



Joint Research Laboratory on
Offshore Renewable Energy

Underwater Wireless charging

VIII Marine Energy Conference 22/06/22

Underwater drone battery charging

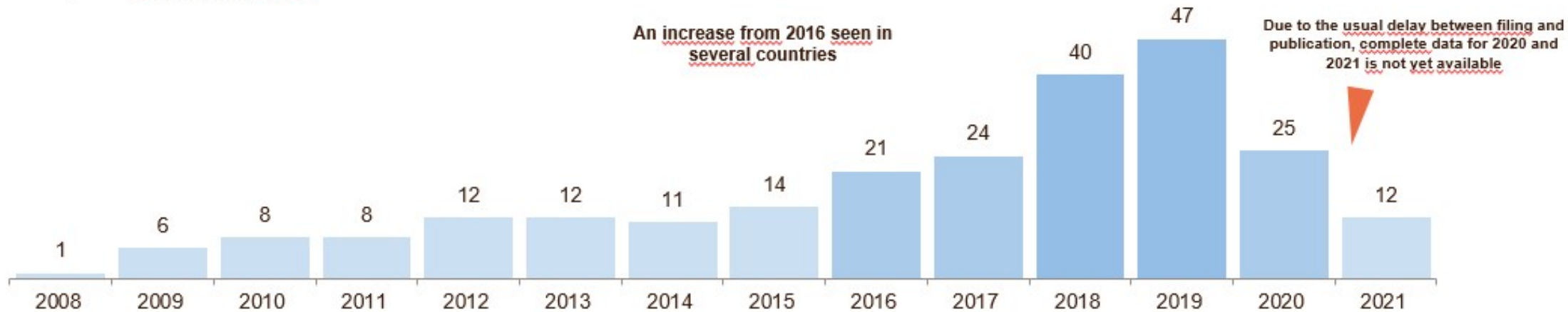
- Marine operation cost of working hours are very costly
- Maximizing drone underwater operating time is of paramount importance
- Even short tasks can benefit. Underwater location is a difficult task and bringing the drone to the operations location is very time consuming. Moving the drone back and forth for recharging is very costly.(KOTAZERO).
- True autonomus UUV are not a reality but underwater charging is an important issue in this path.

Two alternatives

- Power tether: Commercially available, operation distance limited to tether length, increased draft
- Underwater power transfer: Under development, unlimited distance, no additional draft. Need for docking

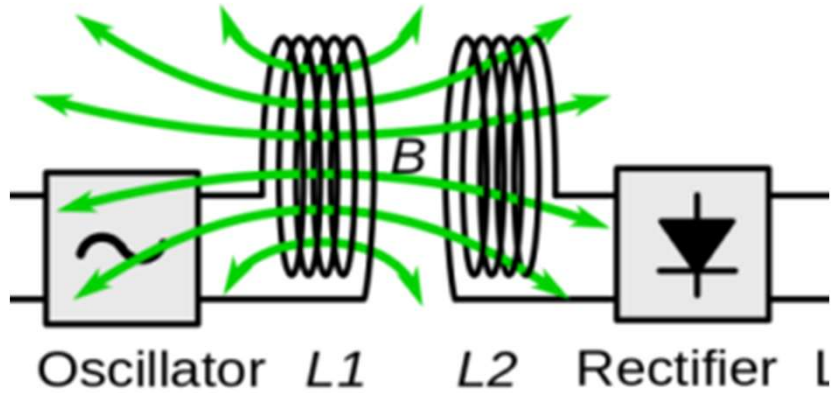
Temporal distribution

Unit : patent families filed by year



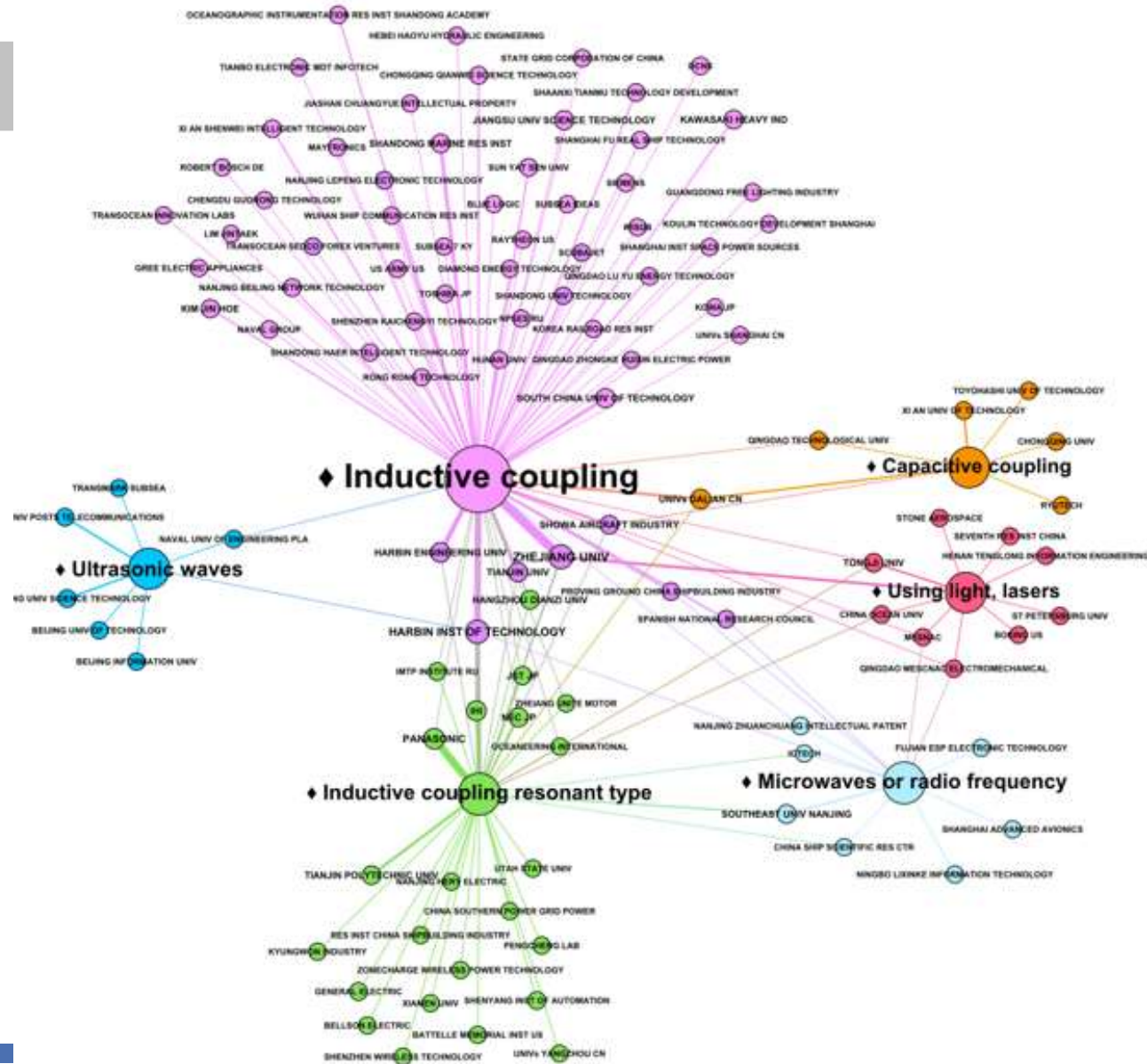
Technological Characterization

Euskampus JRL-ORE Via INNO survey



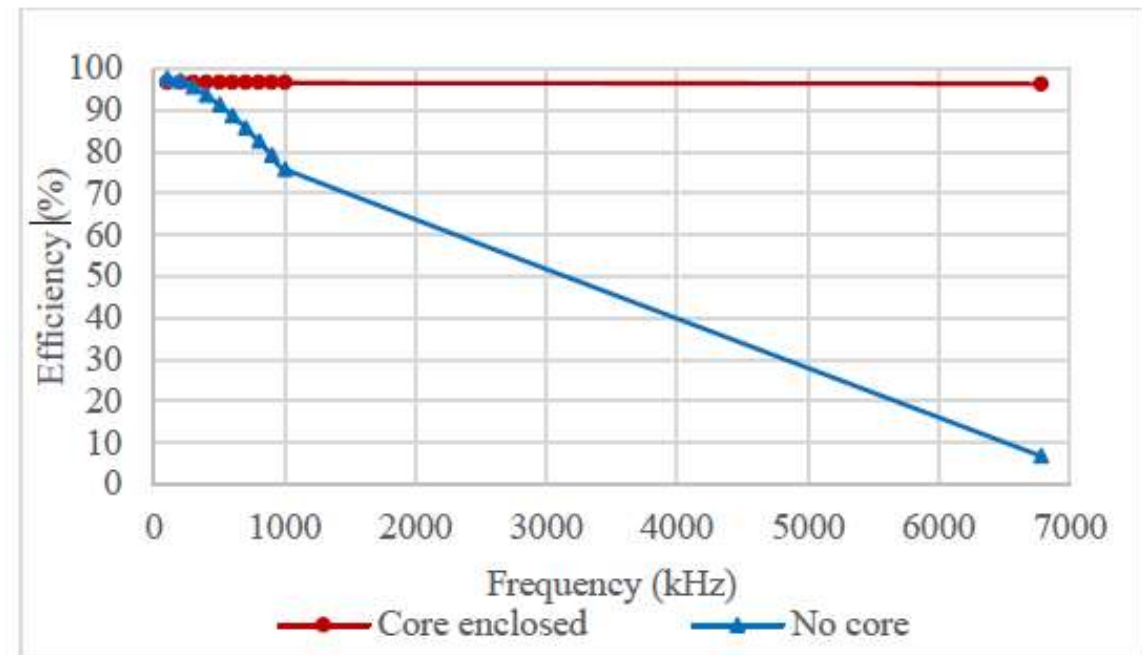
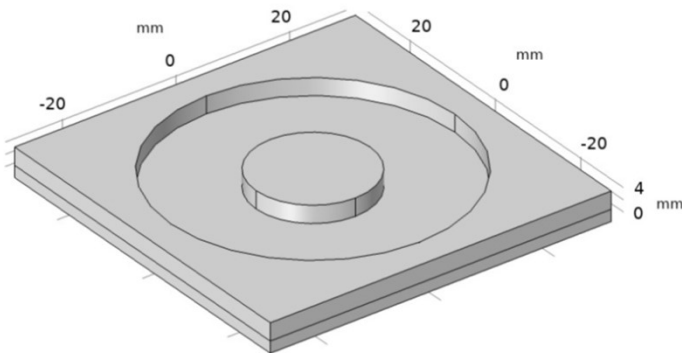
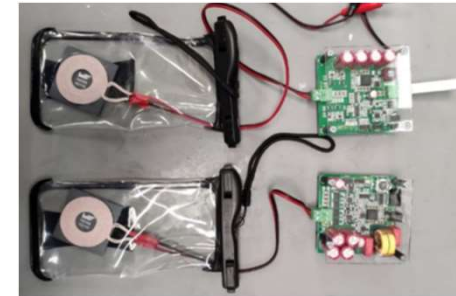
Air: Good Isolator

Sea wáter: High electrical conductivity,
increased power losses at high frequencies



JRL-ORE proposal (Split Core Transformer)

I. R. Holgado, I. Martínez de Alegría, I. Kortabarria, J. Andreu and J. L. Martín, "Wireless Power Transfer: Underwater loss analysis for different topologies and frequency values," *IECON 2020 The 46th Annual Conference of the IEEE Industrial Electronics Society*, 2020, pp. 3942-3947



JRL-ORE proposal

Goal: Operation up to 100 m depth, beyond that “Champions league”

Hypothesis: Due to extremely high operational costs, higher cost than consumer products admissible, lower efficiency admissible due to residual impact of cost of electricity

Split core transformer contactless charging: Reduced magnetic field losses in sea water
200 W prototype in operation, 70% efficiency

Need for improved tightness

Ferrite behaviour at 10 bar, seawater environment

Need for pressure vessel for tests, or underwater tests



Educational innovation project

URPEKARI

*Itsas Energiarentzako Urpekari Autonomoen
Diseinu Taldea, Grupo de diseño de Vehiculos
Submarinos Autonomos para Energías Marinas,
AUUV design group*

The Goals

Origin- JRL-ORE activities: Two scientific goals

- **Submarine Geological Survey**
- **Underwater drone battery charging**

Project Goals

- **Improve teaching process in Bachelor and Master. Project Oriented Learning and Learn by teaching**
- **Attract young students and researchers to Marine Engineering**
- **Networking and Sponsorship**

Misiones URPEKARI: 1 year, very limited budget

Conference cycle

2022/03/23 12:00

Joannes Berque (Tecnalia)

Introducción a la Energía Eólica Offshore

Paraninfo. Facultad de Ciencia y Tecnología. Campus de Leioa.

2022/04/13 12:00

Pablo Rodríguez (UTM-CSIC)

Técnicas de adquisición de datos del fondo marino. Plataformas autónomas en la investigación del medio marino.

Salón de Grados. Facultad de Ciencia y Tecnología. Campus de Leioa.

2022/05/04 12:00

Ander Biain (Solarpack Corporación Tecnológica)

La investigación geotécnica en proyectos de Energía Eólica Marina.

Paraninfo. Facultad de Ciencia y Tecnología. Campus de Leioa.

2022/05/06 10:00

Aitor Irulegi (Kotazero)

Kotazero, mantenimiento e inspección de infraestructuras con drones bajo el agua.

Sala de Juntas II-I. Escuela de Ingeniería de Bilbao

2022/05/16 12:00

Gemma Ercilla (ICM-CSIC)

Fondos marinos: Geomorfología y Sedimentación.

Salón de grados. Facultad de Ciencia y Tecnología. Campus de Leioa.

Student Group

Seven 1st course bachelor students

First step: Building of a glider

Autonomous work: Guidance of profesor only through two weekly meetings and sporadic tutorship

3 Master students from UPV/EHU and Erasmus/Burdeaux: Underwater power transfer demonstrator

URPEKARI Hackaton
17/12/2022
Plentzia Club Kai Eder



Not a “real competition”

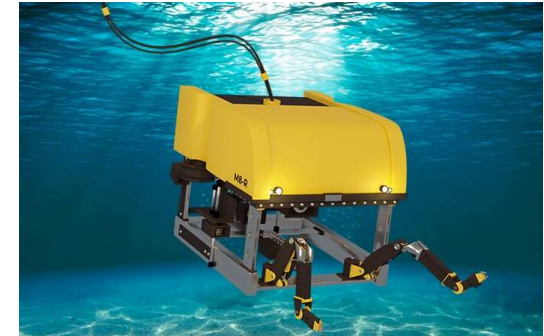
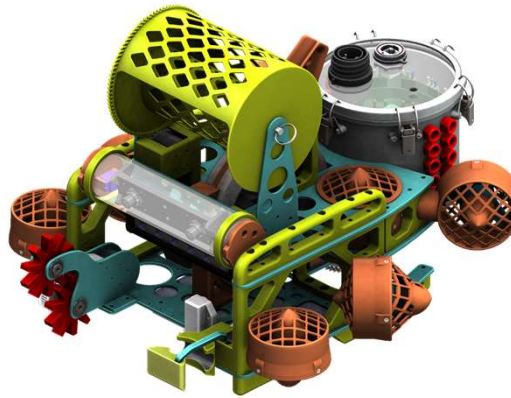
Demonstrators for general public:
glider, drone, underwater charging?
Security issues must be adressed
first

Open to companies proposals

URPEKARI: a longer time vision

Keep the group activity beyond the first year

Take part in MATE ROV competition at different levels (primary, secondary, bachelor)



[MATE ROV Ranger Flythrough](#)

It is up to all of us

- Need for funding (Not huge Budget, one of the main costs is attending the competition)
- MATE regional competitions: Possibility of Euroregion focus: Nouvelle-Aquitaine, Euskadi, Navarra
- Increasing the sponsoring culture in our companies. Sponsor with long term, no direct benefit, visión.

