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IER Institute of Energy Economics
and Rational Energy Use

The German Data Centre Register on Efficiency and Sustainability

German Data Centre Conference

20 September 2022,
Frankfurt, Germany

Peter Radgen

Projekt on behalf of :

Contract Number:
37EV201030

Umwelt Bundesamt

Under the technical supervision of the:

Bundesministerium für Wirtschaft und Klimaschutz

Background and Motivation

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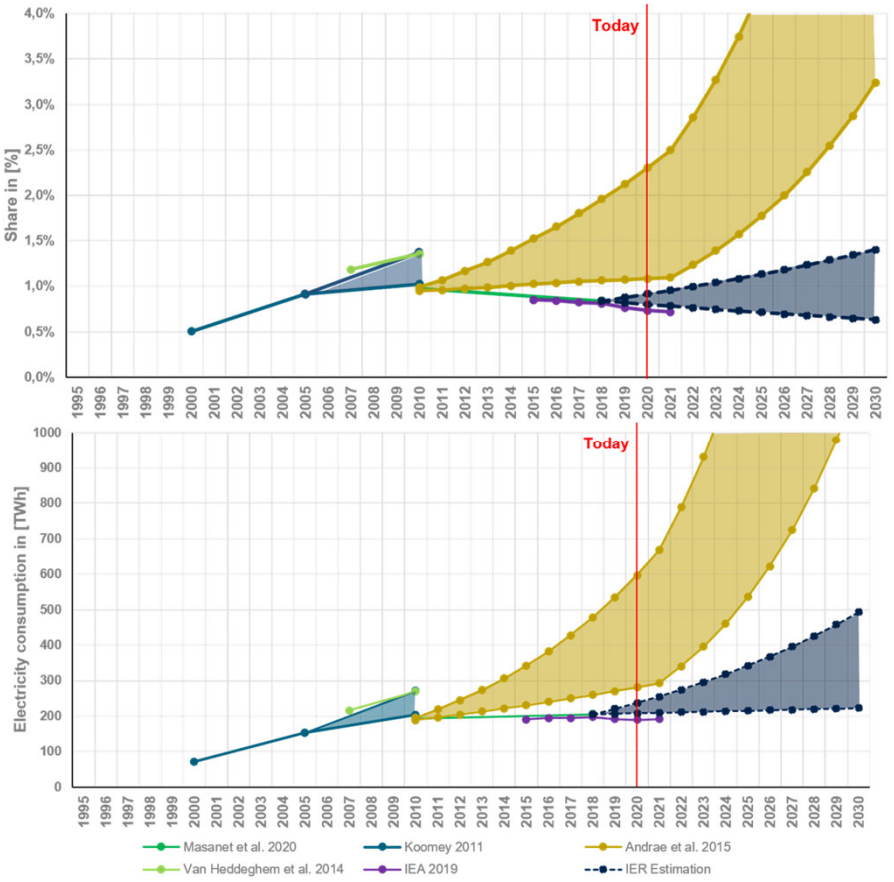
- Large growth in the area of digital infrastructures with significant increase in electricity consumption.
- Lack of transparency with regard to electricity consumption, growth and efficiency, therefore a uniform approach is required for recording and evaluating the efficiency of data centers.
- Energy efficiency and use of renewable energies at European level (cf. RED II and EED Directive).
- Energy Efficiency with high priority given the recent political developments
- However little precise knowledge – data are mostly based on assumptions and best guesses

Development of global power consumption in data centers



To be noted: All numbers are given in German format

The Colour of Data Centers

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Roses are red!

Violets are blue !

Datacenter are Green

Bildquellen: Helmholtz Forschungsakademie Hessen; Obi Baumarkt; Gartencenter Shop 24; FAZ.net/Equinix, 2022

The Three Question Marks

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- **Building design and construction ?**
  - What construction materials for the building ?
  - What raw materials for the hardware and where they come from ?
  - What plant dimensioning and design ?
- **Operation ?**
  - How and where was the electricity generated ?
  - Which refrigerants are used ?
  - Emissions of the emergency power systems ?
  - Is the waste heat used ?
- **Dismantling ?**
  - Re-Use or Refurbishment of IT Hardware ?
  - Re-Use or Recycling of building materials and technical infrastructure ?

There is a lack of
- transparency for comparability and
- incentives for improvement

Development of a Data Center Register

Creating a Win-win situation for all actors

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Data center operators

- Visibility of own digital services and climate protection measures
- Competition for the most efficient data centers
- Uniform evaluation standards for comparing data centers
- Creation of a market for waste heat from data centers

Data center customers

- Overview of available data center services
- Selection of energy-efficient, climate-friendly data centers

Regulators

- Targeted measures to promote IT infrastructures and IT locations
- Basis for development of data center market and services
- Development of connected load and energy consumption for power plant and power grid planning
- Recording greenhouse gas emissions for monitoring climate protection obligations

Data Collection and Data Sharing

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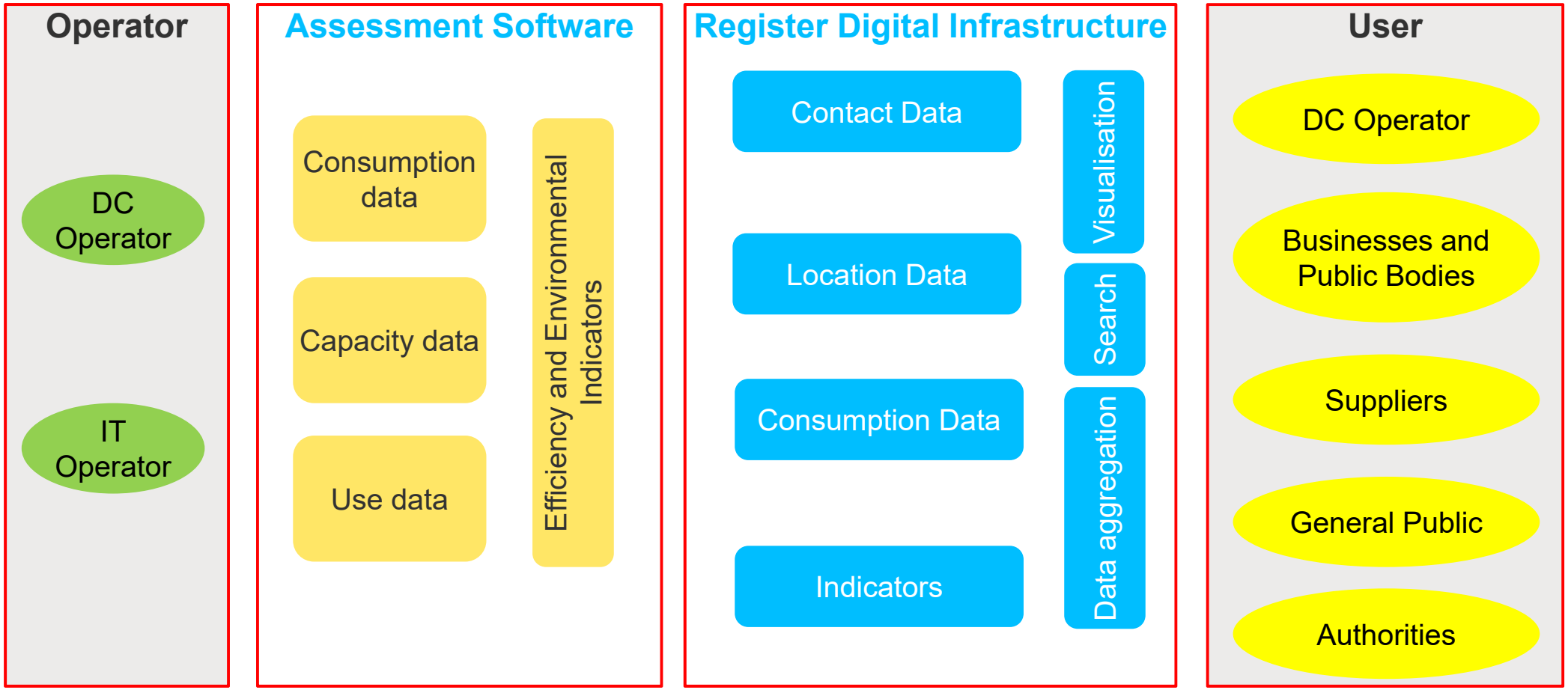

Relevant Data Points from Data Centres

What to include in the Register currently under development

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Data Centre (Basic)

- Identification code
- Designation by Owner
- Name of Owner
- Geographical Position (Country, Postcode, Town, Street, Street Number)
- Building area (gross floor area)
- IT-Area (Whitespace)
- Land Area
- Availability class EN 50600 / ISO 22237
- Contact Data (Name, Phone, Mail, Full Address)

Data Centre (Technical Data)

- Nominal connected loads of the IT and the entire data centre
- Classification of the data centre according to IT connected load (<100kW, <500 kW; < 1MW, < 5MW; <10MW, <50 MW; <100 MW; >= 100 MW)
- Installed electrical power of emergency generators (if any)
- Installed electrical capacity of generators by energy source (if available)
- Installed electrical storage capacity of the uninterruptible power supply (UPS) system
- Information on the refrigerants and refrigerant charge quantities used
- If applicable, further information

Data Centre (Energy)

- Total Energy Consumption of Data Center
- Annual energy consumption of information and communication technology systems
- Annual energy consumption of cooling systems
- Total consumption of fuels and combustibles
- Type and quantity of refrigerant used in the cooling system, as well as the quantities of refrigerant disposed of and refilled during the year
- Total annual amount of heat discharged from the data centre
- Amount of energy recycled
- Total water consumption and water quality
- Electrical work of self-generated electricity by energy source
- Annual Data Traffic

Data Centre (Indicators)

- Power usage Effectiveness (PUE)
- Energy Reuse Factor (ERF)
- Renewable Energy Factor (REF)
- Cooling Efficiency Ratio (CER)
- Water usage effectiveness (WUE)
- Average CPU utilisation ration

Example Visualisation of Register Data

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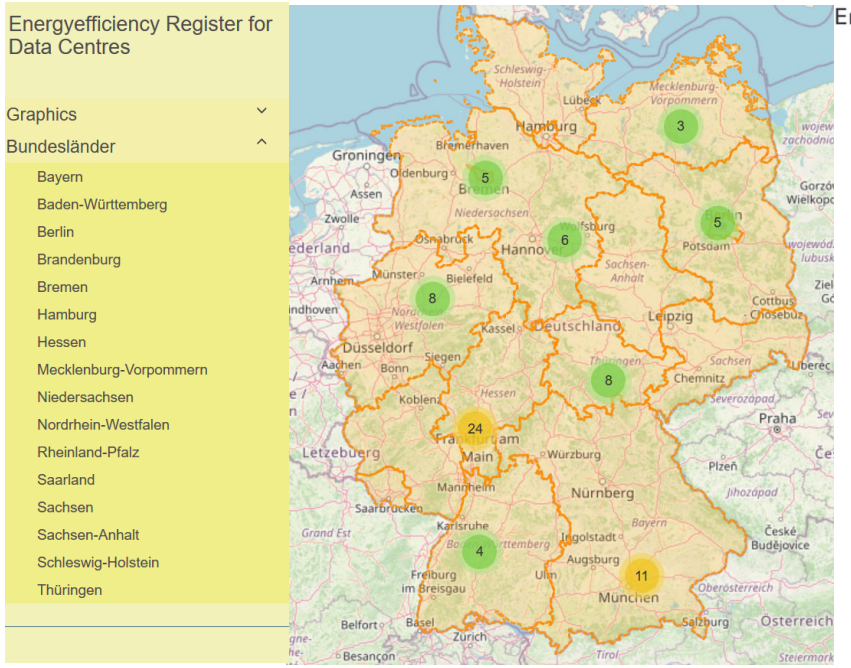
- Limitation of the display area (country, state, postal code areas) by sidebar and 'click' on map
- Representation of the number of data centers in clusters; color as indicator for average PUE
- Tabulated data of consumption values and PUE



Name	Stromverbrauch(kWh)	IT (kWh)	PUE	Detaillierte Infos
	3014407	1773181	1.70	weitere Infos
	3014407	1884004	1.60	weitere Infos

Defining an Energy Efficient Datacentre

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- Generally efficiency is defined as the ratio between use and efforts
- Whereas the efforts are typically clear (electricity to run the datacentre), the use is much harder to define
  - The number of computing operations performed by the servers?
  - The storage space occupied with user data?
  - The data transferred via the external network interface?
  - The cooling provided for the servers?
  - …

- Useful metrics for efficiency are different for different types of data centres and can have a very different level of detail.
- Selected metrics should be able to distinguish between technical aspects and organisational aspects of efficiency
- Organisational improvements are cheaper and quicker to implement but technical improvements provide more stable effects

Analysis Software for Data Center Evaluation and Data Provision to the Data Centre Register

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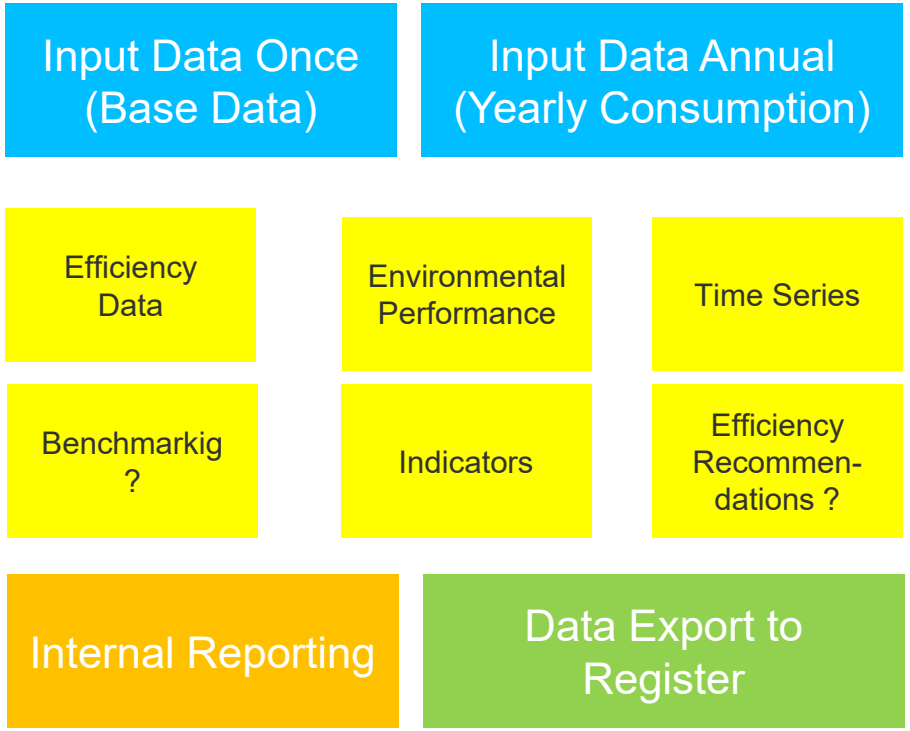
Software Development for the Analysis of the energetical and environmental performance of data centres to

- Easily collect the necessary data
- Support in identifying energy saving opportunities
- Pinpointing to poor operation practices
- Calculate the indicators automatically and in an uniform and comparable way
- Provide an interface for the data export the public energy efficiency register of data centres



Upcomming Reporting Requirements for Energy Statistics

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COMMISSION REGULATION (EU) 2022/132 of 28 January 2022 amending Regulation (EC) No 1099/2008 of the European Parliament and of the Council on **energy statistics**, as regards the implementation of updates for the annual, monthly and short-term monthly energy statistics

- A **new category on Data Centers had been added** to the energy statistics regulation

2.6.3.1.16. Data centres.

A data centre is defined as a structure or a group of structures used to house, connect and operate computer systems/servers and associated equipment for data storage, processing and/or distribution, as well as related activities.

What's in the legislators store for data centers ?

Immediate program §8 Abs.1 KSG for the sector buildings

- Energy Efficiency Act (EnEfG) as an implementation of the revised EU Energy Efficiency Directive (EED) into German law.
- Upcomming requirements for data centers (**data centers > 1 MW_{el} or public data centers > 100 kW_{el}**).
- **Data center and IT infrastructure operators must provide data** on energy consumption and energy efficiency.
- Information will be **made available in a public register**, if necessary blocking of data in case of security requirements.
- **Mandatory EMS or EMS** with certification
- **Minimum requirements** for new data centers
  - Minimum standard PUE < 1.3
  - Waste heat recovery > 30 percent %.

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BMWK/BMWSB 13.07.2022

Sofortprogramm gemäß § 8 Abs. 1 KSG

für den Sektor Gebäude

1. Präambel: Notwendigkeit und Vorschlag für ein Sofortprogramm im Gebäudesektor

Mit dem Inkrafttreten des Bundes-Klimaschutzgesetzes (KSG) hat sich die Bundesregierung einen verbindlichen Rechtsrahmen zur Einhaltung der nationalen Emissionsziele mit jährlich sinkenden Jahresemissionsmengen für die Sektoren Gebäude, Energie, Industrie, Verkehr, Landwirtschaft sowie Abfallwirtschaft gesetzt. Das KSG enthält ein Monitoringsystem zur Erreichung dieser Sektorziele. Auf dieser Grundlage wurde am 15. März 2022 vom Umweltbundesamt (UBA) die Schätzung der Treibhausgasemissionen des Vorjahres veröffentlicht. Demnach weist der Gebäudesektor eine Überschreitung von 2 Mio. t CO_2-Äq gegenüber dem zulässigen Wert von 113 Mio. t CO_2-Äq für 2021 auf. Der Expertenrat für Klimafragen hat in seinem Prüfbericht vom 13. April 2021 dieses Ergebnis bestätigt. Gemäß KSG müssen die für den Gebäudesektor verantwortlichen Ressorts BMWK und BMWSB ein Sofortprogramm vorlegen, das die Einhaltung der Jahresemissionsmengen des Sektors für die folgenden Jahre sicherstellt.

Das sich parallel in der Abstimmung befindende Klimaschutz-Sofortprogramm (KSSP) sollte ursprünglich die Anforderungen eines Sofortprogramms gemäß § 8 Abs. 1 KSG erfüllen. Da der Abstimmungsprozess zum KSSP bis zum 13.07.2022 noch nicht abgeschlossen werden konnte, legen die beiden zuständigen Ressorts ein Sofortprogramm Gebäude nach § 8 Abs. 1 KSG vor, das weitgehend den für das KSSP vorgeschlagenen Gebäudemaßnahmen entspricht.

2. Handlungsbedarf im Gebäudesektor

Es besteht hoher klimapolitischer Handlungsbedarf im Gebäudesektor. Der Gebäudesektor emittierte im Jahr 2020 119 Millionen Tonnen CO_2-Äquivalente. Im Bezugszeitraum 2010 bis 2019 konnten die Emissionen (nicht klimabereinigt) um etwa 18 Prozent gemindert werden. Dennoch hat der Gebäudesektor sowohl 2020 als auch 2021 sein Klimaschutzziel aus dem Bundes-Klimaschutzgesetz verfehlt. 2021 lag der Wert bei 115 Millionen Tonnen CO_2-Äquivalenten (Ziel 113 Millionen Tonnen CO_2-Äquivalente), was rund 15 Prozent der Gesamtemissionen des Jahres ausmacht.

Um das Ziel für 2030 (maximal 67 Millionen Tonnen CO_2-Äquivalente) einhalten zu können, ist eine deutliche Steigerung der Minderungsrate angezeigt. Aufgrund der Wohnflächenzunahme sind bis 2019 die klimabereinigten Endenergieverbräuche von Wohngebäuden gegenüber 2010 um rund zwei Prozent gestiegen. Die aktuelle Lücke zum Klimaziel im Jahr 2030 beträgt laut Projektionsbericht 24 Millionen Tonnen CO_2-Äquivalente, kumuliert von 2022 bis 2030 beträgt die Lücke 152 Millionen Tonnen CO_2-Äquivalente.

Quelle: www.bmwsb.bund.de/SharedDocs/downloads/Webs/BMWSB/DE/veroeffentlichungen/bauen/sofortprogramm-sektor-gebaeude.pdf;jsessionid=8256CCC41FF44E601ACAA9DFD8F1082D.2_cid373?__blob=publicationFile&v=1

Summary

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- Improving the energy efficiency in data centres is an important cornerstone for ensuring the overall benefits of digitalisation
- A good and detailed knowledge of energy efficiency and sustainability of data centres is an obligatory first step for realizing improvements
- Collecting and delivering the necessary data will require relevant efforts but will be worthwhile as for other energy intensive industries
- The results of the PEER-DC project can be used as blue print for a European Register as proposed in the framework of the recast of the Energy Efficiency Directive.

PEER-DC – Be part of it !

- If you are interested to become a first mover and be engaged from the beginning, please write an email to us
- PEER-DC@IER.uni-Stuttgart.de
- We are organizing an online workshop for interested DC operators on September 26, 2022 from 9:00-11:00.
- Please send an email to receive the dial in details.

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www.peer-dc.de
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