

United Technologies

Building & Industrial Systems

Carrier E20II
Basic Hourly Analysis Program
Training

By

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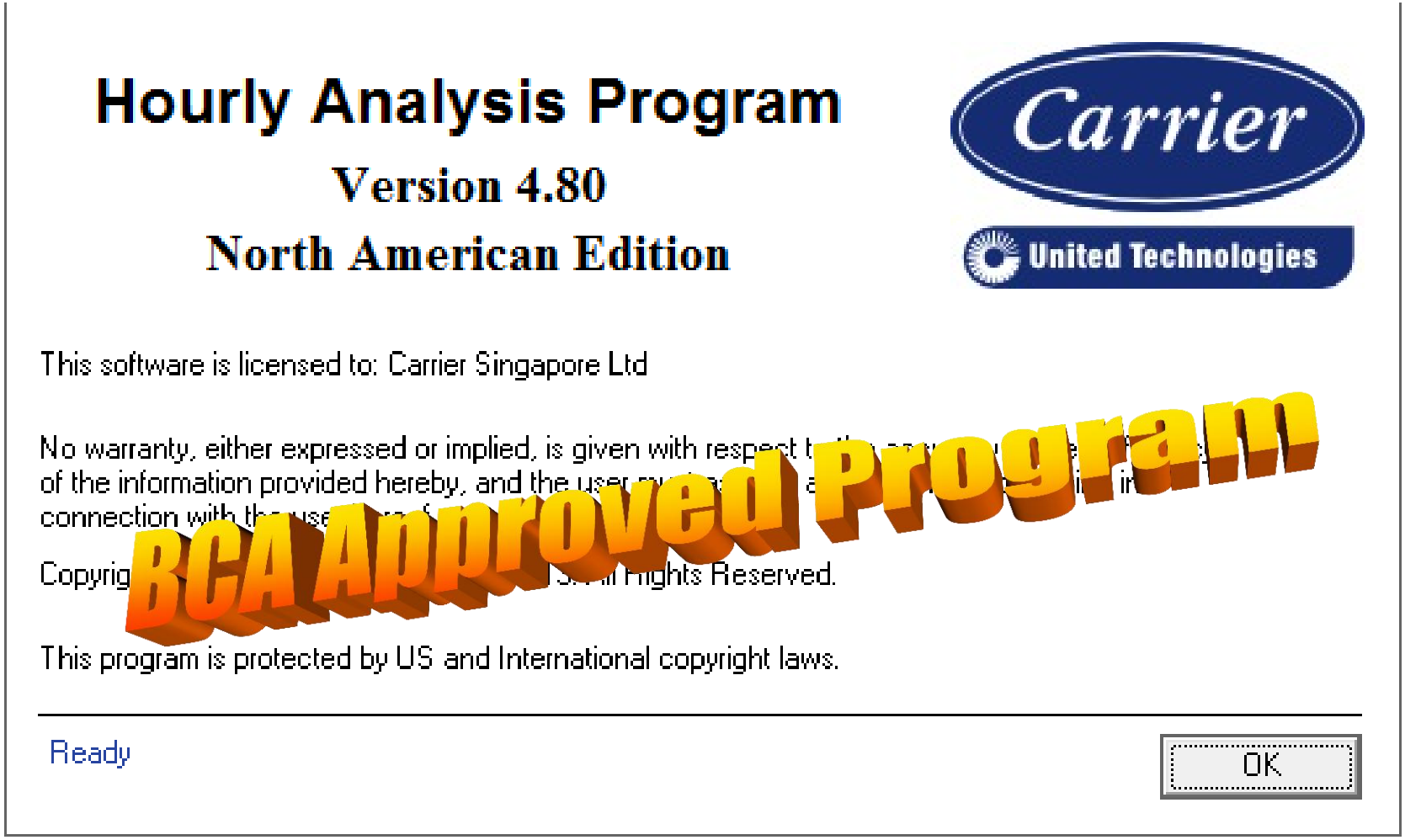
Plan & Specs

Carrier Hourly Analysis Program

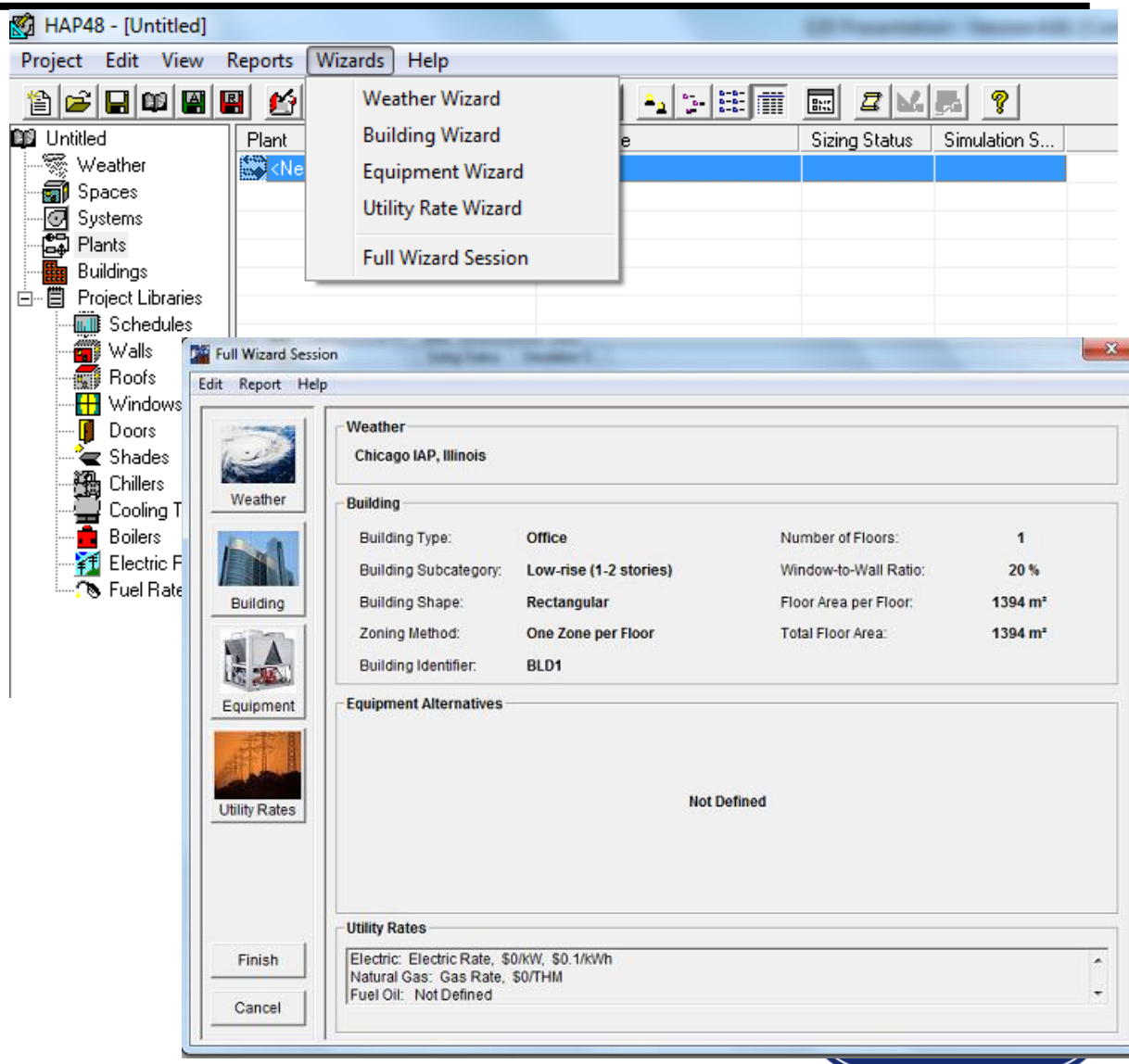


New Features In HAP - Ver 4.8

- “Import Project HAP Data” feature in the main window to allow full merging of projects
- Added variable refrigerant flow (VRF) equipment models
- Added variable speed / flow condenser water pump control
- Reversible Chillers – Added Air-to-Water & Water-to-Water reversible chillers. Reverse cycle to supply hot water to serve heating when in heating mode
- Induction Beams And Active Chilled Beams

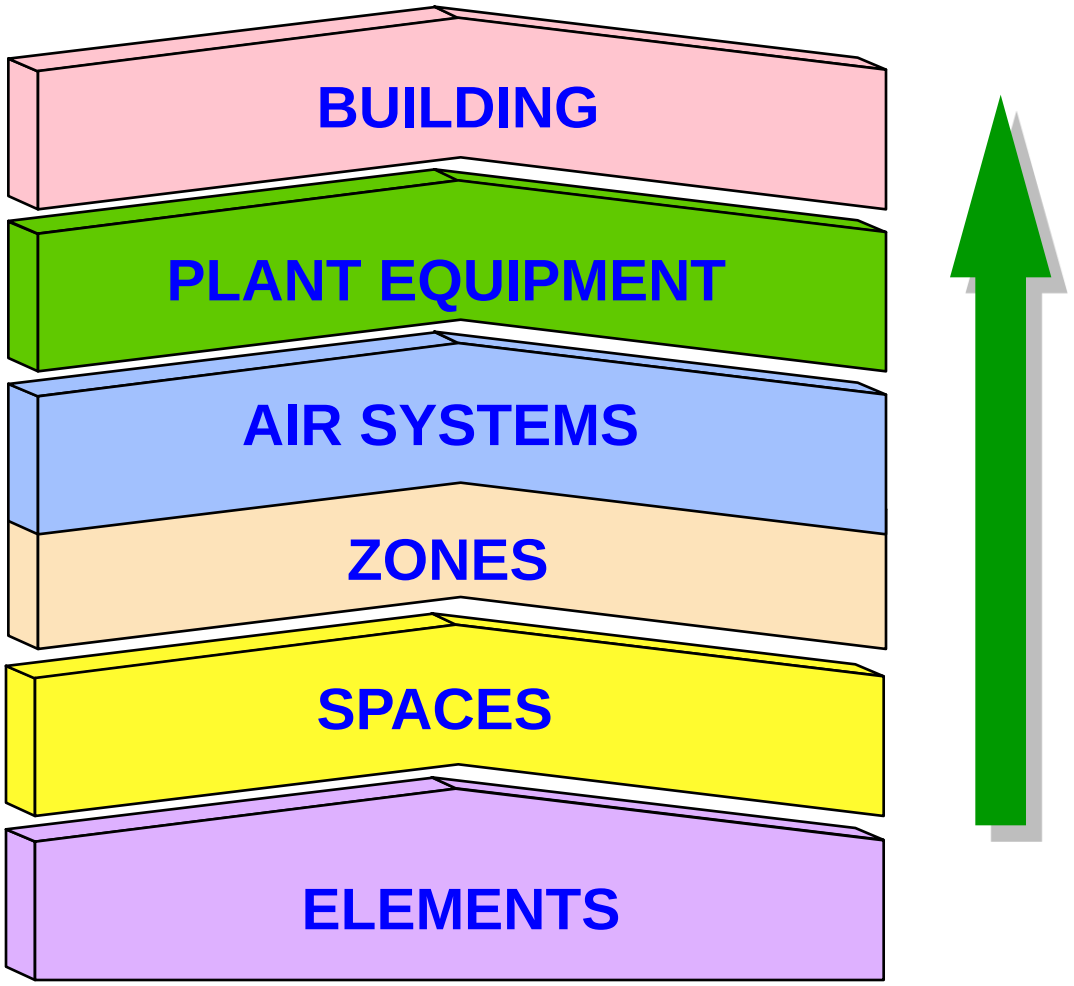
Introducing HAP Wizard Session

- Top Down Approach
- Well Suited for Preliminary or Schematic Design
- Bring a User through a Series of Input Screens i.e. Building Location, The Building, Type of Equipment & Utility Rates
- Applies Intelligent Assumptions to convert User Inputs to a Details Interface
- Wizard Inputs can be Edited Once Returned to Main HAP Program



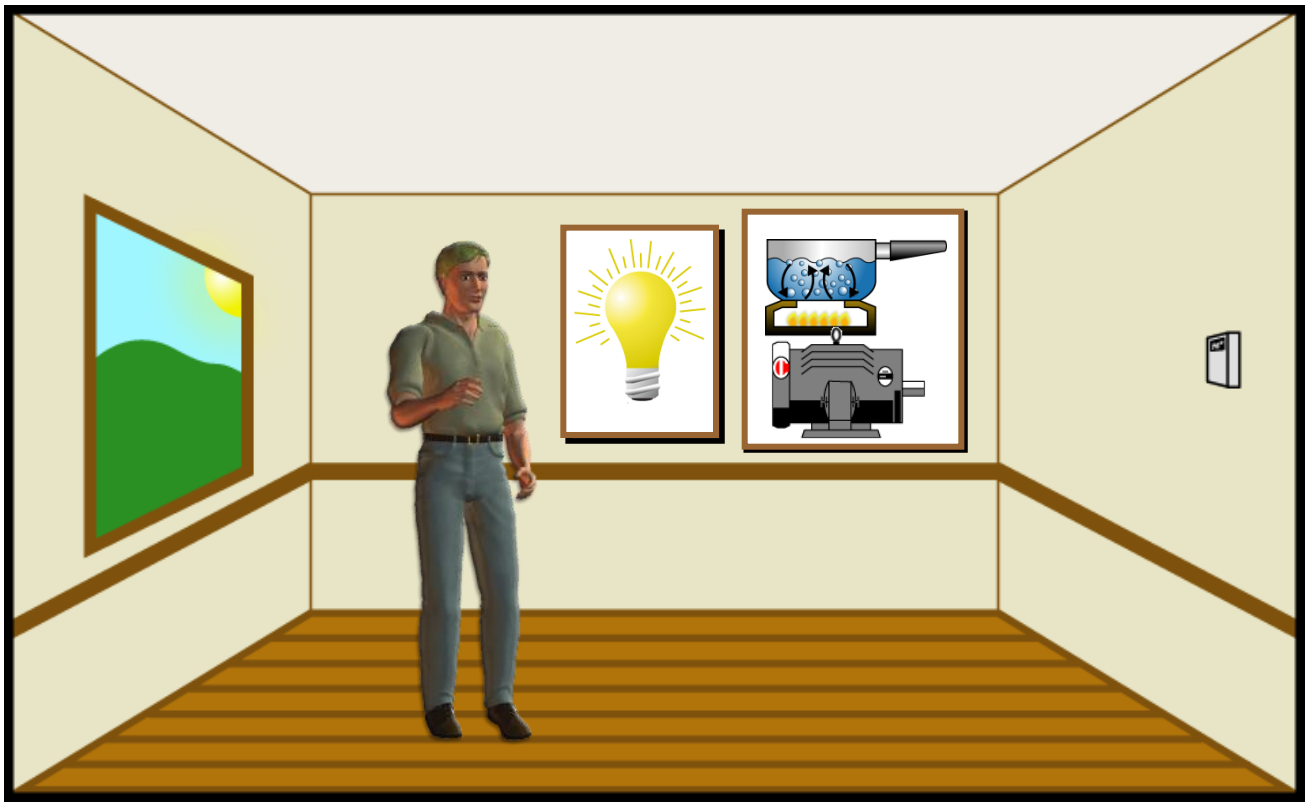
HAP Energy Modeling Building Block Approach

- Bottom Up Approach
- All Data is Directly Entered by the User
- A Sum of the Building to Estimate Operating Costs
- Miscellaneous Building Energy Consumption
- Utility Rate Structures Applied
- Energy Reports in Dollars
- A Way to Model Multiple Alternatives in Design

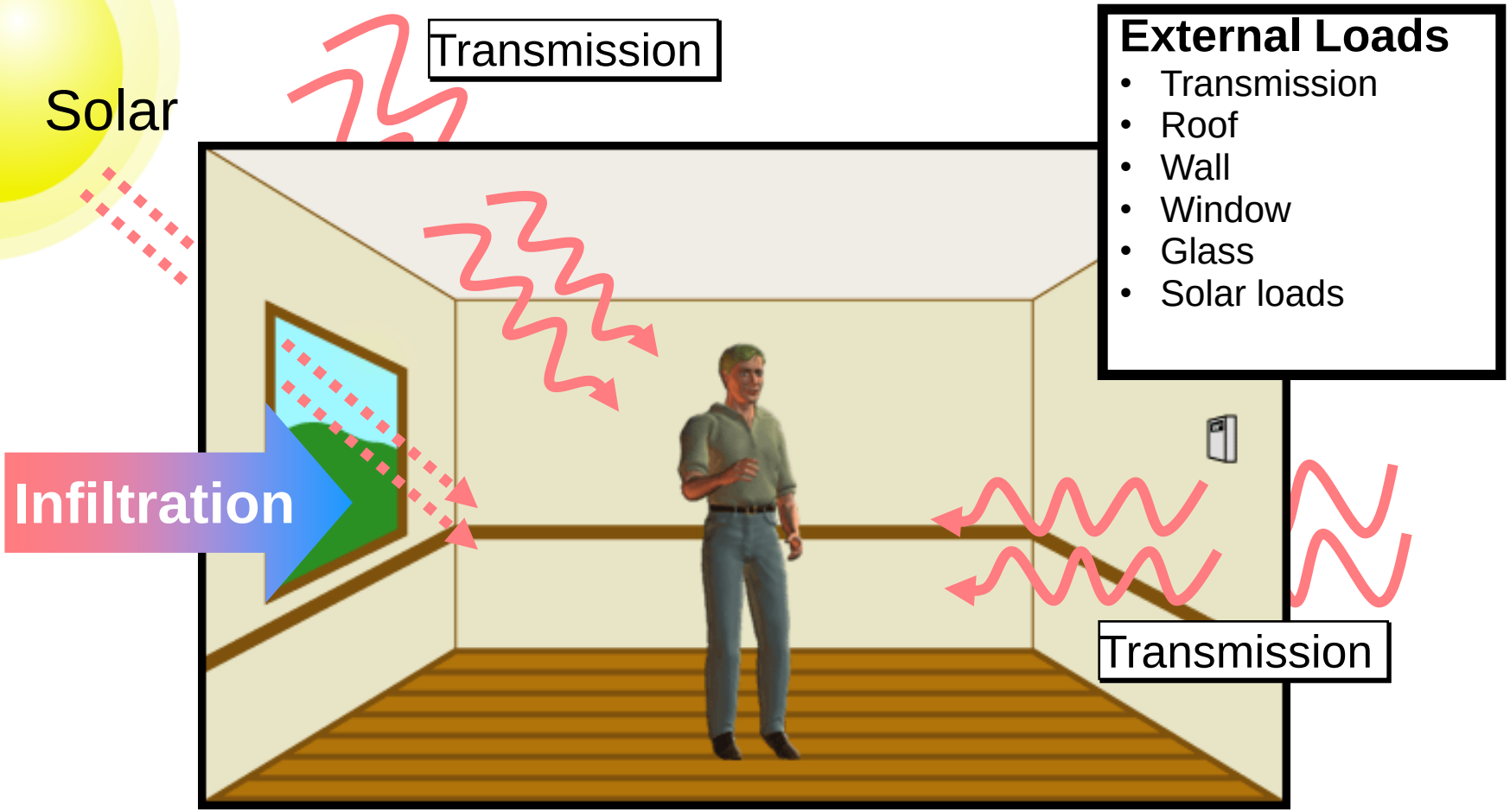


Internal Heat Load

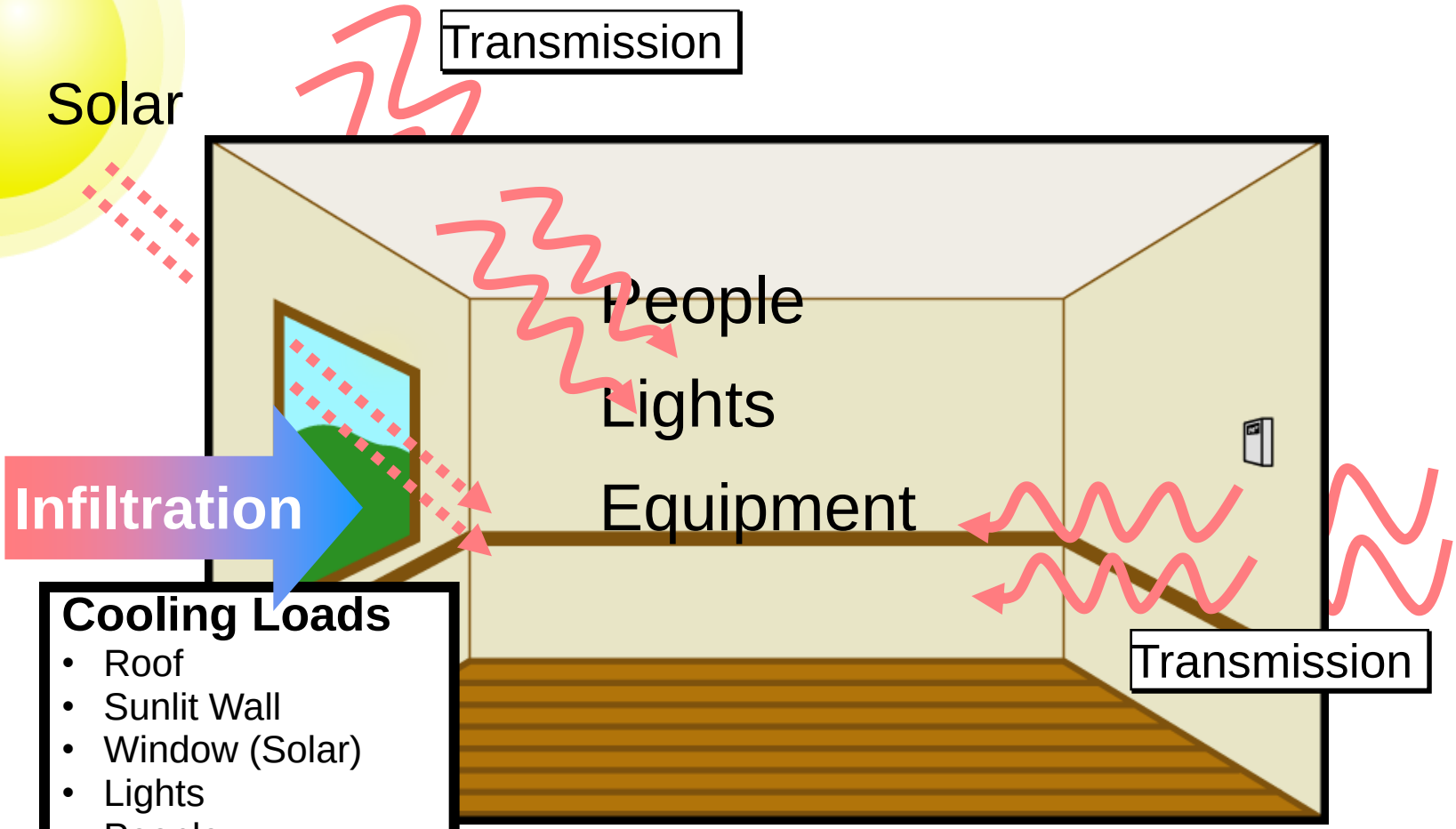
- People
- Lights
- Other Electric
- Schedules
- Miscellaneous



External Heat Load



Building Load

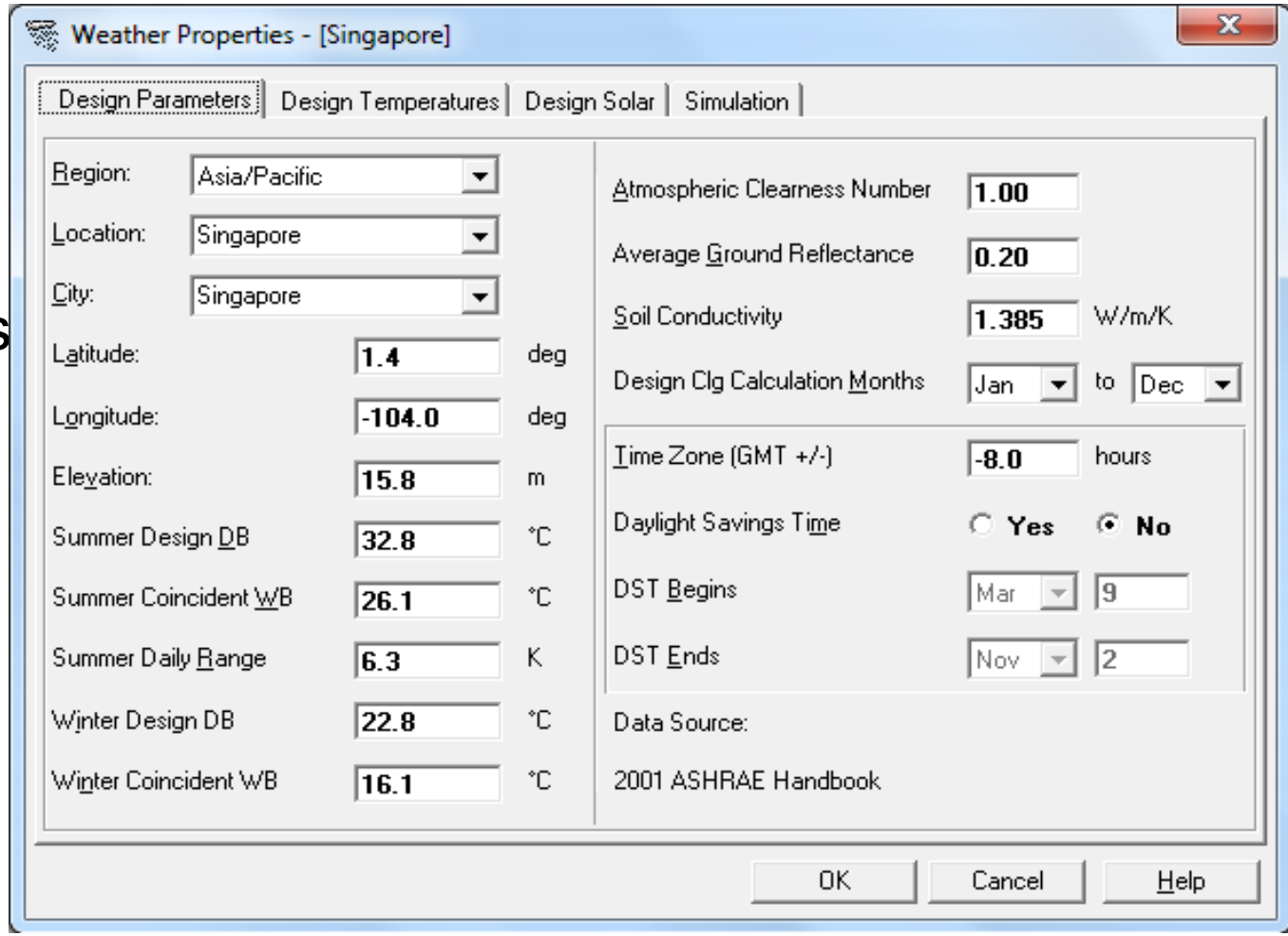


Cooling Loads

- Roof
- Sunlit Wall
- Window (Solar)
- Lights
- People
- Equipment
- Infiltration
- Ventilation

Define Weather Properties

- Space
  - Design Parameters
  - Design Temperatures
  - Design Solar
  - Simulation



Define Weather Properties

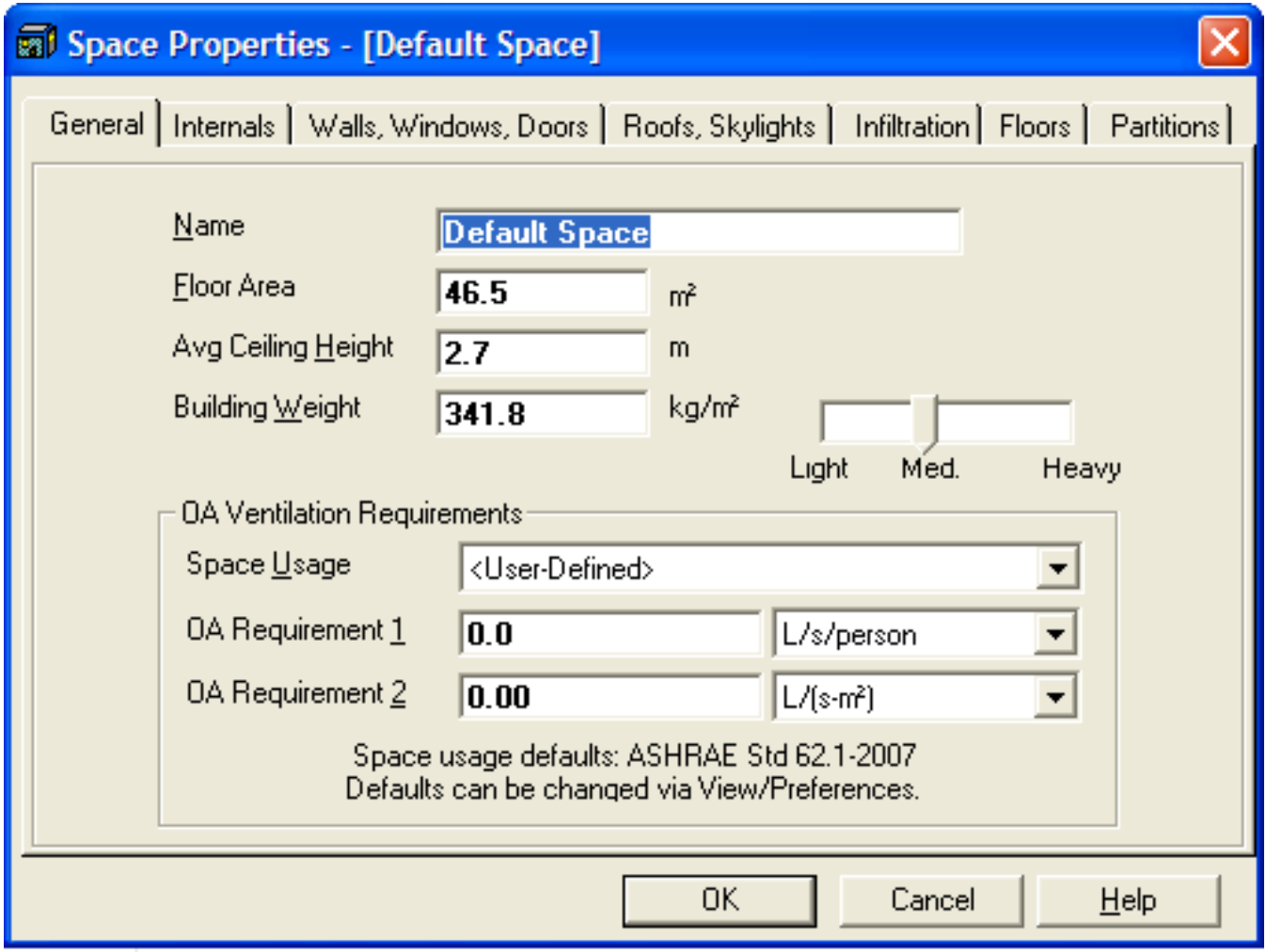
- Design Parameters
  - Atmospheric Cleanliness No.
  - factor used to correct sky solar radiation profiles for unsually clear or hazy conditions
  - Very clear conditions, >1.15
  - Typical conditions, ~ 1.00
  - Very Hazy conditions, <0.85
  - Average Ground Reflectance
  - Solar Radiation reflected by Ground Surface. Typical Values shown below:

Surface Type	**Reflectance**
New Concrete	0.31 to 0.34
Old Concrete	0.22 to 0.25
Bright Green Grass	0.21 to 0.31
Crushed Rock	0.20
Bitumen and Gravel Roof	0.14
Bituminous Parking Lot	0.09 to 0.12

Notes:
1. Reflectance varies with angle of incidence.
2. Data from 2001 ASHRAE Handbook of Fundamentals, Table 10, pg 30.16.

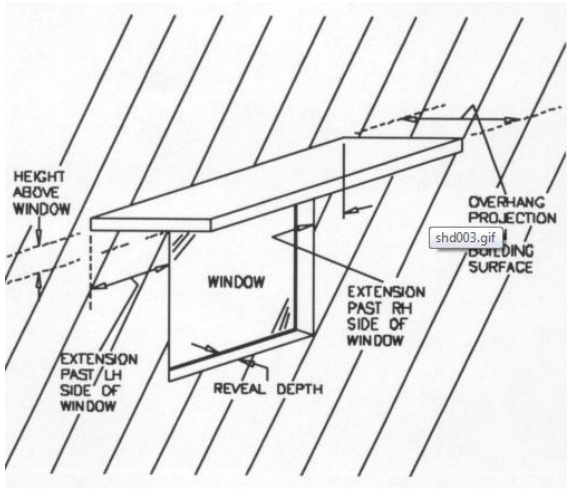
Space Sizing

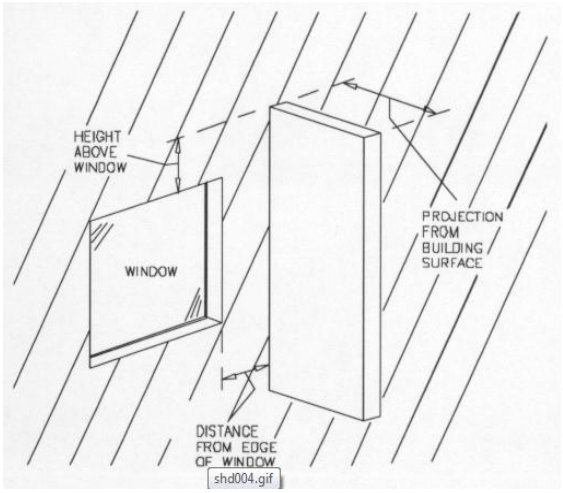
- Space
  - General
  - Internals
  - Walls, Windows, Doors
  - Roof
  - Infiltration
  - Floors
  - Partitions



Space Properties

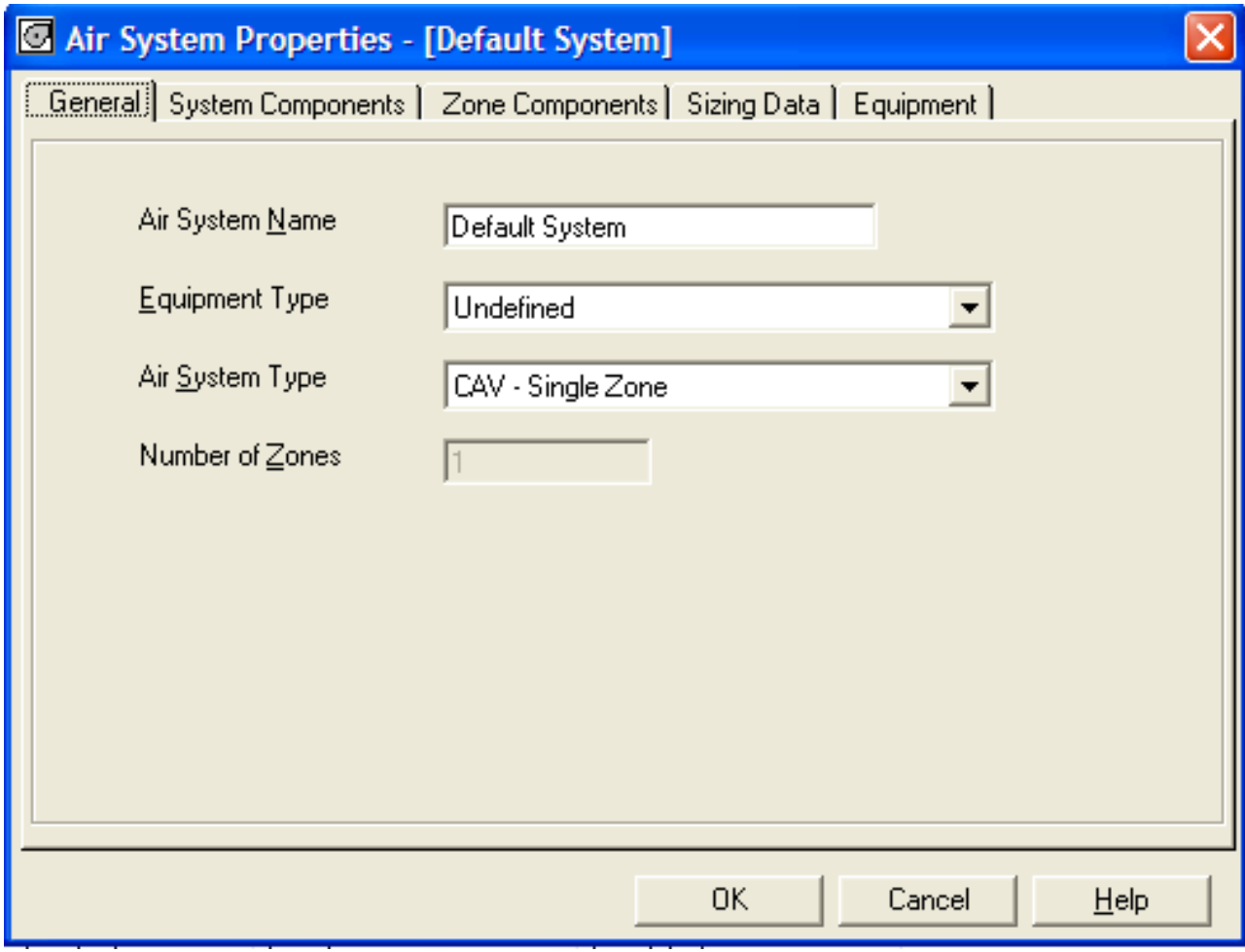
- General
  - OA Requirement 1 and 2
    - One or two outdoor air requirements can be defined for the space. Typically one outdoor requirement is needed.
    - When both outdoor air requirements are specified, they will be additive. 2 OA requirements maybe needed due to the space requiring 2 codes.
- Internals
  - Ballast Multiplier range is from 0.1 to 2.00.
- Shades
  - Overhangs & Fins





System Specification

- Systems
  - General
  - System Components
  - Zone Components
  - Sizing Data
  - Equipments



System Specification

Cooling Coil Capacity Control

1. **Constant Temperature, Fan Cycled -** The supply fan is cycled on and off to modulate cooling provided to the zone. While the supply fan is cycled on, air is delivered to zone terminal at the design supply air temperature. This option is only offered for Chilled Water AHU CAV Single Zone systems.

2. **Constant Temperature, Fan On -** Air is delivered to zone terminals at the design supply air temperature at “occupied” hours. Provides maximum cooling to zones at all times, conditioning must be modulated by varying the supply airflow. This option is offered, VAV, CAV, Dual Duct and Multizone systems.

3. **Cycled or Staged Capacity, Fan On -** During "occupied" system operating hours, the supply fan runs continuously to condition and ventilate. In a DX unit, compressors cycle or unload to modulate the cooling provided to zones in the system. In a chilled water unit, water flow or water temperature is modulated to control cooling coil capacity.

4. **Temperature Reset by Greatest Zone Demand -** During "occupied" system operating hours, the supply fan runs continuously to condition and ventilate. The supply air temperature is reset according to the greatest sensible cooling load among zones served by the system. When this control is selected, you must also specify the maximum cooling supply temperature allowed. The control algorithm will not reset the supply temperature above this level. In VAV systems, supply temperature is reset such that one or more VAV boxes are fully open.

5. **Temperature Reset by Outdoor Air Schedule -** Supply air temperature (SAT) is reset according to an outdoor air temperature schedule. When this control is used, the minimum and maximum SATs are defined along with the corresponding outdoor air temperatures (OAT). The minimum SAT is always the design value. The remaining SAT and OAT values are defined by the user. This is used more in Winter Conditions

Thank You!