Study on the energy-saving measures and the introduction of renewable energy for the winter season road management instructions in Aomori Pref. in Japan
ID: 20

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Outline of presentation

1.Introduction;

Location and climate of Aomori pref.

2. Actual conditions of energy consumption by road management facilities

3.Concept to introduce “Energy saving measures & renewable energy” to road management facilities;

Basic policy & six priority projects

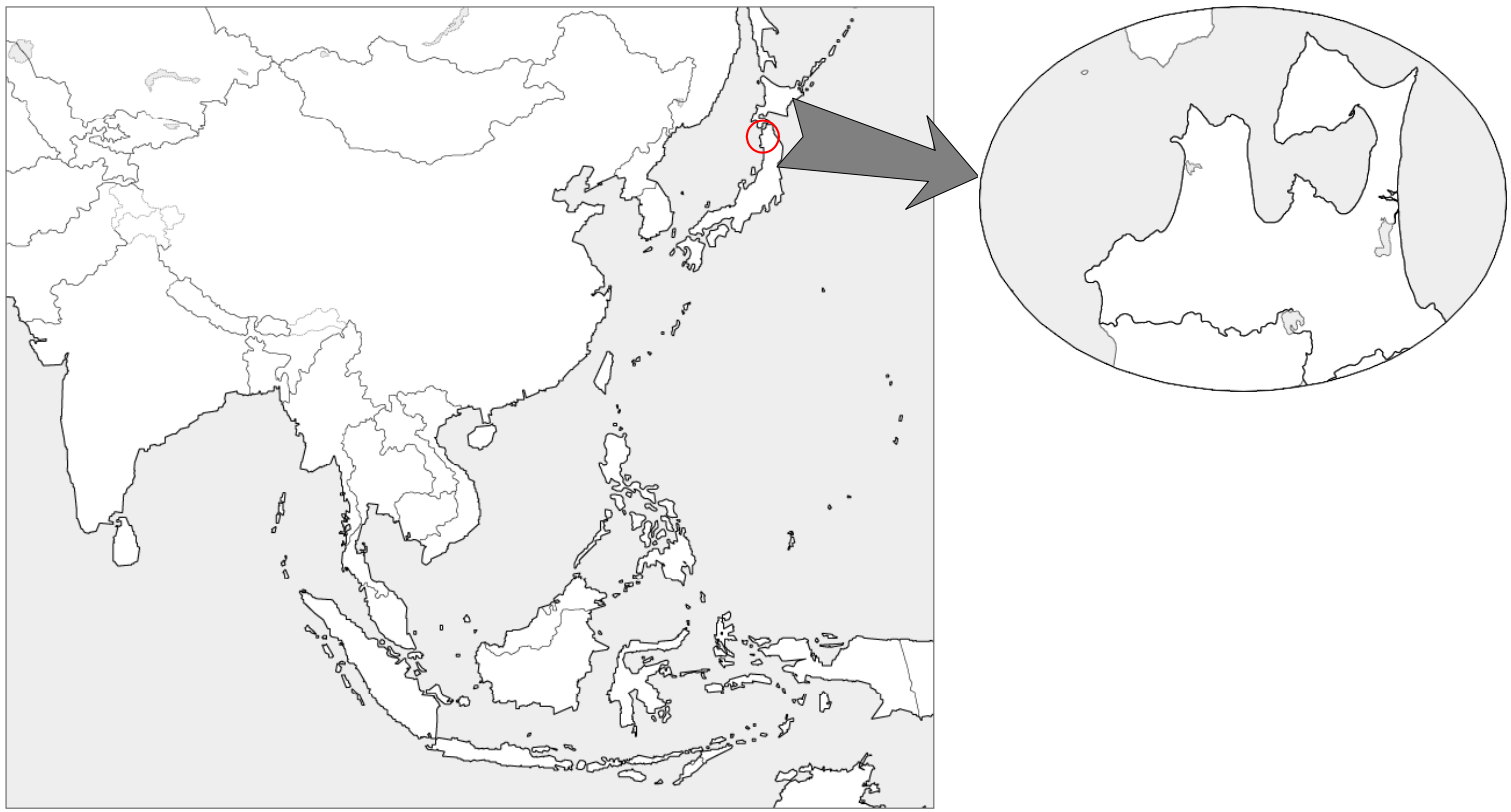
4.The target reduction values for energy (fossil fuels, costs and CO2) and the Road Map

INTRODUCTION

1.Aomori prefecture (Lat.41° N, Population 1,400,000 people) is located at the northern tip of Japan's main island

2.Heaviest snowfall in Japan, and Drifting snow caused by strong seasonal winds the Sea of Okhotsk is famous.

3.Light emitting delineators and non-water sprinkle melting snow facilities are essential for safe road traffic.

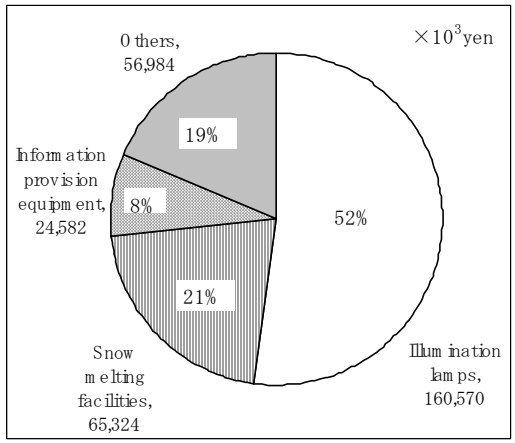


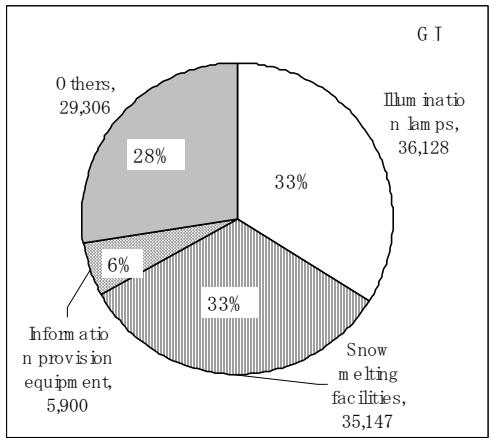
Location of Aomori Prefecture

ACTUAL CONDITIONS OF ENERGY CONSUMPTION BY ROAD MANAGEMENT FACILITIES

Road illumination occupies more than half of the total running costs. Moreover, in energy volume base, road illumination and snow melting facilities have almost the same volume, and these totals occupy approximately 70% of overall total.

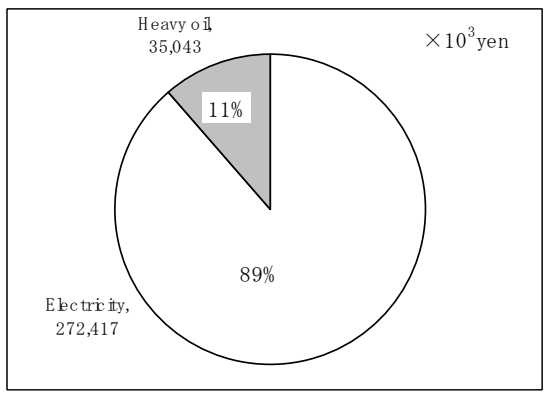
This demonstrates the need for cost savings and changes toward using eco energy in illumination and snow melting.

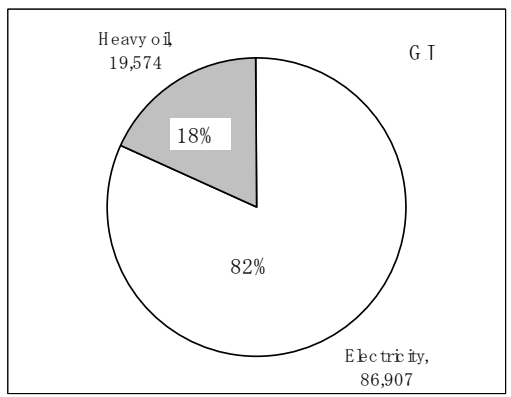




（Running Cost Base）　　（Energy Consumption Base）

Annual Energy Consumption by road management facilities by application (2006)





（Running Cost Base）　　（Energy Consumption Base）

Annual Energy Consumption by road management facilities according to energy source (2006)

CONCEPT TO INTRODUCE ENERGY SAVING MEASURES AND RENEWABLE ENERGY TO ROAD MANAGEMENT FACILITIES IN AOMORI (Basic policy)

<Policy 1>

Introduction of eco energy sets Life Cycle Costs (LCC) to be the investment standard.

⇒ Carrying of calculation of LCC of each energy saving measures and renewable energy in the guideline

<Policy 2>

Thorough introduction of energy saving in the existing road management facilities

Some energy saving measures can be achieved by daily management that requires little cost .

⇒ Carrying of Energy saving diagnosis method etc. in the guideline

<Policy 3>

In the event of renovating or new construction of road management facilities, consider introducing renewable energy.

When considering the introduction of renewable energy, in addition to LCC, the regional characteristics (abundance/available supply), stable procurement and differences in long-term running costs compared to conventional energy (commercial electricity, kerosene, heavy oil) should be taken into consideration.

⇒ Carrying of the abundance/available supply of renewable energy etc. in the guideline

PRIORITY PROJECTS

◆Priority Project 1: short term goal (~5 years)
Energy saving measures by daily management

◆Priority Project 2: short term goal (~5 years)
Energy saving measures along with facility investment such as replacing road illumination lamps to more highly efficient lamps

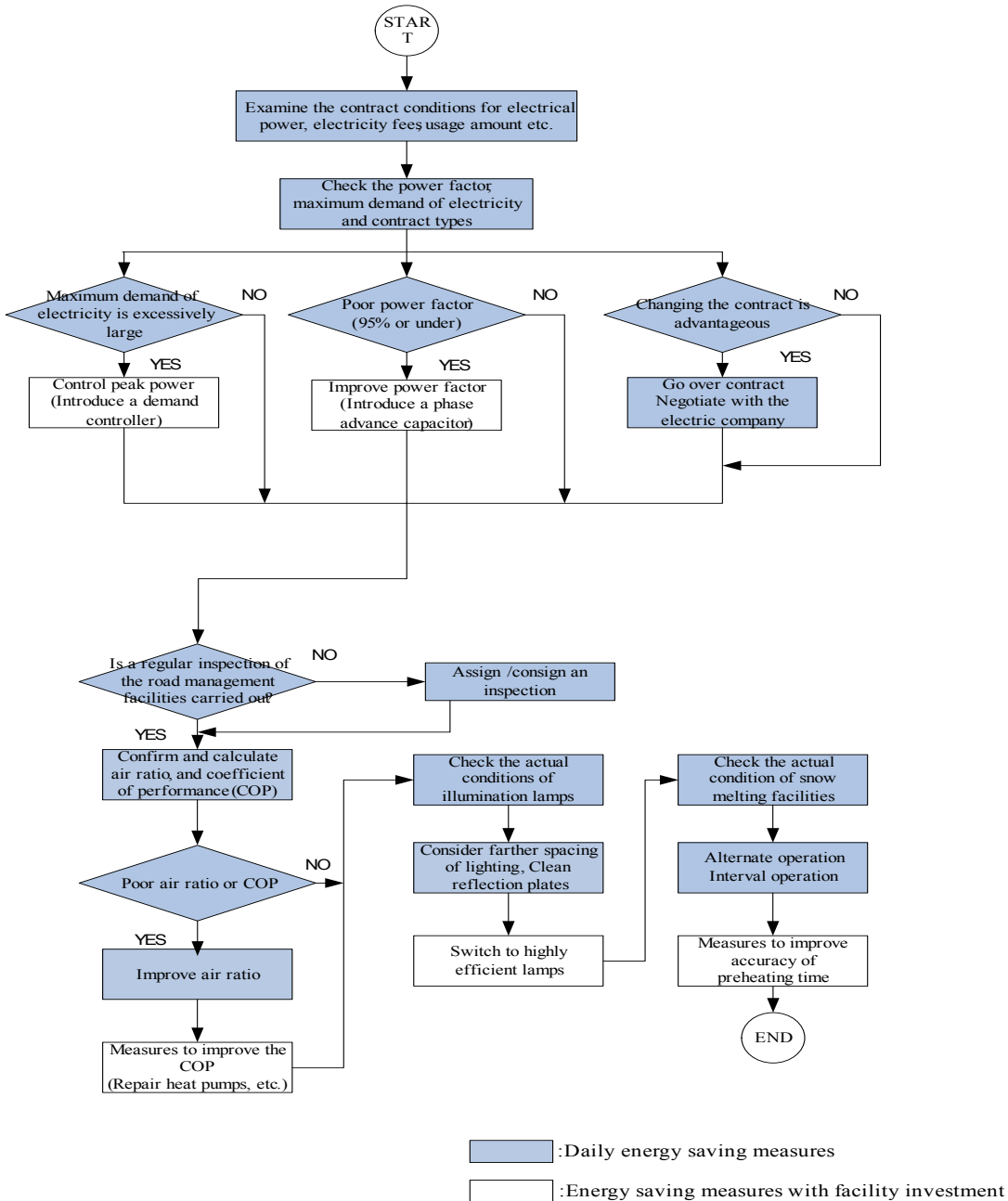
◆Priority Project 3: short term goal (~5 years)
Replacing to or newly installing facilities equipped with photovoltaic generators

◆Priority Project 4: medium term goal (6~10 years)
For non-water sprinkler, snow melting facilities, replace kerosene (heavy oil) / hot-water boilers with, or newly install, wood boilers

◆Priority Project 5: long term goal (11~20 years)
For non-water sprinkler, snow melting facilities, replace hot air source heat pumps with, or newly install, geothermal heat pumps

◆Priority project 6: long term goal (11~20 years)
For electrical power required by road management facilities, change to in-house generation (BDF diesel generator, wind electricity, etc.) or power supply from public electric industry

PROCEDURE FLOW OF PRIORITY PROJECTS 1, 2 (ENERGY SAVING) CONSIDERATIONS



PRIORITY PROJECT 1:ENERGY SAVING MEASURES BY DAILY MANAGEMENT

1). Check operational efficiency, such as power factor, air ratio, coefficient of performance (COP) during facility operations. Carry out an improvement scheme in cases where operation efficiency is lower than the design value.

2). Carry out an improvement scheme in cases where facility operations are considered to be consuming excessive energy.

3). Convert to energy saving by changing the lighting rate at the entrance and middle of tunnels.

4). Improve illumination intensity by cleaning the light reflectors on tunnel walls.

5). Regarding electricity, measures should be taken in order to reach a power factor of 100%.

6). A less expensive electrical power contract should be chosen according to the maximum quantity and time of usage of the electrical power.

7). Farther spaced lighting by illumination lamps, etc., the intermittent operation of snow melting devices, control of facilities where alternative operations are possible according to the weather conditions.

8). Carry out improvement proposals in consideration of the check record during the working season and at the end of the season.

PRIORITY PROJECT 2:ENERGY SAVING MEASURES ALONG WITH FACILITY INVESTMENT SUCH AS REPLACING ROAD ILLUMINATION LAMPS TO MORE HIGHLY EFFICIENT LAMPS

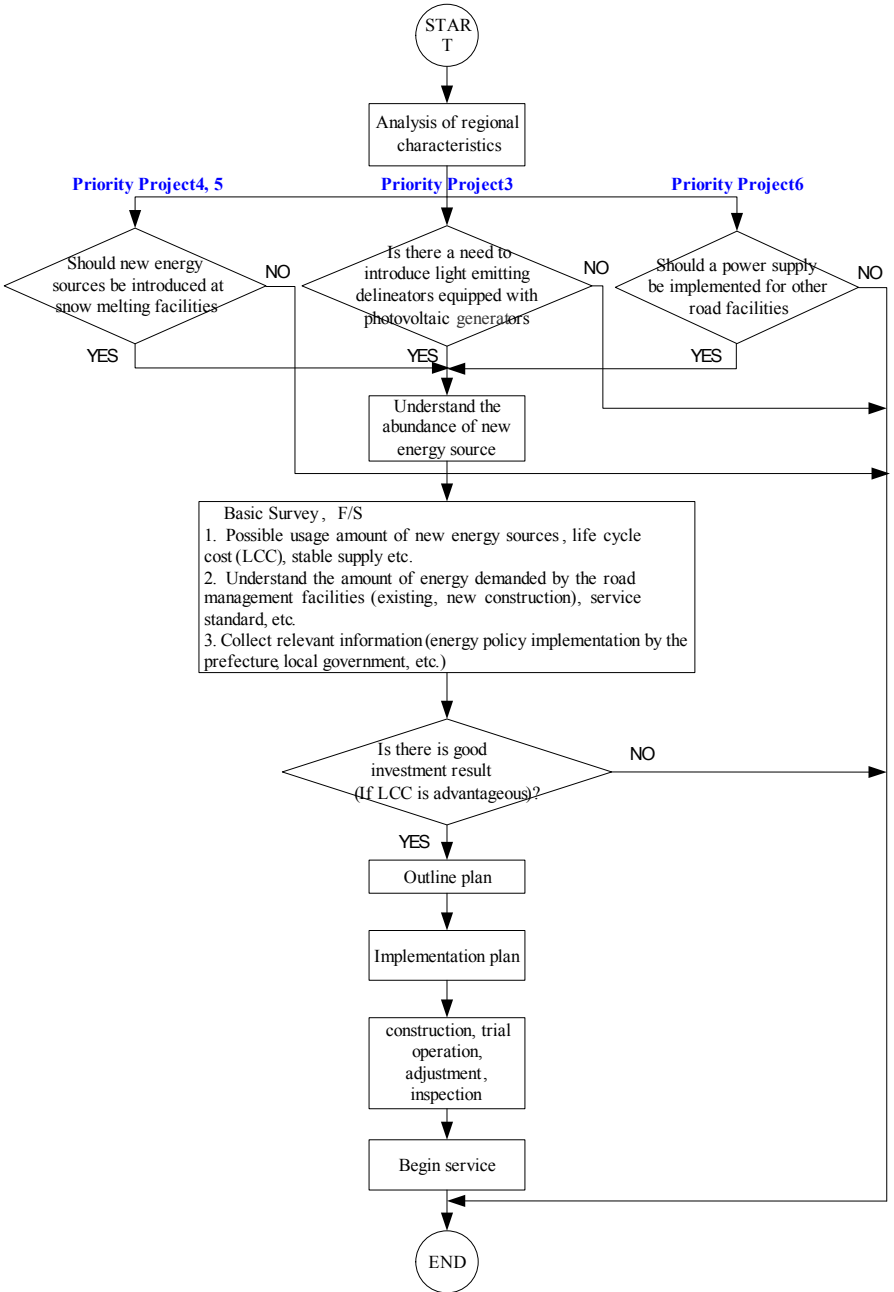
LCC of to every lamp

Price of 1 lamp(yen)＋〔Consumption electric power of 1 lamp（W）×Illumination time for a year（h）／1,000×Electric power unit price（yen/kWh）／（Average span of life（h）/Illumination time for a year（h））

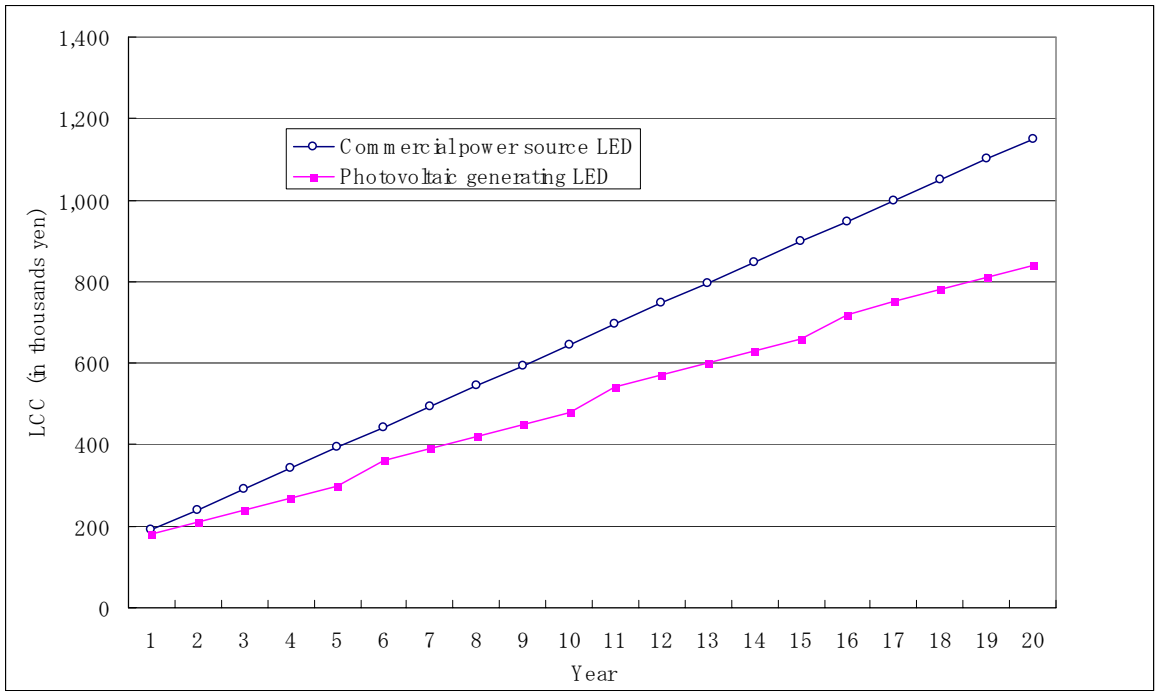
Kind of the lamp	Radiation efficiency (lm/w)	Average span of life (h)	Price of 1 lamp (yen)	LCC for a year of to every 1 lamp 12hours lighting a day (yen)
Mercury lamp (400W)	55	12,000	6,000	12,604
High pressure sodium-vapor lamp (180W)	105	24,000	16,000	5,203

*The contract demand is cut even the electricity charges even the basic fare, because it becomes to half.

PROCEDURE FLOW OF PRIORITY PROJECTS 3-6 (RENEWABLE ENERGY) CONSIDERATIONS



PRIORITY PROJECT 3 :INSTALLATION OF LIGHT EMITTING DELINEATORS (LIGHT EMITTING SAFETY POST) EQUIPPED WITH A PHOTOVOLTAIC GENERATOR



・Purchase price of one light emitting delineator- photovoltaic generator: 100,000 yen, commercial power source: 50,000 yen

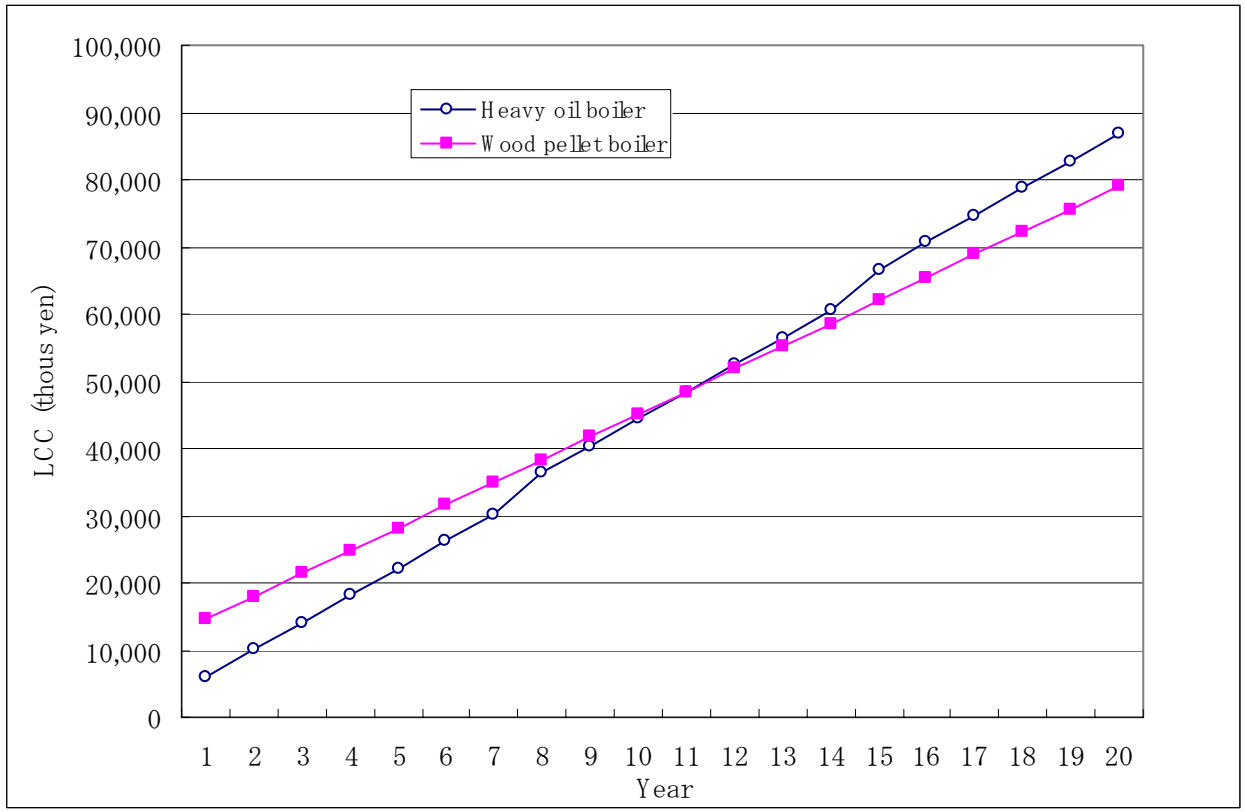
・Construction cost of one light emitting delineator- photovoltaic generator: 50,000 yen, commercial power source: 90,000 yen

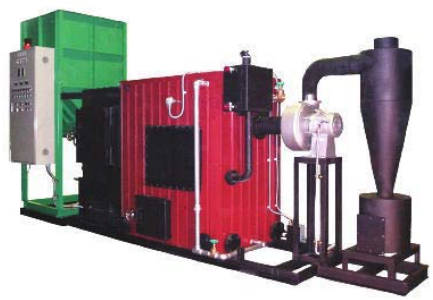
・Yearly maintenance cost of photovoltaic generating systems- battery replacement (once in every 5 yrs): 30,000 yen, maintenance check: 30,000 yen

・Commercial power source systems- Yearly electrical power consumption: 28,000 yen, maintenance check: 22,500 yen

Comparison of life cycle costs by different power supply systems

PRIORITY PROJECT 4 : SWITCH FROM HOT-WATER KEROSENE BOILERS AT THE SNOW-MELTING FACILITIES TO WOOD PELLET BOILERS





- Kerosene boilers (400,000 kcal)- cost: 2m yen, durable yrs: 7 yrs, heavy oil 72 yen/L
- Wood pellet boilers (400,000 kcal)- cost: 11m yen, durable yrs: 20 yrs, wood pellet 30 yen/kg
- Operations of 120 days / yr (December to the following March) and 50% a load rate
- Excluding maintenance and building expenditures

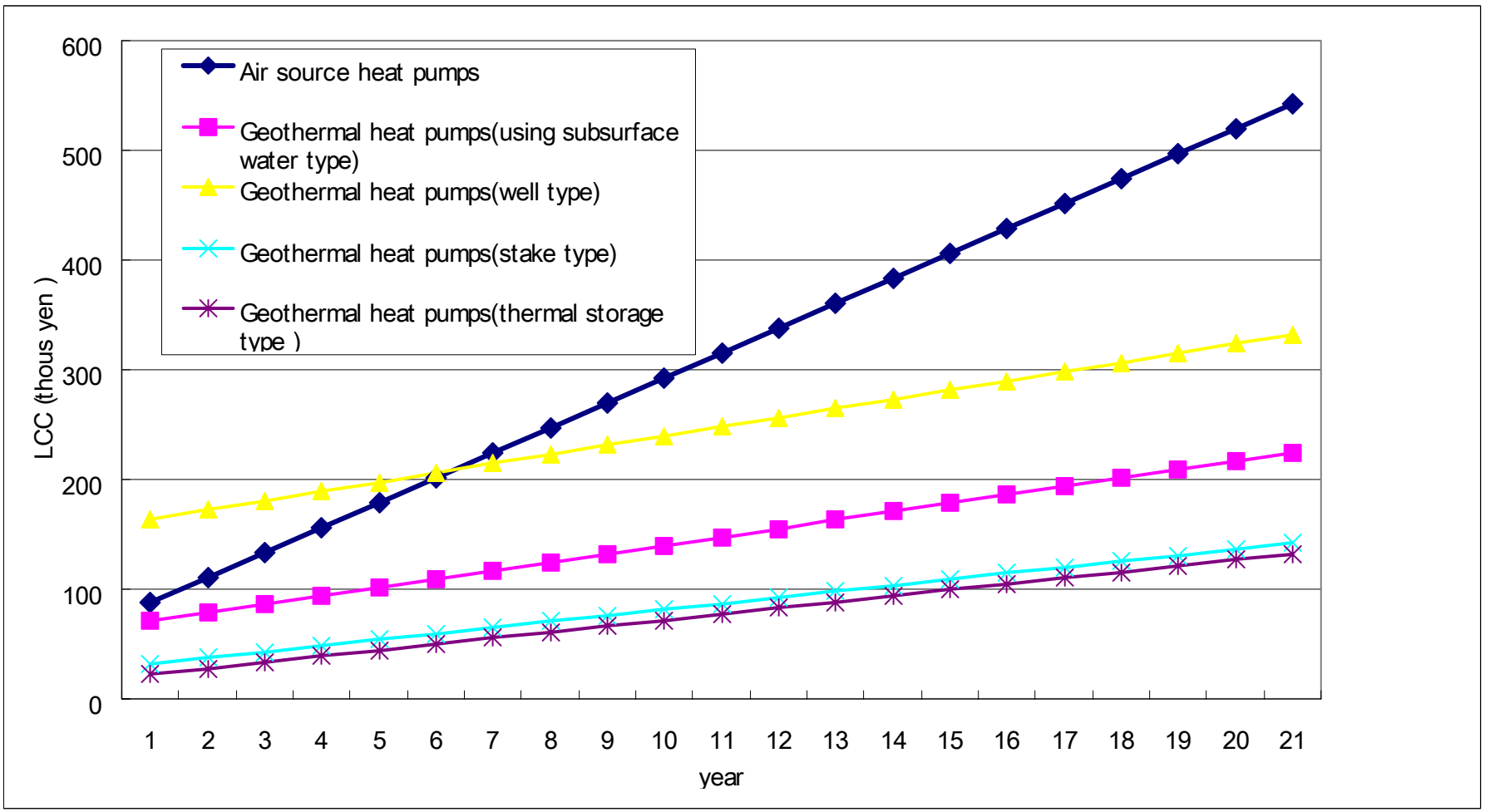
Comparison of life cycle costs for hot water boilers for snow melting facilities

PRIORITY PROJECT 5:FOR NON-WATER SPRINKLER, SNOW MELTING FACILITIES, REPLACE HOT AIR SOURCE HEAT PUMPS WITH, OR NEWLY INSTALL, GEOTHERMAL HEAT PUMPS (#1/2)

	Air source heat pumps	Geothermal heat pumps			
		using subsurface water type	well type	stake type	thermal storage typ
Initial cost (thous yen／m²)	88	70.6	164	32	22.4
Running cost (thous yen／m²)	22.7	7.7	8.4	5.5	5.5

Execution case of the subterranean water heat returning style non-water sprinkling melting snow institution

PRIORITY PROJECT 5:FOR NON-WATER SPRINKLER, SNOW MELTING FACILITIES, REPLACE HOT AIR SOURCE HEAT PUMPS WITH, OR NEWLY INSTALL, GEOTHERMAL HEAT PUMPS (#2/2)



Comparison of life cycle costs for heat pumps for snow melting facilities (thousyen/m^2)

PRIORITY PROJECT 6 : FOR ELECTRICAL POWER REQUIRED BY ROAD MANAGEMENT FACILITIES, CHANGE TO IN-HOUSE GENERATION (BDF DIESEL GENERATOR, WIND ELECTRICITY, ETC.) OR POWER SUPPLY FROM PUBLIC ELECTRIC INDUSTRY

(1)Bio Diesel Fuel Power Generator
(2) Wind Power
(3) Small or Medium size Hydropower
(4)Advanced utilization of Power Supply Public Electric Industry (Big Size Hydropower)

Bio Diesel Fuel(B100) Power Generator

Wind electricity by the investment of the citizen in Aomori pref.

Establishment of the power generation device to resisual flow discharge outlet works

Small size Hydropower Generation using Tunnel spring water

TARGET REDUCTION VALUES FOR FOSSIL FUELS AT ROAD MANAGEMENT FACILITIES

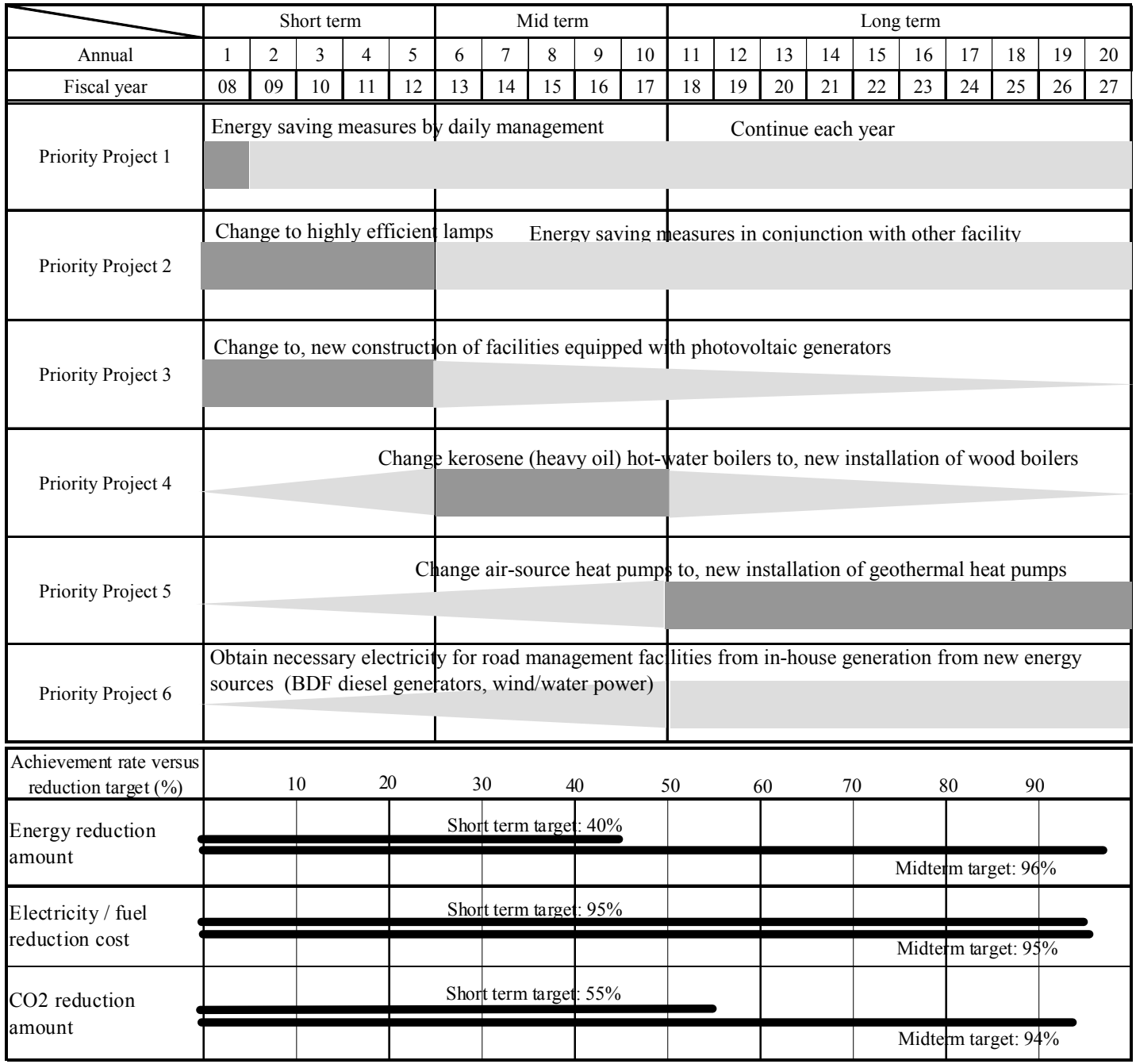
Item	Short term -5 yrs	Mid term 6-10 yrs	Long term 11-20 yrs	Basis for setting the target value
Priority Project 1	3,200 GJ (3%)	—	—	From the results of energy saving inspection etc., a 3-10% reduction is determined as possible. A 3% reduction is by implementing only energy saving on. (Based on actual achievement in 2006)
Priority Project 2	3,000,000kWh (30%)	—	—	Assuming that other prefectural governments would also have the same scale, based on actual achievements by the Sampachi Regional Prefectural Government Development Bureau. (Based on actual achievement in 2005, 2006)
Priority Project 3	— (0%)	—	—	The target value is not set because the number of actual delineators equipped with commercial power source, etc., is small.
Priority Project 4	—	19,574GJ (100%)	—	Considering that the durable years of heavy oil (kerosene) hot-water boilers is approximately 7 years, in the case where 3 heavy oil (kerosene) hot-water boilers in the prefecture are replaced by wood boilers. (Based on actual achievement in 2005)
Priority Project 5	—	—	428,000kWh (70%)	Considering that the durable years of air-source heat pumps is approximately 15-20 years, in the case where 10 air-source heat pumps in prefecture are replaced with geothermal (groundwater) heat pumps. (Based on actual achievement in 2005)
Priority Project 6	—	—	— (0%)	The reduction target value has not been set because future conditions are hard to determine by the current situation.
Cumulative Sum Upper line: Total Calories Lower line: Reduction Rate of Total Energy in Road Management	14,000GJ 13.1%	33,574GJ 31.5%	35,115GJ 33.0%	—

TARGET REDUCTION VALUE OF RUNNING COSTS AND CO2 REDUCTION FOR ROAD MANAGEMENT FACILITIES

Item	Short term ~ 5 years	Mid term 6~10 years	Long term 11~20 years
Priority project 1	9,224 thou yen 410 tons	—	—
Priority project 2	48,000 thou yen 1,530 tons	—	—
Priority project 3	— thou yen 0 ton	—	—
Priority project 4	—	296 thou yen 1,357 tons	—
Priority project 5	—	—	2,996 thou yen 218 tons
Priority project 6	—	—	— thou yen 0 ton
Cumulative sum (Reduction rate to total energy for road management)	57,224 thou yen (18.6%) 1,940 tons （14.2%）	57,520 thou yen (18.7%) 3,297 tons （24.1%）	60,516 thou yen (19.7%) 3,515 tons （25.7%）

[Upper line: reduction cost, lower line: CO2 reduction]

ROAD MAP


Short term
Mid term
Long term
Annual
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Fiscal year
08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Priority Project 1
Energy saving measures by daily management
Continue each year
Priority Project 2
Change to highly efficient lamps
Energy saving measures in conjunction with other facility
Priority Project 3
Change to, new construction of facilities equipped with photovoltaic generators
Priority Project 4
Change kerosene (heavy oil) hot-water boilers to, new installation of wood boilers
Priority Project 5
Change air-source heat pumps to, new installation of geothermal heat pumps
Priority Project 6
Obtain necessary electricity for road management facilities from in-house generation from new energy sources (BDF diesel generators, wind/water power)
Achievement rate versus reduction target (%)
10 20 30 40 50 60 70 80 90
Energy reduction amount
Short term target: 40%
Midterm target: 96%
Electricity / fuel reduction cost
Short term target: 95%
Midterm target: 95%
CO2 reduction amount
Short term target: 55%
Midterm target: 94%

Cover of the leaflet

Cover of the quick manual

The technology of energy progresses.

This guidelines contents are the present technology level and a continual renewal necessary.

We control the progress of these targets (PDCA cycle), while organize a working group and grasping new technology.