Project title:	GrowSave; Energy & Resource Efficiency Knowledge Transfer for the PC Sector
Project number:	PE/PO 011a
Project leaders:	Chris Plackett & Jonathan Swain, FEC Energy
Report:	Year Three, July 2017
Key staff:	Edward Hardy, Jenny Beynon & colleagues, FEC Energy
Location of project:	FEC Energy, Kenilworth, CV8 2LS, commercial nurseries and various meeting venues
Industry Representatives:	James Broekhuizen, Colin Frampton, Roly Holt, Jamie Satterthwaite, Neil Stevenson
Project start date:	1st August 2014
Project end date:	31st July 2019

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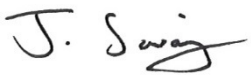
AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Signature Date: 01/03/18

Report authorised by: Jon Swain

Signature Date: 01/03/18



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Headline

GrowSave delivers a programme of technology transfer and information dissemination activities to AHDB Horticulture protected crops (PC) sector levy payers and provides up-to-date information about energy saving and energy efficiency.

Between August 2016 and July 2017 the project has delivered the following activities:

- Technical presentations at TGA Conference
- Technical seminar covering the topic of biomass heating systems and the likely impact of the proposed reforms to the RHI scheme
- Presentation on Next Generation Growing at BPOA Annual Conference
- Presentation on Air Movement at BPOA technical event
- Study Tour to Belgium and the Netherlands for the soft fruit sector
- Three editions of the AHDB Horticulture Energy News newsletter, dedicated to energy topics
- Regular news and updates delivered via AHDB Grower and the GrowSave website
- Energy benchmark data via the GrowSave website
- Technical Update publications covering the topics of: sources of carbon dioxide, sensors, assimilation lighting, cold storage

All of the activities were designed to encourage growers to take energy saving actions in their own business.

Background & Introduction

GrowSave is AHDB Horticulture's communications platform that disseminates energy saving information and supports the implementation of energy saving technologies by the UK protected cropping (PC) sector. The programme has been running for 10 years. It is delivered by the FEC Energy team and steered by a group of edible and ornamental growers. The format of outputs and the project programme are deliberately kept flexible. This is to allow the project to respond to the energy issues that the industry is facing at any given time.

The current phase of the project builds on previous activities that were funded under a series of AHDB Horticulture (formerly HDC) projects, the latest of which was project reference PE/PO 011. This report outlines the activities delivered in the third year of the project, which ran from 1st August 2016 to 31st July 2017. The project is scheduled to run for a further two years.

Summary of Work Completed

The following table summarises the deliverables over year three of the project and compares them to the work plan specified in the contract:

Activity Area	Contracted Activity	Delivered Activity
Website	Provide at least one update per week	News stories added as per contract. Blogs from FEC Energy specialists added on a regular basis.
Grower workshops / technical seminars	Deliver four workshops / seminars	**'What's Next for Renewable Heat?'** held at Vale Golf Club, Evesham, and Springhill Nurseries on 16/05/17. BPOA Technical Conference, 20/06/17 - *Optimising air movement for protected ornamental crops* The remaining event days will be used in 2017-18 for the proposed NGG study group project and a repeat of the Renewable Heat event to take place in Scotland.
Technical presentation at PC Crop Association conferences / meetings	Provide presentations / technical support to two Crop Association conferences / meetings	Presentations were given at two Crop Association events: 1. TGA Conference, Chesford Grange Hotel, 28/09/16. Topics were: an update on the latest issues affecting energy use in greenhouse horticulture, including energy pricing, the viability of renewable heating systems and Climate Change Levy targets. 2. BPOA Annual Conference, Whittlebury Hall, 18/01/17. Topic was the use of NGG techniques in ornamentals.
Energy benchmarks	Deliver information and data via the GrowSave website to allow growers to do energy use comparisons	Done via the Managing Energy section of the website where information is given on comparison methods using degree-days. Degree-day data and ambient temperature data given to allow comparisons to be made.
AHDB Horticulture Energy News	Deliver three editions of the energy specific newsletter	Delivered to contract with three editions completed in December 2016, March 2017 and June 2017.
AHDB Grower News Columns	Deliver columns of ~750 words in each edition of AHDB Grower	Delivered to contract.

Activity Area	Contracted Activity	Delivered Activity
Technical updates	Publish four technical updates covering topics relating to recent energy developments	Updates have been written on the following topics: 1. Conventional & Alternative Sources of CO_2 2. Sensors 3. Cold Storage 4. Assimilation Lighting

Description of Activities

The activities of the GrowSave project were discussed and planned with the grower coordinators at two advisory group meetings held on 28th September 2016 and 9th March 2017. The latter was held as a video conference; although well attended, the format did not lend itself well to group discussion and some of the group had technical difficulties. It is intended to hold future meetings in person, when possible, with the option of a video link for those who cannot attend. Regular contact was also maintained with industry groups including the TGA, CGA, PTG and BPOA. These industry inputs formed the basis of the work programme described here.

Website and Social Media

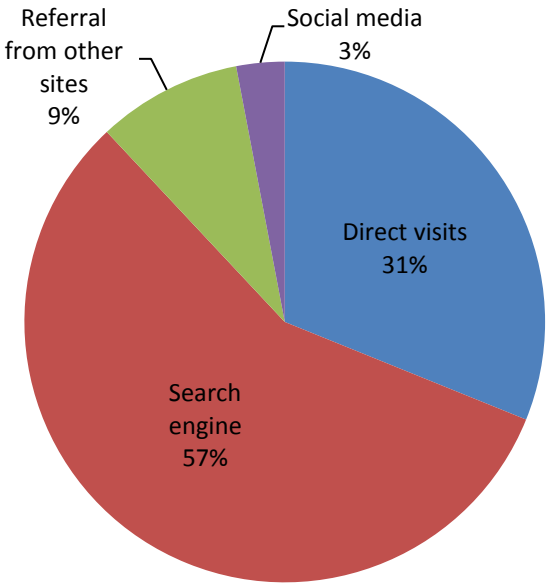
The project website has been regularly updated with articles and news items. In addition, reports from GrowSave events have been posted together with any associated hand-outs or presentations.

Website metrics have been recorded using Google Analytics. There were 7,709 website visits with 18,891 page views between 1st August 2016 and 31st July 2017. New visitors accounted for 5,282 (69%) of these visits. Direct website visits numbered 2,403, while 3,991 were directed via Google.

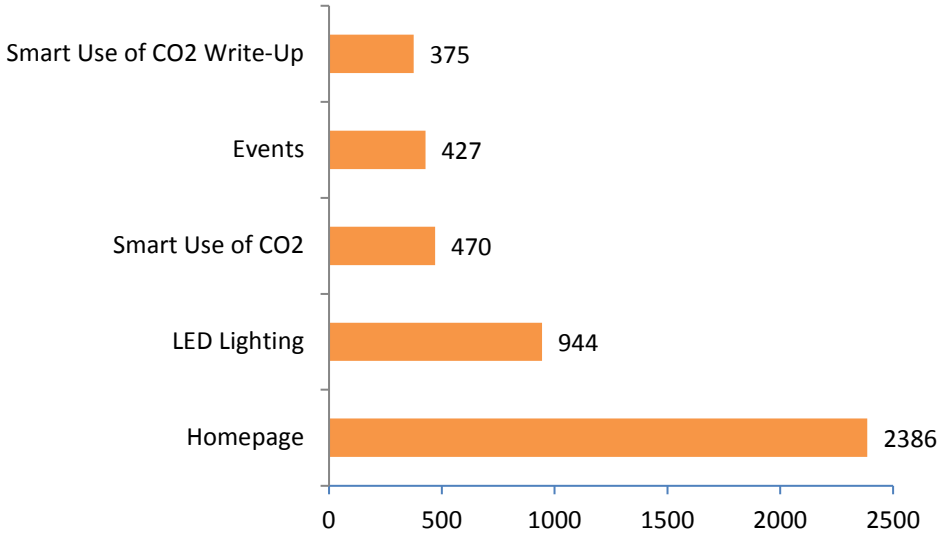
The number of visits to the website has increased by 7% compared to the same period in 2015-16, believed to be due, in part, to Search Engine Optimisation, with the proportion of visitors reaching the website via a search engine increasing from 48% to 57%.

In addition to the website, GrowSave has been reaching growers through social media, including Facebook and Twitter. The number of website sessions resulting from social media links increased from 2% to 3%.

The four most popular routes of access to the GrowSave website were:



The top five most popular subject pages were:



The number of visits to the homepage increased considerably over 2015-16, rising from 1,488 to 2,386. Once again, LED Lighting remains a popular topic, as does the Events page. The top five pages visited account for just under a quarter of all the page views, indicating that visitors view a wide range of site content.

Going forward, subject to available funding, GrowSave would like to implement a new digital strategy, with a focus on redesigning the website to bring it up-to-date in terms of both layout and content, making it easier for users to navigate and find the information relevant to them. An increase in the use of social media is also an ongoing focus, and it is hoped that this will drive more people to the website.

Workshops and Seminars

The topics for workshops / seminars were decided based on grower demand and the guidance given by the project advisory group. Where possible, events were held that would attract both edible and ornamental crop growers.

A study tour was delivered under the GrowSave project identity to non-PC sectors. This work has been separately funded and was not covered by the contract for project PC/PO 011a. However, it should be noted that foundation information used as the basis of this additional work came from the resources of PC/PO 011a and its predecessors.

Details of the two GrowSave events and study tour, the background to them and the number of attendees are given in the table that follows.

Workshop / Seminar Title	**Details**	**No. of Delegates**
Soft Fruit Study Tour Location: Belgium & the Netherlands Date: 25th-27th January 2017	The aim of the study tour was to look at growing techniques used by growers in Belgium and the Netherlands, and compare these to current practice in the UK. The tour included visits to a research facility (Hoogstraten), semi-closed glasshouse (Red Star) and several independent growers. Various technologies and NGG techniques were observed.	**Total: 10** 6 growers 3 consultants 1 tour guide
What's Next for Renewable Heat? Location: Vale Golf Club, Evesham & Springhill Nurseries Date: 16th May 2017	Information regarding the proposed changes to the RHI scheme was presented to growers and other interested parties, with the aim of highlighting the financial impact of the new regulations on anyone considering installing a renewable heating system in the near future. Following the presentations, delegates were invited for a tour around Springhill Nurseries, which had recently commissioned a CHP system, comprising of a biomass boiler and steam turbine. The presentations and site visit were filmed. Videos are available on the website.	**Total: 24** 11 growers 6 manufacturers / suppliers / installers 4 consultants 3 journalists / marketing

In addition to the specific GrowSave events, technical support on energy topics has been given to several PC sector events / Crop Association meetings. Details of these events are as follows;

1. **TGA Conference, 28th September 2016**. Chris Plackett from FEC Energy gave delegates an update on the latest issues affecting energy use in greenhouse horticulture. This covered several topics including energy pricing, the viability of renewable heating systems and Climate Change Levy targets.
2. **BPOA Annual Conference, 18th January 2017.** Jon Swain talked about whether or not NGG has a place in ornamentals production, and considered which techniques might be applicable.

3. **BPOA Technical Conference, 20th June 2017.** Jon Swain presented on the topic of optimising air movement for protected ornamental crops.

The seminar on 'What's next for renewable heat?' and subsequent visit to Springhill Nurseries were filmed. The videos, which contained the full presentations and some shorter summaries, were made available via the GrowSave website. This webpage was the eighth most viewed page with 289 visits. The table below shows how many times each of the videos has been viewed. These videos are relatively long and would, perhaps, attract more views if they were shorter.

Video	Views
Presentations: Part 1	61
Presentations: Part 2	49
Site Tour	89

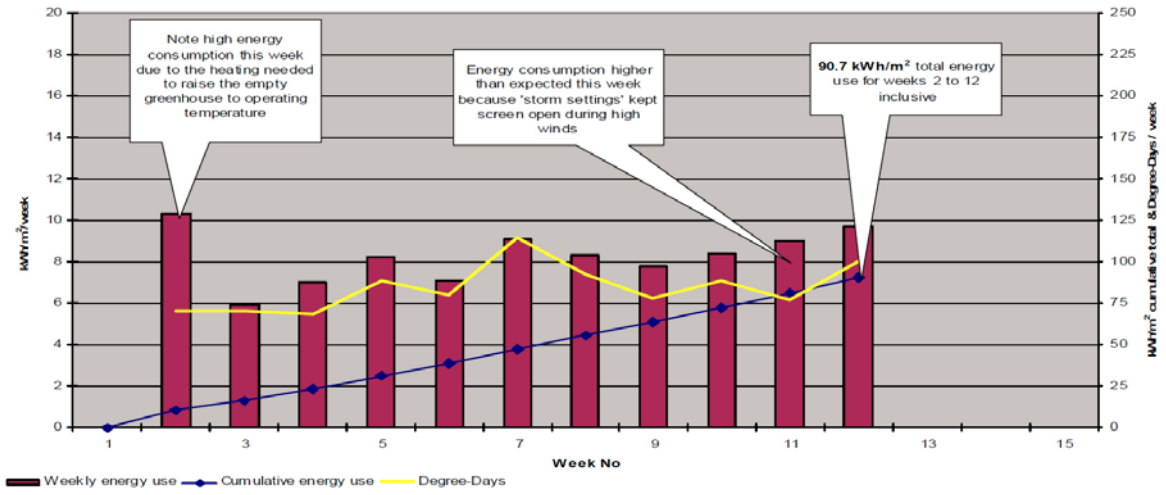
The original programme allowed for four events over the course of the year. As only two events have been delivered, the two additional days will be carried forward to the 2017-18 programme. The intention is to use these days within the Next Generation Growing (NGG) project. The inclusion of the NGG study groups will necessitate a portion of the GrowSave budget to be reallocated.

Energy Benchmarks

GrowSave provides information to allow growers to benchmark the performance of their nurseries against other, similar facilities. However, factors like the wide range of protected crops grown in the UK and the existence of some established industry initiatives like the Tomato Working Party mean that providing energy use benchmarks is not feasible under the current project.

Two of the largest factors affecting the energy use of glasshouses are the prevailing weather conditions (particularly the ambient temperature) and operating temperature. Therefore, if information on these two parameters is used by growers alongside their own energy use data, they can compare their own performance against others.

Throughout the project, the GrowSave website has provided weather data (temperature and solar radiation) and degree-day information so that growers can use this to carry out energy performance benchmarking. An example of the information available and how it can be used is shown below. The webpages showing graphs for Energy Performance Indicators received a total of 201 views during the period 01/08/2016-31/07/2017, while Energy Price Trends received 130 page views.



AHDB Horticulture Energy News and AHDB Grower

Three editions of AHDB Horticulture Energy News have been produced and delivered as inserts within AHDB Grower. The content of each of the editions focused on topical stories and information at the time of publishing. In all cases, the stories were designed to appeal to as wide a cross-section of levy payers as possible.

A short column (500 to 750 words) with topical news on either the GrowSave project or energy related projects has also been included in all six AHDB Grower editions. Topics covered include news on upcoming events, reports of recent meetings, information on the progress of AHDB Horticulture energy projects and general energy developments.

These publications are distributed to a mailing list of around 2500 levy payers.

An example of an Energy News publication is given below. The following table describes the articles and the publications they appeared in.

ENERGY USE IN HORTICULTURE ACCORDING TO CCL DATA

The latest reporting period for the NFU Climate Change Levy (CCL) scheme for horticulture ended in December 2016, with 105 growers making data returns. The majority met their target, making in excess of £4m savings and demonstrating reductions of 43,000 tonnes of CO_2.

The CCL is a tax on energy bills. Under the scheme, eligible businesses can receive some relief on the amount of tax they pay on energy. In order to receive the discount, there is a legal contract committing you to meet energy efficiency targets. The latest reporting period is the industry's demonstration of performance towards those targets. During this period, 75% of companies demonstrated satisfactory achievement against targets set in 2008, with the remainder required to take action to stay in the scheme.

The scheme gives feedback on performance against targets and also against previous reporting periods. The graph, above, shows that the sector as a whole had a 5% reduction in energy consumption related to output compared to 2013/14, despite some increases in protected cropping. The high temperature edible sector demonstrated excellent savings.

CCL will have a bigger impact on business from April 2018, when an increase in the levy will offset the end of the Carbon Reduction Commitment Energy Efficiency Scheme. An increase in CCL means an increase in total energy cost. The current available discount on CCL charges is 90% for electricity and 65% for natural gas, LPG and other qualifying fuels.

It is possible to protect against future increase in CCL by participating in the horticulture scheme. Not only will the savings from the discount increase as the levy rises, the discount rates are also going to increase. The combined effect of these changes is that the value for growers, who currently receive CCL discount, is to virtually double their savings. For example, for the target period 2018/19 the discount will be around £7,000/ha, which will increase to £13,750/ha in the 2019/20 target period.

It is important that any growers, who are able to benefit, are in the scheme so that they continue to make even bigger savings. In fact, any growers who were previously in the scheme may wish to return to ensure they also make savings.

Being part of the scheme is not only an incentive to reduce the amount of CCL paid on energy bills, it also demonstrates a good ethic to suppliers, showing growers have official energy saving targets and are committed to improving the energy sustainability of their business.

The NFU is the trade association responsible for the horticulture, pig and poultry CCL schemes. FEC Energy administers the scheme for the NFU. If you think you might be eligible and would like to know more, contact them on ***024 7669 3043*** or ***ccl@fec-energy.co.uk***.

RENEWABLE HEAT INCENTIVE (RHI) REFORMS

Growers who are interested in the RHI scheme may be aware of the proposed reforms, including the restructuring of the tariffs. Less clear, however, is the timeframe over which these changes will be imposed. The intention is to legally impose the reforms as soon as possible after the general election – the shortest timeframe possible being around eight weeks from the introduction of the legislation to parliament.

When the changes become law, the impact on industry could well be positive. Smaller biomass systems will remain appealing, while biomass systems larger than 1MW will receive a better rate than at present, as the rates will be independent of system size.

Scrutiny over eligible heat use is likely to be more intense, especially concerning the drying of woodchip and waste, but the RHI scheme looks set to continue with the government committed to support until 2020. In the meantime, the existing scheme will continue as is, subject to the usual quarterly tariff reviews.

ENERGY EFFICIENCY AND THE SEVEN 'C'S

Energy efficiency has always been the most cost-effective way of reducing use and saving money, but it's challenging to know where to start. We break the approach down into what we call the seven 'C's. Here are a few simple ideas to help you deal with the issue:

The seven 'C's

1. Control
You can use less energy by controlling better. At the simplest level, this is turning things off when they are not required. Timers, thermostats and motion sensors can give you more automated control. At the more sophisticated end of things, understanding your climate control computer and its settings can help to minimise energy consumption. ***http://www.growsave.co.uk/past-events/basic-climate-control***

2. Containment
Reduce energy losses by 'containment', i.e. not letting energy escape. Insulation is a cheap, unsophisticated and reliable way of reducing heat loss. Similarly, cutting levels of incidental ventilation through sealing and maintenance of glass and vents can prevent heat escaping unnecessarily. Not exciting stuff, but very cost effective. ***http://www.growsave.co.uk/services/energy-saving/greenhouse-structure***

3. Consuming equipment
Old equipment can be considerably less efficient. The energy savings from updating alone could mean new equipment pays for itself in just a few years. Some examples are:

- Older boilers could be operating at <70% efficiency, while a modern equivalent might achieve >90%.
- General lighting by halogen and old-style fluorescent lights can be replaced with LEDs or high-frequency fluorescents, resulting in savings of up to 80%. ***http://www.growsave.co.uk/database/energy-management-in-protected-cropping-horticultural-lighting/maintenance***
- Modern refrigeration equipment can cut costs, as efficiency has improved by over 40% in recent years.

4. Counting
This refers to measuring and monitoring energy usage. In a commercial environment, web-based systems can allow an energy manager to monitor a site in real-time, allowing close evaluation of performance and identification of potentially faulty equipment. ***http://www.growsave.co.uk/managing-energy/monitoring-energy***

5. Cost
Not an efficiency thing, but one of the easiest ways to cut energy bills is to reduce the price you pay. Loyalty to your energy provider seldom guarantees the best prices, so shop around. Consider using a broker to negotiate a better deal on your behalf, but be aware of commission charges. ***http://www.growsave.co.uk/news/category/energy-contracts-and-prices***

6. Care
With all the best equipment and control in the world, waste will still occur if nobody cares. We all have a social and moral responsibility to care about our energy use. Management and staff need to care when and where things are going wrong and take active steps to improve. This can include actively trying to reduce consumption through more efficient practices, regular maintenance and education about how best to improve. ***http://www.growsave.co.uk/database/energy-management-in-protected-cropping-good-housekeeping/monitoring-energy***

7. Create
Take advantage of government funded renewable subsidies and become a self-supplier of heat (Renewable Heat Incentive) and/or electricity (Feed-in Tariff). Examples of how this might benefit growers include:

- Replacing an old oil boiler with a biomass unit for heating a glasshouse.
- Installing solar panels on roofs for electricity generation. What isn't used on-site can potentially be sold back to the grid.
- Generating heat and electricity with a Combined Heat and Power (CHP) unit.

These schemes can help make purchasing 'renewable' technology more economically viable and reduce dependence on fossil fuels and grid supply. ***http://www.growsave.co.uk/services/renewable-energy***

Before buying new equipment, consider how you can use your existing setup more effectively. It could be well worth investing in expert advice (e.g. an on-site energy audit, a feasibility study for a proposed project or an assessment of glasshouse operation), as this could identify additional savings.

Date	AHDB Grower Topic	Energy News Topic
December 2016	CCL discount deadline	• Biomass CHP • Heat Networks • Heat Metering • Uncertain Energy Prices • Next Generation Growing
February 2017	Green Christmas	
March 2017	Opportunities for renewable heating	• Reducing CO_2 • Vertical Farming • Solar Glass • NGG - Humidity Control
April 2017	Best practice irrigation management	
May 2017	Renewable Heat event write-up	
June 2017	NGG Study Groups; LED Lighting	• End of ROCs • CCL Summary • Energy Efficiency • NGG - Radiation Heat Loss
2017-18	• Understanding Humidity • Soft Fruit Tour • Humidity Control workshop write-up	• Grid Support • Grants • NGG Tips

Other Articles

In addition to the AHDB publications, GrowSave has had additional material published, including two articles for The Commercial Greenhouse Grower (March & June 2017), a write-up on the 10th Anniversary of GrowSave, and several articles on hortidaily.com.

Technical Updates

The technical updates summarise information about the latest energy topics and techniques. They provide information about topics ranging from new commercial developments to the latest research results. The following example shows the style and format of a technical update.


grow|save
helping horticulture save energy
TECHNICAL UPDATE
SENSORS
INTRODUCTION
Sensors are the eyes and ears of your control system and fundamental to its operation. Inaccurate measurements, due to faulty or poorly maintained sensors, can result in wasted energy, substandard crop performance and even increased disease so they are very important. In this technical update, we discuss what to watch out for when choosing and looking after sensors in glasshouses.
TEMPERATURE
Temperature is probably the most common condition measured in glasshouses and covers heating systems as well as air and crop temperature measurements. Most conventional sensors these days are electronic, either resistance based or thermistor. Stability and accuracy are good with these sensors, although it's important to occasionally use a second sensor to check for drift. Sensors fail from time to time and, when they do, it's usually quite obvious. In these cases, the control system to which they are attached will normally alarm.
PLANT TEMPERATURE
Infra-red cameras have been used to monitor plant temperature for more than a decade now, but uptake has been slow in the UK. This is because of relatively high costs and the absence of user friendly applications to integrate the produced data into the environmental control system. However, that is changing now, with Priva and Hoogendoorn both offering solutions in which the infra-red camera plays an integral part in control.
Foliage, fruit or flower temperature can indicate when the plant is under stress, or when the dew point is reached, and provides the grower with useful additional information about the environment. The temperature data can also be used to calculate Vapour Pressure Deficit (VPD).
HUMIDITY
Wet and dry humidity sensors
Humidity measurements are derived from the comparison between two identical temperature sensors, one of which is kept dry and the other moistened by distilled water on a sock or wick. The evaporation of water from the wick lowers the temperature, so that the wet bulb thermometer shows a lower temperature than the dry bulb thermometer. The humidity is calculated from the difference between the dry and wet bulb measurements.
Wet and dry bulb humidity measurement is both accurate and reliable, as long as the wet bulb is kept moist with clean distilled water. The most common errors
SENSORS
JUNE 2017

In the period covered by this report text has been prepared for Technical Updates on the following topics;

1. **Conventional & Alternative Sources of CO_2** (released in two parts)

   Evaluation of sources and costs associated with CO_2 enrichment in glasshouses; removing pollutants from self-supply.

2. **Sensors**

   Measurement of climate and plant conditions using sensors and technology to allow improved control of the growing environment.

3. **Cold Storage (still in design; due to be published September 2017)**

   An overview of cold stores and a selection of tips on how to improve operating efficiency.

4. **Assimilation Lighting (still in design; due to be published September 2017)**

   A review of developments in the technology over recent years, including changes in costs and unit efficiency.

These Technical Updates are available via the GrowSave website: http://www.growsave.co.uk/technical-updates.

Financial Benefits

Energy prices have fluctuated over the last 12 months, with a general upward trend meaning consumers are paying more this year than last. With increased energy costs comes an increased desire to reduce energy usage.

Climate Change Levy

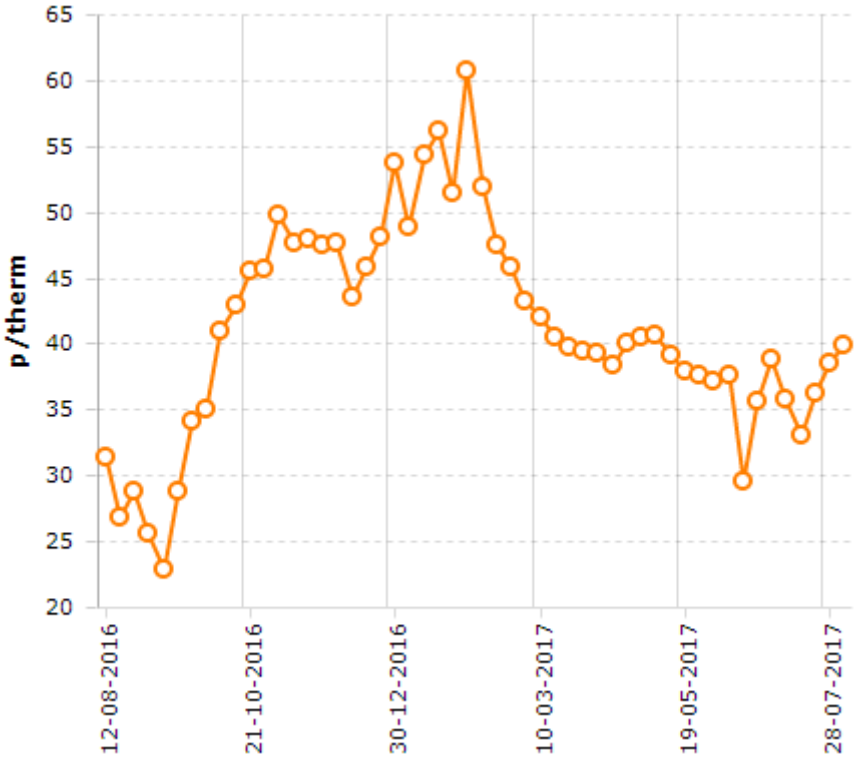
Comparing the latest Climate Change Levy (CCL) data available (from 2015-16) with the previous reporting period (2013-14) shows that there has been approximately a 5% decrease in specific energy consumption across the PC sector. There are currently 130 nurseries signed up to the CCL scheme with an estimated total annual fuel bill in the region of £35million. Energy savings by the PO/PE sector over the last two years are estimated at £2million. Over the same period, the cost of the GrowSave project has been around £150,000, equivalent to just 7% of the estimated savings.

While the direct impact of GrowSave is hard to quantify, it is not unreasonable to think that the project could have contributed to these 130 sites reducing their specific energy consumption. For example, a leading tomato grower, having attended GrowSave seminars and events, went on to install a biomass boiler on one site and a biomass CHP on another, both receiving RHI payments.

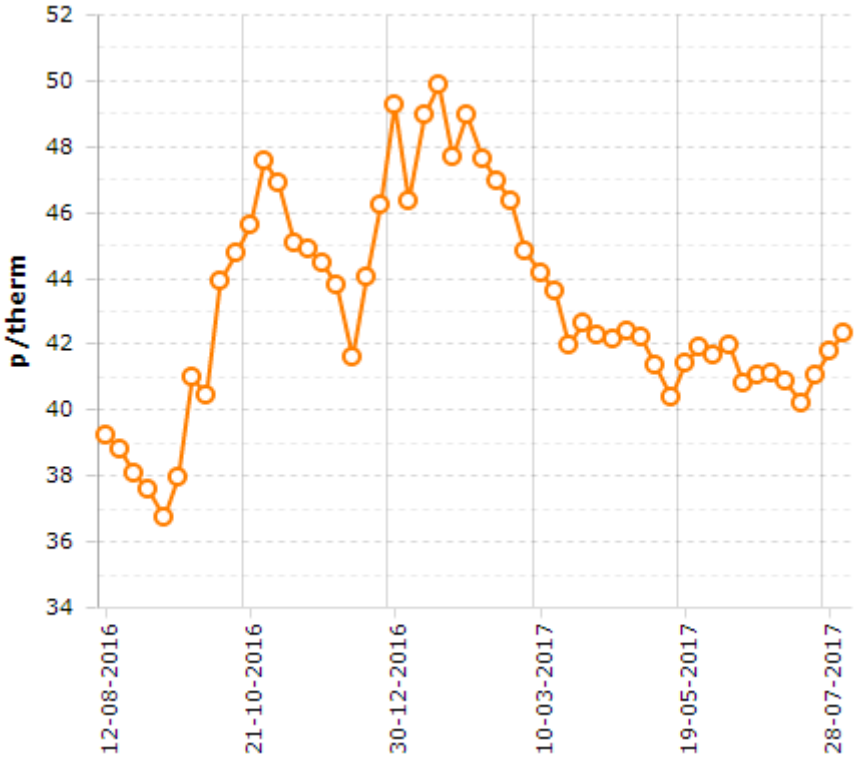
To offset the end of the Carbon Reduction Commitment Energy Efficiency Scheme, the CCL is set to increase in 2019, meaning an increase in total energy costs. However, growers who have signed up to a Climate Change Agreement (CCA) receive a discount on CCL, so their savings will actually increase. By means of an example, the value of CCL discount for a tomato grower with a gas boiler will rise from around £7,000/Ha in 2018-19 to £13,750/Ha 2019-20. This could incentivise growers not currently on the scheme to join, or even re-join. To help growers achieve their energy targets, GrowSave will continue to provide relevant information on energy savings and efficiency.

Price trends for the year (available from: http://www.growsave.co.uk/energy-price-trends)

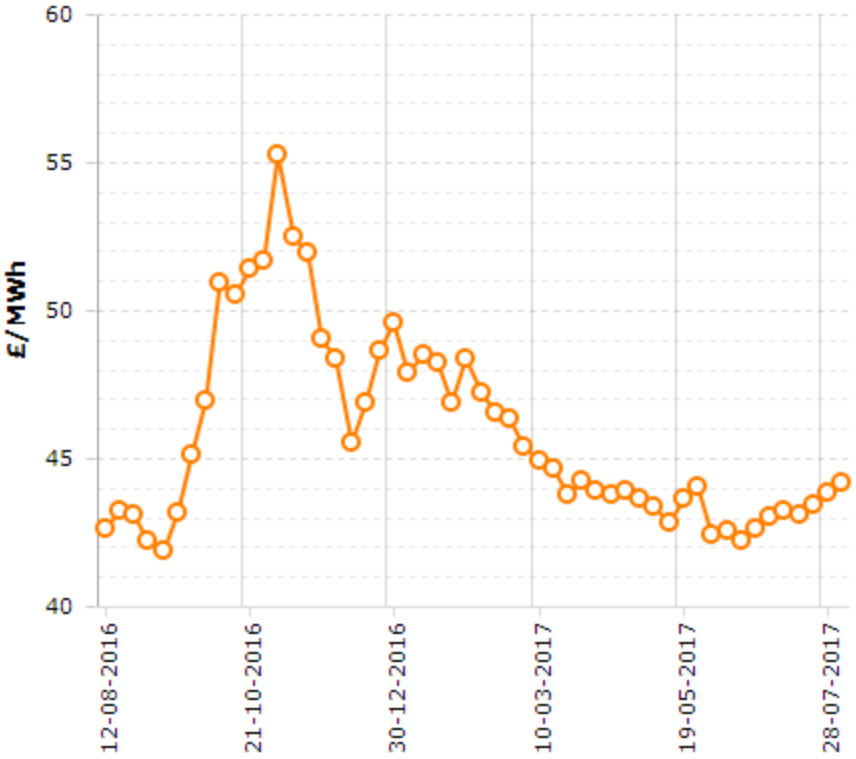
Gas - day ahead



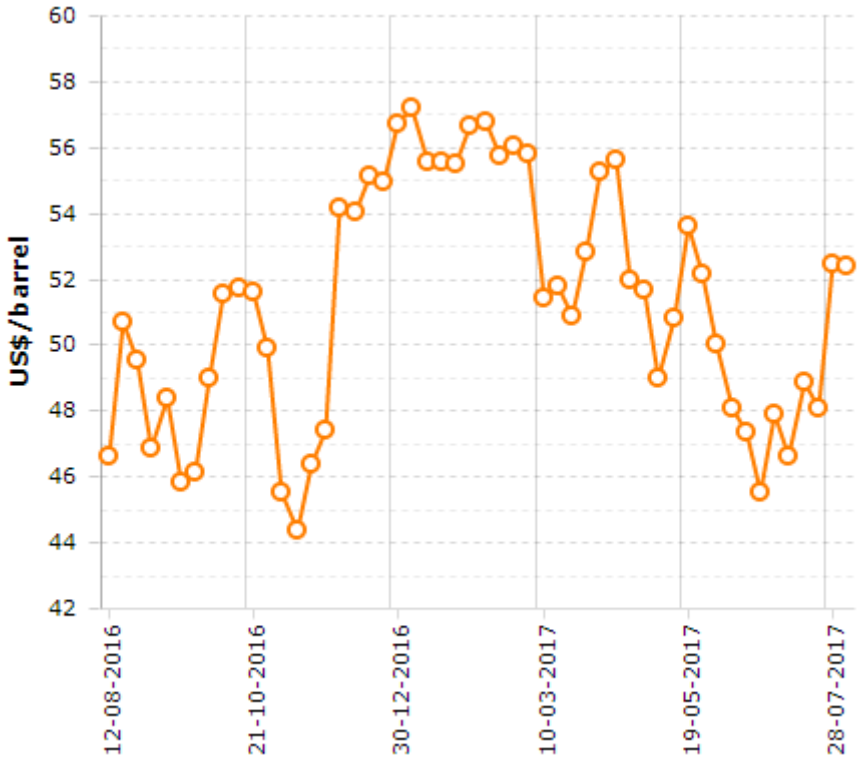
Gas - season ahead



Electricity – year ahead



Oil – Brent crude



Summary & Highlights

1. The GrowSave website has continued to be regularly updated with the latest energy information for growers. The materials from GrowSave events, such as technical meetings, have also been made available via the website. Statistics show that there were 7,709 website visits over the period covered by this report and the most popular topics included LED lighting and the Smart Use of CO_2.
2. A series of seminars and grower meetings have been delivered. These have concentrated on working with growers to identify the best energy efficiency solutions for their business. The main topics covered included biomass heating and the RHI, as well as air movement and NGG techniques.
3. Four Technical Updates have been written, which give information on some of the latest developments in greenhouse energy saving. These feature information on sources of CO_2, sensors, cold storage and assimilation lighting.