Additional Information1：
Validity of PUE as indicator for Energy efficiency

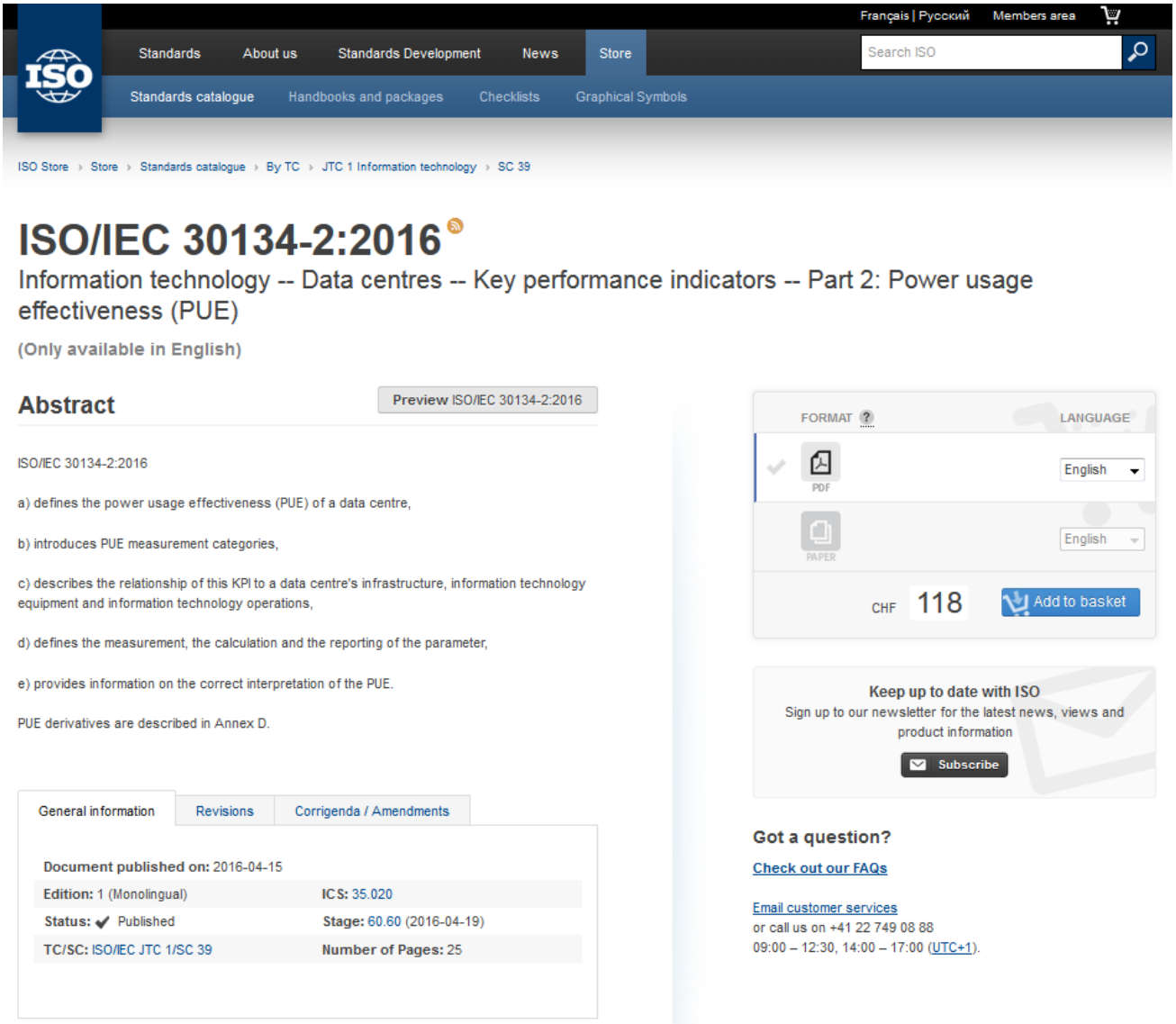
DPPE (Data center Performance Per Energy) is the index for energy efficiency of data center and consists of the four sub- indices shown in the following table.
DPPE has been developed by Green IT Promotion Council, which is a part of JEITA (Japan Electronics and Information Technology Industries Association). JEITA has been promoting standardization of DPPE in ISO.
Since facilities for data center, air conditionings and power supply equipment, will realize saving energy in this project, PUE which represents the facility energy efficiency should be selected from the four sub- indices shown in the following table.

Sub-metrics description	Equation	Corresponding action
ITEU（IT Equipment Utilization）	= Total energy consumption of IT equipment (actual) /Total rated energy consumption of IT equipment (rated)	Efficient operation of IT equipment: Approaches to improve utilization ratio through consolidation and virtualization and by reducing the number of equipment in operation.
ITEE（IT Equipment Energy Efficiency）	= Total rated capacity of IT equipment (rated) /Total rated power of IT equipment (rated)	Approaches to introduce IT equipment with higher energy saving performance.
PUE（Power Usage Effectiveness）	= Total energy consumption of data center (actual) /Total energy consumption of IT equipment (actual)	Approaches to reduce energy consumption caused by **facilities** such as efficiency improvement for **air conditioning system** and **power transformer system** as well as the programs to use natural environment effectively
GEC（Green Energy Coefficient）	= Energy level generated by green energies (natural energies such as photovoltaic power / wind power) (actual) /Total energy consumption of data center (actual)	Approaches to install and use equipment to generate green energies such as photovoltaic power, wind power and hydraulic power etc.

GEC was renamed as REF(Renewable Energy Factor) in ISO.
Source：http://home.jeita.or.jp/greenit-pc/topics/release/pdf/dppe_e_20120824.pdf

【Reference: Status of PUE standardization in ISO】

As of 15 April 2016, International Standard (ISO/IEC 30134-2:2016) for PUE has been published as follows:



Source: http://www.iso.org/iso/catalogue_detail.htm?csnumber=63451

International harmonized stage codes

STAGE	SUBSTAGE						
				90 Decision			
	00 Registration	20 Start of main action	60 Completion of main action	92 Repeat an earlier phase	93 Repeat current phase	98 Abandon	99 Proceed
00 Preliminary stage	00.00 Proposal for new project received	00.20 Proposal for new project under review	00.60 Close of review			00.98 Proposal for new project abandoned	00.99 Approval to ballot proposal for new project
10 Proposal stage	10.00 Proposal for new project registered	10.20 New project ballot initiated	10.60 Close of voting	10.92 Proposal returned to submitter for further definition		10.98 New project rejected	10.99 Approval to New project approved
20 Preparatory stage	20.00 New project registered in TC/SC work programme	20.20 Working draft (WD) study initiated	20.60 Close of comment period			20.98 Project deleted	20.99 WD approved for registration as CD
30 Committee stage	30.00 Committee draft (CD) registered	30.20 CD study/ballot initiated	30.60 Close of voting/ comment period	30.92 CD referred back to Working Group		30.98 Project deleted	30.99 CD approved for registration as DIS
40 Enquiry stage	40.00 DIS registered	40.20 DIS ballot initiated: 12 weeks	40.60 Close of voting	40.92 Full report circulated: DIS referred back to TC or SC	40.93 Full report circulated: decision for new DIS ballot	40.98 Project deleted	40.99 Full report circulated: DIS approved for registration as FDIS
50 Approval stage	50.00 Final text received or FDIS registered for formal approval	50.20 Proof sent to secretariat or FDIS ballot initiated: 8 weeks	50.60 Close of voting. Proof returned by secretariat	50.92 FDIS or proof referred back to TC or SC		50.98 Project deleted	50.99 FDIS or proof approved for publication
60 Publication stage	60.00 International Standard under publication		60.60 International Standard published				
90 Review stage		90.20 International Standard under periodical review	90.60 Close of review	90.92 International Standard to be revised	90.93 International Standard confirmed		90.99 Withdrawal of International Standard proposed by TC or SC
95 Withdrawal stage		95.20 Withdrawal ballot initiated	95.60 Close of voting	95.92 Decision not to withdraw International Standard			95.99 Withdrawal of International Standard

Additional Information 2:
Validity of "reference PUE value=2.0"

Selection of measured original PUE value

Since there is no data center and measured PUE values in Lao, the measured PUE values in other countries are adapted. The following table shows the PUE surveillance reports which were conducted in various area. Since Singapore and Lao PDR are relatively similar in climate, we decided to select the measured PUE value =2.07 in Singapore National Environmental Agency's report as the original PUE and adjust conservatively it as the reference PUE.

Upon an analysis based on adjustment taking into account the difference in temperature condition between Lao PDR and Singapore, equivalent PUE value for Lao PDR is estimated as 2.003. The details of the analysis are as shown in the following section. For the sake of the conservativeness, it is concluded that the reference PUE value of this methodology is 2.0.

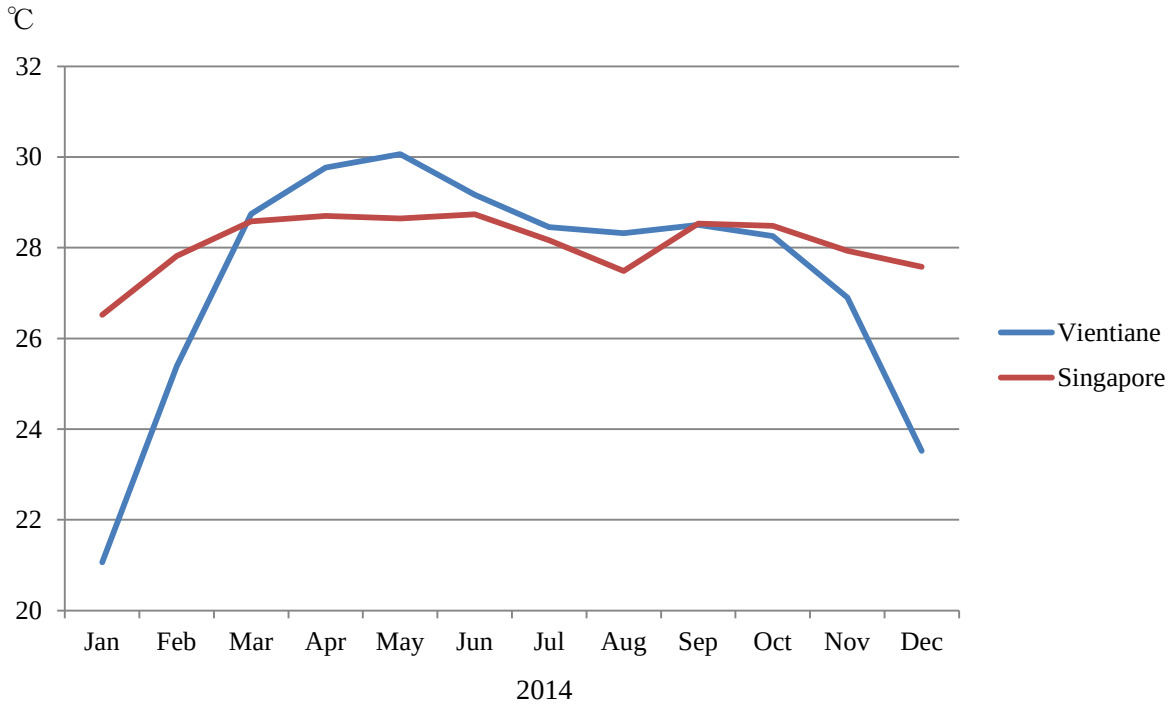
Report Name	Surveillance Period	Owner	Number of data center	Annual average PUE	Region	adjusted PUE ∗
Data Centre Energy Efficiency Benchmarking	June 2010-September 2012	Singapore NEA (National Environmental Agency)	23	2.07	Singapore	2.003
Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431	April 2007	The United States EPA(Environmental Protection Agency)	22	2.0	North America	2.45
N. America Campos Survey Results	January 2013	Campos(Private research farm)	300	2.9		
FY2010 Green IT Promotion Council Investigation and analysis committee Report(Only Japanese)	June 2010 – January 2011	Green IT Promotion Council(a part of JEITA:Japan Electronics and Information Technology Industries Association)	25	1.77～1.93(not annual average.)	Japan	2.003
FY2014 The Project of supporting energy efficient cloud utilization by small and medium enterprises(Only Japanese)	April 2014-March 2015	Japan Ministry of Economic, Trade and Industry	103	1.91		

∗ Adjusted PUE value is conservatively calculated based on difference of climate conditions between Laos and areas where the original PUE values were measured.

[Supplementary Information] Analysis on the PUE value based on adjustment

Since the monthly average temperature from March to October in Singapore and Vientiane is equivalent, it is appropriate to use same PUE value = 2.07 in Singapore as PUE value in Vientiane. However, there are the following differences from November to February and it is cooler in Vientiane than Singapore. It is necessary to adjust the average PUE2.07 in Singapore.

	Vientiane	Singapore	difference
Nov	26.9	27.9	1.0
Dec	23.5	27.6	4.1
Jan	21.1	26.5	5.4
Feb	25.4	27.8	2.4



Based on Green IT Promotion Council Investigation which was conducted in 2010, PUE is increasing when the average outside temperature rises and the difference of PUE in the case of 20 degrees and 30 degrees is the maximum 0.2.

Since March to October temperature in Vientiane exceeds in Singapore, the adjusted PUE value should be higher (worse) value. We took equivalent PUE value =2.07 in this period from the conservative point of view.

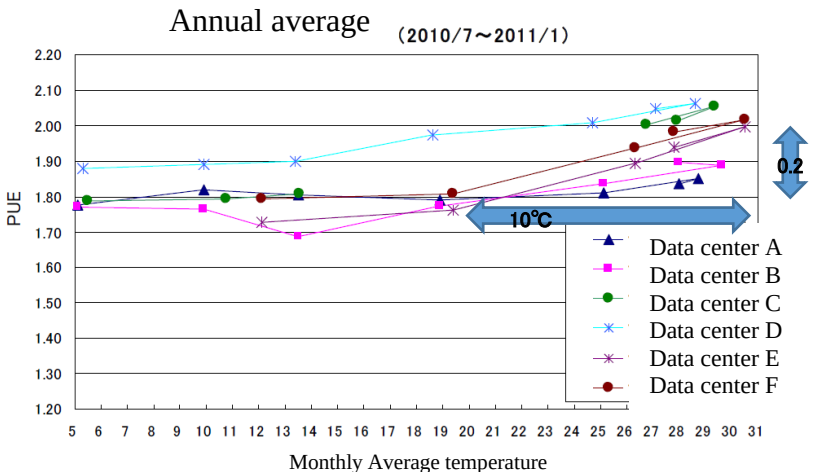
On the other hand, November to February temperature in Vientiane falls below in Singapore, the adjusted PUE value should be lower (better) value. We conservatively adjusted the original PUE value=2.07 assuming that there is difference 10℃, which greatly exceeds the difference between the actual average temperature.

The adjusted annual PUE in Vientiane is 2.003 as the following formula.

(2.07×8monthes +1.87×4 months)÷12months=2.003

We concluded that the reference PUE value is 2.0 which is lower (worse) than the adjusted PUE value=2.003 form the conservative point of view.

For reference, the adjusted PUE value of the other measured PUE in North America and Japan is also higher (worse) than 2.0.



Monthly Average temperature and PUE value per Data center

Source: FY2010 Green IT Promotion Council Investigation and analysis committee Report(Only Japanese) P119

Source of Reference Report

Name of Report	URL
Data Centre Energy Efficiency Benchmarking	http://www.e2singapore.gov.sg/DATA/0/docs/Resources/NEA%20DC%20Energy%20Benchmarking%20Summary-%20Final%20Report%20(3).pdf
Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431	https://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Congress_Final1.pdf
N. America Campos Survey Results	https://www.digitalrealty.com/information-library/
FY2010 Green IT Promotion Council Investigation and analysis committee Report(Only Japanese)	http://home.jeita.or.jp/greenit-pc/activity/reporting/110628/pdf/survey04.pdf
FY2014 The Project of supporting energy efficient cloud utilization by small and medium enterprises(Only Japanese)	http://www.meti.go.jp/policy/it_policy/green-cloud/report_.pdf

Additional Information 3: Airtightness indicator

We selected the IP code as airtightness indicator. The IP Code, International Protection Marking, IEC standard 60529 classifies and rates the degree of protection provided against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures. It is published by the International Electrotechnical Commission (IEC).

The IP code consists of 4word including IP as following.

IPxx

The first and the second digit indicate the level of protection. The methodology requests IP54 and better .

[Solid particle protection]
The first digit indicates the level of protection that the enclosure provides against access to hazardous parts (e.g., electrical conductors, moving parts) and the ingress of solid foreign objects

level	Object size protected against	Effective against
0	—	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, slender screws, ants etc.
5	Dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment.
6	Dust tight	No ingress of dust; complete protection against contact (dust tight)

[Liquid ingress protection]

The second digit indicates the level of protection that the enclosure provides against harmful ingress of water

level	Protected against	Effective against	Details
0	Not protected	—	—
1	Dripping water	Dripping water (vertically falling drops) shall have no harmful effect.	Test duration: 10 minutes Water equivalent to 1 mm rainfall per minute
2	Dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.	Test duration: 10 minutes Water equivalent to 3 mm rainfall per minute
3	Spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.	Test duration: 5 minutes Water volume: 0.7 litres per minute Pressure: 50–150 kPa

4	Splashing of water	Water splashing against the enclosure from any direction shall have no harmful effect.	Test duration: 5 minutes Water volume: 10 litres per minute Pressure: 50–150 kPa
5	Water jets	Water projected by a nozzle (6.3 mm) against enclosure from any direction shall have no harmful effects.	Test duration: at least 3 minutes Water volume: 12.5 litres per minute Pressure: 30 kPa at distance of 3 m
6	Powerful water jets	Water projected in powerful jets (12.5 mm nozzle) against the enclosure from any direction shall have no harmful effects.	Test duration: at least 3 minutes Water volume: 100 litres per minute Pressure: 100 kPa at distance of 3 m
6K	Powerful water jets with increased pressure	Water projected in powerful jets (6.3 mm nozzle) against the enclosure from any direction, under elevated pressure, shall have no harmful effects.	Test duration: at least 3 minutes Water volume: 75 litres per minute Pressure: 1000 kPa at distance of 3 m
7	Immersion up to 1 m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).	Test duration: 30 minutes Tested with the lowest point of the enclosure 1000 mm below the surface of the water, or the highest point 150 mm below the surface, whichever is deeper.
8	Immersion beyond 1 m	The equipment is suitable for continuous immersion in water under conditions which shall be specified by the manufacturer. However, with certain types of equipment, it can mean that water can enter but only in such a manner that it produces no harmful effects.	Test duration: continuous immersion in water Depth specified by manufacturer, generally up to 3 m
9K	Powerful high temperature water jets	Protected against close-range high pressure, high temperature spray downs.	Test duration: - Water volume: 14–16 litres per minute Pressure: [8000–10000 kPa / 80–100 Bar] at distance of 0.1–0.15 m Water temperature: 80 °C