KTC
한국기계전기전자시험연구원

SERBIA-KOREA COOPERATION PROJECT

INTRODUCTION OF THE COOPERATION PROJEC IN SERBIA IN THE FIELD OF DISTRICT HEATING & SMART METERING, 2021-2023

Establishment of smart monitoring system based on IoT for district heating and establishment of renewable energy network plan in Belgrade city, Serbia

KOREA TESTING CERTIFICATION INSTITUTE

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한국기계전기전자시험연구원

CONTENTS

1. Introduction of KTC

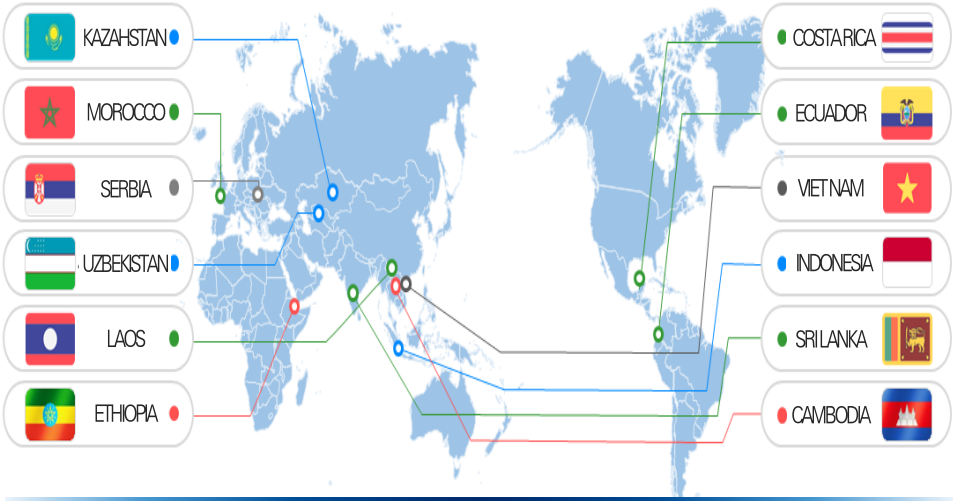
Korea Testing Certification Institute (KTC)

☑ KTC is a comprehensive testing and certification organization in the fields of legal metrology, electrical and electronics, energy, and carbon neutrality.

The institution has designated key strategic areas such as electric vehicles, batteries, renewable energy, hydrogen, and carbon reduction as part of its green transition initiative, and is working to strengthen its testing, certification, and technology development capabilities.

☑ KTC has extensive experience in international development cooperation (ODA) projects in the fields of legal metrology and testing & certification..

KTC has implemented projects to establish testing laboratories and support institutional advancement in countries including Indonesia, Vietnam, Kazakhstan, Serbia, Ecuador, and Costa Rica. (25 projects for 10 years)



KTC IS SUPPORTING ENHANCE THE TESTING AND CERTIFICATION SYSTEM IN PARTNER COUNTRY WITH ODA PROJECT

2. Project Outline

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Project Title	Establishment of smart monitoring system based on IoT for district heating and establishment of renewable energy network plan in Belgrade city, Serbia	
Project Objective	Development and demonstration of a district heating smart monitoring system incorporating IoT technology and preparation of a roadmap linked to renewable energy for Belgrade, Serbia	
Project Period	2021.05 ~ 2023.04	
Organizations to Participate	Serbia	• Ministry of Environmental Protection • Belgrade city • JKP Beogradske elektrane (JKP BE)
	Korea	• Korea Testing Certification Institute • KevinLAB • Korea District Heating Corp.

2. Project Outline

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Activity

I. Establishment of smart metering & monitoring system

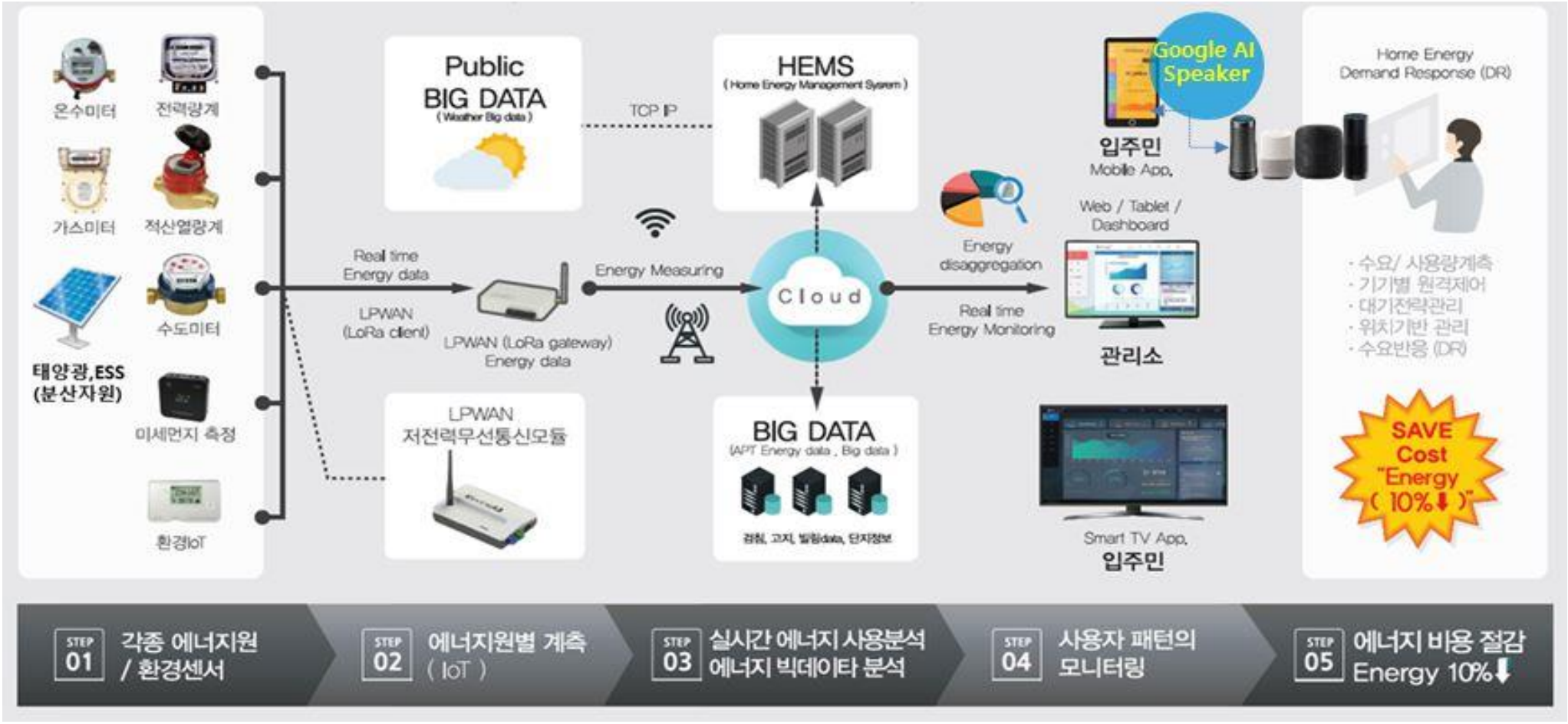
II. Establishment of district heating network road map

III. Strengthening capacity of related experts

3. Result of the Project

3.1 Establishment of the Smart metering & monitoring system

It consists of a cloud-type home energy management system (HEMS).
- Provides usage information, analysis, alarm functions, etc. through Web and App



3. Result of the Project

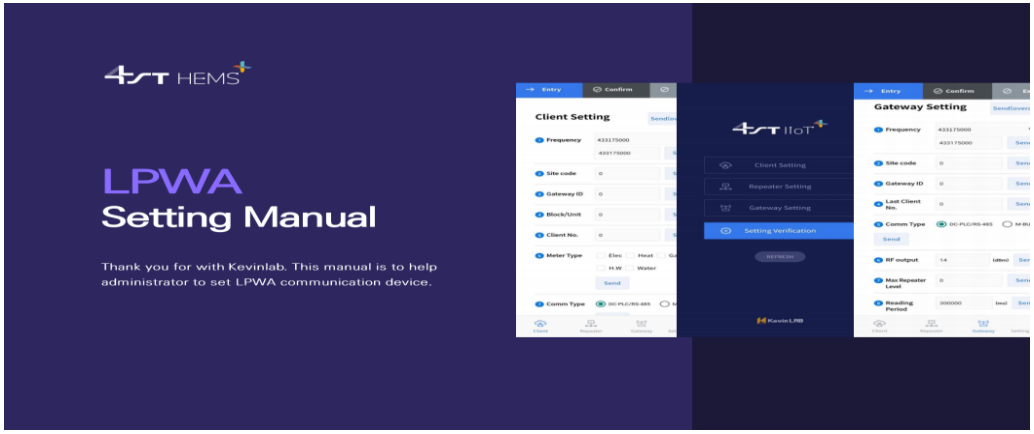
3.1 Establishment of the Smart metering & monitoring system

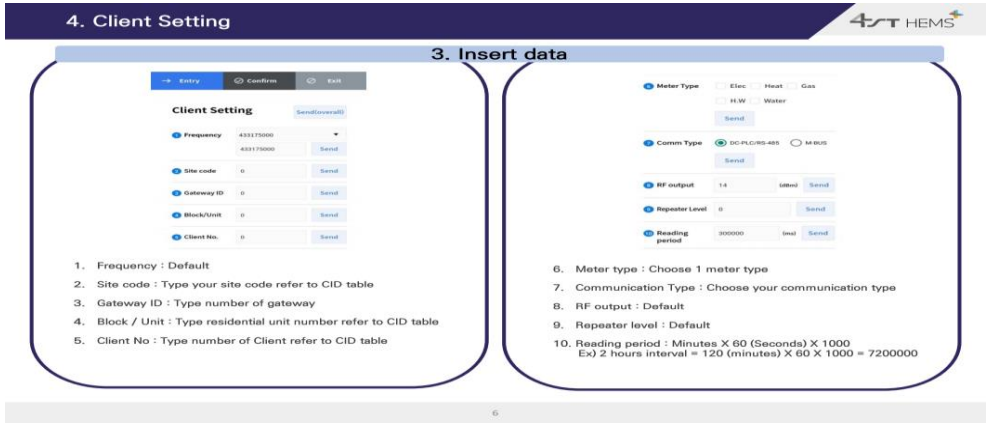
Complete the installation of heat meters and smart metering & monitoring system for 50 houses

3. Result of the Project

3.1 Establishment of the Smart metering & monitoring system

Complete training the officers who will be in charge of the system management to support heating smart metering/monitoring demonstration system setting and operation



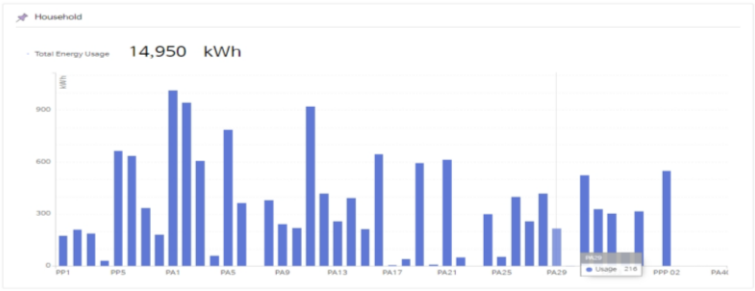


3. Result of the Project

3.1 Establishment of the Smart metering & monitoring system

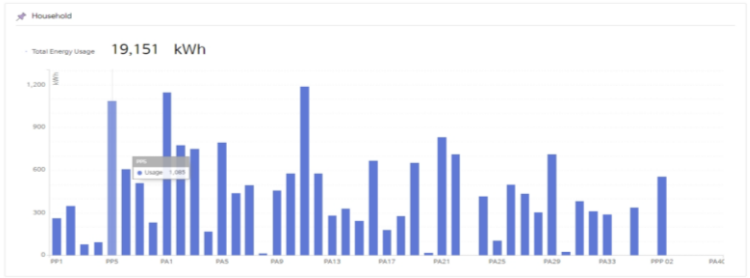
Complete collection and analysis of heating consumption data by household for 3 months after installation of the system (November 2022 to January 2023)

Consumption on
Nov: 14,950kWh



Consumption on
Dec: 21,757kWh

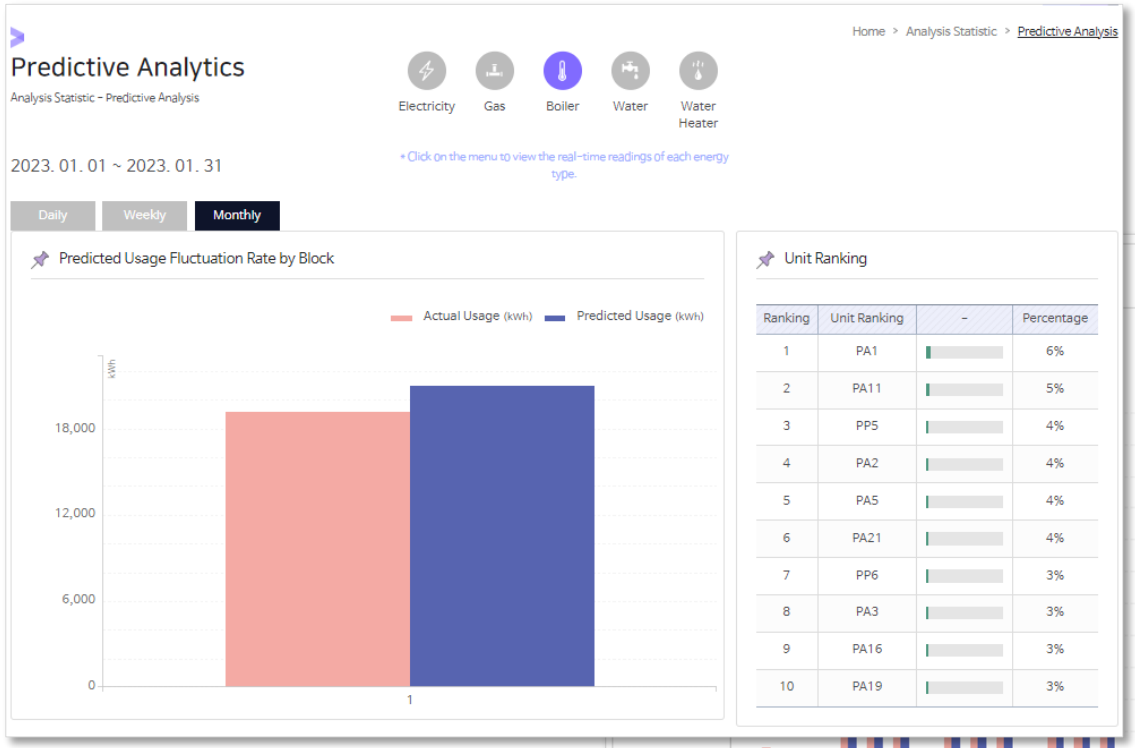
Consumption on
Jan: 19,151kWh

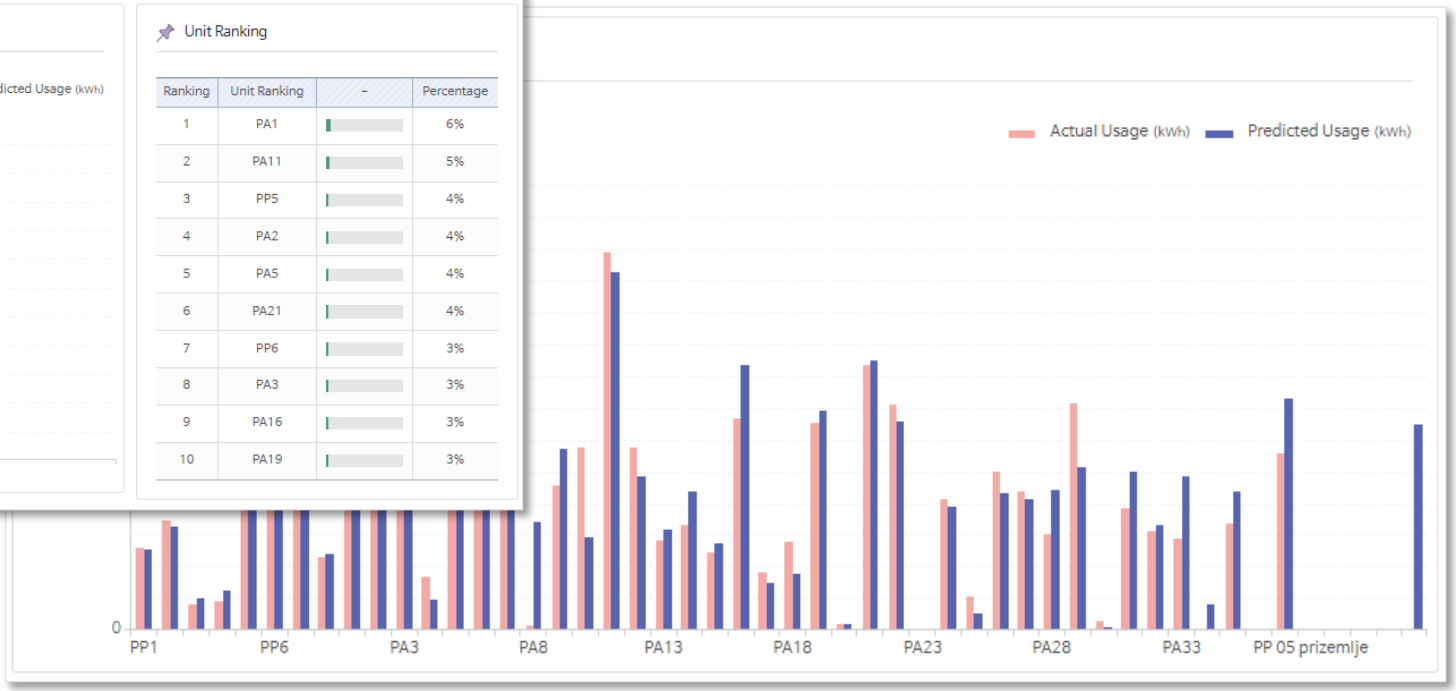


3. Result of the Project

3.1 Establishment of the Smart metering & monitoring system

As usage prediction and real-time usage check became possible through the monitoring system, it is estimated that each household made efforts to reduce heating consumption.





3. Result of the Project

3.1 Establishment of the Smart metering & monitoring system

As a result of monitoring, usage in January was 11% reduced compared to December.

Despite the lower average temperature in January 2023 compared to December 2022, heat consumption was reduced (21,757kWh → 19,151kWh)

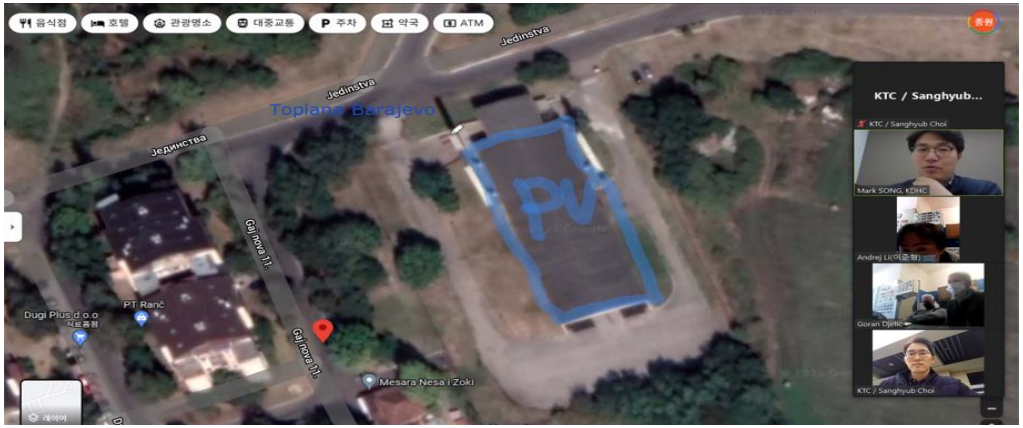
Heat Consumption & Temperature	Dec. 2022	Jan. 2023
Heat consumption	21,757kWh	19,151kWh
Average Temperature	Max : 10.0 °C Min : 2.8 °C	Max : 8.8 °C Min : 2.4 °C

Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average
2022 Nov	Max	21	12	13	20	14	11	12	15	18	18	15	16	16	18	14	17	12	14	10	8	7	10	11	9	10	5	5	7	7	8	N/A	12.4
	Min	8	7	9	5	10	10	10	8	3	4	9	7	7	4	6	5	7	7	5	5	3	2	4	4	2	-1	3	1	2	5	N/A	5.4
2022 Dec	Max	5	7	10	10	12	12	7	8	14	17	5	3	3	6	9	18	9	2	5	6	9	8	14	11	14	18	13	9	15	16	16	10.0
	Min	4	3	2	4	6	6	4	4	5	5	2	-3	-4	0	1	3	2	-1	-1	-1	-2	3	4	5	5	5	5	1	0	8	5	2.6
2023 Jan	Max	16	15	14	11	13	13	14	15	11	9	6	7	10	7	11	9	14	14	15	3	3	5	9	4	3	2	1	1	N/A	4	6	8.8
	Min	3	4	3	3	0	4	2	0	5	5	4	3	2	2	1	4	7	10	3	0	0	1	3	1	1	0	0	0	N/A	0	0	2.4

3. Result of the Project

3.2 Establishment of district heating network road map

Complete the survey on the current status of district heating networks in Belgrade
KDHC is going to share the road map of the district heating road map in 2022



3. Result of the Project

3.2 Establishment of district heating network road map

Complete preparation of the report of roadmap for district heating network linked to renewable energy for Belgrade

Roadmap for integrating renewable energy into the Belgrade district heating system

December. 2022

Executing Agencies

Korea District Heating Corporation

Korea Testing Certification Institute

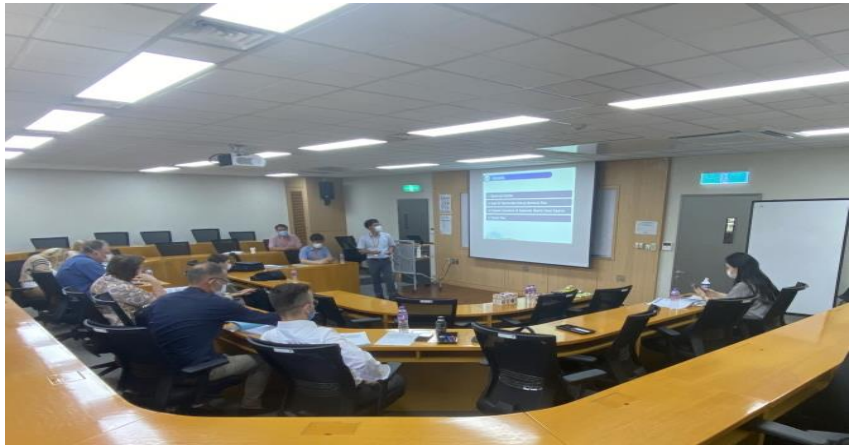
...hensive Review Results

...ering JKP BE's policy priorities, the conditions for each heat source, ...logical aspects, and construction scale, a roadmap has been established ...wn in the table below.

...-14> Applied Technologies and Timing for Each Heat Source

...eat Source	Conditions	Applied Technology	Timing
...ovi Beograd	△	TENT-A Cascading + Thermal Storage	Mid-Long Term
Zemun	○	Solar Thermal	Short Term
Batajnica	◎	Deep Geothermal	Mid-Long Term
Dunav	◎	Solar Thermal (Gas Engine)	Short Term
Borčar	X	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
...njička Banja	○	Wastewater	Mid-Long Term
Konjarnik	△	Incineration + Thermal Storage	Short Term
Mirijevo	△	Thermal Storage + Konjarnik Integration	Short Term
...Voždovac	○	Deep Geothermal	Mid-Long Term
...Medaković	○	Solar Thermal	Short Term
Miljakovac	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
Resnik	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
Cerak	◎	Solar Thermal + Shallow Geothermal (Gas Engine)	Short Term
...anovo Brdo	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
...železnik	△	Deep Geothermal	Mid-Long Term
Sremčica	△	Deep Geothermal	Mid-Long Term
Barajevo	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term

- 90 -



3. Result of the Project

3.2 Establishment of district heating network road map

Considering JKP BE's policy priorities, the conditions for each heat source, technological aspects, and construction scale, a roadmap has been established as below.

No.	Heat Source	Condition	Applicable Technology	Time of application
1	Novi Beograd	△	TENT-A Cascading + Thermal Storage	Mid-Long Term
2	Zemun	○	Solar Thermal	Short Term
3	Batajnica	◎	Deep Geothermal	Mid-Long Term
4	Dunav	◎	Solar Thermal (Gas Engine)	Short Term
5	Borčar	X	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
6	Višnjička Banja	○	Wastewater Thermal	Mid-Long Term
7	Konjarnik	△	Incineration + Thermal Storage	Short Term
8	Mirijevo	△	Thermal Storage + Konjarnik Integration	Short Term
9	Voždovac	○	Deep Geothermal	Mid-Long Term
10	Medaković	○	Solar Thermal	Short Term
11	Miljakovac	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
12	Resnik	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
13	Cerak	◎	Solar Thermal + Shallow Geothermal (Gas Engine)	Short Term
14	Banovo Brdo	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term
15	železnik	△	Deep Geothermal	Mid-Long Term
16	Sremćica	△	Deep Geothermal	Mid-Long Term
17	Barajevo	△	Hydro Turbine + Hydrogen Fuel Cell	Mid-Long Term

3. Result of the Project

3.2 Establishment of district heating network road map

The total investment cost for the 11 heat sources , and the Novi Beograd heat source is the most effective in terms of CO2 reduction per investment.

No.	Heat Source	Fuel Reduction Effect (ton)	CO2 Reduction(tco2)	Investment Cost (USD)	CO2 Reduction per Investment (kgCO2/USD)
1	Novi Beograd	109,667	295,312	3,016,018	97.91
2	Batajnica	3,074	8,278	36,000,000	0.23
3	Borčar	4,365	11,753	15,714,890	0.75
4	Višnjička Banja	3,166	8,525	400,000	21.31
5	Voždovac	5,068	13,646	53,600,000	0.25
6	Miljakovac	10,269	27,653	27,857,143	0.99
7	Resnik	3,603	11,266	3,142,857	3.58
8	Banovo Brdo	13,854	37,305	38,571,219	0.97
9	železnik	1,675	4,511	16,000,000	0.28
10	Sremćica	2,543	6,677	8,000,000	0.83
11	Barajevo	1,605	2,805	1,571,489	1.79
Total		158,890	427,732	203,873,616	2.10

3. Result of the Project

3.3 Strengthening capacity of related experts

Complete the invitational program “Invitational program for roadmap of establishing district heating system network incorporating renewable energy”

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THANY YOU

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