EUROPEAN SOLAR MANUFACTURING COUNCIL

EU PVSEC 2026 · ORAL PRESENTATION

# A Tradable Certificate Framework for 40% “Made in Europe” Content in PV and BESS Manufacturing

*The European Solar Content Credit Certification Scheme (ESCC-CS)*

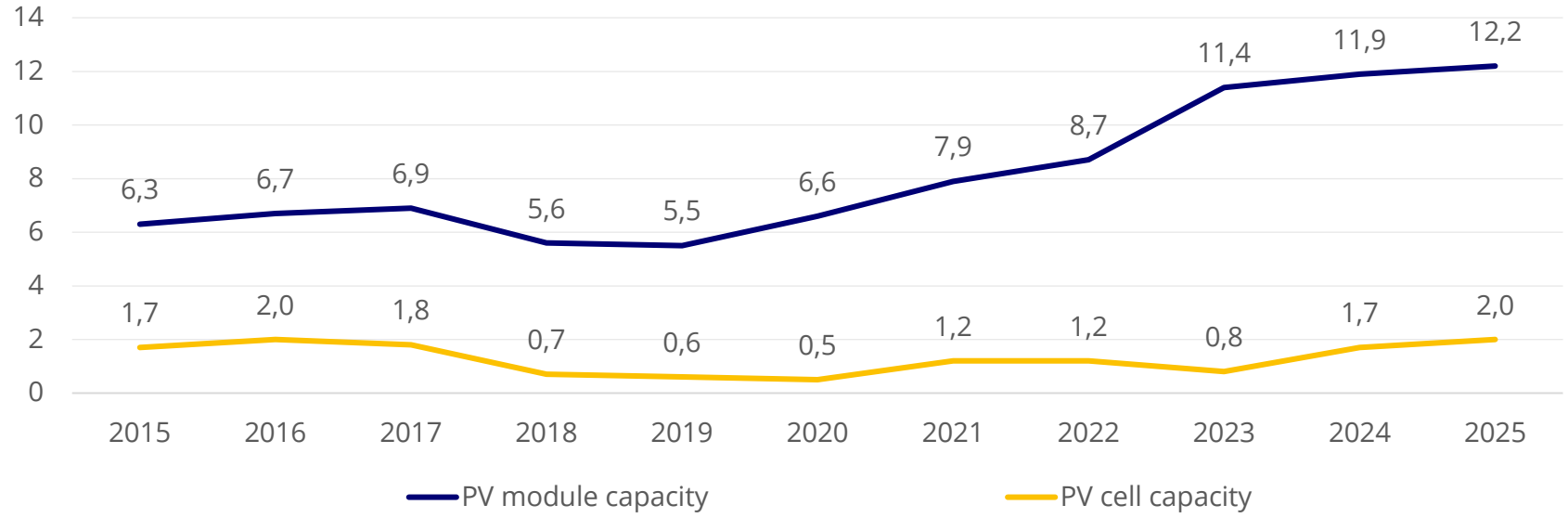
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THE CHALLENGE

# Europe's Solar Ambition Outpaces Its Manufacturing Base

## EU PV MODULE AND CELL MANUFACTURING CAPACITY (GW)




*Cumulative PV module and cell manufacturing capacity within Europe (collected and compiled by Becquerel Institute and ESMC.*

**750 GW**

EU deployment target by 2030

**~85%**

of global PV hardware manufactured in China

The Net Zero Industry Act (NZIA) sets a target of **40% domestic manufacturing** for strategic net-zero technologies by 2030. The Clean Industrial Deal reinforces this with a matching KPI. Neither instrument is enforceable — and market dynamics alone have not induced sufficient re-shoring.

THE CONCEPT

# The European Solar Content Credit Certification Scheme

**The paper proposes translating the NZIA's target into an enforceable, market-based certificate scheme — without tariffs or direct subsidies.**

## ESCC-CS

- Applies to PV modules, inverters, mounting structures & BESS
- 40% EU value-added content required per final product
- Comply physically, or by purchasing certificates
- Verified through a central EU registry and independent audit
- Subsidy-free and self-financing through certificate trading

**1 ESCC = €1**

of verified European value creation

BACKGROUND

# Building on Existing EU Legal Foundations and Geopolitical Trends

| 2018 | 2024 | 2024 | 2025 | 2026 |
|---|---|---|---|---|
| **RED II** | **NZIA** | **Solar Charter** | **Clean Industrial Deal** | **Industrial Accelerator Act** |
| Certificate & registry model for Guarantees of Origin | Non-binding 40% domestic-manufacturing benchmark | Voluntary value-based procurement commitments | Matching 40% KPI + "buy European" conditions | Proposed "Made in EU" preferences, EU-wide |

Existing EU customs law does not recognize European manufacturing in the way EU industrial policy intends to reward it. Article 24 of the Community Customs Code states:

*"goods whose production involved more than one country shall be deemed to originate in the country where they underwent their last, substantial, economically justified processing..."*

Commission Implementing Regulation (EU) No 1357/2013 applies this to PV modules and cells, setting origin by **where the cell is made**.

## SIMILAR MECHANISMS ARE EMERGING OUTSIDE THE EU

**CN**

**China — NEV Dual-Credit (2018)**

Manufacturers earn New Energy Vehicle credits equal to a rising share of sales, from 14% (2021) up to 38% (2025); surplus credits trade between manufacturers.

**US**

**US — Buy American Act (1933 / 2021)**

Federal procurement requires domestic content rising from 60% today to 65% (2024–2028), then 75% from 2029 onward.

**US**

**US — One Big Beautiful Bill (2025)**

Introduced Foreign Entity of Concern (FEOC) restrictions on clean energy tax credits, requiring rising domestic content: 50% (2026) → 80% (2029) for solar components.

**IN**

**India — ALMM (2021)**

Domestic content required for government-backed and net-metered PV projects, extended upstream from modules to cells (2026) and wafers (2028).

**EU**

**EU Member States — National Bonus Schemes**

France, Italy, and Austria already apply national "Made in Europe" bonuses via feed-in tariffs, tax credits, and auctions.

PROPOSED FRAMEWORK

# Four Final Product Categories, Four Certificate Classes

| Final PV Module | Final PV Inverter | Mounting Structure | Final BESS |
|---|---|---|---|
| **ESCC-M** | **ESCC-I** | **ESCC-S** | **ESCC-B** |
| Cells, solar glass, encapsulants, ribbons, backsheets, assembly | String, central, hybrid & microinverters | Fixed systems & trackers, incl. steel, aluminium, drive components | Cell, pack, and system-level manufacturing |

Certificate classes are **non-fungible across categories** — an inverter maker cannot buy module-chain certificates to comply. Compliance always corresponds to verified value creation within the *same* product's supply chain.

PROPOSED FRAMEWORK

# Two Routes to Compliance

## 1 Physical Compliance

The final product itself carries verified ESCC certificates covering ≥40% of its ex-works value.

## 2 Certificate-Based Compliance

A shortfall is covered by purchasing surplus certificates — from over-compliant final products or EU component producers within the same product category:
ESCC-M, ESCC-I, ESCC-M, ESCC-B

### Certificate lifecycle

- Issued at verified EU manufacturing step
- Transferable along the supply chain
- Cancelled at grid connection (EU) or withdrawn from the physical product at customs exit (export)
- 3-year lifespan proposed, to prevent stockpiling (needs to be investigated)

PROPOSED FRAMEWORK

# Measuring European Value Creation

### Ex-works conversion cost

Labour + energy + CAPEX amortization + R&D + overhead + administration attributable to EU manufacturing (net of material inputs)

## Two ways to calculate it:

### Tabulated Reference Values

Standardized, independently benchmarked values published by the central registry — protects sensitive cost data

### Audited Company Data

Manufacturer-specific, independently verified costs

**EXAMPLE OF EUROPEAN VALUE CREATION (400 W MODULE) [1]**

| # | COMPONENT | €CT/WP |
|---|---|---|
| 1 | PV manufacturing equipment | 1.7 |
| 2 | PV grade polysilicon | 3.0 |
| 3 | PV grade silicon ingots | 3.1 |
| 4 | PV wafers | 1.5 |
| 5 | PV cells | 4.9 |
| 6 | Solar glass | 2.0 |
| 7 | PV encapsulants | 1.2 |
| 8 | PV ribbons | 0.6 |
| 9 | PV backsheets | 0.9 |
| 10 | PV connectors | 0.4 |
| 11 | PV junction boxes | 0.6 |
| 12 | PV module assembly | 5.6 |
| | **Total final PV module** | **25.5** |

**WORKED EXAMPLE — 400 W MODULE**

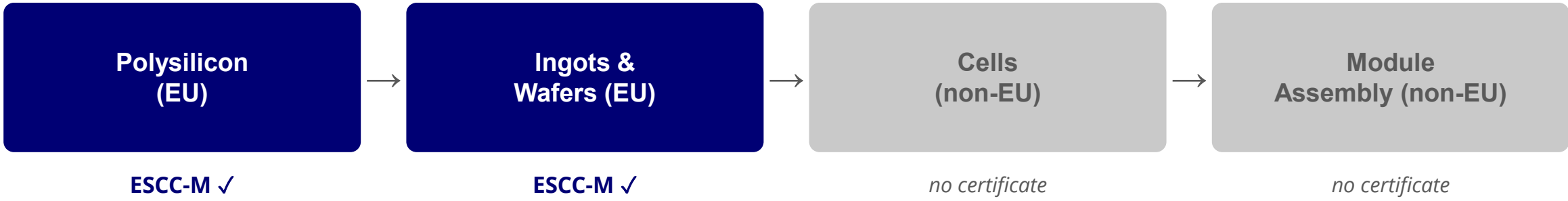
| | | |
|---|---|---|
| **Fully European module** | 25.5 ¢/Wp | **≈€102 / module** |
| 40% threshold | 10.2 ¢/Wp | **≈€41 / module** |
| EU cells + EU assembly | 10.5 ¢/Wp (41%) | **✓ compliant** |
| EU assembly + EU ancillaries | 11.3 ¢/Wp (44%) | **✓ compliant** |
| EU assembly only | 5.6 ¢/Wp (22%) | **✗ shortfall** |

*[1] S. Nold et al., "SolarPower Europe (2025): Reshoring Solar Module Manufacturing to Europe: A Cost Gap Analysis and Policy Impact Simulation".*

PROPOSED FRAMEWORK

# Certificates Follow Value, Not Just the Final Product

A module assembled outside Europe can still generate certificates for European upstream steps:




European polysilicon and ingot/wafer producers **still earn ESCC-M certificates** for their verified value creation — even though the final module is assembled abroad and put on another market. If an importer of such a module want to put it on the EU market, then the importer must then buy certificates from EU producers.

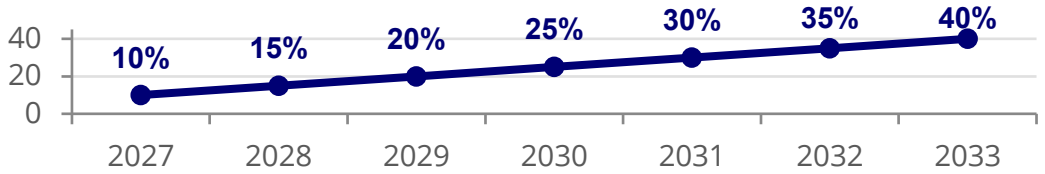
PROPOSED FRAMEWORK

# Not All Value Chains Steps Start Equal

## SUPERCREDIT MULTIPLIERS

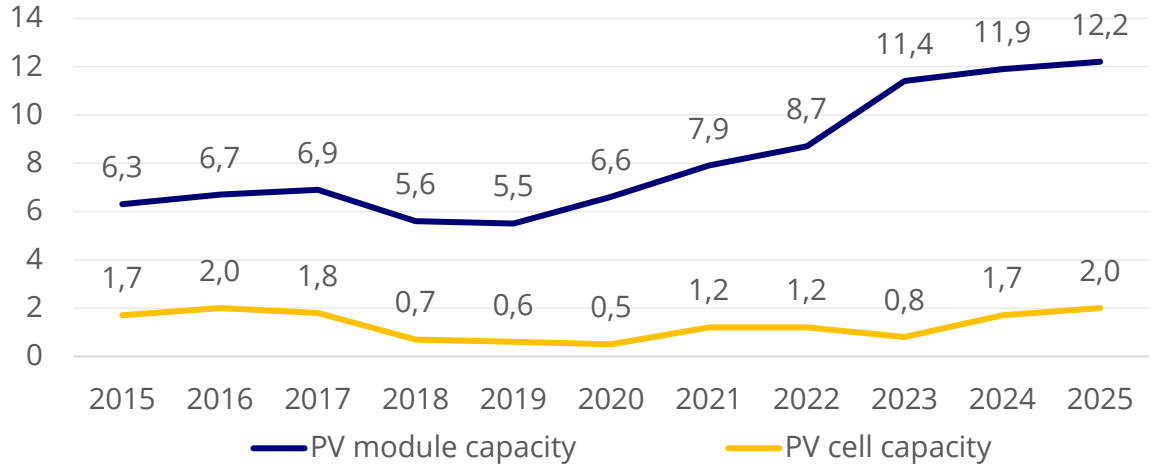
Example: 1 ESCC from European wafer production **could count as 1.5 ESCCs** toward compliance — accelerating re-shoring of structurally weak segments like polysilicon, wafers, cells.

## PHASED THRESHOLD (MODULES)



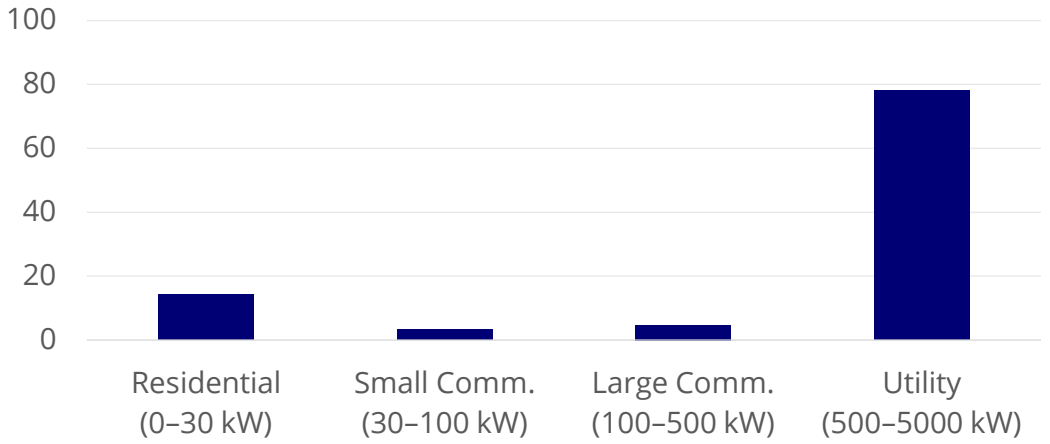

*Illustrative trajectory between confirmed 2027 and 2033 endpoints*

## EU PV MODULE AND CELL CAPACITY (GW)




*Cumulative PV module and cell manufacturing capacity within Europe (collected and compiled by Becquerel Institute and ESMC.*

## EU PV INVERTER CAPACITY BY SEGMENT (GW)




*ESMC survey: Total EU inverter manufacturing capacity by 2027. 152 GW across all segments*

## MODULES

**Current EU capacity is insufficient** to supply 40% of the ~60–80 GW placed on the EU market each year.

## INVERTERS

**EU + near-term expansion capacity** already exceeds current demand — though actual production and market share still lag behind 40% today.

PROPOSED FRAMEWORK

# Governance: EU Coordination, National Delivery

### Central EU Registry

Tracks all ESCC transactions & digital wallets by utilizing the Digital Product Passport

### National Issuing Bodies

Issue ESCCs from verified declarations; confirm chain of custody, per Member State

### Independent Audit

Accredited verifiers confirm value creation under ISO 17029 / 17065

*MODELLED ON THE AIB / EECS GUARANTEE-OF-ORIGIN REGISTRY SYSTEM [2]*

## DIGITAL PRODUCT PASSPORT (DPP) INTEGRATION

**Certificates are digitally bound to component serial numbers**, with QR codes / secure links enabling traceable tracking. Digital transfers comply with eIDAS; certificates cancel automatically at market entry — preventing double-counting or fraud and giving the European Commission cross-country oversight and enforcement powers.

*[1] P. K. R. Holzapfel et al., " Relevance of guarantees of origin for Europe's renewable energy targets".*

# A Global Trend — and a Deliberate WTO-Aware Design

**Two design paths, different legal exposure:** a procurement-limited scheme offers stronger WTO footing (Art. III:8(a)/GPA); a binding, market-wide scheme — the approach adopted here — carries greater legal risk but broader impact, similar to CBAM's reliance on GATT Art. XX.

**FR**

**France**

2013 EU-made bonus repealed after violating Art. 34 TFEU

**IN**

**India**

2016 WTO loss after its own procurement defence was rejected

**US**

**United States**

IRA tax credits found WTO-inconsistent, Jan. 2026 — now appealed

**CN**

**China**

NEV dual-credit policy: binding, tradable, technology-based quota

***All geopolitical superpowers, i.e., China, the US, and India, are all moving toward more binding, less trade-liberal content protection for strategic clean-tech sectors. EU hesitation due to legal caution may carry a competitiveness cost that outweighs the legal risk.***

SUMMARY

# Making the NZIA's 40% Benchmark Enforceable

1. Translates the NZIA's non-binding 40% benchmark into an enforceable, market-based instrument, incentivizing EU manufacturing across the full value chain with flexible compliance and end-to-end DPP traceability.

2. Subsidy-free by design: rather than drawing on public funds, certificate trading channels capital from lower-cost producer countries, often benefiting from weaker labour and environmental standards, to European manufacturers, bridging the cost gap through the certificate market itself.

3. One tradable unit (ESCC) applied across four final product categories, each with its own non-fungible certificate class

4. Different product streams start from different positions: modules need a phased threshold; inverter capacity already suffices

5. Open questions:
   - The scope of the binding obligation, procurement-limited (WTO-safer, narrower) vs. market-wide (riskier, broader impact),
   - Actual value creation and transfers to European manufacturers; simulations and calculations are needed
   - Implementation costs of (1) the system and for (2) manufacturing companies; financeable via (1) EU funds and (2) trading revenue respectively?

***The direction of travel with regards to policies for domestic manufacturing among the world's major economies is unambiguous — the EU's hesitancy may carry a competitiveness cost that outweighs the legal risk.***

# Thank you

*Questions & discussion welcome*

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