Project title:	GrowSave; Energy & Resource Efficiency Knowledge Transfer for the PC Sector
Project number:	PE/PO 011a
Project leaders:	Jonathan Swain & Edward Hardy, FEC Energy
Report:	Year Five, July 2019
Key staff:	Jonathan Swain, Edward Hardy & colleagues, FEC Energy
Location of project:	FEC Energy, Kenilworth, CV8 2LS, commercial nurseries and various meeting venues
Industry Representatives:	James Broekhuizen (PE), Colin Frampton (PO/SF), Roly Holt (PE), Neil Stevenson (PE/PO), Richard Harnden (SF), Salih Hodzhov (SF), Sandy Booth (SF)
Project start date:	1st August 2014
Project end date:	31st July 2019

DISCLAIMER

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

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 …

Report authorised by:

Signature Date …

CONTENTS

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 2018 and July 2019 the project has delivered the following activities:

- Technical presentations at the TGA and BPOA conferences
- Technical seminar on air movement in glasshouses
- Technical seminar on the use of heating and lighting for soft fruit
- Workshop on humidity control in glasshouses
- Seminar on the lessons learned from the Next Generation Growing study groups
- Technical seminar on climate control for soft fruit
- Three editions of the *GrowSave News* newsletter, dedicated to energy topics
- Regular news and updates delivered via *The Grower* magazine and the GrowSave website
- Energy benchmark data via the GrowSave website
- Technical Update publications covering the topics of improving light transmission in glasshouses, air movement, using glass for soft fruit, utilising data for climate optimisation, and irrigation efficiency.

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

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 over 10 years, focused on the PO and PE sectors. In the GrowSave year 2018-19, Soft Fruit was included for the first time as part of the main programme. It is delivered by the FEC Energy team and steered by a group of edible, ornamental and, as of this year, soft fruit growers. The format of outputs and the project programme are deliberately kept flexible, so as 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 fifth year of the project, which ran from 01 August 2018 to 31 July 2019. This is the final year under the current contract.

Summary of Work Completed

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

Activity Area	Contracted Activity	Delivered Activity
Website	Design and publish Soft Fruit specific website to contain relevant content. Provide at least one update per week per website.	Website developed specifically for Soft Fruit content as per contract. News stories added to both websites as per contract. Blogs from FEC Energy specialists added on a regular basis.
Grower workshops / technical seminars	Deliver six workshops / seminars including two specifically for Soft Fruit.	**'Air Movement'** held at W. D. Smith & Son, Wickford on 09/10/18. **'Heating & Lighting for Soft Fruit'** held at Stonebridge Golf Club, Coventry on 19/11/18. **'Basic Humidity Control'** held at Roundstone Nurseries on 23/01/19. **'Advanced Humidity Control'** held at Roundstone Nurseries on 24/01/19. **'Next Generation Growing – Lessons Learned'** held at Mill Nurseries on 14/02/19. **'Climate Control for Soft Fruit'** held at New Forest Fruit on 27/02/19.
Technical presentation at PC Crop Association conferences / meetings	Provide presentations / technical support to three Crop Association conferences / meetings, including one specifically for Soft Fruit.	Presentations were given at two Crop Association events: 1. TGA Conference, 27/09/18. Topics included energy prices, acronyms, renewable energy update. 2. BPOA Technical Conference, 15/01/19. Topics focused on air movement and climate control. 3. Soft Fruit Conference – to be delivered in November 2019
Energy benchmarks	Deliver information and data via the GrowSave website to allow growers to carry out 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.

Activity Area	Contracted Activity	Delivered Activity
GrowSave News	Deliver three editions of the energy specific newsletter	Delivered to contract with three editions completed in December 2018, April 2019 and June 2019.
The Grower news columns	Deliver columns of ~750 words in each edition of AHDB's *The Grower*	Delivered to contract.
Technical updates	Publish five new technical updates, including one specifically for Soft Fruit, covering topics relating to recent energy developments; review and update five for Soft Fruit.	New updates have been written on the following topics: 1. Improving light transmission in glasshouses 2. Air movement 3. Using glass for soft fruit 4. Utilising data for glasshouse climate optimisation 5. Irrigation efficiency (in progress) The following have been reviewed for applicability to Soft Fruit: 1. Screens 2. Modern heat storage 3. Thermal storage 4. Alternative sources of CO_2 5. Conventional sources of CO_2

In addition to the main programme's contracted activities, FEC Energy has also delivered the following, as outlined in the table below.

Activity Area	Additional Contracted Activity	Delivered Activity
Videos	Deliver three short videos on Air Movement, paid for by knowledge transfer budget for Protected Ornamentals.	In progress, at Draft 2 stage
Conferences	Attendance at industry conferences and events beyond contract.	Edible Vine Crop Research Day, 27 February 2019 SmartHort, 06 & 07 March 2019 Mushroom Conference

Activity Area	Additional Contracted Activity	Delivered Activity
Conference	Attendance at industry conference paid for by Protected Ornamentals	Climate Control for Cut Flowers
Social Media	Beyond contract	Regular updates via Twitter

Description of Activities

The activities of the GrowSave project were discussed and planned with the Steering Committees. Meetings were held either in person or via conference call. Regular contact was maintained with industry groups including the TGA, CGA and BPOA. These industry inputs formed the basis of the work programme described here.

Website and Social Media

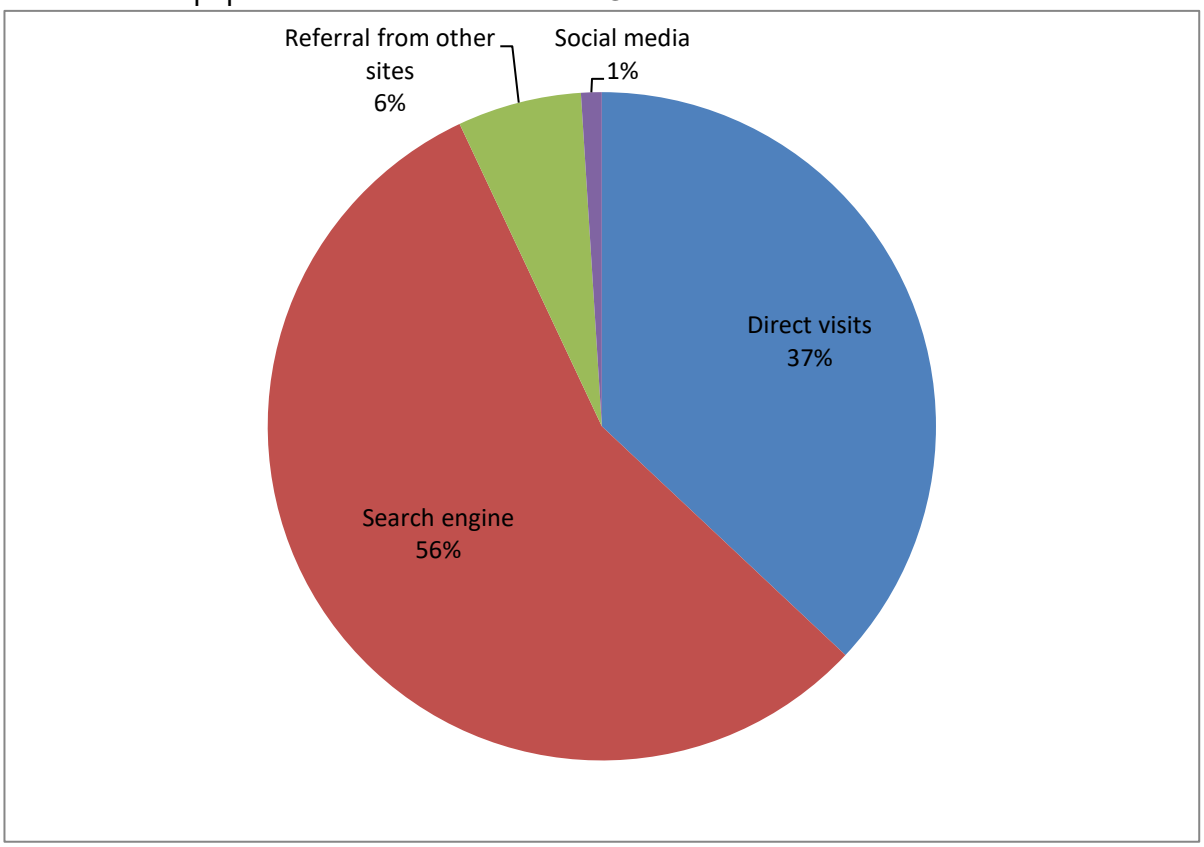
A new website was launched specifically for the Soft Fruit sector, which contains information relevant to the industry. Meanwhile, the original GrowSave website continues to be updated for PE and PO. Both websites have been regularly updated with articles and news items, as well as reports from GrowSave events.

Website metrics have been recorded using Google Analytics. The main website (growsave.co.uk) received 10,349 visits with 19,321 page views between 1st August 2018 and 31st July 2019. New visitors accounted for 8,337 (81%) of these visits. Direct website visits numbered 3,716, while 5,292 were directed via Google.

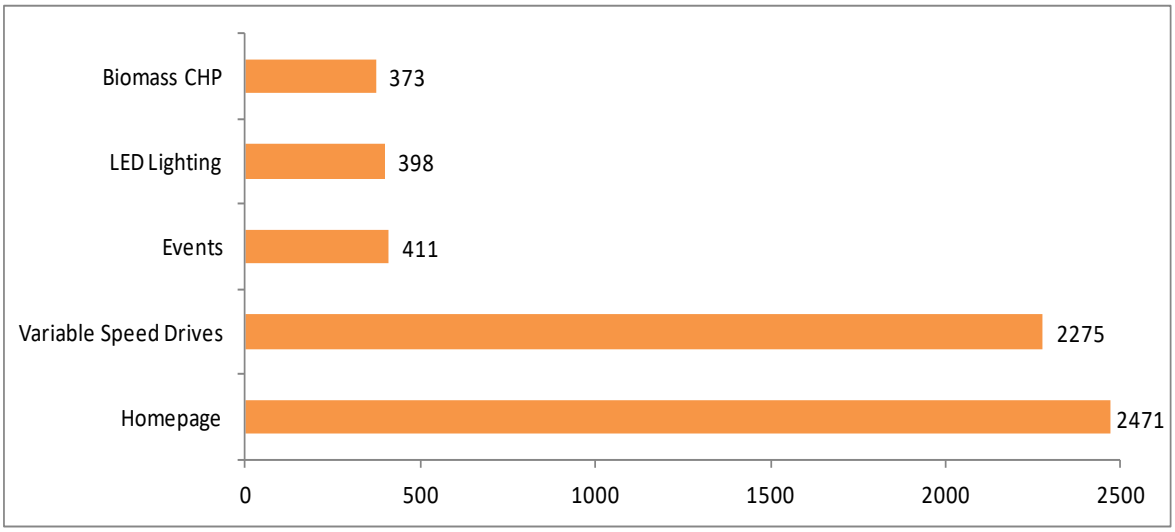
The number of visits to the website has increased by 14% compared to the same period in 2017-2018. Part of this increase is believed to be due to the popularity of GrowSave events this year, as well as work carried out alongside the marketing team at AHDB. Both AHDB and GrowSave marketing channels have been used to notify AHDB members of new Technical Updates, GrowSave News editions and events.

In addition to the website, GrowSave has been reaching growers through articles and press releases on websites, including HortiDaily, Horti Biz and the AHDB website. The number of website sessions resulting from referral links was 6%.

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



The top five most popular webpages were:



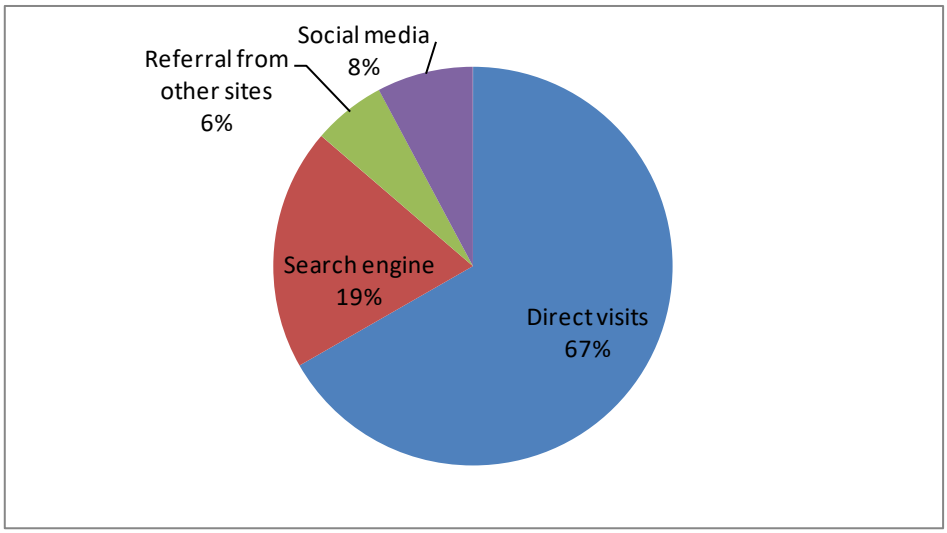
LED Lighting remains a popular topic, once again featuring in the top five most visited pages, as did the Events page, which saw an increase in traffic this year. This is possibly due to the increased number of events throughout the year, which were all well attended.

The most popular page after the Homepage was Variable Speed Drives, which features high up on the Google results page when searching for information on that subject.

The top five pages visited account for less than a third of all the page views, indicating that visitors view a wide range of site content.

The newly developed Soft Fruit website (softfruits.growsave.co.uk) has received 98 visits since its launch earlier this year. There have been a total of 679 page views from 89 new visitors.

A breakdown of the routes of access to the Soft Fruit website is shown below:



The five most popular pages were:

- Homepage
- Knowledge
- Managing Energy
- Climate Control
- Generating Energy

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.

Regular contact with the industry has been maintained through social media. The use of Twitter has helped to promote events and notify followers of new publications. GrowSave currently has 173 followers on Twitter.

Workshops and Seminars

The topics for workshops / seminars were decided based on grower demand and the guidance given by the steering committees. The inclusion of soft fruit into this year's programme meant two dedicated Soft Fruit events in addition to the four events contracted for edible and ornamental crop growers.

The Next Generation Growing study group programme concluded in November 2018 after running for 12 months. The programme focused on Next Generation Growing

(NGG) techniques and made extensive use of the LetsGrow.com online data sharing platform. Within the programme, GrowSave hosted three online training sessions covering the principles of NGG, which were led by a Dutch NGG expert, as well as a wrap-up session concluding what had been learned. Consultancy visits were carried out to the individual growers together with the Dutch expert, who also provided detailed weekly feedback on the data gathered by the online platform. The lessons learned from the study group were fed back to the industry in the form of a half-day seminar.

Details of the GrowSave events, including the background to them and the number of attendees, are given in the following table.

Workshop / Seminar Title	Details	No. of Participants
NGG Study Group Date: November 2017 – November 2018	The aim of the study group was to introduce Next Generation Growing (NGG) techniques, pioneered by growers in the Netherlands, to UK growers. The programme revolved heavily around the LetsGrow.com online platform, where growers were encouraged to share their climate data. Weekly feedback was provided by a Dutch NGG consultant. Visits to the individual growers were carried out in February and June. Online training sessions were held in March, April and July 2017, and a wrap-up session in November 2018.	**Total: 6** 5 growers 1 crop consultant
Air Movement Location: W. D. Smith & Son, Wickford Date: 9th October 2018	This event focused on how to achieve good air movement in a glasshouse. Presentation of the theory was given by Dutch industry expert Peter van Weel, who also led visual demonstrations of different fan setups using a smoke machine. The trials considered air movement using horizontal fans as well as a Nivolator (horticulture specific vertical fan) within the ground level ornamentals crop. The trials were filmed for future use.	**Total: 17**
Heating & Lighting for Soft Fruit Location: Stonebridge Golf Club, Coventry Date: 19th November 2018	GrowSave's first soft fruit specific workshop focused on the technical and financial viability of providing supplementary heat and light to a soft fruit crop. Consideration was given primarily to glasshouse crops.	**Total: 32**
Basic & Advanced Humidity Control Location: Roundstone Nurseries, Chichester Date: 23rd & 24th January 2019	A two-day workshop focusing on the basics of humidity control on day one and more advanced methods on day two. The popularity of the event run in January 2018 meant there was still significant demand for this topic. It was decided to break down the content across two days to cater for a wider audience, with some cross-over required to ensure all attendees started at the same level.	**Day 1: 16 (fully booked)** **Day 2: 16 (fully booked)**
Next Generation Growing – Lessons Learned Location: Mill Nurseries Date: 14th February 2019	Following the conclusion of the NGG study group, the outcomes and lessons learned were fed back to the wider industry through this half-day seminar. Presentations were given by GrowSave and Dutch NGG expert, Mark van der Werf, who was instrumental to the study group's success.	**Total: 26**

Soft Fruit Climate Control Location: New Forest Fruit, Brockenhurst Date: 27th February 2019	The event focused on optimising climate control strategies in glasshouses for soft fruit. Consideration was given to air movement, humidity control and CO_2 supplementation.	**Total: 22**

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, 27 September 2018**. Tim Pratt 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 Technical Conference, 15 January 2019.** Jon Swain presented the topics of air movement and climate control, focusing on how to identify problems and the best solutions.

GrowSave also had a presence at a number of other industry conferences. These were the Edible Vine Crop Research Day, the Mushroom Conference and AHDB's SmartHort conference.

Energy Benchmarks

GrowSave continues to provide information to allow growers to benchmark the performance of their nurseries against other similar facilities. However, factors such as the wide range of protected crops grown in the UK and the existence of some established industry initiatives, such as 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 the information on these two parameters is used by growers alongside their energy use data, they can compare their 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. The webpages showing graphs for Energy Performance Indicators received a total of 231 views during the period 01/08/2018-31/07/2019, while Energy Price Trends received 82 page views.

GrowSave News and The Grower

Three editions of GrowSave News have been produced and delivered as inserts within AHDB's *The 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 1000 words) with topical news on either the GrowSave project or energy related projects has also been included in all six editions of the bi-monthly publication of The Grower. 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 3300 people affiliated and port of horticultural business' payers. The following table describes the articles and the publications they appeared in.

Date	AHDB Grower Topic	GrowSave News Topic
Aug – Sep 2018	The Circular Economy	
Oct – Nov 2018	Climate Settings	
Dec 2018 – Jan 2019	Humidity Control	• New facilities opened at STC • Medium Combustion Plant Directive • Capacity market suspended • Energy market update • Updated factsheets
Feb – Mar 2019	Air Movement	
Apr – May 2019	Vertical Farming	• £30m grant fund announced • Summary of workshops • Streamlined Energy and Carbon Reporting scheme • Energy market update
Jun – Jul 2019	Soft Fruit	• New energy efficiency support schemes proposed • Six tips for energy efficiency • CCL results • Energy market update

Other Articles

In addition to the AHDB publications, GrowSave has been featured in an article for The Commercial Greenhouse Grower (June 2019) 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. In the period covered by this report, text has been prepared for Technical Updates on the following topics:

1. **Air Movement**

   The importance of air movement for an optimum glasshouse climate and how to achieve it.

2. **Improving Light Transmission**

Methods of improving light transmission in glasshouses.

3. **Using Glass for Soft Fruit**

   Converting and designing glasshouses for soft fruit.

4. **Utilising Data for Glasshouse Climate Optimisation**

   How to effectively use sensors and data to control climate for optimum performance.

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

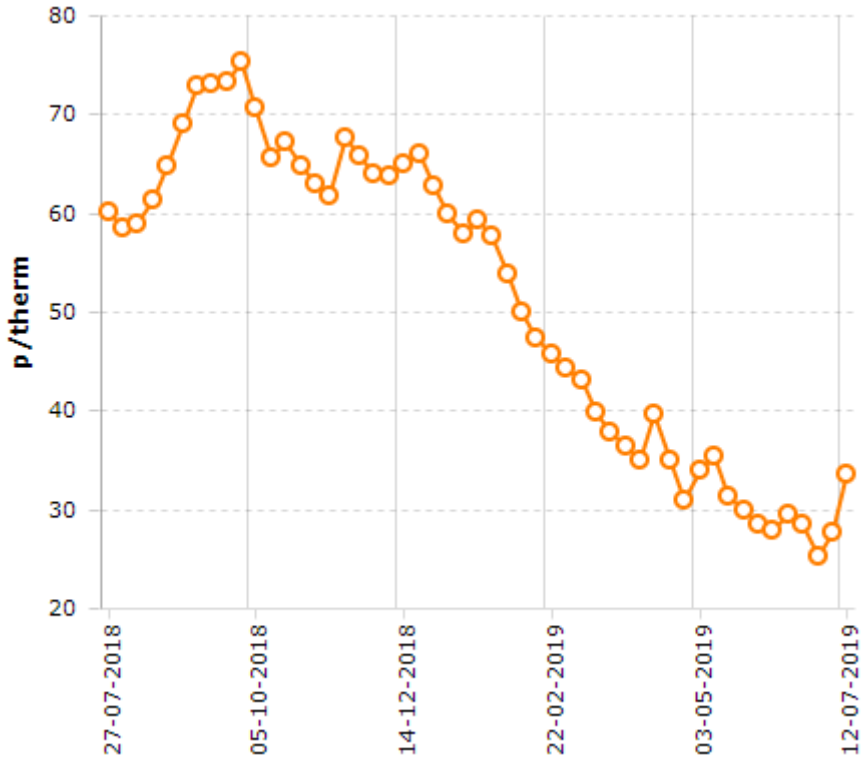
5. **Irrigation/pumping Efficiency**

   This technical update is in progress and seeks to inform growers about how to manage the electrical efficiency of pumping irrigation and heating water around a nursery. Wit consideration of control techniques, efficiency of primary umping equipment, maintenance and variable speed drives.

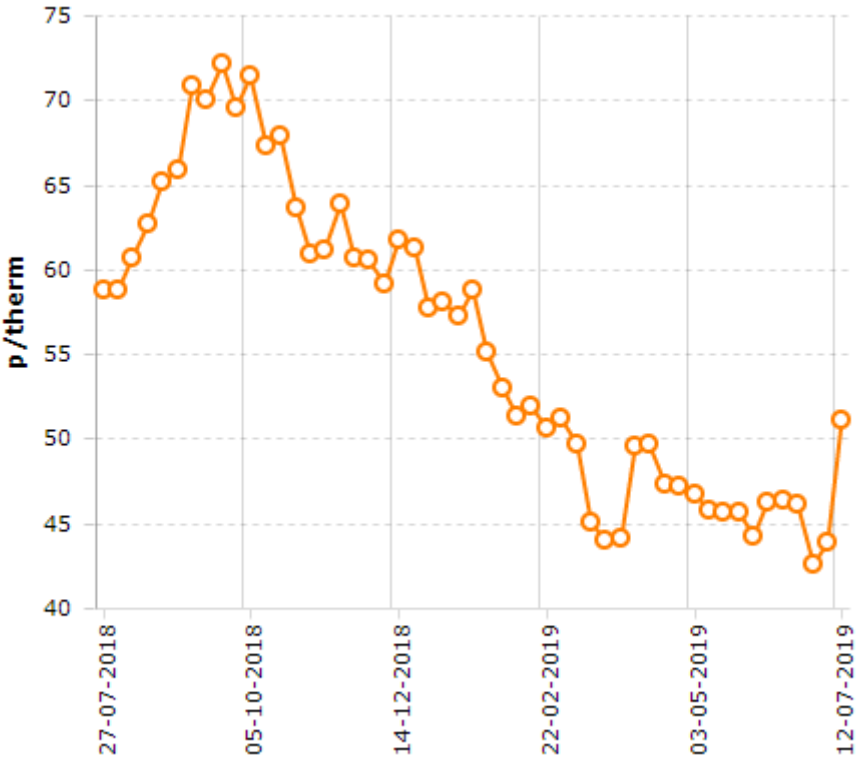
Financial Benefits

Over the last 12 months, wholesale energy prices have seen a general downward trend, following an initial spike in prices during the autumn of 2018. At the time of writing, prices are below where they were 12 months ago meaning some users have been paying less this year than last. Up-to-date energy prices can be found at http://www.growsave.co.uk/energy-price-trends.

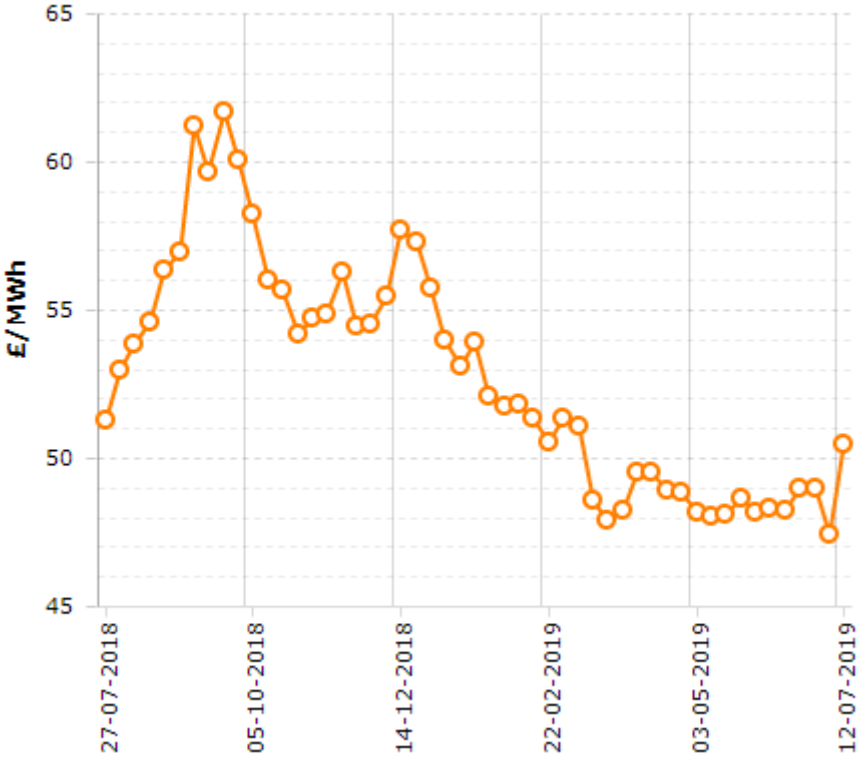
Gas – day ahead



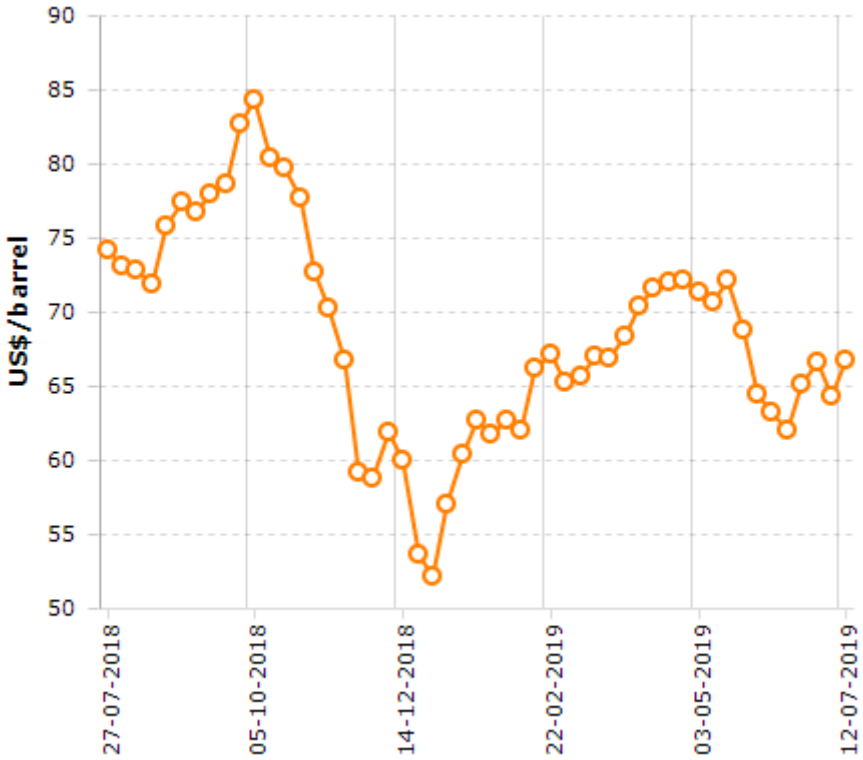
Gas – season ahead



Electricity – year ahead



Oil – Brent crude



Despite reduced wholesale energy costs, some users will see an increase in their energy costs, as those on fixed price contracts will not benefit immediately from reductions in the transient wholesale market. In addition, the impact of non-commodity costs (transmission charges, green taxes etc.) means that the actual cost of electricity is less than half of the unit rate. Therefore, opportunities exist in flexible purchasing of electricity and benefit can be had by installing generation equipment. Anecdotally, both have been topics of interest in this GrowSave year. Additionally, growers can continue to save money through increased energy efficiency and reduced energy usage.

Sector Impact

The financial impact the GrowSave programme has on UK Horticulture is not easily quantified. One useful metric, however, is Climate Change Levy (CCL) data. The three Target Periods have coincided well with the last five years of the GrowSave programme and can help to gauge impact.

Considering CCL data at the end of 2018, there were 126 glasshouse sites in the scheme. Excluding mushroom facilities, this drops to 111 horticultural sites, which reported in all three Target Periods. These sites represent 88% of those in the data, but only 77% of the glasshouse area, as some large sites have been excluded.

The following table summarises the energy use reported in each TP and how the Specific Energy Consumption (SEC) – i.e. the energy use per unit area – has varied over the years. The total energy use in each case is for the two-year period.

Target Period	Total energy use (GWh)	Cropped area (hectare years)	Energy use per unit area (kWh/m² p.a.)	Average energy use per site (MWh p.a.)	Average cropped area each year (m²/yr)
TP1: 2013 & 2014	2,306	695	332	10,608	31,977
TP2: 2015 & 2016	2,512	733	343	11,316	33,021
TP3: 2017 & 2018	2,538	751	338	11,434	33,822

As can be seen from the data, the total energy used by the sector has increased by around 10% over the three Target Periods. However, the cropped area has also increased, meaning SEC has remained relatively stable. The aim of the CCL scheme is to incentivise improved energy efficiency, which can be measured as kWh/m^2 or kWh/kg of produce. While there appears to have been a small increase in energy per unit area across the sector since 2013, this does not reflect any increase in produce. With many growers now using lighting, or extending the growing season through the winter, for example, it is possible that crop output has risen at a greater rate than energy usage.

It is also important to consider where the energy has come from, with many growers now using renewable technologies to provide heat and electricity. The availability of government incentive schemes, such as the Renewable Heat Incentive and Feed-in Tariff, has meant energy has been ‘cost-neutral’ to a large number of self-producers.

Of the 111 sites considered, 32 are making use of renewables: 10 producing electricity only (e.g. solar and wind), 13 heat only, and nine producing both electricity and heat. This gives 22 sites using renewable heat. These sites are most affected under CCL rules, which assume a higher calorific value of biomass than is actually the case, potentially resulting in higher energy usage figures being reported than in reality.

It may also be the case that many growers producing their own heat are, in fact, using more energy than before. However, many businesses have found themselves financially better off as a result, due to both incentives and increased crop yields.

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 10,349 website visits over the period covered by this report and the most popular topics included LED lighting and variable speed drives.
2. A bespoke soft fruit website was designed and launched.
3. A series of workshops and grower meetings has been delivered. These have concentrated on working with growers on identifying issues and how to rectify them with energy efficient solutions. In particular, the main topics covered focused on glasshouse climate control through air movement and humidity control.
4. Two specific soft fruit skills and knowledge workshops were held.
5. Four Technical Updates have been written and one is to be completed, which give information on how to optimise the glasshouse climate, featuring

the topics of air movement, light transmission and the use of sensors and data.

6. With the addition of soft fruit one Technical Update has been written specifically for this sector on how to design a glasshouse, while five existing Technical Updates were targeted specifically at Soft Fruit.
7. Other contracted and non-contracted activities have taken place to cement GrowSave's reputation as the go-to place for horticultural energy saving.