A Finnish Environmental Classification for Building Projects: Experiences and New Developments

Laura Sariola
The Building Information Foundation RTS sr, Po.Box 1004, 00100 Helsinki, Finland, Europe

Jorma Säteri, Helsinki Metropolia University of Applied Sciences, Finland, jorma.sateri@metropolia.fi

Timo Rintala, Green Building Partners Oy, Kutomotie 16, 00380 Helsinki, Finland, timo.rintala@gbp.fi

Abstract. There are a lot of international or national environmental classification systems for building projects. The Building Information Foundation RTS noticed a need for national classification system in Finland, where the target was to improve indoor air quality, moisture management, carbon footprint, energy efficiency, material choices and worksite technology and of course to save money in construction processes and maintenance of the premises. A Finnish Environmental Classification system called Green Leadership Tool for construction processes has been developed for managing the actual building process, environmental, economic and sociocultural aspects as described in the CEN/TC 350 standards. The criteria were made with construction industry and published by The Building Information Foundation RTS in the year 2017.

The major part of the criteria utilizes existing classifications and certifications developed in Finland as EPD’s, Building Performance Indicators of GBC Finland, the emission classification of building materials and cleanliness classification of HVAC devices (M1-label), Classification of Indoor Environment (CIE2018), Energy Audit (E-Value), Green Factor Tool, Drychain10 and other relevant information provided into market.

The tool and criteria are suitable for all property owner’s despite of the background and business model. There are four construction project types included: new building, renovation and partial renovation, enlargement/change of the space and two main buildings types: office/service and residential buildings. The Finnish legislation has been updated on the year 2017, the new LEVEL’s certification criteria have been developed and the new Classification of Indoor Environment 2018 has been updated and consequently there was a demand to update the RTS criteria as well. The classification was launched in the spring 2017 and there are 83 active projects and 140 users in the tool on April 2019. The environmental classification of building processes follows the changes, developments and needs of the market, therefore the criteria will be updated continuously. The new criteria have been used in several projects and experiments of the criteria and projects will be presented.

1. Introduction
Responsible development of residences, offices and service buildings is valued highly. Making better use of natural resources and realizing lower property usage costs incentivizes investments in environmental factors when buildings are designed. This approach is valued by residents, property developers, and owners, as well as societal decision-makers.

RTS Environmental Classification is a system for managing construction process in a sustainable way. The system recognizes best national (Finnish) building strategies and practices. While there are
globally accepted certification schemes, a need for national tool with local perspective and integration to local best practices has been recognized especially in non-profit real estate sector as municipalities renovating and building schools, day care centers, health care centers and other social property. The environmental classification tool makes it easier to agree upon matters such as the energy efficiency targets of buildings and solution development.

The classification was launched in the spring 2017, it follows the changes, developments and needs of the market, therefore the criteria will be updated continuously.

The tool has been developed primarily for the Finnish public real estate owners as municipalities, but it is suitable for all property owner’s despite of the background and business model. The purpose of the classification system is to manage, monitor and lead the construction project efficiency and achieve all the way better premises to avoid problems in the future. The expected outcome of the tool is an enhanced environmental performance of the final built building. The real outcome and constructed premise will be certified. The certification after construction phase is mandatory if the owner of the project like to use certification label. The third phase, Use, is not mandatory if the highest certification level is not on purpose to obtain, but possible to show real situation after few years use.

There are four construction project types included: new building, renovation and partial renovation, enlargement/change of the space and two main buildings types: office/service buildings and residential buildings. To receive a certification, the whole construction process must pass a quality check and the outcome must be verified by a third-party auditor which is trained by The Building Information Foundation RTS sr. The auditor must pass a test arranged by the RTS. The Committee PT20 RTS Environmental Classification is responsible for future developments.

2. Best practises used in the tool

High indoor air quality is recognized as a crucial issue of both national health and economy in Finland. There are several projects and programs going on to ensure and excite to improve good indoor air quality, moisture management and use of EPD’s as a source of carbon footprint calculations in Finland. When the project started, the work group named three main targets for the classification:

1. To improve energy efficiency
2. To improve indoor air quality
3. To improve moisture management

The Finnish legislation is ground for the tool, every target is above the basic requirements. In addition, there are few key classifications and certifications utilized to create the criteria for the Green Leadership Tool. These key factors are the Building Performance Indicators of GBC Finland, the Emission Classification of Building Materials and Cleanliness classification of HVAC devices (M1-label), Classification of Indoor Environment, Energy Audit (E-Value), Green Factor Tool (GF) and Drychain10.

2.1. Classification of Indoor Environment 2018

The Finnish Society for Indoor Air Quality, FISIAQ, has a leading role in indoor air improvement and especially in developing the Finnish Classification of Indoor Environment 2018, even though the publication is a result of co-operation of many organizations. The Classification of Indoor Environment has three parts:

1. The classification of indoor climate gives target and design values for thermal conditions, odour intensity, noise levels, ventilation and indoor air pollutants.
2. Guidelines for design and construction including classification of cleanliness in construction, principles and procedures for the main stages of construction works.
3. The Emission Classification of Building Materials contains target values for odours and emissions of the materials, fixtures and furniture and recommended maximum surface area of materials based on their emissions.

![Figure 1 Target values for operative temperature: The dark area represents the target value range (target temperature + allowed deviation).](image)

A temperature control is essential for the indoor environment. In the updated classes S1 and S2, the temperature must stay within target value range 90% of the operating time on the dark area. There is an exception in the class S2 for residences where the temperature must stay 80% of the time within target value range within dark area. The content must be considered when setting targets in the Green Leadership Tool. One third of the points in the tool can be gathered from indoor air quality related criteria.

2.2. The Emission Classification of Building Materials

The Finnish Society of Indoor Air Quality and Climate (FiSIAQ) introduced over twenty years ago in 1995 a Classification of Indoor Climate, Construction Cleanliness, and Finishing Materials. The first revised edition, Classification of Indoor Climate 2000, was published in 2001 and the second edition Classification of Indoor Environment 2008 was published in 2008 and the third edition was published on May 2018. Based on the criteria set in the classifications, The Building Information Foundation RTS sr started M1-labelling of building products in 1996, named Emission Classification of Building Materials and Cleanliness Classification of Air-handling Components.

The new criteria for Emission Classification of Building Materials mentioned in the third part has been set in the classes M1 and M2. The content must be considered when setting targets in the Green Leadership Tool. All the standards behind the Classification of Building Materials can be found from the protocol: M1 Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials. One of the accepted testing laboratories is in the USA and other in Europe.
2.3. The Building Performance Indicators

The Building Performance Indicators were developed to react to the demand of key indicators that assesses environmental efficiency of properties and to ensure principles of sustainable development. The project was implemented with support of SITRA and published by the Green Building Council Finland in the year 2013. The eight indicators are based on the European CEN/TC 350 standards including E-Value, Life-Cycle Carbon Footprint, Life-Cycle Cost, Indoor Air Class, Measured Energy Consumption, Operational Carbon Footprint, Base-load Demand, User Satisfaction.

2.4. The Green Factor Tool and iWater

The Green Factor tool (GF) was developed to find out environmental impacts of green infra-structure and to measure actions for climate change adaptation, mitigation and for urban green compensation in ILKKA-project coordinated by Aalto University and City of Helsinki in the year 2014. The tool is put in place and implemented by several Finnish, Swedish, Norwegian and German municipalities. Green Factor tool idea was implemented to the Green Leadership tool to help preserve green infrastructure and nature elements characteristic to the area.

iWater – Integrated storm water management projects on the years 2015-2018 purpose was to develop Integrated Stormwater Management concept to support urban planning and to create high quality and resilient urban environments in the Baltic Sea region. The targets are integrated to the RTS Environmental Classification.

2.5. Environmental Product Declarations (RTS EPD)

The Building Information Foundation RTS sr launched a national EPD program first time in 1998, second time in 2004 and third time in the year 2016 and after that there have been produced several RTS EPD’s published by the RTS. Environmental performance of construction products is compiled according to the standard EN 15804+A1 and (A2) and with a guidance’s and methodology processed in the committee PT18 RT EPD’s. The Information gathered to the Environmental Product Declaration (EPD) is verified by a third party and certified by the PT18 RT EPDs work group. It is possible to gain points in the Green Leadership Tool, if over 10 verified EPDs according to EN 15804 have been used in the project despite of the publisher of the EPDs.
2.6. Moisture management with Drychain10

Drychain10 was developed to control moisture management by considering ten critical points as moisture outside the building, rain, roof and walls, ventilation, condition of water pipes, moisture proof in bathrooms and other spaces, moisture content of the concrete and surface coating, wetting of the building materials and poor maintenance. The project was implemented by City of Oulu in the year 2016, the operator is RALA. Part of the Drychain10 requirements have been adapted to the Finnish legislation on December 2017 and therefore excluded from the new criteria of RTS Environmental Classification system.

3. The new requirements of the RTS GLT Environmental Classification

The table below (Table 1) will show a list of the criteria to be achieved at minimum in office buildings and demonstrate the scale of the star classes. There are five classes, 1-5 stars, where the highest number of points a project earns the most precious label of five stars. The whole process has three phases: Design, Construction and Use.

Table 1 Classification scale and new requirements

| Criterion                              | 1 star | 2 stars | 3 stars | 4 stars | 5 stars |
|----------------------------------------|--------|---------|---------|---------|---------|
| Points                                 | 25     | 40      | 55      | 70      | 85      |
| P1.2 HVAC Commissioning                |        |         | 50%     | 50%     | 50%     |
| P1.3 Userguide and training            |        |         |         | 100%    | 100%    |
| P2.1 Moisture safe design              |        |         | 75% (DC10) | 75% (DC10) | 75% (DC10) |
| P2.2 Moisture safe construction        | 75%    | 75%     | 75%     | 75%     |
| Y1.1 Life cycle carbon footprint       | 15%    |         |         |         | 30%     |
| Y2.1 Energy efficiency                 | 20%    | 30%     | 40%     | 40%     |
| S1.1 Indoor temperature                | 25%    | 50% (S2) | 50% (S2) | 50% (S2) |
| S1.2 Air quality                       | 50% (S2) | 50% (S2) | 50% (S2) | 50% (S2) |
| S1.4 Material emissions                | 50% (M1) | 50% (M1) | 50% (M1) | 50% (M1) |
| In-use audit after 1 or 2 years         |        |         |         | yes     |

The content of the criteria set in the RTS Environmental Classification is demonstrated in the table below and new criteria set in the version 1.1 has been bolded and highlighted in grey colour:
### Table 2 Criteria of the Green Leadership Tool in the version 1.1

| Main group       | Groups                   | Criteria                                                                 | New RTS GLT Criteria                                                                 |
|------------------|--------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Process          | Commissioning           | P1.1 Design phase audit                                                  | No changes                                                                           |
|                  |                          | P1.2 Commissioning                                                        |                                                                                      |
|                  |                          | P1.3 Userguide and training                                              |                                                                                      |
| Moisture safety  | P2.1 Moisture safe design| Adapted requirements in Finnish legislation and Drychain10               |                                                                                      |
| Site sustainability | P3.1 Sustainable construction | Adapted requirements in CIE2018                                          |                                                                                      |
| Site sustainability | P3.2 Site dust management |                                                                                      |                                                                                      |
| Economy          | Life cycle costs        | T1.1 Life cycle costs                                                    | Adapted LEVEL’s requirements                                                        |
| Maintenance      | T2.1 Durability          | Adapted LEVEL’s requirements                                             |                                                                                      |
|                  | T2.2 Maintainability     |                                                                                      |                                                                                      |
|                  | T2.3 Adaptability        |                                                                                      |                                                                                      |
| Environment      | Carbon footprint        | Y1.1 Life cycle carbon footprint                                          | Adapted LEVEL’s requirements                                                        |
|                  |                          | Y1.2 Resource efficiency                                                 | New criterion, adapted LEVEL’s requirements                                           |
| Energy           | Y2.1 Energy efficiency  | E-value (class A-30%), adapted requirements in Finnish legislation       |                                                                                      |
|                  | Y2.2 Energy metering     |                                                                                      |                                                                                      |
|                  | Y2.3 Consumption targets |                                                                                      |                                                                                      |
|                  | Y2.4 Core system efficiency |                                                                                      |                                                                                      |
| Water            | Y3.1 Water efficiency   | Adapted LEVEL’s requirements for resilience, iWater                       |                                                                                      |
| Local impacts    | Y4.1 Ecological value    |                                                                                      |                                                                                      |
|                  | Y4.2 Cyclist and strollers spaces |                                                                                      |                                                                                      |
| Health and wellbeing | Indoor Air Quality     | S1.1 Indoor temperature                                                  | Adapted CIE2018 requirements and LEVEL’s requirements for resilience (S1+ 3°C). Included low emitting fixture in S1.4. |
|                  | S1.2 Air quality        |                                                                                      |                                                                                      |
|                  | S1.3 User controls      |                                                                                      |                                                                                      |
|                  | S1.4 Material emissions |                                                                                      |                                                                                      |
| Visual comfort   | S2.1 Daylight           | No changes                                                                 |                                                                                      |
|                  | S2.2 Lighting quality   |                                                                                      |                                                                                      |
| Acoustics        | S3.1 Space acoustics    | Adapted requirements in Finnish legislation (STI-INDEX)                   |                                                                                      |
|                  | S3.2 Sound insulation   |                                                                                      |                                                                                      |
| Innovation       | Innovation              | I Innovation                                                              | No changes                                                                           |

#### 3.1. Criterion P2.1 Moisture safe design - an example of the content

This criterion is a compulsory criterion in three, four- and five-star building projects. Moisture management has been considered also in the criterion P2.2 Moisture safe construction, which is compulsory in two to five-star building projects.

Content of the criterion P2.1 Moisture safe design

Design phase includes identification of moisture risks and managing the risks by ensuring that the design solutions will work. High-quality management of moisture risks (75% of the weighted value) can also be fulfilled by acquiring the Drychain10 status.

Management of moisture-related risks during the design phase, 75% of the weighted value.

1: A qualified impartial Moisture Safety Expert, whose supervisory responsibilities cover the phases of general design and implementation planning, has been named for the project.

- Designer: Contract on appointing a person in charge and a list of tasks.
- Developer:
- User:

2: The site has been subjected to a moisture risk assessment, which was prepared by all designers. Based on the risk assessment, a specific risk category for each building section has been defined.

- Designer: Moisture risk management report and memo of the procedure.
• Developer: a report of reviewing the moisture risk assessment with the contractor.

3: Drying times for critical structures have already been calculated in the design phase, thus ensuring a realistic construction schedule in which the drying times are being considered by adding the critical times of the project to the schedule.
• Designer: A general schedule completed with critical times of the project.
• Developer:
• User:

4: The moisture risk management of the building project have been made based on description of the risk management in a separate document or risk list.
• Designer: Moisture risk management report and memo of the procedure.
• Developer: a report of reviewing the moisture risk assessment with the contractor.
• User:

5: Renovation: input parameters for renovation purposes has been obtained from a condition assessment of the building. If indoor air problems have been detected before the renovation, a qualified building health expert must be included in the project.
• Designer: Summary report of the condition assessment of the building, audit report of the building health expert AND report on the risks that have been considered in the plans for the design phase moisture safety plan.
• Developer: a report of reviewing the moisture risk assessment with the contractor.
• User:

Separate inspections for moisture risk structures, 25% of the weighted value:

6: For high (category R2) and very high (category R3) moisture risk structures (according to moisture risk assessment) a separate building physics audit has been performed by an impartial building physics engineer OR the building has only normal structures considering moisture risks.
• Designer: building physics audit report OR moisture risk assessment for R1 category.
• Developer: a report of reviewing the moisture risk assessment with the contractor.
• User:

7: The project task force has dealt with the risks identified during the building physics audit, risk management plan has been decided and remarks are corrected in the plans.
• Designer: a report of the risks identified during the audit AND confirmation of settled repairs.
• Developer: Audit reports of moisture risk assessment of constructions (risk categories R2 and R3) on construction site by a qualified moisture management supervisor.
• User:

4. Audit and Certification procedure

Today there are 50 committees in the Building Information Foundation RTS sr. Twenty of these are principal committees, like PT20 RTS GLT Environmental Classification. There can be workgroups under the principal committees like classification work groups.
Figure 4. Organization chart

The auditors, who are trained experts authorized by the Building Information Foundation RTS, inspect the contents and scores of the reports saved on the tool and decide whether to grant approval. RTS invites auditors to audit projects; auditors cannot select projects independently. RTSs’ classification working group processes the auditing reports, confirms the classification, and certifies the project. After that the RTS sends a certificate of approval to the project owner and publish basic information of the projects on the web.

Companies that have chosen to use RTS Environmental Classification for construction processes have noted, that most important thing is that the tool focus on the most relevant issues: it considers Finnish legislation and northern climate and it will guide the process and help with material choices. The RTS Environmental Classification has been used for construction processes of new buildings as hospitals, day-care centres, schools, accommodation services, restaurants, public real estate, dwellings and renovations.

5. Conclusions

RTS Environmental Classification will help construction industry in setting environmentally acceptable targets for construction projects when operating in Finland. The Finnish legislation and both indoor air and outdoor air circumstances have been considered and therefore the constructor have no reason to find out the information from other sources. This will help when setting targets to the project. The Classification of Indoor Environment (CIE) has been used in multiple projects from the beginning. By including all the CIE requirements to the RTS the process and outcome can be certified after the project. There are 90 projects going on in May 2019, most of the projects are office and residence buildings, in addition there have been started four hospital projects.

With continuous update of the existing classification systems and with wide cooperation of the construction industry it is possibly to create and maintain successful methods and tools in striving for healthier and more comfortable buildings and in addition to improve construction processes and maintenance of the premises. There is a lot of discussion about carbon footprint calculation and it will be among energy efficiency and indoor air the most relevant subject to improve in the future. To respond to the demand of life cycle approach, the Building Information Foundation started a project to create criteria for in use -period. The main targets are HVAC, safe and security and environment. There will be created “a toolbox” for real estate management team for continuous improvement in the project. The project will be concluded in the end of the summer 2019.
6. Acknowledgement

The writers like to thank all the experts and users of the RTS Environmental Classification for participating criteria development.

7. References (some of them only in Finnish)

[1] CEN/TC 350 standards
[2] Classification for Indoor Environment 2018, Finnish Society of Indoor Air Quality and Climate, FISIAQ, Espoo, Finland (will be published on May 2019 in English)
[3] Cleanliness Classification of Air-handling components, The Building Information Foundation RTS sr, http://m1.rts.fi
[4] Drychain10, Rakentamisen Laatu RALA ry, http://kuivaketju10.fi/
[5] Emission Classification of Building Materials, The Building Information Foundation RTS sr, http://m1.rts.fi
[6] Green Leadership Tool Criteria 2018, The Building Information Foundation RTS sr, http://glt.rts.fi
[7] HTP Values 2016: CONCENTRATIONS KNOWN TO BE HARMFUL, Publications of the Ministry of Social Affairs and Health 2016:8
[8] LEVEL’s criteria, http://www.buildup.eu/en/news/introducing-levels-common-language-sustainable-buildings-0
[9] M1 Emission Classification of Building Materials: Protocol for Chemical and Sensory Testing of Building Materials, The Building Information Foundation RTS sr, http://m1.rts.fi
[10] The Building Performance Indicators, Green Building Council Finland ry, http://figbc.fi/en/building-performance-indicators/
[11] The Green Factor tool (GF), http://ilmastotyokalut.fi/en/
[12] iWater, http://www.stadinilmasto.fi/en/adapting-to-climate-change/iwater-integrated-storm-water-management/

**Finnish legislation:** (can be searched from www.finlex.fi by reference code (e.g 465/2014), some of them are described only in Finnish or Swedish)

- Decree of the Ministry of Social Affairs and Health on Health-related Conditions of Housing and Other Residential Buildings and Qualification Requirements for Third-party Experts (545/2015)
- Decree of the Ministry of the Environment on Foundation Structures 465/2014
- Land Use and Building Act (amendment 222/2003 included)132/1999.
- Land Use and Building Decree 895/1999.
- Ministry of the Environment Decree on the fire safety of buildings 2017
- Terveydensuojelulaki. Suomen säädöskokoelma 763/1994.
- The National Building Code of Finland, Ministry of Environment, http://www.ym.fi/en-US/Land_use_and_building
- Ympäristöministeriön asetus rakennuksen ääniympäristöstä 2017
- Ympäristöministeriön asetus rakennusten kosteusteknisestä toimivuudesta 782/2017
- Ympäristöministeriön asetus uuden rakennuksen energiatehokkuudesta 1010/2017
- Ympäristöministeriön asetus uuden rakennuksen sisälmastosta ja ilmanvaihdosta 2017