



## Bridge Greenhouses

# Energy Efficiency in Glasshouses

Practical actions and techniques growers and site staff  
can do to reduce energy costs

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## ABOUT US

- ▶ Bridge Greenhouses construct and equip modern commercial glasshouses for growers, garden centre operators and research organisations.
- ▶ Specialists in renewable energy and all forms of heating systems, as well as LED lighting, screen systems and climate control.



## SCREENS

- ▶ Install energy screens!
- ▶ Instant cheap energy saving, and increased humidity control
- ▶ Shade screens don't save much energy; 20 – 25%
- ▶ If you have one look at installing a second one.





## ENERGY SCREENS

- ▶ Loads of different modern cloths.
- ▶ Thermal/Shade
- ▶ Clear & Light Diffusion
- ▶ Blackout
- ▶ Many modern cloths are breathable to allow venting above a closed screen = no gapping to minimise heat loss





## ENERGY SCREENS: CLEAR & LIGHT DIFFUSION

- ▶ Clear energy screens for daytime deployment with 89% light transmission
- ▶ Diffusion cloths scatter the light = reach deeper and more even distribution
- ▶ Maximise light to the crop while saving energy
- ▶ Energy saving of around 47%
- ▶ Double screen with shade
- ▶ Triple screen with shade + blackout



## ENERGY SCREENS: THERMAL SHADE

- ▶ 50 to 70% energy saving depending on number of strips
- ▶ Maximise energy saving
- ▶ Also provides shading during the day
- ▶ Good option for single screen installations
- ▶ Good compromise but they are a compromise

## ENERGY SCREENS: BLACKOUT

- ▶ Generally around 70% energy saving
- ▶ Daylight control or with grow lights
- ▶ Different combinations of black/white
- ▶ Can be used to keep greenhouse cool



## OTHER SCREEN SAVINGS

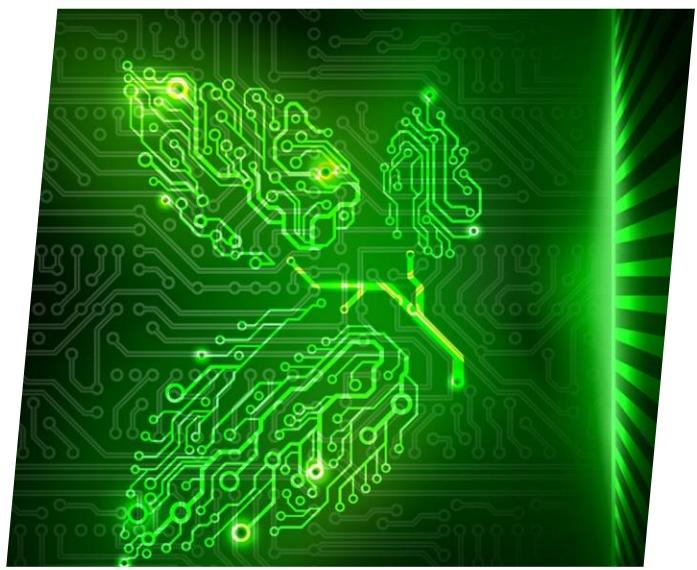
- ▶ Vertical screens or even bubble wrap for sides to prevent cold spots around edges.
- ▶ Apex screens – stop cold air movement above a closed screen
- ▶ Replace fixed screens with retractable for better control, and maximizing free energy from the sun.
- ▶ Change damaged or dirty screens. Cold air drops through holes/tears, and dirt reduces light transmission.







## CONTROLS & SENSORS



- ▶ Measure, record and analyse as much data as your control system will allow.
- ▶ Assess usage with min weekly meter readings.
- ▶ Compare with previous years, trying to account for climate differences using degree days
- ▶ Calibrate sensors – temperature, humidity, CO2, radiation
- ▶ Calibrate burner modulation after service



## CONTROLS & SENSORS



- ▶ Add extra sensors – plant temperature, temperature & humidity above screens etc.
- ▶ Add extra sensors in large heat storage tanks to control smaller layers
- ▶ Check setpoints – e.g. ensure pumps turn off when not needed
- ▶ Check graphs for anomalies – e.g heating and venting – why?
- ▶ Control vents accurately
- ▶ Is everything in Auto?
- ▶ Make sure it's working!



## CONTROLS - HEAT/VENT HUMIDITY

- ▶ Modern breathable screen = vent above the closed screen first.
- ▶ Vent both Lee & Wind sides - minimise vent opening, maximise air movement
- ▶ Gap screens up to max 5%
- ▶ Pipe temp for humidity control as a last resort.
- ▶ Older screens = gap before venting to get rid of heat otherwise cold air is trapped above a closed screen.
- ▶ Check vent motor limits to ensure vents shut tightly



## DEHUMIDIFIERS

- ▶ Modern large-scale dehumidifiers potentially offer large energy savings
- ▶ Cheaper than heating
- ▶ Keep glasshouse sealed so save heat and CO<sub>2</sub>
- ▶ Can also heat/cool if needed
- ▶ Expensive to buy



## AIR MOVEMENT

- ▶ Temperature variations < 2DegC
- ▶ Less risk of cold spots/condensation so less need for pipe temperature to reduce humidity= less energy
- ▶ All types of fan help create uniform temperature and humidity – not heating the roof, and not heating cold spots
- ▶ Vertical fans move warm air from top to bottom of glasshouse, so more even vertical temperature
- ▶ Air tubes equalise horizontally and vertically





## LIGHTING

- ▶ Swap HPS for LED!
- ▶ With modern LED lights there are almost no instances where it's not commercially viable to swap
- ▶ HPS = potentially unwanted heat, from expensive electricity, and in wrong place; LED Much less heat output
- ▶ HPS = shading from large fixture; LED = much slimmer, so less shading
- ▶ HPS = wastes energy producing wrong spectrum; LED = exactly the right spectrum for crop, and can even be variable
- ▶ LED = dimmable to give only the amount of light required
- ▶ LED = No maintenance and don't need to change bulbs
- ▶ Turn off the lights as soon as possible
- ▶ Control DLI (Daily Light Integral) - total number of moles that reach the plants during the daily photoperiod. Only give the amount of light that the crop needs.





## LIGHT TRANSMISSION

- ▶ Take advantage of solar gain to lower heating temperatures at night or when cloudy.

Add coatings to glass - many types available such as:

- ▶ Anti reflect to increase light transmission
- ▶ Diffusing to increase light distribution and penetration
- ▶ Both reduce the amount of supplementary lighting required.
- ▶ Shading coating, to help keep cool, reducing need for additional cooling, or running extraction fans



## MAINTENANCE

- ▶ Clean the glass! Increases light transmission, to increase yield and reduce heating/lighting requirements.
- ▶ >10% light, 8% energy saving!
- ▶ Repair broken or missing glass
- ▶ Fix leaks
- ▶ Seal gaps around doors





## STAFF TRAINING

- ▶ Nominate energy manager
- ▶ Turn off lights
- ▶ Close doors
- ▶ Switch off machinery when not required
- ▶ Feedback any measured savings etc to keep interest



## HOMEWORK

- ▶ Write an energy policy, and regularly update
- ▶ Research alternative energy sources such as PV, wind, AD, CHP etc
- ▶ Check for available grants/assistance





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Thank You!