Energy consumption
in the services sector

Surveys of EU Member States

Data 1995-1999

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ABBREVIATIONS

MJ   Megajoule
TJ   Terajoule (10^6 MJ)

kWh   Kilowatt hour
GWh   Gigawatt hour (10^6 kWh) $\boxed{1TJ = 3.6 \ GWh}$

m^2 Square meter

LPG   Liquified petroleum gas

NACE   Statistical Classification of Economic Activities in the EU

SUMMARY

This publication is a compilation of the results of the "Energy Consumption in the Services Sector" project, which covers all European Union Member States except Luxembourg and Ireland. The purpose of this project was to collect information on energy consumption in the services sector directly through surveys complemented by studies.

The **Introduction** gives a general presentation of the project and includes a description of its scope and main definitions.

The section on **National results** shows the information provided in the national reports. After a brief description of the main results in each Member State, a standard set of four tables is presented per country in homogeneous units:

- Total consumption. In addition to the data on specific energy uses, some countries have reported figures for total consumption in the services sector by type of fuel.

- Consumption for space heating and hot water. Data are presented by branch and type of fuel.

- Consumption for air conditioning, cooling and ventilation. Data are presented by branch and type of fuel (usually electricity).

- Consumption for specific uses of electricity. Data are presented by branch and specific use.

The individual results presented in this section are complemented by a detailed description of the methodology used in each country included in **Annex I**.

LIST OF ORGANISATIONS WHICH PERFORMED THE SURVEYS

Belgium :

Walloon Region and Brussels	Institut Wallon du Développement Economique et Social
Flanders	VITO (Vlaamse Instelling voor Technologisch Onderzoek)

Denmark	Danmarks Statistik
Germany	DIW (Deutsches Institut für Wirtschaftsforschung)
Greece	National Statistical Service of Greece (NSSG)
Spain	Instituto Nacional de Estadística (INE)
France	CEREN (Centre d'Etudes et de Recherches Economiques sur l'Energie)
Italy	ENEA (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente)
Netherlands	Centraal Bureau voor de Statistiek (CBS)
Austria	ÖSTAT and IEW (Institut für Energiewirtschaft, Technische Universität, Vienna)
Portugal	Direcção Geral de Energia
Finland	Statistics Finland
Sweden	Statistics Sweden (SCB)
United Kingdom	Building Research Establishment (BRE)

INTRODUCTION

Background to the project

Traditionally, energy statistics have been collected and analysed from the supply side. For this reason, information on energy consumption in the services sector is estimated indirectly. Since this approach is not precise, a direct survey of the energy consumed by users considerably improves the quality of the statistics collected in this field.

On the other hand, the disaggregation of the energy consumption in sevices for the various branches of activitivity and the knowledge of the consumption in the different uses was rather poor in most Member States. Therefore, there was a need to perform direct surveys (occasionally supported by studies)

- to improve the quality of the information on energy consumption in the services sector

- to study the breakdown of the energy consumption in the various branches of activity belonging to the services sector

- to determine the energy consumption by different uses.

After conducting a similar project in the domestic sector in 1997, Eurostat, in co-operation with DG Energy and Transport (DG TREN), launched a project whose objective was the direct collection of information on energy consumption in the services sector in the EU Member States.

In order to achieve this objective, a specific survey or study was conducted in each Member State with the financial support of DG TREN or Eurostat. Since resources were limited, the surveys were financed over a four-year period: from 1997 to 2000. This is also the reason why the reference years of the national reports are not the same: they range from 1995 to 1999.

Only two Member States, Luxembourg and Ireland, did not take part in this project and therefore no results are shown for either of these countries.

To harmonise the results as far as possible, Eurostat drafted a common general methodology and a common set of tables in which to display the data. In addition, the organisations conducting each national survey were requested to provide, in their final reports, a description of the methodology used for the work and comments on the most important data and conclusions reached.

Service-sector activities covered

The service sector branches covered in this project are defined according to the Statistical Classification of Economic Activities in the EU (NACE Rev.1). Six main divisions (two-digit level) were selected for the analysis:

1.- Hotels and Restaurants (NACE 55). This branch covers hotels, motels, camping sites, other provision of short-stay accommodation, restaurants, bars, canteens and catering.

2.- Health and Social Work (NACE 85). This branch includes human health activities, veterinary activities and social work activities with or without accommodation.

3.- Education (NACE 80). This branch covers primary, secondary and higher education as well as adult and other education.

4.- Other Community, Social and Personal Service Activities (NACE 90-93). These branches represent the following activities:

- NACE 90. Sewage and refuse disposal, sanitation and similar activities.
- NACE 91. Activities of membership organisations: business, employers' and professional organisations, trade unions, religious organisations, political organisations, etc.
- NACE 92. Recreational, cultural and sporting activities.
- NACE 93. Other service activities. It includes activities such as washing and dry-cleaning, hairdressing, etc.

5.- Offices and Administration (NACE 60-67, 70-75, 99). These branches represent the following activities:

- NACE 60. Land transport; transport via pipelines.
- NACE 61. Water transport.
- NACE 62. Air transport.
- NACE 63. Supporting and auxiliary transport activities; activities of travel agencies.
- NACE 64. Post and telecommunications.
- NACE 65. Financial intermediation, except insurance and pension funding.
- NACE 66. Insurance and pension funding, except compulsory social security.
- NACE 67. Activities auxiliary to financial intermediation.
- NACE 70. Real estate activities.
- NACE 71. Renting of machinery and equipment without operator and of personal and household goods.
- NACE 72. Computer and related activities.
- NACE 73. Research and development.
- NACE 74. Other business activities.
- NACE 75. Public administration and defence; compulsory social security.
- NACE 99. Extra-territorial organisations and bodies.

6.- <u>Commerce (NACE 50-52)</u>. These branches represent the following activities:

- NACE 50. Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel.
- NACE 51. Wholesale and commission trade, except of motor vehicles and motorcycles.
- NACE 52. Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods.

Energy sources and uses

The definitions used for conventional and renewable energy sources are the same as those used in the Eurostat energy balances published every year.

With regard to energy uses, for the sake of simplification, energy consumption in the services sector has been divided into three categories:

1. <u>Energy consumption for space heating and hot water for sanitary purposes</u>. The consumption figures should refer to the total energy consumed for space heating, i.e. principal and secondary sources added to the consumption for hot water for sanitary purposes.

2. <u>Air-conditioning</u>. Consumption for air conditioning is reported under this heading. Air conditioning is often linked to space heating. If so, only the energy used for cooling should be reported here.

3. <u>Electricity consumption (specific uses of electricity)</u>. Electricity consumption for uses which can be performed only with electricity, such as office automation (computers, printers, photocopiers, etc.), lighting, other electrical appliances (refrigerators, ovens, deep-freezers, etc.), and consumption for processes (ovens in bakeries, washing machines in laundries, etc.) should be reported under this heading.

It should be noted that consumption of fuels used for transportation purposes are not included in the reported figures, following the general principles of the Eurostat energy balances.

NATIONAL RESULTS

MAIN RESULTS

Belgium (Tables 1)

The total energy consumption in the services sector in 1996 amounted to 150 044 TJ. About two-thirds of this total were used for space heating and hot water, while the rest was mainly electricity consumption for lighting, cooling and ventilation and other specific uses. No data on consumption per square meter was available at national level.

The main energy commodity used for space heating and hot water production was natural gas, acounting for over 50% of the total. Heating oil was also very widely used, at about 43% of the total. By branch, natural gas was also the most frequently-used type of fuel, the only exception being *Education,* where heating oil was slightly more common. *Offices & Administration* was the branch consuming most energy for space heating and hot water, followed by *Other Community & Social Activities.*

The figures for air conditioning, cooling and ventilation refer to the electricity consumed for air treatment, cooling devices and circulation pumps. *Commerce* was the branch with the highest consumption for this use, followed by *Offices & Administration.*

Finally, specific uses of electricity accounted for 8 089 GWh, 75% for lighting and 25% for electrical appliances. *Offices & Administration* and *Commerce*, in this order, were the highest branch consumers for both uses.

Denmark (Tables 2)

The total energy consumption in the services sector in 1997 was 92 783 TJ. From this total, 42 982 TJ corresponded to space heating and hot water. Data on consumption per square meter was available for space heating and for the overall consumption of electricity.

District heat is by far the most frequent type of energy commodities used for space heating and hot water, accounting for about 66% of the total. Natural gas (18%) and heating oil (13%) are also used fairly frequently. *Commerce* and *Offices & Administration* were the branches with the highest consumption for this use, but *Health & Social Work* showed the highest consumption per square meter.

Data on air conditioning, cooling and ventilation refers mainly to ventilation devices, since air conditioning is not very common in Denmark. The total consumption for this use was 2 343 GWh, all electricity. Half of this total was consumed by the *Commerce* branch.

Electricity consumption for specific uses amounted to about 7 000 GWh. Lighting accounted for 47% of the total, processes for 45% and the rest was consumed by electrical appliances. *Commerce* and *Offices & Administration* were the branches with the highest electricity consumption for specific uses.

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Germany (Tables 3)

According to the 1997 applications balance prepared by the German Electricity Association (VDEW), total energy consumption in the German services sector amounted to 1 536 000 TJ. Heating/gas oil represented about 35% of the total, followed by electricity (28%), natural gas (27%) and district heat (7%). Data per square meter were reported per branch for the various energy uses.

Total consumption for space heating and hot water was 726 828 TJ. Heating oil (39%) and natural gas (37%) were by far the most frequent types of energy commodities used for this purpose. Average consumption per square meter was 839 MJ/m^2, but at branch level it ranged from 911 MJ/m^2 in *Offices & Administration* to 655 MJ/m^2 in *Education*. *Offices & Administration* was also the branch with the largest consumption in absolute terms.

The consumption of energy for air conditioning, cooling and ventilation amounted to 3691 GWh, 81% of which was electricity. About 55% of this consumption was recorded in *Commerce*. Average consumption per square meter in the whole services sector was 4 kWh/m^2.

Electricity consumption for specific uses amounted to 76 808 GWh. Its distribution by uses was as follows: lighting 37%, electrical appliances 42% and processes 22%. *Offices & Administration* and *Commerce* recorded the highest consumption for lighting and electrical appliances, while *Hotels & Restaurants* and *Health & Social Work* registered the largest figures for processes. In terms of consumption for lighting per square meter, the overall average was 31 kWh/m^2, ranging from 37 kWh/m^2 in *Commerce* to 16 kWh/m^2 in *Other Community, social and personal service activities*.

Greece (Tables 4)

The results presented for Greece correspond to 1998 and do not cover the whole services sector. The branch *Education* and one sub-branch of *Offices & Administration* (Public administration and defence) are not included, since data retrieved from administrative sources were not compatible with data for other branches.

Consumption for space heating and hot water in the branches reported was 34 648 TJ, distributed mainly between electricity (63%) and heating oil (33%). *Commerce* and *Hotels & Restaurants* consumed the most energy for this purpose.

Consumption for air-conditioning in the branches reported amounted to 944 GWh, with electricity the predominant type of energy commodities used (97%). Again, *Commerce* and *Hotels & Restaurants* were the two branches with the highest shares of consumption. Overall average consumption per square meter for air conditioning was 38 kWh/m^2.

Finally, electricity consumption for specific uses in the branches analysed was 3 231 GWh. Of this total, 2 393 GWh (74%) were consumed by electrical appliances and processes (it was not possible to split these two specific uses). The rest was consumed

by lighting, with an average consumption per square meter (of space heating) of 28 kWh/m^2. Once more, *Commerce* and *Hotels & Restaurants* reported the highest consumption figures.

<u>Spain</u> (Tables 5)

The results provided correspond to companies in the services sector with 100 or more persons employed and were collected for year 1998. Therefore, the reported figures underestimate the consumption in the services sector in absolute values. However, some conclusions can be drawn from the relative differences between types of energy commodities.

Based on the figures reported, the overall energy consumption in 1998 showed a clear majority share of electricity (78%). Natural gas (10%) and fuel oil/gas oil (9%) had also important shares.

Regarding consumption for space heating and hot water the distribution by type of energy commodity was mainly concentrated in electricity (36%), heating oil (34%) and natural gas (26%). Of the total consumption reported for air conditioning, 96% was electricity. Consumption for lighting represented about 53% of the electricity consumption for specific uses.

<u>France</u> (Tables 6)

Total energy consumption in 1996 in the services sector accounted for 687 262 TJ. It was mainly divided between electricity (38%), natural gas (31%) and fuel oil/heating oil (23%). These results are temperature corrected.

Consumption for space heating and hot water was 447 667 TJ. The breakdown by type of energy commodity showed a different structure from that of total consumption: natural gas was the most heavily-consumed fuel (41%), followed by heating oil (33%), electricity (16%) and other fuels (10%). The average consumption per square meter was 616 MJ/m^2. *Offices & Administration* was the branch with the highest consumption for this use, but *Other Community, social and personal service activities* consumed most per square meter: 979 MJ/m^2. In the other branches this indicator ranged from 446 MJ/m^2 to 785 MJ/m^2.

Total consumption for air conditioning was estimated at 6 411 GWh, using electricity almost exclusively. *Offices & Administration* and *Commerce* presented the highest figures for total consumption and consumption per square meter. Overall consumption per square meter was 70 kWh/m^2.

Finally, the specific uses of electricity consumed 41 254 GWh. This total was divided into consumption for lighting (60%) and electrical appliances plus processes (40%). Again, *Offices & Administration* and *Commerce* showed the highest consumption figures.

Average consumption for lighting per square meter was 34 kWh/m^2, with a range at branch level from 56 kWh/m^2 to 10 kWh/m^2.

Italy (Tables 7)

In 1999, total consumption in the services sector was 576 050 TJ. Natural gas (41%) and electricity (36%) were the two main types of energy commodities. District heat (10%), fuel oil/gas oil (8%) and LPG (3%) were also consumed. No data on consumption per square meter were reported.

Consumption for space heating and hot water amounted to 376 325 TJ, the majority being based on natural gas at 235 278 TJ (about 63%). This was followed by district heat (16%), heating oil (12%), LPG (4%) and electricity (3%). The most consuming branch for this energy use was *Hotels & Restaurants* followed by *Offices & Administration*.

Energy consumption for air conditioning was exclusively electricity, at a total of 11 954 GWh. *Offices & administration* represented 40% of the total, followed by *Hotels & restaurants*, *Other Community, social and personal service activities* and *Commerce,* all at around 17%.

Consumption for specific uses of electricity was estimated at a total of 41 936 GWh. The breakdown by use was lighting 62%, electrical appliances 9% and processes 29%. *Offices & Administration* was the heaviest consumer for lighting, electrical appliances and in total, while *Commerce* was the heaviest consumer for processes and the second largest in total.

Netherlands (Tables 8)

The results in the Netherlands correspond to 1999 but are limited to some sub-branches of the *Offices & Administration* branch. There are consequently no figures for the whole services sector in any of the tables.

Consumption for space heating and hot water in the sub-branches studied was mainly covered by two types of energy commodities: natural gas (51%) and electricity (43%). Regarding air-conditioning and cooling, the consumption reported was limited to electricity.

Austria (Tables 9)

In 1998 a total consumption of 144 278 TJ was reported in the services sector. The breakdown by type of fuel is not included, since it was not fully compatible with the tables by use reported later.

Consumption for space heating and hot water amounted to 71 515 TJ. The breakdown by type of energy commodity included district heating (29%), heating oil (25%), natural gas

(24%), electricity (12%) and other fuels (8%). Three branches show similar levels of consumption for space heating and hot water: *Other Community, social and personal service activities*, *Offices & Administration* and *Education*. Average consumption per square meter was 80 MJ/m^2.

Electricity was the only energy commodity consumed for air conditioning, cooling and ventilation. The total figure was 1 497 GWh, consumed mainly by *Offices & Administration* (42%) and *Hotels & Restaurants* (18%).

Finally, electricity consumption for specific uses reached a total value of 11 190 GWh, divided into lighting (35%) and electrical appliances and processes (65%). *Offices & Administration* had the largest consumption for these uses, followed by *Commerce* and *Other Community, social and personal service activities*.

Portugal (Tables 10)

The figures for energy consumption in the services sector refer to 1997. Data on total consumption is not available.

Consumption for space heating and hot water was 15 367 TJ. This consisted of three types of energy commodities: LPG and manufactured gas (48%), electricity (27%) and heating oil (25%). Natural gas was available in Portugal only from 1997 onwards. The breakdown by branch showed that *Hotels & Restaurants* had the highest consumption, followed by *Offices & Administration*. Overall average consumption per square meter was 188 MJ.

Electricity was the only type of fuel used for air conditioning. Consumption for this use amounted to 570 GWh. *Offices & Administration*, *Hotels & Restaurants* and *Commerce* were the main consuming branches. Average consumption per square meter was 10 kWh/m^2.

Total electricity consumption for specific uses was 5 893 GWh, split between lighting (62%) and electrical appliances and processes (38%). The heaviest consumer branch was *Commerce* due to its large consumption for lighting, but *Offices & Administration* and *Hotels & Restaurants* had also significant figures. Average consumption for lighting per square meter was 37 kWh/m^2, ranging from 79 kWh/m^2 in Hotels & Restaurants to 24 *kWh/m² in Education*.

Finland (Tables 11)

The figures for energy consumption in the services sector refer to 1998. Data for total consumption were not available but they have been estimated by Eurostat as the addition of consumption for the energy uses. Consumption per square meter was reported for the different energy uses.

Total consumption for space heating and hot water amounted to 54 902 TJ, most of which (33 706 TJ (61%)) consisted of district heat. Heating oil also had a significant share of 28%, followed by electricity (7%). With regard to branches, *Offices & Administration* and *Commerce* presented the largest consumption figures. Overall average consumption per square meter was 697 MJ/m^2, with a range by branch from 980 MJ/m^2 in *Health & Social Work* to 613 MJ/m^2 in *Offices & Administration*.

Total reported consumption for air conditioning, cooling and ventilation was 3 461 GWh, all electricity. Again, *Offices & Administration* and *Commerce* were the branches with the highest consumption. Average consumption per square meter was 44 kWh/m^2.

Specific uses of electricity consumed 7 755 GWh, split between lighting (40%) and electrical appliances plus processes (60%). Consumption for lighting per square meter ranged from 78 kWh/m^2 in *Hotels & Restaurants* to 22 kWh/m^2 in *Education,* the overall average being 40 kWh/m^2. *Offices & Administration* and *Commerce* were the main consuming branches for these specific uses of electricity.

Sweden (Tables 12)

The figures for energy consumption in the services sector refer to 1997. Data on total consumption is not available, but consumption per square meter was reported for the various energy uses.

Total energy consumption for space heating and hot water was 66 235 TJ. District heat took the largest share of 64%, followed by heating oil (22%) and electricity (8%). *Offices & Administration* showed the highest consumption of district heat and the highest overall, while *Health & Social Work* came second for overall consumption. Consumption per square meter was fairly homogeneous in all branches, ranging from 579 to 486 MJ/m^2, the average being 516 MJ/m^2.

Consumption for air conditioning was quite low at only 121 GWh, all electricity. 50% of the total was consumed in *Offices & Administration.* Average consumption per square meter was also low at 4 kWh/m^2.

Finally, electricity consumption for specific uses amounted to 11 095 GWh, distributed as follows: lighting 53%, electrical appliances 31% and processes 16%. *Offices & Administration* and *Health & Social Work* reported the highest consumption results. Figures for lighting consumption per square meter were not available.

United Kingdom (Tables 13)

Total consumption in the services sector in 1995 amounted to 833 500 TJ. Natural gas was the most heavily-consumed energy commodity (47%) followed by electricity (35%), heating oil (15%) and solid fuels (2%). No data are available on consumption per square meter.

Consumption for space heating and hot water amounted to 561 200 TJ. Again, natural gas was by far the most frequent type of energy commodity for this use (64%), with other fuels broken down as follows: heating oil 21%, electricity 12% and solid fuels 3%. Only consumption for electricity and solid fuels could be split completely by branch, while the distribution of natural gas and heating oil was available only for all energy uses.

Total consumption for air conditioning, cooling and ventilation was 5 083 GWh, all electricity. *Commerce* recorded the highest branch consumption for these uses (46%).

Electricity consumption for specific uses was 58 610 GWh divided into lighting (52%) and electrical appliances and processes (48%). Again, *Commerce* recorded the highest figures of all branches for both uses followed by *Offices & Administration*.

NATIONAL TABLES

The following pages present the harmonised tables per country on which the above comments are based. These refer to:

- total energy consumption (in TJ)
- consumption for space heating and hot water (in TJ)
- consumption for air conditioning, cooling and ventilation (in GWh)
- consumption for specific uses of electricity (in GWh)

TABLES 1 : BELGIUM (Reference year: 1996)

1.1.- TOTAL CONSUMPTION

TJ

All branches	Heating Oil	Natural gas	LPG and Manuf. gas	Solid fuels	Electricity	Other	TOTAL
TOTAL	44,280	57,075	308	104	47,844	433	150,044

1.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER[1]

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Solid fuels	Electricity	Other	TOTAL
1		2,213	6,708	113		144		9,178
2		4,591	6,092		38	160	116	10,997
3		7,855	7,611	33	36	93	94	15,722
4		7,451	14,048	53	6	158	112	21,828
5		16,047	16,105	8	24	643	60	32,887
6		6,123	6,511	101		802	51	13,588
TOTAL		44,280	57,075	308	104	2,000	433	104,200

[1] Including 1859 TJ of other uses.

1.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		395	395
2		565	565
3		236	236
4		170	170
5		1,123	1,123
6		2,158	2,158
TOTAL		4,647	4,647

1.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1		477	261	738
2		460	161	620
3		457	54	511
4		811	159	971
5		2,135	1,091	3,226
6		1,751	272	2,023
TOTAL		6,091	1,998	8,089

TABLES 2 : DENMARK (Reference year: 1997)

2.1.- TOTAL CONSUMPTION

TJ

All branches	Gas Oil/ Heating oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	TOTAL
TOTAL	19,288	9,888	293	34,934	28,380	92,783

2.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	TOTAL
1	**320**	319	452	109	233	1,054	**2,167**
2	**648**	254	1,539	11	92	4,308	**6,204**
3	**410**	348	1,606	25	131	5,647	**7,757**
4	**395**	269	1,097	15	148	3,456	**4,985**
5	Sub-branch data	1,099	1,741	38	304	6,798	**9,980**
6	**306**	3,140	1,137	95	499	7,018	**11,889**
TOTAL		**5,429**	**7,572**	**293**	**1,407**	**28,281**	**42,982**

2.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		179	**179**
2		139	**139**
3		132	**132**
4		151	**151**
5		581	**581**
6		1,161	**1,161**
TOTAL		**2,343**	**2,343**

2.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances	Processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption			
1		167	16	244	**427**
2		330	29	306	**665**
3		390	23	232	**645**
4		188	20	447	**655**
5		1,049	380	859	**2,288**
6		1,156	91	1,067	**2,314**
TOTAL		**3,280**	**559**	**3,155**	**6,994**

TABLES 3 : GERMANY (Reference year: 1997)

3.1.- TOTAL CONSUMPTION[1]

TJ

All branches	Heating oil, gas/diesel oil	Natural gas, LPG and Manuf. gas	Solid fuels	Electricity	District heating	Wood and peat	TOTAL
TOTAL	536,000	420,000	26,000	436,000	115,000	3,000	1,536,000

[1] Final energy consumption according to the 1997applications balance prepared by VDEW

3.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Solid fuels	Electricity	District heating	TOTAL
1	821	28,002	24,679	1,965	2,200	8,319	9,652	74,817
2	731	48,772	46,418		3,840	4,809	16,819	120,658
3	655	36,716	34,956		2,897	821	12,665	88,055
4	842	17,512	16,654		1,392	6,059	6,034	47,651
5	911	83,289	76,700	2,568	6,567	12,042	28,721	209,887
6	666	72,079	68,004	605	5,692	14,522	24,858	185,760
TOTAL	839	286,370	267,411	5,138	22,588	46,572	98,749	726,828

3.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	Other	TOTAL
1	5.6	531	10	541
2	2.2	372	0	372
3	0.6	76	0	76
4		0	0	0
5	2.8	462	206	668
6	7.2	1,565	469	2,034
TOTAL	4.0	3,006	685	3,691

3.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances	Processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption			
1	21	1,990	2,720	8,318	13,028
2	23	3,885	3,176	5,306	12,367
3	21	2,896	2,325	297	5,518
4	16	1,310	2,498	1,218	5,026
5	32	7,607	10,783	1,191	19,581
6	37	10,474	10,508	306	21,288
TOTAL	31	28,162	32,010	16,636	76,808

TABLES 4 : GREECE (Reference year: 1998)[1]

(1) Branch 3 (Education) and part of branch 5 (NACE 75: Public administration and defence) not included.

4.1.- TOTAL CONSUMPTION

TJ

All branches	Heating Oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
TOTAL							

4.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
1		2,512	0	494	6,099	0	109	**9,214**
2		3,804		100	1,382	0		**5,286**
3								**0**
4		376		66	800	0	4	**1,246**
5		1,598	0	46	3,673	0	6	**5,323**
6		3,097	0	421	10,010	1	50	**13,579**
TOTAL		**11,388**	**0**	**1,127**	**21,964**	**1**	**170**	**34,648**

4.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	Other	TOTAL
1	66	339	7	**346**
2	24	77	10	**87**
3				
4	25	18	1	**19**
5	17	81	4	**85**
6	38	399	8	**407**
TOTAL	**38**	**914**	**31**	**944**

4.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)[2]	Total consumption		
1	37	254	678	**932**
2	6	19	192	**211**
3				
4	25	27	87	**114**
5	28	163	393	**556**
6	29	376	1,043	**1,418**
TOTAL	**28**	**839**	**2,393**	**3,231**

[2] Lighting per m² of space heating

TABLES 5 : SPAIN (Reference year: 1998)[1]

(1) Data refer to companies with 100 or more employees

5.1.- TOTAL CONSUMPTION

TJ

All branches	Fuel oil and gas oil	Natural gas	LPG and Manuf. gas	Solid fuels	Electricity	Other	TOTAL
TOTAL	5,352	5,515	1,424	135	44,060	25	56,511

5.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Solid fuels	Electricity	Other	TOTAL
1	624	1,356	639	168	2	468	0	2,633
2	343	680	549	60	5	127	9	1,430
3	251	616	409	22	1	38	1	1,087
4	264	137	323	18	0	140	0	618
5	193	1,373	1,092	143	27	2,391	5	5,031
6	226	148	249	4	0	1,419	0	1,820
TOTAL	255	4,310	3,261	415	35	4,583	15	12,619

5.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	Other	TOTAL
1	58	257	8	265
2	42	104	8	112
3	19	18	1	19
4	76	156	2	158
5	45	1,253	19	1,272
6	70	689	78	767
TOTAL	52	2,477	116	2,593

5.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1	37	351	256	607
2	20	110	130	240
3	18	92	56	148
4	31	137	358	495
5	71	2,899	1,993	4,892
6	49	948	1,156	2,104
TOTAL	54	4,537	3,949	8,486

TABLES 6 : FRANCE (Reference year: 1996)

6.1.- TOTAL CONSUMPTION

TJ

All branches	Fuel Oil/ Heating oil	Natural gas	Electricity	Other	TOTAL
TOTAL	158,656	211,457	262,562	54,587	687,262

6.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	Electricity	Other	TOTAL
1	785	15,324	19,620	8,114	5,101	48,159
2	691	31,277	33,005	8,132	8,927	81,341
3	490	27,090	33,299	5,216	10,466	76,071
4	979	10,174	19,840	8,042	2,222	40,278
5	698	35,799	48,664	23,594	15,475	123,532
6	446	26,127	28,935	18,464	4,760	78,286
TOTAL	616	145,791	183,363	71,562	46,951	447,667

6.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	Other	TOTAL
1	70	496	1	497
2	69	823	0	823
3	52	91	0	91
4	50	253	1	254
5	72	2,700	2	2,702
6	73	2,044	0	2,044
TOTAL	70	6,407	3	6,411

6.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1	31	1,921	1,016	2,937
2	21	2,491	1,633	4,124
3	10	1,553	518	2,071
4	35	1,437	387	1,824
5	43	7,704	8,204	15,908
6	56	9,785	4,605	14,390
TOTAL	34	24,891	16,363	41,254

TABLES 7 : ITALY (Reference year: 1999)

7.1.- TOTAL CONSUMPTION

TJ

All branches	Fuel oil and gas oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
TOTAL	45,469	235,278	16,624	204,576	59,423	14,680	576,050

7.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
1		16,440	60,041	16,014	2,758	14,524	463	110,240
2		8,514	32,346	212	1,138	23,068	72	65,350
3		3,462	10,861	5	155	10	0	14,493
4		3,906	29,214	219	1,732	7,537	8,096	50,704
5		11,561	71,509	123	2,088	14,041	376	99,698
6		1,586	31,308	51	2,653	242	0	35,840
TOTAL		45,469	235,278	16,624	10,524	59,423	9,007	376,325

7.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		2,129	2,129
2		694	694
3		358	358
4		2,022	2,022
5		4,833	4,833
6		1,917	1,917
TOTAL		11,954	11,954

7.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances	Processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption			
1		4,684	255	681	5,620
2		1,421	63	663	2,147
3		716	172	143	1,031
4		4,429	578	2,118	7,125
5		9,665	2,320	1,933	13,918
6		5,162	295	6,637	12,094
TOTAL		26,077	3,683	12,176	41,936

TABLES 8 : NETHERLANDS (Reference year: 1999)[1]

[1] Data refer only to branch "Offices and administration" (NACE 65-67 and 70-74)

8.1.- TOTAL CONSUMPTION

TJ

All branches	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
TOTAL						

8.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
1 2 3 4 5 6	370	296	12,375	10,409	990	80	24,150
TOTAL							

8.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1 2 3 4 5 6		1,145	1,145
TOTAL			

8.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

| Branches | Lighting | | Electrical appliances | Processes | TOTAL |
	Consumption per m² (kWh/m²)	Total consumption			
1 2 3 4 5 6	33	3,643	3,226	2,394	9,263
TOTAL					

TABLES 9 : AUSTRIA (Reference year: 1998)

9.1.- TOTAL CONSUMPTION

TJ

All branches	Fuel oil and gas oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
TOTAL							144,278

9.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	LPG and Manuf. gas	Electricity	District heating	Other	TOTAL
1		3,557	885	337	2,072	476	1,179	**8,506**
2		958	2,064	4	1,219	6,072	255	**10,572**
3		3,919	5,560	43	575	3,984	288	**14,369**
4		3,604	4,163	133	1,156	4,326	2,998	**16,380**
5		2,953	3,268	771	2,861	5,062	379	**15,294**
6		2,541	1,415	212	732	625	869	**6,394**
TOTAL	80	**17,531**	**17,356**	**1,500**	**8,614**	**20,545**	**5,968**	**71,515**

9.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		270	270
2		193	193
3		105	105
4		164	164
5		632	632
6		132	132
TOTAL		**1,497**	**1,497**

9.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1		353	799	**1,152**
2		289	590	**879**
3		369	673	**1,042**
4		300	1,518	**1,818**
5		1,931	2,517	**4,448**
6		667	1,184	**1,851**
TOTAL		**3,909**	**7,281**	**11,190**

TABLES 10 : PORTUGAL (Reference year: 1997)

10.1.- TOTAL CONSUMPTION

TJ

All branches	Fuel oil and gas oil	LPG and Manuf. gas	Electricity	TOTAL
TOTAL				

10.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	LPG and Manuf. gas	Electricity	TOTAL
1		1,239	4,007	442	5,688
2		1,009	121	295	1,425
3		96	293	229	618
4		281	1,415	716	2,412
5		1,227	1,386	1,234	3,847
6		0	163	1,214	1,377
TOTAL	188	3,852	7,386	4,130	15,367

10.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		414	414
2		45	45
3		3	3
4		54	54
5		200	200
6		63	63
TOTAL	10	780	780

10.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1	80	343	741	1,084
2	34	59	208	268
3	24	191	83	274
4	27	376	131	507
5	29	984	579	1,563
6	56	1,087	899	1,986
TOTAL	37	3,040	2,643	5,683

TABLES 11 : FINLAND (Reference year: 1998)

11.1.- TOTAL CONSUMPTION[1]

TJ

All branches	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
TOTAL	15,394	644	44,176	33,706	1,361	95,281

[1] Estimated by Eurostat

11.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
1	791	973	66	486	1,896	87	3,508
2	980	2,326	0	317	5,465	143	8,251
3	678	3,045	56	198	5,116	407	8,822
4	851	719	3	281	2,093	489	3,585
5	613	4,102	20	1,742	11,305	208	17,377
6	657	4,229	499	774	7,830	27	13,359
TOTAL	697	15,394	644	3,798	33,706	1,361	54,902

11.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1	122	543	543
2	36	305	305
3	19	245	245
4	88	370	370
5	39	1,103	1,103
6	44	895	895
TOTAL	44	3,461	3,461

11.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1	78	346	300	646
2	46	385	421	806
3	22	284	676	960
4	63	267	704	971
5	30	859	1,601	2,460
6	48	983	930	1,913
TOTAL	40	3,123	4,632	7,755

TABLES 12 : SWEDEN (Reference year: 1997)

12.1.- TOTAL CONSUMPTION

TJ

All branches	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
TOTAL						

12.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil	Natural gas	Electricity	District heating	Other	TOTAL
1	518	1,200	63	540	1,508	197	3,508
2	579	1,963	502	306	11,370	665	14,806
3	523	3,785	264	814	8,362	565	13,790
4	502	1,615	112	749	2,451	142	5,069
5	486	4,555	1,439	1,735	14,765	312	22,806
6	494	1,139	156	1,105	3,724	132	6,256
TOTAL	516	14,258	2,536	5,249	42,180	2,013	66,235

12.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1	7	17	17
2	3	5	5
3	3	8	8
4	5	7	7
5	4	61	61
6	5	23	23
TOTAL	4	121	121

12.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances	Processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption			
1		377	218	116	711
2		1,384	798	426	2,608
3		860	496	265	1,620
4		637	367	196	1,200
5		1,669	963	513	3,144
6		961	555	296	1,812
TOTAL		5,887	3,397	1,812	11,095

TABLES 13 : UNITED KINGDOM (Reference year: 1995)[1]

[1] Figures calculated on a floor area basis

13.1.- TOTAL CONSUMPTION

TJ

All branches	Heating Oil	Natural gas	Solid fuels	Electricity	TOTAL
TOTAL	127,400	393,600	18,500	294,000	833,500

13.2.- CONSUMPTION FOR SPACE HEATING AND HOT WATER

TJ

Branches	Consumption per m² (MJ/m²)	Heating Oil (2)	Natural gas (2)	Solid fuels	Electricity	TOTAL
1		32,200	79,300	600	3,200	
2		2,500	73,900	100	2,600	
3		40,900	44,000	13,900	5,900	
4		31,800	57,600		20,500	
5		9,500	91,800	3,900	15,400	
6		10,500	47,000		17,200	
TOTAL		118,400	359,500	18,500	64,800	561,200

(2) No breakdown by branch is available for space heating and hot water but for all uses. The figures shown by branch correspond to all uses and their addition is <u>not equal</u> to the figures shown under TOTAL

13.3.- CONSUMPTION FOR AIR-CONDITIONING, COOLING AND VENTILATION

GWh

Branches	Consumption per m² (kWh/m²)	Electricity	TOTAL
1		611	611
2		0	0
3		389	389
4		972	972
5		750	750
6		2,361	2,361
TOTAL		5,083	5,083

13.4.- CONSUMPTION FOR SPECIFIC USES OF ELECTRICITY

GWh

Branches	Lighting		Electrical appliances and processes	TOTAL
	Consumption per m² (kWh/m²)	Total consumption		
1		2,222	4,472	6,694
2		3,222	1,611	4,833
3		3,750	2,861	6,611
4		4,722	4,889	9,611
5		4,833	6,167	11,000
6		11,500	8,361	19,861
TOTAL		30,249	28,361	58,610

ANNEX I

METHODOLOGY OF THE NATIONAL REPORTS

BELGIUM

The report on energy consumption in the services sector was carried out by the *Institut Wallon*, which presented the data for Belgium as a whole. The *Institut Wallon* was in charge of collecting data for Brussels and the Walloon Region, while data for Flanders were collected by VITO (*Vlaamse Instelling voor Technologisch Onderzoek*). The reference year of the study was 1996.

METHODOLOGY

Sources of information and data collection method

The *Institut Wallon* prepared the regional energy balances for the tertiary sector in *Brussels* and *Wallonia*. Information was compiled in two different balances:

1- "High-voltage" energy balances, prepared each year, registered the consumption of clients connected to a high-voltage network. These balances were the result of an annual questionnaire distributed to the main consumers and the extrapolation (branch by branch) of the total electricity consumption per sector supplied by the electricity companies.

2- "Low-voltage" energy balances, calculated by the *Institut Wallon*, were based on their own available data, regional energy balances and total low-voltage electricity consumption.

The specific consumption of each branch was calculated with a different parameter:

- Hotels and Restaurants*:* calculation of specific consumption in hotels was based on square metres and the number of rooms of a particular sample. Hotels with fewer than 50 rooms were excluded from the sample.

- Health and Social Work*:* surface (m²) and number of beds were the reference units used to calculate specific consumption. Information was based on questionnaires.

- Education: specific consumption was calculated per pupil and surface (m²).

- Other Community, Social and Personal Service Activities: only data concerning specific consumption in swimming pools were available. Specific consumption was expressed in square metres of water surface.

- Offices and Administration: specific consumption was calculated by dividing the sample into private and public offices. The sample included small offices in houses or appartments. The reference unit was the surface (m²).

- Commerce: specific consumption was divided into two categories according to the store/shop surface (m²). One group consisted of stores/shops with a surface area of less than 400 m², while another consisted of supermarkets with a surface area of 400 m² to 2 500 m².

VITO prepared a report on energy consumption in the services sector in *Flanders*. The methodology used varied from one sector to the next. In general, four different sources were used:

1- Survey conducted with clients using high-voltage power or direct current. The electricity consumption from this survey in the services sector was used to estimate the total electricity consumption in the sector. Low-voltage electricity consumption was added to the estimated high-voltage electricity consumption from the survey. Fuel consumption was extrapolated using the factor "surveyed electricity/total electricity consumption estimated". The responses were considered to be representative of the whole sector. This methodology was used to calculate energy consumption in the "Hotels and Restaurants" and "Commerce" branches.

2- Energy simulation programme considering a stock of buildings for 14 different types of buildings. The programme calculated the energy consumption, using energy consumption data by type of building and type of specific use. Since the programme did not calculate energy consumption by type of fuel, results from different surveys were used to estimate it. This methodology was followed in analysing energy consumption in the "Other community, Social and Personal Service Activities" and "Offices and Administration" branches.

3- Energy consumption data from existing publications or previous surveys were also used to determine energy consumption in the "Health and Social Work", "Education", "Other Community, Social and Personal Service Activities" and "Offices and Administration" branches.

4- The study of "Energy demand and saving potential in the services sector in Belgium 1992-2003", conducted by STEM, was used to determine specific energy uses in all branches.

Results

VITO estimated that its report covered about 85% of energy consumption in the services sector. According to this report, total energy consumption in the Flemish services sector was 80 752 TJ in 1996. When calculated by the "subtraction method" (energy consumption in Belgium minus consumption in the Walloon Region minus consumption in Brussels), the figure was 95 840 TJ. Since VITO admitted that energy consumption in the services sector in Flanders was not fully covered by its report (this affected electricity consumption in particular), the *Institut Wallon* modified some data for Flanders in order to calculate the total results for Belgium. For this reason, the electricity balance from Flanders was changed and electricity consumption was shared proportionately amongst sectors and uses. The Flemish data on energy consumption were also modified in order to provide homogeneous results:

- *pro rata* in order to calculate energy consumption by fuel and electricity consumption by use in swimming pools and railway facilities;

- it was estimated that 4% of total electricity consumption was for space heating and hot water.

DENMARK

Statistics Denmark carried out the survey of energy consumption in the services sector. The reference year was 1997.

METHODOLOGY

Sources of information and data collection method

Sources of information in Denmark were divided into primary and secondary sources.

1- Primary sources. "Hotels and restaurants", "Commerce" and part of "Offices and Administration" were studied using a questionnaire survey. Questionnaires were sent to 2 000 businesses with five or more employees. The questionnaires were split into energy use for processes and energy use for space heating and hot water. Use of electricity was classified in five end uses. The number of workplaces was divided into three categories (5-19, 20-49 and more than 50 employees) and energy consumption was estimated by using the information on the number of workplaces in each category. Finally, energy consumption in businesses with fewer than five employees was estimated.

2- Secondary sources:

- Telephone interviews. For schools and hospitals, telephone interviews were carried out. The information collected was estimated as key figures per m², per student and per bed.

- Information from registers, including:

a) DTI register. This register of energy consumption in buildings, consisting of data collected by energy consultants under a government-financed project for better energy policies in Denmark, was used to estimate energy consumption in "Education" and part of "Offices and Administration". The data covered 1 369 businesses. Data were collected together with data on m² for the buildings in which the businesses were located. Figures extracted from the DTI register included no information on the end use of electricity.

b) ENI base. This register, holding information on electricity consumption and end uses, was used to classify electricity by end use. It was operated by the DEFU, an institute for research and development in the energy field.

c) ELO and green accounts. Energy consumption in branches not covered by the methods mentioned above was estimated by very general key figures from another database called Energy Management System (ELO). The figures were reported as energy use for space heating and hot water and electricity use per m². There were some special features in a few branches using green accounts (electricity used by trains and diesel used by trains and ships).

Results

The total population of workplaces in Denmark was obtained from the Central Business Register and amounted to about 317 000; the total number of employees was 1.5 million. However, many of these enterprises had no activity. For this reason, a threshold based on the sales figure (50 000 Danish Crowns (DKK)) was used to split the population into two groups. Energy consumption was first estimated for enterprises engaged in "normal" activity, and then a ratio covering small businesses was added.

In order to construct an appropriate m² variable for the branches in the services sector, addresses from the Central Business Register and from the Central Register of Buildings and Dwellings (BBR) were matched. Because of the lack of information, problems were encountered with data on branches engaged in government activity. The Central Register of Building and Dwellings showed a total of 120 million m² in the services sector for a stock of 210 731 buildings. This quantity was used as a guideline for the following branches: "Education", "Health and Social Work" and the sub-sector "Research and Development". The sum of m² that was obtained by merging the two registers was 100 million m². The sum of square meters was adjusted by employee numbers in order to match the total sums.

Small businesses were not represented in the square meter variable. Consequently, a supplement was estimated to represent energy use by small businesses. The source was the register storing information on businesses receiving reimbursement for energy tax. A ratio was created between the reimbursement to businesses with sales of less than DKK 50 000 and those with sales of DKK 50 000 or more. These ratios were multiplied by the figures on energy consumption estimated by means of the square metre variable. Then, the total for each energy type and the relative shares of each branch were calculated.

Other specific considerations on results were mentioned for:

- Wood and other solid fuels. Information on the consumption of these types of fuel was received from very few places. Commerce was the only branch consuming wood and waste for energy purposes.

- Fuel oil. There was high consumption in the sub-sector "Water transport", amounting to nearly 90%, implying that it was not possible to make an appropriate estimate of where the residual is consumed.

- Energy consumption for space heating and hot water. There was a high consumption per m² in "Health and Social work" as well as in some sub-sectors from "Other Community, Social and Personal Service Activities" and "Offices and Administration". The main reason was the difficulty in separating energy consumption for space heating and for hot water, so the energy reported included energy for processes. Another problem was the difficulty in separating branches.

- Electricity consumption. "Other" specific uses were highly dominant, which may indicate that enterprises had difficulty in classifying their electricity use. When looking at kWh/m² figures, it must be stressed that not all electricity use was connected to buildings and square meters.

- Air conditioning. It was not possible to estimate electricity use for air conditioning. Given the Danish climate, air conditioning can be assumed to be fairly uncommon. The classification used in the ENI database showed ventilation only. Although a small fraction included air conditioning, it was not possible to separate this out.

GERMANY

The German Institute for Economic Research (DIW) and the Munich University of Technology (TUM) compiled the report on energy consumption in the services sector. The reference year of the study was 1997.

METHODOLOGY

Source of information and data collection method

Three statistical sources were used as the basis for the report:

1- Energy balance for Germany. The six branches studied were all part of the services sector, which was a part of the TCS (trade, commerce and services) sector. A characteristic of the TCS sector was that the branches it embraced could not be classified as industry, private households or transport. This sector was therefore a residual variable. Up to 1995, the energy balance lumped the figures for the TCS sector together with those for private households. In the German energy balance, energy deliveries to these two sectoral groups of consumers were treated as final energy consumption. This means, among other things, that the effects of changes in stocks were not taken into consideration. Energy balances from 1995 onwards provided a breakdown between private households and TCS. This subdivision was based to a considerable extent on estimates and extrapolations derived from market research and data from other sources. Final energy consumption in the energy balance represented the final stage of energy use, but no figures were provided on useful energy consumption (energy made available directly to the user for the application at hand).

2- Applications balances. These are drawn up by the German Electricity Association (VDEW) and stand between an energy balance and a useful energy balance. They break down the final energy consumption figures provided in energy balance into applications and sectors. Changes in stocks were estimated for specific sectors, and therefore results might differ from figures in the energy balance.

3- DBU Study. The study "Structuring Energy Consumption in the Commercial and Power Sector as a Basis for Activating Energy-Saving Potentials" (DBU study) was published in 1999. It was conducted by the Fraunhofer Institute and the Munich University of Technology (TUM) together with the Research Centre for the Energy Industry (FIE). This study was based on a primary survey of almost 3 000 establishments in Germany in 1994-95.

The DBU Study constructed 23 groups (corresponding to the service branches) that were comparable in terms of their energy-related situation. Industries were broken down according to the activity classification in force in 1994. Differences between the 1994

classification for the TSC sector and the one in force since 1995 are negligible. As a whole, the database was good to extrapolate the consumption figures for electricity and fuels in the branches concerned, as well as the uses to which they are put, from the final energy consumption figures shown in the 1997 energy balance.

Results

1997 results were obtained following three stages:

1- Identification of the enterprises interviewed in the DBU study and classification into the six NACE services sectors.

2- Determination of fuel and electricity consumption in the services sector on the basis of the 1994 DBU study figures and comparison of the results with the data in the energy balance and the applications balance according to energy sources and use. The information on annual fuel consumption used for different purposes was extracted from the DBU database and broken down into space heating and hot water, process heat and cooling, refrigeration/air conditioning, lighting and power. DBU data on fuel consumption were divided into the six branches and a small-scale consumer category not included in those branches. They were presented by end use of energy and, for each branch, the useful floor area was also given in thousands of m². As a result of the survey method, process heat was underestimated. This underestimate was corrected and the 1994 adjusted consumption figures were the basis for the extrapolations in 1997. Electricity consumption was extracted from the DBU database and broken down into the six branches plus the remainder used by small-scale consumers. Again, because of the survey method, electrical process heat and electrical space heating were underestimated. The DBU 1994 electricity input was adjusted using the applications balance and correction coefficients. The 1994 adjusted consumption figures were used as the basis for extrapolating electricity consumption in 1997.

3- Extrapolation of and plausibility checks on the data determined for 1994 with reference to the key data from the energy balance and applications balance for 1997. Fuel and electricity consumption for 1997 were arrived at by extrapolating the 1994 adjusted consumption figures on the basis of the data in the energy balances and the application balances for 1994 and 1997. From the 1994 and 1997 energy consumption data (energy balance), a correction coefficient was calculated which was applied to the adjusted DBU 1994 fuel consumption figures. This enabled the 1997 fuel consumption figures to be calculated. Percentage shares of energy sources for each use were calculated on the basis of the final energy consumption according to the 1997 application balance. This made it possible to break down fuel consumption for space heating and hot water by energy source in 1997. Differences arose between data in the energy balance and the extrapolated data, but could be explained by changes in stocks (not counted in the energy balance) and by the problem in separating the subsectors of private households and TCS.

The extrapolation of electricity consumption was based on the adjusted figures for electricity consumption in 1994 from the DBU study and the figures from the energy balances. Electricity input in 1997 for various uses, for the six branches and overall could thus be calculated.

GREECE

The report on energy consumption in the tertiary sector was carried out by the National Statistical Service of Greece (NSSG). The reference year of the survey was 1998.

METHODOLOGY

Sources of information and data collection method

A questionnaire covering a sample of enterprises was designed to elicit the results. The survey unit was the enterprise. The sampling method chosen was stratified random sampling. The sample size was 4 200 enterprises; the sampling frame was the 1995 Value Added Tax Register, updated if possible by other administrative sources before the survey. The sample was stratified into eight main strata according to the number of employees in the enterprise. In "Hospitals", the number of beds was used. The allocation of the sample to the strata was based on the following factors:

- The total number of enterprises in each stratum.
- The variability of observations within each stratum.
- The cost of obtaining an observation from each stratum.

The distribution of the sample in branches of economic activities was proportionate within each stratum; this gave a self-weighted sample. The sample design allows results to be extrapolated at country level, but not at regional level.

The questionnaire was designed to cover both national and European needs and also to be convenient for the interviewers. The following main variables were included:

- Principal activity of the enterprise (NACE 4-digit level).
- 1998 average number of employees and, of these, the number of indoor workers.
- Periodicity of the enterprise activity (for seasonal activities).
- Number of appliances consuming energy by kind.
- Number of PC units and printers.
- Number of beds (hotels and hospitals).

The method of data collection used was the personal interview. An informative letter was sent in advance to each enterprise chosen to encourage the enterprise to cooperate and to keep energy bills necessary for the survey. Of the 4 200 questionnaires, 3 758 were returned in valid form. The response rate was 89.5%. The majority of the non responses was due to the register used.

When data collection was complete, the questionnaires were checked for clarity, consistency and completion. In cases of ambiguity, enterprises were contacted by phone for clarifications. After the final checks, the primary data were entered and processed.

The sample of 4 200 excluded the "Public Sector" and "Education" branches, where administrative sources were used as follows:

- Accounts of State theatres/stadiums and National Accounts estimates were used to retrieve data on branch 92 (Entertainment, cultural and sport activities).

- The accounts of State R&D institutes were used for branch 73 (R&D).

- Surveys from the Ministry of Education helped to draw information on the number of students in "Education".

- State annual accounts of income and expenditure and of public services and municipalities were also used.

Results

The results of the survey were extrapolated to the whole country.

The consumption per m^2 for air conditioning was calculated on the basis of the electricity consumption per m^2 of cooled space. Electricity consumption for air conditioning was also broken down by an estimate based on a similar survey by the Applied Physics Department of the University of Athens.

In the table of specific uses of electricity, electrical appliances and processes were calculated together because of difficulties in making a proper breakdown. Figures for lighting consumption per m^2 were calculated on the basis of electricity consumption per m^2 of heated space.

The main results shown in the tables excluded the "Education" (NACE 80) and "Offices and Administration" (NACE 75, 99) branches.

SPAIN

The Spanish Statistical Office (INE) carried out the survey on energy consumption in the services sector. The reference year of the survey was 1998.

METHODOLOGY

Sources of information and data collection method

1- Registers. The INE's Central Business Register (DIRCE) was used. DIRCE is an organised compilation of data which identifies enterprise-type units, locates their territorial distribution and classifies them by size and economic activity on the basis of administrative sources and statistical records supplemented by other information from the INE's permanent statistical work. Variables recorded in DIRCE that were used for the inquiry included enterprise identification, economic activity and size classification. DIRCE is based on two sources: social-security data and fiscal records. Public administration activities and private non-profit bodies were therefore partially covered.

2- Questionnaire. Information was collected through a standard questionnaire sent to a sample of 3 897 enterprises, which covered the services sector. However, no information was available for branches NACE 51, 75 and 99. The enterprises surveyed were those with 100 or more employees, which represented 0.22% of all enterprises. The questionnaire response rate was 68%. The questionnaire was structured in two parts:

- Characteristics of the enterprise: identification data (number of employees, principal activity, company name, address of headquarters etc.), general information on the enterprise (principal activity, period of activity, premises, accounting data) and contact person.

- Data on energy consumption. This part of the questionnaire was designed with the assistance of the IDAE (*Instituto para la Diversificación y Ahorro de la Energía*). It covered three main groups of data:

a) Energy consumption in 1998. Electricity and fuel consumption (electrical energy, motor fuel, fuel oil, natural gas, LPG, coal, wood and other types of energy) and breakdown of energy consumption by use (heating and hot water, air conditioning, lighting, other electrical equipment and other uses).

b) General characteristics of company facilities. Total surface area of company premises and percentage with heating and air conditioning, number of computers, percentage of fluorescent or other low-energy lights among totals light points installed and solar energy consumption (surface area of solar panels installed).

c) Specific characteristics of some branches of activity. Health and veterinary activities (number of beds and operating rooms), education (number of students and classrooms) and hotels and restaurants (number of rooms, tables and heated pools).

Data collection was conducted in two stages: first, enterprises whose principal activity was not included in other inquiries on the services sector; secondly, enterprises whose principal activity was included in one of the inquiries conducted in the services sectors.

Results

Once collection ended, data were recorded and errors identified. Errors were corrected by telephoning the firms; if this proved impossible, manual input was based on the information provided by enterprises with the same principal activity.

Questionnaires in which essential information was missing were disregarded unless the enterprise could be contacted. After data editing and quality control, the results at population level were estimated. The results were raised using estimators once the population of enterprises within the framework of the inquiry had been stratified according to the main economic activity at the various NACE digit levels. The estimate of the total value of a variable for a group of strata was the sum of the estimates of the variable in each stratum.

FRANCE

CEREN (*Centre d'Etudes et de Recherches Economiques sur l'Energie*) compiled the report on energy consumption in the services sector. The reference year of the study was 1996.

METHODOLOGY

Sources of information and data collection method

The CEREN general working methodology to study energy consumption in the services sector was based on a permanent panel of establishments followed up annually.

Three main types of source were used for this study:

1- Consumption questionnaires. This information was obtained from an existing panel containing the number of establishments through the years in the tertiary sector. This panel serves to assess trends in the sector, mainly concerning changes in unit consumption and in the type of energy used. The sample was 13 000 questionnaires. Climate corrections were applied to the data received through these questionnaires.

2- "Flow" survey. In addition to the annual questionnaires on energy consumption, the study included the results of the survey "*Flux dans le Tertiaire existant*". This survey defined improvements concerning heated areas, showing information about elasticity of the variable m²/employee and heated area transfers. This also enabled changes in total area, trends in space heating per energy type and changes in the m²/employee rate to be observed. The sample size was 6 000 enterprises.

3- "New Tertiary" survey. This survey was performed by phone contacts with the property managers. The aim was to know, for each branch, the annual impact of new heated areas and the energy equipment installed in connection with other characteristics of the premises. Data were needed for evaluating new establishments taking part in the study and for ascertaining heating consumption by fuel type.

Additional information was also used. INSEE and UNEDIC provided data on staff numbers in the services sector in 1995 and 1996. Other external data used were the number of establishments, beds and pupils.

Results

In order to build a model of general corrections to data received through the questionnaires, two hypotheses were defined concerning changes in consumption in terms of degree days: space heating consumption is proportionate to total degree days, and consumption for other uses is independent of the climate.

Through this model a correction coefficient was calculated which enabled energy consumption to be converted to standardised energy consumption (consumption in a normal year) in a given year. In order to determine the degree days, CEREN used the average maximum and average minimum temperatures recorded in 126 observatories during the period 1986-96. Starting from the daily average temperature, the daily degree

days were calculated branch by branch. For this purpose, a calculation base (the number of days and months) was defined following a specific hypothesis for each branch. The model was applied to energy consumption in all branches of the services sector. The results allowed a comparison of energy consumption in normal and real climatic conditions.

Further considerations on the results (tables) delivered were the following:

- Data on consumption per m² for air conditioning were estimated on the basis of a CEREN study of electricity uses.

- The data distribution between electricity consumption for lighting and for other uses was estimated; it is therefore not the result of the specific questionnaires used. The results have to be interpreted with caution.

- The total heated area in each branch was estimated by multiplying the heated area per employee by the total staff in the branch. A ratio consumption/m² ratio was used to estimate space heating consumption by branch.

- The services sector was classified into branches according to the INSEE economic activity codes (NAF). CEREN presented a classification in eight branches. In order to show the results in six branches, according to the NACE codes, some adjustments to the codes and transfers between branches were made.

- The study did not cover public lighting, the armed services, large research centres or establishments with fewer than ten employees.

ITALY

ENEA, in cooperation with the National Statistical Institute of Italy (ISTAT) and the Ministry of Industry (MICA), carried out the survey of energy consumption in the tertiary sector. The reference year of the survey was 1999.

METHODOLOGY

Sources of information and data collection method

The method used to collect the data was a survey of energy consumption carried out for the first time in Italy. Sample selection and projection of the results were carried out by ISTAT. The ENEA and the MICA prepared a questionnaire to obtain the results and performed the data validation.

A sample selection representing the main activities in the services sector was extracted from the ASIA database (ISTAT's database of active enterprises covering public and private units in the services sector). The sample size from ASIA was 14 251 units: 16% from "Hotels and restaurants", 12% from "Health and Social Work", 5% from "Education",

11% from "Other Community, Social and Personal Service Activities", 42% from "Offices and Administration" and 14% from "Commerce".

The population from which the sample was selected was limited to units with more than 10 employees. The sample of 46 448 units was stratified in three groups:

- Units employing more than 50 employees.

- Units with fewer than 50 employees, belonging to high-energy-intensive branches (Commerce, Education, Health and Social Work and Other Community, Social and Personal Service Activities).

- Units with fewer than 50 employees, belonging to low-energy-intensive branches. 14 251 units were taken from this stratified sample: all units in the first group, 23% from the second group and 15% from the third.

A questionnaire was designed and sent to the sample units selected. The questionnaire was divided into four parts:

1- General information on the unit: main economic activity and activity code, seasonal character of the activity, average number of employees, contact person and address.

2- Energy consumption: quantity and value (national currency excluding VAT) of the energy consumed by the unit, by type of energy source.

3- Co-generation, renewable energy sources and heat recovery: data on the electricity and heat produced inside the units: installed capacity, type of technology used and total energy production, specifying the amount of energy delivered and own consumption.

4- Additional information on the unit's energy-saving activities and annual water consumption.

A mail package including a presentation letter, the questionnaire and instructions was sent to all units in the sample. A reminder letter was sent two months later to 9 000 units to cover non-responses. In addition, a help desk accessible by a freephone number was set up for the period of the survey.

Results

The data collected were checked for coherence. Errors were corrected directly when possible, or by phone interview in cases of doubt. In some circumstances telephone interviews were also used to check information in the questionnaire or to complete partial information. Data control focussed on the coherence and compatibility of the information reported in the questionnaire, such as energy consumption and expenditure.

Results were drawn from 3 076 units with available data, equivalent to a response rate of 21.6% of the sample chosen. Nevertheless, the results available were representative at national level. Weighted coefficients compiled by ISTAT were used to project the results at general level.

A division between the total consumption and effective consumption of every sector was made, indicating total and disaggregated consumption by type of use for each fuel.

The survey did not cover electricity consumption broken down by type of use. Electricity consumption was therefore estimated by splitting the total electricity consumption of each branch according to the estimated shares of the various uses (Source: CESI, personal communication, 1996; the estimates referred to the consumption structure of the early 1990s). Figures for "processes" represent use for driving power, and figures for "electrical appliances" refer to kitchen appliances, computers, photocopiers and fax machines. Consumption per surface unit could not be calculated due to the lack of information on the surface area occupied by the economic activities surveyed.

NETHERLANDS

Statistics Netherlands carried out the survey of energy consumption in the services sector. The reference year was1999.

METHODOLOGY

Sources of information and data collection method

Information was taken mainly from a specific survey of energy consumption by enterprises in the "Offices and Administration" branch (branches NACE 65, NACE 66, NACE 67, NACE 70, NACE 71, NACE 72, NACE 73 and NACE 74). Each branch was observed at a three-digit level.

The population consisted of all enterprises (19 251) with 5 or more employees. The sample was made up of 2 581 enterprises, and there were 1 067 usable responses (many enterprises could not be observed properly and became non-responses).

Results

The data received were checked. The first method was based on the median of energy consumption per employee: individual data that moved too far from this value were considered suspicious and were checked again. The second method was a comparison between the data received and the bills of the energy firms: the aim of this check was to eliminate calculation errors by respondents. The finished microdata set was further elaborated following the microlab method. This implied that data were calculated for all enterprises in the population, even for those not delivering energy data.

Mean energy per employee was calculated per sample cell. For every enterprise not observed, the average was multiplied by the number of employees to obtain an estimate of the energy consumption. A consumption value was therefore assigned to each element of the population, and totals were calculated by adding up the individual data.

Two sets of results were given: data on enterprises with five or more employees only, and data on enterprises of all sizes.

It should be noted that, in the case of air conditioning, only the "electricity" column could be calculated, since for "other fuels" there were no records of which part was used for "cooling" in air-conditioning installations, so that all fuel was attributed to "space heating and hot water".

AUSTRIA

The Austrian Statistical Office, ÖSTAT, and the Institute of Energy Economics (IEW) of the Technical University of Vienna carried out the survey of energy consumption in the services sector. The reference year of the survey was 1998.

METHODOLOGY

Sources of information and data collection method

The survey was done by means of a questionnaire carried out by spot check. The first step was to draft the questionnaire. In addition to the square meters of the company, two major categories of data were requested: first, energy consumption data for different end uses, making a distinction between electricity and other energy types, and secondly the availability of major appliances and their age.

The returned questionnaire forms were checked for completeness and plausibility. Where forms were returned with data but some questions were overlooked or ignored, the IEW inquired the missing data by phone. A second questionnaire was sent out to companies which did not return the first one. Plausibility tests were also done electronically.

The first questionnaire was sent to a sample of 11 970 companies. The second questionnaire was sent to 8 596 companies. The total useable response from the two questionnaires was 3 108 and the total with useable detailed information was 1 489.

An overview of the available literature in the services sector and an investigation of results and studies in scientific publications targeting the services sector in other countries were carried out to enable the IEW to assess and compare the results.

Results

The description of the results was carried out by the IEW. The results were structured in 14 economic sub-sectors according to the ÖSTAT classification and in the six aggregated sub-sectors of the NACE classification. The types of fuel Investigated were hard coal, brown coal (lignite), briquettes, cokes, petrol (gasoline), petroleum, diesel, heating oil (gasoil), heating oil light, heating oil medium, heating oil heavy, LPG, other types of oil, natural gas, waste, wood, bark, other biomass, heat pumps, solar panels, district heating and electricity.

PORTUGAL

The DGE (*Direcção Geral de Energia*) carried out the study of the energy consumption in the services sector. The reference year was 1997.

METHODOLOGY

Sources of information and data collection method

1- <u>DGE's database</u>. DGE produces annual statistics on energy consumption by type of economic activity according to the CAE-rev.2 (National classification). Information on electricity consumption (by type of consumption and by type of economic activity) as well as on fuel consumption (gas oil, fuel, LPG and gasworks gas) was available on the DGE's database. Statistics on electricity were based on the final consumer's invoice. In the case of petroleum products, it was difficult to distribute the consumption by final users and therefore, not possible to identify the economic activity affected by final consumption. The most difficult cases are LPG and fuel oil.

2- <u>Study on the energy consumption patterns in the services sector</u>. This study was published in 1994 by the DGE being 1991 the reference year. The results were obtained from a data collection on a representative sample of the various sub-sectors of the services sector. The sample was formed by 520 premises representing all branches of activity in the services sector and all regions in the country.

Data was collected through a questionnaire delivered to the selected sample and completed with interviews when needed. The questionnaire was divided into five parts including general and more specific information of the premise, energy consumption and type of systems employed as well as statistical and other information. Besides the figures obtained through the questionnaire, several organisations were contacted for completing the available information or for obtaining additional data like surface of each sub-sector.

The study included data on the services sector at dessagregated level (sub-sector, sub-group and division) covering:

- Total consumption and specific consumption.
- Energy consumption by type of fuel (electricity, gas and fuel) in %.
- Energy consumption by type of use in %.

Results

The figures of the study were used as the base to produce the results for 1997. Therefore, 1991 results were extrapolated to 1997. Nevertheless, some assumptions were taking into account in order to calculate 1997 results:

- The surfaces of each branch in 1997 were estimated using the specific consumption of electricity in each division reported for 1991 together with the

global energy consumption figures recorded in the DGE database. These areas were compared with those in the 1997 Statistical Yearbook.

- Since the DGE database only showed figures for electricity consumption by type of economic activity (CAE classification) from 1994 onwards, it was necessary to estimate the figures for 1991. The global growth of the services sector from 1991 to 1994 (around 10%) was used for this purpose assuming an uniform growth for each branch of the sector.

- The distribution of the different types of fuels among uses was made taking into account three assumptions:

a) Lighting, air conditioning and appliances used only electricity as fuel.

b) The other types of fuels were only used for space heating and hot water purposes.

c) Natural gas was only available from 1998 onwards and consequently was not taken into account when calculating results for 1997.

- Finally to draw the 1997 results from 1991 figures, the following energy consumption growth rates were assumed: 30% for LPG, fuel and gas oil and 44% for electricity. Regarding surface growth in each branch, the following rates were used: 20% for "Hotels and Restaurants", "Other Community, Social and Personal Service Activities", "Offices and Administration" and "Commerce", 10% for "Health and Social Work" and 15% for "Education".

FINLAND

Statistics Finland compiled the report on energy consumption in the services sector. The reference year of the study was 1998.

METHODOLOGY

Sources of information and data collection method

The information was collected as follows:

1- Energy consumption questionnaire. A questionnaire was mailed to a stratified sample of 2 032 enterprises and establishments in the services sector. The questionnaire was divided into five parts: data on enterprise/establishment, use of heating energy, use of motor fuels, electricity consumption and other energy consumption. The number of usable responses were 541 (a response rate of 26.6%).

2- Simplified energy consumption questionnaire. It was decided on the basis of comments received from respondents to the first questionnaire that it should be simplified and mailed to those enterprises and establishments that did not reply as well as to those indicating they were unable to reply to the first questionnaire. The simplified questionnaire was divided into four main parts: the use of heating energy for space and

tap water heating, information on electricity consumption, space operating time and a section in which the enterprise was asked for its permission to obtain information on energy consumption either from the property manager or from the electricity or district heating supplier.

3- Energy consumption questionnaire for hospitals: a separate questionnaire was designed for hospitals, seeking data on the special features of hospital operations and a breakdown of fuel consumption by end use. Steam-operated equipment was a major item of energy consumption in hospitals. The questionnaire was sent out to all hospitals run by the State, local authorities and federations of municipalities. It was structured in seven parts: contact information, electricity consumption, use of steam, use of heating energy for space and tap water heating, use of engine fuels, other energy consumption and enterprise/establishment capacity utilisation. The response rate was 35%.

4- Other sources of information:

- The Association of Finnish Local and Regional Authorities. This Finnish association collects data on energy consumption in different types of building in municipal ownership by sending questionnaires to local authorities. The figures show specific energy consumption for the buildings monitored.

- State-owned properties. The Real Estate Board collects data on energy consumption in 15 state-owned properties by type of building. The Real Estate Board and the Ministry of Defence both hold about 40% of all state-owned real property.

- Motiva. Energy inspections designed and developed by the Energy Information Centre Motiva have been carried out in almost 2 300 service sector buildings in order to find ways of raising standards of energy efficiency. The inspections looked among other things at the consumption of electricity and the breakdown by different uses.

- Register of business premises: Statistics Finland maintains a register of business premises classified by type of heating energy and type of building. Data were used to assess energy consumption by central and local authorities.

Results

Staff numbers and floor surface areas of business facilities were found to be correlated. Statistics Finland's Business Register provided data on personnel numbers for enterprises and establishments.

However, enterprises and establishments with more than 600 employees were analysed separately. The floor surface areas were divided by sample probability, which gave the total surface floor area for each industry.

Specific consumption of heating and electric energy per unit of surface area was calculated for industries on the basis of the responses obtained. Each response corresponded to the surface area and the energy that was obtained by dividing the

figures by sample probability. The energy quantities and surface areas for the industry were summed and the specific consumption figures computed for the industry.

Heating energy fuels were obtained on the basis of the responses by calculating industry percentages of heating energy for different fuels.

In Finnish service industries, all the energy required for air conditioning is generated by electricity. It was not possible to provide separate figures for cooling and ventilation, because all systems used in Finland are integrated.

SWEDEN

The Swedish Statistical Office (SCB) carried out the survey of energy consumption in the services sector. The reference year of the survey was 1997.

METHODOLOGY

Sources of information and data collection method

Basic data came from a survey on energy use in premises, which has been carried out yearly since 1976. For 1997, the population investigated was 92.000 premises.
The survey comprised a questionnaire on the:

- year of completion of the building;
- total heated surface area and distribution into different uses of the premises;
- heating system used;
- consumption of district heating, oil, natural gas and electricity.
- Electricity specific uses: heating, hot water for sanitary purposes, fans with or without heat recycling, air-conditioning, cold storage rooms, etc.

Results

The following considerations have to be taken into account when interpreting the results:

1- Heated surfaces were enumerated and added for each branch. The energy used for heating referred to the total surface area of the property. Therefore, the amount of energy was divided proportionately once the surface area of each specific use was calculated.

2- Energy used for purposes other than heating was divided into air-conditioning, lighting/office automation, other electrical appliances and processes. This breakdown was accomplished according to the findings of a study from 1990 based on face-to-face interviews with the owners of the premises and on physical inspections.

3- Heating of water for sanitary purposes was included in the heating table in cases where the electricity used for hot water and other uses was indicated in the questionnaire.

4- Part of the electricity consumed for other uses was transferred to air conditioning according to the results of the1990 survey. When electricity for air conditioning was quantified in the questionnaire, the surface area for air conditioning was regarded as the whole surface area of the premises. Therefore, the air-conditioned surface area was probably overestimated.

5- Part of the electricity reported for other uses was moved to electricity consumption for heating and hot water and air conditioning. The rest was divided between lighting and electrical appliances. This distribution followed the patterns of the 1990 study.

UNITED KINGDOM

The Building Research Establishment (BRE) carried out the study of energy consumption in the services sector. Its reference year was 1995, although estimated results were also provided for 1996.

METHODOLOGY

Sources of information and data collection method

Two approaches were used:

1- Floor-area-based calculation. The first approach was based on comprehensive floor area data, combined with detailed energy use data.

Good national coverage for floor area broken down by occupant activity was available in the UK. The floor area provided appropriate national scalars, provided that building stock is broken down into sub-sectors with similar demands for energy services. Hence, by disaggregating using appropriate activity groupings and by paying attention to choosing building characteristics and building services that are typical of that activity, a picture of energy use in the the services sector could be drawn by using a minimal sample size.

In 1994, floor area in England and Wales was already classified by the occupant's activity. Data were derived from valuations used to determine the rateable value of non-domestic property. Data on the number of rateable premises were available for all subsectors except Crown properties (national government offices and defence), churches and agricultural buildings. Where rateable floor area data were not available or were insufficient, average floor area was obtained from other data sources.

Once the 1994 floor area for premises in England and Wales had been derived, it was extrapolated to cover Scotland and Northern Ireland by multiplying by the ratio of the UK population to that of England and Wales. This method assumed that the structure, the energy demand and the energy performance of the building stock of the service sector in Scotland and Northern Ireland were the same as those of the rest of the UK. In addition, one factor that this method failed to address was climatic differences.

The 1994 floor area was then updated to the 1995 and 1996 floor areas by adding the appropriate amount of newly-built floor area to the 1994 total. The new floor area was

determined using a database that records the floor area and building categories for all new-build projects that have applied for planning permission.

The next step was to combine floor area data with energy use data. The main data source used was some detailed energy audits reconciled to fuel bills for a significant sample of service-sector premises. These are called "N-DEEM (Non-Domestic buildings Energy and Emissions Model) Energy Surveys" and contain information on building services and electrical equipment installed and their annual energy use as well as details of building characteristics, occupancy patterns and the activity of the occupiers. These data are collected as part of an ongoing project for the Global Atmosphere Division of the UK Government's Department of the Environment. The key output was a matrix of energy use per m^2 by fuel use by end use for each activity class.

For some activities with a significant number of energy audits, multiplication of the sample GJ/m^2 by the appropriate national area provides good estimates of national energy consumption by end use. For other activities where sample sizes were not sufficient, two options were available: either use data from alternative sources where available, or substitute the energy consumption per m^2 from a sub-sector which had a similar energy demand profile. The first option was preferred. In practice, for many sectors, sample and alternative data sets were used in combination to provide the best possible picture of energy use for a particular activity.

2- Employee-based calculation. The second method uses UK Office of National Statistics employment data combined with energy use data.

As the detailed energy survey data from the audits also contains information on the number of staff in each premises, it was also possible to carry out a similar calculation based on national employee statistics using these data. The results were based exclusively on the sample of detailed energy surveys, filling in appropriate values from similar activities where none exist. This calculation was based on 1995 and 1996 employment statistics to give national estimates for two years.

Results

The results presented in the tables referred to the floor area method.

The two approaches gave a similar energy breakdown between end uses, with the exception of the heating and process energy use, but a significantly different energy breakdown between activity classes in the service sector. In this regard, the most notable difference was the relative size of the commerce and other activities divisions.

In addition, the floor area method gave results that were in much closer agreement with the sub-sectoral energy use breakdowns published in the UK Digest of Energy Statistics, which uses data derived from purchase returns reported by fuel suppliers. The superiority of the floor area method is also due to some defaults of the employment method:

- Not all of the energy use data contained employee numbers, whereas floor area was present in all instances.

- There were considerable variations in staffing levels relative to energy use in some sectors, particularly the education and health sectors.

- Staff working from home or "away from the office" were not captured in the survey.

- As the main services sector energy use was "space conditioning" (heating, cooling and lighting), space conditioned provided a better basis for assessing energy use.

Further considerations refer to the activity classification and the end use classification. In the survey, the activity classification system designed for the N-DEEM project was used. This classification system was developed to provide the best match between various existing data sources available and to provide effective means of differentiating between activities with distinct energy use patterns. In practice, there were a few areas where the activity classification system did not provide a match with the NACE categories.

Through the analysis of the detailed survey data used for this study, a classification system for energy end uses was developed with the following uses: catering, computer accessories, computer, cooling, hot water, fans, heating, lifts, light, process, pumps, small power, telecommunications and other.