CONSUMPTION OF ELECTRICITY FROM RENEWABLE RESOURCES BY HOUSEHOLDS AND INDUSTRY IN SWEDEN AND ROMANIA

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Abstract. Renewable electricity production, from sources such as wind power and solar power, is sometimes criticized for being variable or intermittent. However, the International Energy Agency has stated that deployment of renewable technologies usually increases the diversity of electricity sources and, through local generation, contributes to the flexibility of the system and its resistance to central shocks. Sweden is among the five most important countries of the EU-27 group, followed by Romania on eleven, due to installed capacity for power generation using renewable energy. In both countries, it is interesting to study the share of energy produced using renewable energy in total energy output, the efficiency measures are taken and the selling prices of electricity are applied to household and industrial consumers.

Keywords: renewable energy, electricity, electricity prices, electricity production, electricity use

1. Introduction

Harnessing renewable energy is made on three important premises conferred by namely, accessibility, affordability and acceptability.

In the energy sector in most European countries there is a reconsideration of priorities for consumers and increase security of supply of environmental protection, and within this process, renewable energy and offers an affordable solution for medium and long term guaranteed.

The strategic objective proposed by the White Paper for a Community Strategy is to double, by 2010, the contribution of renewable emerge EU member countries, which must arrive gradually from 6% in 1995 to 12 % total consumption of primary resources.

In Romania, the share of renewable in total primary resources consumption in 2010 is to reach about 11 % and 11.2 % in 2015 [4].

Electricity production in Sweden is basically fossil-free. Approximately half of the electricity production comes from hydropower and the remainder is provided by nuclear power.

Despite rising industrial output, the use of oil has fallen from more than 70 % of the total energy supply in 1970 to around 30 % today. This is mainly due to diversification of fuels and more efficient use of energy.

The share of renewable energy sources in the Swedish energy system has increased rapidly during the past decade, from 22 % of the total energy supply in 1994 to 28 % today [15].

2. Electricity supply and use in Sweden

According to Table 1, Sweden produced in 2008, 145962 GWh, less than in 1998 with 8590 GWh. Interesting is that despite decreased overall electricity production, increased electricity production by wind power. In 2008, Sweden produced 1996 GWh electricity by wind power, which means 1 % of total electricity production in 2008, 6.5 times more than in 1998.

Electricity use has increased in the decade 1998-2008 with 125 GWh. This growth is due:

- electricity-usage growth in manufacturing industries, mines and quarries with 1874 GWh;
- electricity-usage growth in services with 541 GWh;
- of reducing power-on agriculture with 519 GWh;
- of reducing power-on households with 1362 GWh;
- of reducing losses with 409 GWh.

Electricity use in Sweden in 2008 is due to a rate of 23 % electricity consumption by households and 39 % electricity consumption by manufacturing industries, mines and quarries.

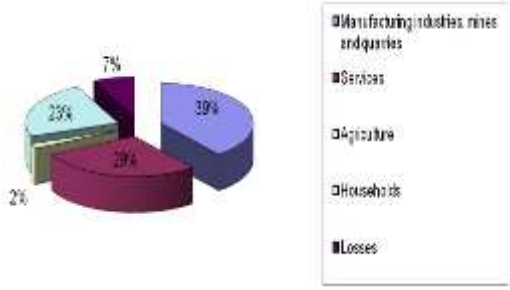

Figure 1. Electricity use in Sweden in 2008

3. Electricity supply and use in Romania

According to the Romanian Energy Regulatory Authority (ANRE), domestic consumption of electricity increased by 6.12 % during March 2009 – March 2010. In the same period households have maintained the same

consumption of electricity (1.02 TWh), while electricity consumption in other types of consumers (industry, services and transport) increased by 7.98 %.

Table 1. Electricity supply and use 1998-2008, in Sweden (GWh) [14]

The table shows the net supply of electricity as well as the use during the year 1998-2008

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Production											
Hydro power	73829	70862	77848	78418	65811	53087	60085	72010	61192	65591	68550
Nuclear power	70500	70200	54772	69211	65550	65454	75000	69764	64983	64279	61266
Conventional thermal power	9915	9354	8797	9524	11265	13315	12889	12260	13152	13406	14151
CHP in industry	4002	3887	4151	3918	4552	4637	4620	4821	5142	5707	6063
CHP in public steam and hot water works	5686	5220	4370	5120	5650	6694	7382	6737	7249	7163	7402
Condensing steam power	224	239	251	462	1033	1882	887	680	749	510	666
Gas turbines and others	3	8	25	24	30	102	0	22	12	26	20
Wind power	308	358	456	482	608	679	850	949	988	1432	1996
TOTAL PRODUCTION	154552	150774	141873	157635	143234	132535	148824	154983	140315	144708	145963
Total production (%)	96.20	94.69	88.57	93.39	87.69	84.51	90.49	92.33	88.88	90.02	91.96
Imports (%)	3.80	5.31	11.43	6.61	12.31	15.49	9.51	7.67	11.12	9.98	8.04
Imports	6102	8456	18308	11164	20110	24286	15646	12868	17547	16051	12754
TOTAL SUPPLY	160654	159230	160181	168799	163344	156821	164470	167851	157862	160759	158717
Use											
Manufacturing industries, mines and quarries	54684	55309	57804	57119	56412	55301	56228	56698	57406	57944	56558
Services	40327	39890	40929	42082	41643	40526	41168	40298	40039	40964	40868
Agriculture	3167	3201	2976	3278	3280	3093	3110	3811	3252	2967	2648
Households	34832	34318	33747	36065	35134	35743	35190	34423	34807	33457	33470
Losses	10865	10570	11094	11802	11882	10701	11024	12357	10860	10691	10456
Total use within Sweden	143875	143288	146550	150346	148351	145364	146720	147587	146364	146023	144000
Exports	16779	15938	13631	18454	14754	11457	17750	20264	11497	14736	14716
TOTAL USE	160654	159226	160181	168800	163105	156821	164470	167851	157861	160759	158716

Table 2. Electricity supply and use
March 2009 – March 2010, in TWh, in Romania [7]

Indicator	March 2009	March 2010	%
1	2	3	4 = 3/2×100
Production	5.19	5.07	97.68
Delivered	4.77	4.66	97.69
Imports	0.09	0.12	133.33
Exports	0.45	0.09	20.00
Domestic consumption	4.41	4.68	106.12
Househlds	1.02	1.02	100.00
Other consumers	2.63	2.84	107.98

In table 3 is apparent that in the next decade is estimated that it will produce 100 TWh, with 41.64 % more than in 2010, which in absolute terms represents an increase of 29.4 TWh. The production of electricity from renewable sources is expected to increase too during 2010-2020 with 1.7 TWh.

Table 3. Evolution of electricity production in Romania in 2003-2020 (projected) (TWh) [12]

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
Total production	56.63 (100%)	56.48 (100%)	59.41 (100%)	62.4 (100%)	62.7 (100%)	65.5 (100%)	67.7 (100%)	70.6 (100%)	72.2 (100%)	74.5 (100%)	89.5 (100%)	100 (100%)
Renewable sources	13.57 (24%)	16.83 (29.8%)	20.21 (34%)	17.75 (28.4%)	16.00 (25.5%)	18.00 (27.5%)	19.50 (28.8%)	21.70 (30.8%)	22.30 (30.9%)	23.00 (30.9%)	26.00 (29%)	32.50 (32.5%)
Nuclear	4.90 (8.7%)	5.55 (9.8%)	5.54 (9.4%)	5.55 (8.9%)	7.00 (11.1%)	10.80 (16.54%)	10.80 (16%)	10.80 (15.2%)	10.80 (15%)	10.80 (14.5%)	21.60 (24.1%)	21.60 (21.6%)
Power plants	38.16 (67.3%)	34.10 (60.4%)	33.66 (56.6%)	39.10 (62.7%)	39.70 (63.4%)	36.70 (56%)	37.40 (55.2%)	38.10 (54%)	39.10 (54.1%)	40.70 (54.6%)	41.90 (46.9%)	45.90 (45.9%)

To produce electricity in the period 2010-2013 has set a budget of 148.5 million Euro [5].

3. Energy Efficiency Measures

In Sweden, since 2006 households can benefit from a 30 % tax credit when converting from direct electric heating and oil-based heating to systems based on bio mass or heat pumps [13].

According to data provided by Swedish Energy Agency [1], exist two mesures in terms of household sector that Sweden implemented to inform and educate people about electricity. “Energy declarations” measure, which began since 2008 has one additional legislation. Sweden

also has taken numerous measures in terms of household heating system with renewable energy.

In industry sector has taken the "EKO Energy - Programme for Efficient Use of Electricity" measure [2] since 2007. The measure type is information, education and training. The semi quantitative impact of these measures was low.

In Romania, since 1st July 2007, all the electric energy and natural gas consumers have become eligible consumers and can choose their own supplier.

The Romanian Energy Efficiency Fund has been established for financing the energy efficiency investments in a revolving system. The Government Ordinance OG no. 22/2008 on energy efficiency and promotion of renewable energy source utilization by the final consumers explicitly stipulates the allocation of funds from the budget for subsidizing the energy efficiency programmes and measures [3].

4. Evolution of electricity prices in Sweden and Romania

The price of electricity to households grew by approximately 155 % during 1998-2009, representing an increase in relative terms 0.0367 Euro per KWh.

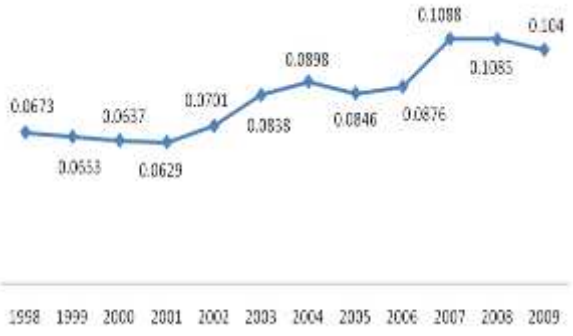

Figure 2. Evolution of electricity prices in period 1998-2009, by medium size households, in Sweden (Euro per KWh) [11]

Electricity price for industry (medium size industries) also increased during 1998-2009. Growth was 1.7 times. Maximum price was recorded in 2003, and was 0.0666 Euro per kWh.

EU has set a target that by 2010, 21 % of electricity be produced from renewable sources such as wind, solar, hydroelectric, geothermal, and biomass.

According to a Eurostat survey, Sweden aims to produce more electricity from renewable energy sources. This could mean that electricity prices could fall in the near future. Of course, assessment is relative because there are many macroeconomic and microeconomic factors that can influence the price of electricity derived from renewable resource.

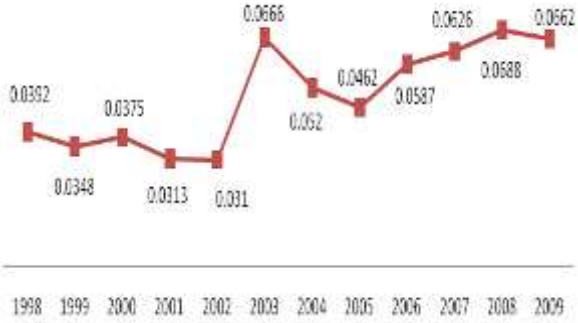

Figure 3. Evolution of electricity prices in period 1998-2009, by medium size industries, in Sweden (Euro per KWh) [11]

According to ANRE (figure 4) in Romania in March 2010 the weighted average price of electricity bought 169.54 lei/MWh, equivalent to 41.39 €/MWh (exchange rate set by BNR at 4.0958 lei/€), the price obtained through "negotiated contracts with other providers". These types of contracts are acquired the largest share of 1183 GWh of electricity.

During the same period analyzed is the more electricity sold through negotiated contracts with other providers (1191 GWh) in a weighted average price of 167.29 lei/MWh, equivalent to 40.84 €/MWh.

According to data published on the official website of the company Electrica S.A. for households, starting with January 1, 2010, applied prices ranging from 0.1256 lei/KWh and 0.7336 lei/KWh [9]. At a fixed exchange rate of BNR (01/01/2010) of 4.2265 RON/€, the average price is 101.64 €/MWh. Prices for industrial consumers is ranging from 0.1229 lei/kWh and 0.8263 lei/kWh [10], which resulted in an average price, expressed in euros, to 112.29 €/MWh.

Although Sweden has a GDP per capita higher than Romania, the electricity charges for household and industrial consumers are lower. The average price charges by Sweden (2009), to electricity is 66.2 €/MWh, while in Romania (01.01.2010) electricity price is 101.64 €/MWh. Average price charges to industrial consumers is 104 €/MWh, while in Romania the average price on electricity is 112 €/MWh.

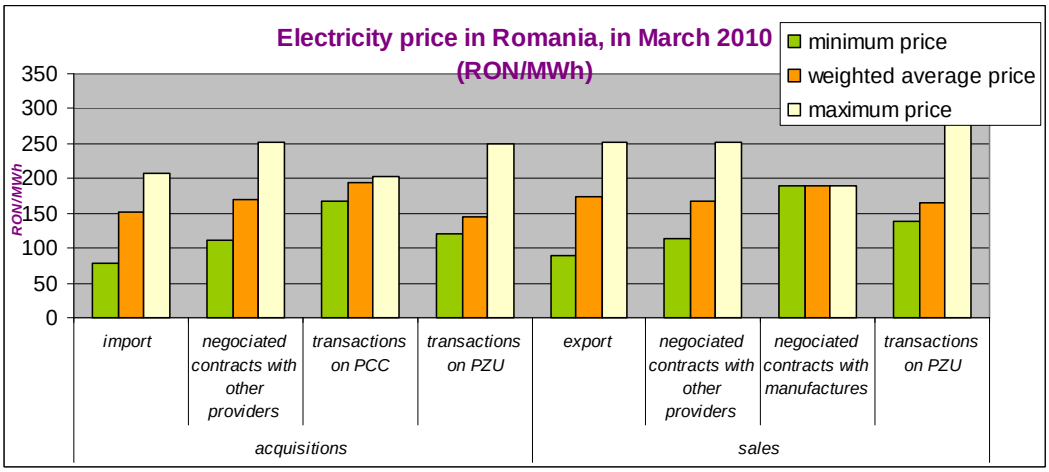

Figure 4. Electricity price in Romania, in March 2010 (RON/MWh)

5. Conclusions

Percentage of electricity produced from renewable energy sources in Sweden was 48.47 % in 2006 and the objective is to increase to 60 % in 2010 while in Romania, the share of renewable in total primary resources consumption in 2010 is to reach about 11 %. Sweden and other European Union member countries made more use of renewable energy investments than Romania. EU directives and Swedish law strongly stimulates households and industrial consumers to consume electricity from renewable energy sources. Romania supported intensive use of renewable energy too, but this support has declined due to strong global economic crisis impact. Since the trend is increasing use of renewable energy into electricity, thus diminishing the power consumption of conventional energy resources (which are limited and so their price increases), we appreciate that electricity prices will drop in next time.

Acknowledgement

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