Grid Connectivity and Industrial Tariffs: A Key Cost Factor for Solar Manufacturing in Kazakhstan

A Key Cost Factor for Solar Manufacturing

Content Partner: J. v. G. technology GmbH

Turnkey solar module production lines — since 1997

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Technical Overview: Grid Connectivity and Industrial Tariffs for Solar in Kazakhstan

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

~27 KZT

Electricity Cost

Industrial tariff range: ~24–30 KZT/kWh ($0.05–0.07 USD)

~11 kWh

Power per Module

Consumption per module produced: ~10–12 kWh

6–18 mo

Grid Connection

Typical grid connection timeline for industrial facilities

3 Zones

Regional Scope

Kazakhstan North / South / West grid zones analyzed

Focus: Grid connectivity & industrial power costs · Region: Kazakhstan · Source: PVKnowHow / J.v.G. Technology GmbH

Kazakhstan's Energy Landscape: Key Facts

Power System Overview

- Unified Energy System (UES) covers North and Central zones
- South and West zones operate with partial interconnection
- Grid heavily reliant on legacy coal-fired generation capacity
- National grid operator: KEGOC

Industrial Relevance

- Industrial consumers access preferential tariff tiers
- Tariff class determined by voltage level and load profile
- High-load manufacturing qualifies for lowest per-kWh rates
- Tariffs set by regional energy regulators — vary by zone

Industrial Electricity Tariff Structure

Parameter	North Zone	South Zone	West Zone
Tariff Range (KZT/kWh)	~24–28	~26–30	~25–29
USD Equivalent	~$0.05–0.06	~$0.06–0.07	~$0.05–0.07
Voltage Level Access	High voltage (HV)	High voltage (HV)	Mixed HV/MV
Grid Stability Rating	Moderate–High	Moderate	Variable
Renewable Integration	Growing	Active (solar)	Limited

Grid Connection Process & Timeline

1

1 — Site Assessment & Load Application

Submission of technical load application to regional grid operator

Defines connection voltage level and required capacity (MW)

2

2 — Technical Conditions Issued

Grid operator issues technical conditions (TU) — typically 30–90 days

Specifies transformer requirements, protection relays, metering

3

3 — Design & Permitting

Connection infrastructure design, state expert review required

Permitting phase frequently the longest variable — 3–9 months

4

4 — Construction & Testing

Physical grid connection built; relay protection tested and commissioned

Final grid operator acceptance inspection required

5

5 — Commercial Power Supply

Industrial tariff contract signed; metering activated

Total timeline: **6–18 months** depending on zone and load size

Power Consumption Profile: Solar Module Manufacturing

Total Consumption per Module

- ~10–12 kWh per module (full production line)
- Lamination is the most energy-intensive single process step
- Heating platens to 135–180°C accounts for majority of thermal load

Annual Factory Load Estimate

- 100 MW/yr line: ~4–5 GWh/year total electrical consumption
- Peak demand load: typically 1–3 MW depending on line configuration
- Stable baseload profile favorable for industrial tariff classification

Cost Impact at Scale

- At 24–30 KZT/kWh: ~$0.50–0.84 electricity cost per module produced
- Electricity represents a meaningful share of total variable manufacturing cost
- Tariff optimization and connection voltage level directly affect unit economics

Grid Stability: The Primary Operational Risk

Risk Factors

- Voltage fluctuations can damage sensitive laminator heating systems
- Unplanned outages mid-cycle cause module scrap — rework not possible post-lamination
- Frequency deviations affect PLC-controlled process equipment
- West zone historically most exposed to supply interruptions

Mitigation Measures

- UPS systems for control and automation equipment
- On-site diesel backup for critical process continuity
- Power quality monitoring and surge protection at entry point
- Contractual supply reliability clauses with regional energy supplier

Regional Grid Zone Comparison

North Zone

- Best-developed industrial grid infrastructure
- Proximity to major coal generation base
- Most favorable connection timelines for large loads
- Astana / Karaganda industrial corridor most accessible

South Zone

- High solar irradiation — strong strategic fit for PV manufacturing
- Grid capacity constraints in some sub-regions
- Active renewable energy development — policy support present
- Almaty corridor: higher tariffs but strong logistics access

West Zone

- Dominated by oil & gas industrial load profile
- Grid reliability lower than North/South benchmarks
- Limited renewable integration to date
- Long connection timelines; higher mitigation investment required

Cost Impact Analysis: Grid vs. Off-Grid Scenarios

Grid-Connected (Optimal)

- Electricity cost: ~24–28 KZT/kWh at high-voltage industrial tariff
- Requires 6–12 month connection lead time for well-served industrial zones
- Lowest long-run cost per module — preferred for >50 MW/yr scale

Grid-Connected (Constrained Zones)

- Electricity cost: ~26–30 KZT/kWh; lower voltage access only
- Connection timeline: 12–18 months; higher infrastructure investment
- Grid instability risk requires additional on-site backup investment

Hybrid / Off-Grid (Backup)

- Diesel or gas genset backup adds ~$0.10–0.18/kWh when operated
- Only viable for short-duration outage bridging — not baseload supply
- On-site solar + battery storage not yet cost-competitive at this scale in KZ

Strategic Considerations for Site Selection

1

Grid Capacity Verification

Confirm available HV capacity at substation level before site commitment — avoids costly post-purchase surprises

2

Tariff Class Planning

Structure load profile and connection agreement to qualify for lowest industrial tariff tier from day one of operations

3

Timeline Risk Management

Build 6–18 month grid connection lead time into project schedule; parallel-track permitting with equipment procurement

An experienced European turnkey provider integrates power infrastructure planning into factory setup methodology — reducing grid-related project delays for new manufacturers entering Kazakhstan.

Key Takeaways

1 Electricity cost is competitive

At ~24–30 KZT/kWh ($0.05–0.07), Kazakhstan's industrial tariff is favorable for energy-intensive solar manufacturing

2 Grid connection timeline is the critical path

6–18 months must be planned into project schedules; North zone offers fastest timelines

3 Stability risk requires active mitigation

Grid interruptions mid-process cause irreversible module scrap — power protection investment is non-negotiable

4 Zone selection materially affects economics

North and South zones preferred; West zone requires higher contingency budget and longer lead time assumptions

Source: PVKnowHow / J.v.G. Technology GmbH · Data reflects composite industrial scenarios based on real project parameters · Kazakhstan, 2024

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

www.jvg-thoma.com

Contact

J.v.G. Technology GmbH

Möningerberg 1a, 92342 Freystadt, Germany

info@jvg-thoma.de | www.jvg-thoma.com

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