GREENHOUSE - Q AND A

TIPS AND ADVICE

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Ask the Experts

Question : From Michigan. I have a 30' X 96' freestanding greenhouse with a 250,000 BTU input heater . During the cold snaps this winter I could only get 53 deg. F indoors. I've had the plumber change the propane gas lines to a larger size. I've had to rent portable heaters. Now, I've been told it could be the heat exchanger. I didn't have this problem last year ?

The winter of 2002/2003 in the continental east has been considerably colder than what is perceived to be the norm. It just might not be the heater. It could be that you just don't have enough heat.

Here's all the background information:

The structure is a couple years old and was a 30 foot X 96 foot freestanding house. The cladding on this particular house was single wall corrugated polycarbonate. The grower has purchased a 250,000 BTU input high efficiency heater from a local greenhouse equipment supplier. The grower told us the supplier used the *good old rule of thumb when sizing*. During the recent cold snaps of the winter of 2002/2003 (i.e. 23 deg. F outdoor conditions), the heater was running continually and was struggling to maintain 53 deg. F indoor temperatures. The grower hadn't seen this condition in the previous years operations ... so he thought there was a problem with the unit heater ... so the plumber was called in ... get the story.

First .... propane lines were increased in size ... which by the way will cost some dollars.

Still no improvement ... the grower had to rent temporary heaters for the crop ..... which by the way cost more dollars.

Second ..... plumber suggested the heat exchange may be shot ..... that's when client contacted us, he

already had spent considerable dollars on the problem.

Okay ..... let's look at the facts.

The heater was rated for 250,000 input BTU's, 200,000 output BTU's. (or 80% thermally efficient).

The cladding was corrugated single wall polycarbonate that has a U valve of 1.3 (manufacturers listing).

A 30 foot wide freestanding house has about 48' feet exposed face area per foot of length.

23 deg. F outdoor conditions / 53 deg. F indoor (at the best).

Let's just consider the conducted roof loss only and see if the heating problem was indeed a fault of the heater or was it by chance a problem with the *old rule of thumb selection*.

There's nothing involved with this and here's the exact means behind the madness:

Deg F heating effect = 200,000 BTU's / (96* 48 * 1.3) = 33.38 deg. F

So there you have it.

That 250,000 BTU heater, with a cladding surface area of 48' X 96' and with a U value of the cladding of 1.3 will only provide a 33.38 deg. F temperature rise.

Now using simple math, if it's 23 deg F outside and the heater provides a 33.38 deg. F heating effect
... well ... 23 + 33 = 56 deg F.

(Boy thats close to the reported 53 deg. F)

(note: we didn't consider the gable ends losses or infiltration in the above ..... so the growers reported 53 deg. F wasn't that crazy).

The heater was functioning about the best that it could.

Needless to say, the grower, after had spending considerable dollars and loss of crop quality etc., wasn't a happy camper.

The problem was ..... the *old rule of thumb selection*. ... Don't let it get you ... Resist taking short cuts. Always size the heating system for your local areas design low outdoor temperatures and site conditions. Be realistic !!! When considering heating systems don't just look at the dollar signs when making your choice look at the BTU signs instead. Make a wise, enlightened decision when you decide upon your heating. (See below for complete consideration for sizing).

As a foot note to the above, and we see this all the time out here in the West. Last spring was an eye opener for many of the seasonal growers. The spring of 2002 was nasty ... a lot of -20 to -30 deg. F outdoor temperatures .... spring was colder than winter..... . Crop quality suffered and losses occurred. The moral of the story is even though you consider yourself as a seasonal grower, it can still get mighty cold during those seasonal times, so prepare yourself accordingly.

If we looked at the above example, with that 250,000 BTU input heater, just to make a point, at a balmy 0 deg. F outdoor temperature, heck ... the best indoor temperature would be 33 deg. F. (brrrr ... that's just above freezing).

While on a roll ...

This is another common problem that we come across in Alberta.

And it goes like this.

"I bought a turn key package from the East and I'm unable to keep the heat up on the nasty days."

Well folks ..... you should have done your home work .

You should have provided a better description to the person's that sold you the heating equipment, that's just maybe why their price was cheaper.

The reason why you cannot keep the heat up in your greenhouse. It's **ELEVATIONAL DERATION**. That's right that 250,000 BTU input/200,000 BTU output and if you really read the label ... that's sea level capacity (low elevation). ... and as you go up in elevation ....

the heating capacity drops. Supplier's in the east seldom consider this deration when they size up stuff.

Example: Say we were to get the client above to physically move his greenhouse structure lock stock and barrel from Michigan out to Calgary, hit it with some balmy 23 deg. F night time outdoor temperatures, you'll never be able to heat to 56 deg. F indoor temperatures.

Why ...

Cause the output will now only be : 200,000 X 0.88 (12% altitude deration) = 176,000 BTU's

While on the heat subject ... with the last few years of obscene rises in utility costs. How much does cladding choice effect the heating requirements.

To make things simple, let's use the 30' X 96' freestanding unit above and rip off the corrugated polycarbonate on the roof and replace with double poly and still keep that good old 250,000 BTU heater. The U value of double poly is 0.5 when new plus we like to add 10% safety cause sooner or later it will have a few hole, which derates the U valve. Again we'll consider the conducted loss of the roof only. I caution you .... you'll find the results surprising.

Using the same formula.

Deg F heating effect = 200,000 BTU's / (48 X 96 X . 55) = 78 deg. F

Therefore, that 250,000 BTU input unit heater would be able to heat the greenhouse to 101 deg. F (23 + 78) if needed. Or if on thermostat control set at say 65 deg. F well ....guess what it would actually cycle on and off.

I told you the results would be surprising.

Anyhow Folks

When selecting your heating system.

- Use realistic design temperatures for both outdoors and indoors
- Use realistic U value properties for the cladding systems (and explore the options)
- Consider realistic infiltration rates (i.e. we've seem many cases where none was considered or allowed for !!!)
- Consider your siting conditions i.e. exposure factors, elevation above sea level, fuel source choices.
- Consider adding a 10% safety factor to your actual heating requirements and rest well at nights.
- Before considering changing heat sources and systems because of the recent energy costs, do consider energy conservation steps first. This approach is far less costly and provides a quicker payback. Energy conservation techniques that's right for any greenhouse project has tremendous saving potentials just by some simple common sense applications.

If you have any questions please feel free to contact our office. The drip is only costing you money.

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