TECHNICAL REPORT

ISO/IEC TR 23050

First edition
2019-03

Information technology — Data centres — Impact on data centre resource metrics of electrical energy storage and export

Reference number
ISO/IEC TR 23050:2019(E)

© ISO/IEC 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **iv**

Introduction ..... **v**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions, abbreviated terms and symbols **1**
3.1 Terms and definitions 1
3.2 Abbreviated terms 2
3.3 Symbols 2

4 Objectives **2**
4.1 Energy storage types and dispositioning 2
4.2 Energy flow in data centres 3

5 Determination of Excess Electrical Energy Factor (XEEF) **4**

6 Measurement of Excess Electrical Energy Factor (XEEF) **4**

7 Reporting of Excess Electrical Energy Factor (XEEF) **5**
7.1 Construct for communicating XEEF data 5
7.2 Additional information for public reporting of XEEF 5
7.3 Supporting information for public reporting of XEEF 5
7.4 Trend tracking data 5

Annex A (informative) **Example of energy flow representation in a data centre, showing XEEF in complement with other KPIs (PUE, REF, ERF)** **7**

Bibliography **9**

© ISO/IEC 2019 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see http://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability for and by Information Technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© ISO/IEC 2019 – All rights reserved

Introduction

The global economy is now reliant on information and communication technologies and the associated generation, transmission, dissemination, computation and storage of digital data. All markets have experienced exponential growth in that data, for social, educational and business sectors and, while the internet backbone carries the traffic, there are a wide variety of data centres at nodes and hubs within both private enterprise and shared/collocation facilities.

The historical data generation growth rate exceeds the capacity growth rate of the information and communications technology hardware and, with less than half (in 2014) of the world's population having access to an internet connection, that growth in data can only accelerate. In addition, with many governments having digital agendas to provide both citizens and businesses with ever-faster broadband access, the very increase in network speed and capacity will, by itself, generate ever more usage (Jevons Paradox). Data generation and the consequential increase in data manipulation and storage are directly linked to increasing power consumption.

With this background, it is clear that data centre growth, and power consumption in particular, is an inevitable consequence and that growth will demand increasing power consumption despite the most stringent energy efficiency strategies. This makes the need for key performance indicators (KPIs) that cover the effective use of resources (including but not limited to energy) and the reduction of CO_2 emissions essential.

Within the ISO/IEC 30134 series, the term resource usage effectiveness is more generally used for KPIs in preference to resource usage efficiency, which is restricted to situations where the input and output parameters used to define the KPI have the same units.

This document describes the treatment of data centre metrics in circumstances where electrical energy is stored and exported from within the data centres boundaries of other standards in the ISO/IEC 30134 series.

Additionally, this document will provide Excess Electrical Energy Factor (XEEF) as a metric to indicate the weight of this mechanism within the data centre energy balance.

This document deals with the storage and export of electrical energy, whatever form of storage is used; it could eventually serve as a model to handle a similar process of storage and export of non-electrical energy, such as chilled water thermal energy.

In order to determine the overall resource efficiency of a data centre, a holistic suite of metrics is required. This document complements the series of KPIs conforming to ISO/IEC 30134-1, which defines common requirements for a holistic suite of KPIs for data centre resource efficiency. This document does not specify limits or targets for the KPI and does not describe or imply, unless specifically stated, any form of aggregation of this KPI into a combination with other KPIs for data centre resource efficiency.

© ISO/IEC 2019 – All rights reserved

Information technology — Data centres — Impact on data centre resource metrics of electrical energy storage and export

1 Scope

This document describes the treatment of data centre metrics in circumstances where electrical energy is stored and exported from within the data centre boundaries of other standards in the ISO/IEC 30134 series.

This document specifies the Excess Electrical Energy Factor (XEEF) as a Key Performance Indicator (KPI) to quantify the electrical energy provided back from data centre to the utility.

This document has the structure common to the standards of the ISO/IEC 30134 series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 30134-1, *Information technology — Data centres — Key Performance Indicators — Part 1: Overview and general requirements for KPIs*

ISO/IEC 30134-2, *Information technology — Data centres — Key Performance Indicators — Part 2: Power Usage Effectiveness (PUE)*

ISO/IEC 30134-3, *Information technology — Data centres — Key Performance Indicators — Part 3: Renewable Energy Factor (REF)*

ISO/IEC 30134-6[1)], *Information technology — Data centres — Key Performance Indicators — Part 6: Energy Reuse Factor (ERF)*

3 Terms, definitions, abbreviated terms and symbols

For the purposes of this document, the terms and definitions given in ISO/IEC 30134-1, ISO/IEC 30134-2, ISO/IEC 30134-3, ISO/IEC 30134-6 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Terms and definitions

3.1.1
storage energy
energy stored by any means in order to be recovered later

1) To be published. Current stage:40.60.

© ISO/IEC 2019 – All rights reserved

3.1.2
data centre excess energy
energy stored in the data centre, from whatever source(s) it comes, and exported from the data centre in the form of electrical energy

3.1.3
data centre gross energy input
energy provided to the data centre from all types of sources, consumed by the data centre as E_{DC}, or exported from the data centre in the form of electrical energy

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC 30134-1, ISO/IEC 30134-2, ISO/IEC 30134-3, ISO/IEC 30134-6 and the following apply.

XEEF Excess Electrical Energy Factor

3.3 Symbols

For the purposes of this document, the symbols given in ISO/IEC 30134-1, ISO/IEC 30134-2, ISO/IEC 30134-3, ISO/IEC 30134-6 and the following apply.

E_{Excess} data centre excess energy (annual) in kWh

E_{IN} data centre gross energy input (annual) in kWh

4 Objectives

4.1 Energy storage types and dispositioning

Data centre practitioners can find it valuable to store electrical energy within their premises, especially when it is easily available from their local generation, from utilities or other electrical grids outside the data centre. The stored energy can either be used within the data centre when energy is less available or more expensive to obtain or exported to an electrical grid outside the data centre, public or not, when the energy stored exceeds the needs of the data centre.

A large variety of technologies are used to store electrical energy in data centres: thermal energy, in the form of heat or cold, mechanical energy, electrical energy. The recovered energy could be provided in a different form, very often thermal or electrical.

When recovered energy is used within the data centre, whatever form it takes, it is taken into account within the calculation of PUE (specified in ISO/IEC 30134-2).

When recovered energy is exported from the data centre in the form of electrical energy to an electrical grid, be it public or not, this excess electrical energy is represented by XEEF.

NOTE When using energy, data centres create energy losses that could be captured and reused; when this captured energy is reused within the data centre, it is taken into account within the PUE calculation; when this captured energy is reused outside the data centre, it is represented through ERF.

Many data centre KPIs in the ISO/IEC 31034 series (including PUE, REF and ERF) are calculated using the energy consumed by the data centre (E_{DC}).

© ISO/IEC 2019 – All rights reserved