

Glazing Case Study

SimCosm India Pvt. Ltd.

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Summary

This case study has been done to show benefit of changing glazing on overall building energy consumption. Several strategies are available in the market to do this. Most notable are double and triple glazing schemes with glass having outside reflectance to keep the solar radiation out. Gas filled cavities are also especially common which gives better insulation capabilities to the overall glazing.

Glazing Case Study

- Case Assumptions
- LEED Energy Targets
- Snapshots Of Model
- Base Case Results
- Design Iteration
- Conclusions

Case Assumptions

- Space Area: 18,500 m²
- Location: Chennai, India
- Analysis type: LEED Energy Analysis
- External wall area: 9,000 m²
- Window opening area: 3,135 m²
- Lighting power density: 11 W/m²
- AC COP: 2.5
- Cooling set point: 21°

Glazing Used

- Base Case: Single 6mm Clear Float Glass. U Value: 5.17 W/m² K
- Double Glazing: Reflectance of outside glass 25%. Inside glass clear float. 12mm cavity filled with Argon gas. U Value: 2.7 W/m² K
- Triple Glazing: Reflectance of outside glass & middle glass 25%. Inside glass clear float. 12mm cavity filled with Argon gas. U Value: 2.0 W/m² K

LEED India CS Energy Targets

Reduce design energy cost compared to the energy cost budget for regulated energy components described in the requirements of **ASHRAE 90.1 – 2004 / Final version of Energy Conservation Building Code (ECBC) 2006**

New Buildings	Existing Building Renovations	Points
10.5%	3.5%	1
14%	7%	2
17.5%	10.5%	3
21%	14%	4
24.5%	17.5%	5
28%	21%	6
31.5%	24.5%	7
35%	28%	8



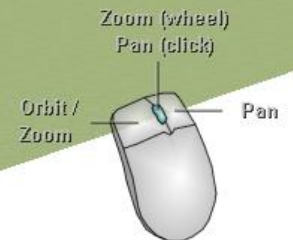
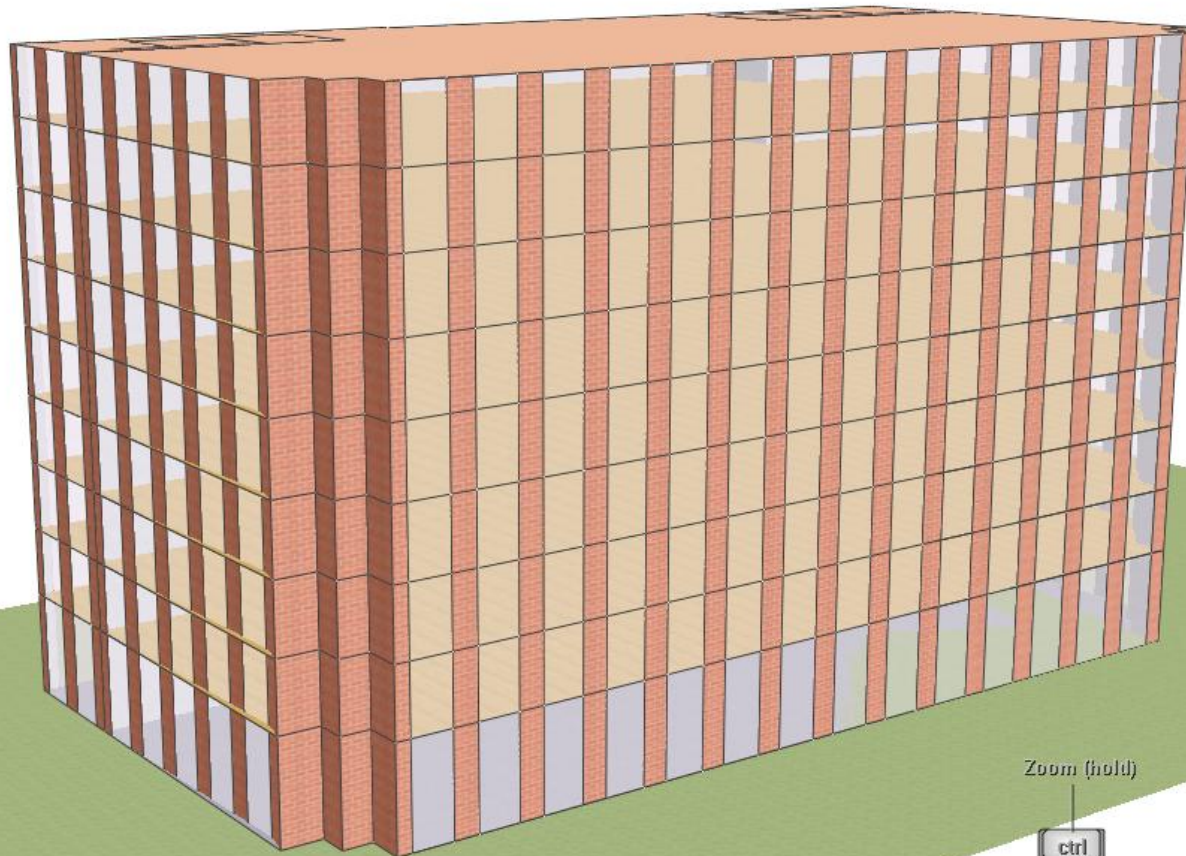
LEED - INDIA

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN



INDIAN GREEN BUILDING COUNCIL

Base Model – 8 + Gr. Floor Office



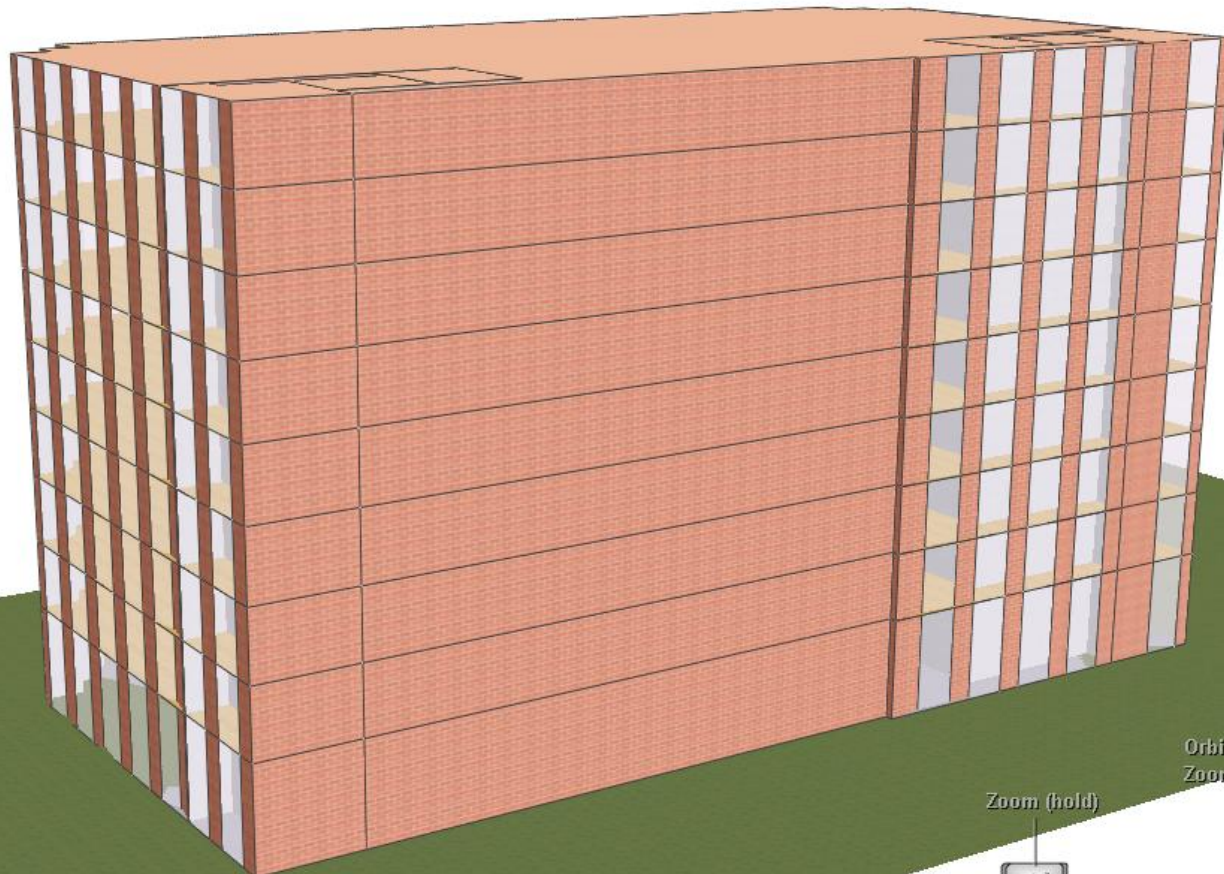
Zoom (hold)

ctrl

Press F2 to toggle controls



Base Model – 8 + Gr. Floor Office

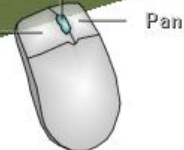


Zoom (hold)



Orbit /
Zoom

Zoom (wheel)
Pan (click)



Pan

Press F2 to toggle controls



Base Case Results

As Per LEED India CS

Analysis Done in *ApacheSim*

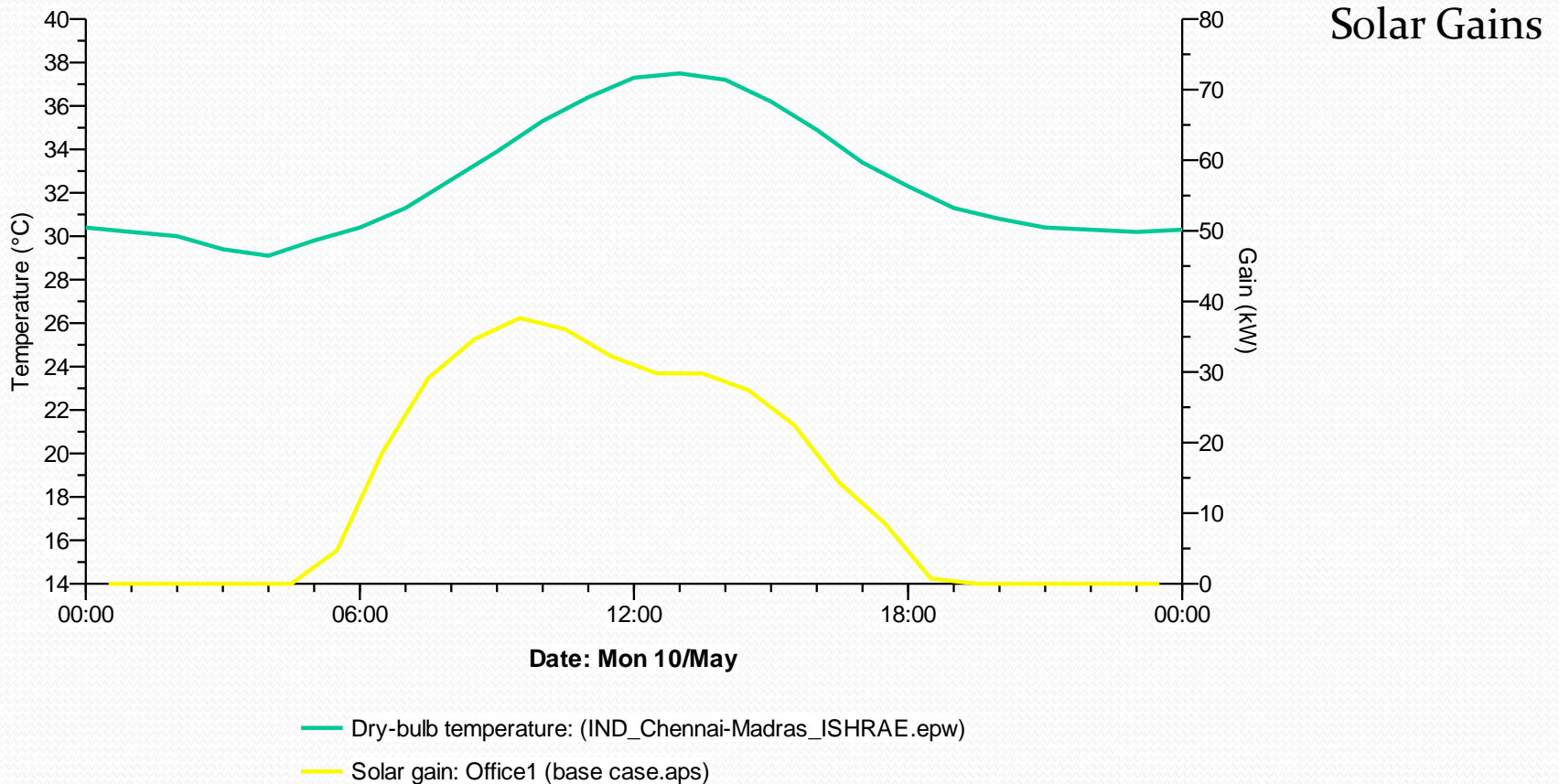
Baseline Building Performance

Description (Annual MWh)	Base Case
Chiller Energy	2,018.91
Pumps & Fans Energy	706.62
Lighting Energy	493.52
Equipment Energy	538.38
Total Energy	3,757.42

Baseline Building Performance

Description (Results On 10th May at 12:30 pm)	Base Case
Mean Dry Resultant Temp. (°C)	24.22
% Of People Dissatisfied	19.37
Room CO2 concentration (ppm)	635.00
Internal Gain (kW)	70.22

Baseline Building Performance : 10th May (Hottest Day)





Design Iteration

Using Double Glazing
Analysis Done in *ApacheSim*

Results Summary

Description (Annual MWh)	Base Case	Double Glazing	Benefit (MWh)	% Benefit
Chiller Energy	2,018.91	1,796.84	222.07	11.00
Pumps & Fans Energy	706.62	628.89	77.72	11.00
Lighting Energy	493.52	493.52	0.00	0.00
Equipment Energy	538.38	538.38	0.00	0.00
Total Energy	3,757.42	3,457.63	299.79	7.98

← HVAC System Energy Reduced

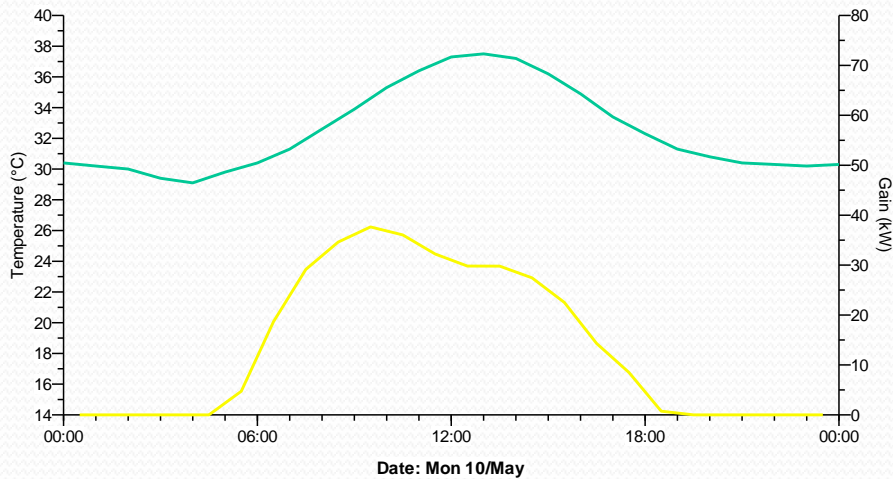
← Total Energy Reduced

Results Summary

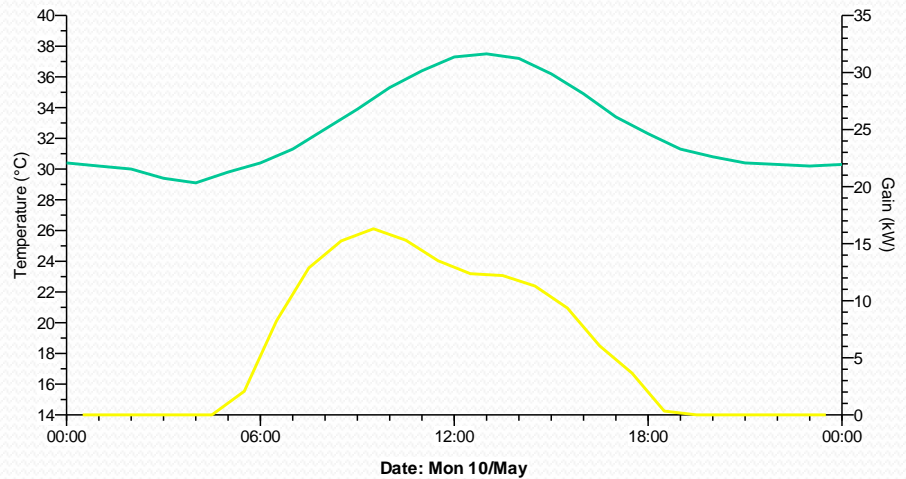
Description (Results On 10th May at 12:30 pm)	Base Case	Double Glazing
Mean Dry Resultant Temp. (°C)	24.22	23.47
% Of People Dissatisfied	19.37	14.99
Room CO2 concentration (ppm)	635.00	635.00
Internal Gain (kW)	70.22	70.22

Usage of double glazing has giving significant benefit on the HVAC system, the results of which can be seen in the room variables as well. Room temperature has dropped almost a degree in comparison to the base case and comfort levels are also improved.

Performance Comparison



— Dry-bulb temperature: (IND_Chennai-Madras_ISHRAE.epw)
 — Solar gain: Office1 (base case.aps)



— Dry-bulb temperature: (IND_Chennai-Madras_ISHRAE.epw)
 — Solar gain: Office1 (base case.aps)

Solar gains have reduced by about 50%. Note the pattern of the graph is the same but the solar gain value in kW has significantly reduced from a peak of about 40kW to a peak of 16kW with double glazing



Design Iteration

Using Triple Glazing
Analysis Done in *ApacheSim*

Results Summary

Description (Annual MWh)	Base Case	Triple Glazing	Benefit (MWh)	% Benefit
Chiller Energy	2,018.91	1,728.08	290.82	14.40
Pumps & Fans Energy	706.62	604.83	101.79	14.41
Lighting Energy	493.52	493.52	0.00	0.00
Equipment Energy	538.38	538.38	0.00	0.00
Total Energy	3,757.42	3,364.80	392.61	10.45

← HVAC System Energy Reduced

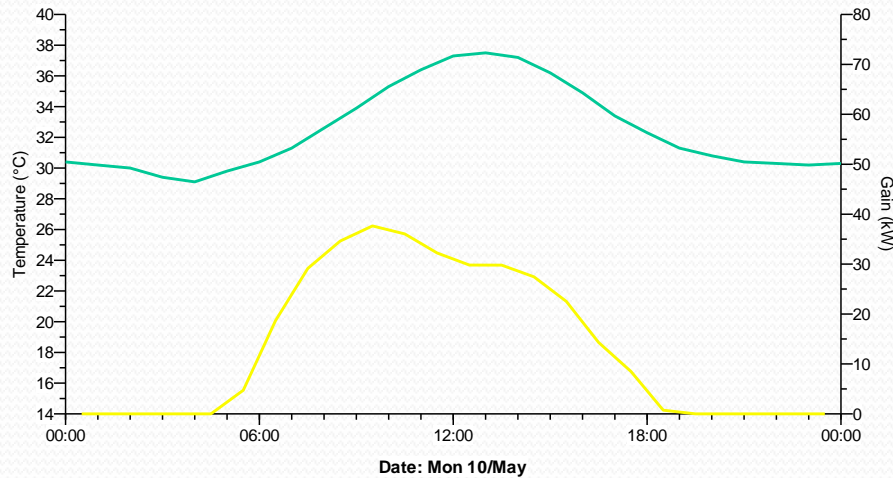
← Total Energy Reduced

Results Summary

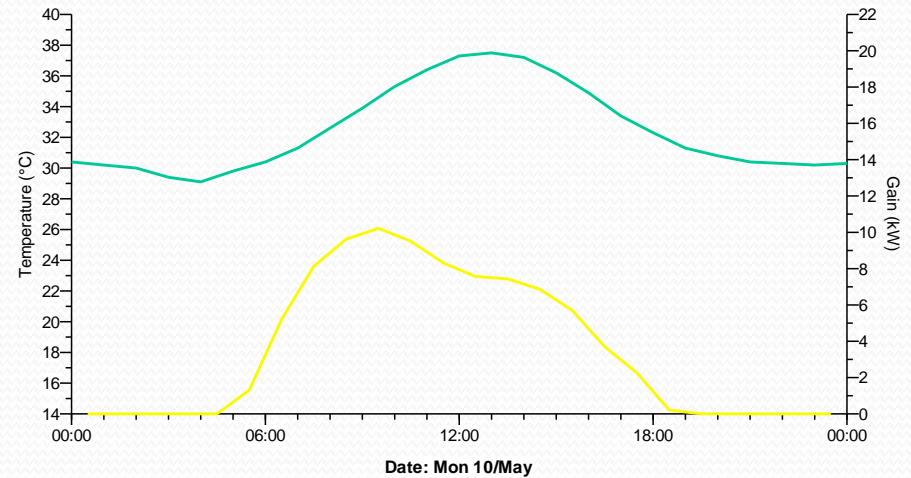
Description (Results On 10th May at 12:30 pm)	Base Case	Triple Glazing
Mean Dry Resultant Temp. (°C)	24.22	23.22
% Of People Dissatisfied	19.37	13.73
Room CO2 concentration (ppm)	635.00	635.00
Internal Gain (kW)	70.22	70.22

As expected, usage of triple glazing has further improved the HVAC system numbers. Room temperature has dropped a full degree in comparison to the base case and comfort levels are also improved.

Performance Comparison



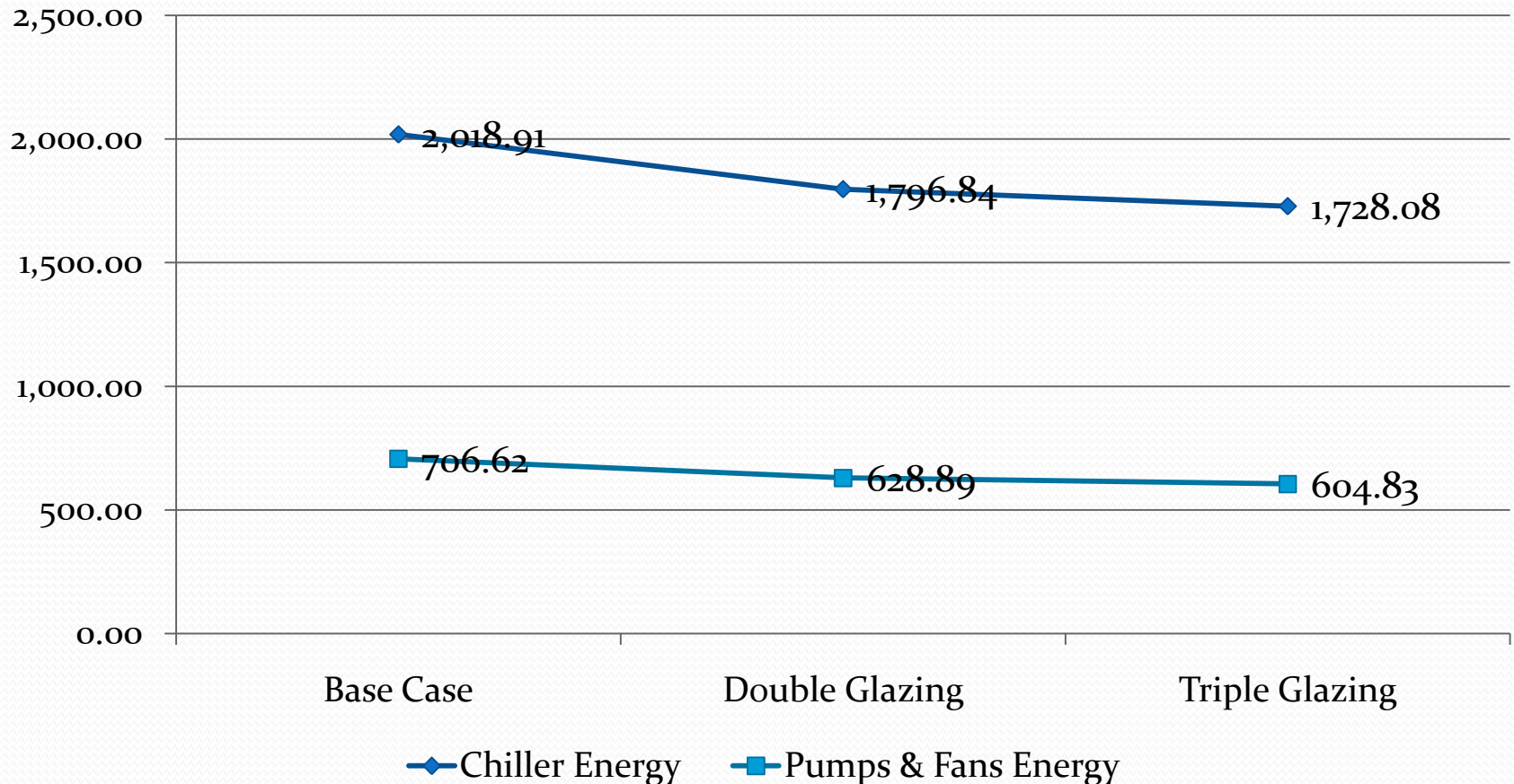
— Dry-bulb temperature: (IND_Chennai-Madras_ISHRAE.epw)
 — Solar gain: Office1 (base case.aps)



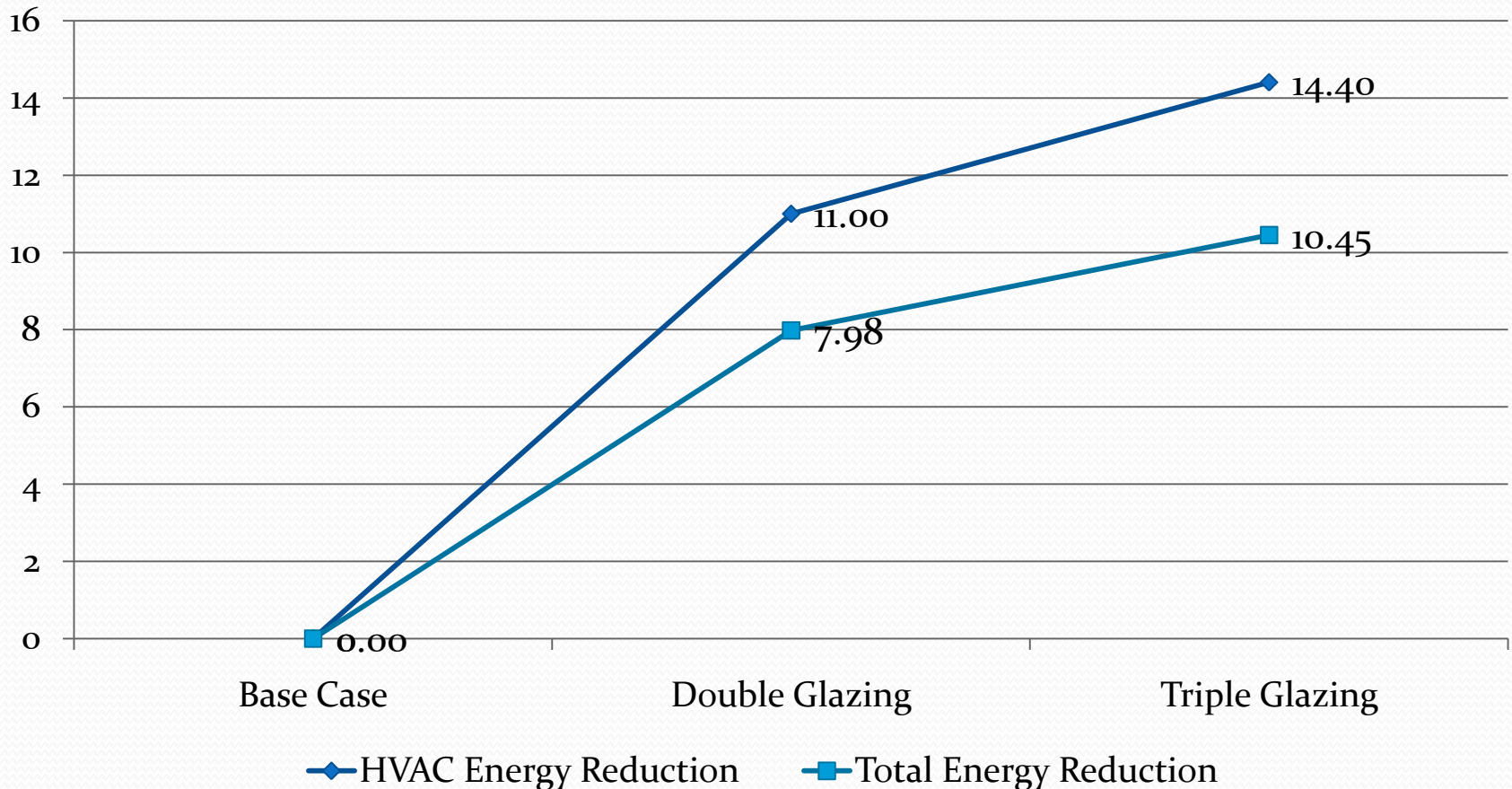
— Dry-bulb temperature: (IND_Chennai-Madras_ISHRAE.epw)
 — Solar gain: Office1 (base case.aps)

Solar gains have reduced by about 70%. Note the pattern of the graph is the same but the solar gain value in kW has significantly reduced from a peak of about 40kW to a peak of 10kW with triple glazing

Performance Comparison

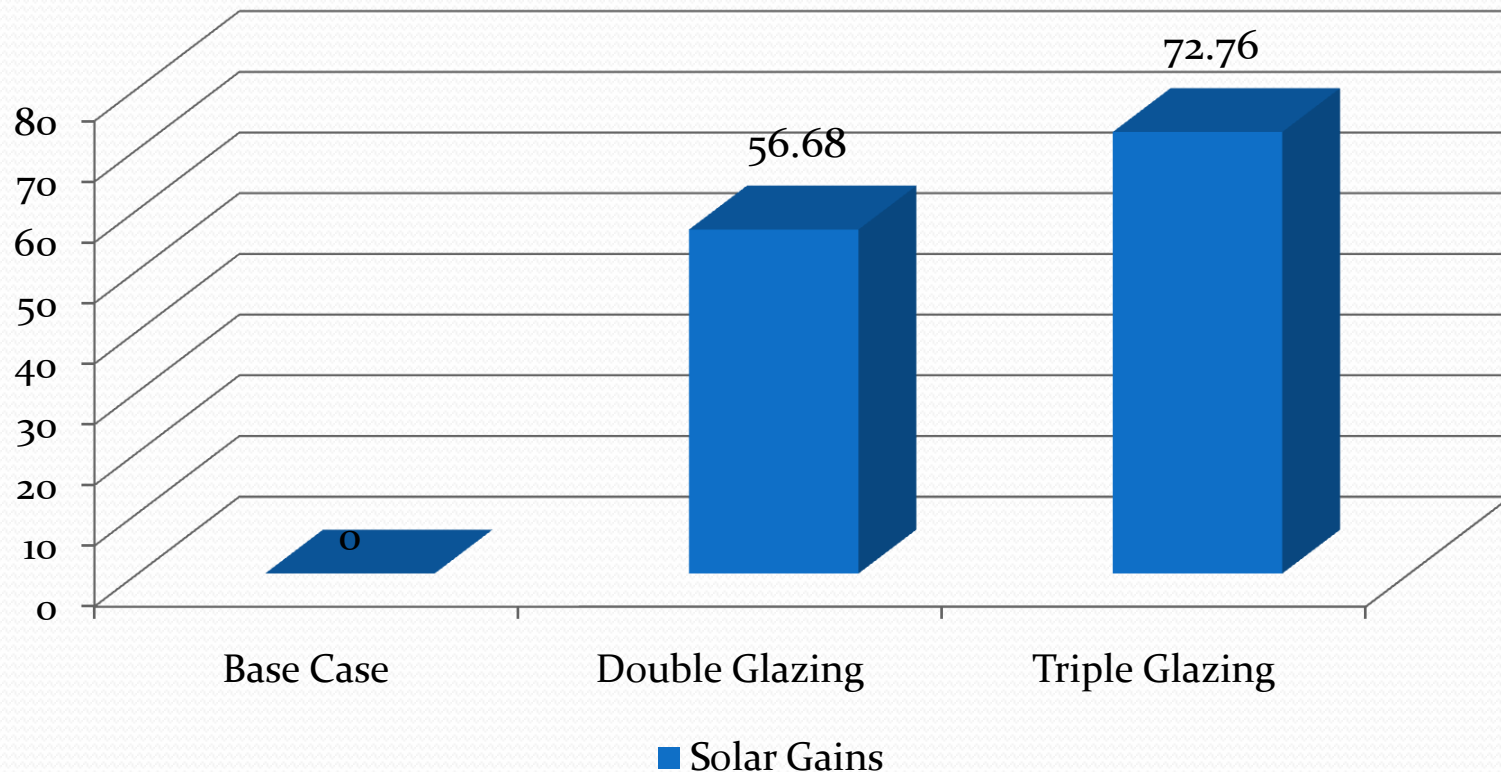


Performance Comparison



Performance Comparison

% Reduction in Solar Gains



Conclusions

- Changing glazing can significantly affect energy numbers for a commercial building where AC is the norm.
- Use of double glazing has been shown to give a **11%*** reduction in HVAC loads and **8%*** reduction in overall energy numbers
- Use of triple glazing has been shown to give a **14.4%*** reduction in HVAC loads and **11%*** reduction in overall energy numbers

* Please note that benefit percentage will vary on case to case basis. Energy simulation of building design is recommended to get exact benefit before selection of solution.

About ApacheSim

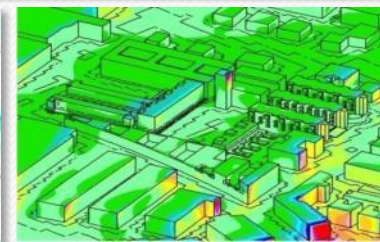
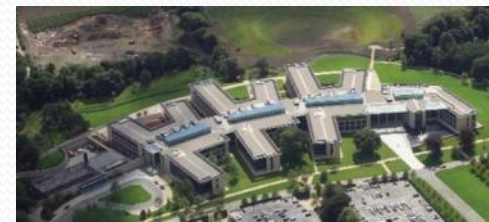
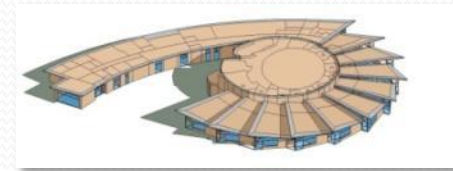
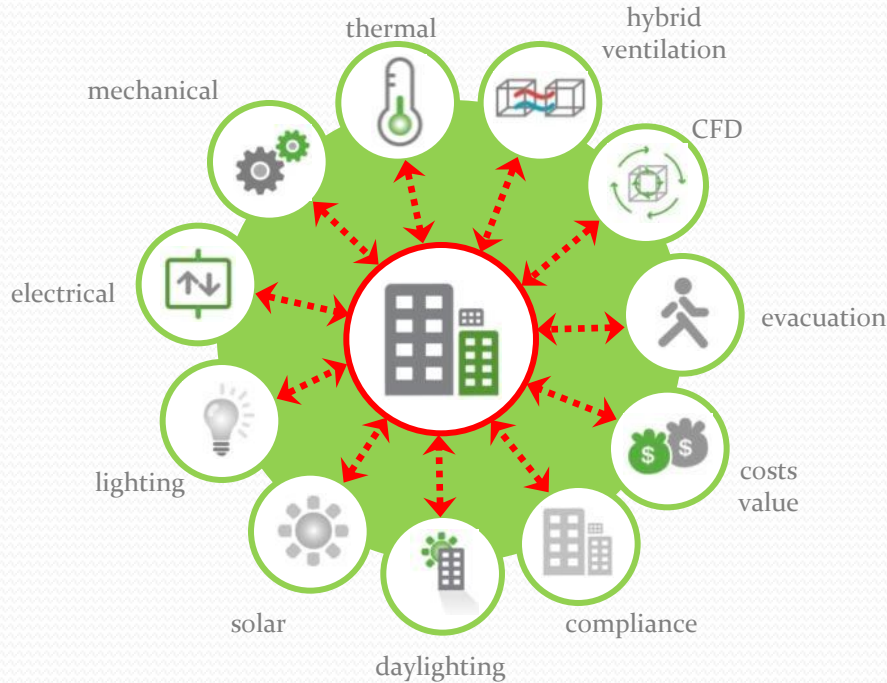
- ApacheSim's output dataset can be browsed to interrogate every aspect of building thermal performance, from individual surface temperatures to annual energy consumption
- The results are displayed by the <Virtual Environment> program Vista, along with the weather data used to drive the simulation
- Results are accessed via graphical views of the building, allowing interrogation of data at a hierarchy of levels: building, room, surface, opening
- Vista generates graphs, tables, monthly summaries, ranges or user-specified synopses which can be copied and pasted into other Windows applications to assist with reports, presentation and additional analysis
- Room performance indicators include:
 - Room temperatures: air, mean radiant, dry resultant
 - ISO Comfort indices: Predicted Mean Vote (PMV) and Percentage of People Dissatisfied (PPD).
 - Room loads: heating, cooling, humidification, dehumidification
 - Load breakdowns: casual and solar gains, conduction and ventilation losses, plant inputs
 - MacroFlo-generated air flows for rooms or individual openings
 - Surface temperatures
- Building and system performance indicators include:
 - Totals of room and ventilation loads: heating, cooling, humidification, dehumidification
 - HVAC loads
 - System energy from ApacheHvac linked simulation or idealised plant heating and cooling energy
 - Building energy consumption: lights and small power
 - Carbon emissions for system and building, optionally broken down by fuel
- Multiple results can be displayed simultaneously or Aggregated
- Simulation results can be displayed in either Metric or US Units
- Graphical and numerical data can be exported to Excel, Word and other applications.

[Brochure](#)



Providers of IES <Virtual Environment> Integrated Building Performance Analysis

SimCosm



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