Can BIM be a disruptive technology for EPC assessment?

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BIM is in may EU countries high on the agenda. This article is focusing on the potential of BIM in relation to the energy performance of building assessment and also in relation to a better quality of the works.

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According to Wikipedia*, building information modelling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. Building information models (BIMs) are files (often but not always in proprietary formats and containing proprietary data) which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset. Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, bridges, ports, tunnels, etc.

* https://en.wikipedia.org/wiki/Building_information_modeling

BIM developments in Europe

The future market uptake of BIM is difficult to predict with great accuracy, but it clearly is a development with great potential.

In terms of requirements, an increased number of countries impose the use of BIM for certain types of projects, e.g.:

- Since 2007, obligatory in Norway for public buildings, in Finland for any project above 2 M€ and in the USA for any major project
- Since 2012 mandatory in the Netherlands for any major public project
- Since 2014 mandatory in Hong Kong for any public project
- Since 2016 mandatory in South Korea for any project above 50 M$ and in the UK for public projects

QUALICHeCK responds to the challenges related to compliance of Energy Performance Certificate (EPC) declarations and the quality of the building works. Find out more at http://qualicheck-platform.eu.

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In a 2016 report 'Shaping the Future of Construction – A breakthrough in mindset and technology' by the World Economic Forum, prepared in collaboration with the Boston Consulting Group, the market view on a whole range of new technologies has been collected. From this survey, it appears that integrated BIM has the highest likelihood AND the highest expected impact on the construction sector in the future compared to thirteen other new technologies (such as advanced building materials, augmented reality, 3D printing of components, big data analytics…).

What can BIM mean for EPC calculations?

At present, the calculation of the EPC of a building is an activity on its own. One has to collect all input data (surfaces, volumes, product and system data, …) and enter them into the software tool. This can be very time consuming. Reducing the effort to collect and enter input data can rely on either simplified calculation procedures (for e.g. dwelling treated as a single zone, default values for various systems, simplified description of thermal bridges) or on calculation software with embedded product characteristics databases.

With BIM, and of course depending on the level of development of the BIM approach, all the input data for EPC calculations are part of the BIM model. Of course, specific tools have to be developed for the EPC calculations, with the ability to use BIM files for input data, and to generate results that are integrated into the BIM. Such BIM approach can very substantially reduce the required efforts for producing an EPC. As such it will be more easy to generate and evaluate variations to optimize the overall performance. In the "as built" stage, it will again be relatively easy to verify if the requirements are met.

What can be the impact on the calculation procedures themselves? An interesting example are **thermal bridges**: with a detailed description of the building envelope through BIM, and given the calculation power or modern computers, it becomes possible to have a 3-dimensional transmission analysis of the building shell, meaning that there is no need any more to have a specific analysis of thermal bridges.

Another example is the **assessment of overheating risks**. At present, most countries use simplified procedures which only give a rough indication of the risk of overheating and/or the related energy consumption for achieving appropriate thermal comfort. With a detailed BIM model, much more refined assessment methods can be used without requiring specific efforts for collecting input data.

Most countries have at present (very) simplified procedures to assess the energy performance of **HVAC systems**. With BIM, a more refined assessment becomes possible as the actual characteristics of the systems are easily available.

BIM and standardisation

In order to accelerate the market uptake of BIM, standardisation of protocols is important. Within CEN, Technical Committee 442 (Building Information Modelling) was created in September 2015. In ISO, Technical Committee 59 (Buildings and civil engineering works) is also dealing with BIM.

With the market uptake of BIM, and assuming that BIM models will be used for EPC calculations, there might be also new tasks for standardisation in relation to EPBD related standards. BIM offers the possibility to have a better physical modelling of energy processes (see examples mentioned ahead for thermal bridges, overheating assessment, HVAC modelling). It is important that the (CEN and ISO) standards reflect such development. A liaison officer between CEN TC 442 and the energy related CEN TC's has been nominated.

BIM and convergence of national EPC calculation procedures

At present, there are still major differences in the national EPC calculation methods. With the new set of CEN standards, one can expect more convergence in the EPC calculation procedures. However, one observes sometimes very big differences in the visions on the need for simplification and this is often a barrier for further convergence.

With BIM, there is the possibility to come with limited or no efforts for the user to a more accurate physical modelling of the energy performances and therefore the possibility of nearly no differences in views between member states. If the thermal bridges are automatically calculated due to the fact that the BIM model has all relevant information, why should countries have different procedures?

BIM and EPC compliance

At present, data collection for calculating the EPC of a building is in most cases an autonomous activity not linked to other design and execution processes. This might fundamentally change if BIM becomes mainstream. All relevant product and system data can then be directly integrated into the BIM objects (brick, thermal insula-

tion, fan, heat pump, …), together with an information about their compliance to the national procedures for determining input data. Moreover, an integrated BIM model will be updated according to design or execution modifications, making that it will effectively represent what is constructed. Therefore, the energy performance calculation can be made for the as-built building.

As a result, it might mean that, once the BIM approach has become mature, there is nearly no need for specific compliance efforts related to the compliance of EPC and its input data.

BIM and quality of the works

Another potential advantage of the market uptake of BIM is the possibility to come to a better quality of the works. This can be illustrated for ventilation systems. If the BIM model of the installation includes all components, it will be easily possible thanks to dedicated software to assess if the required air flow rates can be achieved, if the acoustical performances can be reached.

BIM and smartness indicator

The issue of the smartness indicator proposed by the EC for the amendment of the EPBD is the topic of another article in this journal. With the expected market uptake of BIM, it probably becomes also possible to set up in a cost-effective manner more refined assessment methods for the smartness indicator of a buildings.

Conclusions

It is at present not clear how quickly BIM will become mainstream for new and existing building projects, but there is no doubt that its importance will substantially grow in the coming decade. BIM can offer major opportunities in relation to the energy performance assessment of buildings, including compliance and enforcement. Moreover, it can at the same time contribute to better quality of the construction and of the installed energy systems, as well as to the market uptake of smart building systems. ■