

REDHAKHOL FOREST DIVISION

Odisha Forest Department
Sambalpur District, Odisha

REQUEST FOR PROPOSAL

DESIGN, IMPLEMENTATION, CLOG-RESISTANCE SYSTEM AND MAINTENANCE OF A SOLAR-BASED IoT DRIP IRRIGATION SYSTEM

15 km Bio-Fencing Plantation / AMC Years 2–4/Naktideul Range

Tender Notice No.	F & E/RKL/ 019 (OFFLINE)/2026-27, Dated- 20.06.2026
Name of Project	Design, Implementation, Clog-Resistance & Maintenance of a Solar-Based IoT Drip Irrigation System — 15 km Lemon / Lime Bio-Fencing Plantation
Cover Type	Single Sealed Cover
Bid Availability	20.06.2026 to 06.07.2026
Last Date of Submission	06.07.2026 (up to 5.00 PM)
Date of Opening	07.07.2026 (11.30 AM)
Location	Forest–village boundary, Naktideul Range, Sambalpur District, Odisha
Coverage	15 km three-row zig-zag citrus bio-fence
Project Duration	Year 1 — design, supply, installation & commissioning; Years 2–4 — operation & maintenance
Indicative Cost	As per Fund Availability
Prepared / Issued By	Divisional Forest Officer, Redhakhoh Forest Division, Rairakhoh, Sambalpur – 768109

PART I — PROJECT BACKGROUND & IMPLEMENTATION APPROACH

Redhakhol Forest Division proposes to design and implement a Solar-Based Drip Irrigation System with IoT Integration to sustain the 15 km Lemon / Lime bio-fencing plantation to be established along the forest–village boundary in the Naktideul Range, Sambalpur District. The bio-fence comprises a three-row zig-zag citrus plantation that requires reliable, low-maintenance irrigation through the critical establishment and fruiting years.

Three irrigation units (one per 5 km) are required for the full 15 km plantation. Each unit operates fully off-grid on solar power with IoT-based remote monitoring and automated control, and is protected by a dedicated multi-stage clog-resistance system suited to borewell groundwater. The system is designed for sustained, unattended operation in a remote forest location with minimal manual intervention.

PART II — SCOPE OF WORK

The implementing agency shall undertake the complete design, supply, installation, commissioning, integration, training and maintenance of the Solar-Based IoT Drip Irrigation System across three units covering the 15 km bio-fencing plantation. The scope is organised into the following components.

(NOTE: Below components in the Scope of Work is suggestive model, Bidders may propose better alternatives, better design than proposed, may remove components that are redundant, duplicate or unnecessary, and propose such cost optimization models without altering the core idea and functionality of automated Off grid IoT Based Solar Drip irrigation System)

(Note: Bidders while proposing for the solutions shall consider value for money without altering the core idea stated in this document)

Component F1 — Solar Power Infrastructure

One unit per 5 km; three units total for the full 15 km plantation. Each unit shall comprise:

Sl.	Component	Specification
1	Solar PV Panels	Min. 5 kW peak capacity per unit; half-cut design, monocrystalline; IP65-rated; galvanised MS mounting structure with tilt angle optimised for Odisha latitude (~21°N).
2	Solar Charge Controller	MPPT-type, min. 40A, compatible with 24V/48V battery bank; overcharge, over-discharge and short-circuit protection.
3	Battery Bank	Minimum 48V, 300 Ah Li-FePO ₄ (Lithium Iron Phosphate), sized to provide 11.1 kWh of usable energy for running a 5 HP load for 3 hours and continuous operation of IoT systems without solar input.
4	Solar Pump	(a) Primary Borewell Pump — 5 HP DC solar submersible pump; min. 30 m head; compatible with borewell depth of 250 ft / 76 m. (b) Surface Booster Pump — 3 HP DC solar surface motor/pump to draw water from ground-level tanks and pressurise the main line to 1.5–2.5 bar.

Sl.	Component	Specification
5	Solar Inverter / VFD	Solar pump controller / VFD (dual-output capable or paired with automated changeover switch for sequential operation of borewell and booster pumps); remote ON/OFF and sequence scheduling via IoT RTU; supply and installation.
6	Civil Works	Foundation for MS mounting structure; electrical earthing; conduit runs for DC/AC wiring; weather-proof junction boxes; theft protection.

Component F2 — Drip Irrigation Distribution Network

A full drip irrigation network serving all three plantation rows across the 15 km total length (5 km per unit):

Sl.	Component	Specification
1	Overhead Storage Tank	15,000 L HDPE storage tank(s) or other alternatives on a 1 m high ground-level brick masonry / RCC plinth; 2 Nos. per unit (6 total) at central location; thermal insulation and UV protection.
2	Main Line/ Sub Main line/ Drip Lateral as required	laid along plantation alignment; trenched to a minimum depth of 60–90 cm. minimum 4LPH to each tree; Adequate mm diameter of pipelines with min. Adequate Pressure Normal (PN) for pipelines
3	Drip Emitters	Pressure-compensating inline drippers; 4 LPH; one per plant; clog-resistant; self-flushing anti-suck-back membrane (Non-Drain / NDW feature).
4	Filter Unit	Sand + screen filter at pump outlet; disc filter at sub-main inlet; min. 120 mesh to protect emitters;
5	Fertigation Unit	Venturi-type fertigation injector, with bypass valve, for future nutrient application.
6	Control Valves & Fittings	Ball valves at all junctions; double-acting kinetic air release & vacuum-breaker valves at high points; flush valves at lateral ends; pressure gauges at main and sub-main inlets.
7	Zonation	Each unit classified into three zones, irrigated one at a time via IoT. The controller shall irrigate sequentially (Zone 1 → Zone 2 → Zone 3).

Component F3 — IoT Integration & Automation System

Each of the three units shall be equipped with a complete IoT automation system enabling remote monitoring, automated scheduling and real-time alerting:

Sl.	Component	Specification
1	IoT RTU / PLC Controller	IP65 weatherproof enclosure; controls solenoid valves, monitors sensors and transmits data over 4G GSM / 5G / Wi-Fi
2	Automated Solenoid Valves	remotely operable via IoT controller
3	Soil Moisture Sensors	automated irrigation triggered when moisture falls below a configurable threshold.

Sl.	Component	Specification
4	Rain Gauge	Tipping-bucket rain gauge; automatically suspends scheduled irrigation during / after a user-defined rainfall threshold
5	Flow Meters	for water-use monitoring and leakage detection.
6	IoT Platform	real-time dashboard for soil moisture, pump status, zone-valve status, flow rates, solar generation, battery state-of-charge, rainfall and schedules
7	Alerts System	notifications to registered users (DFO, Range Officer, VSS) for pump failure, low battery, sensor disconnection, zone-valve fault and leakage alarms.
8	Automated Irrigation Scheduling	Programmable scheduler with daily / weekly / seasonal settings; supports time-based and soil-moisture-threshold modes simultaneously; manual override from app or on-site panel.
9	Role-Based User Access	Admin (DFO / Range Officer) — full control; Operator (members) — monitoring + manual override; minimum 10 user accounts.
10	Solar Energy Monitoring	Daily solar generation log; battery state-of-charge history; pump run-hours; integrated dashboard; fault alerts for under-generation and low battery.
11	Sequential Pump Control Logic	RTU / PLC programmed and wired for sequential dual-motor operation — borewell and booster pumps cannot run simultaneously. Two-phase daily cycle: Phase 1 fills ground-level tanks via the borewell pump; Phase 2 runs pressurised zonal irrigation via the booster pump. Includes dry-run protection and tank overflow protection via integrated level sensors.

Component F4 — Installation, Commissioning, Training & Support

The implementing agency shall undertake the following post-supply activities:

- Complete installation and civil works for all three units (pump installation in borewells — borewells provided by the Division; coordination required).
- Full system commissioning, including calibration of all soil-moisture sensors, flow meters and IoT data streams.
- Integration testing — verification of automated irrigation cycles, sensor-triggered operation, remote override via mobile app, and app / SMS / WhatsApp alert delivery.
- Site Acceptance Test (SAT) — formal testing covering all functionalities, with punch-list closure before final handover.
- Two-day hands-on user training at site for Forest Division staff and VSS members — operation, mobile-app usage, routine maintenance and basic fault diagnosis.
- Operation & Maintenance manuals in Odia and English for each unit.
- Twelve-month on-call technical support post-commissioning, with remote diagnostics and on-site visits for critical faults within 48 hours.

Component F5 — Clog Resistance System

Given the remote location and the nature of the water source (borewell groundwater with potential iron, sediment and biological load), a dedicated multi-stage clog-resistance system shall be designed, supplied and

installed as an integral sub-system of the drip network. It protects the entire pipeline, emitter and sensor network throughout the project life. The clog-resistance system is a mandatory component, verified at SAT and during each AMC inspection cycle.

F5.1 Multi-Stage Filtration at Source

Sl.	Component	Specification
1	Gravel / Media Filter	Pressure sand / gravel media filter at pump discharge; removes coarse particulate (sand, silt, iron-oxide) from borewell water; flow rate matched to pump; GI / FRP housing; automatic or manual backwash.
2	Screen Filter (Primary)	Stainless-steel woven screen filter; min. 200 mesh (75 micron); in-line after the gravel filter; removable cartridge; self-flushing or manual flush valve.
3	Disc Filter (Secondary)	Multi-disc filter stack; min. 130 micron; automatic self-cleaning preferred, manual cleaning provision mandatory.
4	Chemical Dosing Unit	Inline dosing unit for controlled injection of chlorine solution or citric acid at the main line; periodic biological-clog prevention (algae, biofilm); adjustable dose rate; compatible with fertigation injector;
5	Pressure Differential Indicators	ΔP gauges across each filter stage to indicate clogging; visual alarm on the IoT dashboard when differential pressure exceeds the set threshold, prompting filter cleaning.

F5.2 Emitter-Level Clog Resistance and Pipeline Protection

Sl.	Component	Specification
1	Anti-Clog PC Drippers	Inline drippers with a large turbulent-flow labyrinth; self-flushing anti-suck-back membrane preventing soil ingestion when off
2	Lateral Flush Valves	Automatic flushing end-caps
3	Pipeline Protection	Flushing Manifold for periodic high-velocity flushing, Air Release / Vacuum Breaker Valves to prevent air-lock and vacuum-induced siphoning of soil into laterals during shutdown, UV-Resistant Pipe Materials, IoT-Integrated Clog Detection.

F5.3 Periodic Chemical Flushing Protocol

- A site-specific Clog Prevention & Chemical Flushing Protocol shall be prepared as part of the O&M manual, specifying: media-filter backwash frequency (min. monthly in dry season), disc-filter cleaning (min. fortnightly), lateral end-flush schedule (min. at the start of each season) and acid / chlorine flush cycle (min. quarterly).
- The first chemical flushing shall be demonstrated live during the SAT and signed off by the DFO.
- All chemical dosing shall use food-grade citric acid or calcium hypochlorite at concentrations safe for plants and soil; maximum permissible doses to be specified in the O&M manual.

Component F6 — Annual Maintenance Contract (AMC): Years 2, 3 & 4

Following the 12-month defect-liability and on-call support period (Year 1), a comprehensive maintenance programme shall be sustained for Years 2, 3 and 4 to ensure continued performance of the entire system

through the critical establishment and fruiting period. AMC costs for each year are quoted separately in the component Bill of Quantities (Part III).

F6.1 AMC Scope (applicable to each of Years 2, 3 & 4)

Sl.	Activity	Scope & Frequency
1	Scheduled Preventive Maintenance	Minimum 2 comprehensive site visits per year (one per 6 months) for all 3 units: inspection of panels, battery, pump, inverter/VFD, pipework, filters, emitters, IoT hardware and sensors; tightening of joints and clamps; lubrication; performance verification against baseline on the dashboard.
2	Filter Cleaning & Backwash	Backwash of sand / gravel media filter, screen-cartridge cleaning / replacement and disc-stack cleaning at every visit; additional visits within 48 hours of any IoT ΔP alarm.
3	Clog Detection & Emitter Clearing	Zone-by-zone flow test using IoT data; physical inspection of flagged laterals; emitter flow-catch test; replacement of clogged / damaged emitters; lateral flushing; documentation of clogged-emitter count per zone per km.
4	Chemical Flushing & Acid Wash	Quarterly acid / chlorine flush of laterals and emitters; annual full-system acid wash of main, sub-mains and laterals; record of dosage, duration and post-flush flow test after each cycle.
5	Damage Rectification & Pipe Repairs	Repair / replacement of damaged main, sub-main and lateral sections (wildlife, UV, mechanical, soil movement); sealing of leaks; replacement of fittings and end-caps; materials within scope up to 2% of total pipe length per year; beyond 2% treated as additional work.
6	Solar System Maintenance	Annual cleaning of PV panels; battery checks; verification of charge-controller settings and protection cut-offs; inspection of connections, earthing and cable insulation; replacement of blown fuses / damaged terminals within scope.
7	Pump & Motor Maintenance	Annual pull-out and inspection of the submersible pump (impeller, winding insulation); replacement of wear parts (seals, bearings, impeller) within scope; re-installation and performance test against commissioning baseline.
8	IoT System & Sensor Maintenance	Annual calibration of all soil-moisture sensors; replacement of out-of-calibration sensors within scope; firmware updates to RTU and app; verification of connectivity and cloud sync; testing of all solenoid valves.
9	Tank & Civil Infrastructure	Annual inspection of overhead tanks for algal growth, sediment and structural integrity; tank cleaning and disinfection; inspection of MS / RCC supports for corrosion, cracks or settlement; minor rectifications within scope.
10	Emergency Breakdown Response	24/7 remote monitoring via the dashboard; response to breakdown alerts within 4 hours (remote); on-site rectification within 72 hours (non-critical) and 24 hours (critical); fault / resolution records in quarterly reports.

F6.2 Excluded items (handled as separate work orders): replacement of major equipment due to theft, vandalism or wildlife damage beyond normal wear; pipeline damage exceeding 2% of total length in any year; extension of pipeline beyond the original 15 km scope; and borewell deepening or pump upgrade due to water-table decline.

PART III — BILL OF QUANTITIES (COMPONENT-WISE)

The indicative cost is presented component-wise. Each component amount is inclusive of all design, supply, civil works, installation, commissioning, testing, training, O&M manuals and the 3-year cloud-platform subscription. Installation, commissioning and training (Component F4) are included within the component rates. GST is applicable as per prevailing rates.

Ref.	Component	Amount (Rs.) inclusive of GST
F1	Solar Power Infrastructure — 3 off-grid units (5 kWp PV, MPPT controller, 48V/300Ah LiFePO ₄ battery, 5 HP submersible + 3 HP booster pumps, VFD, civil works)	
F2	Drip Irrigation Distribution Network — 15 km (HDPE storage tanks, main & sub-main lines, LLDPE laterals, PC drippers, filters, fertigation, valves & fittings)	
F3	IoT Integration & Automation — RTU/PLC, solenoid valves, soil-moisture / rain / flow sensors, communication modules, cloud SCADA (3-year subscription)	
F5	Clog Resistance System — multi-stage source filtration, anti-clog emitters, automatic flush end-caps, anti-drain check valves, ΔP gauges, chemical dosing, IoT clog detection	
	Sub-Total — Design, Supply, Installation, Commissioning & Training (F1–F5)	Rs. _____
F6	Annual Maintenance Contract — Year 2	
F6	Annual Maintenance Contract — Year 3	
F6	Annual Maintenance Contract — Year 4 (incl. 4-year system health audit)	
	Sub-Total — Annual Maintenance Contract (Years 2–4)	Rs. _____
	GRAND TOTAL — Full Project Value (F1–F5 + AMC Years 2–4, inclusive of GST)	Rs. _____

Note: Amounts are indicative and to be finalised against detailed design and prevailing market / GST rates at the time of implementation. AMC for Years 2–4 is estimated per year; Year 4 includes the comprehensive 4-year end-of-project system health audit.

PART IV — TECHNICAL BID

Bidders must fulfil the following conditions and submit the relevant documents in sealed cover. However, the Authority reserves the right to relax the components to promote competition and value to the public money.

4.1 Legal Status

- Registered Proprietorship / Partnership Firm / Private/Public Limited Company specialising in solar energy, or irrigation engineering, or IoT/automation systems.
- Certificate of Registration under relevant law is mandatory

4.2 Technical Qualification – Solar and Irrigation

- The bidder (or a declared sub-contractor) shall demonstrate prior completion of at least ONE solar-powered pumping / irrigation system in any government, institutional or agricultural project in India, in the last 5 years
- Experience in supply and installation of drip irrigation systems covering minimum 5 km or 5 acres; completion certificate/work order shall be attached.

4.3 Technical Qualification – IoT and Automation

- The bidder (or a declared sub-contractor) shall demonstrate prior supply and installation of at least ONE IoT-based remote monitoring or automation system (SCADA/RTU/PLC-based) with cloud platform and mobile app in a private/government/institutional project in India, in the last 5 years
- Relevant work order/completion certificate/system screenshots/photographs, and cloud platform demo access shall be provided with the technical bid

4.4 Financial Capacity

- Average annual turnover of minimum Rs. 50 lakhs during last three financial years
- Audited Balance Sheets / CA Certificate for last 3 financial years
- Net financial loss in not more than two of the last three years

4.5 Performance Security and Document Fee

- Performance Security: At 3% of the contract Value (only to selected bidders after award of work)
- Tender Document Fee: Rs. 1000/- (Non-refundable) as DD in favour of DFO, Redhakhol

4.6 Other Requirements

- Valid GST Registration Certificate | PAN Card copy
- Self-attested undertaking of non-blacklisting by any Government department
- Declaration of Non-insolvency
- Declaration of no relationship with Forest Department

PART V — IMPLEMENTATION, WARRANTY & MAINTENANCE FRAMEWORK

5.1 Implementation Phases & Milestones

Sl.	Implementation Milestone	Stage (at cumulative basis)
1	Procurement / mobilisation — detailed design finalised and bank guarantee for any advance in place	10%
2	Supply of all materials at site (solar panels, pumps, battery, pipes, IoT hardware, clog-resistance components) — verified by DFO	25%
3	Installation of all 3 units complete (solar, piping, IoT, clog-resistance sub-system) — pre-commissioning inspection passed	35%
4	Full commissioning, clog-resistance SAT (live chemical-flush demo, flow-deviation algorithm verified), cloud platform live, training delivered, O&M + Clog-Prevention Protocol submitted — Final Handover Certificate	20%
5	Retention — released at the end of the 12-month defect-liability period, subject to satisfactory Year 1 performance	10%

5.2 Warranty & Defect Liability

- Equipment warranty: minimum 1 year for all hardware (solar panels, pumps, RTU, sensors, valves, clog-resistance components) from commissioning; manufacturer warranty certificates submitted at handover.
- Solar PV panels: minimum 10-year product warranty and 25-year performance warranty per manufacturer datasheet.
- Clog-resistance system: all anti-clog drippers, flush caps, check valves and filters carry minimum 1-year warranty; performance verified at SAT and each AMC cycle.
- IoT platform: 3-year cloud subscription included, with a service-level target of 99% platform uptime.
- Defect Liability Period: 12 months from the date of the Final Handover Certificate.

5.3 AMC Performance Standards (Years 2–4)

- System uptime: the irrigation system shall be operational for at least 95% of scheduled irrigation days in each AMC year.
- Clog-free emitters: at least 95% of all drip emitters shall deliver within $\pm 10\%$ of rated flow (4 LPH) at each quarterly inspection; emitters beyond the 5% threshold to be cleared or replaced within scope.
- Filter performance: filters cleaned and restored to design differential pressure within 48 hours of any IoT ΔP alert.
- Emergency response: critical faults resolved within 24 hours; non-critical within 72 hours; all incidents logged on the IoT platform.
- Reporting: quarterly AMC reports submitted within 15 days of quarter-end.
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5.4 General Conditions

- Borewell locations, exact alignment and unit positions to be fixed on the ground in consultation with the concerned VSS, Gram Panchayat and the Divisional Forest Officer prior to installation.
- All works to comply with relevant electrical-safety, solar-installation and irrigation standards; earthing and theft / wildlife protection to be provided for all field equipment.
- Force majeure (natural disasters, floods, pandemic restrictions) to be recognised with documented evidence and DFO acceptance.
- Technical decisions on system performance, clog resistance, IoT functionality and maintenance compliance rest with the Divisional Forest Officer.

– Sd/–

**Divisional Forest Officer
Redhakhoh Forest Division.**

PART VI — DECLARATION AND UNDERTAKING BY BIDDER

I/We, the undersigned, hereby declare and certify that:

- The information provided in this bid document is true, accurate, and complete to the best of my/our knowledge and belief
- I/We have read, understood and accept all terms, conditions and specifications in this Tender Document (NIT No. F & E/RKL/ 019 (OFFLINE)/2026-27, Dated- 20.06.2026 including the Clog Resistance System specifications (Component F5) and AMC obligations (Component F6) for Years 2, 3, and 4
- I/We confirm that the solar PV, pumping, IoT/SCADA, drip irrigation, and clog resistance systems offered meet all technical specifications and that hardware supplied will carry valid manufacturer warranties
- I/We confirm that the anti-clog drippers, multi-stage filtration system, automatic flush caps, and IoT clog detection algorithm offered meet the specifications in Component F5 and that clog resistance performance will be verified at SAT
- I/We confirm that the cloud IoT platform offered will maintain minimum 99% uptime SLA and the 3-year subscription is included in our quoted price
- I/We commit to performing the Annual Maintenance Contract for Years 2, 3, and 4 as quoted in BOQ-F6 at the rates submitted, including the 4-year system health audit in Year 4
- I/We are not blacklisted or debarred from any Government department or public sector undertaking
- I/We accept that the DFO's decision on all technical matters (system performance, clog resistance, IoT functionality, AMC compliance) shall be final and binding
- I/We agree to the payment milestones, AMC payment schedule, warranty obligations, and penalty clauses as stipulated in Part V of this tender document

The quoted rates are inclusive of all design, supply, civil works, installation, clog resistance system, commissioning, training, O&M manuals (incl. Clog Prevention Protocol), 3-year cloud subscription, and 12-month on-call support. AMC rates for Years 2–4 are quoted separately in BOQ-F6. GST has been quoted separately on both.

Name of Firm/Agency: _____

Name of Authorised Signatory: _____

Designation: _____

Date: _____

Seal:

Signature:

Place: _____

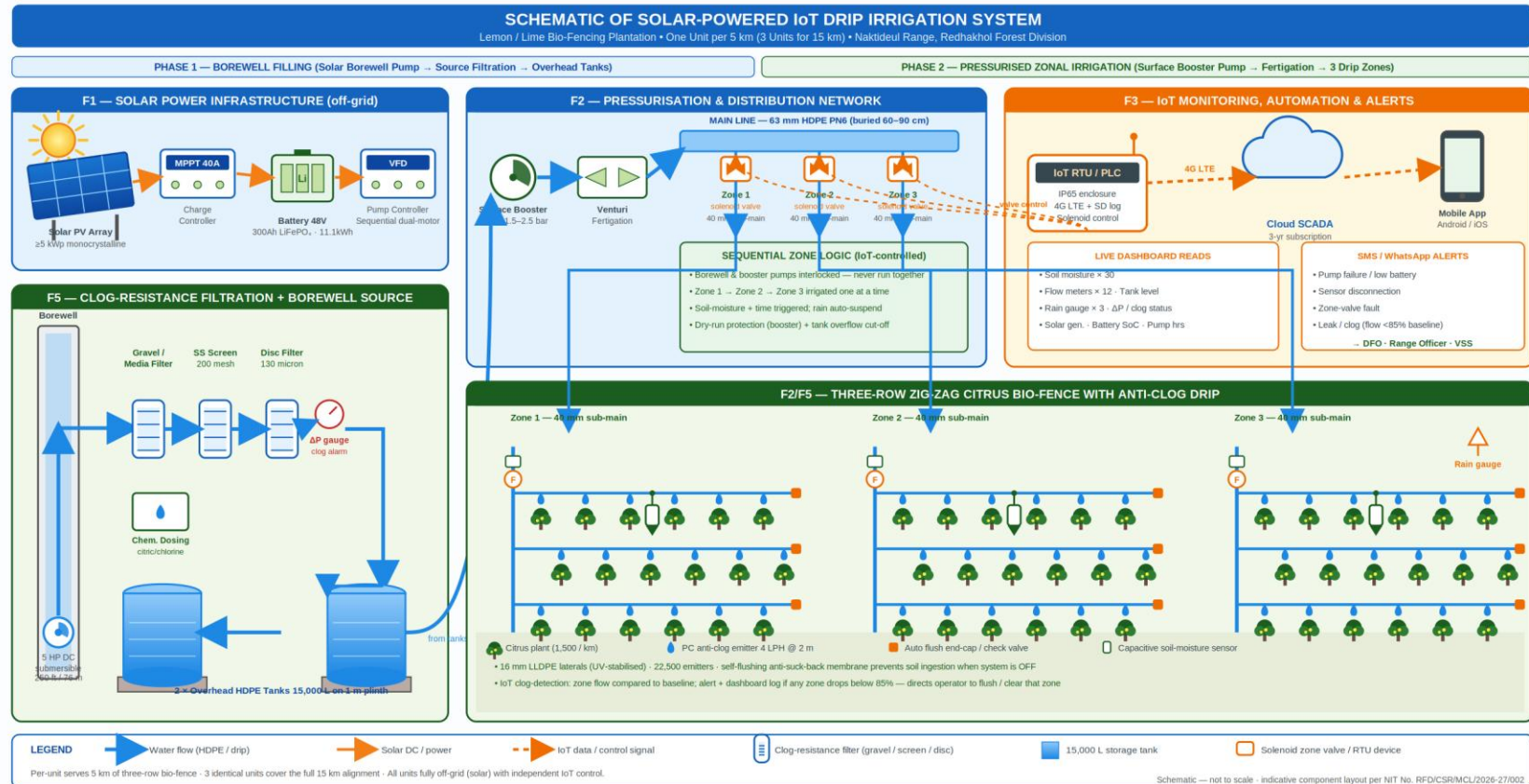
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Phone/Mobile: _____

Email: _____

ANNEXURE A — MODEL SYSTEM SCHEMATIC

Solar-Powered IoT Drip Irrigation System · Lemon / Lime Bio-Fencing Plantation · 15 km, Three-Row Zig-Zag · Naktideul Range



(NOTE: Above schematics is only suggestive model, Bidders may propose better alternatives, cost optimization without altering the core idea and functionality of automated Off grid IoT Based Solar Drip irrigation)