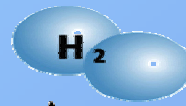




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HYMAC



PLANNING FOR THE IMPLEMENTATION OF THE HYDROGEN ECONOMY IN THE MACARONESIA: STATIONARY APPLICATIONS

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PROJECT SUMMARY

The HYMAC project belongs to the transnational cooperation program of the European Commission called INTERREG III-B.

HYMAC Project is based on the implementation of an energy Plan where Hydrogen is the driving force of the Economy in the Macaronesian Region (Canaries, Azores and Madeira).

These Islands have a big diversity of renewable energy sources (biomass, wind, photovoltaic, hydraulic and geothermal) and are extremely dependent on conventional energetic systems; they are the perfect laboratories to develop prototype demonstrations and educational projects.



GENERAL OBJECTIVES I

- Identification of the PRODUCTION technologies, STORAGE, DISTRIBUTION and USES (centralized and decentralized) and as terrestrial fuel.
- Analysis of the possible problems, of the challenges to consider, the Investigation lines that are developing at the moment.
- Identify the most appropriate for each case (Macaronesia).
- For the case considered: Analysis of the investment costs and operative prospective, the foregone term of commercialization of the technologies, the environmental impact.
- Preparation of a private-public partnership for the setting in gradual march.
- Systematizing and Comparison of the best technologies in Hydrogen USE (centralized, decentralized and terrestrial transport).
- To increase the potential of the renewable energies in the Macaronesia.



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GENERAL OBJECTIVES II

- Identification in each region the most appropriate economic and social agents (public regional institutions, energy production companies, production teams and maintenance companies, manufacturers, terrestrial transport companies, managerial and union organizations and civic entities).
- This plan will be taken to the society, through a perception program elaborated specifically for each of the implied regions and will be directed to all the social stakeholders.
- Financing search in technological development programs for the concrete applications of these technologies in the Macaronesia.
- Identification of the fiscal allowances: paying-off the equipment, reduction of taxes for the installations, special taxes on fuels (Model EXTERNE).
- To apply the directive one on market emissions (saving of emissions of CO₂ on the conventional technologies).
- Creation in the mark of the Structural Funds for the period 2007-2013, of a specific program: "Transition toward the Hydrogen like energy vector".





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LOCATION:

The HYMAC Project is based on the implementation of an energy Plan where the Hydrogen is the driving force of the Economy in the Macaronesian Region. The involved Macaronesian Archipelagos of this project are: Canaries, Azores, and Madeira. They are located in the Atlantic Ocean: Canaries and Madeira close to the African coast and Azores is 1500 km. from Lisbon.

These islands have a big diversity of renewable energy sources (biomass, wind, photovoltaic, hydraulic and geothermal) and are extremely dependent on conventional energetic systems. For these reasons, they are the perfect laboratories to develop prototype demonstration projects to validate technology.



EDUCATION

OBJECTIVES OF HYMAC: HYDROGEN EDUCATION GUIDES

- Achieving an increase in the number of students, teachers and public in general, who understand the concept of a hydrogen economy and how it may effect them.
- Launching a comprehensive public education campaign about the hydrogen economy.
- Increase the number of local government representatives, students and public in general who understand the concept of a hydrogen economy and the future importance.
- Collaboration from schools, companies ... for the success educational programs and thus, develop a scientific culture at local level.
- Design, edition and elaboration of the hydrogen educational guides for teachers and students of the Macaronesian Region.



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Development and implementation of an educational and training program for all sectors of the society

The work package on “Hydrogen Economy Perception in the Macaronesian Region” (education) was very important.

Its objective was, firstly, education on the “new green fuel”; secondly, knowing the perception on hydrogen in order to discover the advantages and, above all, the disadvantages that the target has in being participant in the road towards the hydrogen economy; and thirdly, as a consequence of the previous, eliminating the existing prejudices and creating awareness of the benefits which the clean vector can present for our society, in our economy and in our environment.

The target has been structured in several levels:

Not specialized public Level.

Primary Education Level.

Secondary Education Level

University Education Level

Industrial-commercial Level



In the not specialized Level, an informative leaflet about the hydrogen economy was elaborated.

In the levels of Primary and Secondary Education, training and educational guidelines have been developed and have been given out to the teachers and pupils respectively.

The University of Las Palmas de Gran Canaria developed a hydrogen guide, created to help interested teachers bring the exciting world of hydrogen to their students. Hydrogen and fuel cells are topics not often covered in classrooms or traditional textbooks.

The activity guide used several techniques to encourage students to document their thoughts, ideas and questions. Class discussions followed most activities, which allowed students to discuss and share their thoughts and learn from each other.



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The units were designed to be flexible, so that teachers could adapt them.

Moreover, visits to the research centres were concerted for the secondary Level as well as oral presentations.

At University Level, a 200 hour specialization course on hydrogen technology will be given through university seminars.

In the industrial-commercial level, a leaflet on hydrogen economy, security and hydrogen, and hydrogen production and storage were elaborated.



Expected results of the training educational program

The results which are expected to obtain with the development and execution of the work packages are the followings:

- A data base with the hydrogen economic actors.
- Financial sources inventory
- Technical basic design of the demonstration activities.
- Environmental, economic and social impact reports, in the three regions.
- Hydrogen viability report as energetic vector in the Macaronesian region.
- Establishment of a public-private consortium.
- Strategic actions for hydrogen Education and training.
- Reduction of CO2 emissions with a penetration of 1 Mw
- Diminution of the fossil fuel dependency.
- Increase of energy production through renewable energies.
- Rationalization of the biomass use (urban and agricultural waste).
- Effects in the employment growth.
- Localization of one emplacement per region for the demonstration actions.
- Coverage of energy demand increase in the tourist sector.



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With this Project, it is expected to demonstrate that hydrogen based energy systems could be the key for sustainable future in the Canaries, Azores and Madeira regions, and we know that its success will depend on:

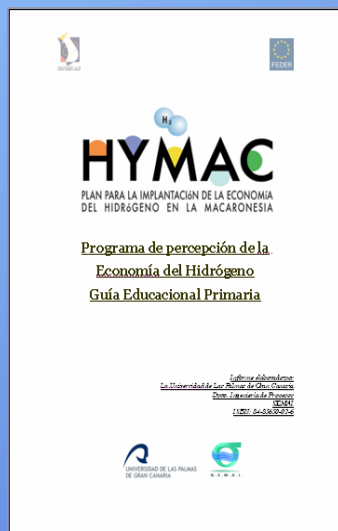
A cost-effective and efficient planning to carry out the transition towards a hydrogen economy.

The public institutions support as well as their intervention.

The social acceptance of this new energy system.

PRIMARY LEVEL: 6-12 YEARS OLD

The material used for the development of the educational objectives are:
Educational Guides for students ages 6-12.



PRIMARY LEVEL: 6-12 YEARS OLD

Number of educational centres and students where the educational guides given:

# Schools	# Students
29	1933

Analysis of the results achieved after the evaluation of the experience, by teacher and students:

- The subject , matter of study (hydrogen as an energy vector) has awakened the interest of the students.
- The students thought the guides were easy to follow.
A majority of the teachers declare that they would repeat the experience without a doubt.

The students have understood the proposed concepts.

Some teachers suggested supporting the educational material provided with instructors or technicians to carry out certain activities.

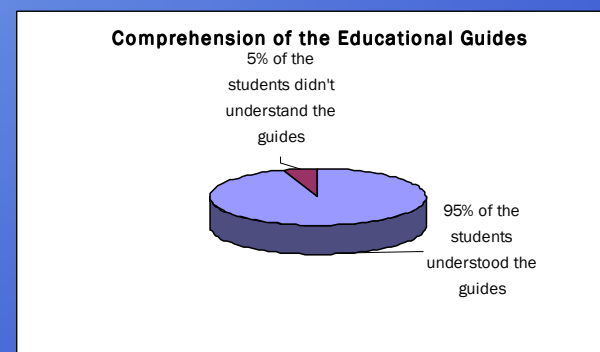
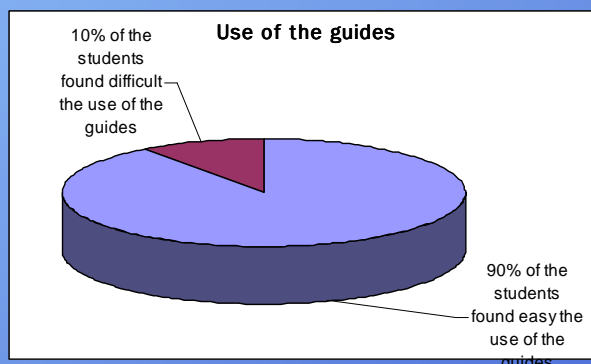
SECONDARY LEVEL: 12-16 YEARS OLD

The materials used for the development of the educational objectives are:
Educational guides for students ages 12 to 16.

Number of educational centres and students where the educational guides given:

# Schools	# Students
36	1725

Analysis of the results achieved after the evaluation of the experience, by teacher and students:





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SECONDARY LEVEL: 12-16 YEARS OLD

- Secondary students have perceived, in general, more positive aspects than negatives in the use of hydrogen as an energy vector.
- They consider that the main barrier for the use of hydrogen, is the economic factor.
- The totally of students, wish to continue learning about hydrogen as an energy vector.





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S.E.M.A.I.

The University of Las Palmas de Gran Canaria designed this educational program on Hydrogen including the following concepts:

- In a “Hydrogen economy”, Hydrogen is used to power our cars, homes and business.
- Hydrogen can be made from abundant and diverse resources found in the Macaronesian region.
- Just like gasoline and other fuels, Hydrogen can be used safely.
- Technical basic design of the demonstration activities.
- Hydrogen viability report as energetic vector in the Macaronesian region.
- Strategic actions for hydrogen Education and training.
- The social acceptance of this new energy system.





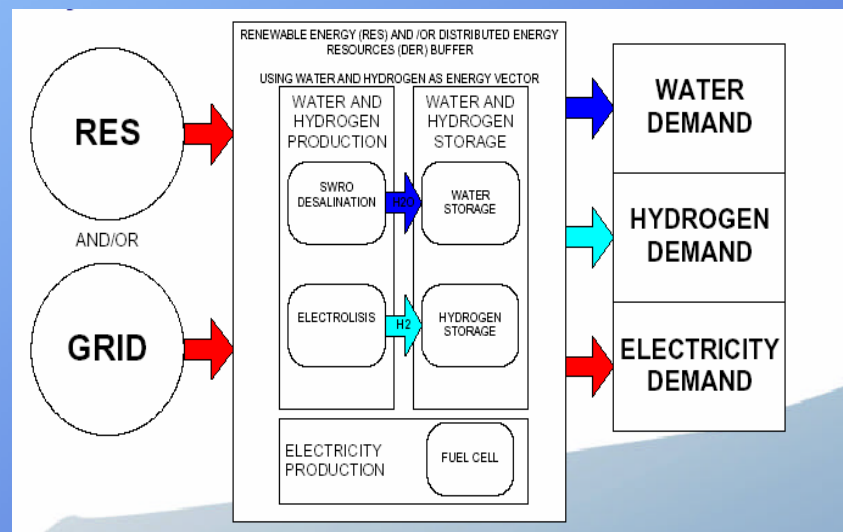
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DEMONSTRATION

RES2H2:

Stand-alone power, water and hydrogen production



RES2H2 operation scheme

NEXT STEPS

- **HY-EDUCATION:** Developing a European Educational Hydrogen Portal and e-guides.
- **HY-LAB:** Creation of a university hydrogen applications laboratory.
- **HY-La Graciosa:** Making the Small Island of La Graciosa self-sustainable, using wind, hydrogen and desalination Technologies.
- **HY-BIOGAZ:** Design, installation and evaluation of a FC integrated in a wastewater plant.
- **HY-METHANOL:** Design, installation and evaluation of a methanol plant using CO₂ and Hydrogen.



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COORDINATOR



INDUSTRIAL ENVIRONMENTAL SECTION (SEMAI)
PROCESS ENGINEERING DEPARTMENT.
UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA (ULPGC)

PARTNERS

- . INSTITUTO TECNOLÓGICO DE CANARIAS: ITC.
- . INSTITUTO TECNOLÓGICO DE ENERGÍAS RENOVABLES: ITER.
 - . GOBIERNO DE CANARIAS.
 - . CABILDO DE LANZAROTE.
- . UNIÓN ELÉCTRICA DE CANARIAS: UNELCO.
 - . MANCOMUNIDAD DEL SURESTE DE G.C.
 - . BEN MAGEC.
- . AGENCIA REGIONAL DA ENERGÍA E AMBIENTE DA REGIAO AUTONOMA DA MADEIRA.
- . LABORATORIO DE AMBIENTE MARINHO E TECNOLOGÍA. LAMTEC.
- . EMPRESA DE ELECTRICIDADE DOS AZORES

COLLABORATORS:

1. GASCAN
2. CABILDO DE TENERIFE
3. CARBUROS METÁLICOS

PROJECT TIME
2 YEARS (2005- 2007)





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S.E.M.A.I.

THANK YOU VERY MUCH FOR YOUR ATTENTION

ULPGC-SEMAI IS ALWAYS LOOKING FOR NEW PARTNERS AND
COLLABORATORS

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