



ABOVE: Deb and Dan Carey in their Brewhall. The copper shrouds cover a four vessel Steinecker brew plant.

RIGHT: The business end of the Brewhall. ShakesBeer in foreground,

The brewery the Careys built

New Glarus moves



New Glarus
Brewing
Company

New Glarus,
Wisconsin
USA, 53574

T: +1 608 527 5850
www.newglarusbrewing.com

There is a Louis Pasteur quotation painted on the wall of our original Brewhall reading: “Let me tell you the secret that has led me to my goal: my strength lies solely in my tenacity”. It has a special meaning to me and my wife Deb. We have had a tough journey to say the least, but this year we are on track to sell over 90,000hl – all of it in Wisconsin. This is the story of our new \$21 million brewery.

By **Daniel Carey**

I met Deb, in 1983 while I was Brewmaster at a microbrewery in Montana. Deb operated a small graphics business and was hired to market our beers. We married and have raised two daughters. Our path eventually lead to Anheuser Busch where I worked as a Brewing Supervisor. Deb dreamed of returning home to Wisconsin and she encouraged me to leave the ‘grind of corporate life’ to build our own destiny. Although scared to death, I quit A-B in 1993. We moved to Wisconsin, wrote a business plan, raised capital and started our own little brewery. We didn’t have much: \$40,000 in seed money generated by remodelling and reselling a few

homes. With luck and hard work Deb raised the balance of the required funds through a bank loan and stock offering. She is a true entrepreneur – one of those rare individuals that can find opportunities others might miss.

Together we went about building our company. Deb runs the ‘business end’ dealing with bankers, lawyers, wholesalers, and tax men ... you know, the fun stuff. I just brew the beer.

Our goal has always been simple. Hire good people. Pay them well. Never compromise on quality. Stay involved in day-to-day operations. Only sell beer ‘around the smoke stack’. We are unique in our market. I know of no other brewer that makes such a diverse portfolio of brands out of one brewery. We



The new hilltop brewery overlooks the small village of New Glarus.



The administration wing and Visitor Centre were designed by Deb Carey.

produce upwards of twenty brands per year – many of them rotating specialty beers. We brew light American-style lagers and bitter microbrewery-style pale ales, German-style *hefeweiss* and bock beers, English-style stouts and bitters, Belgian-style sour browns, our own unique style of intense fruit beers and many more.

In 1994, our first full year of production, we sold 2,700hl. We have won numerous awards including at least one medal every year at the Great American Beer Festival since 1996 as well as winning 'Brewery of the Year' three times. We even won a few at the Brewing Industry International Awards. (*Dan is being too modest, he has won six medals including two Championship Speciality Trophies for his Wisconsin Red cherry beer. Ed.*)

Later as a judge, I have fond memories of drinking fresh cask ale in Burton on Trent! Recently, a local cheese-maker won 'Best Cheese in the World' at the World Cheese Awards in Dublin for a cheese made with our Raspberry Tart Ale!

We never imagined we would ever sell over 10,000 hl but, year after year, our business grew. Our brewery was in a constant state of uncomfortable expansion. By 2005 we had reached the tipping point – selling 46,000 hl with no more room for development. On a fateful day in August, 2005 Deb said, "I'm projecting sales of 65,000 hl in 2006 and 76,000 hl in 2007. Can you brew that much beer?" Contract brewing was never considered; Deb always

said, "Why would you let somebody else raise your children?" So I naively replied, "Let's build a new brewery!"

Designing the brewery

We started the design phase in late 2005. We imagined a plant capable of producing 120,000 hl per annum yet easily expandable to 300,000 hl. In February, 2006 we awarded the contract to Krones for most of the equipment with the help of Handtmann GmbH of Biberach, Germany for cellar piping and Gresser GmbH of Regensburg, Germany for cellar vessels.

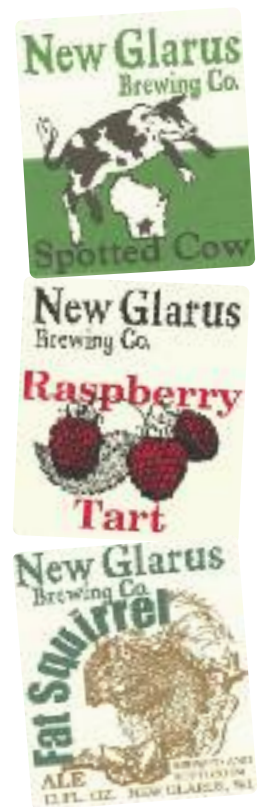
We do no advertising but 'spread the word' during daily brewery tours. Customers can drop by, watch the brewing process and speak with our brewers. In this age of consumer skepticism this sends a powerful message. So, the new brewery not only had to be state-of-the art, it had to be 'tourist friendly' and beautiful – not a 'beer factory'. It needed to fit into the green, rolling farm country of Wisconsin. Of course, this all

costs money!

We could have built more economically in an industrial park but decided on a beautiful undeveloped 15-hectare hilltop site overlooking the village of New Glarus. I found inspiration in a few German breweries including Ayinger and the hilltop plants of Andechs and Weihenstephan. We spent most of 2006 in the design phase. Deb raised all the capital by herself.

The beauty of copper

Fritz Maytag of Anchor Brewery once said, "I would like to think that a brewhouse has to be beautiful and I don't want to find out that you can do it with a brewhouse that was not." The four Krones brewhouse vessels we purchased were stainless steel – sleek and modern. I wanted our brewhall to have a traditional feel so I travelled to Germany and met up with Erwin Hueimmer, a well-known second-hand brewery equipment broker. You may remember his father's entertaining adverts in *Brauwelt*. We visited many shuttered



Installation at New Glarus



LEFT: Threading the needle with a copper hood. Note the calandria peeking out of the floor.

RIGHT: Gently placing the conical conditioning tanks.

BELOW LEFT: CCVs secured into place waiting for the barn structure to be built.

BELOW RIGHT: This is our fermentation and finishing cellar – Home of our “Spotted Cow” Ale. Small dairy farms dot the Wisconsin landscape making the Red Barn an important part of the Wisconsin experience.



“Southern Wisconsin is known for its milk and cheese factories so we easily found skilled staff. We hired both union and non-union contractors. They levelled the site, constructed the buildings, moved in equipment, installed five kilometres of stainless piping and 15 kilometres of electrical cable.”

German breweries looking for just the right copper hoods to cover our four stainless vessels. I doubt there is any American brewer that has tasted more small-town Bavarian bier nor eaten more local bratwurst than me! Finally we found two beautiful 1960s vintage Huppmann copper brewhouses – one in Aldingen and the other in Leimen. We removed and shipped four copper hoods to Krones’ Steinecker plant in Freising to cover the modern vessels.

Building the brewery

Our plan was to build a 7,000m² brewery including the waste water treatment plant, administrative offices, laboratories and gift shop. The site was an undeveloped corn field so we had to pipe up all of the utilities including electricity, natural gas, water and the sewer from the village about one kilometre away.

We broke ground at the end of 2006 and spent a year building our dream brewery. Deb and I were on the site every day which was fundamental to our success. I am sure that saved us a great deal of

money. I left our original Riverside Brewery, two kilometres away, in the capable hands of my Assistant Brewmaster, Jean Hengstl. Deb designed the building and directed the construction. I set about directing equipment installation and piping. I brought our best Maintenance Technician, Perry Whitaker, from the Riverside Brewery with me. Krones supplied a Project Manager, Herwig Losbichler, from Austria. He poured his heart and soul into this project. I have never worked with a more knowledgeable brewery construction manager. We could not have finished the brewery without Perry and Herwig.

Southern Wisconsin is known for its milk and cheese factories so we easily found skilled staff. We hired both union and non-union contractors. They levelled the site, constructed the buildings, moved in equipment, installed five kilometres of stainless piping and 15 kilometres of electrical cable. We had BBQ cookouts and gave each tradesman a take-home six-pack of beer every Friday. Thanks to the fine planning

of our Krones Engineering Team and the efforts of our workers, construction moved quickly. After the brewery was completed, we celebrated with all of the contractors and their families in our new hilltop beer garden. We were sad to see them leave but gained many friends.

On November 15, 2007 – the same day our first granddaughter was born – we brewed our first batch. Two years and three months from ‘idea to mash-in’! Those of you that have survived a green-field brewery start-up know that twenty-plus-hour days are the norm! To my surprise, we achieved flavour match on the first batch. In fact, our taste panel prefers the beer from the new brewery – it is smoother and more drinkable.

The brewing equipment

Because we brew so many different beer types the brewery is extremely flexible.

Control System

The brewing process is controlled by a Krones BOTEC software package. Computers run under the Windows



XP operating scheme using a graphic system.

Malt Receiving and Storage

Bulk malt is received via pneumatic trucks. Two 50-ton and two 25-ton silos give a three week storage capacity. Specialty malts are received in 1000kg supersacks and 25kg bags.

Water Treatment

City Water is treated with a sodium ion exchanger for general plant usage. A 140m-deep well on brewery property supplies the water for brewing. Iron is removed from this well water by aeration followed by sand filtration which lowers the iron content from 0.3 ppm to 0.02

ppm. Then the brewing water is acidified with lactic acid to drop alkalinity from 280 ppm to 60 ppm (as CaCO₃).

Brewhouse

The brewhouse is capable of producing six brews per day and with the addition of a prerin receiver, 11 brews/day. One brew yields 120 hl cold wort. A 2.5 t/h Künzel malt handling system feeds a hopper above the mill and consists of a destoner, horizontal sieve cleaner, automatic hopper scale, permanent pipe magnet, mechanical conveying system and aspirator. The five-tonne per hour 'Variomill' steep conditioning mill gently prepares the malt for bottom



entry into the mash tun and insures efficient lautering. The roller gap on this two roll mill can be adjusted automatically for different malt types.

A 'ShakesBeer' mash conversion vessel is used mainly for upward infusion mashing. But decoction mashing is deployed for Bavarian style weiss and dark beers. For decoctions the lauter tun serves as the mash holding vessel. A 'Pegasus' lauter tun clocks a residence time of less than 130 minute for brews of 1062° (15.5°P).

The 'Stromboli' boiling system was chosen for its low energy attributes. Hop pellets and three hop dosing pots feed the kettle. A typical sequence is 24 minute boil, followed by a 12 minute pause and then a final 24 minute boil yielding 6% evaporation. Steam flow to the calandria is automatically monitored and controlled to insure consistent evaporation. Steam pressure is 2 bar g so twenty-four brews can be made

OPEN FERMENTERS.

FAR LEFT: Open fermentation is not common in the US but makes for a very smooth beer.

LEFT: The business end of the open fermenters. Tanks by Gresser and pipe fence by Handtmann.



PACKAGING AT NEW GLARUS.

FAR LEFT: The Krones 18,000 bph bottling line. We use the standard American 355 ml long neck bottles.

LEFT: Filling kegs on our KHS Till Transomat 5/1.

*BEER PROCESSING
AT NGB.*

*RIGHT: We do not filter
our beer using an Alfa-
Laval BRPX 714
centrifuge instead.*



*ABOVE: A two-speed
flash pasteuriser
supplied by Nerb of
Attaching, Bavaria*

*RIGHT: Single use
cellar CIP system
supplied by Handtmann
of Germany.*



between CIP runs. We have noted a significant improvement in hop utilisation, smoothness of beer flavour and quality of beer foam compared with our older brewery.

Energy conservation was an important consideration in the brewery design. Therefore a vapour condenser and condensate cooler is included with the Stromboli. The condensate cooler heats process water from 15°C to 82°C while a vapour condenser heats further to 96°C. This hot water is sufficient for all cleaning and keg filling needs. A prerin vessel, energy storage tank and lauter wort heater will be installed once production justifies.

A whirlpool is used for wort clarification. Trub is discharged and stored in a dedicated tank before being pumped to the lauter tun after completion of lautering and on to the

spent grain silo. Residual extract can be recovered from the trub by transferring to the lauter tun during sparge. Wort is cooled in a two stage wort cooler by means of 15°C water followed by 3°C chilled water. Ales are cooled to 20°C and lagers to 8°C. Cooling time is 50 minutes.

Yeast Propagation and Storage

Two 45 hl tanks are used for yeast propagation and storage. Propagation procedures are flexible – a ‘dual tank system’ or ‘single tank system’ can be used. One vessel is

glycol cooled only while the second is steam heated as well as glycol cooled so that wort can be sterilised if desired.

Cellar Tanks

There are twelve cylindroconical tanks supplied by Gresser of Regensburg in Germany – two at 240 hl, eight at 480 hl, and two at 720 hl - all with an additional 40% head space for ale fermentation. Cellar residence for ales is two to three weeks and, for lagers, three to six weeks depending on brand. A

single use CIP system, supplied by Handtmann, is used for all cellar cleaning. Two 240 hl open top fermenter are used for beers that benefit from manual skimming and top cropping. I prefer brewing in open top fermenters so I use these tanks as much as possible! Pipe fences are hard piped with swing bend technology supplied by Handtmann GmbH which is very flexible.

This piping system allows for a 'single tank' or 'two tank' fermentation process. Krausen transfers are possible. The cellar is set up for semi-automatic operation which, in my opinion, is the most rational choice for a brewery of this size. Brewers 'set a path' by moving bend swings to the correct position and opening hand valves as needed. Swing bends are protected by proximity switches and strategic air operated butterfly valves and variable speed pumps are controlled by BOTECH so that the entire process is fully automated after that point.

Finished beer treatment

Our customers prefer beer with a natural haze of 150 EBC so we do not utilise a traditional filtration process. Instead we use an Alfa-Laval BRPX 714 centrifuge as our only clarification step. We palletise kegs of our hazy beers upside down which necessitates flipping at the pub to insure a uniform haze at tapping. We also use this centrifuge to produce clear beers with < 0.6 EBC when fresh. In this case, at least one week of lagering at -2°C is required as well as PVPP and silica gel stabilisation (dosed at CCV outlet and removed at centrifuge). It is more difficult to produce a beer with stable haze than it is to produce a clear beer!

The beer is then flash pasteurized using a two-speed Nerb pasteuriser before priming sugar and yeast dosing. Many of our beers are bottle conditioned. We feel fermentation in the bottle helps with flavour stability as well as adding unique and desirable complexity to ales. We have a 12hl dextrose solution mixing tank which is steam-heated so that the sugar solution can be held at 80°C. Dosing of sugar is controlled by a mass flow meter. Freshly propagated yeast is also dosed inline to achieve 0.2 to 4 million yeast cells/ml depending on the brand.

Some of our beers are brewed at high gravity (1062° – 15.5°P) and

dilution is controlled by an Anton Paar mPDS 2000 v3 Evaluation Unit. Then beers that are not bottle-conditioned are fully carbonated in our CCV either by the 'bunging' or 'krausening'. An inline carbonator built by Krones and controlled by an Orbisphere Model 3610 CO₂ analyser is used for final adjustment of carbonation.

Three ASME-certified bright beer tanks, rated to 1.5 bar, are used – two 750 hl tanks from Gresser (their first ASME Certified Vessels) and one 250 hl tank from JV Northwest of Oregon, USA. One of the 750hl tanks has a pumped recirculation loop to avoid stratification when making our bottle-conditioned brands. Packaging involves a second-hand Krones bottling line filling 18,000 bottles per hour and a KHS Till Transomat 5/1 rated at 65 kegs per hour

Utilities

On the utilities side;

- 6,000kg/hr Cleaver-Brooks natural gas boiler
- Two 60-ton Vilter ammonia refrigeration units cooling a 300hl reservoir of 30% propylene glycol solution
- Two 50hp Quincy rotary screw air compressors and Domnick Hunter refrigeration drier supply air to a 60 hl reservoir.

Thinking about flooring coverings

The first place I look when I enter any brewery is the floor. The choice of flooring in a brewery is critical. A failed floor is not only unattractive and difficult to repair, it is a perennial source of contamination. It is always best to choose wisely. For most of our production area we opted for a flooring system by Kagetec of Gronau, Germany, using Argelith ceramic tiles. The floor has proven to be not only rugged but beautiful. It was installed by Kagetec using its 'AR System' where fully vitrified tiles were laid in epoxy directly onto a prepared power-floated concrete slab. The ceramic tiles are completely encased in epoxy resin. The specialised installation method and the small hexagonal shape ensures an optimised slope situation with an absolute smooth and hygienic floor finish.

In the Packaging Hall we chose a seamless flooring system from Industrial Protective Coatings of De

Pere, Wisconsin. This floor is ¼" urethane. In previous projects we found that urethane floors stain when exposed to acid. Therefore a top coat of an acrylic urethane was included to resist staining and fading.

Waste water treatment

The village of New Glarus has a population of 2,100 people. Our new brewery would have overwhelmed the public waste-water plant and the surcharge penalties would have been severe. Therefore we opted to build our own facility. The project objectives were to construct a system that was easy to operate, simple to maintain and be expandable to handle future brewery production increases. It should be aesthetically pleasing, economical to operate, provide consistent high-quality effluent while eliminating land application of the brewery's high strength wastewater.

The system features primary and secondary treatment. Primary treatment consists of flow equalisation, screening and dissolved air flotation clarification for removal of particulates. Secondary treatment is accomplished with activated sludge with membrane clarification (ASMC); an aerobic suspended-growth biological process to remove soluble biodegradable organic matter coupled with submerged hollow-fibre micro-filtration membrane clarification to remove suspended solids prior to discharge to the village treatment works. The entire system is controlled and monitored with a programmable logic controller and data-logging industrial computer.

The submerged membranes replace the passive settling clarifier in a conventional activated sludge process. This filtration process is not adversely affected by filamentous bacteria and consistently produces high quality effluent by providing a positive barrier to suspended solids. Since the ASMC system allows more bugs per unit volume, a much smaller footprint is required than a conventional activated sludge system allowing the entire ASMC system to fit in a 52ft x 52ft (250m²) area.

The wastewater treatment system consistently achieves BOD and TSS reductions of well over 95% or more. The effluent averages 6.2 mg/l BOD and 10.3 mg/l TSS. The whole plant was then hidden behind another Wisconsin red barn. ■

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