



# Water Abstraction (C2) and Water Use (C3)

**Data sources, stumbling blocks and simple data validation techniques**

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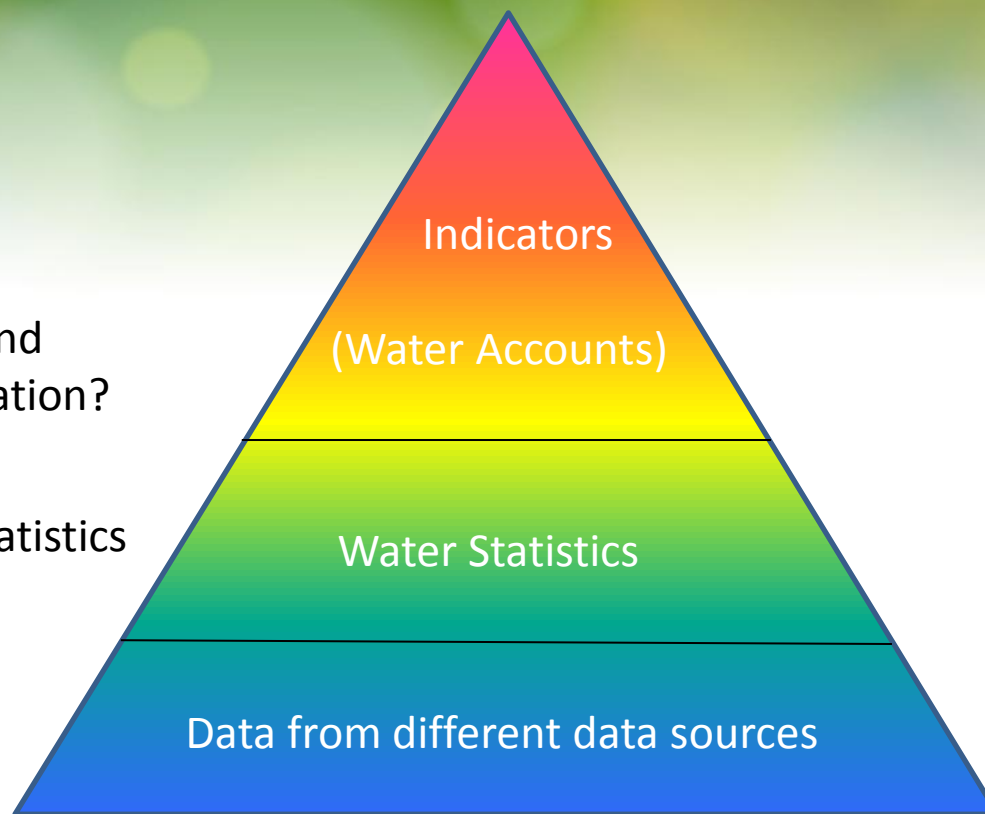


# Presentation Outline

How to validate statistics and indicators before dissemination?

How to make meaningful statistics (stumbling blocks)?

How to collect data?





# 1. Data Collection





# Example from SPAIN

See [http://www.ine.es/en/inebmenu/mnu\\_medioambiente\\_en.htm](http://www.ine.es/en/inebmenu/mnu_medioambiente_en.htm)

## A. Annual survey on water supply and sewerage

- All units classified in NACE Divisions 36 or 37, excluding irrigation communities, for cities > 15 000 inhabitants
- Remaining units: sample
- Total coverage of about 85% of the total population

## B. Annual survey on water usage in the agricultural sector

- All irrigation communities > 2 000 ha
- Samples for smaller irrigation communities
- Represents approximately 60% of the total irrigation area
- Total of ca. 750 samples for Spain

## C. Annual survey on water usage in the industrial sector

- Manufacturing industries > 200 employees + samples
- From 2007-2010 included in Waste Generation in Industries Survey, now specific survey





# SPAIN: A ) Annual survey on water supply and sewerage - Variables

- **Water supply variables**

- Abstraction from fresh groundwater and surface water
- Water from desalination
- Water supplied to the public network
- water registered and distributed by type of user
- Volume of water non-registered:
  - Real losses
  - Apparent losses
- Total value of water invoiced

- **Sewerage variables**

- ...





## SPAIN: B) Annual survey on water usage in the agricultural sector - Variables

- Income and expenses
- Water rights
- Estimated losses in the water transport networks
- Water abstracted from groundwater and surface water
- Water supplied and purchased water to and from other communities
- Distribution of water to agricultural holdings





## SPAIN: C) Annual survey on water usage in the industrial sector - Variables

- Abstraction from groundwater and surface water
- Abstraction from other water resources
- Water supplied by means of public network
- Total amount of used water
- Treatment of wastewater





# Overview on typical data sources

- **Public water supply and desalination:**
  - Municipal surveys
  - Water Supply Association
  - Census
- **Agriculture:**
  - Agrarian statistics
  - Data from water authorities
  - Data from farmers associations
- **Manufacturing industry:**
  - Industry surveys (specialised or combined)
- **Service industry:**
  - Municipal surveys (data from public water suppliers)
  - Statistics about employment and tourism x water use coefficients
- **Self supply of households:**
  - Not connected households x water use coefficient
  - In combination with data from water authorities and Water Supply Association







## Gap filling via interpolation, extrapolation and use of water use coefficients

### **(Linear) interpolation:**

- E.g. Population connected to public water supply data only available from census data (2001 and 2011), then linear interpolation might help to calculate missing values (such as self-supply by households).

### **Extrapolation from metered abstractors to non-metered abstractors:**

- Precondition: Similarities between the sampled group and the non-sampled group are required

### **Water use coefficients:**

- E.g. range of typical household water use / capita (in Europe): ca. 90 l/day – 300 l/day
- Production specific water use coefficients
- Consult „Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters Tables 1 – 7“



# Example for water use coefficients (manufacturing industries)

*Table 8-3: Water use coefficients for different industry sectors (German example)*

| industry sector<br>line of production | production device                 | Unit                            | water use/unit           | Reference                                       |
|---------------------------------------|-----------------------------------|---------------------------------|--------------------------|---|
| food industry                         | cereals                           | 1 t cereals                     | 1.5 - 8 m <sup>3</sup>   | Hosang et al., 1998                             |
|                                       | canned fruits or vegetables       | 1 t cans                        | 4 - 14 m <sup>3</sup>    | Hosang et al., 1998                             |
|                                       | candies                           | 1 t product                     | 6 - 26 m <sup>3</sup>    | Hosang et al., 1998                             |
|                                       | sugar                             | 1 t beets                       | 10 - 30 m <sup>3</sup>   | Hosang et al., 1998                             |
|                                       | meat and fishproducts             | 1 cattle and horses or 2.5 pigs | 0.3 - 0.4 m <sup>3</sup> | Hosang et al., 1998                             |
|                                       | abbatoir                          |                                 |                          |   |
|                                       | creamery (fresh milk)             | 1000 L milk                     | 4 - 6 m <sup>3</sup>     | Hosang et al., 1998                             |
|                                       | creamery                          | L milk                          | 1 - 1.5 L                | Mutschmann et al., 2002                         |
|                                       | cheese dairy or butter production | 1000 L milk                     | 10 m <sup>3</sup>        | Hosang et al., 1998                             |
|                                       | margarine                         | 1 t margarine                   | 20 m <sup>3</sup>        | Hosang et al., 1998                             |
| leather and textile industry          | brewery                           | 1000 L beer                     | 5 - 20 m <sup>3</sup>    | Mutschmann et al., 2002;<br>Hosang et al., 1998 |
|                                       | wine and liqueur distillery       | 1000 L corn                     | 4 - 6 m <sup>3</sup>     | Hosang et al., 1998                             |
|                                       | shoes                             | 1 pair of shoes                 | 5 L                      | Hosang et al., 1998                             |
|                                       | leather, tannery                  | 1 t of skins                    | 40 - 60 m <sup>3</sup>   | Hosang et al., 1998                             |
|                                       | woollaundry                       | 1 t wool                        | 20 - 70 m <sup>3</sup>   | Hosang et al., 1998                             |
|                                       | bleachery                         | 1 t product                     | 50 - 100 m <sup>3</sup>  | Hosang et al., 1998                             |
| leather and textile industry          | dyeing factory                    | 1 t product                     | 20 - 50 m <sup>3</sup>   | Hosang et al., 1998                             |
|                                       | synthetic fibre                   | 1 kg product                    | 200 L                    | Mutschmann et al., 2002                         |



## Recommendations and Guidance

Data Collection Manual for the OECD/Eurostat  
Joint Questionnaire on Inland Waters

([http://ec.europa.eu/eurostat/ramon/coded\\_files/OECD\\_ESTAT\\_JQ\\_Manual\\_version\\_2\\_21.pdf](http://ec.europa.eu/eurostat/ramon/coded_files/OECD_ESTAT_JQ_Manual_version_2_21.pdf))

International Recommendations for Water  
Statistics

(<http://unstats.un.org/unsd/envaccounting/irws/>)





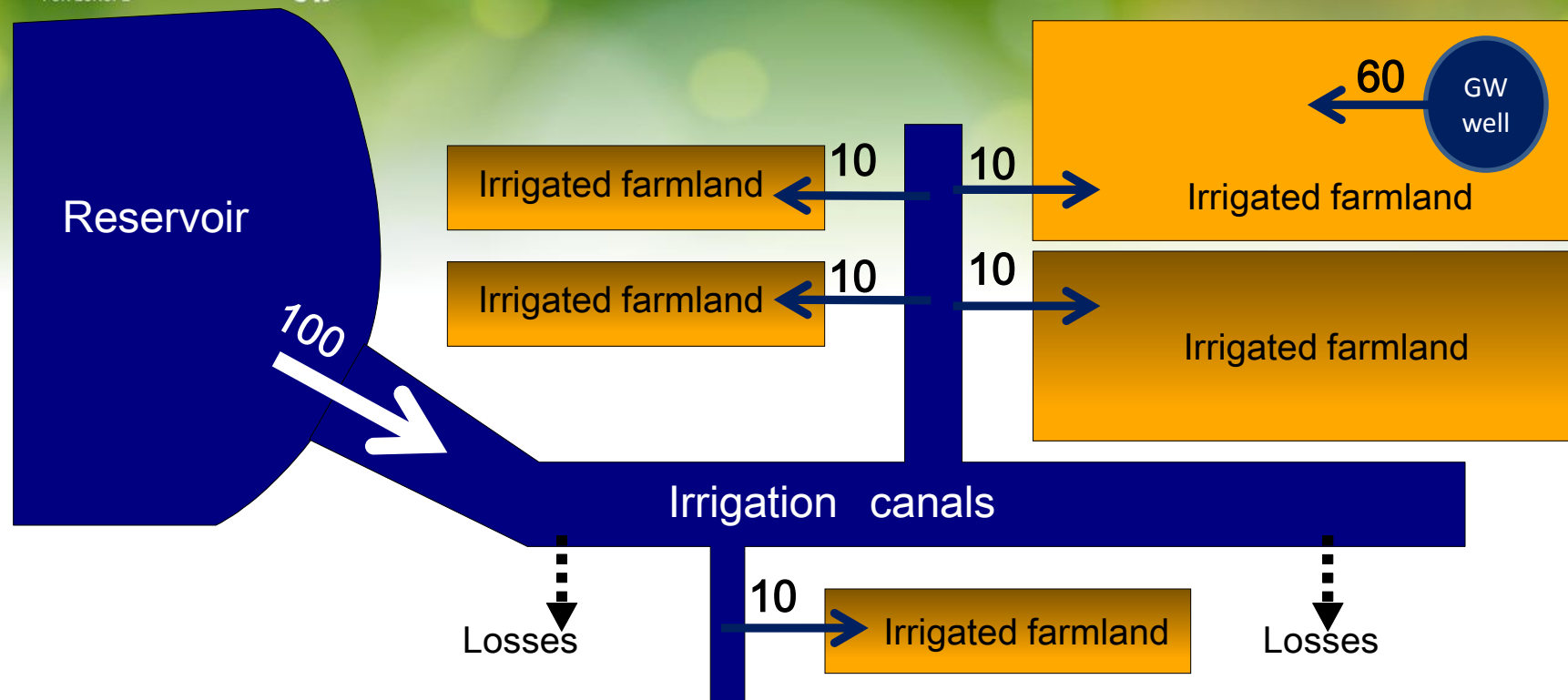
## 2. Stumbling Blocks

**Be careful with system boundaries**

- Irrigation canals
- Industry parks
- Water abstracted and used for cooling purposes
- Reuse and recycling of water



# Irrigation canals

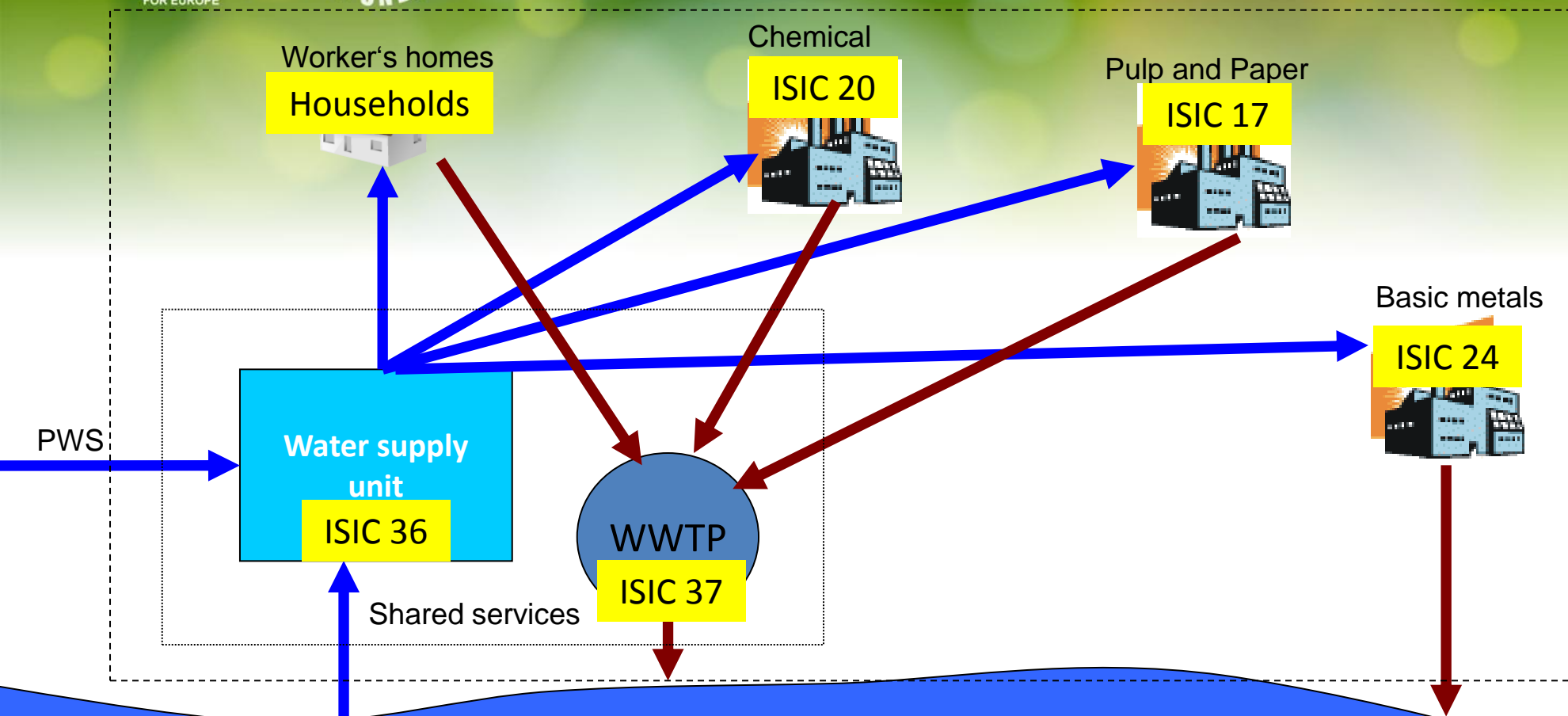


## Questions:

How many units of water are abstracted by Agriculture (ISIC 01)? **60**  
 How many units of water are used by Agriculture (ISIC 01)? **110**

**Note:** Operation of irrigation canals is classified as ISIC 36 (water supply) (ISIC rev. 4.0)!

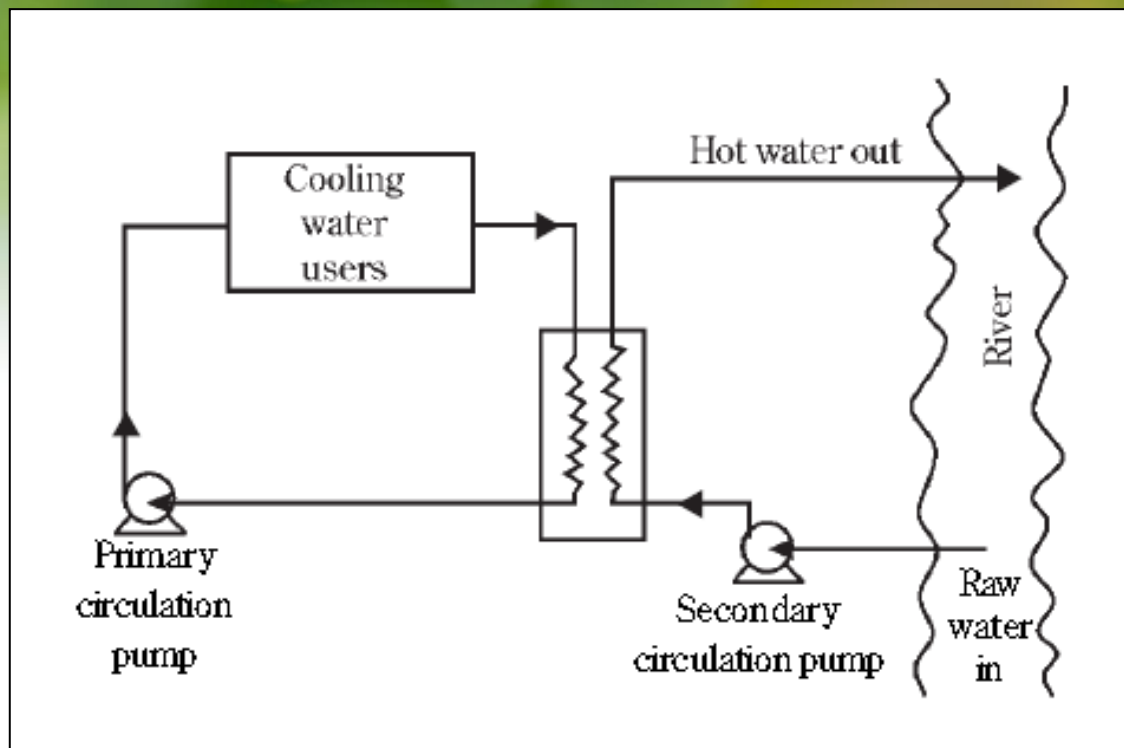
# Industrial Parks



**Note:** Even if industries are organised in industrial parks with shared services, they have to be considered individually (according to their main activity).



# Cooling water

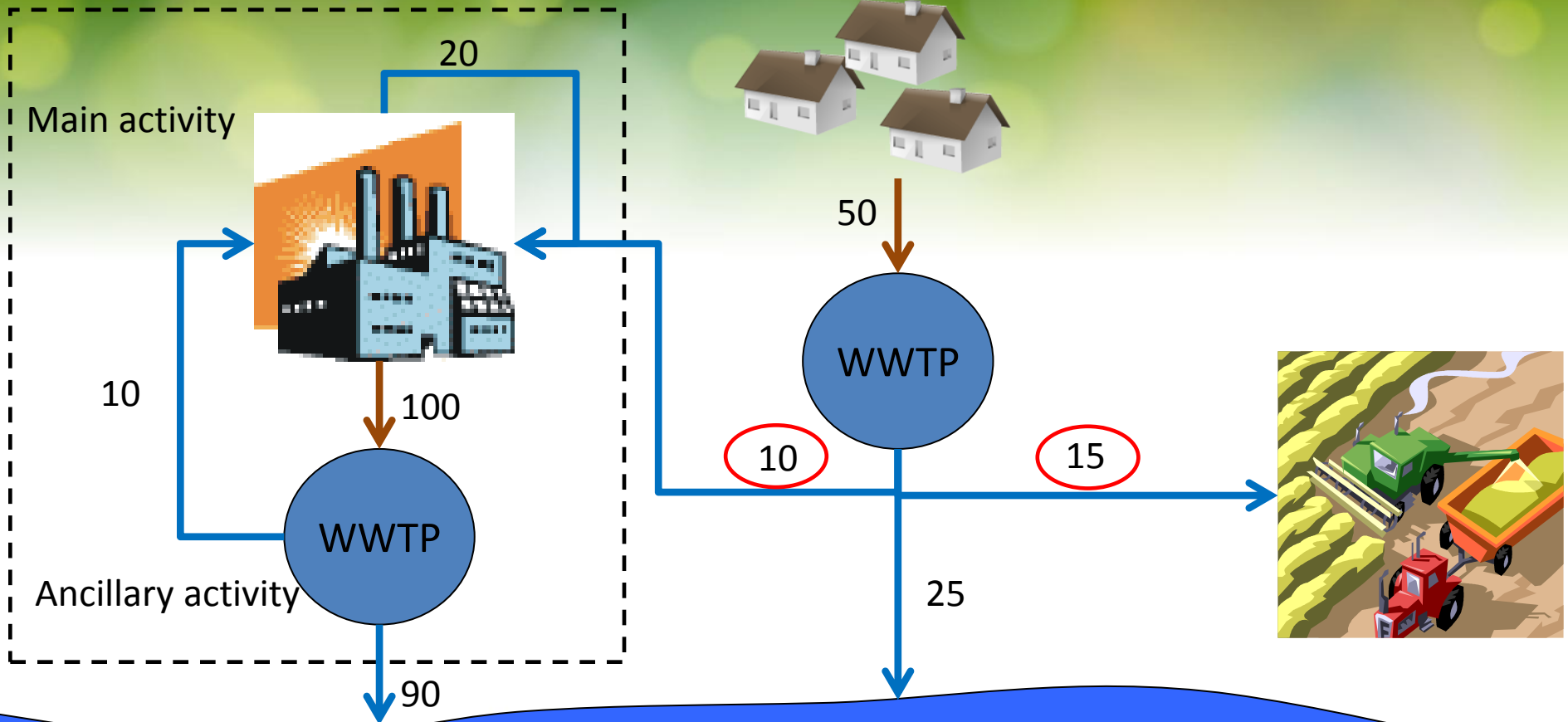


**Cooling water could be the dominating water abstraction and use:**  
Electricity production, metal industry, oil industry, chemical industry, pulp and paper

**Note:** Cooling water is not separated from other water uses in C2 and C3. Keep it separately in your national records; suggestion to add it in C2 and C3 or make footnotes



# Reuse and Recycling of Water



**Question:** How many units of water are re-used?

**Note:** Reused water is delivered directly to a user as reclaimed wastewater.  
Recycling within industrial sites is excluded.





# 3. Simple Data Validation

Can the values be true?



# What is questionable here, why?

Time series data on the indicators for 1990-2013, Table C-2 Freshwater abstraction:

|   | Unit  | 1990                   | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |      |
|---|---|------------------------|------|------|------|------|------|------|------|------|------|------|
| <b>Surface and groundwater abstracted</b> |   |                        |      |      |      |      |      |      |      |      |      |      |
| 1   | Fresh surface water abstracted                  | million m <sup>3</sup> |      | 0    | 0    | 0    |      | 1000 | 0    | 1000 | 1100 | N.A. |
| 2   | Fresh groundwater abstracted                    | million m <sup>3</sup> | 4790 | 5000 | 4714 | 4502 | 6390 | 3064 | 4072 | 3993 | 7112 | N.A. |
| <b>Freshwater abstracted</b>              |   |                        |      |      |      |      |      |      |      |      |      |      |
| 4   | <b>Freshwater abstracted</b><br>(Row 1 + row 2) | million m <sup>3</sup> | 4790 | 5000 | 4714 | 4502 | 6390 | 4090 | 4072 | 4993 | 8212 | 4913 |
| <i>of which abstracted by</i>             |   |                        |      |      |      |      |      |      |      |      |      |      |
| 6   | Water supply industry (ISIC 36)                 | million m <sup>3</sup> |      | 205  | 210  | 212  | 2215 | 220  | 222  | 225  | 228  | 230  |
| 7   | Households                                      | million m <sup>3</sup> | 110  | 105  | 104  | 100  | 95   | 120  | 90   | 98   | 95   | 93   |
| 8   | Agriculture, forestry and fishing (ISIC 01-03)  | million m <sup>3</sup> | 1300 | 1400 | 1400 | 1500 | 1500 | 1100 | 1000 | 1800 | 1400 | 1200 |
| 9   | Manufacturing (ISIC 10-33)                      | million m <sup>3</sup> | 3000 | 3100 | 2800 | 2500 | 2400 | 2500 | 2600 | 2700 | 3000 | 3200 |
| 10  | Electricity industry (ISIC 351)                 | million m <sup>3</sup> | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| 11  | Other economic activities                       | million m <sup>3</sup> | 180  | 190  | 200  | 190  | 180  | 150  | 160  | 170  | 180  | 190  |

# What is questionable here, why?

Time series data on the indicators for 1990-2013, Table C-2 Freshwater abstraction:

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|---|---|------------------------|------|------|------|------|------|------|------|------|------|------|
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| <b>Freshwater abstracted</b>              |   |                        |      |      |      |      |      |      |      |      |      |      |
| 4   | <b>Freshwater abstracted</b><br>(Row 1 + row 2) | million m <sup>3</sup> | 4790 | 5000 | 4714 | 4502 | 6390 | 4090 | 4072 | 4993 | 8212 | 4913 |
| <i>of which abstracted by</i>             |   |                        |      |      |      |      |      |      |      |      |      |      |
| 6   | Water supply industry (ISIC 36)                 | million m <sup>3</sup> |      | 205  | 210  | 212  | 2215 | 220  | 222  | 225  | 228  | 230  |
| 7   | Households                                      | million m <sup>3</sup> | 110  | 105  | 104  | 100  | 95   | 120  | 90   | 98   | 95   | 93   |

## NOTE:

- Avoid empty cells. Is it "0" or "N.A."?
- Look at time series. Consistent development or outliers?
- Abstraction by water supply industry usually develops continuously (e.g. increases continuously due to increased connection rate; reduction possible e.g. due to technical measures to reduce losses)
- Households' water abstraction usually develops continuously (e.g. reduces because increase of connection rate)
- Abstraction by manufacturing is strongly dependent from the economic situation and technical developments.
- Agricultural abstraction is strongly influenced by weather conditions in the growing season



## C-3: Water use, validation techniques

1. Check if values for freshwater abstracted are identical with C-2
2. Check water balance of the table, e.g. total freshwater available minus losses = sum of water use by households and economic activities.
3. Check time series: Empty cells, outliers?





## C-3: Water use, validation techniques (cont.)

4. Losses: Calculate losses in % of water abstracted by water supply industrie. Check with water supply industry.
5. Water use by households and economic activities: Right order of magnitude? Methods:
  - Re-calculate household water use per capita per day with population data. Check with indicators from water supply industry (typical range in Europe e.g. 90 – 300 l/capita/day)
  - Re-calculate irrigation water per irrigated area. Check with farmers association
  - Water use by manufacturing industry difficult to validate the aggregated data as cooling water and single producers may have a big influence. Check consistency of data of the biggest users.





Other experiences (collection, stumbling blocks, validation)?  
Please share them with us

**Thank you very much for your attention!**

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