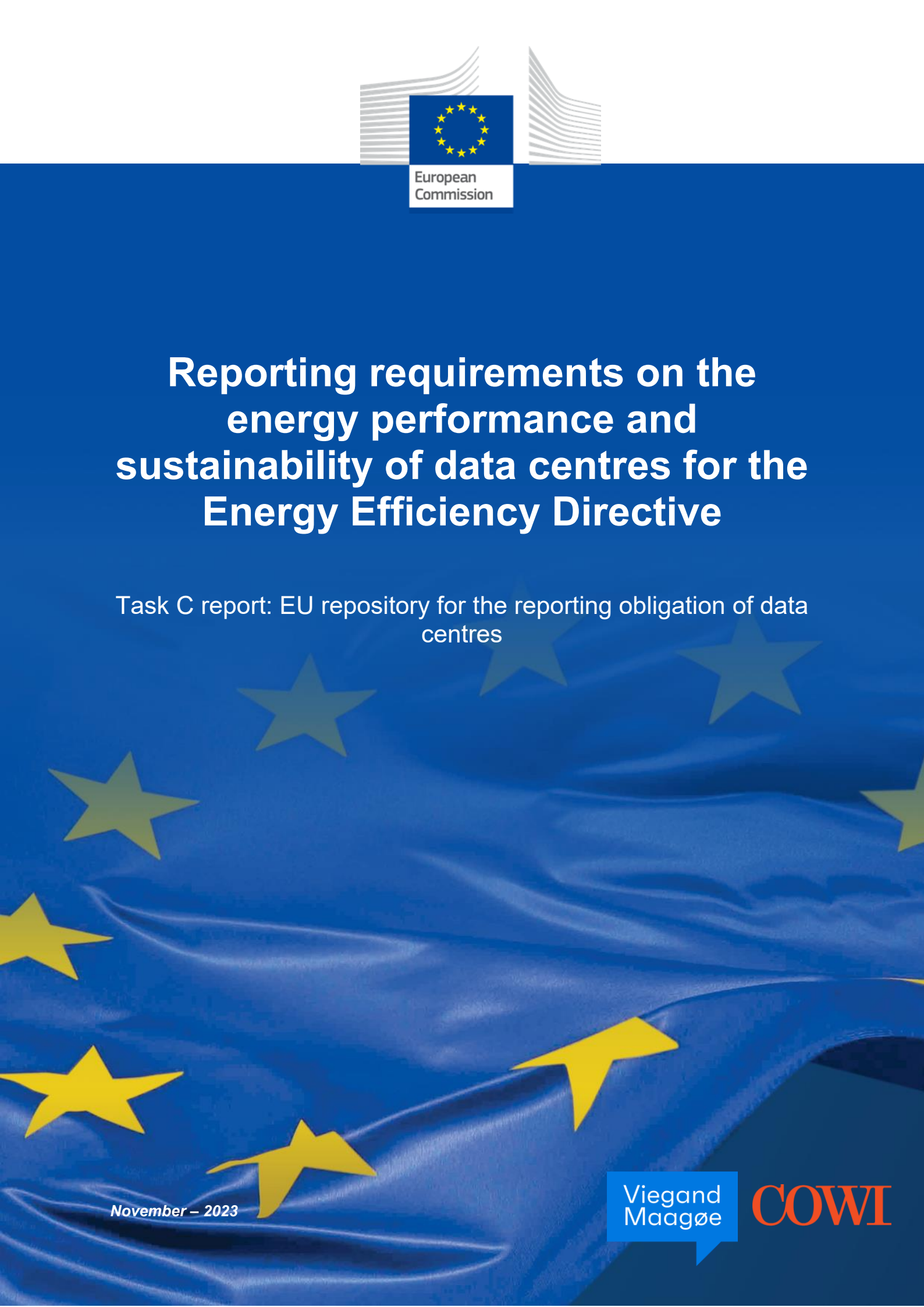
Reporting requirements on the energy performance and sustainability of data centres for the Energy Efficiency Directive

Task C report: EU repository for the reporting obligation of data centres



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Reporting requirements on the energy performance and sustainability of data centres for the Energy Efficiency Directive

Task B report: EU repository for the reporting obligation of data centres

Directorate-General for Energy

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Task C: Options for an EU repository for the reporting obligation of data centres

1 Introduction

Data centres are estimated to have the fastest growing energy consumption and carbon footprint across the whole ICT sector, mainly due to technological advances such as cloud computing and the rapid growth of the use of Internet services. In the EU, from 2010 to 2018 data centre energy consumption increased by 42% and is forecast to further increase by 28.2% by 2030[1], representing about 3.2% of the EU final electricity demand. Reducing the energy demand of ICT, including data centres, is an important step in achieving the ambitious climate targets of the EU – a reduction of overall GHG emissions of 55% by 2030 compared to 1990 levels.

The European Green Deal and the Climate Law (Regulation (EU) 2021/1119) represents a major leap in that direction. As a part of the 'Fit for 55' package, the recast Energy Efficiency Directive[2] (EED recast), includes new obligations that target data centres.

To support sustainable development in the ICT sector, the Article 12 of the EED recast asks data centres to make information about their energy performance publicly available. These reporting requirements would apply to all DCs, old and new, whose IT installed power demand is above a threshold.

2 Objectives

In line with the EED recast, the Commission will adopt a delegated act to establish a common EU scheme for the reporting of the sustainability of data centres within EU.

While the negotiations were ongoing and within the frame of uncertainty about its final outcome, the Commission started preparing the necessary evidence by means of this study and whose specific objectives are to:

- Organise a consultation with relevant stakeholders and Member State representatives.
- Assess and propose the main elements that will define the scope of reporting on the energy performance and sustainability of data centres: how are data centres defined, which data centres will be required to report and possible exceptions to this obligation.
- Assess and propose the main elements of the reporting scheme: which entities will be responsible to fulfil the reporting obligation for each data centre, access to data and ways to ensure the consistency and quality of the reported data.
- Identify, assess, and propose the possible indicators that can be used to report the energy performance and sustainability of data centres, as well as their respective calculation methodologies.
- Identify, assess, and propose the possible data and information, which data centres will need to report along with the energy performance and sustainability indicators.
- Propose options for an EU-wide repository that will be used to gather, keep and publish the reported data.

[1] Own calculations based on figures provided in European Commission (2020b). Energy-efficient cloud computing technologies and policies for an eco-friendly cloud market.
[2] OJ L 231, 20.9.2023, p. 1–111 EUR-Lex - 32023L1791 - EN - EUR-Lex (europa.eu)

3 Structure and objectives of this document

Task C report describes the EU-wide repository that will be used to gather, keep and publish the reported data taking into account user aspects. It makes use of technical options available at the Commission IT platforms, such as EU login.

The report is covers:

- The description of the input data for the purpose of reporting.
- The output data calculated from the input data.
- The summary of statistics that will be publicly available, in an aggregated form.
- The different users of the EU repository, and their tasks and levels of access.
- The reporting cycle from granting access to reporting entities to the publication of statistics.

4 Input data

Reporting entities will register their input data in the e-platform by means of a form, with different fields to be filled in with the information required. This section describes the attributes for each input data or field, which are:

- Data type: text, number, etc.
- Unit: kWh, kW, dimensionless
- Frequency of reporting
- Data validation: it defines rules or criteria to reduce errors by users when registering the data.

4.1 Building information

Input data name	**Data type**	**Unit**	**Frequency reporting**	**Data validation**
Reporting entity name	Text	N/A	First year of reporting	
Data Centre Name / ID	Text	N/A	First year of reporting	
Location	Text /postal code	N/A	First year of reporting	If postal code
Type of Data Centre according to classification in section 5	Text	N/A	Annual	3 possible values: enterprise, colocation, and co-hosting

4.2 Domain of control

Input data name	Data type	Unit	Frequency reporting	Data validation
Domain of control - Physical Building	Y/N	N/A	Annual	Y/N
Domain of control - Mechanical & Electrical Plant	Y/N	N/A	Annual	Y/N
Domain of control - Data Floor	Y/N	N/A	Annual	Y/N
Domain of control - Racks	Y/N	N/A	Annual	Y/N
Domain of control - IT Equipment	Y/N	N/A	Annual	Y/N
Domain of control - Operating System / Virtualisation Layer	Y/N	N/A	Annual	Y/N
Domain of control - Software	Y/N	N/A	Annual	Y/N
Domain of control - Business Process	Y/N	N/A	Annual	Y/N
Domain of control – All above	Y/N	N/A	Annual	Y/N

4.3 Operation data

Input data name	Data type	Unit	Frequency reporting	Data validation
Electrical Infrastructure redundancy Level	Text	N/A	Annual	

Cooling Infrastructure redundancy Level	Text	N/A	Annual	
Number of modular capacity steps or separately provisioned halls	Number	N/A	Annual	
Number of Racks	Number	N/A	First year of reporting or if changes	

4.4 Indicators

Input data name	**Data type**	**Unit**	**Frequency reporting**	**Data validation**
Data centre total floor area	Number	Square meters	Annual	
Data centre computer room floor area	Number	Square meters	Annual	Cannot be > building floor area
Rated IT Electrical Load (kW)	Number	kW	Annual	Check with DC floor area (1-10 kW/m2)
Total DC energy consumption	Number	kWh	Annual	
Contributions from backup generators (energy)	Number	kWh	Annual	
Fuel consumed in backup generators	Number	kWh	Annual	
Type of fuel	Text	N/A	Annual	
Electrical grid functions	Text	N/A	Annual	
Average battery capacity	Number	kW	Annual	

Battery time	Number	hours	Annual	
ICT equipment energy consumption	Number	kWh	Annual	Cannot be > Rated IT Electrical Load x 8760 Cannot be > total DC EC
Total water input	Number	Cubic metres/litres	Annual	
Total potable water input	Number	Cubic metres	Number	Cannot be > annual water input
Wate heat reused	Number	kWh	Annual	Cannot be > total DC EC
Average waste heat temperature	Number	Celsius	Annual	(20 – 99C)
Cooling degree days	Number	Degree days	Annual	
Renewable energy consumption	Number	kWh	Annual	Cannot be > total EC DC
Total renewable energy consumption from Guarantees of Origin	Number	kWh	Annual	Cannot be > renewable energy
Total renewable energy consumption from Power Purchasing Agreements	Number	kWh	Annual	Cannot be > renewable energy
Total renewable energy consumption from on-site renewables	Number	kWh	Annual	Cannot be > renewable energy
ICT capacity servers	Number	Dimensionless (SERT)	Annual	
ICT capacity storage	Number	terabyte	Annual	

Confidence of ICT capacity	Text	N/A	Annual	
Incoming traffic bandwidth	number	Gbps	annual	
Outgoing traffic bandwidth	number	Gbps (gigabits per second)	annual	
Incoming data traffic	number	PB (PetaBytes)	annual	must be less than incoming traffic bandwidth * 3.942
Outgoing data traffic	number	PB	annual	must be less than outgoing traffic bandwidth * 3.942

5 Output data

5.1 Metrics

The e-platform will use the data registered by the reporting entities to calculate the metrics, which will be only available to the European Commission with access to data centres in all EU), and Member States with access only to data centres in its territory.

Metrics and their formula are shown in the next sections.

5.1.1 PUE

$$PUE = \frac{\text{Total DC energy consumption}}{\text{ICT equipment energy consumption}}$$

5.1.2 WUE

$$WUE = \frac{\text{Annual water input}}{\text{ICT equipment energy consumption}}$$

5.1.3 ERF

$$ERF = \frac{\text{Energy reused}}{\text{Total DC energy consumption}}$$

5.1.4 REF

$$REF = \frac{Renewable\ energy\ consumption}{\text{Total DC energy consumption}}$$

5.2 Summary statistics for publication

This section describes the specifications for summary statistics that will be for general public. i.e. what information views will be summarized for disclosure to the public. It distinguishes two levels of information: information of each data centre and aggregated information of each Member State, with the option to select which Member State or Member States to display, or to select EU.

The size categories of data centres are based on the data centre IT installed power and are as follows:

- Small data centre: 500 –1000 kW
- Medium size data centre: 1 – 2 MW
- Large data centre: 2 –10 MW
- Very large data centre: >10 MW

5.2.1 Member state / EU level

The information displayed will correspond to the selected Member State territory or to all EU:

- Table 1: Number of data centres per type
    - Rows: types of data centre
    - Columns: years (time series)
- Table 2: Number of data centres per size range
    - Rows: size ranges
    - Column: years (time series)
- Table 3: Indicators and metrics
    - Rows:
        - Average PUE
        - Average WUE
        - Average ERF
        - Average REF
    - Columns: years (time series)
- Distribution curve of data centres per size (kW ICT installed)
- Table 4: Indicators and metrics per type of data centre (for a given year)
    - Rows:
        - Average PUE
        - Average WUE
        - Average ERF
        - Variation ERF
        - Average REF
    - Columns: types of data centre
- Table 5: Indicators and metrics per size range (for a given year)
    - Rows:
        - Average PUE
        - Annual water input (sum of all data centres)
        - Average WUE

- Average ERF
- Average REF

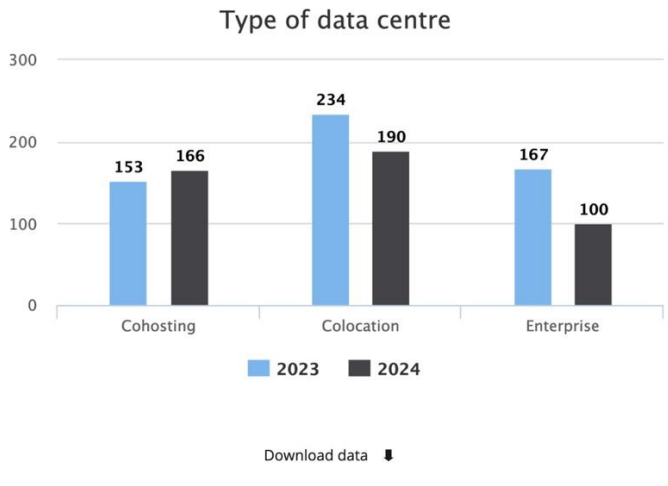
- Columns: ranges of sizes

5.2.2 Examples of visualization

This section shows some examples of visualization in form of graphs of the summary statistics described above.

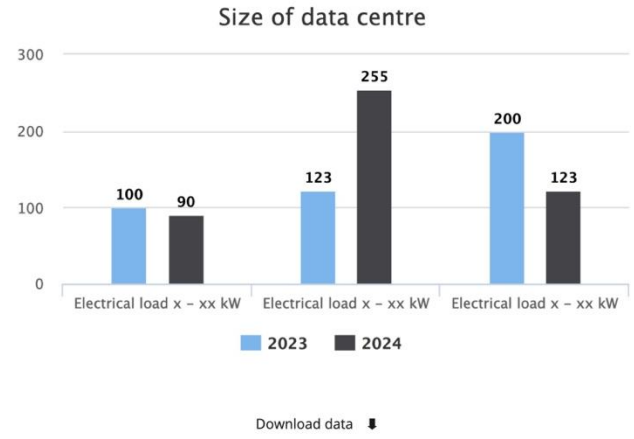
- **Types of data centres**

  Possible visualization:



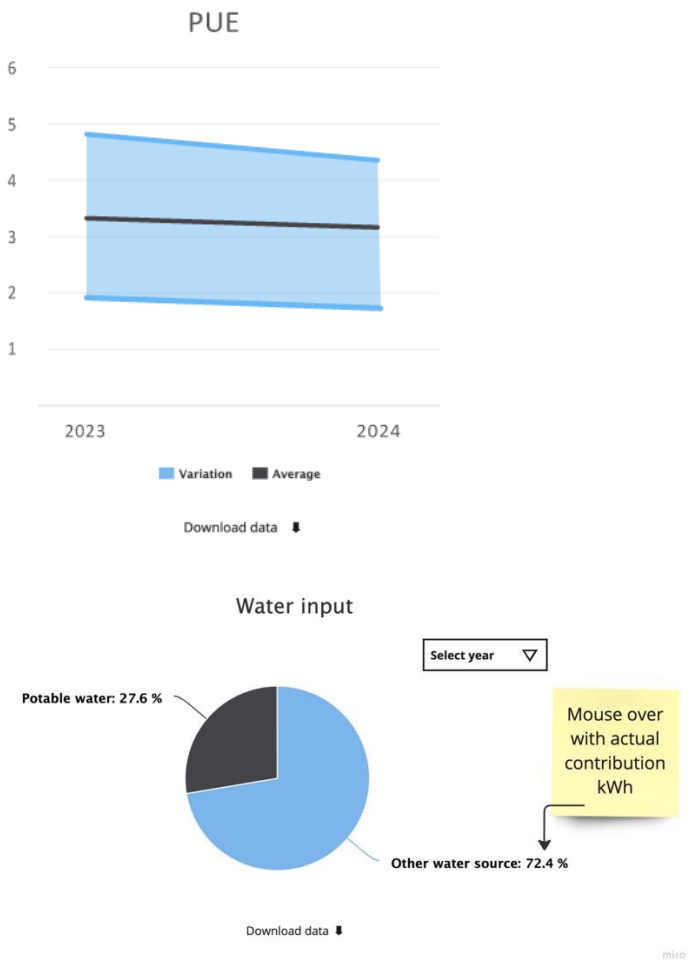
- **Size of data centres**

  Possible visualization:



- **PUE**

  Possible visualization:



6 User management in the e-platform

This section describes the different users involved in the reporting and their specific roles in terms of tasks and levels of access to the e-platform.

The different users are the following:

- European Commission.
- Member States or Competent authorities (other than European Commission).
- Reporting entity.
- General public.

The types of tasks and access levels are:

- Control and modify the platform.
- Creation of data centres accounts.
- Accounts administration (enable and disable data registration).
- View and download raw data (all data, member state data or reporting organisation data).
- Reporting data (add, edit and delete forms, add, edit and delete data in each account).

- Validate data.
- Generate public statistics.
- View public statistics.

Table 1 shows which tasks and access levels correspond to the different users:

Table 1: Users and tasks and access levels

Tasks/Users	European Commission	Member States or Competent authorities	Reporting entity	General public
Control and modify the platform	X			
Accounts administration	X (accounts hosting)	X (data centres in their territory)		
Creation of data centres accounts		X (depending on the reporting method)	X (depending on the reporting method)	
View and download data	X (all data)	X (Member state level data)	X (own data)	
Reporting data		X (depending on the reporting method)	X (depending on the reporting method)	
Validate data	X (at user interface level)	X		
Generate public statistics	X			
View public statistics	X	X	X	X

7 Reporting cycle and workflow

This section provides the description of the reporting cycle and a workflow for users to understand which actions they are responsible for in the implementation of the e-platform.

Two main categories of reporting methods can be identified, from which Member States can choose when implementing the reporting scheme:

- The data centre operator reports directly to the EU database.
- The data centre operator reports to the Member State authority which, then regularly, uploads bulk data to the European database. This option will be suitable for those Member States where there is a national reporting scheme.

Both options are described in the following sections.

7.1 Data centre operator reporting directly to the EU e-platform

In this option, the reporting cycle comprises the following steps:

0. **Access to the e-platform for reporting entities.**

   The reporting entities will create an account in the e-platform for each data centre within the scope of the reporting obligations under their responsibility. There will be as many accounts as data centres.

1. **Opening of reporting calendar**

   Each year the reporting calendar will be organised by the Competent Authority who will communicate the deadline for registering the data together with the necessary instructions for the reporting entities.

2. **Registration of information by reporting entities**

   The reporting entities will access the e-platform through EU Login for each data centre under their responsibility and register the information required by the reporting scheme. Until the deadline, the reporting entities will be able to add, edit, save or delete data.

3. **Closing of reporting calendar**

   Once the reporting calendar is finalised, i.e. after the deadline, the Competent Authority will close the reporting task, so the reporting entities will no longer be able to add, edit, save or delete data.

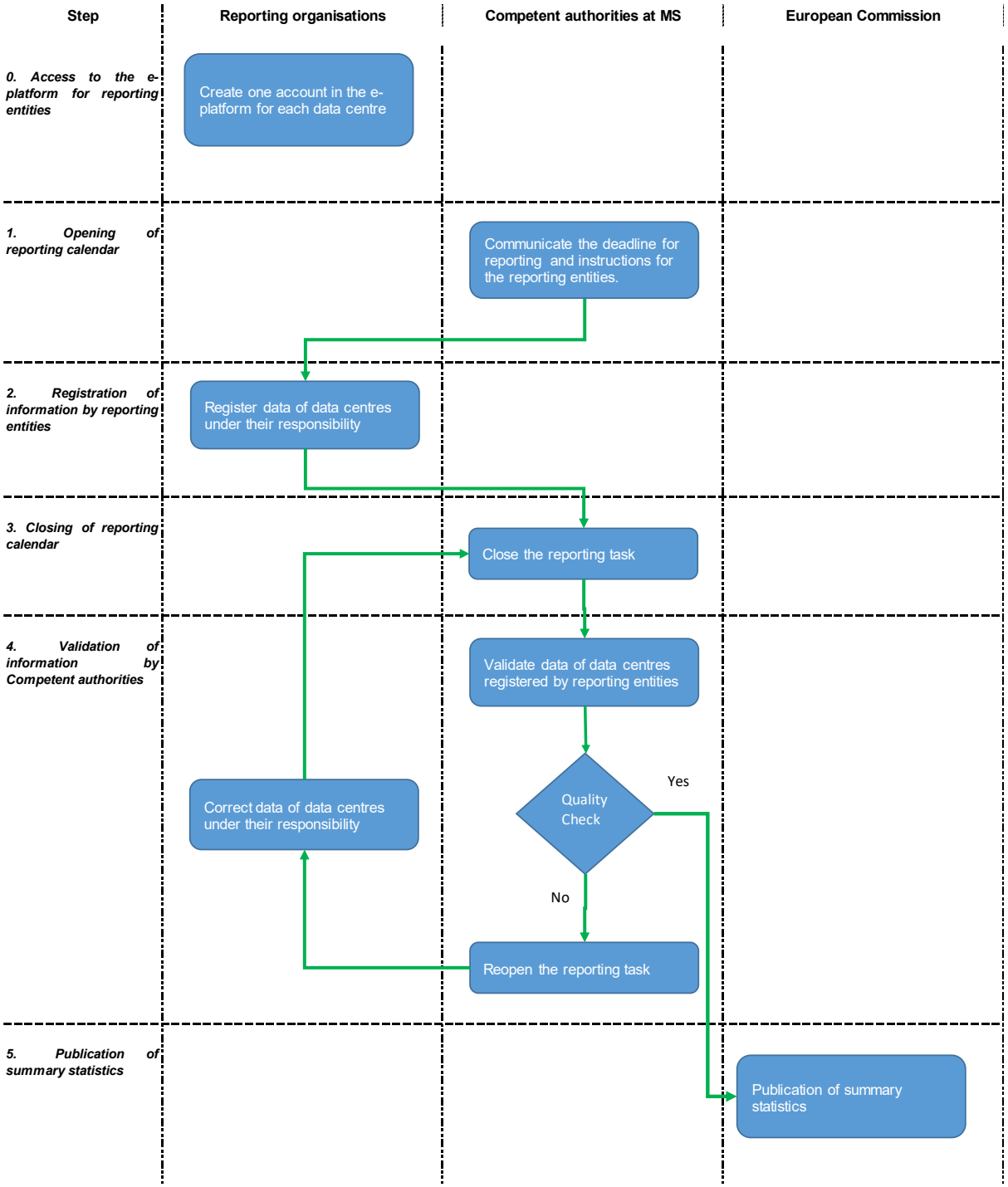
4. **Validation of information by Competent Authorities**

   The Competent Authorities will validate the information registered by reporting entities. This validation will include a quality check, and in case of any deviation, the Competent Authority will require the correction to the reporting entity. To this end, the Competent Authority will reopen the reporting task so the reporting entity will be able to modify the information previously registered or register new information.

5. **Publication of summary statistics**

   The European Commission will prepare and publish the summary statistics described in section 6.2.

The following flowchart represents the steps in the blue blocks which are placed under each entity responsible for it.



7.2 Data centre operator reporting to Member State

In this option, the reporting cycle comprises the following steps:

0. The reporting entities register the information according to the national scheme

The reporting entities will create an account in the e-platform for each data centre within the scope of the reporting obligations under their responsibility. There will be as many accounts as data centres.

1. **Information processing at national scheme**

   The Competent Authorities will process the information registered by reporting entities. This process may include a quality check, and in case of any deviation, the Competent Authority will require the correction to the reporting entity, any other administrative step that the Competent Authority establishes in the national scheme.

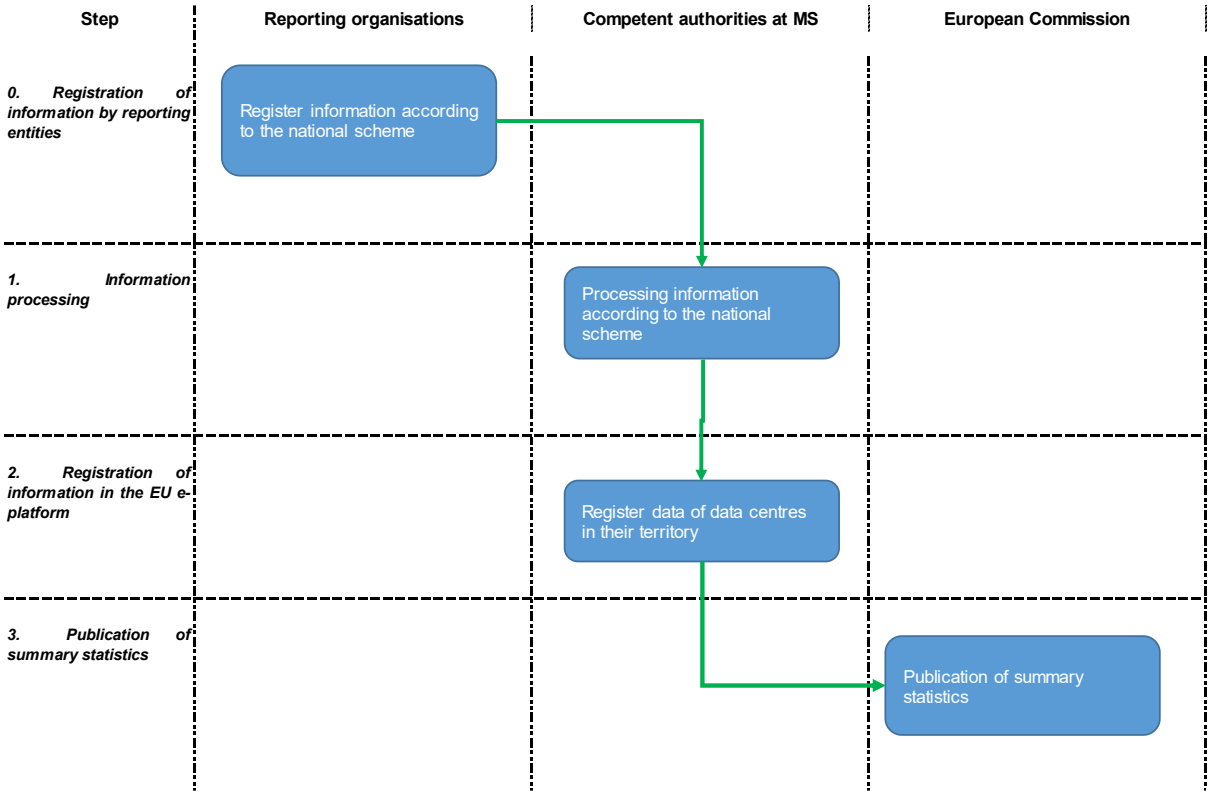
2. **Registration of information by the Competent Authority**

   The Competent Authority will access the e-platform and register the information required by the reporting scheme for the data centres in its territory.

3. **Publication of summary statistics**

   The European Commission will prepare and publish the summary statistics described in section 6.2.

The following flowchart represents the steps in the blue blocks which are placed under each entity responsible for it.



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