SDG BLOCKCHAIN ACCELERATOR

Impact Measurement Framework

1. Project Information

- **Project Name:** AegisGrid: using blockchain to address Tanzania's electricity losses
- **Challenge & UNDP Office:** UNDP Tanzania – Frequent energy theft, poor billing transparency, and limited integration of renewable energy into national utility systems
- **Document Version:** 1. This version of the document focuses on the PoC plus the next stage of development for AegisGrid (MVP), with some Projected Outcomes estimated on a longer timeframe (i.e. 24 months) to estimate potential impact further out in time. For the 24 month outcomes, development of the solution beyond the MVP would be needed.

2. SDG Alignment

SDG 7: Affordable and Clean Energy

- Target: By 2030, double the global rate of improvement in energy efficiency
- Indicator: Reduction in electricity losses from current 14% baseline
- AegisGrid Impact: Immutable consumption tracking reduces meter tampering and billing fraud

SDG 9: Industry, Innovation and Infrastructure

- Target: Develop quality, reliable, sustainable and resilient infrastructure
- Indicator: Number of electricity consumers with transparent, blockchain-verified billing
- AegisGrid Impact: Modernizes utility infrastructure with blockchain technology

SDG 11: Sustainable Cities and Communities

- Target: Reduce the adverse per capita environmental impact of cities
- Indicator: Improved energy efficiency in urban electricity distribution
- AegisGrid Impact: Better monitoring enables targeted loss reduction in urban areas

SDG 16: Peace, Justice and Strong Institutions

- Target: Develop effective, accountable and transparent institutions
- Indicator: Increased transparency in utility billing and consumption reporting
- AegisGrid Impact: Blockchain provides immutable audit trail for electricity transactions

3. Key Performance Indicators (KPIs)

KPI	Measurement Method	Target / Threshold	Notes

Electricity loss reduction	Comparison of pre/post implementation loss percentages	Reduce from 14% baseline to <10%	Primary business impact metric
Successful blockchain transactions	Cardano transaction logs	99%+ success rate	All transactions tracked in Cardano Preview
Energy readings tokenized	On-chain ledger count	100% of monitored consumption	Each token = 1 hour electricity reading
Customer billing disputes	TANESCO customer service records	50% reduction in billing disputes	Transparency reduces customer complaints
Revenue recovery	TANESCO financial records	Recover $7M+ annually from reduced losses	Based on 14% loss reduction
System uptime	Platform monitoring	99.5% availability	Critical for utility operations
User adoption rate	Platform analytics	80% of large power users onboarded	Focus on high-value customers first
Data accuracy	Comparison with traditional meters	99.9% accuracy vs manual readings	Blockchain verification vs legacy systems

4. Tracking Methods

On-chain Metrics:

- Transaction success rate via Blockfrost API
- Tokens minted/burned counts
- UTxO state monitoring
- Smart contract execution logs
- Batch processing efficiency metrics

Off-chain Metrics:

- Dashboard user activity analytics
- TANESCO loss percentage reports (monthly)
- Customer satisfaction surveys
- Energy consumption pattern analysis
- System performance monitoring

Integration Points:

- Real-time meter data ingestion tracking
- API response time monitoring
- Database synchronization verification
- Automated reconciliation between on-chain and off-chain data

5. Baseline vs Projected Outcomes

Metric	Baseline	Projected Outcome (after 24 months of implementation)
Electricity losses	14%	10%
Active large power users	0	500+
Hourly readings tokenized	0	4.3M/year
Revenue recovered	$0	$7M+per year
Billing accuracy	85% (assumed)	95%+
Customer complaints	100/month (assumed)	Reduce by 50%

6. Monitoring & Reporting Plan

Frequency:

- Real-time: Blockchain transaction monitoring
- Daily: System performance and uptime metrics
- Weekly: Energy consumption and tokenization summaries
- Monthly: Loss reduction analysis and financial impact
- Quarterly: Comprehensive stakeholder reports

Responsible Parties:

- **Technical Monitoring:** Blockchain Operations Team

- **Business Impact:** Project Manager with TANESCO liaison
- **Financial Analysis:** Finance team with UNDP oversight
- **User Experience:** Customer Success team

Reporting Format:

- Live dashboard for real-time metrics
- Weekly automated email summaries
- Monthly executive briefings
- Quarterly impact assessment reports
- Annual SDG contribution analysis

Tools & Systems:

- Blockfrost API for on-chain monitoring
- Custom dashboard for user analytics
- PostgreSQL for off-chain data analysis
- Automated alerting system for anomalies
- Integration with TANESCO's existing reporting

7. Risks & Mitigation

Technical Risks

- **Risk**: Data inconsistency between on-chain and off-chain records
    - **Mitigation**: Regular reconciliation scripts and automated alerts for mismatches
- **Risk**: Double-spend or UTxO conflicts during batch minting
    - **Mitigation**: UTxO reservation logic, retries, and cooldowns; consider persistent locks for multi-process
- **Risk**: Key compromise or unauthorized minting
    - **Mitigation**: Secure key storage, access controls, and regular key rotation
- **Risk**: Blockfrost/API downtime or rate limits
    - **Mitigation**: Retry logic, monitoring, and backup API endpoints
- **Risk**: Missed transaction confirmations
    - **Mitigation**: Monitoring scripts to detect and reprocess unconfirmed or failed transactions

Operational Risks:

- **Risk:** TANESCO system integration challenges
  - **Mitigation:** Phased integration, extensive testing, dedicated liaison team
- **Risk:** User adoption resistance
  - **Mitigation:** Training programs, incentive structures, gradual onboarding
- **Risk:** Regulatory compliance issues
  - **Mitigation:** Legal review, government stakeholder engagement, compliance monitoring

Financial Risks:

- **Risk:** Implementation costs exceeding projections
  - **Mitigation:** Detailed budget tracking, milestone-based funding, cost optimization
- **Risk:** Longer ROI timeline than expected
  - **Mitigation:** Conservative projections, interim value capture, scalability planning

Security Risks:

- **Risk:** Unauthorized access to sensitive data
  - **Mitigation:** Encryption, access controls, regular security assessments
- **Risk:** Meter tampering at physical level
  - **Mitigation:** Tamper-evident devices, anomaly detection algorithms, field audits