



# *Legal and Regulatory Developments on Energy Storage*

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# Transposition of the Electricity Directive (EU) 2019/944 to the Greek Law 4951/2022

# Definitions for Storage in the “Electricity Directive” Directive (EU) 2019/944

**‘energy storage’** means, in the electricity system, deferring the final use of electricity to a moment later than when it was generated, or the conversion of electrical energy into a form of energy which can be stored, the storing of such energy, and the subsequent reconversion of such energy into electrical energy or use as another energy carrier;

**‘energy storage facility’** means, in the electricity system, a facility where energy storage occurs.

**‘fully integrated network components’** means network components that are integrated in the transmission or distribution system, **including storage facilities**, and that are used for the sole purpose of ensuring a secure and reliable operation of the transmission or distribution system, and **not** for balancing or congestion management;

# Definitions for Storage in the Greek Law 4951/2022

(unofficial translation)

- *Definitions for*

**Electricity storage**: the postponement of the final use of electricity at a time subsequent to its production, with converting it into a form of energy that can be stored, the storage of said energy and the subsequent re-conversion of said energy in electricity.

**Electricity storage station or storage station**: All the facilities connected to the Transmission System or the Electricity Distribution Network, including pumped storage stations and hybrid stations, and perform exclusively the function of storing electricity.

- Definition for **License of Electricity Storage**
- Definition for **Pumped Storage Hydro Stations**
- Definition for **Hybrid Stations (RES + Storage)** only for the non interconnected islands and Crete

**Energy storage clauses have been incorporated in Greek law, with special emphasis on electricity storage**

# Ownership of Electricity Storage by the TSO

(exact transfer of the provisions of the Electricity Directive in the Greek Law)

1. **TSO shall not own, develop, manage or operate energy storage facilities.**

2. By way of **derogation**, the TSO may own, develop, manage or operate energy storage facilities,

i. where they are **fully integrated network components** after **RAE's approval**, or

ii. where all the **following conditions are fulfilled**:

(a) **other parties**, following a **tendering procedure** approved by RAE have **not** been awarded a right to own, develop, manage or operate such facilities, or could not deliver those services at a reasonable cost and in a timely manner;

(b) such facilities or **non-frequency ancillary services** are necessary for the TSO to fulfil his obligations for the operation of the transmission system and they are **not used to buy or sell electricity in the electricity markets**; and

(c) **RAE has assessed the necessity of such a derogation**, has carried out an *ex ante* review of the applicability of a tendering procedure, including the conditions of the tendering procedure, and has granted its approval.

RAE may draw up guidelines or procurement clauses to help the TSO ensure a fair tendering procedure.

# Ownership of Electricity Storage by the DSO

(exact transfer of the provisions of the Electricity Directive in the Greek Law)

1. DSO shall not own, develop, manage or operate energy storage facilities.
2. By way of **derogation** the DSO may own, develop, manage or operate energy storage facilities,
  - i. where they are fully integrated network components after RAE's approval, or
  - ii. where all of the following conditions are fulfilled:
    - (a) other parties, following a **tendering procedure** approved by RAE, have not been awarded a right to own, develop, manage or operate such facilities, or could not deliver those services at a reasonable cost and in a timely manner;
    - (b) such facilities are necessary for the DSO to fulfil their obligations for the operation of the distribution system and the facilities are **not used to buy or sell electricity in the electricity markets**; and
    - (c) RAE has assessed the necessity of such a derogation and has carried out an assessment of the tendering procedure, including the conditions of the tendering procedure, and has granted its approval.

RAE may draw up guidelines or procurement clauses to help distribution system operators ensure a fair tendering procedure.

# 2

## New licensing procedure



# Types of Electricity Storage Stations and their License evaluation procedure

- 1. Standalone Electricity Storage Stations (BESS):** Evaluation according to the criteria of Law 4951/2022 and the License Regulation for Electricity Storage (to be issued). Are awarded Electricity Storage License for 25 years.
- 2. Pumped-Hydro Storage Stations (PHS):** Evaluation according to the criteria of Law 4951/2022 and the License Regulation for Electricity Storage (to be issued). Are awarded Electricity Storage License for 35 years.
- 3. Hybrid stations** (awarded license for 25 years)
  - 1. Electricity Storage (BESS) + RES Stations without ability to charge from the network:** Evaluation according to Law 4685/2020. Are awarded “RES Certificate” for 25 years.
  - 2. Electricity Storage (BESS) + RES Stations with ability to charge from the network:** Evaluation according to Law 4685/2020 as a **special project**. Are awarded “RES Special Project Certificate” for 25 years.
  - 3. Hybrid Stations (BESS + RES) for the non interconnected islands and Crete:** Evaluation according to Law 4685/2020 as a **special project**. Are awarded “RES Special Project Certificate” for 25 years.

# New Licensing Criteria for the Standalone Electricity Storage Stations

The licensing criteria for the standalone electricity storage stations (BESS) according to the Law 4951/2022 are:

- Objections notified to RAE in any way related to:
  - a) National security, b) public health and safety, c) the protection of the environment.
- Energy efficiency
- Economic viability of the project (IRR)
- Technical capability of the applicant
- Financial capability of the applicant
- No health and safety issues regarding the installation itself and regarding the equipment of the network and/or the system.
- the operational constraints which the project undertakes to satisfy, in order to become possible to connect to congested networks, accompanied by assessment of their impact on activity and in the business plan of the project.

# Licensing Administrative Challenges for RAE

**RAE strongly supports and implements the removal of regulatory barriers for participation in the electricity market:**

- **By July 2022**, RAE had already licensed **337 licenses** with total capacity of **23.5 GW** [Standalone BESS, Mix (RES+BESS) and PSH]. Most of them were standalone battery systems issued between Jan 2021 and July 2022.
- Law 4951/2022 **repealed all these licenses** which must be updated in order to incorporate various power and capacity characteristics of the electricity storage facility.
- The updated License includes a variety of technical characteristics with regards to power and capacity of the storage facility.
- RAE considers this as an unnecessary administrative load for the update of the existing licenses.

# Innovative Projects Licensing Challenges for RAE

- **The Electricity Directive** uses the term “**Energy Storage**”.
- **The Greek Law** uses the term “**Electricity Energy Storage**”.

RAE considers innovative technologies in their licensing process

- Innovative **hydrogen projects** incorporating RES, electrolyzers, hydrogen storage tanks and fuel cells (Law must be updated to extent natural gas terms to hydrogen and alternative gases)
- **Synchronous electricity energy storage** units (synchronous condensers with or without freewheel)
  - This technology is about storing energy in the magnetic field of a reactor as opposed to the non-synchronous electricity storage units that use inverters (batteries).
- Rest of energy storage technologies such as **Compressed Air Energy Storage**



3

# Connection to the Grid Priority

# Connection to the System Priority Groups/Subgroups

Group A RES/HECHP	A1 30km from the borders	A2 Strategic Investments	A3 West Macedonia All projects per investor	A4 RES > 150MW RES with direct subsea cable	A5 RES + Storage >300 MW, >250MWh	A6 Wind Parks	A7 Megalopoli	A8 Epirus > 50MW	A9 West Greece, >20MW	A10 East Macedonia Thrace PV>50 MW Wind> 20MW
Group B RES/HECHP	With PPAs									
Group C RES/HECHP	C1 Energy Communities with Local Governments	C2 Energy Communities Kozani, Florina >100MW	C3 Wind Parks <=6MW	C4 Private Energy Communities Kozani, Florina	C5 Energy Communities East Macedonia, Thrace	C6 Energy Communities West Greece				
Group D	D1 RES + Storage <u>without</u> ability to charge from the network					D2 RES + Storage <u>with</u> ability to charge from the network				
Group E	E1 HECHP	E2 Biomass, Biogas	E3 Small Hydro	E4 Geothermal	E5 Wind Park	E6 PV on buildings	E7 Self Generators	E8 Offshore Wind		
Group F	Rest of RES/HECHP									
Group Parallel to C	P1 Biogas from waste sites	P2 RES/HECHP Self generators, no surplus energy to the network	P3 HECHP	P4 Biomass, Biogas	P5 Small Hydro	P6 Geothermal	P7 Solar Thermal	P8 Offshore Wind	P9 Mix RES+ Storage before Law 4821/2021	

# Connection to the **Network** Priority Groups

Group A	Group B	Group C	Group D	Group E
<ul style="list-style-type: none"> <li>-Biomass from waste land</li> <li>-Pilot sea floating PV projects</li> </ul>	<ul style="list-style-type: none"> <li>-Agricultural Biomass &lt;=3 MW</li> <li>-Biogas&gt;=3 MW</li> <li>-Innovation CRES projects</li> <li>-Self Gen / Net metering</li> <li>-Self Gen/Virtual Net Metering</li> <li>-PV Energy Com. Virtual Net Metering</li> <li>-Small Hydro &lt;=500 kW</li> <li>-Geothermal</li> </ul>	<ul style="list-style-type: none"> <li>-RES projects by irrigation Organizations</li> <li>-HECHP distance heating, agricultural use</li> <li>-PV/Wind non-profit Energy Com</li> <li>-Self Gen. RES/HECHP, LV connected</li> </ul>	<ul style="list-style-type: none"> <li>PV/Wind Energy Com for. Profit</li> </ul>	<ul style="list-style-type: none"> <li>All the rest</li> </ul>

Electricity storage installations are allowed in relevant groups, where RES are allowed

# RAE Guidelines to System and Network Operators

## Transparency on Grid Connection Terms – Deadline 30/09/2022

(List of applications for connection terms ought to be published by Operators in their website, using the following template by 30/09/2022.

If not published, hearing process will be initiated towards imposition of fines)

### ΠΑΡΑΡΤΗΜΑ

Πίνακας (ενδεικτική μορφή)

Αριθμός Πρωτοκόλλου Αίτησης στον Διαχειριστή	Αριθμός Πρωτοκόλλου ΡΑΕ (ΑΔ-XXXXX)	Ημερομηνία κατάθεσης Αίτησης στον Διαχειριστή	Είδος <sup>1</sup>	Εταιρεία <sup>2</sup>	Ισχύς (MW)	Θέση <sup>3</sup>	Κατηγορία <sup>4</sup>	Ημερομηνία έναρξης εξέτασης Αίτησης	Τρέχουσα κατάσταση φακέλου			Ημερομηνία Προσφοράς Σύνδεσης	Ημερομηνία Οριστικής Προσφοράς Σύνδεσης	Προτεραιότητα Σύνδεσης <sup>5</sup>	
									Πλήρης/Ελλιπής	Ημερομηνία	Ημερομηνία ενημέρωσης αιτούντος για τυχόν ελλείψεις			Ομάδα	Υποομάδα

<sup>1</sup> Π.χ.: Fast Track, ΣΔΑΜ, ΚΟΙΝΑ/ΑΠΑΛΛΑΣΣΟΜΕΝΑ, με Βεβ. Παραγωγού.

<sup>2</sup> Καταγράφεται ο νόμιμος εκπρόσωπος σε περίπτωση συλλογικών αιτήσεων.

<sup>3</sup> Θεωρείται πλήρης προσδιορισμός (π.χ. Νομός, Δήμος, θέση).

<sup>4</sup> Καταγράφεται η κατηγορία της επένδυσης (π.χ. Φ/Β, Α/Π, μΥ/Η, Βιομάζα, ΣΗΘΥΑ, Αποθήκευση, Αποθήκευση με ΑΠΕ, Αντλησιοταμίευση, κλπ).

<sup>5</sup> Σειρά προτεραιότητας για τη χορήγηση όρων σύνδεσης βάσει της ΥΠΕΝ/ΓΔΕ/840134/7123 ΥΑ (ομάδα / υποομάδα)



# 4

## Technical Requirements for Grid and Demand Connection

# Requirements for Grid and Demand Connection

The **technology neutrality** in order to trigger competition among storage technologies among various applications and scale thus enhancing innovation and reducing costs.

The **revision of** requirements for grid connection of generators (**RfG**) and on demand connection (**DCC**) **under development**.

Need for new technical requirements for storage because:

- **Storage** units are connected to the grid through **bidirectional converters**, they shouldn't be treated as single power generating units or demand facilities
- **Storage** facility's **configuration** limitations (e.g., **standalone or hybrid sites**) or
- other specifications for **synchronous or asynchronous operation** when connected to the grid.

# 5

## System Operation Requirements

# Energy Availability Requirement (EAR) for FCR service

ENTSOE has expressed its wish to **harmonize the duration of the EAR to either 15 min or 30 min**, which has resulted in a high regulatory risk for batteries.

For a **15 min EAR**, the needed battery sizing is of **less than 1 hour** whereas for a **30 min EAR** it is closer to **1 hour and a half**.

ENTSOE proposes a 30 min EAR for batteries already built, a 1.5 h battery will be necessary to provide the FCR service.

Thus, in an already installed batteries facility of 10 MW and less than one hour, the decision could lead to a **40% revenue decrease** as the asset would only be able to prequalify 6 MW of FCR instead of the initial 10 MW. [The batteries designed with 15-minute discharge duration]

**ACER** (working closely with the NRAs) is expected to issue a **decision by the end of 2022**.

# 6

## Funding Initiatives

# Funding Initiative for Grid Connected Electricity Storage

The European Commission has approved the **Greek state's funding initiative** for **900 MW of energy storage**. Under the state aid rules, **€ 341 million** will be allocated to grid-connected electricity energy storage systems in the form of an investment grant during project construction, followed by annual support during the first ten years of operation. The funding is valued at **380,000€/MW** (378,000 USD/MW). **A competitive bidding process** will be organized to award the project, with awarding date **by the end of 2023** and **projects completion by the end of 2025**.

These projects will partly be funded by Greece's portion of the **EU-wide Recovery and Resilience Plan**, the program to mitigate the negative economic effects of the Covid pandemic. The annual support for each project will be assessed and an adjustment will be made through **a clawback mechanism** if the energy storage units generate **excess market revenues**.

**RAE has already issued RAE Decision 12/2021 (Recommendation) to Ministry of Environment and Energy on the CONE of each technology, including Storage technologies.**

# Funding Initiative for Pumped Hydro Storage in Amfilochia

- The European Commission has **approved**, under **EU State aid rules**, a Greek measure to support the construction and operation of a **pumped hydroelectricity storage facility in Amfilochia**, Greece. The measure will be partly funded by the Recovery and Resilience Facility ('RRF'), following the Commission's positive assessment of the Greek Recovery and Resilience Plan and its adoption by Council.
- The aid will take the form of a **€250 million investment** grant and of an annual support – financed from a levy on electricity suppliers – to complement market revenues, in order to reach an acceptable rate of return on the investment. The supported storage facility will have a capacity of **680 Megawatts (MW)** and will be directly connected to high-voltage transmission lines.

# RAE Decision 12/2021: Characteristics for each technology (CONE)

Πίνακας 2: Στοιχεία υπολογισμού του κόστους κεφαλαίου, των πάγιων ετησίων δαπανών λειτουργίας και του WACC, για τις τεχνολογίες αναφοράς, για το έτος 2022

A/A	Τεχνολογία αναφοράς	Επενδυτικό κόστος [€/kW]	Πάγια έξοδα λειτουργίας [€/kW]	Διάρκεια ζωής [έτη]	Έτη κατασκευής	WACC [%]
<b>A</b>	<b>Ηλεκτροπαραγωγή</b>					
A1	Μονάδα ΦΑ συνδυσμένου κύκλου	450	10,0	30	3	7,0%
A2	Μονάδα ΦΑ ανοικτού κύκλου	350	15,0	30	2	7,0%
A3	Συστήματα συμπαραγωγής	700	21,0	30	4	7,0%
A4.1	Μικρά υδροηλεκτρικά (Run-Of-River / Diversion)	1.500	37,5	40	3	7,0%
A4.2	Μεγάλα υδροηλεκτρικά (συμβατικά)	1.200	30,0	40	4	7,0%
A5	Φωτοβολταϊκά σε στέγες (οικιακά)	800	20,0	22	1	5,5%
A6.1	Φωτοβολταϊκά εμπορικά [<1 MW]	700	17,5	22	1	5,5%
A6.2	Φωτοβολταϊκά εμπορικά [<10 MW]	600	15,0	22	1	5,5%
A6.3	Φωτοβολταϊκά εμπορικά [>10 MW]	500	12,5	22	1	5,5%
A7	Χερσαία αιολικά πάρκα	1.000	30,0	22	1	6,0%
A8.1	Θαλάσσια αιολικά πάρκα (πλωτά)	3.500	140,0	20	2	7,0%
A8.2	Θαλάσσια αιολικά πάρκα (σταθερής βάσης)	2.500	100,0	20	2	7,0%
A9	Βιομάζα	1.400	56,0	20	2	7,0%
<b>B</b>	<b>Αποθήκευση</b>					
B1	Μεγάλης κλίμακας μπαταρίες [3h]	250	5,0	10	2	7,0%
B2	Μονάδες αντλησιοταμίευσης (με υφιστάμενο κάτω ταμιευτήρα)	800	4,0	50	4	7,0%
B3	Μονάδες αντλησιοταμίευσης (συμβατικές)	1.500	7,5	50	4	7,0%
<b>Γ</b>	<b>Απόκριση ζήτησης</b>					
Γ1	Πρωτογενής, οικιακός τομέας, κ.λπ.   Τιμή ενεργοποίησης (1.500 €/MWh)	70	10,0	15	1	7,0%
Γ2	Υπηρεσίες   Τιμή ενεργοποίησης (3.500 €/MWh)	38	8,5	15	1	7,0%
Γ3.1	Βιομηχανία I   Τιμή ενεργοποίησης (250 €/MWh)	25	7,0	15	1	7,0%
Γ3.2	Βιομηχανία II   Τιμή ενεργοποίησης (500 €/MWh)	25	7,0	15	1	7,0%
Γ3.3	Βιομηχανία III   Τιμή ενεργοποίησης (1.500 €/MWh)	25	7,0	15	1	7,0%



# RAE Decision 12/2021: De-rating capacity factor for each technology (%)

Πίνακας 1: Συντελεστές απομείωσης ισχύος (de-rating capacity factors), για το έτος 2022

Α/Α	Τεχνολογία αναφοράς	De-rating factor [%]		
		2022	2025	2030
<b>A</b>	<b>Ηλεκτροπαραγωγή</b>			
A1	Μονάδα ΦΑ συνδυσμένου κύκλου	94,33%	94,33%	94,33%
A2	Μονάδα ΦΑ ανοικτού κύκλου	94,33%	94,33%	94,33%
A3	Συστήματα συμπαραγωγής	27,68%	27,68%	27,68%
A4.1	Μικρά υδροηλεκτρικά (Run-Of-River / Diversion)	42,16%	42,16%	42,16%
A4.2	Μεγάλα υδροηλεκτρικά (συμβατικά)	49,63%	49,63%	49,63%
A5	Φωτοβολταϊκά σε στέγες (οικιακά)	1,14%	1,14%	1,14%
A6.1	Φωτοβολταϊκά εμπορικά [<1 MW]	1,14%	1,14%	1,14%
A6.2	Φωτοβολταϊκά εμπορικά [<10 MW]	1,14%	1,14%	1,14%
A6.3	Φωτοβολταϊκά εμπορικά [>10 MW]	1,14%	1,14%	1,14%
A7	Χερσαία αιολικά πάρκα	11,91%	11,91%	11,91%
A8.1	Θαλάσσια αιολικά πάρκα (πλωτά)	11,91%	11,91%	11,91%
A8.2	Θαλάσσια αιολικά πάρκα (σταθερής βάσης)	11,91%	11,91%	11,91%
A9	Βιομάζα	52,17%	52,17%	52,17%
<b>B</b>	<b>Αποθήκευση</b>			
B1	Μεγάλης κλίμακας μπαταρίες [επίπεδο χωρητικότητας]	75,00% [3h]	85,00% [4h]	95,00% [6h]
B2	Μονάδες αντλησιοταμίευσης (Closed-Loop)	100,00%	100,00%	100,00%
B3	Μονάδες αντλησιοταμίευσης (Open-Loop, including self inflows))	91,50%	91,50%	91,50%
<b>Γ</b>	<b>Απόκριση ζήτησης</b>			
Γ1	Πρωτογενής, οικιακός τομέας, κ.λπ.   Τιμή ενεργοποίησης (1.500 €/MWh)	94,40%	94,40%	94,40%
Γ2	Υπηρεσίες   Τιμή ενεργοποίησης (3.500 €/MWh)	94,40%	94,40%	94,40%
Γ3.1	Βιομηχανία I   Τιμή ενεργοποίησης (250 €/MWh)	94,40%	94,40%	94,40%
Γ3.2	Βιομηχανία II   Τιμή ενεργοποίησης (500 €/MWh)	94,40%	94,40%	94,40%
Γ3.3	Βιομηχανία III   Τιμή ενεργοποίησης (1.500 €/MWh)	94,40%	94,40%	94,40%

Thank you for your attention !!!



ΡΥΘΜΙΣΤΙΚΗ ΑΡΧΗ ΕΝΕΡΓΕΙΑΣ  
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