Google.org Impact Challenge: AI for Government Innovation

Nearly Free Energy (NFE) – Draft Application

I. Organization and Submitter Info

1. Organization Name
Nearly Free Energy

2. Country
Uganda (with operations expanding to East Africa and pilot work in the United States)

3. Classification
Social Enterprise

4.a Founded
2024

4.b Annual Budget (USD)
~$50,000 (early-stage, pilot operations)

4.c Full-time Employees
2

5.a Website

https://nearlyfreeenergy.com (or placeholder)

6. Google.org funding before
No

7. Discovery
Social Media (LinkedIn)

8. Primary Contact
Aaron Tushabe – Co-Founder

II. Impact

11. Project Name
AI-Powered Distributed Grid Intelligence for Public Infrastructure

12. Topics
Resilience; Economy (public infrastructure and affordability)

13. Geographic Scope
County / Municipal; National (scalable)

14. Regions
EMEA; North America

15. Stage
Prototype (live pilot with paying users)

16. Problem Statement

16.a
Public electricity systems in rapidly growing urban and peri-urban areas are increasingly unreliable, expensive, and unable to manage real-time demand fluctuations. Utilities lack visibility into distributed consumption and have limited tools to optimize load, leading to frequent outages, inefficient infrastructure investment, and constrained economic activity.

16.b
This project directly affects grid load balancing, demand forecasting, outage response, and infrastructure planning workflows within utilities and regulatory bodies. It introduces real-time decision support and automation into how public electricity systems are monitored, managed, and optimized.

16.c
The challenge is significant and growing at a global scale. In 2013, approximately 1 billion people lacked access to electricity, with another 1 billion connected to unreliable grids. By 2023, global electrification efforts reduced those without access to ~600 million, but the number of people connected to unreliable grids has surged to an estimated 3 billion. In South Africa, recurring load shedding disrupts economic activity and essential services, while in Lagos, Nigeria, widespread reliance on 24/7 diesel generators drives high costs and severe air pollution. These trends highlight a critical gap: expanding access alone is not enough—there is an urgent need to improve reliability

through intelligent, flexible grid systems.

17. Proposed Solution

17.a

We are building an AI-powered distributed grid intelligence platform that serves as a real-time control layer for national electricity systems—turning community-scale microgrids into coordinated assets that improve reliability, reduce peak demand, and expand affordable access.

17.b

The platform integrates smart meter and telemetry data (RS-485/Modbus), edge controllers, and GCP (Cloud Run, BigQuery) with AI models for time-series forecasting, demand optimization, anomaly detection, and agentic workflows. These AI agents continuously analyze grid conditions and autonomously trigger actions such as battery dispatch, demand response, outage alerts, and customer support, enabling dynamic, real-time system optimization.

17.c

We have demonstrated feasibility through a live pilot microgrid with paying users, where we collect real-time energy data and operate a working system that improves uptime, visibility, and load balancing. Early results show smoother demand curves and reduced dependence on unstable grid supply.

17.d

To ensure adoption, we are designing the platform as a government-integrated system with dashboards, APIs, and reporting aligned to utility workflows such as grid planning, outage management, and demand response. We are engaging regulators and utilities to enable distributed energy resources to function as coordinated grid assets within national systems.

18. End Beneficiaries

18.a

Urban and peri-urban households, small businesses, utilities, and regulators.

18.b

We incorporate feedback through pilot deployments, user billing data, and direct engagement with communities and operators.

18.c

Initial reach: hundreds of users, scaling to tens of thousands across multiple deployments over 36 months.

19. Expected Outcomes

19.a
Improved electricity reliability, reduced outages, and more efficient grid utilization.

19.b
Metrics: uptime, cost per kWh, peak load reduction, customer satisfaction.

19.c
Failure signals: no measurable improvement in reliability, low adoption by utilities, or inability to integrate with existing workflows.

19.d
Expected improvements include 20–40% reduction in peak load stress and significant improvements in uptime.

19. Expected Outcomes

19.a
This solution will improve public electricity services by increasing reliability, reducing dependence on diesel generation, and enabling governments and utilities to manage distributed energy resources as coordinated grid assets. It will expand access to clean, affordable, and reliable electricity while improving planning and operational efficiency.

19.b
Key metrics include: number of people with improved reliable electricity access; MWh of distributed energy storage deployed; reduction in peak grid load (%); uptime improvements (%); reduction in diesel generator usage; and number of utilities/regulators actively using platform data for planning.

19.c
Failure indicators include: inability to scale deployments; low adoption by utilities or regulators; no measurable improvement in reliability or peak load reduction; or lack of engagement from DER operators and ecosystem partners.

19.d
Within 12 months, we aim to enable deployment of at least 1 MWh of distributed energy storage across Africa through direct deployments and partner-led adoption. Within 36 months, we target improving access to reliable, clean electricity for at least 1 million people by scaling autonomous microgrids and supporting an open ecosystem of DER operators using our platform.

III. Innovative Use of Technology

21. Why is your proposed solution necessary to address the problem versus currently available alternatives?
Current approaches either expand centralized grid capacity (slow, capital-intensive) or deploy isolated off-grid systems (limited coordination, no grid support). Existing tools lack real-time, system-wide intelligence and cannot integrate distributed energy resources (DERs) into utility operations. Our solution introduces an AI-driven control layer that coordinates microgrids as grid assets—enabling forecasting, automated dispatch, and demand response. This uniquely improves reliability at scale, reduces peak stress without new generation, and provides governments with actionable, real-time planning data.

20. Technologies
GCP (Cloud Run, BigQuery), smart meters, edge computing, time-series AI models, optimization algorithms.

21. Why needed
Existing systems lack real-time intelligence and integration of distributed energy resources.

22. Dataset
Yes

23. Data access
Through smart meters, utility collaboration, and anonymized operational data.

24. Ethics
We use anonymized data, ensure transparency, and align with responsible AI principles.

25. Open source
Yes

26. How might you leverage Google's pro bono technical support and expertise to accelerate project outcomes?
We will leverage Google’s AI and cloud expertise to build and scale our distributed grid intelligence platform. Specifically, we seek support in developing robust time-series forecasting and optimization models, designing agentic AI workflows for autonomous grid operations, and optimizing our architecture on GCP (BigQuery, Cloud Run) for real-time data processing at scale. We also aim to learn from Google’s experience operating highly reliable, large-scale infrastructure (e.g., data centers) to inform how we design resilient, fault-tolerant energy systems. Additionally, we would benefit from guidance on responsible AI deployment, model evaluation, and integration with public sector data workflows to ensure reliability, scalability, and government adoption.
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AI model optimization, scaling infrastructure, and system architecture design.

IV. Feasibility

27. Why is your organization uniquely positioned to lead this project?
Nearly Free Energy uniquely combines hands-on microgrid deployment with AI-driven software development in emerging markets. We operate a live pilot with real users and data, giving us practical insight into grid constraints, customer behavior, and operational challenges. Our team spans energy systems, embedded hardware, and cloud/AI engineering, enabling end-to-end execution from meters to models. We are also actively engaging regulators and utilities on DER policy and integration, positioning us at the intersection of infrastructure, data, and government adoption—where this problem must be solved.

29. Describe the work you have done to demonstrate the technical feasibility of your approach.
We have deployed a live pilot microgrid with ~10 paying customers, instrumented with smart meters (RS-485/Modbus) and cloud ingestion to GCP (Cloud Run, BigQuery). We collect continuous telemetry (kWh, voltage, load profiles) and run initial analytics for load visibility and anomaly detection. We have tested controlled battery dispatch to smooth peak demand and validated end-to-end data pipelines (edge → cloud → dashboards). Success metrics include sustained data uptime (>95%), accurate load measurement, improved peak smoothing on pilot circuits, and reliable billing/alert workflows. These results demonstrate feasibility of real-time data-driven operations and AI-assisted optimization.

30. Key technical risks, dependencies, maintenance, and mitigation strategies
Key risks include hardware integration variability, intermittent connectivity, data quality gaps, and model performance in low-data environments. Adoption depends on utility/regulatory alignment and integration with existing workflows. Ongoing needs include device maintenance, data pipeline reliability, and model monitoring. Mitigations: modular, standards-based design (Modbus/REST); offline-first edge control with local fallbacks; redundancy and buffering for connectivity; continuous data validation and monitoring; phased model rollout with human-in-the-loop; training and SLAs with partners; and close coordination with regulators/utilities to ensure smooth integration and sustained operations.

31. Policy, administrative, privacy, and logistical risks and mitigation
Policy risk: delays or uncertainty in DER interconnection and PPA frameworks. Mitigation: early engagement with ERA/utility stakeholders, alignment to existing codes, and pilot-based regulatory sandboxes.
Administrative risk: slow procurement/adoption within public entities. Mitigation: lightweight pilots, clear ROI metrics, and integration with existing workflows and reporting.
Privacy/data risk: handling consumer energy data. Mitigation: data minimization, anonymization, role-based access, encryption in transit/at rest, and compliance with local data protection laws.
Logistical risk: installation/maintenance at scale. Mitigation: standardized hardware kits, local

partner installers, remote monitoring, and SLA-driven support.

32. How will public servants be trained, supported, and incentivized to adopt and use this solution as part of their regular workflows?
Government entities are not primary users of the platform; their role is to create enabling regulatory frameworks that build trust in DER operators. We will support regulators through targeted briefings, data-sharing dashboards, and policy workshops that translate system insights into actionable regulation. By providing clear visibility into demand patterns, grid impact, and reliability improvements, we enable regulators to confidently design and enforce DER policies. Incentives for adoption come from improved oversight, better planning data, and the ability to expand reliable electricity access without additional public infrastructure investment.

33. Provide additional detail about 3-5 key project team members, especially those in technical roles.
Microgrid/Energy Systems Engineer – designs and operates DER systems, battery dispatch, and grid integration.
Backend/Cloud Engineer – builds scalable data pipelines and APIs on GCP (Cloud Run, BigQuery).
Data Scientist/ML Engineer – develops forecasting, optimization, and anomaly detection models.
Embedded/IoT Engineer – integrates smart meters (Modbus/RS-485) and edge controllers.
Operations/Deployment Lead – manages field installation, partner coordination, and system reliability at scale.
Policy & Partnerships Lead – drives regulatory engagement (e.g., ERA), supports DER policy development, secures government buy-in, and enables partner operators in new markets to navigate regulation and scale deployments.

VI. Scalability

36. Based on your previous selection, detail how you'd replicate success beyond your initial proposal.
We will scale through a dual approach: direct deployments and an open ecosystem model. We will standardize our microgrid architecture (hardware + AI software) into repeatable deployment kits and publish the platform as open source, enabling local DER operators to adopt and deploy in their markets. We will partner with utilities and regulators to integrate these systems into national grids, creating a coordinated network of distributed assets. As we scale, we will expand our team across engineering, partnerships, and operations to support multi-country deployments and ecosystem growth.

37.a Financial sustainability
Sustained via electricity sales (10–30% gross margins) from NFE-owned microgrids, plus SaaS fees and revenue share from partner-operated systems. As deployments scale, recurring revenues from energy and platform services cover operations, maintenance, and continued expansion without grant funding.

37.b Technical sustainability
Cloud-native architecture on GCP with automated monitoring and CI/CD; offline-capable edge controllers ensure resilience. Open-source platform enables contributions from partners/operators. Standardized hardware kits and SLAs support maintenance, while local partners handle installation and support at scale.

38. What key learnings, datasets, models, codebases, or other artifacts will your project generate, and how will you share them with other organizations to help advance the field?
We will generate real-world energy datasets (anonymized usage, demand response, grid performance), AI models for forecasting and optimization, and an open-source microgrid OS. Our company culture is to work in the open—we already publish our work via our website and public wiki (nearlyfreeenergy.com; bookstack.nearlyfreeenergy.com). We will continue sharing code, documentation, and operator playbooks to enable other DER operators and governments to replicate and build on our approach globally.

VII. Project Budget and Timeline

41. Funding Request
$2,500,000

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42. Personnel & Staffing — $600,000
Covers salaries for core team: AI/ML engineers, backend/cloud engineers, energy systems engineers, and operations staff. Includes hiring additional technical talent to build forecasting, optimization, and agentic AI systems, as well as project management and field deployment coordination.

43. Technology Development — $300,000
Development of AI models (forecasting, optimization), software platform (microgrid OS), APIs, dashboards, and data pipelines. Includes costs for software engineering, model training, testing, and integration with edge devices and utility systems.

44. Infrastructure & Deployment — $1,900,000
Procurement and deployment of smart meters, edge controllers, and battery-integrated systems for pilot and scale-up sites. Battery storage is a primary cost driver, with an estimated requirement of ~1.5 kWh per household at approximately $450 per kWh deployed. This category covers battery capacity, installation materials, field operations, connectivity, and cloud infrastructure (GCP compute, storage, and data processing).

45. Partnerships & Ecosystem Growth — $150,000
Government engagement, regulatory workshops, and partnership development with utilities and DER operators. Includes ecosystem-building activities, training sessions, and support for onboarding partners to deploy and operate microgrids using the platform.

46. Monitoring, Evaluation & Overhead — $50,000
Measurement of impact metrics (uptime, peak reduction, access), reporting, and program evaluation. Includes minimal indirect costs such as administration, coordination, and compliance (kept under 5%).

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