# *How the hydrogen production from RES could change energy and fuel markets. A review of recent literature.*

Agatino Nicita, Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano" (CNR ITAE), +39 090 624258, nicita@itae.cnr.it
Gaetano Suadrito, Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano" (CNR ITAE), +39 090 624274, gaetano.squadrito@itae.cnr.it

## Overview

The goal that the international community has set itself is to reduce greenhouse gas emissions in the short / medium term, especially in Europe that committed itself to reducing Green House Gas (GHG) emissions to 80-95% below 1990 levels by 2050. Renewable energies play a fundamental role in achieving this goal. In this context, the policy of the main industrialized countries of the world are being directed, all of which are oriented towards increasing the shares of electricity produced from renewable sources.

In recent years, the production of renewable energy has increased considerably, but given the availability of these sources, there is a mismatch between production and demand. This arises some issues as balancing the electricity grid, and in particular the use of the energy surplus, as well as the need to strengthen the electricity grid.

Among the various new solutions that are being evaluated, there are: the accumulation in batteries, the production of compressed air and the production of hydrogen that appear to be the most suitable to associate with the water accumulation (pumped hydro). Concernig the hydrogen, recent research highlights that the efficiency hydrogen storage thechnologies have lower performance compared to advanced lead acid batteries on a DC to DC basis, but"...In contrast, according to the cost of Hydrogen storage is competitive with batteries and could be competitive with CAES and pumped hydro in locations that are not favorable for these technologies." (4)

This shows that, once the optimal efficiency rate is reached, the technologies concerning the production of hydrogen from renewable sources will be a viable and competitive solution.

But what will be the impact on the energy and fuel markets? The production of hydrogen through electrolysis will certainly have an important economic impact especially in the transport sector, leading to the creation of a new market and a new supply chain that will change the physiognomy of the entire energy market.

## Methods

The analysis is focused on socio-technical-economic studies, in particolar research conducted through a multidisciplinary approach or in which the economic and social issues coming out from the introduction of storage hydrogen technologies are considered. Research and studies conducted in the last 10 years have been analyzed.
The acquired data will be classified into categories such as: scenarios, roadmaps, forecasts, backcasts. In doing so, it was adopted the cataloging method used by McDowall and Eames (3).

## Results

The analysis has allowed to build a framework about forecasts, models and scenarios that have been developed in recent years regarding the economic and social impact linked to the production of hydrogen from renewable sources.

The purpose of this research activity was to identify the aspects that have not yet been explored or which must be further researched in order to have a broader and more concrete vision of the possible changes that can occur in the electricity and fuel markets by exploiting the surplus of energy from renewable sources to produce hydrogen.

The results obtained can be usefull and constitute the basis for further investigations aimed at examining and evaluating the effects and repercussions on the electricity and fuel markets following the introduction to hydrogen.

## Conclusions

The state of the art of technologies, energy policies and energy market development forecasts seems to indicate that the introduction of a "hydrogen market" is ineluctable.

This new market offers new possibilities and introduces new challenges. In fact, it ranks between the fuel market and the electricity market, laying the basis for further development of power generation from innovative energy sources.

## References


[1] Ball M., Weeda M., 2015. The hydrogen economy e Vision or reality? International journal of hydrogen energy 40 (2015) 7903 e7919

[2] Bockris J. O'.M., 2013. The hydrogen economy: Its history. International journal of hydrogen energy 38 (2013) 2579 - 2588

[3] McDowall W., Eames M., 2006. Forecasts, scenarios, visions, backcasts and roadmaps to the hydrogen economy: A review of the hydrogen futures literature. Energy Policy 34 (2006) 1236–1250.

[4] Moliner R., Lazaro M.J., Suelves I., 2016. Analysis of the strategies for bridging the gap towards the Hydrogen Economy. International journal of hydrogen energy 41 (2016) 19500 e19508

[5] Sovacool B. K., Brossmann B., 2010. Symbolic convergence and the hydrogen economy Energy Policy 38 (2010) 1999–2012