Energy saving from the coast

Adnams' new Huppmann brewhouse and a truly green warehouse

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Suffolk-based brewer Adnams beat fifteen other finalists to become the overall winner of the *Carbon Trust/Daily Telegraph Innovation Awards 2007*. The Carbon Trust is a private company set up by the UK government in response to the threat of climate change. It works with both the business and public sectors to create practical business-focused solutions and accelerate industry's transition to a low carbon economy.

By **Roger Putman**

To showcase the best in UK low carbon innovation, the Awards recognise bodies that are pioneering innovative technologies and new ideas that help reduce carbon emissions. Adnams was chosen for embracing energy efficiency across its operations, from the building of a low-carbon distribution centre to the development of energy-efficient brewing processes. Adnams, which has an ultimate carbon neutral policy, has further reduced its carbon footprint by creating a new beer bottle – the lightest on the market.

Driving the final four miles into Southwold from the busy A12 you spot a hill which is a slightly different green compared to the others, then an access road with Adnams' signage and you have passed the new distribution centre without realising it is even there. Hidden from the road, the 85 acres site drops away into the base of an old gravel working. Just over 4 acres has been built on and the remainder is grazed scrubland incorporating some new hedging to encourage bird life, lagoons and reed beds to cope with the site effluent and even a bank of sand to provide a summer escarpment home with a sea view for a colony of sand martins. An electricity supply line leaps from hummock to hummock across the site indicating just how much of the land had been claimed for road aggregate over the last 30 years.

There are two buildings; a 1.5 acre warehouse and a smaller one with similar contours and construction shared by cellar services and vehicle maintenance. The energy-saving buildings cost some 15% more than a conventional build but looking at life-time costs, it is going to save a fortune as energy costs escalate and regulations on using too much of it become more irksome. The first 2.1 metres are conventional enough – Leicestershire bricks which provide strength and protection against the inevitable crunches in a busy vehicle yard. Then there is hemp and lime blockwork covered with a lime mortar render and clay-based paint on the outside. The blocks of conventional size incorporate quarry waste, lime and hemp, the latter having excellent mechanical, insulation and even anti-rodent properties. Adnams even invested £20,000 at the block-makers to ensure their technology was up to industrial scale production. Between the two skins is a sprayed mix of lime and more hemp. Being uncompacted, the U-value improves even more. The whole wall which is

Adnams new Huppmann brewhouse showing the copper on the right connected to the vapour heat recovery cylinder on the left.

45mm thick has a U-value of 0.18 against the standard regulatory requirement of 0.35. It also provides excellent sound insulation but of course there are no neighbours. Adnams calculate the wall itself has captured some 150 tonnes of CO_2 whereas traditional building materials would have added 600 tonnes to the atmosphere. The only slight drawback is the brickies having to learn new skills as the blocks are more brittle when handling.

Glulam and golpla

The revolution continues above the eaves. The roof is made of single span curves of laminated and glued Swedish softwood (glulam). At their deepest point they approach two metres thick and are 25cm wide. The main warehouse is spanned by 16 of them. The beams were picked up from Harwich docks and they travelled two at a time with their 48m length giving some transportation problems on the way. The beams have to be supported on steel columns but the roof elements require 24 times less energy than equivalent steelwork to produce and lock up even more CO_2. The arches are self insulating and provide a 35m-wide unencumbered warehouse space below. Thin galvanised corrugated sheet is then covered with sedum, a low-maintenance, low-growing green plant which contributes to even lower U-value and greatly enhances eco-credibility with Britain's biggest green roof.

Head Brewer Mike Powell Evans, obviously pleased with his new pre-run vessel and lauter tun.

After almost 12 months, its insulating properties are undiminished but wind-blown grass seeds have taken root and the whole thing is in need of a bit of a mow! Water run-off is collected for vehicle washing, toilet flushing and lastly to water the roof if it flags during a dry spell.

Two solar panels on the roof which cannot have been more than

Down at the new warehouse

A long shot with cellar services and vehicle workshops on the left and the huge span of the main warehouse on the right.

Inside the warehouse showing the headroom, as yet unused auxiliary heating and the huge 2-metre high Glulam support beams.

The loading bay for the local delivery fleet. Note the large bore pipes to collect rain water from the roof.

The remodelled brewery frontage. The top metre of wall is new as is the dormer windowed roof. The inset shows a considerable improvement in the appearance of the corner to Victoria Street.

3m^2 provide 80% of the centre's hot water requirement. Daylight ingress is via a clerestory and roof lights. Movement sensors are installed throughout the complex so that lights go out if an area is not being used. So far auxiliary heating and cooling machines lie unused. This is helped by a cunning air lock arrangement. Trunker vehicles drive into separate loading and unloading areas at each end. After a spell to dissipate any vehicle fumes, the doors close and forklift trucks can run into the warehouse area without any temperature-upsetting draughts coming in from the outside. Cask beer straight off the rack arrives at below 10°C and acts as a 'cold sink' to keep the air cool and cool down any deliveries which have had to travel further during warm weather. All beer is despatched at cellar temperature. The 13 dray docks down one of the long sides of the warehouse are designed so that the vehicle bed and the dock surface are flush to limit manual handling. Picking errors are minimised by pre-assembling each load in the large area between the warehouse and loading dock. As this warehouse is so much larger than the one vacated back in Southwold as it has a large office attached, direct comparisons are difficult but Adnams reckon that the new design per square metre saves 55% of electricity and 30% of gas consumed equating to some £50,000 saving at 2006 energy prices.

At the south facing and naturally warmer end of the building on the first floor are the offices – protected from the fierce Southwold sun (joke!) by overhanging eaves and a *brise soleil* above the windows. This arrangement shades the window when the sun is high in the sky but allows its radiation to help heating in the winter when the sun is lower. The office staff have natural ventilation – they can open the windows!

Outside, the use of concrete is minimised by covering the car park with golpla, which is a recycled plastic matrix which supports the growth of grass while allowing hard standing for vehicles. The foul effluent runs to a buried septic tank which weirs over into a series of sunken lagoons leading to a reed bed disposal system to the local stream.

Every little helps

The new warehouse has eliminated some 80 van and lorry movements in Southwold each day as well as 60-odd employees cars which would previously have jostled for road space and parking spots in the popular seaside town. Other green successes involve simple things like being the only customer currently who recycles its hop pellet boxes back to Morris Hanbury. Using a

The gently arched roof showing the sedum and some ferrule grasses as well as a small set of solar panels to heat the hot water.

Detail of the low growing sedum roof covering.

Many of the office staff previously housed in the town have moved to this space-age open-plan facility which stretches across the entire southern end of the warehouse building.

local waste-contractor who sorts the rubbish and recycles where he can rather than sending the lot to expensive landfill. Adding the trub back to the lauter tun grains rather than disposing of it with the yeast and thus enhancing the yeast value in the co-product market as a pig feed. Head Brewer Mike Powell Evans is proud to have cornered two-thirds of the UK crop of new aphid-resistant hop Boadicea which obviously needs less insecticide to grow. In order to keep up to date with the latest green thinking, the brewery also has the services of Simon Davey on a year's industrial secondment from the University of East Anglia Environmental Science department and boy will he have a lot to write up in his thesis! Another big contributor for which Adnams won a recent Starpack Award is the light weighting of the 500ml bottles from 455g to only 299g, the lowest weight ale bottle on the UK market. O-I were planning to move production from Alloa to Harlow where a NNPB (narrow neck press and blow) process was in operation which allows the molten glass to flow more readily in the mould and can be spread more thinly. In the quest for a lower weight, the chunky ADNAMS on the bottom which required an incised groove to find the bottle front for label justification has been replaced with 'beer from the coast' which does not need specific label placing so there is no glass weakening groove. Early designs came in just over 300g but further work got it just below that magic figure. "If this becomes an industry standard, remember where you saw it first," said Mike. The glass light weighting on just about 10,000 barrels a year is equivalent to all the carbon contributed by the entire brewery staff going to and from work and all the mileage clocked up by the sales team. Every little helps and all this will come in very handy when the UK government and the Carbon Trust work out the rules for labelling every package with its carbon footprint.

Perhaps we should point out a slightly less green change at this point – the horse deliveries of beer to drops in Southwold town are no more and the animals have been pensioned off. The horses could not trudge in from the new warehouse each day anyway and they took four days to do just a dozen deliveries; a 18 tonner does the lot in one go every Wednesday morning. A little bit of history has gone but the carbon conscious brewery were thinking of the extra fuel being consumed as the drays snarled up the traffic!

Huppmann brewhouse

While the warehouse and new bottle await more plaudits, another exciting project is being commissioned in downtown Southwold at the brewery – for the Head Brewer has a new Huppmann brewhouse to play with. We last met Mike in the August 2001 issue of *The Brewer International* when he commissioned the first phase of his new FV block situated over the road from the brewhouse in the old bottling stores. There were nine vessels then, today there are 19: 1 × 90, 2 × 170 and 16 × 250brls. All vessels are by Briggs and each can turn down to 50% volume by using only the bottom set of cooling panels so the smaller vessels are useful for short volumes of seasonal specials and yeast propagation brews. Anyway, 250s would not fit in the chisel end of the old building! Since our last visit he had changed over to hop pellets and the increasing volume of new vessel space allowed him to strip out two 150 brl squares, 6 × 90brl rounds, four smaller 45brl squares and the three ancient sausage-shaped copper fermenters. I was pleased to hear that these latter have not been scrapped but await installation as features in Adnams' rapidly-expanding chain of upmarket Cellar and Kitchen shops which have spread as far as Stamford over 100 miles away. Powell Evans mused that they would make fantastic small meeting rooms redolent of the old London porter brewers who had larger and larger banquets in their vats.

While the warehouse was being planned, the brewery came under scrutiny as well. Powell Evans told the Board he could not guarantee continuity of beer supplies long term. His plant was wearing out. There were terminal cracks in some of the old copper and once you start repairing them, Mike observed that you will forever have to chase them as they advance further. So wort was leaking inexorably into the copper insulation and the old cast iron mash tun was on its last legs as well. Extracts were 90% on a good day and hop utilisation was 24% with pellets and even lower on bottling brews at higher collection gravities. Even though Adnams had put only 14 brews through the new plant by the time of my visit, the extracts were 98% and the hop utilisation had climbed to 34%. An impressive improvement.

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Lauter tun

The lauter tun-based brewhouse gives a degree of future-proofing if there is a decrease in malt quality; forward contracts for Maris Otter are protecting supplies at the moment but who can guess whether even the land will be available for classic but lower-yielding malting barleys in the future? Currently, manning levels to the end of fermentation are eight and this will drop to three once the new plant is fully commissioned. Demanning is always traumatic in a small brewery and Adnams have given well over a year's notice and temporaries have been brought in to cover early leavers and operators who do not want to retire early are going on paid-for retraining courses.

As well as being far better insulated than the old plant which ensures temperature optima are maintained, the Huppmann vapour condenser allows energy consumption to be a full 50% lower. Adnams used to evaporate 10% out of a 165-barrel copper now they will strip 6% out of 200 brls and the copper vapour condensation saves a further 44%. Water consumption will remain about the same as extract is recovered from a thinner mash (3.5litres per kg against 2.5 in the old plant) with similar sparge levels (3.2 litres) although cleaning moves from manual to CIP. Adnams are already on an enviable 3.3 litres per litre but, of course, site packaging involves only cask beer. Bottles are filled at Marstons as is the embryo keg brand Spindrift (a pale 5%ABV beer with a pleasant 28BU and 1.8 vols of CO_2) and Cains do the canning. These packages total less than 10% of output.

The vacated old fermenting room was the site for the new plant. John Bowler of PES assisted with a tightly specified tender document which went to three major suppliers. Adnams were impressed by Huppmann's professional approach to the document while their competitors were suggesting more of an off-the-shelf construction. The space within the building is extremely tight for four vessels and thank heavens for CAD to route the mains efficiently in the area below the working platforms – the way they are crammed in below the lauter has to be seen to be believed! Adnams were also impressed by the Kitzingen firm's range of skills with qualified brewers doing the design and commissioning. The 24-hour phone helpline for IT, mechanical or brewing problems really did work –"I really enjoyed working with them," said Mike. In the end the cost difference was a 'small country pub.' Adnams must know a supply of most economically priced pubs as that equated to just £300,000! So the brewhouse cost £2.3million with a further £1m set aside for enabling work in making the building ready

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Huppmann brewhouse – the low-down

Materials are exactly the same as before. Pale malt comes from three existing 35 tonne silos while speciality malts are tipped from sacks into 500kg working bins. Caramel in an ISO transitanks within a warmed room is piped via a meter to the copper. Hops, copper finings and brewing salts for the copper are weighed and put into the four 'hop pots' and are collected at the appropriate time with a hot wort flush. Malt is transferred to a hopper above the Millstar steep conditioning mill at around 5 tonne per hour. Once milling and mashing starts, the grist will disappear at 16 tonne per hour. Water at 60°C is fed in above the mill feeder roller to condition the husk. A single set of rollers currently set with a gap of 0.3mm then crush the corns before mash water is sprayed in to reach the desired mashing heat. The energy load on the rollers is feed back to the feed roller which will throttle back if the grains are not pliable enough to grind. An FBP (effing big pump!) transfers the mash to the waiting jacketed and stirred conversion vessel. There is a 90 minute stand in this 260hl working volume vessel before the temperature is raised to 76°C for transfer to the lauter tun.

The lauter tun is 5.2m in diameter (21 square metres) so the typical 5000kg mash lies at 235kg/m^2. Huppmann's MLM lauter run off control will rake faster and then drop into the bed in response to bed differential pressure readings. After an initial recirculation of two minutes, the run off takes 110 minutes to a 500hl prerun vessel which contains the entire produce. Once the

The heat exchanger used to elevate the wort temperature to almost boiling on its way from prerun tank to the copper.

The hopper above the Millstar mill is on the left with the mash conversion vessel in the right foreground. The lauter tun is beside the steps.

and moving the services.

The deal was signed in autumn 2005 and work started on the building. Cellars below were made ready for concrete piles while the walls were raised in height by about a metre. The opportunity was also taken to tidy up the Victoria Street corner of the site and introduce a small full-height window on to the outside world. The roof space has dormer windows and will eventually be furnished as offices. The control room would sit on the brewing floor and once all the old kit is finally redundant, it will be stripped out and a laboratory installed the other side so that production and lab teams can multiskill.

Improved the façade

This rebuilding in a conservation area necessitated a road closure which could not be contemplated after July 2006 when the tourist season moved into full swing. The completed building has improved the façade at the front of the brewery and once the new darker bricks have weathered a little you will not guess that some of the brickwork dates from 2006.

With the new warehouse opened in August 2006, the old warehouse near the brewery became a base for Huppmann operations and the kit started to be delivered from early September. All mechanical connections were made by January this year. February saw the electrics and control systems (BrewMaxx) connected. March was water and pressure testing and degreasing and the first mash took place on 16th March. Engineer Bob Lee was in charge with Powell Evans being more involved with the specification and then the product matching. As it takes a week to taste the results of any tweaking, the programme is proceeding carefully but Powell Evans was pleased that the very first brew was 'within the target area'. He was also pleased that a sulphidic note often detectable in young beer which required careful conditioning out before putting the cask on sale had gone. There is no sacrificial copper in the new set-up – only the *Reinheitsgebot*-busting lauter tun rake feet which drip a few atoms of zinc, manganese and copper into the passing wort. The first mash was a step temperature and as soon as the Germans appreciated the qualities of fully modified Maris Otter, they returned to a single infusion at 65°C. FAN levels are slightly lower, probably because the mash temperature no longer drifts down during the stand. The copper vapour is fully condensed but Adnams do not use the Huppmann 'dynamic low pressure boil' to control volatiles for a generous amount of hops added 20 minutes before the end of the boil needs to have its aroma locked in. So the first 40 minutes of the boil directs

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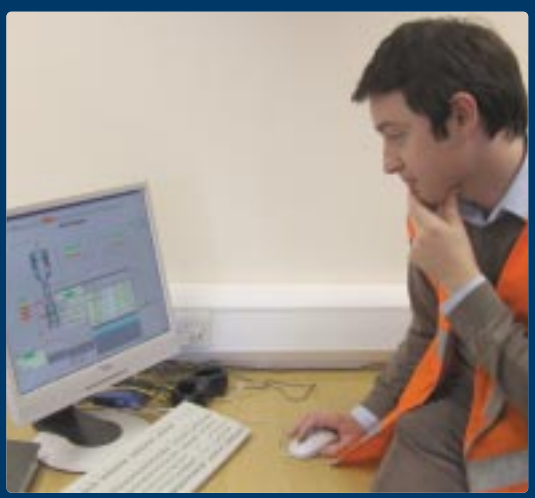
copper/whirlpool is empty, the wort at around 73°C is passed via a heat exchanger and heated to 96°C using water recovered from the shell and tube copper vapour recovery cylinder which sits on the copper hearth in front of the two vessels. The 660hl energy tank containing the hot water at up to 98°C sits in the yard alongside a similar tank of chilled water for wort cooling.

An external heater raises the wort to boiling and it enters the copper tangentially and/or through the spreader above the wort surface. The heat exchanger on the way to the copper saves time and a lower duty on the boiling surfaces will allow a clean every 20 brews which in Adnams' case means once a week. After 60 minutes boil and all the additions in, it only takes four minutes to get the whirlpool swirl and the wort then settles for 15 minutes before run off starts from the topmost of three run off points in the lower side and base of the sloping bottomed 460hl vessel. Wort cooling commences at 150hl/hr to allow the yeast to be injected and is then ramped up to 500 hl per hour until close to the end of the run when it is throttled back again to protect the integrity of the trub cone. The cone is then recovered and pumped back on to the lauter grains for discharge into a hopper on the ground floor which takes the entire lauter tun charge and then blows it to one of two new spent grain tanks. You need two these days as FEMAS rules dictate they should be in place cleaned.

Wort cooling is via a two stage cooler. The first section works on incoming town water. The second stage uses a chilled liquor store at 12°C, the bulk being chilled overnight using cheap rate electricity. By controlling the flow of both water sources, Adnams can ensure that a consistent volume of hot water is recovered from the system during the hottest summer and chilliest winter.

Pipefitters heaven. Beneath the lauter tun shwing the rakes gear box, inlet mains and run off pipes, all eased elegantly into a very tight space.



Brewer Fergus Fitzgerald ponders some of the BrewMaxx software mimic displays.

Adnams receives a prestigious environmental award – BBC's Sarah Montague with Jonathan Adnams (centre) and Tom Delay CEO of the Carbon Trust at the Award ceremony.

most of the wort from the external calandria on to the copper spreader and then a proportion of the flow is redirected to below the level in the copper so that there is less flash off. The condensate is available to underlet the lauter which must give a rather pleasant smell!

Future work

Future work involves burtonising the brewing liquor at point of use rather than adding salts to the hot liquor tank. This move will allow the hot water to be used to flush process mains before use without the risk of scaling. $CaCl_2$ will be added to the mash mixer and sparge flow while $MgSO_4$ is added to one of the 'hop pots' to be picked up by the circulating copper wort. Sulphuric acid will still be added to the incoming town water to remove bicarbonate. The other job involves some slow starts to fermentation and cold side aeration where Powell Evans reckons the equipment does not give small enough bubbles and the oxygen meter was reading 13.7ppm (on air!) which I am told was defying the laws of the universe!

He was confident for the future but refused to tell me the planned date to turn off the old plant and go 100% for fear of getting the inevitable 'this beer's come from that new fangled German kit and it ain't a patch on the old stuff' comments if the date was in the public domain. I was quite chuffed that he thought *The Brewer & Distiller International* might have such an influence in this rural corner of East Anglia!

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At three brews a day over 16 hours, the old brewery capability was 112,000 barrels. The new side will output 140,000 in the same time and the inclusion of a second boiler could allow a three-hourly brewing cycle rather than four and produce four brews daily or 185,000 barrels. Plenty of room for expansion then, although Adnams, who style themselves as a wholesale brewer with a few pubs (about 80 of them), is finding the current cask beer market very tough. Only 7% of output goes through the pubs and the company is finding the cask market very competitive – especially where free houses are lured into taking a firkin from PBD-subsidised hobbyists – sorry, local micro brewers; so longer term suppliers lose a firkin but still have the same costs in maintaining the account. Lobbying continues in the UK to set duty rate reductions for smaller producers at the same rate as the economies of scale afforded to larger ones so that the price into the market place is similar and not £20–£30 lower! Adnams have done a serious amount of research into the brands and who drinks them. The working man now drinks Fosters and Carling so 'Beer from the Coast' is targeting the 'thinking and discerning' customer in the ABC1 bracket. We can expect to see new products to explore gaps in the current portfolio. Being the most easterly brewery in the land must be played on as a selling point for if it isn't, Adnams would have cheaper distribution if it moved to the intersection of the A1 and A14 some 97 miles away!

The brewery stays in Southwold for reasons of cost – the building is already there, quality (matching is a lot easier by expanding an existing plant than starting afresh in a new one) but most of all – provenance, Adnams is Southwold as it has been since 1872. ■

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