HEATING AND COOLING IN OFFICE BUILDINGS

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The application of advanced heating and/or cooling systems must be based on a careful prior analysis of the building and its heating and/or cooling requirements. Descisions should be based on comprehensive system simulations using realistic operation conditions.

While most of the systems in this study cannot currently compete with conventional heating and cooling equipment in purely economic terms, there has been a reduction in fuel requirements as a result of their installation. Electricity consumption has, however, tended to increase. System selection must therefore achieve the appropriate balance between fuel and electricity consumption.

Not all systems, however, are selected purely on economic grounds. Environmental factors constitute an increasingly important consideration. Furthermore, with most novel technologies, the cost of the component parts is likely to decrease over time. This, coupled with possible future increases in fuel and electricity prises, will make advanced systems for energy supply economically more competitive in the longer term.

BACKGROUND

Energy efficient heating and cooling is now a standard consideration in the design process of an office building, and energy conservation is widely practised. However, more advanced heating and cooling systems using solar heating, improved heat pumps, heat storage, absorption cooling etc., are also being developed.

The initial investment in advanced systems is higher than for those of a more conventional design, and decisions relating to their installation need to be based on a comprehensive knowledge of the alternatives available.

The purpose of the CADDET analysis project this paper is based upon, is to assist both decision makers and those who prepare the background information by compiling and analysing information on existing advanced energy supply systems installed in commercial buildings in CADDET member countries.

METHOD

Because of the considerable differences in building design, internal heat gain, operating strategies etc., direct analysis and comparison has not been feasible. Instead, a consistent set of technical and economic parameters has been established by taking one existing and well documented building as the model for a theoretical analysis in which the performance of each of a number of heating and/or cooling system types has been simulated and analysed.

Assessments: The building is situated in a climate as in Amsterdam, the Netherlands, and is equipped with a VAV ventilation system. Internal heat gain is 35 W/m^2. An annuity method is used for economic calculations.

RESULTS

Some of the main results are given in the figures below.

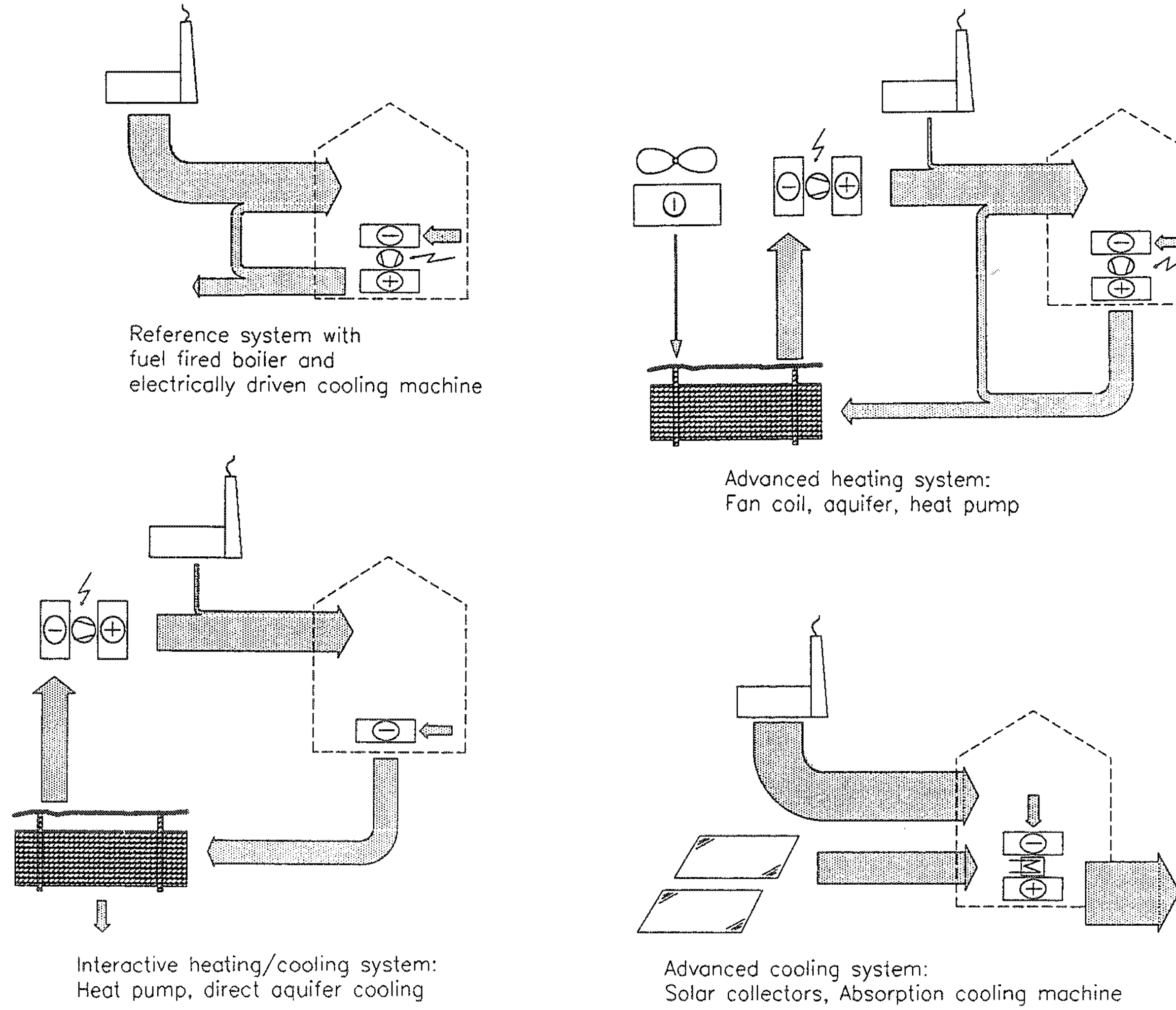

Figure 1. Heating and Cooling Systems Studied. Note that the aquifer is used for both heating and cooling supply in the interactive heating and cooling system. Filled arrows indicate heat flows.

As can be seen from the results above, the reference system with conventional equipment for heating and cooling is still the most economic system. In terms of energy consumption, it depends on if a decrease in electricity or fuel consumption (or perhaps both) is preferable, which system is the best alternative. Results given in Figure 3 on indirect CO^2 emissions are based on electricity produced by coal condensing plants, with a 40% efficiency.

Much more information about the results presented here, as well as other results and a more detailed background can be found in the reference.

REFERENCE

Abel, E., Aronsson, S., Jilar, T., Nilsson, P-E., *New Technologies for Heating and Cooling Supply in Office Buildings*, CADDET Analysis Support Unit Report, Sittard, the Netherlands, 1990.

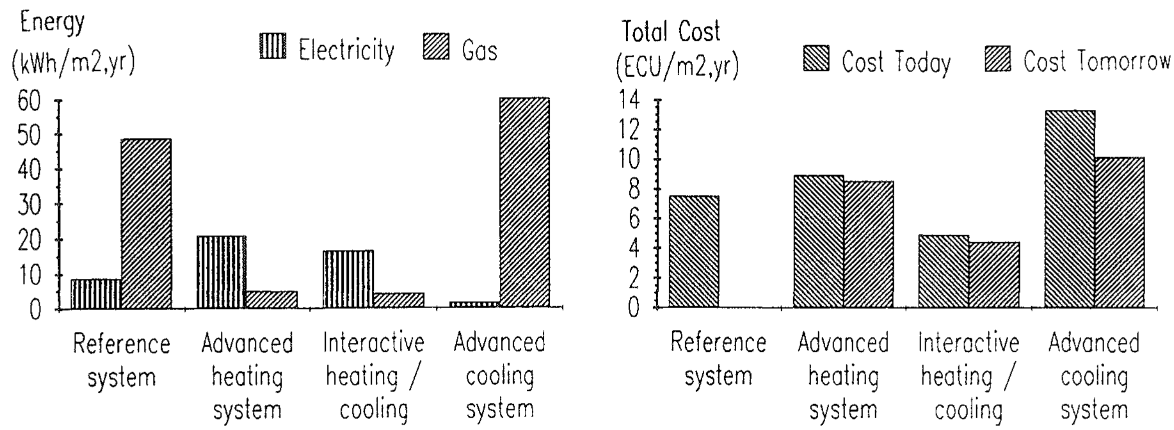

Figure 2. Energy and Economy Results. Electricity price 84 ECU/MWh, Gas price 20 ECU/MWh.

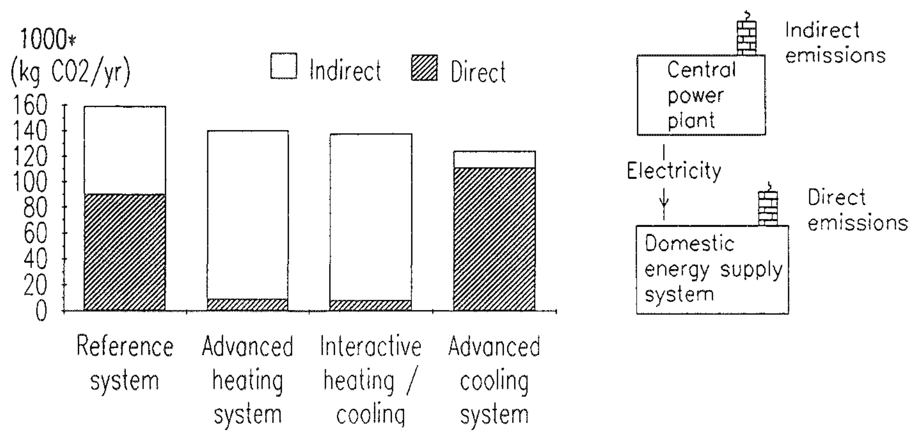

Figure 3. Environmental Impact Results