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)

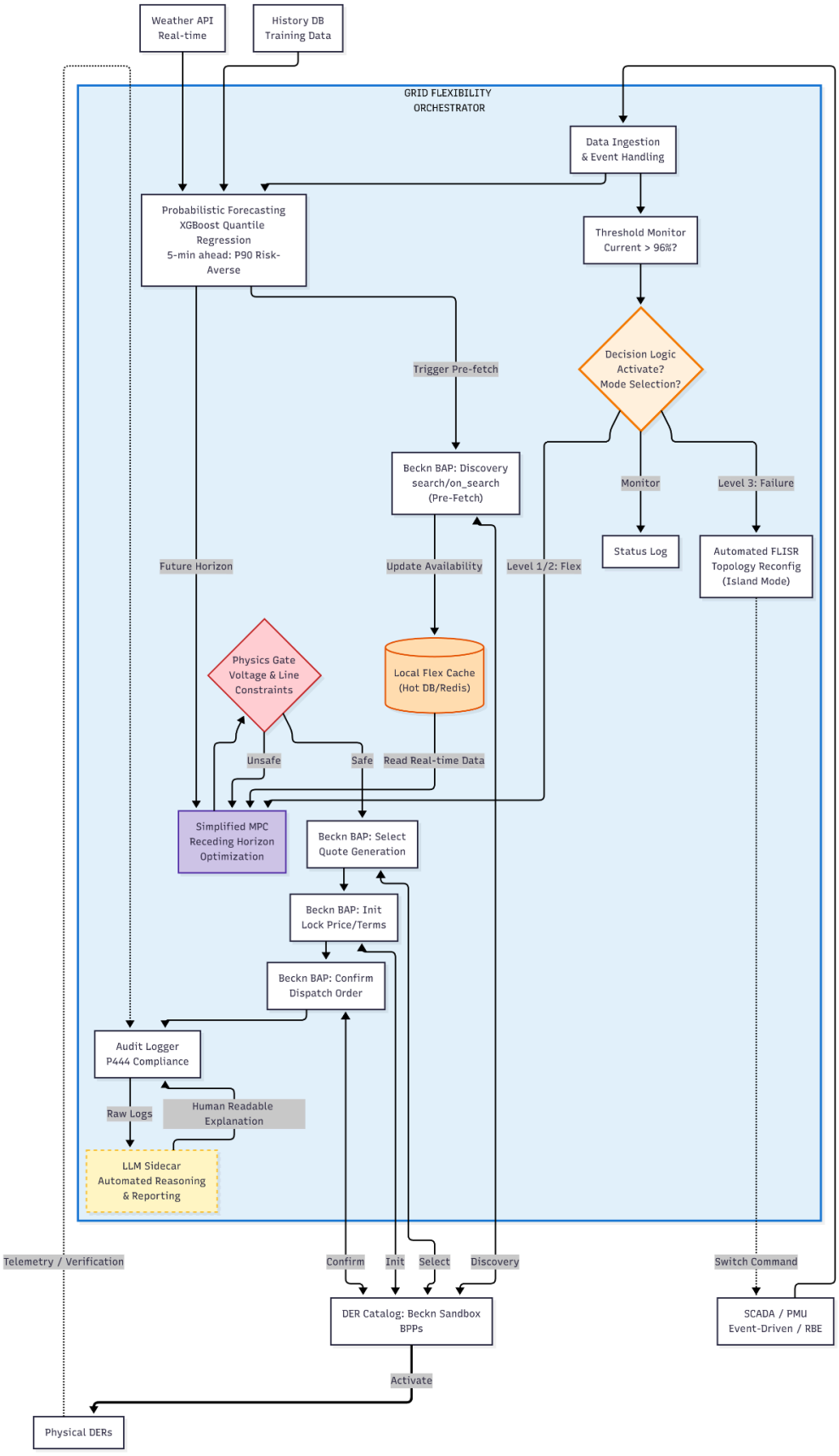
GridGuard is an autonomous "Feeder Co-Pilot" that resolves grid constraints in real-time, eliminating the latency of manual control. Addressing the challenge of managing volatile Distributed Energy Resources (DERs), our agent functions as a Virtual Lead Party (VLP) to orchestrate flexibility via the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


Weather API
Real-time
History DB
Training Data
GRID FLEXIBILITY
ORCHESTRATOR
Data Ingestion
& Event Handling
Probabilistic Forecasting
XGBoost Quantile
Regression
5-min ahead: P90 Risk-
Averse
Threshold Monitor
Current > 96%?
Trigger Pre-fetch
Decision Logic
Activate?
Mode Selection?
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)

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