Bmeister Engenharia & Consultoria

Texiglass

EIFS / ETICS
External Thermal Insulation Composite System
INFLUENCE ON THERMAL PERFORMANCE OF BUILDINGS

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EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

- EIFS / ETICS Definition
- Brazilian Energy Outlook
- Proposal
- Climate
- Computer Simulation
- Results and Discussion

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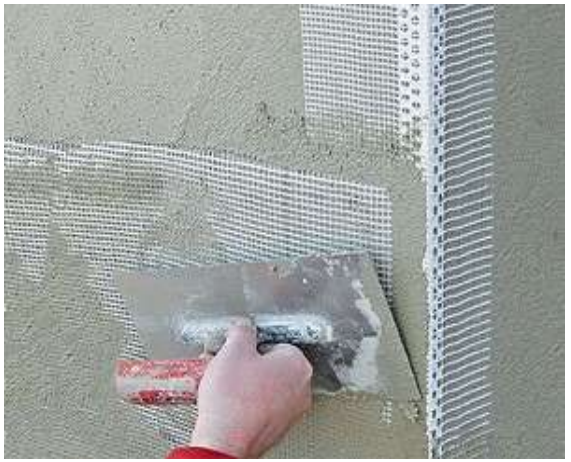
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – COMPONENTS

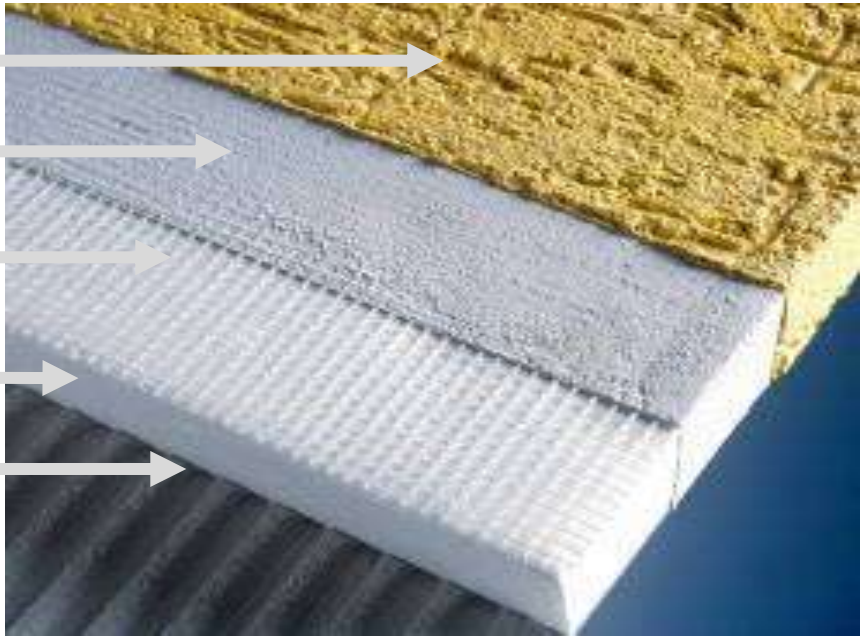
What ETICS / EIFS are ?

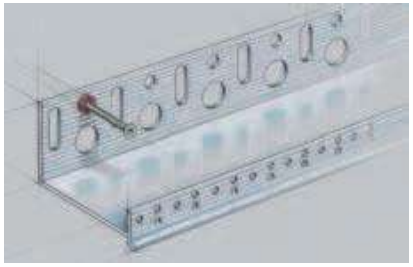
ETICS *(External Thermal Insulation Composite Finish)* or EIFS *(External Insulation Finish System)* are external wall insulations which come up to the increasing requirements of heat / cooling protection for building covers

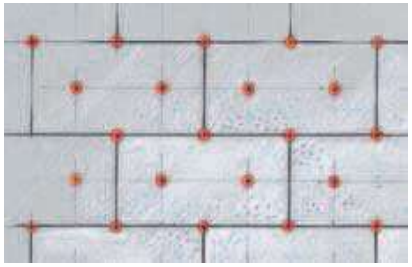


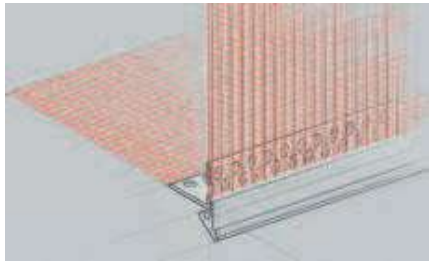
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – COMPONENTS

- Finish coat
- Adhesive cement basecoat
- Fiber glass mesh reinforcement
- Insulation material (EPS)
- Adhesive cement mortar
- Auxiliary materials









EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

EIFS / ETICS - Advantages

•Projects thermal insulation in new buildings;

• Projects thermal insulation in existing buildings (retrofit);

• Improved environmental comfort for existing buildings;

• Reduced consumption of electric energy with air conditioning systems;

• Certification and labeling of existing buildings;

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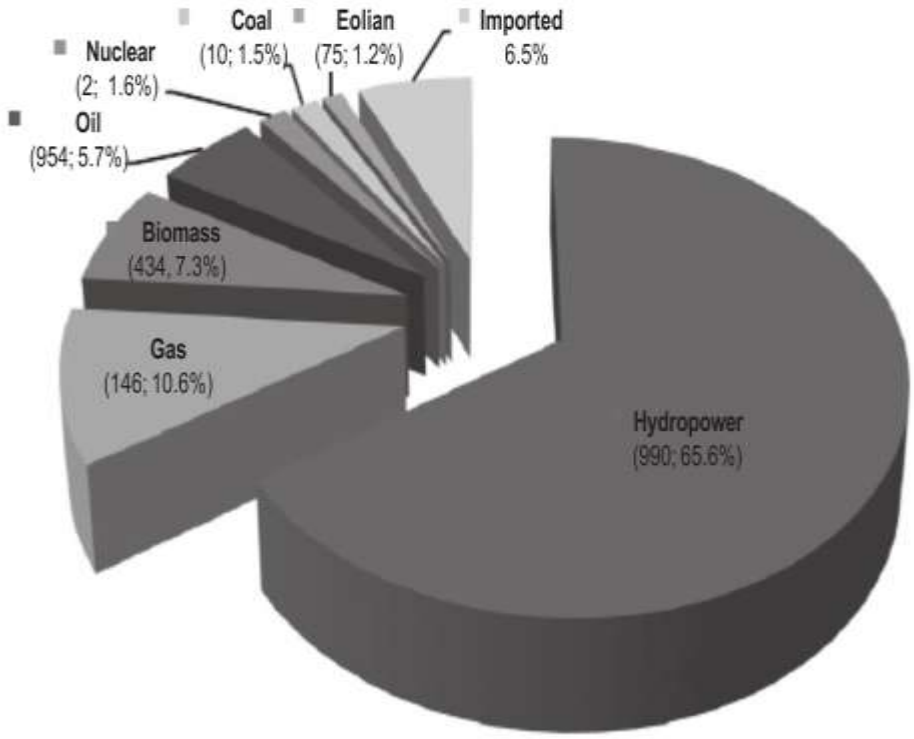
BRAZIL'S ELECTRIC CRISIS CREATES OPPORTUNITIES FOR ALTERNATIVES

Brazilian energy matrix is unbalanced and largely dependant by hydroelectric power (70%)

- Today, the 10 largest hydroelectric power plants in operation in Brazil (excepts Itaipu and Ilha Solteira) have very low reservoir levels;
- There is a strong random component: the rainfall season which feeds the reservoirs .
- Brazil's is facing risk of electricity shortage due to depleted reservoirs at the country's hydroelectric facilities



BRAZIL'S ELECTRIC CRISIS CREATES OPPORTUNITIES FOR ALTERNATIVES

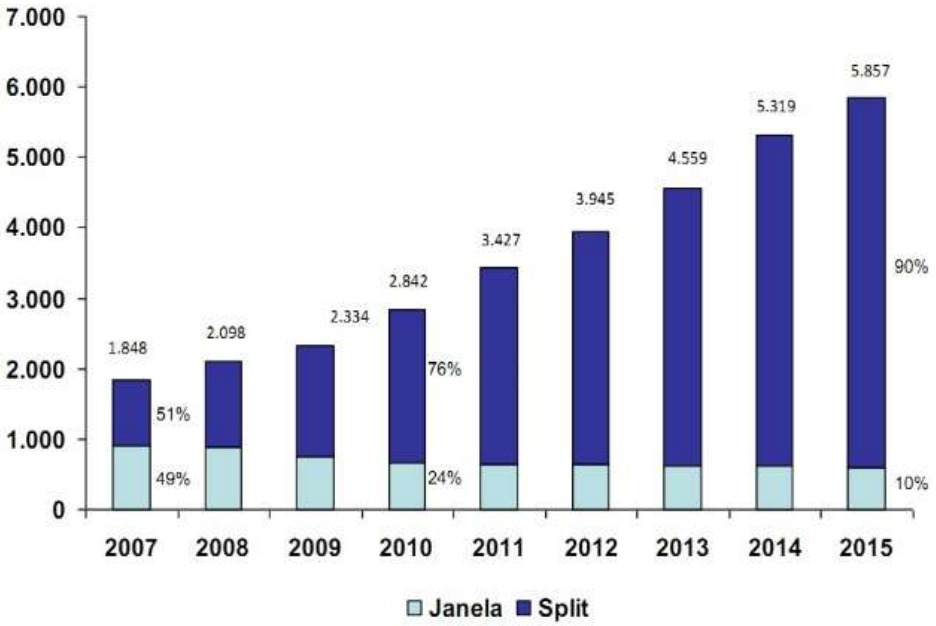
Residential consumption increases 7% - year

- Since 2012, almost all thermoelectric units are working at full capacity due to low reservoirs levels.
- Emerging middle class are demanding more appliances and more energy;
- In the last 10 years there was a population growth of 10.9%. The energy consumption growth was 40.7% for the same period;
- The rate of transmission losses in Brazil is 20 % . World average is 9 % and the German is 4 % ;

ECONOMIA

O Nacional > Economia

Booming sales of air conditioners bring attention to the risk of blackout in Brazil



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COMPARING THROUGH COMPUTER SIMULATION WITH DIFFERENT MATERIALS

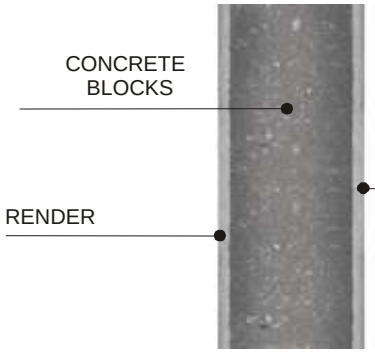
Demand of materials with low thermal conductibility. New building technologies should be sustainable.

This study will compare insulation performance of concrete wall versus entire building envelope wrapped with EIFS/ETICS;

BRICK WALLS

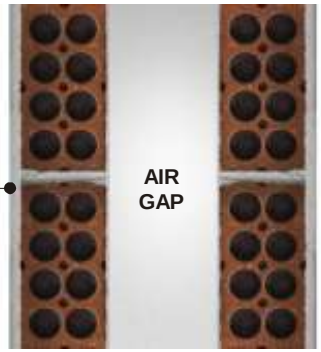
U VALUE
3,65

LIGHT WEIGHT CONCRETE BLOCKS



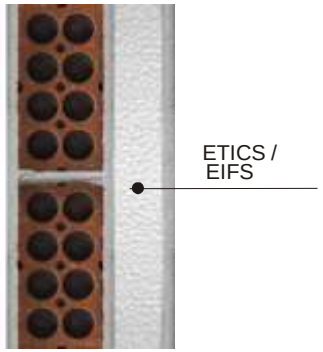
U VALUE
0,69

VENTILATED BRICK WALL



U VALUE
0,60

EIFS EPS PANEL OVER CONCRETE WALL



U VALUE
0,315

BRAZIL'S ELECTRIC CRISIS CREATES OPPORTUNITIES FOR ALTERNATIVES

Brazilian labeling program is giving first baby steps

• Even with the energy labeling program for buildings not yet fully running, there is a trend of change in construction practices;

•These trends are observed mainly in certification projects (Green Building);

• It's essential to understand the impact of these solutions in the global heat exchange at the building;

• It's important to check the performance within the climate zone where it is inserted.

HEAT FLOW – HEAT EXCHANGES BETWEEN MAN AND HIS SORROUNDINGS

Important considerations about thermal comfort

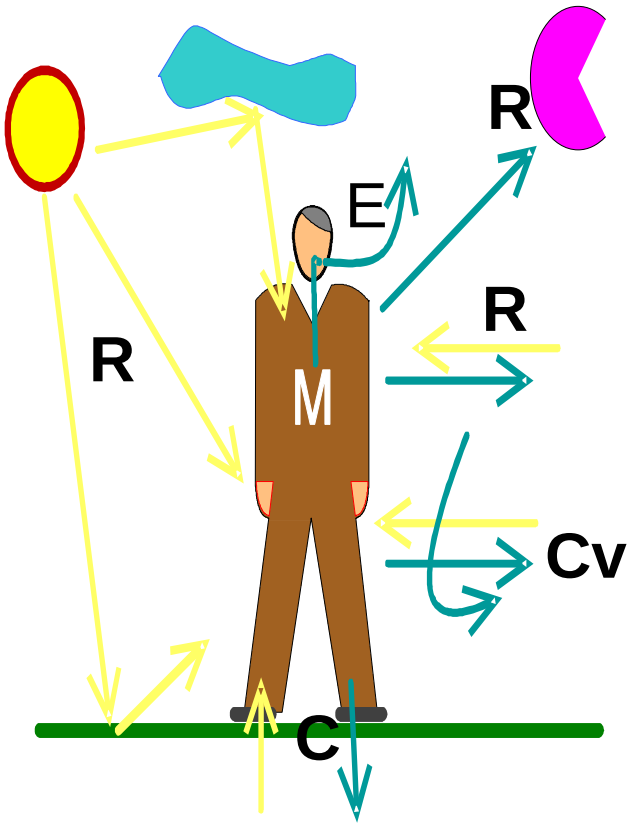
• M - Metabolism , or internal heat production of the body under certain activity . Can be increased by intake of food and fluids .

• R - exchange by radiation . Between the Sun and the body , between the body and the vault of heaven , between the body and the other bodies (walls , etc.)

• C - exchanges by conduction, contact. Between the body and every surface he touches.

• Cv - exchange by convection. Between the body and the air that is in immediate contact.

• E - exchange by evaporation / sweating . Heat elimination by pulmonary exchange, and on the exhale through the skin pores.



EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – INTEGRATED COMPUTER SIMULATION

What is Computer Simulation by Finite Elements Method?

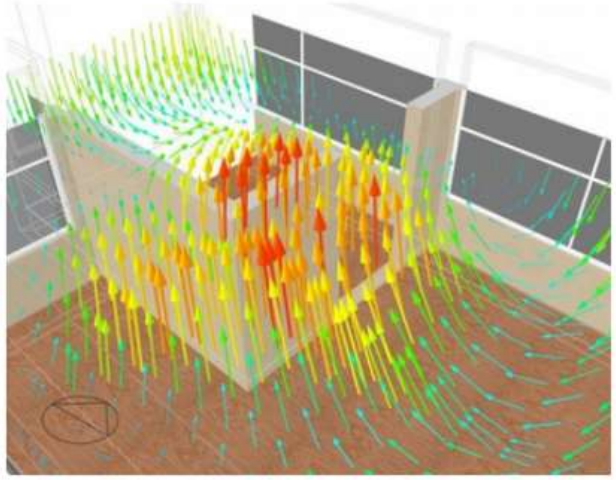
FEM - MEF is used to answer several questions:

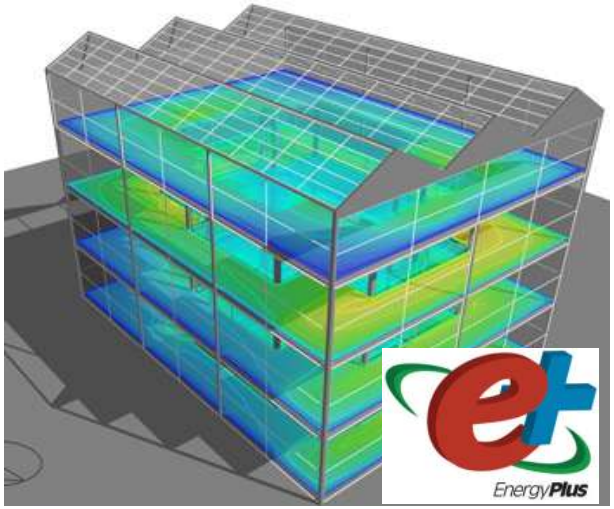
- Is the energy consumption of the air conditioning system appropriate for your project ?

- Will the sizing of air conditioners provide a good comfort conditions ?

-Will natural ventilation provide occupants with adequate comfort in the summer ?

- What arrangement in the design of the building can be done to increase the efficiency of the project?

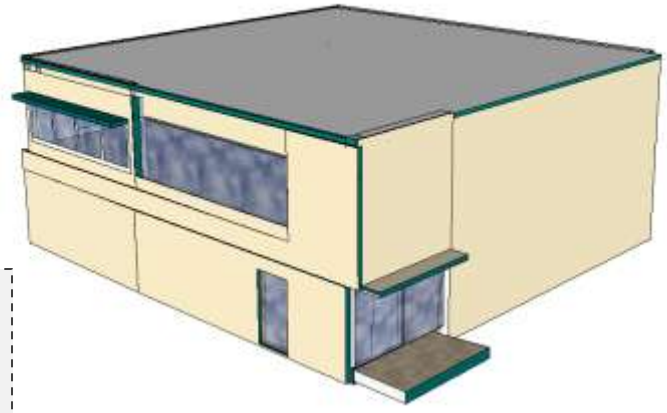




EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – INTEGRATED COMPUTER SIMULATION

Architecture :
-Roof
-Walls
-Windows
-Floor

Air conditioning systems



EnergyPlus

Environmental variables :
- Temperature
- Humidity
- Solar radiation
- Winds

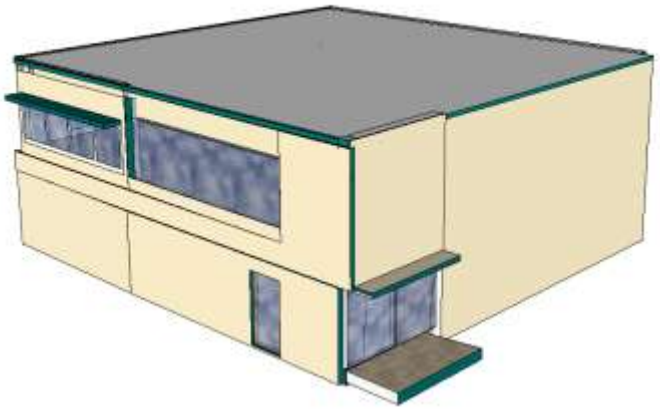
Internal variables :
- Occupation lighting
- Equipment
- Usage patterns

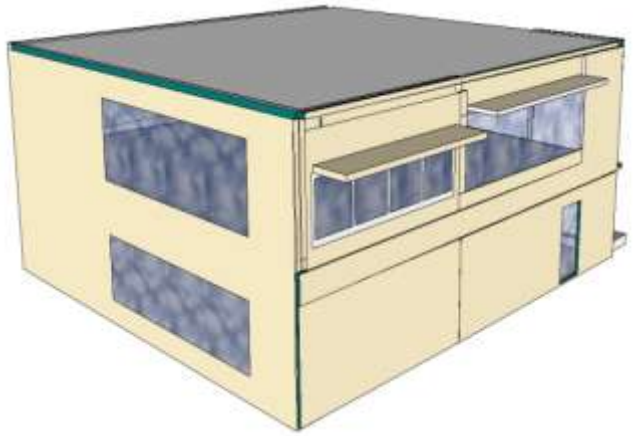
SURROUNDING GEOMETRY PLAYS IMPORTANT ROLE IN THE THERMAL PERFORMANCE

Main objective is to compare through computer simulation with different materials.

Simulation in a building with 450 m² using two different construction systems (conventional masonry and External Thermal Insulation Composite System)

- Simulated in three bioclimatic zone (city Sao Paulo)
- Three thermal zones were created by defining each thermal zone:
- Lighting System
- Electrical Equipment
- Occupancy rate and air conditioning system
- The ideal air conditioning load was evaluated (through a model of ideal air conditioning)

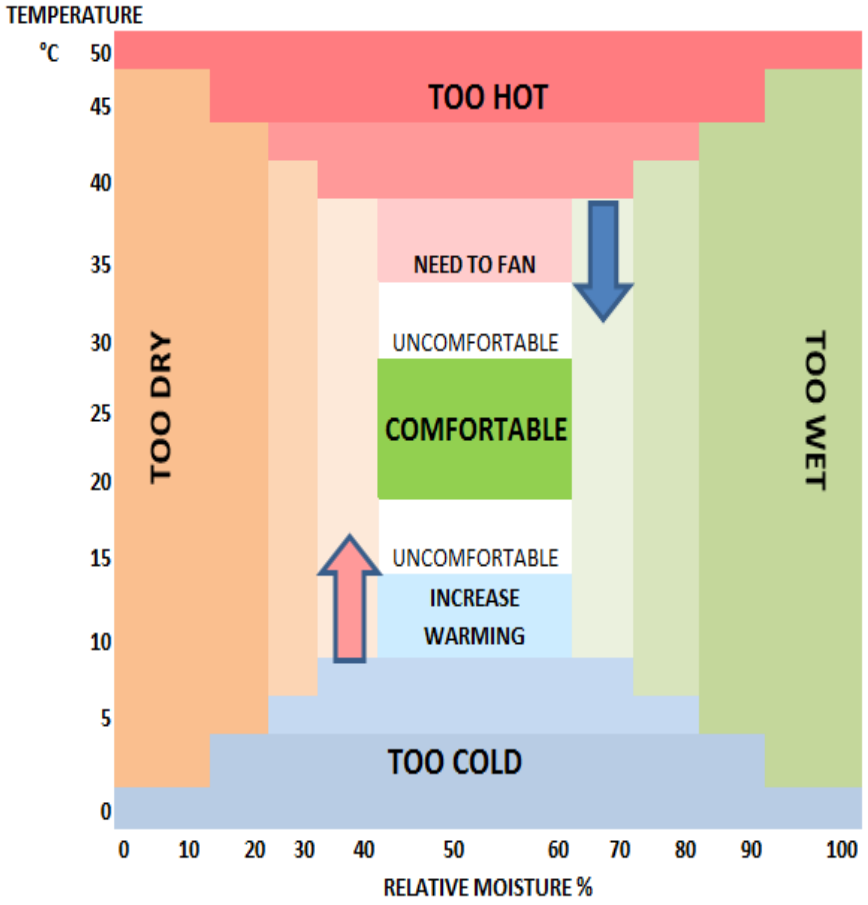




EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – INTEGRATED COMPUTER SIMULATION

Main objectives

- Knowing the impact on electricity consumption through consumption of air conditioning
- Understanding which tipology that fits better to the system and what thermal zone ;
- Adapting an appropriate strategy for thermal comfort to reduce the use of air conditioning .
- Find the thermal load required to maintain the environment within the pre set temperature (20-24 ºC) .



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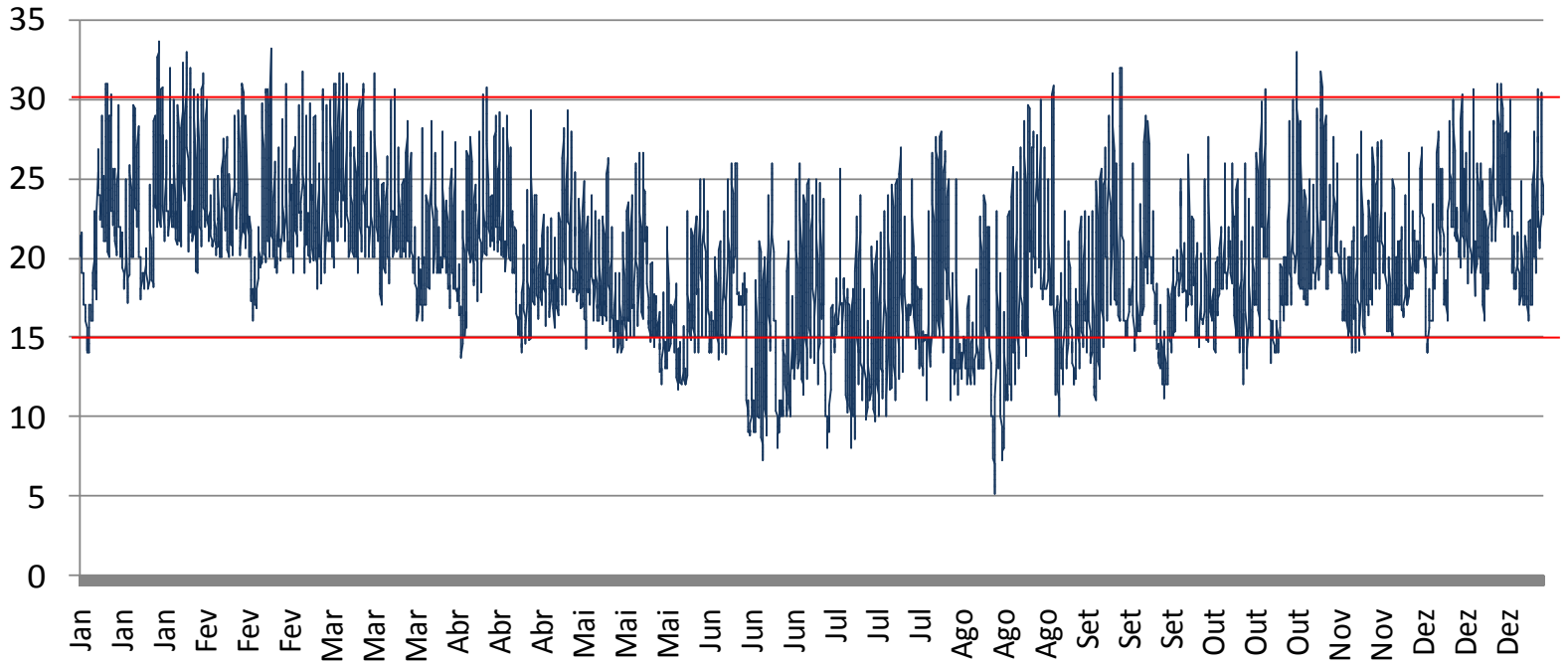
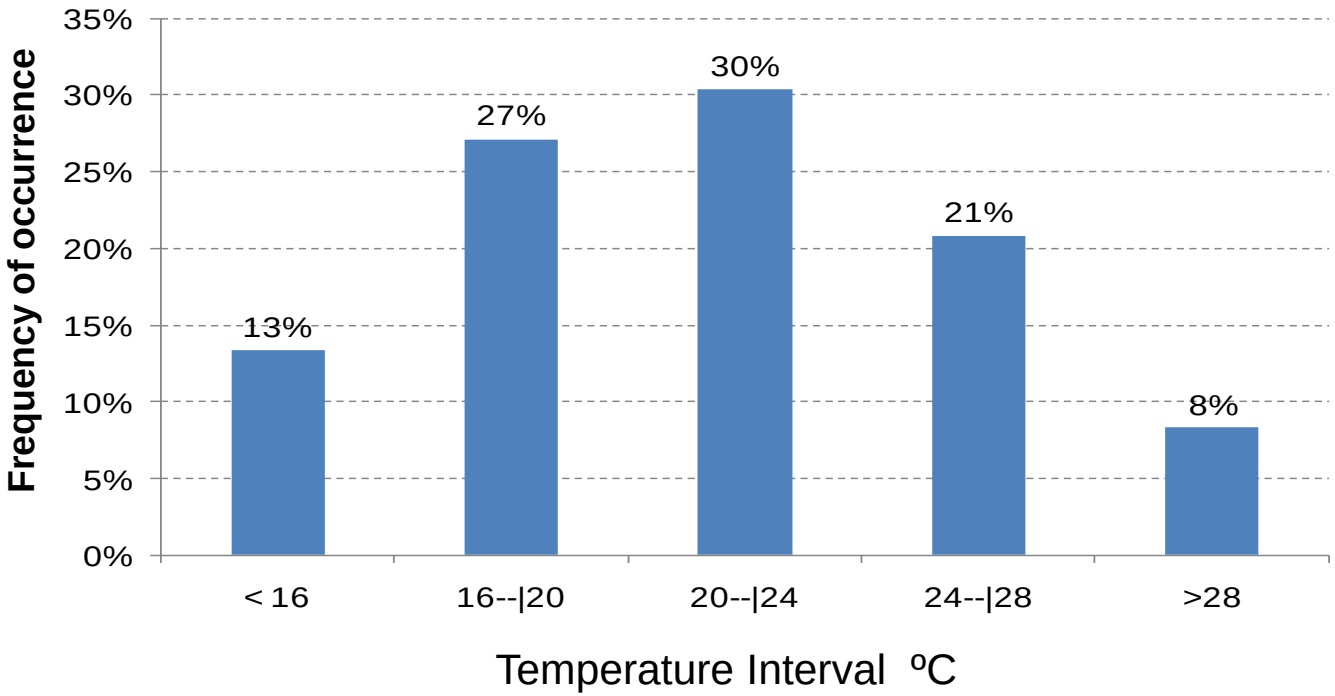
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – BUILDING CLIMATIC DATA

Typical climatic year – Temperatures measured hourly



HEAT FLOW – HEAT EXCHANGES BETWEEN MAND AND HIS SORROUNDINGS

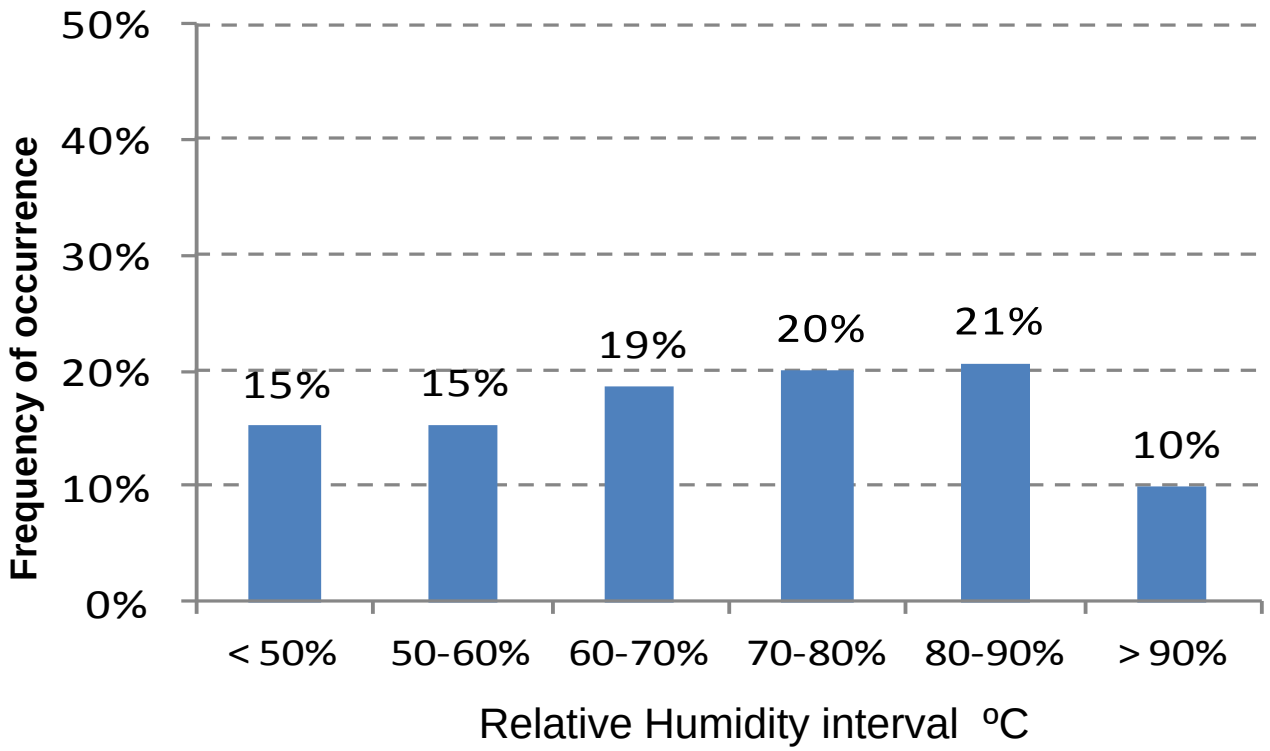
City of São Paulo: Air Temperature



Only business hours, from 8h às 20h

HEAT FLOW – HEAT EXCHANGES BETWEEN MAND AND HIS SORROUNDINGS

City of São Paulo: Relative Humidity



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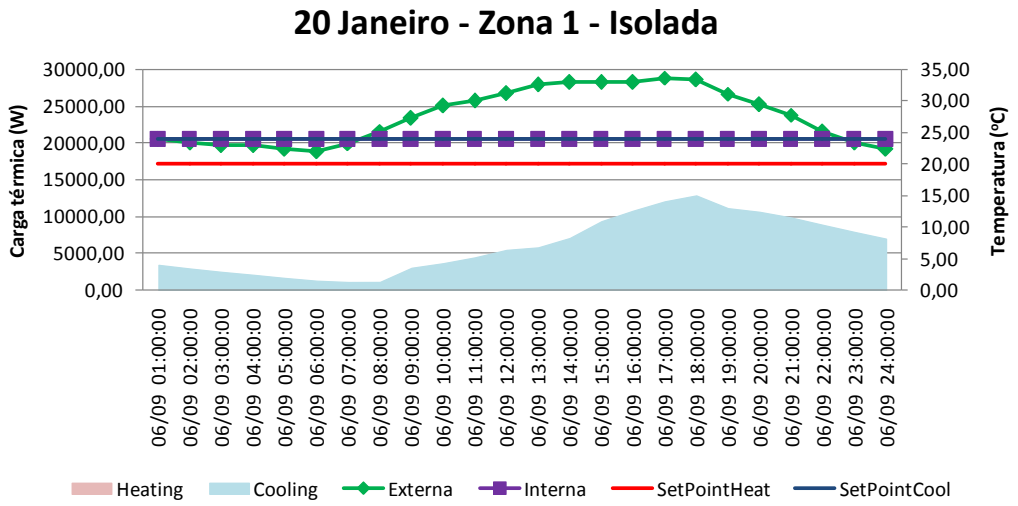
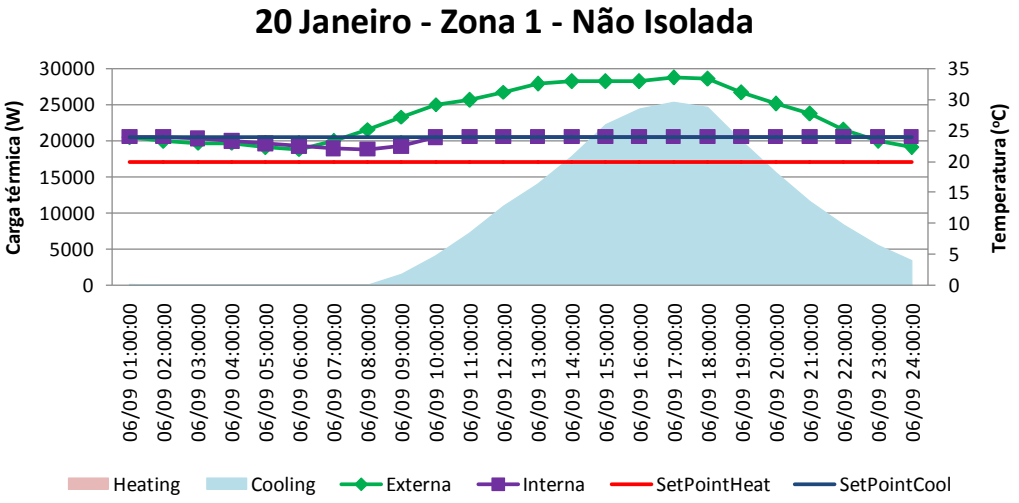
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Results

- Analysis of a typical summer day ;
- Temperatures set to be held between 20 and 24 ºC
- The thermal insulated building load showed a lower need for air-conditioning

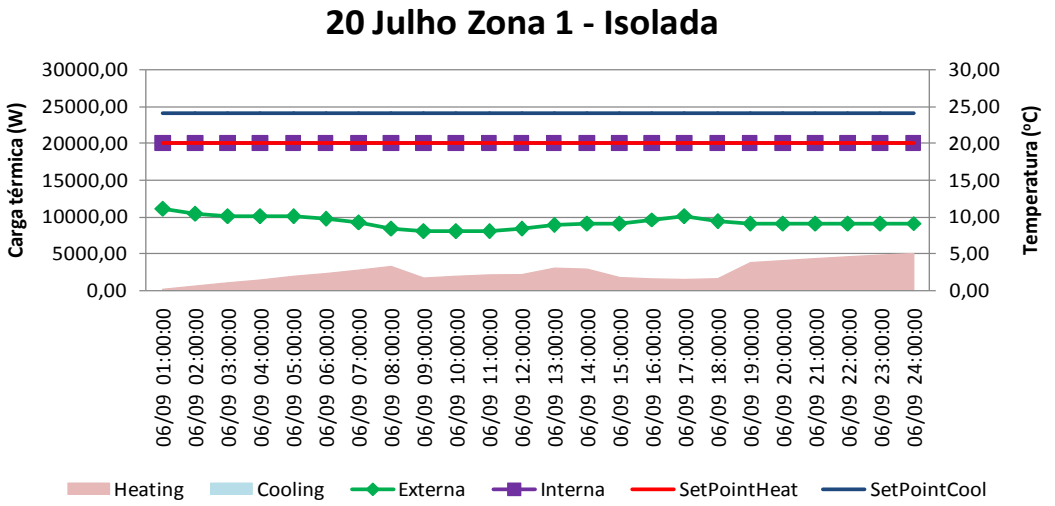


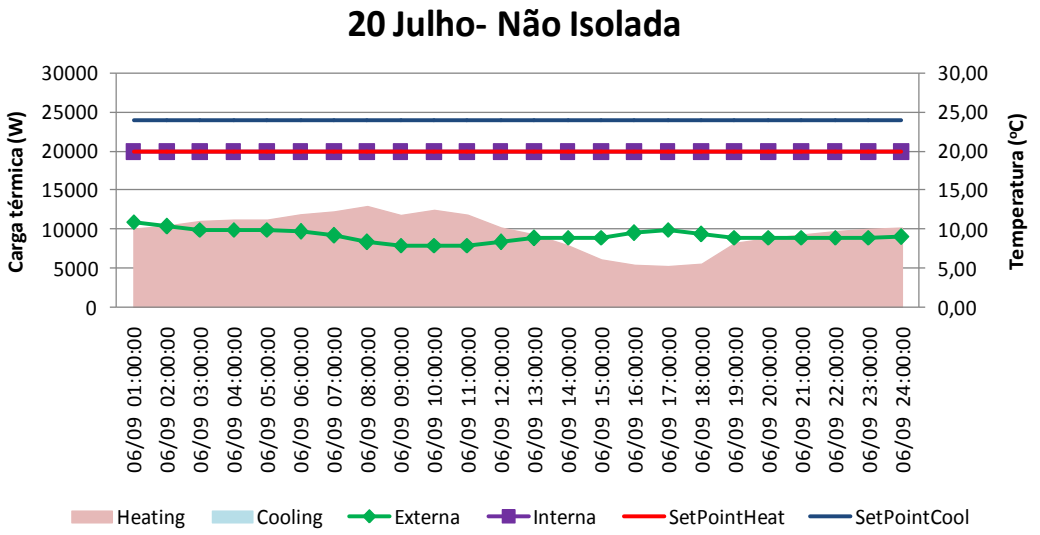


EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Results

- Analysis of a typical day in winter;
- Temperatures set to be held between 20 and 24 ºC;
- The thermal insulated building load showed a lower need for space heating;





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EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Results

Building	Insulated	Non Insulated	Diference	Savings %
Heating (kW/h)	1100	7793	6693	14%
Cooling (kW/h)	35891	41031	5140	87%
Total			11833 kW/h	
Aplying average energy cost per kW		**R$ 0.35**	**R$ 4,141.55**	

Potential savings of R$ 4,141.55/year to 450 m²

EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Discussion

- According with the ABNT NBR 15575, a building structure and external walls has to present a useful life higher than 40 years.

- So, during a service life, we can consider ETICS can bring an interesting return over investment.

- The payback period will be 15,5 years

Year	CF	PV
0	65,000.00	65,000.00
5	4,141.55	(44,292.25)
10	4,141.55	(23,584.50)
15	4,141.55	(2,876.75)
20	4,141.55	17,831.00
25	4,141.55	42,680.30
30	4,141.55	63,388.05
35	4,141.55	84,095.80
40	4,141.55	104,803.55
45	4,141.55	125,511.30
50	4,141.55	146,219.05

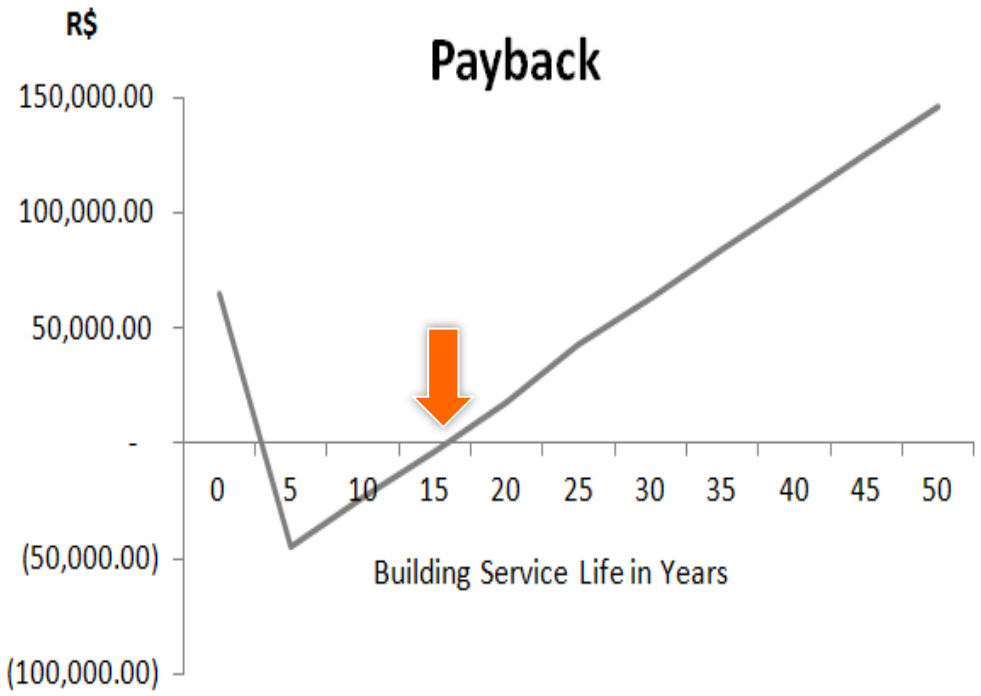
EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Discussion

- Projects in energy savings should not be understood as a short-term return of investment.

- For the building studied in this work, the potential gain justifies investment in a retrofit application of EIFS / ETICS system.

- The owner should invest around R$ 65.000 for insulations in walls and roof and the payback period will be 15,5 years as we can see below



EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Discussion

Concerning the government interest in energy savings, if there was a real interest in promoting this technology implementation, like many other countries, the government would win twice.

It would stimulate energy savings in various sectors of the economy, generating a significant reduction of installed power capacity and consequently a cost reduction of electricity production and the cost of maintaining power generation plants.

Another gain would come from the stimulus generated in the economy, enabling a construction industry which today is restricted and limited to a few projects.

Countries members of European Community decided some years ago that would be better subsidize investments and creating thermal building regulations on insulation and thus reduce the need for heavy investment to increase the installed capacity of electricity generation.

EXTERNAL THERMAL INSULATION COMPOSITE SYSTEM – CASE STUDY

Thank you!