1. Toolbox: ECOTECT

1.1. Description of the tool

ECOTECT is an environmental design tool for predicting and analyzing building energy performance and environmental impacts. It contains extensive analysis functions which comprise

- **Solar analysis**
  - Shadows and reflections
  - Shading design
  - Solar availability
  - Solar exposure
- **Lightning analysis**
  - Daylight factors
  - Illuminance level
  - Right to light
- **Thermal analysis**
  - Heating and cooling loads
  - Comfort levels
  - Temperature distribution
- **Acoustic analysis**
- **Visual Access/ Impact analysis**

The tool is driven by the concept that environmental design principles are most effectively addressed during the conceptual stages of design. The software responds to this by providing essential visual and analytical feedback from even the simplest sketch model to highly complex 3D models. The model is completely scalable, handling simple shading models to full-scale cityscapes.

Especially the solar components of the tool are very useful. For simple shadow analysis, the annual sun path and daily sun path in the software can be turned on, allowing to view the shadow casting by a design during various times of the year. For day lightning analysis, the geographic location of a project can be specified, either from a list of locations or in terms of latitude and longitude. Once the project site is set, the design can be opened and a point in the space that is to be analyzed can be specified. The lightning wizard makes it possible to obtain the lumens value of the chosen area.

For analysis, Ecotect overlays a regular 3D grid, subdividing the modeled space that should be analyzed. The grid can be manually applied and adjusted, or automatically fitted to a selected object. The auto-fit option makes it easy to position the grid over complex 3D objects (for example, a curved roof or an irregularly shaped floor). With the grid in place, the weather data by region can be loaded, and the software can run comfort and thermal analyses.

In addition, the tool can calculate the electric generation of photovoltaic panels installed on the roof areas.

1.2. Outcomes of the tool

Active and passive solar gains displayed in
- A wide range of graphing methods (Outcomes can be saved as Metafiles, Bitmaps or animations)
- Tables of data

1.3. Assessment of the tool

1.3.1. Advantages / Disadvantages

Advantages
- Allows to "play" with design ideas at the conceptual stages

- Provides essential analysis feedback even from the simplest sketch model
- Relatively low-priced in comparison to other tools with similar features
- Proper visualization of climate data
- Possibility to export outcomes to various programs, like AutoCAD, Energy Plus,
- RADIANCE, etc., for more specific analysis or validation

Disadvantages
- Calculations not always accurate (problems with summing up the performance of different surfaces)
- The user needs to be aware of the different modeling and data requirements
  o The ECOTECT Help File attempts to guide/educate users about this and when/how it is important. Like any other analysis program it is a matter of "garbage in, garbage out…"

1.3.2. Improvements
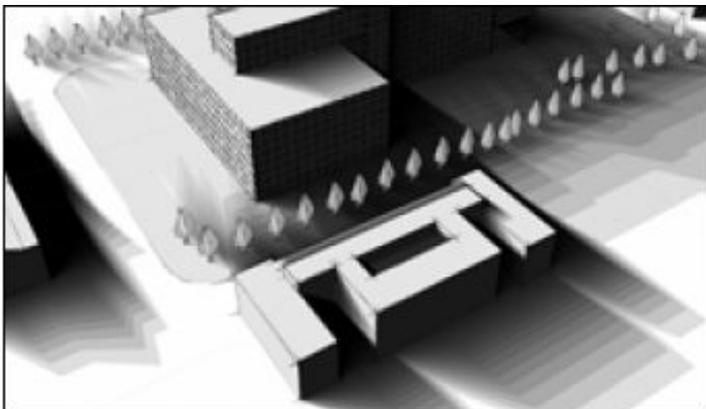- Advancement of the calculating capacity

## 1.4. Examples

Solar Radiation
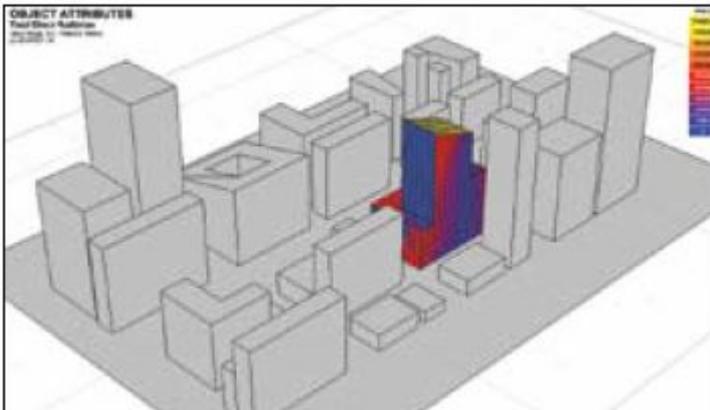
Visualize incident solar radiation on windows and surfaces, showing differential incident solar radiation calculated over any period.

Shadows and Reflections

Display the sun's position and path relative to the model at any date, time, and location using this simulation tool. View how sunlight enters through windows and moves around within the space.

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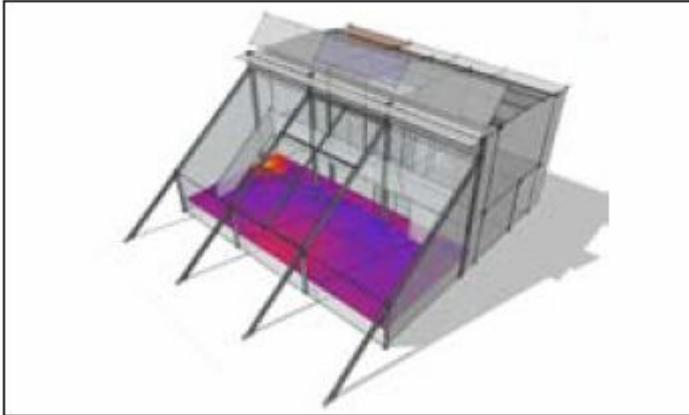
Day lightning

Calculate daylight factors and illuminance levels at any point in the model or over the analysis grid. This tool helps determine potential savings due to daylight-linked lightning design.

1.5. Literature

- Autodesk Ecotect Analysis (2011): Visualize sustainable Design.

- Website U.S. Department of Energy
  Building Energy Software Tools Directory
  http://apps1.eere.energy.gov/buildings/tools_directory/software.cfm/ID=391/pagename=alpha_list

- Website Architecture Week
  Autodesk Ecotect Analysis 2010
  http://www.architectureweek.com/2010/0602/tools_1-2.html