal (PT), Romania (RO), Serbia (RS), Slovenia (SI), Spain (ES), Sweden (SE), Switzerland (CH) and Ukraine (UA). It is important to note that not every participant answered every question in the questionnaire. If a country is not included in a figure or a table, that is because the answer from that country was not obtained.

Indicators for CoS are currently not perfectly harmonised across Europe. The following aspects might be differently defined, depending on the country:

- Voltage levels low voltage (LV), medium voltage (MV), high voltage (HV) and extra high voltage (EHV);
- Exceptional events; and
- CoS indicators.

Unplanned indicators shown in this report can be presented with or without exceptional events (ee), depending on whether a country defines such events and monitors indicators both including and excluding and them.

[2] Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Advisory Opinion on the Kosovo declaration of independence.

Previous Benchmarking Reports are available on the CEER website as listed in 'Related Documents'. The 4th CEER Benchmarking Report (2008) includes exact definitions of continuity indicators (from page 20) and detailed content about exceptional events (from page 42).

The figures in this report are presented the same way as in 7th BR and are divided into time series and boxplots. Since the spread of indicator values makes the reading of some figures more difficult, a logarithmic scale is used for the System Average Interruption Duration Index (SAIDI), the System Average Interruption Frequency Index (SAIFI), Average Interruption Time (AIT) and Energy Not Supplied (ENS) so that all countries can be included in a single figure. There are, however, time series figures where countries are divided into groups, as described in the next chapter. The boxplots show the range of values over six years this report focuses on in addition to the mean and the latest available value (in this case, from 2024). Hence, many indicators are presented in two ways: a tracking of the value over time and boxplots with minimum-maximum ranges and mean values. Other figures (such as those dealing with the length of lines or the percentage of underground cables) are similar to those in the 7th BR, while the exact values can be found in tables included in Annex 3.

2 Main results – Electricity

Since this report includes indicator values from most European countries, substantial differences in indicator values are expected. An indicator value could vary significantly even within the same country over the years. Consequently, a logarithmic scale was adopted for all figures to effectively represent the broad range of values. Figures with the time series are first shown including all countries that provided data, followed by the same time series with countries split into two groups: one, where the values did not lie above the calculated breakpoint in any of the years, and another, where at least one value lies above the breakpoint. This presentation was used to facilitate an easier reading of figures. It has no effect on data as this approach was implemented only to enhance clarity.

To determine each indicator's breakpoint, each country's maximum value of that specific indicator for the observed years (2019 to 2024) was first determined. The median value was then calculated from all country-individual maximum values and multiplied by 1.5. Breakpoints for various indicators are shown in Table 1 below.

Indicator	Breakpoint	Unit
SAIDI unplanned without ee	132.08	Minutes per customer per year
SAIFI unplanned without ee	2.31	Interruptions per customer per year
SAIDI planned	121.5	Minutes per customer per year
SAIFI planned	0.69	Interruptions per customer per year
AIT unplanned	28.425	Minutes per year
ENS unplanned	680.408	MWh

Table 1 – Breakpoints for electricity indicators

$$bp_{Indicator} = 1.5 \cdot \text{median}\left[\max_{Country,\ 2019\text{-}2024} Indicator\right]$$

To evaluate whether interruption indicators are improving (decreasing) or worsening (increasing), trends over the six-year period (2019–2024) were assessed in a way that remains comparable across countries with very different absolute levels. Instead of focusing on raw values, the average relative (percentage) change per year was estimated. This was done by fitting a simple trend line to the time series on a logarithmic scale, which approximates constant percentage growth or decline over time. Logarithmic scale was used because it turns the fitted slope into an average annual percentage change, making trends comparable across countries with different sizes, while reducing the influence of different magnitude levels. In practice, the data were modelled as

$$ln(y_t) = a + b \cdot t + \varepsilon_t$$

Where:
y_t is the observed indicator value in year t;
t represents time, measured in years;
a is the intercept that determines the level at which the fitted trend line is positioned;
b is the estimated trend on the logarithmic scale; and

ε_t is the error term for year t, representing year-to-year deviations from the estimated trend, including natural variation and the effects of factors not included in the model.

The estimated slope *b* was then converted into an annual percentage change using

$$annual\ change = e^b - 1$$

This produces the trend measure used in evaluation (e.g., +0.025 ≈ +2.5% per year; −0.030 ≈ −3.0% per year). Missing values (empty cells) were treated as 'not available' and were excluded from the fit. A trend was only evaluated when at least three yearly observations were available.

The natural logarithm of zero is mathematically undefined. Where a time series contained both zero and positive values, a constant equal to half of the smallest positive observation in that series was added to all observations as ε_t before applying the logarithmic transformation. Series consisting entirely of zero values were classified as stable without fitting a logarithmic trend.

Because year-to-year values naturally fluctuate, a visible increase or decrease can occur even without a persistent underlying trend. To distinguish a 'clear' trend from normal variation, a t-test on the estimated slope was performed. The null hypothesis is that the true slope is zero (no trend), and the test compares the estimated slope to its uncertainty (standard error). This yields a p-value, which can be interpreted as: *if there were truly no trend, how likely would it be to observe a trend at least as strong as the one estimated from the data?* Smaller p-values indicate that the observed trend is less likely to be explained by random fluctuation alone. Given the time span of six years and the fact that some values were not available, a relatively tolerant evidence threshold of p ≤ 0.10 was used.

Finally, each country was classified by combining practical importance and statistical clarity. A country's trend was classified as 'ascending' only if the estimated annual change was at least +2% per year and the p-value was ≤ 0.10. It was classified as 'descending' only if the estimated annual change was at lower than −2% per year (in other words, negative, but higher than 2% in absolute terms) and the p-value was ≤ 0.10. All other cases were classified as 'stable', meaning that either the estimated change was within ±2% per year (too low of a degree of change to be considered meaningful for this purpose) or the data were too noisy to confidently separate the trend from normal fluctuation at the chosen p-value threshold.

2.1 System Average Interruption Duration Index – SAIDI

The System Average Interruption Duration Index (SAIDI) measures the average total duration of electricity (or gas) supply interruptions experienced by a customer over a given year. It is calculated as the sum, across all interruption events, of the duration of each interruption multiplied by the number of customers affected, divided by the total number of customers served.

The evaluation of SAIDI trend lines, the majority of countries have a stable trend line, indicating minor changes in the trend line. SAIDI excluding exceptional events is in decrease (indicating improved performance) in six countries, while some increase can be seen in three out of 30 countries that submitted data for this indicator. SAIDI including exceptional events can fluctuate more than SAIDI excluding them and based only on the statistics, it is hard to evaluate whether the audited years have been good regarding exceptional events (i.e. fewer or less impactful exceptional events) or if there have been improvements in the networks. The interruption indices only consider those faults and interruptions that occur, but not those that are prevented by the system operators. SAIDI values of planned interruptions can indicate multiple things; thus, additional information would be needed for further analysis.

The following country-specific observations can be brought up:

- Sweden has a descending trend line for unplanned SAIDI both with and without exceptional events, while having an ascending trend line for planned SAIDI. This indicates that Sweden increased planned network interventions alongside improving unplanned interruption performance.
- Although Montenegro has one of the highest interruption times in Europe in absolute terms, all their SAIDI indices show a descending trend, indicating continuous improvement.
- Romania has a descending trend line for both the planned SAIDI and in unplanned SAIDI excluding exceptional events.
- Great Britain has a descending trend line for unplanned SAIDI excluding exceptional events, while SAIDI including exceptional events seems to be ascending. Without additional information, it is hard to make further analysis.
- Ukraine also has a descending trend in SAIDI excluding exceptional events, while SAIDI including exceptional events is ascending. In general, the recent large difference between indicator values with and without exceptional events can be explained by the ongoing war in Ukraine.
- Portugal has the lowest planned SAIDI values (in distribution) during the audited time frame, while maintaining their usual values of unplanned SAIDI without exceptional events.

In case of unplanned SAIDI without exceptional events, trend lines are descending for 21% of the participants, stable for 69% and ascending for 10%. Countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line. For unplanned SAIDI including exceptional events, trend lines are descending for 19%, stable for 71% and ascending for 10% of the countries. In case of planned SAIDI, trend lines are descending for 15%, stable for 58%, ascending for 27% of the countries.

Calculated trend lines do not necessarily correlate between different indicators in the same country. For example, a country with a stable trend for unplanned SAIDI including exceptional events may have a descending trend for unplanned SAIDI without exceptional events.

In Belgium, there is a significant difference between the voltage levels that planned or unplanned interruptions are monitored on. Indicators for unplanned interruptions are monitored only on lower (LV and MV) levels, while indicators for planned interruptions are monitored only on higher (HV and EHV) levels. This refers to both the SAIDI and the SAIFI indicators. Moreover, the SAIDI values Belgium provided for this report only include the region of Flanders. Since Belgium monitors indicators for planned interruptions on transmission level only, it is omitted from the figures with planned SAIDI but is included in Table 23 in Annex 3. More information on planned SAIDI and SAIFI in Belgium is provided in Chapter 2.3.

Bosnia and Herzegovina's SAIDI and SAIFI values in this report refer to medium voltage, even though Republika Srpska, one of the two entities in the country, additionally monitors both the SAIDI and the SAIFI on LV level. Unplanned SAIDI including exceptional events is only collected in Republika Srpska and is not included in this report. Instead, the report provides the values for unplanned SAIDI excluding exceptional events since it is monitored in the entire country.

The values in Great Britain are based on the total customer minutes lost per customer per year across all of the electricity distribution networks across England, Wales and Scotland. The Interruption Duration metric used is Customer Minutes Lost. The values for 2023 and 2024 were not yet available during drafting of this report. Electricity distribution data is provided on a financial year basis.

The SAIDI and SAIFI values Greece provided for this report refer exclusively to transmission system. More specifically, they cover the EHV network (400 kV) and the HV network (150 kV and 66 kV), including both the mainland transmission system and the connections with islands. The Distribution System Operator (DSO) of Greece monitors the SAIDI and SAIFI indicators in distribution, but their values were not provided and are not included in this report.

In Iceland, CoS indicators include all unplanned interruptions (even those caused by exceptional events), but do not include planned interruptions. Information is registered in each company's database (including the cause of interruption), which is the base for the annual report in Iceland. If an interruption exceeds a certain value of System Minutes, a company is obliged to immediately report the event to the Regulatory Authority even if it is not an exceptional event by definition.

In Kosovo*, SAIDI had been reported by both the Transmission System Operator (TSO) and the DSO until 2019. Starting with 2020, the TSO of Kosovo* no longer has the obligation to report the SAIDI and SAIFI values separately, but only the AIT values. Since 2021, the DSO of Kosovo* has been collecting indicator values for MV and LV separately but the values shown in figures and tables in this report refer to their distribution network, i.e. low and medium voltage levels combined.

Lithuania only provided the values for SAIDI and SAIFI excluding exceptional events. They explained that the cases that can be considered exceptional in terms of their scope and nature would be those caused by natural disasters and the transmission system operator's network and are not included in the calculation of quality indicators for distribution.

Moldova defines exceptional events according to international standard IEEE-1366 (Major event day). Short interruptions are also included in indicator values provided by Moldova.

In the Netherlands, all unplanned interruptions count toward unplanned SAIDI, which means that SAIDI excluding exceptional events is not monitored. Likewise, Norway does not have a regulatory definition of exceptional events, so all types of unplanned interruptions are included in unplanned SAIDI and SAIFI. The same applies to Malta and Finland, where exceptional events are not excluded from any indicator values. Contrary to this approach, Romania does not calculate SAIDI and the SAIFI with exceptional events.

The SAIDI and SAIFI values in Finland refer to interruptions originating on medium voltage but also include low voltage customers who were affected by those interruptions.

In North Macedonia, SAIDI and SAIFI are calculated for unplanned interruptions only and exclude force majeure (exceptional) events. Separate SAIDI/SAIFI values for planned interruptions are not calculated. The reported values are available only for the medium voltage level (35 kV and 10 kV).

SAIDI is not monitored/calculated in Spain. Instead, an indicator called TIEPI is used which is weighted by installed capacity and is equivalent to Average System Interruption Duration Index (ASIDI).

Slovenia reported extensive flooding on 2023. It was a natural disaster and the reason for the increased value of CoS indicators.

Sweden does not define exceptional events and is, therefore, only included in figures and tables with indicators including exceptional events.

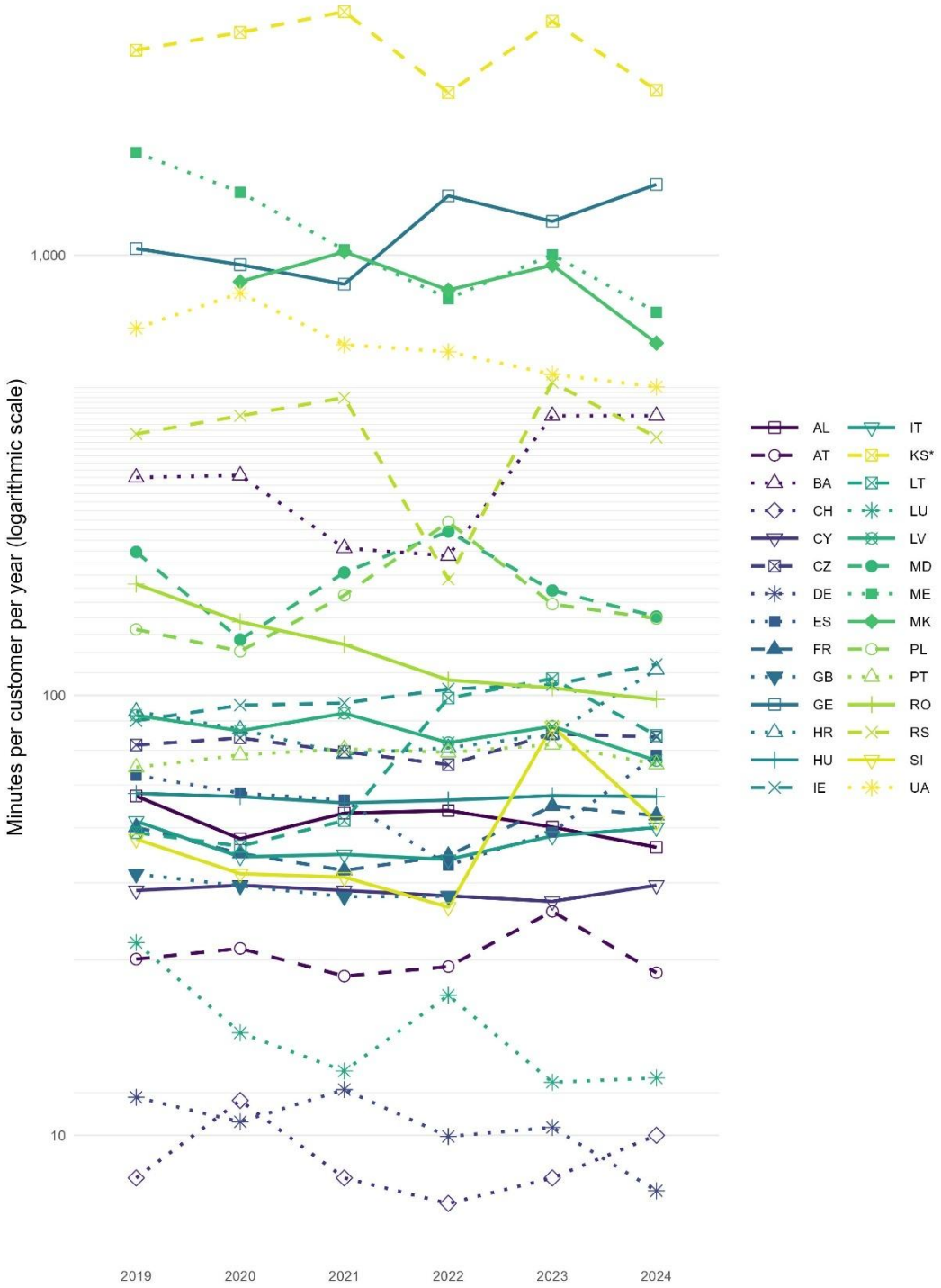


Figure 1 – Electricity SAIDI unplanned without ee, all countries

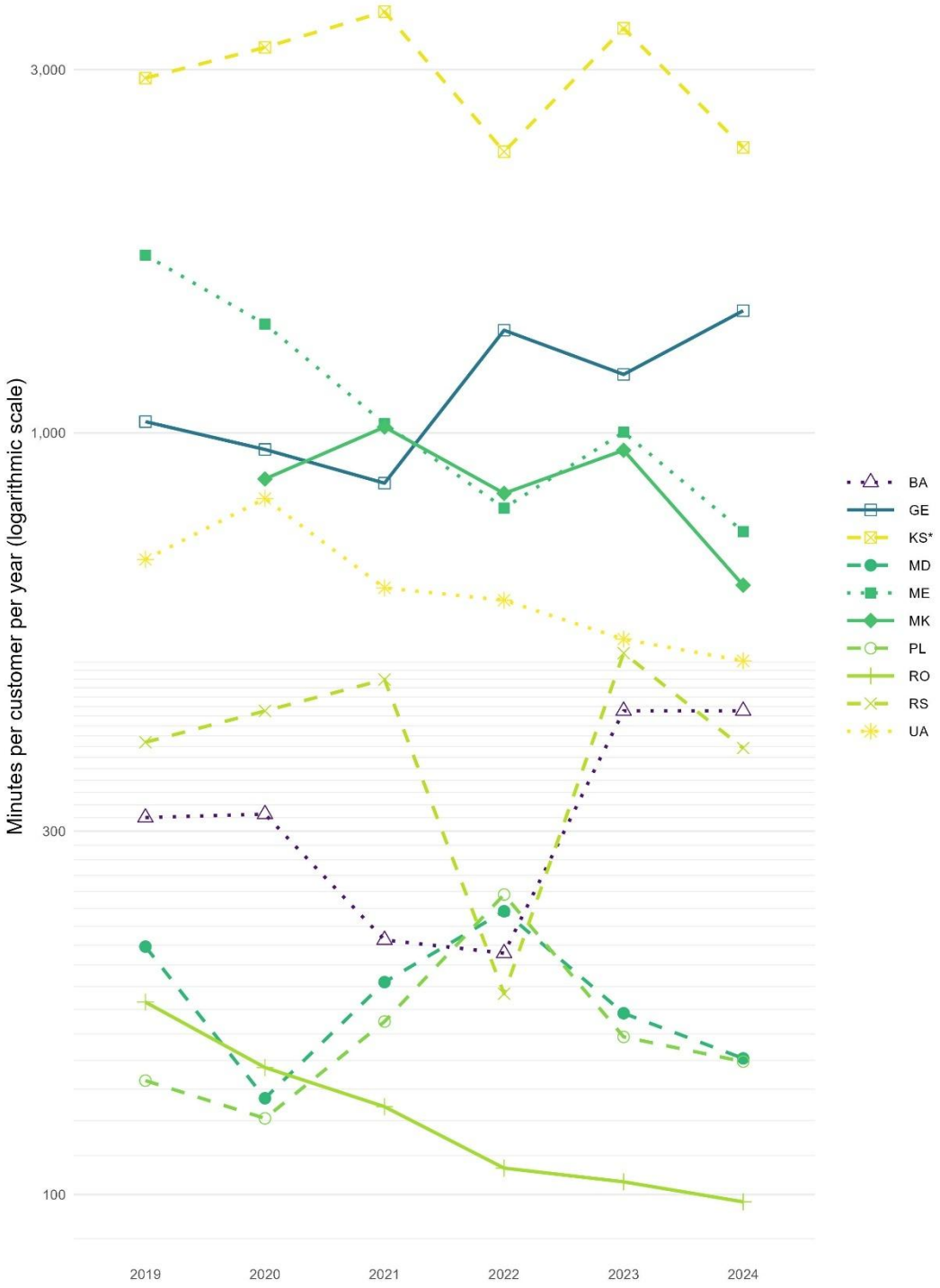


Figure 2 – Electricity SAIDI unplanned without ee, countries above limit

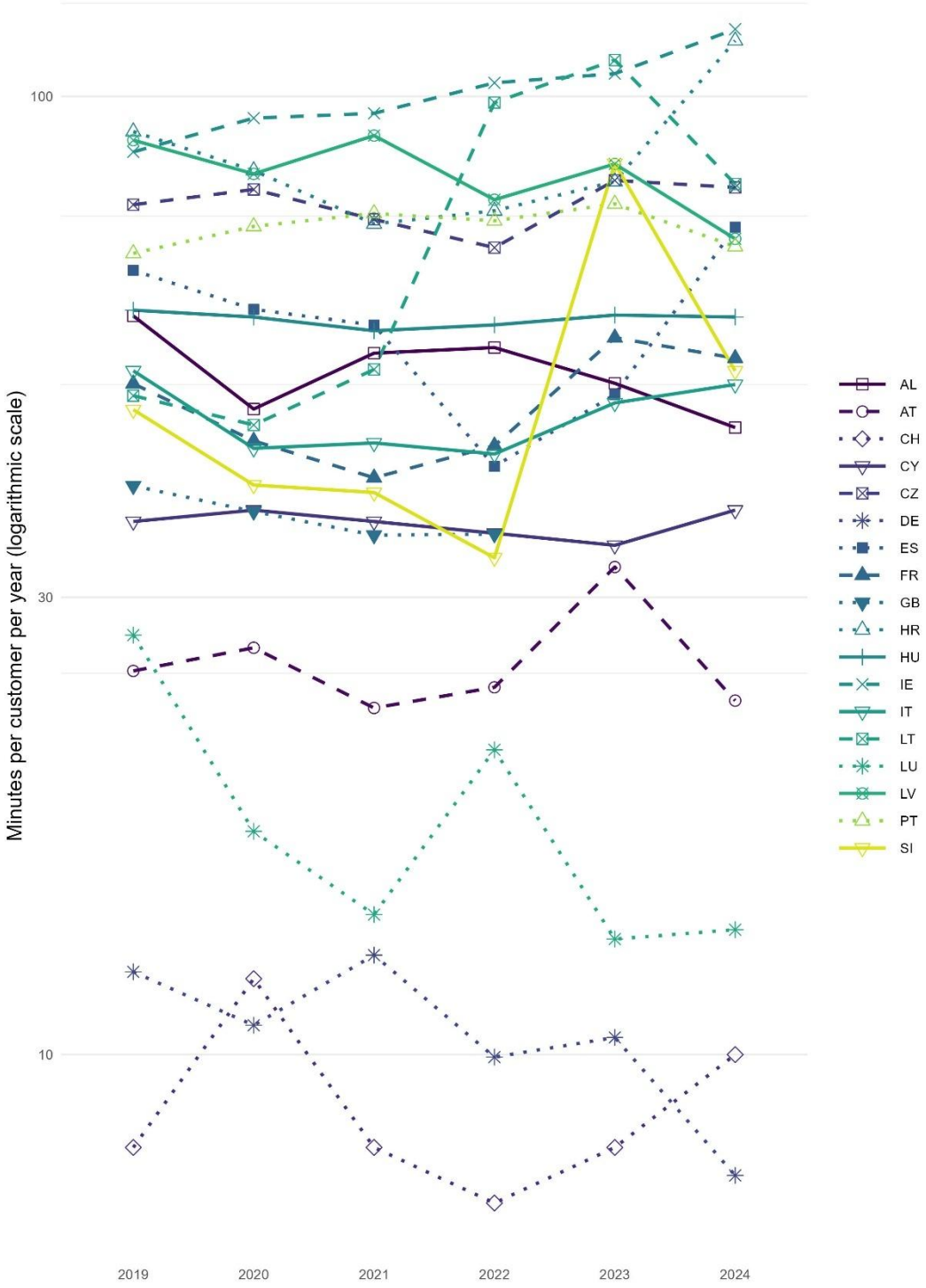


Figure 3 – Electricity SAIDI unplanned without ee, countries below limit

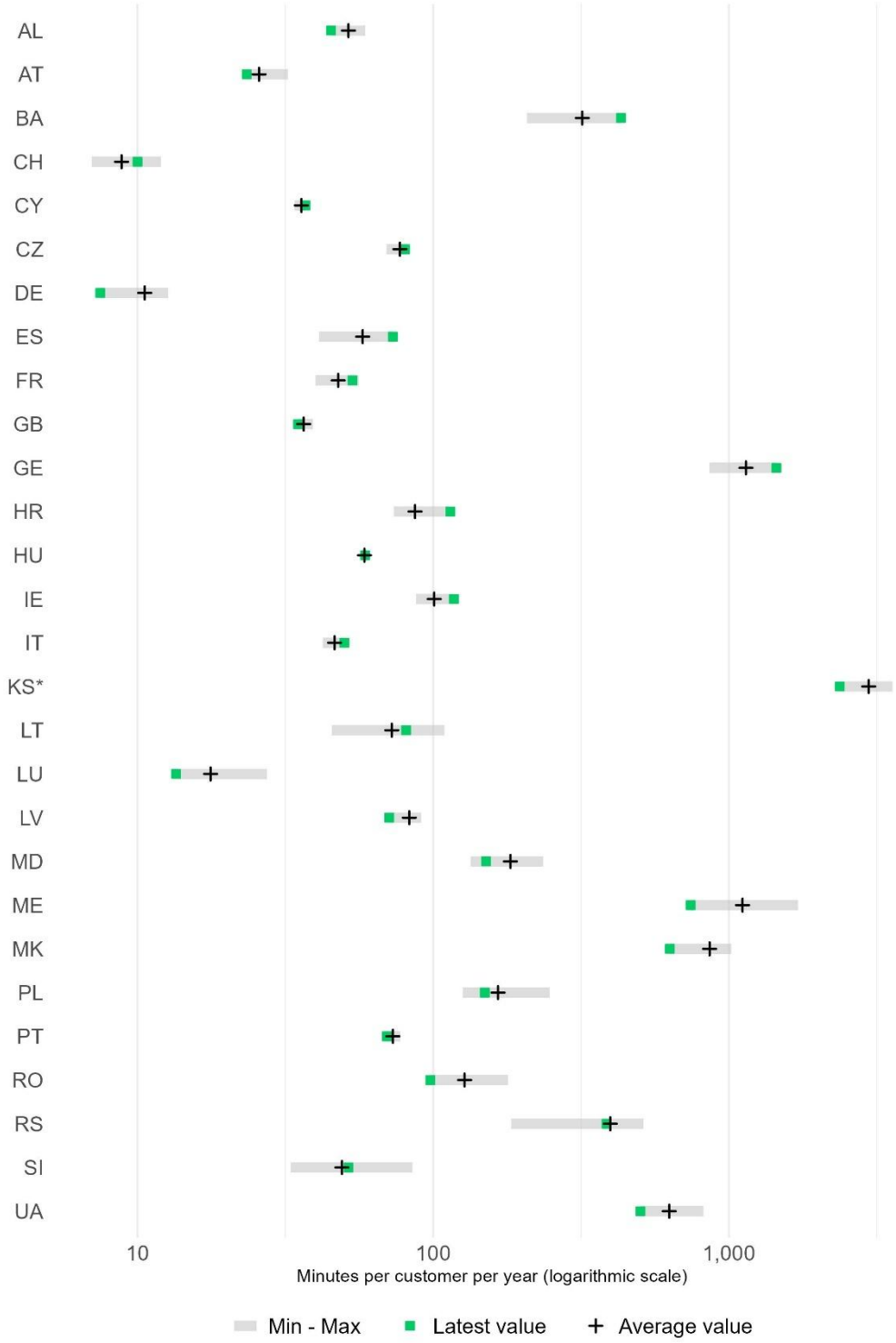


Figure 4 – Electricity SAIDI unplanned without ee, boxplot, all countries

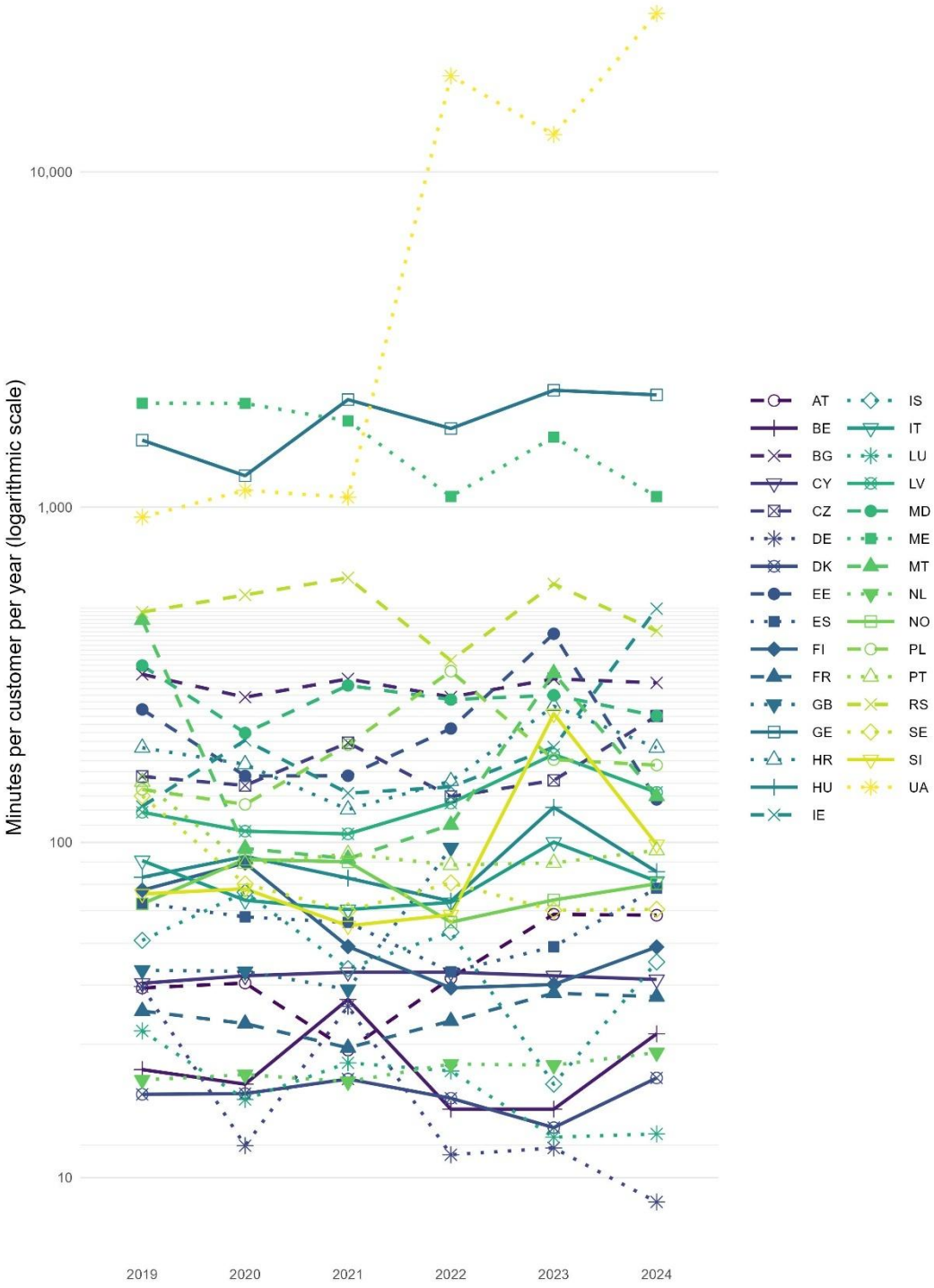


Figure 5 – Electricity SAIDI unplanned with ee, all countries

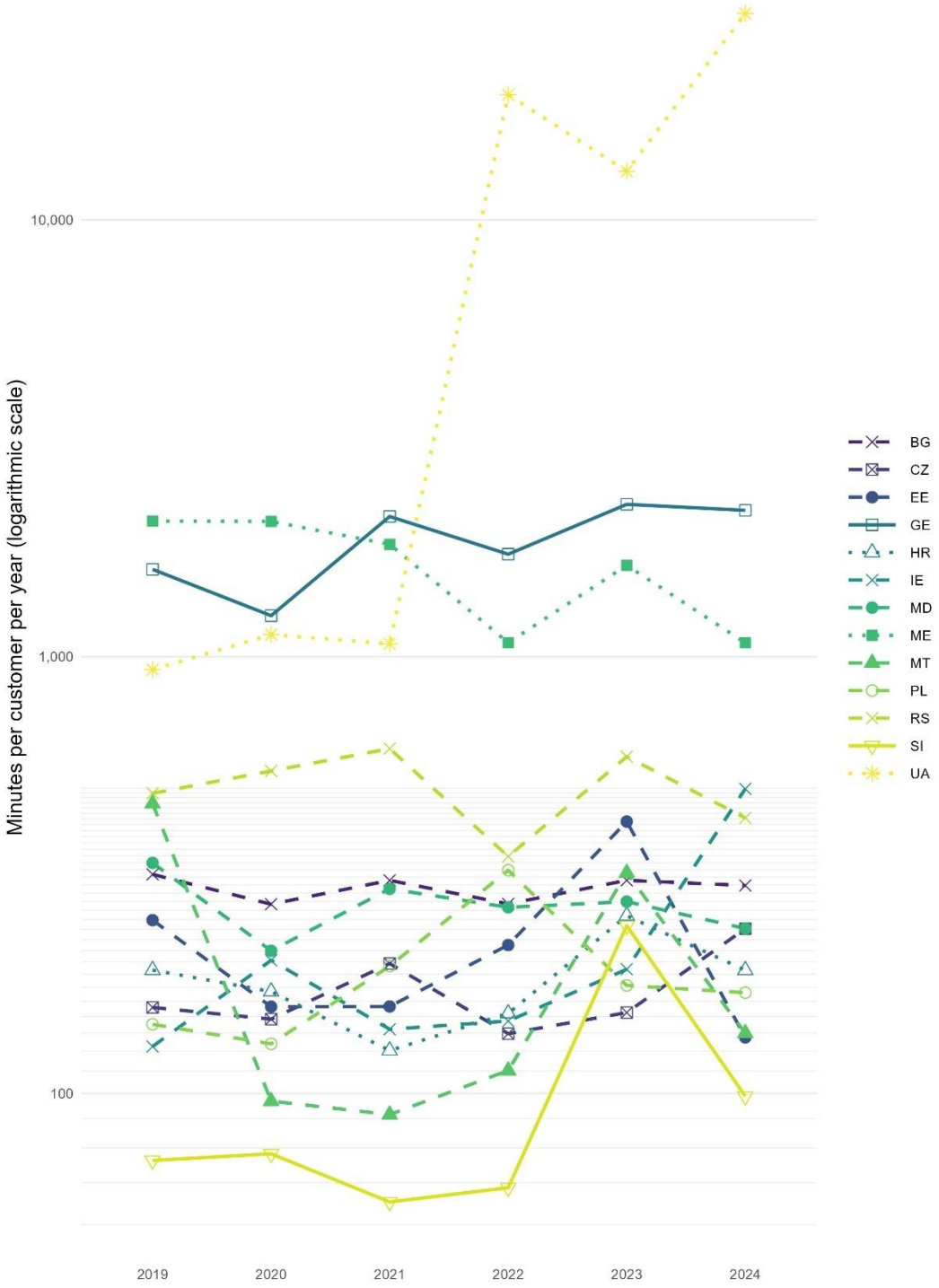


Figure 6 – Electricity SAIDI unplanned with ee, countries above limit

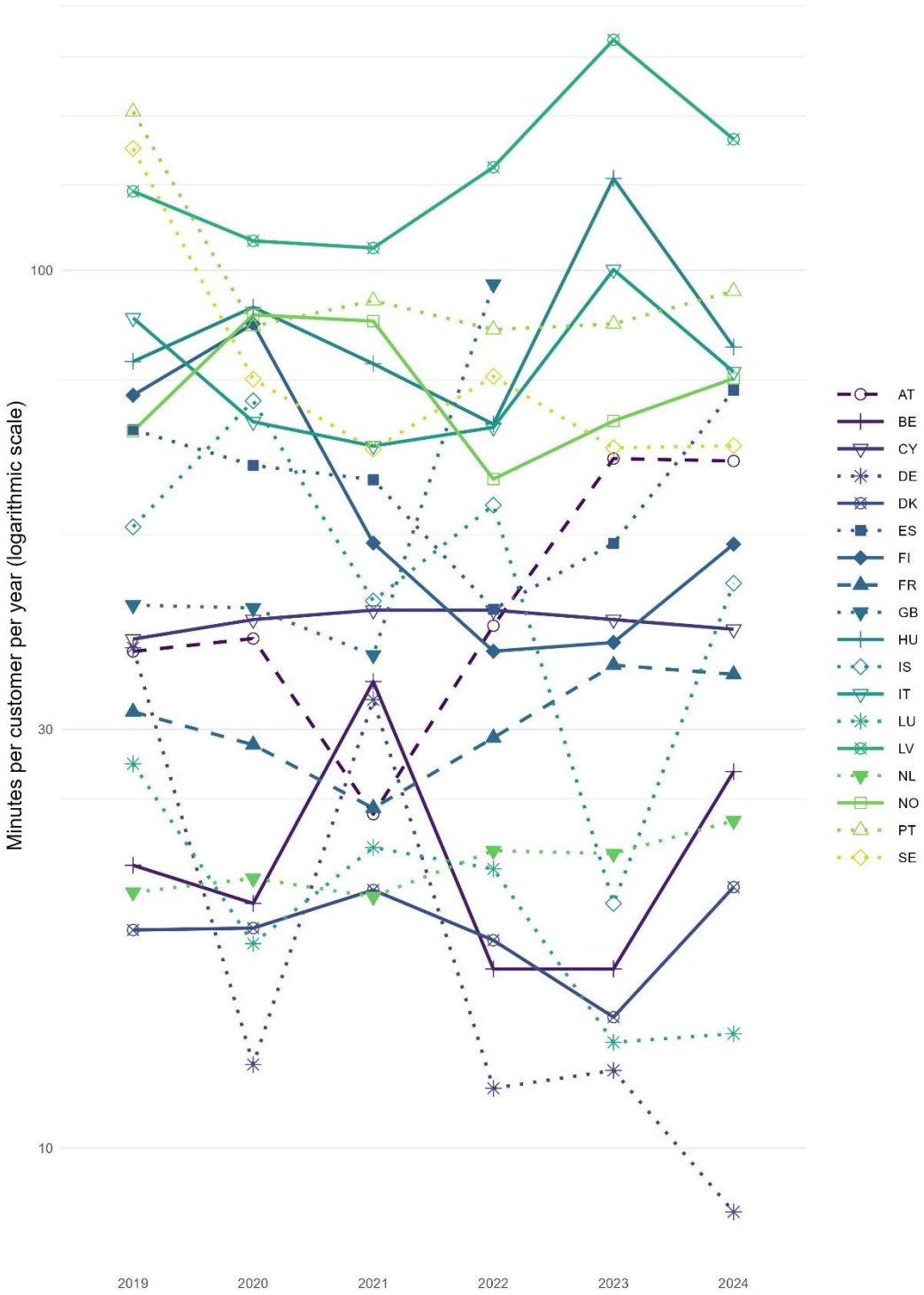


Figure 7 – Electricity SAIDI unplanned with ee, countries below limit

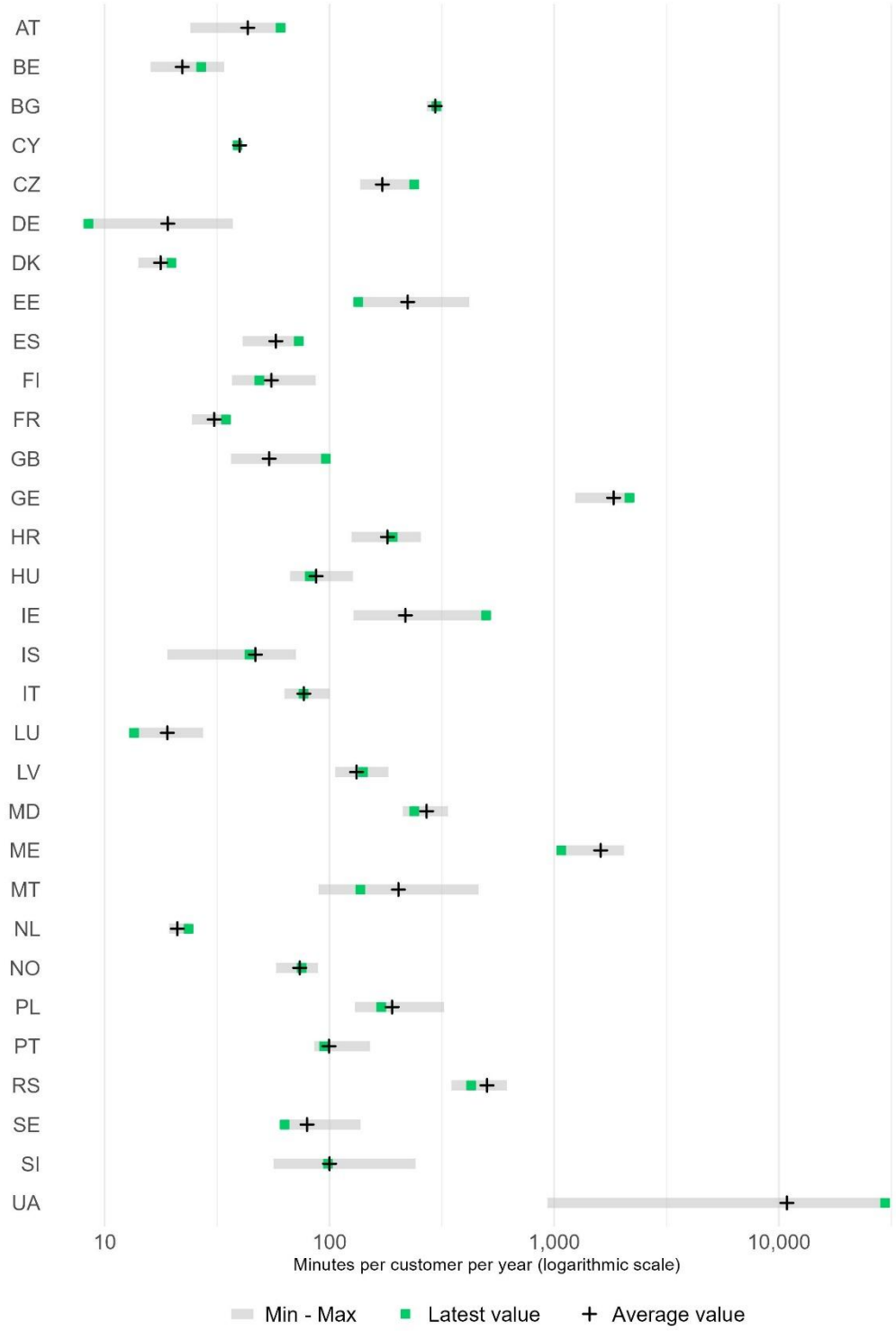


Figure 8 – Electricity SAIDI unplanned with ee, boxplot, all countries

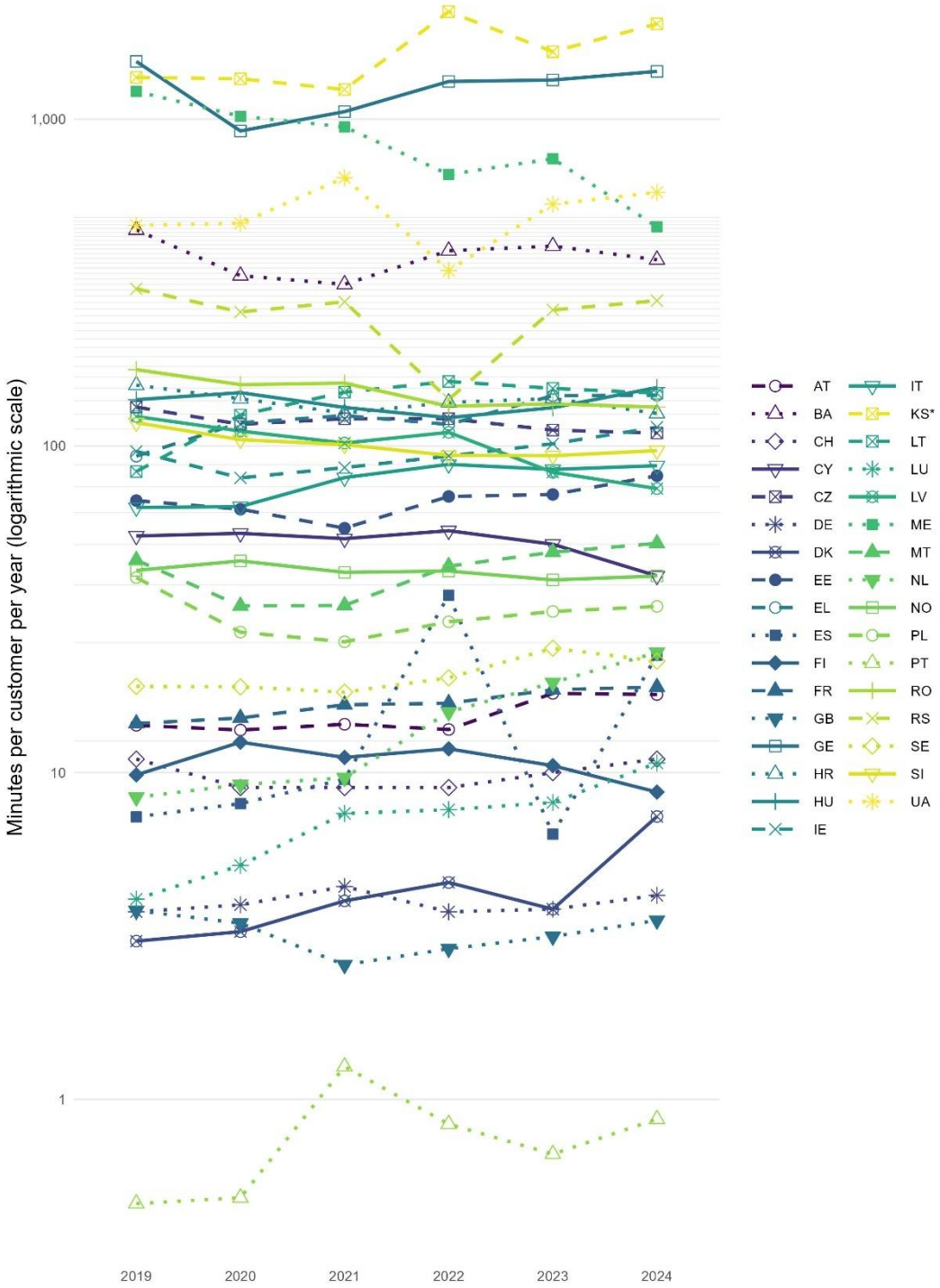


Figure 9 – Electricity SAIDI planned, all countries

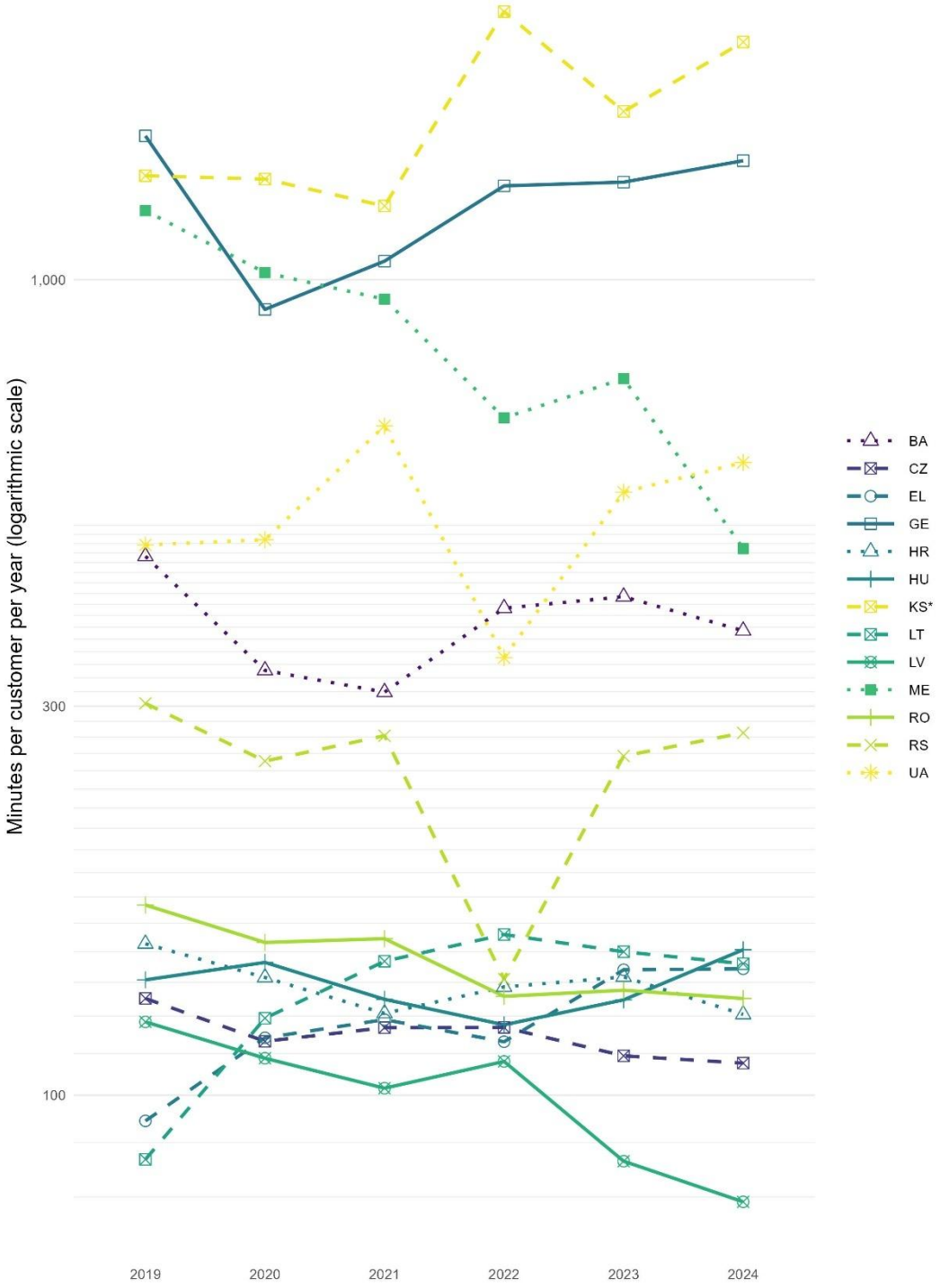


Figure 10 – Electricity SAIDI planned, countries above limit

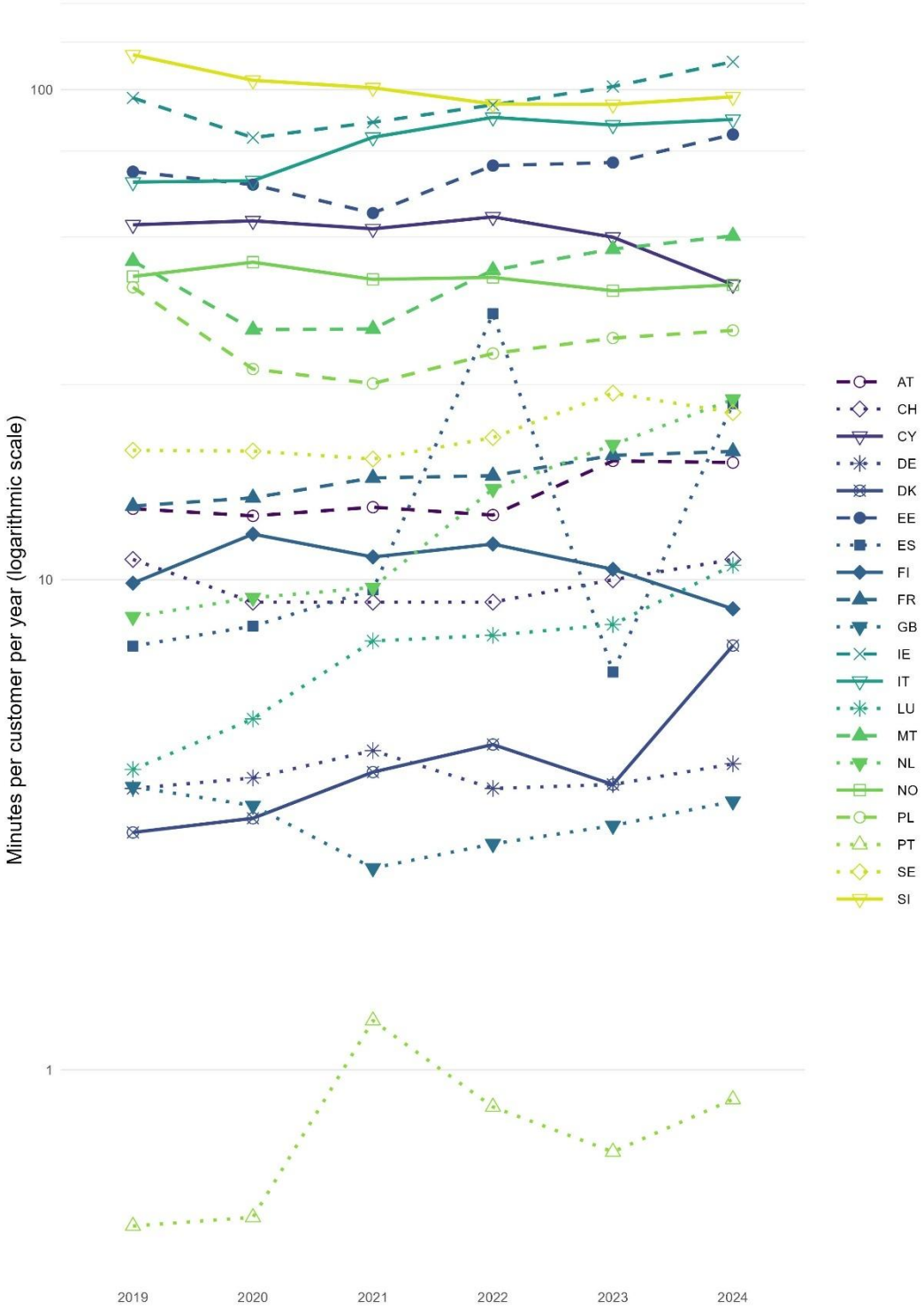


Figure 11 – Electricity SAIDI planned, countries below limit

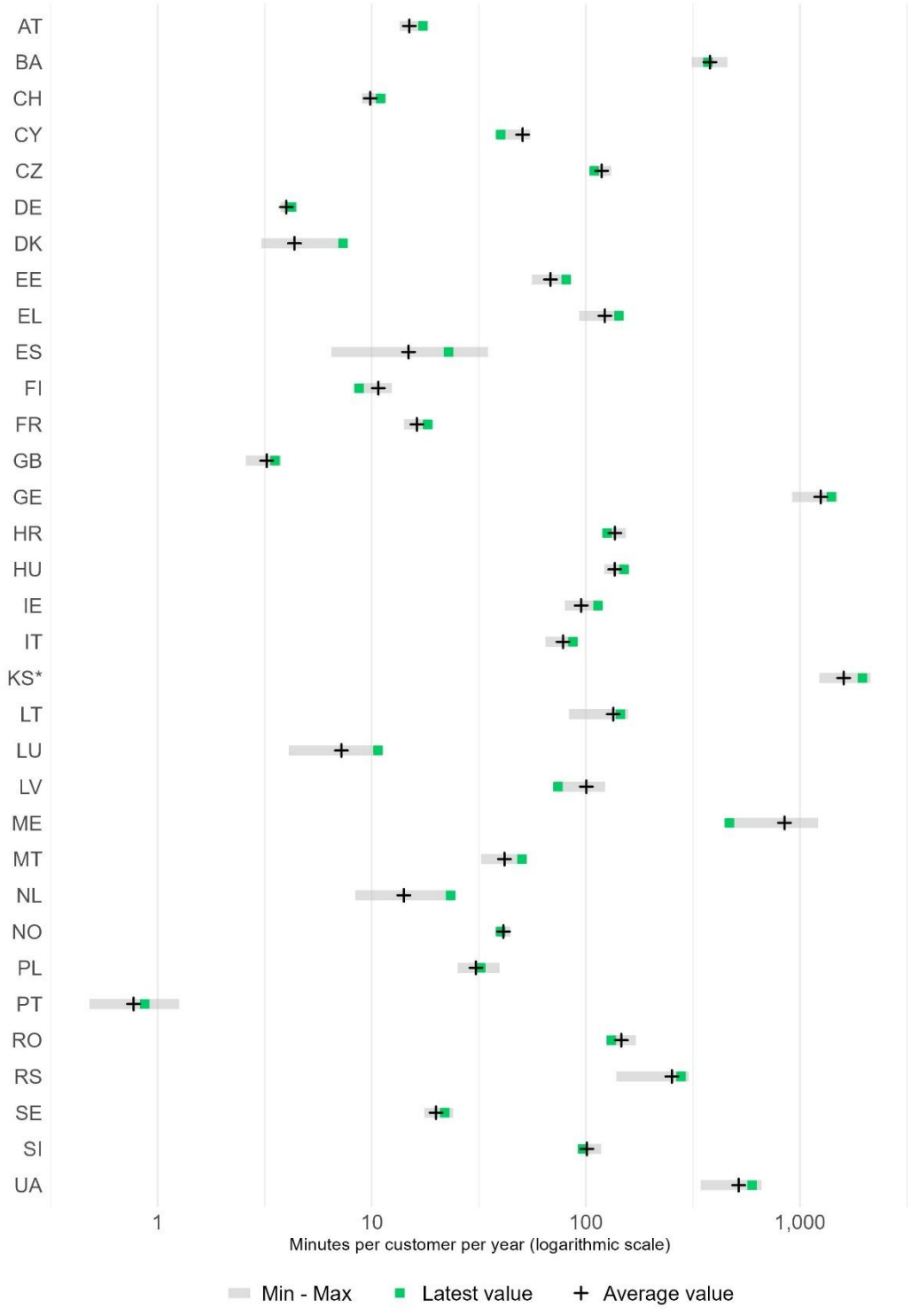


Figure 12 – Electricity SAIDI planned, boxplot, all countries

2.2 System Average Interruption Frequency Index – SAIFI

The System Average Interruption Frequency Index (SAIFI) measures the average number of supply interruptions experienced by a customer over a given year. It is calculated as the sum of the number of customers affected by each interruption event, divided by the total number of customers served.

The trend analysis introduced for SAIDI in the previous chapter is also applied to the SAIFI indicator. The same general considerations apply when interpreting the results: unplanned SAIFI without exceptional events generally shows less year-to-year variability, while unplanned SAIFI with exceptional events fluctuates more. Planned SAIFI should be interpreted separately, depending on the reasons for planned interruptions in that country. Changes in its value may reflect the frequency of planned network works rather than an improvement or deterioration in continuity of supply.

Some of the country-specific observations are:

- SAIFI and SAIDI have closely related trend lines in Sweden. Unplanned SAIFI with and without exceptional events are descending, while planned SAIFI is ascending. In Sweden, these trends are the same for SAIFI as they are for SAIDI
- Montenegro has the similar trend lines for SAIFI indices as it has for SAIDI.
- Great Britain has a decrease in unplanned SAIFI excluding exceptional events, while SAIFI including exceptional events is stable.
- Trend lines for SAIFI in Ukraine are similar to those for SAIDI. It is the only country where unplanned SAIFI including exceptional events is ascending.
- Moldova had stable SAIDI trend lines, however there is a leap upwards with unplanned SAIFI without exceptional events between the years 2020 and 2021. The values have remained at that level since 2021.
- Romania has planned SAIFI with a stable trend line, however the planned SAIDI is descending.

Other than the exceptions mentioned above, unplanned SAIFI without exceptional events is fairly stable. The trend line of only 14% of countries is ascending while it is descending for 18% and stable for 68% of the participants. Countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line.

Even though exceptional events are unpredictable, the indicator unplanned SAIFI with exceptional events is even steadier as the trend lines are stable for 77% of the countries, descending for 17% and ascending for 7%. In case of planned SAIFI, trend lines are descending for 19% of the participants, stable for 53%, and ascending for 28%. Percentages for SAIFI with exceptional events do not add up to 100% due to a rounding error since no decimal points were used.

Chapter 2.1 provided information on what is included in SAIDI in various countries. Most of those rules apply to SAIFI as well, which was indicated when describing the practices on SAIDI.

SAIFI is not monitored/calculated in Spain. Instead, an indicator called NIEPI is used which is weighted by installed capacity and is equivalent to Average System Interruption Frequency Index (ASIFI).

The values in Great Britain are based on the total number of long customer interruptions per customer per year across all of the electricity distribution networks across England, Wales and Scotland. The Interruption Frequency metric used is Customer Interruptions. Just like the values provided for SAIDI, the 2023 and 2024 values for SAIFI were not yet available during drafting of this report.

The higher value of planed SAIFI in the Netherlands in 2024 (0.42 compared to 0.10 or less in the preceding years) is due to increased planned outages for offshore network for wind turbines.

Lithuania also uses regulatory reference levels, i.e. the regulatory minimum electricity distribution reliability levels. These levels, applicable to their DSOs, were 52.12 minutes per customer for SAIDI and 0.72 interruptions per customer for SAIFI for 2019–2021, and 94.058 minutes per customer for SAIDI and 1.062 interruptions per customer for SAIFI for the 2022–2026 regulatory period. The National Regulatory Authority (NRA) NERC has now adopted Decision No. O3-1026 of 24 July 2026, establishing new regulatory minimum reliability levels for DSOs for the 2027–2031 regulatory period: 93.922 minutes per customer for SAIDI and 1.038 interruptions per customer for SAIFI.

As was explained in the previous chapter, Belgium monitors different voltage levels for planned (HV and EHV) and unplanned (LV and MV) interruptions. Moreover, the SAIFI values Belgium provided for this report only include the regions of Brussels and Wallonia. Since Belgium monitors indicators for planned interruptions on transmission level only, it is omitted from the figures with planned SAIFI but is included in Table 26 in Annex 3.

In addition to only providing the SAIDI and SAIFI indicator values for transmission, Greece indicated that exceptional events were excluded from the SAIFI values calculated by the TSO. These would be the incidents with lasting for more than five days. Furthermore, the planned SAIFI and SAIDI indicators are not monitored at transmission level in Greece.

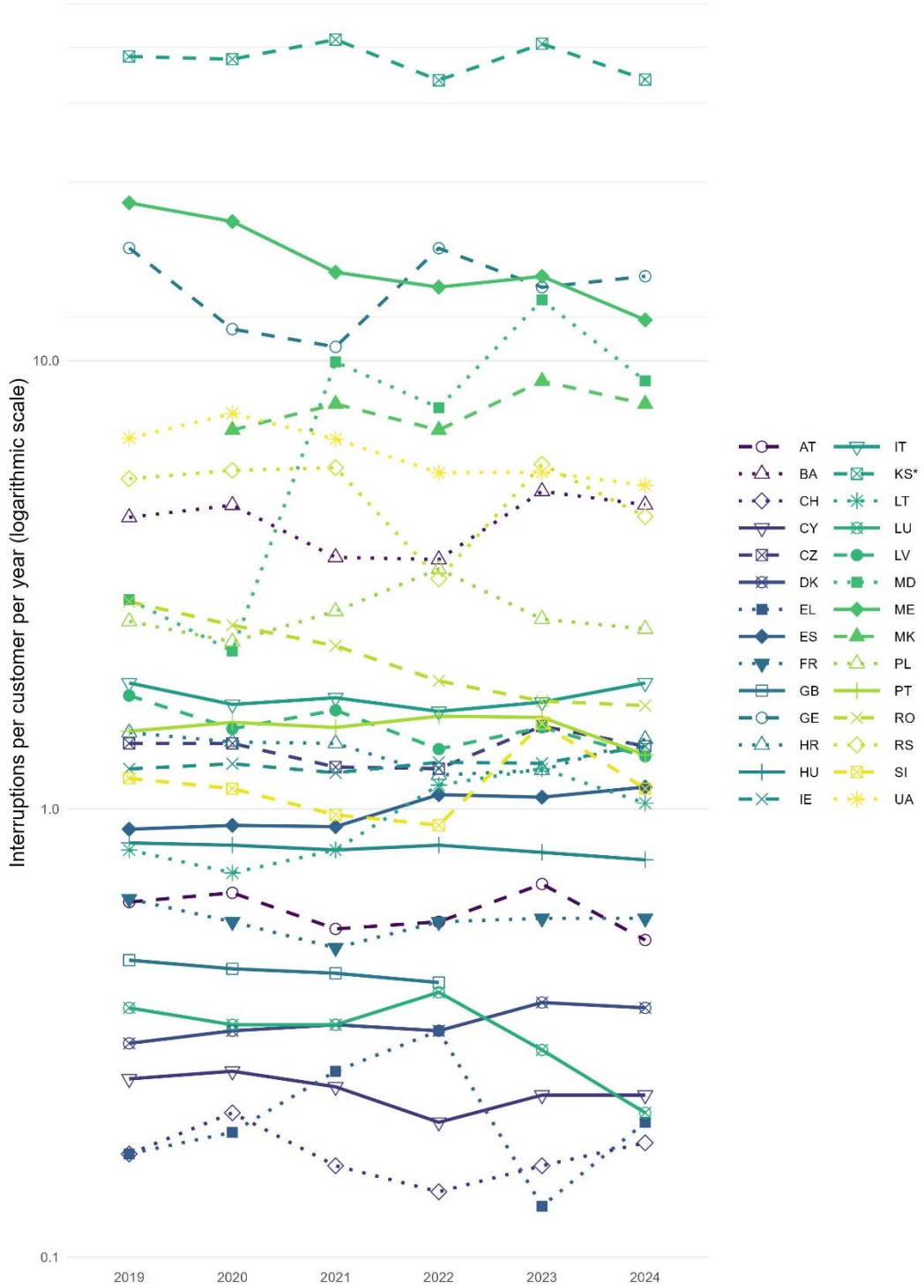


Figure 13 – Electricity SAIFI unplanned without ee, all countries

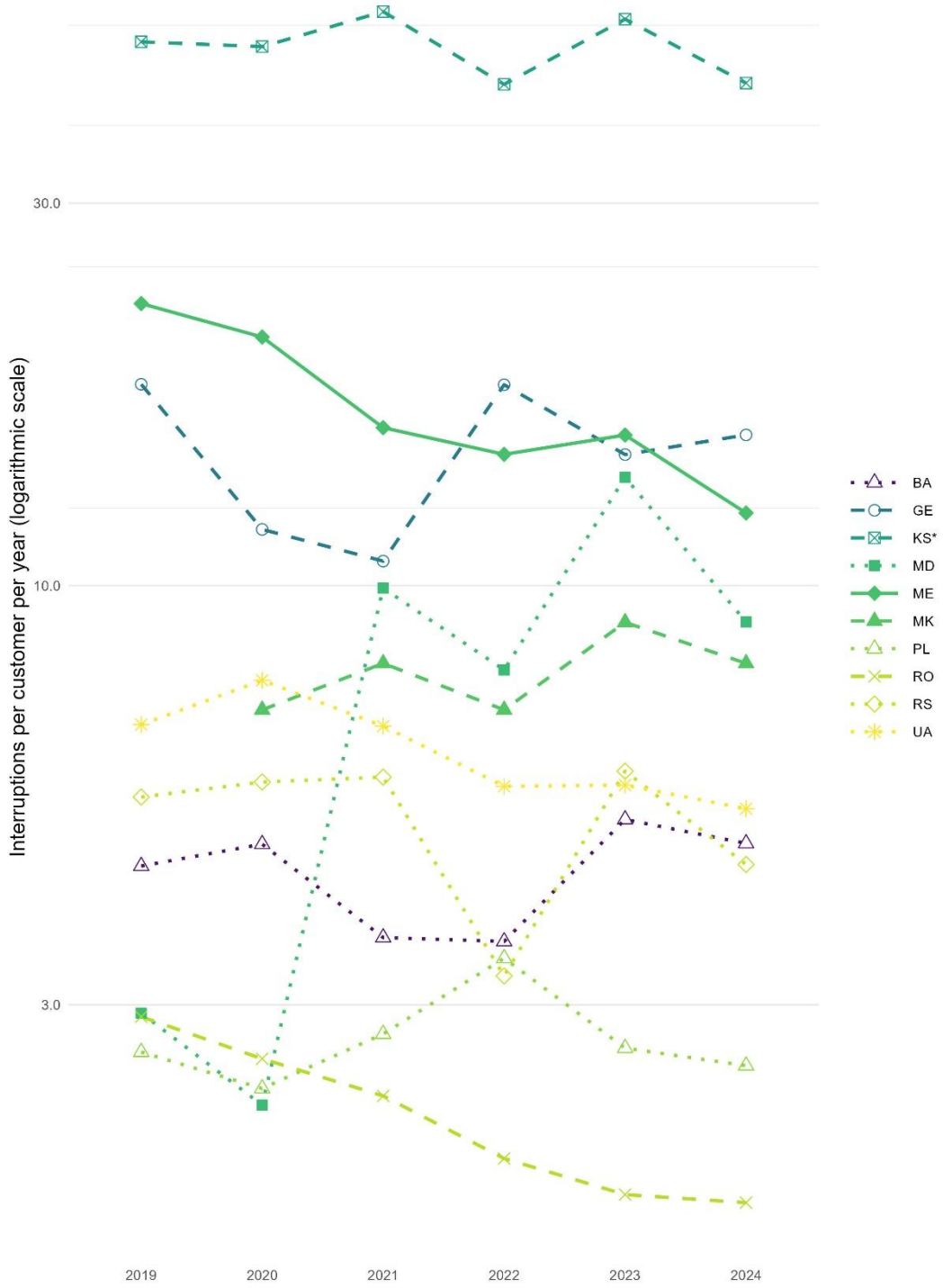


Figure 14 – Electricity SAIFI unplanned without ee, countries above limit

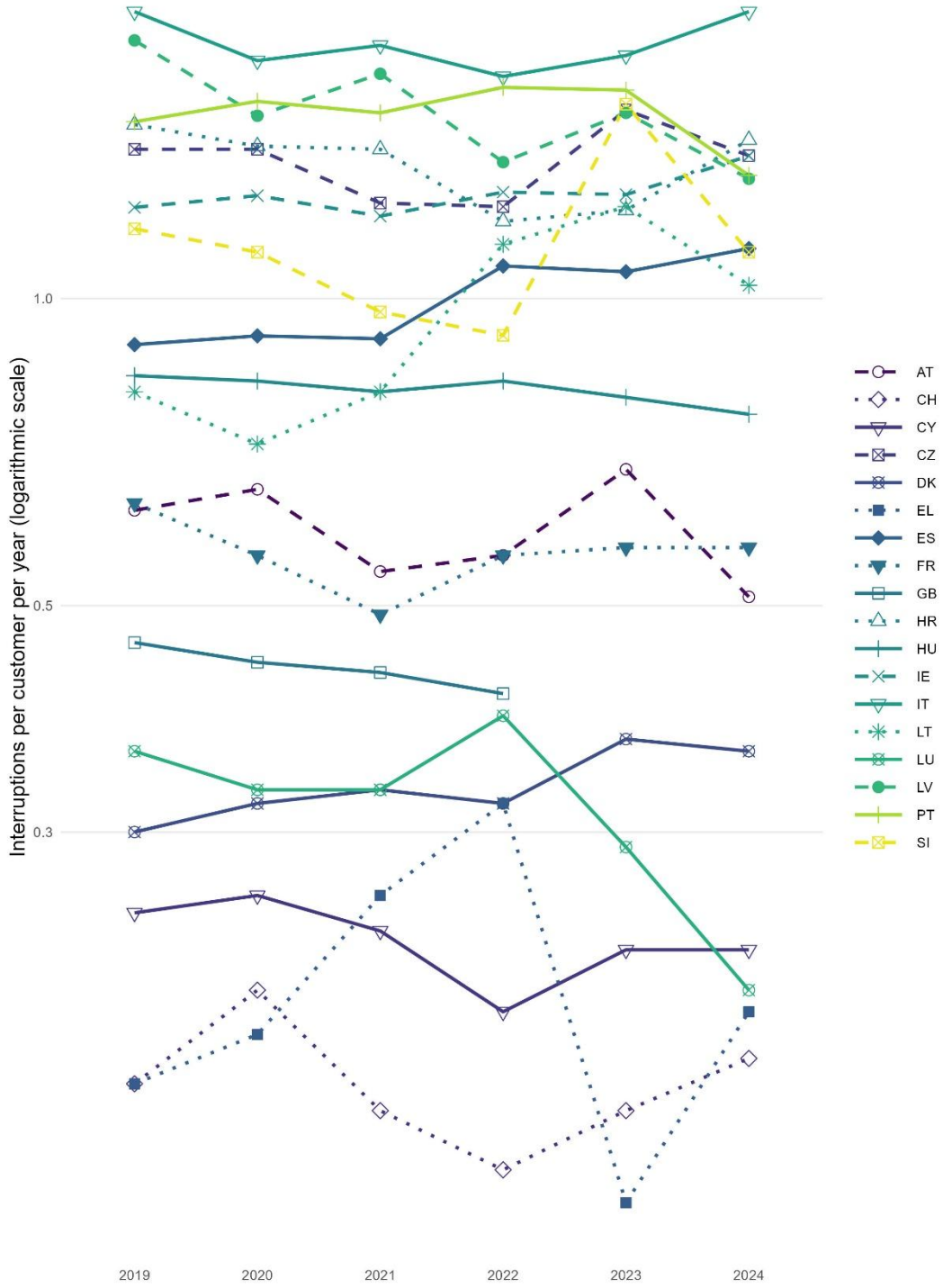


Figure 15 – Electricity SAIFI unplanned without ee, countries below limit

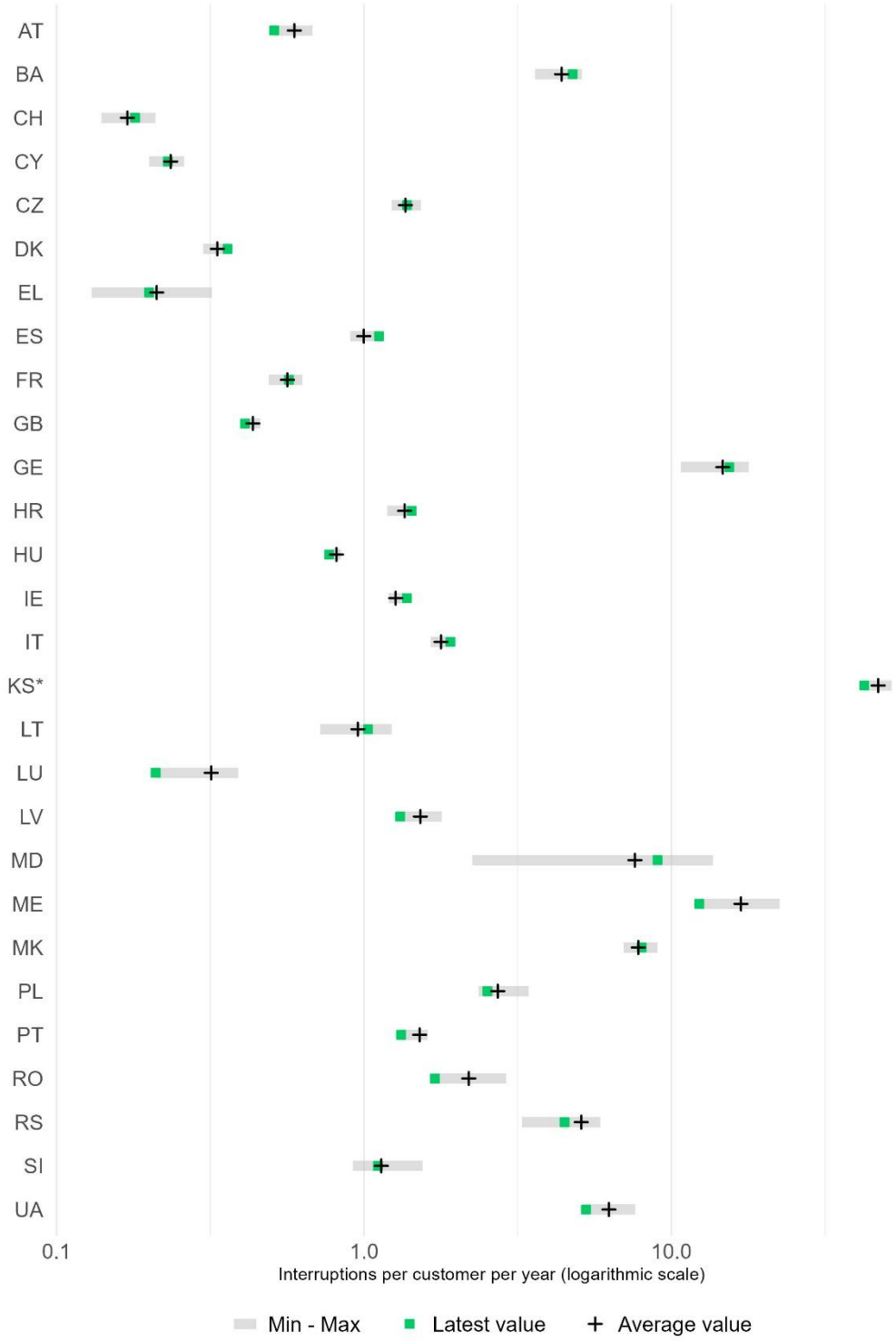


Figure 16 – Electricity SAIFI unplanned without ee, boxplot, all countries

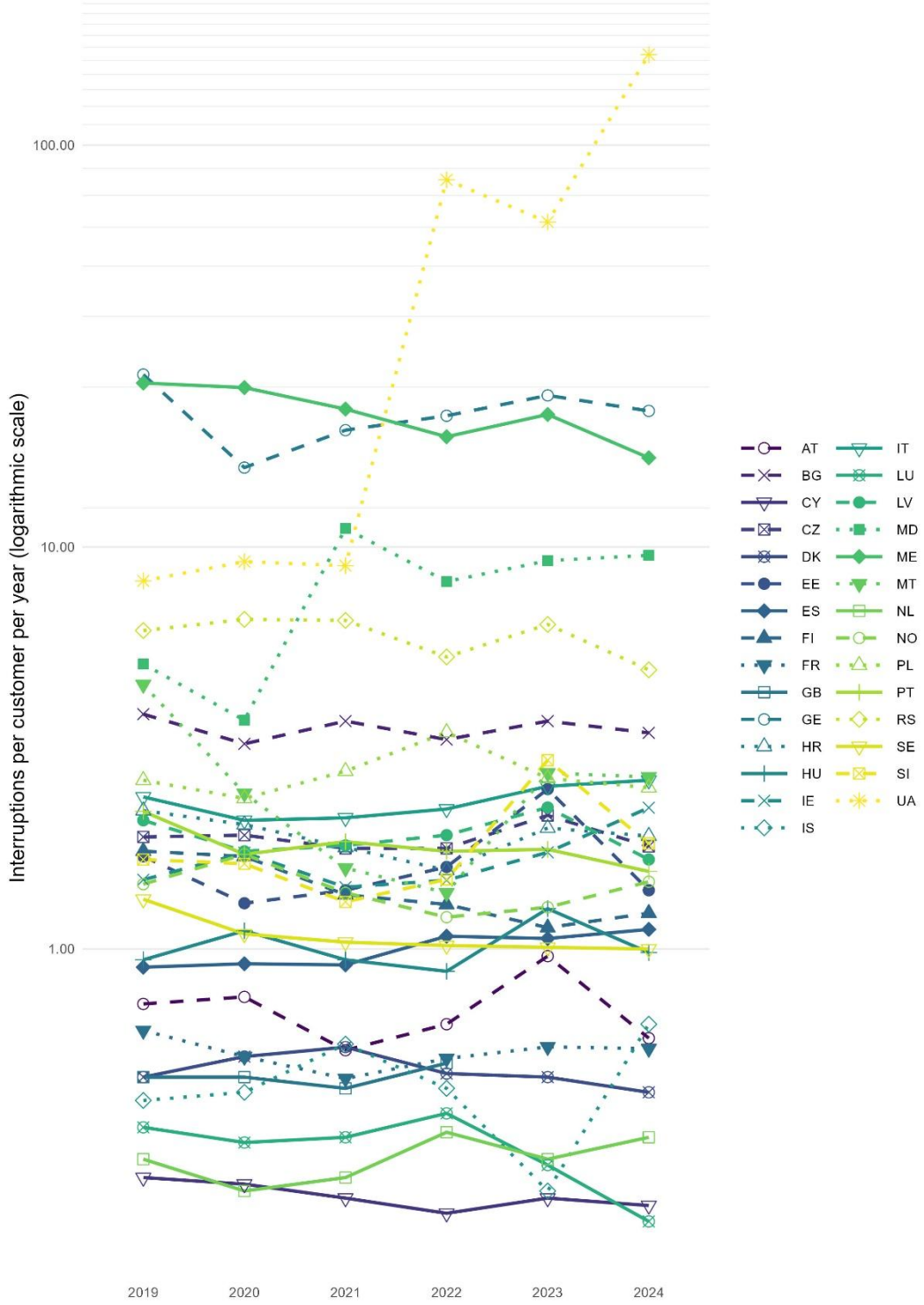


Figure 17 – Electricity SAIFI unplanned with ee, all countries

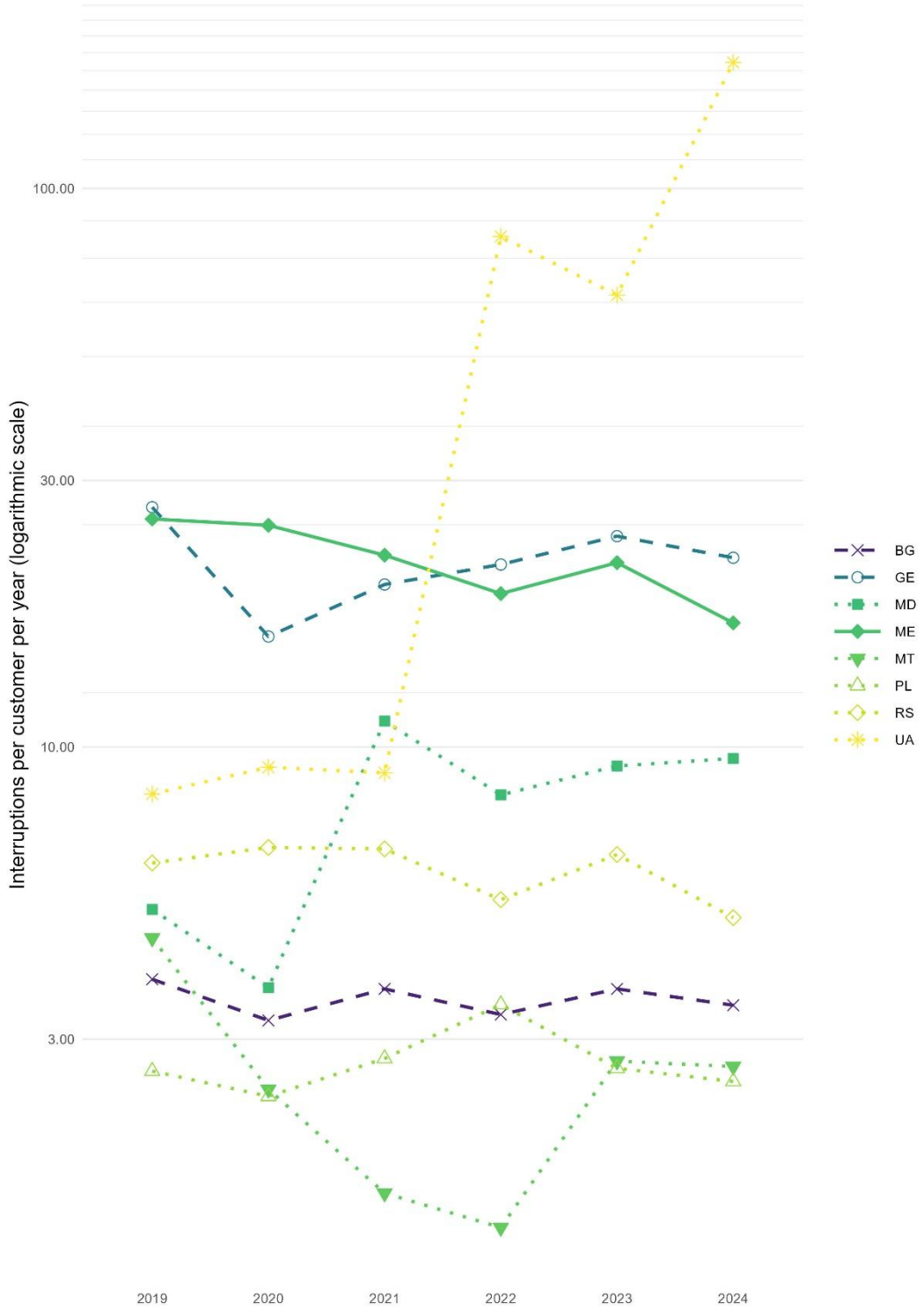


Figure 18 – Electricity SAIFI unplanned with ee, countries above limit

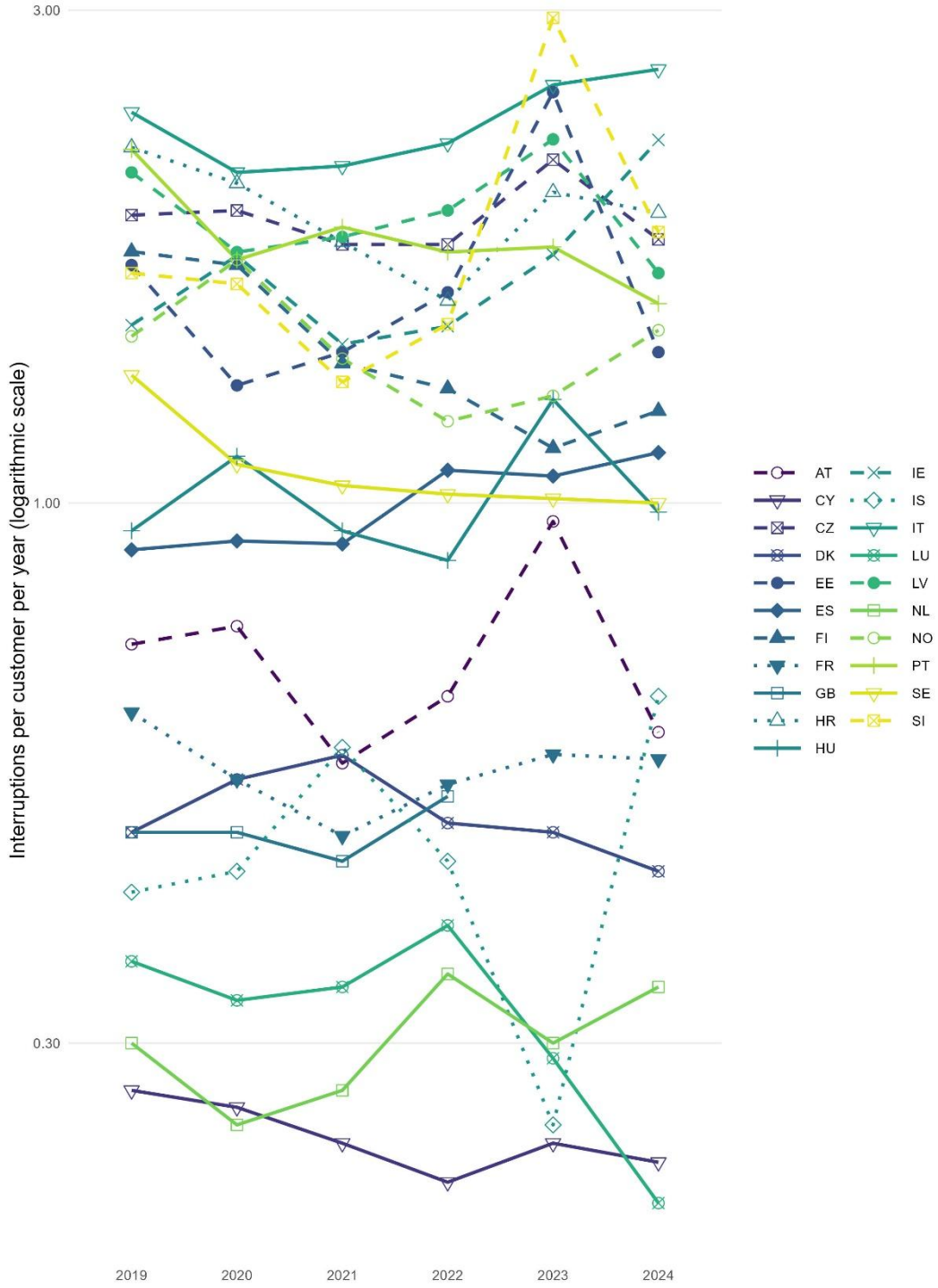


Figure 19 – 'Electricity SAIFI unplanned with ee, countries below limit

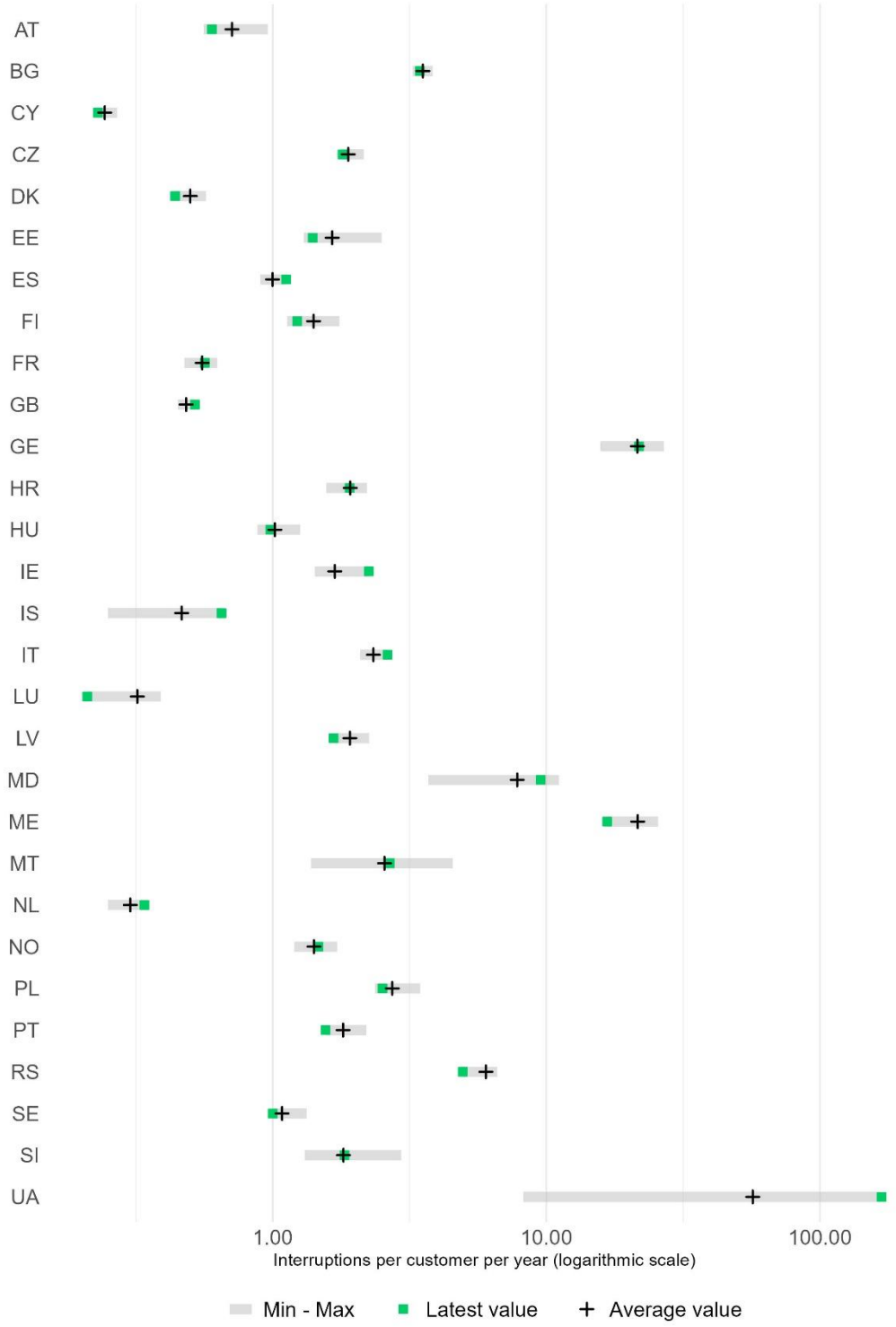


Figure 20 – Electricity SAIFI unplanned with ee, boxplot, all countries

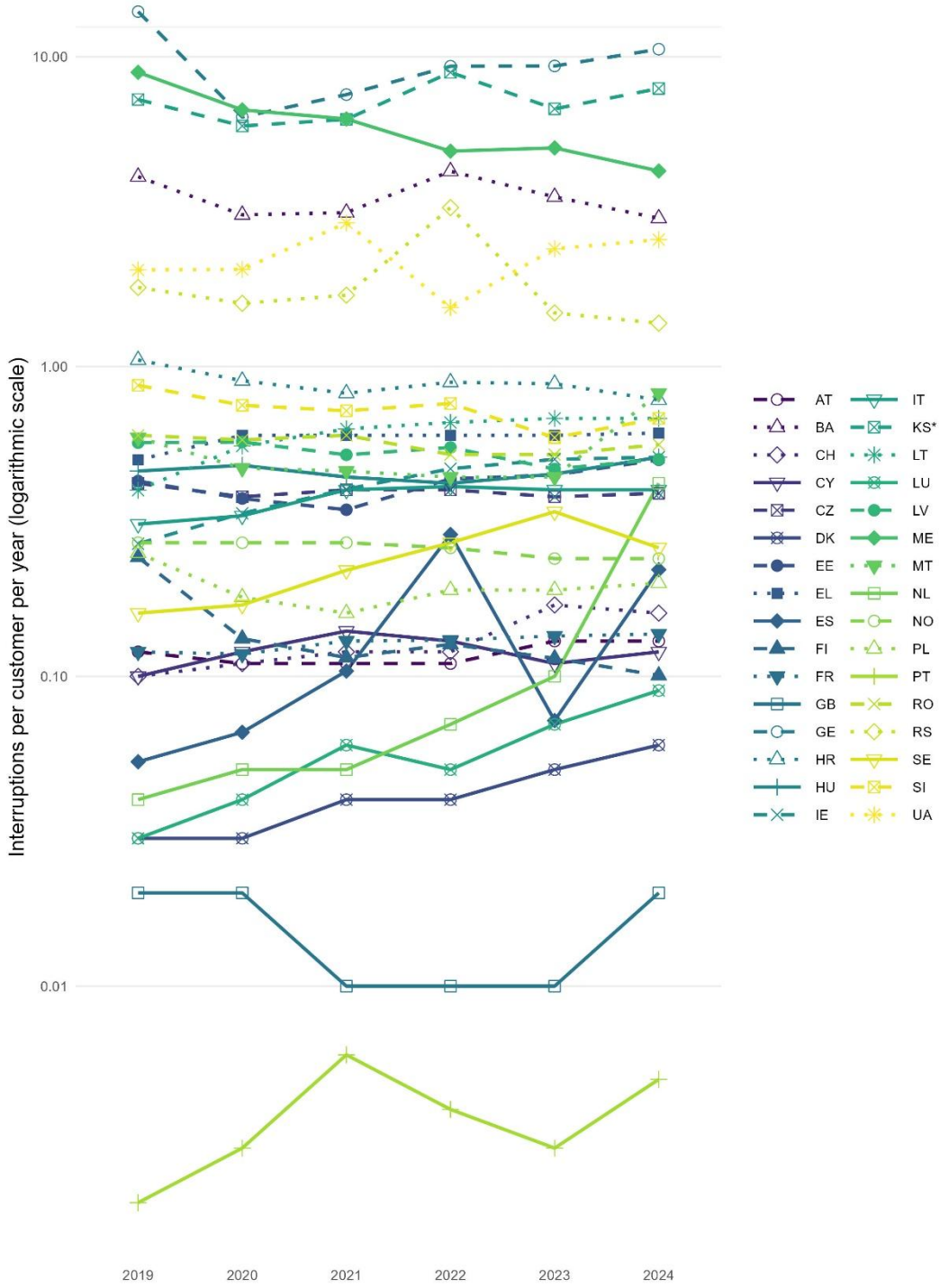


Figure 21 – Electricity SAIFI planned, all countries

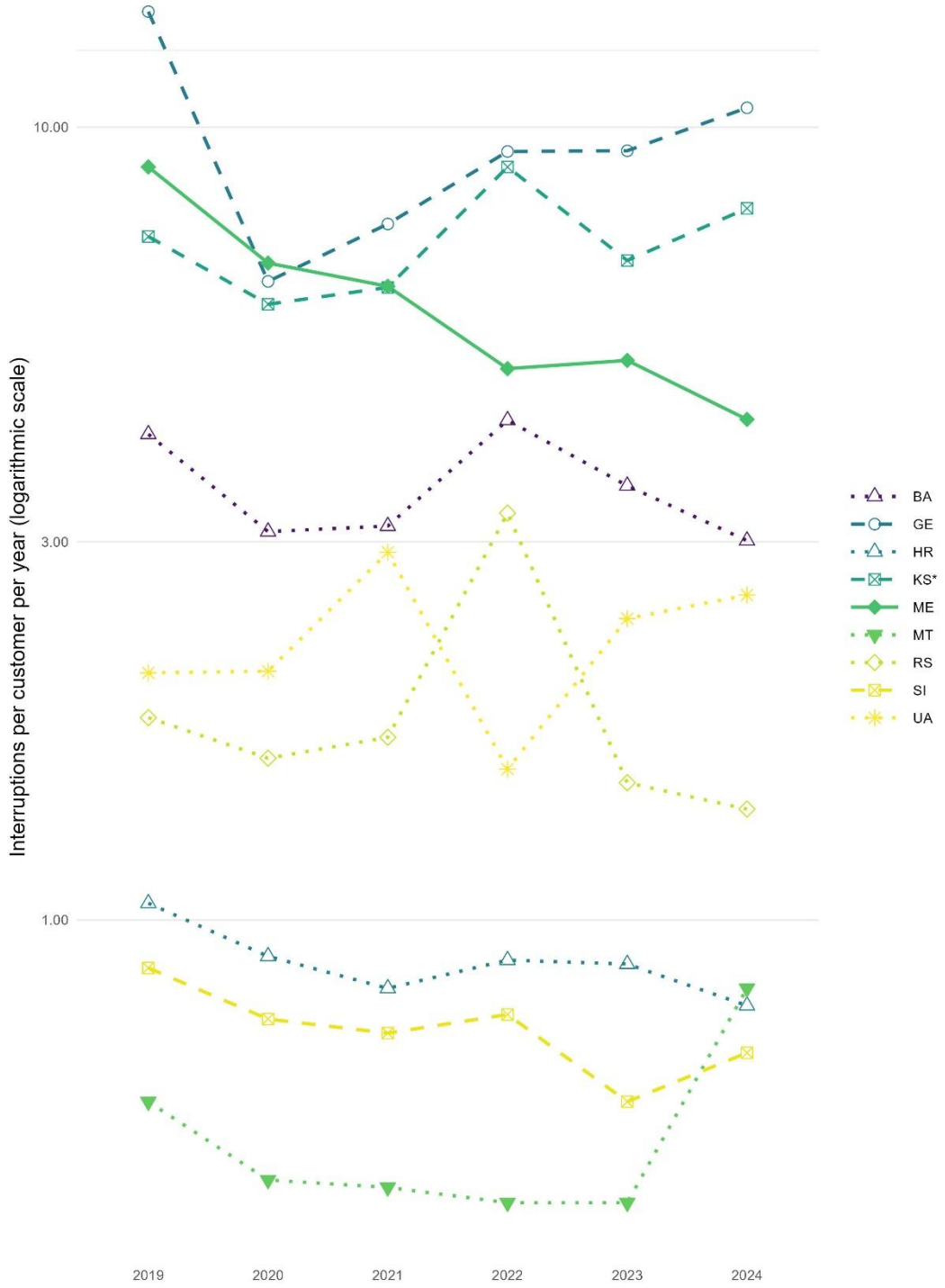


Figure 22 – Electricity SAIFI planned, countries above limit

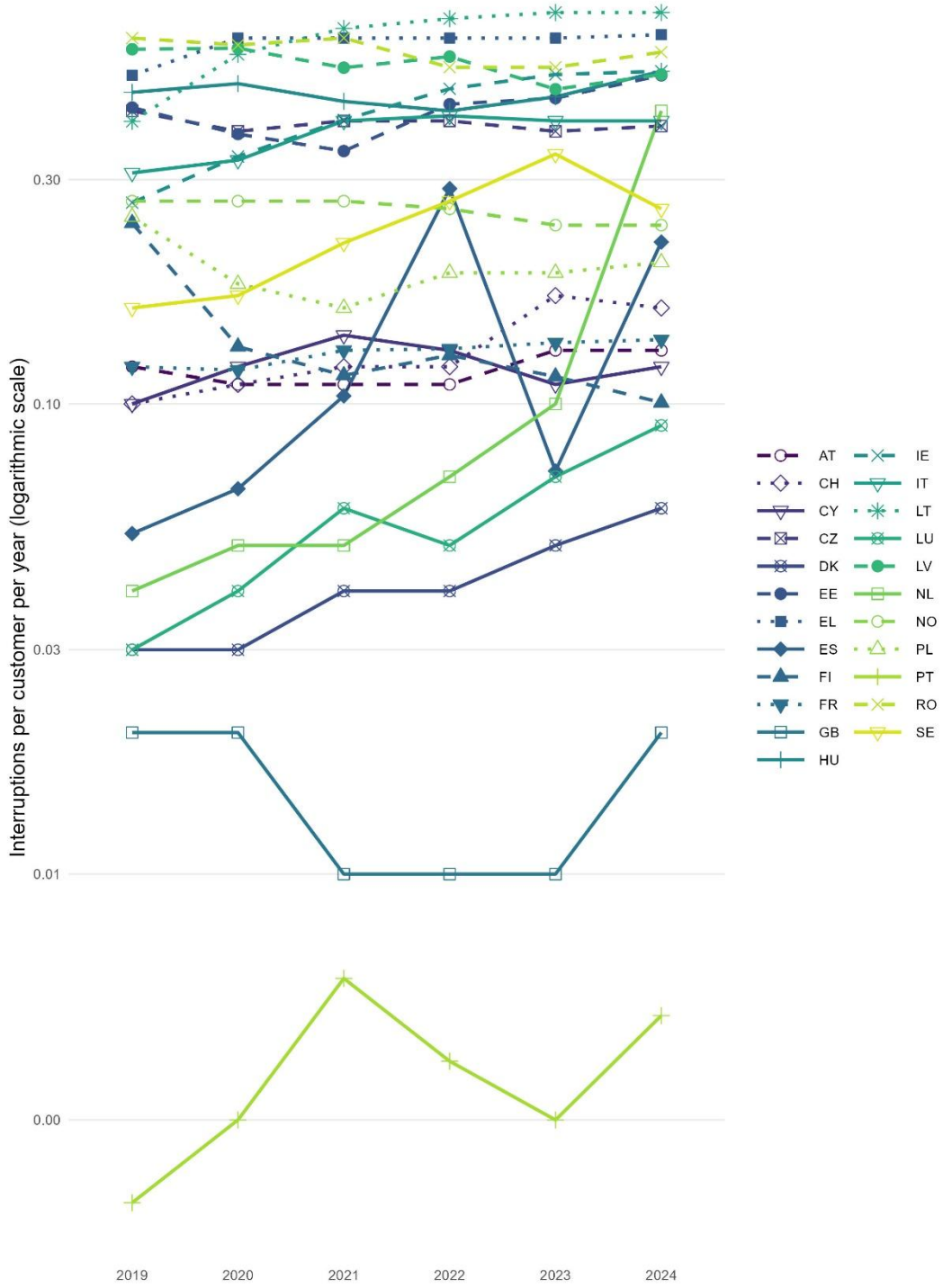


Figure 23 – Electricity SAIFI planned, countries below limit

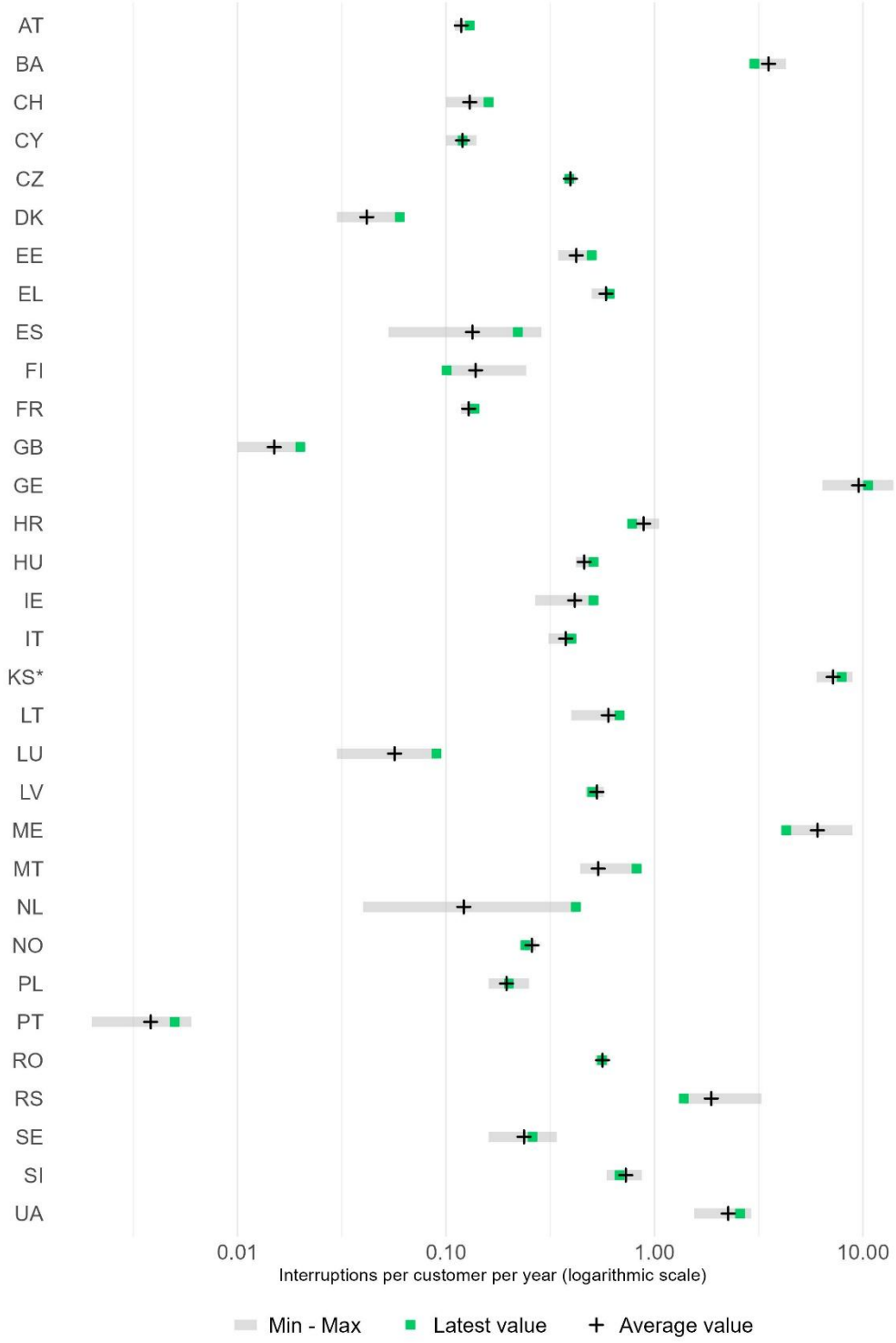


Figure 24 – Electricity SAIFI planned, boxplot, all countries

2.3 Interruptions in transmission networks

The most common indicators for measuring continuity of supply in transmission networks are ENS (energy not supplied) and AIT (average interruption time). ENS gives the total amount of energy that would have been supplied to interrupted users had there be no interruption. AIT is expressed in minutes per year and calculated as 60 times the ENS (in megawatt hours (MWh)) divided by the average power supplied by the system (in megawatt (MW)), representing the equivalent duration for which the whole system would have had to be interrupted to produce the same amount of unsupplied energy. The data are presented in Table 28 and Table 29 in the annex, but readers should keep in mind that the definition of transmission networks vary across Europe and that these differences can significantly affect comparison of data. For exact definitions of transmission network in each country, please refer to Table 2-2 in the 7th BR.

In general, some observations can be brought up:

- Two types of classes can be seen from AIT values: some countries seem to be having a flat trend line while others have much clearer peaks.
- Fluctuations can be in a wide range, from 0 to thousands of minutes.
- Additional data would be needed for further explanatory analysis.

Transmission networks transfer high amounts of energy, thus even a single interruption can cause high ENS values and fluctuations between years can be much higher than in distribution networks. The AIT values also fluctuate greatly. In countries where interruptions in transmission are rare, years with zero or nearly zero minutes of interruption time can be seen, but their peaks can be high if they occur.

Trend line analysis indicates that unplanned ENS indicator value is descending in 17% of the countries, is stable for 78% while it is ascending in 4%. Percentages for ENS do not add up to 100% due to a rounding error since no decimal points were used. Countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line. For unplanned AIT, trend lines are stable for 75% of the participants, descending for 17% and ascending for 8%.

The transmission network in Great Britain uses the indicator ENS rather than AIT, which is not used in formal regulatory or engineering frameworks in Great Britain. In addition, the terms High voltage (HV) and Extra high voltage (EHV) are not used to describe transmission voltages in Great Britain, where transmission is instead defined by specific nominal voltage levels (for example, 132 kV, 275 kV and 400 kV). The British values provided are in financial years, not calendar years. For example, '2024' for indicator ENS relates to the period from 1 April 2024 to 31 March 2025 and is the cumulative of lost energy in MWh across all three onshore transmission operators for the period. The annual value for 2024 was driven by the fire at the North Hyde substation on 20 March 2025, and the associated power outages for Heathrow airport and in West London. This incident accounted for 95% of the total incentivised energy not supplied in 2024-25.

Romania provided the AIT and ENS values for both consumers and producers. Transmission indicators in Serbia include part of the 110 kV network, but not all of it. In Slovenia as well as in Bosnia and Herzegovina, the AIT and ENS values are available only including exceptional events, indicated with footnotes in the annex. Sweden's values for transmission indicators only refer to Svenska Kraftnät, which is the primary TSO of Sweden. The other TSO, Baltic cable,

only has one connection to Germany. Spain uses the indicator TIM which is equivalent to AIT, but, like ENS, it is not separately collected for planned and unplanned interruptions.

In their calculation of the AIT indicator, Poland includes interruptions resulting from unplanned events/failures of network elements for which their TSO is contractually liable and which caused interruptions in the supply of electricity to end-users connected to the transmission network. The indicator does not include interruptions in the supply of electricity from the transmission network which were caused by failures of devices belonging to end-users located behind point of delivery from the transmission network.

In Albania, the AIT and ENS indicators include both planned and unplanned interruptions, but force majeure events (exceptional events) are not included.

Austria uses the ENS indicator, but only for distribution. Norway does not use ENS as a standard monitoring practice, but a comparable indicator has been derived which refers to events in the transmission network that result in outages across all network levels. No additional information was provided on this indicator used by Norway.

In addition to AIT, Belgium monitors planned SAIDI and planned SAIFI, indicators typically used for distribution, only on HV and EHV levels. Their TSO, Elia, explained that customers connected to the EHV and HV usually have multiple connections (redundancy) which allows the TSO to work on one connection without an interruption for the customer. For those with only one connection, work is aligned with downtime, i.e. when the customer does not need power or is carrying out work on their connection point and requests an interruption himself. In recent years, nearly all planned works can be carried out without interruptions to customers or coordinated without customer impact. As a result, the planned SAIDI and SAIFI in Belgium is nearly zero, listed as 0.00 in Table 23 and Table 26.

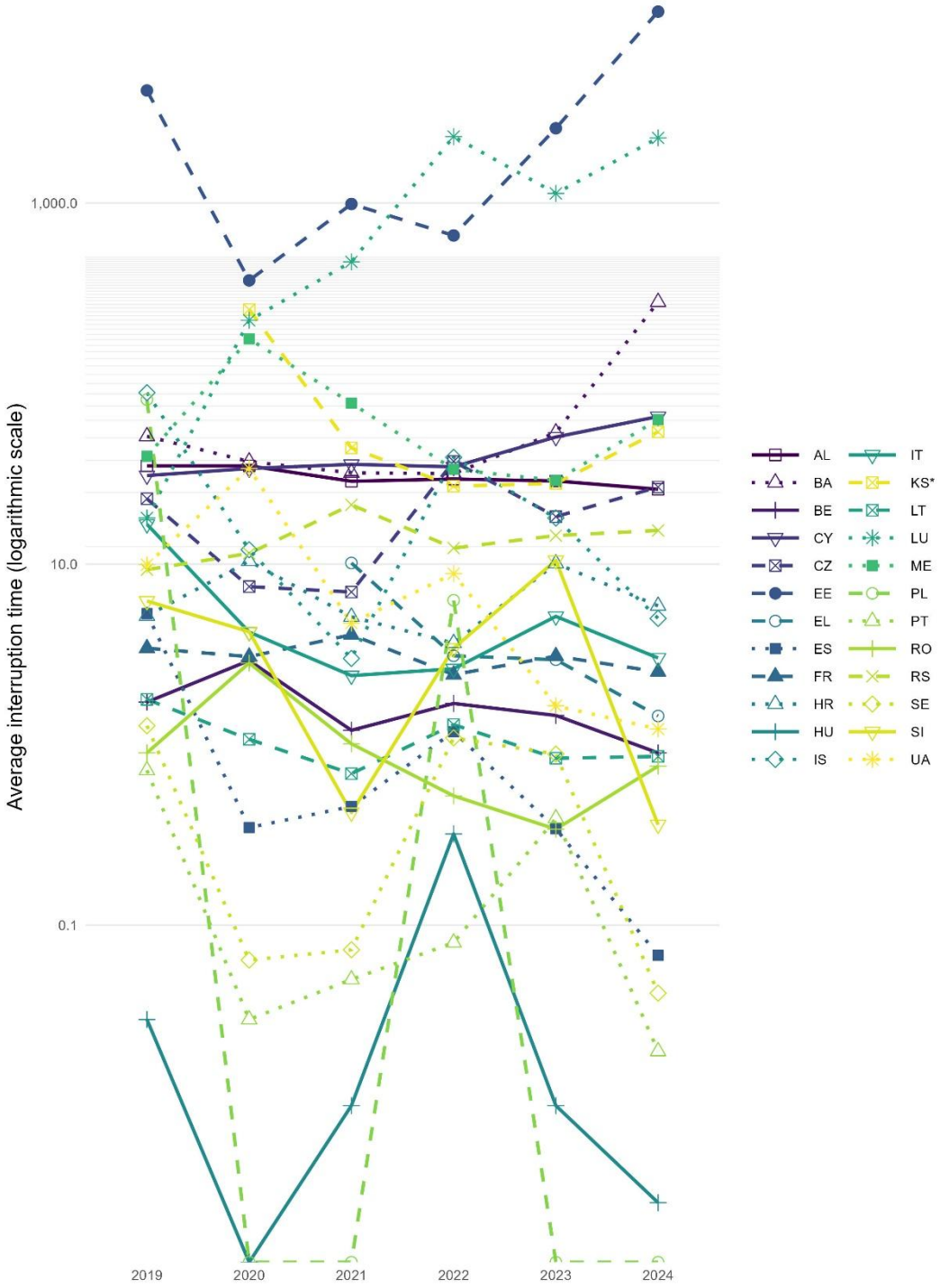


Figure 25 – Electricity AIT unplanned without ee, all countries

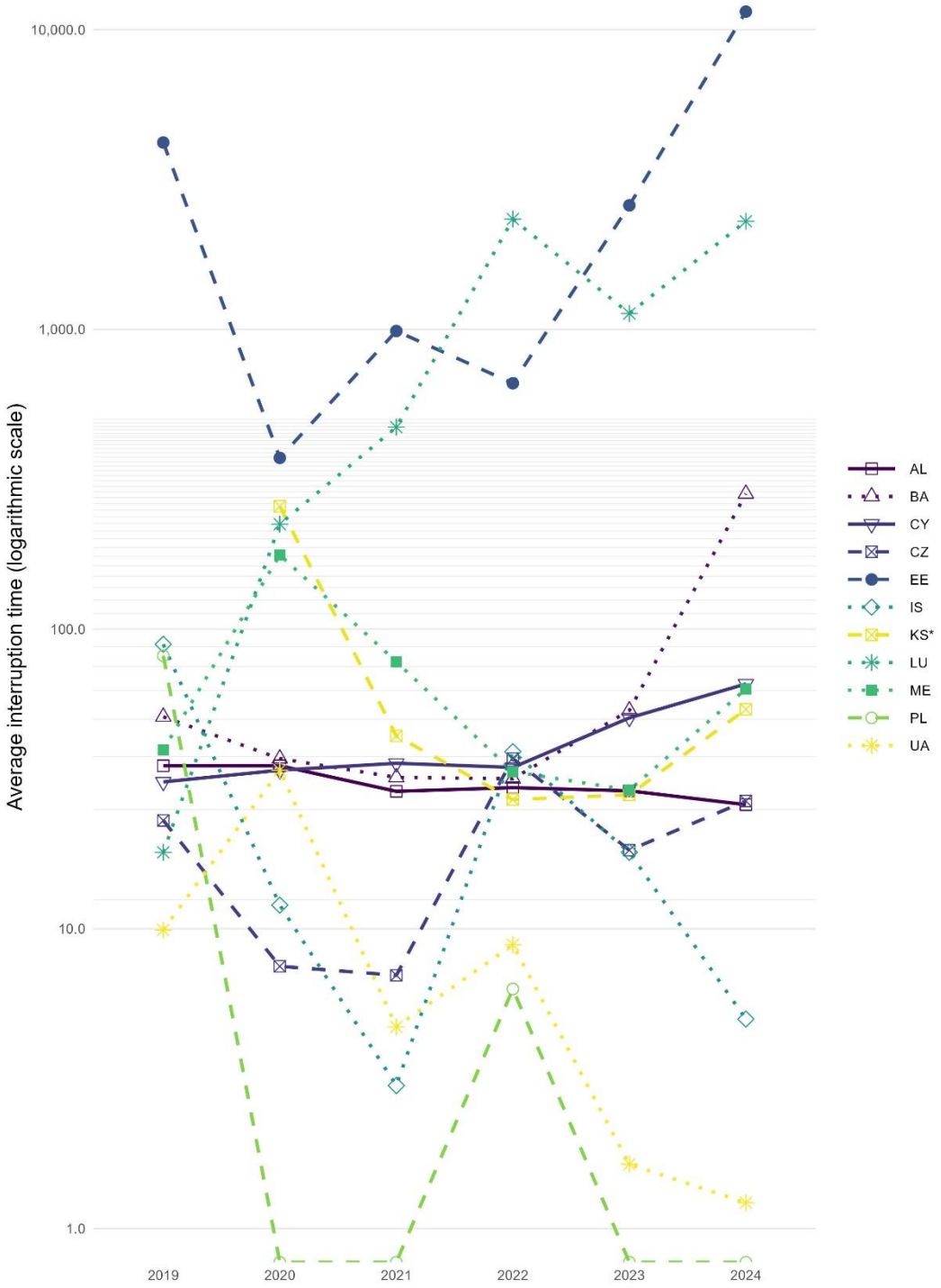


Figure 26 – Electricity AIT unplanned without ee, countries above limit

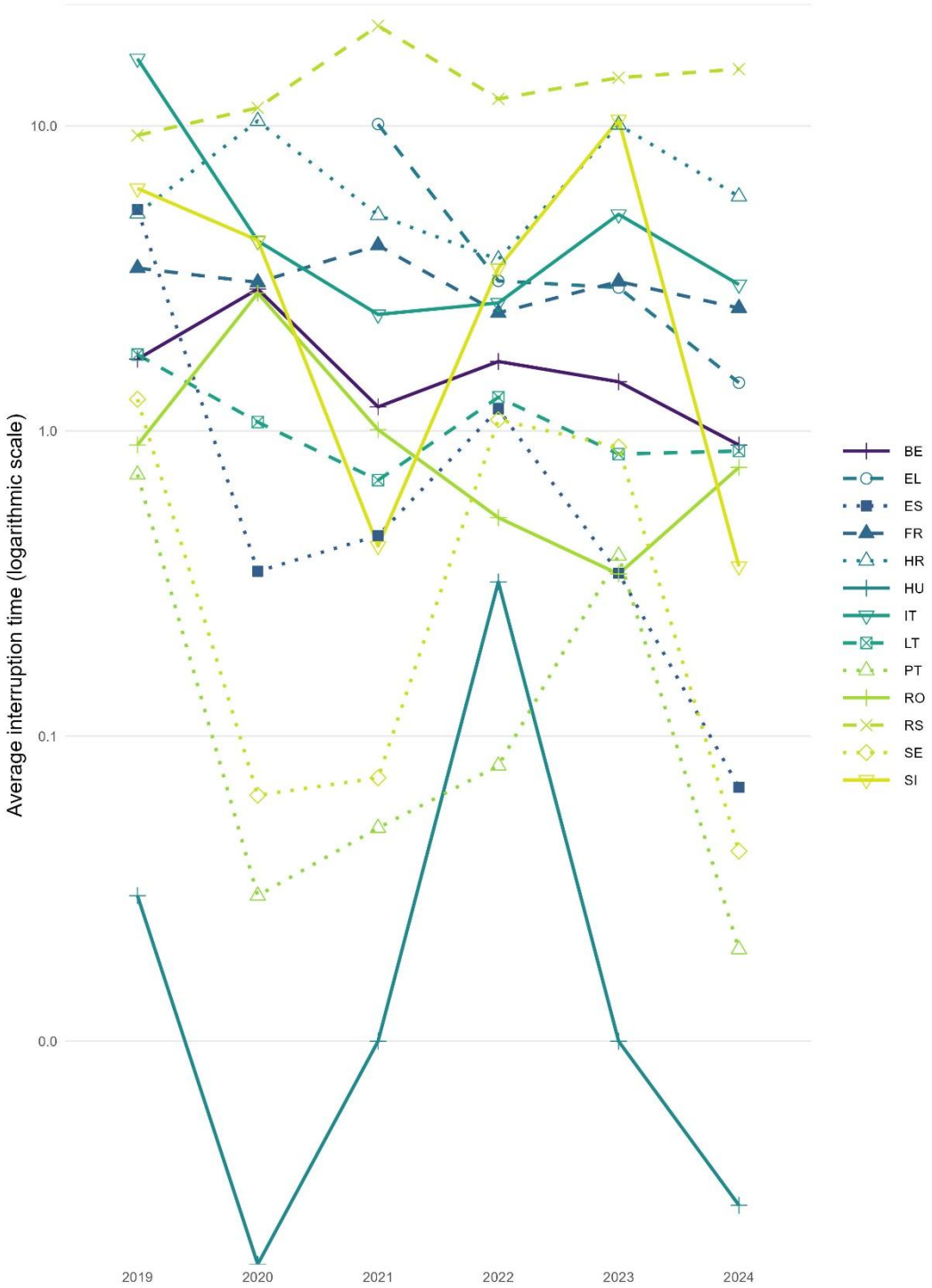


Figure 27 – Electricity AIT unplanned without ee, countries below limit

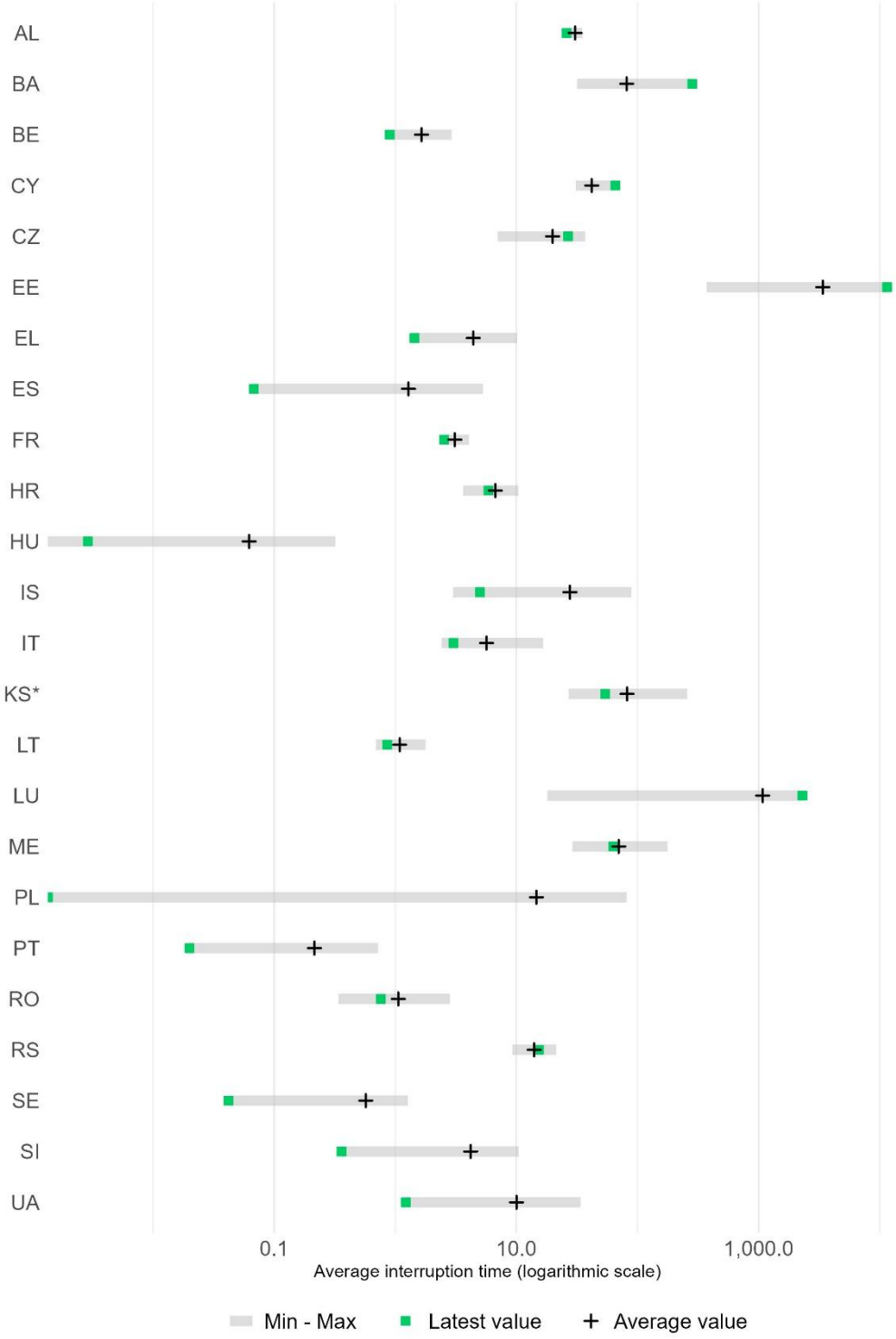


Figure 28 – Electricity AIT unplanned without ee, boxplot, all countries

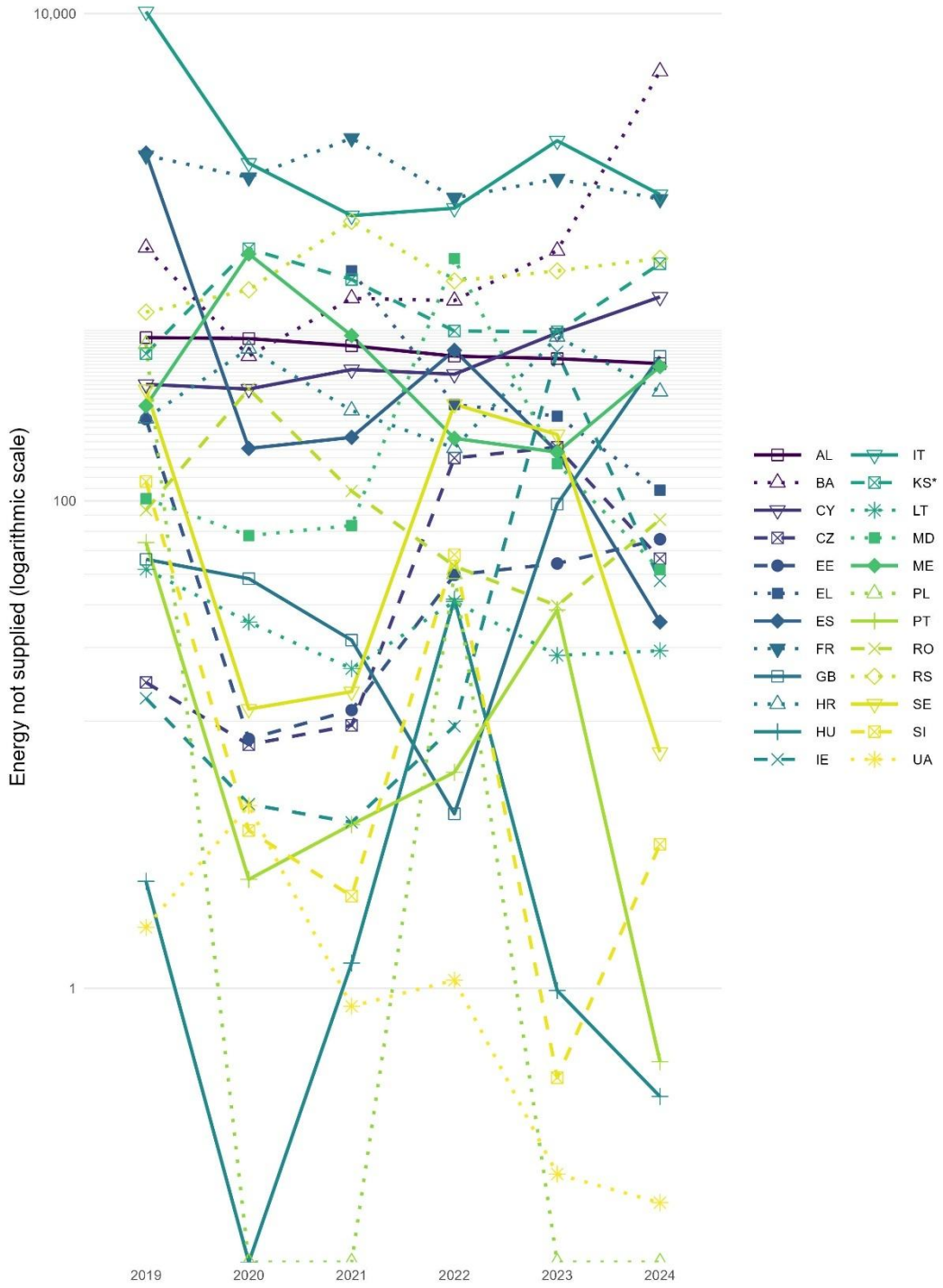


Figure 29 – Electricity ENS unplanned without ee, all countries

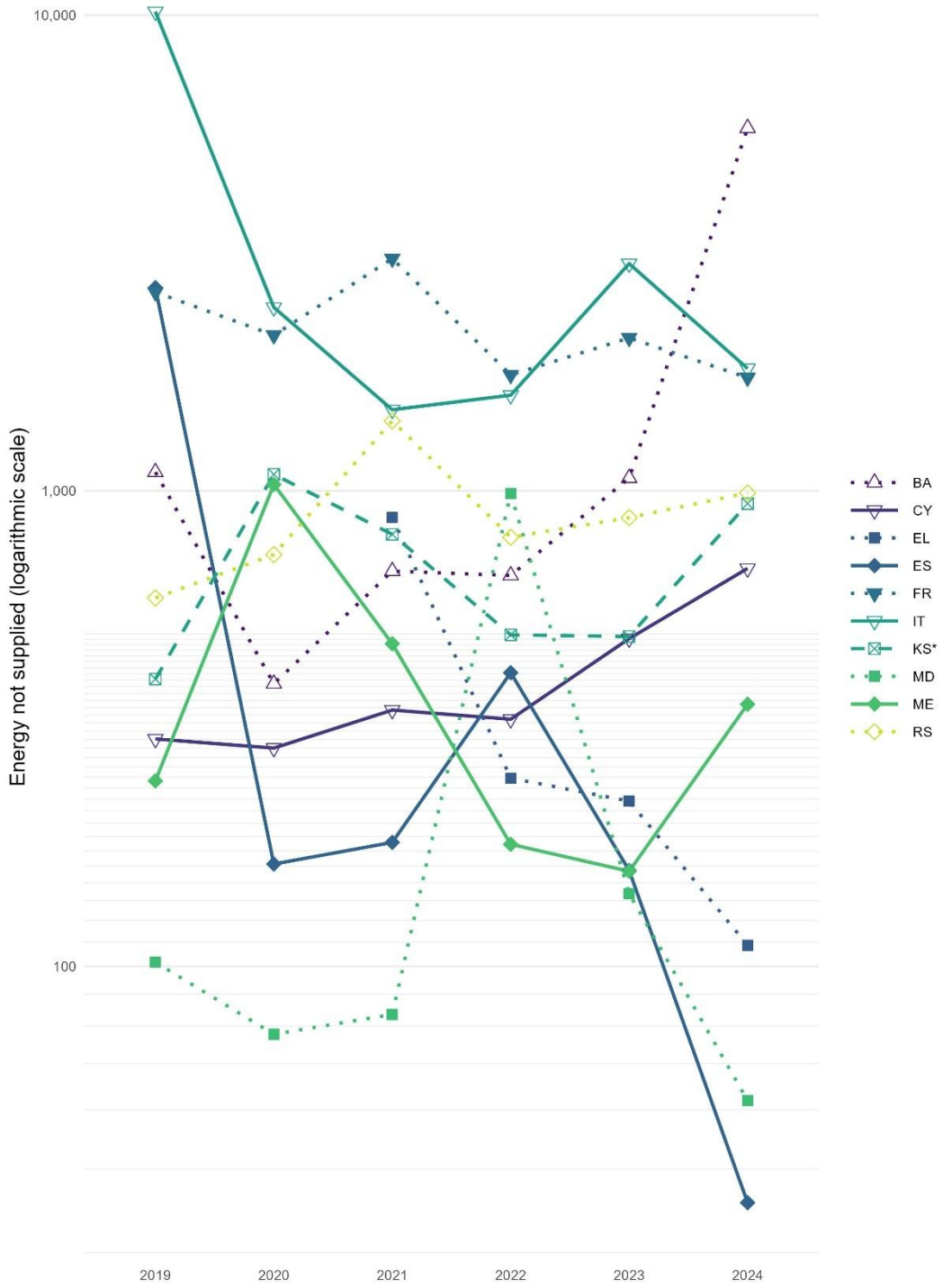


Figure 30 – Electricity ENS unplanned without ee, countries above limit

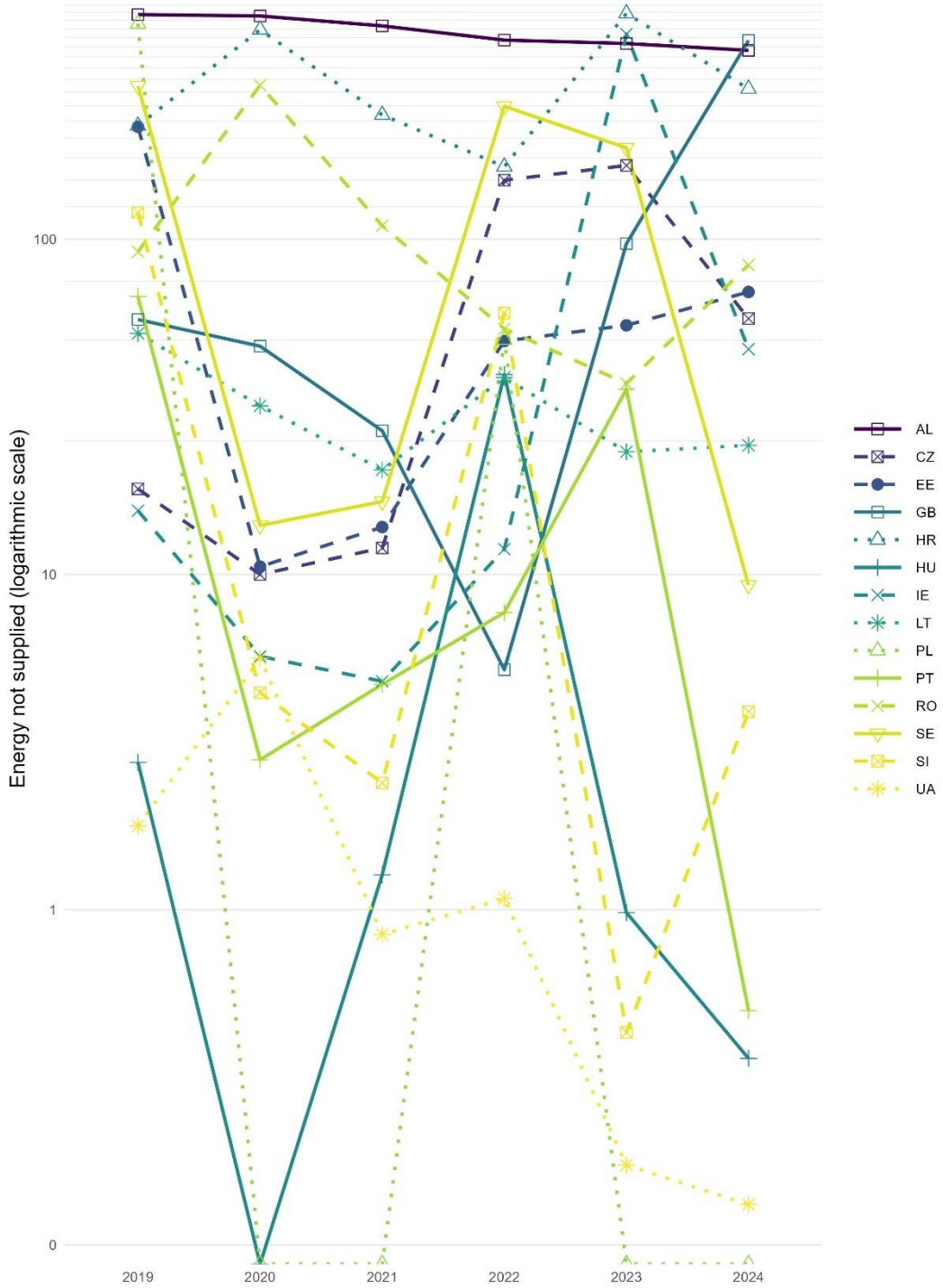


Figure 31 – Electricity ENS unplanned without ee, countries below limit

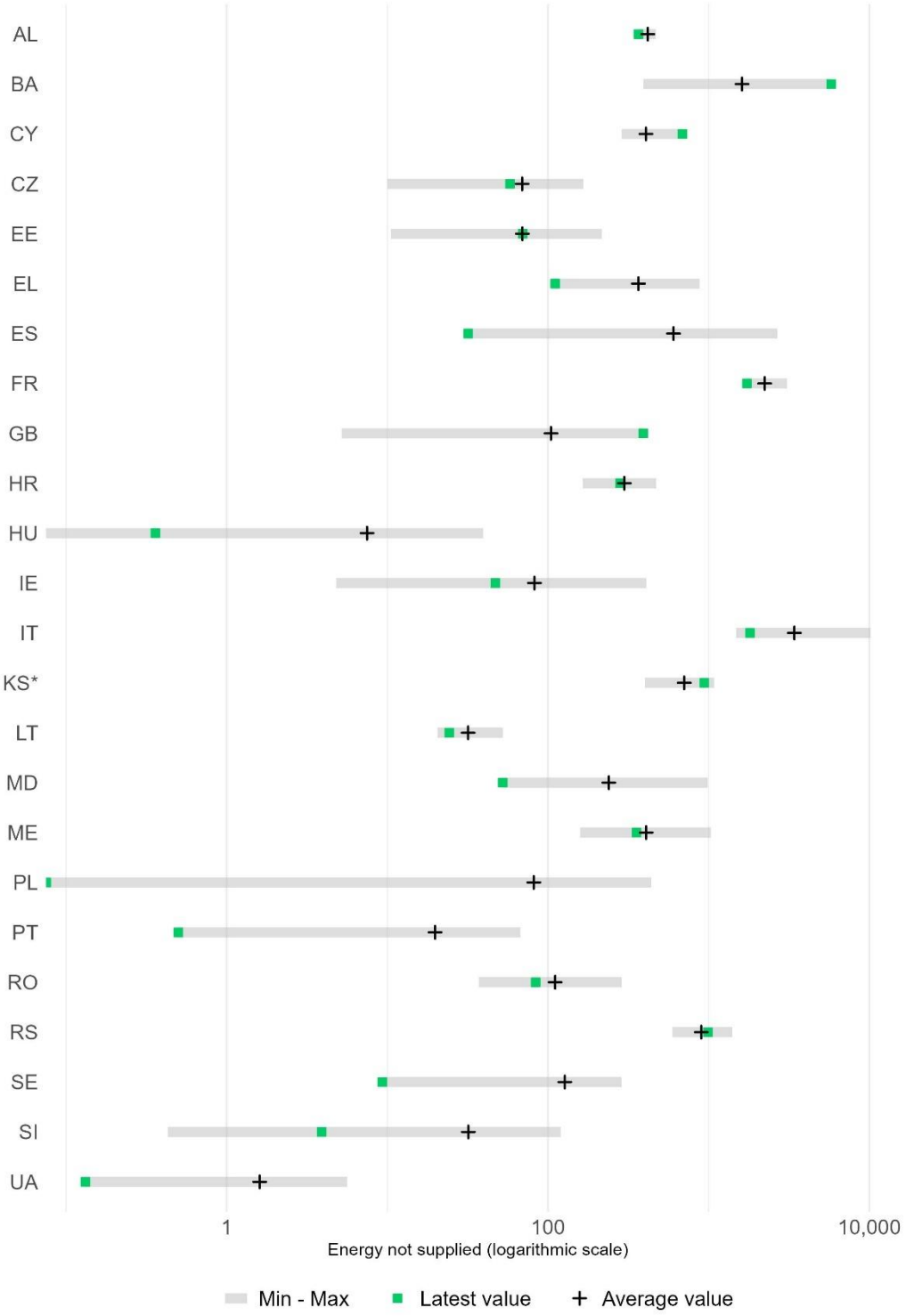


Figure 32 – Electricity ENS unplanned without ee, boxplot, all countries

2.4 Other indicators

In addition to the most common electricity indicators from the previous chapters, many countries use additional indicators for continuity of supply monitoring. The Momentary Average Interruption Frequency Index (MAIFI) measures the average number of momentary (short duration) supply interruptions experienced by a customer over a given year. It is calculated as the total number of customer momentary interruptions divided by the total number of customers served. MAIFI is used by 15 respondents for unplanned interruptions with values shown in Figure 33 and Figure 34. Trend lines are stable for 73% and descending and ascending for 13% of participants (each) showing that the same percentage of countries has an improving and a worsening trend regarding this indicator. This is another case where the percentages do not add up to 100% due to a rounding error since no decimal points were used.

Belgium, which only monitors MAIFI on HV and EHV level, is not included in the figures, but is included in Table 27 in Annex 3.

Lithuania indicated that they changed the reporting scope for MAIFI in 2022. The values provided for 2019-2021 include the HV, MV and LV networks, whereas the values provided for 2022-2024 only include the MV and LV networks.

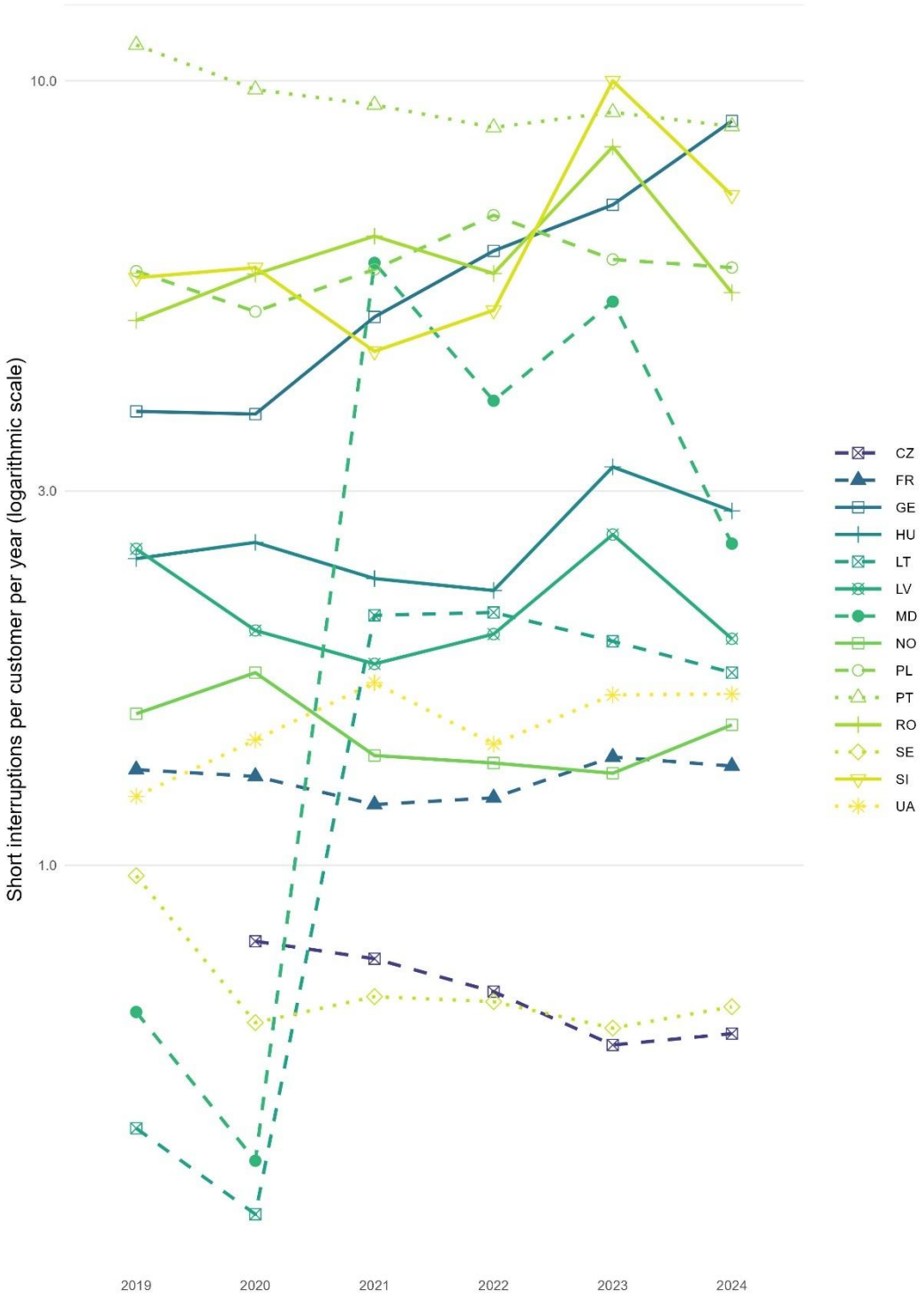


Figure 33 – Electricity MAIFI unplanned, all countries

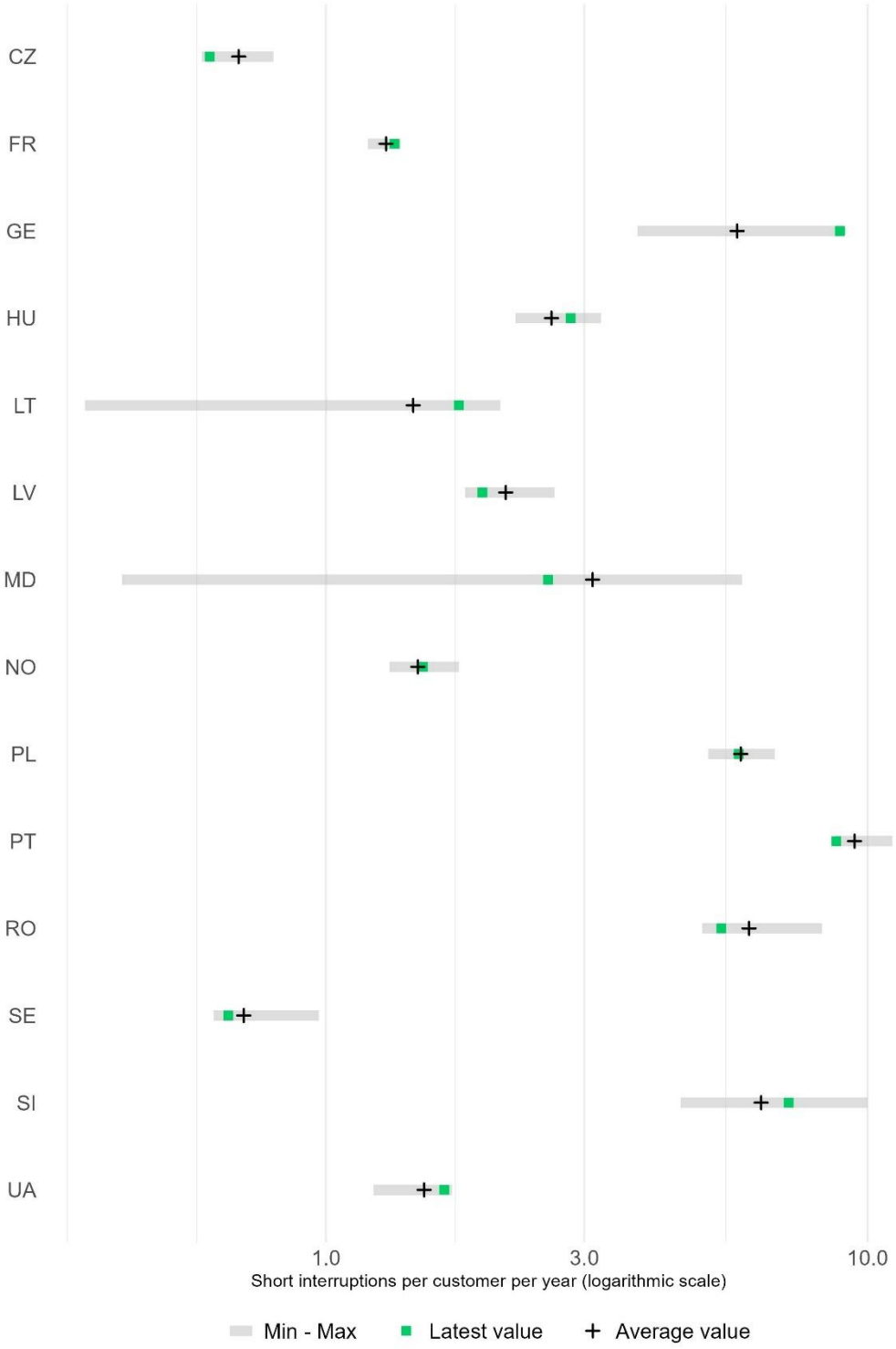


Figure 34 – Electricity MAIFI unplanned, boxplot, all countries

Furthermore, Austria utilizes CAIDI (all interruptions including exceptional events), ASIDI (unplanned without exceptional events) and ASIFI (unplanned without exceptional events) as continuity of supply indicators. CAIDI (Customer Average Interruption Duration Index) measures the average duration of an interruption experienced by customers who are affected by supply interruptions. It is calculated as the total duration of customer interruptions divided by the total number of customer interruptions and is typically expressed in minutes per interruption. CAIDI is also commonly used as an indicator for gas. ASIDI and ASIFI are the similar to SAIDI and SAIFI and their units are the same, except that they are weighted by the contracted transformer power rather than the number of customers.

Indicator	2019	2020	2021	2022	2023	2024
CAIDI	59.92	59.26	56.82	70.17	71.86	107.38
ASIDI	26.22	26.31	21.37	23.98	32.21	25.08
ASIFI	0.62	0.65	0.48	0.50	0.67	0.54

Table 2 – Other electricity CoS indicators in Austria

The Walloon region of Belgium uses an indicator called Duration of recovery, which is calculated by dividing the SAIDI by the SAIFI (making it identical to CAIDI). The Brussels Capital region records the number of outages for public lighting over the course of a year including individual lamp failures, section outages, and other types of faults, but excluding exceptional events.

Indicator	2019	2020	2021	2022	2023	2024
Duration of recovery[3]	52.61	52.91	99.88	48.31	47.65	
Number of outages (public lighting)[4]	8,752	7,688	8,910	8,109	8,898	9,018

Table 3 – Other electricity CoS indicators in Belgium

In addition to unplanned AIT and unplanned ENS excluding exceptional events (Table 28 and Table 29 in Annex 3), Czechia monitors these two indicators for all interruptions as well. AIT is expressed in minutes of system interrupted per year (at transmission level) while ENS is expressed in MWh not served per year (at transmission level).

Indicator	2019	2020	2021	2022	2023	2024
AIT (all interruptions)	97	138	7	78	288	80
ENS (all interruptions)	84	169	12	152	378	58

Table 4 – Other electricity CoS indicators in Czechia

[3] Only in Wallonia. Although named differently, the indicator is calculated the same way as CAIDI.

[4] Only in Brussels.

Estonia also uses CAIDI (average interruption duration in minutes) for both planned and unplanned electricity interruptions.

Indicator	2019	2020	2021	2022	2023	2024
CAIDI unplanned	148.70	123.8	108.90	132.80	168.80	97.00
CAIDI planned	158	171	161	160	158	163

Table 5 – Other electricity CoS indicators in Estonia

Georgia utilizes an indicator called 'Restoration of Internal Unplanned interruption'. Since Georgia divides interruptions of electricity supply into external (caused by reasons which are independent from distribution company such as third-party causes, natural disasters, force majeure etc.) and internal (all other interruptions), quality standards are only applied to internal interruptions. The rule for 'Restoration of Internal Unplanned Interruption' is that the restoration time for an internal unplanned interruption should not exceed 12 hours per consumer. The minimum requirement is that 80% of interrupted customers (in a year) should be restored within 12 hours. The indicator values are expressed in percent and determined as the ratio of the total number of consumers affected by internal unplanned interruptions that were restored within 12 hours and the total number of consumers affected by internal unplanned interruptions. In 2024, 98% of affected consumers had their supply restored within 12 hours. The values are shown in Table 6 below.

Indicator	2019	2020	2021	2022	2023	2024
Restoration of internal unplanned interruption (%)	96	96	98	99	99	98

Table 6 – Other electricity CoS indicators in Georgia

CAIDI for electricity is also used in Croatia, for planned interruptions and unplanned interruptions including and excluding exceptional events.

Indicator	2019	2020	2021	2022	2023	2024
CAIDI unplanned excluding ee	62.07	59.35	52.57	63.82	66.80	79.84
CAIDI unplanned including ee	86.67	83.85	70.01	97.08	127.52	100.23
CAIDI planned	146.06	154.93	153.65	152.54	158.72	161.08

Table 7 – Other electricity CoS indicators in Croatia

ENS including all events is monitored on high voltage level in Latvia. The values in MWh are presented in Table 8.

Indicator	2019	2020	2021	2022	2023	2024
ENS on HV (all events)	1,072	171	1,251	14,030	30	53

Table 8 – Other electricity CoS indicators in Latvia

Norway also monitors the indicator CAIDI in electricity, as well as the Customer Average Interruption Frequency Index (CAIFI) and the Customer Total Average Interruption Duration Index (CTAIDI). These two indicators give a better impression of the continuity of supply as experienced by those network users that are affected by at least one interruption in a year. CAIFI and CTAIDI have the same units as SAIFI (interruptions per customer per year) and SAIDI (minutes per customer per year), respectively.

Indicator	2019	2020	2021	2022	2023	2024
CAIDI	63.00	66.70	78.00	68.20	70.70	66.60
CAIFI	3.10	3.50	3.10	2.80	2.90	3.20
CTAIDI	197	232	239	190	206	211

Table 9 – Other electricity CoS indicators in Norway

Finally, Portugal uses unplanned MAIFI in transmission (EHV) and unplanned MAIFI for high voltage (which is part of distribution), both without exceptional events. They are both measured as number of short event interruptions per customer per year. This monitoring is additional to the MAIFI indicator already monitored for Portugal's distribution network and included in Table 27 in Annex 3.

Indicator	2019	2020	2021	2022	2023	2024
MAIFI unplanned (transmission)	0.04	0.02	0.01	0	0.05	0.02
MAIFI unplanned (HV)	0.94	0.38	0.45	0.38	0.60	0.44

Table 10 – Other electricity CoS indicators in Portugal

2.5 Technical characteristics of electricity networks

The circuit length of low, medium, high and extra high voltage networks in 2024 is shown in the figures on following pages. In addition to circuit length for each voltage level, the respective lengths of underground cables and overhead lines are also separately shown. Readers should keep in mind that voltage levels could have different definitions in different countries and should consult Table 2-1 in the 7th Benchmarking Report for exact definitions.

The definitions included in the 7th BR refer to power lines with alternating current (AC), but not to those with direct current (DC). Many countries in Europe operate high voltage DC (HVDC) subsea cables, often on a different voltage level than what that country typically uses in AC power transmission. One such example is Poland, which operates a 450 kV DC subsea cable, whereas 450 kV is not used for AC power transmission in Poland.

In Finland, the TSO operates HV and EHV networks, whereas DSOs may operate networks from LV to EHV. Until January 2026, DSOs were limited to voltage levels up to HV. A few countries, among which are Moldova and Montenegro, do not define extra high voltage as a voltage level. German HV and MV underground cable lengths include subsea cables as the numbers without subsea cables are no longer available.

France's distribution network length refers to the largest DSO Enedis which covers about 95% of electricity distribution network in France. Ireland's high voltage circuit length includes both transmission and distribution HV figures.

Iceland indicated that the length reported for HV network corresponds to the length of circuits in the transmission system, which are predominantly (>95%) overhead lines. The length reported for low voltage network is the total length of both the LV and MV networks in distribution, which are predominantly (>90%) underground cables. Since only approximate percentages of cables/overhead lines were provided, Iceland is not included in the figures below but is instead included in Table 30 in Annex 3, where circuit lengths per voltage level are presented for all countries that provided data. The same applies to other countries that only provided total length of all circuits in km, but not the length of their overhead lines or underground cables.

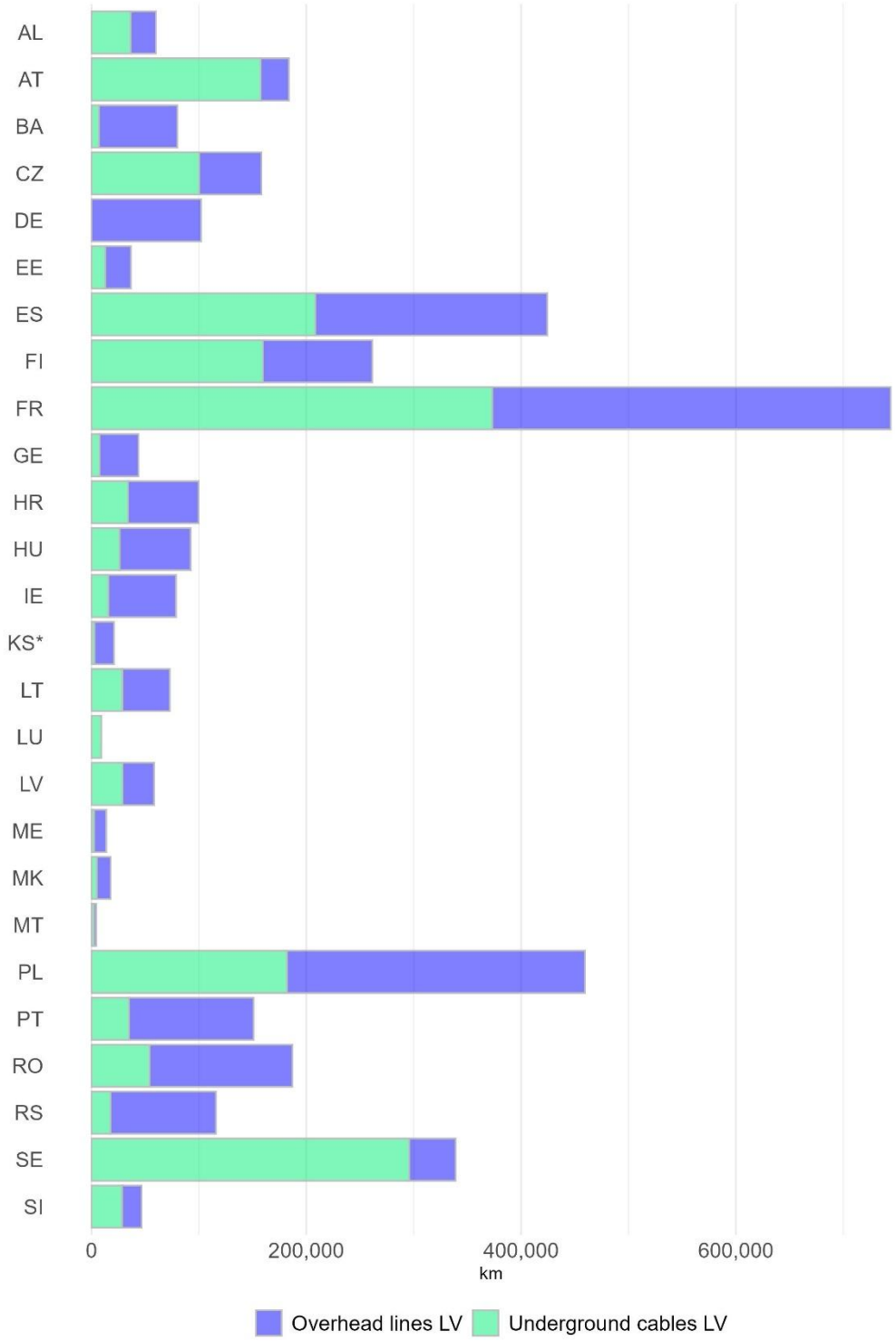


Figure 35 – Network length on LV in 2024

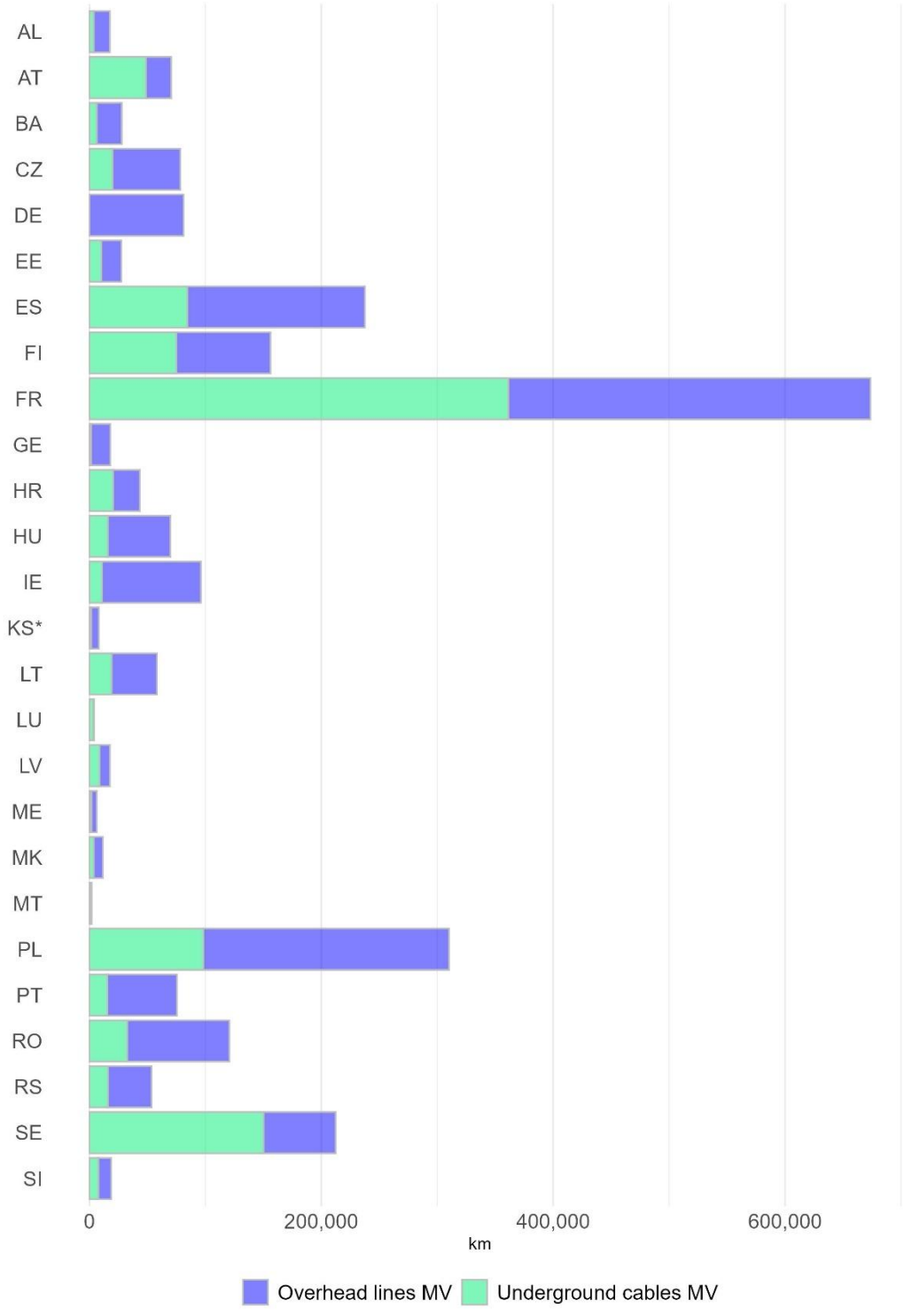


Figure 36 – Network length on MV in 2024

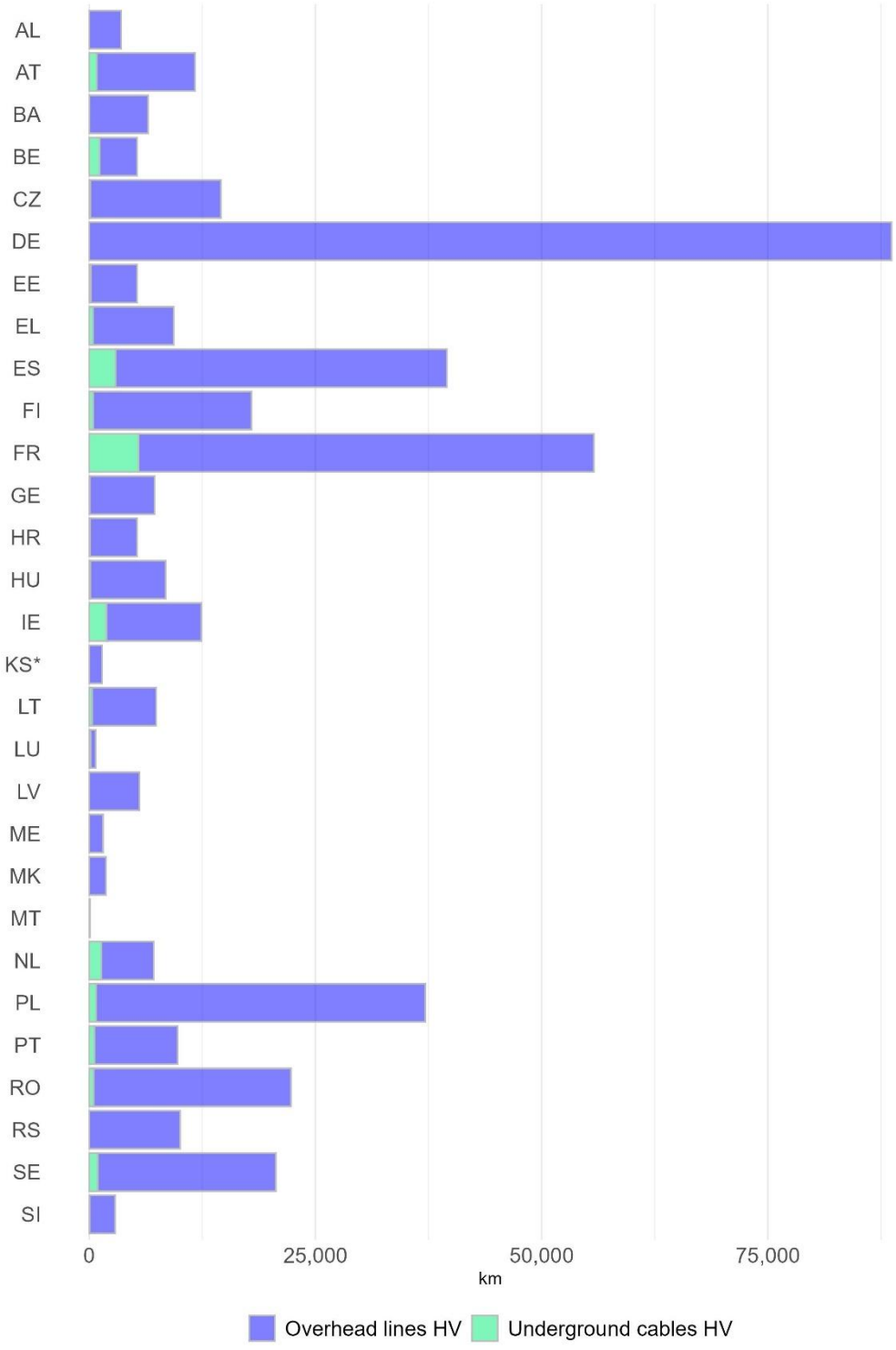


Figure 37 – Network length on HV in 2024

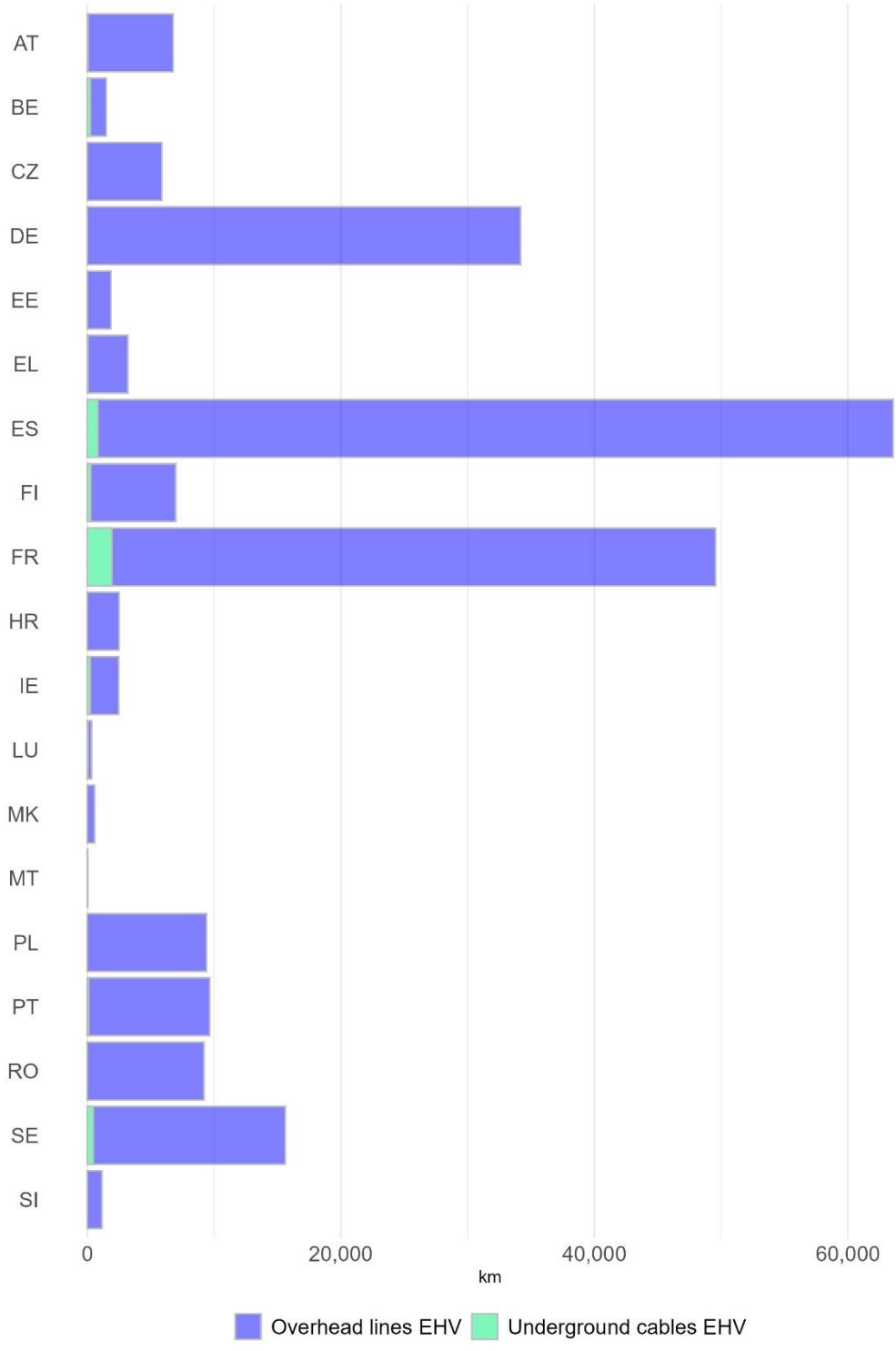


Figure 38 – Network length on EHV in 2024

Figure 39 shows a clustering of European countries according to the percentage of underground cables in the medium- and low-voltage networks. A higher share of underground cabling is generally associated with better continuity of supply performance, although this relationship is influenced by several other operational and environmental factors.

Unfortunately, due to lack of data from many countries, only 24 participants were included in Figure 39.

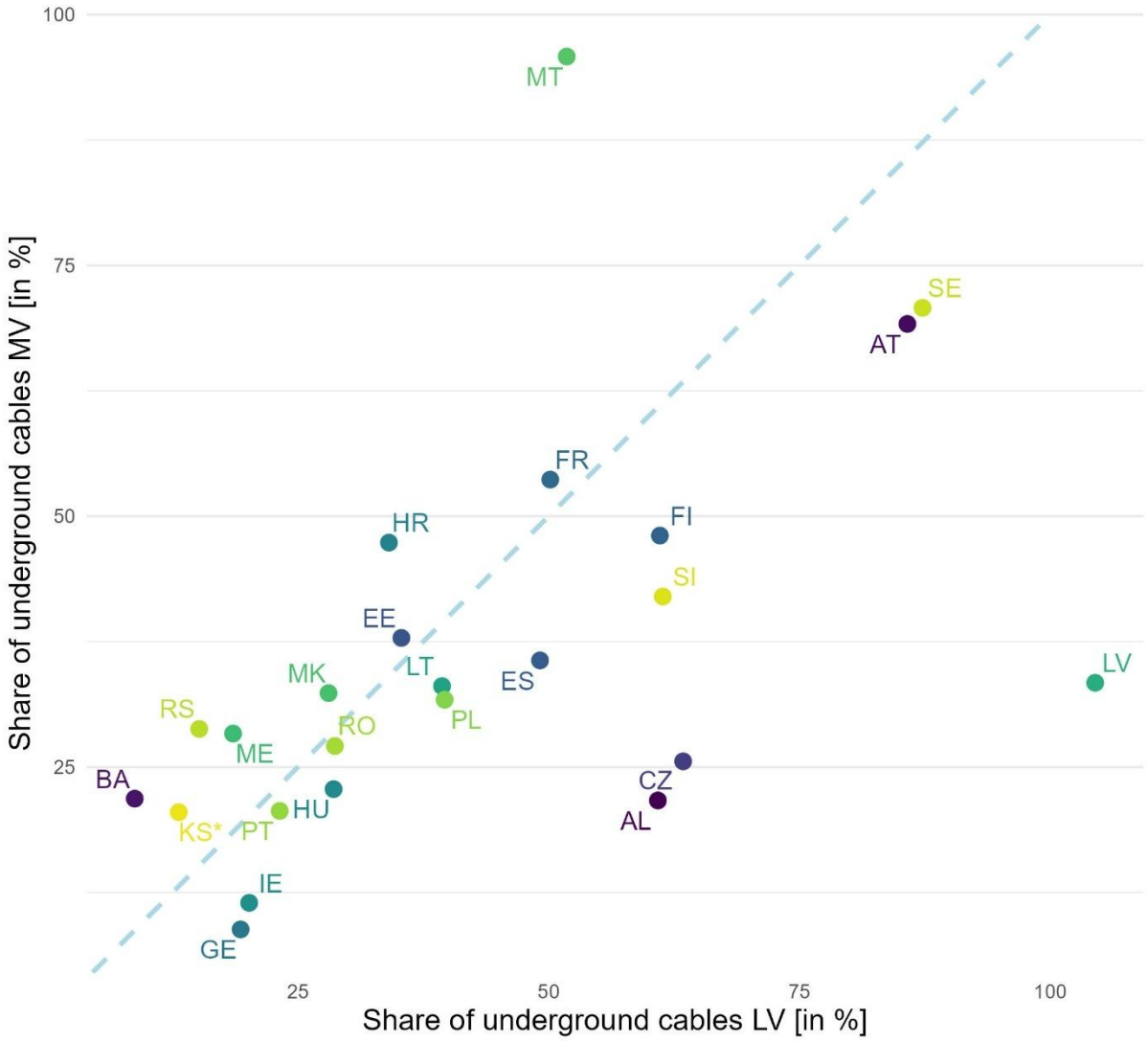


Figure 39 – Share of underground cables on LV and MV

3 Main results – Gas

Continuity of Supply indicators for gas were first collected for and published in the 6th CEER Benchmarking Report on the Quality of Electricity and Gas Supply (2016) while Benchmarking Reports 6.1 (2018) and 7 (2022) continued this practice. As is the case for electricity, the 7th Benchmarking Report only included gas data until 2018. This Benchmarking Report 7.1 provides data for the period from 2019 until 2024.

As in previous editions, participants were asked to provide values for three main indicators for the continuity of supply of gas. These are:

- System Average Interruption Duration Index (SAIDI),
- System Average Interruption Frequency Index (SAIFI) and
- Customer Average Interruption Duration Index (CAIDI).

Since this report includes indicator values from many countries, it is expected that there may be substantial differences not just depending on the year but depending on the country too. Figures showing the time series are first shown including all countries that provided data, followed by the same time series with countries split into two groups: one, where the values did not lie above the calculated breakpoint in any of the years, and another, where at least one value lies above the breakpoint. This presentation was used to facilitate an easier reading of the figures showing the time series. It has no effect on data and was only done for visibility reasons.

To determine each indicator's breakpoint, each country's maximum value of that specific indicator for the observed years (2019 to 2024) was first determined. The median value was then calculated from all country-individual maximum values and multiplied by 1.5. Breakpoints for various indicators are shown in Table 11 below.

Indicator	Breakpoint	Unit
SAIDI unplanned	10.455	Minutes per customer
SAIFI unplanned	0.038	Interruptions per customer
CAIDI unplanned	855.00	Minutes per interruption

Table 11 – Breakpoints for gas indicators

$$bp_{Indicator} = 1.5 \cdot \text{median}\left[\max_{Country,\ 2019\text{-}2024} Indicator\right]$$

In the Belgian region of Wallonia, the quality-of-service indicators (regarding duration) are not monitored for gas. Wallonia sees no reason to restore gas pressure as quickly as possible while compromising safety. This means that the continuity of supply indicator values Belgium provided for gas do not apply to the region of Wallonia.

Finland indicated that they collect information on outage time and the number of interruptions in gas, but that the gas network in the country is small and thus, only the TSO is inspected more thoroughly and is incentivised based on energy not supplied.

Poland responded that they do not examine continuity of supply in gas networks based on SAIDI, ASIDI, SAIFI or CAIDI indicators.

Only Lithuania and Poland answered that they use additional aspects of continuity of supply in their gas networks. Lithuania monitors the percentage of complaints answered on time, percentage of notifications about planned system interruptions, percentage or emergency service arriving time, percentage of requests to connect to network fulfilled on time and percentage of new costumers connected to network on time which all correspond to commercial quality which is not the topic of this report. Portugal monitors a gas indicator called AIT which is the average duration of the interruption (in minutes per interruption). It is the quotient of the overall duration of interruptions at exit points and the total number of interruptions at exit points over the period considered which turns out to be the way the indicator CAIDI is calculated, even though Portugal does not monitor the CAIDI under that name.

Monitoring of the three main continuity of supply indicators in gas is presented in Table 12 but not every country from this table was able to provide indicator values.

Indicator	Number of countries monitoring the indicator	Yes	No
Unplanned SAIDI	13	AT, BE[5], DE, ES, GB, LT, LV, MD, NL, PT, RS, SI, UA	AL, CZ, EE, FI, FR, IT, LU, RO, SE
Planned SAIDI	13	AT, BE[6], DE, ES, GB, LT, LV, MD, NL, PT, RS, SI, UA	AL, CZ, EE, FI, FR, IT, LU, SE
Unplanned SAIFI	13	AT, BE[7], DE, ES, IT, LT, LV, MD, NL, PT, RS, SI, UA	CZ, EE, FI, FR, LU, SE
Planned SAIFI	10	AT, DE, ES, IT, LV, MD, PT, RS, SI, UA	BE, CZ, EE, FI, FR, LU, SE
Unplanned CAIDI	7	AT, DE, ES, LV, MD, NL, UA	BE, CZ, EE, FI, FR, GB, IT, LT, LU, PT, RS, SE, SI
Planned CAIDI	6	AT, DE, ES, MD, NL, UA	BE, CZ, EE, FI, FR, IT, LU, LV, PT, RS, SE

Table 12 – Monitoring of continuity of supply indicators for gas

To assess whether CoS indicators are improving (decreasing) or worsening (increasing), trends were determined by using the same approach as in electricity, described in Chapter 2. A trend was only evaluated when at least three yearly observations were available.

[5] Wallonia does not monitor indicators for interruption duration in gas. The gas SAIDI values for Belgium only include the region of Flanders.

[6] Wallonia does not monitor indicators for interruption duration in gas. The gas SAIDI values for Belgium only include the region of Flanders.

[7] The gas SAIFI values for Belgium include the regions of Wallonia and Brussels.

3.1 System Average Interruption Duration Index – SAIDI

The following table shows what type of SAIDI indicators are monitored in each country. Planned SAIDI means that this indicator is calculated for planned interruptions whereas the definition of how long a customer should be informed in advance differs among the countries.

Indicator	Country	Applies to distribution	Applies to distribution and transmission
SAIDI unplanned	AT, BE, DE, ES, GB, LT, LV, MD, NL, PT, RS, SI, UA	AT, BE, GB, LT, LV, MD, NL, PT, SI, UA	AL, DE, ES
SAIDI planned	AT, BE, DE, ES, GB, LT, LV, MD, NL, PT, RS, SI, UA	AT, BE, GB, LT, LV, MD, NL, PT, RS, SI, UA	AL, DE, ES

Table 13 – Monitoring of SAIDI values for gas

SAIDI values are typically much lower for gas than for electricity. This is due several reasons, one of which is that underground gas pipelines are not exposed to forces of nature in the same way as overhead power cables. Additionally, there are obligatory technical rules and guidelines which are very strict and which affect the structure and the operation of gas networks much more than electricity networks, simply to avoid life-endangering incidents (in worst case).

Trend line analysis of unplanned SAIDI indicates that all countries have a stable trendline. For planned SAIDI, the trend line is descending or ascending for 9% of the participants (each) and is stable for 82%. Countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line.

Slovenia reported extensive flooding in the country in 2023. This resulted in a natural disaster and is the reason for the increased indicator value that year, which is visible in Figure 40. This event also significantly raised the average value for Slovenia in the boxplot (Figure 43). The following year, the value in Slovenia was comparable to that of 2022. Moldova recorded and calculated SAIDI in gas in 2020 for the first time. Their National Regulatory Authority explained that their SAIDI data might be unreliable, due to lack of experience. Germany's SAIDI only applies to pressures below 100 mbar. In Belgium, the region of Wallonia does not monitor indicators for interruption duration in gas. The gas SAIDI values for Belgium only include the region of Flanders.

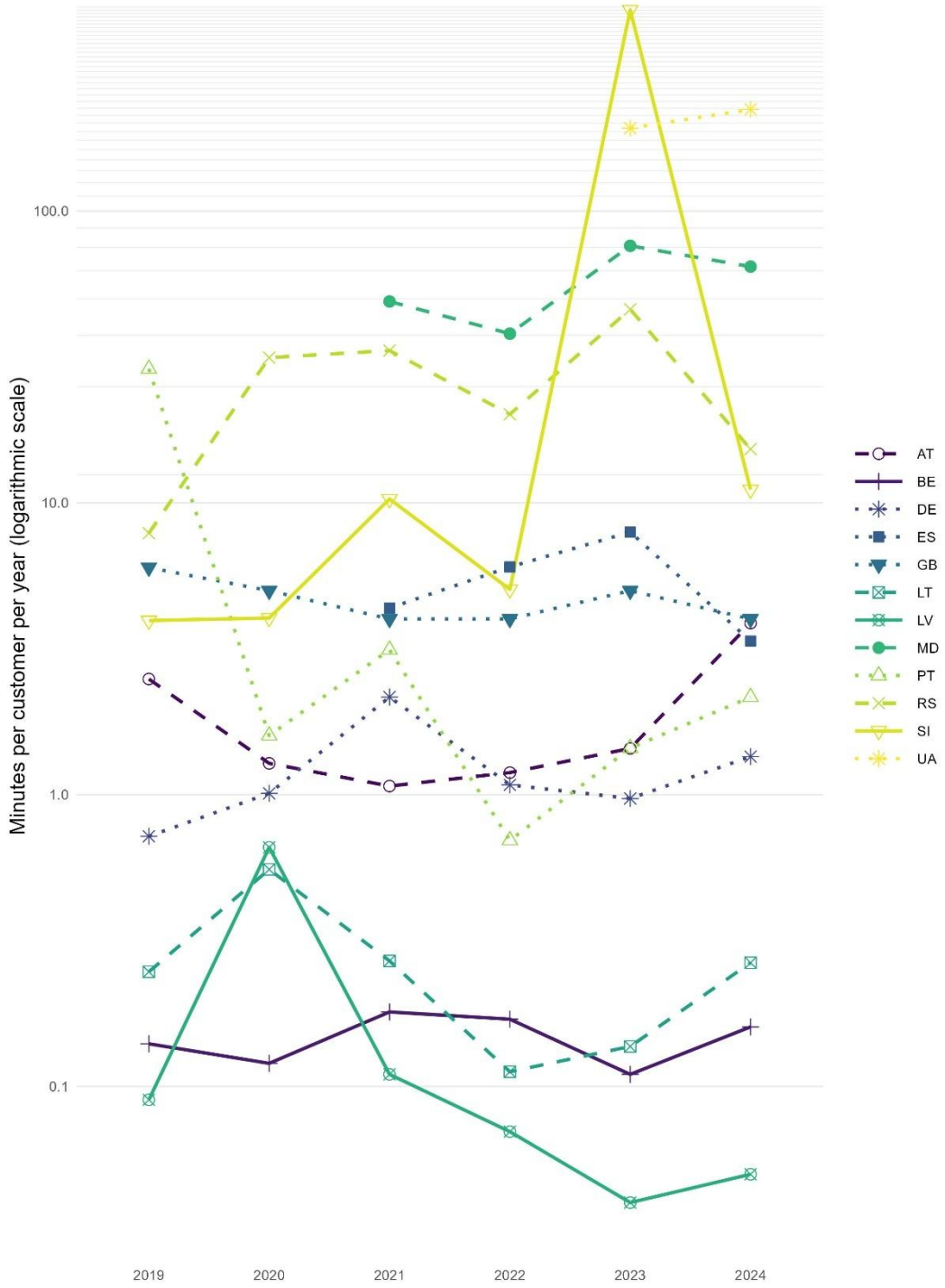


Figure 40 – Gas SAIDI unplanned, all countries

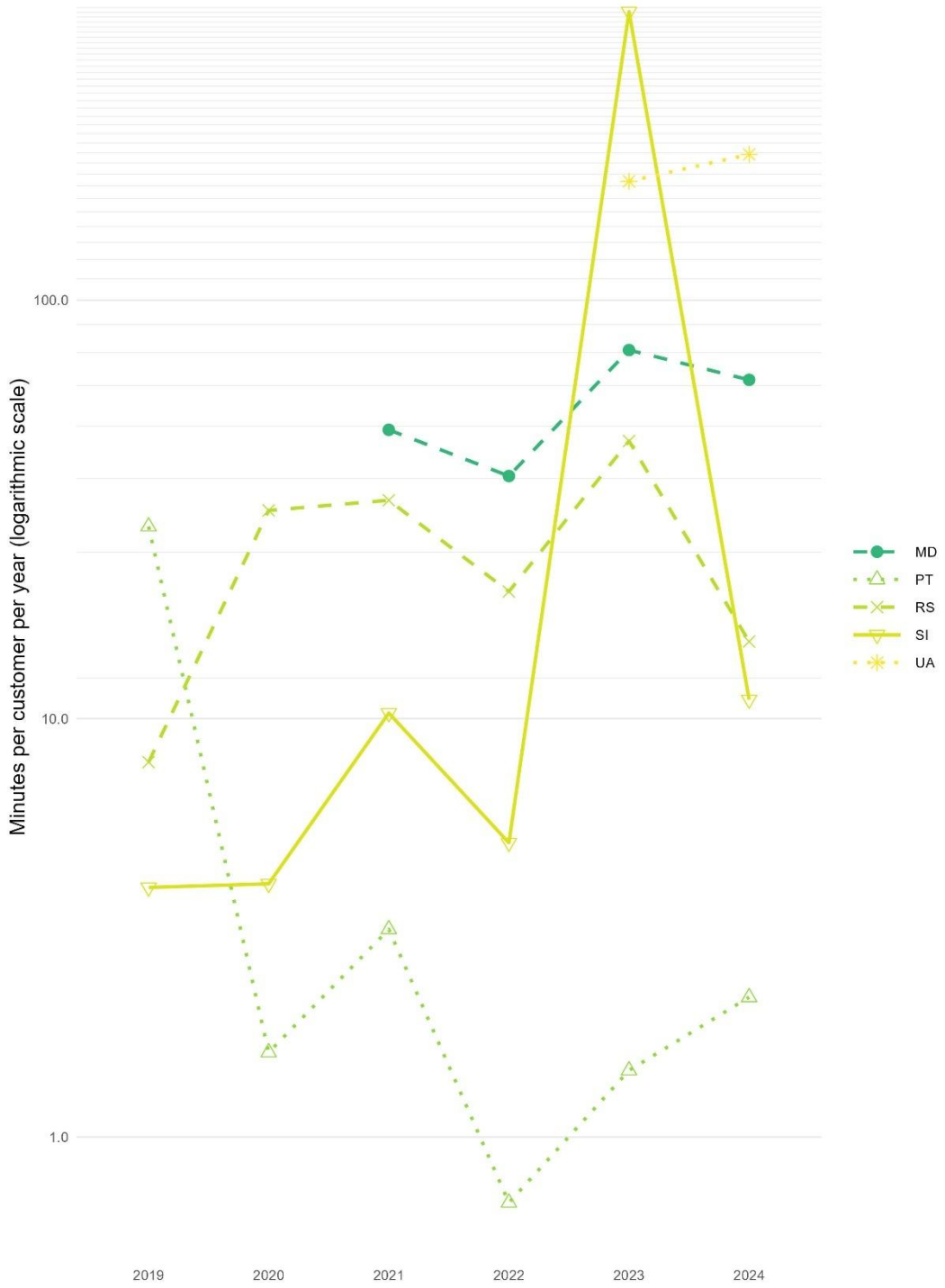


Figure 41 – Gas SAIDI unplanned, countries above limit

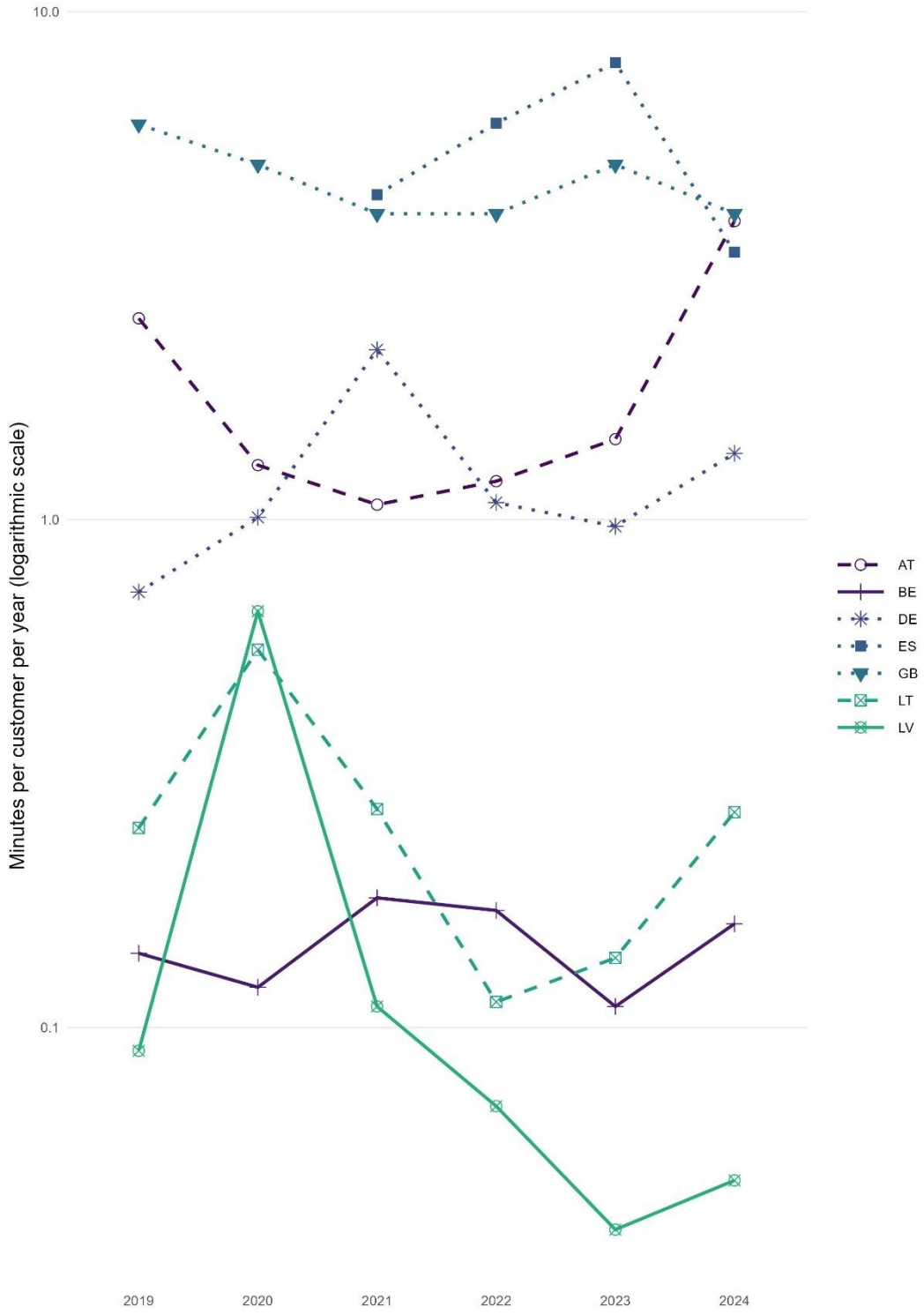


Figure 42 – Gas SAIDI unplanned, countries below limit

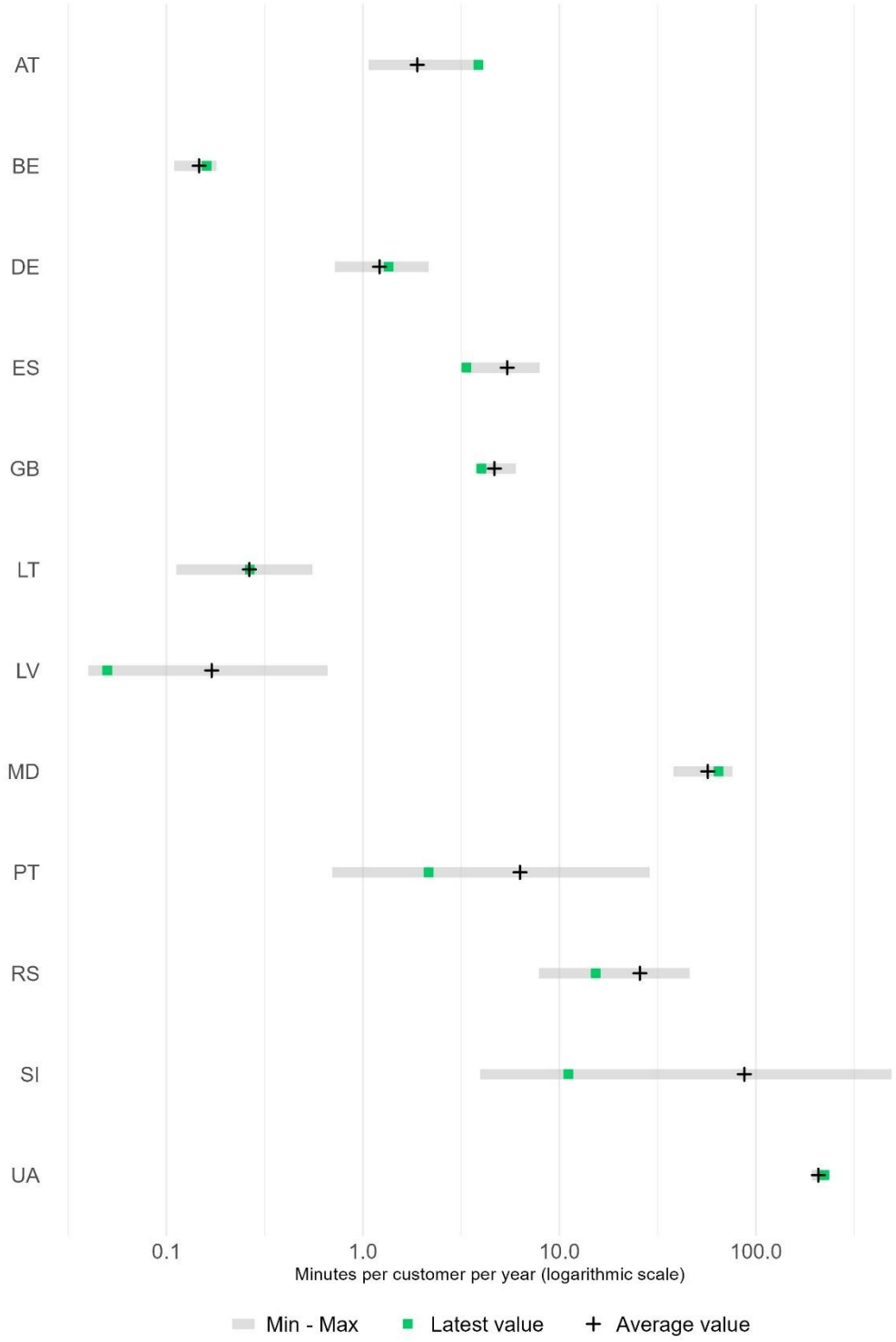


Figure 43 – Gas SAIDI unplanned, boxplot, all countries

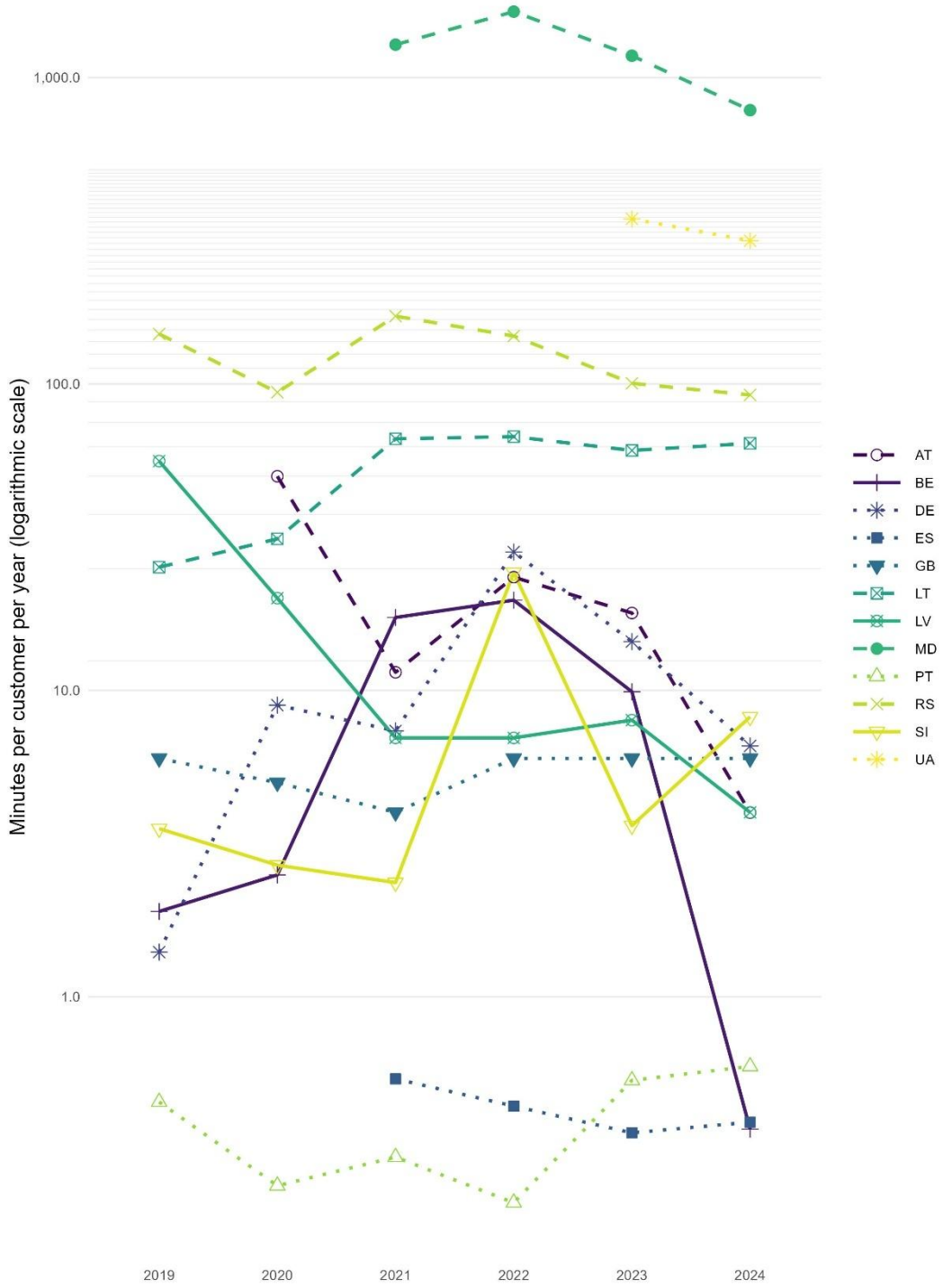


Figure 44 – Gas SAIDI planned, all countries

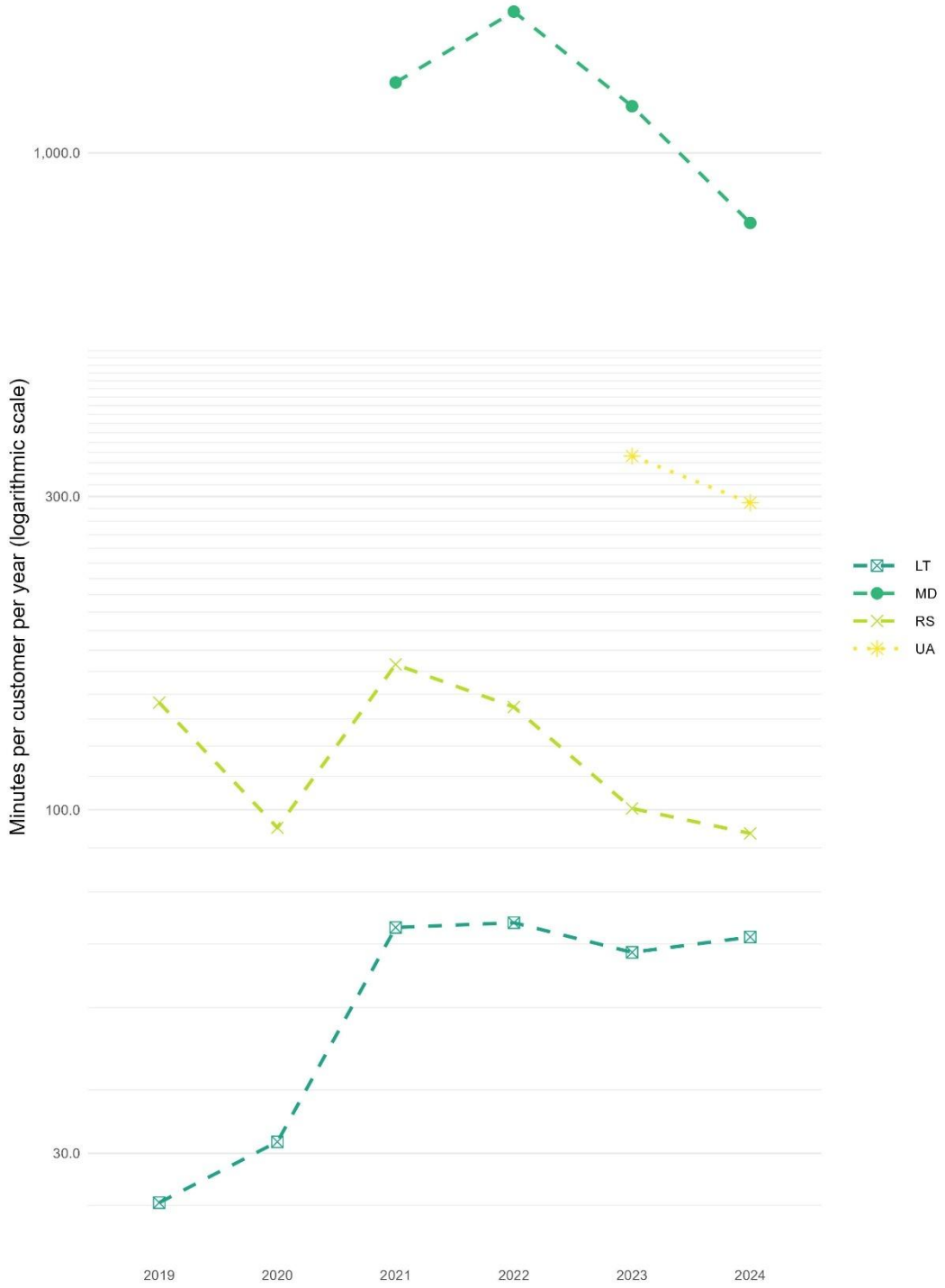


Figure 45 – Gas SAIDI planned, countries above limit

Moldova reported that their planned SAIDI for gas was very high in the past because there was not enough regulatory pressure on system operators. Since then, the NRA has increased the obligations of system operators and is now requiring them to invest more in the development and maintenance of the network and to optimize the cost of using the network.

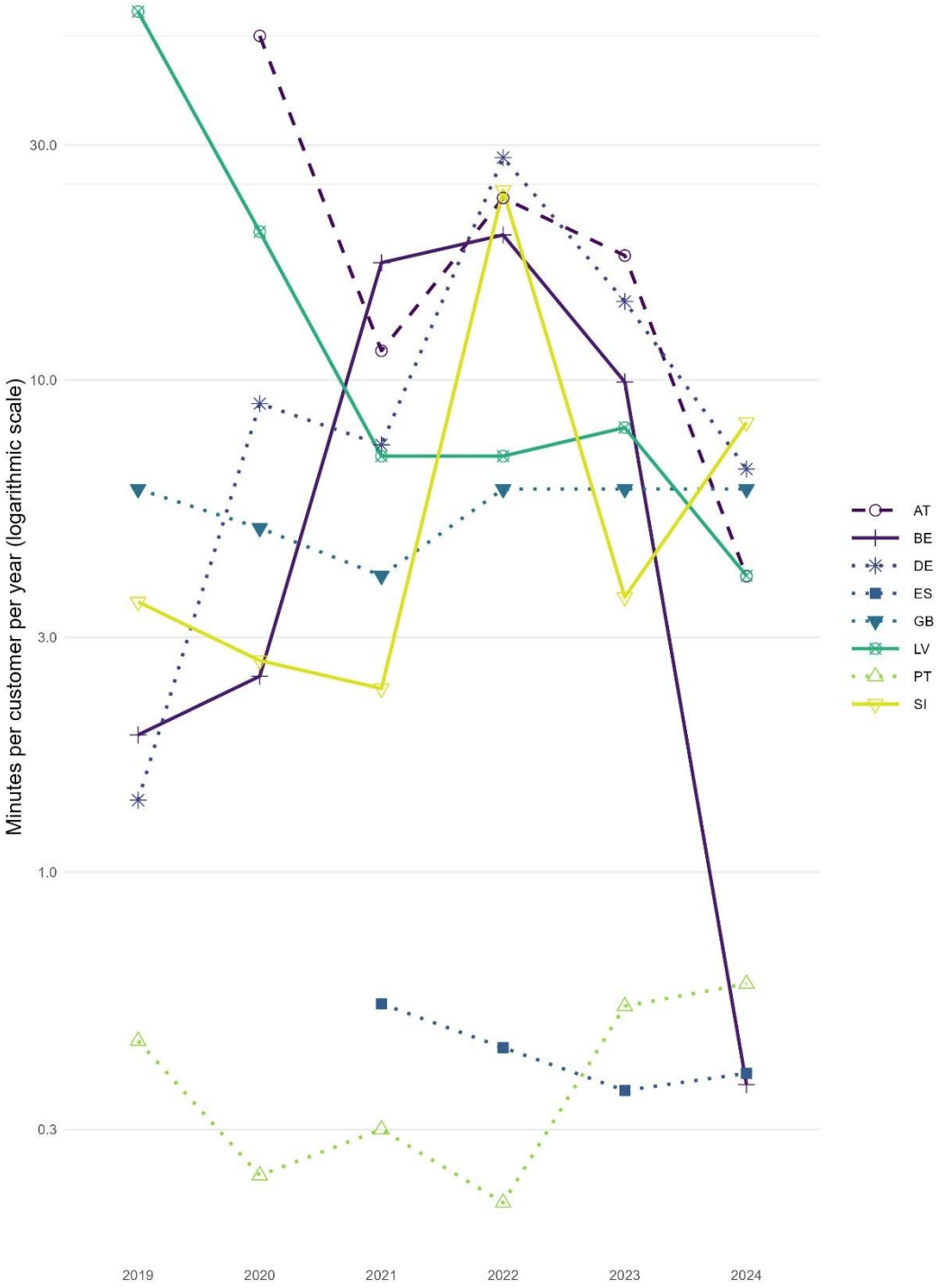


Figure 46 – Gas SAIDI planned, countries below limit

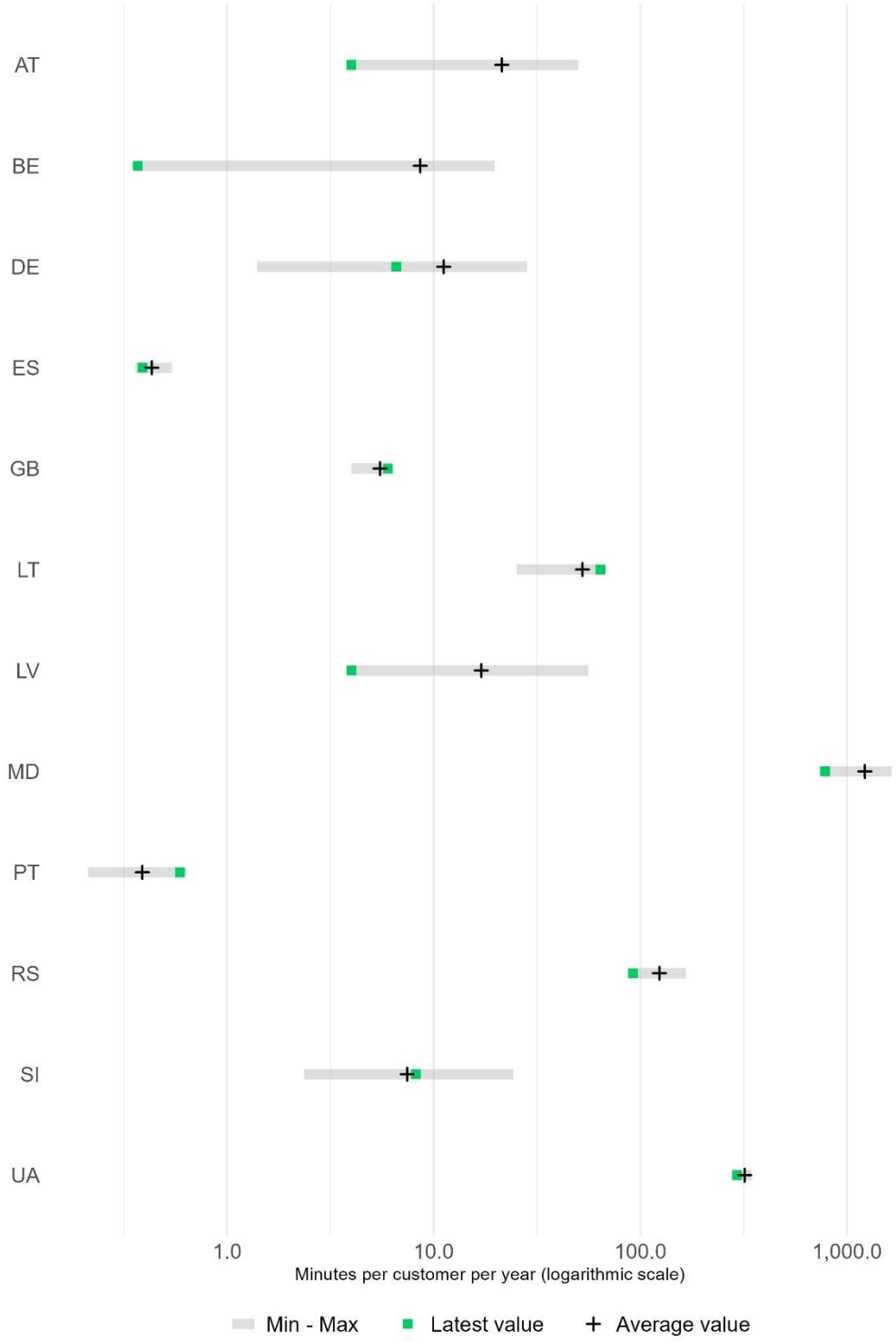


Figure 47 – Gas SAIDI planned, boxplot, all countries

3.2 System Average Interruption Frequency Index – SAIFI

The following table shows what type of SAIFI indicators are monitored in each country. As is the case with the SAIDI, Planned SAIFI shows the value for planned interruptions with each country having their own definition of how long a customer should be informed in advance.

Indicator	Country	Applies to distribution	Applies to transmission	Applies to distribution and transmission
SAIFI unplanned	AT, BE, DE, ES, IT, LT, LV, MD, NL, PT, RS, SI, UA	AT, BE, LT, LV, MD, NL, PT, RS, SI, UA	IT	DE, ES
SAIFI planned	AT, DE, ES, IT, LV, MD, PT, RS, SI, UA	AT, LT, LV, MD, NL, PT, RS, SI, UA	IT	BE, DE, ES

Table 14 – Monitoring of SAIFI values for gas

Similarly to SAIDI, SAIFI values are also typically lower for gas than for electricity. Underground gas pipelines experience a lower number of interruptions resulting in lower SAIFI values.

For unplanned SAIFI, the trend line is stable for all participants, which is equivalent to unplanned SAIDI. In case of planned SAIFI, the trend line is descending for none of the participants, stable for 86%, and ascending for 14%. Countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line.

Extensive flooding in Slovenia in 2023 raised the value of SAIFI as well, which is visible in Figure 48. This event also significantly increased the average value for Slovenia in the boxplot (Figure 51). The value in Slovenia in 2024 was comparable to that of 2022. The gas SAIFI values for Belgium include the regions of Wallonia and Brussels. In the boxplot (Figure 51), the latest available value for Belgium was for 2023.

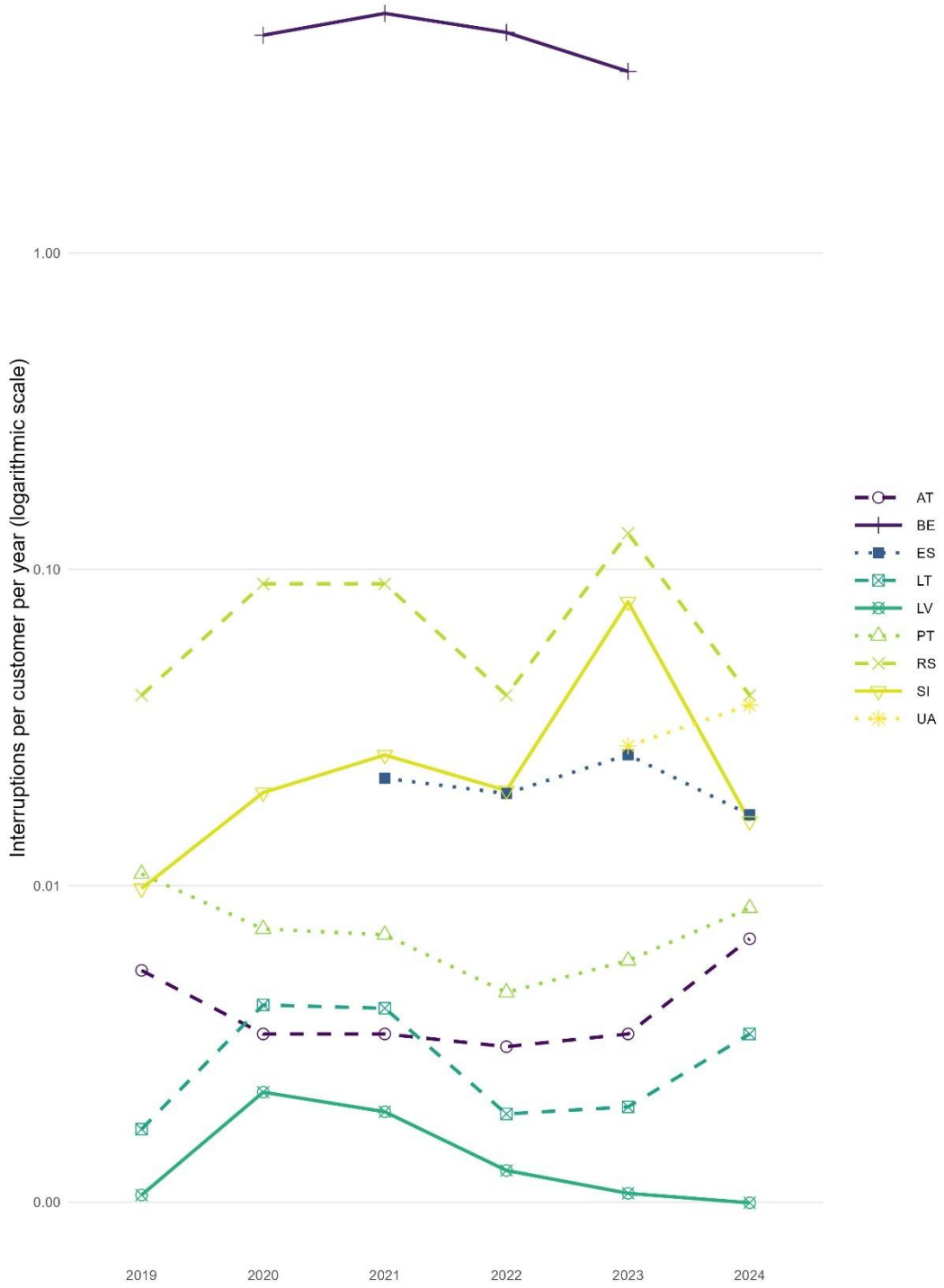


Figure 48 – Gas SAIFI unplanned, all countries

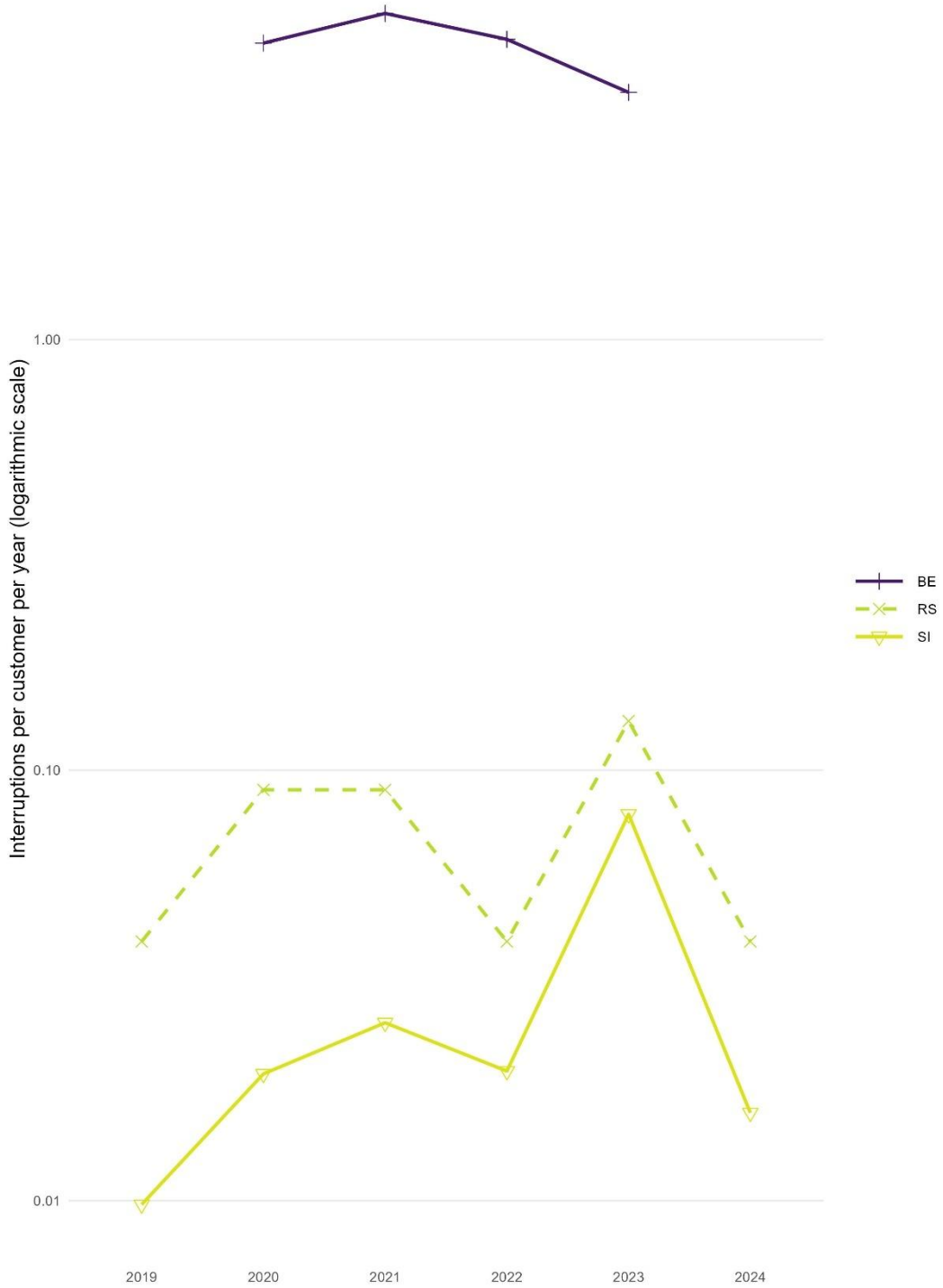


Figure 49 – Gas SAIFI unplanned, countries above limit

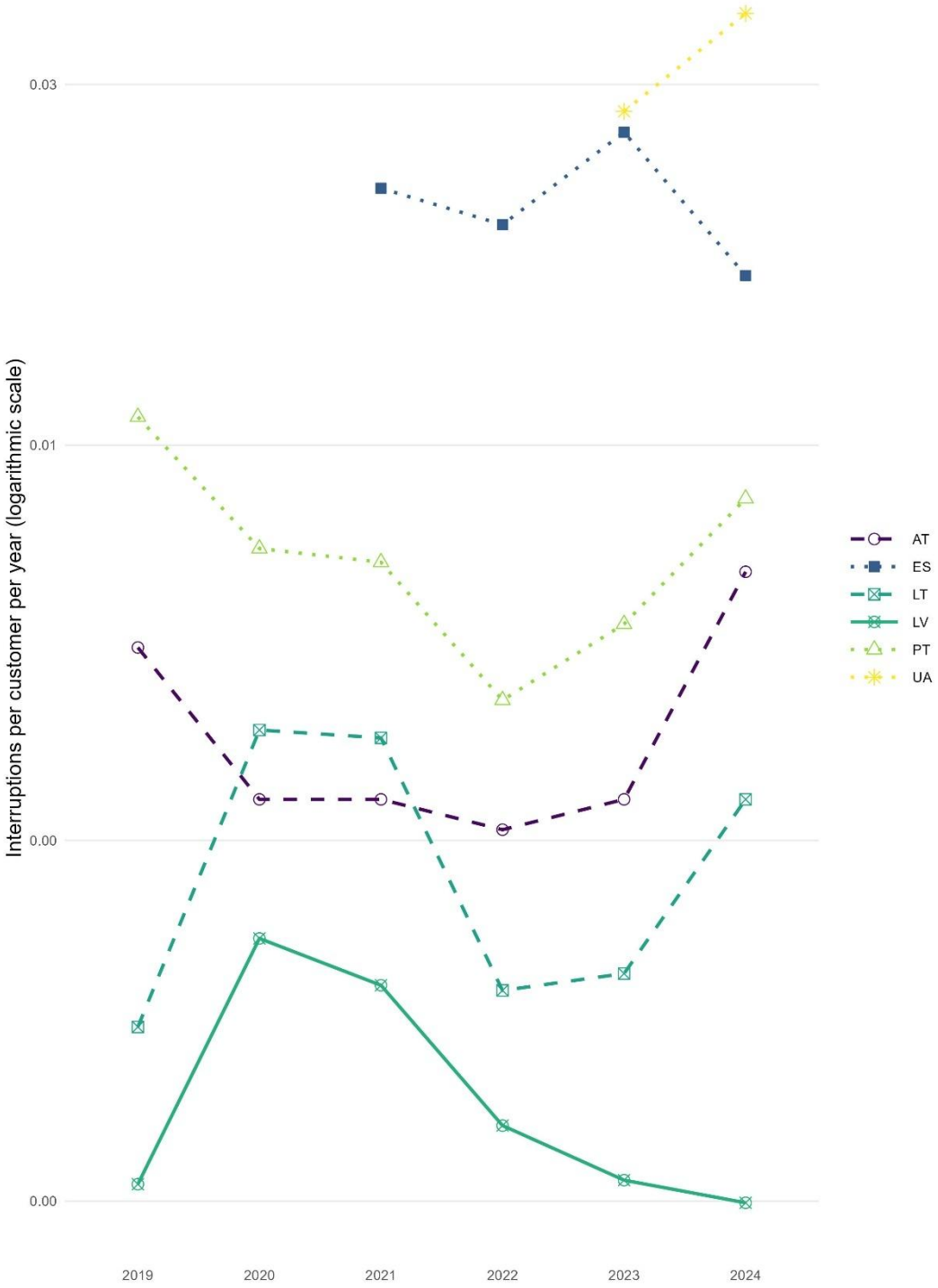


Figure 50 – Gas SAIFI unplanned, countries below limit



Figure 51 – Gas SAIFI unplanned, boxplot, all countries

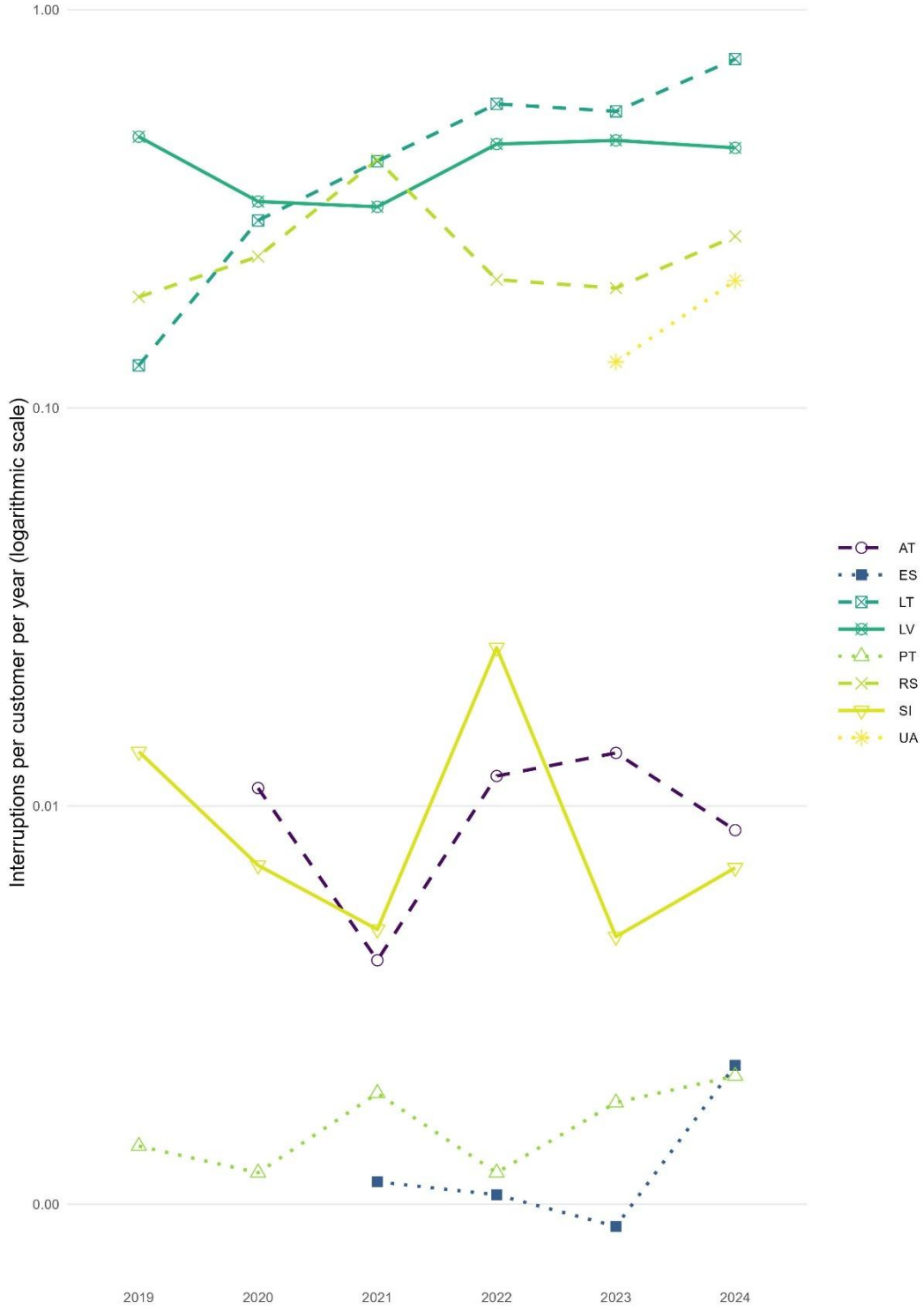


Figure 52 – Gas SAIFI planned, all countries

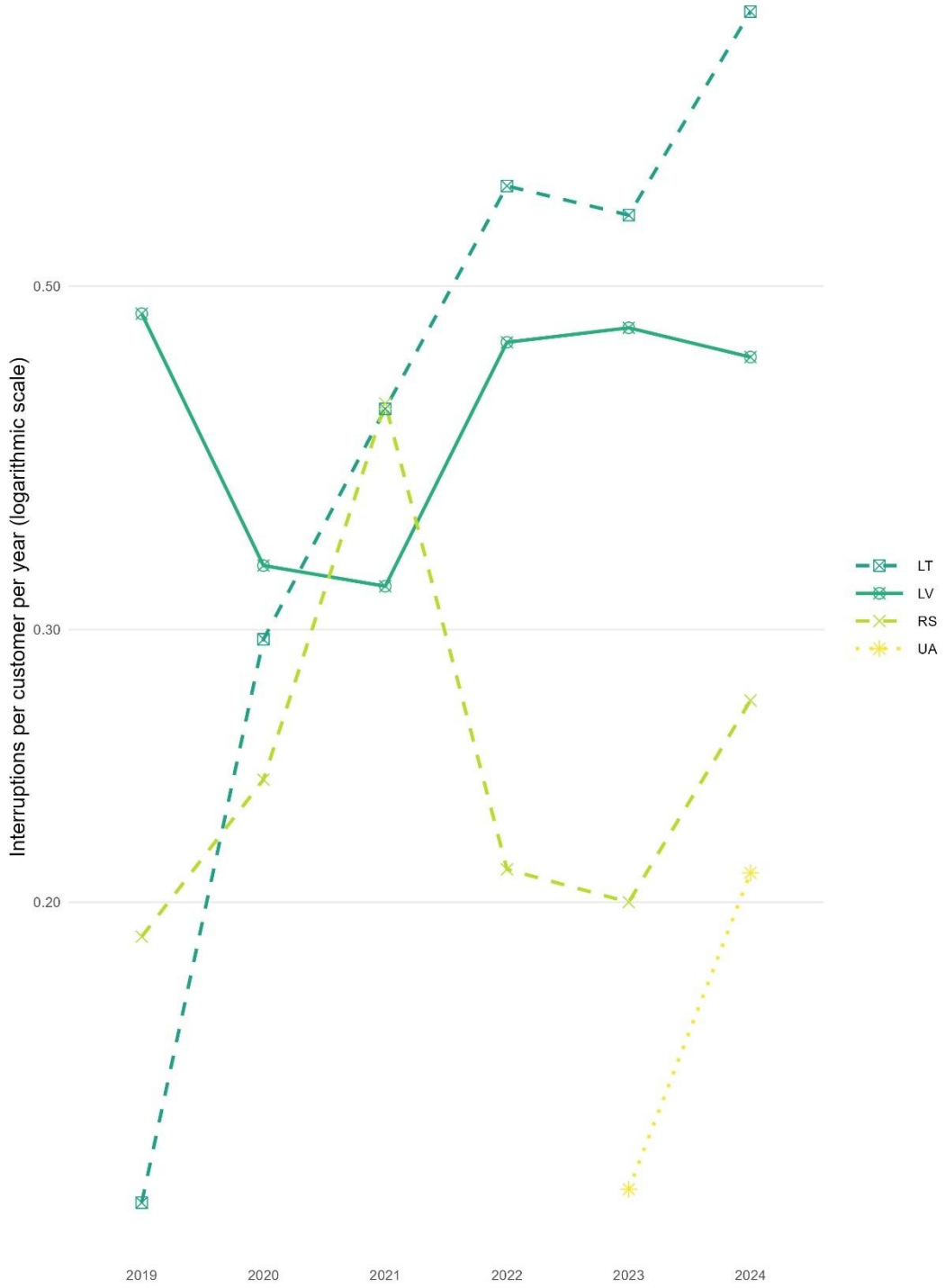


Figure 53 – Gas SAIFI planned, countries above limit

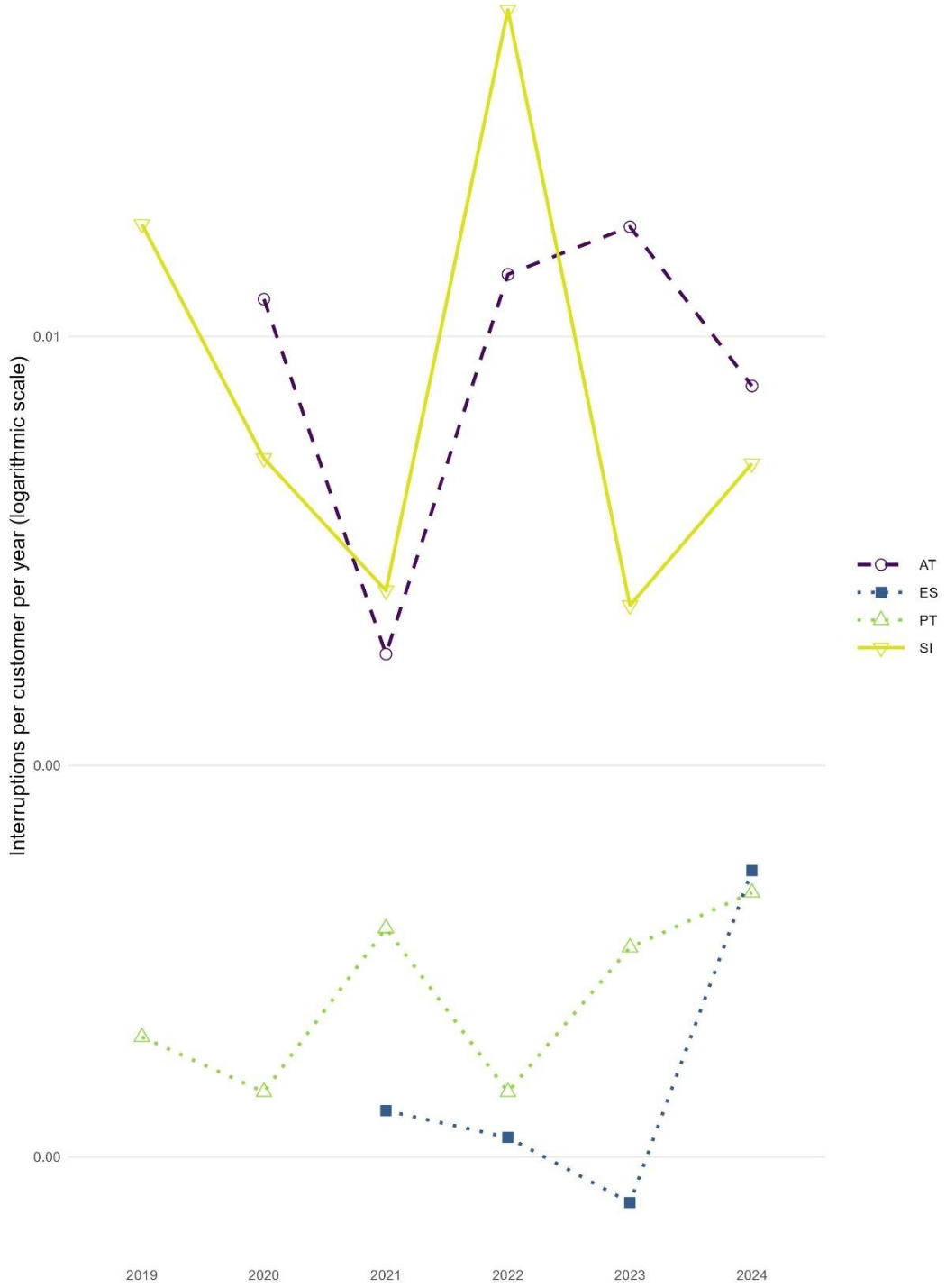


Figure 54 – Gas SAIFI planned, countries below limit

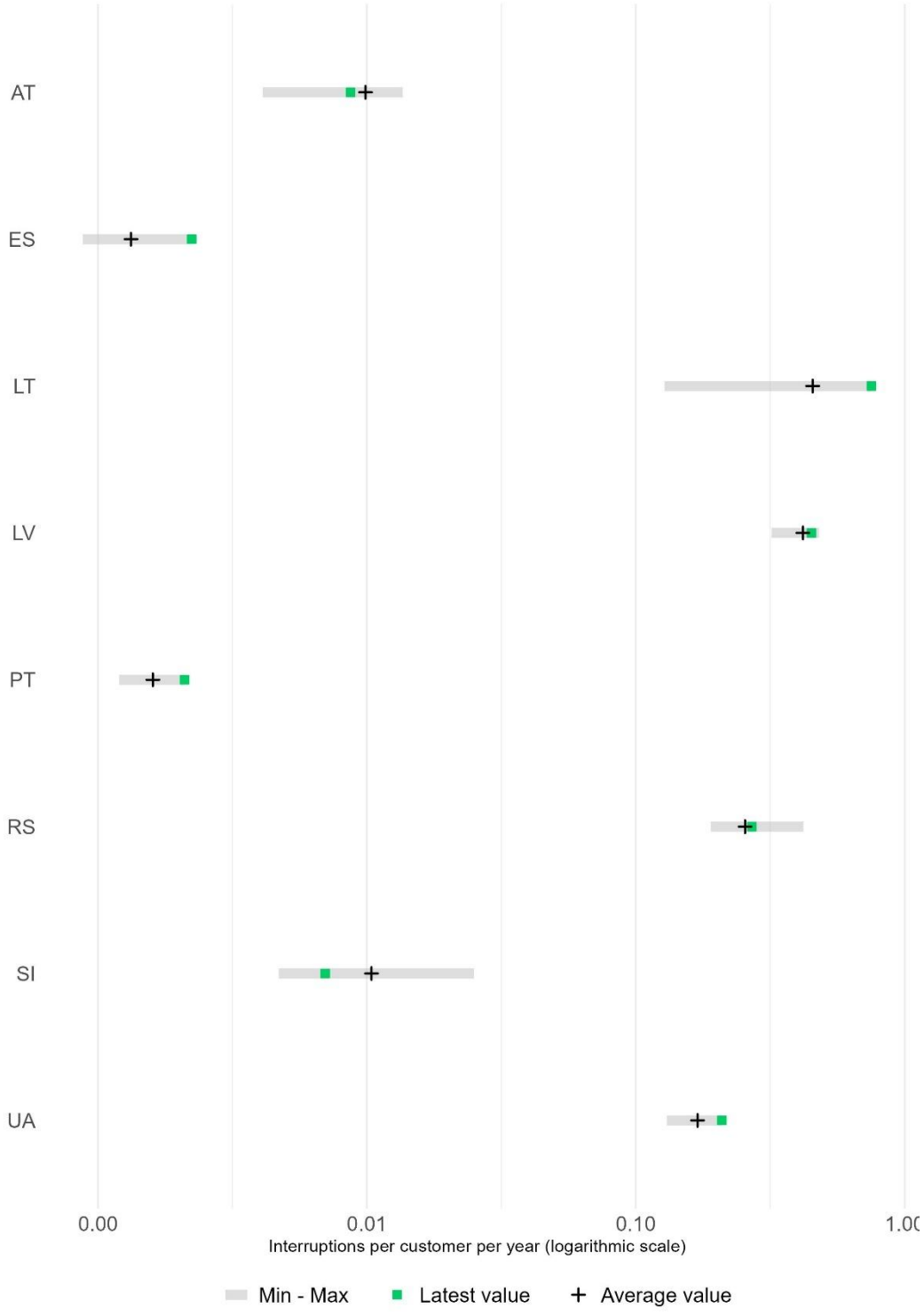


Figure 55 – Gas SAIFI planned, boxplot, all countries

3.3 Customer Average Interruption Duration Index – CAIDI

The following table shows what type of CAIDI indicators are monitored in each country. Since CAIDI indicates average interruption duration, its values for gas can be higher than those for electricity, contrary to SAIDI or SAIFI values. In other words, a lower number of interruptions or a lower number of affected customers does not necessarily result in shorter interruptions. Similarly to SAIDI and SAIFI, CAIDI can also be determined for planned interruptions. Readers should keep in mind that the definition of a planned interruption, i.e. the time that a customer would have to be notified in advance, is not standardised across Europe. Moreover, the CAIDI values in Table 41 and Table 42 in Annex could slightly differ from the CAIDI calculated as SAIDI/SAIFI because of rounding errors.

Indicator	Country	Applies to distribution	Applies to distribution and transmission
CAIDI unplanned	AT, DE, ES, LV, MD, NL, UA	AT, LV, MD, NL, UA	BE, DE, ES
CAIDI planned	AT, DE, ES, MD, NL, UA	AT, MD, NL, UA	BE, DE, ES

Table 15 – Monitoring of CAIDI values for gas

All participants had a stable trend line for unplanned CAIDI. Only five countries had provided sufficient data for proper analysis of unplanned CAIDI while only four did it for planned CAIDI. One country has a stable trend line for planned CAIDI (33%), while three countries (67%) showed improvements (descending trend lines) between 2019 and 2024. As with all other indicators, countries that provided values for fewer than three years were not included in percentages shown since not enough data points were available to confidently determine their trend line.

In Moldova, there was no obligation to record and calculate CAIDI up to and including 2022. For 2023 and 2024, the values were calculated, but the NRA indicated that they do not have fully verified data which means that they could not be included in this report. This applies to both planned and unplanned CAIDI.

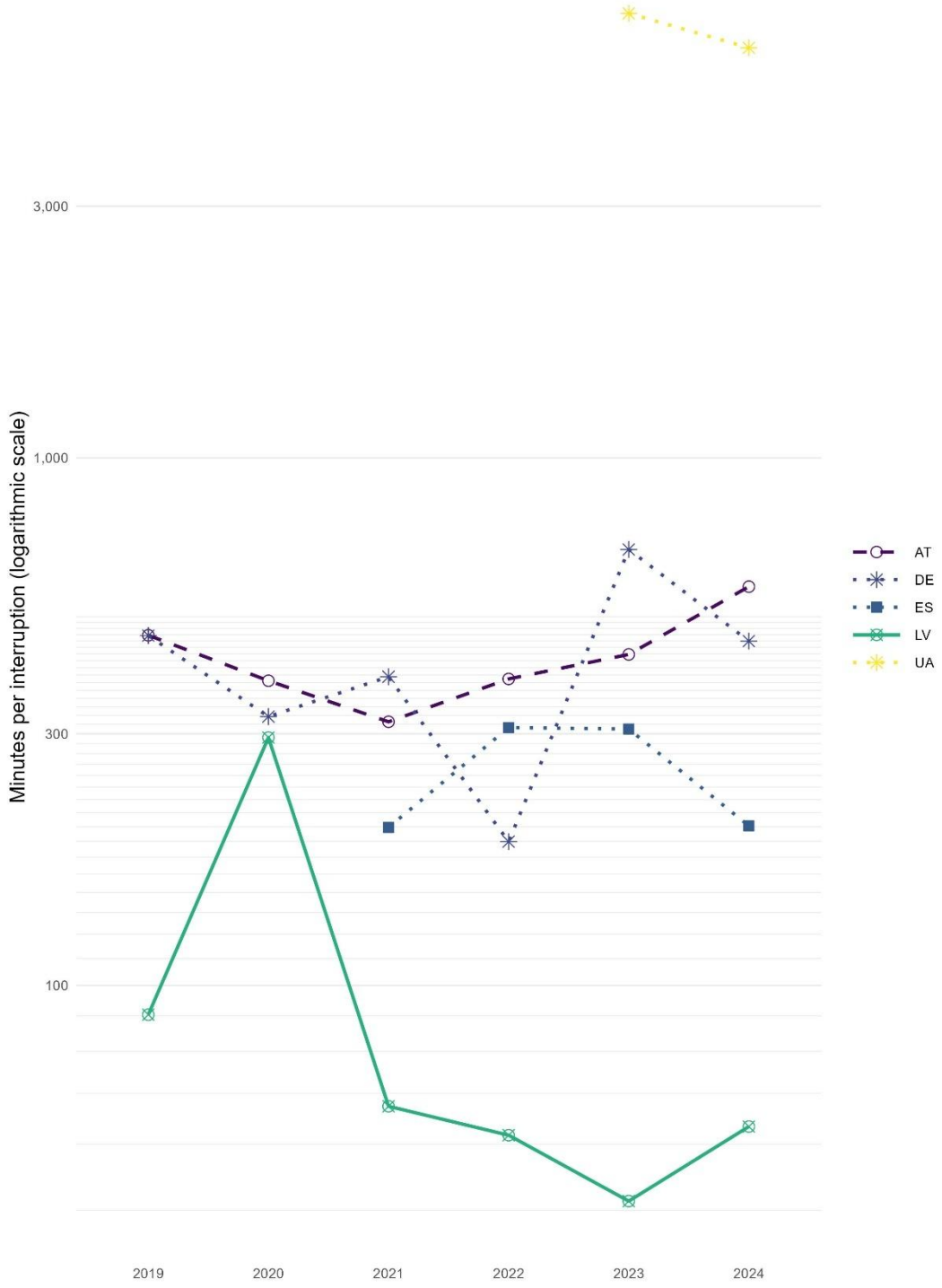


Figure 56 – Gas CAIDI unplanned, all countries

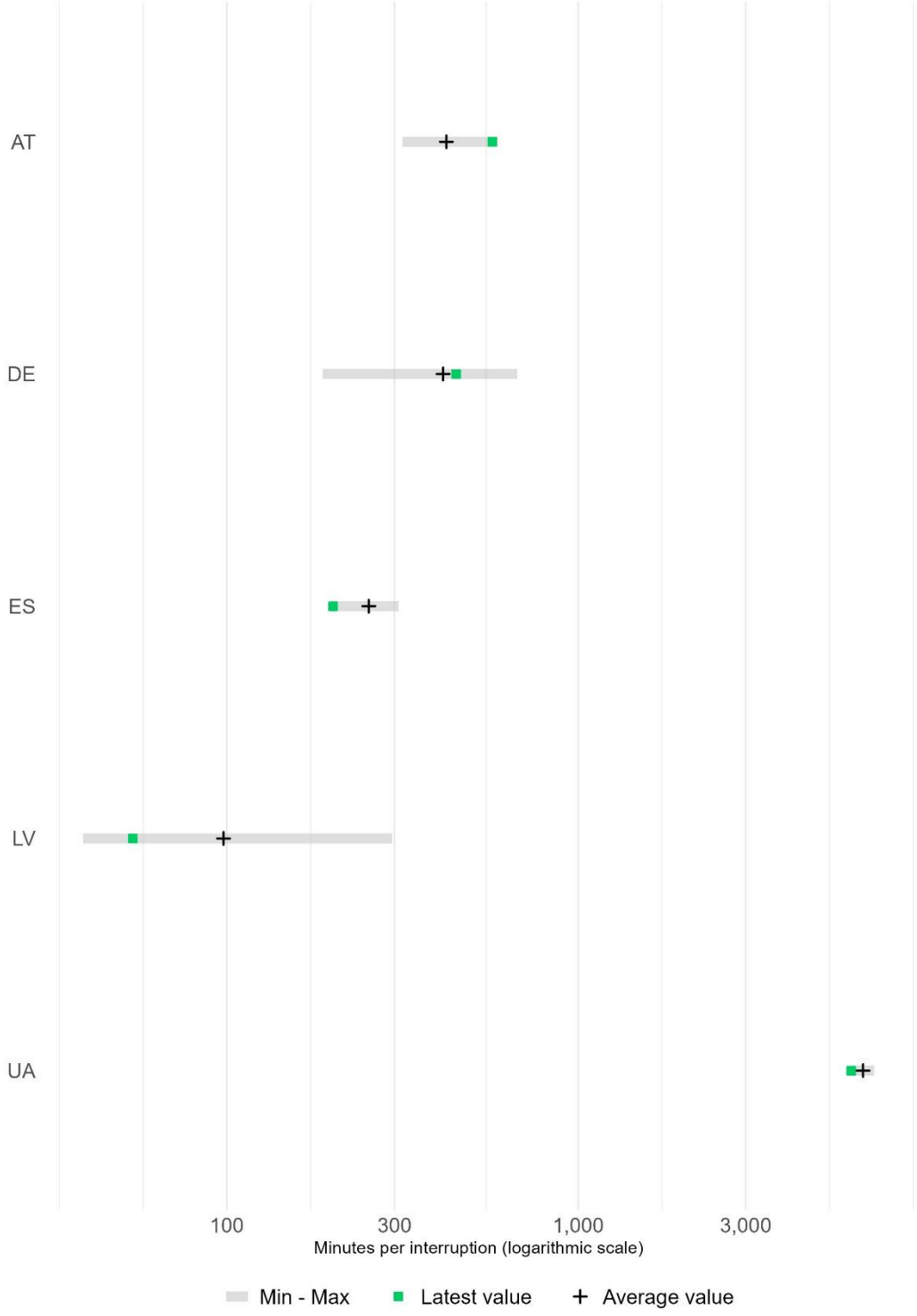


Figure 57 – Gas CAIDI unplanned, boxplot, all countries

3.4 Network length

Albania's domestic gas distribution network is a remnant of the past oil and gas development, consisting of approximately 498 km of mostly non-operational pipelines, primarily for local consumption like thermal power plants and producers. The network is outdated and requires significant rehabilitation and, in some sections, complete replacement.

Albania's current gas distribution structure primarily relies on the Trans Adriatic Pipeline (TAP), a large-scale transmission pipeline bringing Caspian gas to Europe and passing through Albania's coast near Fier. There is no developed large-scale domestic distribution network in place, but plans and projects like the transmission pipeline to the Vlora Power Plant and the gasification of the Korça region aim to establish a national distribution system for industrial, commercial, and residential us

Poland indicated that the length of their transmission network also includes the length of Yamal pipeline which is 684.80 km long. France considers 16 bar to be the border between the high (over 16 bar) and medium pressure (transmission pipelines under 16 bar). The Netherlands considers their high-pressure network to be the same as transmission, which corresponds to pressure above 8 bar.

Similarly, the gas transmission network in Great Britain is the high-pressure network, defined as operating at ≥7 bar. Medium pressure in Great Britain is defined as pressure between 75 mbar and less than 2 bar (≥ 75 mbar and < 2 bar), while low-pressure is anything below 75 mbar. Great Britain also operates intermediate pressure in gas, which is defined as pressure between 2 bar and less than 7 bar.

In addition to high (>12 bar), medium (between 1 and 12 bar) and low-pressure (<1 bar) gas networks, Denmark also operates service pipes. Their length in 2024 was 7,600 km. Estonia considers low pressure to be up to 5 bar, but the pressure in most networks only goes up to 0.1 bar. Other than the high, medium and low-pressure pipelines, Italy also operates pipelines for LPG and propane infrastructure. The length of these pipelines was 3,680 km in 2024. In Moldova’s gas network, high pressure goes from 0.3 to 1.2 MPa and medium pressure from 0.05 to 0.3 MPa.

In Serbia, high-pressure pipelines constitute the gas transmission network, so the length of high-pressure pipelines and transmission pipelines are the same. Medium pressure and low pressure are part of the gas distribution network. In addition, there are other gas pipelines related to upstream activities (i.e. production), for which the NRA does not collect the data.

The gas pipeline length for 2024 is presented in Figure 60 and divided into transmission and distribution pipeline length. The latest year Belgium provided distribution length for was 2023 and in this case, the Belgian values reflect two different years: 2024 for transmission and 2023 for distribution.

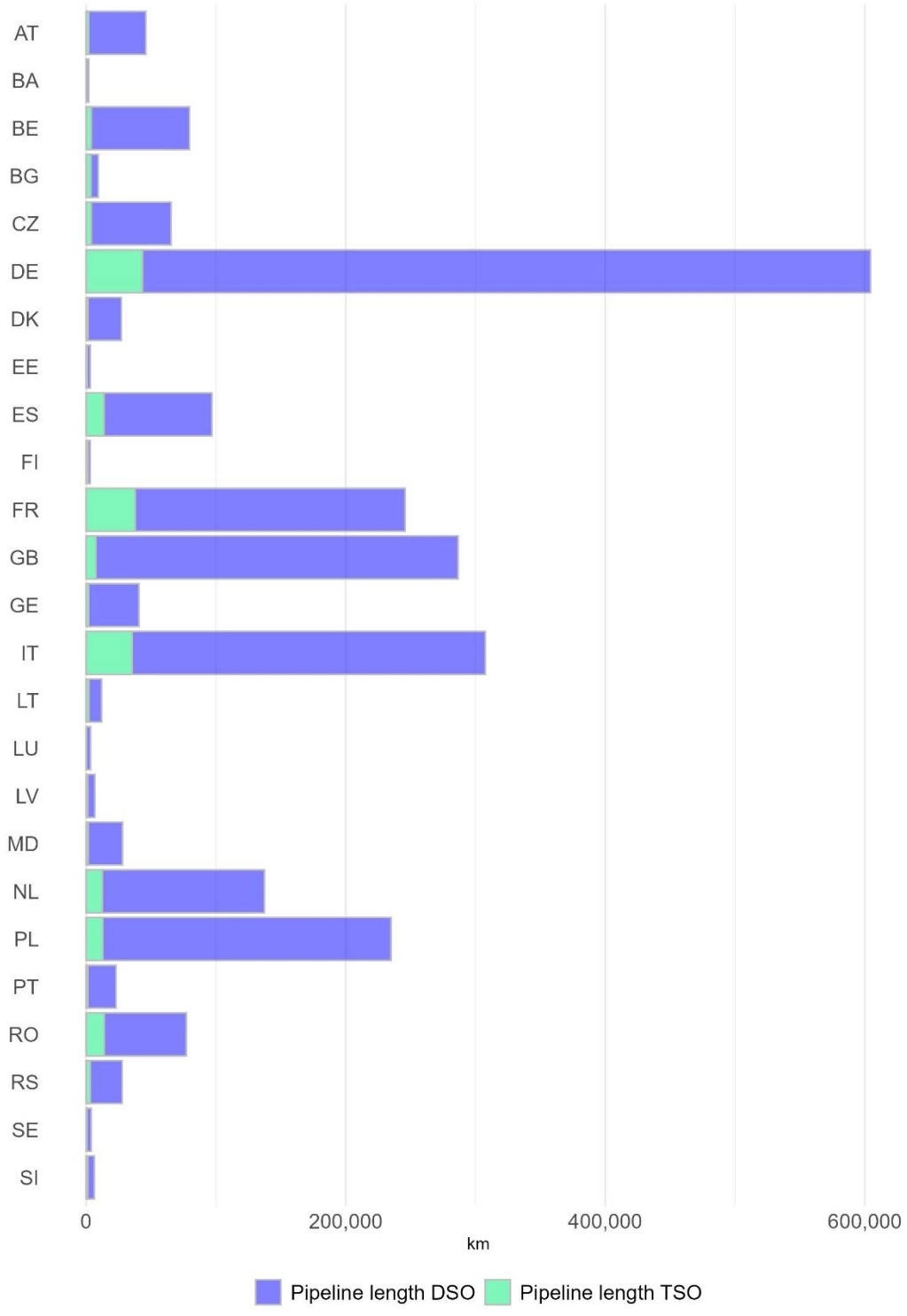


Figure 58 – Gas Pipeline length TSO & DSO in 2024

3.5 Storage

The number of European countries operating natural gas storage infrastructure is presented in Table 16 below, along with the type of storage.

Even though Albania possesses no operational natural gas storage infrastructure, it has plans and ongoing efforts to establish this infrastructure, primarily focusing on the Dumre region, which has potential for underground storage in a salt dome and depleted gas fields. The Dumre deposits have the potential to store up to 2 billion cubic metres of gas, according to a 2012 preliminary feasibility study. This salt dome covers an area of approximately 250 km2. The Dumre project is an exploration initiative aimed at assessing the geological potential of the area for future underground gas storage and other subsurface applications.

Lithuania stores its natural gas in an underground facility in Latvia (Inčukalnis). Sweden indicated that Swedegas owns one storage facility, Skallen with a capacity of 10 million normal cubic metres (Nm3). It is a lined rock cavern (LRC) facility.

In total, 17 European countries operate natural gas storage infrastructure. This number includes Lithuania which uses a facility in neighbouring Latvia. Table XX shows the capacity of gas storage in million cubic metres (mcm) with depleted fields having the highest total capacity.

Type of storage	Number of countries with natural gas storage	Yes	No
Overall natural gas storage	17	BE, BG, CZ, DE, ES, FR, GB, IT, LT[8], LV, NL, PL, PT, RO, RS, SE, UA	AL, EE, GE, LU, MT, SI
Depleted fields	11	BG, CZ, DE, ES, FR, IT, LV, NL, PL, RO, RS	BE, LT, MT, PT, SE, SI
Salt caverns	6	CZ, DE, FR, GB, PL, PT	BE, BG, IT, LT, MT, NL, RO, RS, SE, SI
Aquifers	5	CZ, DE, ES, FR, LV	BG, IT, LT, MT, NL, PL, PT, RO, RS, SE, SI

Table 16 – Natural gas storage across Europe

[8] This facility is in Latvia.

Country	Depleted fields (mcm)	Salt caverns (mcm)	Aquifers (mcm)
Belgium			1,400
Bulgaria	550		
Czechia	3,884	75	177
Germany	8,295	14,122	260
Latvia			2,320
The Netherlands	13,000		
Poland[9]	2,435	874.3	
Portugal		335	
Romania	3,200		
Serbia	450		
Spain	1,730		400

Table 17 – Capacity of natural gas storage (in million cubic metres)

Number of countries where natural gas storage infrastructure is regulated	Yes	No
12	AL[10], BE, BG, ES, FR, IT, LV, PL, PT, RO, SE, UA	CZ, DE, NL, RS

Table 18 – Regulation of the natural gas storage infrastructure

Albanian legislation governing the natural gas sector already includes provisions regulating natural gas storage activities and establishes the conditions under which such facilities would be licensed and operated in the future. Therefore, while there is currently no operational storage infrastructure, there is a regulatory framework in place that would apply once such infrastructure is developed. Albania is included among the countries with existing regulation of gas storage infrastructure in Table 18.

Belgium and Spain have regulated third-party access (TPA). More specifically, Spain uses regulated tariffs and allowed revenues. Bulgaria and Romania reported regulated access as well, with storage prices being regulated in Bulgaria. Sweden implemented a revenue cap on storage infrastructure. In Italy, storage service is subject to unbundling, access and quality of service regulation. In Latvia, the storage booking tariffs were regulated until 30 April 2026.

According to Energy Law Act in Poland a licence is required to perform business activity of the storage of gaseous fuels which is granted by the president of the NRA ERO (Energy

[9] This refers to the 2025-2026 storage year (from 15 April 2025 at 6:00 hrs to 15 April 2026 at 6:00).

[10] Only regulatory framework for gas storage, even though this infrastructure does not yet exist in Albania.

Regulatory Office). Tariffs are specified and approved by the president of ERO after license to store gas fuels is granted. According to this act, storage system operator prepares a development plan aimed to satisfy the current and future demand for storage capacity for a period of 10 years. The same act obliges storage system operators to develop instructions on operation and use of storage installations.

Italy uses these indicators for regulation of gas storage: safety (inspections), continuity (disruptions) and commercial quality. Romania uses indicators to regulate registration of requests/notifications/complaints, contracting of natural gas storage service, notifications of limitations and/or unplanned interruptions and resumption of service provision, notifications of planned limitations and/or interruptions and resumption of service provision, resolving requests/notifications/complaints regarding the service provision, helpline and fulfilment of payment obligation.

In 2015, the NRA of Ukraine adopted the Gas Storage Code and the criteria under which a gas storage facility is subject to a negotiated access regime or a regulated access regime. The operator of gas storage facilities is responsible for the safe and reliable operation, maintenance and development (including new construction and reconstruction) of these facilities. The storage services (injection and withdrawal) are carried out by the operator while the tariffs for these services are set by the NRA (for storage facilities to which the regulated access regime applies). The gas storage operator submits to NRA for approval a ten-year gas storage development plan, based on the actual and forecast supply and demand for storage services. This development plan ensures that the storage facility meets the market needs and the interests of natural gas security of supply.

3.6 LNG

Liquefied natural gas plays an important role in guaranteeing the security of supply as well as raising the integration and competitiveness of the gas market. Since it can be imported by sea, it offers an alternative to traditional gas imports by land, which typically uses cross-border gas pipelines.

Table 19 shows the countries that responded to the questionnaire with a "yes" (14 in total), which does not necessarily mean that they are the only countries in Europe with LNG infrastructure.

Number of countries with LNG infrastructure	Yes	No
14	BE, DE, EE, ES, FI, FR, GB, IT, LT, MT, NL, PL, PT, SE	AL, BG, CZ, LV, RO, RS, SI, UA

Table 19 – LNG infrastructure across Europe

Belgium has LNG ship infrastructure, jetties allowing loading and unloading of small LNG ships (ca. 1,000 m³) up to the largest (267,000 m³) and ship-to-ship operations. The maximum regasification capacity is 197 TWh/y. The LNG gas storage capacity in 2024 was 566,000 m³. They have six loading bays for truck loading. There are currently four operating floating storage and regasification units (FSRU) in Germany: two in Wilhelmshaven and one in Brunsbüttel and Mukran each. In addition, three more are planned on land: Wilhelmshaven, Brunsbüttel and Stade.

France has four LNG terminals: two in Fos-sur-mer (southern France), one in Montoir de Bretagne (western France) and one in Dunkerque (northern France). There are five regasification terminals in Italy: three FSRUs (Piombino, Ravenna and Livorno), one offshore terminal (Rovigo) and one onshore terminal (Panigaglia). Lithuania has a terminal in Klaipėda.

Malta imports natural gas through an LNG terminal located within the Delimara Power Station complex, where two natural gas-fired power stations are located. The LNG infrastructure consists of a floating storage unit (FSU) and an onshore regasification plant located at the Delimara site. The FSU has a storage capacity of 125,000 m³ of LNG, while the regasification plant can deliver a maximum output of 89,000 Nm³ of natural gas per hour.

Poland's LNG terminal is located in Świnoujście. The services currently provided include: unloading LNG from a LNG carriers at the unloading jettys, LNG process storage in cryogenic tanks, LNG regasification and send-out of natural gas to the national transmission system and loading of LNG onto tank trucks and ISO containers, as well as loading of small and large scale LNG carriers and LNG bunkering. The annual regasification capacity of the terminal is up to 8,3 billion cubic metres. The plant has three cryogenic tanks for LNG process storage with a joint capacity of 500,000 cubic metres of LNG. In the Netherlands, the two LNG terminals (Rotterdam and Eemshaven) are connected to the high caloric gas network. Sweden has two terminals for LNG and one regulated gasification plant.

Number of countries where LNG infrastructure is regulated	Yes	No
11	AL[11], BE, DE, EE, ES, FR, IT, LT, MT, PL, PT	CZ, NL, RO, SE, SI

Table 20 – Regulation of LNG

In Albania, the NRA'S decision from 2021 (Decision No. 256, dated 21.12.2021) details procedures and terms for obtaining licenses to perform activities in the natural gas sector, including the operation of LNG terminals. The country does not currently have any operational LNG terminals or LNG facilities. However, the national legal framework governing the natural gas sector includes provisions regulating LNG-related activities, including licensing procedures and operational requirements, should such infrastructure be developed in the future. In other words, the legislation exists, but operational assets do not. Albania is included among the countries with existing regulation of LNG infrastructure in Table 20.

Belgum regulates the third-party access. In Lithuania, the NRA sets the price for regasified gas coming from the LNG terminal. In Germany, tariff regulation and regulation of access is set by the Energy Act (Section 118a and section 26.1 of the Energy Act) and according to LNG Ordinance. Access to LNG facilities must be transparent and non-discriminatory. LNG facilities are eligible for provisions for access as well as for capacity allocation and capacity management. Operators of LNG facilities are subject to cost-oriented charging. They require network tariff approval, which is governed by provisions of the LNG Ordinance. The regulatory framework set out in the Ordinance includes an annual cost-oriented fee calculation based on a planned/actual cost comparison, including interest on the resulting balances, which is to be distributed on an annuity basis over the following years.

Estonia regulates the activity license, obligation to coordinate the standard terms and conditions of the terminal use agreement and the tariff calculation methodology. In Spain, six LNG plants with TPA have regulated tariffs access and allowed revenues and one LNG plant has a temporary specific economical and operation regulation that ends in late 2026. Of the four LNG terminals in France, three are regulated and operated by Elengy and one terminal, operated by Dunkerque LNG, is not regulated.

Regasification service in Italy is subject to unbundling and access regulation. The Rovigo terminal is benefitting from a partial TPA exemption for over 70% of its capacity. Malta regulates its LNG through the Subsidiary Legislation 545.12 called "Natural Gas Market Regulation". The NRA of Poland ERO approves the LNG terminal code and tariffs.

Portugal provided information on its LNG terminal operating capacities: annual natural gas regasification capacity of eight billion cubic metres, storage capacity of 390,000 m^3 (2.5 TWh), mooring adapted for methane tankers with capacities ranging from 40,000 to 216,000 m^3, maximum output to the national gas transmission network of 1,350,000 Nm^3/h and tanker loading capacity of 36 tankers/day.

Albania listed the following indicators used in regulation of LNG: balance of supply and demand, liquidity of gas supplies, storage and withdrawal capacity, interconnection capacity, safety and sustainability, environmental protection, metering and quality, non-discriminatory access, five-year development planning, and transparency. They represent the regulatory principles that would be applied to LNG infrastructure when it became operational.

[11] Only regulatory framework for LNG, even though this infrastructure does not yet exist in Albania.

Portugal uses the following continuity of service indicators for regulation of LNG infrastructure:

- Average effective discharge time for methane vessels (h): quotient between the sum of the effective discharge times and the total number of discharges;
- Average load rate (m^3/h): quotient between the sum of the loaded volumes and the sum of the load times;
- Average methane vessel unloading delay time (h): quotient between the sum of unloading delay times and the number of delayed discharges;
- Effective average tanker filling time (h): quotient between the sum of the filling times and the total number of fillers;
- Average tanker filling delay time (h): quotient between the sum of the filling delay times and the number of delayed fillers.

France also responded that indicators are used for regulation of LNG but did not provide details.

4 Conclusions

This report is based on the 2025 questionnaire by the CEER EQS WS. All 39 participating countries monitor the indicators SAIDI and SAIFI in electricity (some under a different indicator name) but two of them could not provide the values for SAIFI.

In 2024, the latest year covered by this report, many countries had (electricity) SAIDI and SAIFI values that are comparable to those in other years in this report. A few participants had the 2024 value as either their lowest or their highest value of the observed period.

The values of unplanned electricity SAIDI excluding exceptional events ranged from 7.48 to 2,370.60 minutes per customer in 2024 in distribution (with one country providing only the SAIDI for transmission, which was 6 minutes in 2024, both excluding and including exceptional events). The values of unplanned electricity SAIDI including exceptional events ranged from 8.46 to 29,712.00 minutes per customer in distribution (while the 2024 value obtained for transmission was 6 minutes, once again). Regarding unplanned electricity SAIFI, the 2024 values ranged from 0.18 to 42.34 interruptions per customer excluding exceptional events and from 0.21 to 168.05 interruptions per customer including exceptional events in distribution (with one country providing only the SAIFI for transmission, which was 0.20 interruptions per customer in 2024, both excluding and including exceptional events).

Between 2019 and 2024, many countries saw an increase in planned SAIDI and planned SAIFI in electricity, which could be a sign of higher investments in networks (longer or more frequent repair or replacement of components), with the aim of reducing unplanned interruptions in the future.

Due to the possibility of gas storage and very high technical requirements of gas networks, continuity of supply is not the main factor influencing the decisions of gas network operators. Nevertheless, the same interruption indicators that are used for electricity are also used to quantify continuity of supply for gas. The most common indicator for unplanned interruptions in gas is SAIDI, which is monitored by 13 respondents, followed by SAIFI (11 respondents) and CAIDI (six respondents). Planned gas interruptions are monitored as well, with planned SAIDI used by the highest number of participants (13), followed by planned SAIFI (ten participants) and planned CAIDI (five participants). There were countries, however, that could not provide some (or any) of their gas indicator values even though they monitor them.

The value of gas CoS indicators is generally lower than that of electricity with SAIDI unplanned ranging from 0.05 to 223.09 minutes per customer and SAIFI unplanned from 0.000995 to 0.04 interruptions per customer in 2024. Another common indicator used in gas is CAIDI, with the 2024 values being between 54.00 and 5,988.37 minutes per interruption.

Since trend lines were determined for each of the main indicators, provided that enough values were obtained, the analysis of all indicators combined (i.e. one trend line for electricity and one for gas) shows that their value is increasing (worsening) in only a minority of countries over the observed period. In case of gas, an increase of combined planned and unplanned SAIDI, SAIFI and CAIDI was observed in only 5% of the countries with 89% having stable trends and 7% showing an improvement. Percentages for gas do not add up to 100% due to a rounding error since no decimal points were used. In case of electricity, combining all indicators (planned and unplanned SAIDI and SAIFI including and excluding exceptional events, in addition to unplanned MAIFI, AIT and ENS) showed an increase only in 14% of the countries, while 68% had stable trends and 18% showed improvements over time.

Annex 1 – List of abbreviations

Term	Definition
AIT	Average Interruption Time
ASIDI	Average System Interruption Duration Index
ASIFI	Average System Interruption Frequency index
CAIDI	Customer Average Interruption Duration Index
CEER	Council of European Energy Regulators
CoS	Continuity of Supply
DSO	Distribution System Operator
ECRB	Energy Community Regulatory Board
ee	Exceptional Events
EHV	Extra High Voltage
ENS	Energy Not Supplied
EQS WS	Energy Quality of Supply Work Stream
FSU	Floating Storage Unit
HV	High Voltage
LNG	Liquefied Natural Gas
LV	Low Voltage
m^3	Cubic metre
MAIFI	Momentary Average Interruption Frequency Index
mcm	Million cubic metres
MV	Medium Voltage
MW	Megawatt
MWh	Megawatt-hour
NIEPI	Equivalent Number of Interruptions Related to the Installed Capacity
Nm^3	Normal cubic metre
NRA	National Regulatory Authority
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
TIEPI	Equivalent Interruption Time Related to the Installed Capacity
TIM	*Tiempo de interrupción medio* (average interruption time)
TPA	Third-party access
TSO	Transmission System Operator

Annex 2 – List of Country abbreviations

County code	Full country name
AL	Albania
AT	Austria
BA	Bosnia and Herzegovina
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czechia
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
GB	Great Britain (GB is used for Great Britain: England, Scotland and Wales)
GE	Georgia
HR	Croatia
HU	Hungary
IE	Ireland
IS	Iceland
IT	Italy
KS*	Kosovo
LT	Lithuania
LU	Luxembourg
LV	Latvia
MD	Moldova
ME	Montenegro
MK	North Macedonia
MT	Malta
NL	The Netherlands
NO	Norway
PL	Poland
PT	Portugal

County code	Full country name
RO	Romania
RS	Serbia
SE	Sweden
SI	Slovenia
UA	Ukraine

Annex 3 – Data

Electricity

Country	2019	2020	2021	2022	2023	2024
AL	59.00	47.17	53.95	54.68	50.18	45.12
AT	25.14	26.58	23.00	24.17	32.27	23.41
BA	312.57	315.82	215.91	207.40	431.59	431.62
CH	8.00	12.00	8.00	7.00	8.00	10.00
CY	36.00	37.00	36.00	35.00	34.00	37.00
CZ	77.07	79.95	74.41	69.52	81.71	80.34
DE	12.20	10.73	12.70	9.94	10.42	7.48
EL[12]	18.60	19.60	13.00	15.00	4.20	6.00
ES	65.82	59.94	57.72	41.10	48.84	73.02
FR[13]	50.13	43.70	39.99	43.19	55.99	53.30
GB	39.22	36.88	34.84	34.93		
GE	1,034.70	951.20	859.10	1,364.00	1,193.50	1,447.10
HR	91.87	83.68	73.60	75.95	81.49	114.31
HU	59.82	58.84	56.93	57.74	59.12	58.84
IE	87.50	94.90	96.00	103.30	105.60	117.50
IT	51.71	42.92	43.48	42.34	47.87	50.04
KS*	2,923.23	3,207.60	3,574.20	2,340.00	3,398.40	2,370.60
LT	48.71	45.40	51.88	98.51	109.10	81.00
LU	27.40	17.10	14.00	20.80	13.20	13.50
LV	90.00	83.00	91.00	78.00	85.00	71.00
MD	211.58	133.77	190.05	235.46	172.97	150.89
ME	1,711.89	1,389.58	1,028.52	796.75	1,002.28	742.07
MK		870.00	1,018.00	833.00	949.00	631.00
PL	141.11	125.88	168.69	247.68	161.04	149.44
PT	68.57	73.16	75.48	74.15	77.23	69.70
RO	178.90	146.80	130.40	108.30	103.90	97.80
RS	392.46	431.46	474.48	183.52	513.83	385.65
SI	47.10	39.30	38.60	33.00	85.10	51.70
UA	682.00	820.00	626.00	603.00	536.00	502.00

Table 21 – Electricity SAIDI unplanned without ee

[12] Greek values refer only to transmission: EHV (400 kV) and HV (150 kV and 66 kV), including both the mainland transmission system and the connections with islands. Distribution values were not available.

[13] French values in this table are for low voltage only. The following values were provided for medium voltage: 2019: 31.41; 2020: 28.81; 2021: 24.40; 2022: 29.34; 2023: 35.50; 2024: 34.65.

Country	2019	2020	2021	2022	2023	2024
AT	36.79	38.06	24.01	39.36	61.02	60.63
BE[14]	21.00	19.00	34.00	16.00	16.00	26.85
BG	317.30	271.10	307.40	271.50	307.50	299.20
CY	38.00	40.00	41.00	41.00	40.00	39.00
CZ	157.30	147.86	198.28	136.98	153.08	238.28
DE	37.15	12.45	32.42	11.70	12.26	8.46
DK	17.72	17.81	19.68	17.25	14.10	19.83
EE	249.20	157.90	158.10	218.60	419.20	134.30
EL[15]	18.60	22.00	13.00	15.00	4.20	6.00
ES	65.82	59.94	57.72	41.10	48.84	73.02
FI	72.04	86.86	48.90	36.81	37.67	48.75
GB	41.55	41.23	36.45	96.40		
GE	1,584.50	1,241.20	2,093.70	1,716.40	2,232.50	2,162.90
HR	191.53	171.05	125.32	152.42	255.04	191.44
HU	78.70	90.76	78.25	66.78	127.20	81.74
IE	128.00	201.70	140.20	146.40	192.40	498.00
IS	51.00	71.00	42.00	54.00	19.00	44.00
IT	88.23	67.20	63.06	66.22	100.17	76.60
LU	27.40	17.10	22.00	20.80	13.20	13.50
LV	123.00	108.00	106.00	131.00	183.00	141.00
MD	337.10	212.04	293.94	266.71	274.76	238.47
ME	2,043.19	2,039.89	1,808.34	1,076.34	1,618.59	1,075.78
MT	460.80	96.00	89.40	112.80	319.80	137.31
NL	19.56	20.29	19.34	21.82	21.65	23.60
NO	65.57	88.97	87.49	57.82	67.34	75.28
PL	143.92	129.82	195.58	324.27	176.63	170.01
PT	151.55	86.30	92.33	85.59	86.87	94.68
RS	486.47	547.26	615.68	348.75	590.12	427.21
SE	137.62	75.16	62.52	75.70	62.76	63.12
SI	70.20	72.70	56.40	60.80	242.10	98.50
UA	934.00	1,123.00	1,070.00	19,350.00	12,925.00	29,712.00

Table 22 – Electricity SAIDI unplanned with ee

[14] Flanders only.

[15] Greek values refer only to transmission: EHV (400 kV) and HV (150 kV and 66 kV), including both the mainland transmission system and the connections with islands. Distribution values were not available.

Country	2019	2020	2021	2022	2023	2024
AT	13.96	13.50	14.06	13.55	17.48	17.34
BA	458.12	331.90	312.12	395.63	408.70	371.23
BE[16]					0.00	0.00
CH	11.00	9.00	9.00	9.00	10.00	11.00
CY	53.00	54.00	52.00	55.00	50.00	40.00
CZ	131.43	116.44	121.02	121.10	111.76	109.48
DE	3.75	3.94	4.48	3.75	3.82	4.21
DK	3.05	3.26	4.05	4.61	3.82	7.34
EE	68.00	64.00	56.00	70.00	71.00	81.00
EL	93.00	117.60	123.80	116.30	142.50	142.90
ES	7.32	8.04	9.54	34.92	6.48	22.86
FI	9.84	12.39	11.13	11.83	10.50	8.72
FR	14.14	14.70	16.14	16.30	17.94	18.27
GB	3.78	3.46	2.58	2.89	3.15	3.53
GE	1,501.40	919.80	1,054.10	1,303.90	1,317.60	1,399.90
HR	153.36	139.44	125.99	135.76	139.67	125.64
HU	138.50	145.50	131.10	122.00	130.90	150.80
IE	96.20	79.80	85.80	93.10	101.50	114.00
IT	64.77	65.19	79.96	87.81	84.69	86.96
KS*	1,341.56	1,329.00	1,231.80	2,132.40	1,608.60	1,957.20
LT	83.42	124.28	145.98	157.41	149.95	144.96
LU	4.10	5.20	7.50	7.70	8.10	10.70
LV	123.00	111.00	102.00	110.00	83.00	74.00
ME	1,215.70	1,020.47	946.69	677.16	756.53	468.15
MT	44.71	32.38	32.49	42.83	47.28	50.31
NL	8.40	9.19	9.64	15.32	18.85	23.34
NO	41.58	44.46	41.01	41.39	38.88	39.97
PL	39.52	26.91	25.14	28.95	31.13	32.26
PT	0.48	0.50	1.26	0.84	0.68	0.87
RO	171.10	153.93	155.59	132.21	134.51	131.40
RS	302.36	256.91	275.98	138.80	260.59	278.21
SE	18.37	18.30	17.63	19.50	24.03	21.93
SI	117.80	104.50	100.90	93.50	93.30	96.70
UA	473.00	480.00	662.00	344.00	549.00	597.00

Table 23 – Electricity SAIDI planned

[16] Flanders only. Data for 2019-2022 not available. Planned SAIDI is only monitored on HV and EHV.

Country	2019	2020	2021	2022	2023	2024
AT	0.62	0.65	0.54	0.56	0.68	0.51
BA	4.47	4.76	3.64	3.60	5.11	4.77
CH	0.17	0.21	0.16	0.14	0.16	0.18
CY	0.25	0.26	0.24	0.20	0.23	0.23
CZ	1.40	1.40	1.24	1.23	1.53	1.38
DK	0.30	0.32	0.33	0.32	0.37	0.36
EL[17]	0.17	0.19	0.26	0.32	0.13	0.20
ES	0.90	0.92	0.91	1.08	1.06	1.12
FR[18]	0.63	0.56	0.49	0.56	0.57	0.57
GB	0.46	0.44	0.43	0.41		
GE	17.83	11.75	10.73	17.81	14.57	15.42
HR	1.48	1.41	1.40	1.19	1.22	1.43
HU	0.84	0.83	0.81	0.83	0.80	0.77
IE	1.23	1.26	1.20	1.27	1.26	1.38
IT	1.91	1.71	1.77	1.65	1.73	1.91
KS*	47.67	47.02	51.99	42.19	50.88	42.34
LT	0.81	0.72	0.81	1.13	1.23	1.03
LU	0.36	0.33	0.33	0.39	0.29	0.21
LV	1.79	1.51	1.66	1.36	1.52	1.31
MD	2.93	2.25	9.93	7.85	13.65	9.01
ME	22.48	20.42	15.74	14.58	15.41	12.32
MK		7.00	8.00	7.00	9.00	8.00
PL	2.62	2.36	2.76	3.43	2.65	2.52
PT	1.49	1.56	1.52	1.61	1.60	1.32
RO	2.90	2.57	2.31	1.93	1.74	1.70
RS	5.45	5.69	5.77	3.26	5.87	4.49
SI	1.17	1.11	0.97	0.92	1.55	1.11
UA	6.71	7.62	6.68	5.62	5.64	5.27

Table 24 – Electricity SAIFI unplanned without ee

[17] Greek values refer only to transmission: EHV (400 kV) and HV (150 kV and 66 kV), including both the mainland transmission system and the connections with islands. Distribution values were not available.

[18] French values in this table are for low voltage only. The following values were provided for medium voltage: 2019: 0.63; 2020: 0.54; 2021: 0.48; 2022: 0.53; 2023: 0.57; 2024: 0.57.

Country	2019	2020	2021	2022	2023	2024
AT	0.73	0.76	0.56	0.65	0.96	0.60
BE[19]	0.39	0.36	0.34	0.33	0.33	0.54
BG	3.84	3.24	3.69	3.32	3.69	3.45
CY	0.27	0.26	0.24	0.22	0.24	0.23
CZ	1.90	1.92	1.78	1.78	2.15	1.80
DK	0.48	0.54	0.57	0.49	0.48	0.44
EE	1.70	1.30	1.40	1.60	2.50	1.40
EL[20]	0.17	0.19	0.26	0.32	0.13	0.20
ES	0.90	0.92	0.91	1.08	1.06	1.12
FI	1.75	1.70	1.37	1.29	1.13	1.23
GB	0.48	0.48	0.45	0.52		
GE	26.87	15.77	19.54	21.22	23.85	21.82
HR	2.21	2.04	1.79	1.57	2.00	1.91
HU	0.94	1.11	0.94	0.88	1.26	0.98
IE	1.49	1.74	1.43	1.48	1.74	2.25
IS	0.42	0.44	0.58	0.45	0.25	0.65
IT	2.39	2.09	2.12	2.23	2.54	2.63
LU	0.36	0.33	0.34	0.39	0.29	0.21
LV	2.09	1.75	1.81	1.92	2.25	1.67
MD	5.12	3.71	11.13	8.21	9.25	9.54
ME	25.60	24.94	22.05	18.82	21.38	16.68
MT	4.55	2.44	1.59	1.38	2.74	2.68
NL	0.30	0.25	0.27	0.35	0.30	0.34
NO	1.45	1.72	1.38	1.20	1.27	1.47
PL	2.63	2.37	2.77	3.46	2.66	2.52
PT	2.20	1.72	1.85	1.75	1.77	1.56
RS	6.20	6.61	6.57	5.33	6.42	4.95
SE	1.33	1.09	1.04	1.02	1.01	1.00
SI	1.67	1.63	1.31	1.49	2.95	1.83
UA	8.24	9.20	8.99	82.02	64.40	168.05

Table 25 – Electricity SAIFI unplanned with ee

[19] Brussels and Wallonia.

[20] Greek values refer only to transmission: EHV (400 kV) and HV (150 kV and 66 kV), including both the mainland transmission system and the connections with islands. Distribution values were not available.

Country	2019	2020	2021	2022	2023	2024
AT	0.12	0.11	0.11	0.11	0.13	0.13
BA	4.10	3.09	3.14	4.27	3.53	3.01
BE[21]					0.00	0.00
CH	0.10	0.11	0.12	0.12	0.17	0.16
CY	0.10	0.12	0.14	0.13	0.11	0.12
CZ	0.42	0.38	0.40	0.40	0.38	0.39
DK	0.03	0.03	0.04	0.04	0.05	0.06
EE	0.43	0.38	0.35	0.43	0.45	0.50
EL	0.50	0.60	0.60	0.60	0.60	0.61
ES	0.05	0.07	0.10	0.29	0.07	0.22
FI	0.24	0.13	0.12	0.13	0.11	0.10
FR	0.12	0.12	0.13	0.13	0.14	0.14
GB	0.02	0.02	0.01	0.01	0.01	0.02
GE	13.99	6.39	7.55	9.32	9.34	10.58
HR	1.05	0.90	0.82	0.89	0.88	0.78
HU	0.46	0.48	0.44	0.42	0.45	0.51
IE	0.27	0.34	0.40	0.47	0.50	0.51
IT	0.31	0.33	0.40	0.41	0.40	0.40
KS*	7.28	5.98	6.28	8.91	6.79	7.90
LT	0.40	0.55	0.63	0.66	0.68	0.68
LU	0.03	0.04	0.06	0.05	0.07	0.09
LV	0.57	0.57	0.52	0.55	0.47	0.50
ME	8.91	6.74	6.30	4.96	5.08	4.28
MT	0.59	0.47	0.46	0.44	0.44	0.82
NL	0.04	0.05	0.05	0.07	0.10	0.42
NO	0.27	0.27	0.27	0.26	0.24	0.24
PL	0.25	0.18	0.16	0.19	0.19	0.20
PT[22]	0.00	0.00	0.01	0.00	0.00	0.01
RO	0.60	0.58	0.60	0.52	0.52	0.56
RS	1.80	1.60	1.70	3.26	1.49	1.38
SE	0.16	0.17	0.22	0.27	0.34	0.26
SI	0.87	0.75	0.72	0.76	0.59	0.68
UA	2.05	2.06	2.91	1.55	2.4	2.57

Table 26 – Electricity SAIFI planned

[21] Brussels and Wallonia. Data for 2019-2022 not available. Planned SAIDI is only monitored on HV and EHV.

[22] Some values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.002; 2020: 0.003; 2021: 0.006; 2022: 0.004; 2023: 0.003; 2024: 0.005.

Country	2019	2020	2021	2022	2023	2024
BE[23]	0.03	0.03	0.01	0.04	0.02	0.01
CZ		0.80	0.76	0.69	0.59	0.61
FR	1.32	1.30	1.20	1.22	1.37	1.34
GE	3.79	3.76	5.00	6.07	6.95	8.89
HU	2.46	2.58	2.32	2.24	3.22	2.83
LT[24]	0.46	0.36	2.08	2.10	1.93	1.76
LV	2.53	1.99	1.81	1.97	2.64	1.94
MD	1.65	0.42	5.86	3.91	5.23	2.57
NO	1.56	1.76	1.38	1.35	1.31	1.51
PL	5.72	5.08	5.75	6.74	5.92	5.78
PT	11.11	9.75	9.32	8.72	9.12	8.75
RO	4.95	5.67	6.34	5.68	8.24	5.37
SE	0.97	0.63	0.68	0.67	0.62	0.66
SI	5.61	5.78	4.52	5.10	10.00	7.15
UA	1.22	1.45	1.71	1.43	1.65	1.65

Table 27 – Electricity MAIFI unplanned

[23] Values refer to HV and EHV only.

[24] Values for 2019-2021 include HV, MV and LV. Values for 2022-2024 only include MV and LV.

Country	2019	2020	2021	2022	2023	2024
AL[25]	35.00	35.00	28.76	29.58	28.87	25.96
BA[26]	50.99	36.99	32.02	31.68	53.53	282.85
BE	1.72	2.92	1.20	1.69	1.45	0.90
CY	30.92	33.83	35.68	34.57	50.57	65.63
CZ	23.00	7.50	7.00	37.00	18.30	26.70
EE	4,202.32	372.65	987.67	661.00	2,594.00	11,488.00
EL			10.14	3.11	2.95	1.44
ES	5.32	0.35	0.45	1.18	0.34	0.07
FR	3.42	3.07	4.06	2.44	3.09	2.53
HR	5.16	10.38	5.10	3.65	10.08	5.87
HU	0.03	0.00	0.01	0.32	0.01	0.00[27]
IS	89.00	12.00	3.00	39.00	18.00	5.00
IT	16.61	4.20	2.41	2.63	5.13	3.02
KS*		257.00	44.00	27.00	28.00	54.00
LT	1.78	1.07	0.69	1.29	0.84	0.86
LU	18.00	224.00	472.00	2,334.00	1,130.00	2,295.00
ME	39.57	176.82	77.86	33.46	29.03	63.14
PL	81.47	0.00	0.00	6.30	0.00	0.00
PT	0.72	0.03	0.05	0.08	0.39	0.02
RO[28]	0.90	2.83	1.01	0.52	0.34	0.76
RS	9.31	11.46	21.29	12.26	14.39	15.35
SE	1.27	0.06	0.07	1.09	0.89	0.04
SI[29]	6.24	4.22	0.42	3.42	10.48	0.36
UA	9.91	33.8	4.71	8.85	1.64	1.22

Table 28 – Electricity AIT unplanned without ee

[25] The values for Albania include both planned and unplanned interruptions. Exceptional events are excluded.

[26] Unplanned AIT is calculated with exceptional events.

[27] The 2024 value appears to be zero because only two decimal points are used. The actual value is 0.0029.

[28] The table above lists the values for interruptions of consumers. For interruptions of producers, the values are: 2019: 0.06; 2020: 0; 2021: 0.835; 2022: 11.16; 2023: 93.28; 2024: 0.35.

[29] Indicator available only including exceptional events.

Country	2019	2020	2021	2022	2023	2024
AL[30]	467.87	463.53	433.04	392.73	383.69	366.00
BA[31]	1,095.03	393.01	678.07	664.03	1,063.92	5,792.13
CY	300.81	287.83	346.00	331.00	489.00	687.00
CZ	18.00	10.00	12.00	150.00	166.00	58.00
EE	216.46	10.55	13.85	49.70	55.36	69.62
EL			879.12	248.82	222.69	110.77
ES	2,674.00	164.19	182.32	414.57	159.09	31.86
FR	2,617.00	2,125.00	3,079.00	1,753.00	2,097.00	1,730.00
GB	57.60	47.98	26.84	5.20	97.07	391.85
HR	218.03	421.90	235.02	164.65	471.73	281.00
HU	2.75	0.00	1.27	39.50	0.98	0.36
IE	15.50	5.70	4.80	11.90	409.20	47.00
IT	10,179.00	2,431.00	1,481.00	1,589.00	3,005.00	1,808.00
KS*	402.00	1,083.00	810.00	498.00	494.00	940.00
LT	52.39	31.85	20.51	38.69	23.23	24.28
MD	102.09	72.02	79.26	987.13	142.21	52.24
ME	245.57	1,031.71	476.99	180.65	158.55	355.90
PL	439.34	0.00	0.00	50.11	0.00	0.00
PT	67.50	2.80	4.70	7.70	35.70	0.50
RO[32]	91.78	287.98	109.76	54.04	37.13	83.79
RS	595.31	734.46	1,403.00	798.97	878.45	989.86
SE	286.60	14.00	16.50	249.30	187.30	9.30
SI[33]	120.10	4.44	2.39	60.21	0.43	3.90
UA	1.78	5.62	0.84	1.08	0.17	0.13

Table 29 – Electricity ENS unplanned without ee

[30] The values for Albania include both planned and unplanned interruptions. Exceptional events are excluded.

[31] Unplanned ENS is calculated with exceptional events.

[32] The table above lists the values for interruptions of consumers. For interruptions of producers, the values are: 2019: 6.53; 2020: 0; 2021: 90.5; 2022: 1,160.35; 2023: 10,154.26; 2024: 39.06.

[33] Indicator available only including exceptional events.

Country	EHV	HV	MV	LV
AL		3,478	17,505	59,940
AT	6,779	11,693	70,595	183,798
BA		6,516	29,392	80,035
BE	1,633	5,336		
CZ	5,875	14,570	78,419	158,202
DE	38,130	95,832	532,739	1,297,997
EE	1,936	5,363	27,520	36,701
EL	5,340	14,325		
ES	64,620	39,574	237,612	424,383
FI	6,985	17,938	156,226	261,428
FR	49,763	55,813	673,689	744,134
GE		7,186	18,437	38,932
HR	2,515	5,294	43,387	99,756
HU		8,452	69,884	92,261
IE	2,479	12,416	96,204	78,740
IS[34]		3,604		23,586
KS*		1,430	8,091	20,990
LT		7,411	58,146	72,906
LV		5,555	26,490	27,868
MD		6,525	21,959	
ME		1,549	6,328	13,772
MK	577	1,869	11,673	17,764
MT	119	91	1,788	4,369
NL	3,339	7,135	118,136	157,729
PL	9,408	37,147	310,167	459,353
PT	9,661	9,771	75,442	150,924
RO	9,202	22,353	120,704	188,707
RS	0	10,061	55,901	117,224
SE	15,621	20,643	212,407	339,044
SI	1,156	2,876	18,771	46,588

Table 30 – Electricity network length in km in 2024

[34] The length of HV network corresponds to the length of transmission circuits. The length of LV network is the total length of both the LV and MV networks in distribution.

Country	EHV/HV	HV/MV	MV/MV	MV/LV
AL[35]		154	159	27,057
AT	43	499	390	79,619
BA	28	260	177	22,959
BE	141	1,181	118	73,675
CZ	54	698	73	72,611
DK[36]	663	799[37]		
EE	20	366	49	28,775
EL	65[38]	2[39]	22	
ES	831	2,730	1,185	338,854
FI	89[40]	1,145	80	135,363
FR		5,837[41]	52	819,247
GB	10,955			602,675[42]
GE	47	653	79	17,950
HR	31[43]	316	796	28
HU		536	63	66,716
KS*		74	122	10,532
LT	34	362	253	50,871
LU	17	92	1	3,292
LV[44]	26	240		31,061
MD		478	2	15,199
ME		50	100	4,677
MK	5	54	78	7,461
PL	219Error! Unknown switch argument.	2,859Error! Unknown switch argument.	132	264,860
PT	175	727	66	71,826
RO	218			
RS	0	996[45]	1,278	51,066

[35] The number of substations/cabins in Albania is: HV/MV:79, MV/MV: 98, MV/LV: 26,151. The table shows the number of transformers.

[36] In 2023.

[37] EHV or HV to MV.

[38] Refers to 400/150 kV.

[39] Refers to 150/66 kV.

[40] Also includes the 400/220 kV transformers.

[41] DSO and TSO (including from 225 kV and 150 kV to lower level for TSO).

[42] MV is not defined in GB. These values are cumulative asset numbers that interface between HV/LV across GB.

[43] Without the 4 EHV/EHV transformers.

[44] EHV/HV: 330/110kV transformers. HV/MV and MV/LV: data for the largest DSO which serves 99% of the country's territory and users. The remaining DSOs are connected to the largest DSO.

[45] The number provided is for HV/HV and HV/MV combined.

SI	22	222	18	20,267

Table 31 – Number of transformer stations in 2024

Country	EHV/HV	HV/MV	MV/MV	MV/LV
AL		3,088	786	6,381
AT	25,424	33,767	3,130	35,266
BA	7,000	6,443	1,394	6,991
BE	27,243	51,295	1,555Error! Unknown switch argument.	22,498
CZ	18,500	26,503	689	23,807
DKError! Unknown switch argument.	21,668	28,432[46]		
EE	4,538	5,740	211	6,695
EL	17,840[47]	50[48]		
ES	57,483	52,944	5,464	132,482
FI		25,803		26,808
GE	7,785	14,049	623	4,359
HR	5,900[49]	10,294	5,738	9,675
HU		17,759	540	21,831
KS*		2,898	798	4,814
LT	8,905	6,578	1,105	11,952
LU	2,790	3,268	1	1,954
LV[50]	3,725	5,069		6,001
MD		6,137	11.9	3,185
ME		1,615	981	1,923
PL	33,460	63,997		53,542Error! Unknown switch argument.
PT	24,899	18,445	513	21,882
RO	37,363	37,705	1,608	22,974
RS	0	45,444[51]	7,250	22,055
SI	4,950	5,193	134	7,037

Table 32 – Transformer capacity in MVA in 2024

[46] EHV or HV to MV.

[47] Refers to 400/150 kV.

[48] Refers to 150/66 kV.

[49] Without the 2,000 MVA capacity of EHV/EHV transformers.

[50] EHV/HV: 330/110kV transformers. HV/MV and MV/LV: data for the largest DSO which serves 99% of the country's territory and users. The remaining DSOs are connected to the largest DSO.

[51] The value provided is for HV/HV and HV/MV combined.

Country	MV	LV
AL	8,084	1,339,634
BA	2,422	1,642,958
CZ	25,189	6,212,677
EE	2,178	761,822
EL	16,852	6,880,763Error ! Unknown switch argument.
ES	115,918	30,367,050
FI	4,731	1,764,586
FR	94,817	38,387,549
GE	3,506	2,076,081
HR	2,640	2,572,870
HU	8,009	7,571,033
IE	1,781	2,466,797
IT[52]	110,584	37,169,834
KS*	545	752,045
LT	2,346	1,912,756
LU	4,154	176,459
LV	1,587	1,114,816
MD	8,759	1,437,899
ME	639	445,070
MK	1,487	923,031
NL	41,312	9,031,544
PL	52,394	19,149,863
PT	27,351	6,388,442
RO	27,819	10,165,938
RS	6,036	3,822,375
SI	1,629	988,255

Table 33 – Number of electricity connection points in 2024

[52] In 2023. This includes all final consumers and producers.

Country	DSO	TSO
AT	118	3
BA	8	1
BE	16	1
CZ	3	1
DE	866	4
EE	33	1
EL	1	1
ES	330	1
FI	77[53]	1
FR	115[54]	1
GB	14	3[55]
GE	2	1
HR	1	1
HU	6	1
IE	1	1
IT	118Error! Unknown switch argument.	1
KS*	1	1
LT	4	1
LU	4	1
LV	10	1
MD	2	1
ME	1[56]	1
MK	2	1
MT	1	0
NL	6	1
NO	83	1
PL	189	1
PT	11	1
RO	6	1
RS	1	1
SE	166	2[57]
SI	1	1

[53] Does not include (approximately ten) HV distribution system operators.

[54] DSOs connected to continental Europe.

[55] Onshore electricity transmission system is divided into three licensed transmission operator areas; England and Wales (NGET), South of Scotland (SPT) and the North of Scotland and the island groups (SHET).

[56] In addition to one DSO, four closed distribution systems operated in 2024.

[57] This could be reduced to just one TSO: Svenska Kraftnät. The other, Baltic cable, only has one connection to Germany.

UA	32	1

Table 34 – Number of electricity network operators in 2024

Gas

Country	Transmission network	Distribution network
AT[58]	2,000	44,000
BA	260	1,574
BE	4,045	75,554Error! Unknown switch argument.
BG	3,635	5,734
CZ	4,058	61,487
DE	43,488	560,988
DK	1,291	25,900
EE	977	2,307
ES	13,751	83,126
FI	1,248	1,901
FR	37,731	208,000
GB	7,600[59]	279,049
GE	1,980	38,631
IT	35,436	272,176
LT	2,288	9,644
LU	280	3,180
LV	1,190	5,475
MD	1,683	26,356
NL	12,548	124,840
PL	12,820[60]	222,034
PT	1,375	21,640
RO	13,992	63,130
RS	3,133	24,633
SE	601	3,381
SI	1,195	5,137

Table 35 – Gas network length in km in 2024

[58] Approximate length.

[59] Ofgem's most recent verified figures for the transmission network length date from 2020/21, and no updated dataset has since been published. The latest length is therefore a reasonably accurate estimate, based on information provided by National Gas — the owners and operators of the GB gas transmission network.

[60] This includes the length of Yamal transmission gas pipeline: 684.80 km.

Country	2019	2020	2021	2022	2023	2024
BA						84,297
BE	3,004,200	3,058,464	3,104,820	3,136,766	3,152,007	
BG[61]	120,052	132,672	146,491	152,631	158,243	162,911
CZ	8,834	8,854	8,835	9,104	9,147	8,893
DE	14,047,730	14,200,055	14,654,208	14,489,343	14,560,395	14,618,073
DK	88[62]	406,088	402,092	381,098	338,101	314,103
EE	56,848	57,496	61,803	62,194	63,487	65,851
ES[63]	7,944,065	7,979,797	7,974,416	7,989,205	7,990,140	7,982,442
FR	11,340,656	11,319,938	11,341,397	11,287,176	11,175,684	
GE	1,343,145	1,376,317	1,387,456	1,445,672	1,556,484	1,607,878
IT	23,882,000	23,882,000	24,069,000	24,103,200	24,202,000	24,256,300
LT	602,983	610,436	617,890	621,183	619,763	618,476
LV	403,672	399,350	394,883	384,464	377,056	368,983
MD				769,003	809,844	828,300
PL	7,113,097	7,113,125	7,377,401	8,090,821	7,472,444	7,530,549
PT	1,503,438	1,526,386	1,545,922	1,558,776	1,566,123	1,568,438
RS[64]	283,060	293,587	306,879	324,991	327,437	363,040
SE[65]	89,244	87,486	83,968	82,018	80,386	
SI	133,257	134,142	135,032	133,456	133,196	131,055
UA	11,385,218	11,468,465	11,676,735	11,216,519	11,192,315	11,195,103

Table 36 – Number of gas measurement points

[61] The sum of end users and gas regulation stations.

[62] 2019 only includes the number of measurement points for the TSO. Subsequent years include the number for both the TSO and the DSO. Due to a merger, it was not possible to obtain the number for the gas DSO for 2019.

[63] The sum of gas consumers and metering and regulation stations in transmission network and metering stations in transmission network.

[64] The number of gas metering points is considered to be equal to the number of gas consumers.

[65] The number of withdrawal points.

Country	2019	2020	2021	2022	2023	2024
AT	2.49	1.28	1.07	1.19	1.44	3.87
BE[66]	0.14	0.12	0.18	0.17	0.11	0.16
DE	0.72	1.01	2.16	1.08	0.95	1.35
ES			4.36	6.03	7.94	3.36
GB	6.00	5.00	4.00	4.00	5.00	4.00
LT	0.25	0.55	0.27	0.11	0.14	0.27
LV	0.09	0.66	0.11	0.07	0.04	0.05
MD			49.00	38.00	76.00	64.50
PT	28.78	1.59	3.14	0.70	1.44	2.16
RS	7.87	31.45	33.25	20.12	46.06	15.28
SI	3.95	4.03	10.31	5.05	489.29	11.10
UA[67]					192.35	223.09

Table 37 – Gas SAIDI unplanned

Country	2019	2020	2021	2022	2023	2024
AT		49.99	11.46	23.42	17.89	3.99
BE[68]	1.90	2.50	17.30	19.70	9.90	0,37
DE	1.40	8.95	7.38	28.29	14.44	6.59
ES			0.54	0.44	0.36	0.39
GB	6.00	5.00	4.00	6.00	6.00	6.00
LT	25.24	31.24	66.22	67.33	60.69	64.04
LV	56.00	20.00	7.00	7.00	8.00	4.00
MD			1,280.00	1,641.00	1,178.00	782.50
PT	0.45	0.24	0.30	0.21	0.53	0.59
RS	145.63	93.94	166.48	143.42	100.49	92.09
SI	3.54	2.69	2.36	24.27	3.62	8.20
UA					345.62	293.39

Table 38 – Gas SAIDI planned

[66] Wallonia does not monitor indicators for interruption duration in gas. The gas SAIDI values for Belgium only include the region of Flanders.

[67] Values above include outages due to force majeure and faults of other parties. Excluding those, the unplanned SAIDI was: 2023: 38.44; 2024: 46.05.

[68] Wallonia does not monitor indicators for interruption duration in gas. The gas SAIDI values for Belgium only include the region of Flanders.

Country	2019	2020	2021	2022	2023	2024
AT[69]	0.01	0.00	0.00	0.00	0.00	0.01
BE[70]		4.88	5.72	4.98	3.75	
ES			0.02	0.02	0.03	0.02
LT[71]	0.00	0.00	0.00	0.00	0.00	0.00
LV[72]	0.00	0.00	0.00	0.00	0.00	0.00
PT	0.01	0.01	0.01	0.00[73]	0.01	0.01
RS	0.04	0.09	0.09	0.04	0.13	0.04
SI	0.01	0.02	0.03	0.02	0.08	0.02
UA[74]					0.03	0.04

Table 39 – Gas SAIFI unplanned

[69] The 2020-2023 values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.0054; 2020: 0.0034; 2021: 0.0034; 2022: 0.0031; 2023: 0.0034; 2024: 0.0068.

[70] The gas SAIFI values for Belgium include the regions of Wallonia and Brussels.

[71] The values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.0017; 2020: 0.0042; 2021: 0.0041; 2022: 0.0019; 2023: 0.0020; 2024: 0.0034.

[72] The values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.001053; 2020: 0.002226; 2021: 0.00193; 2022: 0.001259; 2023: 0.001066; 2024: 0.000995.

[73] The 2022 value appears to be zero because only two decimal points are used. The actual value is 0.0046.

[74] Values above include outages due to force majeure and faults of other parties. Excluding those, the unplanned SAIFI was: 2023: 0.011; 2024: 0.013.

Country	2019	2020	2021	2022	2023	2024
AT		0.01	0.00[75]	0.01	0.01	0.01
ES[76]			0.00	0.00	0.00	0.00
LT	0.13	0.30	0.42	0.58	0.56	0.75
LV	0.48	0.33	0.32	0.46	0.47	0.45
PT[77]	0.00	0.00	0.00	0.00	0.00	0.00
RS	0.19	0.24	0.42	0.21	0.20	0.27
SI[78]	0.01	0.01	0.00	0.03	0.00	0.01
UA					0.13	0.21

Table 40 – Gas SAIFI planned

Country	2019	2020	2021	2022	2023	2024
AT	461.00	378.00	316.00	381.00	424.00	570.00
DE	460.34	323.22	384.65	187.26	670.32	449.44
ES			199.28	308.13	306.18	200.62
LV	88.00	295.00	59.00	52.00	39.00	54.00
UA[79]					6,958.60	5,988.37

Table 41 – Gas CAIDI unplanned

Country	2019	2020	2021	2022	2023	2024
AT		4,487.00	2,805.00	1,966.00	1,316.00	457.00
DE	5,841.81	1,056.04	3,143.06	1,172.97	1,084.25	546.76
ES			471.60	416.40	405.00	175.89
UA					2,648.79	1,404.47

Table 42 – Gas CAIDI planned

[75] The 2021 value appears to be zero because only two decimal points are used. The actual value is 0.0041.

[76] The values appear to be zero because only two decimal points are used. The actual values are: 2021: 0.0011; 2022: 0.0011; 2023: 0.0009; 2024: 0.0022.

[77] The values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.0014; 2020: 0.0012; 2021: 0.0019; 2022: 0.0012; 2023: 0.0018; 2024: 0.0021.

[78] The 2021 and 2023 values appear to be zero because only two decimal points are used. The actual values are: 2019: 0.0137; 2020: 0.0071; 2021: 0.0049; 2022: 0.0025; 2023: 0.0047; 2024: 0.007.

[79] Values above include outages due to force majeure and faults of other parties. Excluding those, the unplanned CAIDI was: 2023: 3,386; 2024: 3,676.

Annex 5 – About CEER

The Council of European Energy Regulators (CEER) is the voice of Europe's national energy regulators. CEER's members and observers comprise 38 national energy regulatory authorities (NRAs) from across Europe.

CEER is legally established as a not-for-profit association under Belgian law, with a small Secretariat based in Brussels to assist the organisation.

CEER supports its NRA members/observers in their responsibilities, sharing experience and developing regulatory capacity and best practices. It does so by facilitating expert working group meetings, hosting workshops and events, supporting the development and publication of regulatory papers, and through an in-house Training Academy. Through CEER, European NRAs cooperate and develop common position papers, advice and forward-thinking recommendations to improve the electricity and gas markets for the benefit of consumers and businesses.

In terms of policy, CEER actively promotes an investment friendly, harmonised regulatory environment and the consistent application of existing EU legislation. A key objective of CEER is to facilitate the creation of a single, competitive, efficient and sustainable Internal Energy Market in Europe that works in the consumer interest.

Specifically, CEER deals with a range of energy regulatory issues including wholesale and retail markets; consumer issues; distribution networks; smart grids; flexibility; sustainability; and international cooperation.

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More information is available at www.ceer.eu.

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