Development of a Guideline for an Appropriate Selection of BIPV Performance Prediction Methods

Background
Heating alone consumes more than 40% of the EU’s energy and more than half of the global energy, making it the most problematic sector to decarbonise. However, the progress in the deployment of renewable heat has not been as rapid and widespread as for renewable electricity, despite its vast potential at costs that are competitive with those of fossil fuel-derived heat.

In some cases, this potential is economically well explored, such as the growth of solar water heating in China or the widespread deployment of geothermal energy in Iceland. In other cases, sustainable policies are needed to stimulate the market, such as the European energy directives.

The technologies currently used for heat production range from small decentralised applications, such as gas and biomass boilers, heat pumps and individual solar thermal panels, to large-scale industrial boilers and furnaces and large centralised generation units in district heating networks. However, heating is currently mainly achieved with fossil fuel energy directly delivered to the buildings, creating local safety and emission issues.

Despite its magnitude and importance in EU’s energy market, there is still missing a comprehensive assessment of how energy efficiency and decarbonisation can be achieved in the heating sector. Developing a strategy to make it more efficient and sustainable is paramount for EU’s energy and climate targets.

For that, smart cities can be a great ally. A smart city is built on the synergies of the most important sectors involved (electricity production, heating and cooling, transport) and aimed at substantially increasing energy efficiency, while simultaneously supplying sustainable energy.

The Brainport Smart District in Heerlen is planned to be the smartest district in the Netherlands. For such a smart and efficient heating system is paramount for a sustainable future inside the district. With the plans of being fossil fuel free, this district is the perfect place to implement a modern heating system that could influence the way that the world thinks about sustainable development.

Although the Brainport Smart District have big ambitions, and some plans towards accomplishing them are already well defined, the heating plans still lack clear directions and definitions. This project is meant to help guide the Brainport Smart District towards their goals for the heating sector.

Objectives
The main objective of this project is to provide the design team of the Brainport Smart District with enough information to make an educated decision for the final design of the heating system for the district. This will be accomplished by comparing a few of the most promising options for the heating sector of the district, that will be selected in the initial phases of the project. The comparison between the different options will include several different aspects such as technobgic and economic feasibility, reliability of the system and the availability of the on-site resources. The heating system should also accommodate any environmental, political and demographic changes over the long-term, while still being able to follow the basic principles and maintaining the required performance within the district.

Methodology
Credibility of the simulation’s results depends not only on model correctness, but also on accurate formulation of the problem. Therefore, the model has to be sufficient accurate, and has to be consistent with the study’s objectives. With that in mind, validation, verification, and testing (VV&V) techniques must be employed throughout the life cycle of a simulation study starting with the problem formulation and culminating in the presentation of the simulation’s results.