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# The HyRREG Project: A Roadmap for SUDOE

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## 1 Introduction

The HYRREG project is an initiative funded by the European Commission through the IVB program of cooperation of the territorial area of southwest Europe (SUDOE). The two main objectives are: to develop a platform for generating hydrogen related projects and to define a roadmap with the aim of enhancing the competitiveness and development of industry in the fields of hydrogen and fuel cell technologies in the SUDOE area.

The idea of developing a specific roadmap for SUDOE has its origin in the HyWays project. HyWays was an integrated project co-funded by research institutes, industry and the European Commission under the 6<sup>th</sup> framework programme that carried out a road mapping exercise to integrate hydrogen technologies into the European energy system. HyWays used a 'hybrid' methodology: it integrated extensive quantitative computational modelling as well as qualitative components such as actor analysis, conducted through the KCAM methodology [1, 2], and stakeholders preferences for the validation process (see figure 2).



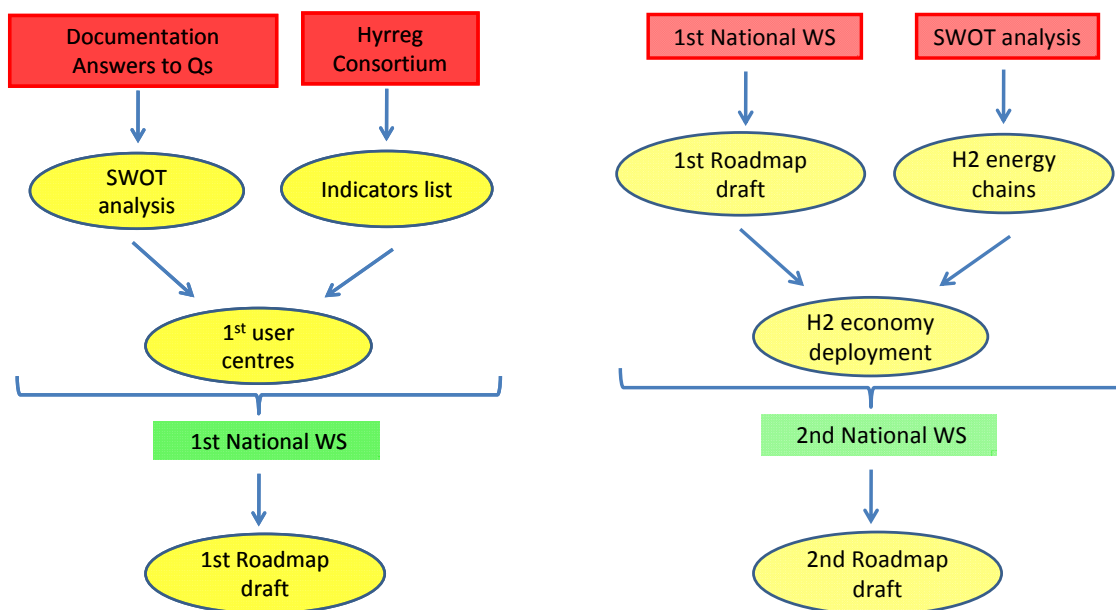
Figure 1: SUDOE regions.

France and Spain took part in the HyWays project and as a result a general analysis of hydrogen deployment in these countries was generated. However, some generalities and assumptions used in the HyWays analysis are not the most appropriate for the SUDOE reality. In addition, there has been a demand from stakeholders participating in HyWays to analyse the SUDOE area thoroughly by regions. In this sense, France has already finished their national roadmap in the project HyFrance and the HiPo project has made progress towards a national roadmap in Portugal. There is now a need for SUDOE to launch a specific hydrogen roadmap for the region.

## 2 Methodology

The HYRREG project is focused on the SUDOE Region (Southwest Europe) which is comprised of 30 regions and autonomous cities representing about 770 120 km<sup>2</sup> (18.2% area of EU-27) and 61.3 m inhabitants (12.4% of EU-27).

SUDOE features related to energy are easily distinguishable from the rest of Europe and that is why it is necessary to create a specific hydrogen roadmap for this area. In contrast to the HyWays methodology, the HYRREG analysis is mainly qualitative. Both stakeholders preferences and country specific conditions such as availability of resources and environmental policies as well as the characteristics of the current and future energy system, are taken into account.



**Figure 2: Methodology.**

The methodology used in the HYRREG roadmap is mainly based on an iterative enquiry process to a selected stakeholders group involved in general in energy context.

In order to define the starting scenario for a hydrogen economy a series of questionnaires (Qs) was prepared. Each questionnaire was devoted to one aspect of the hydrogen energy chain: production, storage/distribution, conversion/final use and perception/promotion. These questionnaires were addressed to the relevant regional actors: the stakeholders. Industry,

public institutions and decision makers were included in the HYRREG database and asked to collaborate by filling in the questionnaires. A first analysis of SUDOE was made using available documentation and stakeholders' answers to Qs. As a result, SWOT (Strength, Weaknesses, Opportunities and Threats) analysis of each region regarding hydrogen economy implementation was carried out.

Based on a list of indicators defined by the Spanish Technological Hydrogen and Fuel Cells Platform [3], the project consortium defined the indicators that would identify the first user centres of hydrogen in SUDOE, i.e., the most promising regions regarding the implementation of a hydrogen economy in each of the three countries participating in HYRREG. Subject to stakeholders' validation, they will be the seed for the hydrogen roadmap.

Once SWOT analysis was made and selection of first user centres was addressed, hydrogen energy chains for each of the first user centres will be identified.

### **3 Actor Analysis: KCAM**

The "Key Changes and Actor Mapping" (KCAM) is part of a process of Actor Analysis, which constitutes a source of largely qualitative information, providing valuable information to stakeholders for use and consideration in the construction of the hydrogen energy roadmap. The aim of the KCAM methodology is to examine qualitative concerns in a structured way, seeking to systematically examine each component of each hydrogen chain selected by stakeholders.

For the purposes of Actor Analysis a "Key Change" may be defined as:

"One of a number of distinct changes that are foreseen as necessary to progress from the current energy system to the end-vision as described in each hydrogen chain selected".

The KCAM methodology differentiates between two kinds of key changes:

- Generic Key Changes – which apply to all regions. They describe the ambient conditions which are true in all instances. They are therefore predominantly related to basic technological parameters. Generic Key Change descriptions have to be validated by an industry-based committee.
- Member State Specific Key Changes – which are applicable only within the confines of each specific region. They apply specifically to the region in question and avoid describing key changes which are more widely applicable such as the technological status of hydrogen technologies. They are related to region specific energy supply and demand trends, energy transportation infrastructure, political disposition and policies, and national societal knowledge and technology acceptance levels. Region specific key changes are validated by representatives and stakeholders from each region following preliminary mapping work by the project team.

Actor Analysis will culminate in an Actor Analysis Report, which presents the methodology as well as Key Change Difficulty Summary Charts and Broad Actor Group Heat Charts, as well as cross-cutting analyses. [2, 4]

#### 4 Roadmap Evolution

As in the HyWays project, HYRREG involves the stakeholders right from the start of the project and integrates their preferences and opinions, making it different from other roadmapping exercises. The stakeholder validation process is present throughout the whole study, at the beginning by consulting them with questionnaires and during the process at workshops where all the steps of the roadmap are discussed.

HYRREG's deployment infrastructure for a hydrogen economy will be established for three timeframes: short term (2020), midterm (2030) and long term (2050). First user centres are expected to occur in the short term and, based on natural resources, state of the art and all aspects reflected in the SWOT analysis, first hydrogen energy chains will be selected.

But technological, political, economic and social aspects will lead to a different evolution of this first scenario. Technological advances, mass-production, economy of scale, environmental policy and social acceptance have to be taken into account when defining the future energy system and in consequence, the future scenario for hydrogen.

The evolution of a hydrogen economy from 2020 to 2050 will be defined in the WS taking into account European and Worldwide previous commitments such as the Kyoto protocol, the European Hydrogen and Fuel Cell Technology Platform guidelines, National initiatives, etc.

**Table 1: Roadmap evolution.**

STEP	ACTION	WHO	SOURCE	Comments
1	SWOT Analysis per region	INTA Stakeholders	Documentation Questionnaires	
2	Indicators list selection	HYRREG partners	Documentation Opinions	
3	FIRST user centres selection	Stakeholders	Indicators list	At workshops
4	Hydrogen energy chains selection for first user centres	Stakeholders	SWOT analysis	At workshops
5	KCAM* analysis	Stakeholders/ HYRREG partners	Hydrogen energy chains	At workshops
6	Infrastructure development vision	Stakeholders	Opinions	At workshops
7	Challenges Recommendations	Stakeholders	Opinions	At workshops

\* Key changes and actors mapping

#### References

- [1] HyWays (2009) "The European Hydrogen Roadmap", <http://www.hyways.de>, accessed 2nd March 2010.
- [2] Hugh, MJ, Roche, MY, Bennett, SJ (2007) "A structured and qualitative systems approach to analysing hydrogen transitions: Key changes and actor mapping", *International Journal of Hydrogen Energy*, Vol. 32 (10-11) 1314 – 1323.

- [3] Abilities Analysis Group of the Spanish Technological Hydrogen and Fuel Cells Platform (2009). "Priorization report for the criteria of first user centres selection".
- [4] Seymour, EH, Murray, L, Fernandes, R (2008) Key Challenges to the introduction of hydrogen—European stakeholder views, *International Journal of Hydrogen Energy*, Vol. 33 (12) 3015 – 3020