Electric energy
Best practice
Brief introduction

Bioethanol Manufacturing and Sales

Hokkaido Bioethanol Co., Ltd Tokachi Shimizu Factory

Hot air heat pump

Introduction of high efficiency steam supply heat pump innovates energy saving in the distillation process, which introduces cutting running cost and reduction of CO_2 emissions

Hokkaido Bioethanol Co., Ltd. has installed the first heat pump system in the world that can recover exhaust heat and effectively supply steam at a temperature of 120℃. By recovering condensation heat from ethanol released during the distillation process, running costs and CO2 emissions from the distillation tower were greatly reduced.

The decisive factor

Reduction of running cost and CO_2 emissions during distillation process

A high efficiency steam supply heat pump system was installed to conserve energy during the distillation process, which accounts for approximately 60% of steam usage for the total manufacturing process, and it has received acclaim for significantly cutting of running costs and CO_2 emissions.

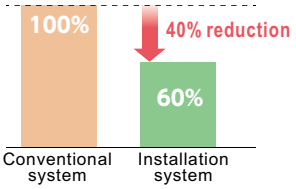
Advantages

Reduction of the energy consumption

By recovering condensation heat from ethanol released during the distillation process with the high efficiency steam supply heat pump and being able to reuse it as steam, 65% of heat energy was recovered, cutting energy on the entire manufacturing process by 40%.

●Conditions for calculating primary energy consumption
◎Power ... 9.76MJ/kWh (*1)
◎Heavy oil ... 39.1MJ/L (*1)
*1: Act of the Rational Use of Energy

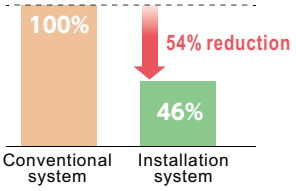
■Primary energy consumption



Reduction of the running cost

Compared to the conventional system, installing the high efficiency steam supply heat pump lowered fuel consumption for the steam boiler during the distillation process, cutting the running cost by 54%.

■Running cost

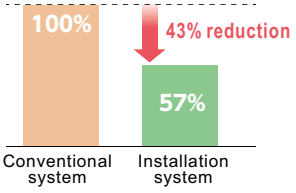


Reduction of the CO_2 emissions

Compared with the conventional system for the same process, CO_2 emissions decreased by 43%.

●Conditions for calculating CO_2 emissions
◎Power ...0.681kg-CO_2/kWh (*2)
◎Heavy oil ...2.71kg-CO_2/L (*3)
*2 Hokkaido Electric Power Co., Ltd. FY2013 fiscal value (after adjustment)
*3 Act on Promotion of Global Warming Countermeasures

■CO_2 emissions



Hokkaido Bioethanol Co., Ltd. was established in 2007 supported by JA (Japan Agricultural Cooperatives) Hokkaido and related organizations and companies to manufacture and sell bioethanol made from Hokkaido's agricultural products, for the purpose of empowering agriculture, preventing global warming, and promoting regional activation.

The Tokachi Shimizu Factory – the production base – has the capacity to manufacture 15,000kl per year of bioethanol, using non-standard wheat and rice and sugar beet as raw material.

Company Profile

Company name
Hokkaido Bioethanol Co., Ltd.
Tokachi Shimizu Factory
Location
73-2 Dai 1 Sen, Aza-Shimizu, Shimizu-cho, Kamikawa-gun, Hokkaido
Phone
+81- 156-62-8877
http://www.h-bioethanol.jp/hbiohp0003/hbiohp002/hbiohp0020.html

Introduction of the world's first "High efficiency steam supply heat pump"

Bioethanol is a fuel made by fermenting and distilling biological resources called biomass. It is used with gasoline. Because it does not increase CO_2 (carbon dioxide) when it is combusted, it is gathering attention as an Eco-friendly energy.

Hokkaido Bioethanol Co., Ltd. was established in 2007 as a pilot project by the Ministry of Agriculture, Forestry and Fisheries for model community usage of biofuel. It manufactures dehydrated ethanol with a concentration higher than 99.5% by grinding, liquefying, fermenting, and distilling, before dehydrating raw materials such as beet syrup or non-standard wheat and rice. Moreover, none of the resources goes to waste. Residue after distillation is dried and shipped out for animal feed. Methane gas is recovered from wastewater generated in the dehydration process and used for boiler fuel.

"We are hoping to commercialize bioethanol production from which great benefits can be expected, such as energy self-sufficiency and the promotion of local agriculture. Government support ends at the end of FY2014 (March 2015), but we are working in unison to procure raw materials, reduce costs, promote sales, and to tackle any other issues in order to contribute to the prevention of global warming along with the empowerment of Hokkaido's agricultural base and activation of the local economy. The high efficiency steam supply heat pump was installed as the key element for the reduction of running costs and CO_2 through energy saving. This was the very first installation of its type in the world, but we have seen significant energy saving as planned."

Hokkaido Bioethanol Co., Ltd.
Tokachi Shimizu Factory
Factory Manager
Mr. Takao Yoshida

Recovery of exhaust heat from the distillation process, which accounts for 60% of the steam needed for the entire manufacturing process

In the distillation process, steam is used to heat the ethanol aqueous solution extracted from the raw materials in the mash tower. This separates the ethanol and water through evaporation. Evaporated ethanol is sent through the condensation tower and cooled and liquefied in the distillate cooler, then taken to the next procedure. In the conventional system, condensation heat from the ethanol removed from the distillate cooler was wasted.

Since the distillation process accounted for 60% of steam usage for the entire manufacturing process other than by-product drying, recovering this waste heat could have a great energy saving effect. This is what brought attention to the high-efficiency steam supply heat pump that could recycle the waste heat and turn it into steam.

In the new system, waste heat is recovered from the distillation process as a 65℃ heat source. The heat pump turns that into saturated steam with a temperature 120℃ and feeds it into the distillation tower. Being able to recycle waste heat as a heat source for the process allowed the use of energy with even higher efficiency.

Energy saving innovation in the distillation process led to significant energy saving

In this system, steam is supplied to the distillation tower by using both the high efficiency steam supply heat pump and the steam boiler. During normal operation, the heat pump takes care of about 70% of the steam volume, but it is highly efficient and basically runs constantly at rated capacity with the COP (coefficient of performance) stable at around 3.5.

"The distillation process requires stable temperature control. Obviously, this was the optimum process for a waste heat recovery and steam supply system using the heat pump, because waste heat is stably obtained," says Factory Manager Yoshida.

With the installation of the high efficiency steam supply heat pump, 65% of heat energy from the distillation process could be recovered. Reusing this saved 40% of energy used for the entire process and 54% in running costs for the distillation process. CO_2 reduction amounted to 43%.

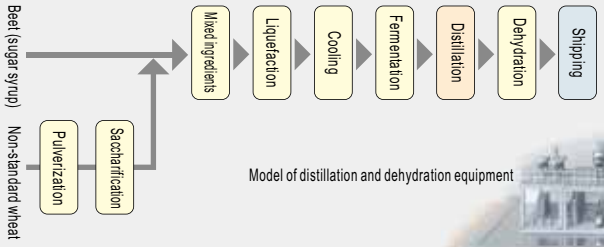
The world's first high efficiency steam supply heat pump is still attracting interest as seen in the continuing number of visitors.

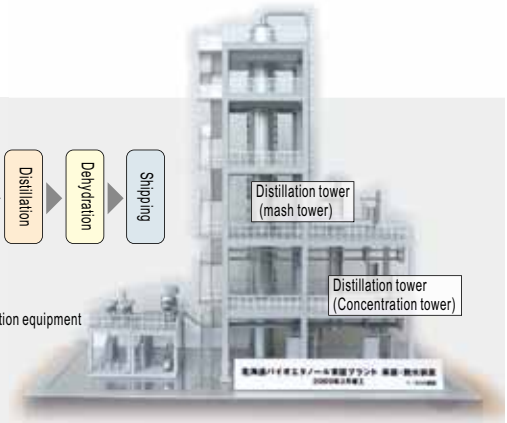
Yoshida says, "Bioethanol is not only about the prevention of global warming. I feel that it plays a great role in agricultural promotion and regional development as well. I will continue working to spread and commercialize bioethanol as an energy source of the future."

■ Facilities overview

High efficiency steam supply heat pump
Kobe Steel, Ltd.
Four units (normal operation)
One unit (back-up)
Steam pressure：0.1MPa
Steam temperature：120℃
Amount of steam：0.51t/h/ unit
Heating capacity：370kW/ unit
COP：3.5

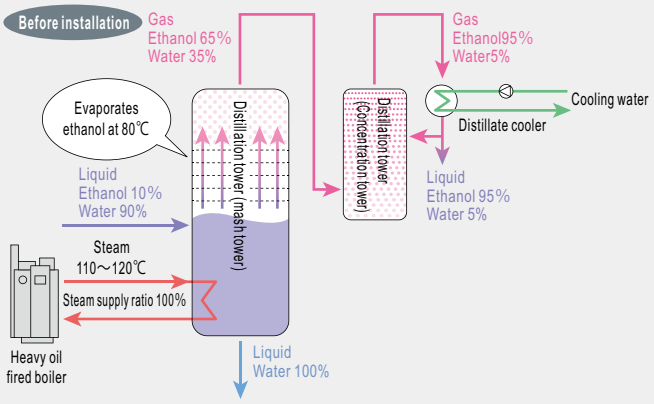
■ Manufacturing process (bioethanol)

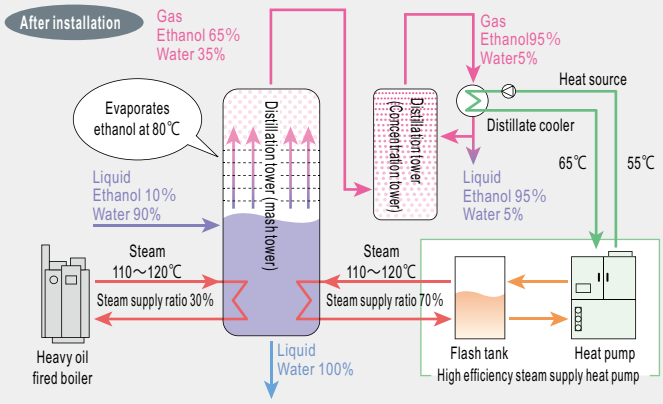




Model of distillation and dehydration equipment

■ System flowchart





[information obtained October 2014]