NH34PWR

Ammonia Based, Fuel Cell Power for Off-Grid Mobile Telecoms Towers

Grant No. 256856

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Diverse Energy Ltd (UK)

Diverse Energy Ltd.

Partners

Partner	Country	Role
Diverse Energy	United Kingdom	Manufacturer of Powercubes
Linde Gas	Germany	Industrial Gas supplier & Fuelling partner
WaterstofNet	Belgium	Environmental reporting & dissemination
Balton	United Kingdom	Installers & Maintainers of telecoms equipment (Africa)
Leading Light	United Kingdom	Monitoring, Software & Data communications
Nedstack	Netherlands	Fuel Cell Stack Manufacturer

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Project Goals

- Develop manufacturing
  - Develop cost and quality targets for manufacture and validating multiple component suppliers,
- Deployment of Cubes
  - Complete the build, deployment, remote measurement of 40 units and validate the system readiness.
  - Units will be with multiple operators, countries and climates in Africa
- Fuel Supply
  - Build a scalable ammonia fuel supply infrastructure based on Linde's current NH3 distribution network.
  - Validate reliable fuel delivery and its integration with the Powercube system.
- Field Support
  - Define, test and prove the installation, maintenance and repair procedures.
- Product Validation
  - Validate the cost savings and environmental benefits for operators
  - Pave the ground for a large scale field demonstration.

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Targets and Milestones

List and schedule of milestones

Milestone no.	Milestone name	WPs no's.	Lead beneficiary	Delivery date	*Means of Verification*
1	Completion of TSB units (outside JTI scope)	1		9	Bills of Lading
2	Completion of assembly plant	1,2	DE	18	PowerCube Production data
3	Complete & install 40 PowerCubes	1,2,3, 4,5,6,	DE, LL	18	Remote monitoring data showing power generated
4	Quality control procedures certified	1,2,4,5	DE	24	Appropriate certificates
5	Dissemination to telecoms	1,7	All	15/ 27	Conference proceedings , catalogues, papers, videos
6	Maintenance, refuelling and stack replacement	1,3,4, 5,6,	LG, BCP, NS	36	On-line monitoring system
7	Environmental validation	1,2	WN, DE	36	Report on source-to-sink & cradle-to-grave
8	Validation of economic and technical capabilities to customers	All	All	36	Sales contracts for future PowerCubes
9	Final Project report	All	All	36	Report submitted to EU

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Technical Accomplishments

Cracker (Ammonia Power Generator)

- DE have designed a higher efficiency cracker
- DE have made a small portable cracker
- DE's cracker can generate low volumes of ultra pure hydrogen
- Integrated a Cracker, Purification and Fuel cell system together to generate electrical power on-demand

Control Systems

- Developed and proven a dynamic control systems to manage & operate the Powercube
- Developed, Produced and Tested on-line internet Web Monitoring Systems

Production of Powercubes

- Fully tested six Powercubes
- Deployed four Powercubes to South Africa
- About to implement two Powercubes for Field Trials
- Future Models could potentially use multiple fuels – a small scale, highly efficient, commercial product.

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RTD Priorities and key objectives

Placing Europe at the forefront of fuel cell and hydrogen technologies

- DE are seeking a long life span (40,000hrs) commercially available Fuel Cell.
- This is pushing the technology to a new level that is not widely available outside of specific industries (CHP / Automotive).

Private Investors

- DE has secured the financial support of both an ‘angel’ and a venture capital investor.

Hydrogen Production and Distribution

DE have developed a unique 'gas reformer' using ammonia as a Fuel source to provide Hydrogen in the appropriate quantities to power telecoms towers depending on site demand.

DE uses an unconventional source of fuel – Ammonia (NH3)

- Ammonia is a mobile form of fuel
- Ammonia is a commercially available fuel
- PowerCube byproduct is deionized water (no CO2 or NOx) produced at point of use.

DE have identified 44,000 possible off grid telecoms sites

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Gaps /Bottlenecks in MAIP/AIP

Gap

- The Fuel Cell lifetime of 40,000 hrs requirement is not currently offered on standard products

Prime Power

- Other users operate Fuel Cells in Back-up capacity
- DE uses Fuel Cells as a prime power provider and therefore require substantial gains in longevity.

There appears to be a lower priority to develop the longevity of fuel cells due to the market favoring back-up applications.

DE is actively seeking commercially viable long-life reliable fuel cell stacks.

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Topics possibly under/over-estimated in AIPS

Narrow Vision Currently

Electrolysis and Hydrogen from biomass appears to be the main focus of AIPS.

Broader Vision Required

Ammonia is already recognized and grant funded in the USA and should be a more focused fuel and we would ask for Ammonia to have more focus within Europe.

Training and Education

DE have already employed 90% staff outside of the Fuel Cell industry.

DE have already employed 10% staff from 'back to work' initiatives in the UK.

DE are looking to create local employment in Africa within 24 months (two positions have already been created in South Africa).

Safety, Regulations, Codes and Standards

DE cannot influence codes and standards for health and safety but we will ensure that our products are compliant with European codes and safety standards

Dissemination & public awareness

- Public awareness – Afrox (Green Marketing Company)
- Industry Perception – Exhibitions, Trial Customer Sites, marketing, Reports & White papers, Journal articles and industry conferences

Technology Transfer / Collaborations

- Linde Gas - providing lease financing to change the market from 'Capital purchasing' (buying the PowerCube) to 'Power Purchasing' (payment by the amount of power used).

- South African Universities – Verifying and testing the Powercube for environmental and efficiency impacts

- DTI (SA) – Funding Powercubes for pilot testing for telecoms operators (black empowerment program)

- UK – R & D contractors (Pera, Sagentia) to assist with design

- Suppliers and Partners – providing essential products/services to supply materials/knowledge to enable the PowerCube to function.

Project Future Perspectives

- **Fuelling** – Linde to design, build and supply bulk fuelling systems to enhance the fuelling infrastructure and volume.

- **Cracker** – Corrosion issues – need to consider alternative materials composites – partners to be sought.

- **Fuel Cells** – Longevity – DE expect to be the leader in Life Time demands outside of the car and CHP industry.

Aim: - For DE to secure Commercial Scale
- Drive industry to improve products

Enhancing cooperation and future perspectives

- Fuel Cells – more investment is required to provide data/research with the aim to improve the product and specifically the longevity of the Fuel Cell Stack

- PEM Membrane – require cost down and standardization of product

- Key desires to ensure Fuel Cells make a commercial impact :
  - Cost Down
  - Increased Lifetime (>40,000 hrs continuous)
  - Increased Reliability / Durability