Guidelines with routines and documentation for handling energy requirements within the building process

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Abstract. As a result of the energy performance of the buildings directive (EPBD 2010), the requirements have been gradually tightened in the Swedish building regulations. For the purpose of the directive to be realized, it is becoming increasingly important to ensure that buildings actually live up to the minimum rules laid down in the Swedish Building Regulations (BBR) or more ambitious requirements imposed directly by the clients. To gain more insight into these questions, today’s building process has been studied through interviews and workshops with regional actors in seven regions around Sweden. A guideline is proposed with new routines and documentation for the building process, i.e. handling of starting clearance, designing of inspection plan and follow-up for final clearance.

1. Introduction

As a result of the energy performance of the buildings directive [1], the requirements have been gradually tightened in the Swedish Building Regulations (BBR). For the purpose of the directive to be realized, it is becoming increasingly important to ensure that buildings actually live up to the minimum rules laid down in BBR or more ambitious requirements imposed directly by the clients. In addition, serious competition is promoted if the energy requirements of authorities or tenders are also followed up with clear verification. However, several reports comparing projected energy performance with real outcomes show that up to 40 percent of the cases [2], the measured energy class is not aligned with design values. With new BBR based on primary energy and normalization, several corrections are needed from measured energy use, which can complicate verification further. An alternative to measurements is to calculate the primary energy use which also implies clear definitions and verifications of input data and calculation programs. The basis for how verification is made, measured or calculated, vary both between municipalities and partly between building permit administrators. Varying requirements with different levels of detail in different projects make the work inefficient for all actors involved (developers, constructors, consultants etc.). Furthermore, the uncertainties regarding requirements for monitoring and verification of energy performance, may lead to a disparity in comparison of different tenders in a procurement.

During the building process (i.e. when handling starting clearance, designing of inspection plan and follow-up for final clearance) it would be advantageous if applicants, administrators, building inspectors and the person in charge of inspection have similar procedures and request similar documentation regardless of the municipality in which the building is to be established.
2. Methodology
The project has been carried out in a central project group consisting of the Swedish Association of Local Authorities and Regions, The Swedish Construction Federation and representatives from seven regions in Sweden (LÅGANs regional networks, i.e. Nätverket för hållbart byggande och förvaltande i kallt klimat, ByggDialog Dalarna, Hållbart byggande i Värmland, Fastighetsnätverket för energi och miljöfrågor i Örebro, Föreningen energieffektiva byggnader i sydost, Lågans nätverk i Norrbotten). First, the construction process of today was identified through interviews of representatives in 21 municipalities and 18 stakeholders (contractors, consultants and property owners). Subsequently, regional and national working seminars were held to propose a guide with checklists and controls with a view to ensuring, during the building process, the energy performance of buildings [3].

3. Results

3.1. The building process today
Today’s building process has been studied as it is described in Sweden’s Planning and Building Act [4]. The building process begins with a request for a building permit that considers the overall technical property requirements of the building. After the building permit has been granted, a more detailed planning is implemented. Before the construction can begin, a technical consultation is held, where both the technical property requirements and the inspection plan are handled. Thereafter the Building committee issues a starting clearance and the construction of the building can begin. During the construction of the building, the person in charge of inspection follows that checks are carried out according to the control plan. Before the building can be occupied, a final consultation takes place and if all technical property requirements are fulfilled the Building committee issues a final clearance. Alternatively, an interim final clearance is given if additional controls are needed to ensure that a certain property requirement is fulfilled. When it comes to energy requirements, it may mean that a final clearance is not issued until an annual energy performance has been measured.

All municipalities that have been analysed follow the construction process as described in Sweden’s Planning and Building Act. However, it differs how detailed the energy requirement is inspected, documented and controlled at technical and final inspection. Different representatives for the municipalities describe their role in slightly different ways:

- some consider the role of the municipality to only be supervisory and should ensure that energy demand calculations are available with underlaying documents.
- some consider that the municipality also should ensure that the energy demand calculations are plausible.
- a third group considers themselves to be a support for the developer, they can discuss the problems and find solutions together to make sure that the requirements are fulfilled.

The reason the representatives describe their role in slightly different ways is probably because:

- laws and implementations are interpreted differently.
- the expertise that exists for energy management differ.
- which categories of buildings (houses, multi-apartment buildings, non-residential premises) that are mainly present in the municipality.

The most common is that two inspections are made during the building process. An assessment is made during the technical consultation and one assessment is made before the final clearance during the final consultation. Apart from that, the representatives for the municipalities refer to that the developer is responsible for fulfilling the energy requirement and the person in charge of inspection is responsible for that the inspection plan is followed. However, it was revealed that the developer is often unknowledgeable, especially in the case of houses, but has a lot of responsibility. This means that the developer is in need of better support.

Finally, the project concludes that in practice, there is only a limited number of follow-ups being done on the energy requirements for most building projects.
3.2. Guidelines for handling energy requirements within the building process in future

Guidelines are proposed with a clearer process where the interim final clearance should only be used in exceptional circumstances. The guidelines specify several activities during the building process that are crucial to fulfill the energy requirements. Some of the activities that are specified are described below:

At the technical consultation

- The developer’s presentation of energy demand calculations during technical consultations shall be done with the help of “the energy assistance”. “The energy assistance” is a standardized presentation of results from energy demand calculations and documentation of the input data used in the calculations.
- The developer’s presentation of the inspection plan during the technical consultation shall contain the necessary controls of building components and constructions which have an impact on the building’s use of energy. The plan shall contain quality checks with self-monitoring and inspections by specialists.
- The inspection plan also includes a plan to measure the building’s use of energy, including the description of required measuring equipment and control of measuring equipment. The person in charge of inspection support the developer to make sure that the inspection plan is sufficiently detailed and has an appropriate plan for measurements.
- The Building committee issues a starting clearance if it is reasonable that the energy requirements will be fulfilled.

During the construction phase

- The contractor is responsible to fulfill the self-monitoring described in the inspection plan and the developer is responsible to make sure that inspections that are supposed to be performed by specialists are carried out.
- The person in charge of inspection is responsible for that the inspection plan is pursued and to clearly state if inspections do not comply with requirements so that actions can be taken.
- Requirements are coordinated continuously by comparing “the energy assistance” and updates of “the energy assistance”, which gives the basis for construction documentation with diversions from original plans.

During the final consultation

- The developer presents the expected energy performance based on:
  a) verified energy demand calculation or
  b) energy performance certificate based on calculated values (valid for max two years).
Regardless of method, calculations are based on results from follow-up according to inspection plan with updated “energy assistance” and construction documentation with diversions from original plans.
- Based on the documents and the report from the person in charge of inspection the Building committee assesses if the fulfillment of energy requirement is:
  a) reasonable and gives final clearance,
  b) uncertain and gives interim final clearance or
  c) uncertain and request an action plan.

After the construction phase

- Two years after the construction, the property owner submits an energy performance certificate based on measured values to the Swedish National Board of Housing, Building and Planning.
- For buildings with interim final clearance, the developer submits the energy performance certificate to the Building committee which gives a final clearance if the energy requirement is fulfilled.
- The Swedish National Board of Housing, Building and Planning gives a contingent fine if the energy requirement is not fulfilled.

The project’s proposal for guidance mainly follows the current procedure in the building process in accordance with Sweden’s Planning and Building Act and Sweden’s current legislation. What is different, besides extended routines, is that:
• An energy performance certificate based on calculated values is only valid for two years.
• An energy performance certificate based on measured values is always used as verification of the energy requirement two years after the construction.
• The Swedish National Board of Housing, Building and Planning can provide contingent fine if energy requirements are not met.

4. Discussion
The proposal for guidance aims to achieve a similar approach in the building process, regardless of in which municipality the building is constructed, which administrator that is in charge of the case and which person who is in charge of the inspection, to make sure that the building fulfil the energy requirement that is intended. The guidance can thereby contribute to that the use of energy that has been stated in a tender is verified in the end and thereby contribute to a pure competition between different contractors.

“The energy assistance” provides a standardized material that enables faster overview of the plausibility regarding fulfilment of the energy requirements. It also provides a documentation that makes it possible to see the energy requirements throughout the whole building process. The guidance proposes to develop common guidelines for controls during the construction which can give significant help to the persons in charge of inspection who are not always experts in energy management.

The interviews with regional actors in regions around Sweden show that interim final clearance is used differently in different municipalities and it also differs who decides whether or not to give an interim final clearance. The guidance proposes a clearer process in which the interim final clearance should only be used during exceptional circumstances. In addition, the fulfillment of energy requirements should be verified for every building with a verified energy demand calculation or energy performance certificate before the final consultation. It should also be verified by measured use of energy two years after the building was commissioned.

What clearly distinguishes the proposal from current legislation is a clearer connection between final clearance, the energy performance certificate and what happens when the requirements are not fulfilled. It also applies the possibility to give a contingent fine. Today, an energy performance certificate is valid for ten years, regardless of whether it is based on calculated values. The guidelines propose that an energy performance certificate for newly constructed buildings that are based on calculated values shall only be valid for two years. In the guidelines it is also proposed to clarify regulations that the verification should take place after two years with an energy performance certificate based on measured values. If the result from the energy performance certificate shows that the requirements for the use of energy are not fulfilled, the Swedish National Board of Housing, Building and Planning can provide a contingent fine.

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