



FINLAND

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INTRODUCTION AND BACKGROUND

Sustainability and predictability are characteristics of the energy policy objectives. During the past few years, Finland has been, for example, one of the leading industrialized countries that utilize renewable energy and especially bioenergy. For more than twenty years, our aim has also been to produce as much electricity as possible in electricity and heat (CHP) co-generation plants. Finland has also managed to set up an exceptionally well-decentralized and versatile energy system that is based on both large and small energy production plants and diverse energy sources.

At the same time, a strong energy technology cluster has been created in our country, and is becoming increasingly important. Finland has been on the international forefront in removing unnecessary regulation and thus has created the preconditions for the internationalization of our energy companies and for the growth of their efficiency.

UPDATE ON MEMBER'S ENERGY FRAMEWORK

UPDATE ON RELEVANT POLICIES

The government of Finland approved a new ambitious climate and energy strategy for Finland in 2008, with detailed insights into climate and energy policy measures up to 2020, and suggestions up to 2050. The strategy clearly proves that the objectives proposed by the European Commission for Finland regarding the reduction of emissions, promotion of renewable energy, and enhancing the efficiency of energy consumption, cannot be attained without new, prominent climate and energy policy measures. In order to attain the set objectives, the efficiency of energy consumption must be enhanced, particularly in housing, construction, and transport. The goal for renewable energy is to increase market share to 38% by 2020. Challenging objectives cannot be attained by implementing individual measures alone, but society as a whole must undergo fundamental change.

A new subsidy scheme (feed-in tariff scheme) has been established in Finland to promote the production of electricity based on wind power, biogas, and wood-based fuel. The Finnish act on production subsidy for electricity produced from renewable energy sources was approved but it must also be approved by the Commission of the European Union. The Biofuels Obligation Act is meant to promote the use of biofuels in automobiles. The target is to raise the share of renewable energy in transportation to 20 per cent by 2020.

UPDATE OVERVIEW ON RELEVANT PROGRAMS AND PROJECTS

Tekes—the Finnish Funding Agency for Technology and Innovation—is the most important publicly funded expert organization for financing research, development, and innovation in Finland with a budget of roughly €600M. The share of energy and climate friendly technologies is €180M. Tekes' programs have proven to be an effective form of cooperation and networking for businesses, universities, and research institutes wishing to develop innovative products, processes, and services.

VITAL STATISTICS

EU member state

Population

5.3 million, urbanization 71%

Territory

338000 km² (10% water, 69% forest)

Capital

Helsinki

GDP/capita

34700 EUR

Average Annual GDP Growth

Most Recent Year(s) – percent

Primary Energy Structure 2010

Production

Total production
(heat and power)
141.3 TWh

	% of total
<i>Biomass and peat</i>	38.8%
<i>Coal</i>	29%
<i>Natural gas</i>	33.4%
<i>Nuclear</i>	21.9%
<i>Hydropower</i>	12.8%
<i>Oil</i>	3.8%
<i>Others</i> (waste, windpower)	1.6%

**Electricity** HYDROGEN R,D&D SPECIFICS**Production**

Total production 77 TWh

% of total

Nuclear	28.4%
Natural gas	14.2%
Coal	18.5%
Biomass and peat	20.3%
Hydropower	16.6%
Waste incineration	0.9%
Oil	0.7%
Wind power	0.4%

Imports

16 TWh

Exports

5 TWh

**Total Demand/
Consumption**

87.5 TWh

(renewables 31%, CO₂-free 59%)

PROGRAMS, PROJECTS, INITIATIVES IN BRIEF

Status and accomplishments

The Tekes' (www.tekes.fi) Fuel Cell and Hydrogen National Technology Program (Fuel Cells 2007–2013, www.tekes.fi/en/fuelcell) aims to improve opportunities for Finnish industry to create breakthrough products in selected fuel cell product segments. The overriding idea is to develop solutions, value networks, and roadmaps ranging from fuels to end applications including hydrogen refueling infrastructure.

In 2010, the thematic group organized a workshop focusing on Finnish hydrogen activities. As a result of the workshop, a roadmap to hydrogen economy and infrastructure was drafted. Luckily, the Woikoski Company took the lead and started to develop a concept for a movable hydrogen filling station, which will be an important piece in future demonstration projects.

Tekes Fuel Cell Programme launched a major demonstration project Demo2013 to demonstrate its results in Port of Helsinki in 2013. The target is to show all kinds of applications in action in the harbor area including power plant, back-up power, and material handling equipment such as forklifts, straddle carriers, and hydrogen fueling stations. All key players are committed to continue their development to be ready for the long term field tests in 2013.

Tekes' Fuel Cell Program is Finland's commitment to the European Joint Undertaking on Fuel Cells and Hydrogen (FCH JU).

Participation

The Äetsä Hydrogen Village initiative is a Finnish pioneer trying to promote hydrogen in Finland. The name comes from the Kemira Chemicals chlorine factory in this village, where the electrolysis process gives as much as over 6000 t/a hydrogen as side product.

Three demos were chosen, a MW-size fuel cell power plant to heat up the whole Äetsä village and to provide electricity for the electrolysis process, some demo cars for positive public image, and a wind hydrogen system to show the potential of private or distributed production of hydrogen. All the demos proceeded on a wider front than ever expected. The MW power plant is on its way to being realized. The demo car project has been merged as part of a wider Finnish Hydrogen Road project.

Last but not least, the Pirkanmaa province in the southwestern part of Finland joined the European HyRaMP project which has to do with European regions and municipalities partnership for hydrogen and fuel cells.

Among specific hydrogen-oriented basic research projects, major activities are directed to solar energy conversion via photosynthesis, utilization of by-product hydrogen, and development of the hybrid sulfur cycle.

The project on solar energy conversion in photosynthesis (University of Turku) focuses on the harnessing of solar energy for biohydrogen production using cyanobacteria. Modification of distinct bioenergetic pathways was shown to result in the enhancement of H₂ production in Synechocystis cells. Tampere University of Technology studies hydrogen production from cellulose and sugars by dark fermentation, using completely stirred tank

reactors, and the metabolic pathways and microbial consortia were successfully optimized through process parameters and the monitoring of microbial community dynamics using molecular methods (HIA Task 21).

Within IEA framework, Finland directly takes part in the HIA Task 25 “High-temperature processes for hydrogen production.” Aalto University Foundation and Outotec Corp. in the project aimed on advanced materials solutions for hybrid-sulfur cycle have recently patented the new “open cycle” (Fig. 1), which has a potential of annual co-production of hydrogen up to 4 million tons worldwide.

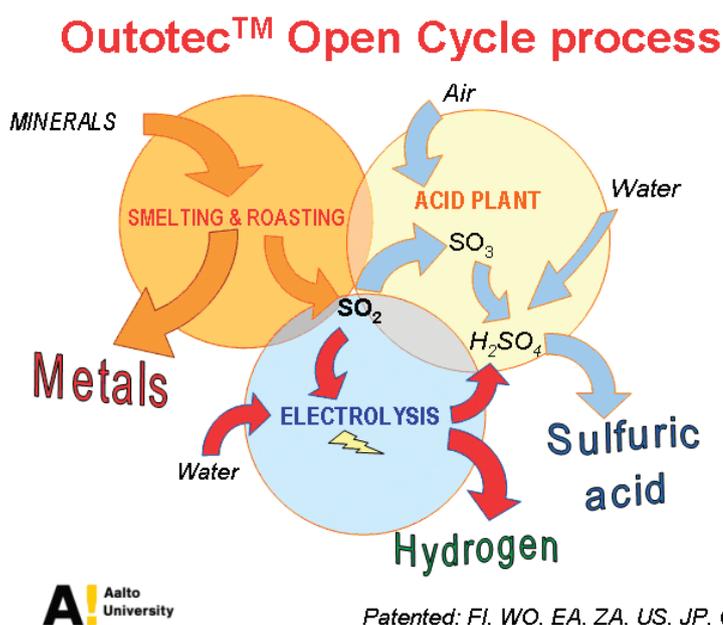


Fig. 1. The new “open cycle” process based on cogeneration of hydrogen and sulfuric acid.

Funding

Tekes Fuel Cell Program (2007–2013) gives governmental funding for Finnish research organizations and companies. The total volume is about 140M€ of which the governmental share is 50M€. To date (2010), Tekes has funded 32M€ for 34 projects of which 17 were new in 2010. More than 60 Finnish companies have already joined the Program’s projects.

REFERENCES

MEMBER WEBSITE

- Tekes, Finnish Funding Agency for Technology and Innovation - www.tekes.fi
- Research. FI - www.research.fi/en
- The CLEEN Ltd - www.cleen.fi
- Aalto University Foundation - www.aalto.fi
- VTT Technical Research Centre of Finland - www.vtt.fi

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