KGM1 PROJECT SUMMARY

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Sector: ENERGY/ AWE (Airborne Wind Energy)
Website: http://www.ghiprog.it/news.php
Category: Start-Up
Title of the innovation: KGM1 Project, a different approach to "Airborne Wind Energy" technology.

Presentation: KGM1, a new revolutionary brand for ENERGY production, uses the most powerful green technology denominated Airborne Wind Energy (AWE) for Off-Grid populations, a growing market of 800 million users.
Our device is small, simple and super-compact, able to fold up for easy transport by train, car, plane, helicopter, boat…
From many ways to produce energy or green energy, we are aiming at the highest level of Airborne Wind Energy performance with a linear generator and a patented set of innovations.
The KGM1 initiative aims to blaze a new trail in the AWE sector with a first small-scale generator (10-20 kW on modular off-grid sizes), customized to the needs of remote and energy-poor communities, islands and disaster-stricken communities, with a potential of worldwide applications.

Designer: Marco Ghivarello
Thematic area: Energy transition

Innovativeness and replicability:

Research project of a current generator that uses «AWE» (Airborne Wind Energy) technology in order to extract kinetic energy from a mass of air in order to transform it into electricity using a kite/wing that flies in the sky, under 100 mt, within a particular trajectory.

KGM1 differs from its competitors with an atypical «linear» type generator based on new but simple solutions, trying to keep away from the "hyper-technology syndrome", which brings an exponential increase in complexity, frequent maintenance intervals and a difficult insurance capacity of the final product.

KGM1 research gave rise to variants of the implemented projects (the first studied in the 2019 master's degree thesis by engineer Montanari, the second currently being tested as well as a third which is described in the EU patent.).

The second prototype (subject of TRL 5) still has a wing control unit (Kite Steering Unit) having a linear stroke, which is driven by the wing itself (a normal production kite now) which feeds a generator connected by a toothed belt.
One of the innovative aspects is given by the fact that the generator no longer works using the "pull peaks" of the ropes, but on the "pull variations" of the same; these variations are created by the different positions and speeds of the kite as it flies within the flight window.

This detail makes it possible to extract more energy from the air mass in short temporal transients and accumulate it on elastic (and electrical) devices at each cycle, resulting in KGM1 being the first AWE generator in the world which has demonstrated an entirely free operation of a feedback motor. Even this innovation alone allows a recovery of approx. 30% of the total energy balance.

The machine then compensates for the less power theoretically produced through an increase in the frequency of the active cycles, with a super short glide stroke synchronized with the flight path - but in fact with a much greater dose of usable energy - since it "sucks" the energy peak given by short time transients during the gusts (which other AWE developed systems lose).

In addition, it also compensates with a more constant kinetic energy imparted to both the kite and the generators (which do not stop during the passive phases), as well as a return of the kite ("depower") which is also performed dynamically by exploiting the kinetic energy accumulated by the kite itself.

It works like an engine.

These features make it possible to increase energy production, maintain dimensions and weights, a probable simplification of the automatic flight control SW and HW, with consequent savings on the total cost of the generator and an increase in reliability.

Last, but not least: KGM1 has chosen - on this first off-grid product - not to use any automatic take-off device, this is made possible by the lower needs of target customers: it means another saving in complexity, SW/HW, lower costs and weights and, once again, an increase in reliability.
KGM1 therefore proposes to enter "through the off-grid back door" of perhaps the most powerful technology to produce green energy technology, anticipating in a simplified way future versions of larger size and complexity that will be destined for the on-grid market.

Therefore, the main features are:
- Constant flight altitude;
- Short or pulsating and linear working stroke;
- "Depowering" maneuver is profoundly different from competitors (= increase in efficiency);
- Kinetic/electrical storage generators and always on the move;
- Accumulation of potential energy during the active phases, suitable for the return of the KSU slide (= increase in efficiency);
- Kite always in motion (= increased efficiency);
- Modular sizes 10-20 kW indicatively.

Environmental impact:

The goal of the KGM1 research project is to create green energy by extracting kinetic energy from an air mass and then converting it into electrical energy with ZERO environmental impact.
In detail, these are the UN Sustainable Development Goals (SDGs) on target:
GOAL 3 – **Sustainable Transport:** Can be achieved indirectly, by having a greater quantity (kWh) of energy available, in this case coming from the wind (and coupled with a lower number of batteries, by changing the energy storage logic, which is another hot topic on which KGM1 intends to work on.)
GOAL 7 – **Energy**: This is the primary objective of this initiative.
GOAL 8 - **Green Economy**: This is an indirectly obtainable goal if the initiative grows.
GOAL 9 - **Industry**: Another indirectly obtainable goal if the initiative grows.
GOAL 11 - **Sustainable Cities and Human Settlements:** A variant of the project on mini-wind sizes is expected to be installed aboard skyscrapers (taking advantage of the great heights and relative stronger and more constant breezes.)
GOAL 13 - **Atmosphere / Climate actions**: Small islands, peninsulas and areas in danger of disappearing: these are points directly and indirectly related to the KGM1 initiative.
GOAL 17 - Partnerships for the Goals

Technical feasibility and team:

Technical feasibility:

Presentation of the 2022 prototype:
https://docs.google.com/presentation/d/13LG5vuHWfjyahBY4uP0kQIvpppXn4ptB/edit?usp=share_link&ouid=108653029879271250506&rtpof=true&sd=true

TU Delft web reference paper:
https://repository.tudelft.nl/islandora/object/uuid%3Af88f2495-34a5-4c32-90c1-

a8664f6768a

Video of the 1st test - TRL 5:
https://www.youtube.com/watch?v=etFqQdWpYZk

Video animation of proto 1 (ref. Master thesis Montanari Federico, speaker Lorenzo Fagiano, https://www.politesi.polimi.it/handle/10589/145343):
https://drive.google.com/file/d/1ywUxwkSI0i737yk2LYiS7A-x0HbMRkU9/view

LinkedIn showcase:
https://www.linkedin.com/showcase/kgm1

Team:

Ghivarello, Marco, Founder and owner of the project. Luca, his son, (Aerospace Engineering Master's Degree) collaborates in his spare time in the design and flight tests.
Sandro La Marca is a SW/HW engineer also currently working in his spare time.
Carin Eve Cole, projects development & communication (Master´s Degree in International Studies EU, Bachelor of Science / Double Major in IT and Business with honors from the University of Maryland, USA. Complete bilingual and bicultural English/Spanish with good proficiency in French. References: https://greenland.net/windsled/contact/).

The project has grown with a «bottom-up» approach, as we all currently work in different or related fields and now only use our spare time on the KGM1 project.

The team is now managing the key aspects of the project but at least 40% of the entire perimeter will be managed by external consultants in order to keep fixed costs low; it will then be necessary to grow by implementing other engineers.

Business model:

 One pager Pitch:
https://drive.google.com/file/d/1QgOQOfBgPmTToC8gRXVf01I88q-A_ZKY/view?usp=share_link

 Pitch:
https://drive.google.com/file/d/12MsrPETgaxMNvn6J_1cHSJdiGlJ8i1NG/view?usp=share_link

 Business Plan:
https://drive.google.com/file/d/1u8IUvXtUxca_5Hi2hbZXqtYTV1XLDNEw/view?usp=share_link

Third party certifications:

 TU Delft web reference paper:
https://repository.tudelft.nl/islandora/object/uuid%3Af88f2495-34a5-4c32-90c1-a8664f6768a5

 Master thesis Montanari Federico, speaker Lorenzo Fagiano,
https://www.politesi.polimi.it/handle/10589/145343

Environmental and social policies adopted:

We are studying with Carin Eve Cole, a kind of ethical constitution of the project, which involves allocating a portion of future corporate revenue money to indigenous peoples / remote and disaster areas via a corporate social responsibility (CSR) area within KGM1.
We have also created a "Doc Pack" containing a letter of presentation, a survey and a non-binding letter of intent that we have started sending to municipalities, entities and potential lenders, with the dual purpose of explaining the technology, spreading greater awareness of the issues in question and at the same time increasing the network of contacts.
A first result of this information campaign is the recent opportunity (March 23) of entering into partnership with a potential supplier of "gravity batteries" in the US, which would also solve the storage issues of energy produced in a green way.

Impact of innovation on the production system or on consumption:

It is too early to define at this stage of the research, but the potential of this technology is universally recognized as a "breakthrough" technology.

Enhancement of the specific factors of innovation:

The Founder, Marco G., strongly believes it comes from the innovations involved, and from the business model itself, designed not to enter as one of the top 50 AWEC teams, but to create a ***leading*** technology within the AWE technology.
In the past 7 years of solitary, or almost, research, without a funding round (except for a microfinancier in the initial stages of the project, who is already on board with a private agreement), he has never changed anything in the technical/scientific aspects of the business model, obtaining continuous growing confirmations on both strategies.

Other Links:

2019-20

- 1° article web magazine “QualEnergia”:

https://www.qualenergia.it/articoli/20170531-nuove-idee-per-un-progetto-di-eolico-di-alta-quota/

- 2° article web magazine “QualEnergia”:

https://www.qualenergia.it/articoli/un-nuovo-tentativo-italiano-per-leolico-ad-alta-quota/

- Spot of partecipation on event Key Energy 2019 (Prof. PHd Gianni Silvestrini, interview, Ms.Elena Comelli):

https://www.qualenergia.it/eventi/linnovazione-apre-nuove-frontiere/

- Article by Leonardo Libero (*http://www.saperescienza.it/biologia/author/87-leonardolibero*) on the magazine “Sapere Scienza”:

http://www.saperescienza.it/rubriche/geologia/ricavare-l-energia-dagli-aquiloni/2760-ricavare-l-energia-dagli-aquiloni

- Interview RAI Aosta 2020:

https://www.linkedin.com/posts/kgm1_a-recent-interview-coming-from-rai-aosta-activity-6735901752807211009-W43T?utm_source=linkedin_share&utm_medium=android_app

2021-23

 Partecipated on 9th international Airborne Wind Energy Conference (22-24 June 2022)

https://www.linkedin.com/feed/update/urn:li:activity:6951471704263045120

 Partecipation in Startup SAUNA (techn. accelerator, Espoo, Finl) 2023:

https://www.linkedin.com/feed/update/urn:li:activity:7036401339748212736

 Partecipation in KEY ENERGY like espositor (fiera, Rimini) 2023:

https://www.linkedin.com/feed/update/urn:li:activity:7042140954161496064