

ERA-Net HY-CO
2. Network Committee Meeting - Brussels -16th March 2005

Swiss
Hydrogen & Fuel Cell
RD&D programmes

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at TEMAS AG

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at SFOE (Swiss Federal Office of Energy)

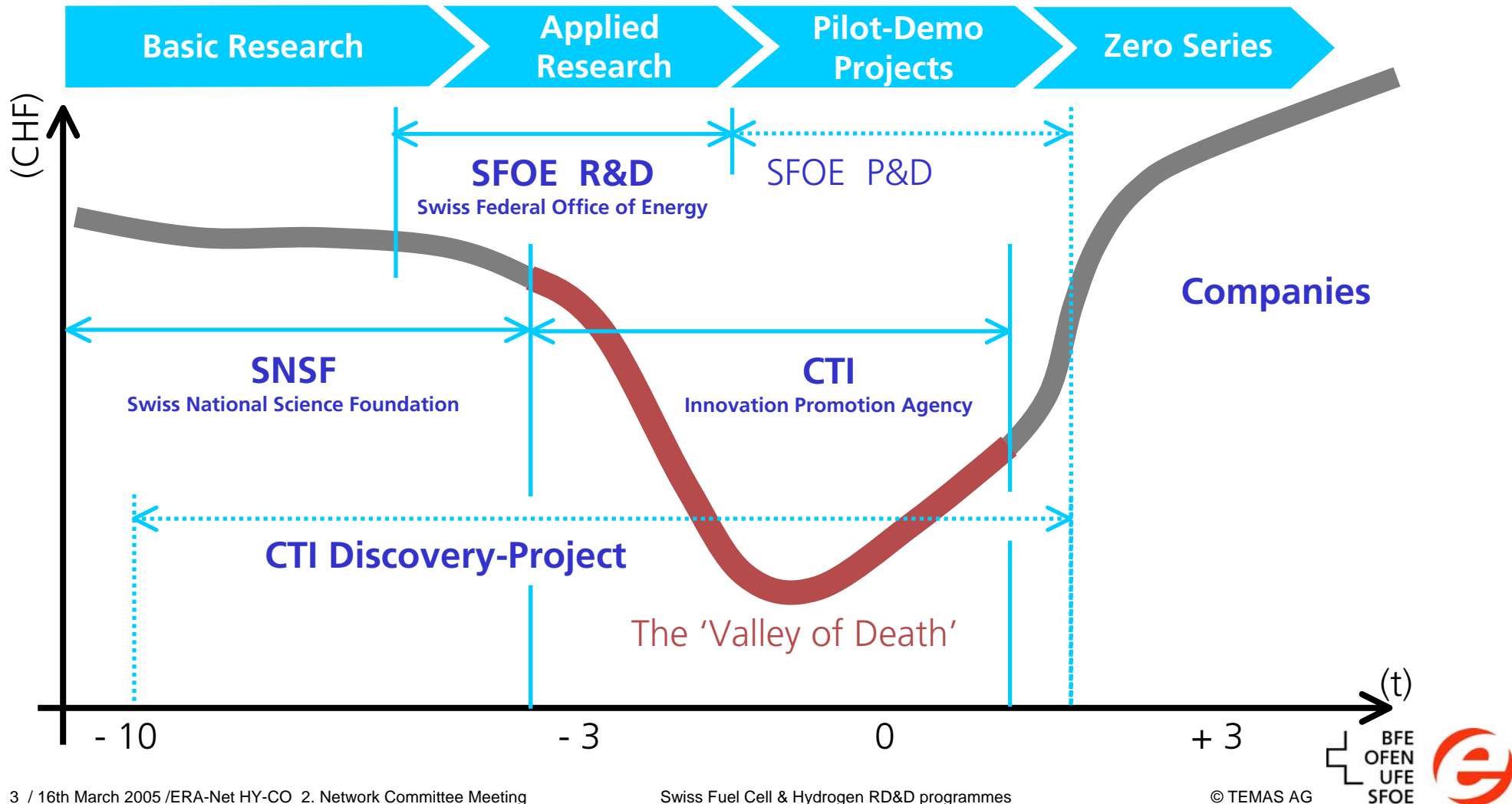
Agenda

- 1. Funding agencies - H2FC budget**
- 2. Budget in relation to other RD&D programmes (not H2FC)**
- 3. Set-up of H2FC RD&D programmes and support**
- 4. Proposal evaluation procedure**
- 5. Visible projects - Assessment of project outcomes**
- 6. Trans-national cooperation
Experience - Expectation
i.e. joint H2FC RD&D programmes and supporting activities**

Funding agencies

The R&D activities are mainly supported by:

- national funding agencies like: SNSF, SFOE, CTI, BBW, ETH-Board, cantonal agencies, etc.
- private organizations like: FOGA or PSEL



Funding budget (yearly average)

Projects, ETH, Uni, UAS:

Hydrogen

MCHF/y	2004	2005-2007
SFOE	0.7
CTI	...	0.1
BBW (EU-Projects)
ETH-Board	2.0
Cantons	2.0
Totally	...	≈5.5

Fuel Cell

2001	2002	2003	2004	2005-2007
1.1	2.4	1.9	1.5	1.0
0.8	0.8	1.0	...	1.5
0.3	0.3	0.3	...	0.5
3.8	4.0	4.0	....	4.5
1.8	2.0	2.0	....	2.5
7.8	9.5	9.2	...	≈10.0

Budget in relation to other RD&D programmes (not H2FC)

MCHF/y 2004	Approx. Totally	H2	%	FC	%	FC+H2	%
SFOE Renew+Rat. Use / Totally	30/50	0.7	2.4/1.4	1.0	3.3/2.0	1.7	5.7/3.4
CTI	116	0.1	0.1	1.5	1.3	1.6	1.4
BBW SNSF/EU-Projects	537/...	...	...	0.5	...	...	...
ETH-Board	1'957	2.0	0.1	4.5	0.2	6.5	0.3
Cantons	...	2.0	...	2.5	...	4.5	...
Totally 2.6% of 440 bnCHF GDP=11 bnCHF Federation ca. 4 bnCHF	4'336	≈5.5	≈0.13	≈10.0	≈0.25	≈15.5	≈0.4

Set-up of H2FC RD&D programmes and support

Possibility of H2FC activities

■ CH Message on the Promotion of Education, Research and Technology

- 2004-2007 no promotion of programmes foreseen
- 2008-2011 process for message on the promotion is on-going extreme effort in lobbying would be required

closed



■ SNSF promotes basic research - projects within

- Independent free research in all scientific disciplines
- National Research Programmes (NRP): ..., Nano Science, ...
- National Centres of Competence in Research (NCCR):
Quantum Photonics, Materials with Novel Electronic Properties,
Nanoscale Science - Impact on, Sustainability



closed

closed

■ CH promotes projects in various fields of activity within the CTI



■ CH sector research: SFOE – Program: hydrogen & fuel cell

- Promotes: projects, associations/platforms: Hydropol, FC realization stage



CTI: Areas of promotion and promotion campaigns

Areas of promotion

CTI Life Sciences

CTI Biotech

CTI Medtech

CTI Enabling Sciences

CTI Nano / Micro

CTI Engineering

Transdisciplinary promotion campaigns

CTI Start-up

CTI Innovation for Successful Ageing

CTI Universities of Applied Sciences

CTI International

EUREKA, IMS,
EU Tech. Committees

Possibility of H2FC activities

	BFE-Bereiche	Bereichsleiter	Programmleiter	
			F + E	P + D
I. Rationelle Energienutzung	Gebäude (inkl. Solararchitektur)	Andreas Eckmanns	Markus Zimmermann	
	Verkehr	Martin Pulfer	Martin Pulfer	
	Batterien, Supercaps			
	Elektrizitätsspeicherung und -transport	Felix Frey	Roland Brüniger	
	Elektrizitätsnutzung (Geräte)			
	Wärme-Kraft-Kopplung (ohne Brennstoffzellen)	Fabrice Rognon	Thomas Kopp	Max Ehrbar
	Verbrennung Brennstoffzellen	Alphons Hintermann	Alphons Hintermann	
Verfahrenstechnische Prozesse (VTP)	Martin Stettler	Martin Stettler		
II. Erneuerbare Energien	Solarwärmespeicherung	Urs Wolfer	Jean-Christophe Hadorn	
	Solarwärme		Jean-Christophe Hadorn	Urs Wolfer
	Photovoltaik		Stefan Nowak	
	Solarchemie inkl. Wasserstoff	Alphons Hintermann	Armin Reller	
	Umgebungswärme (Wärmepumpen)	Fabrice Rognon	Thomas Kopp	Max Ehrbar
	Biomasse (ohne Holz)	Bruno Guggisberg	Bruno Guggisberg	Bruno Guggisberg.
	Kleinwasserkraftwerke			Manuel Buser
	Holz	Daniel Binggeli	Daniel Binggeli	
Geothermie	Markus Geissmann	Harald L. Gorhan		
Wind		Robert Horbaty		

Possibility of H2FC activities



→ Programme SwissEnergy

Programme SwissEnergy (2000-2010)



Objectives:

- Reduction of CO2 emissions by 10 %
- Growth of electricity demand < 5 %
- No reduction of hydropower's contribution in %
- Increase of renewable energy contribution to 1% electricity and 3% heat demand

Organization:



Possibility of H2FC activities



Proposal evaluation procedure

	SNSF Swiss National Science Foundation	SFOE Swiss Federal Office of Energy	CTI Innovation Promotion Agency
Proposal - Calls - Subjects	Calls and individual subjects for: Projects, individual talent, publications, conferences, research cooperations, special programmes 	Calls and individual subjects within - Global energy research concept - Program strategies Collaboration with industry and other funding agencies desired Basic + applied research	'Bottom-up'-Principle individual selection of subjects Direct collaboration Research institute + industry industry: 50% of project costs, lead Joint project need external moderation
Evaluation - Focus - Experts		Focus: Implementation of results Evaluation of: Objectives, expected results, procedure, differentiation, time schedule, milestones, resources, organization Evaluated by internal / external experts	Focus: Innovation technical-scientific-economical potential, sustainability, work packages, finance plan, industry share, state-of-the-art, patents, short and middle-term results Evaluated by independent experts
Inspection - Reviews - Reports	(SNSF is reviewed as a whole) Annual report	Individual Reviews Internal / external experts check Project structure, resources, targets, environment Annual report 	Periodic Reviews Independent experts check achievement of objectives, deliverables, time schedule, finances, ... Intermediate report
Termination - Reviews - Reports	Final report	Individual final review Final report	Final review Final report documentation of discrete solution functional model, prototype, pilot installation

Important projects: In general

In Switzerland are several R&D activities for the production, storage and transformation of **Hydrogen**.

The scientific strengths are

- the **solar thermal** and
- the **photoelectrical water splitting**.

There is a considerable potential to develop optimized **functional materials** for electrodes and membranes.

The Swiss researchers and industry are networked in the **Swiss Hydrogen Association Hydropol** www.hydropole.ch.

The **Swiss fuel cell activities** are focused on **PEFC** and **SOFC** technology.

The numerous research groups have international **approved competences**

- **from the basics**, like material and theoretical modeling,
- **up to the systems integration**.

The results are various visible projects as shown below and a high quality of education. Several companies are involved in the R&D processes, however no industrial breakthrough is achieved. The strategic objective is to mobilize industry through the further **realization of niche market products**. NTP in planning - FC realization stage

Research Institutes for **H₂ Production and Storage**


EPF Lausanne PSI Villingen UNI Fribourg
ETH Zürich UNI Bern UNI Genf

Research Institutes working on **SOFC- or PEFC-technology**

ETH-Zürich EMPA Dübendorf PSI Villingen ZHW Winterthur
EPF Lausanne NTB Buchs EIVD Yverdon HTA Horw + Biel


Visible projects

500 W EnergyCube SOFC stack with SOFconnex Technology
12 kg Demonstrator




Htceramix
EPFL, EMPA
www.htceramix.ch

PEFC Stack
500 W, air cooled



HTI Biel
labs.hti.bfh.ch/index.php?id=747

SAM light car
6 KW PEFC drive




USV for GSM Station
>1 kW PEFC battery replacement




HTA Luzern
www.hta.fh.zh.ch/institute/ipe/projekte.html

PEFC-brane
Low cost high performance membrane




PSI :
ene.web.psi.ch
ecl.web.psi.ch/groups.html

Hy-Light Car (Michelin)
30 kW PEFC drive + SC



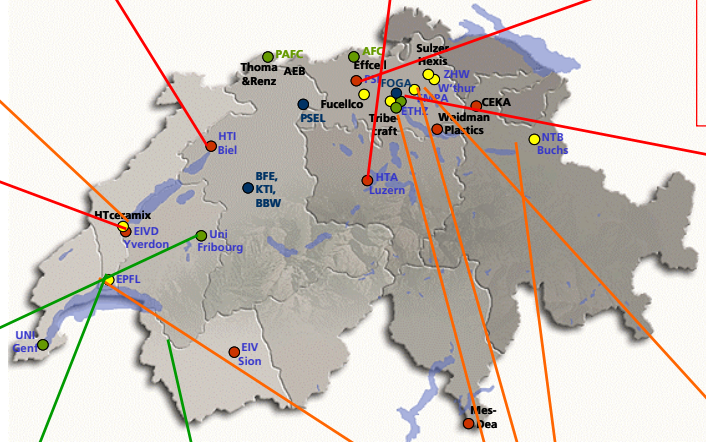
Power Pac System
1 kW PEFC, water cooled



Hydroxy 3000 boat
3 kW PEFC drive
1500 kg,
10 – 15 km/h



EIVD Yverdon
iese.eivd.ch/hydroxy




Hydrogen Snow Cat
Modified 6 piston otto engine
300 kg metallhydride, 5 kg H₂ stored



UNI Fribourg, www.ifres.ch
www.swissalps3000.ch

Photoelectrolysis for Hydrogen Production



EPF Lausanne
photochemistry.epfl.ch
University of Geneva

Water Electrolysis and Hydrogen Storage
at 30 bar, 20'000 m³ H₂



Djeva SA www.djeva.com

Micro-SOFC as Battery
replacement e.g. for cellular phones <1 W SOFC



ETH Zürich, EPF-L, NTB, ZHW
www.mat.ethz.ch

PAC-Car (Shell Eco-marathon)
400 W PEFC drive,
115 kg, < 40 km/h



15 g hydrogen/100 km
ETH-Zürich/PSI
www.imrt.ethz.ch/pac-car

Decentralised Energy Supply Fuel Cell Heating Systems



SOFC
1 kWe, 2.5 kWth
350 kg
lifetime 5'000 h

Sulzer Hexis
www.hexis.com
New generations are in progress

Further FC projects (applications)

<p>PEFC</p>	<p>EBM Münchenstein</p>	<p>Ballard-Alstom 200 kW stat. 2000-2002</p>	<p>Mes-Dea</p>	
<p>SOFC</p>	<p>Fucellco</p>		<p>.....</p>	
<p>PAFC</p>	<p>SIG Genf</p>	<p>ONSI PC 25 A 200 kW stat. 1993 / 40'000 h</p>	<p>AEB Basel Thoma&Renz</p>	 <p>ONSI PC 25 C 200 kW stat. 2000 / 32'000 h</p>
<p>AFC</p>	<p>Effcell</p>	<p>EFFCELL GmbH</p> <ul style="list-style-type: none"> ■ Energy-efficient, economical, unique alkaline ■ 2 kW to 50 kW fuel cell systems for mobile ■ Currently in development ■ Fuel cell vehicle application tests are planned 	<p>.....</p>	
<p>.....</p>				

Experience in trans-national cooperation - FC

- ▶ EU-Projects / activities:
 - ▶ FCTESTNET,
 - ▶ IP REAL SOFC (ETH-Lausanne, EMPA, HTceramix,...)
 - ▶ EU SOFC summer school (Patras, Greece)
- ▶ Lucerne: Internat. Fuel Cell Forum 2004 (U.Bossel)
- ▶ FC day Biel, November 12 2004
- ▶ IEA Implementing Agreement (IA) Advanced Fuel Cells
- ▶ IEA Annexes XV – XX of the IA Advanced Fuel Cells
- ▶ Modeling Seminar, Stuttgart, March 2004 and March 3 / 4 2005
- ▶ HFP EU Hydrogen and FC Technology Platform
 - ▶ Member States Mirror Group
- ▶ Attendance in diverse conferences
- ▶ ERA-NET HY-CO
- ▶ ...

Experience in trans-national cooperation – H2

- ▶ Hydropol (Swiss Hydrogen Association, www.hydropole.ch)
linked with various international organizations
 - ▶ IEA
 - ▶ HFP
 - ▶ Deutscher Wasserstoff Verband (DWV)..)
 - ▶ ..
- ▶ HFP EU Hydrogen and FC Technology Platform
 - ▶ Initiative Group: Education and Training
 - ▶ SRA (Strategic Research Agenda)
- ▶ Attendance in diverse conferences (www.ifres.ch/Homepage/IfRES.htm)
 - ▶ EHEC, GROVE, HYSafe, EMPA, ICCE-12, IHEC, GRC, IASME/WSEAS, ...
 - ▶ IHSC (Advisory Committee Prof. Züttel UniFR)
- ▶ ERA-NET HY-CO
- ▶ ...

Expectations in trans-national cooperation

Contacts

- EU & country representatives
- Research & Industry

- netted research area Swiss
- project partners

Early attendance

- EUREKA (CTI)
- FP6, FP7

- further projects

Active Cooperation within

- HFP
- ERA-NET HY-CO

- balanced research strategy
- impact on EU research topics
- coordination and cooperation between nat. funding agencies
- improved lobbying power
- support in program and platform set-up (best practice)

Thank you for your attention