Tekes Funding and Programme Activities
Hydrogen and Fuel Cells

Presentation for the HY-CO Network Committee Meeting
March 16, 2005

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Outline of the presentation

- Tekes and Finnish innovation system
- Technology program tool
- DENSY - Distributed Energy Systems Technology Program
- Fuel Cell activities as a part of DENSY
Fuel cell development in Finland

Summary

- Main focus on system solutions as a part of the DENSY technology program (SOFC, PEM)
- Financing is growing but major increases in future call for added industrial participation
- Some industrial companies actively involved and a great number of companies interested as a technology users
- R&D concentrated in Helsinki area but research network covers other universities, too. VTT has created a good R&D infra
- Main emphasis on SOFC but also mW size power source is an interesting option
- International cooperation established (cell/stack R&D has a minor role in Finland)
- Tekes’ Technology programs offer our tool for trans-national cooperation
Finland Needs High R&D Investments to Maintain Industrial Competitiveness

A new proposal: +7%/a during 2003-2010; leading to the investment level of 4% of GDP by 2010.

The Barcelona European Council: the goal of increasing R&D investment to 3% of GDP by 2010.

Finland aims at increasing the public sector investments +405 M€ during 2003-07.
Public sector activities of R&D in Finland

PARLIAMENT

GOVERNMENT

Ministry of Trade and Industry

Sitra

Finnvera Oyj

Finpro

Science and Technology Policy Council

Ministry of Trade and Industry

Ministry of Education

Academy of Finland

Universities

Tekes

VTT

Regional TE-Centres

Other ministries and their institutes

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<table>
<thead>
<tr>
<th>Tekes Objectives</th>
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| **Excellence in R&D ensures a strong national knowledge base**  
Excellent R&D increases in Finland with more companies and research organisations participating. This strengthens the national knowledge base in sectors and clusters vital to the national economy and society as a whole. |
| **Internationalisation of innovation**  
The Finnish innovation environment offers companies and research units an excellent framework for adopting and utilising existing international knowledge as well as for networking with high-level international partners to create new knowledge and business opportunities. |
| **Innovative high-growth companies**  
The number of technology-based companies increases; they grow more rapidly and create new job opportunities. |
| **Regional development**  
Technology and innovation support regional development so that the impact objectives of technology policy are fully achieved in each region. |
| **Productivity and renewal of business and industry**  
Strong innovation activity helps existing companies to grow more rapidly. Companies and the structures of business and industry are renewed and diversified, improving the productivity of both the industrial and service sectors. This enhances society's ability to provide job opportunities in an increasingly competitive world. |
| **Direct impact of innovation on well-being**  
Technologies are developed and utilised in a way that ensures balanced development of the economy, social well-being and the environment. |
Impact of Tekes activities

Boosting exports, broadening industrial and economic base, generating new jobs and improving well-being.

Competitiveness, profitability and growth

New businesses, start-ups

Societal and environmental impacts

Projects and programmes

International cooperation

Enterprises

Research institutes and universities

Tekes
- provides expert services and R&D funding
- coordinates programmes

Projects and programmes

International cooperation

Tekes
- provides expert services and R&D funding
- coordinates programmes
During the years 2000-2004 Tekes also had an annual allocation of 5-10 million euros from the EU Structural Funds as the EU share. The funding resources for industrial R&D loans and capital loans for R&D merged in 2004.
Tekes R&D funding per technology application areas in 2003

Each project may be targeted to several areas.

- Biotechnology
- Material technology
- Information and communications technology
- Applications of well-being
- Applications of sustainable development
- Knowledge intensive business services
- Business know-how of the networked economy
- Intelligent products, processes and systems

Million euros

0 25 50 75 100 125 150

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What are Technology Programmes?

- Multiproject programmes initiated, steered and part-financed by Tekes
- Focused on a key technology sector
- Implemented in cooperation by companies and research units
- Companies can participate with their own projects or by joining common research projects
- Projects and results are partially public
Technology programme model

Steering group: enterprises
- preparation
- coordination
- decision making

Tekes
- Grants
- Loans
- Capital loans

Synergy
- Networking
- Part financing

Research projects of research institutes and universities

Company R&D projects

Pictures: © ESA, Okmetic, Stora Enso
Key figures of technology programmes

- 24 ongoing programmes in the beginning of 2004 with a total cost of 1.3 billion euros
- Each programme typically lasts 3-5 years
- 2,000 company participations annually
- 800 research unit participations annually
- Tekes usually finances
  - 60-80% of university projects
  - 25-50% of company projects
# Energy, Environment and Construction Technologies in 2004

## Energy- and Environmental Technology

<table>
<thead>
<tr>
<th>Project</th>
<th>Total budget (mill. euros)</th>
<th>Participating research units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STREAMS - Recycling Technologies and Waste Management</td>
<td>2001-2004 27</td>
<td>140 20</td>
</tr>
<tr>
<td>FINE Particles - Technology, Environment and Health</td>
<td>2002-2005 26</td>
<td>28 17</td>
</tr>
<tr>
<td>FUSION - Fusion Energy Research Programme</td>
<td>2003-2006 18</td>
<td>12 8</td>
</tr>
<tr>
<td>DENSY - Distributed Energy Systems</td>
<td>2003-2007 60</td>
<td>60 18</td>
</tr>
<tr>
<td>ClimBus - Business opportunities in mitigating climate change</td>
<td>2004-2009 70</td>
<td>6 -</td>
</tr>
</tbody>
</table>
Trans-national cooperation

- Technology programmes open a gateway to key Finnish players in relevant fields of technology
- R&D projects in programmes represent the cutting edge of technological development in Finland
- Technology-oriented foreign organisations are invited to cooperate in joint projects, technology transfer or information exchange
  - USA, Japan cooperation based on bilateral agreements
  - EU, IEA
- Programme level cooperation
Technology programme for the development of distributed energy systems

- Duration: 2003-2007
- Programme volume: 60 million euros
- Programme Manager: Jonas Wolff, Technology Centre Merinova Oy
- Further information: www.tekes.fi/programmes/densy
Definition of Distributed Energy Systems

"Local, small sized systems for energy conversion, production and storage as well as related services"

- Real estate-size
- Block-size
- Factory-size
- Production of power, heat and cold
- Especially renewable energy
- Independent or connected to power or heat network
- Mobile, if needed
# Programme Focus

## Business models
- Energy services
- New business concepts
- Customer's decision making tools
- Financing instruments

## Integration
- to local energy source
- to local consumption
- to customer systems
- to external energy system
- DSM

## System solution
- Intelligent components
- Compatibility
- Modelling and measuring tools
- IT, automation, control and supervision
- Standardized solution
- Fuel cell and hydrogen systems

## Industrial production
- Mass-production technologies
- Modularity
- Design
- Lean manufacturing
- Simplicity
- Standardized solution

## Utilizing information technology
- Platforms, applications, models and simulations for evaluation functionality and costs
- Technical services, systems and equipment for providing total service concept

## Demonstrations
Programme status

February, 2005

- 50 research projects in six fields
  - ICT and automation
  - Business concepts
  - Heating and CHP-systems
  - Electrical systems
  - Industrial manufacturing
  - Fuel cell and hydrogen technologies
- 12 research institutes and universities
- Over 45 co-funding companies
- 38 industrial R&D projects
  - Product development
  - Improving manufacturing capabilities
  - Competence building
  - Business development
Project group Fuel Cell and Hydrogen Systems

Scope
- Fuel cell and hydrogen technology in energy production

Objectives
- Finnish SOFC-network
- PEM technology for energy production
- National hydrogen roadmap and business network
Fuel cell development in Finland
FINSOFC 2002-2006 : VTT Processes

- The purpose of the project is to support the industrial SOFC development work
- The main Applications of interest are
  - Stationary CHP 50 kW-5 MW
  - Single house CHP 1-10 kW
  - APU 5 kW and 200 kW modules
- Participants: VTT, HUT, Tekes, Industrial partners
- International cooperation through IEA Advanced fuel cells, EU projects and bilateral cooperation ECN and FZJ
Fuel cell development in Finland

WÄRTSILÄ FUEL CELL PROGRAM

20 kW α-prototype concept

1. Fuel Cell stacks
2. Air pre-heater
3. Fuel processor
4. Process gas heater
5. Fuel pre-heater
6. Catalytic burner
7. Air blower
8. System control and Power conversion
9. Purge gas
10. Water management
Fuel cell development in Finland

POWERPEM 2004-2006: VTT Processes

- Development of a 1 kW power pack concept for production by a new company
- Development of a tool for PEM designing
- Construction of a 1 kW power source including stack and BOP
- Stack testing
- Construction of Power pack
- Demonstration of power pack in light vehicle
- Materials development
  - Bipolarplate materials, metallic and polymer

Participants
- VTT, HUT, Tekes, Industrial partners
Fuel cell development in Finland

PEMDRIVE: Technology Industries

- Development platform for fuel cell powered work machine
- Demonstration and technology development of a PEM-driven machine
  - 2004 planning
  - 2005-6 construction
  - 2007 testing and demonstration

Participants: Industrial partners, HUT, VTT
Fuel cell development in Finland

Alkaline Fuel cell and metal hydride H₂ Storage

Oy Hydrocell Ltd

Web: http://www.hydrocell.fi/
Tel: +358 9 271 0250
E-mail: info@hydrocell.fi

- Fuel Cell: 14,4 V, 1,5 A, 7 Ah, 1,2 kg
- H₂ Storage: HC-MH 200 35 Ah, 2,5 kg
              HC-MH 1200 220 Ah, 11 kg
- Distributor: Woikoski Oy
Development of a disposable mW size power source
To be used for intelligent packages and medical sensors
Mass production by printing
Disposable materials
Enzyme catalysts

Participants:
HUT, VTT, ÅA, Tekes, Industrial partners