

# Should I upgrade my greenhouse to improve energy efficiency?

Upgrading or rebuilding a greenhouse facility is a large task and can be very expensive, it should not be undertaken lightly. If your greenhouses are old and showing signs of structural damage or you want to improve the land-use efficiency, then building new greenhouses with the latest energy efficient equipment is a good option. However replacing or rebuilding greenhouses may not be the most cost effective option to simply reduce energy costs. Upgrading or retrofitting key systems and components with new highly efficient technology could be more cost effective and provide better quicker energy savings.

An upgrade doesn't have to be a whole system, it could be as simple as installing a new thermostat, updating climate control software or repairing and servicing equipment. New technologies are constantly being improved and most modern equipment will be more energy efficient than older equipment. So upgrading a 20 year old piece of equipment could actually improve the whole-of-farm energy efficiency considerably. Choosing what systems or equipment to upgrade will determine the extent of energy savings and the payback period.

The first step is to look at where your energy is being used and asking what other equipment is directly or indirectly influencing the energy use. For example, a high heating fuel bill may not be due to an inefficient heating system, it may be the greenhouse covering has a high heat loss (high U-value), is torn and damaged or there are gaps around entry points allowing hot air to escape, refer table 1.

In this case there is little benefit of installing a new boiler for heating without addressing the air leaks in the system. A new boiler would simply be burning fuel more efficiently to compensate for the lost heat. It would be better to

- Replace the greenhouse covering with one that has a lower U-value (better insulation),
- Stop hot air losses by patching tears or holes in the covering and plug gaps by installing weather strips around vents, louvers, pipe entry points or doors,
- Repair any damage to the insulation on the hot water distribution pipes to stop heat loss during transport
- Replace old or damaged thermostats with a new electronic thermostat to provide more accurate readings
- Calibrate thermostats to ensure readings are accurate
- Check and adjust climate control parameters to stop or reduce clashes e.g. venting while heating.
- Service the burner and clean the heat exchangers in the old boiler to increase burning efficiency.

Addressing these points will increase heat retention within the greenhouse and increase the efficiency of your existing heating system by reducing the workload and fuel required to maintain greenhouse temperatures. These same principles apply to maintain the efficiency of an

active cooling system. The less air leaks there are within a greenhouse the more efficient the air circulation and venting system is, and the more uniformed the internal temperature. A more stable growing environment requires less energy to maintain an optimum temperature. Service control systems and equipment to maintain optimum performance and extend the useful life of that equipment.

If your structure or equipment has reached the end of its life discuss your requirements with a specialist to ensure your new greenhouse design and equipment suits your property, local climate, production system and crop type. You may only need to make some simple changes or upgrade one piece of equipment to give you that increase in productivity, or you may find installing a new high-tech solution is more appropriate.

Don't be too concerned about increasing your energy use by increasing your reliance on technology and mechanization. Although your overall energy use may increase, new technologies are more energy efficient and can provide a greater return on investment than many older systems. The trick is to get the right balance between upgrade costs, production disruptions, energy use and energy use efficiency. Getting the balance right will not only provide an energy efficient production system but can improve productivity and reduce labour time.

Talk to various suppliers or specialists about your specific requirements and ask what they can do for you. Sometimes an off-the-shelf system will not suit requirements and a customized system may offer a greater return on investment.

**Table 1: Cost comparison for structure condition and boiler efficiency**

Heater/Boiler condition	Structure Condition		New		Good		Poor		Bad	
	Boiler Efficiency (%)	Boiler Energy Output (Kj/hr)	No holes or gaps in structure, none or minor air leaks. 1 air exchange/hr		No major holes in structure but a few minor gaps, air leaks. 1.15 air exchange/hr		Major holes in structure and several gaps, multiple air leaks. 2.85 air exchange/hr		Major holes and gaps in structure – neglected, multiple air leaks. 3.8 air exchange/hr	
			Total Cost \$/yr	Cost \$/m <sup>2</sup>	Total Cost \$/yr	Cost \$/m <sup>2</sup>	Total Cost \$/yr	Cost \$/m <sup>2</sup>	Total Cost \$/yr	Cost \$/m <sup>2</sup>
<b>New</b> (1 to 2 yrs old serviced monthly)	60	23048.26	<b>\$7208.00</b>	<b>\$2.19</b>	\$7474.00	\$2.27	\$10507.00	\$3.19	\$12222.00	\$3.71
<b>Good</b> (2 to 3 yrs old, Serviced annually)	57	21895.90	\$7588.00	\$2.30	<b>\$7867.00</b>	<b>\$2.39</b>	\$11060.00	\$3.36	\$12866.00	\$3.91
<b>Poor</b> (3 to 6 yrs old, Serviced every few years)	55	21127.66	\$7864.00	\$2.39	\$8153.00	\$2.48	<b>\$11462.00</b>	<b>\$3.48</b>	\$13334.00	\$4.05
<b>Bad</b> (>6 yrs old, Never serviced)	54	20743.54	\$8009.00	\$2.43	\$8304.00	\$2.52	\$11674.00	\$3.55	<b>\$13580.00</b>	<b>\$4.13</b>