Installing large glazed surfaces on the south façade instead of skylights can reduce the energy demand by up to 30 % if the façade is not shaded. For Moscow the effect is smaller as the solar radiation is lower. Anyway in Russian climates it is advised to use as much glazed surfaces in south façades as possible if facades are not shaded. The glazing quality, particularly a high g-value, is of course to be respected. In climates like Ankara with hot summers and cold winters the situation is more complex. Thus the impact of the glazing orientation and surface on the energy demand for both, heating and cooling, was simulated. The results in figure 10 show that increasing the glazed surface in general decreases the heating demand and increases the cooling demand. But the leverage effect of this parameter is different for all orientations. For the south façade the total energy demand (heating + cooling) decreases with a larger glazed surface. For the north façade it increases slightly and for the horizontal (skylights) it increases considerably. This means that increasing the horizontal glazing area should usually be avoided. Anyway general advises to increase the glazed south façade area in such climates cannot be given. This decision depends on if a cooling device is installed at all and which (primary) energy is used for heating and cooling. Thus a decision has to be taken individually for any project.

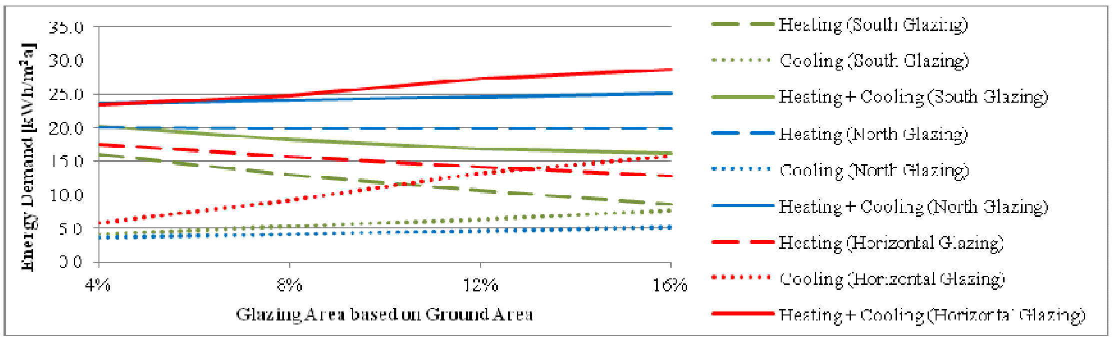

Figure 10 Energy demand for heating and cooling dependent on the glazed surfaces for Ankara

CONCLUSION

The building simulations carried out show the consequences of exporting industrial buildings designed for Europe without adapting the building envelope design to the local climate.

In hot climates it is mandatory to avoid skylights and replace them by glazed surfaces in the façade. If summer overheating is not critical and a heating demand exists in winter, the glazed surfaces should be oriented mainly to the south, otherwise to the north. To keep the cooling demand low or even avoid it, controlled night cooling is an energy-saving solution. Especially at night high ventilation rates are required that should be ensured by mechanical ventilation supported by natural ventilation. Reflective coatings of the roofs can be a small added value as well. Buildings with little thermal capacity are usually more susceptible for overheating why overheating protection becomes more complex.

In cold climates like in Russia the saving potential by orienting vertical glazed surfaces to the south is very high. Due to very high solar radiation in winter especially in Siberia these glazed surfaces should be increased as much as possible as overheating usually is no problem in such regions. Furthermore the air-tightness of industrial buildings in Russia is very important but is unfortunately not considered sufficiently by current building regulations. Improving the tightness is even more effective here than increasing the insulation thicknesses. Moreover this solution is also low cost, but appropriate quality controls like fan pressurization tests should become mandatory also for production buildings and warehouses. Here the most important need for action exists.

Most difficult is the design for regions with hot summers and cold winters like Turkey. Here building simulation should be used, as general advises are difficult to give and the design also depends a lot on the kind of energy used. A potential for heating in these countries is surely the use of solar energy. Here further research for seasonal thermal solar storages is required. Due to the long heating period and the high solar radiation in South Siberia this could also be interesting as a heating support for Russia.

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