# Report of diagnosis project Diagnosis of energy saving at Chulalongkorn University

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Panasonic

グリーンIT推進協議会
Green IT Promotion Council

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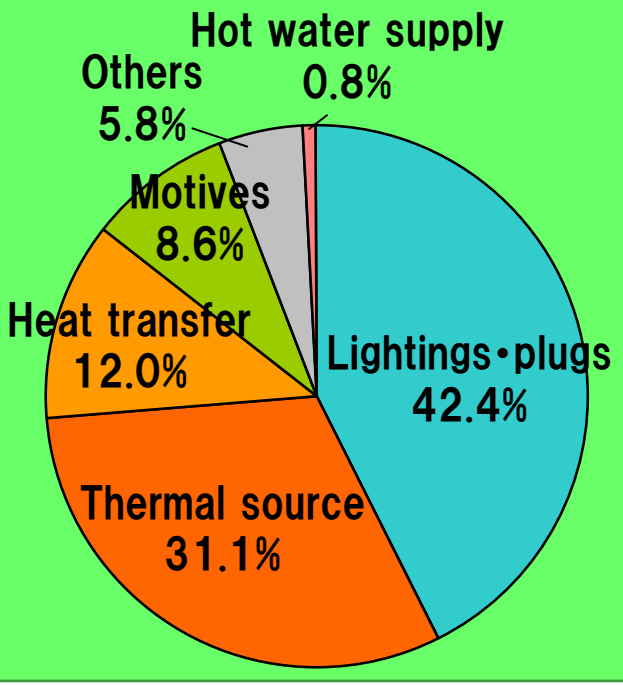
# Back ground & Objectives of diagnosis

Key elements of energy saving in buildings are lightings and air conditioners with large electricity use.

Electricity consumption rate of buildings in Japan




✓Lightings share 21.3% among plugs・lightings, office machines share 21.1% of plug usage
✓Heat source equipments share 26% of thermal source
✓Electricity consumption of lightings and air conditioners share more than half of total consumption of the building

Source：The Agency for Natural Resources and Energy in the Ministry of Economy, Trade and Industry、Energy Conservation Center, Japan「Guide for implementing energy saving at commercial building 2009」

# Introduction of candidate

Our candidate is building of faculty of engineering at Chulalongkorn University.

Chulalongkorn University
จุฬาลงกรณ์มหาวิทยาลัย

Imperial couple receiving wreath from students when arriving Chulalongkorn University.
(from Imperial Household Agency HP)

# Introduction of company

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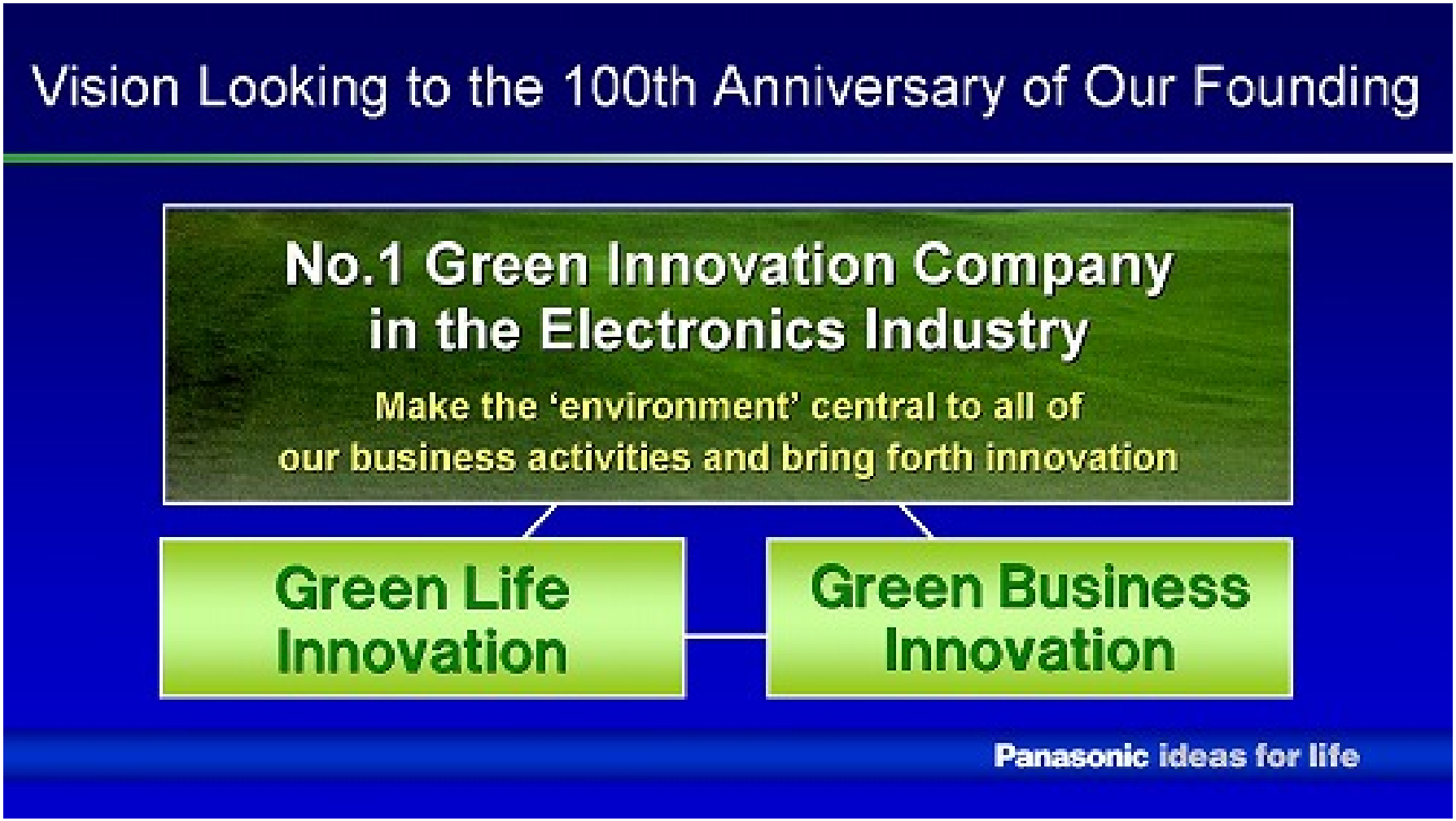


# Introduction of company


**Minimizing CO2 throughout The Entire Business Process**

**Realizing Recycling-oriented Manufacturing**

**Pursue a Green Work-style**

**Providing Environmental Solutions Which Make the Most of Our Expertise**

# Introduction of company

## Green Life Innovation

**Realizing Green Lifestyles to Enrich People's Lives**

Offer Better Living which Provides
People around the World
with a Sense of Security, Comfort and Joy,
in a Sustainable Way

**Living with Virtually Zero CO2 Emissions for the Entire Home and Building**

**Evolution and Spread of Eco Cars**

**Living Surrounded by Recycling-oriented Products**

**Wider Use of Eco Products In Emerging Countries**

# Concept of Smart House “$CO_2 \pm 0$”

eco ideas HOUSE
エコアイディアハウス

**Lifestyle with ‘$CO_2 \pm 0$’, in 3 to 5 years with the synergy of technology & natural blessing.**


Panasonic Center Tokyo

# Concept of Smart House "$CO_2 \pm 0$"

## Saving, Generating & Storing

■Saving by Products

- TV
- Air-conditioner
- Lighting
- DVD Recorder
- Heated Toilet Seat
- Washer-dryer
- Insulation Sheet

Fuel Cell

Solar Batteries

Storage Battery

Energy Saving

Concept of Smart House "CO2±0"

Energy Saving

100%

47%

35%

1990

2009

201X

Fuel Cell + Solar Battery + Storage Battery

Generating & Storing Energy

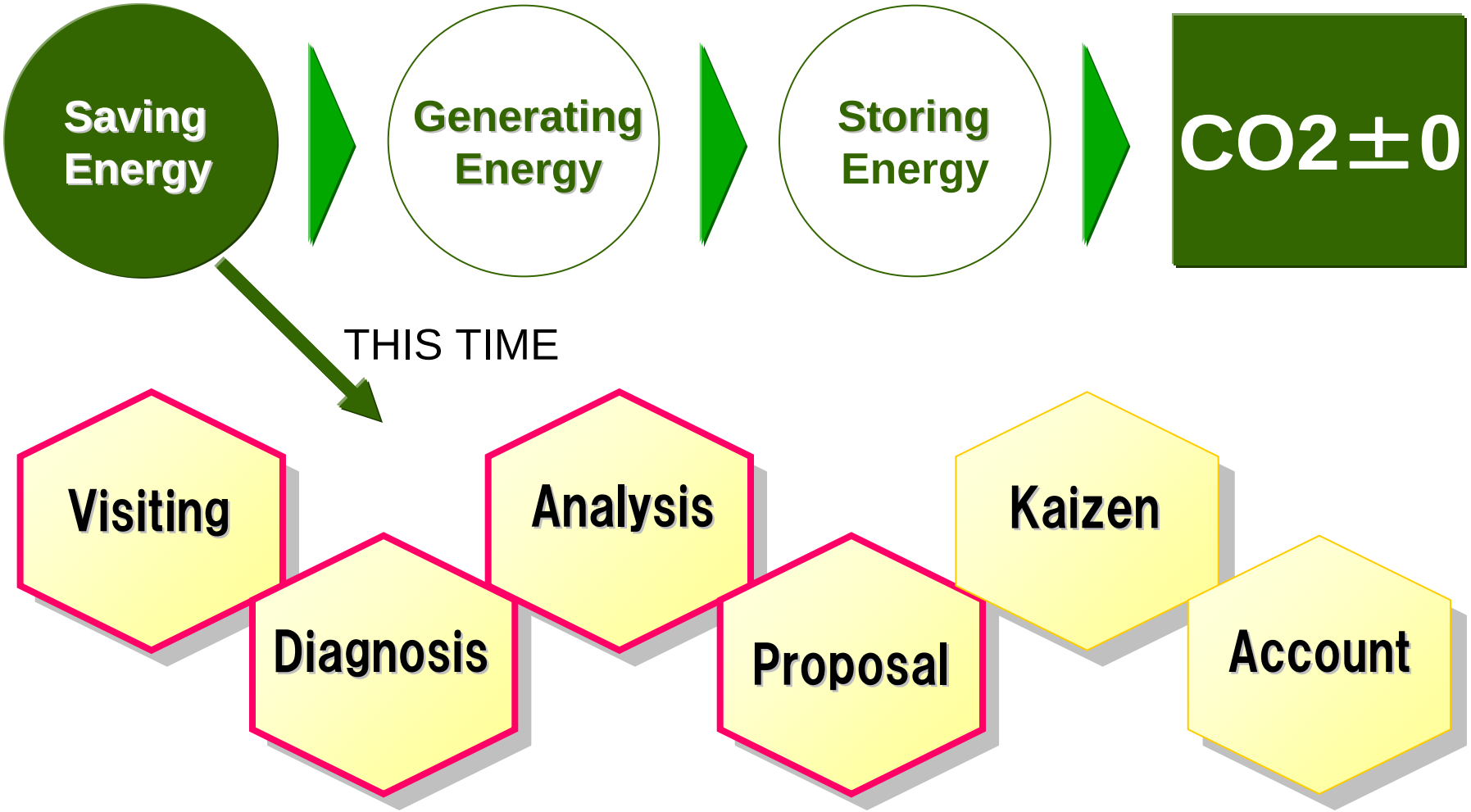
CO2±0

201X

Progress of Energy-saving

Generating & Storing Energy

# Overall picture of diagnosis project



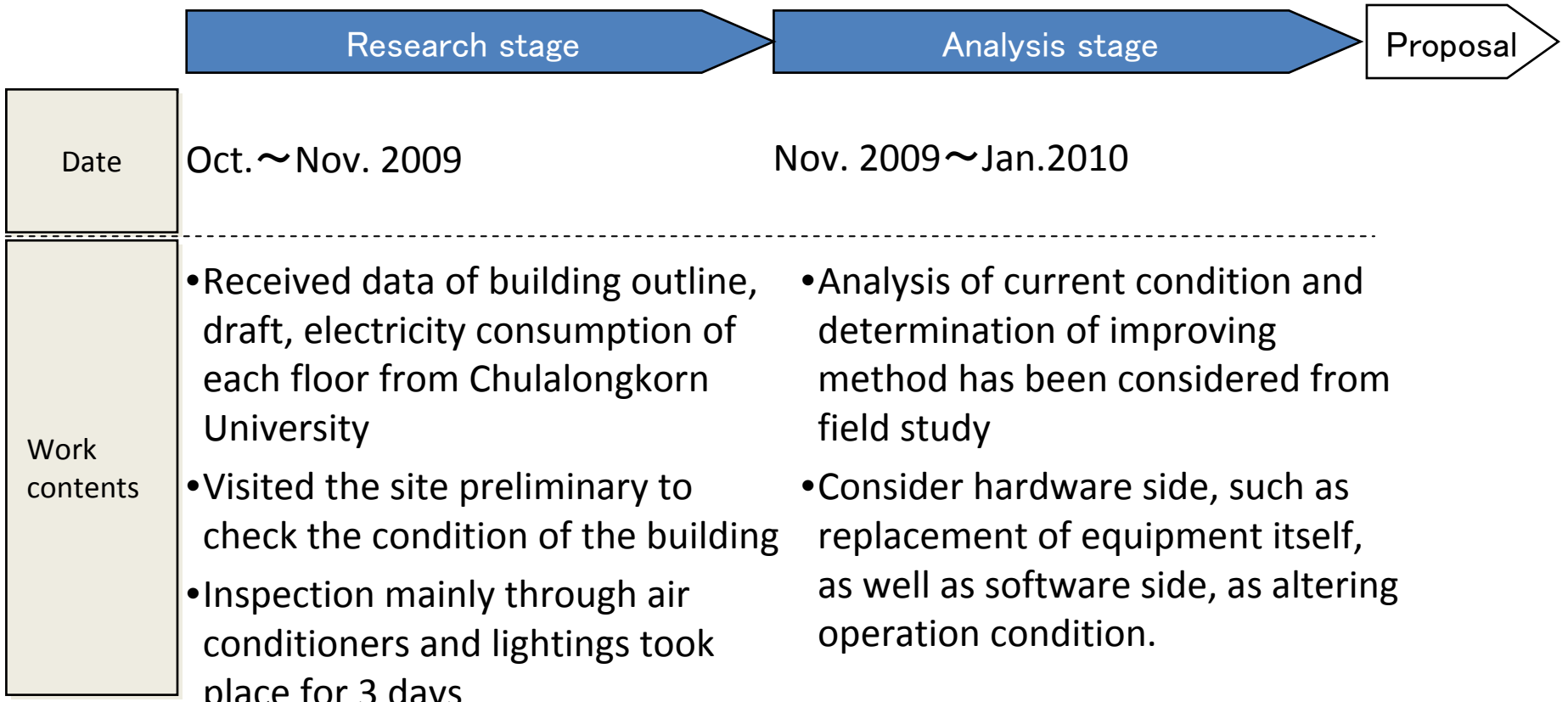
# Overall picture of diagnosis project

Proposed mainly to replace lightings and air conditioners

| Contents diagnosis | Results | |
|---|---|---|
| | Current | Proposals/expected effects |
| Diagnosis took place at Chulalongkorn university on Nov.25～27, 2009.<br>It took place at 21st story high building of Chulalongkorn University faculty of Engineering<br>– Identified using patterns and conditions of air conditioners and lighting equipments | Following results has been revealed.<br>– Not only degradation of air conditioner has been significant but usage area has been modified from initial condition.<br>– Stabilizer of fluorescents were old type. | Thus, we proposed replacement of equipments.<br>– Proposed installation of building multi-air conditioning system<br>– Proposed installation of stabilizer into inverter |

# Contents of diagnosis

Steps of preliminary survey and analysis, actual field diagnosis, analysis of diagnosis data, preparation of improvement idea



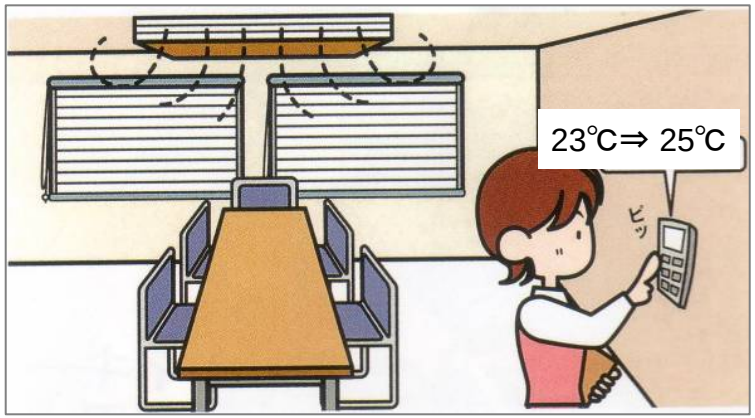
# Current energy efficiency and challenges (summary)

Challenges of both equipments and operation will be revealed mainly through air conditioners, lightings

| Target | Possible improvements・Challenges |
|---|---|
| Reviewing preset temperature of air conditioner | Making the standard stricter by managing to follow the value and altering the standard to 77℉(25℃), since standard had not been followed. |
| Update to high efficiency air conditioner | Reduce cost and CO2 emission by installing multi-air conditioning system |
| Turn FL stabilizer into inverter | Exchange stabilizer for FL36W(copper steel) into inverter. |
| Installation of BEMS (Building and Energy Management System) | Save energy, improve comfort, reduce CO2 by installing BEMS |

# Current energy efficiency and challenges（individual）①

Reviewing preset temperature of air conditioner：Some area has different setup values of temperature.




Setup value：21 ℃


Error message

Although standard of setup value has been set to 23℃, it has not been well managed.
Thus, stricting management to follow the setup value 25℃.

We estimate the annual energy consumption of air conditioner to be 1,908,362kWh/year.
It is expected to reduce 10% of energy consumption by altering setup values to shown above with well management.
Its reduction amount will be 1,908,362×10%＝ 190,836kWh/year
In terms of CO2 quantity, it would be 95,571kg/year

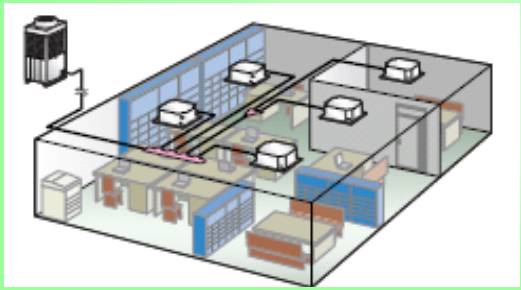
**Review setup values of air conditioners and manage strictly**

# Current energy efficiency and challenges（individual）②

Update to high efficiency air conditioner：Install multi-air conditioning system

BEFORE

AFTER Building multi-air conditioning system



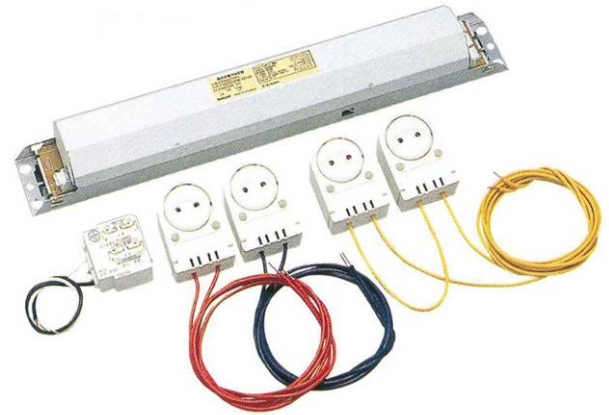
Aging degradation of air conditioner can be seen and its COP is low. Additionally, due to used area being segmentalized than starting condition, it is air conditioned to area in no use.

We estimate the annual energy consumption of air conditioner to be 595,886kWh/year
By installing building multi-air conditioning system, annual energy consumption is expected to be290,676kWh/year
Its reduction amount will be 595,886－290,676＝ 305,210kWh/year
In terms of CO2 quantity, it would be 152,849kg/year
We suppose current COP to be 2.0, after improvement COP to be 4.1.

Improve to building multi-air conditioning system

# Current energy efficiency and challenges（individual）③

Turn FL stabilizer into inverter：Current copper steel stabilizer consumes more electricity than inverter stabilizer.

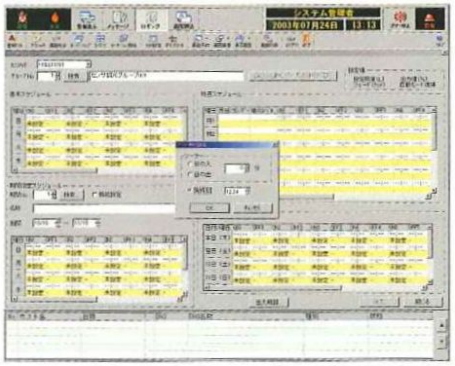
Currently, copper steel stabilizer, 4,630 units in use, consumes 13% more electricity than inverter stabilizer.

Current annual electricity consumption by FL36W is 327,243kWh/year
Electricity consumption by current equipment：FL36W ⇒ 40W
Electricity consumption by improved equipment：T8-32W ⇒ 35W
Target lamp number 4360, Improved equipment number 2908（Exclude current diming lights for energy saving）
Reduced electricity consumption 327,243×（1－35W÷40W）＝ 40,905kWh/year
In terms of CO2 quantity, it would be 20,485kg/year
※It is recommended to improve to inverter when update of stabilizer have come.

Improve FL stabilizer into inverter

# Current energy efficiency and challenges（individual）④

Installation of BEMS：By introducing BEMS, it enables current visualizing energy consumption condition and data analysis.



Currently, consumption of electricity and fuel achievements are controlled. However, electricity consumption by each equipment or hourly consumption are not managed.

BEMS（Building and Energy Management System）is a system enables analysis and comparison of data by storing which is thought to be effective for saving energy.
By simple installation of BEMS will not have significant effect for energy saving but, rotating the cycle of Grasping present situation⇒data analysis ⇒Consideration of countermeasures⇒ Implementation of countermeasures is important.

Make energy saving cycle by installation of BEMS

# Proposals and expected effect（summary）

Implemented 20 energy saving improvement suggestions mainly on air conditioners and lightings

## Effects of suggestions

CO2 reduction amount is expected to be 384,074kg/year in total

| | | $CO_2$ reduction kg/year |
|---|---|---|
| Air conditioner | hardware | 227,356 |
| | software | 104,100 |
| Lightings | hardware | 23,951 |
| | software | 2,857 |
| Others | | 17,438 |
| Total | | 384,074 |

## Contents of each suggestions

| Improvement method | Expected effect |
|---|---|
| ①Reviewing preset temperature of air conditioner | 95,571Kg/year |
| ②Update to high efficiency air conditioner | 152,849Kg/year |
| ③Turn FL stabilizer into inverter | 20,485Kg/year |
| ④Installation of BEMS | Depends on operation |

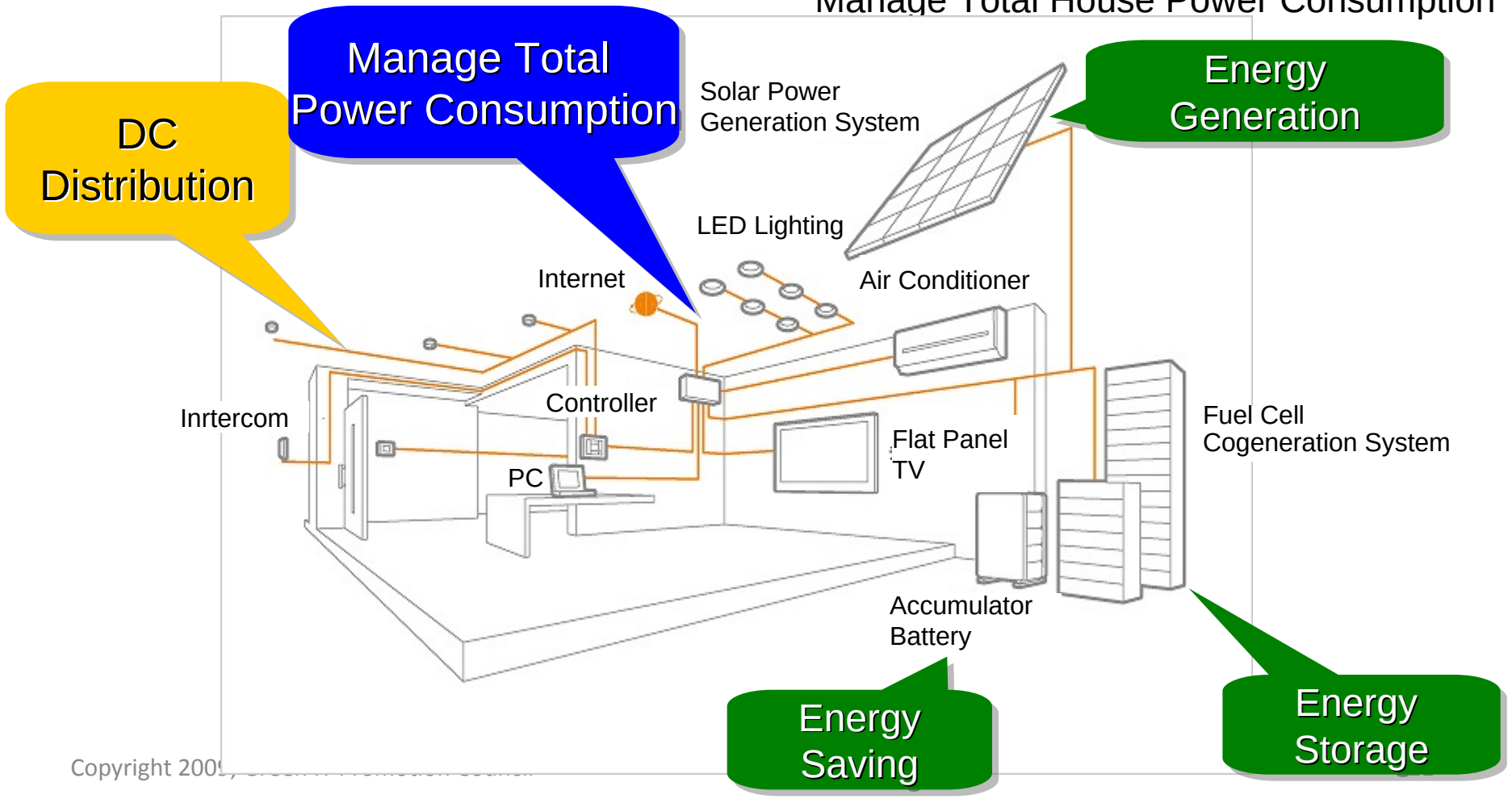
# Suggestions from diagnosis

In university, saving energies of lightings and air conditioners with large electricity use has great value.

- Energy saving of lightings and air conditioners have great effect at classroom buildings and office building
  - Lightings and air conditioners electricity consumption share is large at classroom buildings and office building which differ from factory and data center
- Energy saving by operation on air conditioners are also important
  - It is expected to have great effect by managing strictly on setup value of temperature
  - Automation will be possible by installing BEMS (same for lightings)
- Especially on lightings, consider rapid technology development for energy saving
  - Utilize energy saving technology such as exchanging stabilizers and turn into LED etc.
  - Operation technology has been improved such as BEMS
- Since some includes large investment, it is important to improve on equipment update schedule
  - It is crucial to judge balance between energy loss by aging degradation and technology development on energy saving

# Suggestions from diagnosis

- Realize “Energy Generation, Saving & Storage” by Fully Utilizing Renewable Energy
- Increase Energy Efficiency by “DC Distribution System”
- Connect all Electronics & Equipments with Network and Manage Total House Power Consumption



# Realize ”Green Life Style” Society by Utilizing Renewable Energy