Ministry of Transport and Communications

Finnish sustainability rating system for data centers

User manual, v0.4 for New Constructions

Publications 21/2014

Ministry of Transport and Communications

Vision
Well-being and competitiveness through high-quality transport and communications networks

Mission
The Finnish Ministry of Transport and Communications seeks to promote the well-being of our people and the competitiveness of our businesses. Our mission is to ensure that people have access to well-functioning, safe and reasonably priced transport and communications networks.

Values
Courage, equity, cooperation

Ministry of Transport and Communications

Date
1 September 2014

Title of publication
TIKO - Sustainability rating system for data centers.
User manual, v0.4 for New Constructions

Author(s)
Haverinen Noora, Hyyppä Petri, Känkänen Riina

Commissioned by, date

Publication series and number

Publications of the Ministry of Transport and Communications 21/2014

ISSN (online) 1795-4045
ISBN (online) 978-952-243-408-1
URN http://urn.fi/URN:ISBN:978-952-243-408-1
Reference number

Keywords
datacenter, sustainability, rating, metrics, energy, waste heat, efficiency

Contact person

Language of the report
English

Other information

Abstract
The TIKO sustainability rating system is a weighted credit based system which acts as a systematic tool for the management and assessment of sustainability in datacenters. The TIKO is a tool for designing, building, equipping, operating and managing datacenters in an environmentally, socially and financially sustainable way.
The TIKO-rating covers the data center as an entirety, assessing the building, the IT and the operations as a whole acting as a check-list of sustainability issues that should be taken into consideration. TIKO guides and assesses in seven sustainability categories: leadership, operational management, energy, sustainable site, water, waste and pollution, procurement. Additional points are awarded for sustainable innovations. The intent of the TIKO-rating system is to select the most important aspects concerning datacenters in the Nordic and Finnish environment. The credit values reflect the importance of the factor in overall sustainability of a dc and in relation to other points.
This user manual is intended for datacenter new construction projects. TIKO is further separated into two other schemes: TIKO for existing data center sustainable performance development – for developing an existing DC's sustainability and TIKO Guide for purchasing sustainable data center services – for comparing DC service provides via the TIKO criteria.

Forewords

Data centers are used to house computer systems and associated components, such as servers, telecommunications and storage systems in a controlled, managed environment tailored for today's high computational and storage needs. The demand for internet-based products and services rises constantly, thus creating increasing demand for data centers and associated services. It has been estimated that between 2014 and 2024 the number of data centers and the total square footage of datacenters will more than double.

Increase in demand means that the environmental, social and economic impacts of data centers will become increasingly massive requiring the industry to take sustainable development into consideration.

The Finnish sustainability rating system (TIKO) is a weighted credit based system, which aim is to promote the sustainability of individual data centers and through this development, the industry as a whole. It is a systematic tool for designing, building, equipping, operating and managing datacenters in an environmentally, socially and economic sustainable way. The rating system acts as a check-list of sustainability issues that should be taken into consideration.

TIKO guides and assesses in seven categories: leadership, operational management, energy, sustainable site, water, waste and pollution, procurement. Additional points are awarded for sustainable innovations. It selects the most important aspects concerning datacenters in the Nordic and Finnish environment. The credit values reflect the importance of the factor in overall sustainability of a dc and in relation to other points.

This user manual is intended for datacenter new construction projects. TIKO is further separated into two other schemes: TIKO for existing data center sustainable performance development and TIKO Guide for purchasing sustainable data center services – for comparing DC service provides via the TIKO criteria.

The TIKO sustainability rating system for datacenters was funded by the Ministry of Transport and Communication as a part of the Kide-program's green ICT theme. Ramboll Finland Oy and Proceed Consulting Oy have coordinated and executed the TIKO rating formation, on behalf of the Ministry of Transport and Communications. During the course of the project, three workshops have been held to receive feedback from DC service providers, owners, clients and other stakeholders. Furthermore, special experts from the fields of sustainability, DC-operations, IT-technologies and construction have been used for commenting the work.

The intent is to implement the produced sustainability rating system on pilot projects in 2014 and continuously improve the content of the rating system to include new study results and feedback from projects implementing TIKO. TIKO aims to actively follow developments in the data center area specifications including the work of The Green Grid, EU Code of Conduct etc. and use these developments as input for the TIKO tool and model.

Table of Content

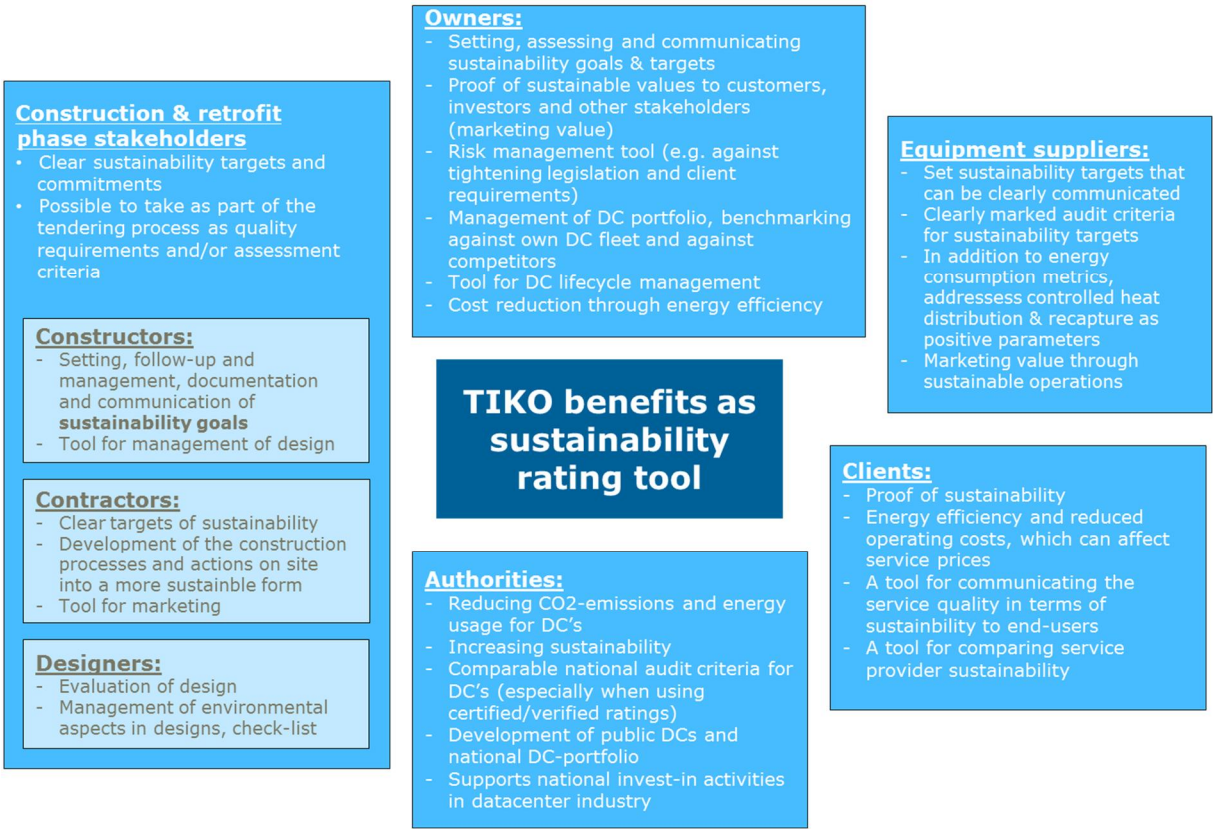
1. TIKO sustainability rating

1.1 Executive summary - TIKO

The TIKO sustainability rating system is a weighted credit based system which acts as a systematic tool for the management and assessment of sustainability in DCs. TIKO has been developed to answer the need of overall sustainable management of data centers.

TIKO emphasizes
1) Numeric metrics for communication and comparison of sustainability performance and
2) Sustainable planning, which takes into consideration the lifecycle of the DC and bases on continuous improvement without strict rules or regulations allowing and encouraging innovation.

TIKO sustainability rating system is a tool for designing, building, equipping, operating and managing data centers in an environmentally, socially and financially sustainable way. The TIKO-rating covers the data center as an entirety, assessing the building, the IT and the operations as a whole acting as a check-list of sustainability issues that should be taken into consideration.



TIKO guides and assesses in 7 sustainability categories: leadership, operational management, energy, sustainable site, water, waste and pollution, procurement. Additional points are awarded for sustainable innovations. The DC's performance in each category is assessed via credits, which can be earned and are valued by different number of points. The credit values reflect the importance of the factor in overall sustainability of a dc and in relation to other points. The overall sustainability rating of the dc is determined by the overall points achieved by completed credits.

At present, the rating system is a tool for the internal development of operations for a datacenter. The aim is to commit a third party to provide certifications for TIKO-experts (by summer 2015), that will be able to provide validation of the attained rating level. The validation will then act as proof of the sustainability performance level of a DC, and also provide means for DC sustainability performance benchmarking and comparison.

TIKO tool will be piloted in 2014 with one or more actual data center cases in Finland, and be updated according to the input and improvement ideas collected during the piloting process. TIKO aims to actively follow developments in the data center area specifications including the work of The Green Grid, EU Code of Conduct etc. and use these developments as input for the TIKO tool and model.

TIKO is further separated into three different schemes:

- TIKO for data center new construction – for building a new sustainable DC
- TIKO for existing data center sustainable performance development – for developing an existing DC's sustainability
- TIKO Guide for purchasing sustainable data center services – for comparing DC service provides via the TIKO criteria

1.2 Background and formation of TIKO

The TIKO sustainability rating system for datacenters was funded by the Ministry of Transport and Communication as a part of the Kide-program's green ICT theme.

The intent of the TIKO-rating system is to pick the most important aspects concerning data centers in the northern Finnish environment. The TIKO-rating covers the building, IT and operations aspects from site selection of data center to the building project and operations. Rating systems have been shown to be very useful tools in, for example, real estate management; LEED and BREEAM sustainability rating systems (including certification) have high demand in the real estate industry and have even been said to be tools for the transformation of the buildings market into a more sustainable future

The TIKO criteria related to the DC building aspect are widely based on USGBC's Environmental Performance Criteria Guide for New Data Centers (based on LEED NC 2.2, referred to from now of as LEED for data centers), BREEAM Data Centres 2010, and the Finnish Green Building Council's study results on the lifecycle metrics of buildings (Rakennusten elinkaarimittarit 2013, referred to as REM from now on in the text). Moreover background studies for data center management, IT and design criteria creation include the EU code of conduct on data centers, other articles and studies on data center sustainability, data center operator best practices and professional opinions (via interviews and commenting).

The foundation of the TIKO rating system is presented in figure 1.

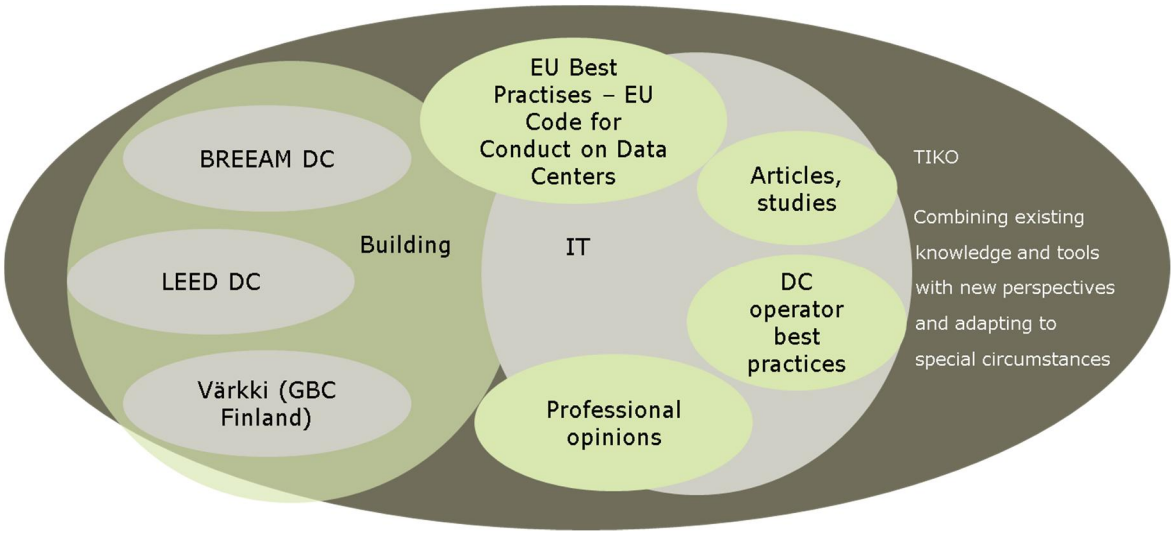


Figure 1: Foundation of the TIKO-sustainability rating system

Ramboll Finland Oy and Proceed Consulting Oy have coordinated and executed the TIKO rating formation, on behalf of the Ministry of Transport and Communications. During the course of the project, three workshops have been held to receive feedback from DC service providers, owners, clients and other stakeholders. Furthermore, special experts from the fields of sustainability, DC-operations, IT-technologies and construction have been used for commenting the work.

This is version 0.4 of the rating system. The intent is to implement the produced sustainability rating system on pilot projects in 2014 and continuously improve the content of the rating system to include new study results and feedback from projects implementing TIKO. Validation of the rating system is achieved through source validity, expert commenting and in testing via pilot cases in the future.

1.3 Need for the TIKO sustainability rating

Data centers are used to house computer systems and associated components, such as servers, telecommunications and storage systems in a controlled, managed environment tailored for today's high computational and storage needs. The data centers normally have redundant power supplies, cooling systems and network systems to ensure 24/7 operations in any circumstance. Typically the redundancy spans from infrastructure down to the individual server level in the form of cabling, power supply etc.

The data centers are typically operated by enterprises and organizations for their own purposes, or they can be so-called co-location data centers where multiple enterprises or organizations share the same data center operated in a rental facility manner. Some of the co-location data centers are operated as wholesale, bulk of the co-location datacenters today are however traditional retail colos.

The demand for internet-based products and services rises constantly, thus creating increasing demand for data centers and associated services. It has been estimated that between 2014 and 2024 the number of data centers and the total square footage of datacenters will more than double (Frost & Sullivan: Data center market update 2012). This is mostly due to internet service growth rates of over 30% (CAGR) during last years (451 Research: market monitor2013). This increase in demand means that the impacts of data centers will become increasingly massive: environmental, social and financial impacts, requiring the industry to take sustainable development into consideration in with growing weight. For example, in 2010 data centers accounted for approximately

1,1-1,5% of total electricity consumption worldwide (Koomey: Growth in data center electricity use 2005 to 2010, 2011); it is estimated that the electricity demand of data centers will double by 2030, and total energy demand will double by 2050 (IEA 2007). As of 2014, the biggest growth is seen in data centers operated in massive scale, either in wholesale co-location facilities or "hyperscale" data center operated by the internet giants e.g. Google, Microsoft, Facebook & al.

The energy aspect is usually the first focus when talking about the environmental and sustainability impacts of data center and it is, by all accounts, the largest environmental factor concerning data centers due to their high intensity energy consumption. Moreover DC companies are especially interested in energy efficiency, as increase in energy efficiency means cost savings and bottom line result increase and thus is a priority for all industry operators and stakeholders. The importance of energy efficiency in data centers is stressed even further, when taking the rising energy costs into account. However, it is important not to forget other sustainability factors of data centers in the long run.

The data center industry development has major impacts on financial and social development: For example, mega class data center investments can change the operations of smaller cities in a major way (via taxes, workplaces, infrastructure impacts, increased interest in the location for other companies etc.). On the other hand, the locations of smaller data centers effect the social sustainability of a country; for example, how can accessibility of internet based services be assured to all citizens regardless of location, and is it better to centralize data centers to certain geographical locations or to disperse smaller data centers on a scattered plot. All in all, sustainability of data centers should be assessed as balance of the three views of sustainability: financial sustainability, environmental sustainability and social sustainability.

When assessing the datacenter industry - its current state, trends and development - it is clear, that there is a strong need for:

1) The development of the data center industry towards a sustainable future; taking into consideration the entire concept of sustainability and

2) The conscious and continuous management of individual data centers.

Furthermore, measurability of the results of development is crucial as clients and other stakeholder require proof of sustainability.

The current metrics for the assessment of the sustainability of a data center are inadequate: first of all, they focus mainly on energy efficiency aspects forgetting about other factors of sustainability, and secondly these metrics do not lead to the right direction. For example, the most used metric, power usage effectiveness (PUE), does not award waste heat utilization. Thus, leading by only one individual metric such as PUE, will ultimately lead to the wrong direction.

This is why a collection of different assessment criteria, a sustainability rating system, which includes both numerical metrics, and qualitative criteria requiring continuous improvement, sustainable management and leadership was developed and named TIKO. The aim of the TIKO sustainability rating system is to promote the sustainability of individual data centers and through this development, the industry as a whole. TIKO aims to be a usable tool for DC-operators and their stakeholders – for internal business and operations development, benchmarking and market value.

2. Implementation of the TIKO-rating

This user manual is intended for data center new construction projects. Please see TIKO for existing data centers and TIKO for client use for other purposes.

The rating system does not provide third party validated certificates at this point. The TIKO assessment is carried out in 7 different categories: leadership, operational management, energy, sustainable sites, water, waste and pollution, and procurement. The final assessment may be done during the DC ramp up phase, the credits with operations period requirements must be committed to and the commitments must be published online.

Each category is further divided into credits which are valued with a different amount of points. The credits describe what is needed to execute in order to achieve points. The credits may also reward different amounts of points according to performance via given thresholds. Prerequisites are credits that do not reward points and a mandatory for all projects. From the actual credits, a project team can choose which points are set as targeted ones.

A credit summary table (Appendix 1) is provided for easy application of the rating – however, the table cannot be used on its own, and needs this manual for further instructions and requirements.

Steps for implementing TIKO:

1. Determine the owner's motivation for TIKO implementation (including the value-add and costs).
   - Is TIKO being implemented as an internal tool for sustainable management and development of data center? (Values: project target setting and communicating, building a sustainable DC, reducing costs via energy efficiency, meeting customer quality requirements etc.)
   - Will an internal audit be made to validate the results?
   - Will an external consultant be hired to make an external audit and validate the TIKO-requirements being met? (value: additional market value)
   - Will external resources be needed in the implementation of TIKO requirements?
   - Is there a specific rating level that will be set as target?

2. Create a TIKO management team to implement the project
   - Mandate from the owner to management team for implementation
   - Management team should consist of at least the following stakeholder representatives: owner, construction management, lead designer, constructor, TIKO-implementation manager (DC & sustainability expert)
   - Allocate resources to the project implementation
   - Allocate responsibilities to personnel
   - Educate the project personnel on TIKO requirement

3. Set TIKO targets (management team):
   - Analyze: which credits are possible, which are economically feasible, which are of most benefit to the project/company
   - Combine the target analysis with the determined level of motivation. Select target credits and conduct a pre-assessment (how many credits will the project aim to achieve, what overall rating level will this result in). Write down a short description of the objective for the project. This will act as guidance throughout the project and be communicated to all involved in the project execution.
   - Form at least the basic structure of the sustainability plan (Prerequisite 1)

- Create a target time-frame and schedule for the project. The time schedule should include targets for individual points.

4. Create a communication plan for internal and external TIKO communication, determine which information will be published.

5. Execute: planning and design, construction according to credit achievement plan.

6. Assess: internal verification of achieved credits and goals.

(7. Verify: external verification by a third party. The third party may be a DC and sustainability consultant.)

The project receives an assessment for all the categories, and an overall project assessment. Furthermore, projects can upgrade their project rating via innovative solutions (up to 10 innovation points can be awarded, an additional 1 point for each innovation), which proves sustainable performance in a numerically established way, and is not assessed in any other credit.

The project is rated as follows:

Category	Achieved points	Total available points	Section score = achieved points / total points
Leadership	X_1	5	X_1 / 5
Operational management	X_2	15	X_2 / 15
Energy	X_3	46	X_3 / 43
Sustainable site	X_4	5	X_4 / 15
Water	X_5	5	X_5 / 33
Waste and Pollution	X_6	5	X_6 / 21
Procurement	X_7	19	X_7 / 21
Total score without innovation points	X_{1+} X_{2+} X_{3+} X_{4+} X_{5+} X_{6+} $X_{7=}$ X_{total}	100	X_{total} / 100
Innovation (10 points possible)	X_8	possible 10 additional points from innovative solutions	
Total score with innovation	X_{8+} X_{total}	100	X_{8+} X_{total} / 100

The assessment, which is received for each of the sections (=section score) and the overall project is assessed according to the following thresholds:

D (PASS) ≥30 %
C (GOOD) ≥50 %
B (EXCELLENT) ≥70 %
A (OUTSTANDING) ≥85 %

The TIKO-rating is designed for data centers. Therefore, if more than 20% of the buildings square footage is in other use than data center usage (e.g. Office use) the non-data center area is excluded from this assessment.

Publishing the results of the assessment can be done via annual reports, online reports, and newsletters to stakeholders, via aggregated reports by environmental organisations (e.g. Greenpeace produces annual reports on how green data centers are) or any other practical channels to the audience.

3. TIKO Criteria

3.1 Leadership

3.1.1 Lea 01 Sustainability plan

Possible points:
Prerequisite 0 points. Completion of this credit is non-optional and is required for all TIKO-projects.

Purpose of credit:
The DC sustainability should be planned in the same regard as other aspects of DC operations. This ensures effective and productive sustainable solutions with the best benefits. The planning needs to be based on continuous improvement throughout the DC lifecycle, so that the DC is up to date in relation to:

- The changing needs of the specific DC itself (customer demand, technology changes etc.)
- The operational surroundings od the DC (changes in market need, service type etc.)
- And the DC industry development.

Compliance criteria:
A sustainability plan to lead the DC, from site set up to management of operations, is created according to the PCDA-principles. The sustainability plan will guide the operators operations from the view of sustainable development. The plan starts by determining the added value wanted via sustainability and creating a strategy for implementing sustainability taking the value creation into account. The operator commits to the sustainability plan that is created. Parts that are not regarded as corporate secrets should be made known to customers and other stakeholders.

The sustainability plan shall at least include the following principles:
1. PCDA-principles include 4 phases which are implemented as a continuous process:
    1. Plan: Identifying and analyzing of the current situation and determination of the wanted future state. The future state needs to be described (includes setting of goals – both numeric and descriptive). The operator shall choose numeric goals (for example from PUE, CUE, renewable energy usage/production, LC of IT-equipment and building or other metrics). The plan shall include descriptions of the acts of sustainable development in the cooperation from all perspectives of sustainable development: environmental, social and financial sustainability. In the operations, this phase also includes identifying and analyzing the possible problems or deviations from target.
    2. Do: Developing and in the operation phase testing of solutions. The sustainability plan shall describe how the wanted sustainable state will be achieved and monitored.
    3. Check: Measuring how effective the solutions were, and analyzing whether it could be improved in any way. A time table is set in the sustainability plan for the check-ups of sustainability. The checkup plan should include a full checkup of all operations in the timeframe of 8-16 months from the beginning of operations. Also the ramp-up phase shall be described.
    4. Act: Implementing the improved solution fully

2. EU code of conduct (http://www.coc.eu/) on DC's is taken into consideration

3. Lifecycle planning according to the Green Grid Data centre life cycle assessment guidelines (http://www.thegreengrid.org/~/media/WhitePapers/WP45v2DataCentreLifeCycleAssessmentGuidelines.pdf?lang=en)
4. Change management plan: Development needs to be planned and conducted in systematic fashion to ensure good quality results were all important aspects are carefully taken into consideration. Thus a change management plan for changes in hardware, software, configuration, processes and the building is made to ensure sustainable development

Verification of implementation:
The operator creates a sustainability plan. Aspects that are not regarded as corporate secrets should be brought to customers and other stakeholders' knowledge. The sustainability plan shall include at least the principles stated above.

3.1.2 Lea 02 Project card

Possible points:
Prerequisite 0 points. Completion of this credit is non-optional and is required for all TIKO-projects.

Purpose of credit:
Gathering of different sustainability metrics will enable benchmarking in the DC industry. The aim is that a third party will gather the information and annually publish summaries of the data so that DC-operators, clients and other stakeholders can compare their sustainable performance in regards to other DCs operating in the same conditions. The organization responsible for the collection and follow-up of the aggregated metrics is still undecided as of the date of writing this DRAFT document (June 2014), but it could well be one of the players in the Motiva study done in 2011 on energy efficient data centers in Finland.

The project card information is to be provided to DC clients when asked.
Publishing of information, for example in annual reports or on the company website is encouraged but not mandatory. Publishing of the information will give clients and the public a chance to compare DC operators sustainable performance. This way, the DC operator has a chance to show that sustainable investments are paying off. Sustainability has increasing market value.

Compliance criteria:
The project card shall be filled out. A Project card template, meeting the requirements of this prerequisite, is found as Appendix 2. The project card information shall be updated annually, including historic graphs of metric performance development.

The following project card data is required by all projects. Please note, that some of the other credits in TIKO requires additional data to be presented in the project card, if selected to pursue.

If a project chooses to market the DC as TIKO-rated, the TIKO rating should be available to customers so that the performance in each category is shown separately in addition to the overall rating. Furthermore, a filled in credit table showing which points have been achieved should be available to clients, if the DCs sustainability performance according to TIKO has not been validated by an external party.

Project card Prerequisite 2 content requirements:

Owner	Company name and contact person details
Operator	Company name and contact person details
Address	Address of the project / data center building
Year of building construction	
Year of operation start	
Site area	
Gross floor area (GFA)	The total floor area contained within the building measured to the external face of the external walls
Net internal area (NIA)	The NIA is the floor area contained within the building measured to the internal face of the external walls, less the floor areas taken up by lobbies, enclosed machinery rooms on the roof, stairs and escalators, mechanical and electrical services, lifts, columns, toilet areas, ducts, and risers.
Floor areas by usage (NIA)	Should at least be given for Data halls, Workshop and storage areas, Office areas and Ancillary areas.
DC capacity	Total kW, including cooling, lighting etc.
Lifecycle carbon footprint of building	Calculating principles and guidance according to REM (*2)
Metrics reporting (3 of the metrics listed to be chosen)	Choose between ERE, NPUE, PUE kw/computing hour, total site kW usage and CUE. The metrics shall be reported once per year accompanied by a graph of the historical performance.
Verbal description of project	Description should include an operation type description and highlight the 5 best sustainable actions implemented to the project
Self-assessment according to TIKO-criteria	Final rating. If a third party has validated the rating, it is to be stated here.
Sub-categories: Leadership Operational management Energy Sustainable site Water Waste and pollution Procurement Innovation points with descriptive names	Score from each subcategory

*1) The NIA is the floor area contained within the building measured to the internal face of the external walls, less the floor areas taken up by lobbies, enclosed machinery rooms on the roof, stairs and escalators, mechanical and electrical services, lifts, columns, toilet areas, ducts, and risers.

*2) Lifecycle carbon footprint is calculated according to principles and guidance given in REM report (Rakennusten Elinkaarimittarit (2013), chapters 7 & 8, http://figbc.fi/wp-content/uploads/2013/01/Rakennusten_elinkaarimittarit_2013.pdf).

Verification of implementation:
Project card

3.1.3 Lea 03 Integrated process

Possible points:
1 point

Purpose of credit:
The TIKO-rating and sustainability is to be taken to be a part of a DC new construction process, not a side process. Sustainability should be a factor in all decisions made. This reduces the cost of sustainability overall and ensures that the data center as a whole is optimized so that sustainability is a major factor.

Compliance criteria:

- Sustainability is to be discussed as part of the agenda in all design and worksite or maintenance and follow-up meetings.
- A TIKO-implementation forum group is to be created, including representatives from the following parties as applicable: environmental specialist, customer/investor/project management, constructor, all designers, main contractor and sub-contractors, operations personnel (if determined), IT-specialist.
- The TIKO-forum should hold at least 4 meetings during a DC new construction project:
  - Meeting 1: Kick-off meeting, agenda includes: general know-how of rating shared, setting of goals, responsibility determination with one environmental specialist named to be responsible for overall TIKO-implementation, documentation principles decided, communication principles decided, process description
  - Meeting 2: Design phase check-up, to see that design solutions comply with the aimed credit requirements. A first phase review of the project from the rating system should be assessed.
  - Meeting 3: Construction phase checkup, including second phase review via TIKO-rating credits
  - Meeting 4: Ramp-up phase checkup. Here it is to be seen to, that all goals that were set were achieved and possible check-ups and modifications are still made. A final report at the end of the ramp-up will be written, on hot the project succeeded in TIKO implementation and sustainability integration to the project. The report will mention improvement suggestions, that will be shared and taken into account in future projects.
- All parties of a DC new construction project (eg. constructors, contractors, consultants, designers, equipment providers) are required to have or produce an environmental management system (eg. ISO 14001) and/or a project specific environmental scheme and targets. All parties must be committed to environmentally and socially responsible action.

Verification of implementation:
Stakeholder and consultation plan, sustainability as a part of meeting agendas in design and worksite meetings, TIKO-forum meeting dates, environmental management systems stated or environmental schemes provided.

3.1.4 Lea 04 Stakeholder involvement

Possible points:
1 point

Purpose of credit:
To design, plan and deliver functional and effective DCs in consultation with stakeholders. The consultations should be made in the right order in the right time frame for optimal effectiveness and reduced costs. Furthermore, as a part of the consultations, promotion of sustainability should be conducted to promote the overall sustainability of the project. A forum for commenting should be given to stakeholders for the operations phase also.

As a part of social sustainability the local community should be consulted especially during large DC projects.

Compliance criteria:
1. All relevant parties and relevant bodies (i.e. stakeholders) are identified and consulted by the project team (including clients, equipment suppliers, authorities, operation and maintenance personnel, etc.). The findings of the consultation of stakeholders should influence the design and therefore must be held before key and final design decisions are made.
    - DC performance metrics should be assessed here extra carefully – performance should be optimized in relation to expected current demand and also future demand. Future DC expansion needs are to be taken into consideration, without creating excessive loads in relation to the loads that are planned for when the DC is taken into use. Relevancy of modular design as a possibility should be assessed.
2. A consultation plan has been prepared and includes a time table and methods of consultation for all relevant parties/bodies and how the relevant parties will be kept informed about progress on the project.
3. The consultancy meetings include sustainability promotion to stakeholders
    - The agenda of all stakeholder meetings should include the presentation of the DC operator's sustainability plan
4. The contractors should be allowed to comment on design solutions in the design phase. To do this, a contractor representative is suggested to be present in design meetings (meeting attendance is not mandatory for credit compliance).
5. A plan for how stakeholders have input on DC sustainability throughout the DC operations
6. At least one interactive work shop is held for the members of the community, especially when the data center is operating in the megawatt-range, ie. over 1 MW, thus having backup generator capacity with significant load. This workshop should include presentation of the project and its sustainable goals, and feedback from the community. The concerns and suggestions of the community should be listed and addressed to as to how they will be taken into consideration during the project - or if not applicable, the reasons should be explained. These should be listen in written form and published in the internet, so that community members that were not in the work shop can study them.

(Requirements 1-3 are modified from BREEAM Data Centre 2010, Man 04 credit requirements)

Verification of implementation:
Stakeholder and consultation plan (may be included in the same document as Lea 03 verification).

3.1.5 Lea 05 Shared best practices and sustainability

Possible points:
1 point

Purpose of credit:
To share best practices and sustainability information with other DC operators and stakeholders. This drives to develop the DC industry as a whole.

Compliance criteria:
Share and publish best practice information and ways of conduct in order to promote sustainability industry wide. Business secrets are excluded from publishing requirements.

Also publish a project sustainability summary with the project's sustainability goals and major sustainability practices described. Include contact information, for people wanting to contact the company about sustainability and environmental questions and/or comments.

Verification of implementation:
Commit to publish sustainability best practice information as a part of the annual report of the company, on the company website, or as a part of the sustainability plan (if public). Include a sustainability contact and publish contact information.

3.1.6 Lea 06 Incentives for increased sustainability

Possible points:
1 point

Purpose of credit:
To encourage the continuous development of sustainability, and commit all stakeholders to the implementation and development of sustainability. Creating incentives on employee level will encourage personnel to truly implement sustainability in their work. Moreover continuous development will enable the dc in staying up to date and forming new ways of sustainable conduct.

Compliance criteria:
Describe (f.ex as a part of the sustainability plan) how incentives are used to increase sustainability, especially energy efficiency. The incentives may concern any stakeholder, preferably many. Examples of incentives are:

- Pricing of services via energy usage not floor space. This acts as an incentive for purchasing lower powered servers (in cases which clients buy their own servers). Prices should be checked in agreed periods so that decreases in energy usage are truly reflected in customer prices, on the other hand increased reflects on the pricing too.
- Incentives for DC operating personnel according to metrics (f. ex. PUE, actual energy usage, incentives of new applicable methods for sustainable development and encouraged and rewarded etc.)
- Targets and goals are set for equipment suppliers, contractors etc. and possible bonuses paid if they are achieved.
- Encourage DC customers to multi-tenancy and shared physical hardware, as applications are migrated from physical to virtual machines

Verification of implementation:
Description of incentives, their implementation and expected outcome

3.1.7 Lea 07 Private public partnership (PPP)

Possible points:
1 point

Purpose of credit:
To provide the public sector expertise and efficiencies via private sector participation. Also to ensure the development of the dc industry as a whole, thus encouraging individual parties to work in cooperation and participate in development of the field in larger scale.

Compliance criteria:
PPP model of the DC is described and put into action. All forms of PPP are accepted and encouraged. This may be, for example, via concrete cooperation:

- by backing up of public DC info and building a shared network
- working in cooperation with the public sector towards its goals concerning IT, clouds, DCs and other related interests through mutual studies and innovation
- use of CSC and/or University computing facilities in a shared manner, in order to enable efficient research opportunities where high requirements are set for computation resources.

Verification of implementation:
Description of PPP involvement and projects, informing of participation in some public media (eg. internet pages, info/newsletters to stakeholders, annual report etc.)

3.2 Operational management

3.2.1 Op 01 Capacity optimization

Possible points:
2 points

Purpose of credit:
To optimize the DC capacity so that the performance requirements (both current and future) are taken into consideration. The performance of the DC needs to take into account the requirements of the future services, applications, customers etc. Underutilization results in costs from extra energy usage and other resources without income. Under estimating the capacity requirements will require new investments; if these are not taken into consideration in the initial planning, they will not be conducted in the most efficient manner.

Compliance criteria:
Optimize the DC capacity, so that both the current and future needs are taken into consideration, without oversizing the DC. This includes optimizing supporting systems such as cooling and back-up generator capacity. Utilization should be increased and power capacity purchases should be deferred. Furthermore, modular design of the DC should be taken into consideration from the beginning, so that the DC capacity can be built up in modules according to demand.

Also a shared DC-to-DC network is encouraged to share excess capacity and even loads when necessary.

Verification of implementation:
Documented implementation. Requires a written analysis and a description of actions: Performance analysis and plan including forecast and timeframe of performance requirement development. Planning of dc capacity and supporting systems accordingly, including description of actions. Calculations on the costs of free, non-utilized capacity.

3.2.2 Op 02 Temperature

Possible points:
1 point

Purpose of credit:
To optimize the temperature of the DC so that minimum cooling is required, at the same time taking into consideration the equipment lifecycle. Cooling requires large amounts of energy, but underutilizing the equipment lifecycle is also a waste of resources.

Compliance criteria:
The temperature of the DC should be optimized. This usually means, that the goal temperature is lifted close to the maximum temperatures that the equipment can handle, in order to decrease cooling requirements. The temperature is to be optimized so that the equipment lifecycle is taken into consideration. Working in cooperation with suppliers to find equipment that can stand high temperatures is encouraged. If free cooling (outdoor air, snow or water) is used, the temperature should be optimized according to these surrounding circumstances. ASHRAE Technical Committee (TC) 9.9 defined standards (http://tc99.ashraetcs.org/index.html) and recommendations are to be used as reference for optimal thermal profiles.

Verification of implementation:
Optimize the running temperature of the DC to decrease cooling requirements without compromising equipment lifecycle or the surrounding environment. Documented implementation. Requires a written analysis and a description of actions.

3.2.3 Op 03 Virtualization and cloud computing

Possible points:
1-4 points

Purpose of credit:
Virtualized server infrastructure serving multiple tenants can balance compute and storage loads across physical servers and thus be operated at higher utilization rate and increase operational efficiency. Cloud computing reduces the carbon footprint due to improved infrastructure efficiency and reduced need for IT infrastructure to support the user base of the DC. Cloud computing also increases flexibility and rapid change management when demand is changing. The main benefit of cloud computing from energy efficiency viewpoint is that it centralizes and increases the utilization rate of computing and storage capacity. Typical utilization rate of servers in use today is 20-30%, in cloud computing platforms, utilization rate target is 80-90%. The higher utilization rate will bring substantial benefits from energy efficiency and thus cost reductions to the operators and customers of cloud computing platforms.

Compliance criteria:

1. Rather than using geographic redundancy (with geographically scattered multiples DC's all with their own replicated applications and data) as a primary way of ensuring continuity virtualization should be preferred when applicable.
2. Implement a cloud computing platform

Credits will be awarded in thresholds:

1p = documented implementation.
2p = virtualisation rate over 50%
4p = virtualisation rate over 90%

Verification of implementation:
Documented implementation. Requires an written analysis and a description of actions.

3.2.4 Op 05 Metrics reporting

Possible points:
1 point

Purpose of credit:
To encourage information sharing and healthy competition in sustainability metrics in the DC industry. Thus encouraging industry wide development in regards to metrics use, measurement, performance indicator publishment and sustainability. Moreover, stakeholders, like investors and customers, should have a chance to compare their

service quality in sustainability terms, before making investment, involvement or purchase decisions.

Compliance criteria:
At least three sustainability metrics are chosen, listed and published at least quarterly showing historical performance of each metric. At least two of the chosen metrics are from the following list:

- Energy Reuse Effectiveness ERE as determined by Green Grid
- Power Usage Effectiveness (PUE) as determined by Green Grid
- Carbon Usage Effectiveness (CUE) as determined by Green Grid
- NetPUE as described by Royal Institute of Technology (2010).
- kW/computing hour
- Total site kW usage

(For more information on the green grid metrics see http://www.thegreengrid.org/library-and-tools.aspx)

Verification of implementation:
Report at least 3 sustainability metrics on a quarterly basis including historical performance data straight to customers. At least two of the reported metrics shall be chosen from the list above. The metrics are published online, in an annual report or other forum.

3.2.5 Op 06 Resilience optimization

Possible points:
1 point + 0,5 points, overall 1,5 points

Purpose of credit:
The resilience level needs to be optimized in relation to operation requirements, so that no unnecessary energy is wasted. E.g. if operational customer requirements are only for Tier2-level resilience (Tier levels as defined by the Uptime Institute), there is less benefit of running the datacenter with Tier3/4 level redundant setup, adding extra cost for both build and operation phases.

Also this criteria emphasizes the right timing for adding system resilience – e.g. discouraging the unnecessary use of redundant cooling (N+2) etc., and instead encourages turning off unnecessary load.

Compliance criteria:

The needed resilience level is studied, determined and justified on the basis of business needs and not over or under sized. Conducting this part will earn 1 point.
Multiple levels of resilience are used. Conducting this part will earn an additional 0,5 points.

Notice that the objective analysis shall be based on comparing the operational system against known business & customer requirements, and shall thus always be based on the judgement of the people responsible for the analysis. No strict guidelines are possible to be set for this credit.

Verification of implementation:
Documented implementation. Requires a written analysis and a description of actions.

3.2.6 Op 07 Hand over and commissioning

Possible points:
1+1 points, overall 2 points

Purpose of credit:
To ensure that the DC operates as planned (verification of system and process performance) and all adjustments are made to optimize performance and energy usage. Hand over and commissioning is conducted from two perspectives: the building perspective and the IT perspective.

Compliance criteria:

- Building handover and commissioning, worth 1 point:
- An appropriate project team member(s) (commissioning expert) is appointed to monitor and program pre-commissioning, commissioning and, where necessary, re-commissioning on behalf of the client, according to the set goals in the sustainability plan. Moreover, this person oversees and checks the user manual provided for the DC building and is responsible for maintenance personnel training in regard of the building functions. The person or people should have knowledge of both building works and IT-equipment, thus an overall picture of DC operations.
- The main contractor accounts for the commissioning program, responsibilities and criteria within the main program of works.
- A specialist commissioning manager is appointed (by either client or contractor) for complex systems such as:
  - Air conditioning / cooling systems
  - Mechanical ventilation, displacement ventilation, complex passive ventilation
  - Building management systems (BMS)
  - Renewable energy sources
  - Microbiological safety cabinets and fume cupboards
  - Cold storage enclosures and refrigeration plant
  - Uninterruptible Power Supply (UPS) systems
  - Standby power generation systems
  - The specialist commissioning manager must have been appointed during the design stage and the
  - scope of their responsibility includes:
  - Design input: commissionable design reviews
  - Commissioning management input to construction programming
  - Commissioning management input during installation stages
  - Management of commissioning, performance testing and handover/post-handover stages.

- The conditions are tested within 12 months of the beginning of operations as follows:
  - Testing of all building services under design load conditions, including heating/cooling/ventilation/humidity control/power supply systems and those in office/ancillary areas.
  - Where applicable, testing should also be carried out during periods of extreme (high or low) load conditions.
  - Free cooling systems should be tested on a seasonal basis.
  - Re-commissioning of systems (following any work needed to serve revised loads), and incorporating any revisions in operating procedures into the operation and maintenance manuals.

IT commissioning, test loads, worth 1 point:

- Acceptance tests have been conducted on all main components including compute, storage and networking, power, … all systems.
- Test runs are to be made with different artificial loads, simulations should be made on how the dc performs under different loads and circumstances. Test runs shall be

made against at least designed maximum load, and expected load for the first 12 months of operations.
- Each DC has its unique traffic, hardware and applications and other features. An analysis of the ongoing operations of a DC (its workload and behavior) should be conducted within 8-16 months from the beginning of operations. The achievements of set goals, especially related to energy efficiency, are checked upon. Changes are made according to findings if necessary.

Source: slightly adjusted from BREEAM Data Centres 2010 (Man 01 – Commissioning credit)

Verification of implementation:
Documented implementation.

3.2.7 Op 08 Security

Possible points:
0,5 points + 0,5 points + 0,5 points, overall 1,5 points

Purpose of credit:
To ensure that physical security, data security, contingency and recovery plans are taken into consideration properly. Information security can be seen as a part of social sustainability, as the information processed in data centers may is to be handled as confidential per se.

Compliance criteria:
Physical security 0,5 points: The data center facility should be physically secured via controlled access and other precautions taken, as to ensure that client data is safe and the opportunity for crime is designed out. Normal practice is that all access to the data center premises is controlled and logged, with video surveillance when applicable. Only authorized personnel shall have access to the site and the floor plan is isolated. The actual level of security of the facility is dictated by the type of data that is handled in the facility, the end-user requirements and the tier ratings and other design targets of the facility. Some, but not all facilities employ a 24/7 human presence on-site.

Data security, 0,5 points: In today's environments the data security is seen perhaps even more important than the physical security aspects, which are typically well handled in Finnish data centers. From data security point of view, it is important to focus on both processes and practices on data security. Good baselines for basic requirements can be found from e.g. Finnish government VAHTI and KATAKRI regulations, which dictate the levels of security that must be applied if governmental data with certain classifications is handled or stored in facilities in Finland. CERT-FI has been part of the taskforce forming these regulations, and can be consulted for applying these in practical level. Customers may set differing commercial requirements for the data center operations.

For more information about VAHTI, see:
http://www.vm.fi/vm/en/16_ict/03_information_security/index.jsp

For more information about KATAKRI, see:
http://www.defmin.fi/files/1870/KATAKRI_versio_II.pdf

For more information about CERT-FI, see: https://www.cert.fi/en/

Contingency and recovery plan, 0,5 points:

Contingency plan, recovery plans made and documented, document reviewed and used in operations.

Verification of implementation:
Documented implementation, plans approved by the data center operations team.

3.2.8 Op 09 Life cycle costing

Possible points:
1,5 points

Purpose of credit:
Lifecycle costing should be the base of all investments. The DC should be built so that the DC lifecycle, building lifecycle and IT-equipment are all taken into account. The DC is calculated to have a lifecycle of 20 years and the building to have a lifecycle of 60 years. Thus the DC should be built so, that the building will have a use after the primary DC use is not economical anymore – for example an innovative campus space etc. The IT-equipment lifecycle is 3-years in the calculations – they should be renewed in a time frame, when the performance and energy efficiency of new equipment is of more value than the possible "time left" of the old equipment.

Compliance criteria:

Life cycle costing shall be used as base for all investments. The building investment should be analyzed in two parts with life cycles of a) 20 years (DC lifecycle) and b) 60 years (building lifecycle). The calculations should be done in accordance to REM (see information on page 5 and http://figbc.fi/wp-content/uploads/2013/01/Rakennusten_elinkaarimittarit_2013.pdf).

IT-equipment investments should be calculated with a 3-4 year lifecycle. The calculations should be done in accordance to The Green Grid Data centre life cycle assessment guidelines.

Notice that running a data center dedicated for cloud computing in hyper scale, which has strictly managed process and optimized equipment, the life cycle of IT equipment will be different than for running e.g. a co-location data center with widely varying equipment base.

Verification of implementation:
Lifecycle calculations, implementation according to results.

3.2.9 Op 10 Healthy work environment

Possible points:
0,5 points.

Purpose of credit:
The work environment in the DC (both IT-hall and office area) needs to be both physically and emotionally healthy for employees.

Compliance criteria:

Temperatures, air conditioning, ventilation, daylight and other indoor environmental aspects are to be in conditions that are recommended and checked by occupational health. The work environment is to support employee's emotional wellbeing by supporting education, involvement in cooperation development, providing appropriate amounts of personal development depending on employee wishes and so forth.

Verification of implementation:
A plan for a healthy and supportive work environment is made and it is checked with the occupational health of the firm. The plan is implemented.

3.3 Energy

3.3.1 Ene 01 Sustainable cooling system

Possible points:
1-15 points

Purpose of credit:
Energy efficiency is the most important aspect of environmental sustainability concerning data centers. Data centers require huge amounts of energy for the IT-equipment and processes. Most of the energy used turns into heat energy during the processes, which in turn includes two important sustainability aspects:

1. DCs of today need huge amounts of energy for cooling, so that the temperatures do not rise too high for the IT equipment. Approximately 30-40% of the total energy used in a typical data center is used for cooling. Free cooling techniques can minimize this percentage and thus decrease the energy requirements of DCs significantly.

2. Heat accounts for major energy losses in data centers. The waste heat from the IT equipment is usually not utilized, but merely let out of the building. New forms of utilizing the waste heat need to be developed so that the losses are turned into gains of in other uses. Capture and re-utilization of waste heat is encouraged in TIKO as one of the most important aspects in DC sustainability.

Compliance criteria:
In this credit, either free cooling or heat utilization can be chosen as these techniques have a major impact on each other and may sometimes not be feasible to be implemented at the same site. Capture and re-utilization of waste heat is preferable over free cooling techniques, to encourage the maximal efficiency of the whole ecosystem including surrounding infrastructure. However, if a project does execute heat utilization and re-utilization, and in addition uses free cooling to cover possible cooling requirements, the free cooling points may be taken into consideration as 3 innovation points.

Free cooling, 1-5 points:
- Primary cooling of the DC is conducted via natural, free cooling sources such as cold outside air, water, snow or other sources.
- Criteria to achieve 1 - 5 points:

%- free cooling measured in time (minutes per year of free cooling/ 525600 minutes)	Points achieved
< 90% of the time	5 points
80 % -90 % of the time	3 points
70% of the time	1 point

- Furthermore, other free cooling techniques such as indirect evaporative cooling, and heat wheel cooling are preferable and used where applicable and to the maximum extent possible.
- The different technique applicability to the project should be assessed and best solutions implemented.

Capture and re-utilization of waste heat, 1-15 points
- Creating forms of capturing and reutilizing heat loss requires innovation in order to complete in a profitable manner. However, heat utilization should be a priority and conducted even when the investment is not financially profitable and only heat

recovery related costs are covered (the result being plus/minus zero in monetary terms, sustainability result is highly positive).
- The heat may be, for example, distributed to the local heat network, reutilized in the proximity of the DC (office building, parking house, garage, green house etc.).
- Note: A project with the public sector innovating the area plan so that heat utilization is profitable may account for a PPP point (Lea 07)
- The points are based on the percentage of systems critical components (compute, storage, networking) waste heat targeted to be collected – e.g. if target is to recapture and reuse all waste heat, maximum 15 points shall apply.

Verification of implementation:
Free cooling: Documented implementation. Calculations and verification of the percentage cooling time is required within a year of the beginning of operations. The free cooling method and percentage is published information.

Capture and re-utilization of waste heat: Documented implementation. Calculations of profitability and heat recovery efficiency should be calculated. Moreover, a description summary of heat loss recovery and utilization is published and available for other DCs for benchmarking (recovery form, utilization subject).

3.3.2 Ene 02 ERE calculations

Possible points:
1-6 points

Purpose of credit:
Energy Reuse Effectiveness (ERE) assesses the energy use of a DC in a more reliable from the sustainability point of view than the most common metric PUE. The aim is that sustainable innovations regarding overall energy efficiency, for example the reutilization of heat loss, can be taken into account in the energy efficiency metrics in the DC industry. PUE is too often used as an assessment metric on its own, which can lead to misguided conclusions of the DC energy efficiency.

Compliance criteria:
Calculate the ERE of the DC according to Green grid instructions:
ERE: A METRIC FOR MEASURING THE BENEFIT OF REUSE ENERGY FROM A DATA CENTER.

Please note, that the ERE measurement is still in the development phase, and updates may be made.

Points are awarded according to the table below:

ERE number	Points
1-1,5	6 points
1,51-1,7	3 points
1,71-1,8	1 point

Verification of implementation:
ERE calculations, publishing of results.
ERE metric used here as defined by The Green Grid specifications.

3.3.3 Ene 03 Certified IT equipment

Possible points:
2 points

Purpose of credit:
The IT-equipment's energy usage of a DC is a major factor in energy effectiveness. Certified equipment should be valued, in order to improve comparison of energy efficiency as a factor in purchase decisions.

Compliance criteria:
Over 75% of the IT equipment shall be EnergyStar certified (under its Tier 1 specification and have power management enabled).

For more information about EnergyStar, see https://www.energystar.gov/products/specs/node/142. Other certification schemes may be used, if the requirements are atleast as strict as energy star requirements.

Verification of implementation:
Based on the cost of equipment, at least 75% of the IT-equipment fulfills the requirements of this credit. Calculations for verification

3.3.4 Ene 04 On-site renewable energy and symbiosis

Possible points:
1-3+4 points, overall 7 points

Purpose of credit:
To encourage renewable energy production and reduce the use of fossil fuel as a source of energy. It is also encouraged that parties create symbiosis and ecosystems, where they benefit from the presence of each other in the proximity.

Compliance criteria:

On-site renewable energy production, 1-3 points:

- points received according to the following table:

Percent [%] of onsite renewable energy produced per year / total energy usage per year	points
10 %	3 points
5 %	2 points
3 %	1 point

Renewable energy sources are as defined by the Carbon Trust:

"Renewable energy refers to energy that occurs naturally and repeatedly in the environment. This can be energy from waves, wind, the sun and geothermal heat from the ground. Renewable energy can also be produced from plant sources such as wood or crops grown specifically as a fuel.

Organic fuel sources can also be found in by-products from manufacturing and other processes. Under certain circumstances, these can be converted to renewable energy using environmentally acceptable processes. Biomass fuels are replaceable and while

they liberate CO2 when they are burnt, this is generally the same amount of CO2 that was taken up when the biomass grew, so they are considered to be carbon neutral. As the term suggests, renewable energy will not run out, unlike energy from fossil fuels. (Renewable energy sources, Carbon Trust, 2010)

Symbiosis, 4 points:

The DC is built so that it works in a symbiosis with other companies in regards of energy usage. Working in symbiosis means that a deep cooperation is built, where companies benefit from, for example, each other's waste outputs. For example, the DC may be built next to a landfill site or water treatment site in order to use 100% biomass energy in DC operations and the DC may transfer the waste heat to the other plant in turn.

Verification of implementation:
On-site renewable energy: Calculations of renewable energy produced on-site. Description of implementation.

Symbiosis: Description of implementation, publishing.

3.3.5 Ene 05 Energy metering and metric control

Possible points:
4+1 points, overall 5 points

Purpose of credit:
Metering gives accurate energy usage data and enables controlling of the processes in real time. This ensures that deviations from the norm can be detected easily, also improvements on energy efficiency are more likely identified. Moreover, results of improvement actions on energy efficiency can be measured. Automated control of systems by a BMS is encouraged, so that energy efficiency is accurately optimized at each moment.

Compliance criteria:
Energy metering, 4 points:

- Requires energy sub-metering and automated reporting of the following measures and performance metrics, when applicable:

1. Lighting and lighting controls: power (kW) and consumption (kWh) by data center room.
2. Electrical power (kW) and consumption (kWh) or other energy sources for all mechanical cooling systems including (chillers, cooling towers, chilled water and condenser water pumps, cooling tower sump heaters or equivalent mechanical equipment for DX systems.)
3. Chilled water generation or equivalent for DX systems: tons, (based upon chilled water flow, supply and return temperature), and kW/ton or equivalent if other energy sources are used.
4. Heating water or steam generation: energy kBTU/per energy unit input.
5. Computer room cooling systems: power (kW) and consumption (kWh).
6. Uninterruptible backup power systems: power (kW) input and power output (kW) and consumption (kWh) input and output for each uninterruptible backup power systems.
7. Engine generator power equipment: power (kW) output and consumption (kWh) for each generator. Fuel consumption (diesel or natural gas) for all generators.
8. On-site renewable energy power generation: production power (kW) and production (kWh), and site specific weather characteristics (irradiance, wind, and temperature)
9. On-site power generation: production power (kW) and production (kWh).

10. The data center is designed to enable sub-metering of IT electrical power (kW) and consumption (kWh) to specific internal business unit or external customers based upon utilization (source: LEED DC).

BMS system, 1 point:

- A BMS is set up for all major building systems, which monitors, controls, and optimizes reports (metrics include at least energy by sub-metering units, temperature, humidity, water usage). The BMS should be automated.
- The BMS is connected to the IT systems so that the building systems are regulated according to IT load: For example, the data center cooling systems should be capable of automatically increasing or decreasing their capacity to match the IT heat load to optimize the energy consumption of the support infrastructure at varying IT work loads

Verification of implementation:
Description of metering and automation.

3.3.6 Ene 06 Energy simulation of DC

Possible points:
3,5 points

Purpose of credit:
To reduce environmental and economic impacts by reducing excessive energy use. By an energy simulation, all systems can be optimized in relation to each other.

Compliance criteria:
An energy simulation of the building including its technology systems is conducted during the pre-design phase and energy is optimized accordingly at both 100% design load and at expected average actual load. Also, the energy simulation is used for comparing different design solutions (when concerning major impacts, for example building orientation).

The building energy usage should comply with at least ANSI/ASHRAE/IES 90.1-2010 for data centers requirements in minimum.

For more information see
http://tc99.ashraetcs.org/documents/Standard%2090_1_2010%20Applicability%20to%20Datacom.pdf

Energy simulation of the whole data center is a hard task when the exact load parameters are not known in the initial phases, which is typical situation in a co-location environment. For a cloud-computing purpose built datacenter, where the loads and ramp-up phases are well known, the simulation results can be more exact. In any case the simulation of energy flows can be performed on the system level, when e.g. evaluating the waste heat re-use in pre-warming backup generators and/or fuel for the generators, or other reuse objects.

Energy simulation is encouraged to be performed for the data center, since the lessons to be learned are most likely valuable tools for enhancing energy efficiency and thus allow significant cost saving opportunities.

Verification of implementation:
Energy simulation and summary

3.4 Sustainable Site

3.4.1 SS 01 Site selection

Possible points:
2 points

Purpose of credit:
To promote sustainability factors in DC site selection. Site selection determines certain factors which cannot be changed.

Compliance criteria:
At least 3 sites should be assessed and compared from a sustainability point of view. At least the following criteria should be assessed in written form while choosing and comparing possible DC locations (in addition to business needs based criteria):

- power supply reliability, local infrastructure reliability, fiber network connectivity (to ensure safe, reliable data)
- renewable energy supply by suppliers and price of renewable energy purchasing
- availability of free cooling (local climate and temperature)
- reutilization possibilities of possible waste heat recovered (nearby buildings, district heating networks etc.)
- availability of local experts
- site in relation to national development (eg. spread out of centralized DC model)
- impacts on the local community (impacts on the power grid, sewage, finance, general development etc.)
- site condition: greenfield, brownfield, polluted site, existing building (see SS 02 site condition)
- lifecycle impacts and costs of development on site
- effects on endangered species, recreational areas, views/scenes etc. in proximity of DC
- site accessibility
- noise impacts form the DC (generators, cooling towers etc.) on local community
- gains from and for neighbors, cooperation possibilities, symbiosis

Verification of implementation:
Assessments and comparison of 3 sites by sustainability factors listed above.

3.4.2 SS 02 Site condition

Possible points:
0,5-1,5 points

Purpose of credit:
To encourage the use of previously developed sites. Extra points are given when damaged land is rehabilitated. By choosing sites that have already been developed, nature is preserved.

Compliance criteria:
Choosing a brownfield site to redevelop will achieve the DC 0,5 points. Selecting a polluted site to be remediated, will award the DC 1,5 points.

Verification of implementation:
Description of site condition, verification of pollution by an authority or analysis of polluted land.

3.4.3 SS 03 Water discharge from site

Possible points:
1 point

Purpose of credit:
To emphasize the importance of storm water design and management, and limit the sites disruption of natural water hydrology.

Compliance criteria:
A storm water expert creates a fundamental storm water management strategy, which concerns both the quantity and quality of site storm water. The developed site should not load the local drainage system or other infrastructure more than the undeveloped site did.

Verification of implementation:
A storm water management plan and implementation.

3.4.4 SS 04 Vegetation selection and green space maximization

Possible points:
0,5 points

Purpose of credit:
Data centers often have large sites surrounding the actual data center building. Green space and vegetation should be maximized for the support of biodiversity and storm water control. Vegetation should also preferably be selected so, that it survives in the surroundings without extra watering or fertilizing.

Compliance criteria:
The amount of open space on site should be maximized and vegetated (minimum pavement, gravel etc., only for parking, transportation and other specified needs). The vegetation should be selected so that it does not need additional watering under normal climate circumstances. A landscape specialist will conduct a site use plan.

Verification of implementation:
Site plan concerning vegetation and documented implementation

3.5 Water

3.5.1 Wat 01 Water usage minimization, water recycling

Possible points:
2 points

Purpose of credit:
To minimize water usage in cooling systems and thus reduce both environmental and economic impacts

Compliance criteria:
A technology/strategy is adopted which demonstrates over a 30% reduction in the potable water consumption associated with the data centers cooling process. E.g. usage of closed circuit in water cooling allows for maximum points, usage of fresh water from district pipeline could be described as the worst option.

- Closed water circulation: 2 points
- Water reused over 3 times in circulation (-> over 30% reduction in water usage): 1 points
- Water not reused in circulation: 0 points.

Verification of implementation:
Calculations, documented implementation.

3.5.2 Wat 02 Water Usage Effectiveness (WUE)

Possible points:
0,5 points

Purpose of credit:
A metric enables the setting of numeric goals and assessment. Moreover, metrics enable comparison and benchmarking of water usage effectiveness.

Compliance criteria:
Water usage effectiveness shall be calculated according to Green Grid specifications. The metric is added to the project card and published according to requirements set out in Prerequisite 2.

For more information, see http://www.thegreengrid.org/~/media/WhitePapers/WUE

Verification of implementation:
WUE calculations and publishing.

3.5.3 Wat 03 Water metering and leakage detection

Possible points:
1+1 points, overall 2 points

Purpose of credit:

Metering gives accurate water usage data and enables controlling of the processes in real time. This ensures that deviations from the norm can be detected easily, also improvements on water efficiency are more likely identified. Moreover, results of improvement actions on water efficiency can be measured. Automated leakage detection is encouraged to avoid large scale water damage.

Compliance criteria:
Water metering, 1 point:
Water metering of the main water supply to each building, and sub-metering in areas and applications that use a major portion of the total water (over 10%) needs to be installed. The water meters shall have a pulsed output, and should be connected to the Building Management System (BMS) for the monitoring of water consumption.

Leakage detection, 1 point:
A leak detection system is installed. The system informs of major leaks in an audible manner, is designed and sophisticated enough to avoid false alarms.

Verification of implementation:
Description of metering and connection to BMS, description of leakage detection.

3.5.4 Wat 04 Temperature and quality of water released

Possible points:
1,5 points

Purpose of credit:
If water is used as a source of cooling, and released into nearby water bodies after usage, the effect of the released water on the local ecology is minimized.

Compliance criteria:
The effects of the released water on water ecology are studied. For example, the water needs to be at such a temperature that no harm to the water body ecology occurs due to temperature differences; also the water quality needs to be sufficient.

Verification of implementation:
A study, taking into consideration the water quality and temperature released and the local ecology characteristics, is conducted. Actions are made to correct water quality and temperature if they are not suitable for release without actions. Documented implementation.

3.6 Waste and pollution

3.6.1 WP 01 Waste management plan

Possible points:
2 points

Purpose of credit:
To ensure that waste reduction, recycling and waste treatment of the whole supply chain have been optimized.

Compliance criteria:
A waste and pollution management plan is developed and put into practice. The management plan takes the whole supply chain into consideration, starting at DC building phase (if applicable) and continuing through out the operation of the building. Aspects to consider include not shipping fully assembled racks, minimization of packaging, minimization of transport etc. Suppliers, service providers and other stakeholders are introduced to the plan and informed about actions required by them.

Verification of implementation:
Plan, description of implementation.

3.6.2 WP 02 Construction site waste management

Possible points:
0,5-1 points

Purpose of credit:
To divert construction waste from landfills by reusing and recycling.

Compliance criteria:
A construction site waste management plan is conducted.

When 75% of construction site waste is diverted from landfills (recycled or reused), the project earns 0,5 points.

When 80% of the construction site waste is diverted from landfills (recycled or reused), the project earns 1 point.

(Modified from LEED for Data Centers and BREEAM Data Centres 2010)

Verification of implementation:
Plan of construction waste management. Calculations of waste diverted from landfills by weight: recycled and reused waste (kg) / all waste (kg).

3.6.3 WP 03 Emission impacts

Possible points:
1 point

Purpose of credit:
To reduce emissions, especially carbon emissions, of DCs in order to limit negative effects, such as global warming, on the globe.

Compliance criteria:
Calculate the Carbon Usage Effectiveness (CUE) of the DC (according to Green Grid).
The emissions of the DC equipment selected meet or exceeds EPA Tier 2 standards.
Emission impacts of power systems are studied and alternative power, for example, solar and fuel cells are used when applicable.

For more information see
http://www.thegreengrid.org/~/media/WhitePapers/Carbon%20Usage%20Effectiveness%20White%20Paper_v3.pdf?lang=en

Verification of implementation:
Calculation of CUE and publishing.

3.6.4 WP 04 Recycling of servers and electronic equipment

Possible points:
1 point

Purpose of credit:
To recycle IT-equipment that may not be suitable for DC use, but can be utilized in other forms.

Compliance criteria:
100% of IT-equipment at the end of its life cycle must be diverted to re-use (functioning equipment) or handled as waste in an appropriate way (broken equipment).
SER waste, see more information http://www.serty.fi/en/toiminta-ja-jaesenet/lainsaeaedaentoe

Verification of implementation:
Included in the waste management plan of WP 1 or as a separate plan.

3.7 Procurement

3.7.1 Pro 01 Procurement of renewable/ low-carbon energy

Possible points:
6 points

Purpose of credit:
To reduce the use of fossil fuels and encourage the use of renewable, low-carbon energy

Compliance criteria:
100% of the purchased power (electricity, heat and cooling) is renewable or low-carbon energy. A commonly proven certificate from the energy producer is required.

Renewable or low-carbon technologies include (from BREEAM Data Centres 2010):

- Solar
  - Solar hot water
  - Photovoltaic
- Water
  - Small scale hydro power
  - Tidal power
  - Wave power
- Wind
  - Wind turbines
- Biomass
  - Biomass single room heaters/stoves
  - Biomass boilers
  - Biomass community heating schemes
- Combined Heat and Power (CHP) for use with the following fuels:
  - Biomass
  - Natural gas
  - Sewerage gas and other biogases
- Community heating
  - Including utilizing waste heat from processes such as large scale power generation where the majority of heating comes from waste heat.
- Heat Pumps
  - Ground source heat pumps
  - Water source heat pumps
  - Geothermal heating systems
  - Air source heat pumps
  - For heat pumps to comply, the heat source (ground or water) must be from a
  - Renewable source, for example soil, outside air, ground water, or a river.
- Other
  - Fuel cells using hydrogen generated from any of the above 'renewable' sources

Verification of implementation:
Certificates from energy providers used as baseline for evaluation.

0p not planned.
2p 50%-70% certified green energy
4p 71-90% certified green energy
6p 100% certified green energy

3.7.2 Pro 02 Sustainable procurement

Possible points:
3+2 points, overall 5 points

Purpose of credit:
To add sustainability as a basic principle in procurement

Compliance criteria:
A sustainable procurement plan, 3 points:

- The sustainable procurement plan must be included as part of the sustainability plan, including economic, social and environmental sustainability aspects.
- For example:
  - Economic aspects include: best value for money, price, quality, availability, functionality, lifecycle costs
  - Environmental aspects include: life-cycle assessment/ life-cycle impacts of product, from cradle to grave assessments, CO2-emissions over lifecycle, energy efficiency
  - Social aspects include: effects on issues such as poverty, international equity concerning distribution of resources, labor conditions, human rights, black economy related issues (also tax and pension payments etc. relate to the financial aspect also).
  - In addition, bidding is regarded as the primary form of procurement in order to promote innovation and reduce costs. Lifecycle costing should be the primary basis for all purchase decisions when comparing products or services.

Procurement via bidding, 2 points:

- Procurement of IT preferably done via a tendering process, which is described in the procurement plan.
- Requirements:
  - Tenderers are given specifications on how their offers are assessed: The overall weighting of price, may not exceed 50%, and thus the quality must weigh over 50% in decision making. Of the quality aspect, energy efficiency must be assessed by given metrics and its weighing must be at least 20% in the quality aspect. At least the peak performance energy usage and the power consumption (per watt figures) on the expected utilization level should be taken into account.
  - Energy star, SPEC Power certified or other certified products are preferred over non-certified products. If certification is not available, the tenderers must be able to show proof of the energy efficiency claims of the products in the specific environment of this specific DC.

- Additional requirements concerning only new construction projects:
  - Designers, contractors and other service providers are also chosen via a tendering process, in which quality weighs at least 50% in the assessment. The service providers are given the TIKO-rating which they must commit to in the offers. Their experience on environmentally responsible projects is assessed, and contributes to at least 30% of the quality assessment.

Verification of implementation:
Sustainable procurement plan in sustainability plan. Description of implementation of bidding

3.7.3 Pro 03 Building and materials re-use

Possible points:

1+1 points, overall 2 points

Purpose of credit:
To encourage re-use of building materials when existing buildings occur on site. Re-use reduces the need for new material production. Also to encourage finding innovative new uses for old materials.

Compliance criteria:
When there is an existing building on-site, the building and materials are encouraged to be reused in any case when they are not out of date (i.e. harmful, inefficient in terms of water usage, energy etc.). The materials and building parts that cannot be reused sustainably are exempt from the calculations.

Building reuse, 1 point: (structural: walls, floors, roof): maintaining 75% of the building based on area calculation (m2) gives 1 point.

Materials reuse, 1 point: (HVAC materials & resources, electrical wire, racks, doors etc. including materials which are used for different purposes than their original purposes for example, a door as a table cover): 5% = 1 point. Calculations are based on either estimated kilograms or area surfaces, whichever is more easily applicable.

(Modified from LEED for data centers 2009)

Verification of implementation:
Calculations, documented implementation.

3.7.4 Pro 04 Regional resources

Possible points:
0,5-1+2 points, overall 3 points

Purpose of credit:
Using regional materials reduces transportation and increases socially sustainability by supporting the local economy. Moreover, local experts are important as local knowledge and best practices in local conditions are extremely valuable information in regards to sustainable performance.

Compliance criteria:
Regional materials, 0,5-1 points: Materials that are extracted, processed and manufactured locally (within 200km of project site) receive points calculated based on the costs of the material.

% of regional material based on costs	
10 %	0,5 point
20 %	1 points

Local experts, 2 points: At least one primary expert in the project is local (project management consultant, constructor, etc).

Verification of implementation:
List of resources and materials used including the origin source

3.7.5 Pro 05 Healthy materials

Possible points:
1 point

Purpose of credit:
Some materials include unhealthy materials which can cause irritation in sensitive people. These materials should be avoided so that personell health is not compromised at work.

Compliance criteria:
Paints, adhesives, coatings, sealants and other materials need to be checked for VOC's and other unhealthy materials – materials found to withhold unhealthy materials are not to be used. Moreover, an existing building should be checked for possible moisture damage and the new building built to ensure that no damage from moisture is caused in the future.

Verification of implementation:
Documented implementation, information from suppliers.

3.7.6 Pro 06 Sustainable sourcing

Possible points:
2 points

Purpose of credit:
The background and production conditions of purchases should be checked in order to avoid things such as child labor and other inhumane conditions.

Compliance criteria:
A plan with principles for responsible sourcing is made. The backgrounds and origins of materials are checked, so that all materials come from sustainable sources. Materials with certifiably sustainable backgrounds are preferred. Especially backgrounds of IT-metals are checked.

Verification of implementation:
A sustainable sourcing plan with principles and implementation description is made. Suppliers are given the information and warned about consequences if the conditions are not followed.

3.8 Innovation

Possible points:
1-10 extra points

Purpose of credit:
To award sustainable innovations in the field and not limit the sustainability views to the credits separately listed. A project can lift their overall TIKO rating by achieving additional innovation points. Each innovation is worth 1 point, excluding the possible free cooling innovation which is worth 3 innovation points (see ENE 01).

Compliance criteria:
Innovation points are earned for sustainable development which is not assessed in any credit. Examples of innovation credits could be, for example

- educational use of DC, sustainability education
- connecting to local community – for example warming a greenhouse, with public use for elderly, school or kindergarten planting activities
- technical innovations with energy savings, e.g. usage of free cooling together with recapture and reuse of energy

Verification of implementation:
The innovation points described and published (including a description of how the implementation advances sustainability).

4. References

BREEAM Data Centres, 2010 http://www.breeam.org/podpage.jsp?id=391

Carbon Trust http://www.carbontrust.com/about-us

CERT-FI https://www.cert.fi/en/

ERE: A METRIC FOR MEASURING THE BENEFIT OF REUSE ENERGY FROM A DATA CENTER.
http://www.thegreengrid.org/~/media/WhitePapers/ERE_WP_101510_v2.ashx?lang=en

Frost & Sullivan: Data center market update 2012, presentation in 24x7 Fall Conference 2013

IEA http://www.iea.org/

KATAKRI http://www.defmin.fi/files/1870/KATAKRI_versio_II.pdf

Koomey: Growth in data center electricity use 2005 to 2010, 2011, presentation in 24x7 Fall Conference 2013

Rakennusten elinkaarimittarit (REM) 2013
http://figbc.fi/wp-content/uploads/2013/01/Rakennusten_elinkaarimittarit_2013.pdf.

USGBC's Environmental Performance Criteria Guide for New Data Centers, LEED for data centers, 2009 http://www.usgbc.org/home

VAHTI http://www.vm.fi/vm/en/16_ict/03_information_security/index.jsp
451 Research: market monitor, 2013 https://451research.com/ , presentation in 24x7 Fall Conference 2013

TIKO- Sustainability Rating for Data Centers - New Construction Version

v 0.4

Credit table summary (to be used together with the User Manual)

Credit	Summary	Action	Points	Verification	Criteria suitable for existing buildings
Leadership		Total points for section	5		
Lea 01: Sustainability plan (prerequisite)	Make a sustainability plan according to PCDA-principles. EU code of conduct on DC's, lifecycle planning and change management should also be taken into consideration in the plan. Commit to fulfillment of plan. As a part of plan, set numerical and verbal goals.	Make a sustainability plan	Requirement, no points achieved - required in order to proceed with rating	Sustainability Plan	Applicable
Lea 02: Project card (prerequisite)	Fill in project card, return to determined third party for benchmarking information	Fill in and publish Project card (App2)	Requirement, no points achieved - required in order to proceed with rating	Project card	Applicable
Lea 03 - An integrated process	A part of the actual DC project, not a side project. Requirements for meetings and TIKO-implementation team. Requirement of environmental scheme for all project parties	Plan and implement	1	Documented implementation	New construction
Lea 04 Stakeholder involvement	Stakeholders identified, taken to participate in project, consultation plan, sustainability promotion to stakeholders, interactive workshop with local community, roles & responsibiltiies of the project clearly defined	Plan and implement	1	Stakeholder and consultation plan	New construction
Lea 05 Shared best practices and sustainability	Best practices are shared and published. Publishing a project summary (including sustainable goals) online, and creating a social media forum for opinions	Share and publish	1	Published in e.g. customer newsletter.	Applicable
Lea 06 Incentives for increased sustainability	Create a plan which uses incentives to increase sustainability, especially energy efficiency (may concern any stakeholder)	Create a plan with description of actions.	1	Action plan	Applicable
Lea 07 PPP	Private public partenership, all forms accepted	Description of actions/studies etc.	1	Description	Applicable
Operational management		Total points for section	15		
Op 01 Capacity optimization	Optimize DC capacity so that current and expected future needs taken into account without oversizing.	Create a plan with description of actions.	2	Documented implementation. Written analysis and a description of actions.	Applicable
Op02 Temperature	Temperature optimization (equipment lifecycle taken into consideration, cooling)	Measure and create a plan for optimisation of temperature	1	Operational environment temperature optimised according to e.g. ASHRAE envelope.	Applicable
Op 04 Virtualisation and cloud computing	Cloud computing and virtualisation technologies encouraged to be taken into use.	Implement a virtualisation and cloud computing platform.	4	1p = documented implementation. 2p = virtualisation rate over 50% 4p = virtualisation rate over 90%	Applicable
Op 05 Metrics reporting	3 metrics reported and published at least quarterly.	Choose metrics, publish and report	1	Project card	Applicable
Op 06 Resiliance optimization	Part 1: resiliance level studied, determined and justified on the basis of actual business needs Part 2: Multiple levels of resiliance used	Study resilience level	1+0,5	0,5p = no oversized resilience e.g. Tier3 setup serving in practice only "8-5 type" of customers. 0,5p = multi-tier capability.	Applicable
Op 07 Hand over and commissioning	Part 1: Commissioning expert team, commissioning manager for complex systems, full system test within 12 months of operations start with variable loads. Part 2: Analysis of DC traffic, hardware and applications and other features 8-16 months after beginning of operations. Check up on set goals, corrective actions	Commission according to credit requirements	1+1	Documented commissioning process	part 2 Applicable
Op 08 Security	Part 1: Physical security (controlled access, isolated floorplan, recording cameras etc.) Part 2: Data security (according to e.g. VAHTI/KATAKRI for public sector customers) Part 3: Contingency and recovery plan (contingency and recovery plans for both physical and data security incidents)	Create security and contingency plans	0,5+0,5+0,5	Approved plans	Applicable
Op 09 Life cycle costing	LCC as the base of all investments. Assessed in 2 parts: 20 year DC life-cycle analysis and 60 year building life cycle (60 year LCC for the possible reuse of the building after DC use not applicable). Calculations conducted according to Värkki. Active IT equipment (servers, storage, ..) lifecycle in calculations is 3 years	LCC calculations: over 20 year + 60 year periods, IT investment (3 years)	1,5	LCC calculations and results	part 2 Applicable
Op 10 Healthy work environment	Healthy work environment both a) physical and b) emotional. Assessment by occupational health officers	Create a healthy work environment plan	0,5	Plan for healthy work environment, assessment result summaries published to personnell	Applicable

TIKO- Sustainability Rating for Data Centers - New Construction Version

v 0.4

Credit table summary (to be used together with the User Manual)

Credit	Summary	Action	Points	Verification	Criteria suitable for existing buildings
Energy		Total points for section	46		
Ene 01 Sustainable cooling systems	Free cooling OR Capture and re-utilization of generated heat: Creating forms of capturing and utilizing heat loss. Profitability calculation, heat recovery efficiency reported on project card.	Primary cooling via free cooling (air, water, other resources). Points by procentual free cooling, measured in time over a period of 365 days. Free cooling metric added to project card. Profitability calculation, heat recovery efficiency, description of actions	Free cooling max 5 points, heat utilization 5-15 points	Free cooling: 5 points: < 90% of the time 3 points: 80 % -90 % of the time 1 points: 70% of the time Capturing & re-utilisation of heat: The points are based on the percentage of systems critical components (compute, storage, networking) waste heat targeted to be collected – e.g. if target is to recapture and reuse all waste heat, maximum 15 points shall apply.	Applicable
Ene 02 ERE calculation	ERE calculation according to the Green Grid definitions, giving more realistic results than PUE/NPUE.	Calculate perfomance	1-6	Calculated ERE value: 6 points: 1-1,5 3 points: 1,51-1,7 1 point: 1,71-1,8	Applicable
Ene 03 Certified IT equipment	Over 75% of the IT-equipment is Energy Star	Choose certified equipment	2	EnergyStar certificate	Applicable
Ene 04 On-site renewable/low-carbon energy and symbiosis	Part 1: Producing renewable/low carbon energy on site. Part 2: Working in symbiosis regarding energy usage	Describe and calculate	3+4	Documented implementation	Applicable
Ene 05 Energy metering and metric control	Part 1: a)submetering and automated reporting, b) metering for internal business units/customers Part 2: a) automated system, b) system connected to IT-systems so that building systems regulated according to IT-load	Describe submeters, metering, automation	4+1	Documented implementation. Part 1: 0,5p separate, automated metering for IT load vs infrastructure load 1p as above, metering by room/zone level 2p as above, metering by e.g. PDU level 4p as above, metering by device level Part 2: Connection to BMS 0,5 points, BMS and IT systems connected so to that building systems regulated according	Applicable
Ene 06 Energy simulation of DC	Energy simulation, including technology systems is done during design phase (both expected actual avarage load, and 100% design load). Used to optimize and compare design solutions.	Simulate	3,5	Model and result interpretion	NO
Sustainable site		Total points for section	5		
SS 01 Site selection	At least 3 sites assessed and compared according to sustainability principles when selecting site.	Assess	2	Documented implementation	
SS 02 Site condition	Greenfield 0 points, brownfield redevelopment 5 points, polluted site restoration 10 points.	Assess	1,5	Documented implementation	Applicable
SS 03 Water discharge from site	Part 1: A storm water expert is chosen. Expert creates storm water management strategy concerning quality and quantity of stormwater and other water discharge from site. Part 2: Rain water collected and used for non-potable uses	Create a plan and implement	1	Documented implementation	Applicable
SS04 Vegetation selection and green space maximization	Open space is maximized, vegetated surfaces maximized, plants and vegetation chosen so that it does not need additional watering under normal climate circumstances	Create a plan and implement	0,5	Documented implementation	Applicable
Water		Total points for section	5		
Wat 01 Water usage minimization, water recycling	Water usage minimization in cooling systems	Make a plan	1	Action plan	Applicable
Wat 02 Water Usage Effectiveness (WUE)	Calculated according to Green Grid specifications, added to project card and published	Calculate perfomance	0,5	Calculation results	Applicable
Wat 03 Water metering anf leakage detection	Part 1: Water metering and submetering, connected to BMS system Part 2: Leakage detection system	Install metering equipment	1+1	Documented implementation	Applicable
Wat 04: Temperature and quality of water released	If water used as a source of cooling, and the circulated water is released back into nearby water bodies, the temperature and quality of the water needs to be studied in relation to local water body ecology and optimized.	Studies, plan	1,5	Study of effects	Applicable

TIKO- Sustainability Rating for Data Centers - New Construction Version

v 0.4

Credit table summary (to be used together with the User Manual)

Credit	Summary	Action	Points	Verification	Criteria suitable for existing buildings
Waste and pollution		Total points for section	5		
WP 01 Waste management plan	A waste management plan concerning whole supply chain is made and put into practice.	Create a plan and communicate	2	Waste management plan 1p waste management plan for construction phase 1p waste	Applicable
WP 02 Construction site waste management	1 point when 50% of construction waste is diverted from landfill waste, 2 points when 80% is diverted	Create plan and calculate	0,5-1	Documented implementation	
WP 03 Emission impacts	CUE calculated and added to project card, equipment meet EPA Tier 2 standards, emission impacts of power systems are studied and alternative power (eg. Solar and fuel cells) are used when possible	Calculate	1	Project card	Applicable
WP 04 Recycling of servers and electronic equipment	100% of IT-equipment at the end of its life cycle must be diverted to re-use (functioning equipment) or handled as waste in an appropriate way (broken equipment).	Described in Waste management plan	1	Waste management plan	Applicable
Procurement		Total points for section	19		
Pro 01 Procurement of renewable/low-carbon energy	Purchasing 100% of energy consumption from renewable/low-carbon resources	Purchase certified energy	6	Certificate from provider. 0p not planned. 2p 50%-70% certified green energy 4p 71-90% certified green energy 6p 100% certified	Applicable
Pro 02 Sustainable procurement	Part 1: Sustainable procurement plan (financial, social, environmental aspects, bidding primary form of procurement), LCC base of all investments Part 2: IT procurement via bidding, service providers through bidding	Create a plan with description of actions.	3+2	Sustainable procurement plan	Applicable
Pro 03 Building and materials reuse	Part 1: maintain 75% of existing walls, floors and roof Part 2: reuse 5-10% of materials	Make a plan and calculate	1+1	Action plan	NO
Pro 04 Regional resources	Part 1: Materials from within 200km of project site Part 2: Local expert	Make a plan and calculate	1+2	Action plan	NO
Pro 05 Healthy materials	All materials are determined healthy. For example paints, adhesives, coatings, sealants do not contain VOCs or other harmful compounds. Building designed so that moisture damage is designed out, or an existing building checked for moisture.	Make a plan and calculate	1	Action plan	NO
Pro 06 Sustainable sourcing	A plan with principles for responsible suorcing is made. Certified products preferred, especially IT-metal backgrounds are checked.	Make a plan and calculate	2	Action plan	Applicable
		Total points	100		
Innovation		Total points for section	up to 10 additional points		
In 01	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 02	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 03	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 04	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 05	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 06	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 07	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 08	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 09	Sustainability which is not assessed in any other credit. Info added to project card and published		1		
In 10	Sustainability which is not assessed in any other credit. Info added to project card and published		1		

Project card for TIKO - Sustainability rating for data centers		Unit

Basic project data		
Owner		
Company		
Contact person		
Phone number and e-mail		
Operator		
Company		
Contact person		
Phone number and e-mail		
Project address		
Year of building construction		
Year of operation start		
Site area		m^2
Gross floor area (GFA)		m^2
Net internal area (NIA) (*1)		m^2
Floor areas by usage (NIA)		
Data halls		m^2
Workshop and storage areas		m^2
Office area		m^2
Ancillary areas		m^2
Tier-level		
DC capacity (Total kW, incl. cooling etc.)		kW

Sustainability data		
Lifecycle carbon footprint of building (*2)		t CO_2
Reference study period		years
Lifecycle cost of building (*2)		€ / year
Reference study period		years
Metrics reporting (3 of the metrics below)		
NPUE (Net PUE)		
PUE (Power Usage Effectiveness)		
kW/computing hour		kW/h
Total site kW usage		kW
CUE (Carbon Usage Effectiveness)		

Verbal description of project (incl. operation type description and highlights of 5 best sustainable actions)	

Self-assessment according to TIKO-criteria		
Overall rating		%
Sub-categories:		
Management		%
Energy		%
Sustainable Site		%
Water		%
Waste and pollution		%
Materials		%
Innovation points with descriptive names:		
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%
	1 %	%

(*1) The NIA is the floor area contained within the building measured to the internal face of the external walls, less the floor areas taken up by lobbies, enclosed machinery rooms on the roof, stairs and escalators, mechanical and electrical services, lifts, columns, toilet areas, ducts, and risers.

(*2) Lifecycle carbon footprint of building and lifecycle cost of building is calculated according to REM report principles and guidelines (Rakennusten Elinkaarimittarit (2013), chapters 7 & 8, http://figbc.fi/wp-content/uploads/2013/01/Rakennusten_elinkaarimittarit_2013.pdf).