

Assessing Factory Site Suitability in Malawi: A Guide to Power, Transport, and Industrial Zones

Power, Transport & Industrial Zones — A Framework for Solar Module Manufacturing

Content Partner: J. v. G. technology GmbH

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Technical Overview: Factory Site Suitability in Malawi



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

Solar

Factory Type

Solar module manufacturing facility — turnkey concept delivered by an experienced European provider

Site

Primary Focus

Infrastructure & site suitability assessment — power, transport, and industrial zone analysis

3

Critical Factors

Power grid stability ·
Transport corridor access ·
Industrial zone designation and readiness

MW

Region: Malawi

Landlocked Southern African market — assessed across Blantyre, Lilongwe, and Liwonde SEZ locations

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Malawi's Industrial Landscape: Structural Context

National Industrial Baseline

- Predominantly agrarian economy — tobacco, tea, sugar account for the majority of export earnings
- Manufacturing sector remains underdeveloped — solar module production would represent a significant industrial first-mover position
- Malawi 2063 national vision explicitly prioritises industrialisation as a strategic economic objective
- Investment promotion administered by the Malawi Investment and Trade Centre (MITC)

Policy & SEZ Framework

- Special Economic Zones Act enacted December 2023 — new regulatory framework for designated industrial production areas
- Four sites identified for SEZ and industrial park development: Mzuzu (72 ha), Lilongwe Area 55 (417 ha), Blantyre Matindi (130 ha), and Liwonde
- ARISE IIP signed a development agreement with the Government of Malawi in February 2024 for construction of an SEZ and dry port
- Export Processing Zone (EPZ) regime operational since 1995 — qualifying manufacturers may apply for EPZ status regardless of physical zone location

Blantyre: Commercial Hub Assessment

Location Strengths

- Malawi's commercial capital and largest industrial concentration — population over 800,000
- Best-developed road network in the country — direct access to Beira corridor via Mozambique
- Matindi Industrial Park (130 ha) designated as SEZ site — designs for access roads and wastewater infrastructure submitted to Blantyre District Council
- Proximity to existing manufacturing base reduces supplier and workforce recruitment lead times

Power Infrastructure

- Grid-connected — substations upgraded under MCC Infrastructure Development Project; distribution extensions now active in and around Blantyre
- 98% of Malawi's power generated in the south — Blantyre is closest to generation source, reducing transmission losses
- Grid reliability remains a constraint — industrial users must plan for backup power regardless of substation proximity

Site Suitability Verdict

- Strongest existing infrastructure profile of assessed locations
- Industrial land availability constrained — Matindi SEZ still in planning and approval phase as of 2025
- Recommended for investors prioritising existing logistics networks and workforce depth over greenfield cost

Lilongwe: Capital City Assessment

Location Strengths

- Political capital and largest city — population approximately 989,000; home to government ministries and regulatory bodies
- Area 55 Industrial Park (417 ha) — largest designated SEZ site in Malawi; over K2 billion in land compensation already disbursed
- International airport proximity supports executive travel and airfreight for high-value components
- Growing administrative and services economy provides white-collar workforce pipeline

Power Infrastructure

- Kanengo substation: 20 MW Battery Energy Storage System (BESS) under construction — launched November 2024, GEAPP-funded (\$20M grant), target commission 2025
- Power generated predominantly in southern Malawi — Lilongwe sits at end of long transmission corridor, historically prone to bottlenecks
- MCC transmission upgrades have improved Lilongwe grid stability, but industrial-grade reliability remains uncertain

Site Suitability Verdict

- Largest land bank of the three assessed sites — suitable for phased capacity expansion
- Area 55 SEZ progress has been slow — limited physical development on-site despite significant compensation payouts
- Recommended for investors with a long-term horizon and appetite for first-mover positioning in a developing industrial park

Liwonde SEZ: Corridor-Adjacent Opportunity

Strategic Position

- Located on the Nacala Rail Corridor — the 912 km multimodal rail route connecting Nacala port through Liwonde to Tete, Mozambique
- ARISE IIP development agreement (February 2024) includes SEZ and dry port construction at Liwonde — direct rail-to-factory logistics potential
- Liwonde is the only assessed site with direct rail connectivity to a deepwater port — significant for heavy industrial inputs

Power & Utilities

- Grid access more limited than Blantyre or Lilongwe — requires greater reliance on captive generation for industrial loads
- SEZ utility readiness is a prerequisite for development — Ministry of Trade has confirmed utilities must be in place before investor rollout
- Solar-plus-storage hybrid systems particularly viable at this location given land availability and irradiation levels

Site Suitability Verdict

- Highest strategic upside if ARISE IIP SEZ is developed on schedule — integrated dry port dramatically reduces import logistics complexity
- Highest infrastructure risk in the near term — utilities and road access still in development phase
- Recommended for investors with flexible timelines and strategic interest in rail-linked manufacturing and export positioning

Power Grid Challenges

| Challenge | Current Situation | Implication for Solar Manufacturer |
|---------------------|--|--|
| Grid access rate | Only 15.6% national electricity access as of 2023 — 6.1% in rural areas | Industrial zones may lack adequate connection infrastructure — due diligence required pre-lease |
| Generation capacity | 653 MW installed capacity in 2023 — backlog of 70,000 new connections; unable to supply emerging industrial projects | Grid power cannot be assumed as reliable industrial base load — captive generation is a necessity, not an option |
| Outage frequency | Regular outages due to insufficient generation and unreliable transmission and distribution infrastructure | Production line downtime risk — uninterruptible power for lamination and testing processes is critical |
| Investment deficit | Estimated USD 2.5 billion required to address energy deficit — long-term structural gap | Systemic improvement unlikely in investor planning horizon — off-grid strategy must be part of site planning |

Hydropower Dependency Risks

The Hydropower Concentration Problem

- Hydropower accounts for approximately 88% of Malawi's 653 MW installed generation capacity (2023)
- Hydro plants are frequently affected by drought and low water levels — seasonal and climate-driven variability is structural
- Unpredictable rainfall patterns pose direct risks to reliability of major hydropower stations contributing the majority of national electricity supply
- 98% of generation located in the south — long transmission corridor to Lilongwe creates voltage stability issues in central and northern regions

Climate Exposure & Trend Risk

- Cyclone events in 2022–2023 (Freddy, Ana) damaged transmission infrastructure and disrupted the Nacala rail corridor — compound infrastructure risk
- Climate projections for Southern Africa indicate increasing drought frequency — hydropower output likely to become less reliable over time
- Seasonal dry periods (May–October) typically correlate with reduced generation — manufacturing ramp-up planning should account for seasonal grid behaviour
- A solar module manufacturer dependent on grid power would face the paradox of production disruption due to the very resource its products harness

Backup Power Strategy

1

Tier 1: Solar PV + Storage

On-site rooftop or ground-mounted solar PV with battery energy storage — primary captive generation; low operating cost and aligned with product category. BESS technology increasingly cost-competitive in the region.

2

Tier 2: Generator Backup

Diesel or HFO generator sets as firm backup for periods of low solar irradiation or battery depletion — sized to cover critical production processes and not entire facility load. Fuel storage and supply chain to be assessed per site.

3

Tier 3: Grid Supplement

Grid connection retained as an opportunistic supplement during periods of stable supply — reduces dependence on diesel backup. Grid used for non-critical loads (lighting, offices, ancillary systems) where possible.

- ❏ A proven turnkey manufacturing concept from an experienced European provider integrates captive power planning into the facility design — backup power infrastructure forms part of the complete factory delivery, not a post-installation afterthought.

Logistics & Transport Corridors

Malawi's Landlocked Reality

- Malawi has no coastline — all imports and exports transit third-country ports and border crossings
- 90% of Malawi's freight moves by road — rail attracts less than 10% of total traffic
- Logistics costs are among the highest in the SADC region — freight cost is a material input cost for any manufacturing operation dependent on imported components
- Four active seaport options: Nacala (Mozambique), Beira (Mozambique), Dar es Salaam (Tanzania), Durban (South Africa)

Road Infrastructure Condition

- Main arterial routes between Blantyre, Lilongwe and border crossings are in generally usable condition
- Secondary roads and off-arterial access to industrial sites are frequently poor — site-specific access assessment is essential
- Road transport from Beira port to Blantyre: typically 2–5 days under normal conditions
- Heavy machinery and oversized loads (e.g. production line equipment) require specialist route surveys and permit applications

Rail Infrastructure

- Nacala Rail Corridor (912 km, Nacala–Liwonde–Moatize) is the only functional railway currently serving the Malawian market
- Nacala port rehabilitated and modernised — inaugurated October 2023 by presidents of Mozambique, Zambia, and Malawi; financed by USD 249M Japanese soft loan
- Rail transit times on Nacala corridor can reach 25 days for some users — planning lead times must be factored into supply chain design

Nacala vs. Beira Corridor

| Factor | Nacala Corridor | Beira Corridor |
|--------------------|--|--|
| Port type | Deepwater natural port — one of the deepest in Africa; rehabilitated 2023 | Established multi-purpose port — historically dominant for Malawian trade; strong break-bulk capability |
| Distance to Malawi | Approximately 830 km to main economic centres — shortest port distance for Malawi | Longer road distance to Blantyre but Beira has strengthened its share of Malawian trade 2016–2020 |
| Rail connectivity | Only functional rail linking Malawi to a seaport — 912 km multimodal corridor via Liwonde | Sena/Limbe rail line historically damaged by flooding and civil war — not currently operational for Malawi traffic |
| Modal split | Rail accounts for 90% of freight through Nacala port — rail tariffs reported as high | Road dominant — Beira road corridor handles the majority of Malawi's commercial traffic by volume |
| Strategic outlook | Growing investment and regional cooperation — Malawi secured a 99-year dedicated terminal at Nacala port (August 2024) | Established and familiar corridor for Malawian operators — preferred by majority of current freight forwarders |

Key Investor Risks

Power & Infrastructure Risk

- Grid power is structurally unreliable — industrial investors must budget for captive generation from project inception
- USD 2.5 billion investment required to address Malawi's energy deficit — systemic improvement is a long-term proposition
- SEZ utility readiness (power, water, wastewater) is not yet confirmed at all designated sites — pre-lease due diligence is critical

Logistics & Supply Chain Risk

- Landlocked geography structurally elevates import costs for manufacturing inputs (cells, EVA, glass, frames, backsheet)
- Corridor disruption risk: cyclones, flooding, and political instability in transit countries (Mozambique) can close routes without warning
- Transit times and port dwell times are variable — inventory buffer requirements must be built into working capital planning

Regulatory & Market Risk

- SEZ Act (2023) is new — implementing regulations and institutional capacity still being developed; investor protections are untested in practice
- Currency risk: Malawian Kwacha has experienced significant depreciation — USD-denominated input costs against MWK revenue base creates FX exposure
- Early engagement with MITC, local legal counsel, and site utilities providers is strongly advisable prior to committing to a specific location

Strategic Conclusion

Blantyre

- Best near-term infrastructure
- Closest to Beira corridor
- Industrial land constrained
- Suitable for investors prioritising operational readiness

Lilongwe


- Largest SEZ land bank (417 ha)
- Regulatory proximity to government
- BESS investment improving grid
- Suitable for long-horizon first-movers

Liwonde SEZ

- Only rail-linked site to deepwater port
- ARISE IIP dry port in development
- Utility readiness not yet confirmed
- Suitable for export-oriented strategy

All Sites

- Captive power is non-negotiable
- Corridor disruption planning essential
- Site-specific due diligence required
- Turnkey provider integration reduces risk

 Site selection is not a final decision made once — it is an ongoing process aligned with SEZ readiness, corridor investment, and power infrastructure development. A phased assessment approach is recommended before capital commitment.

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.

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Source:

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