

## Mine water for the generation and storage of renewable energy: A hybrid hydro-wind system

**Héctor Álvarez, Guillermo Domínguez,**

**Almudena Ordóñez\***

Dep. Mining Exploitation and Prospecting; School of Mining, Energy and Materials Engineering, University of Oviedo, Spain.

**Javier Menéndez**

SADIM Engineering, Langreo, Asturias, Spain.

**Rodrigo Álvarez**

Dep. Mining Exploitation and Prospecting; School of Mining, Energy and Materials Engineering, University of Oviedo, Spain.

**José María Asenjo**

HUNOSA Grupo SEPI, Oviedo, Asturias, Spain.

**Jorge Loredó**

Dep. Mining Exploitation and Prospecting; School of Mining, Energy and Materials Engineering, University of Oviedo, Spain.

### **Abstract**

Mine water is normally considered as a waste to be managed. However, new applications are increasingly being sought for the water that floods mining voids, especially its use as an energy resource. The worldwide energy market, within the current transition framework, is searching for creative approaches to produce and store clean energy. In particular, underground pumped hydroelectric energy storage systems (UPHS) constitute efficient and flexible alternatives to deal

with intermittent renewable energy sources. In this work, an UPHS is designed using the mine water and the voids of a closed coal mine in Asturias (NW Spain) as lower reservoir. Moreover, this system is combined with a wind energy generation facility and the efficiency of the hybrid system is evaluated. With an investment cost of 193 M€, a 40 MW UPHES joined to a 60 MW wind farm would generate benefits of about 54 M€ in 40 years. Reduction of CO<sub>2</sub> emissions (30,000 equivalent tons per year) and social benefits in a traditional mining area are other intangible advantages of this system.

**Keywords:** Mine water, underground mining reservoir; energy storage, underground pumped hydroelectric energy storage.