Digital Energy Grid Hackathon — Idea Submission Template

1. Team Information

- Team Name: GridFlex
- Institution / Organization: Independent
- Team Members (2–4): Meet Bhorania (AI Engineer, Technical Lead)
  Manan Suthar (Frontend Engineer)
- Designer, Business Strategist
- Contact Emails: meet.bhorania@gmail.com, manannsuthar@gmail.com
- Discord User names: meet5867, manansuthar

2. Problem Focus

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

3. Solution Overview (max 150 words)

GridFlex addresses a challenge that's becoming critical as AI scales: datacenters are massive energy consumers, and that demand is only growing. We've built a platform that makes compute workloads flexible by coordinating them with the energy grid in real time. The system uses three agents working together. A Workload Intelligence Agent tracks AI training jobs and figures out which ones can be delayed without breaking SLA commitments. A Grid Market Agent monitors energy prices and carbon intensity through the Beckn Protocol, looking for optimal windows when power is cheap and clean. An Orchestration Engine ties it all together, making split-second decisions to shift workloads to low-carbon periods while keeping costs down. By treating compute clusters as flexible loads, datacenters can participate in P415 flexibility markets. This creates new revenue while cutting energy costs by 25-35% and carbon emissions by 40-60%. It's a practical way to scale AI infrastructure without overwhelming the grid.

4. Technical Architecture (max 200 words or diagram)

GridFlex uses a three-layer architecture with Beckn Protocol at its core.

Agent Layer: The Workload Intelligence Agent uses Ray for distributed tracking across GPU clusters and Prophet/LSTM models to forecast demand patterns. It identifies which training jobs can be deferred and calculates flexibility windows. The Grid Market Agent connects to energy markets via Beckn's search and select workflows, pulling real-time data from the UK Carbon Intensity API, wholesale prices, and P415 signals. It publishes compute availability as Beckn catalog items. The Orchestration Engine runs multi-objective optimization (NSGA-II with reinforcement learning) to balance three goals: minimize cost per inference, enforce carbon caps under 200g CO2/kWh, and maintain sub-5-minute response times.

Beckn Integration: Compute clusters publish their available job slots via Beckn catalogs. Grid operators query these catalogs and confirm bookings through the init/confirm workflow. Every transaction gets an audit trail with verifiable settlement for P415 compliance.

Infrastructure: We're building on Python/FastAPI for the backend, React for the operator dashboard, PostgreSQL for state management, and GCP Vertex AI for model hosting. This stack lets us iterate quickly and scale when needed.

See Figure 1 for the complete system architecture.

Assumptions: We're working with simulated GPU workload data and energy market APIs initially, using 30-minute scheduling windows to align with P415 requirements, and integrating with the Beckn sandbox environment for protocol validation.

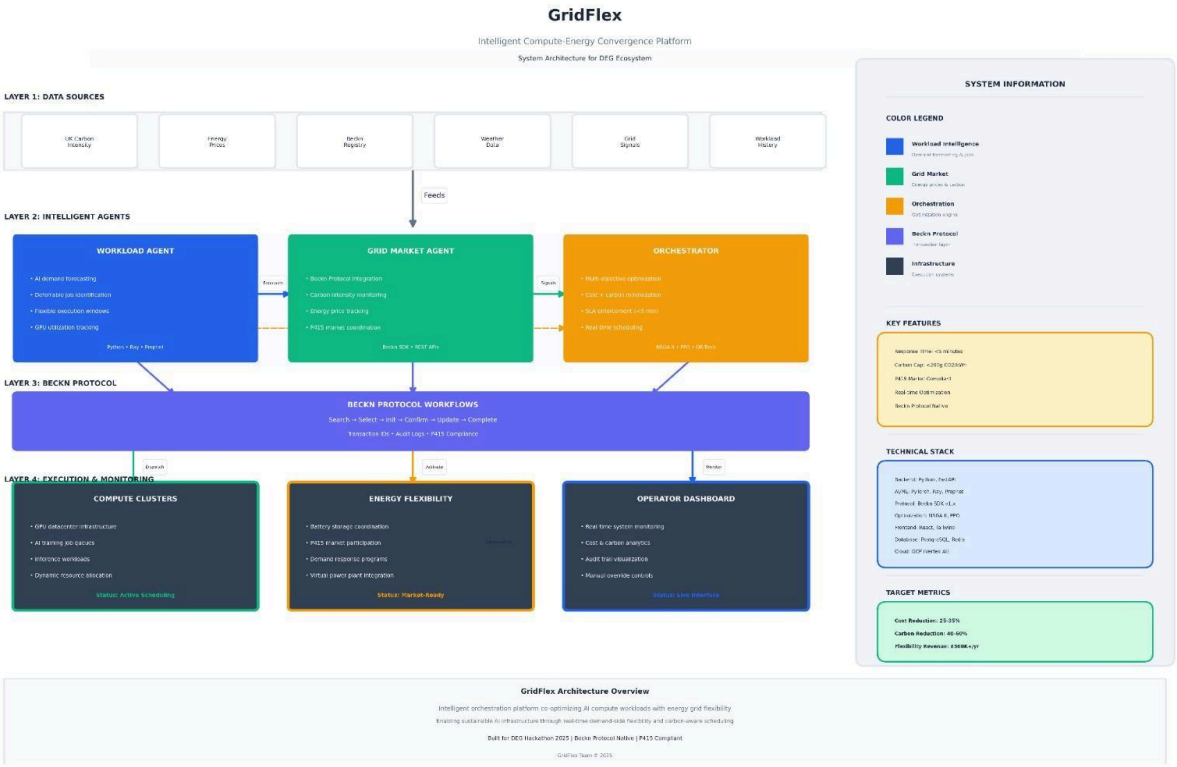

Figure 1: GridFlex System Architecture

5. Agent Workflow (max 150 words)

Our agents coordinate through Beckn Protocol workflows. In the Discovery Phase, the Workload Agent publishes flexibility catalogs to Beckn, describing each job's energy needs (say, 150kWh), deferral window (4 hours), and flexibility premium (£0.15/kWh). Grid operators query these catalogs to find available capacity. During Selection & Booking, when the Grid Agent spots optimal conditions—like a 02:00-06:00 window with sub-100g CO2/kWh intensity and £0.08/kWh pricing—it initiates a Beckn order. The Orchestration Engine checks if this works with the current queue and confirms if

all constraints align. Execution is where it happens: confirmed orders trigger workload rescheduling. The system streams real-time data (power draw, actual carbon intensity, cost savings) through Beckn update messages. When done, settlement happens via Beckn complete with transaction IDs that link back to P415 market records. Every decision, data source, and transaction gets logged for regulatory review.

6. Business Model & Impact (max 150 words)

Revenue Model: GridFlex runs on a hybrid SaaS plus marketplace model. Datacenters pay monthly subscriptions based on GPU count: £2,000 for under 500 GPUs, £5,000 for 500-2000 GPUs, and £8,000 for larger deployments. On top of that, we take 20% of P415 flexibility payments they earn by shifting workloads. This aligns our incentives with theirs.
Stakeholder Value: Cloud providers cut energy costs by 25-35% and hit carbon-neutral targets without sacrificing performance. AI companies lower training expenses by 20-30% while keeping SLA promises intact. Grid operators gain 50-200MW of flexible capacity per major datacenter, which reduces strain during peak demand.
Market Opportunity: The UK has over 30 large datacenters, representing a £15-25M addressable market annually. AI compute demand is growing at 40% per year, so we're planning international expansion to EU and US markets by Q3 2026.
Impact: Each participating datacenter prevents 2-3 million tons of CO2 emissions per year while generating over aspects.

7. References / Inspiration (optional)

- UK National Grid Carbon Intensity API: https://carbonintensity.org.uk.
- Beckn Protocol Documentation: https://developers.becknprotocol.io.
- Ofgem P415 Flexibility Market: https://www.ofgem.gov.uk.

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