



Flexible Aerogel Insulation for Industrial Applications

Insulation Improvement Proposal by the e'-AIM Method of Maintenance (Eco-Advanced Insulation Method)

January , 2 0 1 3
Kanden Plant Co . Inc. ,

Preface

I reported improving the efficiency of the energy of the coal-fired thermal power station of CHP-3 Thermal Power Station & CHP-4 Thermal Power Station by the e'-AIM Method of maintenance in a brief session of the Feasibility Study of the New Mechanism relate to Multiple Application of Energy Efficiency Improvement Measures at the Coal Thermal Power Station of Mongolia in January , 2012 .

In addition ,About the effect prediction of CHP-3 Thermal Power Station & CHP-4 Thermal Power Station , because I was not able to obtain basic performance data of existing steam pipe insulation materials , the study on the improvement of the efficiency quoted the appropriate data of the Japanese Plant and calculated quantity of annual heat loss and quantity of annual CO₂ emission .

I explain a summary of Aerogel Insulation and the e'- AIM Method of Maintenance this time .

Aerogel insulation : Pyrogel XT(Product name)

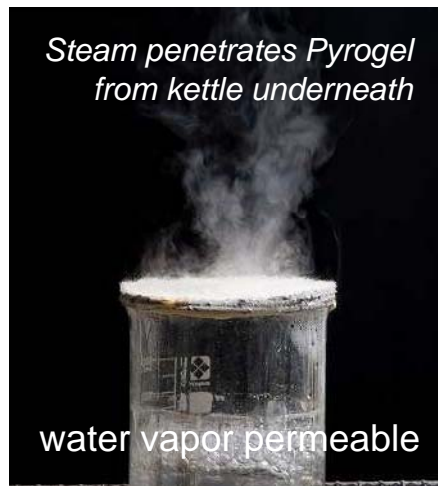


Pyrogel XT (Thickness : 5 and 10 mm)

Use Temperature Range :

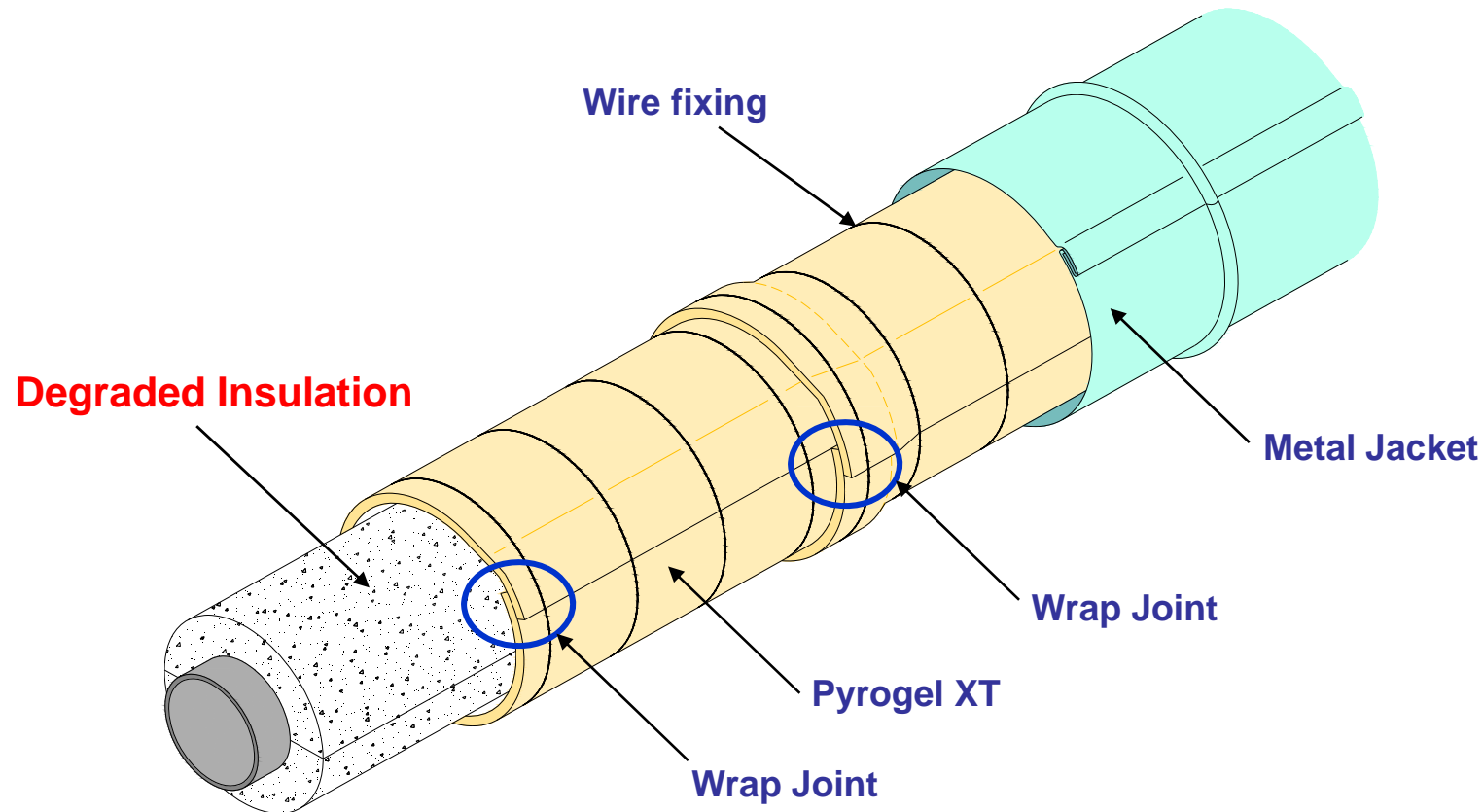
-40 ° F to 1200 ° F (-40 ° C to 650 ° C)

- **3 to 5 times lower k -value than perlite, calcium silicate, cellular glass, or mineral/glass fiber.**
- **Excellent productivity, especially on towers, vessels, and large pipe.**
- **Excellent water repellent.**
- **Resists mechanical abuse and thermal degradation.**



Summary of the e ' - AIM Method of Maintenance (Patent of NICHIASU CO.)

Easy installation just by wrapping around piping or equipments.
(Increase thermal insulation method of maintenance)



Insulation Improvement Proposal

Project: Ulan Bator of Mongolia

CHP 3 & CHP4 Thermal Power Station

Target Area: CHP3 Thermal Power Station TG-7

- ① Extraction steam pipe
- ② Feed water pipe
- ③ Main steam pipe

CHP4 Thermal Power Station TG-1, TG-4

- ① Extraction steam pipe
- ② Feed water pipe
- ③ Main steam pipe

Improvement : CHP3 Thermal Power Station TG-7

★ e'-AIM spec.

PyrogeIXT10mm × New cladding over the degraded insulation

★ Heat Loss Estimate (w)

Target Area	Present condition	After control
CHP-3 TG-7	290.722	159,094
Total	290.722	159,094

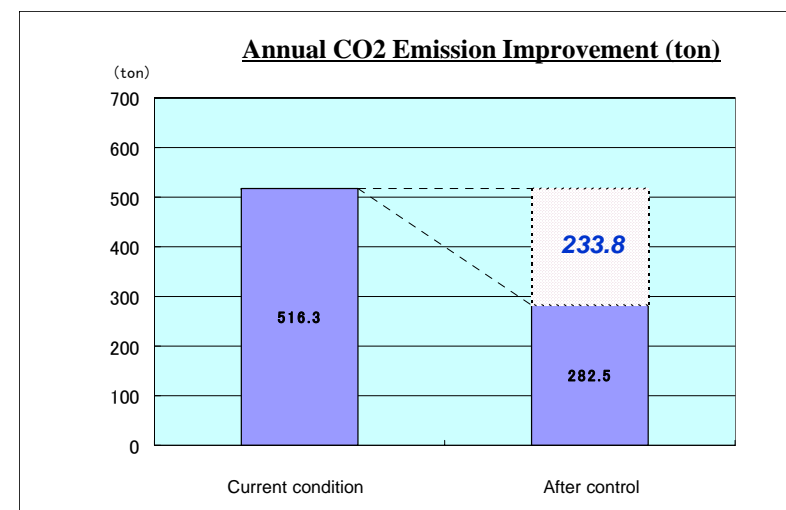
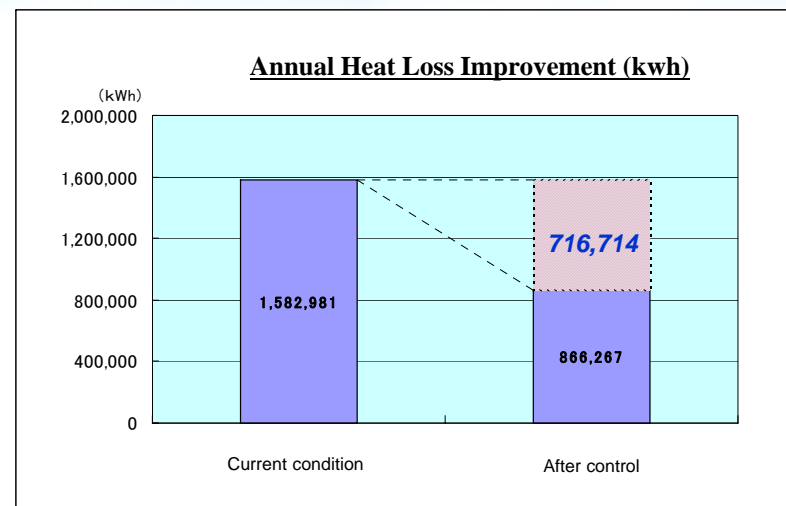
★ Calculation Condition

Operation time (h/year)	5,445	5,445
CO2 Emission Coefficiency(g/co2/Mj)※1	90/6	90. 6

Heat Toss (kW h/year)	1,582,981	866,267
CO2 Emission (ton/year)※2	506.3	282.5
Annual Heat Loss Improvement	△ 716,714 kWh	
Annual CO2 Emission Improvement	△ 233.8 ton	

※1 Reference ; Greenhouse—Emission Calculation Method

※2 Heat loss (kWh/year) × 3.6 (MJ/kW) × 90.6 (g/MJ) × 10⁻⁶(ton/g)



Improvement : CHP4 Thermal Power Station TG-1

★ e'-AIM spec.

PyrogeIXT10mm × New cladding over the degraded insulation

★ Heat Loss Estimate (w)

Target Area	Present condition	After control
CHP-4 TG-1	330.536	204.259
Total		

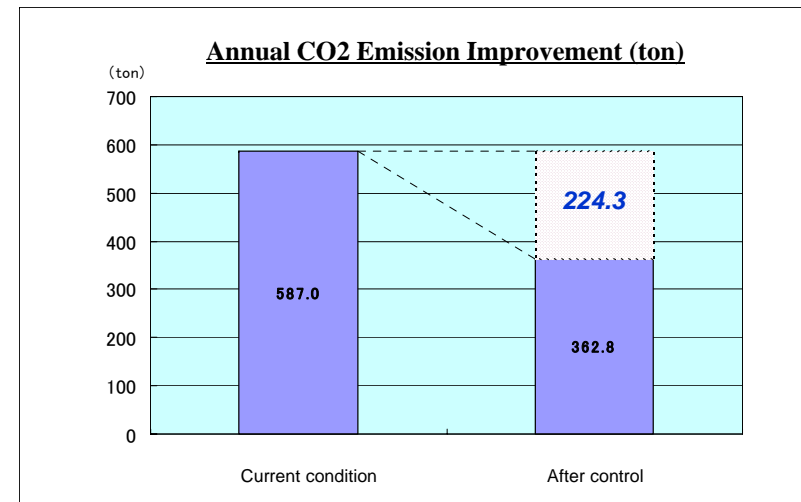
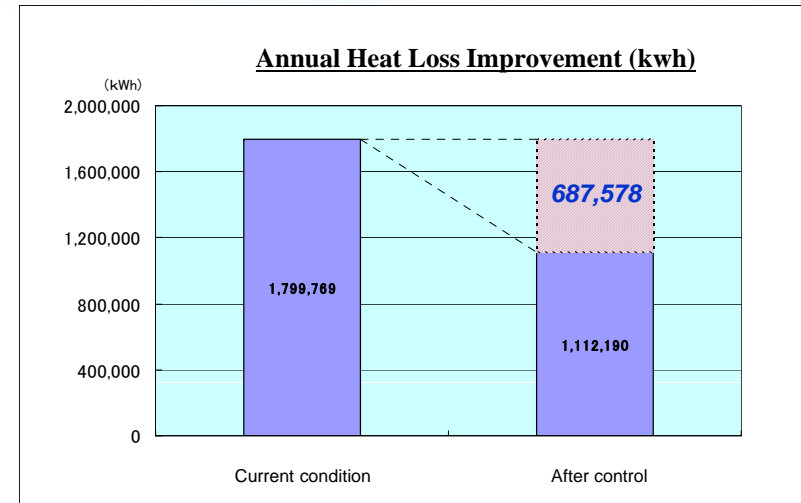
★ Calculation Condition

Operation time (h/year)	5,445	5,445
CO2 Emission Coefficiency(g/co2/Mj)※1	90. 6	90. 6

Heat Toss (kW h/year)	1,799,769	1,112,190
CO2 Emission (ton/year)※2	587.0	362.8
Annual Heat Loss Improvement	△ 687,578kWh	
Annual CO2 Emission Improvement	△ 224.3 ton	

※1 Reference ; Greenhouse—Emission Calculation Method

※2 Heat loss (kWh/year) × 3.6 (MJ/kW) × 90.6 (g/MJ) × 10⁻⁶(ton/g)



Improvement : CHP4 Thermal Power Station TG-4

★ e'-AIM spec.

PyrogeIXT10mm × New cladding over the degraded insulation

★ Heat Loss Estimate (w)

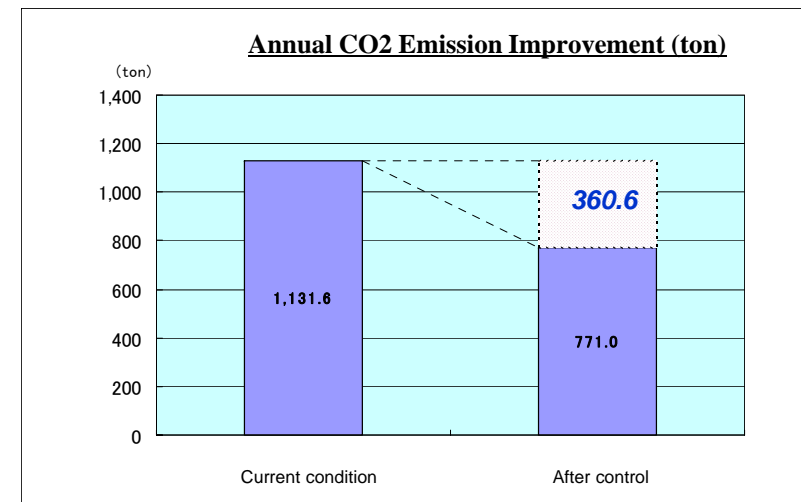
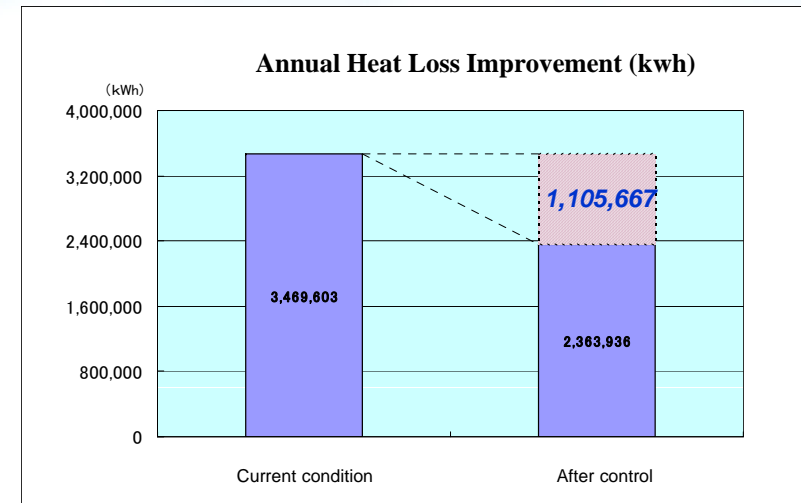
Target Area	Present condition	After control
CHP-4 TG-4	637,209	434,148
Total	637,209	434,148

★ Calculation Condition

Operation time (h/year)	5,445	5,445
CO2 Emission Coefficiency(g/co2/Mj)※1	90. 6	90. 6
Heat Toss (kW h/year)	3,469,603	2,363,936
CO2 Emission (ton/year)※2	1,131.6	770.0
Annual Heat Loss Improvement	△ 1,105,667 kWh	
Annual CO2 Emission Improvement	△ 360.6 ton	

※1 Reference ; Greenhouse—Emission Calculation Method

※2 Heat loss (kWh/year) × 3.6 (MJ/kW) × 90.6 (g/MJ) × 10⁻⁶(ton/g)



Past Experience (1/3)

Pyrogel/PyrogelXT Past Experience

(Year 2007)

No	Customer	Site		Plant	Objective
1	Petroleum Chemistry	Kanagawa	Kawasaki	Petroleum Plant	Heat Inace Pipe
2	Petroleum Chemistry	Kanagawa	Kawasaki	Petroleum Plant	Pipe
3	Petroleum Chemistry	Kanagawa	Kawasaki	Boiler	Steam Condensate Pipe
4	Petroleum Chemistry	Kanagawa	Kawasaki	Petroleum Plant	Heat-exchange Equipment
5	Petroleum Chemistry	Kanagawa	Kawasaki	Petroleum Plant	Trench Pipe
6	Pharmaceutical Company	Yamaguchi	Ube	Reactor Plant	Reactor Vessel / Pipe
7	Electric Power Company	Shimane	Matue	Process Plant	Valve

(Year 2008)

No	Customer	Site		Plant	Objective
1	Pharmaceutical Company	Hokkaido	Tomakomai	Petroleum Plant	Trench Pipe
2	Gas Company	Tokyo	Harumi	Underground Pipe Line	Steam Pipe
3	Electric Power Company	Kanagawa	Kawasaki	Coal Generation Plant	Indicator Box
4	Pharmaceutical Company	Niigata	Niigata	Reactor Plant	Reactor Vessel
5	Steel Company	Tokyo	Tokyo	Process Plant	Heat Dryer
6	Chemical Company	Yamaguchi	Shunan	Refiner	Pipe
7	Pharmaceutical Company	Hokkaido	Tomakomai	Petroleum Plant	Pipe
8	Pharmaceutical Company	Kanagawa	Kawasaki	Petroleum Plant	Trench Pipe
9	Pharmaceutical Company	Kanagawa	Kawasaki	Petroleum Plant	Equipment (950E.D.×2,300h) (CUI)
10	Chemical Company	Ehime	Niigata	Petroleum Plant	Steam Pipe (CUI)
11	Gas Company	Tokyo	Koutou-ku	Underground Pipe Line	Steam Pipe
12	Pharmaceutical Company	Yamaguchi	Shunan	Process Plant	Pipe
13	Engineering Company	Nagasaki	Nagasaki	Ship	Gas Duct

(Year 2009)

No	Customer	Site		Plant	Objective
1	Chemical Company	Mie	Yokkaichi	Turbine Facility	Oil Pipe (8B, 1 1/2B)
2	Pharmaceutical Company	Okayama	Kurashiki	Petroleum Plant	Oil Pipe (6B)
3	Pharmaceutical Company	Osaka	Sakai	Petroleum Plant	Steam Pipe (CUI)
4	Pharmaceutical Company	Okayama	Kurashiki	Petroleum Plant	Oil Pipe
5	Chemical Company	Okayama	Kurashiki	Chemical Plant	Pipe
6	Electric Power Company	Akita	Nosiro	Turbine Facility	Water Intake Pump
7	Electric Power Company	Nagasaki	Nagasaki	Turbine Facility	Turbine
8	Chemical Company	Yamaguchi	Shunan	Chemical Plant	Pipe
9	Gas Company	Kumamoto	Kumamoto	Gas Plant	Tank
10	Food company	Hokkaido	Mihoro	Process Plant	Dryer
11	Gas Company	Kumamoto	Kumamoto	LNG	Tank
12	Engineering Company	Nagasaki	Sasebo	Coal Generation Plant	Trench Pipe
13	Engineering Company	Tokyo	Harumi	Underground Pipe Line	Steam Pipe
14	Pharmaceutical Company	Wakayama	Wakayama	Chemical Plant	Pipe (CUI)
15	Pharmaceutical Company	Kanagawa	Kawasaki	Chemical Plant	Pipe (CUI)
16	Pharmaceutical Company	Yamaguchi	Onoda	Chemical Plant	Steam Pipe
17	Chemical Company	Niigata	Itoigawa	Chemical Plant	Reactor Vessel
18	Engineering Company	Hokkaido	Mihoro	Process Plant	Dryer
19	Automobile Company	Aichi	Hekinan	Aluminum Parts Process	Furnace
20	Gas Company	Hiroshima	Hatsukaichi	LNG	Pipe
21	Engineering Company	Chiba	Chiba	Chemical Plant	Equipment
22	Pharmaceutical Company	Osaka	Sakai	Chemical Plant	Tank (CUI)
23	Pharmaceutical Company	Yamaguchi	Onoda	Chemical Plant	Reactor Vessel
24	Electric Power Company	Yamagata	Sakata	Coal Generation Plant	Heater
25	Gas Company	Tokyo	Koutou-ku	Underground Pipe Line	Pipe
26	Engineering Company	Nagasaki	Nagasaki	Ship	Gas Duct
27	Chemical Company	Kanagawa	Kawasaki	Chemical Plant	Gas Duct
28	Electric Power Company	Kagoshima	Busuki	Geothermal Plant	Steam Pipe

Past Experience (2/3)

(Year 2009)

No	Customer	Site	Plant	Objective
29	Gas Company	Hiroshima	Hatsukaichi	LNG Gas Pipe
30	Engineering Company	Oita	Ikuju	Geothermal Plant Steam Pipe
31	Gas Company	Aichi	Nagoya	Underground Pipe Line Boiler / Pipe
32	Engineering Company	Osaka	Sakai	Petroleum Plant Urheading Device
33	Engineering Company	Okayama	Kurashiki	Chemical Plant Pump
34	Engineering Company	Nagasaki	Nagasaki	Ship Gas Duct
35	Engineering Company	Kagoshima	Isolate Island	Coal Generation Plant Diesel Engine
36	Engineering Company	-	-	PC Plant Pipe / Equipment

(Year 2010)

No	Customer	Site	Plant	Objective
1	Pharmaceutical Company	Kanagawa	Yokohama	Underground Pipe Line Valve etc
2	Gas Company	Tokyo	Tokyo	Underground Pipe Line Pipe
3	Gas Company	Tokyo	Tokyo	Underground Pipe Line Pipe
4	Chemical Company	Kanagawa	Yokosuka	Chemical Plant Equipment
5	Gas Company	Kanagawa	Yokohama	Gas Plant Pipe
6	Engineering Company	Niigata	Niigata	Coal Generation Plant Pipe
7	Gas Company	Hokkaido	Hakodate	Gas Plant Pipe
8	Electric Power Company	Hokkaido	Data	Coal Generation Plant Turbine
9	Chemical Company	Niigata	Tainai	Chemical Plant Equipment
10	Electric Power Company	Yamagata	Sakata	Coal Generation Plant Steam Pipe
11	Electric Power Company	Aichi	Toyotake	Coal Generation Plant Pipe
12	Electric Power Company	Shimane	Matsue	Coal Generation Plant Valve
13	Engineering Company	Okayama	Kurashiki	Chemical Plant Pipe
14	Engineering Company	Ehime	Imabari	Chemical Plant Pipe
15	Engineering Company	Yamaguchi	Ube	Chemical Plant Tank (CUI)
16	Gas Company	Kumamoto	Kumamoto	Gas Plant Equipment
17	Engineering Company	Nagasaki	Itahaya	Incinerator Plant Pipe
18	Engineering Company	Yamaguchi	Shuunan	Chemical Plant Duct
19	Pharmaceutical Company	Yamaguchi	Shuunan	Chemical Plant Pipe
20	Pharmaceutical Company	Yamaguchi	Onoda	Chemical Plant Tank
21	Pharmaceutical Company	Yamaguchi	Shuunan	Chemical Plant Tank
22	Engineering Company	-	-	Gas Plant Pipe
23	Pharmaceutical Company	Fukuoka	Omura	Chemical Plant Pipe
24	Engineering Company	Yamaguchi	Onoda	Chemical Plant Equipment
25	Engineering Company	Kanagawa	Kawasaki	Chemical Plant Pipe

(Year 2010)

No	Customer	Site	Plant	Objective
26	Engineering Company	Kanagawa	Kawasaki	Chemical Plant Pipe (CUI)
27	Engineering Company	Kanagawa	Kawasaki	Chemical Plant Pipe (CUI)
28	Pharmaceutical Company	Osaka	Ibaraki	Chemical Plant Equipmnet (CUI)
29	Electric Power Company	Hokkaido	Tomakomai	Coal Generation Plant Gas Duct Line (CUI)
30	Chemical Company	Niigata	Tainai	Chemical Plant Steam Pipe
31	Engineering Company	Yamagata	Sakata	Coal Generation Plant Steam Pipe
32	Pharmaceutical Company	Chiba	Ichihara	Chemical Plant Pipe (CUI)
33	Chemical Company	Chiba	Ichihara	Chemical Plant Equipment (CUI)
34	Chemical Company	Chiba	Ichihara	Chemical Plant Pipe (CUI)
35	Engineering Company	Tokyo	Tokyo	Incinerator Plant Pipe
36	Engineering Company	Wakayama	Wakayama	Chemical Plant Oil Tank (CUI)
37	Gas Company	Hiroshima	Hatsukaichi	Gas Plant Steam Pipe / Water Pipe
38	Chemical Company	Aichi	Nagoya	Chemical Plant Steam Pipe
39	Engineering Company	Tokyo	Fuchu	Train Engine Pipe
40	Electric Power Company	Ibaraki	Toukai	Coal Generation Plant Steam Pipe
41	Electric Power Company	Hokkaido	Shiruichi	Coal Generation Plant Steam Pipe (CUI)
42	Chemical Company	Gifu	Mishima	Chemical Plant Steam Pipe
43	Engineering Company	Nagasaki	Nagasaki	Ship Gas Engine Duct
44	Engineering Company	Kagoshima	Ibusuki	Coal Generation Plant Steam Pipe
45	Pharmaceutical Company	Yamaguchi	Onoda	Chemical Plant Tank (CUI)
46	Electric Power Company	Yamaguchi	Onoda	Coal Generation Plant Oil Pipe (CUI)
47	Chemical Company	Yamaguchi	Onoda	Chemical Plant Steam Pipe
48	Chemical Company	Okayama	Okayama	Chemical Plant Steam Pipe
49	Electric Power Company	Fukuoka	Takahama	Coal Generation Plant Equipmnet (CUI)
50	Electric Power Company	Aomori	Rokkasho	Atomic Energy Facility Trench Pipe
51	Engineering Company	Tokyo	Tokyo	Incinerator Plant Pipe
52	Engineering Company	Oita	Oita	Coal Generation Plant Trench Pipe (CUI)
53	Gas Company	Hiroshima	Hiroshima	Gas Plant Pipe
54	Gas Company	Hiroshima	Hatsukaichi	Gas Plant Pipe

Past Experience (3/3)

(Year 2011)

No	Customer	Site		Plant	Objective
1	HVAC control	Saitama	Saitama	Underground Pipe Line	Steam Pipe
2	Electric Power Company	Osaka	Sakai	Coal Generation Plant	Steam Pipe
3	Chemical Company	Hyogo	Takasago	Chemical Plant	Pipe
4	Electric Power Company	Fukui	Takahama	Atomic Energy Facility	Diesel Generator (CUI)
5	Pharmaceutical Company	Osaka	Sakai	Chemical Plant	Pipe (CUI)
6	Pharmaceutical Company	Chiba	Sodegaura	Chemical Plant	Equipment (CUI)
7	Pharmaceutical Company	Yamaguchi	Ube	Chemical Plant	Equipment
8	Chemical Company	Shizuoka	Mishima	Chemical Plant	Steam Pipe
9	Electric Power Company	Oita	Oita	Coal Generation Plant	Oil Pipe Line (CUI)
10	Electric Power Company	Fukui	Ooi	Atomic Energy Facility	Equipment (CUI)
11	Electric Power Company	Fukuoka	Kitakyushu	Coal Generation Plant	Duct (CUI)
12	Chemical Company	Osaka	Osaka	Chemical Plant	Equipment
13	Electric Power Company	Niigata	Niigata	Coal Generation Plant	Steam Pipe
14	HVAC control	Aichi	Nagoya	Underground Pipe Line	Boiler
15	Pharmaceutical Company	Chiba	Ichihara	Chemical Plant	Pipe (CUI)
16	Electric Power Company	Niigata	Kitaurahara	Coal Generation Plant	Equipment (CUI)
17	Engineering Company	Nagasaki	Isahaya	Incinerator Plant	Duct
18	Electric Power Company	Oita	Oita	Coal Generation Plant	Steam Pipe
19	Chemical Company	Tokyo	Kodaira	Chemical Plant	Pipe
20	HVAC control	Aichi	Nagoya	Underground Pipe Line	Boiler
21	Electric Power Company	Ibaraki	Toukai	Atomic Energy Facility	Equipment
22	Chemical Company	Yamaguchi	Onoda	Chemical Plant	Steam Pipe
23	Electric Power Company	Oita	Oita	Coal Generation Plant	Gas Turbine Pipe
24	Electric Power Company	Hokkaido	Atsuma	Coal Generation Plant	Gas Duct (CUI)
25	Chemical Company	Kanagawa	Kawasaki	Chemical Plant	Tank
26	Chemical Company	Okayama	Kurashiki	Chemical Plant	Steam Pipe
27	Pharmaceutical Company	Ibaraki	Takahagi	Chemical Plant	Equipment
28	Chemical Company	Hyogo	Takasago	Chemical Plant	Steam Pipe
29	Chemical Company	Shizuoka	Mishima	Chemical Plant	Steam Pipe
30	Chemical Company	Yamaguchi	Ube	Chemical Plant	Equipment / Pipe
31	Chemical Company	Yamaguchi	Shuunan	Chemical Plant	Steam Pipe
32	Electric Power Company	Ibaraki	Toukai	Atomic Energy Facility	Steam Pipe
33	Chemical Company	Okayama	Kurashiki	Chemical Plant	Steam Pipe
34	Paper Company	Gifu	Nakatsugawa	Paper Process	Steam Pipe

(Year 2011)

No	Customer	Site		Plant	Objective
35	Electric Power Company	Hokkaido	Date	Coal Generation Plant	Oil Pipe Line
36	Chemical Company	Osaka	Osaka	Chemical Plant	Equipment
37	Chemical Company	Osaka	Osaka	Chemical Plant	Steam Pipe
38	Chemical Company	Hyogo	Himeji	Chemical Plant	Steam Pipe
39	Electric Power Company	Hokkaido	Date	Coal Generation Plant	Oil Pipe Line (CUI)
40	Electric Power Company	Aomori	Rokkasho	Atomic Energy Facility	Pipe
41	Pharmaceutical Company	Chiba	Ichihara	Chemical Plant	Duct (CUI)
42	Pharmaceutical Company	Okayama	Kurashiki	Chemical Plant	Equipment
43	Gas Company	Okayama	Kurashiki	Gas Plant	Pipe
44	Gas Company	Hiroshima	Hatsukaichi	Gas Plant	Oil Pipe
45	Chemical Company	Yamaguchi	Shuunan	Chemical Plant	Tank (CUI)
46	Pharmaceutical Company	Ibaraki	Takahagi	Chemical Plant	Vessel
47	Electric Company	Tokyo	Mitaka	—	Material Parts
48	Engineering Company	Kanagawa	Kawasaki	Incinerator Plant	Duct
49	Tire Maker	Tokyo	Nishitokyo	—	Vessel
50	Electric Power Company	Tokushima	Anan	Coal Generation Plant	Duct (CUI)
51	Chemical Company	Yamaguchi	Iwakuni	Chemical Plant	Pipe
52	Electric Power Company	Kyoto	Maihuru	Coal Generation Plant	—
53	Engineering Company	Ibaraki	Tsukuba	Underground Pipe Line	Pipe
54	Ceramic Company	Kanagawa	Chigasaki	Furnace Plant	Backup Parts
55	Pharmaceutical Company	Ibaraki	Kamisu	Chemical Plant	—
56	Pharmaceutical Company	Oita	Oita	Chemical Plant	Tank (CUI)
57	Chemical Company	Niigata	Niigata	Chemical Plant	Steam Pipe

Conclusion

Effect by the e'-AIM Method of Maintenance :

- **Reduction of the industrial waste with the dismantling of the deterioration thermal insulation .**
- **Recovery of the performance + Energy loss by the addition of the thermal insulation performance , Reduction of the CO2 emission .**
- **Reduction of the risk of the piping corrosion of re- deterioration of existing thermal insulation .**

The case for the purpose of a strict evaluation recommends the enforcement of a newly detailed investigation plan of the thermal insulation .