STUDY ON A METHODOLOGY TO BENCHMARK THE PERFORMANCE OF THE EU MEMBER STATES IN TERMS OF: I) EFFICIENT PRICE FORMATION; AND II) EASY MARKET ENTRY AND PARTICIPATION FOR NEW ENTRANTS AND SMALL ACTORS

Final Report

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Objective: Development of a methodology to collect data and determine two composite indicators to measure the performance of the individual EU Member States with regards to (1) efficient price formation (the ACER's index on efficient price formation) and with regards to (2) easy market entry for new players and small actors (the ACER's index on easy market entry for new players and small actors).

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Acronyms

AC	Alternating Current
ACER	Agency for the Cooperation of Energy Regulators
BRP	Balancing Responsible Party
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-E TP	ENTSO-E Transparency Platform
CACM	Capacity Allocation and Congestion Management
CCM	Capacity Calculation Methodology
CEER	Council of European Energy Regulators
CEP	Clean Energy Package
CEREMP	Centralised European Register of Energy Market Participants
CI	Composite Indicator
CNEC	Critical Network Element
CR	Concentration Ratio
DA	Day Ahead
DC	Direct Current
DSO	Distribution System Operator
DSR	Demand side response
EPAD	Electricity Price Area Differential
EU	European Union
EUR	Euro
FB	Flow based
GDP	Gross Domestic Product
ICT	Information and Communication Technology
ID	Intraday
MACZT	Margin Available for Cross-Zonal Trade
Max	Maximum
MCCC	Margin from Coordinated Capacity Calculation
Min	Minimum
MMR	Market Monitoring Report
MW	Megawatt
MWh	Megawatt hour
NEMO	Nominated Electricity Market Operator
NRA	National Regulatory Authority
NTC	Net Transfer Capacity
OOII	Overall Open Interest Index
OTC	Over the Counter
PPAT	Persons professionally arranging transactions
PTDF	Power Transfer Distribution Factor
REMIT	Regulation (EU) No 1227/2011 on wholesale Energy Market Integrity and Transparency
RES	Renewable Energy Source
SIDC	Single Intraday Coupling
SO	System operator
STR	Suspicious transaction report
TSO	Transmission System Operator
VBA	Visual Basic Advanced
VOLL	Value of Lost Load

1 EXECUTIVE SUMMARY

The European Union Agency for the Cooperation of Energy Regulators ("ACER") has asked DNV to conduct a study to determine a methodology to collect data and calculate composite indicators for barriers to efficient price formation and barriers to easy market entry and participation for new entrants and smaller actors. This report covers the approach, tasks and insights of this project, and also includes a description of interactions and consultations with National Regulatory Authorities (NRAs) and external stakeholders for this project.

Project approach

For this project the following tasks were defined and executed:

Task 1: Identify barriers and potential indicators to measure these barriers

Task 2: Select most suitable indicators and design the underlying data collection process

Task 3: Design the Composite Indicators (CIs) and the tool to calculate the CIs

Task 4: Conduct a pilot study for volunteering Member States.

Over the course of this project a range of interactions with NRAs and external stakeholders took place with ACER. Most notably, the project included a kick-off webinar with external stakeholders (e.g. generators, traders, suppliers, aggregators, industry associations), a public consultation (45 responses), and interviews with selected stakeholders (16 in total). Moreover, NRAs and selected stakeholders were approached by means of a questionnaire to collect underlying data for determined indicators. Three NRAs volunteered to deliver data for their respective Member State to support a pilot study for the testing of the CI calculation tool. This data was complemented by additional data which was provided by ACER and other stakeholders.

Definitions for efficient price formation and for new entrants and small actors

After the initial contact with NRAs and stakeholders it became apparent that the key terms in the project objective should first be defined. The definitions of **efficient electricity price formation** are based on a combination of standard economic textbook definitions and the European electricity market design as defined within the EU legal framework. This implies that there are multiple dimensions of the prices and the **price formation** to consider. It was concluded that ***all products*** should be considered, as a there are few, if any, product prices in the electricity sector that are not relevant for the formation of wholesale prices. ***All timeframes are relevant***, as similar to all product prices having an impact on each other, the same also applies to prices for different timeframes. Prices should be ***cost-reflective***, whereas to the extent possible, all costs should be considered and internalised when prices are determined. In addition, prices should be ***unrestricted***, which means that prices are determined without administratively determined constraints, and any restrictions should be proportionate and not lead to undue discrimination. ***Integrity*** is another dimension, which means that prices should be determined without any type of abusive actions, such as abuse of dominant positions or trading based on inside information. ***Transparency*** is important to ensure equal and sufficient information to all participants. In regard to **efficiency** of price formation, both static efficiency for the allocation of existing resources (in the short term), and dynamic efficiency for investments decision signals (for the longer term) are considered and potential barriers are identified.

The composite indicator concerning **new entrants and smaller** *actors* should provide information about the challenges for new actors without relevant experience in the electricity sector and for existing, but relatively small actors. They often gained their experience ***from other markets***, such as energy efficiency services, telecom and broadband, or from information technology and software development. Some ***pursue a different business model*** than the established market players, such as aggregating flexibility from end-users or prosumers, or they ***leverage market innovation*** offering new customer services which are different to the services of a traditional utility or electricity supplier. In addition, some new entrants specifically ***focus on new technologies***, or a technology that just recently became relevant in the electricity markets, such as rooftop PV or battery storage. It should be noted that this study considers new entrants ***spin-offs*** of existing market participants out of the scope, as these actors generally have relevant market experience, as well as new

business models, technologies and services offered by well-established market players. Some are still ***just relatively small*** and impacted more by market aspects than larger actors. At times, these small actors are constrained in size by their nature and, thus, cannot enjoy economies of scale despite having a reasonable business model. The indication for these players is particularly concerned with unjustified market aspects posing a hindrance to them but not others. As such, these barriers include dimensions of competence and structure of authorities and processes, requirements and limitations concerning size and experience of the market participants, and the relative relevance of costs for small actors and new entrants vis-à-vis incumbent players.

Determination of barriers and indicators

As markets are generally subject to several barriers of different nature that may prevent prices from being efficient or complicate market entry, barriers are grouped into **three categories**: (1) market structure and performance, (2) infrastructure, operation and access to the transmission and distribution network and provision of network services, (3) policies and regulation at national level as well as market design. The objective of these categories is to provide a better overview of the **barriers** and to help identify the responsible areas for reducing or removing the barriers. For all identified barriers, specific **indicators** are sought – features or metrics that indicate the presence and significance of the individual barrier. Most of these specific indicators comprise of several pieces of information, e.g. closed-ended questions on specific features, quantitative information or a combination of these two. There is one set of questions or **data** items for each indicator. Some barriers and indicators are partly or entirely relevant for both composite indicators.

In this project, a systematic process was executed to identify and select barriers, indicators, and data collection requirements. Several steps were applied, i.e. desktop analysis, stakeholder interviews, a public consultation, and the development of questionnaires to collect the input data from different data sources. In several interactions with ACER and NRAs the outcomes of this process were discussed and reviewed. The barrier categorisation and applied hierarchy helped to structure the amount of information and drive towards delivering **a shortlist of barriers and indicators** from an initial longlist. Moreover, the availability of required data to measure indicators helped to determine which barriers and indicators could already be measured in the short-term, whereas others were postponed for future definition and application.

Barriers, indicators and data for efficient price formation and for new entrants and small actors

The process as described above has resulted in the following shortlist of barriers to efficient price formation and to new entrants and small actors.

Table 1-1 Barriers to efficient price formation

Barrier category	Barrier
Regulation and market design	Explicit price restrictions
	Potential market distortions due to support schemes granted to different technologies or market participants
	Potential market distortions due to capacity mechanisms
	End-user price regulation*
	Unavailability or little incentive to contract dynamic retail prices*
	Restrictive requirements in prequalification, product characteristics and other features of market design**
Market structure and performance	Insufficient competition and liquidity in wholesale markets
	Scope for strengthening market integrity
	Scope for increasing market transparency
Network services and operations	Failure to maximise availability of cross-zonal capacity
	Delineation of bidding zones not reflecting structural congestions
	Scope for improving transparency, cost-reflectivity and non-discrimination in the structure of network tariffs
	Lack of transparency in information provided by System Operators (SOs)*

Note: *Same barrier and same indicators for both composite indicators. ** Same barrier but different indicators for each composite indicator.

For the composite indicator on efficient price formation, this study determines that:

- In the regulation and market design category, potential market distortions due to explicit price restrictions and various support schemes applicable to the wholesale market as well as requirements and product characteristics that become restrictive for some market players are the most relevant barriers to effective price formation. While other barriers also are important, their expected impact on wholesale prices seems more limited

- In the market structure and performance category, insufficient competition and liquidity (e.g. due to few participants) is the barrier with the largest potential impact on wholesale price formation
- Within the network services and operations category, the barriers related to the delineation of the bidding zones and the availability of cross-zonal capacity have the highest potential impact on wholesale electricity prices

Table 1-2 Barriers to easy market entry and participation for new entrants and small actors

Barrier Category	Barrier
Regulation and market design	Complex, lengthy and discriminatory administrative and financial requirements Adequacy of the legal framework to enable new entrants and small actors Restrictive requirements to participate in capacity mechanisms and interruptibility schemes
	End-user price regulation* Unavailability or little incentive to contract dynamic retail prices*
	Restrictive requirements in prequalification, product characteristics and other features of market design**
Market structure and performance	Insufficient competition in the retail market
Network services and operations	Lack of incentives to consider non-wire alternatives
	Lack of transparency in information provided by System Operators (SOs)*

Note: *Same barrier and same indicators for both composite indicators. ** Same barrier but different indicators for each composite indicator.

For the composite indicator on easy market entry and participation for new entrants and small actors, this study determines that:

- In the regulation and market design category, complex, lengthy and discriminatory administrative and financial requirements, inadequate national legal frameworks and restrictive requirements in prequalification, product characteristics and other features of market design are the most relevant barriers hindering the entry and participation of new and small market players.
- In the categories of market structure and performance and network services and operations, all the barriers identified can have a significant impact on business opportunities for new entrants and were also emphasised by the stakeholders in the public consultation and interviews performed as part of this project.

For the barriers listed in Table 1-1 and Table 1-2, a total of 76 indicators are proposed, of which 16 need to be further developed and may potentially be used in the near future. Identified barriers and indicators provide a **comprehensive basis** for the determination of the composite indicators. The **barriers and indicators can be tailored in the composite indicator calculation tool as markets develop**. For instance, indicators can be replaced in case countries perform equally, and indicators can be added as new barriers emerge.

Furthermore, the project indicates that **data for respective indicators is readily available**, as based on data already held by ACER and data delivered by respective NRAs for the pilot study for 3 Member States (Task 4). The pilot data collection from the developed NRA questionnaire worked well and delivered non-ambiguous input for the Composite Indicator calculation tool (Task 3). **Data from other sources** (ENTSO-E, CEER, etc.) **were complementary** to data delivered by NRAs for initial assessments and calibrations.

Determination of weights for the barriers and indicators

At the outset, the barriers and indicators are developed in such a way that their importance for the composite indicator is comparable. Accordingly, the default weight of the barriers and indicators is uniform, meaning that each indicator for its specific barrier is equally important. The same holds for the barriers respective their importance for a category. To account for perceived differences and differences in line of economic theory, the individual weights of indicators, barriers, and categories are adjusted for their perceived and economic relevance. Perceived relevance is derived from a public consultation and the interviews conducted with stakeholders during this study while the economic relevance is assessed in view of the individual definitions of barriers and indicators. The weights for barriers and indicators have been derived for efficient price formation and easy market entry and participation for new entrants and small actors distinctly. It follows

that weights of barriers and indicators prevalent in both assessments are not uniform across the two composite indicator calculations.

Composite Indicator calculation tool

Task 3 of this project describes the concept of composition indicator construction, methods for normalisation, methods for weighing and combining indicators, composite indicator calculation and approaches to assess the robustness of composite indicator calculation using sensitivity analysis. Furthermore, suggestions for treatment of missing data are discussed.

In order to assess the overall functionality of the assessed market(s) in terms of efficient price formation and easy market entry and participation for small actors and new entrants, composite indicators are developed for the two objectives. These composite indicators serve to portray an overall value for the overarching evaluation of the country with respect to the market functionality. As such, it constitutes a composite evaluation of the country's treatment of the different barriers.

The conceptual approach outlined is realised by using a **Microsoft Excel Tool** for the calculation of the two Composite Indicators. **This tool allows the distinct parameters to be set**, i.e. indicators, barriers, and categories as well as the weights and aggregation methods for the respective aggregation processes. After specification of the parameters, weights and methods, the **data is required to derive the initial indicator scores.** For that purpose, the raw data is translated into indicator scores as noted in the indicator definition. This translation is indicator specific. In case of missing raw data, the treatment thereof is specified in an Excel-based data inventory provided to ACER. In the methodology for constructing the composite indicator, different **missing data treatment options** are possible and may be used in the calculation. To assess the **robustness** of the composite indicator calculation and resulting scores, a **sensitivity analysis** in the form of a Monte Carlo Analysis with uniformly distributed randomisation is included in the CI calculation Tool.

The CI calculation tool delivers insights into key CI contributors and into opportunities increasing the level of data completeness. The CI calculation tool can be used for a **stand-alone country analysis** to review the reasons for the barrier, category and CI score(s) and identify prevalent barriers and potential measures to improve market performance. The CI tool can also be used for **cross-country comparison** to identify best practices and barriers common to most/all countries and barriers that have been overcome across the board. The CI calculation tool can be also used to **monitor the evolution of CI scores over time**, and consequently the improvements introduced by Member States in terms of efficient price formation and easy market entry and participation for new market entrants and small actors

Member State pilot study

The CI calculation tool was tested in a **pilot study for three EU Member States**, using data as provided by **voluntarily participating NRAs**, and complemented with other data made available by ACER. A questionnaire was developed to collect data from the participating NRAs for the three Member States. The CI calculation tool was tested using the collected data, and outcomes and insights were shared and discussed with the NRAs.

The pilot study appeared to be very useful to assess the CI calculation tool's fit for purpose and the underlying methodologies to collect and process data with the volunteering NRAs, such as the design of **the NRA questionnaire** and the treatment of missing data. It appeared that **data for respective indicators is readily available,** as based on data already held by ACER and data delivered by the three participating NRAs. **Missing data remains an issue but only affects the pilot Member States' results to a limited degree**. Different approaches are discussed and are possible to mitigate for missing data.

Key insights and recommendations

The project results in a range of insights and recommendations with regard to **methodology**, **data** and **CI determination**. These include the selection and definition of barriers and indicators thereof, the approach to gather data and to calculate an overall value for the assessment of the two composite indicators. Recommendations to further test and refine applied methods for weighing, treatment of missing data, and sensitivity analysis, have further been identified.

ACER intends to use the methodology to build the indicators and analyse the barriers across the EU Member States. ACER also intends to progressively include the indicators in the Electricity Wholesale Volume of its annual Market Monitoring report, starting with the 2020 Market Monitoring Report (MMR)[1] that will be published in Q4 2021. ACER will continue enhancing the methodology to include new barriers and indicators in the analysis as the electricity markets evolve.

[1] All published editions of the MMR are available at: https://www.acer.europa.eu/en/Electricity/Market%20monitoring/Pages/Current-Edition.aspx

2 INTRODUCTION

Article 15 of Regulation (EU) 2019/942 which establishes a European Union Agency for the Cooperation of Energy Regulators (recast)[2] states that:

ACER is to annually publish a report on the results of the monitoring and reporting on the electricity and natural gas sectors identifying any barriers to the completion of the internal markets for electricity and natural gas. In order to fulfil this requirement, the Agency produces an annual Market Monitoring Report (MMR).

The objective of the MMR is to assess the functioning of the Internal Energy Market (IEM) and to show how energy markets can work more efficiently for the benefit of energy consumers in the European Union (EU). The MMR is split into three different volumes focused on (1) electricity wholesale markets, (2) gas wholesale markets and, (3) retail markets and consumer protection aspects.

The Electricity Wholesale Markets Volume of the MMR provides an in-depth year-on-year analysis of the remaining barriers to an efficient integration of the electricity wholesale markets in the EU, with a focus on cross-border aspects. It also provides recommendations on how to remove them.

In addition, Article 15 of the Regulation (EU) 2019/942 also requires ACER to assess:

1) State interventions preventing prices from reflecting actual scarcity
2) Regulatory barriers for new market entrants and smaller actors

With regards to 1), ACER aims to assess the presence of any type of barrier to efficient price formation. In this context, ACER identified a preliminary list of aspects which may be considered when evaluating the presence of such barriers in the Member States of the Union (hereinafter MSs). These aspects include:

- The implementation of price caps and/or bidding limits
- Price regulation in one or more market segments
- The lack of locational electricity wholesale price signals, including inefficiently defined bidding zones
- Insufficient availability and/or use of dynamic pricing for end-consumers
- Poorly designed network tariffs discouraging market participants' response to price signals
- The design of certain balancing services, including imbalance settlement mechanisms, which may hinder efficient price formation
- Specific entry and/or exit barriers in electricity wholesale markets
- Measures aiming to protect local market participants, including direct or indirect subsidies
- Restrictions to cross-zonal trade, including limited amounts of cross-zonal capacity available to trade or capacity curtailments at times of scarcity
- The use of overly conservative assumptions in either the European or the national resource adequacy assessments as a basis to establish capacity mechanisms
- The impact of all types of capacity mechanisms[3] on adequacy levels and price formation

With regards to 2), ACER requires special attention should be given to the need for increased flexibility in the electricity systems. Consequently, the participation of demand side response (DSR), non-incumbent suppliers, aggregation, distributed generation, energy storage (including electro mobility), and citizen energy communities should at least be considered. ACER identified a preliminary list of aspects which may be considered when assessing the presence of barriers to the entry and participation for new market players. These aspects include:

2 Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (recast) (recast ACER Regulation), available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32019R0942

3 Beyond the formal definition of capacity mechanisms included in the CEP, e.g. considering all types of capacity mechanisms described in the chapter 3 of the Staff Working Document accompanying the EC Final Report of the Sector Inquiry on Capacity Mechanisms, available at: https://ec.europa.eu/competition/sectors/energy/capacity_mechanism_swd_en.pdf

- The lack of an adequate national strategy to promote the entry and participation of new market players including the consideration of their role as alternative to network development
- The absence of a legal framework which defines the roles and responsibilities of these market players
- Complex administrative and permitting procedures
- The lack of provisions ensuring a level-playing field between new and existing market players
- Technical (e.g. qualification process) or market requirements (e.g. size or granularity of the product) that may hinder the participation of these players in all market timeframes, including participation in capacity markets
- Insufficient level of liquidity in any market timeframe
- Discriminatory access to the network, including network charges design
- Barriers preventing efficient price formation, as described above

In order to fulfil its monitoring obligations concerning these two topics, ACER intends to develop new methodologies and indicators. In particular, ACER is interested in developing two composite indicators (hereafter 'CIs') to measure the performance of the individual Member States with regard (1) efficient price formation (ACER's index on efficient price formation) and with regard (2) easy market entry for new players and small actors (ACER's index on easy market entry for new players and small actors). Based on these methodologies and indicators, ACER aims to provide a comprehensive picture of the relative performance of each Member State concerning the topics described above.

ACER has asked DNV to conduct a study to determine a methodology to collect data and calculate composite indicators for barriers to efficient price formation and barriers to easy market entry and participation for new entrants and small actors. This report covers the approach, tasks and insights of this project, and also includes a description of interactions and consultations with National Regulatory Authorities (NRAs) and external stakeholders for this project.

The results of this study will be progressively incorporated in upcoming editions of ACER's MMR.

Structure of the report

This report is structured as follows: The introduction (Section 2) is followed by a brief description of the underlying project, i.e. its objectives and tasks in section 3. Section 4 of this report covers a description of the definitions and scope of efficient electricity price formation and new entrants and small actors, as based on several interactions with NRAs and stakeholders. Section 5 covers the scope as defined in Task 1 of this project, and provides a description of identified barrier categories, the terminology applied in this project, and the process conducted in this project to structure the amount of information and select a shortlist of barriers and indicators from an initially determined longlist. Section 6 covers the scope as defined in Task 2 and provides a description of the barriers monitored for the composite indicator concerning efficient price formation. Section 7 covers the scope as defined in Task 2 and provides a description of the barriers monitored for the composite indicator concerning new entrants and small actors. Sections 8 and 9 cover the scope as defined in Task 2 and provide a description of all indicators defined for the barriers to efficient price formation and the barriers to easy market entry and participation for new entrants and smaller actors, respectively. Section 10 covers the scope as defined in Task 3 and describes the concept of composition indicator construction, methods for normalisation, methods for weighing and combining indicators, composite indicator calculation and approaches to assess the robustness of composite indicator calculation using sensitivity analysis. Section 11 covers the scope as defined in Task 4 and describes the approach and outcomes of the testing of the CI calculation tool for three Member States. Section 12 provides a summary of key insights and recommendations with regard to methodology, data and CI determination.

3 OBJECTIVES AND APROACH

3.1 Objective

The objective of this project is to propose a methodology to assess barriers to efficient electricity price formation, and barriers to easy market entry and participation for new entrants and small actors in the electricity markets of the individual EU Member States[4], in order to enable ACER to further develop its electricity wholesale market monitoring tasks to effectively fulfil its monitoring responsibilities set in Article 15 of Regulation (EU) 2019/942.

More specifically, the objectives of this project are to:

a) Identify, select and define key qualitative and quantitative indicators to measure these barriers

b) Identify the data sources and propose a data collection process to calculate the selected indicators

c) Provide a methodology to combine the selected indicators and create two Composite Indicators (CIs), i.e. the Agency's index on efficient price formation and the Agency's index on easy market entry for new players and small actors

On the basis of the methodologies and indicators, ACER aims to provide a comprehensive view of the relative performance of each Member State concerning the barriers described above.

3.2 Project Tasks

The following tasks are defined and executed in this project:

Task 1: Identify barriers and potential indicators to measure these barriers

Task 2: Select most suitable indicators and design the underlying data collection process

Task 3: Design the Composite Indicators (CIs) and the tool to calculate the CIs

Task 4: Conduct a pilot study for volunteering Member States

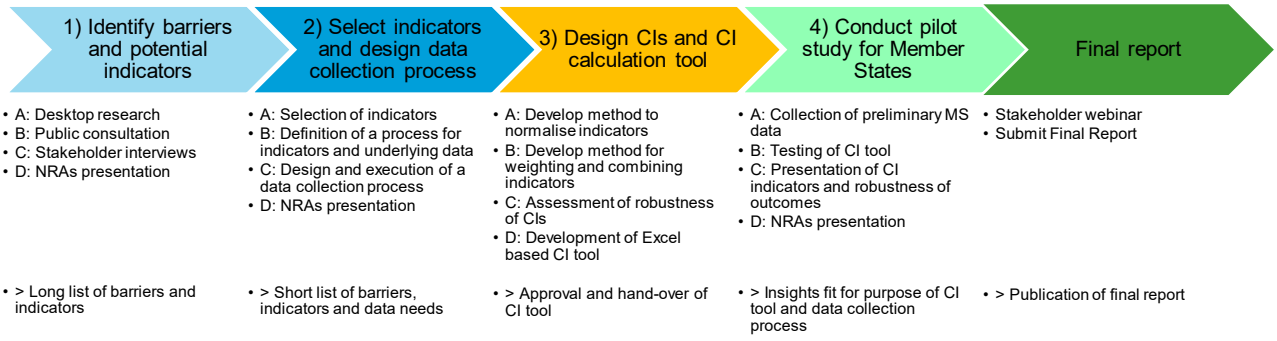

Figure 3-1 Project Tasks

[4] To the extent possible, the methodology may also be used to assess the situation in other European counties typically included in ACER's MMRs such as Norway and Switzerland.

3.2.1 Task 1: Identify barriers and potential indicators

In Task 1 existing and potential (future) barriers for efficient price formation and easy market entry and participation for new entrants and small actors are identified, as well as potential indicators and metrics to measure these barriers. Task 1 is split into the following sub-tasks:

A. Desktop research of relevant reports and publications, e.g. European Commission, ACER, and stakeholders

B. Public stakeholder consultation and evaluation

C. Selected stakeholder interviews

D. Interactions (web-conferences) with National Regulatory Authorities (NRAs)

The outcome of Task 1 is a long list of relevant barriers and potential indicators and data collection procedures, to be applied and further refined in Task 2.

3.2.2 Task 2: Select indicators and design data collection process

In Task 2 suitable indicators are determined ("short list") from the potential indicators as defined in Task 1 ("long list"), as well as the underlying data collection process. Task 2 is split into three main sub-tasks:

A. Selection of the most suitable indicators

B. Definition of a process to treat indicators and underlying data

C. Design of a data collection process and collection of data using Microsoft Excel based questionnaires.

The outcome of Task 2 is a short list of barriers and indicators as based on public consultation and analyses that are to be applied in Task 3

3.2.3 Task 3: Design Composite Indicators and CI calculation tool

In Task 3 a calculation method and Excel-based CI tool is developed for weighted aggregation of the shortlisted indicators for efficient price formation and easy market entry and participation as determined in Task 2. Task 3 consists of the following steps:

A. Develop a method to normalise indicators

B. Develop a method for weighting and combining indicators, as well as treatment for missing data

C. Assessment of the robustness of composite indicators using sensitivity analysis

D. Development and hand-over of a Microsoft Excel-based CI tool

The outcome of Task 3 is an Excel-based CI calculation tool using barriers, indicators and collected data as defined in the previous tasks which is to be submitted to ACER for further deployment.

3.2.4 Task 4: Conduct pilot study for Member States

In Task 4 the CI calculation tool is tested for three Member States, using data as provided by voluntarily participating NRAs, and complemented with other data as made available by ACER. Task 4 consists of the following steps:

A. Collection of data for participating (piloting) Member States

B. Testing of the CI calculation tool using collected data

C. Presentation of the CI calculation tool outcomes for the participating (piloting) Member States

Task 4 provides an insight into the CI calculation tool's fit for purpose of and underlying methodologies to collect and process data and to calculate respective CIs in terms of efficient price formation and easy market entry for new players and small actors in electricity wholesale markets.

3.3 Project alignment and interactions

Figure 3-2 provides an overview of these interactions, which have been set up and conducted in coordination with ACER. Most notably, the project includes a kick-off webinar with external stakeholders (e.g. generators, traders, aggregators, industry associations), a public consultation that is set up and operated by ACER, as well as a set of interviews with representative stakeholders. Moreover, NRAs and selected stakeholders are approached by means of a questionnaire to collect underlying data for determined indicators.

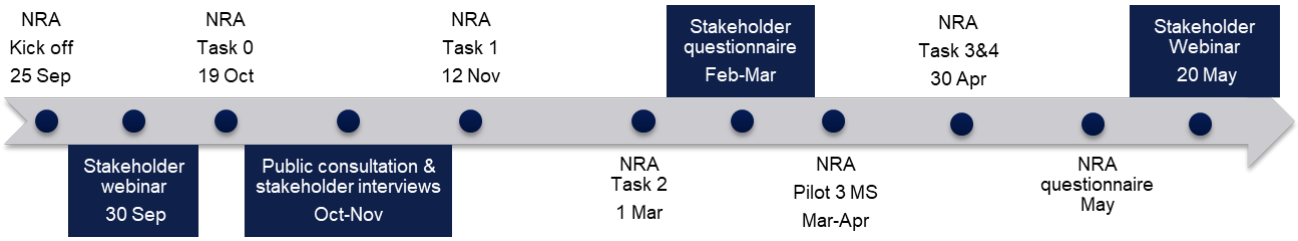

Figure 3-2 Project interactions

4 BASIS FOR WORK – DEFINITIONS AND SCOPE

After initial interactions with NRAs and stakeholders it was apparent that the key terms in the project objective need to be first defined. What is efficient electricity price formation? Which *prices* are meant here? What is meant by *efficient*? What is the definition of *new entrants*? Where do we draw the line between *small* and *large actors*? This section provides the outcome of these various interactions and can be seen as the underlying basis for the scope of this project.

4.1 Efficient electricity price formation

The interpretation of 'efficient electricity price formation' is based on a combination of standard economic textbook definitions and the European electricity market design as defined within the European legal framework. This implies there are multiple dimensions of the prices and the price formation to consider, as illustrated by the bullet points below.[5] More details are provided in subsequent sections when the barriers and potential indicators for inclusion in the composite indicator(s) are analysed.

- **All products**. Formally, we consider wholesale prices and how these are determined. However, this delimitation has little practical impact on our analysis. Electricity is traded at multiple trading venues and with a variety of product definitions. In terms of volume, the forward markets and day-ahead markets are the most important. TSOs operate several 'product markets' for products tailored to support them in their tasks related to balancing and congestion management. As DSOs increasingly consider alternatives to grid reinforcement, new product markets begin to emerge. Even retail prices, or the process of determining retail prices, may have an important impact on how e.g. day-ahead prices or forward prices are determined. The same argument applies to other features of product definitions – irrespective of whether the customer would traditionally be classified as a retail or a wholesale customer. For a profit maximising electricity producer or consumer, it is the price and the product and trading venue requirements that matter, not the name of the product. To the extent possible, such participants will organise their sale or purchase of electricity such that at the margin, they are indifferent with the choice of trading venue and product. Hence, there are few, if any, product prices in the electricity sector that are not relevant for the formation of wholesale prices.
- **All timeframes** are relevant. Both long-term forward contracts as well as prices for balancing products are relevant. Similar to the way in which product prices have an impact on each other, this also applies to prices for different timeframes. Hence, the analysis should also consider the ability to take advantage of for example the flexibility of a load, a storage or a production facility.
- **Cost-reflective**. Demand and supply should be free to match in all market timeframes allowing prices to reflect market conditions meaning that prices should reflect costs of supply and demand´s willingness to pay for a service or a product. For supply, the key concept is the cost of supplying, while for demand, the key issue is the willingness to pay for the service or product. To the extent possible, all types of costs related to the provision of electricity should be considered, when determining prices. In the same way, end-users' willingness to pay is equally relevant. Prices have a signalling effect that incentivizes market participants to adjust their behaviour. If the costs are not correctly reflected in the market price then the prices incentivise behaviour that does not lead to the most efficient use and development of the electricity sector. In particular, it is important that the price signals incentivise market participants to support the efficient operation and planning of the electricity network. This implies that the costs related to system balancing[6], and to congestion management[7], should be implicitly internalised in the electricity wholesale prices as much as possible.

5 The order of the bullet points does not signal the perceived importance of the different features.

6 Balancing prices (including imbalance charges) should reflect the real-time value of energy (see Recital 17 of Regulation (EU) 2017/2195 establishing a guideline on electricity balancing).

7 In a zonal electricity system, bidding zones should reflect structural congestions in order to provide effective price signals for new generation capacity, demand response and transmission infrastructure (see Recital 30 of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast)).

- **Unrestricted** means prices are determined without state or regulatory interventions (unless market constraints reflect a classical market imperfection that needs to be corrected) and no participants are excluded from the process determining the prices. As an example, it implies that there should be similar or equal balancing responsibilities for all market participants. For some services or market timeframes, some minimum requirements to entry and participate may be necessary, e.g. to ensure the service is efficient for a TSO or a DSO as buyer of a service. Such requirements need to be proportionate and cannot lead to undue discrimination.
- **Integrity** means that prices are determined without market abuse (i.e. without market manipulation or attempted market manipulation), and trading based on inside information.
- **Transparency** is important to ensure equal and sufficient information to all participants.

Economic textbooks describe two features of efficiency, which are useful to bear in mind. **Static efficiency** concerns how existing resources are allocated. Is the current dispatch following a merit order? Is demand satisfied at the prevailing price(s)? **Dynamic efficiency** concerns investments. In the electricity sector, this should apply to investments on the supply and demand side, as well as the networks. In reality, and in particular for the network assets, investment decisions are determined by many other factors and not just prices, such as obligations to connect new grid customers. Nevertheless, when looking for indicators for efficient electricity price formation, we will consider both static and dynamic efficiency.

4.2 New entrants and small actors

The composite indicator concerning new entrants and small actors should provide information about the challenges for new actors without relevant experience in the electricity sector and for existing, but relatively small actors. We are not suggesting any sharp definition of 'new' or 'small' but will focus on barriers that tend to be different and more important, the less experience or the smaller size the actors have.

New entrants may have different profiles as follows:

- They often gain their experience on other markets, such as energy efficiency services, telecom and broadband, or from information technology and software development
- Some pursue a different business model than the established one, such as aggregating flexibility from numerous end-users or prosumers. Currently, there is a lot of innovation in the electricity market related to origination (sourcing) of flexibility and to use of such flexibility in the provision of network services. Some suppliers offer a broader set of services to their customers, such as energy management
- Others focus on a new technology, or a technology that just recently became relevant in the electricity markets, such as rooftop PV or battery storage

Some players will be out of the scope of the definition of "new entrants" as follows:

- Some new actors in the market are spin-offs from existing market participants. Such actors will normally have relevant experience
- New entrants emerging in the same market, focusing more on new services and less on the traditional role of a supplier or a utility. Nevertheless, new business models and new technologies can also be pursued by large utilities with decades of experience in the electricity sector. Innovation is not limited to new entrants. The indicator will thus not focus on new roles, services or technologies alone, but it should identify particular challenges for new or small actors in this respect

The diagram below aims to illustrate the focus for the indicator on barriers to new entrants and small actors. The indicator emphasises the green parts of the value chain.

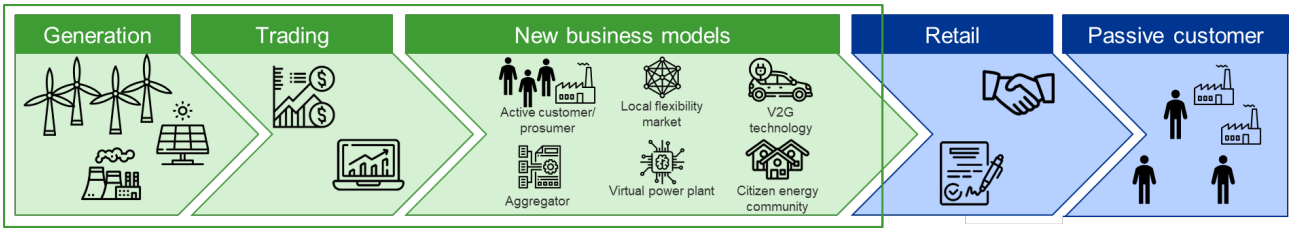

Figure 4-1 Electricity market value chain

While there are many large utilities, there are even more well established but small participants in the electricity market. Small and large participants in the same market perceive challenges and potential barriers differently. A language requirement is different for an actor that is already operating internationally than for a local player with few employees. Large actors will in many aspects be able to benefit from economies of scale. Particular attention should be paid to factors that hit small actors harder than large actors and that could be avoided by e.g. a different regulatory approach or a different market design. While it is possible to harmonise e.g. participation requirements in a market segment across national borders, it is not possible to change the fact that potential customers in different countries might represent substantial cultural differences.

For some new entrants and small actors, there might be significant knowledge gaps, e.g. regarding how balancing and imbalance pricing works, how grid tariffs are designed and the relevant design options, and the obligations of market participants. Such special features and issues that the electricity market participants must observe, differentiate the electricity market from other markets. Many of these features simply reflect the physics of electricity and are equal for all market participants. Our focus will naturally be on issues that hit 'smaller' or 'younger' market participants harder than the established incumbent players and are not easily explained or justified in the technical features of the electricity system. The indicator should thus capture to which extent inexperienced market participants face barriers beyond the 'natural' or necessary complexity of the electricity market.

4.3 Regulatory barriers to efficiency

While it might be fair to assume that the aim of any regulation is to contribute positively to both the efficiency of price formation as well as to new entry and a level playing field for small actors, it might be considered naïve to ignore the possibility of inefficient regulation. However, an analysis of the efficiency of concerned EU regulations falls outside of the scope of this report. Instead, we employ an underlying assumption that the **design** of EU regulations is per definition efficient or seeks to implement efficient price formation and to facilitate market access and participation for new entrants and small actors. The scope for the indicators will thus partly be to determine if or to what extent the **implementation** of EU regulation is efficient or successful.

5 DETERMINATION OF BARRIERS AND INDICATORS

This section covers the scope as defined in Task 1 of this project, and provides a description of identified barrier categories, the terminology applied in this project, and the process conducted in this project to structure the amount of information and select a shortlist of barriers and indicators from an initially determined longlist.

5.1 Barrier categories

Markets are normally subject to various barriers that may prevent prices from being efficient or complicate market entry or participation for new entrants and small actors. To portray a structured overview of such barriers facing the electricity market, the barriers are grouped into three categories. In this section we explain how we define these three categories.

The following categories are used:

- **Regulation and market design**

  These are barriers related to market design and functionality, e.g. the detailed rules for the day-ahead or intraday market, design of TSOs' and DSOs' procurement of network services from connected network customers, etc. These barriers can be caused by the unsuccessful implementation of legislation, e.g. by network and market operators, regulators and/or legislative bodies.

- **Networks, TSOs and DSOs**

  These are physical barriers as well as TSO or DSO behaviour and practice, e.g. barriers related to infrastructure, operation and access to the transmission and distribution network, network and system operations, constraints management, sharing of information, etc.

- **Market structure and performance**

  These are barriers related to the market participants and their behaviour or features, e.g. barriers due to immature and small markets, markets with high concentration, incumbents, etc.

The purpose of using these three categories is to provide for a better overview of the barriers, both to help understand the 'origin' of the different barriers and to identify the party that could possibly help reduce or remove the barrier. The categorisation does not imply that e.g. regulators have created a barrier, but rather that regulators might play an important role in reducing it. It seems fair to assume that few, if any, barriers can be removed by the effort of one single party.

Some of the barriers and indicators are nearly identical for the two composite indicators. The reason for this is that the same feature exhibited by the market can impact both how prices are determined and to what extent prices are efficient, as well as how easy it is to enter the market. But while the underlying market feature may be the same, the motivation for using it as an indicator will then typically be different.

5.2 Hierarchy and terminology

The project is focused on developing a methodology to determine two **composite indicators**, for two **groups of barriers** – barriers to efficient price formation and barriers to easy market entry and participation for new entrants and small actors (in short, barriers to new entrants and small actors).

Within each group of barriers, we consider three **categories of barriers** previously explained in section 5.1. For all identified barriers we search for specific **indicators** i.e. features or metrics that indicate the presence and significance of the individual barrier. Most specific indicators comprise of several pieces of information, e.g. three to six closed-ended questions pertaining to specific features or a combination of quantitative information. There is one set of questions or data items for each indicator.

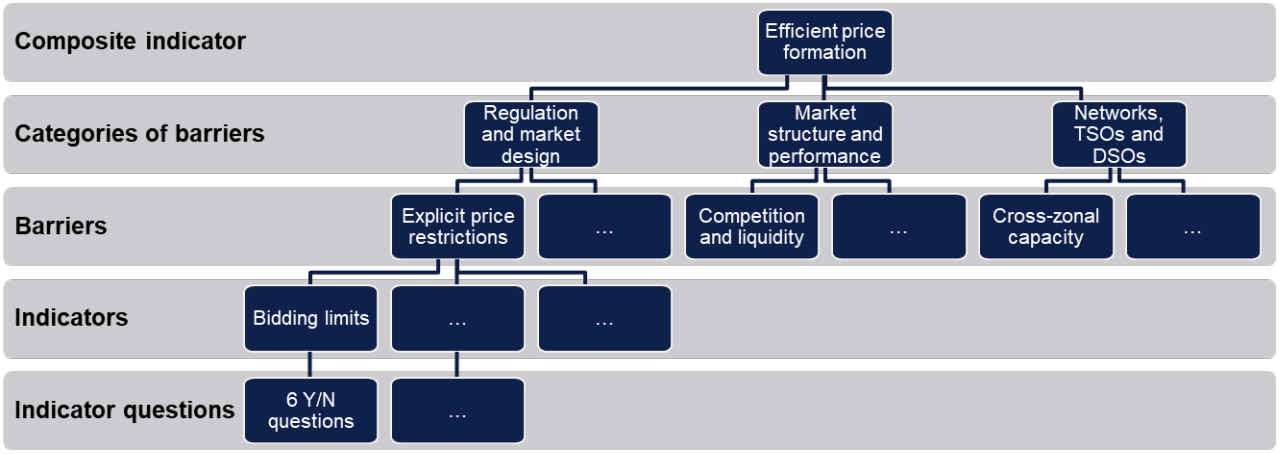

Figure 5-1 Hierarchy and terminology - from indicator questions to composite indicator

Some barriers and indicators are partly or fully relevant for both composite indicators. This will be explained in the section that describes these barriers and indicators.

5.3 From a longlist to a shortlist of barriers and indicators

This project relies on a diligent process for the identification and selection of barriers, indicators, and data collection requirements. As described in section 2 (Task 1 and Task 2), several steps have been applied, i.e. desktop analysis, stakeholder interviews, public consultation, and the development of stakeholder questionnaires to conduct the data collection to build some indicators. In various interactions with ACER and NRAs the outcomes of this process were discussed and reviewed. The barrier categorisation and hierarchy applied has helped to structure the amount of information and drive towards delivering a shortlist of barriers and indicators from an initial longlist.

Moreover, the availability of required data to measure indicators helped to determine which barriers and indicators can already be applied at this stage, whereas others have been postponed for later (future) application. Hence, where data must come from other sources than already existing databases or from a dedicated questionnaire to NRAs, it was agreed to leave the detailed design of sub-indicators to a later stage. Some indicators can potentially be developed in close cooperation with stakeholders, e.g. the indicators based on stakeholders' perceptions of information transparency, or perceived barriers to entry and exit in different market timeframes and products.

For some identified barriers and potential indicators, a deeper assessment than what was possible during this project is recommended to determine robust indicators. This concerns in particular potential distortions due to capacity mechanisms, for which there are currently no indicator proposed.

A total of 16 stakeholder interviews were conducted for this project, and a total of 45 responses to the public consultation were received and analysed. The stakeholder interviews and public consultation included participants from industry associations, generators, suppliers, traders, large industrials, aggregators, and network operators.

The first step involved determining a long list of barriers which followed the process shown in Figure 5-2.

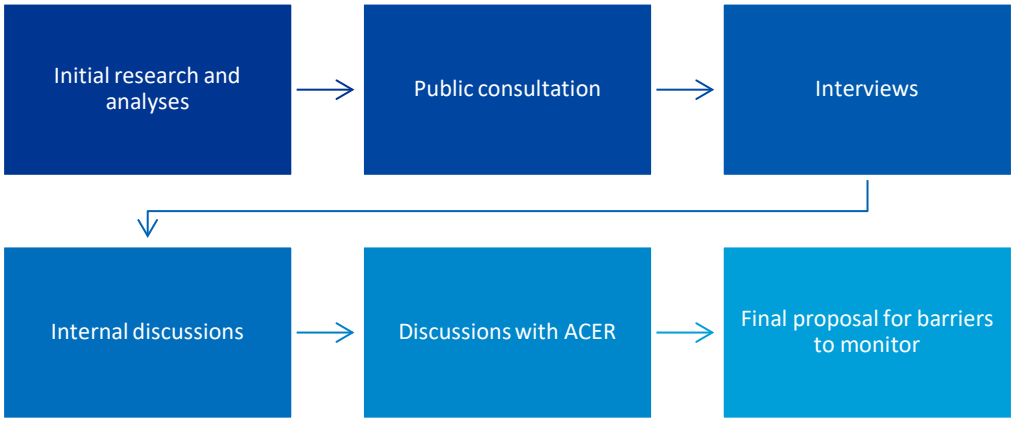

Figure 5-2 Process from long list to short list of barriers

The second step involved determining a long list of indicators which followed the process shown in Figure 5-3.

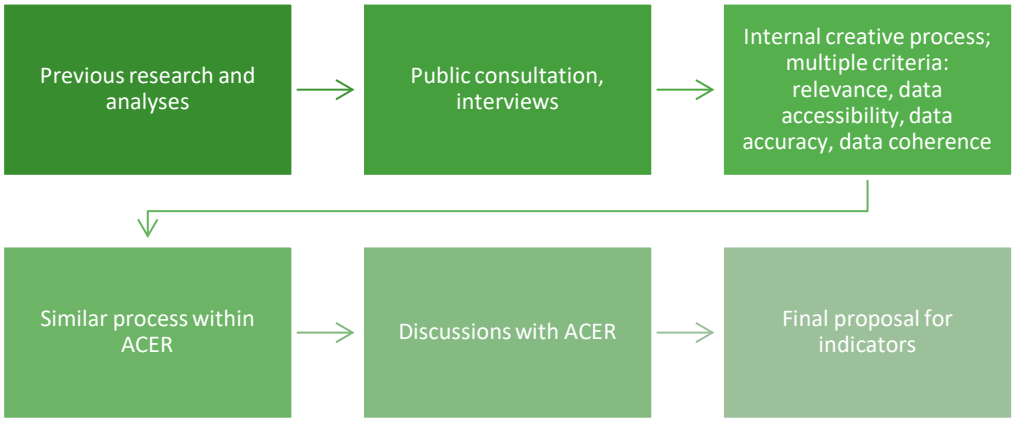

Figure 5-3 Process from long list to short list of indicators

6 BARRIERS TO EFFICIENT PRICE FORMATION

This section covers the scope as defined in Task 2 of this project and provides a description of the barriers monitored for the composite indicator concerning efficient price formation. It should be noted that some barriers, or the indicators for some barriers, are used for both composite indicators. These are marked with an * in the heading. For each of the barriers, there is one or more indicators used to produce numerical results for each country. These indicator descriptions can be found in sections 8 and 9.

6.1 Regulation and market design

6.1.1 Explicit price restrictions

Bidding limits and caps or floors on clearing prices may prevent prices from reflecting the actual state of the electricity system. Price caps can also work as an anchor for market participants and steer prices towards the cap. Hence, price caps and floors tend to represent real barriers to price formation, depending on their nature, aim, and the restriction procedures and in particular if the objective of the limit is to prevent prices from settling outside the limit.

Regulation (EU) 2019/943[8] states in Article 10.1 that there shall be no limits to the wholesale electricity prices. However, an exception applies for technical bidding limits in Art 10.2. In particular, in some price setting algorithms, like Euphemia for DA and ID timeframes, maximum and minimum technical limits are utilised to improve the computation of the optimisation problem the algorithm is designed to solve. If such technical limits are moved further up or down if they are hit, with the intention that the algorithm is essentially supposed not to hit the limits, the impact of the limit is considered to be low. While recognising the existence of such technical barriers, the primary focus area of this barrier is other than the technical bidding and price limits, if any.

The scope of this barrier is forward, day-ahead, intraday, balancing energy and imbalance prices, although such limits are generally not observed in forward markets.

6.1.2 Potential market distortions due to support schemes granted to different technologies or market participants

In the presence of externalities – that is, consequences of market activity that affect other parties without this being reflected in market prices – a support scheme may be a corrective measure if properly defined. To what extent a specific support scheme represents a barrier or enabler to efficient price formation depends on its objective and nature and design. The scope of this barrier are those schemes, or features of schemes, that prevent prices from being efficient, e.g. because some design details are not well defined or because they do not address externalities.

The objective of support schemes for renewable energy sources is to promote a higher share of electricity generation from renewable energy sources and/or increase the speed of investments in renewable energy, i.e. a recognition that the energy transition is not fast enough. This could be the case if the generators' emission costs do not properly reflect the societal cost of emissions, or if prices do not properly reflect the societal costs of emissions, in which case a support scheme for RES is one possible solution to correct the pricing failure. As an example, a RES scheme would be a barrier to efficient price formation if it incentivises beneficiaries to produce more than the market can absorb in the short-term. RES support is often explained by the argument that raising emission costs for CO_2 intensive technologies sufficiently higher may have negative intermediate consequences on employment, and thus a combination of policy instruments, including RES support schemes and taxation of emissions, is often chosen in practical policy making.

The objective of other support schemes varies, from case to case. Accelerated depreciation or favourable tax schemes may be introduced to encourage faster and larger investment activities to increase employment. Credit guarantees to

8 Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast) is available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0943

manufacturers of network or power generation components may similarly be used to ensure high activity in domestic manufacturing industries. A third example is where producers of electricity with certain technologies, e.g. nuclear power generators, are not held financially responsible for all the costs they incur, such as the decommissioning costs or costs for handling the nuclear waste, e.g. due to concerns for its impact on (industrial) electricity prices. These 'other' schemes can be barriers to efficient price formation, e.g. if they distort the merit order[9] or if they lead to a higher use of electricity than the total costs would suggest.

A challenge to assess this barrier is that it is insufficient to simply map the existence of support schemes as the design of the schemes also matters. Moreover, it would be difficult to agree on a methodology to systematically assess the impact on efficiency of the different support scheme designs across Europe.

6.1.3 Potential market distortions due to capacity mechanisms

As set out in Article 21 of Regulation (EU) 2019/943, Member States may introduce capacity mechanisms as a last resort to eliminate residual resource adequacy concerns. Even though capacity mechanisms are a legitimate temporary measure, their design and implementation may influence efficient price formation. In particular, certain designs of capacity mechanisms can directly block price spikes in day-ahead markets, e.g. setting explicit or implicit caps for capacity providers. In addition, some centralised capacity mechanisms can also lead to structural overcapacity.

As mentioned below in section 8.1.3, this study has not been able to conclude on unambiguous indicators to measure this barrier. In the future, it will be needed to perform a deeper assessment in order to analyse the absence of scarcity price signals (i.e. low occurrence of price spikes) in day-ahead markets, the existence of structural overcapacity due to capacity mechanisms as well as some potential restrictions in cross-border participation. This assessment should overcome the difficulties to agree on the underlying concepts of price spikes, scarcity and overcapacity.

6.1.4 End-user price regulation*

Note: this barrier is relevant for both composite indicators, but for partly different reasons. The nature of the barrier is, however, the same.

Directive (EU) 2019/944[10] states that Member States shall ensure the protection of energy poor and vulnerable household customers by social policy or by means other than public interventions in the price setting for the supply of electricity. Nevertheless, such public interventions may be applied if they are limited in time and proportionate as regards their beneficiaries, among other compliance criteria. In addition, Member States may apply public interventions in the price setting to household customers and to microenterprises during a transition period in order to establish effective competition for electricity supply contracts between suppliers, and to achieve fully effective market-based retail pricing of electricity. Nevertheless, such public interventions shall be set at a price that is above cost, at a level where effective price competition can occur and shall minimise the negative impact on the wholesale electricity market, among other compliance criteria.

In spite of these conditions, some Member States still maintain a high level of public interventions in the price setting with the intention of protecting households and/or non-household customers from significant increases in wholesale energy prices. Such price interventions may represent a barrier to efficient price formation and new entrants and small players:

- Consumers benefiting from public interventions in the price setting are extremely difficult to reach with competitive offers and by new entrants such as aggregators.
- In some cases, regulated prices are set below cost levels or with a squeeze margin thus hampering the development of competitive retail markets, minimising the economic incentive for switching, discouraging investments and hindering the emergence of new entrants.

9 Altering the merit order may in occasions be also counterproductive to decarbonisation objectives.

10 Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU, available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32019L0944#

- Price-regulated markets can be explicitly discriminatory against some market participants when only a limited number of suppliers is allowed to offer regulated prices.

The greater the size of the regulated customer segment, the stronger the barrier, as it reduces the potential dynamic response from the demand side.

6.1.5 Unavailability or little incentive to contract dynamic retail prices*

Note: this barrier is relevant for both composite indicators, but for partly different reasons. The nature of the barrier is, however, the same.

Consumers should have the possibility of participating in all forms of demand response benefiting from the full deployment of smart metering systems and, where such deployment has been negatively assessed, choosing to have a smart metering system and a dynamic electricity price contract[11], as set out in Directive (EU) 2019/944. This would allow them to adjust their consumption according to real-time price signals that reflect the value and cost of producing and transporting electricity in different periods. In addition, dynamic electricity prices provide an opportunity for suppliers to reduce their hedging costs.

However, dynamic electricity price contracts for residential customers are currently not available in all EU Member States or if so, dynamic offers are not sufficiently attractive for consumers for various reasons.

Firstly, dynamic pricing is only possible when smart meters with reliable consumption readings in time slots that match with market intervals as well as the corresponding ICT infrastructure are available. However, only nine Member States completed their smart meter roll out in 2019 and the roll-out plans and statistics diverged widely, suggesting that a delay in smart-meter roll out is likely[12]. In addition, the corresponding consumption records, data processing and billing procedures need ICT infrastructure to be in place. In particular, Energy Management Systems need to be integrated with the telemetry software in order to create multiple tariffs and tariff periods adjusted to the different load curves of the consumers and identify peak periods and opportunities for consumption savings.

Secondly, retail customers must be incentivised to enhance their flexibility potential and interest in dynamic electricity price contracts. In 2019 on average, only 37% of the final price consisted of the energy component, while the remaining 63% of the electricity bill consisted of non-contestable charges, i.e. the sum of network costs, taxes, levies and other charges[13]. A low share of the energy component does not give price signals to consumers and it blurs the benefits of dynamic pricing.

6.1.6 Restrictive requirements in prequalification, product characteristics and other features of market design*

Note: this barrier is relevant for both composite indicators, but for partly different reasons. The nature of the barrier is, however, the same.

Restrictive requirements in the market design can limit market participation and activity and cause low competitive pressure and inefficient price formation. On the one hand, the potential impact on price formation explored under this barrier could come indirectly via entry and exit activity, or directly via product design, e.g. in balancing markets or potentially in day-ahead and intraday markets. On the other hand, the potential impact on new entrants and small actors explored under this barrier could come as risks associated with entry-decisions or via limitations for their business models posed by prequalification or product requirements.

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11 Dynamic electricity price contract means an electricity supply contract between a supplier and a final customer that reflects the price variation in the spot markets, including in the day-ahead and intraday markets, at intervals at least equal to the market settlement frequency, as set out in Directive (EU) 2019/944.

12 For more information please see ACER MMR 2019 Energy Retail and Consumer Protection Volume of the 2019 ACER´s Market Monitoring Report, available at: https://extranet.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202019%20-%20Energy%20Retail%20and%20Consumer%20Protection%20Volume.pdf

13 See footnote 12.

A variety of relevant restrictions can fit under this barrier: Refusal to leave the market may prevent prices from reflecting scarcity. Obligations to offer, to offer under specific terms, or to participate in specific sub-markets can lead to distorted prices in the short-term. Over time, it can also lead to lower investments in resources or power plants that are subject to such obligations, potentially implying higher long-term prices.

Similarly, product design requirements that e.g. excludes significant resources from participation, or otherwise negatively affect the business case for some potential suppliers, are likely to cause inefficiencies in the price formation – unless such requirements reflect fundamental requirements of the system. A location requirement might be very efficient with respect to congestion management, but not necessarily equally efficient for balancing services. A limitation of opportunities to aggregate resources might be more relevant for some services but not necessarily for other services.

6.2 Market structure and performance

6.2.1 Insufficient competition and liquidity in wholesale markets

In electricity markets with low liquidity it is complicated or costly for market participants to find counterparts, and the result can be inefficient prices. An electricity market is considered liquid if a significant number of market participants are able to sell and buy products in large quantities, quickly, without significantly affecting prices and without incurring significant transaction costs.

In terms of economic value for market participants, the forward, day-ahead and intraday timeframes are the most important. These are also traditional markets in the sense that they are open for all market participants on both the buy and sell side of the market.

For other types of products, the current market design for balancing services (including close-to-real-time transactions), normally envisages only one potential buyer per TSO-area. Hence, liquidity is less likely to be measurable with traditional liquidity metrics for the forward, day-ahead and intraday timeframes, such as churn factors or bid-ask spreads. Suggested indicators in section 8.2.1 thus focus on the forward markets and the day-ahead and intraday timeframes. However, each individual indicator does not necessarily cover all timeframes. Liquidity should be measured at bidding zone level, and then aggregated to country level, unless otherwise explained for each indicator.

6.2.2 Scope for strengthening market integrity

Wholesale energy markets provide key price signals that affect the choices of producers and consumers, as well as investment decisions in generation, storage and demand resources, and transmission and distribution infrastructure. It is therefore essential that these price signals reflect a fair and competitive interplay between supply and demand, and that no profits can result from market abuse.

REMIT[14] sets an EU-regulatory framework specific to wholesale energy markets introducing the explicit prohibition of market abuse, i.e. market manipulation, attempted market manipulation or insider trading. ACER, NRAs, persons professionally arranging transactions, market participants, or any person observing potential market abuse can contribute to the transparency and integrity of wholesale energy market under REMIT.

6.2.3 Scope for increasing market transparency

Transparency in wholesale energy markets refers to the obligation of market participants to disclose inside information. Greater transparency reduces the risk that markets are manipulated, and the price signals distorted. Transparency in

14 REGULATION (EU) No 1227/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2011 on wholesale energy market integrity and transparency, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011R1227

wholesale energy markets is thus crucial in creating a level-playing field for all market participants and ensuring that consumers pay a fair price for their electricity.

6.3 Networks, TSOs and DSOs

6.3.1 Failure to maximise availability of cross-zonal capacity

A key objective of any electricity market design is to ensure efficient congestion management. Grid congestions are unavoidable and imply that the value of electricity is locational. To efficiently steer necessary investments as well as the daily system operation, prices need to signal where electricity is most needed.

In a zonal electricity system like the European one, correct locational signals require TSOs to make the existing transmission capacity available to the market in a coherent, objective, non-discriminative and reliable manner via transparent processes.

In a meshed electricity network, the actual transmission capacity between any two nodes is an endogenous variable, depending on how production and consumption are split between nodes. The zonal design in Europe implies, however, that available transmission capacity between bidding zones is declared before the production and consumption per node are determined.

The objective and non-discriminatory treatment of all market participants further requires cross-zonal capacity to not be reduced in order to give priority to trades within each bidding zone. Article 16.4 of the Regulation (EU) 2019/943 thus requires that the maximum level of capacity of the interconnections and the transmission networks affected by cross-border capacity shall be made available to market participants complying with the safety standards of secure network operation. Article 16.8 defines that if at least 70 % of the cross-zonal capacity is made available to the market participants, the maximisation criterion is met.

The barrier considered here addresses the issue of adequate amounts of cross-zonal capacity given the current bidding zones delineation. Potential barriers stemming from an inefficient delineation of bidding zones are assessed separately (section 6.3.2). The liquidity in the forward markets is considered in the barrier addressing insufficient competition and liquidity in wholesale markets (section 6.2.1).

6.3.2 Delineation of bidding zones not reflecting structural congestions

As mentioned in section 6.3.1, in order to ensure an efficient operation and planning of the EU electricity network and provide effective price signals for generation capacity, demand side response and transmission infrastructure, bidding zones should reflect structural congestion.

In order to identify how far the actual bidding zone delineation addresses structural congestions in an efficient manner, the following aspects can be assessed. First, the extent to which TSOs need to resort to costly remedial actions (redispatching and/or countertrading) to resolve congestions derived from intra-zonal exchanges. Second, the extent to which bidding zones cause congestions somewhere else in the network.

Bidding zones that do not reflect the most significant grid constraints will prevent market prices (forward, DA, ID and imbalance prices) from reflecting these grid constraints. On the other hand, bidding zones defined so small that virtually all grid constraints, both structural as well as more intermittent constraints, are handled by the day-ahead and/or intraday markets may impact the hedging opportunities in the forward market. One of the challenges of defining bidding zones is to thus balance the potential benefits of small bidding zones for congestion management against the potential disadvantages in terms of liquidity and transaction costs in forward markets.

The barrier considered here addresses the inefficiencies in the congestion management design, while the liquidity in the forward markets are considered in the barrier addressing insufficient competition and liquidity in the wholesale market (section 6.2.1).

6.3.3 Scope for improving transparency, cost-reflectivity and non-discrimination in the structure of network tariffs

Network tariffs have the core objective to recover the costs incurred by transmission or distribution system operators finding the right balance between different tariff setting principles including transparency and predictability, cost reflectivity and recovery and non-discrimination. Network tariffs may represent a barrier to efficient price formation when they trigger an inefficient behaviour of some network users because of a lack of transparency and effective stakeholder involvement when setting the network methodology and tariffs, non-cost-reflective network tariffs and a different treatment of the same user groups without a proper justification.

6.3.4 Lack of transparency in information provided by system operators*

Note: this barrier is relevant for both composite indicators, but for partly different reasons. The nature of the barrier is, however, the same.

Access to information is important for prices to reflect the fundamentals of the traded goods. Insufficient transparency, e.g. due to lack of publication or inconvenient disclosure of information, increases the risk that market transactions are made without proper or sufficient recognition of the relevant facts, and thus that prices are inefficient and not reflecting the actual conditions in the market.

The legislation therefore sets clear requirements to various stakeholders about the disclosure of information, with an aim to make information available i) at the right time, ii) with sufficient precision/level of detail, iii) in a useful format, and iv) of a sufficient quality.

For the wholesale market of electricity, information about available network capacity is vital – the crux of the market design is essentially how to deal with the spatial dimensions of electricity. TSOs have vital responsibilities in this context, e.g. to provide information about both the state of the system, how TSOs conduct calculations of the network capacity, etc. Furthermore, due to their roles as neutral parties and their responsibility to facilitate the electricity market, TSOs are also responsible for a transparency platform, such that market parties can have equal and good access to important information.

Insufficient transparency can also complicate the commercial operations of new entrants and small actors – at least as far as their business models rely on offering services that aims to relieve constraints or issues, about which information is not readily available in the first place. In that sense, their business models are particularly dependent on sufficient transparency from system operators. If TSOs or DSOs do not provide sufficient and timely information about the state of the network and how they go about in system operation, an important potential market for new entrants and small actors is essentially limited, if not closed.

7 BARRIERS TO NEW ENTRANTS AND SMALL ACTORS

This section covers the scope as defined in Task 2 of this project and provides a description of the barriers monitored for the composite indicator concerning new entrants and 0073mall actors. It should be noted that some barriers, or the indicators for some barriers, are used for both composite indicators. These are marked with an * in the heading. For each of the barriers, there is one or more indicators used to produce numerical results for each country. These indicator descriptions can be found in section 9.

7.1 Regulation and market design

7.1.1 Complex, lengthy and discriminatory administrative and financial requirements

The electricity sector requires a high level of quality in the market participants' operations (e.g. producing, selling or consuming electricity, as well as investing in such activities).

There are significant technical and economic risks, and administrative and financial requirements are generally imposed to mitigate or comply with such risks. When this is performed in a sufficient way, this ensures the absence of barriers to entry and participate in electricity markets for new entrants and small actors. However, if such requirements go beyond what is strictly necessary, they may represent unfair or inefficient constraints towards new entrants or small actors. If so, they may prevent them from investing in some types of assets, from adequate access and connection to the network, from entering and participating in some timeframes or product markets (e.g. markets for local congestion management), etc.

It should be noted that there might also be exit conditions that are particularly complex to manage for new entrants or small actors. These exit conditions are primarily handled under the barrier on restrictive requirements in prequalification, product characteristics and other features of market design in section 7.1.6.

While it is conceivable to assess the height of such barriers, it is challenging to define a threshold value in a way that above a limit, it becomes an inefficient barrier that ideally should be removed (or at least reduced). Hence, the ambition for the indicators for this barrier is to measure the relative height of this barrier in each country.

7.1.2 Adequacy of the legal framework to enable new entrants and small actors

The legal framework defines and regulates the markets from a legal perspective. It is also equally important to note the practical implementation of the legislation, regardless whether it concerns European Regulations, Directives[15] or national law. Hence, it cannot be taken for granted that the national legal framework is fully adequate in all its details.

For this barrier, the scope is to what extent there is an adequate national legal framework properly defining the roles and responsibilities concerning new entrants and small actors and their opportunities with respect to flexible resources. A lack thereof constitutes a barrier to the extent that new entrants and small actors are deterred from entering the market due to e.g. irregularities or inconveniencies within the national framework, undefined consequences for a set of operations, and discriminatory benefits for incumbent players or large actors. Establishing a transparent and non-discriminatory legal basis for operations, can alternatively further encourage new entrants and small actors.

The scope of this barrier is limited to the Regulation (EU) 2019/943 and the Directive (EU) 2019/944, and if the implementation is sufficient with regard roles, resources, and requirements.

The key roles assessed are the following:

- Active customer

[15] A 'Regulation' is a binding legislative act. It is immediately and entirely applicable in all Member States and it overrules national laws. A 'Directive' sets objectives but Member States have freedom when transposing it to the national legislation.

- Aggregator
- Citizen energy community
- Independent aggregator

The relevant resources assessed are the following:

- Ordinary consumption by end-users (as basis for DSR)
- Energy storage, both behind the meter and with separate meters
- Local generation, both behind the meter and with separate meters

7.1.3 Restrictive requirements to participate in capacity mechanisms and interruptibility schemes

As set out in Article 22 of Regulation (EU) 2019/943, any capacity mechanism shall select capacity providers by means of a transparent, non-discriminatory and competitive process, provide incentives for capacity providers to be available in times of expected system stress and be open to participation of all resources that are capable of providing the required technical performance, including energy storage and demand side management. However, the requirements of the eligibility and allocation processes as well as the design of the capacity product may hinder entry and participation for new entrants and small actors.

Similarly, some restrictions in the eligibility, allocation and the product design of some interruptibility schemes[16] may represent a barrier for new entrants and small actors.

7.1.4 End-user price regulation*

Refer to section 6.1.4 for the description of this barrier.

7.1.5 Unavailability or little incentive to contract dynamic retail prices*

Refer to section 6.1.5 for the description of this barrier.

7.1.6 Restrictive requirements in prequalification, product characteristics and other features of market design*

Refer to section 6.1.6 for the description of this barrier.

7.2 Market structure and performance

7.2.1 Insufficient competition in the retail market

The retail electricity market, as the key link between end users and the wholesale and balancing markets, play a significant role throughout the electricity sector. New entrants and small actors are highly dependent on a well-functioning and effective competition in the retail market. The lower the competitive pressure, the greater difficulty for the new entrants to enter and compete since incumbents may destroy their business model.

The level of competition in some retail markets can be insufficient for different reasons including:

- A market structure with high levels of concentration of nation-wide or vertically integrated suppliers,
- A low number and a low entry-exit activity of suppliers that is indicative of little dynamism in the retail market and

16 Interruptibility schemes refer to a particular type of reserves which only include demand response capacity. Beneficiaries are contracted for their availability to reduce load when asked by the TSO.

- A bad market performance because of a low correlation between the energy component of retail prices and wholesale prices.

7.3 Networks, TSOs and DSOs

7.3.1 Lack of incentives to consider non-wire alternatives

As regulated monopolies, the DSOs' incentives to consider other than traditional network assets when facing increasing demand for network connection and utilisation depend entirely on the revenue regulation of the DSOs. New entrants and small actors may provide services to DSOs as a core element of their strategies and business models. If alternatives to grid reinforcements are more beneficial for the society, but DSOs are not considering such options due to lack or inadequate incentives, this could lead to a barrier to new entrants and small actors.

7.3.2 Lack of transparency in information provided by system operators*

Please refer to section 6.3.4 for the description of this barrier.

8 INDICATORS TO MEASURE BARRIERS TO EFFICIENT PRICE FORMATION

This section covers the scope as defined in Task 2 of this project and provides a description of all indicators proposed to measure the barriers to efficient price formation as described in section 6. The respective indicators are described in tables that contain an overall description, information about the type of indicator, and the data sources. If it is quantitative, more details about the data and calculation are included, in particular for those quantitative indicators that are not a trivial index. In general, detailed information about the underlying sub indicators or questions, the scoring and evaluation, including how missing data will or should be treated, is not included here but reported separately to ACER in the form of a combined questionnaire and scoring tool in Excel.

8.1 Regulation and market design

8.1.1 Explicit price restrictions

8.1.1.1 Presence of price restrictions other than technical limits in line with Art 10.1 of Regulation (EU) 2019/943

Description	The aim of this indicator is to map out the presence of bidding and clearing price limits (caps and floors) in all timeframes, including balancing energy and imbalance prices, other than the technical limits that may be applied in the day-ahead, intraday and balancing markets as set in Art 10.1 of the Regulation (EU) 2019/943. The indicator assesses the compliance with Art 10.1, and to what extent countries set artificial bidding or clearing price limits. The indicator is assessed at country level. However, for countries with more than one bidding zone, it is estimated as the average for all bidding zones in the country.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions aimed to identify artificial bidding or clearing price limits in the different market timeframes.
Evaluation	The higher the score, the lower the barrier.

8.1.1.2 Values of the effectively applied maximum price limits (compared to the value of lost load) and minimum price limits

Description	The aim of this indicator is to map out the extent to which some countries have bid limits that deviate from the rest of the countries. The indicator consists of two sub-indicators: upper (cap) and lower (floor) limit. Hence, there will be two scores per country for this indicator. For clarity, information about technical limits is also collected. The maximum price limits will be compared to the value of lost load (VOLL), pursuant to Article 10 or 11 of the Regulation (EU) 2019/943, or alternatively, an estimate of the value of lost load that is most commonly used for other purposes. The indicator is assessed at country level. For countries with more than one bidding zone, it is estimated as the average for all bidding zones in the country.
Type of indicator	Quantitative (index and EUR/MWh)
Data sources	Questionnaire to NRAs
Content	The indicator comprises two sub indicators: one for the upper and another one for the lower limits across all timeframes. Both are based on detailed questions referring to the upper and lower bidding limits and limits on market clearing or settled prices in forward, day-ahead, intraday and balancing energy prices as well as the upper and lower limits on imbalance prices.
Underlying data and units	• Bidding and clearing price limits in EUR/MWh • VOLL in EUR/MWh

Units of the indicator	• Sub-indicator for the upper limit: index • Sub-indicator for the lower limit: EUR/MWh
Evaluation	• The higher the upper limit, the lower the barrier. • The lower the lower limit, the lower the barrier.

8.1.1.3 Number of hours when the maximum or minimum price limits are reached

Description	The aim of this indicator is to assess if the narrowest (technical or artificial) price limits are too restrictive by requesting the aggregated time when the narrowest price limits for the day-ahead and intraday markets and for the balancing energy markets were reached in the last 2 years. The indicator is assessed at country level. For countries with more than one bidding zone, it is estimated as the aggregated value for all bidding zones in the country.
Type of indicator	Quantitative (hours)
Data sources	Questionnaire to NRAs
Content	It is calculated based on the number of times the market clearing price is equal to one of the technical or artificial limits and the duration of one market time unit (in minutes).
Evaluation	The shorter the duration, the lower the barrier.

8.1.1.4 Application of automatic procedure if the price limits are reached

Description	Technical limits for bids or clearing prices may be necessary for power exchange algorithms to calculate clearing prices. According to Article 10.2 of the Regulation (EU) 2019/943, *NEMOs shall implement a transparent mechanism to adjust automatically the technical bidding limits in due time in the event that the set limits are expected to be reached. The adjusted higher limits shall remain applicable until further increases under that mechanism are required.* The aim of this indicator is to assess the procedure and routines if technical limits for the day-ahead and intraday markets are expected to be reached. The indicator is assessed at country level.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions to determine if the routine for adjusting the technical bidding limits is published and automatic.
Evaluation	The higher the score, the lower the barrier.

8.1.1.5 Restrictions in the design of the imbalance settlement mechanism

Description	This indicator aims to analyse some design features of the imbalance settlement mechanism with regard to the target model, including the imbalance settlement period and the existence of more than one final positions for each balance responsible party (BRP), as opposed to a single position, and different imbalance prices for different BRPs, as opposed to single imbalance pricing.
Type of indicator	Qualitative (score)
Data sources	ENTSO-E
Content	The indicator is an index calculated based on the number of imbalance positions and prices as well as the duration of the settlement period.
Evaluation	The higher the score, the lower the barrier.
Clarifications	The scope of this indicator may be expanded in the future, including the assessment of the publication of estimated imbalance settlement price, the gate closure time for the notification of internal trade schedules, the cost recovery scheme, the share of imbalance settlement positions in which the TSO applies dual or single pricing and the correlation between the imbalance settlement price and ID prices when the target model in place (i.e. single pricing and single position).

8.1.2 Potential market distortions due to support schemes granted to different technologies or market participants

8.1.2.1 Presence of support schemes and share of total capacity benefiting from the support

Description	The aim of this indicator is to map out the presence and significance, in terms of market share, of different support schemes for both RES and non-RES. This mapping covers total capacity last year benefiting from the support and new capacity installed last year benefiting from the support. There will be two scores per country for this indicator: one for the total capacity last year and another one for the new capacity installed last year.
Type of indicator	Qualitative (score)
Data sources	• CEER Status Review of Renewable Support Schemes in Europe for data on RES support schemes. Previous report: https://www.ceer.eu/documents/104400/-/-/80ff3127-8328-52c3-4d01-0acbdb2d3bed • Questionnaire to NRAs for non-RES support schemes and RES support schemes other than those included in the CEER report.
Content	The indicator comprises two sub indicators: one for the share of total capacity remunerated last year and another one for the share of new capacity installed last year and benefiting from the support. Both sub indicators can be combined with a scoring system per type of scheme, such that less distorting designs (i.e. those allocated through a competitive process) obtain a higher score. The ultimate results are two volume weighted average scores for the country.
Evaluation	The lower the scores, the lower the barrier.

8.1.2.2 Total support per total MW installed or MWh generated

Description	This indicator aims to assess the unitary support granted to different types of technologies (both RES and non-RES but with the exemption of payments granted via capacity mechanisms or interruptibility schemes) for the total capacity last year and the new capacity installed last year. There will be two scores per country for this indicator: one for the total capacity last year and another one for the new capacity installed last year.
Type of indicator	Qualitative (score)
Data sources	• CEER Status Review of Renewable Support Schemes in Europe for data on RES support schemes. Previous report: https://www.ceer.eu/documents/104400/-/-/80ff3127-8328-52c3-4d01-0acbdb2d3bed • Questionnaire to NRAs for non-RES support schemes and RES support schemes other than those included in the CEER report.
Content	The indicator comprises two sub indicators: one for the total unitary support corresponding to the total capacity last year and another one for the new unitary support corresponding to the new capacity installed last year. Both sub indicators can be combined with a scoring system per type of scheme, such that less distorting designs (i.e. those allocated through a competitive process) get a higher score. The ultimate results are two volume weighted average scores for the country.
Evaluation	The lower the scores, the lower the barrier.

8.1.2.3 RES with balance responsibility and with total or partial reduction of their compensation during negative prices or network congestions

Description	This indicator aims to assess if RES generators are financially responsible for their imbalances and how their incentives are affected by negative prices or network congestions. The scope is national.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs

Content	The indicator comprises two sub indicators: share of RES capacity installed with balancing responsibility and share of RES capacity with total or partial reduction of their remuneration when there were negative wholesale prices or network congestions last year.
Evaluation	The higher the score, the lower the barrier.

8.1.3 Potential market distortions due to capacity mechanisms

Indicators for this barrier will be defined in the future. A deeper assessment is needed to determine robust indicators to measure:

- Absence of scarcity price signals, e.g. low occurrence of price spikes in day-ahead markets
- Structural overcapacity
- Restrictions in cross-border participation

8.1.4 End-user price regulation

8.1.4.1 Public interventions in the setting of retail prices

Description	Public interventions in the price setting reduce the business opportunities of new entrants and small actors. In particular, the requirements to provide regulated prices usually only allow a few market participants to get access to this customer segment and consumers benefiting from regulated prices are usually extremely difficult to reach with competitive offers. This composite indicator measures the presence of price intervention in the price setting and its level of penetration in terms of consumption, number and type of consumers benefiting from price intervention.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on CEER data
Content	The indicator comprises four sub indicators measuring the share of consumers (household, non-household and vulnerable) and consumption benefitting from public interventions in the price setting.
Evaluation	The higher the score, the lower the barrier.
Clarifications	The scope of this indicator may be expanded in the future including the share of consumers and/or consumption allowed/entitled to have price regulation.

8.1.4.2 Difference between average regulated and non-regulated retail prices over the year

Description	When regulated prices are set below cost levels or with a squeeze margin, they hamper the development of competitive retail markets, minimise the economic incentive for switching, and become a barrier for new entrants and small players. This indicator aims to assess if the average regulated prices are lower than the average non-regulated prices over the year.
Type of indicator	Quantitative (EUR/MWh)
Data sources	ACER calculation based on prices published in the comparison tool websites
Content	$$Difference_{reg/non-regl} = \frac{\sum_{i=1}^{n} Regulated\ price_i}{n} - \frac{\sum_{i=1}^{m} Non-regulated\ price_i}{m}$$ Where: n = number of regulated prices offered m = number of non-regulated prices offered The regulated prices can be fixed or variable. When different regulated prices are set based on the time-of-use, we estimate the average of these prices before comparing with other offers for regulated prices available, if any. The average regulated and non-regulated prices are compared for the same type of consumers.

Evaluation	The lower the difference, the lower the barrier created by regulated prices.

8.1.5 Unavailability or little incentive to contract dynamic retail prices

8.1.5.1 Share of final household consumers with smart meters among total households (metering points)

Description	Consumers only can conclude a dynamic electricity price contract if they are equipped with smart meters with reliable consumption readings in specific time slots matching with market intervals and if the corresponding ICT infrastructure is available. This indicator aims to assess the share of smart meter roll out among final household consumers.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	CEER
Evaluation	The higher the share of final household consumers with smart meters, the more household consumers have the option to conclude dynamic electricity price contracts and the lower the barrier.

8.1.5.2 Share of energy component in the retail electricity prices

Description	The final electricity prices depend on their constituent components, which include energy costs, network charges, charges for renewable energy (RES charges), other taxes and levies and the value added tax (VAT). This indicator measures the share of the energy component in the retail electricity prices. If the electricity price signal in the actual energy bill is highly diluted due to other items (e.g. taxes and levies) being much higher, the potential value of offers from new entrants and small actors might seem insignificant.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on ACER Retail Database
Content	The share of the energy component is calculated based on the breakdown of the standard incumbent electricity offers available in the capital city of each country to household consumers with an annual electricity consumption of 3,500 kWh.
Evaluation	The lower the share of the energy component in the retail electricity prices, the lower the price signal to consumers, thus discouraging to enhance their flexibility potential and interest in dynamic electricity price contracts, and thus, the higher the barrier.

8.1.5.3 Standard deviation of the day-ahead wholesale prices

Description	This indicator aims to assess the annual volatility of the day-ahead wholesale prices. A higher volatility of the wholesale prices incentivises the end-users to conduct dynamic electricity price contracts. Furthermore, higher volatility suggests a higher potential benefit of a more active relation between suppliers and end-users.
Type of indicator	Quantitative (index)
Data sources	ACER calculation based on ENTSO-E data
Content	The standard deviation of day-ahead wholesale prices, calculated for the whole year.
Evaluation	The higher the standard deviation, the higher the level of dispersion of prices, and the lower the barrier.

In addition to the indicators mentioned above, the following indicators could be assessed in the future:

- Share of final household consumers equipped with smart meters without Energy Management Systems integrated with the telemetry software
- Share of consumers equipped with smart meters still receiving estimated bills

8.1.6 Restrictive requirements in prequalification, product characteristics and other features of market design

8.1.6.1 Restrictions of products and other characteristics of the market design of balancing markets that impact efficient price formation

Description	This indicator aims to assess design features of balancing markets and products that may impact price formation such as, the settlement and the activation rules in place, if free bids are not allowed or if balancing energy prices are predetermined in balancing capacity contracts. The scope of this indicator covers all types of reserves for balancing energy and balancing capacity markets.[17]
Type of indicator	Qualitative (score)
Data sources	• ENTSO-E • Questionnaire to NRAs • ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises six sub indicators to measure if procurement of standard balancing energy and capacity products is already in place, if the balancing energy price is predetermined in the balancing capacity contracts, the lead-time between procurement and delivery[18], the activation rules, the pricing rules for settlement and eligibility of free bids in each balancing reserve type.
Evaluation	The higher the score, the lower the barrier.

In addition to the above indicators, the following indicator could be assessed in the future:

- Qualitative assessment of restrictions to entry and exit

8.1.6.1 Qualitative assessment of restrictions to entry or exit

Description	This is a survey-based indicator aimed to assess if explicit restrictions to entry or exit apply and to what extent such restriction are barriers to efficient price formation and to new entrants and small actors. Implicit restrictions to entry, e.g. unusually high administrative hurdles, are analysed through other indicators. Market exit conditions pose a significant consideration before entering the market. As an example, the minimum period of notification before market exit and the rules pertaining to decommissioning may constitute a barrier to market entry and for small actors, as such conditions increase the potential for losses. Exit conditions thus may have a similar effect as tough requirements to enter a market. The scope is national. For countries with more than one bidding zone or more than one TSO, a country assessment should be made
Type of indicator	Qualitative (score)
Data sources	Questionnaire to stakeholders
Content	A set of closed-ended questions to measure i) the existence of restrictions to entry (e.g. if foreign ownership is problematic, if the lack of own production assets is an issue to enter some markets, if licensing conditions for behind the meter production or storage is significantly simpler than for utility scale assets) and ii) to determine if exit conditions are challenging in some respect (e.g. if producers are not entitled to close some non-profitable power-plants, if suppliers are aggregators are not entitled to close their business without specific consents). The indicator also aims to measure the average length of notice periods for various exit decisions. Some questions are tailored for the composite indicator on barriers to efficient price formation, while other questions are tailored for the composite indicator on barriers to new entrants and small actors.

17 It is important to note that the scoring system for this indicator re-scales the individual scores for those Member States where the TSO/s do not use all types of reserves (i.e. frequency containment reserves, automatic frequency restoration reserves, manual frequency restoration reserves and replacement reserves) to avoid they get penalised for not using all types of reserves.

18 Lead-time between the balancing capacity auction and the start of the contract period in which the balancing capacity must be offered as balancing energy in the real-time market.

Evaluation	The higher the score, the lower the barrier.

8.2 Market structure and performance

8.2.1 Insufficient competition and liquidity in wholesale markets

8.2.1.1 Share of energy production required to be sold at regulated prices or under some regulated mechanism aside the market

Description	This indicator aims to assess to the extent to which one or more domestic producers are required to offer electricity at regulated prices. This might limit the size of the market open for market-based pricing. The indicator measures the share of installed capacity that is required to sell production at regulated prices and the share of volume that was actually sold. The scope of the indicator is the obligation that hold for the calendar year being analysed (e.g. the obligation to offer for 2020). If the country has more than one bidding zone, the indicator should be calculated for each bidding zone, and a volume-weighted average is to be calculated using the total production per bidding zone as weights.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	Questionnaire to NRAs
Evaluation	The lower the share, the lower the barrier.

8.2.1.2 CR3: market share of the 3 biggest business groups

Description	The concentration ratio (CR) is a traditional structural measure of market concentration based on market shares. A common approach is CR3, which measures the total market shares of the 3 largest actors in one market. This indicator aims to measure a potential limitation of competition and consequently of liquidity. The higher the percentage, the lower the competitive pressure and potential liquidity, all else equal.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	CEER
Evaluation	It is assumed that a CR3 at and below 30% represents a competitive market; this receives the maximum score. Between CR3 of 30% and 100%, the score reduces linearly to zero. The lower the share, the lower the barrier.
Clarifications	Market share calculations are normally performed based on company or ownership but calculations on the BRP level can be even more relevant. A company which is BRP for another company has full information regarding their bids and their bidding strategy. Capacities shall as much as possible be attributed to “mother companies” or business groups. This means that partnerships are divided among the owners and that consolidated companies are attributed to the parent companies. For parent companies with more than one BRP account, an aggregation must be made.

8.2.1.3 Number of generators covering more than 5% of national generation

Description	The number of market participants covering more than 5% of the national generation is a common metric to measure market concentration. It is based on the same data and completes the picture provided by CR3. This indicator aims to measure a potential limitation of competition and consequently of liquidity. The higher the number, the higher is the competitive pressure and potential liquidity, all else equal.
Type of indicator	Quantitative (score between 0 and 10)

Data sources	CEER
Evaluation	It is assumed a score of zero for a monopoly, rising to a maximum score for 10 generators or more. The higher the number, the lower the barrier.
Clarifications	Market share calculations are normally performed based on company or ownership but calculations on the BRP level can be even more relevant. A company which is BRP for another company has full information regarding their bids and their bidding strategy. Capacities shall be attributed to "mother companies" or business groups as much as possible. This means that partnerships are divided among the owners and that consolidated companies are attributed to the parent companies. For parent companies with more than one BRP account, an aggregation must be made.

8.2.1.4 Overall liquidity index

Description	The churn factor can be defined as the overall volume traded through exchanges and brokers expressed as a multiple of physical consumption. It is a common direct measure of market liquidity and assesses the "relative size" of the market compared to its physical size. This indicator aims to display an overall liquidity index per country based on the churn factors of different market timeframes. In addition, the indicator aims to reflect proxy hedging in neighbouring or regional forward markets. To account for proxy hedging, the country specific churn factor is adjusted based on churn factors in countries with highly correlated day-ahead prices, resulting in a country specific liquidity index. This indicator covers all timeframes before real time, i.e. forward, day-ahead and intraday.
Type of indicator	Quantitative (index)
Data sources	ACER calculation based on inputs from NEMOs, EU reports, ENTSO-E transparency platform (ENTSO-E TP), private data providers and NRAs
Content	The overall liquidity index per country is calculated as follows: $$OLI = CF_{forward} + CF_{DA} + CF_{ID}$$ Where: CF_{ID} = yearly churn factor in intraday markets in the country, as the overall volume traded intraday divided by the physical consumption. Since the share of CF_{ID} over *OLI* is very low, CF_{ID} could be taken out of the calculations if data availability is not sufficient. CF_{DA} = yearly churn factor in day-ahead markets in the country, as the overall volume traded day-ahead divided by the physical consumption $CF_{forward}$ = yearly churn index in the forward markets, as defined below: $$CF_{forward} = CF_{forward-country} + CF_{forward-neigbouring}$$ $$= \frac{CV_{country}}{Consumption_{country}} + \frac{\sum_i \frac{CV_j}{Consumption_j} \times Correction\ factor_{ij}}{n}$$ Where: $CF_{forward\text{-}country}$ = yearly churn factor in forward markets in the country $CV_{country}$ = contract volume of the contracts traded during the year *y* and referred to the relevant country $Consumption_{country}$ = consumption during the year *y* in the country $CF_{forward\text{-}neighbouring}$ = yearly churn factor in other neighbouring or regional forward markets CV_j = volume of the contracts traded during the year *y* in the other neighbouring or regional forward market *j* $Consumption_j$ = consumption during the year *y* in the neighbouring or regional forward market *j*

	Correction factor$_{ij}$ depends on the correlation between day-ahead prices in the country analysed (or each bidding zone *i* of the country) and the bidding zone *j* (or hub, if applicable) in the following way:
	• If correlation is below 0.8, the correction factor is 0 (zero)
	• If correlation is 0.8 or higher, the correction factor is the actual correlation minus 0.1. The highest possible correction factor is thus 0.9, the lowest is 0.7, unless it is set to zero by the previous condition
	• The correlation here means the Pearson coefficient between the day-ahead prices in the country analysed i (or each bidding zone of the country i) and the reference day-ahead price reference underlying the hedging product for the bidding zone j or for the hub if applicable (e.g. the Nordic system price)
	n = number of bidding zones and hubs *j* where the correlation of the day-ahead prices is equal or above 0.8.
	
	It is important to note that even though we calculate the overall liquidity factor at country level, some underlying data will be collected at bidding zone or regional level (e.g. the EPADs, the Nordic system price forward products, etc.).
	Examples where proxy hedging is common
	In some markets, proxy hedging is at least as common as hedging in terms of a local forward contract. In the Nordic market, proxy hedging by means of buying or selling (Nordic) system price contracts and German forward contracts (in addition to EPADs) are conceivable hedging strategies. Other markets, such as the Dutch or the Austrian markets, might also rely on neighbouring markets like the German market for hedging.
	In the case of the Nordics area, the overall liquidity index per country would thus be calculated as the sum of these elements:
	• EPAD volume of the bidding zones of the country divided by physical consumption in the bidding zones
	• Volume of forward contracts in other markets, such as system price forwards or German forwards, etc., divided by the physical consumption in the relevant bidding zone, multiplied with the correction factor
	  • In the case of the Nordic system price, the consumption in the 'system price area' is the sum of the physical consumption in all bidding zones that are basis for the system price calculation
	  • The correction factor is calculated as the Pearson coefficient between the day-ahead prices of each bidding zone and the day-ahead Nordic system prices, the German day-ahead prices, etc., minus 0.1

Evaluation	The higher the score, the lower the barrier.

8.2.1.5 Bid-ask spread of the most frequently traded forward products

Description	Bid-ask spreads are an indication of transaction costs for market participants. The bid-ask spread can be seen as the interval of uncertainty around the yet unknown market value of a forward contract at a given point in time. A higher bid-ask spread means that a trade can be concluded within a bigger price interval and might cause some volatility of the forward prices. Time is normally available for hedgers to let brokers work to reduce bid-ask spreads and reveal the 'real' price of the forward contract. The exchange bid-ask spread on the screen is often the maximum market maker spread allowed for less liquid contracts. OTC spreads are often lower, and brokers are most often used to assist in closing the bid-ask spread. Brokers therefore normally have a high market share in less liquid contracts. Closing a bid-ask spread can take time. The average of exchange bid-ask spreads is therefore not a relevant measure. The average of the best bid-ask spread per week (exchange and OTC) is a more relevant measure when assessing the efficiency of different hedging instruments and should be monitored on a regular basis. In general, the bid-ask spread will be lower if a market has a higher liquidity.

	The indicator aims to display the absolute value of the bid-ask spread, measured over a period relevant for hedging needs. In principle, this indicator could be applicable to all timeframes before day-ahead, but for practical reasons we only select one of the most used products, which are typically the yearly products.
Type of indicator	Quantitative (EUR/MWh)
Data sources	ACER calculation based on private data providers
Content	For each bidding zone, we calculate the average of the lowest bid-ask spread per week for the period between 18 months and 6 months ahead of the delivery of the yearly product. Please note that in the absence of sufficiently granular information, the lowest of the daily reported bid-ask spread within a week will be considered. The metric is calculated separately for each bidding zone. For countries with more than one bidding zone, it is the average bid-ask spread for all bidding zones that should be reported.
Underlying data and units	Bids and asks from NEMOs and OTC brokers
Evaluation	The lower the calculated bid-ask spread, the lower the barrier.

8.2.1.6 Correlation of day-ahead and intraday prices

Description	The better the liquidity, the easier it will be for market participants to position themselves such that at the margin and ex ante, participants are indifferent between contracting in the DA, ID or in the markets for balancing energy – all else equal. Uncertainty and random outcomes will cause differences between the actual DA prices, actual ID prices and actual balancing energy prices. Thus, we cannot expect to find perfect correlation across timeframes when examining real prices. However, it seems reasonable to expect even lower correlation in DA or ID markets with a low liquidity. Furthermore, it is not trivial to device an approach to calculate a single metric for the correlation of more than two variables. The indicator assesses to what extent there is such correlation of prices for the same market time unit across DA and ID timeframes. The indicator aims to display the actual level of this correlation per country and year.
Type of indicator	Quantitative (index)
Data sources	ACER calculation
Content	For each bidding zone, calculate the correlation of DA and ID prices as follows; $$\frac{\sum_i \left(p_i^{DAM} - \bar{P}^{DAM}\right)\left(p_i^{ID} - \bar{P}^{ID}\right)}{\sqrt{\sum_i \left(p_i^{DAM} - \bar{P}^{DAM}\right)^2 \sum_i \left(p_i^{ID} - \bar{P}^{ID}\right)^2}}$$ Where p_i^{DAM} = is the day-ahead price for hour *i*, $i \in [1, 8760]$[19] $\bar{P}^{DAM}$ = is the average day-ahead price for all hours of the year p_i^{ID} = is the average intraday price for hour *i*, $i \in [1, 8760]$ $\bar{P}^{ID}$ = is the average of all hourly average intraday price for the year Please note that to select the average intraday price for hour *i*, the following order of priority is used: 1) The price of the last trading hour (i.e. one hour before the delivery time) for all bidding zones that are part of the Single Intraday Coupling (SIDC); 2) The price of the last trading hour on local trades for bidding zones that still do not participate in SIDC; 3) The volume-weighted average price of all trades that occurred with hourly continuous products;

[19] The number of hours would be 8784 for leap years.

	4) The price of the closest-to-delivery-time auction for bidding zones that only have auction products.The metric is calculated separately for each bidding zone. For countries with more than one bidding zone, the average correlation for all bidding zones is used.
Underlying data and units	• DA prices • ID prices
Evaluation	The higher the correlation, the lower the barrier.
Clarifications	In the future, this indicator could be calculated based on REMIT data. The average intraday price for hour *i* could be estimated as the volume-weighted average of all the transactions placed in the last hour (i.e. one hour before the delivery time).

8.2.1.7 Overall open interest index

Description	Open interest is a common indicator to assess the liquidity of a market. The higher the open interest, the more liquid the market is - all else equal. One of the relevant differences between geographical markets is the sheer size, measured by e.g. load. Hence, the observed open interest will be normalised with load. Open interest refers to all open positions with a clearing house at a given point in time. It corresponds to the total amount of energy in forward contracts that have not been closed out by an offsetting trade yet, fulfilled by means of the physical delivery of the underlying asset or executed via cash settlement. An important metric to understand financial markets is the development of open interest over time. When a contract is bought or sold for hedging purposes, the intention is to keep the new position until the contract goes to delivery. If the contract is bought (sold) for trading purposes, the idea is most often to sell (buy) a similar contract for a higher (lower) price at a later point in time. The first of the trader's transaction will increase open interest, while the second will reduce open interest. The size of the open interest in a contract in relation to the traded volumes of the contract shows to what extent the contract is primarily used for hedging purposes or for short-term speculative trading. The indicator aims to display the value of the open interest relative to demand per country for the end of year. The indicator should ideally be calculated for each bidding zone separately, but it can also be estimated at country level. In countries with more than one bidding zone, the country-specific open interest indicator can be estimated as the average of all the bidding zone scores in the country. To account for proxy hedging, the country specific open interest is adjusted based on open interest in countries with highly correlated prices, resulting in an overall open interest index. This indicator only covers the forward markets.
Type of indicator	Quantitative (index)
Data sources	ACER calculation based on inputs from NEMOs, EU reports, ENTSO-E transparency platform (ENTSO-E TP), private data providers and NRAs
Content	The overall open interest index (OOII) per country is calculated as follows: $$OOII_{country} = \frac{OI_{country}}{Consumption_{country}} + \frac{\sum_i \frac{OI_j}{Consumption_j} \times Correction\ factor_{ij}}{n}$$ Where: $OI_{country}$ = open interest in forward markets in the country (i.e. all contracts with delivery within the country) $Consumption_{country}$ = consumption during the year *y* in the relevant country OI_j = open interest in a neighbouring or regional forward market *j* $Consumption_j$ = consumption during the year y in the neighbouring or regional forward market *j* *Correction factor*$_{ij}$ depends on the correlation between day-ahead prices in the country analysed (or each bidding zone *i* of the country) and the bidding zone *j* (or hub, if applicable) in the following way: • If correlation is below 0.8, the correction factor is 0 (zero)

	• If correlation is 0.8 or higher, the correction factor is the actual correlation minus 0.1. The highest possible correction factor is thus 0.9, the lowest is 0.7, unless it is set to zero by the previous condition • The correlation here means the Pearson coefficient between the day-ahead prices in the country analysed i (or each bidding zone of the country i) and the reference day-ahead price reference underlying the hedging product for the bidding zone j or for the hub if applicable (e.g. the Nordic system price) n = number of bidding zones and hubs *j* where the correlation of the day-ahead prices is equal or above 0.8. It is important to note that even though we calculate the open interest at country level, some underlying data will be collected at bidding zone or regional level (e.g. the EPADs, the Nordic system price forward products, etc.)
Evaluation	The higher the index, the lower the barrier

In addition to the indicators mentioned above, the following indicators could be assessed in the future:

- Number of active traders active in the wholesale market normalised with the demand in the country
- Market share of the TSOs allowed to participate as BRPs in balancing markets
- CR3 in the balancing capacity market (i.e. market share of the three biggest balancing service providers in terms of total balancing capacity activated) or number of balancing service providers providing more than 5% of the total balancing capacity activated
- CR3 in the balancing energy market (i.e. market share of the three biggest balancing service providers in terms of total balancing energy activated) or number of balancing service providers providing more than 5% of the total balancing energy activated

8.2.2 Scope for strengthening market integrity

8.2.2.1 Market surveillance at the NRA

Description	This indicator aims to identify if the NRAs perform surveillance activities of the electricity wholesale markets at national level. National market surveillance has a deterrence effect that minimises the risk of market abuse.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER (confidential)
Content	Quantitative analysis of the market timeframes and products where each NRA performs market surveillance.
Evaluation	The higher the share, the lower the barrier.

8.2.2.2 REMIT data sharing in place

Description	ACER shares the information about transactions on wholesale energy markets with NRAs upon request in order to facilitate an efficient monitoring of trading in wholesale energy products and a review of anomalous instances. This REMIT data serves for preliminary investigations to detect potential market abuse. This indicator aims to measure how the NRAs request to get access this data, i.e. as raw REMIT data or via a Business Intelligence tool.
Type of indicator	Qualitative (score)
Data sources	ACER
Content	A set of closed-ended questions about the types of REMIT data sharing options that are accessible for the NRAs.
Evaluation	The higher the score, the lower the barrier.

8.2.2.3 Public market abuse decisions

Description	An intense NRA enforcement of market abuse may lead to sanction decisions due to market manipulation and/or insider trading in the wholesale energy markets that have deterrence effect minimising the risk of market abuse. In some Member States, the national regulatory framework also allows NRAs to issue non-sanction decisions to request some market participants to establish compliance with the national law regarding some REMIT provisions within a specific timeframe. This indicator measures whether or not the NRAs issued at least one market abuse decision or one non-sanction decision to request some market participants to establish compliance with the national law regarding some REMIT provisions in the last 2 years.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs, and ACER website: https://www.acer.europa.eu/en/remit/REMITATACER/Pages/Enforcement-decisions.aspx
Content	A set of closed-ended questions to identify sanctions and non-sanctions decisions issued in the last 2 years.
Evaluation	The higher the score, the lower the barrier.

8.2.2.4 Maximum possible financial penalty for market abuse

Description	Any market abuse can have a serious impact on market confidence, result in significant losses to market participants and distort the price signal. It is therefore essential that competent authorities can impose effective sanctions that have a strong deterrent effect, reduce the opportunities and incentives for market abuse and reinforce the integrity of the electricity markets. This indicator aims to measure the maximum sanction levels. It is important to note that this indicator does not aim to compare the penalty regimes among NRAs but to determine if the sanction is high and dissuasive.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	The indicator is based on the maximum possible financial penalty for market abuse, i.e. market manipulation or attempted market manipulation as well as trading based on inside information. It is estimated as the ratio of the financial penalty normalised with the country's GDP.
Evaluation	The higher the score, the lower the barrier.

8.2.2.5 Quality of suspicious transaction reports

Description	Persons professionally arranging transactions (PPATs) in wholesale energy products, such as organised marketplaces and trade-matching systems, have the legal obligation to monitor their platforms to identify market abuse according to Art 15 of REMIT. In case of any reasonable suspicion, they must send a suspicious transaction report (STR) to the NRA without delay. This indicator assesses the quality of the STRs submitted by the PPATs in order to measure the robustness of the surveillance function to detect and deter market abuse.
Type of indicator	Qualitative (score)
Data sources	ACER
Content	A qualitative analysis of each STR submitted to the NRA is performed. The maximum score corresponds to the highest quality. The total score per country is estimated as the average of all the STRs submitted to the corresponding NRA.
Evaluation	The higher the score, the lower the barrier.

In addition to the above indicators, the following indicators could be assessed in the future:

- Quality of data provided under REMIT
- Compliance culture in trading firms

8.2.3 Scope for increasing market transparency

8.2.3.1 Share of market participants indicating in CEREMP[20] the inside information platform used to disclose inside information

Description	According to Article 4(1) of REMIT, market participants shall publicly disclose inside information which they possess with regard to the businesses or facilities that they or their parent undertaking or a related undertaking own or control, or whose operational matters they or their undertaking are responsible for, either fully or in partially. In spite of this legal requirement, some market participants still do not disclose their inside information platform. This indicator aims to assess the share of market participants in each country that indicate the inside information platform (IIP) used to disclose inside information in the CEREMP.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on CEREMP available at: https://www.acer-remit.eu/portal/european-register
Evaluation	The higher the share, the higher the level of transparency and the lower the barrier.

8.2.3.2 Share of volume and share of transactions in organised marketplaces[21]

Description	Organised marketplaces foster the level of transparency of the wholesale electricity markets. Trades result from a large, open and transparent competition between the orders of the exchange members, thus reflecting the best information available at the time under the market conditions. This indicator measures the share of volume and share of number of transactions traded in organised marketplaces.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on private data providers and NRAs questionnaire in the framework of the MMR
Content	The indicator is estimated as the share of volume of energy traded i) in power exchanges and ii) OTC (bilateral trading through brokers) but cleared at the power exchanges.
Evaluation	The higher the scores, the more transparent the country and the lower the barrier.
Clarifications	In the future, this indicator may also include the share of number of transactions made in organised marketplaces based on REMIT data.

In addition to the above indicators, the following indicator could be assessed in the future:

- Overall transparency in the publication of data by the main NEMOs in a country

8.2.3.3 Overall transparency in the publication of data by the main NEMOs in a country

Description	This is a survey-based indicator aimed to assess the overall transparency of the data provided by NEMOs in line with four criteria, i.e. completeness, accuracy, timeliness and user friendliness based on an assessment performed by some stakeholders.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to stakeholders
Content	Some stakeholders should assess the level of transparency of the data provided by each NEMO as High, Medium or Low according to the following evaluation criteria: • Completeness: all types of data needed by the users are available, there are not data gaps, users are informed about missing data and they can report missing data • Accuracy: data and data definitions are correct; the users are informed about inaccuracy and they can report inaccuracies • Timeliness: all types of data are published on time and there are not delays in data availability

20 CEREMP is the Centralised European Register of Energy Market Participants. More information available at: https://www.acer-remit.eu/portal/ceremp

21 They are also known as organised markets as set in REMIT.

	• User friendliness: users can easily find what they need, and it is clear for them which data are available, data are logically presented, download options allow for easy, fast and reliable access to the data and service requests are handled efficiently and satisfactorily.
Underlying data and units	List of currently designated NEMOs and Member States where they provide services: https://acer.europa.eu/en/Electricity/MARKET-CODES/CAPACITY-ALLOCATION-AND-CONGESTION-MANAGEMENT/IMPLEMENTATION/Pages/DESIGNATION-OF-NEMOs.aspx
Evaluation	The higher the score, the lower the barrier.

8.3 Networks, TSOs and DSOs

8.3.1 Failure to maximise availability of cross-zonal capacity

8.3.1.1 Share of hours when the minimum 70% target is met

Description	In order to ensure sufficient cross-border capacity, the Clean Energy for all Europeans Package (CEP)[22] sets a minimum level of cross-border capacity to be met[23]. The indicator assesses the extent to which this minimum is met. The indicator aims to display per country and year the percentage of hours in the day-ahead timeframe (until coordinated intraday capacity calculation is implemented) when the minimum 70% target (Margin Available for Cross-Zonal Trade ≥ 70%) is met. The indicator is built on the analysis performed in the ACER report monitoring of the MACZT in the EU per semester starting the analysis in the first semester of 2020[24]. The percentage of hours when the minimum 70% target is met per year is established as the arithmetic average of results of both semesters.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	• % hours when MACZT ≥ 70% and bidding zone borders: ACER calculation based on TSOs data provided in the scope of the ACER MACZT monitoring report • Maximum exchange per border (MW): ACER calculation
Content	$$\frac{\sum_{y \in CCAs}\left[(\%\ hours\ when\ MACZT\ \geq\ 70\%\ on\ y\ ) * \sum_{borders \in y} \max Exchange_{border}\right]}{\sum_{borders \in CCAs} \max Exchange_{border}}$$ Where: y = country CCA = Capacity Coordination Area Max Exchange: • On borders where net transfer capacity (NTC) applies, Max Exchange = average of max hourly NTC, both directions, in the year • On borders where flow-based (FB) capacity calculation applies, Max Exchange = maximum actual hourly exchange, import/export in the year
Underlying data and units	• % hours when MACZT ≥ 70% • Bidding zone borders • Maximum exchange (MW) per border
Evaluation	The higher the share, the lower the barrier.
Clarifications	• For hours when ACER is not provided with any information, it will be considered that 70% is not reached • For hours when ACER is not provided with information on critical network elements for certain hours, it will be considered that 70% is not reached • For hours when the limiting element is not located in the country, so ACER does not have MACZT, it will be considered that 70% is reached

22 The Commission's Clean Energy for All Europeans legislative proposal covered energy efficiency, RES generation, the design of the electricity market, security of electricity supply, and governance rules for the Energy Union. Relevant material along with the adopted directives and legislation is available at: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-alleuropeans

23 In particular, the CEP requires that at least 70% of the maximum admissible active power flow in critical network elements considering contingencies is made available for cross-zonal trade.

24 ACER´s "70% target report" is available at: https://extranet.acer.europa.eu/en/Electricity/Market%20monitoring/Pages/Cross-zonal-capacity-70-target.aspx

8.3.1.2 Average relative margin available on network elements for which the relative margin is below 70%

Description	In order to ensure sufficient cross-border capacity, the CEP sets a minimum level of cross-border capacity to be met, the 70% target. The indicator assesses the level of capacity that is made available on the network elements when the 70% level is not met. The indicator aims to display the percentage of cross-zonal capacity actually available relative to the maximum technical capacity that could be made available for cross-zonal trade for the hours and critical network elements when the 70% target is not reached in the day-ahead timeframe[25] (i.e. when the Margin Available for Cross-Zonal Trade ('MACZT') is below 70%). This indicator is calculated on a yearly basis and at Member State level. The indicator is built from the dataset collected by ACER in the scope of the ACER report monitoring of the MACZT in the EU per semester and per Member State starting the analysis in the first semester of 2020.
Type of indicator	Quantitative (percentage between 0% and 70% or numeraire between 0 and 0.7)
Data sources	ACER calculation based on TSOs data provided in the scope of the ACER MACZT monitoring report
Content	$$\frac{\sum_{CNEC \in CNECs\ with\ MACZT<70\%} \frac{MACZT_{CNEC}}{Fmax_{CNEC}}}{Number\ of\ CNECs\ with\ MACZT < 70\%}$$ Where CNECs = Critical Network Elements declared by a Member State CNEC = Critical Network Element MACZT = Margin Available for Cross-Zonal Trade (MW) Fmax = Maximum flow on critical network elements, respecting operational security limits (MW)
Underlying data and units	• CNECs declared by the Member State • Level of MACZT on each CNEC • Fmax
Evaluation	The higher the share, the lower the barrier.

8.3.1.3 Frequency of the allocation constraints effectively limiting the offered cross-zonal capacity

Description	When calculating the capacity to be made available for cross-zonal trade, TSOs may, besides monitoring the CNECs, apply some allocation constraints. 'Allocation constraints' are defined in the Guideline on Capacity Allocation and Congestion Management (CACM)[26] as the constraints to be respected during capacity allocation to maintain the transmission system within operational security limits and have not been translated into cross-zonal capacity or that are needed to increase the efficiency of capacity allocation. Allocation constraints are, in practice, maximal values (MW) limiting the total export or import from/to a bidding zone, or on one or several bidding zone borders. This indicator is calculated on a yearly basis and at Member State level. Estimation per Member State: The limiting CNECs define a domain for each coordination area. For each coordination area, ACER would verify whether the allocation constraints is "redundant" or not with the domain defined by the CNECs, i.e. if the allocation does not reduce further the size of the domain: • If the allocation constraint is redundant, then it means that the allocation constraint is not limiting the offered cross-zonal capacity more than the CNECs. • If the allocation constraint is not redundant with the domain, it means that it further reduces the domain and, so, the offered cross-zonal capacity. Estimation per year: ACER monitors allocation constraints per semester. The frequency of the allocation constraints which limit the offered cross-zonal capacity per year is estimated as the arithmetic average of results of both semesters.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)

25 Until coordinated intraday capacity calculation is implemented.

26 Commission Regulation (EU) 2015/1222 of 24 July 2015, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R1222&from=EN

Data sources	ACER calculation based on TSOs data provided in the scope of the MACZT monitoring report
Content	Percentage of time when the allocation constraints applied by a country limit the import or the export on at least one bidding-zone border of the country. Min equal to 0 when 0% of hours the allocation constraints limit the offered cross-zonal capacity or if the country does not apply any allocation constraints. Maximum equal to 100 when 100% of hours the allocation constraints limit the import or export on at least one of its bidding-zone borders.
Underlying data and units	• Hourly limiting CNECs of all the coordination areas in which the country has at least one bidding-zone border • Hourly allocation constraints
Evaluation	The lower the share, the lower the barrier.

8.3.2 Delineation of bidding zones not reflecting structural congestions

8.3.2.1 Redispatching and countertrading volumes to solve congestions which are not cross-border relevant

Description	Redispatching is a TSO measure to relieve network congestions by altering generation, load or both. TSOs normally solve network congestions on non-cross border relevant network elements through redispatching. This indicator aims to assess to what extent countries need to resort to redispatching measures to deal with congestions on non-cross border relevant network elements. The energy contracted for redispatching is normalised with the total domestic load (excluding network losses) to make the number comparable across bidding zones and countries. For countries with more than one bidding zone, the indicator is calculated for each bidding zone separately and for the country as a whole.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on NRAs questionnaire in the framework of the MMR and Eurostat/ENTSO-E TP data
Underlying data and units	• TSOs' redispatching volume for resolving congestions physically located within the country on network elements that are not cross-border relevant • Annual energy load (excluding network losses) per country
Evaluation	The lower the share, the more efficient the congestion management and the lower the barrier.

8.3.2.2 Amount of loop flows on structurally congested network elements originated in a country

Description	A loop flow refers to a physical flow on a network element where the source and sink are located in the same bidding zone and the network element or even part of the network element is located in a different bidding zone. The impact of loop flows is manifold; the main one is that they tend to reduce the amount of cross-zonal capacity available for trade. While a certain amount of loop flows is likely to remain in any close-to-optimal bidding zone configuration, a bidding zone/country originating a relatively high amount of loop flows indicates that the bidding zone delineation does not contribute, per se, to maximise the amount of cross-zonal capacity available for trade. While certain levels of cross-zonal capacity (e.g. the 70% target envisaged in the CEP) can still be achieved, a relatively high amount of remedial actions would be needed to counteract the impact of such loop flows. This indicator describes the contribution in terms of loop flows of each bidding zone on network elements with cross-border relevance. For countries with more than one bidding zone, the indicator is calculated for each bidding zone separately and for the country as a whole.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	Possible sources:

	• (potentially in the future) ENTSO-E technical report to be published every 3 years according to Article 34 of the CACM Regulation • (potentially as a proxy) ACER calculation based on a limited number of common grid models (CGMs)
Content	For each bidding zone and/or country, average share of burdening loop flows, compared to the thermal capacity, over network elements of cross-border relevance. Notes: • Burdening flow means a flow identified on a network element in the direction that is aggravating a constraint on that network element. • Structural congestion means congestion in the transmission system that is capable of being unambiguously defined, is predictable, is geographically stable over time, and frequently reoccurs under normal electricity system conditions.
Underlying data and units	• Loop flows allocated to each bidding zone as derived from flow decomposition (MW) • Thermal capacity of the network elements (MW)
Evaluation	The lower the share, the better the definition of the bidding zones within the country, and the lower the barrier.

8.3.3 Scope for improving transparency, cost-reflectivity and non-discrimination in the structure of network tariffs

8.3.3.1 Transparency setting the tariffs methodology and the network tariffs

Description	This indicator covers two layers of transparency: i) transparency during the process of setting methodologies, which is mainly achieved by consultations; and ii) public availability of relevant tariff-related information to the network users and stakeholders including costs and other inputs, methodology and resulting charges.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions about what information and how this information is publicly available, what sorts of consultations are arranged before setting network tariffs, etc.
Evaluation	The higher the score, the lower the barrier.

8.3.3.2 Non-network related charges in network tariffs

Description	Due to national or regional regulations, some TSOs and DSOs are required to recover some charges for services that are not related to TSO or DSO activities via the transmission and/or distribution tariffs. These requirements lead to non-cost-reflective network tariffs. This indicator aims to identify the nature of these non-network related charges as well as their relative weight over the total costs recovered by the network tariffs.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions to identify the nature of non-network related charges in the network tariffs (e.g. RES support schemes, NRAs, NEMOs and other institutions costs, costs of measures for ensuring adequacy, etc.) and their aggregated share over the network tariffs.
Evaluation	The higher the score, the lower the barrier.

8.3.3.3 Cost-reflective network charges for producers

Description	This indicator aims to assess the types of network charges paid by electricity producers connected to the transmission and distribution systems and their cost-reflectiveness.

	The scope is both connection charges and use of network charges paid for the shared use of electricity network. Connection charges are imposed as one-off or on-going charges covering the costs (or part of the costs) of connecting new users to the transmission and distribution system.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions to identify whether producers pay chargers to recover part of the costs for building/upgrading/maintaining the transmission and distribution infrastructure (i.e. return on capital, depreciation and operational expenditures) and the nature of these network charges. i.e. power-based, lump-sum, energy-based and any possible combination of them.
Evaluation	The higher the score, the lower the barrier.

8.3.3.4 Limited availability of time-differentiated network tariffs

Description	The inclusion of time elements in tariffs primarily aims at reflecting the costs of related network investments/infrastructure, losses and congestion costs. In the context of the specific national conditions, they can provide therefore economic signals for more cost-efficient use of the network. In addition, time-differentiated network tariffs are a main driver of demand side response and flexibility encouraging consumers to consume when prices are lower. This indicator aims to measure the availability of time-differentiated network tariffs including the type of granularity of time signals (i.e. time periods) and the share of users benefiting from these network tariffs. Seasonal time differentiation is not accounted for as time-differentiation.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions about what shares of consumers (household and non-household) are subject to different types of network charges with time-differentiation.
Evaluation	The higher the score, the lower the barrier.

8.3.4 Lack of transparency in information provided by system operators

8.3.4.1 Data completeness of the ENTSO-E transparency platform (TP)

Description	The ENTSO-E Transparency Platform (TP) is an online data platform for European electricity system data. Many institutions submit data to comply with publication requirements specified in Regulation (EU) 543/2013. These data providers are the European TSOs, DSOs, power exchanges, larger generation companies and merchant link operators. ENTSO-E TP include data items on load, generation, transmission, balancing, outages, and congestion management. The aim of this indicator is to measure how transparent the data providers are by measuring the completeness of some data items on the ENTSO-E TP.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on the ENTSO-E transparency platform. Third countries are excluded in the analysis unless specifically stated in Regulation (EU) 543/2013.
Content	For each data item, the number of expected data records is calculated, e.g. 8760 or 8784 for hourly data, etc. Similarly, the number of missing data records is calculated for each data item. Then, the indicator is calculated as follows: $$Completeness_{overall} = \frac{\sum_{i=1}^{n} R_{expected}{}_{item\ i} - \sum_{i=1}^{n} R_{missing}{}_{item\ i}}{\sum_{i=1}^{n} R_{expected}{}_{item\ i}}$$ Where: n = number of data items taken into consideration

Underlying data and units	Data items on borders: • NTCs [11.2] • Commercial schedules [12.1.f] • Physical flows [12.1.g] Data items on areas: • Day-ahead prices [12.1] • Forecast and actual total load [6.1.a&b]
Evaluation	The higher the average data completeness, the higher the transparency in data provision and the lower the barrier.

8.3.4.2 Completeness of the data provision to assess the minimum 70% target

Description	The CEP identified the lack of sufficient cross-zonal capacity as one of the main barriers to the integration of electricity markets. It established a clear rule: a minimum legally binding 70% of each country's cross-border transmission capacity must be available for trade with neighbours from 1 January 2020. ACER produces biannually a report assessing the scope for improvement to meet the minimum cross-zonal capacity target set in the CEP. The report relies on data provided by TSOs. This indicator aims at assessing the quality and completeness of the data provided by TSOs in the framework of this report. The indicator is calculated on a yearly basis and at Member State level: • At Member State level, the level of completeness is estimated in each border. For Member States with more than one border, it is estimated as the arithmetic average of the data completeness of all the DC and AC borders in the Member State. • Since ACER monitors the MACZT per semester. The annual level of completeness is estimated as the arithmetic average of results of both semesters.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on TSOs data provided in the scope of the MACZT monitoring report.
Content	A set of closed-ended questions to measure the level of completeness of the data provided by the TSOs to ACER to monitor the MACZT. Concerned data items are: • On DC borders: Fmax, NTC values as calculated by TSOs and allocation constraints • On AC borders: margin from coordinated capacity calculation (MCCC), margin from non-coordinated capacity calculation (MNCC), critical network element with contingencies (CNECs), power transfer distribution factors (PTDFs), NTC, forecast schedules and allocation constraints The indicator is the ratio of total points over the maximum number of points.
Evaluation	The higher score, the higher the share of data completeness, and the lower the barrier.

8.3.4.3 Transparency of the capacity calculation methodology

Description	Price formation is an information-gathering process. Well-informed buyers and sellers make offers based on their knowledge of prices associated with trades in the market. Cross-border capacity influences prices. The availability of cross-border capacity determines the level of influence of neighbouring markets with the market considered. It enables price convergence. Understanding the methodology for calculating capacity (CCMs) allows stakeholders to anticipate available levels of cross-border capacity. It allows stakeholders to estimate the influence of neighbouring markets. Ideally, the level of transparency should aim at ensuring that network users can reproduce the calculation of available capacity, identifying necessary inputs, calculation steps, and output.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER qualitative assessment of CCMs developed by TSOs.
Content	A set of closed-ended questions to measure three aspects of the level of transparency of the capacity calculation methodologies as follows: • Legal requirements: it assesses to what extent some provisions of the CACM Regulation are explicitly included in the CCMs. • Level of detail: it assesses if the provisions on the CCMs are sufficiently detailed to allow reproducibility of the calculation (e.g. possibility for third parties to replicate it).

	• Data publication: it assesses whether provisions of the CCM ensure transparency over the information used (i.e. availability and quality of information).
Evaluation	The higher the score, the more transparent the CCM, and the lower the barrier.

9 INDICATORS TO MEASURE BARRIERS TO NEW ENTRANTS AND SMALL ACTORS

This section covers the scope as defined in Task 2 of this project and provides a description of all indicators proposed to measure the barriers to easy market entry and participation for new entrants and small actors as described in section 7. The respective indicators are described in tables that contain an overall description, information about the type of indicator, and the data sources. If it is quantitative, more details about data and calculation are included, in particular for those quantitative indicators that are not a trivial index. In general, detailed information about the underlying sub indicators or questions, the scoring and evaluation, including how missing data will or should be treated, is not included here but reported separately to ACER in the form of a combined questionnaire and scoring tool in Excel.

9.1 Regulation and market design

9.1.1 Complex, lengthy and discriminatory administrative and financial requirements

The definition of the indicators for this barrier needs to be finished in the future. An in-depth assessment is needed to determine the underlying questions to measure:

- Collaterals required in different timeframes
- Complex and lengthy administrative procedures

9.1.1.1 Collaterals required in different timeframes

Description	This is a survey-based indicator aimed to assess the necessity (for BRPs or other market participants) to provide collaterals to TSOs, DSOs, NEMOs, other market platforms or clearinghouses in order to participate in different market timeframes. The overarching aim of the indicator is to reveal the financial burden due to such requirements and if they are equal for all participants. The indicator should also assess if DSOs have different requirements for various suppliers of flexibility (to the extent DSOs use flexibility as a supplement to traditional asset-based network expansion policies).
Type of indicator	Qualitative (score)
Data sources	Questionnaire to stakeholders
Content	A set of closed-ended questions to assess i) whether multiple collaterals are required for the same timeframe and if the financial requirements are disproportionate and potentially discouraging the participation of new and small actors in open markets and ii) the nature of the collaterals i.e. if they are a fixed amount per MWh and if they are different for domestic and non-domestic participants, for non-physical and physical asset owners, for supply and demand side BRPs, and for different BRPs actors (e.g. aggregators, foreign traders, etc.).
Evaluation	The higher the score, the lower the barrier.

9.1.1.2 High, complex and lengthy administrative procedures

Description	This is a survey-based indicator aimed to assess the complexity and speed of various administrative procedures. Complex and lengthy administrative procedures to obtain various required licences and approvals may hinder the easy entry and participation for new entrants and small actors in different market timeframes. The scope of the indicator is licenses and/or other sorts of approvals to build and purchase assets, connect and access to the network, participate in different market timeframes and exit the market.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to stakeholders

Content	A set of closed-ended questions i) to rank the complexity and duration of different types of administrative procedures in each country and ii) to estimate the number of authorities, network or market operators requiring a licence, approval, certificate, etc., related to different activities.
Evaluation	The higher the score, the lower the barrier.

9.1.2 Adequacy of the legal framework to enable new entrants and small actors

9.1.2.1 Complete definition of roles and responsibilities

Description	The indicator depicts whether the new types of actors and their roles and responsibilities are clearly defined in the national regulatory framework. In cases of missing or insufficient definition of roles and responsibilities, the national legal framework is incomplete and may constitute a barrier to entry and participate. Grey areas that may emerge from a lack of clear definitions are considered a barrier from the legal framework perspective, as they do not guarantee legality of the operation undertaken in the grey area. The scope is limited to important roles for new market entrants and small actors.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions to assess if the national regulatory framework regulates roles and responsibilities for active customers, aggregators and independent aggregators and citizen energy communities according to the legal provisions set in the Directive (EU) 2019/944.
Evaluation	The higher the score, the lower the barrier.

9.1.2.2 Eligibility of all types of actors to participate in the different timeframes and product markets

Description	With the CEP, the European legislators have stressed that e.g. the demand side resources should be included in market arrangements on an equal footing with any other resources. As new entrants may build their business models on services towards (small) end-users of electricity and optimisation of their flexibility (in their consumption and/or in production or storage opportunities), the eligibility of all types of actors, regardless what types of flexible resources they have access to, in all timeframes and product markets is most important for new entrants and small actors. The aim of the indicator is to assess the eligibility of all types of actors to enter and participate in different timeframes and product markets. The scope covers both distribution and transmission network related services, in addition to wholesale energy markets, and includes all kinds of flexible resources.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions to assess to what extent various types of actors (e.g. active consumers, aggregators, etc.) are legally eligible to enter and participate in different market timeframes and product markets.
Evaluation	The higher the score, the lower the barrier.

9.1.2.3 Market participation of demand side flexibility

Description	The aim of this indicator is to assess the level of participation, by means of counting the number and market share of aggregators and active consumers per country.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions pertaining to number and market activity of aggregators and active customers.

Evaluation	The higher the score, the lower the barrier.

In addition to the indicators mentioned above, the following indicators could be assessed in the future:

- Best practices and limitations in the participation of flexible resources
- Level of satisfaction of different market actors with the definitions of their roles and responsibilities and the national legal frameworks

9.1.3 Restrictive requirements to participate in capacity mechanisms and interruptibility schemes

9.1.3.1 Restrictions in the eligibility process hindering the participation of new entrants and small actors

Description	This indicator aims to assess if all types of technologies and aggregation are allowed to participate as capacity providers in the different capacity mechanisms, as well as determining the minimum eligible capacity.
Type of indicator	Qualitative (score)
Data sources	• Questionnaire to NRAs • ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises three sub indicators to assess the eligible technologies, aggregation and the minimum eligible capacity.
Evaluation	The higher the score, the lower the barrier.
Clarifications	The scope of this indicator may be expanded in the future including the assessment of connection restrictions based on the voltage level.

9.1.3.2 Restrictions in the product design hindering the participation of new entrants and small actors

Description	This indicator aims to assess the following: • If there is a level playing field between generation, demand side resources and energy storage in the provisions of the capacity agreements • If some types of capacity mechanisms have a minimum share of capacity targeted for DSR in the auctions • If there are time-limited obligations during the delivery period since short obligation periods encourage the participation of DSR, energy storage and intermittent and other non-hydro RES
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	The indicator comprises three sub indicators to assess the availability of multi-year agreements for DSR and energy storage, the existence of capacity targeted for DSR in some auctions, and the delivery period.
Evaluation	The higher the score, the lower the barrier.
Clarifications	The scope of this indicator may be expanded in the future including the assessment of the notice period to deliver (if applicable).

9.1.3.3 Restrictions in the allocation process hindering the participation of new entrants and small actors

Description	This indicator aims to assess the minimum bid size and the lead-time between the capacity contracting and the capacity delivery, if applicable. A bid size that is too big or a lead-time that is too long may hinder the participation of new entrants and small actors.
Type of indicator	Qualitative (score)

Data sources	• Questionnaire to NRAs • ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises two sub indicators to assess the minimum bid size and the lead-time between capacity contracting and delivery.
Evaluation	The higher the score, the lower the barrier.

9.1.3.4 Participation of DSR, energy storage and intermittent and other non-hydro RES in capacity mechanisms

Description	This indicator aims to assess the annual participation of DSR, energy storage and intermittent and other non-hydro RES in capacity mechanisms based on the capacity that received payments according to auctioning results for delivery in the relevant year regardless of the year of the procurement.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER (NRAs questionnaire in the framework of the MMR)
Content	$$Participation\ in\ year\ X = \frac{\begin{array}{c}(DSR + \\ Other\ storage\ excluding\ hydro\ and\ hydro\ pumped\ storage\ + \\ Intermitent\ RES + \\ Other\ non-hydro\ RES\ )\ capacity \\ that\ received\ payments\ according\ to \\ auctioning\ results\ for\ delivery\ in\ the \\ year\ X\ regardless \\ of\ the\ year\ of\ the\ procurement(MW)\end{array}}{Total\ capacity\ (MW)}$$
Evaluation	The higher the score, the lower the barrier.

9.1.3.5 Interruptibility schemes: Restrictions in the eligibility process hindering the participation of new entrants and small actors

Description	The indicator aims to assess if all types of loads/sectors and aggregation of individual loads are allowed to participate in the interruptibility schemes as well as the minimum eligibility capacity.
Type of indicator	Qualitative (score)
Data sources	• Questionnaire to NRAs • ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises three sub indicators to assess if all loads/sectors and aggregation are allowed to participate and the minimum eligible capacity.
Evaluation	The higher the score, the lower the barrier.

9.1.3.6 Interruptibility schemes: Restrictions in the allocation process hindering the participation of new entrants and small actors

Description	This indicator aims to assess if a high minimum bid size in the interruptibility schemes may hinder participation of new entrants and small actors.
Type of indicator	Qualitative (score)
Data sources	ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises a sub indicator to measure the minimum bid size for interruptibility schemes.
Evaluation	The higher the score, the lower the barrier.

9.1.3.7 Interruptibility schemes: Participation of aggregators

Description	This indicator aims to assess the annual participation of aggregators in interruptibility schemes based on the realised payments for delivery in the corresponding year irrespective of the procurement date.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER (NRAs questionnaire in the framework of the MMR)
Content	$Participation\ in\ year\ X = \frac{(Realised\ payments\ for\ aggregators\ to\ delivery\ in\ year\ X\ irrespective\ of\ the\ procurement\ date\ (MEUR))}{Total\ payments\ for\ all\ capacity\ providers\ (MEUR)}$
Evaluation	The higher the score, the lower the barrier.

9.1.4 End-user price regulation

Please see 8.1.4 for the description of all the indicators to measure this barrier.

9.1.5 Unavailability or little incentive to contract dynamic retail prices

Please see 8.1.5 for the description of all the indicators to measure this barrier.

9.1.6 Restrictive requirements in prequalification, product characteristics and other features of market design

9.1.6.1 Restrictions in the prequalification process to get access to balancing markets

Description	The technical requirements of the prequalification process to obtain get access to balancing markets are mainly designed for large-scale generators, which can exclude the smaller-scale/aggregated generation or demand-side bids from getting access to these markets. This indicator aims to assess some technical requirements of the prequalification process that may become restrictive for new entrants and small players such as, long full activation times, specific access restrictions to some types of capacity and energy providers, high minimum nominal capacity and long minimum and short maximum duration of the delivery period. The scope of this indicator covers all types of reserves for balancing energy and balancing capacity markets.[27]
Type of indicator	Quantitative (score)
Data sources	• ENTSO-E • Questionnaire to NRAs
Content	The indicator comprises five sub indicators to measure the activation time, the type of capacity or energy provider, the type of load participation, the minimum nominal capacity required to participate in different reserve types and the minimum and maximum duration of the delivery period.
Evaluation	The higher the score, the lower the barrier.

9.1.6.2 Restrictions of products and other characteristics of the market design of balancing markets

Description	This indicator aims to assess design features of balancing markets and products that can hinder participation of new entrants and small actors such as, the settlement rule in place, a high and long product resolution, symmetrical requirements of balancing products and a long lead-time between procurement and delivery.

[27] See footnote 17.

	The scope of this indicator covers all types of reserves for balancing energy and balancing capacity markets.[28]
Type of indicator	Qualitative (score)
Data sources	• ENTSO-E • ACER (NRAs questionnaire in the framework of the MMR)
Content	The indicator comprises five sub indicators to measure product resolution (size and time), if separation of procurement for upward and downward balancing capacity is allowed, the lead-time between procurement and delivery and the pricing rules for settlement.
Evaluation	The higher the score, the lower the barrier.

In addition to the mentioned indicators above, the following indicator could be assessed in the future:

- Qualitative assessment of restrictions to entry and exit

9.1.6.3 Qualitative assessment of restrictions to entry or exit*

See 8.1.6.1 for the description of this indicator.

9.2 Market structure and performance

9.2.1 Insufficient competition in the retail market

9.2.1.1 CR3: Market share of the 3 largest suppliers in the whole retail market by volume

Description	The concentration ratio (CR) is a traditional structural measure of market concentration based on market shares. A common approach is CR3, which measures the total market shares of the 3 largest actors in one market. This indicator aims to measure a potential limitation of competition. The higher the percentage, the lower the competitive pressure and the higher the potential risk for new entrants and small actors.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	CEER
Evaluation	The assumption is made that a CR3 at and below 30% represents a competitive market; this receives the maximum score. Between CR3 of 30% and 100%, the score reduces linearly to zero. The lower the share, the lower the barrier.
Clarifications	Market share calculations are normally performed based on company or ownership. Market shares shall be attributed to “mother companies” or business groups as much as possible. This means that partnerships are divided among the owners and that consolidated companies are attributed to the parent companies.

9.2.1.2 Number of suppliers for household consumers with market shares higher than 5% by volume/metering points

Description	The number of national retail suppliers of electricity in a country is a complementary indicator to CR3 as it contains information on the tail of the distribution of suppliers. Nevertheless, as a national measure, it may not reflect the competitive position at a local or regional level. This indicator aims to measure the number of market participants covering more than 5% of the national retail market by volume or by metering points. Similarly as CR3, this indicator aims to identify a potential limitation of competition and consequently of liquidity of the retail market. The higher the number, the higher is the competitive pressure and potential liquidity, all else equal.
Type of indicator	Quantitative (score between 0 and 10)

[28] See footnote 17.

Data sources	CEER
Evaluation	The assumption is made that a score of zero is given for a monopoly, rising to a maximum score for 10 national suppliers or more. The higher the number, the lower the barrier.
Clarifications	Market share calculations are normally performed based on company or ownership. Market shares shall be attributed to "mother companies" as much as possible. This means that partnerships are divided among the owners and that consolidated companies are attributed to the parent companies.

9.2.1.3 Entry/exit activity

Description	Entry and exit activity is an important indicator of competition. In a competitive market, new suppliers will enter the market if the profits are sufficiently high and if market entry barriers (e.g. administrative, regulatory, legal etc.) are reasonably low. In turn, the higher number of suppliers should ensure a wider range of offers and better choice available to consumers and more competitive pressure on incumbent suppliers. A new entry or the credible possibility of new entry, therefore, exerts competitive pressure on existing suppliers to the benefit of consumers. This indicator aims to measure the average entry/exit activity in the retail markets for households and non-households over the last 3 years assessed as the percentage of entry/exit activity in a given year with respect to the national electricity demand.
Type of indicator	Quantitative (percentage or numeraire between 0 and 1)
Data sources	ACER calculation based on CEER and ENTSO-E data
Content	For each year, absolute values are used to calculate the indicator on a 3 year average basis as follows: $$\frac{\sum_{i=1}^{n} \frac{Entry/exit\ activity_i}{National\ electricity\ demand_i}}{n}$$ Where: Entry/exit activity = total entry and exit activity estimated as new entrants plus suppliers exiting the market* National electricity demand = national energy consumption ((MWh) n = years (3) **If data on new entrants and suppliers exiting the market every year is not available, the net entry activity would be used instead (i.e. total suppliers in year y+1 minus total suppliers in year y, which is equal to new entrants minus suppliers exiting the market)*
Evaluation	The higher the share, the lower the barrier.

9.2.1.4 Correlation coefficient between the energy component of retail prices and wholesale prices for household consumers

Description	The energy component of retail prices and wholesale prices usually correlate better in markets characterised by lively competition, where final retail prices closely follow the wholesale market price, i.e. the offers available to consumers contain a direct reference to wholesale costs and a mark-up. This indicator measures the relationship between the change in the energy component of retail prices and the change in wholesale prices in the electricity market for household consumers, expressed by the correlation coefficient of these two variables.
Type of indicator	Quantitative (index in the range -1 to 1)
Data sources	ACER calculation based on Eurostat data and ACER database on retail offers and other relevant data. The methodology is further described in Annex 6 of the ACER Market Monitoring report 2015[29].

29 ACER Market Monitoring report 2015 is available at: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER_Market_Monitoring_Report_2015.pdf

Evaluation	If the energy component of retail prices and the wholesale prices correlate well in a Member State, this should reflect in a positive high value of the correlation coefficient, while the negative and low value imply a weak correlation. The higher the score, the lower the barrier.

9.3 Networks, TSOs and DSOs

9.3.1 Lack of incentives to consider non-wire alternatives

9.3.1.1 Presence of innovation incentives for Distribution System Operators (DSO)

Description	The indicator aims to assess if the DSO regulation incentivises DSOs to consider non-wire alternatives, e.g. short- or long-term contracts with aggregators, distributed energy resources, large end-users, etc., on equal terms with traditional grid reinforcements by means of new wires/cables, new substations, transformers, etc. Grid operation with increased risk of involuntary curtailment of supply or demand is another type of non-wire alternative and are not considered here. The scope is national and covers no particular timeframe.
Type of indicator	Qualitative (score)
Data sources	Questionnaire to NRAs
Content	A set of closed-ended questions pertaining to incentives and approach to consider non-wire alternatives when DSOs experience increased demand for network capacity.
Evaluation	The higher the score, the lower the barrier.

9.3.2 Lack of transparency in information provided by system operators

See 8.3.4 for the description of this indicator.

10 COMPOSITE INDICATOR CALCULATION TOOL

This section covers the scope as defined in Task 3 of this project and describes the concept of composition indicator construction, methods for normalisation, methods for weighing and combining indicators, composite indicator calculation and approaches to assess the robustness of composite indicator calculation using sensitivity analysis. Furthermore, suggestions concerning the treatment of missing data are discussed.

10.1 Concept of Composite Indicator Construction

To assess the overall performance of the market(s) in terms of efficient price formation and easy market entry and participation for small actors and new entrants, composite indicators (CIs) are developed for the two objectives. These composite indicators serve to denote a single value, showing the overarching evaluation of the respective country performance for either efficient price formation or easy market entry and participation for small actors and new entrants. As such, the calculated value constitutes a composite evaluation of the country's treatment of the different barriers. In addition to the construction of these CIs, the concept shall allow for the analysis of data on different levels of granularity. As a result, the country performance may be compared as a whole while equally allowing to identify concrete barriers, potentials of improvements, changes across time[30], and country-specific as well as cross-country limitations for market performance.

The construction of the both composite indicators follows a stepwise aggregation approach. The aggregation is aligned with the identification of the barriers by their respective indicators. The barriers are then aggregated by the subsequent categorisation. Finally, the value for the overarching evaluation, the composite indicator, is constructed as a weighted mean of the individual scores of the identified category scores. Figure 10-1 shows the general approach for the derivation of a composite indicator for the respective market functionality in question. It portrays the individual aggregation steps from indicator scores to composite indicator with an exemplary number of indicators, barriers and categories. Additionally, the level of raw data is shown. Raw data comprises the basis for the composite indicator calculation. The required data is distinctly specified for every indicator. Consequently, some indicators make use of multiple raw data sources while others are represented by a single type of raw data. Moreover, the indication of the presence of a barrier, i.e. maximum attainable score, is subject to individual scoring methods. This includes fixed maxima and dynamic maxima. The latter is used when an indicator indicates the prevalence of a barrier as relation among the assessed countries. Depending on the type of indicator, raw data may be quantitative data, a derivative of other raw data, or a qualitative indication. Data sources are diverse and have been identified on the basis of data availability and quality.

[30] To assess such trends, the CI calculation must be conducted for several years.

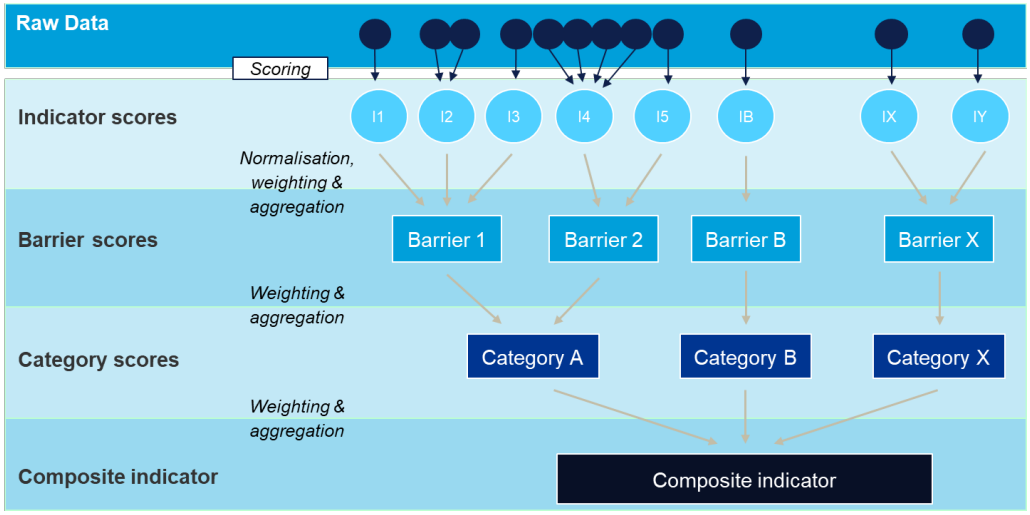


Figure 10-1 Composite Indicator Calculation

In order to accommodate future changes of electricity markets and the potential emergence of new and omission of prevalent barriers, the construction of the composite indicator is dynamic by nature. Consequently, the concrete translation of indicator scores to barrier scores, barrier scores to category scores, and category scores to composite indicator scores may constitute different mathematical calculations. Two calculations are permissible: The weighted arithmetic mean and the weighted geometric mean. The weighted arithmetic mean is used in cases in which all parameters may compensate one another.[31] If the parameters to be aggregated are considered indispensable, the weighted geometric mean is calculated. This differentiation is used, because the geometric mean yields a zero score, if any score of the parameters is zero (i.e. full indication for the prevalence of the barrier). In the default case, it is assumed that no parameter is indispensable. Therefore, the arithmetic mean is used unless an indispensable parameter is identified. In the prevailing cases, no such indicator has been identified and the arithmetic mean is, hence, used for all aggregation steps.

The weights applied to the aggregation method are derived from a standardised process. This process assumes equal weights across all indicators to measure each barrier as starting point. For the barriers and categories identified, this basic assumption is then refined by considering answers and remarks in the public consultation conducted under Task 1 (see sections 3.2.1 and 5.3). The results showcase the relative perceived relevance of one barrier and category over the others. They, thus, constitute the empirical basis for the weights used for the barriers and categories. In order to account for deviations between perception, as portrayed in the consultation process, and economic rationality, the weights are updated for economic rationality and reason. In cases of clear biases or misconceptions prevalent in the results of the consultation process, the weights are corrected accordingly. Finally, the weights are subject to a sensitivity analysis once the calculation of aggregated scores has been undertaken. The weights identified and established for the barriers and categories for the two market functionalities in question are portrayed in Table 10-1 and Table 10-2.

[31] Here, „parameter“ is defined as the variable used in the aggregation process. I.e. if indicators are aggregated to a barrier, the indicators are the “parameters”. If a category is derived by aggregation, the barriers are the “parameters”.

Table 10-1 Weights to Efficient Price Formation

Category	- Weight	Barrier	- Weight
Regulation and market design	0.4	Explicit price restrictions	0.09
		Potential market distortions due to support schemes granted to different technologies or market participants	0.09
		Potential market distortions due to capacity mechanisms	0.04
		Restrictive requirements in prequalification, product characteristics and other features of market design	0.09
		End-user price regulation	0.04
		Unavailability or little incentive to contract dynamic retail prices	0.04
Market structure and performance	0.3	Insufficient competition and liquidity in wholesale markets	0.15
		Scope for strengthening market integrity	0.08
		Scope for increasing market transparency	0.08
Networks, TSOs, DSOs	0.3	Failure to 'maximise' availability of cross-zonal capacity	0.11
		Delineation of bidding zones not reflecting structural congestions	0.11
		Scope for improving transparency, cost-reflectivity and non-discrimination in the structure of network tariffs	0.04
		Lack of transparency in information provided by SOs	0.04

Table 10-2 Weights to Easy Market Entry and Participation of Small Actors and New Entrants

Category	- Weight	Barrier	- Weight
Regulation and market design	0.64	Complex, lengthy and discriminatory administrative and financial requirements	0.15
		Adequacy of the legal framework to enable new entrants and small actors	0.15
		Restrictive requirements in prequalification, product characteristics and other features of market design	0.15
		End-user price regulation	0.06
		Unavailability or little incentive to contract dynamic retail prices	0.06
		Restrictive requirements to participate in capacity mechanisms and interruptibility schemes	0.06
Market structure and performance	0.18	Insufficient competition in the retail market	0.18
Networks, TSOs, DSOs	0.18	Lack of transparency in information provided by System Operators (SOs)	0.09
		Lack of incentives to consider non-wire alternatives	0.09

Apart from the specification of the parameters, aggregation methodology and weights, the quality of the raw data is paramount to the construction of the composite indicator. To guarantee comparability across countries of the derived parameter and composite indicator scores, comparability needs to be established across raw data. Therefore, the definitions provided above for the data required for the derivation of the indicator scores need to be followed. In addition, the time stamp of the data provided shall be consistent across all data sources.

In addition to the quality of data, the data needs to depict a sufficient degree of variability. If significant data across countries shows minimal variability, the interpretability of the calculated scores is limited. To account for this limitation, the upper and lower bound of the indicator scores may be refined according to the variability of the data provided. In such cases, however, it ought to be noted that while the variability of the calculated scores would increase and facilitate interpretation, the synthetic increase of variability shall be considered in the interpretation, i.e. if all countries perform rather poorly in the indicator scores for one particular barrier, a decrease of the upper bound for normalisation does not imply that high scoring countries do not perfectly address the barrier. On the contrary, it shows that in comparison these countries perform better. They, nonetheless, are not perfectly addressing the barrier. Depending on the insights to be drawn from the composite indicator, different refinements of the indicator boundaries to increase or decrease variability may be undertaken.

This possibility to calibrate the tool for individual needs reveals its dynamic nature. Besides the possibility to refine the upper and lower bounds for the indicators, the calculation of the composite indicator may further be calibrated by introducing different treatment methods for missing data. In addition, indicators may be added or taken out. It follows that

the concept of the composite indicator construction stipulates a fixed framework with different parameter levels and linkages and grants flexibility for aspects that are or will be subject to change.

10.2 Calculation of the Composite Indicator

The conceptual approach outlined in the paragraph above is realised by use of a Microsoft Excel Tool. This tool allows the distinct parameters to be set, i.e. indicators, barriers, and categories as well as the weights and aggregation methods for the respective aggregation processes. Here, the system for normalisation of the indicators is further defined. This implies that the type and the upper and lower bound of the permissible indicator score is defined. The normalisation translates the initial indicator values into indicator scores with a range from 0 (full indication of the barrier) to 1 (indication for fully mitigated barrier).

The tool thus uses as input the specification of the parameters (name, linkage across indicators, barriers and categories, lower and upper bound, direction), weights, aggregation methods, and data. The raw data is translated into indicator values as defined in the indicator definition. This translation is indicator specific. In the case of missing raw data, the treatment of it shall be specified in the indicator definition. In the methodology for constructing the composite indicator, different missing data treatment options are possible and may be used in the calculation:

a) **No treatment:** In the default case, any data that is not provided is considered as a “zero” score. It states that the indicator for the prevalence of the barrier assumes that the barrier is fully prevalent in the respective country.

b) **Penalty treatment:** Missing data that is treated by use of a penalty results in the use of the lowest indicator score prevalent in the existing dataset on that indicator as proxy for the missing data. The resulting proxy may be the same as if no treatment had been introduced, if the lowest prevalent indicator score is equal to “zero”.

c) **Correlation treatment:** This treatment may take two forms. On the one hand, given a predefined threshold, the missing data is proxied by the country score from the indicator with the highest correlation with the indicator where the country score is missing. In that case, the normalised score of the existing highest correlating indicator is translated to the normalised score of the indicator with the missing data. On the other hand, if no indicator has a correlation with the indicator with the missing data higher than the threshold, the missing data score is filled as the average of the existing indicator scores of the indicator with the missing data minus a predefined penalty.

d) **Weight change:** If a significant amount of countries portrays missing data for the indicator in question, the weight of the respective indicator may be changed. In addition to this treatment, the individual missing data points need to be treated – or not treated – in accordance with the three options a), b), and c).

e) **Minimum data availability requirement:** In addition to indicator-specific missing data treatment, a minimum requirement as percentage of the total number of indicators for a category may be set. If the minimum requirement is not met, the category score will receive a “zero” score.

Once the missing data treatment has been specified per indicator, the composite indicator is then calculated. The resulting composite indicator, as well as the category scores are visualised within the calculation tool. Figure 10-2 shows such a visualisation[32].

[32] Please note that this is an example visualisation based on the pilot study conducted as further explained in section 11.

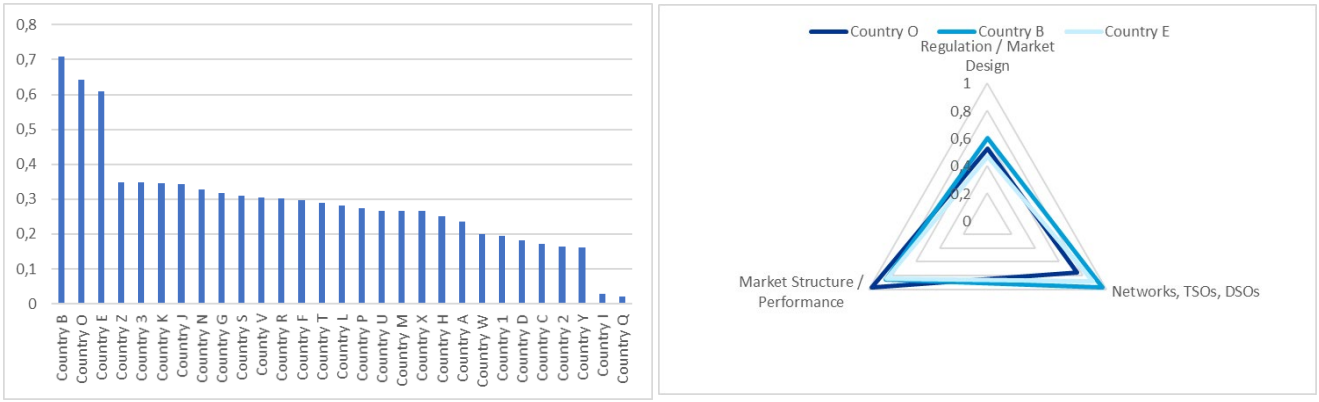


Figure 10-2 Visualisation of Results

Further, the distinct results of the calculation steps, i.e. normalisation and aggregation steps, are portrayed in the Microsoft Excel Tool as output and allow the analysis and interpretation of the micro-foundations of the composite indicator. In addition, the correlation between indicator values as well as the percentage of available data per indicator and per country is shown.

10.3 Sensitivity Analysis

To assess the robustness of the composite indicator calculation and resulting scores, a sensitivity analysis in the form of a Monte Carlo Analysis with uniformly distributed randomisation is foreseen. Such analysis may be used for:

a) Testing the sensitivity of the calculated scores for uncertainty in the specified weights,

b) Testing the sensitivity of the calculated scores for uncertainty within the dataset – both regarding missing data and existing data, and

c) Generally assessing the relationship between indicators, barriers, categories and the composite indicator.

The output of the analyses shows the statistical parameters of the country scores of either the composite indicator score or a specified category score. Such parameters include the average scores, their standard deviation, the quantiles and the minimum and maximum score. A graphical output is shown in Figure 10-3.[33]

33 Note that the countries and country scores in this example are not based on real data and merely serve as examples to the design of the output of the sensitivity analysis.

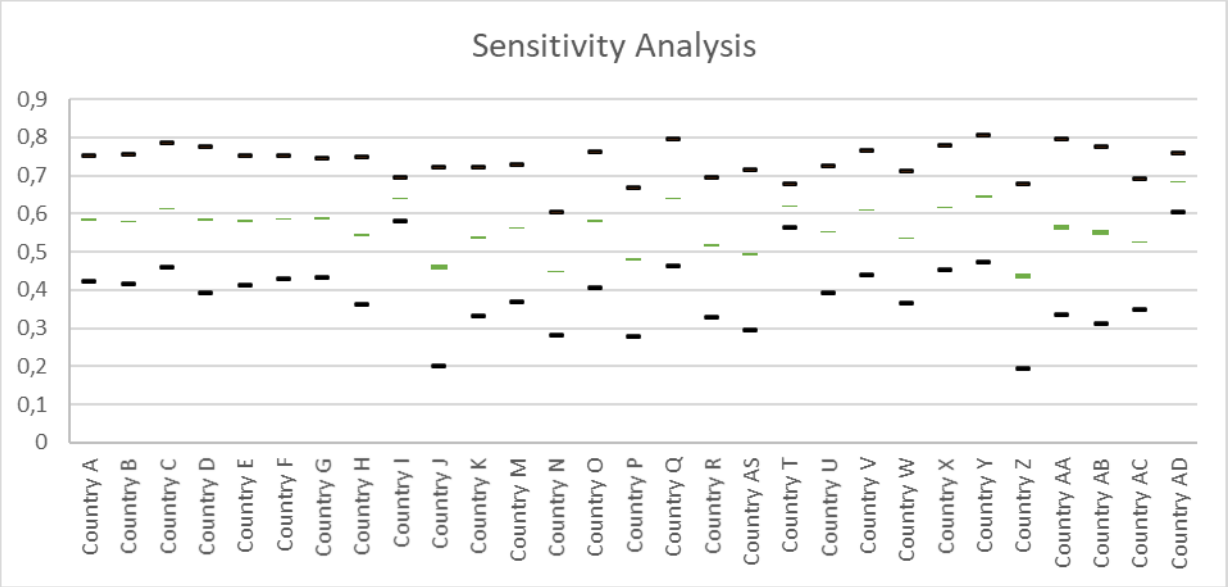


Figure 10-3 Example Output of Sensitivity Analysis

The statistical parameters may be used to interpret the robustness and impact of the variability in question, i.e. if the minimum of a country score is ranked higher than the maximum of another country score, it may be followed that this country tops the other in all variable cases assessed. Various other interpretations may be undertaken. Particularly, the sensitivity analysis of the composite indicator for variability of missing data points issues a strong case on the impact of missing data as well as the robustness of the calculated score irrespective of missing data. By conducting such analysis, certain conclusions from the composite indicator and category score calculations may be justified even when not all data has been provided.

The Excel tool that may be used to calculate the composite indicator as described above incorporates a VBA macro with which the sensitivity analysis can be undertaken. As such, one can specify if all data, only specific data, or no data shall be randomised as well as if the weights shall be randomised. Randomisation may be conditioned on boundaries within which the randomisation shall take place. By thoroughly defining the boundaries, it is possible to randomise only one factor, i.e. one weight or parameter, in order to assess its concrete impact on the overall score. Furthermore, the number of iterations has to be defined. It is recommended that the iterations for statistical meaningfulness of the resulting output and computational speed be optimised.

11 MEMBER STATE PILOT STUDY

This section covers the scope as defined in Task 4 of this project and describes the approach and outcomes of the testing of the CI calculation tool for three Member States, using data as provided by voluntarily participating NRAs, and complemented with other data as made available by ACER and other stakeholders.

Task 4 consists of the following steps:

A. Collection of data for participating (piloting) Member States

B. Testing of the CI calculation tool using collected data

C. Presentation of the CI calculation tool outcomes for the participating (piloting) Member States.

It delivers insights with regard the fit for purpose of the CI calculation tool and the underlying methodologies to collect and process data and to calculate respective CIs in terms of efficient price formation and easy market entry for new players and small actors in electricity wholesale markets.

11.1 Collection of data for the Pilot Study

To assess the clarity and availability of the defined parameters as well as the general functioning of the outlined methodology, a pilot study was carried out. For that purpose, a questionnaire for the aggregation of raw data from piloting NRAs was developed and distributed. After the submission of the questionnaires by the NRAs, unanswered or unclear questions were refined and additional answers were requested. Non-piloting NRAs have equally received the questionnaire in order to comment on the clarity of the questions and feasibility of answering to the questions included. Three NRAs volunteered to participate in the pilot study and submitted their data. In addition to raw data from the questionnaire, ACER contributed various datasets with raw data of both piloting and non-piloting countries.

The raw data was gathered in an inventory, specifically designed for the gathering process of the pilot study. In the case of partial unavailability of raw data, i.e. in cases in which three of five questions have been answered that are required to calculate one specific indicator score, the minimum already obtained indicator score has been assumed. Indicators where data would have been required, but no underlying raw data was available were scored as a miss for the respective country. If no country submitted raw data for the respective indicator, the indicator was excluded from the pilot study analysis. On this basis, the data availability for the participating countries was 93% for the composite indicator calculation of *easy market entry* and between 79% and 88% for *efficient price formation*.

Furthermore, some indicators were not fully defined when the pilot study commenced. These indicators, and those where no data was available for any country, were excluded from the pilot study. On this basis, the pilot study was conducted for the two composite indicators, taking into consideration the three categories for the two composite indicators, and 16 barriers, and 46 indicators. Some of these barriers and indicators are included in both calculations for the composite indicators. Figure 11-1 shows an overview of the allocation of barriers and indicators to the categories per composite indicator. The composite indicator for efficient price formation is constructed from a balanced set of barriers and indicators per category. In contrast, the composite indicator for easy market entry and the participation of new entrants and small actors is dominated by the category of *Regulation / Market Design*. These allocations are in line with the relative weight of the respective categories. While the former composite indicator portrays a rather uniform weight for all categories, the latter offers a higher weight to the dominating category.

Category	Regulation / Market Design	Market Structure / Performance	Networks, TSOs, DSOs
Barriers	5	3	4
Indicators	12	12	9
Weight	0,4	0,3	0,3

Category	Regulation / Market Design	Market Structure / Performance	Networks, TSOs, DSOs
Barriers	4	1	2
Indicators	9	1	4
Weight	0,64	0,18	0,18

Figure 11-1 Pilot Study Parameters (Efficient Price Formation left, Easy Market Entry right)

After receipt of the data, the calculation of the composite indicators was undertaken. Sensitivity analyses were conducted and the results were interpreted. In two sessions, one with the ACER project team and another with NRAs and a broader ACER participant list, the results of the pilot study were presented and discussed.

11.2 Pilot Study Results

The results of the pilot study reveal both insights and sensitivities of the methodology and the country performance in question. The evident insights relate to the country scores and the identification of micro-foundations for these scores. Figure 11-2 shows the country scores (y-axis) of the composite indicator for easy market entry and participation of new entrants and small actors. The highlighted countries B, O, and E are the piloting countries. First and foremost, their comparatively high score in relation to the scores of the other countries may be attributed to the other countries' data unavailability.

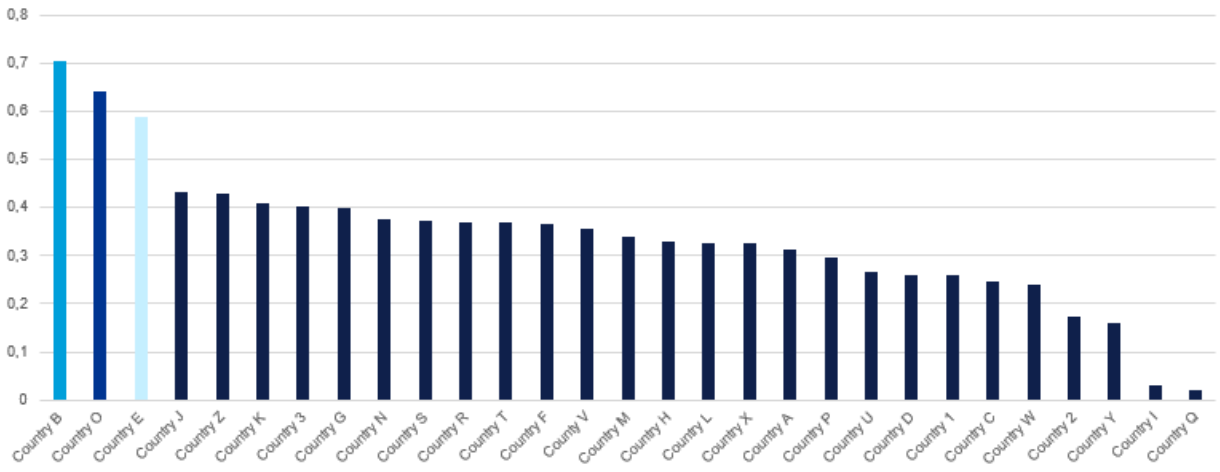


Figure 11-2 Composite Indicator Score for Easy Market Entry and Participation of New Entrants and Small Actors

By analysing the final scores and their micro-foundations, the country scores may be interpreted as stand-alone scores and in comparison to other country scores. For instance, insights of stand-alone scores justify the final score of a country as well as reveal potential opportunities for improvement for the country in question. Figure 11-3 portrays one of such breakdowns with which the underlying reasons for the obtained scores can be justified.

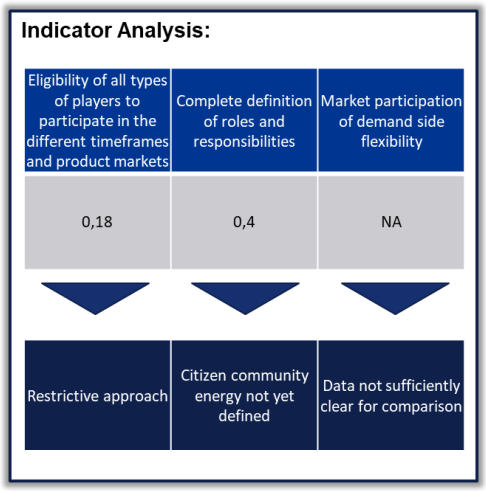


Figure 11-3 Stand-alone analysis of scores

The comparison to other country scores such as depicted in Figure 11-4 may be used to identify best practices and barriers that are addressed rather poorly across-the-bench.

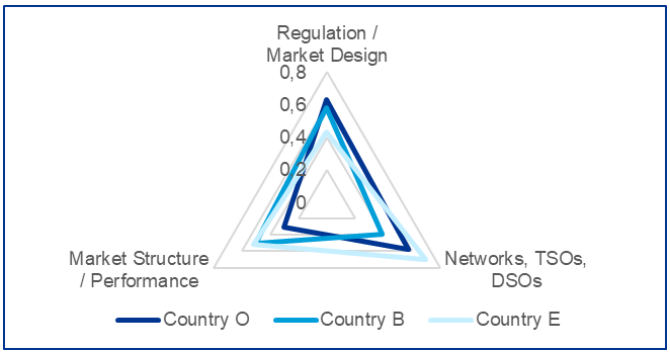


Figure 11-4 Cross-country comparison of scores

The pilot study also highlighted the fact that these types of analyses may in part also be undertaken when missing data is a limitation to the representativeness of the composite indicator. By isolating the barriers or categories with missing data, the scores obtained from the other barriers and categories may still be meaningfully interpreted. Apart from this segmentation, missing data treatment may reveal the data's potential impact. In addition, a sensitivity analysis can be used to assess the overall significance of missing data. Such analysis is conducted by running a Monte Carlo analysis with randomised indicator scores where data is missing. Weights and all other scores remain as set in the default calculation. Figure 11-5 shows the results of such analysis for a preliminary dataset and where only the missing data for the three piloting countries is subject to analysis. In the case at hand, it should be noted that the country composite indicator scores are similarly impacted by missing data and that therefore no general trend can be expected for one of the countries, if the missing data issue was resolved. This, however, need not be the case. Other cases in which such trends can be perceived are conceptually equally possible.

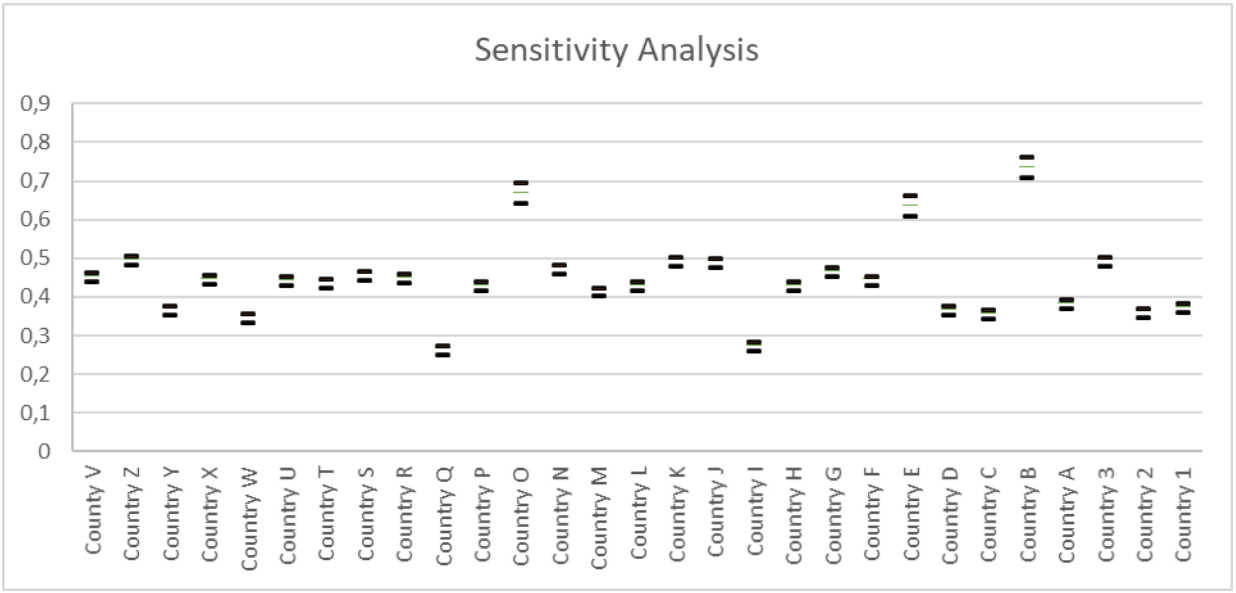
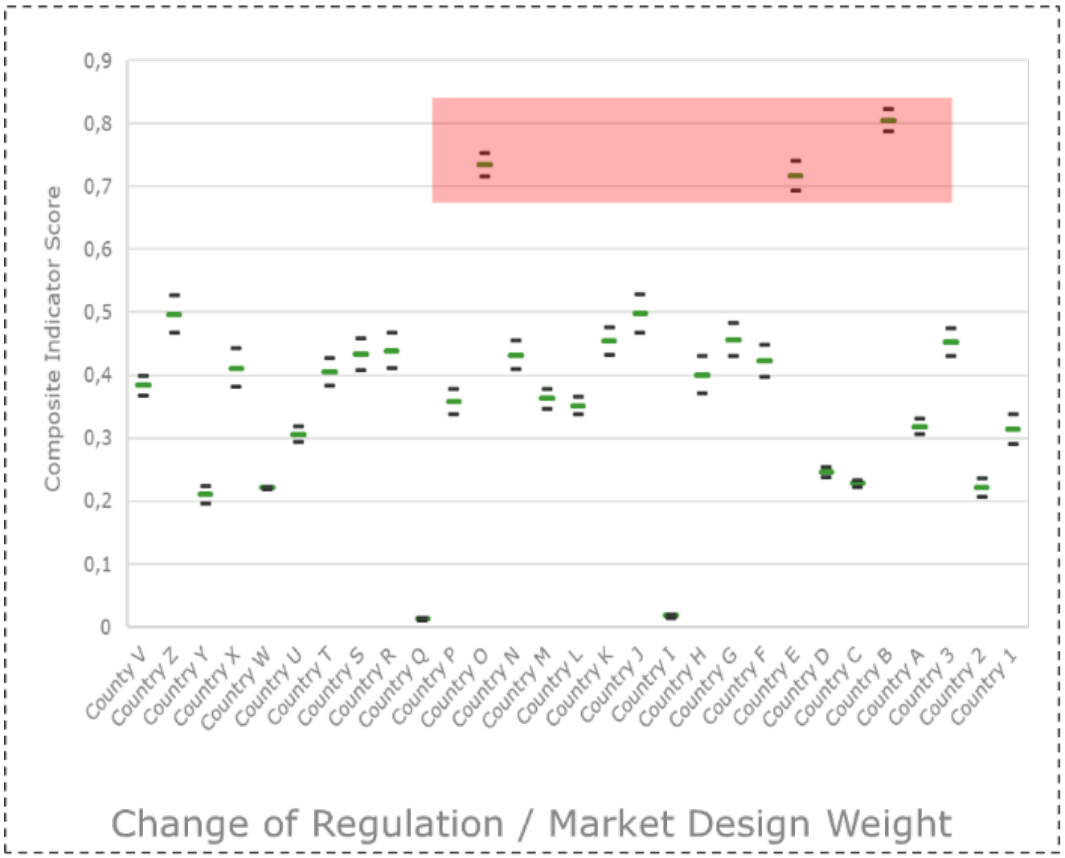


Figure 11-5 Sensitivity Analysis for Missing Data

In addition to the analysis of the relevance and treatment of missing data, a distinct analysis on different weighting has been undertaken. For that purpose, the weight of one category has been allowed to fluctuate between an increase and decrease of 0.1 points which accounts for a weight change of approximately twenty percent. The analysis reveals that for the preliminary dataset the final composite indicator scores vary only slightly. However, the ranking of the countries may change, if one category is weighted slightly differently to the weight specified in the default case. Figure 11-6 shows the comparison of two composite indicator scores depending on the weight change of either the Regulation / Market Design or the Market Structure / Performance category.



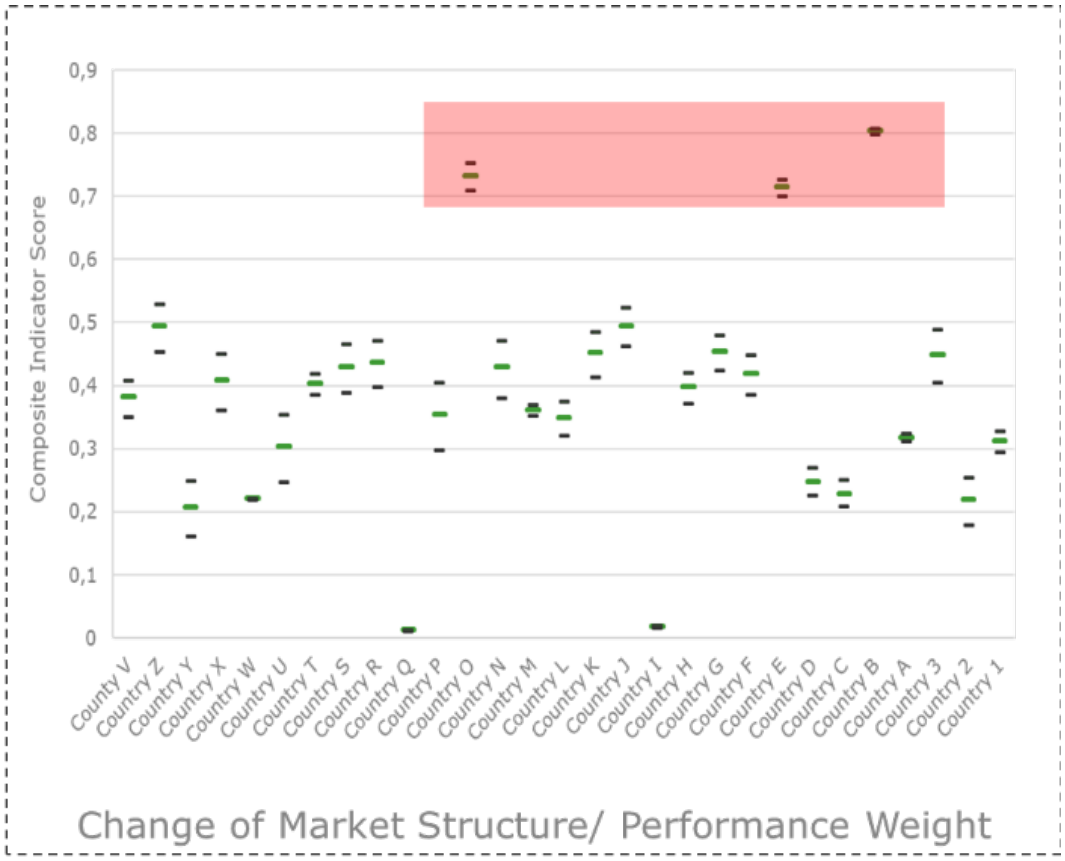


Figure 11-6 Comparison of Category Weight Changes

Following on from these various insights drawn from just preliminary and initial analyses of the country scores and micro-foundations, the pilot study suggests that the methodology outlined is able to facilitate the assessment of efficient price formation and easy market entry and participation of new entrants and small actors across different member states. The potential impediments of missing data and clarity of data definitions have been addressed – multiple remedies have been identified and implemented. The methodology allows countries to be compared across one another. One can also identify distinct impediments and barriers for market performance for a single country. The comparison and identification can be undertaken for different levels of granularity. Despite the unavailability of data across multiple time periods at the current stage, it is expected that trend analyses will become equally possible by using the methodology and calculation tool. It remains to be seen, which further insights can be drawn from the results of the methodology outlined and for which particularities the methodology may require further refinement. To the extent possible, the methodology appears to be reasonably robust and dynamic enough to allow for both expectable changes and additional analyses.

12 INSIGHTS AND RECOMMENDATIONS

The project results in a range of insights and recommendations with regard to **methodology**, **data** and **CI determination**. The recommendations listed here should be regarded as a basis for further improvement of the methodology and data collection for the calculation of the two Composite Indicators.

12.1 Methodology

Insights

- Identified barriers and indicators provide a comprehensive basis for determination of composite indicators for efficient price formation and for easy market entry & participation for new entrants and small actors.
- Identified barriers and indicators are derived from stakeholder interviews, public consultation, NRA interaction, and desktop research.
- A total of 3 barrier categories, 16 barriers, and 46 indicators are used for the pilot study. 20 indicators are to be included in the future.

Recommendations

- Deploy current set of barriers and indicators, and address including identified 20 indicators in the future.
- Adapt indicators as the market develops; replace questions or indicators if/when all countries perform equally, add questions or indicators as new issues are on the table.

12.2 Data

Insights

- Data availability for respective indicators, as based on data already held by ACER and data from the pilot study for 3 Member States, is reasonably good.
- NRA data collection through the questionnaire works well and delivers non-ambiguous input for the CI calculation tool.
- Data from other sources (ENTSO-E, CEER, etc.) will be complementary to data delivered by NRAs for initial assessments and calibrations.
- Missing data remains an issue but affects the results of the pilot Member States only to a limited degree. Different approaches are possible to mitigate for missing data.

Recommendations

- Continue to interact and agree with associations on options to deliver data for specific indicators.
- Continue to interact with NRAs to guarantee a high level of data completeness and comprehensive responses on the data questionnaire.

12.3 CI determination

Insights

- The CI calculation tool delivers insights into key CI contributors and opportunities increasing the level of data completeness.

- The CI calculation tool includes methods to assess robustness and sensitivities of outcomes.
- The CI calculation tool can be used for a **stand-alone country analysis** to review the reasons for the barrier, category and CI score(s) and identify prevalent barriers and low-hanging fruits to improve market performance. The CI tool can also be used for **cross-country comparison** to identify best practices and barriers common to most/all countries and barriers that have been overcome across the board. The CI calculation tool can be also used to **monitor the evolution of CI scores over time**, and consequently the improvements introduced by Member States in terms of efficient price formation and easy market entry & participation for new market entrants and small actors.

Recommendations

- Further test and refine applied methods for weighing, treatment of missing data, and sensitivity analysis.
- Apply appropriate presentation and comparison of input data and CI calculation tool outcomes.
- Drive application of CI calculation tool for market monitoring purposes.

13 APPENDIX

This appendix comprises relevant documents developed and used within the study on a methodology to benchmark the performance of the EU Member States in terms of efficient price formation and easy market entry and participation for new players and small actors.

13.1 Stakeholder interviews

A total of 16 stakeholder interviews were conducted as structured interviews. The interviews were arranged as online meetings. The duration was in most cases approximately one hour. The interviewees received a brief summary of the project description and were asked to explain their views on the most important barriers to efficient price formation and to new entrants and small actors. They were also asked about ideas on how to measure such barriers and address potential data availability or collection issues.

DNV·GL

STAKEHOLDER INTERVIEW – INTRODUCTION AND QUESTIONS

Objectives and scope

Article 15 of the Regulation (EU) 2019/942 establishing a European Union Agency for the Cooperation of Energy Regulators (recast)[1] requires ACER to monitor i.a. any barriers to the completion of the internal markets for electricity. In addition, the Agency is also required to assess i) *state interventions preventing prices from reflecting actual scarcity*, and ii) *regulatory barriers for new market entrants and smaller actors*.

In this context, ACER aims to assess the presence of any type of barrier to efficient price formation with regards to i) and to easy market entry and participation for new players and smaller actors with regards to ii) In particular, with regards to ii), ACER considers that special attention should be given to the need for an increased flexibility in electricity systems. Consistently, the participation of demand side response, non-incumbent suppliers, aggregation, distributed generation, energy storage (including electro mobility), and citizen energy communities should at least be considered.

DNV GL is assigned to propose a methodology to assess:

1) barriers to efficient electricity price formation,

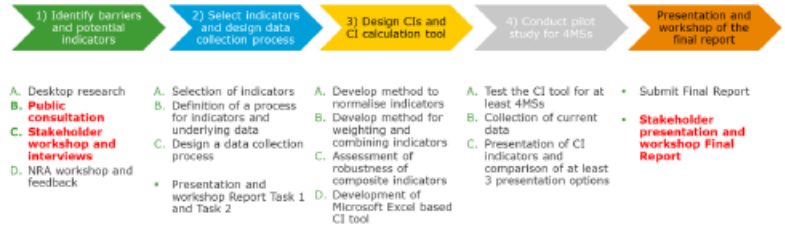
2) barriers to easy market entry and participation for new players and smaller actors,

in the electricity markets of individual Member States.

Hence, we are grateful that you have found time for an interview. These interviews will help us fulfil the three objectives of our study:

- Identify, select and define key qualitative and quantitative indicators to measure (1) and (2)
- Identify the data sources and propose a data collection process to calculate the selected indicators
- Provide a methodology to combine the selected indicators and create two Composite Indicators for (1) and (2) with a view to evaluate the performance of the Member States.

The key components of this methodology are illustrated in the diagram below. From a long list of potential barriers and indicators, a short-list will be developed with the aim of creating two composite indicators – one for efficient price formation and one for easy market entry and participation for new players and smaller actors. The composite indicators will eventually be calculated per Member State.

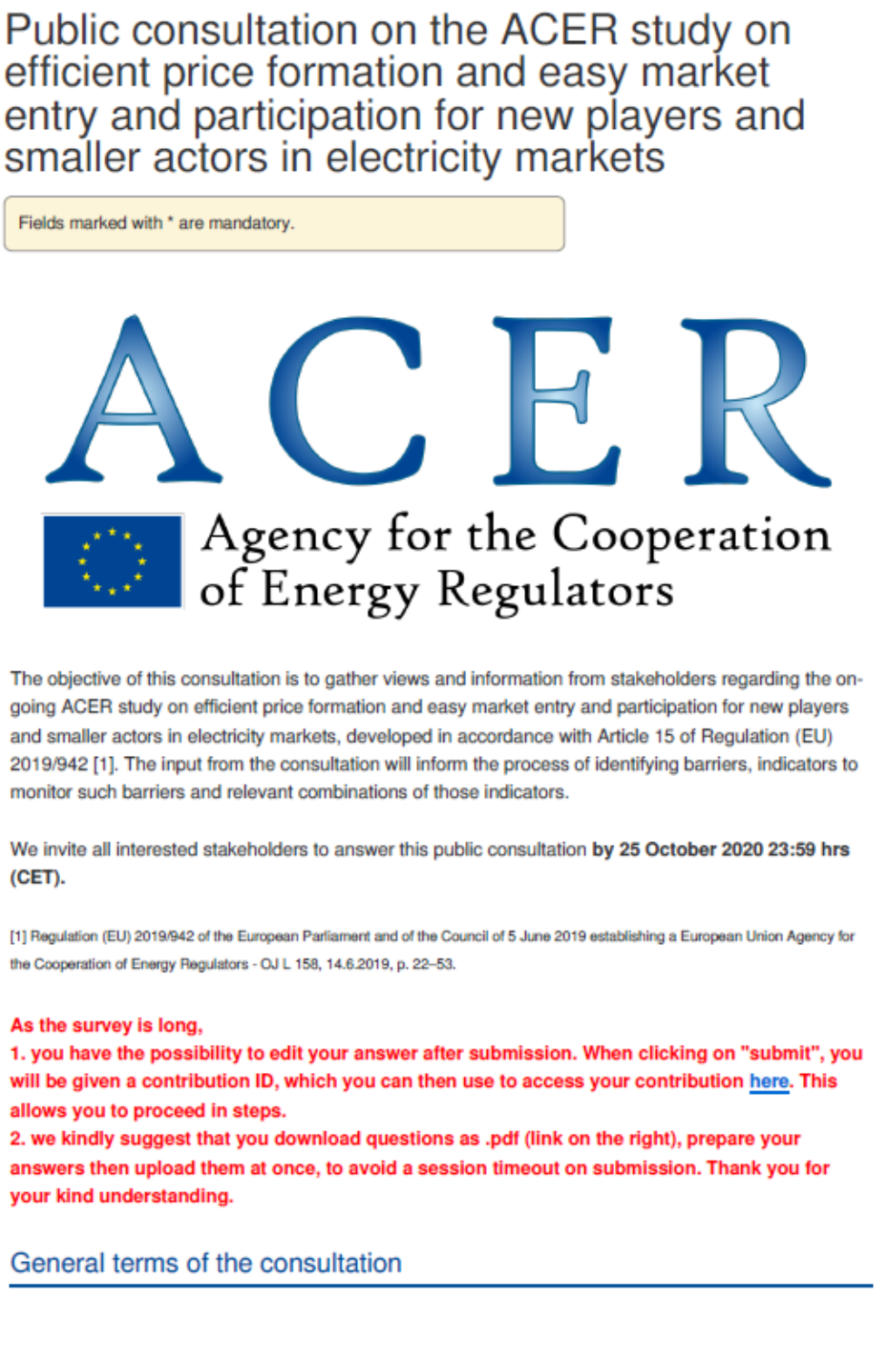


[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ%3AL%3A2019%3A158%3ATOC&uri=uriserv%3AOJ.L_.2019.158.01.0022.01.ENG

Stakeholder interview guide v1.3

13.2 Public Consultation

A public consultation was formulated consisting of detailed questions for stakeholders to address the importance of barriers and to suggest potential indicators and metrics to measure individual barriers or a group of barriers.



Public consultation on the ACER study on efficient price formation and easy market entry and participation for new players and smaller actors in electricity markets

Fields marked with * are mandatory.

ACER

Agency for the Cooperation of Energy Regulators

The objective of this consultation is to gather views and information from stakeholders regarding the on-going ACER study on efficient price formation and easy market entry and participation for new players and smaller actors in electricity markets, developed in accordance with Article 15 of Regulation (EU) 2019/942 [1]. The input from the consultation will inform the process of identifying barriers, indicators to monitor such barriers and relevant combinations of those indicators.

We invite all interested stakeholders to answer this public consultation **by 25 October 2020 23:59 hrs (CET).**

[1] Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators - OJ L 158, 14.6.2019, p. 22–53.

As the survey is long,
1. you have the possibility to edit your answer after submission. When clicking on "submit", you will be given a contribution ID, which you can then use to access your contribution here. This allows you to proceed in steps.
2. we kindly suggest that you download questions as .pdf (link on the right), prepare your answers then upload them at once, to avoid a session timeout on submission. Thank you for your kind understanding.

General terms of the consultation

1

13.3 NRA questionnaire

The NRA questionnaire constitutes a Microsoft Excel-based questionnaire developed to facilitate the gathering of raw data from the national regulatory authorities (NRA). The questionnaire includes an explanation of the specific barriers and indicators in question. Calculations in the background of the questionnaire directly derive indicator scores from the input provided by NRAs. The questionnaires are uniform, i.e. every NRA is asked to fill out the same questionnaire.

NRA Questionnaire for Data-gathering on Monitoring of European Electricity Market Performance

	Heading
B	Barrier description
C	Explanation of the indicator; what it aims to assess
R	Relevant regulation pertaining to the indicator and/or the questions
	Question Cell
	Input Cell

ACER
European Union Agency for the Cooperation of Energy Regulators

DNV

This questionnaire serves to gather data in the process of assessing the functioning of European electricity markets.

As such, the data is used as input for the calculation of two composite indicators which depict 1) efficient price formation and 2) easy market entry and participation for new entrants and small actors.

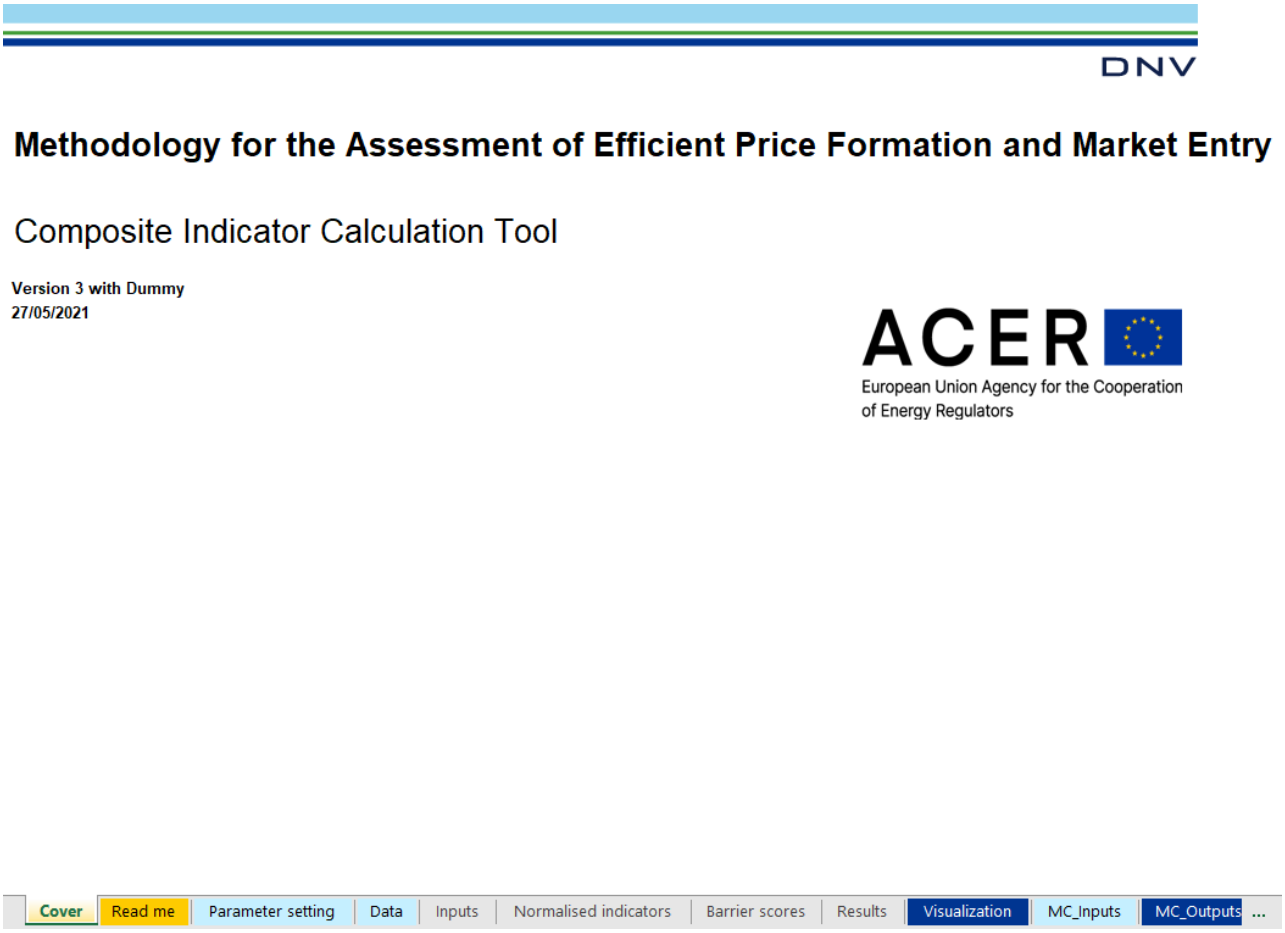
To use the questionnaire, a couple of clarifications are in order:

1. The sheets "Instructions" and "Overview" are explanatory sheets. No input is required here.
2. In the sheet "Contact information", please provide contact information in case we have follow up questions.
3. In the "Overview" sheet, there are links to questions pertaining to each barrier and indicator. On the top of each sheet with questions, there is a link back to the "Overview" sheet.
4. All other sheets are input sheets. Each of them includes questions pertaining to one specific barrier.
   - A brief explanation of the barrier and the indicator in question is provided in each sheet.
   - **Please note that since this questionnaire only includes the questions to be answered by the National Regulatory Authorities, the list of questions, indicators, barriers, and categories that may be used for the calculation of the composite indicators is not exhaustive.**
   - The cells to be filled are on the right-hand side of the respective question (column G). In cases of matrix answers, the cells are further to the right (Column H to N)
   - In most cases, a dropdown menu predefines permissible selections. In other cases, the unit in which the answer shall be provided is given as default in the input cell. Input cells of matrix answers are typically empty be default. In some instances, a dropdown menu shows permissible answers there, too.
   - You can make comments about each reply provided (these comment cells are usually located in column O). We encourage NRAs to provide explanations of the replies in order to facilitate their interpretation and analyis.
5. **Please note that the default date of interest for the data you provide is "as of December 2020". In cases in which a different date (i.e. for comparison purposes) is required, the date is indicated accordingly.**
6. Regarding data requested about Renewable Energy Sources (RES):
   - For indicators under the barrier "Potential market distortions due to support schemes granted to different technologies or market participants", RES includes hydropower.
   - For indicators on the market design under the barriers "Restrictive requirements in prequalification, product characteristics and other features of market design" and "Restrictive requirements to participate in capacity mechanisms", RES does not include hydropower. It refers to intermitent RES (wind, solar) and other non-hydro RES (biomas, biogas, tidal, etc.).

Instructions | Contact information | Overview | Explicit price restrictions | Support schemes | Competition | Market integrity | Network tariffs | Leg

13.4 CI calculation tool

The CI calculation tool is distinctly developed for the calculation of the composite indicators as described in this study on a methodology to benchmark the performance of the EU Member States in terms of efficient price formation and easy market entry and participation for new players and small actors. The macro-enabled Microsoft Excel workbook allows a flexible approach to the number, relationship, weight, and aggregation method of the different categories, barriers and indicators. The tool further includes different automated treatment possibilities for missing data. It comprises a VBA based Monte Carlo analysis for conducting sensitivity analyses for the calculation results on the composite indicator and the category level.



About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimising the performance of a wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.