BEIREK

SERVICE PROGRAM

Solar PV End-to-End Project Delivery Management

Owner-Side Solar Power Plant Delivery Management Program

BEIREK LLC - THE PROJECT MANAGEMENT COMPANY

An implementation program that manages a solar power plant investment on the owner's side through development, design, finance preparation, engineering, procurement and construction (EPC), construction, commissioning, acceptance, handover, operations and maintenance (O&M), and asset performance within one delivery system.

> A power asset is not complete when modules, inverters, mounting systems, and transformers reach the site. It becomes a manageable and revenue-producing plant when project rights, site data, permits, grid and revenue arrangements, design, contracts, quality, testing, operating capability, and evidence work together against defined acceptance criteria.

PREPARED BY
BEIREK LLC
THE PROJECT MANAGEMENT COMPANY

SERVICE PROGRAM
SOLAR PV END-TO-END PROJECT DELIVERY MANAGEMENT
US ENGLISH · VERSION 3.4-FINAL

PROGRAM FRAMEWORK

1. A manageable PV investment requires one decision and evidence chain from project rights through operations

Solar PV End-to-End Project Delivery Management treats a solar project as one asset-delivery program rather than a collection of disconnected advisory reports or equipment packages. Utility-scale ground-mounted, commercial and industrial rooftop, carport, agrivoltaic, distributed-portfolio, and battery energy storage system (BESS) configurations use the same underlying control logic; their technical, legal, commercial, and operating conditions are determined for the actual project.

The service may begin when an investment is still an idea or early-stage development; an acquired project requires due diligence; evidence gaps remain before financing; the delivery model is unresolved; the EPC contract does not protect the owner's requirements; procurement and construction interfaces are fragmented; schedule or cost pressure is increasing; commissioning or acceptance is disputed; handover is incomplete; or an operating plant has performance and warranty problems.

The program's first output is not more activity but a decision-ready project definition. It establishes what asset will be developed, under which rights and revenue arrangement, at which site, on what technical basis, through which delivery model, within what capital and schedule boundaries, and under what acceptance and operating conditions. Sources, assumptions, limitations, responsibilities, and decision dates are recorded.

Acceptance requires the client team to explain the current project purpose, authority structure, data sources, critical uncertainties, decision gates, remaining professional-opinion needs, and no-go conditions without BEIREK assistance. The service does not guarantee generation, financing, permits, grid connection, completion date, or investment return.

1.1 The program creates value when the investor can provide decision authority and verifiable project inputs

The service is suitable for investors that can define capital and decision authority, disclose project facts, appoint the required legal, tax, environmental, social, technical, insurance, and finance specialists, own the employer's requirements, and accept a hold at a decision gate. It is unsuitable where rapid approval is expected from unauthorized information, an undefined capacity, unacquired land rights, unconfirmed grid availability, unsupported generation, or fixed price and completion promises.

PROGRAM FRAMEWORK

1. A manageable PV investment requires one decision and evidence chain from project rights through operations

CONTINUED · 02

The maturity review tests six connected domains: project and land or building rights; measurement and site data; permits, environmental and social conditions, and stakeholders; grid and energy-sale or consumption arrangements; technical design and deliverability; and financing, contracts, and operating readiness. Strength in one domain cannot cancel a critical failure in another through an aggregate score.

Project type changes the scope. A ground-mounted plant emphasizes land rights, topography, geotechnical conditions, drainage, roads, fencing, and grid corridors. A rooftop project emphasizes structural capacity, fire, waterproofing, live-facility, and access interfaces. Carport and agrivoltaic projects reconcile vehicle, user, or agricultural functions with energy design. BESS introduces different safety, fire, control, grid, contract, and life-cycle responsibilities.

BEIREK's scope is project management, owner-side integration, controls, and acceptance preparation. Licensed engineering sign-off, design certification, energy-yield opinion, laboratory testing, legal title, tax or customs opinion, credit or investment advice, insurance acceptance, environmental and social assurance, safety authority, contractor means and methods, and grid or regulatory decisions remain with the responsible qualified parties.

Acceptance requires a written record of project type, current stage, information quality, critical gaps, client and specialist roles, open conditions, immediate containment actions, and unsuitable expectations. The engagement scope is frozen from this maturity result; undefined responsibility is not transferred to BEIREK.

PROGRAM FRAMEWORK

2. The right delivery model aligns owner capability with the risks assigned through the contract structure

A delivery model is not merely a contract label. It allocates who manages design, procurement, construction, interfaces, price, schedule, change, performance, acceptance, and long-term responsibility. The same plant requires different owner teams, expertise, data, controls, and contingencies under different models. Selection considers the investor's management capacity, design maturity, packaging options, market competition, schedule, price uncertainty, number of interfaces, financing requirements, and operating objective.

Under a project management consultancy (PMC) or owner's representative model, contracts and fundamental risks remain with the owner while BEIREK operates governance, coordination, controls, and acceptance systems. Under engineering, procurement and construction management (EPCM), design and package management may be more integrated, but construction and supply contracts and a substantial share of interface risk may remain with the owner. The actual contract terms govern over the title.

Under EPC, one principal contractor assumes the defined design, procurement, construction, testing, and delivery scope. Turnkey may express a broader expectation of completion and operable handover, but the word alone does not transfer risk when scope, exclusions, owner inputs, and acceptance criteria are not written. Under EPC + O&M, delivery and long-term operations and maintenance can be linked; construction acceptance, long-term performance, and warranty still require distinct criteria.

Comparison covers scope and design authority, interfaces, price and schedule basis, supplier access, change, security, warranty, delay and performance remedies, acceptance, intellectual property, data, licenses, spares, transition to operations, dispute route, and termination. Qualified legal, tax, insurance, and technical advisers own their opinions. BEIREK integrates the decision facts and implementation dependencies.

Acceptance requires the selected model's rationale, owner capability, retained rights, transferred and retained risks, specialist needs, contract packages, interface owners, control system, and acceptance authority to be explicit. No model is declared universally superior; it must be executable under the actual project conditions.

PROGRAM FRAMEWORK

3. Six decision gates tie irreversible capital and site commitments to evidence

The program has six principal phases: diagnostic and investment thesis; development and financeability; employer's requirements, design, and procurement; mobilization, construction, and site control; commissioning, acceptance, and handover; and O&M, asset performance, and lifecycle. Phases may overlap, but an irreversible capital or site commitment is not authorized before the relevant decision gate passes.

Gate 1 approves the project definition, target asset, rights and site condition, demand or revenue logic, grid path, initial capacity range, critical measurement and adviser needs, and no-go conditions. Gate 2 accepts the development file and investment basis, including rights, permitting path, site data, environmental and social conditions, grid and revenue arrangement, energy-yield basis, cost and cash cases, and financing gaps.

Gate 3 freezes the employer's requirements, design basis, applicable standards, design responsibility, packaging strategy, EPC interfaces, cost and schedule baseline, and procurement authority. Gate 4 tests construction readiness through issued-for-construction design, permits and access, mobilization, health, safety and environment controls, quality, logistics, temporary facilities, personnel, cash, and open risks.

Gate 5 releases energization, commissioning, and performance testing based on completion, safety, authorized roles, grid conditions, test protocols, calibrated instruments, data, and punch status. Gate 6 accepts provisional or final acceptance, transition to commercial operation, and handover based on contractual evidence, performance results, documents, training, spares, open warranties, and residual risks. Each gate may proceed, proceed conditionally, hold, remediate, or stop.

Program governance ties decisions to source records. Recommendation, review, approval, execution, verification, and acceptance are separate roles. A conditional decision has a precise boundary, compensating control, owner, expiry, and reopening trigger. Schedule pressure cannot silently cancel a critical safety, right, grid, design, or quality condition.

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

Development establishes a project that can be delivered under defined rights, permits, grid, revenue, design, financing, and implementation conditions; it does not maximize the theoretical module capacity of a site or roof. Land ownership, lease, easement, access, cable and road corridors, grid facilities, building use, common areas, expropriation, and similar rights are reviewed by qualified advisers under the applicable law and project structure.

The rights register tracks each parcel, building, corridor, or facility by right type, parties, scope, coordinates or boundary, duration, renewal, transfer, termination, consideration and escalation, use restrictions, third-party rights, security, lender requirements, registration status, and open conditions. Visible physical access does not establish legal access; an executed agreement does not establish technical suitability.

Project rights extend beyond land. Corporate and special-purpose-vehicle authority, permit applications and approvals, grid-connection rights, energy sale or self-consumption arrangements, ownership of data and studies, supply and contractor contracts, intellectual property and software licenses, securities and warranty rights, insurance, and shareholder or investor approvals where relevant are tracked together.

The development file records the source document itself, owner, date, scope, validity, applicable parcel, building, or project entity, approving party, outstanding condition, and next decision. A summary presentation or data room folder name is not evidence. Due diligence tests source validity and cross-source consistency through the responsible disciplines.

Acceptance requires critical rights to be defined, appropriately authorized and durable, transferable where the project structure requires, reconciled to the physical layout and corridors, and aligned with lender and security requirements. Remaining legal or commercial conditions must be tied to the responsible adviser and decision gate. BEIREK does not provide legal opinions on title, lease, or project rights.

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

CONTINUED · 02

4.1 Site and resource evidence converts theoretical capacity into a practicable design boundary

Site data is not simply an input to capacity; it is a design boundary. The topographic survey puts coordinate and elevation systems, parcel and use limits, slopes, drainage paths, existing roads, structures, lines, obstacles, vegetation, access, and grid corridors onto a controlled base map. Instruments, method, date, accuracy, coverage gaps, and raw data are recorded.

The geotechnical program examines soil strata, bearing, settlement, excavation, corrosion, groundwater, drainage, erosion, liquefaction or swelling, fill, slopes, foundations and piles, roads, and platforms in proportion to project risk. A qualified geotechnical professional determines investigation quantity and location from variability, layout, loading, and the decisions to be supported rather than site size alone.

For rooftops, carports, and existing structures, the structural assessment covers existing drawings and calculations, material and condition inspection, measurement, connections, added permanent and imposed loads, wind, snow, seismic conditions, waterproofing, fire and egress, maintenance access, live-facility constraints, and strengthening where required. Visual inspection alone is not structural approval.

Meteorological and resource data define irradiance components, temperature, wind, precipitation, snow, humidity, soiling, albedo, and extreme conditions for the applicable design and energy model. Source, period, spatial representativeness, missing data, correction, long-term adjustment, and uncertainty are disclosed. A short site-measurement period cannot by itself establish long-term climate behavior.

Acceptance requires every discipline to use the same coordinate system, parcel or building, design life, loading, and climate basis; raw and processed data to remain traceable; critical gaps to be managed through further measurement or an approved conservative boundary; and qualified professionals to own their respective design and conformity judgments.

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

CONTINUED · 03

4.2 Permit and stakeholder commitments remain traceable through design, construction, and operations

The permit program is not a list of application names. It is a dependency schedule for the decisions required to hold project rights, design, access the site, construct, energize, operate, and close. Each permit or approval records the authority, legal basis, applicant, prerequisites, technical attachments, fees, formal process, validity, conditions, appeal, modification, and renewal requirements. Qualified legal and regulatory advisers determine applicability.

Environmental and social management covers, as relevant, site selection, biodiversity, land use and livelihoods, cultural heritage, water, drainage and erosion, waste, noise, dust and traffic, labor and supply chain, community health and safety, fire, grievance response, emergency planning, climate resilience, and dismantling or restoration. The clean-energy purpose does not remove project-specific impacts.

The stakeholder register tracks rights holders and users, neighbors, local communities, workers, authorities, the grid party, buyer, financing parties, contractors and suppliers, insurers, and operators by impact, expectation, authority, communication, and decision need. Disclosure, consultation, approval, negotiation, and grievance response are distinct activities.

The commitment register ties a permit condition, environmental or social mitigation, lender requirement, design input, construction method, monitoring criterion, owner, source, date, cost or schedule effect, and closure evidence. A commitment in a study is not implemented unless it reaches the specification, contractor plan, site inspection, and operating instruction where applicable.

Acceptance requires the critical permitting path and formal status to be source-confirmed, design and construction dependencies visible, responsible roles appointed, change impacts controlled, and open grievances and commitments owned. BEIREK does not issue permits, provide environmental or social assurance, or guarantee stakeholder acceptance.

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

CONTINUED · 04

4.3 The grid and revenue structure aligns the technical delivery point with the commercial calculation basis

The grid and revenue architecture defines where electricity is delivered, under which technical conditions, through whose facilities and meters, with which loss and curtailment responsibilities, and how revenue or savings are calculated. A connection application or capacity letter does not mean that every design, schedule, cost, testing, protection, data, and commercial condition is fixed.

The grid basis records the point of connection, voltage, active and reactive power, protection and control, short-circuit and grid studies, communication and remote control, metering and data, power quality, fault contribution, islanding, curtailment, testing and witnessing, commissioning sequence, grid-facility scope, ownership, operations, maintenance, and boundary responsibility against current requirements from the responsible grid and design parties.

Depending on the project, the revenue or savings arrangement may use a power-purchase agreement, market sale, self-consumption, lease or service structure, portfolio balancing, or another permitted model. Quantity, price and adjustment, delivery point, losses, measurement and settlement, forecasting, imbalance, curtailment, outage, credit and security, tax, invoicing and collection, change, force majeure, early termination, and remaining rights are reviewed with qualified legal, tax, market, and finance advisers.

The commercial model uses the same plant configuration as the technical model. DC and AC definitions, connection limit, losses and curtailment, measurement points, operating schedule, planned outages, storage behavior, saleable energy, and meter data reconcile across design, energy-yield study, financial model, and contract. Gross generation from one model cannot be used as delivered energy in another.

Acceptance requires grid and revenue conditions to be confirmed from source documents; technical and commercial boundaries to match; open authority and buyer conditions to connect to schedule, cash, and risk; and meter, data, and settlement responsibility to be explicit. BEIREK does not guarantee connection, price, offtake, credit, collection, or curtailment outcomes.

09

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

CONTINUED · 05

4.4 The energy-yield study makes sources, losses, and uncertainty decision-ready rather than promising an output

An energy-yield study combines solar resource, design, equipment, site, grid conditions, and operating assumptions into an estimate of deliverable energy. It is not a software export or a single annual-generation number. The purpose, version, resource data, site and design scope, calculation method, responsible specialist, information date, limitations, and independent-review status are recorded.

Unconstrained resource, horizon and near shading, plane-of-array conversion, soiling and snow, spectral and angular effects, module temperature, nameplate and mismatch, nonlinear behavior, DC wiring and connections, inverter conversion and clipping, AC cable, transformers, auxiliary consumption, availability, grid outage and curtailment, degradation, and metering differences are separated on one basis. Losses are not counted twice and are supported by project-specific evidence.

P50 and P90 are statistical energy cases at defined exceedance probabilities; they are not guarantees. Resource variability, measurement and model uncertainty, data period, loss uncertainty, correlation, and calculation method are disclosed. P90 is not produced by arbitrarily reducing P50. A qualified energy-yield professional owns the method and result; lenders and investors make their own decisions.

Design alternatives are compared by more than total energy. The study considers time profile, delivery point, curtailment, equipment loading, thermal and electrical limits, land use, constructability, maintainability, warranty, and cost. A higher simulated output alone does not establish a better investment decision.

Acceptance requires model inputs to reconcile with design and contracts, the loss tree and uncertainties to be traceable, raw data and versions to be retained, and critical sensitivities to pass into the financial model. No P50/P90, capacity factor, availability, or production result is used as a service promise without an identified project study.

PROGRAM FRAMEWORK

4. Development and bankability align rights, site evidence, permits, grid conditions, and economics on one basis

CONTINUED · 06

4.5 Investment and operating economics use the same capacity, schedule, and risk assumptions as the technical basis

Capital expenditure (CAPEX) is not limited to modules and inverter quotations. Land or building rights, development, surveys, permits, design and advisers, equipment, grid facilities, civil, structural, and electrical work, logistics, tax and customs, insurance, temporary facilities, testing, spares, construction-period financing, reserves, and price, currency, and schedule uncertainty are assembled on the same scope breakdown.

Operating expenditure (OPEX) may include land or lease, staff and management, monitoring, security, cleaning, vegetation and drainage, planned and corrective maintenance, spares and consumables, specialist inspections, communications and software, metering and market costs, insurance, taxes, out-of-warranty events, major replacement, and dismantling or restoration provisions. A responsibility transferred to another party does not disappear from the model; its allocation is shown.

The financial model connects controlled sources for capacity and energy definitions, construction and commissioning schedule, saleable or offset energy, price and revenue conditions, CAPEX payments, OPEX and replacement, tax and depreciation, working capital, financing drawdowns, interest and fees, repayment, reserves, and downside cases. If Financial Modeling & Valuation is separately engaged, that service owns the model; the PV delivery program reconciles the technical, schedule, and contract inputs.

Financial-close dependencies may include project and land rights, permits, grid and revenue arrangements, environmental and social conditions, technical due diligence, design and energy yield, EPC and O&M contracts, security and warranties, insurance, equity and debt documents, accounts and reserves, and closing conditions. Qualified legal, tax, finance, insurance, and technical professionals own their respective opinions.

Acceptance requires the cost scope to reconcile with work breakdown and contracts; quantities, prices, currency, tax, escalation, date, payment, contingency, and source to be explicit; cash to align with the critical path; and debt and revenue conditions to use the same technical model. BEIREK does not guarantee financing, closing, investment returns, or debt-service performance.

PROGRAM FRAMEWORK

5. Design freeze converts the owner's requirements into measurable technical and contractual baselines

The employer's requirements translate the investment thesis into measurable technical, commercial, construction, operating, and acceptance conditions. They address the project boundary, capacity definition, design life, energy delivery point, site or building and climate data, standards and regulations, grid, performance and loss definitions, quality and safety, access and maintenance, data and cybersecurity, documents, testing, training, spares, warranty, and acceptance.

The design basis records resource and site data, loads, codes, design life, material environment, electrical architecture, control philosophy, construction and operating assumptions, design responsibilities, calculation and modeling methods, interfaces, exceptions, and verification plans in one version. Supplier catalogues do not replace a project design basis.

Requirements are traced to source, rationale, responsible discipline, verification method, and acceptance record. Unmeasurable phrases such as high quality, financeable, maintainable, or best practice are translated into material, calculation, test, access, document, spare, service, data, or acceptance criteria. Conflicting requirements are escalated to an authorized decision rather than hidden.

A design freeze does not prohibit all later change. It establishes the approved project configuration, data and calculations, open exceptions, specifications released for procurement, documents issued to site, and impact review required for later change. Early equipment release states the remaining design assumptions and reversibility risk.

Acceptance requires requirements to be sourced and owned, reconciled with the design basis and contract schedules, assigned to relevant specialist and authority reviews, and supported by resolved critical interfaces. Open exceptions must be accepted at the gate, and post-freeze changes must be controlled for cost, schedule, quality, permit, and other material impacts.

5.1 Multidisciplinary design is controlled through common asset and interface records

Structural and mechanical design connects module layout, fixed or tracking mounting, foundations and piles, corrosion, wind, snow, seismic and temperature effects, tolerances, drainage and erosion, roads and platforms, fences and gates, equipment foundations, cable support, fire and emergency access, cleaning and maintenance, building-envelope interfaces, and constructability. Qualified engineers own the design and professional approval.

PROGRAM FRAMEWORK

5. Design freeze converts the owner's requirements into measurable technical and contractual baselines

CONTINUED · 02

PV array design reconciles module configuration, string length, DC/AC ratio, orientation and tilt, row spacing, horizon and near shading, terrain following, electrical and mechanical tolerances, thermal boundaries, cleaning and maintenance access, and other land uses with energy yield and construction cost. Catalogue maximum power is not project capacity.

Electrical design covers DC strings, combining and isolation, cable sizing and routing, voltage drop, earthing and equipotential bonding, lightning and surge protection, inverters, medium- and high-voltage collection, transformers, switchgear, protection and control, auxiliary systems, meters, substation, and the grid interface. Qualified professionals complete short-circuit, load-flow, protection-coordination, grounding, power-quality, and similar studies as applicable.

The supervisory control and data acquisition (SCADA) and communications architecture defines devices and signals, time synchronization, data frequency, weather and meter sources, alarms and events, remote-command authority, retention, user access, backup, cybersecurity, software licenses, and O&M and warranty uses. Remote access does not replace safety and operating authority.

Design review tests calculations, drawings, models, equipment data, interfaces, regulatory requirements, and site reality in the same version. Independent review, when used, has a defined scope and limitations. Acceptance requires critical calculations to be authorized and traceable, carried into site and procurement documents, updated across disciplines when design changes, and available to construction and commissioning teams in the current approved version.

PROGRAM FRAMEWORK

6. Equipment and procurement decisions combine total cost with technical compliance, traceability, and long-term service

Equipment selection is not a brand ranking. It is the demonstrated fit of a specific product, factory, service system, and project requirement. Modules, inverters, mounting or trackers, transformers, medium- and high-voltage equipment, cables, connectors, protection, meters, SCADA, weather stations, security, and BESS are assessed against the design basis, certification, site and climate, mechanical and electrical interfaces, lead time, quality, change control, service, spares, warranty, and lifecycle.

The technical specification defines function and performance, environment and design conditions, applicable standards, materials and construction, interfaces and dimensions, quality planning, documentation and certification scope, samples and tests, factory acceptance testing (FAT), packaging and logistics, site support, commissioning, training and spares, software and data rights, warranty, and acceptance. Supplier standard exceptions are reviewed in a controlled list.

The procurement strategy considers package boundaries, design and performance responsibility, competition, market capacity, long-lead items, local-content and customs conditions, currency and payment risk, security, warranties and remedies, logistics and storage, alternatives, and interface management. More packages do not always mean better competition; the owner's capacity to manage interfaces creates a practical boundary.

Bids are normalized for scope, quantity, technical exceptions, tests and documentation, Incoterms, currency, tax and customs, price adjustment, payment, delivery, validity, security, delay and performance remedies, warranty, service, spares, liability, intellectual property, termination, and dispute provisions with qualified advisers. A low price is shown together with missing scope or front-loaded cash.

Acceptance requires selected equipment to be included in the approved design and energy model; product, production site, and version evidence to be confirmed; technical and commercial exceptions to reach authorized decisions; procurement to reconcile with construction and cash; and change notice, traceability, testing, documentation, service, and warranty conditions to be executable in the contract.

PROGRAM FRAMEWORK

6. Equipment and procurement decisions combine total cost with technical compliance, traceability, and long-term service

CONTINUED · 02

6.1 Supplier qualification traces approved equipment from the factory to the installed asset

Supplier qualification reviews the contracting entity, actual production site, product and certificate scope, quality system, capacity and allocation, critical subcontractors, change control, commercial resilience, service and spares, and warranty response in proportion to risk. A corporate presentation or a reference to a similar product does not confirm the offered configuration.

FAT uses an approved protocol, exact tested configuration, software and version, samples and materials, instruments and calibration, operating conditions, expected criteria, raw results, witnesses, deviations, correction, and retest. A supplier demonstration does not replace the approved test. A FAT result does not by itself approve shipment, contractual acceptance, or installed-site performance.

The logistics plan covers packaging and preservation, loading, route and ports, handling, dimensions and permits, insurance, customs, tracking, site access and unloading, lifting, temporary storage, climate and security, shelf life, damage and shortage inspection, incident notice, and warranty or carrier recovery. Delivery is not successful if early equipment cannot be protected on site.

Site receiving records purchase and package identity, quantity, packaging and seals, physical condition, transport data, photographs, certificates and shipping documents, storage requirements, nonconformance, quarantine, insurance or warranty notice, and release authority. Signing a delivery note does not replace contract interpretation of technical acceptance or transfer of title and risk.

Acceptance requires current supplier and product qualification, FAT deviations to carry into the shipment decision, equipment identity and condition to remain traceable from factory to installation, logistics to reconcile with site readiness, and nonconforming material not to be used without an authorized technical and quality decision.

PROGRAM FRAMEWORK

7. Construction starts only when design, site, HSE, logistics, quality, and cash conditions are ready together

Mobilization establishes the operating system before moving people and machinery to site. Site authority and access, permits and notices, issued-for-construction design, methods and risk assessments, health, safety, and environment (HSE) plan, quality plan, organization and competence, temporary facilities, power, water and communications, roads, storage, security, emergency response, equipment, and logistics readiness are tested together.

Site governance defines authority for the owner, BEIREK, EPC and other contractors, designers, supplier representatives, quality, HSE, grid parties, and specialists. Site access, work permits, isolation, lifting, excavation, energization, inspection hold points, nonconformance, design questions, change, daily records, and emergency stop routes are consistent across documents and field practice.

Construction-readiness review confirms for each work front the current drawing and specification, prior-work acceptance, materials and equipment, personnel competence, method and HSE controls, quality inspection and test plan, calibrated tools, access and logistics, weather and site condition, interfaces, and hold points. Adding labor to an unready work front does not create progress.

The baseline and look-ahead plan connect area, crew, quantities, prerequisites, materials, design, inspection, dependencies, and daily production under the same work breakdown. The constraints register records the issue, source, affected work, owner, required date, temporary control, and closure evidence. Reported progress is validated against accepted physical quantity and quality records.

Acceptance requires current approved information at the point of work; functioning authority and communications; passed critical HSE and quality prerequisites; alignment among logistics, materials, teams, and schedule; owned design, permit, and interface issues; and each work front released from real readiness evidence.

7.1 Field progress is verified through safety, quality, and completion evidence before percentage reporting

Construction management integrates excavation, foundations and piles, mounting, modules, DC cables and connectors, inverters and transformers, medium- and high-voltage systems, substations, SCADA, roads, drainage, fencing, and auxiliary systems through area and interface sequences. Each activity proceeds from controlled documents, competent teams, approved materials, methods, HSE controls, inspection and test plans, and handoff records.

PROGRAM FRAMEWORK

7. Construction starts only when design, site, HSE, logistics, quality, and cash conditions are ready together

CONTINUED · 02

The HSE system addresses DC electricity and arc hazards, energized systems, excavations, lifting, work at height, live roofs and facilities, traffic, cranes and logistics, heat, cold and weather, fire, BESS thermal events where relevant, security, ergonomics, wildlife, dust, noise, waste, and community interfaces in proportion to project risk. Contractors retain their means, methods, and HSE responsibilities; owner and authorized stop or inspection rights follow the actual contract and law.

Quality assurance and quality control (QA/QC) cover design, suppliers, incoming materials, storage, samples and first work, installation tolerances, torque and connections, cables and terminations, grounding, testing and calibration, welding, concrete and fill, waterproofing, labeling, cleaning and preservation, nonconformances, and completion evidence. Records are produced while work is accessible rather than reconstructed later from photographs.

The field record ties date, area and team, work and asset identity, current documents, material lot, weather and site condition, installed quantity, inspection and raw test results, witness, photograph or location, nonconformance, design query, stoppage, incident, rework, acceptance, and release to subsequent work. A daily report is not by itself a quality or contractual acceptance record.

Acceptance requires critical work to pass defined hold and witness points; nonconformances to close through containment, cause, correction, and retest; HSE incident and risk actions to have effectiveness checks; installed assets to trace to design and materials; and completion status to be reproducible from raw field evidence.

7.2 Schedule, cost, risk, and change are managed against the same baseline and contract record

Project controls are a decision system, not merely a reporting function. The approved scope and work breakdown connect schedule, cost, commitments, cash, procurement, documents, interfaces, risks, changes, quality, completion, testing, decisions, and actions through one coding structure. The baseline states its scope, assumptions, data date, version, and approval; later facts do not silently rewrite history.

PROGRAM FRAMEWORK

7. Construction starts only when design, site, HSE, logistics, quality, and cash conditions are ready together

CONTINUED · 03

The schedule records activities, durations, logic, calendars, resources, quantities and productivity, long-lead items, owner and authority inputs, access, weather and site assumptions, tests, and acceptance points. The critical and near-critical paths, total and free float, and required dates for decisions and information remain visible. Actual progress is supported by completed and accepted physical quantities, documents, or test results; an invoice or declared percentage is not sufficient evidence.

Cost control reconciles budget, contract, commitment, approved and pending change, accrual, invoice, payment, forecast, and contingency by scope, code, currency, and date. Cash is connected to payment terms and the critical path. A proposed saving is not accepted without showing its consequences for quality, warranty, energy, schedule, and lifecycle value.

The risk register records source, cause or trigger, affected objective, current controls, residual exposure, owner, action, specialist input, due date, and gate consequence. The change register records the request and basis, affected design, permit, contract, and site work, alternatives, cost, schedule, cash, quality, HSE, energy, and warranty effects, decision, and implementation evidence. An urgent site containment action does not become an undocumented permanent change.

Contract administration covers notice, records, instructions, variations, time and cost claims, securities, payments, tests and acceptance, delay and performance remedies, warranty, dispute, and termination with advice from authorized legal and contract professionals. BEIREK coordinates contemporaneous records and program effects; it does not issue a legal opinion on entitlement or liability. Acceptance requires current status, variance, and forecast to reconcile to source records and critical risks and changes to reach authorized decisions.

PROGRAM FRAMEWORK

8. Commissioning and acceptance convert physical completion into safe, evidenced operating readiness

Commissioning is not simply energizing equipment. It converts installed systems into a safe and functional energy asset in the correct sequence, under approved design and contract conditions. The completion system defines plant and subsystem boundaries, pre-commissioning checks, mechanical completion status, punch-list classes, energization authority, test packages, and responsible roles.

Prerequisites include accepted construction and quality records, closure of critical nonconformances, safe access and isolation, current single-line diagrams and settings, readiness of protection, SCADA, and meters, grid and authority conditions, approved test protocols, calibrated instruments, competent personnel, communications, emergency arrangements, and participation by the operating team. Schedule pressure cannot override safety or energization authority.

Functional and performance tests record the requirement, method, configuration, operating conditions, raw data, expected range, actual result, witness, deviation, correction, and retest for the DC and AC systems, inverters, transformers, switchgear, protection, grounding, SCADA and communications, weather systems, meters, remote control, alarms and events, grid compliance, and BESS where applicable. Performance results are interpreted with weather, grid condition, plant configuration, availability, exclusions, data quality, and contractual correction methods.

Provisional acceptance certificate (PAC) and final acceptance certificate (FAC) are used only with the meaning and authority assigned by the relevant contract. PAC may mark transition into a warranty or defect period after specified completion, tests, documents, and open-item conditions. FAC may mark closure of the remaining obligations. Title, risk, payment, commercial operation, and warranty commencement can each follow separate provisions.

Acceptance requires every test to use the correct configuration and conditions, raw data to be retained, failed or conditional results to lead to an authorized decision and retest, technical readiness to remain separate from contractual acceptance, and PAC or FAC to be issued only by the authorized party. BEIREK does not guarantee a test or performance outcome.

PROGRAM FRAMEWORK

8. Commissioning and acceptance convert physical completion into safe, evidenced operating readiness

CONTINUED · 02

8.1 Handover is complete when asset knowledge and operating capability pass into client control

Handover is broader than transferring files or keys. The owner and O&M team must be able to operate the asset safely and in accordance with the contracts by taking over authority, information, system access, competence, materials, service links, and open risks. Handover planning starts during design and procurement rather than in the final project week.

The document set includes approved requirements and design basis, as-built drawings, calculations and model files, equipment identity, data and certificates, material and quality records, FAT and site tests, completion and commissioning dossiers, settings, protection, metering and grid records, permits and commitments, O&M manuals, asset and spare-parts registers, software, licenses and secure access, warranties and contacts, training, open work and risks, and acceptance records.

Documents are tested for accuracy and usability, not merely presence. As-built drawings reconcile with site reality; asset codes reconcile with physical labels and SCADA; warranties reconcile with equipment identity and contract; spare records reconcile with actual stock; and settings reconcile with the commissioned version. Superseded drafts are withdrawn from effective use while the history is retained.

Transition to commercial operation addresses, where applicable, the commercial operation date (COD), grid, market, and metering conditions, commencement of power sale or self-consumption, billing and settlement, insurance, O&M responsibility, warranty notices, data and performance monitoring, emergency arrangements, and remaining work. COD can have different definitions across project agreements and is not treated as one universal date.

During the handover drill, owner and O&M roles safely contain a fault, find the current drawing and asset record, reach the relevant warranty and supplier route, export data, confirm a spare, and operate the work-order and notification process. Handover is accepted when the system works without BEIREK and open conditions have authorized owners.

PROGRAM FRAMEWORK

9. The O&M and lifecycle system manages energy results with asset condition, warranty, and decision ownership

The O&M model is selected for the ownership structure, risk, competence, site geography, equipment, data, warranty, revenue arrangement, and service market. The owner may use an internal team, comprehensive outsourcing, specialist packages, a performance-oriented arrangement, or a hybrid. Regardless of the service label, operating authority, HSE, remote monitoring, planned and corrective maintenance, cleaning and vegetation, spares, testing, warranty, and reporting responsibilities are explicitly allocated.

Service levels and performance measures define the asset and data boundary, calendar and time zone, exclusions, planned and unplanned states, measurement source, data quality, response and resolution time, availability and performance calculations, reporting, and remedy route. Targets are not quantified without a project study or contract, and they do not permit HSE or quality controls to be bypassed.

The warranty register tracks equipment and work package, responsible party, coverage and exclusions, start and duration, notice and evidence, inspection and testing, operation and maintenance prerequisites, remedy, spare or replacement, cost and access, serial or lot traceability, open claim, tolling condition, and expiry. Warranty rights are protected through timely first-event records and contractual notices.

Asset performance reconciles energy, availability, losses, alarms and events, equipment condition, HSE, work orders, repeat failures, warranties, spares, costs, and revenue or savings within the same asset and time definitions. Variance from energy or budget is separated into weather, curtailment, design, equipment, data, operating, commercial, and definition effects. Acceptance requires responsibilities to function, records to reconcile to sources, critical actions to carry effectiveness evidence, and the owner to be able to sustain the system.

9.1 Failures and performance gaps remain traceable from source evidence to corrective decision and verified result

Failure management starts by protecting people and the asset. An event record identifies the asset, time, symptom, alarms and raw data, weather, grid, and operating conditions, affected capacity or energy, safety and systemic risk, current containment, work order, owner, and notification requirement. Remote restart does not become the default response when the cause and safety conditions are unknown.

PROGRAM FRAMEWORK

9. The O&M and lifecycle system manages energy results with asset condition, warranty, and decision ownership

CONTINUED · 02

The maintenance strategy uses equipment criticality, failure mode, safety and environmental consequences, energy and revenue effects, lead time, spares, access, manufacturer requirements, warranty, and condition data. Calendar-based, usage- or event-based, condition-based, predictive, and run-to-failure approaches are combined in proportion to risk. The manufacturer's manual is interpreted together with the project's environment and failure history.

Availability definitions state the asset boundary, time denominator, partial capacity, planned maintenance, grid or authority outage, curtailment, weather event, data loss, owner or contractor cause, force-majeure treatment, and exclusions. Contract calculations, technical analysis, and internal reports are not presented as equivalent if they use different definitions.

Root-cause analysis separates the symptom, failure mode, physical cause, detection or escape point, systemic cause, and contributing conditions. Actions can address design, settings, software, materials, stock, training, procedure, monitoring, supplier, warranty, contract, and portfolio learning as well as repair. Effectiveness is verified over a suitable duration and condition through repeat-failure, energy or capacity, alarm, and test evidence.

A performance-improvement proposal states the baseline, source data, causal hypothesis, technical change, energy and availability effect, CAPEX and OPEX, outage and implementation risk, permit, grid, warranty, and insurance consequences, measurement and verification plan, and stop criteria. Approved work does not become a promised benefit until it is demonstrated under the defined conditions.

9.2 Life extension, repowering, and decommissioning decisions use evidence from the operating asset

The asset lifecycle continues to produce technical and commercial decisions after first acceptance. Capacity expansion, BESS addition, inverter or module replacement, tracker or mounting improvement, SCADA and cybersecurity renewal, grid services, life extension, asset sale, repowering, partial removal, or full closure add responsibilities to the existing design and project rights.

PROGRAM FRAMEWORK

9. The O&M and lifecycle system manages energy results with asset condition, warranty, and decision ownership

CONTINUED · 03

Option analysis reviews asset condition and remaining life, failure and warranty history, grid and project rights, permits and environmental and social conditions, technology compatibility, site area and interfaces, energy and revenue scenarios, implementation outage, CAPEX, OPEX, and cash, contract, insurance, and tax effects, reuse and waste, and downside conditions. An existing grid right does not automatically cover a new configuration.

Repowering design tests interfaces with the existing modules and mounting, DC and AC systems, inverters and transformers, protection, SCADA, grid, foundations and structures, fire protection, access, and O&M. Coexistence of new and old equipment can change series, voltage and current conditions, communications, warranty, spares, data, and performance definitions. Design and professional judgments remain with authorized specialists.

The decommissioning plan addresses isolation and de-energization, hazardous material, lifting and transport, modules and electrical equipment, structural materials, waste classification and traceability, reuse, recovery, or disposal, data and asset records, permits and authorities, land or building restoration, stakeholders, cost, and financial provision with authorized specialists. Acceptance requires the selected option to be supported by source evidence, assigned responsibilities, applicable permits, financial resilience, and a measurable final condition.

PROGRAM FRAMEWORK

10. Clear responsibility and acceptance boundaries distinguish owner-side management from unlimited outcome liability

BEIREK acts as the owner's program integrator and project management company. It establishes the project charter, governance, decision gates, and control system; coordinates workstreams and specialist inputs; manages source, interface, risk, change, decision, document, and acceptance records; tests the relationship among scope, schedule, cost, cash, and quality; and prepares commissioning and handover. It does not issue a design or performance certificate.

The investor or client owns the investment objective, project and corporate authority, budget and financing, appointment of specialists and contractors, land or building access, employer's requirements, major commitments and changes, acceptance under its contracts, energy and revenue decisions, operating model, and final disclosures. It shares available information and uncertainty in time, appoints competent roles, and obtains the required professional advice.

The EPC contractor and other contractors are responsible for their contract scope, design and coordination obligations, methods, personnel and equipment, HSE, quality, procurement, schedule, cost, tests, documentation, warranties, and remedies. Suppliers own the offered product, production site, specification, quality, certification, delivery, testing, service, and warranty. The actual allocation is governed by the contracts and applicable law.

Designers and engineers own their calculations, drawings, specifications, statutory duties, design reviews, and professional opinions. Laboratories and test parties own their methods and results; the grid company and authorities own their decisions. Legal, tax, customs, environmental and social, HSE, finance, insurance, cybersecurity, energy-yield, and other specialists provide their own professional advice. Lenders, investors, and buyers make independent decisions.

The O&M organization owns safe operation after handover, competence, monitoring, maintenance, incidents and emergencies, data, spares, warranty, contract and service levels, performance, and regulatory requirements. The responsibility matrix records input, recommendation, review, approval, implementation, verification, acceptance, source, timing, and escalation for every material activity and is retested at decision gates. BEIREK communications cannot imply an authority or assurance it does not possess.

PROGRAM FRAMEWORK

10. Clear responsibility and acceptance boundaries distinguish owner-side management from unlimited outcome liability

CONTINUED · 02

10.1 Each workstream closes with a decision-ready deliverable and defined acceptance evidence

Core deliverables include the project diagnostic and program charter; maturity and suitability decision; delivery model and responsibility matrix; development, rights, permits, environmental and social, grid, and revenue registers; site and resource data basis; energy-yield and loss model; CAPEX, OPEX, and financial-model inputs; employer's requirements and design basis; design, interface, and change registers; and supplier, FAT, logistics, and material controls.

Construction and asset deliverables include the baseline schedule and cost and cash system; risk, decision, action, change, and contract registers; mobilization and construction readiness; HSE and QA/QC evidence; completion, commissioning, and performance tests; PAC and FAC decision files; handover and commercial-operation readiness; O&M, warranty, and asset-performance system; and lifecycle and closure plan. The applicable set is frozen for the project phase and contracts.

The acceptance index connects each requirement to its source, owner, deliverable and version, test or review method, raw evidence, deviation, correction, retest, approval, remaining condition, and residual risk. Project rights, permits, design approval, technical readiness, contractual acceptance, PAC and FAC, grid or commercial operation, financing condition, and O&M handover remain separate statuses; one cannot be inferred from another.

Professional and out-of-scope matters include engineering calculation, design or signature; energy-yield or independent technical assurance; contractor methods and HSE authority; laboratory or certification work; legal, tax, customs, environmental and social, or cybersecurity opinions; independent audit; insurance, credit, or investment advice; securities placement; authority, grid, or buyer decisions; factory management; and direct construction or O&M services unless separately authorized.

The service does not guarantee a permit, grid connection, energy production, P50 or P90 result, availability, capacity factor, price or revenue, CAPEX or OPEX, financing, completion date, performance, warranty recovery, buyer, or investment return. Acceptance requires no unknown owner at critical interfaces, current sources and controlled versions, a functioning decision, control, and acceptance system, trained owner and O&M roles, tested handover, and explicit disclosure of every remaining external condition.

PROGRAM FRAMEWORK

10. Clear responsibility and acceptance boundaries distinguish owner-side management from unlimited outcome liability

CONTINUED · 03

10.2 The first engagement tests project maturity and the delivery model at one decision gate

The first step is a **project-maturity and delivery-model review**. The client provides the current project definition, land or building rights, site and resource evidence, permit and grid status, revenue basis, available designs and contracts, cost and schedule assumptions, specialist opinions, and decision authorities. Gaps record their decision impact and completion owner; they are not filled with assumptions.

BEIREK tests six maturity domains: rights and site; permits and stakeholders; grid and revenue; technical basis; financing and contracts; and operating readiness. It compares PMC/owner's representative, EPCM, EPC, turnkey, and, where relevant, EPC + O&M against actual conditions. The project-opening memorandum records sources and assumptions, critical gaps, containment actions, the recommended model, specialist dependencies, and evidence for the next decision.

The gate decides whether to proceed, proceed with conditions, wait for evidence, remediate the project structure, or stop. It does not guarantee project results. Scope and the next phase are frozen only against approved sources, responsibilities, and boundaries.

BEIREK

SOLAR PV END-TO-END PROJECT DELIVERY MANAGEMENT

Technical Appendix

TECHNICAL MODULE

A1. Development and permitting checklist

The checklist shows the sources, conditions, and authorized opinions on which the development file relies for investment and design decisions. Each row identifies the source owner, document date and version, applicable project company, parcel, building, or facility, validity, open condition, owner, required decision date, and closure evidence.

Area	Minimum control	Decision evidence
Company and authority	Project vehicle, signature and board authority, ownership, financing approval	Current registry and authority record
Land or building	Title, lease, easement, access, cable, road, and grid corridors	Authorized legal review and boundary reconciliation
Site data	Topography, geotechnical and structural data, meteorology, constraints	Controlled raw data and specialist report
Permit route	Competent authority, prerequisite, application and approval, validity, change	Official source and conditions register
Environmental and social	Impacts, commitments, stakeholders, grievances, monitoring, closure	Authorized study and implementation trail
Grid	Connection point, technical conditions, facility scope, test, date	Current grid-party source
Revenue or consumption	Sale or self-consumption, metering and settlement, price, credit	Authorized contract and commercial review
Technical basis	Capacity definition, design basis, energy yield, limitations	Specialist source and approved version
Commercial and finance	CAPEX, OPEX, schedule, cash, contracts, finance conditions	Reconciled model and conditions register
Operation and life	O&M model, warranty, spares, data, improvement, decommissioning	Lifecycle and responsibility plan

Critical-defect review remains separate from any score. Absence of a project right, a technically unusable site or building, an unworkable grid route, an unmet permit or environmental and social condition, undefined energy delivery, a material design or safety gap, unfinanceable cash requirements, or an unworkable contract structure can hold or stop progression. Strong commercial interest does not cancel a critical defect.

TECHNICAL MODULE

A1. Development and permitting checklist

CONTINUED · 02

Document completeness is tested against source reality. A selected parcel or building right is traced into the layout and cable route, relevant permit and grid file, and contract and financing condition. A permit commitment must reach the design input, contractor plan, site control, and O&M instruction. Presence in a data room does not demonstrate implementation.

Change simulation identifies affected rights, permits, environmental and social commitments, grid, design, energy yield, cost, contracts, and financing when capacity, layout, equipment, cable or connection, project company, revenue arrangement, or schedule changes. Acceptance requires missing facts to appear as explicit assumptions, professional opinions to remain with their owners, and the client to update the list without BEIREK.

The planned review considers approaching expiry and application dates, open authority and specialist questions, conditions holding design, financing prerequisites, and alignment of rights with project life. When a source document expires, the response is not limited to changing a status color; affected design, contracts, program, and decision gates are reassessed.

TECHNICAL MODULE

A2. Design inputs and design-freeze matrix

The matrix maintains one controlled version of design reality from the investment objective through construction and acceptance documents.

Input area	Controlled content	Verification and freeze
Project boundary	Parcel or building, delivery or connection point, ownership, interfaces	Reconciliation to rights and contract source
Capacity and product	DC, AC, and grid definition; module and inverter configuration	Same version in energy, grid, procurement, finance models
Site or building	Coordinates, topography, geotechnical data, existing structures and constraints	Raw data, specialist review, scope gaps
Environment and loads	Resource and climate, wind, snow, seismic, temperature, corrosion, water	Source, period, method, design value
Standards and permits	Applicable code, authority, permit, financing requirement	Authorized interpretation and current version
Structural and mechanical	Layout, mounting, foundations, drainage, roads, access, fire	Calculation, drawing, specification, interface review
Electrical and grid	DC, inverter, transformer, MV/HV, protection, grounding, meter, connection	Authorized study, settings, grid source
Controls and data	SCADA, communications, time, alarms, remote command, retention, cybersecurity	Signal and interface register, test method
Construction and O&M	Method constraints, tolerance, access, cleaning, maintenance, spares	Constructability and operability review
Tests and acceptance	FAT, site test, commissioning, performance, PAC/FAC, handover	Requirement, criterion, raw evidence, authority trail

Each input records its identity, source owner, information date, version, status, reviewer and approver, applicable facility and contract, uncertainty, affected outputs, and next-review trigger. Draft, under-review, approved, conditionally approved, superseded, and archived states are separate. The latest email attachment or supplier-portal file is not design truth until it enters controlled records.

Interface review records provider and recipient, dimension and tolerance, required date, document, test, acceptance, and residual risk for module-to-mounting, mounting-to-foundation or building, DC-to-inverter, inverter-to-transformer, transformer-to-grid, equipment-to-SCADA, cable-to-road, drainage, or building, fire and emergency access, logistics and lifting, and construction-to-O&M boundaries. A meeting decision is not closed until it reaches the source drawings and specifications.

TECHNICAL MODULE

A2. Design inputs and design-freeze matrix

CONTINUED · 02

The freeze records the approved configuration and open exceptions. Before procurement or construction release, relevant inputs must be sufficient, specialist and authority reviews defined, critical interfaces resolved, and remaining assumptions approved with reversibility, cost, and schedule risk. Later change updates its effects on design, permit, energy, procurement, field work, tests, O&M, warranty, and the financial model.

In the handover test, the client traces a selected requirement from source through approved design, site installation, raw test, and acceptance record, then demonstrates review, approval, distribution, and withdrawal of a superseded version after a controlled input change. The matrix is accepted when this works without BEIREK.

Design questions and technical submittals cannot silently alter a source input. The response identifies the affected requirement, calculation, drawing, specification, contract and permit context, site work, and test result. If a temporary field solution is to become permanent design, it re-enters authorized review, versioning, and distribution.

TECHNICAL MODULE

A3. Equipment and supplier evaluation matrix

The matrix places technical suitability, supplier qualification, total commercial conditions, and lifecycle responsibility on a comparable basis.

Area	Evaluation question	Typical evidence
Identity and site	Who contracts, and who manufactures where?	Registry, ownership, factory and subcontractor confirmation
Technical fit	Does the exact product meet approved specification and design?	Data sheet, drawing, calculation, sample, exceptions list
Certification and tests	Is evidence valid for the product, site, standard, and period?	Body confirmation, scope, validity, raw report
Quality and traceability	Can product and critical components be controlled by lot?	Quality plan, audit, test, serial or lot, change record
Capacity and delivery	Are allocation, lead time, and disruption response credible?	Capacity basis, order position, program, continuity plan
Interfaces	Are mechanical, electrical, data, installation, and test duties aligned?	Interface matrix and coordinated submittals
Commercial basis	Are price, currency, tax, Incoterms, payment, and security comparable?	Normalized offer and contract schedules
Warranty and service	Are failure, site support, spares, software, and remedy executable?	Service network, SLA, spares and warranty process
Lifecycle	Are maintenance, renewal, compatibility, and exit risks visible?	OPEX, spares, obsolescence, data rights, dismantling terms

Risk class determines evaluation depth. Modules, inverters, transformers, switchgear, mounting or trackers, cables and connectors, protection, SCADA, and BESS that influence performance, safety, grid compliance, certification, or long outages require stronger product, factory, quality, test, change, and service evidence. A high aggregate score does not cancel a failed critical requirement.

Bid normalization places scope and quantity, technical exceptions, tests and documents, delivery and schedule, currency, tax and customs, payment and financing cost, security, delay and performance remedies, warranties, service and spares, and logistics on a common basis. Missing design, material advance payment, or owner-transferred site and test scope can separate a low bid price from the actual total cost.

TECHNICAL MODULE

A3. Equipment and supplier evaluation matrix

CONTINUED · 02

The qualification test traces one critical item from specification to the offered model, factory and certificate scope, design and energy model, contract, FAT, shipment identity, site acceptance, installed asset, and commissioning result. Product or production-site change does not inherit approval automatically. Provisional approval is limited by quantity and duration, compensating controls, affected client, grid, or certification conditions, decision authority, and expiry.

Performance review tracks conformance, complete and timely delivery, documents, damage, site support, nonconformance and corrective action, unauthorized change, warranty response, and commercial compliance. Deterioration can trigger increased inspection, containment, alternate sourcing, allocation change, suspension, or exit, with procurement, schedule, cash, quality, energy, warranty, and O&M consequences visible.

FAT and site performance feed back into qualification. A conditional test, delayed corrective action, repeated logistics damage, missing commissioning support, or rejected warranty request changes approval status where relevant. Continued commercial relations do not preserve qualification automatically; temporary controls and review dates are explicit.

TECHNICAL MODULE

A4. Construction quality and HSE evidence register

The register demonstrates safe and conforming construction through source evidence created while work is performed rather than through an after-the-event narrative.

Register field	HSE evidence	Quality and completion evidence
Work and location	Area, crew, activity, time, interface	System, subsystem, quantity, asset, work package
Current basis	Method, risk assessment, permit, plan	Drawing, specification, ITP, inspection and acceptance criteria
Competence	Role, training, authority, supervision	Installer, inspection, test, approval roles
Material and equipment	Safe condition, certificate, inspection, isolation	Approved product, lot, condition, calibration
Prerequisite	Access, weather, barriers, emergency, adjacent activity	Prior-work acceptance, tolerance, cleanliness, protection
Execution	Observation, permit, interim control, stop	Raw measurement, photo or location, witness, hold point
Deviation or event	Hazard, near miss, incident, containment, notice	Nonconformance, cause, segregation, rework, concession
Closure	Correction, effectiveness, learning, restart authority	Correction, reinspection or retest, acceptance, release

The inspection and test plan (ITP) defines work sequence, characteristic, method, frequency or sample, acceptance criterion, responsible and witness roles, hold and surveillance points, record, and release to subsequent work. Points are set in proportion to contract and risk. Evidence for foundations, grounding, cables, connections, waterproofing, and other concealed work is retained before access is lost.

A nonconformance records the source requirement, exact location or asset, affected quantity, current condition and containment, technical and HSE effect, designer or supplier input, proposed disposition, approval authority, rework, repair, concession, or rejection, retest, and residual risk. A concession does not merge technical conformance with contractual acceptance. Repeat nonconformance triggers root-cause and systemic action.

An HSE event is managed through first aid and emergency response, securing the area, notice, evidence preservation, authorized review, causes, corrective and preventive action, communication, and restart conditions. BEIREK may coordinate review and action tracking; it does not assume the contractor's or statutory HSE authority and does not issue a legal opinion on fault.

TECHNICAL MODULE

A4. Construction quality and HSE evidence register

CONTINUED · 02

The acceptance test traces a system or site area from approved design and material records through work-front readiness, daily record, raw inspection and test, nonconformance closure, completion status, and commissioning package. The register is accepted when it can reconstruct field reality without relying on memory or one person's files.

Area handover protects the physical and documentary state between work packages. Releasing and receiving parties jointly confirm completed and open work, temporary protection, access and HSE restrictions, material and equipment condition, current documents, and prerequisites for the next activity. Transfer of responsibility does not erase hidden defects or damage.

TECHNICAL MODULE

A5. Commissioning and PAC/FAC matrix

The matrix keeps technical, safety, grid, data, commercial, and contractual states separate from physical completion through final acceptance.

Stage	Minimum prerequisite and test	Decision or evidence
System definition	Plant and subsystem boundary, asset code, responsibility, interface	Approved completion structure
Mechanical completion	Installation, inspection and test, critical nonconformance, cleaning and preservation	Completion certificate and punch class
Pre-commissioning	Continuity, insulation, torque, grounding, settings, rotation and function	Raw test and authorized release
Energization	HSE and isolation, current drawing, protection, emergency, grid, authority	Energization permit and switching record
Functional test	DC and AC, inverter, transformer, switchgear, protection, SCADA, meter, remote control	Requirement, method, raw result, deviation trail
Grid synchronization	Connection conditions, protection, communications, meter, witness, data	Grid and technical-role record
Performance test	Test window, plant configuration, weather, grid, exclusions, data	Contract calculation and raw-data package
PAC	Contract completion, tests, documents, open items, authority	Conditional or unconditional provisional acceptance
Warranty and closure	Punch items, failure and warranty, documents, training, spares, conditions	Closure and effectiveness evidence
FAC	Final contract obligations and authority	Final acceptance and residual risk

Each test row records the requirement and source, method or protocol, exact tested configuration, prerequisites, instruments and calibration, inputs and environmental conditions, expected range, raw result and data file, witness, date, deviation, owner, correction, retest, and approval. A summary report does not replace raw data or professional evaluation. Photographs and video can support but do not replace calibrated measurements.

Punch items are classified by their safety, critical-function, performance and energy, grid and authority, quality and warranty, document and O&M, or minor visual consequences. Conditional progression states the exact boundary, temporary control, owner, cost and schedule effect, due date, retest, and authorized residual-risk acceptance. Critical safety, protection, grounding, traceability, or grid conditions are not removed to protect the schedule.

TECHNICAL MODULE

A5. Commissioning and PAC/FAC matrix

CONTINUED · 02

A performance test is interpreted separately from technical readiness, contractual guarantee, and energy-yield estimate. Resource and grid conditions during the window, operating capacity, outages and exclusions, measurement points, data quality, and contractual correction method are explicit. A test conducted under inadequate conditions does not become valid merely because it produces a favorable result.

The use test traces a failed or conditional criterion from its source to the deviation record, technical and contractual decisions, correction, retest, PAC or FAC effect, and residual risk. The matrix is accepted when no critical criterion disappears into a general punch list and the next stage is not shown as approved solely because work continued.

When the test package is handed over, raw data, calibration, software and settings versions, correction calculations, witness records, and signatures or approvals are held in one index. If a recalculation is made, the former result remains available and the reason is explained. The acceptance outcome is therefore not dependent on the final summary table alone.

TECHNICAL MODULE

A6. O&M and warranty responsibility matrix

The matrix allocates operating and maintenance activities with executable authority among the asset owner, operator, EPC or other contractor, equipment supplier, grid or market party, specialist, and insurer.

Activity	Responsibility and interface question	Acceptance evidence
Control center and data	Who monitors, receives alarms, and authorizes remote commands?	Access, shift, event, cybersecurity records
HSE and emergency	Who holds site and electrical authority, isolation, event and authority notice?	Authority, plan, drill, action closure
Planned maintenance	How do task, frequency, method, warranty, and outage reconcile?	Controlled plan, work order, test
Failure and repair	Who owns containment, diagnosis, spare, approval, return to service?	Event, root cause, repair, verification trail
Cleaning, vegetation, site	Who manages energy, safety, water, environment, access, season?	Plan, field record, effect, acceptance
Spares and consumables	Criticality, quantity, storage, ownership, reorder, obsolescence?	Stock, condition, consumption, replenishment record
Warranty	Who owns notice, evidence, inspection, removal, freight, recovery?	Warranty register, decision, remedy, closure
Performance and SLA	Who approves definition, source, exclusion, calculation, report, remedy?	Reconciled data and authorized decision
Regulatory and grid	Periodic test, report, meter, market, and connection duty?	Authorized source, date, submission
Lifecycle	Major renewal, repowering, waste and decommissioning, provision?	Condition, decision, implementation evidence

Each activity identifies information and input, recommendation, review, approval, execution, safety authority, verification, acceptance, cost, system of record, service level, escalation, and backup role. A provider's description as comprehensive does not automatically transfer grid, market, land or building, insurance, statutory authority, equipment-warranty, or asset-owner decisions. The actual contracts and regulation govern the matrix.

For each asset, the warranty matrix records serial or lot and location, contract and supplier, start and duration, product, performance, and workmanship coverage, exclusions and O&M prerequisites, notice address and time, required evidence and tests, inspection and removal authority, remedy and cost allocation, open claim, and closure. Correspondence is issued separately where it does not satisfy contractual notice.

TECHNICAL MODULE

A6. O&M and warranty responsibility matrix

CONTINUED · 02

The shift and emergency test runs the chain from a SCADA alarm through safe field containment, technical diagnosis, work order, grid or client notice and warranty, spare part, repair, and return-to-service test. Remote and field roles demonstrate their different authority over the same event. Critical passwords and remote access remain under secure client control.

For handover acceptance, the client performs planned maintenance, responds to an unexpected failure, validates a critical spare, issues a warranty notice, calculates performance, and submits an authority or grid report without BEIREK. The matrix is accepted when no source or responsibility gap remains, service and performance definitions reconcile with the contract, and open warranty matters have owners.

When an O&M provider or supplier changes, open work orders, spares, passwords and remote access, warranty files, software and licenses, temporary field controls, performance definitions, and ongoing authority obligations pass through a controlled transition. Former-party access is terminated while evidence history is preserved.

TECHNICAL MODULE

A7. Project risk and change register

The register connects development risks, construction events, contractual claims, and operating exposures to the same decision system without treating them as the same type of record.

Register field	Required content
Identity and category	Rights, permits, environmental and social, grid, revenue, technical, supply, HSE, quality, schedule, cost, cash, data, O&M
Source and date	Contract, permit, drawing, test, system, specialist opinion, event, assumption
Cause or trigger	Condition creating the exposure and sign of occurrence
Effect	Safety, rights and compliance, design, energy, quality, schedule, cost and cash, revenue, warranty, reputation
Current control	Prevention, detection, limitation, alternative, contract, insurance, reserve
Residual exposure	Remaining likelihood, severity, uncertainty, velocity, reversibility
Owner and dependency	Authorized party, specialist, authority or grid, decision and resource need
Action and date	Specific response, resource, stage, evidence, due date
Gate or contract consequence	Proceed, conditional, hold, improve, stop, notify, reserve rights
Closure	Verified result, effectiveness, residual-risk acceptance, version, approval

Risks are connected across workstreams. A delayed grid or permit condition can affect design, procurement authority, critical path, cash, an EPC event, and a financing prerequisite. A module or inverter change can update energy yield, design, certification, logistics, testing, warranty, spares, and O&M. The register shows the overall project decision rather than only local actions.

Change control records the request source, reason and urgency, current approved reality, alternatives, affected rights, permits, design, equipment, field work, tests, and documents, HSE, quality, energy, O&M, and warranty effects, cost, schedule, cash, and contract consequences, required specialist or authority review, decision, and implementation evidence. Emergency containment is not permanent design or contract approval.

TECHNICAL MODULE

A7. Project risk and change register

CONTINUED · 02

A contractual event is held separately with notice requirement and date, instruction and correspondence, cause, affected activity and critical path, cost and resource record, mitigation duty, concurrent events, reservation of rights, and authorized legal or contract advice. Appearance in the risk register does not create contractual notice or legal entitlement. BEIREK coordinates source and program effects; it does not decide legal outcome.

Weekly review addresses active triggers, critical actions, new events, and near decision dates. Monthly review addresses aggregate exposure, contingency, cash, and scenarios. The decision gate addresses hard-to-reverse commitments. Closure requires source evidence and effectiveness rather than a statement that the action was performed. The register is accepted when the client can take a credible trigger from source to decision and verified outcome without BEIREK.

The aggregate view considers events dependent on the same site, schedule, cash, or specialist capacity. Several risks converging on one critical decision date or the same contingency can matter more than their separate scores. Opportunities and favorable assumptions are recorded separately and do not arithmetically offset downside exposure.

TECHNICAL MODULE

A8. Asset performance scorecard

The scorecard presents energy results with safety, asset condition, data, grid, work orders, warranty, cost, and commercial conditions.

Dimension	Controlled measurement area	Decision use
HSE and compliance	Events, emergency, authority, overdue statutory or grid action	Stop, containment, resource allocation
Resource and grid	Irradiance and weather, grid outage and curtailment, meter status	Context for expected and deliverable energy
Energy and losses	Gross, net, delivered energy; model-to-actual variance; loss categories	Cause analysis and improvement
Availability	Plant or equipment boundary, duration, partial capacity, exclusions	SLA, technical, management decision
Equipment condition	Alarms, tests, thermal and electrical inspection, repeat fault, aging	Maintenance, spares, warranty, renewal
Work orders and maintenance	Open and overdue work, response and resolution, plan compliance, verification	Team and provider control
Warranty and supplier	Open claim, age, evidence, remedy, recurrence, recovery	Rights protection and supplier action
Data quality	Missing or late data, clock and meter reconciliation, unknown loss	Confidence and data action
Cost and commercial	OPEX, major maintenance, stock, insurance, saleable energy, billing and collection	Cash, budget, asset decision
Lifecycle	Remaining life, obsolescence, capacity and compatibility, closure provision	Life extension, repowering, exit

Each measure defines its formula, unit, asset and time boundary, source system, owner, update frequency, target or threshold, exclusions, data quality, and contractual use. Availability or performance ratios with the same name are not compared as the same result when their denominator, exclusions, or meters differ. Definition change is shown with its effect on the former basis.

Energy variance is separated into resource and weather, horizon, shading, soiling or snow, module and DC, inverter, AC and transformer, availability, grid and curtailment, meter and data, and model or definition effects within a common time and asset boundary. Unknown variance is not permanently hidden in an other category; it carries a data and investigation action. Negative variance is not always equipment failure, and positive variance is not necessarily permanent improvement.

TECHNICAL MODULE

A8. Asset performance scorecard

CONTINUED · 02

Daily operating control covers critical alarms, HSE, grid, plant status, open work, and the short-term plan. Weekly review covers repeat failures, losses, maintenance, spares, and warranties. Monthly review considers performance, OPEX, revenue or savings, risks, and lifecycle across the portfolio. The scorecard connects to decisions and actions rather than remaining a colored report.

Improvement acceptance requires a reliable baseline, evidenced cause, approval of safety, permit, grid, warranty, and financial effects, controlled change, and testing over a defined measurement and verification window. The scorecard is not a guarantee of energy, availability, capacity factor, or commercial performance.

When the data-quality threshold is not met, the result is marked missing or estimated rather than presented as certain. Time, scale, and aggregation differences among meters, SCADA, inverters, and meteorological sources are reconciled. If late data changes history, the former report and decision trail remain available and affected commercial or warranty calculations are reopened.

The scorecard also records the status of corrective decisions: approved, in execution, awaiting an external party, under verification, ineffective, or closed. This distinction prevents a completed work order from being mistaken for a recovered performance outcome and keeps unresolved systemic causes visible across reporting periods.

BEIREK

PROGRAM CONCLUSION

CONCLUSION

Solar PV End-to-End Project Delivery Management

Durable delivery requires the client to manage rights, design, EPC interfaces, field evidence, acceptance, warranties, and O&M from current sources. BEIREK establishes and hands over this control; it does not guarantee project outcomes. Closeout acceptance requires current requirements to reconcile with approved design and the installed asset; open nonconformities, incomplete tests, and handover conditions to remain visible with authorized owners; the operating team to perform critical scenarios; warranty and notice periods to be tracked; and baseline, change, and decision records to remain available. The client must be able to trace a field event from source through ownership, technical or contractual review, decision, and closure evidence without BEIREK. The final decision is not based on physical completion alone. Authorized parties approve acceptance conditions, residual risks, operating restrictions, and specialist opinions within their respective responsibilities. BEIREK tests package integrity and handover readiness; it does not issue engineering approval, contractual acceptance, statutory permission, energy results, or commercial-performance commitments.