

REPORT ON SMALL HYDROPOWER STATISTICS:

GENERAL OVERVIEW OF THE LAST DECADE (1990-2001)

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EXECUTIVE SUMMARY

ESHA, the European Small Hydro Power Association, has carried out this report in the framework of the FP 5 EC funded project “Thematic Network on SHP”.

The following report compiles the main statistical information on small hydropower plants in the European Union from 1990 to 2001. The aim of this report is to offer practical and concise information on the development of the SHP sector during the last decade through the statistical analysis. This objective has derived from the real demand of such information (i) to monitor the market development of the sector and (ii) to assess the implementation of the political framework concerning RES in general and SHP in particular. Indeed, little or no statistical information on SHP at European level is available or easily accessible what makes it difficult not only for individuals but also for national bodies to analyse the real situation of the SHP sector.

Small-scale hydro plants include plants with installed capacity less than 10 MW and therefore mini plants (< 1MW) are also included in this publication.

The following report is divided in three parts:

- **Part I** of the report offers a general view of the sector development over the reference period both at European and National level.
- **Part II** concentrates on the importance of SHP in the renewable energy mix over the last decade.
- **Part III** gives an overview of the main legislation promoting RES over the reference period both at European and national level.

SHP statistics in the EU, 1990-2001: Key figures

	Average annual increase per period
SHP installed capacity	8%
SHP electricity generation	12%

All figures of this publication are taken from the EUROSTAT database on SHP, 1990-2001. Special thanks to EUROSTAT for its collaboration.



GLOSSARY

SHP	Small Hydropower
RES	Renewable Energy Sources
EU-15	European Union
MW	Megawatt
GWh	Gigawatt-hour
TWh	Terawatt-hour
ktoe	Thousand tones of oil equivalent
Mtoe	Million tones of oil equivalent



PART I: GENERAL OVERVIEW

a) EU-15 at glance

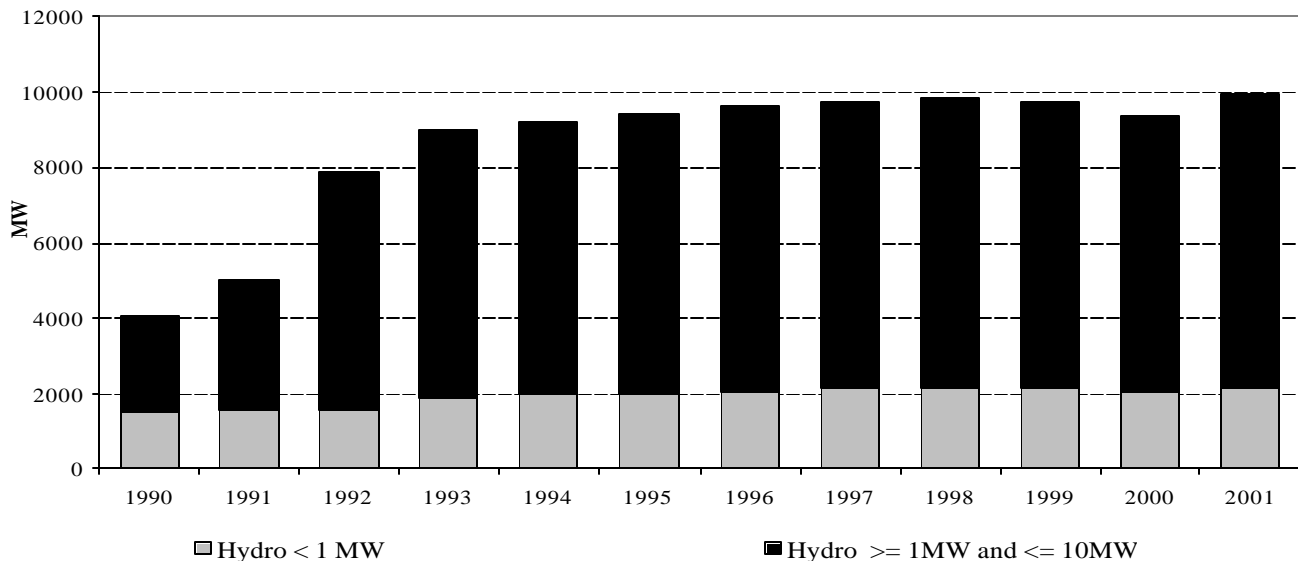
As shown in *table 1*, Small Hydropower (SHP) *installed capacity* in the European Union (EU-15) has more than doubled over the reference period, from 4 032 MW in 1990 to 9 909 MW in 2001. This increase contributed to a higher share in the total electricity installed capacity from 0.81% in 1990 to 1.68% in 2001.

Table EU.1: EU-15 SHP installed capacity, 1990-2001

	Installed capacity, EU-15 MW	Contribution to total electricity installed capacity %
1990	4 032	0.81
1991	5 030	0.97
1992	7 862	1.51
1993	8 943	1.69
1994	9 185	1.72
1995	9 417	1.75
1996	9 654	1.76
1997	9 754	1.75
1998	9 844	1.75
1999	9 751	1.70
2000	9 356	1.60
2001	9 909	1.68

Installed capacity of SHP plants less than 1 MW increased at a lower rate than plants from 1 MW to 10 MW during the reference period in EU-15. While plants less than 1 MW increased by 40% their installed capacity in the EU from 1 514 MW in 1990 to 2 121 MW, plants between 1 and 10 MW tripled their capacity from 2 518 MW in 1990 to 7 788 MW in 2001. *Graph 1* shows this different trend.

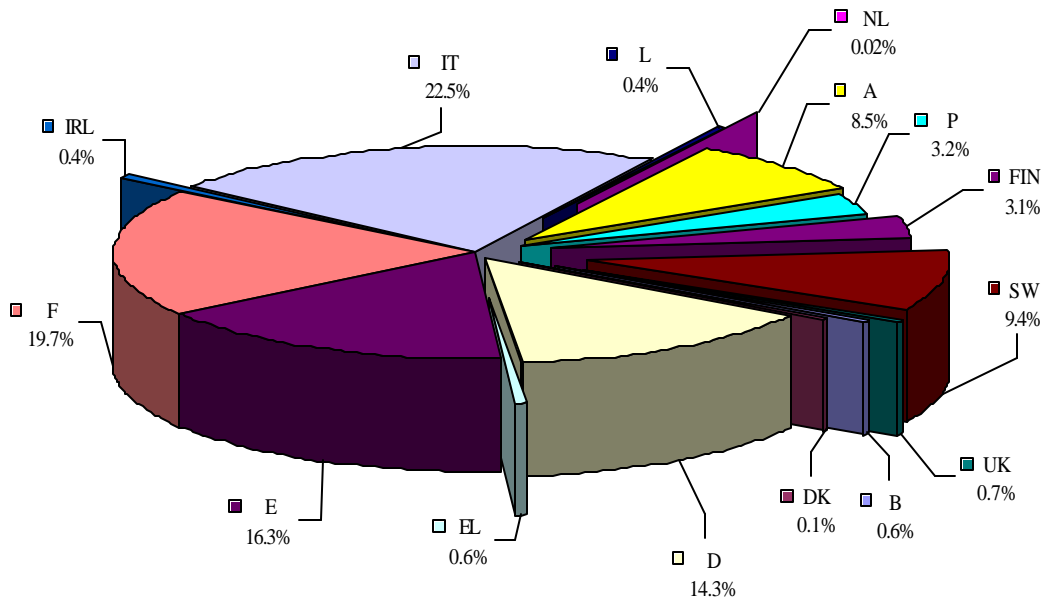
Graph EU.1: EU-15 SHP installed capacity breakdown, 1990-2001





According to 2001 figures, Italy accounted for about 22 % of the total SHP installed capacity in the EU-15 followed by France (20%) and Spain (16%). SHP installed capacity in the Netherlands represented only 0.02% of EU-15 SHP installed capacity in 2001. *Graph 2* illustrates the contribution made by each Member State to the SHP installed capacity in the EU-15 in 2001.

Graph EU. 2: Member States' Contribution to EU-15 SHP installed capacity, 2001



Electricity generation in the EU-15 has increased by 30% over the last decade from 2 060 TWh in 1990 to 2 671 TWh in 2001. Within the electricity mix, electricity produced from SHP in the EU-15 has more than tripled over the reference period from 11 462 GWh in 1990 to 39 729 GWh in 2001, as shown in table 2. While the electricity generation from plants less than 1 MW rose by 39% over the reference period, electricity production increased about five times from plants between 1 and 10 MW during the same period. In 2002, SHP contributed to 1.5% of the total EU-15 electricity generation and by 11% to the EU-15 Hydropower electricity. These figures reveal an increase in the EU-15 electricity mix from 1990 values.

As *table 3* shows, Member State's shares in the EU-15 SHP electricity generation have changed between 1990 and 2001. Some Member States like Germany and France have kept a leading position in the EU-15 context over the reference period. Nevertheless, their shares in the total EU-15 have followed a downward trend as other Member States have favoured the SHP development in last years. This is the case in Italy, Spain and Austria representing about 22%, 11% and 11% of the EU-15 SHP electricity generation in 2001, respectively.



Table EU.2: EU-15 SHP electricity generation, 1990-2001

	Gross electricity generation Hydro < 1 MW GWh	Gross electricity generation 1 MW < Hydro < 10 MW GWh	Gross electricity generation Hydro < 10 MW GWh	SHP contribution to total electricity generation %	SHP contribution to Hydropower %
1990	6 120	5 342	11 462	0.56	4.14
1991	5 128	10 872	16 000	0.72	5.59
1992	5 083	18 194	23 277	1.04	7.62
1993	7 403	26 139	33 542	1.50	10.94
1994	8 210	29 037	37 247	1.64	11.92
1995	8 319	28 824	37 143	1.60	12.04
1996	8 398	29 722	38 120	1.58	12.29
1997	9 107	28 369	37 476	1.54	11.85
1998	8 785	30 018	38 803	1.56	11.86
1999	8 485	29 260	37 745	1.49	11.47
2000	8 179	31 550	39 729	1.53	11.50
2001	8 519	30 878	39 397	1.47	10.80

Table EU.3: Member States' Contribution to EU-15 SHP electricity generation, 1990-2001

	B	DK	D	EL	E	F	IRL	IT	LU	NL	A	P	FIN	SW	UK
1990	0.06	0.24	24.86	0.52	5.98	47.04	0.17	9.11	0.58	0.01	0.00	2.28	9.14	0.00	0.00
1991	0.04	0.23	36.63	0.47	4.49	39.22	0.15	8.54	0.34	0.01	0.00	1.85	8.04	0.00	0.00
1992	0.63	0.12	26.70	0.21	9.30	31.62	0.92	23.21	0.29	0.00	0.00	0.90	6.10	0.00	0.00
1993	0.36	0.12	18.76	0.24	8.57	20.45	0.65	22.67	0.19	0.00	11.92	1.33	3.75	10.98	0.00
1994	0.42	0.09	18.65	0.28	9.11	22.36	0.23	23.67	0.23	0.00	10.43	1.56	3.12	9.83	0.00
1995	0.50	0.08	19.47	0.26	11.43	20.72	0.21	20.03	0.22	0.00	11.04	1.32	3.19	10.27	1.27
1996	0.36	0.05	17.32	0.33	13.88	20.32	0.46	23.23	0.16	0.00	10.94	1.73	2.55	7.69	0.98
1997	0.47	0.05	18.07	0.40	12.52	18.02	0.25	21.68	0.24	0.00	10.96	1.70	2.68	11.66	1.30
1998	0.55	0.07	16.18	0.37	13.48	18.66	0.29	21.44	0.32	0.00	10.70	1.46	3.42	11.46	1.60
1999	0.52	0.08	18.61	0.48	10.31	20.09	0.33	22.79	0.23	0.00	11.26	1.56	2.64	10.48	0.61
2000	0.64	0.07	20.13	0.42	11.17	19.17	0.31	20.43	0.30	0.00	11.08	2.21	3.00	10.52	0.54
2001	0.62	0.07	19.38	0.34	11.26	19.33	0.24	21.97	0.34	0.00	10.81	2.49	2.94	9.66	0.53



Final *electricity consumption* in the EU-15 has increased by 27% over the reference period from 1 793 TWh in 1990 to 2 278 TWh in 2001. As *graph 3* illustrates, most of the electricity is consumed in the industrial sector (about 41% in 2001) followed by households (about 29% in 2001) and the services sector (about 25% in 2001).

Graph EU. 3: Final electricity consumption in EU-15, 1990-2001

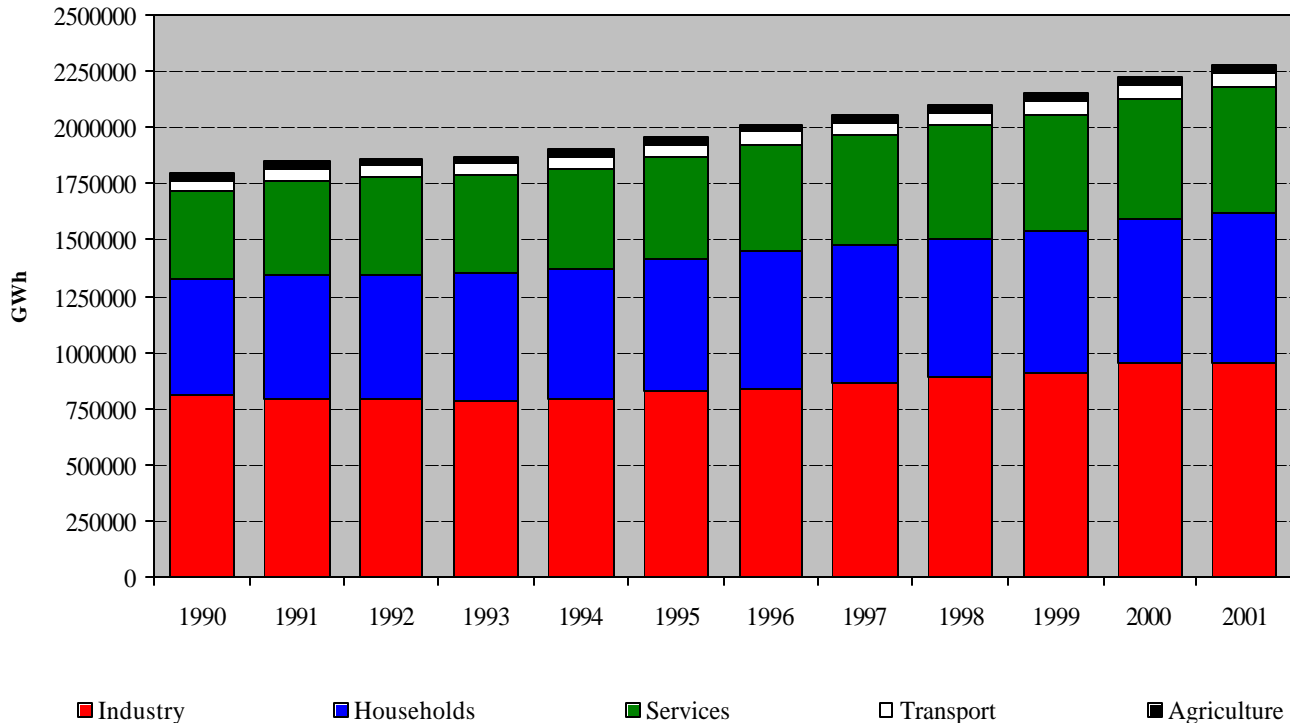


Table 4 shows the contribution of the electricity production from SHP to the final electricity consumption in the EU-15 from 1990 to 2001. As it can be appreciated, SHP contribution to the electricity needs has increased over the reference period but what should be remarkable is to evaluate the contribution that the SHP sector could make to the electricity needs of the Union, specially taking into account that some Member States like Denmark, France, Ireland or Sweden are net importers of electricity.

Table EU.4: SHP Contribution to EU-15 Final Electricity Consumption in %, 1990-2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
EU-15	0.64	0.87	1.25	1.79	1.96	1.90	1.89	1.82	1.85	1.76	1.78	1.73



b) Member States outlook

The following section looks at the situation of SHP (Small Hydro Power) in each Member State, highlighting the main trends in the SHP development over the last decade. *Table 5* offers a general overview:

Table EU.5: Members States SHP Overview, 1990-2001

	SHP Installed Capacity in MW			SHP Electricity Generation in GWh		
	1990	2001	Trend	1990	2001	Trend
B	2	60	up	7	246	up
DK	9	10	stable	27	29	stable
D	360	1421	up	2850	7634	up
EL	30	60	up	60	135	up
E	162	1618	up	685	4436	up
F	1732	1956	up	5392	7617	up
IRL	7	37	up	20	93	up
IT	317	2233	up	1044	8656	up
L	28	40	up	67	133	up
NL	2	2	stable	1	1	stable
A	0	843	up	0	4260	up
P	121	317	up	261	982	up
FIN	298	309	stable	1048	1158	stable
SW	964	935	down	0	3807	up
UK	0	68	up	0	210	up

1- Belgium

Table 1 shows the main statistics regarding SHP *installed capacity* in Belgium during the last decade. SHP installed capacity has multiplied by 30 over the reference period from 2 MW in 1990 to 60 MW in 2001. Although this increase has contributed to a higher share of SHP in the total electricity installed capacity in Belgium, only 0.39% of the total installed capacity corresponded to SHP in 2001. Likewise, the weight of Belgium in the EU-15 SHP installed capacity went up over the reference period but contributed only to 0.61% in 2001.

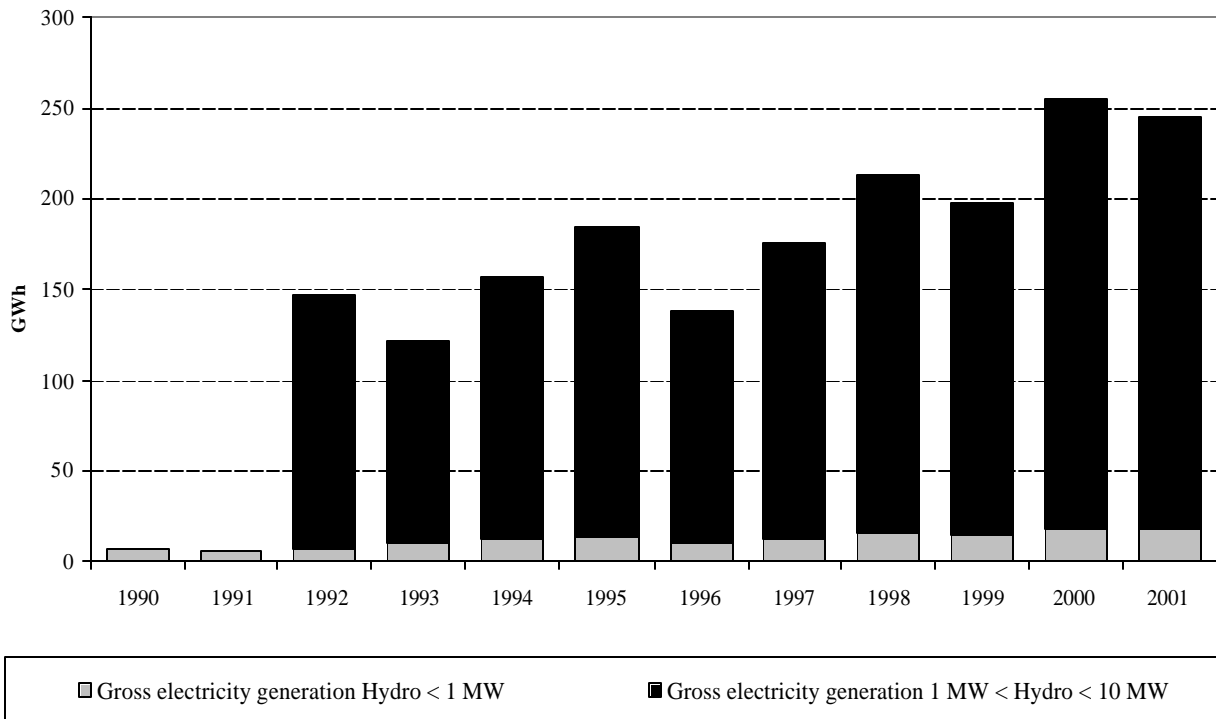
SHP *electricity generation* went up from 7 GWh in 1990 to 246 GWh in 2001. The contribution of SHP to total electricity generation in Belgium has increased from 0.01 % in 1990 to 0.31% in 2001. More remarkable is the SHP share in the electricity generation from hydropower. While in 1990 SHP represented 0.78% of the electricity generated by hydropower, in 2001 almost 15% of the electricity generated by hydropower corresponded to SHP. *Graph 1* illustrates the evolution of SHP electricity generation from 1990 to 2001 distinguishing between plants less than 1 MW and those larger than 1 MW.



Table B.1: Trends in the installed capacity in Belgium, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	2	2	0	14145	0.01%	0.05%
1991	3	3	0	14098	0.02%	0.06%
1992	51	3	48	14038	0.36%	0.65%
1993	49	4	45	14053	0.35%	0.55%
1994	50	5	45	14899	0.34%	0.54%
1995	59	5	54	14916	0.40%	0.63%
1996	59	5	54	14851	0.40%	0.61%
1997	59	5	54	14693	0.40%	0.60%
1998	59	5	54	15395	0.38%	0.60%
1999	60	6	54	15569	0.39%	0.62%
2000	60	6	54	15672	0.38%	0.64%
2001	60	6	54	15528	0.39%	0.61%

Graph B.1: Trends in the electricity generation in Belgium, 1990-2001





2- Denmark

Table 1 shows the main trends in SHP *installed capacity* in Denmark during the last decade. SHP installed capacity has been stable over the reference period at 10 MW while the country's electrical installed capacity has increased by 40%. As result, the contribution of SHP to the total installed capacity went down over the reference period. Likewise, since other Member States have favoured the development of SHP, the contribution of Denmark to the EU-15 installed capacity has followed a downward trend over the reference period.

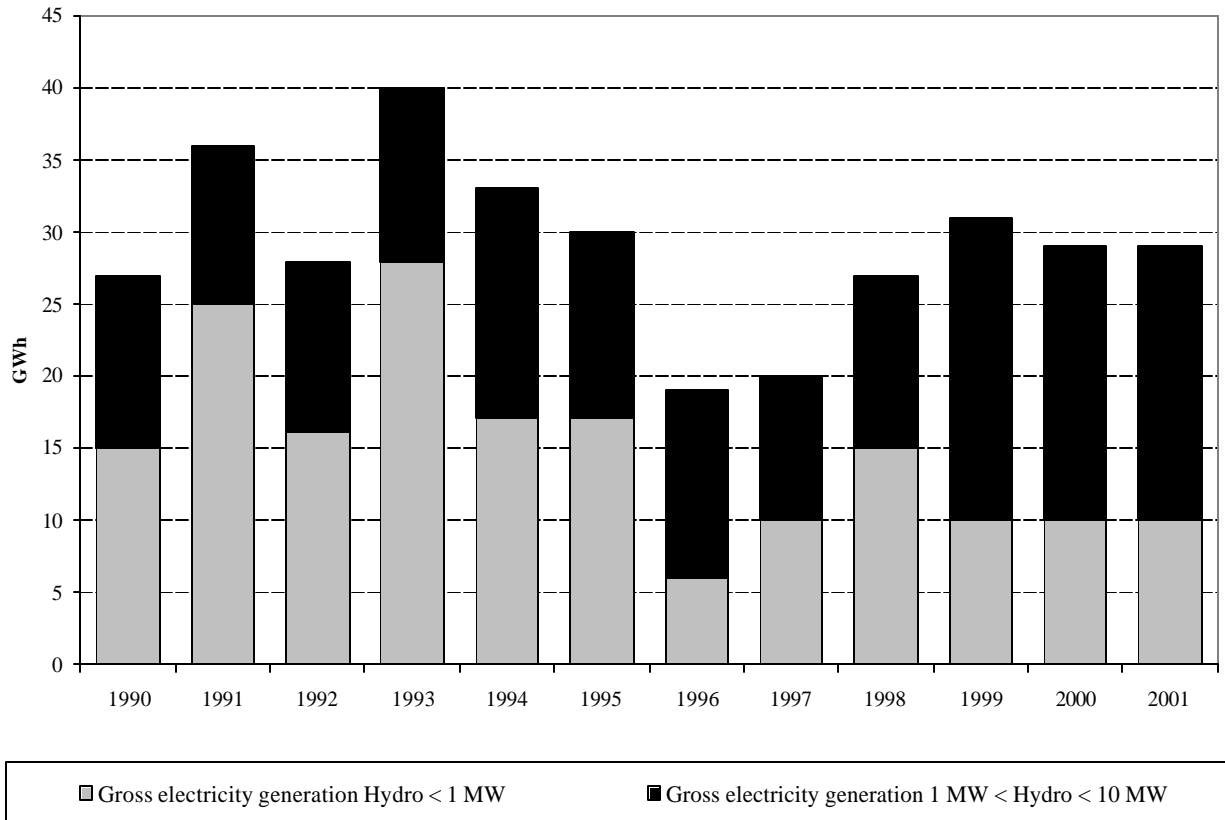
SHP *electricity generation* in Denmark grew by 7% over the reference period, from 27 GWh in 1990 to 29 GWh in 2001. In Denmark, SHP contributed 100% to the electricity generated from hydropower over the reference period. SHP less than 1 MW contributed in an important proportion to the SHP electricity generation, as shown in *graph 1*. SHP share in the country's electricity generation has decreased from 0.1% in 1990 to 0.08% in 2001.

Table DK.1: Trends in the installed capacity in Denmark, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP< 10 MW	SHP< 1 MW	1 MW< SHP< 10 MW	Total installed capacity in MW	SHP contribution	
1990	9	5	4	9133	0.10%	0.22%
1991	9	5	4	9570	0.09%	0.18%
1992	10	6	4	10031	0.10%	0.13%
1993	10	6	4	10354	0.10%	0.11%
1994	8	4	4	10604	0.08%	0.09%
1995	10	6	4	10691	0.09%	0.11%
1996	10	6	4	11160	0.09%	0.10%
1997	10	7	3	11813	0.08%	0.10%
1998	11	7	4	12545	0.09%	0.11%
1999	11	5	6	12727	0.09%	0.11%
2000	10	5	5	12661	0.08%	0.11%
2001	10	5	5	12767	0.08%	0.10%



Graph DK.1: Trends in the electricity generation in Denmark, 1990-2001



3- Germany

As shown in *table 1*, SHP *installed capacity* in Germany rose almost four times over the reference period from 360 MW in 1990 to 1 421 MW in 2001. Since SHP installed capacity has been growing at a higher rate than the total electrical installed capacity in the country, its contribution to the national installed capacity has gone up from 0.37% in 1990 to 1.19% in 2001. Germany had one of the leading positions regarding SHP capacity in EU-15 together with Italy, France and Spain. In 2001, Germany accounted for about 14% of the total SHP installed capacity in the EU-15.

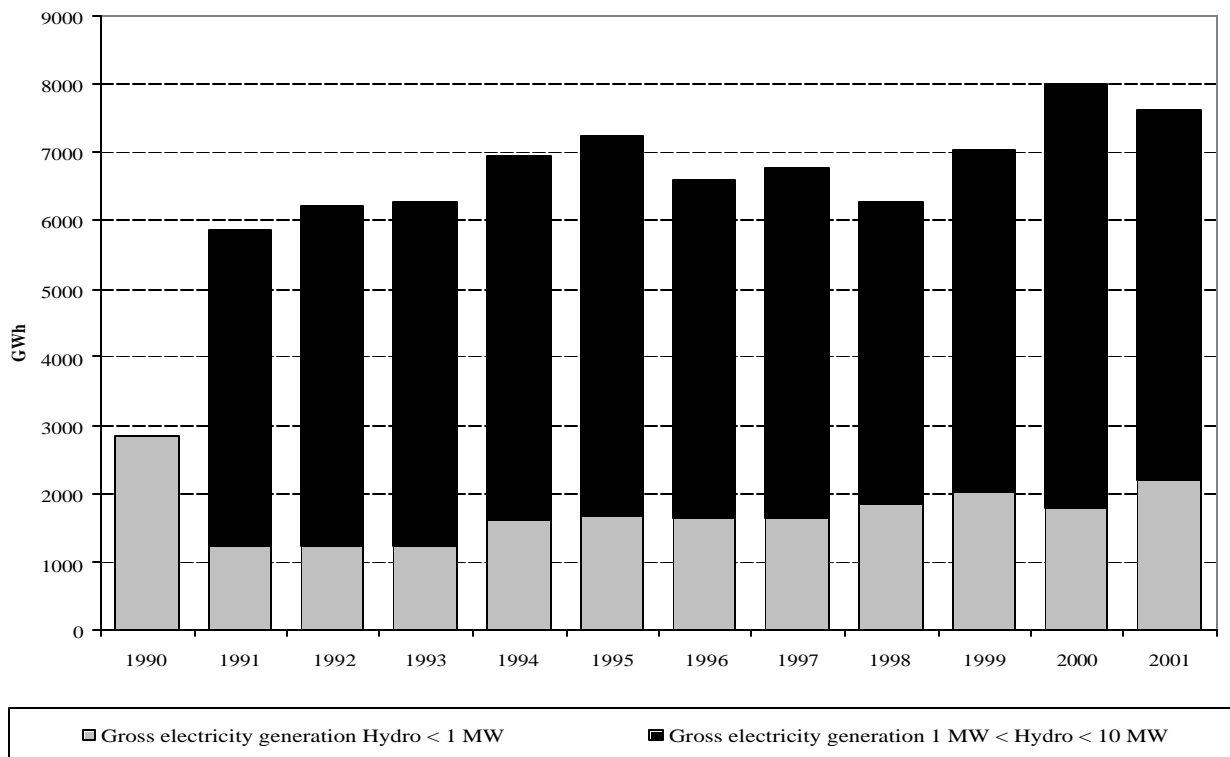
Electricity generation from SHP plants in Germany tripled from 1990 to 2001. This increase contributed to a higher share in the country's electricity generation from 0.6% in 1990 to 1.3% in 2001. Likewise, the contribution of SHP to the electricity production from hydropower rose from 14.5% in 1990 to 30.7% in 2001. *Graph 1* illustrates the trend in SHP electricity generation over the reference period.



Table D.1: Trends in the installed capacity in Germany, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	360	360	0	97598	0.37%	8.93%
1991	1286	374	912	118227	1.09%	25.57%
1992	1291	362	929	115558	1.12%	16.42%
1993	1296	362	934	114628	1.13%	14.49%
1994	1351	417	934	114811	1.18%	14.71%
1995	1340	418	922	115342	1.16%	14.23%
1996	1361	442	919	114896	1.18%	14.10%
1997	1370	463	907	113983	1.20%	14.05%
1998	1418	536	882	113624	1.25%	14.40%
1999	1404	534	870	114691	1.22%	14.40%
2000	1421	534	887	118267	1.20%	15.19%
2001	1421	534	887	119389	1.19%	14.34%

Graph D.1: Trends in the electricity generation in Germany, 1990-2001





4- Greece

SHP *installed capacity* in Greece doubled over the reference period from 30 MW in 1990 to 60 MW in 2001. Despite this increase, SHP installed capacity in Greece accounted for about 0.55% of the total electrical installed capacity of the country and for about 0.61% of the total EU-15 SHP installed capacity in 2001. SHP less than 1 MW has seen a new incentive as from 2000.

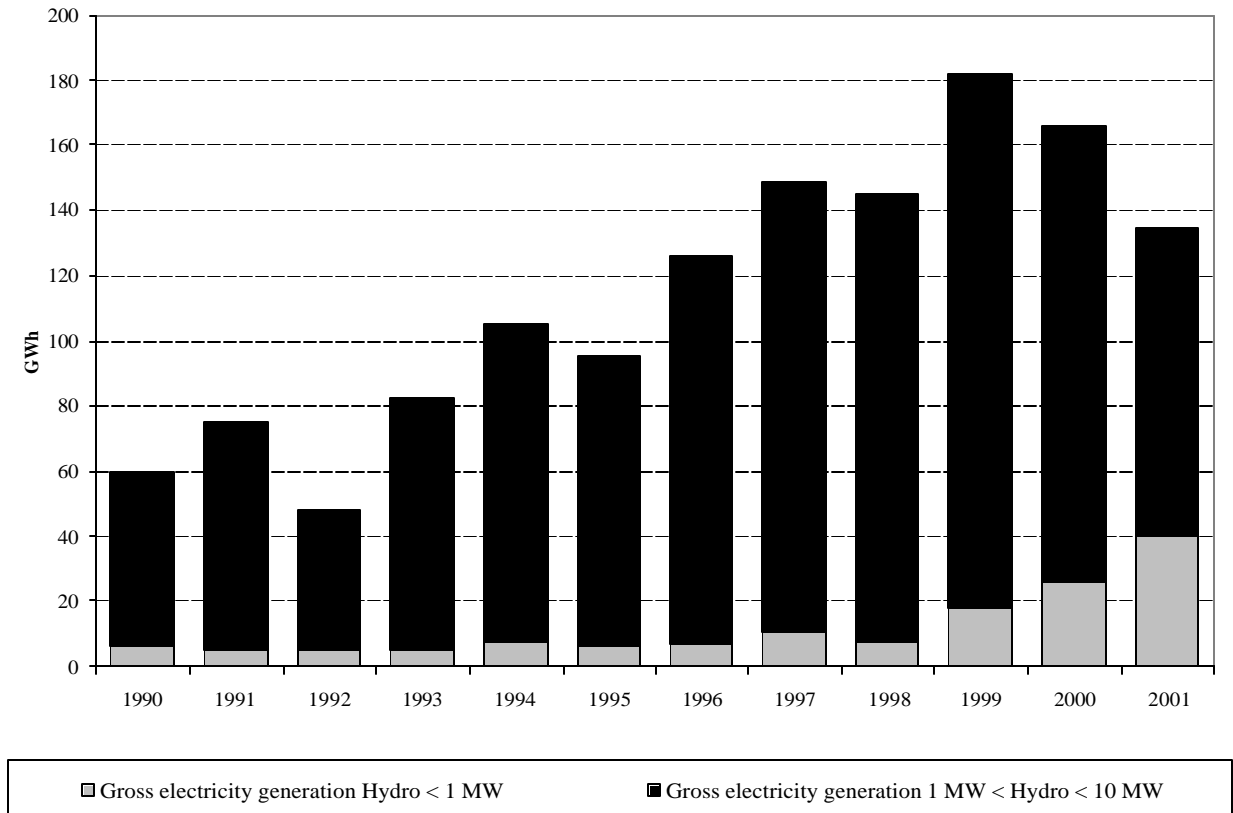
Table EL.1: Trends in the installed capacity in Greece, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	30	2	28	8514	0.35%	0.74%
1991	30	2	28	8914	0.34%	0.60%
1992	30	2	28	8978	0.33%	0.38%
1993	41	2	39	8794	0.47%	0.46%
1994	100	3	97	8923	1.12%	1.09%
1995	42	3	39	8942	0.47%	0.45%
1996	42	3	39	9125	0.46%	0.44%
1997	43	4	39	9575	0.45%	0.44%
1998	44	4	40	10017	0.44%	0.45%
1999	49	7	42	10905	0.45%	0.50%
2000	56	14	42	10903	0.51%	0.60%
2001	60	15	45	10969	0.55%	0.61%

SHP *electricity generation* in Greece has doubled over the reference period, from 60 GWh in 1990 to 135 GWh in 2001. This increase has contributed to a higher participation in the country's electricity generation from 0.17% in 1990 to 0.25% in 2001. The contribution of SHP to the electricity produced from Hydro in Greece has increased from 3% in 1990 to 5% in 2001. This is quite remarkable taking into account only 5% of the country's electricity was generated by Hydropower in 2001. As *graph 1* shows, electricity generation from plants less than 1 MW has followed a more stable upward trend while electricity generation from plants larger than 1 MW has been decreasing since 1999.



Graph EL.1: Trends in the electricity generation in Greece, 1990-2001



5- Spain

SHP in Spain has followed an upward trend visible in all figures reported in *table 1*. SHP **installed capacity** increased almost ten times over the reference period showing one of the major increases in the EU-15. SHP plants between 1 and 10 MW have developed faster than those of less than 1 MW. The remarkable improvement of SHP in Spain has been translated into a higher contribution of SHP to the total electrical installed capacity as well as to the EU-15 SHP installed capacity. In the year 2001, about 3% of the total electrical installed capacity in Spain corresponded to SHP. Likewise, Spain held one of the leading positions contributing by 15% to the EU-15 SHP installed capacity in 2001.

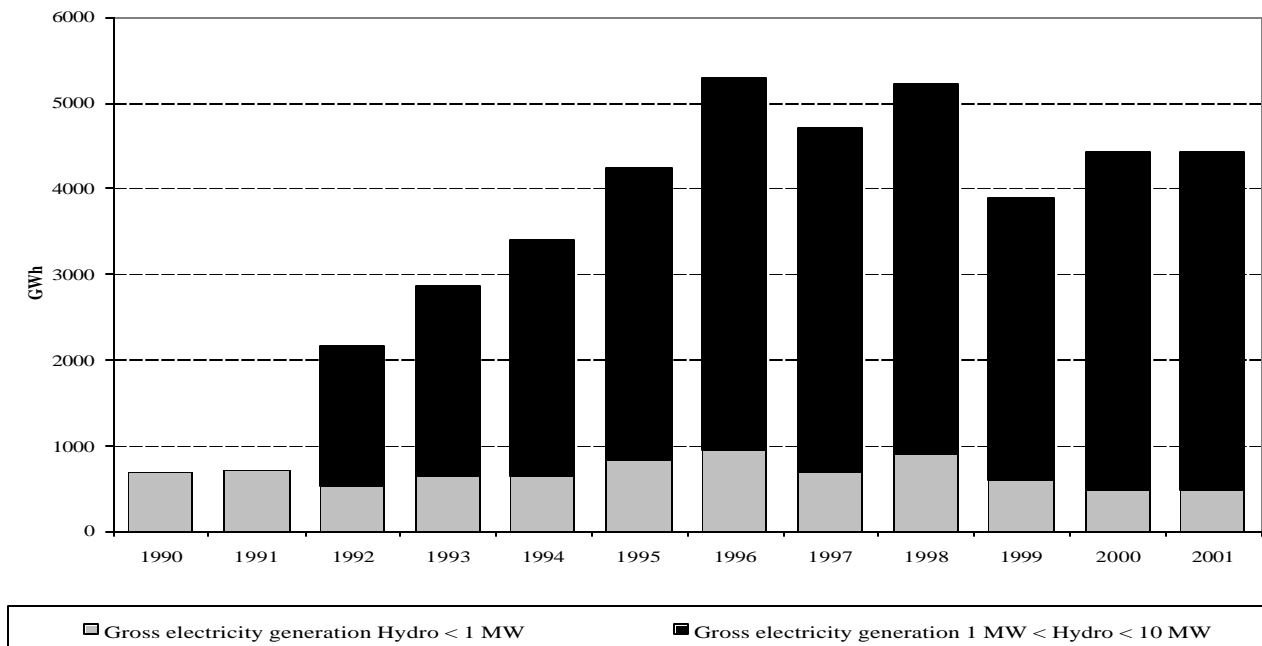


Table E.1: Trends in the installed capacity in Spain, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	162	162	0	43417	0.37%	4.02%
1991	169	169	0	43629	0.39%	3.36%
1992	1090	181	909	43841	2.49%	13.86%
1993	1180	189	991	43913	2.69%	13.19%
1994	1242	191	1051	44489	2.79%	13.52%
1995	1313	196	1117	45849	2.86%	13.94%
1996	1414	210	1204	46921	3.01%	14.65%
1997	1465	214	1251	48586	3.02%	15.02%
1998	1506	209	1297	50010	3.01%	15.30%
1999	1530	227	1303	52413	2.92%	15.69%
2000	1567	228	1339	53529	2.93%	16.75%
2001	1618	234	1384	55508	2.91%	16.33%

While country's *electricity generation* and hydroelectric generation have increased by 57% and 67% respectively over the reference period, electricity generation from SHP rose by six times from 685 GWh in 1990 to 4 436 GWh in 2001. In 2001, about 10% of the hydropower electricity was generated by SHP and it contributed by 2% of the total country's electricity generation. Spain accounted for about 11% of the EU-15 SHP electricity generation in 2001 what shows a clear development and favourable conditions of the SHP sector. SHP electricity generation has followed an upward trend over the reference period especially since 1992 as can be seen in *graph 1*.

Graph E.1: Trends in the electricity generation in Spain, 1990-2001





6- France

From 1990 to 2001, SHP *installed capacity* grew at a higher rate (+12.9%) than the total electrical installed capacity (+11.7%) in France. As *table 1* shows, although SHP contribution to the total installed capacity has remained stable over the reference period around 2%, this figure is one of the highest in the EU-15. In 1990, France accounted for about 43% of the total SHP installed capacity in the EU-15. Since then and due to the promotion of SHP in other Member States, the share has decreased to about 20% in 2001. Nevertheless, France still held a dominant position in the EU-15.

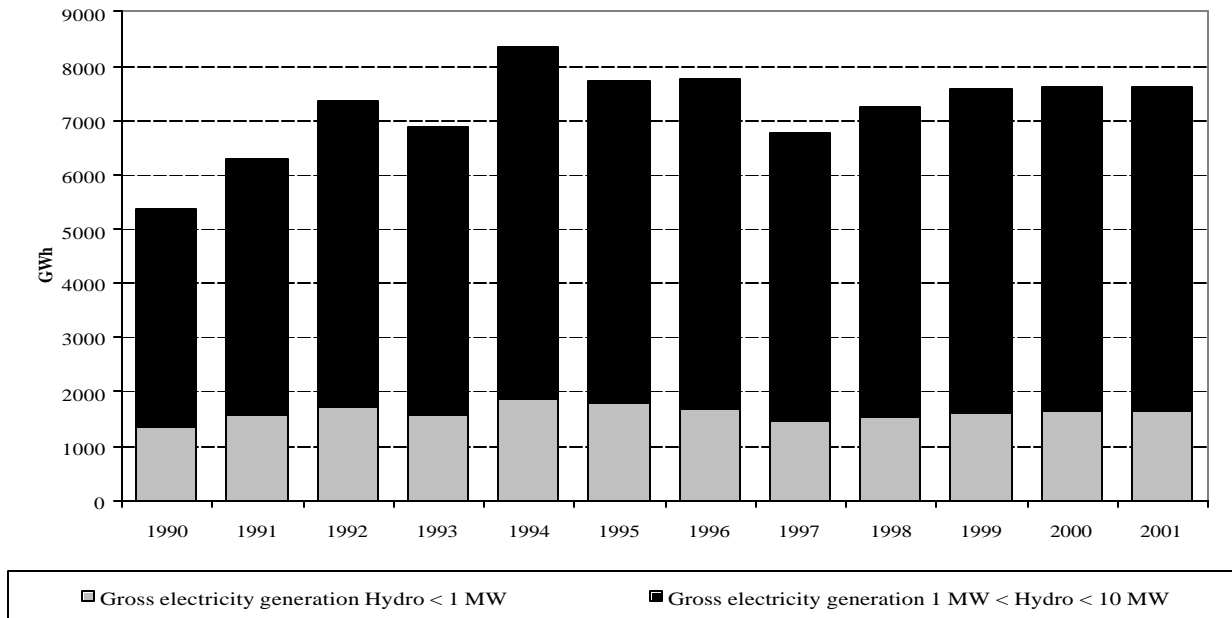
Table F.1: Trends in the installed capacity in France, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	1732	403	1329	103410	1.67%	42.96%
1991	1787	410	1377	104348	1.71%	35.53%
1992	1828	409	1419	104450	1.75%	23.25%
1993	1898	423	1475	107648	1.76%	21.22%
1994	1943	433	1510	107232	1.81%	21.15%
1995	1946	429	1517	107614	1.81%	20.66%
1996	2002	427	1575	109696	1.83%	20.74%
1997	2004	427	1577	113905	1.76%	20.55%
1998	2005	420	1585	112347	1.78%	20.37%
1999	2016	406	1610	114583	1.76%	20.67%
2000	1956	407	1549	115632	1.69%	20.91%
2001	1956	407	1549	115513	1.69%	19.74%

SHP *electricity generation* in France went up by 41% from 5 392 GWh in 1990 to 7 617 GWh in 2001. SHP contributed by 10% to the country's hydroelectricity generation and by 1% to the total country's electricity generation. In 2001, France accounted for about 19% of the SHP electricity generated in the EU-15. Although this share is smaller than the one in 1990 (47%), France still had a leading position at EU-15 level. *Graph 1* illustrates the trend in the electricity generated by SHP in France over the reference period.



Graph F.1: Trends in the electricity generation in France, 1990-2001



7- Ireland

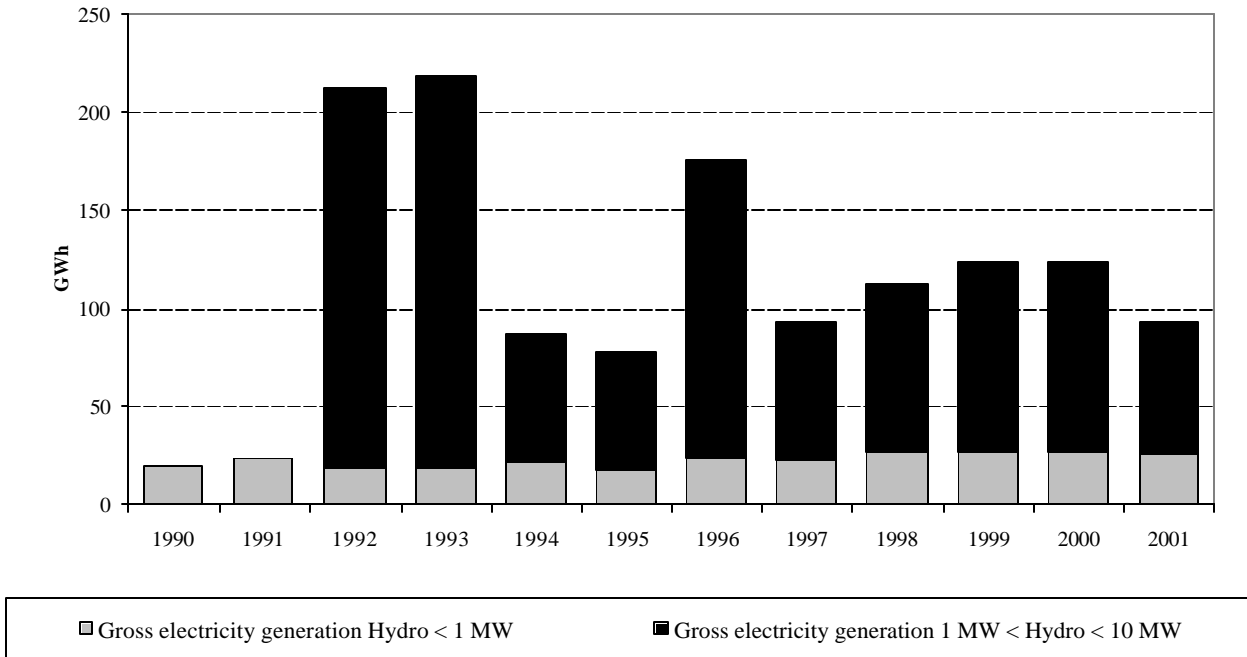
Table 1 shows the main trends in the SHP *installed capacity* in Ireland over the reference period. SHP installed capacity increased about five times from 7 MW in 1990 to 37 MW in 2001. This increase contributed to a higher share of SHP in the total electrical installed capacity from 0.18% in 1990 to 0.78% in 2001. It also contributed to a higher share in the EU-15 SHP installed capacity from 0.17% in 1990 to 0.37% in 2001.

Table IRL.1: Trends in the installed capacity in Ireland, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	7	7	0	3820	0.18%	0.17%
1991	11	11	0	3811	0.29%	0.22%
1992	67	5	62	3933	1.70%	0.85%
1993	68	6	62	3933	1.73%	0.76%
1994	29	6	23	3911	0.74%	0.32%
1995	29	6	23	4393	0.66%	0.31%
1996	54	7	47	4405	1.23%	0.56%
1997	55	8	47	4291	1.28%	0.56%
1998	55	8	47	4457	1.23%	0.56%
1999	34	7	27	4346	0.78%	0.35%
2000	34	7	27	4705	0.72%	0.36%
2001	37	10	27	4717	0.78%	0.37%



Graph IRL.1: Trends in the electricity generation in Ireland, 1990-2001



As *graph 1* shows above, SHP *electricity generation* has increased about four times over the reference period in Ireland, from 20 GWh in 1990 to 93 GWh in 2001. Although SHP represented about 10% of Ireland's hydro production in 2001, it contributed only to 0.37% of the country's electricity generation in the same year. This is due to the fact that only 4% of the electricity in Ireland was generated by Hydropower in 2001.

8- Italy

SHP *installed capacity* in Italy rose about seven times over the reference period. About 3% of the total electrical installed capacity in Italy corresponded to SHP in 2001, one of the highest in the EU-15. Likewise, about 22% of the EU-15 SHP capacity in 2001 was installed in Italy, the highest of EU-15. Figures in *table 1* show the relevant development of SHP in Italy, especially as from 1992.

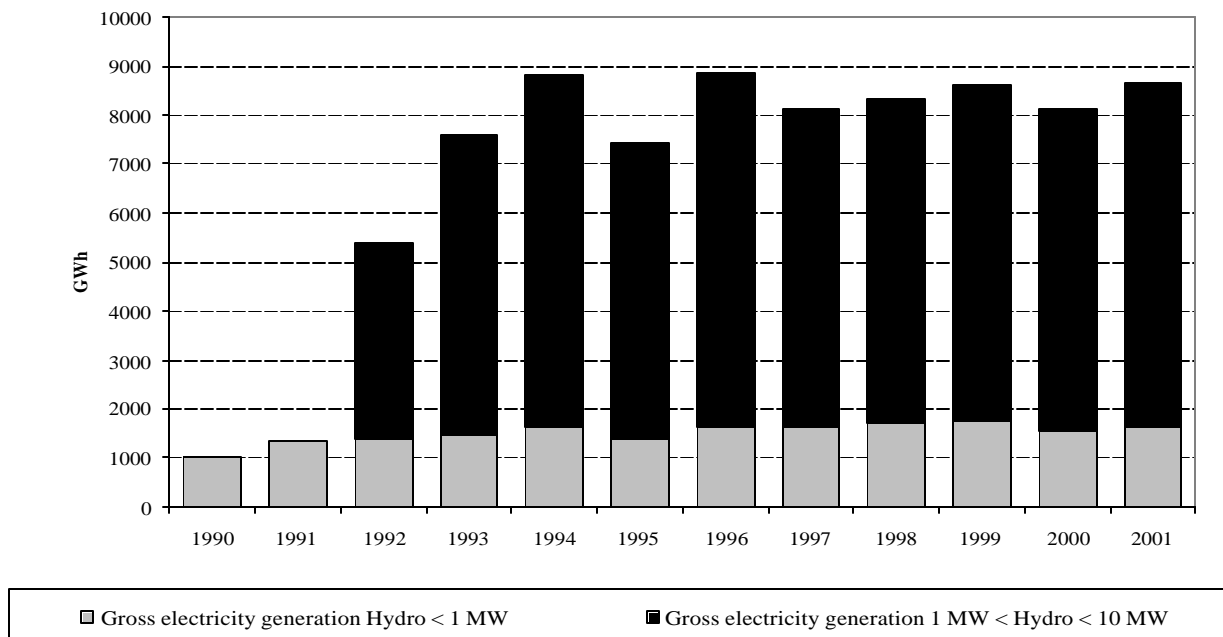


Table I.1: Trends in the installed capacity in Italy, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	317	317	0	56563	0.56%	7.86%
1991	322	322	0	57875	0.56%	6.40%
1992	2047	338	1709	61632	3.32%	26.04%
1993	2076	353	1723	63504	3.27%	23.21%
1994	2104	367	1737	64156	3.28%	22.91%
1995	2144	357	1787	65913	3.25%	22.77%
1996	2159	380	1779	68217	3.16%	22.36%
1997	2186	403	1783	70252	3.11%	22.41%
1998	2210	406	1804	72352	3.05%	22.45%
1999	2201	414	1787	73684	2.99%	22.57%
2000	1768	300	1468	75421	2.34%	18.90%
2001	2233	384	1849	76135	2.93%	22.54%

While *electricity generation* and hydroelectric production have increased by 29% and 54% over the reference period, SHP electricity generation raised about 8 times from 1044 GWh in 1990 to 8 656 GWh in 2001. SHP contributed to about 16% of the electricity generated by Hydropower and to about 3% of the total electricity generation of the country in 2001. Hydropower represented about 19% of the electricity generation in Italy in 2001. Italy held a leading position representing about 22% of the SHP electricity generation in the EU-15 in 2001. As *graph 1* illustrates, the expansion of SHP in Italy has been remarkable over the reference period.

Graph IT.1: Trends in the electricity generation in Italy, 1990-2001





9- Luxembourg

As *table 1* shows, SHP *installed capacity* in Luxembourg has increased by 43% over the reference period. SHP contribution to the electrical installed capacity of the country represents one of the highest in the EU-15, around 3% over the reference period. Nevertheless, this relevance at national level diminishes when comparing at EU level. In 2001, only 0.4% of the EU-15 SHP capacity was installed in Luxembourg.

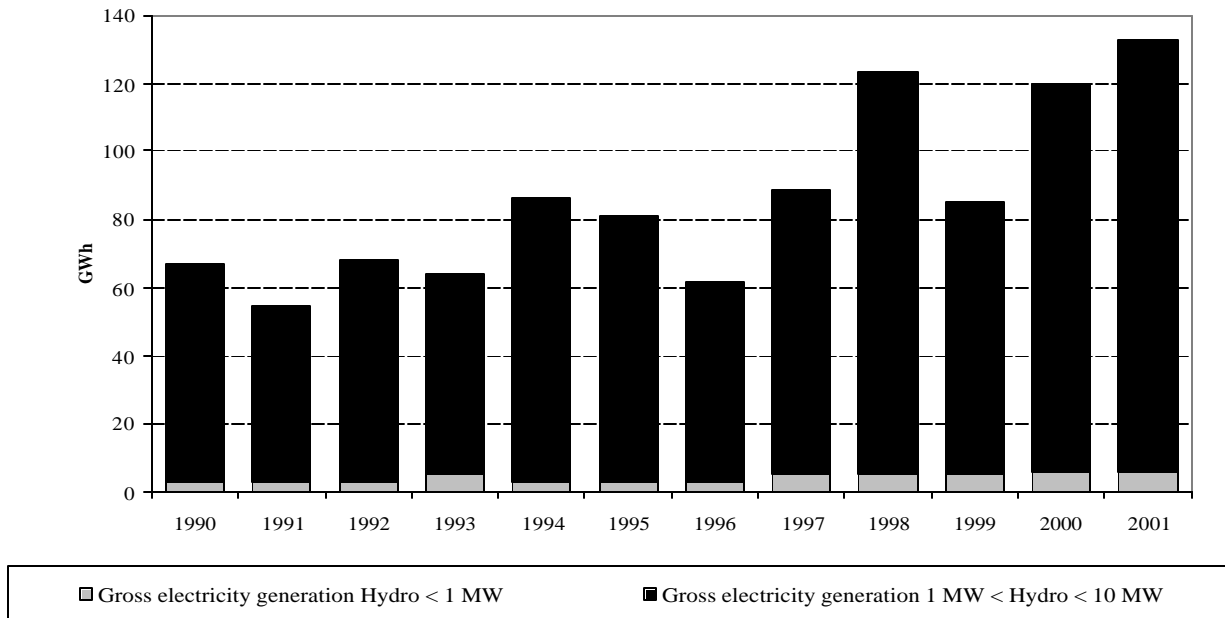
SHP *electricity generation* in Luxembourg doubled from 67 GWh in 1990 to 133 GWh in 2001. This increase is quite remarkable considering that the total electricity generation in the country has decreased by 10% over the reference period. Hydropower represented about 71% of the country's electricity generation in 2001. SHP contributed by 15% to the Hydropower generation and by 11% to the total electricity generation in Luxembourg in 2001. SHP generation is mostly dominated by plants larger than 1 MW as *graph 1* illustrates.

Table L.1: Trends in the installed capacity in Luxembourg, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	28	1	27	1240	2.26%	0.69%
1991	28	1	27	1248	2.24%	0.56%
1992	28	1	27	1238	2.26%	0.36%
1993	28	1	27	1238	2.26%	0.31%
1994	28	1	27	1238	2.26%	0.30%
1995	30	1	29	1257	2.39%	0.32%
1996	35	1	34	1264	2.77%	0.36%
1997	35	1	34	1278	2.74%	0.36%
1998	35	1	34	1210	2.89%	0.36%
1999	39	2	37	1214	3.21%	0.40%
2000	39	2	37	1227	3.18%	0.42%
2001	40	2	38	1155	3.46%	0.40%



Graph L.1: Trends in the electricity generation in Luxembourg, 1990-2001



10- The Netherlands

SHP in the Netherlands has followed a stable trend over the reference period. *Installed capacity* has remained unchanged from 1990 to 2001 at 2 MW. SHP in The Netherlands was rather small, contributing only by 0.01% to the total electrical installed capacity of the country and by 0.02% to the EU-15 SHP installed capacity in 2001.

Table NL.1: Trends in the installed capacity in The Netherlands, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	2	2	0	17567	0.01%	0.05%
1991	2	2	0	16853	0.01%	0.04%
1992	2	2	0	17480	0.01%	0.03%
1993	2	2	0	17602	0.01%	0.02%
1994	2	2	0	18348	0.01%	0.02%
1995	2	2	0	18994	0.01%	0.02%
1996	2	2	0	20395	0.01%	0.02%
1997	2	2	0	20091	0.01%	0.02%
1998	2	2	0	20158	0.01%	0.02%
1999	2	2	0	20619	0.01%	0.02%
2000	2	2	0	20999	0.01%	0.02%
2001	2	2	0	20311	0.01%	0.02%



SHP *electricity generation* in The Netherlands has remained constant over the reference period at 1 GWh. Statistics reflected that all production of electricity from SHP came from plants larger than 1MW. SHP contributed to 0.85% of the Hydro electricity generation in 2001. Hydropower represented only 0.12% of the total electricity of the country in 2001. The contribution of SHP to country's electricity generation has been almost negligible over the reference period.

11- Austria

Table 1 shows the major trends in the SHP *installed capacity* in Austria over the reference period. In 2001, SHP in Austria contributed to almost 5% of the total electrical installed capacity of the country, the highest contribution of SHP at national level in the EU-15. About 8% of the EU-15 SHP capacity was installed in Austria in 2001.

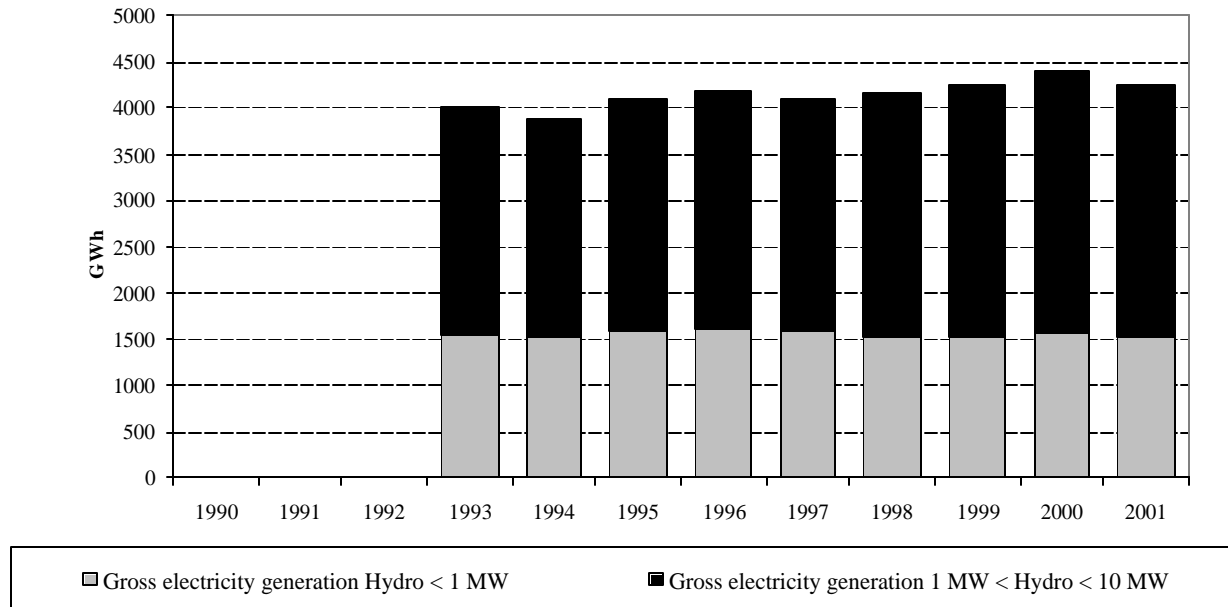
SHP *electricity generation* in Austria was 4 260 GWh in 2001, what represented about 10% of the electricity generated by Hydropower and about 7% of the country's electricity generation. Hydropower contributed by 68% to the total electricity generation in 2001. Comparing to previous years, 2001 figures showed a decreasing trend in the sector. As *graph 1* illustrates plants less 1 MW represent an important part of the SHP sector in Austria.

Table A.1: Trends in the installed capacity in Austria, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP< 10 MW	SHP< 1 MW	1 MW< SHP< 10 MW	Total installed capacity in MW	SHP contribution	
1990	0	0	0	16686	0.00%	0.00%
1991	0	0	0	16779	0.00%	0.00%
1992	0	0	0	17231	0.00%	0.00%
1993	816	282	534	17261	4.73%	9.12%
1994	820	284	536	17426	4.71%	8.93%
1995	821	284	537	17439	4.71%	8.72%
1996	824	285	539	17519	4.70%	8.54%
1997	835	289	546	17859	4.68%	8.56%
1998	837	287	550	17453	4.80%	8.50%
1999	837	287	550	17843	4.69%	8.58%
2000	843	282	561	17718	4.76%	9.01%
2001	843	282	561	17657	4.77%	8.51%



Graph A.1: Trends in the electricity generation in Austria, 1990-2001



12- Portugal

Total electrical installed capacity in Portugal rose by 49% over the reference period, which represented the highest increase in the EU-15. About 3% of this *installed capacity* corresponded to SHP in 2001. This high contribution is a reflection of the SHP development in Portugal over the reference period. As shown in *table 1*, SHP installed capacity tripled from 1990 to 2001. At EU-15 level, about 3% of the EU-15 SHP capacity was installed in Portugal in 2001.

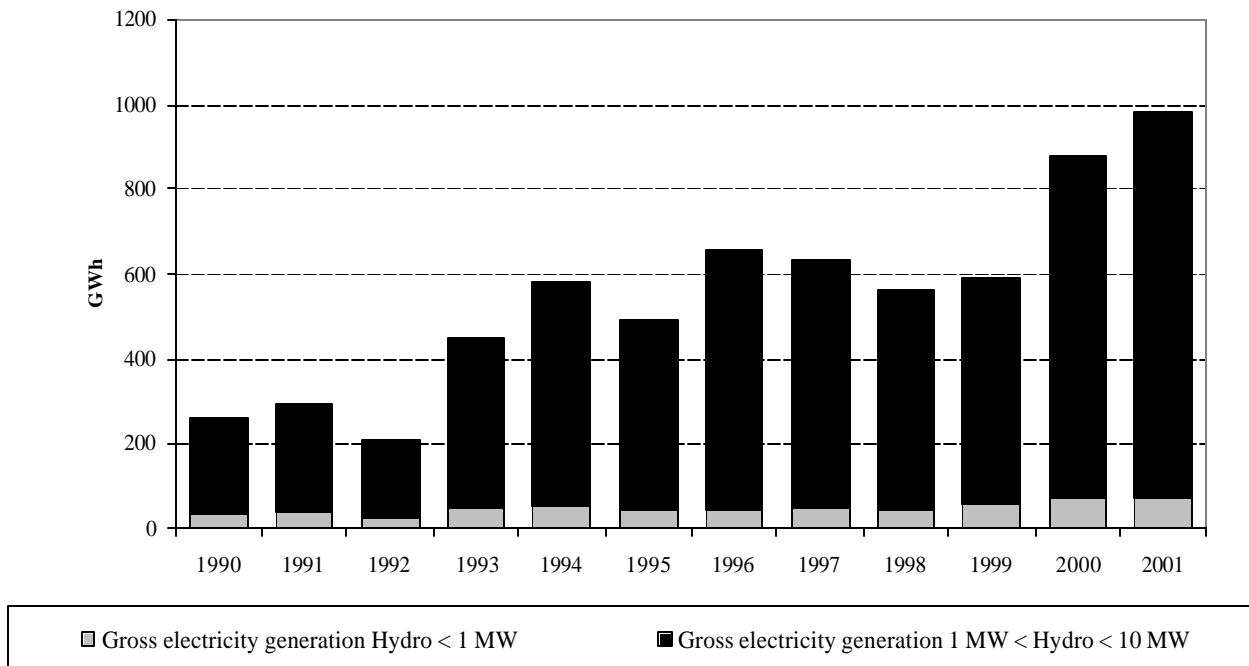
Electricity generation from SHP has increased almost four times over the reference period from 261 GWh in 1990 to 982 GWh in 2001. SHP represented about 7% of the hydropower generation and about 2% of the country's electricity generation in 2001. About 31% of the electricity generated in Portugal came from Hydropower in 2001. As *graph 1*, SHP sector has followed an upward trend over the reference period.



Table P.1: Trends in the installed capacity in Portugal, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	121	24	97	7396	1.64%	3.00%
1991	121	23	98	7448	1.62%	2.41%
1992	154	23	131	8199	1.88%	1.96%
1993	211	24	187	8699	2.43%	2.36%
1994	235	29	206	8806	2.67%	2.56%
1995	246	22	224	9318	2.64%	2.61%
1996	248	22	226	9380	2.64%	2.57%
1997	245	22	223	9468	2.59%	2.51%
1998	247	19	228	9786	2.52%	2.51%
1999	257	22	235	10758	2.39%	2.64%
2000	307	27	280	10898	2.82%	3.28%
2001	317	27	290	10990	2.88%	3.20%

Graph P.1: Trends in the electricity generation in Portugal, 1990-2001





13- Finland

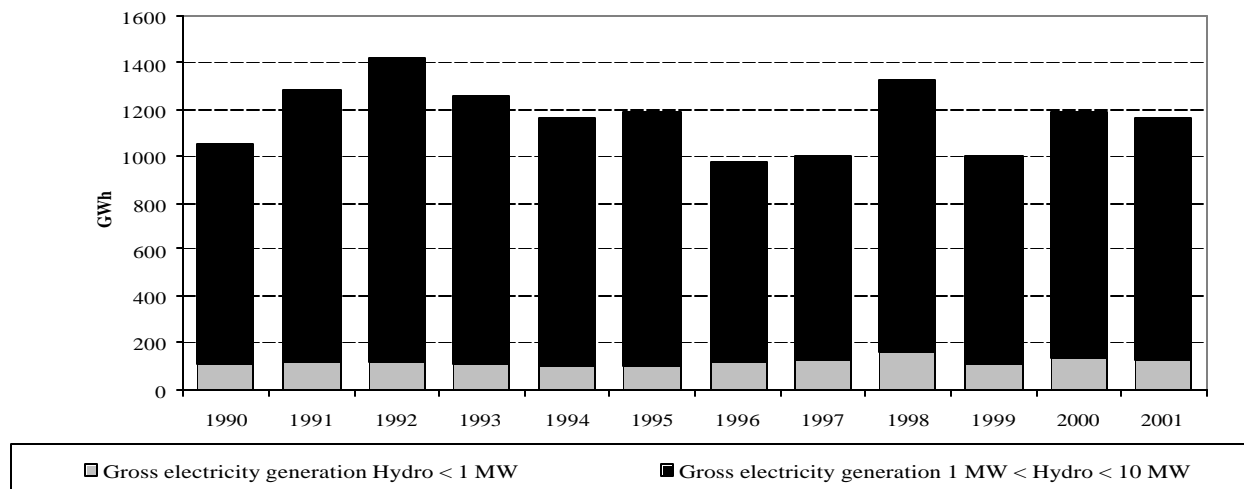
SHP in Finland has remained quite stable during the reference period. As *table 1* shows, SHP *installed capacity* grew by 4% from 1990 to 2001. This stable trend together with an upward trend in the country's electrical installed capacity had as result a decreasing contribution of SHP to the total installed capacity over the reference period. In 2001, Finland accounted for about 3% of the total SHP installed capacity in the EU-15 placing a similar position as Portugal.

Table FIN.1: Trends in the installed capacity in Finland, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	298	25	0	13220	2.25%	7.39%
1991	298	25	0	13350	2.23%	5.92%
1992	300	25	48	13358	2.25%	3.82%
1993	303	26	45	14081	2.15%	3.39%
1994	305	27	45	14155	2.15%	3.32%
1995	310	25	54	14438	2.15%	3.29%
1996	310	30	54	14574	2.13%	3.21%
1997	304	30	54	15702	1.94%	3.12%
1998	304	30	54	16150	1.88%	3.09%
1999	304	30	54	16164	1.88%	3.12%
2000	308	29	54	16258	1.89%	3.29%
2001	309	29	54	16472	1.88%	3.12%

Electricity generation from SHP has remained in a stable upward trend since 1990, increasing by 10% over the reference period. Hydropower in Finland accounted for about 20% of the country's electricity generation. The SHP sector represented about 2% of the total electricity generation and about 9% of the hydropower generation in 2001. *Graph 1* shows the trend in the SHP electricity generation during the last decade.

Graph FIN.1: Trends in the electricity generation in Finland, 1990-2001





14- Sweden

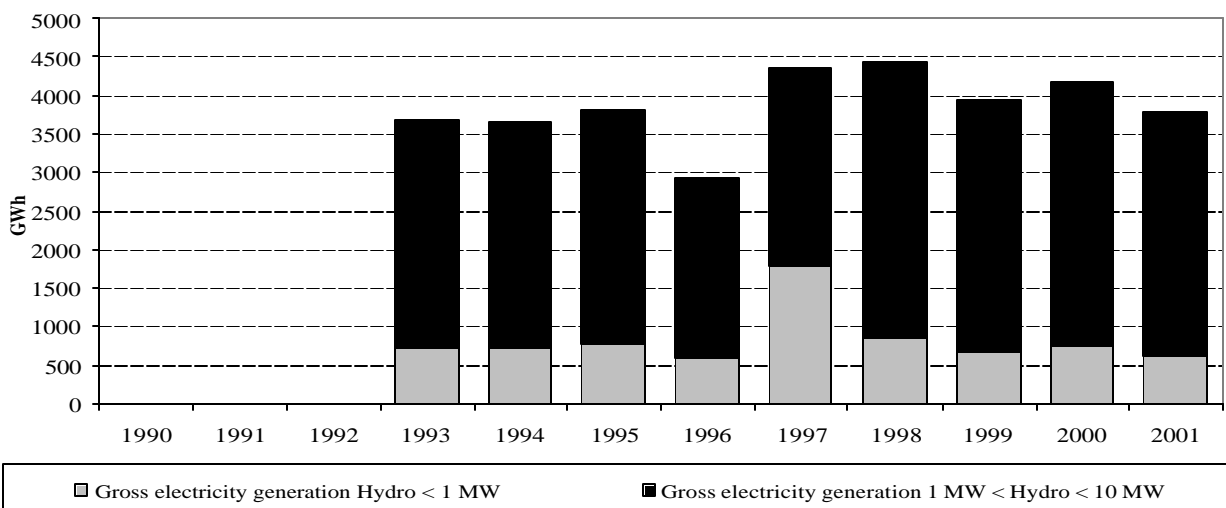
Sweden is the only Member State where SHP *installed capacity* has decreased by 3% over the reference period from 964 MW in 1990 to 935 MW in 2001, as shown in *table 1*. This decrease has contributed to a lower share in the total electrical installed capacity of the country. The biggest fall occurred at EU-15 level. In 1990, about 24% of the SHP installed capacity in EU-15 corresponded to Sweden but in 2001 this contribution decreased to 9%.

About 3 807 GWh of *electricity* was generated by SHP in 2001 which represented about 5% of the electricity generated by Hydropower and about 2% of the total electricity generation in Sweden. Hydropower contributed by 50% of the total electricity generation of the country in 2001. In last years, SHP is following a decreasing trend. *Graph 1* shows the evolution of the sector over the reference period.

Table S.1: Trends in the installed capacity in Sweden, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP < 10 MW	SHP < 1 MW	1 MW < SHP < 10 MW	Total installed capacity in MW	SHP contribution	
1990	964	204	760	34187	2.82%	23.91%
1991	964	204	760	34477	2.80%	19.17%
1992	964	204	760	34560	2.79%	12.26%
1993	965	204	761	34648	2.79%	10.79%
1994	968	203	765	34473	2.81%	10.54%
1995	971	209	762	33623	2.89%	10.31%
1996	973	209	764	34158	2.85%	10.08%
1997	969	209	760	34536	2.81%	9.93%
1998	936	171	765	33029	2.83%	9.51%
1999	943	168	775	34080	2.77%	9.67%
2000	919	178	741	33721	2.73%	9.82%
2001	935	157	778	33652	2.78%	9.44%

Graph SW.1: Trends in the electricity generation in Sweden, 1990-2001





15- United Kingdom

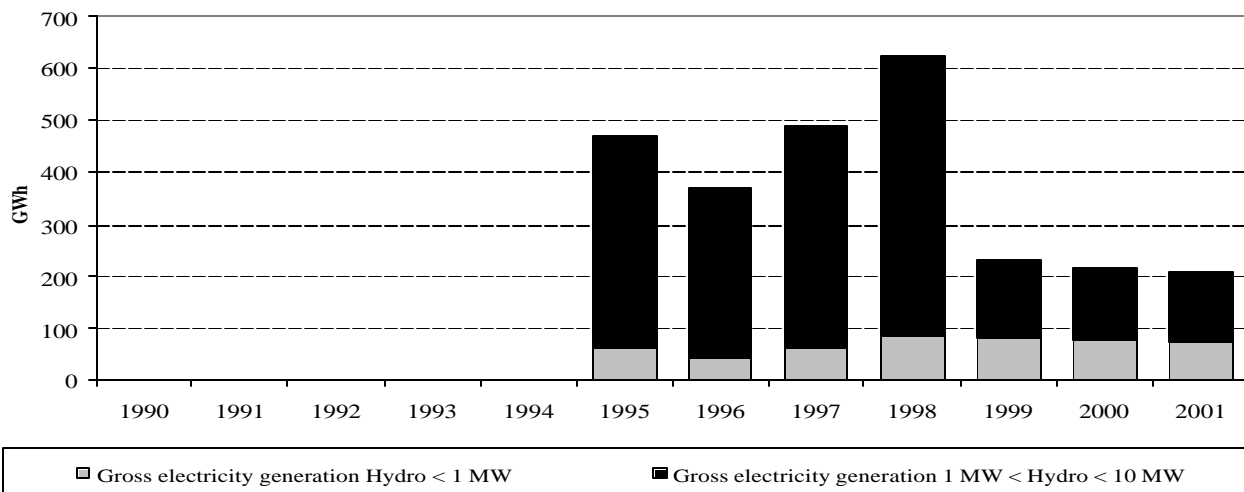
According to figures in *table 1*, SHP development in UK took place as from 1995. The Statistics show an instable trend regarding SHP *installed capacity*. In 2001, SHP contributed to 0.09% of the country’s electrical installed capacity and to 0.69% of the EU-15 SHP installed capacity.

Table UK.1: Trends in the installed capacity in United Kingdom, 1990-2001

	SHP Installed Capacity in MW			Electrical Capacity		Share to EU-15 SHP installed capacity
	SHP< 10 MW	SHP< 1 MW	1 MW< SHP< 10 MW	Total installed capacity in MW	SHP contribution	
1990	0	0	0	73020	0.00%	0.00%
1991	0	0	0	70031	0.00%	0.00%
1992	0	0	0	65356	0.00%	0.00%
1993	0	0	0	69197	0.00%	0.00%
1994	0	0	0	69086	0.00%	0.00%
1995	154	17	137	70125	0.22%	1.64%
1996	161	19	142	73372	0.22%	1.67%
1997	172	23	149	72785	0.24%	1.76%
1998	175	24	151	73345	0.24%	1.78%
1999	64	25	39	75605	0.08%	0.66%
2000	66	26	40	78569	0.08%	0.71%
2001	68	27	41	79794	0.09%	0.69%

SHP *electricity generation* had a small significance over the reference period in the UK mainly because Hydropower represented only about 2% of the total electricity generation during the last decade. SHP electricity generation was 210 GWh in 2001, which represented about 3% of the Hydropower generation and about 0.05% of the country’s electricity generation. In fact, electricity generation from Hydropower has decreased by 10% over the reference period in the UK. *Graph 1* illustrates the evolution of the SHP sector during the last decade.

Graph UK.1: Trends in the electricity generation in United Kingdom, 1990-2001





PART II: SMALL HYDROPOWER IN THE RENEWABLE ENERGY MIX

When evaluating the relevance of each RES in terms of primary energy production, electricity and heat production, it is important more than ever to make the difference between large and small hydropower. Because hydropower is the largest RES in the EU-15 in terms of electricity generation and the second largest in terms of primary energy production, it has been stressed that the potential of hydropower has already been exploited and hydropower is a mature and developed technology.

This section shows how the small hydropower reality is far away from the general picture of the hydropower sector and in fact small hydropower is still developing offering a lot of potential to be exploited. This section shows the real situation of the SHP within the renewable energy mix and how it needs the same support given to other RES like wind or biomass.

RES primary energy production (electricity and heat) has increased by 39% from 1990 to 2001 in the EU-15. As *graph 4* shows, SHP electricity generation has increased at a higher rate than the RES primary production and the hydropower electricity generation. It has been estimated that electricity generation from SHP increased by 12% annually as an average. This increase has resulted in higher contribution to RES primary production as *table 6* shows.

Graph EU.4: Trends in the RES production in the EU-15, 1990-2001

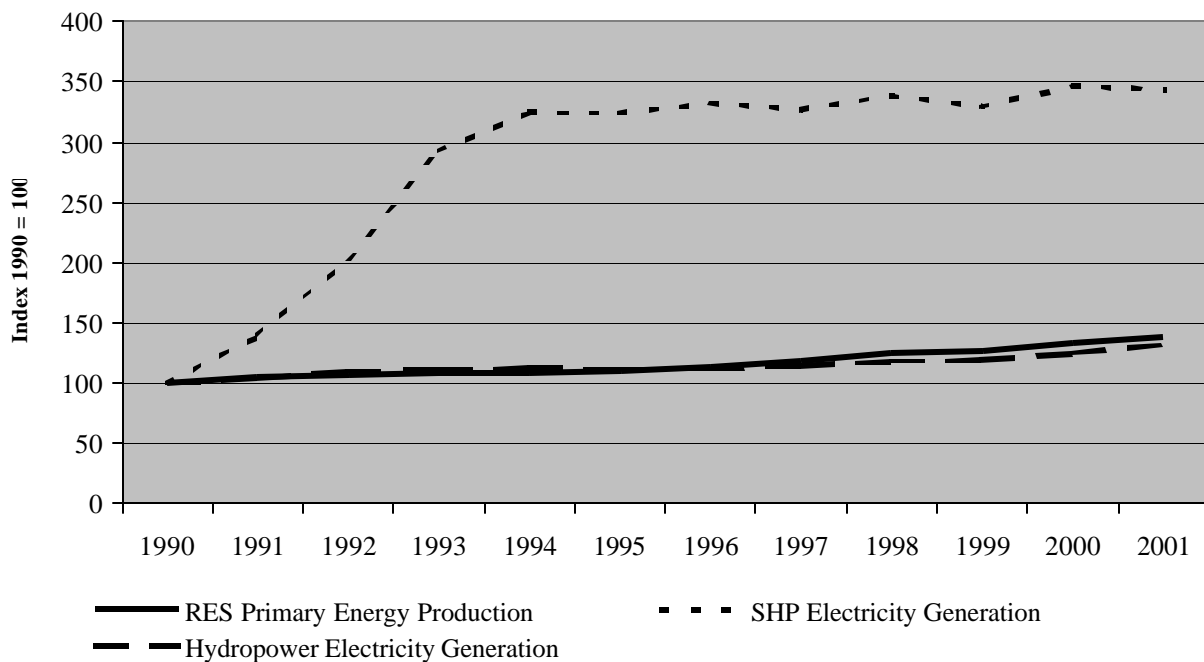


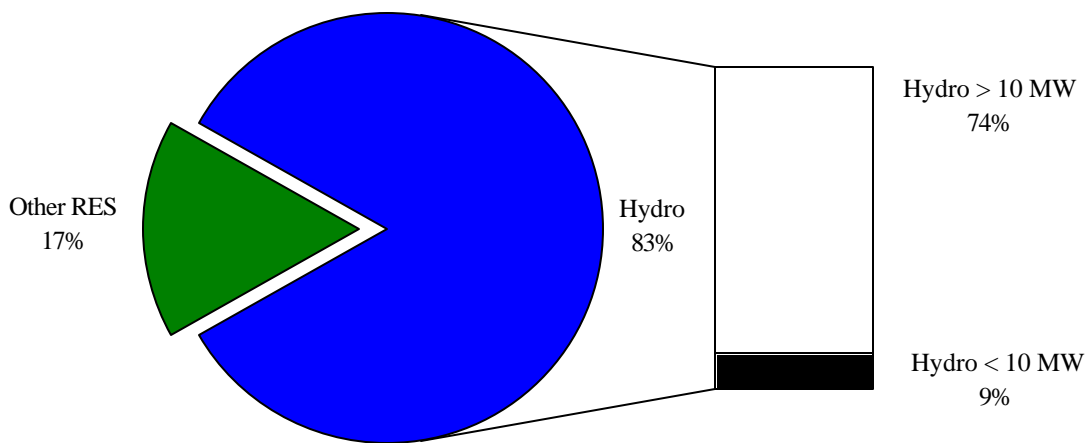


Table EU.6: Contribution of hydro to RES primary energy production in the EU-15, 1990-2001

	Hydropower contribution to RES primary production	SHP contribution to RES primary production
1990	35.99%	1.49%
1991	35.70%	2.00%
1992	37.43%	2.85%
1993	36.76%	4.02%
1994	37.30%	4.45%
1995	36.21%	4.36%
1996	35.43%	4.36%
1997	34.94%	4.14%
1998	34.23%	4.06%
1999	33.87%	3.89%
2000	33.84%	3.89%
2001	34.19%	3.69%

RES electricity generation rose by 47% from 1990 to 2001 in the EU-15. Hydropower is the largest RES in terms of electricity generation accounting for about 83% of the RES electricity generation in 2001. Nevertheless, SHP only represented 9% of the RES electricity generation in the EU-15 in 2001, as graph 6 shows. This contribution is similar to wind and lower than biomass. Figures in table 7 show how the contribution of hydropower to the RES electricity generation has followed a downward trend over the reference period while the SHP contribution has increased from 1990 to 2001.

Graph EU.5¹: RES electricity generation share in the EU-15, 2001



¹ Other RES includes wind, solar pv, geothermal electricity and biomass



Table EU.7: Contribution of hydro to RES electricity generation in the EU-15, 1990-2001

	Hydropower contribution to RES electricity generation	SHP contribution to RES electricity generation
1990	93.20%	3.86%
1991	93.08%	5.21%
1992	93.20%	7.10%
1993	92.50%	10.12%
1994	91.99%	10.97%
1995	90.98%	10.95%
1996	90.16%	11.08%
1997	89.07%	10.55%
1998	87.71%	10.40%
1999	85.95%	9.86%
2000	83.89%	9.65%
2001	83.49%	9.02%

As regards *Member States*, Sweden, France, Austria and Spain had the largest contribution to the RES electricity generation in the EU-15 in 2001. *Table 8*, show those Member States with an active RES policy.

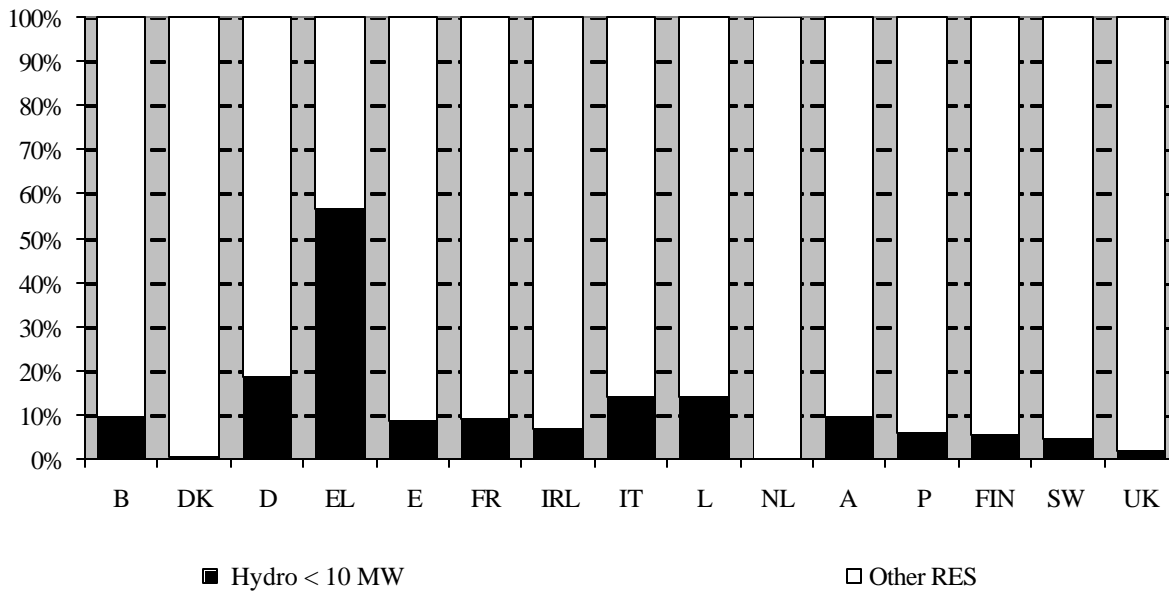
Table EU.8: Member States' Contribution to EU-15 RES electricity generation in %, 1990-2001

	B	DK	D	EL	E	F	IRL	IT	LU	NL	A	P	FIN	SW	UK
1990	0.47	0.26	7.77	0.67	9.03	19.80	0.33	12.96	0.29	0.40	11.31	3.37	5.35	25.33	2.64
1991	0.50	0.34	7.18	1.03	9.41	20.48	0.31	15.96	0.27	0.42	11.01	3.25	5.95	21.40	2.49
1992	0.52	0.43	7.56	0.73	6.61	22.66	0.32	15.10	0.20	0.42	11.34	1.82	6.01	23.47	2.82
1993	0.47	0.50	7.63	0.78	8.01	21.04	0.31	14.61	0.15	0.47	11.78	2.91	5.74	23.38	2.22
1994	0.50	0.58	7.95	0.85	8.87	24.43	0.36	15.15	0.22	0.50	11.19	3.44	5.28	18.18	2.50
1995	0.54	0.62	8.76	1.13	7.68	23.04	0.29	13.49	0.26	0.58	11.69	2.80	5.77	20.85	2.49
1996	0.53	0.70	8.96	1.32	12.38	21.16	0.30	14.97	0.27	0.78	10.77	4.62	5.41	15.73	2.12
1997	0.52	0.92	7.71	1.16	10.73	19.78	0.29	14.48	0.28	0.98	10.95	4.03	5.46	20.30	2.40
1998	0.55	1.15	8.31	1.06	10.40	18.47	0.39	14.22	0.30	1.04	10.85	3.81	5.84	20.76	2.86
1999	0.61	1.27	8.99	1.36	7.83	21.00	0.36	15.26	0.21	0.93	11.33	2.37	5.54	19.52	3.42
2000	0.63	1.46	10.09	1.11	9.32	18.40	0.36	14.04	0.23	1.03	10.98	3.28	5.66	20.23	3.18
2001	0.60	1.48	9.33	0.80	12.09	18.96	0.31	14.24	0.22	1.01	10.40	3.74	4.96	19.00	2.85



As mentioned before, about 83% of the RES electricity generation in EU-15 corresponded to Hydropower in 2001. Some Member States like Austria (96%), France (95%), Sweden (95%), Luxembourg (91%), Portugal (88%) and Italy (87%) were above the average and therefore Hydropower represented the almost solely RES. Nevertheless, graph 6 shows how these percentages decrease when calculating the SHP contribution to RES electricity generation in each Member State in 2001.

Graph EU.6: SHP contribution to RES electricity generation in each Member State, 2001





PART III: EVALUATION OF EU POLICY IMPACT ON THE SHP DEVELOPMENT

Development of renewable energy has for some time been a central aim of Community energy policy, and as early as 1986 the Council² listed the promotion of renewable energy sources among its energy objectives. Significant technological progress has been achieved since then thanks to the various Community RTD and demonstration programmes such as JOULE- THERMIE, INCO and FAIR which not only helped in creating a European renewable energy industry in all sectors of renewables but also in achieving a world-wide leading position. This technological leadership has been maintained by the contribution of the 5th RTD framework programme. With the ALTENER programme³, the Council for the first time adopted a specific financial instrument for renewables promotion. The European Parliament for its part has constantly underlined the role of renewable energy sources. In its *White Paper*, “An Energy Policy for the European Union”⁴ the Commission put forward its views as regards Community energy policy objectives and instruments to achieve them. The White paper set some objectives for 2010 for each RES technology. The 2010 scenario for small hydropower was estimated in additional 4 500 MW of installed capacity reaching 55 TWh of electricity generation in the EU-15. The *RES-E Directive*⁵ contributed a step forward in the promotion of green electricity establishing a framework to increase the share of green electricity to 22% of gross electricity consumption by 2010 and to help to double the share of renewable energy to 12% of gross energy consumption by 2010 in the EU-15. The Directive called for the promotion of electricity from RES through (i) quantified national targets for consumption of electricity from renewable sources of energy, (ii) national support schemes plus, if necessary, a harmonised support system, (iii) simplification of national administrative procedures for authorization and (iv) guaranteed access to transmission and distribution of electricity from renewable energy sources. The Directive sets reference values for the fixing of national indicative targets for electricity produced from RES for 2010 but it does not set objectives for each technology as the White Paper does. The Directive should be transposed into national law in 2003.

At National level efforts to improve and promote RES have been undertaken in the last decade. Legislation as regard renewable energy has been implemented in the EU-15:

In *Belgium*, the measures for the promotion of renewable energy are included within the federal policy of sustainable development, rational use of energy and national plan for the reduction of CO₂ emissions. The Environment plan for sustainable development was adopted in 1995. The electricity law of 1999 created a new legal base on which the price of electricity generated from RES will be supported. In addition, measures like fiscal incentive in the form of tax deduction for investments, investment subsidy, price support for green electricity, funding for specific studies, RTD loans and grants and grants for dissemination and promotion activities. In 2002, quotas and tradable green certificates were set up in Flanders and Wallonia. The green certificate system is the current RES support scheme in force in Belgium.

Renewables have featured prominently in *Denmark*'s 1990 and 1993 Energy 2000 plans as well as the 1996 Energy 21 which set out Danish energy policy. Acts on electricity supply and carbon dioxide quotas were passed in June 1999. In addition there were several types of economic incentives like green taxes to support renewable energy, electricity production subsidy, investment subsidies for RES or grants disbursement for renewable energy. Nevertheless, electricity from nuclear and large hydro power plants are not defined as green electricity in Denmark. As regards small hydro, Denmark has a very small hydro resource.

² OJ C 241 of 25.9.1986, p.1

³ OJ L 235 of 18.9.1993, p.41

⁴ COM(95) 682 of 13.12.1995, “An Energy Policy for the European Union”

⁵ Directive 2001/77/EC



Germany's energy policy continues to be characterized by efforts to reconcile political, economic and environmental objectives. The German government has made climate protection one of its key policy issues. From 1991 to 2002 the "Electricity Feed-in Law" (EFL) regulated the input and favourable payment of electricity from renewables. In concrete, small hydropower was encouraged by the EFL and micro hydro plants benefited from a renewable support program of the Ministry of Economic. Since the 'Renewable Energy Act' (EEG) came into force in April 2002, RES experienced a remarkable growth. The main investment support scheme for the promotion of RES is the EEG itself.

To date, legislation has been the primary instrument that has been used to stimulate the penetration of renewable energy technologies in **Greece**. During the 90's two significant measures were taking to reinforce efforts to promote the penetration of RES, law 2244/1994 "Regulation of power generation issues from renewable energy sources and conventional fuels and other provisions", which increased the financial attractiveness of renewable electricity generation, and the establishment of the Operational Programme for Energy which provided direct grants for energy investments. Law 2773/1999 for liberalization of the electricity market maintained the favourable pricing regime for RES by placing also emphasis on the access priority to the grids. Law 2941/2001 "Simplification of procedures for establishing companies, licensing Renewable Energy Sources plants, regulation.....and other provisions" filled some gaps in the legislation. The Renewable Energy Sub-programme for Energy (1994-1999) was the main funding mechanism for RES installations. The New Operational Programme for Energy will run until 2006. Three small hydro plants were included in the first period of the Public Power Corporation Plan up to 1998.

A number of national plans and sub-plans for renewable energy have been drawn up during the last decade in **Spain**. Promotion of renewable energy has been supported by the Spanish government under the National Energy Plan (1991-200), trough two Renewable Energy plans (PER 86-88 and PER 89-90) and the current National RES Development Plan (2000-2001) which includes an objective of 2 230 MW installed capacity for small hydro by the year 2010. The government strategy to promote increased use of renewable energy is based on two principles: favourable buy-back rates and financial support via capital subsidies.

French policy is to promote renewable energies when they are competitive. In 1996 the government launched the "EOLE" programme promoting wind energy. In 1997, France's National Communication on Climate Change outlined the future development of renewable energy. Government supports renewable energy in several ways, including direct funding of local and regional projects, financial incentives and information/education programmes. Independent small hydro producers benefit from a purchase price guarantee for 15 years.

One of **Ireland's** energy objectives is to produce as much of national energy requirements from indigenous sources as is economically possible. Since 1994, the development of renewable energy electricity generating capacity has been encouraged through a series of government supported Alternative Energy Requirement (AER) competitions. The AER programme operates as a competitive process with tendering based on bid price per unit of electricity. Currently the AER VI is in force. Exploitation of small hydropower has been encouraged by the AER programmes up to date.



In **Italy**, encouragement of renewable energy started in 1991, with laws 9 and 10 liberalising the electricity industry and facilitating access by independent renewable electricity producers. A subsequent Directive CIP6/92, introduced in 1992, allocated premium buy-back rates for independently generated renewable electricity. In 1995, the Interministerial Committee for Economic Planning approved the National Plan for Sustainable Development. In 1999, Italy developed a plan called “White Paper for the valorisation of Renewable Energy Sources”. This document indicated policies, strategies and targets to achieve for 2008-2012. The target for small hydropower was set at 3 000 MW.

The importance of non-hydro renewable energy in **Luxembourg** is limited. Nevertheless, renewable energy is being encouraged by a number of measures including guaranteed electricity markets and favourable rates and grants for renewable energy technologies. Key policy developments include the Energy Efficiency Law adopted in 1993, which led to a 1994 Grand Ducal regulation on purchase price regulations surplus electricity produced by CHP and renewable energy sources. Since December 1996, expenditure on certain technologies, including renewables is tax deductible. The Luxembourg’s legislation concerns mainly tariffs and grants.

Renewable energy policy has evolved rapidly in **the Netherlands** over the 1990s. The current policy framework to encourage renewable energy is laid out in the 1997 White Paper Renewable Energy – Advancing Power. This paper focused on the liberalisation of the energy market and set goals with respect to renewable energy up to 2020. In addition there are several investment support schemes. Nevertheless, the Netherlands’ hydro potential is extremely limited due to its topography.

Since 1997, incentives for renewable electricity generation were provided in **Austria** by the “Promotion Instrument for Electricity from Renewables” which excluded hydropower. In 2002, the Austrian Parliament adopted new legislation to comply with the RES-E Directive, the Green Electricity Act. This act implements a feed-in system for RES. There is a purchase obligation for electricity from RES. In addition to this obligation the Act fixed minimum % targets for RES-electricity for the year 2008: 9% electricity from small hydro.

The development of small hydro in **Portugal** is a good case study of removing non-technical barriers to private investment in the power sector. In 1988, Decree-Law 189/88 came into force, defining the rules for the independent production from renewables. In parallel, the licensing procedure to use water for electricity generation was clearly established by legislation. Both regulations were responsible for the small hydro boom in the early 1990’s.

In **Finland**, the legislation directly governing renewable energies is not very broad. In 1997, the Government presented to the Finnish Parliament its report on Energy Policy and outlined an Energy Strategy paper for the long-term energy policy, which included a commitment to increase the use of bioenergy. In 1999, Finland adopted a national energy target in form of an “Action Plan for Renewable Energy Sources” covering Hydropower as well. In addition, investment support schemes and a range of measures to address non-financial barriers to the development of renewable energy technologies are in place.

In 1997, the **Swedish** Parliament passed a decision ‘On Sustainable Energy Supply’. This energy programme established investment support for renewable energy projects including small hydropower. In 1998, the Swedish National Energy Administration was set up with the responsibility of running the 1997 energy programme. The future development of hydro in Sweden is closely connected to public acceptance. In 2003, Sweden implemented the green certificates system as RES support scheme.



In the *United Kingdom*, the Non-Fossil Fuel Obligation (NFSO) schemes were the main measures in place to develop renewables. The NFSO originated in 1989 as a mechanism for protecting nuclear power during the privatisation of the electricity supply industry was extended to include renewables in 1990. There have been five NFSO until 1998. The NFSO-5 included 261 projects of which 22 were hydro. In 2002, introduced the Renewable Obligation (RO) as the main mechanism in England and Wales and separately in Scotland through which the government planned to achieve the targets for renewable electricity set in the RES-E Directive. In addition, the policy included an exemption or renewable electricity and heat from the Climate Change Levy, an expanded support programme for renewable energy and a regional strategic approach to target RES. The Government proposed an initial 10 years strategy. Small hydropower has been eligible for ROs while large hydro has not.

As conclusion, it must be mentioned that while several legislation supported RES development in the last decade, both at European and national level, in the case of small hydropower, the positive effect has been diminished due to the implementation of some environmental regulation affecting directly or indirectly SHP. Among this type of legislation, the European Union passed recently a Directive⁶ establishing a framework for Community action in the field of water policy (Water Framework Directive), which could have negative impact on the SHP development in the coming years.

⁶ Directive 2000/60/EC



CONCLUSIONS

The main conclusions that can be drawn from the analysis of this report as regard SHP development in the European Union during the last decade are:

- 1- SHP installed capacity in the EU-15 has followed an upward trend as for 1990 increasing more than double over the reference period and contributing by 2% to the total electricity installed capacity in the EU-15 in the year 2001.
- 2- SHP electricity generation in the EU-15 has followed an upward trend as for 1990 increasing by 30% from 1990 to 2001. Electricity generation from SHP contributed about 2% to the total electricity generation in the EU-15 in the 2001. About 9% of the RES electricity generation and 4% of the RES primary energy in the EU-15 were produced by SHP plants in 2001.
- 3- More Member States in the EU-15 have followed a stable or upward trend as regards SHP installed capacities and electricity generation from 1990 to 2001. Some countries like Germany, Greece, Spain, Italy, Luxembourg, Portugal and United Kingdom have developed the SHP sector during the last decade. In Belgium, Denmark, France, The Netherlands and Finland, the trend has been more stable as for 1990. Nevertheless both Sweden and Ireland have followed a downward trend.
- 4- Numerous Member States reached maximums in capacity and generation in the period 1995 to 1998 like United Kingdom, Sweden and Finland. In Ireland the peak takes place in 1992-1993. As for 1992 the SHP development really began in Spain. Highest figures for capacity and generation were reached in France from 1996 to 1999.
- 5- In 2001, Italy accounted for 22% of the EU-15 SHP installed capacity and electricity generation holding a leading position in terms of SHP capacity and production.
- 6- Trends in the SHP over the last decade show not only the positive impact of RES policy implemented across the EU-15 but also the negative effect and risk of some legislation and environmental movements in some Member States.