

**FROM MACRO TO MICRO ENERGY INDICATORS :**

**HOW TO COLLECT THE RIGHT DATA  
IN THE INDUSTRIAL SECTOR**

An example how it is difficult  
to appreciate energy efficiency at a micro-level:

## 2 TILES PLANTS in the South-West of France

the different steps to make tiles are :

- extraction of the earth
- casting
- drying
- cooking

Both plants have the **same technology** for each step,  
but the first one consume **25%** more than the second one.

**Why ?**

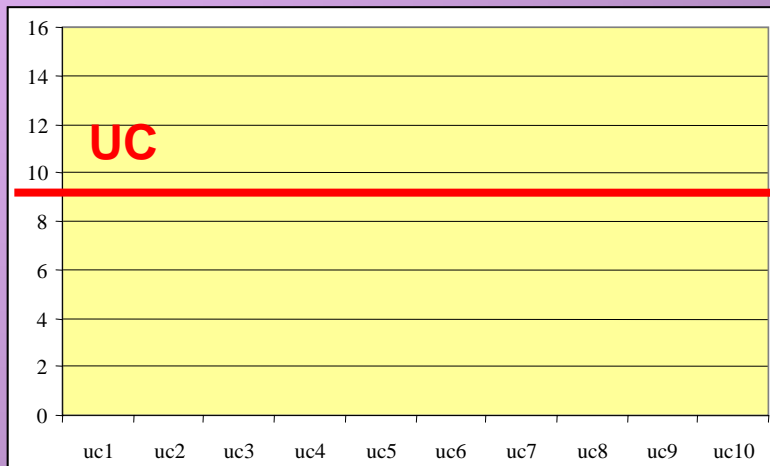
## Comparison between macro- and micro levels

### MACRO LEVEL

**TOTAL PRODUCTION OF CEMENT = P**  
(tons) - Source Production surveys

**TOTAL ENERGY CONSUMPTION OF CEMENT INDUSTRY = C** (TJ) – Source Energy suppliers

**Unit consumption per ton :**  
**UC =  $10^6 * C / P$  (MJ/ton)**



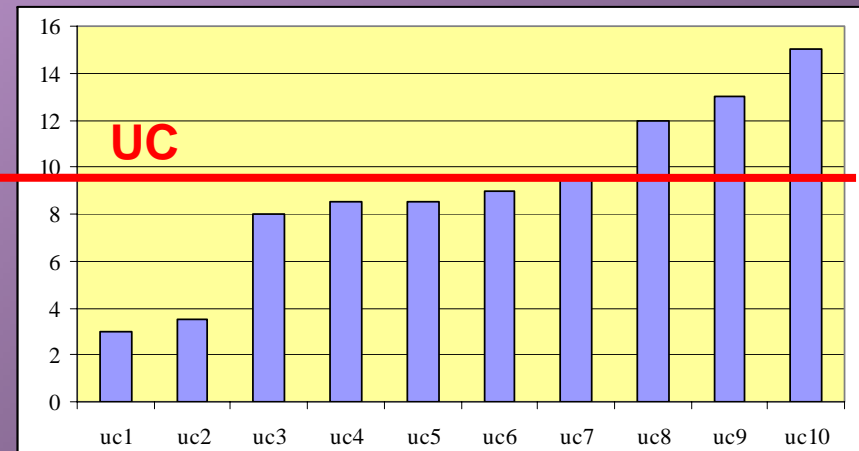
### MICRO LEVEL

**10 cement plants : 10 productions**  
P1, P2... P10 ( $\sum P_i = P$ )

10 values of energy consumption :  
C1, C2... C10 ( $\sum C_i = C$ )

10 values of unit consumption :  
uc1, uc2... uc10  
Distribution of uc1, uc2...uc10

Source :  
from  
the  
same  
survey



# Surveys in Industrial Sector

## DRAFT OF ANY SURVEY

### I. WHAT IS THE UNIVERSE (set of all units in the investigation field) ?

### II. PRELIMINARY QUESTIONS

Mandatory survey or voluntary survey ?

Exhaustive survey or sampling survey ?

Mail survey, phone survey, survey by surveyor ?

### III. THE IMPLEMENTATION OF THE SURVEY

Draft of the questionnaire

Organisation within the statistical body in charge of the survey

Management of the mailing

Management of verification of questionnaires (numerous phone calls)

Reminder mailing

Computerisation

Results

### IV. EDITING THE FINAL REPORT AND DISSEMINATION OF FINAL RESULTS

## DEFINITION OF THE INDUSTRIAL SECTOR

- **ACTIVITY ( code NACE) : usually from NACE 13 to 37 except NACE 23**
- **with an ACTIVITY OF PRODUCTION (the offices – headquarters – and warehouses of industrial firms are to be removed from the survey)**
- (for pragmatic reasons) **LOWER LIMIT IN TERMS OF « NUMBER OF EMPLOYEES »**
- **Does it exist a DATABASE OF ENTERPRISES? of production units ?  
(1 enterprise could comprise several production units)**

## **WHICH BODY will organise the data collection ?**

National administration : Ministry of Industry,  
National Institute of Statistics,  
Energy Agency

Private company : Association of industrialists  
Energy suppliers

...

**WHAT is its target ?** Energy policy  
Energy efficiency  
Commercial target

...

*(because any data collection is expensive and time consuming)*

**Is it possible many actors set up their forces in a unique survey aiming at different targets?**

## QUESTIONS TO BE ASKED COULD CONCERN :

- **HOW MUCH ENERGY** is consumed ?
- **WHICH TYPE OF ENERGY** is consumed ?
- **WHY** is this energy consumed (use of energy) ?
- **HOW** is this energy consumed (through which equipment) ?
- **WHEN** is this energy consumed (electricity peak load) ?

The **DATA COLLECTION** must be adapted according to the questions asked :

- type of survey (surveyor, mail, phone... mandatory/voluntary)
- size of the sample
- budget
- time constraint

# **SURVEY BY MAIL MANAGED BY PUBLIC ADMINISTRATION AMONG A LARGE SAMPLE OF CONSUMERS**

This type of survey is the most commonly carried out in many countries

**MANDATORY SURVEY** → legal formalities to comply with

The main target is to answer the questions :

**Which type of energy is consumed ?**

**How much energy is consumed ?**

**(other questions)**

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

The main target is producing the following type of table :

*period concerned*



**Year** : 2006

*unit*



Amount of energy consumed in **toe**

*geographical coverage*



**Country** : xxxx

Activity	Coal	Fuel oil	Natural gas	Electricity
Iron & steel Cement Chemicals Pulp & Paper ...	xxx	yyy	zzz	ttt

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## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### THE QUESTIONNAIRE

- **Which unit ?**

In order to avoid mistakes, **you must ask the industrialists in the same unit as it appears on the bills (physical units as tons, MWh... ) Never ask the industrialist in toe or GJ (except for gas if it is the unit used on the bills)**

- **Ask the amount in your national monetary unit too**

- ➔ to calculate the prices of energy from consumers source
- ➔ to check to coherency between quantities and values

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**SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS****THE QUESTIONNAIRE (following)**

- Stockable energy (coal, fuel oil...) :  
**consumption = initial stock + purchases - final stock**  
**You must ask initial stock, purchases and final stock**
- Network energy (natural gas, electricity)

(usually) the industrialist has MONTHLY BILLS

You can ask copies of these bills :

- ➔ to check the sum of 12 monthly consumption
- ➔ to get useful information on monthly consumption of electricity

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### THE QUESTIONNAIRE (following)

#### THE TYPES OF ENERGY

You must **simplify the nomenclature of energy carriers** compared to international nomenclatures.

For instance :

Coal Lignite Coking coke <i>(be careful to the net calorific values)</i>	Heavy fuel oil (high/low sulphur) Heating oil LPG Petroleum coke	Natural gas Coke oven gas Blast furnace gas	Heat purchased	Electricity : - purchased - selfproduced
	Naphtha Refinery gas Diesel oil ? Benzine ?			

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

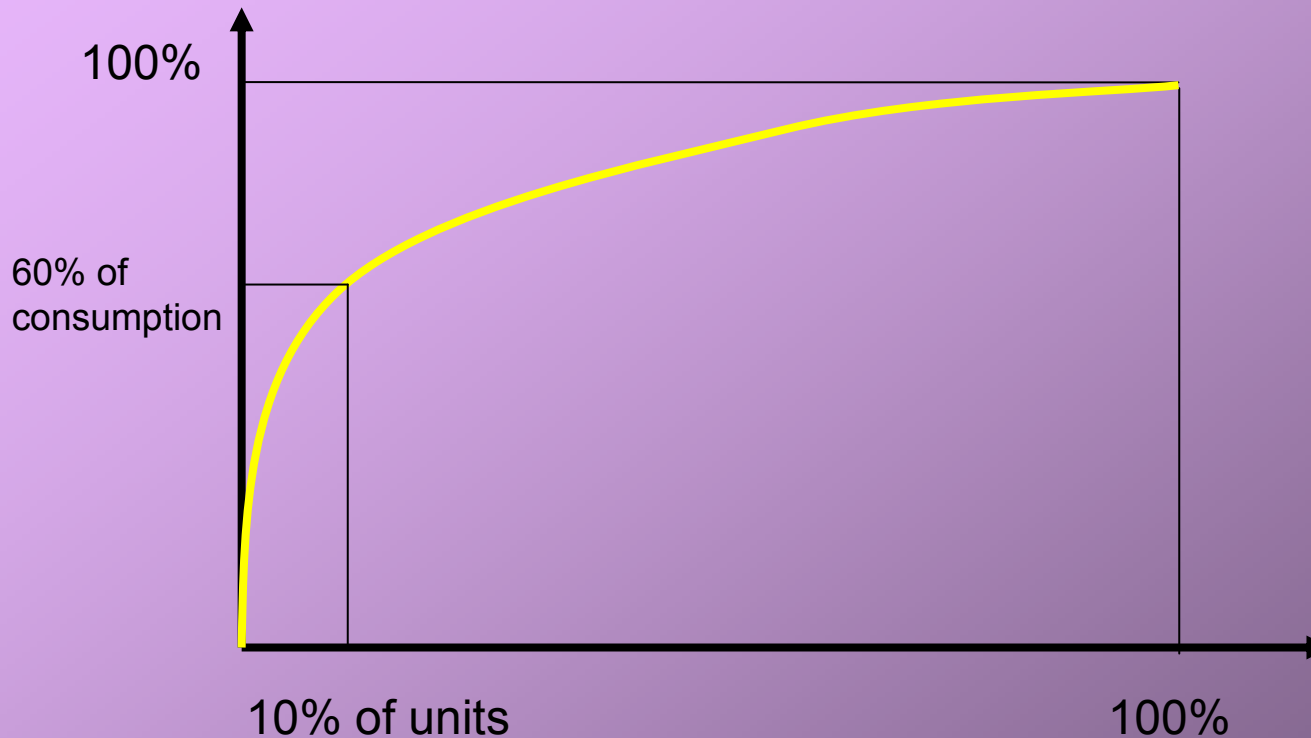
Example of questionnaire (used in Hungary)



## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### The very high concentration of industrial energy consumption

Cumulative consumption



Units	Cons	Cum. cons
Unit 1	1000	1000
Unit 2	900	1900
Unit 3	700	2600
Unit 4	350	2950
Unit 5	200	3150
...		

Number of units sorted by decreasing consumption

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### HOW TO CHOOSE THE SAMPLE TO BE SURVEYED ? The notion of STRATIFIED RANDOM SAMPLE

Stratified : by activity  
by size

The sampling rate differs in each cell of the table in order to maximize the usefulness of each questionnaire

Nb plants Nb surveys	10-19 empl	20-49 empl	50-99 empl	>=100 empl	TOTAL
Iron & steel	50 30	30 20	15 10	8 8	103 68
Brick & tiles	80 40	40 30	25 12	15 15	160 97
Pulp & paper	150 30	80 40	30 15	5 5	265 90
Textile	500 25	350 25	80 40	40 30	970 120
...					

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### BEFORE LAUNCHING THE SURVEY :

- **Register the survey as mandatory survey among the relevant Administration**  
(which enterprises will be surveyed, interest of the survey, draw of the questionnaire...)
- **Very detailed explanatory notice**  
(definition of the concepts and nomenclatures used, numerous examples...)
- **Informing the main enterprises**
- **Announcement in specialised press**
- **Timetable of the survey**

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

Example of timetable

Task	weeks																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Announcement/Tests	■	■	■														
Mailing of questionnaires				■	■												
Management of returns						■	■	■	■	■	■						
VERIFICATIONS						■	■	■	■	■	■	■	■				
Reminder mailing							■	■									
PHONE CALLS							■	■	■	■	■	■	■	■	■		
Computerization						■	■	■					■	■	■	■	
COMPARISONS WITH EXTERNAL DATA							■	■							■	■	
Reporting						■									■	■	■
DISSEMINATION OF RESULTS																■	■
Counterparts									■	■							■

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### CHECKING THE QUESTIONNAIRE

**INTERNAL VERIFICATION** : data are checked without any external information

**Prices (calculated as Value/Amount) - Comparison with national prices**

**heat / electricity / global production ratios  $< 1$**       *(if questions on CHP are asked)*

**sum of uses = the total consumption**      *(if uses of energy are asked)*

**EXTERNAL VERIFICATION** : data are compared with information coming from other sources

**Unit consumption with the global unit consumption coming from the set of all questionnaires dealing with the same activity**

**Annual evolution of the consumption of EACH plant (possible only after the second year of survey)**

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### COMPUTERIZATION

Which tables are the most important ? less important ?

Which software will be used ?

Are the statisticians expert with this software ? Do they need training ?

**THE EXTRAPOLATION** realised carefully and checked step by step

Extrapolation is needed because you survey a sample only, but the results must fit the whole industry

- Extrapolation rates = inverses of sampling rate, cell by cell--cf sampling table  
or
- Duplication of questionnaires (hot deck procedure)

**TRAPS** plants that cannot be estimated from extrapolation

plants that must not be into account in the extrapolation process

empty cells in the sampling tables must be group together with proxicells

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

### Example of RESULTS

#### **Consumption by activity and energy carrier**

(in physical units / toe or TJ)

nomenclature used to publish the results

#### **Prices of energy** from consumers source

#### **Selfproduction of electricity**

energy consumed, heat/electricity produced

#### **Uses of energy**

raw material, space heating, manufacturing, boilers

## SURVEYS BY MAIL AMONG A LARGE SAMPLE OF CONSUMERS

# Dissemination of results

Who is interested in ?

What kind of results are they waiting for ?

## REPORTS

Written reports

- Abstract

- Main results

- Detailed results

Internet

- Excel tables downloads

## Advertising

## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

**TARGET OF THESE SURVEYS IS  
ANSWERING TO THE QUESTIONS :**

**Why energy is consumed ?  
How is energy consumed ?**

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## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

# FRENCH SURVEYS IN THE INDUSTRIAL SECTOR

- **Voluntary** surveys
- Managed by a **private** organisation (Ceren)
- Financed by **Energy suppliers AND Administration**
- On a **small sample** of quite plants (700 each year)
  
- Data collection carried out by **surveyors**
- Results are **partly public, partly private** (property of the enterprises that pay for them)

## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

Example of questionnaire (used in France)



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## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

# ENERGY EFFICIENCY AT A MICRO LEVEL

**Only surveys by surveyor allow data collection that collect simultaneously the four following elements :**

- **input product**
- **output product**
- **energy consumed**
- **technology used**

**This four elements characterize**

**ENERGY EFFICIENCY AT A MICRO LEVEL**

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## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

# COMPARISON MICRO LEVEL / MACRO LEVEL

## Cost of the data collection

A survey by surveyor costs from 10 to 15 times more than a survey by mail

## Timing

A survey by surveyor needs more time  
(difficult to estimate because it depends  
on the number of surveyors)

## Quality of the data collection

The voluntary cooperation of the industrialist is needed  
Checking the data is as necessary as in a mail survey,  
but it is more difficult (training of surveyors)

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## OTHER TYPES OF SURVEYS IN INDUSTRIAL SECTOR

### COMPARISON MICRO LEVEL / MACRO LEVEL (following)

**MICRO LEVEL** is needed to set up a politic of energy saving actions

**MACRO LEVEL** allows evaluation of the results of such a political action

**MICRO and MACRO LEVELS ARE COMPLEMENTARY EVALUATIONS, and not substituable.**