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REPORT

including an analysis of the implementation of quantitative targets and the results achieved in the production of electricity from renewable energy sources

Warsaw, December 2007

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1. Legal basis

This report complies with the provisions of Article 9f(4) of the Energy Act of 10 April 1997 (Journal of Laws 2006, No 89, item 625, as amended), and with the obligations under Article 3(3) of Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market. Pursuant to Article 3 of this Directive, Member States of the European Union are required to publish, for the first time not later than 27 October 2003, and thereafter every two years, a report including an analysis of the progress in meeting the national indicative targets for the production of electricity from renewable energy sources.

2. Objectives of the report

The objective of the present report is to analyse and assess the results of the measures implemented to promote the production of electricity from renewable energy sources (RES), including measures taken as a result of commitments on climate change.

The most important objectives of Poland's energy policy are to ensure a reliable supply of fuels and energy, strengthen economic competitiveness and minimise the harmful effects of the energy sector on the environment. One of the elements contributing to the achievement of these priorities is an increase in the use of renewable energy sources, which results in a decrease in the Polish economy's dependence on imported energy carriers and reduces air pollution by preventing emissions of pollutants that are produced when conventional energy carriers are used.

The strategic objective of Poland's energy policy is to increase the use of RES so that electricity produced from RES accounts for 7.5% of the country's gross electricity consumption by 2010, and to increase its use further by 2020. This objective is to be achieved in such a way that the use of specific types of RES contributes to competition, promoting the most cost-effective sources, but without resulting in an unreasonable increase in energy prices for consumers. The projected share of electricity produced from RES is in line with the indicative quantitative target established for Poland in Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.

The data used in this report are taken from the Polish energy regulator (Urz•d Regulacji Energetyki), Agencja Rynku Energii S.A. and the National Administrator for the Emissions Allowance Trading Scheme.

3. Indicative targets

Table 1 shows the percentage share of Polish gross electricity consumption which must be produced from RES in order to achieve the indicative target for 2010 in accordance with Directive 2001/77/EC.

Table 1

Targets set for the share of electricity from RES in Poland's gross electricity consumption

Year	Share of electricity from RES, %
2001	1.9
2002	2.0
2003	2.2
2004	2.3
2005	2.5
2006	3.0
2007	3.9
2008	5.0
2009	6.2
2010	7.5
2011	7.5
2012	7.5
2013	7.5
2014	7.5

4. Electricity production from renewable sources

Experts believe that biomass (energy crops, firewood, waste from agriculture and industry,) biogas, wind power and hydropower are the sources offering the greatest potential for use in Poland within the framework of the current aid mechanisms. Due to its low cost-effectiveness for electricity production, solar energy technology can play an important role mainly in heat generation, as well in electric power grids on islands which are not connected to the national grid. Next in line is the use of geothermal sources. However, due to lack of experience with electricity production from such sources, implementation of geothermal prototype projects in the immediate future is anticipated only in local CHP plants.

Table 2 shows the installed capacity for different RES technologies for the period 2002–06.

Table 2

Installed capacity at RES power plants 2002-06

Installed capacity [MW]	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half 2007**[2]
Hydropower	**840**	**873**	**881**	**922**	**931**	**932**
Large-scale (≥10 MW)	630	**637**	**638**	664	666	670
Small-scale (<10 MW)	210	236	**243**	**258**	265	262
Biomass	**1**	**17**	**52**	**190**	**239**	**265**
Biomass power plants and CHP plants	**1**	**17**	**52**	**190**	**239**	265
Power plants and CHP plants – co-incineration	**-**	**-.**	**n.a.**	**n.a.**	appro x.	n.a.
Biogas	**15**	**18**	**22**	**33**	**35**	**43**
Landfill gas	**15**	**15**	**17**	**24**	**27**	30
Sewage treatment plant gas	**-**	**2**	**3**	**7**	**7**	13
Agricultural biogas	**-**	**1**	**2**	**1**	**1**	1
Wind power	**59**	**60**	**65**	**124**	**173**	**240**
Total	**915**	**967**	**1020**	**1269**	**1378**	**1480**

Electricity from RES] as a share of Polish gross electricity consumption increased from 2.02% in 2002 to 2.80% in 2006.

Table 3 shows the quantity of electricity produced from RES and its share in gross electricity consumption for the period 2002–06.

Table 3

Electricity from RES as a share of Poland's gross electricity consumption

	2002	**2003**	**2004**	**2005**	**2006**
Electricity production from RES (GWh)	2767	2250	2893	3760	4222
Gross electricity consumption in Poland (GWh)	137057	141463	144831	145749	150706
Percentage of electricity from RES	**2.02%**	**1.59%**	**2.00%**	**2.58%**	**2.80%**

RES electricity as a percentage of Poland's total electricity consumption has increased, albeit unevenly, since 2002. Most of the growth took place in the last two years following the introduction of green certificates, which created the right conditions for investment in RES.

[1] Data taken from Agencja Rynku Energii S.A for 2002-06 and the Polish energy regulator (Urz•d Regulacji Energetyki) for the first half of 2007.
[2] Estimates.
[3] Installed capacity of units in which fossil fuels are co-incinerated with biomass (not included under "Total").
[4] Data taken from Agencja Rynku Energii S.A for 2002-03 and the Polish energy regulator (Urz•d Regulacji Energetyki) for 2004-06 and the first half of 2007.

In 2006 electricity production from renewable sources exceeded 4 TWh for the first time. Table 4 and figure 1 show the quantity of electricity generated from different RES for the period 2002–06.

Table 4

Quantity of electricity produced from different types of RES 2002–06[4] (GWh)

Type of RES	**2002**	**2003**	**2004**	**2005**	**2006**	1st half of 2007[2]
Hydropower	2279	1672	**2081**	2176	2030	1214
Biomass	379	398	**604**	1345	1818	994
Biogas	48	56	**66**	104	117	70
Wind power	61	124	142	135	257	236
Total	**2767**	**2250**	**2893**	**3760**	**4222**	**2514**

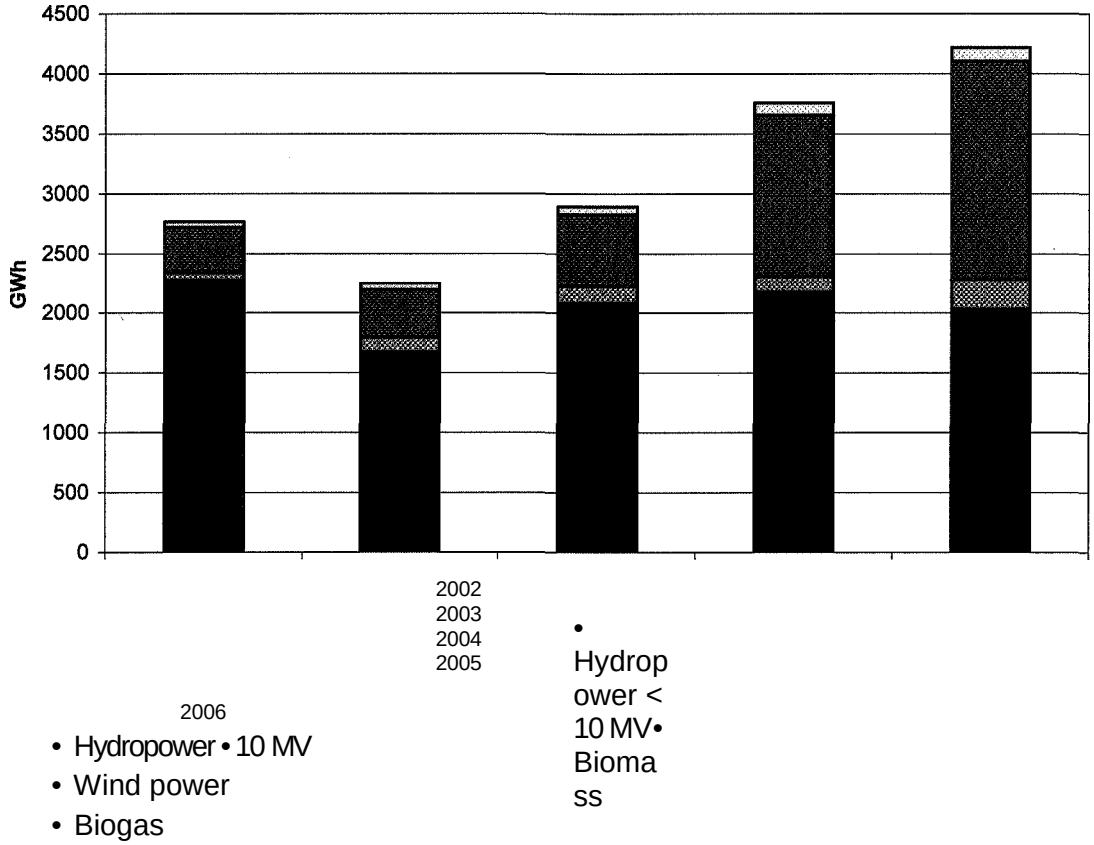


Figure 1 Quantity of electricity produced from different types of RES 2002–06[4] (GWh)

The structure of electricity production from RES in 2002–06 shows that the largest share is accounted for by hydropower and biomass power plants and CHP plants, followed by wind and biogas, which play significant roles. Less electricity was produced from RES in 2003 than in 2002 despite the fact that installed capacity increased. This was caused by meteorological conditions, which led to a reduction in electricity production at hydropower plants. A significant increase in the production of electricity using biomass, biogas and wind power took place in 2004-06.

5. Emission prevention by using renewable energy sources within the framework of Poland's commitments in the area of climate change

Poland has long been reducing its emissions of greenhouse gases. The main factor bringing down such emissions has been the decrease in consumption of primary energy in the economy (by approx. 30% from the reference year 1988). At the same time, the structure of fuel use has changed towards less use of coal and increased use of RES

Figure 2 and Table 5 show the quantities of greenhouse gases emitted in Poland in the period 1988–2005.

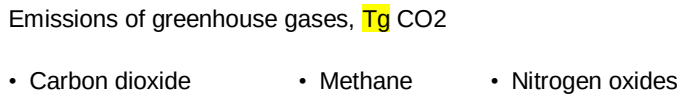


Figure 2 Total emissions of greenhouse gases in Poland 1988–2005, expressed in CO2 equivalents

Table 5

Total emissions of greenhouse gases in Poland 1988–2005

Greenhouse gases[5]	1988	2000	2001	2002	2003	2004	2005
				(Tg)			
Carbon dioxide	494.9	333.3	330.8	317.6	330.9	325.4	326.5
Methane	2.345	1.887	1.831	1.801	1.827	1.815	1.824
Nitrogen oxides	0.137	0.101	0.102	0.097	0.097	0.098	0.100
			Expressed in CO2 equivalents (Tg)				
Carbon dioxide	494.9	333.3	330.8	317.5	330.9	325.4	326.5
Methane	49.2	39.6	38.4	37.8	38.4	38.1	38.3
Nitrogen oxides	42.5	31.4	31.5	20.0	30.2	30.4	31.1
Halogenated							
HFCs	0.026*	0.595	1.073	1.523	1.825	2.436	2.750
PFCs	0.250*	0.224	0.270	0.287	0.278	0.285	0.261
SF_6	0.013*	0.016	0.018	0.021	0.019	0.023	0.024
Total (Tg CO2)	**586.9**	**405.1**	**402.1**	**387.2**	**401.6**	**396.6**	**399.0**

* data for 1995 (reference year for industrial gases)

The major greenhouse gas emitted in Poland is carbon dioxide, coming mainly from the combustion of fossil fuels. According to data for 2005, the largest emission of greenhouse gases came from the combustion of fuels in energy production processes (82.1%), then from agriculture (8.7%), industrial processes (5.9%), landfilled waste (3.1%) and the use of solvents and other products (0.2%).[6]

Table 6 shows the quantity of emissions of CO2 which were avoided during 2000–2006 by replacing conventional power plants and CHP plants with RES.

Table 6

Avoided CO2 emissions 2000–06

	Avoided CO2 emissions
Year	**Quantity (Mg)**
2000	2 331 000
2001	2 782 000
2002	2 767 000
2003	2 250 000
2004	2 893 000

[5] Data recalculated by the National Administrator for the Emissions Allowance Trading Scheme in April 2007 in accordance with the latest IPCC guidelines.
[6] Data from the National Administrator for the Emissions Allowance Trading Scheme, October 2007.

2005	3 320 000
2006	3 661 000

6. Specific RES technologies

6.1. Hydropower

Together with biomass, hydropower is the dominant renewable energy source, but its role is diminishing each year in relation to biomass. Electricity production from RES in 2003 was lower than in preceding years due to the fact that precipitation was lower and unevenly distributed over the year. The main increase in capacity over the next few years is expected to take place at small hydropower plants. Given the lack of potential and environmental conditions, there are no plans to build new large hydropower plants in Poland.

Table 7 shows the installed capacity at hydropower plants in the period 2002–2006. Table 8 shows the quantity of electricity produced, and Figure 4 provides a graphical representation of the same data.

Table 7

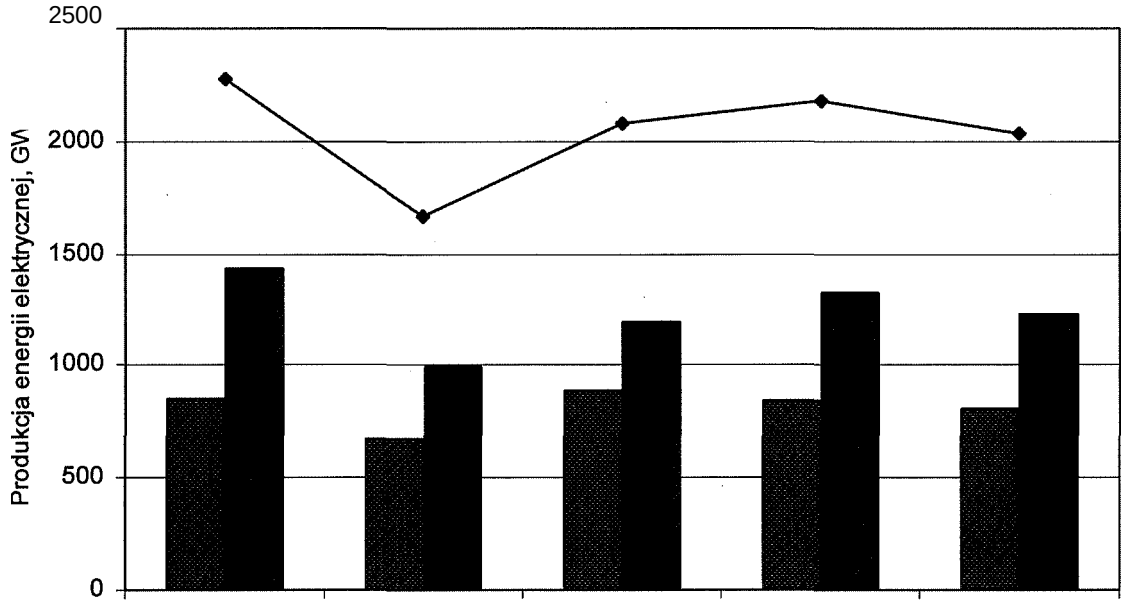
Installed capacity at hydropower plants 2002–06

Hydropower plants	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half of 2007**[2]
Installed capacity [MW]	840	873	881	922	931	932
plant capacity • 10 MW	630	637	638	664	666	670
plant capacity < 10 MW	210	236	243	258	265	262

Table 8

Electricity produced at hydropower plants in Poland 2002–06

Hydropower plants	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half of 2007**[2]
Electricity production (GWh)	2279	1672	2081	2176	2030	1214
plant capacity • 10 MW	1432	998	1191	1330	1227	688
plant capacity < 10 MW	847	673	890	846	803	526



Text on the left axis: Electricity production (GWh)

plant capacity < 10 MW (Small-Scale Hydropower, SHP)
plant capacity > 10 MW
total

Figure 4 Electricity produced at hydropower plants in Poland 2000–06

6.2. Wind power

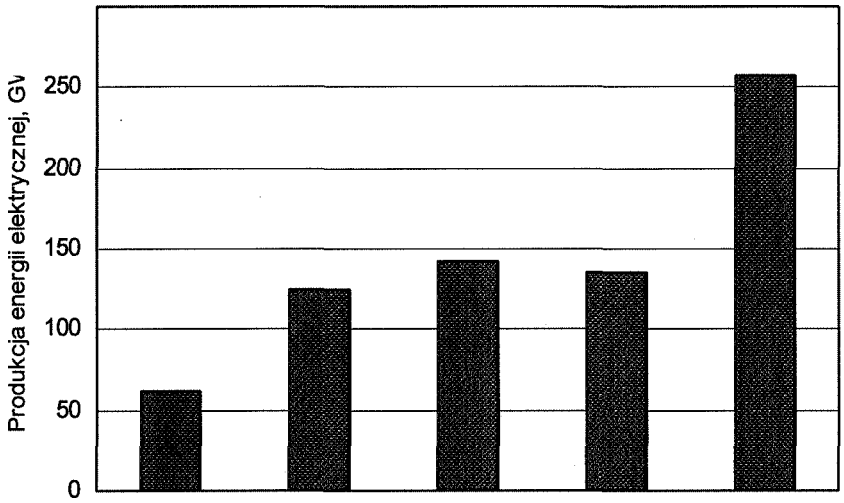
During 2000–06, electricity production at wind power plants increased from around zero, rising to almost 240 GWh in the first half of 2007. In 2006, wind power plants generated 257 GWh, which corresponded to 6.1% of the electricity produced from RES, and 0.17% of the country's gross electricity consumption, although their share of electricity produced from RES is forecast to increase to some 30% by 2010. It is planned to develop wind power both on land and at sea. Initial data for electricity production at wind power plants in the first half of 2007 suggest that electricity production from those sources may be twice that recorded in the previous year.

Table 9 and Figure 4 show the quantity of electricity produced and the installed capacity at Polish wind power plants.

Table 9

Electricity production and installed capacity at wind power plants in Poland, 2002-06

Wind power plants	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half of 2007**[2]
Installed capacity [MW]	**59**	**60**	**65**	**124**	173	**240**
Electricity production [GWh]	**61**	124	**142**	135	257	236



Text on the left axis: Electricity production (GWh)

Figure 4 Electricity production at wind power plants in Poland

6.3. Biomass

1818 GWh of electricity was produced from biomass in 2006. This was more than 1628 GWh more than in 2002, i.e. an increase of more than 400%. Electricity production from those sources is expected to continue growing over the next few years, mainly as a result of an increase in distributed generation based on CHP. Waste biomass and biomass from energy crops should account for an increasing percentage of biomass used in the co-incineration process; accordingly, mechanisms have been introduced requiring biomass other than forestry biomass to be used for this technology. This type of biomass should be used mainly in the timber, pulp/paper and wood board industries.

Figure 5 and Table 10 below show the quantity of electricity produced and the installed capacity at biomass power plants in Poland.

- Total production

- Co-incineration

Figure 5 Electricity production from biomass in Poland,[4] (GWh)

Table 10

Electricity production[4] and installed capacity[1] at biomass power plants 2002-06

Biomass	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half of 2007 2007[2]**
Electricity production (GWh)	379	**398**	604	1345	1818	**994**
Including co-incineration	-	-	**n.a.**	877	1314	727
Installed capacity [MW]	**1**	**17**	**52**	190	239	265

6.4. Biogas

Since 2002, electricity production from biogas has more than doubled, rising from 48 GWh in 2002 to 117 GWh in 2006. Biogas electricity is generated from landfill gas, biogas from the fermentation of sewage sludge at sewage treatment plants and biogas from agricultural biogas plants. In addition to electricity and heat generation (mainly by cogeneration), biogas is expected to be used as transport fuel in future. The first agricultural biogas plant in Poland started generating electricity and heat in 2005. Sources of this type are likely to be developed further in future, using not just animal faeces as a fuel, but also damp biomass from energy crops grown specially for that purpose. There are plans to develop other uses for biogas as well, but in the longer term agricultural biogas plants may dominate the sector because they have the greatest technical potential.

Table 11 shows the installed capacity of biogas power plants and the quantity of electricity produced.

Table 11

Electricity production and installed capacity at biogas power plants in Poland, 2002-06

Biogas	**2002**	**2003**	**2004**	**2005**	**2006**	**1st half of 2007[2]**
Electricity production (GWh)	**48**	**56**	**66**	**104**	**117**	**70**
Landfill gas	**48**	**45**	**50**	**74**	**80**	**46**
Biogas at urban sewage treatment plants	**n.a.**	**8**	**12**	**30**	**35**	**23**
Agricultural biogas	**n.a.**	**3**	**4**	**1**	**2**	**1**
Installed capacity [MW]	**15**	**18**	**22**	**33**	**35**	**43**
Waste gas	**15**	**15**	**17**	**24**	**27**	**30**
Biogas at urban sewage treatment	-	**2**	**3**	**7**	**7**	**13**
Agricultural biogas	-	**1**	**2**	**1**	**1**	**1**

Figure 6 Electricity production from biogas in Poland,[4] (GWh)

6.5. Photovoltaics

The installed capacity of photovoltaic cells in Poland is less than 1 MW and most sources are not connected to the grid. Amendments to Article 9e(5) of the Energy Act, incorporated in February 2007, make it possible to issue certificates of origin for sources which are not connected to the grid, which will promote the wider use of photovoltaic cells. Photovoltaics currently account for an insignificant part of total electricity production from renewable sources because of the very high investment costs involved, and it is solely used for special purposes at present. However, new developments in photovoltaic technology (e.g. enabling the cost-effective production of thin-layer cells) may mean that energy from this source accounts for a greater share of electricity production from renewable sources in future.

7. Promotion of electricity from renewable energy sources

Since 1 October 2005 a new system for promoting electricity from renewable energy sources has been operating in Poland. In accordance with the Energy Act, energy companies selling electricity to end users are required to obtain and present for redemption to the Head of the Energy Regulatory Office a specified number of certificates of origin for electricity produced from renewable energy sources, or to pay substitution fees. The promotion system introduced in Poland in the form of green certificates is a market mechanism supporting optimum development and competition. Separating certificates of origin for electricity produced from renewable energy sources from the energy itself has made it possible to trade the property rights associated with these certificates on the stock exchange.

The counterpart to this mechanism, as a consequence of the physical separation of electricity from the certificates of origin, is the requirement for energy companies which act as vendors of last resort to automatically buy, at the average market price, all the electricity generated from renewable sources which are linked up to the grid and located within the area covered by the vendor of last resort in question.

Legal provisions authorising making it possible to obtain grants and preferential loans awarded by the National Environmental Protection and Water Management Fund and provincial environmental protection and water management funds for investments in RES are also an important factor which contributes to the development of renewable energy. These resources, in accordance with the Environmental Protection Act of 27 April 2001 (Journal of Laws No 62, item 627, as amended), are intended to promote actions to support the use of local sources of renewable energy and to support the introduction of more environmentally friendly energy sources. Funding from the *Ekofundusz* Foundation is also allocated for investments in this area.

Further support for renewable energy is provided by the 2004-06 National Development Plan, which allocates public resources from the EU structural funds and Cohesion Fund. The Infrastructure and Environment operational programme will continue these activities. Under the programme, support will be given to projects involving the construction or capacity expansion of power stations using wind energy, hydropower

in small hydropower plants up to 10 MW, biogas and biomass and projects entailing the construction or capacity expansion of heat generating stations using geothermal or solar energy. The programme also provides for financial support for the development of electricity grids to which new renewable energy sources can be linked.