Communitary Bioclimatic Building for Exhibition Situated at the South Patagonia (Argentine)

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SUMMARY - A demonstration bioclimatic building intended for communitarian activities is hebery presented. It is placed in the coalmine settlement of Rio Turbio in the extreme SW of Austral Patagonia, Argentine. The energetics design has ordered the project in three levels of energy quality according to the assigned destination of the building and the frequency of its use. Passive technology and the heat recovery systems are hereby expounded as well as the prototypal constructive details.

1. INTRODUCTION

The locality of Rio Turbio is placed in the South West at the extreme limit of the Argentine Patagonia in Latitude 51°33´ South and Longitude 72°26´ West, on the frontier with Chile. In the greatest part of the year it is an isolated region with rigorous climatic conditions (4.000 Degree Days).

Preliminary studies in the locality itself detected over use of energy in the residential and terciary sectors together with a low ambiental quality and a low hygrothermic habitability level.

Consequently it was considered necessary to design and construct a building for community use to serve as demonstrator for the use of adequate technology for the climate and conditions of the region and at the same time to provide guiding lines conserning design and a conscious use of energy.

The functional and surface requirements were defined after consultation with the local community.

For the implantation of the building, a yard was selected in the civic and commercial area of the city, with the necessary configuration to optimize aspects such as orientation and solar gain. The architectural language responds to the best typology current in the Patagonian south region.

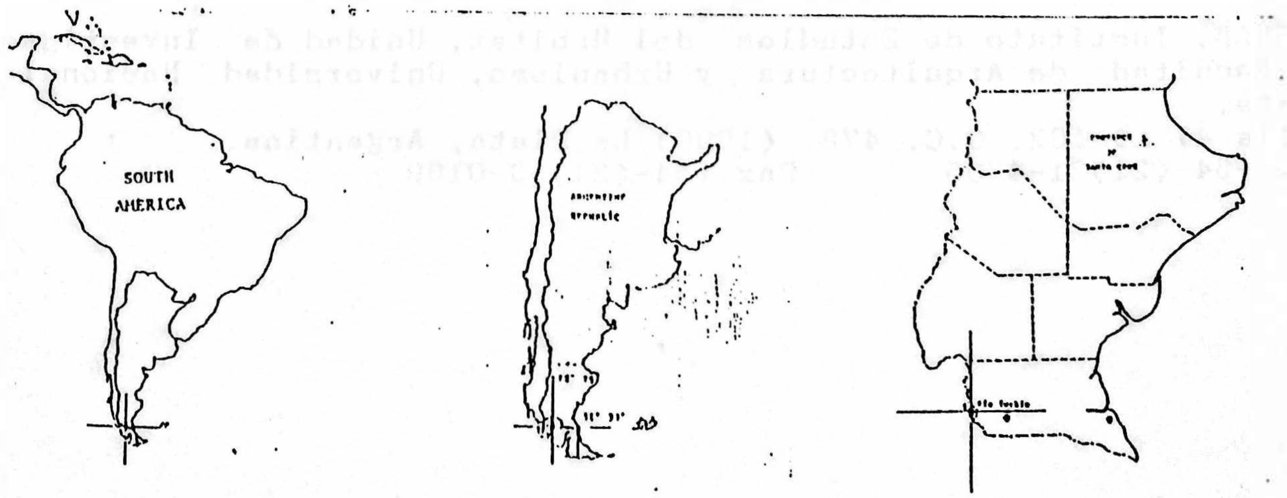

Figure 1. Location of the mining village.

2. DESCRIPTION OF THE PROJECT

The building, with a total surface of 240 m² was functionally structured in the four following areas:

1. Administrative area.
2. Shool-rooms.
3. Multiple-use area.
4. Service area, accesible from the areas mentioned before.

From the thermic point of view and depending on its occupation (the time it is occupied and the number of people that occupy each area), and considering its functional destination, the project was ordered in three levels:

a. High occupation zone.
b. Medium occupation zone.
c. Low occupation zone.

2.1. High Occupation zone

The high occupation zone corresponds to the administrative and service areas. The administrative area is oriented to the North quadrant to optimize solar gain' whereas the service area (office, toilets, engine room) is placed facing the South quadrant to avoid thermic loss in that sector, and offers only the minimun openings necessary for lighting and ventilation. It is the zone in which the highest level of energy saving is obtained. Constructively it is of high thermal mass with a 0.5 to 0.6 W/m³°C volumetric rate of heat loss ("G").

2.2. Medium occupation zone

The zone of medium occupation is the school-rooms area placed on the first floor and with its spaces oriented to the North to avail direct gain. A lower energy saving was considered due to its minor occupation level. The volumetric rate of heat loss ("G") was fixed between 0.6 and 0.8 W/m³°C.

2.3. Low occupation zone

The zone of low occupation, the multiple use area, was placed on the west flank, directly connected with the entrance and acting as a space stopper on the west quadrant, from where most of the winds blow. It is an area of contingent use and so a low thermal mass is desirable. It was fixed between 0.7 and 0.9 W/m³°C.

In Figures 2 to 5 floor, section and view are shown.

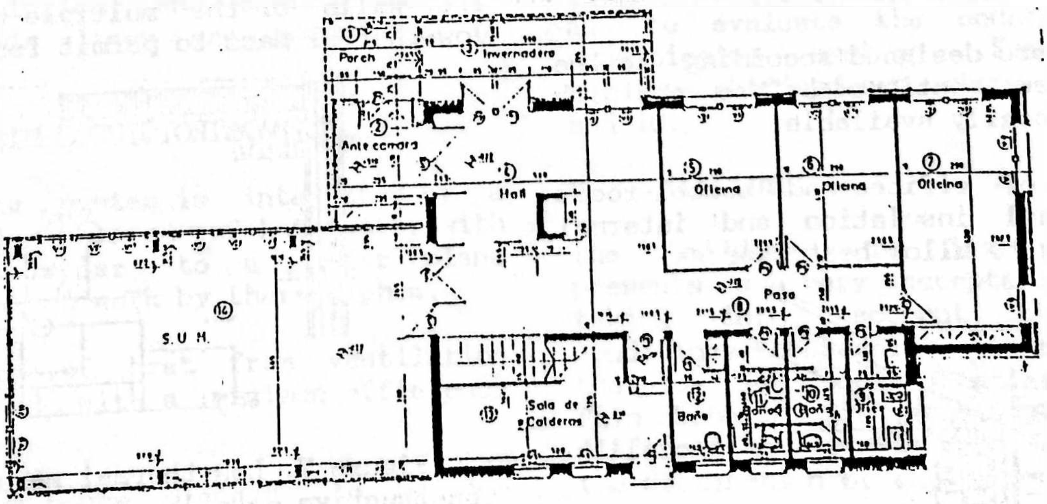

Figure 2. Ground floor.

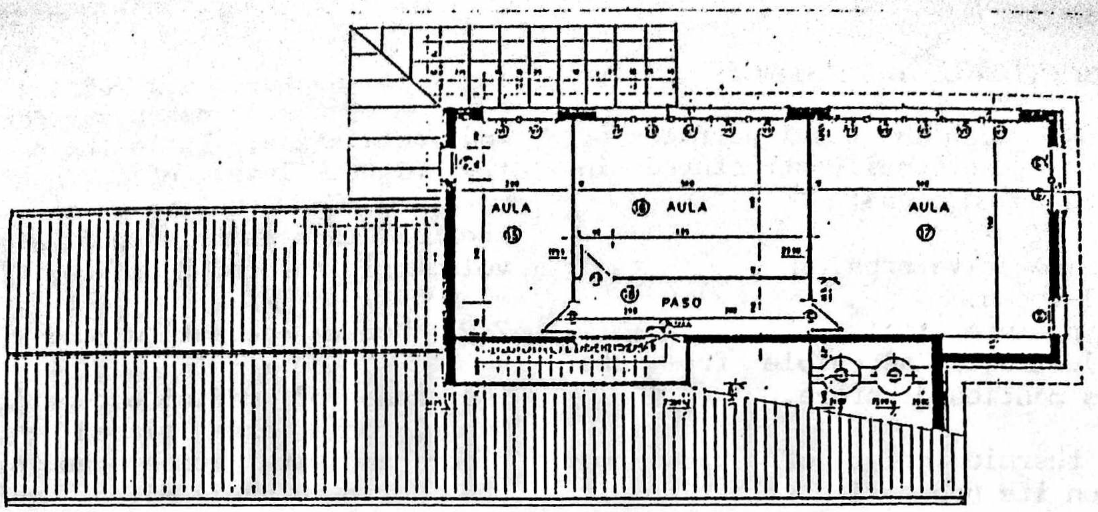

Figure 3. First floor.

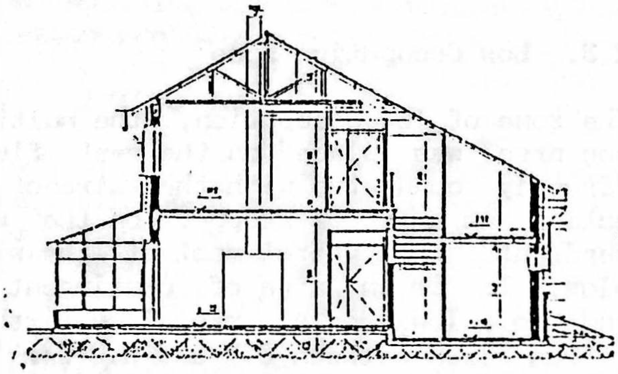

Figure 4. Section A-A.

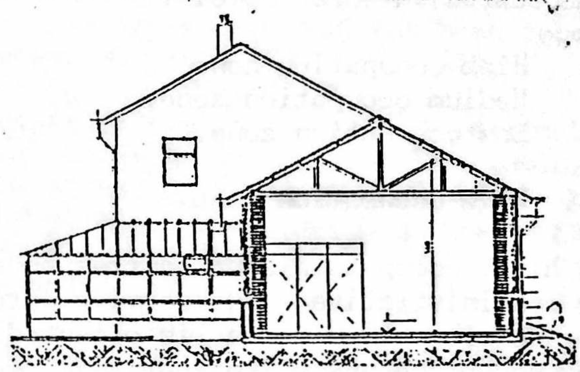

Figure 5. Section B-B.

3. CONSTRUCTIVE TECHNOLOGY

The walls were designed according to the guiding lines mentioned before and with meterials locally available.

The walls of offices and school-rooms have external insulation and internal thermal mass to allow heat storage.

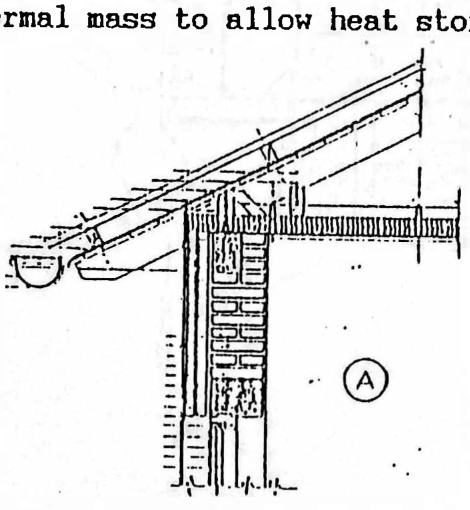

Figure 6. High thermal mass wall. Constructive detail.

The walls of the multiple-use area of low thermal mass to permit fast heating.

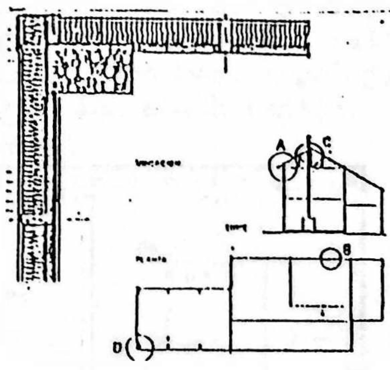

Figure 7. Low thermal mass wall. Constructive detail.

On roofs an insulation of 12.5 cm thickness is considered. Floors have insulation of variable density according to the thermal inertia of the zones. Windows, with double glass panes, have, in a high percentage, fixed glass panes to reduce thermal loss due to air infiltration.

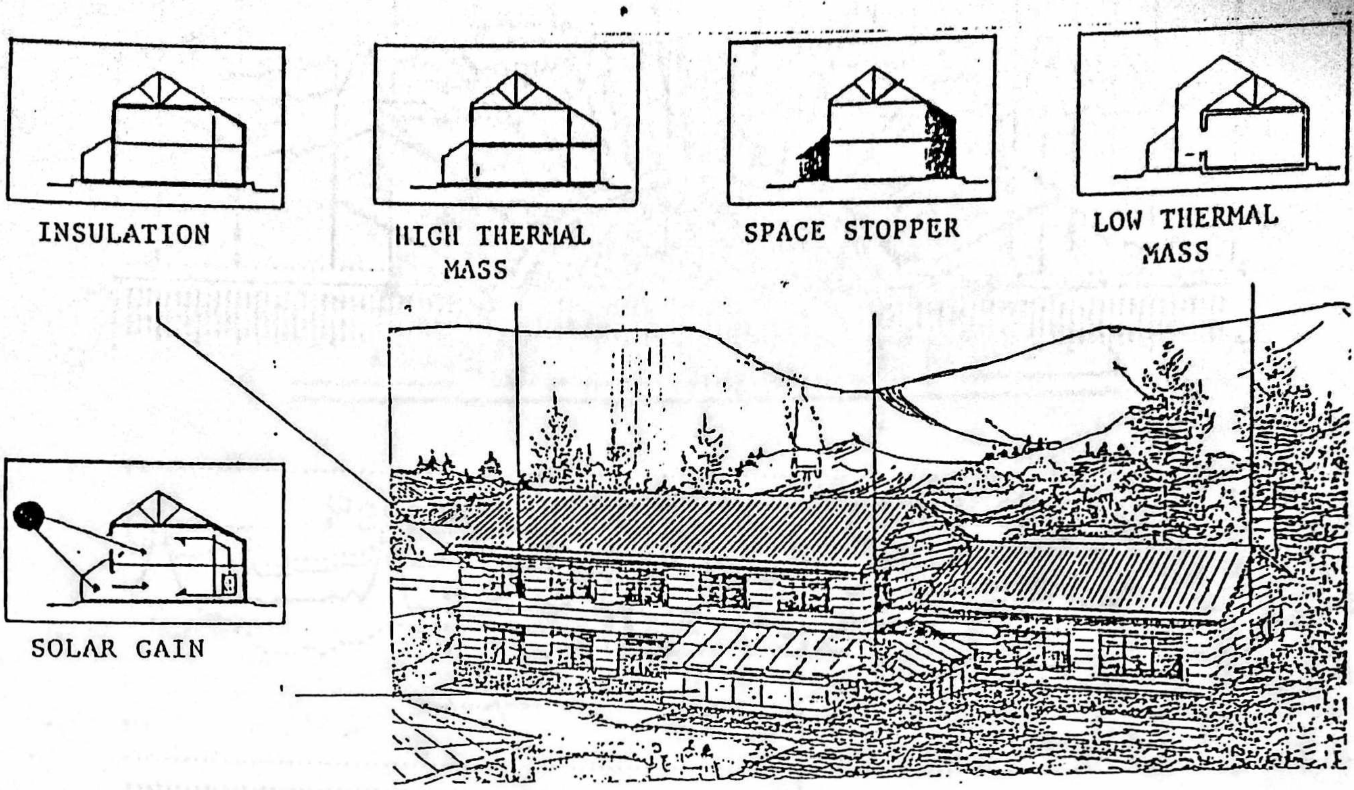

Figure 8.Energy saving guide lines.

The entrance functions with a double-door system that generates a space stopper to lessen thermal loss.

The technological and energy conservation guide lines are summarized in Figure 8.

4. THERMIC CONDITIONING SYSTEMS

The heating system is integrated by a cascade boiler system of hot water with radiators similar to a solar plane collector which work by thermosiphon.

Recuperators of heat from ventilation air are used with a minimun efficiency of 25%.

The green house planned to provide energy to the hall at the entrance, supplies a 20% of solar energy.

Direct solar gain globally supplies a 37% of annual energy for heating in the areas of higher occupation.

5. THERMAL BALANCE

Transistory and stationary thermal balances were made in order to study the thermal behavior of the building as well as to evaluate the constructive and conditioning systems. Some of the results obtained are shown in Figures 9 and 10.

6. CONCLUSIONS

The building, in its simulation, presents a very acceptable behavior taking into account the climate conditions concerning temperature and the low incidence of solar radiation. This behavior is possibly due to the different strategies used according to the destination of the areas.

The adopted strategies allow a good use of the different contributions of energy, among which, solar gain through the windows and through the greenhouse is considered specially important. The latter supply respectively a 37% and 20% of tha annual global energy for heating in tha areas of major occupation.

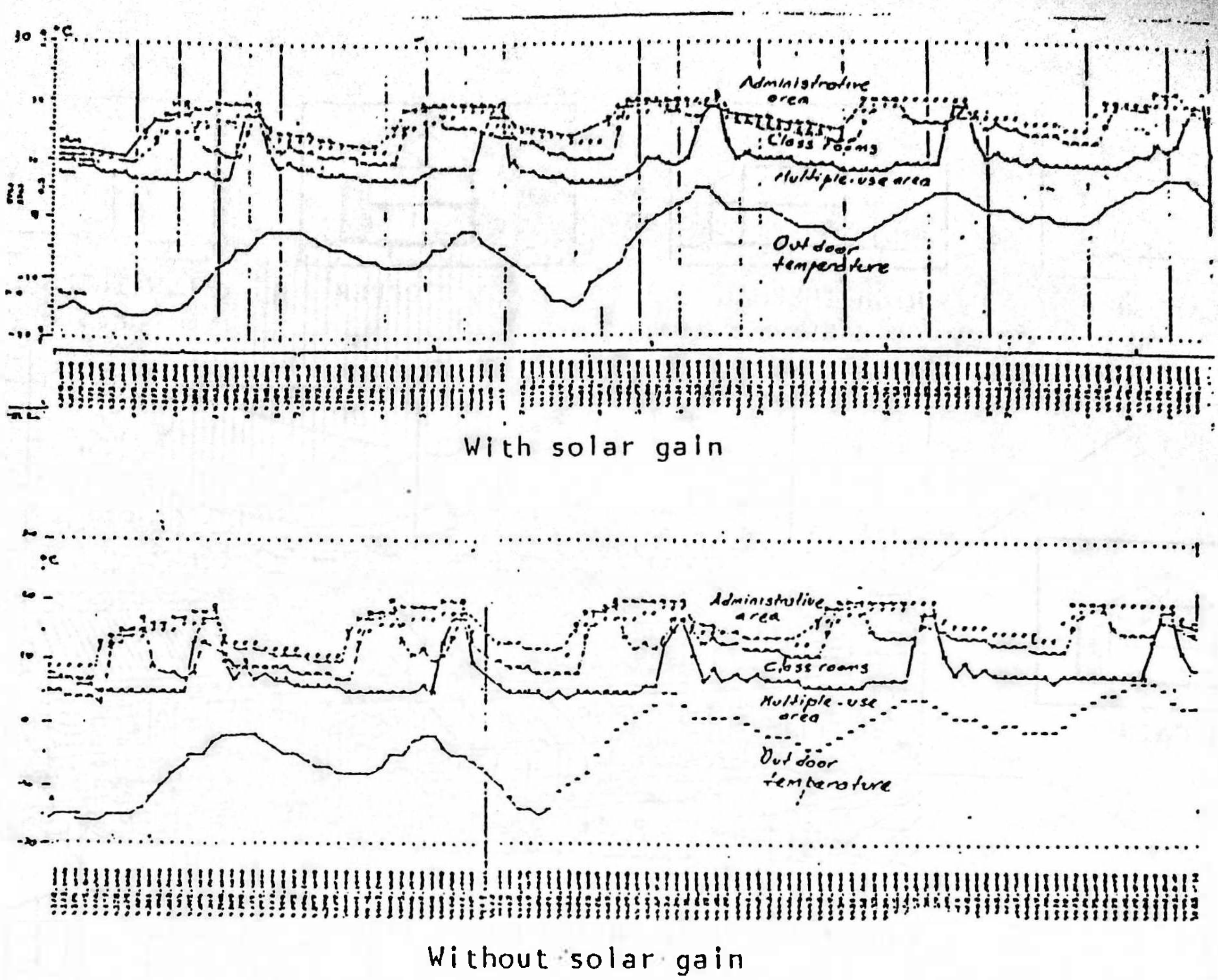

Figure 9. Transistory thermal balance.

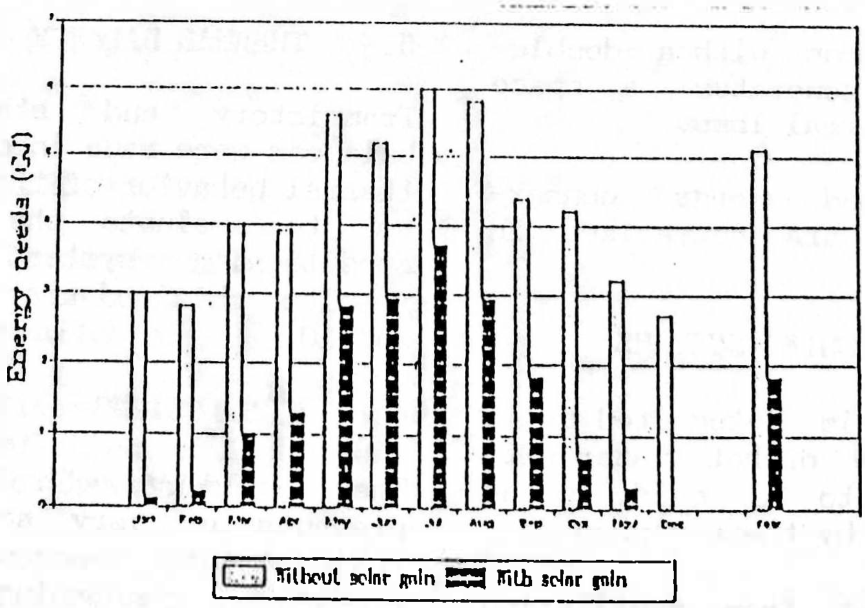

Figure 10. Stationary thermal balance.