Digital Energy Grid Hackathon

1. Team Information

- Team Name: Shiftly.ai
- Institution / Organization: National University of Singapore, Southampton University
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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

Rapid AI compute growth strains the UK grid, yet data centers lack practical mechanisms to participate in flexibility markets. Our solution bridges this gap via three synchronized agents.

The Grid Agent (BAP) monitors real-time grid signals and carbon intensity, broadcasting flexibility requirements via the Beckn protocol. The Compute Agent (BPP), integrated directly with a Slurm cluster, responds by autonomously shifting or pausing workloads and calculating P415/P444 settlement metrics. Simultaneously, the Battery Agent negotiates discharge during high-carbon windows to offset inflexible demand.

By transforming data centers from "blind" consumers into responsive assets, we reduce carbon intensity and £/inference costs. An associated dashboard with metrics and a "Explain with AI" feature which helps visualize the agent's real-time trade-offs and thought process, demonstrating a seamless bridge between digital infrastructure and the Digital Energy Grid.

4. Technical Architecture

Our system orchestrates three NestJS services with agents via the Beckn Protocol to optimize data center energy usage.

- Grid Agent (GA): Acting as the BAP, the GA ingests real-time signals from NESO, BMRS, and UK Carbon Intensity APIs. It utilizes the OpenAI Agent SDK and Claude Sonnet 4.5 to formulate flexibility needs (MW, carbon cap) and reason across options to minimize £/inference.
- Compute Agent (CA): A BPP interfacing with a Slurm Docker cluster via slurmrestd. It dynamically maps Slurm job states (deferral, interruption) to Beckn catalog items using a custom compute_flex attribute pack.

- Battery Agent (BA): A BPP managing battery storage assets, offering discharge capacity during high-carbon intervals.

Orchestration: The GA triggers Beckn flows, using LLM and heuristics to negotiate between interrupting compute (CA) or discharging batteries (BA).

Assumptions:

- P415/P444 settlements are simulated.
- The Dockerized Slurm cluster acts as a valid proxy for a UK Tier-2 data center.
- Direct BAP-BPP connectivity or the provided Beckn Sandbox with the gateway.

5. Agent Workflow

The workflow is driven by grid signals and executed via Beckn protocol flows:

- Discovery (/search, /on_search): The GA detects high prices or carbon intensity. It broadcasts a flexibility requirement. The CA offers Slurm job manipulations as catalogue offers, while the BA offers discharge options.
- Selection & Order (/select, /init, /confirm): The GA uses LLM reasoning to select the optimal mix of compute deferral and battery discharge. It locks the contract using FlexibilityOffer objects.
- Execution: The CA sends commands to slurmrestd to pause/shift jobs; the BA discharges energy.
- Fulfilment (/status, /on_status): The GA polls for updates. The CA updates the FlexibilitySession with actual kW/kWh reduction and CO_2 saved. This data serves as the proof of delivery for simulated settlements.

6. Business Model & Impact

Our business model operates on performance-based revenue sharing. We retain a percentage of the revenue generated from flexibility events and energy cost savings, aligning our incentives directly with the data center's success. There are no upfront fixed fees.

Stakeholder Value:

- Data Centers: Unlock new revenue streams from existing assets and accelerate Net-Zero goals.
- Aggregators (VLPs): Gain automated orchestration and streamlined P415/P444 settlement reporting.
- Grid Operators: Access "virtual" capacity to defer expensive physical infrastructure upgrades.
- AI Enterprises: Benefit from reduced inference costs and verified low-carbon compute.
- Communities: improved grid stability faster connections for new housing

Scalability & Impact: This software-defined solution requires no new physical infrastructure. As AI demand grows, our flexible capacity scales linearly. By leveraging Beckn for interoperability, we instantly bridge the gap between booming digital demand and grid stability, creating compounding environmental and financial returns.

7. References / Inspiration

https://www.datacenterdynamics.com/en/news/report-home-building-to-halt-in-west-london-due-to-data-center-power-demands/

https://www.elexon.co.uk/bsc/mod-proposal/p415/

https://www.elexon.co.uk/bsc/mod-proposal/p444/

https://www.elexon.co.uk/bsc/mod-proposal/p483/

https://github.com/beckn/protocol-specifications-new

https://github.com/beckn/missions/blob/main/docs/starter_kit/starter_kit.md

https://api.carbonintensity.org.uk/

https://www.neso.energy/data-portal/api-guidance

https://bmrs.elexon.co.uk/api-documentation/endpoint/forecast/demand/day-ahead

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