CERIS : Civil Engineering Research and Innovation for Sustainability

# REDAWN – Reducing Energy Dependency in Atlantic Area Water Networks

**Summary**

The water industry is the 4th most energy intensive sector in the Atlantic area, responsible for significant contributions to climate change and reductions in the competitiveness due to the associated costs. REDAWN aims to improve the energy efficiency of water networks through the installation of innovative micro-hydropower technology. This technology will recover wasted energy in existing pipe networks across irrigation, public water supply, process industry, and waste-water network settings.

**Project Description**

To be developed by Instituto Superior Técnico (from Universidade de Lisboa and CERIS) in partnership with Action Renewables Ltd (the coordinator of the project), Trinity College Dublin (the organizer of the project proposal), University of Naples Federico II (external support), Hidropower Ltd, FAEN, Feragua, the WATEF Network, SMPGA, and the University of Cordoba, the three-year project activities commenced in September 2017, with the support from the EU's Atlantic Area co-operation programme 2014-2020.

The multidisciplinarity project will be led by the Project Technical Director, Prof. Helena M. Ramos, at IST, with the assistance of several colleagues from the Civil Engineering Department/Hydraulic Division, and from Electrotecnical Engineering Department, with eventual other punctual interactions with other research areas. There are also three Portuguese Associate Partners (EEM, EDA, PPA) which will give us the feedback of the developed measures/techniques and the interest for the energy and water-energy nexus in near future.

The water industry in Europe is contributing for significant energy consumption, with the associated $CO_2$ emissions, which in turn impact negatively on the environment and the economy. European business competiveness and citizens are impacted by the design, building and operational costs in water systems. The REDAWN project will make significant advances in improving the energy efficiency in this sector and so with positive environmental and economic impacts. The research team are very enthusiastic to have received a percentage of this funding and are looking forward to working on this project in the coming years.

**Project Partners**

The REDAWN project brings together 15 partners from 5 countries around the Atlantic coast working towards greater efficiency in water networks.

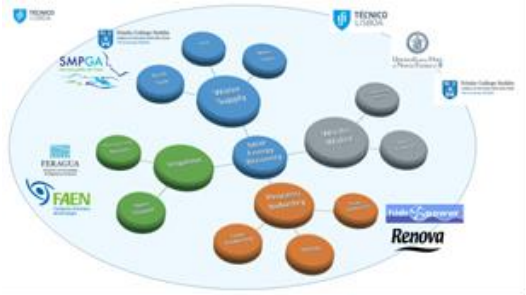


*Figure 1. Consortium composition and application.*

**Project Aims**

At present, exists significant potential to save energy, costs and environmental impacts in European water networks, and therefore improving the energy efficiency of water suppliers and users. REDAWN will develop both micro-hydropower technology and policy to realise this potential, and generate understanding to overcome technological, institutional and social barriers to exploitation. The nature of the challenge requires an integrative response that crosses many boundaries and borders – technical, practice, industry, social, policy and environmental. REDAWN is set up to enable the engineering, environmental science and business researchers to interact directly with practitioners from European industry.

Together, these partners are committed to bringing their established expertise to the table and open to learning with, through and from each other. Three scaled demonstrations shall cover the irrigation, process industry and waste/storm/water sectors. This WP will be led by IST with the assistance of TCD, UNINA, Hidro and FAEN.

Other partners (Feragua and SMPGA) will contribute to individual pilots and overall system designs. Associate partners UCO and Renova SA will facilitate the scale demonstrations with detailed site and technical information.

**Results**

Analysis of a PAT modeling is presented for application in water pipe systems as an interesting and promising energy converter to improve the system energy efficiency. The study is focused on the use of a Computational Fluid Dynamics (CFD) model in conjunction with laboratory data for representing PAT performance. The first stage of the procedure concerns a systematic analysis of the role played by the characteristic PAT parameters in the computational mesh definitions of the CFD model, with the aim of defining the most efficient

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**Project Reference**

1018P.05200

**Leading Institution**

Action Renewables Ltd (United Kingdom)

**Partners**

Trinity College Dublin (Ireland), Università degli Studi di Napoli Federico II (Italy), EEM – Empresa de Eletricidade da Madeira (Portugal), EDA Renováveis (Portugal), IST – Instituto Superior Técnico(Portugal), Northern Ireland Water (Ireland), Water Efficiency Network University of Bath (Ireland), Hidropower Ltd (Slovenia), Renova (Portugal), Asociación Feragua de Comunidades de Regantes de Andalucía (Spain), Universidad de Córdoba (Spain), PPA – Parceria Portuguesa para a Água (Portugal), FAEN – Fundacion Asturiana de la Energia (Spain), Syndicat Mixte de Production d'eau potable du Granvillais et de l'Avranchin (France)

**CERIS Principal Investigator**

Helena Ramos (helena.ramos@tecnico.ulisboa.pt)

**CERIS Research Team**

Dídia Covas, Jorge Saldanha Matos, Maria Manuela Portela

**Funding**

EU Interreg Europe

**Period**

2017-2022

**Total**

2 900 000.00€

**CERIS**

570 599.95€

set of capturing the main features of the PAT behaviour under different operating conditions. In the second stage, comparisons of CFD results and experiments were carried out to examine some system components for better understanding the PAT response. Specifically, the behaviour of the pressure distribution along the PAT installation when implemented in a water pipe system are analysed, and the links between pressure variation and the head drop in different system components responsible for the head losses and net head definition are also examined (Figures 2-5).

*Figure 2. PAT mesh and scheme.*

*Figure 3. Hydraulic Lab: PAT set-up.*

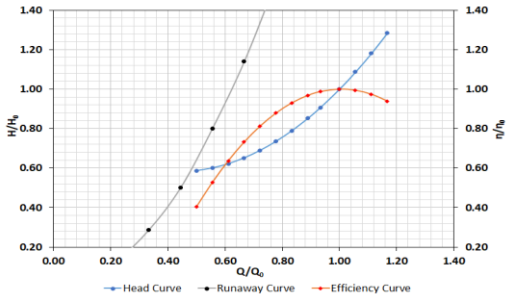


*Figure 4. Characteristic curves of the tested PAT for N = 1020 rpm.*

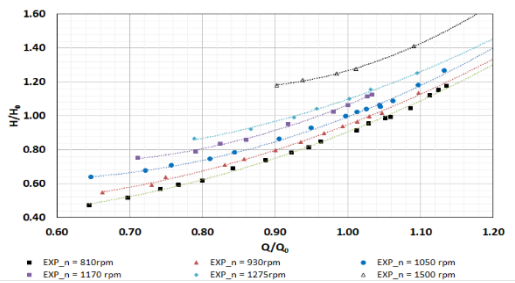


*Figure 5. Experimental results for different rotational speeds.*