

Cracking the Code: Key Factors for Success in UAE's Solar Manufacturing Business Environment

Leveraging National Energy Strategies and Local Content Requirements for Sustainable Growth.

Content Partner: J. v. G. technology GmbH

Turnkey solar module production lines — since 1997

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Technical Overview: Success Factors for UAE Solar Manufacturing



Created as part of the PVKnowHow Knowledge Network



Prepared by J.v.G. Technology GmbH



European specialists in turnkey solar module production lines

Key Project Data

GW-sc...

Production Scale

Utility-scale solar module manufacturing (market-driven output targets)

Multi-...

Investment Level

Project-dependent multi-million USD industrial CAPEX

12-24 ...

Ramp-Up Period

From equipment commissioning to full production capacity

UAE

Target Region

Primary focus: Abu Dhabi & Dubai industrial zones

 **Line Type:** Automated solar module production · **Source:** PVKnowHow / J.v.G. Technology GmbH

UAE Solar Market: Current State

Market Size & Growth

- Installed solar capacity: ~7.90 GW as of 2024
- Market valued at 11.0 TWh in 2024
- Projected to reach 73.5 TWh by 2033 (CAGR ~22.3%)
- Capacity projected to grow from 7.90 GW (2024) to 36.06 GW by 2029

Key Demand Drivers

- Government-backed utility-scale mega-projects (1 GW+ scale)
- Growing commercial & industrial (C&I) rooftop segment
- LCOE as low as 1.69 US cents/kWh — cost-competitive with gas
- ~3,568 annual sunshine hours; peak irradiance ~5.8 hrs/day

Policy & Regulatory Framework

UAE Energy Strategy 2050

- Target: 44% renewable energy in national energy mix by 2050
- Planned investment: AED 150–200 billion in renewables by 2030
- 19.8 GW of renewables targeted by 2030 (NDC commitment)

Dubai Clean Energy Strategy 2050

- 75% of Dubai's energy from clean sources by 2050
- MBR Solar Park targeting 5 GW by 2030 (world's largest single-site)
- DEWA Phase 6 record tariff: USD 1.6215 cents/kWh (2024)

Binding Climate Legislation

- Federal Decree-Law No. 11/2024 (effective May 2025): binding MRV obligations
- NDC: 47% GHG emissions cut from 2019 levels by 2035
- "Make it in the Emirates" — local content procurement push

Manufacturing Opportunity: Why UAE?

Export & Tariff Advantage

- MENA functions as a "tariff haven" for module exports to the US
- US tariffs on Southeast Asian modules: up to 651%
- MENA carries a ~10% import tariff advantage vs. Asia
- Regional manufacturing capacity could reach 44 GW by 2029

Strategic Location

- Hub for exports to Europe, Africa, and South/Southeast Asia
- World-class ports, airports, and logistics infrastructure
- Strong aluminum industry: local frame sourcing possible
- Industrial electricity tariffs ~\$0.11/kWh (2024 estimates)

Local Demand Pull

- Government procurement prioritizing locally manufactured content
- Large utility-scale off-takers: DEWA, EWEC, Masdar
- Self-sufficiency in MENA module production forecast by 2026
- \$54B committed to UAE energy infrastructure through 2030

Factory Setup: Infrastructure Requirements

Facility & Line Configuration

- A 50 MW semi-automated line requires ~2,000–3,000 m² of floor space
- Fully automated systems support throughput of up to ~600 modules/hour
- Line type: automated solar module production (cell stringing to final testing)
- Turnkey procurement from an experienced European provider reduces integration risk
- On-site team training included — no prior manufacturing experience required

Location Options

- Free zones (e.g., KIZAD, JAFZA): tax and duty-free frameworks available
- Industrial zone factory rent: ~\$8.17/sq ft/year (varies by emirate)
- Free zone operation: potential 10-year tax/duty exemption on equipment
- Abu Dhabi and Dubai most active for large-scale industrial solar manufacturing

Production Line: Key Process Steps

1

1 — Cell Stringing & Pre-Inspection

Solar cells interconnected into strings; EL and visual inspection prior to lay-up

Defects must be resolved before lamination — rework is near-impossible after

2

2 — Module Lay-Up & Assembly

Glass / EVA / cell strings / EVA / backsheet assembled in sequence

Manual or robotic loading depending on automation level

3

3 — Lamination

Chamber sealed; vacuum applied; EVA crosslinks under heat (~135–180°C, ~20 min)

Critical quality gateway — determines module lifetime (25+ year target)

4

4 — Framing, Junction Box & Testing

Aluminum frame applied; junction box attached; EL and IV curve testing

IEC certification compliance verified at this stage

5


5 — Final QC & Packaging

Visual inspection, labeling, and packing for logistics

Output sorted by power class for delivery or warehouse

Cost Structure: CAPEX & OPEX Overview

Cost Category	50 MW Semi-Automated Line	Notes
Production Line Equipment (CAPEX)	~€1.5M – €2.5M	Turnkey, core equipment; cell stringing to final test
Facility (Lease)	~2,000–3,000 m ² required	Leasing preferred over new build for capital efficiency
Raw Materials (OPEX/year)	~€15M – €20M (at full capacity)	BOM accounts for 75–85% of production cost per module
Working Capital Requirement	~€1.5M – €3M additional	Cover 3–6 months OPEX before revenue stabilizes
Solar Cells (BOM share)	~50–60% of BOM	Primary cost driver; sourcing strategy is critical
Industrial Electricity	~\$0.11/kWh (2024 estimate)	Competitive tariff; arid region — water access must be planned

 Source: PVKnowHow / J.v.G. Technology GmbH composite data. Figures are indicative; project-specific CAPEX varies by scale, automation level, and technology choice.

Semi-Automated vs. Fully Automated Line

Criterion	Semi-Automatic	Fully Automated
Loading / Unloading	Manual by operator	Robotic handling systems
Throughput	~100–300 modules/hour	Up to ~600 modules/hour
Best Suited For	Medium-scale (25–100 MW/yr); lower CAPEX	High-volume (>200 MW/yr); minimized unit cost
Initial Investment	Moderate upfront	Higher upfront; lower cost-per-module at scale
Downtime Risk	Higher (manual load/unload cycle)	Lower (continuous flow possible)
Ramp-Up Period	12–18 months typical	18–24 months to full capacity

Key Risks & Operational Challenges

Supply Chain

- Solar cells: ~50–60% of BOM — sourcing concentration risk
- No domestic cell manufacturing in UAE; cells must be imported
- Global silicon commodity price volatility affects raw material costs

Skilled Labor

- Unskilled/semi-skilled labor is widely available (expatriate workforce)
- Specialized solar manufacturing technicians require targeted recruitment
- Training programs from turnkey provider partially offset skills gap

Market & Competitive Risk

- Chinese manufacturers projected to control ~85% of MENA capacity by 2028
- Global module oversupply may compress margins for new entrants
- Tariff environments can shift — export dependency on US market carries policy risk

Environment & Infrastructure

- Arid climate: dust management critical for production equipment uptime
- Water availability and cost must be factored into facility planning
- Permit and licensing timelines vary by emirate and free zone

Market Outlook: 2025–2030

1

Demand Trajectory

UAE capacity projected to grow from 7.90 GW (2024) to 36.06 GW by 2029 – CAGR of ~35.5%

2


Manufacturing Scale-Up

MENA module manufacturing capacity could reach 44 GW by 2029; regional self-sufficiency forecast by 2026

3

Investment Flow

\$54B committed to UAE energy infrastructure; \$30B dedicated climate fund active; AED 150–200B in planned renewables investment by 2030

 Middle East annual power sector investment projected to more than triple to ~\$126B by 2035 (IEA). Solar and wind to account for ~\$45B/year by 2035.

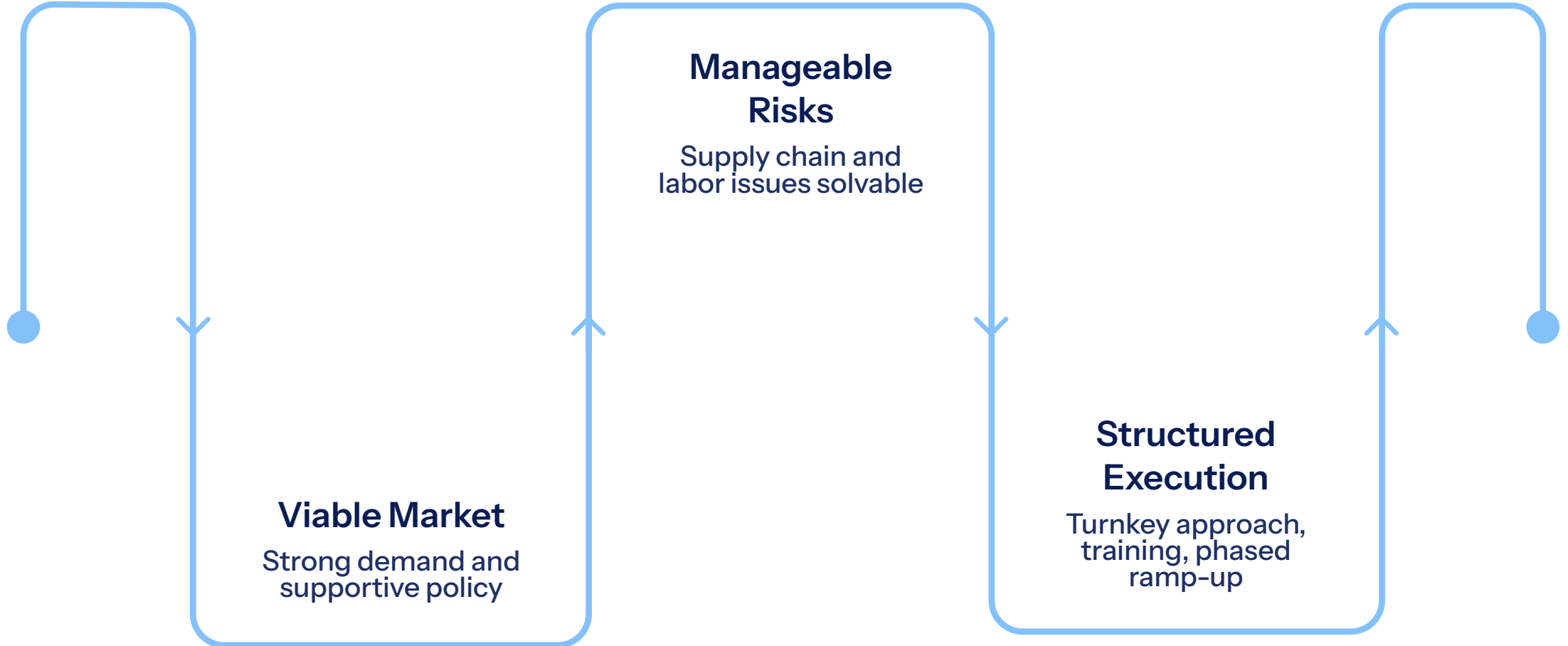
Strategic Feasibility Assessment

Favorable Conditions

- Binding national renewable targets create predictable long-term demand
- Free zone tax and duty incentives reduce investment cost burden
- Tariff arbitrage creates viable export pathway, especially to US market
- Proven turnkey manufacturing concept available – reduces execution risk
- 12-24 month ramp-up to full capacity is achievable with structured commissioning

Conditions Requiring Mitigation

- No domestic cell supply: upstream sourcing strategy must be secured pre-launch
- Global oversupply may require cost-per-watt discipline from day one
- Skilled workforce gap: training investment must be embedded in project plan
- Tariff policy volatility: export market diversification advisable
- Working capital requirement ~€1.5M–€3M above equipment CAPEX



Recommended Next Steps

01

Site & Zone Selection

Evaluate Abu Dhabi (KIZAD) vs. Dubai (JAFZA) free zones for regulatory and logistics fit

02

Detailed Feasibility Study

Commission project-specific CAPEX/OPEX model; define production scale (50–200+ MW/yr); validate off-take pipeline

03

Turnkey Partner Engagement

Engage an experienced European turnkey provider; define line configuration (semi-auto vs. fully automated) and technology scope

04

Upstream Sourcing & Cell Supply

Secure cell supply agreements prior to line commissioning; evaluate long-term backward integration options

05

Regulatory & Licensing

Initiate permit process; align with "Make it in the Emirates" local content framework; confirm off-take / PPA structure

About the Content Partner

J. v. G. technology GmbH – The DESERT Company

Founded in 1997 in Bavaria, Germany. Family-owned engineering company specializing in turnkey solar module production lines.

More than 90 factory projects delivered worldwide.

On-site team training included – no prior manufacturing experience required.

Key areas:

Turnkey PV manufacturing lines | DESERT Technology® |
TÜV-certified module designs | Factory planning to production

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Source:

<https://www.pvknowhow.com/countries/uae/solar-manufacturing-in-uae>

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