# Reference

# Company Profile

## Industry-leading manufacturer of environmental test chambers

| | |
|---|---|
| Name | ESPEC CORP. |
| Head Office | 3-5-6, Tenjinbashi, Kita-ku, Osaka |
| Represented By | Masaaki Ishida |
| Established | July 25, 1947 |
| Incorporated | January 13, 1954 |
| Paid-up Capital | ¥6,895 Million |
| Shares Issued | 23,781,394 Shares |
| Employees | 1,512 (consolidated) |
| Main Business | Manufacture and Sales of Environmental Test Chambers, Energy Device Equipment, Semiconductor Equipment and Plant Factory.<br>After-sales Service, Commissioned Tests and others. |

Head office

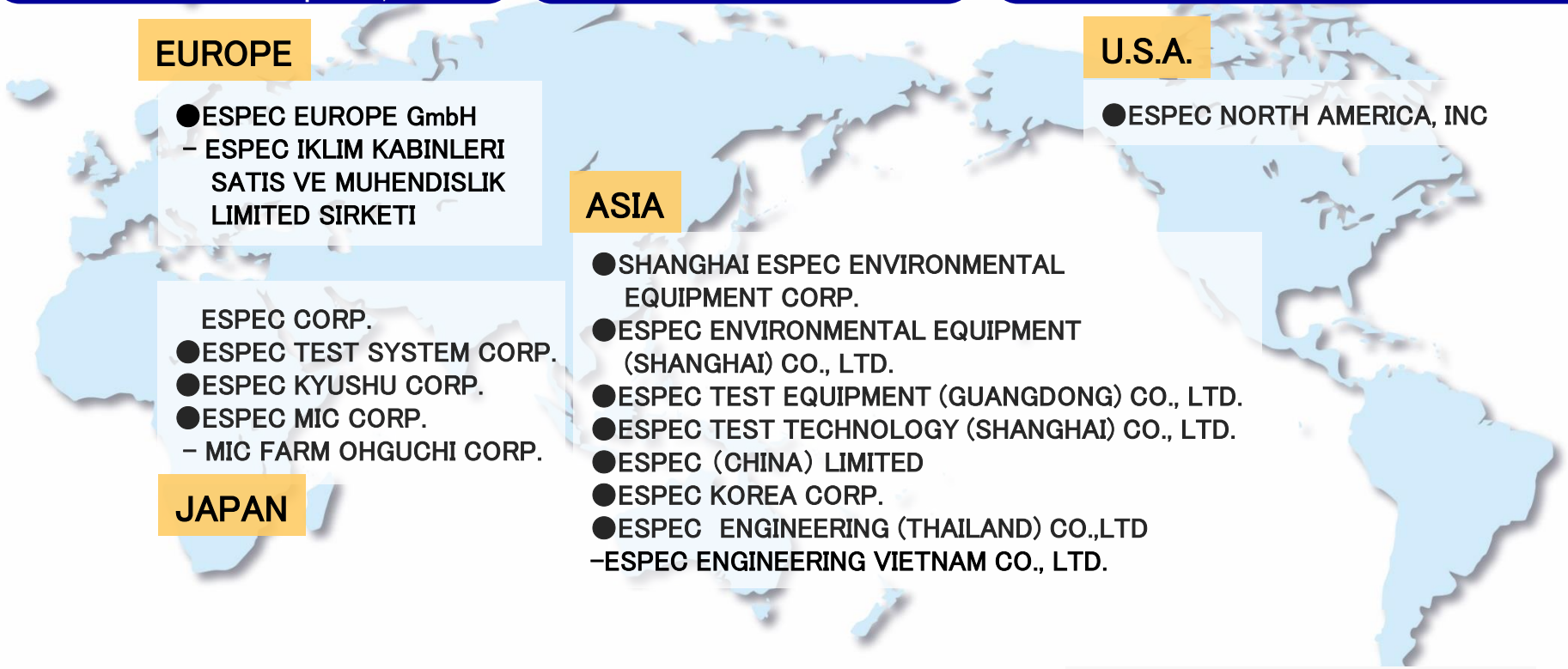
**Share of Environmental Test Chambers:** Over 30% worldwide, Over 60% domestic (As of March 31, 2020)

# Global Network

**Consolidated Subsidiaries**
**12 companies**
(Global 9 companies,
Domestic 3 companies)

**Global Network**
**46 countries**
**42 companies**

**Business Facilities in Japan : 25**
**Domestic Agencies in Japan : 46**



## EUROPE

●ESPEC EUROPE GmbH
– ESPEC IKLIM KABINLERI SATIS VE MUHENDISLIK LIMITED SIRKETI

## U.S.A.

●ESPEC NORTH AMERICA, INC

## ASIA

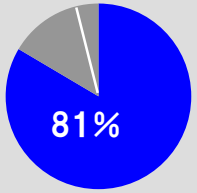
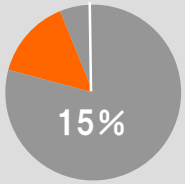
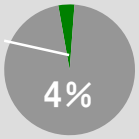
●SHANGHAI ESPEC ENVIRONMENTAL EQUIPMENT CORP.
●ESPEC ENVIRONMENTAL EQUIPMENT (SHANGHAI) CO., LTD.
●ESPEC TEST EQUIPMENT (GUANGDONG) CO., LTD.
●ESPEC TEST TECHNOLOGY (SHANGHAI) CO., LTD.
●ESPEC (CHINA) LIMITED
●ESPEC KOREA CORP.
●ESPEC ENGINEERING (THAILAND) CO.,LTD
–ESPEC ENGINEERING VIETNAM CO., LTD.

## JAPAN

ESPEC CORP.
●ESPEC TEST SYSTEM CORP.
●ESPEC KYUSHU CORP.
●ESPEC MIC CORP.
– MIC FARM OHGUCHI CORP.

●: Consolidated Subsidiaries
–: Non-consolidated Subsidiaries

# Summary of ESPEC Business (Per Market / Use)

| | | Main Products | Market | Use | Sales composition (FY2019) |
|---|---|---|---|---|---|
| Equipment Business | Environmental Test Chambers | •Temperature & humidity chamber<br>•Thermal shock chamber<br>•Bench-top type temperature & humidity chamber<br>•HAST chamber<br>•Walk-in type temperature & humidity chamber<br>•Combined temperature & humidity chamber<br>•HALT & HASS test chamber<br>•FPD equipment | •Electronic component and equipment market<br>•Automobile market<br>•Semiconductor market<br>•Medicine, Cosmetics, Foods market<br>•LCD and Organic Electro-Luminescence market | •For R & D<br>•For credibility and evaluation<br>•For production and inspection |  |
| | Energy Device Equipment | •Charge-discharge Cycle Evaluation Equipment<br>•LIB safety evaluation system<br>•Fuel cells evaluation system | •Next generation automobile market<br>•Secondary batteries market<br>•Fuel cells market | •For R & D<br>•For credibility and evaluation<br>•Safety evaluation<br>•For production | |
| | Semiconductor Equipment | •Burn-in system<br>•Semiconductor evaluation system<br>•Instrumentation system | •Semiconductor market<br>•Automobile market | •For production and inspection<br>•For development and evaluation | |
| Service Business | After-sales Service and Engineering | •After-sales service<br>•Construction around equipment | •Electronic component and equipment market<br>•Automobile market<br>•Semiconductor market | — |  |
| | Commissioned Tests and Facility Rentals | •Commissioned test •Resale<br>• Equipment rental •Calibration | | •For R & D<br>•For credibility and evaluation | |
| Other Business | Environmental Preservation | Reforestation (Tree planting), Waterfront biotope restoration, Urban greening | | |  |
| | Plant Production Systems | Plant factory, Equipment for growing plants | | | |

# History of Environmental Test

## What is Environmental Test

Test to analyze and evaluate effects of environmental factors such as temperature, humidity, pressure, and light on various industrial products like electronic components in order to ensure product quality.

<1950s>
The environmental test was JIS-standardized in Japan for consumer products.

<1970s-1990s>
"Reliability" and "quality control" became important issues in product development. Demand increased dramatically due to a rapid shift toward computerization and the use of electronic components.

<Today>
Demand is expanding in 5G and IoT field, also the development field of automobiles' electrification and automated driving functions.

1961 Japan's First Environmental Test Chamber

【 Low temperature & humidity chamber 】
"Lucifer"

Over 60% domestic

Over 30% worldwide

To Worldwide Market Share No.1

【 Temperature & Humidity Chamber】
"Platinous J series"

# Transition in Business

## Expanding business based on the “environmental creation technology” refined during the course of developing environmental test chambers

Growth of ESPEC

Integrated circuit

large scale integration

LCD

surface mount package

Eco cars such as EVs, HVs, and PHVs

5G, IoT and automated driving,

storage of electricity generation of electricity

1965 1975 1985 1995 2005 2015 Present

Business expansion

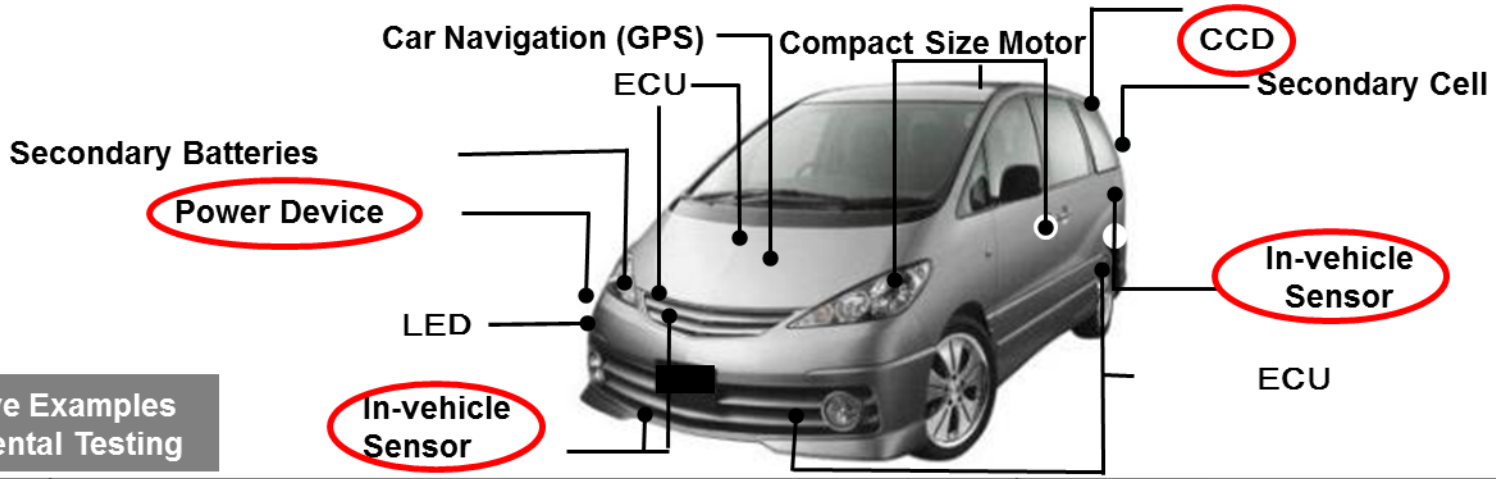
1982
Launching the semiconductor equipment business

1986
Launching the FPD Equipment business

1994
Launching the evaluation system business

2011
Launching the energy device equipment business

# [Equipment Business] Usage Case with Environmental Test Chambers




**Representative Examples for Environmental Testing**

| Device | Process/Test Condition | | Our Products |
|---|---|---|---|
| 【Power Device】  | Inspection | ■Thermal shock test: −40℃⇔+125℃ | Thermal shock chamber |
| | | ■High temperature exposure: +175℃、+85℃ | (Compact size) Oven |
| | | ■Burn-in test | Burn-in chamber |
| 【In-vehicle Sensor】  | Inspection | ■Temperature cycle test of printed circuit board: −40℃⇔+110℃ | Temperature & humidity chamber (Platinous) /Oven |
| | | ■ Temperature characteristic test after soldering: Linear change between -30℃ and +85℃ | Burn-in chamber, Rapid-rate thermal cycle chamber |
| | Evaluation | ■ Thermal shock test : −30℃⇔RT⇔+80℃、−55℃⇔+155℃ | Thermal shock chamber |
| 【CCD／CMOS】  | Production | ■ Diffusion Test: +150℃ | Compact size Oven |
| | | ■ Drying after cleaning: +85℃ | Clean Oven |
| | Evaluation | ■Screening: +85℃ | Temperature chamber (Platinous)／Burn-in chamber |
| | Inspection | ■Temperature and humidity test: +85℃／+85%rh、+60℃／90%rh | Temperature & humidity chamber (Platinous) |
| | | ■Acceleration test: +120℃／100%rh | HAST chamber |
| | | ■ Thermal shock test : −40℃⇔+125℃、−20℃⇔+85℃ | Thermal shock chamber |

# [Equipment Business] Main New Products

| Release Date | Name of product | Features |
|---|---|---|
| Aug. 2020 | Expanded Environmental Stress Chamber AR Series Lineup | •Launched four new models as rapid-rate temperature cycle type products, bringing the total lineup to 32 models across the series |
| Mar. 2020 | Transportation Evaluation System | •Recreates transport environments for pharmaceuticals and medical devices Applications in biopharmaceutical R&D and medical equipment quality control |
| Feb. 2020 | Walk-In Type Temperature (&Humidity) Chamber for Drive-In Series | •Recreates various weather environments in a large space accommodating two vehicles |
| Feb. 2020 | Walk-In Type Temperature (&Humidity) Chamber for High-Power Series | •Complies with international IEC standards and German automobile industrial standard |
| Dec. 2019 | Thermal Air Test System | •Materials testing is possible under actual use conditions such as in vehicles through combinations of various types of material testing equipment |
| Dec. 2018 | Aging Cabinet | •There is no temperature rise due to defrosting, and long-term continuous operation of high humidity environment is possible while maintaining below 5℃<br>•Equipped with sterilization mode |
| Nov. 2018 | Standard type secondary battery charge-discharge tester for automobiles | •Supports charge-discharge testing for large capacity secondary batteries in automobiles |
| Oct. 2018 | Environmental Stress Chamber AR series Rapid-Rate Temperature Cycle Type (5K/min) GOOD DESIGN AWARD 2018 | •Conforms to IEC standards and a German automobile industry standard<br>•Uses European F-gas Regulation-compliant low-GWP refrigerant R-449A |
| Mar. 2018 | Environmental Stress Chamber AR Series Rapid-Rate Temperature Cycle Type | •Second F-gas Regulation-compliant low-GWP refrigerant (R449) environmental testing chamber |

# [Equipment Business] New Product Introduction (1)

(Released in Feb. 2020)

## ■Walk-In Type Temperature (&Humidity) Chamber for High-Power Series

<Features>

- Compliant with IEC International Standards and German Automotive industry standard LV124
  (Can perform rapid temperature change testing of samples at 3K/minute)
- Low GWP coolant (R-449A) as standard equipment

Walk-In Type Temperature (&Humidity) Chamber for High-Power Series

(Released in Dec. 2019)

## ■ Walk-In Type Temperature (&Humidity) Chamber for Drive-In Series

<Features>

- Closely recreates various weather environments in a large space of approximately 500 ㎥ accommodating two vehicles to perform actual vehicle testing
- Multiple environmental factors can be recreated simultaneously, including humidity, sunlight, rain, snow, fog, and wind

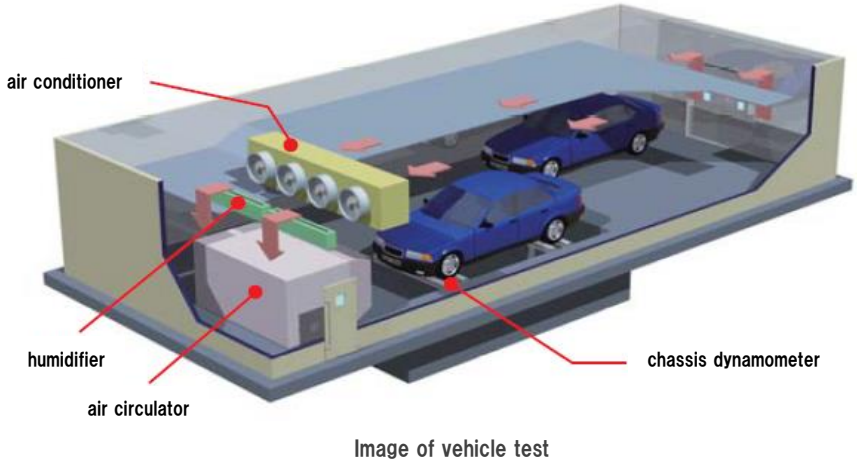



Image of vehicle test

Walk-In Type Temperature (&Humidity) Chamber for Drive-In Series

# [Equipment Business] New Product Introduction (2)

**For the medical field** (Released in Feb. 2020)

## ■ Transportation Evaluation System

<Features>
- Enables simultaneous recreation of temperature and vibration environment during transport to test medicine, etc. in actual transportation environment
- Two types of equipment for biopharmaceutical and reagent R&D application and medical equipment quality control application

2 models of Transportation Evaluation System

**For material field** (Released in Dec. 2019)

## ■ Thermal Air Test System

<Features>
- Can be combined with various materials testing instruments to perform materials testing in actual usage environment with given temperature
- Uses ESPEC's proprietary new method for cooling and heating test pieces efficiently

Example of set up with friction and wear testing machines and hardness meter (Left)
Thermal Air Test System (Right)

# [Equipment Business] Examples of Products Delivered (1)

(Delivered in July 2018)

■Delivery examples of temperature (& humidity) chambers, test chambers for use for building materials

Uses

Reproduce the environment inside apartments (temperature and humidity) and outdoors (weather such as rain, snow, and solar radiation), conduct performance evaluations and durability tests of building materials for sash, balcony, etc.

Temperature (& humidity) chambers, test chambers for use for building materials

Temperature (& humidity) chambers are movable so that building materials for testing can be easily changed

Furnished with irradiation equipment and watering (rain) equipment, to reproduce an outdoor weather environment

# [Equipment Business] Examples of Products Delivered (2)

(Delivered in March 2016)

■Smart System Research Facility,
Fukushima Renewable Energy Institute, AIST
(Koriyama city, Fukushima)

Product delivered:
Large walk-in type temperature & humidity chamber

Uses:
Performance and safety evaluation for large power conditioners for solar power generation
Supports heat generation loads of 100 kw and large weights (21 tons)

Large walk-in type temperature & humidity chamber

■National Laboratory for advanced energy storage technologies (NLAB), National Institute of Technology and Evaluation (Nanko, Osaka City)

Product delivered:
1.Walk-in type temperature & humidity chamber for charge-discharge testing
2.External short-circuit testing equipment (energy devices equipment)

Uses:
1.Evaluate the performance of storage batteries by repeatedly charging and discharging them
2.Evaluate safety by confirming that storage batteries will not catch fire or rupture if they short circuit

Walk-in type temperature & humidity chamber for charge-discharge testing

# [Equipment Business] Usage Case with Energy Device Equipment

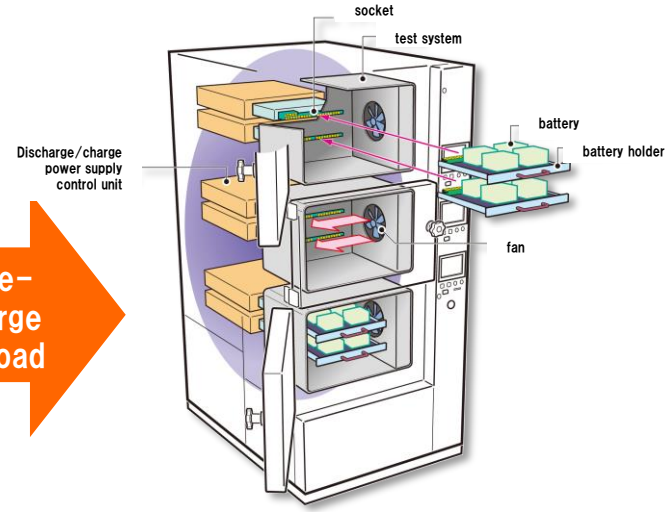
## Charge-discharge Cycle Evaluation Equipment

Equipment for ensuring the reliability and safety of lithium-ion secondary batteries for next-generation vehicles (e.g., hybrid and electric vehicles)

Charge-discharge Cycle Evaluation Equipment

Secondary Batteries

Charge-discharge cycle load




Checking the charge-discharge characteristics of secondary batteries

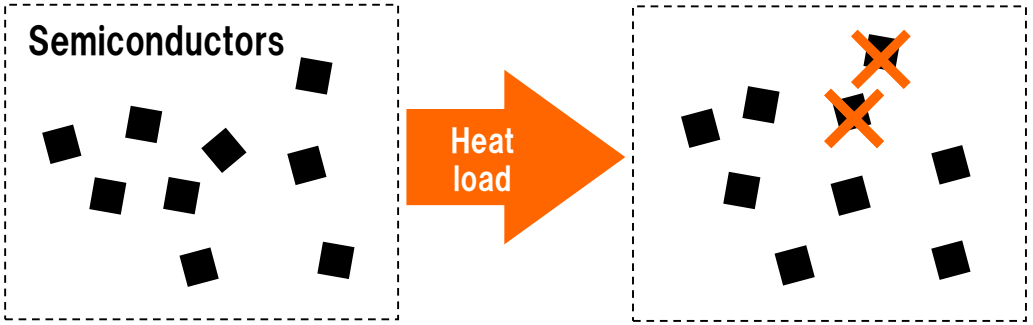
Evaluating the performance and life of secondary batteries

# [Equipment Business] Usage Case with Semiconductor Equipment

## Screening

Eliminate defective products to maintain initial-period quality at the final inspection stage of semiconductor device manufacturing

Burn-in chamber

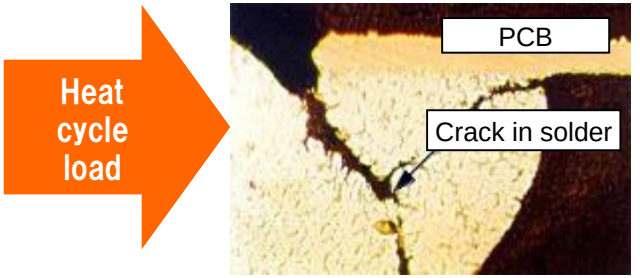



Elimination of latent early failures

## Reliability Evaluation

Used to evaluate basic failure patterns to ensure reliability in the development of new technologies

Conductor resistance evaluation system




Electrical evaluation of reliability of joints in electronic parts

# [Service Business]

## After-sales Service and Engineering

Preventive maintenance of products, maintenance service, and the upgrading/improvement and installation/relocation of products

■ Speedy response via one of the most extensive networks in Japan

■ Launching new services by utilizing the network function mounted in the equipment

## Commissioned Tests and Facility Rentals

Commissioning of testing, analysis, and evaluation; consulting; equipment rental; sales of used products; calibration of test equipment, etc.

■ The company has four commissioned test centers in Japan, one in Thailand, two in China.
(Japan: Utsunomiya, Toyota, Kariya and Kobe, Thailand, China: Shanghai, Suzhou)

・The centers are also recognized as official calibration facilities under the Japan Calibration Service System (JCSS).

■ [First in world] Opened Battery Safety Certification Center. (in September 2015)

・ Providing a one-stop service for testing and certification application services compliant with United Nations regulations on the safety of automotive rechargeable batteries.

・ Entered into business alliance with TÜV SÜD Japan Ltd., a third-party certification agency (in October 2014)

Battery Safety Certification Center

■ [First in Japan] Acquire ISO/IEC 17025 test facility certification simultaneously in the three fields of automobiles, trains and airplanes

■ The Toyota Test Center provides one-stop services for testing LV 124, the German Automotive Manufacturer Testing Standards

* ISO/IEC 17025: An international standard in which an authoritative third-party organization certifies whether a test facility or calibration organization is capable of producing accurate measurements or calibration results

# [Service Business]

**May 2020 start of “Home-based online service”**
**Support continuity of customers’ development operations**

## When using ESPEC products

Operate equipment and monitor samples from home

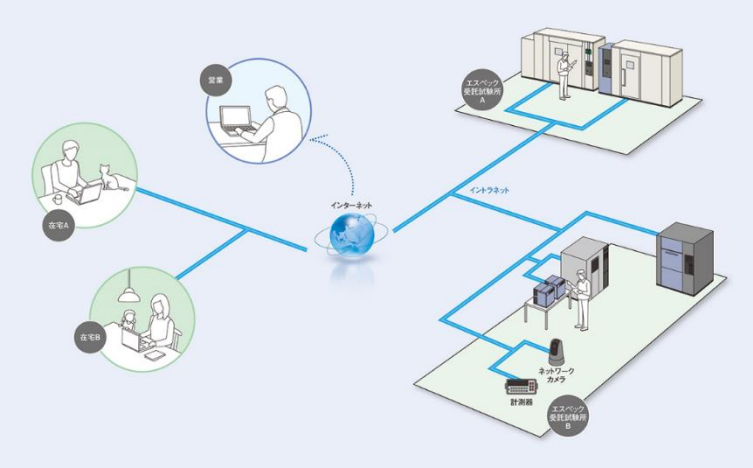
- Centralized management (monitoring and data analysis)
- Receive operating status by email
- Monitor samples using in-chamber monitoring camera (launched in March 2020)

Image of in-chamber monitoring camera

## When using commissioned testing center

All testing operations performed on behalf of customer, from start to finish, including transportation

- Remote consultation
- No need to attend in person
- Remote instruction



# [Service Business]

**Realization of 100% green electricity**
**for commissioned testing services at Kariya Test Center**

In January 2020, we became the first commissioned testing facility to convert to green electricity using a green electricity certificate.*

We expect to reduce annual $CO_2$ emissions by approximately 768 t.

*A certificate issuer receives certification from a third-party certifying organization (JAPAN QUALITY ASSURANCE ORGANIZATION) for environmental added value of electricity generated from renewable energy. The certificate can be traded as a system.

Kariya Test Center

# [Service Business]

## World's first Battery Safety Certification Center compliant with United Nations regulations

Providing a one-stop service to support the implementation of 9 safety tests and applications for certification by certification agencies, as stipulated by UN ECE R100-2. Part II, a United Nations regulation.
(The facility was opened within the Utsunomiya Technocomplex in September 2015.)

Crush Testing Equipment
(No. 1 Safety Test Room)

No. 2 Safety
Test Room

## Renovated the Toyota Test Center First testing facility in Japan to address the German Automotive Manufacturer Testing Standards

Supporting Japanese automotive equipment manufacturers seeking to develop global operations by addressing all test items set forth by the LV124 German Automotive Manufacturer Testing Standards
(Renovated the Toyota Test Center in September 2019)

Toyota Test Center

# [Other Business]

## Environmental Preservation

■Reforestation (Tree planting)

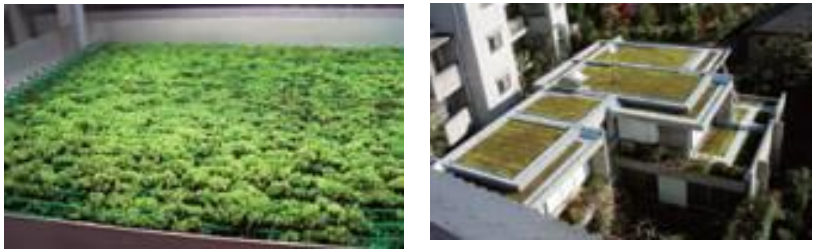
Recovery of local forest by selecting species and planting out seedlings using potential natural vegetation data.

■Waterfront biotope restoration

Reconstruction of natural environment, development of vegetative revetments, and water quality improvement using aquatic plants.

■Urban greening

Provision of roof and wall greening systems that use moss to effectively alleviate heat island effect.



## Plant Production Systems

Provision of various cultivation environments employing advanced environmental control technologies to control light, temperature, humidity, carbon dioxide, etc.

Plant factory

Phyto-toron

# [Other Business]

**Produced a high value-added vegetables using deep-seawater**

At a plant factory  near Haneda Airport,
production and sales of vegetables high in minerals
with the use of deep sea water.


Interior of the plant factory and Factory-produced vegetables "mineraleaf"

# [Other Business] Examples of Products Delivered

## ■Arid Land Research Center, Tottori University

(Delivered in March 2016)

Products delivered:

Experimental System for Analyzing Responses of Dryland plants to Climate Changes (2 units)
(Simulates the climates of arid lands, including high temperature, low humidity, strong sunlight, and high winds)

Uses:

Plant cultivation experiments and experiments to develop efficient water-usage technologies in arid lands, research to solve issues facing arid lands

Experimental System for Analyzing Responses of Dryland plants to Climate Changes

Experiment in progress

# Strengthen Technology Development Capability

## New technology development building completed

Objective : Strengthen technology development capabilities and promote preservation of biodiversity by encouraging open innovation

Concepts : “Open innovation,” “Open communication,” and “Coexistence with the natural environment”

Location : Kanokodai, Kita-ku, Kobe, Hyogo (in Kobe R&D Center)

Start of operation : May 2020 (Construction started in June 2019)

Building area : 1,580㎡

Gross floor area : 4,557㎡ (Three story building)


New technological development building

# ESPEC Identity Corporate Philosophy

## Our important values that have been passed on since our inception

## “THE ESPEC MIND” (Excerpt)

**The Origin**
To engage in a higher level of value exchange as a public institution

**Mission**
Provide more certain Seikankyo (living environment) via environmental creation technology

**Style**
Progressive, Reliable, Open, Fair

**Declaration**
What ESPEC promises society

“compliance,” "culture," "human rights," "the environment," “education/enlightenment.”

# ESPEC Business and SDGs

## Equipment Business　Service Business

**Contribute to the development of cutting-edge technologies through the supply of products and services that harness "Environmental Creation Technology"**

- Supply products and services that contribute to the development of cutting-edge technology, with a view to solving social and environmental issues


## Environmental Preservation

**Contribute to biodiversity preservation**

- Promote the nature restoration/revival business, which contributes to biodiversity preservation and global warming mitigation


## Plant Production Systems

**Contribute to the stable supply of food to address global warming and extreme weather**

- Supply plant factories that can systematically grow safe vegetables
- Supply plant production systems to promote research into drought-tolerant plants

# ESPEC Business and SDGs

## Environmental（E）

- Contribute to global warming mitigation
- Reduce environmental impact
- Eco-site and eco-operation
- Prevent pollution
- Preserve biodiversity


## Social（S）

- Improve customer satisfaction and ensure product safety
- Supply chain management
- Respect human rights and promote the success of diverse human resources in the workplace
- Provide appropriate disclosure and communication of information
- Give back to society


## Governance（G）

- Enhance governance
- Promote risk management
- Ensure compliance

# Initiatives tackling environmental problems

## Environmental management in line with the Mid-term Plan on the Environment

Aim to contribute to the realization of a sustainable society through business activities
Currently we are implementing the 7th Mid-term Plan on the Environment
(planned implementation period: FY2018-FY2021)

## Forest preservation activity - Kehara Forest Creation Program

In March 2018, designated as an affiliated business of the Japan Committee for United Nations Decade on Biodiversity
Since 2007, the Company's employee volunteers have increased to over 1,000 participants

## ESPEC Foundation for Global Environment Research and Technology (Charitable Trust)

Provides funding support every year for research, technology development on global environmental conservation.
Established in 1997 on the 50th anniversary of ESPEC

## ESPEC Midori-no-gakko schools

Human resources certification, etc. based on Act on the Promotion of Environmental Conservation Activities through Environmental Education
Seminars and events are held throughout Japan to train leaders who will think about the global environment

# Initiatives tackling environmental problems

(March 2018)

## Designated as affiliated businesses of the Kebara Forest Creation Program: Creating a Mountain Full of Treasures—The Kyoto Model Forest Project, and The Japan Committee for the United Nations Decade on Biodiversity

- The Kebara Forest Creation Program is a project in which ESPEC and ESPEC MIC CORP. are working with the Fukuchiyama City Oecho Kebara Residents Association regarding forest conservation activities

- ESPEC formulated Creating a Mountain Full of Treasures Project which freshly reveals the attractive treasures in the forest: The variety of living creatures which live in the Kebara Forest. ESPEC conducts conservation activities such as cutting down and thinning, produces maps showing where the living creatures are, and maintains walking courses

Participants in the Kebara Forest Creation Program


This project is designated as a project recommended by the Japan Committee for the United Nations Decade on Biodiversity (UNDB-J)

# To a company where employees can be more active

## Initiatives to promote women's success

From the Ministry of Health, Labor and Welfare:
The Company received the "Kurumin" certification, which is granted to companies that support child-rearing. And the highest ranking of the certification mark "Eruboshi" based on the Act on Promotion of Women's Participation and Advancement in the Workplace.

The female leadership development program

## Employee Education System Enhancement

- Implement a Global Trainee Program aimed at developing human resources who are capable of working in international settings
- Enhance the education program to support management executive education and self-development
- Promote work style reforms

On-site training in the Global Trainee Program (U.S.)