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

(1) Team Information

Team Name: Synapse Energy

Institution: Imperial College London

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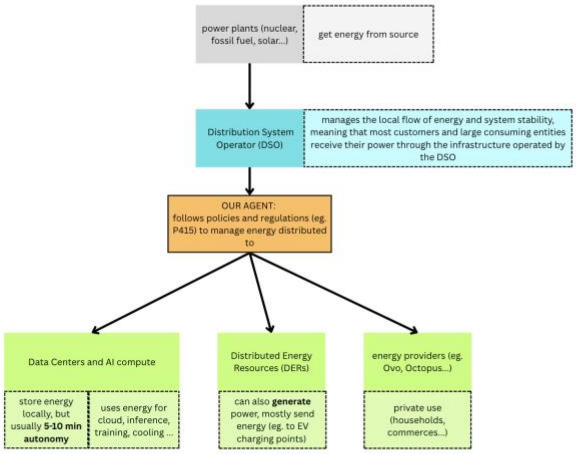
(2) Problem Focus

We have selected problem focus 2: Compute-Energy Convergence in a DEG world.

The development of AI tools has grown dramatically in the past 5 to 10 years and will continue to grow exponentially. Consequently, it is critical to manage and distribute energy intelligently to optimise consumption and avoid spikes in energy grid stress levels. Currently, energy is managed by the DSO and data centres are not yet fully dynamic notes in the energy ecosystem. This is why we are building Synapse Energy: to reach a DEG world, we must give smart systems that understand the flexible energy demand and stakeholders, and optimises distribution, complying with regulations and policies like P415 for transparency and fairness.



(3) Solution Overview (max 150 words)

We are creating a dashboard product that uses AI reinforcement learning to pre-emptively anticipate supply / demand and provide signals to data centres to reduce compute asset demand during peak times and inversely providing signals to foster higher compute performance when energy is in excess, cheap or green.

An agent will receive live grid signals, time information etc. and compute necessary outputs such as predicted supply vs demand under standard circumstances. The main lever that we can pull is changing how many non-time critical compute assets such as AI training on large power-intense data centres.

We want to advise when and where the grid can optimise its assets and how to leverage DERs and data centre use.

(4) Technical Architecture (max 200 words)

The AI agent will use Claude's Sonnet as the base decision LLM orchestrator coordinating MCP tools and the PHP backend.

Key agents and roles:

- MCP orchestrator (tooling, timeouts, audit), PHP Grid/DER/Settlement controllers (feeder checks, Beckn discovery/activation),

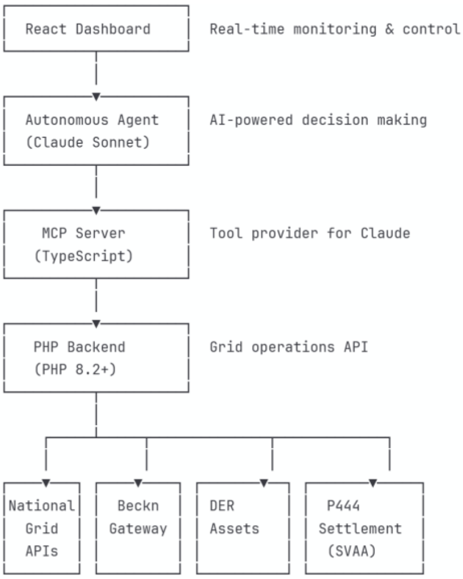
Data sources/APIs/models:

- Beckn for transactions
- National Grid ESO and Elexon BMRS for telemetry/price signals, SVAA for settlement,

Our optimisation model solves a short-horizon linear program that allocates dispatchable generation, battery charge/discharge, and load supply across prosumers and data centres. It enforces power balance, capacity and ramp limits, and AI-job deadlines. The objective minimises operating cost by prioritising renewables, reducing peaks, and avoiding compute-delay penalties.

The frontend will be a simple webpage dashboard that is coded primarily in PHP (basically html) with CSS for styles and JS for basic actions, however most of the underlying logic, API calls etc. will be performed on the PHP web server.

The system will run using PHP on a Google Cloud Compute web server.



(5) Agent Workflow (max 150 words)

Our AI agent integrates seamlessly with the Beckn protocol to enable intelligent, real-time flexibility sourcing for grid stability. Using the Beckn search flow the agent discovers DER providers based on location, capacity, and response time, returning a marketplace-style catalogue of available assets. The agent then evaluates these options and triggers internal activation via the backend which then manages control signals, OBP ID creation, in line with the relevant regulations (P444 & P415). Throughout the process, the MCP server orchestrates tool calls, enforces timeouts, logs audits, and ensures regulatory compliance. This architecture uses Beckn for open, interoperable DER discovery while maintaining secure, deterministic activation and settlement internally delivering a scalable, standards-aligned flexibility automation platform for system operators and energy markets.

(6) Business Model & Impact (max 150 words)

Business Model:

The system transforms data centres from passive consumers into revenue generating .. The operator reduces operational expanse (OPEX) through engineer arbitrage- shifting compute loads to low-cost, low carbon windows.

Simultaneously, it generates new revenue streams by monetising flexibility under P415, effectively selling deferred demand to the wholesale market during peak stress which subsidises the cost per inference.

Impact:

1. Distribution -The solution ensures sustainable AI scaling by decoupling growth from grid instability
2. Trust- automated, tamper-proof logs of every energy transaction
3. Optimisation – Automated & Predictive; uses AI and real-time data to balance load dynamically
4. Visibility – Real-time, granular view of all distributed assets (EVs, solar, batteries)

(8) Declarations

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*Submission Format: 1-2 page PDF uploaded via Dora Hacks

*Deadline: 23/11/25 17:00 GMT