D3.2

Definition of KPIs functions for the two pilot cities

T3.3: Specifications of a generic numerical simulation framework to predict district performance while both optimising investment and helping verifying scalability

SINFONIA

"Smart INitiative of cities Fully cOmmitted to iNvest In Advanced large-scaled energy solutions"

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Publishable executive summary

Within the SINFONIA project, the overarching objective of WP3 is to develop a framework to facilitate the replication of the SINFONIA solutions demonstrated in the two pilot cities. This overarching objective is split into 3 mains sub-objectives:

1. to characterise the scaling and replication potential of the solutions and approaches demonstrated in Innsbruck and Bolzano,
2. to define the Key Performance Indicators which will be monitored during the demonstrations to assess the refurbishment performances, and, using a modelling approach, the functions to calculate these KPIs,
3. to validate the scaling and replication potential of the solutions and approaches demonstrated in Innsbruck and Bolzano (with the modelling approach) in view of preparing district refurbishment applications within the five early adopter cities.

The present deliverable presents the outcomes of Task 3.3 dedicated to the "*Specifications of a generic numerical simulation framework to predict district performance while both optimising investment and helping verifying scalability*", and which addresses the second of the above objectives. The task therefore aims at:

- defining the KPIs that allow characterising the energy performance of a district and that can be used when assessing the impact of refurbishment (both in terms of energy and cost),
- specifying a modelling and simulation tool able to calculate these KPIs, including the simulation of the impact of scaling and replicating the solutions tested in the two pilot cities.

When starting the task, the following observations were made and taken into account when specifying the tool:

- The number and diversity of indicator frameworks can be overwhelming: it is key to focus on a limited number of key indicators (KPIs), shared by all the city players.
- Although KPI functions may be relatively simple, the calculation of the current and future values of these KPIs implies to simulate a variety of data to mitigate data gaps, to be able to model the city to understand the impacts of refurbishment plans, and to make hypothesis on the future values of different exogenous factors
- In order to prepare replication in the early adopter cities, a generic approach - which can be easily replicated – is needed.

Selection of Key Performance Indicators

In WP3, the purpose of the indicators is to:

- Provide information on the current state of the districts and city (in terms of energy efficiency);
- Inform on the impact of district refurbishment measures replicating the SINFONIA demonstrations so as to select the 'best' option , i.e. find the optimal investment to maximise the performance of the district (in terms of energy savings and CO_2 abatement), taking into account the local context and constraints.

A limited set of KPIs to be calculated was first defined, taking into account the work already carried out in other projects (CityKEYS, Smart Cities Information System) and the work started internally in

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SINFONIA (in WP4 and WP5). Various indicators and KPIs are indeed used at different scales throughout the project, from the technological level to the EU wide level, as illustrated in Figure 6.

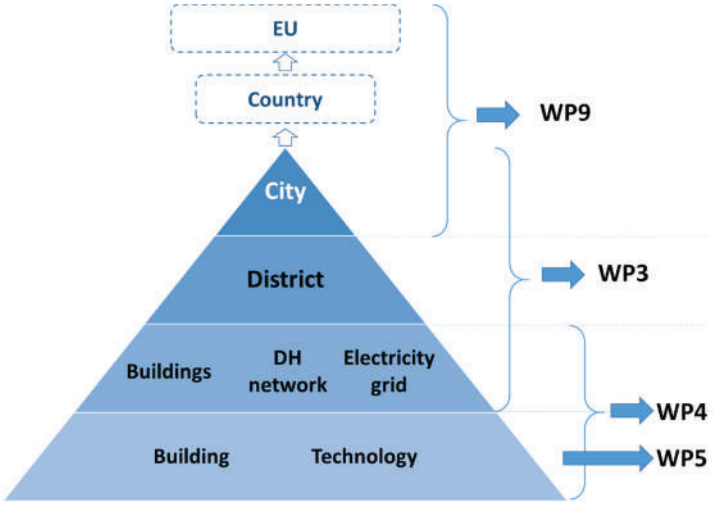

FIGURE 1: LEVELS AT WHICH INDICATORS ARE CALCULATED IN THE DIFFERENT WPS

The KPIs already used by some of the partner cities were also taken into account, and it will be possible to define and add other KPIs at a later stage, in case it is specifically needed by a city.
The following KPIs will be calculated 'by default' in the first version of the prototype tool.

- Energy consumption: delivered energy, primary energy.
- Energy production: share of renewable energy.
- CO_2 emissions.
- Total investments related to a refurbishment plan.
- Energy consumption costs.
- Economic payback time.

How to calculate KPIs

KPIs are calculated at different scales (district, city – which is an aggregation of districts) and for different cases:

- Present state
- Future state:
  - 'business as usual' case, with no specific refurbishment plan,
  - alternative scenarios with different refurbishment plans.

Although the 'functions' to calculate the KPIs are well defined, calculating KPIs is not an easy task since it depends on many parameters (e.g. energy carriers, primary energy factors, characteristics of buildings and energy systems, delivered energy, energy flows, etc.) whose value is not always known. In WP3, the simulation-based tool is developed to mitigate the partial lack of data and to calculate the present and future values of KPIs.

Calculation of present state

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The minimum datasets required for the calculation are then listed. The process of data collection has been started in Innsbruck and Bolzano to prepare the following task (validation of the tool). Additional sources of data have also been found in the literature.

Calculation of future state

To calculate the future values of KPIs, the 'refurbishment routes' have to be defined, i.e. each city must characterise the set of refurbishment measures (among the 'SINFONIA portfolio') that are going to be implemented in the future. The selection of the measures to be implemented depends on the scalability and replication potential of these measures. A preliminary qualitative approach is therefore proposed to highlight the 'go / no-go' related to scaling and replication when choosing a specific solution or set of solutions.

The calculation of KPIs also requires additional inputs related to exogenous parameters such as costs of implementing energy efficient solutions, energy prices, interest rates, energy mix, etc. A first database containing average costs for different families of retrofitting solutions has been developed. Another database containing parameters such as current energy prices and primary energy factors, and projections for future values, is also being developed in cooperation with WP4 and WP9.

Decision Support Tool for district refurbishment

Finally, the specifications of the simulation-based tool used to calculate the KPIs are outlined, and will be further detailed in Task 3.4 where the tool is developed. Beyond the calculation of KPIs, the tool also aims at providing decision support to city players when replicating SINFONIA solutions and planning long-term district refurbishment.

An agile software development approach is used, i.e. the specifications and solutions evolve through the collaborative effort of the SINFONIA team. This approach promotes adaptive planning, evolutionary development, early delivery (July 2016 – M26) and continuous improvement (until March 2018 - M46), and it encourages rapid and flexible response to the feedbacks received from the cities testing the tool.

The prototype tool will first be tested with data from the two pilot cities Bolzano and Innsbruck. The robustness of the tool with regard to the quality (level of detail and accuracy/uncertainty) of the input data will be assessed (sensitivity analysis). The tool will then be validated with the Early Adopter Cities willing to take part in this validation phase.

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