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SAWEA
South African Wind Energy Association

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8:00 am – 5:00 pm

CAPE TOWN, SA
CTICC 2

2025 PRESENTATION

# Potential Avenues for Driving the Growth of the Renewable Energy Industry in South Africa

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*22 October 2025*

## SPEAKER **OVERVIEW**

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# PRESENTATION **OVERVIEW**

**01** • Introduction and motivation

**02** • Methodology and data

**03** • Findings

**04** • Conclusion

# Introduction and motivation

# Introduction and motivation

- Global energy transition is reshaping trade and industrial structures
  - Presents both challenges and opportunities for developing economies
  - Technological transformation and new industrial opportunities

- Why South Africa?
  - Resource export dependent
  - Dependence on coal
  - Premature deindustrialization
  - High unemployment, inequality.

- Renewable Energy (RE) sector offers a unique opportunity.

- South Africa risks missing industrial opportunities in the green transition without a clear diversification strategy
  - Understanding where SA can diversify within the RE space is key to ensuring that the transition is green, job rich and inclusive.

- Countries grow by undergoing structural change
  - Shift from low productivity to high productivity products (sectors)
  - Diversifying into more complex, capability-rich industries.

- Can South Africa leverage the global renewable-energy transition to build new productive capabilities and move up the economic complexity ladder?
  - What RE products should SA focus on to maximize industrial growth and job creation?

# Objectives

- Identify product-level industrial diversification opportunities in South Africa's RE sector
  - Assess the relative size and composition of South Africa's RE Space
  - Measure the complexity of the RE sector (RECI Index)
  - Identify frontier products that enhance complexity
  - Evaluate which of these products are labor-intensive.

- Links the green industrialization agenda with economic complexity framework.

- Data-driven approach to identify realistic diversification.

- Evidence based guidance for Industrial Policy and capability development in RE sector.

# The concept of Economic Complexity

- Measures the **knowledge, skills and productive capabilities** embedded in an economy (**what it produces and exports**).

- Products differ in amount of knowledge and know-how (PCI)
  - The more sophisticated the product the more hidden capabilities it reflects.
  - E.g., iron ore (low pci) → rolled steel sheet (medium pci) → permanent magnet generator for wind turbine (high pci)

- Countries differ in diversity and sophistication of the products they can make (ECI)
  - Examining what countries export can infer the underlying capabilities.

- **Why Complexity matters:**
  - Better predictor of long-term development.
  - Economies with more diverse and sophisticated industries (higher ECI) grow faster and more sustainably because their capabilities allows them to diversify further.

# Methodology and data

## Analytical framework

- Apply the theory of economic complexity and industrial relatedness.

- ECI measures desirability to diversify into a product (shift to more complex products).
  - Predicts future growth (Hausmann et al 2014).
  - Higher ECI, higher development.

- Relatedness (Distance) - measures feasibility.
  - New capabilities are more easily accumulated if they are combined with others that already exist.
  - Determined by the alignment of current to required industrial capabilities.

## Empirical strategy

- Construct a **Renewable Energy Complexity Index (RECI)** extending Mealy & Teytelboym (2018).

- Generate **relatedness metrics** in line with Hidalgo et al. (2007).
  - Create a measure that infers the similarity between know-how required by a pair of industries (products) by looking at probability that they are co-produced.

- Apply network analytics to map South Africa's RE sector within the product space.

- Identify **frontier RE products** by combining complexity and relatedness measures (building on methods from Mealy et al. and Hausmann et al.).

- Incorporate a labour-absorptive capacity measure (Estmann et al., 2022)
  - To assess workforce accommodation potential.

# Data

- BACI trade data, 6-digit HS revision 1992 (1995-2023)

- To identify RE products we use the mapping of Rosenow and Mealy (2024)
  - Traded products associated with value chains of solar PV, wind turbines and Evs

| Tech Type | Number of products |
|---|---|
| **Solar** | 92 |
| **Wind** | 112 |
| **EV** | 91 |
| **Other (hydro, biomass, geothermal)** | 30 |

  - Collated as end products, subcomponents, processed and raw materials.

- Raw → Processed → SubComponent → End-Product
  - Iron ore → Steel → Tower sections → Turbine tower
  - Copper ore → Refined copper → Coils → Generator
  - Rare earths → Magnet alloys → Magnets → Direct-drive nacelle
  - Balsa → Composite → Blade segments → Rotor blade

# Export profile of RE vs non-RE Products, 2023

| | Number | | | | Export Value (current US$) | | | |
|---|---|---|---|---|---|---|---|---|
| Classification | Global Products | SA RCA products | % of Global products | % of SA RCA Products | Global products (US$ M) | SA RCA products (US$ M) | % Global products | % of SA RCA products |
| **Non-RE** | | | | | | | | |
| Manufacturing | 3295 | 424 | 88 | 82 | 16157 | 33 | 77 | 27 |
| Mining | 169 | 55 | 4 | 11 | 1430 | 69 | 7 | 58 |
| **RE** | | | | | | | | |
| Manufacturing | 262 | 21 | 7 | 4 | 3073 | 5 | 15 | 4 |
| Mining | 34 | 16 | 1 | 3 | 416 | 13 | 2 | 11 |
| **TOTAL(Non-RE+ RE)** | **3760** | **516** | **100** | **100** | **21077** | **120** | **100** | **100** |
| RE Value Chain | | | | | | | | |
| Raw Materials | 25 | 10 | 8 | 27 | 361 | 11 | 10 | 60 |
| Processed Materials | 103 | 21 | 35 | 57 | 691 | 5 | 20 | 29 |
| Subcomponents | 154 | 6 | 52 | 16 | 1803 | 2 | 52 | 11 |
| End Product | 14 | 0 | 5 | 0 | 634 | 0 | 18 | 0 |
| **TOTAL RE** | **296** | **37** | **100** | **100** | **3490** | **18** | **100** | **100** |

- Heterogeneity across sectors in RE-related products (manufacturing and mining).
- Policy debate often centers on high-tech components and end-products.
- SA’s RCA lies mainly in raw and processed materials.
- Suggest that diversification is one of moving up the value chain.

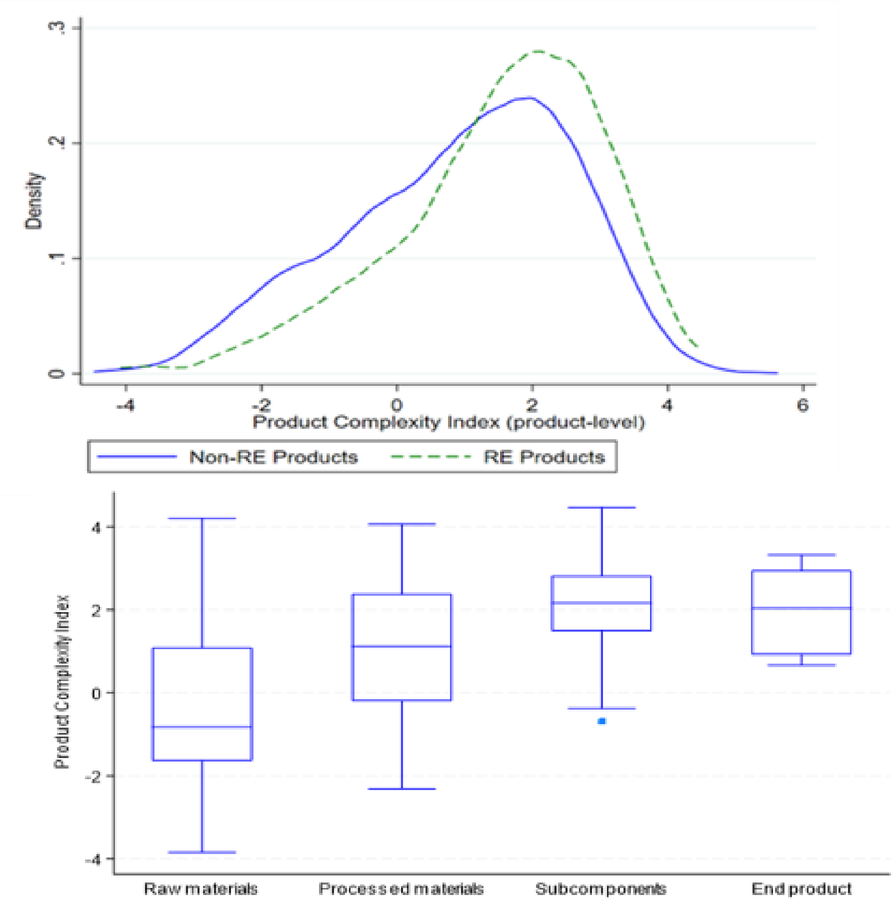
# Findings

# South Africa’s Current RE Exports

| HS6 | Description | Tech Category | Value Chain Segment | PCI | Export Value (Million USD) | RE Export Share (%) | Global PCI Rank |
|---|---|---|---|---|---|---|---|
| 260111 | Iron ores: non-agglomerated | Resource-based | Raw materials | -2.18 | 5.20 | 23.02 | 291 |
| 260200 | Manganese ores and concentrates | Resource-based | Raw materials | -3.04 | 2.90 | 12.83 | 294 |
| 842139 | Machinery: filtering/purifying gases | Med-tech | Subcomponents | 2.52 | 1.88 | 8.34 | 85 |
| 260112 | Iron ores: agglomerated | Resource-based | Raw materials | -0.71 | 1.88 | 7.30 | 268 |
| 711590 | Precious metals, n.e.s. | Low-tech | Processed | 1.47 | 1.37 | 6.05 | 169 |
| 760110 | Aluminium: unwrought | Primary | Processed | -1.02 | 1.35 | 5.98 | 275 |
| 750210 | Nickel: unwrought, not alloyed | Primary | Processed | 0.98 | 0.68 | 3.00 | 209 |
| 740200 | Copper: unrefined, copper anodes for | Primary | Processed | -2.32 | 0.44 | 1.95 | |
| 260800 | Zinc ores and concentrates | Resource-based | Raw materials | -1.64 | 0.33 | 1.48 | 285 |
| 260300 | Copper ores and concentrates | Resource-based | Raw materials | -2.33 | 0.28 | 1.24 | 293 |

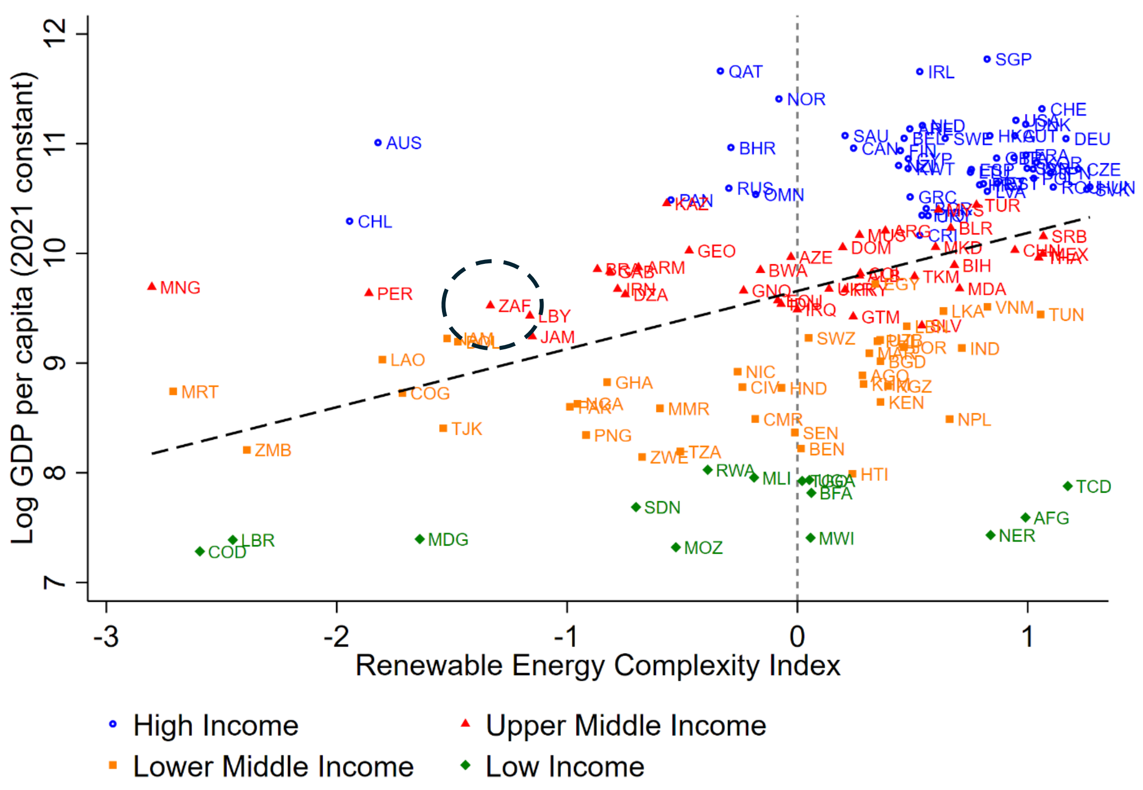
- SA is exporting the building blocks of the green economy but not the finished products.
- SA’s comparative advantage lies in raw materials (~46% of exports).
- Limited role in technologically sophisticated segments of RE value chain.
- SA needs to understand the capabilities that underpin complex production.

## Complexity of RE Products



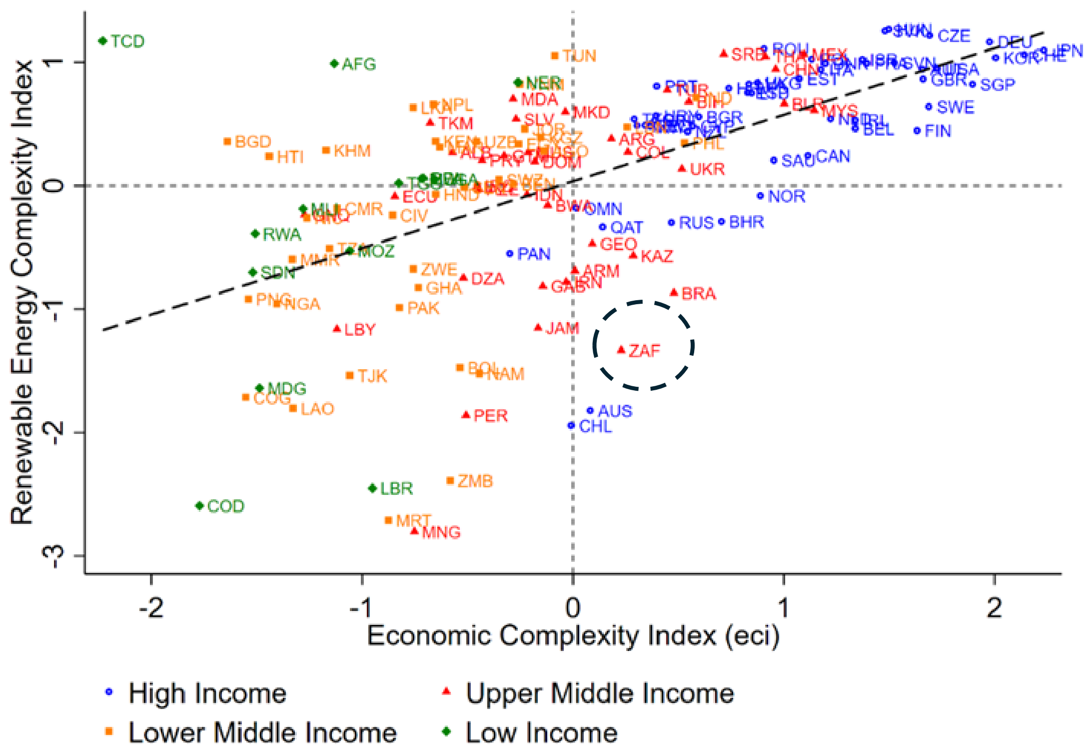

- On average RE products are complex than other traded goods.
  - Desirability-strategic shift into RE production can help developing countries build complexity.
- Cross-product heterogeneity across RE value chains
  - End products and subcomponents
- SA's comparative advantage in raw and processed materials, offers limited complexity gains.
  - Real opportunities lies in subcomponents and end products
- Which of these are feasible given existing capabilities?
  - Relatedness

# Income vs RECI



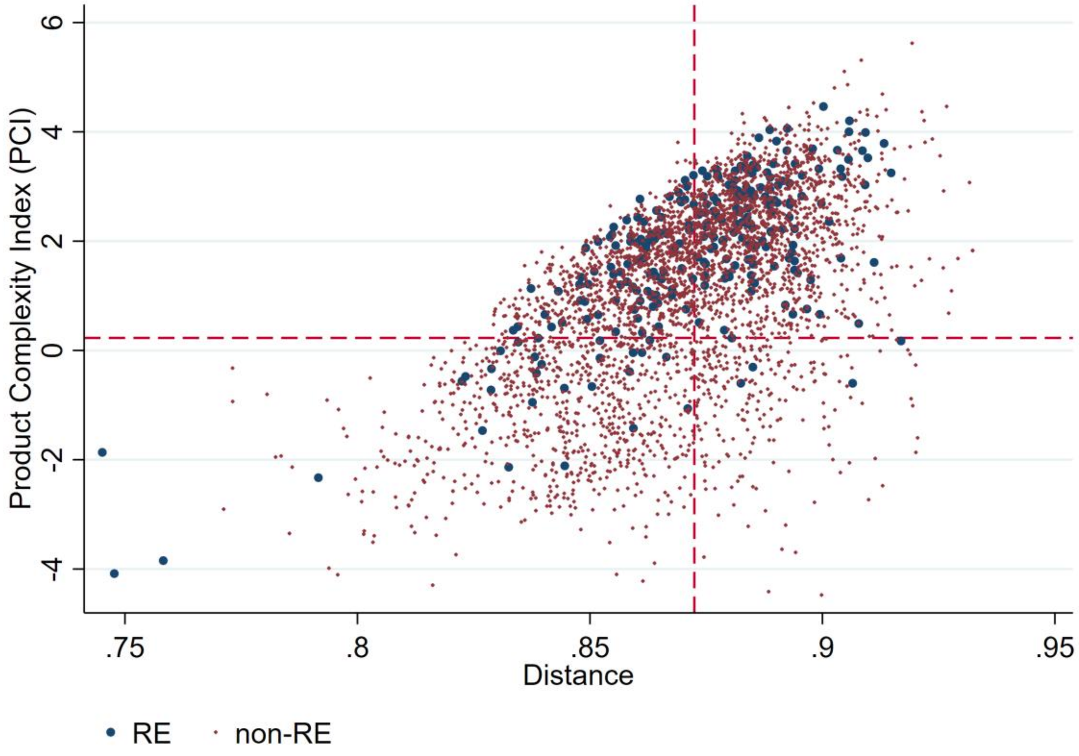

- Higher income countries= more complex in RE value chain trade structures.
  - Reflecting technological capabilities and integration into advanced value chains.
- SA is underperforming.
  - Level of RE complexity is low relative to its overall level of economic development.
- SA plans have been relatively less focused on RE value chain.

## ECI vs RECI



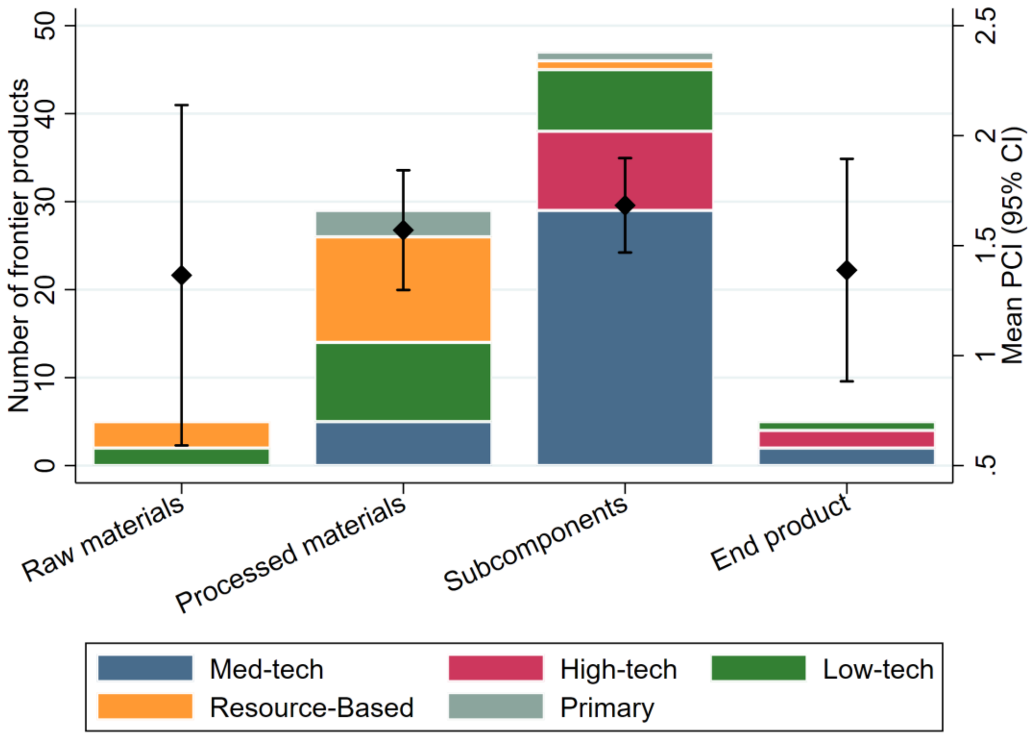

- Complex economies = stronger RECI.
- SA's RE base is less complex (underperforming) given the current capabilities.
  - For its level of ECI, its RECI is relatively low
  - Underdeveloped RE sector- there is room to grow and advance.
- The RE complexity gap suggests that perhaps RE products are easily achievable in the SA economy.
  - Strong economic case for investing in the RE value chain.
- What frontier RE products would move SA up to the line fastest?

# Feasibility vs Desirability: Where RE Opportunities Sit




- Identify realistic diversification opportunities
- Products not yet produced and exported competitively by a country but lie on the edge of its current capabilities
  - High complexity
  - Low distance
  - High opportunity gain.
- Prioritize RE products that are close to existing capabilities and raise complexity.

# Frontier Opportunities




- 86 frontier products
- Mainly subcomponents dominated in medium-technology industries (highest PCI)
- Presents a critical opportunity for SA to diversify into high-complexity products within the global supply.

## Conclusion

- Economic complexity = a tool to guide industrial policy focused on industrial diversification.

- RE sector = opportunity to build complexity
  - The question is: Can it create jobs (next steps).

- South Africa strong economic case for investing in the RE value chain if the right products are prioritized.

✓ The RE transition is not just an environmental imperative – it is an opportunity to leverage existing industrial capabilities to drive the (re)industrialization of the SA economy along a less carbon intensive path.

## Next Steps

- Evaluate which of these products are labor-intensive
- Product Space Mapping

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- The research results are independent, and the views and opinions expressed based on the research findings do not necessarily reflect those of the MFA or DFC.

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## THANK YOU FOR LISTENING!

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