

## 6 Summary

It was possible with minor corrections to analyse the office building with the software Thermplan. The inexistence of integrating cooling devices made it hard to estimate improvements in this sector. Since cooling is a more important topic than heating in this region of Argentina, Thermplan is not appropriate to be used in a further analysis. But according to Thermplan, the building would not meet the requirements of EnEV 2004. Neither in terms of  $Q_p$ , nor in terms of  $H_t$ . There are many energetical deficits. The cladding has a very high percentage of windows area and since the windows are only single vitreous, the transmission losses are very high.

An explanation for this can be found in the political situation. Currently, there are no binding governmental regulations. The Argentinean norm for constructing houses, IRAM, is not obligatory compared to the German EnEV norm. The current, high subsidized energy prices also do not force enhancements. Both facts could change rapidly as climate change is now undoubted and many governments start introducing reduction goals and subventions for energy improvements.

Even if it might take a while until regulations are introduced, the building could be used to step in front with a positive example showing comprehension for the situation

and foresight of what will happen. Although some investments do not pay off with the current low energy costs, a rise in energy costs should be considered in amortisation calculations as the price development in other countries is increasing. The average rise in Germany for gas prices from 2000 to 2008 was 9% per year.<sup>41</sup>

In order to start with improvements on a broader level, it is important that an energy program is passed from the head of the organisation. Without serious support from the top management or the sponsor it is hard to execute the required changes. To structure and document improvements, a detailed energy management plan should be passed and published to the stakeholders.

The energy management plan needs measurable goals for several stages in order to evaluate the progress and results. These tasks should be tracked and documented with energy software. In regular time periods, reports should inform the stakeholders of new actions, changes and the current status of the building.

Therefore, the energy management plan should consist of an action plan with short- and long-term actions. The plan recommended in Table 7 is derived from a general analysis of the weak points (see Table 12). The actions that have the lowest complexity, a fast payback, a high effect on the employee comfort and energy efficiency, are preferred in stage one. The more complex improvements should be dealt with in stage two.

Parallel ongoing methods need to be established, e.g. an **employee satisfaction poll** because users can give feedback and resolving ideas on uncomfortable regulations. Separately, **regulation and information** is needed that users reduce energy consumption through a more conscious use of energy.

To get a better insight of the building and the thermal behaviour, it is necessary to start **ongoing measurements** for temperature, pressure and wind conditions. In order to exchange existing light bulbs with energy-saving lamps and care more about the energy consumption of devices, an **energy procurement system** should be established. This is part of the **maintenance and operation system** that should also focus on possible efficiencies. The system can be used to develop guidelines and recommendations for improvements in the existing building as well as during the planning of new buildings.

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<sup>41</sup> See Figure 16 in the appendix

Stage and Goal	Actions (with Chapter)	Ongoing Methods
1: 2008 – 2010 Reduction of CO <sub>2</sub> compared to 2007 by 10	<u>Short term actions:</u> <ul style="list-style-type: none"> <li>• Insulation ex-Radiator (4.2)</li> <li>• Insulation Central Heating Pipes and better adjusted heat outlets (4.4.2)</li> <li>• Use of night ventilation (4.4.1)</li> <li>• Integration of edge connectors (4.5)</li> <li>• Reparation of Sun Protection (4.1.2)</li> <li>• New Insulation on SE and NW (4.2)</li> </ul>	<ul style="list-style-type: none"> <li>• Employee satisfaction polls (4.6)</li> <li>• Recommendations for Actions</li> <li>• Measurements for temperature, wind and pressure</li> <li>• Energy Procurement System</li> <li>• Concept for Maintenance and Operation</li> <li>• Guidelines for new buildings and building extensions</li> </ul>
2: 2010 – 2012 Reduction of CO <sub>2</sub> compared to 2007 by 20 %	<u>Long term actions:</u> <ul style="list-style-type: none"> <li>• New Insulation of NE and SW (4.2) or new façade system (4.3)</li> <li>• Efficient Central Heating (4.4.2)</li> </ul>	<ul style="list-style-type: none"> <li>• Recommendations for building improvements and reparation</li> <li>• Guidelines for efficient facility management</li> </ul>

**Table 7: Draft for an energy management plan**

The actions of the first step consist of short time improvements as enhanced insulation on the SW side or insulation of the central heating pipes. Since the users are dissatisfied with the heating outlets during the winter period, the outgoing temperature of heat has to be adjusted in order to save energy. Night ventilation especially during the supper period helps to keep the heat outside during the day. Edge connectors reduce energy consumption of stand by machines. The reparation of sun protection is also not a cost-intensive task, but it will reduce the use of electricity. A new insulation for the SE and NW side has to be investigated further as the costs for this task are uncertain. This applies also for the actions in stage two. But decisions regarding improvements should not only consider monetary values, but also social (urban development, influence of users, comfort) and ecological factors (emissions).

In the second stage, the employee questionnaire has to be analysed and long term examinations regarding thermal conditions have to be evaluated. Parallel, the investigations on the new passive façade could take place. The change to a water-based heating transport system should also be part of the second stage.

It is important to continue this plan and add further stages in the future.