DELIVERABLE T1.2.3

D.T1.2.3 – Generation of 3D building models in the pilot areas

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A.T1.2 Creation of realistic 3D building models

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1. Introduction and aims

The deliverable T1.2.3 is related to the generation of 3D Building Models (3D BM) starting from the collected geodata (D.T1.1.1), harmonized (D.T1.1.2) and structured in geospatial databases (D.T1.1.3) and employing the developed methodology presented in D.T1.2.2. The document presents the results in the 8 pilot areas (one more with respect to the planned quantification in the AF). The document is restricted to project partners (PP), reviewers and JS.

2. Recap of the developed methodologies for generating 3D building models

Giving the fact that no new geospatial data acquisitions could be performed, BOOSTEE-CE 3D building models must be produced only based on the available geodata collected in the pilot areas (D.T1.1.1), harmonized (D.T1.1.2) and structured in geospatial databases (D.T1.1.3):

- building footprints, with/without attribute information (such as number of floors, building height, etc.)
- point clouds acquired with LiDAR flights, from where buildings heights and roof shapes could be inferred
- DTM/DSM of the surrounding environment for the PV potential estimation (D.T1.3.1).

Starting from these data, two methods have been adopted and upscaled in order to create the 3D building models necessary for the future activities of the project. The methods rely on the available geodata, which differ from PA to PA:

1. Building footprint with attribute information: the shp files of the PA's topographic maps contain locations and shapes of buildings. Each building (or group of buildings) is characterize by a polygon (its footprint) enriched with a table of information (generally called attributes). Among this information, we could find evidences of the building height or number of floors. Hence using extruding functions, a LOD1 building model can be generated. These 3D geometric entities keep the attributes and, in a dedicated viewer, can be queried to retrieve information.
2. LiDAR point clouds with building footprints: the 3D point clouds feature a variable density of points, going from few per square meter to some dozen points per square meter. The point clouds describe quite decently the shape of the buildings, particularly for the denser clouds. According to the point density, we have applied two methods:
   2.1 Sparse point cloud (few points/sqm): geometric intersection of the point cloud with the available footprints, derivation of the highest point in the identified part of the cloud and extrusion of the footprint up to such height value to generate LOD1 building models.
   2.2 Dense point cloud: geometric intersection of the point cloud with the available footprints, fitting of geometric primitives / shapes of building roofs to the identified part of the cloud and generation of LOD2 building models. The fitting procedure is performed in an iterative way, testing various roof shapes and identifying the shape leading to the smallest least squares residual.

The presented methodology comprises different software modules available either in the open-source domain or as in-house tools of the project partners.

3. Produced 3D building models in the pilot actions

In the following figures (Fig.1-8), for each PA location, a view of the 3D building models in LOD1 is presented. The project's target aims to some 300 buildings in total although we have reached a much higher number. Digital buildings are created in LOD1 and LOD2 format (for the specific pilot buildings with investment). The building geometries are used in 3DEMS module of OnePlace (D.T2.2.2). Here the buildings are visualized with the free Google Earth engine. The collected attributes of each building are accessible by clicking on the digital models (Fig. 3). The generated 3D building models could be used for visualization and query purposes (e.g.

retrieve energy audit, display energy consumptions or flows, etc.) as well as to perform / compute urban planning, noise propagation/pollution, dynamic lighting, photovoltaic (PV) potential of building roofs, sun occlusion, etc.

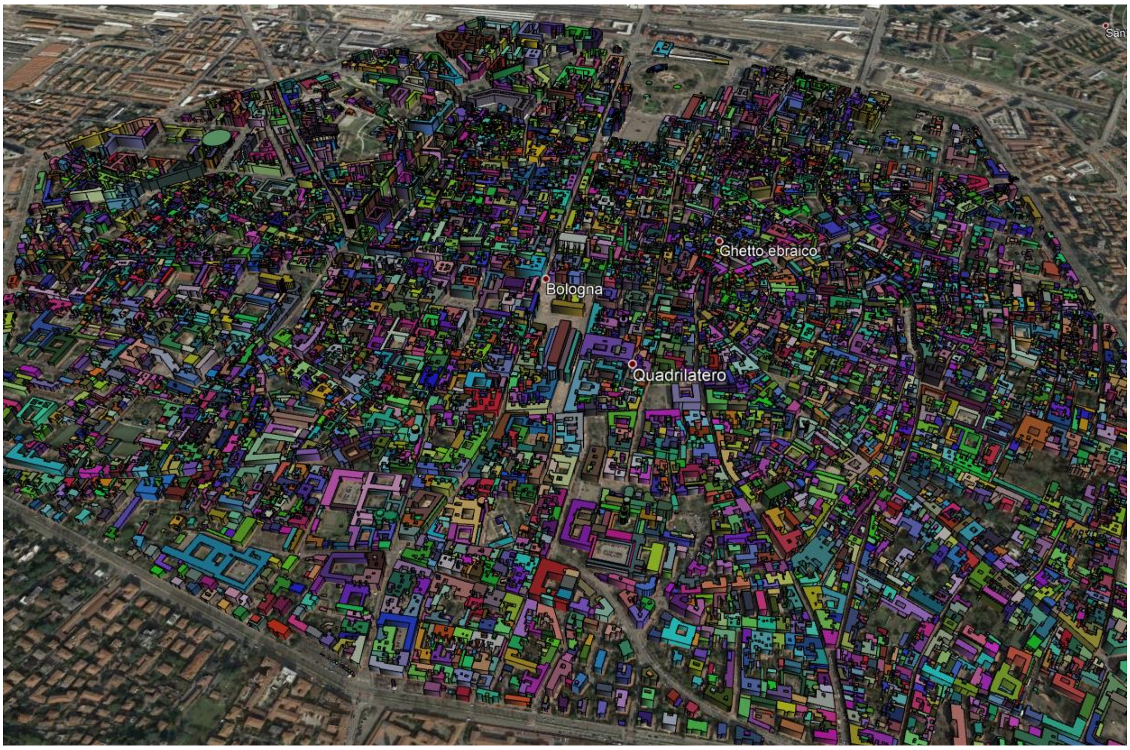

Figure 1: Generated 3D building models for PA1 – Emilia Romagna, Italy (PP7).

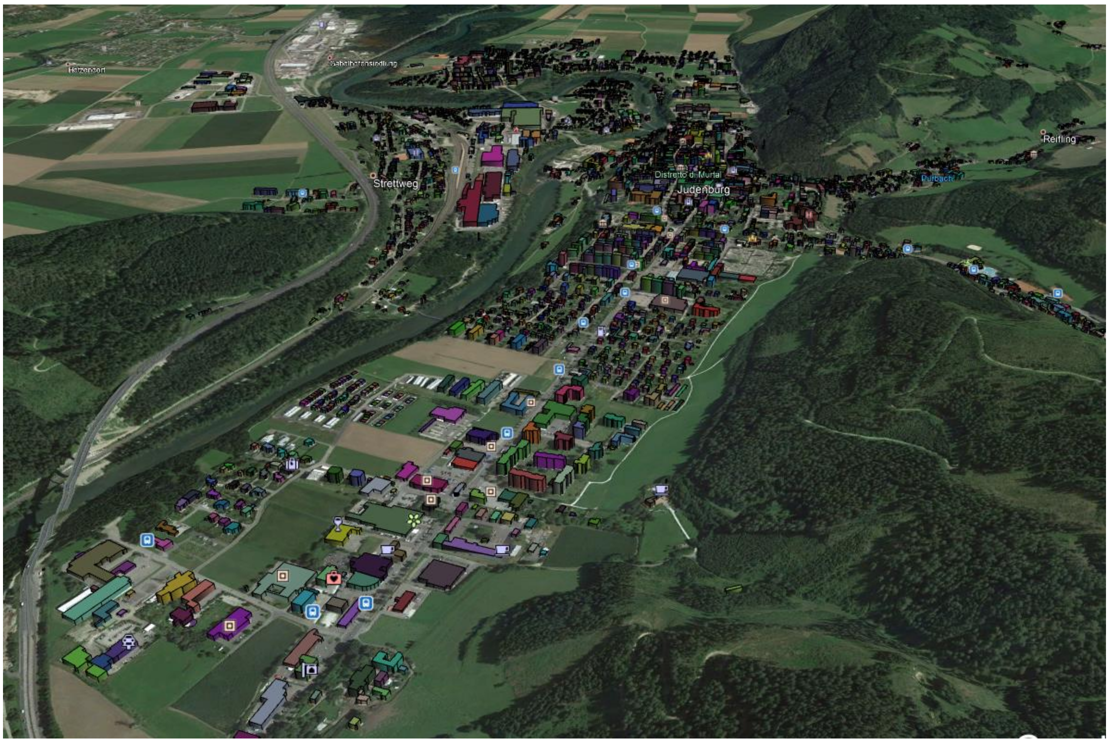

Figure 2: Generated 3D building models for PA2 – Judenburg, Austria (PP10).

Figure 3: Generated 3D building models for PA3 – Zlin, Czech Republic (PP3) – Kromeriz (above) and Holesov (below) municipalities.

Figure 4: Generated 3D building models for PA4 – Tolna, Hungary (PP6).

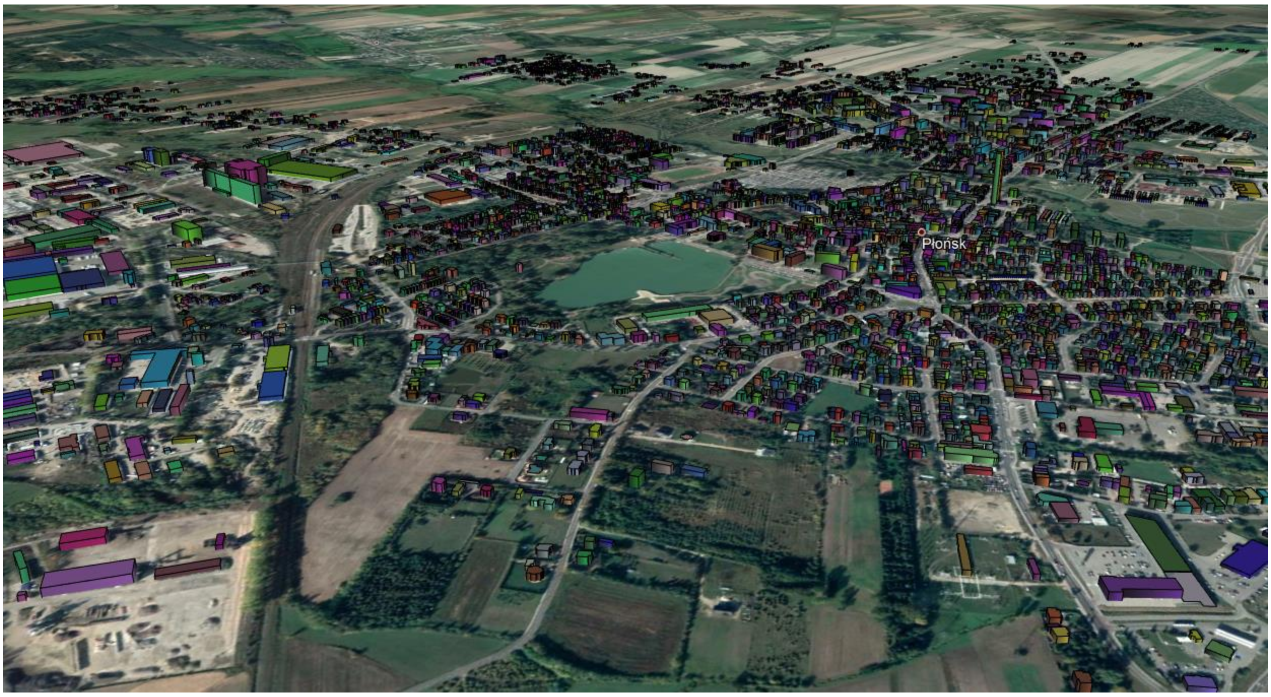

Figure 5: Generated 3D building models for PA5 – Plonsk, Poland (PP13).

Figure 6: Generated 3D building models for PA6 – Koprivnica, Croatia (PP9).

Figure 7: Generated 3D building models for PA7 – Velenje, Slovenia (PP8).

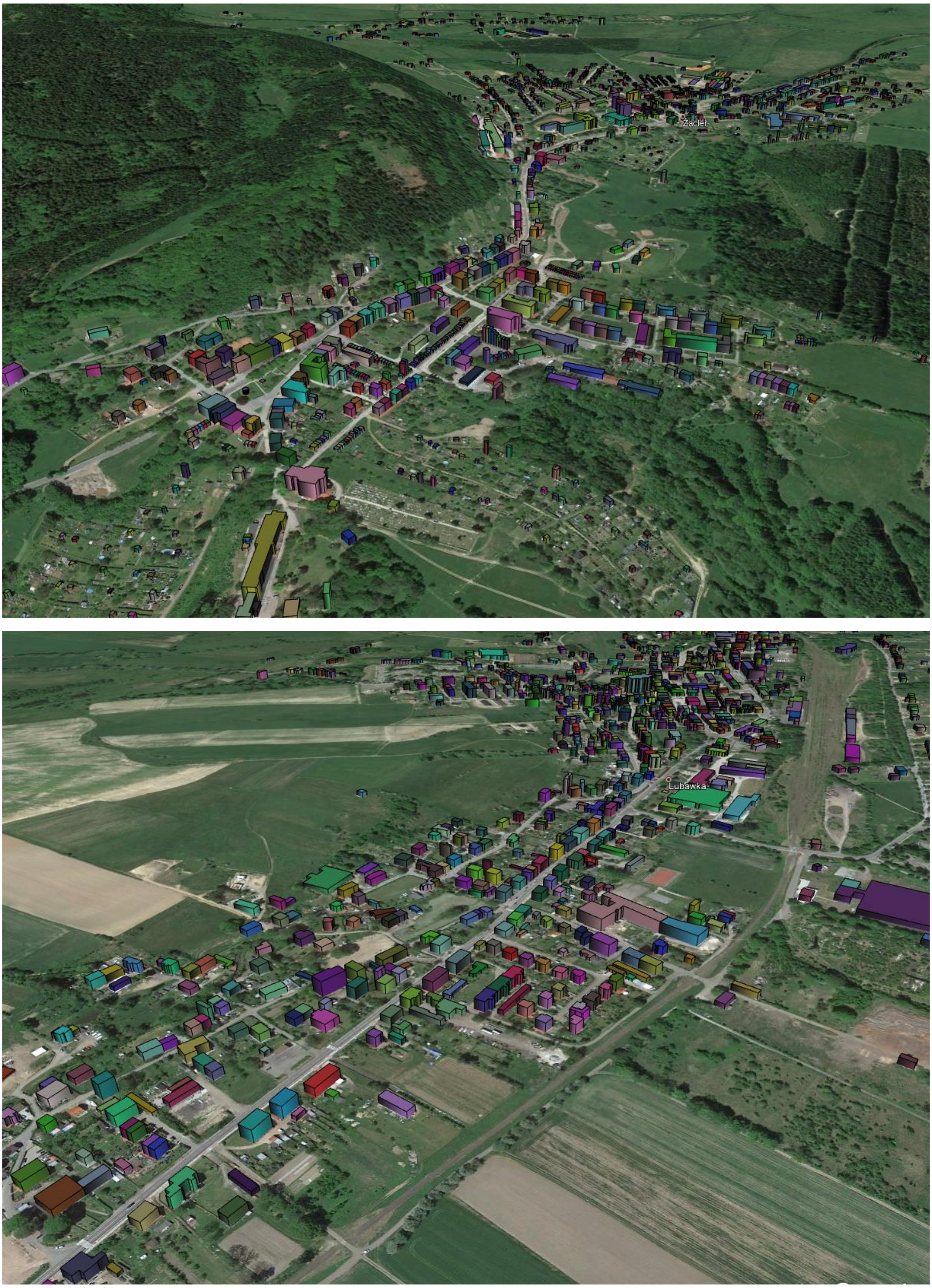

Figure 8: Generated 3D building models for PA8 – the CZ-PL cross-border region (PP12) – Zacler (above) and Lubawka (below) municipalities

4. Conclusions

The document reported the generated 3D building models in the project PA areas. The results are input for the OnePlace platform – 3DEMS module, they are queryable to retrieve energy-related information and will be combined with texture information such as photovoltaic (PV) maps. Within OnePlace they could be also used by spatial planners and energy managers to improve energy efficiency policies and activities.