SolChain

Team GreyDevs • BCOLBD 2025

A Blockchain-Based P2P Solar Energy Sharing Microgrid System

Abstract :

SolChain is a decentralized solar microgrid platform that leverages blockchain, IoT, and also enables secure, peer-to-peer (P2P) energy trading in regions with unstable grid infrastructure. **Built on a Proof-of-Stake (PoS)** sidechain, SolChain ensures **low-latency and high-throughput transaction processing** while periodically anchoring Merkle roots to a Layer-1 blockchain (e.g., Ethereum) for auditability and regulatory compliance. Smart contracts manage tokenized microtransactions denominated in SolarTokens (ST), enabling real-time settlement and enforcement of trade agreements. Zero-knowledge proofs (ZK proofs) ensure user data privacy, while **smart meters** with LPWAN (e.g., LoRa) connectivity allow l**ow-cost deployment** in off-grid or weak-grid rural areas. **Integrated AI/ML modules perform decentralized pricing, anomaly detection, and demand forecasting using distributed edge intelligence**. This poster details SolChain's technical architecture, decentralized governance (via DAO), and deployment strategy, establishing a robust, scalable model for community-driven clean energy access in

Governance

- **Network Membership:** KYC onboarding, roles (prosumer, consumer, validator, regulator).
- **Business:** DAO, AI pricing, 0.1 kWh min trade, SLAs & compliance.
- **Tech:** Nodes by community/partners, IPFS off-chain, anchors to Ethereum.

Security

- ZK privacy, role-based access, bonded fraud proofs.
- Key mgmt in Web3 wallet; anomaly detection on edge.

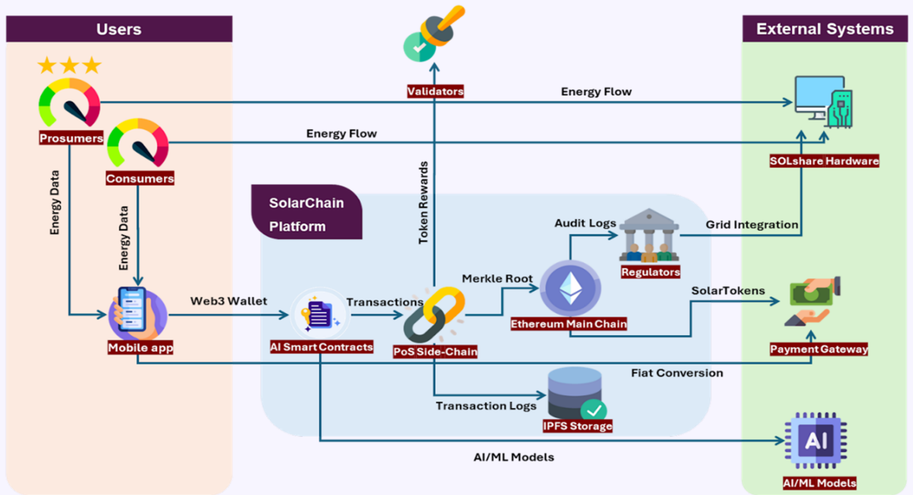
Problem

- ⚠ **Centralized control** & **unstable grids unfair pricing** and low transparency.
- ⚠ **High** internet/infra **cost** in rural areas; **low digital trust**.
- ⚠ **Limited visibility** of ownership/distribution; **theft & tampering risks**.

Solution

- ✔ LAN-first **microgrids with smart meters + IPFS-backed logs**.
- ✔ **Blockchain settlement** with 1 kWh = 1 ST; DAO governance.
- ✔ **AI-driven matching, pricing, anomaly detection;** regulator read-only audits.

Architecture



Key Benefits

Fair Pricing
Decentralized market

Tamper-Proof
On-chain settlement

Low Cost
LPWAN & edge

Auditable
Merkle ↔ L1

Risks & Mitigation

Risk	Mitigation
Regulatory uncertainty	Engage with policymakers, ensure compliance
Tech adoption resistance	User training, community awareness programs
Cybersecurity threats	Blockchain security, regular audits
Hardware/IoT failure	Local maintenance hubs, warranty support
Financial sustainability	Transaction fee model, partnerships, grants
Grid integration challenges	Hybrid model (solar + existing grid fallback)

Partners

Government:
SREDA, BERC, BPDB, IDCOL, BREB.

Tech:
SOLshare, smart meter & storage vendors.

Finance/NGO:
ADB, PPPs, local banks, universities.

Token & Incentives

1 ST = 1 kWh;
on-chain settlement; validator fee ~0.5%.

Fiat rails via bKash / M-Pesa; local gateways per region.

Prosumers earn; consumers save via dynamic pricing.

Market Snapshot

Aspect	Details	Aspect	Details
Market Size	40% of Bangladesh lacks reliable power	**Edge**	Low cost, transparent, scalable
Problem	Grid instability, diesel dependency	**TAM**	$3.5B Bangladesh energy market
Solution	P2P solar trading via blockchain + IoT	**SAM**	$1.2B off-grid & microgrid users
Revenue	Transaction fees, subscriptions	**SOM**	$150M target adoption in 5 yrs

Roadmap

Phase 1- 2026
- Prototype & 10-community pilot
- PoS sidechains;
- 10,000 kWh traded
- AI smart contracts

Phase 2 - 2027
- 5,000 users;
- BREB + bKash
- Optimize AI;
- NGO campaigns
- Regional expansion

Phase 3 - 2028+
- 100k users; 1M kWh/mo
- Global rollout
- Est. SolChain DAO
- SDG 7 & 13 impact

Competition

Platform	Blockchain	Local Pricing	Auditability	Rural Fit
SolChain	Yes	AI/Dynamic	Merkle↔L1	LAN-first
SOLshare	No token econ	Fixed	Limited	Good
IDCOL Projects	No	Admin-set	Low	Wide
Power Ledger	Yes	Varies	High	Urban-first

TEAM
Ghagra Salem Debnath (BUET)
Md Abu Russel (BUET)
Md Abu Sufian (KUET)
A H M Fuad (BUET)

Github

Documents