

## DENMARK

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### INTRODUCTION AND BACKGROUND

”Our Future Energy”

The new Danish government, which was elected in mid-2011, wishes to continue the clear course towards a society independent of fossil fuels. The new government has launched a new plan, “Our Future Energy,” that increases the already ambitious goals for how fast society should convert to 100% renewable energy. The new main milestones are:

- 2020: 50% of the traditional consumption of electricity is covered by wind power
- 2030: No more use of coal in Danish power plants and phase out of oil burners
- 2035: All supply of electricity and heat is based on renewable sources
- 2050: The Danish energy supply is 100% based on renewable energy. That applies to all sectors, such as electricity, heating, industry, and transport.

In order to reach these goals, three focus areas are of vital importance: Energy efficiency, electrification (smart grids, electric cars and heat pumps), and expansion of renewable energy. Further research, development, and demonstration of the new technologies are required.

Increased efforts to improve the energy efficiency of households and industries will be brought about by raising the energy savings target that energy companies have to implement among their consumers. A new strategy for energy renovation of existing buildings will include minimum requirements for building components. Subsidies will be available for green energy renovation of housing.

Promotion of electrification will be realised by expanding the capacity of transmission lines to neighbouring countries. Smart grids will be enabled by agreement with energy companies for installing intelligent electricity meters. Incentives will increase demo projects with dynamic tariffs.

Substantial subsidies are expected to accelerate charging network for electric vehicles.

Biogas will be given access to new outlets through support that allows biogas to be used for industrial applications and concentrated to meet natural gas standards.

### UPDATE ON MEMBER’S ENERGY FRAMEWORK

Public funding of hydrogen and fuel-cell R,D&D continued to increase during the last 10 years. From 2009 to 2011, the national funding increased from 130 million DKK to 190 million DKK, equal to around 50% in two years.

### VITAL STATISTICS

#### EU Member since 1973

(Faroe Island and Greenland are not members of EU)

#### Population

5.56 million

#### Territory

43,098 km<sup>2</sup>

#### Capital

Copenhagen

#### GDP/capita

315,000 DKK (2010)

#### Average Annual GDP Growth

(Source: Statistics Denmark)

2007: 1.5%

2008: -1.5%

2009: -5.8%

2010: +1.3%

#### Primary Energy Structure 2010

##### Production

**Total production: 983 PJ**

Oil: 523 PJ (53%)

Natural gas: 307 PJ (31%)

Renewables: 137 PJ (14%)

Waste: 16 PJ (2%)

Total: 140 PJ (2010)

##### Imports

Oil: 117 PJ (51 %)

Coal: 112 PJ (49 %)

##### Exports

Oil: 335 PJ (72%)

Natural gas: 132 PJ (28 %)



## Electricity HYDROGEN R&D&D SPECIFICS

### Production

Total:	140 PJ (2010)
Coal:	44% of total
Natural gas:	20% of total
Renewables:	32% of total
	- Wind: 20%
	- Biomass: 11%
	- Biogas: 1%

### Total Demand/ Consumption

Total end user consumption	2010:	662 PJ
Oil:	286 PJ (43%)	
Natural gas:	75 PJ (11%)	
Coal:	6 PJ (1%)	
Renewables:	60 PJ (9%)	
Electricity:	115 PJ (17%)	
District heating:	119 PJ (18%)	
Transport:	32%	
Industry:	21%	
Commercial:	14%	
Residential:	32%	

Realisation of the new national energy plan with a high percentage of renewable energy includes handling of considerable balancing problems. This has increased focus on development of efficient electrolysers. A number of projects with electrolysers have received public funding lately. Notably, a couple of projects are based on the "Power to Gas" concept; that is, how to store surplus renewable power as gas (hydrogen or methane) in the gas network, including caverns. A key component is an SOEC electrolyser, which has the potential to enable high system efficiencies above 80%.

A national field test of hydrogen in polymer distribution pipes for natural gas is now running in its third phase. The test project began in 2003. In phases 1 and 2, samples have been analysed annually for possible material deterioration. The tests are carried out in a small grid at Danish Gas Technology Centre. Hydrogen is circulated in the grid under conditions similar to real operation. The results from phases 1 and 2 are quite positive. Due to some minor uncertainties in the development of polymer material characteristics, a third test phase was decided upon. Based on the project results, two smaller hydrogen grids with polymer pipes have been put into operation in Denmark, and a third grid is expected in 2012 (as a part of the Danish fuel-cell based micro-cogeneration program). The phase 2 report is available from the DGC's website.



A new test centre for hydrogen and fuel cells in Hobro has also been approved, and it will be operational in 2014. Funding consists of regional and EU support. Its main task will be to support the local fuel-cell industry cluster with testing and certification, according to European directives and international standards.

During 2011, the first 700 bar hydrogen filling station in Denmark was opened in Holstebro. Subsequently a couple of Hyundai fuel-cell cars were acquired for demonstration purposes.

The national network for hydrogen in the transport sector continues to arrange workshops on the Danish and Scandinavian future. The most recent was held in December 2011. A brief introduction is available through the presentations available at the website [www.hydrogenlink.net](http://www.hydrogenlink.net).



## ENDNOTES

Danish Energy R&D projects (database): [http://iis-03.risoe.dk/nethtml/risoe/ENS/efp\\_uk.htm](http://iis-03.risoe.dk/nethtml/risoe/ENS/efp_uk.htm)

Denmark in figures 2011 (report): <http://www.dst.dk>

Key energy statistics 2010 (report): <http://www.ens.dk>

## REFERENCES

Danish Gas Technology Centre ([www.dgc.dk](http://www.dgc.dk))

Danish Energy Agency ([www.ens.dk/en-us](http://www.ens.dk/en-us))

Partnership for hydrogen and fuel cells ([www.hydrogennet.dk](http://www.hydrogennet.dk))

National network for advancing hydrogen for transport in Denmark ([www.hydrogenlink.net](http://www.hydrogenlink.net))

## CONTACT INFORMATION

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