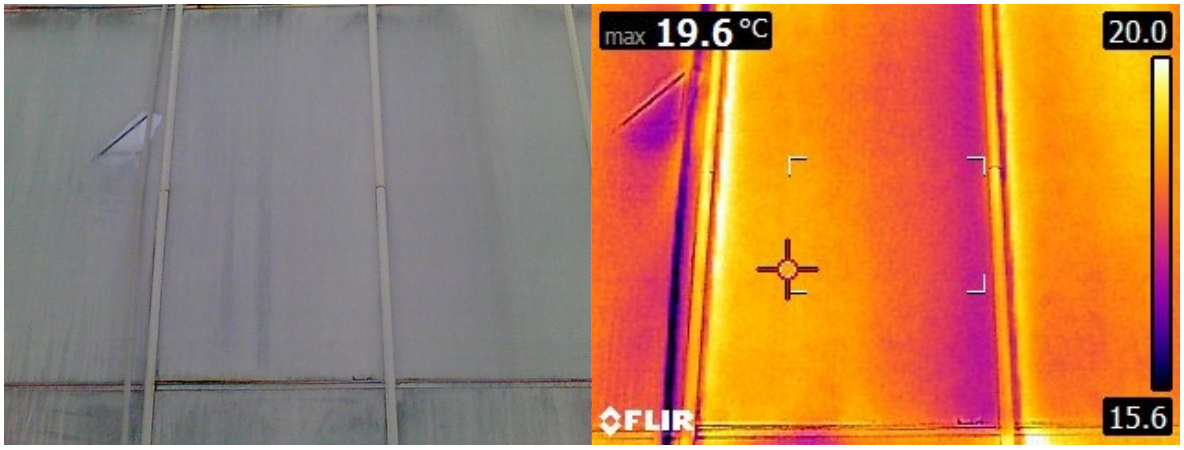
Thermal imaging of Auckland greenhouses and the five key findings for preventing heat loss

Summary

In this study, a thermal imaging camera was used at four different covered crop grower sites to display and visualise how heat loss was occurring at different areas of their process.

The thermal imaging camera captured and created an image using infrared radiation. The created image represents the temperature of the process and visually displays heat loss.

An example of a thermal image of a glass house window is shown below, on the right. The reference photo is on the left.



In the thermal image, there is a small red cross near the centre of the image, which shows where the camera is measuring the temperature. So, the 19.6°C refers to the location of the red cross, which in this image is on the surface of the glass.

The temperature scale on the right side of the image indicates the fluctuating temperatures inside the image. The brightest yellow are the warmest areas, while the blue coloured areas are the coldest.

This is how the photos throughout this document will be displayed: the reference photo first, and the temperature in the top left corner of the thermal image.

The purpose of this study is to identify trends across multiple different sites that could be addressed, compare different greenhouse types, and identify any major areas of heat loss in greenhouses. The findings have been separated into five different articles:

1. Reducing fuel costs by insulating hot water pipes and high temperature surfaces. Just 50 metres of un-insulated pipework can cost a business $5,000 per year in energy bills.
2. Greenhouse material comparison: glass vs single skin plastic vs twin skin plastic. When comparing different greenhouse materials, two types of heat loss were seen. One, Conduction losses through the material and two, infiltration losses from gaps in the material. Losses between twin-skin, single-skin and glass are all compared to see which has the highest rates of heat loss.

3. Plastic wrapped glasshouse walls vs non-wrapped glasshouse walls. Plastic wrapping maintains an additional 1°C inside a glasshouse, which equates to between $9,000 and $11,000 in cost savings per year for a 1-hectare glasshouse.
4. Aluminium wrapped glasshouse walls. A look at using aluminium based plastic wrap to reduce heat loss through glasshouse walls.
5. Dirty greenhouse walls and the effect on heat loss. A major area of avoidable heat loss is the presence of dirt on the plastic wrap. Dirt spots increase the amount of heat transfer through the plastic, due to the spots being held at a higher temperature than the rest of the plastic. If around 10% of a 10,000m^2 single-skin plastic house had grime or dirt stuck to the surface, this would cost the business an additional $4,500 to $6,000 per year.

The recommendations from this report are:

1. Insulate exposed areas around the boiler house and exposed pipework.
2. Investigate plastic wrapping glasshouses over winter. Bubble wrap and plastic both work but try and use long, consecutive pieces to reduce infiltration as much as possible.
3. Clean any large dirty spots around plastic sheets with warm soapy water, to reduce the impact of these spots on heat loss.