D. ANNEX: PLUGINS' USER MANUAL

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This set of plugins are developed for the Italian context, but could be adapted to other country/scenario.

Two plugins serve as support the manual editing of cartographic bases:

- *Navigate through features*: easily display one by one the features in a selected layer;
- *Spatial join max area*: performs a spatial join assigning to the feature the value of the feature on the other layer that cover it more.

A three steps plugin serves to build the Building and Volumes layers of MEM, as follows:

- *Step 1 - Assign ID_CAD*: assigns the Cadastre ID to the volumetric units;
- *Step 2 - Create energy layers*: creates the Building and Volumes, estimating the external walls and calculating the compactness ratio;
- *Step 3 - Assign EPC and Typology*: finds if there is a corresponding EPC, assigns building’s Typology and fills out the energy information on the basis of ID_EPC or Typology.
D.1 USER GUIDE

This document describes how to use Municipal Energy Model plugin and how data must be formatted to be processed by Municipal Energy Model plugin.

Municipal Energy Model plugin is a QGIS plugin and it need to be installed like any other plugin in QGIS.

The internal name of Municipal Energy Model plugin is Giko-plugin sometime is referred with this name instead of Municipal Energy Model in the code.

D.1.1 Installation

You can get latest version from the release page of GitHub repository. To install this plugin you need to uncompress the downloaded file in the QGIS plugin folder. See documentation of your QGIS version about plugin installation. The usual location of user plugin is ~/.qgis2/python/plugins.

After that you must open QGIS and enable Municipal Energy Model plugin in Plugins -> Manage and Install Plugins....
For more information about QGIS plugin read [http://docs.qgis.org/1.8/en/docs/user_manual/plugins/plugins.html](http://docs.qgis.org/1.8/en/docs/user_manual/plugins/plugins.html).

D.1.2 Introduction

When you have successfully installed *Municipal Energy Model* plugin, you should see under the menu Plugins two additional options: Municipal Energy Model and Municipal Energy Model - tool. The first menu entry is the plugin itself with the main steps, the second menu entry is a set of tools developed as side utilities.
D.2 **MUNICIPAL ENERGY MODEL**

The outputs of *Municipal Energy Model* plugin are **Building** and **Volumes** layers.

The user needs to go through each step to obtain the final layers. These steps are: 1 - Assign ID_CAD, 2 - Create energy layers and 3 - Assign EPC and Typology.

The first step is to assign the cadastre identification number from layer provided by the DBT (Database Topografico Regionale). In the step 2 the plugin elaborates data from step 1 to identify building and each volume of the same building. The plugin also performs the computation of compactness ratio and detect wall surfaces. In the final step 3 the plugin fills each building/volumes with energy efficiency values.

D.2.1 Step 1 - Assign ID_CAD

The first step is open through Plugins -> Municipal Energy Model -> 1 - Assign ID_CAD.

The inputs of this step are three layers: volumes layer, cadastre layer and cadastre terrain layer. The output of this step is a layer called **SpatialJoin** containing the **Volumes layer** plus the cadastre identification code from **Cadastre layer** or **Cadastre terrain layer**.
• **Volumes layer** must contain footprint of each building and each *feature* must have an attribute `UN_VOL_AV` that it provide height of each building/feature. This layer should also contain `USE` attribute.

• **Cadastre layer** must contain the `COD_CATAST` attribute and each geometry must match as much as possible the volumes geometries. This layer will be spatial joined with *volumes layer*.

• **Cadastre terrain layer** must contain the `CHIAVE` attribute. This layer is used in the case that for a *feature* in *volumes layer* doesn’t have a cadastre identification code in *cadastre layer* is used the terrain cadastre identification code.

**Remark:** `UN_VOL_AV` contain the height of described building. It is used in the follow step, so, if it is missing you will get an error in the following step.

**Note:** If a *feature* in *Volumes layer* covers multiple *feature* of *Cadastre layer* or *Cadastre terrain layer* the plugin assigns the value from the *feature* that have the biggest common area.
D.2.2 Step 2 - Create energy layers

This step creates **Volumes layer** and **Building layer**. **Volumes layer** contains the height information of a building. In fact a building could be composed by two or more volumes with different height. **Building layer** contains the sum of each volumes for the specific building. A volume is considered part of a building when touches another volume with the same cadastre identification code.

After this step you have these two layer that contains unfilled attribute that they will be filled in the next step.

During this step is performed the follow computation: estimating the wall surface, computing compact ratio.

To check if the estimate wall surface is correct you could enable the generation of temporary layer **intersection**. This layer is composed by the segments that are considered common part of the same building. They are the intersection of volumes belonging to the same building.
D.2.3 Step 3 - Assign EPC and Typology

This step fills Volumes layer and Building layer with the information provided by EPC and statistic data.

This step needs additional information:

- **ISTAT layer** is a layer containing the section and the ISTAT code **SEZ2011**. This identification code must be the same used in ISTAT age CSV file.
- **EPCs CSV file** is a CSV file containing energy efficiency values from the Energy Performance Certificate Database. Each field of CSV file must match the name used in the Volumes layer and Building layer.
Typology CSV file is a CSV file containing for each typology the statistic data. This is used if EPC data are not available.

ISTAT age CSV file is a CSV file that provide prevalent age of the ISTAT section, to assign it to the buildings without this information.

During this step, it is associated to each building an age from ISTAT data. After that is computed the ID_MEM. When ID_MEM is generated the plugin searches the corresponding EPC certificate and if it is not available uses statistical data.

ID_MEM is an internal identification code formed by USE-ID_CAD_volumenIndex.

D.2.4 Notes

CSV file format

CSV file are text file where values are separated by comma. In Municipal Energy Model plugin the first row of each CSV file have a special meaning. The first row is used as header. In this way the plugin can look for specific field searching for the header name instead of position.

ISTAT age CSV file

This file contains the association from ISTAT identification code, called SEZ2011 to the average age of this ISTAT section, as the following example.

<table>
<thead>
<tr>
<th>SEZ2011,SEZ_AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>152060000001,1946-1960</td>
</tr>
<tr>
<td>152060000002,&lt;=1945</td>
</tr>
<tr>
<td>1520600000027,&gt;=2006</td>
</tr>
</tbody>
</table>

- SEZ2011 is the ISTAT identification number provided in the ISTAT layer.
- SEZ_AGE is a text field containing >=[year], <=[year] or [year]-[year].

Typology CSV file

This file contains for each typology the statistical data needed for the computation, as the following example.

<table>
<thead>
<tr>
<th>TYPOLOGY,wind_r,area_r,vol_r,h_level,U_env,U_roof,U_ground,U_wind,Eph,Eth,ETC,EFER,EPW,EPT,E_HEAT,E_DHW,E_H-DHW</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1-A-1.0,0.08,0.75,0.49,3.11,1.22,1.12,1.16,3.44,183.35,141.46,16.79,3.89,45.99,229.33,0.80,0.68,0.74</td>
</tr>
</tbody>
</table>

- TYPOLOGY is an attribute computed by the Municipal Energy Model plugin that is composed by USE_AgeRange_CompactnessRatioRange.
- statistic data other fields that will be read and imported in the Building and Volumes layer.
ID_EPC CSV file

This file contains for each ID_EPC the energy efficiency data, as the following example.

<table>
<thead>
<tr>
<th>ID_EPC</th>
<th>SUP_NETTA</th>
<th>VOLUME_NETTO</th>
<th>AGE</th>
<th>wind_r</th>
<th>area_r</th>
<th>vol_r</th>
<th>h_level</th>
<th>U_env</th>
<th>U_roof</th>
<th>U_ground</th>
<th>U_wind</th>
<th>Eth</th>
<th>ETC</th>
<th>EFER</th>
<th>EPW</th>
<th>E_HEAT</th>
<th>E_DHW</th>
<th>E_H-DHW</th>
<th>PV_AREA</th>
<th>ST_AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1-10-1234</td>
<td>515.36</td>
<td>1991-2005</td>
<td>0.131</td>
<td>0.851</td>
<td>0.747</td>
<td>2.59</td>
<td>0.70</td>
<td>0.74</td>
<td>0.83</td>
<td>3.05</td>
<td>131.34</td>
<td>75.02</td>
<td>18.09</td>
<td>0.00</td>
<td>60.44</td>
<td>191.78</td>
<td>0.58</td>
<td>0.38</td>
<td>0.52</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- **ID_EPC** is EPC identification code.
- **statistic data** other fields that will be read and imported in the Building and Volumes layer.
D.3 MUNICIPAL ENERGY MODEL - TOOL

D.3.1 Navigate through features

This menu entry open a dialog that allows to navigate through features of selected layer. In the upper part of dialog you can choose the layer that you would navigate. In the central part is displayed the number of features and the current index. You can change the current index to navigate directly to a feature. In the lower part you can locate the forward button (<<), Current button and next button (>>). The current button reset the focus on the current index in the case you moved the view on your layer.

Remark: This dialog is topmost, this mean that will stay on top of QGIS window when lost focus.
D.3.2 Spatial join max area

This menu entry opens a dialog that allows a spatial join with custom criteria. A field from layer 2 is added to the layer 1 and it saved in the provided location.

The particularity of this spatial join is that in case of a feature of layer 1 cover two or more features of layer 2 will be used the feature from layer 2 that have biggest common area with feature of layer 1.