MITSUBISHI HEAVY INDUSTRIES, LTD.

Our Technologies, Your Tomorrow

Q-ton Air to Water

Commercial use
CO_2 for Air to water heat pump

Europe

UK
Spain

Watford

London

Cádiz

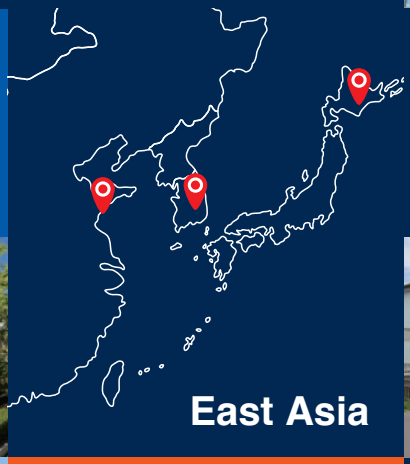
Changwon

Case Examples

Europe & East Asia

Las Palmas de
Gran Canaria

Jecheon



East Asia

Hokkaido

South Korea
Japan
China

Busan

Pohang

Qingdao

MAP

Case Examples

Europe & East Asia

Q-ton Air to Water

Commercial use
CO_2 for Air to water heat pump

Europe

UK

Case Study 01 — Watford

Medical Centre
Colne House
ESA30E-25×1　Tank(1,000L)×1

Case Study 02 — London

Guest Rooms
Lancaster Hall Hotel
ESA30E-25×2　Tank(2,000L)×2

Europe

SPAIN

Case Study 03 — Cádiz

Sport Center
Activa Club Sport Centre
ESA30E-25×2　Tank(4,000L)×3

Case Study 04 — Las Palmas

Hotel
Alisios Canteras Hotel
ESA30E-25×1　Tank(3,000L)×1, (1,000L)×1

East Asia

KOREA

Case Study 05 — Jecheon

Dorm Building
Semyung University
ESA30E-25×1　Tank(1,000L)×1, (10,000L)×1

Case Study 06 — Changwon

Office Building
Doosan Heavy Industries
ESA30E-25×1　Tank(8,000L)×1

Case Study 07 — Busan

Guest Rooms
Busan Business Hotel
ESA30E-25×1　Tank(30,000L)×1

Case Study 08 — Pohang

Dorm Building
Handong Global University
(Kukje) ESA30E-25×2　Tank(4,000L)×2
(Lothem) ESA30E-25×4　Tank(8,000L)×2

East Asia

JAPAN

Case Study 09 — Kamishihoro

Dairy Farming
DreamHill
ESA30-25×1　Tank(500L)×5

East Asia

CHINA

TEST CASE

Case Study 10 — Qingdao

Office Building
MHI-Haier (Qingdao) Air-Conditioners Co., Ltd.
ESA30E-25×1　Tank(8,000L)×1,(3,000L)×1,

Case Study
01

Watford

Colne House

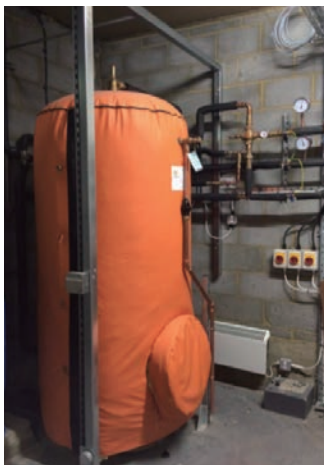
medical centre

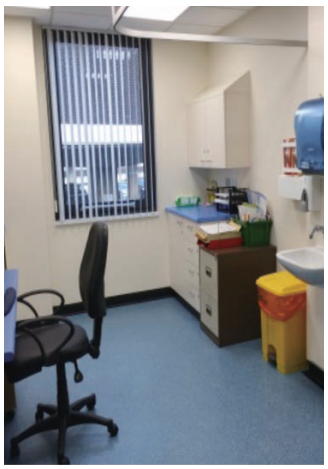
Information

Project:	Colne House, Watford
Project outline:	Sanitary hot water supply & space heating
Installer:	AVC Group of Companies
Products:	MHI 30kw Q-ton system together with 3 pipe KX6 VRF system

sanitary hot water to 15 consulting rooms and 4 treatment rooms

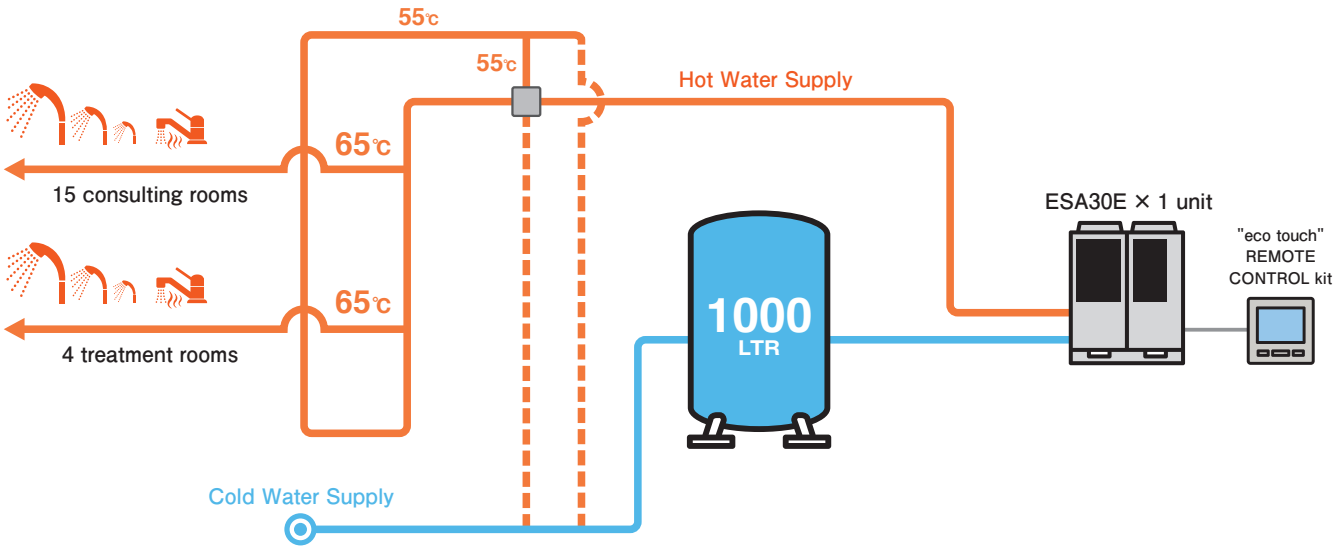
"Colne House" is a brand new medical centre containing two doctors surgeries.
The new Q-ton CO_2 heat pump was installed to provide sanitary hot water to 15 consulting rooms and 4 treatment rooms.
The 3 pipe KX6R VRF system for space heating and cooling comprises of 4 outdoor units feeding 40 indoor fan coils.
The system is centrally controlled by an intelligent touch screen panel for extensive programming for optimal energy efficiency.
Both surgeries are supplied by one 30 kilowatt Q-ton model which is connected to a 1,000 litre stainless steel tank with water stored at 75°C.
The combined system enables low running cost and carbon reductions.





How Q-ton is installed and how it works **System diagram**

ESA30E-25×1　Tank(1,000L)×1



Case Study

02

London

Lancaster Hall Hotel

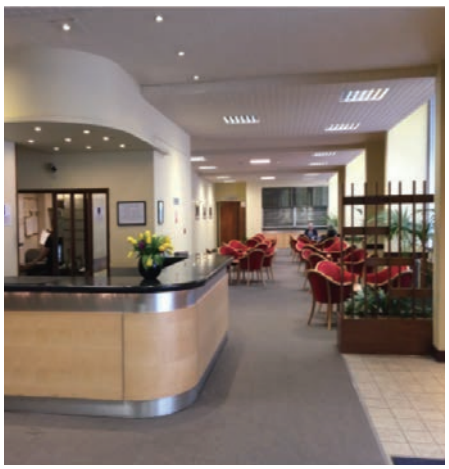
Information

Project:	Lancaster Hall Hotel, London
Project Plan:	Sanitary hot water refurbishment
Products:	Two 30kw Q-ton system
	Two 2,000 litre hot water storage tanks

Guest Rooms

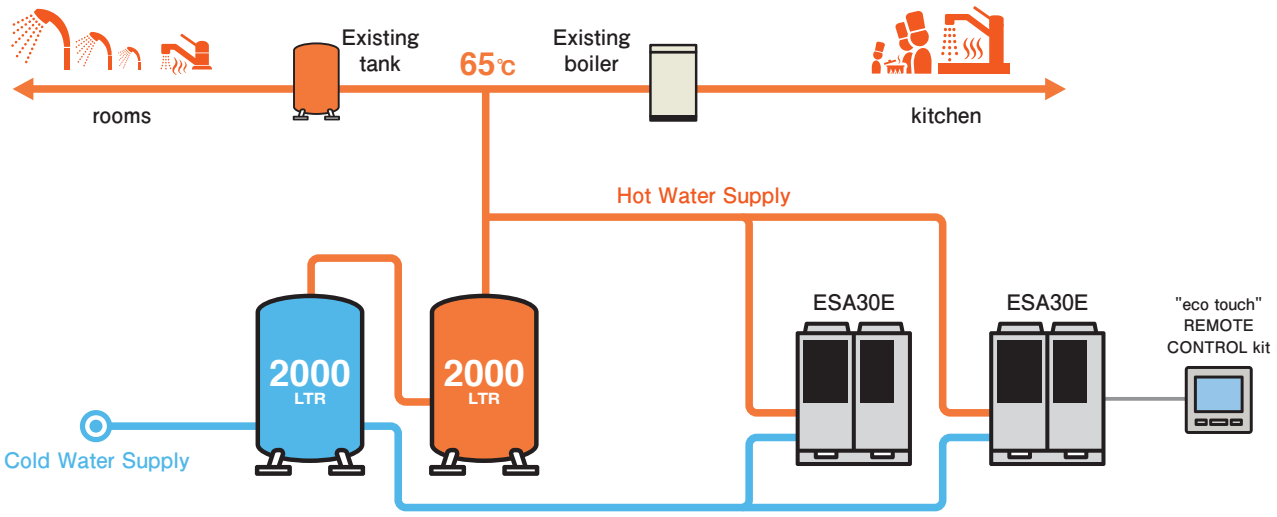
The system is now fully operational and supplies 12,000 litres per day of domestic hot water at 65°C.

The Lancaster Hall Hotel is situated in the heart of London's popular Lancaster Gate & Bayswater which attracts many tourists and business travellers.
In order to make sure Lancaster Hall Hotel can accommodate sanitary hot water efficiently for all of their customers, MHIAE connected two Q-ton to two 2,000 litre hot water storage tanks.
The hotel consists of two separate boiler rooms with completely segregated hot water and heating systems utilising five boilers running at different pressures in order to cater for 250 people on site.
The system is now fully operational and supplies 12,000 litres per day of domestic hot water at 65°C.
The hotel is now saving up to 40% running costs reductions compared to their existing boiler and 45% savings on carbon emission.
Mitsubishi supplied an effective solution improving quality and comfort to their client. Q-ton ticked all the boxes and contributes to substantial running cost and carbon emission savings.



How Q-ton is installed and how it works **System diagram**

ESA30E-25×2 Tank(2,000L)×2



SPAIN Europe

Case Study
03

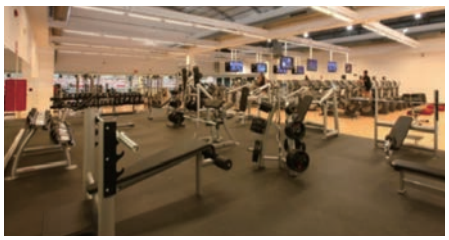
Cádiz

Activa Club Sport Centre

Information

Project:	Activa Club Sport Centre, Bahía Mar Commercial Centre, Santa María Port (Cádiz)
Project Plan:	Installation to provide domestic hot water to showers and locker rooms
Products:	Two 30 kW Q-ton units One 4,000 litres accumulator installed indoors

hot water circuit

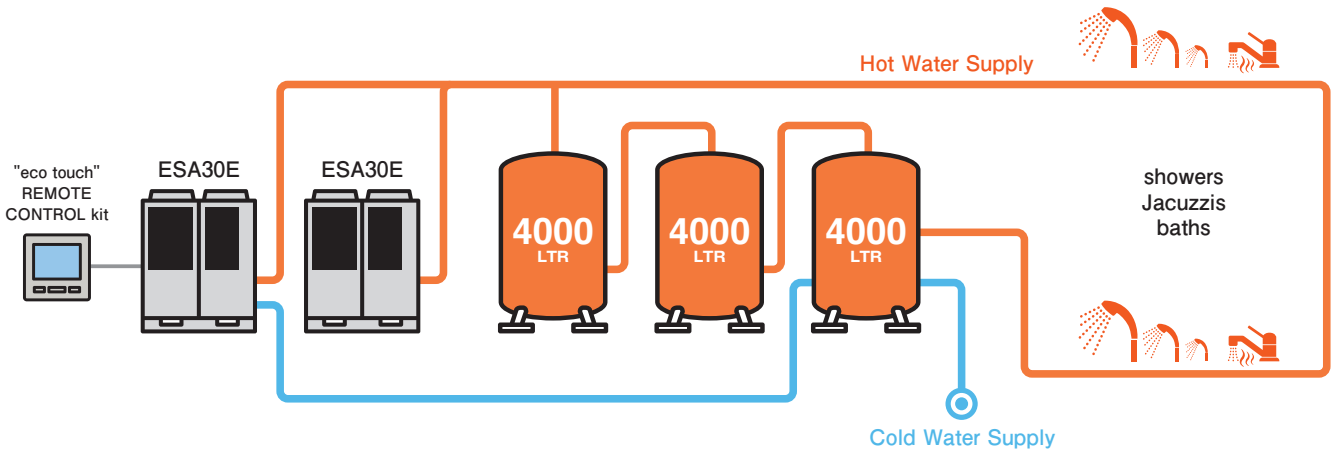


home showers, cold water pools, Jacuzzis, essence showers, revitalising showers, and Turkish baths

The Activa Club Sport Centre is a place where the three great areas of sport, health and relaxation come together, with the utmost professionalism and comfort.
Facilities of 3,000m² with equipment of the latest technology, exercise rooms and a hot water circuit.
Given the high demand for DHW derived from the hot water circuit, which features home showers, cold water pools, Jacuzzis, essence showers, revitalising showers, and Turkish baths, they sought a highly efficient system with a quick return of investment. This was the main reason why they chose the Q-ton system.
The installation comprises two Q-ton modules and a accumulator of 4,000 litres supplied by MHI, and 8,000 litres in a conventional water tank, to meet the sport centre's demand of 13,500 litres/day.
Both, the Q-ton modules and the accumulators were installed indoors. The Q-ton system offers the possibility of both, an indoor or outdoor installation, allowing greater versatility and flexibility to meet the project's needs.
The system supplies domestic hot water at 60°C, and storages it at 65°C.
The average COP of the installation is 4.42, achieving estimated annual energy savings of 80% compared to a gas boiler. The forecasted savings of CO_2 emissions is of 94%. The estimated return of investment of this product is less of a year (compared to a gas boiler) and afterwards, everything will be savings.

How Q-ton is installed and how it works **System diagram**

ESA30E-25×2　Tank(4,000L)×3



Case Study

04

Las Palmas

Alisios Canteras Hotel

Information

Project:	Alisios Canteras Hotel, Las Palmas de Gran Canaria
Project Plan:	Installation to supply the hotel with Domestic Hot Water
Products:	One 30 kW Q-ton unit
	One 1,000 litres accumulator installed indoors

Guest Rooms

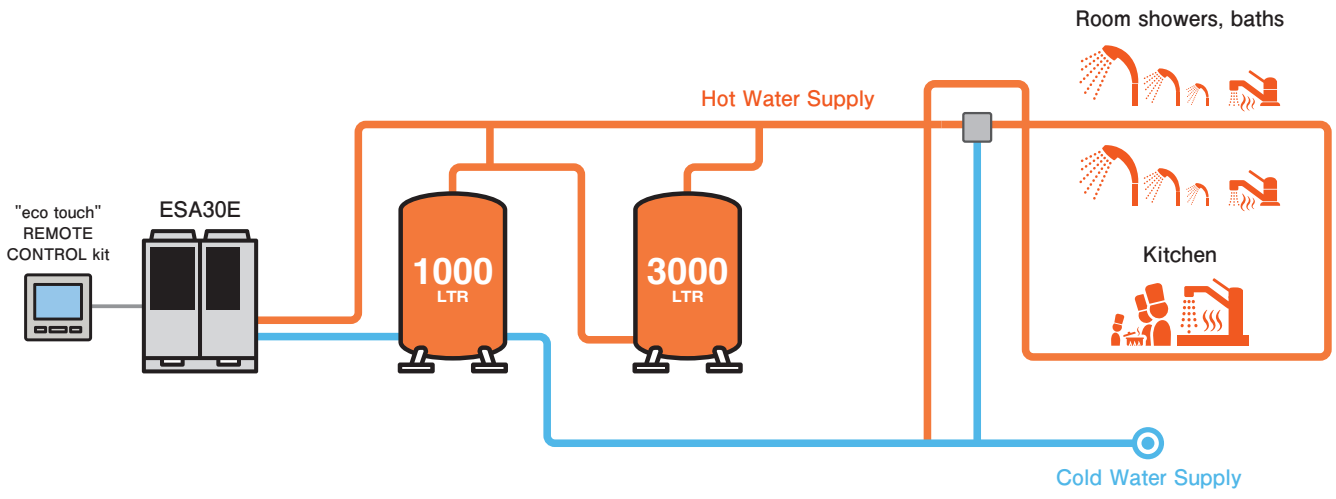
Owner's Voice

"I was looking for an efficient solution in harmony with our philosophy of respect for the environment, but also attractive in annual consumption and savings. I recommend MHI's Q-ton system to any hotel that takes into account these premises."

The Alisios Canteras hotel is located in Playa de las Canteras, on the island of Las Palmas de Gran Canaria, in surroundings ideal for contemplating an unmatchable sunset or for enjoying the clemencies of an average temperature of 21°C. It is a 3 stars hotel with 130 beds.
In order to renew the domestic hot water (DHW) system of the hotel, and prioritizing it's energy efficiency, a Q-ton module was installed along with a 1,000 litres accumulator and a 3,000 litres conventional tank, to meet the hotel's demand of 5,740 litres/day. The former DHW system consisted of a gas boiler.
The installation took place on the roof of the hotel, placing the Q-ton module outdoors given it's flexibility to be installed indoors or outdoors, and the accumulator was installed in a covered area in order to protect it a little bit more.
The Q-ton module has a blue-fin coating that protects the unit from corrosion and saline environments, a key factor for coastal areas or, in this case, in the Canary Islands. The system supplies domestic hot water at 60°C.
The average COP of the project is 4.71, achieving energy savings of 64% against the system previously installed: a gas boiler. The savings in CO_2 emissions represents 41%. The return of investment of this system is expected to be in less than a year (when compared to the gas boiler previously installed), and after that, everything will be savings.

How Q-ton is installed and how it works **System diagram**

ESA30E-25×1　Tank(1,000L)×1, (3,000L)×1



Case Study
05
Jecheon

Semyung University

Name: Semyung University (Yeji)
Address: 579 Sinwol-dong Jecheon-City Chungbuk

Introduction to Installation Facility

This university is built on a site of approximately 562,000m² and accepts approximately 8,640 students.
Under the guiding spirits of TRUTH, CREATIVITY, and SERVICE, this university, with six departments and 23 faculties, aims to cultivate people who will benefit society as well as develop the country and the world.

Dorm Building

How Q-ton is installed and how it works

System diagram

Hot water supply system installation date: February 2015

ESA30E-25×2 Tank(1,000L)×1, (10,000L)×1

Use application: Hot water supply to shower
Dorm Building area: Yeji: 2,272m²

Assigned to hot water supply in the dorm

Case Study
06
Changwon

Doosan Heavy industries & Construction

Name: Doosan Heavy industries (Main office)
Address: 22, Doosan volvo-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, Korea

Introduction to Installation Facility

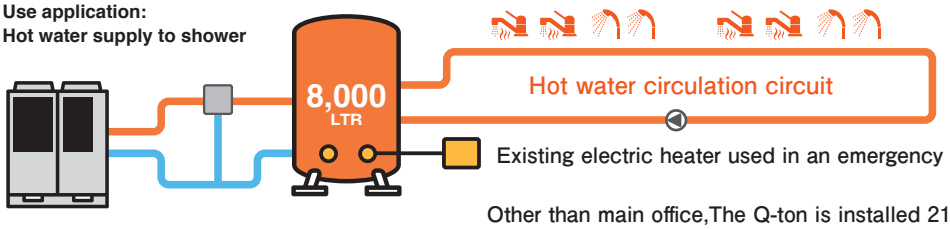
Doosan Heavy Industries is a leading company engaged in production of electric power facilities, plant facilities, infrastructure facilities, parts of large-scale transportation equipment, and seaport crane mechanisms.
The company's nuclear power business with its advanced technology related to pressurised-water reactors is famous in Japan, too.
Doosan Group comprises Doosan Infracore, Doosan Engine and other companies.

Office Building

How Q-ton is installed and how it works **System diagram** Hot water supply system installation date: October 2014

ESA30E-25×1 Tank(8,000L)×1
Use application:
Hot water supply to shower

Building area: Approximately 2,317m²



Other than main office,The Q-ton is installed 21 in total in 6 factories, 2 office buildings, 2 domitories, Learning center, Guest house.

Case Study
07
Busan

Busan Business Hotel

BUSAN BUSINESS HOTEL

Name: BUSAN BUSINESS HOTEL
Address: 67 Bujeon-ro Busanjin-gu Busan

Introduction to Installation Facility

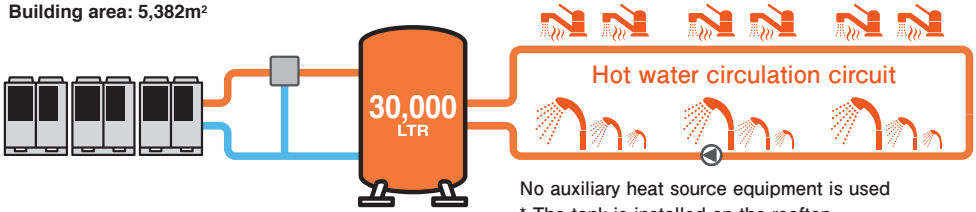
A new business hotel located in Seomyeon, a large town in Busan. This location offers easy access to sightseeing areas along with local amenities including tax-free shops, casinos, department stores, shopping centres and restaurants.

Guest Rooms

How Q-ton is installed and how it works **System diagram** Hot water supply system installation date: April 2015

ESA30E-25×1 Tank(30,000L)×1
Use application: Hot water supply in hotels
Building area: 5,382m²

Number of guest rooms: 234



Newly installed tank

No auxiliary heat source equipment is used
* The tank is installed on the rooftop.

Case Study
08
Pohang

Handong Global University

Name: Handong Global University (Kukje, Lothem)
Address: 558 Handong-ro Buk-gu, Pohang Gyeongbuk

Introduction to Installation Facility

Handong University, built on a site of approximately 223,442m², has 14 departments and approximately 4,400 students.
This university educates 21st century leaders of Korea and the world with the goal of growing to be a "Global Leadership University" capable of transforming the world.

(Kukje) Dorm Building

ESA30E-25×2　Tank(4,000L)×2

(Lothem) Dorm Building

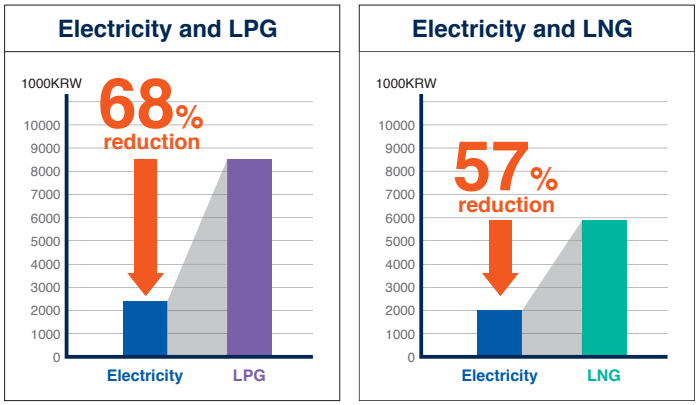
ESA30E-25×4　Tank(8,000L)×2

Introduction of Remote Monitoring System

(Kukje) Dorm Building

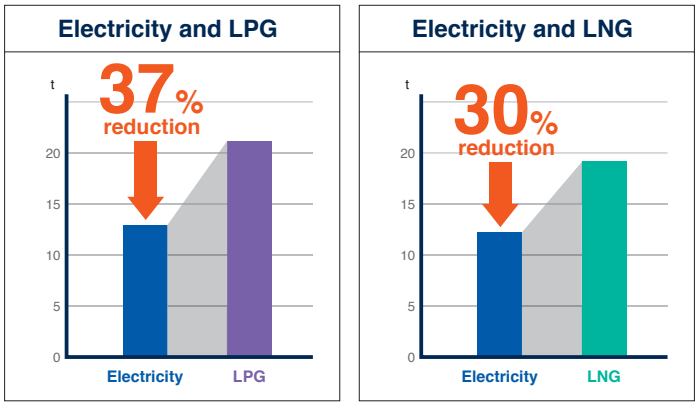
Cost comparison

from July to September 2015



CO_2 emissions

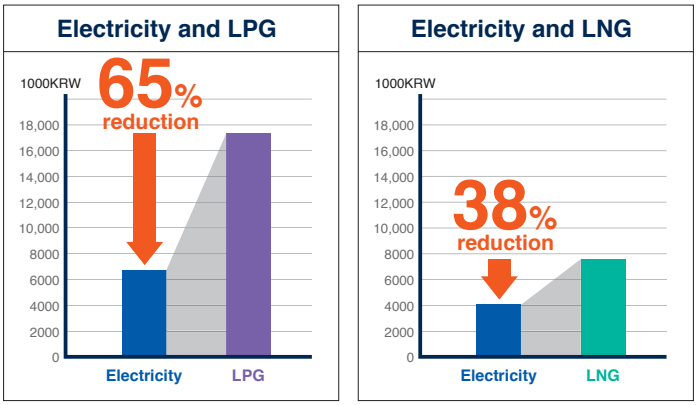
from July to September 2015



(Lothem) Dorm Building

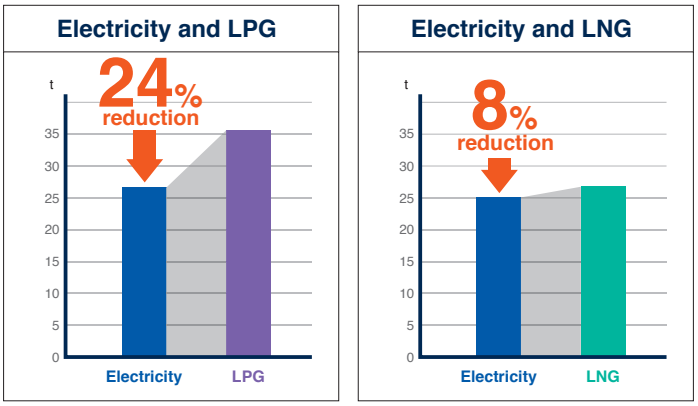
Cost comparison

from July to September 2015



CO_2 emissions

from July to September 2015



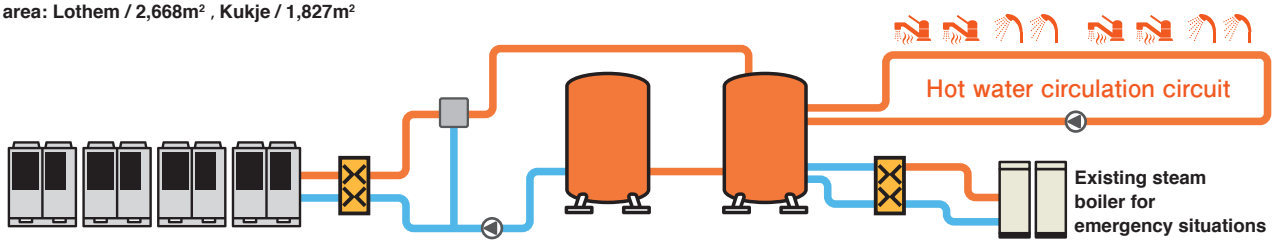
How Q-ton is installed and how it works

System diagram

Hot water supply system installation date: February 2015

Use application: Hot water supply to shower
Building area: Lothem / 2,668m², Kukje / 1,827m²

Assigned to hot water supply in the dorm



Classification	Current state of equipment		Remarks
Current state of main equipment	Q-ton	Lothem : 30 KW x 4 units Kukje : 30 KW x 2 units	Occupancy load Lothem : 600 people Kukje : 278 people
	Hot water storage tanks	Lothem : 8,000L x 2 Kukje : 4,000L x 2	Existing hot water tanks are used.
	Heat exchangers	Lothem : 30,000Kcal/h x 4EA Kukje : 30,000Kcal/h x 2EA	Applied to heat exchangers because groundwater is used.
	Circulation pumps	Lothem : 20 LPM x 4 units Kukje : 20 LPM x 2 units	For circulating hot water with heat exchanger

JAPAN East Asia

Case Study
09

Kamishihoro
Hokkaido

Daily Farming

"DreamHill"

Information

Project:	DreamHill, Kamishihoro-cho Hokkaido
Project outline:	Supply 65°C hot water to clean the facility
Installer:	ESA30-25 x 1 unit, cylinder tank (500L) x 5, "eco touch"" REMOTE CONTROL x 1

Dairy farming facility

Cost reduction plan and objectives

"Qton for commercial use was introduced to reduce the load on the boiler when in full operation, and to use as a measure against ageing of the boiler. As a result, significant cost reductions were achieved."

"Producing hygienic, delicious milk. One of the largest dairy farms in Japan with leading-edge dairy technology."

Milking is an important process in the production of hygienic great-tasting milk. For stable and efficient production, a rotary milking machine called a "Rotary Parlour" was introduced in the milking parlour. The equipment can milk 50 cows at a time. At this farm, 1,400 cows are milked three time a day. The Q-ton plays an important role in cleaning the milking equipment, which is an essential step, inside the milking parlour

● Address : 277 Oribe Higashi 7-sen, Kamishihoro-cho, Kato-gun, Hokkaido
● Total size of breeding area : 650 ha ● Number of cattle being raised : 1,710

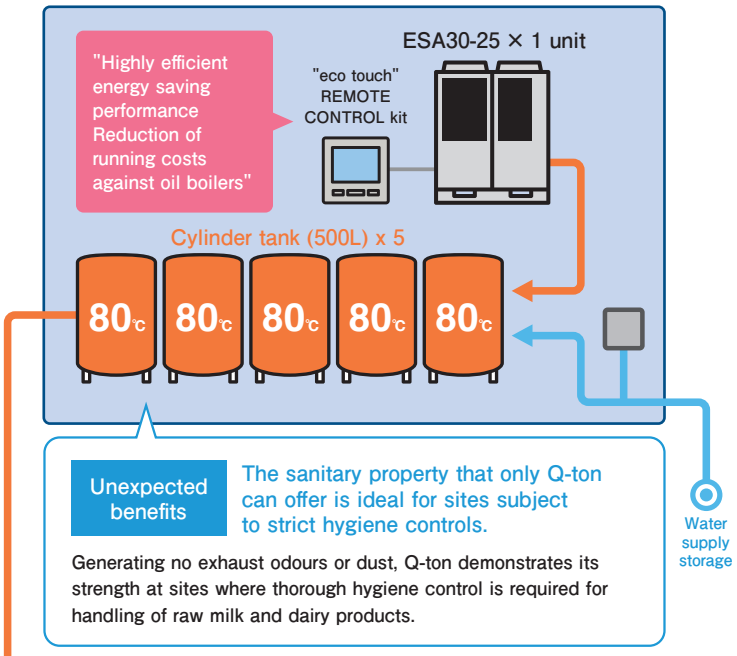
"Kamishihoro-cho is located in the northern part of Tokachi Region. It is at the east foot of a mountain in the majestic Daisetsuzan National Park, the largest national park in Japan. ""DreamHill"" is about 15-minutes drive from Kamishihoro-cho town hall.
It is one of the largest dairy farming facilities in Japan with vast 650 ha grounds and 1,700 cows in a lush green region preserved for agriculture and dairy farming. In May 2013, the farm opened ""Ice Factory Dream"", an outlet for the public to visit to try icecream and cakes produced from fresh milk."

Number of cows milked per day:
approximately
1,400

System diagram

"Steady supply of hot water 24 hours a day, any time of day or night. Used in large dairy farming facilities to clean equipment and inside the milking parlours, the system plays an important role in the technically advanced production plant. This also is key in reducing running costs."

Newly installed facility



Unexpected benefits

The sanitary property that only Q-ton can offer is ideal for sites subject to strict hygiene controls.

Generating no exhaust odours or dust, Q-ton demonstrates its strength at sites where thorough hygiene control is required for handling of raw milk and dairy products.

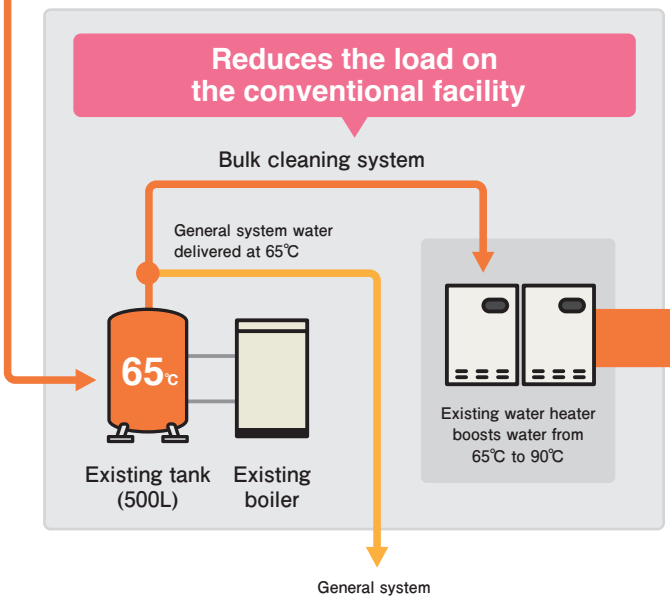
System: Q-ton + existing heavy oil boiler for hot water

"In this facility, one Q-ton ESA30-25 unit and five cylinder tanks (500 litres) were installed in September 2013. Connecting them with the existing 500 litre tank made it possible to store sufficient amounts of hot water, easing the burden on the boiler that was running at full capacity. Installing Q-ton made it possible to supply a steady supply of hot water while at the same time improving the reliability of facility maintenance. A key point was that Q-ton dispelled any concerns that hot water could not be supplied during a breakdown. In addition, Q-ton's high efficiency and energy-efficient performance drastically reduced running costs– by two thirds of what it was before. A support service contract for Q-ton is being considered in order to ensure seamless operation as Qton is seen as business critical."

Running costs

reduced by two thirds of previous amount

Existing facility



Milking facility

"Rotary parlour" that milks 50 cows.
It takes about 10 minutes to rotate once.

90℃

Supply hot water to clean the facility

Milking machine used in the rotary parlour

As milking parlours operate around the clock, a steady supply of hot water, and temperature control, are required. Traditionally, hot water from a boiler (fuelled by heavy oil) was used to clean milking machines and milking parlours. However, due to the rising price of crude oil and ageing boilers.The risk of problems and failures was increasing. The company decided to install Q-ton to modernise the parlour operation.

MHI-Haier (Qingdao) Air-Conditioners Co., Ltd.

Information

Project:	Mitsubishi Heavy Industries-Haier (Qingdao) Air-Conditioners Co.,Ltd.
Project Plan:	Dining-room,Shower room
Products:	One 30 kW Q-ton unit One 8,000 litres storage tank, One 3,000 liters storage tank

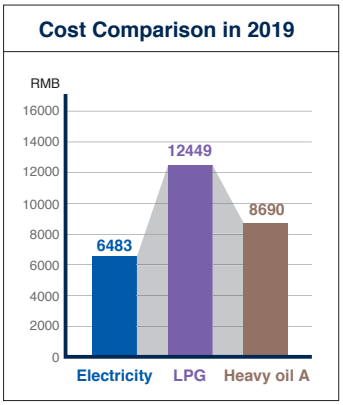
Dining-room,Shower room

Q-ton using the electricity contributes to energy saving than a boiler using heavy oil A and LPG.

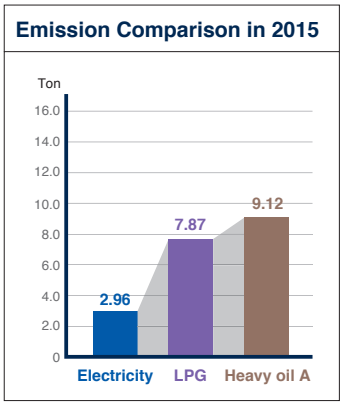
Founded in Tsingtao China, in 1993 as a joint company with Haier Group, the largest Chinese electric home appliance manufacturer, to meet the increasing domestic demand in China. Manufactures and sells commercial use air-conditioning machinery.
Q-ton was installed for the hot-water supply of a dining-room and a shower room.
Q-ton using the electricity contributes to energy saving than a boiler using heavy oil A and LPG.

Comparison

Comparison of energy fare with alternative energy

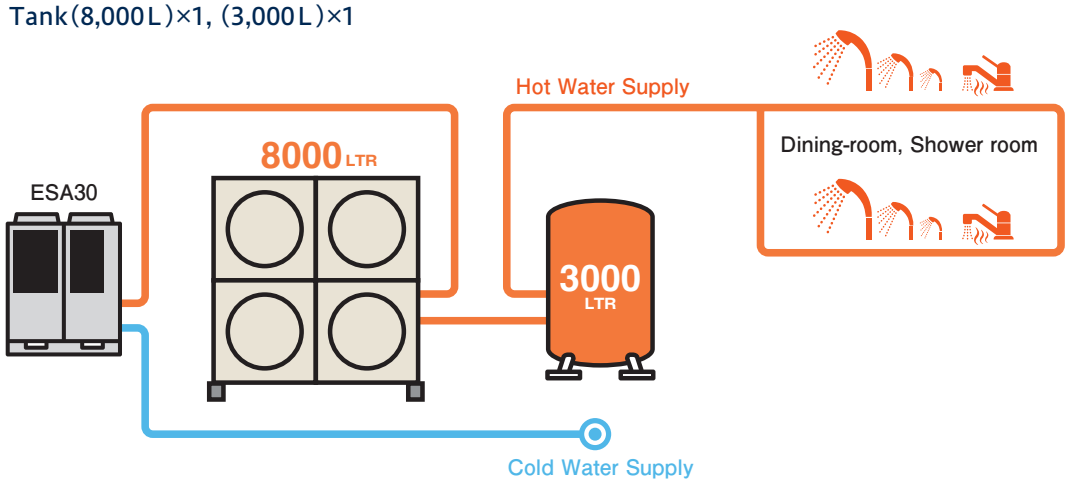


Comparison of carbon dioxide emissions



How Q-ton is installed and how it works **System diagram**

ESA30E-25×1 Tank(8,000L)×1, (3,000L)×1



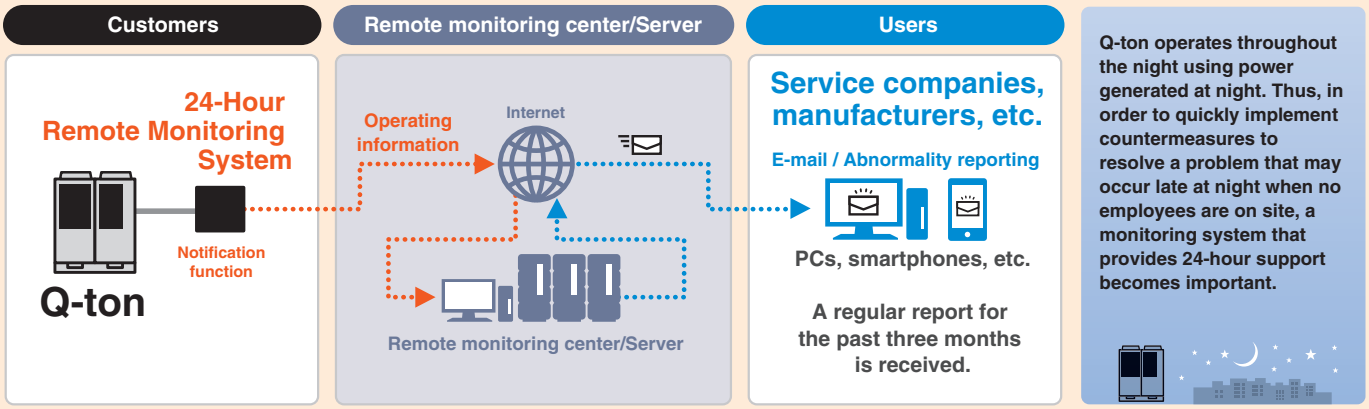
Option

Unique to Q-ton

24-Hour Remote Monitoring System

Mitsubishi Heavy Industries' unique monitoring system monitors the operation status of customers' equipment 24 hours a day, 365 days a year.

Should a problem occur on the equipment, this system enables you to immediately understand the operation status and quickly implement countermeasures.



Note) The 24-hour remote monitoring system does not support the following two functions depending on the area. Please contact our person in charge.
・Activation of abnormality alarms ・Abnormality prediction function

Customers' benefits

1 Customers can receive support for energy-saving operations.

Customers can receive proposals on an optimum hot water storage schedule to eliminate excess and deficiency, and also receive periodic reports on power consumption and the equivalent monetary value of energy-saving effects.

2 Customers can receive proposals about failure prevention measures and maintenance of the equipment based on the data obtained from 24-hour monitoring.

We make proposals on maintenance as needed based on the equipment's operation status data that is collected on a continual basis by the monitoring system.

The monitoring system monitors the discontinuance of system protection functions and the presence/absence of the protection and control functions.

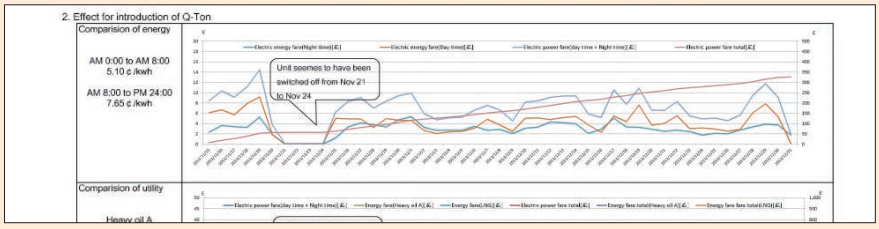
The system monitors the operation status and whether any problems have occurred on elemental components such as compressor, water pump and fan motor.

The system monitors the water heat exchange performance.

3 E-mail warnings and provision of operating data enable you to make appropriate responses faster.

The system monitors the operation status on an ongoing basis and, if any abnormalities are detected, activates an alarm over the Internet. Understanding the operation status beforehand enables you to carry out restorative steps sooner.

Report on Effects of Introduction



- Table showing changes in electricity charges
- Comparative table of fuel and light expenses
- Comparative table of CO_2 emissions
- Table of operating time and period
- Trends in electricity bills and economic effects
- Trends in CO_2 emissions and effects of reduction
- Trends in electricity usage
- Trends in heating volume, etc.

Note) As described above customer benefits will be supported by distributor.

An Example of Abnormality Reporting

E-mail / Abnormality reporting

Customer name: MHI Heat Pump Solution Sales Section
System No.: 01
Customer address: Japan (detail info is needed)
Urgent Contact: MHI Q-ton 001810367164880
Malfunction Unit No.: 0
Alarmed time: 2015-09-01 07:47:04
Alarm No.: E54
Compressor running time: 192 hours
Water pump running time: 195 hours
This is an automated message from MHI.
Please do not reply to this email.

If a problem is detected, we will promptly determine the cause and propose necessary countermeasures to prevent equipment failures.

MITSUBISHI HEAVY INDUSTRIES, LTD.

Mitsubishi Heavy Industries, Ltd.
Air-Conditioning & Refrigeration Division
16-5, Konan 2-chome, Minato-ku, Tokyo, 108-8215 Japan
http://www.mhi.co.jp

ISO9001
Our Air-Conditioning & Refrigeration Division is an ISO9001 approved factory for residential air conditioners and commercial-use air conditioners (including heat pumps).

BIWAJIMA PLANT
Mitsubishi Heavy Industries, Ltd.
Air-Conditioning & Refrigeration Division
Certified ISO 9001
Certificate number : JQA-0709

MITSUBISHI HEAVY INDUSTRIES-MAHAJAK AIR CONDITIONERS CO., LTD.
Certified ISO 9001
Certificate Number : 04100 1998 0813

ISO14001
Our Air-Conditioning & Refrigeration Division has been assessed and found to comply with the requirements of ISO14001.

Certificate Number:YKA4003622

MITSUBISHI HEAVY INDUSTRIES-MAHAJAK AIR CONDITIONERS CO.,LTD.
Certificate Number : 04104 1998 0813 E5

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