Organisation of Surveys on Attitudes Towards Hydrogen as Energy Carrier

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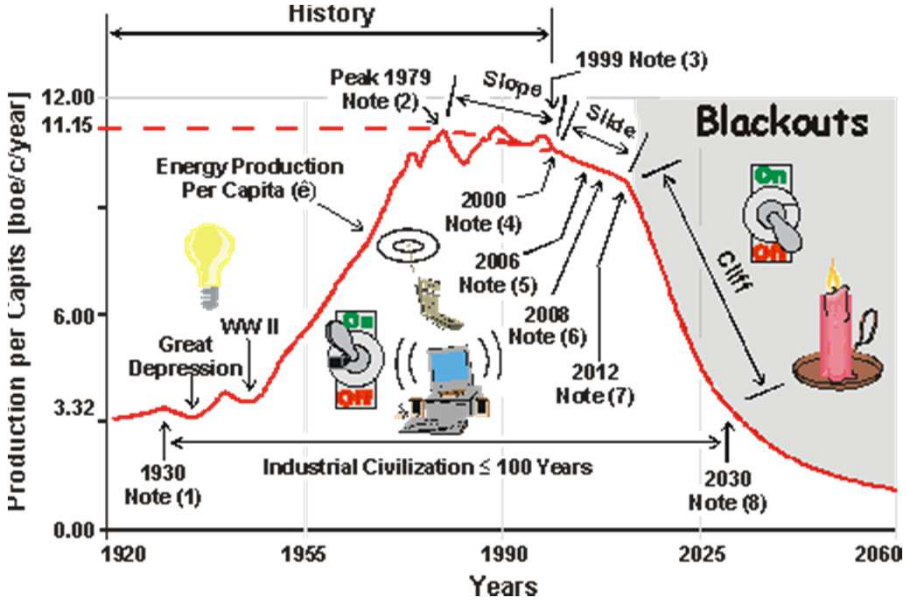
Introduction

Already for several decades (from 1970th) researchers worldwide are working on hydrogen as energy carrier

What it is and Why?

Olduvai Theory: energy production from fossil resources versus energy consumption



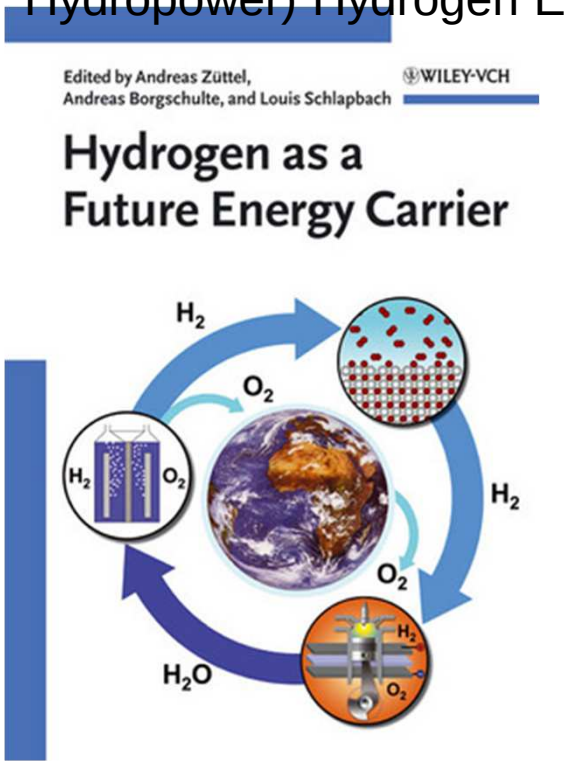
Accordingly estimations from that theory on 2025 we will be equal with 1930, when there were fossil resources and no technologies, but on 2025 we will have technologies and no fossil resources. Therefore it is necessary to elaborate alternative energy sources today. Also Latvia's energy balance is based mostly on the burning of fossil fuels and importing it from neighbor countries.

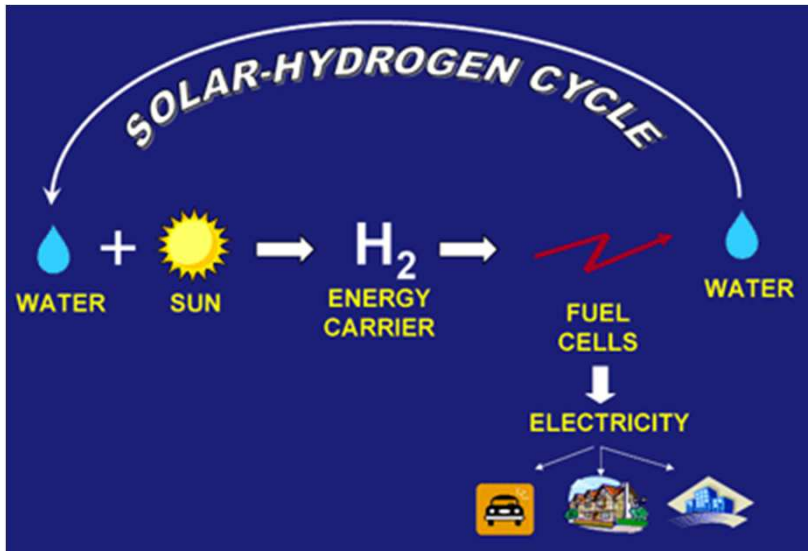
Introduction

HYDROGEN

Hydrogen is considered to be an ideal energy carrier. It can be produced from water by using a variety of energy sources, such as solar, nuclear and fossil, and it can be converted into useful energy forms efficiently and without detrimental environmental effects. The only by-product is water or water vapour

When solar, wind, hydropower energy are used to produce hydrogen from water, both the primary and secondary forms of energy become renewable and environmentally compatible, resulting in an ideal, clean and permanent energy system - the Solar (Wind, Hydropower) Hydrogen Energy System.





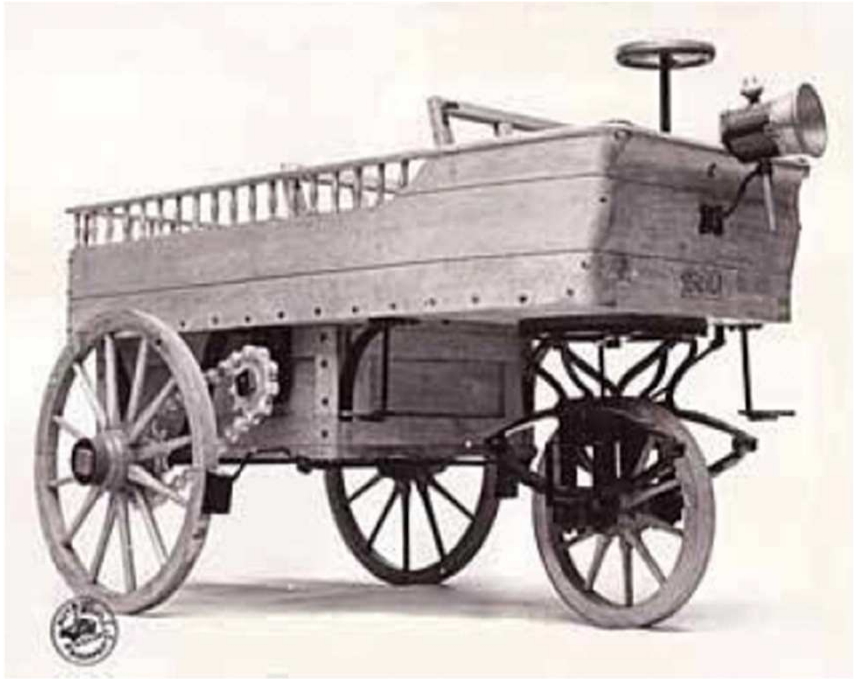
Introduction

HYDROGEN

Hydrogen as fuel is used before oil distillation was discovered (1840).

Between 1807 and 1986 was a time of great development for hydrogen cars. From the first Rivaz car designed by Francois Isaac de Rivaz of Switzerland to the Hippomobile to the GM Electrovan to several models designed by Musashi, hydrogen vehicles grew by leaps and bounds over these years.

The Lenoir Hippomobile was propelled by a 1-cylinder, 2-stroke engine. The hydrogen was created for the car by electrolyzing water and the resulting gas was run through the horizontal engine.



Introduction

HYDROGEN

Today, we have a “hydrocarbon economy” but the transition toward a “Hydrogen Economy” has already begun.

In the very near future we will have weaned ourselves from carbon and we will live in a “Hydrogen Economy” powered by hydrogen energy from renewable resources.

Hydrogen has the potential to do for the energy revolution what the computer and the Internet have done for the information revolution.

Fuel cells are considered the “microchip of the hydrogen age,” the key to abundant energy from secure, renewable resources.

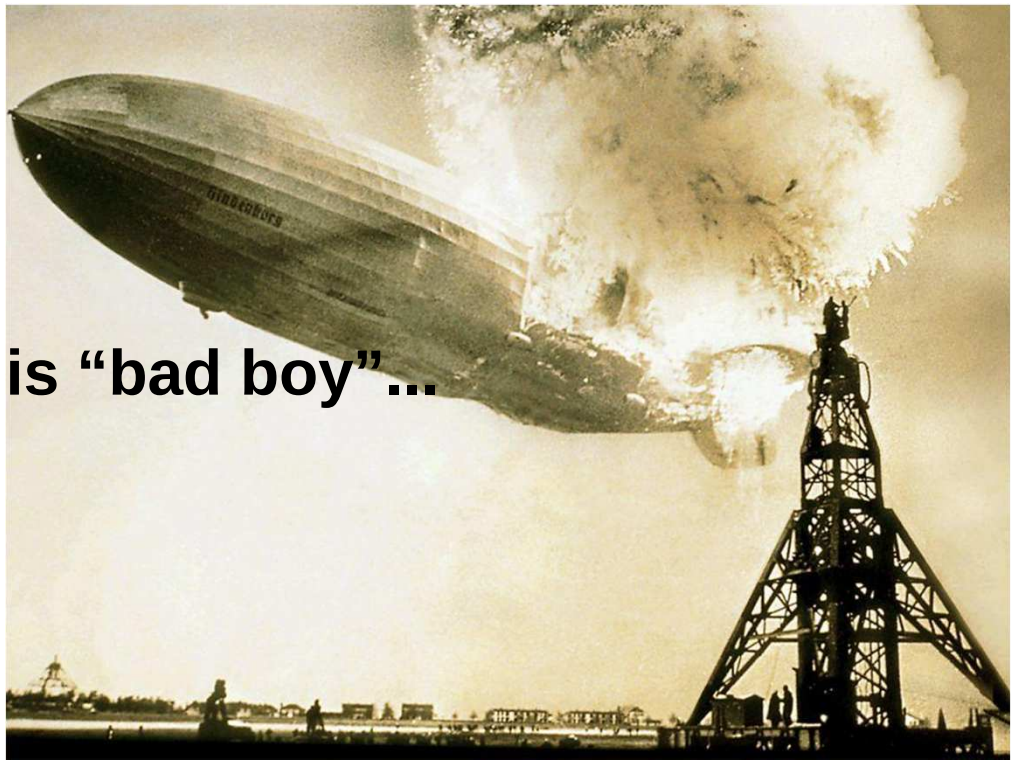
Fuel cells supplying homes, businesses, and industries could be as independent power sources or linked to a national power grids

Introduction

Different countries have different approach and different attitude of public and politicians regarding Hydrogen as energy carrier.

Why it is so complicate?

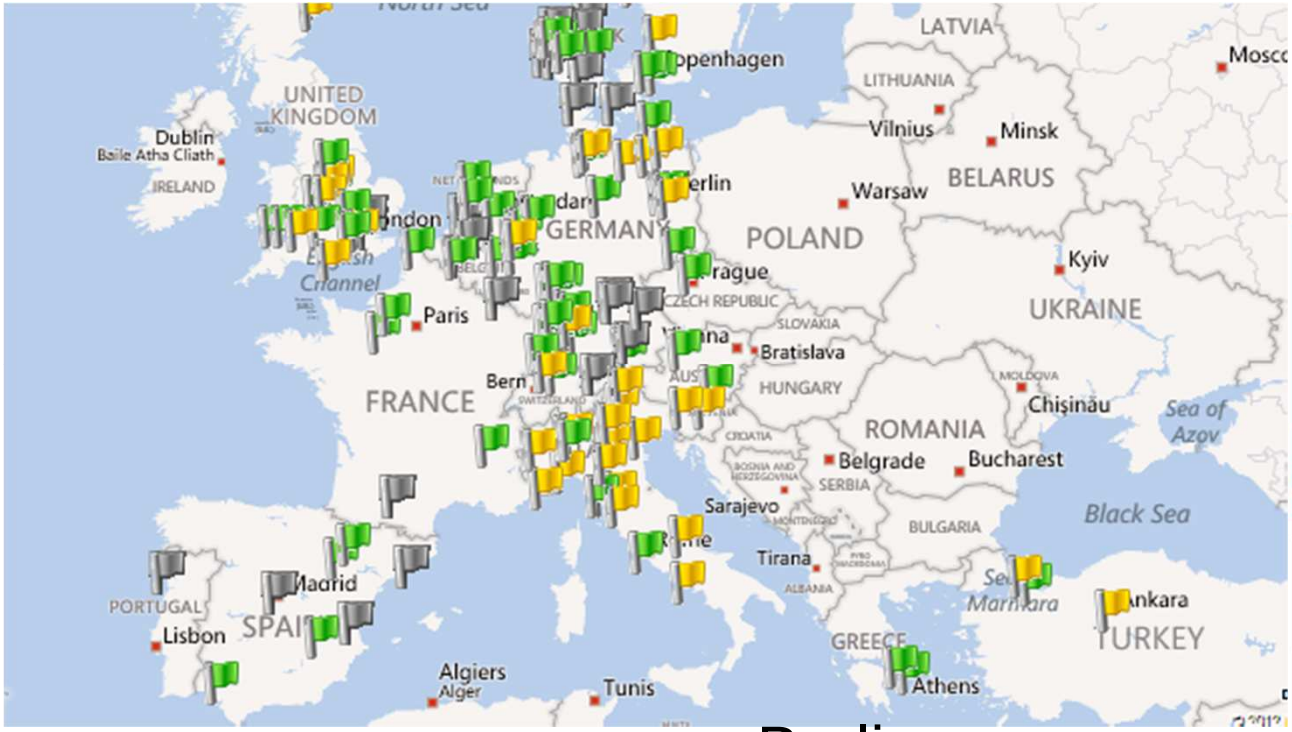
From 1930th the Hydrogen is “bad boy”...

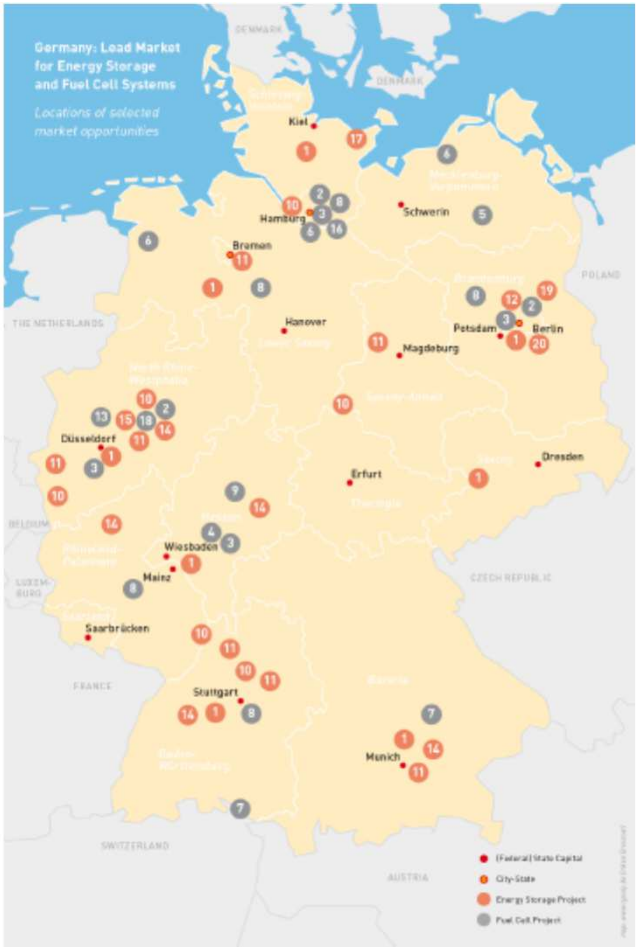


Thursday, May 6, 1937: German passenger airship LZ 129 Hindenburg caught fire and was destroyed during its attempt to dock with its mooring mast at the Lakehurst Naval Air Station, which is located adjacent to the borough of Lakehurst, New Jersey. Of the 97 people on board[N 1] (36 passengers, 61 crew), there were 35 fatalities; there was also one death among the ground crew.

Hydrogen demonstration

Europe: Hydrogen Refueling Stations and Projects (Germany)





London

Berlin

Hydrogen acceptance to public

On acceptance of hydrogen technologies lot of research is done in Germany, in Australia, in the Netherlands, in China, in India, in Norway, in USA, in Brazil, in London, Teeside and Wales, in Iceland, in Italia etc

And in Lithuania (Milciuviene, *et al. 2006),* in some extent also in Latvia (Dimants, *et al,* 2012)

With hydrogen technology information dissemination in Latvia works the Latvian Hydrogen Association (www.h2lv.eu) whose active members are students – authors of this study. There are several questionnaires used in research, our choice was evaluation scale 1 – 10, as it is more and more used for attitude evaluations.

A survey of potential future project

University of Latvia Campus – Technical Design of CHHP System Latvia

Combined Hydrogen, Heat and Power (CHHP) system in University Campus (see site plan in Fig. 1) is design on base of fuel cell power plant DFC300 (FuelCell Energy, USA) [28] with power output 300 kW – AC 380V, 50 Hz. In this system:

- Electricity will be used to power the Academic Centre of Natural Sciences (ACNS) (include Biology, Chemistry, Geography and Earth Sciences – research laboratories, lecture-rooms, professor rooms etc., 200 researchers and professors, 2000 students (for all campus – about 20 000);
- Heat will be used for ACNS heating maintenance in cold season (October – April), for hot water and for other technical purposes (kitchen, laboratories etc) through all the year;
- Proposed electricity consumption for the Academic Centre of Natural Sciences is about 800 MWh/year; heat consumption – 350 MWh/year

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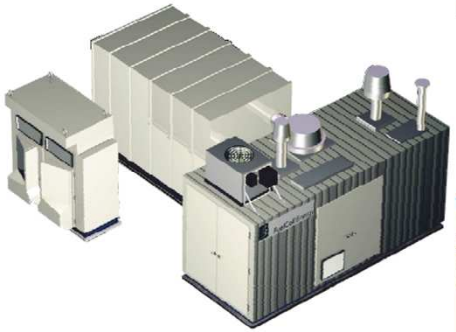
The Hydrogen Education Foundation's
Hydrogen Student Design Contest
2012-2013: Development of Hydrogen Fueling Infrastructure in the Northeast
www.HydrogenContest.org

Awards

University	Award	Score	Design
University of Maryland	**Grand Prize**	91.1%	**2.7MB PDF**
Washington State University	**Honorable Mention**	89.7%	**6.9MB PDF**
UC Davis	**Honorable Mention**	88.3%	**1.5MB PDF**
Missouri S+T	Top Ten Finisher	85.8%	**1.5MB PDF**
National University of Malaysia	Top Ten Finisher	85.8%	**2.2MB PDF**
Ohio University	Top Ten Finisher	77.7%	**1.2MB PDF**
Latvia University	Top Ten Finisher	68.8%	**1.5MB PDF**
Kyushu University	Top Ten Finisher	68.7%	**3.4MB PDF**
Florida International University	Top Ten Finisher	65.5%	**1.9MB PDF**
University of Bridgeport	Top Ten Finisher	63.7%	**1.5MB PDF**

A survey of potential future project

University of Latvia Campus – Technical Design of CHHP System Latvia



A survey of potential future project

Social-economical survey via questionnaire was performed in February and March, 2012 to explore readiness of the society to use renewable technologies in the University of Latvia campus.

Respondents are related to University of Latvia (students, professors, researchers, and possible future students, etc.). Faculties intended to locate in Academic Centre of Natural Sciences participated in the survey.

In the survey were questions on respondent's environmental knowledge, attitudes, behaviour as well as information on socio-economic characteristics of respondents. Including, questions about the project acceptance, scientific value and safety issues.

A survey of potential future project

Some descriptive statistics (arithmetic mean, mode, median and indicators of variability) on question about information on knowledge about hydrogen as energy resource are reflected in table:

Table1. Main statistical indicators of responses on the question "*I am fully informed for hydrogen usability as energy resource"*

	Indicators	Values
N	Valid	364
	Missing	0
Mean		6,57
Std. Error of Mean		0,140
Median		7,00
Mode		10
Std. Deviation		2,678
Variance		7,171
Range		9
Minimum		1
Maximum		10

Source: Survey performed by authors in March 2012, n=364

Evaluation scale 0-10, where 0 – do not have information about issue, 1 fully disagree, 10 fully agree

A survey of potential future project

Table 2 reflects distribution of the answers by faculty for statement: *I am fully informed for hydrogen usability as energy resource*.

		Faculty represented					
		Faculty of Biology	Faculty of Physics and Mathematics	Faculty of Geography and Earth Sciences	Faculty of Chemistry	Riga Technical University	Total
	1	6	0	0	3	0	9
	2	3	2	3	5	0	13
	3	4	1	8	6	0	19
	4	8	2	6	4	0	20
	5	10	5	12	8	0	35
	6	7	0	8	7	1	23
	7	14	6	5	9	0	34
	8	7	9	6	11	0	33
	9	5	13	4	9	0	31
	10	14	10	5	14	0	43
Total		78	48	57	76	1	260

Source: Survey performed by authors in March 2012, n=364

Evaluation scale 0-10, where 0 – do not have information about issue, 1 fully disagree, 10 fully agree

A survey of potential future project

Distribution of answers for statement: *I am fully informed for hydrogen usability as energy resource* by gender

	Gender				Total		
	Female	Share (%)	Male	Share (%)	Number	Share (%)	
1	13	6,84	4	2,31	17	4,68	
2	12	6,32	4	2,31	16	4,41	
3	21	11,06	5	2,89	26	7,16	
4	15	7,89	12	6,94	27	7,43	
5	22	11,58	18	10,40	40	11,02	
6	18	9,47	15	8,67	33	9,09	
7	28	14,74	22	12,72	50	13,77	
8	18	9,47	27	15,61	45	12,40	
9	18	9,47	27	15,61	45	12,40	
10	25	13,16	39	22,54	64	17,64	
Total	190	100	173	100	363	100	

Source: Survey performed by authors in March 2012, n=364

Evaluation scale 0-10, where 0 – do not have information about issue, 1 fully disagree, 10 fully agree

Conclusions

As the survey results show, most of the respondents are very positive (with surprisingly high evaluations) for respondent knowledge level on hydrogen usability as energy resource.

It can be concluded that in average academia and students demonstrated positive attitude towards hydrogen energy and demonstrated good knowledge level about hydrogen technologies and are willing to accept and support technology implementation in University of Latvia Academic Centre of Natural Sciences.

Also results indicate that most informed on hydrogen usability as energy resource are in Faculty of Physics and Mathematics, less informed are in Faculty of Biology. Interesting conclusion is that male persons are much more informed on hydrogen as energy resource.

Thank you for attention

cfi = Institute of Solid State Physics, University of Latvia