



Netherlands Enterprise Agency

Power management guide for data centers

Commissioned by the ministry of Economic Affairs and Climate Policy

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“POWER MANAGEMENT GUIDE FOR DATA CENTERS”

In support of the sector-wide initiative to promote balanced power management in servers

By D. H. Harryvan, Certios B.V.

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This guide to power management for data centers is primarily intended for colocation centers, but can be used for all data centers that are working on the introduction of measure FD1, Server Power Management, from the recognized list of measures (EML) for commercial data centers. The document should be read in conjunction with the model energy efficiency declaration (EEV) attached to this document as appendix 1.

The guide and model EEV have been developed in collaboration with Netherlands Enterprise Agency (RVO), NLdigital, the Dutch Datacenter Association and Certios, and builds on the results of track 1 of the Lower Energy Acceleration Program (LEAP) of the Amsterdam Economic Board. The report "analysis LEAP track 1 Power management" has been published on the RVO website "energy saving datacenters" and describes the results of a field test of server power management at both large and small companies. The report demonstrates once again that balanced power management in servers leads to significant energy savings without any noticeable performance loss compared to the often used "high performance" setting. The report confirms the correctness of measure FD1 in the EML.

In order to support a broad acceptance and implementation of the power management measure, the sector organizations have started an initiative and asked their members to start implementation with immediate effect. The initiative is supported by RVO with procedural documentation, such as this guide and the model EEV in addition to technical documentation, such as the previously mentioned LEAP report and the document "happy flow manual" that is also published on the RVO website "energy saving data centers"¹

¹ <https://www.rvo.nl/file/happy-flow-manual-engels>

Considerations:

1. On 1 January 2008, the Activities Decree for Environmental Management² (hereinafter the 'Activities Decree') came into force. The obligation to take energy-saving measures with a payback period of five years or less falls under the rules of the Activities Decree from 1 January 2008³. Data centers subject to a permit requirement may also be subject to such an obligation based on the regulations in the permit. After the Environment Act enters into force, the power management measure (FD1) will fall under the Environment Activities Decree.
2. In 2019, server power management is included in the recognized measures list for energy saving (EML) of annex 10 belonging to art. 2.16 of the Activities Decree. This list includes all measures with a payback period of five years or less. The government ensures that new insights and developments in energy-saving techniques are incorporated into this list. An updated list is foreseen under the Environment Act in 2023.
3. The trade organizations for data centers, NLdigital and the Dutch Data Center Association (DDA) recognize the need to take energy-saving measures, a large number of which the industry has implemented very successfully in recent years. NLdigital and DDA are industry associations and support the sector-wide initiative as such. With their support, they do not commit data centers that are affiliated with one of the sector associations.
4. The sector organizations see added value in providing implementation guidelines described in this guide on power management for the application of measure FD1, power management, from the EML for commercial data centers. By establishing implementation guidelines, a uniform working method is propagated that supports the implementation of this initiative.
5. The approach for the phased implementation of power management as laid down in this guide fits within the objectives of the climate agreement. By participating in the initiative, the company agrees to take steps to implement measure FD1 as mentioned in the EML. The company also demonstrates the ambition to make a substantial contribution to energy savings for its own servers and those of customers housed in its data centers in the Netherlands. This guide describes a phased approach for the specific measure FD1, "power management". Participation in this initiative does not affect current or future obligations under the Activities Decree, the Environmental Management Act, the 'Wabo' or the Environment Act.

² <https://wetten.overheid.nl/BWBR0022762/2021-07-01>

³ Activities Decree artikel 2.15

Article 1 Definitions

For the purposes of this declaration, the following terms are further defined:

EEV: For readability purposes, the energy efficiency declaration is referred to in this document as "EEV".

Power management in servers: Power management is a collection of techniques that can influence the electrical power demand of ICT equipment and/or components. The techniques are used in servers to adjust the energy consumption to the workload of the server in question.

Measure FD1 of the EML: Power management is included as a recognized energy-saving measure (FD1) in Annex 10 of the Activities Decree of the Environmental Management Act:

Activity;	Operating a server room.
Number of the measure;	FD1
Description of the measure;	Matching deployment of servers in server room to demand.
Possible techniques compared to baseline;	Apply Power management to servers.
Baseline situation based on a reference technique;	The CPU (central processing unit) runs continuously at maximum speed.
Technical preconditions;	Not applicable.
Economic preconditions;	The server room has an installed power of at least 5 kW.
Applicable at an independent or natural time?	Independent moment: Yes, Natural moment: Yes.
Special circumstances;	Not applicable.

Intended setting PM: Power management (PM) in servers depends on the settings on the servers. These settings are at the firmware (BIOS) and Operation System (OS) level. The intended setting realizes the automatic application of ACPI-C and ACPI-P states for the full range, depending on the workload on the server. The settings have different names, depending on the vendor, and can be adjusted in two locations:

- For hardware controlled power management the BIOS setting should be "balanced".
- For OS controlled power management the BIOS setting should be "OS-controlled" and the OS setting "balanced".

"high performance" exception: In situations where sporadic delays of 10 microseconds or less result in noticeable delays, "high performance" settings may be desirable.

Energy-saving measure: All known energy-saving measures within the meaning of the Environmental Management Act that have a payback period of five years or less. These are in any case the measures included in the most recent recognized measures list (EML) as published in the 'Staatscourant'.

Data center: The location of the company which, in the context of environmental legislation, is a facility or facilities within the meaning of the Environmental Management Act or in the regime under the Environment Act, has been designated as an environmentally taxing activity.

Customer: Customer of the data center means a company and/or person who has a contractual relationship with the data center for placement of ICT equipment within the data center.

Article 2 Power management own servers

There are two groups of servers in the context of server power management, namely;

- Physical servers under management of the data center, to be called "own servers".
- Physical servers under management of customers of the data center

Regarding the servers under management of the data center;

The Company implements balanced power management on its server equipment in the Netherlands by:

- a) Configuring new servers with the balanced power management settings by default.
- b) making an inventory of the existing physical server park and the current power management settings
- c) adapting the power management settings where possible in the shortest possible time and making a detailed plan for adapting the power management settings on the remaining servers.
- d) For those servers where balanced power management is not set, a justification for the exception will be documented.

The above actions will be documented.

Article 3 Power management customer servers

Regarding the servers under management of customers of the data center; The company makes an effort to implement balanced power management with its customers by having its customers sign a so-called "energy efficiency declaration" (EEV), this statement includes at least that;

- a) New servers will be equipped with the balanced power management settings by default.
- b) Within 3 months after signing the energy efficiency declaration there will be an inventory of the existing physical server park of the customer within the data center, including the current power management settings.
- c) Within 6 months after completion of the inventory the power management settings are adjusted where possible and there is a detailed plan to adjust power management settings on the remaining servers.
- d) For those servers on which balanced power management is not implemented a justification for the exception will be documented.

The above actions will be documented by the customer.

As an alternative to a separate EEV, the provisions of the EEV can be included in the contract between the data center and the customer, for new and/or existing customers.

The company's effort commitment towards obtaining an EEV consists of at least the following communications:

General Letter

In this letter, the customers should be informed and made aware of the technical and social desirability of measure FD1 and the way in which it is implemented with the sector initiative. In this context, attention should be drawn to the legal obligation for the data center to take the measure. It is also indicated that failure to take this measure may under certain circumstances lead to administrative penalties on the part of the customer.

In addition, it is expressly requested to endorse the Energy Efficiency Declaration (EEV) and to take measure FD1. It is recommended that this letter is brought to the customer's attention.

Letter addressed to customer

If the general letter does not lead to the desired result, signing the EEV and by extension taking the action, then the second step for the data center is to contact the customer directly.⁴ The aim is to create urgency through direct contact. It is advisable that taking the measure is as approachable as possible (possibly offering guidance) and that the positive effects of the measure are mentioned, with reference to the report "analysis LEAP track 1 Powermanagement" on the RVO website "energy saving data centers".

⁴ This letter must adequately demonstrate that it is a direct letter (e.g. by using customer data).

Telephone or face-to-face contact with the customer

If direct mail contact does not result in the signing of the EEV and the taking of the measure, then the data center should make direct verbal contact with the customer (e.g., by phone, through Teams, or face-to-face). This should specifically identify why the measure is not being taken. To the extent possible, the data center should address these concerns so that the customer still proceeds to take the measure.

The above actions will be documented by the data center.

Article 4 **Quality criteria**

The company and the industry associations are making a concerted effort to achieve uniform policies for the approach to power management at data centers - defined in this initiative. Part of this effort is the establishment of quality criteria for the initiative.

The starting point is that the power management settings can only be verified by visual or automated checks of these settings on the server. For this reason it was decided to focus the quality criteria on the administration of the steps mentioned in article 2.

Administration at the company includes;

- a. The inventory of the own server park and the power management settings
- b. If not yet implemented, the plan for adjustment of the power management settings
- c. The administration of all EEVs signed by customers
- d. Insight into the degree of coverage by signed EEVs, in units that are to be defined and as far as possible.
- e. In accordance with Article 3; copies of communication between the company and the customer who does not want to sign EEV.

Administration at the client's side includes

- a. The signed EEV
- b. The inventory of the companies servers and power management settings
- c. If not yet implemented, the plan for adjustment of the power management settings

Appendix 1

Model Energy Efficiency Declaration (EEV)

Also known as Energie Efficiëntie Verklaring

By D. H. Harryvan, Certios B.V.

Commissioned by RVO Reference: P015621012

Version 1.0 Date: 23-03-2022

Considerations:

1. On January 1, 2008, the Activities Decree for Environmental Management (hereinafter referred to as the Activities Decree) came into effect. The obligation to take energy-saving measures with a payback period of five years or less falls under the rules of the Activities Decree starting January 1, 2008. Data centers subject to a permit requirement may also be subject to such an obligation based on the regulations in the permit. After the Environment Act (Omgevingswet) enters into force, the power management measure (FD1) will fall under the Environment Activities Decree (Besluit activiteiten leefomgeving).
2. In 2019, server power management is included in the recognized measures list for energy saving (EML) of annex 10 belonging to art. 2.16 of the Activities Regulation. This list includes all measures that pay for themselves in five years or less. The government ensures that new insights and developments in energy-saving techniques are incorporated into this list. An updated list is foreseen under the Environment Act in 2023.
3. By signing this document, <the customer> agrees to take steps to comply with measure FD1 as mentioned in the recognized measures list (EML). Signing this document does not affect any current or future obligations under the Activities Decree, the Environmental Management Act, the 'Wabo' or the Environment Act.

Article 1 Definitions

For the purposes of this declaration, the following terms are further defined:

EEV: For readability purposes, the energy efficiency declaration is referred to in this document as "EEV".

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Possible techniques compared to baseline;	Apply Power management to servers.
Baseline situation based on a reference technique;	The CPU (central processing unit) runs continuously at maximum speed.
Technical preconditions;	Not applicable.
Economic preconditions;	The server room has an installed power of at least 5 kW.
Applicable at an independent or natural time?	Independent moment: Yes, Natural moment: Yes.
Special circumstances;	Not applicable.

Intended setting PM:	<p>Power management (PM) in servers depends on the settings on the servers. These settings are at the firmware (BIOS) and Operation System (OS) level. The intended setting realizes the automatic application of ACPI-C and ACPI-P states for the full range, depending on the workload on the server. The settings have different names, depending on the vendor, and can be adjusted in two locations:</p> <ul style="list-style-type: none"> ○ For hardware controlled power management the BIOS setting should be “balanced”. ○ For OS controlled power management the BIOS setting should be “OS-controlled” and the OS setting “balanced”.
"high performance" exception:	In situations where sporadic delays of 10 microseconds or less result in noticeable delays, "high performance" settings may be desirable.
Energy-saving measure:	All known energy-saving measures within the meaning of the Environmental Management Act that have a payback period of five years or less. These are in any case the measures included in the most recent recognized measures list (EML) as published in the ‘Staatscourant’.
Data center:	The location of the company which, in the context of environmental legislation, is a facility within the meaning of the Environmental Management Act or in the regime under the Environment Act, has been designated as an environmentally harmful activity.
Customer:	Customer of the data center means a company and/or person who has a contractual relationship with the data center for the
placement	of ICT equipment within the data center.

Article 2 Declaration

Parties:

1. The data center <data center>
2. The customer <customer name>

Agree as follows:

<customer> deals responsibly with the capacity in energy it has contracted with the data center and makes an effort to avoid unnecessary use of electricity, by making good use of the technological (hardware/firmware and software) options to reduce power consumption.

<customer> is informed about the legal energy saving obligation and takes the energy saving measures with a payback period of 5 years or less, if applicable to the user.

- For this purpose, note is taken of the most recent recognized measures list , which has been published within the framework of the Activities Decree of the Environmental Management Act.

In particular

1. <customer> implements the balanced power management measure on its server equipment present in the branch of the data center for which this EEV has been drawn up by :
 - a. New servers will be equipped with the balanced power management settings by default.
 - b. Within 3 months after signing the EEV, to do an inventory of the existing physical server park and the current power management settings.
 - c. Within 6 months after completion of the inventory, the power management settings have been adjusted where possible and there is a detailed plan for adjusting power management settings on the remaining servers.
 - d. For those servers where balanced power management is not set, a justification for the exception is documented.

The above actions will be documented by <the customer>.

<Datacenter> will administer the rejection/approval of this Energy Efficiency Statement, under the existing confidentiality obligations.

Thus agreed

On <date>

At <place>

<data center>

<client>

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Netherlands Enterprise Agency
Prinses Beatrixlaan 2
PO Box 93144 | 2509 AC The Hague
T +31 (0) 88 042 42 42
[Contact us](#)
www.rvo.nl

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