# Step-WISE Technical Toolkit Miniguide Part 1 & 2

Public Document

Changelog

| Version: | Date: | Status: | Author: | Reviewer: | Comments: |
|---|---|---|---|---|---|
| **1.0** | 14.10.24 | Working | Alessandro Piccinini [R2M] | Davide Quaggiotto [R2M] | Miniguide Part 1&2 of 4 |
| **2.0** | 06.05.25 | Final | Amisha Panchal [IES] | Dave Sweeney[IES] | Updated based on ICD Release 2025.0 |

## Disclaimer



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# Contents

# 1 PART 1

## 1.1 iCD Installation

1. Download SketchUp - version 2020 or higher (we highly recommend using the latest version).

2. Download the latest iCD installer from the IES Download Centre.

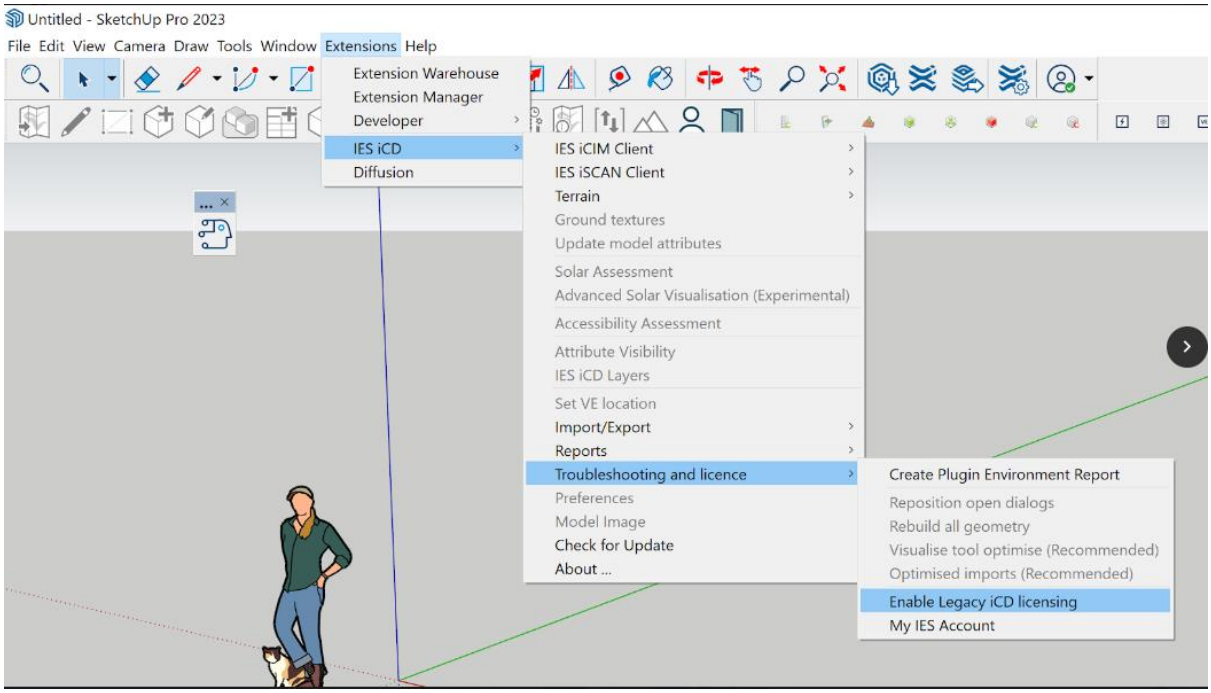
3. Launch SketchUp and go to **Extensions → IES iCD → My IES Account → Log-in**.

4. For first-time access, you will need to create an account. Click "Sign up now," enter your email address, and create a password.

    - For more detailed instructions: see Installation and Licensing on the IES website.

    - Free on-demand training courses: "Getting Started with iCD " and "iCD Advanced Modelling" are available in the help section (last icon on the iCD toolbar).

    - **Note**: If you encounter issues, deselect the "legacy" license option in the iCD menu and restart SketchUp.

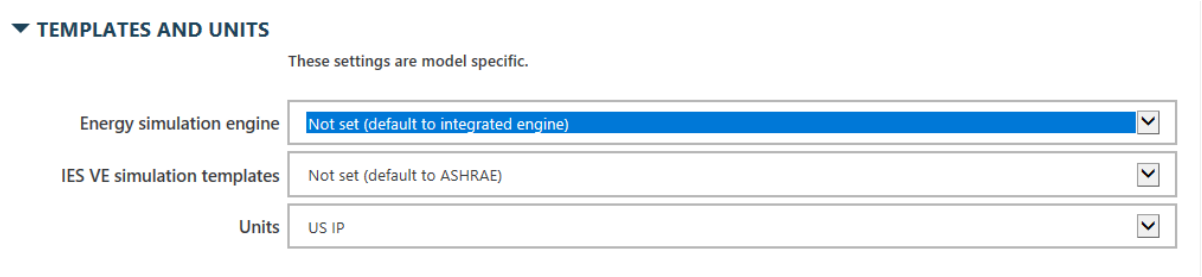



After restarting, you can activate your account using the "My IES Account" button on the toolbar. First, you must register with the online Microsoft authentication database using your email. Once registered, log in with your credentials to activate your license.

## 1.2 Discovering iCD

iCD is a master planning tool that allows detailed modelling or large-scale city-wide models, providing insights based on a wide range of data.

1. Open SketchUp and create a new model.
2. Enable the iCD toolbar (View > Toolbar > Tick IES iCD > Close)
3. Enable the tag tray (Window > Default Tray > Ensure "Tag" tray is ticked), which will open the Layers of ICD.
4. Open the ICD menu in Extensions (Extensions > IES iCD> Preferences). In the extension, you can, for instance, set the simulation engine, adjust the carbon emission parameters (kg CO2 per kWh) and energy costs.




There are two energy simulation engines available: **IES VE** and the **IES iCD - Integrated Engine**. The integrated engine is built into iCD and is now the default simulation engine. It offers the option to use the IES Apache engine if VE is not installed on the user's machine. The iCD integrated engine allows access to advanced attributes for the detailed input.

You can choose between two types of simulation models: **ASHRAE models** and **ICL models**, each offering different attributes for building envelope performance or HVAC system details.

For more details, visit Navigating the iCD plug-in.

## 1.3 Creating a model from an OSM import

For urban or municipal-scale modelling, the fastest way to import large-scale geometry is using **OpenStreetMap (OSM)**. iCD also supports **GIS (GeoJSON)** or **Shape files**, which will be covered in the next pages.

To import OSM maps:

1. Click the **OSM Import** button in the toolbar.
2. Save your model in the desired folder.
3. Search for the desired location (i.e. Milan) using the search bar or by navigating the map.
4. Select the location and right-click on the map to "Place import site." The location is marked with a yellow pin.
5. Set the import radius by clicking the yellow pin, saving the settings, and then selecting the import options.
6. Click **Import**.

For more details, visit OSM Import.

## 1.4 Creating geometry manually

After importing OSM data, missing buildings can be manually added by either drawing from scratch or importing a DWG file (i.e. from cadastral maps).

1. Draw the footprint using the **Line Tool** or **Rectangle tool** ;
2. Use the **Create button** to access available objects, and select the **building object**. iCD will generate the corresponding building.
3. Once the building is created, attributes can be added or modified.

**Note:** Once the footprint is created, if you select all the zones and then generate the thermal zones, they will be connected. However, if you create the thermal zones one by one, they will remain separate. In either case, the attributes can be modified individually by clicking the "plus" button.

If needed, the user can split these two buildings later. To do this, right-click on them, then go to **IES iCD > Combine/Split > Split Up Objects**.

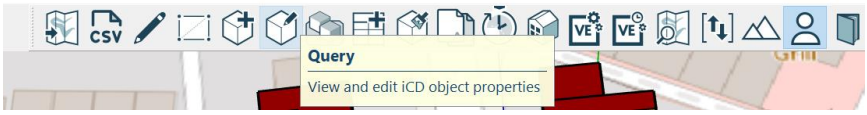
For more details, visit Creating objects from drawn polygons or Create geometry from a .dwg file.

## 1.5 Object attributes

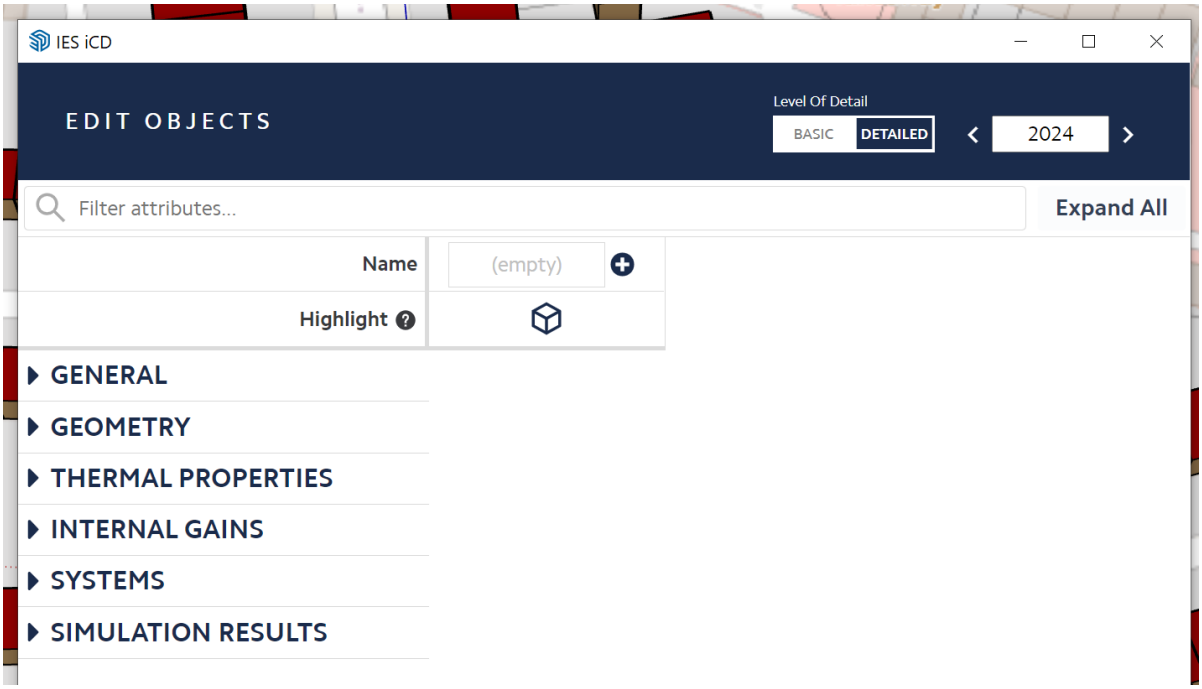
Once the geometry is imported from OSM and the missing buildings are manually added, we can modify the attributes of the created buildings using the **Query Tool**.

1. **Use the Query Tool.**
2. For each building, the following parameters can be modified (see pictures below):

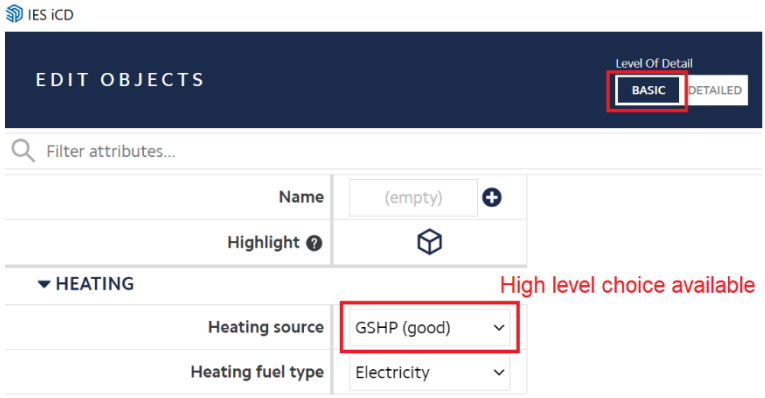
   The Query Tool can be accessed through the toolbar :

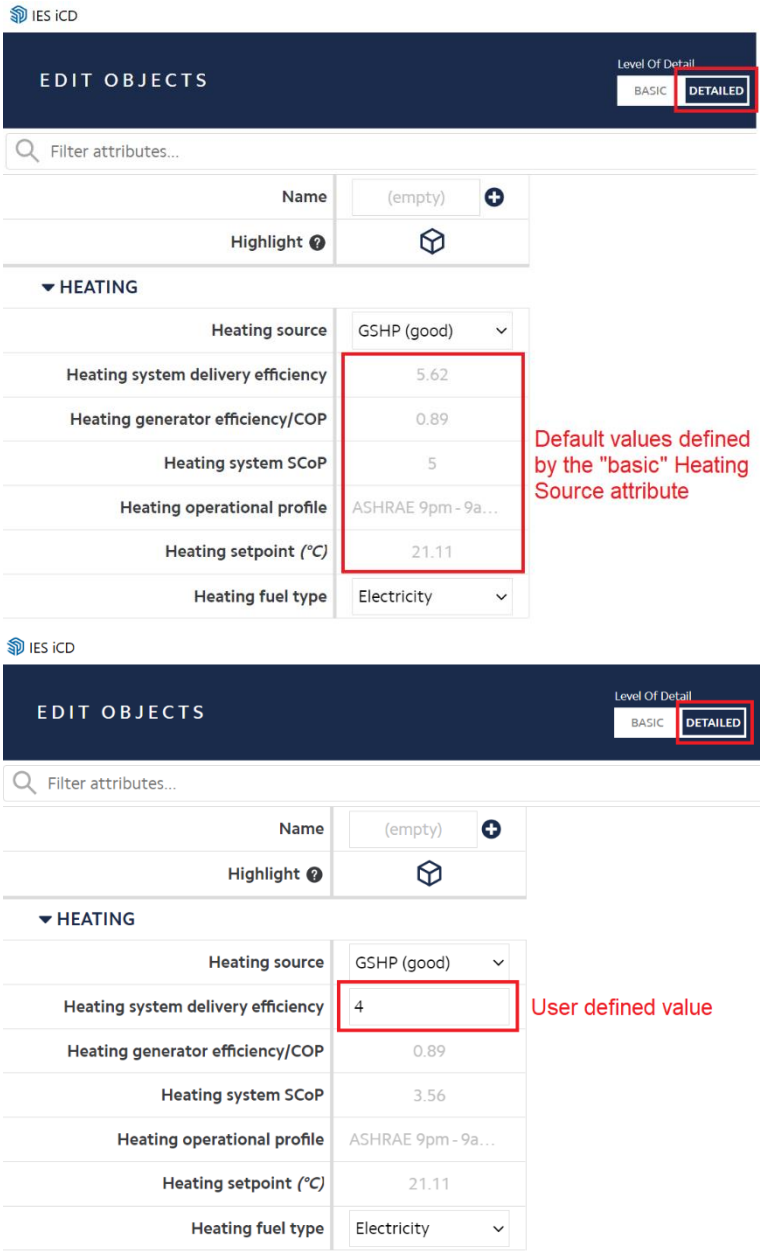



   There is a list of attributes that can be amended using the query tool. These are also grouped by type (shown in the figure below), and there is also a choice to interact with the attributes at either a basic or detailed level, chosen through the toggle in the top right of the Query Tool. This is to accommodate both projects which have a limited amount of information on each building (e.g. regional energy plans with hundreds of buildings) or single building project where exact parameter values are available.




See below example of The "Heating Source" . The attribute in the basic level sets the default values of the detailed attributes depending on the option selected. If the user then moves into that layer, they can set the values of those attributes manually.






The full list of attributes can be accessed here : 4.9. Editing Data

It is not necessary to input all parameters to run the simulation. However, the more parameters you provide, the more precise and detailed the simulation will be. If no parameters are entered, iCD will use default values.

In some cases, the user may have very important information for specific iCD buildings including Electricity & Gas Consumption Data's, HVAC Data's, Boiler's Energy, Building Operational Cost etc. This available information can be incorporated to the corresponding buildings by creating new attributes using the customise option as explained here: 4.9.9.1. Create a custom attribute . We suggest applying this action just for specific cases.

## 1.6 Export and Import file CSV

To further speed up the parameter modification process, we can use the **CSV export** feature. This allows us to select specific parameters for modification. You can edit these parameters directly in Excel or a similar program, and then re-import the CSV file with the updated parameters.

We have created **archetype files** for the countries involved in the project to guide the selection of parameters.

To proceed with the export and import of parameters, follow these steps:

1. Export the CSV file in Extensions > iCD > Import/Export > Export CSV with the **Name** (which will serve as the match key) and other attributes, such as the **number of storeys**, **external wall**, and **external windows**.
2. Open the CSV file and make the changes using the archetypes to populate the data.
3. Go to I**mport CSV**, set the match key as the name, and assign the other attributes as existing attributes with the correct labels.

Post-simulation consumption data can also be exported. If you do not select the "Aggregate results (exports only)" option, the exported data will be distributed monthly rather than as a total sum.

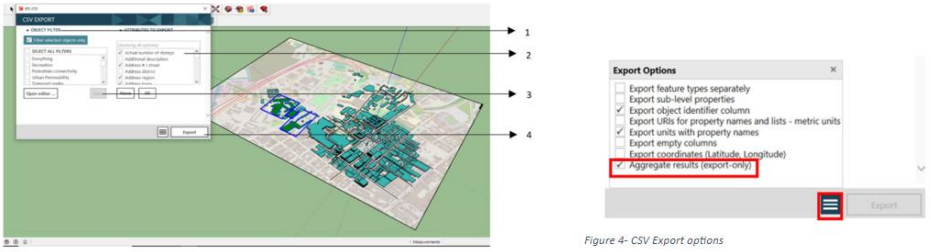



*Figure 4- CSV Export options*

For more details, visit [CSV Import.]

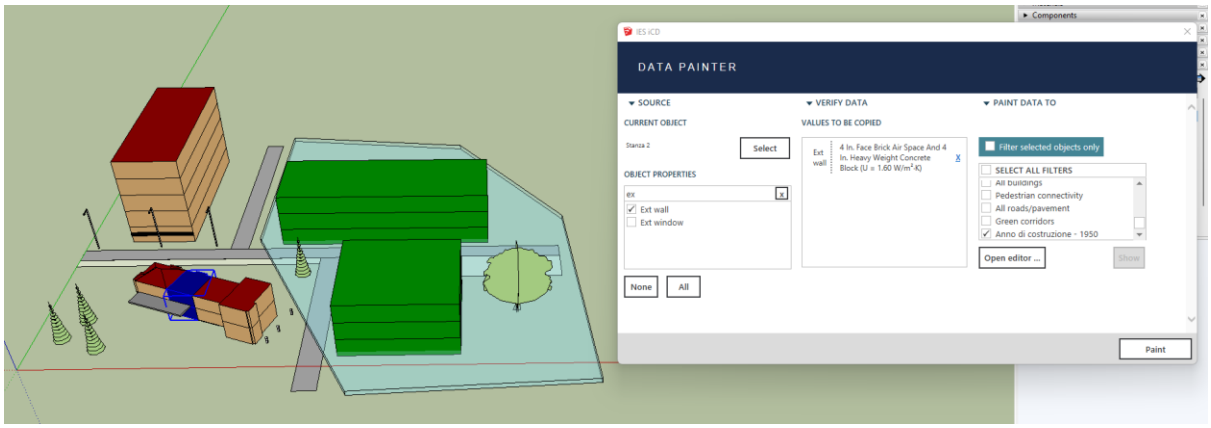
## 1.7 Data Painter and filters

If there are buildings with similar characteristics, we can use the **Painter Tool** to apply parameters from one building to another.

1. Click the **Painter** button in the toolbar.
2. Select the source building and its object properties (e.g., storey height, roof type).
3. The selected parameters will be displayed in the **Verify Data** section.
4. Select the buildings where you want to apply the data (**Paint Data to**) and click **Paint**.

**Note:** You can create custom filters to apply the data more selectively. To create a filter:

1. Click on **Open Editor** > **New** (e.g., for residential buildings).
2. Choose **Primary Use** and select options like **Single-Family Detached**, **Single-Family Terraced**, or **Single-Family Attached**.
3. Click **Apply** and select the "Residential Buildings" filter, then click **Show** and paint the data. The parameters will only be applied to the buildings within the filter.




For more details, visit [Data Painter.]

## 1.8 Adjacent buildings

If we want we can create **adjacent buildings**, which is an object type that can be used to model buildings which do not need to be subject to analyses. It is important to note that in iCD, adjacent buildings do not have the same level of details and do not carry as many attributes as regular buildings. No analysis can be performed on an adjacent building. However, adjacent buildings cast a shadow over buildings and have an impact on solar heat gain.

To create Adjacent buildings, we can follow these steps:

1. **Draw the footprint** using the “Line tool” or the “Rectangle tool”.
2. Click on the **Create** button, select **Adjacent Building** under object type, and enter the relevant data.
3. Click **Create from Selection**.

In a similar way, by selecting a different object type, we can create:

- **Shades** (Local, topographical and vegetated)

Local shades, Topographical shades and Vegetated shades are objects that cast a shadow over building envelope / glazed areas. These object types can be used to model protection against radiative solar heat gain or natural landforms that alter the global solar exposure over a building.

- **Road**

Road is an object type used to model roads and streets in iCD. It is an essential object in order to run accessibility and walkability assessments.

- **Pavement/ Sidewalk**

Pavement / Sidewalk is an object type that allows modelling Pavement or sidewalks in iCD. In the absence of roads pavement can be used in order to run accessibility and walkability assessments.

- **Hard landscape**

Hard landscape and Pervious hard landscape are object types that allow to model hard landscape elements in iCD, such as stones, rocks or pavement. Modelling a landscape as a Hard landscape or a pervious hard landscape has an incidence on site rainwater runoffs.

- **Soft landscape**

Soft landscapes (turf, shrubs, ground cover, mixed vegetation and wetlands) are object types that allow to model soft landscape elements in iCD. Modelling soft landscape depending on its type has an incidence on site rainwater runoffs.

- **Parking Bay**

Parking bay is an object type that allows the user to model parking lots in iCD. Modelling parking bays has an effect on site rainwater runoffs.

- **Water**

Water is an object type that allows the model bodies of water in iCD.

For more details, visit iCD objects.

## 1.9 Point objects

**Point objects** are elements that do not require a footprint to be created. This group includes items like photovoltaic panels (PV), lights, and charging stations.

1. Click on the **Create** button, and select the point objects (e.g., PV).
2. Add the relevant data.
3. Click **Create from Selection**.

*Note: **Duplicating point Objects**: Point Objects can be copy-pasted using the traditional method (Ctrl + C and Ctrl + V). To copy multiple Point Objects at the same time, use the command **Ctrl + C x [number of point objects].***

4. *Example: Enter **Ctrl + C x 10** to add 10 point objects to the model.*

**Example**

- *Click the Create Button, Create the PV, add the PV attributes, and position it in the model.*
- *Click **Create from Selection**.*

***Note:** Once the solar assessment is completed, the results can be visualized in the report under **Extensions > IES iCD > Reports > Ready-made Reports > Site Renewable Reports > Full Site**.*

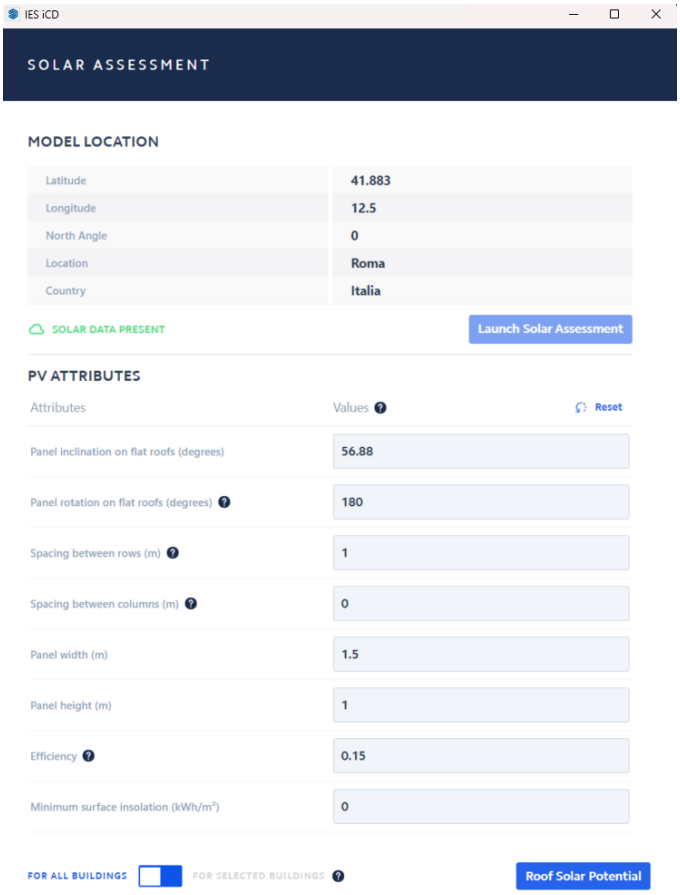
For more details, visit Object's Geometry and Data Assignment.

## 1.10 Solar Assessment and Roof Solar Potential

A method to speed up the implemetation of PV panels and their analysis is through the use of Solar Assesment.

The **Solar Assessment** allows the user to generate insolation data based on the project's geographic location. Once the geo-location is set, the Solar Assessment can be accessed via **Extension tab > IES iCD > Solar Assessment**.

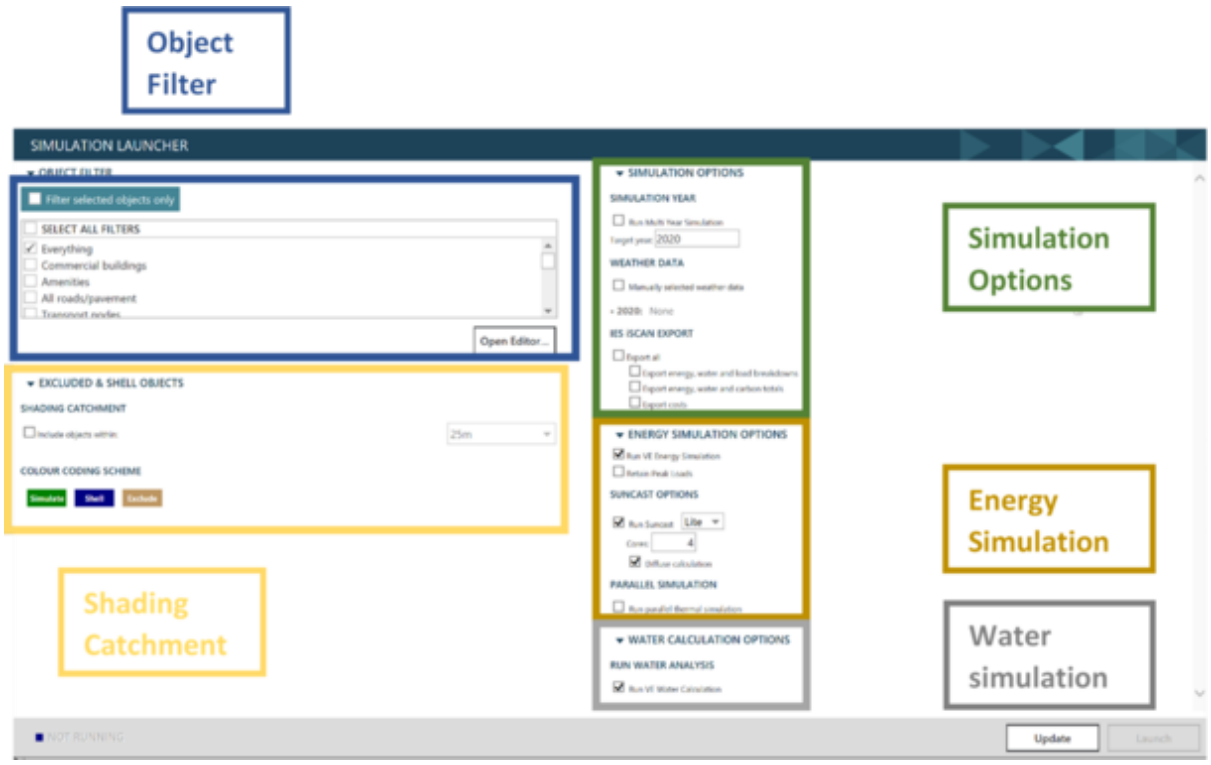
The Solar Assessment can also be used to automatically populate the model with PV panels. Once the assessment is completed and the results are saved, the panel for planning and designing PV systems on various rooftops (PV attributes) will be unlocked. At this point, the relevant parameters need to be entered, as shown in the image.




For more details, visit Photovoltaic (PV) panels.

## 1.11 Run Simulation Options

The iCD Simulation Launcher enables users to conduct energy and water simulations using the VE calculation engine. These simulations generate data that can later be visualized through reports, in the visualization tool, or directly in the Query menu of each building.




The general workflow for running simulations is as follows:

1. **Select the buildings** you wish to simulate.
2. Click the Simulation button in the toolbar.
3. **Choose the shading catchment options**.
4. **Select the simulation options** and click **Update**.
5. **Launch the simulation**.

For more details, visit: [iCD Simulation Launcher].

## 1.12 Create a Model from GIS Files and CSV Files

To the geometry creation, another method for creating geometry is by using **GeoJSON** or **Shape files**. GeoJSON is a widely-used topographical format that includes geometries and polygons. It contains various information, such as building names, locations, and heights. GeoJSON files can often be downloaded for free from government websites.

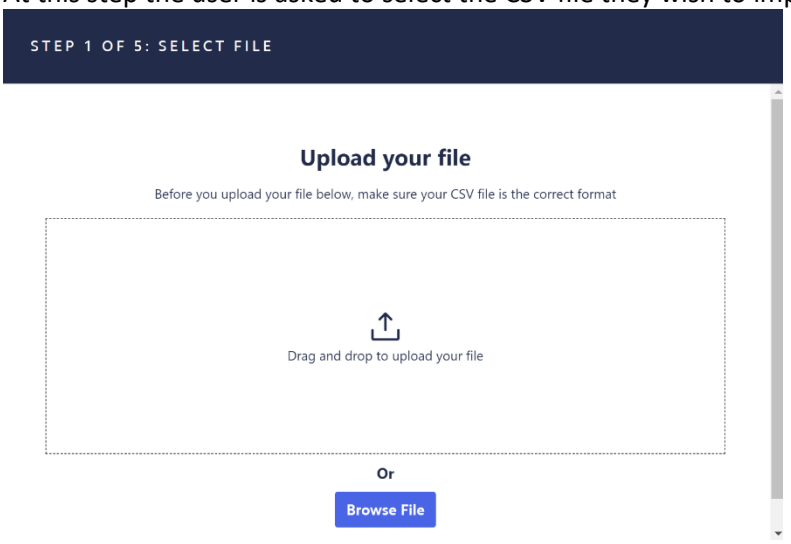
GeoJSON files can be imported into the iCD model via **Extension > IES iCD > Import/Export > Import GeoJSON (with attribute mapping)**. Once the GeoJSON file is imported, it can be enriched by incorporating and using a CSV file, as previously explained.

1. **Additional data to be added through CSV import**: Number of storeys, primary use.
2. **CSV Import**: the functionality is accessible directly from the toolbar via the below icon

The CSV import is broken down into 5 steps described below.

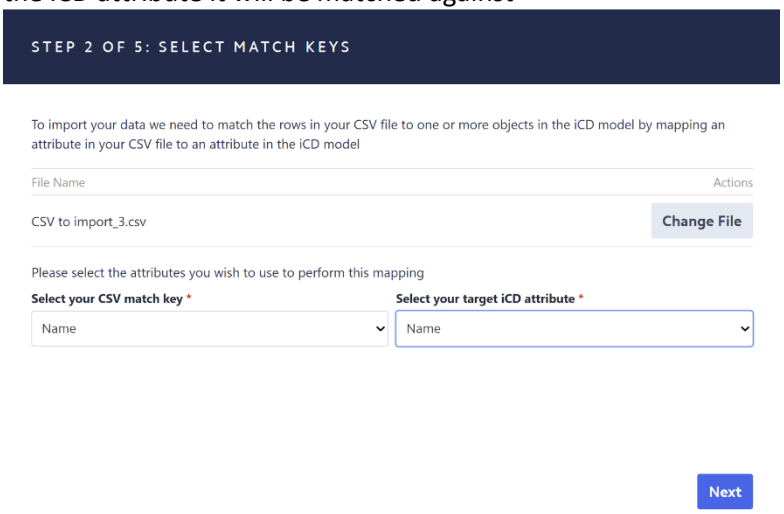
Selecting CSV file

At this step the user is asked to select the CSV file they wish to import.




Selecting the match key

At this step the user can choose the CSV column that will be used as a match key as well as the iCD attribute it will be matched against

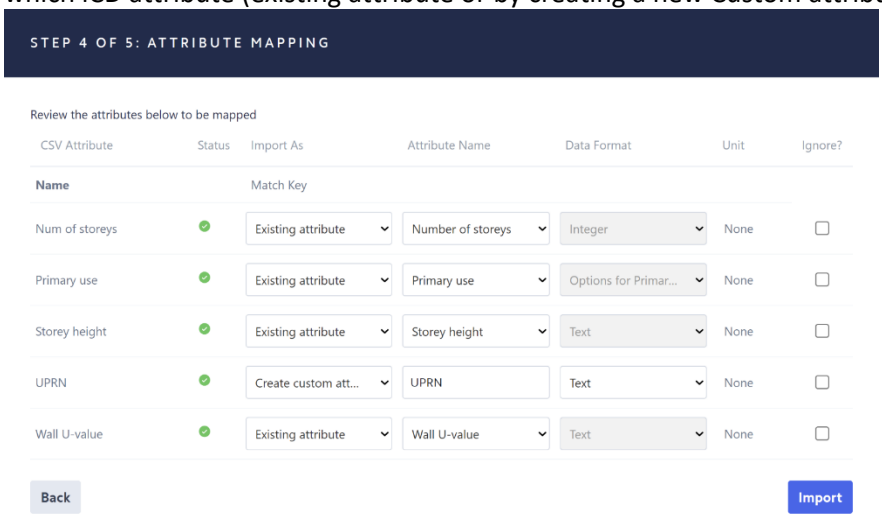



Reviewing the match

The user can review the objects targeted by the CSV import based on the selected match key.

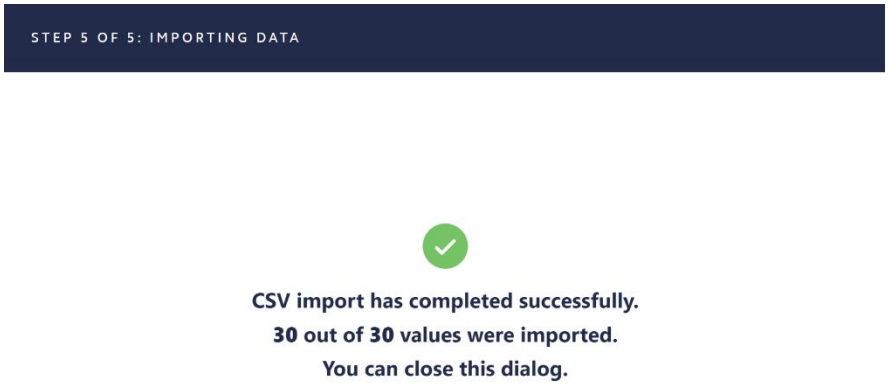

Attribute mapping

At this stage the user defines which column in the CSV file is meant to be imported into which iCD attribute (existing attribute or by creating a new Custom attribute).

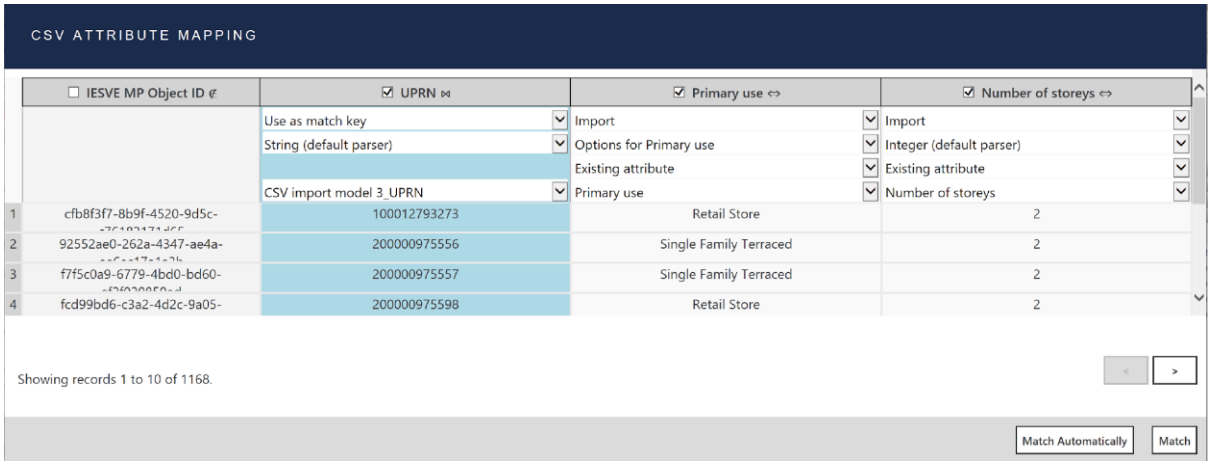



Importing data

The data are imported to model as part of this stage and iCD gives the user an overall feedback



3. Import the GeoJson File.
4. Browse for the CSV File.
5. Use **UPRN** as a matching key.
6. Import the following columns:
    - **Primary Use** (Existing attribute, Option for primary use),
    - **Number of Storeys** (Existing attribute, Integer, Number of storeys),
    - Import other attributes as custom attributes (create a new list of strings and assign a name to each new attribute).
7. Click **Match**. Once the match is made, click **Assign.**




For more details, visit Data Import/Export.

# 2 PART 2

## 2.1 Results visualisation

The results of the simulation can be easily viewed in iCD using several methods:

- Using the Query Tool: Navigate to the "Simulation Results" section.
- Accessing Reports: Go to Extensions > IES iCD > Reports > Ready-made Reports, then select an appropriate report, such as Energy Reports > Full Energy Report.

Note:

- Each report's images or graphs can be saved as PNG files by clicking the arrow next to the graph title. The visuals can also be customized by adjusting the graph elements.
- If the water simulation is completed, you can view the detailed water report, which includes various schematics.

For more details, visit: Data visualisation and reports.

## 2.2 Scenarios

iCD enables the comparison of multiple design options by analyzing them within a model to identify the optimal solution. It allows users to evaluate the effects of various parameters on both the water and energy performance of a project. To use the scenario tool follow the steps:

1. **Set Up the Base Case:** The currently open model is considered the base scenario. Before creating any scenarios, make sure to run a simulation on the current model.
2. **Create a New Scenario:**
    - Go to *Toolbar* > *Scenarios* > select the base scenario > *Duplicate*, then give it a name (e.g., *Scenario 1*).
    - Open ***Scenario 1*** and make changes to the model, such as adding insulation to the walls.
3. **Simulate the Modified Scenario:**
    - Run the simulation again by clicking the *Simulation* button in the toolbar, selecting the building, using the *Filter Selected Building Only* option, clicking *Update*, and then *Launch*.
4. **Compare Scenarios:**
    - Click the *Scenario* button in the toolbar, select both scenarios, and choose *Compare Selected* to generate the *Energy Reports* > *Full Energy Report*.

**Note:** After comparing, you can generate the *Renewable Energy Report* to view the different components.

Examples Scenario:

- **Scenario 2:** Add heat pumps and photovoltaic panels (PVs).
- **Scenario 3:** Modify profiles and setpoints.
- **Scenario 4 (CO2):** Enhance the environment by adding trees, green areas, etc.

Experiment with different changes to see their effects on the project's performance.

For more details, visit: Scenarios for comparative analyses.

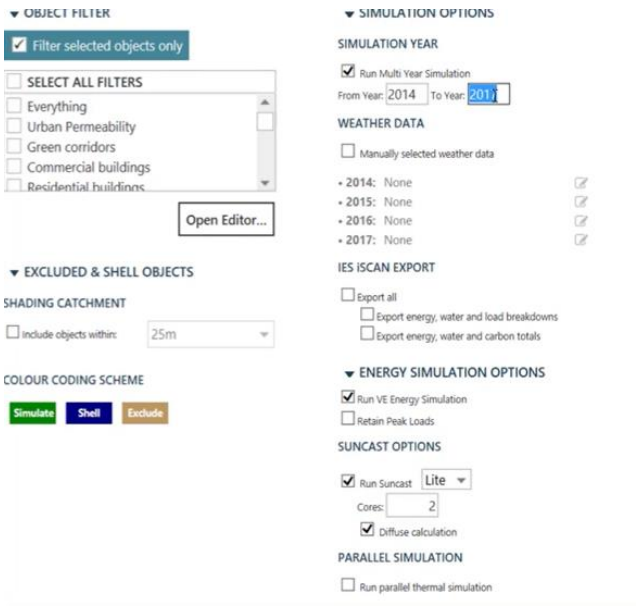
## 2.3 Time Dimension e Multi-year simulation

This feature can be useful for defining a model in relation to a previously dated scenario. If desired, with **custom attributes**, you can define the **"Date Constructed"** and **"Date Demolished"** to provide a complete overview of all buildings, even if that information is not available. If the **"Date Constructed"** and **"Date Demolished"** attributes do not appear, they can be unlocked by navigating to **Extension > IES iCD > Attribute Visibility**.

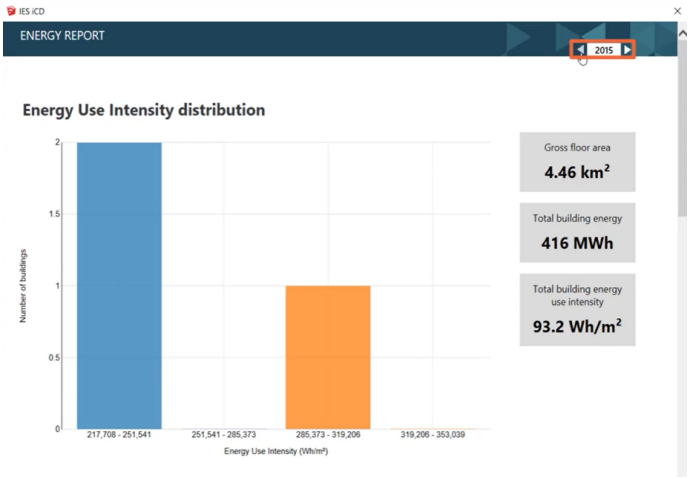
1. Click on **Time Dimension** to visualize the buildings that have been demolished and constructed throughout the timeline.

2. If you choose a specific date, once the scenario related to that date is run, the demolished and constructed buildings will be added to specific layers in iCD. You can access these layers by going to **Extension > IES iCD > iCD Layers**.

3. If you navigate back in the timeline, you can modify all attributes (such as wall insulation, HVAC, etc.). When you return to the present, the attributes will revert to their current state. This is particularly useful for conducting **Multi-Year Simulations**.




IES will execute all simulations for the selected years. When generating the report, you can choose the year you wish to display. The same applies to the **Visualization Tool**.




For more details, visit: Time Dimension.

## 2.4 Basic Carbon Emissions Analysis

In iCD, it is possible to perform a **Carbon Emissions Analysis** semi-automatically.

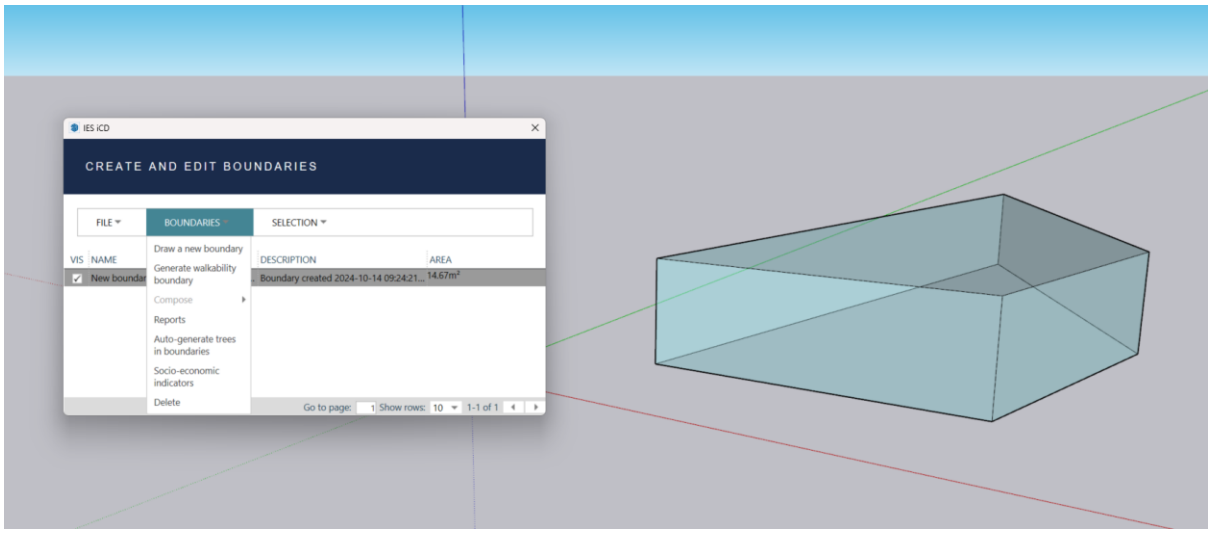
1. First, you need to define the **CO2 emission coefficient** for each energy source in **Extensions > IES iCD > Preferences** (i.e., Biogas, Electricity, etc.).

2. After that, you can run the simulation, considering factors like trees and electric vehicle charging stations (you can select these three types for the simulation).

3. Select the three elements and view and modify the **CO2 Emissions** tab with the **Query tool.**

4. Generate a report on carbon emissions by navigating to **Extensions > IES iCD > Reports > Ready-made Reports > Site Renewable Reports > Full Carbon Emissions**.

***Note***: You can use the **Boundary Tool** to create trees and automatically generate them within the defined boundary. First, we need to create a new boundary. After creating the boundary as shown below, the Auto-Generate tree in the boundaries can be clicked.




For more details, visit: Carbon analysis.

## 2.5 Basic Cost Analysis

Like the carbon emissions analysis, iCD can also conduct cost analyses.

1. In **Extensions > IES iCD > Preferences**, you need to define the **current currency** and the costs for each energy source used.

2. After that, launch the simulation. If a simulation has already been completed, you can use those results.

3. Once the simulation is complete, you can view the report by navigating to **Extensions > IES iCD > Reports > Ready-made Reports > Site Reports > Cost Savings Breakdown**.

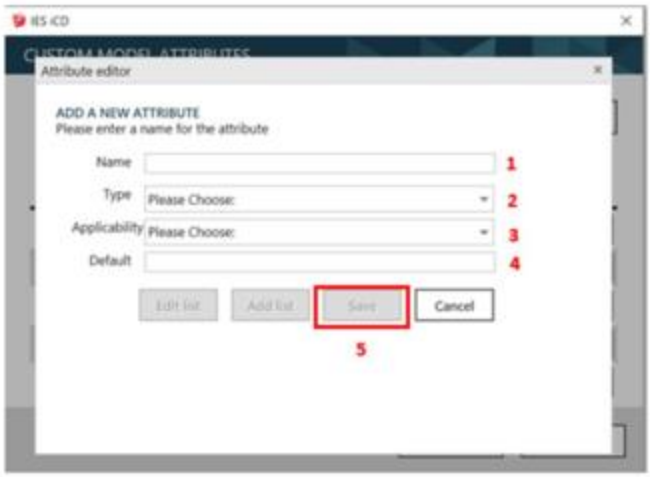
For more details, visit Basic cost analysis.

## 2.6 Creating a custom attribute

The ***Customize*** feature in iCD allows users to create additional attributes for the model, enabling the incorporation of specific data as needed.

1. **Open the Customize Menu:** Select *Customize*  from the iCD toolbar.
2. **Add a New Attribute:** In the *Custom Model Attribute* window, click *Add Attribute*.
3. **Define the Attribute:**
    - **Name:** Enter the attribute's name (e.g., "Services").
    - **Type:** Choose the attribute type from the list (i.e. text, list, integer, true/false, or number) based on the requirement.

4. **Set the Applicability:** Determine where the attribute applies (e.g., to all objects, buildings only, floor plans only, rooms only, landscaping, or shading). The attribute will be available only for the selected category.
5. **Specify a Default Value:** Set a default value for the attribute before saving the configuration.




2.6.1

- **Example 1:**
  - Create an attribute named "Services" and select the type as *List*.
  - Add items to the list (e.g., "Pharmacy," "ATM," "Supermarket") and save.
  - Choose the newly created list, set a default value, and save the attribute.
- **Example 2:**
  - To indicate buildings equipped with electric vehicle charging stations, use a *Boolean* attribute (True/False).
  - Alternatively, choose the *Number* type, define a unit of measurement (e.g., number of charging stations), and enter the data accordingly.

This process ensures that custom attributes align with the specific needs of the project model.

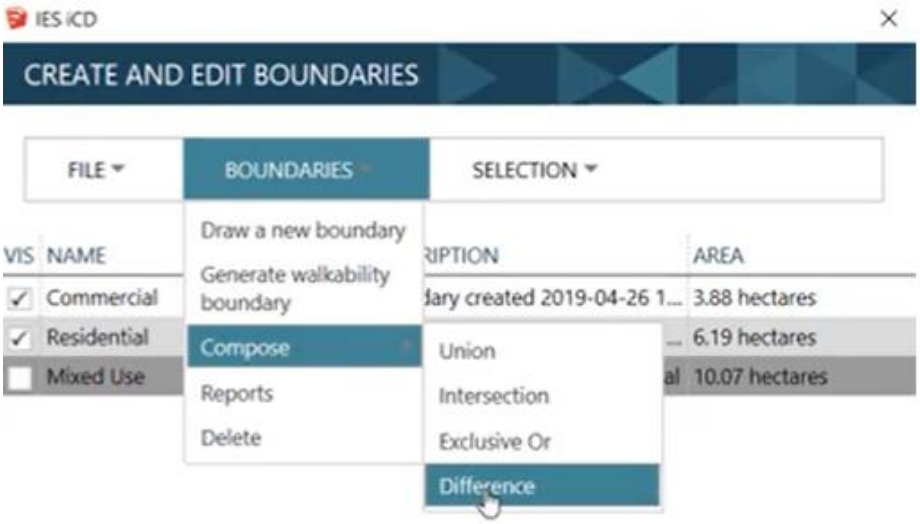
For more details, visit Create a custom attribute.

# 3 PART 1 and 2 - Extra Features

## 3.1 Boundaries

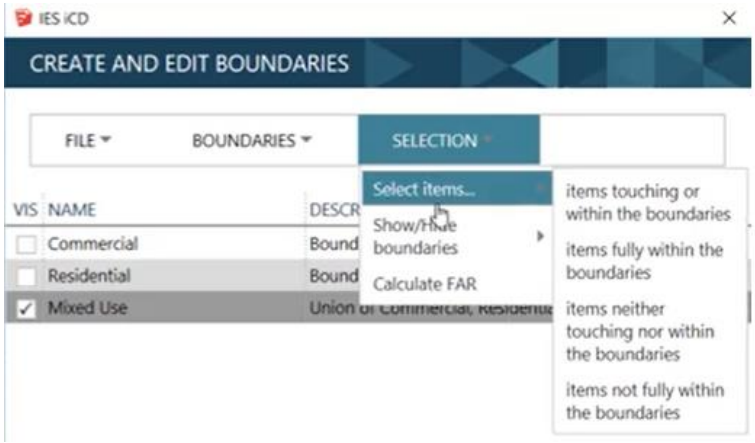
This tool simplifies the process of dividing a group of buildings into specific areas:

1. **Open the Boundary tool**  **.**
2. **Draw the Boundary:** Outline the boundary around a building and any point objects.
3. **Create the Boundary:** Click the *Create* button, then name the boundary.
4. **Use the Boundary Button:** Access the *Boundary* option in the toolbar to finalize the boundary setup.




***Note:***

- ***Reports:***
  *For large master plans, reports are valuable for visualizing partial model simulation results. To generate a report for specific areas, select the buildings within the defined boundary.*
- ***Using the Selection:***
  *The Selection Tool allows for a quick selection of buildings within the boundary. This is particularly useful for tasks such as simulating a subset of the master plan or modifying specific attributes.*




## 3.2 Accessibility Assessment

This tool is used to measure the distances between services or specific amenities within the model. The **"Roads and Pavements"** must be modelled and enabled.

1. Navigate to **Extension > IES iCD > Accessibility Assessment**.
2. Select the attribute and choose the corresponding value. Click on the map to set the desired location.

For more details, visit: Accessibility Assessment.

## 3.3 Walkability Boundaries

iCD allows to perform a Walkability Assessment which shows the area covered under a given walking distance to a point in the model. The **"Roads and Pavements"** must be modeled and enabled.

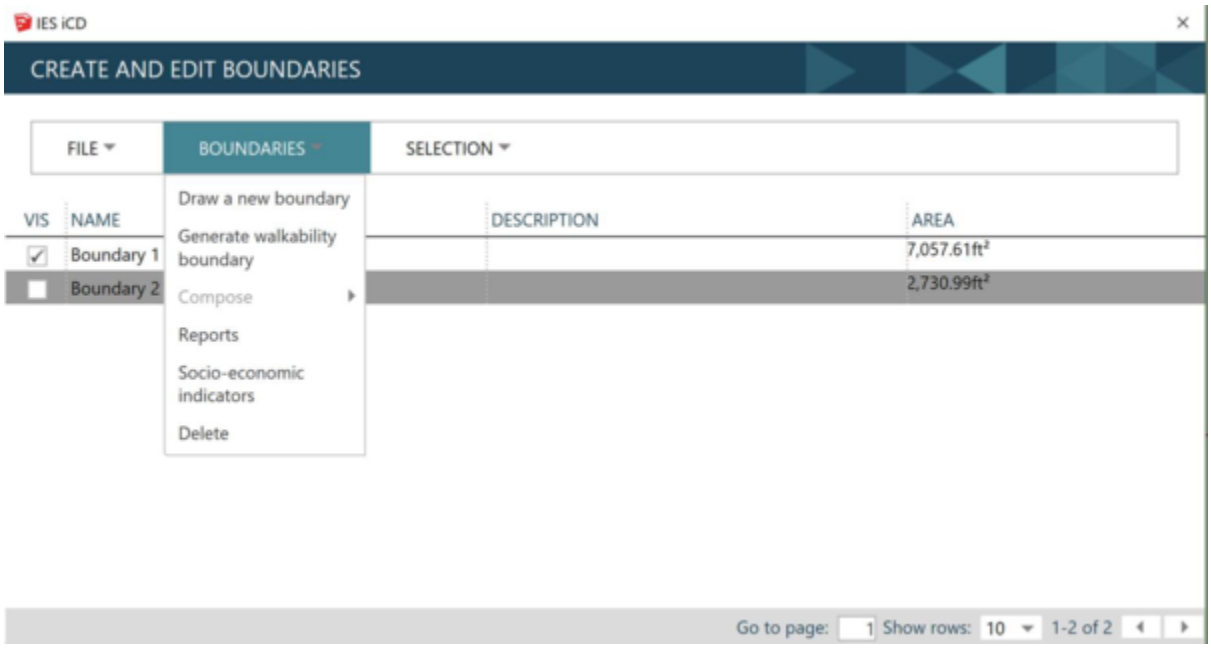
1. Click the **Boundary** button in the toolbar.
2. Navigate to **Boundaries > Generate Walkability Boundaries**.

For more details, visit: Walkability Assessment.

### 3.3.1 Socio-Economic Indicators and Custom calculations

The Socio-Economic Indicators dialogue allows the end-user to perform a series of calculations over a number of years, based on specific inputs. The user can use these calculations to generate values for the default socio-economic indicators or create their own custom indicators and calculations.

Custom calculations (or Socio-Economic Indicators) are done at a boundary level. It is then necessary to have defined boundaries in the model prior to doing these calculations.
There are two ways to access the Socio-Economic indicators Dialog:
1. You can right-click on the desired boundary and select **IES iCD > Socio-economic Indicators**.
2. Or open the Boundary tool in the tool bar. Select the desired boundary from the list by ticking the box on its left side. Then click **Boundaries > Socio-economic indicators**).



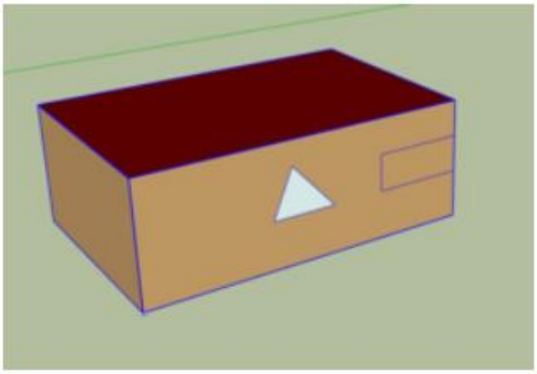

For more details, visit: Socio-Economic Indicators and Custom calculations.

## 3.4 Complex Geometry

iCD allows the manual creation of complex geometry.

1. The creation of Complex Geometry starts from a SketchUp model or an imported model.
2. Right-click on your building and select **IES iCD > Preview Geometry.** Here, you can see how iCD interprets what you have drawn (thermal zone, local shade, etc.).
3. To create your **iCD Object**, first right-click and select **Make a Group** to unify it into a single block, and then click the **Create Object** icon in iCD.
4. It is important to correctly define the desired spaces at this stage and ensure that each one is represented by an appropriate bounded volume.

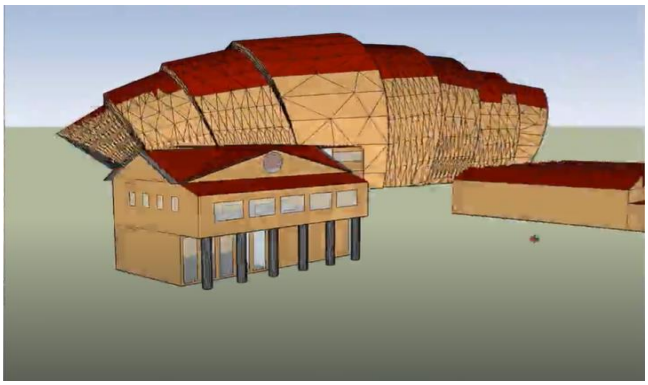
- iCD interprets polygons (or circles) within a face that define a bounded volume as glazing.
- iCD interprets faces that do not define a bounded model as local shades.



**Note:** Once the iCD model is created, it is possible to convert the iCD complex geometry into a SketchUp model and make changes as a SketchUp element. You can convert a simple geometry building into a Complex Geometry Building by following these steps:

- Right-click on the building to open the contextual menu.
- Go to **IES iCD > Convert to Complex Geometry**.
- Double-click on the building to edit it.

**Note**: models can be imported from VE as 3D AutoCAD drawings, from Blender, or from Rhino (exporting as SKP files).



For more details, visit Object's Geometry and Data Assignment.