

# ELECTRICITY MARKET DEVELOPMENT: DRY RUN PROCESS MODEL FOR ENERGY REGULATORS



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# ELECTRICITY MARKET DEVELOPMENT: DRY RUN PROCESS MODEL FOR ENERGY REGULATORS

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## List of Acronyms or Abbreviations

Balancing Market
Day-Ahead Market
Distribution System Operator
European Union
Factory Acceptance Test
Intraday Market
Independent Power Producer
Information Technology
National Regulatory Authority
Over-the-Counter
Regulatory Authority for Energy in Greece
Site Acceptance Test
System Operator
National Association of Regulatory Utility Commissioners
Transmission System Operator
United States Agency for International Development

## I. Introduction

This dry run model document is aimed at assisting the National Regulatory Authorities (NRAs) of Europe and Eurasia in their undertakings of market liberalization and reforms and increasing their understanding of how to plan and prepare for an introduction of live market operations. Due to the sophistication of market designs that have been introduced in the region, stakeholders need training on appropriate mechanisms and tools to cope with the complexity of the market models.

It is therefore necessary to develop methodologies for designing and implementing an effective dry run process. This document is one of the deliverables developed under the Electricity Market Development Initiative, which is funded by the United States Agency for International Development (USAID) Europe and Eurasia Bureau and implemented by the National Association of Regulatory Utility Commissioners (NARUC).

In order to ensure the successful implementation of competitive electricity markets in the region, it is important to develop methodologies for designing and implementing an effective dry run process to establish a robust market operation at the initiation of the nascent markets. Conducting a dry run can increase market stakeholders' understanding and acceptance of a new market structure, mitigate risks, and ensure a smooth go-live process.

This document is designed to guide and equip NRAs with the necessary knowledge to oversee the implementation of an effective dry run process by providing best practices and recommendations on timing and key issues to be considered prior to initiating live operations of a new market structure. In addition, a webinar series held in June 2021 that focused on dry runs provided capacity building during the project, outlining an overview of the dry run process as well as its purpose and importance.

During the webinar series, participating NRAs provided feedback and firsthand experiences of conducting dry runs. Subsequently, this information was considered during the development of this document, which provides a methodology and a practical approach with suggestions regarding the design of a dry run. Its main objectives are to:

- Explain the significance of implementing a dry run prior to approving and initiating live operations of emerging competitive electricity and balancing reserve markets to energy regulators
- Equip energy regulators with the necessary knowledge to understand, govern, and supervise an effective dry run process
- Cover relevant topics for preparing and facilitating the implementation of a dry run in the region

Countries in the region are each at different stages of implementing electricity markets, and often have different overall situations occurring within their electricity sectors. To accommodate this setting, this document takes a broader approach of the dry run process as a "one size fits all" approach cannot be applied.

The document structure is based on key focus areas identified as important for planning and conducting a dry run:

- Chapter 2: Presents the rationale and potential objectives of dry runs, provides a high-level description of the different dry run sub-processes, and explains the overall process flow
- Chapter 3: Presents design stages for a dry run, including identifying involved stakeholders and market segments in which dry runs are typically executed

- Chapter 4: Deals with preparations for a successful dry run and creating a plan for execution, including designing dry run exit criteria
- Chapter 5: Details the execution of a dry run and highlights the different processes and steps needed
- Chapter 6: Guides NRAs on how to interpret and analyze the outcome of the dry run
- Chapter 7: Elaborates a summary of key recommendations for a dry run from the NRA perspective
- The annex presents some recent examples of dry run processes in different countries (i.e., Georgia, Turkey, Greece, and Ireland)

Typical decision points in a dry run process have been included in some sections that provide practical guidelines on how to evaluate different options available. These decision points are depicted from the NRA perspective. Each decision point has a predefined structure. Firstly, the key question is stated. Secondly, the typical options are listed along with pros and cons. Thirdly, the recommendation specifies the preferred option considering the listed arguments and accumulated dry run experience.

### 2. Scope and rationale of a dry run process

This chapter will outline the scope and rationale of a dry run process. Subsequently, the typical sequence of a dry run will be briefly described, providing an overview of the different phases of a dry run. These phases will be presented in greater detail throughout the following chapters of the document.

#### 2.1. Scope and objectives

Market liberalization and market design changes are major reform processes for countries and regions that pursue enhanced competitiveness and transparent energy markets. In the context of energy market changes, the implementation of a dry run facilitates successful market commencement and limits the risk of issues arising during real market operation.

Dry runs are important when entering into new market mechanisms with an unknown market outcome and where information technology (IT) systems and market participants play a crucial role in the success of market commencement. A dry run is commonly performed when introducing complex administrative, organizational, and technical changes in the electricity sector that involve significant modifications of existing arrangements and affect multiple participants and stakeholders. The dry run process is used as a tool to ensure a smooth transition and mitigate associated risks. Therefore, dry runs are conducted in order to prevent damages that may occur due to the failure of new or updated market structures.

For the purposes of this document, the discussion of dry runs is limited to exercises with stakeholder participation (i.e., where market participants have a chance or may be obliged to participate in the dry run).<sup>1</sup> Based on the different use cases and purposes for conducting a dry run, it is also important to note that there are two fundamental options for organizing a dry run. All dry runs represent some form of test or 'rehearsal,' and are often set up as a separate standalone exercise. Alternatively, a dry run may also take the form of a so-called 'parallel run.' The key differences between the two approaches and their impacts can be explained as follows:

#### • Standalone dry run as a test and rehearsal

In many cases, a market dry run is organized as a standalone test or rehearsal that is completely decoupled from the daily operations of the existing market and related operational processes. This type of dry run is usually focused on capacity building for market stakeholders, and concentrates on market rules, procedures, and market operational aspects.

In addition, it often serves to test the readiness of related IT systems and processes. Corresponding dry runs are sometimes organized as a single event taking place over the course of one or a few days, but also can take the form of multiple events conducted over a longer period of time.

Due to their standalone nature, this type of dry run is usually based on either pre-defined training or use cases, or independent user entries. As a consequence, there is no guarantee that the outcomes of the dry run process will reflect real market conditions and market behavior, such that it may not be possible to use them for further analysis of the overall functioning and impacts of planned market reforms.

At the same time, the more flexible nature may allow market participants to experiment (e.g., with order structures and pricing). In turn, this may help to identify possible issues and undesired outcomes that may not otherwise be observed.

<sup>&</sup>lt;sup>1</sup> This is in contrast to purely internal dry runs, which may for instance be internally performed by a systems vendor or as part of the system delivery toward a client (like a market and/or system operator).

#### • Dry run as a parallel run

In a parallel market dry run, the dry run is performed in parallel with an existing market mechanism and is at least partially based on the same inputs that are also used in the real market. For example, when reforming the bidding procedures for an organized day-ahead market (DAM), existing bids and offers may be used to test a new market clearing algorithm. Similarly, a parallel run could be used to test for the impact of a new real-time balancing mechanism and its impact on imbalance charges for system users. In all cases, however, the outcomes of the parallel run are typically published in parallel with those of the real market.

By definition, the scope and form of a parallel run is thus fundamentally influenced by the difference between the 'old' and the 'new' market arrangements, and the presence of any formalized market mechanisms in general. Furthermore, the application of a parallel run must generally remain limited to market-related processes, such as bidding, clearing and settlement, and, where applicable, the self-scheduling of generators or notification of transactions and exchanges. In contrast, all final operational procedures, such as real-time dispatch instructions, will still be performed according to the existing arrangements.

In contrast to a standalone test, a parallel run is usually based on regular sessions that are conducted over a longer period of time. As such, it may thus be more effective in familiarizing market stakeholders with the new market arrangements, processes, and systems, potentially at the cost of allowing for less flexibility in experimenting on the user side. Furthermore, a parallel run makes it easier to compare the outcomes of the new market arrangements with the results of the existing market. It may thus be particularly valuable in cases where the transition to the new market remains subject to a final proof of its intended benefits and improvements compared to the status quo and/or its ability to ensure an orderly market outcome under different situations.

#### Text box 2-1: Parallel Run Example - Core Flow-Based Market Coupling (Core FB MC)

The Core Flow-Based Market Coupling project aims to develop and implement the daily operation of a Flow-Based (FB) day-ahead market coupling across the whole Core capacity calculation region (Core CCR) in the framework of the single day-ahead coupling (SDAC). The Core CCR consists of the bidding zone borders between the following EU Member States' bidding zones: Austria, Belgium, Croatia, the Czech Republic, France, Germany, Hungary, Luxembourg, the Netherlands, Poland, Romania, Slovakia, and Slovenia.

Core transmission system operators (TSOs) and nominated electricity market operators (NEMOs) have aligned on the specific key performance indicators (KPIs) with NRAs. Core TSOs shall continuously monitor the effects and the performance of the application of this methodology during the parallel run. The following figures show two KPI from the report:

- 1) Price spreads and more frequent price convergence across the Core bidding zones (maximum, minimum, and average values)
- 2) Distribution of the Core Social Welfare (absolute values of producer surplus and consumer surplus )







The main objectives of a dry run process are depicted in Figure 3 below. The rest of the subsections describe each objective in more detail.



Figure 3. Dry run main objectives

Source: DNV

#### **Capacity Building**

Capacity building is the process of increasing the understanding and agility of the involved stakeholders during the introduction of a market segment. A set of topics need to be covered (depending on the knowledge level of participants), such as electricity market theory, legal frameworks, market processes, market operations and procedures, bidding strategies, IT systems, etc. Capacity building is commonly organized through workshops and seminars during the dry run preparatory phase as well as throughout the execution phase.

A dry run communication policy needs to be developed to disseminate relevant dry run information and results to concerned market participants, typically via reports and dedicated websites. The communication policy needs to address each of the identified stakeholder groups separately (see section 3.3) and set requirements accounting for confidentiality rules and the legal/regulatory framework.

#### Test market operational procedures

In a similar manner to market design assumptions, the market operator, TSO, and NRA, as well as other stakeholders to a lesser degree, have the possibility to check market operational procedures that are supported by the applicable IT platforms (e.g., clearing algorithm functioning, transfer of data between platforms, etc.).

In case of an extended dry run period, initial findings are available for analysis during the execution phase. Interpretation and analysis should start as soon as the first results are available, although a comprehensive and final analysis of all results might only be possible after the execution phase has concluded.

Nevertheless, in case there are problems with market operational procedures, the parties managing the dry run and/or the NRA may want to implement possible modifications during the dry run process in order to test/verify how the modified procedures work. Another option would be to execute the entire dry run process without changing market operational procedures and introduce modifications later on. However, this option would limit the possibility to perform additional testing on modified features or might require postponing the wet runs and expanding the dry run phase.

#### Identify problems, bugs, and risks

This activity relates to IT platforms, which are an essential tool for the operation of particular market segments and processes (such as for the bidding and clearing of centralized markets, contract

notifications, and physical nominations). All problems with IT platforms need to be reported to the responsible IT personnel without delay. Each troubleshooting ticket should indicate, at least, the following: the unique identifier, a description of the problem, the person who reported the problem, and the status of the problem.

Each of the problems reported by these tickets should be resolved as quickly as possible and feedback should be provided to concerned participants. Issues with trading IT systems usually represent a significant part of the problems related to introducing a new market segment. All important issues that affect the proper operation of the system need to be resolved before the end of the dry run process.

#### Verify market participants' system access

An important problem related to the trading platform is market participants' access to the IT system. Most access-related issues are typically reported in the beginning of the dry run. Problems might be related to access to the system, access to certain features, or user authorizations, etc. Problems with system access during the go-live phase would be a disaster. Thus, it is of utmost importance that access is granted and reported problems are resolved during the dry run.

#### Verify system readiness

Similar to the previous objective, verification of the trading platform readiness is key. Although the platform should already be tested before the initiation of the dry run process (factory acceptance tests [FAT], site acceptance tests [SAT], etc.), the dry run process establishes indicators that will show if the platform is reliable, secure, and ready for the go-live phase. Problems identified during the dry run need to be resolved.

#### Verifying market design assumptions and benefits of planned reforms

During the dry run process, the NRA, the market operator, and/or the system operator (SO) have a final chance to check the efficiency and robustness of the market design defined in the market rules and processes that are supported by the IT platforms. Initial findings about design problems may be acquired and market design flaws can be identified. In turn, the NRA, market operator, or SO may initiate amendments of market rules and processes where required to address remaining issues in the new market design.

The ability for such checks obviously depends on the plausibility and credibility of simulated market outcomes. To achieve these goals, it is desirable for all relevant participants to participate in the dry run and behave as they would in the real world. Otherwise, the robustness of the dry run outcomes may not be good enough for market analysis purposes. In case a widespread participation in the dry run process cannot be achieved on a voluntary basis, there may be reasons for requiring participation on a mandatory basis.

Furthermore, results typically improve as market participants accumulate experience and knowledge of the market process and agility in using the trading platform. Consequently, if the objective of a dry run is to validate the final market design, it should be conducted for a sufficient period of time to ensure an adequate analysis of market processes can be conducted during the dry run period.

It is hard to ensure that market participants behave 'as they would if in the real world.' In theory, one might aim to demand that all bids and offers should be reflective of real costs. Nevertheless, such heavy regulatory intervention will often conflict with the overall aims of market liberalization. Moreover, such an obligation may be difficult to apply when market participants still need to gain the necessary experience and/or need to understand future pricing patterns (e.g., with regard to the pricing of ancillary services or hydropower from larger reservoirs, which may be difficult before the start of the real go-live phase). For similar reasons, some degree of potential participants' experimentation with bidding behavior may even be desirable, especially to check the robustness of the new market design and whether it can handle extreme and/or unexpected situations.

#### 2.2. Outline of the dry run – phases

In this section, a high-level overview of a structured approach to conducting a dry run process is provided. In Figure 2, four phases are presented. This outline could be used as a guiding principle for NRAs looking at either initiating a dry run or trying to interpret one.



Figure 4. High level outline of a dry run process

#### Source: DNV

A general outline of dry run process contains the following phases:

- **Objectives and requirements** This initial phase covers the definition of objectives and requirements for the dry run process. A list of possible objectives was presented in detail in section 2.1 of this chapter. The objectives defined will condition the design of the dry run. Requirements represent the necessary general conditions that need to be fulfilled in order to proceed with the dry run preparation phase. In the broad sense, this includes the existence of a legal and regulatory framework, a competent and capable dry run responsible party, and an operational trading IT platform that supports market processes (e.g., with relevant inputs and documentation). This phase and the preparation phase may also be handled as a single phase depending on NRA and dry run responsible party's preferences.
- **Preparation** This phase constitutes an important step during which a set of organizational, administrative, and technical activities are undertaken with the objective to prepare for the dry run execution phase. These activities commonly encompass the identification of market segment(s), parties to be involved (roles and responsibilities), definition of capacity building needs and training manner, verification of system readiness, establishment of execution exit criteria, and the overall scheduling and planning of the dry run sequence. It is necessary to envisage certain resources for management of the potential deviances and problems during execution of the dry run in the plan. The dry run responsible party is responsible for this phase, with the eventual inclusion of other stakeholders when needed.
- **Execution** In this phase, it is important to guide the dry run in accordance with the adopted plan during the preparation phase. It is important to handle potential deviations of the dry run in comparison with the adopted schedule and maintain the flexibility and efficiency of the dry run.
- Interpretation and analysis This phase runs partly in parallel to the execution phase. Any experiences from the dry run process and, where applicable, the first available results, are assessed to identify potential problems. Depending on the overall scope of the dry run, this phase may focus on one or two key aspects as follows:
  - <u>Correctness and readiness of implementation:</u>
     IT and business processes are commonly analyzed using a dedicated tracking tool. The entire operational process and sub-processes are analyzed by evaluating the fulfillment

of the timing schedules and communication processes (data exchange) between different stakeholders. For this purpose, an established communication policy and confidentiality rules are very important.

• Validation of market design:

This phase may also serve to validate the underlying market design and its correct implementation. In contrast to the first aspect, this analysis focuses on the interpretation of market inputs and outputs with regards to market participant behavior, compliance, efficiency, and the impact of market results.

• **NRA monitoring role** – A market dry run is typically managed by the party that is also responsible for real-life operation afterwards, such as a market operator or SO. Nevertheless, the NRA should monitor the dry run and, where applicable, initiate, support, and/or approve necessary modifications to market rules and procedures or other relevant parts of the market design. For this purpose, the NRA should take an active role in reviewing and analyzing emerging market dry run results and introduce corrective measures when necessary. In parallel, the NRA may also need to monitor the fulfillment of exit criteria (i.e., where the NRA has the authority to decide whether the executed dry run is successful or whether an extension to the dry run period is needed for further testing).

## 3. Design of a dry run

This chapter describes the initial phase in a dry run process, which deals with designing the dry run through defining market segments subject to a dry run, identifying general objectives, and outlining the most relevant involved stakeholders and minimum requirements for the dry run.

#### 3.1. Involved market segments

An essential and fundamental aspect of a dry run is to select the market segment(s) that it should focus on. This will determine the structure, complexity, and duration of the dry run sequence. In the European target model (Figure 5), the DAM is the key market segment and is used by many countries as a starting point for introducing a market framework. It is a well proven market mechanism that efficiently visualizes the marginal cost of electricity and maximizes the utilization of transmission capacity throughout the European region.

In connection with the DAM, there are also other market segments such as the intraday market (IDM) and balancing markets (BMs) that could be included in or become the subject of a separate dry run. In addition, back-office processes such as settlement and other activities around collaterals could also be tested during the dry run. It could also be important to test the entire data communication flow from a DAM system through to the TSO nomination system.

Below is a list that provides an overview of relevant market segments that could be included in a market dry run. These market segments can be recognized in the EU Target Model, which is presented in Figure 5.

- Forward energy markets
- Forward cross-zonal transmission markets
- Bilateral contracts (e.g., OTC) nomination
- Day ahead market
- Intraday market
- Ancillary services and/or real time BMs
- Capacity allocation mechanisms



#### Figure 5. EU Target Model

Source: Florence Forum, Project Coordination Group (PGC), 2009

Often, the question of whether to implement a joint or a single dry run arises. In case different market segments are planned to be introduced approximately at the same time, a joint dry run process for all market segments is recommended. However, if there is a longer time period between the introduction of different market segments (market segments are introduced successively), it is preferable to organize separate dry run processes for each of the market segments.

It is logical that the duration of a joint dry run process will be longer than a dry run covering a single individual market segment. But it is also true that the duration of a joint dry run process will be less than the duration of separate consecutive dry runs for the same segments. It is also possible to perform separate dry run sessions of each market segment in parallel and introduce a joint dry run session at the end of dry run period. This option allows for handling the additional complexity of a joint dry run once the market segments have been tested separately.

### **3.2.** Identification of objectives

The selection of the market segment(s) subject to the dry run has a direct influence on definition of objectives. The main objectives are listed in section 2.1, with capacity building and overall systems and stakeholders' readiness being the most important objectives.

Objectives need to be tailored to the current situation and the expectations placed on the dry run process. It might be suitable to distinguish between key objectives (necessary to accomplish) and non-key objectives (second level of relevance) in accordance with the situation and preference. For example, a key objective could be the capacity building of participants and increasing the operational capability of the market operator (without proper knowledge, it is difficult to run any activity, process or business).

Another key objective could be testing the efficiency of the applicable market design and/or market operational procedures. An example of a non-key objective could be verifying system readiness in a situation where the personnel for IT support is evaluated/certified with a high score (competent, professional, providing excellent service) and the provided IT solution is standard or has gone through extensive testing.

#### 3.3. Involved market stakeholders

After deciding which market segment(s) will be subject to the dry run, stakeholders should be identified, as well as their responsibilities. Typically, we can distinguish between stakeholders actively involved in the dry run process and observers monitoring and analyzing the obtained results. Figure 6 presents the key stakeholder groups that are typically involved in a dry run process.



Figure 6. Involved stakeholders during market dry runs

#### Source: DNV

#### Dry run responsible party

The dry run responsible party is in charge of conducting and monitoring the dry run process. This means that it is responsible for the administrative, technical, and organizational issues related to the dry run and will also be responsible for the market segment and trading IT platform operation during the go-live phase once the dry run is finished. Thus, the responsible party needs to organize communication with the stakeholders. This is commonly organized using a dedicated website, where stakeholders may get up-to-date public data structured through reports as well as relevant information about the dry run process.

Mostly, the market operator is the responsible party. However, on some occasions, forming a steering group/committee to oversee and guide the dry run process could be useful, especially when multiple parties are actively involved. The steering group usually serves as a coordination and potentially decision-making body and may also judge on the successful completion of the dry run. In other cases, these responsibilities may remain with the market operator.

The dry run responsible party may also involve external parties, such as consultants or experts that provide support during dry run process. This external support makes sense, especially for capacity building and coordination purposes. For instance, an independent Project Manager Office could work on behalf of the whole process.

#### **Market Operator**

The market operator typically takes the role of the dry run responsible party for the dry run for the DAM or IDM.

#### SO

The SO or TSO has the role of the dry run responsible party in case the dry run covers the BM or ancillary services market. It is important to note that in the case that the TSO purchases its own losses on the market (for example on the DAM segment), it should participate in dry run process as well.

#### Market participants

Market participants take part actively in the dry run by submitting fictitious bids and offers in the market. Depending on the market segment covered under the dry run, different market participants need to be involved. For example, a dry run for the BM segment could only engage participants that might prequalify for balancing service provisions. The following market participants can be distinguished:

- **Generators** are typically represented by large generators or utilities and small generators. During the dry run, it is very important to include the generators that, due to size and portfolio, have a considerable impact on the market. The participation of small generators is less critical. Even if some are not participating in the dry run, they could be bundled under a dummy generator portfolio to simulate bidding behavior.<sup>2</sup>
- Wholesale consumers are large customers purchasing electricity for their own use directly from the market (where the market rules permit).
- **Retail suppliers** purchase electricity for the purpose of selling it to end consumers.
- Traders purchase electricity to sell (or vice versa), thereby helping to ensure market liquidity.

#### Other involved parties

Other involved parties that could be actively involved in the dry run but have a secondary role are:

- **Distribution System Operators (DSOs)** are in most cases responsible for electricity metering<sup>3</sup> and providing metered data at the distribution network for the timely calculation of imbalance settlements. In addition, DSOs are commonly responsible for the development and implementation of the load profiles for settlement purposes. It is important to note that in the case the DSOs purchase their own losses on the market (for example on the DAM market segment), they should participate in dry run process as well.
- The clearing house/entity is responsible for the realization of the clearing process. It acts as central counterparty between sellers and buyers, assumes counterparty risk, and guarantees the physical and financial settlement of transactions. The clearing may be done either through in-house or external clearing. In the first case (in-house), the clearing and settlement is done within the market segment (i.e., by the responsible market segment operator), which could allow for more agility to introduce improvements and correct errors in the algorithm. In the second case (external), the clearing is done by an external institution.<sup>4</sup> The clearing house may also be responsible for the management of collaterals through calculating daily requirements and handling collateral accounts.
- The collateral managing bank is a party (commercial bank) responsible for the constitution of collaterals (such as cash deposits or bank guarantees) on the request of a market participant for a particular market segment, the daily calculation of the market

<sup>&</sup>lt;sup>2</sup> "Dummy" market participants should be prepared to simulate realistic market behavior during the dry run execution. This is typically done by proficient experts such as personnel from the dry run responsible party.

<sup>&</sup>lt;sup>3</sup> This is in accordance with The Harmonized Electricity Market Model. "The Harmonized Electricity Market Model." ebIX®, EFET and ENTSO-E. Version 2020-01.

https://eepublicdownloads.entsoe.eu/clean-documents/EDI/Library/HRM/Harmonised\_Role\_Model\_2020-01.pdf

<sup>&</sup>lt;sup>4</sup> For example, "European Commodity Clearing AG (ECC)." European Commodity Clearing AG. <u>https://www.ecc.de/en/</u>

participant's collateral requirements, and the execution of collaterals on the request of the concerned market segment operator in case the market participant (buyer) did not pay. These processes can be tested in the dry run using fictitious data inputs.

The following stakeholders are not directly involved in the dry run, but assume a monitoring or observatory role.

#### NRA

The NRA is expected to assume a monitoring role and be involved in decisions that require its authority (e.g., defining exit criteria or approval of successful dry run completion). For example, at the end of each session, the NRA could analyze achieved results, record progress, and work with market participants to understand unintuitive results.

The NRA's participation in the dry run process should stress the responsibility of the market participants for their behavior in the dry run and expertise in the overview/review of relevant market segment design and market operational procedures. The NRA could be the decision maker regarding the successful completion or extension of the dry run based on the outcomes as well information provided by the dry run responsible party and other stakeholders.

The NRA might be involved from the start of the dry run to oversee the development of new market segment changes and even participate actively in the process by assuming the role of a market participant (see the Georgian experience in section 8.1). However, the NRA could also take a more distant position and simply focus on defining the preconditions to be fulfilled by the dry run, the analysis to be provided by the parties executing it, and the exit criteria (see the Turkish experience in section 8.2).

#### Other interested parties

Other interested parties might be informed about the dry run for transparency reasons, such as relevant electricity associations, universities, experts, IT vendors, and others. Naturally, this is subject to the discretion of the dry run responsible party and the NRA. In case of informing other parties, a communication policy should be developed with the objective to maintain confidentiality and control the dissemination of information. The participation of other interested parties is mainly expected during the interpretation and analysis phase, as they can receive valuable additional insights and comments.

A general distribution of responsibilities among stakeholder is presented in the table below.

Stakeholder	Responsibility			
Dry run responsible party	Provides technical support and corrects flaws			
	Provides capacity building and training			
	Provides information and user manuals			
	Organizes workshops			
	Monitors the dry run			
	Prepares and submits reports and data			
	Operates the dry run			
Market participants	Provide feedback and report problems, bugs, and issues			
	Submit bids and offers			
	Gain familiarity of systems and market procedures			
NRA	Evaluates success and further capacity needs			
	Approves the dry run			
	Conducts capacity building and training			
	Oversees the preparation phase and monitors the dry run			
	Evaluates the dry run results			

Table I	. Responsib	oilities of stak	eholders dur	ring the dr	y run process
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In a dry run, it is important to reach a high participation level by transmitting the benefits of taking part in the dry run. This would incentivize participants to behave during the dry run in a realistic manner as they would in real market operation, leading to better preparation and qualitative results. The dry run participation could be mandatory or voluntary. Depending on the circumstances and market segment(s), one or the other might be more suitable:

- **Mandatory participation:** Typically, if a new market segment will be mandatory, the participation of market participants in the dry run process should be mandatory. The participation of the biggest generation, trading, and supply companies in the dry run is crucial to obtain coherent results and assess if all or most participants are confident with the platform operation and trading process. If there is a concern that relevant dry run market players are against the introduction of the market segment, the NRA could declare participation in the dry run as mandatory.
- Voluntary participation: If a new market segment will be voluntary, the participation of market participants in the dry run can be voluntary or mandatory based on the NRA's analysis of participant interest and the significance of the market segment. For instance, participating in ancillary service markets is voluntary, but it might make sense to make participation mandatory for generators above a certain capacity threshold. In case the voluntary participation method is chosen, the level of participation should be monitored, and additional measures could be taken (i.e., introducing fictitious players to the dry run to ensure the dry run fulfils necessary objectives). The bids and offers of such fictitious players can be managed by the dry run operator or the NRA staff to ensure dry run outputs are closer to real life market outputs. In addition, it is possible to enable voluntary participation of potential market participants, which include companies that are not yet in business on the market segment but might participate in the future.

The decision point table below presents different options on mandatory participation in the dry run.

#### Text box 3-1: Decision point 1 – Mandatory participation of market participants

Key question: Should the participation of market participants in the dry run be mandatory?

**Option 1:** Participation in the dry run is mandatory for a predefined set of users. This option might be needed when participation is crucial for the success of the dry run or key market players are not interested in taking part in the dry run.

- Pros: There is a formal obligation to participate in the dry run for particular market participants, ensuring their contribution to the process.
- Cons: Market participants are "forced" to participate in dry run. Although their formal participation is ensured, their "real" contribution could be questionable.

**Option 2:** Participation in the dry run is voluntary – no mandatory participation is envisaged. It is considered that market participants will recognize their interest in joining the market and participate in the dry run.

- Pros: Voluntary participation in the dry run increases chances for success of the dry run since involved participants are keen to build capacity with the platform and tend to behave as they would in reality.
- Cons: Could result in a low participation level and key market players might decline to take part in the form of protesting the market opening or because they might have institutional knowledge on market mechanisms and prefer not to show interest at the expense of others that need capacity building.

**Recommendation:** As a basic rule, in case the market segment for which the dry run is organized requires mandatory participation, then Option 1 is recommended (for example, in BMs). In the opposite case, Option 2 is recommended (for example, in ancillary services markets).

In case of Option 2, if there is a significant risk of non-participation of relevant market participants in the dry run (i.e., obstruction of the market development, lack of interest, or other reasons), implementing Option I should be reconsidered, especially if the market segment introduced is crucial. For example, the DAMs are generally voluntary markets once operational. But, due to their significance, participation to their dry run can be mandatory to ensure the systems are properly tested, the participants receive capacity building opportunities, and a proper impact analysis can be conducted regarding the new market mechanism. Another solution is the creation of "dummy" users that would simulate the behavior of relevant market participants.

In both cases, it is recommended to allow additional interested participants to participate in market operations. In some cases, even the NRA takes the role of a fictitious market participant to become familiar with the platform and operating process.

#### Text box 3-2: Georgia Dry Run Example: Extensive involvement of the NRA

The dry run process in Georgia started in July 2020 and is ongoing.<sup>5</sup> Since its beginning, it has encompassed several trading and simulation sessions for the DAM, IDM, and BM. The main objectives of the dry run process are to check system readiness (e.g., interconnection between platforms and data exchange), build capacity among market participants, and verify market design assumptions (e.g., price formation, bidding strategies, etc.) before the go-live phase.

In preparation for the dry run process, capacity building sessions for market participants were organized covering key subjects such as the electricity market legal and regulatory framework, bidding strategies, portfolio management, and risk management. As a next step, market participants' electronic registration to the trading platform was made possible. This allowed participants to become familiar with the operational processes of the platform and strengthen their usage experience (e.g., trading, data requirements, uploading templates and data, etc.).

In Georgia, dry run participation is voluntary, and participants have the possibility to trade in the DAM, close bilateral contracts only for daily nominations of imbalances, and trade in the BM.

The role of the NRA during the dry run is to monitor the process and continue developing its monitoring tools and templates. In Georgia, the NRA has also taken the role of a market participant during specific sessions in order to gain technical and organizational experience. For the results analysis, the NRA receives the data from market operators after each session to evaluate potential market abuses. Throughout the dry run, the NRA can adjust the list of information that the market operators are required to send. In case of suspicious bidding behavior, the NRA interacts directly with market participant to understand the reasons behind the behavior. The intention here is to enable market participants to understand the monitoring process and experience it.

It is important to point out the collaborative approach between the NRA and dry run operators (IDM/DAM, BM) in Georgia. In fact, the parties jointly monitor capacity building needs and obstacles that appear during operational procedures.

Activity	Responsible	Participating
Dry run operation	Market operators (DAM/IDM and BM)	
Overseeing and monitoring dry run	Market operators (DAM/IDM and BM), GNERC	
Ensure familiarization of the systems and market procedures	Market operators (DAM/IDM and BM), GNERC	Existing and potential market participants
Bidding behavior and strategy	Market Participants	Existing and potential market participants
Capacity building and training	Market operators (DAM/IDM and BM), GNERC	Existing and potential market participants
Technical support	Market operators (DAM/IDM and BM)	
Source: NARUC dry run webinar – Cas	e of Georgia, GNERC, 20	21

#### Table 2. Responsibilities and Participants in Georgian dry run

<sup>&</sup>lt;sup>5</sup> The March 1, 2022 commencement of the go-live phase is planned.

#### 3.4. Minimum requirements and preconditions

As a last step, minimum requirements for the dry run need to be given. The fulfillment of all of these requirements is a prerequisite for a dry run process, and if they are not fulfilled, the NRA needs to initiate measures to remedy the situation. The following are the most common minimum requirements:

- The existence of a lawful legal framework that defines the market segment for which the dry run will be performed. The legal framework (including market rules and operational procedures) should define in sufficient detail the market segment design and all related business processes. Operational procedures should cover the dry run responsible party's activities and the processes needed from the market participant's side.
- The existence of a dry run responsible party that will be responsible for the market segment in real market operation, and hence during the dry run. The dry run responsible party needs to have sufficient capacity to execute the dry run (utilizing third parties, if applicable).
- The existence of a trading platform that is used for the market segment and that will be used for the dry run. This platform is operated by the dry run responsible party and is fully operational and interconnected with other systems in the electricity sector landscape. The platform must fully support the business processes of market segment defined in the legal framework, pass relevant tests (e.g., FAT, SAT, operational acceptance, etc.) and be ready for real market operation.
- The existence of documentation that covers all relevant IT aspects for successful market segment operation. These include different IT-related rulebooks, user manuals, and data definition documents that facilitate reliable and secure work on the trading platform.

The following figure (Figure 7) provides an overview of the requirements and objectives that need to be in place before moving to the preparation phase.



Figure 7. Objectives and requirements for a dry run Source: DNV

### 4. Preparations for a successful dry run

Detailed and thorough preparations are required for the execution of a successful dry run. This involves the determination and planning of all activities to be undertaken during the dry run, the necessary preparations, and the scope and approach for the interpretation and analysis phase. In addition, it is essential to provide for sufficient training and capacity building, either as part of the dry run itself or during the preparational phase.

The basic activities of the preparations phase are described in more detail in the following sections, including country cases and decision points that present different available options.

#### 4.1. Scheduling and planning the dry run sequence

A planning document should be prepared with a description of all activities that need to be undertaken by the market participants. It should be organized in a Gantt (or similar) diagram that graphically illustrates the duration and inter-dependence between activities and market participants. The planning document should entail all activities and the connection between them across all phases: preparatory, execution, and interpretation and analysis. An overview of activities allows an assessment of the entire dry run sequence and the risk of potential delays or bottlenecks in the process.

From a practical point of view, the planning process should begin by defining general tasks and continue by defining more specific tasks and details. The following are some of the key aspects that should be contained in the plan:

- **Capacity building**: How and when capacity building should be realized (e.g., number, content and schedule of workshops and trainings) and which stakeholders will be the involved must be specified.
- **Dry run sessions**: The number, timing, and duration of dry run sessions must be defined. The dry run execution phase could be planned to include several dry run sessions. The dry run is typically conducted for representative periods that can shorten the process required time in order to do more trials. A dry run process can have different dry run sessions (i.e., one session of three days, another session of seven days with different scenarios, and a next session of two months). At the beginning of the execution phase, it is logical that these sessions are shorter (with a duration of a few days) as market participants still need to accommodate to the new market specificities and trading platform. During these initial sessions, problems accessing the trading platform and exchanging messages within business processes are common. After market participants gain sufficient experience with regard to the trading platform/market segment,<sup>6</sup> longer sessions could be organized with a duration of a week, which could include or exclude weekend days. Dry run execution could also include a continuous session at the end of the dry run.
- Scenarios: Some of these sessions could have specific scenarios assigned to them to test the behavior of market participants in unusual conditions, such as scarcity of generation or transmission capacity, high water conditions (e.g., flood) and the testing of defined fallback measures.<sup>7</sup> Dry run sessions with defined scenarios are considered useful as they provide additional details about the functioning of the market segment. If implemented, they should not be scheduled in the beginning of the dry run execution, but later on when market

<sup>&</sup>lt;sup>6</sup> This is typically done in months before market opening.

<sup>&</sup>lt;sup>7</sup> This relates to measures that can be used in extraordinary situations when normal business operations are not possible. For example, this may happen when the DAM coupling process is unable to produce day ahead coupling results or in case of problems with the operation of the trading platform. In these cases, procedures should be in place to receive bids and offers in an alternative way (for example, via e-mail), notify market participants, and postpone or cancel market operations.

participants have gained sufficient proficiency in operating and understanding the market segment.

- Analysis and discussion of results: During these sessions, the dry run responsible party and the NRA should analyze achieved results in predefined periods (e.g., on meetings that would be organized each day or every few days with the same objectives as before).
- **Progress monitoring**: The NRA and the dry run responsible party should track progress in terms of market participants' usage of trading platform, and gain a sufficient understanding of the market segment and quality and usability of the submitted data.
- **Calibration of the dry run**: The risks and flaws identified during dry run process should be mitigated and eliminated, and this procedure should also be part of the plan. For example, it is possible that during execution phase, the NRA and the dry run responsible party discover a problem in the business processes of the new market segment. If this happens, it is better to introduce changes to the business process of market segment (and trading platform) before the dry run period is concluded. This way, it is possible to test if the changes are producing the predicted outcome. Still, there is an issue of applicability for this approach as larger changes require a significant amount of time to modify both the regulatory framework and the trading platform.
- **Exit criteria**: The planning document needs to include the evaluation of the exit criteria to judge if the dry run has been successfully completed. The defined exit criteria need to be assessed based on dry run outcomes. It is important to note that during the dry run, some of the initially established criteria may be modified.

#### Text box 4-1: Ireland Dry Run Example: Market trial schedule

The Integrated Single Electricity Market (I-SEM) that went live in May 2018 was a major reform program of the Single Electricity Market (SEM), which was implemented in the late 2000s. Besides full market coupling with the British electricity market, the new I-SEM arrangements include six markets or auctions (the DAM, the IDM, the BM, the capacity market, financial transmission rights (FTR) auctions and a forward market) spanning different trading timeframes with separate clearing and settlement mechanisms.

The detailed market design of the I-SEM was developed by the Regulatory Authorities (RAs) in both Northern Ireland and Ireland in 2014, while market implementation was the responsibility of the two TSOs, EirGrid and SONI.<sup>8</sup> As part of the preparation phase, the TSOs and the NRAs identified critical events and provided a high-level roadmap for each event and a number of milestones that market participants had to meet. Figure 8 gives an overview of key activities and milestones associated with the "pathway to market trials" (see also section 8.4.).



The following text boxes address several options to be considered when preparing the dry run process, namely with regard to the introduction of different scenarios, modification of operational procedures, and the number of dry run sessions to be organized.

<sup>&</sup>lt;sup>8</sup> EirGrid Group is the independent TSO in Ireland and Northern Ireland, through EirGrid and SONI, respectively. The Single Electricity Market Operator (SEMO) is part of the EirGrid Group and operates the I-SEM across the two jurisdictions. For more information, visit:

<sup>&</sup>quot;About Us." EirGrid Group. <u>https://www.eirgridgroup.com/site-files/library/EirGrid/Section-A-Who-we-are-and-what-we-do-(1).pdf</u>

#### Text box 4-2: Decision point 2 – Number of scenarios to be considered

Key question: How many scenarios should be addressed during the dry run?

**Option 1:** Only one scenario is applied during dry run. This "normal" or "base" scenario would correspond to the operation of the energy market in a normal situation in the energy sector.

- Pros: Simplicity, and less burden on NRA, the dry run responsible party, and market participants
- Cons: Uniformity of data and failure to obtain information about possible market behavior under different scenarios

**Option 2:** Several scenarios are applied during dry run. "Base" scenarios would exist in addition to scenarios describing specific situations that may happen in the energy sector, such as high-water seasons, congestion on borders, the tripping of large unit(s), or a combination of all of the above mentioned.

- Pros: Possibility to test market outcomes in different conditions and obtain valuable information for the interpretation and analysis phase
- Cons: Higher implementation complexity, budget, and time required. More effort is needed from participants.

**Recommendation:** Option 2 is recommended through a staggered approach. At the beginning of the dry run a "base" scenario can be used. Later on, additional scenarios should be tested depending on the estimated capacity of stakeholders.

#### Text box 4-3: Decision point 3 – Modification of operational procedures

Key question: Is testing the modification of operational procedures during dry run allowed?

**Option I:** Any modification of operational procedures during the dry run execution is not allowed.

- Pros: Simplicity, there are no complications stemming from the change of the procedures
- Cons: Delayed opportunity to test operational improvements through quickly adapting the procedure

**Option 2:** Allow modifications of operational procedures during the dry run. The modification of operational procedures is permitted, for example, within one scenario. An operational procedure change could be prepared in advance during the preparation phase, or ad hoc, within the execution phase.

- Pros: Modified operational procedures are tested and based on results, optimum solution could be quickly identified.
- Cons: Complexity, as changes of related procedures also involve changes in processes and the IT platform

**<u>Recommendation</u>: Option 2 is recommended** in case there are possibilities to test potential improvements of operational procedures. This depends on the capabilities of the dry run responsible party, market participants, and the IT platform itself. It is assumed that enforced changes will not be significant.

#### Text box 4-4: Decision point 4 – Number of dry run sessions

Key question: How many sessions should be organized in the dry run?

**Option I:** Smaller number of sessions

- Pros: Simplification
- Cons: Rigid approach with lack of flexibility that might have a negative impact on data quality

**Option 2:** Larger number of sessions

- Pros: Fulfill the possibility to use the dry run for a deeper investigation of the market
- Cons: Complicated, especially if combined with different scenarios

**<u>Recommendation</u>**: Option 2 is recommended in case of a longer dry run period, where it provides a better opportunity to acquire profound knowledge about the market segment. Option I could be used in case of smaller dry run periods, with simple and small market segments where introducing more sessions (and scenarios) does not provide much added value.

#### 4.2. System readiness

Trading platform readiness is one of the minimum requirements for the dry run process since it represents the basis to perform market activities. It is assumed that the system is already tested and accepted for operation by the dry run responsible party and that it is working correctly in accordance with the legal framework (including market rules and operational procedures). It should be noted that these tests were not executed in a realistic market-like environment, but in a controlled environment and in accordance with predefined (the vendor's and the dry run responsible party's) scenarios and free tests (i.e., tests without particular scenarios) undertaken by competent personnel. Furthermore, it is expected that interfaces/data exchange with other systems (existing or new, in case more market segments are bundled in a joint dry run) are working correctly and supporting related business processes.

During the dry run, market participants will have access to the trading platform in the same manner as in real market operation with an overview of public data and their private data – resulting from their activities on the market segment. Read-only access to the trading platform data could be granted to the NRA for analysis purposes and under strict confidentiality. Similarly, other interested parties might already be granted access to selected market inputs and results (i.e., in line with future transparency rules in the new market).

After implementing the trading platform, system access and security related problems commonly emerge. Other typically system errors are related to the trading platform integration and data exchange between IT platforms within common business processes. It is therefore of utmost importance that IT experts from the dry run responsible party or an external service provider have adequate tools for tracking and resolving bugs and platform user complaints in order to create trust in the system.

#### 4.3. Dry run execution exit criteria

Establishing exit criteria for the dry run is crucial to assess if the dry run was successful after completion and if it is feasible to move toward the market go-live phase. By identifying the risks of the new market framework and setting clear expectations, the dry run responsible party can define the specific exit criteria. The exit criteria could be seen as a list of success factors that are monitored during the dry run process and evaluated at the end of the dry run. In case the exit criteria are not met, it may be necessary to extend the dry run. The following exit criteria cover most relevant dry run aspects:

• Data collection is adequate for the purpose of interpretation and analysis: Collected data during the dry run period needs to be sufficient in quantity (according to the planning document). In general, this depends on the reliability of the trading platform IT system and on participation level.

- Market outcome can be explained, is based on market fundamentals, and follows intuitive participant behavior: Data collected during the execution phase (i.e., bids and offers, market results) needs to have an adequate quality level (i.e., present realistic market participant behavior, unintuitive situations can be explained, sufficient diversity of participants is achieved, most relevant market players have participated in the dry run, etc.).
- **IT system provides needed functionality:** The trading platform needs to provide the requested functionality without outstanding major issues (such as endangering the work of the particular/relevant subsystem) or critical issues (endangering the work of entire system).<sup>9</sup> From a technical point of view, only minor issues that affect the operation of the trading platform and that can be (expectedly) resolved quickly may be tolerated. These activities are performed by competent IT experts of the dry run responsible party or an external service provider.
- Dry run participation levels are adequate: Market participants should be committed to the dry run and their level of participation needs to be adequate. If their participation in the dry run is not satisfactory, it may be necessary to investigate the reason for this (e.g., insufficient capacity, deliberate obstruction, lack of interest, etc.) and undertake remedial measures (e.g., improve capacity building, impose obligations, charge penalties, show clear commitment to market opening on the established deadline, etc.).
- Satisfactory level of capacity and knowledge was reached: The level of capacity and knowledge among stakeholders should be satisfactory, and participants must be able to operate in the market. The capacity level of market participants needs to be monitored and should show a learning curve development throughout the dry run (e.g., regarding the usage of the trading platform). In case the capacity level is considered insufficient at specific milestones or for specific topics, it is necessary to undertake additional capacity building activities.
- Full compliance of all processes and IT systems with market rules and operational procedure: The dry run operations of market participants on the trading platform need to demonstrate that all business processes and IT systems have been implemented in full compliance with the applicable market rules and operational procedures.<sup>10</sup> Any identified inconsistency or deviation needs to be corrected.
- Data dissemination and communication policy is effective: A communication policy and data dissemination rules need to be in place and must be effective. It is necessary to identify cases where stakeholders were not able to access the requested data and/or cases where delivered data was inaccurate, incomplete, and/or inconsistent.<sup>11</sup> For example, it should be verified whether requested data are either available on a dedicated website or reports can be requested and delivered by e-mail.
- Each identified issue needs to be resolved, typically by the dry run responsible party or involved external IT experts.

<sup>&</sup>lt;sup>9</sup> For example, users can not access the platform, interfaces with other relevant systems are not working, the graphical user interface is frozen, or there is no response from the database.

<sup>&</sup>lt;sup>10</sup> In accordance with Decision point 3: Modification of operational procedures, in section 4.1.

<sup>&</sup>lt;sup>11</sup> Data accuracy, completeness, and consistency are key elements of data quality. Data accuracy requires data to be correct and represented in a consistent and unambiguous form. Data is considered complete if all essential fields are filled and if there are no gaps or missing information. Data consistency is the process of keeping information uniform/consistent as it moves across a network and between various applications on a computer.

During the dry run, the NRA and the dry run responsible party monitor the progress made toward fulfillment of the exit criteria. In case the progress is unsatisfactory (behind schedule), corrective measures need to be introduced. The following figure illustrates a simplified exit criteria assessment at the end of the dry run. In this example, the capacity and knowledge level does not meet minimum expectations and would presumably lead to additional capacity building activities and a dry run extension.

Exit criteria	
Data collection for interpretation and analysis completed	$\checkmark$
Market outcome can be explained	$\checkmark$
IT system delivered needed functionality	
Dry run participation is satisfactory	
Satisfactory level of capacity and knowledge	×
Dry run operation according to market rules	$\checkmark$
Dry run operation according to operational procedures	$\checkmark$
Data dissemination and communication policy is effective	V

Figure 9. Exit criteria checklist (illustrative)

Source: DNV

#### Text box 4-5: Ireland Dry Run Example: Market Readiness Reporting Strategy

The I-SEM that went live in May 2018 was a major reform program of the SEM, which was implemented in the late 2000s.

The NRAs and TSOs established a Market Readiness team and published a Market Readiness Reporting Strategy and Market Readiness Reporting Plan. These documents provided the basis of how the program interacted with all participants. EirGrid plc/SONI Ltd's work entailed developing a wide range of metrics to build a comprehensive view of the I-SEM market and market participant readiness. The metrics covered the main components of the market arrangements, such as legal arrangements, systems, and business processes.

In addition, market participants were asked to voluntarily self-assess their progress toward readiness by completing online questionnaires. This information was aggregated by the dry run responsible party and the output was then discussed with the NRAs. While EirGrid plc/SONI Ltd were responsible for coordinating and publishing the results of Market Readiness surveys, the NRAs oversaw the process, queried the results, and ensured that any risks or concerns were flagged and explained. As an illustrative example, in the following the survey results about DAM and IDM readiness are presented.

Readiness Status by Metric and Participant Category

	Day-Ahead & Intraday Markets	Market Participants	ICOs	MDPs	System Operators (incl. CM Delivery Body)	Market Operator (incl. Nemo)	EirGrid/SONI as AoLR
Read	iness Per Participant Category	$\bigcirc$					$\bigcirc$
A	Readiness of Business Strategy, Planning, and Financial Resources	DL.3					
в	Readiness of Legal and Contractual Framework: Agreements and Contracts						
с	Readiness of Systems	<u>рия</u>					
D	Readiness of Business Processes and Procedures						
E	Readiness of People and Organisation						
F	Readiness of IT infrastructure and Other Facilities	094					
G	Registration						
н	Market Trial: Preparation						
ï	Market Trial: Management & Reporting				$\bigcirc$		
J	Market Trial: Execution	$\bigcirc$			$\bigcirc$	$\bigcirc$	⊖
ĸ	Deployment of back-end systems to support FTR market						
ι	Deployment and Transition to live: Planning & central market processes and systems					$\bigcirc$	
м	Deployment and Transition to live: Participants						

Source: I-SEM Project Managers' Group, 20 July 2017

## 5. Execution of a dry run

#### 5.1. Capacity building and training

Comprehensive capacity building and training represent an essential component of any dry run process. Much of this will be achieved through practical exercises and experience gained during the simulation of market activities (see section 5.2). But, in addition, it should involve more formalized training sessions (i.e., to develop and strengthen the skills, abilities, and agility of involved stakeholders).<sup>12</sup>

As illustrated by the example in Figure 11, this training should:

- Provide an overview of the new market arrangements, relevant rules and procedures, and clearly describe the roles, functions, and responsibilities in the new market
- Clearly describe the principles, sequence, functioning, and requirements of relevant market segments, processes, and interactions in the new market framework

The overall objective of such training should be to provide all participants with the necessary understanding of the new market processes to prepare them for successful participation in the training during the dry run process and, ultimately, in the new market. The scope and depth of training should be adapted to the level of stakeholders' knowledge or experience.

For instance, the implementation of a new market segment requires more capacity building than amending an existing market segment. Several different topics should be covered via workshops/webinars/seminars within dry run process, and sufficient time interval between consecutive workshops must be provided. Naturally, the list of topics should be adapted to the market segment(s) covered under the dry run.



#### Training topics

Figure 11. Example of DAM training topics

#### Source: DNV

Capacity building needs to be evaluated for successful internalization and understanding of the presented material. For this reason, it is important to support stakeholders during as well as after the

<sup>&</sup>lt;sup>12</sup> Different stakeholders commonly have different preferences toward capacity building topics, depending on their position in the market and interests.

workshop by answering written questions and publishing question and answer lists on the dedicated website. Post-training evaluation could be conducted based on dry run output performance or through questionnaires, where target stakeholders would self-estimate their knowledge and progress.

Alternatively, an evaluation could be performed through a form of voluntary quizzing where target stakeholders answer a set of questions or through official exams (for example for trading system training). In case the results of these tools are unsatisfactory, it is necessary to investigate the reason behind (e.g., insufficient capacity, deliberate obstructions, lack of interest, potential problems with certification system, etc.). If the dry run responsible party and/or NRA determine that more capacity building is necessary, additional workshops and capacity building sessions should be organized.

If so desired, the market operator could also introduce a certification system (i.e., to test and verify successful participation of trainees and their ability to deal with the new features and systems in the new market). In practice, however, it may be of limited value to introduce such a certification scheme solely for the purpose of a market dry run.

Instead, corresponding certification schemes are often introduced (e.g., by market operators on a permanent basis). Although this capacity building system is a recurrent process and extends beyond the dry run, it could complement other initiatives for capacity building during the dry run. For example, market participants would likely be interested in obtaining certificates during the dry run that enable them to participate in the market after the go-live phase. The certification could be delivered by the market operator or by an external competent party.

The following decision point presents different options on capacity building tools for market participants.

#### Text box 5-1: Decision point 5 – Capacity building tools

Key question: What tools/methods are useful for capacity building?

**Option I:** Use quizzes for market participants

- Pros: Simple activity, easy to prepare, no need for activities regarding certification system nor preparation of exams
- Cons: Motivation of market participants could be small, with many of them not willing to participate in this way of knowledge checking

Option 2: Use official exams as tests for knowledge

- Pros: Simpler solution, no need for activities regarding certification system. More fitting to capacity building during the dry run period. Market participants are encouraged to learn to get better scores (a reflection of their knowledge)
- Cons: Motivation of market participants to engage in capacity building may be lower as there is no tangible benefit in comparison with receiving certification

**Option 3:** Give certifications to market participants

- Pros: Formal evaluation of market participant knowledge, followed with a certificate noting that sufficient capacity was built during the dry run and provides/ensures participation in the go-live phase (future market). It is also a handy tool to encourage participation in the dry run. There is a possibility to recognize certifications from other countries.
- Cons: Requires establishment of the certification system. The certification should not be limited to dry run, and seems more important for continued operation of the market after the go-live phase.

**<u>Recommendation</u>**: Option 2 may be considered an essential element that should become part of any dry run process.

Option 1 could be also used in parallel with other options, especially in the beginning of the capacity building process and for introductory training topics.

Implementation of a certification system seems difficult to justify for the sole purpose of conducting a dry run. However, any certificates obtained during the dry run may remain valid for the go-live phase and could indeed be used as the start of a permanent process, which may become very valuable for successful operation of the related market segment.

#### 5.2. Simulation of market activities

The execution should be in accordance with the schedule and plan created in the preparation phase. As discussed in section 3.1, the market processes to be simulated during the dry run naturally depends on the overall scope of the dry run and the underlying market reforms.

For illustration, the following text considers an example of introducing an organized wholesale market with centralized bidding and clearing. Consequently, the sequence described in this section and as presented in Figure 12 largely follows the market operation flow. A short description of each basic step will be presented in this chapter, and differences between a simulated dry run and real market operation will be underlined. In addition, the perspectives of various stakeholders will be presented, providing a holistic insight into the dry run execution.

The sequence presented in Figure 12 follows the steps of a typical centralized market (DAM or BM). It is important to note that the dry run sequence need to be tailored to the market segment(s) selected. For instance, for an OTC market or an IDM, the dry run sequence will be different and cover fewer steps.



Figure 12. Basic steps of dry run execution (illustrative example of a centralized market)

Source: DNV

The following table presents the basic differences between the processes of the dry run, the parallel run, and real market operation.

Process	Real market operation	Dry run (new market)	Parallel run
Bidding	Based on real bids and offers to existing market	Based on independent bids and offers (for dry run only)	Using same bids and offers as for existing market
Market clearing	Real prices, volumes, and flows	Simulated prices, volumes, and flows	Simulated market outcome, in parallel to the existing market
Results sharing	Firm results	Simulated results	Simulated results published in parallel with the results of the existing market
Scheduling of generation and cross-border exchanges	Based on market outcome/results of trading platform	Simulation of scheduling process, based on simulated market results	Simulation of scheduling process, based on simulated market results
Settlement (potentially including an imbalance settlement)	Firm settlement statements and invoicing, based on real market results and meter values	Preparation of pro- forma settlement statements and invoices, based on results of simulated market outcomes and mock-up imbalances	Preparation of pro- forma settlement statements and invoices, based on results of simulated market outcomes and real meter values

Table 3. Dry run	, parallel run,	, and real market	operations differences
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#### Market participant registration and engagement

In the real market, all market participants will have to undergo a formal registration process and prove fulfillment of defined legal, organizational, administrative, and/or technical requirements. Depending on the market segment, additional requirements might be in place. For instance, to participate in the BM, market participants need to prove their capability for balancing services provisions, based on a test procedure determined by the TSO. In addition, market participants may have to provide sufficient collateral as a precondition for participating in the market.

Some processes are not normally tested during a dry run process. For example, it would be highly unusual to require the provision of collateral, except maybe at symbolic levels to test monetary transaction capabilities and margin check and margin call procedures. Accordingly, the same requirements, processes, and interactions are covered through dedicated training sessions, as discussed under section 5.1.

#### Market participant access to trading systems, login etc.

After successful registration, market participant can access the trading system and perform market activities. The trading system needs to register market participant login and logout actions as well as their activities within the trading system. This information is relevant in order to avoid disputes and enable audits and investigations. Furthermore, if the trading platform has this functionality, it is recommended to define different users and user authorizations for each market participant. Different stakeholders should have different rights and privileges guaranteed to them in the trading system.

Figure 13 shows the data access rights of different stakeholders during dry run process.



Figure 13. Data access rights of stakeholders during the dry run

Source: DNV

#### Bidding

Bidding during the dry run execution is an activity of market participants. They submit bids (purchase) and offers (sale) on the trading platform until gate closure (predefined deadline). Submitted bids and offers in the dry run are simulated, but should ideally reflect market participants' logical behavior on the market segment and reflect their portfolio and conditions. Therefore, entering fictitious but realistic bids and offers is important to produce reasonable prices and volumes in the simulated clearing step during dry runs. This especially relates in case of dry run execution with a predefined scenario, which illustrates some extraordinary circumstances, such as scarcity of generation, high water conditions (for hydroelectric power plants), limitations in cross border transmission capacity, etc.

Even though the bidding and market outcome during the dry run cannot be considered to represent the exact real market outcome, the results should be as realistic as possible. In practice, participants may apply different bidding strategies, partially reflecting differences in their generation portfolio and their competitive position in the market. Consequently, it may be desirable to explicitly allow – or even incentivize – market stakeholders to try different strategies during the dry run period.

The bidding process is dependent on the type of dry run that is executed – a short period, extended dry run, or potentially a parallel run. During a parallel run, inputs (bids and offers) are taken from an existing market but are used in a new market structure. This approach is also applicable in case of moving from a local market to market coupling. Another situation that would be suitable for a parallel run is when the market operator aims to test a new software or clearing algorithm (e.g., after developing an in-house software to replace the existing one).

**Responsible:** Market participants bid during the execution phase. The dry run responsible party and the NRA have supervisory roles overviewing bidding data in connection with market segment clearing data and reviewing their quality from the aspect of plausibility and usability in the interpretation and analysis phase.

#### Text box 5-2: Decision point 6 - Market participants bidding

Key question: Should there be bidding limitations for dry run participants?

**Option 1:** Market participants can submit bids and offers without the need to account for plausibility considering the given conditions and portfolio.

- Pros: Simplicity of requirements (all results are accepted) and experimentation possible
- Cons: Unintuitive biding situations are common. There is a high risk that results are not useful for interpretation and analysis. Trying to understand unintuitive results requires extra effort.

**Option 2:** Market participants are only allowed to place bids and offers that can be justified (logical and intuitive) within the context and conditions (e.g., bid and offers based on a given scenario and portfolio).

- Pros: Submitted data are of higher quality than in Option 1. The interpretation and analysis phase can be more efficient, and prices and volumes tend to be closer to reality.
- Cons: Higher requirements for participants and complexity to set the rules. There is little space for participants to experiment.

**Option 3:** Allow experimentation and testing of bidding strategies, as long as the strategies can be explained to the NRA.

- Pros: Market operation will be tested on unusual or unexpected strategies, providing additional useful feedback on the functioning of the market (possibly applicable in the go-live phase).
- Cons: Highest complexity, the NRA needs more involvement analyzing experiments and strategies in addition to Option 2.

**Recommendation: Options 2 and 3 are recommended**. While in the beginning of the dry run Option 2 is more adequate as market participants get used to the platform, Option 3 should also be considered. Option 3 is suitable to test different scenarios and evaluate biding behavior. Option 1 should be avoided as the risk of obtaining illogical and not usable results is high.

#### Market calculation sequence (market clearing)

Market clearing is an activity under the responsibility of the dry run responsible party. Market clearing is performed after the gate closure (i.e., is done in accordance with the predefined timetable) and is conducted based on submitted bids and offers. Quantities bought and sold on the market segments, as well as market (clearing) prices are calculated through market clearing process (e.g., using the market clearing algorithm). Another potential output of market clearing is the flows on interconnectors (under market coupling). Functionality in this step is basically the same as in real market operation. The dry run responsible party and the NRA analyze the market clearing and bidding data in order to evaluate the sensitivity and robustness of the market against gaming practices. In the execution phase, this analysis is brief, but a more thorough and detailed analysis is performed in the interpretation and analysis phase.

It is recommended that specific workshop(s) are organized to educate market participants on the clearing model and participant's obligations to make suitable clearing arrangements.

**Responsible:** Market clearing is a process carried out by the dry run responsible party. The dry run responsible party and the NRA analyze the outcome.

#### **Results sharing**

The dry run responsible party is responsible for disseminating results to stakeholders. Results from market clearing (volumes and prices) are submitted to concerned market participants and uploaded to the market transparency platform in accordance with data confidentiality rules. It is important that dry run participants are conscious of the results of their bidding behavior and are confronted with their fictitious obligations toward the market. Furthermore, through DAM/IDM outcomes, the TSO obtains relevant information from the market operator and can prepare the final daily schedules. Other stakeholders may access the data from their domain of interest if outlined in the preparatory phase.

**Responsible:** The dry run responsible party is responsible for disseminating results to stakeholders.

#### Generation and exchange scheduling

Depending on the principal market design, market participants may have to self-schedule their own generation based on the DAM results and nominate physical generation (and exchange) schedules to the SO. When implementing a self-scheduled market, it will thus be important to also include this 'scheduling process' into the dry run.

Yet, by definition, the dry run will have the nature of a 'theoretical exercise' or 'game' while it will not affect the physical operation of the power system, which will continue to be determined by existing market and operational arrangements. Consequently, the scope of the dry run simulation must be limited to the preparation and communication of all relevant information during the planning stage, ideally using the same IT and communications system as after the go-live phase. Nevertheless, these activities must be clearly separate from the systems and processes used in the existing market as well as from any operational systems (for instance, used for real-time dispatch).

**Responsible:** The market participants are responsible for self-scheduling (albeit virtual) and need to adjust their schedule position due to changing generation or demand conditions. The dry run responsible party is responsible for managing the virtual scheduling exercise and must ensure the 'scheduling process' and relevant communications run smoothly.

#### Settlement

In line with the market design, the dry run may also have to cover the (new) settlement processes as faced after the go-live phase. Similar to previous activities, this should involve all necessary interactions between market participants and the operators responsible for different types of settlement. Simulation of settlement during the dry run creates specific challenges that need to be addressed:

- The frequency and duration of the simulated market during the dry run will generally be different from real life. For instance, a dry run may simulate several days during the same day, which may also require several settlement runs during the same day. Likewise, not all settlement activities are conducted every day. For instance, an imbalance settlement is often carried out on a monthly basis only (i.e., depending on the availability of meter values). In these cases, it may be useful to apply a different pattern for the dry run (i.e., consider one or a few 'market days' for the corresponding settlement cycles only).
- Similarly, the settlement of imbalance or ancillary services will often be based on metered values rather than market transactions. Consequently, it will become necessary to complement the simulated market data from the previous phases of the dry tun with additional information. While real data may still be available in a parallel run, some sort of mockup values will typically have to be used for a standalone exercise.
- During a dry run, proforma invoices are prepared but there will be no invoices or payments.

### 6. Interpretation and analysis of dry run results

This chapter provides information on ways to interpret and analyze the dry run outcome. The basic approach is to analyze the results in line with the objectives and exit criteria of the dry run. It is important to recognize the differences between a dry run period vs. actual operation of a market. The execution of the dry run is based on the idea of non-applicability of results compared to the actual operation. However, the dry run results provide a preliminary idea of the market outcomes and, in particular, whether these results are in line with the expectations, creating trust in the market implementation process.

During the preparation phase, the exit criteria shall be established (section 4.3). The criteria indicate which aspects should be checked and analyzed to objectively assess the success of the dry run. The following are common exit criteria of a dry run process:

- Data collection is adequate for the purpose of interpretation and analysis
- Market outcome can be explained, is based on market fundamentals, and follows intuitive participant behavior
- IT system provides needed functionality
- Dry run participation levels are adequate
- Satisfactory level of capacity and knowledge was reached
- Full compliance of all processes and IT systems with market rules and operational procedure
- Data dissemination and communication policy is effective

#### 6.1. Realistic and comprehensive data sets

Defining realistic and representative market results should be concluded based on discussions among the relevant parties (market participants, dry run responsible party and NRA). Dry run sessions ending with clearly non-applicable and non-realistic results could be removed from the analysis. However, the results that are removed must be also assessed to determine the underlying reasons.

This will allow all parties to decide if there is a need for mitigation measures to ensure that these results will not happen again. For instance, unintuitive bidding behavior should be explained and understood via interactions with participants. In addition, the outcomes in rare market conditions can be simulated through specific scenarios. This allows for an assessment of participants' behaviors in specific market situations and a way to obtain additional market insights.

#### 6.2. Responsibility and coordination between key stakeholders

It is important to divide the responsibility of the analysis between the dry run responsible party and the NRA. These two stakeholders are the key parties in interpreting and analyzing the dry run outcome. However, it might be that the NRA only gets a secondary role assigned. Likewise, it is important to establish the content and the periodicity of data and reports the dry run responsible party needs to produce.

Furthermore, based on the obtained information and own analysis, the NRA needs to assess the successful completion of the dry run. For this purpose, a declaration of market readiness from the dry run responsible party is necessary. The NRA might even require final acceptance from the other involved stakeholders, including the TSO. It is of utmost importance that the readiness of involved stakeholders is ensured before moving to the go-live phase.

In this sense, it is important to have continuous communication between the NRA and the dry run responsible party. This would avoid misalignment or non-acceptance of a dry run shortly before the

go-live deadline. Further, a collaborative approach between the NRA and dry run responsible party with periodical meeting is recommended (e.g., in the form of workshops or steering committee) to:

- Monitor and evaluate the completion of key milestones in the project timeline and underlying processes
- Evaluate reports on delays or concerns of other parties related to the readiness of the entire process
- Ensure that a sufficient level of knowledge has been achieved by market participants or decide if more capacity building (training/tests) is needed
- Generate qualitative and quantitative reports aggregating the information about the dry run progress
- Make the final go-live decision or introduce needed adjustments to the timeline/plan

In addition to assessing the exit criteria, gathering the stakeholders' view of the situation provides added ratification on the successful dry run completion. This is done to get solid support and lower the risk that some parts of the business processes are not ready. The level of involvement and mandate of the market participants should be designed such that they should not have the mandate to delay or halt the implementation. Table 5 provides a suggested layout for an approval and acceptance structure.

	· · ·	
Required Approval	Market operator/TSO acceptance	NRA acceptance
Technical approval		
- Trading platform provided performance (i.e., access,		
security, reliability) as expected		
- Software performed as expected		
- Communication means were effective		
- Data dissemination channels performed as expected		
- Interface and data exchange between the trading		
platform and other system components worked as		
expected		
- Supporting IT system delivered needed functionality		
Operational approval		
- Market operator managed trading platform		
successfully and handled business processes on time		
- The participants used trading platform successfully		
Regulatory approval		
- Operation of the trading platform run was in		
accordance with the valid regulatory framework		
Legislation approval		
- Operation of the trading platform was in accordance		
with the valid legal framework		
Market participants readiness		
- Market participants showed a level of knowledge that		
enabled their successful operation on the trading		
platform		

#### Table 4. Collaborative approach to dry run acceptance (example of signatures form)

#### 6.3. Risks and mitigation measures

Throughout the dry-run process, the party responsible for the dry run as well as the NRA should carefully monitor for correct implementation of the new market design; proper performance of all IT and communication systems; and the sufficient understanding of the new rules, processes, and systems by market participants and their ability to successfully deal with them.

The NRA should also probe for market manipulation and market inefficiencies during the dry run and where necessary, suitable mitigation measures should be explored and implemented. Depending on the severity of any issues observed and the time required to resolve them, this may even require an extension of the dry run and a delayed go-live phase for the new market framework.

For illustration, Table 4 shows a few examples of possible risks and countermeasures.

Risk	Mitigation measures
The capacity building process is unsuccessful -	Monitor the success of capacity building,
market participants fail to gain sufficient	identify areas not well understood, and provide
knowledge about the new market	additional training in identified areas.
arrangements, processes and/or IT systems.	Reconsider training tools and engagement
	measures.
IT and/or communication systems do not	Identify and resolve root causes, engage into
provide expected functionality, reliability,	additional testing.
efficiency, and confidentiality.	
Market participants have problems accessing	Identify and resolve root causes, engage into
and/or using IT and communications systems.	additional testing. Conduct additional training.
Timing issues – the dry run reveals that market	Review and, where necessary/possible, adjust
timelines do not provide sufficient time for	timelines. Alternatively, review the feasibility of
certain processes.	reducing calculation/processing times.
Implausible and/or inaccontable prices	Povious prising algorithms, implementation and
Implausible and/or macceptable prices	bidding behavior. Where applicable assess
	susceptance to market power/manipulation
	susceptance to market power/manipulation.
	As necessary, adjust pricing and algorithms,
	consider bidding/price caps, and provide
	additional training.
Non-intuitive market outcomes that are not	Review the correct implementation of all
well understood by market parties	pricing principles and algorithms and their
······································	vulnerability to manipulation. Explore the
	potential for providing further information and
	increase transparency of pricing. Assess the
	need to adjust pricing principles.
Inability of market arrangements to deal with an	Review, amend, and/or expand fallback
extreme/unexpected situation	measures and solutions
	incasti es and solutions.
Observation of extreme and/or inefficient	Review bidding, clearing, and pricing rules and
market outcomes	algorithms. Assess their frequency and impact
	and decide on the possibility to accept such
	outcomes. Where necessary, explore the need
	tor (limited) modifications of pricing rules.

#### Table 5: Illustration of potential risks and possible mitigation measures

#### 6.4. Perspective of the dry run responsible party

In this section, the perspective of the dry run responsible party (market operator or TSO) is discussed. The dry run responsible party has a wide range of parameters and criteria to assess the dry run. In this sense, waiting for the end results of the dry run phase might not be appropriate to identify issues that are visible early on. The dry run responsible party will be controlling most of the data generated during dry run. Thus, it is proposed that the dry run responsible party establish three main focus areas for the quantitative/qualitative interpretation and analysis phase. The dry run responsible party should report to the NRA, and in a briefer format to other stakeholders.

• Firstly, the **IT system and related topics**: The dry run process allows the dry run responsible party to confirm the well-functioning of all IT and business processes in simulated but realistic conditions and should, therefore, be an ultimate feasibility check to identify and mitigate IT issues. The outcome should be a report on mitigation measures for identified IT

issues and the resolution process using a dedicated tracking tool to monitor of the dry run process.

- Secondly, the **market design and functions**: The dry run process is conducted to evaluate market design aspects and market impacts in case of changes in the market design and to implement corrective measures that prevent undesired outcomes. The outcome should be a report on economic impact covering effects on volumes, price, competition, etc. As mentioned previously, sufficient participation and realistic bidding behavior are pre-conditions to obtain meaningful results.
- Thirdly, **operational aspects** such as timing and business processes: The dry run process allows the dry run responsible party to assess the entire operational process and subprocesses prior to the go-live phase. This includes evaluating the fulfillment of the stipulated timing schedules and communication processes with different stakeholders, including exchanging data. In this regard, the dry run allows for the training of stakeholders and knowledge testing, and in this way, creating trust in the market implementation process. The occurrence of operational issues is common during the dry run process and should be reported to the NRA. Identified gaps may require amendments in the communication process or additional capacity building (e.g., organizing training sessions before the execution of the next dry run session).

Moreover, reporting and data sharing is normally done in different timeframes and subject to different levels of analysis. While no analysis can be provided for real time data, weekly or monthly reports or market readiness reports should include detailed interpretation and analysis of results. Similarly, some issues can be detected or followed up in daily reporting.

Types of reports			
<b>Daily reports</b> Provision of a predetermined daily data (short-term) report – include			
	provision of relevant daily data		
Weekly or monthly Provision of predetermined weekly or monthly reports, or reports a			
reports	the end of the dry run in case of a shorter execution phase – includes		
	provision of a more detailed analysis and data		
Market readiness	Qualitative and quantitative report aggregating the information about		
report	the dry run process, including recommendations on the final go-live		
	decision or needed adjustment of the timeline/plan		

Table 6. Type of reports and data access

#### 6.5. Perspective of the NRA

In this section, the role of the NRA in the interpretation and analysis phase is detailed. The NRA will need to verify the success (or indicate failure) of the dry run objectives and approve market launch. For the NRA, it will be important to ensure market data transparency and availability of data and results. In addition, non-discrimination of participants (fairness) and the existence of a competitive market needs to be verified.

This means that all the market participants are treated equally, and competitive market behavior is observed. The NRA shall also assess the communication process and feasibility of the time schedule used in the market operations. Another important check is to confirm that confidential information is handled properly, and that data is not being disclosed to the wrong parties.

The following figure presents the three main fields of analysis under the NRA's responsibility.

Market impact of market design	<ul> <li>Price volatility, price convergence across regions (in case of market coupling or market splitting), bids/offers reflect (reasonably) the economics of resources</li> <li>Traded volumes and market liquidity reflects healthy bidding behavior (supply and demand)</li> <li>Bidding strategy is coherent</li> </ul>
Competition assessment	<ul> <li>Participation levels in different markets (e.g. bilateral market, DAM or BMs)</li> <li>Behavior analysis according to portfolio conditions for each participant</li> <li>Concentration of market power and price responsiveness</li> </ul>
Communication process and data exchange	<ul> <li>Templates are used correctly and include all necessary data for market operations and related analysis</li> <li>Transparency of dry-run results (activated bids, prices, energy) is achieved without compromising data confidentiality to encourage realistic bidding</li> </ul>

Figure 14. Main fields of analysis by the NRA

#### Source: DNV

It is advisable that the NRA create a monitoring team to oversee the dry run and build capacity before market implementation. Typically, the monitoring team should be small in size and is bound to a confidentiality agreement to avoid any information leakage. The main tasks to be covered by the monitoring team are listed below:

- Develop tools and templates for the monitoring process. Through the dry run process, additional data needs could be identified.
- Collect additional (relevant) information to perform effective analysis from complementary sources (i.e., from the market operator or the TSO).
- Interpret results and identify unrealistic outcomes. In case of unrealistic outcomes, the NRA should interact with participants to clarify the situation and avoid any future market abuse (i.e., individual engagement). This could serve to define bids and offers ranges and sets alerts for the unrealistic behavior of specific participants.
- Compare the bidding behavior of participants with real market operation to identify inconsistencies
- Assess if established market rules are applied
- Monitor the overall readiness of participants by asking market participants to self-assess their progress by completing questionnaires or by using a certification process.
- Participation in the dry run process is typically voluntary but could be mandatory if market
  participation is mandatory. In case of low participation in the dry run, measures to increase
  engagement should be implemented and making dry run participation mandatory can be an
  option. A significant level of participation from generators and major suppliers should be part
  of the dry run process. Depending on the market (DAM, IDM, or BM), different levels of
  participation are needed. For instance, for the DAM, significant participation is required to
  obtain meaningful results, whereas an IDM dry run can be conducted with far less participation.
- Flag risks or concerns, define mitigation strategies, and communicate them to the dry run responsible party (or steering committee).

#### Text box 6-1: Turkey Dry Run Example: Participation issues and limited role of the NRA

Turkey has a long experience with implementing dry run processes in the electricity sector. The first dry run took place before August 2006 when the merit-order based dispatch was implemented. During the first dry run, capacity building and acceptance from participants were the key objectives. Since then, four additional dry run processes have followed. Today, Turkey has an operational wholesale (portfolio-based DAM and IDM) and BM.

Participation in the dry run was always voluntary, which led to participation issues at the beginning. Some relevant IPPs tried to slow down the market opening by resisting participation in the dry run and attempted to postpone the new market design. Nevertheless, the NRA and the TSO showed full commitment to the new market design and dry run process, which subsequently resulted in a high participation level.

Turkey's experience shows that, if not managed, the market participant's attention and active participation in the dry run process only happens during the final month before market opening. In Turkey, this resulted in the identification of new flaws at a late stage of dry run and the need to extend the dry run period.

Figure 15 presents the different dry run process implemented in Turkey. In some of these dry runs, there was no pre-set market opening, and the market opening was conditioned on the market operator's notice of the dry run's successful completion to the regulator, the Energy Market Regulatory Authority (EMRA). In contrast, during some of the other dry runs, market opening was set to a specific date and the dry run period was predefined.

EMRA was not involved in the dry run process and there were no reporting requirements to EMRA during the dry run. However, after having to postpone the implementation of new rules and expand the dry run in 2009, EMRA used staff-level frequent visits to the market operator to observe and monitor dry run activities. In rare occasions, EMRA also formally inquired about the dry run process.



## 7. Summary of recommendations for the dry run

The following is a summary of recommendations about the involvement of the NRA during the dry run.

- The reasonability of bids and offers and consequent clearing data need to be analyzed by the dry run responsible party and the NRA. This should be done during joint sessions within the confidentiality and frequency defined in the preparatory phase (e.g., once per day or once every three days, etc.). The NRA may decide not to include some data in the dry run results due to lack of quality and plausibility.
- The NRA and the dry run responsible party should be particularly interested in the functioning
  of the chosen market design, applicability of market rules, and day-to-day operation of business
  processes defined in operational procedures. These topics should be analyzed critically to
  identify if any improvement measures are needed. If agreed upon, market rules and/or
  operational procedures may be amended during the dry run so that new design changes could
  be tested in the continuation.
- The NRA should assess if participants in the market segment have built their capacity and understanding regarding the related market segment and trading platform, which would enable them to successfully conduct market operations. This can be evaluated in different ways (such as questionnaires, certifications, or tests). In case of inadequate knowledge level at the end of the dry run, additional capacity building might be required before the go-live phase.
- During the dry run execution, the NRA should monitor the dry run, focusing on the functioning of the market segment and general analysis of the market data. The NRA could even request information about software (and hardware) issues to gain understanding about (un)readiness of the platform for successful market segment operation. It is recommended that the NRA is involved in monitoring the dry run sessions with regard to market segment supervision, plausibility, and the usability of market results for describing market trends during the dry run period and the well-functioning of market procedures. Another benefit of the NRA's close involvement in the dry run process is a probable increase in the level of market participants' responsiveness and seriousness when participating in the dry run.
- It is necessary to track the progress/success of the dry run execution, keeping in the mind success criteria (exit criteria) defined in the preparatory phase. In case the progress of the dry run execution is not going as well as predicted or is not satisfactory in a particular area (such as capacity building, trading platform readiness, reasonability of market output, etc.), it may be necessary to modify the execution schedule in a manner that will remove spotted deficiencies and put the market segment back on track. In coordination with the dry run responsible party and in consultation with the stakeholders, the NRA would adopt the decision to extend the dry run execution. If the NRA concludes that the exit criteria defined in the preparatory phase for the dry run is fulfilled, the dry run execution can be declared as successfully completed

## Annex: Country experiences with dry runs

In this chapter, the dry run experiences of Georgia, Turkey, Greece, and Ireland are briefly described. The objective is to add practical knowledge on different dry run processes and reflect the NRA's role in the respective dry run. As mentioned before, each dry run process needs to be adapted to the market conditions and the objectives of each country. Thus, these country experiences should be taken as examples.

#### I.I. Georgia

The dry run process in Georgia started in July 2020 and is ongoing.<sup>13</sup> Since its beginning, it has encompassed several trading and simulation sessions for the DAM, IDM, and BM. The main objectives of the dry run process are to check system readiness (e.g., interconnection between platforms and data exchange), build capacity among market participants, and verify market design assumptions (e.g., price formation, bidding strategies, etc.) before the go-live phase. All in all, the dry run process aims to create trust in the market implementation process.

Before executing the dry run process, a general legal framework of market operation was developed, namely the December 2019 Law of Georgia on Energy and Water Supply designed in compliance with the Third Energy Package. Subsequently, the electricity market concept design and electricity market rules for DAM, IDM, and the balancing and ancillary services market were defined. These legal documents provided the framework for market opening and set the requirements for market participation.

In preparation for the dry run process, capacity building sessions for market participants were organized covering key subjects such as the electricity market legal and regulatory framework, bidding strategies, portfolio management, and risk management. As a next step, market participants' electronic registration to the trading platform was made possible. This allowed participants to become familiar with the operational processes of the platform and strengthen the usage experience (e.g., trading, data requirements, upload the templates and data etc.). The responsibilities were distributed among market operators, the Georgian National Energy and Water Supply Regulatory Commission (GNERC), and market participants as reflected in the following table.

Activity	Responsible	Participating		
Dry run operation	Market operators (DAM/IDM and BM)			
Overseeing and monitoring the dry run	Market operators (DAM/IDM and BM), GNERC			
Ensure familiarization of the systems and market procedures	Market operators (DAM/IDM and BM), GNERC	Existing and potential market participants		
Bidding behavior and strategy	Market Participants	Existing and potential market participants		
Capacity building and training	Market operators (DAM/IDM and BM), GNERC	Existing and potential market participants		
Technical support	Market operators (DAM/IDM and BM)			

Source: NARUC dry run webinar – Case of Georgia, GNERC, 2021

<sup>&</sup>lt;sup>13</sup> The 1st of March 2022 commencement of go-live phase is planned.

In Georgia, dry run participation is voluntary, and participants have the possibility to trade in the dayahead market, close bilateral contracts (e.g., OTC) only for daily nominations of imbalances, and trade in the BM. A pre-requisite is that participants are registered with the respective market operators. For this purpose, the market operators provide support with the login and submission processes. Non-key market participants that have not registered are bundled in a "dummy" residual portfolio group.

Initially, a total of six simulation sessions have been performed, specifically three sessions in the DAM with the allocation of specific roles and conditions (scenarios) and three sessions in DAM, BM, and IDM with real market participants roles and portfolios. In the following months (until market opening), one-day, three-day, and longer dry run sessions are foreseen. In this sense, GNERC has suggested three months of activity in simulation mode.

The time schedule of a dry run sessions in Georgia looks as follows:

- One week before delivery, the BM takes place.
- Two days before physical delivery, OTC nominations are delivered to the DAM operator.
- One day before delivery, the DAM takes place and results are sent to the BM market operator.
- One day after physical delivery (once the metering information of each balancing group is available), imbalances are calculated by the BM market operator. Proforma invoices are generated but no financial payments or physical obligations are required during the dry run process.

An important part of the dry run is the interpretation and analysis of results. Here, the market operators analyze the submitted bids and offers, which should reflect participants' logical behavior in accordance with the respective portfolio and technical conditions. Besides, through the analysis of result it can be determined if there is a need for more capacity building (for instance, with regard to the applicability of market rules or use of the platform). Furthermore, market operators are interested in bug-free system functioning and therefore try to identify any technical obstacles during the different dry run sessions.

The role of the NRA during the dry run is to monitor the process and continue developing its monitoring tools and templates. In Georgia, the NRA has also taken the role of a market participant during specific sessions in order to gain technical and organizational experience. For the result analysis, the NRA receives the data from market operators after each session to evaluate potential market abuses.

Throughout the dry run, the NRA can adjust the list of information that the market operators are required to send. In case of suspicious bidding behavior, the NRA interacts directly with market participant to understand the reasons behind the behavior. The intention here is to enable market participants to understand the monitoring process and experience it.

It is important to point out the collaborative approach between the NRA and dry run operators in Georgia. In fact, the parties jointly monitor capacity building needs and obstacles that appear during the operational procedures.

So far, the main challenges in the Georgian dry run process have been:

- Technical problems in data exchange processes between different software
- Capacity building of market participants to prepare bids (buy or sell electricity). The Georgian
  DAM does not have complex bid structures like block bids which results in challenges for
  thermal generators. Furthermore, Georgia is a hydro heavy country and calculating the
  opportunity cost of hydro resources constitutes another challenge. Thus, Georgia is in the
  process of collecting global experiences and assessing how to apply a suitable approach.

### I.2. Turkey

Turkey has a long experience with implementing dry run processes in the electricity sector. The first dry run took place before August 2006 when the merit-order based dispatch was implemented. In the first dry runs, capacity building and acceptance from participants were key objectives. Since then, four additional dry run processes have followed.

Today, Turkey has an operational wholesale (portfolio-based DAM and IDM) and BM. Participation in the dry run was always voluntary which led to participation issues at the beginning. However, after initial resistance from key IPPs, a high level of participation was achieved. The following figure presents the different dry run process implemented in Turkey.



#### Figure 16. Turkey dry run processes

#### Source: NARUC dry run webinar - Case of Turkey, NARUC, 2021

In some of these dry runs, there was no pre-set market opening, and the market opening was conditioned on the market operator's notice of the dry run's successful completion to the regulator, the Energy Market Regulatory Authority (EMRA). In contrast, during some of the other dry runs, market opening was set to a specific date and the dry run period was predefined.

EMRA was not involved in the dry run process and there were no reporting requirements to EMRA during the dry run. However, after having to postpone the implementation of new rules and expand the dry run in 2009, EMRA used staff-level frequent visits to the market operator to observe and monitor dry run activities. In rare occasions, EMRA also formally inquired about the dry run process.

The five dry runs performed in Turkey reflect following key lessons and challenges:

- The main objectives of the dry runs were performing software testing (e.g., development of load profiles application software), allowing for participant capacity building, and increasing the operational capability of the TSO.
- Some relevant IPPs tried to slow down the market opening by resisting participation in the dry run, and tried to postpone the new market design. Nevertheless, EMRA and the TSO (DAM operator until 2015) showed full commitment to the new market design and dry run process, which subsequently resulted in a high participation level.
- Ensuring participation is of utmost importance, especially in DAM and BM where a critical mass for meaningful market results is needed. The participation in the IDM dry run can be

lower due the nature of this market. Thus, dummy participants and bids were used in the IDM dry run to facilitate the process.

- Experience shows that attention to and active participation in the dry run happens during the final month before market opening. This may result in the identification of new flaws and the need to extend the dry run to avoid the appearance of severe real-time issues.
- After some technical problems with existing market software (for clearing the market), an inhouse DAM software was developed. An in-house software gives the possibility of making quick updates whenever necessary. A parallel run allowed for testing of the software before implementation.

#### I.3. Greece

In 2020, immense changes were implemented in Greece's electricity market architecture. A mandatory pool, which was based on the mandatory participation of producers, was replaced with a voluntary DAM. In this new setup, bilateral contracts are allowed, energy financial products are traded, and the settlement process is improved. The changes contributed to the further development of competition in wholesale and retail market.

Within this setup, two operators are responsible for operating the different market segments: the Hellenic Energy Exchange<sup>14</sup> (HEnEx) operates financial energy products, the DAM and the IDM, while the Independent Power Transmission Operator (IPTO - ADMIE) operates the BM. EnExClear, a subsidiary of HEnEx, is responsible for the clearing and settlement of transactions concluded in the DAM and IDM, as well as the clearing and settlement of positions in the BM.

A binding timeline (Table 8) was established by two Ministerial decisions<sup>15</sup> and a decision by the Regulatory Authority for Energy (RAE) to set the starting date of the new market segments. Initially, September 17, 2020, was planned as a starting date. The RAE monitored the implementation of the timeline and proceeded to all necessary actions for the operators to adhere to the foreseen timelines and for the market participants to provide input during this process.

Mark	Subject	Duration (year 2020)
Α	Submission of regulatory documents by IPTO, HEnEx, and	January - March
	EnExClear to RAE for approval	
В	Contracts signing (HEnEx, IPTO, EnExClear)	January - March
С	IT system completion and independent tests of each operator with market participants	January - June
D	Common integration tests of all IT Systems (HEnEx, IPTO, EnExClear) for trading/clearing	June - July
E	Dry run for both trading and clearing in DAM, IDM, and BM	August - September
F	Go-live start	November

#### Table 8. Dry run Greece - binding deadlines in final timeline<sup>16</sup>

Source: NARUC dry run webinar – Case of Greece, RAE, 2021

<sup>&</sup>lt;sup>14</sup> EnExGroup consists of Hellenic Energy Exchange S.A. (HEnEx S.A.) and EnEx Clearing House S.A. (EnExClear S.A.) As a part of the EnEx Group, HEnEx is designated by RAE as NEMO.

 $<sup>^{\</sup>rm 15}$  In accordance with the legal framework

<sup>&</sup>lt;sup>16</sup> Initially, it was planned that the go-live phase would start on September 17, 2020. However, after RAE's decision, the dry run period was extended, and the commencement of the go-live phase was postponed to November 1, 2020.

The operators were required to submit progress reports to the Ministry and the regulator on the evaluation of results of the trial tests as well as declarations of contractual and technical readiness. RAE issued 60 decisions for the operation of the three new markets (DAM, IDM, BM) including a major revision of the Electricity Network Code in line with the provisions of the EU Target Model.<sup>17</sup>

Dry run tests were executed from August 3 till September 7, 2020, as initially planned. The main objectives of the dry run were:

- Assess market procedures, timings and reports
- Conclude any remaining technical deviations
- Test near-actual market conditions
- Fine-tune any modalities before the beginning of the go-live phase

During this period, the operators – each for its own market segment(s) – monitored day-to-day operation of the platform(s), supported market participants on technical issues, and evaluated market participation and market results. Market participants were responsible for self-evaluating the results of their participation in the market.

In September 2020, RAE initiated a public consultation on the starting date of the new market segments after the receipt of the technical and operational progress reports from HEnEx and IPTO and letters from the stakeholders.<sup>18</sup> Based on the received input, it was concluded that the dry run period was not sufficient, and the NRA decided that the first physical day of delivery for the new market segments should be November I, 2020.<sup>19</sup> An additional six weeks of dry runs was implemented to address key remaining issues: participants' on-boarding, IT systems' improvements, improvement of balancing reports and submission of amendments for regulatory approval based on dry run results.

#### I.4. Ireland

The system in Ireland is operated by EirGrid plc/SONI Ltd<sup>20</sup> as TSOs/market operators. In 2014, the regulatory authorities in both Northern Ireland and Ireland developed a detailed wholesale market design, which was implemented by the TSOs. The I-SEM had the objective to fully facilitate coupling with the electricity market in the rest of the EU with go-live in May 2018. The new I-SEM arrangements include six markets or auctions (the DAM, the IDM, the BM, the capacity market, rights FTR auctions, and a forward market) spanning over different trading timeframes with separate clearing and settlement mechanisms.

The new market arrangements triggered changes to the regulatory framework as well as fundamental changes to the systems and processes. The NRA worked with EirGrid plc/SONI Ltd to coordinate activities and provide a consolidated readiness function for I-SEM. Market readiness monitoring and reporting processes were carried out collectively by the NRA and EirGrid plc/SONI Ltd. In this sense, they were responsible for participant readiness, with the TSOs managing systems readiness and the NRAs managing market readiness.

Through the Market Readiness Assessment process, reports were regularly provided to go-live decision makers including the I-SEM Steering Group and the SEM Committee. The I-SEM Steering

 $<sup>^{\</sup>rm 17}$  Greece is the last EU country to implement this transition.

<sup>&</sup>lt;sup>18</sup> The Public Power Corporation, the Hellenic Association of Independent Power Producers, the European Federation of Energy Traders, and the Hellenic Association of Electricity Trading and Supply Companies.

<sup>&</sup>lt;sup>19</sup> Instead of the September I7, 2020 as initially planned

<sup>&</sup>lt;sup>20</sup> EirGrid Group is the independent TSO in Ireland and Northern Ireland, through EirGrid and SONI, respectively. SEMO is part of the EirGrid Group and operates the I-SEM across the two jurisdictions. For more information, visit:

<sup>&</sup>quot;About Us." EirGrid Group. <u>https://www.eirgridgroup.com/site-files/library/EirGrid/Section-A-Who-we-are-and-what-we-do-(1).pdf</u>

Group was responsible for deciding whether to proceed with significant aspects of the project and making a recommendation to the SEM Committee about the final I-SEM go-live decision.

The NRAs and TSOs established a Market Readiness team and published a Market Readiness Reporting Strategy and Market Readiness Reporting Plan. These documents provided the basis of how the program interacted with all participants. EirGrid plc/SONI Ltd's work involved developing a wide range of metrics to build a comprehensive view of I-SEM market and market participant readiness. The metrics covered the main components of the market arrangements, such as legal arrangements and systems and business processes.

In addition, market participants were asked to voluntarily self-assess their progress toward readiness by completing online questionnaires. This information was aggregated by EirGrid plc/SONI Ltd and the output was then discussed with the NRAs. While EirGrid plc/SONI Ltd were responsible for coordinating and publishing the results of the market readiness surveys, the NRAs oversaw the process, queried the results, and ensured that any risks or concerns were flagged and explained. As an example, the survey results about the DAM and IDM readiness are presented in the following figure.

Readiness Status by Metric and Participant Category							
Day-Ahead & Intraday Markets		Market Participants	ICOs	MDPs	System Operators (incl. CM Delivery Body)	Market Operator (incl. Nemo)	EirGrid/SONI as AoLR
Readi	ness Per Participant Category						$\bigcirc$
A	Readiness of Business Strategy, Planning, and Financial Resources						
в	Readiness of Legal and Contractual Framework: Agreements and Contracts						
с	Readiness of Systems	<b>•</b>					
D	Readiness of Business Processes and Procedures						
E	Readiness of People and Organisation						
F	Readiness of IT infrastructure and Other Facilities						
G	Registration						
н	Market Trial: Preparation						
I	Market Trial: Management & Reporting				$\bigcirc$		
ı	Market Trial: Execution	$\bigcirc$			$\bigcirc$	$\bigcirc$	€
к	Deployment of back-end systems to support FTR market						
ι	Deployment and Transition to live: Planning & central market processes and systems				$\bigcirc$	$\bigcirc$	$\bigcirc$
м	Deployment and Transition to live: Participants						

Figure 17. Day-Ahead and Intra-Day readiness report<sup>21</sup>

Source: I-SEM Project Managers' Group, 20 July 2017

As part of the preparation phase, the NRAs identified critical events and provided a high-level roadmap for each event and a number of milestones that market participants must meet. In the following figure, the key activities and milestones associated with the "pathway to market trials" event are illustrated.



Figure 18. Pathway to Market Trials

Source: I-SEM - High Level Framework for I-SEM Go-Live Readiness, 20 January 2017

<sup>&</sup>lt;sup>21</sup> MDP: Meter Data Providers; AoLR: Agent of Last Resort

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