WORLD BREWING CONGRESS
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#ElevateBeer

Optimization of Energy Supply and Recovery System in the Brewing Process

水と生きる SUNTORY

SUNTORY BEER LIMITED
Tonegawa Brewery
Kohei Yamada

Outline

SUNTORY

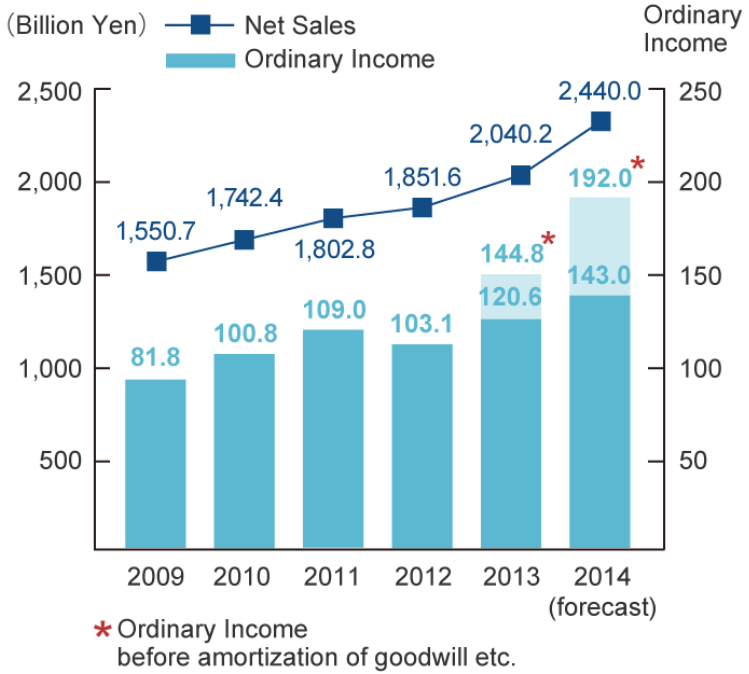
- Outline of Suntory
- Energy Reduction Plan
- Minimization of Heat Input to the process （Step1）
- Optimization of Total Energy Recovery （Step2）
- Summary

Suntory Group

Group companies *	329
Employees *	37,613
Consolidated sales **	¥2,455.2 billion
Consolidated ordinary profit **	¥153.8 billion

Suntory Holdings Limited

Head office	Dojimahama 2-1-40, kita-ku, Osaka 530-8203, Japan
Inauguration	1899
Establishment	February 16, 2009



* as of December 31, 2014

** January 1 - December 31, 2014

Outline of Suntory - Group companies

Outline of Suntory - Our products and service

SUNTORY

Beer

Whisky, Liqueurs & Spirits

Beverage

Health Foods

Wine

Business Development

Outline of Suntory - Breweries of Japan

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Kyoto Brewery, 1969

Tonegawa Brewery,1982

Musashino Brewery,1963

Kyu-shu Kumamoto Plant, 2003

Outline of Tonegawa Brewery

Completion date	April 20, 1982
Location	Gunma Prefecture
Plant manager	Seisuke Takaoka
Number of employees	115
Site area	240,000㎡
Production capacity	4.2 million hl/year

2016.4.1

Products of Tonegawa Brewery

SUNTORY

[Content]

[Beer]

[Low-malt beer]

[Non-alcoholic beer taste]

[Packaging container]

[Can]

500ml 350ml 330ml 250ml

[Bottle]

[Barrel]

20l 15l 10l

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Energy Balance after Renewal Project

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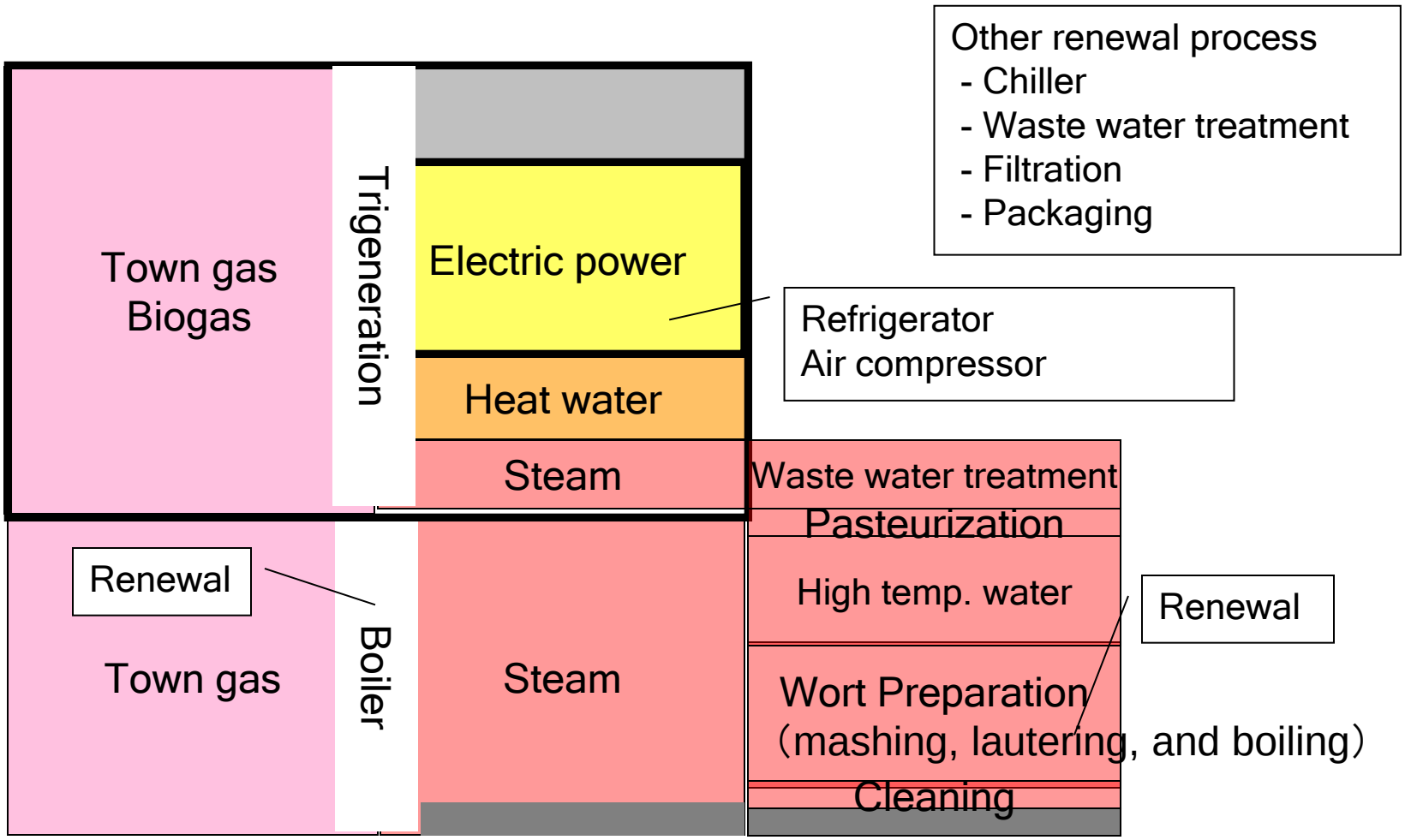
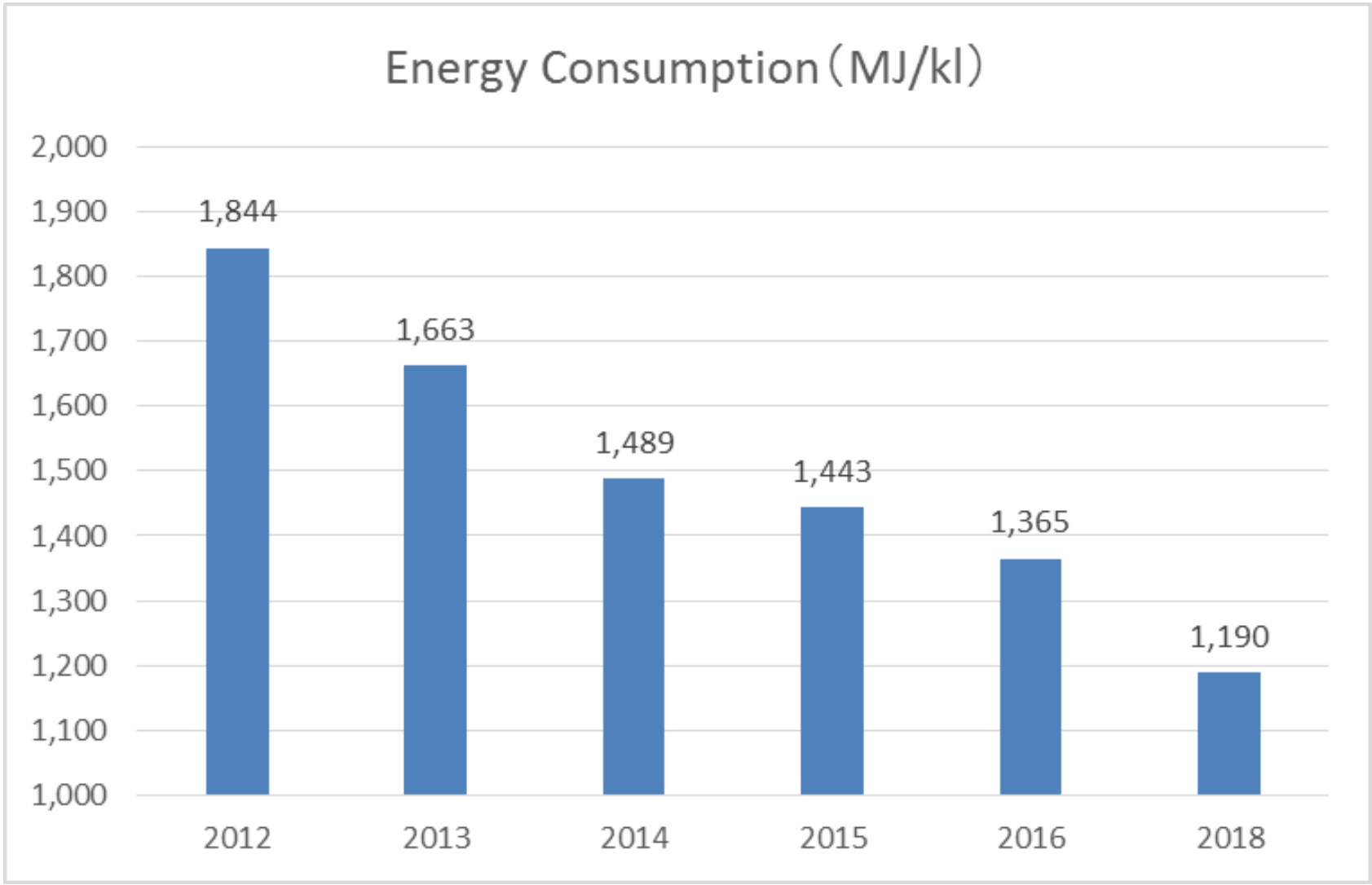


Equipment renewal from 2012 through 2015

Energy Reduction Plan



Target: 35% cut by 2018 (Compare to 2012)

Energy Flow

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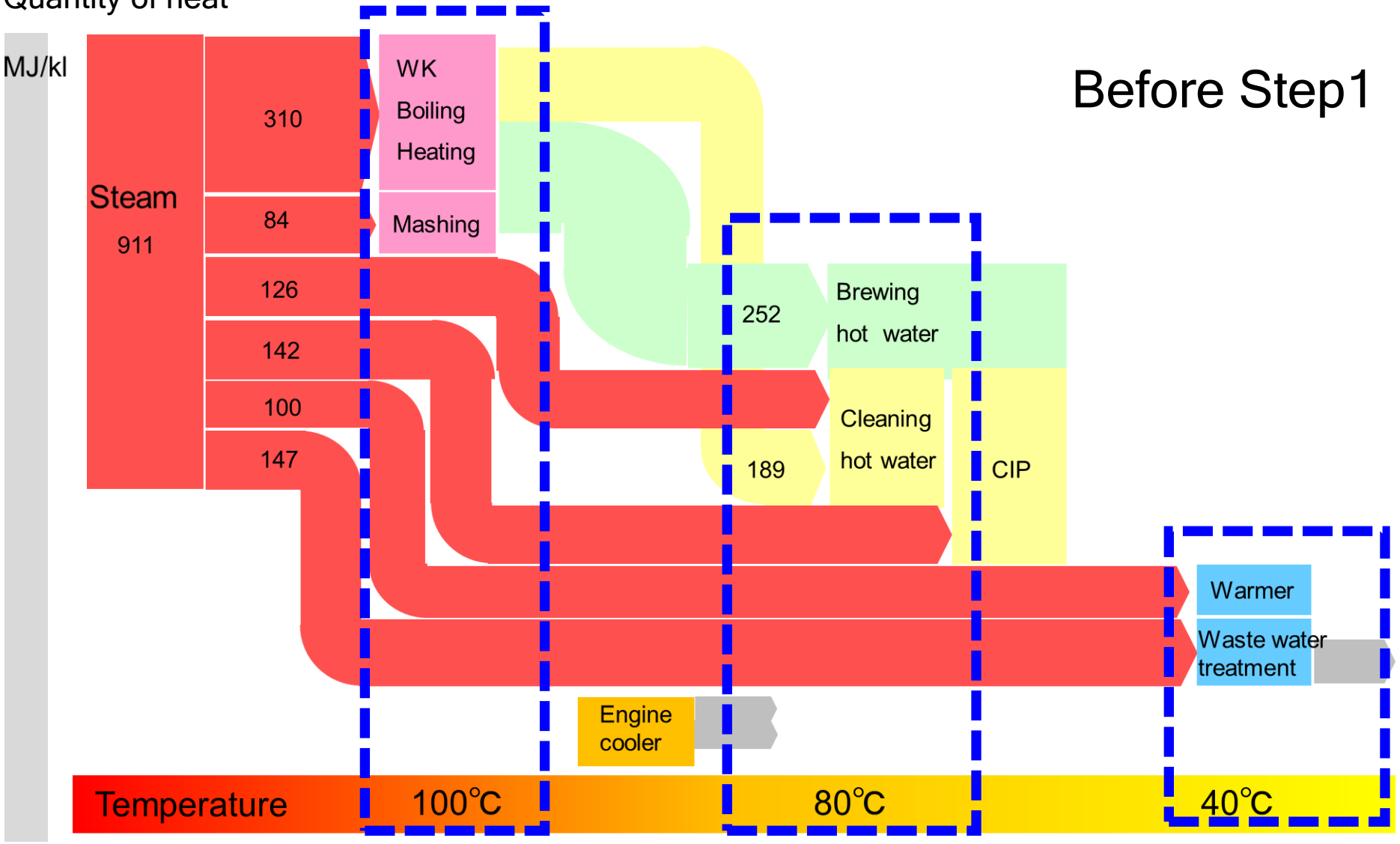
Quantity of heat



Before Step1

Analysis in using Temperature and Heat Quantity
（TQ Analysis）

Approach for Energy Reduction

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Step2

Optimization of Total Energy Recovery

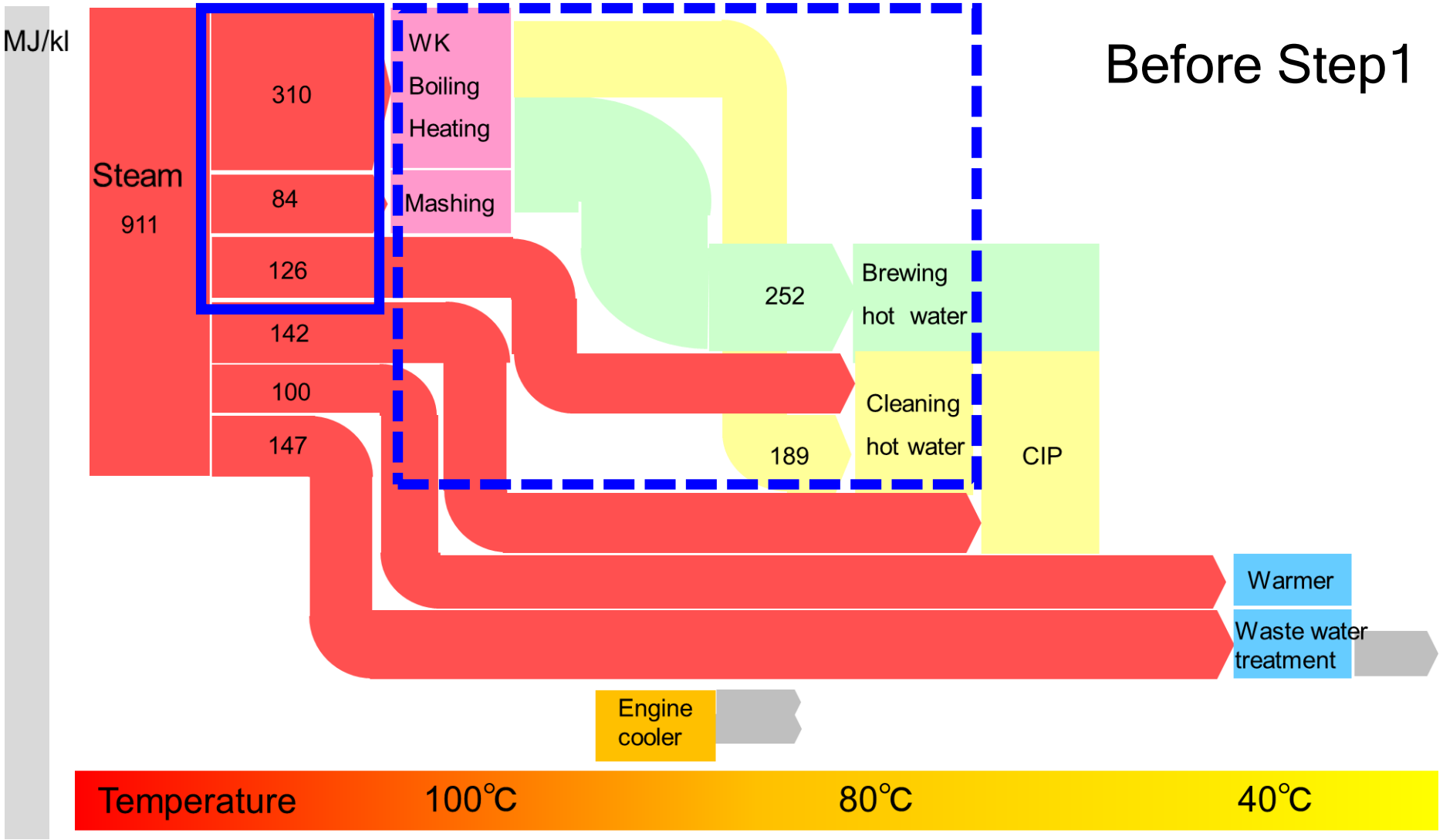
Step1

Minimization of Input Heat to the process

Minimization of Heat Input to the process

SUNTORY

Quantity of heat



Before Step1

Focus on Wort Boiling Process

Energy Balance of Wort Boiling

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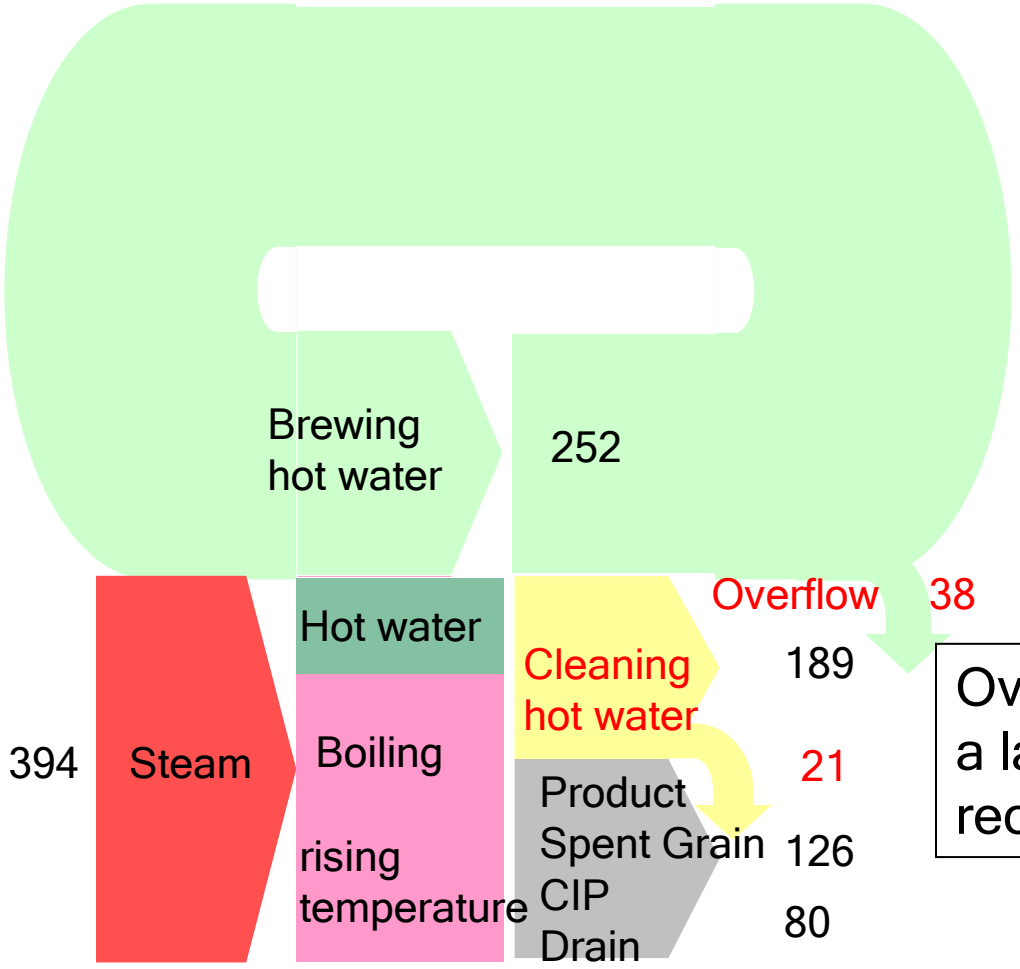
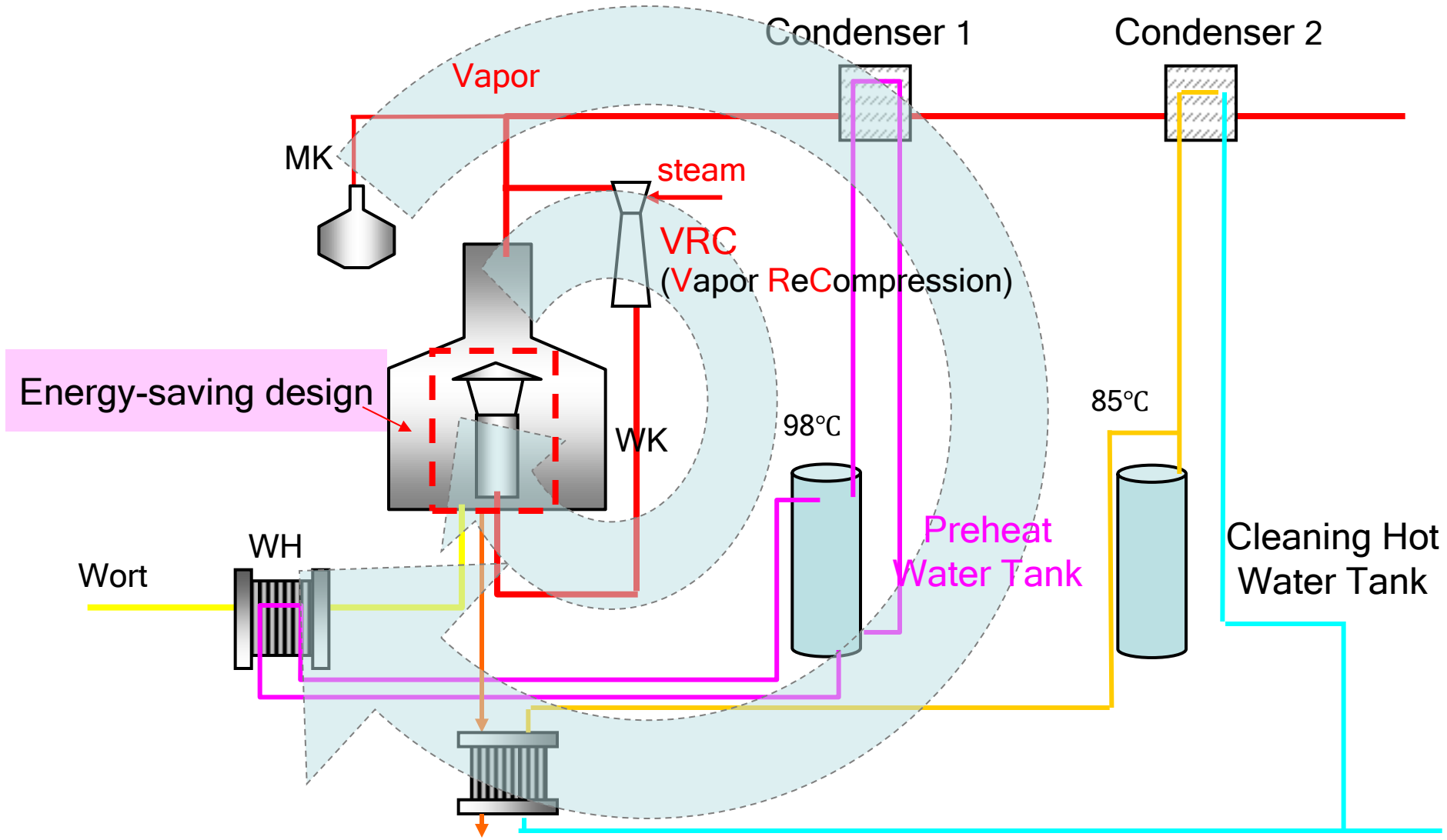


Large Input

Overflow caused by a large quantity of recovered hot water

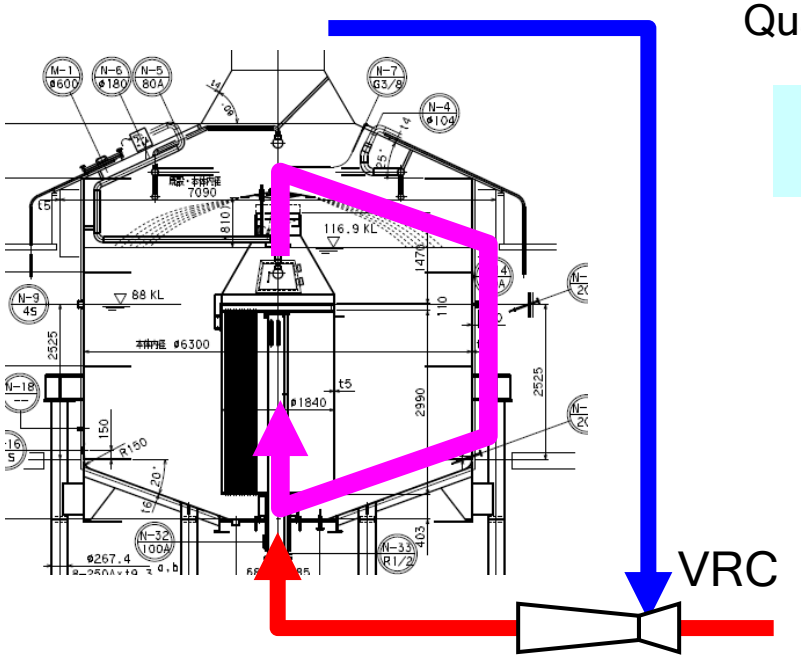
Necessity of heat recovery in each process

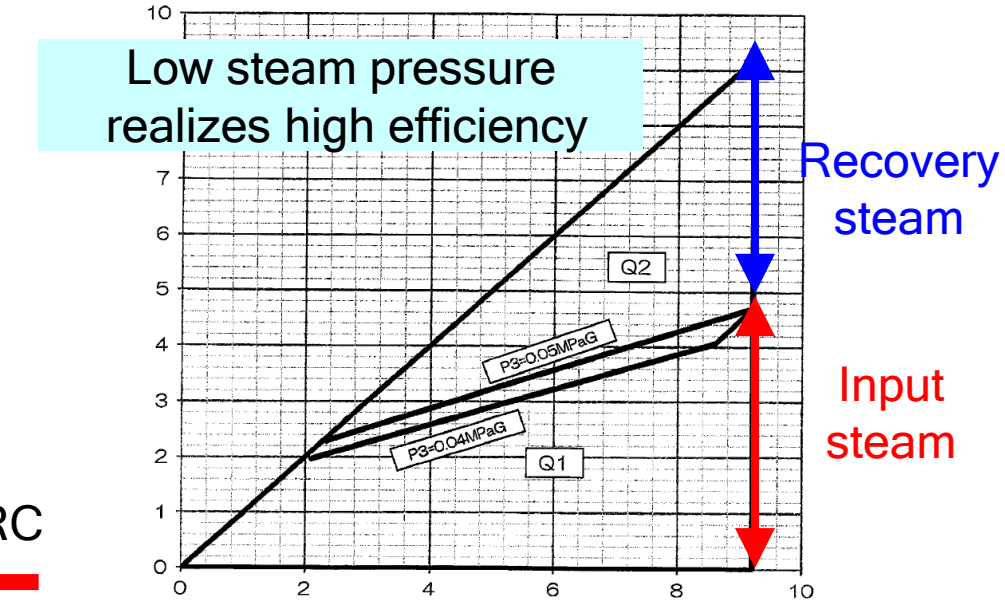
New Boiling Process



Installation of Closed 3-Loop Heat Recovery

Design of Vapor Recompression





Energy Reduction

VRC Efficiency 45～50%
Steam Pressure <0.05MPa

Re-designed the thermal compression and the internal boiler to run with lower steam pressure for higher heat recovery

Evaluation of New Wort Boiling

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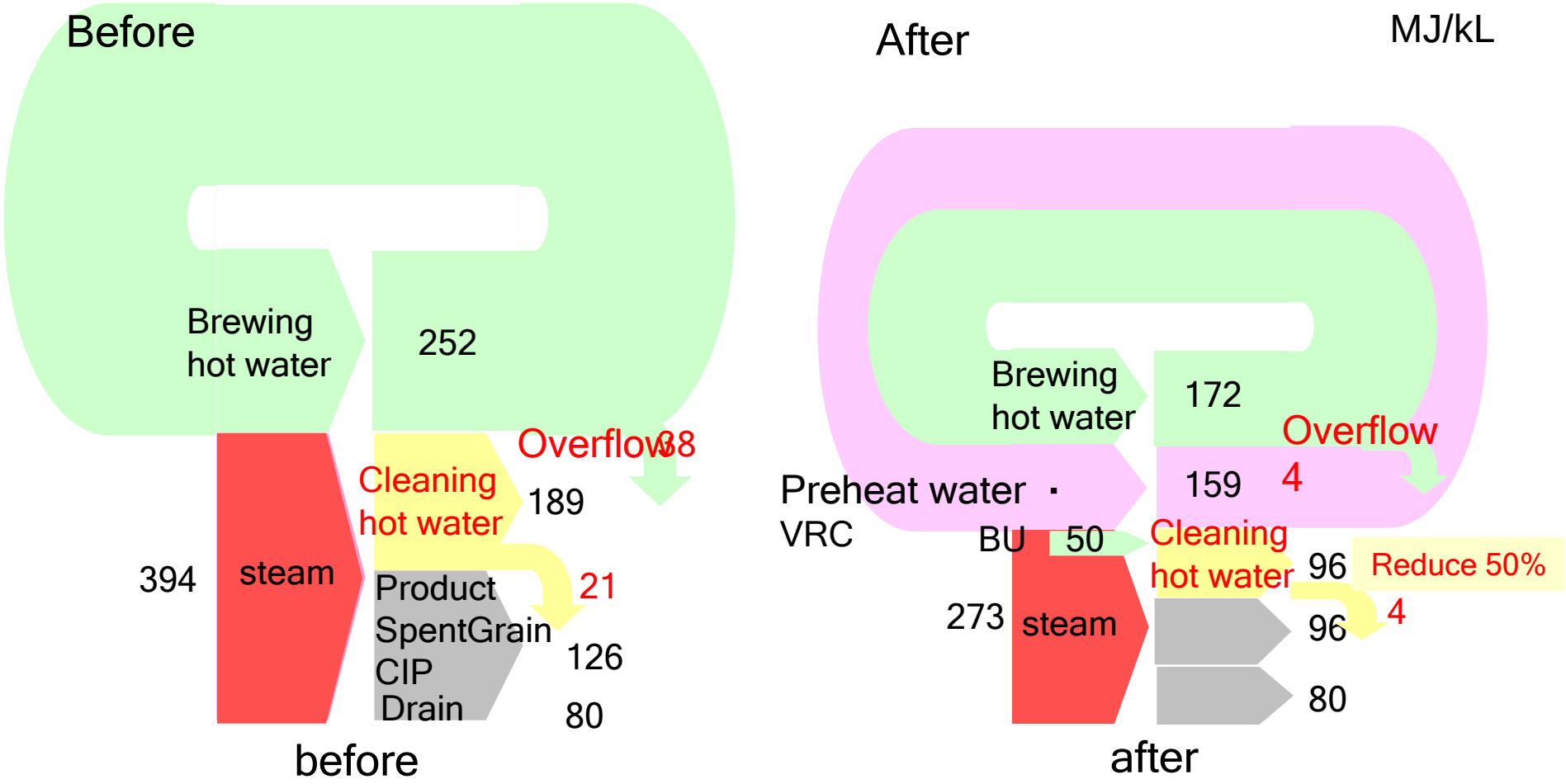

Plan	Preheat water ・VRC	Overflow	Hot water recovery	total
Result	159	50	-92	117

Increasing of heat recovery and Reduction of Overflow

Energy Flow after Step 1

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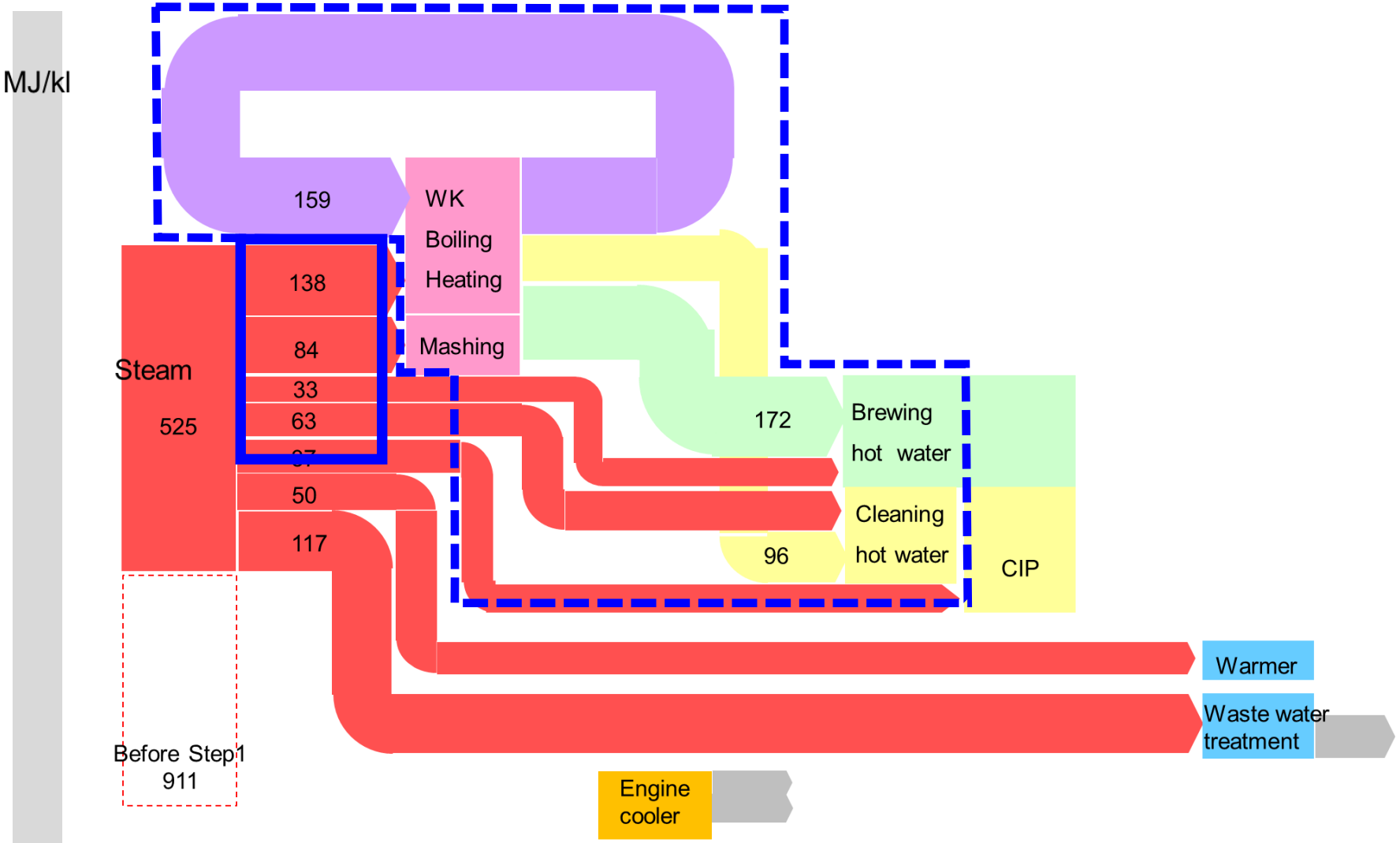
Quantity of heat



Minimization of Heat Input to Wort Preparation

Approach for Energy Reduction

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Step2

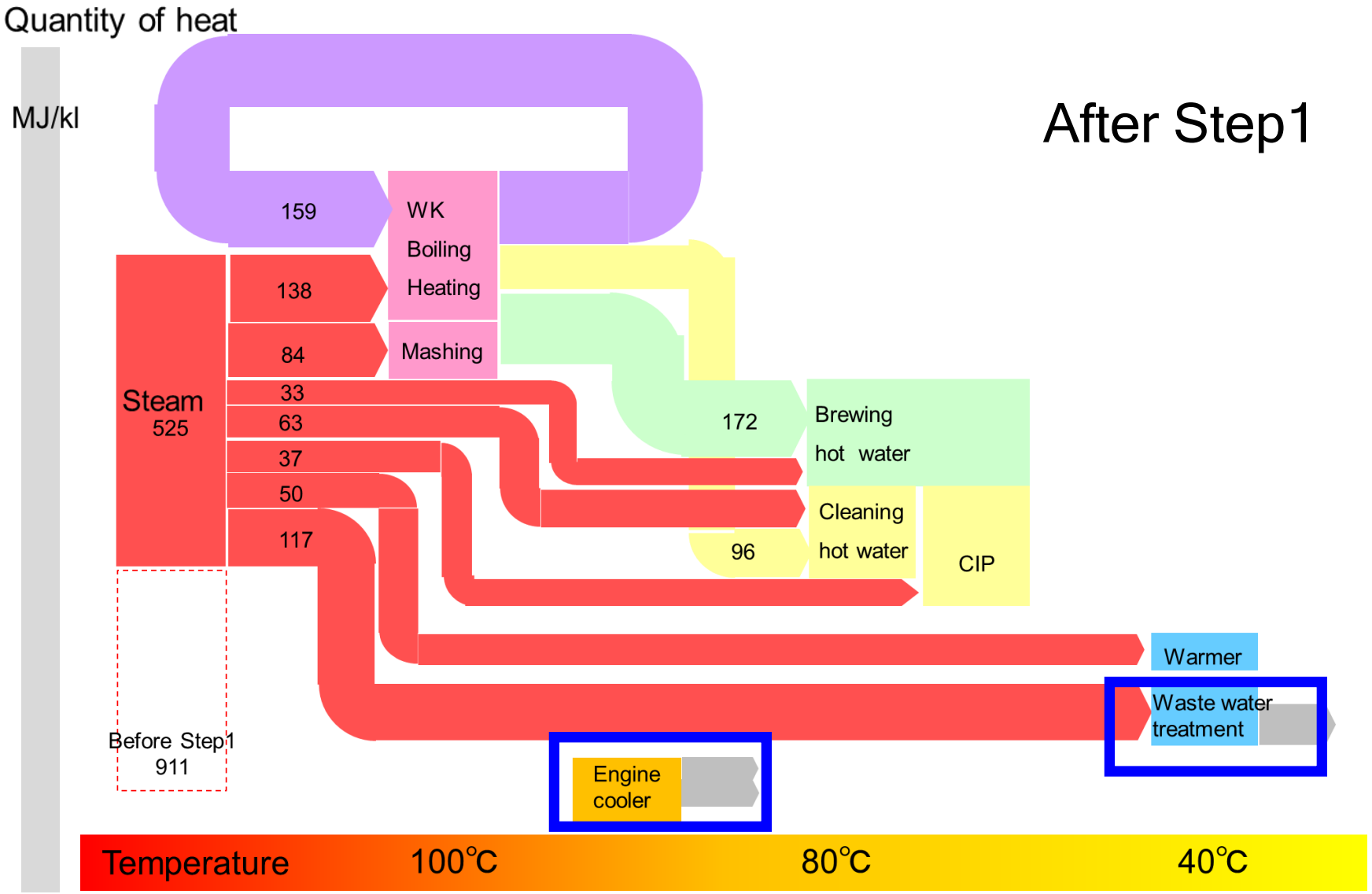
Optimization of Total Energy Recovery

Step1

Minimization of Input Heat to the process

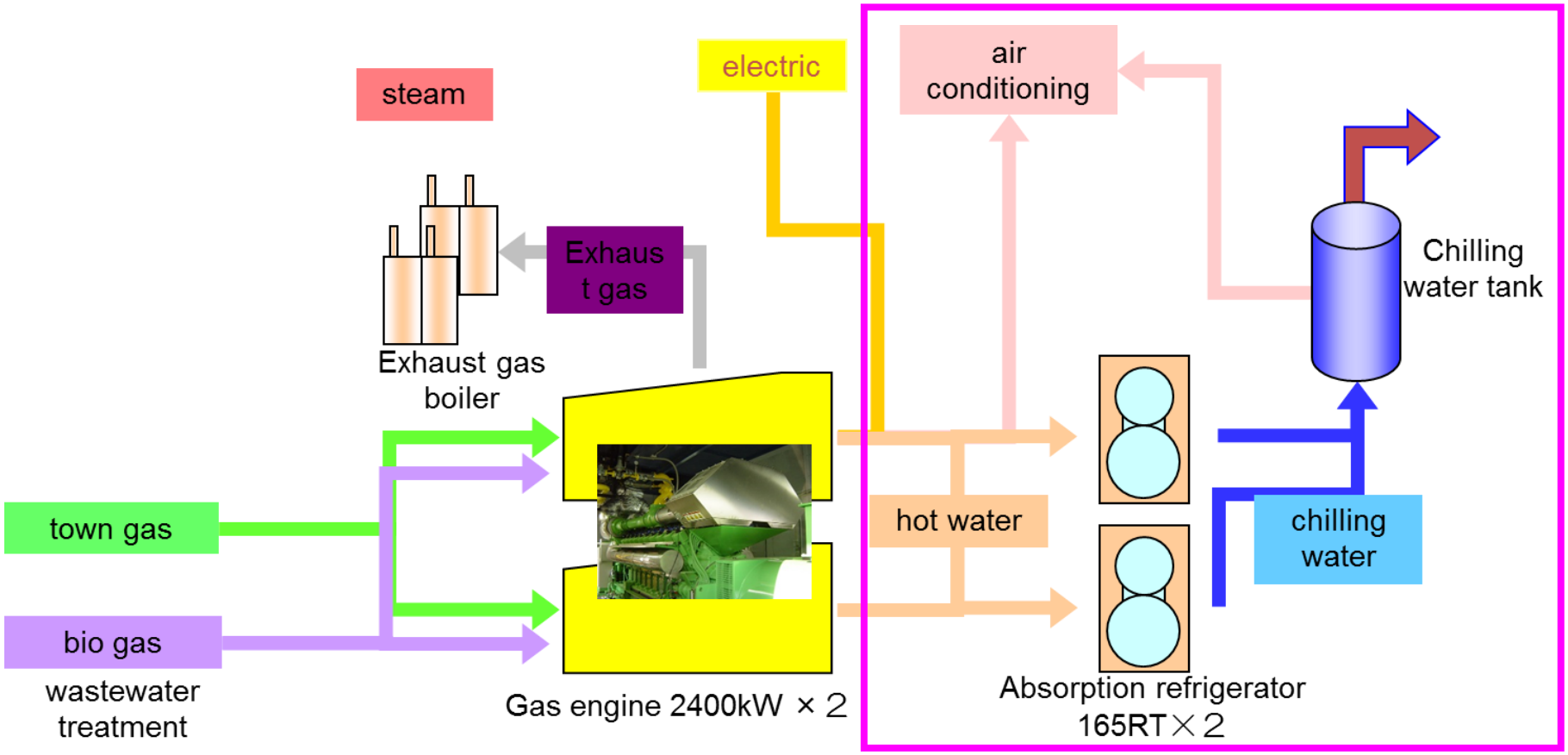
Optimization of Total Energy Recovery

SUNTORY



Optimized recovery of waste heat by heat exchange in sources with close temperature conditions in whole plant

Energy Loss of Trigeneration

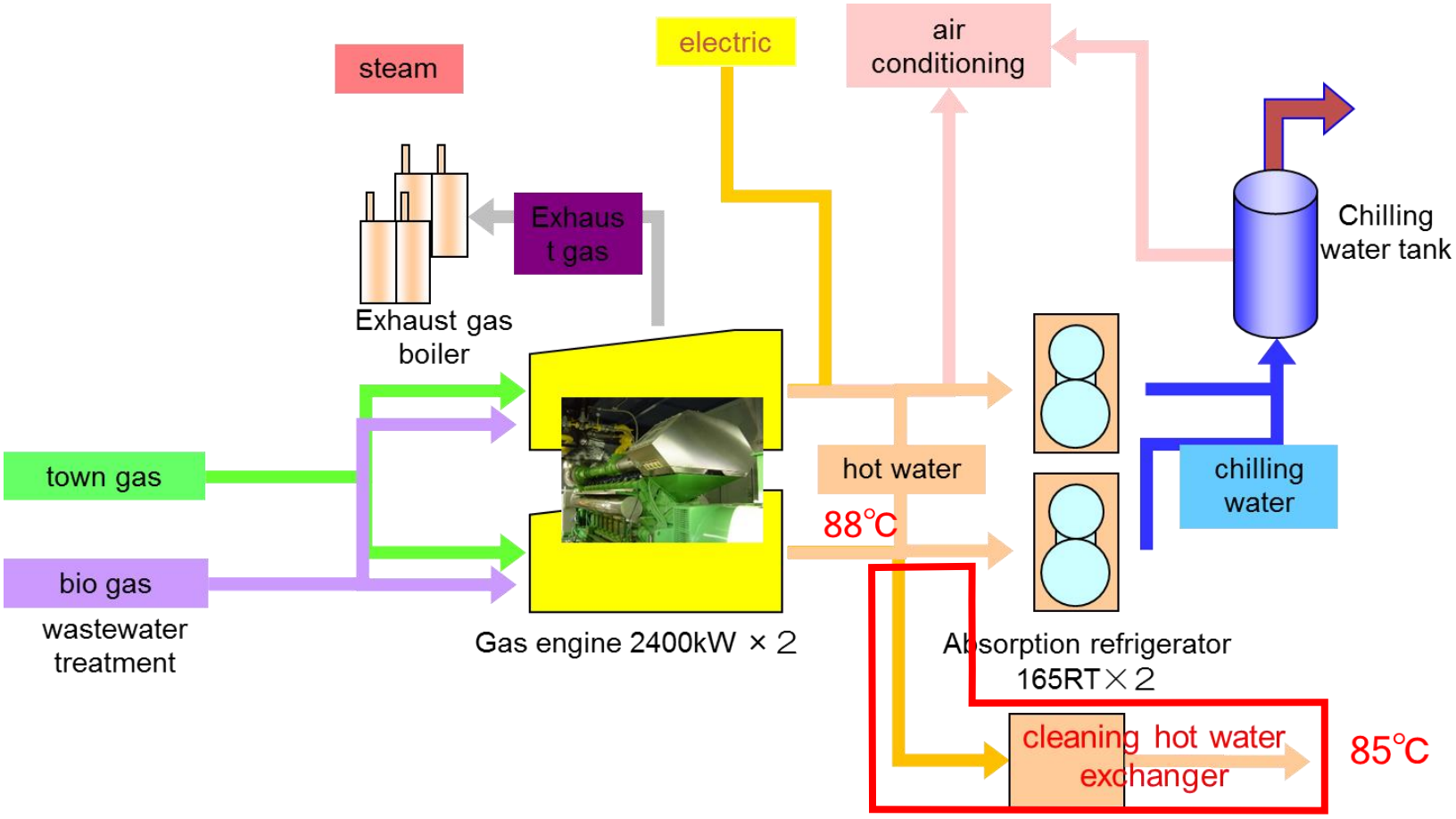


Problems of Absorption refrigerator

- Short operating time - engine cooling water discharged to the atmosphere
- Not good efficiency of the refrigerator （COP=0.66）

Large loss of waste heat utilization from gas engine

New Heat Recovery Exchanger



Exhaust heat of Trigeneration recovered by Cleaning hot water, which means water used at Clean-in-place

- Maximizing the temperature of cleaning hot water
- Balancing the amount of heat usage and recovery

Energy loss of the waste water treatment

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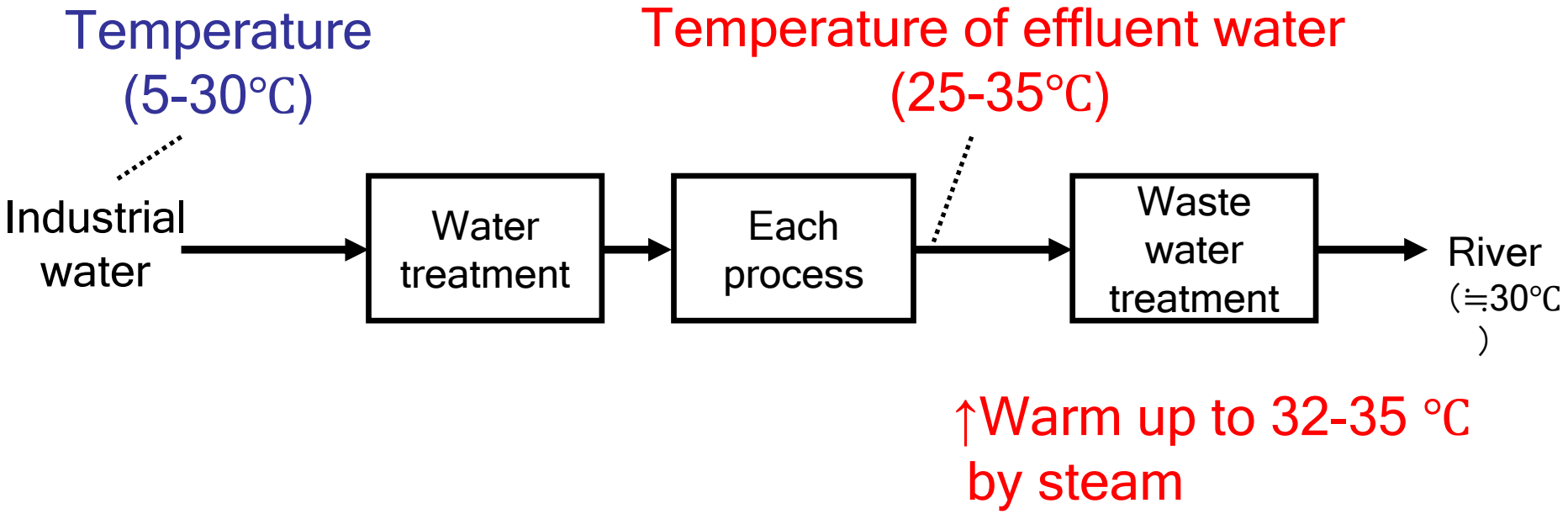
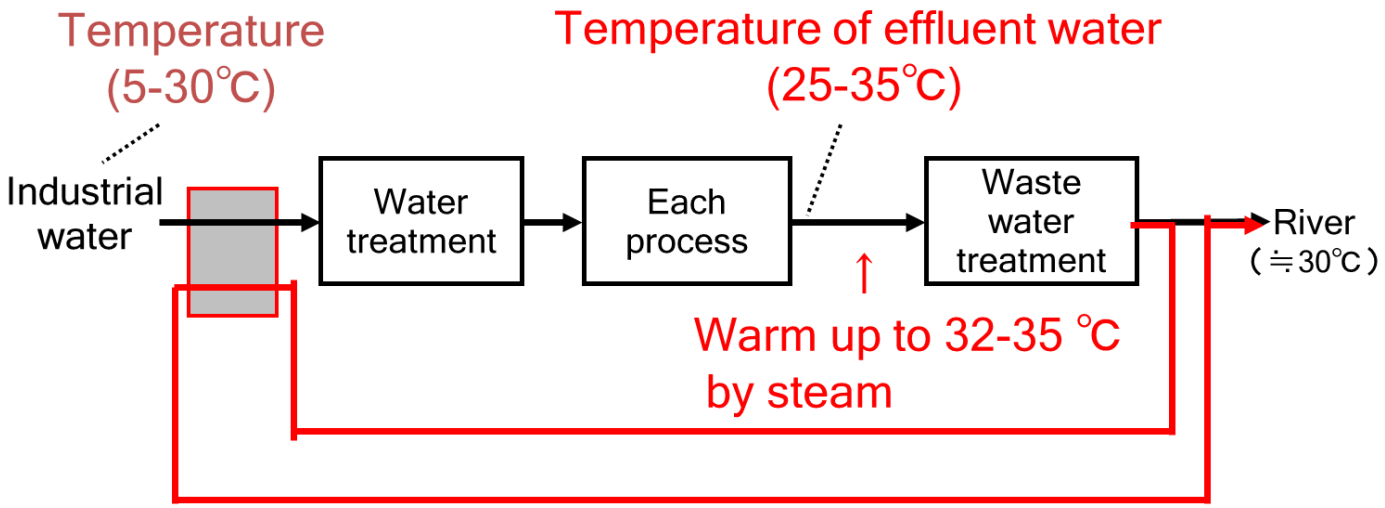


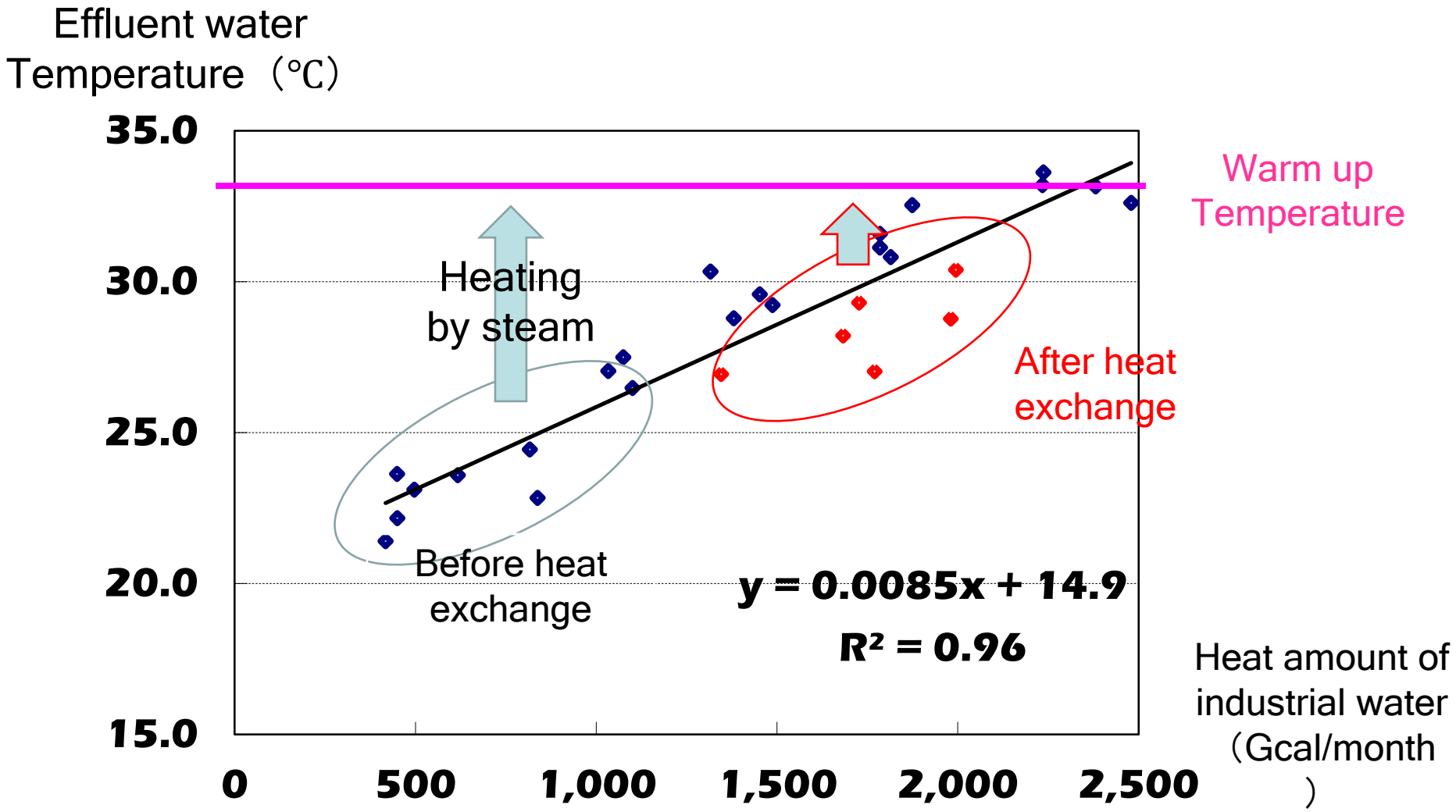
- Processing temperature of Waste water treatment should be kept at 32-35 ℃
- Industrial water with a temperature 5-10 ℃ in winter should be warmed up

Introduction of industrial water heat exchanger



Reduction of Heating steam by heat exchanging between treated wastewater and industrial water

Evaluation of industrial water heat exchanger



Correlation in the heat amount of Industrial water and Effluent water temperature

Energy Flow after Step 2

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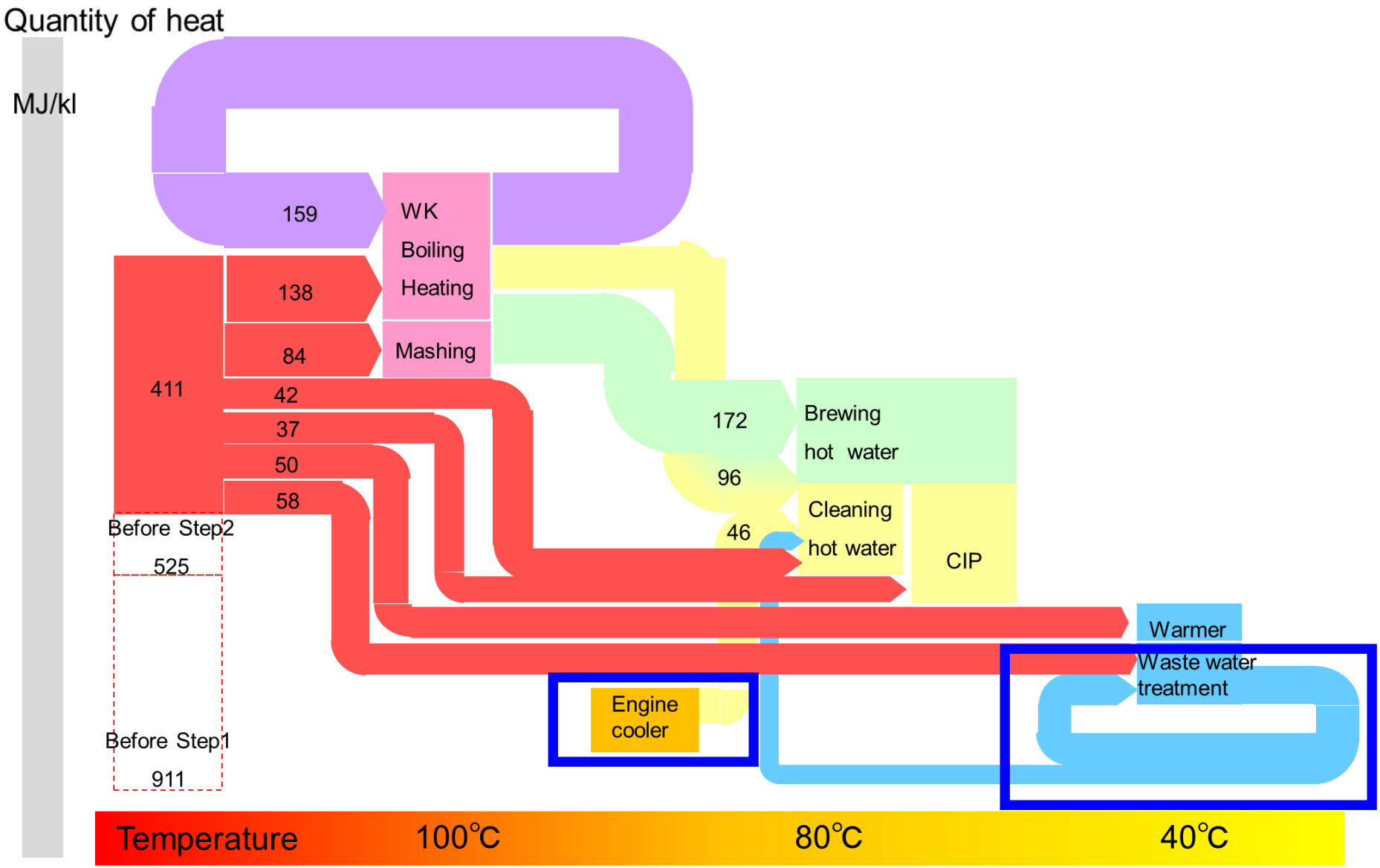

Increasing heat recovery from Trigeneration and Waste water treatment

Summary

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- Consideration by analyzing the energy consumption in the brewery by TQ Analysis
- Installation of a closed 3-loop heat recovery system that can reuse heat in its own process to minimize the input energy
- Maximization of the heat recovery by minimizing the energy loss of between recovered heat and use heat

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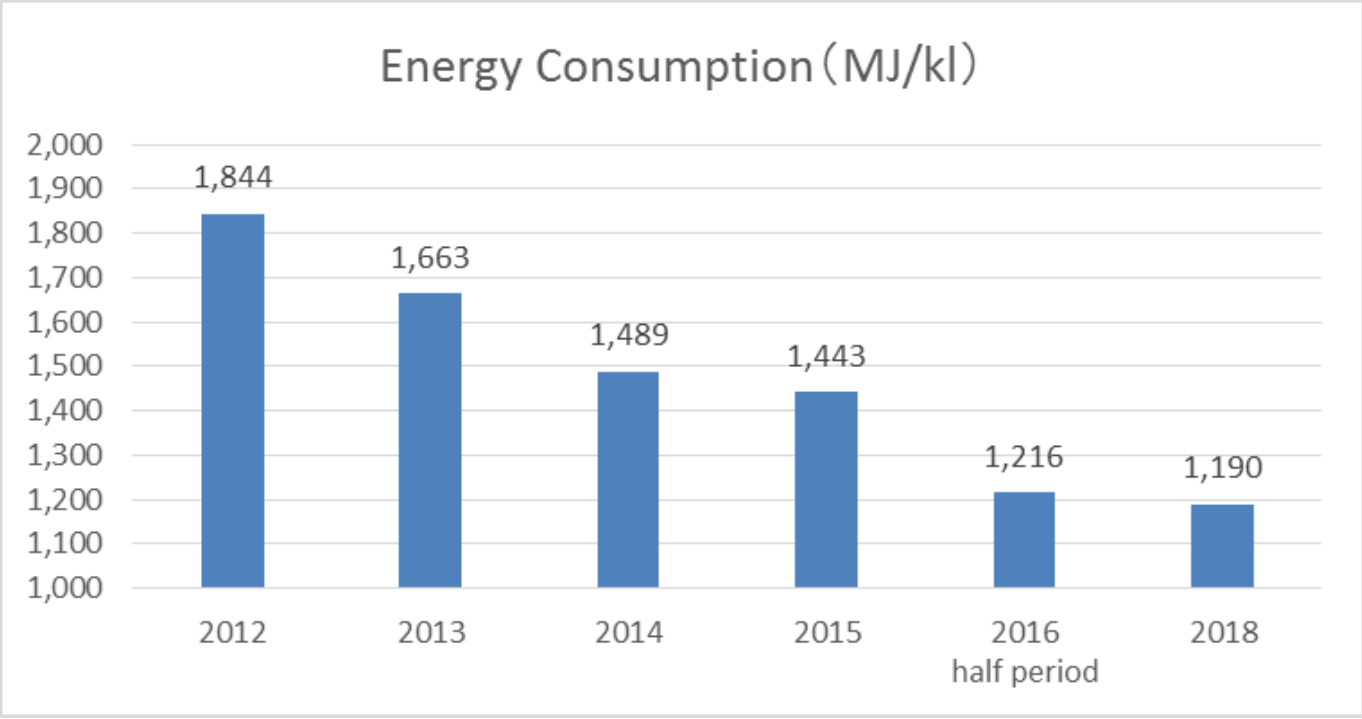
Achieve the target 1,190MJ / kl in 2018

- Adjustment of the entire heat utilization
- Reduction of electric power consumption of air conditioning
- Reduction of electric power by saving water



Thank you for your kind attention!