Interaction of obligatory regulations and voluntary ecolabels for climate change mitigation in the Finnish building sector

R Holopainen¹, M Airaksinen², K Bergbom¹, H Vaarala¹

¹Ecolabelling Finland, Urho Kekkosen katu 4-6 E, Helsinki, 00100, Finland
²Finnish Association of Civil Engineers RIL, Lapinlahdenkatu 1 B, Helsinki, 00180, Finland

riikka.holopainen@ecolabel.fi

Abstract. This paper compares the existing Nordic Swan Ecolabel criteria for new buildings with the National Building Code of Finland. The added value of the ecolabelling is presented and the role of the ecolabelling as a test bed for upcoming building regulations is introduced.

1. Introduction

Three types of voluntary environmental labels have been identified by the International Organization for Standardisation (ISO). Type III labels are voluntary programmes providing quantified environmental data of a product, e.g. the Environmental Product Declarations (EPDs). Type II label is based on self-declaration of environmental predication, not certified by an impartial third party. Type I is a voluntary, multiple-criteria based, third party programme. It awards a license that authorises the use of the environmental label on a product or service that is proven environmentally preferable within a specific product or service category [1, 2].

One example of Type I labels is the official ecolabel of the Nordic countries, the Nordic Swan Ecolabel, which was established in 1989 by the Nordic Council of Ministers as a voluntary ecolabelling scheme for Denmark, Finland, Iceland, Norway and Sweden. Currently the Nordic Swan Ecolabel has over 60 different product groups with more than 200 different product types and more than 25,000 different products.

The criteria development process (Fig. 1) of the Nordic Swan Ecolabel is based on preliminary studies highlighting areas where the need for requirements is greatest. Development of new criteria and revision of existing criteria takes place in close contact with businesses and other stakeholders with relevant knowledge, using available literature from academic institutions and experts. The final proposal is passed by the Nordic Ecolabelling Boards. The final proposal is then uploaded to both Nordic and national websites, together with background documents and comments from the public consultation.
2. Nordic Swan criteria for new buildings
Nordic Swan includes criteria for both new and renovated buildings. The criteria have requirements for the entire building process, from cutting of trees to recycling of waste. This paper concentrates on new buildings, where the criteria for new built small houses, apartment buildings and pre-school buildings have been revised in 2015 [3].

The criteria are valid for following newly constructed building types: small houses, apartment buildings, buildings for pre-schools and schools/educational buildings, extensions to existing buildings and homes for the elderly. The extension to an existing building must be a residential building, pre-school or school, and only the extension part can be ecolabelled. The homes for the elderly must be classified as homes and not as care facilities. This also applies to residential institutions for persons with physical or mental functional impairment. Shared areas for the home's residents and staff areas can also be covered by the Nordic Swan Ecolabel.

The criteria consist of 41 obligatory requirements and 14 point-score requirements. The 41 obligatory requirements consist of
  a) general requirements (O1-O3)
  b) requirements for resource efficiency (O4-O14) divided into energy and climate (O4-O6), waste (O7 and O8) and indoor environment (O9-O14)
  c) requirements for chemical products, construction products, construction goods and materials (O15-O29) divided into general requirements (O15), chemical products (O16-O21), construction products, construction goods and materials (O22-O26) and timber, bamboo and fibre materials (O27-O29).
  d) quality management of the construction process (O30-O34)
  e) quality and regulatory requirements (O35-O40) and
  f) instructions for residents and property managers (O41).

The obligatory requirement O3 sets the number of point-score requirements to be achieved. Point-score requirements P1-P5 refer to the requirements for resource efficiency, especially to energy and climate. Point-score requirements P6-P13 refer to the requirements for chemical products, construction products, construction goods and materials. Point-score requirement P14 deals with innovative measures taken in
the construction process such as ecosystem services, environmentally friendly transports or energy-related measures.

3. Comparison between Swan label criteria and the National Building Code of Finland

The Swan label criteria and the National Building Code of Finland [4] are compared in this chapter. Here the obligatory (O) and voluntary point-score (P) ecolabelling requirements are shortly presented and followed by the possible corresponding requirements set by the National Building Code of Finland.

3.1. General requirements of the Nordic Swan Ecolabel

The Overall description of the building (O1) includes details of the building dimensions, structures, systems, materials, supplementary buildings. It also demands a statement of individual electricity metering. Responsibility for Nordic Swan Ecolabelling (O2) states the licence holder’s responsibility for all requirements in the criteria document and for the fulfilment of the requirements, no matter who the work is performed by, until the building is ready for occupation. The number of points achieved (O3) defines the minimum number of filled point-score requirements in order to be granted a Nordic Swan Ecolabel licence. For Finnish buildings this minimum number is 16 for apartment buildings, 15 for small houses and 14 for pre-school and school buildings.

3.2. Energy consumption and production

The overall energy consumption O4 must fulfill the energy class A according to the Ministry of the Environment's regulation for buildings' energy performance (1010/2017). For pre-schools and schools, the maximum energy consumption is 85% of the regulations limit of 100 kWh/m². Cottages and holiday homes are treated as small houses for permanent residence and holiday apartments as apartment buildings. The energy calculation must be performed in accordance with Ministry of the Environment's regulation for buildings' energy performance or equivalent in Finland. For extensions to existing buildings, the energy requirement and energy calculation concern only the extension part of the building.

The point-score requirement P1 includes energy contributions from local energy sources or energy recovery. Here maximum 6 points can be achieved by the utilization of local energy sources (solar collectors, solar cell panels or heat recovery from domestic hot water consumption).

National Building Code of Finland sets the minimum requirement for the calculated energy performance reference value (E-value), which is a building’s calculated annual consumption of delivered energy weighted by energy carrier factors per the building’s net heated area. The E-value calculated in accordance with the building’s intended use category and shall not exceed the limit values set by the building code. National Building Code of Finland calculates the energy use by using standardized building occupancy and equipment usage schedules.

One point-score can be achieved by individual metering and display of domestic hot water consumption (P2). Also, one point can be achieved by calculating the hot water circulation (HWC) energy losses for building types with requirements on maximum waiting time for hot water in the tap by the national building regulations (P3).

National Building Code of Finland assumes the domestic hot water consumption calculated by standard heat load which is a function of square meters.

The lighting management requirement O5 requires automatic demand control for outdoor and indoor lighting. Exceptions are lighting inside apartments, workplace lighting, worktop lighting, lighting fitted into technical installations and equipment, lighting of lifts and emergency lighting.
National Building Code of Finland by default uses a standard load by using standardized occupancy/load periods, but there is an option to calculate also in a detailed level energy consumption if the building has an advanced lighting management system.

Energy-efficient white goods must fulfill specific energy class requirements: class A++ for washing machines, fridges, freezers and tumble dryers; class A+ for dishwashers; class A for ovens and combined washing machine and tumble dryers and class B for extractor hoods (O6). Maximum 3 point-score requirements can be collected from products classified in the best energy class within a product type/category (P4). Maximum 3 point-score requirements can also be collected if all products within one type/category of energy-labelled sanitary tapware fulfill the required energy class of that type/category (P5).

National Building Code of Finland assumes all white goods as a standard load and does not specify the loads based on different classifications.

3.3. Climate impact of materials

The point-score requirement P6 recognizes reducing the climate impact of cement and concrete use with two alternative ways. First alternative: at least 50% of a certain product type is covered by cement products that contain cement clinker at maximum 70% by weight. Points can be achieved from max 2 of following product types (1 point per product type): foundations, bearing systems and ground/floor decks, roof elements, wall elements, façade elements, balcony elements, terraces and verandas. Second alternative is to collect max 2 points of following measures (1 point per measure): deliberate work to differentiate concrete quality as required for the building (i.e. different concrete qualities for different construction details) or deliberate work with slim/lean concrete structures by taking various measures (high-performance concrete, reinforcement material, reinforcement technique, edge foundations, etc.).

National Building Code of Finland takes the material properties into account as thermal properties and calculates the energy consumption based on these. Currently Finland is creating a method to calculate embodied energy and CO₂ emissions of building materials during the whole life cycle. The method is assumed to be in line with European standards.

3.4. Green initiatives

A maximum of 3 points can be achieved for innovative measures taken in the construction process (P14). These innovative measures cover ecosystem services (green roofs/façades, local disposal of surface water, opportunities created for urban cultivation, creation of gardens for biological diversity, creation of habitats for insects, birds, and bats), environmentally friendly transports (indoor bicycle workshops for residents, at least 1.5 bicycle parking spaces per flat provided and equipped with access to frame locks, at least 50% of bicycle parking weather protected, at least one parking space equipped with access to charge electric vehicles) and energy-related measures (fixed or movable exterior solar protection on all south-facing windows, intelligent monitoring and display of the residential unit/preschool/school's energy consumption, possibility of energy storage in the building for flexibility, all white goods within a product group connected directly to the district heating network or the domestic hot water network).

National Building Code of Finland does not recognize green indicatives, but those are voluntary bases.

3.5. Requirements for waste sorting and recycling

Possibility for sorting at source O7 requires sorting vessels with at least four waste fractions in residential units and at least five waste fractions in pre-school or school kitchens or adjacent spaces. O9: Waste sorting stations with at least six waste fractions are obligatory for apartment buildings with more
than eight flats, pre-schools and schools (O9). Maximum 3 points can be achieved by recycling of building waste (P13). Here 3 points are achieved if the ratio of building waste from the construction process that is sorted for recovery or recycling of materials is 70% or higher. For 60-70% 2 points are given and for 50-60% 1 point. National Building Code of Finland does not set yet the requirement of building waste recycling. However, many construction companies have already long time developed their own system. The household waste is well recycled or used as energy, but in building material waste new investments are needed in order to increase building site waste recycling.

National Building Code of Finland does not set minimum requirement for waste sorting, but at city level there are requirements for waste sorting.

3.6. Requirements for indoor environment

Radon prevention measures should comply with national official requirements and radon level limits (O10). If the building is not built radon-proof, the risk analysis of the presence of radon from both the ground and filling materials must be conducted and support the level of radon prevention measures.

National Building Code of Finland sets requirements levels for radon concentration.

A moisture prevention plan or a description for moisture prevention work is required (O11). A competent moisture expert technician with required experience must be nominated to monitor adherence to the moisture prevention plan. The moisture prevention work should at least include the selection of damp sensitive materials and technology, relevant for the origin of harmful moisture, weather protection and other handling of materials and building/construction elements at the construction site, measures taken to ensure that the building dries out sufficiently and statement of the time this is estimated to take, determination of the highest permitted moisture status of various materials (critical moisture state) and control of moisture protection by calculating or measuring the moisture in concrete. If measures are conducted, borehole measurements must be undertaken as surface moisture measurement is not sufficient to determine whether the concrete slab is dry enough. National guidelines must be followed.

National Building Code of Finland sets requirement for moisture prevention and prevention of risks of moisture damage.

A function-control must be performed for ventilation systems before they are taken into use (O12). For apartment buildings the control must be performed for at least 10% of the total number of flats, but minimum one flat. Pre-schools and schools must have automatic controls for demand management of air volume/ventilation.

National Building Code of Finland sets requirement for ventilation rate and system performance. The function control is done by the system providers.

Noise environment planning/projecting must be performed for pre-schools and schools (O13). Here reverberation and one additional parameter must fulfil noise class B and other parameters noise class C. Temporarily occupied rooms, such as entrance halls, photocopying rooms, changing rooms and WCs, are exempted from this requirement. The P8: Residential buildings can achieve 1 point if the building fulfills recommended supplementary requirements for low frequencies concerning impact noise and/or airborne noise according to the national acoustic environment standard, in combination with sound class C. Residential buildings can achieve 3 points if the building fulfills the sound class B for two optional acoustic environment parameters.

National Building Code of Finland set requirements for maximum noise levels in different types of occupation spaces and at day and night time. In addition, the health authorities have recommendations for noise levels.
Daylight requirements are set by the obligatory requirement O14. Daylight factors (DF) for pre-schools and schools must be at least 2.5% in common rooms/playrooms or classrooms as the average value. For residential buildings the required DF of the national building code must be fulfilled in at least one occupiable room per residential unit. The DFs must be calculated using a specified computer program. If a DF limit is not stated in the relevant country’s building code, compliance can be demonstrated by using a DF requirement from another Nordic country of choice.

National Building Code of Finland sets requirements for daylight indirectly by setting the minimum requirement of window area in living rooms.

Requirements for formaldehyde emissions are set by the obligatory requirement O15. All wood-based panels containing more than 3% by weight formaldehyde-based additives have specific requirements for formaldehyde emissions except panels solely marketed as façade panels.

National Building Code of Finland sets requirements for impurities in indoor air.

3.7. Requirements for chemical products, construction products, construction goods and materials

All construction products, construction goods, materials and chemical products to be used to construct the Nordic Swan Ecolabelled building must be listed in the product list and logbook of the building (O15) except products that are used to a very limited extent or has limited impact on health and the environment.

National Building Code of Finland does not set requirements for labelling, that is for voluntary bases.

The classification of chemical products (O16) must be in line with current legislation (CLP Regulation (EC) No 1272/2008. Carcinogenic (Carc), mutagenic (Muta.) or reprotoxic (Rep) classified chemical substances according to CLP Regulation 1272/2008, may not be used in the production of Nordic Swan Ecolabelled buildings (O17). Few exemptions are listed in the criteria documents. The criteria contain concentration limitations to preservatives or combination of preservatives in indoor paints and varnishes (O18) and other chemical products for indoor use (O19). The criteria have prohibitions or restrictions to various individual substances or substance groups (O20) including e.g. the substances on the ECHA Candidate List, substances evaluated by the EU to be PBT substances (persistent, bioaccumulative and toxic) or vPvB substances (very persistent and very bioaccumulative).

National Building Code of Finland only sets requirements for indoor air concentration levels and other issues must be done according to law.

Nanoparticles from nanomaterial may not be constituent in chemical products, excluding pigments, naturally occurring inorganic fillers, synthetic amorphous silica and calcium carbonate and polymer dispersions (O21). The criteria have restrictions (O23) for active adding of nanoparticles from nanomaterial to the glass on balconies or the outer glass surface of windowpanes, window doors and exterior doors. There are also restrictions to the surfaces where chemicals or additives added to provide an antibacterial or disinfecting surface can be used.

National Building Code of Finland do not give the criteria for this, but the issue is handled in other parts of the Finnish legislation.

Several construction products, goods and materials are excluded from the set requirements, such as thermal, acoustic and technical insulation, sealing products, drainage pipes and electricity cables (O22). However, also these groups have restrictions to used substances such as substances on EU Candidate list etc.
National Building Code of Finland is not giving requirements but the law.

The use of chlorinated plastics (PVC) including polyvinylidene chloride PVDC is not permitted on interior surface layers on floors, roofs and walls (O24). However, service areas where unauthorized persons do not have access, are excepted from this rule.

National Building Code of Finland only sets requirements for indoor air concentration.

3.8. Requirements for recycled material, copper, wood products and ecolabelled products

A certain proportion of recycled material must be used in windows and exterior doors made from non-renewable materials (O25). Recycled plastic resources may not contain lead or cadmium in levels exceeding 100 ppm. According to the point-score requirement P12 one point can be achieved for each category of construction product and construction material outside the vapor barrier consisting of at least 25% of recycled or reused raw material. Maximum point score is 3.

National Building Code of Finland does not set requirements for the use of recycled material.

Obligatory requirement O26 concerns copper in domestic water pipes and as façade and roofing material. Domestic water pipes made of copper are not permitted. The maximum copper content of the cladding for roofs and façades and products for roofs and façades is 10% by weight. The requirement excludes closed water piping systems and service areas.

National Building Code of Finland does not set requirements for the use of copper.

Nordic Ecolabelling maintains a list of prohibited tree species (www.nordic-ecolabel.org/wood/), which are not permitted to be used in Nordic Swan Ecolabelled buildings (O27). This restriction is also valid for timber and wood products used in construction but not incorporated in the building (e.g. wood in casing and mold). The used wood raw material must be stated, and the supplier of the material must be Chain of Custody certified by the FSC/PEFC schemes (O28). Point-score requirement P11 gives one point if at least half of the need for wooden mouldings (mouldings, skirtings, baseboards, level drops and similar) is covered by certified timber products and 2 points if the entire requirement is fulfilled by certified timber products. Same requirements for the supplier as in O28 apply also for P11. Of all wood raw material used in Nordic Swan Ecolabelled buildings a minimum of 70% by weight must origin from forestry certified under the FSC or PEFC schemes or be recycled material. The remaining proportion of wood raw material must be covered by the FSC/PEFC control schemes or be recycled material. Point-score requirements P7 gives maximum 2 points can be achieved by fulfilling 1-2 of following measures (1 point per measure): 1) bearing systems/joists of wood or other renewable material, 2) bearing walls or bearing roof structures of wood or other renewable material or 3) façades for which more than 50% of the façade area is of maintenance-free wood or another maintenance-free renewable material. Obligatory requirement O29 concerns durable/resistant wood for outdoor use. Use of timber impregnated with heavy metals and/or biocides is not allowed with the exception of timber in class B according to the Nordiska Träskyddsrådet (Nordic Wood Preservation Council) classification or corresponding classification. There can also be exceptions for wood in direct contact with water or ground or with specific demands of strength.

National Building Code of Finland does not set requirements for the use of wood products.

Points can be achieved from using ecolabelled construction products or conscious product choice. Maximum 10 points can be achieved by using Ecolabelled (Nordic Swan Ecolabel or EU Ecolabel) construction products (P9). For each product category 1 point is given if at least 10% of the product requirement is covered by ecolabelled products and 3 points if at least 50% of the product requirement is covered by ecolabelled products. P10 gives maximum 2 points can be achieved by following
measures: 1) 2 points if all expansion joints with the highest demand on flexibility are phthalate free, 2) 2 points if all conduits are PVC-free and contain a maximum of 0.05 weight% bromine and chlorine respectively and c) 1 point if all products within one of the following product categories are PVC-free: drainage pipes, main cables and plastic pipes for central vacuum cleaners.

National Building Code of Finland does not set requirements for the use of ecolabelled products.

3.9. Quality management of the construction process

Requirement concerning air permeability (O30): The air-tightness of the whole building envelope must be measured for small houses, pre-schools and school buildings and it must fulfill the requirements set by the construction project. For apartment buildings and extensions to apartment buildings, the air-tightness must be measured for a representative selection. This selection must constitute at least 10% of the total number of flats, but at least one flat. Both flatwise and stairwise measurement of air permeability are approved.

National Building Code of Finland sets requirement for air tightness value.

Requirement concerning management of requirements on products and materials (O31): The license holder must ensure that the requirements O15 - O29 are fulfilled. If the license holder uses subcontractors, a documentation is needed that the subcontractor is aware of and adheres to the materials requirement. Also new products and materials, added after the license is granted, must be approved by Nordic Ecolabelling if they are subject to the requirements in chapter. All parties involved in the construction process must have the relevant knowledge to be able to ensure fulfilment of the Nordic Swan requirements (O32). This includes employees, supervisors, site managers, sub suppliers and subcontractors. Information on how chemical products must be handled to avoid risks to people must be translated if necessary. The self-monitoring of the contractor is obligatory, and this must be documented during the construction (O33). The necessary routines to be monitored are waste handling at construction sites, moisture/damp prevention, secure execution of water installations, air permeability and testing, electrical installations, ventilation, heating system and routines for the performance of pre-inspection of the building before the independent third-party control or final inspection. An independent third party with relevant expertise must inspect the completed building (O34).

Here the National Building Code of Finland refers to the Finnish law.

The documentation that is sent in with the application must be archived by the license holder (O33). The license holder must document a list of the constructed Nordic Swan Ecolabelled buildings and store the documentation for at least five years after occupation (O36). If the license holder is planning to make product and market changes (O37) or unforeseen non-conformities (O38) that affect Nordic Ecolabelling's requirements, a written notice of these must be submitted to Nordic Ecolabelling. The license holder must have routines for the documentation, reporting and handling of any complaints/claims concerning Nordic Swan Ecolabelled buildings. It must also be clearly stated that the license applicant is responsible for the customer and is the party that the customer must contact concerning any complaints and claims (O39). The license holder must ensure that all relevant applicable laws and provisions regard to safety, working environment, environmental legislation and site-specific terms/concessions apply at all production sites for Nordic Swan Ecolabelled buildings (O40).

National Building Code of Finland has no requirements here but refers to the Finnish law.

3.10. Instructions for residents and property managers
The Nordic Swan Ecolabelled building must contain overall general information and operation and maintenance instructions (O41) including a maintenance record book. The maintenance record book guides the property manager and the inhabitant how to use and maintain the building and the technical systems considering also the environmental viewpoint.

National Building Code of Finland refers to the Finnish law.

4. Discussion
The Finnish Building Code sets the minimum level for construction. The mandate of the regulation is not able to include all relevant issues in the National Building Code, therefore both the Ministry of the Environment and the Ministry of the Interior have regulations concerning e.g. indoor environment.

The comparison between the criteria of the Nordic Swan Ecolabel and the National Building Code of Finland clearly shows how the ecolabelling criteria has a wider perspective to safe and environmentally conscious construction, especially regarding the use of chemical substances and material. The tighter requirements for materials, energy-efficiency and utilization of natural daylight enable a more comprehensive inspection of the indoor environment.

5. Conclusions
As a conclusion of the comparison between the Nordic Swan ecolabelling of buildings and the Finnish Building Code, it can be concluded that they both have an important role in the climate change mitigation of the Finnish building sector. The role of the obligatory Building Code is to state the minimum level for construction. The role of the voluntary ecolabelling of buildings is to enhance the construction industry into continuous improvement and to speed up the technological development.

Ecolabelling can therefore act as a test bench for upcoming building regulations. Here the forerunners can first test fulfilling the requirements of the ecolabel and after this piloting period specific issues from the ecolabelling criteria can be introduced in the National Building Code.

In line with European standards, the Ministry of the Environment is introducing a method to calculate embodied energy and CO₂ emissions of building materials during the whole life cycle. The Nordic Swan Ecolabel should therefore also consider introducing the calculation of the carbon footprint in the upcoming criteria revision.

6. References
[1] GEN 2004. Introduction to ecolabelling. Global ecolabelling network (gen) Information paper. https://globalecolabelling.net/assets/Uploads/intro-to-ecolabelling.pdf
[2] ISO 14024:2018 Environmental labels and declarations. Type I environmental labelling, Principles and procedures.
[3] Nordic Ecolabelling 2016 Small houses, apartment buildings and buildings for schools and pre-schools. Criteria document.
[4] The National Building Code of Finland. http://www.ym.fi/en-US/Land-use-and-building/Legislation-and-instructions/The-National-Building-Code-of-Finland