



# ECTOS Ecological City Transport System

Edited by Icelandic New Energy  
[www.newenergy.is](http://www.newenergy.is)

## Second Newsletter



Preparations for the arrival of the three DaimlerChrysler 'Citaro' hydrogen fuel cell buses continue according to schedules. During the first two years of ECTOS the work emphasis has been on preparations for erecting a Hydrogen fuel station, preparing a maintenance facility and formulating the research Methodology. The socio-economic and environmental studies connected to the project have already started but the most impressive milestone so far, is the hydrogen filling station, whose components arrived in Iceland on March 11<sup>th</sup> 2003. The filling station is a turn-key solution delivered by Norsk Hydro Electrolysers, currently under construction at Skeljungur's (Shell Iceland) fuel-station site at Grjótháls, Reykjavík (see special description, page 3). The inauguration, of the station, which will take place on April 24<sup>th</sup> will mark a historical moment in the energy arena. It is the first step towards a hydrogen based economy in Iceland. An international conference will be held parallel to the inauguration and a DaimlerChrysler Sprinter, powered by a fuel cell, will represent the state of the art for Hydrogen technology. This will be the first hydrogen vehicle to drive on Icelandic roads, running on virtually CO<sub>2</sub> free hydrogen from the Skeljungur station. The hydrogen fuel cell Citaro buses will be delivered to Reykjavik in August 2003 and introduced to the Icelandic public. The buses will then go into normal public bus operation in September and they will be operated until 2005. The demonstration is the basis for all the information generation,- regarding performance of the technology, both for the buses and the infrastructure, and for all the socio-, economic and environmental research.

Simultaneously to the opening of the filling station there will be a conference in Iceland (April 24-25<sup>th</sup> [www.newenergy.is](http://www.newenergy.is)), on the theme "Making Hydrogen Available to the Public". The objective of the conference is to evaluate the scenario of hydrogen as a fuel and give insights to public acceptance at the onset of a new Millennium. Gaining direct experience from constructing and operating a fuel station where the possibility exists to service personal vehicle is an important learning experience.



ENERGY, ENVIRONMENT  
AND SUSTAINABLE DEVELOPMENT





A bird's eye view of the hydrogen filling station

Using the designers outline of the hydrogen station we recognise the following components:

1. The station is connected to the city's electricity grid and fresh water system. The water needs to be extremely clean and deionised. On the Reykjavík grid mix 85% is provided by hydraulic power and 15% by geothermal power. (figures from 2001)
2. This is the cabin that contains the electrolyser. It splits water into hydrogen and oxygen in the volumetric proportions of 2:1 respectively. Its production capacity is  $60\text{Nm}^3$  of Hydrogen gas every hour and the station's electricity consumption is estimated to be  $4.8 \text{ kWh/Nm}^3$ .
3. This is the cooling unit. During the electrolysis some heat escapes. The hydrogen needs to be dried and purified.
4. The electrolyser works under pressure and delivers the hydrogen at approx 15 bars. Thereafter the hydrogen goes through a specific

compressor unit (4), which delivers the gas into the storage cylinders.

5. The storage cylinders keep the hydrogen under 440bar pressure. In this station the cylinders are made of steel.

6. The dispenser unit is supplied with clamps that attach tightly to the fuel tanks of vehicles. This is essential so that no hydrogen gets lost on the way, since hydrogen is the lightest element on earth and diffuses extremely rapidly up in the air.

7. On the station both the function of an electrolyser and that of a fuel cell is explained in simple terms. The light, transparent walls that surround the station, are illustrated with general information and plain figures. The texts are both in Icelandic and English.



Some envelopes arriving at Icelandic New Energy contain interesting issues. A note arrived from Colac, Victoria in Feb 2003 reading:

*Dear Icelandic New energy*

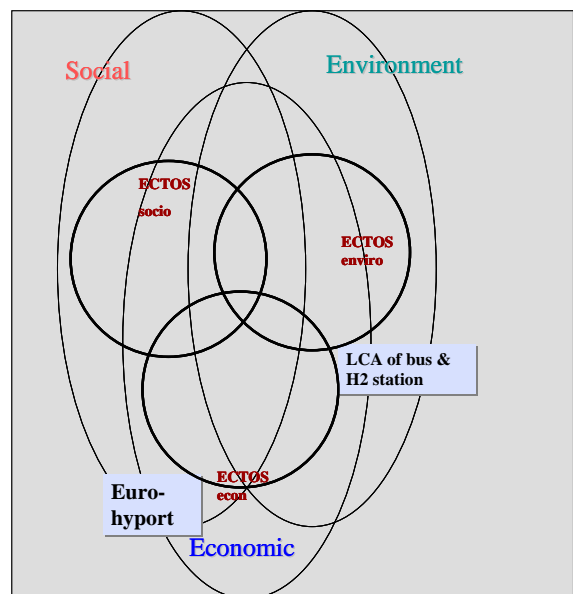
*My name is Denver and I am interested in how hydrogen fuel will be made cheap in iceland to sell all around the world for a globe economic of clear energy for cars and planes I would like to know more about it could you please send me some more information on it, - D. g.'*

Of course we replied and sent him a note, some brochures and the last NewsLetter. – But we had no answers to the child's impressive question.

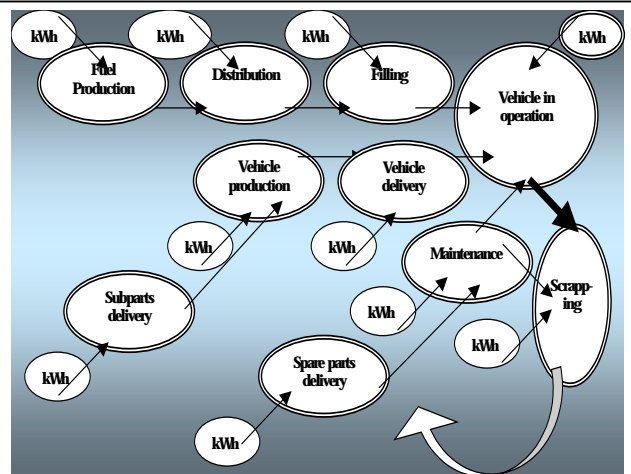


ECTOS and Icelandic New Energy will be represented at the Hanover Industry Fair 2003 at the Norsk Hydro Booth.

The Methodology for the research within ECTOS is ready. It is a 200-page document with a general description of how data will be collected and processed during the project time. The theme of the research is social acceptance, environmental aspects of hydrogen technology in Icelandic conditions and economic evaluations. The public acceptance will be surveyed by telephone questionnaires, checklists carried out on board the fuel cell buses and detailed interviews with key people within society. The environmental issues mostly touch on air quality and emission measurements but also Life Cycle Analysis for the equipment and the fuel. The electricity used to electrolyse water at the Reykjavik Hydrogen station comes from the national grid. The combination of energy sources for the grid is simple: 85% comes from hydropower and 15% from geothermal sources. A Well-to-Wheel analysis for the fuel will therefore probably show less air emission in Reykjavik than in most other places. However the Methodology should provide a framework for comparative measures in other places. An exact price tag for the entire 'hydrogenisation' of Iceland will probably not be one of the outcomes of ECTOS, but surely many questions on costs will be answered by the end of the two years test drive with the fuel cell buses.



The research group within the ECTOS had to select carefully the most important issues to be studied within socio-economic and environmental aspects. The drawing above attempts to show that the data collection often overlaps disciplines and that data will also be brought in from other projects. The diagram below shows a fraction of the inventory that needs to be established for the material- and energy use within an LCA analysis.





Pictures from the construction site, Skeljungur's Hydrogen production, compression and filling station, 1<sup>st</sup> – 23<sup>rd</sup> of March 2003.

### ***ECTOS and CUTE - Cooperating***

The ECTOS project is a test of running a hydrogen station and driving hydrogen fuel cell buses in Reykjavik, Iceland. A similar fuel cell bus test, The CUTE project (Clean Urban Transport for Europe) is being carried out almost simultaneously in 9 Continental European cities (London, Madrid, Stuttgart, Hamburg, Amsterdam, Luxembourg, Porto, Stockholm and Barcelona). Hydrogen filling depots will be constructed in all these cities. The projects are complimentary through shared learning, information exchange and dissemination. Yet, there are some differences between the two. The ECTOS includes building the first hydrogen station in conjunction with an ordinary petroleum station as well as socio-economic and environmental studies; whereas the CUTE mostly focuses on the technology-performance under various conditions. The CUTE hydrogen stations will also test the reforming technology for natural gas to hydrogen. The ECTOS has a higher local impact; 3 fuel cell buses amount to 4% of the total bus fleet in Reykjavik and that alone allows for a real-scale data collection and a more reliable outcome that can be extrapolated. The cooperation platform for the projects is the Fuel-Cell-Bus-Club that was founded in Amsterdam 2001.(see further: [www.ectos.is](http://www.ectos.is) and on [www.fuel-cell-bus-club.com](http://www.fuel-cell-bus-club.com) )

***The international media still gives INE and ECTOS great attention. During the last year Swiss TV made a news interview and a 25 minutes program on hydrogen and renewable energy in Iceland. Japanese TV reporters, CBC and Norsk Radio also filmed and made interviews. Articles appeared in Worldwatch magazine (World and I), the British engineers bulletin and the web based media: Hydrogen gazette and Science Direct ([www.h2gazette.com](http://www.h2gazette.com), [www.sciencedirect.com](http://www.sciencedirect.com) ). During the summer of 2003 the information dissemination will mainly be directed to the Icelandic public.***