This project is funded by the European Union

sAlbage

albufera Energy Storage

ScioniX

UNIVERSITY OF Southampton

SALBAGE PROJECT

H2020-FETOPEN-1-2016-2017 (GA nº 766581)

Madrid, 27 Noviembre 2018

TU Graz

Graz University of Technology

DTU Danmarks Tekniske Universitet

ICTP

Instituto de Ciencia y Tecnología de Polímeros

CSIC

Consejo Superior de Investigaciones Científicas

UNIVERSITY OF LEICESTER

Our Company…

Albufera Energy Storage S.L. is a Spanish SME located in Madrid. A team of 17 people working with the focus put in three main lines of work:

- **Distribution, Advising, Consulting and Engineering**: on energy and electrochemical systems adapted to the specific needs of customers.
- **Training:** organizing specialized courses as well as an annual congress on Metal-advanced batteries.
- **R&D:** mainly devoted to the development of Al-based batteries. We are currently participating in European and National projects.

IAEa Instituto de Almacenamiento Energético Albufera

MaBiC17 Metal Air Batteries International Congress

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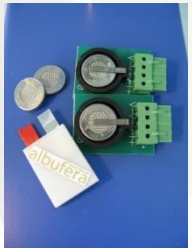
R&D Team, *where are we*?

- ✓ In Madrid Science Park (PCM)
- ✓ In a 100 m² laboratory full of specific equipment: glove box, potentiostats, press, 3D printer…



R&D Team, *what do we do*?

- **Projects:**
  - ✓ **ALION** (H2020 NMP13-2014, GA: 646286) **Development of a high specific energy Al-ion rechargeable battery.**
  - ✓ **ALPAM** (Spanish Ministry of Defense Coincidente Program Exp. 1003215003300). **Development of a primary Al-air battery for military applications**
  - ✓ **CEBRA** (Spanish Ministry of Economy, Industry and Competitiveness, Torres Quevedo Program PTQ-14-07037) **Development of high efficiency cathodes for Al-air batteries.**
  - ✓ **ALIENA** Spanish Ministry of Economy, Industry and Competitiveness (RETOS-Colaboración Program 2015) **Innovative storage for stationary applications based in Aluminium.**
  - ✓ **SALBAGE (**H2020 FET OPEN-2017) **Sulfur-Aluminium Battery with Advanced Polymeric Gel Electrolytes.**

R&D Team, *what do we do*?

- **Patents:**
  - ✓ **ES 254017A1** *"Celda electroquímica de aluminio/manganeso"*
  - ✓ **ES3432.2** *"Celda electroquímica de aluminio/aire recargable"*
- **Other:**
  - ✓ We publish our non-patentable results in high rated peer-review journals and participate regularly in National and International scientific congresses and conferences.
  - ✓ We belong to relevant societies and networks such as ISE, SIBAE, RSEQ, E3TECH...

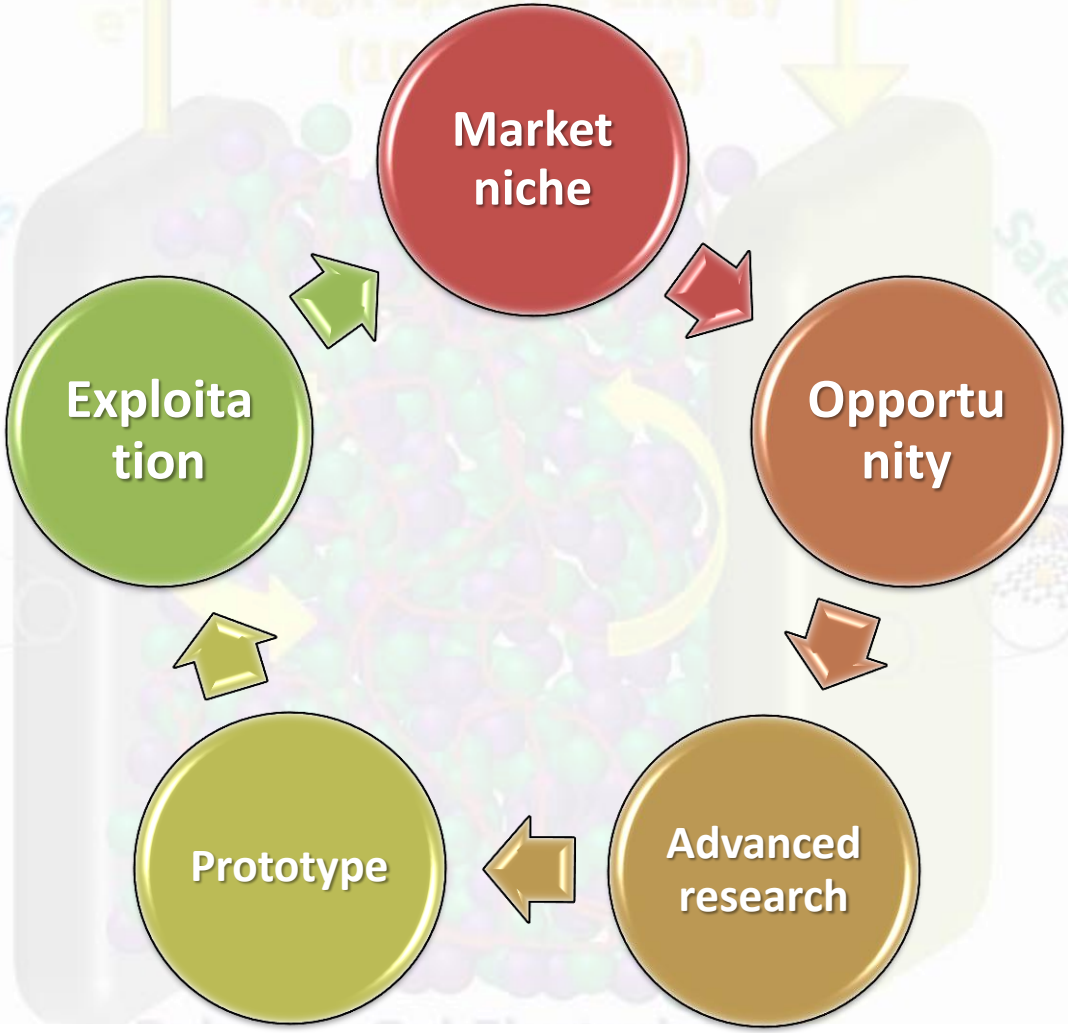
The opportunity

- Nowadays there is a strong interest and research efforts in the development of new Energy Storage Sistems (ESS).
- Most batteries use Lithium, but it has some important drawbacks.
  - scarcity
  - geolocalization
  - safety issues (explosions, flames..)
- There is a need for alternative materials in the so-called "post-Litium era".
- The use of solid-like electrolytes is also encouraged to avoid safety issues.

The idea

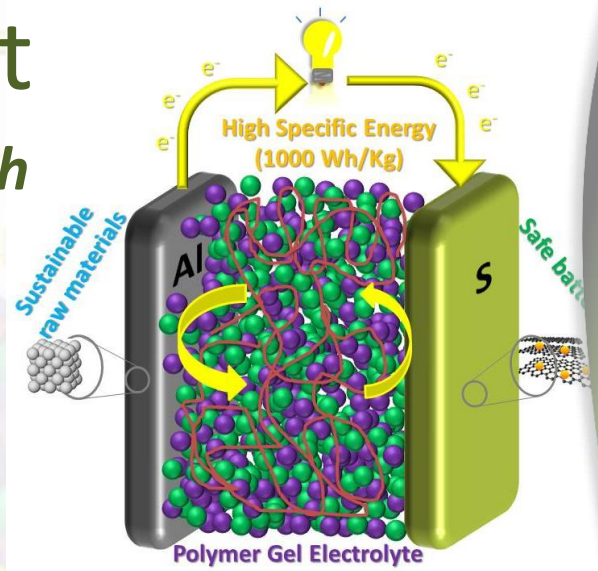
- **Aluminium** is a very interesting material and in Albufera we work in the development of Aluminium-based batteries.
- **Sulfur** is being studied with potential application as cathode in lithium batteries.
- The use and development of **new electrolytes** is needed. And we propose the use of Ionic Liquids and Deep Eutectic Solvents in a **polymerized** version.
- The combination of these elements in a battery **has never been tried before**.

The idea


Market niche
Opportu nity
Advanced research
Prototype
Exploita tion

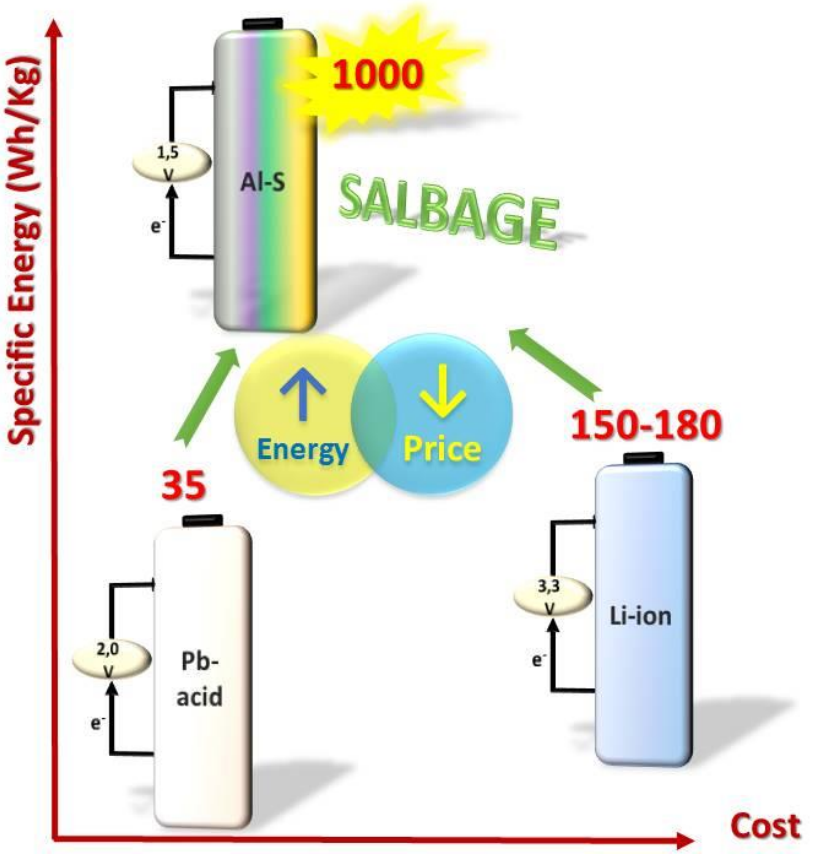
The project

SALBAGE: *Sulfur-Aluminium Battery with Advanced Polymeric Gel Electrolytes*.



- Development of a new **secondary** battery.
- Focused in the synthesis of solid-like electrolytes based on **polymerizable Ionic Liquids** and **Deep Eutectic Solvents** to obtain **polymer-gel electrolytes** with an overall ionic conductivity in the range of 1-10 mS/cm at room temperature.
- The aluminium negative electrode will be combined with a sulfur positive electrode including the unprecedented use of **redox mediators**, to facilitate sulfur reaction kinetics and boost performance.

The goals



With target battery parameters of **1.5V** and **1000 Wh/kg** as main objective of the project, Al-S batteries have the potential to:

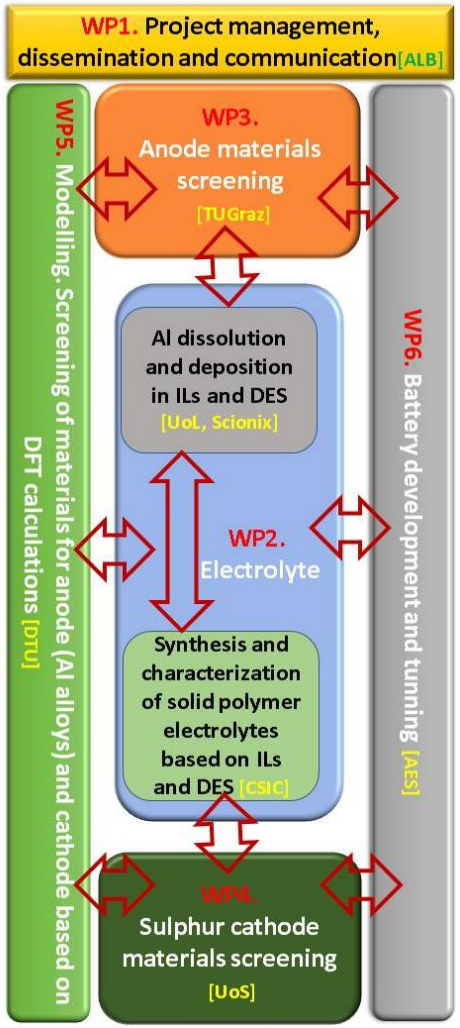
- **reduce prices by a 60%** (from 350 to 200€/kWh)
- **increase capacity by a 600%** (from 150 to 1000Wh/kg), with respect to Li-ion.

Consortium

7 partners from 4 countries

- 4 Universities
  - University of Southampton (UK)
  - University of Leicester (UK)
  - Tech. University of Gratz (Austria)
  - Tech. University of Denmark (Denmark)
- 1 Research Center → ICTP-CSIC (Spain)
- 2 SME
  - Scionix (UK)
  - **Albufera Energy Storage (Spain)**

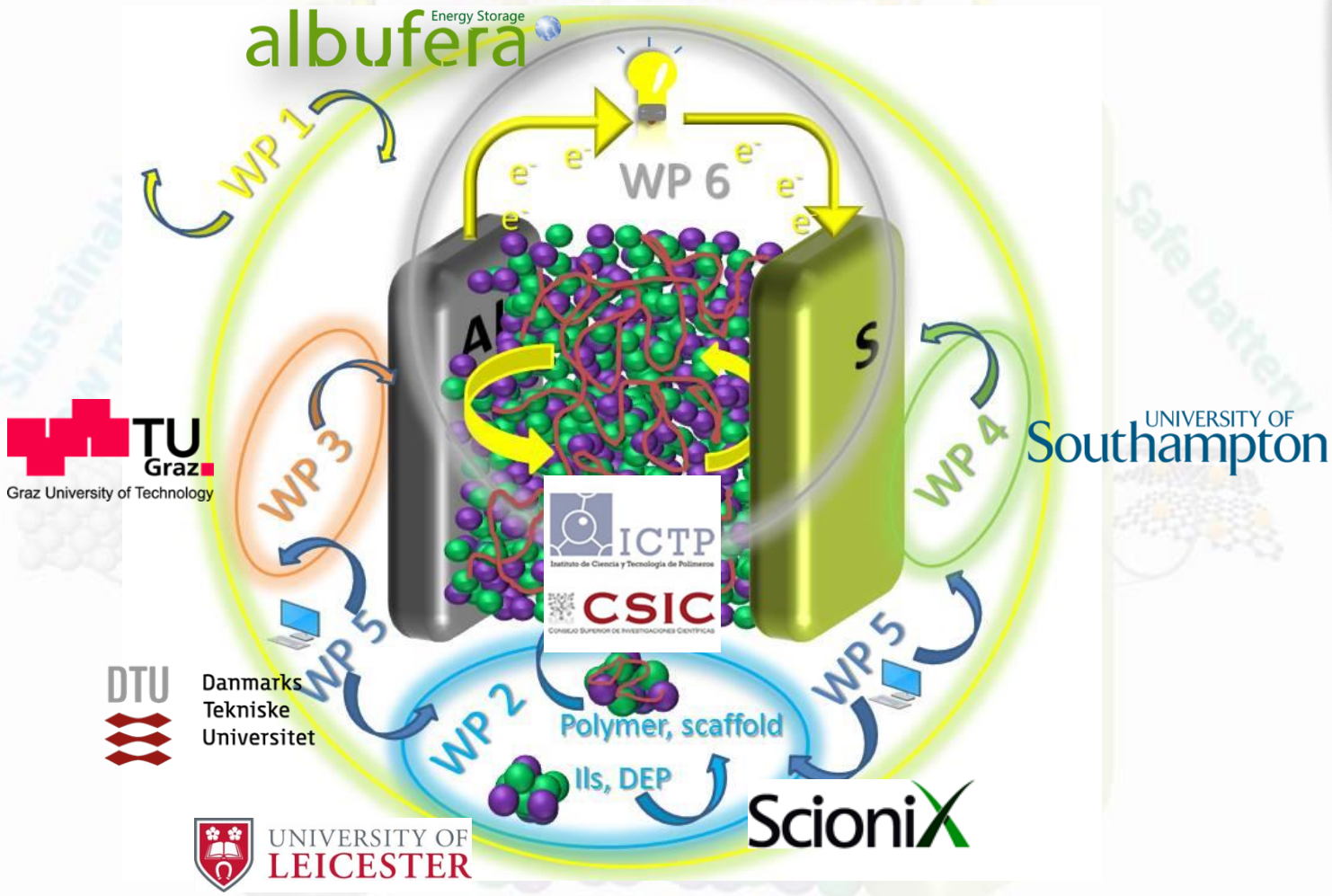
Project Structure



6 WPs

- WP1 Coordination and dissemination activities
- WP2 Electrolyte
- WP3 Anode
- WP4 Cathode
- WP5 simulation and computational tecnhiques
- WP6 Integration and prototyping

Project Structure



Project Structure

- Identify leaders and participants for each WP. (Multidisciplines)
- Give each partner a defined WP.
- Divide PM/budget effort coherently.

UoL& Scionix	Electrolyte based on ILs and DES	WP2, M1
CSIC	Polymer gel electrolyte development	WP2, M2
TUG	Aluminium anode development	WP3, M3
UoS	Sulfur cathode development	WP4, M4
DTU	Computational modelling	WP5, M5
AES	Al-S battery cell new design and Market	WP6, M 6&7

Our Role

- **WP1:** Coordination and Dissemination tasks
  - **Coordinatio**n of the project's activities.
  - **Monitoring the progress**
  - **Identify risks**
  - **Dissemination and communication**
- **WP6:** Propotype construction and electrochemical tests at lab-scale
  - **Electrochemical characterization** of Al-S cells
  - **Design of unit cells**
  - **Tuning of the cell design**

Proposal Preparation

The FET Open call is highly competitive.

- Only **disruptive** ideas are considered. You need:
  - A clear idea
  - A clear oppotunity
  - A strong and competent consortium
  - A well structured and appealing proposal
- You must correctly address the **gatekeepers**:
  - Long-term vision
  - Breakthrough scientific and technological target
  - Novelty
  - Foundational
  - High-risk
  - Interdisciplinarity

Gate Keepers SALBAGE

*GK Novelty: The use of gels based on PILs and PDES in the context of batteries **has never been reported**, whereas PGEs are a **cutting-edge** technology, just starting to be studied by some scattered research groups*

*GK Breakthrough: (…) With target battery parameters of 1.5V and 1000 Wh/kg as main objective of the project, Al-S batteries have the potential to **reduce prices** by a 60% (from 350 to 200€/kWh) and **increase capaci**ty by a 600% (from 150 to 1000Wh/kg), with respect to Li-ion*

*GK Foundational : (…) The **foundational character** of the proposal lays on the combination of a new class of materials based on aluminium, sulfur and a Polymeric Gel Electrolytes (…) to obtain a new battery technology with a series of approaches which combination (….) has never been tried before.*

*GK High-risk: The present proposal entails some unavoidable **risks**, (…) an Al-S battery has never been attempted before, but it is expected that it will lead to major performance improvements.*

*GK interdisciplinary: To achieve the challenging targets of the SALBAGE project, a **strong consortium** is mandatory. (…) an **interdisciplinary team** has been gathered around.*

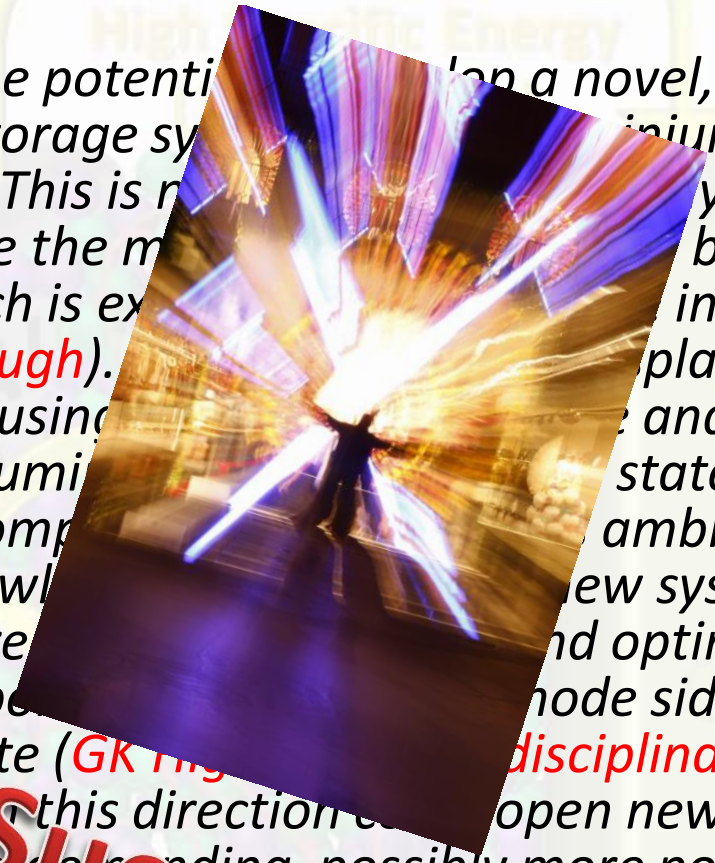
*GK Long-term vision: (…) to obtain a new battery technology unexplored with many potential applications that might be called to become **the battery of the future**, able to avoid the problems derived from the use of lithium (…)*

Summary Evaluation Report

(…) The project has the potential to develop a novel, currently not anticipated, energy storage system, i.e. an aluminium sulphur battery (GK Novelty). This is novel and would display an important breakthrough because the majority of present-day batteries are based on lithium which is expensive, not available in Europe and unsafe (GK Breakthrough). The proposed idea displays an alternative approach using two largely available and significantly cheaper resources- aluminium and sulphur. The state-of-the-art has been described completely. The research is ambitious since there is only little knowledge present on this new system (GK Foundational) and it requires development and optimization of many individual components, that is the cathode side, the anode side and the electrolyte (GK High-risk, interdisciplinary). However, any possible success in this direction could open new ways for a cheaper, less resource-demanding, possibly more powerful, and safer technology (GK Long-term vision).

Summary Evaluation Report

(…) The project has the potenti[illegible] a novel, currently not anticipated, energy storage sy[illegible]um sulphur battery (GK Novelty). This is n[illegible]y an important breakthrough because the m[illegible] batteries are based on lithium which is ex[illegible] in Europe and unsafe (GK Breakthrough). [illegible]plays an alternative approach usin[illegible] and significantly cheaper resources- alumi[illegible] state-of-the-art has been described comp[illegible] ambitious since there is only little know[illegible]ew system (GK Foundational) and it re[illegible]nd optimization of many individual compo[illegible]node side, the anode side and the electrolyte (GK [illegible]disciplinary). However, any possible success [illegible] this direction [illegible] open new ways for a cheaper, less resour[illegible]ding, possibly more powerful, and safer technology (GK Long-[illegible]).



Success!

Proposal preparation timeline

07/2016
First summary idea and contact with potential partners

08/2016
First meeting with partners (ISE Congress)

09/2016
consortium formed and first virtual meetings

Meeting every 2 weeks with revision of the sucesive drafts

12/2016
final draft sent to external review

01/2017
Submision

06/2017
Evaluation result

11/2017
Project Starts

Proposal: some hints

Think about the reader.

- Make it easy to read (use correct and clear language)
- Make it straight and concise (numbers and facts)
- Make it appealing (figures and images)
- Make it easy to evaluate: address all the point that the evaluator is going to search for.
- Clearly explain the approach and project layout (Gantt, WPs)
- Address the risks
- Address the gender issues

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Good luck!

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Thank you for your attention!!

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www.salbageproject.eu
info@salbageproject.eu

ana.cudero@albufera-energystorage.com

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