



Bizen Green Energy  
Green, and More

# Case Study of net Zero Energy Building(ZEB) for existing Commercial Building

Bizen Green-Energy, Inc  
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## Contents



Bizen Green Energy  
Green, and More

1. What is Bizen-Green Energy?
2. Ako Royal Hotel ZEB project
3. What is ESCO?
4. Financial support from Japan Gov

# What is Bizen Green-Energy



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Bizen Green-Energy(BGE) is

- Energy consulting company at a local area
- Energy saving
  - Design energy saving plan
  - Calculate amount of energy saving, pay-back year
  - Suggest financial options, subsidy, bank loan, lease(ESCO)
  - Support steps to installing energy saving equipment
- Renewable energy
  - Propose the best renewable for customer needs
  - Support steps to installing energy saving equipment
- Policy planning
  - Research data needed for energy saving policy
  - Propose a new policy scheme for energy saving and renewables installation
  - Advice a method to spread energy savings

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## What is ZEB



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net Zero Energy Building(ZEB)

Energy Consumption  $\leq$  Energy Generation

- Renewable Energy generated onsite or nearby

nealy net Zero Energy Building(nZEB)

Energy Consumption-Energy Generation  $\leq$  National Target  
20-100kWh/m<sup>2</sup>

ZEB concept comes from EU

Target of ZEB and nZEB are mostly for new buildings

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# Ako Royal Hotel ZEB project

## Target

- Long-Term Target : **0(ZERO)** CO<sub>2</sub> Emission in 2030
- Short-Term Target : Energy **40%down** CO<sub>2</sub>**50%down** compared to 2008

## Approach

- Installing high efficiency equipment based on ZEB Design Concept
- Development of energy management system
- Change in awareness of Energy Savings leads many ideas

## Result

- Result : Energy **40%down** CO<sub>2</sub>**39%down** compared to 2008
- Energy Consumption per Area : 1,414MJ/m<sup>2</sup>/y(smaller than average office)
- Pay-Back : 5.4年 w 2/3government subsidy (16.2年 w/o subsidy)
- Multiple effects : achievement of short-term target and favorable review from customers make staff confident, increase visitors, propose new services, produce good synergy

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# About Ako Royal Hotel

## About Ako Royal Hotel

Address : Nakasu3250, Kariya, Ako  
Type : Hotel Structure : SRC  
Floor : 6 Total floor area : 5840m<sup>2</sup>  
Guest Room : 44 Capacity : 115  
Rooms :

Banquet Hall  
Seminar Room:6  
Japanese Restaurant  
Café, Large spa

Before Project(2008)

Energy Consumption : 14,558GJ/y

Energy Consumption per Area : 2,493MJ/m<sup>2</sup>/y(Average Hotel2,685MJ/m<sup>2</sup>/y)

Building



Banquet



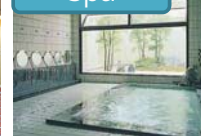
Entrance



Seminar



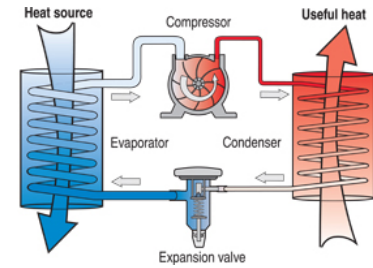
Spa



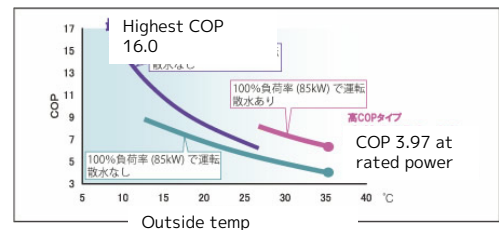
Usage	Existing Facilities	New Facilities
lighting	Fluorescent lamp	LED down-light, LED lamp
Air Conditioning	Banquet : Chilling Unit Guest Room : Multi Air-conditioning Unit	Banquet, Guest Room : Multi Air-conditioning Unit
Water Heating	Oil Boiler	Large heat pump water heater
Other	Window Glass : Single Glass Refrigerator : Prefabricated refrigerator	Window Glass : Low-E Pairglass Refrigerator : Packaged refrigerator Renewables : 20kW PV

# Key Technology

- Heat Pump with Inverter
- Heat Pump can transfer heat from heat source to heat use
- Heat Pump is used for air-conditioner, refrigerator, water heater, etc
- Efficiency of heat pump is shown as COP(Coefficient of Power), COP 3 means heat pump outputs(transfers) 3 heat energy by 1 input energy
- Typically, heat pump COP is about 3 at full output, over 5 at middle output
- In Japan, Heat Pump controlled by Inverter is popular
  - Advantage:
    - Higher efficiency at middle power range
    - Accurate power control
  - Disadvantage:
    - Expensive than non-inverter
- Inverter can change motor(compressor) output by changing frequency of electric wave



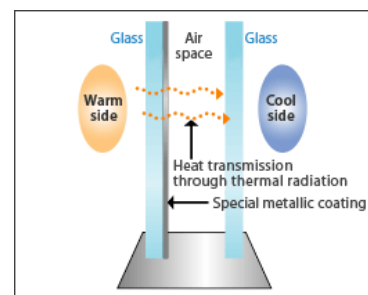
Source:IEA  
<http://www.heatpumpcentre.org/en/aboutheatpumps/Sidor/default.aspx>



Source:Toshiba carrier  
<http://www.toshiba-carrier.co.jp/products/industry/usx.htm>

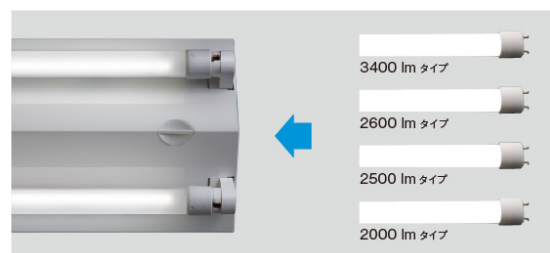
# Key Technology

- Low-E Pairglass
  - Improve thermal insulation by coating special metallic that reflects infrared at outside glass
  - In Japan, changing existing window glass to Low-E pairglass is easy thanks to attachment



Source:AGC  
[http://www.agc.com/english/products/jirei\\_hall.html](http://www.agc.com/english/products/jirei_hall.html)

- LED
  - Light-Emitting Diode (LED) is a semiconductor device
  - Longer lifetime : about 10 years
  - High efficiency : 120lm/W-150lm/W
  - Thanks to light directivity, electricity to light up a room is 0.5 of fluorescent, 0.05 of incandescent
  - Easy control of lighting

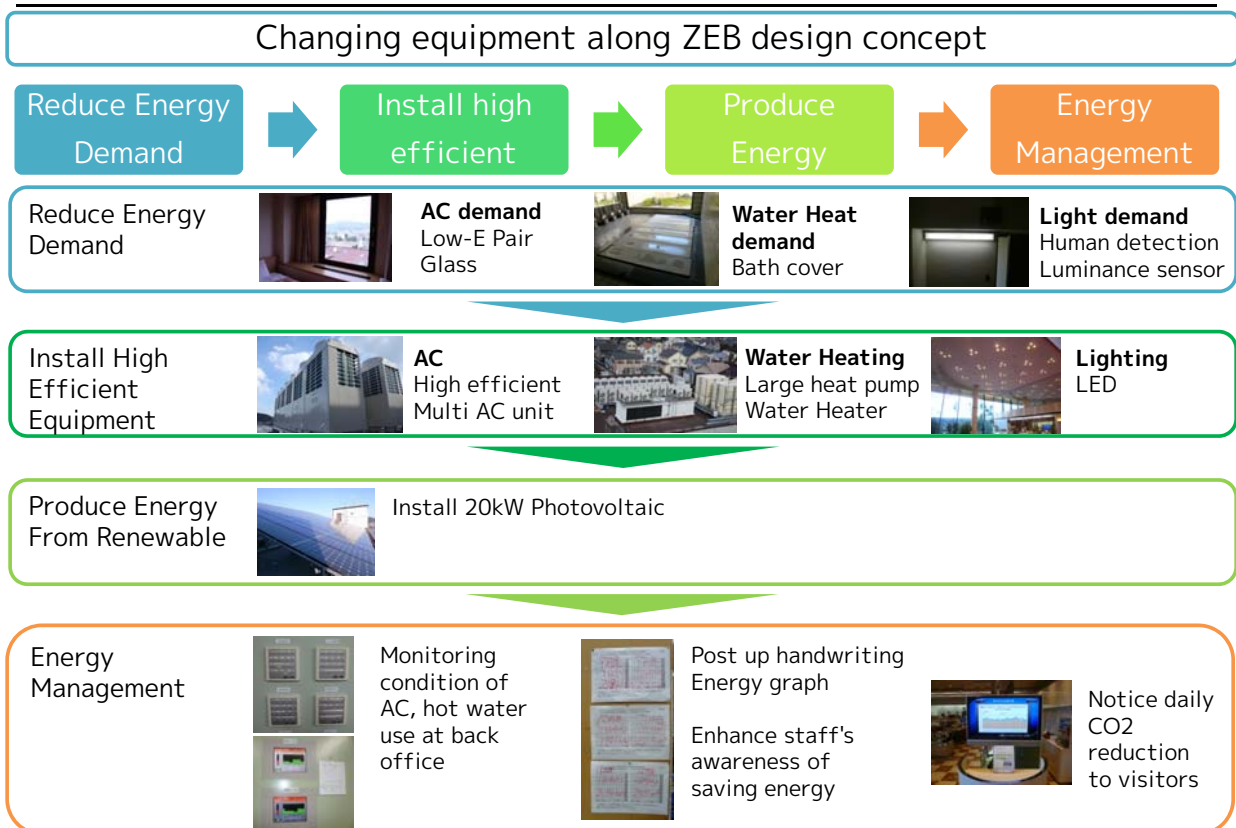


Source:panasonic  
<http://www2.panasonic.biz/es/everleds/special/baselight/index.html>

# Key Technology

- Sensor
  - Reduce energy use automatically
  - Temperature sensor : Air-conditioning unit
  - Human detection sensor : lighting
  - Luminance sensor : lighting
  
- BEMS(Building Energy Management System)
  - Constituted with a logger and many sensors
  - Figure out real time energy use of building, each equipment
  - Analyze data and find out room for improvement

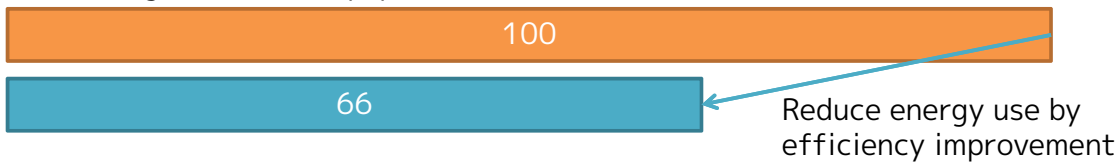
# Project Design



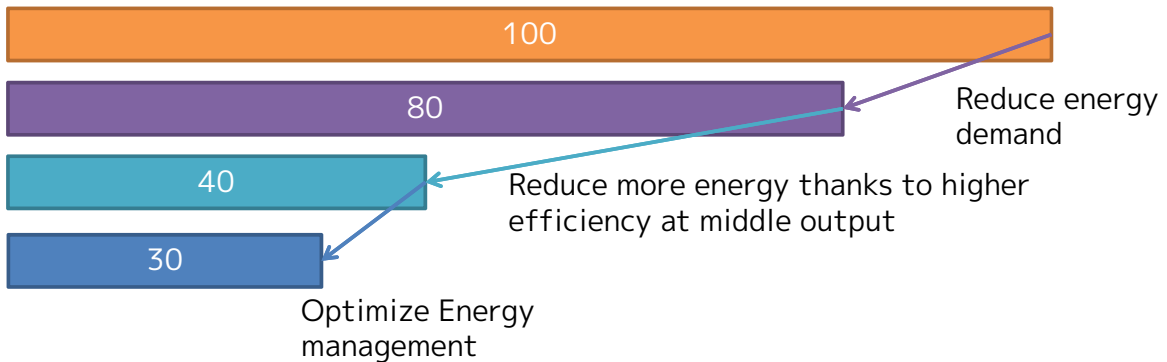
# Maximize Energy Savings

Maximize energy savings by utilizing higher efficient point

Install high efficient equipment



Combine high efficient equipment with demand reduction, energy management

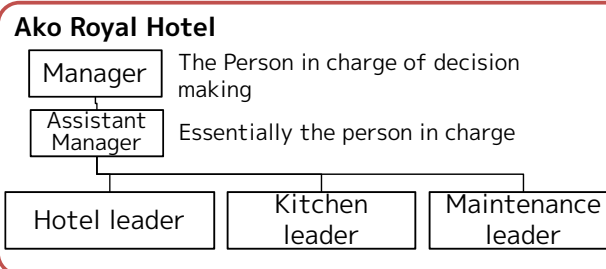


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# Energy Management

1. Develop energy management system with making a person in charge clear
2. Handwriting enhance the energy-saving consciousness of staffs
3. Regular Measurement keep the energy-saving consciousness

Energy Management System



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Monitor the energy saving situation  
Advice to accomplish energy saving target

Handwriting graph

Put up handwriting graph at staff room

Share target and current situation

Keep awareness of saving energy



Report to visitors

Report CO2 reduction of last day

Reporting current situation of Ako ZEB project to visitors keeps staff aware of saving energy

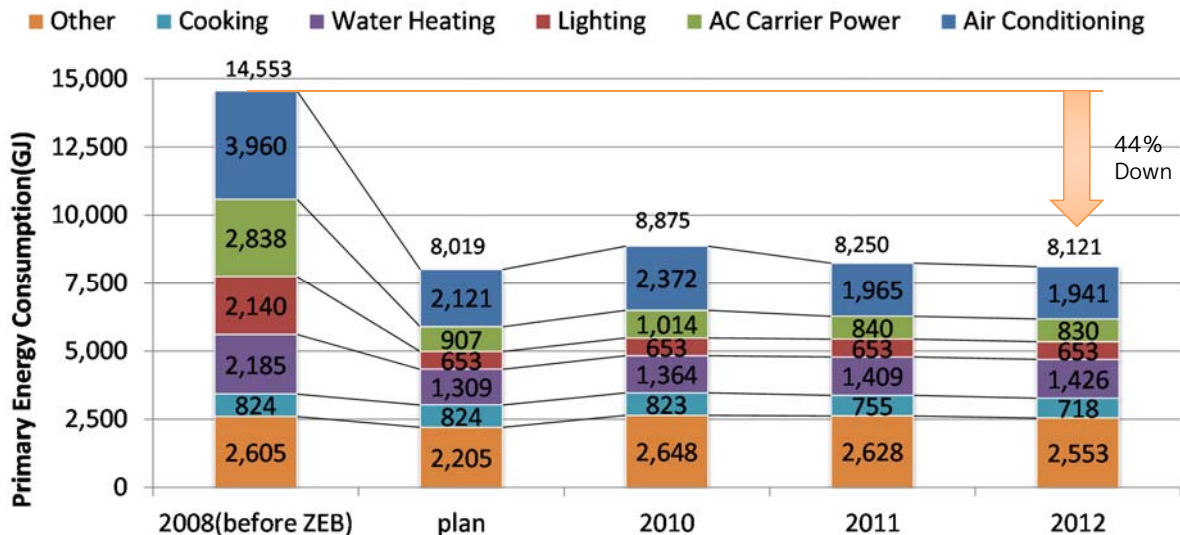


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12

# Project Result

- Energy · CO<sub>2</sub> : Primary Energy 44%down CO<sub>2</sub> emission39%down against 2008
- Energy per area : 1,391MJ/m<sup>2</sup>/y(53%of average hotel, lower than average office)
- Energy saving : 1.3million yen/y(130 thousands dollar)
- Project Cost : 210million yen(2.1million dollar)
- Payback : 5.4years w 2/3govment subsidy (16.2years w/o subsidy)



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13

# Project Effect

## Change in awareness

- Propose ideas, improve operation to achieve target
  - Change staff costume(casual costume)
  - Demand management, Operation of ceiling fan at entrance
- Propose new services to improve the hotel image
  - Offer a bag used to take home leftovers



## Visitor's Interest

- Most visitors do NOT know the project before they come
- Visitors feel comfortable despite large energy saving (no dissatisfaction)
- Most visitors turn off TV, light at check-out (unexpected effect)

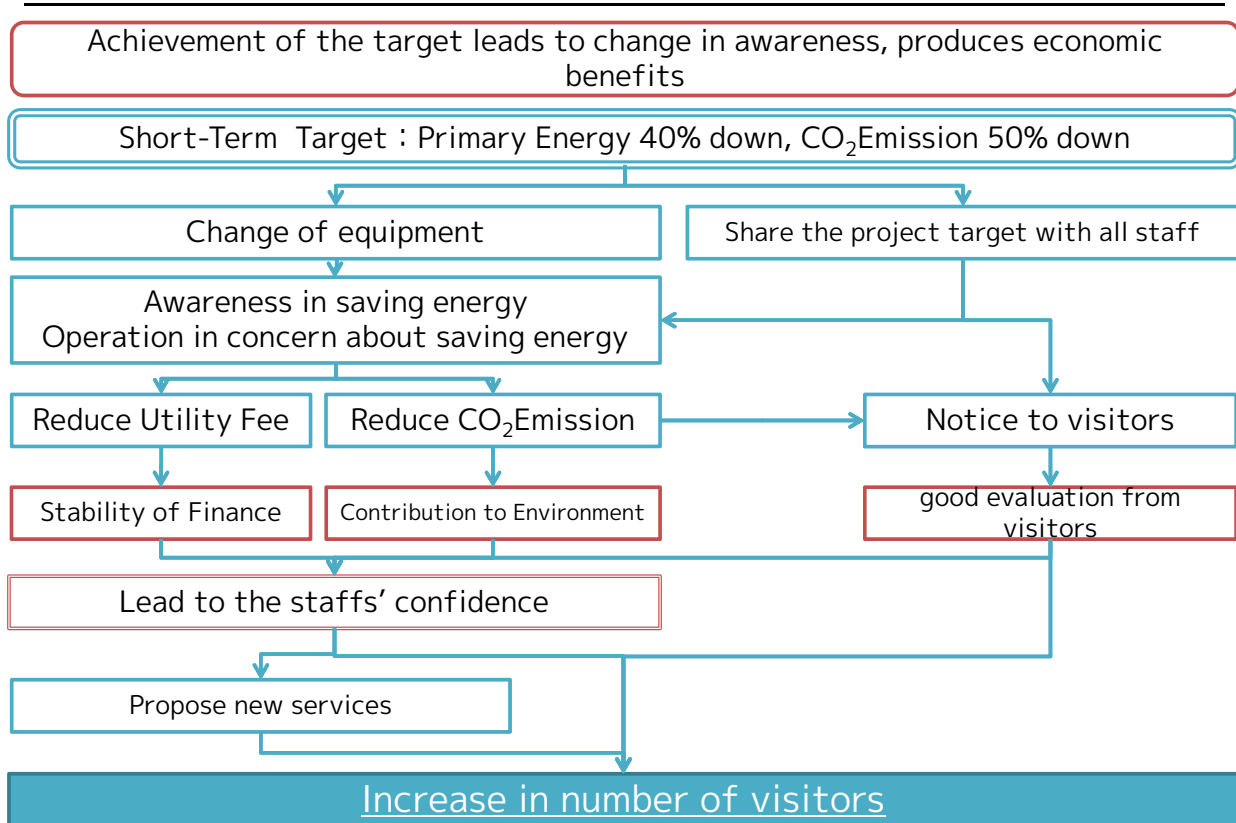
## Visitor's Increase

- Visitors are increasing after the ZEB project
  - Visitors 7%up customer at restaurant 10%up in 2012 against 2010

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14

# Change in awareness of Energy Saving



# Energy Savings is just a method

## Key Point

Energy Savings is just a Method to improve business condition

## Benefit

Finance Status : reduce expense and stabilize finance status

To visitors : motivate visitors to concern about environment(saving energy)  
improve hotel comfort

To staff : good evaluation from visitors  
get a confidence with project success

To hotel : propose new services by staff  
increase visitors

## Important Point

**Produce many benefits by success of an energy saving project**

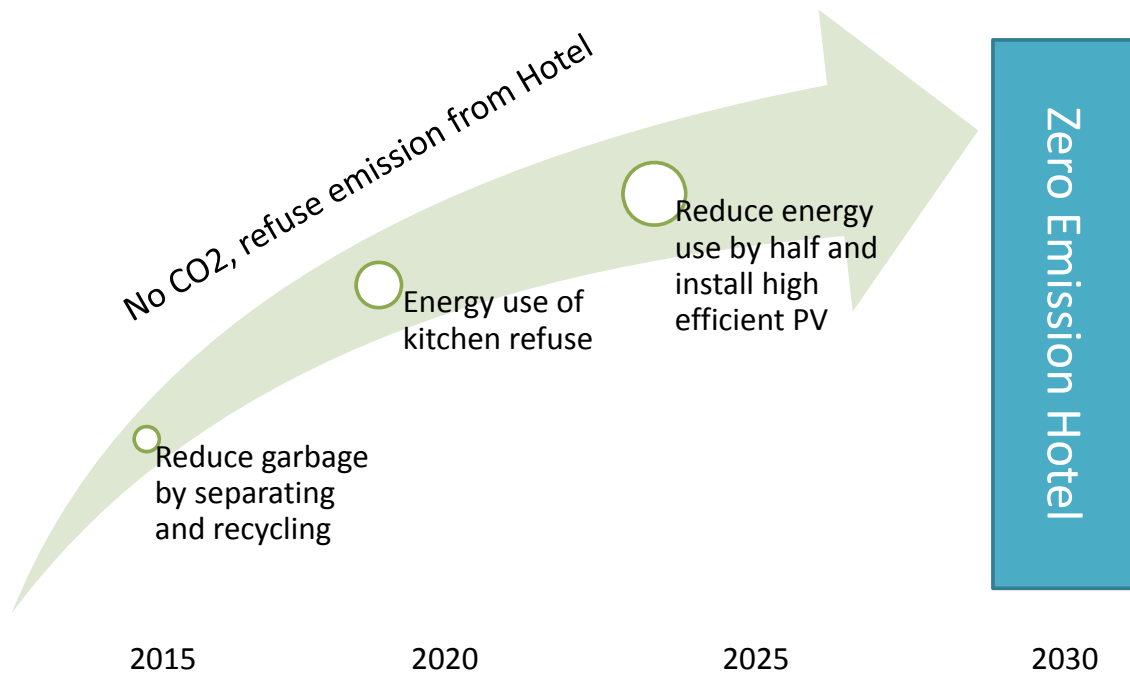


# Steps to Zero Emission Hotel



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Achieve the zero emission hotel by 2030 with energy innovation



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17

## Summary



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### Energy Saving Result

- The 2012 Result : **Primary Energy 44%down against 2008**
- Energy per area : 1,391MJ/m<sup>2</sup>/y (53%of average hotel)
- Payback : 5.4years w 2/3government subsidy (16.2years w/o subsidy)

### Suggestion

- Handwriting graph keeps staff concern about achievement of the project
  - Do not depend excessively on BEMS (automated measurement)
- Produce many benefits by success of an energy saving project

### Next Steps

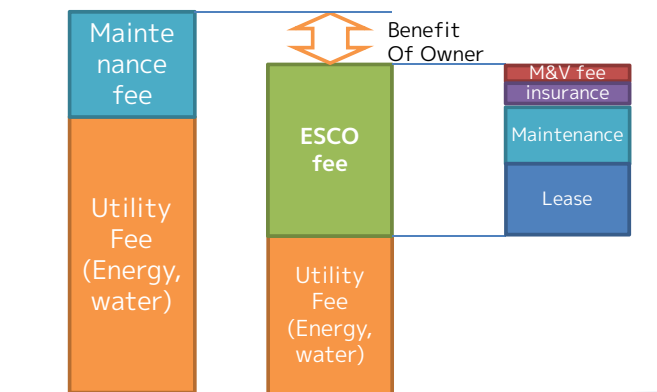
- Aim at achievement of the zero emission hotel by 2030
- Staffs propose new ideas for the achievement, offer new services to customers

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18

# What is ESCO?

- Energy Saving Company(ESCO) is a private company that guarantees a financial benefit produced by installing high efficient equipment and retrofitting existing equipment
- Utilizing lease scheme, averaging payment to install high efficient equipment
- To guarantee financial benefit, ESCO implement design, installation, operation



- ESCO does not spread in Japan
  - Staff is not familiar with process of ESCO project
    - No detail manual to proceed ESCO project
  - High costs to participate in ESCO project
    - It takes months to make proposal to ESCO project
    - If fault, no money is paid to proposal
  - Small scale of ESCO Project
    - Most project contract fee is less than \$ 1 million

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## Financial Support from Japan Gov.

- Subsidy
  - Over \$ 1 billion subsidy to install energy saving equipment
  - Mostly, the subsidy covers 1/3 of installation cost
  - Japan offers many subsidy projects, Requirement to receive depends on each project
    - Example
      - Over 25% energy reduction before install
      - Select larger energy reduction per subsidy
  - Documentation for the subsidy is so complicated that consultant helps building owner to make document, in many cases.
- Tax Benefit
  - Use a special depreciation, which is 30% of cost of high efficient equipment

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# Contact



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## About Project

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## About Hotel

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