

MEDREG Med-TSO

Joint Workshop on the Guarantee of Origin in the Mediterranean Region

29 October 2025

Milan, Italy

Workshop Report

Jointly organized by



Co-funded by
the European Union

ABOUT THE EVENT

As Mediterranean countries accelerate the deployment of renewable energy and explore new avenues for cross-border electricity trade, Guarantees of Origin (GOs) have become a central tool for building transparency, consumer trust, and market credibility. With the European Union moving toward a harmonised GO framework under the [RED II/RED III](#) directives and the [EN 16325:2025 standard](#), the Mediterranean basin faces a crucial moment: to ensure future interoperability, national systems must evolve while addressing diverse regulatory, technical, and institutional challenges.

The joint MEDREG–Med-TSO workshop brought together NRAs, TSOs, issuing bodies, and experts from across the region to examine how GOs can support the traceability of renewable energy, green market integration, avoid green washing and ultimately cross-border PPAs between the EU and Southern Mediterranean partners. The discussions explored:

- The regulatory foundations required for robust GO schemes.
- Digital infrastructure and certification processes.
- Market challenges linked to cross-border energy exchanges.
- The emerging need for mutually recognised certificates between regions.

The workshop aimed to reach a first understanding of the state of art of the implementation of the GO and the challenges that needs to be addressed by the region stakeholders to ensure transparency, credibility, and regional interoperability in renewable energy markets.



Table of Contents

INTRODUCTION.....	4
1. Regulatory Foundations and the Emerging GO Landscape.....	4
1.1 Divergent levels of system maturity	4
1.2 The role of governance and institutional clarity.....	6
1.3 Maturing toward interoperability: the North Macedonian example	7
1.4 Lessons from mature EU systems: Portugal and Spain.....	7
2. Technical Requirements and Digital Infrastructure for Reliable Certification.....	9
2.1 The shift towards a unified, multi-carrier certification ecosystem	9
2.2 Digitalisation as the backbone of credibility	12
2.3 Italy's digital certification ecosystem: an advanced model.....	13
2.4 Spain's comprehensive monitoring and oversight model.....	13
3. GOs as Enablers of Cross-Border Renewable Markets and PPAs.....	16
3.1 The growing demand for cross-border renewable electricity.....	16
3.2 Barriers to cross-border PPAs: the certification gap	16
3.3 Pilot projects as stepping stones	17
CONCLUSIONS AND WAY FORWARD	18

INTRODUCTION

The opening remarks stressed the strategic nature of GOs for the energy transition and the importance of cooperation between regulators and TSOs to ensure reliable, fraud-resistant and internationally compatible certification systems. Speakers highlighted that GOs are not a niche administrative tool but a basis of renewable electricity disclosure, a facilitator of consumer choice, and, increasingly, a precondition for cross-border renewable electricity trading.

The introduction also underlined that while the EU has built mature certification ecosystems, Southern and Eastern Mediterranean countries are navigating early-stage implementation. This asymmetry calls for structured cooperation, capacity building, and the alignment of national systems with evolving European standards.

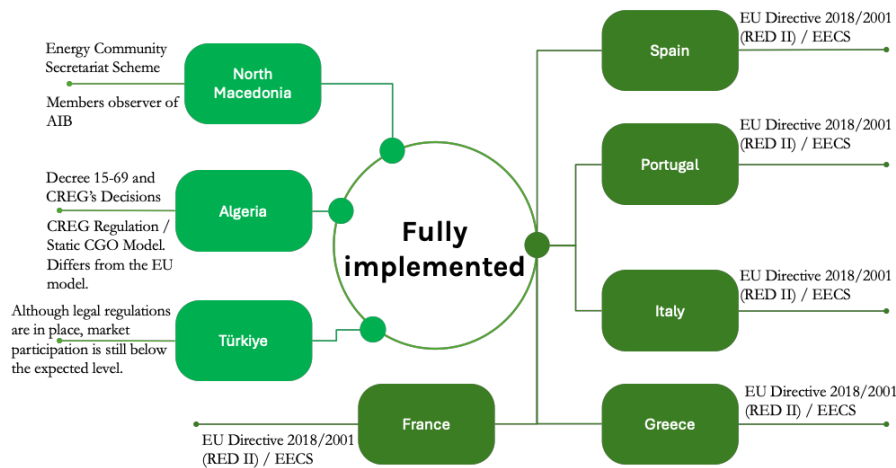
1. Regulatory Foundations and the Emerging GO Landscape

The Mediterranean region presents a highly diverse regulatory landscape for Guarantees of Origin (GOs). While several EU Member States operate mature, fully interoperable systems based on the European Energy Certificate System (EECS), many Southern and Eastern Mediterranean partners remain in the early stages of developing national certification frameworks. This diversity, although reflective of different market maturities and institutional histories, creates challenges for regional harmonisation and future cross-border renewable electricity exchange.

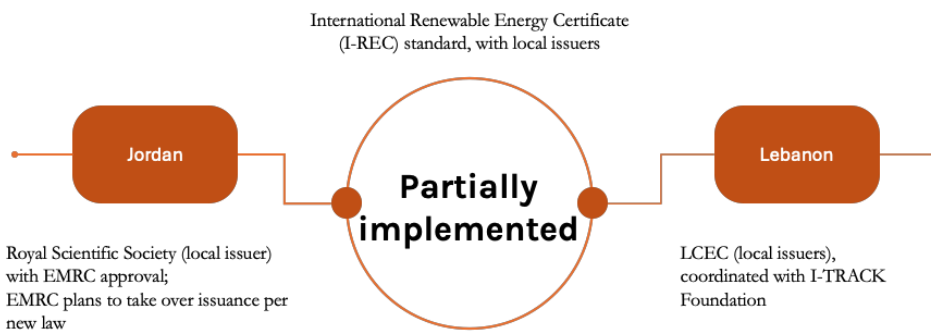
1.1. Divergent levels of system maturity

MEDREG's mapping exercise shows that the region can be broadly divided into three groups, each exhibiting different capabilities in terms of issuing bodies, registry sophistication, legal frameworks, and disclosure rules.

Fully implemented systems — mainly EU Member States such as Portugal, Spain, Italy, France, and Greece — possess the institutional and digital infrastructure required to issue, transfer, and cancel GOs in accordance with the EN 16325 standard. Their systems are typically integrated with the AIB Hub, enabling cross-border trade of certificates. These countries have well-defined supervisory responsibilities, with NRAs validating supplier disclosure and market participants obliged to cancel GOs transparently. In North Macedonia, the government has adopted a clear timeline: the decree for administering GOs (2024), the selection of a service provider (January 2025), adoption of rules (March 2025), launch of the GO register (April 2025), and issuance of the first GOs (May 2025). The National Electricity Market Operator "MEMO", now holds observer status at the AIB — a meaningful step for future EECS alignment. Lastly in Algeria, the GOs system is implemented, however, it presents a critical distinction from the EU/AIB model: The CREG primarily certifies the production installation itself (MW) as renewable, verifying compliance with metering and counting rules before commissioning. This results in a static certification of the facility.

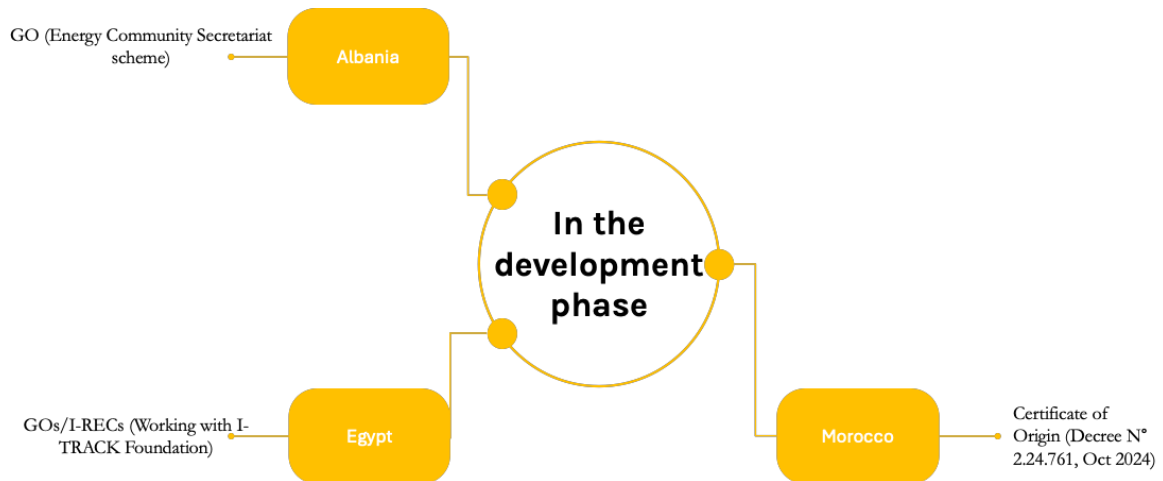


Partially implemented systems include countries such as Albania, Türkiye, which have either adopted GO legislation or are developing national registries but are not yet fully interoperable with EU systems.



Countries without national GO systems, such as Morocco (pending the publication of its national decree), Egypt, Tunisia, and Jordan (in the midst of transition), largely rely on voluntary certification schemes such as I-REC. These systems provide a valuable starting point for private sector certification but lack the regulatory force, disclosure obligations, and interoperability required for cross-border electricity markets involving the EU.

Jordan, in particular, presented a candid assessment of its challenges. Despite being a regional leader in renewable penetration — reaching 27% of electricity generation from RES by 2025 — the country does not yet have a formal national GO mechanism. Currently, the Royal Scientific Society acts as the International Renewable Energy Certificates (I-RECs) issuer, but forthcoming legislation will shift the mandate to the Energy and Minerals Regulatory Commission (EMRC). This transition highlights the institutional complexity many Southern Mediterranean countries face, where several bodies share roles related to energy certification, environmental reporting, and commercial regulation.



1.2. The role of governance and institutional clarity

A recurrent theme in the workshop was the necessity for clear and independent governance structures. In systems where the issuing body is not institutionally separate from market operations or commercial activities, risks emerge around conflicts of interest, inaccurate reporting, or insufficient transparency.

EU Member States typically assign the issuing role to either:

- Transmission System Operator (TSO) (as in Portugal),
- Dedicated energy agency (as in Italy),
- National regulator (as in Spain).

This ensures that the issuing authority is insulated from competitive pressures and able to apply EN 16325 standards rigorously.

As MEDREG emphasised, the independence of the issuing body is not simply an organisational preference but a core safeguard of certificate credibility. If market participants perceive even the possibility of double counting or inconsistent issuance, the entire system loses value.

Jordan's case illustrates how overlapping institutional mandates can slow progress. Without explicit delineation of authority — in Jordan's case between EMRC, the Ministry, the Royal Scientific Society, and the national grid operator — certification systems risk fragmentation, inconsistent issuance, and gaps in monitoring.

“Certifiers must not have financial or operational interests in the generating facility or certificate buyer.” – **Mr. Lamine Zitouni - MEDREG Secretariat**

1.3. Maturing toward interoperability: the North Macedonian example

North Macedonia’s progress was highlighted frequently as a model for countries moving from partial implementation to full EU alignment. The step-by-step development — from legislation to registry deployment — reflects a regulatory culture that prioritises transparency, consumer protection, and regional integration.

A key milestone was the Mediterranean Energy Market Observers - MEMO’s transition to observer status within the Association of Issuing Bodies (AIB). This status allows participation in working groups, alignment with the European Energy Certificate System (EECS) procedures¹, and preparation for future full membership. Achieving full interoperability will require demonstrating compliance with technical and regulatory criteria, including registry security, issuance procedures, and auditing protocols.

“The vision is clear: A transparent, interconnected Europe where GOs flow as freely as electricity itself.” – **Ms. Anastasija Stefanovska - ERC**

This sentiment encapsulates the broader ambition of non-EU Mediterranean markets: to position themselves as trust-worthy partners in the future Euro-Mediterranean electricity market.

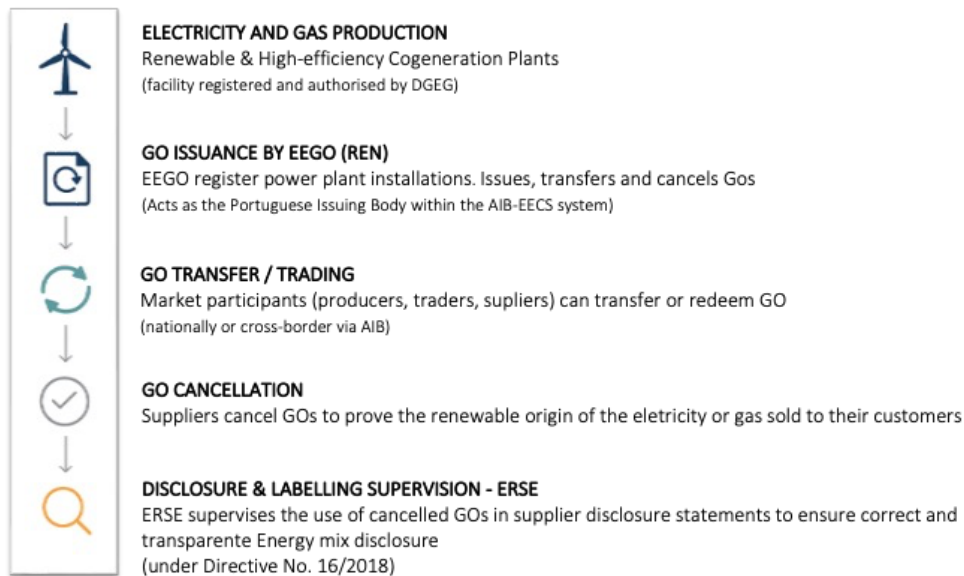


1.4. Lessons from mature EU systems: Portugal and Spain

Both Portugal and Spain presented detailed case studies demonstrating how robust regulation, advanced digital systems, and strong monitoring capacity result in a transparent and effective GO market.

¹ <https://www.aib-net.org/eecs>

- Portugal’s system, supervised by Energy Regulator - Entidade Reguladora dos Serviços Energéticos - ERSE, incorporates several layers of reliability:
 - REN, the TSO, operates the issuing body - Entidade Emissora de Garantias de Origem (EEGO).
 - CERTIGY, the registry, is fully interoperable with the AIB Hub.
 - GO auctions offer transparency and revenue opportunities for the national budget.
 - Supplier disclosure rules are strictly enforced by the regulator.



“The GO system is designed to provide transparency, reliability, and consumer confidence.” – **Ms. Ana Santos - ERSE**

- Spain’s experience underscored the importance of market oversight. National Commission for Markets and Competition (CNMC)’s monitoring role includes:
 - Verifying production data transmitted by TSOs/DSOs,
 - Auditing registered generation units,
 - Supervising cancellation and disclosure by suppliers,
 - Publishing annual data on issuance, transfer, and redemption volumes (2024: 146 519 GWh issued).

These examples show that a functioning GO market requires not only a registry but an entire ecosystem of regulatory and technical processes.

2. Technical Requirements and Digital Infrastructure for Reliable Certification

Guarantees of Origin (GOs) rely on trust. The stakeholders should be able to trust that the energy claimed as renewable was truly generated as such, and that no double counting occurred, and that the certificate follows a transparent and auditable lifecycle. While regulation provides the legal basis for this trust, it is technology and digital infrastructure that ensures it functions in practice. Throughout the workshop, speakers emphasized that a GO system is only as strong as the accuracy of its metering data, the integrity of its registry, and the security of its communication protocols.

This section explores the key technical pillars that underpin robust GO systems, drawing extensively on contributions from MEDENER, GSE (Italy), CNMC (Spain), and others.

2.1. The shift towards a unified, multi-carrier certification ecosystem

The European standard EN 16325:2025 expands the original GO system from electricity to renewable gas, hydrogen, and heating/cooling. This expansion requires a fundamental rethinking of registry architecture. Instead of treating GOs as isolated data fields, systems must support multi-carrier certificates, each with tailored metadata (e.g., purity levels for hydrogen, injection points for gas, or thermal energy metering).

“A Guarantee of Origin is the passport of renewable energy, proving where, when, and how each megawatt-hour was generated.”

Mr. Markos Damasiotis - MEDENER

This concept of a “passport” implies standardisation — every certificate, regardless of energy carrier, must follow consistent formatting and verification rules to enable cross-border trust.

Requirement	Technical Implementation
Standardisation and Compliance Framework	<ul style="list-style-type: none"> - Adoption of harmonised standards (SFS-EN 16325:2025) - Clear compliance and third-party verification procedures (<i>the GO system must operate under transparent, rule-based compliance checks and be subject to independent verification to ensure credibility, accuracy, and trust</i>) - Alignment with EU/national directives on renewables (RED II and III)
Registry Infrastructure	<ul style="list-style-type: none"> - Centralised or interconnected digital registries - Strong cybersecurity protocols (multi-factor authentication, encryption, redundancy) - Unique identifier for each GO to ensure uniqueness - Full audit trail ensuring traceability - Cross-border interoperability with EU/international platforms
Issuance, Transfer, and Cancellation Rules	<ul style="list-style-type: none"> - Standard unit (1 MWh with precise time-stamping) - Transparent rules for issuance and cross-border transfers - Cancellation procedures preventing double disclosure or reuse
Measurement and Verification (M&V)	<ul style="list-style-type: none"> - Certified metering devices ensuring accurate production data - Automated, real-time or near real-time data integration with the registry - Independent accredited bodies for verification and compliance checks
Market Transparency and Accessibility	<ul style="list-style-type: none"> - Clear supplier disclosure rules linking GOs to reporting obligations (fuel mix disclosure, consumer information) - Automated reporting functionalities reducing administrative burden - Public reporting of issuance, transfers, cancellations - Equal market access for large and small producers
Scalability and Innovation Readiness (The system remains future-proof , ready to connect with technological	<ul style="list-style-type: none"> - Extension of GOs beyond electricity (gas, hydrogen, heating & cooling) - Compatibility with emerging systems (APIs, blockchain, digital IDs)²

² i)The GO system must remain technologically adaptable and It should ii) integrate via APIs with external platforms to automate data flows, iii) leverage blockchain for tamper-proof (απαρβίαστο) and trusted records, and iv) apply digital IDs to ensure traceability and certification of each production unit or certificate.

Requirement	Technical Implementation
innovation and international markets).	- Use of machine-readable data formats (XML, JavaScript Object Notation- JSON) for automated processing ³
Governance and Oversight	- Independent supervisory authority - Stakeholder engagement (producers, regulators, consumers) - Transparent dispute resolution and anti-fraud mechanisms

³ Use of structured, machine-readable formats (XML/JSON) instead of Word or PDF enables automatic and accurate data exchange. Production data submitted to the registry is processed without manual intervention, reducing errors, accelerating procedures, and supporting real-time updates. The result: less bureaucracy, higher accuracy, and full automation in GO management.

2.2. Digitalisation as the backbone of credibility

The main message during this session was that manual or fragmented processes are incompatible with modern GO systems. An effective registry must integrate several technologies:

Automated metering data collection

Metering devices must feed timestamped and verified production data directly into the GO system without manual intervention. This ensures:

- Reduction of human error
- Prevention of manipulation
- Consistent alignment between meter readings and certificate issuance

Italy's GSE highlighted its integration with the TSO and DSO metering databases, enabling issuance to occur with minimal delays once data is validated.

Machine-readable formats

EN 16325:2025 strengthens interoperability requirements by mandating structured formats. This enables:

- Real-time exchange between registries
- Transparent audit trails
- Compatibility with AIB Hub or future non-EU hubs

Cybersecurity and registry integrity

Registries must implement:

- Encrypted communication channels
- Multi-factor authentication
- Immutable logs
- Strict role-based access control

Given the high commercial value of GOs, cybersecurity is no longer optional but a regulatory expectation.

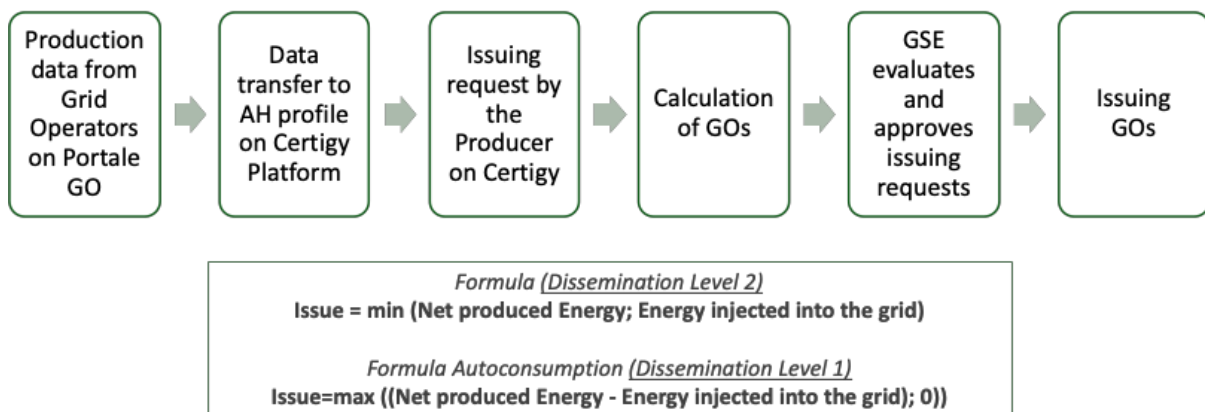
"Digitalisation is at the heart of a reliable GO scheme: automated data flows, secure registries, and transparent processes enable a trustworthy system."

Mr. Gianmarco Piamonti – GSE S.p.A

2.3. Italy's digital certification ecosystem: an advanced model

Italy, through GSE, presented one of the most digitally mature GO systems in Europe. The architecture combines:

- Dedicated GO Portal allowing producers, traders, and suppliers to manage certificates seamlessly.
- Automated plant registration processes, synchronised with TSO records to verify commissioning dates, capacities, and technology types.
- Integration with the AIB Hub, enabling cross-border issuance and transfers.
- TWO specialised market platforms:
 - o PB-GO (bilateral GO marketplace)
 - o M-GO (auction-based GO trading platform)
- A transparent auction mechanism where revenues offset national renewable support scheme costs.



This approach demonstrates how a certification system can evolve beyond compliance into a strategic energy-market instrument.

2.4. Spain's comprehensive monitoring and oversight model

Spain's CNMC offered a regulatory perspective grounded in rigorous supervision. Unlike systems that rely solely on registries, Spain embeds monitoring into each stage of the GO lifecycle:

Auditing Production Devices

CNMC verifies that each renewable facility complies with technical and regulatory conditions. This includes:

- annual audits
- inspection of metering devices
- cross-verification with TSO/DSO data

Supervision of Market Players

Suppliers must substantiate their electricity disclosure with cancelled GOs. CNMC cross-checks:

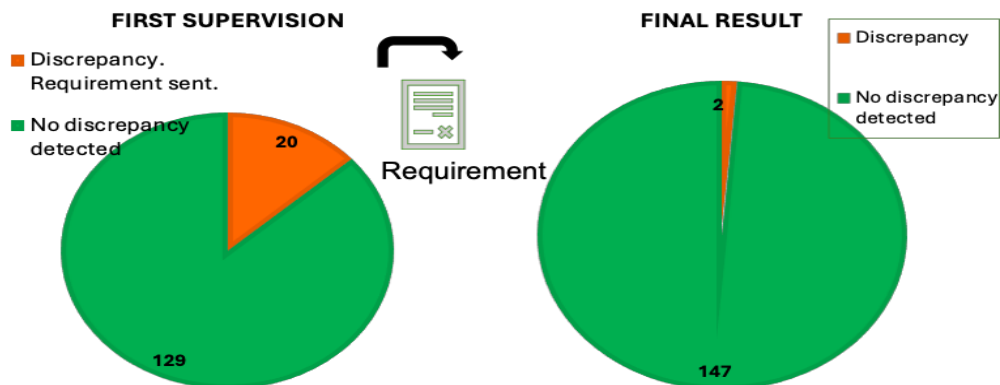
- Supplier reports
- Customer bills
- Disclosed energy mix

Transparency through data publication

In 2024 alone, Spain managed:

- 146 519 GWh issued
- 90 569 GWh transferred
- 82 456 GWh redeemed

The publication of such data builds public trust and aligns Spain fully with RED II/RED III disclosure requirements.



“The aim of the GO system is to provide reliable information to final customers. Monitoring and control are fundamental pillars of credibility.”

Mr. José Miguel Unsión – CNMC

Workshop discussions reinforced that a GO system is much more than a registry; it is a digital ecosystem embedded in regulated energy markets. The maturity of this ecosystem determines whether GOs are merely symbolic or capable of enabling cross-border green electricity trading.

Countries that lack automated metering integration, auditing frameworks, or structured data formats will face significant challenges in connecting to European markets or meeting investor expectations for transparency.

3. GOs as Enablers of Cross-Border Renewable Markets and PPAs

As Mediterranean countries consider deeper energy integration with the EU, Guarantees of Origin are becoming a key enabler of cross-border commercial arrangements, particularly renewable Power Purchase Agreements (PPAs). The workshop revealed how GOs sit at the intersection of regulatory convergence, digital trust, and market interoperability.

3.1. The growing demand for cross-border renewable electricity

Corporate buyers across Europe are increasingly seeking renewable electricity from outside the EU, especially from Southern Mediterranean countries with abundant solar and wind resources. However, no matter how cheaply foreign renewable electricity can be produced, its value in the EU depends on trust in its origin.

GOs are therefore indispensable. Without a certificate interoperable with EN 16325 and the EECs system, renewable electricity imported into Europe cannot be marketed as green — diminishing its commercial attractiveness.

Paolo Cutrone from RES4Africa presented Morocco as a case study illustrating the tension between high renewable potential and insufficient certification infrastructure.

3.2. Barriers to cross-border PPAs: the certification gap

The core barrier identified during the workshop is the absence of mutually recognized certification between EU and non-EU Mediterranean countries. Even if energy can be physically transmitted, it cannot be sold as “green” unless the certifying authority is trusted and transparent.

Morocco, for instance, is finalizing a national GO decree (Decree 761.24.2). Until it is fully implemented and demonstrates compliance with EN 16325 principles, GO-based green exports will remain constrained.

Other barriers include:

- Lack of a wholesale market with transparent price references,
- Unclear or variable export fees that reduce competitiveness,
- Limited long-term transmission capacity allocation,
- Gaps in grid governance and congestion management.

“There is still no mutually recognised GO system in the region. Without interoperability, cross-border PPAs cannot scale to their potential.”

Mr. Paolo Cutrone– RES4Africa

3.3. Interoperability as the key to Euro-Med electricity integration

Speakers stressed that interoperability, defined by the ability of registries and issuing bodies to exchange trustworthy certificates, is the cornerstone of future cross-border renewable markets. Interoperability requires:

- National GO system aligned with EN 16325;
- Issuing body with institutional independence;
- Transparent issuance and cancellation procedures;
- Tamper-proof registry architecture;
- Regular monitoring and audits.

Countries not aligning with European standards risk exclusion from the emerging Euro-Mediterranean electricity market.

3.4. Pilot projects as stepping stones

Several speakers noted that pilot projects are valuable for identifying practical obstacles and building mutual trust. Examples include:

- Bilateral GO exchanges between an EU country and a non-EU partner,
- Test PPAs for small-scale cross-border RES projects,
- Registry interoperability tests using anonymised or simulated data.

These pilots could be facilitated by MEDREG and Med-TSO through joint working groups.

CONCLUSIONS AND WAY FORWARD

The workshop showcased significant progress but also revealed gaps between EU and Mediterranean partner countries. Key conclusions include:

- **Harmonisation is essential for regional GO interoperability**

Countries should progressively align with EN 16325:2025, EECS, and EU disclosure rules.

- **Strengthening institutional roles and regulatory clarity**

Issuing bodies must operate with independence, transparency, and full oversight from NRAs.

- **Technical infrastructure must evolve toward automation and integration**

From metering to issuance, data flows should be machine-readable, verifiable, and secure.

- **Regional cooperation is indispensable for cross-border PPAs**

Future renewable exports, from Morocco and beyond, will depend on mutually recognisable certification.

- **Pilot projects should be launched**

A Mediterranean pilot GO exchange or a pilot PPA corridor could reveal practical barriers and solutions.

