Energy audits by energy specialist Peter Mos

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Published in the Grower 60(10), 2005, p. 58-59

One of the world specialists in energy conservation in greenhouses, Peter Mos of Priva in The Netherlands, visited New Zealand in early September 2005. He performed technical energy audits at ten greenhouse properties in the Auckland and Christchurch areas. At all sites he visited, he recommended at least a few improvements in greenhouse control, some substantial. At most sites, Peter made some worthwhile discoveries regarding the heating installation. The estimated energy saving after implementation of his basic recommendations varies between 3 and 20% for the various sites. All growers involved were impressed by Peter's practical knowledge. I was fortunate to travel with Peter, and take in a bit of his know-how. This article presents some of his findings in general terms.

Peter Mos
Peter Mos has 30 years experience in heating installations and climate control in greenhouses in the Netherlands, first as technician at Brinkman, and later in technical positions at Priva. For four years, Priva has recognised the need for specialised advice on energy saving. Peter Mos was the first to fill the position of energy consultant. He has served many growers in Holland and increasingly travels the world to do energy audits. Demand is growing and recently another technical energy consultant and a crop/energy consultant were appointed. Peter obviously knows Priva computers inside-out, but he also understands other greenhouse computers. However, most smaller computers have limited energy saving capabilities, and even Peter can't make a lot of improvements.

In New Zealand
Peter Mos was invited to New Zealand by Hamish Alexander of Southern Paprika in Warkworth. Later nine others came on board too. Peter performed technical energy audits at ten greenhouse companies, varying from small businesses to large corporates. Some of them are participant in the project '*Improving energy efficiency in greenhouse vegetable crops*' funded by SFF/Vegfed/NGC/SE. The duration of the energy audits varied from two hours to two days, but most were one-day visits. The recommended changes in computer settings were often implemented by Peter, in teamwork with the grower. Other recommendations were reported verbally by Peter to the growers, and he also emailed as an additional written report. Peter's visit was part-sponsored by Vegfed's Tomato Sector, while the participating growers paid their share. All growers were extremely satisfied with Peters findings. Here follow some examples of Peter's recommendations.

Humidity control
Humidity is usually controlled by heating and venting to remove moisture. Unfortunately some growers do this too drastic, for example so that windows are open (e.g. 30%) and pipes are warm (e.g. 65 °C) at the same time. This costs a tremendous amount of energy. Where Peter found this, he adjusted the settings (always together with the grower), such that windows were on a crack and pipes were at a modest temperature (e.g. 45 °C). Figure 1 show graphs of two greenhouse compartments side-by-side: compartment 1 has the settings as the grower had them, while compartment 2 has the new settings of Peter Mos. Not only did Peter manage to cut the energy use (here perhaps by 15% per year), but he also improved the temperature and humidity.

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Minimum pipe temperature
The setting for minimum pipe temperature is often 40, 45 or even 50 °C. A lot of energy can be saved by reducing the use of minimum pipe. Naturally, this should never compromise the quality of plants or produce. Peter Mos recommends switching minimum pipe off sooner and more often by using 'influences'. Make the minimum pipe temperature depending on radiation, i.e. gradually drop the pipe temperature at more sunshine. Also make the minimum pipe temperature depending on indoor and outdoor conditions, e.g. let it become higher at higher humidity inside, or let it switch off when it gets warmer outside. Peter suggested or implemented particular settings, related to the type of computer used on site.

Pumps off
Most pumps run continuously, also unnecessarily. This wastes electricity, and also a bit of heat (because all valves leak a little bit when the pump is running). The pumps can be switched off when not used in summer, and also (automatically) in short intervals when no heat or minimum pipe is needed. Peter recommended changes in settings for pump control and for minimum pipe to achieve this.

Pipes
It is important to consider the number and size of pipes per bay. In a compartment with more pipes (or thicker pipes) the minimum and maximum pipe temperature can be set lower than in a compartment with fewer (or thinner) pipes.

Return water temperature
On several sites we encountered a too high return water temperature, e.g. 70 sometimes even 80 °C. This is due to a high pipe temperature and high flow rate. Too high return water temperature causes problems. Firstly, the condensor cannot be cooled and secondly the buffer cannot be fully utilised. Firstly, the condensor needs cold water to cool the flue gases, or otherwise the flue gases remain too hot to be used for CO2 enrichment. Secondly, the heat buffer can deliver hot water only when cold water fills the buffer up again. We came across a situation where the return water was nearly 80 °C, and the buffer water was only just over 80 °C. In this case, it is impossible to get any use out of the buffer. The buffer, which is a huge investment, was sitting there idle, and even worse, wasted energy.

Change a buffer from 'closed' to 'open'
Where there was a heat buffer, Peter Mos often recommended changing the way it operates, namely from a 'closed' type to an 'open' type of operation. Nearly all buffers in NZ are 'closed', but most can be changed to 'open' without major adjustments. 'Closed' buffer means the buffer is set to 'fill' (warm up) during the day, and to 'empty' (release the heat) during the night. In contrast, an 'open' buffer can be 'filled' and 'emptied' at any time, even at the same time. An open buffer has several advantages over a closed buffer. Using an open buffer will overcome a common problem, namely that the boiler is too small. Obviously, any buffer but especially an 'open' buffer should be properly insulated.

Heating installation
The above were examples of greenhouse control. Peter also inspected the heating installation (burner, boiler, condensor, buffer, pipes, pumps, valves) and did some surprising findings. The growers involved were impressed. Further details will be reported later.

Acknowledgements. *Thanks to Peter Mos (Priva) for sharing his knowledge with us; to Vegfed's Tomato Sector for financial support for Peter's visit; to SFF, NGC and SE for funding our project on energy saving in greenhouses; to Hamish Alexander for initiating Peter's visit; to the growers involved for hosting Peter; to Bert Houter (Technolutionz Ltd) for data processing .*

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Peter Mos or Priva, The Netherlands (in orange shirt) in discussion with Jason Culbert, grower at Under Glass Karaka Ltd. Jason says Peter's visit was extraordinary useful. It will shave up to 5% of the company's energy consumption.

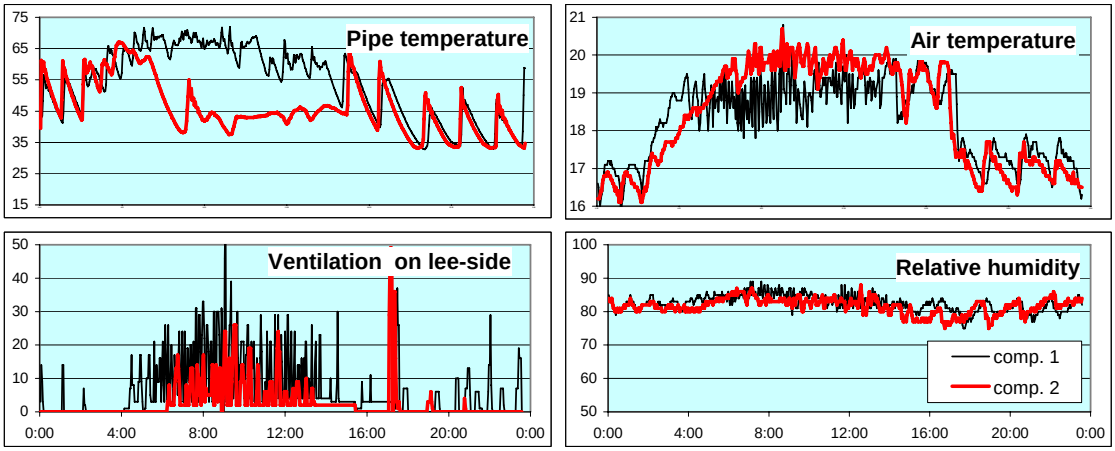

***Fig 1**. Example of improvements: Peter Mos changed the settings in compartment 2 (red line), so that the vents opened less wide and the pipe temperature remained lower. This resulted in higher air temperature and lower humidity (as desired), and lower energy use. This was a cold day (9 Sep05) on the South Island.*

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