

Services sector data and surveys

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Bruno Lapillonne, Vice President, Enerdata

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Overview of data for indicators in the service sector

- Activity data
- Energy consumption by branch of activity (e.g. hospitals, offices)
- Energy consumption by end-use
- Case studies in EU countries

▶ **Activity data**

➤ Energy consumption by branch and end-use

➤ Case studies in EU countries :

- France
- Germany
- Sweden

Activity data

- Value Added : total and by branch:
- Employment: total and by branch
- Floor area of buildings (m²) : total and by branch
- Indicator specific to branches (e.g. number of students for education)

Sources of activity data: value added

- Value Added : total and by branch:
 - usually collected by National Statistical Offices;
 - The branch covered follows standard classifications
 - should be measured at constant price
 - published by National Statistical Offices often in current prices, sometimes also at constant price
 - if constant price not available, data may be given with price index by branch and/or index of volume by branch → can be used to calculate value added values at constant price (see slides on industry)

- Employment: total and by branch: usually collected by National Statistical Offices

Service sector data: classification of branches (Nace 2)

- Whole and retail trade (Section G),
- Transportation and storage (Section H),
- Hotels and restaurant (Section I)
- Information and Communication (Section J),
- Financial and insurance) (Section K),
- Real estate (Section L),
- Professional, scientific and technical activities (Section M)
- Administration and support services (Section N).
- **Public** administration and defence (Section O)
- Education (Section P):
- Health and social work activities (Section Q)
- Arts, entertainment and recreation (Section R)

For energy consumption analysis and indicators grouping of various sectors in a sector called “**private office**” with homogenous end-uses , including: Sections H (Transportation and storage), J (Information and Communication), K (Financial and insurance), L (Real estate), M (Professional, scientific and technical activities), and N (Administration and support services).

Sources of activity data: value added

- Floor area of buildings (m²) : total and by branch
 - based on specific surveys
 - Or modeled from long- term construction statistics
 - Or a combination to interpolate between surveys
- Indicator specific to branches (number of beds in hospitals, of person-nights for hotels, of pupils in education): usually collected by National Statistical Offices;

- Activity data
- ▶ ➤ **Energy consumption by branch and end-use**
- Case studies in EU countries

Energy consumption by end-use

Usual end-uses and types of equipment considered to breakdown total energy consumption and electricity consumption by branch and by in service sector buildings :

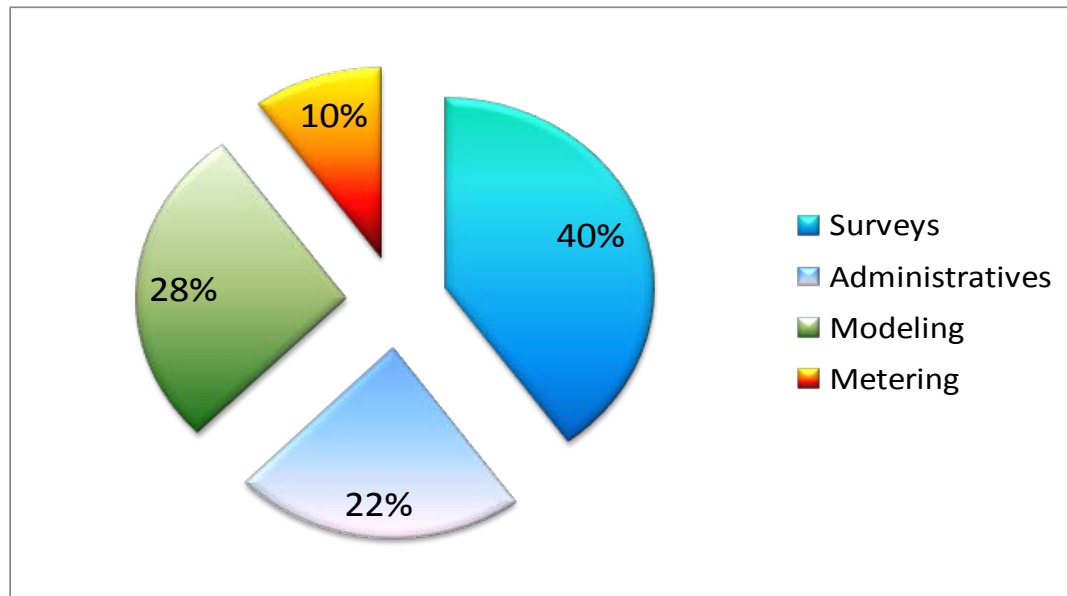
- Heating
- Cooling
- ICT
- Lighting
- Other thermal uses (water heating, cooking) : hotels, hospitals
- Refrigeration: commerce

Energy consumption by branch/end-use: main sources

- Surveying : the most common approach (e.g. France, Sweden, Germany) but alone cannot provide detailed data by end-use
- Modeling: usually combined with survey to get data by end-use (e.g. France) or to interpolate between survey years (e.g. Germany)
- **Administrative Sources:** utilities are required to provide the information (case of electricity and gas): implies a law and a similar classification between utilities ; work well if reduced number of utilities
- Auditing/Measuring/Metering : problem of representativeness:
 - can be used to estimate or model data by end-use (e.g. Sweden) ;
 - problem of representativeness → can be used to estimate or model data by end-use if the sample is representative
 - metering very expensive; (e.g. EL-TERTIARY project in EU*)

Energy consumption by branch/end-use: main sources at world level

- The most comprehensive sources are surveys , followed by modeling (around 2/3 for both)
- The other source is administrative
- Metering include audits data.

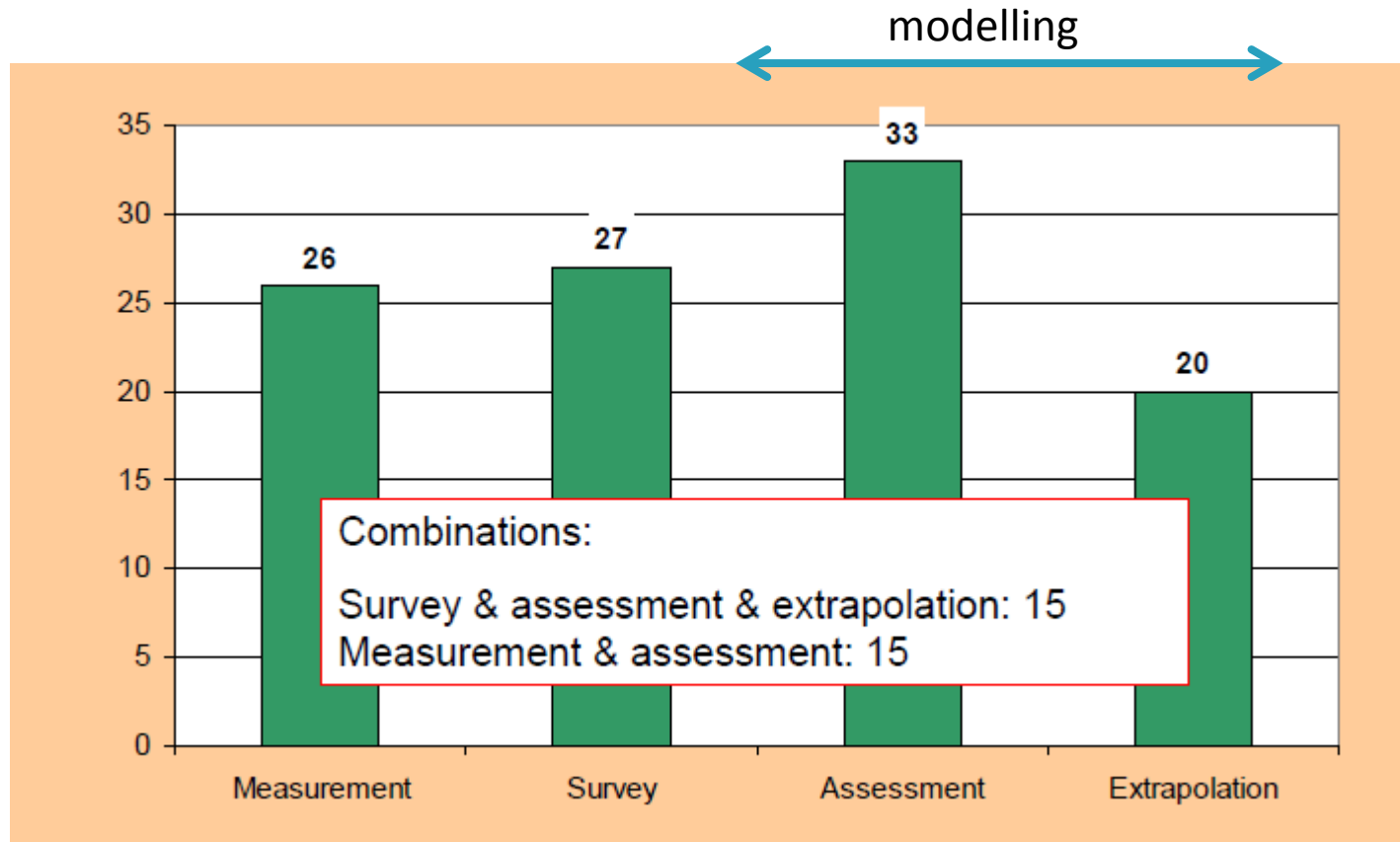


Source: AIE survey 2011 (march 2012), based on 40 sources worldwide

Energy consumption by branch/end-use: main sources in EU countries

Overview of methods used in EU countries:

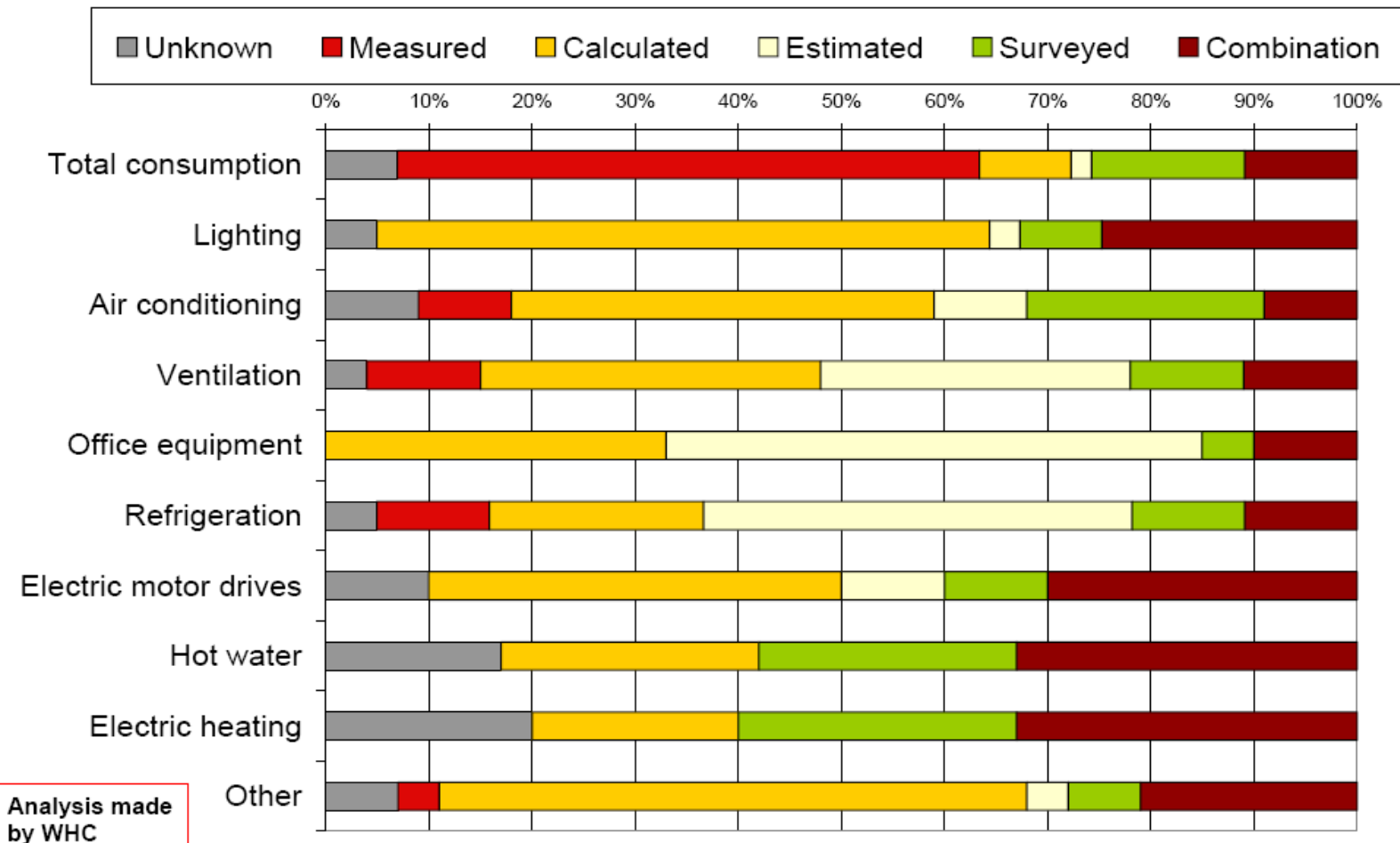
¼ surveys , ¼ measurements, about half modeling



Source: WHC (EL-tertiary project), based on a review of 106 studies

Energy consumption by branch/end-use: main sources in EU countries

Most often calculation (modeling) / estimation



Analysis made by WHC

Source: WHC (EL-tertiary project), based on a review of 106 studies

Actual data availability in ODYSSEE for indicators in services

Few countries are providing energy consumption by branch and end-use in the EU

Number of EU countries with data

Total number of employees in the service sector	27
Total electricity and non electricity consumption of services	27
Employment in administrations, health, trade, hotels, education	26
Electricity consumption of offices, health, trade , hotels , education	11
Electricity consumption of public offices, administration	9
Non-electricity consumption of private offices, health, trade , hotels , education	9
Number of person-nights in hotels-restaurants	8
Non-electricity consumption of public offices, administration	7
Number of pupils/students	6
Number of beds in health/social action (hospitals)	6
Floor area : Health, Education research	5
Floor area : Offices, trade, hotels	4
Floor area : Administrations	2

Surveys in service sector

- Among the best practice, we can quote: France, Germany, UK , Sweden and Denmark
 - France: since 1986 CEREN, a consulting company, has carried out yearly surveys sponsored by ADEME , utilities and the Ministry
 - Germany: surveys every 2/3 years since 2001 carried out by Fraunhofer ISI, TU Munich and GfK (2001, 2004, 2006; 2008) with interpolation of interim years (→ complete time series since 2001).
 - Sweden: Annual survey of energy use in non-residential buildings since 1976 and energy audits in about 130 buildings each year since 2005.

- Activity data
- Energy consumption by branch and end-use
- **Case studies in EU countries :**
 - France*
 - Germany
 - Sweden
 - Denmark

*Source: Grégory Chédin, ADEME, *ODYSSEE-MURE meeting , Madrid, 21/22 June 2010*

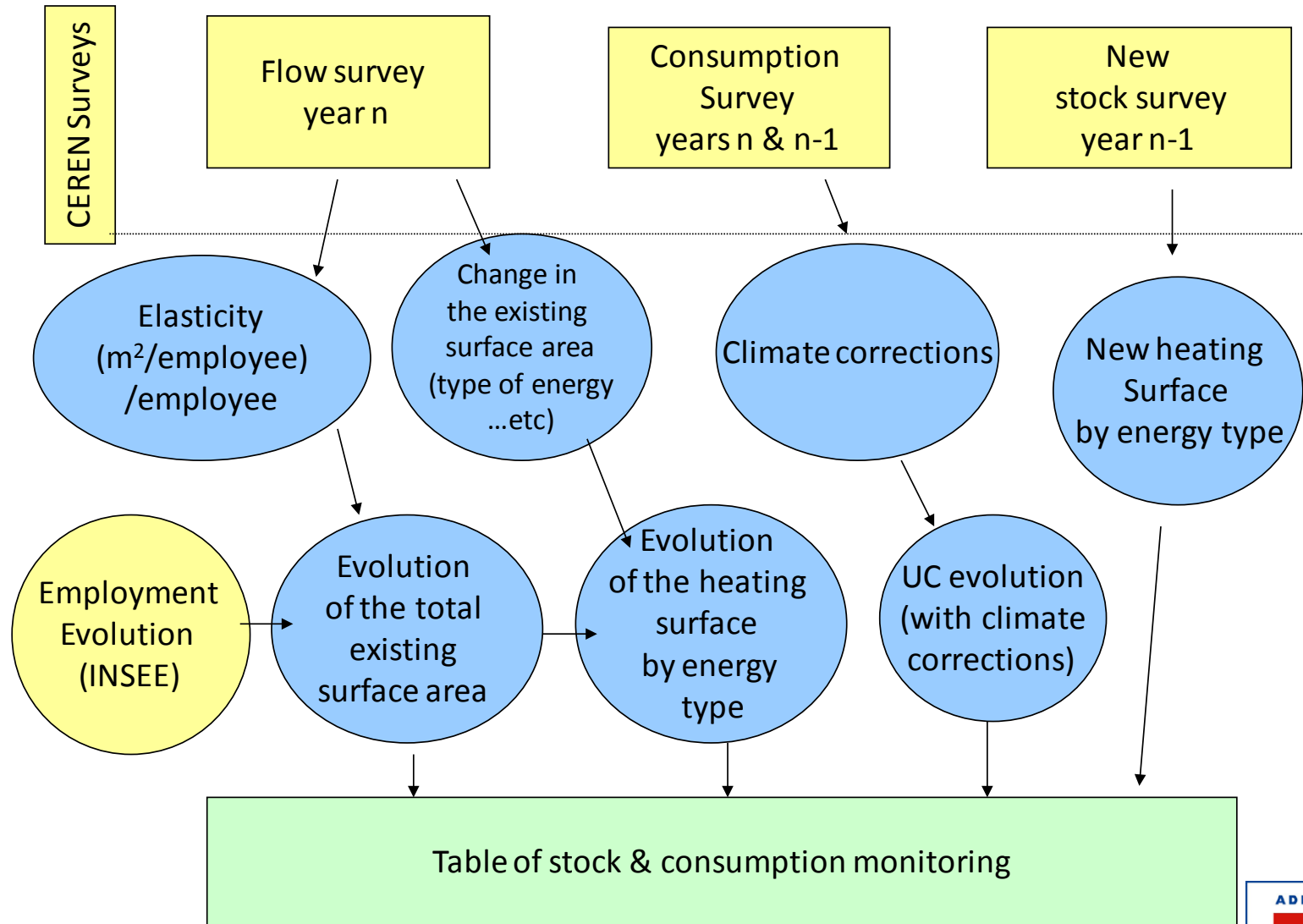
Overview of French surveys in service sector

- Two surveys on the existing stock (heating area, consumption, end-use, characteristic of the building, technology used) :
 - Since 1986, survey on consumption (12 000 questionnaires)
 - Since 1991, survey on flow (5 000 questionnaires)
- Since 2002, survey on the new stock (about 2500 questionnaires : building permit, type of energy installed, characteristics of the building)
- Yearly cost: about 630 k€ for ADEME

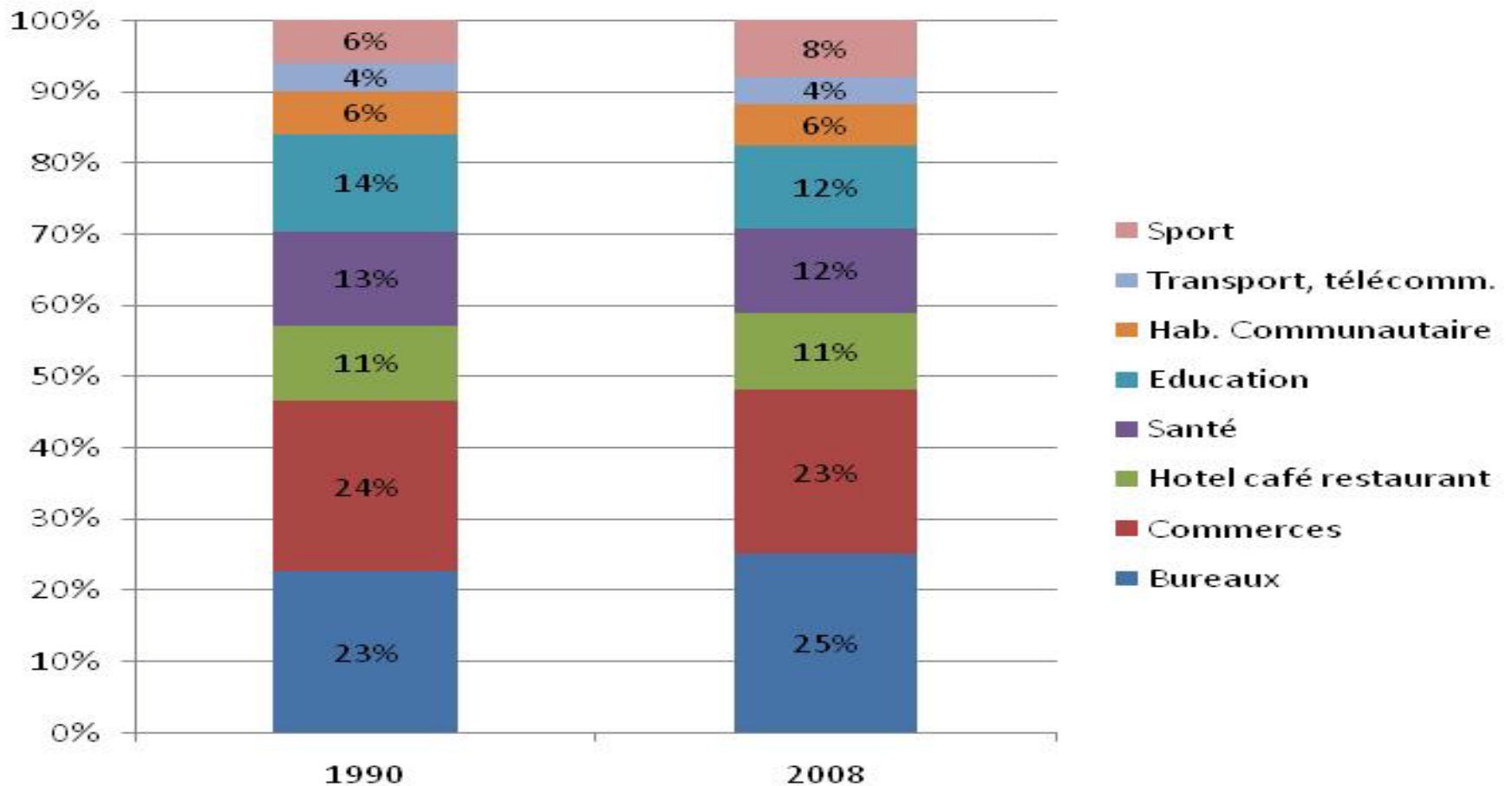
French surveys in service sector: data produced

- Energy consumption by branch (9 branches) : public offices, private offices; health; wholesales and retails trade; hotels and restaurants; education and research; transport; sport, leisure and culture; community building
- Floor area by branch: calculated from an average ratio per m2 from the survey and total employment of the branch from NSO
- End-use consumption: annual consumption based
 - Space heating by energy: calculated from an average unit consumption/m2 multiplied by heated area; separation existing and new dwellings (based on the surveys)
 - Other end-uses: based on allocation by fuel and by branch from a comprehensive survey:
 - ✓ Cooking by energy
 - ✓ Water heating by energy
 - ✓ Air conditioning
 - ✓ Other electricity uses

French surveys in service sector: methodology



French surveys in service sector : final energy consumption by sub-sector



- Activity data
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- **Case studies in EU countries :**
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 - **Germany***
 - Sweden
 - Denmark

*Source: Barbara Schlomann, Fraunhofer ISI, Karlsruhe, Germany, , ODYSSEE-MURE meeting , Madrid, 21/22 June 2010

German surveys in service sector : survey design

Size of sample	Approx. 2,000 workplaces
Selection of sample	Quotas (stratified sample)
Survey modules	<p>(1) Broad survey: face-to-face interviews in 2000 companies</p> <p>(2) Inspection of 100 workplaces by engineers (new module in the ongoing survey)</p> <p>(3) Specific survey on renewable energies by short phone interviews in 10,000 workplaces and detailed interviews in 300 workplaces (+some checks in the company)</p>
Questionnaire	<p>Several stages:</p> <ul style="list-style-type: none"> ▪ General questions about company structure, energy consumption and level of equipment with relevant energy technologies ▪ Sector-specific questions ▪ Questions about energy management
Data checks, margins	Specific energy consumption; exclusion of max. 20%
Activities for extrapolation	<p>For most subsectors: employees</p> <p>For some sub-sectors: sector-specific activities (number of students/pupils, number of hospital beds, water volume for baths, traffic units for airports)</p>
Stratification	12 groups, 29 splits, sub-splits
Secondary statistics	Agriculture, airports

German surveys in service sector: extrapolation method

- For survey years:
 - Calculation of a specific fuel and electricity consumption (per employee or sector-specific activity) by sub-sector from the 2000 workplaces included in the survey.
 - Extrapolation to the country by multiplying the specific consumption value from the survey by the actual number of employees (or sector-specific activity) in Germany.
- For years not covered by the survey:
 - Interpolation (or extrapolation) of the specific fuel and electricity consumption (incl. temp.-adj.) from the survey multiplied by the actual activity of the respective year.

German surveys in service sector: main results

- Energy consumption by energy carriers and 12 sub-sectors*. Data available for the survey years and the years between by interpolation → complete time series since 2001
- New feature of the 2008 survey: short-term extrapolation to the following year (2009)
- Energy consumption by end-uses (electricity and heat) and sub-sectors.
- Detailed information on energy consumption structures, energy features and energy management in the sub-sectors of the very heterogeneous tertiary sector

* Now 14)

German surveys in service sector: energy consumption by end-uses (2006)

2006			Consumption		Shares											
			Elec.	Fuels & district heat	Electricity						Fuels and district heat					
Grp. No.	Split	Definition	absolute	absolute	Lighting	Power	Process heat	Process cold	AC	Comm-unications	Space heating	Power	Process heat	Process cold	AC	Space heating
			[TWh]	[TWh]												
1		Construction *	3.7	13.5	46.0	15.5	4.9	0.5	0.2	13.5	19.3	27.4	8.2	0.0	0.0	64.4
2		Office-like companies	25.6	72.6	44.9	3.1	4.1	0.9	2.0	41.8	3.1	0.0	3.6	0.0	0.2	96.2
3		Manufacturing enterprises	4.0	6.4	44.0	29.2	2.2	0.3	1.0	8.6	14.7	0.5	23.3	0.0	0.0	76.1
4		Retail trade	29.2	41.9	55.5	7.6	3.1	14.6	1.5	8.0	9.8	0.0	4.3	0.3	0.1	95.2
5	21	Hospitals	7.0	12.6	22.0	30.6	31.5	0.9	4.5	10.6	0.0	0.0	22.6	0.0	2.5	74.9
5	22	Schools	3.8	19.3	66.9	9.6	2.0	1.8	1.5	11.5	6.6	0.0	5.4	0.0	0.1	94.5
5	23	Public baths	4.9	12.4	14.5	71.5	13.5	0.0	0.1	0.4	0.0	0.0	98.8	0.0	0.0	1.2
6		Hotels, restaurants, homes	16.5	48.9	24.2	36.1	12.7	17.4	0.3	2.8	6.6	0.0	32.5	0.0	0.0	67.5
7	5	Bakers	0.6	1.3	7.5	16.8	57.3	16.6	0.1	1.6	0.2	0.0	73.2	0.0	0.0	26.8
7	6	Butchers	0.6	0.5	15.0	14.6	18.2	45.7	0.9	3.4	2.3	0.0	36.5	0.0	0.0	63.5
7	7	Other food	0.1	0.2	20.3	3.0	2.6	0.2	4.5	3.5	65.9	0.0	50.0	0.0	0.0	50.0
8		Laundries	0.3	0.4	22.3	20.3	49.1	0.1	1.7	0.9	5.6	0.0	87.8	0.0	0.0	12.2
9		Agriculture	5.2	36.3	20.8	46.9	15.6	10.4	2.1	3.1	1.0	56.8	13.0	0.0	0.0	30.3
10		Horticulture	0.3	3.9	52.3	17.4	11.6	1.2	2.3	11.6	3.5	0.0	86.9	0.0	0.0	13.1
11		Airports	1.4	2.0	35.4	30.3	8.1	2.0	10.1	9.6	4.5	24.9	4.0	0.0	11.9	59.3
12		Textiles, clothing, forwarders	0.7	2.0	77.0	1.1	5.0	0.6	0.0	13.2	3.1	0.0	18.6	0.0	0.0	81.4
Sum Groups 1 - 12			104.1	274.2	40.8	19.2	8.6	8.2	1.6	15.4	6.3	9.1	18.0	0.1	0.3	72.7
13		Rest	1.4	0.3	44.0	29.2	2.2	0.3	1.0	8.6	14.7	0.0	30.0	0.0	0.0	70.0
Extrapolation result			105.5	274.5	40.9	19.3	8.5	8.0	1.6	15.3	6.4	9.9	17.7	0.1	0.3	72.1
		Street lighting	3.4		98.0	0.0	0.0	0.0	0.0	2.0	0.0					
		Share installations MFH	1.3		29.0	70.0	0.0	0.0	0.0	1.0	0.0					
		Military	1.2	7.3	44.9	3.1	4.1	0.9	2.0	41.8	3.1	41.1	6.8	0.0	0.0	52.1
		Others	6.3		10.9	75.6	4.8	0.8	0.9	6.8	0.1					
		Undocumented	12.2	7.3	40.5	46.8	2.9	0.5	0.7	8.3	0.4	41.1	6.8	0.0	0.0	52.1
Calculations tertiary			117.7	281.8	40.8	22.2	7.9	7.3	1.5	14.5	5.8	9.9	17.7	0.1	0.3	72.1

- Activity data
- Energy consumption by branch and end-use
- **Case studies in EU countries :**
 - France
 - Germany
 - **Sweden***
 - Denmark

*Source: ODYSSEE-Linn Stengård, STEM, The Swedish Energy Agency, MURE meeting , Madrid, 21/22 June 2010

Swedish survey in service sector

- Population of the survey : 8500 tertiary buildings (about 5 percent of total number)
- Performed yearly (since 1976)
- Total cost of surveys in 2009: about 100 k€
- Survey performed by Statistics Sweden (until last year) by order of The Swedish Energy Agency. Statisticon is performing the surveys of energy use in 2009.
- Results
 - Total stock of buildings, type of heating systems (number of heating pumps etc.)
 - Energy use for heating and hot water per energy carrier, surface area, geographical area (and by branch for tertiary buildings)
 - Electricity use

Energy audits in tertiary buildings (Sweden)

- Purpose of audits
 - Evaluation of means of energy savings
 - Breakdown of the energy use
 - Energy saving potentials
- Inspection of 130 buildings per year, total 900 premises in 6 years
 - Random selection of buildings by Statistics Sweden
 - One branch each year
 - ✓ 2005: 123 office buildings
 - ✓ 2006: 129 schools
 - ✓ 2007: 159 health care buildings/hospitals
 - ✓ 2008: 134 buildings used for sports and recreation (sports centres, swimming pools, ice hockey rinks etc.)
 - ✓ 2009: 94 retail buildings, shopping centres etc.
 - ✓ 2010: 160 hotels, restaurants .
- Yearly cost (in 2009, lower earlier years): about 8,8 k€

Use of data from surveys, metering and audits in Sweden

- The data from the surveys are official energy statistics
- Survey data is used in energy balances together with yearly data from suppliers of electricity, district heating and oil products
- Data is also used for by STEM for its forecasting and for follow-up of energy service directive, by the Ministry of finance etc.
- The data from energy audits are not official statistics yet
- The purpose of the studies is to improve official energy statistics

- Activity data
- Energy consumption by branch and end-use
- **Case studies in EU countries :**
 - France
 - Germany
 - Sweden
 - **Denmark***

*Source: The Trade and Service Sector: Denmark's Data Collection Strategy Peter Dal, DEA, "From Macro to Micro Energy Indicators, IEA, 28 April 2006, Paris

Energy Statistics on the Trade and Service Sector: Head Lines

- Surveys conducted for the years 2002 and 2004 - but no comprehensive surveys
- Use of many data sources and estimations
- Difficult split problem: Flats > < Service Sector
- Special attention on electricity and district heating, which counts for 80% of total energy consumption
- The national accounts statistics defines the sub-sectors. That ensures correspondence with the economic statistics and facilitates the construction of indicators

Energy Consumption in the Trade and Service Sector: Collection of Data

- DEA is coordinator and responsible for the Danish energy statistics and international reporting
- Excellent co-operation between the three main actors
- **Danish Energy Authority (DEA)**
 - Data from the supply companies (aggregated)
 - Natural gas consumption (very disaggregated)
 - Electricity and heat survey (autoproducers)
 - Data on biomass
- **Association of Danish Energy Companies (DE)**
 - Electricity consumption (13 branches in the service sector)
- **Statistics Denmark (DSt)**
 - Surveys for the years 2002 and 2004
 - Register statistics: Return of energy taxes
 - Register statistics: Building and dwelling register

The Official Danish Energy Statistics on the Service Sector

- The energy consumption for the **Total Trade and Service Sector** is based on data from DEA and Association of Danish Energy Companies
- The decomposing of the total in the 4 sub-sectors **Wholesales, Retail Trades, Private Services and Public Services** is prepared by using data from Statistics Denmark
- The split of **Total Energy Consumption** into **Space Heating** and **Other Purposes** is prepared by using data from Statistics Denmark (surveys and BDR-statistics) + DEA-analysis

The Danish National Accounts Statistics defines the Sub-sectors

- The Danish national accounts statistics covers at most detailed level 130 branches of which 60 belongs to the trade and service sector
- The national accounts statistics includes energy balances (matrices), but the disaggregated consumption data is not of high quality
- DEA aggregates the 60 branches are into 4 sub-sectors. The data are –after a analytical work - used for construction of weights
- Final DEA-statistics for the 4 sub-sectors: DEA-total multiplied by the weights

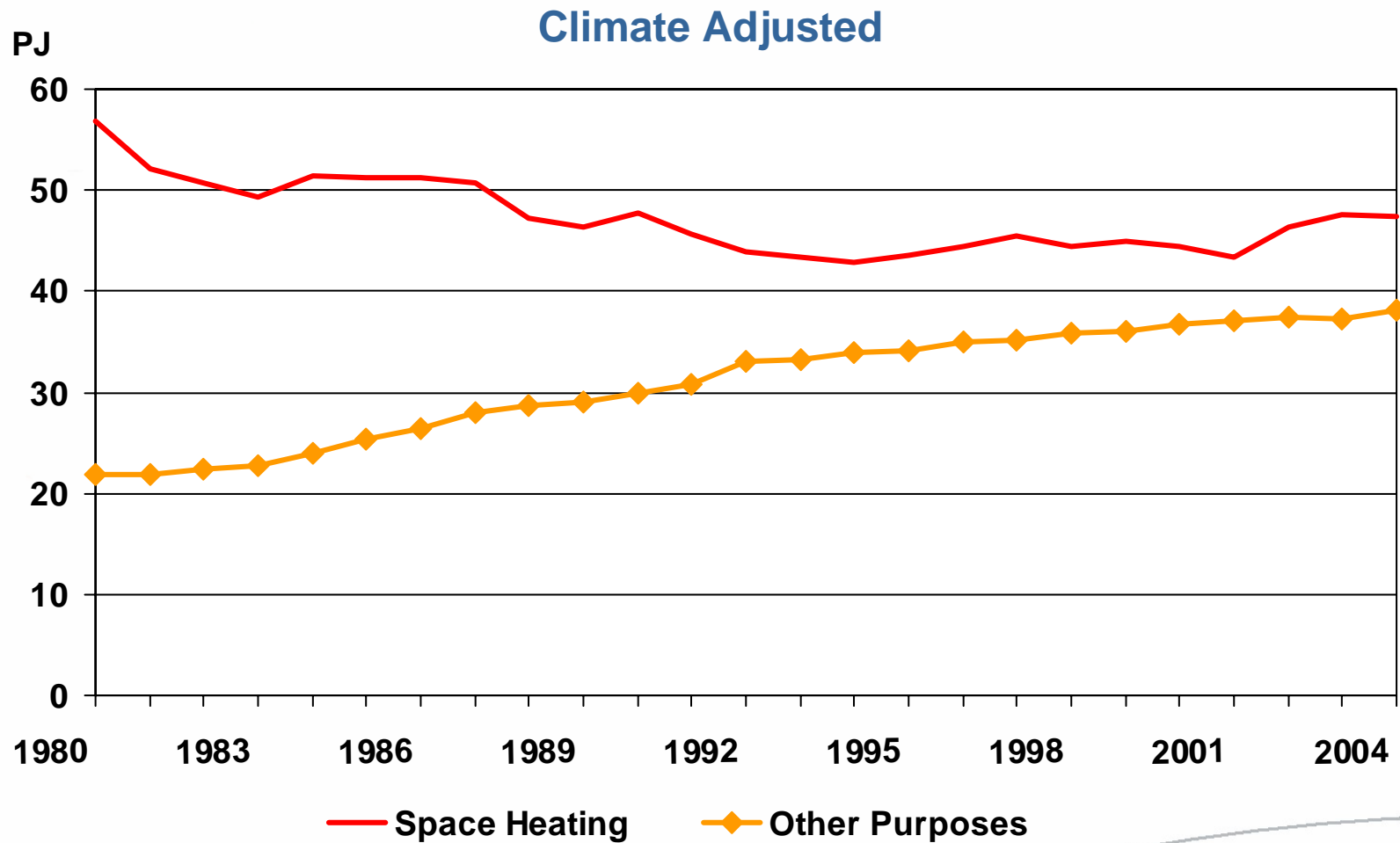
The Danish Building and Dwelling Register (BDR)

- Established 1977, on basis of the general real property valuation
- Legal Basis: Act on Registration of Building and Dwellings
- Nation wide coverage
- Units
 - Built-up properties
 - Buildings
 - Dwelling units
 - Business and institution units
- Updating: The municipalities
- Important information about
 - Number of dwellings
 - Heated floor surface (m²)
 - Heating installations

BDR: Buildings - Type of use

- **Dwelling purpose - all year**
 - Farm dwellings
 - Single - family house
 - Row house
 - Flat
 - College
 - Institution
- **Buildings for production purposes**
 - Agriculture
 - Industry
 - Office, commerce, public administration
 - Hotels, services
 - Cinemas, churches
 - Education, day care institution
- **Buildings for leisure purposes**
 - Summerhouses
 - Sport purposes

Energy Consumption in the Trade and Service Sector by Type of Use



Electricity Consumption in the Trade and Service Sector by Branch

1990-2004: Private Service +35,3% and Public Service+20,8%

