Digital Energy Grid Hackathon — Idea Submission Template

1. Team Information

- Team Name: LockedIn
- Institution / Organization: Imperial College London
- Team Members :

- Pruthvi Shrikaanth — AI/ML Developer
- Kishan Patel — Software Engineer
- Shivansh Jadli — Energy Systems Analyst
- Keshava Joshi and Lakisanan Ratnarajah — UX & Dashboard Developer

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2. Problem Focus

Select one problem statement your solution addresses:

☒ Problem 1: Utility Interface with Agentic Orchestration for Grid-Scale Demand Flexibility

☐ Problem 2: Compute–Energy Convergence in a DEG World

3. Solution Overview (max 150 words)

We are building an intelligent DSO Co-Pilot Agent that continuously monitors feeder and substation loads, forecasts short-term demand, detects overload risks, and dispatches DER flexibility in real time. The agent integrates forecasting, anomaly detection, decision-making, Beckn compliant DER discovery, and automated activation through a unified engine. A Command-Centre Dashboard provides DSOs (e.g., UK Power Networks) a live operational view of feeders, DER availability, forecasted stress events, planned curtailments, and audit logs. Every activation is tagged with VLP, OBP, and settlement references to align with Ofgem's P415/P444 flexibility reforms. This system demonstrates how an autonomous agent can act as a reliable control-room co-pilot to supporting fast, transparent, and scalable flexibility procurement at local grid levels.

4. Technical Architecture (max 200 words or diagram)

The system consists of five main components:

1) Feeder Simulator — Generates realistic, noisy 1-minute electricity load values for multiple feeders.

2) AI/ML Forecasting Agent — A RandomForest-based model trained on historical time-series to forecast 1–5 minutes ahead, however this is subject to change depending on our approach once the project is accepted. Exposed as a predict_from_history() API.

3) Detection & Orchestration Engine — Monitors feeder load, compares forecasted peaks with thresholds, and triggers flexibility events when necessary.

4) Optimizer & DER Selector — A greedy knapsack-style planner that selects the best DERs on the affected feeder to cover the required load reduction.

5) Beckn-Compatible Command Layer — Generates catalog entries and activation orders containing VLP, OBP, dispatch_reference, and P444 settlement identifiers. Includes mock Flask endpoints.

A Streamlit dashboard displays feeder telemetry, DER capabilities, active events, and audit logs. All operations—inputs, decisions, forecast values, DER selections, activations—are stored in an append-only JSONL audit ledger.

Assumptions: mock data only, Python-based orchestration, simplified Beckn message structures.

5. Agent Workflow (max 150 words)

1. Telemetry ingestion: Each minute, the orchestrator reads the latest feeder loads.
2. Forecasting: AI/ML agent predicts the next 1–5 minutes of load.

3. Detection: If predicted load exceeds 125% of recent average, a flexibility event is triggered.

4. Discovery: Orchestrator retrieves the Beckn catalog of DERs on the affected feeder.

5. Planning: Optimizer chooses DERs to meet the required demand reduction and generates a Beckn order request with P415 + OBP + settlement fields.

6. Dispatch: Mock DER endpoints return acceptance or failure along with delivered kW.

7. Audit Logging: All decisions, forecasts, and responses are stored for P444 settlement validation.

8. Dashboard View: Real-time monitoring via Streamlit.

6. Business Model & Impact (max 150 words)

Our solution enables a scalable flexibility marketplace where utilities can procure demand reductions within seconds, avoiding feeder overloads and expensive infrastructure upgrades. Utilities benefit from reduced peak stress and improved grid reliability. Aggregators and VLPs gain transparent mechanisms for automated settlement via OBP-linked baselines under the P444 scheme. Consumers/DER owners benefit from incentives for providing flexibility. The modular AI-driven system allows scaling across feeders, regions, and DER types. Its Beckn-aligned open ecosystem supports interoperability across energy retailers, DSOs, VLPs, and device manufacturers, accelerating the adoption of decentralized grid-friendly technologies.

7. References / Inspiration (optional)

Mention any prior work, open datasets, or publications you're building upon.

8. Declarations

- IP & Licensing: Submitted under MIT Commons License
- Submission Format: 1-2 page PDF uploaded via Dora Hacks
- Deadline: 23/11/25 17:00 GMT