



CASE 109

Clustering Beer, Energy and Food

Executive Summary:

Beer brewing is a worldwide trade, yet the amount of waste produced through the industry is staggering. Only 8% of starch is used and the other 92% of the spent grain, which offers fibers and proteins, is mostly left unused. To produce one litre of beer requires up to 10 litres of water and the CO₂ emissions further deepen the plight for a zero emissions industry. This case shares the options at our disposal to use the available biomass and generate power and nutrition, thereby increasing environmental performance at a lower cost, with higher financial returns and productivity. The purpose is to re-use the elements from the production process. Yeast makes an excellent health supplement, water can be re-used, CO₂ can be captured and the fibres and proteins from spent grains make an ideal animal feed or can be combined with flour to make health bread. In some places around the world, beer brewing is a part of the culture and tradition which makes it more of a challenge to implement change or to introduce alternative ingredients. Buckwheat is a versatile plant that grows fast and at high altitudes, especially in the Himalayas, but has almost met its demise with the introduction of cheaper ingredients such as rice. The Blue Economy approach wishes to provide quality while building culture, tradition and biodiversity as demonstrated in Bhutan.

Keywords: waste, spent grain, water, CO₂, lower cost, financial returns, higher productivity, change, fermentation process, re-use, yeast, zero emissions, health supplement, animal feed, brewing beer, bread, buckwheat, environmental performance, capital investments

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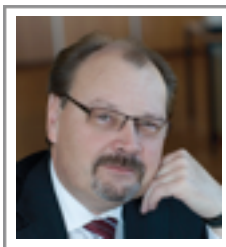
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Photographs: The ZERI Network



Beer Brewing as a Priority of Zero Emissions

Back in 1981, my first business was a trading company that imported amongst others Belgian beer to Japan. Belgians are proud to produce some of the best beers around the world and I was happy to promote the creation of a market in Japan, as many others did. It was obvious that when I returned to Japan 13 years later to develop the concept of Zero Emissions, beer should be included as a priority sector. I was very well aware of the challenges that brewing beer implied: for each litre of beer, at least 10 litres of water are needed. Spent grain was a more impacting one. In the process of brewing beer, starch (8%) is extracted from the grains, and the fibers and protein (92%) are considered waste that is at best picked up by some cattle farmers as animal feed. In addition, the production of beer generates CO₂ which is natural, but no factory recovered it. As I set out in 1994 to determine the priority sectors for the application of the concept of Zero Emissions in preparation for the Kyoto Protocol in 1997, beer was firmly shortlisted as a priority target.

I was quickly confronted with two products on the market. On one hand, there is the purity principle (or *Reinheitsgebot*) which has been strictly applied by the German beer brewers since 1516, the oldest production provision still enforced today with the aim to protect the consumer. This nearly 500-year-old ordinance prescribes that beer is made from barley, hops, water and (wild) yeast, and nothing else. While this method has been celebrated as the way to make beer, the search for higher levels of productivity, lower costs and faster financial returns opened the way for non-Germans to change the ingredients (rice instead of barley as is the case for the famous Budweiser from the USA), and to search for ways to speed up the fermentation process. Traditional beer brewing requires 21 days of fermentation. If this fermentation process could be shortened to one day, it would release capital investments, improve cash flow and offer stronger returns. While I was in my original search to learn about pending innovations in beer brewing, I had a special session with Prof. Erkki Leppävuori, the CEO of VTT the large Finnish Technical Research Institute. He told me that the time for a romantic view of beer in the German style is over. VTT research had improved the fermentation process of beer with genetically engineered enzymes which limit the retention time in the tanks to only 17 hours. I wondered if this was the best way to improve the overall performance of beer or if this was only aiming to cut expenses, even at the cost of tradition and taste.



Erkki Leppävuori



Yuriko Kawaguchi



Yuzo Seto



Sun Hongli



Li Wenhua



Wang Rusong



Higher Value from Available Resources

While I pursued my fact-finding mission in 1994, this information urged me to search for productivity and additional revenues while I desired to preserve the tradition of beer brewing. Instead of embracing innovations that cut costs, I was keen on finding avenues to generate more income with these readily available resources. This is the core principle of The Blue Economy. It was this particular Finnish experience that motivated me to search for higher value from available resources, while remaining truthful to tradition. My arguments were straightforward: we can re-use the 92% of the spent grain (factor 12), we can re-use water (factor 10), we can capture the CO₂ and we can re-use the yeast. Inspired by the work of Prof. Dr. Ernst Ulrich von Weizsäcker, who published the Report to the Club of Rome "Factor 4: Doubling Wealth, Halving Resource Use"¹ and later "Factor 5: Transforming the Economy through 80% Improvements in Resource Productivity", and based on discussions with Dr. Friedrich (Bio) Schmidt-Bleek who created the Factor 10 Institute, I concluded that we could improve resource efficiency of beer with factor 10.

This implies that we have at least 4 additional revenue streams that would allow this tradition to be preserved, while ensuring an improvement in competitiveness and a production of more products. One of the first people to encourage me to take this route was Mrs. Yoriko Kawaguchi, a former top official at the Japanese Ministry of International Trade and Industry and the one responsible for environmental management at Suntory (one of the four leading beer brewers of Japan) at the time. The discussions with Suntory did not go unnoticed, especially with Asahi Beer which had very successfully launched their super dry beer; it has a slightly higher alcohol content (5% instead of 4.5%) and a lower sugar content, reducing bitterness in the process. Mr. Yuzo Seto, the CEO was very keen to differentiate the company and he committed to be a zero emissions company by the end of the century, after only one brief meeting.

Transforming Spent Yeast for Health Benefits

I was encouraged by these bold statements of top Japanese enterprises, but realized that my proposal to have zero waste and zero emissions set a simple yet very clear target. I did have a few follow-up discussions with Asahi in my early days at the UNU, especially with their Chiba Chinese Herb Medicine Laboratory, which was later renamed as Asahi Food & Healthcare, where a decision was made to start transforming all spent yeast into health supplements. It was remarkable that a beer brewer had a medicine laboratory but the findings around beer yeast as a medicine were based on the fact that it contains chromium which decreases blood glucose and helps the body use insulin

¹ Ernst von Weizacker, Amory B. Lovins and L. Hunter Lovins published the book Factor 4 first with Earthscan (London) in 1997, Factor 5 was released in 2010 and co-authored with Karlson 'Charlie' Hargroves, Michael H. Smith, Cheryl Desha and Peter Stasinopoulos and published by Routledge.



more effectively. It is further used for treating diarrhea, influenza and swine flu, and as a source of vitamin B. When I learned about these results and the decision of a beer company to embark on its commercialization, I felt comforted in my pursuit. It is possible to get out of the box.

Zero Waste Emissions Brewery: Japan and China

It was not clear in 1994 that Asahi Breweries' resolve was so great. In 1996, management had already succeeded in making its Ibaraki brewery 100% waste and emissions free. By 1999, all nine Japan-based breweries had eliminated the concept of waste, producing animal feed at much lower cost than the import of overseas feed and the recovery of CO₂ for re-use in the factory; nothing was left to waste including the metal beer caps and the cardboard boxes. I visited the Research Center for Eco-Environment Science (part of the Chinese Academy of Sciences) at the invitation of Prof. Li Wenhua, who is a member of the Chinese Academy of Sciences and a professor at the Institute of Geographic Sciences and Natural Resources Research where he teaches natural resources and environmental security. He is also the Chinese Editor-in-Chief of the Mandarin edition of AMBIO, the environmental magazine of the Royal Swedish Academy of Sciences. I have been travelling to China since 1980 and came to know many scientists over the years. I challenged my Chinese friends on how the Chinese zero emissions brewery would look. Prof. Li Wenhua involved a few of his colleagues, Sun Honglie, also a member of the Chinese Academy of Sciences and Dr. Wang Rusong, one of the most prominent researchers on urban environment, both based in Beijing.

The response from the academicians was straightforward: if you want to see a zero emissions brewery then come and visit the Beijing Yanjing Brewery. When I toured the facility, I realized that the Chinese already had so much in place: all CO₂ was recovered on site back then in 1994; all spent grain was converted into animal feed; all bottles were recycled; and all yeast was used as medicine. I had to admit that Europeans may have a great tradition in beer brewing, and American breweries may be the greatest in the world, but the sustainability management of the beer brewing process in Japan and China was years ahead of what I had encountered elsewhere in the world. It struck me that the Chinese were encouraged to seek overseas partners to improve their financial and technical performance, while I could see that their environmental performance was clearly ahead of anyone else.

Broadening Horizons for Waste Free Breweries

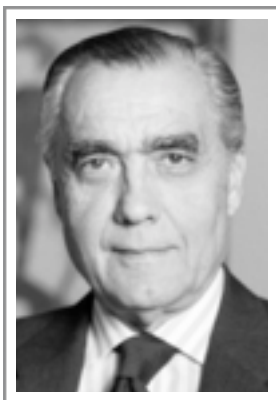
Based on the first-hand knowledge I gathered from China and Japan, we made some simulations in terms of the animal feed production, water savings, medicine and CO₂ emissions, and decided to try to build a coalition of beer brewers around this "obvious" programme. In Colombia, I met with Julio Mario Santo Domingo, the owner of Bavaria which had a monopoly in Ecuador, a dominant market share in Colombia and Portugal (now part of SABMiller). The meeting was cordial and open-minded, but the first



Another Case of The Blue Economy by Gunter Pauli

initiative to convert spent grain into animal feed was only taken a decade later. Then in South Africa, I met with Alan Richards who was the man in charge of the global transformation of South African Breweries (SAB) after Apartheid had come to an end. He claimed that the ideas presented and the experiences shared were exactly what South Africa needed. I immediately organized a visit to the Tunweni Brewery in Tsumeb (Namibia) controlled by the Namibian Breweries as described on page 6 in Case 104. The delegation returned to Johannesburg and wrote a very enthusiastic report, only to fall into the same trap as before: no action. The same pattern of information sharing and meetings at executive level in Brazil with Brahma, in Belgium with Stella Artois and in the UK with Diageo convinced me that there is an incapacity for large enterprises to get out of the core business logic. Diageo was not all that negative; management decided to invite me to the Seychelles to study the options for rendering the Seychelles Breweries waste free. We (Prof. George Chan and I) and the UK-based ZERI team, headed by Suzanne and Dominic Fielden based in Cotswolds, drew up the plans to create double the revenues and jobs but there was never a hint that this would be implemented.

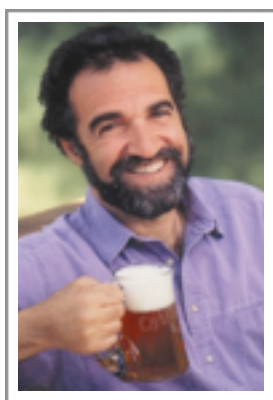
This reality obliged me to pursue another logic; I would work with the small brewers who are known as the “craft brewers”. In Colorado, I met with Charlie Papazian, a nuclear engineer who wrote the book, "The Complete Joy of Home Brewing" and the founder of the Association of Brewers. He was intrigued by the fact that large breweries had no ear for my proposals, hence a reason for small brewers to pay attention to this new business model as a tool to improve their competitive position against a cheap six-pack of beer. He invited me to the Great American Beer Festival where I was welcomed to deliver a lecture on the beer brewery of the future. This is where I came to know Michael Jackson, the British beer expert who was intrigued by my proposals. Charlie was right, small breweries have an interest in creating additional revenues and since most craft brewers started with a different career, there is no clear demarcation line of what brewers can do and what they should do. Charlie immediately decided to come and see the Tunweni Brewery in Tsumeb and he invited Bernd Masche, the CEO of Namibian Breweries, to present the strategy for the sorghum brewery to the next world congress of craft beer brewers held in Brazil in 1998.



Julio Mario Santo Domingo
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Alan Richards



Charles Papazian



Michael Jackson



I have seldom had such an impact with only one lecture. Whereas I had knocked on dozens of doors of large breweries, it was one 30-minute presentation that allowed dozens of beer brewers to get the idea and act on it. We were not equipped to respond to all these requests and it was not our goal to consult brewers around the world on how to make their business model more efficient to generate additional revenues. We decided to organize a special beer training programme in Chico (California) in collaboration with Tom Atmore and Bill Beeghly—founders of the Butte Creek Brewing Company that handcrafts organic beer. I was inspired by these organic beer brewers like Sam Calagione of the Dogfish Head Brewery in Rehoboth, Delaware (USA), Kazuko Komatsu of the Pacific Western Brewing Company in Prince George, British Columbia (Canada), Joe Glorfield of Panorama Brewing Company; Wolaver Organic Ales from Santa Cruz, California (USA), Otter Creek Brewing Company in Middlebury, Vermont (USA).



The pioneering organic beers of North America: Butte Creek, Wolavers, Dogfish Head, Pacific Western and Otter Creek

Michael McBride: The Blue Economy Approach

Michael McBride and his wife Kristi, proprietors of Storm Brewery in Canada, heard the story of the Namibian brewery and Michael went to Africa to see for himself. He concluded that the land space he had available in Newfoundland was insufficient to implement the full programme, but he became the first person to fully implement the mushroom production, and the waste from the mushrooms was turned into feed for earthworms, which were fed to chickens. Michael McBride realized that he could generate considerable revenues from the mushrooms farmed on his own spent grain from his premises and he sold these as snacks to his beer customers at the pub. The Canadian Industry Research Programme funded the trials which were successful. Indeed, if a beer brewer knows how to handle yeast, then he knows how to handle

Amelight

zero emissions

Newfoundland entrepreneur MICHAEL MCBRIDE makes brewing beer an organic experience

BY HEATHER SKYOT

For 35-year-old eco-entrepreneur Michael McBride, the idea of blending his love of beer with a passion for the environment was serendipitous. Last year, Michael succeeded in establishing the first zero emissions microbrewery in Canada. "I had been working for several years in the micro-brewing industry in Ontario when I had my first inspiration to create a zero emissions brewery," he says. "From that moment, I was hooked — I knew it would be my life's work."

Along with the success of his traditional British beers and specialty ales such as Kyle Wild, Killick Pale, Hemp Ale and Rasberry Wheat, the president and chief ale officer of Storm Brewing in Newfoundland Ltd. is generating international attention for his brewery model. "The goal of Storm Brewing as an eco-brewery is to turn every single waste product from the beer-making process into a value-added product which can be sold," says Michael, "as well as increasing productivity, creating more employment, generating higher revenues and eliminating pollution."

Recently, Michael and his wife Kristi took full ownership of Storm Brewing after buying out a third partner. While working with two brewery staff to produce 10 hectolitres of beer each week at the Mount Pearl, Newfoundland-based operation, Michael and Kristi also focus their energy on zero emissions endeavours. "Developing a zero emissions brewery is an incremental process, it will be in perpetual development," explains Michael.

A self-described environmentalist, "but not a radical one," Michael's love for the reduce, reuse and recycle concept began in 1996 after reading *The Ecology of Commerce: A Declaration of Sustainability* by Paul Hawke. Further investigation led Michael to discover the Zero Emissions Research and Initiatives (ZERI) foundation. "I thought the zero emissions theory was a very hairy idea before I went to the fourth Annual ZERI World Congress in Namibia, South West Africa, and saw a model firsthand," he says. "I find it so fascinating that a developing country conceptualized this model, which I was able to bring back to Canada. I thought, 'if they can have a zero emissions brewery in the desert in Africa, why can't I do it in Newfoundland!'"

Backed by a grant from the National Research Council's Industrial Research Assistance Program, Michael took the first step toward his zero emissions goal in June 1999 when he started growing oyster and shiitake mushrooms in his basement on brewery spent grain. After three weeks of tender loving care, the verdict was success.

Michael's next step involved taking the used mashcoen substrate, adding earth-worms and eliminating excess nutrients from the raw material in order to sell it as a high nitrogen garden fertilizer (vermicompost).

This past summer, Michael scaled up the mushroom and vermicompost production, and next year he hopes to sell his fresh exotic mushrooms at the local market. "We have come a long way, and now we will figure out the economic side of things, then research where the market exists," he says.

Identified by the ZERI foundation as a "role model and pioneer," Michael was invited to speak about his experience starting Canada's first zero emissions micro-brewery at last year's fifth Annual ZERI World Congress in Colombia, South America. "This is a lonely business at times, but the conference revitalized me because people were as excited about my project as I am," he says. "Travelling to developing countries has broadened my horizons and expanded my life experiences."

On top of that, Storm Brewing was selected by the ZERI foundation to be one of 10 projects showcased at EXPO 2000 last summer in Hanover, Germany. Michael was asked to speak as part of the ZERI Pavilion seminar series. His topic: the first Canadian ZERI brewery inspired by Namibia.

Michael credits his determination and resourcefulness for the success he's had in turning his microbrewery into an eco-friendly one. "I had people telling me I was crazy, but I chose not to listen to them," he says. "I'm a firm believer that if you are passionate about what you're doing, you can always make it happen."

As for long-term goals, Michael and Kristi plan to add a taproom to their eco-brewery. "This will be a place where the public can experience eco-tourism and great ales at the same time. Basically, it will be a beer-lover's paradise," he laughs. ☺

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mycelium. The international media attention for Storm Brewery was beyond expectations. Now it is important to add that Michael refurbished old facilities and bought second-hand brewery equipment from a bankrupt operation in California. He was applying the concept of The Blue Economy giving new life to stranded assets even before we had named it that way.

The Obstacle in Cameroon

Brauhaase International Management GmbH, the Hamburg-based brewery developer which had been instrumental in the creation of the brewery in the Seychelles, got word of the proposals and Joachim Haase asked me to travel to Cameroon and assess the opportunity to create a brewery based on the zero emissions principles. I accepted the challenge. We documented the site, discussed the local plans and agreed that the model would be to emulate the concept implemented in Tsumeb. Samuel Foyou, the Cameronese partner and the German team were enthused about the opportunity to generate more income and jobs. However, there was an obstacle that we could not overcome: the two leading breweries felt that it was not timely to permit a third player and the new initiative never got the required permits to proceed.

Bread from Beer

This was very different for the Japanese craft brewery Shinano, located in Nagano—the home of the 1998 Winter Olympics in 1998. Hideyo Sekiguchi and his daughter, Megumi, were so committed after our first meeting that they started farming mushrooms and baking bread with their leftovers. They even travelled to Fiji to understand the core principles of integrated biosystems from Prof. George Chan at Montfort Boys Town. The microbrewery on the foothills of Mount Kurohime produced 160 loaves of bread a week, blending 60% of spent grain with 40% flour. Sekiguchi designed a ceramic grinder to process large quantities of spent grain, producing a barley paste that was converted into frozen bread dough. A new industry was born. Bread rich in antioxidants, high in fiber, vitamins and minerals became a solid new business next to the beer brewing. The business model of father and daughter was clear: equip all Japanese microbreweries with this equipment to revive the production of local healthy bread while generating additional revenue. Unfortunately Mr. Sekiguchi passed away unexpectedly and the brewery struggled for a few years before it closed leaving a rich legacy of beer, mushrooms and bread behind.



The production of bread from spent grain is nothing new. It was practiced for hundreds of years and only lost favour after the Second World War when the world started opting for the core business logic, forcing every industry to focus on one competence only. When the Bavarian beer research institute based in Weihenstephan (part of the Science University of Munich), where beer has been produced since the 8th century, reserved a few pages of their magazine to the cases described, only a few brewers reacted. The



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Bavarians explained that every town had a church, a brewery and a bakery and that the spent grain was often reprocessed in the bread. I wondered why this tradition was lost and thanks to a few media interviews in 1998, we reached the Erzquel Brewery from the Cologne region that produces a unique variety of double fermented beer called Junft Kölsch. The owner, Axel Haas, was keen to take on the challenge and relaunch the bread/beer tandem. He started with the local bread production in Bielstein (Germany) and its success lead to an agreement with the World Expo in Hannover to deliver daily freshly baked "beer bread" daily to the EXPO, and permitted the ZERI Pavilion to sell Kölsch beer as an example of the new business model.



Erzquel's bread made from spent grains



Axel Haas, owner of Erzquel Brewery © 2000, Erzquell

The Visby Brewery, owned by Spendrup on the island of Gotland (Sweden), learned about the opportunity and made a quick arrangement with Håkan Jakobsson, the owner of the local Eskelunds Hembageri which is a well-established traditional bakery founded in 1881. It was even decided to have the beer bread wrapped with the same logo as the brewery. The logic of using the spent grain made a lot of sense. During summer, the population swells from 50,000 on average throughout the year to 500,000 from June through August. As the summer holiday visitors enjoy the local beer, little do they realize that their increased consumption of beer translates into an increased production of bread. Håkan Jakobsson was so convinced that this was the way bakeries should



cooperate with breweries that he agreed to publish the beer bread formula as an open source. It was from this moment onwards that we lost track of those doing beer and bread. While this simple teaming up of beer and bread is far from a zero emissions strategy, it does represent a few first steps with dramatically increased resource efficiency.



The Eskelund's bread made with spent grain from the Visby Brewery in Gotland

© 1999, Eskelund

We felt that we had done our work to reach this level and forwarded requests from breweries around the world to either our German or Swedish friends. Inquiries arrived from as far as Gabon, where the brewery SOBRAGA was forced by presidential decree to stop storing spent grain on its premises. We pointed to the experiences from around the world and for reasons unknown and unexplained, the management decided to burn all waste, even though Gabon imports all of its flour to produce bread. This time I could not sit back and listen to the explanation from a distance. I flew to Libreville and sat down with Guillaume Sarra, who was in charge of soft drinks, and insisted that bread could be produced on site and distributed through the existing sales network of SOBRAGA which reaches every corner of Gabon. The project was eventually dismissed because our spent beer bread could not produce a French-type baguette bread that was as white as the imported flour. Sometimes we have to know when to call it the day.



Growing the Beer Project

The founders of ZERI Brasil Foundation were keen to start a beer project that would grow into the Cervejaria Sudbrack in Blumenau (Santa Catarina). This project was originally a family owned, small scale quality beer maker in a city that organizes the third largest Oktober Festival in the world (after the original one in Munich and Ontario, Canada). However, when the control of the company reverted to Kirin from Japan, the dialogues ended. It was yet another avenue where we failed to create the opening and the references we had expected to succeed in Brazil. I was surprised that while we were making headway in Japan, the same breweries would not embrace the principles adopted in Japan.



Carlton Brewery, the Suva-based brewery owned by the Australian Foster Group, is based in Walu Bay, just a few miles from the Montfort Boys Town where Prof. George Chan had successfully installed the integrated peri-urban farming system. Marc Dally, the production engineer, was in favour of re-using all spent grain which was flushed out into the sea and considered feed for the fish, which the fishermen were most appreciative of. Pick-up trucks ferried the spent grain to the school, which was first to farm mushrooms and later to experiment with bread. The free availability of the recipe made it so much easier to look for a quick win, which everyone searches for when there is a need to deliver a proof concept that is out of the box. Bread was the most convincing and mushrooms were a close second.

The New Belgian Brewing Company: Setting an Inspiring Example

I wanted to go beyond the beer, bread and mushrooms and play an instrumental role in designing a truly zero emissions brewery. The two major opportunities emerged in the United States. The New Belgian Brewing Company was founded by Jeff Lebesch and Kim Jordan in 1991, in Fort Collins, Colorado. The couple clearly desired to combine a great beer with a low ecological imprint and a wonderful place to work. In 2008, the company was named the best place to work in America. We initiated the discussions on the waste water treatment and the conclusions were quickly implemented: a biodigester now produces 10% of the energy required by the beer brewer. This employee-owned company opted to be the first one to rely on renewable energy, working together with the City of Fort Collins Utilities to ensure that its energy needs are met by wind, for which the company is prepared to pay a higher price. The brewery is very successful



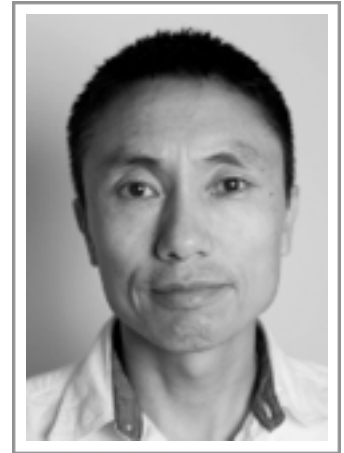
and has grown into the third largest craft brewer of America with a turnover of nearly 200 million dollars.



Jeff Lebesch and Kim Jordan



Jim Lueders at the WildWood Brewery



Kinley Tshering

Jim Lueders: The Man with a Plan

While I was glad to finally see the energy component emerge as competitive, it did not yet project the full systems view that had been in the blueprint at the outset of 1994 when we imagined the breweries of the future. Then in 2002, at the ZERI immersion courses that were organized in Santa Fe (New Mexico) one of my students was Jim Lueders, a brewmaster. Another beer brewer, Dave Thibodeau, co-founder and president of Ska Brewing in Durango, Colorado, joined the next training but the Ska team could never bolster the same energy together as Jim. Since everyone graduated with a project to implement, Jim decided to create the ZERI brewery. It has taken him years to plan, find the second-hand equipment and search for a defunct infrastructure, but influenced by the courses he had from Prof. George Chan and the support from his class, Jim finally opened the WildWood Brewery in Stevensville, Montana. Jim has gone 100% organic, only buys local and has brought the farming of hops and barley back to the region. Upon release, his beer was selected as the best one in the state. The WildWood Brewery is a reference for ZERI and The Blue Economy, it demonstrates not only his perseverance, the commitment to secure self-financing, the use of available resources and the creation of a local economy, but the project is an ongoing initiative that has several planned additions to emerge in five or 10 years as the planned brewery of the future.

Versatile and Traditional Buckwheat

While working in Bhutan to position the country in this new world of globalization and the likely loss of its traditional agriculture that had made the country self-sufficient in food and nutrition for centuries, I learned about the imminent demise of buckwheat. Buckwheat has been farmed in the central Asian Highlands for at least 5000 years; it



was introduced to Europe only 1000 years ago. Common buckwheat yields 750 kg per hectare and bitter buckwheat that has been credited with properties that combat diabetics produces 1600 kg per hectare. It can be farmed as high as 4400 metres above sea level and the period between planting and harvesting is only 30 days. It grows so fast that it crowds out all other vegetation. Honey from buckwheat flowers has up to 20 times more anti-oxidants than any other honey. Buckwheat is an integral part of the Himalayan culture and tradition. However, the opening of the market and the arrival of cheap imported rice quickly shifted consumer preferences.

Kinley Tshering studied forestry at the University of Montana in Missoula just a few miles from Stevensville, where Jim constructed the Wildwood Brewery. While he was a student, he learned how to home brew beer. As director of forestry at the Bhutanese Ministry of Agriculture and Forestry, he became acutely aware of the challenges the communities face and wished to combine his passion for beer and nature with an opportunity to start an original beer brewing venture in Bhutan. Whereas Fritz Maurer had already created the Hefeweizen beer (known as Red Panda Weiss Beer) at the Bumthang Brewery in Jakar (Bhutan), Kinley had a different aim: produce a buckwheat extract, collect wild yeast from the Bhutanese mountains and license the production. The technicalities of this concept were quickly tested by Jim Lueders who travelled to Bhutan and who processed buckwheat malt extracts to produce a fine bitter (and very healthy) beer.

The power of the proposal is that only 8% is extracted from the buckwheat, the rest is used as quality animal feed. Wild yeast offers additional revenue in a quality, taste and performance that is unmatched in the region. The idea caught on and Kinley mobilized Kesang Wangchuck and Karma Tenzin as partners in the venture. While I would never have expected that a beer brewery would be designed to create quality products and have a high resource efficiency, I also never expected that our efforts could preserve tradition and culture, and perhaps offer an opportunity for time-tested farming techniques to survive. After all, the money made on malt extract and wild yeast concentrates are sufficient to finance the whole operation, rendering locally produced animal feed cheaper than the imported goods, and generating the revenues that render the local Bhutanese buckwheat production insensitive to the global market price for buckwheat that is imported around the world from countries like Ukraine.

I am often asked how to compete against the cheap products that flood the market. Indeed, Ukrainian buckwheat is 20 times cheaper than Bhutanese organic buckwheat that has been farmed for 5000 years on those fields. It is possible to outmatch the cheap. How? By generating more value. However, this is not enough to bridge the gap of factor 20. The only way to overcome this tremendous difference in price is to generate more value with several exclusive products that are sustainably derived from a specific geographical area, and change the business model by offering a fair share of



the value that is created by the sale of the final product launched under the brand name PAWO designed by Sy Chen from Japan to the farmers in Bhutan. The license agreements with the Japanese partners (not to be disclosed) foresee that 10% of the sales price of a bottle of beer, or a served pint, will be paid to the Bhutanese and this exceeds the sales price that buckwheat should command to be competitive on the home market. It makes sense to let the farmers enjoy the benefit of the income generated thanks to their hard work. Why would we ever accept that farmers are forced to sell at the low global market price while their contribution is exceptional to our quality of life?

Providing Quality While Building Culture, Tradition and Biodiversity

This is not a matter of subsidies, but rather a fundamental redesign of the production, process and consumer relations. This is what The Blue Economy wishes to achieve in the end. We can dramatically increase resource efficiency with at least factor 12 (instead of using 8%, we now use 100%), we can exploit a unique ingredient like wild Himalayan yeast that had no value but now is generating income, and we can create a link to the customers who will be happy to pay the right price for the organic quality while knowing that one builds on culture, tradition and biodiversity.



Buckwheat in Bhutan

© Bhutan Biodiversity Portal

I had lost hope more than once that the beer brewery zero emissions model would ever come to fruition. The new reality that emerged from a small nation in the Himalayas is inspiring and demonstrates that there is no reason to ever give up, on the contrary to be prepared for the next opportunity. It was my student, Jim Lueders, and the unlikely coincidence that Kinley studied in Montana, that allowed us to go beyond the best we had ever imagined. It took about 20 years to see this come to fruition, but it is perhaps worth waiting another 20 years to see this become a new standard on the market. The key is that we do not want to copy the Bhutan model; we need to search for comparable patterns that allow us to respond with solutions that build on what is locally available.



Capital and Budget Spending

When we review the 20 years of initiatives, then we realize that more money has gone into this than we ever wanted to budget. Actually, if I would have searched for a €12 million budget to finance all that has been spent on research and development, I would have probably been unsuccessful in getting the cash together and we would have never started for lack of funding. We did not worry about the funding and as we began to progress against all odds and pursued our objective of zero emissions, we realized that a sizable budget had been spent. The capital layout is smaller than we expected. Since we never got traction with the large brewers, we ended up working with dozens of small craft brewers. The total capital investment that these investments represent is estimated at €55-60 million. When it comes to employment, we cannot overestimate the direct job generation which numbers at around 1000. The indirect job generation is likely to increase to 8000, especially if we calculate the impact on farming.

We started the mushroom farming on coffee at the same time as we launched beer, bread and energy. To date we have thousands of mushroom farms and only dozens of beer brewers. However, time will tell and the opportunities described will become mainstream. As more mergers and acquisitions consolidate the beer market into fewer and fewer hands (including Belgian hands), the drive to cut costs at all cost and to pursue economies of scale, a new space will be created for the zero emissions breweries. It will take a generation to convince the present logic on the market to embrace the clusters that we know are generating more income than ever imagined. As long as the MBA's do not learn that clusters of businesses generate more income and respond better to the needs of the people and planet, we will rely on a few visionaries to turn our proposals into pioneering cases that are self-evident, yet not mainstream.



Translation into Gunter's Fables

The use of all ingredients of beer has been translated into the Gunter's Fable #30 "The Magic Hat".

For additional information:

http://www.asahibeer.com/brands/beer/superdry/environment/zero_emissions.html

http://www.japanfs.org/en/news/archives/news_id027929.html

<http://www.japantimes.co.jp/community/2000/10/12/general/nagano-microbrewer-takes-eco-friendly-path/#.VSg1JWam2r8>

<http://web-japan.org/trends00/honbun/tj990330.html>

http://www.stormbrewing.ca/STORM_BREWING_2011/STORM_BREWING_in_Nfld._Ltd..html

http://www.stormbrewing.ca/STORM%20BREWING/Limelight_files/Telegram%20-%20EcoBrewery.pdf

<http://www.japantimes.co.jp/community/2000/10/12/general/nagano-microbrewer-takes-eco-friendly-path/>

http://wildwoodbrewing.com/?page_id=11