

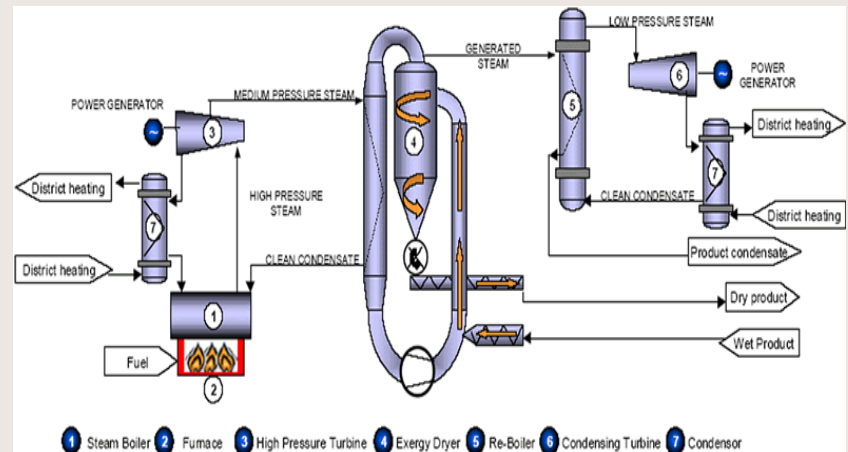
FINDING VALUE IN ZERO WASTE BREWING



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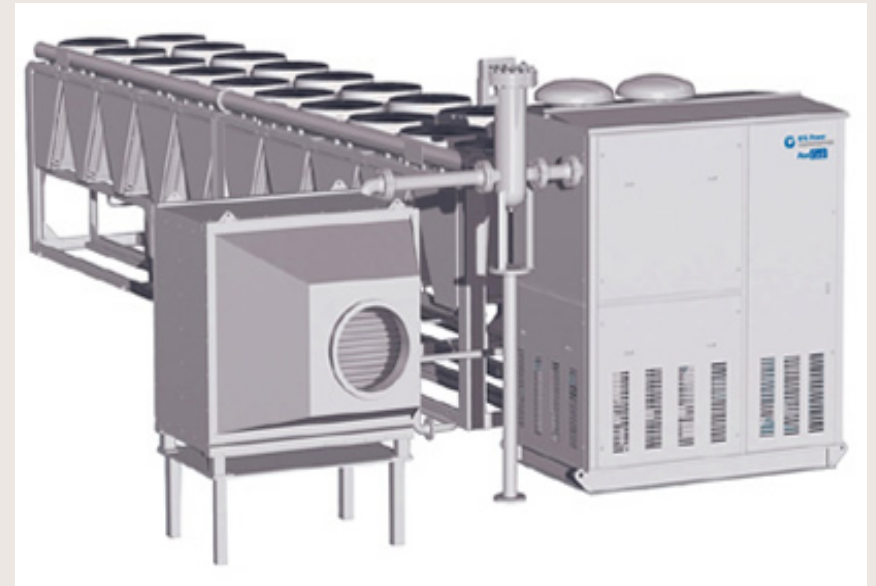
Objectives

- Introduce resource conservation alternatives in use for energy, spent grain, and waste water treatment/biogas recovery.
- Design brewery to recycle virtually all waste from various plant processes.
- Generate information for the selection of suitable solutions with the objective of creating a zero-waste brewery with no impact on the environment.



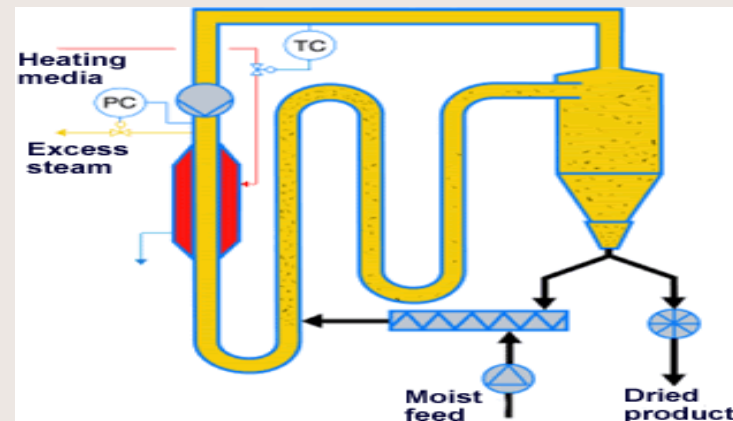
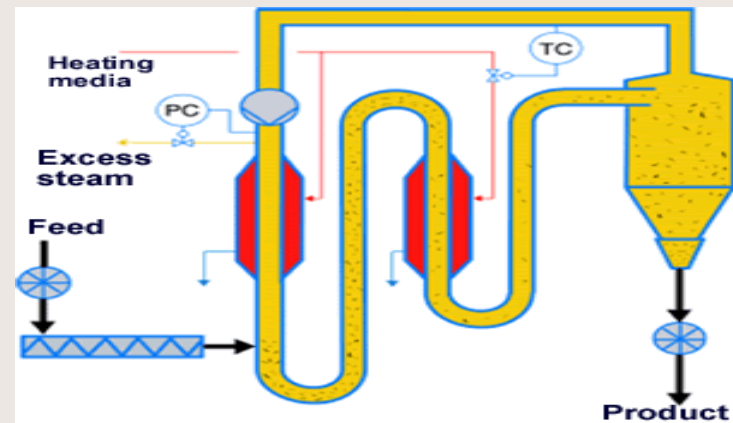
Fuel Cells

- Proven Technology – Generates assured computer-grade power for a range of on-site power needs.
- Scalable Design – Modules operate in parallel to meet any electrical load requirements.
- Environmentally Sound Design – Fuel cells represent one of the cleanest power generating technologies available today.
- Utilize Biogas from anaerobic waste water treatment plant to feed.
- Hydrogen gas is extracted by fuel cells and combined with air to produce electricity, heat, and water.
- Heat is recovered and used to heat brewing water, providing a sustainable, renewable energy source.
- Electricity is used throughout the brewery.



Spent Grain

- Super-Heated Steam Drying – environmental and energy saving drying technology
- The beer industry uses more than 400 million tons of grain annually.
- Wet spent grain is typically fed to cows, but is expensive to transport and has a limited storage life.
- 70-90% of energy is recoverable by re-using steam for heating in the brewery, or by using mechanical vapour recompression.
- Resulting in shelf stable feed products, that can be readily transported at much reduced cost.



Case Study -- Converting waste water to gas to electricity using fuel cell energy

- U.S. Specialty beer brewer produces 700,000 HL per year
- 1000 kW net 480 VAC output of fuel cell system
- Available heat 340 degree C., exhaust flow rate 6,200kg/hr
- 1.4 mm Btu/hr exhaust heat available
- ROI – less than 5 years



Heat Recovery Applications

- Plate heat exchangers can be utilized throughout the brewery to recover energy where practical
- Vapor condenser to recover waste steam from brew kettles is used to preheat process water
- Boiler blowdown heat recovery project reduces steam system energy losses



Additional Energy Efficiency Ideas

- High efficiency refrigeration – modulate energy use in response to actual load
- Co-generation of heat and power
- Install skylights and motion sensors for lighting
- Even without use of fuel cells, methane biogas from waste treatment ponds can be used to fire a co-generator, producing heat and electricity.
- Solar energy - U.S. specialty beer brewer utilizes photovoltaic solar energy from 592 panel solar array for a third of its power requirements
- Wind energy – U.S. specialty beer brewer converted to 100% wind energy.
- Convert used cooking oil from pub operations into biodiesel, to fuel company vehicles

Is there a brewery with no impact on the environment?



Thank You!

To obtain a copy of this presentation and for more information, please contact me as noted below. Cheers!

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