

Facts 2006

Energy and water resources in Norway

Ministry of Petroleum and Energy

Visiting address:

Einar Gerhardsens plass 1

Mailing address:

P O Box 8148 Dep, N-0033 Oslo, Norway

Telephone: +47 22 24 90 90

Telefax: +47 22 24 95 65

www.oed.dep.no

E-mail: postmottak@oed.dep.no

Editor: Mats Øivind Willumsen (OED)
Layout: Kerstin Dokken (OED)
Make up and printing: PDC Tangen 2006
Cover illustration: Kerstin Dokken

ISSN 0809-9472

Foreword

This presentation of energy and water resources in Norway is an annual publication from the Ministry of Petroleum and Energy. Stationary energy supply and central aspects of the management of water resources are described in this publication.

Modern society is becoming increasingly dependent on a secure access to energy. Nature has provided Norway with abundant reserves of crude oil, natural gas, water and wind. This energy wealth is important to the welfare of Norway.

This publication provides an overview of the energy resources, management, research, production, transport, trade and use of energy, special emphasis being laid on hydropower. The legislative framework for the energy supply sector in mainland Norway is reviewed. International cooperation in the field is described. This publication is published to provide pure factual information on energy in Norway.

The 'Facts' publication provides a summary of the most important laws and regulations which place a framework around management. This includes the Energy Act, the Water Resources Act, the Industrial Concession Act and the Watercourse Regulation Act.

All production, transport and use of energy have an impact on the environment. Great emphasis is placed on environmental aspects, when making decisions in the energy area. The environmental perspective is described for different areas in this publication.

In an appendix, a more comprehensive presentation of one area in particular is presented each year. This year, the government's work on establishing a value chain for CO₂ is reviewed. A value chain includes the capture of CO₂ from releases, CO₂ transport and use of



CO₂ to increase oil extraction.

Every effort has been made to present the most up-to-date statistical material available. In most areas, the figures are for 2005.

Oil and gas activities on the Norwegian continental shelf are described in other fact sheets from the Ministry of Petroleum and Energy. See its web site at www.oed.dep.no.

This edition went to press on 26 April 2006.

With regards

A handwritten signature in black ink, appearing to read 'Odd Roger Enoksen'. The signature is fluid and cursive, with a long horizontal stroke at the end.

Odd Roger Enoksen

Minister of Petroleum and Energy

1 Introduction

1.1 Summary	9
1.2 State organisation of the management of energy and water resources	10
1.2.1 The Ministry of Petroleum and Energy	10
1.2.2 Norwegian Water Resources and Energy Directorate	12
1.2.3 Norwegian Petroleum Directorate	12
1.2.4 Petroleum Safety Authority Norway	12
1.2.5 Statnett SF	12
1.2.6 Enova SF	13
1.2.7 Gassnova	13

2 Electricity generation

2.1 Hydropower	15
2.1.1 Water inflow	16
2.1.2 Regulation reservoirs	18
2.1.3 Electricity generation	20
2.1.4 Hydropower potential	21
2.1.5 Small hydropower plants	22
2.1.6 Environmental impact of hydropower developments	23
2.1.7 Norwegian expertise in the hydropower sector	24
2.2 Wind power	24
2.2.1 Environmental impact of wind power developments	26
2.3 Gas-fired power	27
2.3.1 Sequestration of CO ₂	28
2.4 Other forms of electricity generation	28
2.5 Taxes and fees in the power sector	28
2.6 The role of the electricity supply sector in the Norwegian economy	31

3 Energy use and heat production

3.1 Energy use	33
3.1.1 Factors influencing energy use trends	33
3.1.2 Trends in energy use	34
3.1.3 Energy use by sector	34
3.1.4 Energy use by usage	37
3.1.5 Measures to limit energy use	38
3.2 Heat production	39
3.2.1 District heating	39
3.2.2 Oil for stationary consumption	41
3.2.3 Biomass	42
3.2.4 Domestic natural gas use	43
3.3 Environmental impact of energy use	45
3.3.1 Emissions to the air from stationary combustion	46
3.3.2 International agreements and obligations	47
3.3.3 Instruments to limit emissions of pollutants and greenhouse gases	48
3.4 More on Enova SF and management of the Energy Fund	50
3.4.1 Goals for Enova activity	50

3.4.2 Heating	51
3.4.3 Wind power	51
3.4.4 Energy saving	51
3.4.5 Results from Enova's work	51

4 The legal framework for hydropower development

4.1 Introduction	53
4.2 Special legal framework for hydropower development	53
4.2.1 Protection plans and the Management Plan for Water Resources	55
4.2.2 The Industrial Concession Act	56
4.2.3 The Watercourse Regulation Act	57
4.2.4 The Water Resources Act	58
4.3 The Energy Act	59
4.3.1 Administrative procedures pursuant to the Energy Act	59
4.3.2 Local area licences	60
4.3.3 Construction and operating licences	60
4.3.4 Trading licences	60
4.3.5 Marketplace licences	61
4.3.6 Licences to trade power with other countries	61
4.3.7 District heating systems	61
4.3.8 Responsibilities for system coordination, rationing and delivery quality	62
4.3.9 Energy planning	62
4.3.10 Contingency planning for power supplies	62
4.4 Other legislation	63
4.4.1 The Planning and Building Act	63
4.4.2 Competition legislation	63
4.4.3 Natural gas legislation	63
4.4.4 User protection and power contracts	64
4.4.5 The Pollution Act	65
4.4.6 Other legislation	65

5 Owners and organization of power supplies

5.1 Owners and forms of business organisation	67
5.1.1 Owners	67
5.1.2 Forms of business organisation	67
5.2 Organisation and restructuring of the power supply sector	68
5.2.1 Organisation	68
5.2.2 Restructuring the power industry	69
5.3 Companies in the different operating categories	70
5.3.1 Generating companies	70
5.3.2 Grid companies	71
5.3.3 Vertically-integrated companies	71
5.3.4 Trading companies	71
5.3.5 Power brokers	72
5.4 Statnett SF	72
5.5 Key financial data for the power supply sector	73

6 The transmission grid	
6.1 Introduction	75
6.2 Regulation of monopoly operations	76
6.2.1 Income caps	76
6.2.2 Point tariffs	78
6.2.3 Input tariffs	79
6.2.4 Point tariffs for electricity consumption	79
6.3 Environmental impact of electricity transmission	81
7 The power market	
7.1 How the power market functions	83
7.2 Power trading	83
7.2.1 Nord Pool - the Nordic power exchange	84
7.2.2 Managing bottlenecks in the grid	86
7.2.3 The balancing market	86
7.2.4 The end user market	87
7.3 Price formation	89
7.4 International power trading	90
7.5 Electricity output in the Nordic countries	92
8 Research and development	
8.1 Research and development	95
8.2 Research programmes	95
8.2.1 Renergi – clean energy for the future	95
8.2.2 Other strategic research	97
8.2.3 Climit – eco-friendly gas-fired power technology	97
8.2.4 Administration-related energy and watercourse research	98
8.3 International research and development	98
8.3.1 The EU 6th Framework Program for Research	99
8.3.2 The International Energy Bureau	99
8.3.3 Nordic Energy Research	99
8.3.4 Other international collaborations	100
8.4 More information on hydrogen as an energy carrier	100
8.4.1 Norwegian investments in hydrogen	101
9 International cooperation	
9.1 The EEA agreement	103
9.1.1 Regulations for the single market	103
9.2 Participation in EU energy programmes	106
9.3 Nordic cooperation	107
9.4 Baltic cooperation	108

9.5 Economic Commission for Europe (ECE) _____ 108
 9.6 European Energy Charter _____ 108
 9.7 Cooperation with Russia and the Barents Area _____ 108
 9.8 The International Energy Agency (IEA) _____ 109
 9.9 Development cooperation and assistance in the field of public administration 110
 9.10 Global processes within renewable energy _____ 111

10 Water resource management

10.1 Introduction _____ 113
 10.2 Administrative responsibilities for water resource management ____ 113
 10.3 Legal framework _____ 114
 10.3.1 Water resources legislation _____ 114
 10.3.2 The licensing system pursuant to the Water Resources Act ____ 114
 10.3.3 Other administrative authorities and legislation _____ 115
 10.4 The Water Resources Act _____ 116
 10.4.1 General principles _____ 116
 10.4.2 The licensing system _____ 116
 10.4.3 Special provisions relating to works in protected watercourses_ 116
 10.5 Ground water _____ 117
 10.6 Preserving installations in watercourses as part of the cultural heritage __ 117
 10.7 The Water Framework Directive _____ 118

Appendix 1

Energy definitions, conversion factors and the theoretical energy content of various fuels _____ 120

Appendix 2

Challenges linked to establishing a CO₂ value chain. _____ 121

Appendix 3

Key figures for the energy sector for 2005 _____ 126

Appendix 4

Transmission capacity in the Nordic region (MW) _____ 127

Appendix 5

Publications from the Energy and Water Resources Department in 2005 _ 128

Appendix 6

Useful internet addresses _____ 129