Digital Energy Grid Hackathon — Idea Submission Template

1. Team Information

- Team Name: Vibecoding Visionaries
- Institution / Organization: Imperial College London
- Team Members (2–4):

Jonathan - AI Engineer

Calvin - AI Engineer

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- Discord User names: jonathanmrx, tzekhai

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

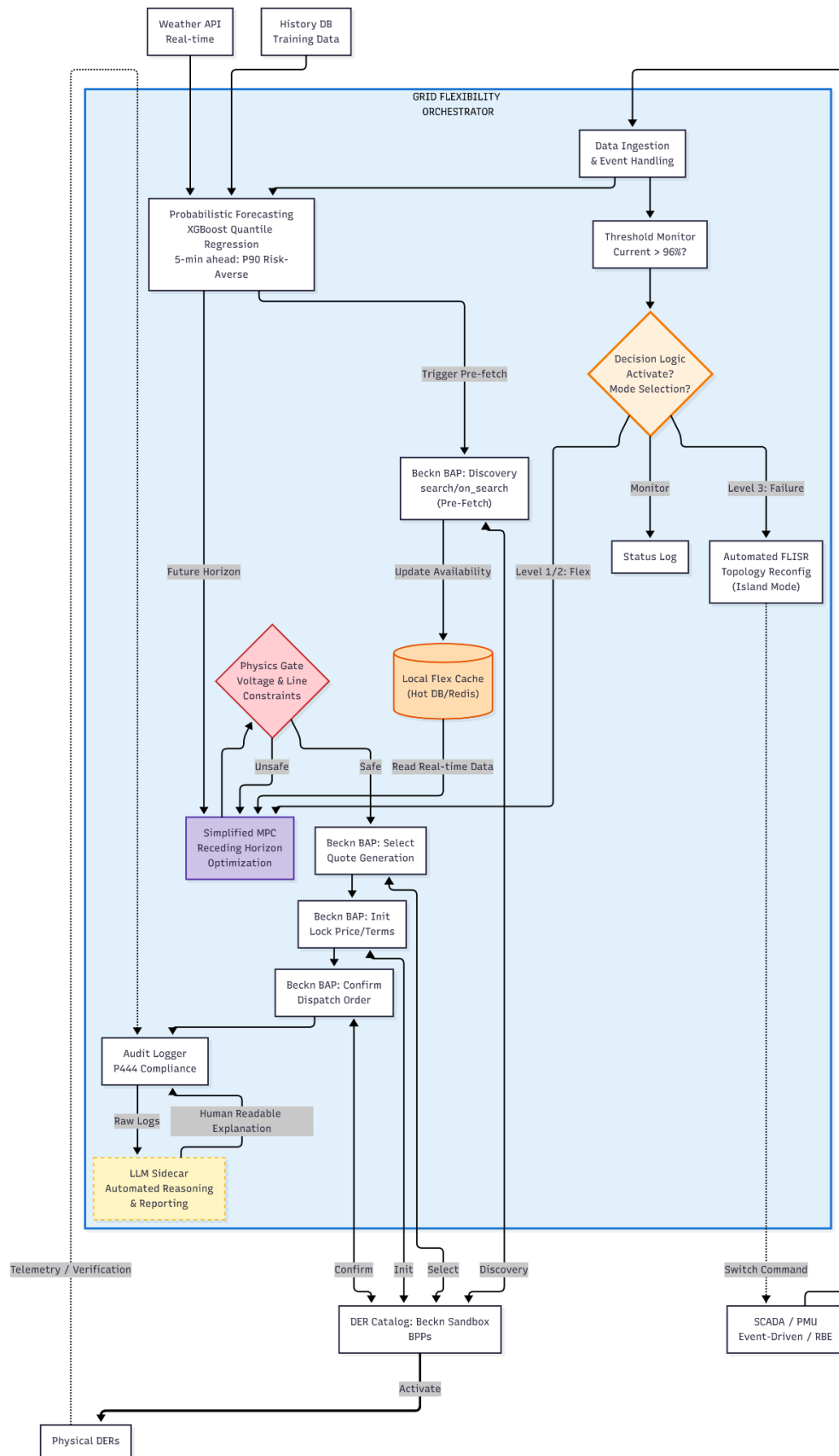## 3. Solution Overview (max 150 words)

GridGuard is an autonomous "Feeder Co-Pilot" that resolves grid constraints in real-time, eliminating the latency of manual control. Addressing the challenge of managing volatile Distributed Energy Resources (DERs), our agent functions as a Virtual Lead Party (VLP) to orchestrate flexibility via the Beckn Protocol.

Leveraging probabilistic ML (XGBoost) and proactive caching, GridGuard predicts overloads and secures DER capacity in under 5 seconds. Uniquely, it implements a tiered defense: optimizing market-based dispatch via Simplified MPC for standard spikes, while escalating to automated FLISR topology reconfiguration (Island Mode) during critical multi-feeder failures.

By generating immutable OBP IDs for P444 settlement, GridGuard ensures regulatory compliance and traceability. This solution transforms the DEG ecosystem by

converting passive infrastructure into a resilient, self-healing, and financially liquid asset class.

4. Technical Architecture (max 200 words or diagram)

GRID FLEXIBILITY ORCHESTRATOR

Weather API Real-time

History DB Training Data

Data Ingestion & Event Handling

Probabilistic Forecasting XGBoost Quantile Regression 5-min ahead: P90 Risk-Averse

Threshold Monitor Current > 96%?

Decision Logic Activate? Mode Selection?

Trigger Pre-fetch

Beckn BAP: Discovery search/on_search (Pre-Fetch)

Monitor

Level 3: Failure

Status Log

Automated FLISR Topology Reconfig (Island Mode)

Future Horizon

Update Availability

Level 1/2: Flex

Physics Gate Voltage & Line Constraints

Local Flex Cache (Hot DB/Redis)

Unsafe

Safe

Read Real-time Data

Simplified MPC Receding Horizon Optimization

Beckn BAP: Select Quote Generation

Beckn BAP: Init Lock Price/Terms

Beckn BAP: Confirm Dispatch Order

Audit Logger P444 Compliance

Raw Logs

Human Readable Explanation

LLM Sidecar Automated Reasoning & Reporting

Telemetry / Verification

Confirm

Init

Select

Discovery

Switch Command

DER Catalog: Beckn Sandbox BPPs

SCADA / PMU Event-Driven / RBE

Activate

Physical DERs

Explain the AI agent you plan to build and how they will solve the problems and create value, while leveraging Beckn and DEG components.
 Include:

- Key agents and their roles
- Data sources / APIs / models used (e.g., Beckn Sandbox, AI models)
- Orchestration or coordination logic

Include all assumptions and references for your architecture design. (Optional:

include a simple diagram or link to a visual model in your submission)

5. Agent Workflow (max 150 words)

The agent executes an autonomous control loop leveraging a tiered state-machine architecture:

1. Sense & Predict: The Utility Agent ingests event-driven telemetry. An XGBoost Quantile Regression model continuously forecasts hyper-local load vectors. If P90 (worst-case) projections indicate imminent constraint violations, the system escalates readiness immediately.
2. Discover (Proactive Caching): Our agent caches Beckn catalogs into a local Hot Cache, searching at a lower risk threshold. This enables sub-10ms querying during spikes and bypassing discovery delays.
3. Optimize: Finite Control Set MPC simulates discrete dispatch strategies over a receding horizon to select the safest asset mix. It applies a strict Physics Gate to validate voltage constraints, ensuring no action destabilizes infrastructure.
4. Act & Audit: The agent locks contracts via the Beckn `init`/`confirm` lifecycle. Transactions are logged with immutable OBP IDs for P444 settlement, enriched by LLM-based reasoning for regulatory transparency.
5. Escalate: In catastrophic N-2 multi-feeder failures, the agent triggers automated FLISR logic, bypassing markets to isolate faults and establish autonomous island topologies.

6. Business Model & Impact (max 150 words)

GridGuard employs a "Flexibility-as-a-Service" (FaaS) hybrid model. We charge DSOs a base SaaS licensing fee for the Agentic Orchestration software (Safety/FLISR logic) and capture a transactional infrastructure fee (Take Rate) on all flexibility volume settled via the P415 framework.

Value Capture:

- Utilities (DSO): Achieves CAPEX Deferral, avoiding costly physical infrastructure upgrades (e.g., £500k/mile cabling) by utilizing "Non-Wire Alternatives" and mitigating regulatory penalties.
- Consumers/DERs: Accelerates ROI on assets (EVs/Batteries) by automating participation in the flexibility market, converting idle capacity into passive income without manual trading.
- Aggregators: Reduces customer acquisition friction via the open Beckn protocol, allowing instant discovery without custom integration.

Sustainability & Scalability:

- Sustainability: Displaces carbon-intensive "Peaker Plants" by optimizing local renewable storage, directly reducing grid carbon intensity.
- Scalability: The Beckn-enabled architecture is asset-agnostic, allowing the Virtual Power Plant to scale from 100 to 1 million nodes with near-zero marginal integration cost.

7. References / Inspiration (optional)

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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